e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:03/March-2023 Impact Factor- 7.868 www.irjmets.com

DESIGN AND FABRICATION OF CHAINLESS BICYCLE WITH SLIP JOINT AND HELICAL GEAR

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ABSTRACT

Chainless Bicycle System (CBS) is a setup which makes bicycles run on the road without chains. CBS uses a shaft-driven concept; it uses a drive-shaft for the transmission of power from the pedals to the wheels in place of chains. In the present era, development in internal gear technology produces various advantages. So, I decided to construct a bicycle using the shaft-driven system rather than using chain-driven. In this system, I use helical gears, shaft rod, slip joint and another two helical gears and the hub assembly. The rider pushes the pedal which rotates the shaft rod using helical gears at the front end. This rotating shaft has a helical gear at the rear end also which meshes with another helical gear on the rear hub along with the rear wheel and drive the rear wheel of bicycle. CBS is fully enclosed, requires less maintenance, and periodic lubrication through grease gun. Chainless Bicycle System is very comfortable and produces efficient transmission of power from the rider's foot to the rear wheel. The rider's footwear, pants do not get accidental damage. Cyclist of this chainless bicycle system does not get injured because of chain bite as in this system chain are not present.

Keywords: Design, Fabrication, Chainless Bicycle, Slip Joint, Helical Gear.

I. INTRODUCTION

A bicycle, also called a pedal cycle, bike, push-bike or cycle, is a human-powered or motor-powered assisted, pedal-driven, single-track vehicle having two wheels attached to a frame, one behind the other. A bicycle rider is called a cyclist, or bicyclist. Bicycles were introduced in the 19th century in Europe. By the early 21st century there were more than 1 billion These numbers far exceed the number of cars, both in total and ranked by the number of individual models produced They are the principal means of transportation in many regions. They also provide a popular form of recreation, and have been adapted for use as children's toys, general fitness, military and police applications, courier services, bicycle racing, and bicycle stunts. The basic shape and configuration of a typical upright or "safety bicycle", has changed little since the first chain-driven model was developed around 1885.However, many details have been improved, especially since the advent of modern materials and computer-aided design. These have allowed for a proliferation of specialized designs for many types of cycling. In the 21st century electric bicycles have become popular. The bicycle's invention has had an enormous effect on society, both in terms of culture and of advancing modern industrial methods. Several components that played a key role in the development of the automobile were initially invented for use in the bicycle, including ball bearings, pneumatic tires, chain-driven sprockets and tension-spoked wheels.

II. LITERATURE REVIEW

R. Bagade,et.al.,[2021] crank mechanism and different type of pedal operated bicycle.A folding bicycle with crank mechanism is a bicycle designed to fold into a compact form, facilitating transport and storage.This bicycle pedals makes an up and down moment in the both sides of the pedals and it is directly connected to wheel bearings.

K.Nagendra Reddy,et.al.,[2021]the development of the chain drive helped make the bicycle that we know today possible.More recently, bicycles with a shaft drive have been developed and it is slowly changing the bike industry. They both have unique advantages and can produce nearly the same efficiency.As we get to know about This paper illustrates the characteristics of the two alternate drive mechanisms, chain drive and shaft drive.

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Seemant Purohit, et.al.,[2016] studied and understand about the bevel gear mechanism. And this contains the single shaft connected in both sides with bevel gears in angled with pedals.The design of bevel gear produces less vibration and less noise than conventional straight-cut or spur-cut gear with the straight teeths.We get an ideas and discussed for the rider comfort and rearrangement of mechanisms.

Amol R. Patil 2, et.al.,[2018]developed a model to rotate the back wheel of a vehicle with the help of propeller shaft is connected at the middle part of the cycle.This author also developed shaft driven bicycle.Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function.

Gregorius Dimas Baskara, et.al.,[2020] The development of transportation in Indonesia is growing rapidly, one of which is developing is a bicycle.The bicycle pedal connected to the sprocket then transfers power through the chain to the rear wheels.Analysis of the strength of the design of a bicycle transmission system without chains is done with mathematical calculations and analysis of the Autodesk Fusion 360 software.

Neeraj Pandey, et.al.,[2016] A shaft driven bicycle is a bicycle that uses a shaft drive instead of a chain which contain two set of bevel gear at both the ends.The torque that is produced from the pedal and transmission must be transferred to the rear wheels to push the vehicle forward.The drive shaft and differential are used to transfer this torque.

Snehal S, et.al.,[2018] Public bicycle usage for metro access provides new opportunities for sustainable transportation, helping to address the “frst-mile” and “last-mile” problems.Smart card data provide valuable insights and massive samples for enhancing the understanding of transfer behavior between metro and public bicycle.Multisource Data Fusion. SC data provides much detailed information about each trip, but not the information about trip purpose, user assessment, and ultimate destination.

Ashwin Kharwa, et.al.,[2017] “I-Bicycle” refers to a bicycle with the hub-less rear wheel. The main idea behind this project is to develop a hub-less or spoke-less wheel. This bicycle overcomes some drawbacks of the bicycle being used nowadays such as heavy design due to the presence of spokes, power consumption issues, space issues. . The bicycle runs with a “rack and pinion system” connected to the rear-wheel. The paddle gear is connected to the pinion whereas the pinion meshes with the internal teeth of the rear-wheel rim.

Jadhav Mukesh Santosh, et.al.,[2019] Retro-direct is a gearing mechanism used on some bicycles in the early 20th century, which provides a second gear ratio when pedaled backwards.the chain runs from the top of a chainging attached to the cranks to the top of a sprocket attached to the rear wheel hub with a freewheel .The roller chain design reduces friction compared to simpler designs, resulting in higher efficiency and less wear.

Shivakumar RV,et.al.,[2021] Chain system there is a loss of power delivery, lesser efficiency, and maximum efforts are required to apply force on pedal for movement.The present work Bicycle consists of oscillating pedal lever, connecting lever, freewheel disc, freewheel sprocket, bearings, and mounting plates. Power transferred through oscillating reciprocation of pedals forced by the driver legs, allows the rotation of wheel.The main purpose of this project is to reduce human effort required for cycling with minimize foot numbness and tingling.

Sairah Abbas, et.al.,[2007] cycling of the current bicycle design used in competitions in order to minimize strain on the athlete's muscles, leading to susceptibility to injury.This crank system eliminates the dead spot, the position where the crank arms are vertical and all the cyclist's leg force is applied along theaxis of the crank.it was determined that changing the cyclist position had a minimal affect on the muscles used when cycling.

Narasaiaboorlah S,et.al.,[2012] the conventional vehicle by a special designed sprocket system consisting of the triple chain series, which helps the vehicle to run at high speed in minimum time period First sprocket used has a diameter of 7cm, second and fourth has 2.5cm while the third one has a diameter of 5cm. Among these four major sprockets, designed to make the vehicle move easily with less amount of power usage than the conventional vehicle.

S. Suneer Bashav,et.al.,[2017] the Engine is connected at the front part of the vehicle. The shaft of the engine is connected with along rod.Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shapedAccording to the direction of motion of the engine, the wheel will be moved forward or reverse. This avoids the usage of chain and sprocket method.

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Mike Padilla,et.al.,[2019] Bicycles equipped with suspension result in increased rider comfort, enhanced wheel contact and control, and less net rolling resistance Forces between the rider, bike, and ground were analyzed using free body diagrams and applying laws of statics and dynamics. This provided strength and size adjustability, low cost, and simplicity. A full-scale working prototype bike designed with these principles was built and superficially tested.

G.A. Oosthuizena, et.al.,[2019] In order for manufacturing suppliers to stay competitive in the global market, innovative and resource efficient process chains need to be a part of the manufacturing strategyThe popularity of bamboo bicycles have increased over the past few years. In order to expand the market even more in developing countries,The Bamboo Bicycle Club uses a BioFibre for the binding material. This material provides a high level of performance and is easier to process than materials that are glass-reinforced.

A.V.Hari Babu, et.al.,[2018] The String Bicycle is a bicycle that uses a rope and pulley drive system instead of a traditional bicycle chain and sprockets. It uses two ropes attached to pulleys attached to swinging lever and cam mechanisms, one on each side of the bike. As the pedal is propelled, the power is transmitted from the pedals to the wheels through a string. This system is highly advantageous because of its low cost and high efficiency.

Kamble P.N, et.al.,[2017] The conventional bicycle employs the chain drive to transmit power from pedal to the rear wheel and it requires accurate mounting & alignment for proper workingThe 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.The torque that is produced from the pedal and transmission must be transferred to rear wheels to push the vehicle forward and reverse.

K. P. Archana, et.al.,[2020] Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. Shaft-driven bikes have a large bevel gear where a conventional bike would have its chain ring. The shaft driven bicycle would replace the existing conventional bicycle which runs by means of chain and sprocket arrangement.

Mukti Advani, et.al. [2006] Bicycle is an accessible, low-cost, non-polluting and healthy mode of travel. We need to encourage lifestyle changes that improve our health, reduce greenhouse gas emissions and our dependence on fossil fuel. This requires an increase in the share of trips made by bicycle significantly by better meeting the needs of bicycle users. It is possible that if bicycle friendly infrastructure is created which includes parking space for bicyclist at or near the bus stop, and safe bicycle paths, number of such commuters may increase.

Ching -Torng Lin, et.al. [2020] the main aim of this project is to design and fabricate a string bicycle. Bicycle is a two wheel vehicle, which is being powered by a rider and can be steered using a handle. The transmission ratio can be changed with a shifting knob located on the right side handle grip. Gear ratios can be changed even when the bicycle is almost stationary.

III. PROBLEM IDENTIFICATION

- Chain gets slipped and get out from the gear.
- Chain breakage.
- Lubrication in chain drive.
- Maintainence of chain is difficult.

IV. OBJECTIVE OF THE PROJECT

To reduce the human effort and fulfilling the enthusiasm of riding bicycle by replacing the existing chain drive system with helical drive.

- Give the comfort and easy ride to the passenger
- Drive pressure and effort is reduced to the bicycle
- Pollution free

V. CONCLUSION

The presented work was aimed to reduce the wastage of human power on bicycle riding. The presented work also deals with optimization i.e. converting rotary motion into the linear motion with aid of two bevel gears.

Instead of chain drive one piece drive shaft for rear wheel drive bicycle have been optimally designed and manufactured for easily power transmission. Hence we are trying to make the transmission smooth and easy by applying the bevel gears and shaft attachment instead of chain, chain sprocket. 6) The results obtained from this work is an useful approximation to help in the earlier stages of the development, saving development time and helping in the decision making process to optimize a design. The drive shaft has served as an alternative to a chain-drive in bicycles for the past century, never becoming very popular.

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