



Design and Fabrication of Multidirectional Rotational Trolley

Kona Ramprasad | Golagani Satish | Pasumarthi Hari Krishna | Pangti Sathish Kumar | Penuganti Lova Raju

Department of Mechanical Engineering, N S Raju Institute of Technology (NSRIT), Visakhapatnam, A.P, India.
Corresponding Author Email Id: golaganisatish2001@gmail.com

To Cite this Article

Kona Ramprasad, Golagani Satish, Pasumarthi Hari Krishna, Pangti Sathish Kumar and Penuganti Lova Raju. Design and Fabrication of Multidirectional Rotational Trolley. International Journal for Modern Trends in Science and Technology 2022, 8(06), pp. 426-430. <https://doi.org/10.46501/IJMTST0806073>

Article Info

Received: 18 May 2022; Accepted: 15 June 2022; Published: 20 June 2022.

ABSTRACT

Normal dumper vehicle unload materials only in one direction that too only at the backside of the tipper trolley by using various powerful hydraulically operated cylinders, which may cause the problems of blockage when the work area is limited. The Multidirectional dumper overcomes the problem of unloading the vehicle on side way by using Pneumatic cylinder used in our prototype but hydraulic cylinder would have to be used in a standard vehicle. By using cylinder and Geneva mechanism the material can be unloaded in as per requirement. However, the Multidirectional dumper is developed and tested for its rotation in all 360° possible angle to unload the materials in the tipper trolley and monitor the inclinations for its gradualism by using Geneva mechanism.

KEYWORDS: 360 degrees trolley, Prototype hydraulic cylinder and truck.

1. INTRODUCTION

Material handling in construction and civil works is one of the basic necessities. 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 dumper carries the material which is loaded from the site, where the material is initially stored. It is then loaded to the dumper and transported to the required site and then unloaded. The major issues raises over here, the incompatibility of the site with the fully loaded dumper causes a lot of settling time for the trolley to get the material properly arranged and transportation time to reach its location.

The dumper unloads the material in only one direction. But this incapability can be full new method mechanism as the Multidirectional dumper. Gothic 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. Hence, we have inversion in the existing mechanism providing the unloading in 3600 rotations. This mechanism prevents blocking of road, saves time and enhances productivity at lowest cost. 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.

This machine is constructed using various materials like chain drive mechanism , MS Sheet, MS Square Pipe, Polished Rod, Double Acting Pneumatic Cylinder, Universal Joint, Pneumatic Pipes, Directional Control Valve, Pneumatic Fluid, Pneumatic Pump, and Reservoir. First of all a base frame structure is prepared using MS Square Pipe. The Trailer body is prepared using MS Sheet.. The universal joint is attached with the frame using welding process. Another universal joint is attached on Bottom of the Trailer Body. A Double 2 Acting Cylinder connects both the universal joint. Pneumatic pipes are connected to the Double acting Pneumatic Cylinder.

Another Side of the Pneumatic pipe is attached to the Directional Control valve. Pneumatic fluid is filled in the Reservoir Tank. Another side of the Pneumatic Pump is connected to the Directional control valve. This assembly is attached with pneumatic cylinder that operates the trailer. And finally the chain drive mechanism has been welded with the main frame of the dumper so that it can rotate the hole load carrying structure. Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. Most often, the power is conveyed by a roller chain known as the drive chain or transmission chain , passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain.

Pneumatic cylinders are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like pneumatic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage. Because the

operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tike Room, pneumatics is used to prevent fluid from dripping onto people below the puppets.

An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use.

A toggle jack is operated by turning a lead screw. In this case of a jack, a small force applied in the horizontal plane is used to raise or lower large load. A jackscrew's compressive force is obtained through the tension force applied by its lead screw. The An Acme thread is most often used, as this thread is very strong and can resist the large loads imposed on most jackscrews while not being weakened by wear over many rotations The rotating trolley with lead screw mechanism is a system through which we can unload the trolley in congested area by rotating the trolley 360 degree about its own center with the help of worm and worm wheel. The trolley can lift at any particular angle for the unloading of trolley with the help of lead screw and universal joint modern age the trolley lifting process is pressure system but here in this project the trolley lifting take place with the help of lead screw by rotating shaft connect with universal joint which provide the motion at any angle. The universal joint is connect with the lead screw. The trolley can lift at any particular angle for the unloading of trolley with the help of lead screw and universal joint. In the modern age the trolley lifting process is pressure system but here in this project the trolley lifting take place with the help of lead screw by rotating shaft connect with universal joint which provide the motion at any angle. The universal joint is connect with the lead screw.

All electric concept of vehicle is that if it becomes a reality would prove to be a lot of fun to drive in the city. The vehicle runs on 8 small electric motors, four motors attached separately to four "wheels" the wheels are

actually spheres and can rotate 360 degrees around itself like a helicopter. The car is designed for a person taking small trips, probably around a city, who needs to move quickly and nimbly around obstacle like yellow cabs and bicycles. May be the coolest thing about the car is that the doors open. May be Doc Brown could use this electric beauty for some future time travelling flicks. The car's spherical wheels are identical and are magnetically coupled they are controlled by magnetic fields which allow the car to rotate quickly and efficiently. Though we haven't taken a peak at the inside we hear it's pretty chic. We only have one issue with this design. It may be great with obstacles in front of you but it doesn't look like it could handle a pothole very well. The clearance is quite low and because the "spherical" wheels don't lift you off the ground like regular wheels those pot holes or unexpected curbs could prove to be a problem while you're speeding around the city.

Trailer measure has wide applications in areas like farming, development and garbage transportation, etc. Conventional trailer has restriction of instrument which don't permits it to dump the material at rear side only. It is highly inconvenience for vehicles to reposition as shown by dumping side in narrow lanes and limited spaces. This inconvenience is overcome by different sides trailer system by using single actuator. The trailer exhausts the material only one way. This difficulty is overcome by new strategy segment as the multidirectional trailer. This instrument is a way to reduce the actual time to settle the trailer. The material is unloaded in three ways band accordingly can be firmly communicated as "Three way trailer." The major outcome of three way directional trailer has defeated space necessity which frequently bring about road blocking. Hence we have inversion in the current mechanism giving the unloading in three directions. This mechanism prevents road blocking, lessen time and increment efficiency at low cost. As considering the mines space accessible is extremely less.

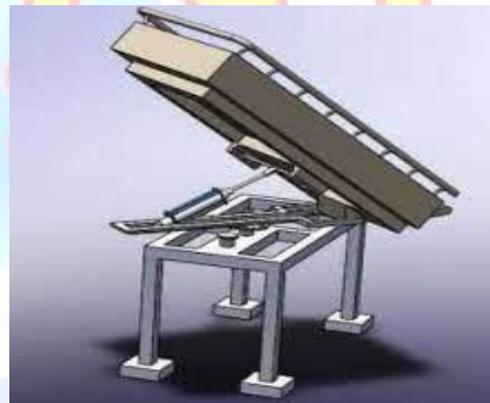
Accordingly it is simple for the driver to dump the trailer and furthermore it decreases time and fuel utilization. For making tipper system with such above conditions pneumatic system can be utilized. The compressed air is going to the pneumatic chamber through the because of which dumping material on left or right side is not possible to expect to take this as an

issue, Multisided tipper tilting is he need of time. To beat one side shifting of trolley, multisided shifting mechanism is come into focus. This will help to dump free material one side of tipper. Presently dropping unloader has been brought about by noticing the trouble in emptying the materials. Dropping trailer can dump just in one side by utilizing pneumatic mechanism.

2. METHODOLOGY

- ❖ To the formation of this project first of all we purchases the mechanical component like-Wheel, Worm Gear, universal joint, lead screw, bearing etc.
- ❖ Draw the rough sketch in creo parametric software for overview of project.
- ❖ Form the frame of trolley in workshop by metal sheet.
- ❖ Fit the frame on wheel axel.
- ❖ Assemble all components of trolley.

BLOCK DIAGRAM



CATIA Model of the Actual Trolley



Components



Fabrication Trolley

OBJECTIVES

- ❖ Normal dumper vehicle unload materials only in one direction that too only at the backside of the tipper trolley by using various powerful hydraulically operated cylinders, which may cause the problems of blockage when the work area is limited.
- ❖ The Multidirectional dumper overcomes the problem of unloading the vehicle on side way by using Pneumatic cylinder used in our prototype but hydraulic cylinder would have to be used in a standard vehicle.
- ❖ By using cylinder and Geneva mechanism the material can be unloaded in as per requirement. However, the Multidirectional dumper is developed and tested for its rotation in all 360° possible angle to unload the materials in the tipper trolley and monitor the inclinations for its gradualism by using Geneva mechanism.

3. CALCULATION

Double acting cylinder calculations output stroke

The force exerted by a double acting pneumatic cylinder can be expressed as

$$F = p A$$

$$F = p \pi d^2/4$$

Where,

F = Force Exerted (N)

P = Gauge Pressure(N/m² Pa)

A = Full Bore Area (m²)

D = Full Bore Piston Diameter (m)

Input Stroke

The Force exerted by double acting pneumatic cylinder on outstroke can be expressed as (1).

$$F = p \pi (d_1^2 - d_2^2)/4 \text{ -----(2)}$$

Where,

d₁ = Full Bore Piston Diameter (m)

d₂ = Piston Rod Diameter

Motor Calculations

$$T = P * 60 / 2 \pi n$$

ADVANTAGES

- ❖ Increased moving ability.
- ❖ Can be used in very closed places.
- ❖ Accommodate on dam site working.
- ❖ Save time and energy.
- ❖ Less skilled technician are needed.
- ❖ Handling is simple.
- ❖ It can be operated manually.
- ❖ The parts can be replaced easily.

4. CONCLUSION

- ❖ The rotation of multidirectional trolley is successfully achieved by using Geneva mechanism and by using pneumatic cylinder.
- ❖ The developed prototype exhibits the expected results. Further modifications in this developed setup will put this work in the main league of use.
- ❖ This concept saves time & energy which leads to efficient and effective working. This further line should be modelled using equations and an experimental agreement.
- ❖ The constructional work or the infrastructural work demands.

FUTURE SCOPE

Design and fabrication of Three axis rotating trailer using pneumatic system has been conceived having studied the trouble in emptying the materials. Our review in the respect in a few automobile garages, reveals the fact that generally some troublesome strategies were embraced in emptying the materials from the trailer. The trailer will empty the material just in one direction only. It is hard to empty the materials in small compact roads and small streets. All the three sides are effectively to unload the trailer in our task are rectified. Automobile engine drive is coupled to the compressor engine, the compressed air its stores when running the vehicle. the pneumatic cylinder are is used to activate this compressed air, when activate the valve. Spur gear is used for rotating the trailer in three

directions & easy for unloading the materials in small compact streets and roads.

- ❖ For 360 degree rotation use automatic system that is motor for the rotation.
- ❖ Use the sensor while rotating the trolley, it doesn't unload the material.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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, International Journal 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 Fabrication of 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 and Development, 4(12), 2017, 27 - 31.
- [5] S. R. Kulkarni, T. S. Vandali, and S. A. Goudadi, Prototype of Collapsible Trolley, International Journal for Scientific Research and Development, 4(5), 2016, 18 - 25.
- [6] AUTOMOTIVE MECHANICS BY W C
- [7] Fundamentals of Vehicle Dynamics
- [8] Neville, A., Stanton, Marsden P.(2001), From fly-by-wire to Drive-by-wire: Safety implications of automation in Vehicles , Automotive engineering, Vol.109, No.9, Pp.102-106.
- [9] Brian T., Murray, D, Ambrosio, Joseph, W., Barbara J. C., System-Safety Process For By-Wire Automotive System, SAE TECHNICAL PAPER SERIES 2000-01-1056A.
- [10] Eng. Brabec P, doc. Eng. Maly M, Eng. Vozenilek R., Faculty of Mechanical Engineering – Technical University of Liberec, Czech Republic, on "Steer-By-Wire simulation model".
- [11] Design and Development of Multistage Dumping Trolley(2016) 1 Omkar Bagade, 2 Vaibhav Deokar, 3 A.H.Pawar 1,2,3, Vishwakarma Institute of Technology, Pune-37.
- [12] A Review on Three Direction Dropping Dumper(2017), A.S.Pal1, A.G.Shahu2, D.P.Mandaokar3, R.I.Meshram4, Ms.U.T.Dhanre, U.G. Student, Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, Maharashtra, India, Associate Professor, Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, Maharashtra, India.
- [13] Design and Fabrication of Three Way Trolley Mechanism, (2015), Prof. Akshay Pachpore, Ajinkya Gharote, Virendra Paulzagade, Department of mechanical engineering M.I.E.T Shahapur, Bhandara, Maharashtra, India.
- [14] Design and Development of 3-Way Dropping Dumper,(2014) Laukik Raut, Ganesh Shinde .
- [15] Design and Fabrication of Unidirectional Dumper ,(2015) Prof. Mrs. R. S. Tupkar¹ Aditya R. Malewar² Rohit A. Ramteke³ Harshal S. Lakhade⁴ Shubham R. Navghare⁵, Department of Mechanical Engineering Priyadarshini College of Engineering.