

1.4 HYBRID STEPPER MOTOR

The word Hybrid means combination or mixture. The Hybrid Stepper Motor is a combination of the features of the Variable Reluctance Stepper Motor and Permanent Magnet Stepper Motor. In the center of the rotor, an axial permanent magnet is provided. It is magnetized to produce a pair of poles as North (N) and South (S)

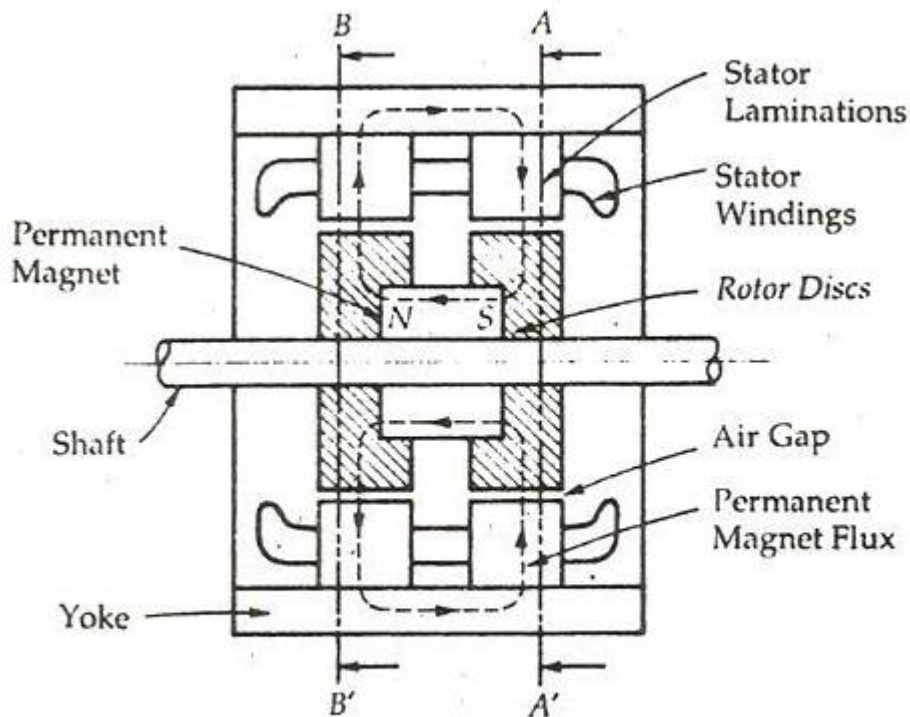


Figure 1.4.1 Hybrid stepping motor

[Source: "special electric machines" by R.srinivasan page:2.26]

At both the end of the axial magnet the end caps are provided, which contains an equal number of teeth which are magnetized by the magnet. The figure of the cross section of the two end caps of the rotor is shown below.

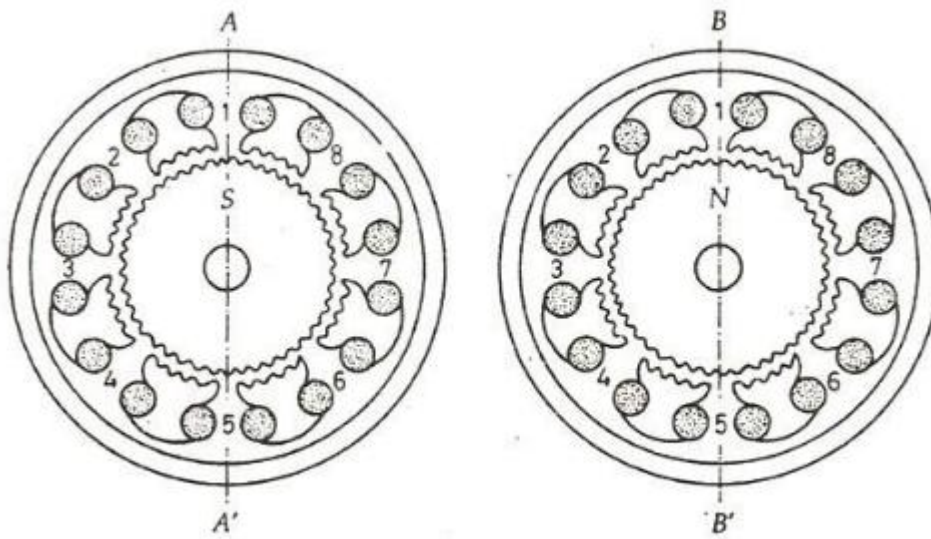


Figure 1.4.2 Hybrid stepping motor

[Source: "special electric machines" by R, srinivasan page:2.26]

The rotor teeth are perfectly aligned with the stator teeth. The teeth of the two end caps are displaced from each other by half of the pole pitch. As the magnet is axially magnetized, all the teeth on the left and right end cap acquire polarity as south and North Pole respectively.

The coils on poles 1, 3, 5 and 7 are connected in series to form phase A. Similarly, the coils on the poles 2, 4, 6 and 8 are connected in series to form phase B.

When Phase is excited by supplying a positive current, the stator poles 1 and 5 becomes South poles and stator pole 3 and 7 becomes north poles.

Now, when the Phase A is de-energized, and phase B is excited, the rotor will turn by a full step angle of 1.8° in the anticlockwise direction. The phase A is now energized negatively; the rotor moves further by 1.8° in the same anti-clockwise direction. Further rotation of the rotor requires phase B to be excited negatively.

Thus, to produce anticlockwise motion of the rotor the phases are energized in the following sequence +A, +B, -A, -B, +B, +A..... For the clockwise rotation, the sequence is +A, -B, +B, +A.....

One of the main advantages of the Hybrid stepper motor is that, if the excitation of the motor is removed the rotor continues to remain locked in the same position as before the removal of the excitation. This is because of the Detent Torque produced by the permanent magnet.

Advantages of Hybrid Stepper Motor

The advantages of the Hybrid Stepper Motor are as follows:-

- The length of the step is smaller.
- It has greater torque.
- Provides Detent Torque with the de-energized windings.
- Higher efficiency at lower speed.
- Lower stepping rate.

Disadvantages of Hybrid Stepper Motor

- Higher inertia.
- The weight of the motor is more because of the presence of the rotor magnet.
- If the magnetic strength is varied, the performance of the motor is affected.
- The cost of the Hybrid motor is more as compared to the Variable Reluctance Motor.