No. 871,325. PATENTED NOV. 19, 1907.

C. J. COLEMAN.

REFRIGERATING APPARATUS.

APPLICATION FILED OCT. 1, 1902.

2 SHEETS—SHEET 1.

Fig. 1.

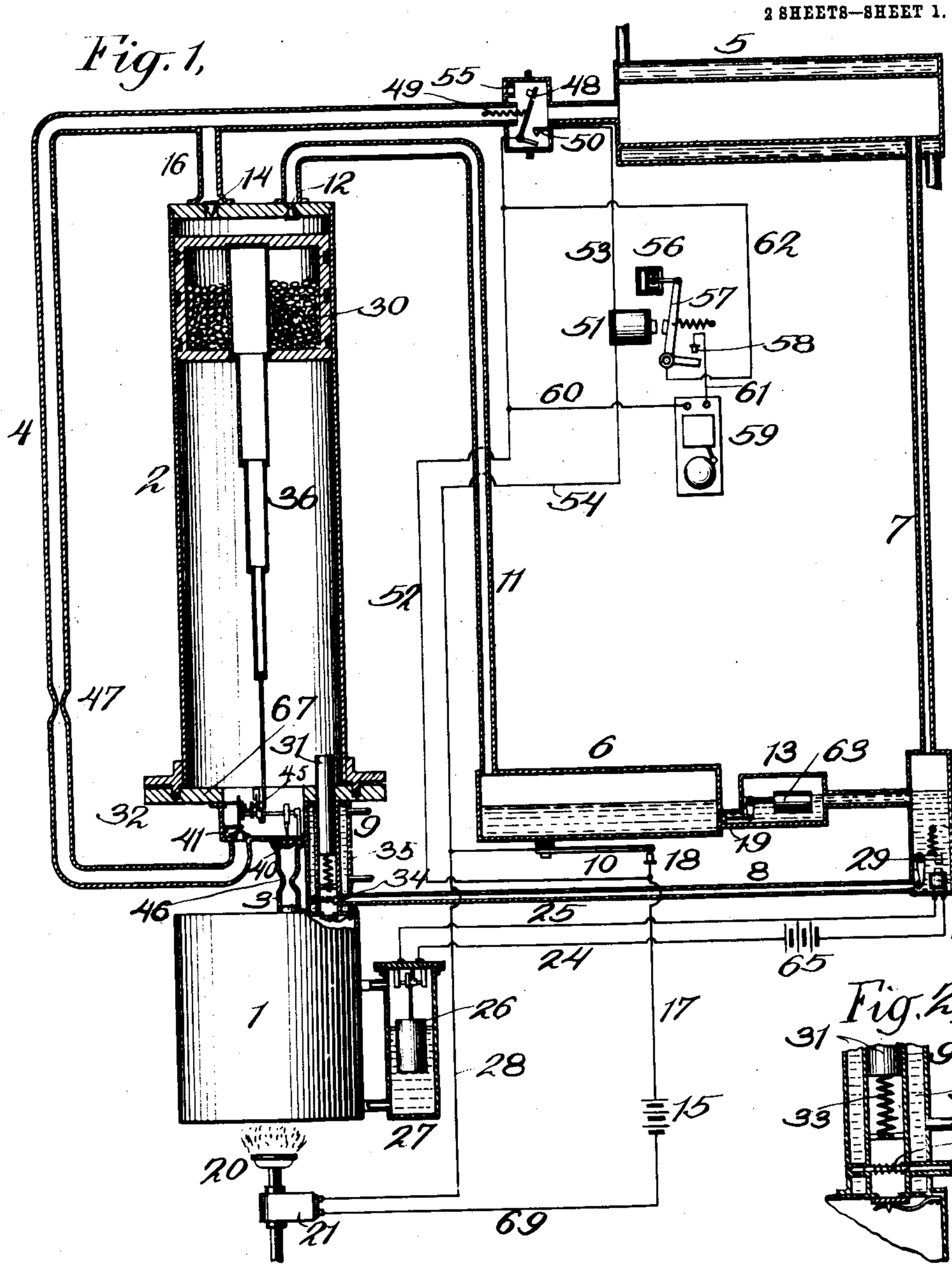

Fig. 2.

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2 SHEETS—SHEET 2.

Fig 3.

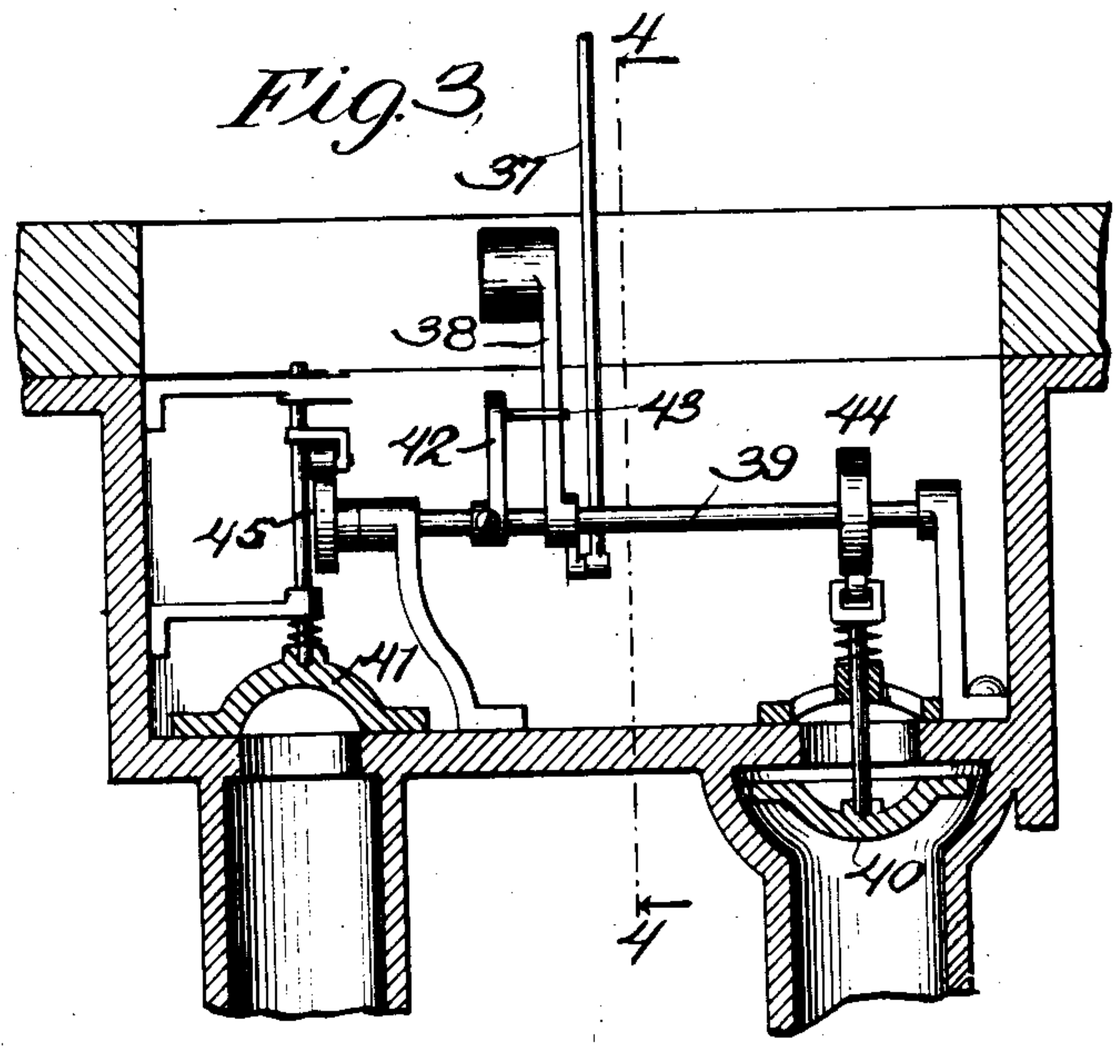
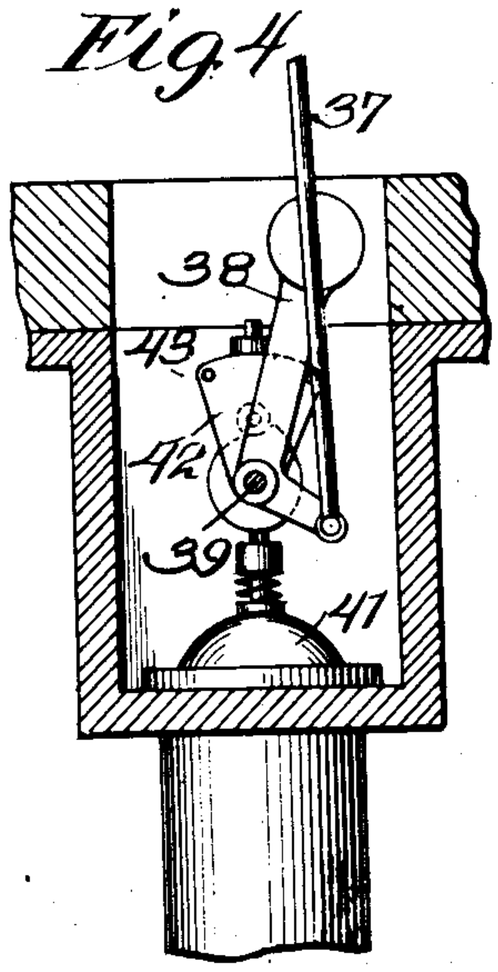


Fig 4.



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REFRIGERATING APPARATUS.

No. 871,325. Specification of Letters Patent. Patented Nov. 19, 1907.

Application filed October 1, 1902. Serial No. 125,546.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at 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 and more particularly to means for utilizing a motive medium in the production of a refrigerating action and for controlling the supply of such medium to dynamic expanding means and for giving an alarm in the event of the checking or stoppage or other retardation of the flow of medium through the refrigerating apparatus.

According to my invention extensible means are provided controlled by a movable compression device or piston and controlling the valve mechanism for admitting and exhausting a motive medium to actuate such movable device or piston, whereby a long stroke is permitted of such movable device or piston with a simple construction of parts. According to my invention such compression device or piston is inclosed in a sealed casing, and a pumping or feeding device is provided for supplying the motive medium to dynamic expanding means, such pumping device being controlled by the movement of the compression device or piston and being sealed with the compressor casing.

According to my invention a movable vane is interposed in the path of a medium flowing through a refrigerating apparatus and this movable vane controls an alarm apparatus so as to actuate the same when the flow of medium is retarded, and retarding means are provided to limit the actuation of the alarm apparatus to a sufficiently long continued checking or stoppage of flow to indicate a substantial impairment of the apparatus.

I will now describe the construction of refrigerating apparatus illustrated in the accompanying drawings and embodying my invention 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 detail of a portion of the pump for feeding the heating chamber. Fig. 3 is an enlarged sectional detail of the valve mechanism. Fig. 4 is a section of the same on the line 4—4, Fig. 3.

The main parts of the apparatus comprise means for expanding a medium by the application of the heat thereto, shown as a heating chamber 1, means for compressing a portion of the medium by the expansive action of another portion of the medium, shown as a compressor 2, means for abstracting heat from the compressed medium, shown as a condenser 5, and means for utilizing the expansion of the condensed medium in the production of a refrigerative or cooling action, shown as a refrigerator or cooling chamber 6.

There are two closed cycles of circulation, one the power cycle and the other the refrigerant cycle, both uniting in the common condenser 5. The power cycle is from the heating chamber 1 through the power feed conduit 3 to the power end of the compressor 2, under the control of the valve mechanism hereinafter described, thence through the exhaust conduit 4 to the condenser 5, thence through the static column conduit 7 and pump feed conduit 8, and thence through the pump 9 to the heating chamber.

The refrigerant cycle is from the cooling chamber 6 through the compressor intake conduit 11 into the upper or compression end of the compressor 2 under the control of the intake valve 12 and out from the compressor cylinder through the outlet valve 14, and through the compressor outlet conduit 16 to the exhaust conduit 4 of the power cycle, to the condenser 5, and from the condenser 5 through the static column conduit 7 to the float chamber 13, and from such chamber under the control of the expansion valve 19 back to the cooling chamber 6.

The application of heat to the heating chamber 1 is shown as accomplished by a gas burner 20, the gas supply of which is regulated by a suitable electrically controlled valve 21, and a thermostatic controller is provided in proximity to the cooling chamber 6 and exposed to the temperature thereof, shown as consisting of a bimetallic strip 10, which acts to close the circuit of the valve 21 and thereby to restrict or shut off the supply of gas to the burner 20 when the temperature in the refrigerator 6 falls below the desired cooling temperature. The circuit controlled by this controller may be traced as follows; from battery 15 by wire 17, contact 18, bimetallic strip 10, wire 28,

valve 21 and wire 69 back to battery. Other circuits are also provided connected to this battery and one of them controlling the gas regulating valve as will be hereinafter described.

I provide means for regulating the supply of condensed or liquid medium to the heating chamber so as to maintain a substantially uniform liquid level therein, such means being shown as including a float 26 located in a chamber 27, connected to the heating chamber above and below the liquid level so that the liquid level in such chamber will correspond with the liquid level in the heating chamber, and also including a pumping device actuated by the piston 30 of the compressor, and an electrically controlled valve 29 for regulating the supply of medium to the pump, this valve 29 being located at the foot of the static column conduit 7. The pumping device comprises a pump plunger 31 fitted to slide in the base or lower head 67 of the compressor and in a cylinder secured to such head and entirely inclosed within the sealed casing of the apparatus and this plunger 31 is normally sustained by a retracting spring 33 in such position that its upper end extends up into the lower part of the piston chamber of the compressor, so that the compressor piston 30 when it approaches the lower end of its stroke, will come in contact with and force downward this pump plunger, the return stroke of the pump plunger being made under the action of its retracting spring 33 as the compressor piston 30 rises. A spring actuated intake valve 34 is provided for the pump cylinder. The cylinder of the pump 9 is provided with a water jacket 35 to maintain a low temperature therein so that the condensed medium which flows into the pump will not become expanded in the pump, as such expansion would impair the effectiveness of the pumping action. The pump supply controlling valve 29 is held normally open by the spring 23 and is controlled by an electro-magnet 22, the armature of which is carried by the valve 29, and the circuit of the electro-magnet 22 is opened and closed by the action of the liquid level float 26 above described. When the supply of liquid in the expansion chamber rises above the normal, the float 26 closes the circuit of the electro-magnet 22 and this electro-magnet by attracting its armature, closes the valve 29 and thereby cuts off the supply of fluid to the pump, so that the pump will draw no fluid, although the movement of its piston may be continued. When the liquid level in the heating chamber 1 falls slightly below the normal, the circuit of the electro-magnet 22 will be opened and the electro-magnet will release its armature and permit the valve 29 to be opened by its spring 23 and the pump will then supply liquid to the expansion chamber. The circuit of the electro-magnet 22 may be traced from the battery 65 through wire 24, contacts of the float device, wire 25, electro-magnet 22 and wire 66, back to battery.

The compressor piston 30 is vertically arranged so that its movement is with and against gravity, and is of substantial weight and is actuated by gravity in performing its down stroke. The piston rod 36 is extensible or telescopic and is shown as made of a plurality of sections arranged to open and close telescopically and to actuate the valve mechanism only at the extremities of the stroke of the piston, the lower section 37 of the telescopic piston rod being connected to the weighted valve actuating lever 38, this valve actuating lever being loosely mounted on the shaft 39 in unstable equilibrium so as to exert a substantial force by its own weight. When the piston approaches the upper extremity of its stroke the lower section 37 of its rod is pulled upwardly, thereby swinging the weighted lever over its center from the position shown in Fig. 4, and after the center of gravity of the weighted lever has passed over its pivotal center, its own weight carries it to the opposite extreme position, and it closes the inlet valve 40 and opens the exhaust valve 41. When the piston approaches the lower extremity of its stroke, the upper end of the section 37 comes in contact with the top of the pocket in the piston and the weighted lever is actuated in the reverse direction, toward the position shown in Fig. 4, and after the weighted lever has been moved sufficiently to carry its center of gravity over its pivotal center, its own weight will carry it to the extreme position shown in Fig. 4, opening the inlet valve 40 and closing the exhaust valve 41. The weighted lever 38 actuates the valves through a motion transmitting means comprising a sector 42, secured upon the shaft 39, and having contact pins 43 spaced apart so as to permit the weighted lever to be moved over its center and to acquire momentum before coming in contact with the pin which is interposed in its path. The shaft 39 is also provided with two cams 44 and 45, the cam 44 being arranged to coact with the stem of the inlet valve 40 to open such valve and the cam 45 being arranged to coact with the stem of the exhaust valve 41 to open such valve, and the valves being provided with light springs tending to move them toward their seats.

For the purpose of regulating the movement of the expanded medium from the heating chamber 1 to the power chamber of the compressor 2, I provide a restricted portion 46 in the power feed conduit 3 so that violent action of the piston will be prevented, and I provide the exhaust conduit 4 with a restricted portion 47 for a like purpose.

Should the circulation of medium in the apparatus become checked or choked at any time by the clogging of any conduit or part thereof, the supply of refrigerant medium to the heating chamber would be checked or stopped, but the diminution in the effectiveness of the action would call for the application of full heat to the heating chamber. I provide that in such a contingency the supply of heating medium will be reduced or cut off and an alarm will be sounded to give notice of the impaired condition of the apparatus. The means provided to this end comprise a light pivoted vane 48 located in the conduit 4 in proximity to the condenser 5, this vane being located in an enlargement or chamber formed therein and arranged in front of the conduit opening so that the medium flowing through such conduit will flow against such vane and hold the vane back in the position shown. Should the flow of the refrigerant medium be checked, this vane will be moved by its spring 49 against the mouth of the conduit and will make contact with a contact point 50 and will thereby close the circuit through the electro-magnet 51 to actuate an alarm apparatus and will also close a circuit through the gas supply valve 21 to restrict or shut off the supply of gas to the burner 20 of the heating chamber.

The circuit for the alarm controlling electro-magnet 51 and the valve 26 may be traced from the battery 15 through wires 17 and 52, vane 48, point 50, wire 53, electro-magnet 51, wires 54, 28, gas valve 21 and wire 29, back to battery. In order that this circuit may not be closed by every trifling retardation of the flow of refrigerant medium, I supply a dash-pot 55 and a plunger on the vane 48 is adapted to enter such dash-pot before the contact 50 is closed, so that the resistance of this dash-pot will prevent the closing of the vane upon the contact 50 unless the stoppage of the movement of the refrigerant medium is extended over a substantial interval of time. I also provide a dash-pot in the alarm controlling apparatus, such dash-pot 56 controlling the movement of the armature 57 of the alarm controlling electro-magnet 51. When the alarm controlling electro-magnet 51 is energized, it attracts its armature, but by reason of the dash-pot 56 the movement of the armature is retarded so that its full movement is not completed unless the energization of the alarm controlling magnet 51 is maintained for a substantial period of time. When the armature 57 completes its full movement it closes a circuit through the contact 58 of the alarm apparatus 59, such circuit being a branch from the wire 52 of the circuit above described and flowing from the wire 52 through the wire 60, alarm apparatus 59, wire 61, contact 58, armature lever 57 and wire 62 back to the wire 52. This circuit is also dependent upon the maintenance of the contact of the vane 48 with the point 50. Thus the sounding of the alarm results only from a substantial impairment of circulation maintained for such a time as to make advisable the cutting off of the power supply and an inspection of the apparatus.

The expansion device for regulating the flow of refrigerant medium into the cooling chamber or refrigerator 6 comprises an expansion valve 19 located between the refrigerator 6 and the float chamber 13, and in the float chamber 13 is a pivoted float 63 which controls the movement of the expansion valve so that the expansion valve is only opened when there is sufficient liquid medium in the float chamber to lift the float. By this means the entrance of unliquefied medium to the refrigerator is prevented. Further the expansion valve 19 is immersed at all times in liquid medium, both on the feed and expansion sides thereof, so that congelation or freezing at the point of expansion is prevented by the constant presence of liquid medium at the point of expansion.

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

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

1. In a refrigerating apparatus, the combination with a source of motive medium of a compressor having a piston and a sealed casing for the same, valve mechanism for admitting the motive medium to such casing to actuate such piston and for exhausting the motive medium therefrom comprising intake and exhaust valves and cams arranged to co-act with the respective stems of such valves to move the valves and swinging weighted levers to accelerate the movement of the cams, and actuating means for such cams actuated by the piston, such cam-actuating means and the valve mechanism and valve-actuating means being sealed in such casing.

2. In a refrigerating apparatus, the combination with a source of motive medium of a compressor having a piston and a sealed casing for the same, valve mechanism for admitting and exhausting the motive medium to such casing to actuate such piston comprising intake and exhaust valves and weight-actuated means coöperative with the valves to cause quick opening and closing movements thereof, and means for actuating such valve mechanism from the piston, such actuating means and the valve mechanism being sealed in such casing.

3. In a refrigerating apparatus, the combination with means for dynamically expanding a motive medium, of a compressor

having a casing and a piston therein, and a pump for feeding the motive medium to the dynamic expanding means, the pump having a piston controlled by the compressor piston through an opening which forms a sealed connection between the pump casing and compressor casing, and the pump casing also having sealed connections with a source of motive medium and with the dynamic expanding means, and the dynamic expanding means having a sealed connection with the compressor casing.

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

CLYDE J. COLEMAN.

Witnesses:

HENRY D. WILLIAMS,

HERBERT H. GIBBS.