Aug. 4, 1931. S. C. CUTLER 1,816,828

AIR WASHING APPARATUS

Filed Oct. 22, 1926

Fig. 1

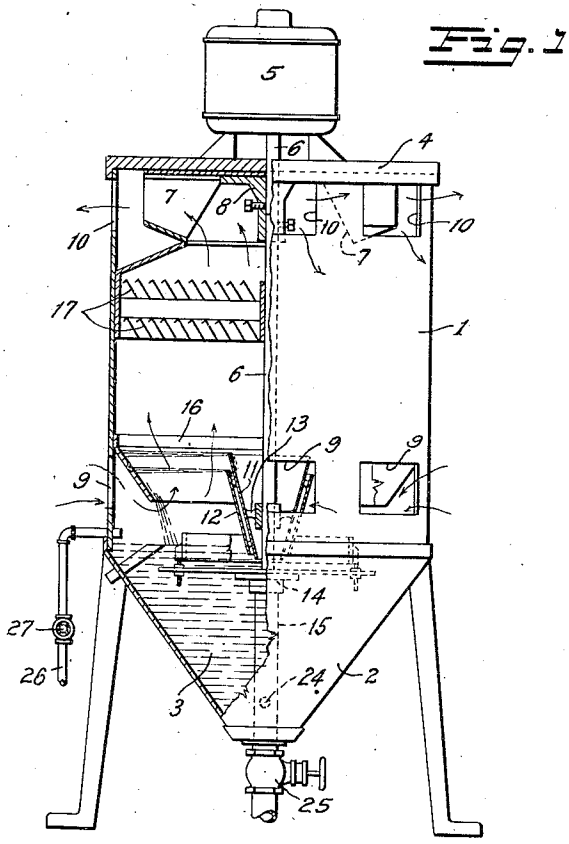
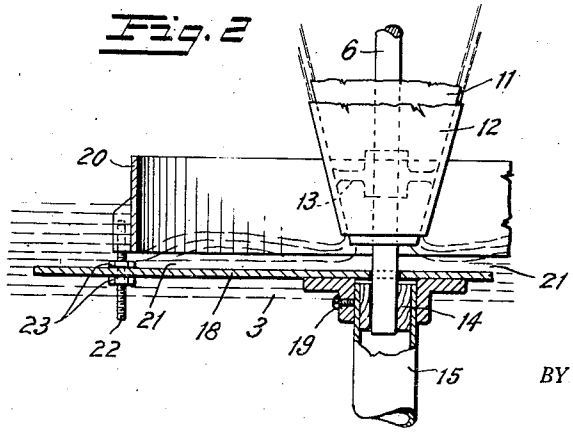


Fig. 2



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Patented Aug. 4, 1931

1,816,828

UNITED STATES PATENT OFFICE

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AIR WASHING APPARATUS

Application filed October 22, 1926. Serial No. 143,389.

This invention relates to air cleansing apparatus and more particularly, with regard to some of its details, to apparatus designed to wash air with a body of liquid, a part or all of which is recirculated through the machine.

An object of this invention is to provide a device of the character described, in which the quantity of spray used in washing the gases may be controlled independently of the velocity of the spray. A further object is to provide a device of the character described, in which the water which has been used to purify the air is itself operated to reduce the amount of impurities contained therein to a minimum. A further object is to produce a device of the character described, which will be simple in construction and easy and reliable in operation. Other objects will be in part obvious and in part described hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is an elevation partly in central section of an apparatus embodying this invention.

Fig. 2 is a detail showing certain of the control elements.

In the drawings the numeral 1 constitutes a casing of generally cylindrical form, having a conical bottom 2, forming a sump 3 for the reception of water. The casing also has a top 4, which may be utilized to support a motor 5, having a shaft 6 extending downwardly, centrally through the casing 2, for operating the rotating pumping elements to be described. Fan blades 7, carried by a spider 8, are attached to the shaft 6 for drawing air inwardly through air inlets 9, upwardly through the casing and out through the outlets 10. The pumping element comprises preferably a plurality of centrifugally disposed similar cones 11 and 12, attached together in parallel, spaced relation to form a unit, which will be hereafter, for convenience, termed the pump. This pump is supported by a spider 13 carried by the vertical shaft 6 for rotation about the axis of the cones. The lower end of the shaft 6 is preferably supported by a bearing 14 carried by a pipe 15, projected upwardly from the bottom 2. This bearing may be conveniently made of lignum vitæ wood, which forms a satisfactory bearing even under the conditions existing here. A conical deflector 16 is attached to an inner wall of the casing opposite or below the discharge of the spray from the cones 11 and 12, as will hereafter be described, and this deflector is so arranged that it carries the water thrown against the casing inwardly, to be again discharged into the sump 3 in the form of a curtain, from the lower edge of the deflector. This deflector is also preferably so arranged as to carry the liquid inwardly away from the inlet orifices 9, thus preventing water from splashing out of the machine.

In the drawings there are also illustrated a plurality of eliminator plates 17 for the purpose of removing from the air, after washing, excess or entrained water.

The mechanism for controlling the spray is as follows:—A plate 18 is carried by a hub 19, carried upon the pipe 15, just below the lower end of the pump and the hub 19 is made adjustable upon the pipe 15 in such a manner that it may be brought nearer to, or further from the lower end of the pump at will. A circular dam 20 surrounds the lower end of the pump in such a manner as to cooperate with the plate 18 to segregate the water immediately surrounding the lower end of the pump from the main body of the water in the sump, and to afford communication between that segregated body of water and the main body of water, by means of an annular orifice 21 between the dam and the plate. In the drawings the dam 20 is supported from the plate by a plurality of studs 22 rigidly attached to the dam and extending through perforations in the plate and having nuts 23 above and below the plate, so

that the position of the dam relative to the plate may be adjusted at will to control the size of the annular orifice 21, thus restricting the flow of water from the main body of the sump to the segregated portion. The lower portion of the pipe 15 may be utilized as an outlet for the sludge and to this end has an orifice 24 near the bottom end of the sump, the discharge of the sludge being under the control of a valve 25 in the discharge pipe.

A pipe 26 may be provided having a valve 27 to admit fresh water to the machine. The operation of the device is as follows:—The sump 2 is first filled with water above the level of the bottom of the pump. Thereupon the rotation of the motor 5, carrying the fan and pump with it, will draw air in at the openings 9 and discharge it through the outlets 10, and at the same time will project a sheet of spray from the periphery at each of the cones of the pump. The excess water of this spray will fall downwardly from the deflector 16 as a sheet, and the air passing through the curtain and then through the spray, becomes thoroughly washed and conditioned. The moisture contained can be accurately regulated by adjusting the temperature of the wash water and it will leave the water substantially saturated. If plates such as 17 be employed, they will serve to eliminate any entrained water at that point. The inner receptacle formed by the plate 18 and the dam 20 is the only source of liquid for the pump and the amount of water within this inner receptacle at any moment is determined by the restricted annular orifice 21. At the same time the rotation of the pump has a vortexial effect upon the water within the inner receptacle and indirectly upon the water within the sump, by reason of the communication between the sump and the inner receptacle through the restricted orifice. In this manner, the water within the sump rotates at slow speed.

With this device, it will be noted that the water picked up by the pump thrown to the side of the casing, falling into the sump, gradually accumulates dust and dirt from the air, the greater portion of which is insoluble and this insoluble matter gradually falls to the bottom of the sump. The vortexial action maintained within the sump by the gentle rotation, gradually carries this dirt toward the apex of the cone, where it may be discharged through the orifice 24 as desired.

It will thus be seen that the restriction of the orifice 21 accomplishes two results:—First, it controls the amount of spray delivered by the pump and second, it controls the amount of vortexial action within the great body of the sump. By proper adjustment not only of the size of this restricted orifice, but by the extent to which it is submerged, one of these factors may be controlled out of proportion to the other. For example, if the orifice is of given size and the plate 18 and dam 20 are deeply submerged, it results in the fact that the pump does not dip deeply into the water within the inner receptacle and thus causes less vortexial action on the inner liquid, causing less vortexial action in the sump, while at the same time the quantity of moisture discharged is not substantially affected.

The adjustment of the size of the orifice and of the height of the plate and dam are not required to be made during operation, since the apparatus may be set up to perform a given service and the adjustments made to conform to this service and thereafter no further adjustments need be made.

In the specification it will be observed that the amount of the liquid should be sufficient to gently move the impurities along the inclined bottom toward the apex of the cone, but it should be so controlled that the swirling liquid within the sump will not pick up the settled particles and stir them again into the liquid.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a device of the character described, a sump, a rotary pumping element adapted to dip into said sump, and means within said sump and surrounding the lower end of said pumping element for restraining the imparting of rotation to the water of said sump by said pumping element, said means comprising a fixed supporting plate, a dam spaced from said plate, and means for varying the position of the plate within the sump.

2. In a device of the character described, means for creating a liquid spray, means for passing air through said spray, the sprayed liquid being returned for re-use by the spraying means, and means in said circuit for purifying said water, including a tank having an inclined bottom and adjustable means for assuring a gentle rotational movement throughout the liquid in said tank.

3. In a device of the character described, in combination a sump, a cone rotating about

a vertical axis and adapted to extend within said sump, a plate within said sump disposed below said cone, a circular dam within said sump surrounding the lower end of said cone, and means for supporting said dam to form a restricted passage way between said dam and said plate to restrict the flow of water from the other portions of said sump to said cone said plate adapted to be variably spaced from the cone.

4. In a device of the character described rotating means for spraying liquid, means for passing air through said spray, a tank having an inclined bottom from which the liquid is sprayed and to which the sprayed liquid is returned, adjustable means for producing a desired rate of rotation of the liquid in said tank to force impurities down the inclined bottom.

5. In a device of the character described rotating means for spraying liquid, means for passing air through said spray, a tank having an inclined bottom from which the liquid is sprayed and to which the sprayed liquid is returned, and means adjustably positioned with respect to said spraying mechanism for maintaining a gentle movement of the liquid in said tank to force impurities down the inclined bottom, the liquid in the tank being rotated at a rate appreciably different from that of the liquid proximate to the rotating means.

6. In a device of the character described, in combination, a sump, a rotary pumping element adapted to extend within said sump, means below said pumping element for confining the portion of the liquid immediately adjacent to said pumping element from the remainder of the sump, a restricted opening between said confining means and the remainder of the sump, said opening being adjustable, said means being adjustable with respect to the pumping element.

7. An air washing apparatus including a casing formed with openings for the passage of air, a shaft disposed within said casing, a pump secured to said shaft, a blower also attached to said shaft and to circulate air through the casing openings, said casing receiving a body of fluid and the intake end of said pump being immersed within said fluid, and means associated with said casing and movable axially towards and away from the intake end of the pump to control the flow of fluid into said pump and the volume of fluid distributed by the latter.

8. An air washing apparatus including a casing formed with openings for the passage of air, a shaft disposed within said casing, a pump secured to said shaft, a blower also attached to said shaft and to circulate air through the casing openings, said casing adapted to receive a body of fluid and the intake end of said pump being immersed within said fluid, means associated with said casing and movable towards and away from the intake end of the pump to control the flow of fluid into said pump and the volume of fluid distributed by the latter, and a collar mounted by said means and adjustable with respect to the same to regulate the flow of fluid towards the intake end of the pump and to isolate such fluid from the remainder of the fluid body within said casing.

9. An air washing apparatus including a casing formed with openings for the passage of air, a shaft disposed within said casing, a pump secured to said shaft, a blower also attached to said shaft and to circulate air through the casing openings, said casing adapted to receive a body of fluid and the intake end of said pump being immersed within said fluid, means disposed adjacent the intake end of said pump and adjustable towards and away from the same to regulate the volume of fluid passing through said pump, and a tube extending within said casing and acting as a support for said last named means, said tube additionally providing a drain for the fluid body within said casing.

In testimony whereof I affix my signature.

SAMUEL C. CUTLER.