Oct. 24, 1950 R. A. LHOTA 2,527,015

AIR WASHING AND CLEANING APPARATUS

Filed June 7, 1945

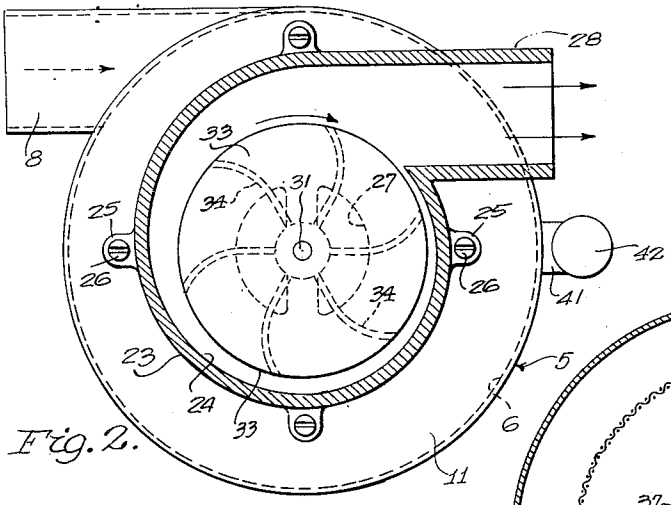


Fig. 2.

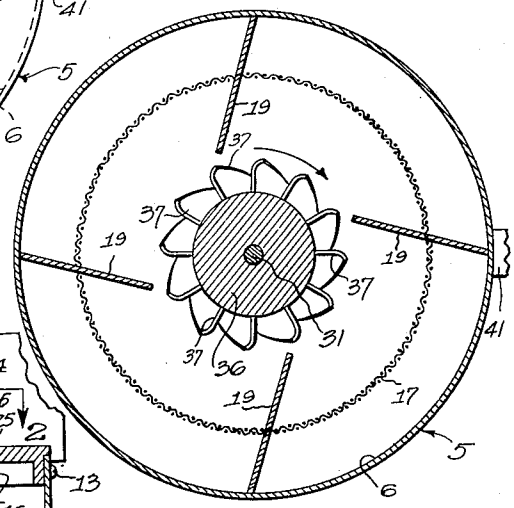


Fig. 3.

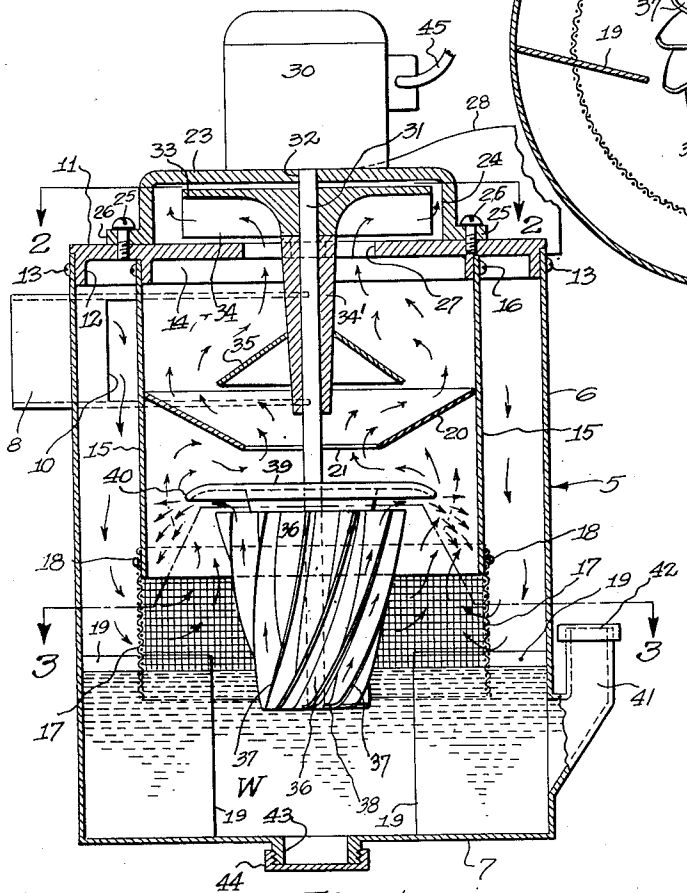


Fig. 1.

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Patented Oct. 24, 1950

2,527,015

UNITED STATES PATENT OFFICE

2,527,015

AIR WASHING AND CLEANING APPARATUS

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Application June 7, 1945, Serial No. 598,002

2 Claims. (Cl. 261—91)

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The present invention relates to improvements in air conditioning, and more particularly, to air washing and cleaning apparatus therefor.

The primary object of the invention is to provide an air washing and cleaning apparatus which is particularly applicable to industrial use for removing impurities and odoriferous matter from the air as well as dirt and dust particles therefrom, whereby air may be recirculated to the building or enclosure in such a condition as to insure the comfort of the occupants.

Another object of the invention is to provide an air cleaning and washing apparatus in which the air from the building or enclosure is passed through a spray of water which has a relatively large surface area and is arranged in such a manner as to provide a series of water curtains through which the air must pass before being returned to the building or enclosure to thereby insure complete cleansing of the air and the removal of dirt and dust particles therefrom.

Another object of the invention is to provide an air washing and cleaning apparatus for industrial use which is provided with a cone-shaped impeller having spirally arranged vanes, the lower ends of which are adapted to be immersed in liquid or water so that upon rotation of the cone, the water will be elevated and directed outwardly by a flange arranged in overhanging relation with the upper end of the cone to thereby direct a spray of liquid or water radially into engagement with a baffle wall, whereupon the particles of liquid or water thus sprayed will fall by gravity and provide another spray curtain through which the air will pass during circulation through the air washing and cleaning apparatus.

Another object of the invention is to provide an air washing and cleaning apparatus in which a series of baffles are arranged in the bottom of the washer tank and disposed tangentially or radially with respect to the cone-shaped impeller to prevent the surface of the liquid or water in the tank from assuming a parabolic shape when the impeller is rotated, thereby insuring the lower end of the impeller being immersed and providing a continuous liquid flow upwardly.

Another object of the invention is to provide an air washing and cleaning apparatus in which all of the parts are compactly contained in a single casing as a unit with the air inlets and outlets arranged tangentially so that a swirling motion will be imparted to the air as it passes through the vertical and horizontal water spray curtains.

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Another object of the invention is to provide an air washing and cleaning apparatus in which a reticulated screening member is provided and extends from the baffle wall against which the water or liquid is radially directed to a position therebelow for being submerged in the washing or cleaning liquid to further insure the removal of dust and dirt particles from the air and thereby thoroughly clean the air.

Another object of the invention is to provide a series of staggered baffles in the upper portion of the washing and cleaning apparatus arranged in the path of the air flow so as to remove particles or grains of water from the air and prevent said particles of water from being drawn upwardly into the exhaust or circulating fan.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawing, wherein:

Figure 1 is a vertical cross-sectional view of the air washing and cleaning apparatus showing the general arrangement and the direction of the air current while passing through the air cleaning apparatus for the removal of dust particles or other foreign matter therefrom;

Figure 2 is a horizontal cross-sectional view taken on line 2—2 of Figure 1 looking in the direction of the arrows and illustrating the centrifugal air fan and the manner in which the same is arranged on the casing of the air washing and cleaning apparatus; and

Figure 3 is a horizontal cross-sectional view taken on the irregular line 3—3 of Figure 1 looking in the direction of the arrows and illustrating the cone-shaped impeller and the arrangement of the spirally shaped vanes thereon as well as the tangentially arranged baffles for preventing swirling motion of the liquid in the lower portion of the casing when the impeller is rotated.

In the drawing, wherein for the purpose of illustrating the invention like reference characters will be employed to designate like parts throughout, the reference character 5 will generally be employed to indicate the casing of the air washing and cleaning apparatus which comprises a circular housing wall 6 provided at the lower end with a bottom wall 7. An air inlet conduit 8 is connected to the upper end of the casing 5 and communicates with the interior of the casing through an opening 10. The air conduit 8 is arranged tangentially with respect to the casing 5 so that air drawn therein will be

rotated and be given a swirling motion to further insure separation of foreign particles from the air such as dirt and dust.

The casing 5 is closed at its upper end by a cover 11 having a marginal flange 12 which is seated within the open upper end of the casing 5 and is held in place by retaining screws 13 arranged at equidistantly spaced circumferential points. Spaced inwardly from the marginal flange 12 is an annular depending flange 14 to which is secured the upper end of a cylindrical baffle wall 15 by means of a series of screws or the like as at 16. The lower end of the cylindrical baffle wall 15 is provided with a reticulated screening baffle 17 which is held in place by a band 18 encircling the upper end of the screening baffle so as to tightly clamp the same to the lower end of the cylindrical baffle 15. The reticulated screening baffle 17 is spaced from the bottom wall 7 of the casing 5 as shown in Figure 1, and may be slotted for being received on a series of tangentially arranged baffle plates 19 which interconnect the inner surface of the cylindrical wall 6 of the bottom wall or floor 7 and are intended to prevent the liquid or water W in the container or casing 5 from swirling so that the upper portion or surface will not assume a parabolic shape and cause the center thereof to recede from the impeller, which will be presently described. An inclined annular baffle 20 is mounted in the cylindrical baffle 15 and is provided with a central opening 21 for permitting air flow therethrough in the direction of the arrows.

Mounted on the top wall or cover 11 is a fan casing 23 which is formed with a volute casing wall 24 and said casing is provided with a series of lugs 25 for receiving machine screws or the like 26 so that the casing 23 may be secured to the top wall or cover 11 and form in conjunction therewith a centrifugal fan chamber. A central opening 27 is provided in the top wall or cover 11 of the casing to provide a suction opening for the fan casing 23 and a discharge jet or conduit 28 is formed integral with the casing 23 as a portion of the volute casing wall 24 to facilitate discharge of the air after it has been cleaned or washed by the cleaning and washing apparatus. An electric motor 30 is mounted on the fan casing 23 and has its armature shaft 31 extending through a suitable opening therein as at 32. A centrifugal fan disc 33 is mounted on the armature shaft and is provided with a series of arcuately curved vanes 34 for drawing air through the suction opening 27 of the fan casing and discharging the same through the discharge nozzle 28. A bearing extension 34' is mounted in the opening 27 and braced by suitable struts to the cover 11 and secured thereto is a conical-shaped baffle member 35 arranged above and in spaced relation from the conical-shaped baffle member 20 in the cylindrical baffle 15. The armature shaft 31 projects a considerable distance downwardly within the casing 5 and has secured to the lower end thereof a cone-shaped hub 36 which is provided on its peripheral surface with a series of spirally arranged blades or vanes 37. The lower portion of the cone-shaped hub 36 is adapted to be immersed in the water W (Figure 1) so as to elevate the water in the direction of the arrows and as shown in Figure 1, the lower end of each of the spiral blades or vanes 37 is bent abruptly in the direction of rotation as at 38 to scoop up the water W and assist in elevating the same along the peripheral surface of the cone-shaped hub 36 between the vanes 37.

The upper end of the cone-shaped hub 36 is provided with a radially extending flange 39 which has its free edge bent slightly downwardly as at 40 so as to direct the water both radially and downwardly as indicated by the arrows in Figure 1. A slight space is provided between the upper ends of the vanes or blades 37 and the disc-like flange 39 on the cone-shaped hub 36 so as to permit the liquid or water which has been elevated to move in a radial direction and thence slightly downwardly.

The cylindrical container 5 is provided with a filler spout 41 having a cap closure 42 for facilitating filling the casing 5 to a predetermined level or height so that the lower end of the reticulated screen 17 will be submerged as will also be the cone-shaped impeller and the lower ends of the impeller blades 37. An outlet 43 is provided in the bottom wall or floor 7 of the casing 5 and is adapted to be closed by a screw cap 44 or the like when the air cleaning and washing apparatus is in operation. The electric motor 30 may be supplied with electric current from a domestic source through a supply cable 45 having a plug on its free end which may be inserted in an outlet socket.

For consideration of the operation of the invention it will be assumed that the casing or housing 5 has been filled with water W to a predetermined liquid level and that the motor 30 has been energized by electrically connecting the cable 45 to a suitable source of electric energy so as to cause rotation of the armature shaft 31 and likewise rotation of the centrifugal fan disc 33 and cone-shaped hub 36 of the impeller. As the disc 33 of the centrifugal fan and cone 36 of the impeller are rotated, air is drawn inwardly through the tangential inlet opening 8 so as to swirl in a spiral path downward through the annular space between the outer housing wall 6 and inner cylindrical baffle 15. Thus the air will finally find its way to the lower end of the cylindrical baffle 15 and will pass in the direction of the arrows through the reticulated screen 17 and upwardly. Due to this spiral swirling or vortex action of the air, the coarser dust particles therein are thrown outward by centrifugal force against the housing wall 16 and drop by gravity directly into the water. The air passing through the screen 17 has been thus freed of its coarser dust particles, leaving only fine dust particles to be removed by the water sprays. Simultaneously, the water W is elevated by the impeller by reason of the blades 37 picking the water up at the lower ends thereof 38 so that the water will travel upwardly over the surface of the cone-shaped hub 36 and will be directed outwardly in a radial fashion in engagement with the cylindrical baffle wall 15. The water particles drop by gravity along the inner surface of the lower end of the cylindrical baffle 15 and maintain the reticulated screen 17 in a wetted condition. Thus, air passing through the screen 17 will be cleaned by being passed through the screen 17 and the vertical cylindrical curtain of water particles falling from the lower end of the cylindrical baffle wall 15. As the air passes upwardly, between the conical baffles 20 and 35, it passes through the radial curtain wall created by the water being thrown by centrifugal force from the disc 39 to the cylindrical baffle wall 15. The air then passes in the direction of the arrows upwardly through the space within the cylindrical baffle wall 15 and

enters the centrifugal fan casing **23** through the suction opening **27** thereof in the top or cover wall **11** of the casing **5**. The fan impeller disc **33** is rotated simultaneously to cause the air to be discharged through the discharge nozzle **28** of the fan casing **23**. The conical baffles **20** and **35** are arranged so as to intercept particles of moisture carried upwardly with the air and so that said particles will drain downwardly to the bottom of the casing **5**. During rotation of the impeller or cone-shaped hub **36** and spiral vanes or blades **37**, the baffles **19** in the lower portion of the casing will prevent the surface of the water from assuming a parabolic shape and receding from the impeller cone **36** and blades **37**. Thus, a constant liquid supply is furnished to the lower end of the impeller and the same is continually immersed in the liquid or water W in the lower end of the casing **5**.

Obviously, the air washing and cleaning device may be used for humidifying or rehumidifying air by regulating the temperature of the water W relative to the temperature of the incoming air, and if the device is used as a humidifying apparatus, it will also operate to clean the air as well as wash the same. When the device is used as a dehumidifying apparatus, the liquid W may be recirculated and properly cooled below the dew point of air being circulated.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment thereof and that various changes may be made in the shape, size and arrangement of parts without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim is:

1. An air washing and cleaning apparatus comprising a casing having spaced outer and inner walls defining an air intake chamber encircling said inner wall and having an air intake passageway in the upper portion thereof, a liquid reservoir arranged in the lower portion of said casing, said inner wall terminating above the liquid level in said reservoir and surrounding a spray chamber therein, a foraminated screening partition extending from said inner wall downwardly below the liquid level in said reservoir, a shaft rotatably mounted within said spray chamber, a liquid-lifting impeller drivingly mounted on said shaft and having a rotary spray ejector at the upper portion thereof adapted to expel a lateral spray curtain outwardly therefrom, a suction fan connected to exhaust air from the upper portion of said spray chamber and drivingly mounted on said shaft, a plurality of longitudinally-spaced, laterally-overlapping baffles of approximately conical form disposed between said spray ejector and said fan, one of said baffles extending inwardly from said inner wall and another baffle extending outwardly from the central portion of said chamber, and a motor drivingly connected to said shaft for rotating said fan, said outwardly extending central baffle and said impeller whereby to draw said air downwardly through said air intake chamber, inwardly through said screening partition and the water descending thereon and upwardly through said spray curtain to said fan.

2. An air washing and cleaning apparatus comprising a casing having spaced outer and inner walls defining an air intake chamber encircling said inner wall and having an air intake passageway in the upper portion thereof, a liquid reservoir arranged in the lower portion of said casing, said inner wall terminating above the liquid level in said reservoir and surrounding a spray chamber therein, a foraminated screening partition extending from said inner wall downwardly below the liquid level in said reservoir, a shaft rotatably mounted within said spray chamber, a liquid-lifting impeller drivingly mounted on said shaft and having a rotary spray ejector at the upper portion thereof adapted to expel a lateral spray curtain outwardly therefrom, a suction fan connected to exhaust air from the upper portion of said spray chamber and drivingly mounted on said shaft, an annular downwardly-directed marginally-disposed baffle of approximately conical form secured to said inner wall within said spray chamber between said spray ejector and said fan and having a central opening therein, a downwardly-directed centrally-disposed baffle of approximately conical form drivingly mounted on said shaft and disposed in said spray chamber between said annular baffle and said fan in laterally-overlapping longitudinally-spaced relationship with said central opening of said annular baffle, one of said baffles extending inwardly from said inner wall and another baffle extending outwardly from the central portion of said chamber, and a motor drivingly connected to said shaft for rotating said fan, said conical baffle and said impeller whereby to draw said air downwardly through said air intake chamber, inwardly through said screening partition and the water descending thereon and upwardly through said spray curtain to said fan.

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