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Yamada et al.

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[54] **COOLING APPARATUS WITH DELAYED OPERATION BLOWER MEANS**

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[52] **U.S. Cl.** **62/157**, 62/180

[51] **Int. Cl.** **F25d 17/00**

[58] **Field of Search** 62/157, 158, 182, 62/180, 155, 234, 80, 154, 140

[56] **References Cited**

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Attorney—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

A cooling apparatus for cooling the interior of a room, in which a blower is started for introducing air cooled by a cooling means into the room after the cooling means for cooling the air in the room is cooled below a predetermined temperature, so that the interior of the room is free from bad odour during starting period.

2 Claims, 4 Drawing Figures

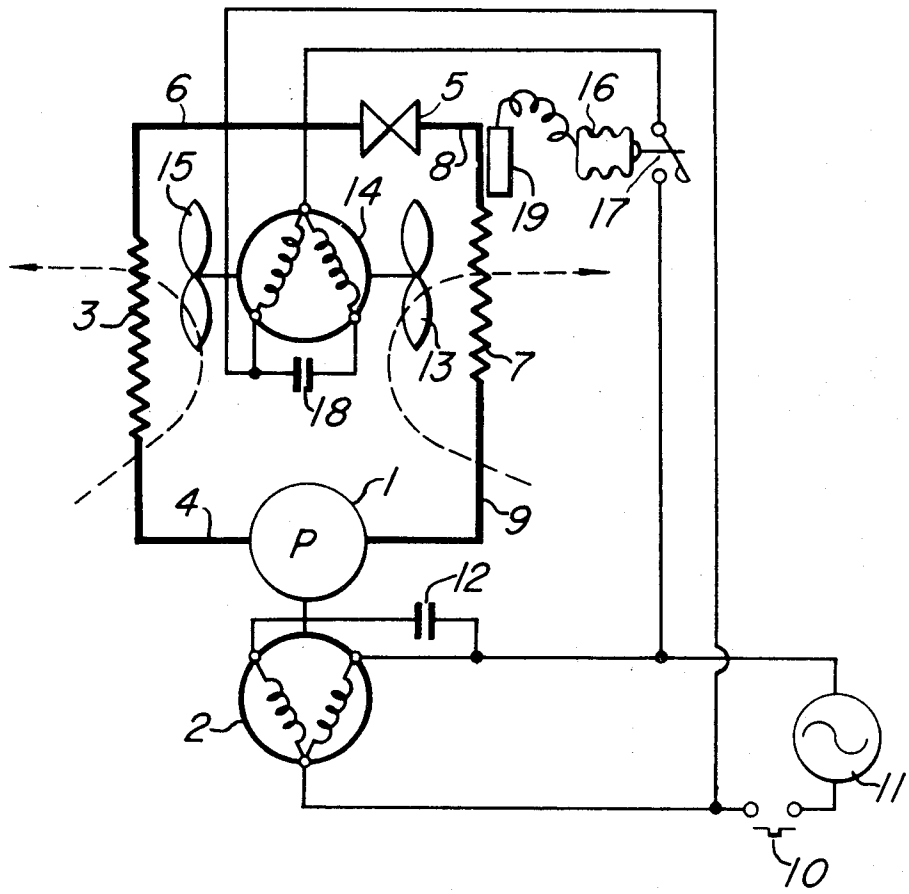


FIG. 1

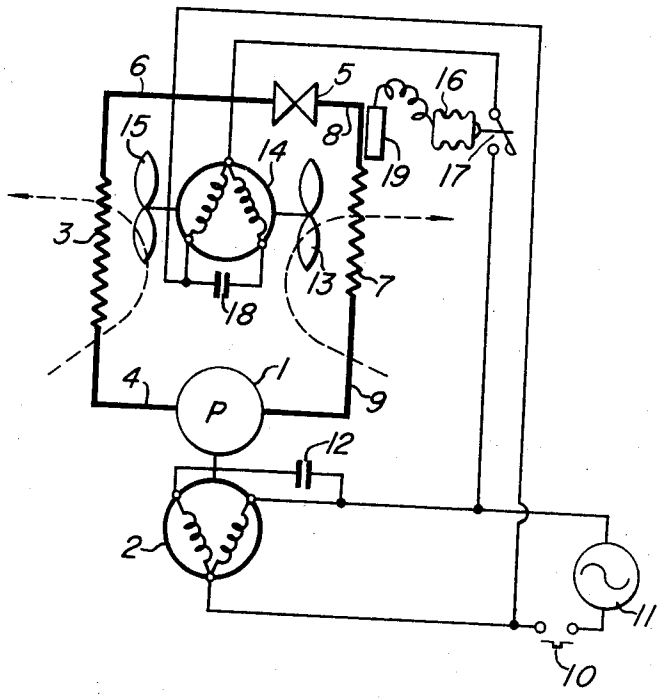
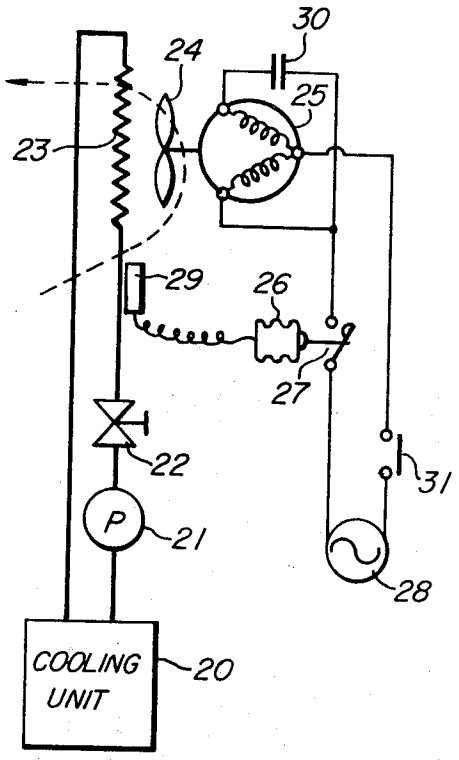


FIG. 2



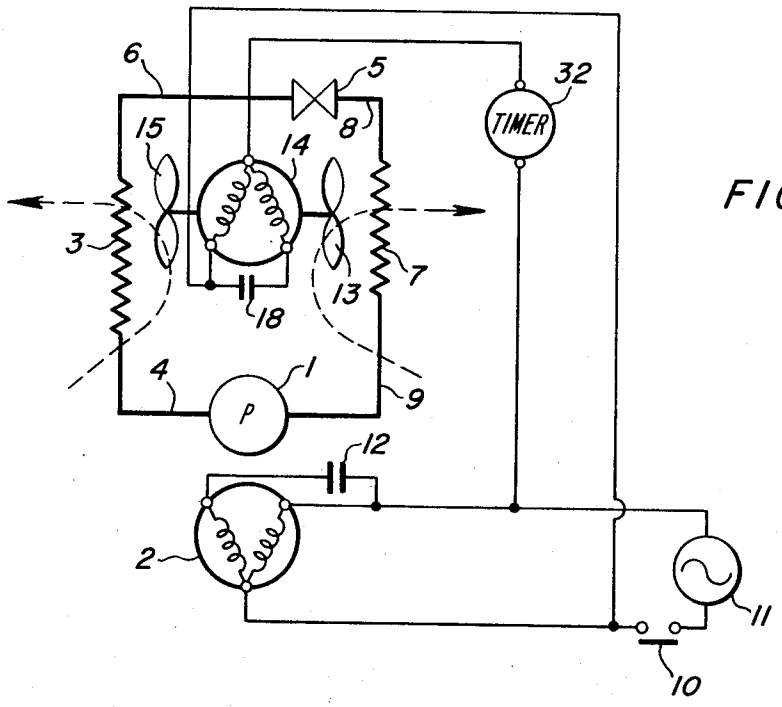

6
5
32
TIMER
8
15
14
3
7
13
18
4
1
P
9
12
2
11
10

FIG. 3

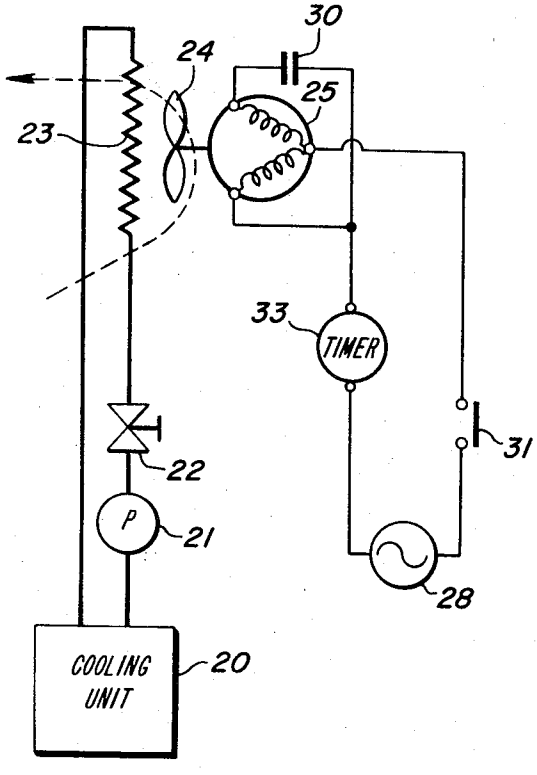

30
24
25
23
33
TIMER
31
22
P
21
28
COOLING
UNIT
20

FIG. 4

COOLING APPARATUS WITH DELAYED OPERATION BLOWER MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a cooling apparatus for cooling interior of a room such as a house, an automobile or other vehicles.

2. Description of the Prior Art

In a conventional cooling apparatus, it has been a common practice to start a blower for circulating air in a room at the same time when a compressor is started for feeding cooling medium to a cooling means, so that uncomfortable odour has often been introduced into the room during the starting period of the apparatus. The odour is mainly produced by nicotine, microorganism or zymogenic organism existing on the surfaces of the cooling means and/or a drain pan and carried into the room by the action of the blower. When the cooling means and the drain pan is higher in temperature such as during the starting period, an intense and uncomfortable odour is produced.

SUMMARY OF THE INVENTION

The present invention has an object to provide a cooling apparatus in which a blower for introducing cooled air into a room is started with a predetermined time delay after the starting of means for feeding cooling medium into a cooling means, so that uncomfortable odour is not introduced from the cooling means into the room.

Another object of the present invention is to provide a cooling apparatus in which a blower for introducing cooled air into the room is started after cooling medium feeding means is started and the temperature of a cooling means is decreased below a predetermined value, so that uncomfortable odour is not introduced into the room.

It is a further object of the present invention to provide a cooling apparatus which comprises a thermostat for detecting a fact that, after cooling medium feeding means such as a compressor or a pump is started for feeding cooling medium into a cooling means, the temperature of the cooling means is decreased below a predetermined temperature until dew is deposited on the cooling unit, and in which a blower for introducing the air cooled by the cooling unit into a room is started in accordance with the operaion of the thermostat.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram showing pipe line connections for cooling medium and an electrical circuits used in a cooling apparatus embodying the present invention;

FIG. 2 is a diagram similar to FIG. 1 but showing another embodiment of the present invention;

FIG. 3 is a diagram similar to FIG. 1 which contains a timer for starting the blower, and

FIG. 4 is similar to FIG. 2 but also containing a timer for commencing operation of the blower as shown in FIG. 3.

DESCRIPTIONS OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, the reference numeral 1 designates a compressor driven by a motor 2. The reference numeral 3 designates a condenser which is connected through a conduit 4 for cooling medium with

the outlet side of the compressor 1, and 5 designates an expansion valve connected through a conduit 6 with the condenser 3. It should of course be noted that a capillary tube may be used in the place of the expansion valve 5. An evaporator 7 is connected through a conduit 8 with the expansion valve 5 and through a conduit 9 with the inlet side of the compressor 1. The compressor motor 2 is connected in series through a main switch 10 with a power source 11. The numeral 12 designates a starting capacitor for the compressor motor 2. A blower 13 is provided opposite to the condenser 3 and the evaporator 7 so as to send the air cooled by the evaporator 7 into a room to be cooled. The blower 13 is driven by a blower motor 14. In the illustrated embodiment, a second blower 15 is provided opposite to the condenser 3 and driven by the blower motor 14. The blower 15 may of course be driven by a separate motor. The blower motor 14 is connected at one of the terminals through a main switch 10 with the power source 11 and at the other of the terminals through a contact 17 of a thermostat with the power source 11. The numeral 18 designates a starting capacitor for the blower motor 14. The thermostat 16 has a heat-sensing portion 19 arranged in heat exchange relation with the evaporator 7. The thermostat 16 is of such a type that closes the contact 17 when the evaporator 7 is below a predetermined temperature. Thus, the thermostat 16 may be so adjusted that the contact 17 is closed when the temperature of the evaporator 7 is below the dew point.

In operation of the cooling unit, the main switch 10 is closed. Then, the compressor motor 2 is started so as to drive the compressor 1. Thus, the cooling medium is compressed by the compressor 1 and circulated through the condenser 3, the expansion valve 5 and the evaporator 7. In the condenser 3, the medium is condensed to discharge heat and, in the evaporator 7, it is again evaporated taking heat therefrom. Thus, the evaporator 7 is gradually cooled down. For a certain period after the start of the compressor 1 during which the surface temperature of the evaporator 7 is above a predetermined value, the contact 17 of the thermostat is kept open, so that the blower motor 14 does not operate. Thereafter, the compressor 1 is continued to operate until the surface temperature of the evaporator 7 is decreased to the predetermined value. This is detected by the heat sensing portion 19 of the thermostat 16. Thus, the contact 17 of the thermostat 16 is closed, so that the blower motor 14 is started to rotate. Therefore, the blowers 13 and 15 are driven to send air through the evaporator 7 and the condenser 3. Thus, the operation of the cooling apparatus is started.

When the blower motor 14 is started to rotate, dew is deposited on the surface of the evaporator 7. In other words, the evaporator 7 is cooled down below the dew point before the blower 13 is started to rotate, so that there are many dewdrops on the surface of the evaporator 7. Since the dewdrops and the resulting water film are effective to solve and cover nicotine, microorganism or zymogenic organism existing on the surface of the evaporator 7, the air which has passed through the evaporator 7 does not carry uncomfortable odour. In an application where a drain pan is disposed in heat exchange relation with the evaporator 7, dew is also deposited on the drain pan. Thus, it is also effective to prevent uncomfortable odour from the drain pan. The dewdrops on the evaporator 7 gradually flow

down onto the drain pan serving also to prevent odour from the drain pan. If the blower motor **14** is maintained stationary even after dew is deposited on the evaporator **7**, it may be possible frosted. Therefore, it is advisable to determine the setting temperature of the thermostat **16** above the frosting temperature. In other words, in an advisable arrangement, the contact **17** of the thermostat **16** is closed after dew is deposited on the evaporator **7** but before it is frosted, so as to operate the blower motor **14** and the blower **13** to send the air cooled by the evaporator **7** into the room to be cooled.

Another embodiment of the present invention will now be described taking reference to FIG. **2.** In this example, cooling brine such as water is cooled by a cooling unit **20** and fed by means of a pump **21** through a valve **22** into a cooling means **23** where it is brought into heat exchange relation with room air sent by means of a blower **24.** As in the example of FIG. **1,** the blower **24** has a blower motor **25** which is controlled by a thermostat **26** having a contact **27.** In FIG. **2,** the reference numeral **28** designates an electric power source, **29** a heat sensing portion of the thermostat **26, 30** a starting capacitor for the blower motor **25,** and **31** a main switch. In FIG. **2,** when the brine is cooled sufficiently by the cooling unit **20,** the supply of air by the blower **24** may be commenced after passage of a certain period of time from the time when the valve **22** is opened and the supply of brine to the cooling means **23** begins. In this case, it is of course essential that the pump **21** has already been set in motion to supply the brine with pressure.

Alternatively, with the valve **22** being opened and the brine being cooled sufficiently by the cooling unit **20,** the supply of air by the blower **24** may be started after passage of a certain period of time from the start of supply of the brine to the cooling unit **23** by the pump **21.** This arrangement is particularly advantageous for a central cooling system. In each of the aforementioned embodiments, the operation of the blower motor **14** or **25** is delayed from the starting of the compressor **1,** the pump **21** or the valve through the action of the thermostat **16** or **26,** however, a time delay means such as a timer **32,** as shown in FIG. **3,** and **33,** as shown in FIG. **4.** or time delay relay may be used in the place of the thermostat. FIG. **3** shows an example in which the thermostat **16, 17, 18** in FIG. **1** is replaced, for example, by a timer **32.** FIG. **4** shows an example in which the thermostat **26, 27, 29** in FIG. **2** is replaced by a time delay relay **33.** According to the inventors' experiments, a time delay of about **30** seconds can provide a satisfactory result. This deodoring effect is particularly great in the case when the cooling appratus is used for colling the passenger compartment of an automobile which accommodates a number of persons in a narrow space, unlike the case of cooling a wide sapce by a room air conditioner, and it has been confirmed through the actual experiment that a time delay of about 15 seconds is sufficient to obtain a satisfactory result.

THE EFFECTS OF THE INVENTION

According to the present invention, a blower for sending cooled air into a room to be cooled is started after the start of a cooling medium feeding means for feeding cooling medium into a cooling means with a predetermined time delay. Therefore, when the cooling means is at a relatively high temperature, that is, when nicotine, microorganism or zymogenic organism is at a condition under which it is apt to produce uncomfortable odour, the blower does not operate so that the odour is not introduced into the room. When the cooling means is cooled down until dew is deposited on its surface, the nicotine, micro-organism or zymogenic organism is solved in the dew. Under this condition, the blower is started so that the cooled air is introduced into the room without carrying the uncomfortable odour.

According to the present invention, since the blower is started after the cooling medium feeding means is started to operate and the cooling means is cooled below a predetermined temperature, the blower is always operated with dewdrops deposited on the cooling means. Therefore, there is no possibility of uncomfortable odour introduced into the room.

In the cooling apparatus of the present invention, the blower is operated after the cooling medium feeding means with a predetermined time delay through the action of the time delay means. This ensures that the blower is always started after dew is deposited on the cooling means.

Further, the feature of the present invention is applicable to any of the types in which a compressor, a brine feed pump or a valve in a brine conduit is used as cooling medium feeding means. Therefore, the present invention can be applied to any type of cooling apparatus such as a central cooling system, a usual room air conditioner or auto air conditioner.

We claim:

1. A cooling apparatus comprising

cooling means adapted to be cooled by cooling medium, a pump for feeding cooling medium

a blower for introducing air cooled by the cooling means into a room and

thermostat means for detecting the fact that the cooling means is cooled down below a temperature at which dewdrops are formed on the surface of the cooling apparatus, under the ambient conditions in which said cooling apparatus is used after the pump is started so as to start the blower.

2. A cooling apparatus comprising

cooling means adapted to be cooled by cooling medium,

a pump for feeding the cooling medium into said cooling means

a blower for introducing air cooled by the cooling means into a room, and

electrical time delay circuit means for starting said blower with a time delay up to the point when dewdrops are formed on the surface of the cooling apparatus under the ambient conditions in which the cooling apparatus is used after the pump is started.

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