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FABRICATION OF ELECTRO HYDRAULIC JACK

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Abstract - ***The project work titled "Electro Hydraulic Jack" has been conceived having studied the difficulty in lifting any type of vehicles. Our survey regarding several automobile garages, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning. The project has mainly concentrated on this difficulty. In this project we are converting the conventional hydraulic jack in to automated hydraulic jack by using linkage mechanism with a help of a motor. Such that the vehicles can be lifted from the floor land without the application of impact force. It works on the principle of Pascal law the invention relates to hydraulic jack and more specifically to an automobile hydraulic jack system. The fabrication part of it has been considered with almost case for simplicity and economy, such that this can be accommodated as one of the essential tools on automobile garages.***

Key Words: *Electro Hydraulic jack, Pascal Law, etc…*

1. INTRODUCTION

The invention relates to hydraulic jack and more specifically to an automobile hydraulic jack system. In most of the garages the vehicles are lifted by using screw jack. This needs high man power and skilled labors in the past both hydraulic and pneumatic jack has been utilized in combination with the structure of the automobile. They have always utilized a separate jack for each of 4 wheels by having the jacks permanently installed on the vehicle. They are ready to operation at all-time lifting device has been installed on vehicle, such as air lifting device. Various types of jack or lift devices has been installed on vehicle which are turned in 1 fashion or another from a horizontal attitude into a vertical attitude and then extended for the purpose of lifting the vehicle. It is an object of the invention to provide a novel hydraulic jack system that only utilized 2 hydraulic jacks, one that is mounted on chassis on side of car between two wheels and 2jacks that is mounted on side of automobile between its side wheels. It is also an object of invention to provide novel jack system that can be operated by driver from inside the car. It is also an object of invention to provide a novel hydraulic system in which a pump supplies pressurized oil to the hydraulic actuator or say hydraulic cylinder which acts as a hydraulic jack which will lift the vehicle. Now the project has mainly concentrated on this difficulty, and hence such that the vehicles can be lifted from the floor land without application of any impact force. By pressing the button in the dashboard, it activates the hydraulic jack automatically. A Patent numbered 4,993,688, was registered dated Feb. 19, 1991, of United States by Thomas L. Mueller on Built in Power Jack. In this, there was a front suspension pneumatic jack that is mounted centrally to the rear suspension of the Automobile between its rear wheels. The system operated from a compressed air reservoir tank that has connections.

1.1 Objective

- To fabricate an electro hydraulic jack system which will lift the vehicles from floor without application of large force.

1.2 Pascal law

Blasé Pascal formulated the basic law of hydraulics in the mid-17th century. He discovered that pressure exerted on fluid acts equally in all directions. His law states that pressure in a confined fluid is trans-mitted undiminished in every direction and acts with equal force on equal areas and at right angle to a container's walls as shown in figure.

This principle is stated mathematically as:

$$\Delta P = \rho g(\Delta h)$$

ΔP Is the hydrostatic pressure (given in Pascal's in the SI system), or the difference in pressure at two points within a fluid column, due to the weight of the fluid.

ρ is the fluid density (in kilograms per cubic meter in the SI system).

g is acceleration due to gravity (normally using the sea level acceleration due to Earth's gravity, in SI in meters per second squared).

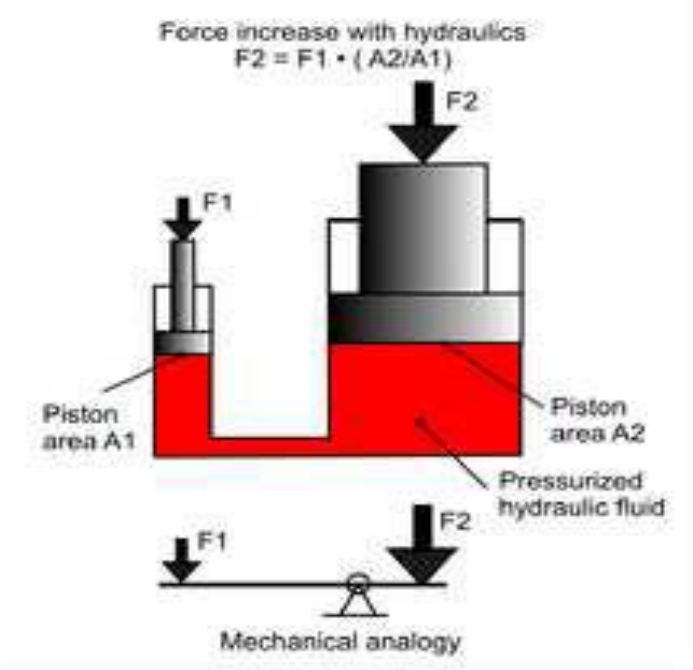

Fig-1 Pascal law

Δh Is the height of fluid above the point of measurement, or the difference in elevation between the two points within the fluid column (in meters in SI).The intuitive explanation of this formula is that the change in pressure between two elevations is due to the weight of the fluid between the elevations. A more correct interpretation, though, is that the pressure change is caused by the change of potential energy per unit volume of the liquid due to the existence of the gravitation Note that the variation with height does not depend on any additional pressures. Therefore, Pascal's law can be interpreted as saying that any change in pressure applied at any given point of the fluid is transmitted undiminished throughout the fluid. Pascal's principle applies to all fluids, whether gases or liquids. A typical application of Pascal's principle for gases and liquids is the automobile lift seen in many service stations and the hydraulic jack. Increased air pressure produced by an air compressor is transmitted through the air to the surface of oil in an underground reservoir. The oil, in turn, transmits the pressure to a piston, which lifts the automobile. The relatively low pressure that exerts the lifting force against the piston is about the same as the air pressure in automobile tires. Hydraulics is employed by modern devices ranging from very small to enormous. For example, there are hydraulic pistons in almost all construction machines where heavy loads are involved.

1.3 Hydraulic system

A hydraulic system contains and confines a liquid in such a way that it uses the laws governing liquids to transmit power and do work and. components of a hydraulic system that store and condition the fluid. The oil reservoir (sump or tank) usually serves as a storehouse and a fluid conditioner. Filters strainers and magnetic plugs condition the fluid by removing harmful impurities that could clog passages and damage parts. Heat exchanges or coolers often are used to keep the oil temperature within safe limits and prevent deterioration of the oil. Accumulators, though technically sources of stored energy, act as fluid storehouses. Pascal's law is the basis of hydraulic drive systems. As the pressure in the system is the same, the force that the fluid gives to the surroundings is therefore equal to pressure × area. In such a way, a small piston feels a small force and a large piston feels a large force. The same principle applies for a hydraulic pump with a small swept volume that asks for a small torque, combined with a hydraulic motor with a large swept volume that gives a large torque. In such a way a transmission with a certain ratio can be built. Most hydraulic drive systems make use of hydraulic cylinders. Here the same principle is used — a small torque can be transmitted into a large force. By throttling the fluid between the generator part and the motor part, or by using hydraulic pumps and/or motors with adjustable swept volume, the ratio of the transmission can be changed easily. In case throttling is used, the efficiency of the transmission is limited. In case adjustable pumps and motors are used, the efficiency, however, is very large. In fact, up to around 1980, a hydraulic drive system had hardly any competition from other adjustable drive systems. Nowadays, electric drive systems using electric servo-motors can be controlled in an excellent way and can easily compete with rotating hydraulic drive systems. Hydraulic cylinders are, in fact, without competition for linear forces. For these cylinders, hydraulic systems will remain of interest and if such a system is available, it is easy and logical to use this system for the rotating drives of the cooling systems, also.

2. LITREATURE SURVEY

P.S. Rana et. al[1] They have research on ” Integrated Automated Jacks for 4-wheelers “.An Automobile hydraulic jack can be easily operated by a single push button provided on the dash board. The jack will be installed on both the sides of chassis according to the weight distributions of the car. The system operates on hydraulic drive which consists of three main parts hydraulic pump, driven by an electric motor, hydraulic cylinder to lift the vehicle

Manoj Patil et. al[2] presented overview of “ Automated Car Jack ”. An automotive jack is a device used to raise all or part of a vehicle into the air in order to facilitate repairs.

An electric car jack works on current supply from the car battery itself making it easy to operate. Operator only needs to press the button from the controller without working in a bent or squatting position for a long period of time to change the tire

Abhijeet [3] did project on "Hydraulic Jack for Heavy Vehicles ".Hydraulic jack system is attached to automobile vehicle on front and rear part of the chassis. There is also a rear suspension hydraulic jack that is mounted centrally to the rear suspension of the automobile between its rear wheels. The system operates from a compressed fluid reservoir tank that has connections for the front and rear car jack outlets.

Shivraj shet et. al[4] discussed about Design And Fabrication Of Automotive Hydraulic Jack System For Vehicles". An inbuilt jacks have been designed and fabricated which is assembled on the vehicle. With the help of the existing brake pad and fluid arrangement of the braking system we incorporate the jack into to chassis of the vehicle with a set of unions, ball valves, master cylinder, five-way directional control valve, separated by a piping arrangements lifts the incorporated jack to action desired without raising any sweat of the driver.

Mohan Krishna [5] discussed about the topic "Experimental Design and Fabrication of a Portable Hydraulic Pipe Bending Machine". The pipe or rod to be bent is supported between the holders and jack is actuated on pipe. It exerts force on the pipe and bends it to the suitable angle depending on the dies used. Applications of bending machines are found to be in production industries, petroleum, chemical, automobile etc…

3. EXPERIMENTAL SETUP

Here we are converting the rotary motion into linear motion for lifting the vehicle using the jack which is fixed in the bottom of the axles by means of a frame. The motor is operated by the control unit. It gets power from the battery. The four numbers of hydraulic jack is arranged under the vehicle body. One shaft is connected to the command moving shaft. The link is used to provide the smooth operation during the up and down movement. When the power is given to the motor it starts rotates. Then the cam rotates the supporting shaft moves up which makes the return spring shaft to move down by touches the ground and lifts the front wheels of the vehicle. The wheels are grounded safely even after the wheel puncture or any other fault in the vehicle. We had made a system which will convert the conventional hydraulic jack in to automated electro hydraulic jack by using linkage mechanism with a help of an electric motor. Such that the vehicles can be lifted from the floor land without the application of impact force. The system consist of bottled jack, dc motor, dc power supply. In normal case we are lifting the jack manually. In our project we are lifting the jack by a dc motor using a linkage mechanism. That is the pumping action of jack is done by the rotary motion of the dc motor.

An inbuilt hydraulic jack system can be easily attached to all currently manufacture automobile chassis. There is a front suspension hydraulic jack that is mounted externally to the front suspension of an automobile between its front wheels. The system operates on the hydraulic power. This arrangement has many advantages such as maintenance and Servicing of vehicle. It reduce the security tension and easy to implement. Quick lifting is one of the main advantage of this electro hydraulic system.it will also reduce the man power and large load can be lifted

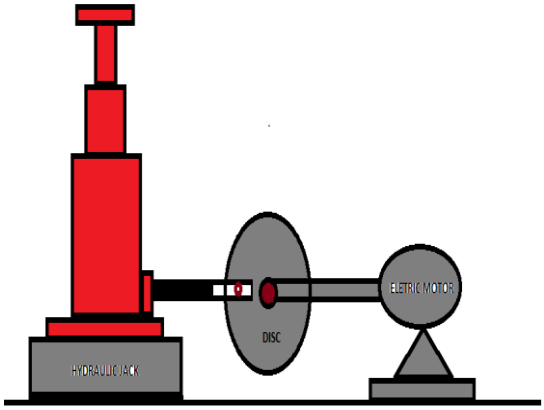

Fig-2 Schematic Diagram for Electro Hydraulic System

4. FABRICATION

4.1 Components

- Hydraulic bottle jack
- Disc
- Dc motor
- Arm
- DC Power Supply
- Switch board

4.2 Construction

First we have made a base frame in which there is a capacity to hold all of the apparatus such as hydraulic bottle jack, motor, arm, disc and power supply. Then a hydraulic jack is fixed in the frame base which is one of the key part of the system. Hydraulic jack is a device to carry large loads with application of small forces. It works on the principle of Pascal's law. This law states that the force applied on the fluid is distributed equally to all parts in all direction in a hydraulic system. An arm is fixed to the jack in which the to and fro motion of the arm lifts the jack. The arm is made up of iron rod which has the capability of carrying disc. The arm consist of a slit at one end. One of the ends of the arm is connected to the handle of the jack.

The end having slit in it is connected to the disc. The arm is connected to the disc with the help of the slit locked up with the disc by a screw protruding through the slit having only linear motion. The arm is connected to a disc which rotates on the motion of the motor. The disc is made up of steel. It has a circular cross section.it consists of a handle. Handle consists of a screw which is also made up of steel. The handle is the one connected to the slit of the arm. The disc is connected to the motor. When the motor is switched on the disc rotates. This rotating motion of the disc is converted into the linear motion of the arm. The disc is connected with a motor.

The motor we used in the project is a wiper motor. The specifications of the motor includes 12V voltage and 5.1A current. It has a power of 150w. The motor is wired to the switch in which a battery can be connected. A battery can be connected to the switch. When in case of lifting of the vehicle, the switch is kept on. The power from the battery is given to the motor to rotate. The motor rotates and the disc connected with the motor also starts to rotate. The arm which is connected with the motor disc gets a to and fro motion. The arm is connected to the jack. The jack gets a pumping motion. This makes the jack to lift up. The vehicle is lifted by the jack.

The electro hydraulic jack system was painted in order to avoid rusting and corrosion. The fabrication of the model was completed successfully. The hydraulic jack was checked and tested with a Hyundai santro. The result was successful.

Fig-3 Fabricated electro hydraulic system

5. RESULT AND DISCUSSION

We had made a system which will convert the conventional hydraulic jack in to automated electro hydraulic jack by using linkage mechanism with a help of an electric motor. Such that the vehicles can be lifted from the floor land without the application of impact force. The system consist of bottled jack, dc motor, dc power supply. In normal case we are lifting the jack manually. In our project we are lifting the jack by a dc motor using a linkage mechanism. That is the pumping action of jack is done by the rotary motion of the dc motor.

The capacity of electro hydraulic jack is 2 tonnes. We had tested our electro hydraulic system in the maruti Alto and Hyundai santro and it was successful. The vehicle is lifted without application of the man force

The fabricated system have the ability of quick lifting and portability.it is easier to use and maintained cost is less. It has smooth operation and simple in construction. The advantages are of the followings;

1. It requires simple maintenance cares
2. The loaded light vehicles can be easily.
3. Checking and cleaning are easy, because of the main parts are screwed.
4. Handling is easy.
5. Manual power not required
6. Repairing is easy.
7. Replacement of parts is easy.
8. No Oil wastage

6. CONCLUSION

An electro hydraulic jack is a device used to carry large loads with the application of small force. Here we fabricated a hydraulic jack which is operated using a DC wiper motor which gets dc supply from the battery of the vehicle without application of man force. Quick lifting is one of the main advantage of this electro hydraulic system. It will also reduce the man power and large load can be lifted. Arrangement is also very useful for heavy loading vehicles and a single person can go on a long drive.

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