

Design and Fabrication of Remote- Controlled Hydraulic Jack

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Abstract - The implementation of improved designs can effectively and economically reduce the efforts required to achieve the desired outcome as generations progress. Power screws, such as those found in hydraulic jacks, This research paper focuses on the enhancement of an existing motorized hydraulic jack through the integration of an electric circuit, enabling remote control functionality and simplifying the process of lifting loads. The main objective is to improve the current car jack design to provide easier, safer, and more reliable operation while reducing potential health risks, such as back pain resulting from prolonged bending or squatting. The modified car jack, which can be operated manually or remotely, utilizes a motor connected to a crank wheel via a universal coupling. This setup allows for speed reduction and increased torque, facilitating the driving of the crank wheel. The ultimate goal is to create a user-friendly hydraulic jack that can be easily utilized by individuals, including women and those who face challenges when changing vehicle tires on the roadside. By incorporating remote control functionality, the designed jack also saves time and minimizes the physical effort required for operation.

Key Words:lead screw, screw jack, DC motor, remotecontrol.

1. INTRODUCTION

Cars are raised off the ground for a variety of reasons, such as tyre replacement, problem examination, or repair. Until recently, the software of manually driven equipment was also referred to as lifting gear. Examples include block and tackles, hoists, spinning screws, gantries, wedges, etc. [5]

The act of raising and lowering is as old as man himself, and through this era, there has been constant advancement in the most efficient and practical means of doing so. These are being observed from the design of a remote-controlled hydraulic jack for easily protecting and maintaining autos. The purpose

of a jack in a car is often to raise the engines so that auto technicians and mechanics have more room to work or have easy access to do various duties underneath the car. Although they are frequently associated with motors, jacks are also used in a number of mechanical programmes and on industrial machinery.

[13]Jacks can be classified into two categories: hydraulic and technological. A standard hydraulic jack is made composed of a cylinder and a piston. lifting or lowering the weight specifically uses the upward or downward movement of the piston rod, while Mechanical jacks can be manually controlled or powered by energy. Vehicle jacks frequently employ mechanical advantages to make the operation of raising up a car simpler, which in turn balances the staff and manpower that would have been used in the process. Greater lift over longer distances is possible with stronger jacks thanks to hydraulic power. The maximum lifting capability of mechanical jacks is frequently rated. Instead of being utilised as an emergency jack to be placed in a car's trunk, hydraulic jacks are often employed for shop work.

[9] The hydraulic jack uses an incompressible fluid that is pressured right into a cylinder by using a pump plunger (this relies upon on the stress generated by using the pump), an oil is commonly used because of its lubricating consequences on the shifting elements. When the plunger is pushed backward, it draws oil out of the oil sump through a suction take a look at valve into the pump chamber. Whilst the plunger is moved ahead, it pushes the oil through a discharge check valve into the cylinder. The suction valve ball is within the chamber and opens with every draw of the plunger. Therelease valve is placed out of doors the chamber and opens when the oil is pushed into the cylinder. The suction valve in the chamber is still closed at this point, causing oil pressure to build up inside the cylinder.

Hydraulic jacks may be divided into three groups based on their design and use, and these groups are bottle jacks, scissor jacks, and ground jacks, respectively. An essential lifting tool used in a typical auto and motorcycle shop is the bottle jack. Lifting equipment is often used in auto and motorcycle workshops. This type of jack is renowned for its adaptability; in addition to being useful for moving cars around, it can also be used to raise them to the necessary height. However, the length of a typical bottle jack is small, are built and engineered for maximum performance and effectiveness. The hydraulic jack design has recently been replaced by a bottle jack, which resembles a bottle and has a cylindrical frame and neck from which the hydraulic ram exits.

These jacks deliver a lot of lift thanks to a hydraulic system and its principles. They come in a broad range of sizes that may still fit in car trunks, and they are especially well suited for big cars like SUVs. The scissor jack is one of the most popular types of jacks hydraulic interconnection of many vertical jacks through valves allows for the uniform distribution of forces while yet allowing for close-range elevation control.

Types of hydraulic jacks

1.1.1 A hydraulic bottle jack:

The vertical piston of a bottle jack directly assists a bearing pad connecting the objects being raised. Only automobiles with extraordinarily high clearance may use it since the elevate with a single action piston is only about twice as high as the jack's collapsed height. The hydraulic coupling of lifting devices, such as houses, multiple vertical jacks through the valves enables the even distribution of forces whilst permitting near manipulate of elevate.



Fig-1 Bottle hydraulic jack

that works with a wide range of motors. It is simple to raise and usually seen in modern cars' spare tyre compartments. Scissor jacks work by rotating a large screw, which causes the two sides to "scissor" together and raise the car to the desired height. An arm is used by the scissor jack to enable the car owner to elevate the vehicle. When raising or jacking up the car to change the tyres, the lug nuts should be loosened. The scissor jack's arm and screw are meant to be rotated clockwise to elevate the platform that the car is resting on or the notch that fits into a tight spot on the car's underside. They are often lightweight and small, making them excellent additions to emergency packs. But in garages with jack stands, ground jacks are frequently used. Considering that they are often more heavy and awkward, they come with wheels for easy moving. These jacks are workhorses, noted for their strength and dependability in particular, and are significantly more expensive than scissor or bottle jacks. Only in situations where repair is carried out often would ground jacks likely be desired. Comparatively, a small scissor jack is great for cars and portable, while a slightly more robust system, such as a hydraulic ground jack, is probably necessary for a car that is on the larger side. In contrast, a bottle jack has a large 3-ton lifting capacity and a height range of eleven to twenty-one inches, making it ideal for cars, SUVs, and other large, heavy-duty vehicles. various hydraulic jack types

1.1.1 A hydraulic bottle jack:

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1.1.1 An electric floor jack

In a floor jack, the lifting pad is moved vertically by the long arm of the bell crank, which is kept horizontal by a horizontal linkage, while the short end of the bell crank is pushed by a horizontal piston. To compensate for the arc taken by the lifting pad, floor jacks typically have wheels and castors. When deflated, this profile has a low profile and allows for significant extension, making it simple to operate underneath a vehicle.



Fig-2Hydraulicfloorjack

Strand hydraulic jack 1.1.1

a strand jack used to raise extremely high weights for engineering and building projects. In order to develop post tensioning systems, strand jacks were developed in Europe in the 1970s. They are now used all over the world to erect bridges, offshore structures, refineries, power plants, large buildings, and other structures where the use of conventional cranes is either impractical or too expensive.exceptional quality, robust, and come from manufacturers with a solid reputation within the business community.



Hydraulic jack Strand, figure 3.

1.1.1 A hydraulic toe jack

For lifting or jacking loads with short clearance heights, hydraulic toe jacks are a specialised jack. Toe jacks have a low foot or toe casting that is raised using an internal hydraulic jack, as the name indicates. They are very useful for lifting and placing big objects or cargo. Forklifts and other low clearance machinery may also be lifted using them. Our toe jacks, which come in a wide range of capacities, are of



Fig-4 Toehydraulicjack

1. METHODOLOGY

The remote-controlled hydraulic jack underwent testing using automobiles equipped with 12V batteries as their power source. Durable electric cables with high corrosion resistance were employed to establish connections between the electric motor, micro-controllers, and the battery's cathode (-) and anode (+) via extension wires. The core component responsible for generating torque in the system is a 12V, 40-watt, 2650 rpm electric motor, which drives a pair of meshing spur gears. The purpose of the gear system, consisting of a driver gear and a driven gear, is to transmit the rotational motion from the prime mover to the crank link. To convert the rotational motion of the gears into the linear motion required by the hydraulic cylinder, a crank mechanism was positioned between the gear system and the hydraulic cylinder.

Second Working Principle

The power source for the jack, either an external battery or an automobile battery, connects to the motor terminals as soon as the power button is activated. The jack consists of several components, including a control unit, switch, electric motor, electric circuit, and jacking assembly. Upon switching on the jack, electric current flows from the power source to the control unit. The motor receives most of the current to initiate the rotation of the shaft, while a smaller portion is directed to the driving gear, which is connected to a larger driven gear to amplify torque. As the shaft rotates, it drives the lever on the push rod back and forth through a mechanism

called the slider crank. This motion, in turn, operates the pump that moves the fluid within the jack cylinder. mechanism on the driving gear.

4.1 1) Verify the motor's current flow.

4.2 2) Measures the motor's performance while it is in use to assess its health.

4.3

4.4 A SYSTEM OF GEAR

4.5

4.6 In order to keep the motor's revolution speed constant, the following specification for a spur gear system was made.

4.7

4.8 Please check [11] for information on the driving gear.

4.9

4.10 Pitch diameter (= 9 mm) = 8 teeth in total.

4.11

4.1 MOTOR DESCRIPTION

4.12

4.13 40 Watts of power.

4.14

4.15 Voltage = 12 V

4.16

4.17 output speed equals 60 RPM

4.18

4.19 = 2800 RPM speed in rotor

4.20

4.21 Kind: Permanent Magnet Type

4.22

4.23 4.2 NEEDED TORQUE

4.24

4.25 Torque refers to a force's moment of turning or twisting around an axis. The force and radius at which it acts are multiplied to determine its size.

4.26

4.27 It takes a tangential force to cause the armature of a motor to spin about its centre. This force grows inside the motor itself.

4.28

4.29 $T = 0.1364 \text{ N-m}$

4.30 The machine's produced torque is the torque indicated by the equation above. However, losses from friction and wind speed result in the output torque being lower than the developed torque.

4.31

THE BEARING'S DESIGN

4.32

- 4.33 Bearing's outer diameter (D) is equal to 47 mm.
Bearing (B) has a thickness of 14 mm. Inner Bearing Diameter (d): 25 mm
- 4.34 Corner radii on the housing and shaft (r1) = 1
(According to the design data book)
- 4.35 (According to the design data book) Maximum Speed is 14,000 rpm.
- 4.36 $D + d / 2 =$ Mean Diameter (dm)
- 4.37
- 4.38 Spring index (C) = (D/d) = 12/2 C = 6 Stress factor = $(47 + 25) / 2$ dm = 36 mm
- 4.39
- 4.40 $K_s = = = 1.128$

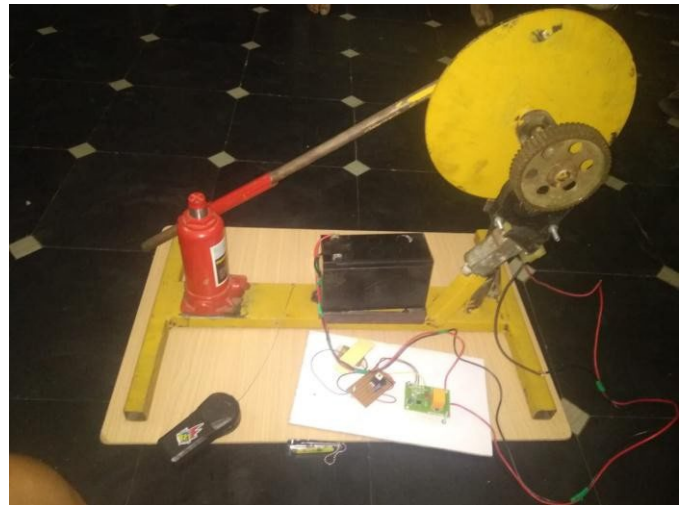
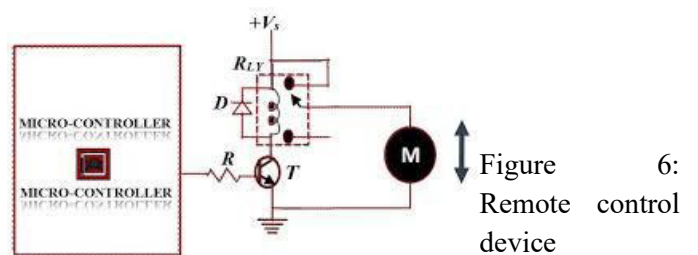


Fig. 5: A remote-controlled hydraulic jack

4.5 DISTRIBUTED CONTROL UNIT

The figure below depicts the control circuit for the DC motor-actuator used in the construction of the jack assembly..



The motor-actuator control circuit for the automobile jack includes a transistor-relay switch responsible for supplying power to the DC motor, enabling its movement. Additionally, the control circuit incorporates a DC motor actuator that emits a modulated infrared beam to assist in the jack's operation.

The receiver in the circuit amplifies and modifies the signal to match the coded language of the microcontroller, facilitating the upward and downward movement of the hydraulic jack..

Fifth Conclusion

In order to establish the necessary torque, stress concentration factor, and all other parameters, an effective work for "Remote controlled hydraulic jack" was built utilising the standard data handbooks by "Khurmi & Gupta" relationship. Mild steel was used to build the remote-controlled hydraulic jack's necessary parts, and manufacturing techniques including marking,

There was cutting, welding, and assembly done. With a small number of links and an easy procedure, this project's functionality was evaluated and found to be satisfactory. Lifting loads will be made easier by the specific Remote operated hydraulic jack design.

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