Design and Fabrication of Chainless Bicycle

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Abstract: The development of the chain drive helped make the bicycle that we know today possible. The chain drive eliminated the need to have the cyclist directly above the wheel. Instead, the cyclist could be positioned between the two wheels for better balance. 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. This paper illustrates the characteristics of the two alternate drive mechanisms, chain drive and shaft drive. After carefully examining the two alternatives, the conventional shaft drive was selected for the project since its cost and flexibility were determined to be better suited for the project.

The shaft drive has been developed more recently and only few companies are manufacturing those types. The shaft drive uses a shaft instead of a chain to transmit power from the rider's legs to the wheels. Typically, gears are sealed inside a housing that is attached to the main shaft. The number of the shaft drive manufacturers is increasing and public interests are growing as well. It is slowly changing the bike industry.

KEYWORDS: Chainless bicycle, Bicycle performance, pedal operation, transmission

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INTRODUCTION

The shaft drive has been developed more recently and only few companies are manufacturing those types. The shaft drive uses a shaft instead of a chain to transmit power from the rider's legs to the wheels. Typically gears are sealed inside a housing that are attached to the main shaft. The number of the shaft drive manufacturers is increasing and public interests are growing as well. It is slowly changing the bike industry. The engineer is constantly conformed with the challenges of bringing ideas and design into reality. New machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. So we are going to make a machine for CYCLE industry using bevel gear gives mechanical advantages and make it multipurpose.

STRUCTURE OF PAPER

The paper is organized as follows In section 1 the introduction of the paper is provided along with the structure objectives and overall description. In section 2 we have discuss Assembly ComponentsIn section 3 we have discuss Concept in Machine Design .In section 4 we have Design of Cycle Frame .In section 5 we have discuss Calculation of Drive Shaft .In section 6 we have discuss Working Principle.In section 7 we have discuss Conclusion .In section 8 we have discuss References
During rainy season the charging may work lead to be effect on the driver then it is used to make an non effect in the rainy season. No more waiting at charging stations for hours, now get your vehicle charged by just parking it on parking spot or by parking at your garage or even while driving you can charge your electric vehicle.

ASSEMBLY COMPONENTS

Drive shaft:

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. 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 the rear wheel. The power from the drive shaft then spins a shaft rod that propels the rear wheel, providingthe cycle with power. The drive shaft connects to a hub transmission that replaces the stacked gears found on a conventional bicycle. This transmission is factory-lubricated and sealed permanently.

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. The elements of the cones intersect at the point of intersection of the axis of rotation. Since the radii of both the gears are proportional to their distances from the apex, therefore the cones may roll together without sliding. The elements of both cones do not intersect at the point of shaft intersection. Consequently, there may be pure rolling at only one point of contact and there must be tangential sliding at all other points of contact. Therefore, these cones, cannot be used as pitch surfaces because it is impossible to have positive driving and sliding in the same direction at the same time. We, thus, conclude that the elements of bevel gear pitch cones and shaft axes must intersect at the same point.

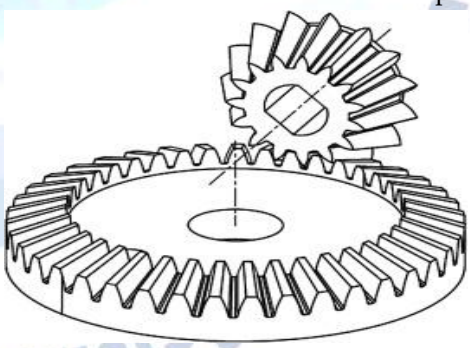


Figure: 2.1 Bevel Gear

Bearings:

A bearing is a machine element that constrains relative motion and reduces friction between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Bearings are required for the front and rear axles.

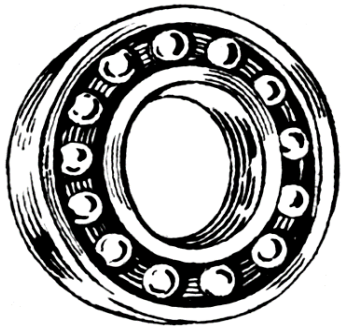


Figure: 2.2 Bearings

CONCEPT IN MACHINE DESIGN:

Consideration in Machine Design When a machine is to be designed the following points to be considered:

–Types of load and stresses caused by the load.

–Motion of the parts and kinematics of machine. This deals with the type of motion i.e. reciprocating. Rotary and oscillatory.

– Selection of material & factors like strength, durability, weight,

– Corrosion resistant, weld ability, machine ability is considered.

–Form and size of the components.

–Frictional resistances and ease of lubrication.

– Convince and economical in operation.

–Use of standard parts.

–Facilities available for manufacturing.

Materials

S.NO	PART NAME	MATERIAL
1	SHAFT	EN-8
2	PEDESTAL BEARING	CAST IRON
3	BEVEL GEAR SET	ALLOY STEEL
4	CYCLE	STD
5	SMALL BEVEL GEAR	ALLOY STEEL
6	RATCHET	STD
7	FRAME	MS
8	MS PLATE	MILD STEEL
9	UNIVERSAL JOINT	ALLOY STEEL
10	ROD	MILD STEEL

DESIGN OF CYCLE FRAME

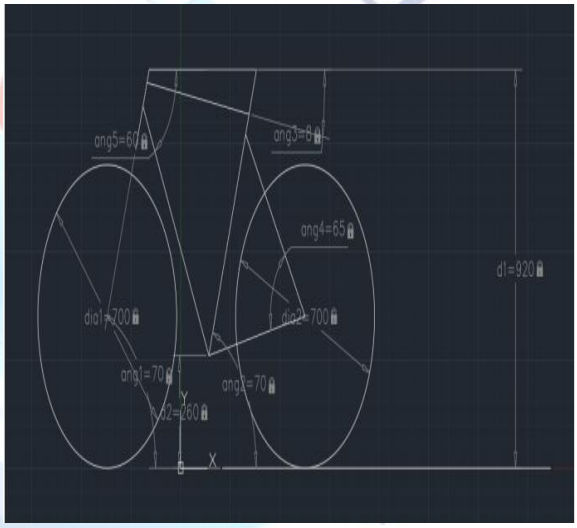
we design a suitable drive shaft which can take the place of chain drive easily and transfer power to the rear wheel from the pedals through pedalling without creating any issue. For keeping running of gears smooth and quiet, this chainless-bicycle system needs periodic lubrication. This setup of bicycle provides the transfer of energy efficiently to the rear wheel from the pedals.

We use the Auto Cad 2016 software to design the bicycle frame.

And required hardware

- ✓ Pentium Iv Processor.
- ✓ 80GB hard disk.
- ✓ 512MB Ram.
- ✓ 300GHz Speed

And we took the required specifications from local industry. We show some figure bellow



Cycle Frame Dimensions In Auto Cad

Above figure we mentioned dimensions .and all dimensions in mm units.

Cycle Frame Designing In Auto Cad

CALCULATION OF DRIVE-SHAFT

Let us assume, the mass of rider= 75 kg

1. Shaft's Inner Diameter(di) = 22mm = 0.022m
2. Shaft's Outer Diameter (do) = 24mm = 0.024m
3. Length of Shaft (L) = 410mm = 0.410m
4. Transmitted Torque (T) = Cyclist's Mass *g* Length of Shaft

= 75 * 9.81 * 0.410

= 301.657 Nm

= 301657 Nmm

5. Polar moment of inertia (J) = π (do4 – di4)/32

= π [(0.024) ^4 – (0.022) ^4]/32 = π (9.752*10^-8)/32

= (3.063681156*10^-7)/32 = 9.574*10^-9 m4

6. Power (P) = 2πNT /60 = 2π*100*301.657/60 = 3158.945 W
7. Shear Stress (τ) = Tϱ/J = (301.657) (7800)/ 9.574*10^-9

= 2.457*10^14 N/ m²

8. Maximum Shear Stress (τmax) = TRo/J = (301.657) (0.012)/ 9.574*10^-9

= 37.812*10^7 N/ m²

A. Front Gear Set Calculation

Module is the term or says unit used to show the size of gears. It is equal to the ratio of the reference diameter of the gear to the total number of teeth. It is shown by 'm' & the unit of size.

Module (m) = Gear reference diameter/ no. of teeth present on the gear

Or, m=d/z

Let, Module (m) = 4

Pressure Angle (α) = 20 degree

On Pinion, no. of Teeth (Zp) = 24

On Gear, no. of Teeth (Zg) = 44

Pitch Circle Diameter (D) = m*Z

Pinion pitch circle diameter (Dp) = 4*24 = 96mm

Gear Pitch Circle Diameter (Dg) = 4*44 = 176 mm

Addendum (ha) = module (m) = 4mm

Dedendum (hd) = 1.25m = 1.25*4 = 5 mm

Clearance (c) = 0.25m = 0.25*4= 1 mm

Working depth (hw) = 2m = 2*4 = 8 mm

Whole depth (h) = 2.25m = 2.25*4 = 9 mm

Thickness of Tooth (s) = 1.5708m = 1.5708*4 = 6.28mm

Tooth Space = 1.5708m = 1.5708*4 = 6.28mm

Fillet Radius = 0.4m = 0.4*4 = 1.6mm

Rear Gear Set Calculation

Module (m) = 4

Pressure angle (α) = 20Degree

On Pinion, no. of Teeth (Zp) = 24

On Gear, no. of Teeth (Zg) = 24

Pitch Circle Diameter (D) = m*Z

Pinion pitch circle diameter (Dp) = 4*24 = 96 mm

Gear pitch circle diameter (Dg) = 4*24 = 96 mm

Addendum (ha) = m = 4 mm

Dedendum (hd) = 1.25m = 1.25*4 = 5 mm

Clearance (c) = 0.25m = 0.25*4 = 1 mm

Working depth (hw) = 2m = 2*4 = 8 mm

Whole depth (h) = 2.25m = 2.25*4 = 9 mm

Thickness of Tooth (s) = 1.5708m = 1.5708*4 = 6.28 mm

Tooth space = 1.5708m = 1.5708*4 = 6.28 mm

Fillet radius = 0.4m = 0.4*4 = 1.6 mm

WORKING PRINCIPLE:

In above figure the input revolution is given by simple paddling to input of bevel gear shaft. The transmission is completed by two bevel gear in paddling unit then offset transmission free wheel arrangement it makes paddling free in reveres paddling, shaft is attach with rear wheel by means of two bevel gear and thus transmission is completed.

ADVANTAGES AND DISADVANTAGES:

Advantages:

- Less jammed as compared to chain drive.

-The rider cannot become dirtied from chain grease or injured by the chain from "Chain", which occurs when clothing or even a body part catches between the chain and a sprocket.

- Lower maintenance than a chain system when the drive shaft is enclosed in a tube More consistent

performance. Efficiency may increase if we are using aluminium material.

Disadvantages:

- A drive shaft system weighs more than a chain system, usually 1-2 pounds heavier.
- Wheel removal is complicated

CONCLUSION:

Instead of chain drive shaft and bevel gear 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 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 designe

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