March 8, 1932. C. E. SCOTT 1,848,202

AIR CONDITIONING APPARATUS

Filed Sept. 24, 1930 2 Sheets-Sheet 1

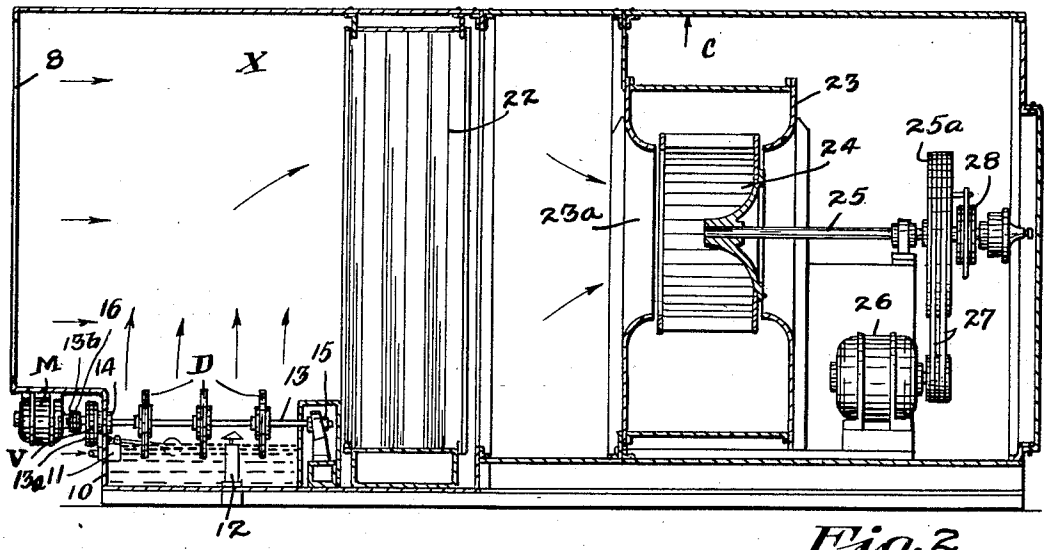

Fig. 2

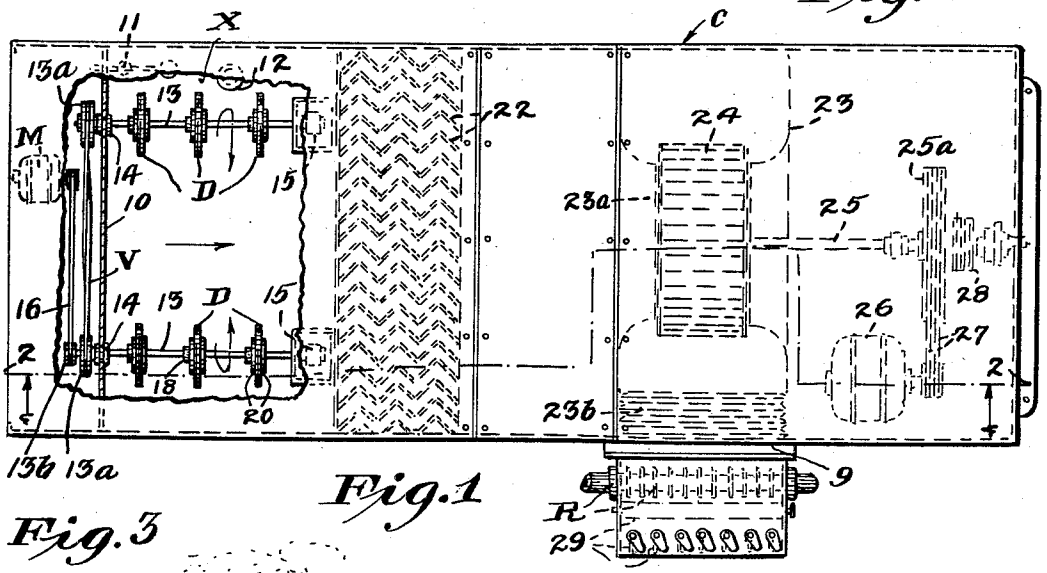

Fig. 1

Fig. 3

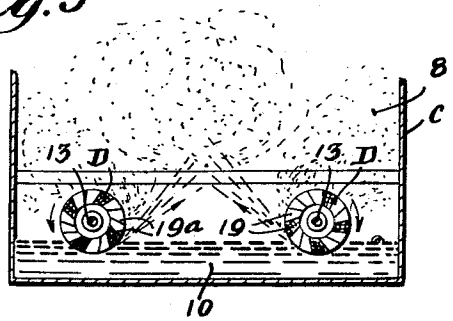

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Fig. 4

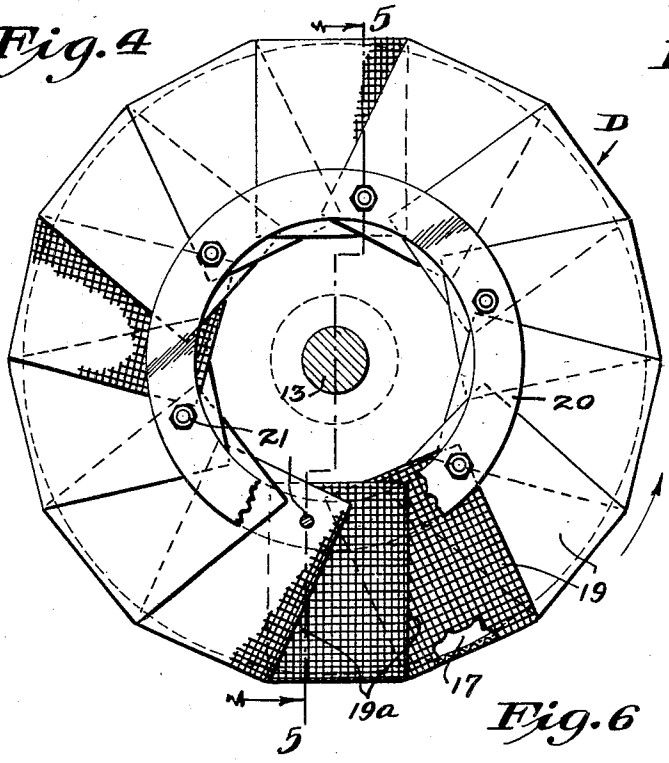


Fig. 5

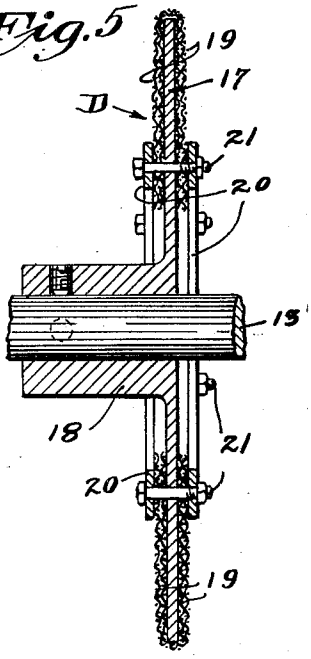


Fig. 6

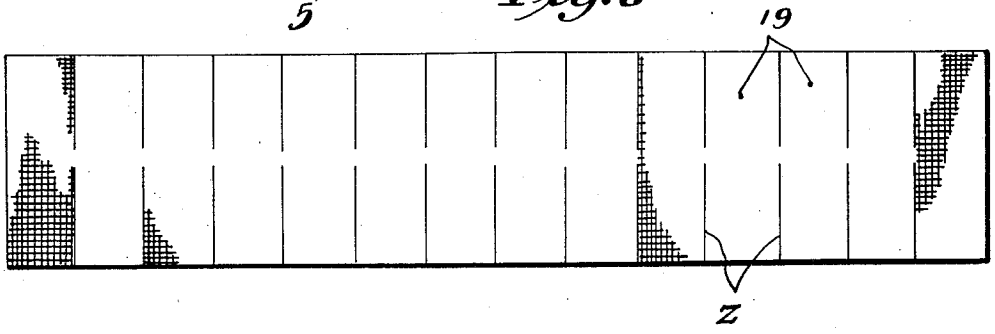


Fig. 7

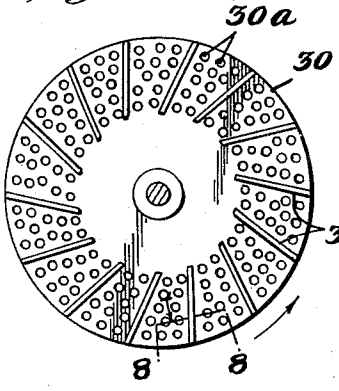
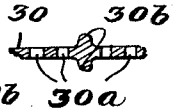


Fig. 8



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UNITED STATES PATENT OFFICE

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AIR CONDITIONING APPARATUS

Application filed September 24, 1930. Serial No. 484,018.

This invention relates to air conditioning apparatus of the type where a forced circulation of air is treated with moisture for cooling, washing or humidifying the air and is an improvement upon the invention disclosed in a co-pending application of Frank V. Burman and Archie S. Feinberg, entitled "Air conditioning apparatus", S. N. 456,899 filed on May 29th, 1930.

It is an object of this invention to provide an improved apparatus for uniformly conditioning air with moisture without requiring the use of manifolds, distribution pipes and a battery of spray nozzles such as are commonly employed in air washers and cooling systems extensively utilized at this time.

A further object is to provide a device of the type described which may be manufactured at relatively low cost, making the device available for use in homes, offices and shops and wherein the air is conditioned with moisture by rotary moisture distributing members partially immersed in a tank and which pick up, subdivide and centrifugally distribute particles of moisture, filling the cross sectional area of the air conditioning chamber.

Another object is to provide in a device of the class described, two oppositely disposed series of moisture distributing elements so related and positioned as to cause particles of water to be projected and centrifugally distributed from opposite sides of the chamber, the two opposing currents of moisture striking, disintegrating and causing the resultant production of a finely divided mist filling substantially the cross sectional area of the chamber.

Another object is to provide an improved and highly efficient moisture distributing element especially adapted for use in air conditioning apparatus and adapted to continuously pick up and subdivide water or liquid and to centrifugally precipitate small particles of moisture outwardly and upwardly.

Still a further object is to provide air conditioning apparatus wherein a series of cooperating rotary moisture distributing elements disposed within an air conditioning chamber and partially immersed in a tank containing liquid are so associated with a blower or fan as to produce a very thorough admixture of finely divided particles of moisture throughout the cross sectional area of the air conditioning chamber.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views, and in which:—

Fig. 1 is a plan view of an embodiment of the invention, many of the parts within the casing being shown in dotted lines, some portions of the casing being broken away to show the rotary moisture distributing elements;

Fig. 2 is a vertical section taken on the line 2—2 of Fig. 1;

Fig. 3 is a diagrammatical view showing the air conditioning chamber of the apparatus in cross section to illustrate the cooperation and function of the moisture distributing elements;

Fig. 4 is a detail cross section through one of the rotary shafts showing a preferred embodiment of moisture distributing element mounted thereon;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 4;

Fig. 6 is a plan view showing a sheet of netting and a manner in which it may be cut to enable it to be readily attached to the disk of my preferred moisture distributing element;

Fig. 7 is a plan view of a modified form of moisture distributing element, and

Fig. 8 is a fragmentary cross section taken on the line 8—8 of Fig. 7.

In the embodiment of the invention illustrated in Figs. 1 to 5 inclusive, the several elements of my apparatus are housed within an elongated rectangular casing C which has an enlarged air intake passage 8 in one end thereof and a discharge passage 9 in one of the side walls and adjacent the opposite end of the casing. The interior of the casing adjacent the air intake 8 constitutes an air conditioning chamber X, this chamber, as shown, comprising approximately one-third of the

volume of the casing. The bottom of the casing in chamber X may be shaped to provide a liquid tank 10, or if desired an independent tank may be mounted in the bottom of air conditioning chamber X. The level of the water or other liquid within tank 10 may be maintained at substantially a predetermined height by suitable means, such as a float valve 11 and as shown, an overflow pipe 12 is provided in the bottom of the tank.

Above the level of the liquid within tank 10 and extending longitudinally of the casing and the air intake passage I provide preferably at least a pair of rotary shafts 13 each journaled in suitable bearings 14 and 15 respectively, provided at the ends of the tank 10. It will be noted that the bearings for the shafts as well as the shafts are disposed above the level of water or liquid in the tank. The shafts 13 are preferably disposed horizontally and extend parallel and are suitably connected together at their outer ends for driving in unison and in opposite directions. As shown, shafts 13 are each provided with belt pulleys 13*a* over which a V-type endless belt V is trained, said belt being crossed to reverse the driving of the two shafts. One of the shafts 13 has fixed to the outer extremity thereof a second belt pulley 13*b* which is suitably connected for driving, such as by an endless belt 16 with an electric motor M. Motor M may be conveniently mounted on the horizontal shoulder of an off-set portion at the air intake end of the casing, as clearly shown in Fig. 2.

A series of highly efficient moisture distributing elements D are fixed to each of the rotary shafts 13 and in the preferred form of the invention, as clearly shown in Figs. 4 and 5, each moisture distributing element comprises a relatively thin disk 17 which may be constructed of some non-corrosive metal, such as aluminum, having an axial hub 18 which, if desired, may be integrally constructed therewith. Fine mesh netting, such as metal screen is secured to the two faces of each disk 17 arranged circumferentially and extending from the peripheral edge for some distance inwardly. I prefer to wrap the netting or screen about the edge of the disk, doubling the same in the manner illustrated in Figs. 4 and 5. Preferably the netting or screen at each side or face of the disk is slit or formed of separate sections, the edges numbered 19*a* thereof being successively overlapped.

A convenient manner of constructing and attaching the netting to the disks is partially illustrated in Fig. 6. An elongated rectangular sheet 19 of screen is provided of somewhat greater than twice the width of the desired radius of the netting surface and this sheet is slit along each of its longitudinal edges on a series of parallel lines Z which extend perpendicular to said longitudinal edges and terminate short of the longitudinal center line of the sheet. The sheet so slit may then be wrapped around the periphery of disk 17 and the slit portions or tongues bent inwardly against the surfaces of the disk, successive tongues being overlapped to leave the edges 19*a*. These edges assist in picking up and forcibly distributing liquid, and may, if desired, extend radially with respect to the disk, although it is simpler and more convenient to incline the same slightly from the radial position.

The netting or screen may be secured in operative position on the faces of the disk in any suitable manner, and as shown, I provide a pair of clamping rings 20 for each disk, disposed at opposite sides thereof and engaging the inner and free edges of the turned flanges or tongues 19. The rings 20 may be clamped together by clamping bolts 21 which may pass through the screen as well as the disk 17 if desired.

Directly behind the air conditioning chamber X of my apparatus a suitable moisture eliminator is mounted extending substantially the full height of casing C. This eliminator may comprise the conventional zigzag plates 22 extending vertically within casing C and while eliminator plates having six bends are illustrated; with my device, because of the very thorough treatment of the air with moisture, it has been found that a four bend eliminator plate is all that is required and that the apparatus will have practically as high a capacity with such a plate and with the blower slowed down somewhat from the usual speed.

Within the end of the casing C opposite from the air conditioning chamber X a relatively large blower is mounted having a blower casing 23 which is disposed transversely of casing C and has its intake 23*a* disposed rearwardly of the delivery end of the moisture eliminator and which has its discharge communicating with the discharge passage 9 through a tubular flexible skirt 23*b* which may be constructed of canvas or other flexible material.

The impeller 24 of the blower is fixed to a substantially horizontal shaft 25 mounted in suitable bearings within casing C and extending longitudinally of said casing. A motor 26 is provided within the casing for driving the impeller. As shown, impeller shaft 25 is provided with a large pulley 25*a* having a variable speed connection with shaft 25. This variable speed connection may be, if desired, a hydraulic clutch mechanism designated as an entirety by the numeral 28 for varying the slippage of pulley 25*a* relatively to the shaft 25 thereby varying the speed of the impeller. Pulley 25*a*, as shown, is connected for driving with the pulley of the motor by means of a pair of V belts 27.

A rectangular casing or hood 30 is connect-

ed with the discharge passage 9 of casing C and as illustrated, a radiator or refrigeration coil R is mounted therein and outwardly of said radiator two series of crossed deflectors 23 are pivotally mounted by means of which discharged air may be distributed as desired.

Operation

In operation the moisture distributing elements and the blower will be driven by the motors M and 26 respectively. When looking at the moisture distributing elements from the intake end of the casing, the right hand elements will be revolved in clock-wise direction and the left hand series of elements in counter clock-wise direction. The elements, it will be noticed, are immersed in the water or other liquid in tank 10 for some distance, but usually, however, for a depth less than the width of the netting 19. Each moisture distributing element in its rotation picks up small particles of liquid between the meshes of the netting or screen, the meshes of said screen subdividing the liquid as it is picked up and capillary attraction and surface tension tending to retain the liquid within the meshes and between the outer surface of the screen and the adjacent face of the disk until centrifugal force is adequate to throw off or precipitate the moisture from the disk.

Fig. 3 illustrates the manner in which the moisture is distributed within the air treating chamber. It will be seen that particles of moisture are thrown off from the two cooperating series of disks in the direction of the center of the air conditioning chamber and also upwardly. The currents formed by the precipitated particles from the opposing series of disks strike with violence, causing the particles to be further broken up and subdivided and resulting in the formation of a dense cloud of finely divided mist above the level of tank 10. By far the greater portion of the liquid picked up by the rotary distributing elements is thrown off before it has moved through a quarter of a revolution, as clearly illustrated in Fig. 3. However, very small amounts of moisture remain in the netting or interstices and cells of the same and mintue particles are thrown off at the top and outer edges of the elements D and in the direction of the side walls of the casing C, setting up a finely divided mist adjacent said walls, as indicated in Fig. 3. This auxiliary moisture distribution cooperating with the substantial distribution and precipitation of moisture at the center of the casing permeates and substantially fills the entire cross sectional area of the air treating chamber above tank 10.

The influence and cooperation of the blower is important in that as the mist forms, because of its communication with the air treating chamber through the eliminating unit at a height above the tank 10, the mist and moisture is spread horizontally through the air conditioning chamber and prevented from escaping through the air intake passage and is drawn through the eliminating unit and into the intake of the blower casing.

While I have illustrated the moisture distributing elements of the two series as being aligned or opposed, in certain cases I prefer to stagger the same slightly, still obtaining the effect of the opposing currents of moisture striking each other and subdividing the particles, but obtaining the additional or increased effect of more thoroughly filling the air conditioning chamber with a fine spray and atomized liquid.

In the rotation of the several moisture distributing elements the lapping edges 19*a* of the screen or netting which extend substantially radially with respect to the disks 17 of the several elements pick up and remove portions of liquid, most of the said removed liquid during the rapid rotation of the disks lodging in the interstices or minute chambers of the netting and being rapidly precipitated by centrifugal force.

In Figs. 7 and 8 a modified and somewhat different form of moisture distributing element is illustrated comprising an integral disk 30 constructed of thin material, such as sheet metal provided with a multiplicity of small, closely spaced, apertures 30*a* therethrough which take the place of the small chambers or cells in the mesh of the netting in the preferred form of the moisture distributing elements. The disk 30 is also provided on each of its faces with a series of ribs 30*b* which are directed almost radially, extending from the circumference of a circle which is spaced from the hub of the disk, to the peripheral edge of the disk. The said ribs, in the operation of the modified form, function in the manner of the edges 19*a* formed by the overlapping portions of the tongues or flanges of the screen in the preferred form, to pick up small portions of liquid and precipitate the same.

From the foregoing description it will be seen that I have provided a comparatively simple and inexpensive air conditioner dispensing with the use of elaborate manifolds, conduits and batteries of spray nozzles, and relying upon the cooperation of a series of rotary moisture pick-up and distributing elements which are supplied with moisture from a tank or other suitable means. It will further be seen that because of the structure of the moisture distributing elements in combination with the association of two opposed series, very finely divided particles of moisture are projected, filling the cross sectional area of the air treating chamber. Attention is further called to the opposing currents of moisture particles centrifugally distributed by the two series of elements which strike

with violence, disintegrating and subdividing to form a fine mist above the level of the liquid in the tank.

It will further be noted that the combination of the moisture distributing elements which rotate in substantially vertical planes with a means for circulating air at an angle to the distribution of water causes the entire air treating chamber to be thoroughly filled with the mist and minute particles of water. All entering air therefore is uniformly treated and its temperature may be quickly reduced and the unevaporated particles removed from the air by passage of the air through the eliminator unit 22. The air is of course drawn through the blower casing and discharged through the hood wherein the radiator and deflectors are mounted. It will, of course, be seen that the air can be tempered or chilled by contact with the radiator R.

It will, of course, be understood that various changes may be made in the form, details, proportions and arrangement of the parts, without departing from the scope of applicant's invention, which, generally stated, consists in a device capable of carrying out the objects above set forth and in the novel parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:—

1. In air conditioning apparatus, a rotary moisture distributing element comprising a substantially imperforate disk having at least one face thereof partially covered with a netting adapted to divide and pick up small particles of liquid and means for driving said element for centrifugally distributing and subdividing said particles.

2. In air conditioning apparatus, a rotary moisture distributing element comprising a disk having at least one face thereof provided with a multiplicity of closely spaced interstices or cells wherein liquid is adapted to lodge and be divided, said face also having a series of projecting edges extending from the central portion of the disk outwardly to points adjacent the periphery.

3. In air conditioning apparatus, a rotary moisture distributing element comprising a substantially imperforate disk having at least one face thereof partially covered with flaps of finely divided netting, said flaps being substantially circumferentially arranged and having lapping edges.

4. In air conditioning apparatus, a chamber, means for setting up a circulation of air through said chamber, a receptacle for containing liquid mounted in said chamber, a rotary moisture distributing element mounted in said chamber and having a portion of its lower periphery immersed in the liquid within said receptacle, said moisture distributing element comprising a substantially imperforate disk and a covering of finely divided netting on at least one face thereof, said netting in combination with said disk defining a multiplicity of closely spaced interstices or cells wherein liquid is adapted to lodge and be divided and means for driving said moisture distributing element to cause finely divided particles of liquid to be precipitated within and against the walls of said chamber by centrifugal force.

5. In air conditioning apparatus, a chamber, means for setting up a circulation of air through said chamber, a receptacle for containing liquid mounted in said chamber, a rotary moisture distributing element mounted in said chamber and having the lower portion of its periphery immersed in the liquid within said receptacle, said moisture distributing element comprising a substantially imperforate disk or plate and a covering of finely divided netting secured to at least one face of said disk or plate, said netting comprising flaps which are circumferentially arranged and have lapping edges adapted to assist in the precipitation and picking up of moisture and means for rotating said element at comparatively high speed.

In testimony whereof I affix my signature.

CLIFFORD E. SCOTT.