Automatic Side Stand Retrieve System

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***Abstract*: Side stand in two wheelers carries entire weight of the vehicle when it is parked. They are perfect on quick stops when one needs to leave the vehicle for a short while. They are provided with a spring that pulls it back into position to ensure extra safety. Sometimes the person who drives the two wheeler may forget to release the side stand. This will tend to unwanted danger and lack of concentration while driving.**

Nowadays, sensors are used to ensure that the stand is in released condition by indicating it using small lights in dash board. There is also a possibility to forget to see the light.

This project focuses on completely avoiding the possibility of driving two wheelers without releasing the side stand. This low cost solution can be useful for all kinds of two wheelers. In this project, we are proposing an idea to overcome one of those accidents which take place due to the non-folding of the bike stand. In the case of classical bikes, the side stand should be folded manually. Unfortunately, it will not work at the urgent times. We are just human beings. We often forget to fold the stand at the when they are in hurry. While taking a deep curve or any obstacles come on the way, there is a high possibility to meet with an accident. So, to avoid this kinds of accidents, we have found a new way to fold the side stand automatically.

***Keywords*: Road Safety, Accident, Two-wheeler**

1. Introduction

1.1 Introduction to the Automobile

Today, Motor cycles are used everywhere in all over the world. Designer should design each and every component in the two wheelers with very at most safe and the product should be economical. In motor cycles, the side stand plays major roll while the vehicle is in rest condition. While the driver starting the motor cycle, there may be a possibility of forget to release the side stand. This will tend to unwanted troubles. To avoid the driver has to ensure that the side stand is released.

Side stand in two wheelers function the entire weight of the vehicle when it is parked. They are perfect on quick stops when one needs to leave the vehicle for a short while. They are provided with a spring that pulls it back into position to ensure extra safety.

A side stand style is a single leg that simply flips out to one side, usually the non-drive side, and the bike then leans against it. Side stands can be mounted to the chain stays right behind the bottom bracket or to a chain and seat stay near the rear hub. Side stands mounted right behind the bottom bracket can be bolted on, either clamping the chain stays, or to the bracket between them, or welded into place as an integral part of the frame.

A centre stand is a pair of legs or a bracket that flips straight down and lifts the rear wheel off the ground when in use. Centre stands can be mounted to the chain stays right behind the bottom bracket or to the rear dropouts. Many motorcycles feature centre stands in addition to side stands. The centre stand is advantageous because it takes most of the motorcycle's weight off its tires for long-term parking, and it allows the user to perform maintenance such as chain adjustments without the need for an external stand. Centre stands are found on most "standard" and "touring" motorcycles, but are omitted on most high-performance sport bikes to save weight and increase ground clearance.

1.2 Reason for Accidents

While the two-wheelers is concerned accidents occurs due to riding the vehicle in high speed, ignores to use helmets, does not maintains the speed limit and forgets to lift the side stand while riding the vehicles. These are the major source for accidents. Forgetting to lift the side stand causes huge accidents in rural areas partly in urban areas too, because all the other source of accident has preventive measure, but accident due to side stand do not have proper preventive measure. If you see the accident status 36% of the accidents occur due to this problem.

Table 2.1

Reason For The Accident	During the Year	Accidents
Forgetting to lift side-stand	2002-2008	36%
Does not maintain speed limit	2002-2008	38%
Does not obey traffic rules	2002-2008	22%
Other problems	2002-2008	04%

2.3 Existing Methods

To prevent accidents, occur due this side-stand many ECU and mechanical project had been found.

2.3.1 Modern ECU

In order to reduce accidents due to carelessness in lifting the side-stand, many advance measures have been introduced like ECU, the modern ECU contains a 32 bit and 40 MHz processor. It will be fast as pc's microprocessor. The ECU decides timing and functioning of engine and its parts. This play its role in dashboard, this indicates the gear shifting, side stand, to wear helmet in digital display E.g., Hero Honda's Karizma ZMR. But the people ignore to listen those indicators and safety rules so, for safe guard many mechanical projects have been found to retrieve the side stand automatically.

2.3.2 Mechanical Project

In existing mechanical project many ideas had been found to lift the side-stand automatically.

(1) One small flat rod is kept attached and pivoted between the gear actuator lever and the side stand of the bike. when the gear is actuated the side stand get lifted automatically.

(2) Small stepper motor is connected between the side stand and the engine, when engine is started the stepper motor gains the source of power and retrieve side stand automatically.

These are some methods to retrieve side stand automatically when the vehicle moves but it is not implemented in practical use due to its drawback.

2.4 Drawback of Existing Methods

ECU methods are implemented only in costlier bikes but it does not implement in normal domestic bikes due to their cost.

When we come across those mechanical projects we could note some drawbacks like wear out of gears, making injuries in legs while actuating gears. Major drawback is it cannot use in all type of two-wheelers. So, in order to solve this we thought and designed **"Automatic Side Stand Retrieve System using Sprocket"** this system can be attached in all type of two-wheelers (mopeds, geared, non-geared, hand geared bikes).

2. Literature Review

V. V. R. Murthy, T. Seethram, V. Prudhvi Raj

Automobiles play a major role in the current world as it reduces human effort and time, mostly bikes. Two wheelers are helpful to reach faster at target locations, but due to carelessness of the driver accidents can occur. Most of the accidents occur due to forgetting the side stand. The side stand is used for supporting a parked motor cycle. They are perfect on quick stop, when one need to leave the vehicle for a short while. When they continue to travel using that bike they forget side stand to retrieve. To avoid this problem, we do project practically for "Sprocket Side Stand Retrieval System". It is based on working principle of bikes. Our set up is kept between chain drive, as all the bikes transmit power with the help of chain drive. A new type side stand which is automatically retracting side stand is invented to prevent such type of accidents.

Bharaneedharan Muralidharan, Thandalam

The present paper relates to motorcycles and more particularly to an improved stand for motorcycles. The objective of this paper is to provide a device responsive to an operating condition of the engine of the motorcycle for moving the stand to its raised position when the motorcycle is in its running position.

Shigley J. E., C. R. Mischke

In modern developing world, automobile plays important role especially two-wheeler i.e. (motorcycles & bikes) plays a major role. Even though they are helpful there are some sad events like accidents due to careless of rider. Major accidents occur due to forgetting of lifting side stand. To rectify this problem many advance measure has taken, but they are useless. So, by considering that it should be implemented practically in all types bikes. the new system Sprocket Side-Stand Retrieve System is designed based on the working principle of bikes. Since all bikes transmit power from engine to rear wheel by means of chain drive. Since designed setup is kept in between chain drive, setup rotates and side stand get retrieves automatically.

Dr. K. Tirupathi Reddy, Syed Ataf Hussain

The main objective in the design and analysis of connecting rod using weight reduction is to achieve suitable design of the connecting rod for stresses produced under loading and suggest weight reduction opportunities. That can be achieved by changing such design parameters in the existing design. Finite element analysis of single cylinder four stroke petrol engines is taken for the study; structural systems of connecting rod can be easily analysed using finite element techniques. The static analysis is done to determine the Von Misses stress, shear stress, elastic strain, total deformation in the present design connecting rod for the given loading conditions using Finite Element Analysis Software ANSYS 18.1. In the first part of the study, the static loads acting on the connecting rod, after that the work is carried out for safe design. Based on the observations of the static FEA and the load analysis results, the load for the optimization study was selected. The results were also used to determine of various stress and the fatigue model to be used for analysing the fatigue strength. Outputs of the fatigue analysis of include fatigue life, damage, factor of safety,

stress biaxiality indication. Then results of present model in ANSYS are compared with the results of existing design in the reference paper.

3.Construction and Components

3.1 Construction

The whole construction of this system is simple and efficient. The arrangement and position of components makes the system to function. Each and every component has its own property and responsibility. The power obtained from the chain drive is transmitted to the appropriate component without power loss. The systematic design of system is made in order to consume only very low amount of power initially for few seconds to retrieve the stand. Then the power consumption does not occur after retrieving the stand. Construction of the proposed "**Automatic Side Stand Retrieve System using Sprocket**" consists of four major components. They are

3.1.1 Components & its Design

- Axle
- Sprocket pinion
- Lifting lever
- pushing lever

3.1.2 Axle

Axle is the metallic rod made up of mild steel. It connects the lifting lever and sprocket centrally. The axle is welded centrally to the sprocket. The axle is hold by a holder. The holder is welded with the frame. The holder is used to prevent vibration and to provide support to the axle. The holder has small metallic tube and a rectangular metal plate.

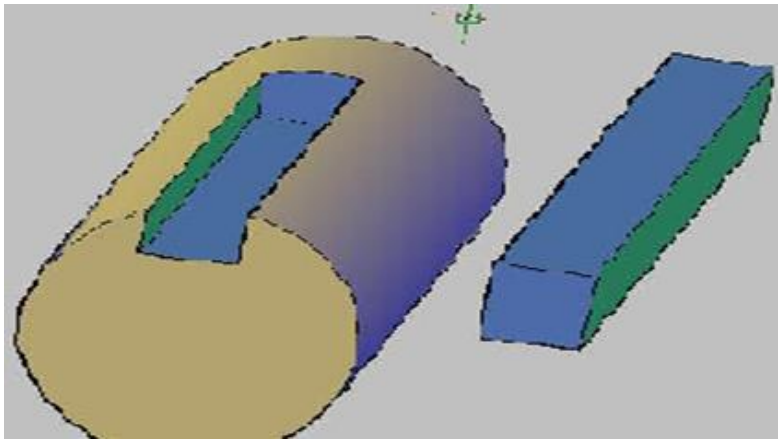


Fig. 3.1 - Axle with Key Way

The metal plate is welded perpendicular to the tube. The diameter of tube is slightly greater than the axle diameter about 2 to 4mm. This is for allowing the axle to rotate freely without friction with the tube.

The other end of the metal plate is welded at the frame. The whole metallic members of holder are of mild steel. The one end of axle is welded with sprocket and other end with lifting lever and thus the power is transmitted from sprocket to lifting lever.

3.1.3 Sprocket Pinion

Sprocket is the major component of this system because it is power transmitting device. It gets power from the chain drive and makes this system to work. It is the device which transmits the linear motion of meshing chain drive into rotary motion by means of the tooth found on it. The sprocket with ball bearings is said to be **Free Wheel.**

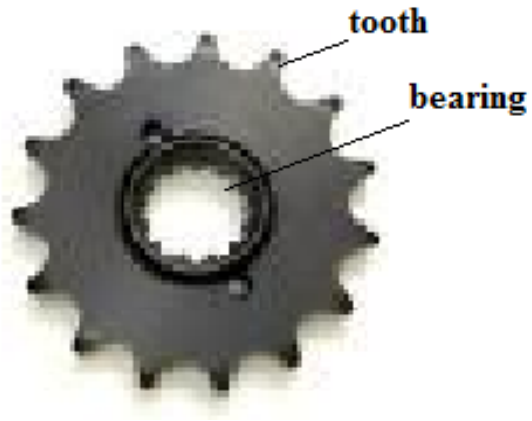


Fig. 3.2 - Sprocket with Bearing

Since it is a free wheel it allows the toothed part to rotate free from central portion in a direction. Hence this type of sprocket is used as the rear power transmission device in by cycle that makes the wheel to rotate and also allows toothed area to rotate in anticlockwise when pedaled anticlockwise direction. This action of sprocket allows attached lifting lever to adjust freely automatically or manually when it does not engages with pushing lever properly.

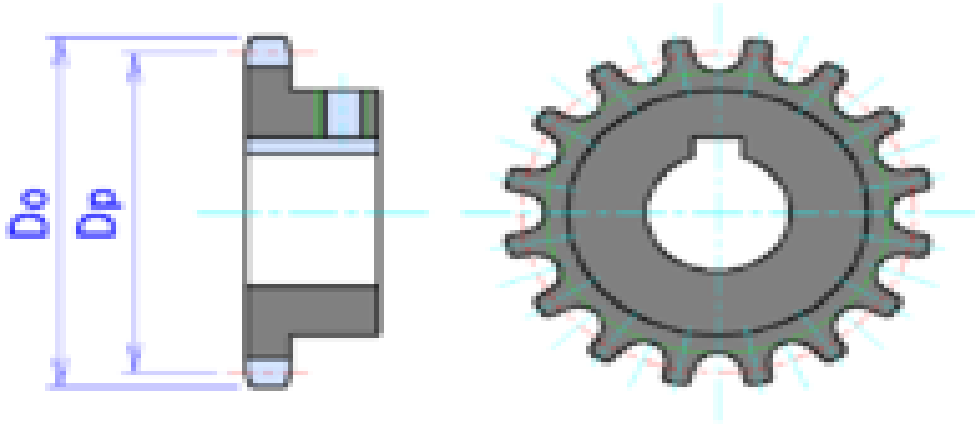


Fig. 3.3 - Sprocket with Nomenclature

Since the sprocket transmits the power from chain drive, it should have the capability to withstand the heavy loads of engine. So to withstand those impacts on toothed area, it is made of high carbon steel. The ball bearings are made up of high chromium steel. Hence all these material gives following properties for sprocket.

- Heavy duty
- Smooth running
- Tempered
- Long life

Hence the sprocket is considered as heart of this system.

3.1.4 Lifting Lever

Lifting lever is the third major component of the system. The lifting lever is the rectangular rod made of MS Rod, which consists of two lifting leaves which is mounted with the edge of axle. The lifting leaves should be parallel to the sprocket pinion. The lifting lever is composed of two metal rods, where both are welded at either sides of the axle. The free ends of the lifting leaves are tapered well. The ends are machined well for tapered shape for smooth engaging with pushing lever.

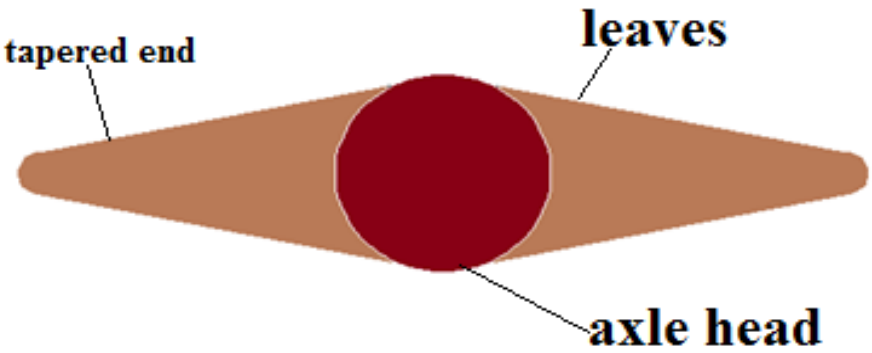


Fig. 3.4 - Lifting Lever

This smooth engagement leads proper retrieving of side-stand. This tapered surface makes the lifting lever as capable to withstand engine impact. When stand is moved vertical in position, the pushing lever engages with lifting leaves. This may not possible in all time, since the angle of lifting lever maybe any degree. So due to effect of freewheel and tapered surface of the lifting lever can adjust itself.

3.1.5 Pushing Lever

Pushing lever is the component pivoted centrally to the side stand. The pushing lever is metallic rectangular plate, whose bottom end is bended in shape of C, and top end is welded with a small piece of rectangular rod. This small piece of rod is used for getting lifted by the lifting lever. Since this rod engages (or) lays over tapered edge of lifting lever, thus the retrieving occurs smoothly.

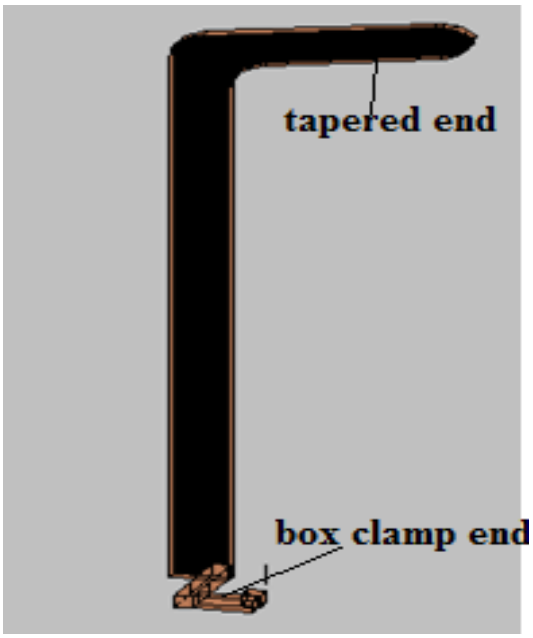


Fig. 3.5 - Pushing Lever

The pushing lever is made of MS Flat Rod with the length according to the distance of side stand arrangement. Its top end is made tapered so as to engage with lifting lever. The bottom end of the lever is made as C-clamp, which holds the side stand as shown in fig 3.5

These are four major components using in this system and other small components like nuts and bolts, hooks etc. are used in this system.

4. Assembling and Arrangement

Assembly of Components

For the functioning of system, the above four components are arranged in two assembly which is described below:

- Inciter assembly
- Retriever assembly

4.1 Inciter Assembly

Inciter assembly consists of axle, sprocket and lifting lever. The Sprocket is mounted on the centre of the axle and the lifting lever is welded at the front side of axle as shown in fig 4.1

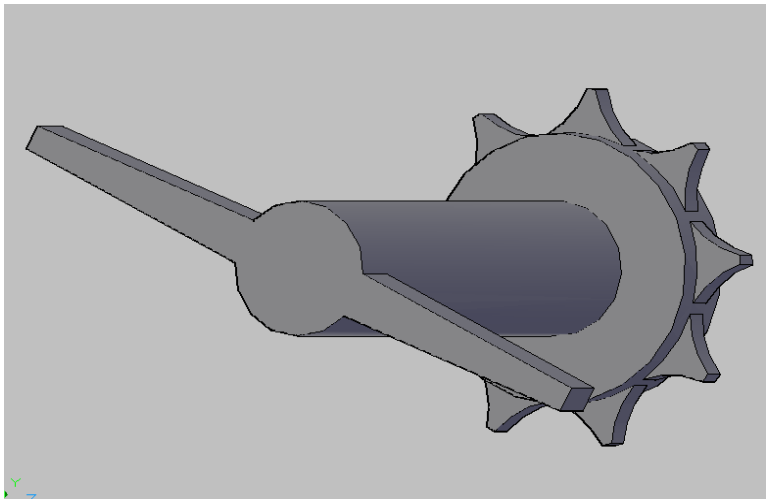


Fig. 4.1 - Inciter Assembly

This inciter assembly is main assembly because it receives the power from the chain and incites the retriever assembly to retrieve the side stand because this inciter assembly is kept under the chain as such that the sprocket attached centrally with the axle get engage with chain drive.

4.1.1 Arrangement of Inciter Assembly

This set up is arranged in the bike as such that this inciter assembly is hold by the small hollow shaft with rod welded at the center which is welded to the bottom side of the bike. As the inciter assemblies sprocket get engage with chain drive. When sprocket rotates, the axle along with lifting lever rotates.

4.2 Retriever Assembly

Retriever assembly consists of pushing lever and side stand. The pushing lever is centrally pivoted with the side stand as the pushing levers tapered end is at the top side and clamp is at the bottom as shown in fig 4.2.

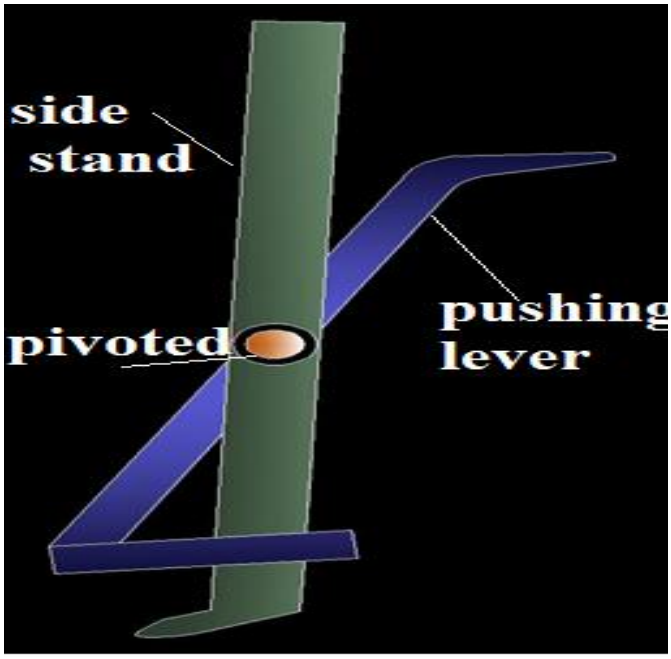
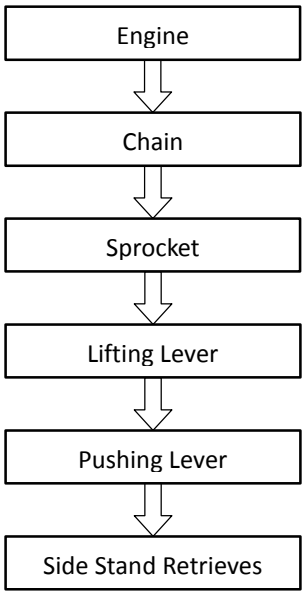


Fig. 4.2 - Retriever Assembly

Side stand of the bike is drilled at the centre as to pivot the pushing lever as shown in figure 4.2. Pushing lever is also drilled at the centre as such the both components kept together and bolted as such that C shaped clamp is at the bottom and flat rod is kept at the top side.

5. Power Source

This chapter deals with the power source of the working component and how each component and assembly of component works is explained below with flow chart.



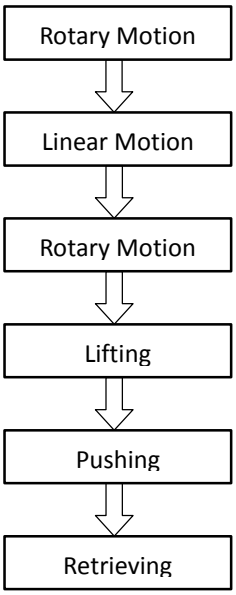
Flow Chart 5.1 - Power Source of Component

5.1 Power Source of Inciter Assembly

Inciter assembly gets the power from the linear chain motion i.e. (as engine transmit power to the rear wheel through chain drive since the setup is kept at the bottom and sprocket get engage with chain so, when chain rotates in anti-clockwise direction the sprocket engaged rotates in clockwise direction) as sprocket rotates the axle rotates as the result lifting lever rotates in clockwise direction.

5.2 Power Source of Retriever Assembly

As the retriever assembly's pushing lever get engage with lifting lever. It gets power from the rotation lifting lever and transmits to the clamp and retrieve the side stand automatically.



Flow Chart 5.2 - Action Flow

6. Working

6.1 Working Principle

Automatic Side Stand Retrieve System Using Sprocket retrieves the side stand automatically if the rider forgets to lift the side stand while moving the bike. It works based on the working principle of the two-wheelers. Every bike transmits power from engine's pinion to the rear wheel i.e. rotary motion of the pinion makes the linear motion of the chain. That linear motion of the chain is

absorbed by rear wheel's sprocket and converted into rotary motion. That rotary motion of the rear wheel makes the bikes to move. Based on this Automatic Side Stand Retrieve System Using Sprocket is designed.

If Sprocket is kept between the chain drive, it makes the sprocket to rotate so, using the sprocket as the major component this system works. It gains the power from the chain and make specially designed component (lifting lever) to rotate. This rotation incites engaged pushing lever to push the side stand to retrieve.

When chain rotates anti-clockwise direction the inciter assembly's sprocket absorbs the power and rotates in clockwise direction.

The working of Sprocket-Side Stand Retrieve System is explained below in both resting & riding condition of two-wheeler.

6.1.1 Resting Condition

When two-wheeler is in resting condition i.e. when rider actuates the side stand of the vehicle to ground, the pushing lever that is pivoted at the centre of the side stand gets engage with the inciter assemblies lifting lever. During this condition the inciter assembly is at rest and retriever assembly pushing lever's tapered end get engage with tapered end of lifting lever.

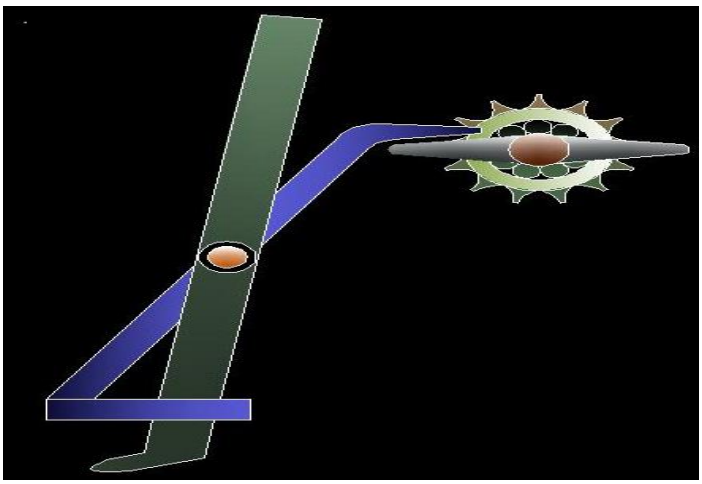


Fig. 6.1 - Resting Condition

Pushing lever's length can be changed according to type of bikes and distance calculated between the side stand and chain drive. Closed coil helical spring which gets pulled, the coil of spring gets tensed during stand resting in ground. This is the condition of system during resting stage.

6.1.2 Riding Condition

When two-wheeler is started, engine's pinion transmits power to the rear wheel by the chain drive. The inciter assembly which is kept at the center of the chain drive gets rotates as the sprocket gets engage with chain drive. So, when the sprocket rotates the lifting lever mounted with axle rotates. Hence the lifting lever lifts engaged the pushing lever and therefore the pushing lever pushes the side stand by clamping it with the C shaped clamp stand holder and hence the spring tensed in the side stand get compressed quickly as a result side stand get retrieves.

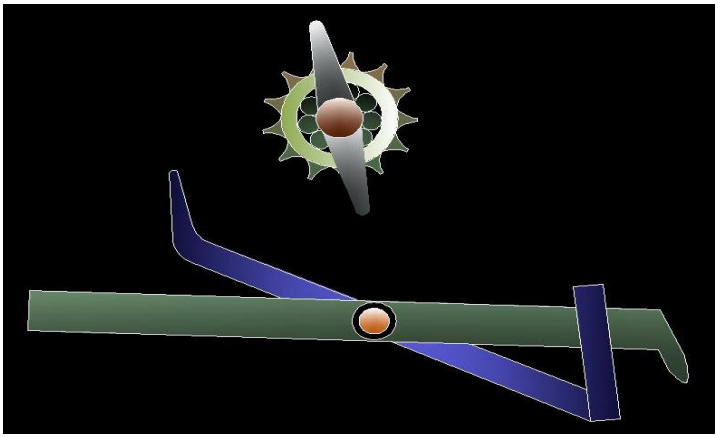
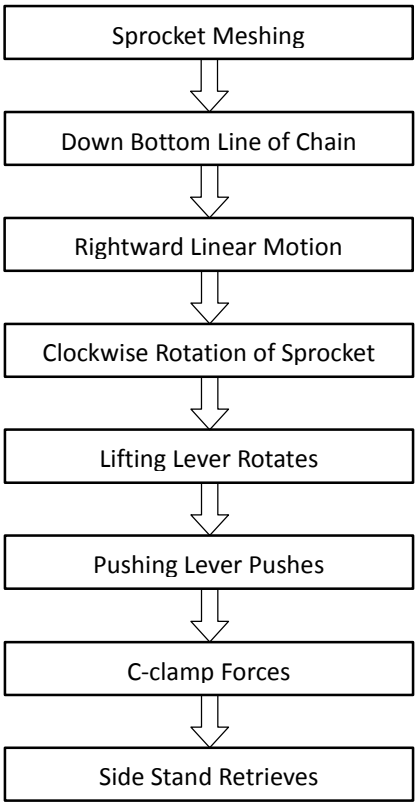


Fig. 6.2 - Resting Condition

The working of Sprocket-Side Stand Retrieve System is explained below in the flowchart 6.1.



Flow Chart 6.1 - Working Positions

6.2 Side View

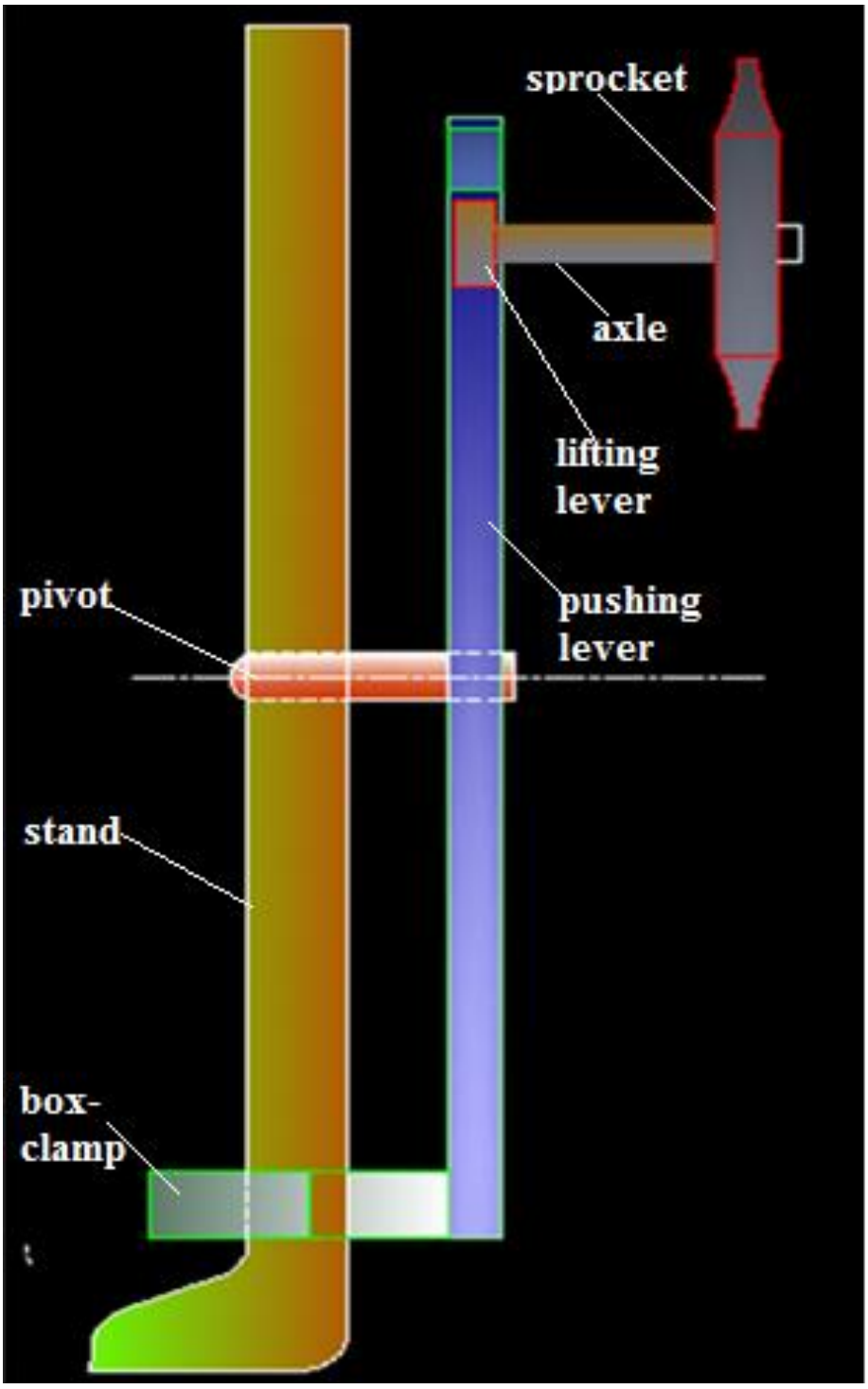


Fig. 6.3 - Side View of Automatic Side Stand Retrieve System Using Sprocket

Specifications of Components
3.1 Specification of Sprocket

Material	High Carbon Steel
Pitch	12.7 mm
Width	30 mm
Teeth	16
Balls	High Carbon High Chromium Steel Balls

3.2 Specification of Axle

Material	Mild Steel
Shape	Cylindrical Rod
Length	50 mm
Diameter	13 mm
Inner Diameter of Supporting Axle	15 mm
Outer Diameter of Supporting Axle	17 mm
Length	30 mm
Thickness	3 mm

3.3 Specification of Lifting Lever

Length of Lever	95 mm
Thickness	10 mm
Tapered Angle	45 deg
Chamfered Angle	20 deg
Position	Parallel to Sprocket
Welded Length	13 mm
Material Used	Mild Steel

3.4 Specification of Pushing Lever

Material	Mild Steel
Length of Lever	180 mm
Thickness	3 mm
Diameter of Hole	8 mm
Length	30 mm
Thickness	10 mm
Diameter of Clamp	28 mm
Diameter of Stand	25 mm
Pivoted Angle	55 deg
Bolt Diameter	8 mm

3.5 Specification of Spring

No. of Coil	32
Diameter of Coil	2 mm
Diameter of Wire	15 mm
Inner Diameter of Coil	12 mm
Mean Coil Diameter	13.5 mm
Type	Closed Coil Helical Spring
Extension Length	17 mm * 2 = 34 mm
Material	Stainless Steel

Calculations

1. Chain Sprocket calculation

The approximate chain length is as follows:

Chain length, L = $2C + \frac{\pi}{2}(D + d) + \frac{(D-d)^2}{4C}$

Where,

D = Diameter of the larger sprocket
d = Diameter of the smaller sprocket
C = Centre distance between sprocket

Also, the circumference, $\pi D = z_1 P$

$\pi d = z_2 P$

z_1 = Number of teeth on longer sprocket
z_2 = Number of teeth on smaller sprocket

$$L = 2C + (z_1 + z_2)\frac{P}{2} + \frac{(\pi D - \pi d)^2}{2C\pi^2}$$

$$= 2C + \left(\frac{z_1+z_2}{2}\right)P + \frac{(z_1-z_2)^2}{4C\pi^2}P^2$$

$$\frac{L}{P} = \frac{2C}{P} + \left(\frac{z_1 + z_2}{2}\right) + \frac{(z_1 - z_2)^2}{4\pi^2\left(\frac{C}{P}\right)}$$

L_N= Number of links = $\frac{L}{P}$

L_N= $\frac{2C}{P} + \left(\frac{z_1+z_2}{2}\right) + \frac{(z_1-z_2)^2}{4\pi^2\left(\frac{C}{P}\right)}$

Length of the chain $(2 \times 603) + \frac{\pi}{2}(80 + 170) + \frac{(170-80)^2}{4\times603}$

Centre Distance, C = 603 mm

Length of Chain = 1206 + 3926990 + 3.3582

Length of Chain = 1602.05 mm

Now, $\pi d = z_2 P$

$$\frac{\pi \times 80}{18} = P$$

Pitch =13.9626mm
Assuming pitch to be standard
i.e.

Pitch = 15 mm

Number of links, $L_N = \frac{L}{P} = \frac{1602.05}{15} = 106.8033$
i.e.

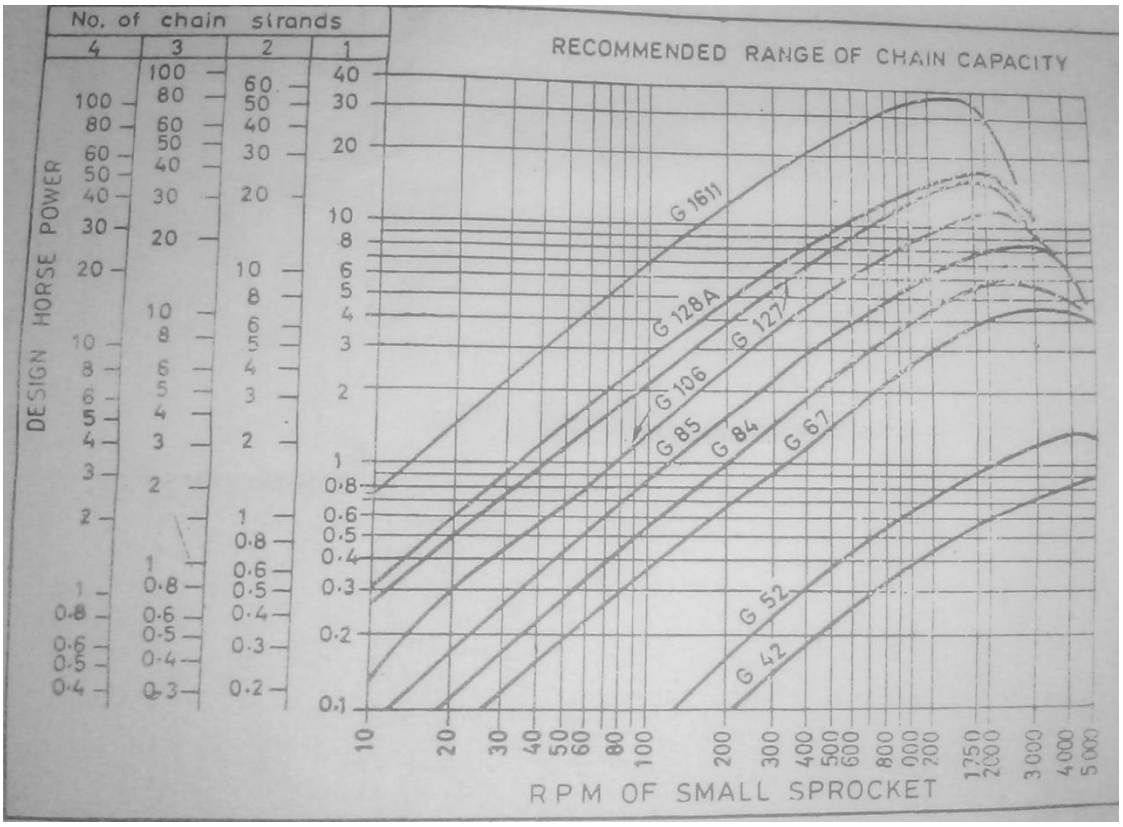
Number of links, L_N = 110

From Design Table

Designation IS 2403	Rolon No.	Pitch P	Roller dia. D_r max.	Width between inner plates W min.	Pin body dia. D_p max.	Plate depth H max.	Trans-verse pitch P_t	Width over bearing pin A_1, A_2 or A_3 max.	Bearing area cm^2	Breaking load kgf	Weight per metre (Average) kgf
	Roller	Chains									
	G42	6.0	4.0	2.8	1.85	5.44	–	7.0	0.07	300	0.12
5.0S	G52	8.0	5.0	3.1	2.3	7.04	–	8.0	0.11	500	0.18
6.1S	G67	9.525	6.35	5.9	3.31	8.14	–	13.1	0.28	1000	0.41
	M84	12.7	7.75	6.45	3.96	11.69	–	15.4	0.39	1500	0.49
8.3S	G85	12.7	8.51	7.85	4.45	11.69	–	16.75	0.5	2000	0.71
10.1S	G106	15.875	10.16	9.85	5.0	14.26	–	19.40	0.67	2500	0.91
12.0S	G127	19.05	12.07	11.7	5.72	15.95	–	22.10	0.89	3100	1.17
	G128A	19.05	11.9	12.7	5.95	17.95	–	24.80	1.05	3300	1.47
16.0S	G1611	25.4	15.88	17.1	8.27	20.8	–	35.00	2.10	4500	2.63
6.1D	D67	9.525	6.35	5.9	3.31	8.14	10.24	23.3	0.56	1800	0.74
8.3D	D85	12.7	8.51	7.85	4.45	11.69	13.92	30.7	1.0	3500	1.36
10.1D	D106	15.875	10.16	9.85	5.08	14.26	16.59	35.8	1.34	4580	1.82
12.0D	D127	19.05	12.07	11.7	5.72	15.95	19.46	41.66	1.78	6000	2.36
16.0D	D1611	25.4	15.88	17.1	8.27	20.8	31.88	68.07	4.2	8700	5.22
6.1T	T67	9.525	6.35	5.9	3.31	8.14	10.24	33.4	0.84	2700	1.09
8.3T	T85	12.7	8.51	7.85	4.45	11.69	13.92	44.6	1.5	5100	2.02
10.1T	T106	15.875	10.16	9.85	5.08	14.26	16.59	52.3	2.01	7100	2.73
12.0T	T127	19.05	12.07	11.70	5.72	15.95	19.46	61.21	2.67	8900	3.54
16.0T	T1611	25.4	15.88	17.10	8.27	20.8	31.88	99.82	6.3	13000	7.85
	Bush	Chains									
	GB68	9.525	5.08	4.77	3.63	8.64	–	12.2	0.27	1100	0.4
	GB65	9.525	5.00	7.55	3.54	9.19	–	15.54	0.39	1300	0.53
	GB66	9.525	6.00	9.55	4.45	9.74	–	17.55	0.51	1200	0.62
	GB66H	15.875	6.00	8.00	4.45	4.74	–	18.65	0.58	1550	0.76
	DB63	9.525	5.08	4.77	3.63	8.64	10.15	24.0	0.54	2100	0.71

At P = 15 mm, Roller Number = G 106

From Chart - Capacity Diagram for Roller Chain



Assuming speed of smaller sprocket be = 50 rpm

Therefore,

Design Horse power = 0.7 H.P.

i.e. Power transmitted = 0.7 H.P.

Or

Power Transmitted = 0.933 kW

2. Shaft Design

Torque $\frac{9.55\times10^5\times P}{N}$

$$\frac{9.55 \times 10^5 \times 0.9333}{50}$$

Torque, T=17826.03 Nmm

Torsional shear stress (τ) for M.S. shaft = 525.389 MN/M^2

Therefore,

Torsional shear stress, $\tau = \frac{16T}{\pi d_s{}^3}$

d_s = Diameter of shaft

$525.389\ \frac{16\times178260.3}{\pi {d_s}^3}$

So,

Shaft diameter, d_s = 12mm

Also, according to May Shear Stress Theory

$d_s\ \frac{16}{\pi\tau_s}$

Maximum bending moment, M = 1120.896 Nmm^2

$d_s \frac{16}{\pi \times 525.389}$

Therefore,

Shaft diameter, d_s = 12 mm

Spring Design

Particular	Equation
Cylindrical compression spring: ***(a) Round section springs:***	
Torsional moment produced in the spring (Fig. 11.2)	$T = \frac{1}{2}FD$
The internal resisting moment	$T = Z_p\tau = \left(\frac{\pi d^3}{16}\right)\tau$
The shear stress due to torque only	$\tau = \frac{8FDK}{\pi d^3}$
The shear stress in the helical spring (considering compressive stress acting along the coil and also direct shear stress)	$\tau = \frac{8FDK}{\pi d^3} = \frac{yGdK}{\pi iD^2}$
The wire diameter, (Table 11.1 and 11.2)	$d = \sqrt[3]{\left(\frac{8FDK}{\pi\tau}\right)}$
	where K is the stress correction factor
According to Wahl, the stress correction factor (Fig. 11.3)	$K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$
The stress correction factor (*Bergstroessar*)	$K = \frac{4C+2}{4C-3}$
	where $C = (D/d)$, the spring index
Very close approximate equation for the stress factor ($2 \geq C \leq 12$)	$K = \frac{2}{C^{0.25}} = 2\left(\frac{d}{D}\right)^{0.25}$

Number of Coils = 32
Diameter of Wire, d = 2 mm
Diameter of Spring, D = 15 mm

Spring Index, C = $\frac{D}{d} = \frac{15}{2} = 7.5$

Stress Correction Factor (K) $\frac{4C+2}{4C-3}$

K $\frac{(4\times7.5)+2}{(4\times7.5)-3}$

Stress Correction Factor, K = 1.1851

Assuming Torsional Shear Stress $\tau = 10$ N/mm^2

d $\sqrt[3]{\frac{8FDK}{\pi\tau}}$

$2^3 = \sqrt[3]{\frac{8\times F\times15\times1.1851}{\pi\times10}}$

Force or Load, F = 1.76 N
Or

Force Required to Lift the Side Stand = 1.76 N

Cost Analysis

1) Cost of the Model

Material	**Cost (In Rs)**
Sprocket (2 Nos.)	100 x 2 = 200
Larger Sprocket (1 Nos.)	150
Wheel Chain	250
Side Stand with Bolt & Spring	100
MS Rods (Frame, Lifting & Pushing Lever)	400
Pedal	80
Total	**1,180**

2) Cost of Finished Model

3) Cost of the System

Work	**Cost (In Rs)**
Material Cost	1,180
Labor charge	300
Painting	90
Total cost	**1,570**

Materials	**Cost (In Rs)**
Sprocket (1Nos)	100
MS Rod (Axle, Lifting & Pushing Lever)	250
Machining Cost	100
Total Cost	**450**

Total Cost of the Model System = 1570 Rs
Total Cost of Setup = 450 Rs

7. Conclusion

"Sprocket-side Stand Retrieve System" will definitely good retrieve system since the setup is compact it does not affect the performance of the vehicle because of the power is obtained from chain drive. Definitely this system could be used in all type of two-wheelers **(TVS-XL, all front, back, hand geared)** for retrieving the side stand, it will be the major system to control accidents due side stand problem and protect the careless rider. This system can be implemented in all types of bikes by changing small variation in size and cost of this system also very low and so it will not affect the economic level also while compare to other system this **"Automatic Side Stand Retrieve System using Sprocket**" will be the life saver.

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