

A Study Work on Design and Development of Hubless Cycle

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Abstract - The bicycle is one of the most common device used for transportation and also for riding purpose. Bicycle can be driven by all kind of people like children and senior citizen. But this bicycle facing some problems likes power consumption, balancing, high weight and size. There is possibility to overcome these problems by designing the hubless wheel or Centerless wheel. That will reduce the material, increased safety over transportation and riding & give space for storage box. Also the contain development of hubless crank to reduce the effort required the driver. For development of this hubless bicycle, we need to develop hubless wheel or Centerless wheel.

Key Words Hubless wheel, Sprocket, Spur gear, Centerless wheel.

1. INTRODUCTION

In general we know that very well the cycle run on chain drive mechanism and it is good and popular way of transportation in rural as well as urban area also. Because initial cost is very low, no fuel is required to run the bicycle. There is no chance to pollute the environment because of absence of any type of fuel so it is eco-friendly. Bicycle can do this because it is very efficiently convert the power our bodies produce into kinetic energy. There are different types of bicycles available in the market for transportation purpose as well as riding purpose.

Innovation in design of wheel in bicycle is possible. The centerless wheel or Hubless wheel, first created by Italian mechanical engineer Franco sbarra, has also been seen in the application of bicycle prototypes. The weight is compromised in using centerless or hubless wheels. It reduce human power also. The concept is development of a mechanical structure Hubless or Centerless bicycle.

2. OBJECTIVES

The Hubless bicycle with gear train mechanism should be fulfilling the following objectives.

Study of Simple Bicycle

- Design of Sprocket
- Design of Chain

- Design of Crank
- Design of Spur Gear
- Design of Hubless Crank

3. ADVANTAGES

- Required less effort.
- Innovative Design – (so good looking).
- Not Harmful – for children & ladies.
- Due to compact and unique design of Hubless Wheel more free space is available.
- Speed will more as per customer satisfaction.
- The maximum speed limit of drive mechanism is improved.
- Generation of Noise and friction is minimized so lubrication is also required in less quantity
- Storage space will available.
- Health Benefits.
- Energy Saving.
- Zero Operating Cost.
- Safety over Riding Bicycle.
- Zero Pollution.

4. LITERATURE REVIEW

The review of literature will help in understanding the concepts of designing of hubless wheel or centerless wheel, design and the performance of chain drives and the pedaling mechanism. R.S.Khurmi in their book “Machine Design” helps to design chain drive, Design procedure and construction for spur gears.

Prof. Jayesh Patel sir who gives uses the way and guidance for development of this Centerless or Hubless bicycle.

4.1 Algat V.V., Bhalerao R.S., Autade K.N., Shimpi G.B., Prof. Ghodake A.P., explained in journal “HUBLESS WHEEL BICYCLE WITH GEAR TRAIN DRIVE MECHANISM” states that “The construction of Hubless wheel bicycle with gear train drive mechanism is designed to convert the human muscle power through pedaling work in to the mechanical work The system is assembled with the combination of pedals, shafts, one small size alloy wheel and one large size Hubless wheel which is function as driving wheel. The pedal and shaft are receiving the human effort and convert in to rotational mechanical motion. This rotational motion is transmit up to the driving wheel via the spur gear drive train. The gear

drive train is the combination of four stages of gear pair. These gear pairs not only transmit the power but also improve the gear ratio step by step. The gears and pinions of drive train are fixing with the bicycle body by using deep groove ball bearings. The last spur gear in the gear train is coupled with the driving wheel through the Hubless mechanism which also performs the holding function of driving wheel. The front wheel is small in size as compared to drive wheel and it only perform the system balancing function without actually participate in driving and driven mechanism. This system has ability to reduce the fatigue on bicycle rider by improving the power transmission efficiency and by extending the maximum limit of bicycle speed."

4.2 Arthur Lidov, in the research paper "SPOCKLESS WHEEL AND SHROUD THEREFOR" explained that "a rotor is rotatable disposed and lateral bearings to laterally stabilize the rotor within the shroud. A series of resiliently mounted bearings are spaced about the shroud for rotatable retaining the rotor within the shroud and for transmitting load and for absorbing any impact forces imparted to the rotors as it rolls over the ground."

4.3 Nanh Souvanny, in the research paper "BICYCLE DEVICE WITH DIRECT DRIVE TRANSMISSION AND HUBLESS WHEELS" explained that "A bicycle device with an internal drive train that eliminates any external mechanical drive train components. An internal drive gear is driven by user pedal input, which provides torque and rotation to a plurality of gear rods, connecting rods and disk gears. The drive train assembled at hubless rear wheel, which rotates a tire tread around a stationary hub. Overall, the present invention provides a sleek, modern upgrade to the traditional bicycle device, and incorporates several features that improve its design."

4.4 Paul E. Lew, in the paper "Hubless Wheel" states that "A Hubless wheel for a vehicle which provides advantageous weight and aerodynamic properties. The wheel includes a rotationally stationary inner hoop, coupled to the vehicle, and a rotatable outer hoop, concentric with the inner hoop. The inner hoop and outer hoop are both fabricated with a woven fiber composite shell. A ground engaging tread is disposed on the radial periphery of the outer hoop. Bearings, preferably three rotating bearings spaced circumferentially around the inner hoop at approximately 120° intervals, are mounted on the inner hoop to be rotationally stationary therewith and each include a support surface on their respective radial peripheries. The support surface is particularly contoured to operatively engage a bearing engaging surface located on the inner periphery of the outer hoop. The outer hoop is axially and radially supported relative to the inner hoop through this engagement to allow rotation there between."

4.5 Bennett Ross, in the paper "SPOKELESS BICYCLE SYSTEM" states that "A spokeless bicycle system for

providing a bicycle that does not have spokes within the wheels- The inventive device includes a frame having a seat structure and handle bars, a rear bracket having rear bearings within that rotatably engages a rear wheel, a front bracket having front bearings within that rotatably engages a front wheel, and a drive train that engages the rear Wheel for driving the rear wheel. The rear rim of the rear wheel includes a rear groove that receives the plurality of rear bearings. The rear rim of the rear Wheel includes a rear gear that is engaged by a drive sprocket from the drive train. The front rim of the front wheel includes a front groove that receives the plurality of front bearings."

4.6 Andrew J. Horst, in the paper "HUBLESS WHEEL AND RELATED STROLLER" states that "A seat is disposed on the frame. The Hubless Wheels are disposed on the frame. The Hubless Wheel includes a rim, an internal sliding structure and at least one bridging component. A tire is disposed on the Hubless Wheel. The rim has an external sliding structure on an inner surface of the rim. The internal sliding structure is disposed inside the external sliding structure. The bridging component is disposed between the external sliding structure and the internal sliding structure. The bridging component revolves on its own axis."

5. WORKING PRINCIPLE

Hubless bicycle run on human muscle power and develop the torque at shaft. Shaft converts the rotational motion. To rotate driving wheel, that input rotational power must be supplied on driving wheel. A Centerless wheel which is also known as Hubless wheel, Spokeless wheel, or rim rider. There is a 4 stage in the gear drive mechanism. These gear pairs use to transmit the power and also increasing the gear ratio at different stages. This mechanism has ability to reduce the fatigue on driver or rider using transmission of power. It is also extending the maximum limit of speed of bicycle. The internal spur gear is assembled with rear wheel and it supported by bearing. The whole support is transferred to the main frame of the body.

6. CONCLUSION

Hubless bicycle can be commercialized in order to replace Hub wheel into Hubless wheel. Through Centerless wheel technology, Hubless bicycle, Centerless wheel, Spockless wheel can be produced. Hubless bicycle is innovative design, which required less effort and speed will more as per customer satisfaction. The maximum speed limit of drive mechanism is improved. Storage space is also available. It can be save the energy and also free pollution.

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