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Review Paper On Stair Case Weight Lifter

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Abstract-*Devices such as hand trucks are used for carrying the load on flat ground, however, these devices fails when it comes to carry the load on steep ways or stairs. This review paper represents an idea of making a vehicle which can climb the stairs automatically after reading all literature survey. The concept will involve incorporating a kind of gearing arrangement which can provide the intermittent motion, thereby, reducing the chances of an accident. In order to provide the intermittent motion, mechanism which enables the device to climb the stairs with ease and comfort shall be used. This will lead to reduction in the efforts applied by the men and can subsequently be easily operated by a single person.*

I. INTRODUCTION

In day to day life, there always arises a need to carry load whether, light or heavy, i.e. at home or any other workplace and while attempting to do so, many people injure themselves. Lifting heavy loads like books, food grains etc. form ground level to the upper level, or even to move patients to the upper floors is not an easy job, especially in the places where there are no lifting facilities (elevators) available. Moreover, buildings in India i.e. in the rural parts or the under developed cities, as well in other parts of the world, where there is still no lifts or escalators facility available. In such cases, human labours are considered to be the only option. Also, with each passing day, labour is becoming costly in the developed countries, where growth rate is getting negative. This problem can be solved if a trolley is made which can lift loads while travelling through stairs.

Manual handling of containers or heavy loads may expose workers to physical conditions (e.g., force, awkward postures, and repetitive motions) that can lead to injuries, wasted energy, and wasted time. There are many conventional hand trucks, which are being used to carry the load from one place to another on the flat surfaces, but they fail to perform the same function when it is required to do so in rocky surfaces or on the stairs.

A hand trolley is a compact transport device used to move heavy loads from one place to another. It is a tool that can be used by a large number of industries that transport physical products. Also called a hand truck or a dolly or a stair climber, the hand trolley is often used by stock persons who arrange and restock merchandise in retail stores. With its proper utilization, trolleys can protect people from back injuries and other health problems that can result from lifting heavy loads.

The stair climbing trolley or the staircase weight lifter can play an important role in those areas to lift loads over a short height, as in schools, colleges, hospital, and in construction area, etc. The main function of this trolley is to carry load not only on flat platform but also on stair case.

A typical hand trolley consists of two small wheels located beneath a load-bearing platform; but the concept presented by us, here, is a bit different in its own way. This vehicle has ten wheels in total i.e. five on each side. Beneath the main frame, on the back side, there is a complete setup for the gears and motor. The power is transmitted to the worm gear drive through the motor which can either be connected to the battery or directly to the main power supply. The use of worm and worm gear makes it possible to reduce the speed by a considerable amount. Further, the worm gear is attached to the spur gear which is made into a mutilated gear, which acts as a Geneva mechanism. The use of mutilated gear enables the device to move smoothly on the stairs. When the gear makes four rotations the wheel makes one rotation.

This sort of arrangement of the mutilated gear by using the Geneva mechanism helps the user to handle the vehicle with ease as the device won't move so fast that the user cannot cope up with that speed. Also, there can be an arrangement for the brake so that the vehicle can stop or start when needed.

In order to reduce the effort applied by the men and to save the precious time by a considerable amount, the staircase weight lifter can introduce a new option for the transportation of loads. The problem faced by normal human in

day to day life inspired us to carry out this project. This project introduces a new horizon for the transportation of the loads.

II. LITERATURE REVIEW

For reducing human comfort for carrying the load on steep ways or stairs, for achieving this objective scope can be observed by following review of research papers.

1. Force analysis of Geneva wheel and face cam used in automat, the literature showed different stresses acting on the Geneva wheel. The stress analysis of the Geneva wheel was done using FEA (Finite Element Analysis). The use of FEA showed a complete view of the stress distribution around the Geneva wheel and Face Cam. The result showed that the deflection was small for the force acting on maximum and minimum position of Geneva wheel. The variation of displacement with the stresses acting on the Geneva for the maximum and minimum condition of the wheel and also face cam increased non-linearly.
2. Design of stair climbing hand truck, this project was also based on the three wheel system but since, the equipment was automated it was much more efficient. The equipment had the limitation of brakes. If the stair size change then controlling the equipment would be difficult.
3. Analysis and synthesis procedures for Geneva mechanism design, a paper which showed the design of the Geneva by analytical method. The result showed that the Geneva continued to function significantly well after approximately one billion index cycles. And it was known that the most significant criteria on which it depends are maximum load (bearing life), maximum contact stress (wear life), and maximum tip and root stress (fatigue life). Thus the results of this paper have been built around the consideration of these mechanical parameters.
4. Design of a staircase material handling system or hand truck, in this paper the design was based on a three wheel staircase lifter, in which the wheel which were 120 degree apart. They found that most of the stairs are at 44degree inclination and thus, they designed the equipment at this particular angle. If the angle was more than that then it would fail to climb.
5. An informational stair climbing intervention with greater effects in overweight pedestrians, a research which was essential to be carried out so as determine the side effects of carrying the load manually at the back or with the hands. This paper showed that climbing the stairs is a widely accessible activity, which consumes 9.6 times the energy used at rest. Because it involves raising one's weight against gravity, greater amount of energy expenditure can be expected in overweight individuals. It is estimated that on an average a 80- kg man, climbing a 3-m flight of stairs 10 times per day would burn 10035 kcal within a year. This is equivalent to a man not eating food for 4 days.
6. Design of a Stair-Climbing Hand Truck, in this study material there were some of the important points which needs to be worked upon. This includes that if a shaft is supported by two round bearings, it can slide and rotate freely. However, if a load is applied to the end of the shaft in any nonparallel direction, the shaft will jam itself between the bearings and will not be able to move. This design also didn't seem to be without flaws. One of the principal concerns is that the wear and fatigue will result from cyclic spoke loading. Also, the current power system of this design adds considerable weight and cost to the product. However, after using it repeatedly, the contact surfaces that cause this frictional binding will begin to wear down.
7. Design Optimization of Worm Gear drive, a design of worm gear drive problem has been considered for the design optimization of worm and worm wheel. Here combined objective function is considered, which minimizes the weight and centre distance and maximizes power and efficiency.
8. Design and manufacturing of six wheel Staircase trolley, the prototype model was made and the testing of the model was done. By the test run of this project, it was realized that it would be capable of carrying heavy load without suffering any deformation or local fractures or failure, if it would go into real world production at an ideal scale. Since the manufacturing of the product was not done by the professionals, it was not accurate enough to provide the economical results. Therefore, proper manufacturing would perhaps reduce this cost. Also, some of the technical issues in designing of this trolley were the stability and speed of the trolley while climbing stairs.
9. Review Paper on Fault Detection of Worm Gearbox, In order to detect faults in worm gearbox various techniques are applied such as Oil Analysis, Vibration analysis, Temperature analysis and Acoustic Emission Analysis. The literature showed the study of various fault detection techniques for worm gearbox such as Wear debris analysis, Vibration Analysis, Acoustic Emission Analysis, and Temperature analysis is studied. Out these techniques the deep study was done on Wear Debris Analysis to detect fault in Worm gearbox. Here Combination of vibration analysis techniques and Wear debris Analysis proves best to detect fault in worm gearbox. Also there is a lot of chance in fault detection of worm gearbox using various vibration analysis techniques including some new approach as Support vector machine, neural network, Fuzzy logic etc.
10. Design and fabrication of a hand trolley, a literature through which we found that the vehicle was easily movable on the flat surface but when it came to driving it on the stairs, it was more difficult compared to the ground. The smooth running of the equipment was not possible and the effort applied by the men was not considerably reduced.

III. CONCLUSION

So literature survey shows us the vehicle is more stable for the complete arrangement and can easily be carried on flat as well as rough surface. It also helps in reducing the effort applied by the men. The use of Geneva mechanism for the

intermittent motion leads to proper movement of the wheels while travelling on the stairs. So from literature survey Geneva mechanism and new ideas selected for dissertation.

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