

DESIGN AND DEVELOPMENT OF REMOTE CONTROL OPERATED SCREWJACK

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Abstract - Doing tire changing work in a bent or squatting position for a period of time is not ergonomic to human body. It gives back ache problem in due of time. A mechanical jack is a device which lifts heavy equipment and vehicles so that maintenance can be carried out underneath. So, to eliminate this problem we invent the mechanism to facilitate the woman, senior citizens or partially disabled person to get over on pillion rider seat. This project focuses at providing a feasible design solution in form of a user-friendly mechanism, remote control screw jack and perform their activities without anyone's assistance. Problems were identified by the survey regarding the dimensions. Major issues like car height, ground clearance etc., were utilized to develop the concepts and its selection.

Key Words: Automatic screw jack, wheel changing, remote control, Knee Problem, Senior Citizens.

1. INTRODUCTION

A screw jack is a portable device consisting of a screw mechanism used to raise or lower the load. The principle on which the screw jack works is similar to that of an inclined plane. There are mainly two types of jacks-hydraulic and mechanical. A hydraulic jack consists of a cylinder and piston mechanism. The movement of the piston rod is used to raise or lower the load. Mechanical jacks can be either hand operated or power driven. Jacks are used frequently in raising cars so that a tire can be changed. A screw jack is commonly used with cars but is also used in many other ways, including industrial machinery and even airplanes. They can be short, tall, fat, or thin depending on the amount of pressure they will be under and the space that they need to fit into. The jack is made out of various types of metal, but the screw itself is generally made out of lead. While screw jacks are designed purposely for raising and lowering loads, they are not ideal for side loads, although some can withstand side loads depending on the diameter and size of the lifting screw. Shock loads should also be avoided or minimized. Some screw jacks are built with anti-backlash. The anti-backlash device moderates the axial backlash in the lifting screw and nut assembly to a regulated minimum. A large amount of heat is generated in the screw jack and long lifts can cause serious overheating. To retain the efficiency of the screw jack, it must be used under ambient temperatures, otherwise lubricants must be applied. There is oil lubricants intended to enhance the equipment's capabilities. Apart from proper maintenance, to optimize the capability and usefulness of a screw jack it is imperative to employ it according to its design and manufacturer's instruction.

Automobile engineering is the one of the streams of mechanical engineering. It deals with the various types of automobiles, their mechanism of transmission systems and its applications. Automobiles are the different types of vehicles used for transportation of passengers, goods, etc. In present scenario, transportation is one of the major requirements of the people for transportation of goods or self from one place to a different place. For a physically disabled or a debilitated person, transportation is a major hindrance and so the mobility of physically disabled people is among the great concern of the human civilization. It is really very hard to realize the problems of senior citizens & partially disabled (having knee problem) person while changing tire of four-wheeler. People who have problem in their physics feel so difficult to move from one place to another. The introduction of some automobile vehicles with three wheels partially fulfils the requirement of handicap for their convenient driving in roadways. But such types of vehicles also need a much range of high effort from challengers to ride in road ways. Also, such types of vehicles are only suitable for specialized case persons whether they must have problem in only leg. Those vehicles may also improve the shocking vibration to challengers which result in breakup of backbone of them.

2. LITERATURE REVIEW

Prof. Kamalakkannan, Kalaiselvan, Vijay.V the work on "Automatic Motorized Screw Jack to Reduced Man Power", according to his work introduced the motorized screw jack. Weight after certain limits cannot be lifted by a person, in such cases we are in need of jack. When it is motorized it becomes more convenient. In order to implement this idea, we have designed and developed a system called motorized jack operating through switch by having full control of the jack, we can easily lift it up and down by using the on/off. this helps to reduce the burden of the worker. The main reason to fabricate the motorized screw jack is to avoid the fatigue of human during lifting of the load. The project is less cost and good efficient for operating.[1]

Asst Prof. Anand A. Kulkarni, Avinash V. Roy, Chaitanya Kale, G Praveen, Himalay Jakuti is work on "design and fabrication of automated motorized mechanical jack "according to this work A jack is a device which is used to raise part of vehicle in order to facilitate vehicle maintenances or breakdown repairs. In normal jack system a mechanical jack is used for lifting the vehicles. The most common form is a car jack, garage jack, floor jack which lifts vehicles so that maintenance can be performed. Jacks are generally used to increase mechanical advantage (lifting the vehicle). Generally, jacks undergo buckling when they reach maximum load conditions (as per the tests conducted by consumer affairs). For this reason, we have to develop the system which can use toggle jack which is automatic in operation using electric

motor. Vehicle's battery can be used as a source of power for this motor. Our research in this regard reveals the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning. This paper attempts to overcome this difficulty and a suitable device is to be designed such that the vehicle can be lifted from the floor without any application of impact force. The operation remains to be an essential part of the system although with changing demands on physical input, the degree of mechanization is increased. [3]

Abhishek Madhukar Barewar, Abhishek Ashok Padole, Yugal Dhanpal Nagpure, Pranav Shivraj Gaupale, Sagar Bhimraoji Nagmote, Chandan Kumar Ram, Rupali Suresh Raut, was done the work on, Fabrication of automatic screw jack, according to his work, the lead screw is used to convert rotary motion into translation motion. The screw jack is a device used for lifting the load with the application of small force. The mechanical advantage of screw jack is the ratio of the load applied to the effort applied. The screw jack is operated by turning a lead screw of jack. The effort required to operate the screw is eliminated by using 12 V DC Motor. The motor operates by 12V DC power supply which is drawn from the vehicle battery itself. The rotary motion transfer from the motor to lead screw through worm gear drive. The driver gear (pinion) located on the motor shaft and the driven gear located on the lead screw causes to transfer rotary motion. The screw jack is the best device lift the heavy load. It is necessary that the jack is portable, easy to use, operate by any unskilled worker. It is desirable that it should be stable and can be operated by switch quickly from inside the vehicle by safety point of view.[4]

3. PROBLEM STATEMENT

Senior citizens, female persons who have problem & who couldn't be set screw jack below the vehicle while changing the tire. To solve this problem, one screw jack mechanism needs to be developed to facilitate partially this person to get over on automatic remote-control operated screw jack

4. OBJECTIVES

The main objectives of this project are:

- To ease work of motorized screw jack by using remote control.
- To design robust, light weight and sturdy screw jack mechanism.
- To design economical automatic screw jack system.
- To provide solution to social problems during changing of vehicle tire.
- To ensure the safety of the person while working with screw jack.

5. METHODOLOGY

We have proposed a methodology to solve the problems. Our methodology is divided in different parts, under different titles. Sequence of proposed methodology is as follows-



6. COMPONENTS OF FABRICATED MODEL

The main parts of the RC operated screw jack are as follow:

6.1 DC MOTOR

A DC motor is a rotary electrical motor that converts direct current electrical energy into mechanical energy. Its action is based on the principle that when a current carrying conductor is placed on a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. D.C motors are also like generators classified into shunt wound or series wound or compound wound motors.

6.2 LEAD SCREW

Lead screw is a linkage in a machine which translates rotating motion into linear motion. The lead screw can be short, tall, fat or thin depending on the amount of pressure they will be under and space that they need to fit into. to optimize the capability and usefulness of lead screw it is imperative to employ it according to its design and construction.

6.3 BATTERY

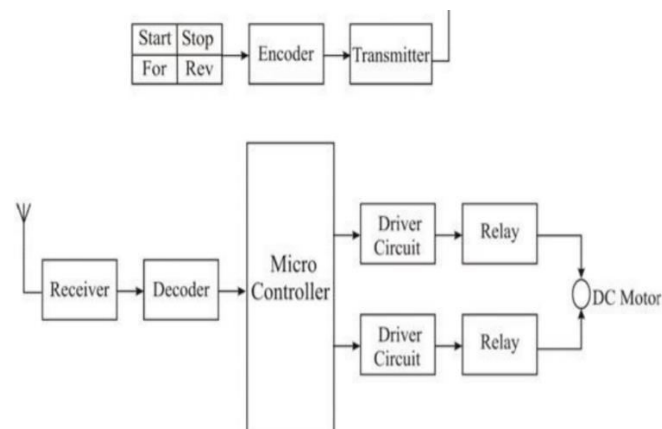
In isolated systems away from the grid, batteries are used for storage of excess solar energy which can be converted into electrical energy. In fact, for small units with output less than one kilowatt, batteries seem to be less the only technically and economically available storage means. Since both the photovoltaic system and batteries are high in capital costs, it is necessary that the overall system be optimized with respect to available energy and local demand pattern.

6.4 CONTROL CABLES

These are used in order to connect the battery to the motor and the switch.

6.5 REMOTE CONTROL UNIT:

Incorporated with the motor-actuator control circuit is a transistor-relay switch that transmits power to the DC motor to enable movement of the car jack. In other words, operation of the screw jack is aided by a DC motor actuator via an infra-red transmitter which transmits a modulated infra-red beam to the receiver. The receiver amplifies and modulates the signal to suite the coded language of the microcontroller for upward and downward movement of the screw jack.



It is used in order to start or stop the entire operation of the object lifting jack generally remote switch is used to operate motor in reverse and forward direction. The remote switch is a class of electrical switches that are electronically actuated. This is designed to provide the simultaneous actuation of multiple sets of electrical contacts, or the control of direction of electric current.

6.6 BASE AND FRAME

A base for the entire set-up has also been made. The motor is mounted on support frame. Base frame is bolted to frame.

7. WORKING OF SCREWJACK

The jack's screw rod is fixed to the motor shaft, the motor gets power from the power source. The on/off switch keys are interface with control circuit with power supply. And we are connecting the dc motor with the mechanical model for the up and down movement when we press the ON & OFF switch. It will send power to motor to rotate in right direction & it will rotate in opposite direction respectively. Using this equipment. By alternating the motor with higher torque, the jack can lift heavy load easily. Our survey in the regard in several automobile garages, revealed the facts that mostly used different methods were adopted in lifting the load for reconditioning. The fabrication part of it has been considered with almost ease for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile & garages. This is a simple type of automation project. The operation remains to be an essential part of the system although with changing demands on physical input, the degree of mechanization is increased.

8. ADVANTAGES

- The screw jack can work on the low power consumption.
- The operation of the screw jack is well controlled.
- Well balanced system.
- Only simple support structures are required Design & fabrication is easy.
- Easy to handle
- Portable
- Operation is noiseless.
- It minimizes misalignment & Less floor space is required.
- It increases the safety and working condition.
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9. FUTURE SCOPE

- The device can also be designed to operate using android application.
- The weight of the product can be reduced by using different lighter material and for lighter load operations.

10. CONCLUSION

The screw jack is the best device to lift and lower the heavy load. It is necessary that the jack is portable, easy to use, operate by any unskilled and elderly person. It is desirable that it should be stable and can be operated quickly by remote from location of load, for safety point of view. Further, it should be stable and easily controllable by a switch so that jacking can be done from a position of safety. It should be easily movable either to a position underneath the axle of the vehicle or some other reinforced support surface designed to be engaged by a jack

Thus, the product has been developed considering all the above requirements. This particular design of the remote-control automatic screw jack will prove to be beneficial in lifting and lowering of loads.

Our project helps to cover all the above parameter.

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