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Propose and Manufacture of Chainless Bicycle

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Abstract:
A chainless bicycle is a bicycle that uses a driven shaft instead of a chain to transmit power from the pedals to the 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. Recently, due to advancements in internal gear technology, a small number of modern shaft-driven bicycles have been introduced. The shaft drive only needs periodic lubrication using a grease gun to keep the gears running quiet and smooth. This "chainless" drive system provides smooth, quite and efficient transfer of energy from the pedals to the rear wheel. It is attractive in look compare with chain driven bicycle. It replaces the traditional method.

Keywords: Bevel gears, Fabrication, Propeller shaft, Reliability, Shaft Driven Bicycle

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 wheel arrangement displayed in the following fig . 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. Recently, due to advancements in internal gear technology, a small number of modern shaft-driven bicycles have been introduced. Shaft driven cycle have a large bevel gear where a conventional cycle would have its chain ring. This meshes with another bevel gear mounted on the drive shaft which is shown in fig.1.

Figure.1. Replacement of chain drive bicycle with drive shaft

The objective of this work is to reduce the human effort and fulfilling the enthusiasm of riding bicycle by replacing the existing chain drive system with bevel gears. The bevel gears are placed at the rear wheels .The rear wheels will rotate with the help of torque transmitted from the pedals to the drive shaft with 90° rotation of bevel gears. The velocity ratio is three that means for every one rotation of the gear the pinion completes three revolutions. Here the power transmission is in perpendicular direction as pinion and gear axis is perpendicular to each other.

II. WORKING

Aim of our Project is to make new kind of transmission system for bicycle for getting high reliability system, and more safe system. A drive shaft, driveshaft, driving shaft, propeller shaft, or Cardin shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them. The shaft is the primary connection between the front and the rear end, which performs both the jobs of transmitting the motion and propelling the front end. Thus the terms Drive Shaft and Propeller Shafts are used interchangeably. In other words, a drive shaft is a longitudinal power transmitting, used in vehicle where the pedal is situated at the human feet. A drive shaft is an assembly of one or more tubular shafts connected by universal, constant velocity or flexible joints. The number of tubular pieces and joints depends on the distance between the two wheels. The job involved is the design for suitable propeller shaft and replacement of chain drive smoothly 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. 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 box. . With our shaft drive bikes; there is no more grease on your hands or your clothes; and no more chain and derailleur maintenance.

III. COMPONENT OF BICYCLE

Paddle: A bicycle pedal is the part of a bicycle that the rider pushes with their foot to propel the bicycle. It provides the

connection between the cyclist's foot or shoe and the crank allowing the leg to turn the bottom bracket spindle and propel the bicycle's wheels. Pedals usually consist of a spindle that threads into the end of the crank and a body, on which the foot rests or is attached, that is free to rotate on bearings with respect to the spindle. Part attached to crank that cyclist rotate to provide the bicycle power.

Fender: Piece of curved metal covering a part of wheel to protect the cyclist from being splashed.

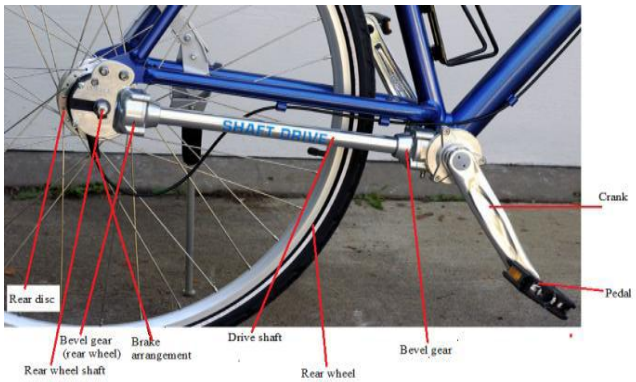

Figure.2. Component of cycle

Front Brake: Mechanism activated by brake cable compressing a caliper of return springs. It forces a pair of brake pads against the sidewalls to stop the bicycle.

Hub: A hub is the center part of a bicycle wheel. It consists of an axle, bearings and a hub shell. The hub shell typically has 2 machined metal flanges to which spokes can be attached. Hub shells can be one-piece with press-in cartridge or free bearings or, in the case of older designs the flanges may be affixed to a separate hub shell.

Wheel rim: The rim of a wheel is the outer circular design of the metal on which the inside edge of the tire is mounted on vehicles such as automobiles. For example, on a bicycle wheel the rim is a large hoop attached to the outer ends of the spokes of the wheel that holds the tire and tube. The rim is commonly a metal extrusion that is butted into itself to form a hoop, though may also be a structure of carbon fiber composite, and was historically made of wood. Some wheels use both an aerodynamic carbon hoop bonded to an aluminum rim on which to mount conventional Bicycle tires.

IV. DESIGN OF BEVEL GEAR AND DRIVE SHAFT

i. BEVEL GEAR:-

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone. Two important concepts in gearing are pitch surface and pitch angle. The pitch surface of a gear is the imaginary toothless surface that you would have by averaging out the peaks and valleys of the individual teeth. The pitch surface of an ordinary gear is the shape of a cylinder. The pitch angle of a gear is the angle between the face of the pitch surface and the axis.

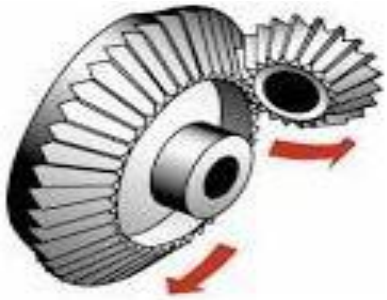

Figure.3. Bevel Gear

The most familiar kinds of bevel gears have pitch angles of less than 90 degrees and therefore are cone-shaped. This type of bevel gear is called external gear because the gear teeth point outward.

ii. SHAFT DRIVE:-

In a chainless cycle, 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 cycle with power. 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. The shaft drive is a patented, light weight and rugged aluminum 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. 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. 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.

Table.1. Mechanical Properties of Shaft Drive

S. No.	Mechanical Properties	Symbol	Units	Cast Iron
1.	Young’s Modulus	E	GPa	105.0
2.	Shear Modulus	G	GPa	36.75
3.	Poisson Ratio	V	–	0.23
4.	Density	P	Kg/m3	7209
5.	Yield Strength	Sy	MPa	130
6.	Shear Strength	Ss	MPa	169

Figure.4. Fabricated setup of modified gear and shaft transmission system

Figure.5. Final assembly

VI. ADVANTAGES

1) Drive system is less likely to become jammed, a common problem with chain-driven bicycles
2) The rider cannot become dirtied from chain grease or injured by the chain from "Chain bite", which
occurs when clothing or even a body part catches between the chain and a sprocket
3) Lower maintenance than a chain system when the drive shaft is enclosed in a tube.
4) More consistent performance. Dynamic Bicycles claims that a drive shaft bicycle can deliver 94% efficiency, whereas a chain-driven bike can
deliver anywhere from 75-97% efficiency based on condition
5) Greater clearance: with the absence of a derailleur or other low-hanging machinery, the bicycle has nearly twice the ground clearance
6) Another advantage that may be noticed about the chainless cycle is that it protects your clothes better. Your footwear and your pants do not get accidentally damaged, and you do not have the same amount of cleaning to do. However, those who are not so crazy about this alternative type of Cycle say that it is enough to choose a cycle with encased chain, or with chain guards, and the problem is solved.

VII. CONCLUSION

Firstly the project were unable to be completed with the drive shaft due to various problems around circumference of the bicycle ,later on this was realized to run successfully with two bevel gears at both end of the drive shaft. The presented work was aimed to reduce the wastage of human power (energy) on bicycle riding or any machine, which employs drive shafts; in general it is achieved by using light weight drive shaft with bevel gears on both sides designed on replacing chain transmission. The presented work also deals with design optimization i.e converting rotary motion in 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. The drive shaft with the objective of minimization of weight of shaft which was subjected to the constraints such as torque transmission, torsion buckling capacity, stress, strain, etc The torque transmission capacity of the bicycle drive shaft has been calculated by neglecting and considering the effect of centrifugal forces and it has been observed that centrifugal force will reduce the torque transmission capacity of the shaft. The stress distribution and the maximum deformation in the drive shaft are the functions of the stacking of material. The optimum stacking of material layers can be used as the effective tool to reduce weight and stress acting on the drive shaft.

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