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# DESIGN & FABRICATION OF STAIR CLIMBING TROLLEY

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**ABSTRACT**

Local Goods transportation generally depends on manual trolleys which are used in ware houses, construction sites, malls, residential relocations etc. These trolleys when they are used on staircases have some severe limitations so here we propose a smartly designed stair case climbing trolley. This stair case climbing trolley which is to be used to carry goods up and down on stair cases easily. The design of stair case climbing trolley is prepared using CATIA-V5 prototype is prepared using rapid prototyping machine and working model is prepared finally. The trolley makes use of triple interlinked wheel arrangement that allows it to do so. The mechanism uses a trolley with a support wheel arrangement which will be used for support when at rest and will be suspended in air while the trolley is moved by lifting it. The interlinked wheel mechanism consists of 3 such connecting shafts for each wheel with a main rod connecting through a free moving bearing mechanism to the three rods. The mechanism allows for efficient stair climbing functionality.

## 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.

Machine description: -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 ensure nothing falls off the platform. The front of the frame may be squared off the boxes or curved for drums and barrels, sometimes a hand truck. Also has a strap for securing loose freight during transport.

## MATERIALS & METHODS

### TYPES OF TROLLEY: -

Different types of these trolleys exist, and the type used is often chosen based on what type of material it will move. Hand trolleys are made of various types of hard materials, including steel aluminum and high impact plastic. Most hand trolleys come in standard sizes and are used for general loads, but there are some that are specifically designed for very small or large products.

Wheeled trolley, Folding trolley, Garden trolley, Kitchen trolley, Sack trolley

### Need for stair climbing trolley: -

Lifting heavy objects to upper stories or lifting patients to upper levels from the ground are not painless jobs, especially where there are no lifting facilities (elevator, conveyer, etc). Moreover, most of the buildings are structurally congested and do not have elevators or escalators. This project can introduce a new option for the transportation of loads over the stairs. The stair climbing hand trolley can play an important role in those areas to lift loads over a short height .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.

### COMPONENTS

Wheels, Bearing, Connecting rod, Goods holder frame, Handle rods, Support rod, Supporting frame, Joints & screws

### Advantages

Easy vertical transportation

Smart approach

Material transport in building

More number of items carry at a time

Less effect to carry goods

Works on both flat and stair case surface.

### Disadvantages

This is not suitable for all types of stairs.

The load is not excited to more than half ton.

Load increases with the applying force

Because there is no visual barrier between the two floors connected by a straight staircase.

**Figure 1: Block diagram of stair climbing trolley**

**Wheel Frame**: A specially designed wheel frame is required to hold the three wheels together on each side of the shaft. In the existing design, the power transmission to the single or double wheel trolley is useless to climb the stairs due to height factor of stairs. The design of the straight wheel frame became more complicated and was needed to be modified with its curved-spherical shape to give proper drive, which creates more frictional force. For these reason, three wheel set on each side of vehicle attached with frame was introduced to provide smooth power transmission in order to climb stairs without much difficulty. Frame arrangement is suitable to transmit exact velocity ratio also. It provided higher efficiency and compact layout with reliable service. Easier maintenance was possible in case of replacing any defective parts such as nut, bolts, washer etc. Computer Aided three dimensional interactive applications is a multi-platform software suite for computer aided design CAD, computer aided manufacturing CAM, Computer –aided engineering CAE, PLM and 3D, developed by the French company Dassault system.

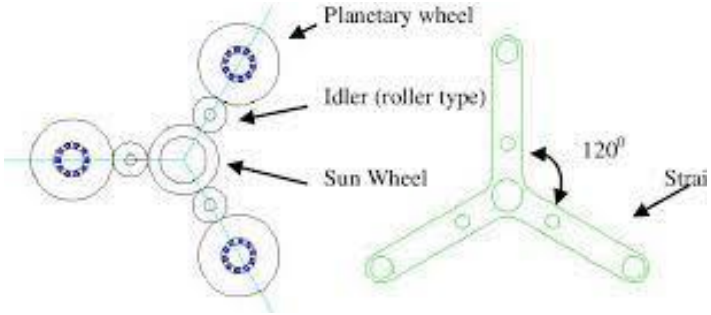


**Figure 2: Straight wheel frame**

**MECHANICAL ENGINEERING**

CATIA enables the creation of 3D parts, from 2D sketches sheet metal, composites, and molded, forged or tooling parts up to the definition of mechanical assemblies. The software provides advanced technologies for mechanical surfacing & BIW. It provides tools to complete product definition, including functional tolerances as well as kinematics definition. CATIA provides a wide range of applications for tooling design for both generic tooling and mold & die. In the case of Aerospace engineering an additional module names the aerospace sheet metal design offer the user combine the capabilities of generative sheet metal design and generative surface design. CATIA offers a solution to shapedesign, styling, surfacing work flow and visualization to create, modify and validate complex innovative shapes from industrial design to class A surfacing with the ICEM surfacing technologies.CATIA supports multiple stages of product design whether started from scratch or from 2D sketches.

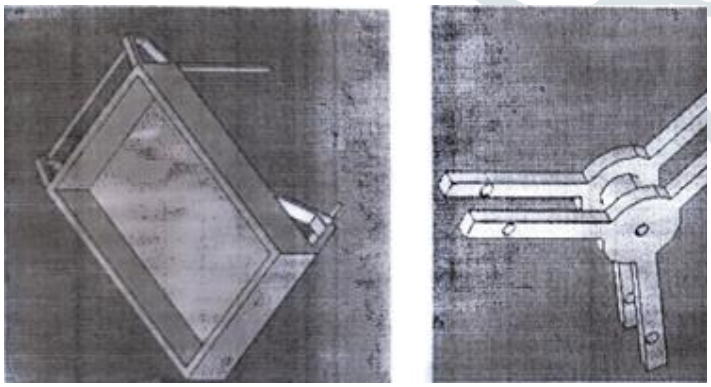

**Figure 3: Design product by CATIA**

**RAPID PROTOTYPING**

It is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three dimensional computer aided design CAD data construction of the part or assembly is usually done using 3D printing or additive layer manufacturing technology.

**Techniques:**

- 3D Printing
- Fused deposition modeling FDM
- Laminated object manufacturing LOM
- Solid ground curing SGC, Selective laser sintering SLS
- Selective lase melting
- Stereo lithography

**3D printing**

3D printing is any of various processes in which material is joined or solidified under computer control to create a three dimensional object with material being added together such as liquid molecules or powder grains being fused together typically layer by layer in the 1990s 3D printing techniques were considered suitable only for the production of functional or aesthetical prototypes and a more appropriate term was rapid prototyping. Today the precision, repeatability and material range have increased to the point that 3 D printing is considered as an industrial production technology with the name of additive manufacturing.3 D printed objects can have a very complex shape or geometry and are always produced starting from a digital 3 D model or CAD file.

**Tube less tires**

Outer diameter =25 cm,

Inner diameter=25 cm.

In some Commonwealth nations are pneumatics tires that do not require a separate inner tube. Unlike pneumatic tires which uses a separate inner tube, tubeless tires have continuous ribs molded integrally in to the bead of the tire so that they are forced by the pressure of the air inside the tire to seal with the flanges of the metal rim of the wheel. No of tires used are 6.

**BALL BEARINGS**

Outer diameter 25 cm

Inner diameter 10 cm

A ball bearing is a type of rolling element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least three races to contain the balls and transmit the loads through the balls.

Mild steel of L Channel, Mild steel of square rod, Mild steel of hollow rod, Mild steel of flat rod, Plywood.

## RESULT AND INFERENCE

After its fabrication, we inferred few limitations like large noise production while moving the trolley up and down the stairs. In order to reduce the noise production the design of the wheel frame is to be modified such that line passing through the mid-point of the trolley wheel should pass through the mid-point of the step.

## CONCLUSION

Though this project had some limitations regarding the strength and built of the structure, it can be considered to be a small step forward as far as stair climbing vehicles are concerned. During the test run of this project, it was realized that it would not be a bad idea to consider this design for carrying heavy loads up the stairs. This product will be well acclaimed if it can be commercialized to suit the needs. Though the initial cost of the project seemed to be higher but more accurate manufacturing would shorten this. AS for the commercial aspects of this project are concerned, if this product can be fully automated and produced at a lower cost the acceptance will be unimaginable. Presently, there are no competitors for such a kind of product in our market.

## References

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