



INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

THREE AXIS PNEUMATIC TROLLEY

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Abstract

Trailer has lots of use in today's world. In industrial and domestic considerations, trolley can haul a variety of products including gravel, agriculture equipment, grain, sand, stone, compost, heavy rocks, etc. By considering large scope of the topic, it is necessary to do study and research on the topic of trolley mechanism in order to make it more efficient. In existing system, trolley can unload only in one side by using Pneumatic jack. In our project we will use three-way pneumatic trolley mechanisms, which will help the trailer to unload in three directions. We will use pneumatic system and automatically operated solenoid valve for this project. By using this kind technique, it will be very easy for the driver to unload the trailer and also it reduces time and fuel consumption. In the previous mechanism is an approach to reduce the idle time to settle the dumper. The material are unload in Three direction and hence can be boldly stated as "Three way directional Dumper." The major outcomes of Three-way directional dumper has overcome space requirement which often result in road blocking and congested area. Hence, we have invert in this mechanism providing the unloading in three way.

Index Terms: Modern Trailer, Pneumatic Cylinder, Valves, Compressor.

1. INTRODUCTION

A trailer is a vehicle designed for carrying bulky material, on building sites. a trailer is usually an open four-wheel vehicle with the load skip in front of the driver, while a dump trolley has its cab in front of the load. The skip can be tip to dump the load; this is where the name "trolley" comes from. A trailer is an integral part of any construction work and so its role is important for completion of any constructional site. One of the problems are cited with trailer in the time and energy for setting the very large trailer in the proper direction to dump the material it is carrying and hence the need of project work riser which is about three way dropping trolley which can dump the material in any direction except the rental one without moving the truck in any direction.

Dumping process widely use in the applications areas like agriculture, construction and garbage transportation etc. conventional dumping system has limitation of mechanism which do not allow to dump the material at rear side only. It is inconvenient for vehicles to reposition according to dumping side in narrow lanes and limited spaces. This difficulty is overcome by multiple sides dumping mechanism by using single actuator having joints at its end. The dumper or trolley unload the material in only one direction. But this incapability can be full with new method mechanism as the Multidirectional dumper. Such type of

advance mechanism is an approach to reduce the idle time to settle the dumper. The material can be unload in three direction and hence can be boldly stated as "Three way dumper." The major outcomes of three way directional dumper has overcome space requirement which often result in road blocking. Hence, we have inversion in the existing mechanism providing the unloading in three ways rotation. This mechanism prevents blocking of road, reduce time and increase productivity at lower cost.

1.1 History

Since 1901, a four-wheel horse-drawn flatbed wagon with a rectangular body lifted with a hand hoist in the front was employed. In middle of the 1920s, the crawler tractors pulling heavy dump trolleys mounted on wheels or tracks were becoming increased popularity. Sometimes crawlers would pull three to six attach trailers. Companies began to produced wagons specification and design for attachment to crawler tractors. The first version was mounted on tracks; however, when speed restrictions posed a problem, the wagons were mounted on wheels to increase speed. Manufacturers of such trailers and haulers included Euclid, James Hagy and Streich and Western By the 1940s, the technological development of dump trucks had reached its peak

2. LITERATURE REVIEW

Ganesh Shinde et al [1] studied the „Modern 3 Ways dropping dumper“ which has been conceived by observing the difficulty in unloading the materials. The research in this topic in several automobile garages, revealed the fact that mostly some difficult methods were adopted in unloading the materials from the trolley. They have specifically focused on the above difficulty. Hence model of suitable arrangement has been designed. The vehicles can be unloaded from the trailer in three axes without application of any impact force. The Direction control valve which activates the ram of Pneumatic cylinder which lift the trailer cabin in required side. Further modifications and working limitation will put this work in the main purpose of use. This concept saves the time & energy which leads to efficient working.

Amboji S. R. et al [2] studied that Tipper has a lot of application in today's world. In an industrial and domestic consideration, tippers can pull a variety of products including gravel, potatoes, grain, sand, heavy rocks, etc. By considering the wide scope of this mechanism, it is necessary to do study and research on the topic of tipper mechanism in order to make it more economical and more efficient. In an existing system, a tipper can only unload on one side by using a Pneumatic jack or conveyor mechanism. By this research, it is very easy for the driver to unload the trailer and also it reduces time and fuel consumption. For making a tipper mechanism with such above respective both mechanisms, namely Pneumatic jack and conveyor mechanism, can be used. But eventually it comes with a question that how both systems can be arranged in a single set up? Answer to this question is nothing but the research of this work.

Alley & McLellan [3] of Glasgow studied Pneumatics was being incorporated into truck-mounted dump bodies relatively early on, in which record shows one of the first Pneumatic dump bodies was the Robertson Steam Wagon with a Pneumatic hoist that received power from the truck's engine or an independent steam engine. Another early Pneumatic dump body in 1907 that was power-driven by steam.

3. CONSTRUCTION

The major parts “THREE AXIS PNEUMATIC TROLLEY” are as follows:

- Pneumatic cylinder
- Trolley
- Chassis (Base frame)
- Gears
- Connecting hoses
- Wheel arrangement
- Flow control valve

- DC Motor
- Battery

3.1.1 Pneumatic Cylinder

A Pneumatic cylinder (also called a linear Pneumatic motor) is a mechanical actuator that is used to give a unidirectional force through a unidirectional stroke. Pneumatic cylinders have many applications, mainly in construction equipment (engineering vehicles), manufacturing machinery, and civil engineering. **SINGLE ACTING PNEUMATIC CYLINDER:** The Single Acting Pneumatic cylinder (see Figure 1), which is the simplest type of Pneumatic motor, contains a spring-loaded piston, with a piston rod that extends through one end of the cylinder. In our project, this single acting Pneumatic cylinder is used.



Fig 1. Pneumatic Cylinder

3.1.2 Trolley

Tractor trolleys are a very popular and cheaper mode of material transport in rural as well as urban areas. Trolleys are mostly used for transporting agricultural products, building construction material, and industrial equipment. The main purpose of trolley manufacturing is high performance, easy to maintain, longer working life, and robust construction. In this work, tractor trolleys are mostly used for agricultural work and sometimes used for transporting building construction material. These trolleys are divided into two types: two-wheeler trolleys and four-wheeler trolleys. The varieties of such trolleys are available, and the use of particular trolleys depends upon their application. They are available in various capacities like 3 tonnes, 5 tonnes, 6 tonnes, 8 tonnes, etc.



Fig. 2. Trolley

3.1.3 Chassis

A chassis is one of the main components of the trolley. It consists of an internal frame which is work that supports the container of tractor trolley in its construction and use. It is a dead vehicle which is attached to the tractor to carry the load. It use as a frame work for supporting the body. It should be rigid enough to resist the shock, twist, and other stresses & its principle function is to carry the maximum load for static and dynamic condition safely. An most important consideration in chassis design is to have adequate bending stiffness along with strength for better handling characteristics. The Chassis is used to support the container on which the load or goods is to be carried out.

Functions of Chassis -

- To carry load of the goods in the body.
- To withstand the forces which is caused due to the sudden braking or acceleration.
- To withstand the stresses which is caused by the bad road condition

3.1.4 D.C Motor

The electrical motor is an instrument, which is use to converts electrical energy into mechanical energy. According to faraday's law of Electromagnetic induction, when a current carrying conductor is placed in a magnetic field, it experience a mechanical force whose direction is given by Fleming's left hand rule. Constructionally a DC generator and a DC motor are identical. The dc machine can be used same as a generator or as a motor. When a generator is in operation condition, it is driven mechanically and develops a voltage. The voltage is capable for sending current through the load resistance. In the case of motor action a torque is developed. The torque can produces mechanical rotation. Motors are mainly classified as series wound, shunt wound motors.

3.1.5. Connecting Hoses

A hose is a flexible hollow tube designed to carry fluid and air from one location to another. Hoses are also known as pipes or more generally tubing. The shape of a hose is generally cylindrical. Hose design is based on a combination of performance and application .



Fig 3. Connectors

3.1.5. Wheel Arrangement

Many vehicles which exist in the form of motorcycle-based machines are often called trikes and often have the front single wheel and mechanics similar to that of a motorcycle and the rear axle similar to the car..

3.1.6. Gear

A gear is a rotating machine part which has cut teeth meshing with another toothed part to transmit the torque. Geared devices can changes the speed, torque, and direction of a power source. Gears uniformly produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same in shape. Two or more meshing gears, working under sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, known a rack, producing translation instead of rotation.



Fig. 4. Chain drive

3.1.7 Flow control valve

flow Control Valves is used to reduce the rate of flow in a section of a pneumatic cylinder, which resulting in a slower actuator speed. Unlike a Needle Valve, a Flow Control Valve regulates air flow in only one direction, it allows free flow in the opposite direction.

Directional control valves are one of the most prior parts in hydraulic machinery as well and pneumatic machinery. They allow air flow into different paths from one or more sources. They generally consist of a spool inside a cylinder which is mechanically or electrically controlled. The movement of the spool restricts or permits the flow of air, thus it controls the air flow.



Fig 5. Flow Control Valve

3.1.7. Battery

A dc motor is simple working device which is use to convert electrical energy into mechanical energy. Dc motor is provide for getting rotary motion of the trolley. This is 12 v dc , 15 rpm rotate the gear.



Fig 6. Battery

4. PRINCIPLES OF WORKING

The compressed air from the compressor reaches to the direction control valve. The direction control valve changes the flow direction according to the valve position handle.

The compressed air pass through the direction control valve and it is entered into the front end of the pneumatic cylinder block. The air pushes the piston for the purpose of lifting stroke. At the end of the lifting stroke air from the valve reaches the rear end of the piston cylinder. The pressure remains the same but the area is less due to the presence of piston rod. This exerts greater pressure on the piston, pushing it at a faster rate thus getting faster return stroke.

5. ADVANTAGES

It require the simple maintenance cares Checking and cleaning are vey easy, because of the main parts are screwed. Handling is very easy. Manual power is not required and Repairing is easy. Replacement of parts are easy.

ADVANTAGES OF PNUMATICS OVER HYDRAULICS

The air used in pneumatic cylinder is dried and free from moisture so that it does not create any problem to the internal parts of the system.

- Moreover, to avoid corrosive actions, oil or lubricants are added so that friction effects can be reduced.
- As most of the pneumatic devices are air based, they have a less complicated design and can be made of less expensive material.

- Mass production techniques can be adopted to produce pneumatic systems, which not only save money but also save time too.
- Initial cost is less; hydraulics equipment cost as much as twice the price of pneumatic equipment.

6. DISADVANTAGES

Initial cost is high. Separate air tank or compressor is required.

7. APPLICATIONS

- All Pneumatic and pneumatic dipper applications. Easy to unload the materials.
- Material handling unit
- Construction site
- Agriculture

8. FUTURE SCOPES

Three axis pneumatic trailer on current system can be possible. Providing ball and socket joint or universal joint at the tip of pneumatic cylinder piston, using external compressor, introduction of single Pneumatic cylinder of pneumatic can make the system a little more efficient. Another change that can be made is to introduce some rollers in between the load cabin and the body of the vehicle. This setup will make the rotation of the load cabin easier and thus the rotating disc will no longer have to experience the complete load.

- Dual stage cylinders can be used.
- Wheel steering can be adopt for avoid the lifting of vehicle along with trailers.
- Sensors and alarms can be used to avoid risks.
- This arrangement can fit on Automated Guided Vehicles (AGV).
- In an automation industry this system can be used with the help PLC system.

CONCLUSION

Trolley has lots of applications in today's world. In industrial and domestic considerations, dumper can pull a variety of products including gravel, grain, sand, fertilizer, heavy rocks, etc. The older dropping trolley or dumper has been conceived by observing the difficulty in unloading the materials "MODERN THREE WAY PNEUMATIC TROLLEY" is nothing but one of the Lifting system in automobile at the time of emergency. Here the additional Pneumatic cylinder and direction Control Valve is provided in the automobile itself.

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