International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 04 | Apr-2016 www.irjet.net p-ISSN: 2395-0072

Downloading Mechanism Using Three Degrees of Freedom in Truck Trailer

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Abstract -This project work titled "Downloading Mechanism using Three Degrees of Freedom in Truck 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. Now the project has 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. By actuating the Direction control valve, the hydraulic oil goes to the hydraulic cylinder through valve. The ram of the hydraulic cylinder acts as a lifting the trailer cabin.

1. INTRODUCTION

A trailer is a vehicle designed for carrying bulk material, often on building sites. Trailers are distinguished from dump trucks by configuration: a trailer 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. A trailer is an integral part of any construction work and hence its role is important for completion of any constructional site. One of the problem are cited with trailer in the time and energy for setting the huge trailer in the proper direction to dump the material it in carrying and hence the need of the project work riser which is about 3 way dropping trailer which can dump the material in any direction except the rental one without moving the truck in any direction.

2. LITERATURE REVIEW

Ganesh Shinde et al studied the „Modern 3 Ways dropping dumper" which has been conceived by observing the difficulty in unloading the materials. The survey in this regards in several automobile garages, revealed the facts that mostly some difficult methods were adopted in unloading the materials from the trailer. They have mainly focused on above difficulty. Hence a prototype 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 valves which activate the ram of the hydraulic cylinder which lifting the trailer cabin in require side. Further modifications and working limitations will put this work in the main league of use. This concept saves time & energy which leads to efficient working.

Amboji Sudhakar R et al studied that Tipper has lots of applications in today's world. In industrial and domestic considerations, tippers 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 tipper 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. By this research it is easy for the driver to unload the trailer and also it reduces time and fuel consumption. For making tipper mechanism with such above conditions both mechanisms namely hydraulic. jack and conveyor mechanism can be used. But eventually it comes with question that how both systems can arrange in single set up? Answer to this question is nothing but this research work.

Alley & McLellan of Glasgow studied hydraulics was being incorporated into truck mounted 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 trucks engine or an independent steam engine was developed

another early hydraulic dump body in 1907 that was power-driven by steam.

2. CONCEPT

In this work the trailer is pulled up in three axes. The figure 1 shows the working principle of hydraulic cylinder used in this modern trailer. For the trailer action we are using hydraulic as a source. The 3/2 direction control valve is used to control the direction of the hydraulic. When the inlet port is open the hydraulic is pumped from the sump using hydraulic is pumped from the sump using hydraulic pump. The trailer is now pushed upward in the "Y" axis direction and the outlet port is activated now, then the trailer was pushdown in Y axis direction. Now the knee joint of the trailer is removed for trailer action in „Z" axis. Then again the inlet port is open. The trailer is now pushed upward in the "Z" axis direction and the outlet port is activated now, then the trailer was pushdown in „Z" axis. Again the knee joint is removed for the trailer action in „X" axis. Then again the inlet port is open. The trailer is now pushed upward in the "X" axis direction and the outlet port is activated now, then the trailer was pushdown in „X" axis. we can dispatch the load in three axis in the trailer by using the universal joint in the hydraulic cylinder.

4. CONSTRUCTION

This machine is constructed using various materials like MS Sheet, Plywood, MS Square Pipe, Polished Rod, Double Acting Hydraulic Cylinder, Hydraulic ose, Directional Control Valve, Hydraulic Fluid, Hydraulic Pump, and Reservoir and dc motor. First of all a base frame structure is prepared using MS Square Pipe. The Trailer body is prepared using MS Sheet. The dc motor is attached with the frame using welding process. And three hydraulic hydraulic cylinders are attached to the frame. A Double Acting Cylinder connects both the tray and dcv in the Frame which in the Trailer body is connected with a Frame. Hydraulic pipes are connected to the Double acting Hydraulic Cylinder. Another Side of the Hydraulic pipe is attached to the Directional Control valve. Hydraulic fluid is filled in the Reservoir Tank. Another side of the Hydraulic Pump is connected to the Directional control valve. This assembly is attached with hydraulic cylinder that operates the trailer. The cylinder and piston arrangement is fitted in front of the trolley that is situated at the back of the frame member.

Fig: photographic view of hydraulic cylinder set up

4.1. Hydraulic cylinders:

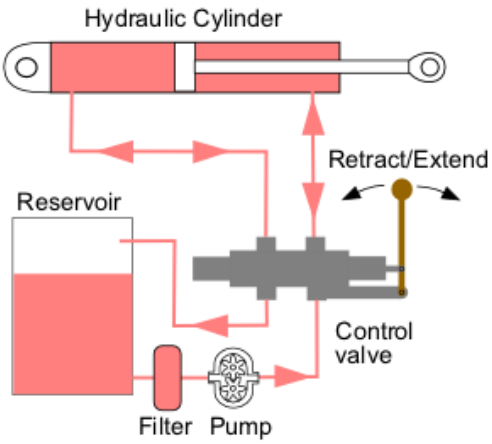

Fig : working principle of hydraulic cylinder

Hydraulic cylinders get their power from pressurized hydraulic fluid, which is typically oil. The hydraulic cylinder consists of a cylinder barrel, in which a piston connected to a piston rod moves back and forth. The barrel is closed on one end by the cylinder bottom (also called the cap) and the other end by the cylinder head (also called the gland) where the piston rod comes out of the cylinder. The piston has sliding rings and seals. The piston divides the inside of the cylinder into two chambers, the bottom chamber (cap end) and the piston rod side chamber (rod end / head end).

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4.4. BATTERIES

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties:

(1) Low cost
(2) Long life
(3) High reliability
(4) High overall efficiency
(5) Low discharge
(6) Minimum maintenance
    (A) Ampere hour efficiency
    (B) Watt hour efficiency

We use lead acid battery for storing the electrical energy from the solar panel for lighting the street and more powerful

4.5. DC MOTOR

A **DC motor** relies on the fact that, like magnet poles repel and unlike magnetic poles attract each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

A simple *DC motor* typically has a stationary set of magnets in the stator and an armature with a series of two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth) with the ends of the wires terminating on a commutator. The armature includes the mounting bearings that keep it in the centre of the motor and the power shaft of the motor and the commentator connections. The winding in the armature continues to loop all the way around the armature and uses either single or parallel conductors (wires), and can circle several times around the stack teeth. The total amount of current sent to the coil, the coil's size and what it's wrapped around dictate the strength of the electromagnetic field created. The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed. By turning on and off coils in sequence a rotating magnetic field can be created. These rotating magnetic fields interact with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a force on the armature which causes it to rotate. In some DC motor designs the stator fields use electromagnets to create their magnetic fields which allow greater control over the motor. At high power levels, DC motors are almost always cooled using forced air.

The commutator allows each armature coil to be activated in turn. The current in the coil is typically

supplied via two brushes that make moving contact with the commutator. Now, some brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes to wear out or create sparks.

Different number of stator and armature fields as well as how they are connected provides different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems which adjust the voltage by "chopping" the DC current into on and off cycles which have an effective lower voltage.

Since the series-wound DC motor develops its highest torque at low speed, it is often used in traction applications such as electric locomotives, and trams. The DC motor was the mainstay of electric traction drives on both electric and diesel-electric locomotives, street-cars/trams and diesel electric drilling rigs for many years. The introduction of DC motors and an electrical grid system to run machinery starting in the 1870s started a new second Industrial Revolution. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles and today's hybrid cars and electric cars as well as driving a host of cordless tools. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.

If external power is applied to a DC motor it acts as a DC generator, a dynamo. This feature is used to slow down and recharge batteries on hybrid car and electric cars or to return electricity back to the electric grid used on a street car or electric powered train line when they slow down. This process is called regenerative braking on hybrid and electric cars. In diesel electric locomotives they also use their DC motors as generators to slow down but dissipate the energy in resistor stacks. Newer designs are adding large battery packs to recapture some of this energy.

4.6. 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. They usually consist of a spool inside a cylinder which is mechanically or electrically controlled. The movement of the spool restricts or permits the flow, thus it controls the fluid flow.

The spool (sliding type) consists of lands and grooves. The lands block oil flow through the valve body. The grooves allow oil or gas to flow around the spool and through the valve body. There are two fundamental positions of directional control valve namely normal position where valve returns on removal of actuating force and other is working position which is position of a valve when actuating force is applied. There is another class of valves with 3 or more position that can be spring centered with 2 working position and abnormal position.

5. WORKING PRINCIPLE

Figure: Photographic view of working of trailer

The hydraulic oil is used to activate the hydraulic cylinder, when the motor is switched on the oil flows into

the hydraulic cylinder. This hydraulic oil is controlled by the directional control valve. The setup consists of three hydraulic cylinders, dc motor, three directional control valves and a tray for lifting purpose. The movable tray consists of hydraulic cylinder and directional control valve for control purpose. When the motor is switched on the hydraulic oil flows over the tube to the hydraulic cylinder. Now the piston of the hydraulic cylinder is ready to lift the tray with the help of the hydraulic oil. This lifting of up and down movements is controlled by the directional control valves. For lifting in three different directions three separate hydraulic cylinders and directional controls are used. The forward and reverse movement of the directional control valve tends to lift the hydraulic cylinder piston up and down. The hydraulic cylinder is controlled by DCV and is used to lift the tray in three directions. Lock is done manually using clamp locker.

6. FUTURE MODIFICATION

As the world progressing at faster rate we meet mover and mover huge construction which head to be dig big and big amount of the earth and thus more efficiently working equipments are to be required and hence the Development of Three Axis Lifting Modern Hydraulic trailer may be used more than the two way or one way. India is progressing at higher rate and hence infrastructural development is on its high. Hence the future of this project work seems promising.

The project work can be modified further more on following basis:-

- Dual stage cylinders can be used.
- Oil pump can be used instead of powered cylinder.
- Capacity can be increased.
- Wheel steering can be adopted for avoiding the lifting of vehicle along with trailers.

7. CONCLUSION

The developed prototype exhibits the expected results. Further modifications and working limitations will put this work in the main league of use. This concept saves time & energy which leads to efficient working. This further line should be modeled using equations and an experimental agreement. The constructional work or the infrastructural work demands efficient and user friendly machinery which will lead to more and more use of three way dropping trailer.

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