DOGO RANGSANG
Research Journal
দগো ৰাংছাং
গৱেষণা পত্রিকা

ISSN : 2347-7180

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Authored By

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Published in
Dogo Rangsang Research Journal : ISSN 2347-7180 with IF=5.127
Vol. 12, Issue. 02, No. 02, February : 2022
UGC Care Approved, Group I, Peer Reviewed, Bilingual and Referred Journal

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DESIGN & FABRICATION OF SHAFT DRIVE FOR BICYCLE

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ABSTRACT: Drive shaft is a mechanical instrument which is used to transfer the rotary motion to the back wheels. This rotary motion is used to run the rear wheels. the details of propeller shaft to substitute its material with composite material and suitability of material is analyzed by evaluating and comparing stress distribution & deformation within the shaft to replace the steel drive shaft with a piece of composite materials with the help of material properties. This was achieved by reducing the weight of the Propeller shaft with the use of different composite materials. The Propeller shaft for determining the dimensions, which were then used for creating a model in NX. And tested in ANSYS for optimization of design or material check and providing a best material. This project is developed for the rotate with back wheel of two wheeler using propeller shaft. Usually in two wheelers chain and sprocket method is used to drive the back wheel. But this project composite material of propeller shaft is used to connect back wheels. These avoid the usage of chain and sprocket method.
Keywords: CAD model, Fabrication Model

1. INTRODUCTION: 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.

Fig.1.1. Replacement of chain drive bicycle with driveshaft

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.

1.1 Use of drive shaft The torque that is produced from the pedal and transmission must be transferred to the rear wheels to push the vehicle forward and reverse. The drive shaft must provide a smooth, uninterrupted flow of power to the axles. The drive shaft and differential are used to transfer this torque

1.2 Functions of the Drive Shaft 1. First, it must transmit torque from the transmission to the foot pedal. 2. During the operation, it is necessary to transmit maximum low-gear torque developed by

the pedal. 3. The drive shafts must also be capable of rotating at the very fast speeds required by the vehicle.

2. LITERATURE REVIEW: The first shaft drives for cycles appear to have been invented independently in 1890 in the United States and England. The Drive shafts are carriers of torque; they are subject to torsion and shear stress, which represents the difference between the input force and the load. They thus need to be strong enough to bear the stress, without imposing too great an additional inertia by virtue of the weight of the shaft. Most automobiles today use rigid driveshaft to deliver power from a transmission to the wheels. A pair of short driveshaft is commonly used to send power from a central differential, transmission, or transaxie to the wheels.

3. COMPONENTS OF BICYCLE:

3.1 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; it consists of three segments as shown in figure **3.2**

Fender Piece of curved metal covering a part of wheel to protect the cyclist from being splashed. **3.3**

Front Brake Mechanism activated by brake cable compressing a calliper of return springs. It forces a pair of brake pads against the sidewalls to stop the bicycle**.** **3.4**

Hub Centre part of the wheel from which spoke radiate, inside the hub are ball bearings enabling to rotate around in axle.

3.5 Bevel gear A kind of gear in which the two wheels working together lie in different planes and have their teeth cut at right angles to the surfaces of two cones whose apices coincide with the point where the axes of the wheels would meet.

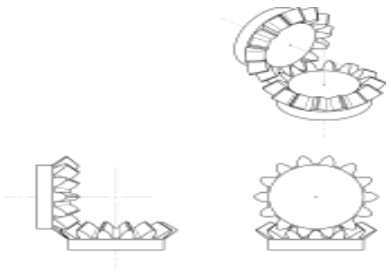


Fig3.1. Bevel Gear

3.6 Driven Shaft 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. 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 derailleurs. Recently, due to advancements in internal gear technology, a small number of modern shaft-driven bicycles have been introduced.

3.7 Merits of Drive Shaft 1.They have high specific modulus and strength. 2.Reduced weight. 3.Due to the weight reduction, energy consumption will be reduced. 4.They have high damping capacity hence they produce less vibration and noise. 5.They have good corrosion resistance. 6.Greater torque capacity than steel or aluminum shaft. 7.Longer fatigue life than steel or aluminum shaft. 8.Lower rotating weight transmits more of available power.

3.8 Selection of 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 Design & Fabrication of Shaft Drive for Bicycle International Journal of Emerging Engineering Research and Technology 45 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 angle of a gear is the angle between the face of the pitch surface and the axis.The most familiar kinds of bevel gears have pitch angles of less than 90 degrees and therefore are cone-shaped.

4. SELECTION OF METHODOLOGY

4.1 Selection of bevel gear

4.2 Selection of Drive shaft

4.3 Placing of bevel gear

4.4 Testing and correction

ADVANTAGES

- This gear makes it possible to change the operating angle.
- iffering of the number of teeth (effectively diameter) on each wheel allows mechanical advantage to be changed. By increasing or decreasing the ratio of teeth between the drive and driven wheels one may change the ratio of rotations between the two, meaning that the rotational drive and torque of the second wheel can be changed in relation to the first, with speed increasing and torque decreasing, or speed decreasing and torque increasing.

5.CAD (NX) SOFTWER MODULES;

1. Sketcher
2. Part modeling
3. Assembly
4. Drafting

5. Wire frame and surfaces design.

There are several good reasons for using a CAD system to support the engineering design function:

- To increase the productivity
- To improve the quality of the design
- To uniform design standards
- To create a manufacturing data base
- To eliminate inaccuracies caused by hand-copying of drawings and inconsistency between
- Drawing

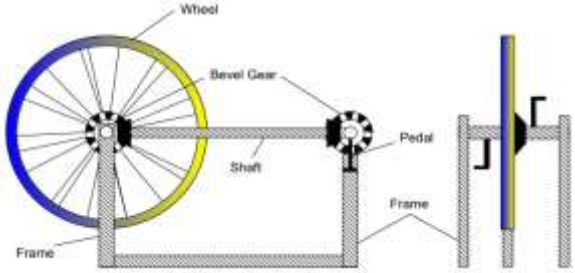
5.1 CAD MODEL OF BEVEL GEAR DRIVE SHAFT

6.CAPABILITIES OF ANSYS

The capabilities of ANSYS package are:

1. **Static Analysis**: to determine displacements, stresses under static loading conditions.
2. **Transient Dynamic Analysis**: To determine the response of a structure to arbitrarily time varying loads.
3. **Modal Analysis**: To compute the natural frequencies, associated mode shapes of the structure, random variation and forced variation problems.
4. **Buckling Analysis**: To determine the buckling loads and determine the buckling mode shape.
5. **Heat Transfer**: To compute the temperature distribution and heat flow within structure.
6. **Field Problems**: Analysis of field intensity and flux density of a magnetic field, analysis of field problems in acoustics and fluid mechanics.
7. **Coupling Effects:** Solution techniques for interfacing multiple field effects such as electrical voltage and current, magnetic intensity and flux and fluid pressure and velocity

CONSTRUCTION OF THE FINAL PRODUCT



6.1 FINAL CONSTRUCTION OF DESIGN MODEL

7.CONCLUSION

In this thesis, the impact of misalignments on root stresses of bevel gears is investigated. 3D modeling is done in NX. Two models with perfect alignment and misalignment are designed. By increasing the number of teeth also, bevel gear is designed.The forces acting on the bevel gear are calculated theoretically. Structural analysis and Modal analysis are done on the designed models to verify the stresses developed. The materials used are Steel and Aluminum Alloy. Analysis is done Ansys.

By observing the analysis results, the stresses are increased almost by double when the gears are misaligned.Analysis is also done by increasing the number of teeth. By observing the analysis results, the stresses are increased but for both the materials of steel and aluminum, the values are less than their respective yield stress values. So we can conclude that by increasing the number of teeth, the power transmission increases.By comparing the results between two materials, the stress values are less when Aluminum alloy 6061 is used compared with that of steel and also its density is less, thereby reducing the weight of the gears. By reducing the weight, mechanical losses will be reduced.

8.FUTURE SCOPE

Prevention of misalignment of gears is of major concern on the life of the gear. More experiments and analyses are to be done by considering other factors affecting by misalignment and try to reduce the effect of misalignment on gear

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