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Investigation of the Bike Wheel Rims With Modified loop Wheel Reinvents

M.E.Scholar Shweta R. Chandure
Dept. of Mechanical Engg.
Dr. Sau. Kamaltai Gawai Institute of Engineering and Technology
Darapur ,Amravati,India
shwetachandure94@gmail.com

Dr. S. M. Kherde
Dept. of Mechanical Engg.
Dr. Sau. Kamaltai Gawai Institute of Engineering and Technology
Darapur ,Amravati,India
sanjaykherde@gmail.com

***Abstract* – In today's world, Bicycles are the most favorite choice when it comes to causes like health, pollution, and environment. Several researches have been done in order to make the ride comfortable. Distinctive sorts of cycles have been produced for different applications like Commuter Bikes, Mountain Bike, and Racing bicycle. This undertaking report introduces the Loop wheel which is outlined to such an extent that the suspension framework is coordinated inside wheel for higher stun engrossing execution and better comfort. Loop wheels offer you a smoother ride. Circle wheel springs are generally comprised of a steel material precisely created to offer ideal pressure and horizontal soundness and quality and strength. The three circles in each wheel work along as a self-amending framework. This spring framework between the center point and the edge of the wheel gives suspension that constantly acclimates to uneven landscape padding the rider from anomalies in the street wheel. The spring design allows the torque to be exchanged easily between the center point and the edge. In this project report loop wheel manufactured using C20 steel material and the analysis is done on ANSYS Workbench R15 to determine the stress developed during forces acting on wheel, maximum deflection, principle stresses.**

***Keywords* – Loop wheel, integrated suspension system, Triangular hub, ANSYS R15. etc.**

I. INTRODUCTION

This project report presents a study of a In-Wheel suspension system which is placed inside a bicycle wheel. The In-wheel suspension system isolates the sprung mass from excitations similar to conventional suspension systems. In traditional suspension systems the isolation is provided by spacious and complicated mechanisms, and mainly in the vertical direction.

However, the in-wheel suspension system, not only fits the suspension mechanism inside the unused space between a wheel's rim and hub, but also allows for isolation both in vertical and horizontal directions. The main focus of this project report is to study, investigate, and show the feasibility of applying such suspension system to a vehicle. In this project report the Loop wheel which is designed such that the suspension system is integrated within wheel for higher shock-absorbing performance and better comfort. Loop wheels offer you a smoother ride.

Loop wheel springs are usually made up of a steel material carefully developed to offer optimum compression and lateral stability as well as strength and durability. The three loops in every wheel work along as a self-correcting system. This spring system between the hub and the rim of the wheel provides suspension that continuously adjusts to uneven terrain cushioning the rider from abnormalities in the road wheel. The spring configuration permits the torque to be transferred smoothly between the hub and the rim. Forces following up on wheel, greatest redirection, standard anxieties. Catchphrases Loop wheel, Integrated suspension framework, Triangular center, ANSYS R15. Presentation this undertaking report exhibits an investigation of an In-Wheel suspension framework which is set inside a bike wheel. The In-wheel suspension framework separates the sprung mass from excitations like regular suspension frameworks. and demonstrate its applicability.

The research begins with the static and dynamics modeling of an in-wheel suspension system. Dist – Amravati. The Static model evaluates the response of the suspension system and investigates the influence of various design parameters on the in-wheel suspension. The study is then continued to improve the design by replacing its rigid mechanism links with optimized compliant structures. This reduces the system's complexity and weight while boosting its performance.

II. LITERATURE REVIEW

Loop wheels: because sometimes it's good to reinvent the wheel -Loop wheels are a new type of

bicycle wheel that have been designed to make cycling more comfortable. Loop wheels feature This spring framework between the center and the edge of the wheel gives suspension that consistently acclimates to uneven landscape padding the rider from anomalies in the street wheel. The spring arrangement allows the torque to be exchanged easily between the center point and the edge.

Front and rear Loop-wheels have different spring rates. A front and rear loop-wheel can be used together as a set, or you can use a single loop-wheel alongside a conventional spoked wheel. Loop-wheels provide suspension on a bike which has none, or can be fitted in addition to suspension forks to give a smoother, more comfortable ride.

Urgent Operational Requirement Build your own loop wheel -The Loop wheels are a new concept wheel for a bicycle. The spokes of a conventional wheel have been replaced with carbon fibre loops which not only attach the outer rims to the centre hub, they also provide suspension. The result is maximum comfort over bumps and less vibration from the road. Replacing the spoked wheels with Loop wheels provides full suspension in a bike which hasn't got room for a traditional suspension system, but each Loop wheel weighs only about 300g more than its spoked equivalent. Unlike suspension forks, which only work in one plane, Loop-wheels provide tangential suspension. That is, they work in every direction.

So they respond to a force hit head-on in the same way as they do to a force from above or below. By using loop wheel bicycle rider gets comfortable ride because Tangential suspension. Pedaling is much smoother and not as jerky, because the springs release energy more evenly. This makes for a very comfortable, easy ride.

Mono Composite Leaf Spring For Light Weight Vehicle Design, End Joint Analysis And Testing" By Gulur Siddaramanna,Shiva Shankar, Sambagam Vijayarangan-Author says, A single leaf with variable thickness and width for constant cross sectional area of unidirectional glass fiber reinforced plastic (GFRP) with similar mechanical and geometrical properties to the multi leaf spring was designed, fabricated (hand-layup technique) and tested. Computer algorithm using C-language has been used for the design of constant cross-section leaf spring.

The results showed that a spring width decreases hyperbolically and thickness increases linearly from the spring eyes towards the axle seat. The finite element results using ANSYS software showing stresses and deflections were verified with analytical and experimental results. Compared to the steel spring, the composite spring has stresses that are much lower, the natural frequency is higher and the spring weight is nearly 85 % lower with bonded end joint and with complete eye unit.

III.DENTIFIED GAPS IN THE LITERATURE

After referring available reference material, it is found that researcher do the work with composite material for making loop, in order to reduce the weight of Bicycle. For cost effective manner here decide to do the experimentation with large diameter wheel the change in material i.e. C20. One research paper found with C20 material but experimentation is done for smaller wheel diameter. Hence scope for Loop suspension system for large diameter wheel with material as C20.

IV.CONCEPTS OF IN WHEEL LOOP

The spring system between the hub and the rim of the wheel provides suspension that constantly adjusts to uneven terrain – cushioning the rider from bumps and potholes in the road. In effect, the hub floats within the rim, adjusting constantly as shocks from an uneven road hit the rim of the wheel. The spring configuration allows the torque to be transferred smoothly between the hub and the rim. We have developed loop wheels with consideration that the weight of the rider and cycle body to be equally distributed over the wheels of the bicycle. Every loop wheel is designed for same compression rate.

Fig.1 working of loop wheel.

Although the origin of the wheel may be obscure, its invention as a load carrying device marked the advent of machinery. Today the wheel is an essential part of most machines in the form of gears, pulleys, cams, sprockets, bearings, and other rotating devices. However, it is still most conspicuous as a load carrier; and, from a technical perspective, the bicycle wheel stands out as one of the most elegant of these. The wire-spoked bicycle wheel was introduced more than a century ago to replace wooden wheels with thick, rigid spokes.

Tensioning the wires made these wheels possible, and with them came the lightweight bicycle that we know today. Wire spokes not only reduced weight but also improved durability. Today's wire wheels can carry more than a hundred times their own weight. In off-road bicycling, skilled riders often jump from high

obstacles, subjecting their wheels to forces of more than a quarter ton. Although the bicycle is the world's most common vehicle, few people understand how its wheels achieve their unusual strength. Constant and better comfort throughout can be achieved by making certain simple necessary changes in the regular design of the front wheel suspension system. The significant change is introduction of a tangential suspension system in the wheel itself. This ensures that it absorbs shocks from all the directions.

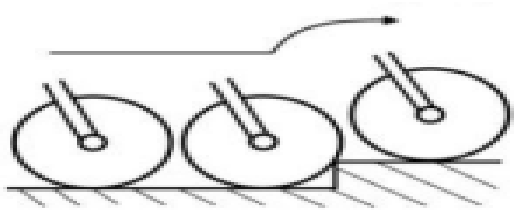

Fig.2 Normal wheel Design.

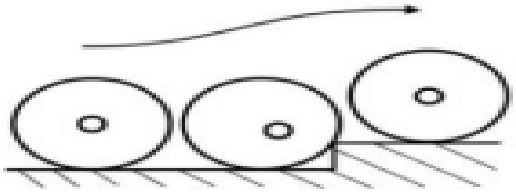

Fig.3 Modified Wheel.

All the shocks, coming in travel through the center that is the hub. In regular design the hub is fixed with rigid spokes joining it to the rim and hence, practically takes no part in providing suspension. Here, understanding the importance of hub, it has been given the ability to move and recoil back to its original position. This skimming center can move not by laying on settled spokes of that of a general bike. Here, the settled spokes of the bike is supplanted with spring like material that has damping capacity.

It is realized that a leaf spring is a straightforward type of spring usually utilized for the suspension in wheeled vehicles. A spring made of various portions of metal bended somewhat upwards and clasped together one over the other. Here instead of clamping the springs to gether, they are used individually.

V. METHODOLOGY AND MATERIALS

The main target was to achieve the desired deflections in the suspension for a particular weight of driver. Considering the application C20 material is selected for loop.The thickness of the circle is controlled by accepting it to be a cantilever shaft and outlining it for bowing disappointment and the plan was then investigated in Ansys programming.

The firmness of the circle can be changed by basically moving the mounting places of the circle in the driver's seat's center point end. By changing the effective length of the loop we can change the stiffness and hence control the hub travel.

The wheel was designed considering the impact forces coming from the ground and lateral forces while cornering. By checking the stresses and nature of deformation for 3 loops only. Using more number of loop will lead to unnecessary increase in weight. The analysis was done on Ansys v15.0 software to check the stresses and deformation in the system. A custom hub is designed to accommodate the entire loop with the help of nut and bolts.

VI.DESIGN AND CAD MODELING

1. Design

Dimension of cross section of the leaf is to be determined. The width of the leaf material was kept as 35mm as it cannot be more than the width of the wheel.
Considering front impact case, using impulse momentum theorem,
F X t = m X v
Time of impact, t=0.5 sec
Mass of cycle including rider, m= 100 kg
Max. Velocity, v = 30 kmph = 8.3 m/s
For 100 kg, F= 981N
For determining the thickness of the Leaf, let us consider it as a cantilevered
Major axis loop (L) =300mm (12inch)
Minor axis loop (h) =195mm (7.8inch)
Width of spring (b) =25mm (1inch)
E=200 mpa

2. Calculation of maximum principle stress

$V\sigma max = 3FL/2nbt^2$ $560=3*981*300/2*1*31.25* t^2$
t=5.0 mm
For 100 kg weight 5.0 mm thickness of the leaf is required
m=100 kg
v=30kmph=8. 3m/s
F=981N
Bending stress
$^{\delta}b = 1.5WL/bt2$
$=1.5*981*300/31.25*(5.0)^2$
$=565.05N/mm^2$
Thickness of spring t = 5 mm

3. Calculation of maximum principal stress

$\sigma max = 3FL/2nbt^2 = 3*370.22*300/2*1*25.4*5^2$
$= 262.36 N/mm^2 < 560 N/mm^2$

4. Calculation of maximum deflection

$\Delta max = 3FL3/8nbt^3 = 3*370.22*3003/8*1*25.4*5^3$
= 5.90 mm.
Above computations were finished considering half segment of spring consequently add up to abandonment would be, ?max = 5.90*2 = 11.80 mm. Henceforth plan safe.

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5.Cad Modeling - Here for CAD displaying reason utilizes a PTC Creo Parametric CAD Software. It is an intense, coordinated group of item outline programming. The manner in which Creo works is that it is comprised of individual applications, including- Creo Parametric, Creo Simulate, Creo Direct, Creo Layout, Creo Options Modeler Each Creo app serves a different purpose in the product development process. This means that Creo takes you through every stage, including concept design work, design and analysis. Here are some different screen shots of different parts developed in CAD Software for modeling purpose which is future help for analysis. Figure shows details for making of model in Creo Software.

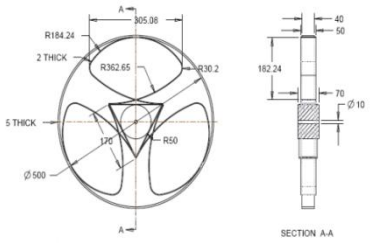

Fig. 4 CAD Drawing of Loop-Wheel.

Fig.5 PTC Cero CAD Model of Loop-Wheel.

VII .RESULT AND DISCUSSION

Steady state structural analysis is performed to check the safety of the design. Using impulse momentum principle, force was calculated when the cycle hits a rigid wall with a velocity of 30kmph. The resultant Equivalent Stress (MPa) and Total Deformation as shown in table. The force obtained was 981 N. i.e. 100 Kg.,

Table1 Result of Deformation and Stress developed.

	Total deformation (mm)	Equivalent Stress (MPa)
Minimum	15.283	0.00039682
Maximum	19.21	31.761

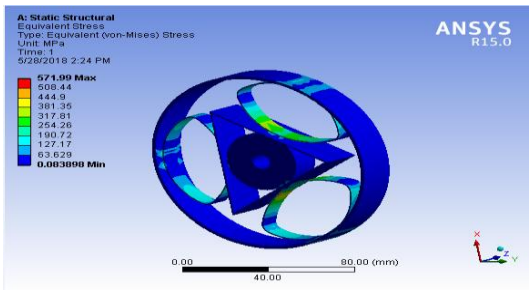

Fig.6Ansys Result of Stress Development.

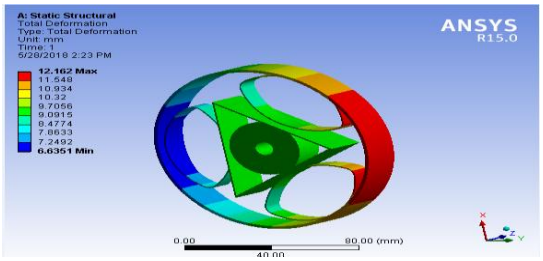

Fig.7Ansys Result showing Deformation.

VIII.CONCLUSIONS

Bicycle with loop wheel suspension system provides smoother ride, high shock absorption capacity, avoids the necessity of additional suspension system. Also this loop wheels can find their applications in wheel chairs, mountain bikes because of their capacity to adjust to uneven terrain, cushioning the rider from abnormalities in the road. Analysis on deformation has been done which shows that the calculated and the values obtained using ANSYS are in accordance with each other which suggest that the design is safe. In loop design, the stresses developed in loop spring under the safe limit of material stress limit and hence the design is accepted but the layout of spokes in conventional wheel enables proper stress distribution than loop spring.

The main problem in the loop design was the high expected deflection occurring due to lateral forces. However from analysis, we can clearly see that the deformation of loop is 5.90 mm in one side and by considering side it is 11.8 mm,Hence the issue is agreeably settled. The circle or the spoke being the weakest part, even after disappointment of circle, the substitution of the segment is basic and more affordable because of adaptability in outline. The disadvantage of the circle configuration regarding pressure and twisting against the traditional wheel configuration is adjusted on account of its capacity to ingest stuns from any heading.

IX. SCOPE FOR FUTURE WORK

Going back to the loop wheels problem of how best to make the springs and thinking that carbon composites were going to be the answer, I took inspiration from my immediate environment. One idea that carbon composite archery bows probably went through similar kinds of stresses as the springs in wheels. So let's try out for other designs like archery bow with carbon composites, no matter it is costly than steel but it is better effective than steel because of its material properties and simple of manufacture. A spring framework between the center point and the edge of the wheel pads the rider from knocks and potholes in the street.Since the suspension framework is situated inside

REFERENCES

[1]. Gulur Siddaramanna, Shiva Shankar, Sambagam Vijayarangan, "Mono Composite Leaf Spring for Light Weight Vehicle – Design, End Joint Analysis and Testing", MATERIALS SCIENCE. ISSN 1392– 1320,Vol. 12, Issue No.3. 2006, PP 220- 25.

[2]. Pankaj Saini, Ashish Goel, Dushyant Kumar, "Design and Analysis of Composite Leaf Spring for Light Vehicles", International Journal of Innovative Research in Science, Engineering and Technology, ISSN: 2319-8753, Vol. 2, Issue 5, May 2013, PP 1-10.

[3]. Baviskar A. C., Bhamre V. G. and Sarode S. S., "Design and Analysis of a Leaf Spring for automobile suspension system-A Review", International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 3, Issue 6, June 2013, PP 406-410.

[4]. Mr. Tharigonda Niranjan Babu, Mr P. Bhaskar and Mr. S. Moulali, "Design and Analysis of Leaf Spring with Composite materials", International journal of engineering sciences& research technology, ISSN: 2277-9655, 3(8): August, 2014, PP 759-756.

[5]. A Text Book of Mechanical System Design, Farazdak Haideri, Third Edition, Chapter 2, Page No. 149 – 241.

[6]. Strength of Materials, S. Ramamrutham, R. Narayanan, Dhanpat Rai Publication Company, Page No. 116-118.

[7]. Amitabha Ghosh, Ashok Kumar Malik, Theory of Mechanism and Machines, third Edition, Affiliated press, Pvt. Ltd, New Delhi 1998.

[8]. An advertising poster "Urgent Operational Requirement: Build your own loop wheel"

[9]. Info@Loop-wheels.com, A advertising poster, "Loop-wheels : because sometimes it's good to reinvent the wheel".