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Design and Fabrication of Cylinder Lifter

Pratik Khawale[1], Aamir Khan[1], Rohan Kulkarni[1]

Nilesh Gadpawar

UG student, Department of Mechanical Engineering, G. V. Acharya Institute of Engineering & Technology, Shelu, Karjat, India.

Assistant professor, Department of Mechanical Engineering, G. V. Acharya Institute of Engineering & Technology, Shelu, Karjat, India.

ABSTRACT

The goal of this project is to make it simple to transport the cylinders up and down the stairs. When doing work, a good tool is essential. However, there was an issue when you wanted to deliver the gas cylinder upstairs to a customer's house. So we devised a method for easily raising the cylinder. We've added a trolley to make it easier to get upstairs. Furthermore, it reduces human effort. This trolley is designed for workers who deliver gas cylinders to customers' homes. This system is usable daily. The design is based on a bearing capable of carrying a single cylinder at the speed of a normal human. A trolley is a small vehicle with wheels that can be moved around and is used to transport cylinders. A cylinder trolley is a type of trolley with rotating wheels that can be moved up and down the staircase. This can significantly reduce back injuries. This study may lead to the development of a new method for transporting heavy cylinders up and down stairs. A trolley is a piece of equipment used to transport heavy objects from one location to another. A trolley aids in reducing the amount of effort required to lift the cylinder up the stairs. Several other designs have been proposed for this project, but we want better stress distribution so that we can travel over uneven surfaces, such as stairs. The trolley in this proposed design is outfitted with a set of Tri-Lobe wheels, which are the most important part of the climbing mechanism that allows the trolley to move along uneven surfaces.

Keywords: Cylinder trolley, Trilobe, Mechanical.

1. INTRODUCTION

In everyday life, we may be required to transport LPG cylinders up and down stairs, particularly in offices, schools, colleges, hotels, industries, and apartments. Where there are no lifts, or it is prohibited to transport heavy objects in the lift. We must carry the cylinder and climb in such cases. As a result, there should be a simple way to transport the cylinder. This is where the cylinder lifter comes into play. The trolley is designed to require as little effort as possible. A standard trolley can only be used on flat surfaces and cannot be used on stairs. We added two more wheels to the LPG cylinder trolley, which now functions as a single unit. Three wheels are connected to the shaft in stair climbing by a triangular plate or tri-lobe of the trolley. This type of trolley is extremely useful for transporting LPG Gas Cylinders. In the proposed design, we created a trolley that can be used on flat surfaces as well as stairs and irregular surfaces with minimal effort. With improved stress distribution, the trolley weighs less and has a higher load carrying capacity. A hand trolley is a small transport device used to transport heavy LPG cylinders from one location to another. It is a very common component used by many industries to physically transport LPG cylinders, also known as Trolley. The person working in the stocks department of ta cylinder retail store uses the hand trolley. When used correctly, trolleys can safeguard individuals from back injuries and other health issues that might come when carrying a big LPG cylinder. A standard trolley features two wheels beneath the weight bearing plane and two handles on the frame. These handles are used to maneuver the gadget. The handles may extend from the frame's top or bottom. An empty trolley is usually placed in an L-shape, with the cylinder on top of the plane. When the LPG cylinder is positioned, it is tilted backwards to balance the load between the support frame and the platform. The goal of this research is to increase the autonomy of people who rely on mobility assistance devices and to lessen the burden on personnel who provide such mobility. The goal of this thesis was to test and construct a consumer grade trolley for usage on stairs. This trolley will undoubtedly assist the workers in resolving the issue of lifting the LPG cylinder and climbing the stairs. Workers must utilize the trolley in the appropriate manner. In addition, workers may save time by performing the operation faster, which entails lifting the gas tank and mounting the stairs with the help of a trolley. We created our trolley so that it is simple to operate. The original gas tank trolley is ideal for transferring the gas tank around the customer's house on flat ground, but our trolley

can securely ascend the stairs. Several versions were developed to allow the trolley to function more easily on stairs and even flat areas. These designs must be thoroughly researched in order to provide a good product. Further development on this product must include the design and production of additional items that employ various techniques for ascending stairs that do not require the usage of power.

2. OBJECTIVES

• The primary goal of this initiative is to eliminate physical labour.

• Adding numerous components to a simple trolley to make a versatile trolley that can automatically climb stairs. • The effort required to transport the cylinder is minimal.

• Because of its small size, the trolley can be readily placed anywhere and transported anywhere; and • Because it has fewer moving components, maintenance is minimal.

• Using the trolley does not necessitate the use of an external power source.

2.1 PROBLEM DEFINATION

The study's goal is to investigate the changes and improvements we've made to the old trolley.

Statement of the Problem:

- People have difficulty lifting and transferring their gas cylinders, especially if they live in a flat.
- It takes a lot of energy to travel up and down the stairs.

OLD DESIGN	NEW DESIGN
1.The trolley was not foldable and difficult to carry.	1. It is small and simple to transport.
2. It necessitated greater human effort.	2. It needed the least amount of human work.
3. The plate that is attached to the Base is not moveable.	3.The plate that is attached to the base is moveable.
4. In the original design, it had only 2 or 3 wheels on each side from which you can only use it on flat surfaces.	4. In this design, instead of a single or double wheel, we added a set of three wheels on either side of the vehicle so that it is not restricted to flat surfaces.

- There are no safety measures on the present gas cylinder trolley.
- Possibility of injury
- The cylinder may fall and cause an accident.

3. DESIGN

3.1 Basic Dimension and Construction

The basic dimension were decided upon the study of cylinder lifter. The external end of the solid shaft is considered as 25mm respectively. The length of the shaft is 700mm.
Two pairs of trilobe and fix wheel used. The diameter of wheel is decided as 130mm for appropriate dimension of the stair which is about the depth of the threads is 300-350mm and height of the riser is 140mm-170mm. The inner lobe radius of Tri-lobe is taken as130mm.
The dimension of the LPG gas considering is
Length of cylinder- 630-635mm
Diameter -314.4 to 317mm
Considering the dimension of the LPG gas cylinder the dimension of the base of the cylinder lifter is 482X457mm and the height of the trolley from the base is 710mm.
For making the frame we used mild steel first making the base of 182X457mm. After that the back of trolley is made with the dimension of 482X710mm. The process used for joining the base and back of trolley is are welding.
The trilobe wheel setup is fixed at the end of the solid shaft by nut and bolt. Solid shaft is directly fixed at the base of the trolley.

Methodology is an aspect that needs to be studied in order to produce a project. Process planning needs to be investigated as best as possible to produce a project or quality products. Here is the sequence of all necessary processes or procedure travelled before a product was fully completed. Method of work should be done with organized and suitable for getting better and better work and results. With the existence of an orderly way of working, then all the work and tasks to be done can be followed and implemented in a safe and order manner. In this chapter we will discuss about the steps that will be taken to complete this project. Every step of the work to be done will be explained in the diagram help with understanding the project`s income.

3.2 PROCESS DESIGN

Process planning needs to be carefully exanimated to produce a quality project or product. Work methods needs to be done in proper and appropriate way to get better and more secure work and results. With the proper methods of work and task performed can be followed and implemented in a safe and order manner.

In this chapter, would like to describe the method of producing this project from material to installation. It aims to control excess production cost and equipment. The steps taken are:

- Find the necessary material & equipment to carry out this project
- Draw the diagram
- Draw the connecting components to be used using CAD
- Arrange all components to be used

- Designing a project framework
- Make testing on ready-made tools

3.3 DESIGN CALCULATION

3.3.1 Design of Shaft

Outer Diameter, D= 25 mm
Length of the shaft = 710 mm
Shaft Subjected To Simple Torsional Moment Bending Moment

As For, Simple Torsion Moment

Shear strength $\tau = P/A$
Assume, load p= 100kg
= 100*9.81=981N Area
Area = $(\pi/4)*D^2$
Area = 490.873 mm^2

Shear strength
τ=981/490.873=1.998 N/mm^2
Shaft Subjected To Simple Bending Moment
$\sigma = 32*M/\pi*D^3$ …….(1)
Where
M – The Applied Bearing Moment For shaft N.mm
D – Diameter for the Solid Shaft In mm
σ – Bending Stress In N/mm^2

$M = \pi/16 * \tau * D^3$
= 6129.787 Nmm …….(II)
Putting Eqn (I) and (II) We Get
$\sigma = (32*6129.787*/ \pi*25^3)$

Material selected is mild steel
For mild steel $\sigma = 580\ N/mm^2$
Allowable bending moment < permissible bending Moment
$3.995\ N/mm^2 < 580\ N/mm^2$
Design is safe and satisfactory

3.3.2 Selection Of Bearing

A ball bearing is a form of rolling-element bearing that employs balls to keep the bearing races apart. A ball bearing's purpose is to minimise rotational friction and to sustain radial and axial loads. It accomplishes this by containing the balls and transmitting the loads through the balls via at least two races. In most cases, one race is stationary, while the other is coupled to the rotating assembly. When one of the bearing races rotates, the balls rotate as well. Because the balls are rolling, their coefficient of friction is substantially lower than if two flat surfaces were moving across one other.Selecting a ball bearing with minimum inner diameter of 30mm, minimum load carrying capacity of 50kg radially and speed greater than 100 r.p.m.

Bearing selected - SKF 6006 open deep groove ball bearing

15x30x13mm
Inside diameter: 15 mm
Outside diameter: 25 mm
Width: 13 mm

3.4 2D Drawing AUTOCAD

1) Frame:

The frame is designed as shown below. The frame is designed for a height of about 710mm and is made up of Mild Steel material. The handle is made parallel to the body of the trolley so that the trolley can be inclined to any angle. The base of the trolley is welded and it is made up of Mild Steel material.

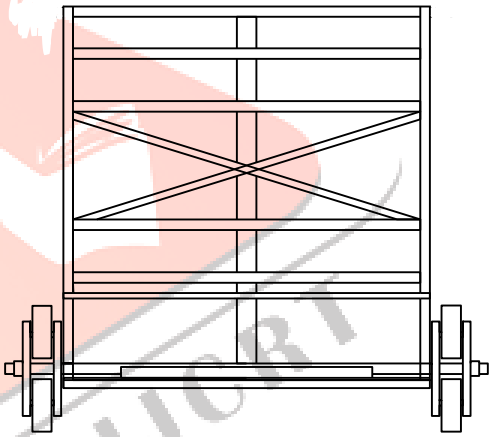

Fig. 3.4.1: Frame

2) Tri-Lobe Wheel Setup:

The Tri-Lobe clamp is used to secure the wheels together. It is difficult to ascend the stairs with a single wheel. The wheels are clamped between the two clamps and secured using nuts and bolts. The wheels are attached to each of the clamp's arms, and when the Tri-Lobe configuration climbs the steps, it spins when it reaches the stairwell's edge. The Tri-Lobe is made by a gas cutting method.

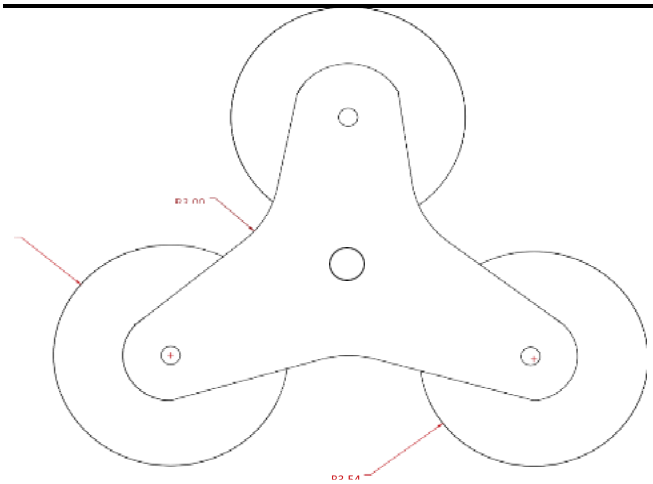

Fig. 3.4.2: Tri-Lobe Wheel

3) Final Assembly Of Trolley:

The final assembly of the trolley is done as shown below. The wheel setup and the shaft assembly are assembled to the body of the trolley with the help of bearing. Here, ball bearing is used. Now the sprockets are connected to the solid shaft and motor shaft with the help of chain drive. As the motor rotates, the shaft and Tri-Lobe assembly rotates with the help of the chain drive mechanism.

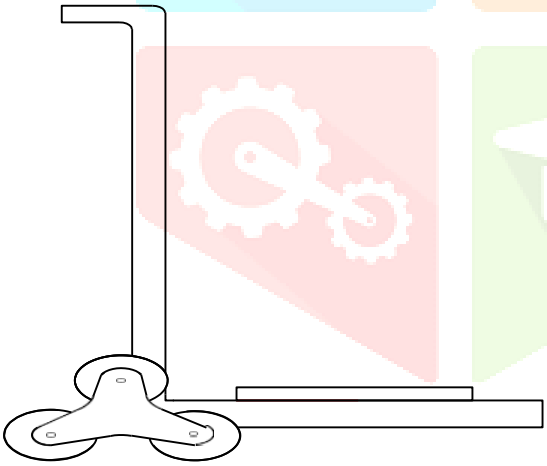

Fig. 3.4.3: Final Assembly of Trolley

3.5 3D DRAWING AUTO INVENTOR

Tri-Lobe Assembly

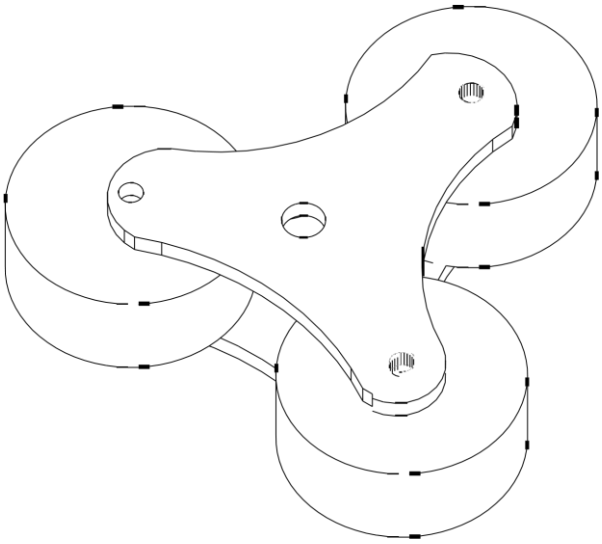

Fig. 3.5.1: Tri-Lobe Assembly

4. ANALYSIS

STRESS ANALYSIS

1) Static Structural Analysis of Clamp:

The design of the clamp was analysed using static structural analysis. The hub of the clamp was fixed to the Solid shaft by welded joint. Based on the overall result of this analysis, we can conclude that the clamp design is safe. Fig.: Static Analysis of Clamp (Von Mises Stress) Fig.: Static Analysis of Clamp (Max Principle Stress)

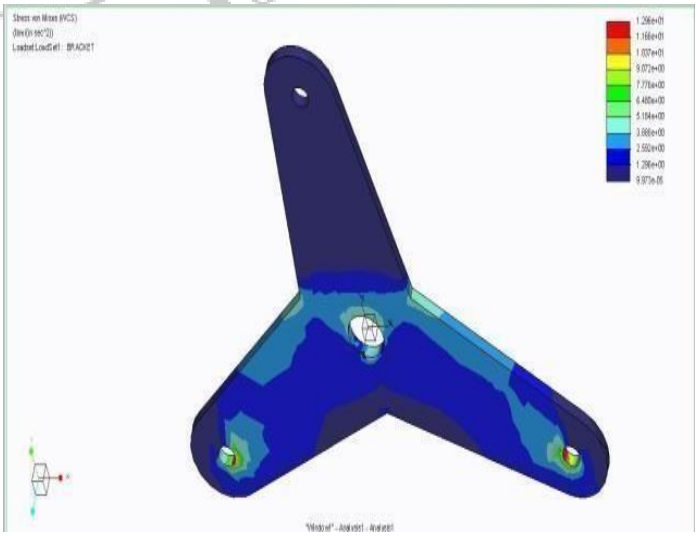

Fig. 4.1: Static Analysis Of Clamp (Von Mises Stress)

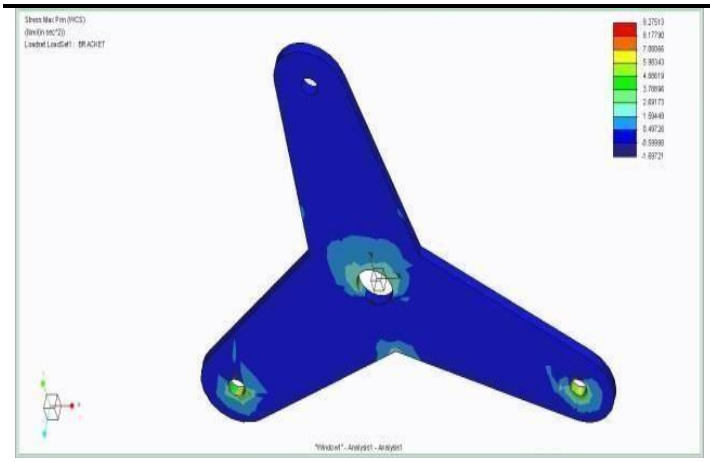

Fig. 4.2: Static Analysis Of Clamp (Max Principal Stress)

2) Static Structural Analysis of Solid Shaft:

The Solid shaft is fixed to the body frame with the help of bearings. Two ball bearings are used to connect shaft with frame and the load is acts through it to shaft. The ends of the Solid shaft are fixed to TriStar wheels. The result of static analysis of Solid shaft is shown below.

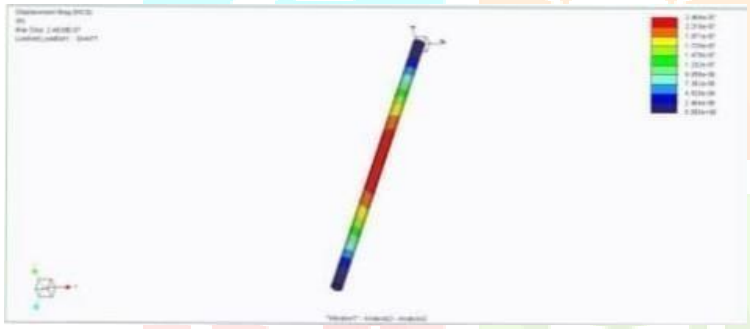

Fig. 4.3: Static Structural Analysis Of Solid Shaft

5. RESULT

The objective of the study is as guideline for producing product. It refers to the problem statement that occurs to find a solution to the problem.

- Innovating trolleys of gas cylinder to go upward and downward the stairs.
- Add safety features at trolleys.
- Save manpower to go up and down the stairs.
- Trolley can protect people from back injury.

We have added a circular stand on trolley on which cylinder fitted and circular stand also eliminates accidents during climbing stairs.

6. MATERIAL USED

A. Mild Steel – It is a type of steel which contains less amount of carbon in it. It generally ranges from 0.05% to 0.25% of carbon whereas others contain carbon from 0.3% to 2%.

B. Steel Plate – For the trilobe of the wheel we used steel plates, for its mechanical properties such as its tensile strength which ranges from 400 to 550 MPa, yield strength is minimum of 250 MPa, Elongation for 8 inch is 20% min., for 2 inch is 23% min. for steel plates and bars. For shapes and parts it is 20% and 21% respectively.

C. Nut And Bolt – Nut is a fastener which has a thread hole. Nut is always used with a bolt to fasten multiple parts together. They are used together for their thread friction.

7. TOOL USED

A. Hand Grinding Machine
B. Welding Machine
C. Drilling Machine

8. CONCLUSION

The main strength of the project is a stair climbing mechanism for a load carrier that takes less effort. Although this project has substantial limitations in terms of building strength and design, it may be considered a tiny step forward in the field of stair climbing vehicles. The initial cost of the project looked to be higher, but more accurate production will minimise this. If this gadget can be completely automated and made at a low cost, its adoption will be astounding. Better results with less effort have always been the major ambition of humans in every industry. Stair climbing trolleys can be used to convey items, books, food grains, and boxes above ground level, as well as patients to transfer from ground level to upper level when lifting facilities are not available. It can also transfer upper levels via steps or work on highly uneven and rocky terrain, minimising manpower and time required to lift the weight.

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