NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal
ISSN No: 2581 - 4230
VOLUME 6, ISSUE 4, Apr. -2020

DESIGN AND MANUFACTURING OF LOOP WHEEL WITH DAMPER

KIRAN VISHNU GAIKWAD
Student, Department of Mechanical Engineering, Dr. D.Y. Patil College of Engineering and Innovation, Varale, Pune, M.S.,India

PRAVIN GOPINATH LALE
Student, Department of Mechanical Engineering, Dr. D.Y. Patil College of Engineering and Innovation, Varale, Pune, M.S.,India

KESHAV HANUMANT MUNGADE
Student, Department of Mechanical Engineering, Dr. D.Y. Patil College of Engineering and Innovation, Varale, Pune, M.S., India

SHUBHAM LAXMAN JADHAV
Student, Department of Mechanical Engineering, Dr. D.Y. Patil College of Engineering and Innovation, Varale, Pune, M.S., India

PROF. S.P.NEHARKAR
Department of Mechanical Engineering, Dr. D.Y. Patil College of Engineering and Innovation, Varale, Pune, M.S., India

ABSTRACT:

Polluted air is one of the major environmental problems in India. Around 20% of total air pollution is from vehicles. The polluted air is very hazardous to human health and it is observed that all the metropolitans are facing severe consequences of polluted air. To reduce pollution created due to two wheelers, many countries are supporting the use of bicycles. It will not only reduce pollution but also helpful to keep human healthy. Problem associated with conventional bicycles is poor suspension and uncomfortable seating arrangement hence it is avoided to use over long distances. Authors have designed a wheel for bicycles with inbuilt suspension. CAD design of a wheel with hardware structure development is presented by authors in this paper. It is suggested to use the wheel for improvement in suspension for better ride experience.

KEYWORDS: Wheel, Loop Wheel, Damper, Suspension, bicycle wheel design, etc.

INTRODUCTION:

Number of two wheelers in India has increased exponentially over last decade. With increase in number of vehicles there are many effects such as traffic on road, air pollution, loss of fuel, loss to the economy. The pollution has become very severe issue and it needs to be improved in coming time as most of Indian cities are facing severe problem of air pollution. Around 20% of total air pollution is coming from automobile in India. The health consciousness has increased in people now a day and many people are motivated to use bicycles.

The suspension is one of the major issues with vehicles. If a suspension is good then vehicles can be used by customers for longer distances. Bicycles are very important from point of view of health improvement and controlling the pollution. The cost of fuel in India is depended on several international market issues as we are dependent on other countries for fuel. About 55% of petrol in India is consumed by two wheelers and hence there is scope for improving this situation. Authors have proposed the improvements in conventional structure of wheel. The suspension is enhanced to improve ride experience. CAD design and calculations for hardware developed are presented in this paper in detail. Regular cycles do not have any suspension system and has less capacity bear the load. This situation is improved by authors through design.

To prepare the hardware mild steel with 0.15 to 0.35 % carbon is used.

OBJECTIVES OF WORK:

Objectives were decided as follows for the work carried out:

- Designing better shock absorbing system for bicycles.
- Enhancing riding experience of bicycle users.
- Developing software and hardware working module for wheel.

SYSTEM DESIGN:

Total mass of rider= 60kg
Total mass of bicycle= 10kg
Total mass of system= 70kg
Total vertical force= 700N
As this force is acting on both the tires for each wheel the value of force=350 N
Now this is the maximum value of force against which we have to design the dampers and loop wheels.

1.Damper Design:

The standard diameter of the wheel= 622mm
Now cylinder used have specifications=25*50
So pressure acting on the cylinder walls=F/A

P=350/[3.14*4(25)2]
=0.713 N/mm2

As the induced pressure value is much less than the Syt of the material our design is safe. So we can go for the cylinder with 25*50 specifications.

2.Loop Design:

Here we are selecting M.S. material for loop, with 5 mm thickness. So we have to design the system against bending stresses by considering the positive bending.
By using the flexural formula for pure bending,

M/I=σ/Y=E/R

I=Moment of inertia
Y=Position of neutral axis
σ=Stress induced
E=Modulus of elasticity
R=Radius of curvature
M=Maximum moment value.
As we know the cross section value of M.S. material strip, we are using for loop.
b= 50 mm
d=5 mm
Moment of inertia(Ixx)=bd^3/12=(50)*(5)^3/12=520.83 mm^4
Position of neutral axis(Y)=d/2=2.5 mm
From the above diagram the maximum value of moment=30.625 N-m

σ=(M*Y)/(I)

=30.625*2.5/520.83
σ=147 N/mm2

Now for maximum Y=d=5 mm

$\Sigma_{Max}=(M*Y_{Max})/(I)$
Σ_{Max}=294 N/mm2

As the Sut of M.S. is lies between 400 to 450 N/mm2 our design is safe.

3. Maximum Deflection:

L=300= major axis of the loop spring.

ϱ_{max}=3FL^3/8Enbt^3

=3*370*(300)^3/8*210*10^3*1*50*(5)^3
ϱ_{max}=2.85 mm

This is the maximum value of deflection occurs when a person sits on the bicycle.

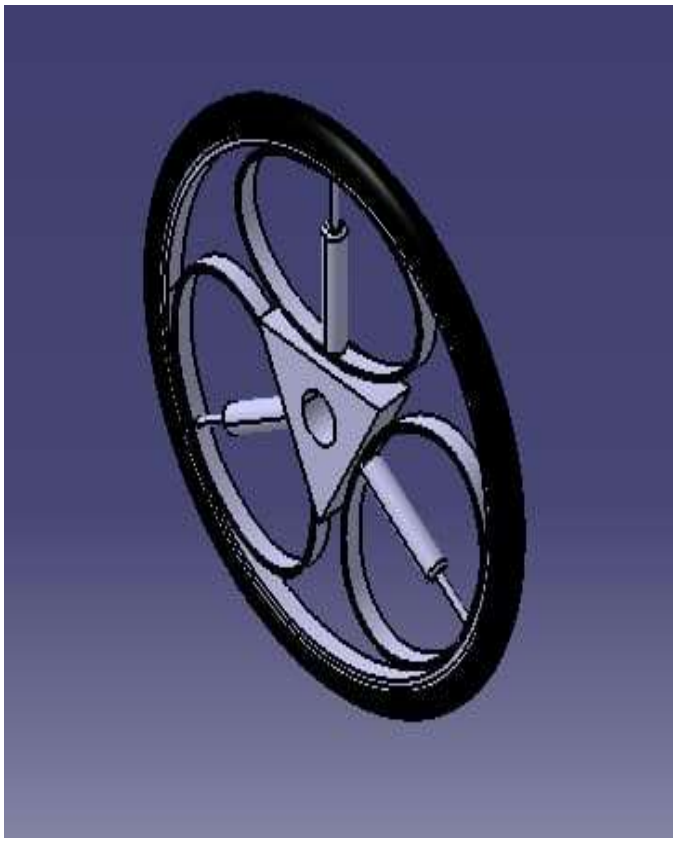

Fig.1: CAD Design for bicycle wheel

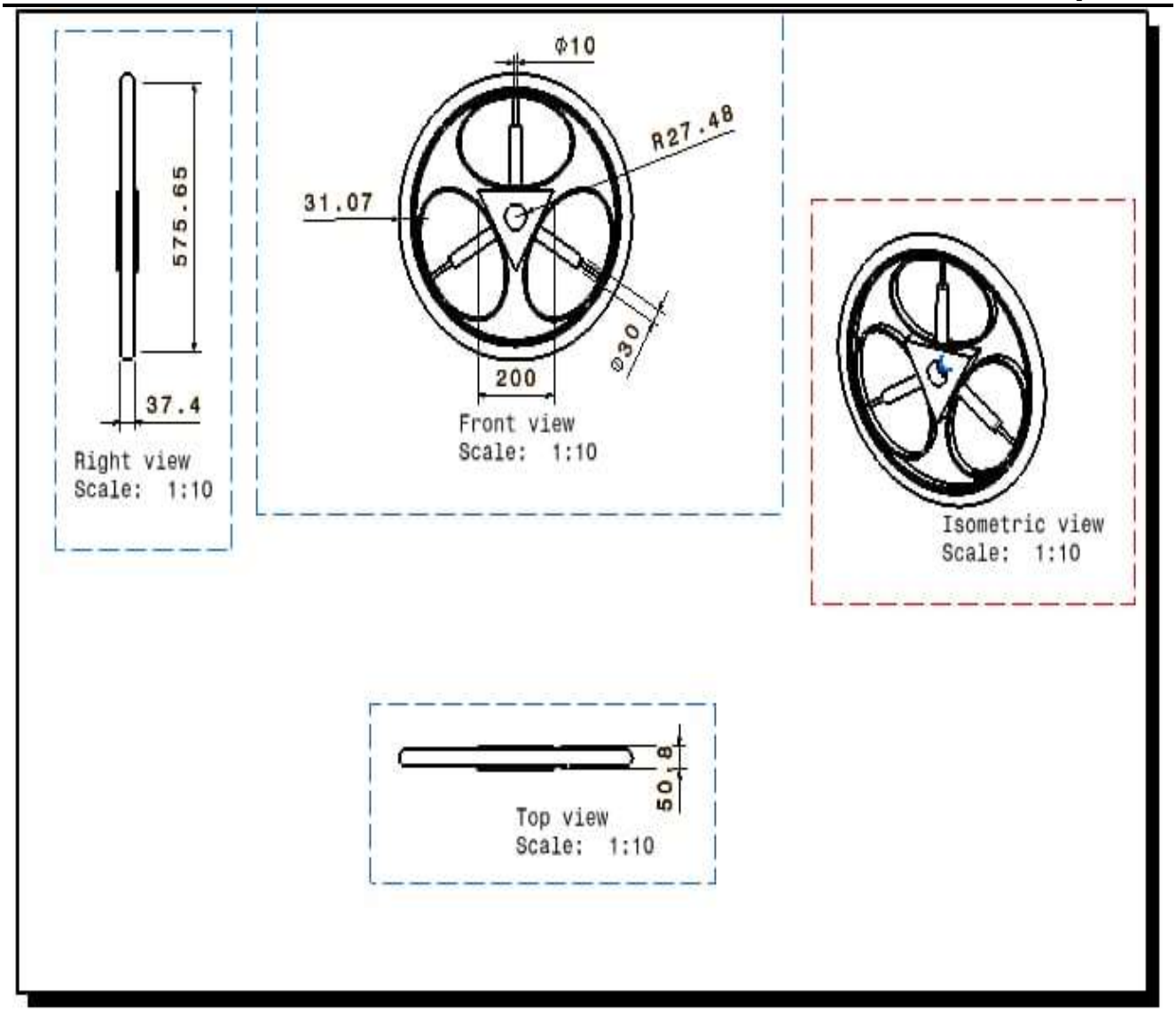

Fig.2: Different views of CAD Design for bicycle wheel

Fig.3: Hardware developed for bicycle wheel

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.

CONCLUSION:

Enhancement of shock absorbing system for bicycle will help in improvement for

daily bicycle users. It results in enhancement of pollution control initiatives. Authors have proposed unique design with suspension arrangement to improve shock absorption. The prototype is tested for load situations and various road types. The design parameters considered are found suitable as per standards and hence further manufacturing of this wheel is possible. Loop wheel are designed to help you push over uneven streets, cobbles, grass, rough tracks and gravel paths with less effort. The composite rubber strips give you extra power to get up or down kerb. These wheels are useful for Handicap's wheel chairs and the mountain bike for the smooth ride.

REFERENCES:

1) Chongxuan, Kang, Wang Bo, and Zhu Shixing. "Design and Experiment of Magnetorheological shimmy damper controller based on deep neural network." (2018): 156-6.
2) Stabile, Alessandro, et al. "Design and verification of a negative resistance electromagnetic shunt damper for spacecraft micro-vibration." *Journal of Sound and Vibration* 386 (2017): 38-49.
3) Snoun, Cherif, and Moez Trigui. "Design parameters optimization of a particles impact damper." *International Journal on Interactive Design and Manufacturing (IJIDeM)* 12.4 (2018): 1283-1297.
4) Chen, Bingsan, Dicheng Huang, and Chunyu Li. "Design and modeling for 2D plate type MR damper." *Frontiers in Materials* 6 (2019): 28.
5) Khot, S. M., and Amey Pramod Marathe. "Design and Analysis of Magneto-Rheological (MR) Damper." *2019 International Conference on Nascent Technologies in Engineering (ICNTE)*. IEEE, 2019.
6) Jeon, Seokcheon, et al. "Comparison of Dynamic Models of Mr Damper for Hardware in the Loop Simulation of Large-Sized Buses." *International Journal of Automotive Technology* 19.4 (2018): 677-685.
7) Eshkabilov, Sulaymon, Hamdam Jumaniyazov, and Davron Riskaliev. "Simulation and Analysis of Passive vs. Magneto-Rheological Suspension and Seat Dampers." *Design, Simulation, Manufacturing: The Innovation Exchange*. Springer, Cham, 2018.
8) Oh, Jong-Seok, et al. "Vibration control of a semi-active railway vehicle suspension with magneto-rheological dampers." *Advances in Mechanical Engineering* 8.4 (2016): 1687814016643638.
9) Chen, Jiangtao, and Rui Liu. "Damping Computation of Nose Wheel Steering Shimmy of Aircraft." *2016 6th International Conference on Machinery, Materials, Environment, Biotechnology and Computer*. Atlantis Press, 2016.
10) Sassi, Sadok, and Khaled Cherif. "Combination of homogeneous electro-rheological fluid and multi-electrodes damper for a better control of car suspension motion." *International Journal of Mechanical Systems Engineering* 2016 (2016).