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DESIGN AND DEVELOPMENT OF MAGNETIC POWER TRANSMISSION SYSTEM

MorePadmakar[1], NiranjanBhalerao[2], Mengde Sujit[3], KhoseVikas[4], Ass.Prof.G.A.Kulkarni[5]

[1,2,3,4,5]*Department of Mechanical Engineering ,*

Genba Sopanrao Moze College of Engineering,Balewadi Pune

ABSTRACT

A magnetic coupling is a coupling that transfers torque from one shaft, but using a magnetic field rather than a physical mechanical connection. Magnetic shaft couplings are most often used for liquid pumps and propeller systems, since a static, physical barrier can be placed between the two shafts to separate the fluid from the motor operating in air. Magnetic shaft couplings preclude the use of shaft seals, which eventually wearout and fail from the sliding of two surfaces against each another. Magnetic couplings are also used for ease of maintenance on systems that typically require precision alignment, when physical shaft couplings are used, since they allow a greater off axis error between the motor and driven shaft. Some diver propulsion vehicles and remotely operated underwater vehicles use magnetic coupling to transfer torque from the electric motor to the output shaft. Magnetic gearing is also being explored for use in utility scale wind turbines as a means of enhancing reliability. The magnetic coupling has several advantages over a traditional stuffing box.

Keyword:-Magnetic gears ,Transmission system,Shaft,Coupling

I. INTRODUCTION

The objective of studying magnetic gears is to replace mechanical gears which are noisy, require frequent maintenance and lubrication, and suffer from friction losses. The magnetic gear is contactless and quiet in operation, and it requires no lubrication. In addition, it slips when overloaded whereas the mechanical gear may break down when overloaded. The magnetic gear has been studied more thoroughly in the last decade although there was a patent in 1901 by Armstrong (1) and an improved one in 1941 by Faus 2). Another significant improvement was contributed by Martin in 1968(3) in which steel pole pieces were used. However, it was not commercially marketed because the transmitted torques was small as ceramic magnets were used. Recently, strong rare earth magnets have been developed, and the new operational principle employing the harmonic magnetic flux has also been developed. As a result, a high torque density can be achieved. Hence, high performance magnetic gears can be marketed for industrial and commercial applications. The theory of mgnetic gearing was established by Dr. Atallah and his colleagues at Sheffield University.

A magnetic coupler transmits a force without any actual physical contact. Since magnetic forces attract and repel, and this force performs work, the action can be linear or rotary. A simple magnetic coupler has a follower and a driver. The driver is connected to a motor, while the follower reacts to the driver's motion, and this results in the transmission of mechanical energy without contact.

To understand a magnetic coupler, it is helpful to understand magnets. A magnet produces a magnetic field or force. This force acts on ferromagnetic materials and pulls them together or pushes them apart. Ferromagnetic

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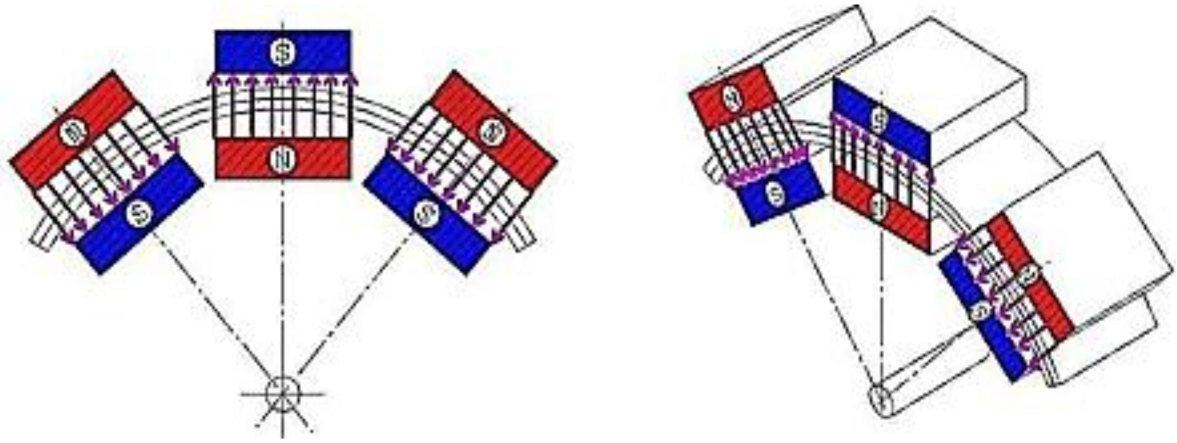
materials include iron, cobalt, nickel, and certain alloys. The overall strength of a magnet is measured by what is termed its magnetic moment, or by the magnetic flux that is produced.

Permanent magnets are made from materials that have their own constant magnetic field. Similarly, electromagnets are created by coils of wire that become magnetic when current runs through the wire. Both of these only have a magnetic force when electricity is applied. The strength of these magnets can be increased by wrapping the coil of wire around a ferromagnetic material. When a change in current in one conductor induces a voltage in the second conductor, both are magnetically coupled.

II. METHODOLOGY

The magnetic coupling works by using the power generated by permanent magnets. No external power supply is needed. These are permanent magnets not electro magnets.



The magnets are installed alternating between poles in a side by side and opposing position as seen in the diagram. The main body of each coupling half is of ferromagnetic material to aid the channeling of the magnetic field correctly and therefore maximizing transmittable torque.

In a rotary drive motor, a magnetic coupler consists of an inner and outer drive. The movement of one drive provides the magnetic force to turn the other. The outer drive is usually referred to as the driver. The inner drive is the follower and this is usually connected to a pump or other device. This radial design is similar to an electric motor.

Drive pumps that are used for corrosive, flammable, or toxic liquids are often operated with a magnetic coupler. Permanent magnets are used and these can be sealed so that they do not come into contact with the liquid. Rotors are held together by the magnetic force and will not slip during rotation. If too much external force is applied, however, the magnets will separate and the drive pump will stop.

One of the advantages of a magnetic coupler is a reduction in vibration. It can also allow for a separation barrier between the follower and driver since force can be transmitted even if the driver and follower are in separate environments. Alignment is not critical because the magnetic force will still work. The coupling can also work along an axis providing a linear force.

An additional benefit of a motor working with a magnetic coupler is the reduction of contact between moving parts. Instead of direct contact, there is an air gap between the motor and the load it is driving. This reduces friction and can increase the efficiency. It also reduces wear and tear on the motor, which may increase its life. Magnetic coupling may also be referred to as a torque coupling.

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Some aquarium pumps are Magnetic Drive Pumps -- they use magnetic coupling between the motor on the dry side of an aquarium wall and the propeller/impeller in the water on the other side of that aquarium wall.[4] With two face-to-face magnetized disks -- one driving magnet on the dry side, and another driven magnet on the wet side of the glass -- there are two options for designing the magnetic pattern on each disk. One option balances the (attractive) section that transfers torque, with magnetic repulsion near the axis, to nearly cancel out axial load. The other option designs the magnetic pattern to maximize the torque, and uses a mechanical thrust bearing to resist the attraction between the magnetized disks.

A magnetic stirrer is another example of magnetic coupling.

Magnetic couplings are often synchronous (output shaft speed equals input shaft speed, or 1:1).

The first few gears in the gear train of an Omega Mega sonic wristwatch have no teeth; instead magnetic north and south poles on neighboring gears act like the teeth and trough of neighboring spur gears, as each gear drives the next gear in the chain.[7] Such magnetic gears, like spur gears, always have gear ratios as the ratios of small integers.

More sophisticated magnetic gearing uses pole pieces to modulate the magnetic field; they can be designed to have gear ratios from 1.01:1 to 1000:1.

III. WORKING PRINCIPLE

A magnetic gear uses permanent magnets to transmit torque between an input and output shaft without mechanical contact. Torque densities comparable with mechanical gears can be achieved with an efficiency >99% at full load and with much higher part load efficiencies than a mechanical gear. For higher power ratings a magnetic gear will be smaller, lighter and lower cost than a mechanical gear. Since there is no mechanical contact between the moving parts there is no wear and lubrication is not required. Magnetic gears inherently protect against overloads by harmlessly slipping if an overload torque is applied, and automatically and safely re-engaging when the fault torque is removed.

Magnomatics has developed a range of magnetic gear technologies for achieving low and high ratios and a linear gear variant. The magnetic gear concept has been extended to provide both an ultra high torque density pseudo direct drive electrical machine and a variable ratio gear topology for continuously variable transmission systems.

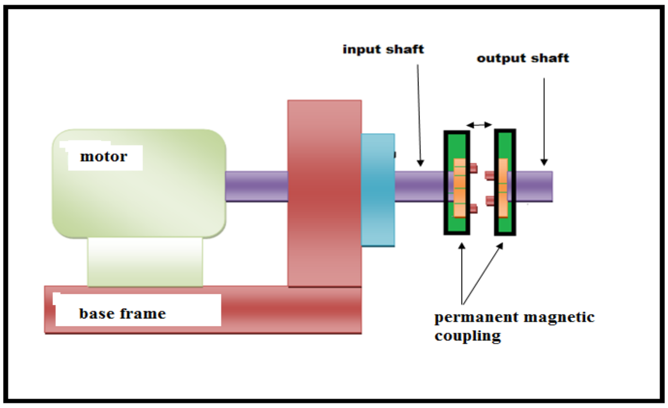

Fig. 3)working of contactless magnetic power transmission system

We supply magnetic couplings based on the real power transmission needs. There is no need to alter your system as the magnetic coupling will be designed to suit your machinery.

These magnetic couplings can be used to connect gear pumps, screw pumps, centrifugal pumps, etc. with all types of electric motor or gear box.

Permanent magnetic synchronous coupling; the magnetic coupling is a synchronous system therefore the rpm of the internal half of the coupling is equal to the rpm of the external half of the coupling.

High-tech torque transmission:

Magnetic Clutches do not transmit torques through mechanical connections like their mechanical counterparts but by using magnetic forces. It has to be distinguished between synchronous- and hysteresis clutches according to the function principle in use.

The hysteresis clutch:

With this type of clutch, one half of the clutch is coated with a hysteresis lining instead of permanent magnets. This hysteresis material works similar to the permanent magnets, but through the hysteresis lining, poles can be changed with low effort. If the nominal torque of the clutch is exceeded, the clutch starts slipping. Thereby the hysteresis material takes up energy from the drive system, due to the permanent changing of poles caused by the passing of the permanent magnets and transforms this into lost heat which is released into the environment.

IV. CONCLUSION

Our system successfully demonstrates the benefits of contactless power transmission like , higher transmission efficiency, reduced power loss, no friction as it is contactless and hence no wear of components and system so greater life of system. Above all there is no noise and vibrations like contact system.

Magnet couplings, clutches and brakes are safe, reliable and particularly economical to operate. They work without wear or contact, are virtually maintenance- free, operate with low bearing friction (concentric ring couplings) and, under conditions of normal use, have an almost unlimited working life. They are particularly useful when it is necessary to ensure a strict, physical separation between the drive and driven side.

A magnetic gear uses permanent magnets to transmit torque between an input and output shaft without mechanical contact. Torque densities comparable with mechanical gears can be achieved with an efficiency >99% at full load and with much higher part load efficiencies than a mechanical gear. For higher power ratings a magnetic gear will be smaller, lighter and lower cost than a mechanical gear. Since there is no mechanical contact between the moving parts there is no wear and lubrication is not required.

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