Design and Fabrication of Shaft Driven Bicycle - A Review

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Abstract— The normal bicycle is the one of the medium of the travelling. Generally we all are aware of the bicycle and most of us have utilized it. 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 to make a new kind of transmission system for bicycle for getting high reliability system, and more safe system. Recently due to advancement in internal gear technology, makes the use of bevel gears for most efficient performance and transmit motion through 90 degrees angle. It replaces the traditional methods.

Key words: Shaft Driven Bicycle, Fabrication

I. INTRODUCTION

A shaft-driven bicycle is a bicycle that uses a drive shaft instead of a chain to transmit power from the pedals to the rear wheel. Shaft drives were introduced over a century ago, but were mostly supplanted by chain-driven bicycles due to the gear ranges possible with sprockets and derailleur. If bevel-gear could be accurately and cheaply cut by machinery, it is possible that gears of this description might supplant, to a great extent. Shaft-driven bikes have a large bevel gear where a conventional bike would have its chain ring. This meshes with another bevel gear mounted on the drive shaft. The use of bevel gears allows the axis of the drive torque from the pedals to be turned through 90 degrees. The drive shaft then has another bevel gear near the rear wheel hub which meshes with a bevel gear on the hub where the rear sprocket would be on a conventional bike, and canceling out the first drive torque change of axis.

The design of bevel gear produces less vibration and less noise than conventional straight-cut or spur-cut gear with the straight teeth. The shaft drives only need periodic lubrications using a grease gun to keep the gears running quite, smooth and efficient transfer of energy from the pedals to the rear wheel. It is attractive in look compared with chain drive bicycle. The shaft connected between the pair of spiral bevel gears. The main application of the spiral bevel gear is in a vehicle differential, where the direction of drive from the drive shaft must be turned 90 degrees to drive the wheels.

II. PROBLEM STATEMENT

The problem statement is to make new kind of transmission system for bicycle for getting high reliability system, and more safe system.

III. OBJECTIVES

There are two main objectives in this work,
- Reduce noise pollution using shaft drive transmission system.
- Increase durability of bicycle with the help of shaft drive.

IV. EXPERIMENTATION

Kenneth S.Keyes(1) have performed a patented work or invention related to drive shaft driven bicycle. The object of his invention was to provide a bicycle having a means of linear transmission from the pedal to hub of the bicycle for better efficiency & speed ratios than prior bicycle. A number of problem may be associated with traditional coaster or 3-speed bicycle chains. They are subjected to slippage if the length of the chain is not correctly adjusted. To overcome above problem, Keyes designed a bicycle which had a driver bevel gear connected to the pedals, a driven bevel gear at the hub of the rear wheel, one or more drive shafts having beveled gears at each end & capable of transmitting the rotation of the driver gear to the driven gear. [1]

Fig. 1: Fabricated setup of modified gear and shaft transmission system

Another experimental study to determine the effects of cycle crank length on maximum cycling power, optimal pedaling rate, and optimal pedal speed, and to determine the optimal crank length to leg length ratio for maximal power production. The experiment has been performed using crank lengths of 120, 145, 170, 195, and 220 mm. [2]

Improved bicycle infrastructure is positively and significantly correlated with higher rates of commuting by bicycle that could include promotion of folding bicycle. Most people understand the general concept of a folding bicycle but do not recognize the overall value of improved product design givens that few people are willing to pay for additional costs. [3]

An individual idea or any possible combination of different ideas can be used, in order to optimize operating performance of driving mechanism for cycle. The velocity ratio of mechanism, torque generated at drive side, pedal crank length, chain drive efficiency, chainring shape are some important parameters used to optimize performance of
The efficiency of the bicycle chain drive depends on the chain operation as it engages and departs from the sprockets on the high-tension part of the drive. [4]

Mayur Linagariya(2) have performed a patented work In a chainless bike, a drive shaft takes over the role of the chain. The pedals are connected to the drive shaft by gears, allowing the drive shaft to transfer power from the pedals to a gearbox on the rear wheel. The power from the drive shaft then spins a shaft rod that propels the rear wheel, providing the bike with power.[1]

The drive shaft connects to a hub transmission that replaces the stacked gears found on a conventional bike. This transmission is factory-lubricated and sealed permanently. Gear changes occur inside the hub, protected from the elements. This transmission is also known as a planetary transmission, since "planet" gears cycle around a central, fixed "sun" gear. Each gear has a different number of teeth, and the various combinations of gears provide a variety of gear ratios, or speeds.[2]

The shaft drive is combined with a multi-speed internal rear gear hub to provide a wide range of gearing for many types of terrain – from city streets to suburban paths to mountain trails.[3]

The shaft drive is a patented, lightweight and rugged aluminium alloy bevel gear drive system. This "chainless" drive system provides smooth, quiet and efficient transfer of energy from the pedals to the rear wheel. The shaft drive is designed and manufactured using the highest quality parts to last for many years.[4]

The bearings used in the shaft are all sealed and lubricated and do not require maintenance. The shaft rod is a solid steel rod, attached at both ends to the bevel gears. The drive shaft has served as an alternative to a chain-drive in bicycles for the past century, although never becoming very popular.[5]

M.Rama Narasimha Reddy(3) have performed a patented work. The design of drive shaft is critical as it is subjected to combined loads. The designer has two options for designing the drive shaft whether to select solid or hollow shaft. The solid shaft gives a maximum value of torque transmission but at same time due to increase in weight of shaft. For a given weight, the hollow shaft is stronger because it has a bigger diameter due to less weight & less bending moment.[1]

The shaft drive transmission system is more efficient, when compared to chain drive transmission system. Using chain drive transmission system transmission of power is very low compared to shaft driven transmission system from pedal to wheel. Shaft driv transmission system produced high torque when compared to chain drive transmission system for constant load and speed.[1]
A bicycle is made up of alloy steel to optimize and minimize the weight of bicycle. The bevel gears are used for transmitting power at a constant velocity ratio between two shafts whose axes intersect at a certain angle. A shaft is a rotating member, usually of circular cross section, used to transmit power or motion. It provides the axis of rotation, or oscillation, of elements such as gears, pulleys, flywheels, cranks, sprockets, and the like and controls the geometry of their motion. For the smooth operation of shaft, bearing mechanism is used. To have very less friction loss the two ends of shaft are pivoted into the same dimension bearing.[2]

Design a suitable drive shaft and replacement of chain drive to transmit power from the pedal to the wheel without slip. It needs only a less maintenance. It is cost effective. Propeller shaft strength is more and also propeller shaft diameter is less and it absorbs the shock. Because the propeller shaft center is fitted with the universal joint is a flexible joint. It turns into any angular position. The both end of the shaft are fitted with the bevel pinion, the bevel pinion engaged with the crown and power is transmitted to the rear wheel through the propeller shaft and gear.[3]

REFERENCES
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