April 25, 1950 H. P. PETERSON 2,505,201

DEFROSTING SYSTEM

Filed Sept. 12, 1946 2 Sheets-Sheet 1

Fig. 1.

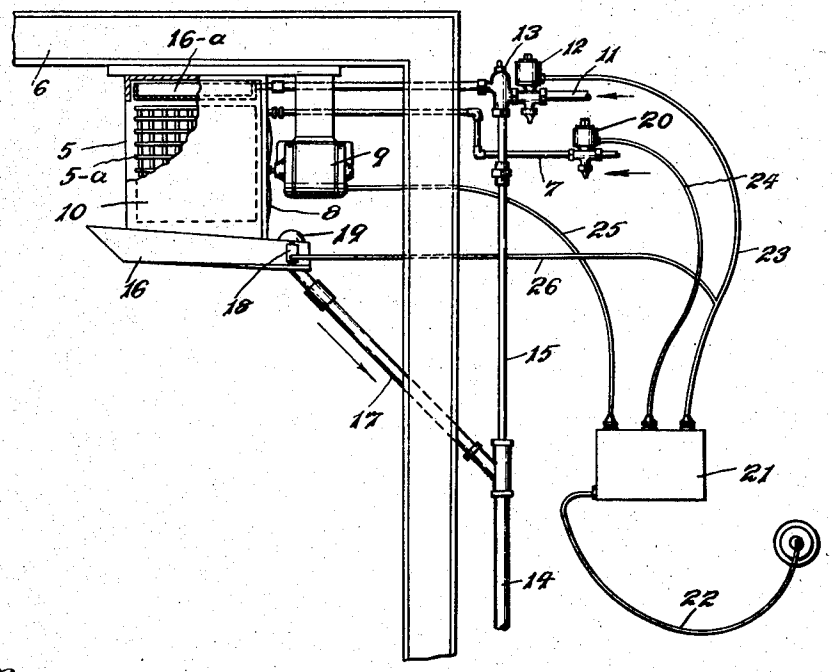
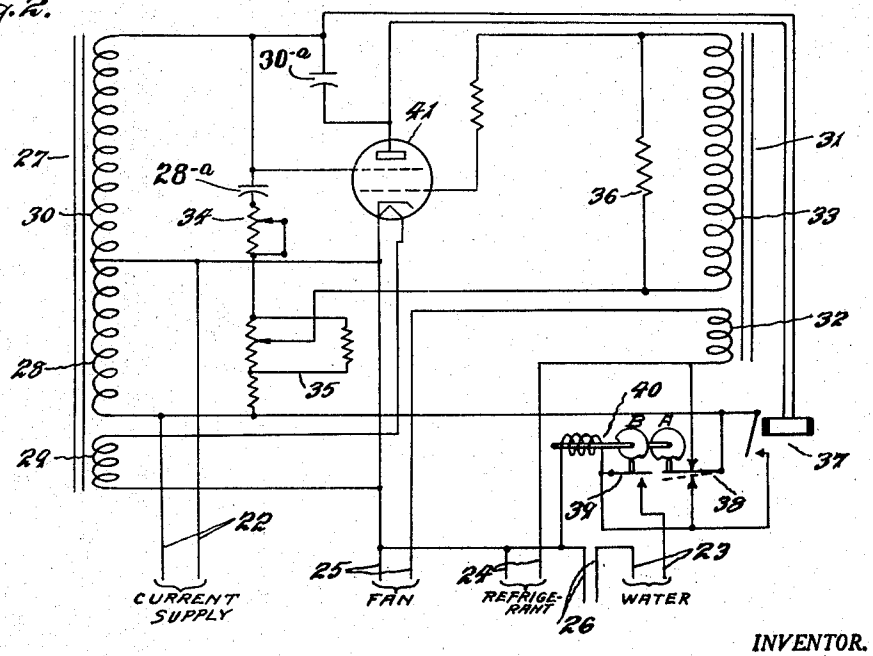


Fig. 2.



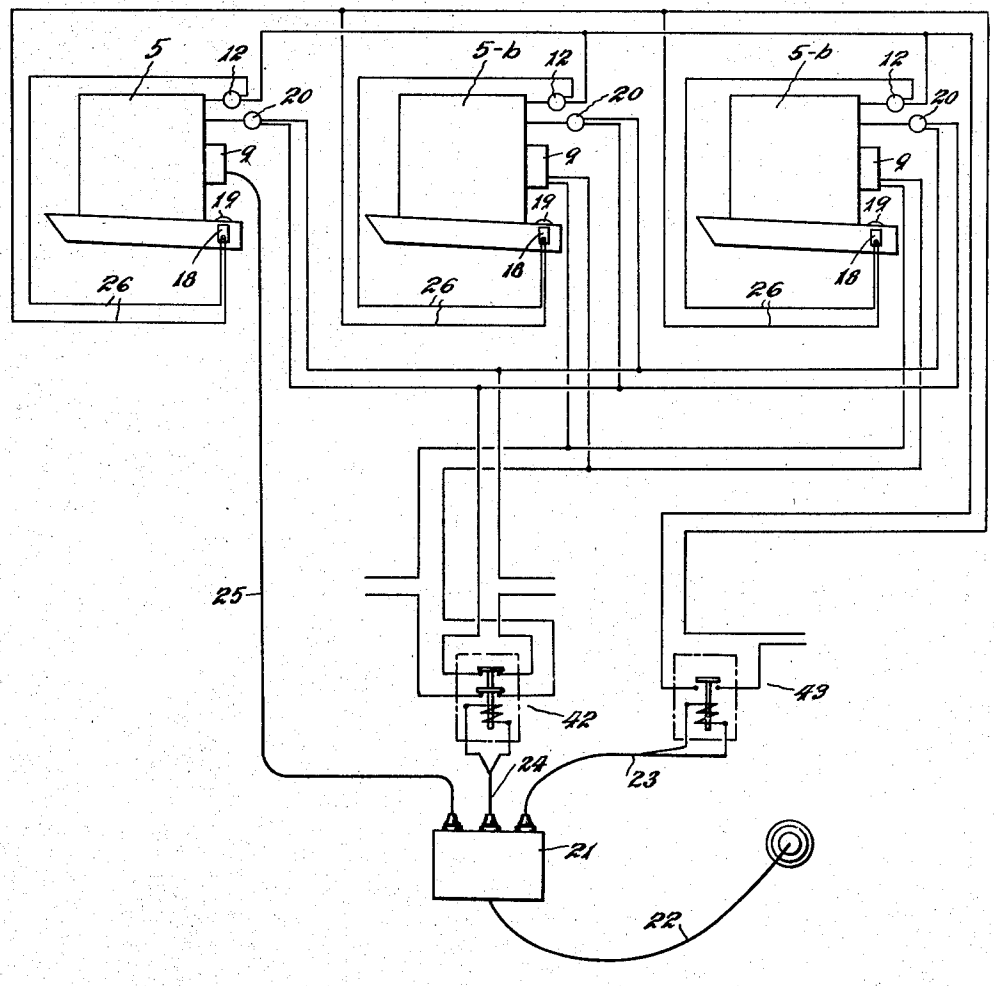
INVENTOR.
HANS P. PETERSON:
BY Louis V. Lucia
ATTORNEY

April 25, 1950 H. P. PETERSON 2,505,201

DEFROSTING SYSTEM

Filed Sept. 12, 1946 2 Sheets-Sheet 2

Fig. 3.



INVENTOR.
HANS P. PETERSON:
BY
Louis V. Lucia
ATTORNEY

Patented Apr. 25, 1950 2,505,201

UNITED STATES PATENT OFFICE

2,505,201

DEFROSTING SYSTEM

Hans P. Peterson, Manchester, Conn., assignor to The Bush Manufacturing Company, Hartford, Conn.

Application September 12, 1946, Serial No. 696,579

4 Claims. (Cl. 62—115)

1

This invention relates to defrosting systems and more particularly to an automatic system for defrosting the cooling coils of refrigeration units which have a tendency to form frost thereon that, if permitted to accumulate, will interfere with the proper operation of the units.

An object of this invention, therefore, is to provide a defrosting system which is automatically operated, in response to an accumulation of frost on a refrigerating unit, for causing a flow of liquid over said frost to thereby remove it.

A further object of this invention is to provide such a system which is automatically responsive to the accumulation of frost on one unit for controlling the removal of frost from the said unit and other units at the same time.

Further objects and advantages of this invention will be more clearly understood from the following description and from the accompanying drawings, in which:

Fig. 1 is an elevational side view of a portion of a refrigeration unit with my improved automatic defrosting system connected thereto.

Fig. 2 is a diagrammatic view of an electronic control circuit used in said system.

Fig. 3 is a diagrammatic view illustrating the electric circuits controlling a series of refrigeration units in response to frost conditions existing in a pilot unit.

As illustrated in the drawings, my improved system may be applied to a single unit, as shown in Fig. 1, wherein the numeral 5 denotes a cooling unit which may be mounted in a refrigerator frame 6 and which commonly consists of a cooling coil 5—*a* that is connected to a refrigerant supply pipe 7.

In the embodiment of my invention shown, I provide a fan 8 which is driven by a motor 9 to move a current of air through the coil in said unit. In the application herein described, the unit may be enclosed within a casing 10 which is open at the front and has a circular restricted opening at the rear in which revolves the fan 8 for moving said current of air through the coil.

Above the said unit may be placed a water distributing means such as a sprayer which may consist of a pan 16—*a* having a perforated bottom. To this pan is connected, for the purpose to be hereinafter described, a water supply pipe 11 which extends to said pan through a suitable solenoid valve 12 and a two-way spring loaded valve 13 that is preset to control the pressure at which the water is supplied to the pan 16—*a* and is connected to a waste pipe 14, through

2

a drain pipe 15, for discharging excess water thereinto.

Below said unit 5 there is provided a drain pan 16 for catching the water which is sprayed over the cooling coil. This pan is provided with a drain pipe 17 which extends to the waste pipe 14.

An electric switch 18, of suitable construction, is provided within the drain pan 16 and is controlled by means of a float 19.

A solenoid valve 20 is also provided within the refrigerant supply pipe 7 for controlling the flow of refrigerant to the cooling coil in the unit 5.

As illustrated in Fig. 2 of the drawings, I employ an electronic control circuit of which the required instruments are preferably contained within a suitable box 21 and which is connected to a current supply by means of an electric conductor 22. The said circuit is also connected to the water solenoid valve 12, the refrigerant valve 20, and the fan motor 9, respectively, by means of cords 23—24—25; the switch 18 being connected to said circuit by a conductor 26 which extends to the conductor 23.

The said electronic circuit may consist of any suitable means for controlling the operation of my improved defrosting system and the particular circuit specifically illustrated in Fig. 2 of the drawings is herein illustrated and described merely for the purpose of disclosing a complete and operative embodiment of the invention.

Ths circuit shown preferably includes an autotransformer 27 having a primary coil 28 and secondary coils 29—30; a current transformer 31 having a primary coil 32 and a secondary coil 33; an adjustable resistor 34, a potentiometer 35, a resistor 36, a differential relay 37, a double acting switch 38, a single acting switch 39, a timing motor 40, and a tetrode tube 41 which is preferably of the type 6SH7 that comprises a heated cathode, a plate and a screen grid as shown in dotted lines.

In the operation of this circuit the current flows from the supply through the conductors 22 to the primary coil 28, and through the secondary coil 29 to the cathode and the filament of the tetrode tube 41. Said current also flows through the secondary coil 30 to the energizing coil of the differential relay 37 and the plate and screen grid of the tetrode tube.

The switches 38 and 39 are preferably operated by cams which are rotated by a timing motor that is so constructed that the operation

of the different elements, during a defrosting cycle, will be timed as hereunder described.

The electric current flow through the above described control circuit may be adjusted by means of the adjustable resistor 34 so that the required amount of current will flow through the tetrode tube 41 to cause operation of the relay 37 when a predetermined amount of frost has accumulated on the coil 5—*a*.

The current flows through the conductors shown and energizes the primary coil of the auto transformer. It then flows through the secondary coil to the combined plate and grid screen tetrode tube 41. The current is adjusted through the adjustable resistor 34 and condensers 28—*a* and 30—*a* are provided for the plate and grid. This plate and grid are in the same circuit, the only difference being that the plate operates at a slight different voltage since the current flows thereto through the conductor 30—*a*, which is for 150 volts, while the current flows to the grid through the conductor 28—*a* which is for 600 volts.

In the operation of the above circuit, the current will flow from the supply through the primary coil of the auto transformer and through the cathode side of the tube. It will also flow through the primary coil of the auto transformer, through the plate and the screen grid.

When the frost has accumulated upon the coil, the overload placed upon the fan motor, by the resistance to the flow of air through said coil, will cause the current to be increased through the secondary coil of the transformer. This will increase the voltage in the screen grid and consequently increase the electronic flow from the cathode to the plate 41. This increase in the current flow will operate the differential relay 37 which in turn will set the timing motor 40 in operation to control the switches 38 and 39 and thereby operate the refrigerant and water solenoid valve.

A cam A mounted on said motor shaft, which operates the switch 38, is so constructed that it will require operation of the timing motor for thirty seconds before operating the said switch. This thirty seconds time period is provided for the purpose of preventing the initiation of a complete defrosting cycle of operation should temporary overloads, such as those caused by the starting of the fan, or other causes, be placed upon the fan motor.

After the thirty seconds of time has been consumed, either by repeated temporary overloads or by a sustained overload such as caused by accumulation of frost in the unit 5, the switch 38 will be moved by the timing motor to the position indicated in dotted lines. This will open the circuit through the primary coil 32, to the fan motor 8 and to the refrigerant solenoid 20, and close the circuit to the timing motor around the relay 37. It will, therefore, be understood that the operation of the switch 38 by the timing motor will cause stoppage of the fan motor and of the refrigerant supply.

Approximately thirty seconds after the fan motor and the supply of refrigerant have been shut off, the cam B of the motor will operate the switch 39 to energize the water solenoid and thereby open the supply of water to the spray pan 16—*a* over the coils of the unit 5.

This supply of water will be maintained for approximately six minutes and, at the expiration of that time, the timing motor will again operate the switch 39 to open the circuit and thereby deenergize the water solenoid and permit closing of the valve 12 for shutting off the water supply.

The defrosting operation will then continue for a period of approximately four minutes longer, after which the timing motor will operate the switch 38 to close the circuit to the fan motor and to the refrigerant solenoid, and thereby again starting the operation of the motor and the supply of refrigerant. As the said switch 38 is operated to its normally closed position, it will open the circuit to the timing motor and thereby complete the defrosting operation and return the refrigerant units to their normal operation.

Should the overflow pipe 17 become stopped, by freezing or otherwise, and thereby prevent the emptying of the drip pan 16, the accumulation of the water in said pan will raise the float 19 to operate the switch 18 and thereby break the circuit to the water solenoid through the conductor 26 and shut off the supply of water.

In the illustration shown in Fig. 3, a plurality of piloted units 5—*b* are connected in electric circuits which will permit the simultaneous defrosting of all of said units in response to conditions affecting only one unit, such as the unit 5, which will act as the pilot unit.

In this application, the electronic relay contained in the box 21 is the same as above described with the exception that instead of operating the refrigerant and solenoid valves, as above described, the circuit will operate separate relay switches, which will control electrical circuits for simultaneously operating the solenoid valves of all of the units and the fan motors of all except the pilot unit.

As shown in said Fig. 3, the fan motor 9 of the pilot unit is connected directly to the electronic relay through the cable or conductor 25. This operates the electronic circuit through the tetrode tube exactly as above described. When the switch 38 of said circuit is in normally closed position, the switch of the separate relay 42 will also be in closed position and when the said switch 38 is in the closed position shown in dotted lines, the relay switch 42 will also be open so that the fan motors and refrigerant solenoids of all of the units in the system will be deenergized and thereby stopping the fans and the flow of refrigerant in all of the said units.

When the normally open switch 39 of the electronic circuit is open, the switch of the relay 42 will also be open. When said switch 29 is closed the switch of the relay 43 will be closed and all the water valve solenoids will be energized to permit the flow of water to the units for defrosting them.

The arrangement shown in Fig. 3 actually provides means for simultaneously controlling a bank of units with the same electronic relay instrument that may be used for operating a single unit. In the case of a single unit the electronic relay circuit in the box 21 is connected directly to the different solenoid valves and to the fan motor, while, in the case of a bank of units, the electronic relay operates to control the relay switches 42 and 43 which in turn control the fan motors and solenoids. This permits the operation of high load switches, such as necessary for controlling a bank of units, with the same instrument that is used for operating low load switches which are adequate for controlling a single unit.

It will be understood that, while I have illustrated and described herein, specific electronic relay circuits, as illustrated in Fig. 2, for controlling the defrosting operations of refrigerating units, other electrical circuits or relays may be used as long as the operations of the various elements are properly timed relatively to each other and controlled by the accumulation of frost upon a cooling unit.

I claim:

1. In combination with an apparatus comprising a cooling unit, a defrosting system including a motor for moving a current of air through said unit, a refrigerant supply, a water supply, an electric circuit including switches for controlling said refrigerant supply, water supply and motor, timing means for causing the operation of said switches in timed relation, and electronic means in said circuit responsive to an overload on said motor for initiating the operation of said timing means.

2. In combination with an apparatus comprising a cooling unit, a defrosting system including a motor for moving a current of air through said unit, a refrigerant supply, a water supply for providing a flow of water through said unit, an electric circuit including switches for controlling said refrigerant supply, water supply and motor, timing means for causing the operation of said switches to stop said motor and refrigerant supply and start the said flow of water, and

electronic means in said circuit responsive to an overload on said motor for initiating the operation of said timing means.

3. In combination with apparatus comprising a cooling unit having a motor for moving a current of air therethrough, means for defrosting said unit in response to an overload on said motor caused by an increase of resistance to said current of air from an accumulation of frost on said unit, and means for rendering said defrosting means irresponsive to temporary overloads on said motor.

4. In combination with apparatus comprising a cooling unit having a motor for moving a current of air therethrough, means for defrosting said unit in response to an overload on said motor, and means for rendering said defrosting means irresponsive to overloads of less than a predetermined duration.

HANS P. PETERSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,001,028	Kitzmiller	May 14, 1935
2,143,687	Crago	Jan. 10, 1939
2,323,511	Baker	July 6, 1943