May 13, 1941. S. W. E. ANDERSSON 2,241,571

CONTROL MECHANISM FOR REFRIGERATORS

Original Filed June 1, 1934 5 Sheets-Sheet 1

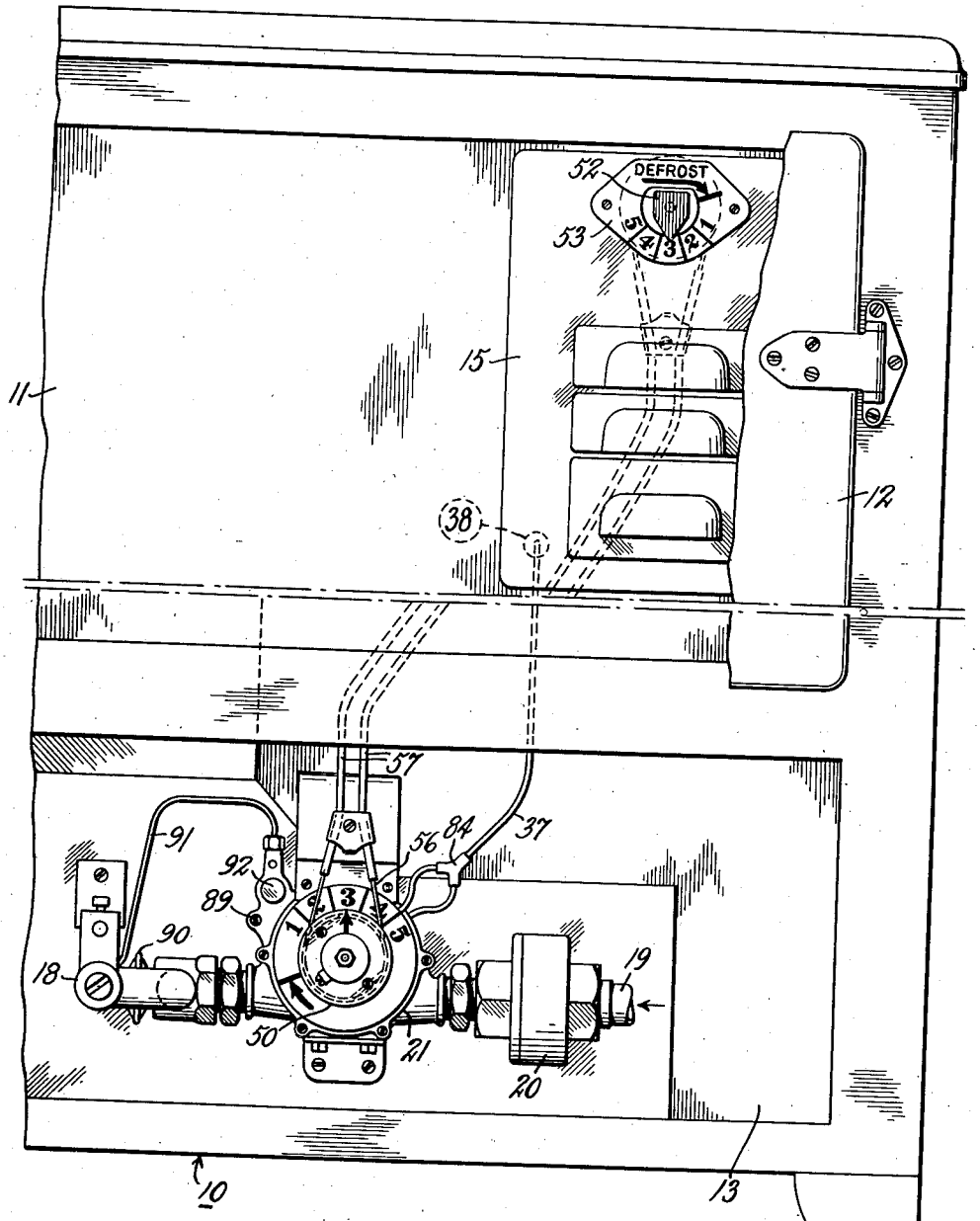


Fig. 1.

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CONTROL MECHANISM FOR REFRIGERATORS

Original Filed June 1, 1934 5 Sheets-Sheet 2

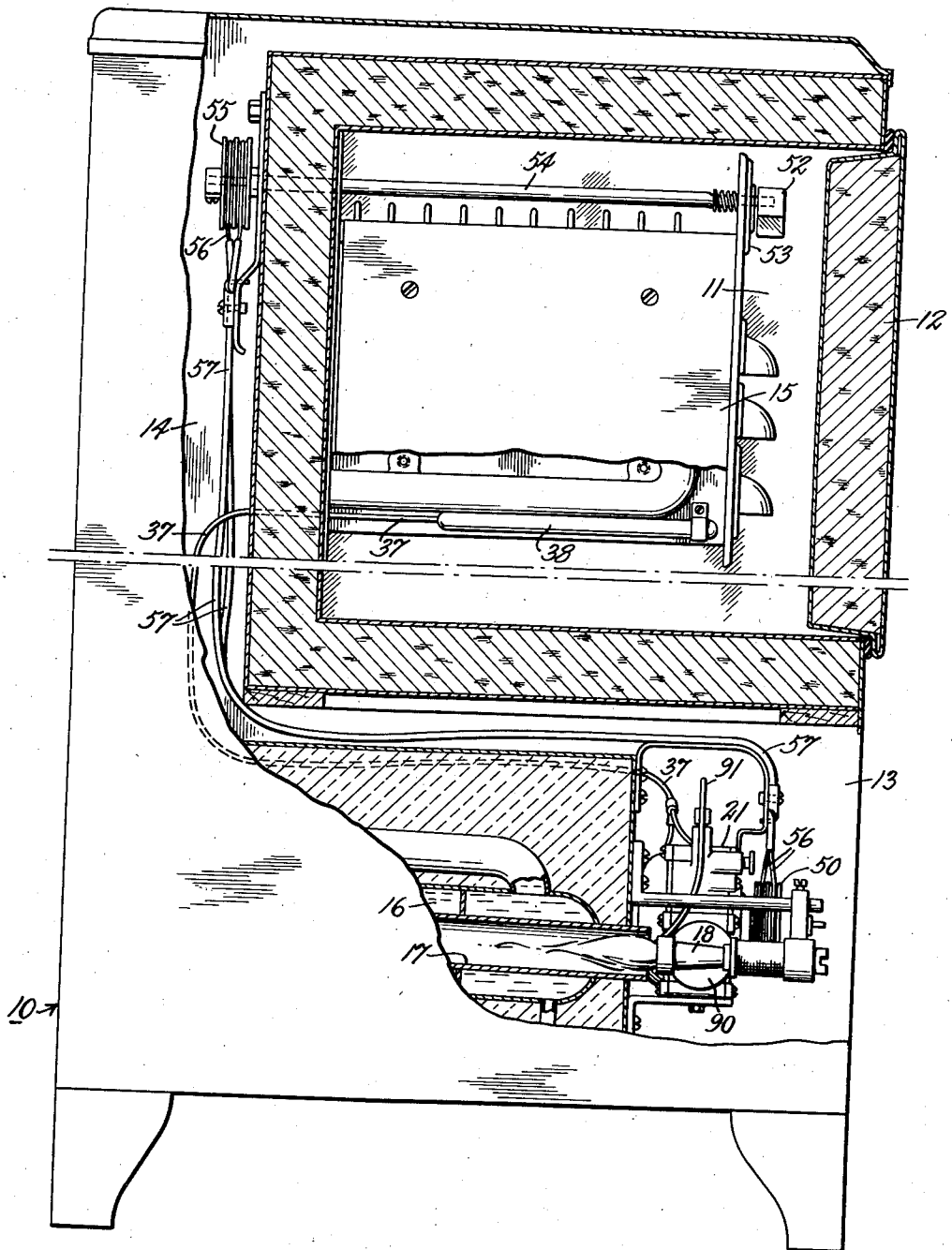


Fig. 2.

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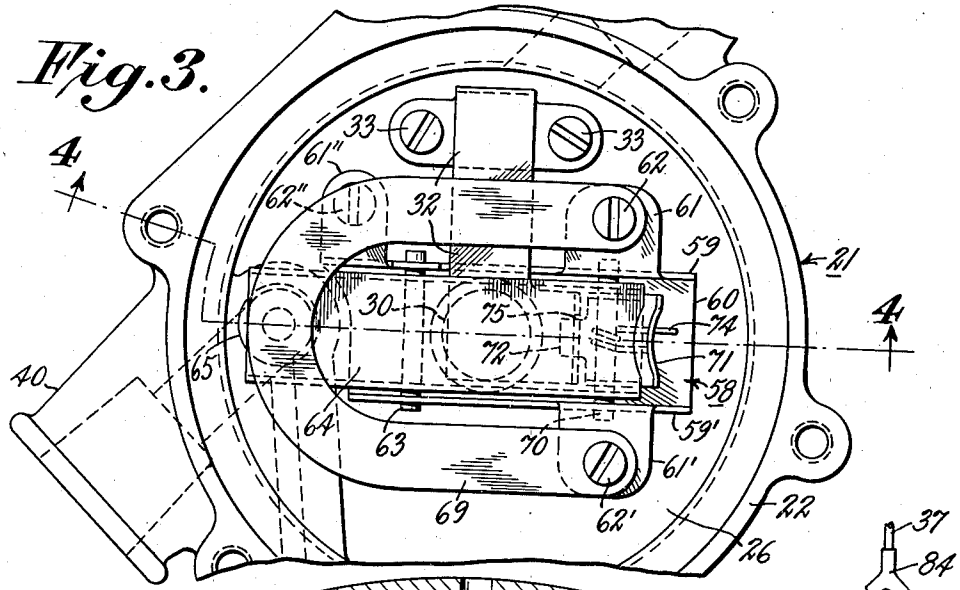
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CONTROL MECHANISM FOR REFRIGERATORS

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Fig. 3.



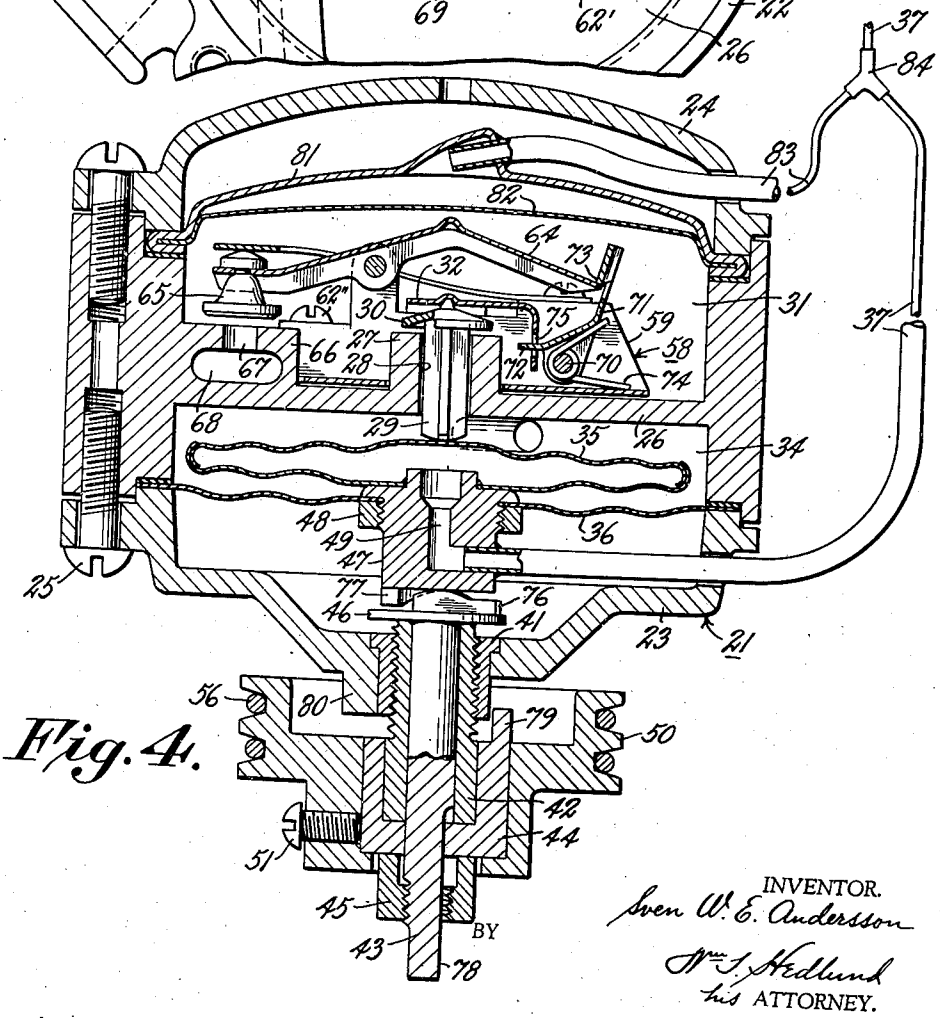


Fig. 4.

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CONTROL MECHANISM FOR REFRIGERATORS

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Fig. 5.

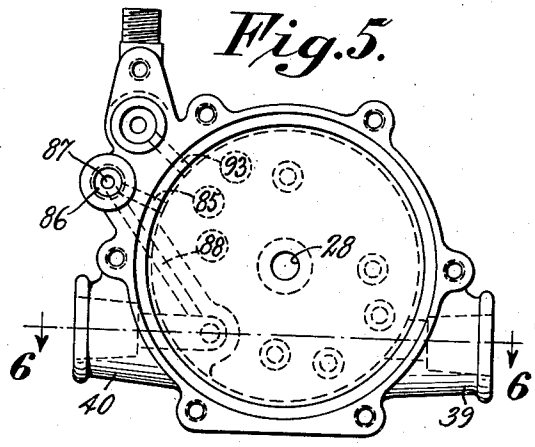


Fig. 6.

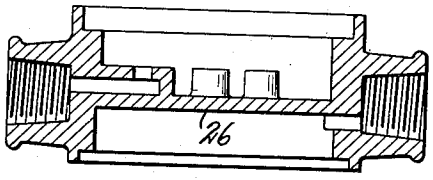
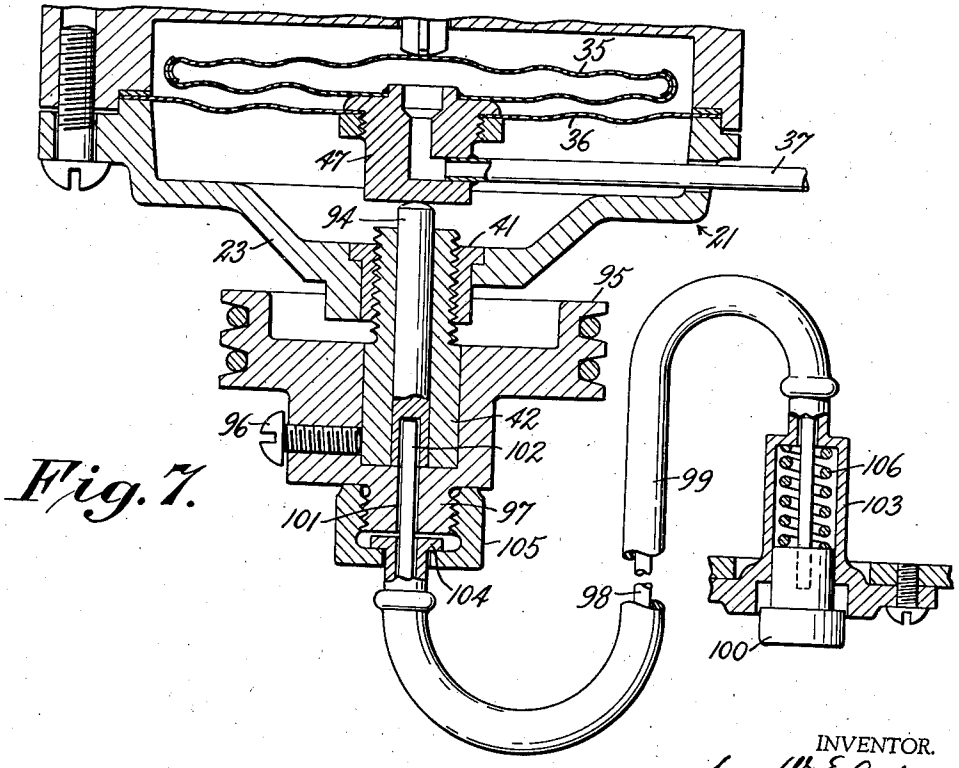


Fig. 7.



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CONTROL MECHANISM FOR REFRIGERATORS

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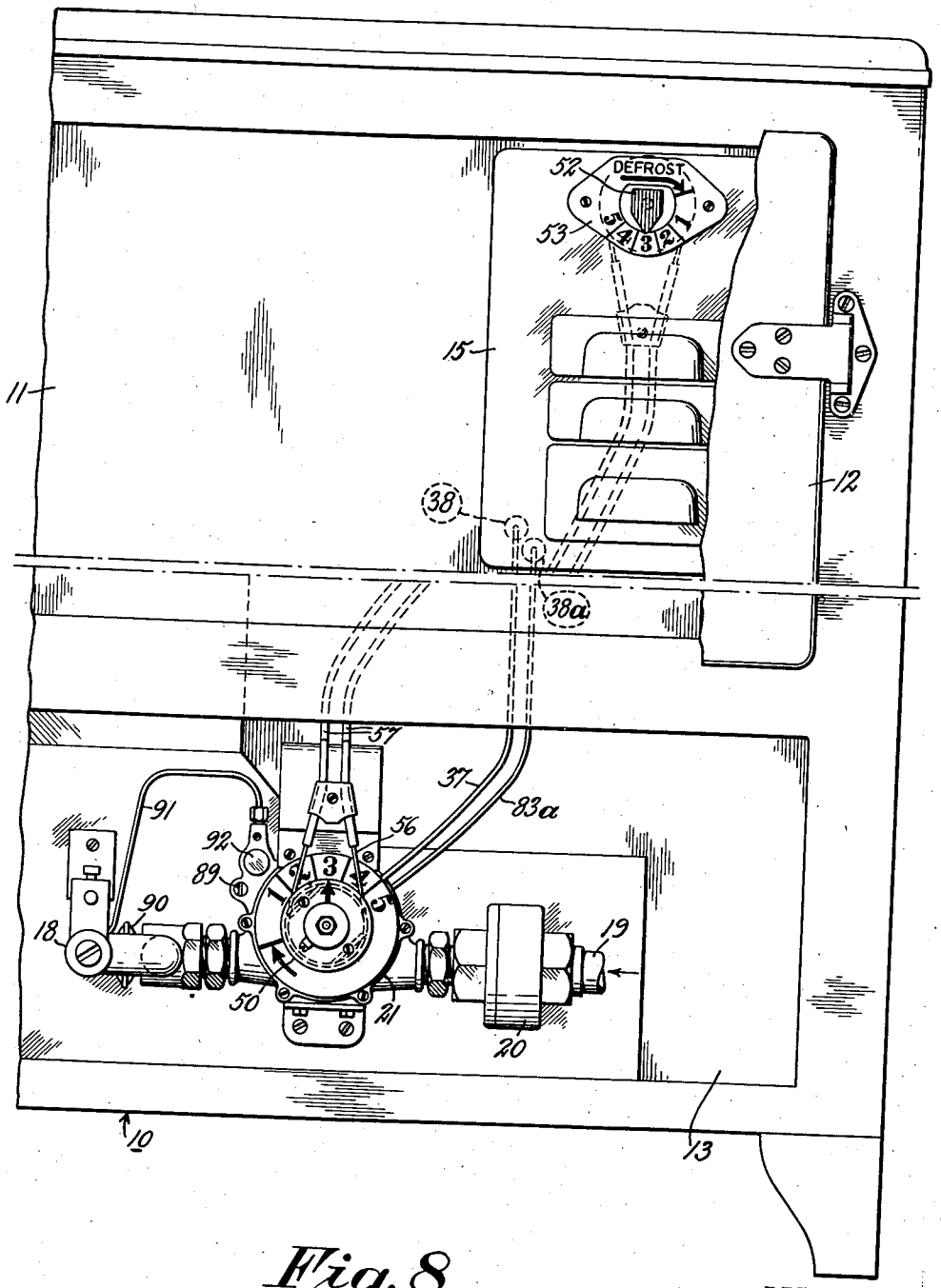


Fig. 8.

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Patented May 13, 1941 2,241,571

UNITED STATES PATENT OFFICE

2,241,571

CONTROL MECHANISM FOR REFRIGERATORS

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

Original application June 1, 1934, Serial No. 728,525, now Patent No. 2,123,920, dated July 19, 1938. Divided and this application March 8, 1938, Serial No. 194,593

9 Claims. (Cl. 137—139)

My invention relates to a control mechanism for refrigerators.

It is an object of the invention to provide a control device which may be remotely operated, for instance, from a point adjacent a cooling element within a storage compartment of a refrigerator. Another object is to provide a control device whereby a refrigerator can be defrosted at will and the defrosting period is terminated automatically upon melting of frost.

It is a further object to provide such a device in combination with a temperature control means for a refrigerator utilizing a minimum number of parts.

This application is a division of my copending application Serial No. 728,525, filed June 1, 1934, now Patent No. 2,123,920, granted July 19, 1938.

In the drawings:

Fig. 1 is a broken view in front elevation of a refrigerator showing the cooling element and a control device contemplated by my invention;

Fig. 2 is a side view partly in vertical section of the arrangement shown in Fig. 1;

Fig. 3 is an enlarged rear end view of the interior of the control device shown in Figs. 1 and 2;

Fig. 4 is a section of the control device on line 4—4 in Fig. 3;

Fig. 5 is a front end view of the housing of the control device;

Fig. 6 is a section taken on line 6—6 in Fig. 5;

Fig. 7 is a partial view of the device similar to Fig. 4, illustrating a modification of the invention; and

Fig. 8 is a view similar to Fig. 1 illustrating another modification of the invention.

Referring to Figs. 1 and 2 of the drawings, a refrigerator cabinet 10, shown schematically in broken view, is of a type well known in the art, comprising an upper heat insulated chamber or food storage compartment 11, accessible by means of an insulated door 12, and a lower apparatus compartment 13, from which a passage 14 extends upwardly at the back of the refrigerator in the rear of the insulated storage compartment 11. In the cabinet is mounted an absorption refrigeration apparatus of the pressure equalized continuous type which itself is well known in the art and needs no further description here. Briefly, however, such apparatus comprises essentially an evaporator or cooling element in which refrigerant fluid, such as ammonia, evaporates by diffusion into an inert pressure equalizing gas, such as hydrogen. The resulting gas mixture flows into an absorber where the refrigerant is absorbed by a suitable liquid absorbent such as water. The inert gas returns to the evaporator and the enriched absorption liquid is conducted to a generator. In the latter, the refrigerant is expelled from solution by heating and the weakened absorption liquid is again conducted through the absorber. The expelled refrigerant is condensed and returned to the evaporator, thus completing the cycle. The generator may be heated by any suitable means such as a gas burner.

Referring again to Figs. 1 and 2, the apparatus, of which only the parts necessary for this description are shown, is mounted in the cabinet with the evaporator 15 located in the storage compartment 11 and the generator 16 located principally in the lower apparatus compartment 13. The other parts of the apparatus are located either in the apparatus compartment 13 or the vertical passage 14. The generator 16 is provided with a flue 17 and is heated by a gas burner 18 directed into the lower end of the flue as best shown in Fig. 2. Gas is supplied to the burner 18 from conduit 19 through a gas filter 20 and a control device 21 respectively.

The control device 21, shown in detail in Figs. 3 to 6, comprises an annular casing or housing consisting of an annular body member 22, a front cover plate 23, and a rear cover plate 24, the cover plates being circular and secured to the body member 22 by screws 25, or other suitable means. The interior of the body member 22 is divided by a partition 26 having a central boss 27 through which is drilled a valve opening 28. Extending through the latter is a stem or valve lifter 29 provided at one end with a valve member 30 in the upper valve chamber 31. The valve member 30 is adapted to seat on the boss 27 to close the valve opening 28. The valve member 30 is biased to its closed position by a suitable leaf spring 32 having one end overlying the valve member and the other end secured by screws 33 to the partition 26. In the valve chamber 34 on the other side of the partition 26 there is located the expansible diaphragm or element 35 of an expansible fluid thermostat. The expansible element 35 is mounted on a resilient diaphragm 36 which is secured at its edge with suitable gaskets between the body member 22 and cover plate 23, thus sealing the valve chamber 34. The expansible element 35 is connected by a capillary tube 37 to a sensitive bulb 38 located in thermal transfer relation with the evaporator 15, as is shown in Figs. 1 and 2. The sensitive bulb 38, capillary tube 37, and expansible element 35 are

charged with a suitable temperature sensitive fluid as well known in the art, and the expansible element 35 is located in operative relation with the valve stem 29, whereby movement of the expansible element 35 responsive to variation in temperature of the evaporator 15 is transmitted by the valve stem 29 to the valve member 30 to control the valve passage 26. The body member 22 is provided with an external boss 39 drilled for passage of gas therethrough into the valve chamber 34 and tapped for gas pipe connection from the gas filter 20 if the latter is employed, or direct connection to the gas supply line 19. A second external boss 40 is drilled for passage of gas from the other valve chamber 31, as more fully described hereinafter, and is tapped for gas pipe connection to the burner 18. Thus the flow of gas to the burner 18 is controlled by valve member 30 which is operated by the expansible element 35 in accordance with the temperature of the evaporator 15.

The cover plate 23 is provided centrally with an inset bushing 41 which is internally threaded to receive in threaded engagement an adjusting assembly comprising a sleeve 42, a pin 43, a cap member 44 and retaining nut 45. The pin 43 is provided near one end with a circular flange 46 so that when the pin 43, sleeve 42, and cap 44 are assembled they are secured together as a unit by the retaining nut 45 which is threaded on the other end of the pin 43 and tightened down against the cap 44. The end of the pin 43 beyond the flange 46 forms an abutment for a member 47. The latter extends centrally through the resilient diaphragm 36 and is secured thereto by a retaining nut 48, thus forming the means by which the expansible element 35 is mounted on the resilient diaphragm 36 and also the means by which the capillary tube 37 is connected to the expansible element, the passage 49 through the member 47 serving this purpose. On the cap member 44 of the adjustment assembly, a grooved pulley 50 is mounted and secured by a set screw 51, or other suitable device. Rotation of the pulley 50 moves the pin 43 on account of the threaded engagement of the sleeve 42 with the fixed cover plate 23, thereby varying the abutment of member 47 on the end of pin 43 to effect the adjustment or setting of the thermostatically operated valve previously described.

It will be understood that the pulley 50 may be replaced by a control knob or dial. However, in the arrangement illustrated it is preferable to have the control knob in the upper part of the refrigerator cabinet on the front of the evaporator, as is shown in Figs. 1 and 2. The adjusting knob 52 is provided with a suitable fixed dial or index plate 53 and is mounted on the end of a rod 54 which extends from the front of the evaporator 15 through the rear wall of the storage compartment 11 into the vertical passage 14 where it is provided with a grooved pulley 55 similar to the pulley 50 on the control device 21. These pulleys are operatively connected by a flexible wire belt 56 provided with a guide casing 57. Turning the knob 52 on the front of the evaporator 15 causes rotation of rod 54, pulley 55, and pulley 50, whereby the adjustment of the control thermostat is varied as previously described. For a purpose which will hereinafter appear, the arrangement just described is so constructed that only a half turn of the control adjustment knob 52 and the parts operated thereby is utilized to obtain full range adjustment of the thermostat.

Referring again more particularly to Figs. 3 and 4, there is provided in the upper valve chamber 31 a bracket 58 which is substantially a channel member comprising side walls 59 upturned from a flat bottom 60. An opening in the bottom 60 of the bracket 58 allows the latter to fit around the central valve boss 27 and the bracket is secured in place on three bosses formed on the partition 26, by tabs 61, 61' and 61'' which extend from the side walls 59 of the bracket and are fastened by screws 62, 62' and 62''. On a pin 63 carried by the bracket 58 is pivoted a valve lever 64 having at one end a valve member 65. A boss 66 on the partition 26 is drilled to form a valve opening 67 and the boss 66 is machined to form a seat for the valve member 65 so that the latter may control flow of gas through the valve opening 67. The latter communicates with a passage 68 which extends through the external boss 40 for passage of gas from the valve chamber 31 to the gas burner 18 as previously described. The valve member 65 and valve lever 64 are biased to the valve closing position by a U-shaped leaf spring 69, the ends of which may be secured by the same screws 62 and 62' which secure the bracket 58 in place as previously described. On another pin 70, carried by the bracket 58, is pivoted a lever 71 having a projection 72 at one end and a catch 73 at the other end, which catch may be formed by striking out a portion of the lever. This lever comprises a trigger and is tensioned by a spring 74 coiled around the pin 70. The valve closing spring 32 is provided with a downturned tab 75, in which tab is a slot which receives the projecting end 72 of the trigger 71. It will now be understood that the catch 73 of the trigger 71 normally engages the end of valve lever 64 to retain the valve member 65 in its open position against the action of the U-shaped spring 69. The engagement of the tab 75 with the end 72 of trigger 71 is such that the trigger 71 will not be tripped to release lever 64 during normal operation of the control valve member 30 and the latter must be moved beyond its fully open position for the tab 75 of the valve spring 32 to lift the end 72 of the trigger 71 against the action of the coiled trigger spring 74.

In order to move the control valve member 30 and the valve spring 32 through an abnormal distance, the previously described pin 43 of the temperature control adjustment is provided with a ridge 76 which cooperates with a spiral cam 77 on the thermostat connecting member 47. This cam extends only 180° and the pin 43 is assembled so that the ledge 76 does not engage the cam during normal operation through the full adjustment range, as previously described. However, when the temperature control adjustment is turned through a further 180° in the direction indicated by the arrows in Fig. 1, the ridge 76 engages the spiral cam 77 and raises the expansible element 35, valve lifter 29, valve member 30, and valve spring 32 whereby the tab 75 operates the trigger 71 to release member 64, as previously described, which allows the valve member 65 to snap closed under the action of the U-shaped spring 69. The adjusting pin 43 is provided with a flat side 78 which cooperates with a corresponding flat side of the aperture through the cap member 44 whereby these parts may be assembled in only one position. The cap member 44 of the temperature control adjustment is provided with a lug 79 which cooperates with a stop 80 on the cover plate 23 to prevent

turning of the temperature control adjustment more than one revolution.

An expansible element 81 provided with a snap action diaphragm 82 is secured with suitable gaskets between the body member 22 and the cover plate 24 thereby sealing the valve chamber 31. The snap action diaphragm 82 of the expansible element 81 and the valve lever 64 are arranged so that downward movement (as seen in Fig. 4) of the center of the diaphragm carries the trigger end of the valve lever 64 into position to be retained by the trigger 71, in which position the valve 65 is open. This valve will be referred to as the defrosting valve, whereas the valve 30 is known as the temperature control valve, or merely control valve. The expansible element 81 is connected by a capillary tube 83 and a T 84 to the capillary tube 37 with the sensitive bulb 38 on the evaporator 15. It will be understood, however, from the following description of operation that a separate bulb 38a and capilliary tube connection 83a may be provided for the expansible element 81, as illustrated in Fig. 8, without changing the result. With the first arrangement however, only one capillary tube is required between the evaporator in the storage compartment and the control device in the lower apparatus compartment of the refrigerator.

In order to provide a minimum flow of gas to the burner for maintaining a pilot flame when either or both of the valves are closed, there is provided a by-pass conduit comprising passages 85, 86, 87 and 88, as best seen in Fig. 5. The by-passed flow of gas from passage 86 into passage 87 is adjusted by a screw type needle valve not shown in Fig. 5, but which is threaded from the exterior into passage 86 which is then closed by a cap screw 89, as shown in Fig. 1. Since the burner 18 is provided with a thermostatic safety device 90, of a type well known in the art, for cutting off the supply of gas to the burner when the flame is extinguished, there is also provided a burner lighter tube 91 controlled by a normally closed manually operated push valve 92. As may be seen in Fig. 5, gas is admitted to the burner lighter valve through a passage 93 from valve chamber 34.

In operation, the gas burner 18 is lighted by opening valve 92 and igniting the gas which issues from the end of the burner lighter tube 91. If the operation is being started for the first time, the evaporator will be at substantially room temperature, wherefore both expansible elements 35 and 81 of the control device 21 will be expanded and valves 30 and 65 will be open. Upon heating of the thermostatic safety valve 90, the latter opens and gas will be admitted to the burner 18 which will become ignited from the flame at the end of the burner lighter tube 91, whereupon the burner lighter valve 92 may be released. After operation of the refrigeration apparatus for a sufficient length of time, the temperature of evaporator 15 will decrease. At a predetermined temperature, the expansible element 81 contracts, that is, the diaphragm 82 snaps inwardly, leaving the defrosting valve lever 64 detained in the open valve position by the trigger 71. The flow of gas to the burner 18, and therefore the operation of the refrigeration apparatus is controlled by the temperature control valve 30 which is operated by the expansible element 35 responsive to the temperature of the cooling element 15 to maintain the latter at a substantially constant value. Turning the control knob 52 on the front of the evaporator 15 over the lower half of the scale varies the adjustment of the control thermostat, as previously described, and thereby varies the temperature at which the evaporator or cooling element 15 will be maintained.

After a further period of operation it will become desirable to remove the frost formation from the evaporator 15, that is, defrost the evaporator. To accomplish this, the control knob 52 on the front of the evaporator 15 is turned clockwise, as indicated by the arrow, to the position marked Defrost. Movement in this direction is limited by the lug 79 contacting the stop 80 on the control device 21, as previously described. The control knob 52 may then be turned back immediately to the setting at which it is desired the apparatus should operate following the defrosting period. In turning the control knob to the "defrost" position, the ledge 76 on the adjustment pin 43 of the control device engages the spiral cam 77 on the connecting member 47 thereby shifting the expansible element 35, valve lifter 29, valve member 30 and valve spring 32 an abnormal distance, and the trigger 71 is swung clockwise, as seen in Fig. 4, by the downturned lug 75 on the valve spring 32 to release the defrosting valve lever 64, whereupon the defrosting valve 65 is snapped closed by the U-shaped spring 69, cutting off the supply of gas to the burner 18 except for that which flows through the by-pass, as previously described, to maintain a minimum pilot flame. The operation of the refrigeration apparatus being interrupted, the temperature of the evaporator 15 will rise to the melting point of the frost coating thereon, whereupon the latter will melt and drop into a suitable receptacle, not shown, positioned beneath the evaporator for this purpose. The expansible element 81 is so designed that upon increase in temperature of the evaporator to the melting point of the frost, the pressure therein increases sufficiently to snap the diaphragm 82 outwardly, thereby opening the defrosting valve 65 and moving the valve lever 64 into such position that it is caught and retained by the projection 73 of the trigger 71, as previously described. Flow of gas to the burner 18 is again resumed and operation of the refrigeration apparatus under control of the thermostatic control valve 30 occurs and the temperature of the evaporator 15 is again decreased to a value determined by the setting of the control knob 52 which was made upon instigation of the defrosting period.

In Fig. 7 there is shown a portion of the control device 21 in a sectional view similar to Fig. 4 illustrating a modification of the arrangement for instigating the defrosting period by shifting the expansible thermostatic element 35. In this modification, the sleeve 42 of the adjustment assembly is provided with an ordinary pin or rod 94 which is reciprocable in the sleeve and has a plain rounded end which forms the abutment for the connecting member 47 of the thermostat. A grooved pulley 95 secured on the sleeve 42 by a set screw 96 is similar to the pulley 50 previously described in connection with Fig. 4 except that the pulley 95 has a hub extension 97 which closes the end of the sleeve 42 and serves as an abutment for the end of the pin 94. There is provided a flexible wire or similar element 98 in a flexible tube or casing 99. One end of the flexible wire 98 is connected to a push button 100 and the other end extends through an opening 101

in the pulley hub extension 97 and is seated in a socket 102 in the end of the adjustment pin 94. The push button 100 is reciprocable in a casing 103 which may be suitably located for ready access by the user as, for instance, on the front of the evaporator 15. One end of the flexible tube 99 is secured to the push button casing 103 and the other end is provided with a flanged member 104 which is secured against substantial axial movement with respect to the pulley hub extension 97 by a retaining ring 105 threaded on the latter. The retaining ring 105 is so designed as to allow rotation of the pulley independently of the flanged member 104 except for a possible slight amount of friction which is substantially constant and therefore unobjectionable.

The push button 100 is biased to its position shown in Fig. 7 by a coil spring 106 in the push button housing 103. To instigate a defrosting period, the push button is manually depressed. This movement of the push button is transmitted by the flexible wire 98 to the pin 94 which shifts the connecting member 47 and expansible element 35 to operate the defrosting valve in the manner previously described. When the push button 100 is released, the parts return to their normal position under the action of the spring 106 and at the end of the defrosting period, operation of the refrigeration apparatus will be resumed, as previously described, to produce refrigeration at the temperature for which the temperature control adjustment described above may be set. In this modification, the temperature adjustment need not be disturbed to effect defrosting.

It will be apparent to those skilled in the art that various other changes may be made in the construction and arrangement without departing from the spirit of the invention, and therefore the invention is not limited to that which is described in the specification and shown in the drawings, but only as indicated in the following claims.

What is claimed is:

1. In mechanism of the character described, a control member, an element responsive to temperature to normally operate said control member, a part movable between definite limits to impart movement to said element to adjust the position of the latter and vary the normal operation of said control member, the ratio of movements of said part and said element being substantially constant between said definite limits, and structure interposed between said part and said element to vary the substantially constant ratio of movements of said element and said part when the latter is moved beyond said definite limits.

2. In mechanism of the character described, a control member, an element to operate said control member, a part movable between definite limits to impart movement to said element, the ratio of movements of said element to said part being substantially constant between said definite limits, and means associated with said part and said element whereby the ratio of the movements of said element to said part is increased above said constant ratio when said part is moved beyond said definite limits.

3. In valve mechanism of the character described, a valve, a thermostat element to operate said valve, a threaded screw axially movable by rotation thereof to adjust the position of said thermostat element, and means between said screw and said thermostat element whereby the latter is moved a greater distance than the axial movement of said screw for a part of a revolution of said screw.

4. In valve mechanism of the character described, a valve, a thermostat element to operate said valve, a threaded screw axially movable by rotation thereof to adjust the position of said thermostat element, and a cam between said screw and said thermostat element arranged to move the latter a greater distance than the axial movement of said screw for a part of a revolution of said screw.

5. In valve mechanism of the character described, a valve, a thermostat element to operate said valve, a resilient diaphragm upon which said thermostat element is mounted and bodily movable therewith, a threaded screw axially movable by rotation thereof to move said diaphragm and adjust the position of said thermostat element, and means interposed between said screw and said diaphragm and arranged to move the latter a greater distance than the axial movement of said screw for a part of a revolution of said screw.

6. In valve mechanism of the character described, a valve, an expansible thermostat element to operate said valve, a resilient diaphragm having an opening, a hub member having an opening and secured to said diaphragm at the opening in the latter, said expansible thermostat element being secured to said hub member and communicating with the opening therein, a threaded screw axially movable by rotation thereof to move said diaphragm and adjust the position of said expansible thermostat element, and means interposed between said screw and said diaphragm to move the latter a greater distance than the axial movement of said screw for a part of a revolution of said screw.

7. In valve mechanism of the character described, a valve, a thermostat element to operate said valve, a member movable to impart movement to said thermostat element, and structure so constructed and arranged that it does not affect the ratio of the movements of said thermostat element and said member in one range of movement of said member and comes into play in another range of movement of said member to vary the ratio of the movements of said thermostat element and said member.

8. In valve mechanism of the character described, a valve, an element responsive to temperature to operate said valve, a member movable to impart movement to said element, and structure so constructed and arranged that the ratio of the movements of said element to said member is substantially constant in one range of movement of said member and progressively different with successive increments of movement of said member beyond said range.

9. In mechanism of the character described, a control member, an element responsive to temperature to operate said control member, a part movable to impart movement to said element, and a cam so constructed and arranged that it does not affect the ratio of the movements of said element and said part in one range of movement of said part and comes into play in another range of movement of said part to vary the ratio of the movements of said element and said part.

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