

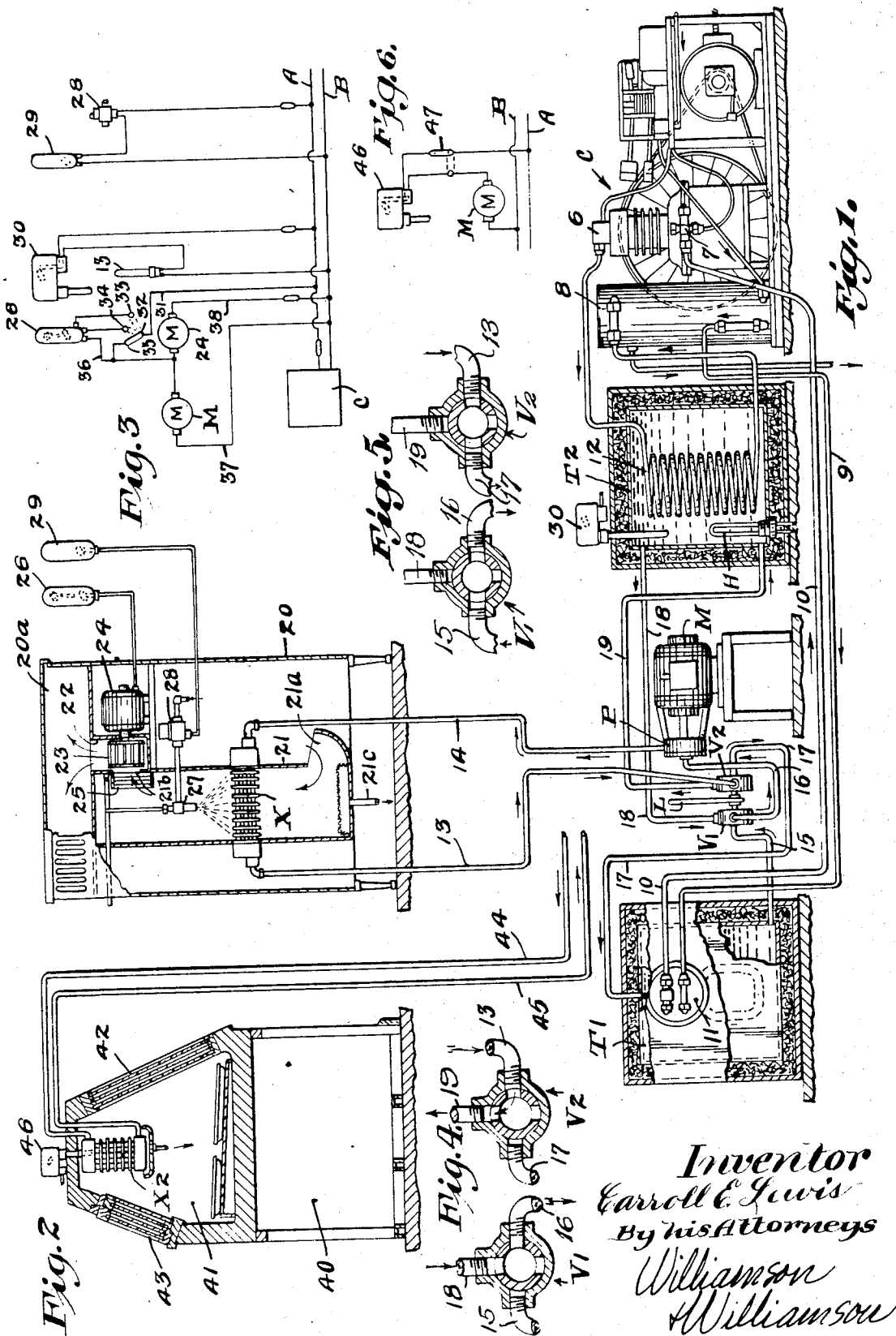
Nov. 13, 1934.

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1,980,688

AIR CONDITIONING AND REFRIGERATION SYSTEM

Filed May 29, 1930



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UNITED STATES PATENT OFFICE

1,980,688

AIR CONDITIONING AND REFRIGERATION
SYSTEM

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Application May 29, 1930, Serial No. 456,936

6 Claims. (Cl. 62—115)

This invention relates to refrigeration and cooling systems and is adaptable equally well for show case and cold storage refrigeration or for cooling and ventilating systems for build-
ings, theatres, etc.

In practically all cooling and refrigerating systems, cooling elements are disposed in the room or compartment to be cooled and a refrigerating medium, usually a cold fluid, is circulated through said elements.

Due to the low temperature of the cooling elements and moisture present in the surrounding air, said elements become incrustated with a layer of frost which greatly lessens their heat-absorbing efficiency. At the present time where such refrigeration or cooling systems are utilized it is necessary to periodically scrape, wash off, or otherwise remove the frost from the cooling elements. This operation is difficult, laborious and consumes considerable time. Usually the owner of the system will postpone defrosting and consequently will operate his system at relatively low efficiency during a large share of the time.

It is an object of my present invention to provide a simple and efficient method associated with a cooling or refrigeration system for defrosting the cooling elements.

It is another object of my invention to provide a thoroughly practical, highly efficient refrigeration or cooling system wherein the cooling elements may be very quickly and automatically defrosted by heat at little expense and without substantially raising the temperature of the chamber, room or building wherein said elements are located.

It is a further object to provide in such a system, in connection with the source of cold circulating fluid supply for the elements, a source of hot fluid supply for defrosting the elements which may be conveniently connected as desired with the cooling elements to melt and defrost the accumulation of snow and ice thereon and wherein the melted frost will be drained or removed from the elements.

More specifically it is an object to provide in a system of the class described, a tank containing the cooling fluid which is cooled from a refrigeration unit and which is connected with the cooling element of the system and a tank containing hot circulating fluid which is also connected with said cooling element and connections and valves whereby one of said sources of said circulating fluid may be connected with, at the same time that the other source is disconnected from, the said cooling element.

A further object is to provide a system of the class described wherein one pump will effect the circulation of both hot and cold sources of fluid, wherein said pump may be automatically controlled to maintain the temperature of the room or compartment at a desired level, and wherein the fluid in the hot supply tank may be conveniently maintained at the requisite temperature, at least partially, through the use of heat from the compressor discharge of the refrigeration unit, which heat would otherwise be wasted.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawing, in which like reference characters refer to similar parts throughout the several views, and in which:—

Fig. 1 is a diagrammatic view showing an embodiment of my invention applied in connection with an air conditioning system, which, as shown, is adapted to wash and cool or heat and humidify the air in a room or building.

Fig. 2 is a diagrammatic view showing a typical refrigerated show case installation which may equally well be served by my system;

Fig. 3 is an electrical diagram showing the various controls which may be utilized in connection with my system when applied to the air conditioning apparatus illustrated in Fig. 1;

Figs. 4 and 5 are cross sections taken through the valves V^1 and V^2 of my system showing the cooperation and function of said valves, and

Fig. 6 is an electrical diagram of the temperature control for regulating the circulation of cold brine through the cooling element X^1 disposed in the refrigerated show case illustrated in Fig. 2.

In the embodiment of my invention illustrated in Fig. 1, a conventional compressor type of refrigeration unit is illustrated, said compressor unit being indicated as an entirety by the letter C and having the usual discharge 6 and intake 7. The compressor illustrated is of the air-cooled type, including the usual condenser 8.

Associated with and connected with said refrigeration unit is a tank T^1 preferably having insulated walls and adapted to contain a source of cold circulating fluid, such as brine which is cooled by an evaporator 11 of the conventional type used in refrigeration systems, said evaporator being connected with the compressor unit C by means of a supply pipe 9 and a return pipe 10.

My system includes a second tank T^2 adapted to contain heated fluid for defrosting the re-

refrigeration or cooling element and said tank is preferably insulated and may contain a heating coil 12, one of the terminals of which may be connected to the discharge of the compressor and the other terminal of which may be connected with the upper end of condenser 8 of the refrigeration unit. It will be seen that the hot exhaust gases from the discharge of the compressor will flow through coil 12, radiating into the brine or other fluid within the tank, a considerable amount of heat and if this heat is not sufficient to raise the temperature of the fluid to the desired point, other heating means, such as an immersion type of electrical heating element H may be also employed within tank T².

For the purpose of circulating both hot or cold brine through the cooling element X, which may be the cooling element of an air cooling and ventilation system or the cooling element of a refrigerated show case, cold storage room or the like, I provide a suitable pump P which may conveniently be operated by an electric motor M, and said pump may be connected with the cooling element X and with the source of hot and cold fluid supply tanks T¹ and T², as follows:—

Conduits extend between the cooling element X and the hot and cold fluid tanks and connect with a pair of cooperating circuit controlling valves V¹ and V² which are simultaneously operated by a handle or lever L and the connections and structures of said valves are such that when a controlling element, such as lever L is thrown in one direction, the cooling element X will be operatively connected with the source of cold fluid supply, while when the lever is thrown in the opposite direction said cooling element X will be operatively connected with the source of hot fluid supply.

My said connections between the hot and cold fluid tanks and the cooling element include a pair of conduits 13 and 14 which are common to both the cold and hot fluid circuits, one end of conduit 14 being connected to the discharge passage of pump P and having its other end connected with the intake of cooling element X, while one end of conduit 13 is connected with the discharge end of cooling element X and its opposite end is connected with the intake passage of my valve V².

The valves V¹ and V² may be of any suitable construction and preferably are of the three-way type, each having a rotary sleeve, as shown, rotating on a horizontal axis, the sleeves of both valves being connected to common operating lever L whereby said valves will be simultaneously operated.

The cold fluid tank is connected to the intake of the valve V¹ by a short conduit 15, said cold fluid passing through said valve, through the curved conduit 16 into the intake of pump P and through the discharge of the pump into the common conduit 14, through the cooling element X, returning from the element X, through the common conduit 13 and into the valve V², through the valve V² and back to the cold fluid tank T¹ through an S-shaped conduit 17 entering the top of said tank.

The hot fluid tank T² discharges through a conduit 18 communicating with the upper portion of said tank, the fluid flowing through valve V¹, through the curved short conduit 16, which is common for both hot and cold fluid flow, through the pump P and through the common conduits 13 and 14, thus circulating through the

cooling element X, and returning through valve V² and conduit 19 back to the lower portion of hot fluid tank T².

It will, of course, be understood that the specific connections and valves above described are merely illustrative of the system and various other connections and valves could be utilized to obtain the functions desired all within the scope of my invention.

In Fig. 1, an embodiment of my system is shown associated with efficient air conditioning apparatus which is adapted to cool and clean air delivered to a room or building and which is further adapted in cold weather to heat and humidify the air. As shown, the air conditioning apparatus includes an ornamental casing 20 open at its lower end and provided with an air delivery chamber 20a at its upper end. Vertically disposed in said casing is a flue 21 having an upwardly curved air intake 21a at its lower end and provided with a lateral outlet 21b at its upper portion, said outlet communicating with a blower casing 22 which has mounted therein a suitable impeller 23 as illustrated of the sirroco type, said impeller being driven by a suitable electrical motor 24. An eliminator 25 for eliminating free unevaporated particles of water may be mounted in the outlet 21b and may comprise the conventional, spaced, zigzag plates against which discharged air is adapted to strike. The circuit for the impeller motor M and also the circuit for the fan motor 24 may be controlled by means of the temperature control or thermostat 26 which in the embodiment of the invention illustrated in Fig. 1 is mounted in the room or building served by the air conditioner. Thermostat 26 is preferably of the two-circuit type and may comprise a conventional two-circuit mercury tube type switch adapted to close one circuit when tilted in one direction to a predetermined point and adapted to close a second circuit when tilted in the opposite direction to a predetermined point.

The cooling element X of my system is mounted transversely in the air flue 21 and directly above the same I have illustrated a moisture discharge nozzle 27 connected with a suitable source of water supply under pressure and regulated by suitable means such as an electromagnetically operated valve 28, the electrical circuit for said valve being controlled by a suitable hydrometer or humidity controlling mechanism 29 which is mounted in the room.

The several electrical control circuits for my system are diagrammed in Fig. 3 and may be briefly described as follows:

The line conductor A is connected by a wire 31 with the movable contact 32 of a three-point switch having the fixed contacts 33, 34 and 35. Contact 35 is connected with wire 36 which is common to both circuits controlled by thermostat 26 and which is in parallel connection with the pump motor M and the fan motor 24, said motors being connected with the line conductor B by wires 37 and 38 respectively. Contact 34 is connected with the lead wire of the warm weather controlling circuit wherein the circuits through the pump motor and fan motor are closed when the temperature of air surrounding the thermostat exceeds a predetermined point. Fixed contact 33 of the switch is connected with the cold weather controlling circuit where the circuit is closed when the temperature of air

about the thermostat is less than a predetermined value.

In Fig. 2, a conventional type of refrigerated show-case is illustrated having the lower compartment 40 wherein if desired, a portion of the apparatus of my system may be housed and having the upper compartment 41 for containing food or other articles desired to be maintained at a low temperature. The show-case also has a plurality of sliding glass panels 42 and 43 in the opposite sides thereof. In the upper portion of the refrigerating chamber 41, a cooling element which may be in the form of a coil X^2 is mounted and operatively connected with supply and return conduits 44 and 45 respectively. It will be obvious that conduits 44 and 45 may be connected with the common conduits 13 and 14 of my system illustrated in Fig. 1.

A temperature control device 46, illustrated as of the immersion tube type, is supported by the show-case and the thermostatic element thereof is subjected to the temperature of the cooling element X^2 .

The electrical circuit for the temperature control 46 is diagrammed in Fig. 6 wherein said control is electrically connected for operating the pump motor M when the temperature of the cooling element X^2 exceeds a predetermined point. It will also be noticed that a shunt switch 47 is interposed in the circuit by which, when desired, the control may be shunted out of the circuit and the pump immediately operated when it is desired to connect the hot brine tank T^2 with the cooling element for defrosting.

Operation

In operation, assuming the system is used for cooling or refrigeration purposes, the valve controlling lever is thrown from the position shown in Fig. 1 to cooling or horizontal position and the cold fluid tank T^1 will then be operatively connected with the pump and common conduits 13 and 14. The movable contact 32 of the temperature control circuit is positioned to engage fixed contact 33 and the thermostat subjected to room temperature will then control the operation of the pump and fan. When the room temperature exceeds a predetermined point the circuit through the pump and fan will be closed and cold fluid will be circulated through the cooling element X and air will be circulated under pressure into the room.

In the normal functioning of my cooling or refrigeration system the cooling elements or coils accumulate frost and ice due to the presence of moisture in the air surrounding them and this accumulation within 24 hours usually is considerable, greatly lowering the efficiency of the system for refrigeration purposes. With my system, to completely defrost the cooling elements it is only necessary to throw the valve control lever L in position to connect the source of hot fluid supply from tank T^2 with the common conduits 13 and 14 and to further throw the temperature control switch in position where movable contact 32 engages contact 35 thereby shunting out thermostat 26 and causing the pump to operate. Hot brine or other circulating fluid is then rapidly circulated through the cooling element quickly melting the accumulated frost on the element and the melted frost drips from the element and is removed through a suitable drain. In actual practice I have found that relatively large cooling elements may be completely defrosted in a few minutes without,

to any appreciable extent, raising the temperature of the surrounding air. As soon as the element X is completely defrosted and the moisture removed therefrom, lever L may be again thrown to the normal position for cooling or refrigerating, movable contact 32 of the switch may again be thrown into engagement with the contact 33 and the system will continue to function efficiently.

In the form of the invention illustrated in Fig. 2, the defrosting operation is similar to that shown in the embodiment of the invention previously described, the lever L being thrown to connect the hot fluid tank with the cooling element X^2 and switch 47 manipulated to shunt out the temperature control 46 whereupon hot fluid will be rapidly circulated through the cooling element melting and removing the frost. In actual tests with refrigerated show cases I have found that within four minutes the cooling elements may be completely defrosted and drained of moisture without raising the temperature of the refrigerating compartment 41 in excess of two degrees.

The temperature of the hot fluid tank may be maintained substantially constant by means of the immersion temperature control 30 which controls the circuit through the electric heating element H. In actual practice the brine or fluid within hot tank T^2 is ordinarily adequately heated for the purpose of defrosting the cooling element by means of the passage of hot compressor gases through heating coil 12 within the tank. In actual tests this source of heat has been found adequate to maintain the brine in the insulated tank at a temperature of substantially 120 degrees and at any time the temperature falls below that point the immersion electric heater will be cut in by the temperature control maintaining the temperature at the desired point for defrosting.

In addition to the functions and advantages of my system previously pointed out, in the form shown in Fig. 1 the system constitutes a highly efficient air conditioning device for use in cold weather, serving to clean, heat and humidify the air which is delivered to a room or building. For such use the movable contact of the temperature control switch is thrown in position to engage contact 34 and valve control lever L is thrown in position to connect the source of hot fluid supply with the common conduits 13 and 14. The cooling element X then becomes a heating element and whenever the temperature within the room falls below a predetermined point the circuit through pump motor M and fan motor 24 is closed and said motors operate causing circulation of hot fluid through the element X and the circulation of air under pressure through the room or building. The switch shown in the humidity control may be closed and the humidity control 29 will then operate solenoid valve 28 to control the amount of moisture discharged in the direction of the element X. Air passing upwardly through flue 21 is first heated by impingement against the element X and its evaporative capacity raised. It is then intimately mixed with the finely divided spray from the humidifier nozzle 27 and passes through eliminator 25 where the unevaporated particles are removed and is discharged into the room or building from the air delivery chamber 20a.

While my system is primarily intended as a highly efficient refrigerating or cooling system wherein provision is made for automatically and

quickly defrosting the cooling coils, it also has the advantage of being readily adapted for use as a heating and air conditioning system when so desired, the controls, the hot brine tank, and source of heat, taken for the most part from the exhaust of the compressor, cooperating with the pump, valve and conduits in the manner previously described.

My method for defrosting the cooling elements or refrigeration system has been brought out clearly from the foregoing description and consists primarily in providing a source of hot fluid supply, the fluid being similar to the fluid used as the refrigerant in the system, introducing for a relatively short period of time said hot fluid into the cooling elements of the cooling system and circulating the hot medium to quickly melt and remove the accumulated ice and frost, said latter step being preferably effected by cutting in the circulation of hot fluid with the usual supply and return conduits for the circulation of the refrigerating means.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the apparatus and in the steps and sequence of steps of the method, without departing from the scope of applicant's invention, which generally stated, consists in a method and apparatus capable of carrying out the objects above set forth, such as disclosed and defined in the appended claims.

What is claimed is:—

1. In cooling and refrigeration systems, a refrigeration unit, a cooling element, a source of cold fluid supply connected with said cooling element and chilled by said refrigeration unit, a reserve source of hot fluid supply also connected with said cooling element, a common means for setting up a circulation with either of said fluid supplies through said cooling element and means for simultaneously connecting one of said sources of fluid supply with said element and disconnecting the other source of fluid supply with said element.

2. In cooling and refrigeration systems, a refrigeration unit including a compressor having the usual discharge, a coil through which a refrigerating medium is circulated, a storage medium for hot fluids, a heating coil within said storage medium connected with the discharge of said compressor and means for causing hot fluid taken from said storage medium to circulate in contact with said first mentioned refrigerating coil when desired.

3. In cooling and refrigeration systems, a source of cold fluid supply, a refrigeration unit for cooling said supply, said unit including a compressor having the usual discharge, a cooling element, connections between said source of cold fluid and said cooling element, a hot fluid tank, a heating coil in said tank connected with the discharge of said compressor and means for disconnecting said source of cold fluid supply from said cooling element and for connecting said source of hot fluid supply with said cooling element.

4. The method of defrosting cooling elements utilized in refrigeration systems which consists in heating a reserve source of fluid by means of hot fluids discharged from the compressor of a refrigeration systems, disconnecting the circulation of the refrigerant in a cooling element of the system and introducing and circulating through said cooling element the heated fluid from said reserve source to melt and remove accumulated frost from the cooling element.

5. In cooling and refrigeration systems of the type having a source of cold fluid supply and a refrigeration unit for cooling said supply and a cooling element, valve means for controlling the circulation of cold fluid from said source through said cooling element, a source of hot fluid supply independent of said refrigeration unit, a circulatory system connecting said source of hot fluid supply and said cooling element, valve means for controlling the circulation of hot fluid through said cooling element, a common pump for circulating said hot fluid and for also circulating said cold fluid and a common valve operating means for disconnecting the circulation of cold fluid and simultaneously connecting the circulation of hot fluid with the cooling element and vice versa.

6. In cooling and refrigeration systems of the type having a source of cold fluid supply and a refrigeration unit for cooling said supply and a cooling element, valve means for controlling the circulation of cold fluid from said source through said cooling element, a source of hot fluid supply independent of said refrigeration unit, a circulatory system connecting said source of hot fluid supply with said cooling element, valve means for controlling the circulation of hot fluid through said cooling element and a pump in said system selectively connected for circulating both said cold fluid and said hot fluid through said cooling element.

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