July 13, 1943. E. GUSY 2,324,386

AIR CLEANER AND HUMIDIFIER

Filed Feb. 3, 1941

Fig. 1.

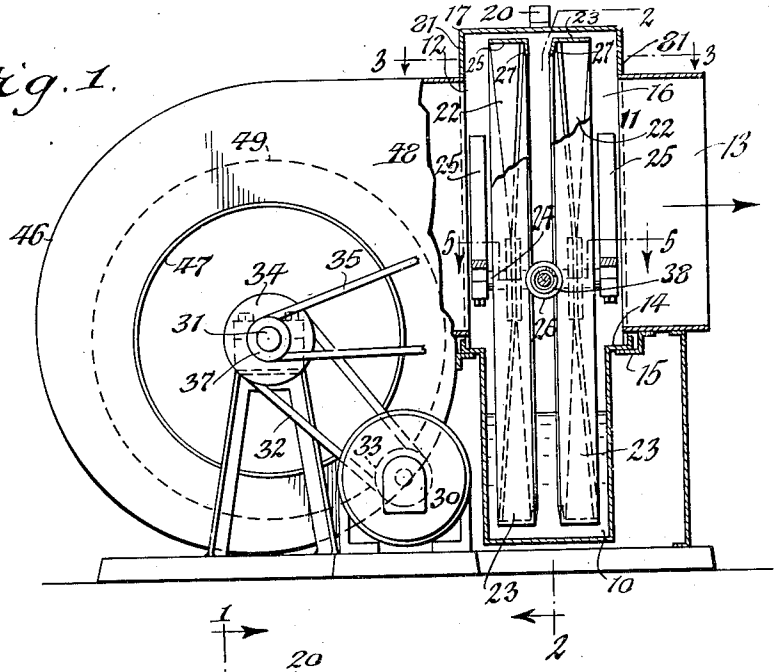


Fig. 2.

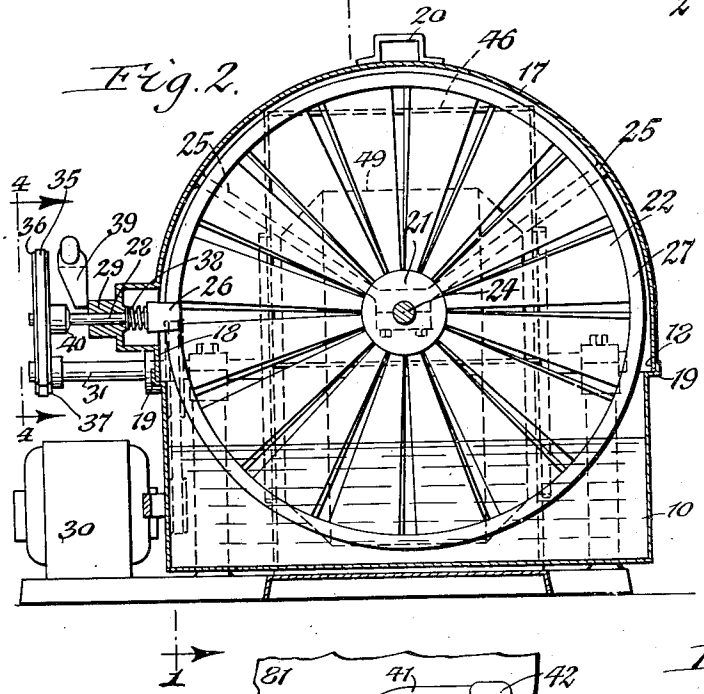
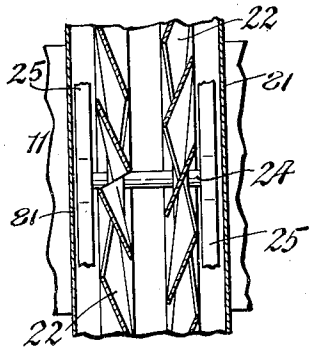


Fig. 3.



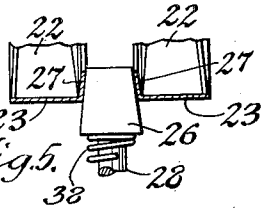
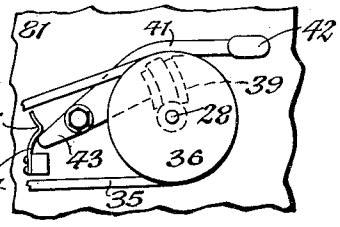


Fig. 5.

Fig. 4.



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AIR CLEANER AND HUMIDIFIER

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4 Claims. (Cl. 261—92)

This invention relates to an apparatus for cleaning and humidifying air for human and also industrial use.

As is well known the air of the outer atmosphere usually contains dust, dirt and impurities and also is deficient in moisture and therefore not in good condition for maintaining the health of persons or for some industrial purposes.

One of the objects of this invention is to provide an air cleaner and humidifier of simple and inexpensive construction whereby air may be efficiently purified and moistened so as to promote the health and comfort of persons using the same and also to better the same for industrial uses requiring pure air and air which is not unduly dry.

Another object of this invention is to so organize the air cleaner and humidifier that the same is compact in construction and capable of being used, when desired, in connection with an ordinary air blower or fan now commonly used for propelling air in buildings and the like.

In the accompanying drawing:

Fig. 1 is a side elevation, partly in section, of one form of this invention which contains a plurality of liquid elevating wheels in connection with the outlet of an air blower or fan.

Fig. 2 is a transverse section of the same, taken on line 2—2, Fig. 1.

Fig. 3 is a fragmentary longitudinal section, on an enlarged scale, taken on the correspondingly numbered line in Fig. 1.

Fig. 4 is a fragmentary side elevation of the apparatus shown in Figs. 1 and 2 and viewed from line 4—4, Fig. 2.

Fig. 5 is a fragmentary horizontal section, on an enlarged scale, taken on line 5—5, Fig. 1.

In the following description similar characters of reference indicate like parts in the several figures of the drawing.

In general this invention comprises a tank adapted to contain liquid such as water, a conduit which is arranged above the tank and through which the air to be cleaned and humidified is propelled, movable elevating means having elements which dip into the liquid in the tank and lift parts of the same into the path of the air passing through the conduit. The elevating means may be variously constructed so that when parts of the same are submerged in the liquid and raised out of the same a thin film of the liquid will adhere to the elevating means and be presented to the stream of air so that any dust or dirt contained in the air will adhere to the film of liquid and thereby be removed from the air and the latter by contact with the liquid will also be humidified. These elevating means preferably include one or more rotary wheels having inclined blades similar to those in an air fan or blower or water propeller and these elevating wheels used either singly or in multiple may be rotated either by power or the same may be rotated by the pressure of the air which is to be cleaned and which is propelled through the air conduit and past the liquid elevating wheel or wheels thereby utilizing the air pressure exerted either at the inlet or at the outlet of an air propelling fan or blower of the kind now commonly used for ventilating and similar purposes.

Referring to Figs. 1–4, the form of my invention there shown is constructed as follows:

The numeral 10 represents a tank which is adapted to contain a body of water in case it is desired to wash the dust or dirt of air and also humidify the air so as to promote health and comfort, but if desired the same may contain other liquids for industrial purposes. Extending over the open top of this tank and communicating therewith is a horizontal conduit 11 for the air which is to be cleaned or washed and humidified, this air being propelled by any suitable means from the inlet 12 of this conduit horizontally across the upper end of the tank, and discharged through the outlet 13 of the conduit. This tank is movably connected with the air conduit for convenience in filling the same with liquid and also cleaning the same when necessary and this preferably is accomplished by connecting the tank with the conduit by means of flanges 14 arranged on the opposite transverse edges of the upper end of the tank and engaging with transverse guideways 15 on the adjacent lower part of the air conduit so that the tank can be slid crosswise on the conduit for placing its upper end in communication with the air conduit or rendering the interior of the tank accessible from the exterior of the air conduit.

Between the inlet and outlet of the air conduit and above the tank is located a treating chamber or space 16 in which is arranged elevating means whereby water is raised from the tank in the form of a film into the path of the stream of air passing through the air conduit. The top of this treating chamber has the form of a removable cover or hood 17 the opposite transverse edges 81 of which normally fit around the adjacent parts of the air conduit and the opposite longitudinal edges 18 of which normally engage with the inner side of longitudinal flanges 19 on the transversely opposite sides of the tank, as shown in Figs. 1 and 2. Placing of the cover or hood

over the treating chamber 16 and removing the same therefrom may be effected manually by a handle 26 arranged at the upper side of the cover, as shown in Figs. 1 and 2. By interlocking the cover with the tank in the manner described it is necessary to remove the cover from the air conduit before the tank can be removed transversely from the conduit and also necessitates placing the tank in its proper position under the air conduit before the cover can be replaced in correct position over the air conduit, thereby preventing the tank from interfering with the free removal or restoration of the liquid elevating device which in the preferred construction is mounted on the cover and projects downwardly into the tank when the parts are in their normal operative position.

Although the liquid elevating device may be variously constructed that shown in Figs. 1–5 is organized as follows:

Within the treating compartment or chamber 16 formed by the cover and tank between the inlet and outlet of the air conduit two liquid elevating wheels are arranged side by side and to rotate about a horizontal longitudinal axis. Each of the elevating wheels preferably comprises a central hub 21, a plurality of elevating blades 22 projecting radially from this hub and inclined with reference to the axis of the wheel, and a cylindrical ring or band 23 connected with the outer ends of said blades. The blades of the two elevating wheels are inclined in opposite directions, as shown in Fig. 3, and the same are arranged side by side in the treating chamber 16 so that their driving rims 24 are opposite each other and some of the lower blades of the same below the axis of the wheels dip in or are partly submerged in the liquid in the tank while those blades thereof which are arranged above this axis project into the cover 17 and extend across the path of the air flowing through the air conduit and the treating chamber. The two elevating wheels have their hubs journaled on a horizontal longitudinal axle or arbor 24 so that they are capable of turning thereon in opposite directions. This axle is preferably mounted at its opposite ends on hangers 25 which project inwardly and downwardly from the inner side of the cover and along the outwardly facing sides of these wheels.

These elevating wheels may be rotated either by power or by the pressure of the air which is propelled through the air conduit. In the absence of power means for rotating the wheel turning of the same is effected by engagement of the propelled air against the inclined blades of the wheels and as the blades of one wheel incline in a direction opposite to the other wheel it follows that the air pressure against the blades of the wheels will cause the latter to turn in opposite directions.

As the elevating wheels turn the lower parts of their blades sweep through liquid such as water in the tank and become coated with a film of the same and as the blades move across the path of the air passing through the conduit this air impinges against the water coated blades, whereby dust or dirt in the air is deposited on the wet blades and separated from the air by the wet film thereon so that the air is purified and the air also becomes mixed with vapors from this water so that the air is humidified and the condition of the same improved so as to promote the health and comfort of the persons occupying the rooms which receive this treated air.

Due to the inclination of the blades of the elevating wheels the air which engages the same under pressure causes these wheels to turn and thereby successively and repeatedly submerge the lower parts of the blades in the water of the tank for coating the same with a film of water and then move the blades across the path of the stream of air in the conduit for removing the dirt from the air and humidifying, these operations of each blade being effected alternately and the operation of each wheel being continuous so long as the same is rotated by air pressure or other means. After the dirt in the air has been removed therefrom by the deposit thereof on the elevated wet blades the purified air continues its course through the air conduit and then the dirt laden blades move through the water in the tank so that the dirt is washed from the blades and replaced by a fresh coat or film of water or moisture for effecting another air cleaning and humidifying operation.

Replenishing the tank with water or renewing this water when the same has become sufficiently dirty or an objectionable amount of sludge has accumulated in the tank may be effected in various ways, for example by removing the tank from the air conduit and dumping the dirty water out of the same and restoring the tank on the air conduit after refilling the same with clean water.

By employing two or more elevating wheels of this character side by side the same form a plurality of baffles which intercept the stream of air passing through the air conduit and compel the air to take a tortuous course as the same passes through the slits between the several blades of each wheel and also through the gaps or spaces between adjacent wheels, thereby ensuring effective cleaning and humidification of the air before leaving the apparatus.

Instead of depending on the pressure of the air passing through the air conduit for rotating the liquid elevating wheels this may be accomplished by power in any suitable manner. As shown in Figs. 1, 2 and 5 the power operated means for rotating the liquid elevating wheels include a friction driving wheel or pinion 26 of conical form arranged between the elevating wheels and engaging its diametrically opposite sides with two driving rims or annular flanges 27 arranged circumferentially on the opposing peripheral parts of the two elevating wheels and concentrically with the axes thereof. Upon rotating this driving wheel the elevating wheels are turned in opposite directions by the frictional engagement of this driving wheel with the driving rims of the respective elevating wheels. Each of the driving rims is inclined so that as a whole the same forms a truncated cone which tapers away from the inner side of the respective elevating wheel and enables the driving wheel to exert a wedging engagement with the rims of the elevating wheels so as to effectively rotate the latter in opposite directions. The friction driving wheel is mounted on the inner end of a shaft 28 which is journaled horizontally and transversely in a bearing 29 which is preferably mounted on one side of the cover 17. The power for rotating the driving wheel 26 may be derived from any desired prime mover, for example an electric motor 30, and motion is transmitted from this motor to the driving shaft 28 by means which include an intermediate shaft 31, a lower belt 32 passing around the motor shaft 33 and the intermediate shaft 31, and an upper belt 34 passing around a

pulley 35 on the intermediate shaft and a pulley 36 on the driving shaft 28.

For the purpose of permitting the water elevating wheels to be rotated either by air pressure or by motor power means are provided for propelling air under pressure to the air conduit and also means for operatively connecting the elevating wheels with and also disconnecting the same from the motor power. The last mentioned effect can be produced by moving the friction driving wheel or pinion 26 in a direction lengthwise of the driving shaft 28 so as to operatively engage this driving wheel with the driving rims 27 of the water elevating wheels or disengage the same therefrom. This may be accomplished by mounting the shaft 28 in the bearing 29 so the same cannot only turn therein but also slide lengthwise in this bearing. The particular means for moving the shaft 28 for this purpose shown in Figs. 2 and 4, include a helical spring 38 surrounding this shaft and interposed between the driving wheel 26 and the bearing 29 and a cam or wedge 39 movable into and out of the space or gap between the bearing 29 and the hub 40 of the pulley 36 on the shaft 28. When the wedge 39 is withdrawn from the gap between the bearing 29 and hub 40, as shown in Fig. 2, the shaft 28 is free and will be moved inwardly by the spring 38 so that the driving wheel 26 engages frictionally with the rims 27 and turns the elevating wheels in opposite directions. Upon moving the wedge downwardly into the gap between the bearing 29 and hub 40 the shaft 28 will be forced outwardly and the driving wheel 26 will be disengaged from the driving rims 27 so that the elevating wheels cannot be rotated by motor power but will be rotated solely by air pressure against the inclined blades of the water elevating wheels. The raising and lowering of the wedge may be effected by various means, for example, by a vertically swinging lever 41 pivoted on the outer side of the conduit cover 17 and provided at one end with a handle 42 for manipulating the same while its opposite end is provided with a retaining arm 43 adapted to engage with a spring 44 mounted on this cover and having a hump 45 over which the retaining arm 43 is adapted to ride for engaging this spring on one side or the other of this hump and thereby yieldingly holding the wedge 39 either in its depressed or operative position or in its elevated inoperative position.

The air which is to be cleaned and humidified may be propelled by any suitable blowing or forcing means and delivered under pressure into either end of the air conduit for treatment by means of a water elevating device and then discharged in a cleaned or washed and humidified condition from the other end of this air conduit. In the example shown in Figs. 1 and 2, the raw air is introduced through the end 12 of the air conduit and therefrom through the end 13 thereof and the means for propelling the air consists of an air blower or fan of usual and well known construction which in the present case has its housing or casing 46 provided with an air inlet eye 47 arranged at right angles to the air conduit and has its tangential air outlet 48 connected with the inlet 12 of the air conduit, as shown in Fig. 1. The rotor 49 of this blower or fan is of the usual form and mounted on a shaft 31 which extends axially through the eye of the fan or blower casing and is the same shaft 31 which also forms part of the means for transmitting motion from the motor 30 to the driving wheel 26.

Instead of blowing the air through the air conduit, as shown in Figs. 1 and 2, the propulsion of the air through the air conduit may be effected by suction, the means for elevating the water for cleaning and humidifying the air may be effected by a single elevating wheel, and this wheel may be turned solely by air pressure, an example of this type being shown in Figs. 6 and 7.

In this last mentioned construction only one water elevating wheel is employed having its hub 50 mounted on an axle 51 which turns in bearings 52 carried by hangers 53 on the hood or cover 54 of the air treating compartment 55, and the hub being provided with a plurality of inclined fan blades 56 which are adapted to sweep downwardly through water or other liquid contained in a tank 57 which communicates at its upper end with the air conduit 58 and upwardly across the path of the air to be cleaned and humidified in the air conduit. In this case the rotation of the water elevating wheel is effected by the pressure of the air against the inclined blades of this wheel thereby causing the blades to successively pick up a film of water from the tank and then present this film to the raw air for removing the dirt or dust from the same and also humidifying the air.

In this form of the invention the water tank is removably mounted on the air conduit and the cover and water elevating wheel are also removable in the manner described with reference to the construction shown in Figs. 1–5.

In the construction shown in Figs. 1–5 the blades of each of the elevating wheels do not overlap one another but as these wheels are turned in opposite directions, the air from the conduit is compelled to take a tortuous course and therefore subject the same to a thorough cleaning and humidifying action.

I claim as my invention:

1. An air cleaner and humidifier, comprising a tank adapted to contain a liquid, a conduit which extends above the tank and through which air is propelled, and two rotary wheels arranged side by side and having their lower parts dipping into the liquid in said tank and their upper parts projecting into the path of the air in said conduit, and each of said wheels having blades and a peripheral driving rim, a rotatable driving wheel, and means for moving said driving wheel into and out of engagement with said driving rims.

2. An air cleaner and humidifier, comprising a tank adapted to contain a liquid, a conduit which extends above the tank and through which air is propelled, and two rotary wheels arranged side by side and having their lower parts dipping into the liquid in said tank and their upper parts projecting into the path of the air in said conduit, and each of said wheels having blades and a peripheral driving rim, a rotatable driving wheel, and means for moving said driving wheel into and out of engagement with said driving rims, including spring means for moving said driving wheel into engagement with said driving rims and cam means for moving said driving wheel out of engagement from said rims.

3. An air cleaner and humidifier, comprising a tank adapted to contain a liquid, a conduit which extends above the tank and through which air is propelled, and two rotary wheels arranged side by side and having their lower

parts dipping into the liquid in said tank and their upper parts projecting into the path of the air in said conduit, and each of said wheels having blades and a peripheral driving rim, a rotatable driving wheel, a driving shaft carrying said driving wheel and provided with a shifting collar, a bearing in which said shaft is journaled, a spring interposed between said bearing and driving wheel for moving the latter into engagement with said rims, and a cam movable into and out of engagement with said collar for shifting said driving wheel out of engagement with said rims.

4. An air cleaner and humidifier, comprising a tank adapted to contain a liquid, a conduit which extends above the tank and through which air is propelled, and two rotary wheels arranged side by side and having their lower parts dipping into the liquid in said tank and their upper parts projecting into the path of the air in said conduit and each of said wheels having blades and a peripheral driving rim, a rotatable driving wheel, a driving shaft carrying said driving wheel and provided with a shifting collar, a bearing in which said shaft is journaled, a spring interposed between said bearing and driving wheel for moving the latter into engagement with said rims, a cam movable into and out of engagement with said collar for shifting said driving wheel out of engagement with said rims, a rock lever carrying said cam, and a spring detent for holding said lever in either extreme of its movement.

EUGENE GUSY.