Design and Manufacturing of Helical Tension Spring Remover for Bike / Moped stand

Mr. Javed Gulab Mulla[1], Mr. Jatingaraya Gangaram Bagale[2], Mr. Akash Revappa koli[3]
[1]Lecturer, Mechanical Engineering Department, A. G. Patil Polytechnic Institute, Solapur, Maharashtra, India [2]Mechanical Engineer, Working in Industry, Pune, Maharashtra, India
[3]Mechanical Engineer, Working in Industry, Pune, Maharashtra, India

Abstract- *In the centre stand or side stand of mopeds or bikes helical tension spring is present. To remove the same spring worker uses screw driver. Whenever the worker removes the spring there are chances that the screw driver may get slipped and it may causes an injury to the worker. It also increases the time to remove the spring. To overcome this problem We designed and manufactured Spring Remover. It consist of one longer screw with thread. On the same screw two nuts are present. Both nuts will have different threads i.e- Left hand Thread and Right hand Thread. The two nuts can move away or closer to each other whenever screw is rotated either in clockwise or anticlockwise direction. On both nuts L-Shape hooks are provided. The same hooks will be located in the eyes of helical Tension Spring whenever it is being removed. With spring Remover the task of worker becomes easy and time gets reduced to remove the said spring. The rotary movement to screw can be imparted with the help of rotating knob, which is provided at the end of the screw.*

Keywords- Helical Tension spring, Spring Remover.

I. INTRODUCTION

Coil springs and Helical Tension springs find many applications such as in Automobiles, Machine Tools and various material handling equipments. In the centre stand or side stand of mopeds or bikes helical tension spring is present. The purpose of providing helical tension spring is to provide easy return movement of the stand during its removal. The mounting and removing of these springs is quite difficult. In the market coil compressor are available for removing the compression spring but for Helical Tension spring used in central stand or side stand used in Bike or Moped worker uses screw driver for its removal. But it is time consuming and not a safety way to remove the spring, because it may cause injury to the worker. So to overcome the above stated problem it is decided to Design and Manufacture spring remover. With spring remover we can remove spring safely with minimum time.

A.

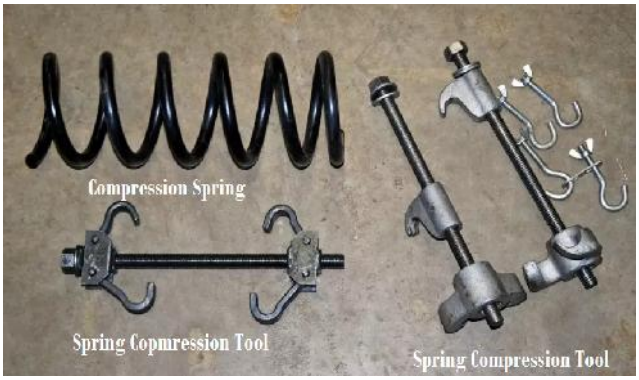

Fig 1: Compression spring and Spring Compression tool.

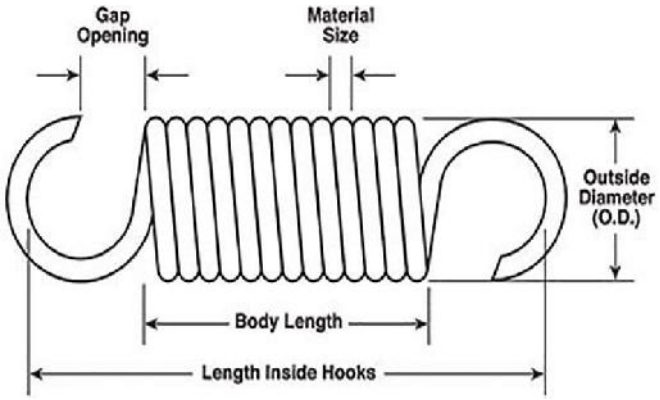

Fig 2: Helical Tension Spring.[1]

II. OBJECTIVES OF DESIGN

This concept of design is new for removing the helical tension spring of centre stand or side stand. By using this design we can achieve the following objective.

a) To remove helical tension spring of centre stand or side stand easily with minimum effort and time.
b) To prevent any injury to worker during removing of spring.
c) To understand different design and Manufacturing parameters for new developing product.

III. METHODOLOGY

Following methodology is adopted for Design and Manufacturing of Spring Remover.

- **Design Calculations-**

While designing the Spring Remover first of all it is studied and observe the helical tension spring of centre stand and side stand of different bikes and mopeds. After studying different springs than design activity is started. Before deciding dimension of each and every component of the assembly necessary design calculation are done by considering suitable permissible stresses.

Assumed Data-

a) Load (W)= 17000 N
b) Tensile stress(σ_t)= 200 N/mm^2 for steel material
c) Shear Stress(τ_s)=400 N/mm^2 for steel material
d) Crushing stress(σ_{ck})= 800 N/mm^2 for steel material

1) Considering failure of screw rod in tension at root diameter,

σ_t =W/0.7853 $(d_c)^2$

200=17000 / 0.7853 $(d_c)^2$

d_c =10.40 mm

We know that, $d_c = 0.84\, d_o$

Therefore Major Diameter (d_o)= 10.40 / 0.84

d_o = 12.38 mm

We know that,

Pitch of Screw (p)=1/n

Assuming no of threads (n)= 4

p= 1 / 4

p = 0.25 ≈ 2 mm

Mean Diameter (d) = d_o-0.5*p

d=12.38-0.5*2

d=11.38 mm

2) Checking screw for crushing failure,

σ_{ck} =W/0.7853(d_o^2 - d_c^2) n

=17000 / 0.7853(12.38^2 -10.40^2) 4

σ_{ck} = 119.98 N/mm^2 < 800 N/mm^2

As Induced crushing stress is less than permissible stress. Hence Screw is safe in crushing.

3) Checking screw for shear failure,

τ_s= W / π *d_c * n* t

=17000 / π *10.40*4*1

τ_s = 130 N/mm^2 < 400N/mm^2

As Induced shear stress is less than permissible stress. Hence Screw is safe in shear.

Table 1: Calculated dimensions of Screw.

Sr. No.	Particulars of Screw	Dimension in mm
1	Core or Root Diameter	10.40
2	Major Diameter or Nominal Diameter	12.38
3	Mean Diameter	11.39
4	Pitch of Screw	2
5	Threaded Length	180

After finding out necessary dimensions for screw, the same calculations are carried out for finding out the dimensions for nut by considering the same material. The various dimensions for nut are shown in the below table.

Table 2: Calculated dimensions of Nut.

Sr. No.	Particulars of Nut	Dimension in mm
1	Core or Root Diameter	12.38
2	Major Diameter or Nominal Diameter	10.40
3	Mean Diameter	11.39
4	Pitch of Screw	2

Above calculated dimensions are not available in actual practice, so the standard nut and screw cannot be used for further replacement in case of wear and tear. We must have to manufacture the same nut and screw with respect to above Table 1 and Table 2 and **Whitworth thread profile** is formed on both Nut and Screw having symmetrical V thread with an included angle of 55°. The same thread profile is formed on both Nut and screw with single point cutting tool on Lathe Machine.

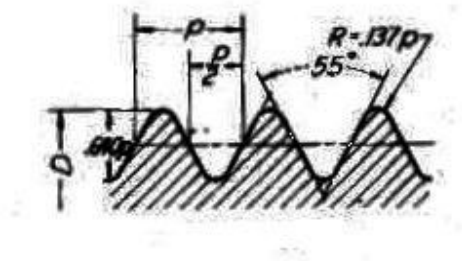

Fig 3: Whitworth Thread profile.[2]

- **Steps followed for Manufacturing –**

The following steps are followed for manufacturing the Spring Remover,

1. Carried out Straight Turning operation on screw to maintain nominal diameter. i.e- **d_o =12.38 mm.**
2. Carried out threading operation on screw as per calculated dimension. i.e- **d_c =10.40 mm**
3. Small rod of suitable diameter is formed into L-shape to fix in the eyes of Helical Tension spring and the same is welded to the square headed nut.
4. Carried out central drilling operation on square headed Nuts and then internal threading operation is done on both nuts. On one nut Left hand thread and on other Nut Right Hand thread are provided. The reason is that whenever knob is rotated either in clockwise or anti clockwise direction both nuts get closer or away from each other, in this way the spring will get expanded or compressed for its removal.
5. Knob is connected at the end of screw by using welding process.

The design of Spring Remover is made using Catia Software. The following isometric view is for Spring Remover,

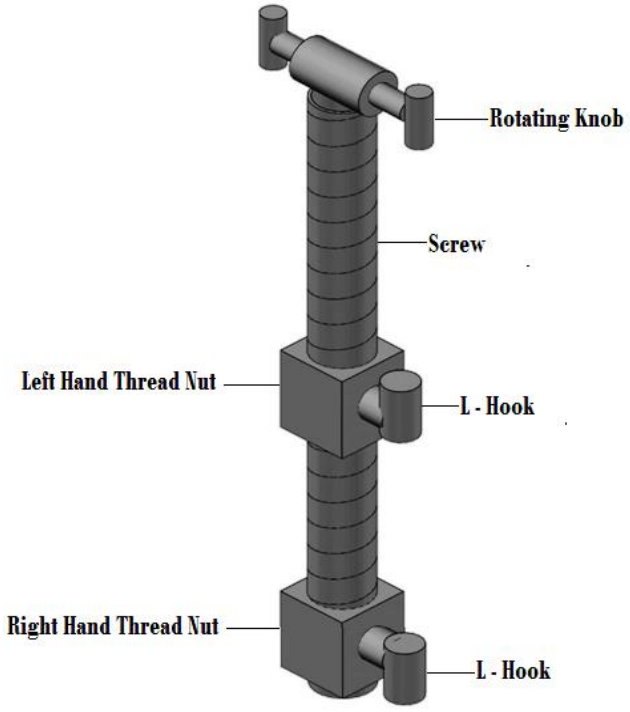

Fig 4: Isometric view for Spring Remover.

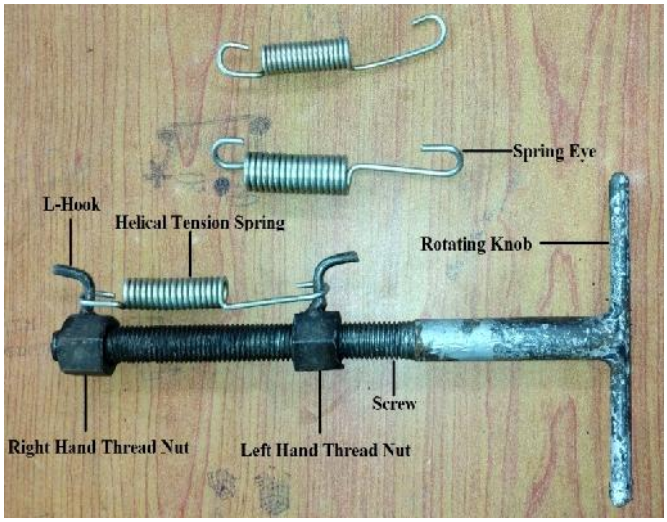

Fig 5: Final Manufactured Spring Remover.

IV.DESIGN PRINCIPLES CONSIDERED WHILE DESIGNING SPRING REMOVER

1. **Contrast-** It refers to the different elements that contain thecomplete design.
2. **Alignment-** It helps to create a sharp, ordered appearance by ensuring the elements have a pleasing connection with each other.
3. **Hierarchy-** Using this principle in design indicates the goals of your design.
4. **Repetition-** Repetition is an important design basic because it helps to strengthen the overall look of the design.
5. **Proximity-**Similar or related elements are grouped together to create a relationship between them.
6. **Balance-** It gives form and stability to an individual design and helps to distribute the elements evenly throughout the whole design.
7. **Color-** It should be carefully considered each time because it is largely responsible for dictating the mood of a design.[3]

V. AESTHETICS AND ERGONOMICS PRINCIPLES CONSIDERED WHILE DESIGNING SPRING REMOVER

1. **Aesthetics principle-** While designing any part of spring remover assembly care is taken that wherever it is possible instead of providing sharp edges there smooth curves or fillets are provided. It also improves looks and avoids any injury to the worker during operation.
2. **Ergonomics principle-** The rotating knob which is provided at the end of screw it has proper length arm, so that any hand of human being can operate it efficiently.[4]

VI. ADVANTAGES AND DISADVANTAGES OF SPRING REMOVER

- **Advantages-**

1. Unskilled worker can operate.
2. Spring can be removed easily with minimum time.

- **Disadvantages-**

1. Spring of maximum length than screw length cannot be removed.

VII.CONCLUSIONS

After completing this work following things are concluded,

1. Different design and manufacturing parameters need to be considered while designing and manufacturing a new component.
2. With such spring remover, the mounting and removal of Helical Tension Spring became easy in consistent of safety.
3. By using spring remover time reduces for mounting and removal of Helical Tension Spring.

REFERENCES

[1]https://www.wcsindustries.com/coil-springsmanufacturer/extension-springs.
[2]https://www.google.co.in/search?q=images+for+different+type+of+thread+profile+in+screw&hl=en&ei=4KiaZPmDPbhseMPg7ikOA&ved
[3]https://www.google.com/search?q=design+principles+considered+while+designing&source=hp&ei=anytzofwn9lbhwo6772iaq&iflsig.
[4]https://studycorgi.com/ergonomics-and-aesthetics-design.