March 17, 1942. E. LEMMERS 2,276,850

GERMICIDAL LAMP IN AIR CONDITIONING APPARATUS

Filed Dec. 24, 1940

Fig. 1.

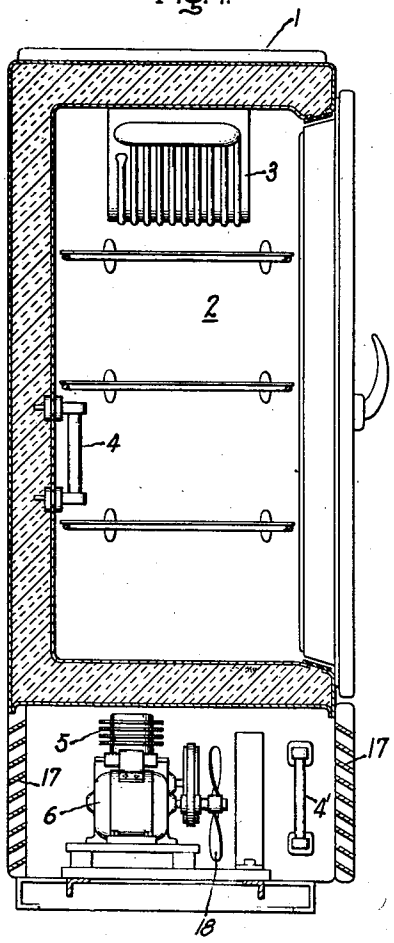


Fig. 2.

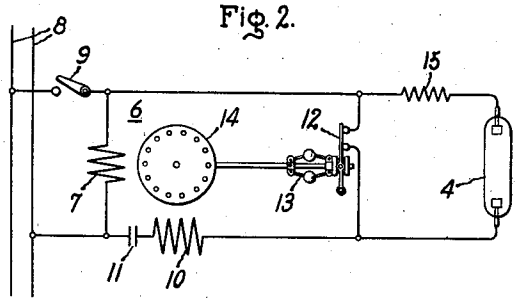


Fig. 3.

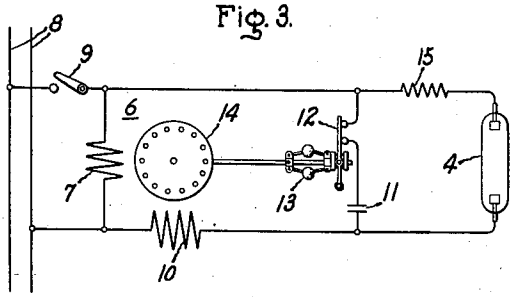
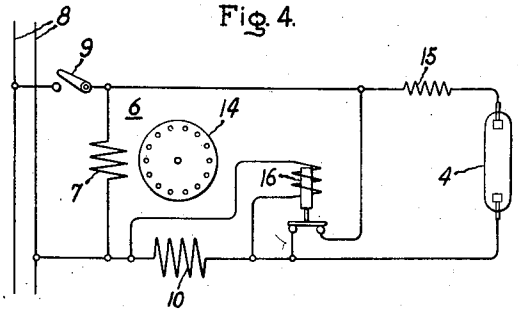


Fig. 4.



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Patented Mar. 17, 1942 2,276,850

UNITED STATES PATENT OFFICE

2,276,850

GERMICIDAL LAMP IN AIR CONDITIONING APPARATUS

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Application December 24, 1940, Serial No. 371,491

10 Claims. (Cl. 62—89)

My invention relates to the starting and the operation of arc discharge lamps, particularly those having germicidal properties. Where such lamps have been employed in refrigerators for air sterilization purposes difficulty has been experienced, because of the low temperature, in starting and operating them if they were designed for use at room temperatures and on domestic lighting circuits. In order to operate satisfactorily under such conditions and have a high output the lamps may comprise a special construction; they may also be provided with some well known means for applying thereto the necessary higher voltage to effect starting under those conditions. It has been found to be cheaper, however, and hence has become common practice to employ a standard form of lamp which is constructed to operate on a materially higher voltage and to employ in circuit therewith a static step-up transformer for producing the higher operating voltage.

It is the object of my invention to provide an improved arrangement of the above-mentioned character whereby the necessary higher voltages for starting or operating the lamp or for both are obtained without the need of special apparatus therefor.

My invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Referring to the drawing, Fig. 1 is a cross sectional view of apparatus involving one embodiment of my invention, and Figs. 2, 3 and 4 are circuit diagrams showing various ways of interconnecting such apparatus.

In Fig. 1, 1 represents an electric refrigerator of well known form comprising the cooling chamber 2 in which is arranged the cooling member or evaporator 3 and the electric arc discharge germicidal lamp 4 such as is used to sterilize and keep air fresh in refrigerators, the lamp with its ballast being constructed to operate on the line voltage at the refrigerator temperature. Below the cooling chamber is the compressor 5 and the electric motor 6 connected to drive the compressor. The motor 6 which, as shown in Fig. 2, is a squirrel cage induction motor of the capacitor starting type, has its main winding 7 connected with the source 8 of alternating current, which may be a 110 volt commercial lighting circuit through the switch 9 which is thermostatically controlled in the well known manner to preserve a uniformly low temperature in the cooling chamber. The starting winding 10 of the motor connects through the phase shifting capacitor 11 and the centrifugal switch 12 across the main winding 7, the centrifugal switch being opened by the speed controlled device 13 mounted on the shaft of the motor rotor 14. The lamp 4 is connected in series with the ballast 15 across the contacts of the centrifugal switch 12. It will be noted that the location of the capacitor is such that it shifts the phase of the voltage induced in the starting winding and because of this shift the voltage does not add directly to the line voltage. Thus the voltage applied to the lamp during the operation of the apparatus is not materially greater than line voltage.

Inasmuch as the lamp is controlled by the switch 9 it is not energized except when the motor for driving the compressor is operating. When the control switch 9 is closed by the thermostat, not shown, the motor starts in the well understood manner, and when it reaches a predetermined speed the centrifugal switch opens to deenergize the starting winding 10. At the opening of the switch 12 a high voltage surge appears across the lamp. The lamp starts and although the voltage thereafter applied to it is not materially higher than the line voltage it continues to operate at the refrigerator temperature until the main switch 9 is opened.

The modified form of my invention shown by Fig. 3 is similar to that shown by Fig. 2 except that the capacitor 11 in this case is arranged next to the centrifugal switch so that after the switch opens it can no longer shift the phase of the voltage induced in the starting winding. The voltage induced in that winding during the normal operation of the motor added to the line voltage gives a materially increased voltage to be applied to the lamp which in this case is constructed to be operated with an applied voltage that is materially higher than the line voltage. For example, the lamp may require 150 to 200 volts to operate, whereas the line voltage is only 110 volts. An additional voltage due to the inductive kick when the centrifugal switch opens assists in the starting of the lamp. After the centrifugal switch is opened the voltage across the lamp continues above the line voltage by a factor approximating the turn ratio between the main winding 7 and the starting winding 10.

In the modification illustrated by Fig. 4 a motor of the resistance split-phase type is used, motors of which type do not employ capacitors in their starting circuits. While I may employ a centrifugal switch to open the starting circuit as in Figs. 2 and 3 I have chosen in this case to show a relay, illustrated at 16, to perform that function, the winding of the relay being connected across the starting winding 10 of the motor so as to be responsive to the voltage of the starting winding. A relay is particularly well adapted for use in apparatus in which the compressor and driving motor are enclosed in a hermetically sealed casing. The lamp in this modification is like the lamp in the modification shown by Fig. 3. When the switch 9 is closed the relay 16, which

is normally closed, remains closed until the motor armature reaches a predetermined speed. At this speed the voltage across the starting winding due to transformer action reaches a value at which the relay 16 operates to open the starting circuit. The lamp then starts and continues to operate as in the previously described modification.

From the above description it will be seen that where the discharge lamp employed in the refrigerator is adapted to operate together with its ballast at line voltage it may be supplied with the necessary starting voltage and where the lamp with its ballast requires a materially higher voltage for its operation as well as for starting, it is unnecessary to employ auxiliary voltage-raising apparatus but by merely making suitable connections between the lamp and the parts of the motor employed the motor may be made to serve the dual function of driving the compressor and of raising the applied voltage for the operation of the lamp. Obviously, the motor used for voltage-raising purposes need not necessarily be that used for driving the compressor as any other motor such as a pump motor, associated with the refrigerator and of the proper construction may be so employed.

Such a lamp, moreover, may be arranged in a chamber or duct of an air conditioning apparatus to sterilize the air passed therethrough and may be connected with the motor which drives the circulating fan in a manner such as described above. By way of example, I have shown the front and back sides of the compressor chamber provided with the louvers 17 and a lamp 4' arranged in the air stream induced by the circulating fan 18 which is mounted on the shaft of the motor. Thus the lamp mounted in the base of the refrigerator serves to sterilize the air warmed by the compressor unit and circulated by the fan thereof through the room containing the refrigerator.

I have chosen the particular embodiments described above as illustrative of my invention and it will be apparent that various other modifications may be made without departing from the spirit and scope of my invention which modifications I aim to cover by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In combination, a chamber, apparatus for conditioning the air therein including a driving motor having starting means and having points in its circuit between which a voltage occurs, due to the functioning of said starting means, materially higher than the motor supply voltage, an electric discharge germicidal lamp in said chamber requiring a starting voltage materially higher than said supply voltage, and means connecting said lamp between said points of higher voltage.

2. In combination, a chamber, apparatus for conditioning the air therein including a driving motor having points in its circuit between which a voltage exists during the normal operation of the motor materially higher than the motor supply voltage, an electric discharge germicidal lamp in said chamber requiring for its operation a voltage materially higher than said supply voltage, and means connecting said lamp between said higher voltage points.

3. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a driving motor for said apparatus having a main winding arranged to be connected across a source of alternating current supply and a starting circuit including a starting winding, an electric discharge germicidal lamp in said chamber, and means connecting said lamp with said circuit to be supplied by the voltage of said source increased by the voltage across said starting winding.

4. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a driving motor for said apparatus having a main winding arranged to be connected across a source of alternating current supply and a starting winding, an electric discharge germicidal lamp arranged in said chamber and requiring for its operation a voltage higher than said source, and means for supplying to said lamp the combined voltages across said windings.

5. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a driving motor for said apparatus having starting means including a starting winding and a switch in circuit therewith arranged to open after the motor has started, and an electric discharge germicidal lamp whose starting voltage is higher than its operating voltage connected to receive the voltage across said switch and arranged in said chamber.

6. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a driving motor for said apparatus having starting means including a centrifugal switch arranged to open when the speed of the motor reaches a predetermined value, and an electric discharge germicidal lamp arranged in said chamber and connected across said switch.

7. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a driving motor for said apparatus having starting means including a switch arranged to be opened after the motor is started, and an electric discharge germicidal lamp in said chamber and connected to receive the voltage across said switch.

8. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a motor associated with said apparatus including starting means, said motor having points in its circuit between which a voltage materially higher than the supply voltage exists during the normal operation of the motor, and an electric discharge germicidal lamp requiring for its operation a voltage materially higher than said supply voltage connected between said points and arranged in said chamber.

9. In combination, a refrigerator having a cooling chamber, apparatus for cooling said chamber, a motor associated with said apparatus including starting means, said motor having points in its circuit between which a voltage surge occurs at starting materially higher than the supply voltage, and an electric discharge germicidal lamp which requires a higher voltage for starting than said supply voltage arranged in said chamber and connected between said points to be started by said surge.

10. In combination, a chamber, apparatus for conditioning the air therein including a driving motor having points in its circuit between which a voltage exists materially higher than the motor supply voltage, an electric discharge germicidal lamp in said chamber requiring for the starting thereof a voltage materially higher than said supply voltage, and means connecting said lamp between said points of higher voltage.

EUGENE LEMMERS.