International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Shock Absorber in Cycle Wheels

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Abstract— *Cycles are the most popular means of transport in terms of being environmentally friendly. The introduction of Spoke-less wheels is to make this ride more comfortable. Integrating the wheels with shock-absorbers further improves suspension for a smoother ride. The spring system between the hub and the rim of the wheel provides suspension that continuously adjusts to uneven or rough terrains – effectively cushioning the rider from bumps and potholes in the road. Spokes usually act as load-carrying components in the wheel. Instead of using spokes, the use of shock absorber will increase its load-carrying capacity with better suspension and absorbing shock and vibration. This concept also helps to reduce damage due to an accident by absorbing forces from the sudden impact.*

Keywords—Shock-absorbers, Suspension, Cycle, Comfort, load carrying capacity

1. Introduction

This concept is put forward after considering all the forces acting on the human body and the cycle during motion. The wheel is one of the oldest inventions of humankind after the discovery of fire. There have not been many changes made to the wheel geometry or engineering itself.

In the modern time where science has made improvements in leaps and bounds, there have been changes made to everything, from material to the design of a cycle. The focus has now shifted to the innovation of a spoke-less wheel. Just like the Soft wheel and the Loop wheel, the initiative is to introduce shock-absorbers in the wheels of a cycle. The integration of shock-absorbers was loosely named Spring wheel. The wheel combines three shock absorbers for better suspension and shock absorbing performance. Spring wheel provides better vibration absorbing quality that leads to elevated comfort while cycling. The Spring wheel maintains better contact with the ground to deal with bumps and shocks. This design is specialized and tested in such a way that it performs well in different terrains. It is strong and durable enough to run on uneven terrains, rough tracks, streets, and highway.

With the use of the Spring wheel, the vibration generated in cycles with spokes is shortened by 2/3 rds. Spring wheels can better overcome wear and tear as compared to a spoked one.

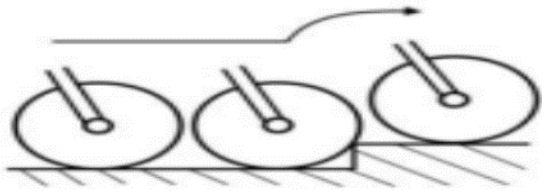

Figure 1: Normal Hub[5]

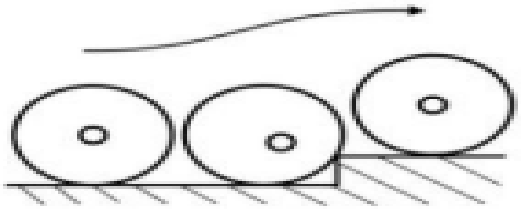

Figure 2: Floating Hub[5]

The central hub of the Spring wheel is a floating type hub. The forces that act on the wheel compress the shock-absorbers. Then the hub shifts corresponding to the force applied and recoils back to its original position after the energy gets dispersed. The three shock absorbers are fitted in a self-locking angle to transmit better torque.

The Spring wheels made and tested to give better comfort to the cyclist while traveling terrestrially.

While cycling, various forces travel through the structure of the cycle and act on the cyclist, which can then lead to back pain and other medical problems. Spring wheel could be the answer to this problem as it provides a better cushioning effect to the cyclist.

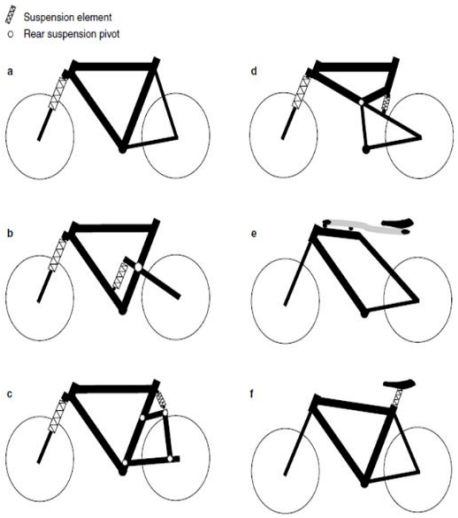

Figure 3: Position of Suspension in Cycle[8]

2. Problem Statement

In normal bicycles, the wheel does not take part in shock absorption internally and the spokes attached to the rim have a less load-bearing capacity in general. We aim to design a new type of wheel with hub, rim, and tire to provide suspension as well as to support rim with better bearing capacity.

3. Objective

Shock-absorbers are introduced between the hub and rim to provide better suspension ability to the wheel. The Spring wheel concept introduced after tackling all the problems face during our daily life. By observing leaf spring concepts in trucks where load capacity is high in an automobile, detailed observation, and study on this concept to form a wheel with maximum shock-absorbing capability during riding was started.

4. Methodology

We begin our work and project by studying many other research papers related to our topic and work on a different mechanism that can be useful to our project. The main target is to achieve the desired suspension. The desired stiffness of the shock-absorbers is achievable by adjusting the nuts on the shock absorber by tightening and loosening it. The wheel design takes into consideration the impact of forces from the ground and the lateral forces while turning the direction of the cycle. Using more shock-absorbers in the wheel will increase the load carrying and shock absorbing ability but also increase the weight, which will require more effort to drive it. We also design a custom hub, design to accommodate the rim, and shock absorber.

5. Advantages

- Improved shock-absorbing performance.
- Enhanced comfort.
- Smoother ride.
- More comfortable than traditional cycle wheels.
- They are vastly stronger when compared to other wheels.

6. Component Used

6.1 Wheel Rim

In the bicycle wheel, the rim is a large hoop attached to the outer ends of the spokes of the wheel that holds the tire and tube. In cross-section, the cycle-rim is depressed in the center and shallow at the outer edges, thus forming a "U" shape that provides support for the bead of the tire casing.

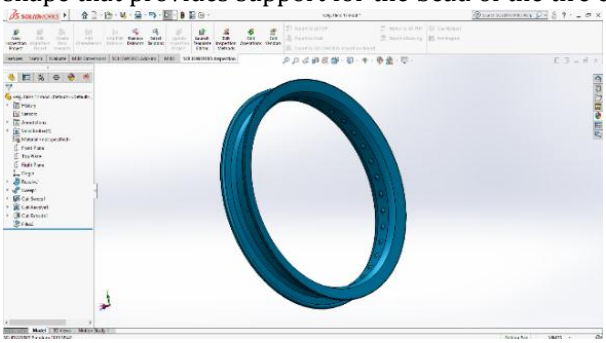

Figure 4: Wheel Rim made in Solidworks

6.2 Wheel Hub

A hub is the center part of a bicycle wheel. It consists of an axle, bearings and a hub shell. The hub shell typically has two machined metal flanges to which spokes can be attached.

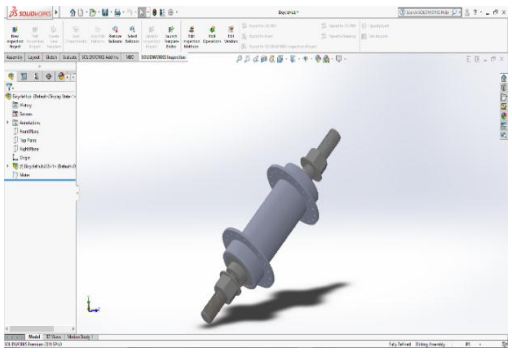

Figure 5: Wheel Hub made in Solidworks

6.3 Coil Over Shock Absorber

In a vehicle, shock absorbers reduce the effect of driving over rough ground, leading to improved ride quality and vehicle handling. While shock absorbers serve the purpose of restricting excessive suspension movement, their intended sole purpose is to damp spring vibrations.

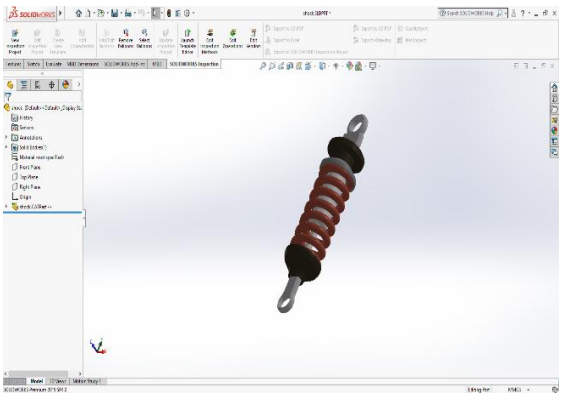

Figure 6: Coil over shock Absorber made in Solidworks

6.4 Triangular Hub Component

Custom made part to hold the shock absorbers with the hub of the wheel.

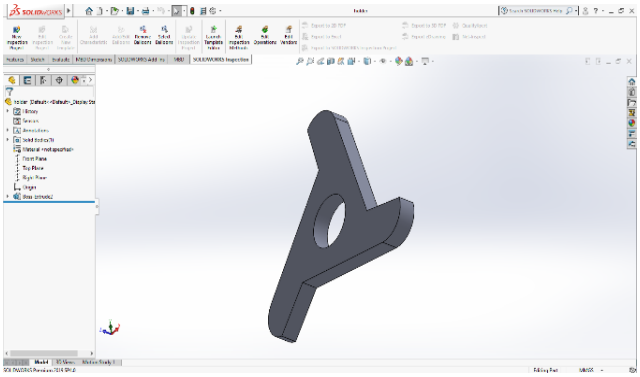

Figure 7: Triangular Hub component made in Solidworks

6.5 Custom Clamps

Again, a custom-made part to hold the shock absorbers with the rim of the wheel.

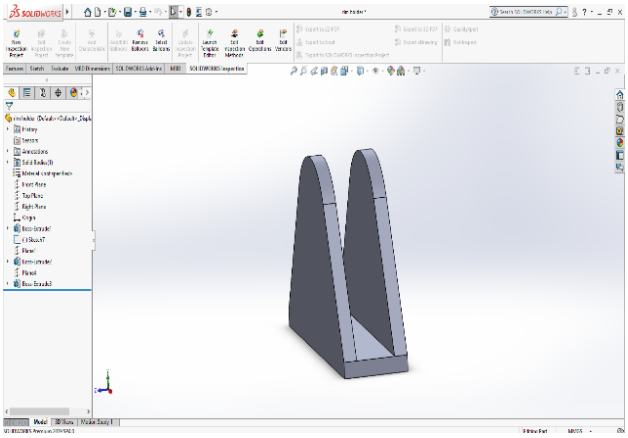

Figure 8: Custom Clamps made in Solidworks

7. Final Model of the Spring Wheel in Solidworks

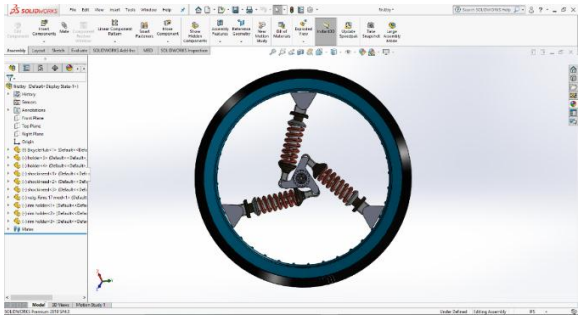

Figure 9: Spring wheel (side view)

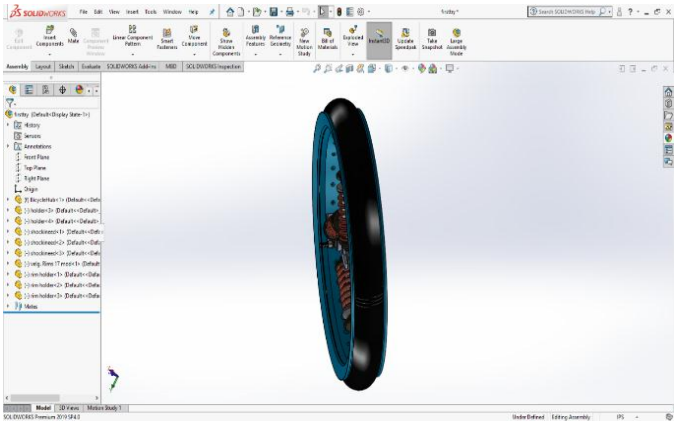

Figure 10: Spring Wheel (Front View)

8. Specifications

Table 1: Critical Specification

Component	dimension	Weight	Material	Load carrying capacity
tyre	26x4 inch ISO 559 120 tpi 1.6-2.0 bar pressure	1.30-1.40 Kg	Magnesium Nylon	136 Kg
tube	22x4 inch	1.2 Kg	Butyl Rubber	90 Kg
rim	22-26 inch	1.7-2.2 Kg	Alloy (Aluminium+Iron +Steel)	145 Kg
Shock absorber	7 inch 0.35"-0.96" width	3 Kg	Alloy	8 Kg (individual)
hub	135-170 mm	500 Kg	Steel	---
Spokes	---	No. 30-40	Steel	50 Kg (individual)
cycle	---	21 Kg	Alloy(Carbon Fiber)	200 Kg

9. Economical stats and comparison

Price of Soft wheels = US $2,000 (A pair) = INR Rs.1,52,315

Price of Loop wheels = US $462-$1493 (A pair) =INR Rs.35,184 to 1,13,703 (depend on the grade)

The estimated price of our wheel :

• Cost of cycle tyre of dimension [26 X 4] with rim = INR Rs.1,500.

• Cost of shock absorber= INR Rs.700

• Use of three shock absorber= 700 x 3=Rs.2,100

• Over all customization of central hub and welding = (approx.) =Rs.1,000 [max]

• Total cost of the making the wheel=INR Rs.4,600

10. Future Scope

The design goal of such wheels is to ensure the comfort of the overall build of the cycle. This paper confirms the credibility of the shock-absorber in the wheel instead of spokes. But in the future, such a design would be improved by utilising more than three shock-absorbers and expanding its applications towards the wheels of motorbikes and other two-wheelers.

11. Conclusion

The design of wheels with shock-absorbers substituting the traditional spokes yielded positive results towards the comfort of cycling and advances of other elements, with very little or no drawbacks. Starting from the ease of cycling that comes with such a design, it also upgrades the shock absorption capabilities. It also removes the need for a shock-absorber for the frame or any other parts for the cycle. This type of wheel finds application in a situation where comfort is the absolute must, and one such area is the wheelchairs for old and sickly. And this paper goes a long way in showing just how effective the altered wheels are in the real world.

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