

Fabrication of 270 Degrees Rotating Hydraulic Modern Trailer

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Abstract— 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. By considering wide scope of the topic, it is necessary to do study and research on the topic of trailer mechanism in order to make it more economical and efficient. In existing system, tipper can unload only in one side by using hydraulic jack or conveyor mechanism. In our project we will use 270 degrees mechanism, which will help the trailer to unload in any directions it uses chain and sprocket mechanism hydraulic system in which we use Hydraulic cylinder and hand operated solenoid valves for this project.

Key words: Hydraulic Cylinder, Chain & Sprocket, Trailer, Conveyor Mechanism

I. INTRODUCTION

A trailer is a vehicle designed for carrying bulk material, often on building sites. They are distinguished from dump trucks by configuration: a dumper 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; this is where the name Trailer comes from. Trailers are normally diesel powered. Trailers with rubber tracks are used in special circumstances and are popular in all over world. Early trailers had a payload of about a ton and were two-wheel drive driving on the front axle and steered at the back wheels. We used hand cranking for single cylinder diesel engine.

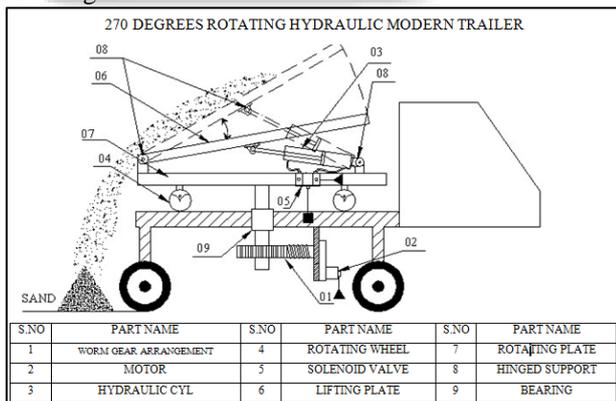


Fig. 1: 270 Degrees Rotating Hydraulic Trailer System

II. OBJECTIVE

Our Aim in in this project is to modify and fabricate the modern 270 degrees rotating hydraulic trailer for industrial application. To give additional two directional motions to the trailer and develop mechanism for reducing time of loading and unloading. To provide easier way dumping.

III. LITERATURE SURVEY

Alley & McLellan[1] studied how the hydraulics can be introduced in truck mounted dump bodies relatively early on, in which record shows the first hydraulic dump bodies was introduced in 1907 as Robertson Steam Wagon with a hydraulic hoist which received power from truck engine. Ganesh Shinde et al.[2] studied the “Design and Development of 3-Way Dropping Dumper” which has been conceived by observing the difficulty in unloading the materials mainly at construction sites. Survey for this paper revealed the fact that most of the construction sites and garages use difficult method to unload the material.

IV. HISTORY

A. Hydraulic Dump Bodies

Relatively early on, in which record shows 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. Hydraulics was being incorporated into truck mounted dump bodies

B. Types of Dump Truck

1) Standard Dump Truck

Another kind of 8x4 dump truck: three rear axles (two powered one lift). A standard dump truck is a truck chassis with a dump body mounted to the frame. The bed is raised by a hydraulic ram mounted under the front of the dumper body between the frames, and the back of the bed is hinged at the back to the truck. The tailgate can be configured to swing on hinges or it can be configured in the "High Lift Tailgate" format wherein pneumatic rams lift the gate open and up above the dump body.

2) Articulated Dump Truck

An articulated dump truck, or "Yuke" in the construction world, has a hinge between the cab and the dump box, but is distinct from semi-trailer trucks in that the cab is a permanent fixture, not a separable vehicle. Steering is accomplished via hydraulic rams that pivot the entire cab, other than rack and pinion steering on the front axle. This vehicle is highly adaptable to rough terrain. In line with its use in rough terrain, longer distances and overly flat surfaces tend to cause driveline troubles, and failures. Articulated trucks are often referred to as the modern scraper, in the sense that they carry a much higher maintenance burden than most trucks. See the first mass produced articulated dump truck (articulated hauler).

3) Transfer Dump Truck

A transfer dump is a standard dump truck which pulls a separate trailer which can also be loaded with aggregate (gravel, sand, asphalt, clinkers, snow, wood chips, triple mix,

etc.). The second aggregate container, (B box) on the trailer, is powered by either an electric, pneumatic motor or hydraulicline. It rolls on small wheels, riding on rails from the trailer's frame, into the empty main dump (A) box. This maximizes payload capacity without sacrificing the maneuverability of the standard dump truck. Transfer dumps are typically seen in the western United States because of the peculiar weight restrictions on western highways. Another configuration is called a Triple Transfer Train, which consists of a B and C box. These are common on Nevada and Utah Highways but not in California. Depending on the axle arrangement, a Triple Transfer can haul up to 129,000 kilograms (280,000 pounds) with a special permit in certain US states. The Triple Transfer usually costs a contractor about \$105 an hour while A/B configures usually runs about \$85 per hour (2007 stats).

C. Traditional Tipper Trailer

1) Single Trolley Trailer

These type of trailers can unload goods in only back side direction, for this type of unloading either hydraulic or conveyor system is used. Trailers with conveyor system are quite effective than trailers with hydraulic jack but these both systems can unload the goods in only back side direction, therefore more space and time required.

2) Double Trolley Trailer

These types of trailers are used to carry more goods at single time. To unload two trolleys skilled driver is required also it requires more space, time and thereby fuel requirement increases.

V. COMPONENTS

The following the components of 270 degree rotating hydraulic modern trailer.

- 1) Chain and sprocket mechanism
- 2) Hydraulic cylinder
- 3) Hydraulic pump
- 4) Hydraulic oil tank (1.5 lit)
- 5) Control system
- 6) Connecting hoses
- 7) Vehicle frame (2*3 feet)
- 8) Servo Motors (12v)



Fig. 1: Chain And Sprocket Mechanism



Fig. 2: Hydraulic Cylinder



Fig. 3: Hydraulic Pump



Fig. 4: Hydraulic Oil Tank



Fig. 5: Control System



Fig. 6: Connecting Hoses

VI. WORKING PRINCIPLE

The material unloading process is done in three axis with the help of locking arrangement and hydraulic system. The fluid is going to the hydraulic cylinder through the direction control valve and flow control valve. The direction control

valve is used to control the flow direction of the hydraulic cylinder in both the direction and flow control valve is used to control the flow of fluid towards cylinder. The hydraulic cylinder is mounted on the rotating plates with locking arrangement of trailer.

The DC motor and rotating plates with cylinder are used to operate the trolley operations in various axis. The fluid is given to the hydraulic cylinder by opening flow control valve, when the knob is moved OFF of 4/2 DCV.

The high pressure fluid goes to the hydraulic cylinder. The fluid pushes the hydraulic cylinder piston and move forward. The piston moves towards the upward direction and the trailer body is lifting the cabinet upwards and material is unloading in one direction by help of locking arrangement. The direction control valve is activated at the time of handle "ON". The pressure is then released from the bottom of the hydraulic cylinder. Then the fluid returns back from the bottom of the cylinder and trailer comes to its original position as in ordinary trailer. Initially trailer is attached with the fluid pump to 4/2 direction control valve which is the source of pressurized fluid for pull/push of hydraulic cylinder. After that this direction control valve is attached to hydraulic cylinder. As a result of which hydraulic cylinder can operate smoothly in both reversed and forward direction.

The Hydraulic Cylinder is Mounted on the rotating plates with tiled angle of 60 degree which is rotated with the help of gear assembly and a motor, with the help of which cylinder is rotated in 270 degree to unload material in three direction. The 2nd end of cylinder is fixed at the centre of trailer with the help of other rotating circular plates. When unloading of material is done in another axis then direction of cylinder change with the help of rotating plates and dc motor. The direction in which unloading is done, that side of trailer is locked by using locking nut for unlocking other two side. The position of cylinder such that bottom of cylinder is in same side of unloading and top side of cylinder is in towards the opposite of unloading side because of that trailer move upward in proper way and material can unload in other direction. For unloading in third direction move the cylinder with help dc motor in proper position and unload material in third axis by making locking arrangement without moving the whole vehicle.

VII. CONSTRUCTION

In modern 270 degrees Rotating hydraulic trailer there are some major parts from that one is hydraulic pump. Hydraulic pump is mounted on truck engine, which is positive displacement type and run with help of belt and pulley. Fluid from pump goes to hydraulic cylinder, other parts of trailer body are mounted on the chassis, in which DC motor is mounted at bottom with support which capacity is depend on trailer size. DC motor consist driver gear and driven gear is mounted on rotating plate. Between two rotating plates double acting hydraulic cylinder is mounted, On one rotating plate bottom end of hydraulic cylinder is fixed using joint and it tiled angle of 60 degree to rotating plates. Other end of cylinder containing connecting rod is fixed to other rotating plate which is connected to trailer body. From hydraulic pump high pressure fluid is supplied to the direction control

valve and flow control valve. The direction control valve and flow control valve is in between the cylinder and pump. Locking agreement is given to trailer body to unlock the remaining two sides while unloading in one side.

A. Advantages & Disadvantages

Increased moving ability: Thus, it does not become tiresome to perform the job.

- Can be used in very compact places
- Where reversing & turning of vehicle is difficult.
- Accommodate on dam site working.
- Saves time & energy.
- Increased complexity:
- It requires complex mechanism for getting desired output.
- Cost increases:
 - 1) More complications lead to increase in cost.
 - 2) Increase in Maintenance.



Fig. 7: Final Fabricated 270 Degrees Rotating Modern Hydraulic Trailer

VIII. FUTURE SCOPE

World Processing at faster rate which demands efficient working equipment's such as user friendly machinery and hence the three way dumper may be used more than the two way or one way. The work can be modified further more on following basis:-Electronic sensors can be used to make the operations easy. Oil pump can be used instead of Pneumatic cylinder. Capacity can be increased. Hydraulic jack can be implemented for backside unloading instead of hydraulic cylinder. This implementation will increase the trolley lifting angle up to 45 to 50°.

IX. CONCLUSIONS

Till now we were using the trolley with single way dumping mechanism. After literature survey it is found that the traditional method used in trolley consumes a lot of time as well as energy. It also requires trained personnel for activating the mechanism. So these problems present in traditional method could be overcome by proposed mechanism. After few modifications, and working on disadvantages will put this paper work in the main league of use. This concept saves time and may lead to efficient working. The constructional work or the infrastructural work demands efficient and user friendly machineries which may lead to more and more use of the present paper work. Design of multisided tipper tilting mechanism is done to help unloading loose material on three side of the tipper as per the

availability of space. The design is safe for the maximum load of 16 MT which is rigid enough to transport loose material from one site to another site

REFERENCES

- [1] Humane Yogesh A., Patil Jyotsna C., and Design and Fabrication of Three Way Tipper Mechanism, *International Journal of Research in Advent Technology*, 2(4), 2014, 2321-9637.
- [2] T. H. Fui and R. Abd. Rahman, Static and dynamics structural analysis of a 4.5 ton truck chassis. *Jurnal Mekanikal*, No. 24, pages 56-67, 2007.
- [3] Dubey and V. Dwivedi, Vehicle chassis analysis: load cases and boundary conditions for stress analysis. In 11th National Conference on Machines and Mechanisms. IIT, Delhi, India, December 2003.
- [4] *International Journal of Applied Engineering Research* ISSN 0973-4562 Volume 10, Number 11 (2015) © Research India Publications.
- [5] *Industrial Fluid Power* By James Johnson
- [6] www.cargobull.com Schmitz Cargobull Traller Compony
- [7] Patent US3817493 - Hydraulic jack for trailers - Google Patents
- [8] Patent US4711461 - Three-a
- [9] A.M. Harte, J.F. McNamara, I.D. Roddy, —A multilevel approach to the optimisation of a composite light rail vehicle bodyshell. In *Composite Structures*, Elsevier, pages 447–453, 2004.
- [10] Zbigniew Sekulski, —Least-weight topology and size optimization of high speed vehicle-passenger catamaran structure by genetic algorithm. In *Marine Structures*, Elsevier, pages 691–711, 2009.
- [11] V. Bhasker, R. Babu and V. Shekhar, —Process integration and automation solutions for rapid designing of automotive frame structures using altair hyperworks. In *Hyperworks Technology Conference*. Altair Hyper works, 2008.
- [12] Automotive Industry Standard. —AIS-053: Automotive Vehicles-Types - Terminology.