

Aug. 16, 1932.

W. MEYER

1,872,483

IMPELLER

Filed May 27, 1929

2 Sheets-Sheet 1

Fig. 1.

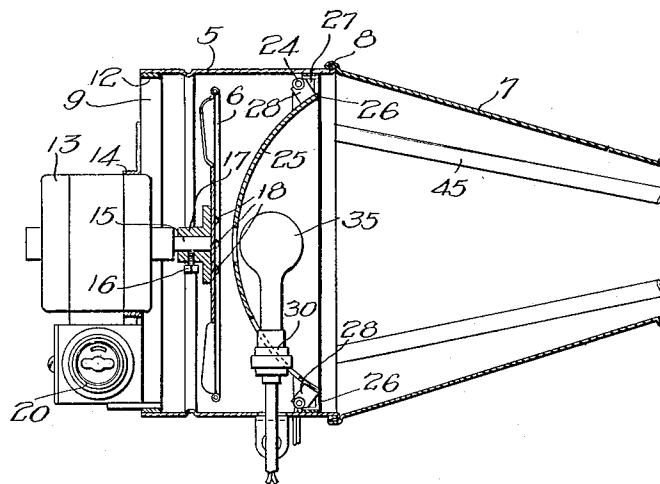
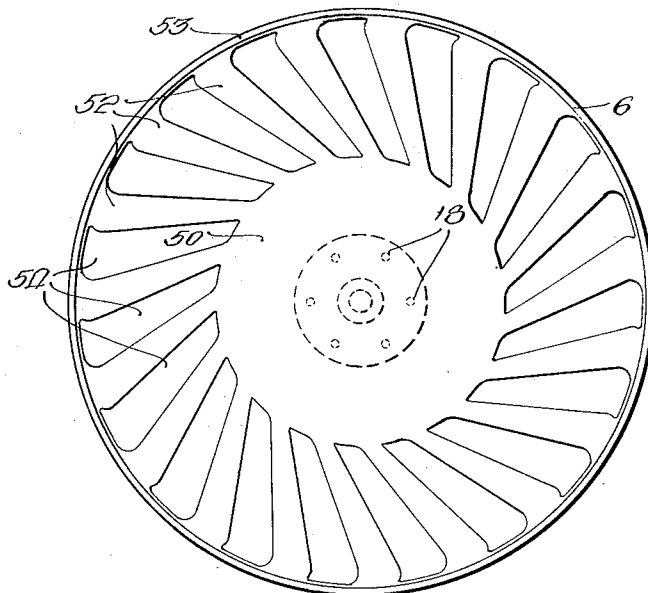


Fig. 2



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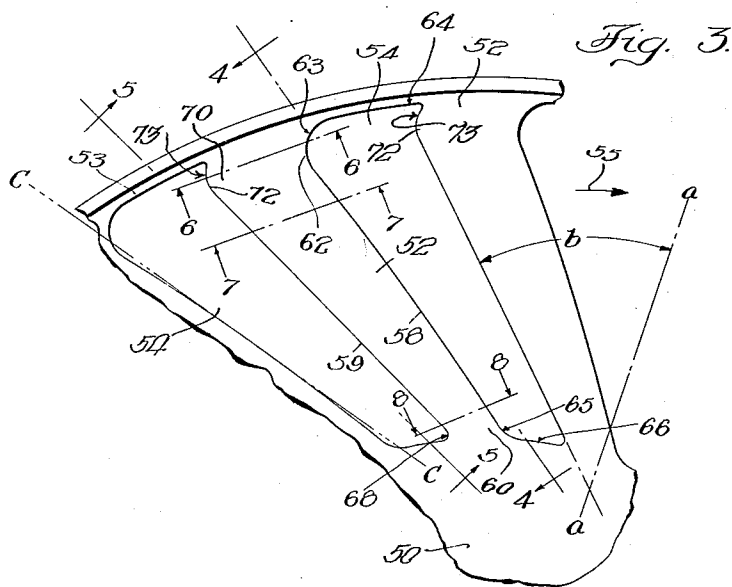
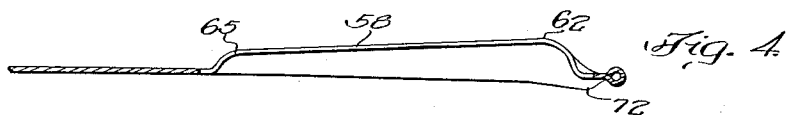
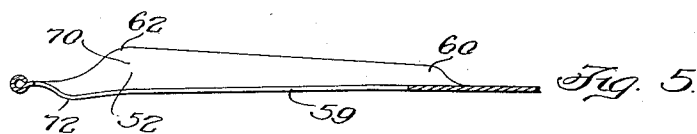
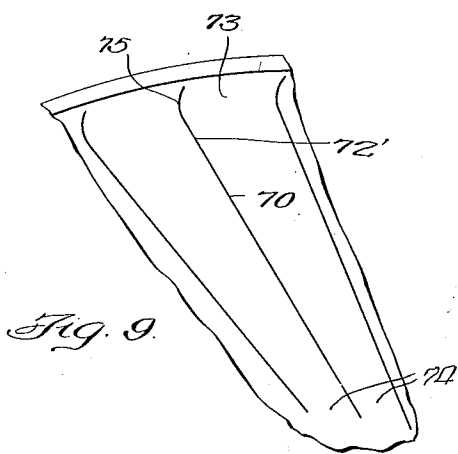
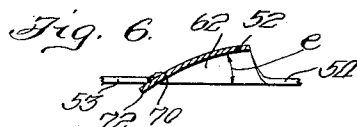
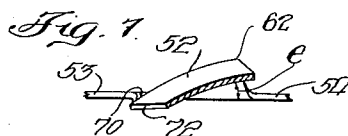
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IMPELLER

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

WILLIAM MEYER, OF CHICAGO, ILLINOIS

## IMPELLER

Application filed May 27, 1929. Serial No. 366,178.

This invention relates to impellers, and particularly to impellers for use in hair driers and the like, for the purpose of blowing or projecting a stream or blast of air upon the scalp and hair to be dried.

While the particular device which I shall describe hereinafter in connection with the drawings is shown in connection with the hair drier of my prior patent, No. 1,541,988, granted June 16, 1925, it is to be understood that the present invention is not limited to such use, but may be employed in all similar work, or wherever a fan or impeller, with the characteristics of the fan or impeller of the present invention is suitable or desired.

The object of the present invention is the provision of a generally improved, simplified, and inexpensive impeller structure and a generally improved, simplified and inexpensive method of forming same.

Another object is to improve the efficiency of the fan or impeller and particularly to improve the efficiency and adaptability of the impeller for the work in connection with which it is employed, as pointed out above.

Another object is to provide a fan which is simple to construct and of relatively great strength and stability.

Another object is the provision of a fan having a relatively high anemometer speed, quiet in operation and with which eddy currents and pockets, particularly at the outer ends of the blades, are eliminated.

Further objects and the advantages and characteristics of the present invention will appear from the following detailed description, taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal section through the hair drier of my prior patent, No. 1,541,988, showing an impeller embodying the present invention, in connection therewith;

Figure 2 is a front elevational view of the fan or impeller;

Figure 3 is a fragmentary front elevational view of the fan on an enlarged scale, to show the details of the vane or blade formation;

Figure 4 is a section, taken on the line 4—4 of Figure 3;

Figure 5 is a section, taken on the line 5—5 of Figure 3;

Figure 6 is a section, taken on the line 6—6 of Figure 3;

Figure 7 is a section, taken on the line 7—7 of Figure 3;

Figure 8 is a section, taken on the line 8—8 of Figure 3; and

Figure 9 is a fragmentary front elevational view of another embodiment of the invention, in which the blades or vanes are arranged closer together.

The hair drier shown is of the type more fully disclosed in my prior patent, above referred to, and comprises an open-ended circular shell or drum 5, forming a chamber within which the fan or impeller, designated in its entirety at 6, revolves. A tapering discharge tube 7, attached at its larger inner end 8 to the open outlet end of the drum 5, receives and directs the air and radiant heat and light to the scalp and hair, or other surface or substance. The air is drawn in through the open inlet end 9 of the drum or shell 5.

A ring 12 is secured internally about the inlet end 9 of the drum 5 and an electric motor 13 is mounted at the inlet 9 of the drum 5 concentrically with respect to the axis of the drum by a supporting frame or mounting bracket 14, which is suitably secured at the inlet end of the drum 5. The motor 13 has a revolvable shaft 15, which projects axially into the inlet end 9 of the drum 5 and fixed upon said shaft 15, as by means of a set screw 16 for rotation with said shaft and within the drum 5 is a hub 17 to which the central portion of the fan is secured, as by means of screws or other fastening devices indicated at 18.

Carried by the frame or bracket 14 are a pair of snap switches 20, one for controlling the circuit through the motor 13 and the other for closing and opening the circuit through a heating coil 24.

By closing the circuit through the motor 13, the fan 6 is started with a resulting projection of cold air from the discharge end of the tube 7. Opening the motor circuit stops the fan and discontinues the stream or blast

of air. Only one of the switches 20 is shown, but the other may be similar and arranged on the opposite side, as in my prior patent, above referred to. The heating coil 24 may be wound helically and supported annularly about the outer edge of a polished metal or other suitable reflector 25, which may be of concave formation shown, or of parabolic or any other suitable or preferred formation. The reflector 25 is mounted concentrically within the discharge end of the drum 5, as by means of spaced angle brackets 26 and its largest external diameter is sufficiently smaller than the internal diameter of the drum 5 to provide an annular passage 27 between it and the interior of the drum, through which the air is delivered to the discharge tube 7. The heating coil 24 is supported annularly about the passage 27 in the path of the stream or blast of air from the inlet 9 to the discharge end of the tube 7 by spaced insulating blocks 28. By closing the circuit through the coil 24, the air delivered from the device may be heated.

A standard or ordinary "Edison" socket 30 supports a lamp 35, which is preferably a high power electric light or incandescent lamp, such as a nitrogen or high power tungsten filament lamp, although this may vary. When the lamp circuit is closed, the rays of light and radiant heat emitted by the lamp 35 are reflected by the reflector 25 and projected outwardly through the outlet end of the tube 7.

The discharge tube 7 is preferably provided internally with ribs or fins 45 extending longitudinally thru the tube for the purpose of projecting the air in a straight line without swirling, turning or circular motion.

The foregoing will suffice for a description of the particular hair drier illustrated. The details of the drier may vary widely, so far as the fan or impeller 6 of the present invention is concerned and, in fact, the fan or impeller may be employed for other purposes and is not limited to use in a hair drier. Such details as have been described are, however, for the purpose of clearly imparting a full understanding of the advantageous characteristics of the present invention, in connection with a particular device, with which it has been found highly efficient and suitable.

The fan or impeller 6 is preferably of unitary construction and is, preferably stamped from a single piece of sheet metal. It comprises the inner generally axial disc-like portion 50, with the vanes or blades 52 struck or drawn out integrally from the same sheet outwardly of the inner mounting portion 50 and integrally connected at their outer ends by the integral surrounding rim 53. The mounting portion 50 may be solid, as shown, and apertured for fastening to the hub 17 by the fastening elements 18, or this mounting portion 50 may be formed with an axial

opening, or otherwise, for attachment in any suitable or preferred manner to the hub 17, or an integral laterally pressed hub portion is even contemplated within the scope of the present invention.

This portion of the impeller or fan may be varied widely. The integral rim 53 is, preferably, rolled over or beaded, as shown particularly in Figures 1, 4 and 5, and I find that this provides excellent strength and rigidity around the rim of the fan. The central disc-like mounting portion 50 forms the hub of the fan and may be termed the hub of the fan. In the embodiment of Figures 3 to 8, the spaces between the blades or vanes 52 are relatively wide and are formed by stamping or cutting out the openings 54 alternately between the blades 52. The fan rotates in the direction indicated by the arrow 55 in Figure 3 and the openings 54 are, preferably, of increasing width outwardly from the central portion 50 to the rim 53. The blades 52 are also preferably of increasing width from the central portion 50 to the rim 53. It is to be noted that the blades or vanes 52 are not radial, but are preferably disposed at an angle  $b$  to the radii, indicated at  $a-a$  in Figure 3. This angle  $b$  is preferably such that the blades slope or are inclined backward or away from the direction of rotation 55 outwardly from the central portion 50 to the rim 53. This backward sloping of the blades outwardly away from the direction of rotation is an important aspect of the present invention. I find by anemometer tests that the efficiency of the fan is greatly increased thereby. Higher anemometer speeds are produced by this backward slope. In addition, this inclination of the blades 54 to the radii  $a-a$  provides longer blades within a given radial dimension and the backward sloping of the blades outwardly toward the rim 53 and away from the direction of rotation 55 seems to give a better outward direction to the blast or stream of air outwardly around and through the annular space 27 between the outer periphery of the reflector 25 and the interior of the drum 5.

I reserve the right, however, to supplement or even correct, if necessary, the theory of action of the fan, but I shall described herein how the invention may be practiced and employed and the advantages and improvements of this invention obtained. The leading edges 58 of the blades 52 may be convex or curved forwardly slightly, as indicated by comparison with the straight dot and dash line  $c-c$  in Figure 3. While this slight convexity may be varied or omitted, where it is present, it may be formed by the operation of drawing or pressing the blades 52 to the desired pitch. The trailing edges 59 are shown as substantially straight, but this, too, may vary within the scope of the present invention.

The blades 52 obviously provide integral connections between the central portion 50 and the integral rim 53.

The blades 52 are pitched to the desired angle to the sheet from which they are drawn or struck, as indicated at *e*, in Figures 6, 7 and 8. This pitch may be greater at or toward the hub or mounting portion 50, as indicated at *e* in Figure 8 and the pitch may diminish gradually towards the outer ends of the blades 52, as at *e* in Figure 6, but this may vary. The blades 52 are, preferably, substantially flat across their width, although they may be cupped slightly toward the direction of rotation of the fan and particularly at the outer ends of the blades as shown in Figures 6 and 7. The inner end of each blade is cupped up at 60 toward its leading edge 58, which cupping may be formed by a drawing of the metal along this portion and the outer end of each blade is cupped forwardly toward its leading edge 58 at 62, which cupping 62 may also be produced by a drawing of the metal along these portions of the blades.

The outer ends of the leading edges 58 are, preferably, rounded at 63 into the outer ends 64 of the openings 54 and the inner ends of the leading edges 58 are preferably rounded at 65 into the inner ends 66 of these openings 54. Due, possibly, to the difference in angular relation between the outer ends of the leading edges 58 and the outer ends of the openings 54 and the inner ends of these leading edges 58 and the inner ends 66 of the openings 54, the curvatures 63 at the outer ends of the blades are, in the illustrated embodiment, on smaller radii than the curvatures 65 the inner ends of the blades. The inner ends of the trailing edges 59 are in substantially the plane of the flat sheet from which the blades are drawn at 68 and at their outer ends the rearward or trailing portions of the blade 54 approach or substantially reach the plane of the flat sheet slightly ahead of the outer ends of the trailing edges at 70. Rearwardly or away from the direction of rotation of the fan, the outer ends of the trailing edges 59 are preferably turned rearwardly or extend across and to the opposite side of the flat sheet or the plane of the mounting portion 50 to provide tails 72 at the outer ends of the trailing edges, which tails are preferably rounded substantially as shown at 73. I find that these trailing tails 72 at the outer ends of the trailing edges 59 provide excellent kick offs for action upon the air or other fluid and that the efficiency of the fan is further increased thereby and pockets and eddies, particularly at the outer ends of the blades are avoided. A greater suction is produced on one side of the fan and a greater compression or blowing or blasting force is produced upon the opposite side of the fan.

If desired, it is to be understood that the leading edges 58 may be thicker than the trail-

ing edges 59 for the purpose of further reducing eddy currents and this may be produced by the drawing of the blades from the flat sheet stock.

The openings 52 may, of course, be still wider than illustrated in Figures 2 and 3 to space the blades or vanes 52 still further apart or these openings 52 may be narrower to space the blades 54 closer together. I also contemplate separating the trailing edges of the blades from the leading edges of the succeeding blades merely by cuts 70, as illustrated in the embodiment of Figure 9. In this case, there need be no openings of appreciable width formed between the blades, but the cuts 70 will free the leading edges 72 to be pressed or drawn to the desired form, as described in connection with the previous embodiment. In this case, the outer ends of the leading edges 72 are cupped up at 73 and the inner ends of these leading edges 72 are cupped up at 74. The outer ends of the trailing edges are, as before, preferably provided with tail portions, which trail behind the outer ends of the blades and provide kick offs which increase the efficiency of the fan. As before, the compression on the front side and the suction on the back side is improved and the air is directed outwardly and effectively and efficiently through the annular space 27 between the outer periphery of the reflector 25 and the interior of the drum 5. The blades are again, preferably, at angles to the radii and preferably slope backward outwardly toward the rim and away from the direction of rotation.

The tail portions or outer ends of the trailing edges, indicated at 75, are again preferably turned in and to the opposite side of the fan, as more fully disclosed in connection with the previous embodiment.

In forming the fan of Figures 1 to 8, inclusive, the openings 54 are preferably first cut out. Either simultaneous with the cutting of these openings or thereafter the blades are pressed to shape and thereafter the marginal bead 53 is rolled. The formation of the fan of Figure 9 may be the same, and the particular order or combination of steps may vary, as desired.

I do not intend to be limited to the precise details illustrated or described.

I claim:

1. An impeller comprising a unitary sheet metal multi-blade structure with the blades pitched angularly relative the normal plane of the sheet metal, and trailing tails turned across and to the opposite side of the plane of the sheet metal adjacent the outer ends of the trailing edges of the blades.

2. An impeller comprising a unitary sheet metal multi-blade structure with the blades pitched angularly relative the normal plane of the sheet metal, and sloping outwardly away from the direction of rotation of the impeller.

3. An impeller comprising a unitary sheet metal multi-blade structure with the blades pitched angularly relative the normal plane of the sheet metal, and sloping outwardly away from the radii of the impeller and away from the direction of rotation of the impeller.

4. An impeller comprising a unitary sheet metal multi-blade, rim and hub structure, with the blades pitched angularly relative the normal plane of the sheet metal and diminishing in width from the rim toward the center of the impeller, said blades sloping outwardly away from the direction of rotation of the impeller and "kick off" tails turned across and to the opposite side of the plane of the sheet adjacent the outer ends of the trailing edges of the blades.

5. An impeller blade having a trailing tail turned rearwardly away from the pressure side and toward the suction side of the blade and disposed adjacent the outer end of the trailing edge of the blade.

6. An impeller having a blade sloping outwardly away from the direction of rotation of the impeller and a tail turned rearwardly away from the pressure side and toward the suction side of the impeller and disposed adjacent the outer end of the trailing edge of the impeller, said blade diminishing in width from the tip of the blade toward the center of the impeller.

7. An impeller blade having a "kick off" tail turned rearwardly away from the pressure and toward the suction side of the blade and disposed adjacent the outer end of the trailing edge of the blade, said blade sloping outwardly away from the direction of rotation of the impeller.

8. An impeller blade having a trailing tail turned rearwardly away from the pressure side and toward the suction side of the blade and disposed adjacent the outer end of the trailing edge of the blade, said blade diminishing in width from the tip of the blade toward the center of the impeller.

In witness whereof, I hereunto subscribe my name this 14th day of May, 1929.

WILLIAM MEYER.

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