Design and Fabrication of Pedal Powered Stair Climbing Trolley

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Abstract: This project aims at developing a mechanism for easy transportation of heavy loads over stairs. The need for such a system arises from day-to-day requirements in our society. Devices such as hand trolleys are used to relieve the stress of lifting while on flat ground; however, these devices usually fail when it comes to carrying the load over short fleet of stairs. In the light of this the project attempts to design a stair climbing hand cart which can carry heavy objects up the stairs with less effort compared to carrying them manually. It also endeavours to study the commercial viability and importance of such a product. Several designs were conceived that would allow a non-industrial hand trolley to travel over stairs, curbs, or uneven terrain while reducing the strain on the user. In our project, the trolley is equipped with Tri-Star wheels which enable us to carry load up and down the stairs. It also eases the movement of trolley in irregular surfaces like holes, bumps, etc. Additionally we are included a wheel setup to pedal it on the ground and while climbing stairs the rear wheel is lifted and locked by locking system.

Keywords - Stair, Wheel frame, Shaft, Gear, Peda

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 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. Stair climbing trolley is designed to lift the high weight with less human effort. Stair climbing trolley is designed to movement on uneven surfaces. In pedal powered stair climbing trolley is used to pedal the trolley in normal surfaces in order to push the trolley.

II. LITERATURE REVIEW

Md.A.Hussain A.Chowdhry .rubaiat I .Linda Shamiuzzman Akhtar “Design and Manufacturing of stair climbing vehicle” Published on (January-10, 2010) at International conference of Dhaka. They invented the vehicle which has four set of wheels Arranged to support its weight when it moves over the flat terrain which are widely used in hospitals, library, Industry or transport any toxic material.

Basil Hamed. Designed the stair climbing robot for rescue applications for disaster as well as for urban search and rescue missions. The robot is controlled using PIC 16F877A. The robot systems is implemented by using micro and visual basic programs experimental Trials showed that the implementation of the behaviour control systems was successful.
Roshan Alaspure. Are developed a mechanism for easy transportation of heavy load over stairs. By using this vehicle the labour cost Can be reduce as well as large amount of load can be transfer uniformly will less power consumption. It has designed in such a way that it can be climb a stepped path with its modified wheel structure.

Marissa L. Jacovich. This paper says that the objective of this thesis was to design and test a consumer grade hand truck capable of climbing stairs. The finished prototype was tested with a pay load of approximately 300lbs and it was determined that the hand truck Design using the Blanco strategy in a visible option for a stair climbing consumer product.

III. 3D DESIGN

Fig 3.1 3D Model side view of Pedal Powered Stair Climbing Trolley

Fig 3.2 3D Model Top view of Pedal Powered Stair Climbing Trolley
IV. CONSTRUCTION

Our proposed model “Design and fabrication of pedal powered stair climbing trolley” need so many raw materials which are mentioned.

4.1. Components

- Tri star wheel
- Shaft
- Frame
- Bearing
4.2 Tri star wheel
In our project, we are using this Tri-Star wheel arrangement in a hand trolley in the place of normal wheel setup to enable the trolley to climb up and down the stair cases and also to up come small obstacles like holes and bumps on its path.

4.3. Wheel frame
A special design 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. 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.

4.4. Shaft
Shaft is a common and important machine element in our project. It is a rotating member, in general has a circular cross-section and it is used to transmit power. Mild steel material is used. The shaft specification is Outer diameter: 15mm, inner diameter: 10mm.

4.5 Frame
Frame is used to carry the total setup of arrangement. It has to able to sustain the total weight of the arrangement. It is joined by arc welding to get permanent joint. This frame is very important to our project. The mild steel material is used in our project to make frame rectangular type is used in our project.

4.6. Cycle wheel
A bicycle wheel is a, most commonly a wire wheel, designed for a bicycle. Bicycle wheels are typically designed to fit into the frame and fork via dropouts and hold bicycle tires. A typical modern wheel has a metal hub, wire tension spokes and a metal or carbon fibre rim which holds a pneumatic rubber tire.

4.7. Hub
A hub is the centre part of a bicycle wheel. It consists of an axle, bearing and a hub shell. The hub shell typically has two machined metal flange to which spokes can be attached.

4.8. Bearing
The bearing allow the hub shell to rotate freely about the axle. The cup and cone hub is used in our project.
Bearing no. 6202 (D.D.B pg4.13)
Outer diameter of bearing (D) = 35mm.
Inner diameter of bearing (d) = 15mm.
Thickness of bearing (B) = 12mm
r1 = corner radii on shaft and housing.
r1 = 1(from D.D.B)
Max speed = 14,000 rpm from (D.D.B)
Mean dia (dm) = (D+d) /2= (35+15)/2
Dm = 25mm.

V. FABRICATION
For that materials first of all we purchased the raw materials based upon requirements and for that we’ve planned to how to buy. After bought we cut raw materials in required dimensions in precise manner by using hand wheel cutting machine. After that we have gone for some rough turning and
finishing by using lathe and grinding machines. After that for assembly purpose we went for welding for permanent joint wherever we required rigidly fixed joints.

VI. RESULT
The vehicle was moving well over the stairs. The trolley can move uniformly in the flat surface. It produce less noise and vibration while moving on the stairs. Due to shape and the size of the wheel frame the vehicle is disturbed when it faced the stairs of different step sizes. Now a days in design the different sizes step are not available so the vehicle showed good performance when the step size was uniform. Test run for the vehicle is done and maximum height the vehicle could climb the stair whose inclined angle was 44°max. The pedal which is used in our design is to move our vehicle from one place to another place in normal surface which reduce the man power.

VII. CONCLUSION
This project provided us an experience and excellent opportunity, to use our knowledge. Our batch members are gained more practical knowledge like planning, assembling, purchasing and also the machining while doing this project work. We have completed the work with the limited time successfully. The “Design and fabrication of pedal powered stair climbing trolley” is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. Thus we are developed the Design and fabrication of pedal powered stair climbing trolley which helps to know how to achieve low cost automation. By using more techniques, they can be modified and developed according to the application.

REFERENCES