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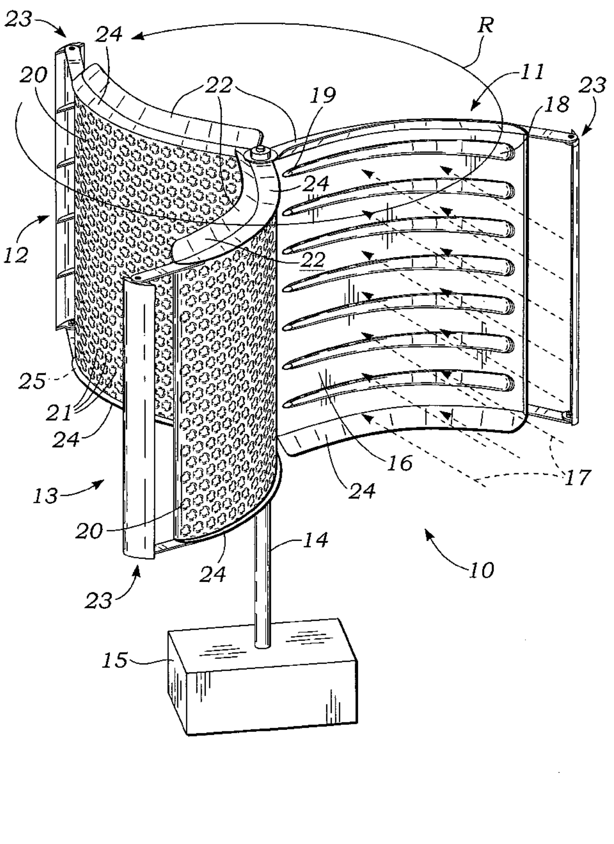
Fig. 1



(57) Abstract: A vertical axis omni-wind turbine having a wind sail centrally mounted to a turbine drive shaft, the wind sail consisting of three generally identical vanes, or blades, separated 120 degrees apart. The blades each have a generally concave surface with an opposite or reverse surface that is generally convex. As designed and mounted to the turbine drive shaft, the wind sail provides a self starting air foil in that each blade includes one side having a generally concave configuration to capture impinging wind thrust with the other side having a generally convex configuration to provide minimal wind resistance. The resulting disparate wind resistance causes a stronger reaction on the concave side of a vane which in turn provides rotation about the vertical oriented drive shaft. The turbine has omni-wind characteristics in that regardless of the wind direction an adequate portion of the concave surface of a rotor blade will always be exposed to impinging wind. The subsequent drive shaft rotation is transmitted to an electrical turbine.

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WIND SAIL TURBINE

Technical Field

The present invention relates in general to turbines for converting wind into electrical energy and more particularly to a self-starting omni-wind multifaceted wind sail.

Background Art

Wind powered electrical turbines are well known in the prior art, however, a search of the art has not disclosed the wind turbine having the characteristics and capabilities of the present invention. Devices of interest are disclosed in: U.S. patent 5,133,637 issued to Wadsworth on 07/28/1992 which relates to a vertical axis wind turbine having vanes for reducing friction on rotor shaft bearing assemblies; U.S. patent 6,308,521 issued to Eylman on 10/30/2001 relating to a universal power generator utilizing the flow of wind to generate energy; and US patent 7,798,766 issued to Dieter R. Sauer, Sir. on 07/21/2010, relating to a vertical axis wind sail turbine with two identical wind sail vanes mounted 180 degrees apart each having a generally concave surface with an opposite surface that is generally convex.

It is thus an aspect of the present invention to provide an improved omni-wind self-starting wind sail for wind driven electrical turbines. It is another aspect to provide a wind sail that is efficient, economical and configured for multifaceted use in a variety of environments; the wind sail including three identical vanes centrally mounted 120 degrees apart onto a turbine drive shaft. Other aspects of the invention will become apparent with a reading of the specification taken with the drawings wherein there is shown and described the wind sail assembly of the invention.

Disclosure of Invention

The invention provides a rotary three-vane, omni-wind, self-starting, wind sail assembly for powering an electric turbine, or other devices, by means of an appropriate takeoff arrangement. The three vanes are generally identical and mounted 120 degrees apart onto a turbine drive shaft. Each vane extends outwardly from the drive shaft with a scimitar-like curvature. The front surface of each vane has the concave configuration of the scimitar-like curvature to capture impinging wind thrust, whereas the rear surface of the vane has the convex configuration of the scimitar-like curvature to provide minimal wind resistance. This vane configuration establishes a disparate wind resistance between the front and rear surfaces of a vane resulting in a stronger thrust on the concave surface which in turn provides resultant thrust for rotation of the turbine drive shaft. The vanes are configured to include unique air collection grooves for channeling air to vane-through air exit ports for jet-like direction of air onto the following vane thereby providing additional rotary force to the wind sail.

Brief Description of the Drawings

Fig. 1 illustrates the three vane wind sail in accordance with the invention;

Fig. 2 is a cut-away view showing the rear surface air disruptors of the vanes;

Fig. 3 is an enlarged view showing the front surface strakes of the vanes;

Fig. 4 illustrates the rear surface of each vane of the wind sail of Fig. 1;

Fig. 5 is an exploded view of the wind sail as shown in Fig. 4;

Fig. 6 is an enlarged view of the front surface strakes and associated air exit ports of a vane as indicated in Fig. 5;

Fig. 7 is a top view illustrating the scimitar-like curvature of the vanes;

Fig. 8 illustrates extension of the torque converters from the vanes;

Fig. 9 indicates the manner in which the torque converter can be pivoted; and

Fig. 10 indicates in cross-sectional view impinging air, and the direction of captured air within the strakes to, and through, the exit ports 19 to thereby exit the vanes and be propelled onto the following vane.

Best Mode for Carrying Out the Invention

The three vane wind sail assembly of the invention is designed to effect maximum capture and utilization of impending air. As disclosed, the vertical axis assembly includes three substantially identical vanes, or blades, centrally mounted 120 degrees apart onto a turbine drive shaft, subsequent drive shaft rotation being transmitted to power an electrical turbine. Each vane extends outwardly from the drive shaft with a curved scimitar-like curvature with the back surface of the scimitar-like curvature having a concave configuration to capture impinging wind thrust, with the front surface of the scimitar-like shape having a convex configuration designed to provide minimal wind resistance. The resulting disparate wind resistance causes a stronger reaction on the concave side of a vane which in turn provides rotation of the drive shaft. Thus, as designed and mounted to the centrally located turbine drive shaft, the vane surfaces cooperate to maximize capture of impinging wind and to force rotation of the drive shaft

The configuration of the wind sail assembly provides for self-starting in that regardless of the wind direction an adequate portion of a concave surface is continually presented to impinging wind, thus providing self-starting and continuous rotation of the drive shaft. Additionally, the wind sail assembly has omni-wind characteristics as the configuration of the combination of the concave and convex surfaces constantly provides adequate exposure to impinging wind to initiate rotation of the drive shaft regardless of the wind direction. The self-starting and omni-wind characteristics are augmented by inclusion of vane-through jet-like air exit ports configured for increasing the rotary force applied to the wind sail. Even though a three vane wind sail configuration is disclosed herein, it is to be understood that the number of vanes may be varied, more wind sails may be mounted to the same shaft, and as well, other modifications and embodiments may be made within the spirit and scope of the invention. For simplicity the invention is herein disclosed by description of individual parts. Further, it is to be understood that the vane parts as well as the vane itself may be molded, or otherwise combined, in a variety of ways. Materials used for construction of the vanes are selected to result in a lightweight and durable wind sail.

Referring now to the drawings, Fig. 1 illustrates in perspective view the wind sail, generally designated 10, of the invention. Wind sail 10 is seen to include three substantially identical rotor vanes, generally designated 11, 12 and 13, which are centrally mounted 120 degrees apart to turbine drive shaft 14 of turbine generator 15. Each vane 11-13 includes substantially identical top and bottom encasement plates 24, and as best shown on vane 11, each vane has a front generally concave surface 16 and as best shown on vane 13 a rear generally convex surface 20. The front concave surface 16 is configured to capture impinging wind, designated by arrows 17, to force counterclockwise rotation of the wind sail 10 about the drive shaft 14, as indicated by arrow R. The rear convex surface 20 includes wind disrupters 21 (vane 12) configured to minimize drag on rotation of the wind sail 10 about the drive shaft 14.

Each front concave surface 16 of vanes 11-13 includes a plurality of rows of open grooves, or strakes, generally designated 18, running in generally parallel horizontal lines from the outer edge to the inner edge of vanes 11-13, that is, toward the drive shaft 14. The open grooves 18 are designed to capture impinging airflow and channel it inwardly toward the center rotor shaft 14 where there is located on each strake a relatively small air exit port 19. The grooves 18 are ribbed on both sides to better hold the air flow, and gradually increase in depth and decrease in width, in funnel-like manner, as they approach drive shaft 14 to thereby increase the velocity of the air therein. The captured air is then exited from grooves 18 through an associated exit port 19 and propelled against the concave surface 16 of the following vane. Exit ports 19 displaces airflow from the center vortex proximate the drive shaft 14. Thus, grooves 18, in combination with air exit ports 19, cooperate to create a jet-like effect directed to a following vane for increasing the rotary force applied to the wind sail 10.

Each vane 11-13 includes an upper air scoop, or flap, 22 projecting outwardly and upwardly at an angle from the top encasement plate 24 of the concave surface 20. Air scoops 22 are designed to meet impinging air at an appropriate angle, such as 45 degrees, and direct it toward the concave surfaces 16. Each vane includes a bottom air scoop, or flap, 25 projecting outwardly and downwardly at an appropriate angle, such as 45 degrees, from the bottom encasement plate 24. Air scoops 22 and 25 function to capture the outside boundary air flow and direct it into the junction area of the vanes 11-13. The back sides of the air scoops are designed to deflect air away from the wind sail 10. Each vane may also include a variable torque converter, generally designated 23, configured to direct air into the grooves 18 and thus produce more rotational torque to the wind sail 10.

Fig. 2 is an enlarged view partially illustrating the rear convex surface disruptors 21 of the vanes 11-13. Disruptors 21 consist of multitudinous indentations arranged in a pattern designed to break up the air flow across the convex surface 20 and thereby create a boundary layer of air that operates to decrease air friction and thus promote rotation of drive shaft 14.

Fig. 3 is an enlarged partial view of the concave surface 16 showing, by the arrows, the direction of air flow in grooves 18 across the convex surface 16 and toward the associated air exit ports 19 of grooves 18. The grooves o 18 can be more clearly seen to decrease in width as they approach the air exit ports 19. It is understood that other configurations of the strakes may be used as may be suitable within the spirit and scope of the invention. Fig. 3 also illustrates in partial view the torque converter 23, which as will be described, extends from top and lower plates 24 and provides variable multipurpose operation of wind sail 10.

Fig. 4 shows in greater detail the rear convex panel 20 of the vanes 11-13. Shown are air disrupters 21, scoop 22, top and bottom plates 24, torque converter 23, and in a cut-away view indicates an air exit port 19. Other air exit ports 19a are shown with the grooves 18 indicated in dotted lines. Torque converter 23 includes vertically extending blade, or airfoil, 23a (see also Figs. 7-9) pivotally mounted to top and bottom plates 24 by extensions 23b and designed to evenly spread rotational torque of the wind sail 10 about the drive shaft 14. Airfoils 23a have a curved outside face and include ribs 23c to grasp impinging wind and increase torque generated by the wind sail 10. Airfoils 23a are pivotally mounted to extensions 23b at pivot points 23e.

Also shown in Fig. 4 is a simplified example of the manner in which vanes 11-13 may be attached to and supported by drive shaft 14. Each of vanes 11-13 includes a longitudinal side member 50 (see also Fig. 5) configured for fitting along drive shaft 14. Top and bottom plates 24 are as well configured at 24a for fitting onto drive shaft 14. An attachment assembly, generally designated 51, captures and supports the lower end of side member 50 with attachment assembly 51a supporting the upper end of side member 50. It is understood that this arrangement is by way of example only and that other suitable means for attachment and support of the vanes 11-13 to drive shaft 14 are within the scope of the invention.

Fig. 5 is an exploded view showing the vane of Fig. 4 with the rear convex surface 20 extended from concave surface 16 to illustrate the inward side of front concave surface 16. The grooves 18 and their respective exit ports 19a are more clearly indicated. Although the bottoms of grooves 18 are shown by way of explanation visibly pushed inwardly, it is understood that depending on the method of fabrication of surface 16 the bottoms of grooves 18 could be covered and not visible. Convex surface 20 illustrates air output holes 19a for exit ports 19 that extend through convex surface 20. Fig. 5 further illustrates the previously discussed simplified manner in which vanes 11-13 may be attached to and supported by drive shaft 14. Shown is the longitudinal side member 50, with support the tabs 50a configured for fitting along the drive shaft 14, the top and bottom plates 24 configured at 24a for fitting onto drive shaft 14.

Fig. 6 is an enlarged view showing, as indicated in Fig. 5, a groove 18 with air being expelled, as indicated by the arrow, from the associated air exit port 19. As indicated the exit aperture dimensions of exit ports 19 may be different from, such as larger than, the dimensions of the entrance aperture from the groove 18.

Fig. 7 is a top view indicating the curved scimitar-like configuration of wind sail vanes 11-13 and the manner of attachment of torque converters 23 to plates 24. As seen, torque converters 23 include an extension arm 23b having an airfoil 23a pivotally mounted thereto at pivot point 23e. Although torque converter 23 is shown to extend the scimitar-like configuration of the vanes 11-13, as further shown in Figs. 8 and 9 the torque converter 23 is constructed to be variably pivotal.

Fig. 8 further shows the manner in which torque converter 23 is pivotally mounted to plates 24. Extension arm 23b is mounted at one end to plate 24 at pivot point 23d, and at the other end to airfoil 23a at pivot point 23e.

Fig. 9 indicates the manner in which the torque converter 23 may be variably pivoted. As shown and described extension arm 23b is pivotal at pivot point 23d and airfoil 23a is pivotal at pivot point 23e. Airfoils 23 may thus be oriented to impinging wind as may be desired for different operating environments and conditions.

Fig. 10 indicates in cross-sectional view, by the arrows, impinging air and direction of air captured by the grooves 18 to, and through, exit ports 19 to thereby exit the vanes 11-13 and be propelled onto the concave surface of the following vane.

While the principles of the invention have been shown and described in a single embodiment, it will be obvious to those skilled in the art that in practice of the invention many modifications may be made in adaptation for specific environments and operating requirements without departing from these principals.

Having thus described the invention, I claim:

Claims

1. Apparatus for utilizing the force of the wind to drive a rotatable turbine drive output shaft, said apparatus comprising:

a longitudinally extending wind sail having three generally identical vane members adjoined at a central portion and extending from said central portion aligned 120 degrees apart;

a longitudinally extending turbine drive shaft;

said central portion of said wind sail configured for receiving said turbine drive shaft for centrally mounting of said wind sail on said turbine drive shaft, said vane members merging to include said central portion therebetween ;

said vane members are adjoined to said central portion configured with each having an concave front surface portion and a convex rear surface portion;

said vane members extending from said central portion in an identical manner such that in rotation when a first vane member first presents a concave front surface portion to impinging wind each of the subsequent vane members likewise first presents a concave front surface portion to impinging wind; and

each said vane member extends from said central portion in a curved scimitar-like configuration.

2. The apparatus of claim 1 wherein the configuration of the combination of the concave and convex surfaces of said vanes constantly provides a sufficient concavity to impinging wind to initiate and maintain rotation of the turbine shaft regardless of the wind direction.

3. The apparatus of claim 1 wherein each said vane front concave surface includes a plurality of open grooves running in generally parallel horizontal lines from the outer edge of said vane toward said turbine drive shaft, said grooves capturing impinging airflow and channeling it inwardly toward said center turbine drive shaft.

4. The apparatus of claim 1 further including an air exit port located on each said groove proximate said turbine drive shaft for exhausting said captured impinging airflow through each said vane and onto the concave surface of a following vane.

5. The apparatus of claim 1 wherein each said vane rear convex surface includes wind disrupters configured to minimize drag on rotation about said turbine drive shaft, said disrupters including multitudinous indentations in said convex surface.

6. The apparatus of claim 1 wherein each said vane further includes at its outer edge a torque converter comprising an airfoil having extension means for supporting said airfoil, said extension means pivotally mounted at one end to said vane and the other end pivotally mounted to said air airfoil.

7. A wind sail responsive to the force of wind to drive a rotatable turbine drive shaft, said wind sail comprising:

a three vane member with each vane having an arced front concave surface portion and an arced reverse convex surface portion, each said vane member adjoined at a centrally located portion and extending in identical manner from said central portion spaced 120 degrees apart;

in rotation when a first vane member presents a concave front surface portion to impinging wind each of the subsequent vane members likewise first presents a concave front surface portion to the wind;

each said vane member extends from said centrally located portions with a generally curved-shaped configuration;

each said vane member having a rear convex surface includes wind disrupters configured to minimize drag on rotation about said turbine drive shaft, said disrupters including multitudinous indentations in said convex surface; and

wherein the combination of the concave and convex surfaces of said vanes provides a sufficient concavity to impinging wind to initiate and maintain rotation of said turbine drive shaft regardless of the wind direction.

8. The wind sail of claim 7 wherein each said vane front concave surface includes a plurality of open grooves running in generally parallel horizontal lines from the outer edge of said vane toward said turbine drive shaft, said grooves capturing impinging airflow and channeling it inwardly toward said center turbine drive shaft.

9. The apparatus of claim 8 further including an air exit port located on each said groove proximate said turbine drive shaft for exhausting said captured impinging airflow through each said vane and onto the concave surface of a following vane.

10. The apparatus of claim 9 each said vane member extends from said centrally located portions with a generally scimitar-shaped configuration.

11. Apparatus responsive to the force of wind for driving a rotatable turbine drive shaft, said apparatus comprising:

a rotor assembly including a rotor shaft and means for utilizing the rotary power of said rotor shaft:

impeller means responsive to wind for driving said rotor shaft;

said impeller means includes as central portion with three identical adjoining vane members extending from said central portion in vertical alignment spaced 120 degrees apart,

each said vane member having a front arced concave surface and a rear arced convex surface,

each said concave surface operating to respond to said wind to force rotation of said turbine drive shaft while said convex surface offers minimal resistance to rotation of said shaft;

each said vane member having a rear convex surface includes wind disrupters configured to minimize drag on rotation about said turbine drive shaft, said disrupters including multitudinous indentations in said convex surface; and

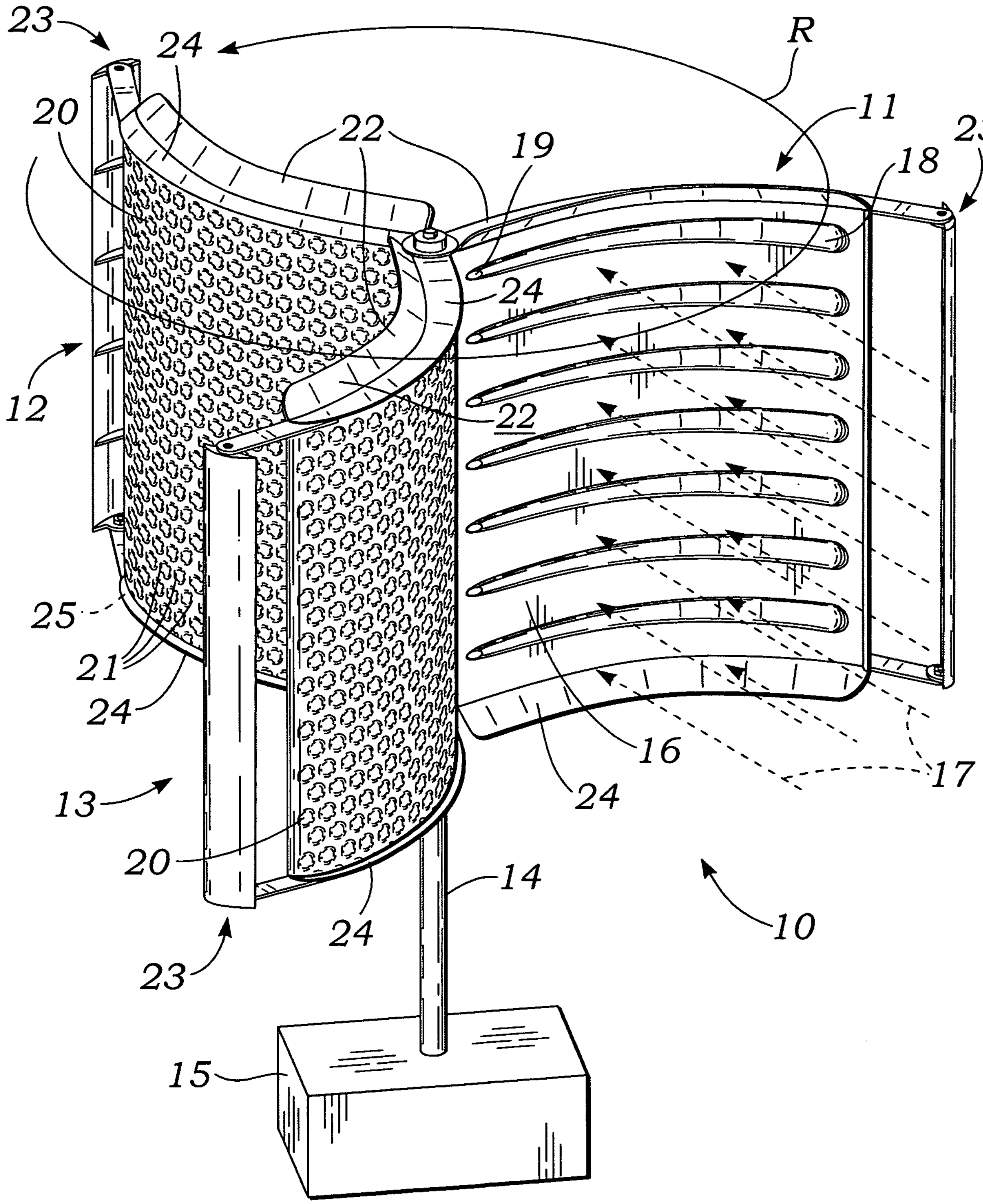
each said vane member having a front arced concave surface and a rear arced convex surface wherein the combination of said first and second vane portions and said central portion are configured to consistently present a sufficient concavity to impinging wind to provide self-starting omni-wind operation.

12. The apparatus of claim 11 wherein each said vane member front concave surface includes a plurality of open grooves running in generally parallel horizontal lines from the outer edge of said vane toward said turbine drive shaft, said grooves capturing impinging airflow and channeling it inwardly toward said center turbine drive shaft.

13. The apparatus of claim 12 including an air exit port located on each said groove proximate said turbine drive shaft for exhausting said captured impinging airflow through each said vane member and onto the concave surface of a following vane member.

14. The apparatus of claim 13 wherein each vane member further includes at its outer edge a torque converter comprising an airfoil having extension means for supporting said airfoil, said extension means pivotally mounted at one end to said vane member and at the other end pivotally mounted to said airfoil.

Fig. 1



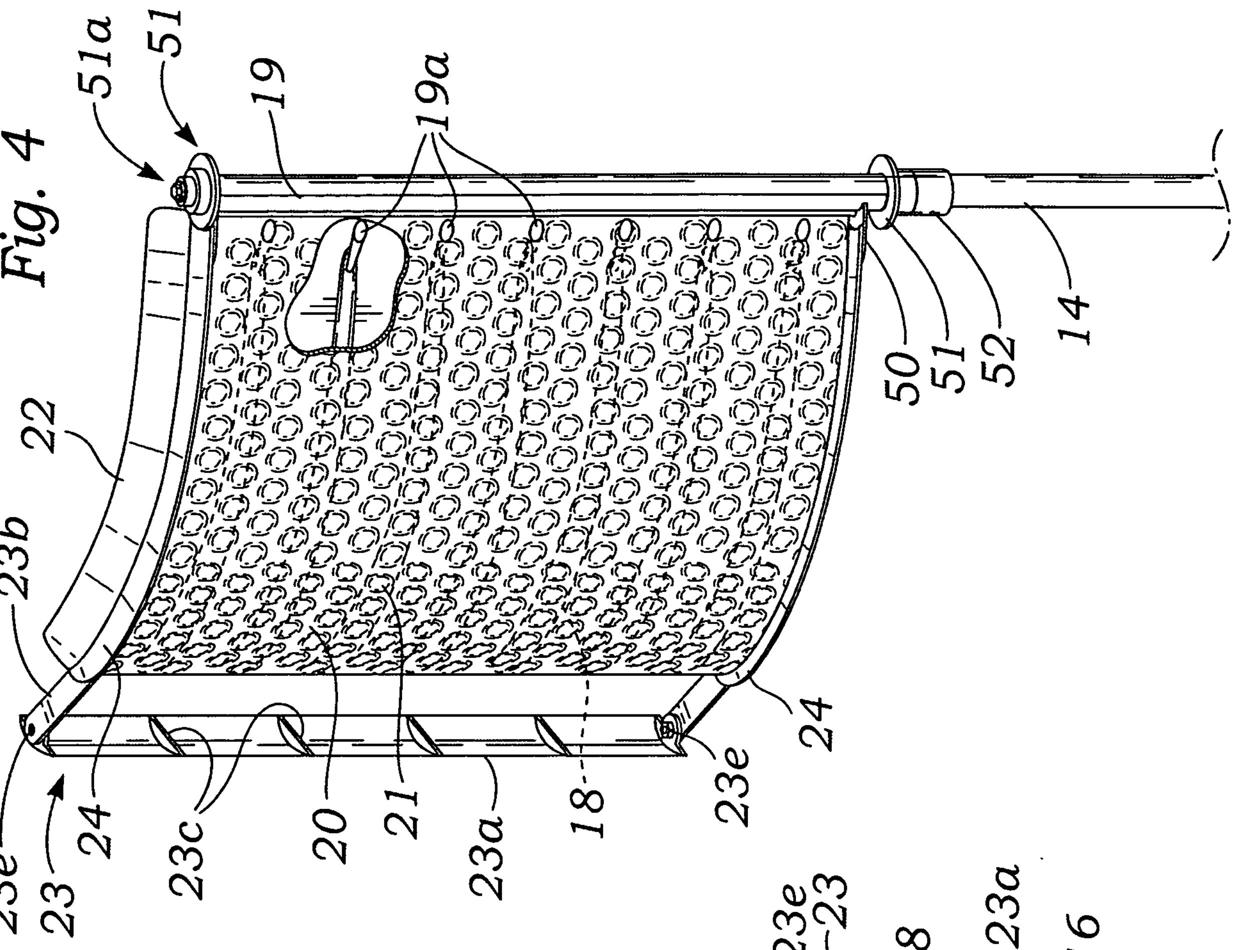


Fig. 4

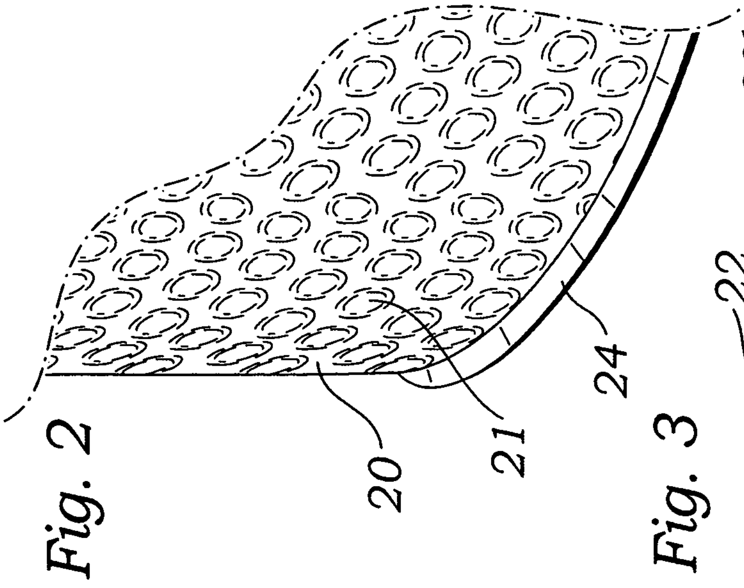


Fig. 2

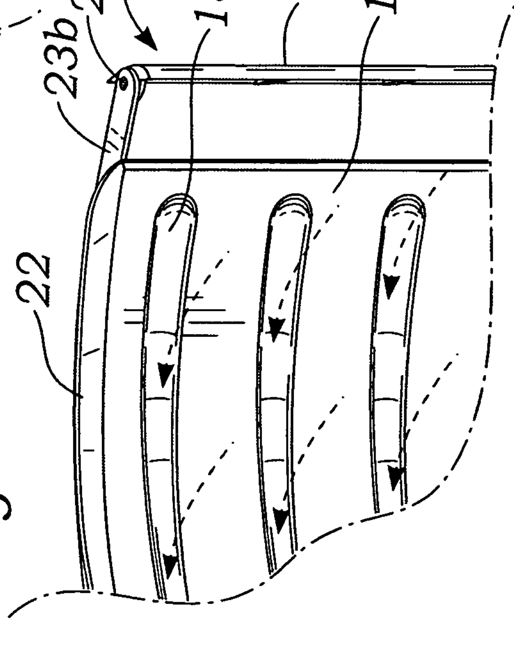


Fig. 3

Fig. 5

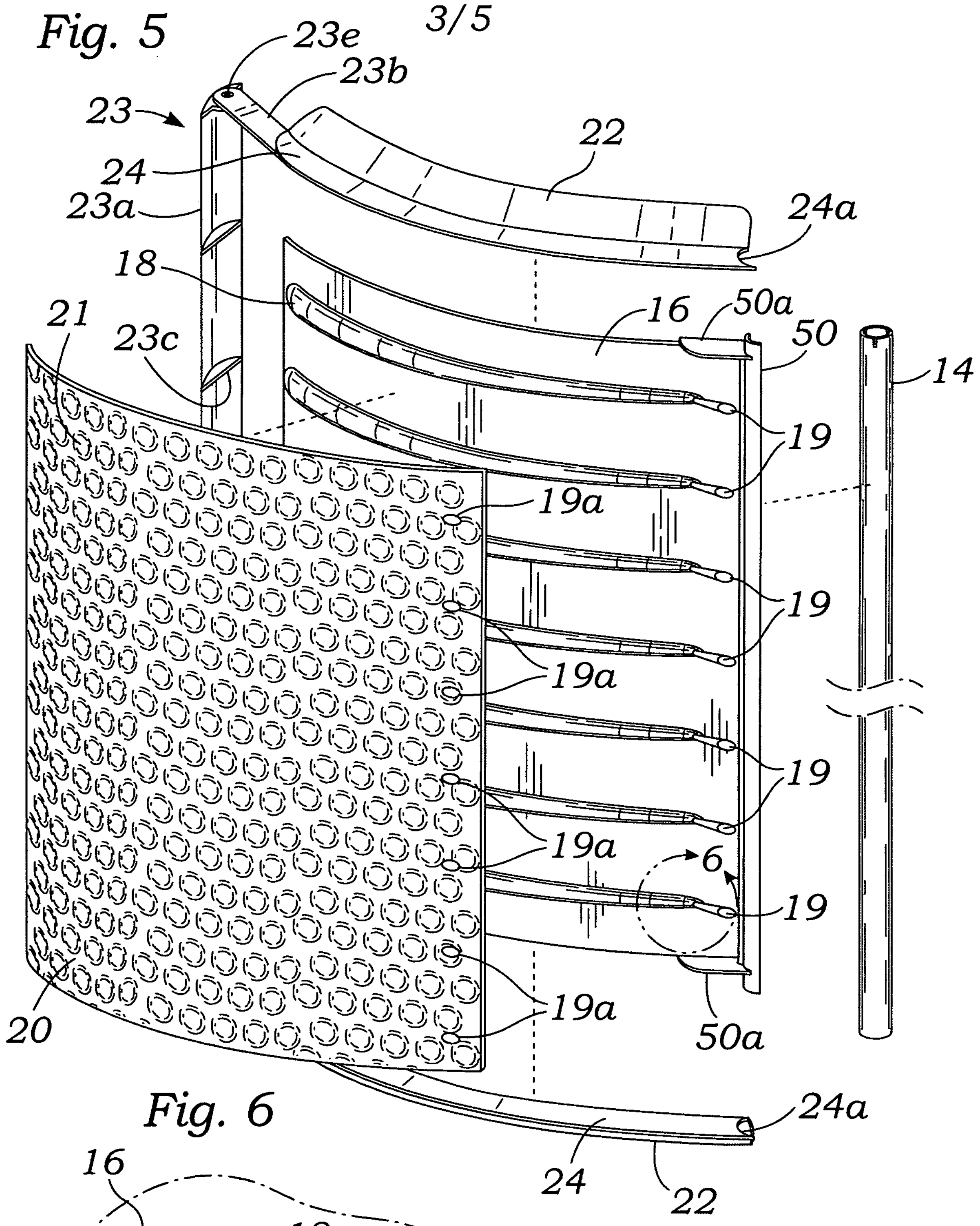

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Fig. 6

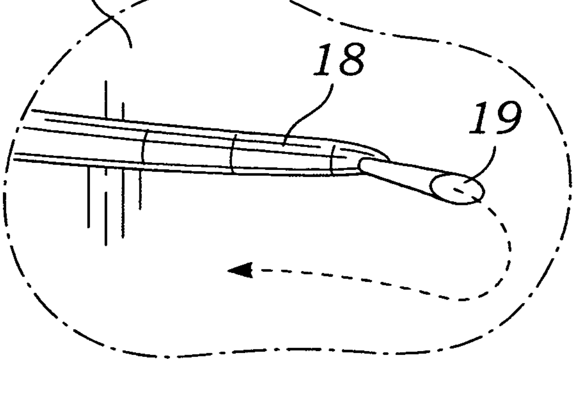
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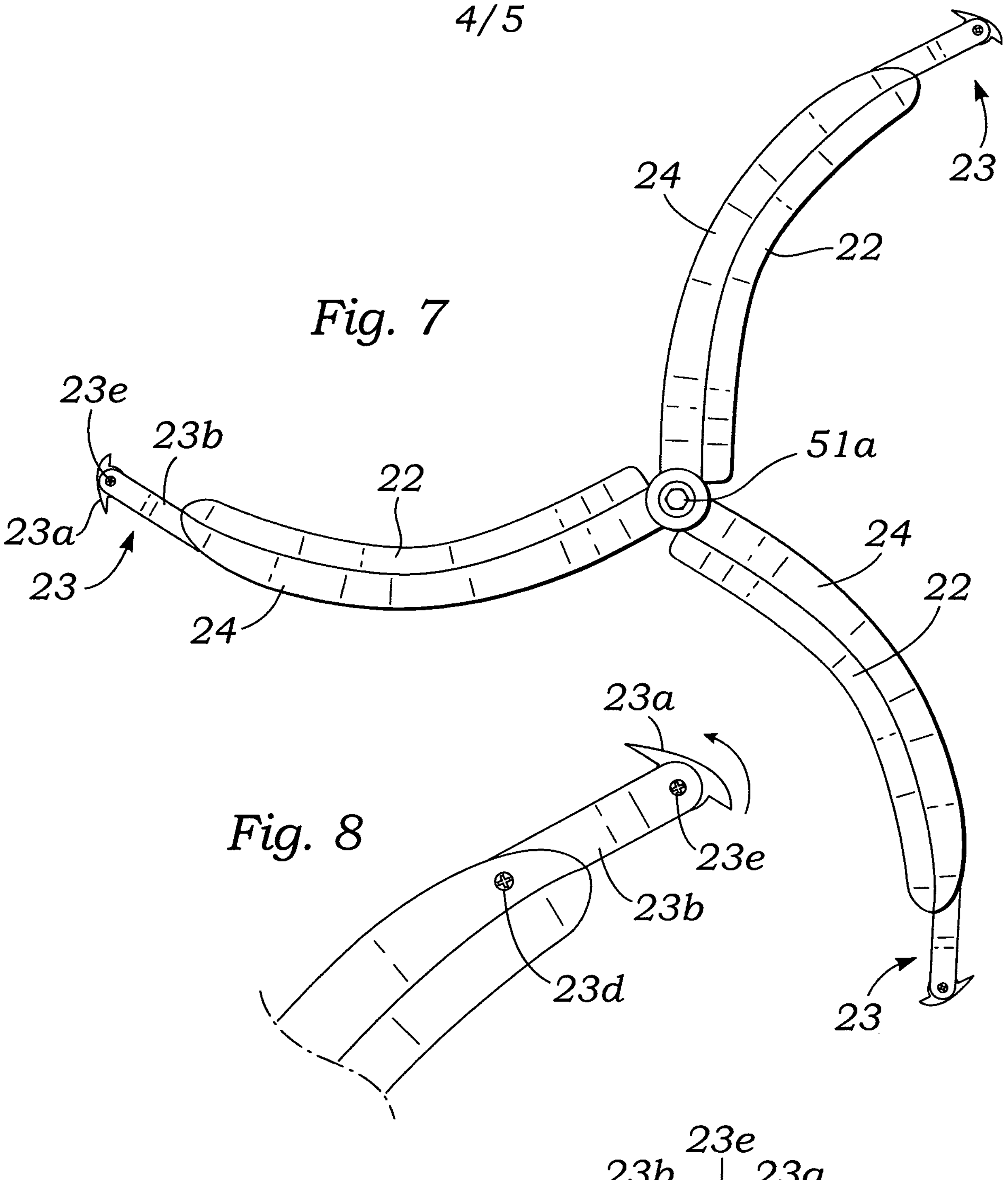
Fig. 7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51a
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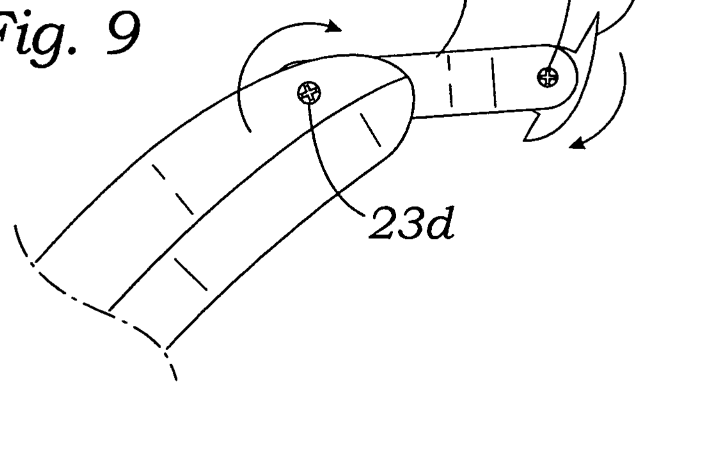
Fig. 8

23a
23e
23b
23d

Fig. 9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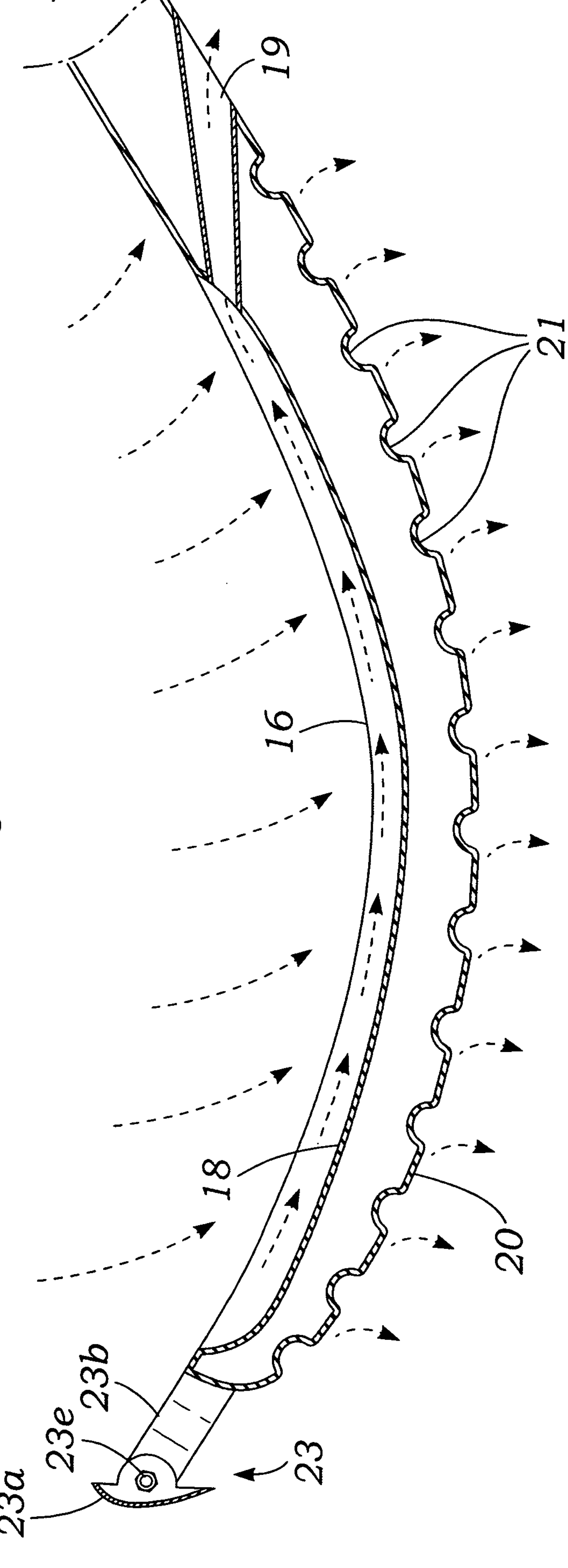

Fig. 10