



GEARLESS TRANSMISSION SYSTEM

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Abstract : Traditional automotive and mechanical transmission systems rely heavily on gear-based mechanisms to transmit power and control speed or torque between input and output shafts. While gears are effective and widely used, they come with inherent drawbacks such as mechanical losses, noise, wear and tear, and frequent maintenance requirements. To overcome these limitations, the concept of a gearless transmission system has emerged as a promising alternative, offering a smoother, quieter, and more efficient method of power transmission. A gearless transmission system eliminates the use of conventional meshing gears, instead employing advanced mechanisms such as frictional drives, magnetic drives, or continuously variable transmissions (CVTs) to transfer torque. One popular model of gearless transmission is the Geneva mechanism, which converts continuous rotary motion into intermittent motion without the use of gears. Another widely adopted design is the magnetic gearless transmission, which uses magnetic fields to transmit motion between components, reducing contact-based losses and mechanical degradation.

The working principle of a gearless system revolves around the idea of variable diameter pulleys, torque converters, or magnetic coupling devices. These systems allow seamless changes in speed ratios and torque distribution without discrete steps, as is the case with gearboxes. This continuous and flexible adjustment leads to improved fuel efficiency in vehicles, less mechanical stress on components, and a more comfortable user experience.

Index Terms – Transmission, Mechanism.

1. INTRODUCTION

In modern engineering and automotive design, the efficiency and reliability of power transmission systems play a critical role in overall performance. Traditional gear-based transmissions, though widely used, come with inherent drawbacks such as mechanical losses, increased wear and tear, noise, and the need for regular maintenance. To address these limitations, the concept of a gearless transmission system has gained significant attention. A gearless transmission system eliminates the use of conventional meshing gears, instead utilizing alternative methods such as belt and pulley systems, magnetic couplings, or continuously variable transmissions (CVTs) to transmit power and control speed or torque. These systems allow for smoother, quieter, and more efficient operation by minimizing frictional contact and enabling seamless changes in speed ratios without mechanical steps. Gearless mechanisms are increasingly being adopted in electric vehicles, bicycles, robotics, and industrial applications where precision, low maintenance and energy efficiency are paramount. They also contribute to environmental sustainability by improving energy efficiency and reducing emissions in automotive systems.

2.1 PROBLEM IDENTIFICATION

Study the limitations of conventional gear-based systems such as high maintenance, friction, noise, and complexity.

2.2 CONCEPTUAL DESIGN

- Research and select a suitable gearless transmission mechanism (e.g., crank and slotted lever mechanism, four-bar linkage, magnetic coupling, or belt drive).
- Sketch basic design ideas and select the most feasible one based on application and constraints.

2.3 MATERIAL SELECTION

- Choose lightweight, durable, and cost-effective materials for the components based on stress analysis and application requirements

3. CONSTRUCTION

- It consist of
 - i. Single Phase AC motor
 - ii. Pulley
 - iii. Bent Link

- iv. Pedestal Bearings
- v. Belts
- vi. Housing
- vii. Frame / Structure
- viii. Electrical Wires
- ix. Nut & Bolt



Fig. Working Model

4. DETAILS OF THE COMPONENTS OR SPECIFICATIONS

- i. Motor:
 - Type: AC Induction Motor (Open Drip Proof - ODP)
 - Voltage: 160 to 240 V
 - Power Rating: 186.5 watts
 - Efficiency: 65% to 75%
 - Purpose: Serve a very specific and important role, especially in low-load, precise-motion systems.
- ii. Pulley :
 - Type: Single-groove V-belt pulley
 - Number of Grooves: 1 (single belt)
 - Material: Cast iron
 - Purpose: In a gearless transmission, we use pulleys and belts to transfer motion and torque instead of traditional meshing gears.
- iii. Bent links :
 - Type: Lead-Acid
 - Capacity: Torque Handling
 - Purpose: Facilitating Smooth Power Transmission
- iv. Pedestal Bearings :
 - Type: Pedestal Bearing(UC 204)
 - Diameter: 25mm
 - Purpose: A pedestal bearing in a gearless transmission system supports and stabilizes rotating shafts, reduces friction, and ensures smooth power transmission.
- v. Belts :
 - Type: V-Belts
 - Purpose: V-belts in a gearless transmission system are used to transmit power between rotating shafts, providing a flexible, efficient, and smooth transfer of energy while accommodating varying loads and speeds.

5. WORKING

A gearless transmission system is a mechanism used to transmit power and motion between shafts without using conventional gears. Instead of meshing gears, these systems rely on alternative methods like linkages, belt drives, magnetic couplings, or other mechanical arrangements to perform the same function. The goal is to reduce mechanical complexity, noise, maintenance, and energy losses while ensuring efficient power transfer. One of the most commonly studied gearless mechanisms is the crank and slotted lever mechanism or a four-bar linkage system. These setups typically include a crank (input link), coupler, slotted lever (or rocker), and a follower (output link). As the crank rotates, the motion is transferred to the coupler, which then moves the slotted lever. The follower receives oscillatory or rotary motion depending on the configuration. Continuously Variable Transmissions (CVTs), used mainly in vehicles, also function without conventional step gears. CVTs use a system of pulleys and a belt that can move across the pulley faces, changing the diameter of contact and thus varying the gear ratio continuously.

Gearless transmission systems are often seen in scooters, electric vehicles, and some industrial machinery, where simplicity, efficiency, and reduced maintenance are preferred. They reduce noise, are lighter, and have fewer moving parts compared to gear-based systems, making them ideal for applications requiring smooth and seamless operation.

The main advantages of gearless transmission systems include low maintenance, less noise, lightweight design, compact size, and smooth, jerk-free operation. Because there are fewer moving parts and no gear teeth to wear down, these systems tend to last longer and require less frequent servicing.

6. RESULT AND APPLICATION

6.1 RESULT

The gearless transmission system offers an efficient and smooth method of power transfer without using traditional gears. One of the key results observed from its implementation is the significant reduction in mechanical complexity and maintenance requirements. By using components like pulleys and belts, the system eliminates gear meshing, which often leads to wear, noise, and energy loss due to friction. As a result, the transmission operates more quietly and efficiently. Additionally, gearless systems allow for smoother acceleration and deceleration, which is especially beneficial in applications like electric vehicles, elevators, and industrial machinery. The system can also accommodate slight misalignments and absorb shocks better than rigid gear mechanisms, leading to increased durability and lifespan of components. Another notable advantage is the ability to achieve variable speed and torque control by simply changing pulley diameters or belt tension.

6.2 APPLICATIONS

- Elevators and Lifts – For smooth, silent, and efficient vertical movement.
- Electric Vehicles – Provides variable speed without complex gear mechanisms.
- Conveyor Systems – Used in industries for continuous material handling
- Machine Tools – Ensures precise and vibration-free motion in lathes or mills.
- Textile Machinery – Offers smooth transmission for delicate operations.
- Fans and Blowers – Reduces noise and improves efficiency.
- Exercise Equipment – Allows variable resistance and smooth motion.
- Agricultural Machinery – Used where flexible and simple power transmission is needed.
- These systems are ideal where low noise, smooth operation, and low maintenance are essential.

CONCLUSION

The gearless transmission system is a modern innovation that provides a more efficient and reliable alternative to traditional gear-based mechanisms. By eliminating conventional gears, this system reduces mechanical losses, minimizes friction, and offers a smoother and quieter transmission of power. One of the most notable benefits of gearless transmission is its low maintenance requirement, as there are fewer moving parts subject to wear and tear. This leads to increased durability and longer service life of the system components. Moreover, gearless systems are generally more compact and lightweight, making them highly suitable for applications where space and efficiency are critical, such as electric vehicles, bicycles, elevators, and automated industrial machinery. They also allow for step less speed variation and better control, which enhances user comfort and performance, particularly in transport systems.

REFERENCES

- [1] R.S. Khurmi and J.K. Gupta, A Textbook of Machine Design, S. Chand Publishing, 2005.
- [2] Amol Shelke, Arun Wakekar, Pravin Jadhav, Shubham Pardeshi, Prof. S.P.Walhekar Design and Fabrication of Weight Operated Material Handling System in International Research Journal of Engineering and Technology (IRJET), Volume 7, and Issue 7:127 – 130.
- [3] V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill, 3rd Edition, 2010.
- [4] Sagar P. Walhekar, Aditya Aher, Sarthak Ghorpade, Satyam Nale, Samarth Nagare, Design and Development of Multi-Functional Agricultural Machine, Journal of Emerging Technologies and Innovative Research, JETIR March 2025, Volume 12, Issue 3: 411-414.
- [5] J.E. Shigley and C.R. Mischke, Mechanical Engineering Design, McGraw-Hill Education, 9th Edition, 2011.
- [6] A. Ghosh and A.K. Mallik, Theory of Mechanisms and Machines, East West Press, 3rd Edition, 2009.