DESIGNING AND WORKING OF 12V DC MOTORIZED SCISSOR CAR JACK SYSTEM IN AUTOMOBILE

A Major Project Report Submitted

In partial fulfillment of the Requirement for the Award of the Degree

of

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

BY

RAVI PRAKASH

(18102134009)

AMAN KUMAR

(18102134052)

DHEERAJ KUMAR

(18102134024)

MD IRFAN AHMAD

(18102134038)

DEPARTMENT OF MECHANICAL ENGINEERING

GOVERNMENT ENGINEERING COLLEGE, BANKA, 813102

2022

DECLARATION

We certify that

a) The work contained in the major project report is original and has been done by ourselves under the general supervision of my supervisor.

b) The work has not been submitted to any other Institute for any degree or diploma.

c) We have followed the guidelines provided by the Institute in writing the report.

d) We have conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute.

e) Whenever we have used materials (data, theoretical analysis, and text) from other sources, we have given due credit to them by citing them in the text of the report and giving their details in the references.

(signature)	(signature)	(signature)	(signature)
Ravi Prakash	Aman Kumar	Dheeraj Kumar	Md Irfan Ahmad
18102134009	18102134052	18102134024	18102134038

APPROVAL OF THE SUPERVISOR(S)

Recommended that the major project report entitled **"DESIGNING AND WORKING OF 12V DC MOTORIZED SCISSOR CAR JACK SYSTEM IN AUTOMOBILE"** prepared by Ravi Prakash (18275), Aman Kumar (18258), Dheeraj Kumar (18256), Md Irfan Ahmad (18253) under my supervision and guidance be accepted as fulfilling this part of the requirements for the award of degree for Bachelor of Technology in Mechanical Engineering**.**

To the best of my knowledge, the contents of this report did not form a basis for the award of any previous degree to anyone else.

Date:

Signature
(Prof. Pranav Kumar)
Supervisor
Asst. Professor
Department of Mechanical Engineering
Government Engineering College, Banka

CERTIFICATE OF APPROVAL

This is to certify that major project work embodied in this report entitled "DESIGNING AND WORKING OF 12V DC MOTORIZED SCISSOR CAR JACK SYSTEM IN AUTOMOBILE" is carried out by Mr. Ravi Prakash (18275), Aman Kumar (18258), Dheeraj Kumar (18256), Md Irfan Ahmad (18253) is approved for the degree of Bachelor of Technology (8th Semester) in Mechanical Engineering of Government Engineering College, Banka.

Date:

Place:

Internal Examiner Name& Signature	**Head of the Department (Mechanical Engineering)**	**External Examiners Name& Signature**

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(Signature)	(Signature)	(Signature)	(Signature)
Ravi Prakash	Aman Kumar	Dheeraj Kumar	Md Irfan Ahmad
18132134009	18102134052	18132134024	18102134038

ABSTRACT

Idea of electric car jack system is to provide a novel jacking system attached to the chassis of the automobile itself. This inbuilt jack can be actuated from inside of the vehicle with the half of switches provided on the dashboard. **A 12v Dc Motorized Car Jack system** can be easily operated by a single push button provided on the dash board. The jack will be installed on both the sides of chassis accordingto the weight distributions of the car. Similarly, it will be installed on the other side of the car. The jacks actuate separately for either side of car as per the breakdown condition. Thecar gets lifted and load gets distributed on three points i.e., plunger or ram of hydraulic cylinder and tires except which is being lifted.

At a time, maximum of two jacks (either both front or rear) can be used to lift the automobile in case of any breakdown or for reconditioning the same. This jack will be very useful for all the senior citizens and especially for females (ladies) who find it extremely difficult to operate the jack manually in any breakdown condition.

Keeping the practical simulation and fabrication in view, mainly mechanical or hydraulic jack can be used. Pneumatic jack is being ruled out due to compressive nature of gases, hence less power would develop and complex design of the system. Hydraulic jack looks promising as incompressible fluid will comparatively provide more power. Increase in weight of the vehicle, design of the jack and last but not the least cost increase needs optimization.

The motive behind using hydraulic system instead of a pneumatic system is the more power produced by the system and simple in design as compared to a pneumatic design. As the hydraulic oil is incompressible so the lifting capacity is more in comparison with the pneumatic system which operates on air which is compressible.

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CHAPTER 1.

INTRODUCTION

1.1 GENERAL INTRODUCTION

Our survey in the regard in several users of vehicles, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning. Now the project is mainly concentrated on this difficulty, such that the vehicle can be lifted from the floor land without application of any impact force. 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 labor. In order to avoid all such disadvantages, the built-in jack should be 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 labor can use it with ease. As automobile market is growing, advance concepts are being implemented to make automobiles more and more versatile and comfortable. Many concepts are implemented day to day to make automobile better and better these days. One such concept is of variable height adjustment in vehicle by adjusting its ground clearance. In this way the vehicle becomes more versatile and can be operated over variety of bad as well as good road conditions.

In existence there are a range of car jacks that are designed to lift a vehicle from the ground. Most of these are however manually operated which implies that they require extra physical effort from the operator. This may mean that it is not easy for elderly and handicapped to operate them. For operation of these jacks, operators are required to be in prolonged squatting position for some duration which can lead to the problem of backache. World over the car jack is an essential device all car owners should possess to assist in servicing their car when need arises and normally, the need is often necessitated by flat tires that need repair or replacement. This study seeks to reduce labor in the car lifting process using a

jack as most car jacks are manually operated there is need to modify them and incorporate them with a prime mover system which replaces manual handling of jacks during operation making it easier and reducing drudgery during maintenance operations.

Also, time consumption in the process of hoisting a vehicle will be reduced as using the available manually operated car jacks is a very time-consuming process, thus there is need to design a motorized jack that improves the timeliness and efficiency in lifting. There will be reduced risk of injury as it is known that for a car jack to be hoisted, the operator has got to be near the vehicle and operating close to the vehicle during jacking is risky, so to reduce the risk of getting injury in the case of malfunctioning of the device the motorized jacking system enables operator to be at a safe distance during the jacking process.

1.2 HISTORY OF JACKING SYSTEM

The original scissor jack design dates back to **1908**, was updated in 1913 from an original design know as a Lazy-Tongs mechanism by Edward Cremieu-Javal, and then again in 1920 by Joseph (Jack) Laurence. Interestingly this "lifting apparatus" was originally designed in reference to lifting ladders.

During road-side emergency like tire puncher, a jack is required to lift the vehicle. It has also been noted that the roadside assistance to come and assist, is not readily available in the remote rural roads of the country. Vehicle workshops are equipped with hi-tech car lifting system where vehicles are raised and lowered using an electrically powered system. However, this is not the case for portable lifting devices. Due to the high cost, maintenance and size, such lifting devices have been found to be mostly confined to work in workshops only and such functionality can neither be placed in car nor be owned by vehicle owners. Hence there is need to design a motorized portable car jack that does not only reduce human efforts but also save time needed to repair the vehicle and that is easy and safe to use. This will be an advantage when it comes to replacing a vehicle tire on the roadside.

This study focuses on design of a motorized car jack that utilizes the12-volt vehicle battery which supplies power to the motorized jack through the cigarette lighter receptacle point

on the dashboard of the car. From the research done it was established that the process of lifting a car using an ordinary jack has become undesirable for motorists in Zimbabwe over the past few years. Motorists have been injured or stuck on the road for long periods of time. The available jacks pose a problem of drudgery and risk of getting injured during jacking process. For this reason, it is fitting to improve the later process so there is need to design and manufacture a system for the existing jacks which can ease the process and make it time-efficient.

CHAPTER 2.

EXISTING JACKING SYSTEM IN THE MARKET

2.1 INTRODUCTION

This chapter described different types of car jacking system available in the market. We are discussing about manual and fully automated jacking system to lift car for tire changing and repair works.

2.2 AUTOMATED JACKS

The champ car utilizes three pneumatic jacks that are activated by pure nitrogen. A detachablehose is connected to the car with carries the compressed nitrogen. It is able to lift the champ car in less than one second.

Figure 1[1]– Automatic car jack

2.3 ELECTRIC CAR JACK

The electric scissor jack is similar to the common scissor jack. The difference is the electric motor that is mounted to the jack to perform the work. This eliminates some of the problematic issues of the common scissor jack. The electric scissor jack still requires an individual to visually check for the correct position under the vehicles frame. It is also necessary for it to be operated on level ground, for the same reasons as the common scissor jack. This electric scissor jack is too largeto fit into the spare tire well. Therefore, this jack would take up unnecessary space in a vehicle

Figure 2 [2]– Fully Automated Electric Car Jack

2.4 MANUAL SCISSOR JACKS

A scissor jack is the most common jack in vehicles today. They are light weight and take up very little vehicle space. Scissor jacks are usually located in the vehicle's spare tire well. Scissor jacks use a screw to achieve its mechanical advantage. It requires quite a lot of torque, operation time, and number of turns to raise a vehicle's tire off of the ground. A scissor jack's lift time can bemeasured in minutes. The top of the jack fits into a small part of the frame. It requires an individual to get down and look under the vehicle. This movement could be very difficult for some people.

This scissor jack is made up of three components. The two bars, as shown if figure 2, are

required foroperation of the jack. If either of the parts are missing, the jack is practically useless. It is imperativethat the scissor jack is operated on level ground, if not it could cause the car to tip or create excess stress on the pins, causing catastrophic failure.

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. Just by turning this screw thread, the scissor jack can lift a vehicle that is several thousand pounds.

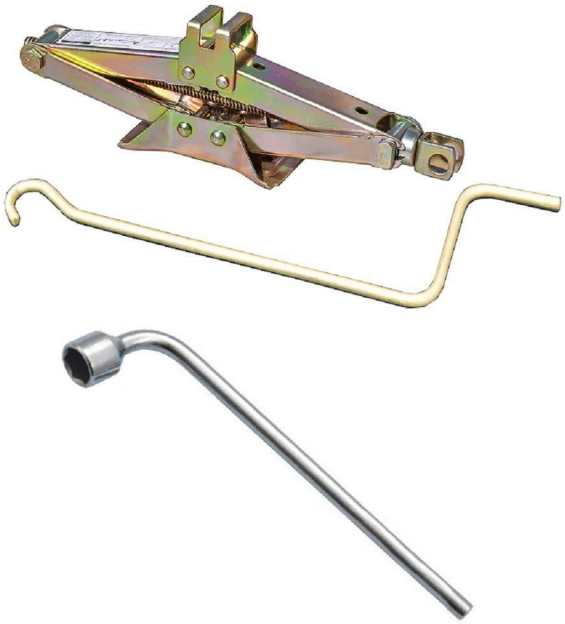


Figure 3 –Manual Scissor Jack

2.5 HYDRAULIC BOLTTEL CAR JACK

A bottle jack uses oil, hydraulic, or some other type of liquid in achieving its mechanical advantage. The bottle jack is fairly easy to use and is also very efficient. It does have clearance issues with a vehicle's underbody, especially if the vehicles clearance is less than usual because of a flat tire. It does not take a lot of time to achieve lifting a vehicle, 1 minute. Bottle jacks are heavy. This makes them difficult to use for elders. They also require one to visually check for the correct frame position.

Figure 4[3] –Hydraulic Bottle Car Jack

2.6 FLOOR CAR JACK

A floor jack is most common used in the garage setting. Rarely would one be carried in a car continuously. A floor jack is capable of lifting a vehicle in about one minute. It takes up the most room compared to the other jacks. Floor jacks, like scissor jacks, can be stressed at the link's pins. This stress can be caused from being used on uneven ground or not properly positioned on the vehicles frame. Overstressing or repeated stress can cause the floor jack to suffer catastrophic failure.

Figure 5 [4]– Floor Car Jack

CHAPTER 3.

LITERATURE REVIEW

3.1 INTRODUCTION

In this chapter we are discussing about this project related work done by different authors.

3.2 LITERATURE REVIEW

Leonardo da Vinci [1] suggested 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 recognizable as the principle we use today.

John Wilkinson, et al [2] discussing the most notable inventor in mechanical engineering from undoubtedly the mechanical genius recognized the need for precision had become as important in industry as the provision of power.

Whitworth Tools had become internationally famous for their precision and quality and dominated the market and inspired young engineers began to put Whitworth's machine tools to new uses.

Barrett J. In Pittsburgh, an enterprising Mississippi river boat captain named 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.

Norton A. S. Suggested the potential for Sleeper's design and hired the young man and purchased the patent. The „Norton" jack was born. Over the coming years thefamous „Norton" jacks were manufactured at plants in Boston, Coati cook and Moline, Illinois.

Khidi T. C. et al In this research paper that the tire puncture problem of the cars on the roads, especially on the highway roads generally needs manual human force to solve the problem by using a mechanical scissor car jack. Our work focused on a bottle car jack and adapting D.C. motor (12 volts) with chain-sprocket set to design a suitable machine. Lifting the car to solve the puncture problem with this new machine is easier, safer, abbreviate the time and more reliable for persons who suffer from their health's. We used drilling, grinding, milling, and welding machines to make up this work. Thedesigned jack had been tested on a passenger car and passed successfully. We used Solid works software program to achieve the goal. In the conclusion, the main physical parameters of the design with reasonable assumptions have been determined through practical considerations. Cast alloy is used as the materials for both chains due to its high strength, toughness, and its economic effects and cast carbon steel used in Jack.

Patil M. et al In this research paper (Automated Car Jack) that 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 that is still included as standard equipment with mostnew 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 isto encounter these problems. An electric car jack works on current supply from the car battery itself making it easyto 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 fulfil the needs of present car jack, some improvement must be made. And they conclude that the main advantages of the modified design over the existing design are that the modified designed motorized jack will save time, be faster and easier to operate and requires less human energy and additional work to operate. There by effectively curb the problems associated with Ergonomics - which is a fundamental concept of design process. Considering all available car jacks in the market, this prototype can be improved by a few modifications on the features and design. The objectives are to design a car jack that is safe, reliable and able to raise and lower the level, to develop a car jack that is powered by internal car power and automated with button system. Based on the testing and results from the analysis, it is considered safe to use Jack car work under certain specifications. Furthermore, the torque supplied on the system is more than enough to lift a car weight around 1200 kg. There are certain weak points that can be improved based design and balancing of the system.

Akinwonmi A. S. et al In his research paper (Modification of the Existing Design of a Car Jack) that modification of the existing motor 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 rotatingspeed to the pinion gear meshing with the bigger gear connected to the power screw to be rotated with requiredspeed 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 back ache problems associated with doing work in a bent or squatting position for a long period of time. The modified car jack is easy to use by pregnant women or whoever had problem with the vehicle tires along the road. The designed motorized jack will also save time and requires less human energy to operate

CHAPTER 4.

OBJECTIVES

4.1 INTRODUCTION

In this chapter we are going to discuss about our project. we built this from manual car jack and wiper motor.

4.2 MAIN OBJECTIVES ABOUT THE PROJECT

In this project we developed a motorized scissor jack from manual jack and wiper motor, based on the results analyzed from the customer requirements, the automated jack system has equally main objectives.

The first objective for the automated jack system was to be reliable.That was accomplished by using high quality parts. The parts came from manufacturers with stringent manufacturing standards. The current jacks in vehicles today do not provide enough reliability for customers. The automated jack system will provide reassurance to the customer by always being ready to be activated.

The automated jack system was integrated into the vehicle. It eliminates the possibility of not having a jack. It also eliminates those confusing jacks that have multiple components. One never hasto worry about where to place the jack on the frame lift points.

This also eliminates the need to visualize the underbody to see if the jack is positioned correctly. “Ease of operation” was the second objective. It was satisfied by having two easily operated

trunk mounted switches. The trunk location prevents accidental operation and easy to reach accessibility. The dial has four positions plus an off. The four positions is for the individual cornersof the vehicle; Left-Front, Right-Front, Left-Rear, Right-Rear. The motorized jack system uses a car wiper motor, which is able hold fifteen hundred pounds of dynamic loading.

The third objective of the motorized jack system was for it to have a built-in

failsafe. A built-in failsafe will prevent catastrophic failure, if the system has a loss of power. This was accomplished by means of the actuators. The actuators have an internal break, preventing the vehicle dropping abruptly in case of power loss.

CHAPTER 5.

NEEDS FOR MOTORIZED JACKING SYSTEM

5.1 INTRODUCTION

In this chapter we are going to discuss about needs for automation in car lifting system, in this chapter we discuss how we turn manual to automated jacking system.

5.2 MANUAL SCISSOR JACK MECHANISM

There are two main kinds of car jack: those operated by screw and those operated by hydraulics. For standard road vehicles, the screw type is most common, often coming in the form of a scissor jack. Their popularity is a result of their ability to generate a great mechanical advantage – i.e.; a large force amplification – from a manually operated arm tool.

These jacks work by using a two-piece mechanism – similar to those found on extending bathroom mirrors – in partnership with a self-locking central screw. Combined, these elements not only enable a vehicle to be lifted through the extension of the scissor mechanism, but also to be held in place by the resistive force of the screw, which without the jack would instantly collapse

The central screw is also how the jack is operated, with an end-mounted circular ring designed to accept a large Allen key-shaped metal arm. When inserted and turned clockwise this arm drives the screw through the scissor mechanism's central pivot points' thread, elongating the jack and, thus, raising the vehicle. In contrast, rotating the screw counter-clockwise unthreads the screw, shortening the jack and, in turn, lowering the car to the ground.

Figure 6[5] – Scissor jack lift car for tyre changing

5.3 CUSTOMER REQUIREMENTS

The automated jack system was designed from customers wants. A customer survey was developed to determine what was important to the customer. The survey was broken into two parts. Part one includes, what was important to the customer in the design of an automated jack system for their vehicle. Part two includes, if the customer was satisfied with the current jack offered in vehiclestoday. They customers were asked to decide their level of importance on the following customer requirements:

- Reliability
- Durability
- Noise during operation
- Ease of operation
- Cost
- Time to operate
- Size
- Stability
- Weight

The completed surveys were tabulated. That gave percentages to the customers' requirements. Partone of the survey supplied the following results: Reliability, Stability, and Durability were the first, second, and third highest levels of importance at 13.62%, 13.42%, and 12.84%, respectively. This means that customers required reliability most, when it comes to an automated jack system on their vehicle. Part two of the survey supplied the following results: Time to operate, Size, and Stability were the first, second, and third lowest levels of importance at 9.43%, 10.40%, and 10.40 %, respectively. That means that customers are most dissatisfied with the operation time of the current jackoffered in cars.

5.4 QUALITY FUNCTION DEPLOYMENT RESULTS

A Quality Function Deployment, QFD, was created to translate customer requirements into the engineering characteristics for an automated jack system. There are three engineering characteristics that have the most relative importance, 0.15, "quality materials", "one turn, dial operation", and "builtin failsafe". The customer requirement, ease of operation, is satisfied by the engineering characteristic, one turn dial operation. This characteristic makes an automated jack system operator friendly for customers. Customers also require a built-in failsafe that will give the automated jack system the stability they requested in the survey. Customers require that the impact parts be made from hardened steel. The steel will increase the durability of the system. This was used in the designof an automated jack system, having a relative importance of 0.12. "Low decibel operation", "light weight power source", and "readily available parts" all had the lower customer importance at 0.06, 0.08, and 0.06, respectively. The customer requirements that were translated into engineering characteristics will be used to design the automated jack system.

	Absolute Importance	Relative Importance
quality material	1.4	0.15
lift system (pneumatic or electric)	1.3	0.14
impact parts made from hardened steel	1.1	0.12
low decibel operation	0.6	0.06
light weight power source	0.7	0.08
one turn dial operation	1.4	0.15
built in fail safe	1.4	0.15
small, compact design	0.8	0.09
readily available parts	0.6	0.06

Table 1 – QFD Results

5.5 FACTORS OF SAFETY

There were a few factors of safety included in the automated jack systems design. The system was designed to lift a vehicle of 4000 pounds of gross vehicle weight. This means that each corner ofthe car will require 1000 pounds of lifting force. The electric linear actuators chosen have a dynamicload capacity of 1500 pounds. This is five hundred pounds greater than what is required by the design. The manufacturer of the electric linear actuator also has their own factor of safety figured into their design.

The other factors of safety were used in the design's force and stress calculations. The actuatoris bolted to mounting flanges. When the forces were calculated, the 1000-pound force was replaced with the actuator's 1500 pounds load capacity. This load was also applied to only one of the flanges.This makes a safety factor of 2 in the force calculations. The system was designed with the possibility of enduring impact. A safety factor of 12 was used for impact in calculating the stresses; tension, bending and shearing to show that the mounting bracket is durable and stable.

CHAPTER 6.

METHODOLOGY

6.1 INTRODUCTION

In this chapter we discuss the methods of this project. The purpose of this project is to overcome the problems facing during car lifting on empty roads during summer. An electric car jack has a frame type of design by using electricity from the car's battery will be developed. Operator only need 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.

6.2 OVERVIEW

A Manual jack is a mechanical device used as a lifting device to lift heavy loads or apply great forces. Jacks employ a screw thread or hydraulic cylinder to apply linear forces. Car jacks use mechanical advantage to allow us to lift a vehicle by manual force alone. More powerful jacks use hydraulic power to provide more lift over greater distance. A scissor jack is a device constructed with a cross-hatch mechanism, much like a scissor.

A scissor jack is operated by turning a lead screw. It is commonly used as car-jacks. In the case of a scissor jack, a small force applied in the horizontal plane is used to raise or lower large load. A scissor jack's compressive force is obtained through the tension force applied by its lead screw. An acme thread is most often used, as this thread is very strong and can resist the large loads imposed on most jacks while not being dramatically weakened by wear over many rotations. An inherent advantage is that, if the tapered sides of

the screw wear, the mating nut automatically comes into closer engagement, instead of allowing backlash to develop. These types are self- locking, which makes them intrinsically safer than other jack technologies like hydraulic actuators which require continual pressure to remain in a locked position. Most scissor jacks are similar in design, consists of four lifting arms, a base plate, a carrier plate, two connection members, eight connection pins,

a power screw and a crank. This crank is usually “Z” shaped. 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 four arms, producing work. The four arms are all connected at the corners with a bolt that allows the corners to swivel.

Garage shops visits were carried out in order to attain practical information and real-life applications and problems being faced. Three possible solutions were generated, and each possible solution was evaluated with reference to its technical strengths and drawbacks. Using binary dominance matrix analysis (BDM), one solution was chosen for further detailed design development based on the simplicity of the design, cost and reliability. Solid Works Software was employed for 3D modeling of the design and related components. 2D drawings were done using AutoCAD.

CHAPTER 7.

COMPONENTS USED FOR CONSTRUCTION OF MOTORIZED SCISSOR CAR JACK SYSYTEM

7.1 INTRODUCTION

In this chapter we discuss about the components used in this project. We discuss about the construction of this motorized system. We also discuss about its uses, drawbacks etc.

7.2 MANNUAL SCISSOR JACK

A scissor jack is a type of device that helps to gradually raise a vehicle off of the ground. It is called a scissor jack because it consists of diagonal metal pieces that expand or contract in a manner resembling a pair of scissors. These jacks are handy because they are compact when they are in their contracted position.

Auto shops or other businesses may use a large electronic or hydraulic scissor jack to raise vehicles up in order to do advanced diagnostics, maintenance, or repairs. The most common and familiar type of scissor jack to most consumers, though, is a manual jack. This type of jack stand is smaller, and is included with many new or used vehicles. The manual jack often fits into a trunk compartment, and it's part of what car buyers get, along with a spare tire, to help them fix any roadside flat tire situations. For a used car buyer, it's helpful to look into the trunk of the vehicle and make sure that these tools are available, along with an owner's manual.

The manual scissor lift jack uses a long handle piece that is a lot like a wrench. The jack user inserts the handle into a point on the jack stand, and turns it, expanding or contracting the "scissor" pieces by threading them through a long, horizontal bolt. Another way that these types of jacks are convenient in a roadside situation is that the long handle piece makes it easier to access the jack when the vehicle is on the ground. The best jacks have adjustable handles so that the user can move the handle from one ground-side horizontal position to the other and then flip the handle over to continue moving the jack bolt in the same direction.

Manual scissor jacks are often used for raising just one corner of a vehicle. The user positions the jack directly behind the wheel and jacks up that side of the vehicle to work on a flat tire or damaged wheel. For more involved vehicle repairs or maintenance, it's good to have more than just a regular manual scissor jack. Vehicle owners who want to have access to the underside of their vehicle should invest in sturdy, solid jack stands, which will hold the vehicle in a raised position more securely. The user can raise up the vehicle with the scissor lift jack and insert the jack stands for better support before moving in under the vehicle.

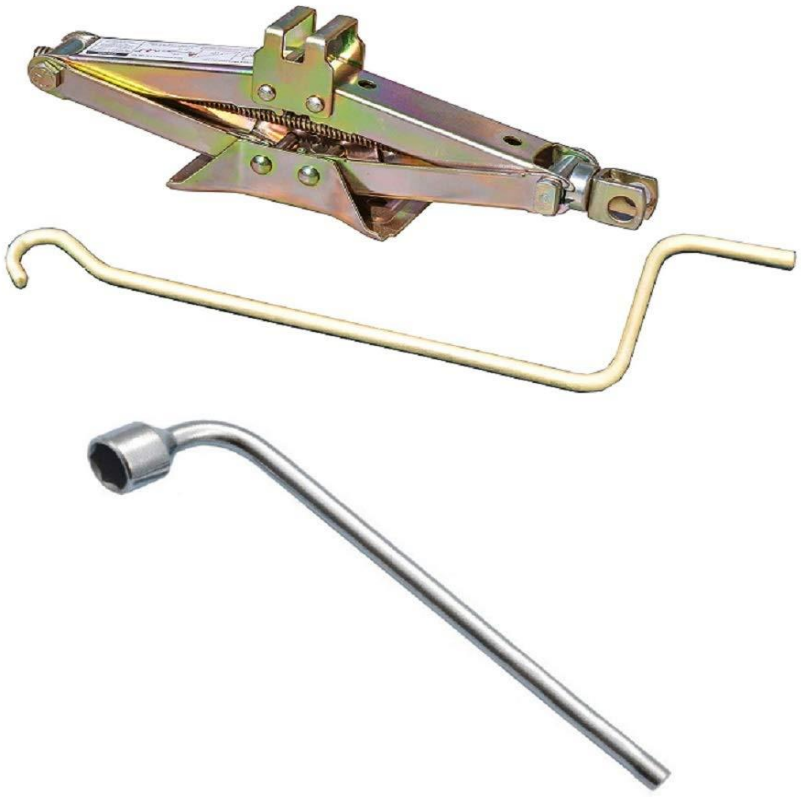


Figure 7 – Manual Scissor Jack

7.3 WIPER MOTOR

Windshield wipers are powered by a small electric motor, usually mounted on the firewall or under the cowl (the area under the windshield's base). The motor activates linkage that moves the wiper arms back and forth. On vehicles with a rear window wiper, a separate motor powers the one in the rear. Signs that a wiper motor is about to fail include slow or intermittent operation, wipers that will operate at only one speed, or arms that stop in the middle of the windshield when turned off. If your wipers don't work, the fault could also lie with other parts of the wiper system. In the winter, for example, trying to use the wipers when the blades are stuck to the windshield because of ice or snow can blow the fuse for the motor or trip a circuit breaker. Other possible causes are the interior switch that

controls the wipers failing, wires in the system being damaged, or the linkage that pushes and pulls the wiper arms breaking. Moving parts in the linkage may also be stuck from corrosion and/or gunk and need lubrication.

Figure 8 – Wiper Motor

7.4 POWER SUPPLY TO THE MOTOR

The DC motor is powered using power from the car's 12V battery. The motor gets that power through the power socket on the car dashboard. The extension socket with a simple switch is shown below.

Figure 9[6] - Charger Socket

Figure 10[7] - Extension Cable with Switch

The sockets are then connected to an extension socket which has switches which will control the motor operation. The motor for the release valve will have a special motor that allows for reverse of polarity as it is imperative that this motor rotates in both directions while in use. High resistance electrical cables with coating were used for these connections from motor to socket. There is no limit on the length of the cabling connections but for the

sake of keeping the system compact, the cable connections were kept at 2 m in length. This connection is enough to ensure that the jack operator is away from the vehicle during lifting or operation of the jack in general thus reducing risk of injury. Also, this connection ensures that the operator can operate the jack in a more comfortable standing position thus reducing the muscular skeletal injuries resulting from the continued manual operation of the jack.

CHAPTER 8.

DESIGN AND CONSTRUCTION OF MOTORIZED SCISSOR JACK

8.1 INTRODUCTION

In this chapter we discuss about the design and construction of this project, we discuss about mechanism, design and many more important aspects. This chapter includes different methods of designing motorized scissor car jack system.

8.2 DETAILS OF MECHANISM

When high pulse is given to the wiper motor, the motor rotates in clockwise direction and when low pulseis given it rotates in anticlockwise direction.

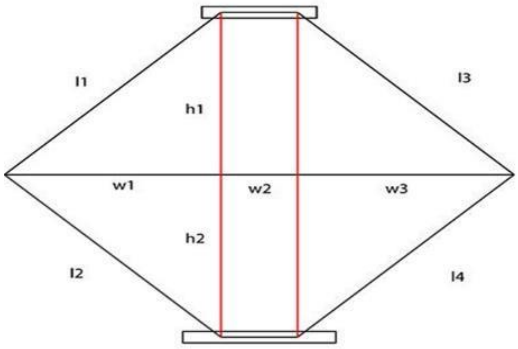
- The ground clearance of the vehicle is assumed to be 165 mm. (Decided on the basis of detailed studies conducted regardingvarious car specifications.)

- When the screw jack carries the maximum load, i.e., when the wheel of the vehicle leaves the ground, the screw jack is assumedto have moved in the vertical axis (linearly) by a distance of 50mm. (Decided after practical observational analysis of conditions.)

- The screw jack supports a quarter of the total vehicle mass, which is approximately 300 kg, i.e., 3000 N of force of car of weight 1200 kg i.e.,12000 N. Considering possible fluctuations during operation, weight is taken as 500 kg i.e., 5000 N.

8.3 DESIGN

A power screw is a mechanical device used for converting rotary motion into linear motion and transmitting power. A power screw is also called translation screw. It uses helical translatory motion of the screw thread in transmitting power rather than clamping the machine components.



Geometric Layout of the Jack

By Symmetry:
l1 = l2 = l3 = l4
w1 = w3
w2 = Constant
h1 = h2
Total height = h1 + h2
(without top and bottom offsets)

Simplified Loading:

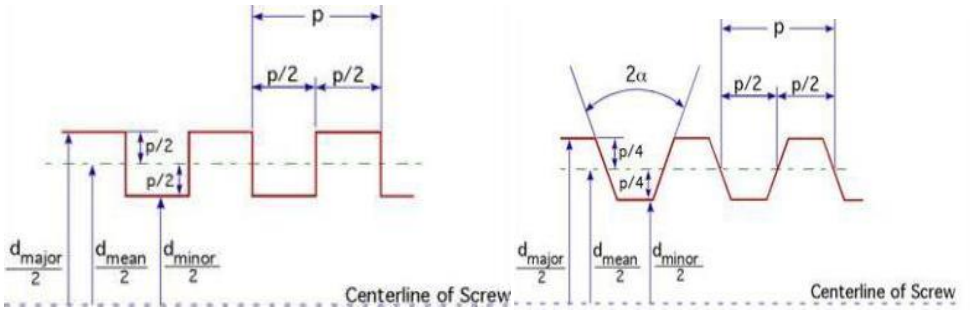
All two-force members or Pin Joints

Arms and plates in compression

Drive screw in tension

8.4 FORMS OF THREADS

There are two popular types of threads used for power screws viz. square and I.S.O metric trapezoidal.



A screw is a mechanism that converts rotational motion to linear motion, and a torque (rotational force) to a linear force. It is one of the six classical simple machines. Other mechanisms that use the same principle, also called screws, don't necessarily have a shaft or threads.

8.5 DESIGN ALTERNATIVES AND SELECTION

There were a few design considerations researched before the final design was decided. One of the designs for the automated jack system was using hydraulic cylinders. There were problems with using hydraulic cylinders in the design. Hydraulic cylinders require a fluid, usually hydraulic, to be compressed to transfer work. This fluid is heavy and susceptible to leaking. The added weight of thefluid and a pump to push the fluid would greatly increase the total weight of the vehicle. This would reduce a vehicle's miles per gallon efficiency. The pump and fluid reservoir would be located in the trunk of the vehicle. Mounting these items in the trunk would reduce the vehicle's available trunk space. As stated above, this system is susceptible to leakage; this would cause the customer to be concerned with leaving objects in the trunk. Miles per gallon and trunk size are important amenities for the customers.

Another problem with this system is that it requires running lines to carry the fluid, adding complexity during the installation process. Hydraulic systems are also susceptible to catastrophic failure due to power loss or leak. All these reasons have concluded that the hydraulic system was not the best option.

The second idea was using pneumatic air cylinders to perform the work of lifting the vehicle.

Pneumatic cylinders provide some advantages over the hydraulic. Pneumatic cylinders use compressed air to transfer work. Air is light, so this system would not add as much weight to the vehicle. This means that the vehicles miles per gallon efficiency would not be greatly affected. A pneumatic system would require using tubes to carry the air. The tubes give the pneumatic system the same problem as the hydraulic, intense

installation. A compressor which is needed to compress the air is required for this system. The compressor would have to be mounted in the vehicle's trunk,reducing the vehicle's available trunk space. Air compressors are also noisy, which is not an admirable trait. Pneumatic systems are also susceptible to catastrophic failure due to power loss or leak. All of these reasons have concluded that the pneumatic air cylinders are also not the best option.

An electric linear actuator was the system that was chosen. The system is light weight and thereis no need for a compressor or pump. The electric linear actuator runs off of 12Vdc, the same as the vehicle's car battery. This system also doesn't need running tubes, as the other systems required. An18-gauge wire will have to be ran to the actuators to provide them power, making installation more efficient. Electric linear actuators are almost silent in operation, providing an attribute that customersdesire.
The electric linear actuators also have a built-in failsafe to prevent catastrophic failure.

The mounting bracket had several alternative designs. One design was to have the actuator lay flat against the bottom of the vehicle. This mount would rotate 90º into lifting position by means of adc servo motor. This design would prevent the device from taking up too much additional road clearance. The major problem with this is that the motor required to produce 1500 pounds of torque is unable to be placed in the required envelope size. In order to generate the lift needed, major torquehas to be applied to the device. The motor size needed to produce the torque was too large for the envelope.

The design that was chosen for the mounting bracket is fixed. The brackets mount behind the vehicle's wheel. The bracket has a C type mount that slides onto the vehicle's frame. It is then welded to the vehicle's frame. This gives a very strong ground for the mounting bracket since it has to support $^1/_4$ of the vehicle's total weight. The bracket has a height of 6.30" from the top of the vehicle's frame. The mounting bracket dimensions can be found on page 12. This locates the electriclinear actuator's motor above the vehicle's tire. The bracket is also primed and painted to prevent oxidation of the steel.

CHAPTER 9.

ASSEMBLY DIAGRAM

9.1 INTRODUCTION

Motorized Jack Which Is Modified from Manual Mechanical Jack. It Shows wiper Motor Connected Parallel with Power Screw of Jack Through circular metal piece. The wiper Motor Is Connected with switch, Which Can Use to Lifting and Lowering the Jack.

9.2 DESCRIPTION OF PRODUCT

- High Quality 2 Ton Motorized Jack
- Simple, Design for Ease of Use and Maintenance.
- Perfect For Travel Use and Emergency Wheel / Tyre Changes.
- Compact and lightweight design.
- Ideal for lifting cars and light vechiles.
- Plugs directly into the vehicle's charging socket or other 12V power source.
- Long lasting and durable construction for long service life.

Figure 11 – Assembled Motorized Scissor Car Jack

CHAPTER 10.

WORKING PRINCIPLE

10.1 INTRODUCTION

In this chapter we discuss the working of motorized scissor car jack. The working principle of motorized scissor car jack is discussed below. With the use of manual jack, wiper motor, charger socket, power adapter etc we made a model called **"Motorized Scissor Car Jack System".**

10.2 WORKING PRINCIPLE

Under favorable conditions, the jack can lift a vehicle chassis when it comes in contact with upper plate, which is caused by rotation of power screw through the electric power taken from car battery (12V) via cigarette lighter receptacle plugged in car. Firstly, motorized jack will be placed under car chassis with some clearance space between top plate and chassis. The cigarette lighter receptacle connected with jack will be plugged in port, thus connecting directly with car battery. When direction of movement will be given by joystick, the power will be taken and motor starts rotating. On giving UP direction, the power screw will rotate within threaded cubical bore in clock-wide direction, which will cause links to move along threaded portion towards each other in load raising process and vice versa. During loading process, jack will eliminate the clearance space between itself and chassis by rising up. When chassis will come in contact with jack, the weight of car will gradually transfer to jack. These developed forces will be distributed among links and cubical bore. The force transmitted to cube will be transferred to screw threads

We have used ON/OFF switch in this project; the ON/OFF switch keys are interface with control circuit with battery. And we are connecting the DC motor with the mechanical model for the up and down movement. When we switch ON, it will send a high pulse to control circuit then the control circuit activates the corresponding relay to rotate the DC motor in forward direction, so that the jack

will move up. When we switch OFF, it will also send a low pulse to the control circuits Its activating relay to rotate the DC motor in reverse direction so the jack will move down. Using this we can lift the load using power jack without human effort.

CHAPTER 11.

ADVANTAGES OF THE SYSTEM

11.1 INTRODUCTION

The most common method of overcoming unforeseen circumstances such as flat tires and replacing them with spares can be a tedious and somewhat difficult process for people who are not experienced in such matters. Besides the conventional method of lifting a car and replacing the flat with a spare can also be a waste of energy.

This project mainly aims to develop an alternate system of replacing flat tyres that can overcome the drawbacks of the conventionalsystem.

11.2 ADVANTAGES OF THE SYSTEM

- By the use of this project, replacing flat tires is a very easy process.

- The conventional method of replacing flat tires is difficult to do for a single person. But with the help of this system a single person, pregnant women, an old man easily replace tire without facing any difficulties.

- This is light weight, easy to handle and portable scissor car jack.

- It requires small amounts of physical strength that helps females, elders and differently abled people.

- The present system requires a spare tire to be present mandatorily, however the developed system can be used to temporarily fill the tire with compressed air such that it can be used till a gas station can be reached and professional help is obtained.
- This is low-cost system. So, every car owner can easily afford.
- Decrease human effort.

CHAPTER 12.

APPLICATION

It makes tire changing process easier for ladies, elders and handicapped people. For ladies, elders and handicapped, changing the tires of car without any external help can prove to be a challenging and difficult task. But using this unit it is possible for them to do the process without any aid.

Reduces the time needed for the operation. Generally, a healthy person requires about 20-25 minutes for changing car tires.

In case of women the estimated time is usually more than half an hour. Using this equipment

The time needed for this process is reduced. The whole tire changing process can be completed within 10 minutes.

CONCLUSION

Side road emergencies such as tire puncture, low air pressure in tires is commonly observed in cars. Conventional car jacks usemechanical advantage to lift the cars, but it is very difficult for the ladies, elderly and handicapped persons to operate the mechanical jack. The significance of this project is that it has culminated in the development of a new car jack design in order tomake the operation easier, safer and more reliable in order to save individual internal energy and reduce health risks especially backache problems.

The principle of the existing car jack was modified by making adjustments and using a prime mover which is the electric motor to control the lifting operation of the jack. The car battery (12V) is used to supply power source to themotor. Human effort was eliminated in raising the jack by the use of the torque generated by the motor as in rotates. The use of long cablings to control the motorized operation meant the jack would be safe to use as the operator can use the jack in a comfortable position and as far away from the vehicle as possible. The torque supplied to the system is more than enough to lift a vehicle weighing around 2000 kg (2 ton). This design of the motorized carjack can consider to be a huge benefit in the lifting and lowering of 2-ton vehicles.

FUTURE SCOPE

The system is associated with a certain level of vibration due to the rotation of the motor and also other components like the gears and links. Therefore, the system can be equipped with rubbers in the linkages since the rubbers absorb some of the vibration energy. This also reduces the noise associated with such kind of a system. A remote-control system can also be incorporated to improve the compatibility of the system by limiting the amount of cabling neededfor the motorized jack electrical components. Also, this enhances safety of the jack and ease of use. The device can also be designed to operate using android application. An alternative power source should also be availed as part of the motorized jack kit, to avoid problems when say, the car battery is flat. This prompts future scope to also involve the development of an alternative power source to the jack. A solar and battery system can be incorporated into the device so that it can function in such a way that the solar panel is used to charge a 12V battery. A scope can be considered to look beyond a maximum of a 2-ton vehicle, and develop the jack for it to be applicable even to be used for heavy duty vehicles.

As a development the web part of the arms can be replaced by stiffening ribs to reduce the overall weight. the top and base plates can be made foldable to make the unit more compact. Permanently mounted jacks on the vehicle can be developed so that tire change can be completely automated.

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