May 26, 1936. L. C. BIRD ET AL 2,042,384

CONSTANT TEMPERATURE REFRIGERATOR

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Fig. 1.

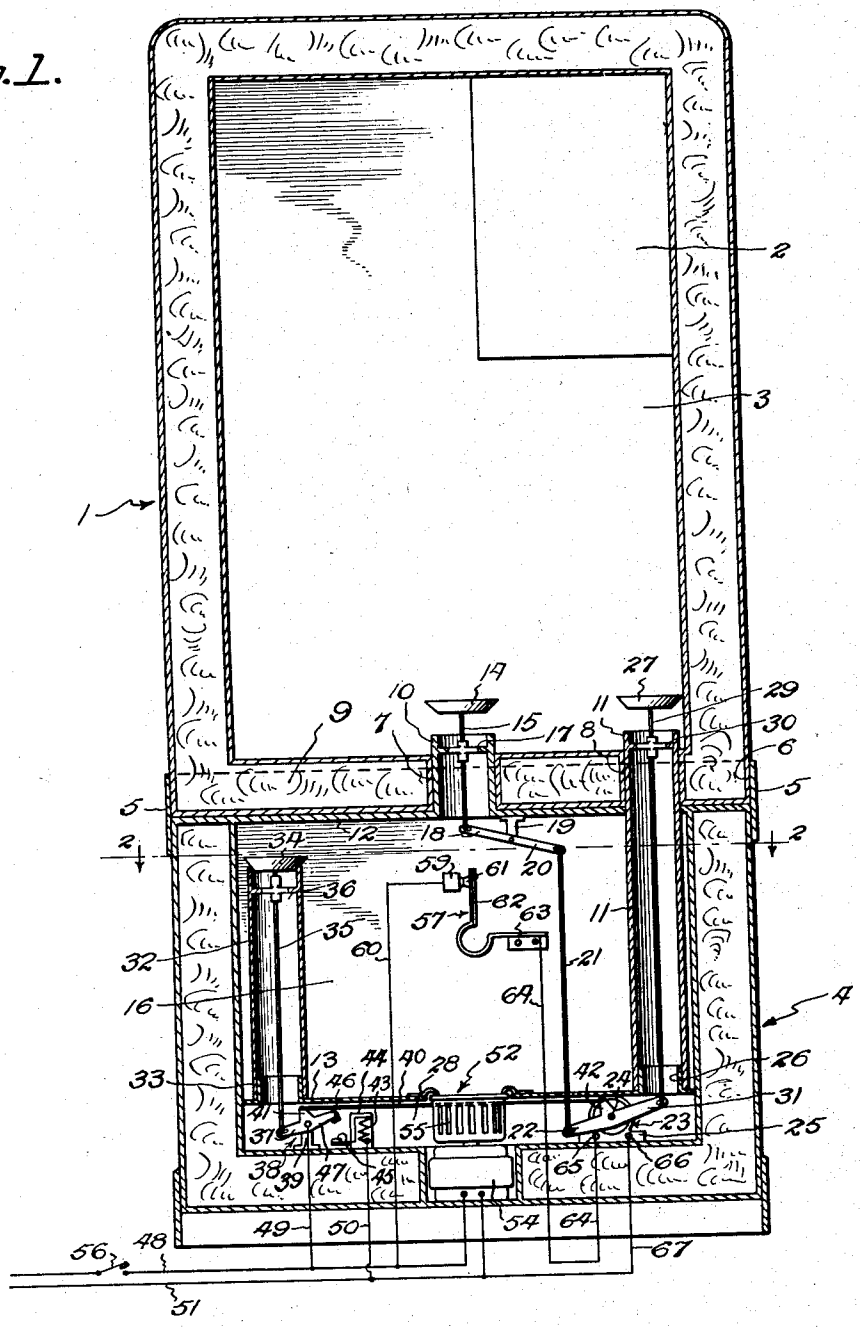

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Fig. 2.

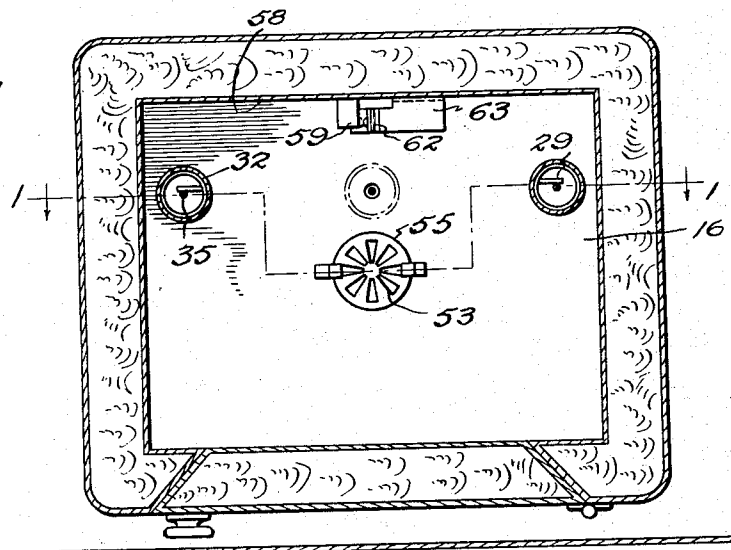
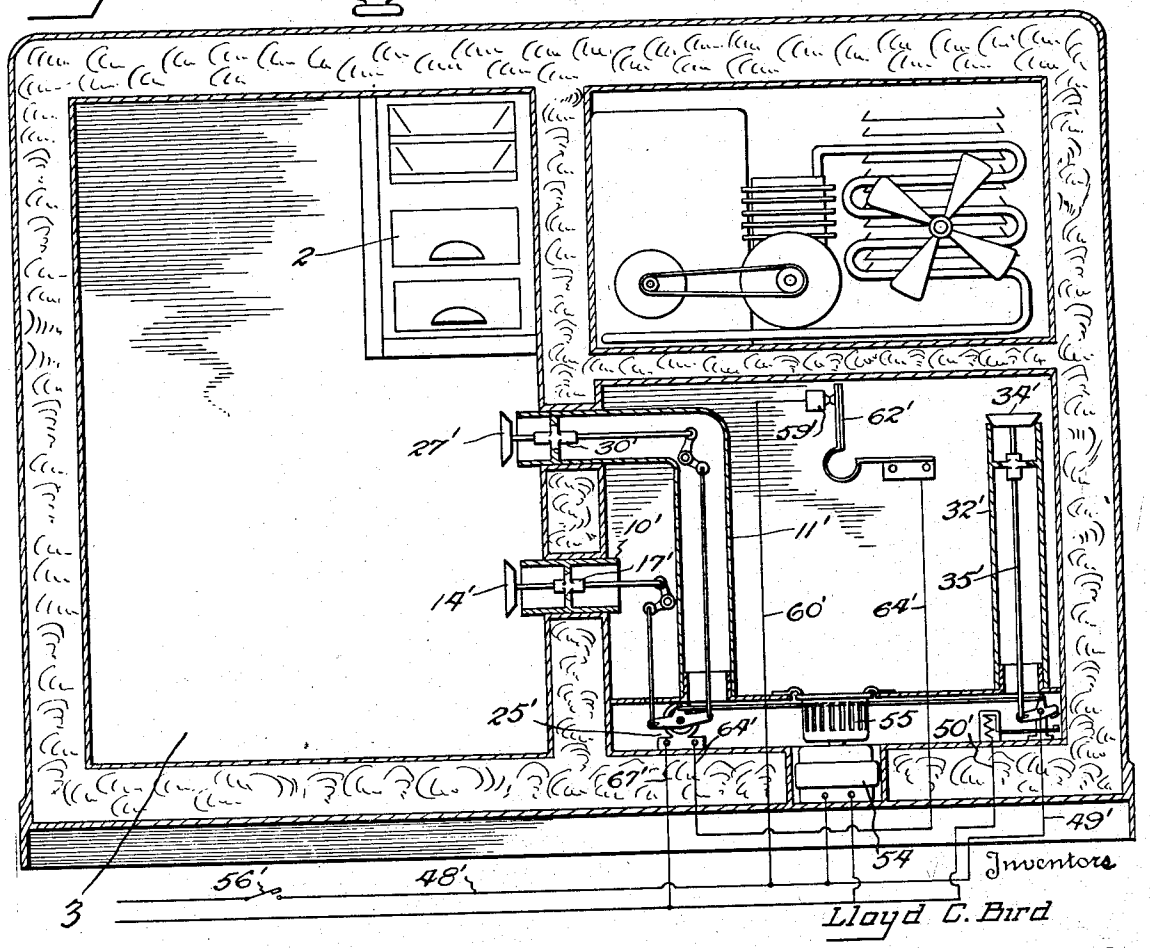


Fig. 3.



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CONSTANT TEMPERATURE REFRIGERATOR

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Application August 15, 1935, Serial No. 36,398

4 Claims. (Cl. 257—3)

This invention relates generally to apparatus for maintaining a chamber at any desired constant temperature; and, more particularly, to apparatus of this character designed for use with standard refrigerators such as are in common use for domestic purposes.

Apparatus for maintaining a chamber at constant temperature are well-known in this art, and are comparatively expensive, the cost of operation increasing with decrease in temperature. The present apparatus is designed to maintain a chamber at a temperature of about 20° C.; and to keep operating expense as low as possible we propose to use the common household refrigerator for the purpose of supplying cooling fluid to the chamber whenever conditions require it.

The apparatus is primarily intended for use in bacteriological laboratories in which the preservation of certain materials requires normal refrigeration, such as is provided by the ordinary household refrigerator. By designing the constant temperature chamber, with its operating controls, as a simple attachment to the normal refrigerator, the expense of maintaining separate cooling units for the 20° C. chamber is avoided; and an extremely economical and desirable combination is produced.

Where the temperature to be held constant approaches average room temperature, which in this case is about 20° centigrade, the problem presented is one that involves both heating and cooling in its solution. Accordingly, the present invention includes, as one of its elements, a heating unit adapted to be automatically operated where the temperature tends to fall below the constant level desired.

From what has been said above, it will be apparent that the main object of the invention is to provide apparatus designed for use primarily in bacteriological laboratories, in which a chamber is maintained at a constant temperature by means which includes a standard refrigerator such as is in common use in ordinary households.

Other objects of the invention will become apparent as the detailed description thereof proceeds.

In the drawings:

Figure 1 is a central vertical section of one form of the apparatus, taken on the line 1—1 of Figure 2;

Figure 2 is a horizontal section taken on the line 2—2 of Figure 1; and

Figure 3 is a central vertical section through a modification of the apparatus shown in Figures 1 and 2.

In the form of the invention illustrated in Figures 1 and 2, the invention comprises a refrigerator 1 of the standard type, having the usual evaporator 2 suitably supported in the refrigeration chamber 3 near the top thereof. So far as mere refrigeration is concerned, the structural details of the refrigerator 1 are not involved in the present invention, and the cooling may be effected by ice or brine or any other well-known equivalent of the mechanically controlled evaporator illustrated diagrammatically in the drawings.

The preferred form of the invention comprises an insulated casing 4 of about the same horizontal cross-section as the casing of the refrigerator 1. A strap 5 is fixed around the upper end of casing 4, and projects above the top thereof to form a recess 6 in which is seated the lower end of the refrigerator 1.

Apertures 7 and 8 extend through the bottom 9 of the refrigerator 1 to receive the ducts 10 and 11, which respectively project upwardly from the top 12 and a false bottom 13 of the casing 4. A poppet valve 14 fixed on the end of a rod 15 controls the flow of cold air from the chamber 3 into the incubator chamber 16.

The rod 15 extends through an aperture in the guide plate 17, and has its lower end slidably and pivotally connected to the end of one arm 18 of a rocker lever, which is pivoted at its center to a bracket 19, suitably secured to the top 12 of the chamber 16. The other arm 20 of the rocker lever is pivoted at its outer end to a link 21, which at its other end is pivoted to the outer end of the arm 22 of a rocker 23, fixed at its center to the rotor shaft 24 of a damper motor 25. This invention is not concerned with the structural details of this damper motor, which is merely illustrated diagrammatically herein. These motors are old and well known in air conditioning systems, and are illustrated for example, in the U. S. Patent to Stewart, No. 1,968,325, July 31, 1931, and to Snediker Reissue No. 18,875, June 30, 1933.

The duct 11 extends upwardly from an aperture 26 formed in the false bottom 13; and a poppet valve 27 at the upper end of duct 11 controls the flow of air from a chamber 28 below the false bottom 13 and through the aperture 8 into the refrigerator chamber 3. The valve 27 is fixed to the upper end of a rod 29 which extends through a guide 30 near the upper end of the duct 11, and which is connected pivotally at its lower end to the arm 31 of the rocker lever 23. It

will be observed from Figure 1 of the drawings, that the mechanism connecting the poppet valves 14 and 27 to the rocker lever 23 is designed to open and close both valves 14 and 27 simultaneously.

A third duct 32 extends upwardly from the false bottom 13 around an aperture 33 formed therethrough. The upper end of the duct 32 terminates a short distance from the top 12 of the chamber 16 and is controlled by a poppet valve 34 fixed to the upper end of a rod 35, extending through the guide 36 to be connected pivotally at its lower end to the arm 37 of a rocker lever 38, pivoted at its center on a standard 39 fixed to the bottom wall of the chamber 28. A link 40 is pivotally connected at its opposite ends to arms 41 and 42 projecting upwardly from the centers of the rocker levers 38 and 23, respectively. The linkage connection is such that the valve 34 is closed when both valves 14 and 27 are open, and vice versa.

An electric heater element 43 is suitably supported on a bracket 44 fixed to the bottom wall of the chamber 28. A contact 45 connected to one end of the heater element is supported on the bracket 44 in position to make contact with the contact 46 suitably secured to an arm 47 of the rocker lever 38, which in this case must be of conducting material. The current for the heater element is derived from a main 48 through a wire 49 tapped to the conducting pivot of the rocker lever 38. A return wire 50 connects the other end of the element 43 to the main 51.

The center of the false bottom 13 is provided with an aperture 52 above a fan 53 which is mounted on the rotor shaft of a motor 54 suitably supported in the bottom of the casing 4. The fan 53 is surrounded by a slotted casing 55, through the slots of which air is forced by the fan in opposite directions below the false bottom 13 to the ducts 11 and 32, respectively. The motor 54 is suitably connected to the mains 48 and 51 and is controlled by a switch 56.

A thermostatic control, designated generally by the reference numeral 57, is suitably supported on the rear wall 58 of the chamber 16. This control comprises a fixed contact 59 connected to the main 48 by a wire 60. The other contact 61 of the thermostat is fixed to a bimetallic strip 62, which at its lower end is suitably secured to a bracket 63 on the wall 58. The bracket 63 is connected by a wire 64 to one of the terminals 65 of the damper motor 25, the other terminal 66 of said motor 25 being connected by a wire 67 to the return main 51.

As shown in Figure 1 of the drawings, both poppet valves 14 and 27 are open and the poppet valve 34 is closed, and the heating element 43 has been cut out of operation. The fan 53 draws cool air from the refrigerator chamber 3, and forces this cool air into the ducts 11 and 32. Since the duct 32 is closed, the air from the fan is forced upwardly through the duct 11 and into the cooling chamber 3, while the air from the chamber 3 is drawn downwardly into the chamber 16, until the temperature in chamber 3 is lowered sufficiently to cause the thermostat to break circuit and cause stoppage of the damper motor 25. It is to be understood that the rocker lever 33 of the damper motor 25 is suitably biased to swing normally to such position as to close the valves 14 and 27 when the operation of motor 25 ceases. When this happens, the link 40 swings the lever 38 into such position as to close the contacts 45 and 46 to energize the heater element 43. At the same time, the valve 34 is opened, and the air circulated by the fan 55 passes across the heater element 43 and up the duct 32 to heat the chamber 16 until its temperature is raised sufficiently to effect closure of the thermostatic contacts 59 and 61. It will be apparent from the disclosure so far, that the valve 34 and the pair of valves 14 and 27 operate in alternation to maintain the temperature within the chamber 16 in close approximation to the temperature desired.

The apparatus shown in Figure 3 is substantially the same as that shown in Figure 1 of the drawings. In this form of the invention, however, the refrigerator and the constant chamber are formed in a single unit. The elements corresponding to the elements of Figures 1 and 2 are designated by the same reference numerals primed. The operation of this form of the invention is substantially the same as that previously described, and will be obvious from inspection of the drawings.

What we claim is:

1. A refrigerator, a chamber, fan means for circulating a cooling fluid between said refrigerator and chamber when the temperature in said chamber exceeds a predetermined maximum, a second chamber, and means in the second chamber and refrigerator operable to cut off the said circulation of cooling fluid and to heat the air in the first named chamber when the temperature thereof falls below a predetermined minimum.

2. A refrigerator, a casing, a partition dividing said casing into two chambers, a duct extending into said refrigerator from one of said chambers, a second duct extending into said refrigerator from the other chamber, a third duct extending into the first named chamber from said other chamber, a heater in said other chamber valves controlling the flow of fluid through each of said ducts, and means controlled by the temperature in the first named chamber for energizing said heater and causing simultaneous opening and closing of the valves of the first and second ducts in alternation with the closing and opening of the valve of the third duct to establish and maintain a substantially constant temperature in the first named chamber.

3. The apparatus set forth in claim 1, in which said last mentioned means comprises a thermostat in the first named chamber, and mechanism controlled by the thermostat for circulating air between said refrigerator and first named chamber when the temperature in said chamber exceeds a predetermined maximum.

4. The apparatus set forth in claim 1, in which said last mentioned means comprises a thermostat in the first named chamber, a heater in said other chamber, and mechanism controlled by said thermostat and heater for closing the first and second ducts and opening the third duct to circulate air in said chambers past said heater when the temperature in the first named chamber falls below a predetermined minimum.

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