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DESIGN OF MOTORCYCLE DOUBLE STAND

Hem Pathak[1]

[1]*Student, Mechanical engineering, Vadodara institute of engineering, Gujarat, India*

Abstract - *The current methods of lifting and supporting sport bikes for home maintenance or storage are limited in options. There are very limited options available for a single stand supporting an entire sport bike on its own. Current double stand requires more strength, causes instability and unstable movement of motorcycle after applying center stand. The reason for this design project was to design a stand for sport bikes this is versatile enough to work on the majority of sport bikes with little modification to the stand by mounting stand frame on wheel rim of motorcycle with rollers, and no modification to the bike. The key feature that were focused on were ease of use with less efforts, many riders find current models hard to maneuver and at times dangerous to operate as The average weight of a sport bike is around 200 to 260 Kg making safety another major focus.*

***Key Words*: Swing arm frame, Rollers, paddle, bearing, Spiral spring.**

1. INTRODUCTION

All two wheeled vehicles when not being driven by a rider are parked using a stand. There are two types of stands commonly used to park a two wheeler. One of these stands is a side stand, provided generally between the wheel centers. To park a two wheeler using a side stand, the leg unit of the stand has to be swiveled to an open position and the vehicle tilted to one side to achieve a parked stationary position.

The other type of stand is a center stand provided between the two wheels or at the rear axle of the wheel. The center stand of a two wheeler keeps the vehicles while parked, in plane normal to the ground level as compared to a slightly tilted position achieved while using a side stand. Both these stands are provided with stoppers to limit the movement of the stand with reference to the vehicle frame.
To use either of these stands a rider has to get off the vehicle, balance the vehicle by holding the handle bar or the body of the vehicle and use his/her foot to push the stand to an open position. Once the center stand has been released from its folded position, the rider has to position one of his/her foot on the side edge of the lower most portion of the stand, to prevent backward sliding of the vehicle, and pull the vehicle towards the rear. This produces a relative movement of the vehicle with reference to the hinged pin of the center stand and the stand comes to a rest against the stopper. The rider has to maintain the balance of the vehicle from the time he/she gets off from the vehicle till the time the stand comes to rest against its stopper as otherwise the vehicle could have fallen to its side on the ground.

Balancing a two wheeler, while standing with both feet on one side of the vehicle is not very easy. Engaging a center stand of a heavy two wheeler, while maintaining proper balance of the vehicle, is beyond the skill level of most of the elderly and female riders.

1.1 Problem Identification

On surveying, it was found that around 72% males and 28% females drive scooters. Among those 72% males, around 20% are oldies and remaining are adults. Mostly females and old people find it difficult to apply centre stand and hence this made us develop and modify the new design of centre stand.

Applying a centre stand manually;
1. Requires more effort for application.
2. May cause back and/or leg injuries.
3. centre stand cannot be used on uneven surfaces.

Applying a side stand;
1. Develops fatigue in stand.
2. Increases chances of accident.
3. Requires more parking space.
4. Reduces battery life since the electrolyte is in constant touch with electrode.

Due to above described problems, centre stand is hardly used

1.2 Design concept of double stand

It comprises of 1) Swing arm frame 2) Ball bearing 3) Paddle 4) Roller wheels. 5) Spiral spring. A swing arm frame is mounted at rear tyre end at the centre bore of wheel through swing arm centre rod. Centre rod connects two swing arm frame on both sides of wheel providing stability to the vehicle, Set of roller wheels are pinned to a swing arm frame having a paddle attached at one end of swing arm frame. Swing arm frame is supported by a ball bearing at the centre bore of wheel rim. A torsion spring is attached with its one end attached to centre rod and other to swing arm frame. Torsion spring is used to regain the original position of swing arm frame after application of double stand by the operator.

2. SPECIFICATIONS OF COMPONENTS

1) Swing arm frame

It is a steel frame consisting of a centre rod having two swing arms to be fixed at centre bore of a wheel

through a roller bearing. Set of paddles are provided along with frame in order to provide motion with legs.

Fig-1: 3D model of swing arm frame

2) Ball bearing

The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls content here. Material – chrome steel.

Table -1: Design specification of ball bearing

Type	Arrangement	Angular contact
Double row roller bearing	DB	30°

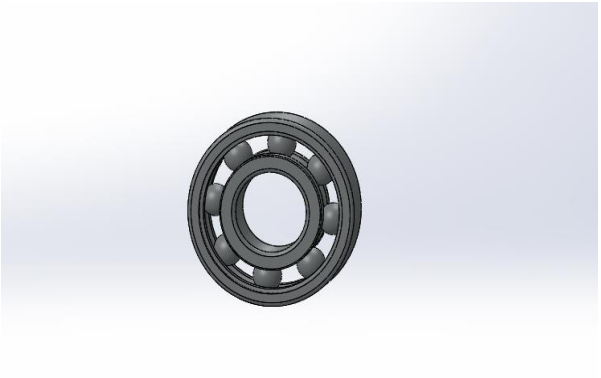

Fig -2: 3D model of ball bearing

Table -2: Specification of ball bearing

Boundary dimensions		
Bore diameter	Outer ring diameter	Width of bearing
20mm	47mm	14mm

3) Paddle

It provides convenience way for the operator to drop down the swing arms against the spring force with the help of legs efforts.

4) Roller wheel[5]

Set of roller wheels is pinned to swing arms in order to reduce the friction between ground surface and vehicle's tire when stand is operated. It reduces the efforts required by the operator due rolling action of wheels and point contact between ground surface and roller wheels.

Table -3: Specification of roller wheels

Wheel diameter	Wheel composition	Bearing type	Load capacity
4"(101.6)	Phenolic	Roller	600

5) Torsion spring[6][7]

Table -4: Design specification

Specifications	**Inch**	**mm**
Thickness of spring strip	0.0393	1
Width of spring strip	0.393	10
Angular Deflection in rev	160	160
Arbor diameter	0.7874	20
Loading of spring	4.5	508

Fig -3: 3D model of spiral spring

Basic relations for spring calculation

$$k = \frac{\pi \cdot E \cdot b \cdot t^3}{12 \cdot 180 \cdot L} \qquad L = \frac{\theta \cdot \pi \cdot E \cdot b \cdot t\text{^}3}{6 \cdot M}$$

$$K = f\frac{R}{t} \qquad S = \frac{6M}{bt^2}$$

k ... torque spring rate

E ... modulus of elasticity in tension

b ... width of spring strip

t ... thickness of spring strip

L ... functional spring length

R ... inner radius

M ... loading of spring

S ... stress

K ... curvature correction factor

θ ... deflection

$$\theta = \frac{160^{o}}{360^{o}}$$

θ = 0.44 rev

Active length of material is given by (L)

$$L = \frac{\theta \cdot \pi \cdot E \cdot b \cdot t\text{^}3}{6 \cdot M}$$

$$L = \frac{(0.44) \cdot \pi \cdot (30 * 10^{6}) \cdot (0.7874) \cdot (0.0393)^{3}}{6 \cdot (4.5)}$$

L= 73.36 inch (1854.2 mm)

Stress (S)

$$S = \frac{6M}{bt^{2}} \qquad S = \frac{6(4.5)}{(0.7874)(0.0393)^{2}}$$

S = 22201.5 psi

S = 153.073954 Mpa

Stress analysis (von- Mises) and total deformation results were carried out using Ansys software with above mentioned specifications.

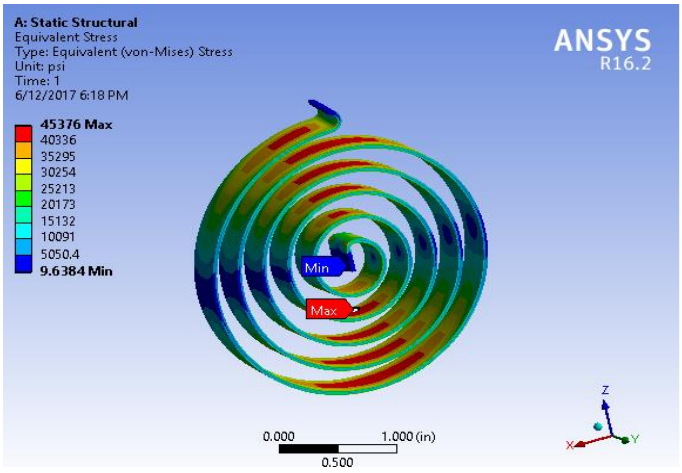

Fig -4: Stress analysis of spiral spring

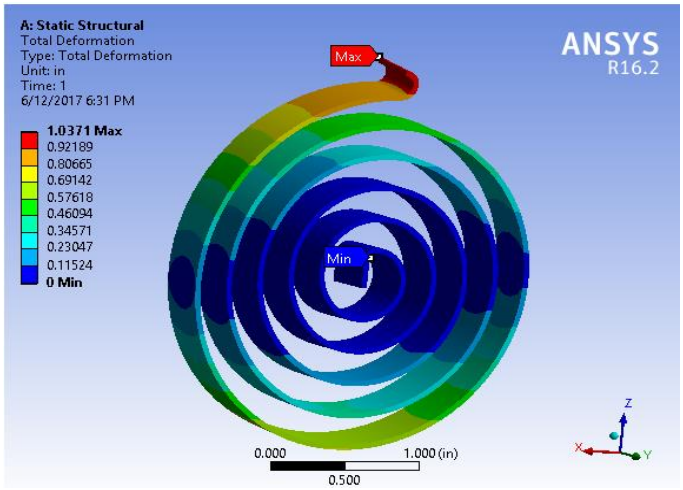

Fig -5: Total deformation of spiral spring

3. WORKING PROCESS

The operator holding the vehicle with his one hand to provide stability to vehicle and one leg is used to drop down the swing arm frame through paddle against the spring force. The roller wheels will be in contact with the ground surface as soon as swing arm is dropped down. Due to point contact between roller wheels and ground surface along with the rolling action provided by wheels, very less effort will be required to move the roller wheels on the ground surface. Which lift the vehicle due to reaction force in upward direction.

Fig -6: 3D model of double stand

4. CONCLUSION

The current methods of lifting and supporting sport bikes for home maintenance or storage are limited in options. There are very limited options for a single stand supporting an entire sport bike on its own. Current double stand requires more strength, causes instability and unstable movement of motorcycle after applying center stand hence the proposed design would significantly reduce the efforts required for applying centre stand, it will reduce leg/ back injuries, it can be used on uneven surfaces and It can eliminate the requirement of side stand which can lead to saving of considerable amount of parking space.

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BIOGRAPHIES

Hem .V. Pathak.
B.E (mechanical) from Vadodara Institute of Engineering and Research. VIER.
Certified in Solidworks and SiemensNX.
Email Id-pathakhem1519@gmail.com