

July 20, 1937.

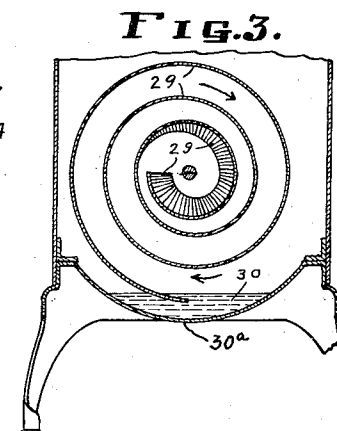
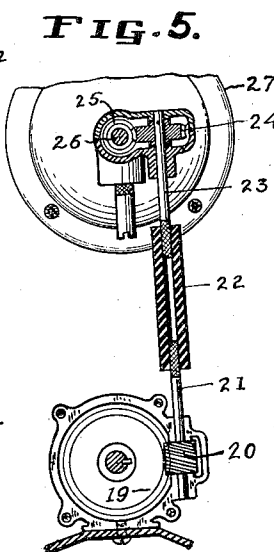
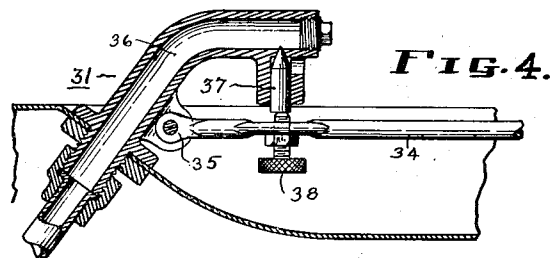
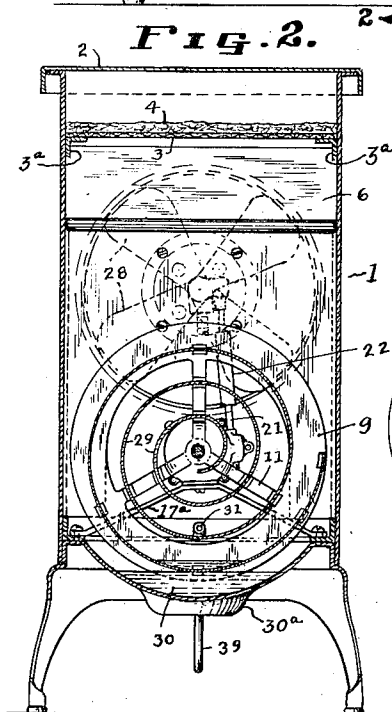
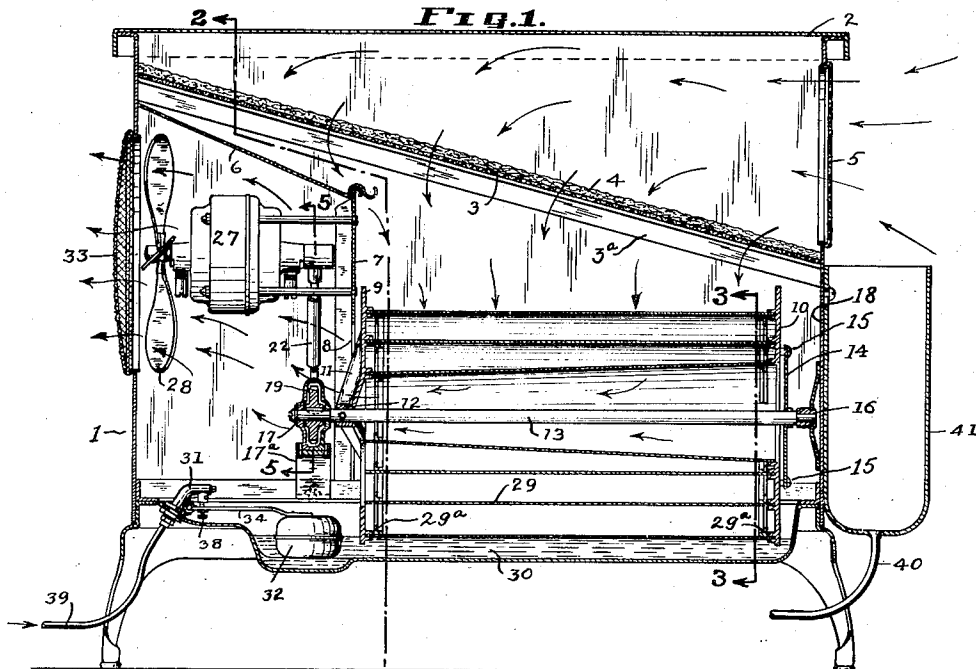
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2,087,436

AIR TREATING APPARATUS

Filed Feb. 20, 1933

3 Sheets-Sheet 1



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AIR TREATING APPARATUS

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3 Sheets-Sheet 2

FIG. 6.

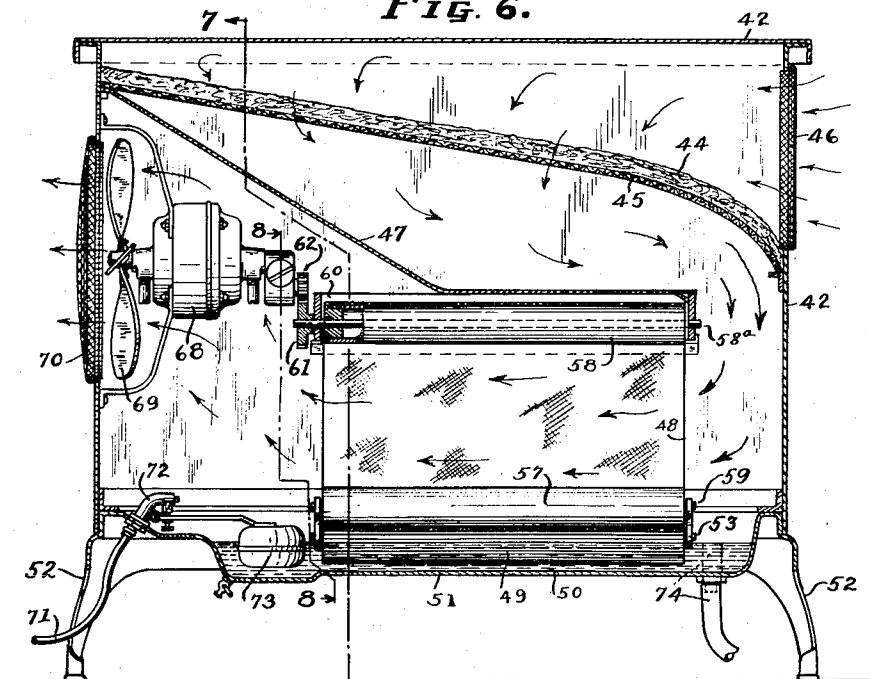


FIG. 7.

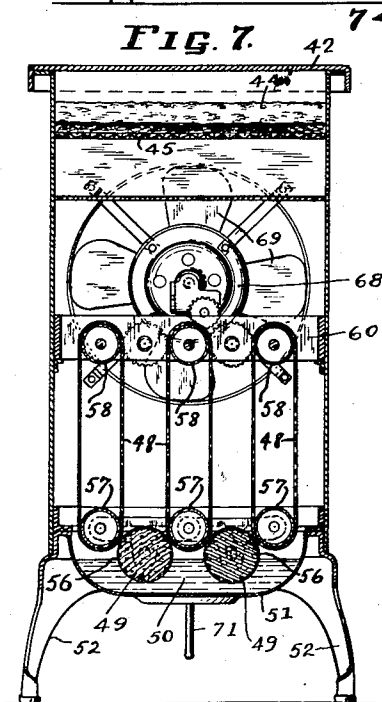
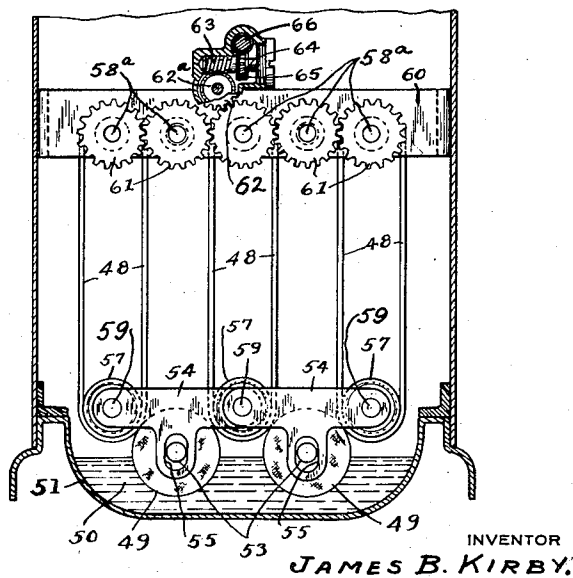


FIG. 8.



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3 Sheets-Sheet 3

FIG. 9.

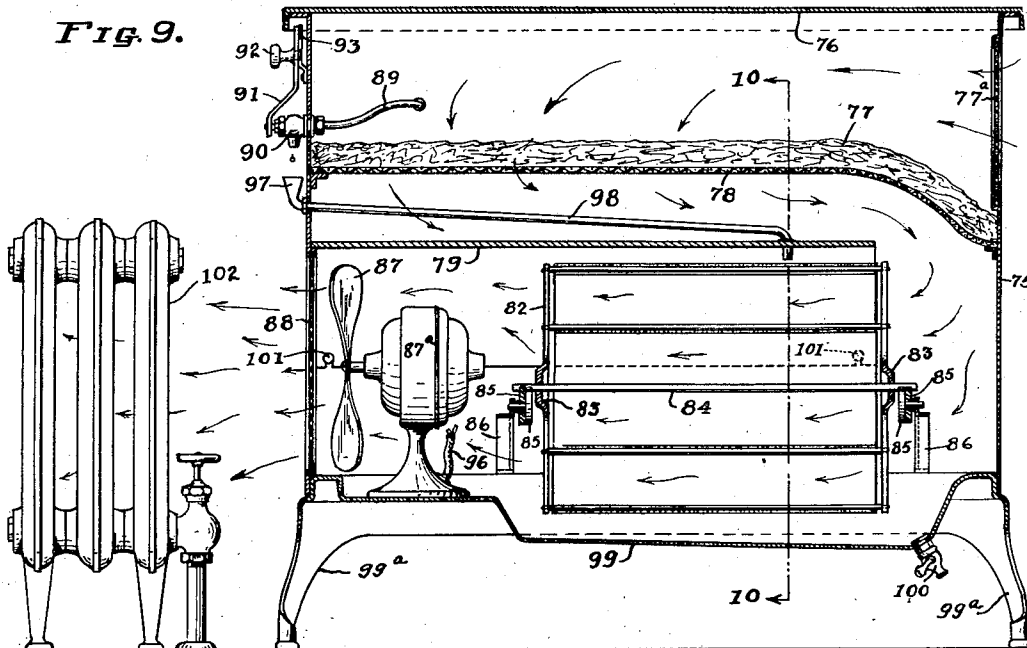


FIG. 10.

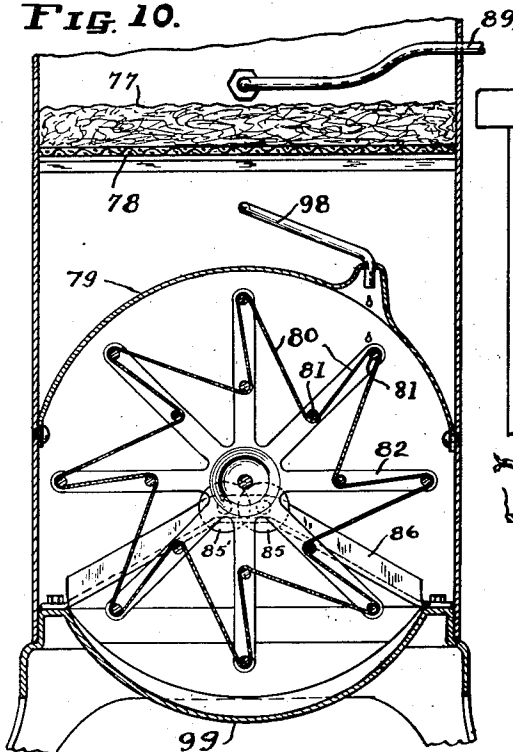


FIG. 11.

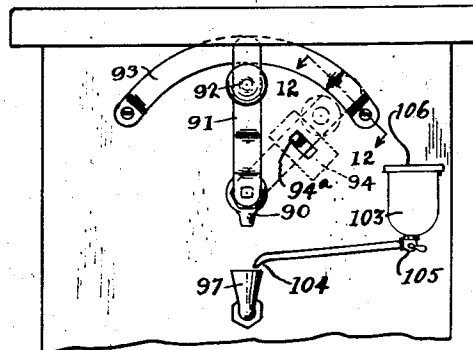
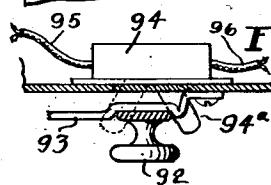


FIG. 12.



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AIR TREATING APPARATUS

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Application February 20, 1933, Serial No. 657,515

7 Claims. (Cl. 261-102)

This invention relates to air treating and air conditioning apparatus and in particular to the cleaning, deodorizing and humidifying of the air of inhabited buildings.

One of the objects of this invention is the provision of a relatively small portable unitary apparatus having means for both filtering and treating air.

Another object of this invention is the provision of an air conditioner which removes dust and odors from the air while at the same time adding moisture to the air.

Another object of this invention is that of providing an air conditioning apparatus which circulates the air in a room or in series of communicating rooms, while at the same time removing dust and odors from the air and adding moisture and heating the air.

Another object of this invention is that of providing an appliance for cleaning and treating air which can be moved about from place to place.

Another object of this invention is the provision of an air conditioning apparatus having means for controlling the addition of moisture to the air.

Another object of this invention is the provision of an air conditioning apparatus or appliance having means for adding moisture to the air only when the apparatus is operating.

Another object of this invention is to provide in a machine of the type disclosed novel means for starting and stopping the air circulating and humidifying provisions of the machine.

Another object of this invention is the provision of novel means for driving an air humidifying device.

Another object of this invention is the provision of an air conditioner having a novel and highly efficient air humidifier.

A further object of this invention relates to the provision of an improved form of casing construction for an air conditioning appliance.

With these and other objects in view, the invention consists in the novel construction, arrangement and combination of parts, hereinafter illustrated and described in some of its embodiments in the accompanying drawings, and particularly pointed out in the appended claims.

In the drawings Figure 1 is a side elevational view in section of one form of my improved air conditioning apparatus.

Figure 2 is a sectional view taken on the line 2-2, Figure 1.

Figure 3 is a sectional view taken on the line

3-3, Figure 2 showing certain details of the humidifying apparatus.

Figure 4 is an enlarged sectional view of the float controlled water valve.

Figure 5 is an enlarged sectional view taken on line 5-5, Figure 1 showing the details of the humidifier drive.

Figure 6 is a side elevational view in section of another form of air conditioner.

Figure 7 is a sectional view taken on line 7-7, Figure 6.

Figure 8 is an enlarged sectional view taken on line 8-8, Figure 6 showing the details of the humidifier and its driving means.

Figure 9 is a side elevational view in section of another form of air conditioner.

Figure 10 is an enlarged sectional view taken on line 10-10, Figure 9.

Figure 11 is an enlarged side elevational view of one end portion of the apparatus showing the details of the control devices of the appliances; and

Figure 12 is a sectional view taken on line 12-12, Figure 11.

The elements of my improved air treating apparatus may be conveniently assembled in the form of a unitary appliance comprising a cabinet 1 in which the individual elements of the device are housed. This cabinet is provided with a removable cover 2 permitting access to the upper part thereof. In the upper part of the machine there is a pervious screen 3 provided for supporting a removable and renewable layer of air pervious filtering and deodorizing material 4, such as cotton batting or any other natural or chemically treated material suitable for this purpose. The screen 3 is removably supported on the angle members 3^a.

The filtering material extends completely across the horizontal area of the cabinet and it is set on an angle with the horizontal to increase the exposed surface of such material whereby the air may be more easily circulated through the device. A screen 5 is provided at one end of the machine for covering the air inlet opening of the device. Beneath the filter supporting screen 3 there is located a removable baffle 6 which is in contact with three of the side walls of the cabinet. One end of the baffle 6 rests upon a vertical partition wall 7 which is apertured at 8 for the passage of air from one part of the cabinet to another.

A humidifying device is located in the compartment of the cabinet defined between the screen 3 and the baffles 6 and 7. This device consists

of a pair of annular rings 9 and 10, the ring 9 having formed therewith spokes 11 and an associated hub 12 which is carried by a shaft 13. The ring 10 is secured in spaced relation to an im-

5 perforate circular disk 14 by any suitable means such as the screws 15. The disk 14 is carried in turn by the shaft 13.

The shaft 13 is journaled for rotation in suitable bearings 16 and 17 provided at the opposite ends thereof. The bearing 16 is carried by the end wall 18 of the cabinet and the other bearing 17 is in the form of a housing carried by a support 17^a and it houses a worm gear 19 fixed to rotate with the shaft 13. The worm gear 19 is driven by a worm 20 and a shaft 21 is fixed to rotate therewith. A flexible coupling 22 connects the shaft 21 to a driving shaft 23. The driving shaft has a worm gear 24 fixed thereon and meshing with a worm 25 which is fixed to rotate with the shaft 26 of the motor 27. At the opposite end of the motor shaft there is secured a fan 28 which rotates with the motor shaft. The wall 7 and baffle 6 cooperate with the cabinet walls to provide a chamber for the fan.

25 The double gear reduction comprising the gears 19, 20, 24 and 25, serves to slowly rotate the shaft 13 and an associated humidifier. The humidifier is in the form of a spirally wound sheet of a porous and preferably rigid inorganic material 29 as for example a stiff asbestos cloth which may be reinforced with a wire screen (not shown) if added stiffness is necessary or desirable. The outer edge of the humidifier is adapted to dip into a body of water 30 carried by a trough 30^a formed in the bottom wall of the cabinet and which is arranged to carry water at a predetermined level under control of a float valve 31 having a valve operating float 32. The cabinet is provided with a screen 33 covering the air outlet opening of the cabinet which is located in front of the fan 28.

The float 32 is connected to an operating rod 34 pivoted at 35 to the body 36 of the valve member. The valve 31 may be provided with an operating member in the shape of a needle 37. The rod 34 is provided with an adjusting screw 38 by means of which the level of the water in the pan 30 may be accurately adjusted. The valve body 36 is connected to a source of water supply by means of a conduit 39. This conduit may be connected to a water supply line of the building in which the device is located or it may be connected to a conduit 40 which communicates with the interior of a tank 41 carried on one end of the appliance. The tank 41 is provided for use where it is not convenient to connect the float valve to a continuous source of supply. An annular strip 29^a as shown in Figure 1 is carried at each end of the spiral sheet 29 to prevent the water running over the edges of the sheet before such water reaches the inner end of the sheet. For the sake of clearness the strips 29^a were omitted in the sectional views, Figures 2 and 3.

65 During the operation of the motor 27 and its associated fan 28, air will be drawn into the cabinet by way of the screened opening 5 whereupon it passes through the filter material 4 where odors and dust are removed from the air. The air from the filter passes through the humidifying device by entering the opening between the walls at the outermost edge of the spiral sheet 29. The air then circulates spirally toward the central section and discharges through the end opening 8 into the fan chamber where it is exhausted from the cabinet by way of the screened outlet 33.

During the operation of the motor 27 the air moistening device is slowly rotated in a counter-clockwise direction as viewed in Figures 2 and 3 so that the outermost end of the spiral sheet 29 dips into the water carried by the tank 30 and scooping up a small amount of water with each revolution. This water is more or less uniformly spread over the entire width of the member 29 and as it rotates the water is carried over the entire length of the member, eventually wetting substantially the entire inner surface thereof.

When the unabsorbed water is carried to the last turn of the spiral it flows past the opening between the disk 14 and the annular plate 10 and is thus returned to the trough 30. This result is accomplished by reason of the spiral shape of the member 29 and also by reason of the fact that the last turn of the spiral is conical in shape and flares outwardly toward the water discharging end thereof as is best shown in Figure 1. The member 29 being formed of a porous material, becomes saturated with water and the absorbed moisture on being exposed to the circulating air is evaporated thereby and exhausted from the machine.

When the filter becomes saturated or filled with dirt the cover 2 may be removed and the cotton batting removed and destroyed and a fresh layer inserted in its place. It is also within the contemplation of my invention to treat the filtering material with suitable chemicals for destroying bacteria and germ life carried by the air.

The machine cabinet is made of a width so that an ordinary standard roll of cotton batting can be used without necessitating the trimming or wasting of this material. The cotton batting is ordinarily placed in one end of the cabinet and unrolled to the required length and then cut off. Care should be taken to avoid matting down the cotton batting as this decreases its porosity without increasing its efficiency as a filter. By the use of cotton batting the effective area of the filtering surface is many times that of the area of the space which it occupies as the entire thickness of the material enters into the filtering process and dust and dirt are selectively deposited throughout the greater portion of its thickness. This material can also be used for extended periods of time as it is capable of holding a considerable amount of dust before its porosity is seriously impaired.

In the form of device shown in Figure 6 there is provided a cabinet 42 having a removable cover 43 overlying a layer of filtering material 44 which may be balsam or vegetable fiber wool or it may be the same as that used in the form of the device illustrated in Figure 1. The filtering material is supported on a removable perforated screen 45. At one end of the machine there is provided an air inlet opening covered by a screen 46.

Below the screen 46 there is located a removable baffle plate 47 traversing the width of the machine and extending from one end wall to a point spaced a slight distance from the opposite end wall of the cabinet. Beneath the baffle 47 there is located a humidifying device which is formed of three flexible belts 48 of considerable width and formed from a material woven from mineral fibers adapted to readily absorb water from contact with a pair of floating rollers 49 which float upon the surface of the body of water 50 carried in a pan 51 which also constitutes the bottom wall of the cabinet.

The water pan 51 and the supporting legs 52 75

may be conveniently formed from a single stamping. This form of construction is also used in the cabinet shown in Figure 1. The rollers 49 may be formed from cork, wood or other materials having a smaller specific gravity than that of water. The rollers are provided with shafts 53 which are guided in slotted bearing members 54 having elongated slots 55 for receiving and guiding the shafts 53. Due to the buoyancy of the rollers 49 they are urged against the belts 48 by the lifting effect of the water in which they are immersed and if the belts 48 are rotated the rollers will uniformly moisten the surface of the belt as it comes in contact with the rollers.

The rollers may be provided with a roughened surface or covered with a fine mesh screen 56 to increase their water-carrying effect and thus transfer a greater amount of water to the belts 48 than they would if they had a smooth surface. The belts 48 are stretched between opposite lower and upper rollers 57 and 58. The shafts 59 of the lower rollers 57 are journaled for rotation in the bearing members 54 and these members are pivotally joined to each other by the shaft 59 of the center lower belt roller. The shafts 58^a of the upper rollers 58 are journaled for rotation in a suitable bearing and supporting member 60 carried by the side walls of the cabinet.

The upper rollers are provided with intermeshing gears 61 one of which meshes with a driving pinion 62 fixed to rotate with a worm gear 62^a driven by the worm 63. The worm 63 is carried on a shaft 64 having a worm gear 65 meshing with a worm 66 by means of which it is driven. The worm 66 is fixed on the shaft 67 of an electric motor 68. The electric motor 68 carries a fan 69 at the opposite end of its shaft for circulating air through the cabinet and discharging it by way of the opening covered by the screen 70.

The water in the pan 51 is supplied by way of a conduit 71 under control of a float valve 72 having a control float 73. An overflow drain 74 is provided to take care of overflow water and to permit the use of a changing supply of fresh water for the air humidifying apparatus. This feature is of importance where a continuous supply of cool water is available in which case the device can be used to filter and cool the air during the warmer seasons. Another advantage of providing the water pan with a drain is that of preventing the accumulation of dirt in the pan although this ordinarily occurs in such quantities as not to be objectionable.

During the operation of the motor 68 the fan 69 causes air to be drawn into the cabinet by way of the screened inlet 46. The incoming dry and dust-laden air first passes through the filtering material 44 where dust and odors are removed from the air. The air then is diverted by the baffle 47 to the end of the chamber in which are carried the belts 48. The air then passes in close proximity to the large area provided by the moistened belts 48. At the time this is taking place the belts are being slowly driven by the motor 68 and during such movement they are absorbing moisture from the rollers 49 and giving it up to the moving stream of air to which they are exposed.

The cleaned and moistened air passes into the fan chamber where it is exhausted by way of the outlet opening covered by the screen 70. It should be noted that the humidifying belts

48 are not in direct contact with the water in the pan 51 and when the motor 68 is stopped the movement of the belts 48 is also stopped. When the belts are stopped they are no longer moistened by the rollers 49 so that they will dry out in a short time and will remain in a dry condition until the motor and circulating fan are again started.

This feature is of particular importance as it adds greatly to the life of the belts 48 and by 10 preventing deterioration from excessive exposure to water and it also prevents the device from giving off odors as might well occur where the belts 48 were maintained in a continuously moistened condition. By use of floating rollers to 15 moisten the belts it is possible to vary the level of the water in the pan 51 a considerable amount without destroying the effectiveness of the appliance.

In the form of device illustrated in Figure 9 20 the operating parts of the machine are housed within a cabinet 75 having a removable top cover 76 beneath which is located a sheet of removable and replaceable filtering material 77 carried by a removable screen 78, in the manner previously 25 described. Beneath the screen 78 there is removably located a semi-cylindrical baffle plate 79 in contact with opposite side walls of the cabinet and with one end wall, the baffle being spaced from the opposite end wall to form a passageway to a humidifying device. A screen 77^a covers 30 the air inlet to the cabinet.

The humidifying device consists of a cloth belt or other porous or wettable material 80 stretched upon a series of parallel rods 81, two of which 35 are carried in radially spaced relation by each of the spokes 82. The spokes terminate in a hub portion 83, carried on a shaft 84. The ends of the shaft 84 are mounted for rotation on a pair of anti-frictional rollers 85 provided at each end of the shaft and in turn mounted for rotation in the supporting members 86. One end of the humidifier is located at a point adjacent to the end of the baffle plate 79 that is spaced from the cabinet end wall. At the opposite end of the humidifier there is located an electrically driven fan 87 and its motor 87^a positioned directly opposite to the opening in the cabinet covered by the screen 88. This particular machine is adapted to use an ordinary air circulating fan which 50 may be readily installed or removed from the cabinet upon the removal of the screen 88.

The appliance is provided with a conduit 89 for connection to a source of water supply. This conduit has a valve 90 controlled by means of a lever 91 and its operating handle 92. The lever 91 is guided by a segment 93 and in one of its extreme positions it contacts with the operating lever 94^a of an electric switch 94 and serves to control the operation of the motor 87^a. The switch 94 is connected to a source of electrical current (not shown) by a cable 95 and it is also provided with a cable 96 for connection with the fan motor 87^a.

When the control member 91 is in the dotted 65 line position shown in Figure 11 and in the full line position shown in Figure 12, the valve 90 is in its closed position and the fan motor 87^a is disconnected from the source of current. When the lever is shifted to the full line position shown in Figure 11 the switch automatically snaps (by means of a spring not shown) to the dotted line position shown in Figure 12 whereupon the fan motor 87^a is connected to a source of electrical current supply and it is placed in operation there- 75

by. The switch shown is a toggle switch of standard construction and it has a spring (not shown) which tends to close the switch when it is in its open position as shown in full lines in Figure 12.

The valve 90 is designed to discharge by drops, a regular flow of liquid which may be increased or decreased by adjusting the position of the operating member 91, thus maximum flow is obtained with the operating member positioned to the extreme left as viewed in Figure 11. In the dotted line position of the handle shown in Figure 11 the valve is completely shut off.

Due to the fact that the amount of water required for the purpose of humidifying the air in a dwelling or other habitable space is not ordinarily very great I have arranged the valve 90 in combination with a funnel 97 spaced a slight distance from the valve so that the flow of water from the valve can be accurately regulated to provide the required number of drops per minute.

The funnel 97 is in communication with a conduit 98 which discharges at its opposite end upon the belt 80 to one side of the vertical plane passing through the axis of the shaft 84. By moistening the fabric at one side of the axle of the humidifier the gravity effect of the weight of the water on this side of the device serves to slowly rotate the device and present new portions of the belt surface to the water supply thus to more or less evenly distribute water over the surface of the belt.

The circulating air which passes around and alongside the band 80 removes sufficient moisture to properly humidify the air passing through the appliance. The combined effect of the evaporation and addition of water to the belt serves to drive it in much the same manner as is followed in the driving of a water wheel. The speed of rotation of the belt depends in a large measure upon the rate of evaporation of the water therefrom and as a consequence of this, the belt serves to control in a measure the humidifying effect of the appliance by slowing down and perhaps even stopping under conditions of relatively high humidity.

In the event of stoppage of the humidifier or when an excessive amount of water is supplied to the machine such excess water falls into a drain pan 99 located beneath the humidifier. This pan is formed with integral legs 99^a and serves as the bottom wall of the cabinet. A draincock 100 communicates with the drain pan and permits the withdrawal of accumulated water therein. The baffle member 79 is removably carried on pins 101. This construction in combination with the removable positioning of the screen 78 and cover 76 permits ready access to the interior of the machine and to the operating parts thereof. In Figure 9 the device is shown in combination with a source of heat in the form of a radiator 102 to heat the air discharged from the machine. The heating member if desired might be located adjacent to the air inlet of the cabinet particularly where a higher degree of humidification is desired.

A cup or container 103 for a liquid chemical is carried on the end wall of the cabinet at a point adjacent to the control devices. A conduit 104 conveys liquid from the container 103 to the cup 97 under control of a valve 105. The cup 103 has a removable cover 106 whereby the cup may be filled with any suitable chemical for scenting, disinfecting or otherwise treating the air passing through the device. The chemical flowing from

the conduit 104 is conveyed to the water vaporizing band 90 where it is there exposed to the air circulating through the cabinet.

As a means for heating the filtered and moistened air I have shown a heating device 102 located adjacent to the outlet opening of the appliance. With the arrangement shown in Figure 9 the air is cleaned, humidified and heated. It is obviously within the scope of my invention to reverse the position of the heating and air-drying means as it might be desired in some cases to pass heated air through the appliance before exhausting it therefrom.

From the foregoing it is apparent that I have provided a small portable air treating machine for filtering, deodorizing, disinfecting, humidifying, circulating and heating or cooling the air of a building.

The filtering material is preferably in the shape of an air pervious relatively thick coherent sheet formed from loosely interlaced vegetable fibers as such fibers are commonly good odor absorbers. If desired the fibers can be chemically treated to increase their absorptive effect, or to scent or disinfect the air.

The humidifier is preferably made from a material not subject to deterioration from water. Many ordinary fabrics are available if suitably treated for this purpose. It is not absolutely necessary that the surface of the humidifier be water absorbing although I do consider it important that such material be wettable by water. The important duty of the humidifier is that of exposing a large surface of water for evaporation and a large list of materials are available for this purpose.

Furthermore it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth are presented for purposes of explanation and that various modifications of said apparatus and procedure can be made without departure from this invention as described in the appended claims.

Having thus described my invention what I claim is:

1. In an air treating device, a casing having interiorly communicating air inlet and outlet openings located in different parts of its walls and also having a displaceable wall part, a removable filter in said casing extending across the passageway connecting the inlet and outlet opening thereof, a removable support for said filter, a removable baffle in said casing beneath said filter and its support, a fan, humidifier and source of water supply in said casing beneath said baffle, said filter, filter support, baffle, fan and humidifier being removable from said casing by way of the displaceable wall part of said casing.

2. A humidifier comprising, casing means, means for circulating air through said casing means, a cage rotatably supported in said casing means having axially extending staggered rods connecting the end portions thereof, an endless sheet of wettable material supported on the rods of said cage forming a cover for said cage which is zig-zag in cross-section, and means for rotating said cage and moistening said sheet in accordance with the relative humidity of the air comprising a source of water supply arranged to supply water drop by drop to said sheet at a point to one side of the vertical plane containing the axis of said cage, said last named means pro-

viding the sole source of water supply for said sheet.

3. A humidifier comprising, casing means, means for circulating air through said casing means, movable oblique surfaces of moisture absorbing mineral material exposed in said casing means to the air circulating therethrough, and means for depositing moisture on said surfaces for moving said surfaces continuously during the operation of said humidifier and in accordance with the relative humidity of the air.

4. An air treating device comprising, casing means, means for circulating air through said casing means, a humidifier formed from a relatively large area of water absorbing material exposed in said casing means to the air circulating therein, a source of water supply comprising a valve and conduit means for supplying a drop-by-drop flow of water directly to the material of said humidifier, and control means for said valve accessible from the exterior of said casing means for supplying to said humidifier a predetermined number of drops of water per minute whereby to control the relative humidity of the air treated by the device.

5. A humidifier comprising, casing means, means for circulating air through said casing means, a balanced body having oblique walls of absorbent material mounted for movement in said casing means, means for continuously supplying water drop by drop to a portion of said walls and for evaporating moisture from other portions of said walls whereby an unbalanced condition of said body is produced and said walls are moved during the operation of said humidifier

directly in accordance with the relative humidity of the air.

6. A humidifier comprising, casing means, means for circulating air through said casing means, a cage rotatably supported in said casing means having axially extending staggered rods connecting the end portions thereof, an endless sheet of wettable material supported on the rods of said cage forming a cover for said cage which is zig-zag in cross-section, means for rotating said cage and moistening said sheet comprising a source of water supply arranged to supply water drop-by-drop to said sheet at a point to one side of the vertical plane containing the axis of said cage, said last named means providing the sole source of water supply for said sheet, and a single control member for stopping both said air circulating means and said cage rotating and sheet moistening means.

7. An air treating device comprising, a portable cabinet having air inlet and outlet openings and a communicating passageway therebetween, said cabinet having a removable top, means for circulating air through the passageway of said cabinet, a rigid air pervious support just below the top of said cabinet inclined in a direction toward the path of the air stream admitted by way of the inlet opening of said cabinet, air filtering material removably carried on said support the area of said air filtering material being substantially greater than the area of the inlet opening of said cabinet, a humidifying device located in the passageway of said cabinet, and a liquid holding member beneath said humidifying device.

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