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Pneumatically Operated Three Axis Tiltable Trailler

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Abstract: Present day sand loaders used in construction industry have a major disadvantages that the trailer In which the sand or the building material are carried can only be made to dump the materials only by tilting the trailer so that the building materials are dumped behind the vehicle. This results in difficulty especially where the place of construction is located by the side of narrow roads. In such case the dumping of sand on other building materials behind the vehicle, as happens in a single axis trailer, results in the sand being dumped mostly on the road instead of near sides of the place construction. This necessitates the use of manual labor for again shifting the dumped sand from the road by using tools like shovels etc. the whole is not only inconvenient but also entails additional labors**.**

In the present work, a novel design incorporating pneumatically operated three axis tillable trailer has been conceptualized a prototype has been substituted. The trailer can be tilted in three mutually perpendicular directions backwards, left sideward's, right side words at a maximum tilt angle of about 45^0 .The axis along which the trailer has to be tilted is easily selected by means of hand liver and then the pneumatic circuit is actuated for bringing about the dumping process.

Keywords: Dumping, Hand liver, Pneumatic, Three axis

I. INTRODUCTION

The word 'pneuma' comes from Greek and means "air in motion, breath, or wind". The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation.

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.

II. COMPONENTS AND DESCRIPTION

1. MAJOR PARTS

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
-

1.1 Air Compressor

The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is 103105 to 12 3105 N/m^2. This is a two stages or two-cylinder reciprocating air compressor. The two cylinders are for low and high compression. The air pressure is measured at various places by the use of pressure gauges. V-belt and pulley are used to drive the compressor.

Compressors can be broadly classifieds into two groups. They are:

- Positive Displacement Compressor
- Dynamic Compressors

1.1.1 Selection Criteria for Compressors

A number of factors are involved in the selection criteria of a suitable air compressor. These are dealt here briefly:

1. Pressure

First of all, the pressure needed must be determined. Most air operated system and tools are designed to operate at a pressure from 6 3105 to 7 3105 N/m^2. A compressor of normal make and type would normally be suitable if this can assure a pressure 6 3105 N/m^2 in the distribution line laid down for a pneumatic tools and system.

2. Capacity

Another important factor in compressor selection is the capacity or volume of air required. This factor is sometimes extremely difficult to evaluate. Obviously, the unit selected should be large enough to supply all the air devices, which will be operating at any given time. If all the air operation is continuous, the capacity required is simply the sum of air compression of each individual tool.

The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is 10 3105 to 12 3105 N/m^2. This is a two stages or two-cylinder reciprocating air compressor. The two cylinders are for low and high compression. The air pressure is measured at various places by the use of pressure gauges. V-belt and pulley are used to drive the compressor.

3. Pressure Gauge

Pressure gauge is used for measuring the outlet pressure of air from the compressor. The gauge used is Bourdon type pressure gauge. The maximum capacity of this gauge is 10 3105 to 12 3105 N/m^2. The gauge is fitted at the outlet of the air compressor.

III. DESIGN AND FABRICATION:

SPECIFICATION: PNEUMATIC CYLINDER

Diameter of the Piston rod (d)	=	8	mm
Pressure acting (p)	=	5	kgf/cm²
Material used for rod	=	Mild steel	
Material used	=	Mild steel	
internal diameter of the cylinder	=	8 mm	

1. **Double acting pneumatic cylinder**

Stroke length : 75 mm = 0.075 m
Quantity : 1
Seals : Nitride (Buna-N) Elastomer
End cones : Cast iron
Piston : EN – 8
Media : Air
Temperature : 0-80 º

2. Hoses

Max pressure : 10 x 10^5 N/m^2
Outer diameter : 6 mm = 6 x 10^{-3}m
Inner diameter : 3.5 mm = 3.5 x 10^{-3}m

IV. FIGURES AND TABLES

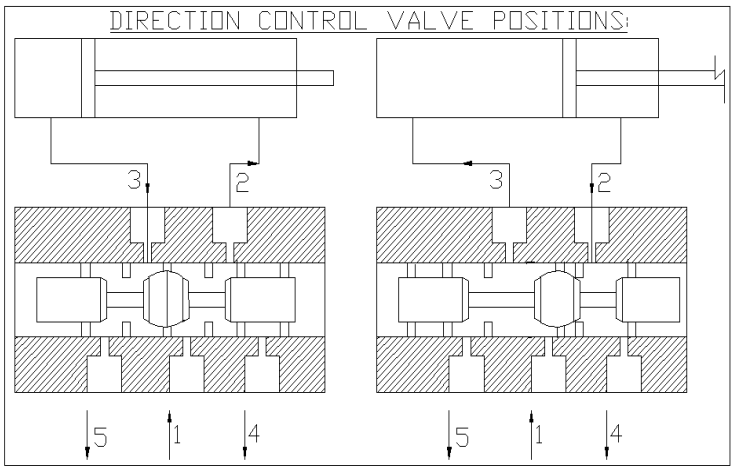

Fig: 4.1 Direction Control Valve Position

3D MODEL

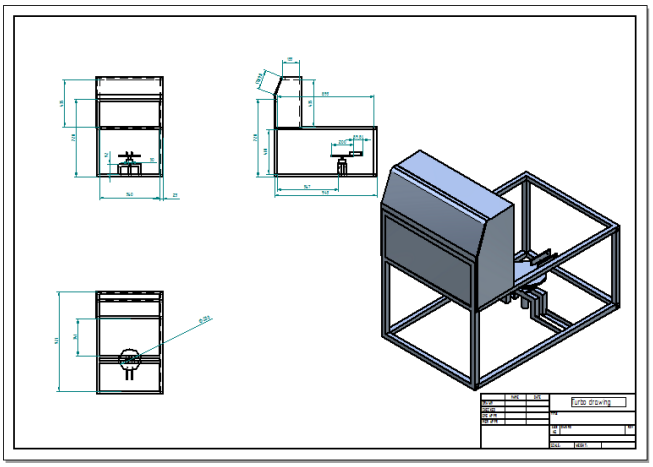

Fig: 4.2 Frame Body

Catia model

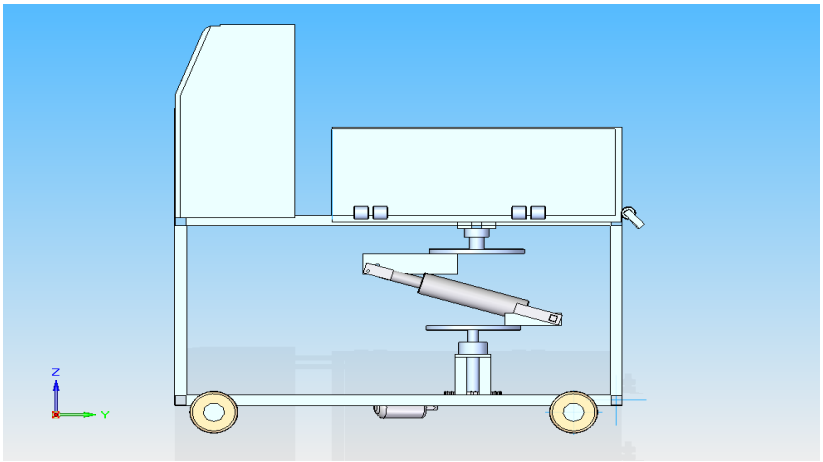

Fig: 4.3 Full Assembly (**SIDE VIEW)**

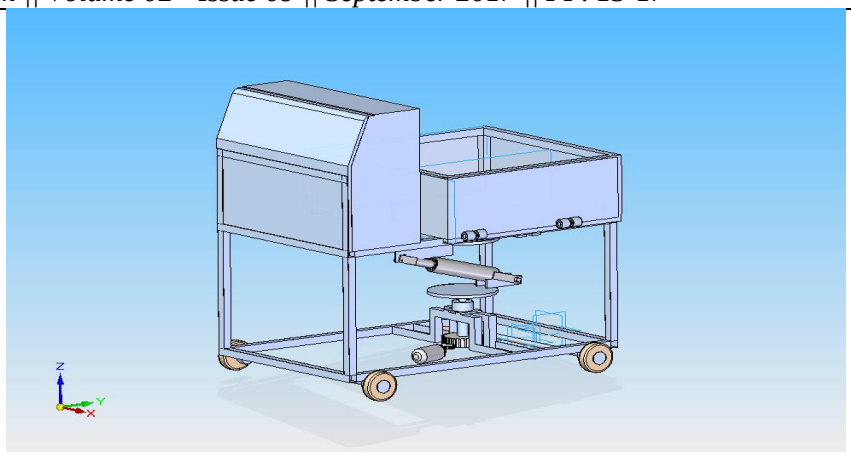

Fig: 4.4 Full Assembly **(ISOMETRIC VIEW)**

i. LIST OF MATERIALS

Sl. No.	*ii. PARTS*	**Qty.**	**Material**
i.	Pneumatic Double Acting Cylinder	1	M.S
ii.	5/3 Direction Control Valve	1	Aluminium
iii.	Battery	1	Lead acid
iv.	Wheel	4	Rubber
v.	Bearing with Bearing Cap	4	Fiber
vi.	Hose Collar and Reducer	-	Brass
Vii.	Stand (Frame)	1	Mild steel
Viii.	Dash Pad	1	Plastic
iX.	D.C Motor	1	Aluminum

COST ESTIMATION

Sl. No.	*iii. PARTS*	**Qty.**	**Material**	**Amount (Rs)**
i.	Pneumatic Double Acting Cylinder	1	M.S	750.00
ii.	5/3 Direction Control Valve	1	Aluminium	1,000.00
iii.	Battery	1	Electronics	1000.00
iv.	Wheel	4	Rubber	350.00
v.	Bearing with Bearing Cap	4	Fiber	400.00
vi.	Hose Collar and Reducer	-	Brass	200.00
Vii	Stand (Frame)	1	Mild steel	2,500.00
Viii	D.C Motor	1	Aluminum	900.00
iX	Flow control valve	1	Lead-Acid	250.00

TOTAL = 8,350.00

2. LABOUR COST

Lathe, Drilling, Welding, Grinding, Power Hacksaw, Gas Cutting:

Cost = 2,500.00

3. OVERHEAD CHARGES

The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost = Material Cost + Labour cost
= 8,350.00 + 2,500.00
= 10,850.00

Overhead Charges = 20% of the manufacturing cost
= 2,170.00

TOTAL COST

Total cost = Material Cost + Labour cost + Overhead Charges
= 8,350.00 + 2,500.00 + 2,170.00
= 13,020.00

Total cost for this project = 13,020.00

V. CONCLUSION

- A prototype model of the pneumatically operated three axis tillable trailer has been designed, fabricated, demonstrated for its functionality
- The prototype can be commercialized for use in tractors and loaders for conveniently dumping sand, jelly stones and other building materials near the place of construction especially located in diversely populated residential areas often with any narrow roads at a nominal cost
- The whole assembly is simple.
- Manual labor involved is very less and maintenance free.

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