June 27, 1939. H. W. NEVIN 2,163,800

VALVE

Original Filed Sept. 8, 1936 2 Sheets-Sheet 1

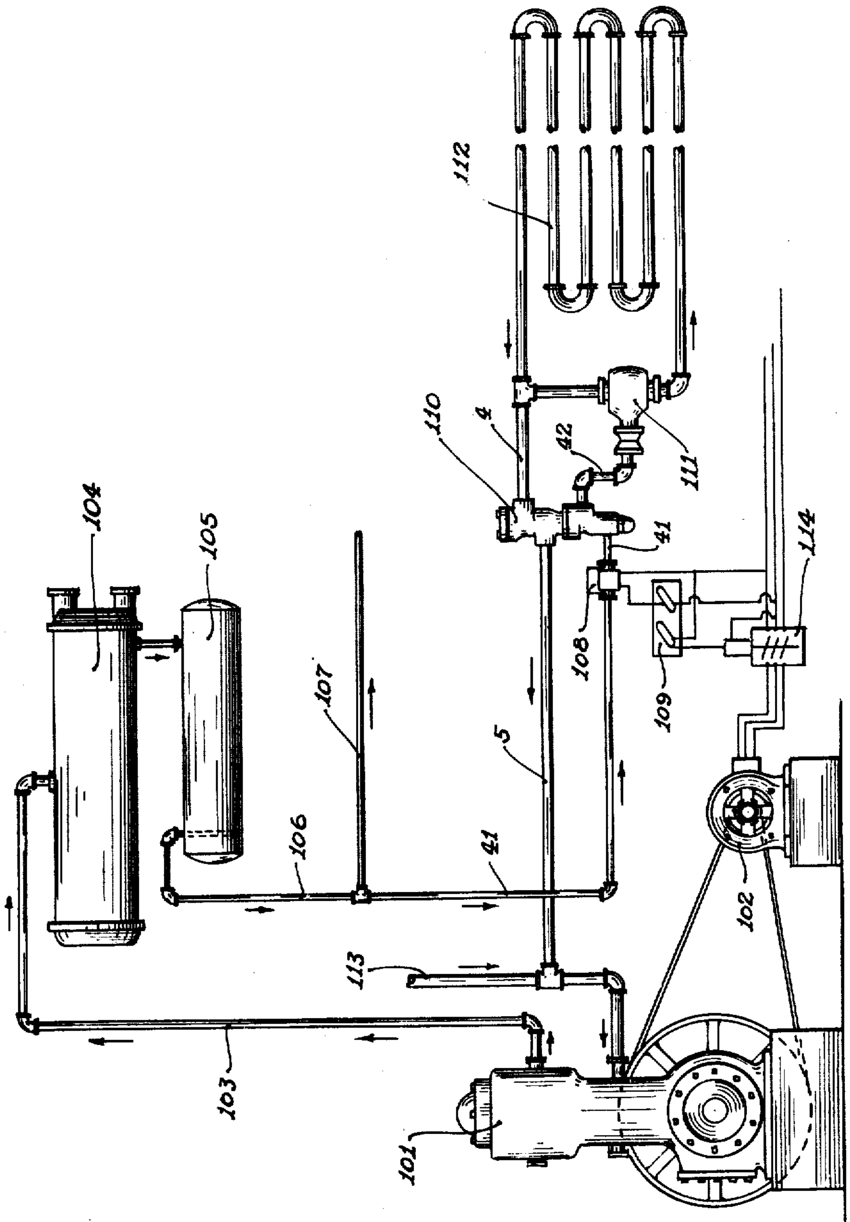

Fig. 1

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VALVE

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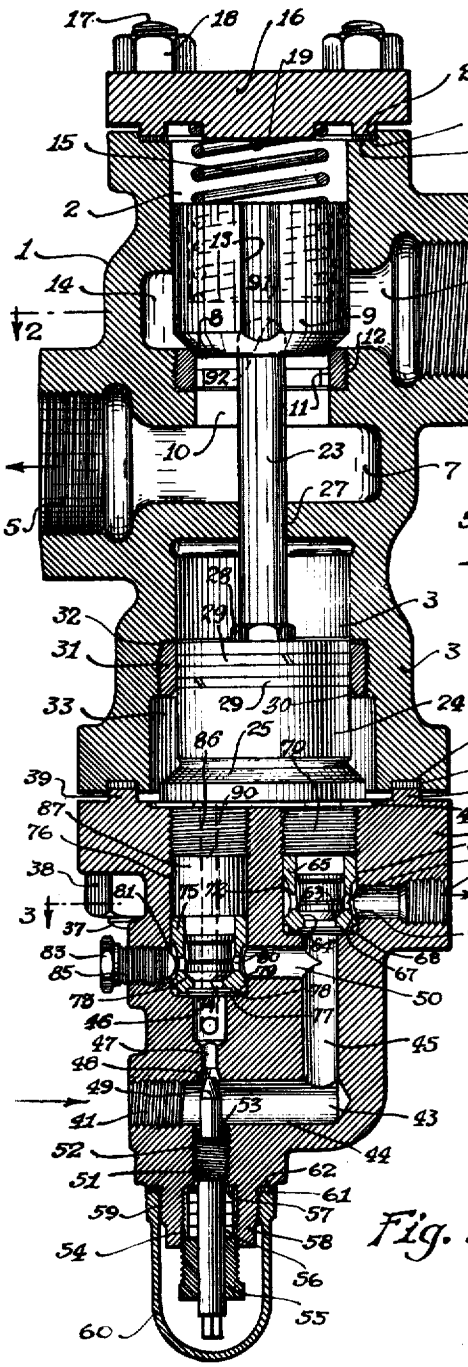

Fig. 2

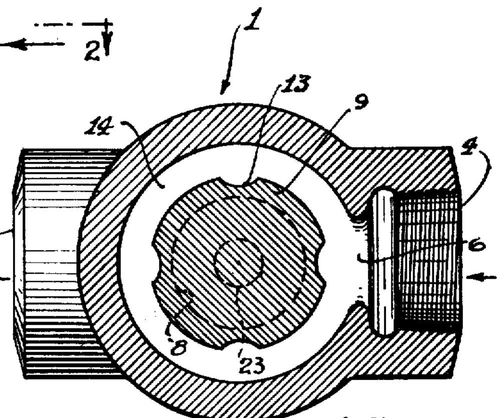

Fig. 3

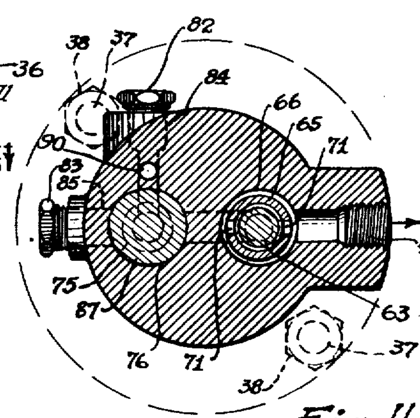

Fig. 4

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2,163,800

UNITED STATES PATENT OFFICE

2,163,800

VALVE

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Original application September 8, 1936, Serial No. 99,775. Divided and this application February 12, 1937, Serial No. 125,497

11 Claims. (Cl. 137—153)

This invention relates to means for automatically opening and closing the low pressure or suction line of a refrigeration system by employing the differential in pressure between the high pressure or liquid line of the system and the low pressure line.

This application is a division of my application entitled Refrigeration system, Serial No. 99,775, filed September 8, 1936.

One of the objects of the invention is to provide means for automatically opening and closing the suction line from the evaporator in a prompt and positive manner so as to accurately control the temperature of the refrigerated space.

Another object of the present invention is to provide for refrigeration systems a simple, practical and efficient automatically operating pressure actuated suction stop valve of strong, durable and comparatively inexpensive construction designed to be connected in the suction line and the liquid line of a refrigeration system between the float valve of the cooling coil and the liquid stop valve of the refrigeration system and adapted to prevent further refrigerative effect at a predetermined time as for instance when a thermostat in the refrigeration chamber operates to close the liquid stop valve.

A further object of the invention is to provide a pressure actuated suction stop valve of this character adapted to prevent the flow of gas through the suction line to the condenser or compressor when the flow of liquid through the liquid line is shut off and permit a free flow of liquid through the liquid line and a free flow of gas through the suction line when the liquid stop valve is open and capable also of effectively preventing counterflow of gas through it when the liquid flow is cut off.

A further object of the invention is to provide a pressure actuated suction stop valve adapted to allow considerable liquid pressure to be applied to it whereby a positive opening of the suction line is effected when the liquid stop valve is opened to permit flow of the liquid to the cooling or expansion coil.

A further object of the invention is to provide means for controlling the speed of operation of the suction stop valve so that the opening of the same may be retarded to the desired extent and a full opening of the suction stop valve assured at the desired time with relation to the flow of the liquid to the cooling coil.

Another object of the invention is to provide a pressure actuated suction stop valve which will be characterized by an exceedingly low cost of operation and maintenance compared with the means heretofore employed for controlling the flow through the suction and liquid lines of a refrigeration system.

As will be apparent from the description which follows, the present invention involves the introduction of a stop valve interposed athwart the high pressure section and the low pressure section of a fluid line having relatively high pressure and low pressure sections.

It is well known of course, that refrigeration systems employ a fluid line having relatively high pressure and low pressure sections. The ammonia comes from the compressor under relatively high pressure and proceeds through the high pressure section of the line to the evaporator, existing in this section of the line as a liquid. In the evaporator, the ammonia passes to the gaseous phase and returns to the compressor under relatively lower pressure to be compressed and recirculated.

It is, of course, common to provide thermostatic means for stopping the flow of liquid from the compressor, this normally being effected by the use of a thermostat which operates to stop the operation of the compressor at a predetermined temperature of the refrigerated space.

Refrigeration plants may be considered for present purposes as being of two types, namely, single chamber installations and multiple chamber installations. In single chamber installations, it is sufficient to provide means for stopping the compressor when the temperature is at the desired point and to start the compressor when the temperature has risen above a selected point.

In multiple chamber installations, two or more spaces such as rooms or brine tanks are refrigerated from a single compressor and condenser. In such installations, a separate thermostat in each chamber operates to perform two functions. The first is to close and break an electrical circuit leading to that chamber from a magnetic starting switch on the compressor. The second function is necessitated by the fact that although the circuit may be broken by the thermostat in one chamber, it may be kept closed by the thermostat in another chamber so that the compressor continues to operate. This second function is to operate a magnetic liquid stop valve in the liquid line leading to the chamber in question. After the flow of liquid to the evaporator has been cut off by the magnetic liquid stop valve, it is necessary to economical controlled operation to close the suction line from the evaporator to prevent further evaporation in the evaporator and a consequent further lowering of temperature in the refrigerated space. This has been accomplished heretofore by a valve in the suction line which has been operated manually or more usually by a magnetic valve controlled by the thermostat. It is obviously impractical to operate the suction line stop valve manually. Magnetic stop valves have been unsatisfactory in practice because of frequent failure due to the necessity of employing an unloader or pilot valve. The differential in pressure in the line is obviously too great to permit positive operation of a valve solely by the employment of a solenoid of any practicable dimensions. The usual solenoid employed has a total lifting power of but three to five pounds and must operate against a pressure differential of about thirty pounds per square inch, or a total pressure of about ninety-four pounds in a two inch line. An unloader employs the pressure of the line to unseat the valve when the solenoid opens a needle valve to reduce the pressure within the unloader piston.

The necessity of closely fitting the piston in the valve cylinder to prevent excessive gas leakage often results in the piston sticking and the coil burning out. Since there can be no refrigeration on the refrigerated space unless the suction line is opened, it is obvious that the failure of the valve is tantamount to a failure of the system. It is immaterial whether the failure of the valve is due to sticking or the burning out of the coil.

The present invention affords positive control of the suction line valve without the employment of electromagnets or pilot valves. In the case of magnetic valves, the object is to overcome the suction line pressure by means of magnetic power and unloaders. In the present invention, the high pressure of the liquid line is utilized to readily overcome the lesser pressure of the suction line.

In an ordinary installation employing a two inch suction line, assuming a pressure of one hundred fifty pounds on the liquid line, the total differential in pressure available to actuate the suction line valve is approximately four hundred pounds.

It will be understood that the present invention is not limited to any particular valve or mechanical structure but is directed broadly to the employment of liquid line pressures to operate suction line valves in refrigeration systems.

In the drawings, similar reference characters in the several figures indicate similar elements.

Figure 1 is a diagrammatic view of a refrigeration system employing the present invention.

Figure 2 is a central vertical sectional view of a pressure actuated suction stop valve constructed in accordance with this invention.

Figure 3 is a horizontal sectional view taken substantially on the line 2—2 of Figure 2.

Figure 4 is a similar view on the line 3—3 of Figure 2.

The operation of the present invention may be readily understood by reference to Figure 1 in which compressor 101, driven by motor 102, forces compressed gas through pipe 103 to condenser 104. The liquid from condenser 104 passes into receiver 105, thence through pipe 106 to pipes 107 and 41. Pipe 107 leads to evaporators not shown. Magnetic liquid stop valve 108 is provided in pipe 41 to close it when actuated by thermostat 109. The liquid passes through the control section of valve 110, thence through pipe 42 and float or thermal valve 111 by which the liquid is fed to evaporator 112 as required.

Evaporator 112 is placed in the space to be refrigerated as for example a brine tank or a chamber. Gas passing from evaporator 112 passes through pipe 4 into the suction cutoff of valve 110, thence through pipe 5 to compressor 101. Pipe 113 leads to the compressor from other evaporators not shown. Motor 102 is started by magnetic switch 114 controlled by thermostat 109.

Valve 110 is shown in detail in Figures 2, 3, and 4, and comprises in its construction a tubular main valve body 1 constituting the upper portion of the body or casing of the device and forming a longitudinal passage having upper and lower cylindrical chambers 2 and 3 and provided with a gas inlet 4 and a gas outlet 5 communicating with the gas inlet by passages 6 and 7 extending inwardly from the gas inlet and the gas outlet and communicating with the upper cylindrical chamber 2. The gas inlet 4 is located at a higher elevation than the gas outlet 5 and the upper cylindrical chamber 2 of the main valve body 1 is provided with a valve seat 8 located between the gas inlet 4 and the gas outlet 5 and adapted to receive an upper valve disk 9 for closing communication between the gas inlet 4 and the gas outlet 5 for shutting off the flow of the gas through the suction line from the cooling or expansion coil of a refrigeration system to the compressor or condenser thereof.

The pressure actuated suction stop valve is applicable to refrigerating systems having a point of controlled varying pressures, the two pressures being the evaporator and the condenser pressures. The passage 6 extends directly from the gas inlet 4 to the upper cylindrical chamber 2 and the passage 7 which extends inwardly from the gas outlet extends across the main valve body 1 from the gas outlet 5 to the opposite wall of the said body 1 and it communicates with a reduced portion 10 of the upper cylindrical chamber 2. The valve seat 8 is formed by a valve seat ring 11 which is threaded into an annular recess 12 formed by an enlargement of the reduced portion 10 of the lower end of the cylindrical chamber 2. The valve seat ring 11 is bevelled at its inner face at its upper edge and the upper valve disk 9 is correspondingly bevelled to fit the valve seat. Grooves 13 in the walls of upper valve disk 9 serve to permit gas passage between chamber 2 and passage 6 to equalize the pressure. The passage 6 is enlarged as illustrated at 14, thus permitting pressure equalization on all sides.

The upper valve disk 9 is urged downwardly by a coiled spring 15 fitted in socket 91 of the upper valve disk 9 and held in place by boss 19 in top cap 16. Top cap 16 is secured to the upper end of the main valve body 1 by threaded studs 17 and nuts 18. The coiled spring positively closes the upper valve disk and while the pressure actuated suction stop valve is preferably arranged in a vertical position, it may, of course, be arranged in any other desired position as the coiled spring 15 will positively close the upper valve disk 9 and maintain the same firmly against its seat 8 when the pressure in the liquid line is reduced as hereinafter fully explained. The top cap studs 17 are fixed to the upper end of the main valve body and the nuts 18 engage the upper face of the top cap which is pierced by the said studs 17. The top cap is provided at its lower face with a central boss 19 which extends into the upper end of the coiled spring and centers the same. The said top cap is also provided at its lower face with an annular rib 20 arranged concentric with the central boss 19 and adapted to bear against a top cap gasket 21 which is fitted in an annular recess 22 in the upper end of the main valve body 1. The annular rib 20 and the top cap gasket 21 form a gas tight joint between the top cap and the main valve body to prevent the escape of gas.

When the upper valve disk is closed, it shuts off communication between the gas inlet and the gas outlet and prevents the flow of gas through the suction line. The upper valve disk is connected by a piston stem 23 with a piston head 24 which carries a lower valve disk 25 and which operates in a lower cylindrical chamber 3. The piston stem 23 extends downwardly from the upper valve disk and is guided at 27 in the main valve disk body and its lower end is preferably threaded into the piston head 24 and provided with a jam nut 28, but the stem 23 which is shown fitted in socket 92 of the upper valve disk 9 may be connected with the upper valve disk 9 and the lower piston head 24 in any other desired manner as will be readily understood.

The piston head 24 is provided with piston rings 29 and the lower valve disk 25 cooperates with a valve seat 30 formed by a removable valve seat ring 31 preferably threaded into the main valve body 1 as indicated at 32. The lower edge of the valve seat ring 31 is bevelled to form the valve seat 30 and the lower portion 33 of the lower cylindrical chamber is enlarged forming an annular space below the valve seat surrounding the lower valve disk 25 and the lower portion of the piston 24.

The lower valve disk 25 is of greater diameter than the piston head 24 and is bevelled as shown to cooperate with the bevelled valve seat. The piston 24 consists of a reduced cylindrical extension of the lower valve disk 25 and is preferably formed integral with the same.

The lower end of the main valve body 1 is provided with an annular groove 34 for the reception of a check valve body gasket 35 and a check valve body 36 is secured to the lower end of the main valve body 1 by lower check valve studs 37 and nuts 38. The check valve body conforms to the configuration of the main valve body and is provided at its upper end with an annular rib 39 which fits within the annular groove 34 of the lower end of the main valve body and bears against the lower check valve body gasket 35. The studs 37 are fixed to the lower end of the main valve body and pierce portions of the upper end of the check valve body and the nuts 38 maintain the annular rib 39 in tight clamping engagement with the lower check valve body gasket 35 to form a liquid and gas tight connection to prevent the escape of any liquid or gas from the device.

The lower check valve body constitutes the lower portion of the body of the device and it is provided in its upper end with a circular recess 40 which communicates with a vertical liquid passage 90 for admitting the liquid to the lower face of the lower valve disk for subjecting the same and the piston head to the pressure of the liquid line for causing such pressure to overcome the action of the coiled spring 15 and open the upper valve disk 9 when the liquid stop valve 100 is opened to permit liquid to flow through the liquid line to the evaporator 112.

The check valve body is provided with a liquid inlet 41 and a liquid outlet 42 and it has a liquid passage 43 connecting the liquid inlet and the liquid outlet and consisting of a horizontal branch or portion 44 and a vertical branch or portion 45. The horizontal branch or portion extends inwardly from the liquid inlet 41 and the vertical branch 45 extends upwardly from the inner end of the horizontal branch or portion 44 to the liquid outlet 42. The liquid inlet and the liquid outlet are threaded for pipe connections and the gas inlet and the gas outlet are also threaded for the same purpose.

When liquid flows through the liquid line it enters the liquid inlet of the lower check valve body and passes through the passage 43 which connects the liquid inlet with the liquid outlet and a portion of the liquid also enters the passage 90 through a chamber 46 communicating with passage 44 and having a lower reduced inlet portion 47 provided with a valve seat 48 with which a needle valve 49 cooperates for controlling the flow of the liquid through the passage 90 and the admission of the liquid pressure to the lower valve disk 25 and consequently the opening of the upper valve disk 9. By adjusting the needle valve 49, the opening of the valve disk 9 for permitting the flow of the gas through the main valve body may be retarded to prevent damage to the valve by the high pressures employed.

The lower check valve body is also provided with a by-pass passage 50 connecting the main liquid passage 43 with the chamber 46 and the passage 44 so that the liquid may flow freely from the lower cylindrical chamber 3 of the main valve body into the liquid line when the liquid stop valve is closed.

The needle valve 49 has a threaded portion 51 which engages an upper threaded portion 52 of a vertical opening or bore 53 in the lower end of the check valve body. This permits an adjustment of the needle valve 49 with relation to the tapered lower end of valve seat 48 of the reduced portion 47 of the chamber 46 of the lower check valve body. The lower portion 54 of the bore or opening 53 is threaded to receive a gland 55 and packing 56 which is interposed between the gland 55 and a stuffing box washer 57 to form a stuffing box to provide a liquid and gas tight connection or joint around the needle valve for preventing the escape of liquid or gas. The lower portion 58 of the check valve body is reduced and exteriorly threaded at 59 to receive a lower cap 60 interiorly threaded at the upper end to engage the threads 59 of the lower reduced portion 58 of the lower check valve body. A bottom cap gasket 61 is arranged between the upper edge of the bottom cap and the shoulder 62 formed by a reduction of the lower portion of the lower check valve body.

Check valves are provided in the main passage 43 and in the by-pass passage 50 for purposes hereinafter described. The check valve of the main liquid passage 43 comprises a check valve disk 63 and a valve seat 64 consisting of an interiorly bevelled portion of a sleeve 65 arranged in a bore or opening 66 extending upwardly from the main passage at the inner end of the liquid outlet. The bore or opening 66 which extends from the main liquid passage to the upper end of the lower check valve body is of greater diameter than the vertical branch 45 of the main liquid passage 43 and it forms a shoulder 67 surrounding the upper end of the vertical branch 45 of the main liquid passage and receiving a gasket 68 which is engaged by the lower end of the sleeve 65. The lower end of the sleeve 65 is reduced interiorly and exteriorly to form an annular rib 69 for engaging the gasket 68. A retaining plug 70 is threaded into the upper end of the bore or opening 66 and engages the upper end of the sleeve 65. The retaining plug 70 holds the sleeve tightly in engagement with the seat gasket 68. The sleeve is provided at the liquid outlet with opposite openings 71 and it has an exterior annular recess 72 which provides an annular space or passage around the sleeve for connecting the openings 71 to facilitate free passage of the liquid through the lower valve body.

The by-pass check valve comprises a check valve disk 73 arranged upon a check valve seat 74 of a sleeve 75 constructed similar to the check valve sleeve 65 heretofore described and arranged in a vertical bore or opening 76 extending from the chamber 46 and the by-pass 50 to the upper end of the lower check valve body. The bore or opening 76 is of greater diameter than the chamber 46 to form a shoulder 77 on which is seated a gasket 78. The lower end of the sleeve is reduced to form a gasket engaging rib 79. Also the sleeve is provided with opposite openings 80 and it has an exterior annular recess 81 forming a space around the sleeve at the said openings. The lower check valve body is provided with clean-out plugs 82 and 83 mounted in threaded openings 84 and 85 which are arranged in line with the openings of the seat forming sleeves of the check valves.

The sleeve 75 is retained in the opening or bore 76 by a retaining plug 86 threaded into the upper end of the bore or opening 76 and constructed similar to the threaded retaining plug 70. A filler block or piece 87 is interposed between the retaining plug 86 and the upper end of the sleeve.

The gas passes through the main valve body in the direction of the arrow pointing toward gas inlet 4 in Figure 2 of the drawings and the liquid passes through the lower check valve body in the direction of the arrow pointing toward liquid inlet 41 in Figure 2 of the drawings, the liquid flowing to the right in the said figure and the gas to the left. Starting from a closed position with the magnetic liquid stop valve of the refrigeration system closed, the thermostat of the refrigeration system opens the magnetic valve and permits the high pressure liquid to extend as far as the float valve on the expansion or cooling coil. As the liquid passes through the lower check valve body which with the parts carried thereby constitutes the control assembly of the suction stop valve, pressure is applied to the high pressure piston which opens the valve on the suction line. When the desired temperature is reached in the refrigeration chamber, the thermostat closes the liquid magnetic stop valve and the float valve releases the pressure between the magnetic stop valve and the evaporating coil. The lowering of the pressure on the piston on the high pressure side of the suction stop valve allows the suction stop valve to close and further refrigeration is stopped until the magnetic liquid stop valve is again opened by the thermostat.

The pressure of the liquid entering passageway 43 will cause a portion of the fluid to pass needle valve 49, through liquid conduit 90 and into chamber 33 against the lower face of valve disk 25, by which valve disk 25 will be raised against the action of spring 15 and thereby open suction valve 9 in passageway 7.

When refrigeration is discontinued and the liquid stop valve closed, the pressures in the liquid line and the suction line will be balanced until after closing of suction valve 9, which closing should be rather prompt for most efficient operation of the refrigeration system. The closing of suction valve 9 is accelerated by means of check valve 73, which check valve will open under pressure of fluid returning from conduit 90, thereby permitting the fluid to quickly pass through bypass 50 into fluid line 43.

Due to the great pressures involved, the opening afforded by needle valve 49 is necessarily very small, normally a ring opening about $\frac{1}{64}$ of an inch in width. When the magnetic liquid stop valve is closed by the thermostat, the pressure in chamber 10 and in all of the channels of the control section of valve 110 drops to the evaporator pressure. It will be readily appreciated that at the lower pressures the back row of liquid through the small opening of needle valve 49 would be very slow. Since prompt response and consequent closing of the suction line is desired, check valve 73 is provided. The weight of piston 24 augmented by spring 15 causes the liquid in conduit 90 to raise the relatively light weight check valve disk 73 and permit the liquid from chamber 33 to pass out through conduit 50 and thence out pipe 42 to the evaporator without delay. After the piston has dropped, check valve disk 73 reseats and remains seated until again urged upwardly when the magnetic liquid stop valve has opened and again closed.

Check valve 63 serves to prevent counterflow of gas through the lower check valve body when the refrigerating system is not in operation.

The pressure in the liquid line to the evaporator or cooling or expansion coil will vary between the liquid cutoff valve and the float or thermal expansion valve. Between these two points the pressure will either be that of the condenser or liquid pressure or that of the evaporator or cooling coil, the pressure being dependent upon the opening and closing of the liquid stop valve which is determined by the desired temperature in the refrigerated space through the action of the thermostat. When refrigeration is required and the liquid stop valve is opened, the condenser pressure is applied to the piston of the suction valve which is greater than the combined pressure of the coiled spring and the evaporator or gas pressure on the upper valve disk 9 causing the valve disk 9 to open. The valve disk 9 remains in its open position as long as liquid is fed to the evaporator coil. When refrigeration is discontinued and the liquid stop valve closed, the pressure in the liquid line between the stop valve and the expansion or float valve is gradually reduced to the pressure inside of the evaporator and this permits the suction stop valve to close. The opening movement of the valve disk 9 is controlled by the needle valve of the control assembly so that the valve disk 9 will open at the proper time with relation to the flow of the liquid through the liquid line. As the device is entirely enclosed, it will operate under any moisture conditions.

I claim:

1. A stop valve comprising a housing, a high pressure passage in said housing, a low pressure passage in said housing, a valve normally seated to close said low pressure passage, a piston actu-

ated means for unseating said low pressure valve, said piston actuated means provided with a piston operable in a chamber interposed between said high pressure passage and said low pressure passage, said piston chamber communicating with said high pressure passage through a communication orifice, an adjustable fixed needle valve in said communication orifice to control flow volume from said high pressure passage through said communication orifice for timing actuation of said piston by fluid pressure provided by fluid passing from said high pressure passage through said communication orifice to said piston chamber, and a by-pass between said high pressure passage and said communication orifice having a pressure actuated check valve interposed therein operable to accelerate closing of said low pressure valve upon release of fluid pressure in said high pressure section, and a check valve in said high pressure passage to prevent counterflow of gas therethrough.

2. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a body portion having a gas inlet and a gas outlet for connection with the suction line of the refrigeration system and provided with a passage connecting the gas inlet and outlet, a valve member operating between the gas inlet and outlet for opening and closing communication between the same, a spring for urging the valve member to its closed position, a piston connected with the valve member, a body portion having a liquid passage for connection with the liquid line of the refrigeration system and provided with a liquid conduit communicating with the liquid passage and arranged to deliver liquid pressure to the piston for actuating the same to move the valve member to its open position, a by-pass passage connecting the liquid conduit with the liquid passage, check valves located in the by-pass passage and in the liquid passage for preventing counterflow of gas through the said passages, said check valves comprising check valve sleeves having interior valve seats, and check valve disks arranged within the sleeves cooperating with the valve seats, the last mentioned body portion being provided with openings receiving the valve sleeves.

3. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a body portion having a gas inlet and a gas outlet for connection with the suction line of the refrigeration system and provided with a passage connecting the gas inlet and outlet, a valve member operating between the gas inlet and outlet for opening and closing communication between the same, a spring for urging the valve member to its closed position, a piston connected with the valve member, a body portion having a liquid passage for connection with the liquid line of the refrigeration system and provided with a liquid conduit communicating with the liquid passage and arranged to deliver liquid pressure to the piston for actuating the same to move the valve member to its open position, means for controlling the passage of liquid through the said conduit for controlling the opening movement of the valve member, and means including a by-pass between said conduit and said liquid passage and a check valve interposed in said by-pass operable to quickly release the liquid pressure from said piston to accelerate closing of said valve, the inlet to said by-pass being located between said controlling means and said piston.

4. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a body portion having a gas inlet and a gas outlet for connection with the suction line of the refrigeration system and provided with a passage connecting the gas inlet and outlet, a valve member operating between the gas inlet and outlet for opening and closing communication between the same, a spring for urging the valve member to its closed position, a piston connected with the valve member, a body portion having a liquid passage for connection with the liquid line of the refrigeration system and provided with a liquid conduit communicating with the liquid passage and arranged to deliver liquid pressure to the piston for actuating the same to move the valve member to its open position, a by-pass passage connecting the liquid conduit with the liquid passage, and a check valve located in the by-pass passage, said check valve being automatically operable by pressure of liquid returning from said liquid conduit whereby pressure against said piston and closing of said valve between the gas inlet and outlet is accelerated.

5. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a body portion having a gas inlet and a gas outlet for connection with the suction line of the refrigeration system and provided with a passage connecting the gas inlet and outlet, a valve member operating between the gas inlet and outlet for opening and closing communication between the same, a spring for urging the valve member to its closed position, a piston connected with the valve member, a body portion having a liquid passage for connection with the liquid line of the refrigeration system and provided with a liquid conduit communicating with the liquid passage and arranged to deliver liquid pressure to the piston for actuating the same to move the valve member to its open position, an adjustable needle valve for controlling the passage of liquid through the said conduit for controlling the opening movement of the valve member, means for quickly releasing the liquid pressure against said piston to accelerate closing of the valve between said gas inlet and outlet, and a check valve in the liquid passage for preventing counterflow of gas therein, said check valve comprising a check valve sleeve having an interior valve seat, and a check valve disk arranged within the sleeve and cooperating with the valve seat.

6. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a body portion having a gas inlet and a gas outlet for connection with the suction line of the refrigeration system and provided with a passage connecting the gas inlet and outlet, a valve member operating between the gas inlet and outlet for opening and closing communication between the same, a spring for urging the valve member to its closed position, a piston connected with the valve member, a body portion having a liquid passage for connection with the liquid line of the refrigeration system and provided with a liquid conduit communicating with the liquid passage and arranged to deliver liquid pressure to the piston for actuating the same to move the valve member to its open position, a by-pass passage connecting the liquid conduit with

the liquid passage, check valves located in the by-pass passage and in the liquid passage for preventing counterflow of gas through the said passages, said check valves comprising check valve sleeves having interior valve seats, check valve disks arranged within the sleeves cooperating with the valve seats, the last mentioned body portion being provided with openings receiving the valve sleeves, retaining plugs threaded into the said openings for securing the sleeves in the said openings, and a filler block interposed between the check valve of the by-pass passage and the retaining plug associated with such check valve.

7. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a body portion having a gas inlet and a gas outlet for connection with the suction line of the refrigeration system and provided with a passage connecting the gas inlet and outlet, a valve member operating between the gas inlet and outlet for opening and closing communication between the same, a spring for urging the valve member to its closed position, a piston connected with the valve member, a body portion having a liquid passage for connection with the liquid line of the refrigeration system and provided with a liquid conduit communicating with the liquid passage and arranged to deliver liquid pressure to the piston for actuating the same to move the valve member to its open position, a by-pass passage connecting the liquid conduit with the liquid passage, check valves located in the by-pass passage and in the liquid passage for preventing counterflow of gas through the said passages, said check valves comprising sleeves having interior valve seats and provided with opposite openings and having an exterior recess extending around each sleeve, check valve disks arranged within the sleeves and cooperating with the valve seats, said last mentioned body portion having clean-out openings communicating with the recesses of the sleeves, and clean-out plugs normally closing the clean-out openings.

8. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a main valve body having a gas outlet and a gas inlet and a passage connecting the same and provided with upper and lower cylindrical chambers and having valve seat rings mounted therein, an upper valve disk cooperating with the upper valve seat ring for opening and closing communication between the gas inlet and the gas outlet, said upper valve disk having wings guided in the upper cylindrical chamber, a lower valve disk cooperating with the lower valve seat ring and having a piston head operating in the lower cylinder, a piston stem connecting the upper valve disk with the piston head, a coiled spring arranged within the upper cylindrical chamber and bearing against the said wings for urging the upper valve disk to its closed position, a lower check valve body secured to the main valve body and having a liquid passage and a liquid conduit communicating with the liquid passage and arranged to deliver pressure to the lower valve disk and the piston head for opening the upper valve disk, means including a by-pass between said liquid passage and said liquid conduit and a valve member operable therein to quickly release the liquid pressure from said piston to accelerate closing said upper valve disk and a check valve in said liquid passage to prevent counterflow of gas therethrough.

9. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a main valve body having a gas outlet and a gas inlet and a passage connecting the same and provided with upper and lower cylindrical chambers and having valve seat rings mounted therein, an upper valve disk cooperating with the upper valve seat ring for opening and closing communication between the gas inlet and the gas outlet, said upper valve disk having wings guided in the upper cylindrical chamber, a lower valve disk cooperating with the lower valve seat ring and having a piston head operating in the lower cylinder, a piston stem connecting the upper valve disk with the piston head, a coiled spring arranged within the upper cylindrical chamber and bearing against the said wings for urging the upper valve disk to its closed position, a lower check valve body secured to the main valve body and having a liquid passage and a liquid conduit communicating with the liquid passage and arranged to deliver pressure to the lower valve disk and the piston head for opening the upper valve disk, a needle valve mounted in the lower check valve body and arranged to control the passage of liquid from the liquid passage to the liquid conduit for controlling the opening movement of the upper valve disk, and check valves for preventing counterflow of gas through the liquid passage and the liquid conduit.

10. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a main valve body having a gas outlet and a gas inlet and a passage connecting the same and provided with upper and lower cylindrical chambers and having valve seat rings mounted therein, an upper valve disk cooperating with the upper valve seat ring for opening and closing communication between the gas inlet and the gas outlet, said upper valve disk having wings guided in the upper cylindrical chamber, a lower valve disk cooperating with the lower valve seat ring and having a piston head operating in the lower cylinder, a piston stem connecting the upper valve disk with the piston head, a coiled spring arranged within the upper cylindrical chamber and bearing against the said wings for urging the upper valve disk to its closed position, a lower check valve body secured to the main valve body and having a liquid passage and a liquid conduit communicating with the liquid passage and arranged to deliver pressure to the lower valve disk and the piston head for opening the upper valve disk, a needle valve for controlling the flow of liquid from the liquid passage to the liquid conduit for controlling the opening movement of the upper valve disk, said lower check valve body having a by-pass communicating with the liquid passage and with the conduit at a point between the needle valve and the piston for permitting free flow of liquid from the piston to the liquid passage, and check valves for preventing counterflow of gas through the liquid passage and the by-pass passage.

11. A pressure actuated suction stop valve for refrigeration systems having a suction line and a liquid line, said valve including a main valve body having a gas inlet and a gas outlet and a passage connecting the same and provided with upper and lower cylindrical chambers and having valve seat rings mounted therein, an upper valve disk

cooperating with the upper valve seat ring for opening and closing communication between the gas inlet and the gas outlet, said upper valve disk having wings guided in the upper cylindrical chamber, a lower valve disk cooperating with the lower valve seat ring and having a piston head operating in the lower cylinder, a piston stem connecting the upper valve disk with the piston head, a coiled spring arranged within the upper cylindrical chamber and bearing against the said wings for urging the upper valve disk to its closed position, a lower check valve body secured to the main valve body and having a liquid passage and a liquid conduit communicating with the liquid passage and arranged to deliver pressure to the lower valve disk and the piston head for opening the upper valve disk, a needle valve for controlling the flow of liquid from the liquid passage to the liquid conduit for controlling the opening movement of the upper valve disk, said lower check valve body having a by-pass communicating with the liquid passage and with the conduit at a point between the needle valve and the piston for permitting free flow of liquid from the piston to the liquid passage, check valves for preventing counterflow of gas through the liquid passage and the by-pass passage, a stuffing box for the needle valve, and a bottom cap threaded on the end of the lower check valve body and covering the needle valve.

HARRY W. NEVIN.

CERTIFICATE OF CORRECTION.

Patent No. 2,163,800. June 27, 1939.

HARRY W. NEVIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 20, strike out the reference numeral 10; line 23, for the word "row" read flow; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of August, A. D. 1939.

Leslie Frazer

(Seal) Acting Commissioner of Patents.

cooperating with the upper valve seat ring for opening and closing communication between the gas inlet and the gas outlet, said upper valve disk having wings guided in the upper cylindrical chamber, a lower valve disk cooperating with the lower valve seat ring and having a piston head operating in the lower cylinder, a piston stem connecting the upper valve disk with the piston head, a coiled spring arranged within the upper cylindrical chamber and bearing against the said wings for urging the upper valve disk to its closed position, a lower check valve body secured to the main valve body and having a liquid passage and a liquid conduit communicating with the liquid passage and arranged to deliver pressure to the lower valve disk and the piston head for opening the upper valve disk, a needle valve for controlling the flow of liquid from the liquid passage to the liquid conduit for controlling the opening movement of the upper valve disk, said lower check valve body having a by-pass communicating with the liquid passage and with the conduit at a point between the needle valve and the piston for permitting free flow of liquid from the piston to the liquid passage, check valves for preventing counterflow of gas through the liquid passage and the by-pass passage, a stuffing box for the needle valve, and a bottom cap threaded on the end of the lower check valve body and covering the needle valve.

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