CLAIMS

1. A rotor assembly for an axial flux machine, comprising:

at least one magnet;

a first support structure configured to have the at least one magnet attached thereto and to provide a flux return path for the at least one magnet; and

a second support structure configured to be attached to the first support structure so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein the second support structure is further configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine.

2. The rotor assembly of claim 1, wherein:

the second support structure is adapted rotate about an axis of rotation of the axial flux machine;

the at least one magnet has a first surface that is orthogonal to a magnetization direction of the at least one magnet and faces away from the first support structure;

the first support structure, the second support structure, and the at least one magnet are configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influence by any other magnetic components, then a distance between a first plane that intercepts a first point on the first surface and to which the axis of rotation is normal and a second plane that intercepts a second point on the first surface and to which the axis of rotation is normal is substantially greater than zero;

the second point is at a larger radial distance from the axis of rotation than the first point; and

the first support structure, the second support structure, and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influence by any other magnetic components, then a ray that

extends away from the first surface at the second point and is normal to the first surface intercepts the first plane.

3. The rotor assembly of claim 2, wherein:

the at least one magnet has an inner edge disposed at the first point;

the at least one magnet has an outer edge that is opposite the inner edge and disposed at the second point; and

the first support structure, the second support structure and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a ratio of the distance between the first and second planes and a distance between the first and second points is greater than 0.002.

4. The rotor assembly of claim 2 or claim 3, wherein the rotor assembly is installed in the axial flux machine, and the distance between the first and second planes is substantially equal to zero.

5. The rotor assembly of any of claims 1-4, wherein:

the second support structure further comprises at least one surface that is tapered in a radial direction so as cause the first support structure to warp to conform to a shape of the at least one surface when the second support structure is attached to the first support structure.

6. The rotor assembly of any of claims 1-5, wherein the second support structure is configured to be attached to a rotatable shaft of the axial flux machine.

7. The rotor assembly of any of claims 1-5, wherein the second support structure is configured to function as an output or input flange of the axial flux machine.

8. The rotor assembly of any of claims 1-7, wherein:

the first support structure is made of at least one first material; and

the second support structure is made of at least one second material which is different than the at least one first material.

9. The rotor assembly of any of claims 1-8, wherein:

the at least one magnet comprises magnet segments; and

the second support structure is further configured to restrict radial movement of the magnet segments when the magnet segments are attached to the first support structure and the second support structure is attached to the first support structure.

10. The rotor assembly of claim 9, wherein:

the second support structure further comprises a circular lip configured to engage outermost edges of the magnet segments to restrict the radial movement of the magnet segments.

11. The rotor assembly of claim 9 or claim 10, wherein:

the first support structure is further configured to allow the magnet segments to slide radially when the second support structure is detached from the first support structure.

12. The rotor assembly of any of claims 9-11, wherein:

the second support structure is further configured to be detachable from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.

13. The rotor assembly of any of claims 1-12, wherein:

the at least one magnet comprises magnet segments; and

the first support structure further comprises ribs configured to restrict angular movement of the magnet segments when the magnet segments are attached to the first support structure.

14. The rotor assembly of any of claims 1-8, wherein:

the at least one magnet comprises a ring magnet configured to be attached to the first support structure.

15. A method, comprising:

attaching at least one magnet to a first support structure of a rotor assembly for an axial flux machine such that the first support structure provides a flux return path for the at least one magnet; and

attaching a second support structure to the first support structure having the at least one magnet attached thereto so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein the second support structure is further configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine.

16. The method of claim 15, wherein:

the second support structure is adapted rotate about an axis of rotation of the axial flux machine;

the at least one magnet has a first surface that is orthogonal to a magnetization direction of the at least one magnet and faces away from the first support structure;

the first support structure, the second support structure, and the at least one magnet are configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influence by any other magnetic components, then a distance between a first plane that intercepts a first point on the first surface and to which the axis of rotation

is normal and a second plane that intercepts a second point on the first surface and to which the axis of rotation is normal is substantially greater than zero;

the second point is at a larger radial distance from the axis of rotation than the first point; and

the first support structure, the second support structure, and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influence by any other magnetic components, then a ray that extends away from the first surface at the second point and is normal to the first surface intercepts the first plane.

17. The method of claim 16, wherein:

the at least one magnet has an inner edge disposed at the first point;

the at least one magnet has an outer edge that is opposite the inner edge and disposed at the second point; and

the first support structure, the second support structure and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a ratio of the distance between the first and second planes and a distance between the first and second points is greater than 0.002.

18. The method of any of claims 15-17, wherein:

the first support structure is made of at least one first material; and

the second support structure is made of at least one second material which is different than the at least one first material.

19. The method of any of claims 15-18, wherein:

the at least one magnet comprises magnet segments, and

attaching the second support structure to the first support structure further comprises attaching the second support structure to the first support structure such that the second support structure restricts radial movement of the magnet segments.

20. The method of claim 19, further comprising:

detaching the second support structure from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.

CLAIMS

1. A rotor assembly for an axial flux machine, comprising:

at least one magnet;

a first support structure configured to have the at least one magnet attached thereto and to provide a flux return path for the at least one magnet; and

a second support structure configured to be attached to the first support structure so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein:

the second support structure is further configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine,

the second support structure is adapted to rotate about an axis of rotation of the axial flux machine,

the at least one magnet has a first surface that is orthogonal to a magnetization direction of the at least one magnet and faces away from the first support structure,

the first support structure, the second support structure, and the at least one magnet are configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a distance between a first plane that intercepts a first point on the first surface and to which the axis of rotation is normal and a second plane that intercepts a second point on the first surface and to which the axis of rotation is normal is substantially greater than zero,

the second point is at a larger radial distance from the axis of rotation than the first point, and

the first support structure, the second support structure, and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a ray that extends away from the first surface at the second point and is normal to the first surface intercepts the first plane.

2. The rotor assembly of claim 1, wherein:

the at least one magnet has an inner edge disposed at the first point;

the at least one magnet has an outer edge that is opposite the inner edge and disposed at the second point; and

the first support structure, the second support structure and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a ratio of the distance between the first and second planes and a distance between the first and second points is greater than 0.002.

3. The rotor assembly of claim 1, wherein the rotor assembly is installed in the axial flux machine, and the distance between the first and second planes is substantially equal to zero.

4. The rotor assembly of claim 1, wherein the second support structure is configured to be attached to a rotatable shaft of the axial flux machine.

5. The rotor assembly of claim 1, wherein the second support structure is configured to function as an output or input flange of the axial flux machine.

6. The rotor assembly of claim 1, wherein:

the first support structure is made of at least one first material; and

the second support structure is made of at least one second material which is different than the at least one first material.

7. The rotor assembly of claim 1, wherein:

the at least one magnet comprises magnet segments; and

the second support structure is further configured to restrict radial movement of the magnet segments when the magnet segments are attached to the first support structure and the second support structure is attached to the first support structure.

8. The rotor assembly of claim 7, wherein:

the second support structure further comprises a circular lip configured to engage outermost edges of the magnet segments to restrict the radial movement of the magnet segments.

9. The rotor assembly of claim 7, wherein:

the first support structure is further configured to allow the magnet segments to slide radially when the second support structure is detached from the first support structure.

10. The rotor assembly of claim 9, wherein:

the second support structure is further configured to be detachable from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.

11. The rotor assembly of claim 1, wherein:

the at least one magnet comprises magnet segments; and

the first support structure further comprises ribs configured to restrict angular movement of the magnet segments when the magnet segments are attached to the first support structure.

12. The rotor assembly of claim 1, wherein:

the at least one magnet comprises a ring magnet configured to be attached to the first support structure.

13. A rotor assembly for an axial flux machine, comprising:

at least one magnet;

a first support structure configured to have the at least one magnet attached thereto and to provide a flux return path for the at least one magnet; and

a second support structure configured to be attached to the first support structure so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein:

the second support structure is further configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine, and

the second support structure further comprises at least one surface that is tapered in a radial direction so as cause the first support structure to warp to conform to a shape of the at least one surface when the second support structure is attached to the first support structure.

14. The rotor assembly of claim, wherein the second support structure is configured to be attached to a rotatable shaft of the axial flux machine.

15. The rotor assembly of claim 13, wherein the second support structure is configured to function as an output or input flange of the axial flux machine.

16. The rotor assembly of claim 13, wherein:

the first support structure is made of at least one first material; and

the second support structure is made of at least one second material which is different than the at least one first material.

17. The rotor assembly of claim 13, wherein:

the at least one magnet comprises magnet segments; and

the second support structure is further configured to restrict radial movement of the magnet segments when the magnet segments are attached to the first support structure and the second support structure is attached to the first support structure.

18. The rotor assembly of claim 17, wherein:

the second support structure further comprises a circular lip configured to engage outermost edges of the magnet segments to restrict the radial movement of the magnet segments.

19. The rotor assembly of claim 17, wherein:

the first support structure is further configured to allow the magnet segments to slide radially when the second support structure is detached from the first support structure.

20. The rotor assembly of claim 19, wherein:

the second support structure is further configured to be detachable from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.

21. The rotor assembly of claim 13, wherein:

the at least one magnet comprises magnet segments; and

the first support structure further comprises ribs configured to restrict angular movement of the magnet segments when the magnet segments are attached to the first support structure.

22. The rotor assembly of claim 13, wherein:

the at least one magnet comprises a ring magnet configured to be attached to the first support structure.

23. A method, comprising:

attaching at least one magnet to a first support structure of a rotor assembly for an axial flux machine such that the first support structure provides a flux return path for the at least one magnet; and

attaching a second support structure to the first support structure having the at least one magnet attached thereto so as to allow torque to be transferred between the at least one magnet and the second support structure via the first support structure, wherein the second support structure is further configured (A) to be attached to a rotatable shaft of the axial flux machine, or (B) to function as an output or input flange of the axial flux machine; wherein:

the second support structure is adapted to rotate about an axis of rotation of the axial flux machine,

the at least one magnet has a first surface that is orthogonal to a magnetization direction of the at least one magnet and faces away from the first support structure,

the first support structure, the second support structure, and the at least one magnet are configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a distance between a first plane that intercepts a first point on the first surface and to which the axis of rotation

is normal and a second plane that intercepts a second point on the first surface and to which the axis of rotation is normal is substantially greater than zero,

the second point is at a larger radial distance from the axis of rotation than the first point, and

the first support structure, the second support structure, and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a ray that extends away from the first surface at the second point and is normal to the first surface intercepts the first plane.

24. The method of claim 23, wherein:

the at least one magnet has an inner edge disposed at the first point;

the at least one magnet has an outer edge that is opposite the inner edge and disposed at the second point; and

the first support structure, the second support structure and the at least one magnet are further configured and arranged such that, if the first support structure, the second support structure and the at least one magnet are stationary with respect to the axis of rotation and not influenced by any other magnetic components, then a ratio of the distance between the first and second planes and a distance between the first and second points is greater than 0.002.

25. The method of claim 23, wherein:

the first support structure is made of at least one first material; and

the second support structure is made of at least one second material which is different than the at least one first material.

26. The method of claim 23, wherein:

the at least one magnet comprises magnet segments, and

attaching the second support structure to the first support structure further comprises attaching the second support structure to the first support structure such that the second support structure restricts radial movement of the magnet segments.

27. The method of claim 26, further comprising:

detaching the second support structure from the first support structure to allow the magnet segments to be removed from the first support structure by sliding in a radial direction.