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Design of Propeller Shaft for Pedalling a Bicycle

B.Koteswararao, D.Ravi, K.Siva Kishore Babu
K L University, Vaddeswaram, Dist.-Guntur A.P. India
basam.koteswararao@gmail.com

Abstract: The people those who are staying in developing countries like India depends on bicycles for transportation due to their financial status. My paper shows a better way to save their energy while pedalling bicycle also the design provides economical and user friendly. Actually chain drive and sprockets causes reduction power loss during Transmission[5] of power from major fir- wheel[2] to rear wheel. The bevel gears are used to rotate the shaft in 90[0] angles. The back wheel of the bicycle is connected with the Bevel gear[1]. Thus the back wheel is rotated in perpendicular to the major fir-wheel. Thus the two wheeler will move forward. According to the direction of motion[3] of the bicycle, the wheel will be moved forward or reverse. A long rod, set of bevel gears and a bicycle is used for this construction. Overall construction is very cheap and does not get wear and tear as the chain and sprocket[4] mechanism. The material used for this assembly is mild steel. This is obtainable everywhere in the country. The present design calculations suitable to local available bicycles.

Keywords : Bevel gear, Fir-wheel, motion, sprocket, Transmission.

I. Introduction

An automobile may use a longitudinal shaft to deliver power from an engine or transmission to the other end of the vehicle before it goes to the wheels. Motorcycle engines positioned such that the crankshaft is longitudinal and parallel to the frame are often used for shaft driven motorcycles. This requires only one 90° turn in power transmission, rather than two. Motorcycles with shaft drive are subject to shaft effect where the chassis climbs when power is applied. A pair of short drive shafts is commonly used to send power from a central differential, transmission, or transaxle to the wheels. This project is developed for the users to rotate the back wheel of a two wheeler using propeller shaft. Usually in two wheelers, chain and sprocket method is used to drive the back wheel. But in this project, the Engine is connected at the front part of the vehicle. The shaft of the engine is connected with a long rod. The other side of the long rod is connected with a set of bevel gears. The bevel gears are used to rotate the shaft in 90^0 angle. The back wheel of the vehicle is connected with the bevel gear (driven).Thus the back wheel is rotated in perpendicular to the engine shaft. Thus the two wheeler will move forward. According 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. Propeller shaft (prop shaft), or Cardan 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. Drive shafts are carriers of torque they are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, whilst avoiding too much additional weight as that would in turn increase their inertia. To allow for variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate one or more universal joints, jaw couplings, or rag joints, and sometimes a splined joint or prismatic joint.

II Working of Shaft Driven Bicycle

Shaft drives operate at a very consistent rate of efficiency and performance, without adjustments or maintenance, though lower than that of a properly adjusted and lubricated chain. Shaft drives are typically more complex to disassemble when repairing flat rear tires and the manufacturing cost is typically higher. 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 because the gear teeth point outward. The pitch surfaces of meshed external bevel gears are coaxial with the gear shafts; the apexes of the two surfaces are at the point of intersection of the shaft axes. Bevel gears that have pitch angles of greater than ninety degrees have teeth that point inward and are called internal bevel gears. Bevel gears that have pitch angles of exactly 90 degrees have teeth that point outward parallel with the axis and resemble the points on a crown. That's why this type of bevel gear is called a crown gear. Shaft drives operate at a very consistent rate of efficiency and performance, without adjustments or maintenance, though lower than that of a properly adjusted and lubricated chain. Shaft drives are typically more complex to disassemble when repairing flat rear tires and the manufacturing cost is typically higher. A fundamental issue with bicycle shaft-drive systems is the requirement to transmit the torque of the rider through bevel gears with much smaller radii than typical bicycle sprockets. This requires both high quality gears and heavier frame construction.

II.I PARTS DESCRIPTION

1.Long Road
2.Set Of Bevel Gears
3.Key
4.Bearing

III Shaft Driven Bicycle Advantages And Disadvantages

III.I 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 "Chain bite" when clothing or a body part catches between an unguarded 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.

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5.Greater ground clearance lacking a derailleur or other low-hanging machinery, the bicycle has nearly twice the ground clearance.
6.Smoothly transfers power from the pedals to the rear wheel using highly efficient and durable gears instead of a sprocket and chain.
7.All the gearing is neatly tucked away inside the rear wheel making it maintenance-free and protected from the elements.

III.II DISADVANTAGES:

1.A drive shaft system weighs more than a chain system, usually 0.5-1 pounds heavier.
2.Many of the advantages claimed by drive shaft's proponents can be achieved on a chain-driven bicycle, such as covering the chain and gears.
3.Use of lightweight derailleur gears with a high number of ratios is impossible, although hub gears can be used.
4.Wheel removal can be complicated in some designs (as it is for some chain-driven bicycles with hub gears).

IV. Designed Objects & Specifications

The Propeller shaft consist of following components.

- ✓ Specifications Of Front Gear
- ✓ Specifications Of Front Wheel
- ✓ Specifications Of Rear Wheel
- ✓ Specifications Of Back gear
- ✓ Specifications Of Shaft:
- ✓ Specifications Of Key Hole
- ✓ Specifications Of Pin
- ✓ Specifications Of Key.

while designing the propeller shaft we have take care about number of teeth on bevel gear and spur gear. The design considerations as follows. *The following values in terms of "cm".*

Product name	Cost(Indian rupees)
Steel road(100 cm)	50/-
Bevel Gears(2)	2 X 200 = 400/-
Key(2)	2 X 25 = 50/-
Bearing	400/-
Machining cost	480/-
Surface coating	100/-
Total	1480 /-

Table:1 cost information

** life span of the shat 3 Years (or 10000 Km to get wear)

IV.I SPECIFICATIONS OF FRONT GEAR:

1. Pitch circle diameter = 20.00
2. Number of tooth = 18
3. Module =1.25
4. Addendum circle diameter =21.25
5. Dedendum circle diameter =18.4375
6. Working depth =2.8
7. Tooth thickness =4.1
8. Minimum total depth =3.0
9. Fillet radius =0.5
10. Circular pitch =3.231

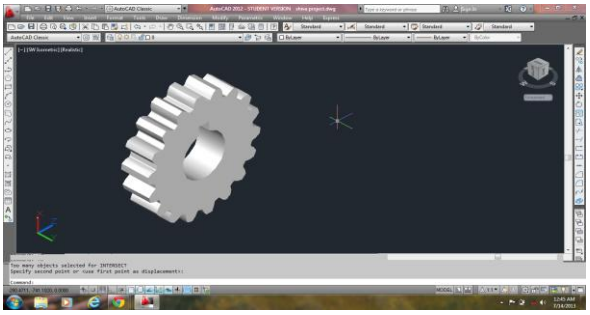

Fig..1 spur gear

Fig.2 front gears

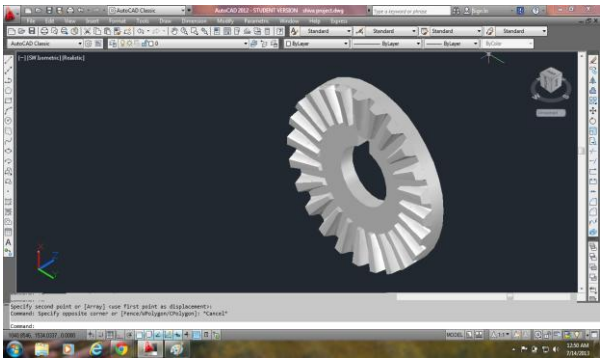

Fig.3 Front wheel & rear wheel

IV.II. SPECIFICATIONS OF FRONT WHEEL:

1. Pitch circle diameter =30
2. Number of tooth =24
3. Module =1.25
4. Addendum circle diameter =31.25
5. Dedendum circle diameter =28.43
6. Working depth =2.8
7. Tooth thickness =3.7
8. Minimum total depth =2.8
9. Fillet radius =0.5
10. Circular pitch =3.64

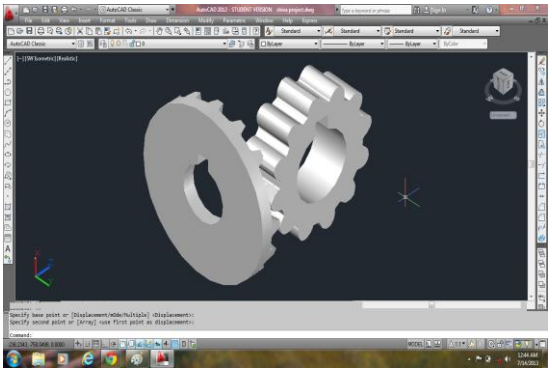

Fig 4: Rear Gears meshing

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IV.III. SPECIFICATIONS OF REAR WHEEL:

1. Pitch circle diameter =20
2. Number of tooth =17
3. Module =1.25
4. Addendum circle diameter =21.25
5. Dedendum circle diameter =18.43
6. Working depth =2.8
7. Tooth thickness =3.7
8. Minimum total depth =2.8
9. Fillet radius =0.5
10. Circular pitch =3.64

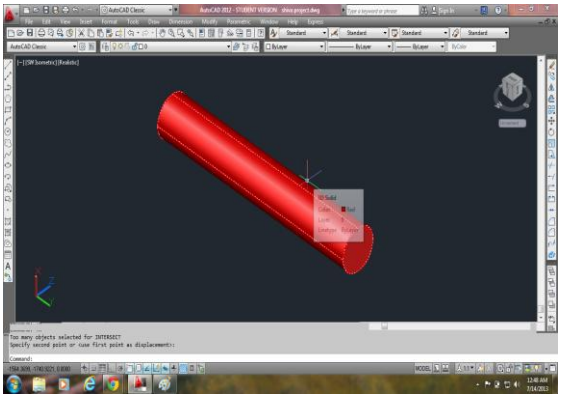

Fig 5: shaft

IV.IV SPECIFICATIONS OF BACKGEAR:

1. Pitch circle diameter =15.00
2. Number of tooth =12
3. Module =1.25
4. Addendum circle diameter =21.25
5. Dedendum circle diameter =13.75
6. Working depth =2.8
7. Tooth thickness =3.7
8. Minimum total depth =2.8
9. Fillet radius =0.5
10. Circular pitch =3.64

IV.V SPECIFICATIONS OF SHAFT:

1. Diameter of circle =8
2. Length of shaft =100

IV.VI SPECIFICATIONS OF KEY HOLE:

1. Radius of circle =8
2. Width of pin hole =4
3. Height of pin hole =1

IV.VII SPECIFICATIONS OF PIN:

1. Length of pin =10
2. Height of pin =1

IV.VIII SPECIFICATIONS OF KEY:

1. Radius of circle =8
2. Width of pin hole =4
3. Height of pin hole =1

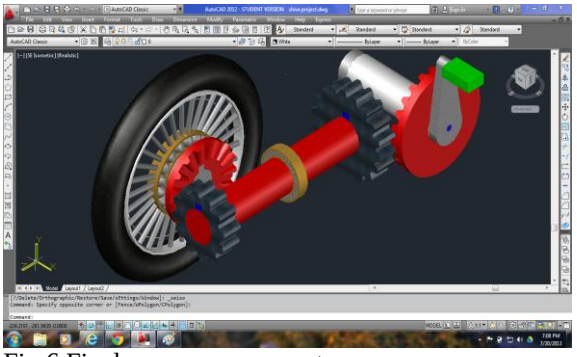

Fig:6.Final gears arrangement

Fig: 7 Final arrangement (two wheeler with propeller shaft) (side view)

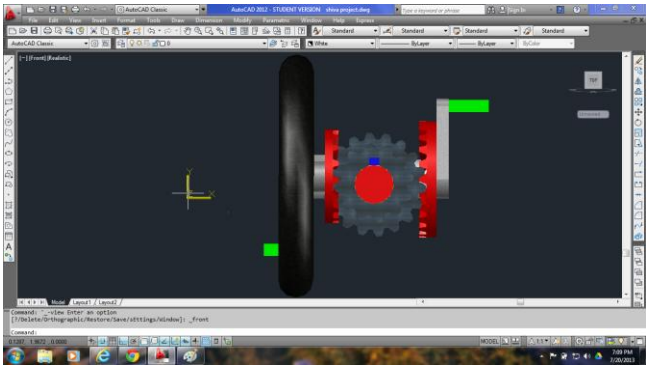

Fig 8.: Front view

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V.CONCLUSION

we prefer the local available steel material to develop propeller shaft. so any where we can produce this shaft with the help of local workshop and also the production cost is very less. We run the bicycle with propeller shaft by the use of bevel gears. By the use of this propeller shaft we can reduce the slipping losses as much as possible. The required force is very less compared to pedal the bicycle by using normal chain drive. 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.

Designed shaft in this paper is to reduce the human power consumption while riding the bicycle with the help of set of bevel gears and bearing for the transmission instead of chain transmission.

Instead of using chain drive for converting rotary motion into linear motion with the serve of bevel gears used in propeller shaft for the easy in transmission.

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 solid shaft is most suitable.

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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