

# DESIGN AND FABRICATION OF STAIR CLIMBING TROLLEY

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**Abstract** - This project aims at making headway for developing a mechanism for transportation of considerable loads over stairs. The requirement for such a trolley emerges from everyday prerequisites in our general public. Hand trolleys are used to lessen the stress of lifting while moving it on flat ground; however, these hand trolley usually fail when it comes to shifting the load over stairs. This project endeavors to design a stair climbing trolley which helps anyone to carry heavy objects up the stairs with less struggle compared to carrying them physically. Several designs were formulated that would allow a non-industrial hand trolley to travel over stairs which reduce the struggle on the user. In this project, the trolley is equipped with Tri-Star wheels which entitle us to convey load up and down the stairs.

**Key Words:** transportation, trolley, lifting, struggle, tri-star wheel, stairs

## 1. INTRODUCTION

The project aim is to design and manufacture a trolley that has multifunction. The trolley is modeled in such a manner that it has tri wheels on every facet that enables shifting the load over stairs. They are set in a triangular shape. This theory concentrates on the maximum intense ergonomically useful to man or woman. The existing challenge related to load wearing equipment of a type that is operated by the hand of shifting upwardly and downwardly on a flight of stairs. Load service is a wheeled mechanism device, is commonly used to hold loads. Its miles is to reduce human efforts.

## 2. TRI-STAR WHEEL

A Tri-Star wheel capability as an ordinary wheel on the flat ground, but has the potential to climb robotically whilst an impediment to rolling is encountered. This wheel configuration contains three tires, every established to a separate shaft. These shafts are positioned at the vertices of an equilateral triangle. While geared on this quasi-planetary style, these triangular sets of wheels can negotiate many kinds of terrain. They can also permit a vehicle to climb over small obstructions inclusive of rocks, holes, and stairs.



## 3. Material Selection

### 3.1 Trolley body

Mild steel is the most well-known type due to the fact its price is tremendously low even as it affords material properties that are best for plenty applications, greater so than iron. Low-carbon metallic includes approximately 0.0503 percentage carbon making it malleable and ductile. Mild steel has a relatively quite low tensile strength, but it is cheap and malleable; surface hardness can be increased through carburizing.

### 3.2 Tri-Star wheel web

Stainless Steel Grade is material with a higher chromium and lower carbon content. Lower carbon minimizes precipitation due to welding and its susceptibility to intergranular corrosion. Therefore, this combination can be utilized as a part of the as-welded condition, even in corrosive conditions. It regularly gets rid of the necessity of annealing weldments besides for applications specifying strain remedy.

### 3.3 Bearing

The most common material used to produce bearing is Chrome Steel. A ball bearing is a sort of rolling-detail bearing that makes use of balls to hold the separation among the bearing races. The reason of a ball bearing is to lessen rotational friction and aid radial and axial loads.

## 4. MANUFACTURING PROCESSES

### 4.1 Gas cutting (Oxy-Fuel cutting)

Oxy-fuel cutting is a value-effective approach of plate edge preparation. The oxyfuel gas cutting process creates a chemical reaction of oxygen with the base metal at elevated temperatures to sever the metal. We've used this reducing to reduce the measured lengths of mild steel pipes and flat bottom plate as in step with our design and necessities.

### 4.2 Pipe bending

Tube bending as a technique starts off evolved with loading a tube right into a pipe bender and clamping it into region among dies, the clamping block and the forming die. The tube is also loosely held through two different dies, the wiper die and the strain die. The system of tube bending involves the

usage of mechanical pressure to push pipe or tubing against a die, forcing the pipe or tube to conform to the form of the die.

### 4.3 Plasma arc cutting

Plasma cutting is a method this is used to cut metal and other metals of different thickness and now and again different substances, using a plasma torch. In this system, an inert gasoline is blown at excessive speed out of a nozzle at the identical time an electrical arc is shaped through that fuel from the nozzle to the floor being cut, turning some of that fuel to plasma. The plasma is adequately hot to melt the metallic being reduce and movements sufficiently speedy to blow molten metal far away from the cut.

### 4.4 Arc welding

These processes use a welding power supply to create and keep an electric arc among an electrode and the bottom to soften metals at the welding factor. They could use both direct (DC) and alternate (AC) cutting-edge, and consumable or non-consumable electrodes. The welding place is every so often included by some sort of inert or semi-inert gasoline, referred to as a protecting gas, and filler material is sometimes used as nicely.

## 5. DESIGN SPECIFICATION & DESIGNED MODEL

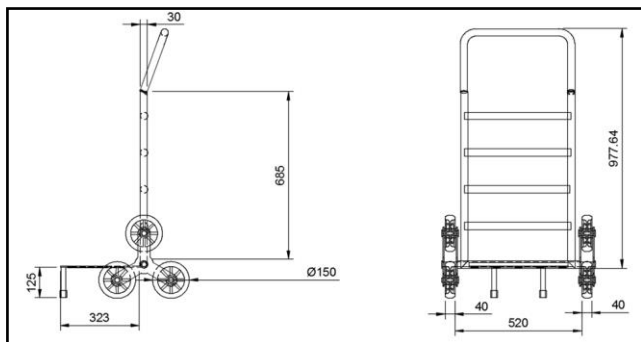
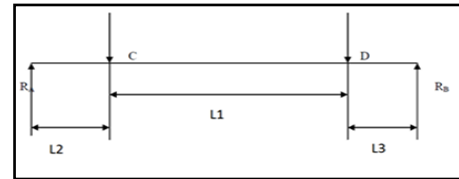


Fig -1 Assembly design with dimensions in mm



Fig -2 Designed & Rendered Model

## 6. CALCULATION



$$L_1=520\text{mm}, L_2=40\text{mm} \ \& \ L_3=40\text{mm}$$

$$F=100+100=200 \text{ Kg}$$

$$\text{Therefore, } 100 \times 9.81=981 \text{ N}$$

Under equilibrium condition sum of all vertical forces is zero

$$R_A - 981 - 981 + R_B = 0$$

$$R_A + R_B = 1962 \text{ N}$$

Taking moment about A ( $\sum m_A = 0$ )

$$(R_A \times 40) + (981 \times 560) - (R_B \times 600) = 0$$

$$R_B = 981 \text{ N}$$

$$R_A = 981 \text{ N}$$

Bending moment at A = 0

Bending moment at B = 0

$$\text{Bending moment at C } 981 \times 40 = 39240 \text{ N mm}$$

$$\text{Bending moment at D } 981 \times 40 = 39240 \text{ N mm}$$

Considering the maximum bending moment

$$M = (\pi/32) \times d^3 \times \sigma_b$$

$$\sigma_b = \sigma_{yt} / \text{factor of safety}$$

For Yield Stress for Stainless Steel,  $\sigma_{yt} = 1300 \text{ N/mm}^2$

$$\text{Therefore } \sigma_b = 1300 / 3 = 433.3 \text{ N/mm}^2$$

$$39240 = \pi/32 \times d^3 \times 433.3$$

$$d = 9.749 \text{ mm say } 10 \text{ mm}$$

(Considering F.S. = 3) (From data book)

$$d = 10 \text{ mm}$$

∴ Diameter of pipe needed to withstand load = 10 mm

## 7. CONCLUSIONS

This project is for building up a trolley for easy transportation of overwhelming burdens over stairs. The requirement for such a framework emerges from ordinary prerequisites in our public. It may be considered as small contribution to our society for domestic motive to boost the loads through domestic load carrier trolley. This trolley runs over the steps very easily.

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