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Design and Improvement of Mechanical Staircase Climbing Trolley

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ABSTRACT:

A trolley can be used to lift heavy items in a workplace or to lift those items to the desired locations. The goal of this research is to develop a straightforward system for easily shifting of large weights on stairs. The frequent lifting of items like books for libraries, medications for hospitals, standard items of any technological or non-technical institutes are the functions of this particular vehicle. It also allows people who are retarded to walk freely across flat surfaces and stairs. The Tri-Star wheels are the most important component of the climbing mechanism in the trolley's proposed design, allowing it to go across uneven surfaces. Three wheels are linked to each Tri-Star wheel using nuts and bolts. In addition, the supporters are added to the base of the frame. These supporters give the support to the entire trolly when there is any problem occurred between the working process. The study starts with the gathering of data via questionnaires, the analysis of that data, and comparisons with related studies

Keywords: Tri-Star Wheel; Trolley; Hand Truck.

Introduction:

There are several occasions in daily life to carry heavy objects between two locations is necessary, such as a travel bag, books, etc. These things can typically be carried effortlessly in the hand in most of these circumstances. However, in recent years, the preference for escalators over elevators has made it more challenging for individuals to carry large objects in their hands, such as while shopping in malls or transporting heavy research equipment between different levels of a university. In such circumstances, the use of traditional trolleys (Figure.1) will be drastically decreased and instead will rely on baskets and other hand-carriageable techniques While using this approach to move big goods will be time-consuming, it could be effective for moving light ones.

Figure 1. Trolly

Methodology:

Converting a roller that can only move over flat surfaces to one that can also climb stairs with extra supporters:

In the early designs, each single or double-wheel set on either side can only move any vehicle on a flat surface as shown in figure 2(a), but additional research on the subject enables us to carry any items on a vehicle upstairs as shown in fig 2(b). Instead of using a single or double wheel, we attached sets of three wheels to each side of the vehicle in this design. These three wheels are 120 degrees apart from the frame and are fastened with nuts and bolts. If there are any interruptions occurred stands are used to support the trolly.

2(a) initial trolly

2(b) modified trolly

Materials required:

a) Frame:

Mild steel is the material that makes up the frame. The handle is designed to be perpendicular to the trolley's body so that it may be tilted at any angle. The trolley's foundation is built of mild steel and is welded together. At the end of the frame two stands are attached when there is any problem occurred between the working process. The frame is designed in the ironcad software as shown in figure 3.

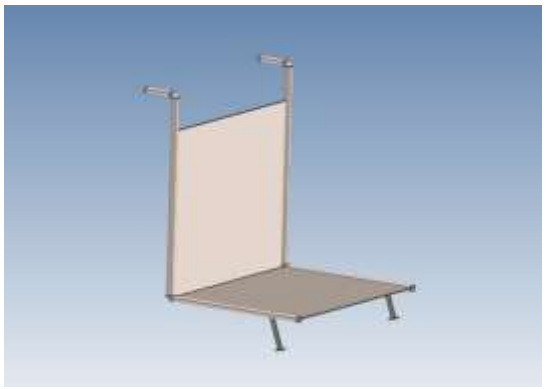

Figure 3: frame

b) Tri-Star Wheel frame Setup:

The main function of the Tri-star wheel frame setup is used to connect the wheels together and it is also used to climb the steps easily. The wheel frame is made up of mild steel and welded together. With the aid of the nuts and bolts, the wheels are secured between the two frames. Wheel frame is designed in the ironcad software as shown in figure 4.

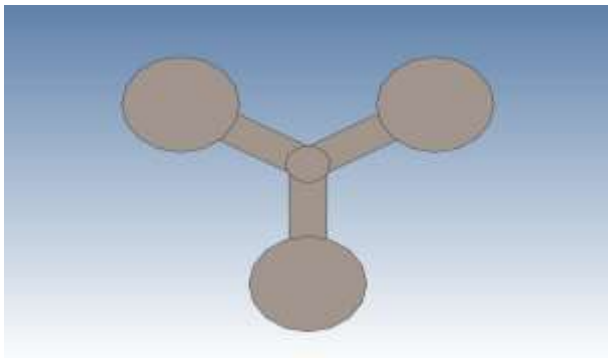

Figure 4: Tri-star wheel frame

c) Trolley's final assembly:

With the aid of bearings, the wheel configuration and shaft assembly are attached to the trolley's body. A ball bearing is utilized here. The Tri-star wheel frame setup is connected to the solid shaft, as the force is applied the Tri-Star assembly rotates. Trolley's final assembly is designed in the ironcad software as shown in figure 5.

Figure 5: Trolleys final assembly

Results and discussion:

Over the stairs, the trolley was travelling smoothly. A level surface allows the trolley to move equally on it. It moves on the steps with minimal noise and vibration. The vehicle is unsteady while facing stairs with various step widths due to the size and form of the wheel frame. Although varied step sizes are no longer accessible in design, the vehicle performed well when the step size was consistent. The vehicle's test run is completed. With our concept, the vehicle is moved from one location to another on a regular surface using a single man.

Conclusion:

- The goal of the current effort is to create a lightweight trolley that can ascend stairs more quickly and efficiently.
- A 3D model of the product has been developed using ironcad Software.
- Since mild steel is inexpensive, malleable, simple to produce, and quick to weld together, it was chosen as the material for this trolley.
- There is no risk of the frame or wheels under typical conditions because of the design's high level of safety.
- The stair climbing trolley can support a load of 100 kg on a flat surface, according the tests that were done.
- It is capable of climbing a 40 to 50^0 incline of stairs while towing a 50 kg load

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