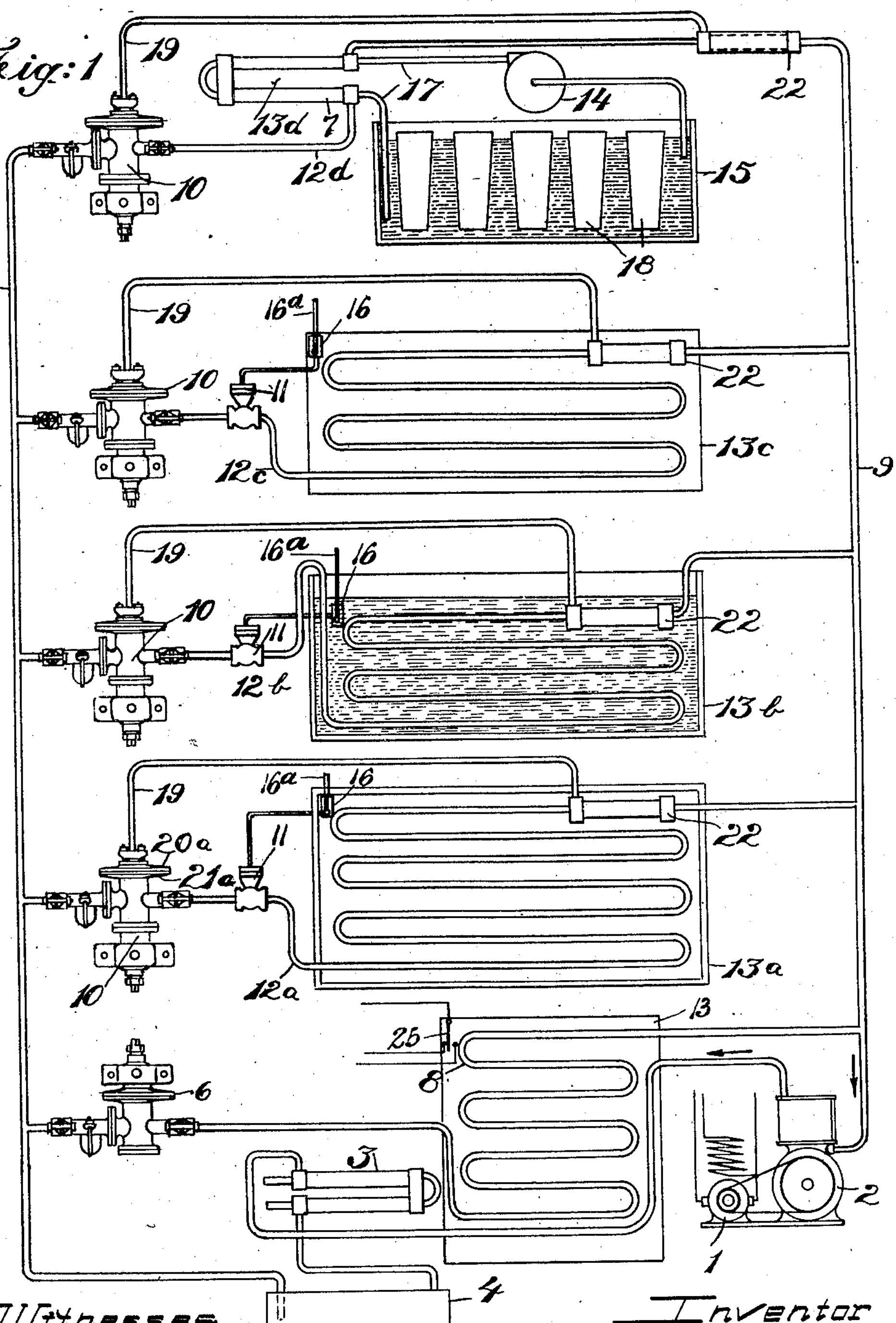
A. T. MARSHALL.
MULTIPLE FEED SYSTEM.
APPLICATION FILED JULY 30, 1910.

1,003,283.

Patented Sept. 12, 1911.

Fig: 1



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UNITED STATES PATENT OFFICE.

ALBERT T. MARSHALL, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE AUTOMATIC REFRIGERATING COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF NEW JERSEY.

MULTIPLE FEED SYSTEM.

1,003,283. Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed July 30, 1910. Serial No. 574,683.

To all whom it may concern:

Be it known that I, ALBERT T. MARSHALL, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Multiple Feed System, of which the following is a specification.

My invention relates to systems whereby expansive fluid is automatically fed through one or more secondary chambers, especially those known as the expansion coils of refrigerating systems, in parallel with a primary or main chamber or coil, in response both to the thermal conditions around such one or more secondary chambers or coils and also to the pressure therein.

The purpose of my invention is to refrigerate one or more secondary compartments, in parallel with a primary compartment, by a simple method of control previous to and during the time the primary compartment is refrigerated in the usual manner.

The accompanying drawing represents a diagrammatic illustration of my invention.

Motor 1 is belt connected to a gas compressor 2, circulating refrigerant, preferably ammonia. The compressed gas is forced through a condenser 3 into a receiver 4, whence leads a feed pipe or main 5 which supplies a number of chambers in parallel as follows: 13 is the primary or main chamber which contains expansion coil 8 connected to high pressure main 5 with a so-called fixed back pressure expansion valve 6 interposed. This valve may be of the construction as shown in my U. S. Patent No. 785,265 of March 21st, 1905 or any other suitable construction. The characteristic feature of this type of expansion valves is that they admit refrigerant to the expansion coil only when the pressure therein falls below a certain amount for which the valve is adjusted, so that so long as this low back pressure has not been reached in the coil no refrigerant is fed to this coil. Coil 8 is connected at its other end to return main 9 which is connected to the compressor and forms the low pressure side of the system. Parallel to coil 8 are connected refrigerating coils 12^a, 12^b, 12^c, 12^d which are disposed in what shall be termed secondary refrigerating compartments 13^a, 13^b, 13^c, 13^d respectively which may serve different purposes, each of said coils being supplied with refrigerant from main 5 by an expansion valve 10 to be referred to hereinafter. Compartment 13^a may serve for storage of certain food products, compartment 13^b, may serve as a tank containing fresh water to be cooled, 13^c may represent a refrigerating counter for markets and 13^d may be a device for cooling brine which is pumped by pump 14 through a pipe 17 which in turn passes through the enlarged portion 7 of refrigerant pipe or coil 12^d. The brine is pumped from and back to a tank 15 which may be used for producing ice in cans 18. Expansion valve 10 is of the type set forth in the U. S. Patent to me dated August 8, 1899 No. 630,617, in which the refrigerant supply is controlled by the movement of a diaphragm one side of which is exposed to pressure fluid, the pressure of which is responsive to variations in temperature, its other side being exposed to the back pressure of the refrigerant. By properly adjusting a spring which counteracts this controlling pressure as clearly described in said patent proper adjustment of the valve to suit the required conditions may be obtained.

The temperature responsive fluid (preferably anhydrous ammonia) is inclosed in a cylinder 22 in each compartment, through which the end of its refrigerating coil passes before joining the return main 9. Each ammonia cylinder 22 is connected by a pipe 19 with the expansion valve 10 of the respective chamber so that the varying pressure of the ammonia charge in each cylinder is imparted to the diaphragm of its expansion valve as described in aforesaid patent. By this arrangement as is well known in the art, the expansion valve supplies all the refrigerant which the coil can evaporate so that at all times the whole length of the coil remains frosted and maintains uniform temperature over the whole length. While by such thermostatic cylinders 22 in conjunction with the type of expansion valves 10 just described a uniform temperature of the whole length of the expansion coil may be maintained, this manner of control does not furnish means for maintaining an exact temperature within narrow limits in the refrigerating compartment itself, so that where such exact temperature may be required owing to the purpose which the chambers serve, as for instance chambers 13^a, 13^b, 13^c, I prefer to employ in addition to the thermostatic charge control just described a thermostat 16 disposed in a suitable place in the chamber which may have any suitable construction well known in the art by which, when the desired temperature has been reached in the chamber, the refrigerant supply is completely shut off. Thermostats 16 may for instance control the admission of compressed air or water supplied by pipes 16^a to operate a shut-off valve 11 interposed between the expansion valve 10 and the expansion coil. Thus the refrigerant is shut off from each chamber individually at the desired moment. Now, in order to stop the operation of the compressor, primary chamber 13 contains an electrothermostat 25 which is suitably connected (not shown) to the electromotor 1 so that when the temperature in chamber 13 has dropped to the desired degree the motor is stopped, and started again when the temperature rises. An arrangement of this kind is for instance clearly illustrated in the patent to Chamberlain and Marshall No. 834,870 of October 20, 1906.

The whole arrangement of the system just described has the effect that at a back pressure in the low pressure side 9 of the system, above the pressure at which expansion valve 6 of primary chamber 13 supplies refrigerant, the secondary chambers alone first receive refrigeration according to their individual requirement and only as their refrigeration is gradually shut down by the cooling of their thermostatic charge in cylinder 22, and as thereby the back pressure in return main 9 falls, expansion valve 6 opens and supplies refrigerant to its coil 8.

The operation of the system is as follows: Assuming the compressor stopped and that all the chambers are warmed up. Thermostat 25 of the controlling or primary chamber then starts the motor and the compressor commences to operate. The pressure in the low pressure side 9 being then still very high valve 6 of the primary chamber does not open yet for the reasons previously explained. But the thermostatic expansion valves 10 of the secondary chambers supply their coils with all the refrigerant the coils can evaporate. Now the coils 12^a, 12^b, 12^c, 12^d all discharging the maximum amount of vaporized refrigerant into the return main 9 the back pressure therein at first does not drop very much until the coils in these chambers commence to cool to the desired degree, when the thermostatic charge at the end of each coil, cooled thereby, gradually reduces the refrigerant supply to its coil, so that now the back pressure in main 9 rapidly drops until the point is reached when valve 6 opens and commences to supply refrigerant to its coil 8 in chamber 13. All the other chambers are of course still supplied sufficiently to maintain the proper refrigeration, which may be obtained by properly adjusting expansion valves 10 with respect to the effect of the pressure of the thermostatic charge upon the valve diaphragm; but still the main work of the compressor at that period is done in the primary chamber 13, the frost in its coil 8 gradually creeping along toward the end. This refrigeration continues until the desired temperature is reached at which thermostat 25 shuts down the motor. When the temperature in chamber 13 rises again the motor commences again to work.

It may be pointed out that of course the system with respect to the capacity of the several chambers and refrigerating compartments is dimensioned so that when for instance the motor is shut down by thermostat 25 and the secondary chambers should require refrigeration, they will not have to wait long until primary chamber warms up sufficiently to start the motor, and in turn when the motor has thus started and supplies refrigerant to the secondary chambers first primary chamber 13 does not have to wait long until the back pressure drops to the point at which valve 6 supplies the coil 8 with refrigerant.

While in this system the chambers or compartments controlled by the thermostat valves 10 always have first claim on the refrigeration at high temperatures of the refrigerant in the coils, the system is unable to produce in the secondary chambers the extremely low temperatures and also the extremely low back pressures in the return conduit which it would if the valves 10 were working without the fixed back pressure valve 6 in the primary chamber. The reason why no extremely low temperatures can be produced in the secondary chambers is, that at no time the refrigerant in the coils of the secondary chambers expands into a very low back pressure, and thus cannot produce low temperatures; because when the low pressure point at which valve 6 opens is reached, this valve continues feeding the refrigerant, so that it thereby prevents the back pressure from falling any appreciable degree below the point for which the valve 6 is set. Thus, valve 6 indirectly controls, to a certain extent, the lower limit of temperature in the secondary chambers.

It is of course obvious that the motor may also be shut down by hand when a certain desired temperature has been reached instead by the thermostat without departing from the spirit of my invention, electrothermostats of the kind as also shown in aforesaid patent to Chamberlain and Marshall being generally provided with means for controlling the motor by hand.

What I claim is:

1. A refrigerating system having a com-

pressor for supplying refrigerant, a primary refrigerating compartment with an expansion coil therein and an expansion valve responsive to predetermined fixed back pressure only, at least one secondary compartment and an expansion coil therein in parallel to said primary coil, an expansion valve for said secondary coil controlled by the temperature of a thermostatic charge at the end of the coil to cause the valve to feed all the refrigerant the coil can evaporate, said fixed back pressure valve having means for adjusting it to only feed refrigerant when said secondary expansion valve is substantially closed by the action of its thermostatic charge.

2. A refrigerating system having a compressor for supplying refrigerant, a primary refrigerating compartment with an expansion coil therein and an expansion valve responsive to predetermined fixed back pressure only, at least one secondary compartment and an expansion coil therein in parallel to said primary coil, an expansion valve for said secondary coil controlled by the temperature of a thermostatic charge at the end of the coil to cause the valve to feed all the refrigerant the coil can evaporate, said fixed back pressure valve having means for adjusting it to only feed refrigerant when said secondary expansion valve is substantially closed by the action of its thermostatic charge, and means for stopping the operation of said compressor when the desired temperature in said primary chamber is reached.

3. A refrigerating system having a compressor for supplying refrigerant, a primary refrigerating compartment with an expansion coil therein and an expansion valve responsive to predetermined fixed back pressure only, at least one secondary compartment and an expansion coil therein in parallel to said primary coil, an expansion valve for said secondary coil controlled by the temperature of a thermostatic charge at the end of the coil to cause the valve to feed all the refrigerant the coil can evaporate, said fixed back pressure valve having means for adjusting it to only feed refrigerant when said secondary expansion valve is substantially closed by the action of its thermostatic charge, and a thermostat for stopping the operation of said compressor when the desired temperature in said primary chamber is reached.

4. A refrigerating system having a compressor for supplying refrigerant, a primary refrigerating compartment with an expansion coil therein and an expansion valve responsive to predetermined fixed back pressure only, at least one secondary compartment and an expansion coil therein in parallel to said primary coil, an expansion valve for said secondary coil controlled by the temperature of a thermostatic charge at the end of the coil to cause the valve to feed all the refrigerant the coil can evaporate, said fixed back pressure valve having means for adjusting it to only feed refrigerant when said secondary expansion valve is substantially closed by the action of its thermostatic charge, and a thermostatically controlled stop-valve for said secondary chamber, to cut off the refrigerant when the desired temperature in the chamber has been reached.

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