

DESIGN AND FABRICATION OF AUTOMATED OBJECT LIFTING JACK

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Abstract

With the increasing levels of technology, the efforts being put to produce any kind of work 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.. 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.

Keyword(s): Lead screw, screw jack, DC Motor, Remote, sensors.

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 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 are 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.

1.1 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. 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.

2. LITERATURE SURVEY

Giuseppe et al. [1], describes the motorized wheelchairs dates back in time with several scientists and researchers evaluating the stair climbing mechanism. This paper evaluates different stair climbing mechanisms viz crawler type, leg type, hybrid type and wheeled type. Various forces and torques acting on the wheelchair while climbing the stairs are evaluated. Preferably the outer support assembly comprises wheels on either side of the chair. An inner support assembly, closer to the center line of the chair, also supports the seat assembly.

Murray and Takakazu [2], the rear wheels are autonomously driven and front wheels are freewheeling castors. This proposed concept is numerically modeled and power calculations for linear actuator are made. Stair ascent and stair descent operations are described along with figures and equations. The control system and the stair edge sensor system are also investigated. The stepping algorithm is discussed in detail. The influence of external factors like cost, weight, aesthetics, range of operation, safety, operational efficiency, comfort is evaluated.

Simpson et al. [3], presented that, the stairs will most likely always be a reality in the real world, because of the high level of spatial efficiency they provide when connecting areas of differing vertical elevations. Stairs do present an increased degree of danger compared to such as gentle slopes but this must to some degree by necessity be simply considered. For example, in the planning of any new buildings the target users should be considered. Clearly for public amenities, such as wheelchair users should be considered, but for example in the case of say a private home in Japan where land space is at a premium (more specifically very expensive) multilevel construction is unavoidable and stairs will most likely continue to be used. A compromise situation in the case of families caring for aging parents is often providing all the essential amenities at ground level (barrier free) and using the upper levels for the younger families' respective bedrooms etc.

Morales R et al. [4], describes the mechanical devices, the movements and the trajectory generation of a novel wheelchair prototype capable of climbing staircases. The key features of the design are the use of two decoupled mechanisms for each axle, one used to negotiate steps, and the other position the axle with respect to the chair to accommodate the overall slope. This decoupling makes many different climbing strategies possible, the overall mechanism becoming extraordinarily versatile from a control point of view. A control system is necessary to synchronize the movements of all the actuators of the wheelchair so that its center of mass can follow arbitrary spatial trajectories.

3. PARTS DESCRIPTION

- Geared dc motor
- Battery
- Pen Description
- Power Supply
- Controller
- Transformer
- Microcontroller

3.1 GEARED DC MOTOR

The electrical motor is an instrument, which converts electrical energy into mechanical energy. According to Faraday's law of Electromagnetic induction, when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is given by Fleming's left hand rule. Constructionally a dc generator and a dc motor are identical. The same dc machine can be used as a generator or as a motor. When a generator is in operation, it is driven mechanically and develops a voltage. The voltage is capable of sending current through the load resistance. While motor action a torque is developed. The torque can produce mechanical rotation. Motors are classified as series wound, shunt wound motors.



Fig3.1;DC Motor

3.2 BATTERY

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt.

Batteries seem to be 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. To be economically attractive the storage of solar electricity requires battery with a particular combination of properties:

Battery Specification:

Capacity : 12V and 7.3 Ah

Rechargeable battery one

Charging time : 3 hour



Fig3.2;Battery

3.3 LEAD ACID WET CELL

Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H_2SO_4). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery. The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents short ends the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead-acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.

3.4 PIN DIAGRAM

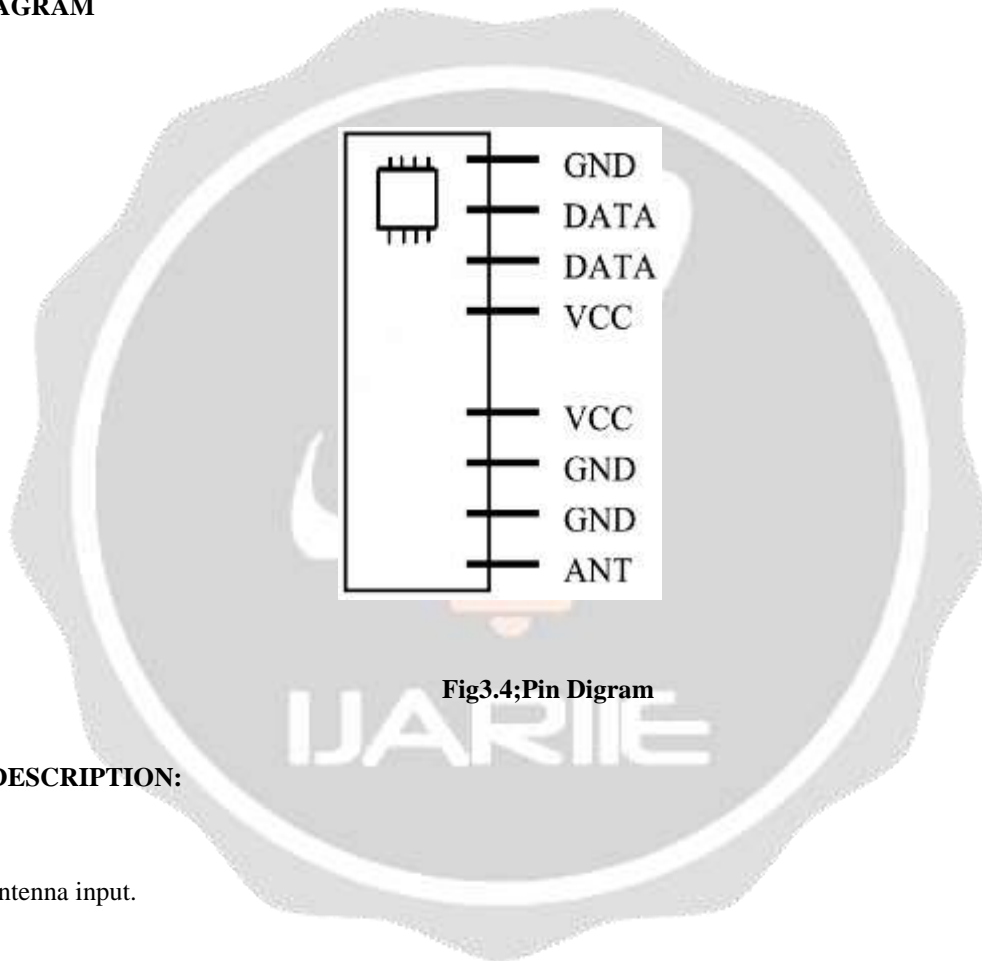


Fig3.4;Pin Diagram

3.4.1. PIN DESCRIPTION:

ANT:

Antenna input.

GND:

Receiver Ground. Connect to ground plane.

VCC (5V):

VCC pins are electrically connected and provide operating voltage for the Receiver. VCC can be applied to either or both. VCC should be bypassed with a .1 μ F ceramic capacitor. Noise on the power supply will degrade receiver sensitivity.

Antenna Input:

It will support most antenna types, including printed antennas integrated directly onto the PCB and simple single core wire of about 17cm. The performance of the different antennas varies. Any time a trace is longer than 1/8th the wavelength of the frequency it is carrying, it should be a 50 ohm microstrip.

Applications:

- Car security system
- Sensor reporting
- Automation system
- Remote Keyless Entry (RKE)
- Remote Lighting Controls
- On-Site Paging

3.5;POWER SUPPLY;

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU.

The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

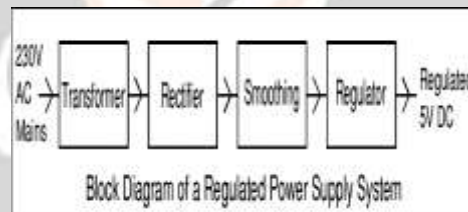


Fig3.5;Power Supply

3.6 TRANSFORMER:



Fig3.5;Transformer

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage. The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol..

3.7 PIC16F877A Microcontroller - Device Overview:

The PIC16F877 is one of the latest products from *Microchip*. It features all the components which modern microcontrollers normally have. For its low price, wide range of application, high quality and easy availability, it is an ideal solution in applications such as: the control of different processes in industry, machine control devices, measurement of different values etc.

4. 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 purpose of our need. By alternating the motor with higher torque the jack can lift heavy load easily.

4.1 BLOCK DIAGRAM

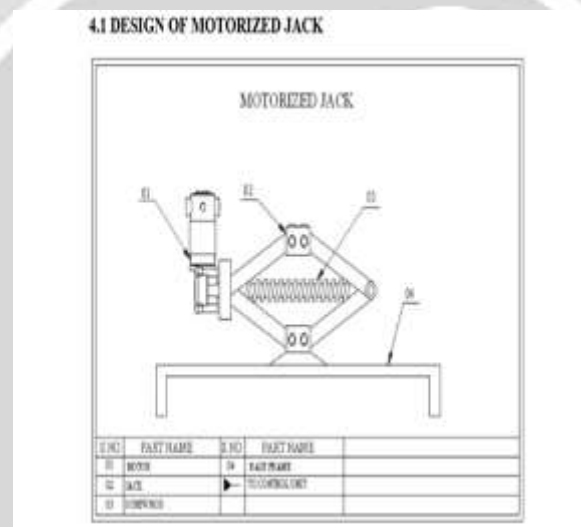


Fig 4.1; Blok diagram

CONCLUSION

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

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