Design and Fabrication of Motorized Hydraulic Jack

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ABSTRACT

This Paper work titled has been conceived having studied the difficulty in lifting the any type of light vehicles. Our survey in the regard in several automobile garages, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning. Now the Paper has mainly concentrated on this difficulty, and hence a suitable device has been designed. Such that the vehicle can be lifted from the floor land without application of any impact force. The fabrication part of it has been considered with almost case for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile garages.

Keyword: - *Hydraulic Bottle Jack, Dc Motor, Spur Gear Mechanism, Base Plate, Crank Link.*

1. INTRODUCTION

This device the motorized hydraulic jack for automobile garages has been developed to later the needs of small and medium automobile garages, who are normally man powered with very minimum of skilled labours. In most of the garages the vehicles are lifted by using screw jack. This needs high man power and skilled labours. In order to avoid all such disadvantages. This, motorized hydraulic jack has been designed in such a way that it can be used to lift the vehicle very smoothly without any impact force. The operation is made be simple that even an unskilled labour can handled, by just demonstrating the working of the motorized hydraulic jack once. The working of Hydraulic Jack is on Pascal's Law principle.

2. LITRERATURE SURVEY

The research survey revealed that few methods were adopted to lift the vehicle for reconditioning, repairing and others. This hydraulic jack has mainly focused on this difficulty. Therefore, a suitable device has been designed for lifting the vehicle without apply any impact force. The device has been considered for simple and economy therefore it is one of the important and essential equipment in automobile service center's which required minimum skilled technician are.

In many auto service center's vehicles are lifted by using screw jack, to avoid this automatic hydraulic jack may be utilized in lifting the vehicles easily without impact force. This can be operated by even unskilled operator. The DC

motor is joined with the lead screw by the help of gear arrangement and lead screw rotation depending on the rotation of the above-mentioned DC motor.

3. CURRENT TECHNIQUES

1. Floor Jack
2. Scissor Jack
3. Hydraulic Bottle Jack
4. Hi-lift Jack

These manually operated jacks involve more human effort and are time consuming. The operator also needs to identify the current position where the jack needs to be placed in order to safely lift the car which sometimes becomes a quite difficult job.

4. DESIGN METHODOLOGY

Design and fabrication of the machine involves the steps mentioned below:-

1. Analyse and review the problems in the Motorized Hydraulic Jack.
2. Designing the required components.
3. The design was evaluated.
4. Observation and calculation were made.
5. Selection of required materials.
6. Fabrication of the Motorized Hydraulic Jack.
7. Testing and trial run were carried out.

5. MAIN COMPONENTS OF PROJECT

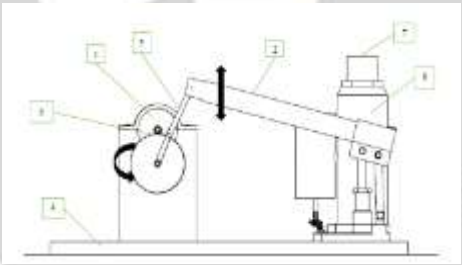


Fig. Components of the model

1. DC Motor
2. Jack Handle
3. Spur Gear Mechanism
4. Base Plate
5. Crank linkage
6. Hydraulic Bottle Jack
7. Lifting floor

6. 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."

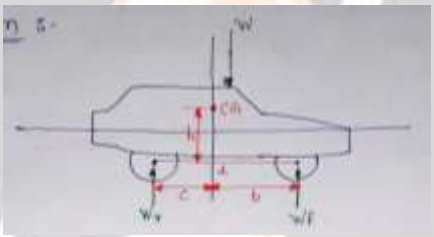
- The diagram of motorized hydraulic jack is shown in fig. The lead-acid battery is used to drive the D.C. motor. The D.C. motor shaft is connected to the crank. If the power is given to the D.C. motor, it will run so that the

crank 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.

Fig. Working of the model

7. CALCULATIONS



Here,
W- Weight of the car
C- Distance between the centre of gravity & rear axle
b- Distance between the CG & font axle
l- Length between the axle of front and rear wheel
h- Height of centre of gravity

Acceleration for stable,

$$\therefore \quad W_f = \left(\frac{C}{L}\right) * W \quad \text{------For Front Wheel}$$

$$\& \quad W_f = \left(\frac{b}{L}\right) * W \quad \text{------For Rear Wheel}$$

$$\therefore \quad W_f = \left(\frac{C}{L}\right) * W$$

$$= \left(\frac{179}{268}\right) * 1800$$

$$= 1202.23 \text{ Kg}$$

$$\& \quad W_f = \left(\frac{b}{L}\right) * W$$

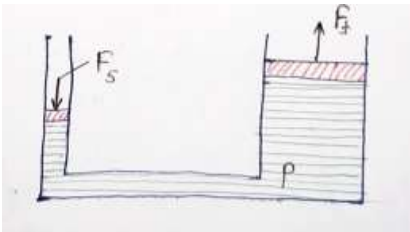
$$= \left(\frac{89}{268}\right) * 1800$$

$$= 597.76 \text{ Kg}$$

Here, for lifting the backside of car we need 598 N of force required and for lifting the front side the required force is 1202 N appox.

Again, for one tyre of backside the net required force is 299 N i.e. $\left(\frac{598}{2}\right)$ & for front side it is $\left(\frac{1202}{2}\right)$ = 601 N.

So, we required the hydraulic jack which have the lifting capacity upto 1000 kg i.e. 1 Ton & we got with capacity upto 2 Ton.



For Ft = 601 N, lifting this force we required 60 to 65 n of force for small cylinder to create pressure for lift required weight.
Now,
∴ F = m*a

F = 6.4285 * 9.8
∴ **F = 63 N**
Hence, Torque, ς = F * r
Here, r = the distance of crank in slider crank mechanism from the fixed point of jack and the crank shaft of DC motor.

∴ ς = 63 * 0.35
∴ ς = 22.05 N-m
∴ **ς = 224.91 Kg-cm**

Now, by observing the lifting time of hydraulic jack, we required the speed of 100 to 120 rpm. Hence, we considered the 120 rpm required.

So,

$$\text{Power, } P = \frac{2\pi NT}{60}$$

$$= \frac{2\pi * 120 * 22.05}{60}$$

∴ **P = 276 Watt**

Hence, according to our calculation there is no perfect DC motor available in market but by approximation of our calculation the motor is available of other specification.

- **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	2000 to 6000 rpm

Fig. DC Motor

- **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. Hydraulic Jack

8. 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 2 ton heavy duty vehicles.

9. REFERENCES

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Fig. Completely images of the model