

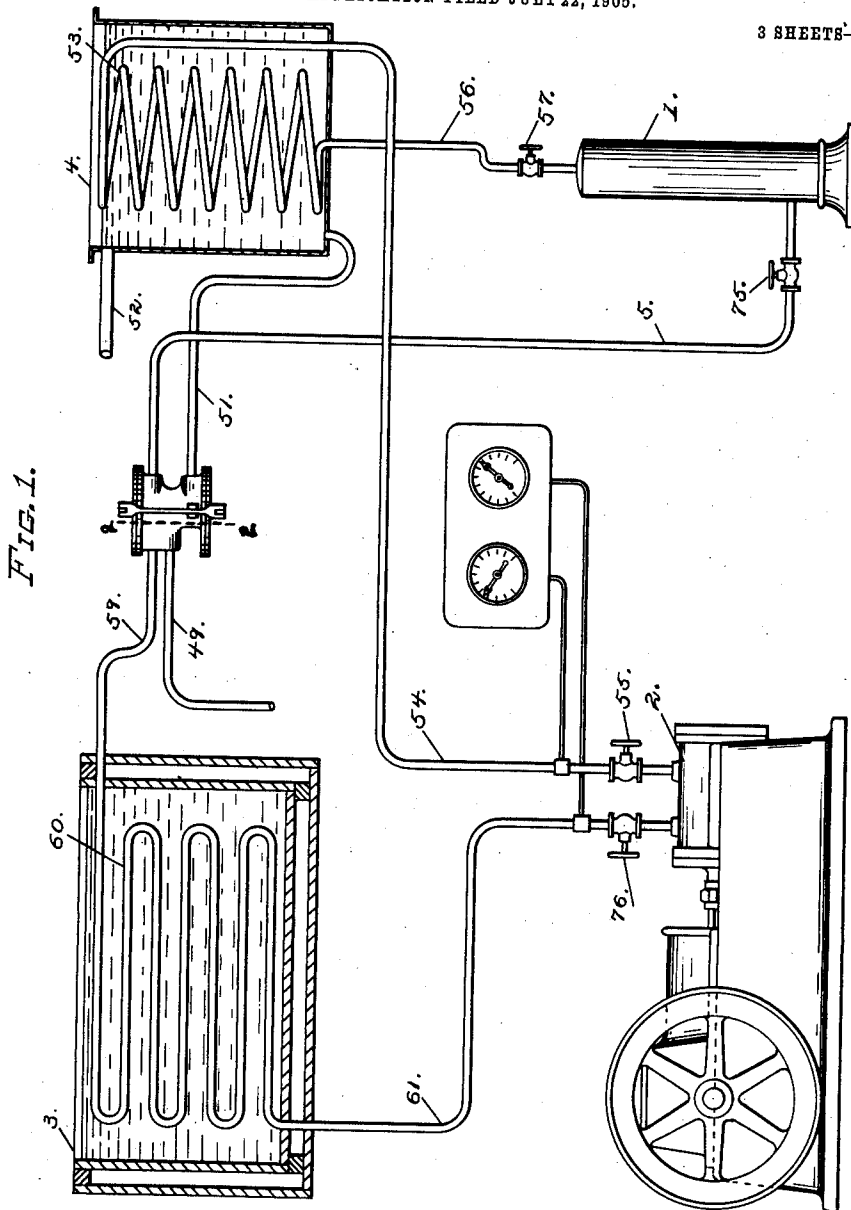
No. 833,325.

PATENTED OCT. 16, 1906.

W. C. HIESTER.
REFRIGERATING MACHINE.

APPLICATION FILED JULY 22, 1905.

3 SHEETS—SHEET 1.



WITNESSES:

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BY

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FIG. 2.

3 SHEETS—SHEET 2.

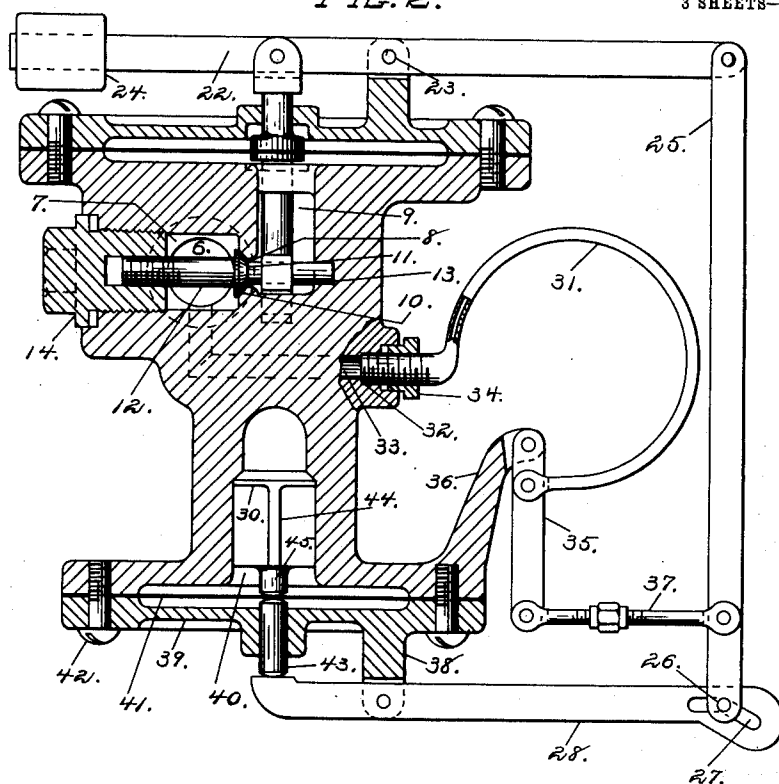
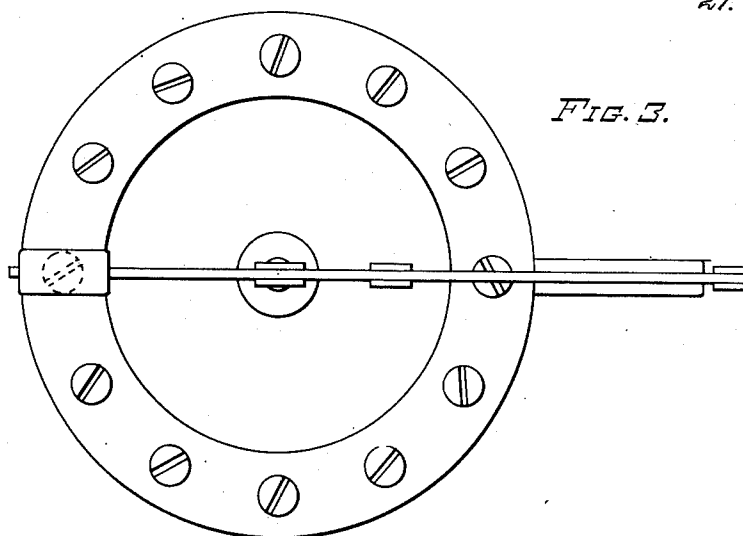


FIG. 3.



WITNESSES

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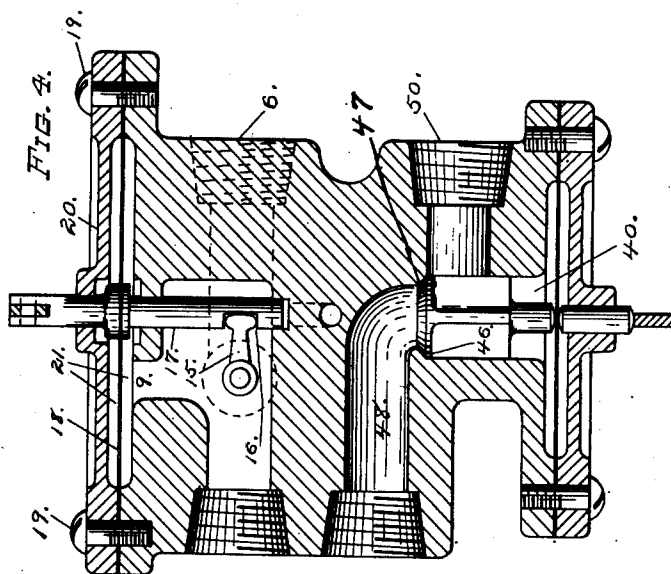
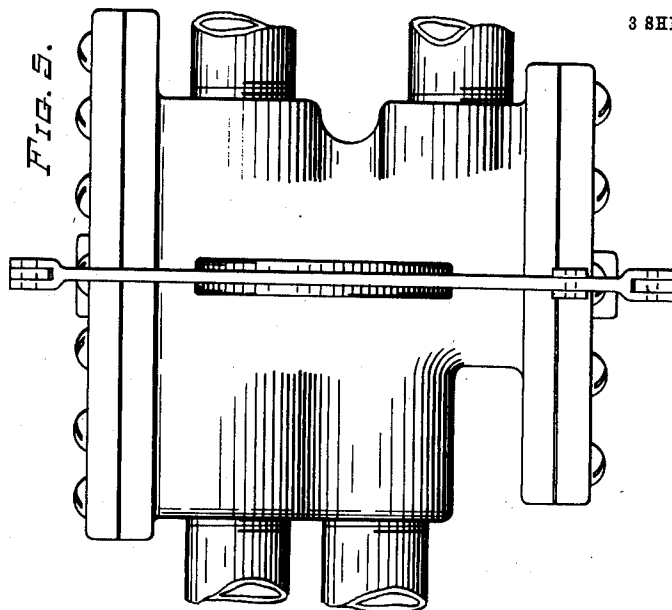
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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REFRIGERATING-MACHINE.

No. 833,325.

Specification of Letters Patent.

Patented Oct. 16, 1906.

Application filed July 22, 1905. Serial No. 270,874.

To all whom it may concern:

Be it known that I, WILLIAM C. HIESTER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Refrigerating-Machines, of which I declare the following to be a full, clear, and exact description.

This invention relates to improvements in refrigerating-machines, and has more particular relation to improvements in automatic controlling mechanisms for the same.

One of the principal objects of the invention is to provide an automatic controlling-valve whereby the desired quantity of liquid ammonia or other refrigerating medium and cooling or condensing water is automatically fed in the proper proportions to secure the most efficient results in operation and cost of maintenance.

A further object of the invention is to provide an improved valve in which both the high and low pressure portions of the system operate conjointly to effect a proper and economical adjustment of the supply of the water or other medium employed for condensing purposes.

The invention also has other objects, all of which will be hereinafter more particularly set forth, and enumerated in the specification and claims which follow.

In the accompanying drawings, which form part of the present specification, Figure 1 represents a side elevation, partly in section, of a refrigerating system with my improvements applied thereto. Fig. 2 represents a detail vertical section through my improved valve on the line 2 2 of Fig. 1. Fig. 3 represents a top plan view of the same. Fig. 4 represents a detail vertical section through my improved valve, taken on a line at right angles to that of Fig. 2. Fig. 5 represents a detail side elevation of my said improved valve.

Before entering into a detail description of my improved valve and its application in a refrigerating system I wish to state some of the known defects in the controlling mechanisms at present in use for governing the supply of refrigerating medium and also controlling the supply of condensing or cooling fluid. In such known systems the attention of an attendant is constantly necessary to change the adjustments of the valves and keep the plant in operative condition. Fur-

ther, even with such constant attention the operation of the plant is not regular and dependency must be placed altogether upon the skill of the operator to keep the valves in the proper relative adjustments necessary for the economical and successful operation of the plant. Even with the best attention from the attendant the plant will very seldom be in the proper adjustment, as the operation of the different feeds is subject to change and he cannot give the time and attention necessary to keep all the conditions normal. Further, with the present controlling devices considerable waste takes place, as the changing conditions of the refrigerating medium can be met with a corresponding change in the suction and the flow of the cooling or condensing medium. The result is that the refrigerating medium or the condensing fluid is not being used proportionately.

The above conditions, with the accompanying waste and cost of maintenance, make small plants for private use out of all reason, and it is to overcome such defects and provide an efficient and economical plant that the present invention is intended.

In the accompanying drawings, 1 represents the supply-tank for the liquid or condensed ammonia; 2, the pump for creating the necessary vacuum in one part of the system and the desired compression for the condenser; 3, the refrigerating-tank, and 4 the condenser-tank.

The tank 1 contains liquid ammonia under compression. This liquid ammonia is fed through pipe 5 to an inlet-port 6 in my improved controlling-valve. The port 6 opens into a closed high-pressure chamber 7, formed at one end with an outlet-port 8 opening into a low-pressure chamber 9. The walls of the port 8 are formed with a conical valve-seat 10, which is arranged to receive a conical valve 11, mounted fast on a valve-stem 12. This stem is journaled at one end, as at 13, in the wall of the chamber 9 and has its opposite end, which is screw-threaded, mounted adjustably in an elongated nut 14, which is screwed into and closes the outer end of the high-pressure chamber 7. The threaded adjustment between the stem and said nut is utilized to seat and unseat the valve 11 as the pressure in the low-pressure chamber 9 varies. The oscillatory move-

ment of the valve-stem necessary to effect this result is secured by means of a laterally-extending arm 15, fast thereon and located in the low-pressure chamber 9. This arm, as best shown in Fig. 4, projects into a notch 16, formed in a vertical stem 17, which passes through and is secured to a horizontal pressure-diaphragm 18, the stem being suitably guided in the walls of the low-pressure chamber. The diaphragm 18 is held firmly in position by bolts 19, which secure a cap-plate 20 down over said diaphragm. The top of the valve and the under side of the cap-plate are hollowed out to provide a diaphragm-chamber 21 to accommodate the movements of the diaphragm. The upper end of the stem 17 extends through the top of the cap-plate 20 and is pivotally secured to a lever 22. This lever is pivotally mounted on the cap-plate, as at 23, and is provided at one end with an adjustable weight 24.

It will be seen from the foregoing description that when the liquid ammonia enters the high-pressure chamber 7 it passes through the port 8 into the low-pressure chamber 9. This pressure in the low-pressure chamber is exerted upon the under side of the diaphragm 18 and raises the same together with the stem 17. This movement will result in rocking forward the valve will be seated and close the port between the high and low pressure chambers until the pressure in the low-pressure chamber reaches the proper gage, when the weight 24 will force the stem 17 down again and open the valve to admit more ammonia. A link 25 is pivotally connected to one end of the lever 22 and is provided at its lower end with a pin 26, which projects laterally into an angular slot 27, formed in a lever 28. The slot 27 is formed with an approximately horizontal portion and an inclined portion. The pin normally plays in the horizontal portion of the slot 27, and the lever 28 is thus moved in accord with the lever 22. When the link 25 is moved outward, however, and the pin brought into the inclined portion of the slot, the relative positions of the levers 22 and 28 will be changed and the valve 30, hereinafter described, will be opened to a greater extent. This movement of the link takes place when the pressure in the high-pressure chamber exceeds a certain fixed point represented by the hollow gage-spring 31. This spring is of the usual construction and is screw-threaded, as at 32, and screwed into the walls of the valve, so that it will communicate with a passage-way 33, connected to the high-pressure chamber 7 and formed in the body of the valve. The spring is also held in position and locked by a lock-nut 34. The outer or free end of the spring is pivotally connected to a pendent link 35, pivotally mounted upon an arm 36 of the valve. The lower end of the link is con-

nected by a turnbuckle-rod 37 to the link 25. Under normal conditions the gage-spring will not act and the pin 26 remains in the horizontal portion of the slot 27; but when the pressure in the high-pressure chamber rises above the pressure for which the gage-spring is set this spring will expand in the well-known manner and will operate the link 35 and through the rod 37 will force the lower end of the link 25 outward, and thus move the pin 26 into the inclined portion of the slot 27 and open the valve 30 to a greater extent. This movement of the valve 30 may be independent of any movement of the lever 22, or it may take place at the same time that the valve is being operated by the movement of said lever 22.

The lever 28, heretofore mentioned, is pivotally mounted in a pendent lug 38, formed on the base-plate 39, which is somewhat similar to the cap-plate 20 and is secured over a water-pressure chamber 40, formed in the lower part of the valve, the cap being hollowed out to permit movement of a diaphragm 41, which is secured between said base-plate and the bottom of the valve by bolts 42. A plunger 43, mounted in the base-plate, forms the connecting medium between the lever 28 and the diaphragm 41. The valve 30, which is provided with suitable guiding-wings 44 and a stud 45, rests upon the top of the diaphragm 41, whereby the movements of the valve are controlled by the movements of the diaphragm. The valve 30 is seated as at 46 and closes the water-port 47, which is connected to the water-supply by passage 48 and pipe 49, as best illustrated in Fig. 4. A passage-way 50 from the chamber 40 permits the water to pass into the supply-pipe 51 and thence to the condensing-tank 4, a suitable overflow-pipe 52 being provided for said tank to carry off the heated water. A certain predetermined quantity of water is necessary to properly condense the compressed gases in a condenser-coil 53, located in the tank 4, and more water than is necessary would simply be a waste. My improved automatic valve after being once set automatically supplies just the right amount of water according to the compression in the coil 53. If the compression in the coil rises, there will of course be a greater quantity of heat to carry off and a greater quantity of water will thus be necessary, whereas if the compression in the coil is reduced there is less heat generated and less water is required to effect the condensation of the gases.

One end of the coil 53 is connected to the outlet-port of the compressor 2 by a pipe 54, having a valve 55, while the other or lower end of the coil is connected to the tank 1 by a pipe 56, also provided with a valve 57.

The low-pressure chamber 9 is connected by a pipe 59 to the refrigerating-coil 60, which is preferably located in the brine-tank 3. A

pipe 61 connects the coil 60 to the inlet-port of the compressor 2. The compressor 2 is of any usual form and is operated by any desired form of motor, the same forming no part of the present invention.

As above stated, the supply of water to the tank 4 is automatically controlled by the pressure within the coil 53. This result is effected because the pressure in the coil is dependent upon the speed of the compressor, and the greater the pressure in the pipe 54 the greater the suction in the pipe 61, the coil 60, the pipe 59, and the low-pressure chamber 9. As the pressure in the chamber 9 falls because of the suction the valve 11 opens and admits more liquid ammonia, because of the downward movement of the diaphragm. This downward movement of the diaphragm and stem 17 causes the water-valve to be opened to a greater extent, as before described, and thus permits a greater amount of water to pass through the pipe 51 into the tank 4 to absorb and carry off the increased heat from the coil 53. Should the additional amount of water fed to the tank not completely compensate for the higher temperature of the gases in the coil 53, it will be seen that the pressure in the high-pressure side of the system will immediately rise. The pressure in the high-pressure chamber will thus soon reach a point at which the gage-spring is set to operate, and the spring will tend to straighten out and open the water-valve to a greater extent, so that sufficient water will be supplied to the tank 4 to cool the coil 53 sufficiently to cause condensation of its contents. It will thus be seen that the water-supply is controlled from both the high and the low pressure sides of the system conjointly. The pipe 5 is provided with the valve 75 and the pipe 61 with the valve 76, while both of the pipes 54 and 61 are connected to suitable gages 77 and 78 for indicating the pressure therein.

While I have shown my refrigerating-coil 60 as mounted in a brine-tank, it will be readily understood that the coil may be mounted in a refrigerator or in any other position, as the cold brine is simply utilized as a medium for conveniently lowering the temperature to any desired point.

The action of my improved valve is as follows: The compressor is first put into operation, and as soon as the suction-pressure has been reduced to that equivalent represented by the weight 24 the expansion or ammonia valve opens and permits a flow of the refrigerant equivalent to the amount necessary to carry the desired suction-pressure. Upon the opening of this valve motion is transmitted to the link 25 and the water-valve is correspondingly opened. A limited amount of water is thus fed immediately to the condenser. After the compressor has been in operation for some time the compressed

gases become hot, and the condenser thus requires more water. This increase in the water-supply is secured in the following manner: After the hot gases have raised the high-pressure side of the system the hollow spring 31 is elongated sufficiently to cause the pin in the link 25 to move out of the horizontal portion of the slot 27 into the inclined portion of the same, which will open the water-valve to a greater extent, and thus supply more water to the condenser without changing the adjustment of the expansion-valve. When the compressor is shut down, only a portion of the condenser-water is shut off at once, as the continued high pressure of the hot gases holds the spring 31 elongated, and thus holds the water-valve open. The valve remains open and water is fed to the condenser until the gases in the high-pressure side of the system cool sufficiently to permit the spring 31 to assume its normal position. In extremely hot weather and when the plant is not in operation the pressure of the gases will rise and the spring 31 will be elongated to open the water-valve until the gases are cooled.

It will be seen from the foregoing description that my improved valve or regulator will control or maintain the supply of the refrigerant needed and will supply the limited amount of condensing fluid necessary.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a refrigerating system the combination with a compressor and a condenser with connections, of a valve for controlling the supply of the refrigerating medium, a valve for controlling the supply of the condensing medium, and mechanism connecting the valves for synchronous adjustments in varying degrees according to the pressure controlled by the refrigerant-valve.

2. In a refrigerating system the combination with a condenser and a compressor with connections, of a refrigerant-controlling valve, a valve for the cooling medium for the condenser, and devices connecting the valves for synchronous adjustments in varying degrees according to the pressure in the connections between the refrigerant-valve and the compressor.

3. In a refrigerating system the combination with a compressor and a condenser, of expansion connections, high-pressure connections, valves for controlling the refrigerant and water respectively, and mechanism for governing the valves from both the expansion and the high-pressure connections of the system.

4. A regulator comprising an expansion-valve with provisions for operation by the expanding gases or suction and a water-valve and connections with provisions for operation by the expanding gases and the refrigerant before expansion.

5. A regulator comprising an expansion-valve with provisions for operation by the expanding gases or suction, and a water-valve and connections with provisions for operation by the expanding gases and the refrigerant before expansion together or independently.
6. In a refrigerating system, a regulator comprising an expansion-valve operated from the expansion side of the system, and a water-valve connected to and operated by the expansion-valve for controlling the cooling in the compression side of the system.
7. A regulator comprising an expansion-valve, means on the low-pressure side of the valve for controlling its operation, a water-valve, connections between the two valves for effecting their conjoint action, and means for operating the water-valve independently from the high-pressure side of the expansion-valve.
8. In a refrigerating system, a regulator comprising an expansion-valve, a diaphragm connection controlled from the expansion side of the system, and a water-valve connected to said diaphragm for controlling the cooling in the compression side of the system.
9. In a refrigerating system, a regulator comprising an expansion-valve, a water-valve, diaphragms for the two valves controlled by the expanding gases and the water respectively and means connecting the diaphragms for conjoint action.
10. In a refrigerating system, a regulator comprising an expansion-valve, means on the low-pressure side of the valve for controlling its operation, a water-valve, connections between the two valves, and a high-pressure expansion-spring and connections for controlling the water-valve from the high-pressure side of the expansion-valve.
11. In a refrigerating system, the combination with an expansion-valve, of a water-valve, an adjustable link connecting the valves, and a connection on the high-pressure side of the expansion-valve for moving said link to effect the adjustment.
12. In a refrigerating system, the combination with a compressor and a condenser, of a refrigerant-controlling valve, a water-controlling valve, means connecting the two valves for conjoint action from the expansion side of the refrigerant-valve, and an adjustable means for governing further the water-controlling valve, governed from the high-pressure side of the refrigerant-valve.
13. In a valve for a refrigerating system, the combination with an expansion-valve, of a water-valve, adjustable connections for varying the relations between the two valves and means for automatically adjusting said connection from the high-pressure side of the expansion-valve.
14. In a refrigerating system the combination with an expansion-valve, of a diaphragm controlling the same with provisions for connecting it in the low-pressure side of the system, a water-valve, positive connections between the two valves and means for controlling this connection from the high-pressure side of the expansion-valve.
- In testimony whereof I affix my signature in the presence of two witnesses.
- WILLIAM C. HIESTER.
- Witnesses:
CHARLES N. LUPTON,
THEODORE M. HIESTER.