

Design and Fabrication of “Chainless Bicycle”

Rishabh Singh¹ Yogendra Singh² Nitesh Kumar³ Prakhar Srivastava⁴

^{1,2,3,4}UG Student

^{1,2,3,4}Department of Mechanical Engineering

^{1,2,3,4}Pranveer Singh Institute of Technology, Kanpur, India

Abstract— In this paper, design and fabrication of chainless bicycle is discussed with the concept to provide a dynamic change to primarily existed bicycles with chain drives which helped the people to cover the paths or distances on wheels, after understanding the need & use of wheels. And recently, bicycles with shaft drives have been developed with unique advantages & better efficiencies. For project-making, the conventional shaft-drive was better suited over its cost & flexibility. The shaft drive uses a shaft instead of a chain to transmit power from pedals to wheels. Here the mechanism is equipped with ball bearings connected with shaft-drive, for high power transmission to wheels. Bearings along with the characteristic of minimizing friction save the energies of people. Pedaling works at a smooth pace to transmit the power from forward sprocket to backward sprocket with bearing-shaft-bearing network. This system will also achieve the variable speeds like internal-gearing systems, but it is better than those systems in several manners. Our work is aimed to reduce the power wastage (human energy) by using light weight drive shaft connecting with ball bearings to make the design standardized.

Keywords: Chainless Bicycle, Shaft-Driven Bicycle

I. INTRODUCTION

The Bicycles with chain drives helped the people to cover the paths or distances primarily on wheels, after understanding the need & use of wheels. But along with this kind of application, a mechanism had been developed called as the bicycles with the shaft drives, which has proven more beneficial to us. Shaft drives were introduced over a century ago, but were mostly supplanted by chain-driven bicycles due to the gear ranges possible with sprockets. Recently, due to advancements in internal gear technology, a small number of modern shaft-driven bicycles have been introduced. Generally shaft drives are manufactured with positioning the gears, sealed inside the housing which is attached to driving shaft. But, now in our case or project, we are applying the mechanism of using roller bearings joint with main shaft to transmit power with rider over wheels of bicycle. We were constantly researching in this field & also are confirmed to make our vision in reality with designing a newer version of bicycles. Actually this version is arising in our brains to give our product, a unique quality & cheap rating, to satisfy the customers with advantageous features. Our smarter product is fully meaningful & also mechanically advantageous for both cyclists & cycle-industries.

II. LITERATURE SURVEY

This project work has done after observing the complications of chained drive mechanism held on the bicycle when bevel gears were used in place of it.

The gearing mechanism was applied then to overcome the problems of chain-drive like less load capacity,

noisy operation can cause vibrations and require frequent lubrication followed by chain adjustments due to slackness appeared. Gearing system having ability to turn or change torque load 90 degrees in direction provided smooth and noiseless transmission. [1] But this modified system, on working conditions, hampered with various demerits like rusting on gears during prolonged period for which they require frequent adjustments as well as maintenances like frequent lubrication on wear and tear of tooth of gears due to which whole wheel alignment may change or shift. Thereby we took the use of bearing-operated mechanism in place of gearing-setup on the bicycle. [2]

Now the focus was on the operations of shaft which was required of low weight and less maintenances. These requirements could have filled with use of composite elements like kevlar or epoxy fibers because of facts like now the conversion would occur from 2 piece shaft into a single piece shaft and also now the shaft would have the high tensile strength, high damping capacity, high torque capacity, long fatigue life and also absorb vibrations.

Now the major outcome would be the reduction in weight of shafts but here our problems wouldn't be almost end. Actually we faced unavailability of these kinds of composite elements in the market and if we somehow accessed them they could be available with high purchasing costs ultimately add on the production of bicycles to us. Thereby we used the mild steel as the material for shafts as it provides perfect pros to our shafts like resistance to breakage, high tensile strength followed by the low weight with load carrying capacities. [3]

Actually we could have faced with cons of using composite materials like their high UV-resistance (so that they may degrade under sunlight) and ability to absorb moisture (becoming sensitive to environment), so now we were satisfied with the suitability of mild steel over these kinds of materials.

A. Conclusion drawn from literature review

We have taken a quite survey of some journals or papers and concluded with the use of bearing-oriented mechanism as a replacement over both chained-driven and gearing-operated mechanisms.

Bearings having the merits of minimizing friction as well as load carrying capacities

So we have applied them along with the less weighted shaft (having ability to encompassing the smooth transmissions).

III. GAP OBSERVED

After going through some research papers and information we have found some distinctions or gaps as follows:

| Implementation of bevel gears | Implementation of bearings |
|--|---|
| <ul style="list-style-type: none"> - Bevel gears were implemented when shaft drives were replaced the chain drives due to a feel of their replacements. - Chain drives were facing the cons of more energy losses on pedalling, frequent maintenances, noise and vibrations on slackness of chain. | <ul style="list-style-type: none"> - This system is altered after understanding the cons of bevel gears when they were also left with the feel of replacements. - The gearing system was also faced some constraints around it like at increasing speeds system was losing its flexibility so vibrations exited there and also wearing of gear tooth was an illness over the gears for their frequent removals. |

Table 1: Distinctions

IV. COMPONENTS USED AND SPECIFICATIONS

A. Bearings

Actually in our project work we took the use of ball bearings as a purpose to reduce the rotational friction on clamping with the sprocket-wheel (so that system can't be jammed) and support radial and axial loads. Here with the use of bearings we have the pros of getting a smooth & noiseless transmission on a less effort to save ultimately the human energies.

- Bearings-19 mm (in size).

B. Shaft-drive

Shaft-driven support was a revolution in place of chained-support to fulfill the requirements of torque transmission capacities so that it becomes useful to attain required speeds of wheels on less-efforts. Here in our project we used shaft induced of mild-steel in place of composite elements and other elements like aluminium due to better comparable mechanical properties.

- Material- Mild Steel.
- Shaft-450 mm (in length).

C. Sprocket Wheels

Generally the sprocket-wheels are having alignment of teeth along the wheels but in our case we having the perpendicular alignment of all teeth to the wheel-axes for the enclosure of bearings.

- Here outer sprocket or front wheel dia-210mm.
- Inner sprocket or rear wheel dia-112mm.
- No. of teeth on front sprocket-32.
- No. of teeth of rear sprocket-16.
- Axle-223 mm (in length).

V. PROPOSED METHODOLOGY

- 1) Here with the bicycle a shaft-section is provided with the support of 2 bearings these bearings are attached on both ends of the shaft to move the wheels with the help of 2 sprockets. Here power is transmitted from bearings to sprockets (firstly pedal on the sprocket to transmit over the lower sized sprocket to move the rear wheel).



Fig. 1: Bearing-Shaft Joint

- 2) The bearings will enclose with sprockets, which having teeth, not exactly along the sprocket-dia or plane, but they will normal to the plane. This perpendicular gesture of the teeth supports the bearings very smoothly with getting fixed in each round. Now the power transmission occurs from pedaling on the bigger sized sprocket to the lower sized sprocket (forward to backward manner in bicycle).



Fig. 2: Bearings Enclosure with Sprocket

VI. CONCLUSION

So finally through our project work we have concluded with following features-

- Our project is relevant to increase the durability, reliability & efficiency of bicycles with its noiseless operation.
- Our work is aimed to reduce the power wastage by using light weight drive shaft connecting with bearings to make the design standardized.

REFERENCES

- [1] Prof. Amit Kumar Kundu, "Design & Fabrication of Shaft Driven Bicycle," IJSTE - International Journal of Science Technology & Engineering, Volume 2, Issue 11, May 2016, www.ijste.org.
- [2] Khan Hassan Zakariya, Kolkar Abhimanyu Dashrath, "Design & Fabrication of Shaft Driven Bicycle," IRJET -International Research Journal of Engineering & Technology, Volume 5, Issue 03, Page No.-2836-2837, March-2018, www.irjet.net.
- [3] R.P. Kumar, "Design and Optimization of Drive Shaft with Composite Materials," International Journal of Modern Engineering Research (IJMER), Vol. 2, Issue 5,

September-October-2012,Page-3422-3423,
www.ijmer.com.

- [4] Anup B. Patel, "Design Optimization & Analysis of Drive Shaft," vol. 1-issue-12, page-432-434, (May-2015), www.ijerst.org.
- [5] K. Mahadevan & K. Balaveera Reddy, Machine design- Design data book: fourth edition, 2013.
- [6] RS Khurmi & JK Gupta, Machine Design, S Chand & Co Ltd: 14th edition, July 3, 2005.

