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# Multidirectional Rotational Trolley (Prototype)

[#1]Elesban Gonsalves, [#2]Abhijeet Kale, [#3]Rohit Badgujar, [#4]Digambar Chaudhari, [#5]Prof. Umesh Divekar

[1]elesbangonsalves004@gmail.com,
[2]abhijeetkale7755@gmail.com,
[3]rohitbadgujar1996@gmail.com,
[4]digamberchaudhari007@gmail.com.

[#1234]Students, Mechanical Department, JSPM NTC, Savitribai Phule Pune University Pune, India
[#5]Professor, Mechanical Department, JSPM NTC, Savitribai Phule Pune University Pune, India

**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 2700 as per requirement. However, the Multidirectional dumper is developed and tested for its rotation in all 3600 possible angle to unload the materials in the tipper trolley and monitor the inclinations for its gradualism by using Geneva mechanism.**

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## I. 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 $360^0$ 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 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.

## II. EQUATIONS

**Double acting cylinder calculations**

**Output Stroke**

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

$F = p A$

$F = p \pi d^2/4$ -------- (1)

where,

F = force exerted (N)

p = gauge pressure ($N/m^2$, Pa)

A = full bore area ($m^2$)

d = full bore piston diameter (m)

**Input Stroke**

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

The force exerted on in stroke can be expressed as

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

where

$d_1$ = full bore piston diameter (m)

$d_2$ = piston rod diameter

**Motor calculations,**

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

Where,

T =torque

P =power

N=motor speed

## III. FIGURE AND TABLE

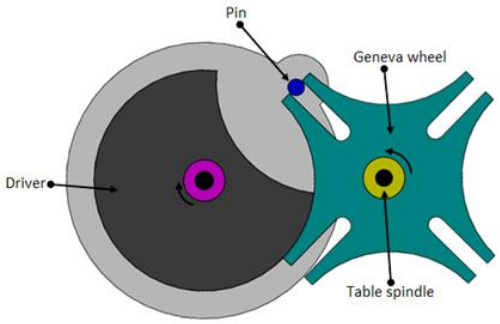


Fig: Geneva mechanism

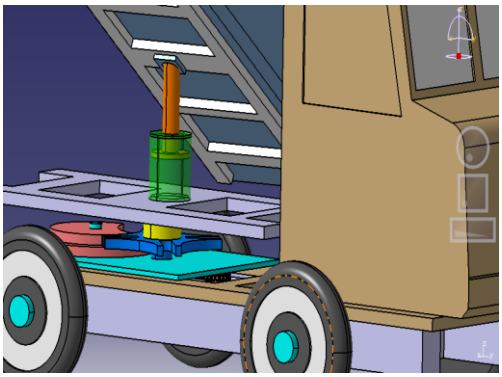

Fig Catia model of the actual trolley

TABLE1

TABLE OF MECHANICAL PROPERTIES

| Sr. | Mechanical Properties | | |
|---|---|---|---|
| 1 | Hardness Brunel | 126 | 126 |
| 2 | Hardness, Rockwell | 71 | 71 |
| 3 | Tensile Strength, Ultimate | 440MPa | 63800 psi |
| 4 | Tensile Strength, Yield | 370 MPa | 53700 psi |
| 5 | Elongation at Break (In 50 mm) | 15.0% | 15% |
| 6 | Reduction of Area | 40.0% | 40.0% |
| 7 | Modulus of Elasticity | 205 GPa | 29700 ksi |
| 8 | Bulk Modulus (Typical for Steel) | 140 GPa | 203000 ksi |
| 9 | Poisson's Ratio | 0.290 | 0.290 |
| 10 | Machinability | 70% | 70% |
| 11 | Shear Modulus | 80.0 GPa | 11600 ksi |

## IV. 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

 

efficient and user friendly machinery which will lead to more and more use of three way dropping dumper.

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