

FABRICATION OF THREE AXIS PNEUMATIC ADVANCE TRAILER

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Abstract - The Fabrication work or the infrastructural work demands efficient and user friendly machinery which will lead to more and more use of modern three axis pneumatic trailer. Trailer has lots of applications in today's world. In industrial and domestic considerations, trailer can haul a variety of products including gravel, potatoes, grain, sand, compost, heavy rocks, etc. In this paper the fabrication of three axis pneumatic advance trailer and used 3 way trailer mechanisms, which will help the trailer to unload in 3 directions. The trailer will unload the material in only one single direction. These are rectified to unload the trailer in all three sides very easily. Now the mainly concentrated on this difficulty, and hence a suitable arrangement has been designed. Such that the vehicles can be unloaded from the trailer in three axes without application of any impact force. 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.

Key Words: Fabrication, Pneumatic system, Methods, Automobile engine drive and vehicle running.

1. INTRODUCTION

Material handling in construction and civil works is one of the basic necessities. The material supply to civil and construction is provided through trucks, dumper etc. The material should be properly loaded, managed, stacked, transported and unloaded. The dumper carries the material which is loaded from the site, where the material is initially stored. It is then loaded to the dumper and transported to the required site and then unloaded. The major issues raises over here, the incompatibility of the site with the fully loaded dumper causes a lot of settling time for the trolley to get the material properly arranged and transportation time to reach its location.

The dumper unloads the material in only one direction. But this incapability can be full new method mechanism as the Three Axis Modern Pneumatic Trailer. Gothic mechanism is an approach to reduce the idle time to settle the dumper. 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 seminar 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.

The material is unloaded in any direction and hence can be boldly stated as three axis modern pneumatic trailer. The major outcomes of three axis modern pneumatic trailer. Has overcome space requirement which often result in road blocking. Hence, we have inversion in the existing mechanism providing the unloading in 180 rotations. This mechanism prevents blocking of road, saves time and enhances productivity at lowest cost. The automotive sector is fast booming section in India. There are variable in automotive industry light and heavy motor vehicle.

2. 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.

2.1 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. 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.

2.2 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 truck's 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 truck's 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.

2.3 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.

2.4 Euclid Dump Trucks:

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."

2.5 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 heavy-duty dump trucks manufactured during this time was by Faun.

2.6 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.

3. FABRICATION OF THREE AXIS PNEUMATIC ADVANCE TRAILER

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 starts 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 completes its 1 rotation then 1 tooth 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 seconds. 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.



Figure 1: Three Axes Pneumatic Advance Trailer

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.

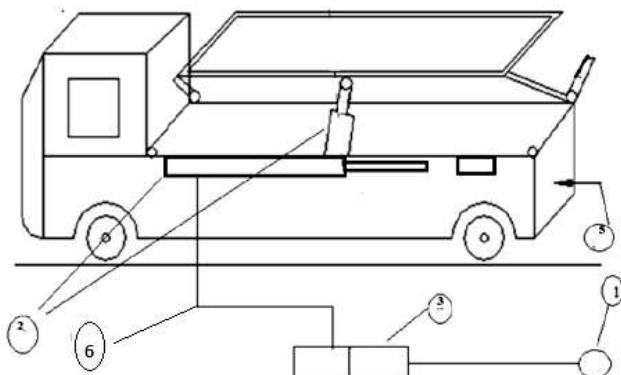


Figure 2: Design of Three Axis Pneumatic Advance Trailer

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 an 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 driven 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. Then having a pressure regulator where the desired pressure to the operated is set. Here a variable pressure regulator is adopted. Through a variety of direction control valve are available, a hand operated spool valve with detent is applied. The spool value used here is 5 ports, 3 positions. There are two exhaust ports, two outlet ports and one inlet port. In two extreme positions only the directions can be changed while the Centro ore is a neutral position and no physical changes are incurred. The 2 outlet ports are connected to an actuator (Cylinder). The pneumatic activates is a double acting, single rod cylinder. The cylinder output is coupled to further purpose.

4. CONCLUSION

In this paper the fabrication of three axis pneumatic advance trailer demands efficient and user friendly machinery which will lead to more and more use of modern three axis pneumatic trailer. Thus developed an Advance Three Axis Pneumatic Trailer which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any one can operate. By using

more techniques, they can be modified and developed according to the applications.

REFERENCES

- [1] A.M. Harte, J.F. McNamara, I.D. Roddy, —A multilevel approach to the optimisation of a composite light rail vehicle bodyshell.||, Composite Structures, Elsevier, pages 447–453. 2004.ZbigniewSekulski, —Least-weight topology and size optimization of high speed vehicle passenger catamaran structure by genetic algorithm.||,Marine Structures, Elsevier, pages 691 –711, 2009.
- [2] AmbojiS. R., Humane Y. A., ChavanR.R. PatilJ. C, KshirsagarP. R., "Design and fabrication of 3 way tipper mechanism", International journal of researching advanced technology vol, No.4, April 2014 E ISSN 2321-9637.
- [3] Ganesh Shinde, PrachiTawale, Laukik Raut3 , Design and Development of 3-Way Dropping Dumper International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 9, September 2014) Student M. Tech CAD/CAM, GHRCE, Nagpur-440016, MH.
- [4] Ganesh Shinde, PrachiTawale, LaukikRaut, "Designs and Development of 3-Way Dropping Dumper" International Journal of Emerging Technology & Advanced Engineering, (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 9, September 2014).
- [5] Khurmi Gupta, 14th Edition. Stress Strain Analysis, Machine Design, S. Chand. Khurmi Gupta,2008,Degree of freedom, Theory of machine, S chand& Company Ltd; (2008)
- [6] P. Manasa, C. VijayaB. Reddy, "Modeling and Analysis of Tractor trolley Axle using Antsy Design and Fabrication of Unidirectional Dumper", Journal of Mechanical and Civil, E-ISSN-2278-1684- ISSN-2320-334X, Volume Vol. 6, Issue 5 (MAY-JUNE) PP 88-92.
- [7] Padmanabhan. S., Chandrasekaran.M.and Srinivasa Raman. V., "Design Optimization of Worm Gear drive", International Journal of Mining, Metallurgy & Mechanical Engineering, Vol. 1, Issue 1 (2013) ISSN 2320-4060.
- [8] Wood, Donald, Dump Trucks [3]. 729 Prospect Ave. Osceola, WI 54020: MBI Publishing Company. pp. 6–9. Wood, Donald (2001). Dump Trucks. 729 Prospect Ave. Osceola, WI 54020: MBI Publishing Company. pp. 11–3.

- [9] Shashidar P., Laxminagaprasad P., Kumar U. Anil, Design and Fabrication of Modern Three Way Dumping Trolley mechanism. ICITSEM-16 ISBN: 978-93-86171-108.
- [10] V. B. Bhandari - "Design of Machine Element" ISBN-13: 978-0-07-068179-8 (2011) pp.330-331;544-562.
- [11] Waghmare S. N., Kamble N. J., Dhamankar A. S., Shinde A. 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.