Aug. 9, 1932. H. E. WILLSIE 1,870,431

REFRIGERATING APPARATUS AND CONTROL THEREFOR

Filed Sept. 6, 1927 2 Sheets-Sheet 1

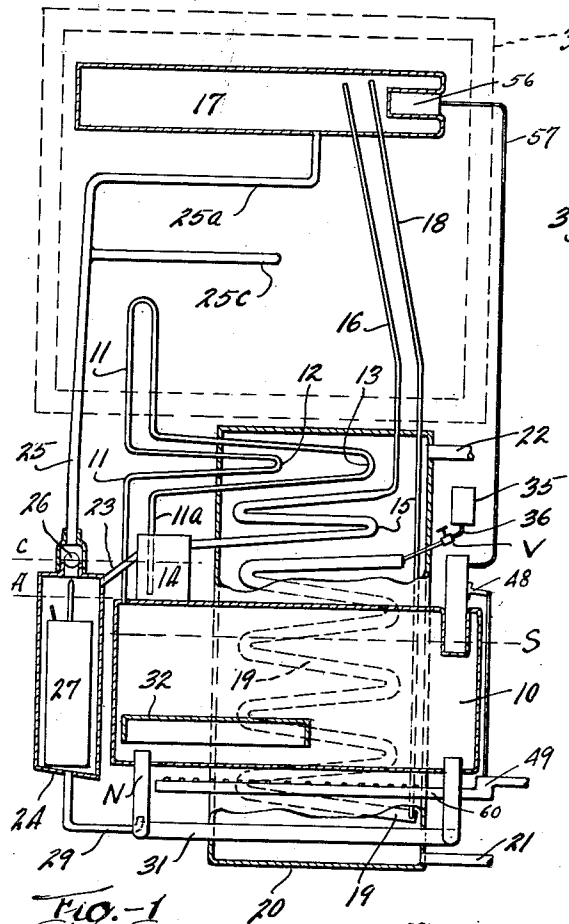

Fig.-1

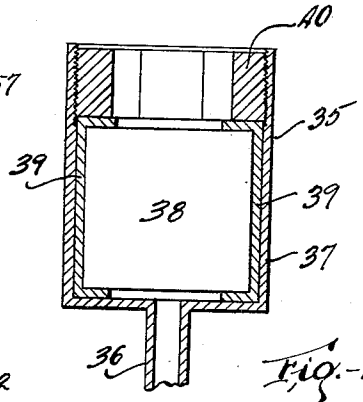

Fig.-4

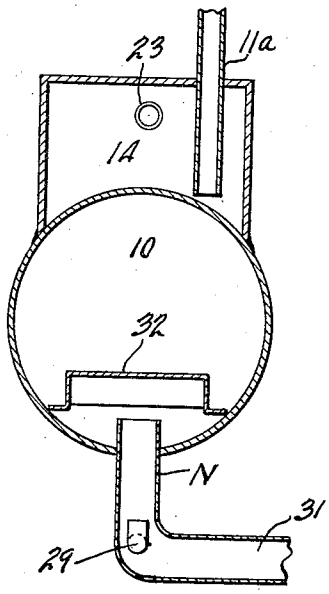

Fig.-5

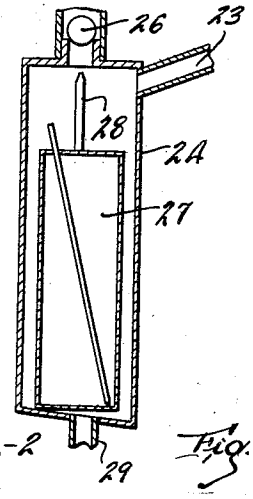

Fig.-2

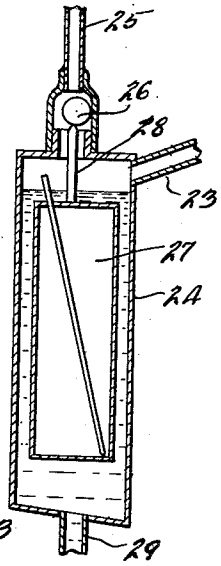

Fig.-3

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REFRIGERATING APPARATUS AND CONTROL THEREFOR

Filed Sept. 6, 1927 2 Sheets-Sheet 2

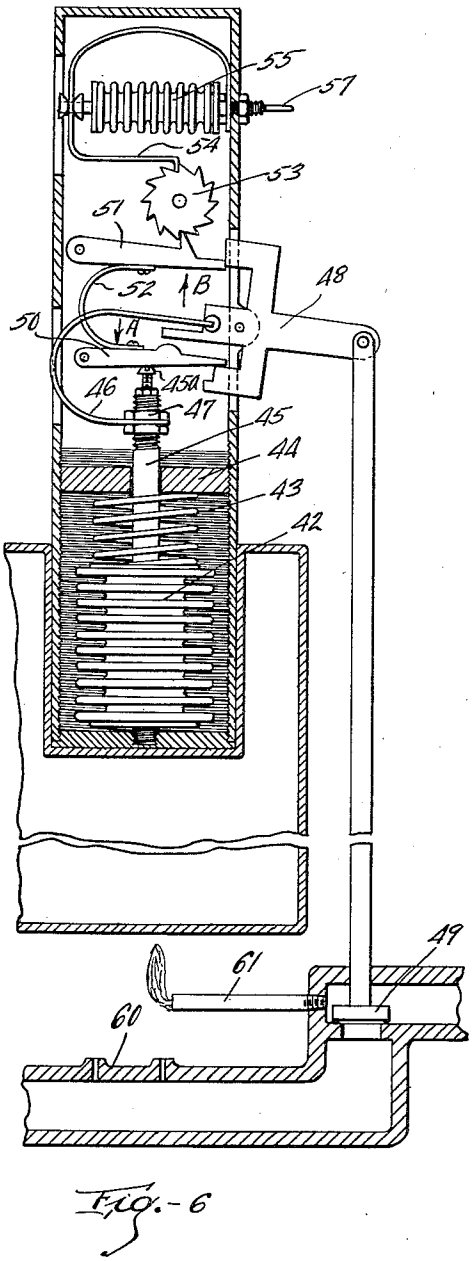

Fig.-6

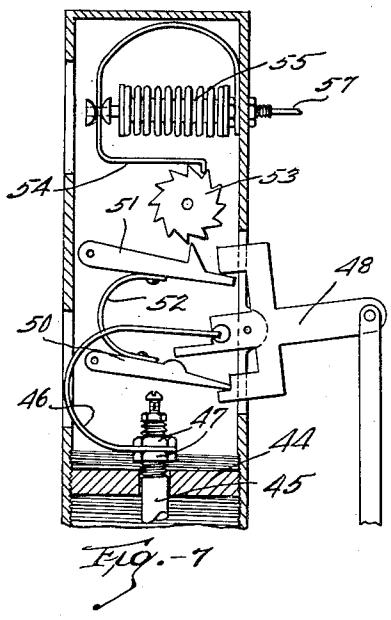

Fig.-7

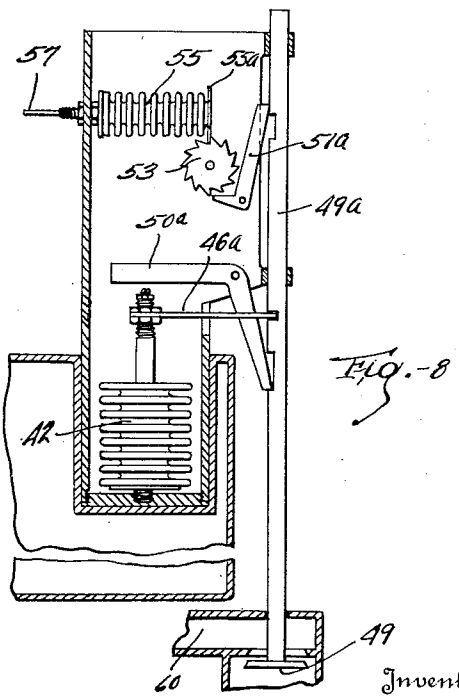

Fig.-8

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS AND CONTROL THEREFOR

Application filed September 6, 1927. Serial No. 217,678.

My invention relates to improvements in refrigeration apparatus of the intermittent absorption type, such as in general have been described in patents issued to me.

The objects of this invention are to provide an intermittent absorption apparatus adapted to operate automatically; and, more particularly to provide an automatic drain adapted to return liquor from the evaporator to the still; to provide a control trap attached to and heated by the still; to provide an absorbing pan within the still; to provide an automatic control for turning on and off the heat according to the temperatures in the still and in the evaporator; to provide automatic means for purging the apparatus of hydrogen; and to provide an arrangement of parts adapting the apparatus to the cooling of a household refrigerating box. Other objects appear in the description.

I attain these objects by the means illustrated in the accompanying drawings, in which Fig. 1 is a diagrammatic vertical sectional view of the apparatus; Fig. 2 is a vertical section through the float chamber during the absorption period; Fig. 3, a vertical section through the float chamber during the heating period; Fig. 4, a vertical section through the purging device; Fig. 5, a vertical section through the control trap and still; Fig. 6, a diagrammatic vertical section of the automatic control; Fig. 7, a similar view of the control in another position; and Fig. 8 a vertical section, showing another arrangement of control apparatus. Similar characters refer to similar parts, and pipes are shown by parallel lines.

In the construction iron or steel is used throughout except where otherwise specified.

The operation of the apparatus is as follows:

A still 10 is filled with aqua ammonia, called liquor, to the level of the dotted line S. Gas flames beneath the still heat the liquor driving ammonia gas and some steam through the pipe 11, the rectifiers 12 and 13 into the control trap 14, then through the rectifier 15, the pipe 16, into the evaporator 17; then through the pipe 18 into the condenser 19, where the ammonia gas is liquefied by giving up its heat under pressure to the cooling water in tank 20. Water flows into this tank through pipe 21 and out through pipe 22. The rectifier 12 drains into the still and the rectifiers 13, 15 drain into the control trap 14, filling it with liquor to the level of the dotted line C. Excess liquor drains through the pipe 23 into the float chamber 24 and thence to the still. By welding the control trap 14 to the still as shown, the liquor therein is heated and ammonia gas is distilled out of the liquor producing a less volatile liquor leg in pipe 11*a* and to some extent hastening the absorbing in the still. When heat is removed from the still the liquid ammonia in the condenser flows through pipe 18 into the evaporator, vaporizes the gas, and abstracts heat from the refrigerating box 30, indicated by dotted lines. The gas returns through pipe 16 into the control trap 14, raises a liquor leg seal in pipe 11*a*, passes through pipe 23 into the float chamber 24 and thence into the cooling loop 31, setting up a circulation therein of liquor from the still-absorber, thus transferring heat to the cooling water and causing the gas to be absorbed.

Any liquor collecting in the evaporator by rectification or from a previous operation drains into pipe 25 which is provided with a check ball 26. This check valve prevents liquid from flowing from the pipe 25 unless it is unseated. During the heating period the outflowing gas must depress liquid from the pipe 11*a* the depth of the pipe in the liquid in the control trap 14 and consequently fills the float chamber with liquor to a similar height above the liquor level in the still; as to the level of the dotted line A. The float 27 is thus raised during the heating period and the rod 28, secured to the top of the float, unseats the check ball 26, allowing liquor to drain from pipe 25 into the float chamber 24 and thence through pipe 29 into the still. During the cooling, or absorbing period, the returning gas forces liquid from the float chamber allowing the float to lower and the check ball to seat, thus preventing liquid from draining from the evaporator during the absorbing period.

The pipe 23 may connect directly to the cooling loop 31 without passing the return

gas through the float chamber, and the float drain can be arranged to thus operate.

An absorbing pan 32 is inverted over the end N of the cooling loop 31 to catch large bubbles of ammonia gas and to hold them in contact with the liquor until absorbed and to prevent bubbles of gas from passing above the liquor level in the still and thus retard absorption. This pan also catches any foreign gas returning with the ammonia gas. The result is a more rapid absorption—especially at the beginning of the absorption period. The pan is preferably supported by the still in a way to allow circulation of liquid about it. The ends of the cooling loop 31 project somewhat into the still thereby causing the still to collect "sluge" that some times forms in an absorption apparatus. The rectifiers 12 and 13 also hasten the beginning of the absorption by reason of the cooling water contracting the gas in the rectifiers. The pipes 11, 16, 18, 25 may be located back of the refrigerating box. The float is described in my application having the Serial Number 197,808. The pipe 25 has a horizontal part 25*a* and a horizontal dead end offset pipe 25*c* to hold ice freezing trays.

Any foreign gas which forms in the apparatus is mostly hydrogen and this tends to collect in the dead end of the condenser 19. To allow the hydrogen to escape there is provided a hydrogen filter 35 connected by pipe 36 to the dead end of the condenser. This filter consists of an iron case 37 containing a porcelain block 38 which allows the slow passage of hydrogen gas but is practically tight to the passage of any other gas in the apparatus. The porcelain block is surrounded on the sides and partly on the ends by the lead jacket 39. The nut 40 is used to tighten the lead onto the porcelain. A hand valve V is shown in the pipe 36.

Referring to Fig. 6, the control is actuated by a bellows 42 partly filled with water or other liquid which vaporizes with pressure at the still temperature at which the gas is shut off. The bellows is provided with a spring 43, an adjusting nut 44, and a rod 45. To the rod is secured a flat spring 46 by the nuts 47. The other end of the spring actuates a pivoted lever 48 to which is attached the gas valve 49. The expansion and contraction of this bellows energizes the spring 46. The lever 48 is held in its two positions by the latch 50 and by the trigger 51 which are pressed by the spring 52. The trigger 51 is controlled by the ratchet wheel 53 which is actuated by the spring 54 and the bellows 55. To the bellows 55 is connected a bulb 56 by the tube 57. The bellows, tube and bulb are completely filled with water or other liquid that melts and contracts at the temperature at which the gas is turned on. To turn on the gas the operation is as follows: The cooling of the still has contracted the bellows 42 and thus energized the spring 46 to operate the lever 48 in the direction of the arrow A to open the gas valve; but this movement of the lever is prevented by the trigger 51, as shown in Fig. 6. When the evaporator containing the bulb 56 becomes warm enough to melt the ice in the bulb 56 the bellows 55 is contracted and through the spring 54 operates the ratchet wheel 53, which releases trigger 51 from control of the lever 48 allowing the spring 46 to move the lever 48 to open the gas valve 49. The latch 50 then drops into a position, shown in Fig. 7, to control movement of the lever 48.

To turn off the gas, the bellows 42 expands from the heat of the still until the adjusting screw 45*a* releases the latch 50 from control of the lever 48; the spring 46 having been energized by the bellows moves the lever 48 in the direction of the arrow B to close the gas valve. The trigger 51 then controls the lever 48. The bellows 55 is expanded by liquid in bulb 56 freezing and the spring 54 moved to engage another notch of the ratchet wheel.

If the spring 46 should break continued expansion of the bellows 42 will move the lever 48 in direction of the arrow B closing the gas valve. Gas from the burner 60 is ignited by the pilot light 61.

By reversing the ratchet wheel the bellows 55 may be filled with a fluid the expansion of which actuates the ratchet wheel.

In the form of control shown in Fig. 8 the bellows 42 energizes a flat spring 46*a* which engages the valve stem 49*a*. Continued expansion of the bellows releases the latch 50*a* allowing the valve to close. Trigger 51*a* then engages the valve stem.

Contraction of the bellows 42 energizes the spring 46*a*. Expansion of the bellows 55 moves the ratchet wheel 53 releasing the trigger 51*a* from the valve stem allowing the valve to open. There is sufficient spring in the bellows 55 to allow its flange 55*a* to pass over the ratchet teeth.

The size and proportions of the float 27 and its chamber 24, as well as the length of the rod 28 and the level of the chamber 24 and float 27 relative to the still may be made such as to terminate the drain past the valve 26 at any time during the boiling operation. In other words, these parts may be so proportioned and arranged that the ball valve 26 will seat at any time during the boiling operation, either a short time after it begins or near its close, as will be readily understood.

What I claim is:

1. The combination in a refrigeration apparatus of a still-absorber, evaporator and condenser connected in an operative cycle, a float chamber, a pipe connected to the bottom of the evaporator and to the float chamber, a pipe connecting the float chamber to the still-absorber, a check valve in the pipe

connecting the evaporator to the float chamber, and a float within the float chamber arranged to unseat the check valve during the heating period.

2. The combination in a refrigeration apparatus of a still-absorber, evaporator and condenser connected in an operative cycle, a float chamber, a drain pipe connected to the bottom of the evaporator and to the float chamber, a check valve in said pipe, a pipe connecting the float chamber to the still-absorber, a return gas pipe connecting the float chamber toward the evaporator, and a float within the float chamber arranged to unseat the check valve during the heating period.

3. In a refrigeration apparatus of the absorption type embodying a still-absorber and an evaporator, the combination of a heat control comprising a fluid filled bellows expanding according to the temperature of the still-absorber, a spring energized by the expansion of said bellows, a lever actuated by said spring and controlling the heat supply, a trigger and a latch controlling the movement of the lever, a ratchet wheel controlling the movement of the trigger, and a liquid filled bellows expanding and contracting according to the temperature of the evaporator arranged to actuate the ratchet wheel.

4. In a refrigeration apparatus of the absorption type embodying a still-absorber and an evaporator, the combination of a heat control comprising a fluid filled bellows expanding according to the temperature of the still-absorber, a spring energized by the expansion of said bellows, a member actuated by said spring and controlling the heat supply, means controlling the movement of said member including a ratchet wheel, and a liquid filled bellows expanding and contracting according to the temperature of the evaporator arranged to actuate the ratchet wheel.

5. The combination in a refrigeration apparatus of a still-absorber, evaporator and condenser connected in an operative cycle, means for alternately heating and cooling the still-absorber, a pipe arranged to drain the evaporator toward the still-absorber, means adapted to close said pipe against flow of liquid from the evaporator, and a float arranged to open said means to the flow of liquid during the heating period.

6. In a refrigeration apparatus of the absorption type, a filter case connected at one end to the apparatus and at the other end opening to the atmosphere, and a filter block permeable to hydrogen within the filter case.

7. In a refrigeration apparatus of the absorption type, a filter case connected at one end to the apparatus and at the other end opening outside the apparatus, and a porcelain block permeable to hydrogen within the filter case.

8. In a refrigeration apparatus, the combination of a still-absorber, an evaporator and a dead end condenser connected in an operative cycle, a filter case connected at one end to the dead end of the condenser and at the other end opening outside the apparatus, and a filter block permeable to hydrogen within the filter case.

In testimony whereof I hereby affix my signature.

HENRY E. WILLSIE.