MANTECH Publications

Journal of Automotive Engineering & Technology
Volume 8, Issue 1, January-April, 2023

"Motor Operated Screw Jack"

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Abstract

With the increasing levels of technology, the efforts are being put to produce any kind of work that has been continuously decreasing. The efforts required in achieving the desired output can be effectively and economically be decreased by the implementation of better designs. Power screws are used to convert rotary motion into reciprocating motion. An object lifting jack is an example of a power screw in which a small force applied in a horizontal plane is used to raise or lower a large load. In this fabricated model, an electric motor will be integrated with the object-lifting jack, the electricity needed for the operation will be taken from the d.c battery, and thereby the mechanical advantage will be increased.

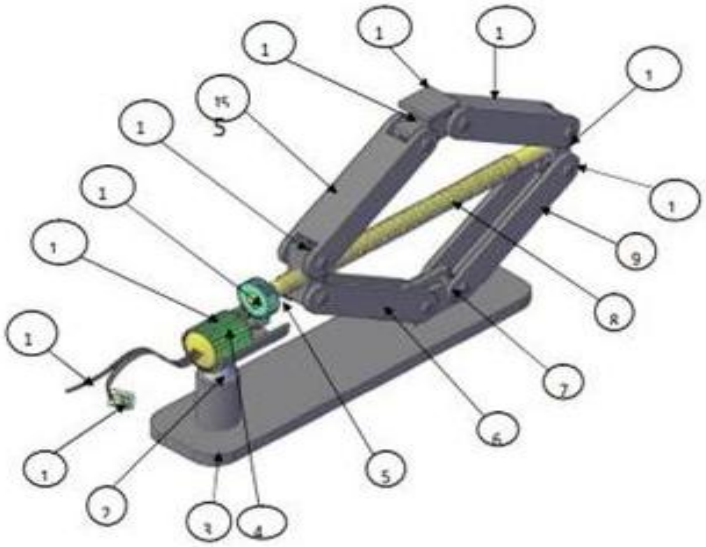
Keywords: *power screws, jack, electric motor and d.c battery.*

INTRODUCTION

This project is the modification of the existing screw jack by incorporating an electric motor in the screw in order to make load lifting easier. In this modified design, the power screw is rotated through its connecting gear with the pinion gear when electrical power flows through the cigarette lighter receptacle connected to the motor, plugged to the automobile 12 V battery source to generate power for the prime mover (motor), which transmits its rotating speed to the pinion gear meshing with the bigger gear connected to the power screw to be rotated with required speed reduction and increased torque to drive the power screw. The significance and purpose of this work is to modify the existing car jack in order to make the

operation easier, safer and more reliable in order to reduce health risks especially backache problems associated with doing work in a bent or squatting position for a long period. The modified car jack is easy to use by pregnant women or whoever had problem with the vehicle tyres along the road. The designed motorised jack will also save time and requires less human energy to operate. A jack is a type of jack which is operated by turning a lead screw. It is also known as a screw jack, and is commonly used as car-jacks. In the case of a screw jack, a small force applied in the horizontal plane is used to raise or lower large load. [Khurmi and Gupta, 2005]. Of the screw-type mechanisms, there are scissor jacks, common in newer cars, and bumper jacks, common in older cars. A jackscrew's compressive force is obtained through the tension force applied by its lead screw.

Most jackscrews are lubricated with grease. Ball screws are a more advanced screw mechanisms that uses a recirculation-ball nut to minimize friction and prolong the life of the screw threads. The thread profile of such screws is semicircular to properly mate with the bearing balls. The disadvantage to this type of screw is that it is not self-locking. [James, M. Gere 2006]. Jackscrews form vital components in equipment. For instance, the failure of a jackscrew on a McDonnell Douglas MD80 due to a lack of grease resulted in the crash of Alaska Airlines Flight 261 off the coast of California in 2000.



Due to large numbers of examples of compound stresses met with in engineering practice, the cause of "failure" or permanent set under such conditions has attracted considerable attention. Project aims to lift heavy loads using mechanical jack wireless control.

Project Description and Working

This is the project, which works on the principle of nut, bolt with dc gear motor and wireless remote control system for lifting up and down the heavy objects. The human pressure is applied. Hence the load can be lifted up or down as per our requirement.

Jack is a mechanical device used as a lifting device to lift heavy loads or apply great forces. A mechanical jack employs a screw thread for lifting heavy equipment. The most common form is a car jack, floor jack or garage jack which lifts vehicles so that maintenance can be performed. Mechanical jacks are usually rated for a maximum lifting capacity.

In our project contain lifting a load automatically with the help of remote. Power provide by vehicle battery itself. So the manually effort does not required.

The life span of the jack will depend greatly on the type of materials used for each component to avoid failure.

The contact members, connecting members, lifting members, pins and the power screw will all use the High Strength Low-Alloy Steel with 50 ksi (345 N/mm2) minimum yield point, 70 ksi (485 N/mm2) minimum tensile strength and 21 % elongation) due to the following reasons:

1. Good Mach inability
2. Good Ductility
3. High Strength
4. Wear Resistance
5. Ease of producing complicated parts
6. Economical

Components with their Material Selection

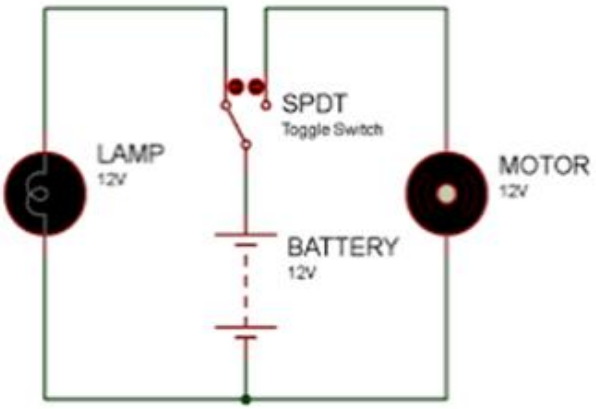
Components

1. Scissor jack
2. Spdt switch
3. Link arrangement
4. Plywood
5. with wire remote
6. Electronic components
7. Power source (battery)
8. Dc gear motor
9. Worm and worm gear

SCISSOR JACK

The end fits into a ring hole mounted on the end of the screw, which is the object of force on the scissor jack. When this crank is turned, the screw turns, and this raises the jack. The screw acts like a gear mechanism. It has teeth (the screw thread), which turn and move the two arms, producing work.

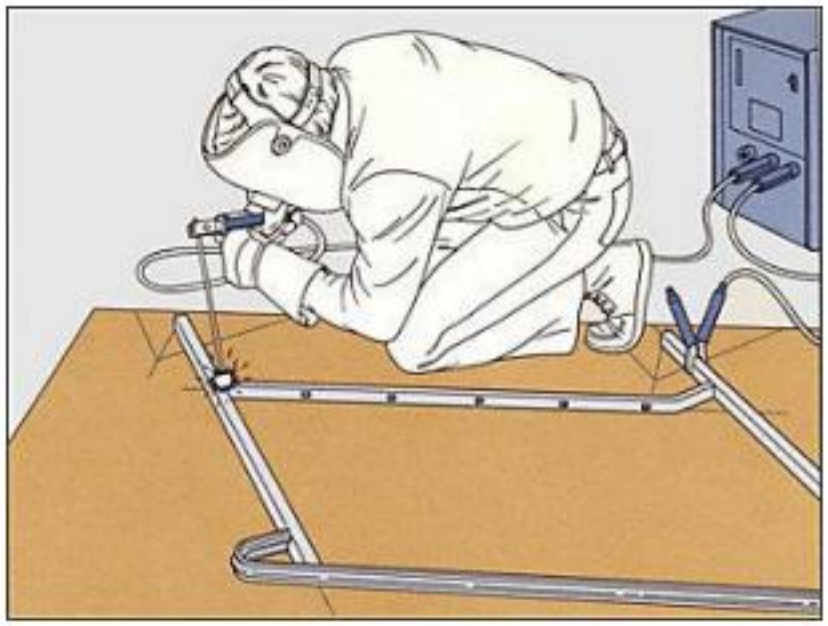
SPDT SWITCH



The SPDT switch has three terminal A, B and C. In this A is common to input terminal which is connected in the source; B is connected with circuit 1 and C is connected with circuit 2. a simple break-before-make changeover switch: A (Common) is connected either to B or to C.

External Iron Frame Work

The external frame work is having length of 1 foot and breadth of 1.5 foot there are welded as pillars, which will give the support for the screw jack .At the bottom of the platform we have attached a plywood sheet. Dc gear motor attached with frame and jack. When a pressure is applied on the surface of the jack whole load goes to bottom of frame or plywood.



Main Frame Structure

This is made of MILD STEEL material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearing properly while assembling.

Metal Cutting

An abrasive saw, also known as a cut-off saw or chop saw, is a circular saw (a kind of power tool) which is typically used to cut hard materials, such as metals, tile, and concrete. The cutting action is performed by an abrasive disc, similar to a thin grinding wheel.

These saws are available in a number of configurations, including table top, free hand, and walk behind models. In the table top models, which are commonly used to cut tile and metal, the cutting wheel and motor are mounted on a pivoting arm attached to a fixed base plate. Table top saws are often electrically powered and generally have a built-in vise or other clamping arrangement.

The free hand designs are typically used to cut concrete, asphalt, and pipe on construction sites. They are designed with the handles and motor near the operator, with the blade at the far end of the saw. Free hand saws do not feature a vise, because the materials being cut are larger and heavier. Walk-behind models, sometimes called flat saws are larger saws which use a stand or cart to cut into concrete floors as well as asphalt and concrete paving materials.

Worm Drive

A worm drive is a gear arrangement in which a worm (which is a gear in the form of a screw) meshes with a worm gear (which is similar in appearance to a spur gear). The two elements are also called the worm screw and worm wheel. The terminology is often confused by imprecise use of the term worm gear to refer to the worm, the worm gear, or the worm drive as a unit. Like other gear arrangements, a worm drive can reduce rotational speed or transmit higher torque. The image shows a section of a gear box with a worm gear driven by a worm. A worm is an example of a screw one of the six simple machines. There are three different types of gears that can be used in a worm drive. The first are non-throated worm gears. These don't have a throat, or groove, machined around the circumference of either the worm or worm wheel. The second are single throated worm gears, in which the worm wheel is throated. Unlike with ordinary gear trains, the direction of transmission (input shaft vs output

shaft) is not reversible when using large reduction ratios, due to the greater friction involved between the worm and worm-wheel, when usually a single start (one spiral) worm is used. This can be an advantage when it is desired to eliminate any possibility of the output driving the input. If a multistart worm (multiple spirals) is used then the ratio reduces accordingly and the braking effect of a worm and worm-gear may need to be discounted, as the gear may be able to drive the worm.

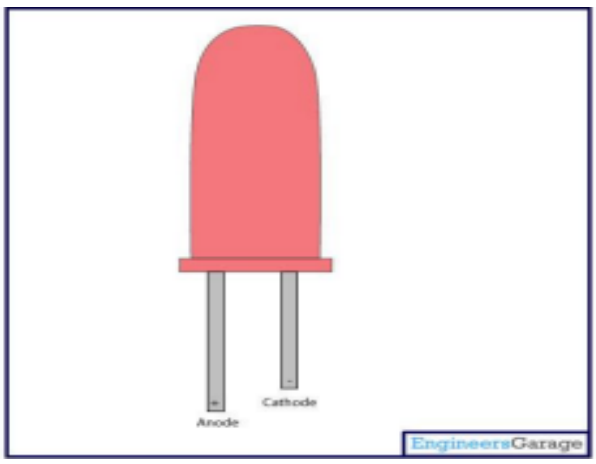
Spray Painting

It's a painting technique where a device sprays a coating (paint, ink, varnish, etc.) through the air onto a surface. The most common types employ compressed gas—usually air—to atomize and direct the paint particles. Spray guns evolved from airbrushes, and the two are usually distinguished by their size and the size of the spray pattern they produce. Airbrushes are hand-held and used instead of a brush for detailed work such as photo retouching, painting

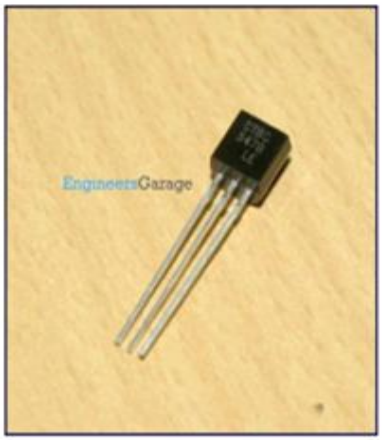
Led Light

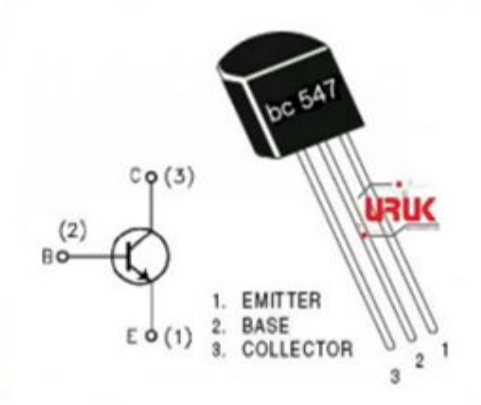
Light emitting diodes (LEDs) are semiconductor light sources. The light emitted from LEDs varies from visible to infrared and ultraviolet regions. They operate on low voltage and power. LEDs are one of the most common electronic components and are mostly used as indicators in circuits. They are also used for luminance and optoelectronic applications. Based on semiconductor diode, LEDs emit photons when electrons recombine with holes on forward biasing. The two terminals of LEDs are anode (+) and cathode (-) and can be identified by their size. The longer leg is the positive terminal or anode and shorter one is negative terminal.

Pin Diagram



BC 547 TRANSISTOR





BC547 is an NPN bi-polar junction transistor. A transistor, stands for transfer of resistance, is commonly used to amplify current. A small current at its base controls a larger current at collector & emitter terminals. BC547 is mainly used for amplification and switching purposes. It has a maximum current gain of 800. Its equivalent transistors are BC548 and BC549.

Specifications:

1. Transistor Polarity: NPN
2. Collector Emitter Voltage V (br)ceo: 45V Transition Frequency
3. Typft: 300MHz
4. Power Dissipation Pd: 625mW
5. DC Collector Current: 100mA
6. DC Current Gain hFE: 150
7. Straight-lead Housing

Parts of Motorized Screw Jack

Description of dc 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. 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.

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 direction of current in the conductor, then the thumb indicates the direction of the motion of conductor.

Principle of Operation of Dc Motor

A uniform magnetic field in which a straight conductor carrying no current is placed .The conductor is perpendicular to the direction of the magnetic field. The conductor is shown as carrying a current away from the viewer, but the field due to the N and S poles has been removed. There is no movement of the conductor during the above two conditions. When the current carrying conductor is placed in the magnetic field, the field due to the current in the conductor supports the main field above the conductor, but opposes the main field below the conductor. The result is to increase the flux density in to the region directly above the conductor and to reduce the flux density in the region directly below the conductor.

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.

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.

ADVANTAGES

1. No manually effort.
2. Easy to handle
3. With wire remote controls.
4. No extra assembly.
5. Smooth operation.
6. Light weight
7. Operated on vehicle battery

CONCLUSION

The motorized scissor jack project can properly work on vehicle battery with its weight. Using spdt with wire remote I can up and down the jack properly I observer that if battery ampere is low then jack cannot work properly and not lift the load.

Project aim is lift maximum 250kg by using the gear motor and this project can test on vehicle battery and it work nice.

Dc gear motor contain worm and worm gear box which is non-return geared box so it's best for jack operation.

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