

DESIGN AND FABRICATION OF LOAD CARRIER TROLLEY

Gaurav Lodaya,¹ Nagsen Ingle², Akash Todkar³

¹BE Student, Department of Mechanical Engineering, College of Engineering Shegaon

²BE Student, Department of Mechanical Engineering, College of Engineering Shegaon

³BE Student, Department of Mechanical Engineering, College of Engineering Shegaon

¹lodayagaurv@gmail.com

²nagseningle@gmail.com

²todkar.akash@gmail.com

Abstract- This paper deals with the designing and production of a trolley, which could climb stair. The technical troubles in designing of this trolley are the steadiness and velocity of the automobile at the same time as climbing stairs. However, the steepness of the stairs is likewise the vital concern of this examine. The want for this sort of machine arises from every day requirements in our society. Devices which includes hand trolleys are used for easy lifting of load on flat ground however, these trolleys typically fail when it comes to wearing the weight from ground to ground through stairs. Inside the situation of this, the challenge attempts to layout a stair mountaineering trolley which can bring heavy objects up the steps with less effort as compared to wearing them manually. In our challenge, the trolley is prepared with tri-star wheels which permit us to hold load up and down the stairs. It also eases the movement of trolley in irregular surfaces like holes, bumps, and many others. This trolley is the hybrid of hand trolley and stair mountain climbing trolley which may be utilized in each functions i.e. Sporting load on equal ground in addition to wearing load from stairs.

Index Term –Mechanical Trolley, Induction Motor, Bearing

I. INTRODUCTION

Lifting heavy loads like cabinet, fridge, washing machine. Up to 150 kg isn't clean job, especially where there are no lifting facilities (elevator). Furthermore, in maximum of the Homes inside the rural areas does now not have elevators or escalators. In this example human labours are considered to be the only solution. Labour is becoming highly-priced each day, wherein increase rate is decreasing. This problem may be solved if a trolley can raise hundreds whilst traveling through stairs. The task introduces a new hybrid for the transportation of the masses over the stair in vertical function and cargo on identical floor horizontally. Maximum of the homes of the agricultural areas are structurally congested and unviability of elevator facility so it's miles difficult and onerous to raise up heavy loads from ground to floor. The stair mountaineering trolley can play an vital position in those areas to raise loads over a stairs, like colleges, hospitals, and in family motive. The car, that could pass higher level thru strain, or run in very rough and rocky surfaces, is called stair mountain climbing trolley. Many elements are taken into consideration at the same time as designing these trolleys, whilst protection and luxury is taken into consideration as fundamental thing for the person that will pull this trolley. This

trolley has braking gadget with peak adjustment association and it'll be used as hand truck also after converting it into horizontal trolley with suspension system furnished to the shaft for soaking up jerks produced while transferring the trolley on stairs. Further detail is discussed in beneath chapters.

1.1 Necessity

In this “Domestic Load Carrier Trolley” the aim of this project is to shift domestic load from one floor to another floor with less efforts and to design a trolley with low cost so that it may be used in rural areas by each and every one.

1.2 Objectives

- 1) To reduce the person energy and efforts for heavy home load shifting through stairs.
- 2) Make contributions this work to society.
- 3) Trolley that may be used for stair mountain climbing in addition to hand trolley at the identical ground

II. LITERATURE SURVEY

Md. A. Hossain, Nafis A. Chowdhury, Rubaiat I. Linda in Jan-2010 have concluded that in the initial design, every wheel contained frame, a solar wheel and three planetary wheels. The planetary wheel was linked with the solar wheel via an idler. The reason of the usage of the idler became to rotate the planetary wheels within the same path of sun wheel. Every planetary wheel became aligned in an instantly line with loafer and sun wheel. The directly wheel body takes more thrust to tilt the wheel body to engage subsequent planetary wheel. The length of every arm is excessive and for this reason creates vibration and the automobile would be unstable. In the gift layout, the wheel frame turned into made curve in order that the front floor of the arm couldn't collide with the threshold of the stair.

Mr. Pratik H. Rathod, Mr. Ravi R. Mishra, Mr. Nitin A. Waghmare in Sept 2013 have researched that stair climber trolleys have a total of six wheels, 3 on each facet. They're set in a triangular sample. The uppermost wheel rests at the top step, with the alternative two wheels set at the decrease step. This allows you to apply leverage as you pull the trolley up a fixed of stairs. Though this undertaking had a few challenge as a primary step of creating any stair mountain climbing hand truck, it became a pioneer venture. At some stage in the check run of this assignment, it was realized that it would capable of carrying heavy load with out suffering any deformation or neighborhood fractures if it might go into real international manufacturing at a great scale. Though the initial cost of the project seemed to be higher but more accurate manufacturing would shorten this.

Prajan Pradip Gondole, Kamlesh Diliprao Thakre in April-2015 have concluded that the stair-climbing hand truck is designed to reduce liability rather than increase it. Conventional hand trucks work well on flat ground, but their usefulness decreases when it

becomes necessary to move an object over an irregular surface. Package deliverymen, for example, often find it necessary to drag loaded hand trucks up short flights of stairs just to reach the front door of a building. The entire purpose of using a conventional hand truck is to avoid having to lift and carry heavy objects around.

III. COMPONENTS USED IN DOMESTIC LOAD TROLLEY & ITS SPECIFICATION

It consists of the following points

3.1 Domestic trolley chassis and material specification

The chassis is made of a base plate of cast iron and hollow rectangular rods of cast iron vertically welded on the base plate, same hole square pipes are used to make a square frame which is used to assist the base plate from the bottom aspect for the safety while carrying load on it.

i) Details of domestic trolley chassis

i) Base plate thickness with square frame support: - 20mm

ii) Square pipe size: - 1 inch i.e. 25.4mm

iii) Square pipe length fixed: - 1066.8mm

iv) Square pipe length adjustable: - 762mm

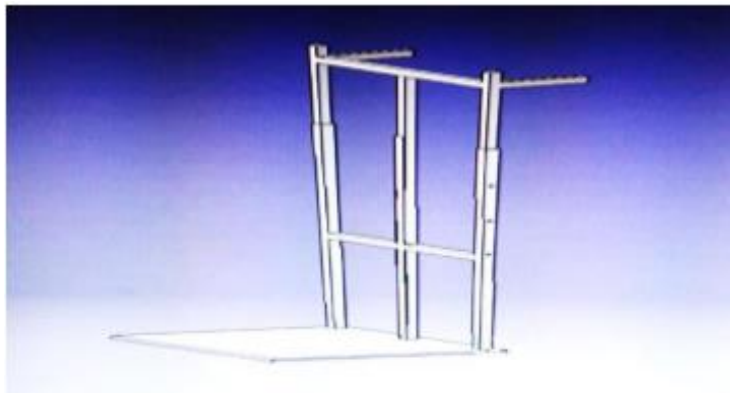


Figure 3.1: Catia design of chassis

3.2 Bearings

Here two pillow block bearings are used for holding shaft with chassis from both ends. This bearing will supply friction much less movement to the shaft as to reduce the power required to tug or push the trolley over the steps.

Specification of bearings.

- i) Model no :- FFX- UCB 204
- ii) Type:- ball bearing
- iii) Bore diameter:- 20mm



Figure 3.2: Bearing.

3.3 Wheels

Here we have used 6 wheels in pair on 3 each with quasi –star frame on both side of chassis fitted with bearing inside the bore of wheel to get friction free movement of wheels.

Specification of wheels

- i) Material:- polypropylene co-polymer wheels
- ii) Diameter:- 150mm
- iii) Thickness:- 40mm
- iv) Bearing used:- ball bearing



Figure 3.3: wheels.

3.4 Supporting wheels

We have used two supporting wheels, they support and give direction to the trolley when it is in horizontal position.

Specification of supporting wheel

- i) Wheel diameter- 63.5mm
- ii) Material – synthetic hard
- iii) Metal casing is used to support the wheels and one fixing socket is provided



Figure 3.4: Supporting wheel

3.5 Quasi-star frame

This body is designed as per stairs are involved, in order that each wheel have an angle of 120 degree between them for easy operating over the steps. Right here curved shape is given to frame with gas slicing in order that it must not impact on stairs while moving up or down.

Specification of quasi-star frame

- i) Material:- cast iron
- ii) Thickness:-2mm.
- iii) Angle between two wheels:- 120 degree



Figure 3.5: Quasi-star frame.

3.6 Ratchet and pawl (brake system)

This system is used for applying brake to the shaft while moving on stairs, while pawl locks one direction with spring tension and other direction is used for motion. Now we have provided an arrangement of brake lever at handle of trolley that will pull the pawl to unlock the second direction

Specification of ratchet and pawl

- i) Material of ratchet:- cast iron
- ii) Material of pawl:- cast iron

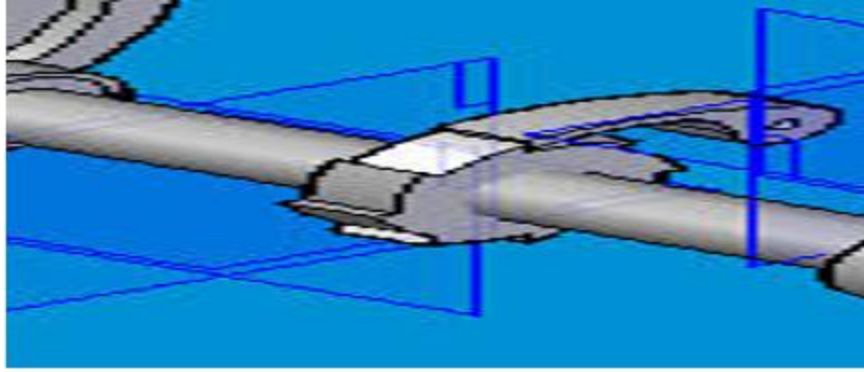


Figure 3.6: Ratchet and pawl.

3.7 Belt system

We have 2 preparations of belt one is at decrease element and one is at top part for fending off the slipping of item at the same time as carrying it from one region to some other. It additionally have lock gadget for tightening and loosing of belt

Specification of belt

- i) Material:- nylon belts
- ii) Clip material:- plastic clips



Figure 3.7: Belt system.

3.8 Shaft

We have designed the shaft for load capacity of 150 kg. Hollow shaft is used for more rigidity.

Specification of shaft

- i) Outer diameter of shaft: - 19.5mm
- ii) Length of shaft: - 609.6mm

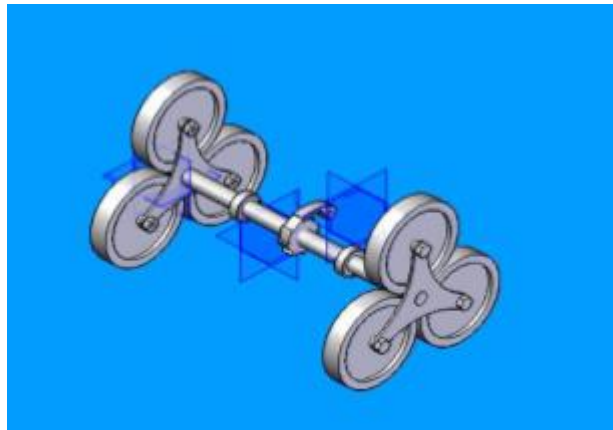


Figure 3.8: Shaft arrangement

3.9 Leaf spring

This spring is used to soak up the shocks produced even as transferring upward and downward over the steps for growing the safety of the object which is being carried at the trolley

Specification of leaf spring

- i) Material: - plain carbon steel



Figure 3.9: leaf spring.

IV. METHODOLOGY OF DESIGN OF AXLE

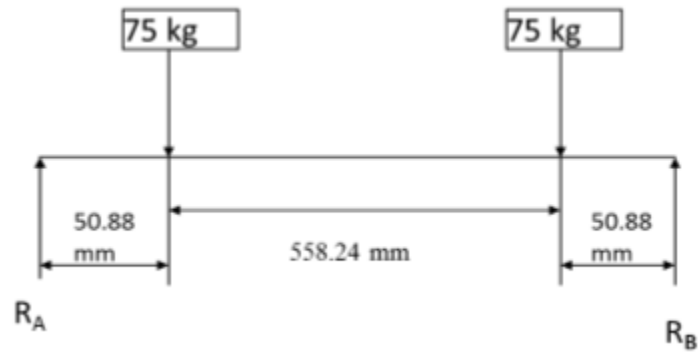


Figure 4.1: force diagram.

$$F = 150 \text{ kg} = 1471.5 \text{ N}$$

Under equilibrium condition sum of all vertical forces is zero, Calculation of end reaction at support-

$$R_A - 735.75 - 735.75 + R_B = 0$$

$$R_A + R_B = 1471.5 \text{ N}$$

Taking moment about A

$$\sum m_A = 0$$

$$(735.75 \times 50.8) + (735.75 \times 609.2) - (R_B \times 660) = 0$$

$$R_B = 735.75 \text{ N}$$

$$R_A = 735.75 \text{ N}$$

Where,

R_A - vertical reaction at A R_B - vertical reaction at B Shear Force calculation S.F at A = 1962 N

$$\text{S.F at C \& D} = 0$$

$$\text{S.F at A \& B} = 735.75 \text{ N}$$

$$\text{Bending moment at A} = 0$$

$$\text{Bending moment at B} = 0$$

Bending moment at C $735.75 * 50.8 = 37376.1 \text{ N mm}$

Bending moment at D

$735.75 * 50.8 = 37376.1 \text{ N mm}$ Considering the maximum bending moment

$M = \pi/32 * d^3 * \sigma_b$ $\sigma_b = \sigma_{yt} / \text{factor of safety}$

For cast iron Yield Stress $\sigma_{yt} = 570 \text{ N/mm}^2$

Therefore, $\sigma_b = 570 / 3 = 190 \text{ N/mm}^2$ $37376.1 = \pi/32 * d^3 * 190$

$d = 12.60 \text{ mm}$ say 15 mm

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

$d = 15 \text{ mm}$

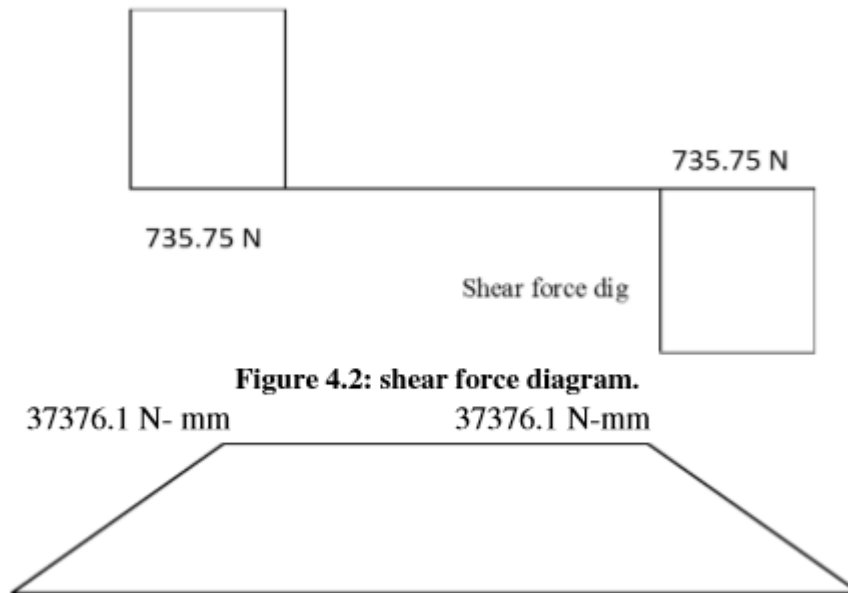


Figure 4.3: Bending moment diagram.

Coefficient of rolling resistance $[C_{rr}] = (0.0048)$

$(18/D)^{1/2} (100/W)^{1/4}$

Where,

D = Diameter of the rolling wheel in inches

W = Load acting normal to the wheel on the frame

In lbs.

Rolling Resistance $[F] = (W.Crr)/R$

The diameter of the wheel = 15 cm

= 5.90 in

The maximum load acting normal to the

Base plate = 150 kg

= 330.69 lbs.

$Crr = (0.0048) (18/D)^{1/2} (100/W)^{1/4}$

$Crr = (0.0048) (18/5.90)^{1/2} (100/330.69)^{1/4}$

$Crr = 0.00621$ $F = (330.69 * 0.00621) / 2.95$

$F = 0.696$ lbs $F = 0.315$ kg

$F = 3.090$ N

Rolling resistance determines the stability of rolling wheel.

IV ASSEMBLY OF TROLLEY

I) First off base plate is reduce into required dimension of 5486. 4mm x 6096mm i. E. Period x width.

II) Then three rectangular bars are taken of duration 1066. 8mm and welded on body as in step with requirement and rectangular body is welded underneath the bottom plate.

III) Then top transferring arrangement is completed through presenting the drills at zero. 5 foot on vertical fixed square bars and movable bars are welded with each other to shape a inflexible handle.

IV) Then quasi star frame is cut with the assist of gasoline cutting and drills are executed on the plates in order that bolt ought to be surpassed to preserve the wheel in between two frames. Two pairs of quasi famous person wheels are prepared and they're welded on the give up of shaft by way of using arc welding.

V) Two leaf springs are welded on corner vertical rectangular rods and pillow bearing is geared up with the assist of nut and bolts at the centre of leaf spring.

VI) One ratchet is welded at the centre of the shaft and pawl is constant on vertical rectangular rod with spring anxiety in it.

VII) One brake lever is to be outfitted on right aspect of deal with so as to work as take hold of to free the route of the trolley.



Figure 5: Overall view on trolley as vertical and horizontal.

VI. RESULT AND DISCUSSION

We have tested the trolley by lifting exceptional household components, output has come as easy transporting components through stairs as much as 150 kg and while horizontally trolley can convey up to 100 kg effortlessly on the ground floor itself. As load varies energy required to raise the factor additionally varies but it reduces the person required to raise the aspect as nicely as it lessen the time require to carry the load as a consequence it reduces the labour value for transferring the family material.

VII. CONCLUSION

Though this assignment had a few barriers regarding the electricity and constructed of the structure, it may be taken into consideration as small contribution to our society for domestic motive to raise the masses through domestic load carrier trolley. This trolley runs over the stairs very smoothly and in destiny it may be made fully computerized and may be used industrial reason.

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