

## **Experimental Study of Remote Control Lifting Jack and Analysis**

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### **Abstract:**

With the increasing tiers of generation, the efforts being put to supply any type of work has been continuously reducing. The efforts required in reaching the favored output may be efficiently and economically be decreased by using the implementation of higher designs. electricity screws are used to convert rotary movement into translatory motion. A screw jack is an instance of a electricity screw wherein a small pressure implemented in a horizontal aircraft is used to raise or lower a huge load. The principle on which it works is much like that of an inclined plane. The mechanical benefit of a screw jack is the ratio of the load carried out to the attempt carried out. The screw jack is operated by using turning a lead screw. the peak of the jack is adjusted by means of turning a lead screw and this adjustment may be executed both manually or through integrating an electric powered motor.

This paper analyzes the amendment of the prevailing motor screw jack by incorporating an electric powered motor inside the screw so that it will make load lifting simpler. on this changed design, the electricity screw is rotated by using connecting motor thru everyday coupling, plugged to the car 12 V battery supply to generate electricity for the high mover (motor), which transmits its rotating speed to the power screw to be circled with required pace reduction and expanded torque to force the power screw. The importance and cause of this work is to regulate the existing vehicle jack as a way to make the operation less complicated, more secure and more dependable if you want to reduce health dangers specially lower back ache issues related to doing work in a bent or squatting position for a long time period.

The changed vehicle jack is simple to apply by using girls or whoever had trouble with the car tyres alongside the street. The designed motorised jack will even shop time and calls for less human strength to function.

### **Key word:**

lead screw, screw jack, DC motor, remote control

### **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 motors in order that a tire may be modified. A screw jack is generally used with vehicles however is likewise used in many different methods, together with commercial equipment or even aero planes.

They may be quick, tall, fat, or skinny relying on the quantity of pressure they'll be below and the space that they want to in shape into. The jack is comprised of diverse forms of steel, but the screw itself is usually constructed from lead. even as screw jacks are designed purposely for elevating and decreasing loads, they may be no longer best for aspect loads, even though some can face up to side masses relying at the diameter and length of the lifting screw. surprise hundreds should also be avoided or minimized. some screw jacks are built with anti-backlash. The anti-backlash tool moderates the axial backlash within the lifting screw and nut meeting to a regulated minimum.

A massive quantity of warmth is generated inside the screw jack and long lifts can purpose critical overheating. To retain the efficiency of the screw jack, it need to be used below ambient temperatures, otherwise lubricants have to be applied. There are oil lubricants intended to enhance the equipment's abilities. other than proper protection, to optimize the functionality and value of a screw jack it is imperative to appoint it in line with its design and manufacturer's education. ensure that you observe the rate, load ability, temperature advice and other applicable elements for software.

## Types of Screw Jack:

Jacks are of mainly two types- mechanical and hydraulic. They vary in size depending on the load that they are used to lift.

### (a) Mechanical Jacks:

A mechanical jack is a device which lifts heavy equipment. The most common form is a car jack, floor jack or garage jack which lifts vehicles so that maintenance can be performed. Car jacks usually use mechanical advantage to allow a human to lift a vehicle by manual force alone. More powerful jacks use hydraulic power to provide more lift over greater distances. Mechanical jacks are usually rated for maximum lifting capacity.

### (b) Hydraulic Jacks:

Hydraulic jacks are typically used for shop work, rather than as an emergency jack to be carried with the vehicle. Use of jacks not designed for a specific vehicle requires more than the usual care in selecting ground conditions, the jacking point on the vehicle, and to ensure stability when the jack is extended. Hydraulic jacks are often used to lift elevators in low and medium rise buildings. 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.

## Operational Considerations of a screw jack

### Maintain low surface contact pressure:

Increasing the screw size and nut size will reduce thread contact pressure for the same working load. The higher the unit pressure and the higher the surface speed, the more rapid the wear will be.

### Maintain low surface speed:

Increasing the screw head will reduce the surface speed for the same linear speed.

### Keep the mating surfaces well lubricated:

The better the lubrication, the longer is the service life. Grease fittings or other lubrication means must be provided for the power screw and nut.

### Keep the mating surfaces clean:

Dirt can easily embed itself in the soft nut material. It will act as a file and abrade the mating screw surface. The soft nut material backs away during contact leaving the hard dirt particles to scrap away the mating screw material.

### Keep heat away:

When the mating surfaces heat up, they become much softer and are more easily worn away. Means to remove the heat such as limited duty cycles or heat sinks must be provided so that rapid wear of over-heated materials can be avoided.

## 2. Literature Review:

Screw kind mechanical jacks have been very not unusual for jeeps and vans of global struggle II vintage. as an example, the arena struggle II jeeps

(Willys MB and Ford GPW) have been issued the "Jack, automobile, Screw kind, capability 1 half ton", Ordnance component number forty one-J-sixty six. This jacks, and similar jacks for trucks, were activated by way of the use of the lug wrench as a handle for the jack's ratchet movement to of the jack. The forty one-J-sixty six jack became carried inside the jeep's tool compartment. Screw type jack's persisted in use for small potential necessities because of low fee of manufacturing boost or decrease it. A manage tab is marked up/down and its position determines the route of movement and nearly no preservation. The virtues of the usage of a screw as a system, essentially an willing aircraft wound spherical a cylinder, became first established by using Archimedes in 200BC along with his device used for pumping water.

There is proof of using screws in the ancient Roman global however it became the superb Leonardo da Vinci, inside the overdue 1400s, who first established the use of a screw jack for lifting hundreds. Leonardo's layout used a threaded bug tools, supported on bearings, that rotated via the turning of a trojan horse shaft to drive a lifting screw to transport the burden - right away recognizable as the precept we use these days. We can't be sure of the meant software of his invention, however it appears to have been relegated to the history books, together with the helicopter and tank, for almost 4 centuries. It is not till the past due 1800s that we've got proof of the product being advanced similarly.

With the commercial revolution of the overdue 18th and nineteenth centuries came the first use of screws in system tools, through English inventors together with John Wilkinson and Henry Maudsley The most extraordinary inventor in mechanical engineering from the early 1800s was surely the mechanical genius Joseph Whitworth, who acknowledged they want for precision had turn out to be as vital in industry as the provision of energy. Even as he would ultimately have over 50 British patents with titles starting from knitting machines to rifles, it was Whitworth's work on screw

reducing machines, correct measuring gadgets and standards masking the attitude and pitch of screw threads that would maximum have an impact on our industry today. Whitworth's gear had emerge as internationally famous for his or her precision and excellent and ruled the market from the 1850s. inspired young engineers started out to position Whitworth's gadget tools to new makes use of. all through the early Eighties in Coaticook, a small metropolis near Quebec, a 24-12 months-vintage inventor named Frank Henry Sleeper designed a lifting jack. Like da Vinci's jack, it turned into a technological innovation because it was primarily based on the precept of the ball bearing for supporting a load and transferred rotary motion, through gearing and a screw, into linear motion for shifting the weight. The device changed into green, reliable and easy to function. It turned into used within the creation of bridges, but by and large through the railroad enterprise, in which it changed into capable of lift locomotives and railway automobiles.

nearby Coaticook industrialist, Arthur Osmore Norton, spotted the capability for Sleeper's layout and in 1886 employed the younger guy and purchased the patent. The Norton" jack become born. Over the coming years the famous "Norton" jacks were manufactured at plants in Boston, Coaticook and Moline, Illinois. Meanwhile, in Alleghany County near Pittsburgh in 1883, an enterprising Mississippi river boat captain named Josiah Barrett had an idea for a ratchet jack that would pull barges together to form a „tow“. The idea was based on the familiar lever and fulcrum principle and he needed someone to manufacture it. That person was Samuel Duff, proprietor of a local machine shop, together, they created the Duff Manufacturing Company, which by 1890 had developed new applications for the original "Barrett Jack" and extended the product line to seven models in varying capacities. Over the next 30 years the Duff Manufacturing Company became the largest manufacturer of lifting jacks in the world, developing many new types of jack for various applications including its own version of the ball bearing screw

jack. It was only natural that in 1928, The Duff Manufacturing Company Inc. merged with A.O. Norton to create the Duff-Norton Manufacturing Company. Both companies had offered manually operated screw jacks but the first new product manufactured under the joint venture was the air motor-operated power jack that appeared in 1929. With the aid of the relatively new portable compressor technology, users now could move and position loads without manual effort. The jack, used predominantly in the railway industry, incorporated an air motor manufactured by The Chicago Pneumatic Tool Company. There was clearly potential for using this technology for other applications and only 10 years later, in 1940, the first worm gear screw jack, that is instantly recognizable today, was offered by Duff-Norton, for adjusting the heights of truck loading platforms and mill tables. With the ability to be used individually or linked mechanically and driven by either air or electric motors or even manually, the first model had a lifting capacity of 10 tons with raises of 2" or 4".

Since then the product has evolved to push, pull, lift, lower and position loads of anything from a few kilos to hundreds of tonnes. One of the biggest single screw jacks made to date is a special Power Jacks E-Series unit that is rated for 350 tonnes –even in earthquake conditions for the nuclear industry. More recent developments have concentrated on improved efficiency and durability, resulting in changes in both lead screw and gearbox design options for screw jacks. A screw jack that has a built-in motor is now referred to as a linear actuator but is essentially still a screw jack. Today, screw jacks can be linked mechanically or electronically and with the advances in motion-control, loads can be positioned to within microns. Improvements in gear technology together with the addition of precision ball screws and roller screws mean the applications for screw jacks today are endless and a real alternative to hydraulics in terms of duty cycles and speed at a time when industry demands cleaner, quieter and more reliable solutions.

Screws Application is used in the elevation of vehicles or objects. The operation of the screw jack is such that it comprises a handle for driving a bolt element (Lead Screw) manually so as to adjust the height of the Jack to elevate a vehicle or the object. The operation of the jack manually makes it difficult for most women and the elderly to operate since much effort is needed to drive the screw jack which results in low linear speed and time consuming. These presently available jacks further require the operator to remain in prolonged bent or squatting position to operate the jack. Doing work in a bent or squatting position for a period of time is not ergonomic to human body. It will give back ache problem in due of time. Suppose car jacks must be easy to use by women or whoever had problem with the tyres along the road. The objective of this paper is therefore to modify the existing design of car jack by incorporating an electric motor into the existing screw jack to make the operation easier, safer faster and more reliable.

### 3. Motorized Screw Jack:

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 research 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 ease for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile garages. The motorized screw jack has been developed to cater to the needs of small and medium automobile garages, which are normally man powered with minimum skilled labor. In most of the garages the vehicles are lifted by using screw jack. This needs high man power and skilled labour. In order to avoid all such disadvantages, the motorized 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 simple so that even unskilled labour can use it with ease. The D.C. motor is coupled with the screw jack by gear arrangement. The screw jack shaft's rotation depends upon the rotation of D.C motor. This is a simple type of automation project. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains to be an essential part of the system although with changing demands on physical input, the degree of mechanization is increased.

#### 4. Parts of Motorized Screw Jack:

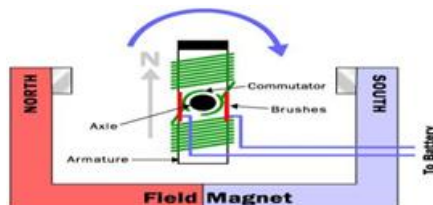
The main parts of the motorized screw jack are as follows:

##### (i) 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

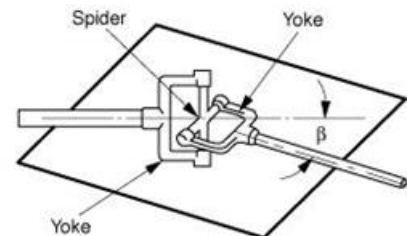
A field magnet

##### 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. In the diagram above, you can see two magnets in the motor, the armature (or rotor) is an electromagnet, while the field magnet is a permanent magnet (the field magnet could be an electromagnet as well, but in most small motors it is not to save power).

##### (ii) Universal Joint:

A universal joint is a positive, mechanical connection between rotating shafts, which are usually not parallel, but intersecting. They are used to transmit motion, power, or both.



The simplest and most common type is called the Cardan joint or Hooke joint. It is shown in Figure. It consists of two yokes, one on each shaft, connected by a cross-shaped intermediate member called the spider. The angle between the two shafts is called the operating angle. It is generally, but not necessarily, constant during operation.

Good design practice calls for low operating angles, often less than  $25^\circ$ , depending on the application. Independent of this guideline ne, mechanical interference in the construction of Cardan joints limits the operating angle to a maximum (often about  $37\frac{1}{2}^\circ$ ), depending on its proportions. Typical applications of universal joints include aircraft, appliances, control mechanisms, electronics, Instrumentation, medical and optical devices, ordnance, radio, sewing machines, textile machinery and tool drives. Universal joints are available in steel or in thermoplastic body members. Universal joints made of steel have maximum load-carrying capacity for a given size. Universal joints with thermoplastic body members are used in light industrial applications in which their self-lubricating feature, light weight, negligible backlash, corrosion resistance and capability for high-speed operation are significant advantages.

### (iii) Remote control:

A remote control is a component of an electronics device, most commonly a television set, DVD player and home theater systems originally used for operating the device wirelessly from a short line-of-sight distance. Remote control has continually evolved and advanced over recent years to include Bluetooth connectivity, motion sensor enabled capabilities and voice control.

## 5. Process involved:

Fabrication and assembly of remote control lifting Jack is as follows:

### (a) 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.

### (b) 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.

### (c) 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) 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.

### (e) Final finishing work:

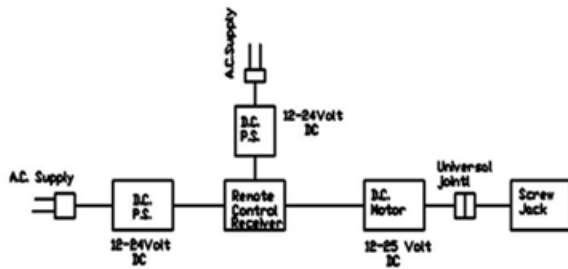
First power screw jack of 2 ton capacity has fixed on the base plate using bolt and nut. Power screw jack has connected to one end of first coupling by using nut bolt. First coupling has connected to one end of universal joint with the help of bolt and nut. The other end of universal joint connected to second coupling with the help of bolt and nut. Finally DC motor is connected to other end of second coupling with the help of nut and bolt. DC motor has connected to main supply through DC power supply.

### (f) Testing:

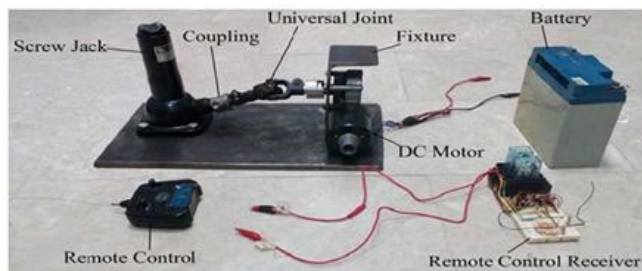
After assembly of all components on base plate, the remote controller circuit was made and tested to lift the

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.

## Line Diagram of remote control lifting jack



## Complete parts of remote control lifting jack



## 6. Conclusion:

Screw Jacks are the right product to push, pull, raise, decrease and position loads of something from multiple kilograms to loads of tonnes. The want has long existed for an progressed portable jack for automotive cars. it is noticeably desirable that a jack become available that can be operated as a substitute from inside the car or from a area of protection off the street on which the vehicle is positioned. one of these jack must desirably be light enough and be compact enough in order that it is able to be stored in an car trunk, can be lifted up and carried through most adults to its function of use, and yet be able to lifting a wheel of a four-five ton car off the ground. in addition, it have to be solid and without problems controllable by using a transfer in order that jacking may be performed from a function of safety. It must be effortlessly movable both to a position beneath the axle of the automobile or some other reinforced guide surface designed to be engaged through a jack. therefore, the product has been developed considering all of the

above requirements. This particular layout of the motorized screw jack will prove to be beneficial in lifting and decreasing of loads.

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