

Study and Evaluation of Automated Motorised Jack

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Abstract- Here we are introducing 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.

Index Terms- Lead screw, screw jack, DC Motor.

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 aeroplanes. 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. Ensure that you follow the speed, load capacity, temperature recommendation and other relevant factors for application.

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. More powerful jacks use hydraulic power to provide more lift over greater distances. Mechanical jacks are usually rated for a maximum lifting capacity (for example, 1.5 tons or 3 tons).

To design is either to formulate a plan for the satisfaction of a specified need or to solve a problem. If the plan results in the creation of something having a physical reality, then the product must be functional, safe, reliable, competitive, usable, manufacturing, and marketing. These terms are defined as follows:

Functional: The product must perform to fill its intended need and customer expectation.

Safe: The product is not hazardous to the user, bystanders, or surrounding property. Hazards that cannot be ‘designed out’ are eliminated by guarding (a protective enclosure); if that is not possible, appropriate directions or warning are provided.

Reliable: Reliability is the conditional probability, at a given confidence level, that the product will perform its intended function satisfactorily or without failure at a given age.

Competitive: The product is a contender in its market.

Usable: The product is ‘user friendly’ accommodating to human size, strength. Posture, reach, force, power and control

Manufacturing: The product has been reduced to a ‘minimum’ number of parts. Suited to mass production, with dimensions, distortion, and strength under control.

Marketing: The product can be bought, and service (repair) is available. It is important that the designer begin by identifying exactly how to recognize a satisfactory alternative, and how to distinguish between two satisfactory alternatives in order to identify the better. From this, optimization strategies can be formed or selected. Then the following tasks unfold

- Invent alternative solution Establish key performance metrics.
- Through analysis and test, simulate and predict the performance of each alternative, retain satisfactory alternatives, and discard unsatisfactory ones.
- Choose the best satisfactory alternatives discovered as an approximation to optimality.
- Implement the design.
- The characterization of a design task as a design problem can introduce the idea that, as a problem, it has solution.

WORKING PRINCIPLE

When the load is being raised or lowered, following forces act at a point on this inclined plane. Load (W):

It always acts in vertically downward direction. Normal reaction (N): It acts perpendicular (normal) to the inclined plane. Frictional force (μN): It acts opposite to the motion. When the load is moving the inclined plane, frictional force acts along the inclined plane in downward direction and when the load is moving down the inclined plane, frictional force acts along the inclined plane in upward direction

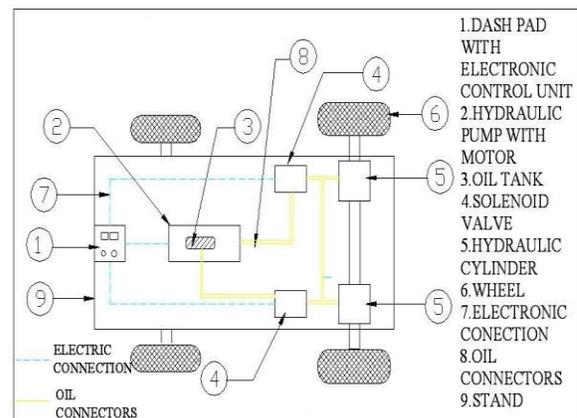
OBJECTIVES

- To provide a safe and simple automatic jack system without use of manual effort.
- To provide an alternative jack system that can operate without external sources of actuation, such as extra hydraulic pumps, reservoirs, or pneumatic systems.
- To provide a novel jack system that can be operated from within the vehicle by means of a dashboard control panel.
- To provide a novel jack system that is directly and permanently incorporated into the vehicle frame in such a way as to prevent the additional risk of damage or weathering.

MOTORISED CAR JACK

Motorised car jacks usually use mechanical advantage to allow a human to lift a vehicle by manual force alone using long, self-locking jack screws to raise the vehicle. Although these jacks are simply designed, they are considered so sturdy and dependable that car manufacturers often include them with new cars, according to Floor Automotive Jacks.

BLOCK DIAGRAM:



COMPONENTS IN MOTORISED SCREW JACK

Lead Screw:

A lead screw is a portable device consisting of a screw mechanism used to raise or lower the load. 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. It is made of various types of metals but the screw itself is made of lead. A large amount of heat is generated in it and long lifts can cause serious overheating. To retain the efficiency, it must be used under ambient temperatures, otherwise lubricants must be applied. These are oil lubricants intended to enhance the equipment's capabilities. Apart from proper maintenance, to optimize the capability and usefulness of lead screw it is imperative to employ it according to its design and construction.

D.C motor:

An electric motor is a machine which converts 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.

Control switch:

It is used in order to start or stop the entire operation of the object lifting jack. The type of switch that is used is known as a toggle switch. The toggle switch is a class of electrical switches that are manually actuated by a mechanical lever, handle, or rocking mechanism. This is designed to provide the simultaneous actuation of multiple sets of electrical contacts, or the control of large amounts of electric current or mains voltages

Control cables:

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

Base and Frame:

A base for the entire set-up has also been made. The motor is mounted on an inverted U shaped support frame. Ball rollers are attached to four ends of the

base for movement and are electrically controlled by switch.

FUTURE SCOPE

- The developed automatic car jack can only withstand below 1000kg of load.
- The developed automatic car jack must be operated on a flat surface.
- The developed automatic car jack is only a prototype and not readily functioning as commercial product
- The design is based on current scissor jack in the market
- The developed automatic car jack is only for normal person
- The developed automatic car jack can only work by using the internal car power (12V)

CONCLUSION

Object lifting jacks are the ideal product to push, pull, lift, lower and position loads of anything from a couple of kilograms to hundreds of tones. The need has long existed for an improved portable jack for automotive vehicles. It is highly desirable that a jack become available that can be operated alternatively from inside the vehicle or from a location of safety off the road on which the vehicle is located. Such a jack should be light enough and be compact enough so that it can be stored in an automobile trunk, can be lifted up and carried by most adults to its position of use, and yet be capable of lifting a wheel of a 40005000 pound vehicle off the ground. 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 motorized automated object lifting jack will prove to be beneficial in lifting and lowering of heavy loads.

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