IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Development Of Side Stand Retrieval System

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Abstract –

Two-wheelers are a very important part of our lives but also responsible for some minor and major accidents because most of the riders forget to stow the side stand to the riding position causing fatal accidents and injuries. About 40 percent of accidents happen due to the parked position of the side stand of the two-wheeler. According to research, there are 2300 two-wheeler accidents reported by over every million people in India. In which every 300 victims die at the site or during the medical proceeding. Forgetting to stow the side stand of the two-wheeler is one of the frequently done mistakes of the two-wheeler riders. These accidents can be prevented by using an automatic side stand retrieval system in two-wheelers. In this, a simple rack and pinion assembly is used to stow the stand when the rider starts the vehicle. The system will monitor the angle of the vehicle from the vertical axis and engine RPM with the help of a gyroscope and a photoelectric sensor. When the angle of vehicle is less than 15 degrees and the engine exceeds 1600 RPM the motor will receive power and the stand will be pushed to its riding position. The design and analysis of rack and pinion is done in Solidworks and Ansys workbench respectively. For manufacturing of rack and pinion and casing EN24 and Aluminum 6061 is used respectively and also achieved FOS of 1.5 for fatigue life cycle of 10^6 hrs. By using this method the rider will never have to worry about the stand ,and this will make sure the safe ride.

KeyWords: Two-wheeler, Side-stand, Stove, Rack & Pinion, Interlocking, Reminder device, Clutch, Engine, Fatigue, Spring, Gyroscope

1. INTRODUCTION

In the present developed world, two-wheelers are a very important part of our lives. It is very economical in comparison to cars. We all know, side stand in any two- wheeler is very important for instant parking. But, if the side stand is not used properly it may cause serious injuries and may also cause the death of the rider. In a developing country like India, accident rates have increased by a huge number. So, it is necessary to prevent such accidents by using some technological measures. The current technology of the side stand is manual, where the riders have to stow the stand by their foot before riding the bike. Though the riders most frequently forget to stow the side stand. To avoid this mistake, an automatic side stand retrieval system is introduced in this paper. The system is an attachment to the

existing stand, which uses a rack and pinion assembly to stow the stand. This system will be operated by a DC motor which will take power from the battery of the vehicle. The system is small, light-weight, cost-effective, and also compatible with all types of two-wheelers (bikes and scooters).

Automatic side stands retrieval system uses very few components which makes it cheap to manufacture. And since rack and pinion are used, the durability of the system is also assured. This system will activate upon switching the bike on.

These devices utilize the ground friction force to retract the stand at the very beginning of motion. The BMW patented the design (Gunther Baron – "Side stand for a Motorcycle," UK patent application GB 2079698A, filed May 1981, by BMW). A Side stand for a motorcycle comprising a member. A free end of the side stand member can move upwardly, whilst in the parking position, relative to the motorcycle also against spring force over a limited angular extent. The side stand member makes contact with the ground when that member is at the lower extreme of the said angular extent with the motorcycle upright the side stand member is retracted automatically when the motorcycle starts.

These all systems are either been used in very expensive vehicles, cause discomfort to the rider, or are not efficient enough for every vehicle.

2. COMPONENTS

An automatic side stand retrieval system is designed with the thought of a system that should be effective and cheap at the same time. Hence very basic components are used for its construction. The components used are:

- Photoelectric sensor
- Gyroscope sensor
- Microcontroller
- Voltage regulator
- Relay
- DC motor

- Rack and pinion assembly
- Feedback Switches
- Battery (Vehicles already have)

The system is designed such that it takes engine rpm and vehicle angle as input signals. The controller controls the motor with the help of relays, which displace the rack connected to the side stand.

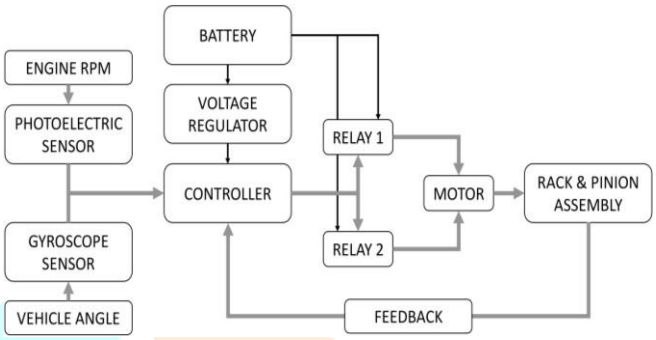

Fig -1: Block Diagram of the automatic side stand retrievalsystem.

Design

The design consists of an assembly consisting of a dc motorand rack & pinion assembly. Here, the motor has to overcome the spring force of the side stand, therefore it is required a geared dc motor.

Firstly, the spring constant of springs used in different two-wheelers was measured by Hooke's Law. For every spring the spring constant was in the range of 24.0 N/mm. From here the torque required to stow the side stand was calculated.

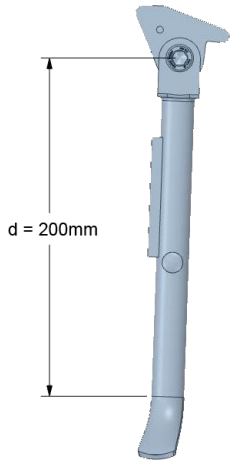

Fig -2: Side stand of a motorbike.

Let,

T = torque required to stow the side stand, Ps = force required to stow the side stand,

d = distance at which force is applied from the pivot point. δ = deflection in the spring

From test

Ps = 80 N

d = 200 mm (0.2 m) So,

$$T = P_s \times d$$

$$T = 80 \times 0.2 \quad \text{----------(i)}$$

$$T = 16\ Nm$$

Secondly, the motor is selected such that it can provide the necessary force on the stand to stow it back at the riding position.

Fig – 3 DC motor (12V)

Thereafter, rack and pinion assembly is designed in Solidworks which will convert the rotatory motion of the motor to translatory and will push the stand.

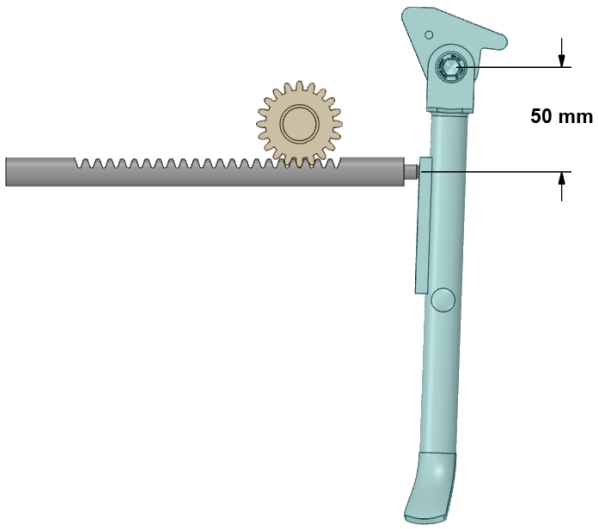

Figure 4. Design of Rack & Pinion.

Since very small space is available near the side stand. The rack assembly is mounted at a distance of 50mm from the frame of the vehicle. Rack & Pinion assembly is housed in its casing which is manufactured from an aluminum block. The motor will be mounted on a steel plate which will also have rack and pinion assembly on it. The mounting plate will be welded onto the frame of the vehicle.

Finite Element Analysis

Finite element analysis is performed for both rack and pinion for ensuring the life of the automatic side stand retrieval system. Transient structural analysis was performed in Ansys Workbench. A satisfactory factor of safety of 1.5 is achieved for both rack and pinion with EN24 material. The design was also verified using transient structural analysis of the complete assembly of the automatic side stand system.

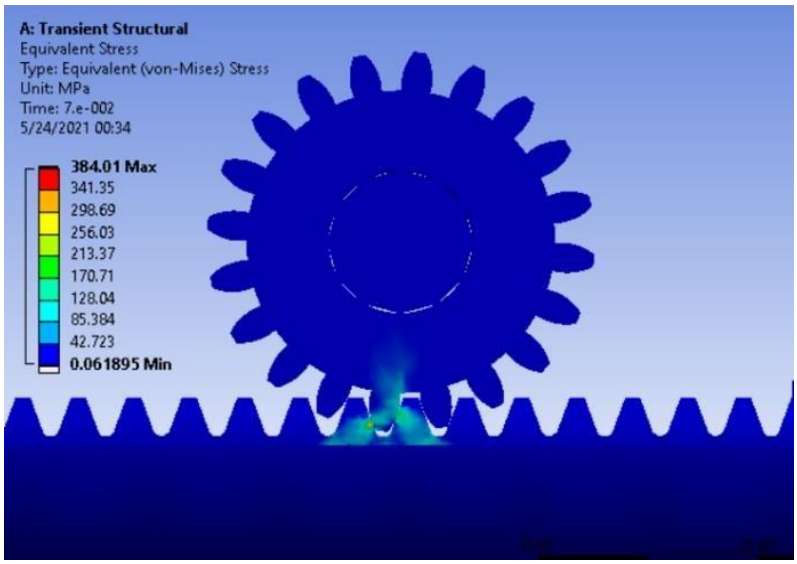

Fig -9: FEA of Rack and Pinion

WORKING

When the rider starts the vehicle, he must increase the engine rpm above the idling rpm at the same time he will also make the vehicle vertical with respect to the ground. Therefore the automatic side stand retrieval system will useboth as input. The gyroscope sensor and photoelectric sensor will measure the angle of the vehicle with respect tothe ground and engine rpm respectively. The signals will besent to the microcontroller. When the vehicle will have an angle (□) less than 15º and engine rpm more than the idlingrpm, in this condition only the motor will receive power and the stand will be pushed to its riding position. Hence the system will ensure that the stand will not stow when the vehicle is in a parked position. Which will reduce any kind of injuries during parking.

After pushing the side stand to the riding position the rack will hit a feedback switch which will trigger the relay and reverse the direction of rotation of the motor. Hence, whenthe rider will park the vehicle again the side stand will worknormally, without any hindrance.

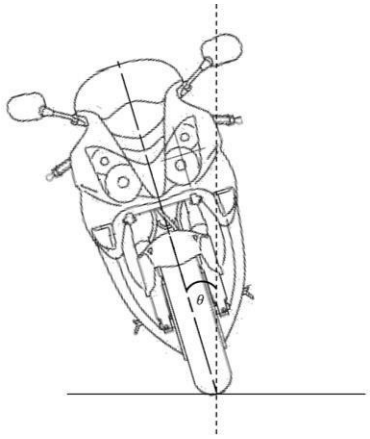

Fig -10: Bike Inclination with vertical axis.

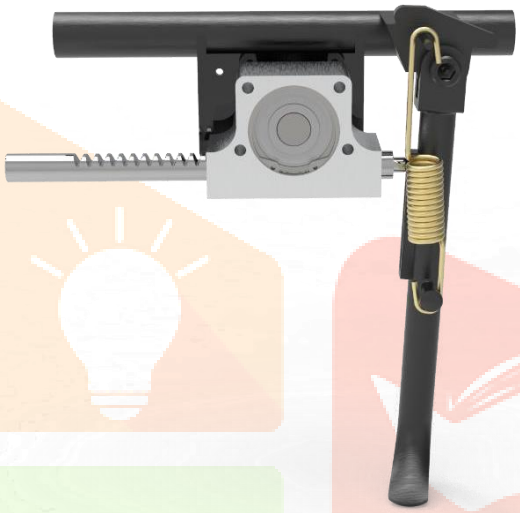

Fig -11: Automatic side stand at parked position.

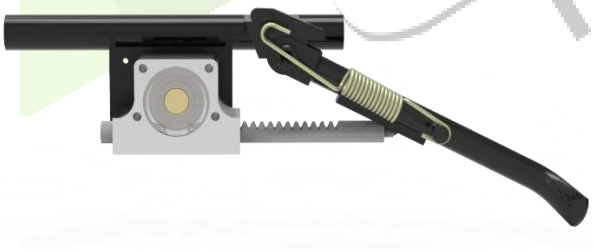

Fig -12: Automatic system pushing the side stand.

3. Result

The torque generated at the stand is 18Nm which is greaterthan the required torque. Hence the stand will stow automatically. Use of EN24 for rack and pinion will increasethe fatigue life to 10^6 hrs. By using this method the rider will never have to worry about the stand ,and this will make sure the safe ride.

4. Conclusion

The automatic side stand retrieval mechanism successfullystows the side stand every time with low power consumption. This will reduce the chance of accidents due tothe parked position of the side stand. This will reduce the effort and also eliminate the forgetfulness of the rider to stow the side stand. Since the automatic side stand retrieval system is very compact and all the electronic components can also be accommodated in the vehicle. It will make the two-wheeler rides far more safe than vehicles with previousgeneration side stand technology. The automatic side standis designed such that it is compatible with the present side stand assembly.

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