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AIR PURIFIER

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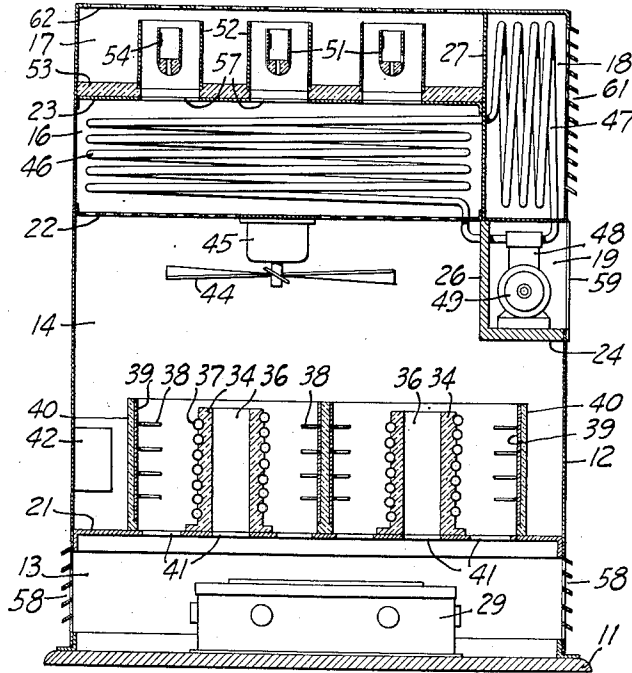
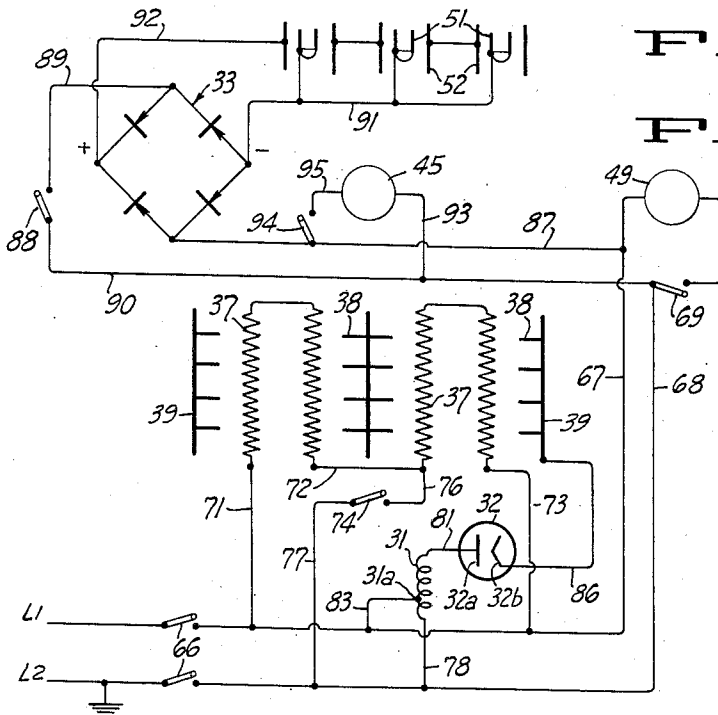


FIG. 1

FIG. 2



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AIR PURIFIER

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8 Claims. (Cl. 21-102)

This invention relates generally to air purifiers and more particularly to air purifiers of the incineration type.

It is often desirable to provide means for the destruction of airborne bacteria and viruses and other nasal irritants such as house dust, the latter being particularly important in the case of asthmatics. Conventional means heretofore provided have often been found to be inconvenient, inefficient and uneconomical. They have required filters which must be replaced periodically or filters or collecting plates which must be cleaned at regular intervals. This is particularly inconvenient in a home and hence has rendered such devices impractical for home use.

In general, it is an object of the present invention to provide a device for collection and disposal of airborne organisms, such as viruses, bacteria spores, mold spores, pollens and organic nasal irritants without the above disadvantages.

Another object of the invention is to provide a device of the above character which accomplishes the destruction of airborne bacteria and viruses and nasal irritants, such as house dust, by means of incineration.

Another object of the invention is to provide a device of the above character in which means are provided for cooling the air before discharge into the room when so desired.

Another object of the invention is to provide a device of the above character in which means are provided for establishing an electric field to direct airborne particles towards the incinerating means.

Another object of the invention is to provide a device of the above character in which means are provided for absorbing ions of the undesired type and generating additional ions of the desired type.

Other objects and advantages of the present invention will appear from the following specification taken in conjunction with the accompanying drawing in which:

Figure 1 shows a cross-sectional elevational view of a device incorporating the present invention.

Figure 2 is a view schematically illustrating portions of the device together with the connecting electrical circuitry.

Figure 3 is a cross-sectional elevational view taken along the line 3-3 of Figure 4 and shows a simplified device incorporating the present invention.

Figure 4 is a cross-sectional view taken along the line 4-4 of Figure 3.

Figure 5 is a schematic of the devices in Figures 3 and 4 together with the connecting electrical circuitry.

In general, the invention consists of a source of heat and means for creating an electrostatic field to drive airborne particles towards the source of heat. In addition, the invention may also include means for cooling the air after it has left the source of heat, and means for absorbing ions of the undesired type and generating additional ions of the desired type. A fan may be used for drawing air through the device.

In the embodiment of our invention illustrated in

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Figure 1, we provide a base 11 which can be formed of any suitable insulating material. A housing 12 is mounted upon the base 11 and is divided into a plurality of compartments 13, 14, 16, 17, 18 and 19 by a plurality of horizontal supporting members 21, 22, 23 and 24 and vertical members 26 and 27. The housing 12 and the horizontal and vertical members may be formed of sheet metal or any other suitable material.

A casing 29 is mounted on the base 11 within the compartment 13 and forms an enclosure for a high voltage autotransformer 31, a high voltage rectifier tube 32, and a full-wave copper oxide rectifier 33. The autotransformer 31 is provided with a tap 31a and rectifier tube 32 is provided with a plate 32a and a cathode 32b.

Arranged within compartment 14 and mounted on the horizontal supporting member 21 are a pair of hollow ceramic cores 34 which are preferably tubular in shape to provide central flues 36 and whose outer surfaces are grooved to accommodate resistance elements 37. A plurality of point electrodes 38 surround the ceramic cores 34 and are carried by tubular members 39 which have outer shells 40 of insulating material mounted upon the supporting member 21. The outer shells insulate the point electrodes from the surrounding structure and insure that the electrostatic field will be concentrated on the point electrodes.

Supporting member 21 is provided with a plurality of holes 41 so that air may pass through the central flues 36 and through the space between the tubular electrodes and ceramic cores 34. A switch box 42 is mounted within compartment 14 on one side of the housing 12 and provides a housing for a plurality of switches hereinafter set forth. Also mounted within compartment 14 is a fan 44 driven by a motor 45 which may be mounted in any suitable way such as by attaching it to the supporting member 22.

Within compartments 16, 18 and 19 is mounted a conventional refrigeration system which consists of an evaporator 46 mounted in compartment 16, a condenser 47 mounted in compartment 18 and a compressor 48 mounted within compartment 19. The compressor 48 is driven by a suitable electric motor 49. The associated piping or coils may be connected as shown in Figure 1.

In compartment 17 is mounted a plurality of ion emitting tubes 51 which are carried within tubular electrodes 52 which are insulated from support member 23 by insulating means 53. Each ion emitting tube is provided with an ion emitter 54 and is constructed in a manner similar to that disclosed in our copending application Serial Number 499,089 filed April 4, 1955.

The side walls of housing 12 have been provided with louvered openings 58 to allow the entrance of air into compartment 13 from which the air passes through openings 41 in support member 21 into compartment 14. Horizontal support members 22 and 23 have been perforated and allow the air to pass from compartment 14 through compartments 16 and 17 where it is discharged through the top portion 62 of the housing which is an open grill. Compartment 19 has been provided with an opening 59 for cooling compressor 48 and motor 49 and compartment 18 has been provided with louvered opening 61 for cooling condenser 47.

The circuit diagram of Figure 2 includes the power supply lines L1 and L2 which may be connected to a standard 120 volts 60 cycle A. C. Line L2 is suitably grounded as shown. Lines L1 and L2 are connected to one side of the double pole switch 66 and the other side of the double pole switch 66 is connected to the motor 49 by conductors 67 and 68. Switch 69 is connected into conductor 68 and provides means for disconnecting the motor 49 from lines L1 and L2. Conductor 67 is connected to one side of each of the re-

sistance elements 37 by conductors 71 and 73 and the other sides of the resistance elements 37 are interconnected by conductor 72. Conductor 72 is connected to one side of the switch 74 by conductor 76 and the other side of the switch 74 is connected to conductor 63 by conductor 77.

One side of the autotransformer 31 is connected to conductor 68 by conductor 78 and the other side of the transformer 31 is connected to the plate 32a of rectifier tube 32 by conductor 81. The tap 31a on autotransformer 31 is connected to conductor 67 by conductor 83. Cathode 32b of the rectifier tube 32 is connected to point electrodes 38 by means of conductor 86.

Conductor 67 is connected to one junction of one pair of opposite junctions of the full wave rectifier 33 by means of conductor 87 and the other junction of the same pair is connected to one end of switch 88 by conductor 89. The other end of switch 88 is connected to conductor 68 by conductor 90. The negative junction of the other pair of opposite junctions of the rectifier 33 is connected to the tubular electrodes 51 by conductor 91 and the positive junction is connected to the electrodes 52 by conductor 92.

Conductor 90 is connected to one side of motor 45 by conductor 93 and the other side of the motor 45 is connected to one side of switch 94 by conductor 95 and the other side of switch 94 is connected to conductor 87.

Operation of our air purifier shown in Figure 1 may now be briefly reviewed as follows: Let it be assumed that switches 66, 69, and 74 have been closed. The resistance elements 37 immediately start to warm up and soon reach a very high temperature which in turn raises the temperature of the ceramic cores 34 to a relatively high temperature. The fan 44 draws air through the central flues 36 and around the heated ceramic cores 34 whereby all the organic contaminants in the air such as bacteria, viruses and nasal irritants such as house dust are carbonized or reduced to gases.

To increase the efficiency of the operation the point electrodes 38 are charged highly positive by the autotransformer 31 and rectifier tube 32 to direct particles of dust and the like towards the resistance elements 37 where they can be more readily incinerated.

It is recognized that the natural thermal gradient between the heating element and surrounding structure tends to drive airborne particles away from the heating element. Applicants point electrodes create an electrostatic field which forces the airborne particles from the point toward the other electrode which in this instance is the heating element.

It is not necessary that the particles actually contact the heating element but it is sufficient if they are brought close enough to be subjected to sufficient radiant energy to be destroyed or gasified.

It will be apparent that as the air passes from the room through the louvered openings 58 and then through the holes 41 and past the heating elements 37, the air will become heated. If it is desired to raise the temperature of the air in the room, this is not objectionable, however, in situations where it is desired to lower or maintain the same air temperature in the room, it is necessary to cool the air passing from the resistance elements 37. To do this, it is merely necessary to close switch 69 to start operation of the refrigeration system so that the air will be cooled as it passes through the coils of the evaporator 46. Thus, the air may be returned to the room at the same temperature or at a lower temperature from that of the temperature of the air in the room.

It is well known that when a resistance element is heated to a high temperature, it generates many ions and most particularly positive ions. The positive ions attach to the airborne organic particles and serve to place a positive charge on the particles. The electrostatic field as hereinbefore described causes the posi-

tively charged particles to be driven towards the heated elements within effective range of the heated element to cause thermal destruction of the particles. If the particles actually come in contact with the heated element, they are discharged. After the charged particles are incinerated, residual smaller charged particles may escape and are carried along by the airstream.

In delivering purified air it is often desirable to control the positive or negative ion concentration. To accomplish this objective it is merely necessary to operate switch 88 to energize the full-wave rectifier 33 to place a negative voltage on ion emitting tubes 51 and a positive voltage on tubular electrodes 52. The positive ions generated by the ion emitting tubes are collected by the negatively charged ion emitting tubes and the negative ions generated by the ion emitting tubes are discharged into the air stream in a manner similar to that disclosed in our copending application Serial number 499,089 filed April 4, 1955. The negatively charged ions serve to neutralize any positively charged incinerated particles passing from the device. Thus, a stream of purified air having an excess of negative ions passes continuously from our device when switch 88 is closed.

By way of example, we have found that our device operates very satisfactorily when the point electrodes 38 are operated at a positive 5,000 volts, but the voltage may range as high as 20,000 volts, if desired.

In Figures 3, 4 and 5, we have illustrated an embodiment of our invention which is suitable for installing in the outlet duct of ventilating and air conditioning systems. In this embodiment we have provided a rectangular member 101 which carries point electrodes 102. A shell 103 of insulating material covers the outer walls of rectangular member 101 for a purpose hereinafter described. Rectangular member 101 may be mounted within an enlarged portion 104 of air duct 106 by any suitable means such as bracket 107. A pair of ceramic plates 108 are spaced apart parallel to the air flow in air duct 106 on rods 109 of insulating material which have their opposite ends mounted on member 101. The sides of ceramic members 108 adjacent the point electrodes 102 are provided with a plurality of grooves 111 in which heating elements 112 are carried.

Spaced plates 108 provide an air passage 113 which provides a chimney effect to air circulating therethrough.

The circuitry for connecting the various elements in the embodiment of our invention shown in Figures 3 and 4 is shown in Figure 5. One terminal of switch 66 is connected to one end of autotransformer 31 by conductor 116 and the other end of autotransformer 31 is connected to plate 32a by conductor 117. Cathode 32b is connected to member 101 and point electrodes 102 by conductor 118. Each of the heating elements 112 have one end connected to conductor 116 by conductors 119 and the other end connected to the other terminal of switch 66 by conductor 121. Tap 31a of autotransformer 31 is connected to conductor 121 by conductor 122.

The operation of the embodiment of our invention shown in Figures 3 and 4 is substantially similar to that described for the embodiment of our invention shown in Figure 1. As the air moves through the air duct 106, the airborne contaminants are forced toward the heating elements 112 by the point electrodes 102 to cause the airborne contaminants to be destroyed or gasified.

It will be appreciated that when the above devices are used for purifying air in the room, the purification process takes place gradually and not instantaneously. By way of experimentation, it has been found that by using such a device, the amount of airborne bacteria and viruses and nasal irritants dropped very rapidly in the first few hours of operation and that the rate of decrease of the amount of bacteria, viruses and nasal irritants in the room gradually decreased until a mere nominal value was reached.

It is apparent from the foregoing that we have provided an air purifier which acts directly upon airborne bacteria and viruses and upon nasal irritants, such as ordinary house dust and the like to destroy or gasify the same. In addition, we have provided means for cooling the air as it passes from the incinerating means and means for neutralizing positive ions in the air stream and for increasing the negative ion concentration.

We claim:

1. In an apparatus for purifying air, a member for incinerating organic matter, means for heating said member to a temperature sufficiently high to incinerate organic matter, means creating an electrostatic field adjacent said member, means for causing air to flow through said electrostatic field and adjacent said member, said electrostatic field being of sufficient strength to drive airborne contaminants toward and within the effective range of said heated member to cause thermal destruction of said airborne contaminants.

2. Apparatus as in claim 1 together with electrostatic means adjacent said air stream for neutralizing positive ions generated by said heated member in said air stream.

3. Apparatus as in claim 1 together with means for cooling the airstream after it has passed said heated members.

4. In an apparatus for purifying air, a housing, a ceramic member mounted within said housing, heating means for heating said ceramic member to incandescence, means creating an electrostatic field surrounding said ceramic member, and means causing an airstream to pass over said ceramic member and through said electrostatic field, said electrostatic field serving to urge airborne contaminants in the airstream towards the ceramic member for thermal destruction of the organic contaminants.

5. Apparatus as in claim 4 wherein said means creating an electrostatic field includes a wall-like member encircling said ceramic member and having a plurality of point electrodes mounted on the same.

6. In an apparatus for purifying air of the type adapted to be inserted in a moving airstream, a duct defining the

path of the airstream, a member for incinerating organic matter and mounted in said duct, means for heating said member to a temperature sufficiently high to incinerate organic matter, means creating an electrostatic field surrounding said member and serving to urge airborne organic contaminants in the airstream towards and within the effective range of said member to cause thermal destruction of said airborne organic contaminants, said means for creating an electrostatic field including a wall-like structure surrounding said member and having a plurality of point-like electrodes mounted thereon.

7. In a method for purifying air, the steps of producing an airstream, maintaining a temperature zone in the airstream wherein the temperature is sufficient to cause thermal destruction of organic contaminants, and establishing an electrostatic field about said zone to urge airborne organic contaminants in the airstream towards said zone for thermal destruction.

8. In a method for purifying air, the steps of producing an airstream, maintaining a temperature zone in the airstream wherein the temperature is sufficient to cause thermal destruction of organic contaminants, establishing an electrostatic field about said zone to urge airborne organic contaminants in the airstream towards said zone for thermal destruction, cooling the airstream after the organic contaminants have been destroyed, and neutralizing positive ions in the airstream.

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