Toke et al. International Journal of Institutional & Industrial Research ISSN: 2456-1274, Vol. 3, Issue 1, Jan-April 2018, pp.61-63

Design and Fabrication of Pneumatic Three Axis Dumping Trolley

Dr.Lalit.K.Toke[1], Dakshant.Y.Sharma[2], Uday.A.Maliye[3], Kalpesh.S.Bodke[4], Uday.M.Rathod[5]

[1]Asso. Prof., Department of Mechanical Engineering, SIEM, Nashik, Maharashtra, India.
[2,3,4,5]UG Students , Department of Mechanical Engineering, SIEM, Nashik, Maharashtra, India.

***Abstract*— The modern dumping mechanism trailer/dumper has been fabricated by detecting the difficulty in unloading the material. In today's world there is a variety of products like industrial waste, agricultural products, stones composts, rocks, gravel etc. Conventional trailers can unload in one direction only. In case of limited space availability they fail to operate. The trailer has mainly concentrated on this difficulty, and hence a suitable arrangement has been designed. In this project we are fabricating the prototype of the dumping mechanism which can operate or unload the goods in three directions smoothly without any application of impact forces. In this we will use pneumatically operated system using direction control valves. It will be convenient to the driver to unload the trailer and to overcome the space requirement from control panel. This mechanism prevents blocking of the road, increases the productivity of the trailer and shortens the time of unloading with small increment in cost.**

***Keywords* — Pneumatic system, Direction control valve, Trailer single acting cylinder.**

1. Introduction

Dumping process has wide applications in areas like agriculture, construction and garbage transportation etc. conventional damping system has limitation of mechanism which do not allows it to dump the material at rear side only. It is highly 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 and locking pins. The dumper unloads the material in only one direction. But this incapability can be full new method mechanism as the multidirectional dumping trailer. This mechanism is an approach to reduce the idle time to settle the dumper. The material is unloaded in three directions 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 directions. This mechanism prevents blocking of road, reduce time and increase productivity at lowest cost.

As considering the mines space available is very less due to which unloading material on left or right side is not possible to take this as a problem Multisided tipper tilting is the need of time. To overcome one side tilting of trolley, multisided tilting mechanism is come into focus. This will help to reduce the efforts to unload loose material one side of tipper. Now days dropping dumper has been conceived by observing the difficulty in unloading the materials. Dropping damper can unload only in one side by using pneumatic/hydraulic jack mechanism. By this project, mainly we focused on above difficulty. Thus it is easy for the driver to unload the dumper and also it reduces time and fuel consumption. For making tipper mechanism with such above conditions pneumatic mechanism can be used.

The material unloading process is done in three axes with the help of locking arrangement and pneumatic system. The compressed air is going to the pneumatic cylinder through the direction control valve and flow control valve. The direction control valve is used to control the flow direction of the pneumatic cylinder in both the direction and flow control valve is used to control the flow of fluid towards cylinder.

2. Literature review

Waghmare et al (2015) suggested that the trolley's sideways movements would be very useful in applications where there is space constraint. By using this mechanism, blocking of the road is prevented and it also results in time saving and increased productivity. Three way dumping trolley is very useful for farmers, site garbage collectors as well for sand, dumping gravels, etc. It does the work in less time as compared to traditional dumpers.

Lavate et al (2017) has developed the three way dumping mechanism which uses the pneumatic system and automatic operated solenoid valves for its operation. When it is required to dump the material at left or right side of the vehicle, the hinges are engaged automatically by the help of pneumatic locking system pin at respective side of trolley and trolley is lifted by actuator connected to trolley and chassis by a Universal joint. By using this technique it will be easy for driver to unload the trailer and also it reduces time and fuel consumption.

Bhoite et al (2017) has come up with the concept of tipper trolley and it is partitioned in two parts, namely Rotation and Dumping. Worm and gear mechanism is used for rotation of tipper. cxWorm is coupled at horizontal position with the electric motor. Electric motor is powered by using Double Pole Double Throw switch to complete the circuit of battery and motor. 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. When the trolley completes its required angle then material is dumped with the help of pneumatic cylinder.

3. Pneumatics

Pneumatic systems used in industry are commonly powered by compressed air or compressed inert gases. A centrally located and electrically powered compressor powers cylinders, air motors, and other pneumatic devices. A pneumatic system controlled through manual or automatic solenoid valves is selected when it provides a lower cost, more flexible, or safer alternative to electric motors and actuators. 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.

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low cost mechanism particularly for sequential (or) repetitive operations. It is capable to full fill the power requirement for this application at lower loads. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and the control system. The main advantage of an all pneumatic system are usually economic and simplicity. It also reduces the cost of maintenance to a low level.

4. Major components

The major parts of "pneumatic three axis modern trailer" are described below:

1. Air compressor.
2. Direction control valve.
3. Single acting cylinders.
4. Connecting hoses.
5. Trailer model frame.
6. Rotating hinge plates.

A. Air Compressor

The main function of the air compressor is to compress the air up to the required pressure. An air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its designed upper limit the air compressor shuts off.

Fig. 1: Air compressor

B. Directional control valve

Directional control valves are one of the most fundamental parts in hydraulic machinery as well and pneumatic machinery. They allow fluid flow into different paths from one or more sources. It consists of a spool, the movement of the spool restricts or permits the flow, thus it controls the fluid flow.

Fig. 2: Direction control valve

C. Pneumatic cylinder

Pneumatic cylinders are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved.

Fig. 3: Pneumatic cylinder

D. Connecting hoses

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

Fig. 4: Connecting Hoses

5. Vehicle model

The proposed model diagram of the trailer and its parts are listed below:

1. Air Compressor
2. Direction Control Valve
3. Pneumatic cylinders
4. Connecting hoses
5. Vehicle model frame

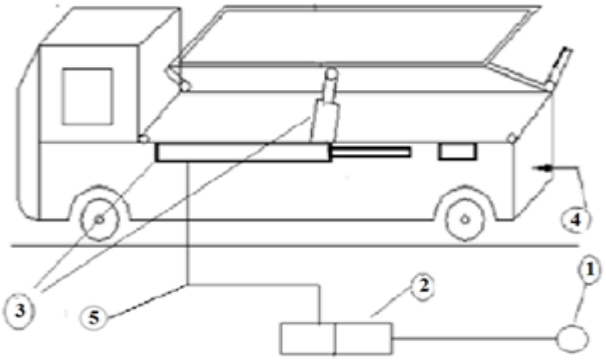

Fig. 5: Vehicle model

6. Methodology

After going through various topics we have decided we select the topic of 3 way pneumatic dumper. We started the work of our project with literature survey. We went through many research papers. We sorted out some papers that were relevant to our topic. We got different ideas from different research papers. Thus we decided rough idea of how we are going to make our project. From this idea we have drawn a Rough model of our project and we came to know different components which we are going to use for our project. From this drawing we started the design and calculation part of different component which will be required to manufacture. From these calculations we have got some specifications of components. We have referred different design data books while doing the calculations. After getting the specifications we have again drawn a drawing.

7. Working principle

This three axis modern trolley is nothing but one of the lifting system in automobile. in this lifting system pneumatically operated. here the on pneumatic cylinder and control valve is provided in our system. in this project, the control valve is used to control the air input. in this mechanism there are four pneumatic cylinders are used which are operated for lifting the trailer in required direction. the mechanism there are three cylinders which ahe used to operate pins provided to cylinder. out of three pins only one pin is close at a time and remaining two are open at a time . the trailer frame consists of three parts support structure. every part is hinged properly to the previous one in the direction where trailer can be unloaded, thus three frames are used . there is a fourth pneumatic cylinder which is operated to lift the trailer .There are four direction control valves are used for operating four pneumatic cylinder. The pin operating cylinders are connected in such a way that there must be only one pin can be operated at a time. The operated pin decides the side of unloading. after operating the pin, control valve of pneumatic cylinder is kept on when the trailer is to be unloaded. The compressed air flows into the cylinder and lift the trailer. The Speed of the trailer is controlled the valve called flow control valve.

8. 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 tipper” 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. 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 per the applications.

References

[1]. Waghmare S. N.,Kamble N. J., Dhamankar A. S., ShindeA. A.,Vishwasrao A. D., Three Directional Dumping System for trolley/dumper. IOSR Journal of Computer Engineering. (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727 PP 69-71.

[2]. Bhoite Swapnil E., Bhosale Kunal N., Jadhav Rahul B., Gadge Ashutosh S. Modification And Fabrication Of Three Axis Modern Trailer for Industrial Application. International Research Journal of Engineering & Technology. (IRJET).

[3]. V. B. Bhandari - “Design of Machine Element” ISBN-13: 978-0-07-068179-8 (2011) pp.330-331;544-562.

[4]. Lavate Sagar T., Karwal Nitin S., Kante Chetankumar C., Kondalkar Akash S. Sonali. S. Mantati. Multiple Side Dumping Trolley Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-6, 2017 ISSN: 2454-1362.

[5]. Shashidar P., Laxminagaprasad P., Kumar U. Anil, Design and Fabrication of Modern Three Way Dumping Trolley mechanism. ICITSEM-16 ISBN:978-93-86171-108.

