

Design and Development of Staircase Climbing Hand Trolley

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ABSTRACT: This paper is related to design and development of most effective and modified machine that is manually operated mechanical cost-effective Staircase climbing hand trolley. This trolley is used to transport goods especially through the place where normal single wheeled trolley cannot go through like staircases rocks and of course it could also run smoothly on the plain surfaces. Generally, in this world the common trolley systems are been found which is quite common and helps in the transportation of the goods but this innovated idea helps more effortless and smooth transportation of goods on the difficult task like the staircases.

Keywords: Tri-star wheels, hand trolley, stair climbing hand cart, non-industrial trolley.

I. INTRODUCTION:

Transportation of goods is highly dependent on manual trolleys. These are used in warehouses, construction sites, malls, residences etc. When it comes to stairs this trolley has huge limitations. They move on flat surfaces & moving over a staircase is a tedious task. So, we propose a smartly designed staircase climbing trolley.

The trolley is smartly designed to carry goods up and down on staircases as well as on flat grounds and rough terrains. The trolley makes use of a triple interlinked wheel arrangement that allows it to do so. The mechanism uses a trolley with 2 support wheels which will be used for support while climbing the stairs. The interlinked wheel mechanism consists of 3 freely moving wheels which is joined as a pair. This mechanism allows for efficient stair climbing functionality. This functionality allows for easy movement of goods across staircases.

II. LITERATURE ANALYSIS:

To minimize man efforts while carrying the load on stairs, for achieving this objective scope

can be observed by following review of research papers.

1. Analysis of Force on Geneva wheel, the literature explained various stresses on the Geneva wheel. The analysis of stress was by using FEA (Finite Element Analysis). FEA explained a view of stress distribution. The result explained that the deflection was small for the force acting on maximum and minimum position of Geneva wheel. Variation of displacement with the stresses increased non-linearly.

2. Design of stair climbing hand truck, this was also a three-wheel system but the equipment was automated and much more efficient. If the size of stair changes it's difficult to control or handle the equipment

3. Analysis & synthesis procedures for Geneva mechanism design, explained Geneva by analytical method. This showed that the Geneva continued to function well after approximately one billion index cycles. And was known that the most significant criteria on which it depends are max load (bearing life), min contact stress (wear life), and max tip and fatigue life. Results of this paper were built by considering these mechanical parameters.

4. Design of a staircase material handling system or hand truck, this paper was based on a three-wheel staircase lifter design, the wheel was 120 degree apart as most of the stairs are at 44-degree inclination they designed at this particular angle. If the angle was more than climbing was tiring

5. An informational stair climbing intervention with greater effects in overweight pedestrians. This research determined the side effects of carrying load manually at the back or with the hands. It's found that climbing the stairs is a widely accessible activity but consumes 9.6 times the energy used at rest as it involves raising weight against gravity, greater amount of energy expenditure in overweight individuals.

6. Design of a Stair-Climbing Hand Truck, in this if a shaft is supported by two round bearings, it slide & rotate freely. But if a load is applied to the end of the shaft, the shaft will not be able to move as it jam itself between the bearings

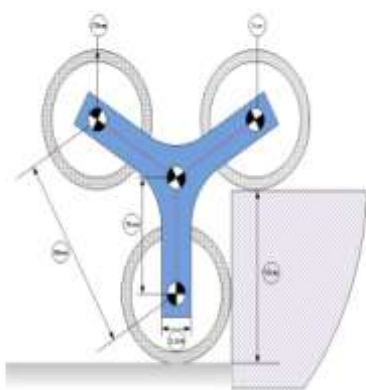
7. Design Optimisation of Worm Gear drive, combined objective function is considered, which improves power and efficiency also reduce weight and centre distance

8. Design and manufacturing of six-wheel Staircase trolley, Professionals didn't manufacture this so it was inaccurate as a result didn't provide the economical results. So, an adequate production will minimise cost and can improvise, some technical issues like stability of this hand cart and speed while in stairs.

9. Design and fabrication of a hand trolley, From this literature we observed that, on flat surfaces the vehicle moved with ease but more difficult in stairs comparatively. The effort wasn't reduced considerably as well as the smooth running was difficult

WORKING PRINCIPLE:

The staircase climbing trolley is designed with a simple chassis and the wheel at an angle of 120 degree each which is assigned to a plate of Y shape and bearings in between which is directly screwed to the chassis and this angle proportional to the length facilitates to rotate the Y shaped plate along with wheels this facilitating good grip and less efforts while climbing the stair.



1. Wheel Measurement



2. wheel Setup



3. Chasis Frame



4. Front View



5.Top view

COMPONENTS USED:

1. Wheels
2. Square pipes for frames
3. Bearings
4. Bolts and Nuts
5. Metal Plates
6. Cast iron strips

APPLICATIONS:

Around Railway Stations- it will help the works of porters.

In construction sites- to transport the essentials.

FUTURE MODIFICATIONS:

1. **Automation-** adding motors and gears can help in reduce the efforts.
2. **More Handy-** a foldable and more compactable design can help in reducing the size

III. CONCLUSION:

The fabrication of stair climbing trolley is in such way that the heavy loads can be carried over stairs as well as flat surface from one place to other place with reduced human effort. This reduces the human effort while carrying heavy loads over stairs and also on flat surfaces and serves more advantages for transporting goods in schools, offices malls through different floors via stairs

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