IOSR Journal of Engineering (IOSR JEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 70-76

Trolley Turning and Lifting Mechanism

MudassirAnsari[1], Amjad Khan[2], Shahid Ali[3], Mohd.Junaid[4]
[123]*(Department of Mechanical Engineering, MMANTC MANSOORA, India)*
[4] *(Department of Civil Engineering, MMANTC MANSOORA, India)*

Abstract: *The material handling vehicles usually take more time to adjust its position, and unload at the exactlocation. This paper explain the design and fabricate a trolley turning and lifting arrangement for such vehicles. This mechanism is proposed to make the unloading easier in multi direction,only by turning the trolley rather than the vehicle in order to make the work more economic and efficient.Multidirectional rotating trolley (MDRT) is used for the movement and removing the material as our required size so we make our new concept multistage damping trolley within a facility or at a site. MDRT can be classified into the following five major categories: to keep uniformity in the final printed copies of the Journal. Please keep in mind that the manuscript importance Thepneumatic power is used to run the trolly,one for the trolley rotation and. Initially the pneumatic power is used to run first cylinder which is responsible for the trolley rotation. After rotating trolley to desire direction, the power supply is switched to direction.*

Keywords: *pneumatic cylinder, Trolley, gear mechanism*

I. Introduction

The automotive sector is fast booming section in India. There are variable in automotive industry light and heavy motor vehicle. Heavy duty vehicle support as the backbone and confront to the working. A dumper whose material can easily be unloaded in one direction that is mostly to its rear end. These inefficiency is been overcomes by the multidirectional dumper. Construction and civil works is one of the basic need of this availability of proper material handling equipment. The material supply to civil and construction is provided through trucks, dumper etc. The material should be properly loaded, managed, stacked, transported and unloaded. The trucks carries the material and transported to the required site and then unloads. The major issues arises over here, the incompatibility of the site with the fully loaded dumper which consumes more time.Conventional Trolley in which the dumper unloads the material in only one direction. But this incapability can be fulfilled by a new method mechanism as the unidirectional dumper. This mechanism is an approach to reduce the idle time to settle the dumper. The material is unloaded in any direction and hence can be boldly stated as "Multidirectional Dumper." The major outcomes of multidirectional dumper has overcome space requirement which often result in road blocking. This paper suggests inversion in the existing mechanism providing the unloading in 1800 rotations. This mechanism prevents blocking of road, saves time and enhances productivity at lowest cost.

II. Literature Survey

Reference [1], noted out the different ways of handling various materials. It involves "short-distance movement that usually takes place within the confines of a building such as a plant or a warehouse and between a building and a transportation agency". It can be used to create "time and place utility" through the handling, storage, and control of material, as distinct from manufacturing (i.e., fabrication and assembly operations), which creates "form utility" by changing the shape, form, and makeup of material. It is often said that material handling only adds to the cost of a product, it does not add to the value of a product. Although it does not provide a product with form utility, the time and place utility provided by it can add real value to a product.

A paper [2], point out that trucks, tippers and dump trucks are used to transport loose material from one place to another place at construction site in mines or in dump yards to accomplish the actual site requirement. The existing system available is to unload material on back side. As considering the mines space available is very less due to which unloading material on left or right side is not possible to take this as a problem multisided tipper tilting is the need of time. To overcome one side tilting of trolley, multisided tilting mechanism is come into focus. This will help to reduce the efforts to unload loose material one side of tipper. Propose work is on placing three hydraulic cylinders each on front side, right side and left side of trolley to unload loose material on back side, left side and right side of trolley respectively. Some design modification is needed in existing system to work on multisided tipper tilting mechanism.

Raj et al. [3], pointed out that in the modern world though there are many developments in the field of engineering. Development of lift simplifies the effort of carrying heavy loads over stairs, it possible to use lift in

all places like schools, college's constructional areas. This paper aims at developing a mechanism for easy transportation of heavy loads over stairs. The main objective 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. A stair climber is manufactured 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 direct current (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.

Deshmukh et al. [4], described that the three way tippers can unload materials in all three sides. Main hydraulic cylinder is placed at middle of front side of chassis i.e. one for back side tilting of the trolley and other two cylinders are placed on along lateral side of the chassis at appropriate distance for left and right side tilting of the trolley. Trolley is connected with chassis with the help of six hinges. Two hinges on each lateral side for left and right side tilting of trolley, two hinges on back side of chassis for back side tilting of trolley. Now with this mechanism it is possible to tilt trolley on all three sides i.e. back, left and right side. For backside unloading of material, hydraulic cylinder no. 1 is in operation and hinge must be disconnected manually by pulling pin from the hinge, for this hole. Diameter is provided on pin head to facilitate manual pulling by inserting rope inside the pin hole.

A paper [5], has clearly pointed that as per the survey more number of accidents happen due to more number of trolleys connected to a single tractor along with more load and it becomes difficult for the driver to control the tractor and its attachment trolleys. In this paper, they have designed a collapsible trolley that can be adjusted in size. So, to eliminate all the trolley related problems and reduce the cost, they have designed a simple trolley so that the work of two trolleys can be done in a single trolley. With this kind of design it becomes easy for the drivers to drive the tractor and the trolley to the long distance safely.

III. Design

3.1 Pneumatic Actuator

A) Stroke length = 150 mm Bore diameter = 32 mm

B) Stroke length = 200 mm Bore diameter = 40 mm

The standard Actuators are available in market as per requirement.

3.2 Design Of Shaft

Length (L) = 300 mm

The standard material is available in market as per requirement.

33. Selection Of Bearing

Bearing: UCP205- Series (25mm)

Inside diameter (d) = 25 mm

Material= Cast Iron

Centre height (h) =33.3 mm

Mount hole center to center (e) =95.3 mm

Mount hole size (s1) =10 mm

Depth=34 mm

Length (a) =127 mm

Overall height (w) =65 mm

Width (b) = 38.10 mm

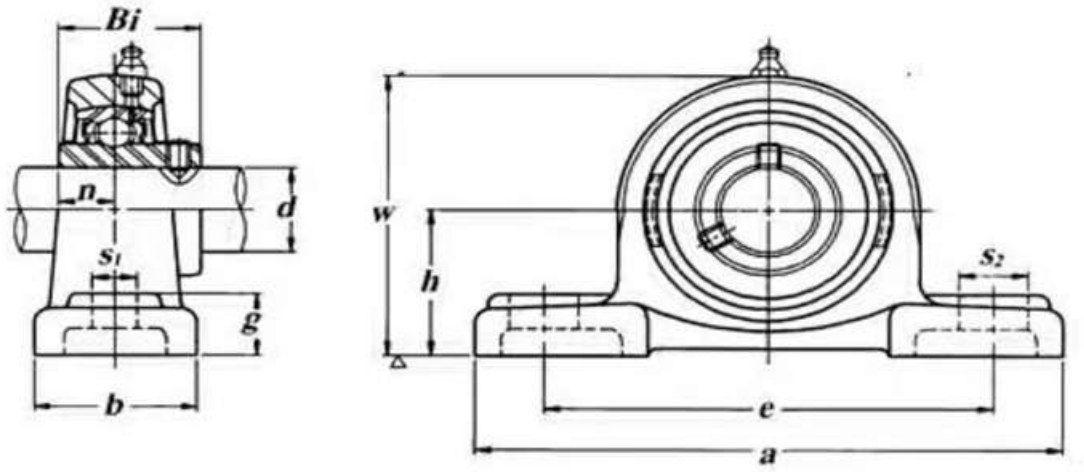

Fig. 1: Pedestal Bearing

Conventional tipper mechanism an unload materials only at the backside of the tipper using hydraulically operated cylinder which may cause the problems of road blockage in the limited space area. The unidirectional dumper overcomes the problem of unloading the vehicle on side way by using hydraulic cylinder. By using cylinder the material can be unloaded in 1800 as per requirement. The unidirectional dumper is developed and tested for its movement in all 1800 possible angle to unload the materials in the tipper trolley and monitor the inclinations for its gradualism (linearity).

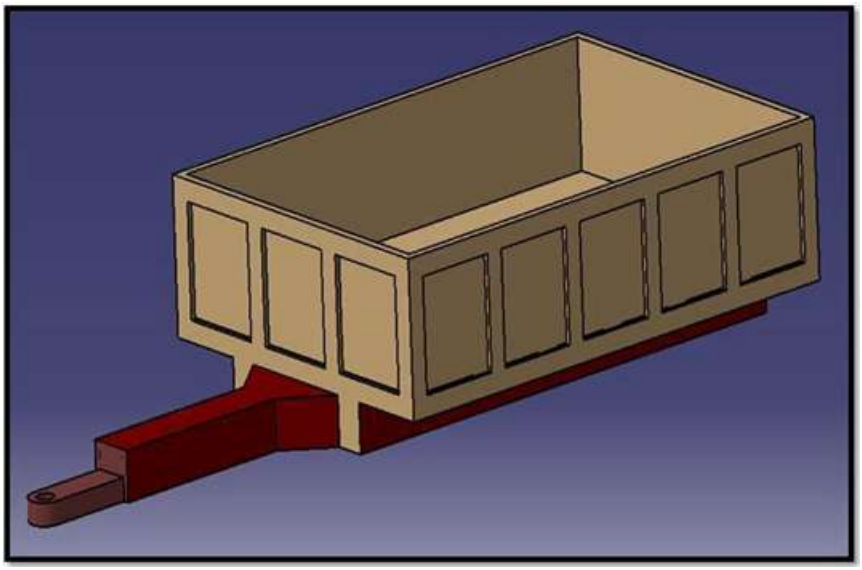

Fig. 2: Virtual Prototype of conventional (existing) trailer design

IV. Components Selected

The Trolley turning and lifting mechanism is the combination of many components which in turn produces the required final finished product.
The main components used are;

4.1 Cylinder And Piston

In the system there are two main cylinders, used for movement of different motions (Rotary and lifting) in the system.

Fig3: Piston and cylinder

4.2. HOSES

This is the main pipe lines through which the pneumatic circuit works these are the flexible pipe line for flowing the air.

Fig. 4: Hoses

Fig.5 Frame

4.3 Frame

The frame is the structural member that supports the entire project assembly, the upper and bottom frame are fitted using pinion shaft and bearing and upper frame of trolley is fitted with hinges

V. Working of the Proposed Model

The mechanical power from the engine is convert as electrical power and stored in the battery and utilized. The complete working process of this mechanism is discussed below.As the engine starts, the piston reciprocates inside the cylinder and this reciprocating motion is converted into a rotary motion of the crankshaft. At the left end of the crankshaft, a magnet is connected, which rotates along with the crankshaft. This magnet is surrounded by the electric coil.The magnet creates a magnetic field around it. These coils are placed around the magnet. When the magnetic flux is cut by the coils, it creates an electromagnetic field, and the potential of this field is 14.5V to 15.5V. The Fig. 3 shows the prototype of multi directional trolley purposed.

Fig. 6 Trolley Prototype

The mechanical power produced from the engine is converted into the electrical power by the use of a magnet and the electric coils arrangement. This electric power is stored into a 12 V battery. The power from the batteryis used to run the two motors (one for the trolley rotation and another for the scissor jack).Initially the power from the battery goes to the trolley motor and runs it, which causes the turning action of the trolley. The direction of rotation of trolley can either be clockwise or counterclockwise which depends on the required direction of unloading the material.

The rotation of the trolley to different direction is achieved just by changing the polarity of connections to the battery. After turning the trolley and bringing it to the required position, the power supply is switched by the manual switches to the scissor jack motor to run it, which leads to the lifting action of the trolley. After getting the suitable inclination of trolley, the material can be unloaded to the particular location.

The trolley turning and lifting mechanism also capable of unloading the material in a particular angle The conventional dumpers need to adjust their position for unloading the materials at once in all the direction, in that situation this proposed mechanism is very useful because unloading in all direction at once can be achieved easily just by lifting the trolley and rotate it in order to dump the materials in multi directions. When unloading is over, the scissor jack motor is run again, which makes the trolley to come back to its horizontal position. When the power supply is switched to the trolley motor to bring it to the initial position.

The complete assembled view of trolley and engine is shown in Fig. 4 below.By this means the arrangement is capable of unloading material in all directions rather than the facing direction.

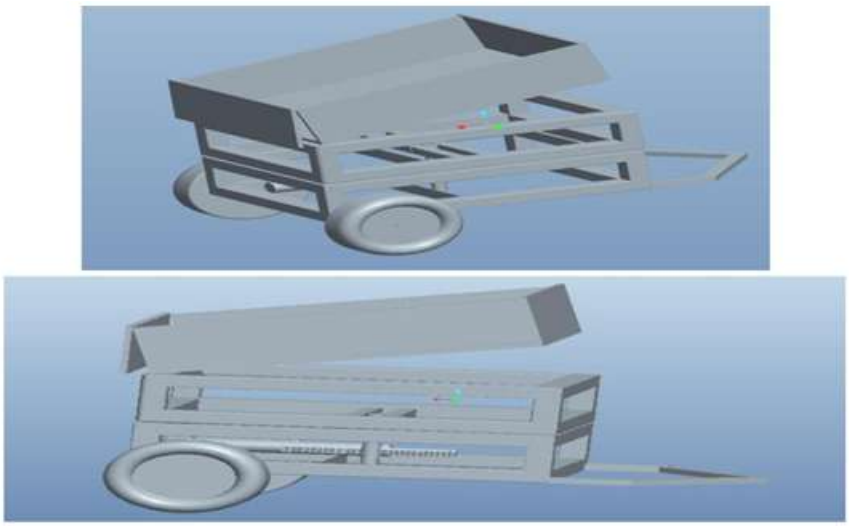

Fig. 7 Constructional Features of pneumatically operated rotating trolley

VI. Performance Analysis

The performance analysis of the trolley turning and lifting mechanism has clearly shown that the mechanism proposed is more efficient, economical and effective.The involvement of turning mechanism in dumper bring advantages like the material can be dumped in any direction with ease and the trolley can easily come back to its initial position.

Both turning and lifting mechanism of the trolley are getting power from the engine in the form of an electrical energy. This energy is first stored into a 12V battery and then supplied to the components. As the electrical power is used and transmitted to components by the use of electrical wires in place of any mechanical arrangement, this results in less noise, less wear of components and less vibration. Use of battery provides a smooth flow of current toward the components.

Sometimes it is not required to dump all the material in one direction, but also in the other two directions. In that case, a convention dumper after unloading materials in one direction, it needs to adjust its position for unloading in other two directions. But with the use of trolley turning mechanism this problem can be easily solve just by lifting the trolley and start turning it for the other directions.

In this model a scissor jack is used according to trolley capacity which is of 5 kg, when to carry more load, scissor jack can be replaced by the other powerful jack like hydraulic. As the complete mechanism is running with the engine power only, it doesn't require any other components. This will make the process as economic and efficient compared to the existing dumpers.

6.1 Tests performed

The various tests carried out for the performance analysis are vibration test, balancing test, turning test and lifting test.

- Vibration test
- Balancing test
- Turning test
- Lifting test

6.1.1 Vibration test

As the vehicle runs at higher speed it starts vibrating and this vibration effect transfers to the components also and if the excitation frequency of components meet with its natural frequency, it causes the catastrophic failure. In order to avoid that, the vibration test has to be performed and it is found satisfactorily performing within a comfortable range.

6.1.2 Balancing test

Balancing test is performed to check the balancing of when the trolley is in motion. As unbalancing leads to more vibration in the vehicle when the vehicle increases its speed.

6.1.3 Turning test
Turning test is performed to check the proper functioning of trolley's turning mechanism which involves a proper meshing of the worm with the worm wheel.

6.1.4 Lifting test
Lifting test involves the proper working of scissor jack which is operated by a DC series motor which causes the lift of trolley after bringing it to the unloading location.

These tests are conducted to ensure the proper working and improved performance of the unloading vehicles in an efficient and economical way.

As the above tests are conducted, the following advantages have been achieved, they are:
- Less vibration and noise.
- Less wear and tear of component due to less mechanical joints.
- Better control over trolley rotation.
- Better control over trolley lift.
- Easy way of arrangement.
- As the DC Series energy is used, this avoids friction and vibration problems.

VII. Conclusion

Nowadays trailers unload goods only in one direction which requires more time. This paper is proposing a trolley turning and lifting mechanism in order to make unloading easier. In the driver can unload the materials in multi direction without the consumption of extra time with a faster work rate and lesser human involvement.

Various tests are performed to analyze efficiency and results and evaluated based on speed and power. It is proved that the proposed mechanism is more effective than unloading mechanism commonly in use nowadays.

References

[1]. Michael G. Kay, *Material Handling Equipment*(McGraw-Hill, 2nd Edition, 2012).
[2]. Hemant A. Gaikwad, Nilesh P. Awate, Design of Multisided Tipper Tilting Mechanism, *InternationalJournal for Scientific Research and Development*,*2(5),*2011, 38 - 40.
[3]. P. Jey Praveen Raj, P. M. Mohamed Fuge, R. Paul Caleb, G. Natarajan**,** Design and Fabricationof Stair Climbing Trolley,*International Journal for Scientific Research and Development,6(2),* 2016, 50 - 53.
[4]. Abhimanyu D. Deshmukh, Vivek R. Patil, Vivek S. Chavan, Mahesh M. Kadam and Dipak M. Bhosale, 3-Way Hydraulic Unloading Trolley,*International Journal for Scientific Research andDevelopment*, *4(12),* 2017, 27 - 31.
[5]. S. R. Kulkarni, T. S. Vandali, and S. A. Goudadi, Prototype of Collapsible Trolley, *InternationalJournal for Scientific Research and Development, 4(5),* 2016, 18 - 25.