May 19, 1931. K. D. PERKINS 1,806,021

HUMIDIFIER

Filed Dec. 2, 1927

Fig. 1.

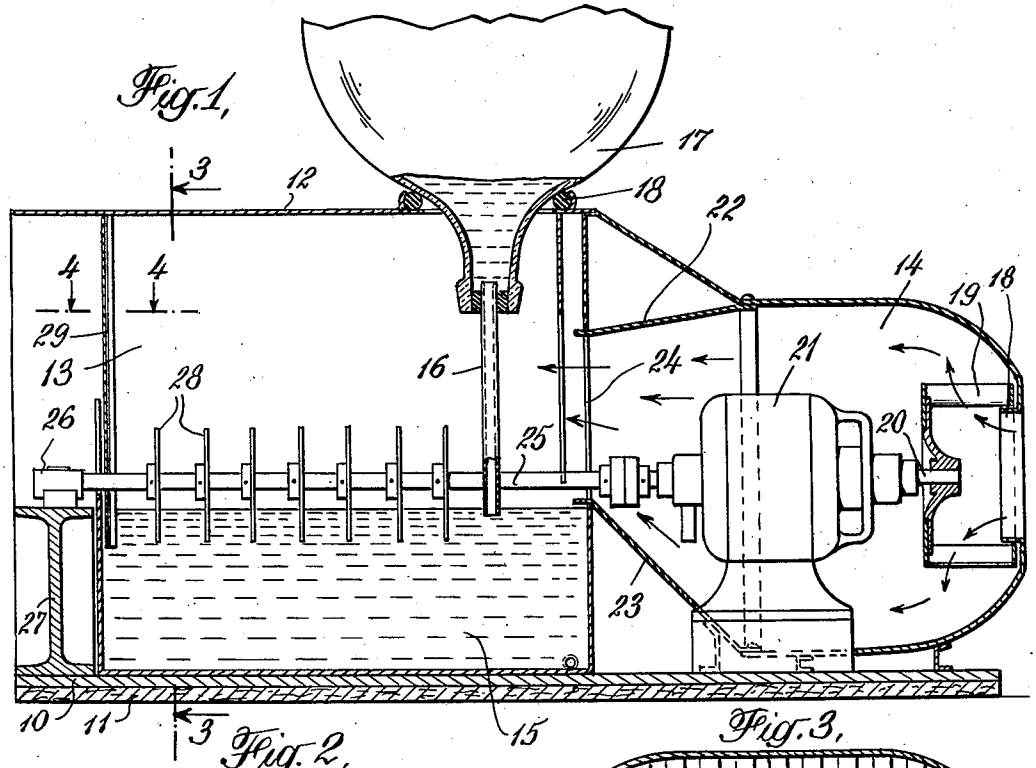


Fig. 2.

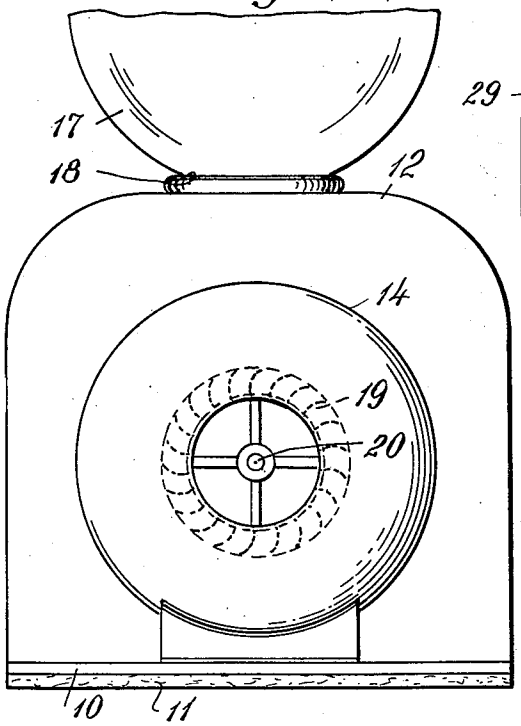


Fig. 3.

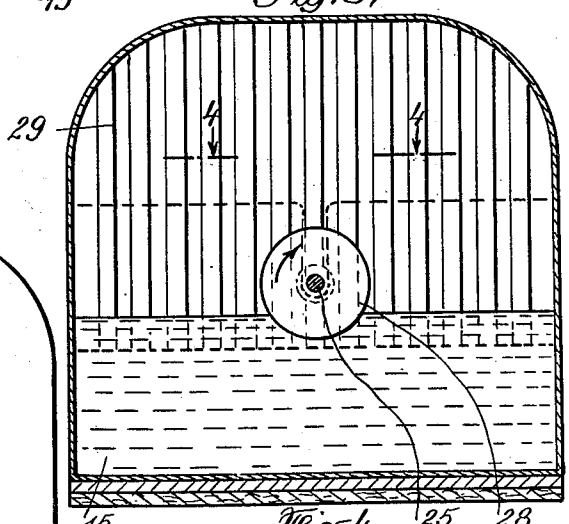
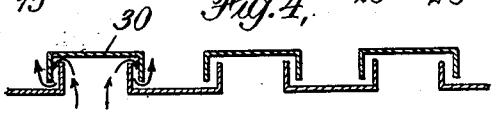


Fig. 4.



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1,806,021

UNITED STATES PATENT OFFICE

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HUMIDIFIER

Application filed December 2, 1927. Serial No. 237,242.

This invention relates to air conditioning apparatus and has particular reference to that type of apparatus which employs a spray, screen or vapor of liquid whereby the air passing therethrough is humidified, dehumidified, washed, cooled, heated, or the like.

While there are numerous forms of humidifiers and the like in present use, the large majority of them are complicated and employ numerous moving parts which are liable to get out of order. In the centrifugal type of humidifier, the liquid under pressure is introduced to the center of a rotating wheel provided with peripheral nozzles, and is thrown therefrom by centrifugal force, but this form of apparatus does not break up the liquid into as finely divided particles as is desirable and involves the use of slip joints and the like in the tubes for conducting the liquid. Other forms of centrifugal humidifiers employ a plurality of teeth or vanes at the periphery of a wheel or the like which must be rotated at high speed in order to finely divide the liquid thrown off thereby. In these types of centrifugal humidifiers, the liquid must be supplied under pressure by pumps, and the liquid distributing nozzles, vanes and pipes are liable to become clogged by impurities in the liquid even when the liquid is carefully strained beforehand. These forms in addition to mechanical objections, require a comparatively large amount of power during operation as well as expensive equipment.

The present invention has for its object the provision of an air conditioning apparatus of the so-called humidifier type which is simple, efficient and relatively inexpensive to make and maintain, and which uses a comparatively small amount of power in operation. In the apparatus of this invention the air which is to be conditioned is passed successively through a series of screens of finely divided liquid, these screens of liquid being produced by a plurality of rotating discs which dip into the liquid. The natural skin adhesion of the liquid to the surfaces of the several discs causes the liquid to be lifted and thrown upwardly from its own surface into a series of fine spray screens, one for each disc. These discs are rotated at a relatively low speed as compared to the high speed of rotation necessary in the centrifugal types of spray humidifiers. It is therefore to be noted that the centrifugal effect of the rotating disc is negligible as compared to the frictional effect of the disc in the liquid whereby the latter is lifted and thrown upwardly from its own surface. This device is highly efficient and silent and produces a spray which is dense and finely-divided so that the air passing therethrough is thoroughly permeated. These discs, in the preferred form of apparatus, are plane plates of sheet metal, so that there is nothing to become broken or wear out, nor are there nozzles and the like which must be periodically inspected for cleaning and repair. Inasmuch as the liquid is supplied in a static state at all times, no pumps or other hydraulic pressure apparatus are required, and the liquid may be supplied by any suitable means such as a constant level tank or float valve chest, or the liquid may be replenished periodically as used.

The air is forced through these successive screens of finely divided liquid by means of a suitable fan through a converging tube whereby its velocity is increased before it enters the spray chamber. An eliminator is provided at the discharge end of the apparatus for the purpose of removing the excess liquid vapor in the air as it passes therethrough. The liquid may be pure water for the purpose of humidifying or de-humidifying air or the liquid may be some disinfecting solution or the like for additionally purifying and conditioning the air. By employing naturally cool or refrigerated water, brine, or the like, the air is cooled, or by heating the water the air may be tempered and even heated before it is discharged for use. While one particular form of the apparatus of this invention is illustrated and described in the accompanying drawings and specification, it is to be understood that the invention is not limited to this precise form, but may be varied to suit particular conditions of use.

For a better understanding of the inven-

tion, reference is made to the accompanying drawings in which

Figure 1 is a longitudinal cross section of the apparatus of this invention;

Fig. 2 is an end view thereof;

Fig. 3 is a vertical cross section of the apparatus taken along the line 3—3 of Fig. 1; and

Fig. 4 is an enlarged cross section of the eliminator taken along the line 4—4 of Fig. 3.

In these drawings numeral 10 designates the base upon which the entire apparatus is mounted, this base being preferably placed upon a mat or cushion 11 of flexible material such as sponge rubber for the purpose of absorbing excess vibrations. The housing 12 which is mounted upon base 10 generally includes the humidifying chamber 13 and the motor and pump chamber 14. The bottom of the humidifying chamber 13 forms a tank for the liquid 15, this liquid being supplied in one form of the apparatus by means of a vertical tube 16 extending below the surface of the liquid and leading from a liquid container 17 which is supported in an opening in the top of housing 12 by means of a rubber sealing ring 18 or the like. This arrangement is a convenient expedient for supplying the liquid in apparatus of the smaller type and the arrangement of tube 16 and liquid container 17 maintains a constant level of the liquid 15 without additional apparatus. However, it is to be understood that the liquid may be supplied from a larger source of supply by means of float controlled level tanks or the like.

The motor and fan chamber 14 is provided with an exterior opening 18 through which air is drawn in large volume by means of multiple blade fan 19, this fan being attached to the shaft 20 of motor 21 which is mounted upon base 10 in any convenient manner. The delivery end of chamber 14 is constricted by means of converging plates 22 and 23 so that a greater velocity is imparted to the air flowing through opening 24 into humidifying chamber 13. The motor shaft is extended at 25 and the outer end thereof is journaled in a bearing 26 mounted upon a suitable support 27. This shaft 25 contains a series of spaced plane discs 28 which dip into the liquid 15. Accordingly as shaft 25 rotates, the discs rotate with it and the liquid is thrown upwardly from its own surface by virtue of the adhesion between the surfaces of the discs and the liquid. The liquid thus raised by each one of discs 28 is distributed across humidifying chamber 12 in the form of a plurality of dense screens of finely-divided liquid. The air introduced by the fan 18 through opening 24 passes successively through these screens of liquid whereby the air is humidified, dehumidified, cleaned, cooled, tempered or the like, before it passes into the chamber or room, the air of which is to be conditioned. In passing out of humidifying chamber 13 the air must traverse eliminator 29. This eliminator comprises a series of interlocking channel-shaped members 30 arranged in a manner shown in an enlarged cross section of Fig. 4. The flow of the moisture-laden air in passing through the eliminator 29 is abruptly changed in direction as indicated by the arrows shown in Fig. 4. This abrupt change in direction causes the excess moisture contained in the air to be deposited upon flat surfaces of channel-shaped members 30 so that the air which finally emerges from the apparatus does not contain excessive moisture which would be subsequently deposited on articles within the room in such a way as to be objectionable. The moisture collected by eliminator 29 subsequently flows into the tank containing liquid 15 as the lower ends of the channel-shaped members 30 comprising eliminator 29 extend into this liquid.

While a particular form of apparatus has been illustrated and described, this form being adapted especially for small installations, it is to be understood that the various connections between the liquid screen formed and discs 28, the motor 21 and the fan 19 may be made in any other way desirable and the liquid may be also supplied in any other convenient way. As pointed out above, the discs as they rotate do not depend upon the centrifugal action to raise the liquid inasmuch as a high speed of rotation is not employed nor desirable. On the contrary the adherence of the liquid to the surfaces of the discs 28 as they rotate causes the liquid to be silently lifted and sprayed from its own surface. The discs 28 are accordingly devoid of projections, nozzles, vanes or the like which are liable to become broken or clogged. The distribution of the liquid is consequently uniform and dense since it is produced by the smooth surfaces of the discs and is not dependent upon spaced cups, vanes or nozzles which tend to distribute the liquid in separate and relatively large globules or jets between which relatively large spaces occur, and which are noisy in operation.

The apparatus of this invention may be conveniently employed as an air humidifier or dehumidifier at normal temperatures but by cooling the humidifying liquid by means of refrigeration or merely by employing naturally cooled liquid, the air passing through the apparatus may be refrigerated for the purpose of lowering the temperature of the rooms or other spaces into which the air thus treated is eventually delivered. Conversely, the air may be preheated before introduction into the apparatus or the liquid tank may be fitted with steam heating coils, electric heating coils or the like whereby the air is tempered or even heated before delivery as well as being humidified or dehumidified.

The liquid supplied may be water or any other liquid and may contain disinfecting or aromatic ingredients or the like for conditioning the air in addition to the humidity factors. The form and fineness of the spray may be adjusted as desirable by altering the size and spacing of the discs and by increasing the speed of rotation of the discs or the velocity of the air current.

I claim:

1. In air conditioning apparatus, the combination of a chamber, said chamber providing a liquid-containing tank, a constant level liquid supply device, a rotatable shaft extending above the surface of the liquid, a plurality of spaced discs arranged on the shaft and partially immersed in the liquid, means for rotating the shaft and discs, means for producing a current of air through the chamber substantially parallel to the shaft, and a device for removing the excess liquid contained in the air.

2. In air conditioning apparatus, the combination of two chambers arranged adjacent one another, an air-admitting opening in the outer wall of the first chamber, a shaft extending longitudinally of both chambers opposite said opening, a fan on the outer end of said shaft adjacent said opening for drawing in air and forcing it through both of said chambers in series, a motor for driving said shaft mounted within the first chamber, said second chamber providing a liquid-containing tank, a plurality of discs mounted on said shaft within the second chamber and partially immersed in the liquid, and a device at the outer end of the first chamber for removing the excess liquid contained in the air.

3. In air conditioning apparatus, the combination of an air-moistening chamber having a body of liquid therein, a shaft extending longitudinally of the air-moistening chamber and having a plurality of discs mounted thereon partially immersed in the liquid, said shaft projecting beyond one end of the air-moistening chamber and having a centrifugal fan mounted thereon, a motor for driving said shaft, a dome-shaped casing mounted co-axially with said fan having an air-admitting opening opposite the end of said shaft and extending rearwardly into communication with the air-moistening chamber to receive the air from the fan and deliver it to said chamber, and a device at the opposite end of the air-moistening chamber for removing the excess liquid contained in the air.

4. In air conditioning apparatus, the combination of an air-moistening chamber, a motor chamber, a tank for holding a body of liquid in the air-moistening chamber, a motor in the motor chamber in close proximity to the air-moistening chamber, a shaft driven by the motor extending substantially throughout the length of both chambers and having a plurality of discs mounted thereon partially immersed in said body of liquid, the motor chamber having an opening in the end thereof, a fan adjacent the opening and driven by the motor for drawing in air and forcing it through the apparatus, a cone converging toward the air-moistening chamber for delivering the air thereto from the motor chamber in a direction substantially parallel to the shaft at relatively high velocity so as to prevent splash from the rotating discs from entering the motor chamber, and a device at the outer end of the air-moistening chamber for removing the excess liquid contained in the air.

In testimony whereof I affix my signature.

KARL D. PERKINS.