Generator

Background of the Invention

1. Field of the Invention

The present invention relates to a generator, in particular a wind powered generator.

2. Description of the Related Art

A first type of wind powered generator utilises a bladed rotor mounted on a vertical post. The rotor is configured to rotate about an axis of rotation when exposed to air flowing in a direction along that axis of rotation.

A second type of wind powered generator utilises a bladed rotor configured to rotate about an axis of rotation when exposed to air flowing in a direction perpendicular to that axis of rotation.

A wind powered generator of this second type is disclosed in United Kingdom Patent number 2 341 646 B.

Brief Summary of the Invention

According to a first aspect of the present invention there is provided a generator for generating an electric current comprising current generating means comprising first generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means; a first rotary part having vanes, said first rotary part arranged to rotate in a first direction around an axis when exposed to a flow of air perpendicular to said axis; said first

rotary part operatively connected to a first of said first and second generator means; wherein said generator further comprises first rotary part barrier means arranged in stationary relation to said first rotary part, said barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said first rotary part, said barrier extending between an air inlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed to a flow of air, and an air outlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed following rotation through said barrier sector to allow the discharging of air, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

According to a second aspect of the invention there is provided a generator further comprising a second rotary part having vanes, said second rotary part arranged to rotate in a second opposite direction around said axis when exposed to a flow of air perpendicular to said axis; said second rotary part operatively connected to the second of said first and second generator means; and second rotary part barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

According to a third aspect of the invention there is provided a

generator further comprising a third rotary part having vanes operatively connected to one of said first and second generator means; and third rotary part barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

Brief Description of the Several Views of the Drawings

The invention will now be described by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a wind powered generator embodying the present invention;

Figure 2 shows an example of a rotary part utilisable in a wind powered generator embodying the present invention;

Figure 3 shows rotary part barrier means arranged in stationary relation to the rotary part shown in *Figure 2*;

Figure 4 shows a simplified section view, along line I-I of *Figure 1*, through a first rotary section of the wind powered generator of *Figure 1*;

Figure 5 shows a simplified section view, along line II-II of *Figure 1*, through a second rotary section of the wind powered generator of *Figure 1*;

Figure 6 shows adjustable air flow control means arranged to control the flow of air into an air inlet region of a wind powered generator embodying the present invention;

Figure 7 shows an enlarged view of the wind powered generator

shown in *Figure 1*;

Figure 8 shows a simplified schematic (with a cut-away section) of an arrangement of current generating means utilisable in a wind generator embodying the present invention;

Figure 9 shows *Figure 9* shows a simplified schematic (with cut-away sections) of the arrangement of the current generating means and the rotary parts of the wind powered generator shown in *Figure 1*;

Figure 10 is a diagrammatic longitudinal section view, along the line III-III of *Figure 1*, through the wind powered generator shown in *Figure 1*;

Figure 11 is a diagrammatic longitudinal section view through a wind powered generator embodying the present invention;

Figure 12 shows a rotary part configured to allow air to flow therethrough during rotation, utilisable in a wind powered generator embodying the present invention.

Written Description of the Best Mode for Carrying Out the Invention

Figure 1

A wind powered generator **101** embodying the present invention is shown in *Figure 1*. The illustrated generator **101** is configured to be positioned in a natural wind environment and, in this example, is shown situated on the roof **102** of a building **103**. An engineer **104** is shown standing adjacent the wind powered generator **101**, performing routine maintenance and inspection work upon the generator **101**.

As shown, generator **101** comprises a first rotary section **105**, a second rotary section **106**, a third rotary section **107** and a generator

electrical means section **108**. Generator **101** is also equipped with inlet ducting means **109** and outlet ducting means **110**. Air flow through the generator **101** is indicated generally by arrows A and B.

Within each of the three rotary sections **105**, **106**, **107** of generator **101** is a rotary part. An example of a rotary part utilisable in a wind generator embodying the present invention is shown in *Figure 2*.

Figure 2

Rotary part **201** is arranged to rotate about an axis when exposed to a flow of air perpendicular to the axis of rotation. In the example shown in *Figure 2*, rotary part **201** is arranged to rotate about an axial shaft **202**, and comprises a hub **203** from which four arcuate vanes **204**, **205**, **206**, **207** extend; alternatively a rotary part having one or more vanes is utilisable. The vanes **204**, **205**, **206**, **207** are evenly distributed about the circumference of the hub **203**. Each vane **204**, **205**, **206**, **207** has three free edges, for example, edges **208**, **209** and **210** of vane **204**; with edges **208** and **210** being side edges, and edge **209** being the front edge, of vane **204**.

Rotary part **201** is arranged to rotate in a first direction, indicated by arrow C, about axial shaft **202** when exposed to a flow of air perpendicular to axial shaft **202**, in the direction indicated by arrow D; in response to rotative air impinging on the underside of a vane, for example the underside **211** of vane **205**.

As rotary part **201** rotates, each vane **204**, **205**, **206**, **207** demarcates a vane free edge path **212** and a vane front edge path **213**; a vane free edge path **212** being the path the free edges of a vane **204**, **205**, **206**, **207**

travel as the rotary part **201** rotates, and a vane front edge path **213** being the path the front edge of a vane **204**, **205**, **206**, **207** travels as the rotary part **201** rotates.

Figure 3

Figure 3 illustrates rotary part barrier means **301** arranged in stationary relation to rotary part **201**. Barrier means **301** is configured to provide a barrier sector for rotary part **201**, for example barrier sector **302** comprising a barrier around a portion of the vane free edge path **212** of rotary part **201**, extending between an air inlet region **303** in which a portion of the vane front edge path **213** is exposed to allow the underside of a vane **204**, **205**, **206**, **207** to be exposed to a flow of air and an air outlet region **304** in which a portion of the vane front edge path **213** is exposed to allow the underside of a vane **204**, **205**, **206**, **207** to be exposed following rotation through the barrier sector **302**. According to the example shown in *Figure 3*, as rotary part **201** rotates in the direction indicated by arrow C, inflowing air, as indicated by arrow E, flows through air inlet region **303** and is discharged through air outlet region **304**, as indicated by arrow F.

In the example shown in *Figure 3*, barrier means provides a second barrier sector between air outlet region **304** and air inlet region **303**, in the direction indicated by arrow C. First and second portions of the free edge vane path of rotary part **201** are exposed in air inlet region **303** and air outlet region **304** respectively.

Barrier means **301** is configured to inhibit air which follows a vane **204**, **205**, **206**, **207** rotating into a barrier sector from discharging outside of

the vane free edge path **212** whilst that vane **204**, **205**, **206**, **207** is rotating through the barrier sector. In this way, the barrier means **301** functions to enhance the rotative effect of air entering the barrier sector.

In the example shown in *Figure 3*, barrier means **301** is configured to provide two barrier sectors which each extend over the distance between the front edge of two vanes **204**, **205**, **206**, **207** of rotary part **201**. Thus, barrier means **301** is configured to provide two barrier sectors each of approximately ninety degrees.

Figure 4

Figure 4 shows a simplified section view, along the line I-I shown in *Figure 1*, through the first rotary section **105** of wind powered generator **101**. First rotary part **401**, which comprises a hub **402** and four arcuate vanes **403**, **404**, **405**, **406** extending therefrom in a similar arrangement to that of rotary part **201**, is arranged to rotate about an axis of rotation through the centre of axial shaft **407**.

Arranged in stationary relation to rotary part **401**, is barrier means **408** providing first and second barrier sectors between an air inlet region **409** and an air outlet region **410**.

Inlet ducting **109** is arranged to direct inflowing air, flowing in the direction generally indicated by arrow A, towards air inlet region **409**. In the illustrated example, inlet air ducting **109** is arranged to direct a flow of air through the air inlet region **409** such that the air impinges on the underside of a vane **403**, **404**, **405**, **406** to rotate the rotary part **401** in the direction indicated by arrows F (in *Figure 4*, this direction is clockwise from inlet air

ducting **109** to outlet air ducting **110**). Air flowing through the barrier means **408** from air inlet region **409** is discharged through air outlet region **410**. Outlet air ducting **110** is arranged to direct outflowing air, flowing in the direction generally indicated by arrow B, away from air outlet region **410**.

In this example, the area of air inlet region **409** is approximately half that of the area of air outlet region **410**. This relationship provides for a partial vacuum to be created within the vane free edge path of rotary part **401** at the air outlet region **410**, as rotary part **401** rotates in the direction indicated by arrows F; to enhance the rotative effects of air flowing from air inlet region **409**.

In addition, barrier means **408** is configured to provide two barrier sectors between air inlet region **409** and air outlet region **410**, in the direction indicated by arrows G, arranged to provide for a vortex to be created within the vane free edge path of rotary part **401** as rotary part **401** rotates; a vortex enhancing the rotative effects of air flowing in the vane free edge path of rotary part **401**.

Rotary part **401** also comprises binding means, in the shown configuration, between the front edge of each vane **403**, **404**, **405**, **406** and the bottom of the succeeding vane **403**, **404**, **405**, **406**, extending between the underside of the vane **403**, **404**, **405**, **406** and the topside of the succeeding vane **403**, **404**, **405**, **406**; for example cable **411** extending between the underside **412** of vane **404** and the topside **413** of vane **405**. Rotary part binding means are configurable to stabilise the relative positions of the vanes **403**, **404**, **405**, **406**, as rotary part **401** rotates, to regulate the amount of deflection experienced by the vanes **403**, **404**, **405**,

406 as rotary part **401** rotates and/or such that a vane **403**, **404**, **405**, **406** being acted upon by rotative air tows a succeeding vane **403**, **404**, **405**, **406**.

Figure 5

Figure 5 shows a simplified section view, along the line II-II shown in *Figure 1* (in the same direction as along parallel line I-I), through the second rotary section **106** of wind powered generator **101**. Second rotary part **501**, which comprises a hub **502**, four arcuate vanes **503**, **504**, **505**, **506** extending therefrom and binding means, in a similar arrangement to that of rotary part **401**. Rotary part **501** is also arranged to rotate about the same axis of rotation along the centre of axial shaft **407** as rotary part **401**.

Arranged in stationary relation to rotary part **501**, is barrier means **507**, providing first and second barrier sectors between an air inlet region **508** and an air outlet region **509**. In this example, the area of air inlet region **508** is approximately half that of the area of air outlet region **509**.

Inlet ducting **109** is arranged to direct inflowing air, flowing in the direction generally indicated by arrow A, towards air inlet region **508**. In the illustrated example, inlet air ducting **109** is arranged to direct a flow of air through the air inlet region **508** such that the air impinges on the underside of a vane **503**, **504**, **505**, **506** to rotate rotary part **501** in the direction indicated by arrows H (in *Figure 5*, this direction is anti-clockwise from inlet air ducting **109** to outlet air ducting **110**). Thus, rotary part **501** is arranged to rotate about axial shaft **407** in the opposite direction to rotary part **401** when exposed to the same air flow through the generator **101**, indicated in *Figures*

1, *4* and *5* generally by arrows A and B. Air flowing through the barrier means **507** from air inlet region **508** is discharged through air outlet region **509**. Outlet air ducting **110** is arranged to direct outflowing air, flowing in the direction generally indicated by arrow B, away from air outlet region **509**.

Third rotary section **107** of wind powered generator **101** is similar in arrangement to rotary section **105**, with the third rotary part (shown in *Figure 9*) being similar to first rotary part **401** and arranged to rotate in the same direction about the axis of rotation along the centre of axial shaft **407**.

Figure 6

Wind powered generators installed in natural wind environments are subject to fluctuations in the inflowing air flow.

Figure 6 shows the same arrangement as shown in *Figure 5*, with the addition of adjustable air flow control means **601**, configured to provide a means of regulating the flow of air into air inlet region **602**. In this example, air flow control means **601** is a screen configured to be moveable in the directions indicated by double-headed arrow J, between a fully open position, in which the air flow through air inlet region **602** is unrestricted by the air flow control means **601**, and a fully closed position, in which the air flow control means **601** prevents the inflow of air from the inlet air ducting **603** through air inlet region **602**. In the example shown in *Figure 6*, inlet air ducting **603** is configured to receive the air flow control means screen **601** in a channel **604** formed therein. Alternative embodiments of air flow control means include shutters and venetian blind style arrangements.

Figure 7

As shown in *Figure 7*, which shows an enlarged view of wind powered generator **101**, inlet air ducting **109** is arranged to have an inlet **701**, allowing air to flow into the inlet air ducting **109** from the natural wind environment, common to rotary sections **105**, **106**, **107**, and an outlet **702**, **703**, **704** individual to each rotary section **105**, **106**, **107** respectively, allowing air to flow from the inlet air ducting **109** into the air inlet region of each rotary part in each rotary section **105**, **106**, **107**. Thus, inlet air ducting **109** has a single inlet **701** common to rotary sections **105**, **106**, **107** and three outlets **702**, **703**, **704**.

Alternative inlet air ducting includes ducting having an inlet common to more than one rotary section, ducting having an outlet common to more than one rotary section, ducting having an inlet and an outlet individual to a rotary section and ducting having combinations thereof.

Outlet air ducting **110** is arranged to have an inlet **705**, **706**, **707** allowing air to flow into the outlet air ducting **110** from the air outlet region of each rotary part in each rotary section **105**, **106**, **107**, individual to each rotary section **105**, **106**, **107** respectively, and an outlet **708**, **709**, **710** individual to each rotary section **105**, **106**, **107** respectively, allowing air to flow from the outlet air ducting **110** into the natural wind environment. Thus, outlet air ducting **110** has three inlets **705**, **706**, **707** and three outlets **708**, **709**, **710**.

Alternative outlet air ducting includes ducting having an inlet common to more than one rotary section, ducting having an outlet common to more than one rotary section, ducting having an inlet and an outlet

individual to a rotary section and ducting having combinations thereof.

Air inlet ducting and air outlet ducting that is all or in part releasably attachable to a wind powered generator is utilisable. This feature allows for a number of wind powered generators of similar construction to be equipped with different ducting, for example according to the installation site of the wind powered generator or the wind environment, whether the wind environment is natural or not. Removable ducting provides for more convenient maintenance of, and transportation of, a wind powered generator embodying the present invention.

Air inlet ducting and outlet ducting that is configured to be adjustable is utilisable. For example, a configuration of air inlet ducting has an inlet section that is adjustable such that the inlet is directable into a flow of air.

Due to the potential variability of ducting between wind powered generators embodying the present invention, the position and construction of air flow control means is correspondingly variable. For example, alternative embodiments of air flow control means includes air flow control means individual to a rotary section, or air flow control means common to more than one rotary section. In addition, the position of air flow control means relative to a rotary section is also variable, for example, referring to inlet air ducting means **109** shown in *Figure 7*, air flow control means may be positioned at each of the outlets **702**, **703**, **704** or may be positioned at the common inlet **701**. Air flow control means may be operated manually, in response to data received from sensors, via a control program, with controls at or remote from the wind powered generator. Each air flow control means may be arranged to be adjusted independently of each other

and/or in common with another.

Figure 8

In a wind powered generator embodying the present invention, at least one rotary part is operatively connected to current generating means comprising generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means.

Figure 8 shows a simplified schematic (with a cut-away section) of an example arrangement of current generating means utilisable in a wind generator embodying the present invention. Current generating means **801** comprises first generator means **802** and second generator means **803**; in this example, first generator means **802** is fixedly mounted about an axial shaft **804** and second generator means **803** is arranged about first generator means **802**, such that the first and second generator means **802**, **803** are concentric about an axis of rotation along the centre of axial shaft **804**.

According to the shown arrangement, first generator means **802** comprises an electrical armature comprising a soft iron core **805** about which electrical windings **806** configured to carry electric current are wound, and second generator means **803** comprises a plurality of permanent magnets **807** secured in a sleeve **808**. This arrangement is a sleeve arrangement, in which the permanent magnets **807** are portably held in position relative to each other.

With the arrangement shown in *Figure 8*, electric current is

generated in response to relative rotation between the first and second generator means **802**, **803**, for example in response to the rotation of one of the first and second generator means **802**, **803** relative to the other of the first and second generator means **802**, **803** with only one, or both, being rotatable about the axis of rotation through axial shaft **804** relative to the other.

Figure 9

Figure 9 shows a simplified schematic (with a cut-away sections) of the arrangement of the current generating means and the first, second and third rotary parts **401**, **501**, **901** respectively of wind powered generator **101**.

As described previously, the first, second and third parts **401**, **501**, **901** are arranged to rotate about an axis of rotation along the centre of axial shaft **407**. First and third rotary parts **401**, **901** are arranged to rotate in a first direction about the axis of rotation, indicated by arrows K, and second rotary part **501**, which is interposed between the first and third rotary parts **401**, **901**, is arranged to rotate in the opposite second direction about the axis of rotation, indicated by arrow L, when the air inlet region associated with each rotary part **401**, **501**, **901** is exposed to a flow of air perpendicular to the axis of rotation, indicated generally by arrow M.

As shown in *Figure 9*, the hub **502** of rotary part **501** is substantially hollow. Similarly, the hub **402**, **902** of first and third rotary parts **401**, **901** are substantially hollow. The hub of a rotary part utilised by a wind powered generator embodying the present invention may or may not be substantially

hollow, for example, according to the arrangement of the rotary part relative to the generator means of the wind powered generator and/or to reduce the weight of a rotary part.

The current generating means **903** utilised in wind powered generator **101** comprises first generator means **904** and second generator means **905**. First generator means **904** is mounted about axial shaft **407**, within the hub **502** of second rotary part **501**. Second generator means **905** is arranged within the hub of second rotary part **501**, about first generator means **904**, such that the first and second generator means **904**, **905** are concentric about the axis of rotation through axial shaft **407**.

First and third rotary parts **401**, **901** are operatively connected to first generator means **904**. First and third rotary parts **401**, **901** are operatively connected to first generator means **904** such that as the first and third rotary parts **401**, **901** rotate in a first direction about the axis of rotation, for example in the direction indicated by arrow K, first generator means **904** is rotated in the same direction. First and third rotary parts **401**, **901**, and first generator means **904** are fixedly mounted about axial shaft **407**, such that axial shaft **407** is rotated in the same direction. According to this arrangement, axial shaft **407** is journalled on bearings provided by a support structure (not shown).

Second rotary part is operatively connected to second generator means **905**. Second rotary part is operatively connected to second generator means **905** such that as the second rotary part **501** rotates in a first direction about the axis of rotation, for example in the direction indicated by arrow L, second generator means **904** is rotated in the same

direction. Second rotary part **502** is mounted about axial shaft **407** such that second rotary part **502** rotates around axial shaft **407**.

Thus, wind powered generator **101** is configured to provide for contra-rotation of the first and second generator means **904**, **905**.

In this example, first generator means **904** comprises an electrical armature comprising a soft iron core **906** about which electric windings **907** configured to carry electrical current are wound, and second generator means **905** comprises a plurality of permanent magnets **908** secured in a sleeve **909**. A sleeve arrangement facilitates construction of a wind generator embodying the present invention, provides for generator means to be secured in a sleeve arrangement utilising a different material to that utilised in a rotary part, allows generator means to be secured to a rotary part indirectly, and facilitates the arrangement of a uniform air gap between first and second generator means. In this example, sleeve **909** is configured to be removably secured to second rotary part **501**. Alternatively, the permanent magnets **908** may be directly secured within hub **502**.

As shown in *Figure 9*, the first and third rotary parts **401**, **901** are mounted about axial shaft **407** such that the vanes of each rotary part **401**, **901** are out of phase with each other. Associated with each of the first and third rotary sections **105**, **107** is an air inlet region for each of the first and third rotary parts **401**, **901**, and this feature provides for a vane of either the first and third rotary parts **401**, **901**, to be exposed in one of these two air inlet regions at any moment in time.

Alternatively, as shown in *Figure 10*, the first and third rotary parts **401**, **901** are mounted about axial shaft **407** such that the vanes of each

rotary part **401**, **901** are in phase with each other.

Figure 10

Figure 10 is a diagrammatic longitudinal section view, along the line III-III shown in *Figure 1*, through the first, second and third rotary section **105**, **106**, **107** and the generator electrical means section **108**. As shown in *Figure 10*, axial shaft **407** is configured to receive electrical connection means **1001** therethrough. Electrical connection means **1001** is configured to provide an electrical connection between the current generating means **903** and generator electrical means **1002**. Generator electrical means **1002** is positioned inside generator electrical means section **108**, which is positioned outside of the rotary sections **105**, **106**, **107** of the wind powered generator **101**. This feature facilitates the construction, transport and maintenance of wind powered generator **101**.

In this example, the electrical connection means **1001** electrically connects the current carrying windings **907** of first generator means **904** with slip rings and brushes contained in the generator electrical means section **108**. According to the shown arrangement, the electrical connection means **1001** comprises extension lengths of the windings **907** extending from the armature core **906** to the generator electrical means **1002**. Alternatively, electrical connection means connected to the windings is utilisable.

As shown, electrical connection means **1001** does not extend all the way through axial shaft **407**. Thus, an alternative configuration of shaft configured to receive electrical connection means therethrough is

configured to receive electrical connection means through a part of the full length of the shaft.

The shown electrical arrangement utilised by wind powered generator **101** is such that alternating electric current (a.c.) is generated. Alternatively, an electrical arrangement of current generating means configured to generate direct current (d.c.) is utilisable. The components of the generator electrical means are thus variable depending on the current generating means utilised. For example, externally or self excited electromagnets may be utilised in place of permanent magnets. Shafts utilisable in a wind powered generator embodying the present invention include shafts configured to receive therethrough a single, or multiple pairs of electric current carrying connections, for example electric cables. A utilisable shaft is provided with packing material, for example electrically insulating material, to surround, cushion and/or position electrical connection means within the shaft.

Figure 11

Figure 11 is a diagrammatic longitudinal section view through a wind powered generator **1101** embodying the present invention. Wind powered generator **1101** is similar in construction to wind powered generator **101**, configured as a modular assembly. The axial shaft **1102** is configured in first, second, third and fourth sections **1103**, **1104**, **1105**, **1106** corresponding to first, second and third rotary sections **1107**, **1108**, **1109** and generator electrical means section **1110** respectively. Each section **1103**, **1104**, **1105**, **1106** is configured to be releasbly engageable with at

least one other section. In the illustrated example, at least one end of each section **1103**, **1104**, **1105**, **1106** is castellated.

Electrical connection means **1111** is also configured to be separable into sections **1112**, **1113**, **1114**. At least one end of each section is provided with an electrical connection junction section, configured to be releasably engageable with at least one other junction section. For example, junction section **1115** of electrical connection means section **1112** is configured to be releasably engaged with junction section **1116** of electrical connection means section **1113**.

This feature facilitates the transport, construction, and maintenance of wind powered generator **101**, and facilitates the replacement of a section or component thereof.

Figure 12

Figure 12 shows a rotary part **1201** utilisable in a wind powered generator embodying the present invention, having a hub **1202** configured to allow air to flow through the rotary part **1201**, in particular as the rotary part **1201** rotates. For example, rotary part **1201** is configured such that as rotary part **1201** rotates in the direction indicated by arrow N, air flows into the hub **1202**, in the direction indicated by arrow P, through the hub **1202** and flows out of the hub **1202**, in the direction indicated by arrow Q. Rotary part **1201** is configured such that as rotary part **1201** rotates in a first direction about an axis of rotation, air flows through the hub **1202** in a direction along the axis of rotation. This feature provides for air flow through the rotary part **1201**, to cool any generator means or electrical connection

means inside the rotary part **1201**.

Claims

1. A generator for generating an electric current comprising current generating means comprising first generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means;

a first rotary part having vanes, said first rotary part arranged to rotate in a first direction around an axis when exposed to a flow of air perpendicular to said axis;

said first rotary part operatively connected to a first of said first and second generator means; wherein

said generator further comprises first rotary part barrier means arranged in stationary relation to said first rotary part, said barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said first rotary part, said barrier extending between an air inlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed to a flow of air, and an air outlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed following rotation through said barrier sector to allow the discharging of air,

said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

2. A generator according to claim 1, further comprising a second

rotary part having vanes, said second rotary part arranged to rotate in a second opposite direction around said axis when exposed to a flow of air perpendicular to said axis; said second rotary part operatively connected to the second of said first and second generator means; and second rotary part barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

3. A generator according to claim **1** or claim **2**, further comprising a third rotary part arranged to rotate in the same direction as, and operatively connected to the same generator means as, said first rotary part; and third rotary part barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

4. A generator according to any preceding claim wherein said rotary parts are arranged to rotate around an axial shaft comprising sections each releasably engageable with at least one other section.

5. A generator according to any preceding claim comprising a rotary part configured to allow air to flow through said rotary part in a

direction along said axis during rotation.

6. A generator according to any preceding claim comprising inlet air ducting arranged to direct a flow of air towards an air inlet region.

7. A generator according to any preceding claim comprising outlet air ducting arranged to direct a flow of air away from an air outlet region.

8. A generator according to any preceding claim comprising adjustable air flow control means configured to control the flow of air into an air inlet region.

9. A generator according to claim **3**, configured such that the vanes of said first rotary part and said third rotary part are out of phase with each other.

10. A generator according to any preceding claim comprising a rotary part having a hub from which a plurality of arcuate vanes extend.

11. A generator according to any preceding claim comprising a rotary part having rotary part binding means extending between two adjacent vanes.

12. A generator according to any preceding claim, wherein said

current generating means comprises generator means secured in a sleeve arrangement, said sleeve arrangement configured to be positioned inside a rotary part such that said generator means is arranged about said axis.

13. A generator according to claim **12**, wherein said sleeve arrangement comprises permanent magnets.

14. A generator according to claim **3**, wherein said first and third rotary parts are arranged to rotate in said first direction and are operatively connected to said first generator means, said first generator means comprising an armature, and said second rotary part is operatively connected to said second generator means, said second generator means comprising permanent magnets.

15. A generator according to claim **14**, in which said first and second generator means are arranged within said second rotary part.

16. A generator according to any preceding claim comprising generator electrical means positioned outside of the rotary section or sections of said generator.