A Review On: Stair Climber Material Handling System

Vishal S. Tighare[1], Achal P. Wankhade[2], Ravi N. Tirke[3], Shubham V.Wankhade[4].
Prof. A. M. Hatwar[5]

Mechanical department DES's COET, Amravati university, Maharashtra

Abstract *–This paper provides the detail study of stair climber material handling System. In this paper illustrates the various reviews about the stair climber material handling System for small scale industrial application considering the average requirement of small Indian organization where the lifts are not available. Therefore, in this paper, an attempt has been taken to summarize the past and current research in the material handling. The main objective of this paper is to present the review about the stair climber material handling System. After studying the previous concept of material handling system we tries to make it automatically without damage the material.*

Keywords-set of wheel, Stair climbing vehicle and wheel frame.

INTRODUCTION

In everyday life we may have to carry so many goods of various quantities through stairs specially in offices, schools, colleges, hotels, industries, apartments etc. where the lifts may not be available, may be full with the people or under repair. It is very tiresome to carry the various objects through stairs manually for higher floor for so many times. In most of building lifts are not installed so there only human labor is solution for caringmaterial. Labor is becomes costly as well as time consuming, where growth rate is getting negative. This problem can be solved if a trolley can lift loads while traveling through stairs.

The paper introduces a new option for the transportation of the loads over the stair. The vehicle is designed in such a way that it has three wheels on each side. They are set in triangular pattern. This project focuses on the maximum ergonomically beneficial to human being. The present project related to load carrying equipment of a type that is automatically operated of moving upwardly and downwardly on flight of stairs. Load carrier is a wheeled mechanism device, is generally used to carry a loads. It reduces human efforts.

LITERATURE REVIEW

SalunkheRohit: Advance material handling trolley using tri-wheel mechanism. International Journal Of Recent Research in Civil And Mechanical Engineering (IJRRCME) Vol. 2, Issue 2, Pp: (160-165), Month: October 2015 – March 2016:-This article aims is developing a mechanism for easy transportationof heavy loads over uneven terrain. 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 height. 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 consisting the tri-wheel or tri- star mechanism eases the movement of trolley in irregular surfaces like holes, bumps, etc.[4]
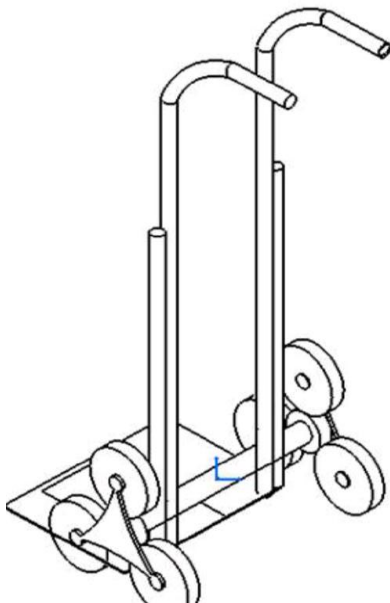
Kyle A. Johnson, et. al. : Described Tumbling Mode, When more precarious obstacles (stairs, debris, loose terrain, etc.) are encountered, Tumbling Mode provides a powered means to keep a robot moving. In Tumbling Mode, a braking mechanism is engaged to act upon the gearing system such that it forces the three wheels to rotate around the center axle of the Tri-Wheel assembly and walk like a Whigs robot over obstacles. This tri-spoke rotation intentionally occurs in the same direction as individual wheel rotation, helping to pull along the robot. The mechanism inducing Tumbling Mode could be engagedpassively, via operator command, or autonomously using feedback from sensors indicating a stall state, potential slippage, or a particular distance from the obstacle to be overcome. The braking mechanism on this vehicle is a small cam-operated drum brake, which is actuated through operator command. Tri-Wheel in Tumbling Mode ascending stairs. Because of its dual ability to roll and climb, the Tri-Wheel rotates about its central axle to approach a step and then rolls along the step surface until it reaches an optimal position to flip over itself once again and continue the climbing process.[5]

Md. A. Hossain, et. Al :.in Jan-2010: have concluded that in the initial design, each wheel contained frame, a sun wheel and three planetary wheels. The planetary wheel was connected with the sun wheel through an idler. The purpose of using the idler was to rotate the planetary wheels in the same direction of sun wheel. Each planetary wheel was aligned in a straight line with idler and sun wheel. The straight wheel frame takes more thrust to tilt the wheel frame to engage next planetary wheel. The length of each arm is high and thus creates vibration and the vehicle would be unstable. In the present design, the wheel frame was made curve so that the front surface of the arm could not collide with the edge of the stair.[7]

PrajanPradipGondole, et. al.: in April-2015: have concluded that the stair-climbing hand truck is designed to reduce liability rather than increase it. Conventional hand trucks work well on flat ground, but their usefulness decreases when It becomes necessary to move an object over an irregular surface. Package deliverymen, for example, often find it necessary to drag loaded hand trucks up short flights of stairs just to reach the front door of a building. The entire purpose of using a conventional hand truck is to avoid having to lift and carry heavy objects around.[10]

Mr. Ravi R. Mishra: Modified In the first design, the power transmission to the single or double wheel trolley is useless to climb the stairs due to height factor of stairs creates huge obstacle on the way of vehicle. also The design of the straight wheel frame became more complicated and was needed modified with its curve-spherical shape to give proper drive, which create more frictional force. 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 obstacles. Frame arrangement is suitable to transmit exact velocity ratio also. It provided higher efficiency and compact layout with reliable service.[8]

P. Jey Praveen Raj: In the modern world though there are many developments in the field of engineering. Still there are difficulties to carry heavy loads over stairs. Development of lift simplifies the effort of carrying heavy loads over stairs, it is not possible to use lift in all places like schools, college's constructional areas. This project aims at developing a mechanism for easy transportation of heavy loads over stairs. The need for such arises from day to day requirements in our society. Devices such as hand trolleys are used to relieve the stresses of lifting while on flat ground. However these devices usually fail when it comes to carrying the load over short fleet of stairs .Our project attempts to design a stair climbing trolley which can carry heavy objects up the stairs with less effortcompared to carrying them manually .The main objective of the project is to find an efficient and user friendly method of carrying various objects through stairs using minimum effort from the user and to also provide a smooth movement while climbing the stair. Under this project we have manufactured a stair climber with tri lobed wheel frames

at both sides. of the climber and three wheels on each sides are used in the tri lobed frame. The wheel assembly is rotated by a gear- motor mechanism where a DC gear motor is used to provide the necessary power for rotation and a pinion gear mesh is used for reducing the rotating speed of the wheel. The motor is connected to a lead acid battery of similar ratings and they are in turn connected to DPDT switch[9].

NEW MODIFIED SYSTEM

This work gives details about the stair climber material handling System, which can climb stair or move along very rough surface. The components uses in stair climber material handling System are e-bike motor, wiper motors, batteries, tri-wheels, microcontroller circuit, remote and trolley. Initially the power is given to the motors through battery, the motors are run simultaneously. The vehicle has four set of wheel arrangement to support its weight. Each wheel frame consists of three sub-wheels attached directly to the motor in clamp through nut and bolt. Using this vehicle, the labor cost can be reduced as well as huge amount of loads can be transferred uniformly with less power consumption. The technical issues in fabricating this vehicle are the stability and speed of the vehicle while climbing stairs. The uses of this special vehicle are in the frequent lift of goods such as books for library, medicine for hospital, regular mails for any institutes or transportation any toxic material for industries.

Front View

Side View

WORKING

First of all the worker have to put the material in the trolley up to the given capacity of trolley. Initially the power is given to the motors through battery, the motors are run simultaneously.Whileclimbing on stair, when first wheel touches the stair simultaneously the upper wheel climb on stair. All four wheels work same. The motors are run according to the input given. The whole system is controlled by microcontroller circuit with the help of remote control .While climbing up on stair the system is run in forward direction and when it comes to down it run reverse. Because the trolley is design in such a way that, material should not come out from the trolley while Climbing on stair i.e. the height of trolley is more than front side shown in figure. And all movement of machine is control by remote control through microcontroller.

COMPARISON BETWEEN OLD AND NEW CONCEPT

OLD CONCEPT:

It is move on flat surface and it required manually operated. In manual system task not perform fast and efficiently. It required human effort. It required more time. High risk of injury during material handling. In manual there is possibility of damaging the material during storage and movement.

NEW CONCEPT:

It move on rough and stair automatically. In this system task perform fast and efficient. It not required human effort. It is time saving concept. Less risk of injury during material handling. It reduce damage of material during storage and movement.

CONCLUSION

In this paper we implement the material handling with less human efforts in minimum time without damaging the material while transportation. In this concept we find out the automatic trolley and it operate automatically. concept of stair climber material handling system which provide the service to reduce the human efforts in many fields like offices, colleges and industries for handling material on stair case. It provide service to replace man in dangerous environment to transfer material on stairs and flat surface, like underground storage godownwhere oxygen is in less amount.

REFERENCES

[1] B. Mohammad Osman Tokhi, G. S. Virk, M. A. Hossain "Climbing and Walking Robots", publish in *Proceedings of the 8th International Conference*.

[2] Helmick.D, Roumeliotis.S, McHenry.M, Matthies.L, "Multi-sensor, high speed autonomous stair climbing", *IEEE/RSJ Conference on Intelligent Robots and Systems (IROS)*, (2002).

[3] J Lawn, *Member, IEEE*, and TakakazuIshimatsu , "Modeling of a stair-climbing wheelchair mechanism with high single step capability Murray*". Ieee Transactions On Neural Systems And Rehabilitation Engineering, Vol. 11, No. 3, September 2003 .*

[4] K. Narendra Kumar1, SalunkheRohit, M. Gopala Anjaneyulu3, B. Gopi Krishna4 1 Assistant Professor, 2Associate Professor, 3, 4Student, 1, 2, 3, 4Department of Mechanical Engineering, Swarnandhra College of Engineering and Technology, Narsapur, Andhra Pradesh, India- 534275

[5] Kyle A. Johnson, William R. Tuck, "The Tri –Wheel: A Novel Wheel-Leg Mobility Concept" *IEEE/RSJ International Conference on Intelligent Robotics and System (IROS)* 2015.

[6] L. Sunil Kumar , V S Sunitha, K Suresh , Udaya S. Kumar , "Design And Fabrication Of Stair Climber Trolley" , A Project Report At Anand Institute Of Higher Technology Chennai-603 103 Anna University , Chennai-600 025 , (2014) .

[7] Md. A. Hossain, Nafis. A.Chowdhury, Rubaiat.I.Linda, "Stair Climbing Vehicle", Published In *International Journal Of Research Publications In Engineering And Technology (2010).*

[8] Mr. Pratik.H. Rathod, Mr. Ravi.R. Mishra, Mr. Nitin.A. Waghamare, "Stair Climbing Truck",published In *International Journal of Emerging Trends in Engineering and Development,(2013)*

[9] P. Jey Praveen Raj, P.M.MohamedFuge, R.Paul Caleb, G.Natarajan, "Design and Fabrication of Stair Climbing Trolley", *International Journal of Recent Research in Civil and Mechanical Engineering (IJRRCME) Vol. 2,* Issue 2, pp: (160-165), Month: October 2015 – March 2016

[10] PrajanPradipGondole, KamleshDilipraoThakre, "Stair Climbing Hand Trolley", Published In *journal Of Emerging Technologies and Innovative Research (JETIR)*, (2015).