Design and Fabrication of Three Axis Modern Pneumatic Tipper

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Abstract— *A dump truck (or, UK, dumper/tipper truck) is a truck used for transporting loose material (such as sand, gravel, or dirt) for construction. A typical dump truck is equipped with an open-box bed, which is hinged at the rear and equipped with hydraulic pistons to lift the front, allowing the material in the bed to be deposited ("dumped") on the ground behind the truck at the site of delivery. In the UK and Australia the term applies to off-road construction plant only, and the road vehicle is known as a tipper, tipper lorry (UK) or tip truck (AU).In this it works only in one axis only. In modern three axis tipper which works in all axis like X,Y,Z.*

Keywords—Dump Truck; Hydralic Pistons; Pneumatic Tipper

1. INTRODUCTION

Automation can be achieved through computers, hydraulics, hydraulics, robotics, etc., of these sources, hydraulics form an attractive medium. Automation plays an important role in automobile. Nowadays almost all the automobile vehicle is being atomized in order to product the human being. The automobile vehicle is being atomized for the following reasons.

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and the control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power).

The main advantage of an all pneumatic system are usually economic and simplicity the latter reducing maintenance to a low level. It can also have out standing advantages in terms of safety.

2. WORKING

1) Hydraulic cylinder

A hydraulic cylinder is placed below the body of truck longitudinally at one end of the truck; the piston end of the hydraulic cylinder is connected by the means of a pivot joint to the chassis of truck as well as with the chassis. In the forward stroke of the cylinder it pushes the truck body upward thus gives necessary lift for tipping. So, in forward stroke of the cylinder truck gets unloaded. In the return stroke of the cylinder the body of the truck comes to its original position.

2) Hinge Joint

The other bottom end of the body of the truck is connected by a hinged joint with the chassis. So, when the hydraulic cylinder pushes the body in its forward stroke the whole body gets tilted about the axis of the hinged joint and the material gets unloaded and by the return stroke of the hydraulic cylinder body comes and seat to its original position with respect to the hinged axis. But in this types of tipper can unload materials only at the backside of the tipper. 3-directional tipper can overcome this problem; it can unload material in all three sides.

B. Operation of Tipper

The tipper truck is important machinery in mining, construction sector to unload the material on site with minimum help of workers. The purpose of tipper mechanism is to unload the trolley of vehicle without or with little assistant of human. It provides the means for unloading the trolley with minimum time period with no effort.

A tipper truck is nothing but whose material can be emptied without handling the material. The front end of platform can be hydraulically raised so that the load is discharged by gravity which is known as "tipper mechanism". Tippers which are in existence to facilitate unloading of material are in only one direction. But it requires a lot of space and often results in blocking of the road. In order to resolve these problems we are providing the modification in existing system. We are providing the sideways movements of the trolley which could be very useful where there is a shortage of space. This mechanism prevents blocking of the road which saves the time and enhances the productivity..

3. COMPONENTS DETAILS

The major parts “PNEUMATIC THREE AXIS MODERN TRAILLER” are described below:
Air compressor **,**Direction Control Valve, Cylinder, Connecting hoses, Flow control valve, Bearing with bearing cap, Wheel arrangement, Vehicle model frame, Rotating Plates.

4. CALCULATIONS

1.1 Pneumatic Cylinder

1.1.1Design of Piston rod

Diameter of the Piston (d)	=	40 mm
Pressure acting (p)	=	6 kgf/cm²
Material used for rod	=	C 45
Yield stress (σ_y)	=	36 kgf/mm²
Assuming factor of safety	=	2
Force acting on the rod (P)	=	Pressure x Area
	=	p x (Πd² / 4)
	=	6 x {(Π x 4²) / 4}
P	=	73.36 Kgf
Design Stress (σ_y)	=	σy / F0S
	=	36/2= 18 Kgf/mm²
∴ d	=	P / (Π d² / 4)
	=	√ 4 p / Π [σy]
	=	√ 4x75.36/{Π x 8}
Min diameter of rod required for the load	=	2.3 mm
We assume diameter of the rod	=	15 mm

1.2 Design of cylinder thickness:

Material used	=	Cast iron
Assuming internal dia of the cylinder	=	40 mm
Ultimate tensile stress	=	250N/mm²
	=	2500Kgf/mm²
Working Stress	=	UltimateTensilestress/ FOS
Assuming factor of safety	=	4
Working stress (ft)	=	2500/4
	=	625 Kgf/cm²

According to 'Lames Equation'

Minimum thickness of cylinder (t) = ri {√ (f_t + p) / (f_t – p) -1 }

Where,

ri = inner radius of cylinder in cm.

f_t = Working stress (Kgf/cm²)

p = Working pressure in Kgf/cm²

∴Substituting values we get,

t = 2.0 {√ (625 + 6) / (625 – 6) -1}

t	=	0.019 cm
	=	0.19 mm
We assume thickness of cylinder	=	2.5 mm
Inner diameter of barrel	=	40 mm
Outer diameter of barrel	=	40 + 2t
	=	40 + (2 x 2.5)
	=	45 mm

LIST OF FIGURES

5. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

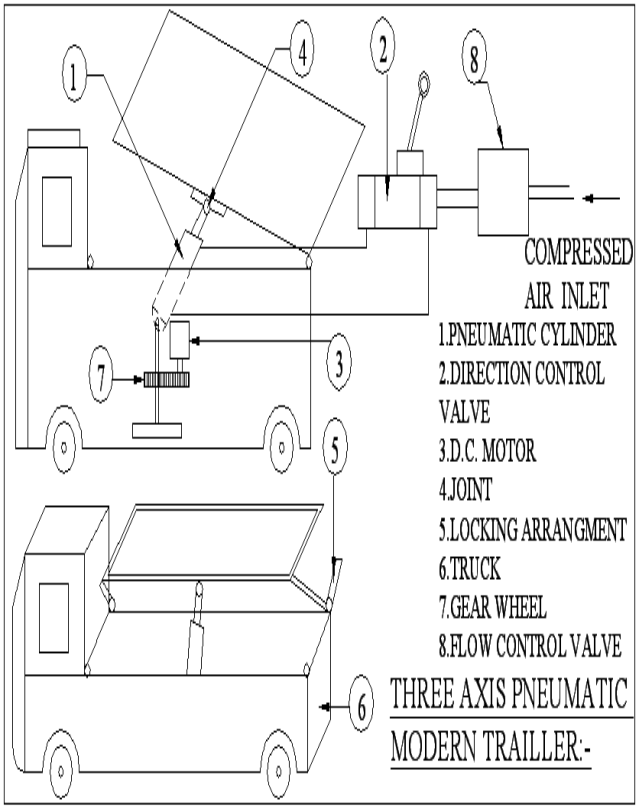

Fig No 1.1 Three Axis Modern Pneumatic Tipper

We are proud that we have completed the work with the limited time successfully. The **"THREE AXIS PNEUMATIC MODERN TIPPER"** is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work.

Thus we have developed a **"THREE AXIS PNEUMATIC MODERN TIPPER"** which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications.

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