

DESIGN AND ANALYSIS OF SHAFT DRIVEN BICYCLE

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Abstract - The conventional bicycle employs the chain drive to transmit power from pedal to the rear wheel and it requires accurate mounting & alignment for proper working. The least misalignment will result in chain dropping. So this problem can be overcome by introducing the shaft drive system. This project includes design and fabrication of shaft driven bicycle. In this project, two spiral bevel gears are used at the pedal side and two straight bevel gears are used at rear wheel side. The drive shaft has two gears mounted one at each end. One is spiral bevel pinion at pedal end and one is straight bevel pinion at the rear wheel end. The use of bevel gears allows the axis of the drive torque from the pedals to be turned through 90 degrees. The bevel gear at the rear end of drive shaft then meshes with a bevel gear rear wheel hub where the rear the flywheel unit would be on a conventional bicycle and canceling out the first drive torque change of axis.

Key Words: : Chainless Bicycle System, Shaft Drive Bicycle, Bicycle with bevel gears, Components of shaft drive bicycles, Design of Chainless Bicycle.

1.INTRODUCTION:

Chainless Bicycle System (CBS) is a setup which makes bicycles run on the road without chains. CBS uses the shaft-driven concept; it uses a drive-shaft for the transmission of power from the pedals to the wheels in place of chains. Shaft Driven Bicycle was introduced over the period almost 100 years ago. In the present era, development in internal gear technology produces various advantages. So, I decided to construct a bicycle using a shaft-driven system rather than using chain-driven. In this system, I use bevel gear in place of chain-ring, also shaft rod in place of chains, and another two bevel gears which mounted on the front and rear end of the shaft and the hub assembly. For the maintenance of Gears to keep their running smooth, quiet and efficient, the shaft-driven bicycle requires periodic lubrication only which can be done by grease gun. Chainless Bicycle System is very comfortable and produces efficient transmission of power from the rider's foot to the rear wheel hug along with the rear wheel.

1.1 Uses of Shaft Drive:

Drive-shaft has gears on its both ends. The Drive-shaft is an intermediate axle which used to connect the gears

on rear wheel hub to the front bevel gear through meshing up with bevel gears on both sides of shaft respectively. For pushing the bicycle forward and reverse it is necessary to transfer the generated torque to the rear wheel, this work has done by drive shaft assembly. It has to provide a secure and smooth pass of power to the axles.

1.2 Objectives of Shaft Drive:

- To increase the durability of a bicycle.
- To reduce the overall maintenance cost of a cycle.
- To make cycle better, comfortable and admirable.
- To increase the overall strength and power.
- To increase the efficiency of the bicycle system.
- To reduce the dirty clothes problem caused by grease.

Comparison of Shaft Drive vs Chain Drive: -

- This Shaft-Driven System is packed and has not affected by weather and only needs periodic lubrication whereas, Chain-Drive System needs lubrication frequently, mainly in poor weather condition that may be dirty and troublesome.
- Shaft Drive System is the most robust, soft and requires less maintenance, costs and cleanliness. Whereas, Chain Drive System is generally open to the elements and generates a lot of dust and dirt also needs their chains adjusting time to time as chain length tends to increase over time. And they can be expensive to restore when they wore out.
- Shaft-Drive System consists of an axle connected to the output of the gearbox through a universal joint, which is a coupling that transmits the torque at a selected angle. At the other end, the axle has connected to the rear wheel hub through a spiral bevel gear. The bevel gear rotates the wheels by turning this axle 90 degrees. Whereas, Chain-Drive System consists of a simple connection chain that connects the sprockets.
 - Shaft-Drive System is very smooth and generates no noise while Chain-Drive System is noisy, especially when the chain is loose.



2. Material Selection:

Based on the availability, cost and mechanical properties, I decided to make the Chainless Bicycle System as per the material I mention below.

Table -1: . Material Selection:



Sr. No.	Element Name	Use Material
1	Shaft	EN-8
2	Bearing	Cast Iron
3	Bevel gear set	Alloy Steel
4	Frame	Mild Steel
5	Universal Joint	Alloy Steel
6	Rod	Mild Steel



Chainless bicycle system has used drive shaft in place of chains to transfer power to the rear wheel by means of pedalling the bicycle through pedals. This system use shaft rod and gears as the main parts to deliver power to the wheel. Chainless Bicycle is very smooth and efficient. The shaft-driven bicycles were introduced 100 years ago but have not got popularity because chain drive bicycles system comes with the possibility of various gear ranges with the sprockets assembly. In the present scenario, few modern shaft-driven bicycles have introduced due to the advantages of internal gear technology.



I design a suitable drive shaft which can take the place of chain drive easily and transfer power to the rear wheel from the pedals through pedalling without creating any issue. For keeping running of gears smooth and quiet, this chainless-bicycle system needs periodic lubrication. This setup of bicycle provides the transfer of energy efficiently to the rear wheel from the pedals.

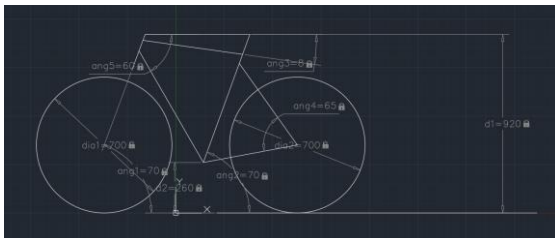
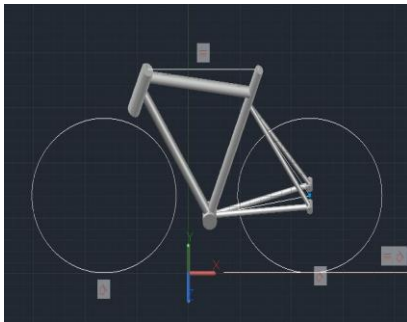


Chart -1: Design of frame

➤The drive-shaft is the chief connection of bicycle which has used to connect the front end that is pedal and crank to the rear hub along with the wheel. Drive-shaft performs the job of propelling the front end and transmitting motion

➤The pedal has connected to the crankset which is further connected to the drive-shaft by mean of bevel gear.

➤Drive-shaft consists of shaft rod, two bevel gears and universal joint. Bevel gears are present at both ends of the drive-shaft.

➤On the bicycle's rear end, drive-shaft bevel gear is connected to the gear on the rear hub assembly along with the rear wheel.

➤The strength of this system is high and takes small maintenance.

➤Drive shaft's centre has fitted with a flexible universal joint. Thus, absorbs shock

➤Use of drive shaft provides protection to clothes and safety of cyclist as there is no more chain bite, also no more grease on hand to maintain the chain.

➤Rider of the chainless bicycle system has not to apply extra power to push the vehicle forward.

Design Optimization:

Design optimization is a principle part of engineering design. By design optimization, we can improve our designs to a very considerable extends. It shows us where the improvement is needed & according to the result; we can

improve our product at minimum cost. We can choose the best property materials for our design. Various methods have applied for the design optimization process includes the mathematical optimization to design and calculation problem formulations, physics law. Design optimization also performs engineering optimization.

3. CONCLUSIONS

➤This Chainless Bicycle System would be able to replace the existing traditional bicycle system of chain and sprocket arrangement.

➤This Chainless Bicycle is run successfully with the use of drive-shaft in place of chain-ring.

➤This chainless bicycle system has manufactured for quiet, smooth and easy power transmission.

REFERENCES:

[1] Aakash Patel, Hitesh Prajapati, Vivek Patel, Amit Patel, "Design & Modelling of Chainless Bicycle with Gear Mechanism", International Journal for Scientific Research & Development| Vol. 5, Issue 05, 2017.

[2] Yashwant Sharma, Praveen Banker, Yogesh Raikwar, Yogita Chauhan, Madhvi Sharma, "R&D ON ELECTRIC BIKE", IRJET- International Research Journal of Engineering and Technology, Volume 05, Issue 02, Feb 2018.

[3] Miss. S. Chandana, Mr. R.Shiva Kumar, Mr. S. Suhas Mr. N.Sai Charan, Mr. Alapati Bhargav, "Design And Analysis Of Shaft Driven Bicycle", IJRI-International Journal Of Resarch And Innovation.