

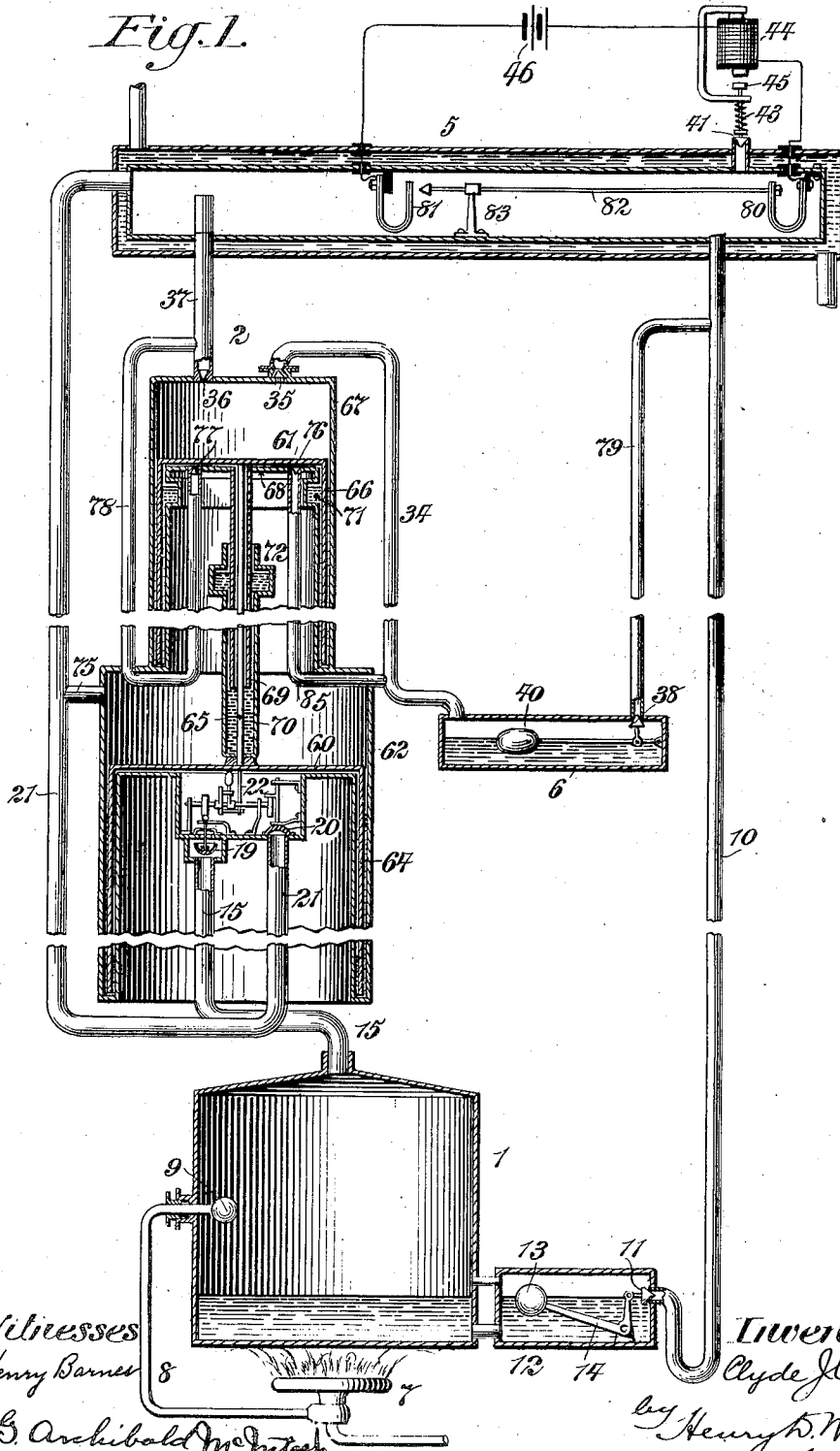
C. J. COLEMAN.
REFRIGERATING APPARATUS.

APPLICATION FILED NOV. 14, 1901. RENEWED JULY 26, 1913.

1,102,999.

Patented July 7, 1914.

2 SHEETS-SHEET 1.



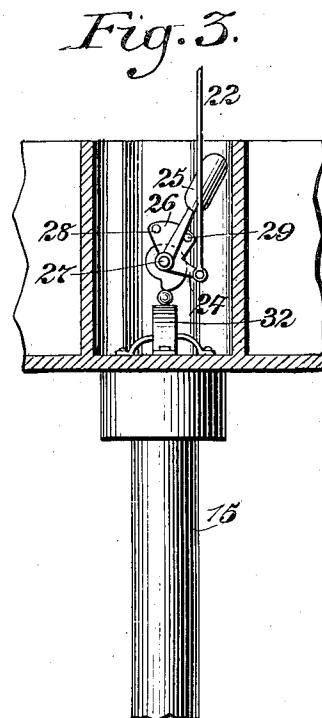
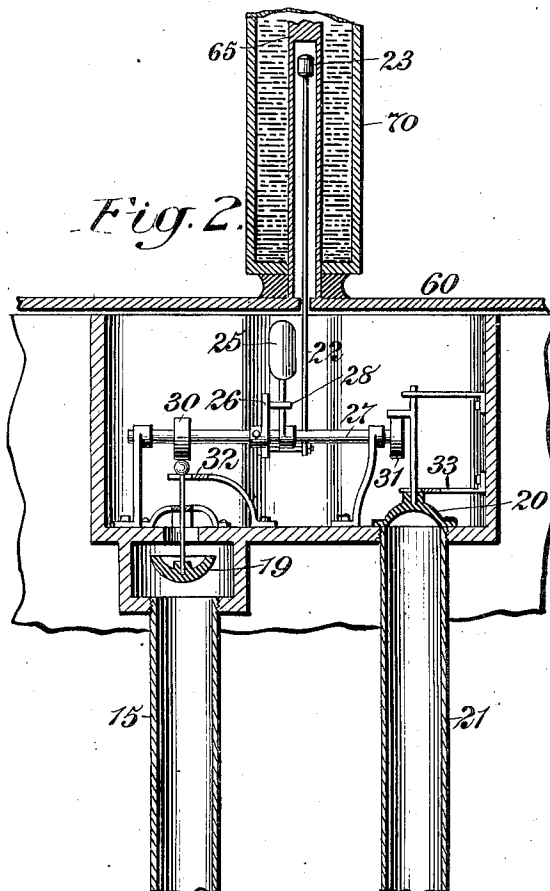
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2 SHEETS—SHEET 2.



Witnesses:
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UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO
VIRGINIA REFRIGERATOR CORPORATION, A CORPORATION OF VIRGINIA.

REFRIGERATING APPARATUS.

1,102,999.

Specification of Letters Patent.

Patented July 7, 1914.

Application filed November 14, 1901, Serial No. 82,172. Renewed July 26, 1913. Serial No. 781,382.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing in the borough of Manhattan, city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to refrigerating apparatus.

My invention consists in the provision of means for removing foreign gases from a refrigerating system controlled by the temperature of the condenser and further differentially controlled by the working temperature of the condenser and the increased temperature resulting from the presence of foreign gases.

My invention further consists in various improvements in construction and combination of parts.

I will now describe the construction of refrigerating apparatus embodying my invention illustrated in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is a sectional elevation of a complete refrigerating apparatus. Fig. 2 is an enlarged sectional elevation of the valve mechanism and adjacent parts. Fig. 3 is an enlarged side elevation of the valve mechanism.

The main parts of the apparatus comprise means for dynamically expanding a medium, which in the embodiment of my invention shown consists of a boiler or vaporizer 1 in which the medium is expanded by the direct application of heat thereto, and of a compressor 2, a condenser 5 and a cooling chamber 6, and the compressor is actuated by the expanded medium from the vaporizer or boiler 1 and acts to exhaust and withdraw another portion of the medium from the cooling chamber 6, and to compress this medium and force it into the condenser 5.

The application of heat to the vaporizer or boiler is shown as accomplished by a gas burner 7, the gas supply of which is regulated by a thermostatic regulator 8, having a bulb 9 exposed within the vaporizer or boiler, and the thermostatic regulator acts automatically to diminish the supply of combustible gas to the flame when the tem-

perature in the vaporizer or boiler rises above a predetermined point. The boiler receives its supply of medium from the condenser 5 through a static column conduit 10 which feeds the condensed fluid or medium and is of sufficient height to overcome the difference of pressure between the condenser 5 and the boiler 1. An automatic valve is provided for regulating the inflow of condensed medium from the static column conduit 10 to the boiler, comprising a float actuated valve 11, located in a chamber 12 alongside of the boiler so as not to be affected by the ebullition within the boiler, and connected to the boiler above and below the fluid level of the boiler so that the fluid level in this chamber will correspond with that of the boiler, and the static column conduit is carried downward a substantial distance below this level to prevent any entrance of vapor into this conduit from the boiler or other chamber. The float 13 of the float valve 11 has a considerable advantage of leverage over the valve, the float being on a long arm and the valve stem connected to a short arm of the float lever 14.

The expanded medium passes out of the boiler and upward through the conduit 15 which leads to the compressor 2.

The compressor 2 has a power part and a compression part and a movable device for each part which, in the embodiment of my invention shown, consists of a separate piston for each part, the two pistons being connected so as to move together and the power piston 60 being of considerably larger area than the compression piston 61. The areas of the pistons are large relatively to the capacity of the apparatus so that the pistons effectively perform their work with a comparatively slow movement. The power piston 60 fits loosely within its cylinder 62 and is sealed so as to confine the expanded medium to the space below this piston, by means of a downwardly extending shell or skirt 64 which projects from the piston 60 and enters an elongated annular well formed in a lower extension of the cylinder and dips within a body of mercury located therein, the annular well being only sufficiently large to permit the skirt 64 of the piston to move freely therein and with a comparatively thin annular column of mercury on each side thereof. The power piston 60 is connected to the compression pis-

ton 61 by a piston rod 65, and the compression piston 61 also has a downwardly extending skirt 66 entering an elongated annular well formed in the lower part of its cylinder 67 and dipping within a body of mercury located therein, whereby a seal is effected which will prevent the medium from passing from one side to the other of the compressing piston.

I also provide means for sealing the piston rod so as to prevent communication between the space above the power piston 60 and the space below the compression piston 61, these two spaces being separated by a partition 68 having a downwardly projecting tubular extension 69 which surrounds the piston rod 65 and dips in a body of mercury located within the tube or well 70 secured to and carried by the power piston 60. Sufficient clearance is provided between the lower end of the tubular extension 69 and the bottom of the tubular well 70 and between the upper end of the wall of the tubular well 70 and the partition 68 to allow for the movement of the pistons. In connection with each of these two last mentioned wells, I have provided a reservoir located at the upper part of a wall of each well to retain a considerable body of the fluid and prevent overflowing, and these reservoirs may be applied as desired for such purpose. I have shown the reservoir 71 at the inner wall of the well for the piston skirt 66 and the reservoir 72 at the outer wall of the well for the tubular extension 69.

An intake valve 19 and an exhaust valve 20 are provided for the control of the medium on the power side of the compressor, the intake valve 19 being located at the upper end of the conduit 15 from the boiler 1 and the exhaust valve 20 being located at the upper end of a conduit 21, leading downward from the compressor and upward into the condenser. These valves are automatically actuated by the movement of the pistons through the actuating rod 22, located in an elongated pocket within the piston rod 65 (see Fig. 2) and having a knob or enlargement 23 at its upper end adapted to be actuated by contact with the upper and lower ends of the pocket in the piston rod and extending downward and pivotally connected to an arm 24 of the controlling weighted lever 25. The actuating rod is operated as the pistons approach the lower end of their stroke by contact of the knob 23 with the upper end of the pocket in the piston rod and moves downward a sufficient distance to swing the weighted lever 25 so that its center of gravity will be moved beyond its pivotal center and so that it will fall by gravity to its right hand extreme position. The actuating rod is operated by contact of its knob 23 with the lower end of the pocket of the piston rod as the pistons approach the

upper end of their stroke, and swings the weighted lever 25 to the left a sufficient distance so that its weight will carry it to its extreme left hand position. This actuation of the weighted lever 25 at each extremity of the movement of the pistons operates the intake and exhaust valves through the sector 26 secured upon a shaft 27 and having contact pins 28 and 29, the shaft 27 having secured thereon the two cams 30 and 31, the cam 30 being arranged to co-act with the stem of the intake valve 19 to open the intake valve when the sector is swung to the right, and the cam 31 co-acting with the stem of the exhaust valve 20 to open the exhaust valve when the sector 26 is swung to the left. The intake valve is provided with a light spring 32 which tends to hold it closed, and the pressure of the expanded medium also, and more powerfully, tends to hold it closed. The exhaust valve 31 is also provided with a light spring 33 which tends to hold it closed, and the pressure within the power chamber of the compressor also, and more powerfully, tends to hold it closed. The cams 30 and 31 are so constructed that one valve is closed before the other valve is opened. In the position of parts shown in the drawings, the valve has been closed and the intake valve opened and the pistons are about to move upward.

For the purpose of preventing back pressure or resistance from the chamber below the partition 68 and above the power piston 60, this chamber is connected to the conduit 21 by a short conduit 75 so as to be at all times freely in communication with the exhaust conduit of the power side of the apparatus.

The compression part of the apparatus is double acting, the chamber above the compression piston 61 being provided with an inlet check valve 35 and an outlet check valve 36, and the chamber below the compression piston being provided with an inlet check valve 76 and an outlet check valve 77, all of these check valves being represented diagrammatically in the drawings, and the portion of the medium performing the refrigerating function is withdrawn from the cooling chamber 6 into the upper compression chamber through the conduit 34, and is forced out of the upper compression chamber by the action of the compression piston through the conduit 37 into the condenser 5, and is withdrawn from the cooling chamber 6 into the lower compression chamber through the conduit 34 and a branch conduit 85, and is forced out of the lower compression chamber by the conduit 78 leading to the conduit 37. The weight of the pistons and connected parts is relied upon to compress the medium during the downward movement of the pistons, the spaces or chambers below the power piston 60 being con-

connected to the condenser during this downward movement, while the direct pressure of the expanded medium forces the pistons upward, the space or chamber above the power pistons being connected to the condenser during this movement.

The portion of the medium performing the refrigerating function is supplied from the condenser 5 to the cooling chamber 6 through the static column conduit 10 and a branch conduit 79 extending therefrom to the cooling chamber. The level of fluid in the cooling chamber is regulated by means of a float valve 38, located at the entrance of the branch conduit 79 to the cooling chamber and its admission controlled by a float 40 located in the cooling chamber.

The condenser 5 is conventionally illustrated and may be of any suitable construction and serves to condense the medium from the power side of the compressor as well as the medium from the compression side of the compressor, the portion of the medium which has performed the power function and refrigerating function being commingled in this condenser; and this condenser supplies condensed medium both to the vaporizer or boiler 1, through the static column conduit 10, and to the refrigerating or cooling chamber 6, through the conduit 10 and branch conduit 79 as above described. The greater diameter of the power piston 60 as compared with the compressor piston 61 enables the portion of the medium which performs the power function to overcome and compel the movement of the portion of the medium which performs the refrigerating function and effectively perform the operation of withdrawing the medium from the cooling chamber and compressing it and forcing it into the condenser.

In the operation of a closed cycle refrigerating system a certain quantity of foreign or uncondensable gases is usually produced, through chemical decomposition and otherwise, and these foreign or uncondensable gases remain in the condenser and interfere with and impede the condensing operation, diminishing the effective surface of the condenser. Under certain conditions a sufficient quantity of these foreign or uncondensable gases may collect and accumulate in the condenser to nearly or entirely fill it and thus effectually prevent the performance of its condensing operation, resulting in raising the temperature of the condenser. My invention includes automatic means for the removal of these foreign gases, controlled by the temperature of the condenser. Further the collection and accumulation of these foreign gases will be initiated at the exit end of the condenser, and the inert condition of the condenser resulting from the collection of the foreign gases will be initiated at the exit end of the condenser,

while the higher temperature of the condensable gases resulting from the diminution of its effective surface by the accumulation of the foreign gases will be apparent at an intermediate point, where the condensable gases would, under proper working conditions, have been cooled by the action of the condenser to a comparatively low temperature. The working temperature of the condenser is usually a variable quantity by reason of the fact that the cooling water or heat abstracting medium is not usually regulated as to temperature, and is therefore subject to considerable variations of temperature at different seasons of the year, and from many other causes, or where cooling water is dispensed with and air is the cooling medium, the variations in the temperature of the air will produce variations in the working temperature of the condenser. With a higher working temperature in the condenser, the temperature indicating the presence of foreign gases will necessarily be a higher temperature, and the difference between the working temperature and the internal temperature in the active part of the condenser will determine the presence of foreign gases. The foreign gases which accumulate at the exit end of the condenser will be inert, and their temperature will therefore approximate or be at the same as the working temperature or the temperature of the heat abstracting or cooling means.

My invention includes the provision of two temperature controlled devices, shown as bimetallic bowed thermostats 80 and 81, the thermostat 80 being located in the condenser, in proximity to the exit end of the condenser and the thermostat 81 being located in the condenser in advance thereof, these two thermostats coöperating in the control of means for removing the foreign gases, such coöperation being effected through an electrical contact device shown as consisting of a contact pin 82 actuated by the thermostat 80, and shown as secured thereto and guided by a supporting piece 83, and having a contact point in proximity to the thermostat 81, and adapted to close an electric circuit by contact with this thermostat 81, the current flowing from the battery 46 through the thermostats and the electro-magnet 44. The armature 45 of the electro-magnet is secured to a blow-off valve 41, which is held closed by a spring 43 and which is located in proximity to the exit end of the condenser. The spring 43 is sufficiently strong to hold the blow-off valve closed against pressure above the normal pressure in the condenser, and the valve is opened by the action of the electro-magnet. In the refrigerating system shown the pressure within the condenser will be at all times during the operation of the system, higher than that of the atmosphere, and the foreign

gases may therefore be removed by simple opening of the blow-off valve, which will permit the foreign gases to escape.

The thermostat 80 is constructed so that an increase of temperature causes its free end to approach its fixed end and the contact rod 82 to be moved away from the other thermostat 81, and the thermostat 81 is constructed so that an increase of temperature causes its free end to move away from its fixed end and therefore to approach the contact rod 82. Therefore if the temperature of the cooling water is increased and foreign gases are not present or not present in sufficient quantities to materially impair the heat abstracting function of the condenser, the contact rod 82 and free end of the thermostat 81 will both be moved to the right and their relative positions will not be substantially altered, and so long as the normal relation of temperatures within the condenser is maintained, the variations in temperature from external causes merely cause both temperature controlled devices to be actuated in the same direction, and the electric contact device will be held open and the blow-off device will not be actuated. Should, however, a sufficient quantity of foreign gases be present in the condenser to materially impair the heat abstracting function of the condenser, the inert foreign gases accumulated at the exit end of the condenser will respond to the variations of temperature of the cooling water while the condensable gases about the thermostat 81 will attain a proportionally greater temperature by reason of the impairment of the heat abstracting function, and the relatively larger movement of the thermostat 81 will close the electric circuit, energize the electro-magnet and cause the blow-off valve to be opened to permit the escape of the foreign gases, and upon the restoration of equal or approximately equal conditions of temperature about the two thermostats, the circuit will be opened and the blow-off valve closed. Thus the device is self adjusting to the variations in the working-temperature of the condenser and acts only when the presence of foreign gases impairs the heat abstracting function of the condenser.

It will be observed that the conduit 10, which conveys the condensed medium out of the condenser, is located somewhat in advance of the thermostat 80 so that this thermostat is out of the path of the medium flowing through the condenser, and this arrangement removes the thermostat 80 from the path of the condensable medium circulating in the condenser and tends to place it more completely under the control of the external conditions, such as the temperature of the cooling water.

In the operation of the compressor substantial variations of pressure will occur

above and below the movable devices or pistons and the mercuric or fluid columns will need to be of sufficient height to accommodate these variations of pressure. The fluid mercury is particularly well adapted for employment as to sealing liquid by reason of its weight, but other fluids would be used within the spirit and scope of my invention.

It is evident that various modifications may be made in the construction shown and above described within the spirit and scope of my invention.

What I claim and desire to secure by Letters Patent is:—

1. A refrigerating apparatus comprising a condenser, a cooling chamber, means for circulating a refrigerant medium through the condenser and cooling chamber, and two temperature controlled devices exposed to the temperatures of different parts of the condenser, and means for the removal of foreign gases from the apparatus controlled by the coaction of the two temperature controlled devices.

2. A refrigerating apparatus having a condenser for the refrigerant medium, in combination with a plurality of temperature controlled devices exposed to the temperatures of different parts of the condenser, and means for the removal of foreign gases from the apparatus controlled by the coaction of the temperature controlled devices.

3. A refrigerating apparatus having a condenser for the refrigerant medium, in combination with a temperature-controlled device located in proximity to the exit end of the condenser, temperature-controlled means located in the condenser at a distance from the exit end thereof and adapted to cooperate with the temperature-controlled device, and means for the removal of foreign gases from the apparatus controlled by the coaction of the temperature-controlled device and its cooperating means.

4. A refrigerating apparatus comprising a condenser, a cooling chamber, means for circulating a refrigerant medium through the condenser and cooling chamber, a temperature-controlled device located in the condenser out of the path of the refrigerant medium circulated therein, temperature-controlled means located in the condenser at a distance from the exit end thereof and adapted to cooperate with the temperature-controlled device, and means for the removal of foreign gases from the apparatus controlled by the coaction of the temperature-controlled device and its cooperating means.

5. A closed cycle refrigerating apparatus having a condenser for the refrigerant medium, a temperature-controlled device exposed to the temperature of the condenser in proximity to the exit end thereof, another temperature-controlled device exposed to the temperature of the condenser in advance of

the exit end thereof, and means for the removal of foreign gases from the apparatus controlled by the coaction of the two temperature-controlled devices.

5 6. A closed cycle refrigerating apparatus having a condenser for the refrigerant medium, a temperature controlled device located in the condenser out of the path of the refrigerant medium circulated therein, another temperature-controlled device exposed to the temperature of the condenser in advance of the exit end thereof, and means for the removal of foreign gases from the apparatus controlled by the coaction of the
10 two temperature-controlled devices.

7. A refrigerating apparatus having a condenser for the refrigerant medium, two thermostats exposed to the temperature of different parts of the condenser, an electric contact device controlled by both thermostats, and means for the removal of foreign gases from the apparatus controlled by the electric contact device.

8. A refrigerating apparatus having a condenser for the refrigerant medium, two temperature-controlled devices exposed to the temperature of different parts of the condenser, circuit-closing means controlled by such devices for closing an electric circuit by the relative movements thereof, and electrically controlled means for the removal of foreign gases from the condenser controlled by such circuit.

9. A refrigerating apparatus having a condenser for the refrigerant medium, two thermostats located in the condenser, one in proximity to the exit end of the condenser and the other in advance thereof, circuit-closing means controlled by both thermostats for closing an electric circuit by the relative movements thereof, and electrically controlled means for the removal of foreign gases from the condenser controlled by such circuit.

10. A refrigerating apparatus comprising a condenser, a cooling chamber, means for circulating a refrigerant medium through the condenser and cooling chamber, two thermostats located in the condenser, one being arranged out of the path of the refrigerant medium circulated therein and the

other in advance thereof and in the path of the refrigerant medium, circuit-closing means controlled by both thermostats for closing an electrical circuit by the relative movements thereof, and electrically controlled means for the removal of foreign gases from the condenser controlled by such circuit.

11. A refrigerating apparatus having a condenser for the refrigerant medium, two thermostats located in the condenser, one in proximity to the exit end of the condenser and the other in advance thereof, circuit-closing means controlled by both thermostats for closing an electric circuit by the relative movements thereof, a blow-off valve located in proximity to the exit end of the condenser, and electrically controlled means controlled by such circuit and controlling such blow-off valve.

12. A refrigerating apparatus comprising a condenser, a cooling chamber, means for circulating a refrigerant medium through the condenser and cooling chamber, two thermostats located in the condenser, one being arranged out of the path of the refrigerant medium circulated therein and the other in advance thereof and in the path of the refrigerant medium, circuit-closing means controlled by both thermostats for closing an electric circuit by the relative movements thereof, a blow-off valve located in proximity to the exit end of the condenser and electrically controlled means controlled by such circuit and controlling such blow-off valve.

13. A refrigerating apparatus having a condenser for the refrigerant medium, a cooling chamber in which a low temperature is maintained by expansion of the refrigerant medium, self-adjusted temperature controlled means within the condenser and electrically operated means for the removal of foreign gases from the apparatus controlled by the temperature controlled means.

In testimony whereof I have affixed my signature in presence of two witnesses.

CLYDE J. COLEMAN.

Witnesses:

HENRY D. WILLIAMS,
HERBERT H. GIBBS.