April 16, 1940. S. W. E. ANDERSSON 2,197,201

REFRIGERATION

Filed Nov. 28, 1936 3 Sheets-Sheet 1

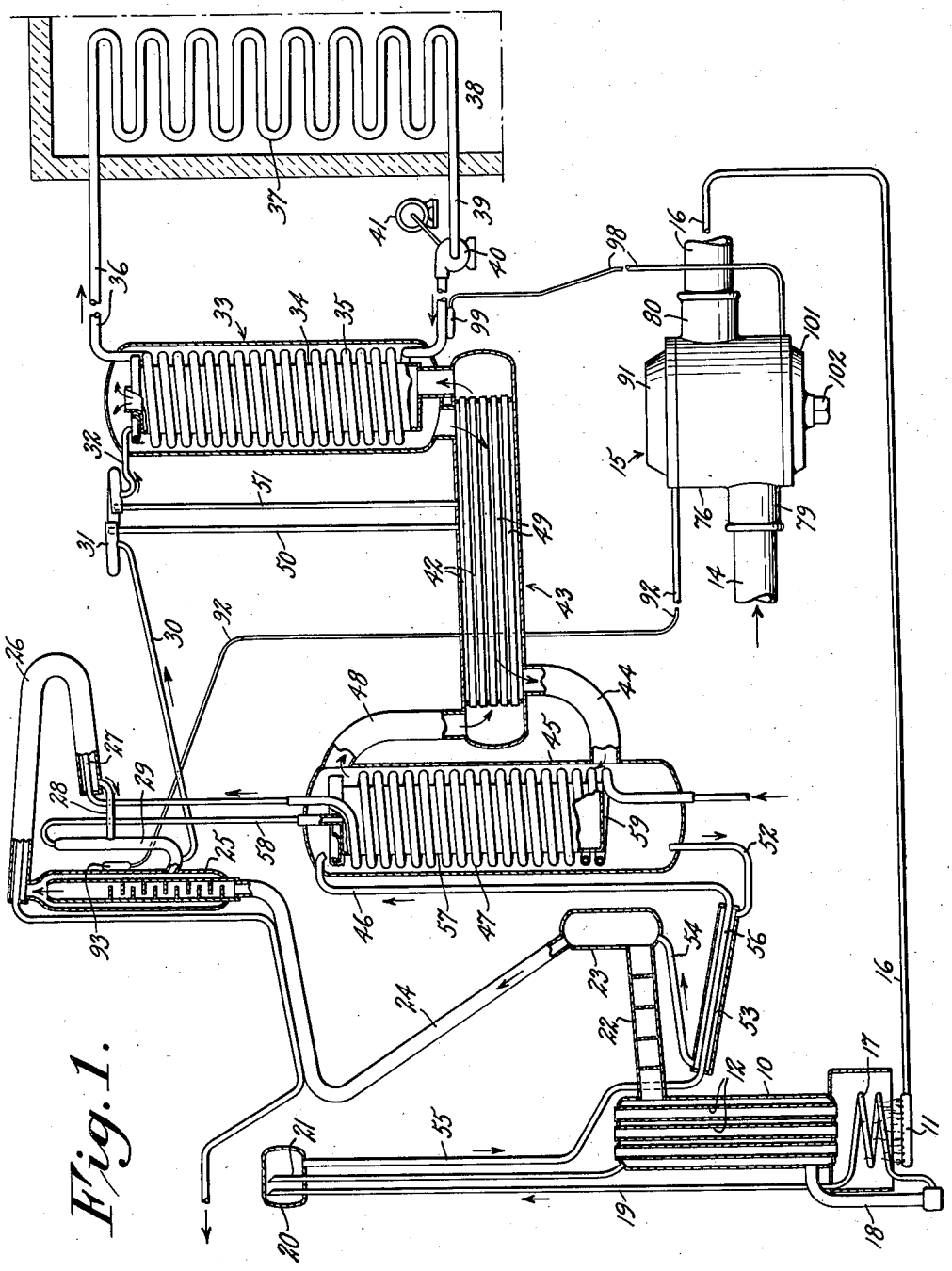


Fig. 1.

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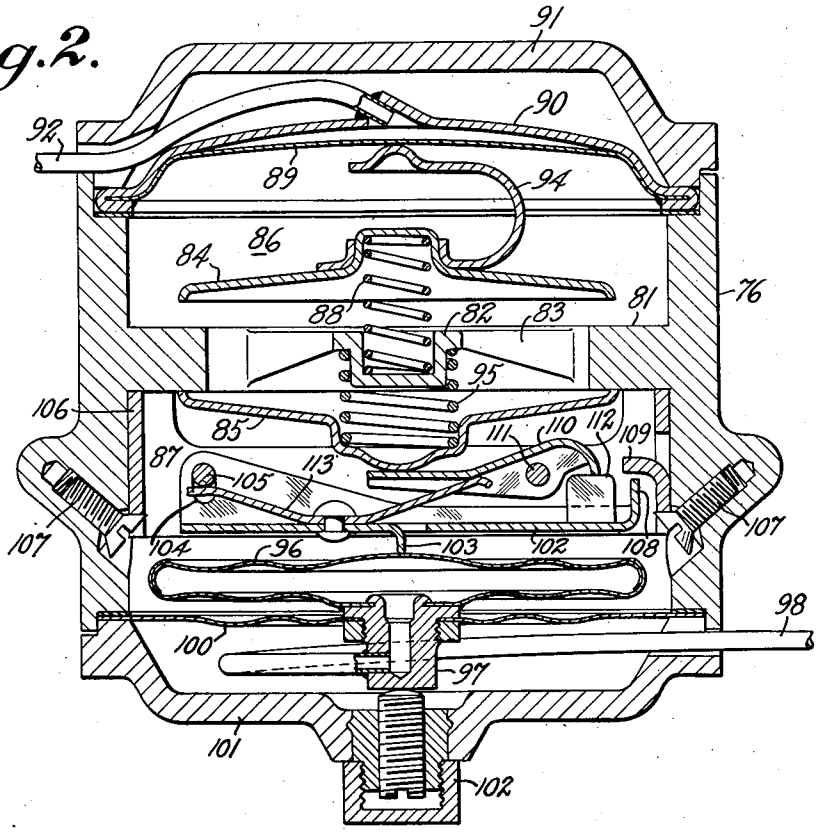
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REFRIGERATION

Filed Nov. 28, 1936 3 Sheets-Sheet 2

Fig. 2.



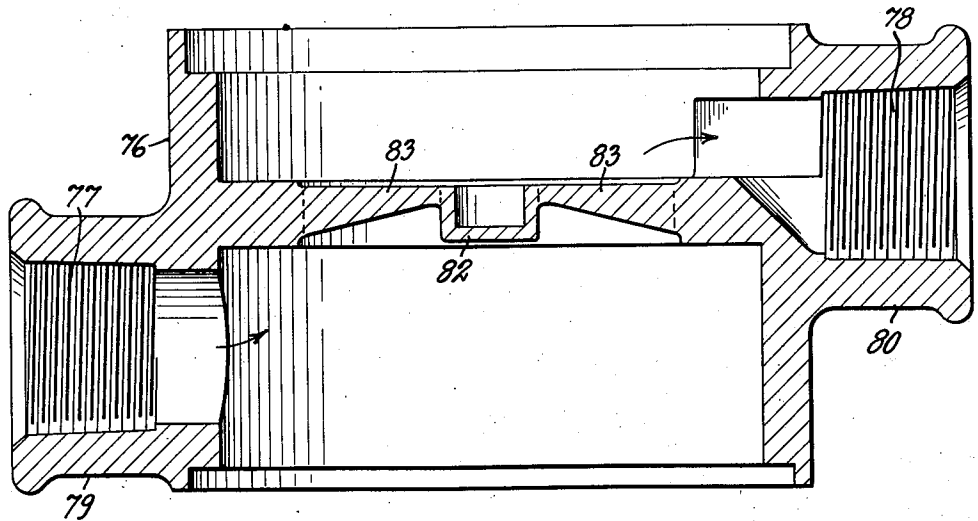


Fig. 5.

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REFRIGERATION

Filed Nov. 28, 1936 3 Sheets-Sheet 3

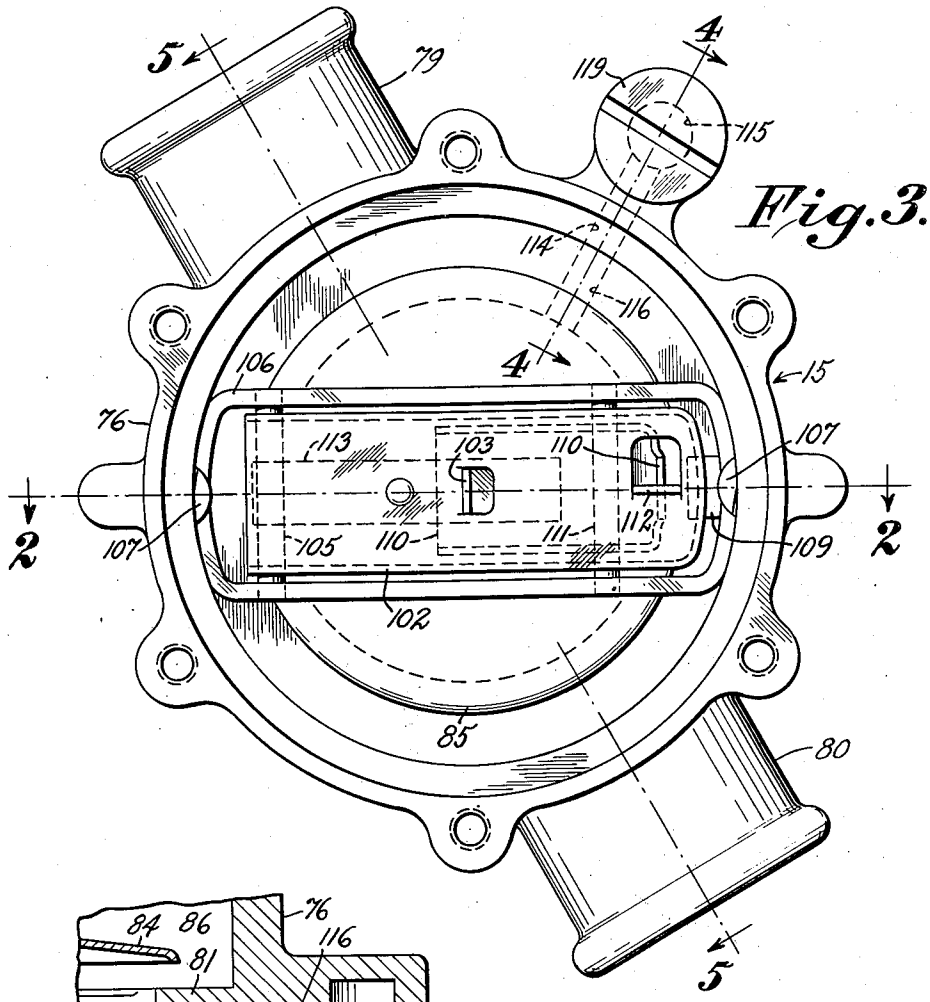


Fig. 3.

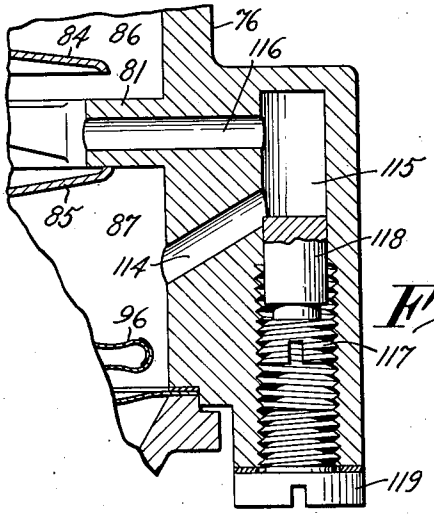


Fig. 4.

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Patented Apr. 16, 1940 2,197,201

UNITED STATES PATENT OFFICE

2,197,201

REFRIGERATION

Sven W. E. Andersson, Evansville, Ind., assignor to Servel, Inc., New York, N. Y., a corporation of Delaware

Application November 28, 1936, Serial No. 113,154

11 Claims. (Cl. 62—5)

My invention relates to refrigeration, and more particularly to a control device for refrigeration apparatus.

It is an object of my invention to provide an improved control device which is sensitive and yet reliable in operation for controlling the heat supply of refrigeration apparatus of the absorption type.

The invention, together with the objects and advantages thereof, will become apparent as I next describe the control device in connection with absorption refrigeration apparatus like that described in application Serial No. 107,852 of Albert R. Thomas, filed October 27, 1936, and the features of novelty which characterize my invention will be pointed out with particularity in the claims forming a part of this specification.

In the drawings, Fig. 1 diagrammatically illustrates refrigeration apparatus of the absorption type provided with a control device embodying my invention; Fig. 2 is an enlarged vertical sectional view taken on line 2—2 of Fig. 3 to illustrate more clearly the control device shown in Fig. 1; Fig. 3 is an end view of the control device shown in Fig. 2 with the bottom cover plate removed and some of the internal parts removed from the casing; Fig. 4 is a fragmentary sectional view taken on line 4—4 of Fig. 3; and Fig. 5 is a sectional view taken on line 5—5 of Fig. 3 with the internal parts removed from the casing.

Referring to Fig. 1, I have shown my improved control device in connection with absorption refrigeration apparatus of a uniform pressure type and like that described in the above application of Albert R. Thomas. The refrigeration apparatus comprises a generator 10 containing a refrigerant, such as ammonia, in solution in an absorption liquid, such as water. The generator 10 is heated by a gas burner 11 which is adapted to project its flame into the lower end of a plurality of tubes 12 which extend vertically upward through the generator. A combustible gas is delivered from a source of supply through a conduit 14, a control device 15 hereinafter to be described, and conduit 16 to the burner 11.

The burner 11 is also adapted to heat a coil 17 which is connected by a conduit 18 to the lower part of the generator 10. Absorption liquid enriched in refrigerant is heated in the coil 17 and is raised by vapor-lift action through a tube 19 into the upper part of a vessel 20 in which the refrigerant vapor and absorption liquid are separated. The liberated refrigerant vapor flows downward through a vertical conduit 21 into the upper part of the generator 10 and this vapor, together with refrigerant vapor expelled from solution in the generator 10, passes through absorption liquid in an inclined conduit 22 and a vessel 23 which together constitute an analyzer.

The refrigerant vapor flows upward from the vessel 23 through a conduit 24 and a liquid-cooled rectifier 25 into a condenser 26. The refrigerant is liquefied in the condenser 26 by a cooling medium, such as water, which circulates through a pipe 27 extending through the condenser. The liquefied refrigerant flows from the condenser 27 through a conduit 28 and U-shaped conduit 29 to the rectifier 25, so that any vaporized absorption liquid accompanying the refrigerant vapor is condensed and drains back to the vessel 23.

From the U-shaped conduit 29 liquid refrigerant flows through a conduit 30, a coil 31, and conduit 32 into an evaporator 33. An inert gas, such as hydrogen, enters the upper part of the evaporator 33 from the upper end of a cylinder 34 arranged within the evaporator. The liquid refrigerant flows downward over the surface of a coil 35 which is arranged about the cylinder 34, and the refrigerant evaporates and diffuses into the inert gas with consequent absorption of heat from the surroundings to produce a refrigerating effect. This refrigerating effect is utilized to cool a fluid, such as brine, for example, which flows through the coil 35 and is conducted by a conduit 36 to a cooling coil 37 which is arranged in a thermally insulated storage compartment 38. The cooled fluid in the coil 37 produces cold in the storage compartment 38 and is conducted through a conduit 39 back to the evaporator coil 35, such circulation of the fluid between the coils 35 and 37 being effected by a pump 40 which is connected in the conduit 39 and adapted to be driven by an electric motor 41.

The resulting gas mixture of inert gas and refrigerant, that is, gas rich in refrigerant, flows from the evaporator 33 through the outer passage 42 of a gas heat exchanger 43 and a downward extending conduit 44 into the lower part of an absorber 45.

The refrigerant vapor is absorbed out of the gas mixture into absorption liquid which enters the upper part of the absorber 45 through a vertically extending conduit 46, and the heat liberated with such absorption of refrigerant is transferred to the cooling medium, such as water, flowing upward within a coil 47 which is disposed within the absorber and connected at its upper end to the conduit 27. The inert gas, which is practically insoluble and weak in refrigerant vapor, passes from the absorber 45 through con-

duit 48, a plurality of parallel tubes 49 which form the inner passage of the gas heat exchanger 43, and cylinder 34 into the upper part of the evaporator 33.

The gas rich in refrigerant vapor flows upward from the outer passage 42 of the gas heat exchanger 43 through a vertically extending conduit 50 into the upper part of the coil 31, and, since the partial vapor pressure of refrigerant in the rich gas mixture is less than the vapor pressure of warm liquid refrigerant flowing through the coil 31, liquid refrigerant evaporates and diffuses into the rich gas mixture with consequent absorption of heat from the liquid refrigerant. The rich gas flows downward through conduit 51 into the outer passage 42 of the gas heat exchanger 43. A local circulation of rich gas is set up in the fluid circuit comprising the coil 31 and conduits 50 and 51, so that refrigerant is pre-cooled in the coil 31 before entering the upper part of the evaporator 33.

The absorption liquid flowing downward in the absorber 45 in counter-flow to the gas mixture becomes enriched in refrigerant and flows through conduit 52, outer passage 53 of a liquid heat exchanger, conduit 54, vessel 23, and conduit 22 to the generator 10. The absorption liquid flows from the generator 10 through conduit 18 to the coil 17, as explained above, and in the latter is raised by vapor-lift action through tube 19 into the vessel 20. The absorption liquid is raised to a higher level in the vessel 20 than it is in the absorber 45, and absorption liquid weak in refrigerant flows from the vessel 20 through conduit 55, inner passage 56 of the liquid heat exchanger, and conduit 46 into the upper end of the absorber 57.

In order to vary the total pressure in the refrigeration system just described with changes in temperature of the condenser 26, due to changes in temperature of the cooling medium or the rate at which it flows through the condenser, for example, a cylinder 57 disposed within the absorber 45 is utilized as a storage vessel for gas in the gas circuit with the upper part connected by conduit 58 to the U-shaped conduit 29, and the lower part having an opening 59 to provide communication with the gas circuit. The cylinder 57 and conduit 58 provide a path of flow from the condenser 26 to the gas circuit, so that any inert gas which passes through the condenser can flow to the gas circuit and not be trapped in the condenser. Further, should the temperature of the condenser increase so that refrigerant is not liquefied therein, the refrigerant vapor will flow through conduit 58 to displace gas in the cylinder 57 and force such gas into the gas circuit. This raises the total pressure in the system so that an adequate condensing pressure is obtained for the increased temperature of the condenser.

In accordance with my invention, the flow of gas to the burner 11 is controlled by the control device 15 which is connected to the conduits 14 and 16. Referring to Figs. 2, 3 and 5, the device 15 comprises a casing 76 having inlet and outlet openings 77 and 78 formed within bosses 79 and 80 to which are connected the conduits 14 and 16, respectively. The casing 76 is provided with a partition or rim 81 and a central hub member 82 which is connected to the rim 81 by spaced radially extending arms 83. The spaces between the arms 83 form a valve opening, and the opposite sides of the rim 81 serve as seats for valves 84 and 85 which are disposed in the upper and lower chambers 86 and 87, respectively, of the casing 76 and independently movable to close the opening and control the flow of gas from the inlet to the outlet.

The valve 84 is in the form of a disk having a downward extending peripheral edge and an upward extending depressed central portion adapted to receive the upper end of a spiral spring 88, the lower end of which fits into the hollow or recessed part of the hub member 82. The hub member 82 serves to locate and guide the spiral spring 88 which is adapted to urge the valve 84 to its open position.

The valve 84 controls the flow of gas to the burner 12 in response to temperature or pressure by the action of a thermal or pressure element arranged at the upper end of the casing 76. This thermal or pressure element comprises a resilient diaphragm 89 having its peripheral edge secured to the peripheral edge of a plate 90 which in turn is secured between the upper end of the casing 76 and a cover plate 91. At a central opening in the plate 90 is secured one end of a tube 92 which extends through an opening in the cover plate 91 and is connected at its other end to a thermal bulb 93 which is arranged in thermal contact with the liquid cooled rectifier 25, as shown in Fig. 1.

The resilient diaphragm 89 and plate 90, tube 92, and bulb 93 constitute an expansible fluid thermostat adapted to contain a suitable volatile fluid which increases and decreases in volume with corresponding changes in temperature. The resilient diaphragm 89 moves toward and away from the rim 81 with an increase and decrease in volume of the volatile fluid; and these movements of the diaphragm 89 are utilized to regulate the valve 84 and control the flow of gas to the burner 11. As shown, the resilient diaphragm 89 is adapted to bear against the upper end of a C-shaped spring 94 which is secured at its lower end to the central portion of the valve 84.

The valve 84 may be termed a high temperature safety valve in that it is normally maintained in its open position by the spiral spring 88. If for any reason the temperature of the liquid-cooled rectifier 25 becomes relatively high, due to failure of the cooling medium to circulate through the condenser 26, for example, the volatile fluid increases in volume and causes the resilient diaphragm 89 to expand and move downward. With such downward movement of the resilient diaphragm 89 the valve 84, through the action of the C-shaped spring 94, is urged toward its closed position against the tension of the spiral spring 88. The C-shaped spring 94 is, therefore, bodily movable and possesses sufficient stiffness to transmit force therethrough from the resilient diaphragm 89 to valve 84. After the valve 84 is seated on the rim 81 and in its closed position, any further downward movement of the resilient diaphragm 89 is taken up by the C-shaped spring 94, so that undue straining of the diaphragm is avoided. Thus, C-shaped spring 94 is contractible or compressible after valve 84 is closed and the ends thereof are brought closer together to take up excessive movement of resilient diaphragm 89. When the high temperature safety valve 84 is caused to move to its closed position, the supply of gas to the burner 11 is shut off completely, whereby heat is no longer applied to the refrigeration apparatus.

The valve 85 is also in the form of a disk having an upward extending peripheral edge and a downward extending depressed central portion

adapted to receive the lower end of a spiral spring 95, the upper end of which fits over the hub member 82 and bears against a flange formed thereon. The hub member 82 also serves to locate and guide the spiral spring 95 which urges the valve 85 to its open position.

The valve 85 controls the flow of gas to the burner 11 in response to pressure or temperature by the action of a thermal or pressure element arranged at the lower end of the casing 76. This thermal or pressure element comprises an expansible diaphragm 96 which is secured to and in open communication with a hollow hub member 97 to which is connected one end of a tube 98, the other end of which is connected to a thermal bulb 99 arranged in thermal contact with the conduit 39 of the refrigeration apparatus, as shown in Fig. 1. The hub member 97 is mounted on a resilient diaphragm 100 which is secured at its peripheral edge between the lower end of the casing 76 and a cover plate 101 having an opening through which the tube 98 passes. The cover plate 101 is provided with an adjustment screw 102 for adjusting the position of the resilient diaphragm 100 and hence the position of the expansible diaphragm 96.

The expansible diaphragm 96, tube 98, and bulb 99 also constitute an expansible fluid thermostat adapted to contain a suitable volatile fluid which increases and decreases in volume with corresponding changes of temperature. The expansible diaphragm 96 expands and contracts with an increase and decrease in volume of the volatile fluid, and these movements are transmitted to the valve 85 to regulate the latter and control the flow of gas to the burner 11.

The structure in chamber 87 for transmitting movements of the expansible diaphragm 96 to effect the control of the valve 85 is mounted within the interior of the casing and comprises a lever 102 having a downward extending projection 103 intermediate its ends against which the expansible diaphragm 96 is adapted to bear. The lever 102 is provided with an elongated opening 104 at one end thereof through which extends a pin 105 fixed to an annular member 106 which is substantially rectangular in section, as shown in Fig. 3. The annular member 106 fits tightly within the casing 76 and is maintained in position against the underside of the rim 81 by screws 107. The lever 102 is adapted to be pivoted on the pin 105 and at the outer end thereof is provided with an upturned end 108 which is adapted to contact an inward extending projection 109 formed on the annular member 106.

A second lever 110 bearing against the bottom of the depressed portion of the valve 85 is pivoted on a pin 111 also fixed to the annular member 106. The short arm of the lever 110 is provided with a downward curved portion which contacts the top edge of an upward extending tab 112 of the lever 102. A flat spring 113 is secured intermediate its ends to the lever 102 with one arm thereof inclined upward and bearing against the underside of the pin 105 about which the lever 102 is pivoted. The other arm of the spring 113 is also inclined upward and bears against the underside of a flange of the lever 110.

The structure which is disposed in the lower chamber 87 and just described is effective to control the valve 85 and hence the flow of gas to the burner 11, so that the cooling element or evaporator 33 of the refrigeration apparatus will be capable of maintaining the storage compartment 38 at a desired low temperature. When the temperature of the storage compartment 38, and hence the temperature of the cooling fluid in the conduit 39, tends to rise above the desired low temperature, the volatile fluid of the expansible fluid thermostat increases in volume and causes the expansible diaphragm 96 to expand whereby the lever 102 against which it bears is moved upward about the pin 105. With such upward movement of the lever 102, the upward extending tab 112 bears against the short arm of the lever 110 and moves the long arm thereof downward against the tension of leaf spring 113. The downward movement of the long arm of the lever 110 permits the spiral spring 95 to urge the valve 85 downward to its open position to increase the flow of gas to the burner 12. With an increased flow of gas to the burner 11 the refrigerating effect produced in the evaporator 33 is increased whereby the cooling fluid in the circuit including the evaporator coil 35 and cooling coil 37 becomes effective to produce more cold in the storage compartment 38.

When the temperature of the storage compartment 38, and hence the temperature of the cooling fluid in the conduit 39, tends to fall below the desired temperature, the volatile fluid becomes reduced in volume and causes the expansible diaphragm 96 to contract whereby the lever 102 is moved downward about the pin 105. With such downward movement of the lever 102, the inclined portion of the leaf spring 113 bearing against the flange of the lever 110 becomes effective to move the valve 85 toward its closed or seated position against the tension of the spiral spring 95. The extent that the spring 113 is effective to move the valve 85 to its closed position is dependent, of course, upon the distance that the tab 112 of the lever 102 is moved downward, the short arm of the lever 110 always bearing against the upper edge of the tab 112. With a decreased flow of gas to the burner 11 the refrigerating effect produced by the evaporator 33 is reduced whereby the cooling fluid in the circuit including the evaporator coil 35 and cooling coil 37 becomes effective to produce less cold in the storage compartment 38.

The inclined part of the spring 113 which bears against the long arm of the lever 110 is made stronger than the spiral spring 95, so that the former is effective to move the valve 85 to its closed position against the tension developed in the spiral spring 95. The inclined part of the lever spring 113 which bears against the pin 105 is preferably made considerably stronger than the part thereof bearing against the lever 10, so that the upper end of the elongated opening 104 in the lever 102 is normally bearing against the pin 105. When the lever 102 is moved upward, due to expansion of the expansible diaphragm 96, the lever 102 pivots about a first point at the pin 105 for a limited distance, in the manner shown in Fig. 2, until the upturned end 108 contacts the inward extending projection 109 of the annular member 106. With further expansion of the expansible diaphragm 96, the lever 102 is pivoted about a second point at the projection 109 and moves upward against the tension of the left-hand part of the leaf spring 113. By providing the elongated opening 104, therefore, the lever 102 can move relative to the pin 105 and against the tension of the left-hand part of the flat spring 113 after the upturned end 108 has contacted the projection 109 of the annular member 106. In this manner any jamming or dis-

tortion of parts of the structure for transmitting movements of the expansible diaphragm 96 to the valve 85 is avoided.

In order to permit gas to be supplied to the burner 11 when the valve 85 is closed, a by-pass is provided in the casing 76 of the control device 15. As shown in Figs. 3 and 4, gas flows through the by-pass from the lower chamber 87 through an inclined passage 114 into a vertical passage 115, and from the latter through a horizontal passage 116 which extends inward at the rim 81 and is in open communication with the valve opening above the valve 85 when the latter is in its closed or seated position on the rim 81. The quantity of gas flowing through the by-pass is controlled by a regulating screw 117 having a plug 118 at the upper end thereof which is moved axially in the passage 115. By turning the screw 117 from the exterior of the casing after removing an outer screw 119, the plug 118 can be positioned in the passage 115 to control the quantity of gas that can flow from the passage 114 to passage 115 and thence through passage 116 to the burner 112.

In view of the foregoing, it will now be understood that the valve 85, which may be termed the normal control valve, effectively controls the flow of gas to the burner 11 in response to a temperature condition of the storage compartment 38, which temperature condition is affected by the cooling element or evaporator 33 of the refrigeration apparatus; and that the flow of gas may be controlled to maintain the storage compartment, and hence the temperature of the cooling fluid circulated between the evaporator coil 35 and cooling coil 37, at a desired low temperature. When the valve 85 is moved to its closed position due to a predetermined contraction of the expansible diaphragm 96, the flow of gas is not completely shut off but a smaller quantity of gas flows through the by-pass to provide a pilot or minimum flame at the burner 11. However, when the temperature safety valve 84 is caused to move to its closed position, as explained above, the supply of gas to the burner 11 is shut off completely, as clearly shown in Fig. 4.

The control device 15 is so constructed and arranged that it is extremely sensitive to relatively small changes of temperature and yet reliable in operation. This has been effectively accomplished by arranging the levers 102 and 110 in such a manner that a small movement of the lever 102 produces a much greater movement of the lever 110, the lever 102 transmitting its movement to the short arm of the lever 110 so that movement at the end of the long arm thereof, which bears against the valve 85, is mutiplied mechanically. Further, since the lower expansible diaphragm or thermal element 96 is on the same side of the valve opening as the valve 85, the structure for transmitting movements of the thermal element to the valve is such that movement of the thermal element produces an opposite or reverse movement of the valve 85. If desired, a small adjusting screw may be employed in place of the upward extending tab 112 of the lever 102 so that compensation can be made for manufacturing variations when the device is initially adjusted. By providing the C-shaped springs 94 and arranging the lever 102 to be pivoted either at the pin 105 or the projection 109 of the annular member 106, as described above, any application of excessive force on the internal parts of the device that normally may be encountered will not impair the sensitiveness of or otherwise injure the device.

Although I have shown my improved control device in connection with a particular type of refrigeration apparatus, I do not wish to be limited to the particular arrangement set forth, and I intend in the following claims to cover all modifications which do not depart from the spirit and scope of my invention.

What is claimed is:

1. A device for controlling flow of gas to a burner adapted to heat refrigeration apparatus of an absorption type and comprising a casing having an inlet and an outlet for gas and a partition having an opening, two valves disposed at opposite sides of said partition for independently controlling the opening and hence the flow of gas from the inlet to the outlet, one of said valves normally being open, spring means to urge one or both of said valves open, means in said opening permitting flow of gas therethrough and forming a mounting for said spring means, means operative to cause said normally open valve to move to its closed position upon rise of temperature of a part of the refrigeration apparatus, and means responsive to temperature of another part of the refrigeration apparatus for controlling said other valve independently of said normally open valve to control the flow of fuel to the burner.

2. A device for controlling flow of gas to a burner adapted to heat refrigeration apparatus of an absorption type and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, two valves disposed at opposite sides of said partition adapted to control the opening and hence the flow of gas from the inlet to the outlet, one of said valves normally being open, means including a member arranged at the opening and having spaced radially extending arms supported by said partition for locating and guiding said normally open valve, means operative to cause said normally open valve to move to its closed position upon rise of temperature of a part of the refrigeration apparatus, and means responsive to temperature of another part of the refrigeration apparatus for controlling said other valve to control the flow of fuel to the burner.

3. A device for controlling flow of gas to a burner adapted to heat refrigeration apparatus of an absorption type and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, two valves disposed at opposite sides of said partition adapted to control the opening and hence the flow of gas from the inlet to the outlet, a hub member arranged at the opening and having spaced radially extending arms supported by said partition, resilient means arranged between said hub member and one of said valves for normally maintaining the latter in its open position, means operative upon rise of temperature of a part of the refrigeration apparatus to cause said normally open valve to move to its closed position against the tension of said resilient means, and means responsive to temperature of another part of the refrigeration apparatus for controlling said other valve to control the flow of fuel to the burner.

4. A device for controlling flow of gas to a burner adapted to heat refrigeration apparatus of an absorption type and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, two valves dis-

posed at opposite sides of said partition adapted to control the opening and hence the flow of gas from the inlet to the outlet, a hub member arranged at the opening having spaced radially extending arms supported by said partition, two resilient members arranged between said hub member and said valves for normally urging the latter to their open position, means operative upon rise of temperature of a part of the refrigeration apparatus to cause one of said valves to move to its closed position against the tension of said resilient means associated therewith, and means responsive to temperature of another part of the refrigeration apparatus for moving said other valve to its closed position against the tension of said resilient means associated therewith and for permitting said resilient means to move said valve to its open position, thereby regulating the flow of fuel to the burner.

5. A device for controlling flow of gas to a burner adapted to heat refrigeration apparatus of an absorption type and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, a normally open safety valve and a control valve disposed at opposite sides of said partition adapted to control the opening and hence the flow of gas from the inlet to the outlet, a by-pass around only said control valve and extending through said partition into said opening between said valves, a valve in said by-pass adjustable from the exterior of said casing, means operative to cause said normally open safety valve to move to its closed position to shut off the supply of fuel to the burner upon rise of temperature of a part of the refrigeration apparatus, and means responsive to temperature of another part of the refrigeration apparatus for effecting operation of said control valve to control the flow of fuel to the burner.

6. A device for controlling flow of gas to a burner adapted to heat refrigeration apparatus of an absorption type and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, an expansible thermal element located at each end of said casing, two valves disposed at opposite sides of said partition and independently movable to control the opening and hence control the flow of gas from the inlet to the outlet, one of said valves normally being open, means for transmitting movement of one of said elements to said normally open valve, structure including a pair of pivoted levers and a resilient member for transmitting movements of the other of said elements to said other valve, said first thermal element being operative upon rise of temperature to close said normally open valve, and said second thermal element being operative to move said other valve toward and away from its closed position in response to decrease and increase, respectively, of temperature, said structure including said levers and said resilient member being mounted within said casing and so constructed and arranged that movement of said second thermal element toward said other valve is taken up by said levers and said resilient member.

7. A device for controlling flow of gas to the burner adapted to heat refrigeration apparatus and comprising a casing having an inlet and an outlet for gas and a partition having an opening, a valve at one side of said partition for controlling the opening and hence the flow of gas from the inlet to the outlet, resilient means to urge said valve open, means in said opening permitting flow of gas therethrough and forming a mounting for said resilient means, and means responsive to temperature or pressure and acting against said resilient means for operating said valve, a second valve at the other side of said partition for controlling the opening and hence the flow of gas from the inlet to the outlet, and means responsive to temperature or pressure for operating said second valve.

8. A device for controlling flow of gas to a burner adapted to heat refrigerating apparatus and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, an expansible thermal element within said casing, a valve for controlling the opening and hence the flow of gas from the inlet to the outlet, and a contractible member having one end operatively associated with said expansible thermal element and the other end operatively associated with said valve and having sufficient stiffness for transmitting force therethrough from said thermal element to said valve responsive to temperature, said member being contractible after said valve is in its closed position whereby the ends thereof are brought closer together to take up excessive movement of said thermal element.

9. A device for controlling flow of gas to a burner adapted to heat refrigerating apparatus and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, an expansible thermal element within said casing, a valve to control the opening and hence the flow of gas from the inlet to the outlet, a C-shaped spring having one arm thereof fastened to said valve member and the other arm thereof operatively associated with said thermal element, said C-shaped spring being bodily movable with movement of said thermal element and having sufficient stiffness to transmit force therethrough to operate said valve responsive to temperature, and said C-shaped spring being compressible after said valve is in its closed position whereby the arms thereof are movable toward each other to take up excessive movement of said thermal element.

10. A device for controlling flow of gas to a burner adapted to heat refrigerating apparatus and comprising a casing having an inlet and an outlet for gas and a partition provided with an opening, a valve to control the opening and hence the flow of gas from the inlet to the outlet, a thermal element within said casing responsive to changes in temperature, and structure within said casing comprising a plurality of parts including a lever to transmit movements of said thermal element to said valve to operate the latter, said structure being so constructed and arranged that said lever is pivotal about two points and pivots about one of said points a limited distance to operate said valve and then pivots about the other of said points whereby distortion of said parts is avoided.

11. A device for controlling flow of gas to a burner adapted to heat refrigerating apparatus and comprising a casing having an inlet and an outlet and provided with a partition having an opening, said partition dividing said casing into two chambers, a valve movable away from and toward one side of said partition for controlling the opening and hence the flow of gas from the inlet to the outlet, an expansible thermal element within one of said chambers on the same side of said partition as said valve, structure in

said one chamber and including a plurality of parts for transmitting movements of said expansible thermal element to said valve to operate the latter in response to temperature, said structure being so constructed and arranged that with rise of temperature said valve opens and moves away from said one side of said partition toward said expansible thermal element, and means embodied in said structure whereby jamming and distortion of said parts is avoided when said valve and said expansible thermal element move toward each other in said one chamber.

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