

Sept. 8, 1953

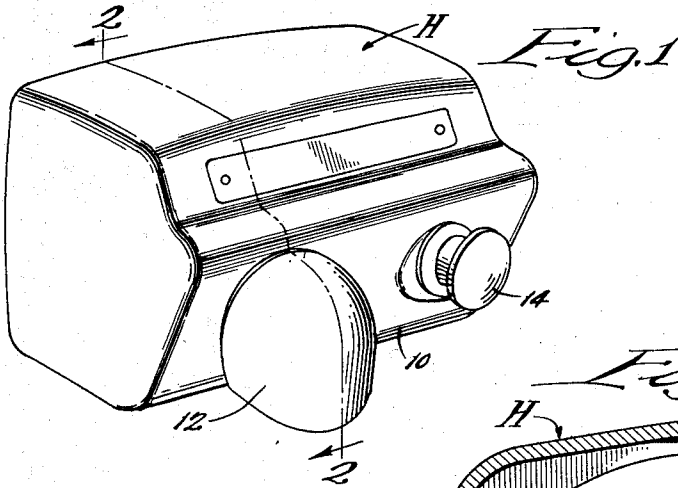
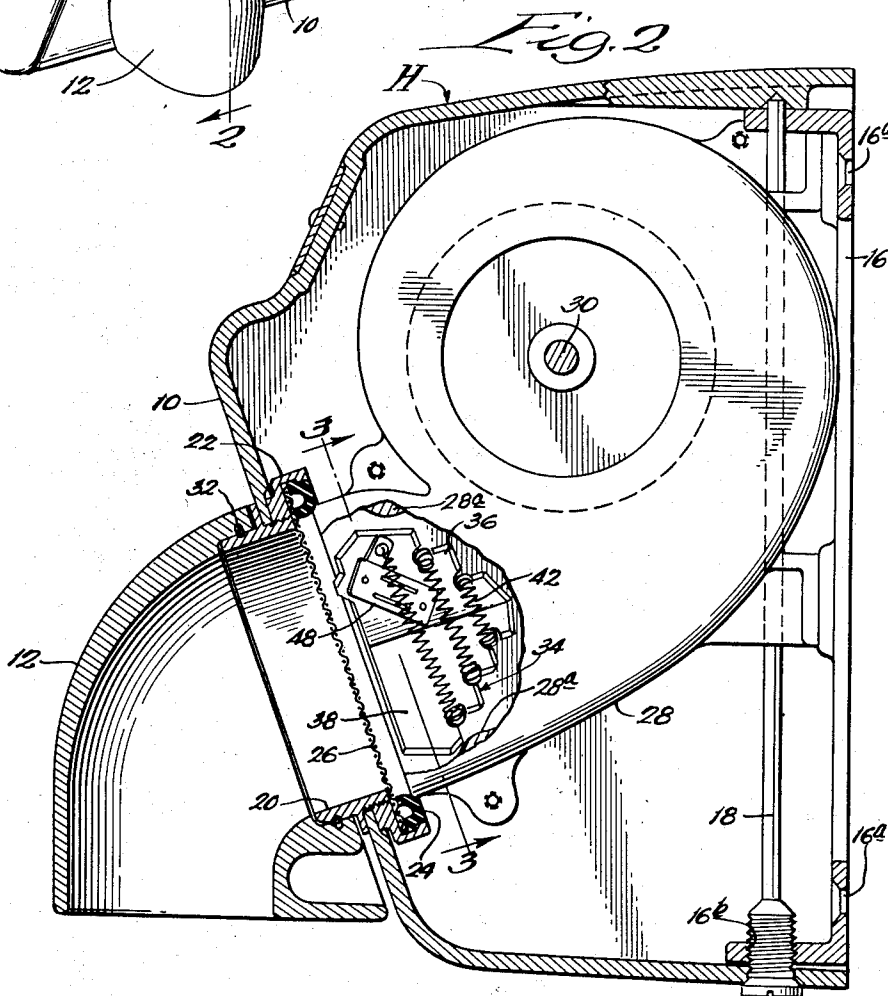
G. S. CLEMENS

2,651,705

HEATER ASSEMBLY FOR ELECTRIC DRIERS

Original Filed March 1, 1949

2 Sheets-Sheet 1



INVENTOR:

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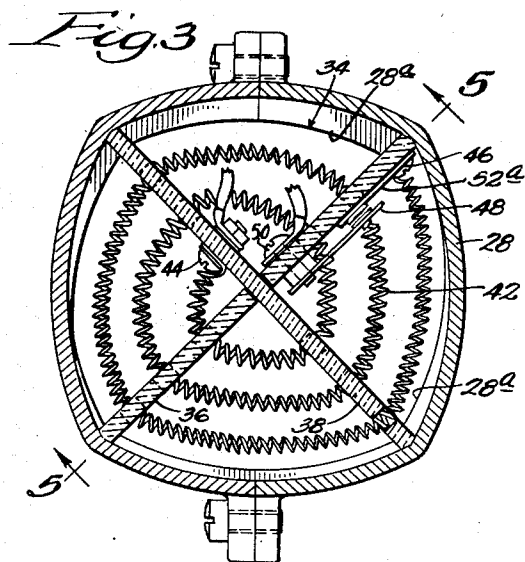
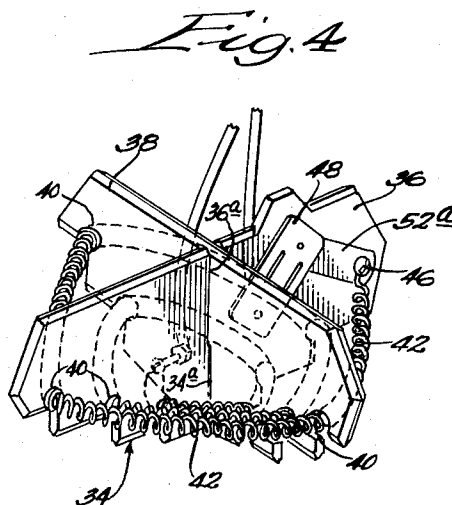
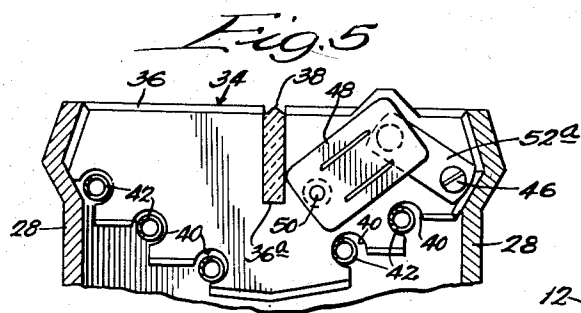
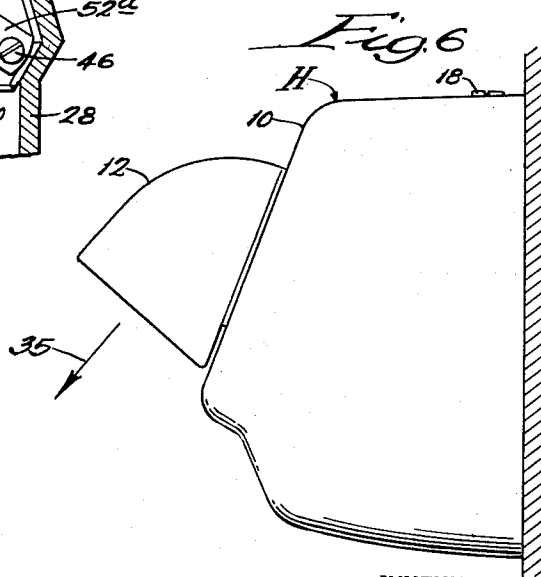
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HEATER ASSEMBLY FOR ELECTRIC DRIERS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,651,705

HEATER ASSEMBLY FOR ELECTRIC DRIERS

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Original application March 1, 1949, Serial No.
79,051. Divided and this application February
24, 1953, Serial No. 338,389

6 Claims. (Cl. 219—39)

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My invention relates to an improved drier adapted to dry the hands or the hair and characterized by a substantially uniform air outlet temperature.

This application is a division of my copending application United States Serial No. 79,051, filed March 1, 1949 which has matured into Patent 2,634,514.

In driers for the hands and the hair it is of vital importance that the air be heated to a maximum degree consistent with safe operation, since the ability of the air to take up moisture is largely determined by the outlet temperature. However, if the air, or any portion thereof, is overheated it burns the user.

Moreover, it has heretofore been impractical to use the same drier for both the hair and the hands. This results from the fact that air for hair drying should be directed at an angle relative to the vertical whereas air for hand drying should be directed substantially downwardly. Downwardly directed air is ineffective for hair drying because it is not possible to get the head under the nozzle unless the drier is specially mounted. Air directed on an angle to the vertical is ineffective for hand drying because it blows droplets of water from the hands on to the clothing of the user.

In accordance with the present invention, an improved drier is provided wherein the temperature of the outlet air is substantially uniform and can be set at a maximum tolerable value without causing any portion of the air stream to be overheated, or any portion of the stream to be inadequately heated. Moreover, the drier is provided with an air directing nozzle rotatable about an axis at an angle to the vertical and has a housing adapted to be mounted either end up on a vertical surface. The drier can thereby produce a downwardly directed air stream capable of drying the hands without blowing droplets on the clothes and an air stream at an angle to the vertical to dry the hair without requiring the user to be directly under the unit.

It is therefore a general object of the present invention to provide an improved drier having a discharging air stream of substantially uniform temperature.

Another object of the present invention is to provide an improved drier adapted to be received on a vertical surface and selectively operable to produce a downwardly directed air stream or an air stream directed at an angle to the vertical.

Further it is an object of the present invention

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to provide an improved drier of simple and inexpensive construction and reliable operation and embodying safety elements to prevent overheating.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, together with other objects and advantages thereof, will be best understood by reference to the following description taken in connection with the accompanying drawings in which—

Figure 1 is a view in perspective of a drier embodying the principles of the present invention;

Figure 2 is a cross-sectional view through the axis 2—2, Figure 1;

Figure 3 is a cross-sectional view through the axis 3—3, Figure 2;

Figure 4 is a perspective view of the heating element of the drier of Figure 1;

Figure 5 is a cross-sectional view through axis 5—5, Figure 3; and,

Figure 6 is an end elevational view of the drier of Figure 1 as oriented for hair drying.

Referring now to the perspective view of Figure 1, the drier includes a housing H having a flat back portion adapted to be received on a vertical surface, such as a wall. The housing H has a relatively flat front panel 10 oriented at an angle relative to the orientation of the back. An air directing nozzle 12 and a switch knob 14 project from the surface of the panel 10 as shown.

As shown in Figure 2, the back of housing H receives the back plate 16 which may, for example, be an aluminum casting. This plate has a plurality of openings 16a adapted to receive screws to affix the plate to a wall or like mounting surface.

The housing H is retained on the plate 16 by the locking rods 18. These each extend through registered holes in the housing H and the back plate 16 to lock the housing H in position relative to the back plate. Screws 18 are threadedly received in openings 16b of back plate 16 to be threadedly held in position.

As seen best in Figure 2, the panel 10 slopes at about 20 degrees relative to back plate 16. This panel has a circular opening which snugly receives the bushing 20. This bushing is held in position by the annular member 22 which is threadedly received on the surface of the bushing within housing H and bottoms against panel 10 adjacent the opening. The member 22 defines an overhanging annular surface in which

the rubber washer 24 is received as shown. A screen 26 is interposed between washer 24 and the member 22.

When the drier is mounted in the upright position of Figure 2, panel 10 slopes downwardly. When the drier is mounted in the inverted position of Figure 6, the panel 10 slopes upwardly.

A fan scroll 28 is mounted within the housing H and has its outlet opening in registry with the air discharge opening in panel 10. An impeller (not shown) is carried by shaft 30 which in turn is driven by a motor (not shown) during operation. Rotation of the impeller causes air to travel from scroll 28 and out the opening in panel 10.

The air directing nozzle 12 is adapted to deflect air at an angle of substantially 70 degrees relative to the panel 10. This nozzle has a circular opening adapted to receive bushing 20 to cause air from that bushing to travel into the nozzle. A snap ring 32 is received in cooperating annular grooves in bushing 20 and nozzle 12, and retaining nozzle 12 in position while permitting rotation thereof.

It will be apparent that nozzle 12 is rotatable about the axis of bushing 20 and hence an axis normal to panel 10 and tilted 20 degrees relative to the horizontal.

When the housing H is in the upright position shown in Figure 2, and the nozzle 12 is directed downwardly, the air leaves scroll 28 in a direction normal to panel 10 and hence with an angle of about 110 degrees downwardly relative to the vertical. The nozzle 12 deflects the air an additional 70 degrees downwardly, thereby causing the air to leave the unit in substantially a vertical downward direction. When so directed, the air has no tendency to blow droplets from the user's hands onto his clothing.

When the housing H is mounted in the inverted position as shown in Figure 6, the panel 10 assumes an angle of about 70 degrees to the vertical, as shown in Figure 2. When the nozzle 12 is turned to direct the air downwardly, it imparts 70 degrees downward movement to the air already moving 20 degrees upwardly, resulting in downward movement at 140 degrees to the vertical upward direction or 40 degrees to the vertical downward direction. This orientation is shown by the arrow 35, Figure 6.

Air discharged at an angle of about 40 degrees to the vertical downward direction is particularly suitable for hair drying since it may be directed on a user spaced from the mounting wall and not directly under the machine.

The scroll 28 receives the heating unit shown generally at 34, Figure 2. This unit is received in the outlet duct portion of scroll 28 and heats the air discharging from the scroll 28. The construction of the heating unit may best be understood by reference to Figures 3, 4, and 5, taken in connection with Figure 2 where the scroll 28 is broken away to show this unit.

As shown in the figures, the heating unit 34 includes two crossed members 36 and 38 having cooperating slots 36a and 38a so that they may be coupled together as shown in Figure 4. These members are snugly received in the discharge or outlet duct of scroll 28 so that the air stream passes about them.

The members 38 and 36 are preferably made of heat resistant material, such as molded "stearite." Each is formed with a plurality of recesses 40, Figure 5, to receive the coils of an electrical heating element. A heating element 42

is wound about the members 38 and 36 and received in the recesses 40.

It will be evident that the coil 42 defines a spiral cone. That is, the successive convolutions increase in diameter from one end to the other and, in addition, spiral in the direction of the axis of bushing 20, Figure 2.

The spiral cone configuration of the heating element 42 is particularly effective in heating the air passing through the outlet duct of the scroll 28. The effectiveness is increased by the fact that the members 36 and 38 are oriented at a 45° angle relative to the axis of shaft 30 and scroll 28, Figure 2, and the ends of the element nearest the common axis of scroll 28 and shaft 30. This attachment is achieved by the conducting screws 44 and 46, Figure 3.

By terminating the heater coil at screws 44 and 46, the spiral cone is provided with three turns each in the quadrants furthest away from the axis of the scroll 28 and two turns in the quadrant closest to this axis. This is best seen in the cross-sectional view of Figure 3. I have discovered that this greatly improves the uniformity of the air temperature. For example, actual tests have shown that with the structure shown, the issuing air temperature varies from 130 to 135 degrees, a variation hardly perceptible to the user. Other driers have shown variations as great as from 95 degrees to 200 degrees, the former temperature being too low for effective drying and the latter so hot that it is uncomfortable.

Moreover, the spiral cone heater element configuration introduces a minimum degree of air resistance.

The scroll 28 is formed with a lip 28a adjacent the outer turn of the heater element 42 as best seen in Figure 3, this lip conforms to the shape of that turn to provide an air space of substantially uniform width between the turn and the scroll 28. This prevents issuance of unheated air from nozzle 12.

The foregoing construction provides a heated air stream of uniform temperature. This is accomplished in part by the spiral cone shape of heater element 42, augmented by the lip 28a, which forces all the air through heater elements of substantially uniform spacing. The provision of only two lengths of heater element in the quadrant closest to the axis of scroll 28 renders the air temperature even more uniform for it compensates for the lower air flow in this quadrant due to the action of the fan impeller. I have discovered that centrifugal fans inherently provide greater air velocity adjacent the outer portions of the scroll and that so proportioning the heater element compensates for the tendency of part of the air stream to heat to a greater extent than other parts.

The uniform temperature of the air stream renders it possible to operate the entire stream at a higher average temperature than otherwise could be used. The ability of the air to take up moisture is thereby increased.

A bimetal safety element 48 is mounted on the member 36 as shown in Figures 2 to 5. This element is anchored at one end by screw 50 and at its opposite end is adapted to coact with stationary contact 52. The latter contact is defined by member 52a which is held in place by screw 46.

When the temperature of the bimetal element 48 exceeds a predetermined value, it flexes to a

spaced position relative to contact 52. This breaks the electric circuit between screws 46 and 48 and interrupts application of power to the heating element 42.

The element 48 is mounted on the right hand half of member 36 as seen in Figure 3. In this position it is particularly effective as a safety device for it exhibits no tendency to open while air flow takes place but rapidly and positively opens in the event air flow discontinues, either by obstruction of nozzle 12 or by stoppage of the impeller. Other positions of the element have not proven as effective for this purpose.

The temperature responsive element 48 acts to deenergize the heating element regardless of the reason for stoppage of air flow. This avoids the need of providing the path for air leakage between scroll 28 and nozzle 12 to form an escape path in the event the nozzle is blocked.

While I have shown and described a particular embodiment of my invention, it will be understood that various modifications and alternative constructions may be made without departing from the spirit and scope thereof. I therefore intend by the appended claims to cover all such variations and alternative embodiments that fall within the true spirit and scope of my invention.

I claim:

1. In a forced-air drier wherein air is heated in a duct while passing therethrough, a housing providing a discharge opening, a duct within said housing and communicating with said opening, said duct being provided adjacent its outer end with a laterally-extending annular recess, intersecting support members mounted in said duct and having inclined outer edges engaging the recess of said duct, and a heating coil wound upon said support members and forming a spiral cone having spaced convolutions, said coil having its outermost convolutions lying adjacent said annular recess, whereby air passing along the side walls of the duct may pass through and laterally of said outermost convolutions for the effective heating of such air.

2. The structure of claim 1, in which a lip extends along at least one side of said duct and inwardly thereof to produce an even flow of air about the adjacent convolution.

3. In a forced-air drier wherein air is heated in a duct while passing therethrough, a housing provided with a discharge opening, a duct within said housing and communicating with said opening, said duct having its forward end portion generally square in cross section but with the side walls thereof generally arcuate, said arcuate side walls providing at their points of junction corners for receiving the ends of intersecting support members, intersecting support members mounted in said duct and having their ends engaging the corner portions of said duct, a heating coil wound upon said support members and

forming a spiral cone having spaced convolutions, the outermost of said convolutions lying adjacent the arcuate side walls of said duct.

4. The structure of claim 3, in which said support members are inclined at their outer ends and in which said duct is provided with an inclined recess for receiving and locking the ends of said support members within said duct.

5. In a forced-air drier wherein air is heated in a duct while passing therethrough, a housing provided with a discharge opening, a duct within said housing and communicating with said opening, said duct having arcuate side walls meeting to form corner portions, intersecting support members mounted in said duct and having their ends received within the corner portions of said duct to lock said cross members against rotary movement, a heating coil wound upon said support members and forming a spiral cone having spaced convolutions, the outermost of said convolutions lying adjacent the side walls of said duct, said duct being provided with a laterally-extending annular recess adjacent said outermost convolution to permit air to expand laterally of said convolution as it is directed thereagainst.

6. In a forced-air drier wherein air is heated in a duct while passing therethrough, a housing provided with a discharge opening, a duct within said housing and communicating with said opening, intersecting support members mounted in said duct, a heating coil wound upon said support member and forming a spiral cone having spaced convolutions, the convolutions being longer as they extend outwardly of the support members and providing between the convolutions a heating coil well with the enlarged mouth thereof facing outwardly, and a thin flat thermostatic control element mounted diagonally upon one of said support members and adjacent to and in parallel relation therewith, said element being secured at its lower end to said support member inwardly of the innermost convolution and extending outwardly at an inclination generally parallel with the inclination of said convolutions, whereby said thermostatic element is enclosed within said coil well and responds rapidly to the temperature thereof while creating negligible resistance to the flow of air, said thermostatic element comprising a flat bimetallic sheet fixedly secured at one end and biased against a contact at its other end.

GEORGE S. CLEMENS.

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