March 31, 1959 B. F. WHEELER 2,879,979

EVAPORATIVE WHEEL

Filed Nov. 8, 1956 3 Sheets-Sheet 1

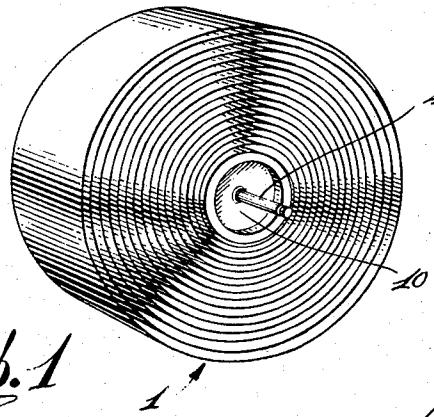


Fig. 1

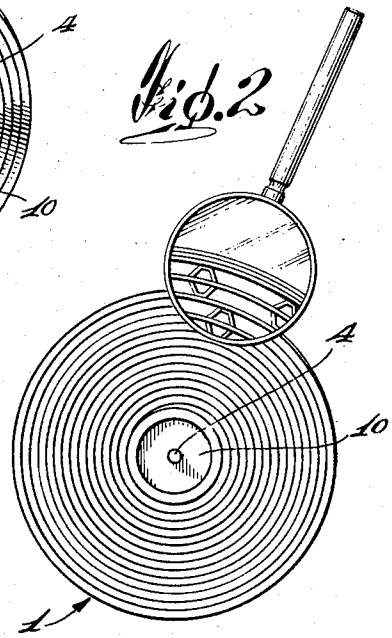


Fig. 2

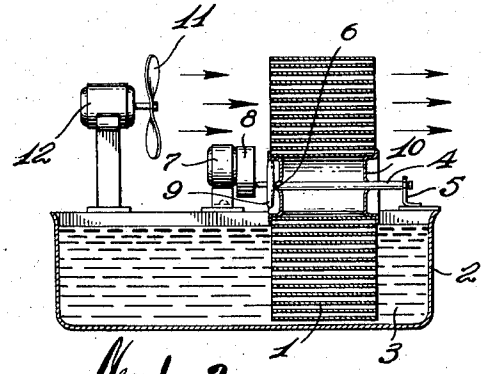


Fig. 3

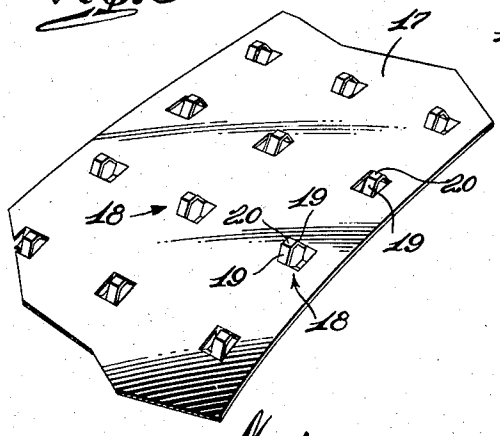


Fig. 4

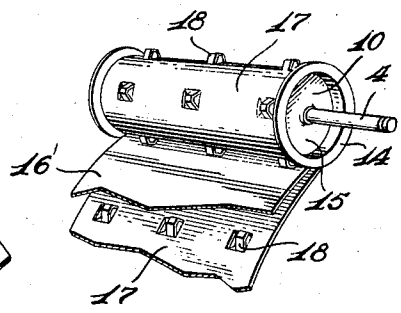


Fig. 5

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EVAPORATIVE WHEEL

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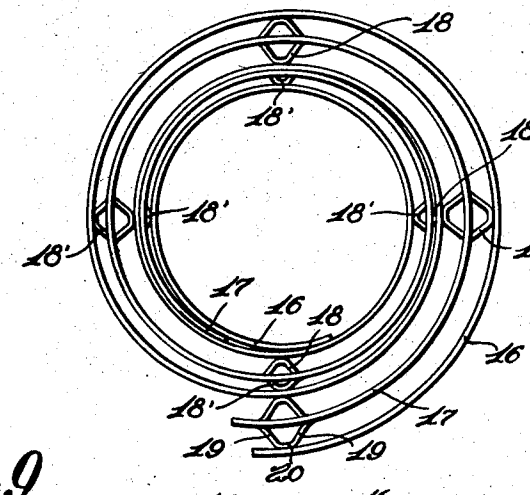


Fig. 6

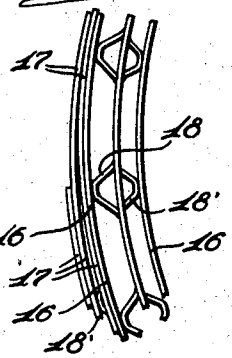


Fig. 9



Fig. 10

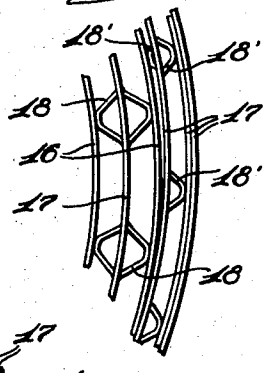


Fig. 7



Fig. 8

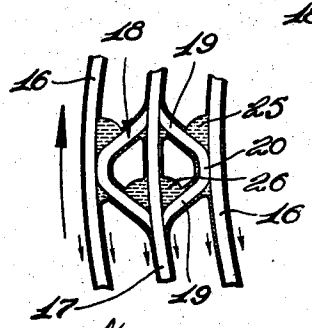


Fig. 11

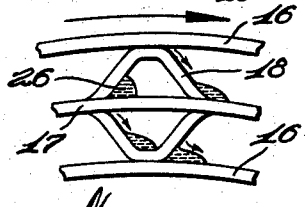


Fig. 12

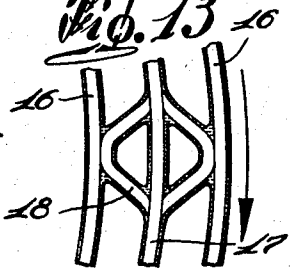


Fig. 13

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EVAPORATIVE WHEEL

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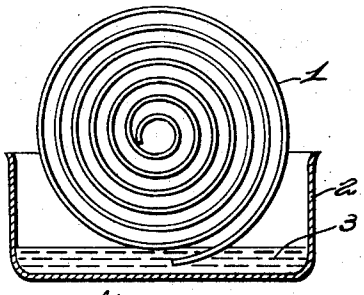


Fig. 14

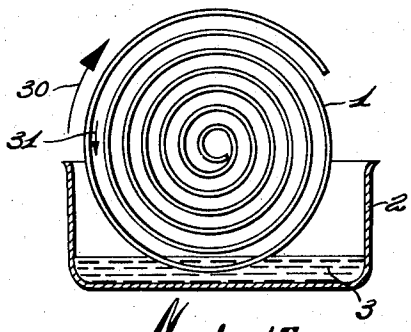


Fig. 15

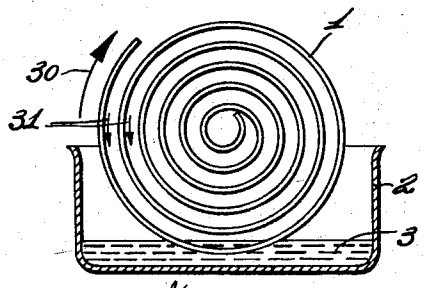


Fig. 16

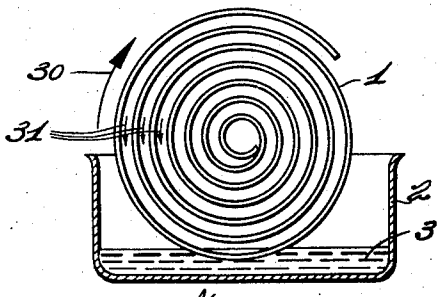


Fig. 17

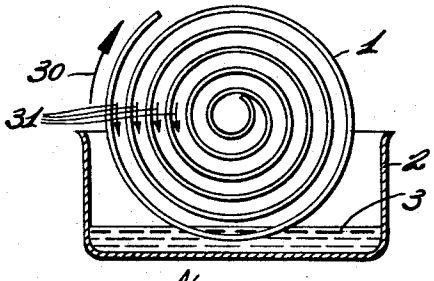


Fig. 18

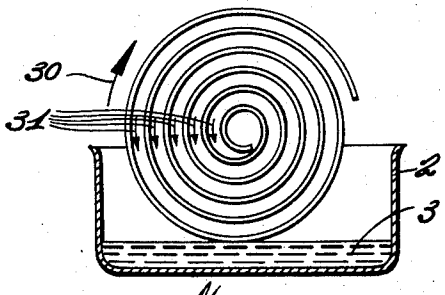


Fig. 19

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United States Patent Office 2,879,979 Patented Mar. 31, 1959

2,879,979

EVAPORATIVE WHEEL

Byrhl F. Wheeler, Montreal, Quebec, Canada

Application November 8, 1956, Serial No. 621,086

1 Claim. (Cl. 261—92)

The present invention relates to humidifying apparatus, and more particularly to an improved evaporative wheel adapted to be used in such humidifying apparatus.

Evaporative wheels or fluid treating wheels, which embody spirally wound sheets of strips forming a drum or rotor used for contacting a liquid with a gas or other fluids, are known.

In known wheel constructions, the spirally wound strips have to be maintained together as a rigid unit by means of U-shaped holding elements, surrounding the wheel, and attached to the core of the wheel. Said holding elements form obstructions to the free passage of the air through the wheel, and cause undue vibration and noise during operation of the humidifier.

Moreover, in known humidifiers of the character described, in which an evaporative wheel is partially immersed in a water containing tank or reservoir, it frequently happens that when the water level within the reservoir is relatively low, and only part of the wheel is wetted by the water, the central part of the wheel remains dry and is inoperative, thereby considerably reducing the evaporative efficiency of the humidifier apparatus as a whole.

Another serious problem arising in known humidifier constructions, is the fact that, the evaporative wheel is normally made of sheet metal which becomes rusty or corroded with use, and difficult to clean, resulting in an unsanitary condition. When the sheets for making the evaporative wheel are made of metal, there is the problem of expansion and contraction of the metal sheets due to the fact that said sheets have lengths of as much as 100 feet. The expansion and contraction effects create a serious problem rendering the evaporative wheel noisy even after a short period of use.

Accordingly, the general object of the present invention is the provision of an improved evaporative wheel, for use in humidifiers, which is so constructed as to obviate the above noted disadvantages.

An important object of the present invention is, the provision of an evaporative wheel in which, one of two spirally wound strips of sheet material is provided with projections extending radially outwardly from both faces of said one sheet, and so formed, as to provide an outside contact surface of substantial area, adapted to contact the other sheet and be secured thereto, to thereby form a rigid wheel unit without the requirement of U-shaped holding elements or other fastening means, thereby eliminating obstructions to the air passage through the wheel and consequently noisy operation. Thus the projections serve as fastening means, as well as, spacer members for the convolutions of the strips.

Still another important object of the present invention is, the provision of an evaporative wheel of the character described, in which the convolutions of the sheet material are made of a synthetic plastic material, preferably polyethylene, which is easily cleaned and maintained in a sanitary condition and which does away with the problem of expansion and contraction.

Still another important object of the present invention is, the provision of an evaporative wheel of the character described in which, the projections mentioned above have such a shape as to retain a reserve of liquid therein, which is allowed to flow down the surface of the wheel convolutions, and reach the inner layers of the wheel, so as to wet the entire operative surface of the wheel, even when the level in the reservoir is relatively low and only the outer marginal portion of the wheel is immersed therein.

The foregoing and other important objects of the present invention, will become more apparent during the following disclosure and by referring to the drawings in which:

Figure 1 is a perspective view of the evaporative wheel;

Figure 2 is an end elevation of the same showing part thereof on an enlarged scale;

Figure 3 is a longitudinal section of a humidifier in which an evaporative wheel according to the present invention is used;

Figure 4 is a partial perspective view of a strip of sheet material provided with struck-out projections;

Figure 5 is a perspective view of the core of the wheel, on which the strips of sheet material are partially wound;

Figure 6 is a diagrammatic partial end elevation of the central part of the convolutions of the wheel;

Figure 7 is a partial diagrammatic end elevation of the peripheral portion of the wheel, in the part thereof where the projections separating the spirally wound sheets start to decrease in height;

Figures 8, 9 and 10 are similar end elevations of the successive parts of the wheel adjacent and following the part shown in Figure 7;

Figure 11 is a partial end elevation of the middle part of the wheel, showing how the water is retained by the projections when that part of the wheel moves upwardly from the water reservoir;

Figure 12 is a similar partial elevation taken when that part of the wheel moves horizontally at the top of the wheel;

Figure 13 is a similar elevation taken when that part of the wheel is moving downwardly towards the water reservoir; and

Figures 14 to 19 inclusive illustrate, in a diagrammatic manner, how the water taken up by the peripheral part of the wheel, gradually moves towards the center or core part of the wheel, and finally wets the entire operative surface of the same.

Referring now more particularly to the drawings, in which like reference characters indicate like elements throughout, the evaporative wheel according to the present invention, which is shown at 1 in Figure 1, is adapted to be used in conjunction with a humidifier unit, the essential components of which are shown in Figure 3. Said humidifier unit comprises a reservoir 2 for containing water 3, in which is partially immersed the evaporative wheel 1, provided with a shaft 4, journalled on a bracket 5 at the front end of the humidifier and terminating short of the rear face of the wheel 1 as shown at 6. The evaporative wheel 1 is rotated at a slow speed, by means of an electric motor 7 and speed reducing unit 8, which drives a supporting wheel 9 engaging a cup shaped member 10, forming part of the core of the evaporative wheel 1. Air is passed through the upper portion of the wheel, by means of a fan 11 driven by an electric motor 12. The air which passes through the spaced convolutions of the wheel 1, comes in contact with the wetted surface of said convolutions, and evaporates at least part of the water and is humidified thereby.

The core of the evaporative wheel 1 consists of the shaft 4, previously described, on which are mounted two spaced

cup shaped members **10** of circular contour, provided with an annular flange **14**, and so mounted that, the recess **15** of each cup shaped member faces outwardly of the wheel, as shown in Figures 3 and 5. The shaft **4** projects from one cup shaped member at one end thereof, and terminates at the other cup shaped member at its other end.

The evaporative part of the wheel, is constituted by at least two strips **16** and **17** of sheet material, wound around the core, so as to form a plurality of spaced spiral convolutions. Said strips **16** and **17** are preferably made of a synthetic resin sheet material such as polyethylene. The strip **16** has a smooth surface on both faces thereof, and is without any holes or projections, while the strip **17** is provided, at spaced areas along its length and width, with struck out projections **18** which extend radially outwardly from the opposite faces of said strip, as clearly shown in Figure 4. Each projection **18** has a dome shape of substantially trapezoidal cross-section, and consists of two inclined and converging straight portions **19**, integral with the main body of the sheet, and joined at their upper end by means of a transverse substantially flat portion **20**. The projections **18**, therefore, consist of a strip portion integral with the strip **17** at both ends, and cut out from said strip **17** along the longitudinal edges thereof. The projections **18** are preferably made by a pair of oppositely moving adjacent dies, working from opposite faces of the sheet material, so as to form oppositely extending projections which are adjacent to each other, as clearly shown in Figure 4.

The outside surface of the substantially flat portion **20**, has an area large enough to make good contact with the face of the smooth and continuous strip **16**, as clearly shown in Figure 6, such that said outside surface of the portion **20** may be secured or fastened to the strip **16**, by means of a glue or adhesive. But in the preferred method of constructing the wheel according to the present invention, and when the strips **16** and **17** are made of polyethylene, said strips are sprayed with a polyethylene solvent as they are wound on the core of the evaporative wheel, whereby the top surface layers of the strips **16** and the outer surface of the portions **20** of the projections **18** become sticky, and will adhere to each other and be cemented together.

According to still another method of securing the various convolutions of the strips **16** and **17**, the latter are first wound on the core of the wheel and then the polyethylene solvent is sprayed through the wheel, that is, between the spaced convolutions of the strips, whereby the solvent penetrates between the outer surface of the portion **20** of the projections **18** and the contacting surfaces of the strip **16**, and partly dissolves the surface layers of said contacting surfaces and renders them sticky, whereby fastening of the same is effected.

According to either one of the above described methods, once the surfaces of the strips **16** and **17** are dried, the various convolutions of said strips are fastened together to make a rigid wheel unit, without the necessity of using additional fastening means.

Due to the fact that the projections **18** extend from both faces of the strip **17**, said strip **17** will be equally spaced from the two adjacent strips **16**, as clearly shown in Figure 6 or Figures 11, 12 and 13.

In order to construct the wheel so that it will be perfectly cylindrical, and also statically as well as dynamically balanced, so as to obtain smooth rotation thereof despite the spiral winding of the strips **16** and **17**, the central part of the wheel, that is the part next to the cup-shaped members **10** forming the core of the wheel, is constructed and assembled as shown in Figure 6, while the peripheral or outer end parts of the strips **16** and **17** are assembled and constructed as shown in Figures 7 to 10 inclusive.

Referring to Figure 6, it will be seen that the inner end of the strip **16**, which is immediately wound on the cup

members **10**, projects beyond the inner end of the strip **17**, and that this strip **17** is provided with a radially inwardly extending projection **18'**, of smaller height than the projections **18** of normal size. Successively, there are provided gradually increasing inwardly extending projections **18'**, until, after one full turn, a projection **18** of normal size is formed. Similarly, there is a first radially outwardly extending projection **18'**, and thereafter there are similar outer projections of gradually increasing size until, after substantially a full turn, the projections are of normal size on both sides of the strip **17**.

In the few last windings of the strip **17** of the periphery of the wheel **1**, the radially inwardly extending projections **18** first start to decrease in height, until the strip **17** comes in contact with the radially inwardly adjacent portion of the strip **16**, as shown in Figure 7. Then the radially outwardly extending projections **18** start to decrease in height, as shown in Figure 8, until the same portion of the strip **17** comes in contact with the radially outwardly adjacent portion of the strip **16**, as shown in Figure 8. Finally, as shown in Figure 10, both strips **16** and **17** are now in direct contact with each other, and to increase the rigidity of the outer layer, the strip **17** is wound for a few turns and fastened as shown in Figure 10.

The shape of the projections **18**, apart from providing good contact surfaces with the strips **16**, in order to properly fasten the convolutions of the strips **16** and **17** together to form a rigid wheel unit, also provide dihedral angles, as clearly seen in Figure 11, which pick up water from the reservoir **2**, said water remaining in said dihedral angles, as shown at **25** and **26** in Figure 11, while the wheel is travelling upwardly from the water reservoir. When the same portion of the wheel travels substantially horizontally, as shown in Figure 12, the water starts to flow down along the strips **16** and **17**, and further adds water to the already wetted surfaces of said strips. Due to this and also to the fact that the sheets are spirally wound, it is possible to obtain a completely wetted surface of the wheel, even if the water level within the reservoir **2** is relatively low, and only the peripheral layers of the strips of the wheel are immersed in said reservoir.

Referring to Figures 14 to 19, it is clearly shown that when the evaporative wheel **1** rotates in the direction of the arrow **30**, and that only the outer peripheral layer of the wheel is immersed in the water **3** of the reservoir **2**, the water lifted by the wheel and collected in the projections **18**, will gradually flow down to the inner layers of the strips, as indicated by the arrows **31** in Figures 15 to 19 inclusive, until all of the operative surface of the wheel is wetted.

While a preferred embodiment according to the present invention has been illustrated and described, it is understood that various modifications may be resorted to without departing from the spirit and scope of the appended claim.

I claim:

An evaporative wheel for a humidifying apparatus comprising a rotor core, two strips of sheet material made of a synthetic resin longitudinally wound in substantially parallel arrangement on said core to form spiral convolutions about the core, one of said strips having smooth opposite surfaces without any projections thereon, the other of said strips having, at longitudinally and transversely spaced areas thereof, pairs of adjacent projections struck out from said strip, the adjacent projections of each pair extending outwardly of and from the opposite faces of said strip, each projection having a dome shape and constituted by two inclined and converging parts forming a dihedral angle with the strip, and an intermediate part connecting the adjacent ends of said converging parts, the other ends of said converging parts being integrally connected to said strip along lines

extending transversely of said strip and spaced from each other longitudinally of said strip, said intermediate part forming a substantially flat and rectangular outer area disposed in a plane substantially parallel to the adjacent portion of said strip, said surface area being in contact with and secured to the first named strip whereby said strips are maintained in spaced relation with each other by means of said projections and form a rigid wheel unit due to the interfastening of the strip convolutions by said outer surface areas of said projections.

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