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Design and Fabrication of Motorized Hydraulic Jack

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Abstract: *The Hydraulic Screw jack has been develop the difficulties that you have face when working with a light motor vehicles. In this device it is very easy to lift the light vehicle and very less time taken. A hydraulic jack uses hydraulic power. In the case of tire puncture or replacing wheels lift the car is more important part. This time we use traditional ways to lift the tire. In that case a physically handicapped person, older person aged person not lifts the tire easily. They require more time and also require more force to lift the tire. In that way to help those who are physically challenged, aged person this project automatic hydraulic jack system is more useful. So, we tried to grab the opportunity. Here we use a wiper motor to drive the hydraulic jack loading subsequently and automatically.*

Keywords: Hydraulic Screw jack

I. INTRODUCTION

Garage jack, which lifts vehicles so that maintenance can be performed. Jacks are usually rated for a maximum lifting capacity for example, 1.5 tons or 3 tons. Industrial jacks can be rated for many tons of load. A revolutionary change has taken place in the field of fluid power technology due to the integration of electronics as a control medium for hydraulic components and system. Efforts have been made to include the latest possible trends in the field of hydraulics and allied control areas to keep the over changing state technology in hydraulics. In the case of tyre puncture or replacing wheels lift the car is more important part. This time we use traditional ways to lift the tyre. In that case a physically handicapped person, Unskilled person or aged person not lifts the tyre easily. They require more time and also require more force to lift the tyre. In that way to help those who are physically challenged, ladies or aged person this project automatic hydraulic jack system is more useful. So, we tried to grab the opportunity. Here we use wiper motor to drive the hydraulic jack loading subsequently and automatically. Our project works on the mechanism of converting rotary motion of the wiper motor into reciprocating motion of the hydraulic jack plunger. A cylinder cage structure of wiper motor ensures maximum power delivered by consuming the available battery power which can be easily generated. Important thing is that power is available at instant and anyone can withdraw easily, without any hazard. Battery is also available in any car so when our external battery will be discharge then we use power in the car.

The proposed system is a comfort based functional system which is used to lift the vehicle without any difficulty, experience and physical work. The system is mainly built valuing the difficulties experienced by the elderly persons and physically challenged persons. The main lead of the proposed system is the number of jacks used is constrained; the power for the actuation is directly obtained from the engine of the vehicle. The direct power extraction leads to the elimination of the battery and the motor, which significantly grades the reduction of weight and the cost. This enhances the affordability of the system

II. LITERATURE REVIEW

Durvesh Rohidas More, Aditya Arun Patil, Adesh Ananta Thakare, Nishank Rajesh Vartaket.al "Design and Fabrication of Motorized Hydraulic Jack System" A hydraulic jack uses hydraulic power. In the case of tyre puncture or replacing wheels lift the car is more important part. This time we use traditional ways to lift the tyre. In that case a physically handicapped person, older person aged person not lifts the tyre easily. They require more time and also require more force to lift the tyre. In that way to help those who are physically challenged, aged person this project automatic hydraulic jack system is more useful. So, we tried to grab the opportunity.

Mohan Kumar R S, Vinayagamoorthi M A, "Design and Fabrication of Automated Inbuilt Hydraulic Jack for Light Motor Vehicle" In the feat of changing the wheel of a light motor vehicle, lifting the vehicle is an unavoidable and a complicated practice. Manual lifting using jack systems requires more human effort and comparatively time consuming

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also. The proposed model is an alternative solution which reduces both the human effort and vehicle lifting time. To lift the vehicle, the user need to exert a gentle push over the lever, that actuates the desired hydraulic jack to the preferred height. In various proposals carried earlier regarding lifting the vehicle more number of jack systems, various power source terminals and requires an additional actuating means, which is redesigned with optimized conditions. The proposed system increases the comfort of the light motor vehicle users which brings them more closer to the technological up gradation. The proposed project is also mainly concentrated towards the ease of differently abled and aged persons.

James Okporand OsasuyiOzuem Odiaet.al "DESIGN AND CONSTRUCTION OF A MICROCONTROLLER BASED REMOTE CONTROLLED CAR JACK WITH ILLUMINATION SYSTEM" Changing a car tire is not an easy task for most car users to do, most especially aged persons and female drivers. This is because of the high man power required to operate these jacks. A lot of vehicle owners have been stranded on their way and some others have had to wait for long periods of time for help from other either other road users or benevolent passers-by before they can change their tire. This is not a convenient experience for most vehicle users. If you have a flat tire by a dark road side at night, you will need to illuminate the area as much as possible before you can easily change the tire. So there is need for one to have a jack that can provide light wit is need for one to have a jack that can provide light within the area that is to be lifted at night time. A car jack is a device used to lift a car so that maintenance can be performed. Jacks are basically used in raising cars so that a tire can be changed and also used when carrying out maintenance under the car (Manoj, 2014). A Car jack is an important tool that will be needed by every vehicle owner at one point or the other when carrying out repair or replacement.

III. METHODOLOGY

Identification of Problem & Literature Review.

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Design a component and material selection.

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Preparation of 3D CAD model.

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Fabrication of the components.

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Assembly of the components.

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Testing of the project.

↓

Result and discussion

Working principle

- It works on Pascal's Law which state that, "It states that the intensity of pressure at any point in a fluid at rest is the same in all direction."
- The diagram of motorized hydraulic jack is shown in fig. The lead-acid battery is used to drive the D.C. motor.
- The D.C. motor shaft is connected to the crank. If the power is given to the D.C. motor, it will run so that thecrank also runs to the same speed of the D.C motor. With the help of gear mechanism we can reduce the rotation speed (rpm) of crank.
- The linkage is attached to the crank. When the crank starts rotates then the link also moving. The movement of linkage is up and down motion due to crank mechanism. Other end of linkage is connected to the hydraulic pump handle.
- The hydraulic handle moves up and down according to the movement of the crank linkage. So the pressurized oil goes to the hydraulic jack and moves the piston upward, so that the vehicle lifts from ground

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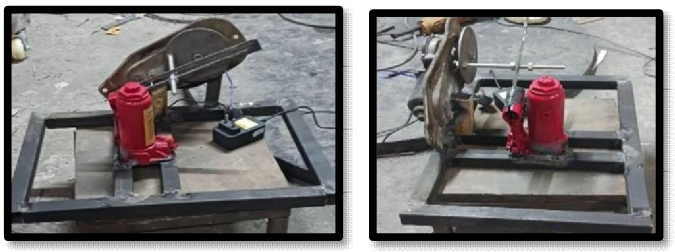

Fig-Working of the model

IV. CALCULATION

1. Wiper motor design-

As we have to lift 1000N force vertically acting we will need a DC Wiper motor. Wiper motors are used to transmit high torques.

For 12 Volt and 24 Amp current motor, Power generated is calculated as,

P=V*I

= (12*24)

P=288 Watts.

Now as per our model the disc with radius 0.04 m which is connected to motor and transferring power is given as, P= (2*3.14*N*T) / (60)

Now for 55 rpm=N

T supplied=50.02 N-m-A

Now the required torque to move the disc is calculated as,

T required=Vertical force*Radius of disc.

=1000*0.04

T required=40 N-m

As the B<A, our design is safe. So we can select the 12V and 24Amp DC Wiper motor.

2. Hydraulic Piston Design

Now to design the cylinder used for lifting we need to calculate the force required to lift the load.

Theoretically to lift the 1000N downward acting force we need to supply 1000N vertically acting force.

Now we are supplying 50.02 N-m torque, and radius of the disc is 0.04m

Hence, T supplied=F*R 50.02/0.04=F F=1250.5 N

As the supplied force is greater than the downward acting force our design is safe.

Motor specification

Name MYZ3- 350 W DC motor

Motor Magnet Type- Permanent Magnet Operating Voltage- 12 to 24 V

Torque-22 N-m i.e. 225 kg-cm Max. Current -approx. 13 to 19 A Type of motor -DC

Power -350 Watt Speed-2000to6000rpm

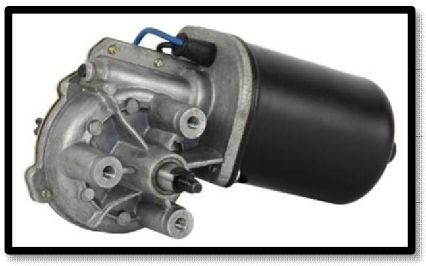

Fig -Wiper motor

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Hydraulic jack

Hydraulic Jack :-

Name-Hydraulic Bottle Jack Material -Alloy Steel, Cast Iron Capacity-2 ton - 30 ton

Usage or application -Heavy duty vehicle lifting Lifting Height 181 – 370 mm

Fig bottle jack

V. FUTURE SCOPE

- Enhanced Load Capacity and Precision: Future hydraulic jacks will be capable of lifting heavier loads with greater precision, expanding their utility in construction, manufacturing, and automotive industries.
- Integration with Smart Technology: Integration with sensors and smart technology will enable real-time monitoring of load, pressure, and jack position, ensuring safety and preventing accidents.
- Automation and Remote Operation: Automated and remotely controlled hydraulic jacks will minimize human involvement in hazardous lifting tasks, improving safety and efficiency in various industries.
- Customization and Adaptability: Customizable hydraulic jacks will cater to specific industrial needs, adapting to different load capacities, lifting heights, and operational environments

VI. CONCLUSION

The principle of the Motorized Hydraulic Jack was modified by making adjustments and using a prime mover which is the DC motor to control the lifting operation of the jack. The car battery (12V) is used to supply power source to the motor. Human effort was eliminated for pushing the jack by the use of the torque generated by the motor as in rotates. The use of long cablings to control the motorized operation meant the jack would be safe to use as the operator can use the jack in a comfortable position and as far away from the vehicle as possible. The torque supplied to the system is more than enough to lift a vehicle weighing around 2000 kg (2 ton). This design of the motorized hydraulic jack can considered to be a huge benefit in the lifting of s2 ton heavy duty vehicles

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