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Magnetic Gear Transmission System

S. Charan Kumar[1], Mr. R. Prabhakaran[2]

[1]Student, Department of Mechanical Engineering, IFET College of Engineering, Villupuram, Tamilnadu, India
[2]Assistant Professor, Department of Mechanical Engineering, IFET College of Engineering, Villupuram, Tamilnadu, India

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ABSTRACT

In the previous years, conventional gear systems were used. Due to the enormous amount of wear and tear and high amount of friction, these conventional gears are replaced using a magnetic gear transmission system. Using this system, multiples of input speed can be obtained. In this system, there is a minimum amount of friction or no friction at all. This system opens up to a whole new idea where a small input of speed can produce a speed that is a multiple of the input and also vice versa where an output speed that is a fraction of input speed can be obtained without transmission losses. The magnetic gear system works on the property of repulsive force between the magnets.

***Index Terms*—Magnetic gear transmission system, conventional gears.**

I. INTRODUCTION

In the modern world, it is necessary to transmit power without losses. Magnets have proved to be the best way to achieve the same. The property of repulsion between like poles of magnet makes it possible for the rotation of the metallic conductors placed between the magnets. This principle helps in attaining the output speed which is either a multiple of the input speed or a fraction of the input speed depending upon the application.

The model consists of neodymium magnets which comprises of both the rotor and stator peripherals. Mild steel is the metal used to obtain the rotational motion due to the magnetic fields between the rotor and the stator.

II. EXPERIMENTAL SETUP

The model consists of the following parts

- Neodymium magnets (Stator)
- Neodymium Magnet (Rotor)
- Mild Steel

A. Neodymium Magnets

The neodymium magnets are the strongest magnets available. They are permanent magnets which are an alloy of neodymium, iron and boron. The magnetic property is almost expected to be 18-20 times the power of a regular normal magnet on the basis of volume. However, the magnetic property depends on its alloy composition.

B. Mild Steel

The metal used is mild steel. The mild steel is also called as low-carbon steel. The content of carbon is0.05–0.25%. Mild steel can be easily magnetized because of its ferromagnetic properties. Hence, it produces rotation when there is change of flux.

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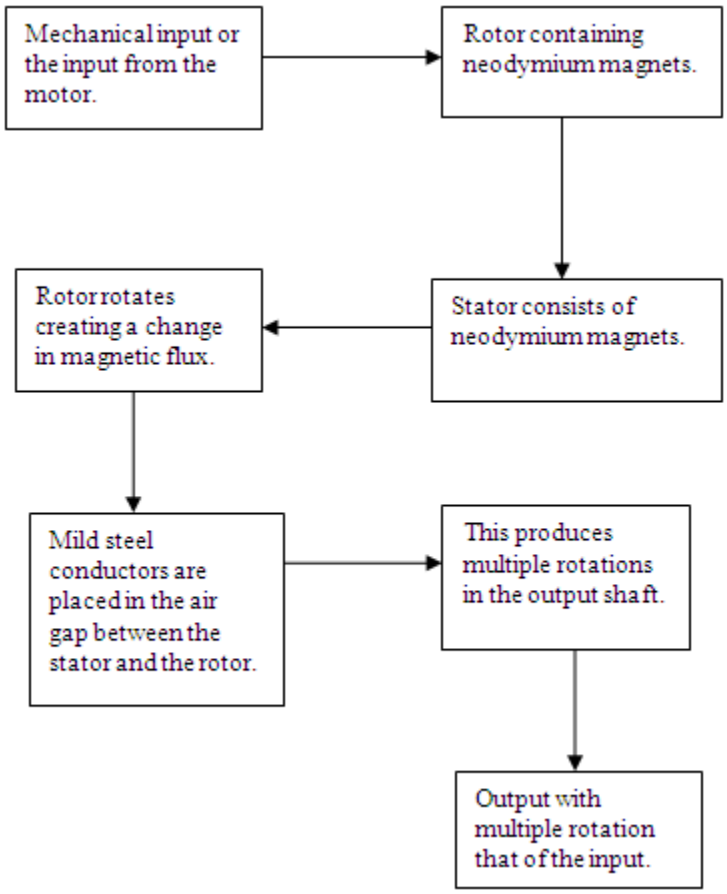
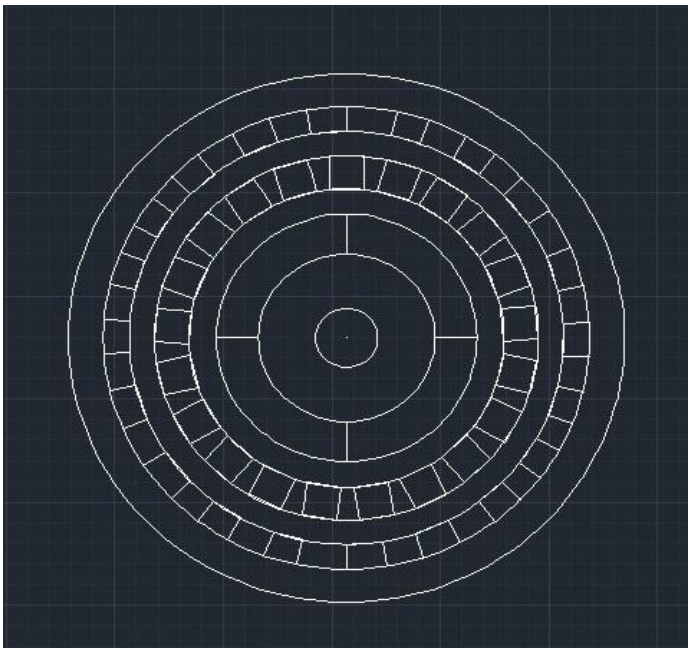
III. BLOCK DIAGRA



IV. 2 D DIAGRAM



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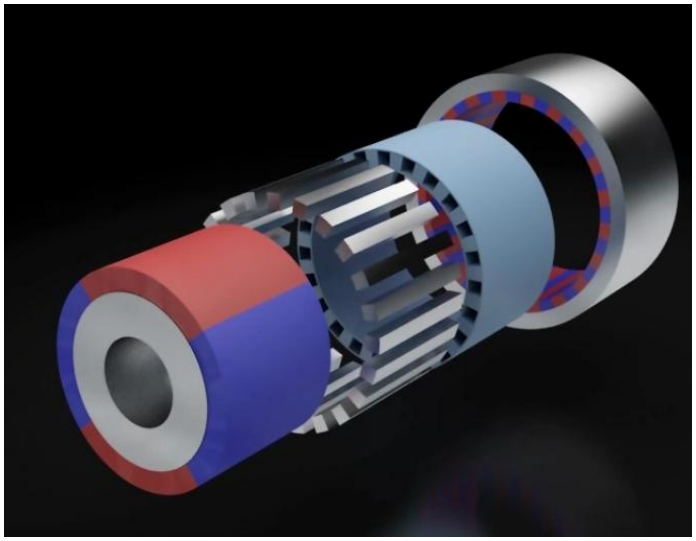
V. 3 D IMAGE



VI. DESIGN CALCULATION

For magnetic gears the pitch is given by

$$Pi_s = R_s\theta_s$$

$$Pi_r = R_r\,\theta_r$$

$$Pi_p = R_p\theta_p$$

$$R_p\,\theta_p = R_p\,\theta_p$$

$$\Theta = 2\pi/P$$

$$R_p/P_p = R_r/P_r = R_s/P_s$$

In the gear train, $R_r = R_s+2R_p$

The pole pair ratio is given as $P_r=P_s+2P_p$

Speed Addition Ratio

In the first mode, the planet gear carrier is the output so the magnetic sun and ring gears are the drivnggears, hence the angular velocity relationship is given by

$$\omega_c = (P_s/ P_s+P_r)\omega_s + (P_r/ P_s+P_r)\,\omega_r$$

In the second mode, the sun gear is the output so the magnetic ring gears and the planet gear carrier are the inputs; therefore

$$\omega_s = (P_s+P_r/ P_s)\,\omega_c - (P_r/P_s\omega_r)$$

In the third mode, the magnetic ring gear is the output so that;

$\omega_r = 0$ or $\omega_s = 0$

Dimension of the magnet is 40mm x 20mm x 10mm

CONCLUSION

The speed of the gears was sensed and the average input and output speeds were taken for an average of 5 readings. The readings are tabulated below.

S.NO	INPUT SPEED (RPM)	OUTPUT SPEED (RPM)	SPEED RATIO
1	32	9.14	3.5
2	29	8.52	3.4
3	31	9.39	3.3
4	31	9.4	3.3
5	28	8.95	3.13

The speed reduction ratio was calculated to be 3.33 which are near to the design value. The difference between actual and design value was due to slip between the gears caused by misalignments.The magnetic gears though have found significant growth in European Countries have not been in use widely due to various complexities. But when solved these would definitely prove to be a better alternative to mechanical gears. Also the development of magnetic gear system is very less in India due to the less popularity of magnetic gear system

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