Design and Fabrication of Stair Climbing Trolley

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Abstract- *Trolley is generally use for the carrying heavy weights with the help of less human effort. The manufacturing of the trolley deals with proper design, accurate fabrication and prescribed analysis using finite element software gives better motion which resist to high load by applying less effort this paper deals with manufacturing of such stair climbing trolley with simple mechanism(i.e. ratchet mechanism) initially the model is sketched using solid works and imported into ANSYS software for structural analysis used to find von-mises stresses under load which deals to fabricate trolley with better performance under heavy duty with less effort.*

Keywords- stair climbing, Dolly, hand trolley

I. INTRODUCTION

A hand trolley is a small transport device used to move heavy loads from one place to another. It is a very common tool used by a large number of industries that transport physical products. Also called a hand truck or a dolly, the hand trolley is often used by stock persons who arrange and restock merchandise in retail stores. When used properly, trolleys can protect people from back injuries and other health problems that can result from lifting heavy loads. A typical hand trolley consists of two small wheels located beneath a load-bearing platform; the hand trolley usually has two handles on its support frame. These handles are used to push, pull and maneuver the device. The handles may extend from the top rear of the frame, or one handle may curve from the back. An empty hand trolley usually stands upright in an L-shape, and products are usually stacked on top of the platform. When the goods are in place, it is tilted backward so that the load is balanced between the platform and the support frame. Especially if heavy or fragile materials are moved, the person operating the trolley should return it to an upright position carefully, to insure nothing falls off the platform. The front of the frame may be squared off for boxes or curved for drums and barrels. Sometimes, a hand truck also has straps for securing loose freight during transport. Professional material handlers prefer to use a hand truck when moving stackable items such as boxes, crates or packages. Heavier items are usually stacked on the bottom of the hand truck, with lighter objects saved for the top. Hand truck users must be careful not to stack it so high that their vision is blocked or the load becomes unstable. Generally, it is safe to load a hand truck to the level of its handles or the top of the frame. The load is then shifted onto the wheels with a backwards lifting motion. The user can maneuver the cargo by steering it left, right or forward. The main objective of the project is to find an efficient and user friendly method of carrying various objects through stairs using minimum effort from the user and to also provide a smooth movement while climbing the stair.

II. LITERATURE REVIEW

Many researchers performed various experimental investigations on stair climbing vehicles such as trolley, trucks, chair for handicapped person, forks etc. it requires an in depth study of maximum load acceptable for a cabin and how stress transferred to wheels alignment.

Pratik H. Rathod et al. [1] designed and fabricated a hand truck which climb stair with less effort which is useful for library, hospital, regular goods carrier etc. the main modification in this truck where made at wheels using plat surface roller plat attached instead of traditional wheel frame. The mechanism based on retched arrangement mechanism. The maximum bending moment was calculated. The inclination of 44 degrees plays a major role which covers more than 90% of all stairways within this limit. There is an optional maximum inclination warning alarm that alerts the operator of an inclination of more than 44 degrees. When truck operated with exceeding the limit there should be taken the necessary safety precautions.

Md. A. Hussain et al. [2] designed and manufactured a stair climbing vehicle using modified form of frame arrangement i.e a curved wheel frame which move on rough surface. To address several technical issues in designing this vehicle is stability and maintain high speed at vehicle wheel arrangement while climbing stairs. The frame arrangement consists of sun. planetary, idler wheel which are assembled to

the shaft which reduces application of load. However, the steepness of the stairs is also the important concern of this study. The vehicle has four set of wheels arrangement to support its weight when it moves over the flat terrain. Each wheel frame consists of three sub-wheels attached with the sun wheel through three idler gears.

III. METHODOLOGY

The mild steel frame with square cross section are welded to form as a trolley using wheel additional setup three in number forming an equilateral shape on both ends of the trolley.

The fabrication is made using design and modeling sketched in SOLIDWORKS software. Analysis is done on the trolley to find Von-mises stresses and deformation to find out the failure criteria on entire trolley setup. The number of nodes and elements formed by meshing component gives the fine analysis requirement.

The step by step procedure made for design and analysis of stair climbing trolley is manufactured by following procedure is represented below:

Identify the Specifications of parts assembled to form a trolley. Make sure about cost estimation for trolley components. Planning and designing for fabrication procedure to be performed.

Sketch the trolley in draft and model software and analysis of entire working model.

SL. NO	COMPONENT	QUANTITY	SPECIFICATION	
1	UCF Bearing	2	UCF ID 25 mm	
2	MSSheet	4	14×14 inch 16 gauge	
3	SquareRod	1	40×40 mm	
4	AxialShaft	1	25 mm Q polish shaft	
5	Square Rod	1	25×25 mm	
6	Wheels	6	OuterDiameter is160mm,	
7	Washers	12	25mm	
8	Nut&bolts	12	14mm	

A. Proposed work

a. The develop a mechanism for easy transportation of heavy load over stairs

b. They can only move on flat surfaces and moving them over a staircase is a very hectic task.

c. This mechanism allows for efficient stair climbing functionality.

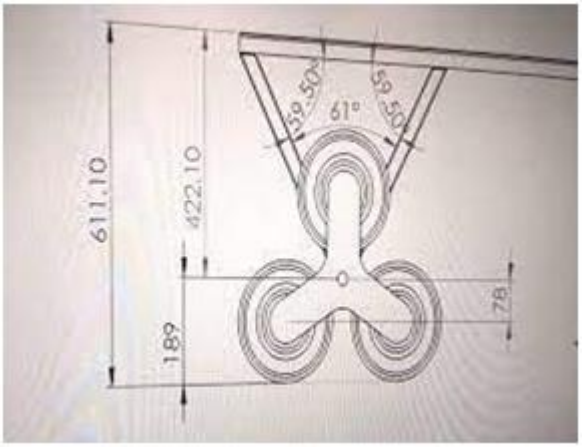
d. *Stair climbing is a low-cost and readily accessible form of exercise that provides a series of health benefits if we do it everyday.*

IV. RELATED WORK

A. Facilities available:

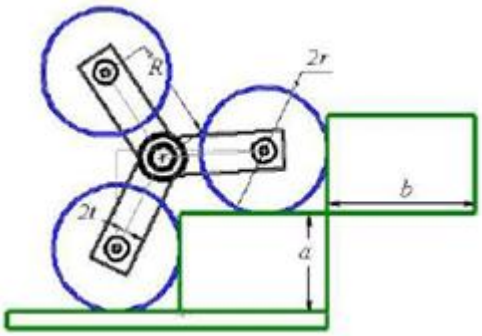
The following facilities are available to carry out Project work at Sharad Institute Of Technology Polytechnic, Yadrav (Ichalkaranji)

- Library facility at Sharad Institute Of Technology Polytechnic, Yadrav
- Adequate workshop, laboratory and computing facilities at Sharad Institute of Technology Polytechnic, Yadrav .
- Software packages available at Sharad Institute of Technology Polytechnic, Yadrav .
- For Modelling:



- **Expected date of completion of work:**

Phase-I-15/11/2021
Phase-II-24/3/2022
Phase-III-18/04/22



B. **Approximate expenditure:**

Part	Quantity	Price
wheel	06	1200
shaft	01	300
Cotterpin	06	100
Weldingcost	01	1000
BallBearing	20	800
Sheet	4	1200
Square rod	2	1500
Total	40	6100

IV. CONCLUSION

The stair climbing trolley is tested under various loads upto designed load, the project worked satisfactorily. The materials used can be alloys to reduce weight. As far the commercial aspects of this product are concerned Presently, there are no competitors for such a kind of product in our market.

V. FUTURE SCOPE

In future it can be modified to Hydraulic lifting mechanism. By using motors with high torque and speed we can increase the working speed of the machine. By using sensors and buzzers its safety features can be improved in future. By making some inversions it can be developed in future to iron all type of cloths.

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