Claims

1. A slotless motor comprising:

a flux ring;

a rotor having a rotational axis;

a plurality of coil windings arranged into an integer N number of distinct blocks, each block being arranged about the rotational axis and having a gap between each adjacent pair of blocks; and

a rotor position sensing element comprising:

a sensor ring having a sensor fixed to the sensor ring; and

a sensor ring attachment extending from the sensor ring; wherein

the sensors are spaced around the rotational axis; and wherein

the rotor position sensing element is configured to hold the sensor ring relative to at least one of the blocks such that the sensor is held in a predetermined position; wherein

the sensor ring attachment is formed as a tapering projection shaped to match the shape of the gap so that an end of the sensor ring attachment is configured to be held in the gap between adjacent blocks.

2. The motor of claim 1, wherein the sensor ring attachment couples the sensor ring to one of the gaps between adjacent blocks.

3. The motor of claim 1 or claim 2, further comprising a motor housing, wherein the housing holds the coil windings in a fixed location relative to the housing.

4. The motor of claim 3, wherein the sensor ring is coupled to the motor housing.

5. The motor of claim 3, wherein the sensor ring is integrally formed with the motor housing.

6. The motor of claim 3, wherein the motor housing is made of a metal.

7. The motor of any one of the preceding claims, wherein the sensor is any one of: a magnetic field sensor, a potentiometric position sensor, an inductive position sensor, an eddy current-based position sensor, a capacitive position sensor, a fibre-optic position sensor, an optical position sensor and an ultrasonic position sensor.

8. The motor of any one of the preceding claims, wherein the rotor position sensing element comprises a plurality of sensors.

9. The motor of claim 8, wherein the plurality of sensors is angularly spaced apart around the rotational axis based on one or more of the number(s) of distinct blocks and/or a number of phases of the coil windings.

10. The motor of any one of the preceding claims, wherein the sensor ring and the sensor ring attachment are integrally formed.

11. The motor of any one of the preceding claims, wherein each block includes a positive integer number X of phases of coil windings.

12. The motor of claim 11, wherein an angular position of largest flux magnitude for each winding is spaced apart from angular positions of largest flux magnitude of adjacent windings by an angle of π/NX radians.

13. The motor of any one of the preceding claims, wherein each coil winding in each block comprises a repeated winding pattern such that each phase winding is wound in a first direction and consecutively wound in a second direction opposite to the first direction.

14. The motor of any one of the preceding claims, wherein the N number of distinct blocks have an N-fold rotational symmetry about the rotational axis such that equivalent locations in each block are spaced apart by 2π/N radians.

15. The motor of claim 12 as dependent on claim 8, wherein each sensor is spaced apart from each other sensor by an angle in radians of:

$$n\left(\frac{2\pi}{N}\right) + m\left(\frac{2\pi}{N \cdot X}\right)$$

wherein *n* is any integer and *m* is any integer except 0 or *pX* and in which *p* is any integer.

16. The motor of claim 12 as dependent on claim 8, wherein each sensor being spaced apart from each other sensor by an angle in radians of:

$$n\left(\frac{2\pi}{N}\right) + m\left(\frac{\pi}{N \cdot X}\right)$$

wherein *n* is any integer and *m* is any integer except 0 or 2*pX* and in which *p* is any integer.