



A Review on Design and Fabrication of automatic jack for a four-wheeler

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ABSTRACT

An automotive jack is a device used to raise all or part of a vehicle into the air in order to facilitate repairs. Most people are familiar with the basic car jack (manually operated) that is still included as standard equipment with most new cars. These days, a car jack is an important tool to have in our vehicle due to unknown upcoming event such as flat tire in our journey. Even so, people who like to rotate their tires themselves or who may install snow tires before the winter and remove them in the spring need to use a jack to perform the job. Changing a flat tire is not a very pleasant experience. Women have a much lighter skeleton that means, among other things, woman can't pull more forces as well as men and are at greater risk of skeletal injuries. Usually, the car purposely tries to get a flat tire at the least opportune moments. On average, 160 injuries are associated with car jacks each year. Injuries have ranged from amputation to fractures and crush injuries. The correct use of jacks can prevent death or injury. Improvement in automotive car jack is really needed to make the tool more efficient, user-friendly, practical to use, changes in industry direction and most importantly high safety features. Further research on car jack is very important. Operating the manual car jack is quite difficult job for pregnant women and old men. The purpose of this project is to encounter these problems. An electric car jack works on current supply from the car battery itself making it easy to operate. Operator only needs to press the button from the controller without working in a bent or squatting position for a long period of time to change the tire. In order to fulfill the needs of present car jack, some improvement must be made.

Key words: Electric car jack, flat tires, crush injuries, improvements in jack, high safety features, car battery, easy to operate.

INTRODUCTION

Automobile industry is one such sector of economy where a constant need in the technology is observed. The new developments to increase the ergonomics of the vehicles and their efficiency are paving a way towards automation with minimum human efforts. As important as it is to increase the overall performance of the vehicle making them economically and environmentally acceptable by users, it is also important that the vehicle demands less maintenance of which some could be done by the users themselves. The complete maintenance of the vehicle however cannot be done by the user alone but situations like flat tyre in middle of journey or repairing and changing of parts cannot be left for the mechanic to get done. This will not only consume time but at places not easily accessible for the mechanic will prove dangerous to the user. A flat tyre at middle of a journey can also lead to dangerous accidents. A flat tyre can be easily changed with the help of jacks. These jacks are carried in the car during journey and when required can be used. In market there are various jacks available for aiding in conditions of vehicle repairing at bottom such as scissors jack or the toggle jack, floor jack, pneumatic jack, bottle jack, H lift jack and so on. Of all these jacks the most common used in the light motor vehicles say cars is the scissors jack or the toggle jack. These jacks were widely used during the World War 2

in the Ford GPW and Willys MB with the capacity of 1.5 tons having the ordinance part no 61-J-66 of the screw type jack. These jacks were used manually by the user and were carried in the jeeps. The use of screws as machine is dated back to 200 BC by Archimedes for pumping water. The similar was also used by the Romans in ancient time. However the first use of screws as jacks to lift the vehicle is said to be given in 1600's by the great Leonardo da Vinci. All these studies and developments thus need to be automated so that the user can use it with minimum efforts. The electric car jack is one such solution which will allow the repairing of vehicle at any place with ease and thereby saving time and energy. This system consists of a screw jack whose screw is connected to DC motor. The motor gets the supply from the car battery and lifts the vehicle when switched on. The switch is also used to stop the lifting of vehicle at required height. Also infrared sensors installed at each tyre will help determine any pressure change due to puncture or wobbling of any the tyres due to loose parts and convey the same output by an LED in the module so that the required action can be taken.

LITERATURE REVIEW

Screw type mechanical jacks were very common for jeeps and trucks of World War II vintage. For example, the World War II jeeps (Willys MB and Ford GPW) were issued the "Jack, Automobile, Screw type, Capacity 1 1/2 ton", Ordnance part number 41-J-66. This jacks, and similar jacks for trucks, were activated by using the lug wrench as a handle for the jack's ratchet action to of the jack. The 41-J-66 jack was carried in the jeep's tool compartment. Screw type jack's continued in use for small capacity requirements due to low cost of production raise or lower it. A control tab is marked up/down and its position determines the direction of movement and almost no maintenance. The virtues of using a screw as a machine, essentially an inclined plane wound round a cylinder, was first demonstrated by Archimedes in 200BC with his device used for pumping water. There is evidence of the use of screws in the Ancient Roman world but it was the great Leonardo da Vinci, in the late 1400s, who first demonstrated the use of a screw jack for lifting loads. Leonardo's design used a threaded worm gear, supported on bearings, that rotated by the turning of a worm shaft to drive a lifting screw to move the load - instantly recognisable as the principle we use today.

PROBLEM STATEMENT

Frequent problem occur with scissor jack is instability. The problem just because the small lower plate of the jack is not able to provide appropriate support on bumpy surfaces and the other is to reduce human effort by mounting the 12v DC power engine to change the pneumatic pressure which provides the required torque to lift the jack. To reduce the time the manual jack takes to lift the vehicle.

OBJECTIVE

The purpose of the 12V DC ELECTRIC CAR JACK is:

- ✓ The aim of the project is to design a simple scissor jacket that is stable even on uneven surfaces with a structural improvement.
- ✓ To make it convenient economically.
- ✓ Create Jack without welding, so that it can have such a long life and be operated roughly.
- ✓ Trying to reduce human effort.
- ✓ To that the lifting time of the car.

Parts of Motorized Screw Jack

The main parts of the motorized screw jack are as follows:

D.C. motor:

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left-hand rule.

Fleming's Left Hand Rule.

Keep the force finger, middle finger and thumb of the left hand mutually perpendicular to one another. If the fore finger indicates the direction of magnetic field and middle finger indicates the direction of current in the conductor, then the thumb indicates the direction of the motion of conductor.

When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

Principle of Operation of Dc Motor

A simplified model of such a motor is shown in figure. The conductors are wound over a soft iron core. DC supply is given to the field poles for producing flux. The conductors are connected to the DC supply through brushes A simple 2-pole DC electric motor has 6 parts, as shown in the diagram below.

- An armature or rotor

- A commutator
- Brushes
- An axle
- A field magnet
- A DC power supply of some sort.

An electric motor is all about magnets and magnetism:

A motor uses magnets to create motion. Opposites attract and likes repel. So, if there are 2 bar magnets with their ends marked north and south, then the North end of one magnet will attract the South end of the other. On the other hand, the North end of one magnet will repel the North end of the other (and similarly south will repel south). Inside an electric motor these attracting and repelling forces create rotational motion. compound wound motors.

PROCESS INVOLVED

Fabrication and assembly motorized screw jack of is as follows:

Making of coupling

We have cut the blank of mild steel rod having diameter 60 mm and length 70mm by using power hacksaw machine from the given rod. Turning operation of MS rod has done on lathe machine which reduces the diameter up to 50 mm. Machining operation has done on CNC milling machine for making slot. Drilling operation has done on drilling machine for making hole of 10mm diameter for fixing bolt and nut. Surface finishing operation has done by grinding machine and filing.

Supporting component

Supporting component has used for fixing the D.C. motor. It has cut from the channel by using power hacksaw machine in required size. Drilling operation has done on drilling machine for fixing bolt. Finishing operation has done on bench vice using file.

Base plate

Base plate is made from mild steel plate. It has used for fixing all components of motorized lifting jack. Base plate has cut from mild steel plate of bigger size in to required size of 120mmx100mm. by using gas cutter machine. Surface finishing operation has done by using grinding machine. There are 4 holes made in the base plate by using drill bit of 10mm diameter on drilling machine.

D.C. Motor

A DC Motor of 12 Volt with a Current of 14 Amps is to produce the movement of the machine. The motor is internal geared one. So, it is strong enough to give the required torque. It can give two different speeds in one direction and two different speeds in the opposite direction.

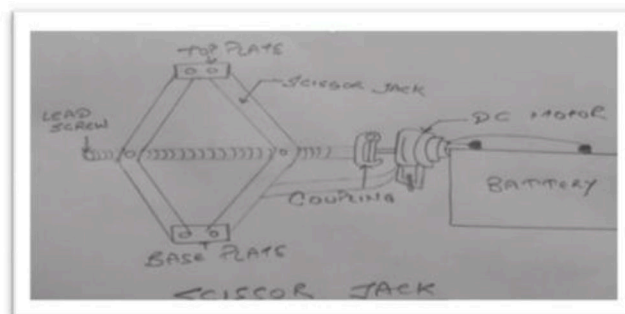
Final finishing work

First power screw jack of 2-ton capacity has fixed on the base plate using bolt and nut. Power screw jack has connected to one end of first coupling by using nut bolt. First coupling has connected to one end of universal joint with the help of bolt and nut.

Testing

After assembly of all components on base plate, the Motorized Screw Jack was made and tested to lift the car. But the battery capacity is not enough to run the motor. So it has removed. Test was conducted by using main power supply instead of battery.

WORKING PRINCIPLE



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, we can easily access the lifting of load in various purposes of our need. By alternating the motor with higher torque, the jack can lift heavy load easily.

CONCLUSIONS

The project carried out by us made an impressive task in the field of automobile and automobile workshops. It is very usefully for the workers to work in the automobile workshop are in the service station. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also provided.

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