

[54] **AIR CONDITIONING SYSTEM**

[72] Inventor: **Russell G. Heston, Jr.**, Little Silver, N.J.

[73] Assignee: **Donald Deskey**, Palm Beach, Fla.

[22] Filed: **April 12, 1971**

[21] Appl. No.: **133,073**

[52] U.S. Cl.**62/129**, 23/2 S, 55/73, 55/222, 55/232, 55/354, 62/123, 62/176

[51] Int. Cl.**G01k 13/00**

[58] Field of Search 23/2 SQ, 2 E; 55/73, 222, 232, 55/354; 62/129, 123, 176

[56] **References Cited**

UNITED STATES PATENTS

3,454,354 7/1969 Kerr 23/2 S

3,522,000 7/1970 Kinney.....55/222 X

Primary Examiner—Meyer Perlin

Assistant Examiner—Ronald C. Capossela

Attorney—James M. Heilman and Heilman & Heilman

[57]

ABSTRACT

An air conditioning system including the usual air heating and air cooling means, blowers, electrical controls and the addition of a means for removing sulfur oxide compounds from the air. The sulfur oxide compounds are media removed by forcing the air through a fabric or belt wetted with an alkaline hydroxide water solution. Automatic means replenish the hydroxide solution when it is exhausted.

10 Claims, 5 Drawing Figures

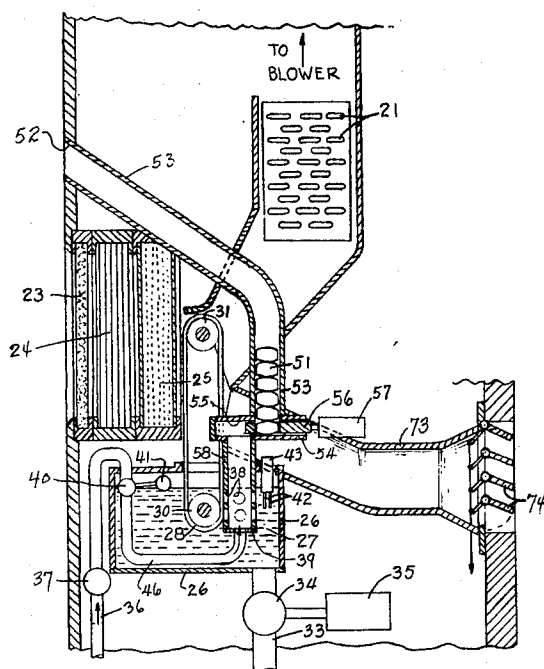


FIG. 1

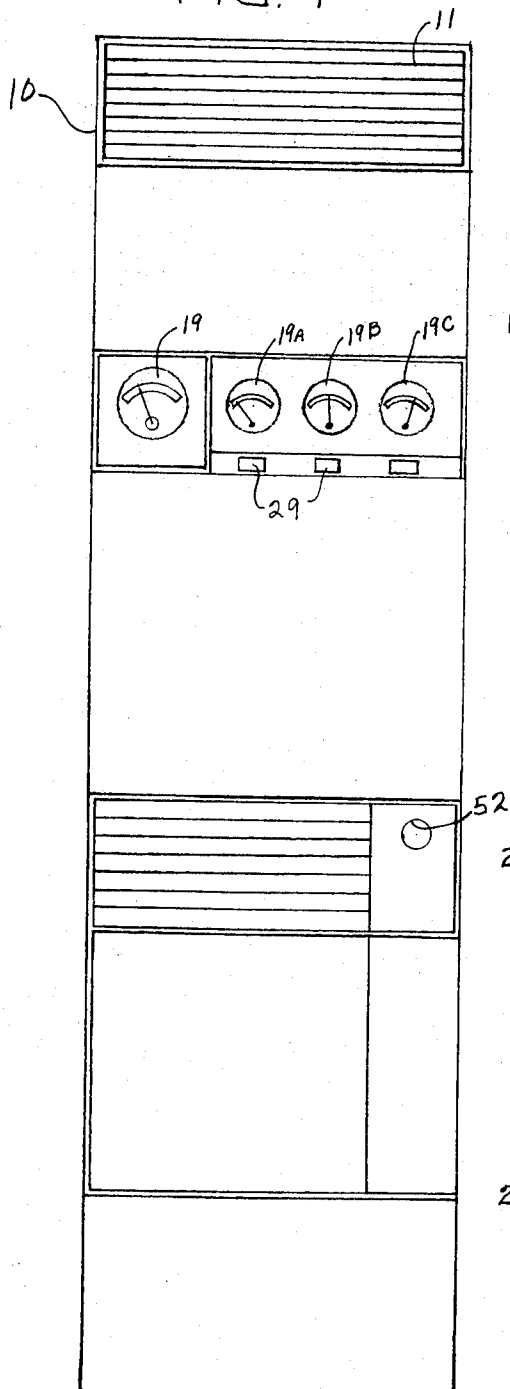
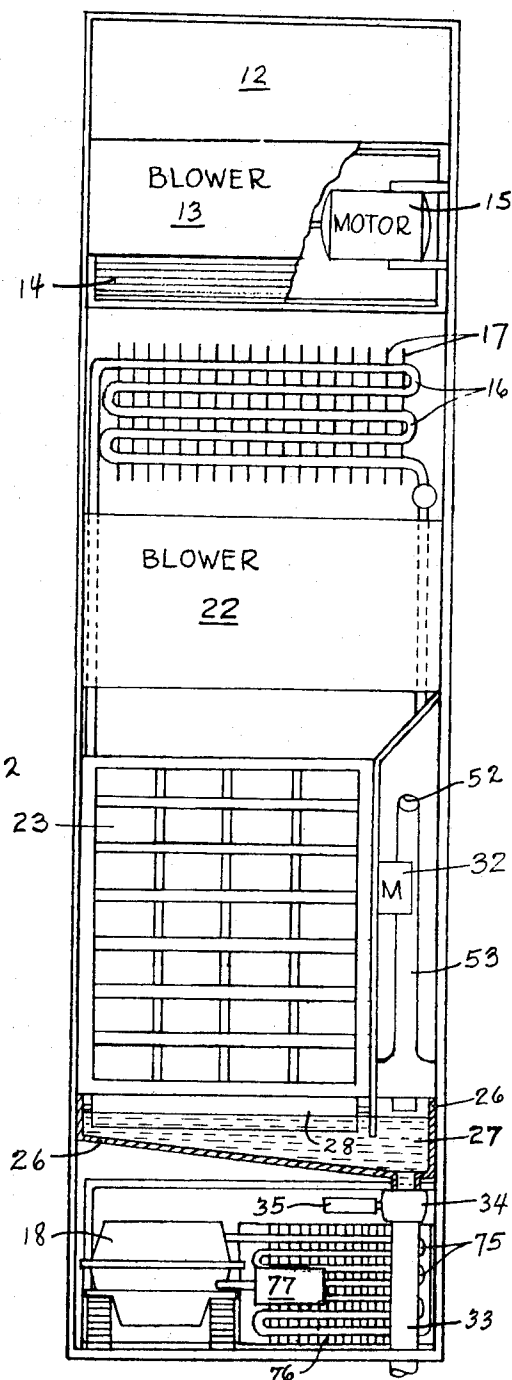
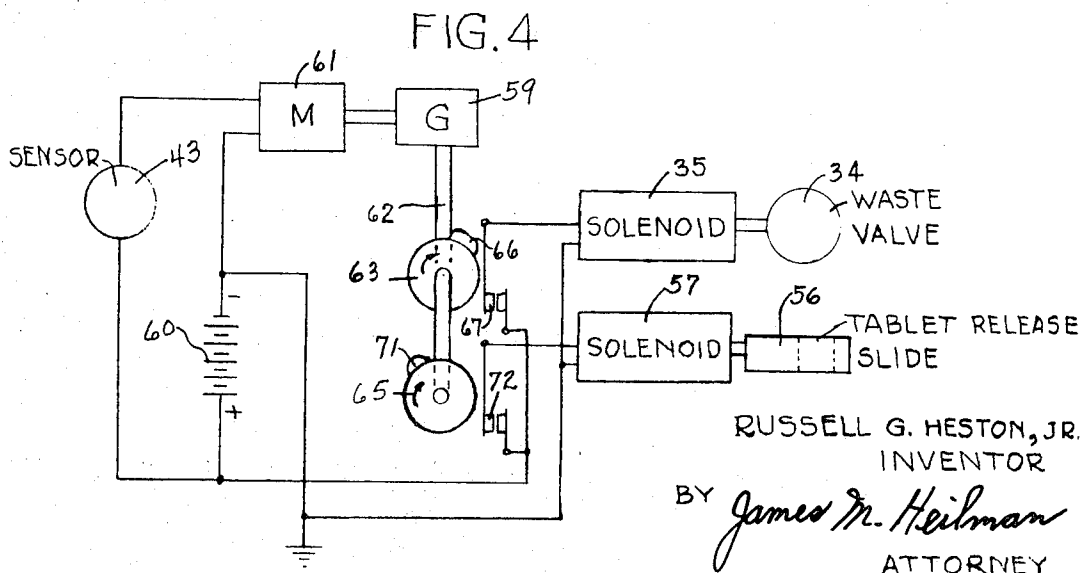
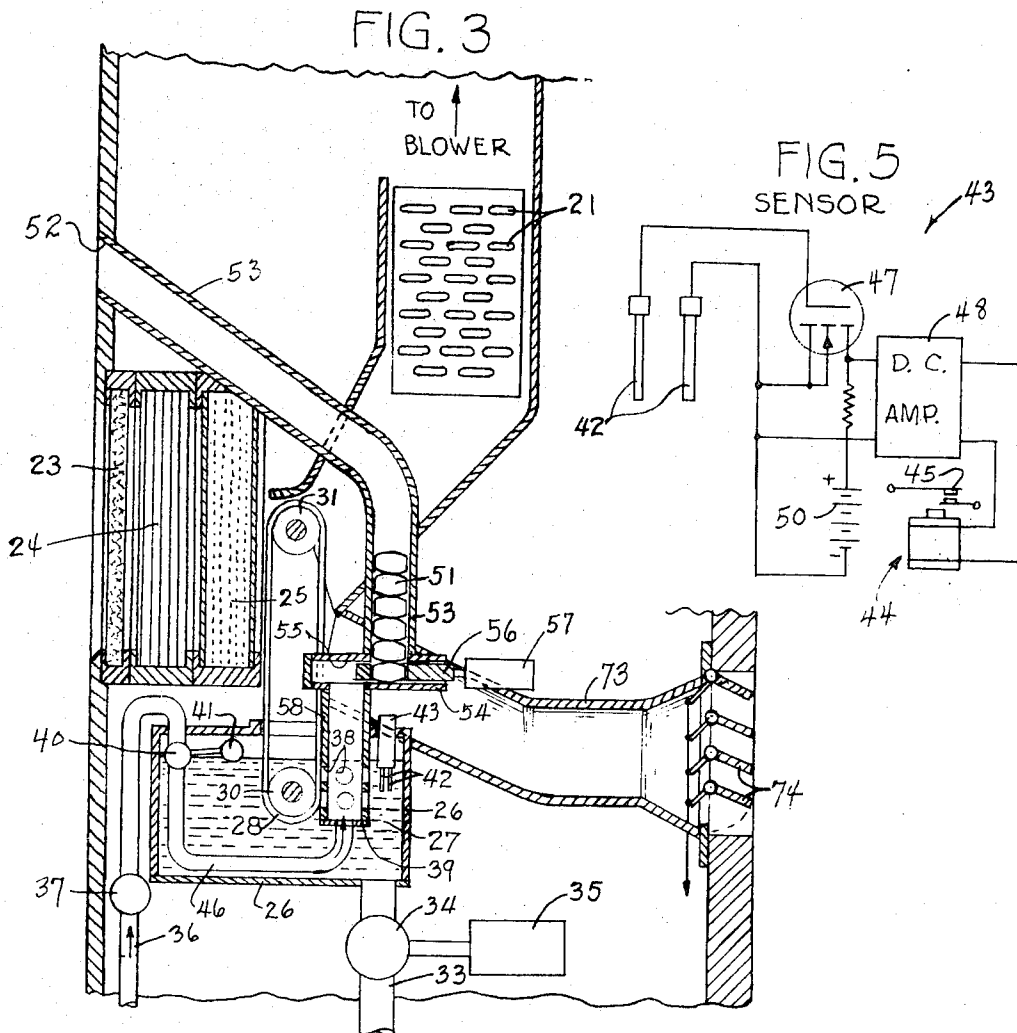


FIG. 2



RUSSELL G. HESTON, JR.
INVENTOR

BY *James M. Heilman*
ATTORNEY



AIR CONDITIONING SYSTEM

BACKGROUND OF THE INVENTION

Air heating and air cooling systems have been in use for a long time but generally not combined in a unitary system. Electrostatic precipitators are also old in the art but they have usually been used in situations where very fine particles, such as are found in smoke, are to be collected from the air. Another very important cleaning device has been used to remove sulfur oxide compounds from the air. U.S. Pat. NO. 2,994,005, assigned to the same corporation as the present application, discloses a spray device which sprays the circulating air with an aqueous solution of sodium hydroxide to remove unwanted sulfur compounds. The present invention combines all the above mentioned air conditioning units into a single housing with automatic control means, and in addition, employs a revolving wetted fabric instead of the spray to remove the sulfur compounds.

A feature of the present invention is the unitary grouping of all the required air conditioning units into a single housing where blowers, air purifiers and control systems can be used for both heating and cooling.

Another feature of the invention comprises a means of eliminating sulfur oxide from the air passing through the unit. An air pervious fabric, wetted with an alkaline hydroxide aqueous solution, is presented to the air stream and removes the sulfur compounds.

Another feature of the invention is the automatic means for changing the hydroxide solution once it has become exhausted. The acidity valve of the solution is sensed by an electric cell and when the acids value (pH) rises above a predetermined value, the solution is removed and replaced by a fresh one.

For a better understanding of the present invention, together with other details and features thereof, reference is made to the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

FIG 1 is a front view of the housing which contains all the air conditioning units.

FIG. 2 is a front view of the system with the front cover removed showing some of the units which make up the system.

FIG. 3 is a cross sectional view of a portion of the unit, showing some of the filters and the means for removing sulfur oxide compounds from the air.

FIG. 4 is a diagram of connections of the control circuit which measures the pH value of the hydroxide solution, drains the tank when the solution is exhausted, fills the tank with water, and then introduces a fresh supply of alkaline hydroxide.

FIG. 5 is a diagram of connections showing one form of sensor unit which can be used to determine the pH value of the solution.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, a housing 10 includes all the air conditioning units. At the top, a grill 11 covers a blower exit 12 where the conditioned air is pumped from the system into the room or space to be cleared. A rotary blower 13 having radially positioned

vanes 14 is run by an electric motor 15. Just below the blower 13 is a first set of conduits 16 having fins 17 for either heating the air or cooling it. It has been found that an arrangement of cooling conduits permanently connected to a compressor 18 and an arrangement of hot conduits is preferable to an attempt to make a single set of conduits carry cold vapors in the summer and hot steam in the winter. For this reason a second set of conduits 21 (FIG. 3) is positioned below the first set and connected to a source of hot fluid, electrical heating elements, or some other type heating arrangement. A second blower 22 may be used to complement the first blower 13 but the second is not always necessary.

Several meters are positioned on the front panel. One of these 19 shows the pH value of the aqueous solution. Another meter 19A indicates the temperature of the air discharged from the blower 13. A third meter 19B measures humidity and a fourth 19C, current input to the electrostatic filter 24. On and off switches 29 are provided for the blower motor 15, the compressor motor 18, and for the electrostatic power pack.

The main air intake is through a first coarse mesh filter 23 (see also FIG. 3). Then the air is sucked through a set 24 of charged conductive plates which create an electrostatic field and attract the finer charged particles such as found in smoke. Finally, the air passes through a layer of activated charcoal 25 which absorbs many of the gaseous odors found in living spaces. These three purification means are preliminary to the main purification structure which removes sulfur oxide compounds, hydrocarbons and other pollutants from the air.

Sulfur dioxide and sulfur trioxide are products of combustion resulting from burning coal, furnace oil and other fossil products having a high sulfur content. Sulfur oxide compounds may also result from chemical manufacturing processes. These compounds are dangerous because they react with water vapor in the atmosphere to form sulfuric acid and sulfurous acid, two corrosive acids which cause injury to the lungs and also corrode metals.

The means which removes sulfur oxide compounds from the air includes a reservoir 26 holding a quantity of aqueous alkaline hydroxide 27 such as sodium hydroxide, NaOH. A fabric belt 28 having many interstices is supported by two rollers 30 and 31, the lower roller being immersed in the solution. The upper roller 31 is turned by a motor 32 (FIG. 2) so that wet fabric is always presented to a portion of the air stream moving through the filters. When the solution in the reservoir 26 is spent due to reaction with the sulfur oxide, it is discarded through a conduit 33 and a valve 34 operated by an electric solenoid 35. The tank is filled with water by means of a conduit 36 and a valve 37. A second valve 40 controlled by a float 41 insures that the tank 26 cannot be filled above a predetermined maximum level.

The strength of the liquid 27 in reservoir 26 is measured continuously by a pH meter which includes two electrodes 42, one of which may be glass, and a voltage determining circuit 43 (see FIG. 5) terminated by a relay 44. This type of circuit device is old in the art and has been used in prior applications to measure the acidity values of many types of solutions. If sodium hydroxide, NaOH, is used as the absorbing means, a

freshly mixed solution may start out with a pH valve of about 12. After continued use, the pH value may be 5 at which time the solution is slightly acid and should be changed. At this time the relay is activated, contacts 45 are closed and an operating circuit is energized which changes the aqueous solution (see FIG. 4). The sensor circuit 43 includes a MOSFET unit 47, a direct current transistor amplifier 48, and a source of potential 50. A similar sensor circuit is described in "Handbook of the Engineering Sciences," pages 689-691, a book published by Van Nostrand Co.

The preferred alkaline solution is water and sodium hydroxide but other alkaline hydroxides can be used with equivalent satisfactory results. Hydroxides of lithium, potassium, and calcium have been tested and were found to absorb the sulfur oxides in an efficient manner. When the reaction occurs (with sodium hydroxide), the following salts are formed; sodium sulfide, sodium sulfate, sodium sulfite, and acid sodium sulfate. All these salts lower the pH value of the solution.

When the spent liquid is drawn off through conduit 33 and water is supplied to the reservoir 26, a tablet 51 of alkaline hydroxide is dropped into the reservoir where it dissolves and forms the desired aqueous solution. The tablets may be entered into an opening 52 in the front panel of the housing to form a supply held by conduit 53. The tablets 51 are supported by a base 54 which is part of a compartment 55 in which a tablet slide 56 is positioned. The slide 56 is operated by a solenoid 57 to move the slide 56 to the left as seen in FIG. 3 so that a tablet 51, moved by the slide can fall through conduit 58 into the water in tank 26.

In order to insure that the alkaline hydroxide tablet is dissolved quickly, conduit 58 is extended to a position well below the solution surface and supplied with holes 38. The bottom of the conduit 58 is blocked by a flange 39 and the end of pipe 46 which delivers water from valve 40. The operation of this portion of the system is as follows: When the sensor 43 detects an acid solution, solenoid 35 operates valve 34 to drain the solution in reservoir 26. Soon after valve 34 is opened, the slide 56 is operated to drop a tablet 51 into the bottom of pipe 58. At the same time water valve 30 is opened because its control float 41 has dropped. Water is forced through conduit 46 into the lower portion of pipe 58 where it is directed into contact with the tablet 51 and then moves through holes 38 and into the reservoir 26. The direct contact of the input stream with the tablet 51 insures that the tablet will be dissolved quickly.

The control of the waste valve 34 and the tablet release slide may be achieved by the apparatus shown in FIG. 4. The sensor 43 contains relay contacts 45 and when these contacts are closed, current is applied to motor 61 from power source 60. Motor 61 is connected through a mechanical gear reduction unit 51 to shaft 62 and turns cams 63 and 65. Cam 63 includes a projection 66 which closes contacts 67 soon after the motor starts and completes a circuit from the battery 60 through solenoid 35 to operate the solenoid, open waste valve 34, and dump the spent solution from reservoir 26. The projection 66 must be made wide enough so that all the liquid in the tank is expelled. As soon as the liquid level in reservoir 26 is reduced, valve 40 is opened due to the operation of the float 41. Dur-

ing the time that the liquid in the tank, the water from pipe 46 flows into the tank, acting as a flushing means to help clean out the dirt and sediment in the bottom of the tank.

Projection 71 on cam 65 operates contacts 72 to activate solenoid 57 and move the tablet slide 56 to the left and drop a tablet 51 into the bottom of pipe 58. When contacts 72 are opened, a spring (not shown) in the solenoid returns the core and the slide to their normal position at which time another tablet drops into the slide cavity.

There may be time when only small quantities of sulfur oxide are processed by the device. The acid sensor will then operate infrequently to dump and refill the tank. However, there will always be considerable evaporation from the tank since air is always blowing through the belt 28. For this reason valve 37 must be in its open position so that the liquid level can be maintained by the float operated valve 40.

An additional air duct 73 may be installed in the system for bringing air from the outside of the building through lower boards 74 forming a part. The boards are adjustable so that this opening may be closed off during normal operation. The boards, or openings may be controlled manually or automatically by any conventional means (not shown) including electrically, mechanically, or pneumatically, and may be regulated by temperature within or by any other desired conventional standard.

When the system is adjusted for air cooling the compressor 18 (see FIG. 2) forces compressed refrigerant fluid from the pipes 16 into an array of pipes 75 which get hot and dispell heat through the aid of cooling fins 76. A small blower 77, coupled electrically or mechanically to the compressor motor 18 forces air through the hot pipes and then expells it to the atmosphere outside the space being cooled. This means of discarding heat is well known in the art.

While my system is shown and described as a unitary assembly, it is understood that it may be manufactured and operated alone as single individual units of modular construction.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an air conditioning system for filtering and controlling the temperature and humidity of a stream of air, the addition which includes a means of extracting sulfur oxide compounds from the air comprising:

- a. a housing having entrance and exit ports for the movement of air;
- b. blower means for moving a stream of air through the housing;
- c. a tank within the housing containing an aqueous solution of an alkaline hydroxide;
- d. an endless belt of absorbent material, having interstices for the passage of air, one portion of the belt being immersed in the solution in the tank;
- e. and means for moving the endless belt to sequentially expose wetted portions of the material to the stream of air to absorb sulfur dioxide compounds from the air stream.

2. An air conditioning control system as claimed in claim 1 wherein a supply of alkaline hydroxide tablets is available in the housing for replenishing the aqueous solution.

5

6

3. A system as claimed in claim 2 wherein a sensing means is immersed in the aqueous solution for determining the pH number of the solution.

4. A system as claimed in claim 3 wherein said sensing means includes a pair of electrodes, an amplifier and a relay.

5. A system as claimed in claim 3 wherein said alkaline hydroxide tablets are contained in a storage conduit positioned above the aqueous solution and are released to fall into the solution when the sensing means operates to indicate a spent solution.

6. A system as claimed in claim 5 wherein a slide dispenser, operated by an electric solenoid, liberates one tablet at a time to the solution.

7. A system as claimed in claim 5 wherein an automatic control means drains the tank of spent solution, fills the tank with water, and then drops an alkaline

hydroxide tablet into the water, said control means including a motor started by the sensing means, and a series of cams turned by the motor for operating contacts and solenoids, said solenoids coupled respectively to a waste valve and said tablet slide dispenser.

8. A system as claimed in claim 7 wherein an exterior port is connected to the system whereby outside air may be introduced into the system, and automatic control means to regulate the quantity of said introduced outside air by regulating the opening of said port.

9. A system as claimed in claim 1 wherein the alkaline hydroxide contains a metal of the group consisting of sodium, lithium, potassium, and calcium.

10. A system as claimed in claim 1 wherein the system includes an evaporator coil for cooling the air after passage through the endless belt.

* * * * *

20

25

30

35

40

45

50

55

60

65