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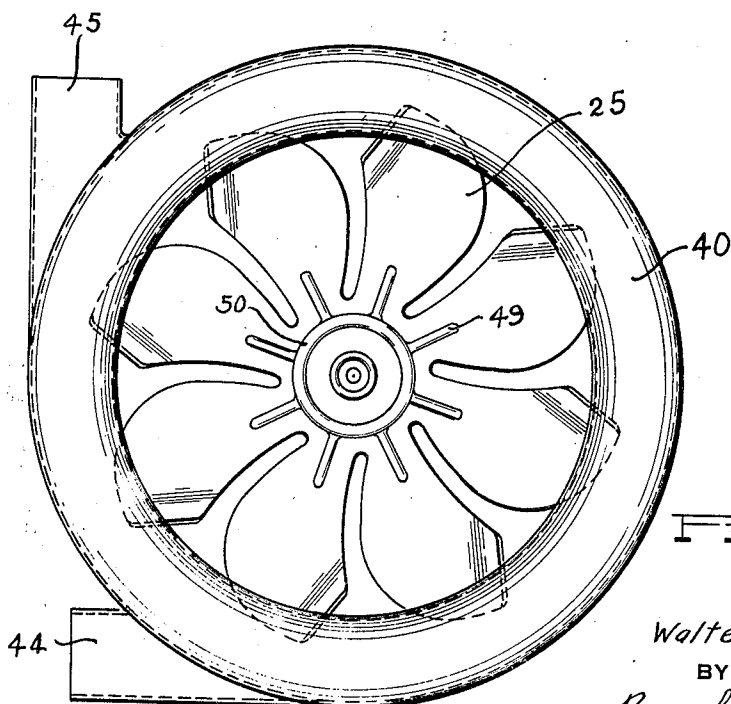
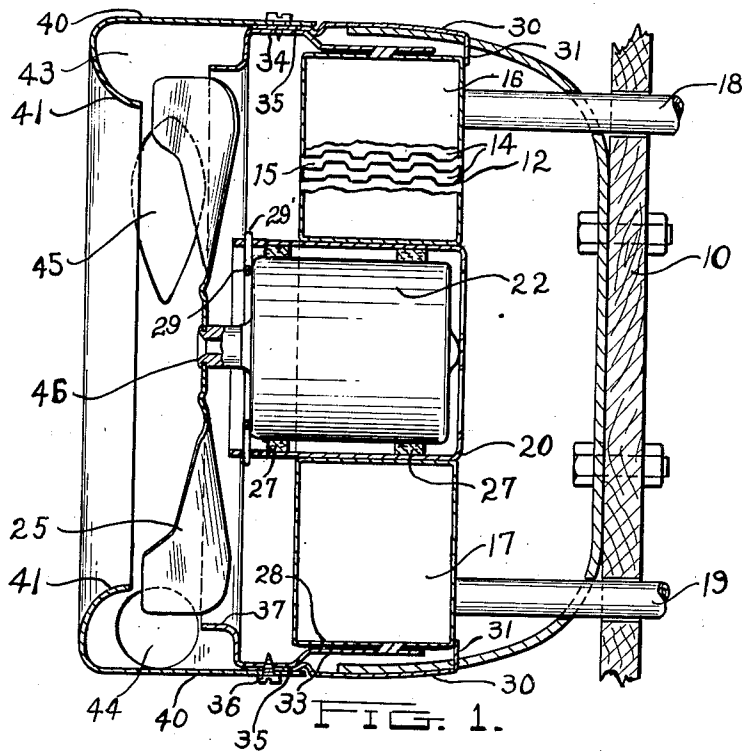
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2,176,325

FLUID IMPELLING MEANS

Filed Aug. 4, 1937

2 Sheets-Sheet 1



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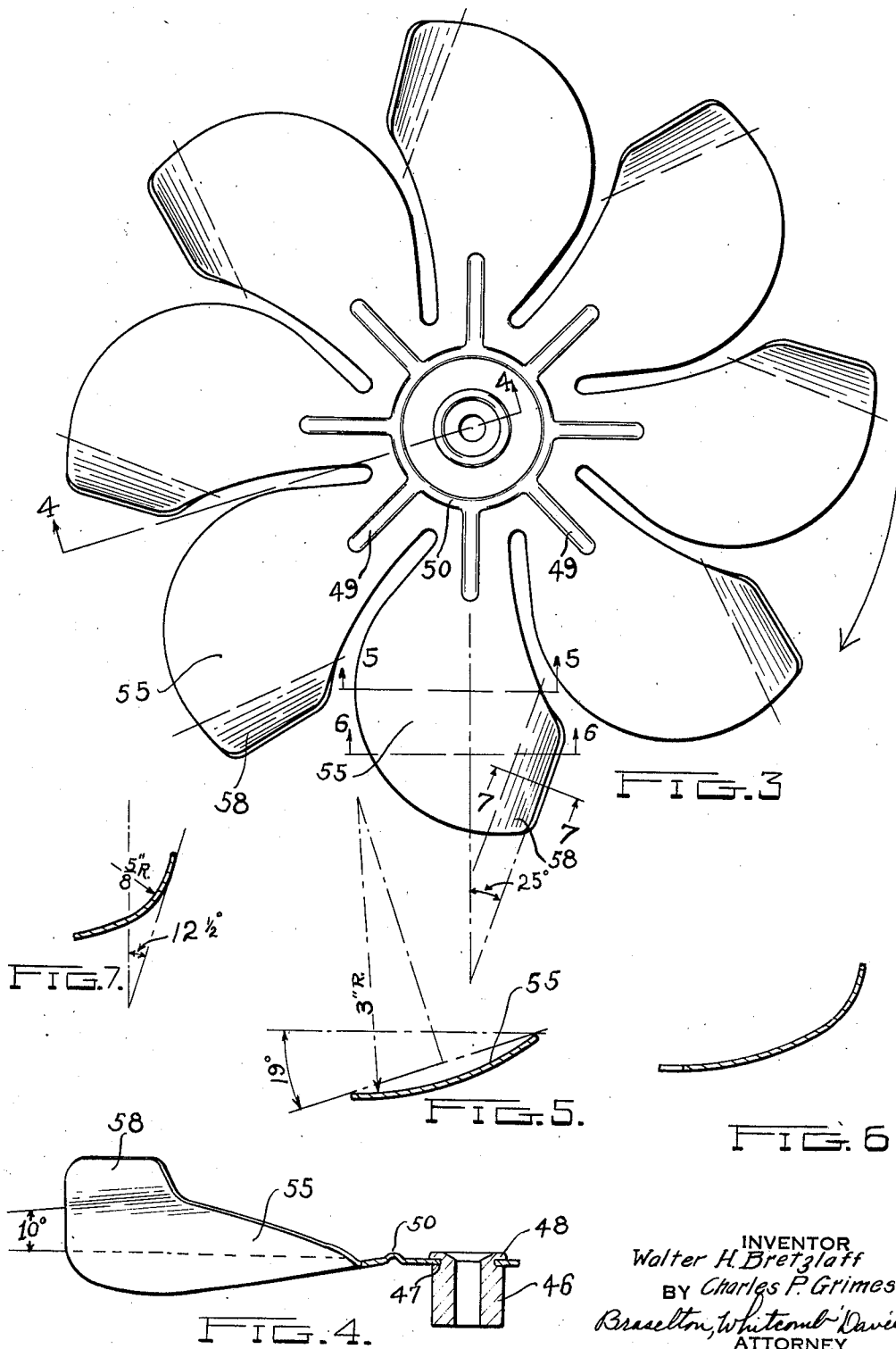
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UNITED STATES PATENT OFFICE

2,176,325

FLUID IMPELLING MEANS

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Application August 4, 1937, Serial No. 157,274

7 Claims. (Cl. 170—159)

Our invention relates to fluid moving means, and more especially to an air moving means for simultaneously moving an air stream in a multiplicity of directions.

5 The invention embraces in a single element a means of simultaneously producing a fluid stream which is non-directional in character.

It is a further object of our invention to provide a fluid impeller of the disc or propeller type normally adapted for producing an air stream in one general direction, the impeller having means formed on the impeller vanes for diverting part of the air stream in another direction.

Another object of our invention is to provide an impeller so formed as to project air from different pressure zones of the impeller in different directions for use under different conditions of velocity and pressure.

Still another object of our invention is to provide in one unit or assembly a disc or propeller type fan in combination with a centrifugal type fan.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawings of a form of the invention, which may be preferred, in which:

Figure 1 is a vertical sectional view showing the fluid moving means of our invention as incorporated in a heat transfer unit;

Figure 2 is a front elevational view of the heat transfer unit incorporating our invention;

Figure 3 is a front elevational view of the fluid moving means;

40 Figure 4 is a detail sectional view showing one of the vanes or blades of the fluid moving means, a section being taken substantially on the line 4—4 of Figure 3;

Figure 5 is a detail sectional view taken substantially on the line 5—5 of Figure 3;

Figure 6 is a detail sectional view taken substantially on the line 6—6 of Figure 3;

Figure 7 is a fragmentary detail sectional view taken substantially on the line 7—7 of Figure 3.

50 While we have shown the fluid moving means of our invention as incorporated in a heater or heat transfer unit, it is to be understood that we contemplate its utilization in any place where a fluid moving means may have utility.

5 Referring to the drawings in detail, and particularly Figures 1 and 2, there is illustrated a heat transfer unit particularly adapted for heating the interior of a vehicle body and numeral 10 illustrates a dash board of a vehicle which forms a support for the heater although any suitable supporting means may be utilized. The heater construction consists of a core structure 12 preferably made up of curved or semi-annular water passages formed by a plurality of spaced walls 14 and between the water passages the walls form ducts or openings 15 through which air or other fluid may pass for absorbing heat to heat the interior of the vehicle. The core structure is inclusive of segmental or sector-shaped headers or tanks 16 and 17 preferably diametrically positioned, the headers being respectively connected to a fluid or liquid supply by means of inlet and outlet pipes 18 and 19. In a vehicle installation, the pipes 18 and 19 are connected into the cooling system employed for cooling the internal combustion engine or prime mover of the vehicle. The core is provided with a central opening lined with a member 20 which forms a means of supporting a motor 22, the latter driving the fluid impelling means 25 of our invention, which will hereinafter be described in further detail. The motor is preferably supported by resilient shock absorbing devices 27 which as illustrated are annular in form and fabricated of cork, rubber, or the like to damp out vibrations which may result from rotation of the motor and air impeller 25.

The motor 22 is held against longitudinal movement by means of a spring clip 29 having ears 29' which extend in openings in the member 20. The core 12 is surrounded by a sheet metal shroud 30 having an inwardly extending flange portion 31 which contacts with a band 28 encircling the core and thus positions the latter. Secured to the shroud 30 is an annular band 33 which surrounds and is secured to the band 28 and forms a support for the latter, the band 33 having an annular raised portion 34 which is secured to an annular extension 35 of the shroud 30 by means of screws 36 or other suitable securing means. The annular band 33 has a forwardly and inwardly extending annular portion 37, the inner edge of which defines an opening adjacent the air moving means. Also secured to the shroud 30 by means of screws 36 is an annular member 40 which has an inwardly projecting portion 41 terminating in front of the tips of the vanes of the air moving means 25. The inner edge of portion 41 defines a circular opening to permit the passage of air forwardly of the heater. The extension 37 of band 33 together

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with the member 40 forms an annular collecting chamber 43 which may have one or more outlets preferably tangentially arranged for a purpose to be hereinafter explained, two of such outlets being shown at 44 and 45.

The air impelling means per se is preferably multi-vaned as shown in Figures 2 and 3, there being eight shown in the form illustrated in the drawings, although any number may be employed. The vanes are preferably formed from a single sheet of metal in the center of which is positioned a hub 46, the latter having a reduced portion 47 fitting into the opening in the impeller 25, after which the portion 48 of the hub may be swaged as illustrated in Figure 4 to secure the impeller and hub together. In order to strengthen or increase the rigidity of the impeller structure, a plurality of radial ribs 49 and an annular rib 50 may be formed out of the propeller blank which not only aids in maintaining the propeller in the proper plane of rotation, but also lends strength to the vanes to resist torque.

Each vane of the impeller is of special construction wherein the body portion 55 of the vane is slightly concave as shown in Figure 5. This portion of the impeller blade is formed to about a 19° pitch which has been found to be a desirable and efficient angular pitch for an impeller of approximately eight inches in diameter. Each vane of the impeller is provided on the trailing edge adjacent the tip with a special configuration for conveying or diverting a portion of the air stream in a generally radial and tangential direction. The fan vane or blade formation for accomplishing this purpose consists of an integrally formed projection 58 which in section is of a configuration, as illustrated in Figure 7, with the trailing edge of this part of the vane arranged preferably at about a 25° angle to the radial axis of the vane as illustrated in Figure 3. It is also to be noted that where the projection 58 joins tangentially with the body 55 of the impeller vane, as shown in Figure 7, we have found in an eight inch impeller, a radius of five-eighths inch to be highly efficient. We have found that the projection functions efficiently to give a very high radial and tangential air flow value when the projection is located with respect to the axis of rotation of the vanes so as to take advantage of a high velocity portion of the vane. This efficient high velocity area, particularly adaptable for creating a radial and tangential air stream in the form of our invention illustrated, occurs at a point from two-thirds to three-fourths of the radial length of a vane from its axis of rotation.

With impeller arrangement above described, we are able to produce a fluid stream in a direction generally axially of the propeller and of relatively low velocity, this air stream being produced by the body or disc portions 55 of the vanes, while the projections 58 take air from the high velocity area of the vanes and, due to the particular configuration, produce an air stream radially and tangentially, thus setting up a pressure in the plenum chamber 43 shown in Figure 1, the pressure set up in this chamber being utilized for other purposes as, for example, defrosting wind shields, conveying heated air to remote locations, etc. Thus, by our arrangement of air impeller, there is provided in a single unitary rotor a means for producing a fluid flow generally axially of the fan or impeller as well as radially and tangentially thereof.

In the particular arrangement, the pressure of the radially projected air flow is increased by the restriction to the flow of air set up by the core 12 through which the air passes under the influence of the impeller 25 and we have found that irrespective of whether the impeller is utilized with a heating structure or another arrangement, the impeller operates at its highest efficiency when there is a certain predetermined partial restriction to the flow of the air on the side adjacent the leading edges of the impeller vanes. In the embodiment illustrated, the heater core supplies this partial predetermined restriction, but restrictions of the character of filters or the like may be used if desired. The combination of our improved air impeller in such a unit is more fully disclosed and also claimed in our copending patent application Serial No. 157,275 filed August 4, 1937.

It is to be understood that the dimensions for particular parts of the impeller structure of our invention herein given are illustrative of a desirable size which we have found to operate efficiently in conjunction with a heat transfer unit, but that we do not limit our invention to the dimensions and angular relationships herein specified, but wish to point out that the dimensions and vane pitch may be modified especially with different sized impellers and with varying degrees of efficiency without departing from the spirit of the invention.

It is apparent that within the scope of the invention, modifications and different arrangements may be made other than is herein disclosed, and the present disclosure is illustrative merely, the invention comprehending all variations thereof.

What we claim is:

1. An air impeller for producing an air stream of variant velocities comprising a hub; a multi-vaned impeller member carried by the hub, each vane having a pitch for creating an air flow of low velocity generally axially of the rotation of said hub into the impeller, said vanes having enlarged integrally formed projections adjacent the outer extremities of said vanes, said projections having a pitch of different angularity than that of the vanes producing the axial air stream, said projections being curved about an axis angularly arranged with respect to the normal longitudinal axis of the vane, inclining to the plane of rotation at an angle of substantially ten degrees and adapted when said impeller is rotated to divert a portion of the air flow produced by the vanes in a substantially radial and tangential direction.

2. A composite air impeller for drawing air through an air flow restriction and delivering a broadly diverging air stream comprising, a supporting member, a plurality of vanes extending outwardly from said member in a plane of rotation, each of said vanes being turned at a predetermined angle of pitch with reference to said plane of rotation, each of said vanes having a tip curved ahead on the trailing edge, the axis of curvature of each vane tip being angularly tipped ahead in the direction of rotation with reference to the axis of each vane, and the axis of curvature of each of said tips being inclined to intersect the plane of rotation at a point more remote from the axis of rotation for moving a portion of the air stream at a higher velocity radially and tangentially of said impeller than the balance of the air stream.

3. A composite air impeller for drawing air through an air flow restriction and delivering a

broadly diverging air stream comprising, a supporting member, a plurality of vanes extending outwardly from said member in a plane of rotation, the overall diameter of the air impeller thus formed being between seven and twelve inches, each of said vanes being turned at a predetermined angle of pitch with reference to said plane of rotation, each of said vanes having a tip curved ahead on the trailing edge, the axis of curvature of each curved vane tip being angularly tipped ahead in the direction of rotation and the radius of curvature of each curved vane tip being between four eighths of an inch and six eighths of an inch.

4. A composite air impeller for drawing air through an air flow restriction and delivering a broad diverging air stream comprising, a central supporting member, a plurality of vanes extending outwardly from said member to an overall diameter of between seven and fourteen inches, said vanes being turned uniformly to a suitable angle of pitch for drawing air substantially axially onto the vanes as the central member is rotated, a tip curved ahead on the trailing edge of the high velocity portion of each vane, and the axis of curvature of each vane tip inclining angularly ahead in the direction of rotation to intersect a plane passing through the axis of rotation and the longitudinal axis of its vane at a point more remote from the center of rotation and said axis of curvature making an angle with said plane of between 15 and 30 degrees.

5. The combination set forth in claim 4 in which the axis of curvature of each curved vane tip intersects the plane of rotation at an angle of between 5 and 20 degrees.

6. The combination set forth in claim 4 in which the radius of curvature of each curved vane tip is between half an inch and one inch.

7. An air moving means comprising a rotatable hub; a multi-vaned impeller carried by said hub, the vanes of said impeller each having a leading edge and a trailing edge, the body of each vane being pitched to create during rotation an air flow generally axially of the impeller; said vanes each having an integrally projecting curved portion extending from the trailing edge thereof, the curved portion having a radius of curvature generated about an axis angularly disposed with respect to the longitudinal axis of the vane, and said radius of curvature being less than one third that of the radius of curvature of the main portion of the blade, said curved portion being arranged on each vane adjacent a high velocity portion thereof and said curved portions being arranged to project a portion of the air stream in a tangential and radial direction with a greater resultant velocity than the peripheral speed of the tip of the blade combination.

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