CLAIMS

1. A planar stator, comprising:

one or more dielectric substrates adapted to be positioned within an annular active region of an axial flux machine that includes a rotor configured to rotate about an axis of rotation;

conductive traces included in at least first and second conductive layers defined by the one or more dielectric substrates, the conductive traces forming windings for poles of the stator; and

at least first and second conductive vias extending between and interconnecting portions of the conductive traces in the first and second conductive layers, the first and second conductive vias being positioned to be located radially on a first side of the annular active region;

wherein:

the conductive traces include a first conductive trace in the first conductive layer,

the first conductive trace includes a first end turn positioned to be located radially on a second side of the annular active region, the second side being opposite the first side,

the first conductive trace extends along a first path that begins at the first conductive via, passes through the first end turn, and ends at the second conductive via, the first path forming less than a full turn of the winding for one of the poles of the stator,

the conductive traces include a second conductive trace in the second conductive layer,

the second conductive trace includes a second end turn positioned to be located radially on the first side of the annular active region,

the second conductive trace extends along a second path that begins at the second conductive via and passes through the second end turn,

the second conductive trace is connected to the first conductive trace through the second conductive via so that the first and second paths are connected in series, and

all conductive vias that interconnect the first and second conductive traces are positioned to be located radially on the first side of the annular active region.

2. The planar stator of claim 1, further comprising:

a third conductive via extending between the first and second conductive layers and positioned to be located radially on the first side of the annular active region, wherein the second path along which the second conductive trace extends begins at the second conductive via, passes through the second end turn, and ends at the third conductive via.

3. The planar stator of claim 2, wherein the third conductive via is positioned such that the first conductive trace and the second conductive trace form a portion of a serpentine shaped winding.

4. The planar stator of claim 2, wherein the third conductive via is positioned such that the first conductive trace and the second conductive trace form a portion of a spiral shaped winding.

5. The planar stator of any of claims 2-4, further comprising:

a fourth conductive via extending between the first and second conductive layers and positioned to be located radially on the first side of the annular active region; and

a third conductive trace in the second conductive layer, the third conductive trace including a third end turn positioned to be located radially on the second side of the annular active region, wherein the third conductive trace extends along a third path that begins at the third conductive via, passes through the third end turn, and ends at the fourth conductive via.

6. The planar stator of claim 5, wherein the one or more dielectric substrates further define a third conductive layer, the third conductive via extends through the third conductive layer, and the stator further comprises:

a fourth conductive trace in the third conductive layer, the fourth conductive trace including a fourth end turn positioned to be located radially on the second side of the

annular active region, wherein the fourth conductive trace extends along a fourth path that begins at the third conductive via, passes through the fourth end turn, and ends at the fourth conductive via.

7. The planar stator of claim 6, wherein:

all conductive vias that interconnect the third and fourth conductive traces are positioned to be located radially on the first side of the annular active region.

8. The planar stator of any of claims 1-7, further comprising an additional via extending between the first and second conductive layers and positioned to be located radially on the first side of the annular active region, wherein the second conductive trace is further connected to the first conductive trace through the additional conductive via.

9. The planar stator of any of claims 1-8, wherein the first end turn is an inner end turn and the second end turn is an outer end turn.

10. The planar stator of any of claims 1-8, wherein the first end turn is an outer end turn and the second end turn is an inner end turn.

11. An axial flux motor or generator comprising the planar stator of any of claims 1-10.

12. A planar stator, comprising:

one or more dielectric substrates adapted to be positioned within an annular active region of an axial flux machine that includes a rotor configured to rotate about an axis of rotation;

conductive traces included in at least first and second conductive layers defined by the one or more dielectric substrates, the conductive traces forming windings for poles of the stator; and

at least first and second conductive vias extending between the first and second conductive layers, the first and second conductive vias being positioned to be located radially on a first side of the annular active region;

wherein:

the conductive traces include a first conductive trace in the first conductive layer,

the first conductive trace includes a first end turn positioned to be located radially on a second side of the annular active region, the second side being opposite the first side,

the first conductive trace follows a first path beginning at the first conductive via, extending through the first end turn, and ending at the second conductive via,

the conductive traces include a second conductive trace in the second conductive layer,

the second conductive trace includes a second end turn positioned to be located radially on the second side of the annular active region,

the second conductive trace follows a second path beginning at the first conductive via, extending through the second end turn, and ending at the second conductive via, and

all conductive vias that interconnect the first and second conductive traces are positioned to be located radially on the first side of the annular active region.

13. The planar stator of claim 12, wherein the first path has a same size and shape as the second path.

14. The planar stator of claim 12 or 13, wherein the first and second end turns are inner end turns.

15. The planar stator of claim 12 or 13, wherein the first and second end turns are outer end turns.

16. The planar stator of any of claims 12-15, further comprising:

a third conductive via extending between the first and second conductive layers, the third conductive via being positioned to be located radially on the first side of the annular active region; and

a third conductive trace in the second conductive layer, the third conductive trace including a third end turn positioned to be located radially on the first side of the annular active region, wherein the third conductive trace extends along a third path that begins at the second conductive via, passes through the third end turn, and ends at the third conductive via.

17. The planar stator of claim 16, wherein the one or more dielectric substrates further define a third conductive layer, the third conductive via extends through the third conductive layer, and the stator further comprises:

a fourth conductive via extending through the first, second and third conductive layers, the fourth conductive via being positioned to be located radially on the first side of the annular active region; and

a fourth conductive trace in the third conductive layer, the fourth conductive trace including a fourth end turn positioned to be located radially on the second side of the annular active region, wherein the fourth conductive trace extends along a fourth path that begins at the third conductive via, passes through the fourth end turn, and ends at the fourth conductive via.

18. An axial flux motor or generator comprising the planar stator of any of claims 12-17.