

G. A. WEGNER.  
REFRIGERATING APPARATUS.  
APPLICATION FILED MAY 13, 1918.

1,325,128.

Patented Dec. 16, 1919.

2 SHEETS—SHEET 1.

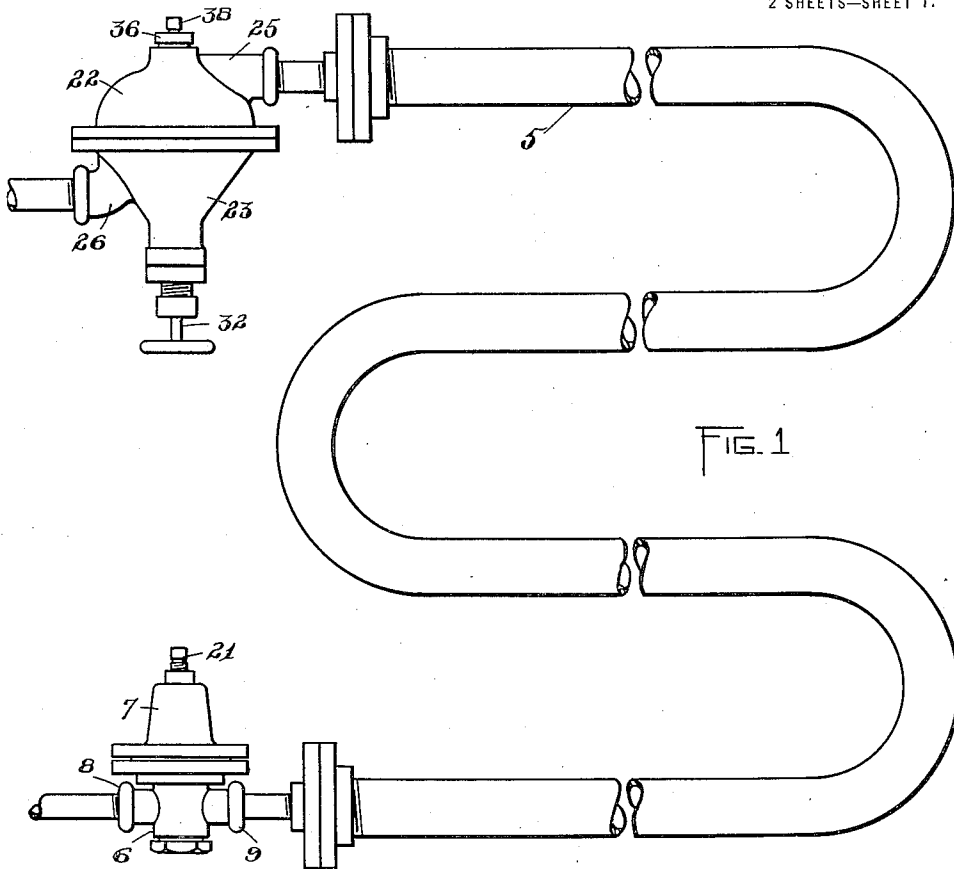


FIG. 1

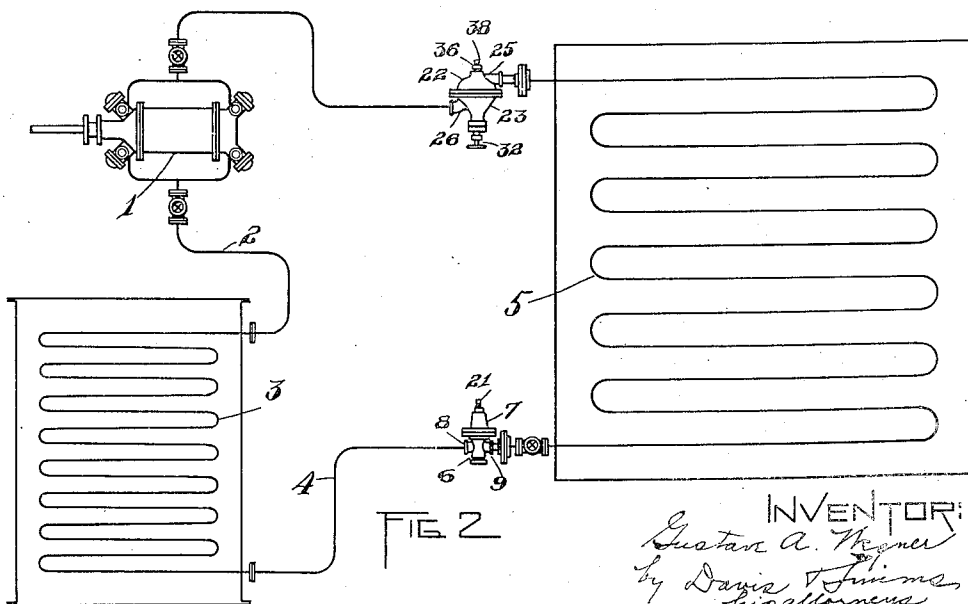


FIG. 2

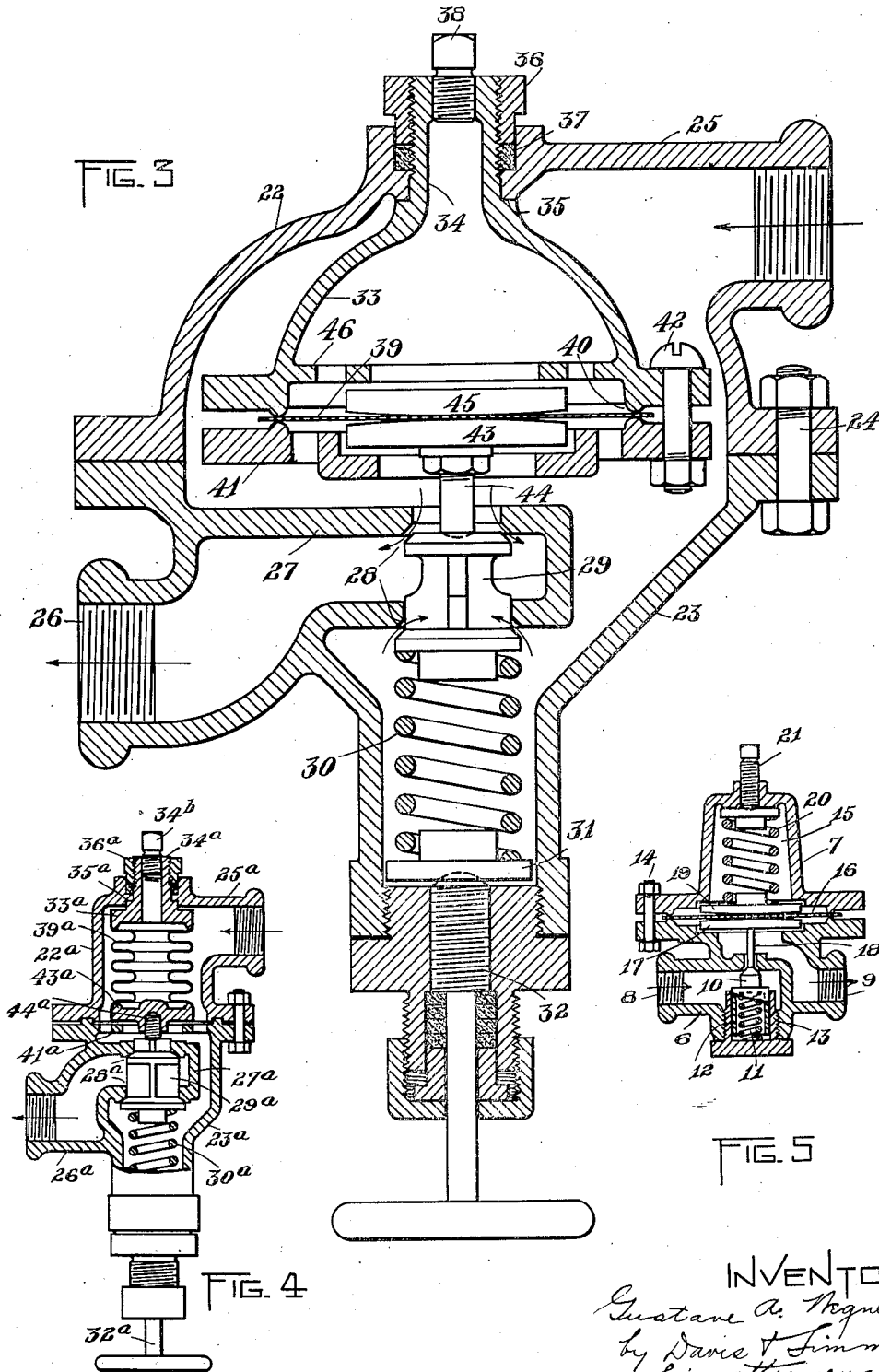
INVENTOR:  
*Gustav A. Wegner*  
by *Davis & Finnes*  
*his attorneys*

G. A. WEGNER.  
REFRIGERATING APPARATUS.  
APPLICATION FILED MAY 13, 1918.

1,325,128.

Patented Dec. 16, 1919.

2 SHEETS—SHEET 2.



INVENTOR:  
Gustave A. Wegner  
by Davis & Simme  
his attorneys

# UNITED STATES PATENT OFFICE.

GUSTAVE A. WEGNER, OF ROCHESTER, NEW YORK, ASSIGNOR OF ONE-HALF TO WEGNER MACHINE COMPANY, OF BUFFALO, NEW YORK, A CORPORATION.

## REFRIGERATING APPARATUS.

1,325,128.

Specification of Letters Patent.

Patented Dec. 16, 1919.

Application filed May 13, 1918. Serial No. 234,271.

*To all whom it may concern:*

Be it known that I, GUSTAVE A. WEGNER, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

The present invention relates to refrigerating apparatus and more particularly to the type employing a volatile liquid refrigerant, such as ammonia, which is compressed, then conducted to a condenser for liquefaction, and, from the latter, to a cooling element in which the liquid is expanded and from which it is reconducted to the compressor.

In refrigerating apparatus of this type it is necessary to control the refrigerant in the cooling element so that the discharge gas is not saturated with liquid, as saturated gas passing to the compressor will destroy the efficiency of the apparatus. Control of the refrigerant in the cooling element is now most generally effected by manually operable means which requires constant attention on the part of an operative and, in addition, is not efficient. Automatic control has been suggested, but, so far as I am aware, has been defective in one way or another.

It is an object of this invention to provide means for effectively and automatically controlling the quantity of liquid which must be expanded in the cooling element to accomplish certain desired results in such a manner that every particle of liquid is evaporated before leaving the cooling element irrespective of the size of the cooling element or the number of heat units to be absorbed by said cooling element, as long as the work required is held within the capacity of the pump or compressor.

To these and other ends the invention consists in certain parts and combinations of parts, all of which will be hereinafter described, the novel features being pointed out in the appended claims.

In the drawings:

Figure 1 is a detail view of a cooling element in the form of a refrigerating coil equipped with the present invention;

Fig. 2 is a diagrammatic view of a refrigerating apparatus embodying the present invention;

Fig. 3 is an axial section through the valve

at the discharge of the cooling element, the controlling means of such valve being included in the valve casing;

Fig. 4 is a sectional view of another embodiment of the invention on a smaller scale; and

Fig. 5 is a sectional view of a pressure controlled valve arranged to control the liquid supply to the cooling element.

The refrigerating apparatus embodies, as usual, a compressor 1 receiving the gas and leading, by piping 2, to a condenser 3 which, by piping 4, leads to a cooling or refrigerating element 5 of any suitable construction. According to this invention the quantity of the liquid refrigerant which may be admitted to the cooling element through the inlet valve depends entirely upon the quantity of dry discharge gas which is permitted to pass through the outlet valve. The inlet valve is so constructed as to permit the liquid to enter at a certain predetermined pressure under which it will readily evaporate within the cooling element. The outlet valve controls the quantity of outgoing gas by the action of a thermostat which is affected by the temperature of such outgoing gas. By partly opening or closing said outlet valve the pressure within the cooling element will rise or fall above or below the expansion pressure and thus shut or open the inlet valve in accordance with its own action.

The pressure controlled or inlet valve may be of any suitable construction, that shown (see Fig. 5) comprising the casing formed of two parts 6 and 7. The part 6 has a passageway therethrough leading to the inlet 8 and the outlet 9 of the casing. This passageway is controlled by a plunger valve 10 pressed toward its seat by a spring 11, a piston 12 being formed on the plunger and operating in a cylinder 13. The piston is exposed to the inlet pressure and cooperates with other devices to determine the position of the valve. The casing parts 6 and 7 are connected by bolts 14, the part 7 having a chamber 15 which is separated from the outlet side of the passageway in the member 6 by means of a diaphragm 16. On one side of this diaphragm a plate or disk 17 is arranged and is engaged by the projecting end 18 of the plunger valve 10, while on the opposite side of the diaphragm, within the chamber 15, a disk 19 is arranged and is

engaged by a coil spring 20. A setting or adjusting screw 21 is mounted on the casing member 7.

If this pressure regulating valve is set by the adjusting screw 21 to a pressure corresponding to a certain boiling point of the liquid refrigerant, it is evident that a constant temperature will be maintained in the cooling element 5 as long as the refrigerant remains at the same pressure and in a saturated state in the cooling element. If the pressure is so chosen that the temperature of the fluid in the coil is several degrees lower than the medium through which the coil passes, the refrigerant will be evaporated and the medium will be cooled. It is evident, however, that the difference of temperature between the boiling point of the refrigerant in the coil and the temperature of the medium to be cooled, depends upon several factors, such as outside temperature, the length of the cooling coil, and the insulation of the inclosure of the medium. These influences are determined under extreme conditions, and the pressure regulating valve is set so as to constantly carry a sufficient supply of refrigerant into the cooling coil or element to meet the above conditions. It may be here stated that where like conditions exist, as where two or more cooling coils or elements are arranged in one room, one pressure regulating valve will answer for a number of cooling elements or coils.

Having established a substantially constant pressure at the inlet of the cooling element or coil 5 it becomes now important to control the outlet from the cooling element or coil so that only a fully evaporated or dry gas will be conducted to the compressor, permitting only such gas to pass which has been heated to the temperature of the room or medium surrounding the cooling element. This is accomplished by placing at or near the outlet of the cooling element or coil, a valve which controls the amount of fluid passing from the coil, and, in turn, is controlled by a thermostat of any construction which is directly affected by the temperature of the fluid discharged from the cooling element or coil. Any valve which will perform these functions is within the scope of this invention.

One form of valve shown in Fig. 3 comprises a casing formed of two castings 22 and 23 bolted together at 24. The casting or part 22 has the inlet 25, while the casting 23 has the outlet 26. A partition 27 is formed in the casting 23 and is provided with two openings 28, the walls of which form valve seats. A valve 29 coöperates with the valve seats and is pressed toward the latter by a coil spring 30 whose opposite end rests against an abutment 31 which is engaged by an adjusting screw 32 operable from the exterior of the valve casing.

The thermostat which controls the valve lies within the valve casing in the path of the fluid passing through the casing and, in this instance, comprises a casting 33 formed with a reduced portion 34 which projects through an opening in the casting 22, a shoulder 35 being provided on casting 33 to abut the casting 22 about the inner end of the opening. The reduced portion 34 is held in the opening by a nut 36 which also acts to hold a packing 37 about the reduced portion to seal the joint between said portion and casting 22. An opening closed by a plug 38 may be provided in the reduced portion for the filling of the thermostat with the expansive fluid such as ammonia. A diaphragm 39 is held against an annular seat 40 on the casting 33 by a plate 41 which is secured in place by bolts 42. One face of this diaphragm is exposed to the liquid of the thermostat while the opposite face connects with the valve preferably through a disk 43 having a projection thereon 44 coöperating with the upper face of the valve. A disk 45 is arranged on the inner face of the diaphragm to coöperate with a flange 46 within the thermostat so as to limit the inward movement of the diaphragm under the action of the spring 30 which acts on the valve. The disk 43 coöperates with the plate 41 to limit the outward movement of the diaphragm.

In operation, the spring 30 is adjusted to begin to close the valve 29 at a temperature equal to or slightly below that at which the surroundings of the cooling medium is to be held. This closing action will take place as soon as the expansive fluid in the thermostat has been cooled by the gas passing from the cooling element or coil 5 to a degree equal to the temperature of the room. This causes the pressure in the thermostat to gradually reduce until the internal pressure of the thermostat is counterbalanced by the pressure of the spring 30, and, if the pressure in the thermostat still further decreases, the valve 29 will gradually close. As gas passing from cooling elements or coils in rooms maintained at zero temperature will eventually reduce the pressure in the thermostat to a much lower point than gas issuing from cooling elements in a room maintained at freezing point, the counter-pressure spring must in the former case be much less in strength than in the latter, and it is for this reason that the adjusting screw 32 becomes an important feature for the regulation of the temperature at which the gas may be permitted to pass the thermostat.

As before pointed out, the temperature of the refrigerant in the cooling element 5 must be held low enough to cool easily the medium to the desired temperature. Any additional heating of the medium will be followed by an increased evaporation of the

refrigerant, and warmer gas passing over the thermostat will result in a larger opening of the valve 29 so that an increased amount of gas will pass to the compressor. On the other hand, the cooling of the medium below the temperature for which the spring 30 has been adjusted will result in a cooler gas passing over the thermostat so that the throttling of the outlet by the valve 29 will take place. As, in the event that ammonia is used, the difference of 1° F. causes, at the temperatures at which this device must work, a difference of about one pound per square inch pressure on the diaphragm 39, it will readily be understood that, by the described action of this device, a substantially even temperature will be maintained automatically.

The embodiment shown in Fig. 4 operates substantially the same as the embodiment shown in Fig. 3, and comprises a two-part casing 22<sup>a</sup> and 23<sup>a</sup> provided with an inlet 25<sup>a</sup> and an outlet 26<sup>a</sup>. The part 23<sup>a</sup> has a partition 27<sup>a</sup> formed with two openings 28<sup>a</sup> closed by a valve 29<sup>a</sup> which is pressed toward its seats by a spring 30<sup>a</sup> whose tension is adjustable by a screw 32<sup>a</sup>. The foregoing parts are substantially the same as the parts in the embodiment shown in Fig. 3. The main difference between the two embodiments is the construction of the thermostat which, in this embodiment, has the "bellows" type of diaphragm, the latter being indicated at 39<sup>a</sup> and having a head 43<sup>a</sup> at one end provided with a projection 44<sup>a</sup> cooperating with the valve 29<sup>a</sup>. A head 33<sup>a</sup> at the opposite end of the diaphragm is provided with a tubular extension 34<sup>a</sup> which extends to the exterior of the valve casing and has a plug 34<sup>b</sup> by which the thermostat may be filled with the expansive fluid. A shoulder 35<sup>a</sup> is provided on the head 33<sup>a</sup> and this shoulder is held in abutment with the valve casing by a packing bushing 36<sup>a</sup> which engages external threads on the tubular extension 34<sup>a</sup>. An internal flange 41<sup>a</sup> limits the expansion of the diaphragm. This type of thermostat is as a rule operated by the expansive force of a non-congealable liquid, such as alcohol, the change of temperature producing by expansion or contraction a change in the length of the bellows.

From the foregoing it will be seen that the control of the necessary admission of the cooling fluid to the cooling medium is entirely controlled by the thermostat placed in the path of the outgoing vapors to be affected by the temperature of the latter so that the thermostat acts upon the opening of the outlet valve and influences thereby the pressure within the cooling element and consequently the action of the inlet valve.

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

1. A refrigerating apparatus of the type employing a volatile liquid refrigerant expanding in a cooling element, distinguished by means at the inlet of the cooling element for maintaining a predetermined pressure of the supply of liquid refrigerant to said element, and a valve controlling the vaporous discharge from said element and in turn controlled by the temperature of said discharge vapor to prevent the passage of saturated gas.

2. A refrigerating apparatus of the type employing a volatile liquid refrigerant expanding in a cooling element, distinguished by a valve at the inlet of the cooling element controlled by a predetermined pressure within said cooling element, and a valve controlling the discharge from said cooling element and controlled by the temperature of the discharge to control the pressure within such cooling element.

3. A refrigerating apparatus of the type employing a volatile liquid refrigerant expanding in a cooling element, distinguished by a valve controlling the discharge from the cooling element, and a thermostat controlled by the temperature of the discharge fluid and controlling said valve to prevent the passage of saturated gas.

4. A structure according to claim 3 combined with means for varying the action of the thermostat so that the valve may operate at different temperatures.

5. A structure according to claim 3 combined with a spring for opposing the action of the thermostat, and means for varying the action of the spring to cause the valve to operate at different temperatures.

GUSTAVE A. WEGNER.