



FABRICATION OF THREE AXIS PNEUMATIC MODERN TRAILER

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Abstract-Our main project is three axis pneumatic modern trailer works on the principles of pneumatic mechanism along with micro controllers. In this project the efficiency of dumping trailers will increase. The unloading of materials can be done to the three directions. This is very useful in the shipping industry. We are choosing this project for the decreasing the man power and time. The combination of pneumatics and micro controllers can be seen in our project. We have chosen this project because of the various attractiveness of pneumatics.

I. INTRODUCTION

Recent day's automation plays a vital role in the development of manufacturing sectors. Automation of manufacturing sectors can be implemented through hydraulic systems, pneumatic systems and robotics system integrated with computers depending on the requirements. Out these systems pneumatic system plays a vital role in the automation and its form an attractive medium. In this paper we are considering a automation in the shipping sector. The automation in the shipping sector was implemented for the reasons stated below.

- To reduce man power
- To increase ship manoeuvring efficiency
- To increase the rest time for seaman
- To increase the life time of machinery
- To high responsibility
- To achieve high safety
- To get better controllability
- Less Maintenance cost

[1] The ""pneuma" is the greek word which is having a meaning of breather wind. The pneumatics is the one of the branch of science that deals with the study of movement of air and its characterization. But pneumatics is generally understand that the application of air in the manufacturing sector and shipping industry as a working medium for controlling and driving of the machinery and the equipment. In the earlier days pneumatics system is used for performing the basic mechanical tasks in the ships but in the recent times, pneumatics plays a vital role in the development of automation technology. For operating the Pneumatic system compressed air is used as a working medium. Sufficient quantity of compressed air with required pressure should be made available depending on the need of the pneumatic system. There are various types of compressors are available in the world out of which reciprocating compressor is the one which is suited for all kinds of application.

Depending on the need from small portable reciprocating compressor to very large reciprocating compressor is available. The compressor will load the air bottle with required size. [2] In the single stage reciprocating air compressor will discharge the air pressure from 6 bars to the discharge pressure is up to 15 bars. To get the maximum discharge in the capacity of 250 bars can be attained with the help of additional stages high pressure reciprocating compressors. The compressors should have all kinds of safety mountings which is necessary for the safety environment. In the case of ship already high capacity reciprocating air compressor are available for the main engine starting which can also be used for the automation system. This can reduce the cost of the installation of automation.

EXISTING METHODOLOGY

The very first version of a dump truck used to haul and dump material was nothing more than a simple dump body style cart drawn by horses. It would have consisted of a two-wheeled cart hinged to the axle with the center of gravity, when loaded, just behind the axle. The loaded front body was hooked, and when unlatched, would dump. These carts were used in open mines and pulled by horses along a railway track. After 1900, a four-wheeled horse-drawn flatbed wagon with a rectangular body lifted with a hand hoist in the front was employed. In the book, 500 Years of Earthmoving, Heinz- Herbert Cohrs cites that before the first dump trucks appeared, excavated materials were being removed and hauled by locomotives and trolleys known as box tip wagons, dump bodies, and scoop tippers.

II. PNEUMATIC THREE AXIS MODERN TRAILER

[3] Pneumatic Three Axis Modern Trailer is nothing but one of the Lifting system in automobile at the time of emergency. In this Lifting system pneumatically operated one. Here the additional pneumatic cylinder and Control Valve is provided in the automobile itself. In this project, the Control Valve is used to activate/deactivate the Air input. The Valve is „ON“ at the time of emergency; the compressed air goes to the pneumatic cylinder. Then the compressed air passes through the tube, and then pushes the pneumatic cylinder, so that the Lifting is applied at the time of Valve in “ON” position (i.e.-Emergency time). The speed of the pneumatic cylinder is varied by using flow control valve. This is the way of controlling Lifting speed of the Trailer at the time of emergency. In our project, we have to apply this Pneumatic Modern Trailer Mechanism in Load Lifting Vehicles. The Control Valve is fixed in near of the driving persons in the four wheeler. The air tank contains the compressed air already filled. The Valve was ON at the time of emergency, the Control Valve was activated. The compressed air flow is controlled by the valve is called “FLOW CONTROL VALVE”. This air flow is already set. Then the compressed air goes to the pneumatic cylinders. The pneumatic cylinders piston moves forward at the time of compressed air inlet to the cylinder. The pneumatic cylinder moves towards the Lifting arrangement.

ADVANTAGES

- Lifting cost will be less.
- Free from wear adjustment.
- Less power consumption
- Less skill technicians is sufficient to operate.
- Installation is simplified very much.

III. MAJOR PARTS

The major parts pneumatic three axis modern tipper is described below:

- Air compressor
- Direction Control Valve
- Cylinder
- Connecting hoses
- Flow control valve
- Bearing with bearing cap
- Wheel arrangement
- Vehicle model frame
- Rotating Plates

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 10105 to 12 105 N/m². 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 classified into two groups. They are:

- Positive Displacement
- Dynamic Compressor

Compressor

Positive Displacement Compressor: Successive volumes of air isolated and then compressed to a higher pressure. There are essential two forms of positive displacement compressor, reciprocating and rotary.

Dynamic Compressors: These are rotary continuous machines in which a high speed rotating element accelerates the air and converts the resulting velocity head into pressure. Positive displacement compressors work on the principle of increasing the pressure of a definite volume in an enclosed chamber. Dynamic (turbo) compressor employs rotating vanes or impellers to impart velocity and pressure to the flow of the air being handled. The pressure comes from the dynamic effects such as centrifugal force.

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 10 105 to 12 105 N/m². The gauge is fitted at the outlet of the air compressor. **Pneumatic valves:** The pneumatic cylinder is regulated and controlled by pneumatic valves. These valves are actuated manually, mechanically, electrically, pneumatically, and by various combined mode of actuation. Types of single acting cylinders:

- Diaphragm cylinder
- Rolling diaphragm cylinder
- Double Acting Cylinder:

In the double acting cylinder the compressed air moves the piston in two directions

Air Seal: Air seal is used to prevent the leakage of air pressure from the cylinder. Normally it is made up of neoprene rubber. If there are any air leakages in the system, it will reduce the efficiency.

Wiper Seal: Wiper seal is provided at the entrance of the cylinder to avoid dust materials from the environment. It is made up of neoprene rubber.

O Ring: The O rings are fitted into the grooves of piston to maintain perfect seal between the piston and the cylinder wall. They are mostly made up of neoprene rubber. In some cases wire mesh also intruded.

Cylinder Barrel: It is made of cold drawn aluminium honed to 25mm.

Piston Rod: M.S. hard Chrome plated Seals: Nitrile (Buna N) Elastomer

End Covers: Cast iron graded fine grained from 25mm to 300mm

Piston: the piston is made up of aluminium metal because of light weight and high durability.

Media: the media which is used for the modern hydraulic trailer system is usually Air.

Temperature Range: the temperature of the system usually ranges from 00c to 850c

Cushions: Adjustable standard on 400mm bore and above. **Flow Control Valve:** In any fluid power circuit, flow control valve is used to control the speed of the actuator. The flow control can be achieved by varying the area of flow through which the air is passing. When area is increased, more quantity of air will be sent to actuator as a result its speed will increase.

III. WORKING PRINCIPLE

In this modern three axis pneumatic trailer system, the air circuit plays a vital role in the system and it is necessary to understand the movement and working principle of the air circuit. First we can start with the compressing of the air; the atmospheric air which is normal pressure is taken by the reciprocating compressor and converted into higher pressure depending on the requirement. Cooling as to be provided for the compressed air to neutralized the heat generated by the compression process. The compressed air is supplied to the compressed air tank and the compressed air tank should have a drain to drain the water accumulated in the tank air moisture condensation. In the ship the main air bottle is used for the three axis trailer operation with the help of the pressure reducing valve because the main air bottle pressure is nearly stored at 35 bars for the main engine starting operation.

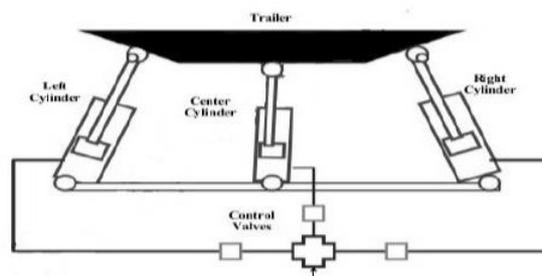


Figure 1 : circuit diagram of three axis pneumatic modern trailer

In the modern three axis pneumatic trailer system we need maximum of 7 bars, 35 bars air pressure will damage the system. but some cases the variable pressure reducing valve will be used depending the requirement of the system also direction control valve are available for the desired operation [5] For the pneumatic circuits usually the 5/2 direction control valve is used for the better compatibility.

The figure shows the circuit diagram of the modern three axis pneumatic modern trailer. The air which is compressed in the compressor is sent to the 5/2 direction control valve. The 5/2 direction control valve will change the flow direction of the compressed air depending on the handle valve position. Then the compressed air from the direction control valve is sent to the cylinder block depending on the valve position. The compressed air admitted in the cylinder block will push the piston upwards. The piston stroke length can be adjusted by means of the operation of hand lever valve position. The earliest versions of truck mounted dump bodies relied on the principle of gravity for dumping. The dump body pivoted off center and, when level, would be locked in place. Releasing the lock would activate the body to dump to the rear. The dump body, when empty, remained locked in a non-dumping position. When loaded, the dump body's center of gravity would shift, activating it to dump. Some of the first trucks with dump bodies designed on this principle appeared as early as 1904 when the Mann gravity dump was built in England.

HYDRAULIC DUMP BODIES

Hydraulics were being incorporated into truck mounted dump bodies relatively early on. Records show that one of the first hydraulic dump bodies was the Robertson Steam Wagon with a hydraulic hoist that received power from the trucks engine or an independent steam engine. Alley & McLellan of Glasgow developed another early hydraulic dump body in 1907 that was power-driven by steam. Elevating the dump body allowed the free flow of material by gravity along chutes and for some distance from the truck. Four screws in each corner that were powered by the trucks power take-off could also elevate the dump body. Gravity pitch would be designed into the body so that coal would feed out from the hopper into the chute. A gate at the bottom of the chute controlled the outpouring of coal.

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CRAWLER TRACTOR-TRAILER

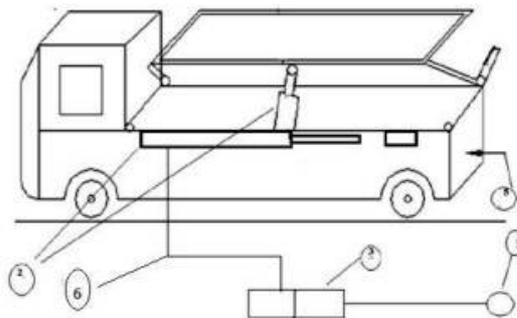
In the middle of the 1920s, crawler tractors pulling heavy dump trailers mounted on wheels or tracks were becoming increasingly popular. Sometimes crawlers would pull two to five attached trailers. Companies began developing wagons specifically designed for attachment to crawler tractors. The first versions were mounted on tracks; however, when speed restrictions posed a problem, the wagons were mounted on wheels to improve speed. Manufacturers of such trailers and haulers included Euclid, James Hagy, LaPlant-Choate, Rex-Watson, and Streich and Western.

EUCLID DUMP TRUCK

Euclid was a pioneer in the development of dump trucks. George Armington Jr., son of founder George Armington, was a hydraulics designer and made two significant contributions to the world of dump trucks. These included the modern heavy duty off-highway truck and the wheel tractor bottom dump wagon. In 1934 the company introduced its 10/11-ton dump truck called the "Trak Truk."

SAINT JOHN FIRST

The dump truck was first conceived in Saint John, New Brunswick when Robert T. Mawhinney attached a dump box to a flat-bed truck in 1920. The lifting device was a winch attached to a cable that fed over sheave (pulley) mounted on a mast behind the cab.



The cable was connected to the lower front end of the wooden dump box which was attached by a pivot at the back of the truck frame. It is mainly based on rotation of tipper trolley and divided in two parts Rotation and Dumping. For rotation of tipper, we used worm and gear mechanism. Worm is directly coupled with electric motor which is at horizontal position on the lower side of dumper, the spur gears are meshed with worm wheel and the axis of rotation of spur gear is vertical, which is directly attached to tipper trolley. The power supply is provided to the electric motor by using Double Pole Double Throw switch to complete the circuit of battery and motor. As a motor start rotating the worm is also rotated at same speed and spur gear which is connected to worm wheel.

The vertical shaft which is connected directly to the center of tipper trolley, when worm complete its 1 rotation then 1 teeth of worm gear moves forward. Spur gear is having 40 teeth on its profile When 10 teeth of spur gear are moved forward then trolley gets rotated by 90° from its initial position in 20 second. The rotating direction of trolley is changed or reversed by Double Pole Double Throw switch. When the trolley completes its required angle then material is dumped with the help of pneumatic cylinder. The compressed air is supplied by air compressor to cylinder. outsourcing. This mechanism cannot only applicable in the shipping industry but also it is applicable for various manufacturing industries. 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



The air flow direction is controlled by solenoid valve. On the cylinder two forces are provided one on upper side & other on one side. For the upper movement of trolley air is supplied through the lower port and for downward movement of trolley air is released from the same port. 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 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 valve provided releases the excesses air and thus stays a head of any hazards to take place.

IV. CONCLUSIONS

This paper will review the need of the modern three axis pneumatic trailer for the ship to perform the operation of lifting heavy weight materials. This paper also studies the importance of pneumatic circuit system and its application in shipping industry. Various parts of the modern three axis pneumatic trailer was studied and their performance was analyzed in terms of the work. Further review is made on the cost wise analysis with the other lifting systems and with the help of pneumatic system lifting operations can be easily carried out without much effort and without

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