Modeling and Fabricating Three Axis Pneumatic Modern Trailers

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Abstract: This project work titled **"**Three Axis Pneumatic Modern Trailers**"** has been conceived having studied the difficulty in unloading the materials. Our survey in the regard in several automobile garages, revealed the facts that mostly some difficult methods were adopted in unloading the materials from the trailer. Now the project has mainly concentrated on this difficulty, and hence a suitable arrangement has been designed. Such that the vehicles can be unloaded from the trailer in three axes without application of any impact force. By pressing the Direction control valve activated. The compressed air is goes to the pneumatic cylinder through valve. The ram of the pneumatic cylinder acts as a lifting the trailer cabin. The automobile engine drive is coupled to the compressor engine, so that it stores the compressed air when the vehicle running. This compressed air is used to activate the pneumatic cylinder, when the valve is activated.

Index Terms **– Trailer, Locking Arrangement, Pneumatic cylinder, Compressed Air.**

I. 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, to achieve high safety, to reduce man power, to increase the efficiency of the vehicle, to reduce the work load, to reduce the fatigue of workers, to high responsibility, Less Maintenance cost. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

$$PV = C \text{ (or) } P_1 V_1 = P2V2$$

II. COMPONENTS AND DESCRIPTION

This technology was brought to its p resent state of perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type. However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. Design engineers have usually two possible sources for obtaining information which they can use to select a bearing for their particular application. The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single-row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore.

2.1. WHEEL ARRANGEMENT

The wheels are fitted to the body of the vehicle with the help of end bearing and bearing caps. The wheels are made up of fiber material.

2.2. TRAILER BODY

The trailer body is made up of mild steel sheet metal. This frame is look like a small model trailer.

2.3. ROTATING PLATES:-

The rotating plates are fixed in the bottom the trailer body, so that the cylinder will rotates in the required side. The plates are made up of mild steel materials.

III. DESIGN AND DRAWINGS

3.1. PNEUMATIC CYLINDER

Design of Piston rod:

Load due to air Pressure.

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 / F0 S
= 36 / 2 = 18 Kgf/mm²
= P / (Π d² / 4)
= 2.3 mm

∴ Minimum diameter of rod required for the load = 2.3 mm
We assume diameter of the rod = 15 mm.

Design of cylinder thickness:

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

According to **'LAMES EQUATION'**
Minimum thickness of cylinder (t) = $ri \{\sqrt{(f_t + p) / (f_t - p)} - 1 \}$
Where,
ri =inner radius of cylinder in cm.
f_t =Working stress (Kgf/cm²)
p =Working pressure in Kgf/cm²
We assume thickness of cylinder = 2.5 mm
Inner diameter of barrel = 40 mm

Design of Piston rod:

Diameter of Piston Rod:

Force of piston Rod (P) = Pressure x area = p x Π/4 (d²)
= 6 x (Π / 4) x (4)²
= 73.36 Kgf
Also, force on piston rod (P) = (Π/4) $(d_p)^2$ x f_t
P = (Π/4) x (dp)² x 625
73.36 = (Π/4) x (dp)² x 625
∴ dp² = 73.36 x (4/Π) x (1/625)
= 0.15
dp = 0.38 cm =3.8 mm
By standardizing dp = 15 mm

Length of piston rod:

Approach stroke =160 mm
Length of threads =2 x 20=40mm
Extra length due to front cover =12 mm
Extra length of accommodate head =20 mm
Total length of the piston rod =160 + 40 + 12 + 20
=232 mm

By standardizing, length of the piston rod =230 mm.

3.2. DESIGN OF BALL BEARING

Bearing No. 6202

Outer Diameter of Bearing (D) = 35 mm
Thickness of Bearing (B) = 12 mm
Inner Diameter of the Bearing (d) = 15 mm

r_1 = Corner radii on shaft and housing

r_1 = 1 (From design data book)
Maximum Speed = 14,000 rpm (From design data book)
Mean Diameter (d_m) = (D + d) / 2
= (35 + 15) / 2
d_m = 25 mm

WAHL STRESS FACTOR

$$Ks = \frac{4C-1}{4C-4} + \frac{0.65}{C}$$

$$= \frac{(4 \times 2.3) - 1}{(4 \times 2.3) - 4} + \frac{0.65}{2.3}$$

$$Ks = 1.85$$

IV. WORKING PRINCIPLE

Since pneumatic circuit plays a vital role in this device, it is very necessary to explain the working of this circuit. Initially starting with air compresses, its function is to compress air from a low inlet pressure (usually atmospheric) to a higher pressure level. This is an accomplished by reducing the volume of the air. Air compressors are generally positive displacement units and are either of the reciprocating piston type or the rotary screw or rotary vane types. The air compressor used here is a typically small sized, two-stage compressor unit. It also consists of a compressed air tank, electric rotor and pulley drive, pressure controls and instruments for quick hook up and use. The compressor is driver by a 1 HP motor and designed to operate in 10 – 100 PSI range. If the pressure exceeds the designed pressure of the receiver a release value provided releases the excesses air and thus stays a head of any hazards to take place. Then having a pressure regulator where the desired pressure to the operated is set. Here a variable pressure regulator is adopted. Through a variety of direction control value are available, a hand operated spool value with detent is applied .The spool value used here is 5 ports, 3 positions. There are two exhaust ports, two outlet ports and one inlet port. In two extreme positions only the directions can be changed while the Centro ore is a neutral position and no physical changes are incurred. The 2 outlet ports are connected to an actuator (Cylinder). The pneumatic activates is a double acting, single rod cylinder. The cylinder output is coupled to further purpose. The piston end has an air horning effect to prevent sudden thrust at extreme ends.

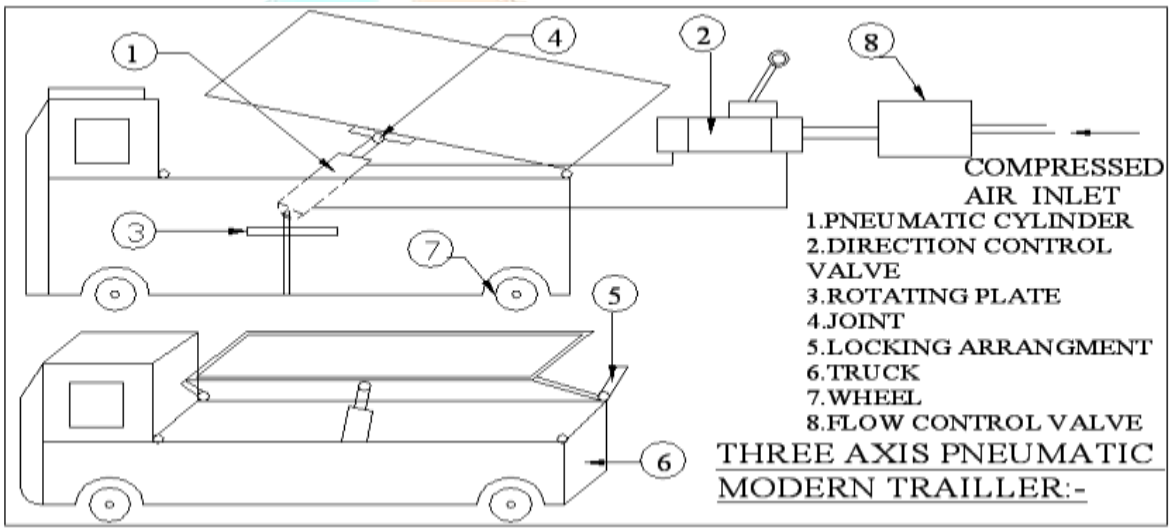

Fig.1. 2D Drawing of Three Axis Pneumatic Trailer

V. 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. The "Three Axis Pneumatic Modern Trailer" 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 Trailer*"* 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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