FABRICATION & DESIGNING OF STAIR CLIMBING TROLLEY

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ABSTRACT-

The investigation and analysis of a stair climbing trolley are described in this work. Hand trolleys are used to transport heavy loads from one location to another. It is a relatively widespread gadget that is used to transport physical products in a variety of industries. This type of trolley will not move. Transferring a large load or an object from the lowest to the top floor is quite tough. Utilising a single wheel in the industry, loads are transferred using cranes, hoisting machines, and other similar devices. However, inSuch an instrument is not employed on a civil building job or at home. In order to transfer the load to it's difficult to get to the top floor. Using stair wheels eliminates this obstacle. A single wheel has been replaced.

Keywords

Trolley, Stair, Climbing, etc.

INTRODUCTION-

A commonplace hand street car comprises of two wheels situated at the lower part of streetcar. The twohandles are given to help the edge and applied the human exertion. Handles are utilized to push orpull the streetcar. The size, shape, and position of handle are extremely as indicated by necessity. Generallystate of handle is l-shape. The wheels are mounting on shaft upheld by bearing. The materialused to make streetcar is different as indicated by the functioning burden. To convey weighty burden the streetcar isproduced using hardened steel and to convey moderate burden streetcar produced using gentle steel. The heap is mounting on top of the streetcar. At times rectangular box is given to convey the heap. Thematerial for rectangular box is exceptionally as indicated by the functioning burden. Once in a while openings or square spaceis given to diminish the weight and such sort of streetcar is utilized for light weight application. Thesorts of streetcar utilized are wheeled streetcar, collapsing streetcar, kitchen streetcar, and mechanized streetcar.Step climbing streetcar is intended to lift the high weight with less human exertion.Regular hand streetcar is intended to development on level surface yet it can't continue on unpredictablesurface or on (step of stepping stool) [2] [3]. In step climbing streetcar multiple wheels aregiven. These mixes of wheels are functionsas single unit. In step climbing streetcar threewheels are associated with the shaft through

three-sided plate or straight pole. Such sort of streetcar isextremely helpful in common development, move books in library and furthermore utilized in home. At the point when individual areharmed around then to lift load by it is exceptionally simple to utilize such sort of streetcar. The primary part toplan the mechanized step climbing streetcar is wheel-outline, wheel, shaft, gear, engine, battery and bearing.

OBJECTIVE:

- Lifting big goods, especially where there are children, is a difficult task.
- There are no lifting facilities available.
- A new option for transporting items up and down stairs has been developed.
- As a result, manpower is reduced.
- It is simple to elevate a load to a sufficient height.

LITRETURE REVIEW

:I "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 International Journal of Recent Trends in Engineering & Research (IJRTER) Roshan All spur. 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. 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 DESIG

1) **Selecting Bearing**:-
   Design and assembly of this product should be included.other prototypes that employ a stair-climbing techniquestrategies. Also, there's the possibility of a design that isn't reliability. A ball bearing is a form of rolling-element bearing that relies on balls to keep the bearing races separated. A ball bearing's aim is to reduce rotational friction.and can withstand radial and axial loads It accomplishes this by utilising at least two races to keep the balls containedand the loads are transmitted through the balls. In most cases, one race is stationary while the other is movingis a component of the rotating assembly. The balls rotate as one of the bearing races rotates.As also, rotate. Because the balls are rolling, their coefficient of friction is substantially lower than if they were station. Two flat surfaces slid against one another. Choosing a ball bearing with the smallest possible inner diameter a minimum of 30mm

2) **Wheel and Shaft Assembly:**

 It's one of the most important parts of this stair climbing trolley for getting up and down the stairs. The four-arm wheel frame has four arms, each with an axel that can spin around its own axis. A bearing supports each wheel.Each arm's length can be modified for separate rotation.Depending on the size of the stairwell.The holes in the wheels are designed for the purpose ofputting the brake pins in to stop individual wheels from movingwheels. The four-arm brake component moves on these axels. These axels also serve to synchronise the four-arm braking component and the four-arm wheel frame by rotating them at the same time.

3) **Tri star Wheel:**

We are adopting this Tri-Star wheel configuration in a hand trolley in place of a standard wheel layout in our project to allow the trolley to climb up and down stair cases as well as up come tiny obstacles.On its way, it will encounter obstacles such as holes and bumps.

4) **The frame of the wheel:**

To keep the three wheels on either side of the shaft together, a unique wheel frame is required.Due to the height factor of stairs the power transfer to the single- or double-wheel trolley in the existing design is worthless for climbing the stairs. As a result, three-wheel sets were installed on each side of the vehicle, each linked to the frame, to offer smooth power transmission and allow for easy stair climbing.

5) Shaft:

In our project, a shaft is a frequent and significant machine component. It's a revolving member with a circular cross-section that's utilised to transport energy. The material is mild steel. The shaft's dimensions are:

The outer diameter is 15mm, and the inner diameter is 10mm.

6) Frame:

The frame is utilised to carry the entire arrangement setup. It must be capable of supporting the entire arrangement's weight. Arc welding is used to create a permanent connection. This frame is critical to our project's success. In our project, we used mild steel to construct the frame, which is rectangular in shape.
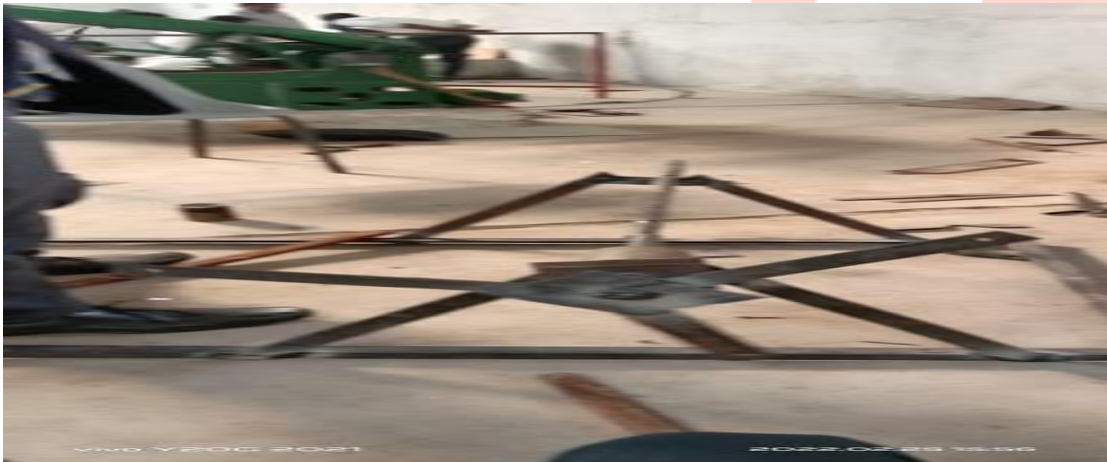
7) Cycle wheel:

A bicycle wheel is a wheel intended for a bicycle, most typically a wire wheel. Bicycle wheels are usually constructed with dropouts to fit into the frame and fork and hold bicycle tyres. A modern wheel typically consists of a metal hub, wire tension spokes, and a metal or carbon fibre rim that houses a pneumatic rubber tyre.

CALCULATION:

-When the trolley climbed up the stairs,it is needed to inclined at about α=30 from the x- direction

$\sum fx = ma$

$F\cos\alpha - Fr = $ normal force

$F\cos\alpha - \mu R = ma$

From the Y-direction_

$\sum fy = 0$

$F\sin\alpha - W + Fn = 0$
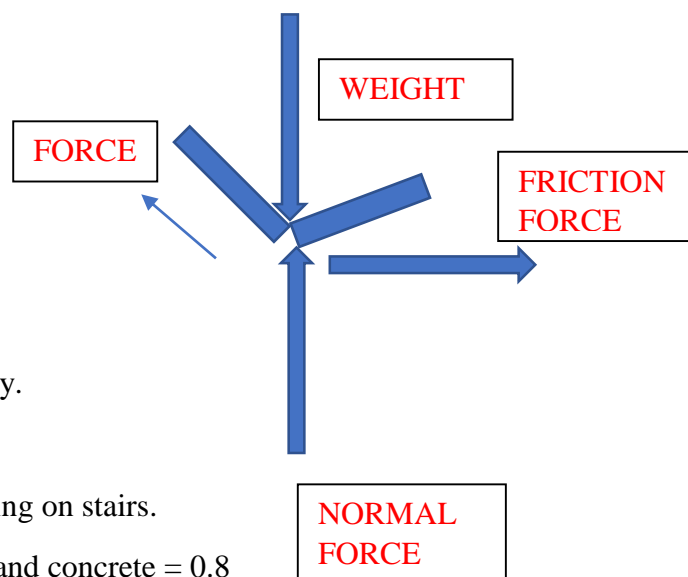
F=maximum force required to pulley the trolley.

M= mass of trolley plus carried load =90kg

A= acceleration of the trolley when load carrying on stairs.

Fr= friction coefficient between trolley wheel and concrete = 0.8

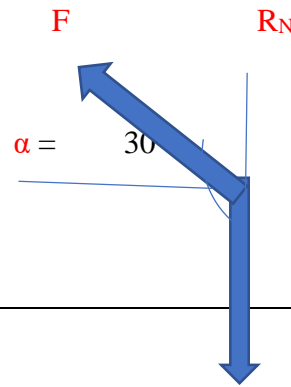W= weight of trolley plus load carrying on stairs.

RN=Normal force to the trolley.

WEIGHT

FORCE

FRICTION FORCE

NORMAL FORCE

$F \cos 30 - 0.8 \times 50 \times 9.81 = 90a$

$F \sin 30 = (100 - 0.8 \times 90) \, 9.81$

At rest condition RN = total weight
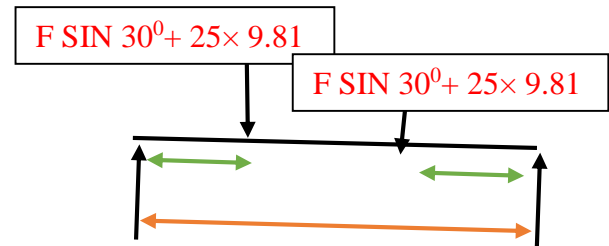
$RN = 90 \times 9.81$

$= 50 \times 9.8R$

Then find out applied force

$F = 549.36N$ W

$A = 0.92 \, m/sec^2$

$RA = RB = F\sin 30 + 25 \times 9.81 = 549.36 \sin 30 + 25 \times 9.81$

$RA = RB = 520N8 \; cm8 \; cm$

Climbing torque on trolley wheel.R_A

$T = (F\cos 30 + RA) \times$ effective wheel diameter

$T = 995.75 \times 0.15$

$T = 149.36 \, N.m.$

Cost Estimations:

S. No	Name of Components	Quantity	Cost of the product
1	Wheels	6 Wheel's	1200 Rs
2	Axle's	6 axles	300 Rs
3	Bearing	4 Bearing	240 Rs
4	Shaft	1 piece	400 Rs
5	Plyboard	1 piece	400 Rs
6	iron	22 Kg	2200 Rs
7	Nut bolt	12 nut bolts	60 Rs
8	Paint & brush	500 gm, 1 piece	200 Rs

Total cost = 4600 Rs

RESULT:

The vehicle was moving well over the stairs. The trolley can move uniformly in the flat surface. It produces 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.

CONCLUTION:

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.

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