

April 11, 1950

W. W. STUART
SELF-CLEANING WET WHEEL

2,503,523

Filed Jan. 17, 1945

2 Sheets-Sheet 1

Fig. 1.

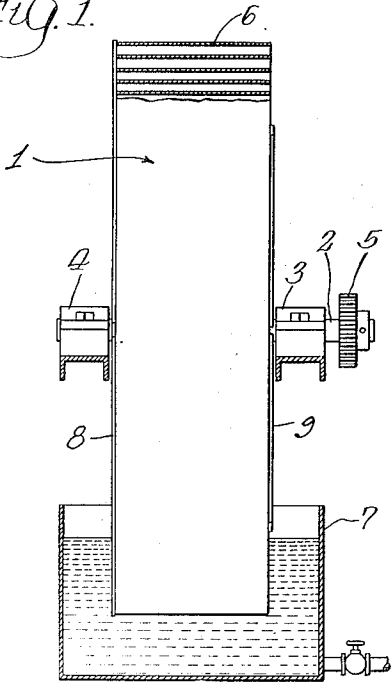
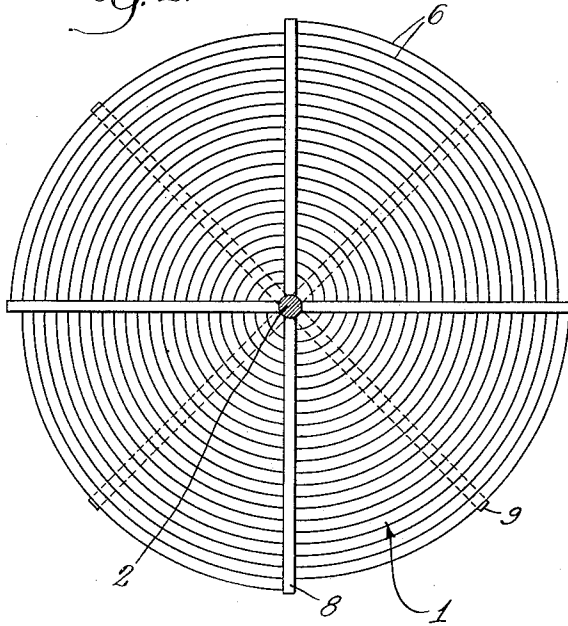


Fig. 2.



INVENTOR.
William W. Stuart,
BY Bair & Freeman
Attys.

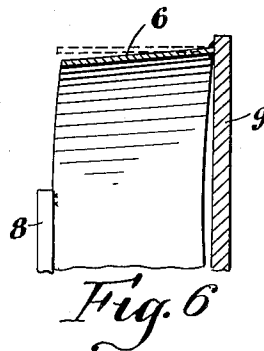
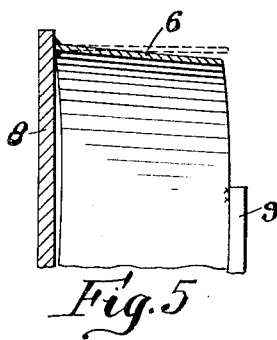
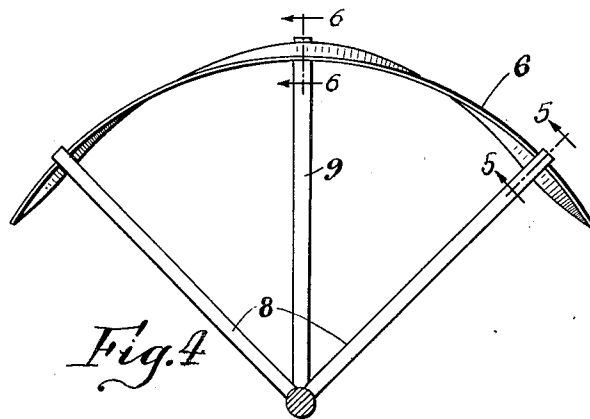
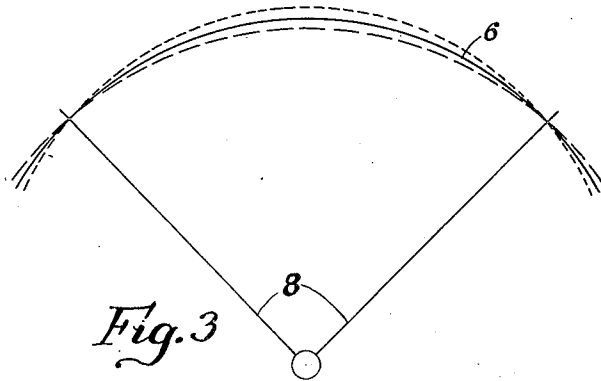
April 11, 1950

W. W. STUART
SELF-CLEANING WET WHEEL

2,503,523

Filed Jan. 17, 1945

2 Sheets-Sheet 2



INVENTOR.
William W. Stuart
BY
Bair & Freeman
Attys

UNITED STATES PATENT OFFICE

2,503,523

SELF-CLEANING WET WHEEL

William W. Stuart, Des Moines, Iowa

Application January 17, 1945, Serial No. 573,222

4 Claims. (Cl. 261-92)

1

My invention is an improvement in wet wheels.

It is my purpose to provide a wet wheel of the kind used for a humidifier or which may be used for other purposes and which has parts so selected, connected and arranged that the member or members which support the water or other liquid for evaporation will be subjected to change in shape upon change in temperature so that coating left by evaporation will be broken up, thus rendering the wheel, to a considerable extent, self-cleaning.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, wherein:

Figure 1 is an elevation of a self-cleaning wet wheel, illustrating a form in which my invention may be embodied, parts being shown in section.

Figure 2 is a side elevation taken at right angles of the view shown in Figure 1.

Figure 3 is a diagrammatic view of two spokes and a portion of a metal sheet shown in Figure 2 and illustrating the action caused by a faster rate of expansion or contraction of the sheet in relation to the spokes.

Figure 4 is a side elevation of a portion of Figure 2 showing the buckling and warping of a portion of the metal sheet upon a drop in temperature affecting the sheet and the spokes.

Figures 5 and 6 are sectional views on the lines 5-5 and 6-6, respectively, of Figure 4.

In the drawings I have shown in Figures 1 and 2 one form in which my invention may be embodied.

In the drawings, reference numeral 1 indicates generally a wet wheel which may be generally built like the wet wheel shown in my Patent No. 2,265,500. In this particular embodiment of my invention a shaft 2 is journaled in suitable bearings 3, 4 and may be driven in any selected way for rotating the wheel. I have shown a gearing member 5 which may be rotated by means not shown, as from an electric motor. Fixed to the shaft at spaced lines around it are sheets 6 which are formed into concentric spirals as shown in Figure 2. These sheets 6 are members which scoop up the water from the tank 7 in which the lower part of the wheel travels. As the wheel rotates the water or other liquid spreads out into thin films on the sheets 6. These films are subjected to contact with air so that the liquid may be evaporated for whatever purpose the wheel is

2

used. It will of course be understood that the wheel may be arranged in such an environment that a current or currents of air may be driven or drawn through the wheel for contacting with the films of liquid on the spiral sheets 6.

The spiral sheets are preferably quite thin and of metal or suitable material which is capable of changing shape to some degree when subjected to changes in temperature.

On the sides of the wheel are bars 8 and 9 which may be relatively thick and heavy, or may be of such different shape and size with relation to the thin sheet 6 that they do not change shape at the same rate as the sheet 6 when subjected to changes in temperature.

It is obvious that the bars 8 may be of a material which does change shape at a different rate from the changes occurring in the sheet 6 or the bars 8 may be of material which has comparatively little change in shape when subjected to a change in temperature. The bars 8 are on one side of the wheel and the bars 9 on the other. The bars 8 are preferably staggered with relation to the bars 9. The bars 8 and 9 are fixed to the edges of the sheets 6.

In the embodiment of my invention now under consideration, I preferably take advantage of the fact that the sheets 6 have a high ratio of surface to mass while the connecting bars 8 and 9 have a high ratio of mass to surface.

It will be obvious that these parts, to-wit, the sheets 6 and the bars 8 and 9 change shape when subjected to changes in temperature. When the temperature of the sheets changes, the sheets change shape much more rapidly than do the bars. This is true even though the sheets and bars be made of the same material, having the same coefficient of expansion. It thus follows that upon changes in temperature, the sheets will be at different temperatures, higher or lower than the temperatures of the bars. A wet wheel of this kind is sometimes wet and sometimes dry, and it is often subjected to air which varies in temperature.

While the wheel is revolving and is being wetted, it will remain generally at a temperature below that of the air entering the wheel. On the other hand, when the wheel stops, the portion out of the water dries off, and the temperature of the wheel rises and approaches that of the temperature of the air. The thin sheets warm up faster than the heavier parts and they cool off faster than the heavier parts.

If the sheets and bars are properly selected and connected, the sheets, being lighter and

weaker than the heavier bars, flex as the parts tend to approach the same temperature or as they approach different temperatures.

When the maximum temperature difference exists between the sheets and the bars, the sheets will be more or less buckled between the heavier bars. It will be obvious that the direction of this flexing or buckling of the sheets which occurs as the temperature of the sheets rises above that of the bars, will be reversed when the temperature decreases. For instance, when the wheel stops, there is a tendency for the sheets and bars to come to substantially the same temperature. This flexing cycle is repeated when the wheel starts to revolve and is wetted. This flexing of the sheets tends to break up the brittle scale that is deposited on the surface from the water carried away by the air. Some of the loosened particles of scale or coating are carried out of the wheel by the stream of moving air and some are washed out of the wheel as it moves through the water in the reservoir indicated at 7.

It will be understood that the particles which enter the air stream may be removed therefrom by suitable filters forming no specific part of my invention, but provided in the air stream and that those particles which enter the water in the reservoir settle in the bottom and may be washed out periodically.

In order to illustrate how different rates of expansion and contraction of the sheets 6 and the spokes 8 and 9 effect buckling and warping of the sheets, Figure 3 shows by solid lines the normal shape of an edge of the sheet between two of the spokes 8. Upon a rise of temperature the sheet will expand faster than the spokes and therefore bow farther outwardly as shown by a dotted line. Conversely, upon a reduction in temperature the sheet will contract more rapidly than the spokes and bow less as indicated by a dash line. Of course after the spokes and sheets have been subjected to the different temperatures for some period of time they will arrive at approximately the same temperature and the initial full line shape of the sheet will be assumed. However, upon a rise or drop in temperature the sheet will warp either as indicated by the dotted line or as indicated by the dash line.

At the same time warping occurs buckling will also occur because, as illustrated in Figure 4, a reduction in temperature will contract the sheet 6 more rapidly than it contracts the spokes 8 and 9 thus causing the right hand edge of the sheet to be depressed as from the dotted position to the full line position as shown in Figure 5 at the spoke 8. At the same time the left hand edge of the sheet will be depressed as shown in Figure 6 at the spoke 9. This throws first a right hand and then a left hand twist in the sheet at the spokes 8 and 9 and this twist continues alternately throughout the length of the sheet at each spoke. Thus is had the buckling action hereinbefore referred to which occurs whenever there is a sudden change in temperature such as a rise caused by stopping rotation of the wet wheel or a drop caused by starting of the wheel.

Actually the first change in temperature is down slightly when the wheel stops due to the surface of the wheel drying by evaporation and thereby becoming cool below ambient temperature. After that the temperature of the wheel rises until it matches ambient. Upon the wheel starting to rotate again the temperature of the sheets 6 is lowered when they come in contact with the water and in addition to these temperature

changes there is a gradual temperature change of each portion of the sheet as the wet wheel revolves.

Considering one point in particular on the wheel, that point is wettest at the low point in the revolution of the wheel and tends to become more nearly dry as the wheel rotates until that point again arrives at its lowest position (in the water). Any portion of the wheel just lifting away from the water is pretty well "filmed over"—that is, many of the air spaces between adjacent sheets are spanned by water films. As the wheel rotates and the air stream through the wheel impinges these films they burst and the air goes through the wheel. A Velometer shows less air going through that portion of the wheel just leaving the water than through the part just about to enter the water. Velometer readings also show less air going through the wheel when wet than when dry.

If the wheel speed (revolutions per minute) is balanced against the air volume in such manner as to have the rising part of the wheel wet and then have the wheel dry before reaching the low point again, the wheel can be made to go through its entire temperature range from close-to-water temperature to a low temperature and then up to approximately room temperature in one revolution. Of course this would involve a reduction in capacity as a humidifier but such condition indicates the strains that are set up in the wheel and these strains will snap the lime deposits from the warping sheets 6. The lime deposits are so brittle that they will not stand much flexing without breaking but give trouble only when they are allowed to accumulate.

The expansion and contraction of the sheet is widthwise as well as circumferentially and therefore there is a pulling toward the left by the spokes 8 and toward the right by the spokes 9 as shown by the left and right hand edges of the sheet 6 in Figures 5 and 6 which also aids in the buckling action. Of course Figures 3 to 6 are somewhat exaggerated but they do illustrate the action that takes place and my experience has been that a wet wheel constructed in accordance with the present disclosure actually does have the desired self-cleaning feature.

There are points on the wheel where the movement of parts is not sufficient to break off all the deposit. It is found however that in practice the self-cleaning feature is so effective that other cleaning need be resorted to only at rare intervals. These intervals vary with the amount of water evaporated, hardness of water and frequency of starts and stops, temperature, humidity of the air in which the wheel operates, velocity and volume of air through the wheel, the nature of the solid matter in the water which may effect the brittleness and strength of the deposit, etc.

It will be seen from the foregoing that I have illustrated a wet wheel which is largely self-cleaning in ordinary operation, by taking advantage of temperature changes to effect changes in the shape of the member which supports the water or other liquid for evaporation.

It will also be obvious that the invention may be practiced with apparatus varying quite widely in structure and it is of course my purpose to cover by my patent to be issued on this application any modified or changed structure which may reasonably and properly come within the scope of my invention and my claims.

I claim as my invention:

1. In a self-cleaning wet wheel, a shaft, a plu-

5

rality of relatively thin spirally-wound metal sheets fixed at one end in spaced relation to the shaft around its circumference, a plurality of relatively thick radial bars fixed to the edges of the sheets at one side thereof, and a plurality of relatively thick radial bars fixed to the edges of the sheets at the opposite sides thereof and in staggered relation to the first radial bars, all of said bars along one side of the sheets being out of axial alignment with the bars along the other side of said sheets whereby the sheet edges flex between the bars as a result of temperature changes ambient to the sheets and the bars affecting the sheets more promptly than the bars.

2. In a self-cleaning wet wheel, a shaft, a plurality of cylinder-like sheets in spaced relation around the shaft, a plurality of radial bars fixed to the edges of the sheets at one side thereof, a plurality of radial bars fixed to the edges of the sheets at the opposite side thereof, the bars on one side of the wheel being staggered and out of axial alignment with relation to the bars on the other side, the entire edges of the sheets between the points where they are fixed to said shaft and the sheets being thinner than the bars whereby they expand and contract at a greater rate than the bars and thereby warp to break up any surface accumulations thereon as a result of temperature changes affecting the wet wheel.

3. In a self-cleaning wet wheel, a shaft, a cylinder-like metal sheet around said shaft and spaced therefrom, means for anchoring sheet parts with relation to each other at a plurality of circumferentially spaced points along one side edge, means for anchoring other sheet parts with relation to each other at a plurality of circumferentially spaced points along the other side edge, the second mentioned points being circumferen-

6

tially staggered with relation to the first mentioned points, said sheet and the means for anchoring its side edges having different rates of expansion in response to temperature rise whereby said sheet warps and the warp changes as temperature ambient to the sheet and the anchoring means rises or falls.

4. A self-cleaning wet wheel comprising a shaft, a spirally-wound metal sheet secured at one end to said shaft, means for anchoring parts of said sheet with relation to each other at a plurality of points along one of its side edges, and means for anchoring other parts of said sheet with relation to each other at a plurality of points along the other side edge thereof, all of the points of said other edge being out of axial alignment with the points of said first edge, the respective side edges being free to flex toward and away from said shaft between the points specifically enumerated, said sheet and its anchoring means having a different surface-to-mass ratio whereby such flexing occurs as a result of temperature changes ambient to said wet wheel.

WILLIAM W. STUART.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,223,227	Robic	Nov. 26, 1940
2,265,500	Stuart	Dec. 9, 1941
2,307,603	Penney	Jan. 5, 1943

FOREIGN PATENTS

Number	Country	Date
11,094	Great Britain	May 5, 1910
11,183	Great Britain	May 9, 1911