International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 5, No. 3, Sep - November, 2020
Pages 32-37 | Cosmos Impact Factor (Germany): 5.195
Received: 02.09.2020 Published: 28.11.2020

INBUILT HYDRAULIC CAR LEFTING

[1]Neelakanthareddy. Y.B [2]Harish Mudegannavar , [3]Siddesh N Bevinahalli
[1,2,3]Mechanical Engineering Department, RTE Society's Rural Engineering college, Hulkoti.
*Email: neelakanthareddy41@gmail.com

INTRODUCTION

Present day technology has resulted in proliferation of new ideas and techniques. These have resulted in the emergence of new devices and recognition of new branches of knowledge enabling special attention and research to cope up with the refined studies made in technology. Though the performance of all automobile accessories differs widely, they aim at providing the best possible comfort, luxury and ease of operation. There are few accessories that are must for every vehicle in order to cope up with certain problems, which are beyond the control of human beings. Keeping this in mind, this project is about using single hydraulic cylinder to lift entire or part of the vehicle.

In day to day life it is very tedious job to operate the jack manually and it is also a very time consuming work as well, to make it easier for everyone especially for aged person and for lady drivers, to provide a safe and simple automatic hydraulic jacking system without manual effort. To provide a novel jacking system that can be operated from within the vehicle by means of loosening the fastener and operating the electric switch. There are certain mechanisms already available for the same purpose which has a definite capacity to lift the car on 2 wheels viz. a screw jack. But the general idea of the project is to minimize the human effort while operating the jack. To provide a novel hydraulic jacking system that is directly and permanently incorporated into the vehicle frame in such a way as to prevent the additional risk of damage.

OBJECTIVES

The primary objective is to provide an inbuilt single hydraulic cylinder jacking system in the automobile that can be operated within the vehicle by means of operating the electric switch.

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 5, No. 3, Sep - November, 2020
Pages 32-37 | Cosmos Impact Factor (Germany): 5.195
Received: 02.09.2020 Published: 28.11.2020

To save considerable amount of time during breakdown and maintenance.

To reduce physical effort to be applied to lift the vehicle.

To facilitate easy and convenient lifting of the vehicle for lady drivers, aged people, beginners etc.

WORKING:

A hydraulic jack uses a fluid, which is incompressible, that is forced into a cylinder by a pump plunger. Oil is used since it is self-lubricating and stable. When the plunger pulls back, it draws oil out of the reservoir through a suction check valve into the pump chamber. When the plunger moves forward, it pushes the oil through a discharge check valve into the cylinder. The suction valve ball is within the chamber and opens with each draw of the plunger. The discharge valve ball is outside the chamber and opens when the oil is pushed into the cylinder. At this point the suction ball within the chamber is forced shut and oil pressure builds in the cylinder.

OBJECTIVES:

The primary objective is to provide an inbuilt single hydraulic cylinder jacking system in the automobile that can be operated within the vehicle by means of operating the electric switch.

To save considerable amount of time during breakdown and maintenance.

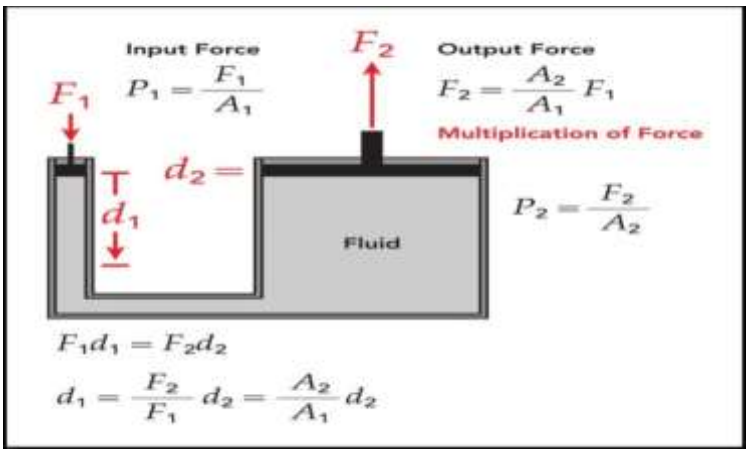
To reduce physical effort to be applied to lift the vehicle.

To facilitate easy and convenient lifting of the vehicle for lady drivers, aged people, beginners etc.

FUNDAMENTAL CONCEPT:

PASCAL'S LAW:

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 5, No. 3, Sep - November, 2020
Pages 32-37 | Cosmos Impact Factor (Germany): 5.195
Received: 02.09.2020 Published: 28.11.2020



Pascal's law

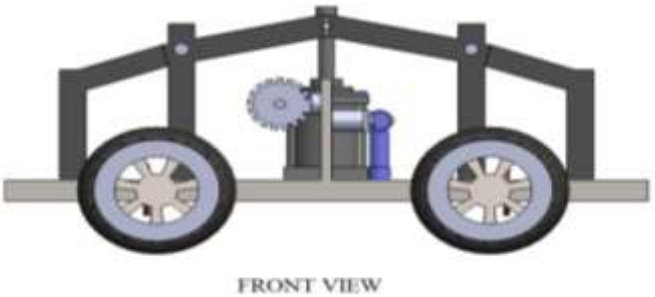
The law states that pressure in a confined fluid is transmitted undiminished in every direction and acts with equal force on equal areas and at right angle to a container's walls as shown in above fig:

Power can be derived in the following ways for the movement of the jack:

- Power can be taken from the running engine on neutral gear.
- Power can be taken directly from the battery.
- Jack can be raised with the help by a hybrid mechanism which uses electric energy from the battery and drives the motor to operate a hydraulic jack.

One of the above options can be chosen according to their efficiency and cost effectiveness. We are currently trying to take the power by second method that is directly from battery which uses electric energy from the battery and drives the motor to operate a hydraulic jack.

WORKING PRINCIPLE:



Position of jack in vehicles

In operation, the operator needs to lose the fastener to release the foldable arms and switch on the electric switch, which operates the electric motor. The motor operates the

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 5, No. 3, Sep - November, 2020
Pages 32-37 | Cosmos Impact Factor (Germany): 5.195
Received: 02.09.2020 Published: 28.11.2020

slider-crank mechanism, thereby actuating the hydraulic jack. The ram of the hydraulic jack pushes up thus pressing the foldable arms against the ground. The hydraulic jack is operated till the vehicle is raised up to required height. The maintenance work can be now performed. The vehicle is lowered down slowly by releasing pressure in hydraulic cylinder with the help of pressure releasing valve.

DESIGN AND FABRICATION

Factors to be considered for a good design

1. High productivity
2. Simplicity of design
3. Safety and convenience of control
4. Low cost
5. Good appearance

Hydraulic Jack Specification

- Type: bottle jack
- Capacity: 2 tons (19620 N)
- Weight to be lifted = 50 kg (490.5 N)

Formula:

For large piston,

$$F_L = P \times A_L \ldots N \longrightarrow \quad (5.1)$$

F_L- force on the large piston = 490.5 N

P- Pressure inside the cylinder. N/mm^2

A_L- cross-sectional area of large piston. mm^2

A_S- cross-sectional area of small piston. mm^2

F_S- force on small piston N

D_L- diameter of large piston = 22 mm

D_S- diameter of small piston = 10 mm

Calculation of effort required at plunger end:

$$F_L = P \times A_L$$

$$490.5 = P \times (22 \times 10\text{-}3)^2 \times \pi/4$$

$$P = 129.017 \times 10^4 \ N/mm^2$$

Force required at small (working) piston,

$$F_S = P \times A_S \longrightarrow \quad (5.2)$$

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 5, No. 3, Sep - November, 2020
Pages 32-37 | Cosmos Impact Factor (Germany): 5.195
Received: 02.09.2020 Published: 28.11.2020

$= 129.017 \times 10^4 \times (10 \times 10\text{-}3)^2 \times \pi/4$

$F_S = 101.34$ N = 10.33kg

Therefore the force required on the working piston to lift the vehicle is 10.33kg which is nearly 5 times less than the weight to be lifted. Hence the jack is within the safety limits.

Electric Motor

- Type: DC gear motor
- Brake Horse Power: 0.13HP = 102.73 Watts
- Voltage range: 4V to 12V
- Speed : 10 rpm at 12V
- Shaft diameter : 8mm
- Shaft length: 25mm
- Gear assembly: spur
- Brush type: carbon
- Motor weight : 0.52 kg

Formula:

Useful available torque,

$$T = B.H.P \times 60/2\pi N \longrightarrow \quad (5.3)$$

$= 102.73 \times 60 / 2\pi \times 10$

$= 98.099 \times 10^3$ N-mm

$= 10^4$ kg-mm = 98100 N-mm

Load on motor:

Working piston force required, $F_P = 10.33$ kg = 101.34 N

Length of the jack plunger, $r_P = 400$ mm

Torque required at plunger end,

$$T_P = F_P \times r_P \longrightarrow \quad (5.4)$$

$= 101.34 \times 400$

$= 40536$ N-mm

Length of the connecting rod, $r_C = 125$ mm

Torque on the motor,

$$T_M = F_P \times r_C \longrightarrow \quad (5.5)$$

$= 101.34 \times 125$

$= 12667.5$ N-mm

Hence the motor is in safety limits.

CONCLUSION AND FUTURE SCOPE

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 5, No. 3, Sep - November, 2020
Pages 32-37 | Cosmos Impact Factor (Germany): 5.195
Received: 02.09.2020 Published: 28.11.2020

CONCLUSION

Automatic lifting of vehicle using single cylinder hydraulic jack system in automobiles will not only save the effort of a person but will also save one's precious time under critical circumstances. This concept will eliminate the need of carrying a conventional mechanical scissor jack while travelling. It is a very feasible concept and if worked over cautiously, will become popular very soon. Motor operated mechanical jacks are already in the market but the jack's design is the area of concern. In order to make built-in jack system practical, jack's shape and type need modification. Mechanical jacks are pretty easily operated but their effectiveness and maintenance may become an issue as they will be move with chassis, constantly underneath hence, chances of rusting and damage is high. Hydraulic jacks look convenient to use and can also prove quite effective and easy to maintain (as completely closed) in long run, they will provide more power too but there are also some challenges like keeping low production cost and designing of jack which can be carried with the chassis given, common ground clearance level of an automobile, and keeping in check the increase in weight of automobile.

FUTURE SCOPE

In this project we have used a foldable links that are manually released and raised but in future this can be fully automated by making some small modifications in current project.

REFERENCES:

1. Mohammed Abuzaid, Prof. Surendra Agarwal Inbuilt Hydraulic Jack in Automobile Vehicles', International Journal of innovations in Engineering and technology, P-76-85. Vol 2. Issue 2 April 2013.

2. P.S. Rana , P.H. Belge, 'Integrated Automated Jacks for 4-wheelers', European Journal of Applied Engineering and Scientific Research, 2012, 1 (4):167-172.

3. M.M. Noor, K. Kadirgama and M.M. Rahman, analysis of auto car jack, 2010