Oct. 13, 1925.

1,557,192

E. J. BRUNNING

REFRIGERATING APPARATUS

Filed April 26, 1920

2 Sheets-Sheet 1

Fig. 4.

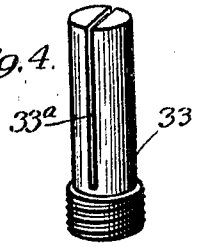


Fig. 1.

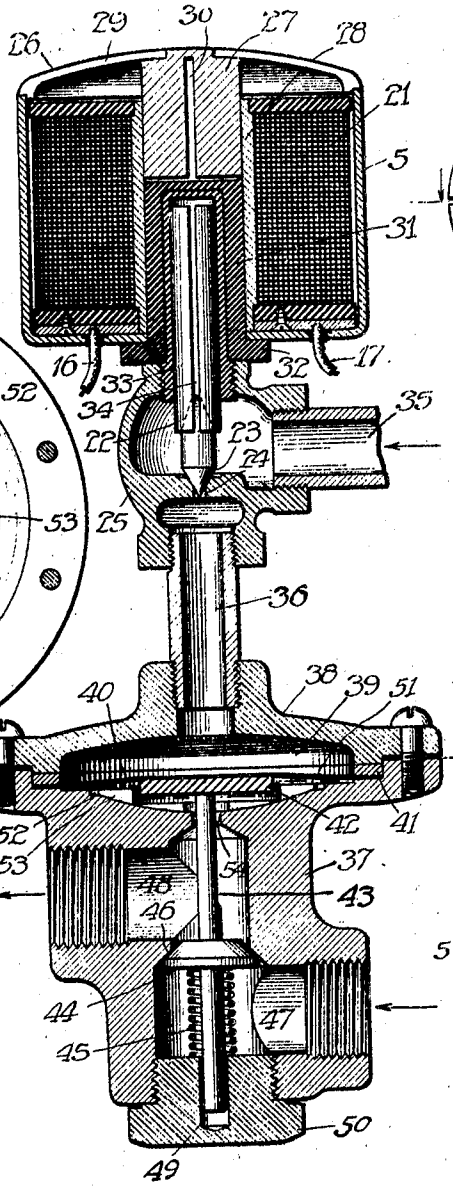


Fig. 5.

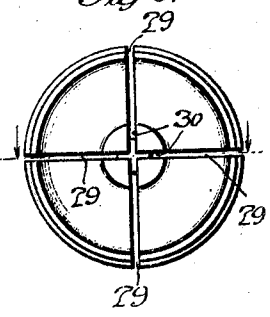


Fig. 2.

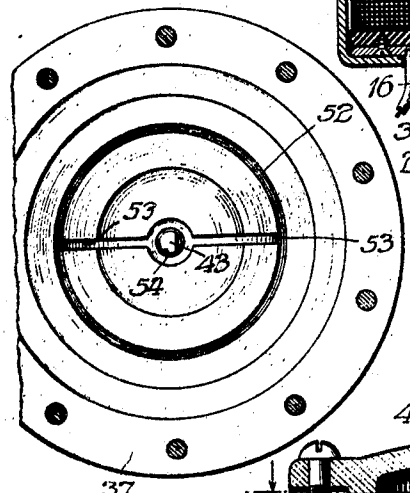


Fig. 3.

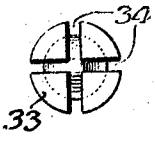


Fig. 6.

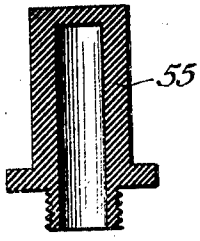
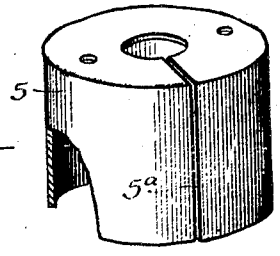


Fig. 7.



Witness

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His Attys

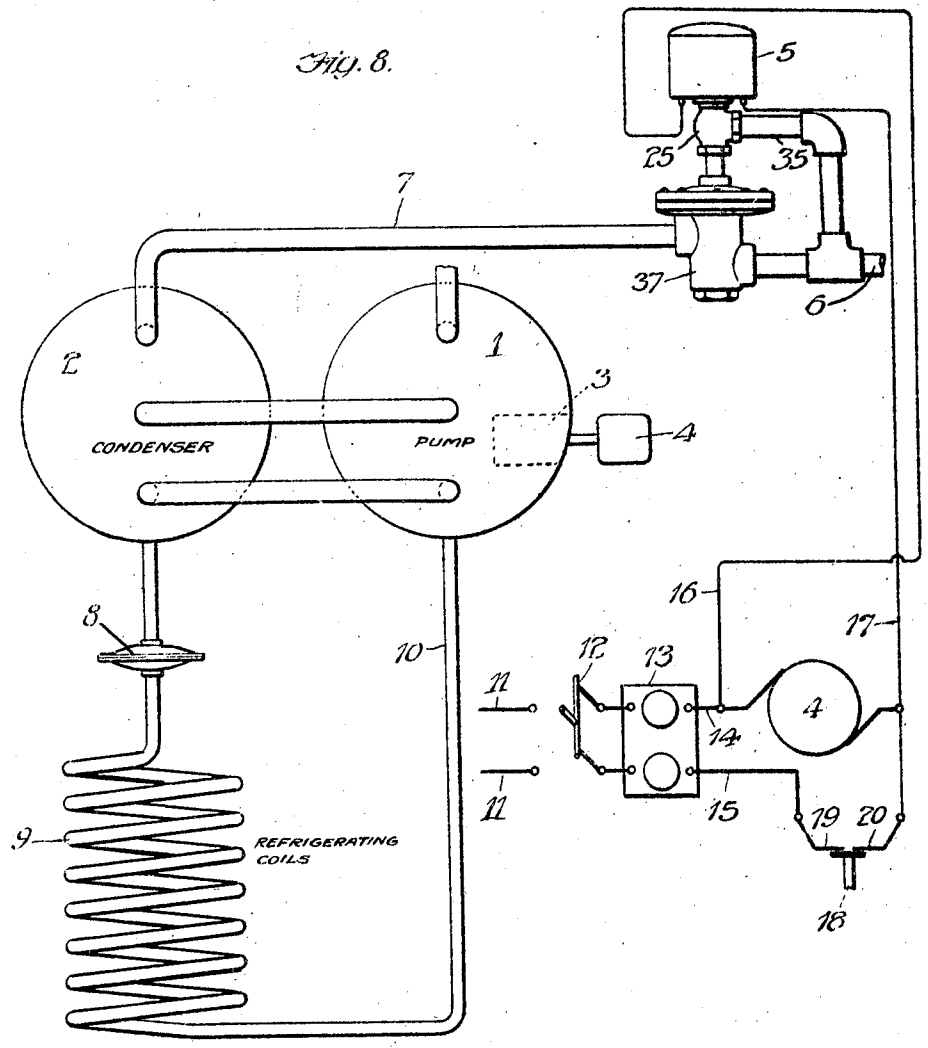
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Fig. 8.



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UNITED STATES PATENT OFFICE.

ERNEST J. BRUNNING, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO DELCO-LIGHT COMPANY, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

REFRIGERATING APPARATUS.

Application filed April 26, 1920. Serial No. 376,540.

To all whom it may concern:

Be it known that I, ERNEST J. BRUNNING, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

My invention relates to a refrigerating system of the type in which a refrigerant, such as sulphur dioxide, is used, and the object thereof is to provide a simple, efficient and reliable means for automatically controlling the water circulating system, such means being electrically controlled by the same current which passes through the usual electric motor for operating the gas pump. The construction and arrangement of said means are such that the water circulation system will be closed to prevent waste or unnecessary use of water when the motor is idle but will be operated immediately upon the operation of the motor and will remain open until the motor stops again.

In the drawings, Fig. 1 is a central vertical section of a controlling means embodying my invention and illustrating one form thereof which is adapted for large refrigerating machines; Fig. 2 a sectional plan view on the line 2—2 of Fig. 1; Fig. 3 a detailed view of the lower end of the controlling valve; Fig. 4 a perspective of the ferrule; Fig. 5 a bottom plan of the solenoid cap; Fig. 6 a section of a modified insulating plug; Fig. 7 a perspective of the solenoid casing; and Fig. 8 a diagrammatic view of a refrigerating system including my invention.

Referring first to the diagrammatic view, Fig. 8, the pump chamber is indicated at 1, the condenser chamber at 2, the pump at 3, the motor for operating the pump at 4, the casing of my water controlling valve at 5, the water inlet thereto at 6, the water outlet therefrom at 7, such outlet extending to the condenser, the expansion valve at 8, the refrigerating coils at 9 and the return pipe from such coils to the pump chamber at 10.

Still referring to the diagrammatic view, the electric connections consist of the line wires 11—11 controlled by the line switch 12, fuses 13, main line wires 14 and 15, extending to the motor 4. A shunt circuit runs from the main wires 14 and 15 to the controlling valve 5, such circuit consisting of the wires 16 and 17. By preference there is interposed in one of the main lines 14—15, an automatic switch, diagrammatically illustrated by the automatic connector bar 18 adapted to automatically connect the terminals 19 and 20, formed in the main line 15.

The main object of my invention is to provide within the casing 5 an electrically operated valve for controlling the flow of water to the condenser chamber accordingly as the pump motor is running or is idle, with the result that the water is admitted to the condenser only when the motor is running. In the same system there is provided the automatic switch 18 which controls the running of the motor accordingly to the temperature desired in the system, with the result that the motor is stopped when the temperature falls to a predetermined minimum.

Referring to the water control means, the same is illustrated in its actual practical embodiment in Fig. 1, which is the particular type used for large sized refrigerating systems. Within the casing 5 there is formed a solenoid coil 21, which is electrically connected with the wires 16 and 17, within which reciprocates a plunger 22 whose lower end is formed as or provided with a valve 23 which is here conical in form and adapted to control a port 24, formed in the pipe fitting or connection 25. The solenoid thus described generally is formed in the particular way now to be described in order that it may properly perform its functions for the particular use in which I employ it. The solenoid casing 5 is provided with a cover 26 having the depending iron core 27 extending within the cylindrical tube 28 of the solenoid. This cover is provided with a number of diametrical slits 29 and the core 27 is provided with diametrical slits 30, and likewise the casing 5 with a slit 5^a. These slits 29 and 30 are so disposed that they do not coincide with each other and hence the connection between the top of the core and the cover is maintained and such core and cover are left connected together, the same being in practice an integral piece. The object of these slits is to prevent the setting up of eddy currents.

Within the solenoid tube 28 there is provided a hollow plug 31 of suitable insulat-

ing material, such as bakelite, the same being provided at its exterior with a flange 32. Within this plug there is provided a ferrule 33, preferably made of brass, and closed at its upper end and open at its lower end. The lower end of this ferrule is screw-threaded into the flange portion 32 of the plug and into the pipe fitting 25. The bore of the ferrule is of a size to receive the solenoid plunger 22 which reciprocates therein. The object of this plug is to prevent the entrance of any water from the pipe fitting 25 into the solenoid, which would obviously have an injurious effect. By preferance the plunger is made of non-corrosive steel inasmuch as it is exposed to the water throughout its length.

The ferrule is preferably split as at 33ª and the plunger is preferably provided with a series of longitudinal slits as shown at 34, for the same purpose as the slits 29 and 30.

The pipe connection 25 is provided with an inlet 35 extending from the water supply pipe or source of water pressure and also with a water discharge pipe 36. The passage of water from the pipe 35 to the pipe 36 is controlled by means of the valve 23, which covers said port 24. The construction thus far described is suitable for refrigerating systems of fairly small capacity, in which event the discharge pipe 36 would run directly to the condenser of the system. However, when my controlling means are used for refrigerating apparatus of larger capacity I employ the particular construction shown in Fig. 1, according to which the solenoid plunger and its valve is a part of a relay device for controlling another valve which is interposed in the water supply from the source of water to the condenser.

Describing the particular construction shown in Fig. 1, the discharge pipe 36 connects with the upper end of a casing formed of the body 37 and cap 38. This pipe discharges into a pressure chamber 39 formed in the upper part of the casing and containing a flexible diaphragm 40 clamped at its edges between the casing and interposed ring 41, located between such edges and the cap 38. To this diaphragm there is secured a head or follower 42 provided with a vertical valve stem 43. A water controlling valve 44 is provided on this stem 43 at a point intermediate its length and adapted to be normally seated, by means of the spring 45, on a valve seat 46, which is formed in the connection between the inlet passage 47 and the outlet passage 48 in the casing 37. This stem 43 extends downwardly below the valve 44 and is guided by the central hole 49 in the screw plug 50. The passages 47 and 48 communicate respectively with the passages 6 and 7, shown on the diagrammatic view. The diaphragm is provided with a leakage port 51 to permit the water trapped thereabove, if the valve 23 has closed, to leak therethrough and to escape to the passage 48. The bottom of the diaphragm chamber is preferably provided with a circular groove 52 and with radial grooves, 53, for conducting water therebelow to the central lower portion of this diaphragm chamber, from whence it then escapes through the central opening 54.

Describing the operation of the construction illustrated in Fig. 1, when both the hand switch and the automatic switch are closed and current is supplied to the motor, thereby actuating the pump, the current will likewise be supplied to the solenoid, and the valve 23 will thereby be lifted by the solenoid action and the port 24 will be open. The water under pressure will thereupon be admitted from the pipe 35 into the pipe 36 and thence against the upper surface of the diaphragm 40. In this construction the valve 23 acts as a pilot valve with respect to the diaphragm-operated water control valve 44. The diaphragm will thereupon be forced downwardly and water valve 44 will be forced away from its seat 46, with the result that the water under pressure will be admitted from the pipe 6 through the water passages 47 and 48 into the water pipe 7 leading to the condenser. When the motor stops either automatically by reason of the automatic action of the switch 18 or the hand switch 12, not only will the motor stop running but the current will be cut off from the solenoid and the valve 23 will thereupon seat and close the port 24. The water trapped below this port will leak through the diaphragm port 51 and out through the passage 48. Thus it will be seen that the water pressure on the diaphragm will be maintained so long as the motor is running and consequently the water valve will remain open against the pressure of the spring during that time and until the pilot valve closes. The water valve 44 is restored to its closed position by means of the spring 45 after the water pressure above the diaphragm has been relieved by leakage through the port 51.

Describing the operation of the device such as used on the smaller capacity apparatus, that is, minus the diaphragm controlled water valve 44, the pipe connection 35 would be the equivalent of the pipe 6 and pipe 36 the equivalent of the pipe 7. Also, the valve 23, instead of being a pilot valve, would be the water control valve itself, which would be adapted to control the passage of water from the source direct to the condenser. Inasmuch as a larger capacity in machines requires rather large water passages, and as the passages in the pipes 35 and 36 must in practice be more or less restricted, I employ the relay arrangement shown in Fig. 1 in order to provide for the larger passages 47

and 48. It will be understood that when the solenoid is used on direct current the cap may be made entirely of brass and the iron parts may be made solid, inasmuch as in such case there are no eddy current losses.

If desired the ferrule may be dispensed with and an insulating plug 55 such as shown in Fig. 6 may be employed to take the place of the plug 31 and the ferrule 33. The ferrule construction is preferred for manufacturing reasons, inasmuch as, being of metal, it takes the screw threads better.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

1. In a refrigerating system, the combination with a condenser; of a pump for causing a refrigerant to flow to the condenser; a motor for operating the pump; a conduit for supplying cooling water to the condenser; a main valve controlling the conduit; and means for opening and closing the main valve, said means comprising a fluid pressure device including a branch conduit connected with said cooling water conduit, a second valve for controlling said device, a single electromagnet for operating the second valve, and means rendered operative immediately upon the closing of the second valve for permitting the closing of the main valve.

2. In a refrigerating system, the combination with a condenser; of a pump for causing a refrigerant to flow to the condenser; a motor for operating the pump; a conduit for supplying cooling water to the condenser; a main valve controlling the conduit; and means for opening and closing the main valve, said means comprising a fluid pressure device including a branch conduit connected with said cooling water conduit, a second valve for controlling said device, a single electromagnet for operating the second valve, and means for relieving pressure on said device, said means operating immediately upon the closing of the second valve whereby the main valve will be closed.

3. In a refrigerating system, the combination with a condenser; of a pump for causing a refrigerant to flow to the condenser; a motor for operating the pump; a conduit for supplying cooling water to the condenser; a main valve controlling the conduit; and means for opening and closing the main valve, said means comprising a branch conduit connected with said cooling water conduit and a fluid pressure operated diaphragm having a leakage port, a second valve for controlling the branch conduit, said leakage port being adapted to relieve the pressure on said diaphragm immediately upon the closing of the second valve whereby the main valve will be actuated.

4. In a refrigerating system, the combination with a condenser; of means for causing a refrigerant to flow to said condenser; a conduit for supplying cooling water to the condenser; a main valve for controlling the conduit; means for causing the movement of the valve toward opening or closing position, said means comprising a fluid pressure device including a branch conduit connected with said cooling water conduit, a second valve for controlling said device, a single electromagnet for operating the second valve; and means dependent upon the temperature of the system for controlling the electromagnet and the means for causing the flow of refrigerant.

5. In a refrigerating system, the combination with a condenser; of means for causing a refrigerant to flow to said condenser; a conduit for supplying cooling water to the condenser; a main valve for controlling the conduit; means for causing the movement of the valve toward opening or closing position, said means comprising a fluid pressure device including a branch conduit connected with said cooling water conduit, a second valve for controllng said device, a single electromagnet for operating the second valve, and means rendered operative immediately upon the closing of the second valve for permitting the closing of the main valve; and means dependent upon the temperature of the system for controlling the electromagnet and the means for causing the flow of refrigerant.

6. In a refrigerating system, the combination with a condenser; of a pump for causing a refrigerant to flow to the condenser; a motor for operating the pump; a conduit for supplying cooling water to the condenser; a main valve controlling the conduit; and means for opening and closing the main valve, said means comprising a fluid pressure device including a branch conduit connected with said cooling water conduit, a second valve for controlling said device, and electromagnetic means for controlling the second valve, the electromagnet being so related to the motor that upon the starting or stopping of the motor the second valve is actuated.

ERNEST J. BRUNNING.