Design of a Rocker Bogie with Spherical Wheel Insertion

Gautam Buragohain[1], Karan Borah[2], Rakesh Nath[3]

[1,2,3]*Mechanical Department, Girijananda Choudhury Institute of Management and Technology, Guwahati-781017, India*

***Abstract*– A rover is a vehicle for driving over rough terrain, especially one driven by remote control over extraterrestrial terrain. It uses a suspension system that has 6 wheel with provide great stability. We aim to introduce the mechanism of the rocker bogie or the rover as a suspension mechanism of normal vehicles. The idea is to replace the normal vehicle chassis with that of the rocker bogie followed by the use of spherical wheels. The following idea tends to encounter various problem that is faced by a normal chassis and also by a normal cylindrical wheel.**

***Keywords* - Rocker-bogie, Suspension, Spherical wheel, Omnidirectional movement.**

INTRODUCTION

Aditiya. V [1] mentioned, a rover is a vehicle for driving over rough terrain, especially one driven by remote control over extraterrestrial terrain. Robotic rovers are used extensively for exploratory and reconnaissance purposes in the fields of scientific exploration and defense. This project focuses on the design and development of a rover with autonomous driving and environmental sensing capability. It can be used as an exploratory rover, providing information about the terrain and surrounding atmosphere. It can also be used as a surveillance robot to alert people in areas with security threats like national borders, terrorist occupied territories etc., where it is difficult for humans to work. The rover will be having a Rocker Bogie Suspension system with 6 wheels for greater stability in maneuvering over obstacles.

Nitin Yadav et al. [2] mentioned that the place, where the value of gravity remain lower than earth's own gravitational coefficient, at that place the existing suspension system fails to fulfil desired results as the amount and mode of shock absorbing changes. To counter anti-gravity impact, NASA and Jet Propulsion Laboratory have jointly developed a suspension system called the rocker-bogie Suspension system. It is basically a suspension arrangement used in mechanical robotic vehicles used specifically for space exploration. The rocker-bogie suspension based rovers has been successfully introduced for the Mars Pathfinder and Mars Exploration Rover (MER) and Mars Science Laboratory (MSL) missions conducted by apex space exploration agencies throughout the world. The proposed suspension system is currently the most favored design for every space exploration company indulge in the business of space research. The motive of this research initiation is to understand mechanical design and its advantages of Rocker- bogie suspension system in order to find suitability to implement it in conventional loading vehicles to enhance their efficiency and also to cut down the maintenance related expenses of conventional suspension systems. The rover is tested over various terrains and its operation is found to be satisfactory. As expected, it evades unmountable obstacles and traverses over obstacles which are less than 1.5 times the size of its wheel diameter.

DESIGN PROSPECT

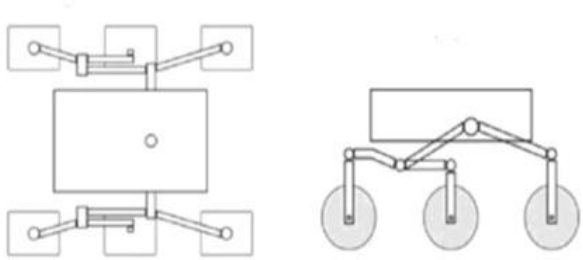

Fig. (i): Model of Rocker Bogie system.

The above figure has taken from the paper that was published by Aditiya. V [1], which show a simple schematic diagram of a Rocker Bogie system.

Nitin Yadav et al. [2] mentioned that, the rocker-bogie design consists of no springs and stub axles in each wheel which allows the chassis to climb over any obstacles, such as rocks, ditches, sand, etc. that are up to double the wheel's diameter in size while keeping all wheels on the ground maximum time. As compared to any suspension system, the tilt stability is limited by the height of the centre of gravity and the proposed system has the same. Systems employing springs tend to tip more easily as the loaded side yields during obstacle course. Dependent upon the centre of overall weight, any vehicle developed on the basis of Rocker bogie suspension can withstand a tilt of at least 50 degrees in any direction without overturning which is the biggest advantage for any heavy loading vehicle. The system is designed to be implemented in low speed working vehicles such as heavy trucks, Bulldozers so as to minimize dynamic shocks and consequential damage to the vehicle when surmounting sizable obstacles.

MODIFICATIONS

The concept of our work is to make use of the idea of rocker bogie system that is basically used in the mars rover for it to travel through unmanned terrain. We intend to fuse the

concept of the rocker bogie suspension system with spherical wheels. As per of idea, the wheel would be spherical which will be housed inside a housing having three arms which will have rollers that are free to rotate about its axis and changes its rotation with respect to the rotation of the spherical wheel as shown in fig. (ia).

Fig. (ia): Spherical wheel housed inside a casing

The spherical wheel will remain in contact with a roller which will be connected to a motor. The motor will drive the roller which will provide the power to the wheels and will make it rotate in a particular direction. The roller plays a necessary role in holding the wheel inside the housing. The motor connect to the rotor will be connected to a bevel gear system which is connected to another motor which will ultimately rotate the roller so as to move the wheel in the desired direction. The arrangement is shown in fig. (ii) and fig (iii).

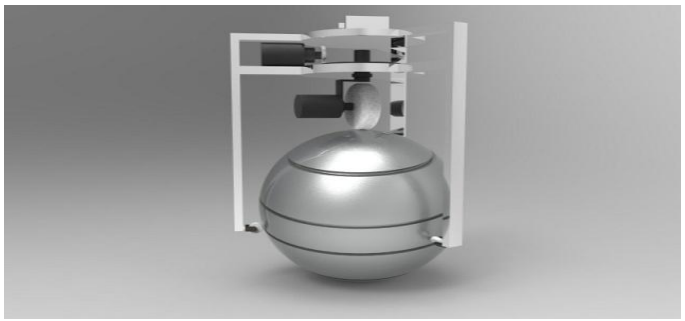

Fig. (ii): Arrangement of wheel, motor and gear

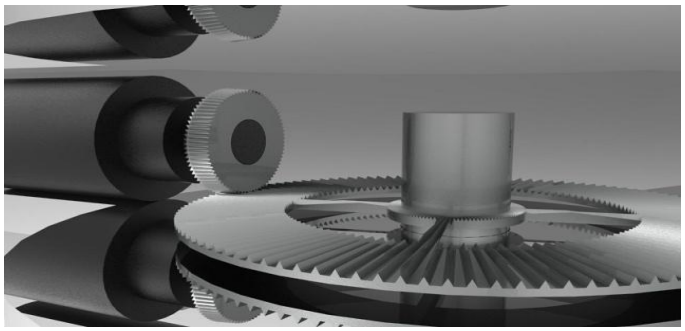

Fig. (iii): Bevel gear arrangement

The overall arrangement will be attached to the chassis of a rocker bogie in place of the normal cylindrical wheel as shown in the fig. (iv). just like the rocker bogie, it will have six wheels which will have individual powering units (motors).

Fig. (iv): Arrangement of the system with the chassis

CONCLUSION

Our idea is to replace the cylindrical wheel to spherical and introduce this system of suspension for normal vehicles. This suspension will reduce of slip as every tire will be in constant contact with the ground. The benefit of using the spherical wheel is that it will provide an omnidirectional movement which we cannot achieve with normal tires. There will be ease in steering the wheels up to 360˚. That is, it will be able to move sideways which will lead to easy parking of the car in places where parking becomes a challenge, where the gap between two vehicles is very less and is tough to get in between with the normal way of parking. And the chassis that is planned to be used is good for unmanned terrain. So it will hold a good suspension overall. Our project will be a prototype of how the system would work with the spherical wheels. We plan to use a high friction material for the wheels. So with proper selection of materials having high friction for the tires, this idea would turn out to be very effective and will deal with the normal problem faced by a normal vehicle.

REFERENCES

[1]. Aditya.V, “Unmanned Terrain with Rocker Bogie Suspension”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 3 Issue IX, September 2015 IC Value: 13.98 ISSN: 2321-9653

[2]. Nitin Yadav, BalRam Bhardwaj, Suresh Bhardwaj, “ Design analysis of Rocker Bogie Suspension System and Access the possibility to implement in Front Loading Vehicles”, Mechanical Department, DITMR College, MDU University, Rohtak, Haryana, India, 2Maclec Technical Project Lab. Pvt. Ltd. New Delhi, India.), IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 3 Ver. III (May. - Jun. 2015), PP 64-67 www.iosrjournals.org