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Three Axis Pneumatic Modern Trailer By Using Single Cylinder

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***Abstract*: This project work titled "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. 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 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.**

***Keywords:* pneumatic cylinder, several automobile garages, methods, automobile engine drive, vehicle running.**

1. INTRODUCTION

A dumper is a vehicle designed for carrying bulk material, often on building sites. Dumpers 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 "dumper" comes from. They are normally diesel powered. A towing eye is fitted for secondary use as a site tractor. Dumpers with rubber tracks are used in special circumstances and are popular in some countries.

Early dumpers had a payload of about a ton and were 2-wheel drive, driving on the front axle and steered at the back wheels. The single cylinder diesel engine (sometimes made by Lister) was started by hand cranking. The steering wheel turned the back wheels, not front. Having neither electrics nor hydraulics there was not much to go wrong. The skip was secured by a catch by the driver's feet. When the catch is released, the skip tips under the weight of its contents at pivot points below, and after being emptied is raised by hand.

Modern dumpers have payloads of up to 10 tones (11 short tons; 9.8 long tons) 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. In the 1990s dumpers with swivel skips, which could be rotated to tip sideways, became popular, especially for working in narrow sites such as road works. Dumpers are the most common cause of accidents involving construction plant. A dumper 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 dumper in the time and energy for setting the huge dumper 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 dumper which can dump the material in any direction except the rontal one without moving the truck in any direction.

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II. HISTORY

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.

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. 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.

The dump body was elevated with struts and beams located on the underside in a scissor like pattern. Pulling the beams close together automatically elevated the dump body. 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.

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.

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." It was the first rear-dump truck that was designed for heavy-duty off road service. This was followed up in 1936 with the company‘s 15-ton Model IFD truck that featured a diesel engine, modern drive line, planetary final drives, leaf-spring suspension, and pneumatic tires. The truck replaced heavy, gasoline powered chain drive Mack trucks that had previously been used for standard work in construction and mining operations.

Another prominent development was the launch of Euclid‘s wheel tractor bottom dump wagon combination. The wheel tractor bottom dump had haul road speeds of 30 miles per hour (48 km) and extended haul distances beyond what was ever considered economically feasible. Along, with LeTourneau‘s Tournapull, the Euclid bottom dump was a major advancement in earthmoving.

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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. 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.

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. 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.

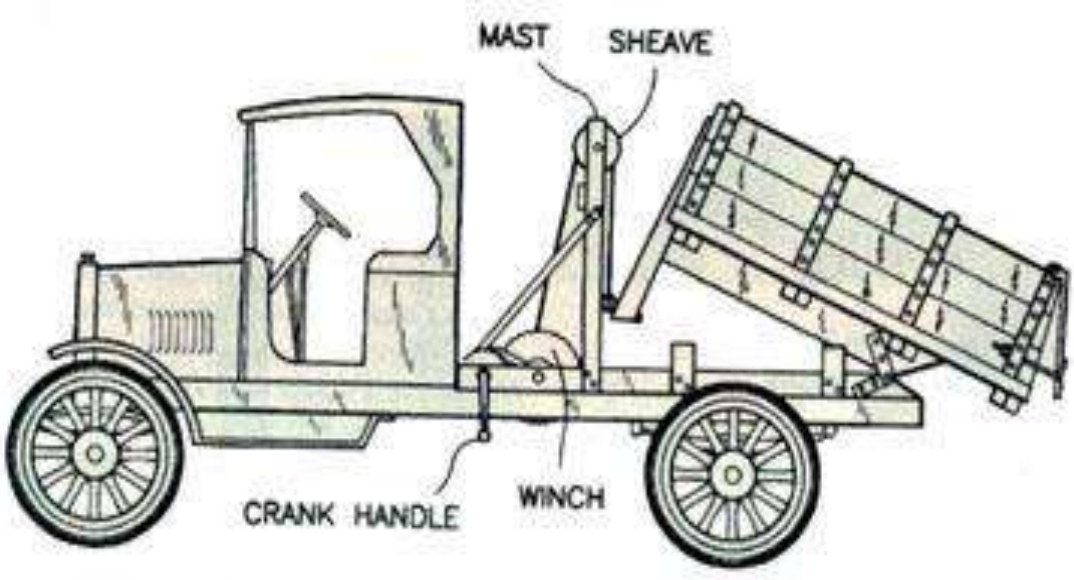

Fig.2.6: Dump Box for Truck

This invention was instrumental in the development of our present trucking industry. To create this first dump truck, a mast was mounted between the cab of the vehicle and the dump box. A cable was threaded over a sheave at the top of the mast and was connected to a winch at the base of the mast and to the lower front end of the dump box. The dump box was pivoted at the rear end of the truck frame. A simple crank handle was used to operate the winch, which raised the front end of the dump box, dumped the load and then lowered the box. A hydraulic system has since replaced the crank handle, but the basic, concept has remained unchanged.

III. TYPES OF DUMP TRUCKS

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 "Yuck" 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, rather 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).

4. Truck and Pup:

A truck and pup is very similar to a transfer dump. It consists of a standard dump truck pulling a dump trailer. The pup trailer, unlike the transfer, has its own hydraulic ram and is capable of self-unloading.

5. Super Dump Truck:

A Super dump is a straight dump truck equipped with a trailing axle, a lift able, load-bearing axle rated as high as 13,000 pounds (5,897 kg). Trailing 11 to 13 feet (3.35 to 3.96 m) behind the rear tandem, the trailing axle stretches the outer "bridge" measurement—the distance between the first and last axles—to the maximum overall length allowed. This increases the gross weight allowed under the federal bridge formula, which sets standards for truck size and weight. Depending on the vehicle length and axle configuration, Super dumps can be rated as high as 80,000 pounds (36,287 kg). GVW and carry 26 short tons (23.6 t; 23.2 long tons) of payload or more When the truck is empty or ready to offload, the trailing axle toggles up off the road surface on two hydraulic arms to clear the rear of the vehicle Truck owners call their trailing axle-equipped trucks Super dumps because they far exceed the payload, productivity, and return on investment of a conventional dump truck. The Super dump and trailing axle concept was developed by Strong Industries of Houston, Texas.

6. Semi Trailer End Dump Truck:

A semi end dump is a tractor-trailer combination wherein the trailer itself contains the hydraulic hoist. A typical semi end dump has a 3-axle tractor pulling a 2-axle semi-trailer. The key advantage of a semi end dump is rapid unloading. A key disadvantage is that they are very unstable when raised in the dumping position limiting their use in many applications where the dumping location is uneven or off level.

7. Semi Trailer Bottom Dump Truck:

A semi bottom dump (or "belly dump") is a 3-axle tractor pulling a 2-axle trailer with a clam shell type dump gate in the belly of the trailer. The key advantage of a semi bottom dump is its ability to lay material in a wind row (a linear heap). In addition, a semi bottom dump is maneuverable in reverse, unlike the double and triple trailer configurations described below. These trailers may be found either of the windrow type shown in the photo, or may be of the 'cross spread' type with the gates opening front to rear instead of left and right.

IV. DUMPING MECHANISM

project being complicated was decide to be developed on a small scale model that should be constructed using light weight material and should be hydraulically operated using plastic piston and cylinder arrangement. Also this hydraulic piston and cylinder arrangement was decided to be motor driven to make the same automatic. These motor run using a battery and are controlled using a remote control that is attached with the base model using wires / FRC cable and these after controlled by operator.

A conventional dump truck is mounted on a truck chassis and has an open dump box hydraulically operated and hinged at the rear of the truck usually by one or more hydraulic rams that raise the dump box to unload contents at a delivery site. These hydraulic rams are either front loaded or mounted in the underbody and are driven from a gear box power take-off. Hydraulic rams mounted in the underbody provide the capability of the dump body to tip the dump box on a three-way basis, either to the left or right side or to the rear.

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1. How A Typical Tipper Trucks Works?

The tipping mechanism is the heart of a three way tipper construction truck. Tipping mechanisms work basically on the following:

2. Hydraulic Cylinder:

A hydraulic cylinder is placed below the body of truck longitudinally at one end of the truck, and the piston end of the hydraulic cylinder is connected by the means of a pivot joint to the chassis of truck. In the forward stroke of the cylinder, it pushes the truck body upward thus gives necessary lift for tipping dumping. So, in the forward stroke of the cylinder, the truck is unloaded. In the return stroke of the cylinder the body of the truck comes to its original position.

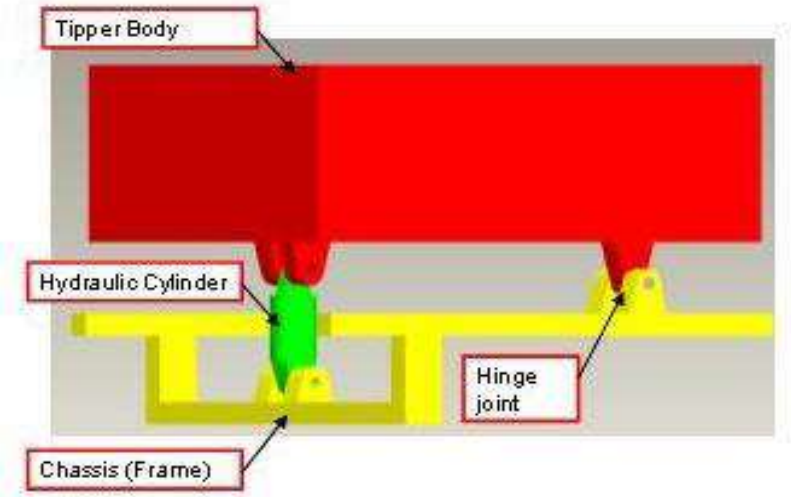

Fig.3.1: Hydraulic Cylinder

3. Hinge Joint:

The other bottom end of the body of the truck is connected by a hinged joint with the chassis. So, when the hydraulic cylinder pushes the body in its forward stroke the entire body gets tilted about the axis of the hinged joint and the material gets unloaded and by the return stroke of the hydraulic cylinder body comes and seat to its original position with respect to the hinged axis. But in this types of tipper can unload materials only at the backside of the tipper. 3-way tipper can overcome this problem, as it can unload material on three sides.

4. Three Way Tipper Mechanism:

As already mentioned, a three-way tipper can unload materials in all three sides. To control the sides of tipping there needs to be required one more pneumatic cylinder apart from the main hydraulic cylinder. Also we require special types of hinge joints in this case.

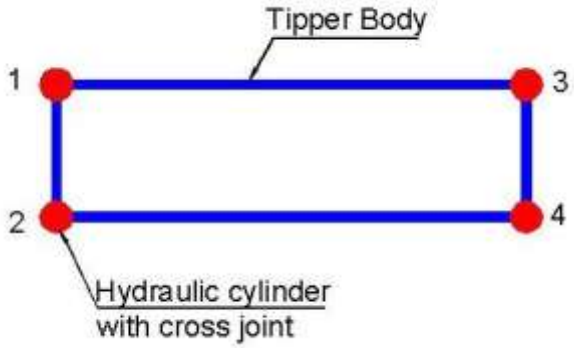

Fig.4.2 Three Way Tipper Mechanism

Please refer to the attached picture of a 3-way tipper arrangement. The main hydraulic cylinder is placed at four corners of the chassis (structure).Each of the four corners of the body is connected by a cross joint with the hydraulic cylinders. The cross joint allows the joining members to tilt with respect to two perpendicular axis. Now, if you consider the side of cylinder 3 & 4 is rear of the vehicle, then by operating cylinder no.1 & 2 will cause rear tipping, operating cylinder 2 & 4 will cause left side tipping, and operating cylinder 1 & 3 will cause right side tipping. Automation of tipping will be possible by using a power pack with plc control or some similar kind of automation devices.

5. Axles:

Single axle dump trucks are the smallest sized dump truck on the market, tandem axle are standard sized, and the tri axle or multi axle dump truck is currently the largest dump truck available that requires a special permit to be operated and is dependent of State/Provincial laws.

6. Dump Body:

All dump trucks despite the number of axles can be fitted with different box lengths. The truck‘s dump bed or body is measured in terms of its payload capacity in cubic yards in two different ways. The first capacity related to the material filled level with the top of the sideboards called ―water level‖ and the other for piled up material in yards called ―heaped.‖ [16] Loads are sold based on volume because the weight of material hauled changes with moisture content. Sand exposed to rain for example, will weigh more than dry sand. Dump beds come in various configurations with each type from four-wheelers for two to three tons payload to large, heavy-duty articulated and drawbar outfits grossing 50- to 60-ton payload capacities. Each type of dump truck will be used for different types of construction or mining tasks based on its configurations.

7. Dump Truck Operations:

During dumping operations, the truck should be on level ground or inclined uphill with the front of the truck facing downward. When the truck is in position, release the lower latches of the tailgate with the hand lever at the front left corner of the body. Then engage the control for the dump truck body. Hydraulic pressure will begin to hoist the dump truck body, and as the body rises, the load will slide backward under the open tailgate. If the load piles up and blocks the tailgate), place the truck in low gear and move it forward until there is more space to dump the remainder of the load. If the load does not slide out easily, have someone dislodge it with a long-handled shovel, taking care not to stand in the immediate dumping area. When dumping a load of rocks or other large solids, see that the tailgate is latched at the bottom, but unfastened at the top, so that the tailgate can drop down and the load can drop. Not all dump trucks have tailgate wings. On those that do not, you have to drop the tailgate down and support it with chains. To spread a load over a large area, shift the truck into low gear and drive it slowly forward while dumping. The dump truck body can be held in any position by returning the control lever to the hold position. When dumping is completed, lower the body by returning the control lever to the lowering position. Then close the tailgate latches. The load in a dump truck should be distributed evenly. Heaped loads to the front put more strain on the hoist. Loads to one side can damage the hinge pins, the dump bed, or bend the truck chassis. Remember: If your load should be distributed unevenly and dumped on uneven ground, you could find yourself in great difficulty.

8. Hydraulic System:

The basic idea behind any hydraulic system is very simple. Force that is applied at one point is transmitted to another point using an incompressible fluid. The fluid is almost always an oil of some sort. The force is almost always multiplied in the process. The picture below shows the simplest possible hydraulic system. In this drawing, two pistons (red) fit into two glass cylinders filled with oil (light blue) and connected to one another with an oil-filled pipe. If you apply a downward force to one piston (the left one in this drawing), then the force is transmitted to the second piston through the oil in the pipe Since oil is incompressible, the efficiency is very good -- almost all of the applied force appears at the second piston. The great thing about hydraulic systems is that the pipe connecting the two cylinders can be any length and shape, allowing it to snake through all sorts of things separating the two pistons. The pipe can also fork, so that one master cylinder can drive more than one slave cylinder if desired.

The neat thing about hydraulic systems is that it is very easy to add force multiplication (or division) to the system. If you have read How a Block and Tackle Works or How Gears Work, then you know that trading force for distance is very common in mechanical systems. In a hydraulic system, all you do is change the size of one piston and cylinder relative to the other.

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9. Hydraulic Multiplication:

The piston on the right has a surface area nine times greater than the piston on the left. When force is applied to the left piston, it will move nine units for every one unit that the right piston moves, and the force is multiplied by nine on the right-hand piston. Click the red arrow to see the animation.

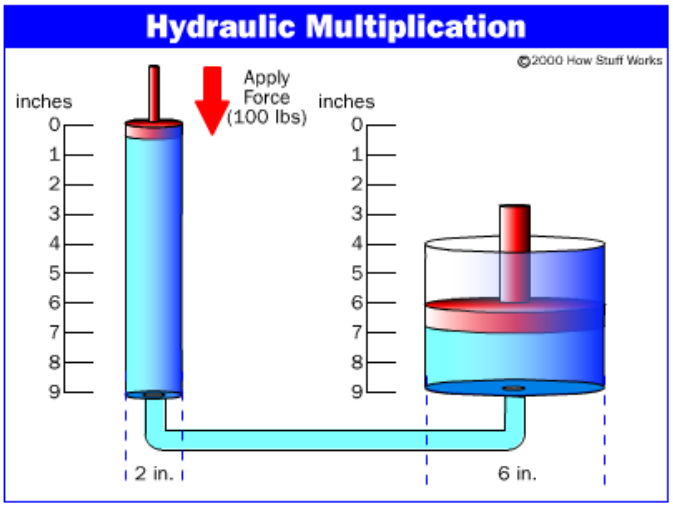

Fig.4.9: Hydraulic Multiplication

To determine the multiplication factor, start by looking at the size of the pistons. Assume that the piston on the left is 2 inches in diameter (1-inch radius), while the piston on the right is 6 inches in diameter (3-inch radius). The area of the two pistons is Pi * r2. The area of the left piston is therefore 3.14, while the area of the piston on the right is 28.26. The piston on the right is 9 times larger than the piston on the left. What that means is that any force applied to the left-hand piston will appear 9 times greater on the right-hand piston. So if you apply a 100-pound downward force to the left piston, a 900-pound upward force will appear on the right. The only catch is that you will have to depress the left piston 9 inches to raise the right piston 1 inch.

10. Air in the System:

It is important that a hydraulic system contains no air bubbles. You may have heard about the need to "bleed the air out of the brake lines" of your car. If there is an air bubble in the system, then the force applied to the first piston gets used compressing the air in the bubble rather than moving the second piston, which has a big effect on the efficiency of the system.

From backyard log splitters to the huge machines you see on construction sites, hydraulic equipment is amazing in its strength and agility! On any construction site you see hydraulically-operated machinery in the form of bulldozers, backhoes, shovels, loaders, forklifts and cranes. Hydraulics operates the control surfaces on any large airplane. You see hydraulics at car service centers lifting the cars so that mechanics can work underneath them, and many elevators are hydraulically-operated using the same technique. Even the brakes in your car use hydraulics.

11. Hydraulic Pumps:

One thing you can see is that the advertised "20-ton splitting force" is generous. A 4-inch piston has an area of 12.56 square inches. If the pump generates a maximum pressure of 3,000 pounds per square inch (psi), the total pressure available is 37,680 pounds, or about 2,320 pounds shy of 20 tons.

Another thing you can determine is the cycle time of the piston. To move a 4-inch-diameter piston 24 inches, you need 3.14 * 22 * 24 = 301 cubic inches of oil. A gallon of oil is about 231 cubic inches, so you have to pump almost 1.5 gallons of oil to move the piston 24 inches in one direction. That's a fair amount of oil to pump -- think about that the next time you watch how quickly a hydraulic backhoe or skid/loader is able to move! In our log splitter, the maximum flow rate is 11 gallons per minute. That means that it will take 10 or so seconds to draw the piston back after the log is split, and it may take almost 30 seconds to push the piston through a tough log (because the flow rate is lower at high

pressures). Just to fill the cylinder with oil, you need at least 1.5 gallons of hydraulic oil in the system. You can also see that one side of the cylinder has a larger capacity than the other side, because one side has the piston shaft taking up space and the other doesn't. Therefore, big hydraulic machines usually have:

- Large appetites for hydraulic oil (100 gallons is not uncommon if there are six or eight large hydraulic cylinders used to operate the machine.)
- Large external reservoirs to hold the difference in the volume of oil displaced by the two sides of any cylinder.

The basic principles that hydraulic systems use to do their work, and then we'll examine several different pieces of hydraulic machinery found on a construction site. You will be amazed at the power and versatility available with hydraulics.

The brakes in your car are a good example of a basic piston-driven hydraulic system. When you depress the brake pedal in your car, it is pushing on the piston in the brake's master cylinder. Four slave pistons, one at each wheel, actuate to press the brake pads against the brake rotor to stop the car. (Actually, in almost all cars on the road today two master cylinders are driving two slave cylinders each. That way if one of the master cylinders has a problem or springs a leak, you can still stop the car.) In most other hydraulic systems, hydraulic cylinders and pistons are connected through valves to a pump supplying high-pressure oil.

12. Dangers:

1) Collisions:

Dump trucks are normally built for some amount of off-road or construction site driving; as the driver is protected by the chassis and height of the driver's seat, bumpers are either placed high or omitted for added ground clearance. The disadvantage is that in a collision with a standard car, the entire motor section or luggage compartment goes under the truck. Thus the passengers in the car could be more severely injured than would be common in a collision with another car.

2) Tipping:

Another safety consideration is the leveling of the truck before unloading. If the truck is not parked on relatively horizontal ground, the sudden change of weight and balance due to lifting of the skip and dumping of the material can cause the truck to slide, or even—in some light dump trucks—to turn over.

3) Back-up accidents:

Because of their size and the difficulty of maintaining visual contact with on-foot workers, dump trucks in car parks can be a threat, especially when backing up.[8] Mirrors and back-up alarms provide some level of protection, and having a spotter working with the driver also decreases back-up injuries and fatalities.

V. THREE AXIS HYDRAULIC TRAILER

The project work is constructed using various material like MDF (Medium density fiber core hard wood plywood, 3/16 nuts & bolts, aluminum sheet, motors (DC), gearboxes, syringes, wheel screw, nuts, toggle switches, push buttons, battery etc.) First of all a base chassis structure is prepared using MDF 8mm sheet. The structure is 22‖ in length and 11‖ in width. This structure incorporates driving motor along with steering motor. These motors are fixed with a fixed reduction radio gearbox of 100:1 to increase torque and reduce speed of the motor. The wheel base is kept 14‖ while the track distance to the output slate of the gearbox which is associated with the driving DC motor this motor and gearbox assembly is fixed in the wheel hub. This is attached with the chassis using aluminum attachment. A steering rod connects both the wheels which in the truck is connected with a steering motor. At the end of this chassis a platform of 26 x 36 cm such these platforms are pivoted on each and off opposite sides. So as to four _Z‘ shaped. Each two platforms are connected using a plastic syringe piston and cylinder assembly that forms the hydraulic piston and cylinder arrangement. Hydraulic fluid in this piston and cylinder arrangement that is pushed and pulled using a head screw arrangement. That is made to run to a flow using gearbox and motor. For the proper guide ways and guide slides are used for the same thing. This assembly is made in three numbers as there are three number of hydraulic cylinder that operated the trolley this power cylinder and piston arrangement is fitted in front of the trolley that is situated at the back of the chassis member.

These motors are connected to the wired remote that incorporated toggle switches and push button by manipulating these buttons the entire project work can be demonstrated and made to work. When the operator pushes the push button the motor operated the piston and cylinder arrangement that pushes the hydraulic fluid to the cylinder beneath. The trolley this piston gets out and pushes the trolley to tilt by operating various cylinders the material can be dropped in 3 ways.

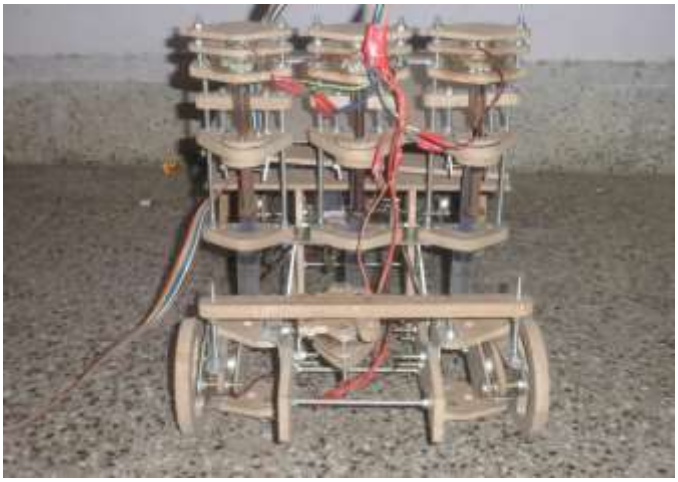

Fig.5.1: Front View

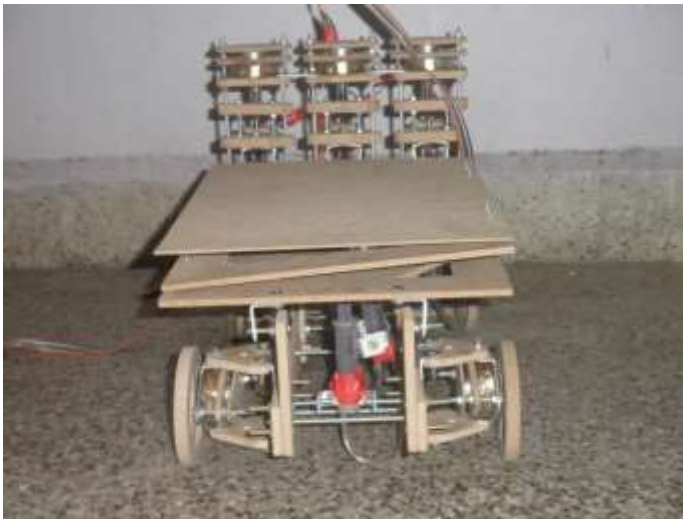

Fig.5.2: Back View

Fig.5.3: Left Side Dumping Action

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Fig.5.4: Right Side Dumping Action

Fig.5.5: Back Side Dumping Action

Advantages:

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

2. Can be used in very compact places: Where the reversing & turning of vehicle is difficult.

3. Can accommodate into pass on dam site working:

4. Saves time & energy.

Disadvantages:

1. Increased complexity: As it requires complex mechanism for getting desired output.

2. Cost increases: As more will be the complications to perform the operation, more will be the cost encountered with it.

3. Maintenance increases: More parts in working leads to more maintenance.

VI. THREE AXIS MODERN TRAILER

Three axis dumping trailer powered by pneumatics Is introduced by

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Pneumatic Three Axis Modern Trailer is nothing but one of the Lifting system in automobile at the time of emergency. In this Lifting system pneumatically operated one. Here the additional pneumatic cylinder and Control Valve is provided in the automobile itself. In this project, the Control Valve is used to activate/deactivate the Air input. The Valve is „ON" at the time of emergency; the compressed air goes to the pneumatic cylinder. Then the compressed air passes through the tube, and then pushes the pneumatic cylinder, so that the Lifting is applied at the time of Valve in "ON" position (i.e.- Emergency time). The speed of the pneumatic cylinder is varied by using flow control valve. This is the way of controlling Lifting speed of the Trailer at the time of emergency. In our project, we have to apply this Pneumatic Modern Trailer Mechanism in Load Lifting Vehicles. The Control Valve is fixed in near of the driving persons in the four wheeler. The air tank contains the compressed air already filled. The Valve was ON at the time of emergency, the Control Valve was activated. The compressed air flow is controlled by the valve is called "FLOW CONTROL VALVE". This air flow is already set. Then the compressed air goes to the pneumatic cylinders. The pneumatic cylinders piston moves forward at the time of compressed air inlet to the cylinder. The pneumatic cylinders moves towards the Lifting arrangement.

Advantages:

- Lifting cost will be less.
- Free from wear adjustment.
- Less power consumption
- Less skill technicians is sufficient to operate.
- Installation is simplified very much.

Major Parts:

The major parts pneumatic three axis modern tipper is described below:

- Air compressor
- Direction Control Valve
- Cylinder
- Connecting hoses
- Flow control valve
- Bearing with bearing cap
- Wheel arrangement
- Vehicle model frame
- Rotating Plates

Air compressor: The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is 10105 to 12 105 N/m2. This is a two stages or two-cylinder reciprocating air compressor. The two cylinders are for low and high compression. The air pressure is measured at various places by the use of pressure gauges. V-belt and pulley are used to drive the compressor. Compressors can be broadly classifieds into two groups. They are:

- Positive Displacement Compressor
- Dynamic Compressor

Positive Displacement Compressor:

Successive volumes of air isolated and then compressed to a higher pressure. There are essential two forms of positive displacement compressor, reciprocating and rotary.

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Dynamic Compressors:

These are rotary continuous machines in which a high speed rotating element accelerates the air and converts the resulting velocity head into pressure.

Positive displacement compressors work on the principle of increasing the pressure of a definite volume in an enclosed chamber. Dynamic (turbo) compressor employs rotating vanes or impellers to impart velocity and pressure to the flow of the air being handled. The pressure comes from the dynamic effects such as centrifugal force.

Pressure Gauge:

Pressure gauge is used for measuring the outlet pressure of air from the compressor. The gauge used is Bourdon type pressure gauge. The maximum capacity of this gauge is 10 105 to 12 105 N/m2. The gauge is fitted at the outlet of the air compressor.

Pneumatic valves:

The pneumatic cylinder is regulated and controlled by pneumatic valves. These valves are actuated manually, mechanically, electrically, pneumatically, and by various combined mode of actuation. Types of single acting cylinders:

Diaphragm cylinder

Rolling diaphragm cylinder

Double Acting Cylinder:

In the double acting cylinder the compressed air moves the piston in two directions

Air Seal:

Air seal is used to prevent the leakage of air pressure from the cylinder. Normally it is made up of neoprene rubber. If there are any air leakages in the system, it will reduce the efficiency.

Wiper Seal:

Wiper seal is provided at the entrance of the cylinder to avoid dust materials from the environment. It is made up of neoprene rubber.

O Ring:

The O rings are fitted into the grooves of piston to maintain perfect seal between the piston and the cylinder wall. They are mostly made up of neoprene rubber. In some cases wire mesh also intruded.

Cylinder Barrel:

It is made of cold drawn aluminimum honed to 25mm.

Piston Rod:

M.S. hard Chrome plated

Seals:

Nitrile (Buna N) Elastomer

End Covers:

Cast iron graded fine grained from 25mm to 300mm

Piston:

The piston is made up of aluminum metal because of light weight and high durability.

Media: the media which is used for the modern hydraulic trailer system is usually Air.

Temperature Range:

The temperature of the system usually ranges from 00c to 850c

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Cushions:

Adjustable standard on 400mm bore and above

Flow Control Valve:

In any fluid power circuit, flow control valve is used to control the speed of the actuator. The floe control can be achieved by varying the area of flow through which the air in passing. When area is increased, more quantity of air will be sent to actuator as a result its speed will increase.

Working Principle:

In this modern three axis pneumatic trailer system, the air circuit plays a vital role in the system and it is necessary to understand the movement and working principle of the air circuit.

First we can start with the compressing of the air; the atmospheric air which is normal pressure is taken by the reciprocating compressor and converted into higher pressure depending on the requirement. Cooling as to be provided for the compressed air to neutralized the heat generated by the compression process. The compressed air is supplied to the compressed air tank and the compressed air tank should have a drain to drain the water accumulated in the tank air moisture condensation. In the ship the main air bottle is used for the three axis trailer operation with the help of the pressure reducing valve because the main air bottle pressure is nearly stored at 35 bars for the main engine starting operation. In the modern three axis pneumatic trailer system we need maximum of 7 bars, 35 bars air pressure will damage the system. but some cases the variable pressure reducing valve will be used depending the requirement of the system also direction control valve are available for the desired operation.

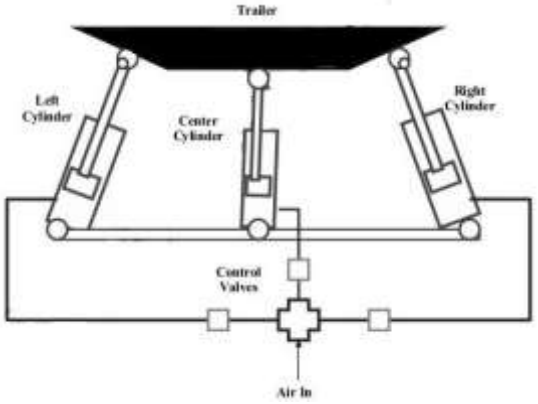

Fig.6.1: circuit diagram of three axis pneumatic modern trailer

For the pneumatic circuits usually the 5/2 direction control valve is used for the better compatibility

The figure shows the circuit diagram of the modern three axis pneumatic modern trailer. The air which is compressed in the compressor is sent to the 5/2 direction control valve. The 5/2 direction control valve will change the flow direction of the compressed air depending on the handle valve position. Then the compressed air from the direction control valve is sent to the cylinder block depending on the valve position. The compressed air admitted in the cylinder block will push the piston upwards. The piston stroke length can adjusted by means of the operation of hand lever valve position. The lifting of the trailer will be done by three cylinder block attached with the trailer as shown in the figure.

VII. THREE AXIS PNEUMATIC MODERN TRAILER

1. Relevance:

This project work titled “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.

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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 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.

2. 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

3. Advantages:

- It requires simple maintenance cares
- Checking and cleaning are easy, because of the main parts are screwed.
- Handling is easy.
- Manual power not required
- Repairing is easy.
- Replacement of parts is easy.

4. Scope of the Work:

- It requires simple maintenance cares
- Checking and cleaning are easy, because of the main parts are screwed.
- Handling is easy.
- Manual power not required
- Repairing is easy.
- Replacement of parts is easy.

5. Methodology:

In this project we are using single cylinder instead of three as per used in current dumping truck. in this we are mounting cylinder on rotating plate which will rotate along with axis.

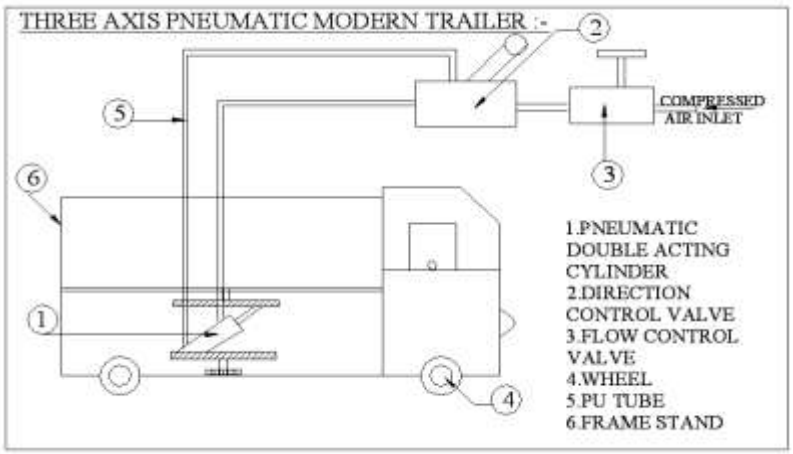

Fig.7.5.1: Methodology

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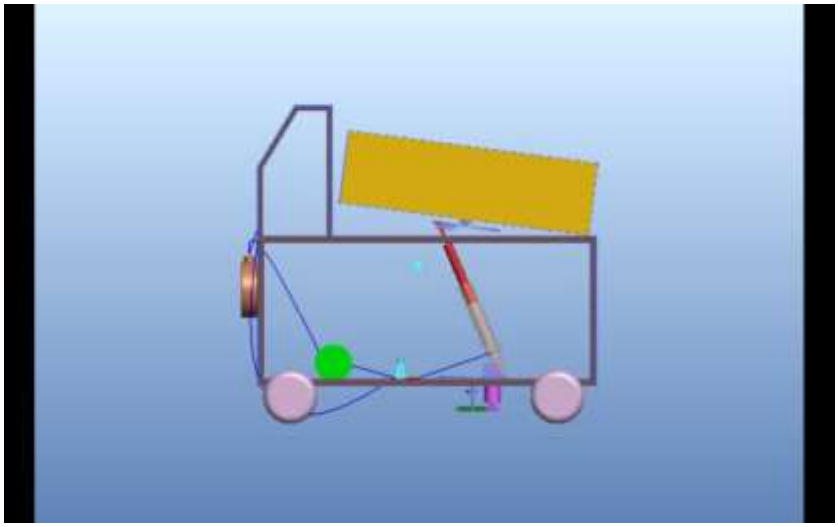

Fig.7.5.2: Back Dumping

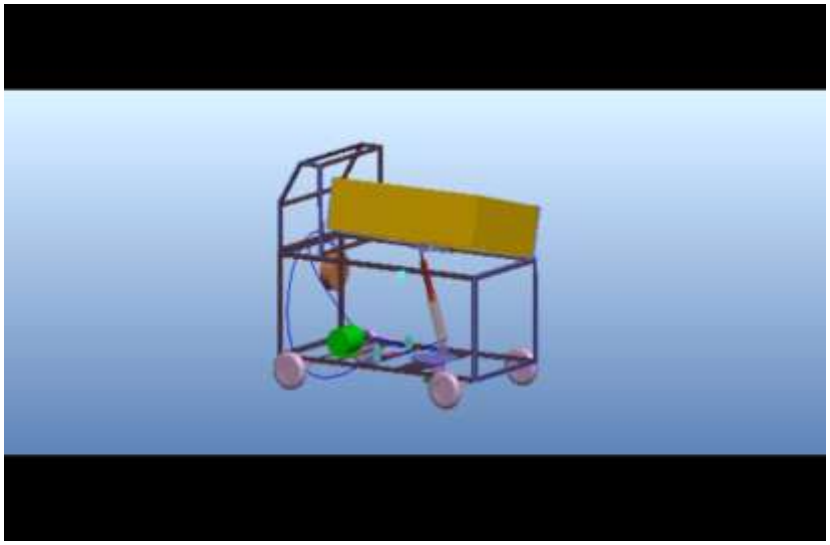

Fig.7.5.3: Right side dumping

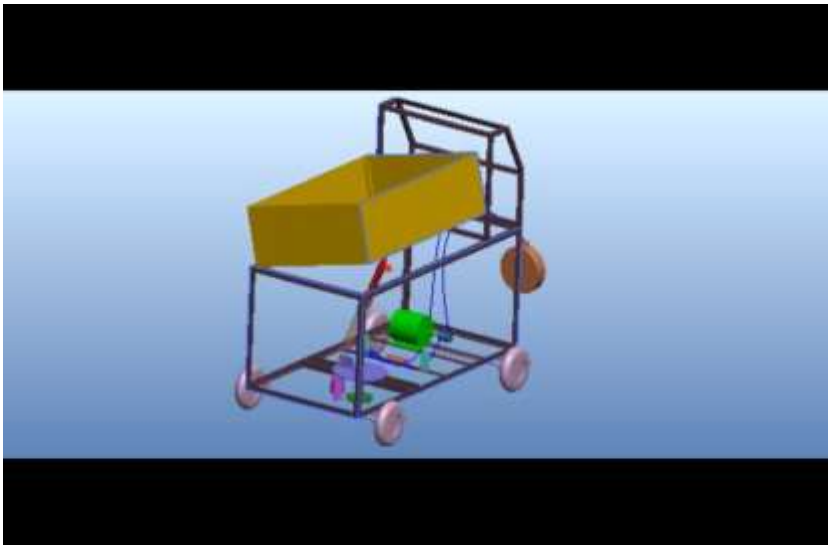

Fig.7.5.4: Left side dumping

VIII. CONCLUSION

This paper will review the need of the modern three axis pneumatic trailer for the ship to perform the operation of lifting heavy weight materials. This paper also studies the importance of pneumatic circuit system and its application in shipping industry. Various parts of the modern three axis pneumatic trailer was studied and their performance was analyzed in terms of the work. Further review is made on the practical plastic model of project with analysis of working and with the help of pneumatic system lifting operations can be easily carried out without much effort and without outsourcing. This mechanism cannot only applicable in the shipping industry but also it is applicable for various manufacturing industries. 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 according to the applications

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