Three Axis Pneumatic Modern Trailer

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***Abstract*:- This project work Three axis pneumatic modern trailer 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. The trailer will unload the material in only one single direction. It is difficult to unload the materials in small compact streets and small roads. In our project these are rectified to unload the trailer in all three sides very easily. 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.**

INTRODUCTION

A Trailer or dumper is a vehicle designed for carrying bulk material, often on building sites. Dumpers are distinguished from dump trucks by configuration. It is usually an open 4-wheeled vehicle with the load skip in front of the driver, while a dump truck has its cab in front of the load. The skip can tip to dump the load, Modern trailers have payloads of up to 10 tones and usually steer by articulating at the middle of the chassis (pivot steering). They have multi-cylinder diesel engines, some turbocharged, electric start and hydraulics for tipping and steering and are more expensive to make and operate. An A-frame known as a ROPS (Roll Over Protection) frame may be fitted over the seat to protect the driver if the dumper rolls over. Some dumpers have FOPS (Falling Object Protection) as well. Lifting skips are available for discharging above ground level. Dumpers are the most common cause of accidents involving construction plant. A trailer is an integral part of any construction work and hence its role is important for completion of any constructional site works. One of the problems cited with dumper is the problem during unloading in narrow roads and mines where it is impossible to unload the materials to the sides. Hence the need of the project work raised which is about 3 way dropping trailer which can dump the material in any direction except the frontal one without moving the truck in any direction.

LITURATURE REVIEW

The word ‘pneuma’ comes from Greek and means 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.

WORKING PRINCIPLE

The compressed air is used to activate the pneumatic cylinder, when the valve is activated the direction of the air flow is controlled. In a movable tray the three axis pneumatic modern trailer is placed. The setup consists of a pneumatic cylinder solenoid valve and a tray for lifting purpose. The movable tray consists of pneumatic cylinder and universal joint for rotating lift the trailer. Another pneumatic cylinder is attached with the locking clamp for side tray plate. When the cylinder is actuated the tray is lifted to a certain height. This can be done by the compressed air as said above. The pneumatic cylinder and universal joint for rotatable tray is used to turn to the three directions.

OBJECTIVE

- 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.

STUDY ANALYSIS

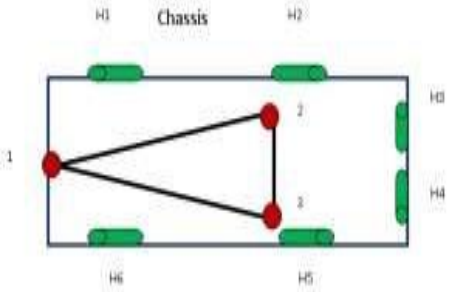
Early Truck Mounted Dump Bodies:
The earliest versions of truck mounted dump bodies relied on the principle of gravity for dumping. The dump body pivoted off center and, when level, would be locked in place. Releasing the lock would activate the body to dump to the rear.

Dump Trucks in the 1950s:
By the 1940s the technological development of dump trucks had reached its peak. In the U.S., bottom dump trucks were already dominating earthmoving sites by the 1950s. As the industry moved away from a reliance on rail operations to haul material, the need for domestically produced construction site tippers began to emerge. One of the heavyduty dump trucks manufactured during this time was by Faun. The truck could carry up to 20 tons and was powered with a 180 horsepower engine. The dump trucks were considered ―off-highway dump trucks because of their width and axle weights.

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. The operator turned a crank to raise and lower the box. Today, virtually all dump trucks operate by hydraulics and they come in a variety of configurations each designed to accomplish a specific task in the construction material supply chain.

THREE WAY MECHANISM

Three way tipper can unload materials in all three sides. Also we require special types of hinge joints in this case as mentioned earlier. It will be having three hydraulic piston cylinders one on cabin side (as in existing system), one each on lateral sides. Six hinges- 2 on each side to give degree of motion on that side. The framing will be rigid enough to sustain the reactive forces generated, refer the attached picture of 3-way tipper arrangement. Main hydraulic cylinder is placed at middle of front side of chassis i.e. 1 for back side tilting of the trolley and other two (2,3) cylinders are placed on along lateral side of the chassis at appropriate distance for left and right side tilting of the trolley.



Two hinges on each lateral side for left and right side tilting of trolley, two hinges on back side of chassis for back side tilting of trolley. Above figure 3.4 shows the hinge position. Now with this mechanism it is possible to tilt trolley on all three sides i.e. back, left and right side. For backside dumping of material, hydraulic cylinder no. 1 is in operation and hinge no.H1,H2,H5 and H6 must be disconnected manually by pulling pin from the hinge, for this hole of 8 mm. diameter is provided on pin head to facilitate manual pulling by inserting rope inside the pin hole. For this operation cylinder 2 and 3 are not in working. The maximum angle of turn made by trolley with horizontal for effective backside unloading of loose material is 45 degree.
For right side dumping of material hydraulic cylinder no. 2 i.e. left side cylinder is in operation and hinge no. H1, H2, H3, and H4 are to be disconnected manually by pulling pin from the hinge. For this operation cylinder 1 and 3 are not in working. The maximum angle made by trolley with horizontal for effective right side unloading of loose material is 200 .Same procedure is adopted for left side dumping of material only change is with hinge disconnection i.e. H3, H4, H5 and H6 are disconnected and hydraulic cylinder no.3 i.e. right side cylinder is in operation. Other two cylinders are in not working position. Hydraulic cylinder 2 and 3 is not directly connected with the trolley; on the top of the cylinder cushioning pad is provided to push the trolley, for side tilting and at the time of return stroke due to self-weight trolley will come to its initial position.

METHODALOGY AND SETUP

In this project we are using single cylinder instead of three as per used in current dumping truck. In this we are mounting a pneumatic cylinder on rotating plate which will rotate along with axis. The project mechanism has mainly concentrated on the difficulty of loading and hence a suitable arrangement has been designed. Such that the load 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.

DESCRIPTION AND EQUIPMENT

PNEUMATIC CYLINDER

All the strange names and terms around pneumatics have evolved through about 100 years of their use in manufacturing. Double acting, four way, quick connect are all terms that were invented to describe (as best as could be) the difference between the parts. Don't let the names discourage you. They're just names. I've used quite colorful terms myself when working with pneumatics, most of which i won't use here..The first thing to remember is: Pneumatics are easy... really! Its all different names and parts that seem to be overwhelming. But enough about that... on to the fun stuff.

AIR CYLINDERS:

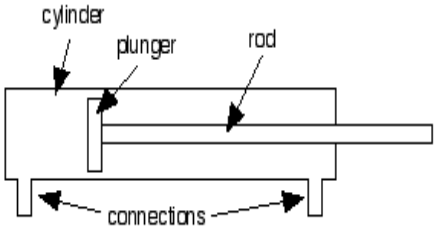
There are only two main kinds of air cylinders: Double acting, and single acting. They come in *all* variations, shapes and sizes. Both kinds are useful for haunt work. Double acting cylinders are useful when you need to

push in both directions, and single acting cylinders are useful when only a push in one direction is needed. And, sometimes 'in a pinch', you can adapt a double to act as a single, and a single to act as a double.

Air cylinders are measured by three main values: "pressure rating", the "bore", and "stroke" There are lots of calculations to accurately figure the power of a cylinder, but most haunt pop-up applications can be handled by air cylinders in the range of 3/4" to 1-1/2" bore, and 3" to 8" stroke. measurements primarily take into account the air pressure (the higher the pressure, the more power); and the bore (the larger the bore - the more power). The power ratings are usually only quoted at maximum pressure. So if a cylinder produces180 pounds of 'push', it will only deliver that at the maximum pressure (usually 250 psi for commerical cylinders). Haunters should work their props to work and much, much lower pressures. A good goal is not to exceed 60-70psi for working props. Going much higher causes more stress on the prop and all parts in the air system, and make your compressor run more often. Even at lower pressures, air cylinders can still move very fast and deliver quite a lot push, so always be very careful around pneumatics!

DOUBLE ACTING CYLINDER

A typical double acting air cylinder



Every double acting air cylinder has these basic parts. A cylinder to hold everything together, a 'plunger' that the air pushes against, two connections to get the air in and out, and a rod that goes in and out. That's it. Here's a simple animation to illustrate the motion...

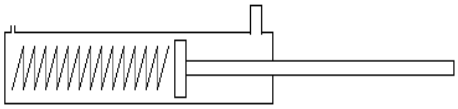
As air is sent into the left connection (pressure is shown in yellow), it pushes against the plunger and the rod goes out. At the same time, air is released out of the right connection. To reverse the motion, air is sent into the right connection, pushing against the plunger on the other side and the rod is forced back in.

The trick to the double acting cylinder is that you have to let air OUT of the other side! This is an important feature of the double acting cylinder, and an advantage that gives you great control over the motion of the rod (but, more on that later!).

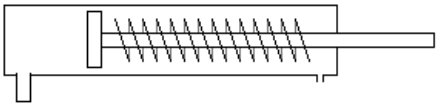
TIP: the most useful double acting cylinder I've found is one with 1/4" connections, 6"-8" stroke, 1" bore, and end clevis mounts. Of course, most any cylinder can be adapted for haunt use!

SINGLE ACTING CYLINDER

Single Acting means the air cylinder rod is ONLY pushed in a single direction, either out or in. There is only one connection for air, and a little hole in the other end to let air in and out. A spring is used to push the rod in the opposite direction after air pressure is removed.



Single Acting Air Cylinder, with the rod normally out without pressure



Single Acting Air Cylinder, with the rod normally in without pressure

As air is pushed into the connection, the plunger begins to move and compress the spring. Exhaust air exits out the exhaust hole on the other end. When air is released, it exits out the connection, and air is sucked into the exhaust hole as the spring pushes the plunger back to its resting position. Basically, the spring is 'push' needed to return the plunger and rod back to their starting position.

When selecting a cylinder for an application, remember that a double acting cylinder pushes in both directions, while a single acting cylinder only pushes in one direction.

3.2 SOLENOID VALVES:

Here's the most confusing part of dealing with pneumatics - solenoids. Just like air cylinders, they come in all sizes, styles, shapes, sizes, and combinations. There's literally something for everyone when it comes to solenoids. The whole 'four port', 'five port', 'two way', 'three way', naming came from the action of the air as it moves through the solenoid. Again, the names aren't as important as what it does. The best combination of flexibility and use for double acting cylinders is what's called a "five port, four way" solenoid (they're also called 'valves').

3.3 COUPLING

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Couplings do not normally allow disconnection of shafts during operation, however there are torque limiting couplings which can slip or disconnect when some torque limit is exceeded. The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement or both. By careful selection, installation and maintenance of

couplings, substantial savings can be made in reduced maintenance costs and downtime.

ADVANTAGES

- Repairing is easy.
- It requires simple maintenance cares.
- Replacement of parts is easy.
- Increased moving ability: Thus, it does not become tiresome to perform the job.
- Can be used in very compact places: Where the reversing & turning of vehicle is difficult.
- Manual power not required
- Can accommodate into pass on dam site working:
- Saves time & energy.
- Handling is easy.
- Checking and cleaning are easy, because of the main parts are screwed.

CONCLUSION

A prototype which exhibits the expected results is developed. With analysis of working and with the help of pneumatic system, lifting operations can be easily carried out without much effort. This mechanism is not only applicable in dumping trucks but also for various manufacturing industries. 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. Further modifications and working limitations will put this work in the main league of use.

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 hydraulic 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.