Dec. 7, 1937. W. E. MOORE ET AL 2,101,555

AIR OR GAS CONDITIONING APPARATUS

Filed July 11, 1935 3 Sheets-Sheet 1

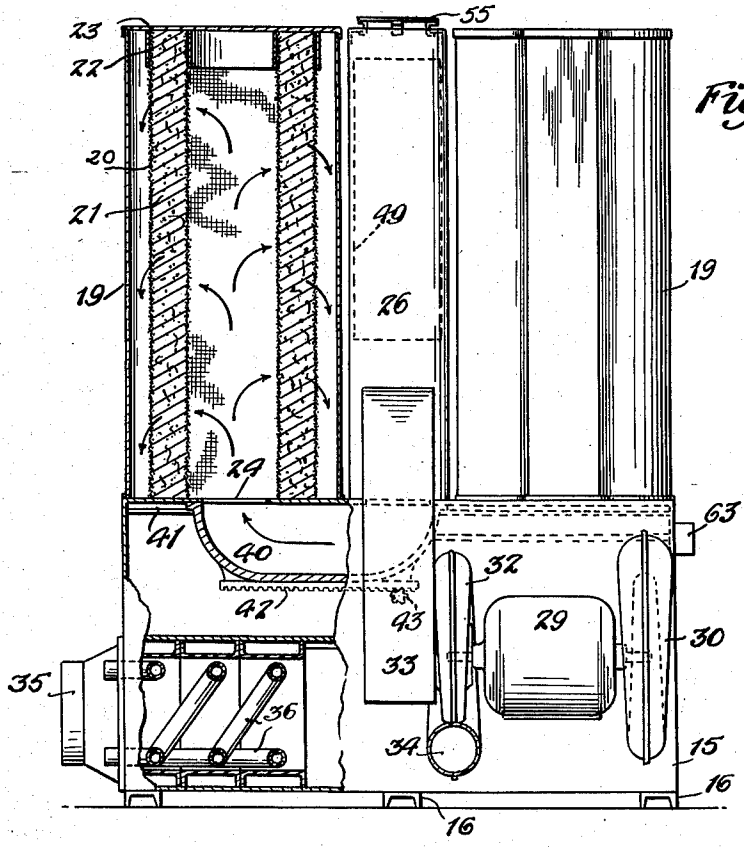


Fig. 1

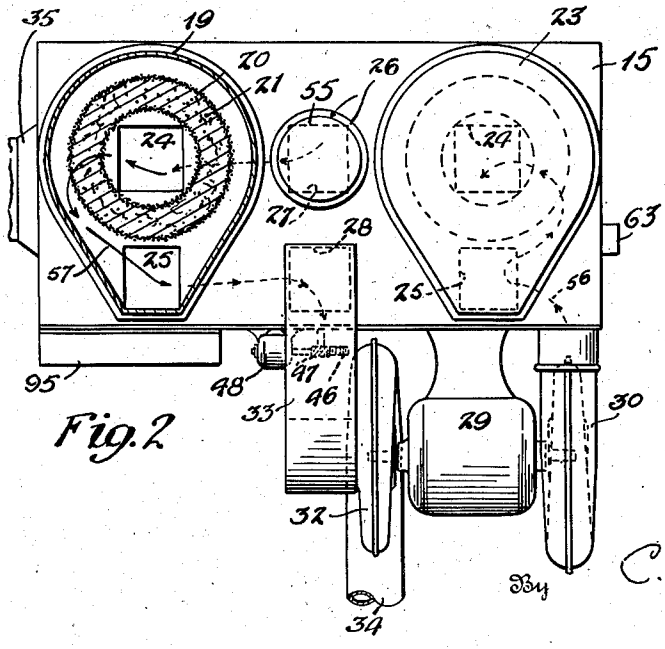


Fig. 2

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AIR OR GAS CONDITIONING APPARATUS

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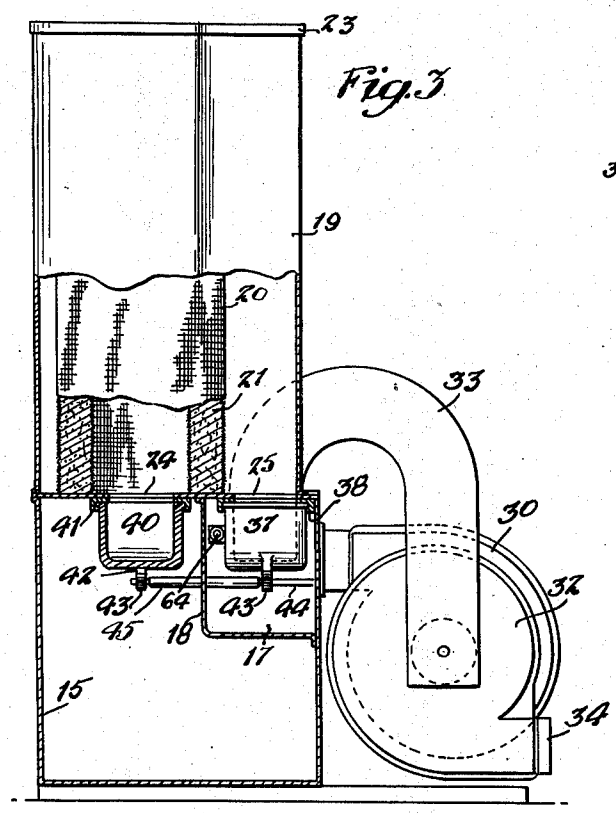


Fig. 3

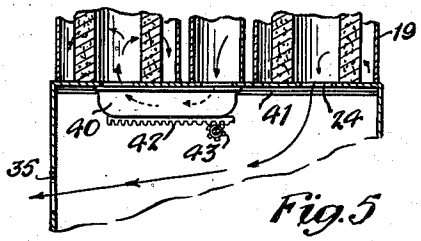


Fig. 5

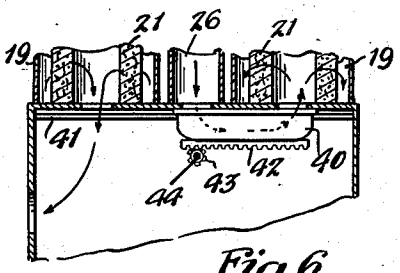


Fig. 6

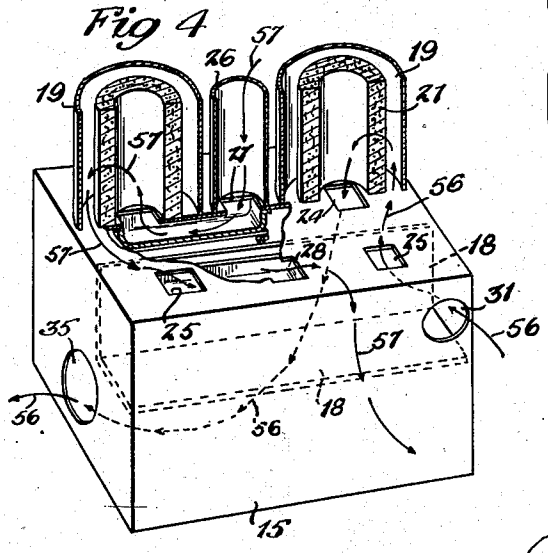


Fig 4

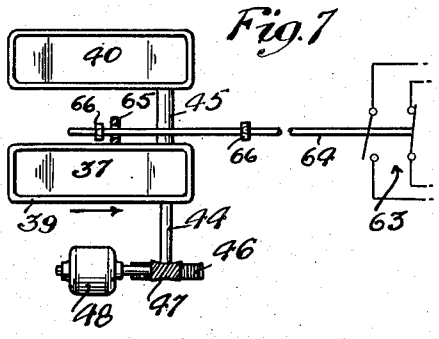


Fig. 7

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AIR OR GAS CONDITIONING APPARATUS

Filed July 11, 1935 3 Sheets-Sheet 3

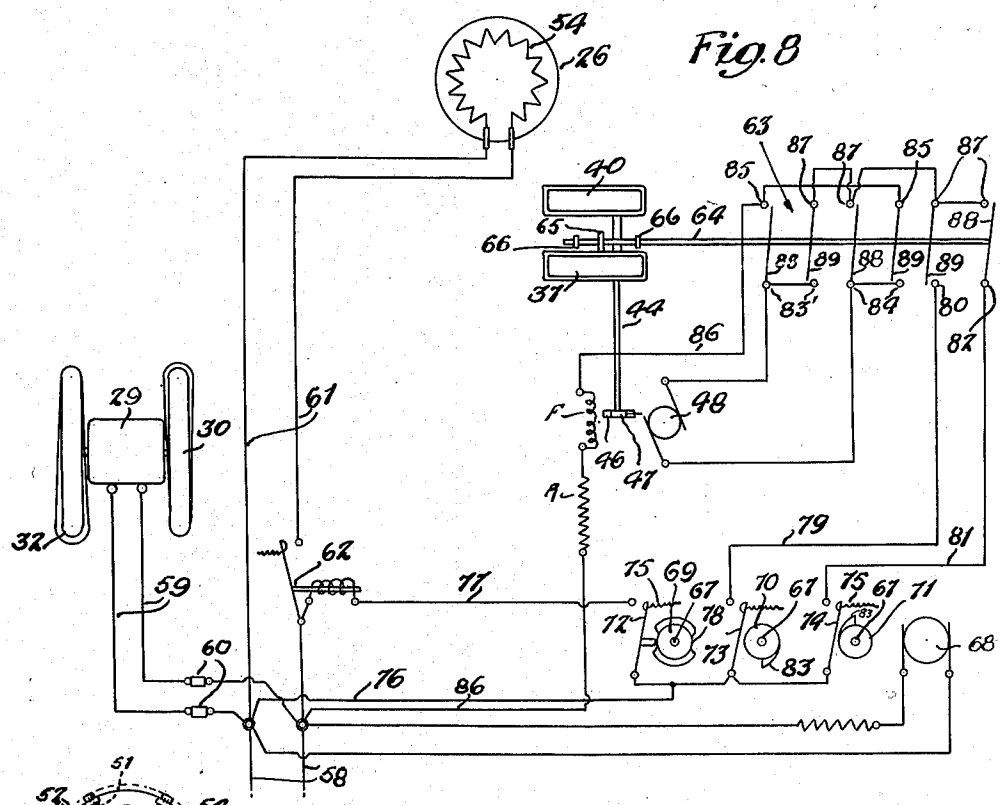


Fig. 8

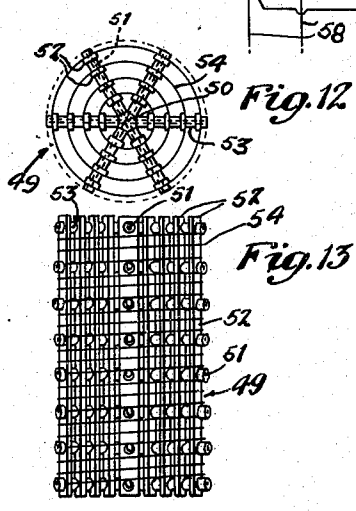


Fig. 12

Fig. 13

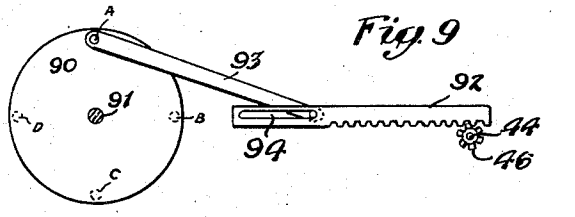


Fig. 9

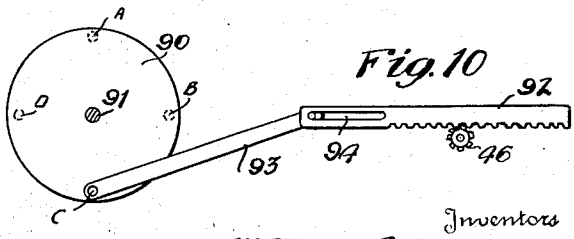


Fig. 10

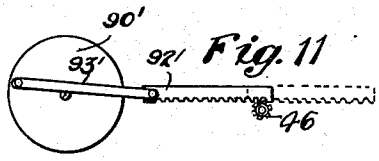


Fig. 11

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UNITED STATES PATENT OFFICE

2,101,555

AIR OR GAS CONDITIONING APPARATUS

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Application July 11, 1935, Serial No. 30,908

14 Claims. (Cl. 183—4)

This invention relates to improvements in apparatus for conditioning air or gas, and more particularly to an apparatus for drying air, although not necessarily restricted to this use.

An important object of this invention is to remove or reduce the moisture content of air in rooms or houses, or for industrial purposes. There are many industrial processes in which the presence of substantial amounts of moisture in air or gas is highly undesirable. An example is the handling or packing of many chemicals and drugs, which can only be carried on in the absence of any substantial quantities of moisture in the atmosphere.

An object of the present invention is the provision of an apparatus which will handle a large volume of air or gas, and efficiently remove moisture or other impurities therefrom.

Another object of this invention is to provide a device of this character which can be operated continuously and which will be automatic in operation.

A further object of this invention is the provision of an apparatus of this character which will be inexpensive to install and operate, simple in construction, and efficient in operation.

Other objects and advantages of this invention will be apparent during the course of the following description.

In the accompanying drawings, which form a part of this specification and wherein like characters of reference denote like parts throughout the same,

Figure 1 is a front elevation of an apparatus embodying this invention, parts being broken away,

Figure 2 is a top plan view thereof, one of the towers being shown in cross section,

Figure 3 is a side elevation thereof, parts being shown in section,

Figure 4 is a schematic perspective view of the apparatus illustrating the passage of the air or gases therethrough,

Figure 5 is a fragmentary sectional view showing one position of the valves,

Figure 6 is a similar view showing the other position of the valves,

Figure 7 is a plan view of the valves and their operating mechanism,

Figure 8 is an electrical diagram illustrating one method for automatically controlling the various operations of the apparatus,

Figures 9 and 10 are details of another method of reversing the operation of the valves,

Figure 11 is a modified form of valve reversing mechanism,

Figure 12 is a plan view of an electrical heater for use with this apparatus, and,

Figure 13 is a side elevation thereof.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of this invention, the numeral 15 designates a generally rectangular closed casing mounted on suitable rails or supports 16. A longitudinally extending duct 17 is arranged in the upper forward portion of the casing and is formed by an L-shaped partition or baffle 18 secured at one end to the top of the casing and at the other end to the forward wall of the casing, as seen in Figure 3. The partition or baffle 18 is connected to both end walls of the casing and completely isolates the duct 17 from the interior of the casing. The casing and baffle are preferably formed of metal.

A pair of spaced towers are secured to the top of the casing 15 and comprise metal tower casings 19 welded, bolted or otherwise secured to the top of casing 15. Tubular adsorbent units are arranged in each tower, extending from top to bottom thereof, and consist of concentric cylinders 20 of wire netting between which a body 21 of activated alumina or other suitable solid adsorbent material is arranged. The outer netting cylinders 20 are arranged in spaced relation to the casings 19 and the adsorbent units are retained in place by concentric depending circular flanges 22 carried by the covers 23 of the towers. Suitable ports or openings 24 are arranged in the top of casing 15 near the rear thereof, and connect the interior of the casing 15 with the cylindrical bore of the adsorbent units. Similar openings or ports 25 are arranged in the forward portion of the top of the casing 15 in alignment with ports 24, and are arranged exteriorly of the adsorbent units, as best seen in Figures 2 and 3. The tower casings 19 are concentric with the adsorber units for the greater part of their circumference, but extend forwardly to cover ports 25 as indicated in Figures 2 and 3. The ports 25 connect the duct 17 with the interior of the casings 19 exteriorly of the adsorber units.

A cylindrical heater casing 26 is arranged between the tower casings 19 and communicates with the interior of the casing 15 by means of an opening or port 27 arranged in longitudinal alignment with ports 24 and midway therebetween. A port 28 is arranged in the top of casing 15 in transverse alignment with port 27 and in longitudinal alignment with ports 25. It will

be seen that ports 25 and 28 communicate with duct 17 while ports 24 and 27 communicate with the interior of casing 15. It will also be seen that the only communication between the interior of casing 15 and duct 17 is through ports 24 and 25 and through the mass of adsorbent material in the tower casings.

A fan operating motor 29 is mounted in front of casing 15 adjacent the right hand end thereof. An intake fan or blower 30 of any suitable construction is arranged at the right of motor 29 to be driven thereby, and communicates with duct 17 through an opening 31 in the forward wall of casing 15. Blower 30 is preferably of a type having an axial intake and peripheral exhaust. A reactivating fan or blower 32 is arranged at the opposite end of motor 29 to be driven thereby, and has its axial intake connected to port 28 by conduit 33, and an exhaust pipe 34 leading to the outside atmosphere.

The left hand end of casing 15 is provided with an air or gas outlet opening 35, and suitable cooling pipes 36 may be arranged at this opening, as indicated in Figure 1, to cool the dried air or gas, if desired.

A valve member 37 is slidably mounted in longitudinal guides 38 extending the full length of the under side of the top of casing 15 within duct 17, and the guides 38 straddle openings 25 and 28. Valve 37 comprises an elongated, generally rectangular cup shaped member open at its top and having flanges 39 about its upper edge to be slidably received in the grooves of the guide members 38. A similar valve 40 is arranged in guides 41 arranged on the under side of the top of casing 15 and straddling ports 24 and 27. The valves 37 and 40, and guides 38 and 41 fit snugly against the underside of the top of casing 15 to prevent escape of air or gas from the valves except through the ports 24, 25, 27 and 28.

Valves 37 and 40 are arranged in transverse alignment and are each provided on the under side with a longitudinally extending rack bar 42 engaging spaced pinions 43 on a transverse shaft 44. A suitable stationary sleeve 45 extends through partition 18 and rotatably receives pinion shaft 44. Pinion shaft 44 extends through the forward wall of casing 15 and is provided at its end, exteriorly of casing 15, with a suitable cog-wheel or gear 46 engaged by a suitable pinion or worm 47 carried by the shaft of motor 48, mounted on the forward wall of casing 15. Operation of motor 48 rotates shaft 44 and pinions 43 to move valves 37 and 40 in unison in the guides 38 and 41. In the left hand position of the valves shown in Figures 1, 4 and 5, valve 40 connects left hand port 24 with heater port 27 while valve 37 connects left hand port 25 with exhaust port 28. In the right hand position of the valves, indicated in Figure 6, valve 40 connects the heater port 27 with the right hand port 24 while valve 37 connects exhaust port 28 with the right hand port 25.

Any suitable type of heating device may be arranged in heater casing 26. Gas burners, hot water coils or electric resistance heaters may be used. In Figures 12 and 13 is illustrated an electrical resistance heater 49 which is efficient and economical to operate, and which can be used to advantage in this apparatus. A frame comprises a central hexagonal post 50 through which suitable wires 51 extend. Vertical bars 52 fit over wires 51 and are suitably spaced by spacing elements 53. Four of the bars 52 are shown on each side of the three wires 51, although any suitable number may be employed, and the ends of the wires 51 may be bent over to prevent displacement of the bars and spacers. Resistance wires 54 are wound helically about each series of bars. While any suitable arrangement of wires may be used, it is preferred to wind each series of bars as they are assembled. Starting from the top center of the heating element, the resistance wire is wound downwardly in a helical path around the inner series of bars, then upwardly around the next series of bars, then downwardly around the next series of bars, and finally upwardly around the outer series of bars, thus forming four concentric helical coils. The completely wound heating element is placed within the heating cylinder 26 as indicated in Figure 1. One or more of the heating units shown in Figure 13 may be used. When more than one are used, they are stacked one upon the other.

The top of heating cylinder 26 is open, and may be covered with a suitable screen. In Figure 1 a plate 55 is shown spaced above the open end of the heater casing 26.

In operation, when for example, the apparatus is to be used for removing or reducing the moisture content of a room or building, fans 30 and 32 are operated by motor 29, and air from the room or building is drawn in through the axial intake of blower 30 and forced into duct 17 through opening 31. With the valves in the left hand position shown in Figures 1, 4 and 5, the air passes from duct 17 through right hand port 25 into tower casing 19, through the walls of the adsorbent unit, down through port 24 into the interior of casing 15 and thence past cooling coils 36 and through pipe 35 into the room or building in dried condition.

At the same time, blower 32 is operating to suck air from the room through open end of heater 26, past the heating element 49 to be heated, through port 27 into valve 40, up through port 24 into the left hand tower, through the adsorbent unit to left hand port 25, through valve 37 to exhaust port 28 and out through pipe 33, blower 32 and exhaust pipe 34 to the atmosphere outside of the room or building. The air from the room is heated and passed through the left hand adsorbent unit to remove the moisture therein and reactivate the adsorbent material, while air passing through the right hand tower is being dried. When the right hand adsorber unit becomes saturated with moisture, valves 37 and 40 are moved to their right hand position in which the reactivated left hand tower is used for drying while the right tower is reactivated in the manner just described. It is desirable to turn off heater 49 just prior to reversing the valve position in order to permit cool air from the room to pass through the reactivated adsorbent material to cool the same, as a cool adsorbent operates more efficiently than does a hot adsorbent. In Figures 2 and 4 the arrows 56 indicate the path of the air being dried while arrows 57 indicate the path of the reactivating air. It will be seen that the air to be dried always passes from the duct 17 directly through the towers to the interior of casing 15 and outlet 35, whereas the reactivating air always passes from the heater through the valves and towers to the exhaust blower without entering casing 15 or duct 17 and without commingling with the air to be dried.

It is preferred to operate the apparatus automatically. Figure 8 is a schematic representation of one method of operating the apparatus automatically, in which the main power lines 58 are

connected to a suitable source of direct current. Leads 59 connect fan motor 29 with the power lines in the usual manner, and suitable fuse boxes 60 may be arranged in leads 59. Resistance element 54 of heater 26 is connected to power lines 58 by wires 61 and a suitable control switch such as solenoid switch 62 is arranged in this circuit to control the resistance heater.

A motor reversing and limit switch 63 is controlled by a push rod 64 extending from the switch 63 through an opening in a lug 65 carried on the side of valve 37. Suitable abutments 66 are adjustably arranged on rod 64 and are so spaced as to be engaged by lug 65 at the limit of the valve movement in either direction, to reverse the three way toggle switch 63 and thereby reverse the operation of the D. C. motor 48 which operates valves 37 and 40.

A cam shaft 67 is suitably geared to a timing motor 68 to be rotated thereby at a relatively low speed, and is provided with three cams 69, 70 and 71 arranged to operate switches 72, 73 and 74 respectively, said switches being normally held in open position by suitable springs 75. All of the switches 72, 73 and 74 are connected to the supply line 58 by wire 76. Wire 77 connects solenoid 62 with the contact of switch 72. Cam 69 has two notches at opposite points thereon to permit switch 72 to open for short intervals at the end of each reactivation period to open switch 62 and permit cool air to pass through heater 26 to the towers.

Wire 79 connects contact of switch 73 to contact 80 of reversing switch 63 while wire 81 connects contact 82 of switch 63 to the contact of timing switch 74. Abutments 83 arranged at opposite points on cams 70 and 71 close switches 73 and 74 to operate valve motor 48. Contacts 83' and 84 of reversing switch 63 are connected to the valve motor 48 while contacts 85 are connected through the series motor field F and resistance R to the supply line 58. The other contacts 87 of switch 63 are connected together.

In Figure 8 the switch 63 is shown with all switch plates 88 and 89 open, for clearness of illustration. In actual operation, however, either switch plates 88 or switch plates 89 are closed, while the others are open.

When rod 64 is in its right hand position switch plates 89 will be closed and in position for operating motor 48 to move valves 37 and 40 to the left. When abutment 83 of cam 70 closes switch 73 current will flow from the supply line 58 through switch 73, line 79, contact 80, switch plate 89, contacts 87, switch plate 89, contact 83' to motor 48, and back through contact 84, switch plate 89, contacts 85 and line 86 to the supply line 58, thus operating motor 48 and moving the valves to the left. When the extreme left hand position of the valves is reached, lug 65 acts through abutment 66 to move rod 64 to the left, thereby opening switch plates 89 while closing switch plates 88 and stopping motor 48. When cam 71 closes switch 74, current flows through switch 74, line 81, contact 82, switch plate 88, contacts 87, switch plate 88, and contact 84 to motor 48 and then back to contact 83', switch plate 88, contact 85 and line 86 to the supply line 58, thereby operating motor 48 in the reverse direction and moving the valves to their right hand position, at which time rod 64 will reverse switch 63 in preparation for the next operation of the valves. The length of each operation is controlled by timing motor 68, and by the size of the cams.

During operation of this apparatus, blowers 38 and 32 will be in continuous operation, and while heater 26 may be in continuous operation, it is preferred to interrupt the circuit to the heater for short intervals by means of switches 62 and 72 and cam 69, to permit cool air to be passed through the adsorbent towers at the end of the reactivation operation.

Figure 8 illustrates automatic operation of this apparatus when using direct current. When alternating current is used, valve motor 48 will not be reversed, but its effect can be reversed, for example, by means of a device such as illustrated in Figures 9 and 10, in which a crank or crank disc 90 is rotated on shaft 91 by the valve motor. Pinion 46 of valve operating shaft 44 is engaged by an operating rack bar 92 connected to the disc 90 by means of link 93 pivoted adjacent the periphery of disc 90 and slidably engaging an elongated slot 94 in rack bar 92.

Figure 9 illustrates the left hand position of the valves, and as disc 90 rotates from point A to point B, rack bar 92 will be moved to the position shown in Figure 10, thereby rotating pinion 46 and moving the valves to their right hand position. Further movement of disc 90 to point C does not move rack bar 92 but moves link 93 to left end of slot 95. Movement of disc to point D returns rack bar 93 and valves to their former position, and further movement to point A merely moves link 93 in slot 94 preparatory to repeating the operation. Slots 94 can obviously be dispensed with, as in Figure 11, and the rack bar 92' moved first one way and then the other by link 93' and disc 90', and controlled by the timing motor.

Limit switch 63 is located on the end wall of casing 15, as seen at the right of Figures 1 and 2. The timing motor 68, cam shaft 67, and the cams and switches associated therewith may all be conveniently located on a control panel or box indicated as mounted on casing 15 at 95 in Figure 2. Variations in the timing control mechanism may obviously be made to suit varying conditions.

The present apparatus is compact and may be installed anywhere that it is needed. It is entirely automatic in its actions and will handle a very large volume of air, while efficiently and economically removing moisture or other foreign material from the air. The invention may obviously be used for treatment of gases other than air and to remove other materials than moisture therefrom.

While the preferred form of this invention has been shown and described, it is to be understood that various changes in the size, shape, arrangement and adjustment of parts may be resorted to without departing from the spirit of this invention or the scope of the subjoined claims.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. In an adsorbent apparatus, a supporting casing having a duct therein, a tower secured to said casing, a tubular body of solid adsorbent material arranged in said tower and extending the entire length thereof, said tubular body of adsorbent material being spaced a substantial distance from the side walls of the tower, there being a port connecting the main body of the casing with the interior of the tubular body of adsorbent, and a second port connecting the duct in the casing with the space between the tower walls and the body of adsorbent, and means to pass a gaseous material from one of said ports through the tubular body of adsorbent material to the other port.

2. In an adsorbent apparatus, a supporting

casing having a duct therein, said casing having a pair of ports spaced a substantial distance apart, one of said ports communicating with the duct in the casing and the other of said ports communicating with the interior of the casing, a tower secured to said casing and surrounding both of said ports, a tubular body of solid adsorbent material arranged in said tower in spaced relation to the walls of the tower, said tubular body being closed at its top and surrounding one of said ports, the other of said ports being in communication with the space surrounding the tubular body, and means to pass a gaseous material from one of said ports through the solid body of adsorbent to the other of said ports.

3. In an adsorbent apparatus, a casing separated into two chambers and having a pair of ports spaced a substantial distance apart, each of said ports communicating with one of the casing chambers, a tower secured to said casing and surrounding both of said ports, a tubular body of solid adsorbent material arranged in said tower in spaced relation to the walls of the tower, said tubular body extending from top to bottom of said tower and surrounding one of said ports, the other of said ports being in communication with the space surrounding the tubular body of adsorbent, means to pass a gaseous material from one of the casing chambers through the ports and body of adsorbent material to the other chamber, a heating device, and means to pass a gaseous material from said heating device through the ports and adsorbent material while out of contact with the gaseous material in the casing chambers.

4. In an adsorbent apparatus, a casing divided into two chambers, a pair of spaced ports adjacent each end of the casing, each port of each pair communicating with one of the casing chambers, a tower surrounding each pair of ports, a tubular body of adsorbent material arranged in each tower in spaced relation with the walls thereof and surrounding one of the ports within the tower, the other of each pair of ports communicating with the space between the tower and body of adsorbent, said body of adsorbent being closed at its upper end, a pair of spaced heater ports arranged in said casing between the towers, each of said heater ports being in communication with one of the casing chambers, a heating device arranged in communication with one of said heater ports, an exhaust pipe connected to the other of said heater ports, a valve mechanism adapted in one position to connect the heater ports with the ports in one of the towers, and in another position to connect the heater ports with the ports of the other tower, means to pass a gaseous material from one of said casing chambers through the ports and adsorbent body of either of said towers to the other casing chamber, means to pass a gaseous material through the heating device and valves and adsorbent body in the other of said towers, and means to operate the valve mechanism to change its operative position.

5. In an adsorbent apparatus, a casing divided into two chambers, a pair of spaced ports adjacent each end of the casing, each port of each pair communicating with one of the casing chambers, a tower surrounding each pair of ports, a tubular body of adsorbent material arranged in each tower in spaced relation with the walls thereof and surrounding one of the ports within the tower, the other of each pair of ports communicating with the space between the tower and body of adsorbent, said body of adsorbent being closed at its upper end, a pair of spaced heater ports arranged in said casing between the towers, each of said heater ports being in communication with one of the casing chambers, a heating device arranged in communication with one of said heater ports, an exhaust pipe connected to the other of said heater ports, a valve mechanism adapted in one position to connect the heater ports with the ports in one of the towers, and in another position to connect the heater ports with the ports of the other tower, means to pass a gaseous material from one of said casing chambers through the ports and adsorbent body of either of said towers to the other casing chamber, means to pass a gaseous material through the heating device and valves and adsorbent body in the other of said towers, and means to operate the valve mechanism to change its operative position, said valve operating mechanism being actuated automatically in accordance with a predetermined adsorbing and reactivating cycle.

6. In an adsorbent apparatus, a casing divided into separated chambers, a pair of spaced adsorbent towers secured to said casing, there being a pair of spaced casing ports in each tower, each port of each tower being in communication with one of the casing chambers, a body of adsorbent material separating the ports of each tower, said casing having a pair of heater ports arranged exteriorly of said towers, a heating device communicating with one of the heater ports, an exhaust pipe connected to the other heater port, a valve alternately connecting one of the heater ports to one of the ports of each tower, a valve alternately connecting the other of the heater ports to the other port of each tower, means to move the valves in unison to connect the heater ports with the ports of first one tower and then the other, and means to pass a gaseous material from one of the casing chambers through the ports of the tower which is out of communication with the heater ports into the other casing chamber.

7. In an adsorbent apparatus, a casing divided into separate chambers, a pair of spaced adsorbent towers secured to said casing, there being a pair of spaced casing ports in each tower, each port of each tower being in communication with one of the casing chambers, a body of adsorbent material separating the ports of each tower, said casing having a pair of heater ports arranged exteriorly of said towers, a heating device communicating with one of the heater ports, an exhaust pipe connected to the other heater port, means to pass a gaseous material from one casing chamber through the ports and adsorbent material of either of the towers, a valve arranged to alternately connect one of the heater ports to one of the ports of each tower, a valve arranged to alternately connect the other of the heater ports with the other port of each tower, automatic means to move the valves in unison from one operating position to the other in accordance with a predetermined adsorbing and reactivating cycle, and means to pass a gaseous material through the heating device to the valves.

8. In an adsorbent apparatus a support, a pair of adsorbent towers thereon, a heating device, a valve slidably arranged on said support and adapted in one position to connect the heating device with the interior of one of the adsorbent towers, and in another position to connect the heating device to the interior of the other of said towers, means to pass a gaseous material through

said heating device to said valve, an electric motor operatively connected to said valve to move the valve, a limit switch connected to said motor, means operated by the valve at the limit of its movement to operate the limit switch and stop the motor, and means to reverse the operating effect of the motor on the valve to move the valve in the opposite direction.

9. In an adsorbent apparatus, a pair of towers, a body of solid adsorbent material arranged in each tower, a heating device having an electric heating element therein, an electric circuit connected to said heating element, a valve mechanism adapted in one position to connect the heating device with one tower and in another position to connect the heating device to the other tower, an electrical valve operating mechanism, a timing mechanism, means operated by said timing mechanism to intermittently move the valve mechanism from one position to its other position, means to pass a gaseous material through the heating device and valve mechanism to the towers to reactivate the body of adsorbent therein, and means operated by the timing mechanism to open the circuit to the heating element near the end of each reactivating operation.

10. In an adsorbent apparatus, a casing divided into two separated compartments, one compartment having an inlet opening and the other compartment having an outlet opening, said casing having two spaced series of three ports arranged in longitudinal alignment, the ports of one series communicating with one casing compartment and the ports of the other series communicating with the other casing compartment, a tower surrounding one port of each series, a second tower surrounding one port of each series, a body of adsorbent material arranged in each tower and separating the ports communicating with each tower, a heating device communicating with the remaining port in one series, an exhaust pipe communicating with the remaining port of the other series, a valve member slidably secured to the wall of the casing within each compartment and adapted to connect the heating device and exhaust pipe to the ports of one tower in one position, and to the ports of the other tower in another position, means to intermittently move the valves in unison from one position to the other position, means to continuously pass a gaseous material into one compartment to be passed through the ports and adsorbent material of either of the towers to the other compartment, and means to continuously pass a gaseous material through the heating device and valves through either of the towers to the exhaust pipe, the valves conveying the gaseous material from the heater through the casing compartments to the towers out of contact with the gaseous material in the two casing compartments.

11. In an adsorbent apparatus, a casing divided into two chambers and having a pair of spaced ports adjacent each of its ends, each port of each pair communicating with one of the casing chambers, a tower surrounding each pair of ports, a tubular body of adsorbent material arranged in each tower in spaced relation with the walls thereof and surrounding one of the ports within the tower, the other of each pair of ports communicating with the space between the tower and body of adsorbent, said body of adsorbent being closed at its upper end, a heating device mounted on said casing, means to connect the heating device alternately with the ports of each tower, means to pass a gaseous material from one chamber of the casing through the ports and adsorbent material of one of the towers to the other chamber of the casing, and means to pass a gaseous material from the heating device through the ports and adsorbent material of the other tower.

12. In an adsorbent apparatus, a casing divided into two chambers and having two pairs of spaced ports, each port of each pair of ports communicating with one of the casing chambers, a tower surrounding each pair of ports, a tubular body of adsorbent material arranged in each tower in spaced relation with the walls thereof and surrounding one of the ports within the tower, the other of each pair of ports communicating with the space between the tower and body of adsorbent, whereby the two casing chambers are normally in communication through the ports and adsorbent material of the towers, a heating device, means to connect said heating device alternately to the ports of each tower to place the tower out of communication with the casing chambers and in communication with the heating device, and means to pass gaseous material from one casing chamber to the other through one of the towers while passing a gaseous material through the heating device to the other tower.

13. In an adsorbent apparatus, a casing divided into two chambers and having two pairs of spaced ports, each port of each pair of ports communicating with one of the casing chambers, a tower surrounding each pair of ports, a tubular body of adsorbent material arranged in each tower in spaced relation with the walls thereof and surrounding one of the ports within the tower, the other of each pair of ports communicating with the space between the tower and body of adsorbent material whereby the two casing chambers are normally in communication through the ports and adsorbent material of the towers, a heating device connected to said casing, a valve mechanism within the casing to connect said heating device alternately to the ports of each tower to place the towers successively out of communication with the casing chambers and in communication with the heating device, means to pass gaseous material under pressure into one of the casing chambers, and means to pass gaseous material through the heating device to the valve mechanism.

14. In an adsorbent apparatus, a pair of towers, a tubular body of adsorbent material arranged in each tower in spaced relation with the walls thereof, a casing arranged at one end of the towers and having ports communicating with the portions of the towers internally and externally of the tubular bodies of adsorbent material, said casing being divided into two chambers, each chamber being in communication with each of the towers through the casing ports, a heating device, a valve mechanism adapted to connect the heating device to the casing ports of each tower alternately, means to pass a gaseous material through the heating device to the valve mechanism, and means to pass a gaseous material into one of the casing chambers, the other of said casing chambers having an outlet for the gases passing therethrough.

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