DESIGN & FABRICATION OF OSCILLATION PEDDLE BICYCLE BY SPUR GEAR BASED LINKAGE.

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Abstract – This paper provides a concise overview of the design and fabrication of an oscillation pedal bicycle using a spur gear-based linkage, highlighting its innovative approach and potential benefits. The concept challenges the traditional rotary motion of pedal-powered bicycles by introducing an oscillating pedal motion, enabled by a carefully integrated spur gear-based linkage system. This innovation offers the promise of a more ergonomic and efficient pedaling experience, mimicking the natural motion of walking. The adaptability of the system to different terrains and its potential for enhancing cycling efficiency make it a compelling advancement in bicycle engineering. While practical implications and widespread adoption are yet to be determined, this project showcases the ongoing human fascination with reimagining and improving the bicycle as a means of sustainable and efficient transportation.

1 – INTRODUCTION

The world of transportation has witnessed a remarkable evolution, driven by the relentless pursuit of efficiency, sustainability, and innovation. One of the most iconic and enduring forms of human-powered transportation is the bicycle, a marvel of engineering simplicity that has been a symbol of freedom and mobility for centuries. In the quest to enhance the performance and versatility of this age-old invention, engineers and designers have continuously explored novel approaches. Among the many innovations, the design and fabrication of an oscillation pedal bicycle using a spur gear-based linkage stands out as a testament to the ingenuity of human creativity and mechanical engineering. This intriguing concept reimagines the traditional bicycle pedal mechanism, introducing an oscillating motion that promises to improve the overall riding experience, offering potential benefits in terms of efficiency, ergonomics, and adaptability to different terrains.

The concept of an oscillation pedal bicycle represents a departure from the conventional rotary motion of pedal-powered bicycles. Instead of the circular rotation of the pedals, this innovation introduces a back-and-forth oscillation, creating a unique mechanical linkage system that propels the bicycle forward. Such a departure from the norm challenges the fundamental principles of bicycle design and necessitates a fresh perspective on how human power can be harnessed to move a bicycle. This shift in the paradigm not only raises intriguing questions but also opens the door to new possibilities for the future of cycling.

At the heart of this innovative bicycle design lies the spur gear-based linkage system, a complex yet elegant mechanism that transforms the oscillating motion of the pedals into a forward drive. Spur gears, with their teeth arranged in a straight line, offer a highly efficient and precise way to transmit motion, making them an ideal choice for this purpose. The careful integration of spur gears into the linkage system ensures that the back-and-forth movement of the pedals is translated into a continuous rotation of the bicycle's wheels, allowing the rider to experience a smooth and consistent ride.

This design and fabrication process is an intricate undertaking that demands a profound understanding of mechanical engineering, materials science, and ergonomic principles. Crafting the spur gear-based linkage system to function seamlessly requires a meticulous approach to design, selection of materials, and precision manufacturing. Moreover, this innovation necessitates the development of specialized components that are not commonly found in traditional bicycles, further highlighting the uniqueness of the project.

Objective of the Research

- To study about the difference in output received by the cycle as compared to the conventional cycle.
- Increase the efficiency of paddling.
- To improve the paddling system.
- To decrease the human efforts and increase the output.

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2. LITERATURE REVIEW

1) An Analysis of "Design and Fabrication of Chainless Bicycle with Folding Mechanism," by *Bharat Chede and Swapnil Choudhary* (Science Direct). Everybody can benefit greatly from this project since riding a bicycle is good for one's physical health, fuel economy, and pollution reduction. Because of its design, this bicycle required less human effort to carry and pedal. When compared to a traditional bicycle, the power transmission mechanism becomes more reliable and effective.

2) A Review of "Chainless Bicycle Design and Fabrication" *N. Phinandra Kumar and K. Nagendra Reddy* For rear-wheel drive bicycles, the bevel gear and chain drive shaft have been replaced with optimal design and manufacturing to facilitate effortless power transfer. The drive shaft's goal was to minimise the weight of the shaft while still meeting all of the requirements, including torque transmission, torsion buckling capacity, stress, and strain. The work's outcomes provide a helpful approximation that can be used in the early phases of development to save time and aid in the process of making decisions about how best to optimise a design.

3) Review of *"Dr. K. Mayandi1, T. Mahanth, M. Dinesh, K. Nishanth*: Design of chainless bicycle gearbox system using four linkages mechanism" A review of the literature indicates that the goal of designing a bicycle gearbox system without a chain is to get around the issue of the maintenance requirements of a bicycle with a chain. Using a four linkage mechanism, the bicycle chain gearbox system's design was altered. The same principle was used to create two different kinds of models. There are four linking mechanisms in these two designs of bicycle systems.

4) A Review of "Push Pedal Chainless Bicycle Design and Fabrication." *T. Mahanth, Science Direct; Dr. K. Mayandi* Review of Literature Declare that the work is designed to be flexible, quiet, and smooth using a "push pedal bike" pre-plan. Using labour is another similar benefit that can be achieved. It has become more seductive with their development. The project is designed in a way that will be very helpful to clients in learning about a mechanical and intuitive force progress framework and in becoming familiar with the incremental steps involved in completing an undertaking task. The project is designed with the goal of being useful and conducive to contemporary application.

5) A Critical Analysis of "On Electric Chainless Bicycle" Thank you, Mr. Mahendra Shelar Science Direct and Mr. Ish Rakesh Raorane1. An independent crank mechanism and crank support members between the steering wheel and the driving wheel are not necessary with this new drive mechanism, according to a literature review. The traditional bicycle is primarily made up of a chain and sprocket mechanism, while the chainless bicycle is already designed. The new bicycle will also be electrically powered in addition to the bicycle's system. Three driving modes will be available on the new bicycle, and they are as follows:

(i) 30 km in electric mode; (ii) 50 km in pedal assist mode; (iii) manual mode.

3. COMPONENTS OF OSCILLATING PEDAL BICYCLE

1. Spur Gear:
2. Bearing:
3. Sprocket wheel
4. Housing
5. Free wheel

Spur Gear: Spur gears are cylindrical toothed parts used

in industrial machinery to control torque, power, and speed as well as transfer mechanical motion. These simple gears are reasonably priced, sturdy, and dependable, and they provide a positive, steady speed drive to support routine industrial processes.

Bearing: In order to achieve the desired motion, bearings are used to lessen friction between moving parts. This is a piece of machinery. The front and rear axles of this project both use bearings. A bearing's job is to give moving parts free rotation around a fixed axis and linear motion. Both the wheel and the axle housing can freely rotate around the axles thanks to the bearing. It is common knowledge that steel or ceramic bearings are used in bicycle axles.

Sprocket Wheel: A sprocket or chainwheel is a profiled wheel whose teeth mesh with a chain, track, or other perforated or indented material. Any wheel with radial projections that make contact with a chain that crosses it is generally referred to as a "sprocket." It differs from a gear because the sprockets never physically mesh with one another, and it differs from a pulley because—aside from

timing pulleys used in conjunction with toothed belts—

pulleys are smooth.

Freewheel: A set of cogs that screw straight onto the

threads of the back wheel is the freewheel. It does not require mounting onto a hub. A modern bicycle usually has one to seven cogs, if any at all. A freewheel is uncommon. On certain modern single-speed motorcycles, though, you can locate them.

Housing: It is the assembly of bearing and shaft that is attached for the rotatory motion of connected parts.

4. MODIFICATIONS

1.The modified bicycle has modified paddles that oscillate just 70°, compared to the 360° rotation of the traditional cycle, which is utilized by the average person in daily life.

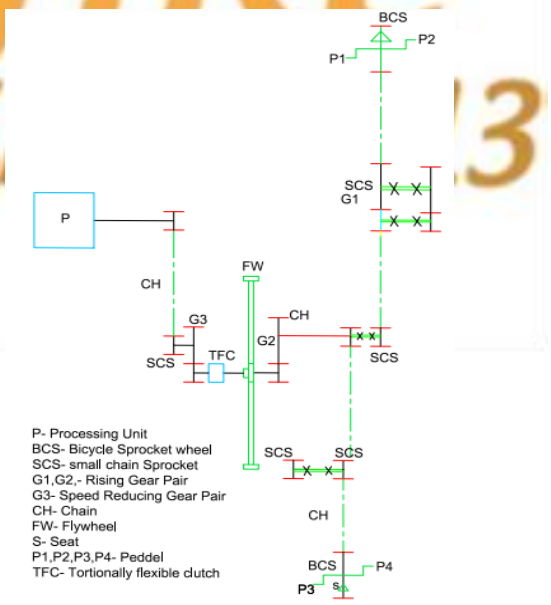
2. A regular bicycle has a transmission angle of 360°, whereas an oscillation cycle has a transmission angle of 70°. This means that the conventional cycle requires more effort than the oscillation cycle.

3. The paddles and sprocket wheel travel to and fro with the chain in a traditional cycle. The sprocket wheel reverses backwards along with the pads while they are in reverse motion, however it only goes forwards during an oscillation cycle that employs a spur gear system.

4. By using this mechanism instead of the traditional cycle, humans can save energy.

5. This oscillation cycle provides greater speed than a conventional cycle, which has a standard speed of sixteen miles.

5. HPFM SCHEMATIC VIEW



6. CALCULATIONS

Conventional Cycle:

Sprocket wheel (front) teeth = 44 Sprocket wheel (rear) teeth = 18

$$Gear\ Ratio\ = \frac{\text{Sprocket whee(front) teeth}}{Sprocket\ wheel(rear)\ teeth} = \frac{44}{18} = 2.4$$

Due to Transmission angle of 360° the efforts induced during

paddling is more.

Oscillating Cycle:

Sprocket wheel (front) teeth = 44 Sprocket wheel (rear) teeth = 9

$$Gear\ Ratio = \frac{\text{Sprocket whee(front) teeth}}{Sprocket\ wheel(rear)\ teeth} = \frac{44}{19} = 4.8$$

Owing to the transmission angle of 70°, paddling requires less effort and produces more output at higher speeds.

As can be seen, the oscillation cycle uses the rear sprocket with nine teeth to increase the gear ratio, decrease human effort, and boost speed.

Additionally, note that in a conventional cycle, the paddles' reverse motion causes the sprocket to reverse when it is attached, but in an oscillation cycle, the sprocket wheel only moves forward, increasing speed.

As a result, the cyclist's pulse rate will be monitored, and as their speed increases, more improvement will be brought about.

7. RESULT AND DISCUSSION

Due to its lengthy idling period and the human limit on thigh oscillation frequency, the conventional cycle is known to be incapable of delivering drive at high speeds. Therefore, in order to guarantee the efficient use of time and the decrease in human force, we have implemented an oscillation cycle using a spur gear mechanism. In a conventional cycle, the sprocket wheel moves back and forth, wasting movement. In an oscillation cycle, however, the paddle movement remains at a 70° angle, increasing the efficiency by 30° over the conventional cycle. The cycle will go faster thanks to this mechanism than it would normally.

8. CONCLUSION

In conclusion, because this project will increase speed and efficiency while reducing human effort, people will find this oscillating bicycle with a bevel gear mechanism more convenient than traditional bicycles.

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