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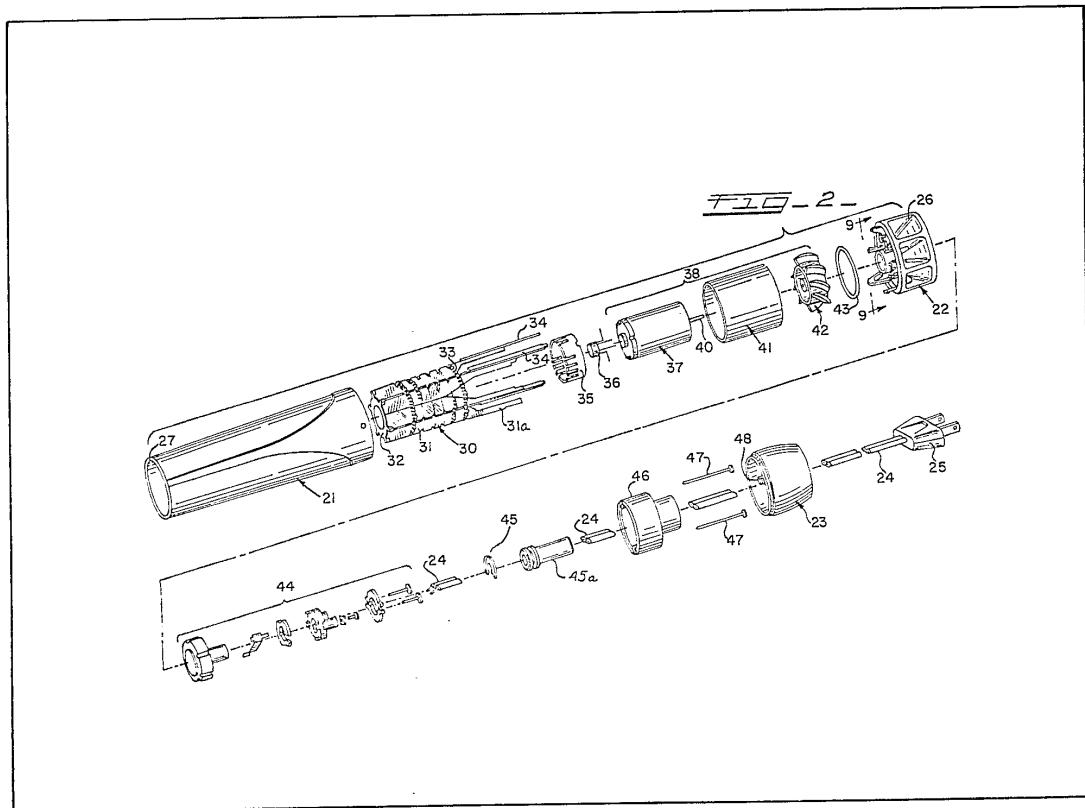
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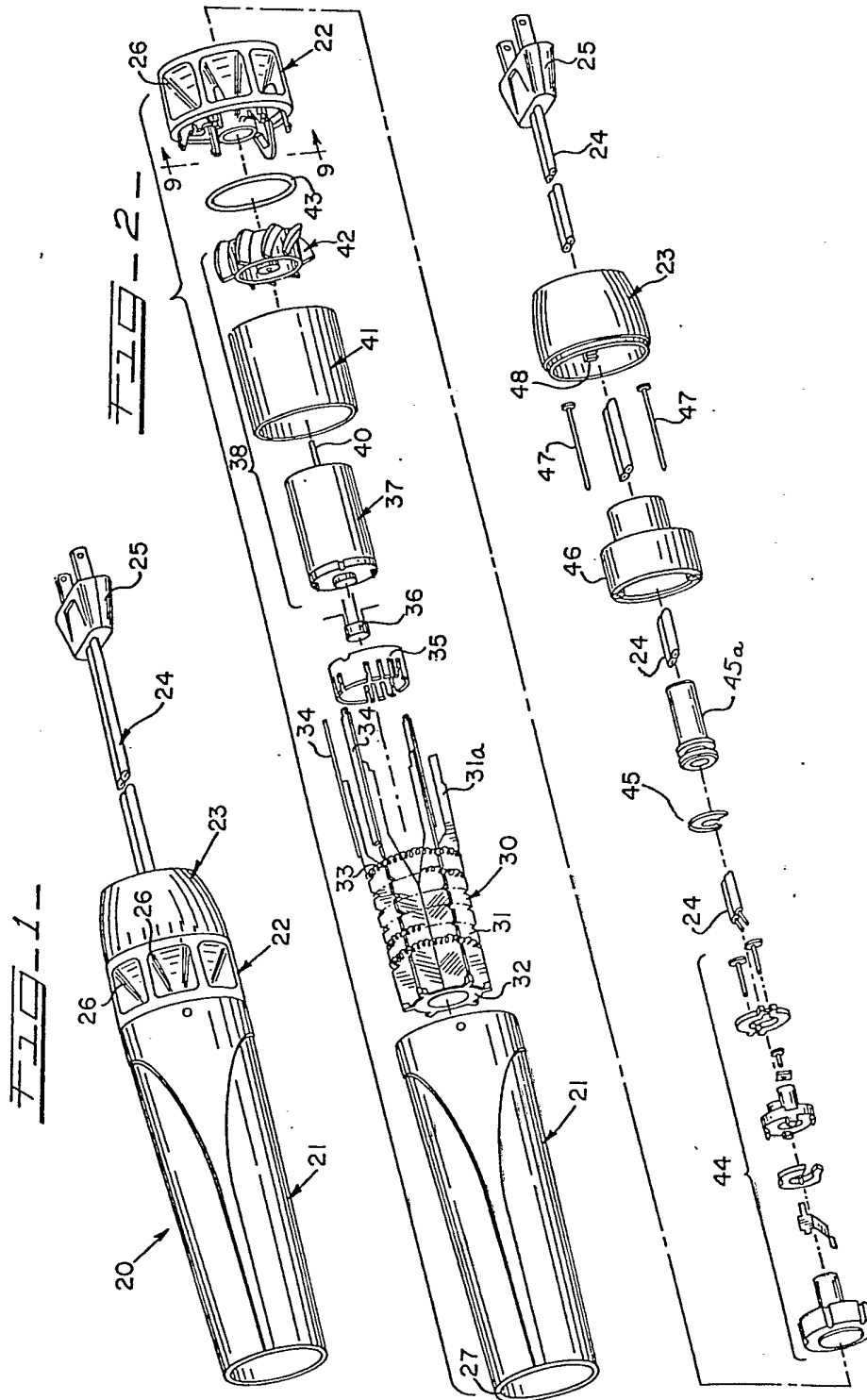
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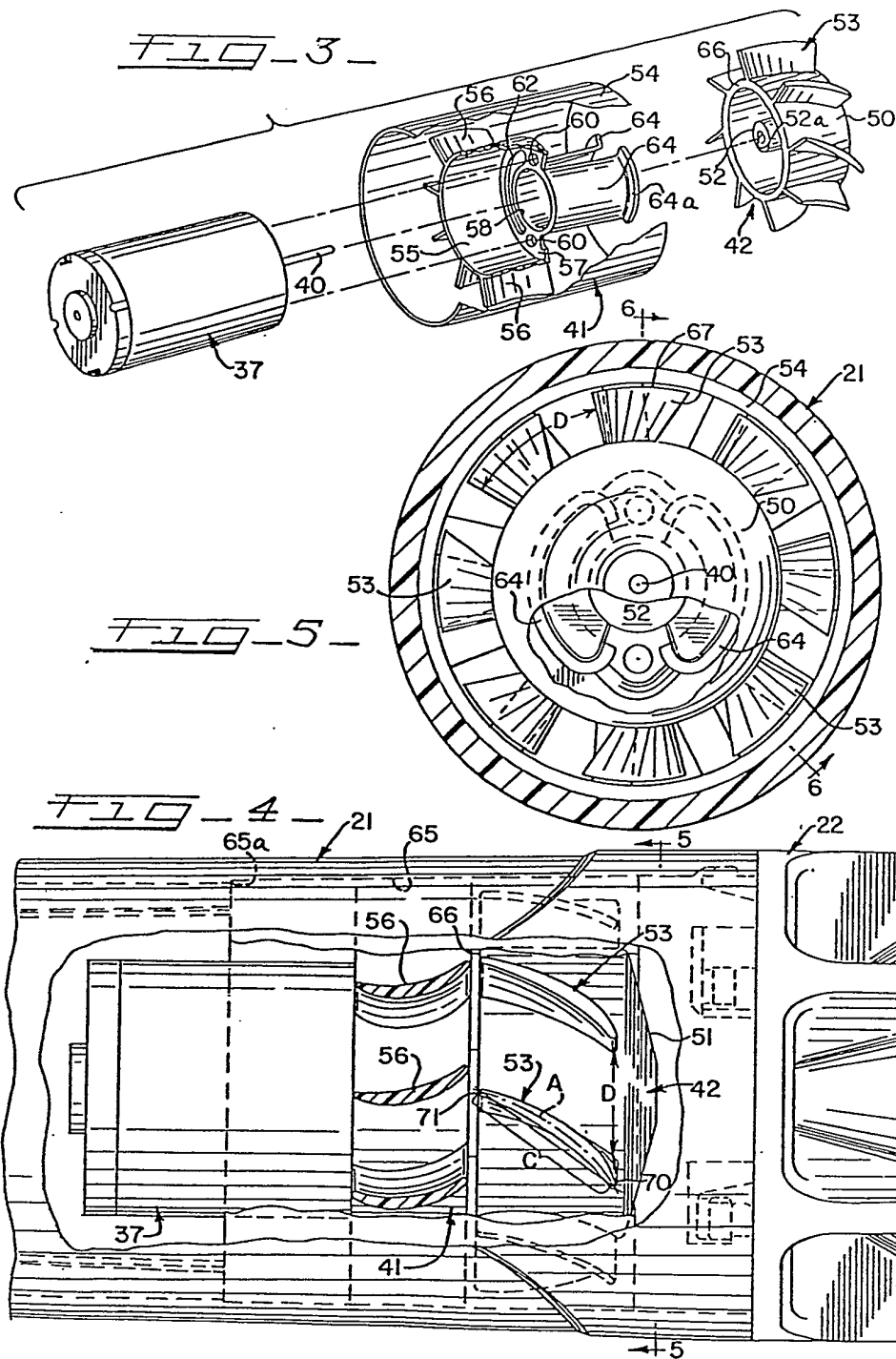
(54) Hand held hair dryers

(57) A hand-held hair dryer or styler is of tubular shape and is not provided with the normal handle grip. An axial-flow fan 42 having a small diameter enables the housing 21, 22 of the dryer or styler to be small enough to be comfortably held in the hand. Sufficient air flow is made available even when appliances are attached to the dryer. A switch knob 23 may be rotated to any one of six positions to control the fan speed and the output of heater coils 33. The housing members 21, 22 are connected by bayonet fasteners and the dryer is grasped in the region of the fan.



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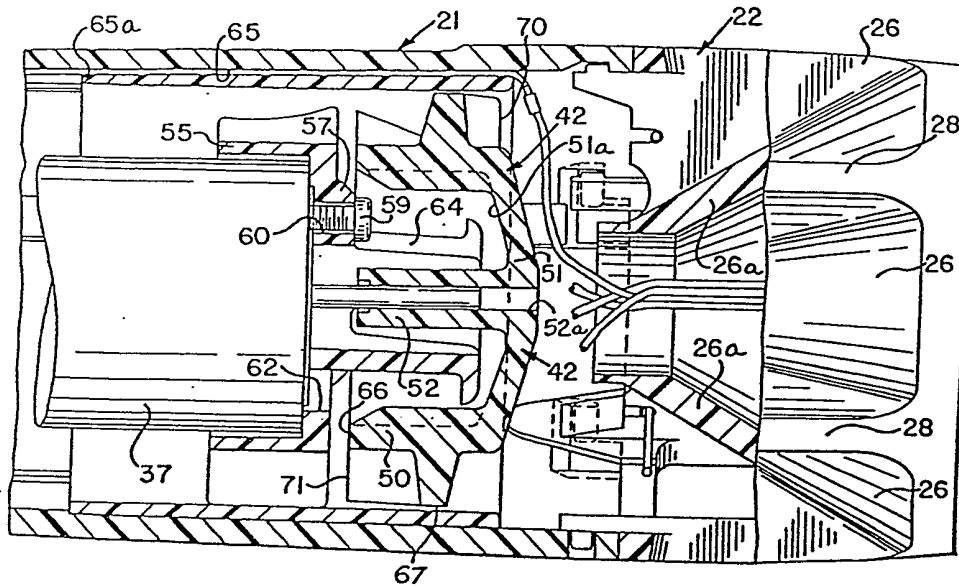


FIG. 6

FIG. 8

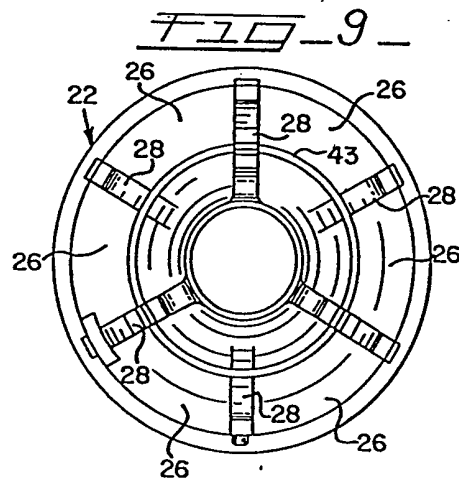
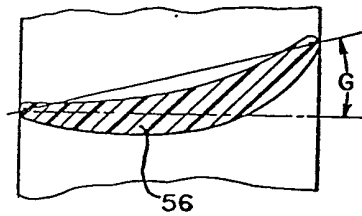
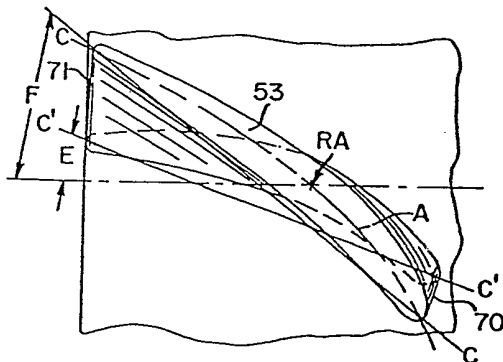
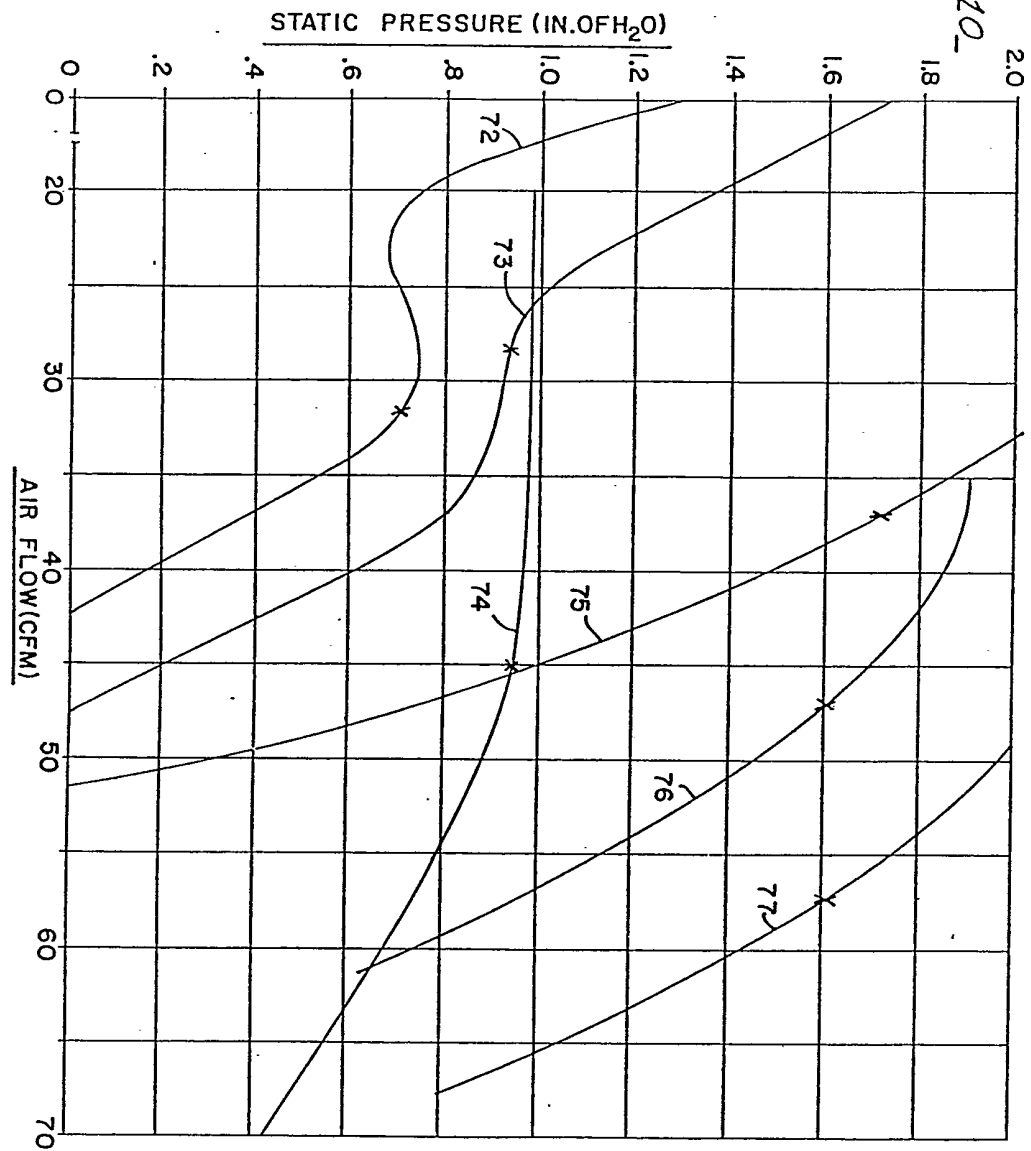


FIG. 9

FIG. 7



720-10

SPECIFICATION

Hair dryer or styler and axial-flow fan therefor

5 This invention relates to hand-held hair styling or drying appliances utilizing axial-flow fans therein. More particularly, this application relates to improvements in axial-flow fan assemblies adapted for use in hand-held styling and drying appliances

10 wherein one embodiment of the fan has a smaller outer diameter than heretofore available while still developing a high pressure differential at a given speed of rotation relative to other known axial-flow fan type hair stylers. In another embodiment, a fan of

15 conventional diameter develops greater pressure differential at high air flow rates than heretofore known axial-flow type hair dryers.

The advent of relatively compact and lightweight hand-held hair styling appliances has, in the recent

20 past, resulted in a rapid increase in the use of these appliances by consumers. Typically, a hand-held hair styling appliance includes a hollow body having inlet and outlet ducts therein together with an air moving fan positioned adjacent the duct thereof, and

25 an air heating coil positioned in the body downstream from the fan and inwardly of the air outlet duct. Originally, hand-held hair styling appliances incorporated radial flow or centrifugal fans, metal bodies, and relatively heavy electric motors. The

30 expense required to produce these stylers was sufficient to limit their use generally to professional beauty operators. More recently, the use of small diameter cross-flow or transverse-flow type fans together with lightweight electric motors and

35 molded plastic body parts has provided the general public with compact, inexpensive and lightweight hair styling appliances. A hand-held hair styler incorporating a small diameter cross-flow fan is shown and described in U.S. patent No. 3,854,489,

40 issued December 17, 1974 to the assignee of the present application.

Most recently, lightweight axial flow fans have been incorporated in hair styling appliances. An axial flow fan is more compact in length than a com-

45 parable transverse flow fan. However, heretofore known axial-flow fans have in order to provide the required air flow, had outside diameters of a sufficiently large dimension to make their use in hair stylers cumbersome. Transverse flow fans have

50 conventionally included a handle positioned generally perpendicular to the flow of air therethrough. Typically, the motor and control switch have been positioned in the handle. The short length of an axial flow fan eliminates the necessity of a separate

55 handle. In presently known axial-flow type hand-held hair styling appliances handles are made detachable from the appliance, are axially extended on the styler, or are pivotally mounted thereto so as to extend either parallel to the air flow or perpendicular to the air flow, as desired. One of the reasons

60 handleless stylers have, heretofore, not been completely satisfactory is due to the larger outer diameter of the fan utilized therein. Unless the outer diameter of the axial flow fan can be reduced to a

65 size which can be easily and comfortably grasped for

relatively long periods of time (5 to 10 minutes or more) by the hand of a user, an external handle, or a longer appliance is necessary for consumer acceptance.

70 A need has arisen for an improved axial-flow fan having air moving characteristics competitive with presently used axial flow and transverse flow fans, and which includes an outer fan diameter sufficiently smaller than that available in presently used axial-

75 flow fans to allow the appliance utilizing same to be easily grasped for long periods of time without discomfort or inconvenience by the hand of a consumer thereby eliminating the need for a conventional handle thereon.

80 It is therefore an object of the present invention, generally stated, to provide an improved axial-flow fan assembly in and for a hand-held hair styling or drying appliance.

It is a more specific object of the present invention

85 to provide an axial-flow fan for a hand-held hair styling appliance wherein the fan has a smaller outer diameter than was feasible heretofore because it has fan blade characteristics capable of producing air flow at high pressure differential for the speed of

90 rotation of the fan.

Another object of the present invention is the provision of an axial-flow fan type hair styling appliance wherein the pressure differential developed therein is high enough to move a sufficient amount of air

95 through highly restrictive attachments, such as styling brushes, combs and the like.

Another object of the present invention is the provision of an axial-flow fan type hair drying appliance wherein the pressure differential is higher for high

100 air flow rates than heretofore known in such dryers.

The present invention provides a hand-held hair drying or styling appliance adapted to provide heated air flow including an air inlet duct and an air outlet duct; an axial-flow fan assembly in a tubular body and adjacent said air inlet duct, said assembly including a tubular fan shroud, an axial-flow fan rotatably mounted in said fan shroud, and a motor

105 drivably connected to said fan; an air heating assembly mounted in said body downstream of said fan assembly; means for controlling the operation of said fan assembly; and means for controlling the operation of said air heating assembly; said axial-flow fan having an outer diameter of sufficiently small dimension to allow a maximum diameter of

110 said tubular body which is suitable for being grasped by a user during use so that the appliance may be used without any additional handle.

Optional and preferred features of the present invention are set forth in the appended claims.

120 Embodiments of the present invention, given by way of example only, will now be described with reference to the accompanying drawings, wherein:

Figure 1 is a perspective view of the hand-held hair styling appliance incorporating an axial-flow fan

125 embodying the present invention.

Figure 2 is an exploded perspective view of the hair styling appliance of Figure 1 showing the interrelation of the heating element, motor, fan, and control switching assembly utilized therein.

Figure 3 is an enlarged exploded perspective view,

130

with portions cut away, of the axial-flow fan, the fan shroud and motor mounting, and the electric motor which drives the fan.

Figure 4 is an enlarged fragmentary side elevational view of the appliance shown in figure 1, with portions cut away, showing the mounted relation between the axial flow fan blades and the stationary guide vanes positioned downstream therefrom.

Figure 5 is a cross-sectional view taken along line 5-5 of figure 4.

Figure 6 is a side elevational view similar to figure 4, partially in section along line 6-6 of Figure 5, showing the mounted working relationship between the fan, motor, fan shroud, and appliance housing.

Figure 7 is an enlarged detail view of the fan blade of the invention shown in Figure 4.

Figure 8 is an enlarged detail view of the stationary guide vane shown in figure 4.

Figure 9 is an end view of the appliance air inlet housing taken along line 9-9 of Figure 2.

Figure 10 is a graph of air flow rates vs. static pressure differential for fans embodying the present invention in relation to prior art fans.

Referring to Figure 1, the hand-held hair styling appliance, generally indicated at 20, incorporating the improved axial-flow fan assembly of the present invention includes a generally tubular fan and heater assembly housing 21 together with an annular air inlet and switch housing 22. Housing 22 is releasably connected to housing 21 by a plurality of bayonet fasteners. Hair styling appliance 20 further includes an annular switch knob 23 rotatably mounted on one end of housing 22. Knob 23 is operatively attached to a six position rotatable switch assembly which is fixedly secured to the interior of the housing 22. The electrical cord 24, through which power for the appliance is obtained, extends axially outwardly of the appliance at the distal end of the switch knob 23 and includes a conventional electric plug 25 positioned at the external end thereof. The changeable fan speed and adjustable heating power of the appliance is controlled by rotating the switch knob 23 to any one of the six positions marked thereon as shown in Figure 1. In this embodiment, the two outer operating positions as marked both produce off or open circuit conditions. The four internal operating positions provide for both dual fan speed operation and four differing heater output wattages. The low fan speed operating condition is utilized with the two lower wattage output positions and the high fan speed operating condition is associated with the two higher wattage output positions.

As shown most clearly in Figure 1, air passing through the styler 20 enters same through a plurality of air inlet ports 26-26 positioned around the tubular outline of the air inlet and switch housing 22. From the inlet ports 26-26 air flows through the fan and heater housing 21 from right to left as shown. First the air is driven through the housing 21 by the fan and then it is warmed by the heating element which is positioned adjacent the left end of the housing 21 as shown. The warm and rapid flowing air exits the styler 20 through a circular air outlet port 27 defining the left end of the appliance as shown. It should be noted that styling attachments (not shown) may be

releasably connected to the air outlet housing 27 to adapt the appliance for various combing and brushing operations in connection with the styling and drying of a user's hair. The apparatus for providing the releasable connection between the housing 21 and the styling appliances (not shown) is the subject matter of a co-pending application Serial No. 30473/78 filed 20 July 1978, published 18 July 1979 under No. 2011991.

The operating parts and portions of the appliance 20 are most clearly shown in Figure 2 to include, in addition to the fan and heater housing 21, from the left the heater assembly 30 including an insulative frame 31, a protective perforate end cover 32, and heating coils 33 wrapped around the insulative frame 31. Additionally, a plurality of elongate conductive buss-bars 34-34 extend axially outwardly of the hollow end arms 31a-31a on one end of the heating assembly frame 31. Buss-bars 34-34 are electrically connected to the switch assembly frame 31. The buss-bars 34 are thinner, in a radial direction, than an equivalent insulated wire (about .025 inch (.635 cm) versus about .050 inch (1.27 cm), respectively). The housing 21 and fan shroud 41, in this embodiment, are made of plastics insulative material. Therefore, the buss-bar need not include further insulation. The use of the buss-bars 34 contribute to the small overall diameter of the styler. An annular plastic coupler 35 is positioned inside the hollow end arms 31a-31a. A conventional bridge rectifier 36 is also positioned inside the hollow end of the insulative frame 31 in conductive relation with the heating element 33, and selected ones of the buss-bars 34-34. A conventional appliance motor 37 is conductively connected to the rectifier 36 and is positioned both inside the hollow arms 31a-31a of the insulative frame 31 and inside the hollow interior of the coupler 35. The electric motor 37 includes a power shaft 40 extending, as shown, from the right end thereof.

A tubular fan shroud 41 is mounted outwardly of the right end, as shown, of the insulator frame 31 so as to cover a portion of same and also cover a portion of the electric motor 37. It should be noted that the shroud 41 can be made integral with housing 21. An axial flow fan 42 is securely mounted on the output shaft 40 and positioned inside the fan shroud 41 to provide efficient flow of air through the appliance. The motor 37, shroud 41, and fan or rotor 42 are collectively designated the fan assembly 38. An additional set of stationary fan blades (Figure 3, 4) are positioned inside fan shroud 41. The stationary blades straighten the flow of air from fan 42 and change same from turbulent flow to laminar flow, thus providing more efficient flow across the heating coils 33. An annular ring 43 is mounted to the interior of the air inlet ports 26-26 in housing 22 to prevent the insertion of solid objects in those inlet ports. It should be noted that both embodiments described below are similar in shape while being of differing sizes.

As stated previously, the entire control switch assembly 44 is mounted in the air inlet and switch housing 22 and is covered by the switch control knob 23. The control switch assembly is the subject matter of our co-pending application No. 24806/78, filed 31

May 1978 published on 17 December 1980 under No. 1581490. A cord strain relief 45 is positioned around the electric cord 24 to prevent it from being pulled out of the styler. A flex relief 45a is mounted to the switch cover 46 to prevent stress fatigue in the cord 24 at the point of exit from the styler body. The switch cover 46 is mounted over the switch assembly 44 to the switch housing 22 by elongate screws 47 or other equivalent fastening means. The switch knob 23 fits over the cover 46 and a pair of arms 48-48 (only one shown) engage the rotatable portion of the switch assembly.

Referring to Figures 3 and 6, the fan rotor 42 of the invention includes a hollow annular hub 50 having a closed shallow cone shape front wall 51 including a cylindrical mounting post 52 extending axially from the center of the back surface 51a of front wall 51. Mounting post 52 includes a round bore 52a axially therethrough in which the output shaft 40 of the electric motor 37 is fixedly retained. A plurality of fan blades 53, in this embodiment eight, extend generally radially outwardly of the outer annular surface on hub 50 in evenly spaced relation therearound.

While the fan or rotor 42 is mounted on the output shaft 40 of the motor 37, the motor, in turn, is rigidly secured along the central axis of fan shroud 41 such that a large portion of the motor and the entire rotor 42 are maintained in mounted relation therein. The shroud 41 includes a hollow tubular outer wall 54 and a second tubular inner wall 55 which is connected to the outer wall 54 by a plurality (in this embodiment eleven) of air-foil shaped guide vanes 56-56 which extend in radial alignment therebetween in evenly spaced relation therearound. The function of the guide vanes is to straighten the flow of air after it exits the blades 53-53 of the rotating fan 42 and change the flow of air from turbulent to laminar, thus creating more efficient passage of the air through the apparatus heating coils 33 (Figure 2). The fan 42 imparts a rotation velocity vector component to the air which passes through it. The guide vanes 56 negate that vector component.

A motor mounting wall 57 extends across the front end of the inner annular shroud wall 55 and includes a central aperture 58 through which power shaft 40 is positioned. A pair of mounting holes 60-60 positioned on opposing sides of aperture 58 provide a mounting to which the motor 37 is retained by suitable fastening means, such as screws 59. Motor mounting wall 57 further includes, in this embodiment, a pair of curvate slots 62-62 (only one shown) through which air may pass to vent the electric motor 37. A pair of curvate arms 64-64 which function as a hair bobbin extend axially outwardly of the motor mounting wall 57 adjacent the central aperture 58 therein. The arms 66 extend into the hollow back side of the fan hub, and substantially surround the mounting post 52. Each arm 64 includes a radially flared distal end 64a. Any hair entering through the air inlet will wrap around the hair bobbin instead of the motor shaft. The bobbin prevents trapped hair from binding the motor shaft 40. The motor 37 is cylindrical in shape and the outside diameter of the inner annular wall 55 approximates the outer diameter of the hub 50, thus providing

aligned annular inner boundary walls for the air stream which flows through the fan blades 53-53 and guide vanes 56-56.

The hollow interior of the fan and heater housing 21 includes an annular recess 65 extending inwardly of the inlet end thereof. The annular recess 65 has a diameter approximating that of the outer diameter of the outer shroud wall 54, and the depth of the recess is greater than the length of the shroud outer wall such that the fan assembly 38 may be mounted therein and retained against axial movement in one direction by the inner edge 65a thereof. It should be noted that the thickness of the inner edge 65a approximates the thickness of the shroud outer wall 54 thus providing a smooth continuous outer boundary for the air stream as it passes through the appliance. The inner surface of shroud wall 54 and the inner surface of housing 21 direct the flow of air through the heater 30 once it passes through the fan blades. After the fan assembly 38 is inserted in recess 65, the air inlet housing 22 may be mounted on the inlet end of housing 21 to substantially fixedly retain the fan assembly in one axial position on the appliance.

When the fan 42 and the motor 37 are properly mounted on the fan shroud 41, a small gap may exist between the downstream end 66 of the fan and the leading edge of the guide vanes 56.

As shown most clearly in Figures 4 and 5, the gap between the inner surface of shroud wall 54 and the outer surface or tip 67 of each fan blade 53 and the gap between the trailing edge 71 of fan blades 53 and the leading edge of the guide vanes 56 should be as small as possible, taking into consideration production tolerances. As the gap between the outer shroud wall and the outer surface of the fan blade increases, a boundary layer condition becomes greater and the efficiency of the entire fan system decreases.

As shown most clearly in Figures 4 and 7, each fan blade is air foil shaped. The fan blades are shaped to produce a positive pressure differential to move air from a position upstream of the blades to a position downstream thereof. If the curved shape of a blade is too slight, too little pressure differential results. If the curvature is too great, a portion of the boundary of the air flow may separate from the blade and decrease the efficiency thereof.

As also shown most clearly in Figures 4 and 7, each fan blade 53 is not only curved, but also twisted, generally clockwise as shown around the radial axis RA of each blade from the hub 50 to the outer tip 67 thereof. The twisting of the blade forms a deeper curve toward the hub end and also increases the angle of incidence at that end. The increased angle of incidence and deeper curve of blade 53 toward the hub 50 is necessary to provide a constant air outlet velocity across the trailing edge 71 of each blade.

When the blade 53 rotates and moves an airstream therethrough, the air adjacent the radially outwardmost portion or tip 67 of the blade is propelled with greater peripheral velocity distance/time than the air positioned toward the hub 50. The increase in curvature and increase in the angle of incidence of the

blade (angle at which air strikes the blade) toward the hub relative the outer tip thereof compensates for the decrease in peripheral velocity. It should be noted that as the curvature of the fan blade becomes greater, the friction between the air and fan blade also becomes greater. Therefore, sound flow through an axial fan takes place toward the outer portions of the radius thereof, and the innermost portion of the fan radius is referred to as a dead core. For this reason, axial flow fans typically have a larger diameter hub in relation to the overall diameter of the fan than do centrifugal flow fans. It should be noted that the minimum hub diameter is also dependent on the outer diameter of any electric motor drivingly connected thereto, unless the motor is remotely positioned from the fan rotor. In a first embodiment of the invention, the diameter of the hub 50 approximates 1.2 inches (3.048 cm) while the outer diameter of the fan is 1.650 inches (approx. 4.19 cm). This outer diameter is substantially smaller than heretofore known axial-flow fans utilized in hand-held hair stylers. The parameters of the fan of the invention enable the largest diameter of the styler body in the first embodiment to be substantially smaller than that of other known axial flow stylers. The narrow body of the styler (the maximum diameter of the body being about 2 inches (approx. 5 cm)) allows a user to hold same conveniently with a hand grasped around the body thereof and eliminates the need for a conventional handle, as used in heretofore known stylers. In a second embodiment of the invention which is adapted for high air flow, the outer diameter of the fan is 1.9 inches (4.826 cm) while the hub diameter remains 1.2 inches (3.048 cm).

The definition of several fan terms enables one to understand more clearly the preferred amount of curvature and twist to be imparted on the blades 53 to produce maximum pressure differential across the blades for a given speed of rotation, preferably 17,000-20,000 rpm with production speed being 19,000 rpm. The straight line distance C, C' between the leading edge 70 and trailing edge 71 of each blade 53 at any cross-section perpendicular to the axis RA therethrough is termed the chord length of the blade. In the first embodiment, the preferred chord length in each blade 53 ranges from about .59 to .69 inches (approx. 1.5 to 1.75 cm) at the tip 67 of the blade with the production dimension being .676 inches (approx. 1.717 cm), and ranges from about .48 to .60 inches (approx. 1.22 to 1.52 cm) adjacent the hub 50 with the production dimension being .589 inches (approx. 1.496 cm). In the second embodiment, the preferred chord length changes at the tip and ranges from about .59 to .72 inches (approx. 1.5 to 1.83 cm). The production dimensions are .707 inches (approx. 1.8 cm) at the tip and .489 inches (approx. 1.242 cm) at the hub. The distance between like positions on adjacent fan blades 53-53 is designated by the letter D. A ratio of the chord length C, C' to the distance between adjacent blades D is termed the solidarity of the fan. It should be noted that if the chord length is changed and the distance between blades is changed in like proportion, the solidarity of the fan may remain constant while the number of fan

blades therein changes.

In both embodiments, it has been determined that the highest pressure output for a given rotation of the fan can be obtained if the solidarity at the outer surface 67 of each fan blade is within the range of about .92-1.05. The ideal solidarity ratio at the hub end of each fan blade ranges from about 1.0-1.28. In the production model of the first embodiment, the solidarity is 1.04 at the tip and 1.25 at the hub; and in the production model of the second embodiment, the solidarity is .92 at the tip and 1.04 at the hub.

The curved longitudinal axis A of each blade 53 illustrates the amount of curvature in the blade. The parameter for measuring curvature is the ratio between the maximum perpendicular distance between the axis A and the chord C, C', as a percentage of chord length. This ratio is termed camber. In the first embodiment, the preferred maximum camber of the blade ranges from about 7.0 to 8.5 at the tip 67 of the blade with the production camber being 7.4, and ranges from about 10.3 to 12.7 at the hub end of the blade, with the production camber being 10.8. In the second embodiment, the camber range at the hub is the same as the first embodiment, with the production camber being 11.0. However, at the blade tip, the second embodiment is flatter than the first embodiment with a camber range of about 3.0 to 5.5 and the production camber is 4.9. In both embodiments the preferred position of maximum camber has been found to be about .4 of the chord length behind the leading edge 70 of the blade.

As shown most clearly in Figures 4 and 7, the setting angle which the blade chord line makes with the rotor axis increases as the reference position on the blade moves outwardly of the rotor hub end. Therefore, the setting angle F of blade 53 taken at the outer tip 67 is greater than the respective setting angle E taken at the hub end of the blade. It has been found that optimum pressure differential through the first embodiment fan for the preferred fan speed occurs when the setting angle F ranges from about 32° to 41° with the production angle being 38.35°, and the setting angle E ranges from about 17° to 23° with the production angle being 20.74°. Since the second embodiment is more volume oriented than the first embodiment, the setting angle F ranges from about 50° to 57° with the production angle being 54°-54' and the setting angle E ranges from about 26° to 32° with the production angle being 29°-42'. It should be noted that during the change in the setting angle as the blade moves outwardly from the hub end to the outer tip end thereof the position of the radially extending axis RA of the blade does not change and all blade rotation is done around that axis. It has been determined that the maximum thickness of the blade in both embodiments for the desired pressure differential, both at the hub and tip ends, approximates 12% of the chord length.

As shown most clearly in Figures 4 and 8, each guide vane 56 on shroud 41 is mounted in the air stream and is curved in a direction opposite that of each fan blade 53. However, since the trailing edge velocity is constant as measured across the blade 53, except for boundary effects, and since each guide vane 56 is stationary, there is no need for guide

vanes to be twisted as the rotor blades are. It has been determined that for both fan assemblies as defined above, the optimum setting angle G as measured between the chord through the leading and trailing edges of the guide vane 56 and the axis of the shroud 41, is between a range of about 13° to 19° with the production angle being 15°. In both embodiments there are eleven guide vanes positioned in evenly spaced relation around the shroud 41. As previously mentioned with the fan blades, the number of guide vanes may also be changed.

Referring to Figures 6 and 9, the annular reverse-cone shape inlet of the fan and shroud assembly 38 of the invention which is positioned in inlet and switch housing 22 is shown to include six similarly shaped ports 26-26 positioned in equally spaced relation around the axis of the housing. The inlet ports 26 are separated from each other by an axially extending structural walls or posts 28. The acutely angled inside wall 26a-26a of each port 26 slopes inwardly toward the fan 42 to direct air into the fan. The path of the air traveling through the inlet ports 26 makes an angle which may vary from at least about 30° up to 360° as it passes through inlet ports 26-26. It is preferred that the cross-sectional inlet opening area of the six ports be at least as great as the annular inlet opening area of the fan assembly in order to provide an efficient air inlet duct for the appliance. Further, since the peripheral velocity in the fan is greatest at the outer tip of the blades, the inside diameter of the air inlet housing should preferably be at least as large as the fan outer diameter to provide unrestricted flow therethrough. Presently, in the second embodiment, sufficient inlet housing structural rigidity is obtained only by partially restricting the inlet flow. Fan performance with the restricted intake will be discussed below. A retaining ring 43 is mounted on the inlet housing 42 across the port openings to prevent the insertion of any solid object into the area of the fan. The inlet ports provide adequate air intake to the fan while maintaining the outer generally tubular shape of the appliance.

Referring to Figure 10, the operating characteristics for both embodiments of the axial flow fan of the invention are compared with other prior art axial flow fans. The abscissa in Figure 10 denotes the air flow through the fan in cubic feet per minute, while the ordinate denotes the static pressure differential developed in inches of water. Line 72 represents the applicant's prior art axial flow fan which is 1.9 inches (approx. 4.8 cm) in diameter. Lines 73 and 74 represent other axial flow hair styler fans which are 2 1/8 inches (approx. 5.4 cm) in diameter and 2 inches (approx. 5 cm) in diameter respectively. Line 75 represents the 1.65 inch (approx. 4.19 cm) first embodiment fan of the present invention, 76 and 77 represent the 1.9 inch (4.826 cm) second embodiment fan of the present invention (line 76 is with the restricted intake mentioned above). The standard operating speeds of the various fans are: line 72 – 17,000 rpm; line 73 – 17,400 rpm; line 74 – 14,000 rpm; lines 75, 76 and 77 – 19,000 rpm. The standard operating points for the respective fans are denoted by an X on their representative line. The superiority of the pres-

ent invention's smaller diameter first embodiment fan for delivering high static pressure at conventional flow rates (below about 45 Cu.ft./min. (approx. 1.27 m³/min)) is shown in Figure 10. The first embodiment provides about 1.7 inches of water pressure (approx. 423Pa) differential while delivering about 37 Cu. ft. (approx. 1.05m³) of air per minute. The ability of the present invention's second embodiment fan to deliver both high static pressure at high rates of air flow is clearly shown. The second embodiment presently provides about 1.6 inches of water pressure (approx. 399Pa) differential while delivering about 47 Cu. Ft. (approx. 1.33 m³) per minute when partially restricted and about 57 Cu. ft. (approx. 1.61 m³) per minute when the air intake is unrestricted.

Attention is directed to application 30105/78 (2012362) from which this application was divided.

CLAIMS

1. A hand-held hair drying or styling appliance adapted to provide heated air flow including an air inlet duct and an air outlet duct; an axial-flow fan assembly in a tubular body and adjacent said air inlet duct, said assembly including a tubular fan shroud, an axial-flow fan rotatably mounted in said fan shroud, and a motor drivably connected to said fan; an air heating assembly mounted in said body downstream of said fan assembly; means for controlling the operation of said fan assembly; and means for controlling the operation of said fan assembly; and means for controlling the operation of said air heating assembly; said axial-flow fan having an outer diameter of sufficiently small dimension to allow a maximum diameter of said tubular body which is suitable for being grasped by a user during use so that the appliance may be used without any additional handle.

2. A hand-held hair drying or styling appliance according to Claim 1, wherein the diameter of said fan is about 1.65 inches.

3. A hand-held hair drying or styling appliance according to Claim 1 or Claim 2, wherein the diameter of said fan is sufficiently small to allow said tubular body surrounding said fan to have an outer diameter of about 2 inches.

4. A hand-held hair drying or styling appliance according to any one of Claims 1 to 3, wherein the said fan and heating control means are positioned upstream of said fan, said motor and said heating assembly are positioned downstream of said fan; said fan shroud and said tubular body are made of insulative material; and wherein said appliance further comprises a plurality of elongate buss-bars extending around said fan assembly between said fan shroud and said housing for conductively connecting said control means to said motor and said heating assembly, said buss-bars being thinner in a radial direction than conductively equivalent electric wires.

New claims or amendments to claims filed on 16/4/82.

Superseded claims 1-4.

New or amended claims:—

CLAIMS

1. A hand-held hair drying or styling appliance adapted to provide heated air flow including an air

inlet duct and an air outlet duct; an axial-flow fan assembly in a tubular body and adjacent said air inlet duct, the tubular body being mounted to a member containing the said air inlet duct with a bayonet fastening, the said axial-flow fan assembly including a tubular fan shroud, an axial-flow fan rotatably mounted in said fan shroud, and a motor drivably connected to said fan; an air heating assembly mounted in said body downstream of said fan assembly; means for controlling the operation of said fan assembly; and means for controlling the operation of said air heating assembly; said axial-flow fan having an outer diameter of sufficiently small dimension to allow a maximum diameter of said tubular body which is suitable for being grasped in the region of the fan assembly by a user during use so that the appliance may be used without any additional handle.

2. A hand-held drying or styling appliance according to Claim 1, wherein the diameter of said fan is about 1.65 inches (4.19 cm).

3. A hand-held hair drying or styling appliance according to Claim 1 or Claim 2, wherein the diameter of said fan is sufficiently small to allow said tubular body surrounding said fan to have an outer diameter of about 2 inches (5cm).

4. A hand-held hair drying or styling appliance according to any one of Claims 1 to 3, wherein the said fan and heating control means are positioned upstream of said fan, said motor and said heating assembly are positioned downstream of said fan; said fan shroud and said tubular body are made of insulative material; and wherein said appliance further comprises a plurality of elongate bus-bars extending around said fan assembly between said fan shroud and said tubular body for conductively connecting said control means to said motor and said heating assembly, said bus-bars being thinner in a radial (of the tubular body) direction than conductively equivalent electric wires of generally circular cross-section.

5. A hand-held hair drying or styling appliance according to any one of the preceding claims in which the fan and heating control means are operable, in use, by rotation of a switch member mounted to the member containing the air inlet duct on the side of the member containing the air inlet duct remote from the tubular body.

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