April 23, 1946. A. S. FEINBERG 2,399,108

LIQUID SPRAY DEVICE

Filed July 30, 1942

Fig. 1.

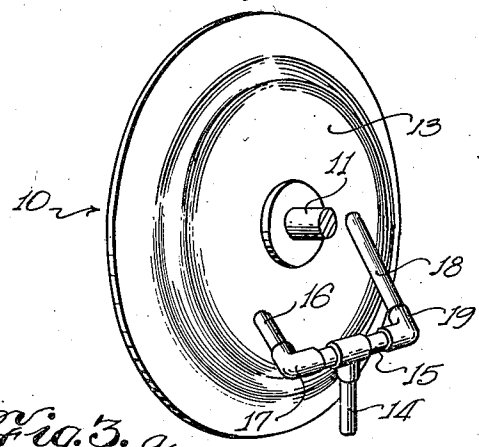


Fig. 2.

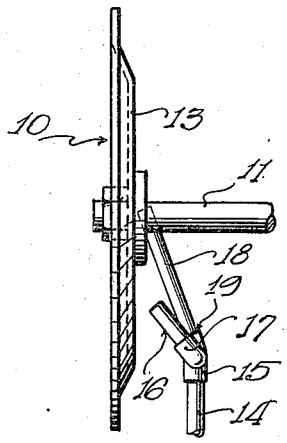


Fig. 3.

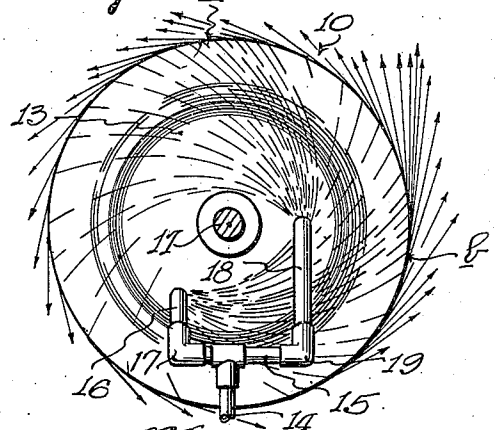


Fig. 4.

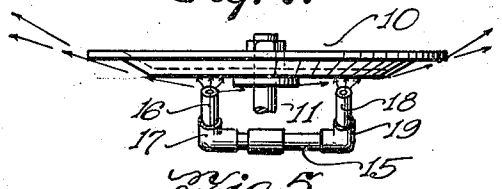


Fig. 5.

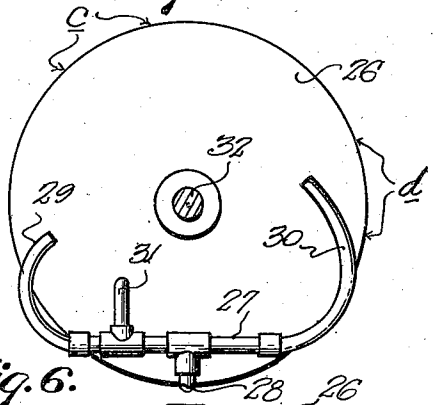


Fig. 7.

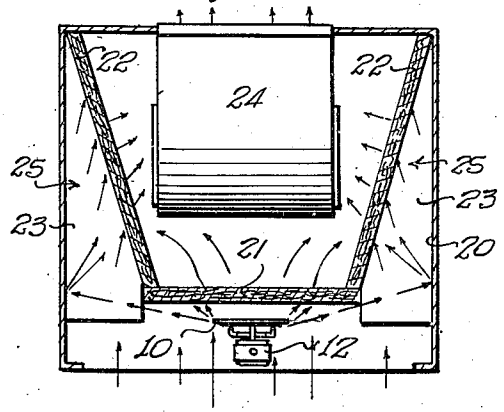
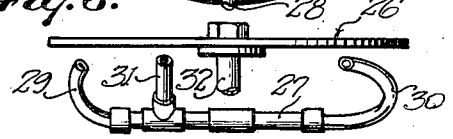


Fig. 6.



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LIQUID SPRAY DEVICE

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11 Claims. (Cl. 299—63)

This invention relates to air cooling apparatus and equipment and it has particular reference to liquid spray devices used in connection with such equipment.

The principal object of the invention is to produce as a liquid spray device, a rapidly revolving disc, against either face of which is directed a plurality of streams of liquid under pressure, and to so dispose the ejector nozzles that they may be individually or collectively moved relative to the face of the disc so that the point of impingement of the water thereon may be changed, whereby to predetermine the points of maximum liquid discharge.

Another object of the invention is to provide a spray device especially adaptable for use in connection with evaporative air cooling or conditioning apparatus of special design whose performance depends largely upon the manner in which the water is projected into the area of influence of the air constrained to pass through the apparatus. In other words, the invention provides the sole medium by which water is projected tangentially from the disc and into the path of air constrained by blower means in an evaporative cooler to effect maximum saturation of all of a series of angularly related filter pads.

With the foregoing objects as paramount, the invention has particular reference to certain salient features of construction and arrangement of parts, to become manifest as the description proceeds, taken in connection with the accompanying drawing, wherein:

Figure 1 is a perspective view of a spray device constructed according to the present invention.

Figure 2 is a side elevational view thereof.

Figure 3 is a rear view of the invention showing the directions taken by the liquid as it is discharged from the disc.

Figure 4 is a plan view showing the forward trend of the liquid as it is discharged into the influence of the air stream created by the blower.

Figure 5 is a slightly modified form of the invention, showing a flat disc and an increased number of spray nozzles.

Figure 6 is a plan view of Figure 5, and

Figure 7 is a more or less diagrammatic plan view, showing one application of the invention.

The present invention is primarily designed to meet the requirements of the air cooling apparatus described and claimed in my co-pending applications Serial Nos. 415,171, which has matured into Patent No. 2,296,155, and 443,389, wherein a common means is provided for breaking up the water into an outwardly directed spray so that at fixed points in the radius, the discharge will be increased in volume. Through this arrangement, a plurality of filter pads or mats arranged at a series of relative angles will, through the aid of baffles, receive a substantially uniform supply of water and will therefore increase the cooling effect on the air passing therethrough.

Continuing with a more detailed description of the drawing, reference is primarily made to Figures 1 to 4 and 7 wherein is shown a disc 10 mounted on a shaft 11 which latter is driven by a motor 12. This disc is so formed that a raised central portion 13 is produced.

Attending the rear face of the disc 10 is a system of nozzles which, in the showing in Figures 1 to 4 consists of a riser 14 and cross-head 15, to one end of which latter a short section of pipe 16 is connected by means of an elbow 17. A similar but longer section of pipe 18 is connected by an elbow 19 to the opposite end of the cross-head 15. These pipe sections have restricted outlet openings and are preferably directed upwardly at an angle relative to the face of the disc 10 as shown to avoid splashing of water as the same impinges the rapidly revolving disc. The screw threaded connections permit angular adjustment of the nozzles.

In Figure 3 the arrows show the paths taken by the liquid as it is discharged against the rotating disc. It will be observed that the water is not distributed over the surface of the disc in a sheet of uniform depth but rather, the volume of discharge is greater at points *a* and *b* on the disc. The force of gravity is taken into consideration in so arriving at the points on the disc where the water in maximum volume leaves the same. Other factors include the rotative speed of the disc and the distance the water is to travel before it arrives at its prearranged point for distribution along the respective filter pads it is required to saturate.

In Figure 7 is shown the preferred application of the invention and illustrates the object in providing for outward discharge with portions thereof in increased volume. In this figure a schematic plan view of an evaporative cooling unit is represented. Within the cabinet 20 is arranged a rear mat 21, parallel with the front and rear of the cabinet. Joined to the sides of this mat are two angular side mats 22 which, combined with the side walls of the cabinet, form substantially triangular air and moisture receiving chambers 23 in which the air is brought into intimate contact with particles of moisture, effective in precooling the air even before it is constrained to pass

through the myriads of interstices of the side mats 22, in which it is thoroughly scrubbed and further cooled preparatory to its discharge from the cabinet by the blower 24.

The particular positioning of the nozzle in relation to the axis of the disc and to each other predetermines the point on the perimeter of the disc from which the greater volume of water is projected as well as the quantity of water projected from these points. Of course, the supply to the nozzles determines the latter but variations in such supply simply mean that corresponding variations occur in the volume discharged at the predetermined points on the disc as specified. The water supply must at all times be in such volume as to insure precipitation by gravity of sufficient water to saturate the filter pad 21 while the water thrown off the disc above its axis is caught up by the triangular baffles 25 at their extended ends and, due to the fact that these baffles 25 are located near the top of and inclined toward the side mats 22, the water falling on the baffles will flow into the mats near their tops and will filter downwardly therethrough to saturate the same. Meanwhile, air is constrained by the blower 24 to flow through the mats, as described.

The water projected onto the disc is propelled therefrom by the rapidly rotating disc tangentially in the plane of the surface on which it is deposited by the nozzles, but due to such rotation, combined with surface tension and gravity, there is produced a slight curve in the streams on the disc. Hence the requirement for adjustability of the nozzles, to properly orient the streams with respect to their objective, i. e., the extended ends of the baffles 25. Another factor, which of course has nothing to do with the construction and operation of the disc but which is important in the general construction and function of the cooler, is the influence on the projected streams of water by the air currents generated by the blower. These tend to force the streams towards the mat 21. This is a desideratum for proper performance in that the baffles 25 may be made shorter and may still catch the water because of the inward inclination of the projected streams, as illustrated in Figure 7. There is no object in operating the spray device in the absence of air currents.

In practice and to insure the best results, the spray disc 10 and its motor are mounted near the top and midway between the edges of the rear pad 21.

In Figures 5 and 6, substantially the same principle is shown but in this modified example, the disc 26 is flat and the number of nozzles is increased. A cross-head 27 is provided on a riser 28 and carries on one end an elbow in which is mounted a short curved nozzle 29 while a longer and similarly curved nozzle 30 is mounted on the opposite end. An intermediate and shorter nozzle 31 projects water onto the face of the disc at a point below that of the nozzle 29.

As the shaft 32 is rotated, water from the series of nozzles will impinge the rapidly rotating disc 26 and will be discharged outwardly in more or less uniform volume except at two points on the disc, approximating the positions indicated by characters *c* and *d*, at which points the discharge is in greater volume than that from the remainder of the disc but in substantially equal volume at these two points.

It will be seen that the distance from the nozzle 29 to the point *d* on the disc 26 is greater than from nozzle 30 to the point *c*, which points are arbitrarily fixed as the discharge for optimum results. Hence, it is necessary to augment the discharge of nozzle 29 by that of the intermediate nozzle 31 and the likelihood that any excess water will leave the disc below the discharge of nozzle 30 is unimportant if there is sufficient discharge at the point on the disc indicated at *d*, projected upwardly so that an ample supply of water at least equal on both sides will be caught by the baffles, as described.

In the foregoing description, the nozzles are described as being mounted to project water on the face of the discs nearest the operating motor but it is understood that in some instances it may be practicable to direct the water against the face of the disc opposite the motor. Moreover, it is not intended that the invention be limited to any specific cross sectional shape of the disc.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

It has been found in practice that the relative spacing of the nozzles with the surface of the disc is a factor which, if even slightly altered, changes the angle of incidence or deflection of the liquid and determines to an important degree the angle of deflection or discharge of the separate streams of liquid. This is essential especially in the preferred application of the invention, that is, in employing it as a means for saturating two separate but complementary filter mats in an evaporative cooling unit. By curving certain nozzles of the spray device, it is found that liquid in greater volume is propelled from the disc by the nozzles than falls therefrom by the force of gravity.

What is claimed is:

1. In an evaporative cooling unit, a liquid spray device including a substantially flat disc and a plurality of nozzles in differentially spaced relation to the axis of said disc and disposed at an acute angle with respect to the face thereof for projecting onto said disc face a plurality of streams of liquid and means for rapidly rotating said disc whereby liquid will be discharged therefrom radially but in increased volume at a plurality of predetermined points in the radius of said discharge.

2. In an evaporative cooling unit, a liquid spray device, including a substantially flat rotatable disc, a plurality of liquid spray nozzles differentially spaced in relation to each other and to the axis of said disc and directed toward and at an acute angle with respect to one face of said disc, means to effect angular adjustment of said nozzles relative to each other and to the face of said disc, and means for rotating said disc.

3. In an air cooling unit, a liquid spray device comprising a substantially flat rotatable disc, means to supply liquid to said disc including a plurality of liquid spray nozzles differentially spaced in relation to the axis of said disc and inclined toward one face thereof whereby the discharge of said nozzles will be propelled outwardly from said disc but in increased volume at predetermined points on said disc, means to effect angular adjustment of said nozzles to each other and to the face of said disc and means for rotating said disc.

4. In an air conditioning machine, a liquid spray device comprising a substantially flat disc mounted on a shaft, means for rotating said shaft, a liquid riser and cross-head, a plurality of

liquid discharge nozzles carried by said cross-head, differentially spaced with respect to each other and to the axis of said disc and adjusted to direct liquid under pressure at an acute angle against one face of said disc at different points for discharge thereby in an outward direction and in increased volume at predetermined points in the radius of said disc discharge.

5. In an evaporative cooling unit, a liquid spray device, including a substantially flat disc mounted on a shaft, means for rapidly rotating said shaft, a liquid riser and cross-head, a plurality of liquid discharge nozzles carried by said cross-head and differentially spaced with respect to the disc axis, means for adjusting said nozzles so as to direct liquid under pressure at an acute angle against one face of said disc at different points for discharge thereby outwardly and in increased volume at predetermined points in the radius of said disc discharge, and to effect a change in the relationship of said nozzles with each other and with the face of said disc to vary the points of maximum liquid discharge.

6. In an air cooling machine, a liquid spray device including a substantially flat disc mounted on a shaft, means for rotating said disc and separate means differentially spaced from the disc axis for directing at an acute angle against one face of said disc a plurality of streams of liquid for discharge thereby outwardly.

7. In an air cooling unit, a liquid spray device including a substantially flat disc arranged for rapid rotation, differentially spaced means for directing obliquely against the face of said disc a plurality of streams of liquid under pressure whereby to effect outward discharge thereof from the periphery of said disc and in increased volume at two predetermined points thereon, and means for rotating said disc.

8. In an evaporative cooling unit, a liquid spray device including a substantially flat disc arranged for rapid rotation, a system of differentially spaced nozzles disposed to project streams of liquid slantingly against a face of said disc, certain of said nozzles being curved to project said liquid substantially against the direction of rotation of said disc, and means for rotating said disc.

9. In an evaporative cooling unit having filter mats disposed in different relative positions therein, means for spraying water comprising a substantially flat disc, means for rapidly rotating said disc, a pair of jets differentially spaced apart for directing water under pressure slantingly against the rear face of said disc to effect centrifugal discharge of water therefrom but to concentrate portions of said discharge in two predetermined directions to effect saturation of said filter mats.

10. In an air cooling machine having a blower therein, a liquid spray device including a substantially flat disc, nozzles for directing a plurality of separate streams of liquid onto the face of said disc for discharge in at least two preselected points on the periphery thereof into the air stream of said blower, said discharge being predetermined in accordance with the angulation and the relative spacing of said nozzles in relation to the radius of said disc, its speed and diameter, and means for rotating said disc.

11. A liquid spray device including a substantially flat disc, means for rotating said disc and adjustable means disposed in angular relationship with one face of said disc for projecting streams of liquid against the disc to be discharged therefrom outwardly in increased volume at at least two preselected points on the periphery of said disc, determinate upon the angularity of said streams in relation to the plane and radius of said disc, and the diameter and rotating speed of the latter.

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