

REVIEW ON ELECTRIC CAR JACK USED IN AUTOMOBILE

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ABSTRACT

When the tire of a car punctures on roads, especially on highway then generally manual human force is required to solve the problem by using a mechanical scissor carjack. Our work is focused on that car jack that adapts D.C. Motor (12-Volts) with the chain-sprocket set to design a suitable machine regarding the problem. Lifting of car with this new machine will be easier and safer. Moreover it consumes less time and also reliable for persons who are having health problems and for those also who are a little bit lazy. Our project runs on 12 Volt D.C. Battery of the same car through the Lighter slot.

Keyword: Car Jack, Automatic Jack, Motorized Jack, Electric Car Jack, Flat tire.

1. Introduction

A typical screw jack or jackscrew is a mechanical device which used to lift heavy loads or to apply great forces on vehicle. A mechanical jack employs a screw thread for lifting heavy equipment. A hydraulic jack uses hydraulic power. The most common form is a car jack, floor jack or garage jack, which lifts vehicles so that maintenance can be performed. Jacks are usually used to lift vehicles weighing between 1000kg to 2000kg.

So, we are designing a car jack which is electrically operated and which run simply by a 12V D.C. battery. This electric screw jack will have a set of bevel gears, a lead screw and a 12V D.C. motor. The conventional design was of electric that can be operated by the chain and sprocket mechanism. Our conventional design has a 12 Volt D.C. motor that is attach with lead screw of the scissor jack, so when the electric supply is given to the electric motor. This car jack will have two way switch so that the motor will turn in both the direction. The motor and the screw will be attached directly or with the help of spur gears.

1.1 Components of electric car jack

- i. Bevel gear
- ii. Lead screw
- iii. 12 V D.C. Battery
- iv. 12 V D.C. Motor
- v. Switches
- vi. Rigid base

1.2 Construction and working of Car Jack

Our project consists of one 12 V D.C motor attached with bevel pinion and one lead screw attached with bevel gear. The shaft angle is 90°. So, the motor will be held horizontal while the lead screw will be held vertical. The motor is connected with the wires having two way switch and end of wires having car lighter plug.

When the 12V D.C. motor is powered with the help of battery and that motor will run the bevel pinion and that bevel pinion will power the bevel gear and the lead screw is connected to the bevel gear. The lead screw is connected to the rigid base and that rigid base will lift the car.

Our project's main objectives are 1. To design an electric car jack which is safe and reliable to raise and lower the load easily without any effort. 2. To develop a car jack that is powered by car's battery and fully automated with the help of switches.

And the problem statements are as per our research the gear drive will be best over chain mechanism. There are many problems related to chain and sprocket like

- i. The production cost of chains is relatively high.
- ii. The chain drive needs accurate mounting and careful maintenance, particularly lubrication and slack adjustment.
- iii. The chain drive has velocity fluctuations especially when unduly stretched.
- iv. Need lubrication and therefore can be messy.
- v. It is dangerous because the chain meshing with a sprocket is a pinch point.
- vi. Noisier than gears.

We referred the research paper "Design And Manufacturing Electrical Bottle Car Jack D.C. 12volt" by Timur Choban Khidir. In this paper the future scope is written as "In this model we currently used chain and sprocket set for transmission. In the future, maybe use the gears or special kind of hydraulic motor and work comparison between each type and choose the best type that transmits power and motion." So, we use the bevel gears as transmission system.

Available present car jack creates difficulties for the elder people and women. And are disadvantageous under adverse weather conditions. Presently available jacks further require the operator to remain in prolonged bent or squatting position to operate the jack which is not ergonomic to human body. It will give physical problems in few minutes. Moreover, the safety features are also not enough for operator to operate the present jack. Further there are more number of jacks available, typically large, heavy and also difficult to store and transport.

The purpose of this project is to overcome the above problems. 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.

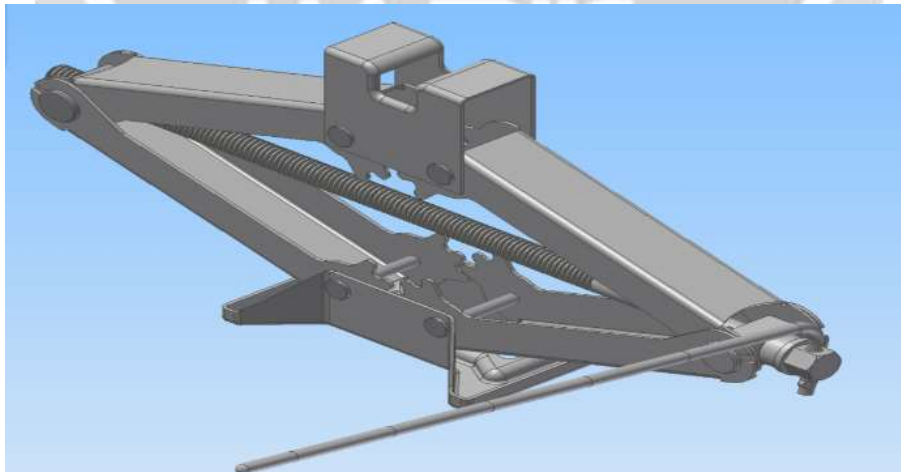


Fig -1 Conventional Car Jack

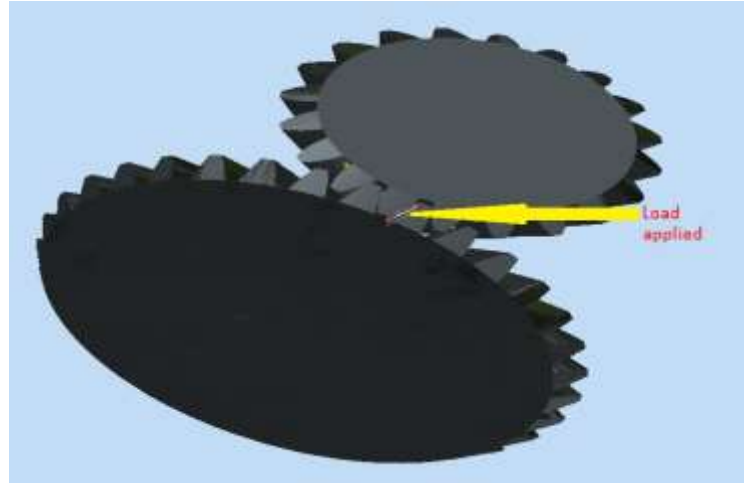


Fig -2 Load acting on bevel in FEA

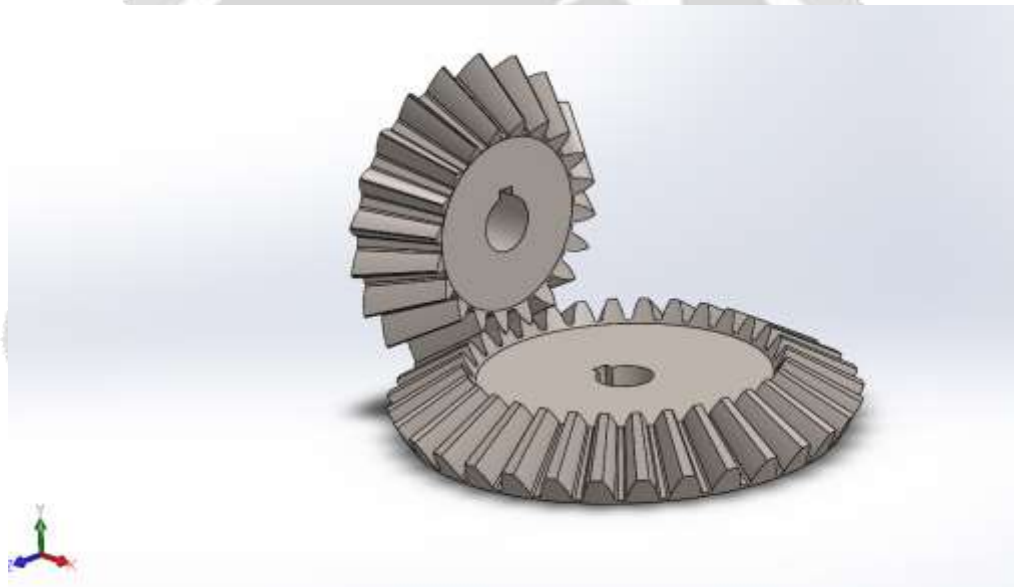


Fig -3 3D Model of Bevel gear

1.3 Necessity of jack

In the repair and maintenance of automobiles (car), it is often necessary to raise an automobile to change a tire or access the underside of the automobile. Accordingly, a variety of car jacks have been developed for lifting an automobile from a ground surface. Available car jacks, however, are typically manually operated and therefore require substantial laborious physical effort on the part of the user. Such jacks present difficulties for the elder and handicapped and are especially disadvantageous under adverse weather conditions.

Further some more jacks are also available typically large, heavy and also difficult to store, transport, carry or move the proper position under an automobile. In addition, to the difficulties in assembling and setting up jacks. Such jacks are generally not adapted to be readily disassembled and stored after automobile repairs have been completed. Car jacks must be easy to use for women or whoever had problem with the tire in the middle of nowhere. In light of such inherent disadvantages, commercial automobile repair and service stations are commonly equipped with large and hi-tech car lift, wherein such lifts are raised and lowered via electrically-powered systems. However, due to

their size and high costs of purchasing and maintaining electrically-powered car lifts, such lifts are not available to the average car owner. Engineering is about making things simpler or improving and effective.

Such electrical-powered portable jacks not only remove the difficult task of lifting an automobile via manually-operated jacks, but further decrease the time needed to repair the automobile. Such a feature can be especially advantageous when it is necessary to repair an automobile on the side of a roadway or under other hazardous conditions.

2. Literature Review

Author Timur Choban Khidir says in his research paper (Design and Manufacturing Electrical Bottle Car Jack D.C. 12 volt) 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 carjack 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. The designed jack had been tested on a passenger car and passed successfully. We used Solidworks 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. Depending on the analysis of FEA, it shows that the max. Nodal displacement value of the system of carjack is about 1.048e-001 mm and max. Von Mises 3.625e+008, when max. load (19620 N) applied Furthermore, it seen that max. Von Mises stress, max. safe point. And we tried this carjack on the vehicle (Kia Rio model 2005 its curb weight is 1090 kg) practically to see whether it raise the vehicle or not. [1]

Author Manoj Patil, Gaurav Udgirkar, Rajesh Patil and Nilesh says in his 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 (manually operated) that is still included as standard equipment with most new 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 is to encounter these problems. An electric car jack works on current supply from the car battery itself making it easy to 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 concludes that the main advantages of the modified design over the existing design are that the modified designed motorised 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. [2]

Author A. S. Akinwonmi and A. Mohammed says 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 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 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 tyres along the road. The designed motorised jack will also save time and requires less human energy to operate. The design when adopted will effectively curb the problems associated with Ergonomics - which is a fundamental concept of design process. And they concludes that The limitation of this design is that it is only applicable to vehicles not weighing above 1000 kg. [3]

3. Conclusion

Electric Car Jacks are the ideal product to push, pull, lift, lower and position loads of anything from a couple of kilograms to hundreds of tones. Their 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 desirably 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 3,000-4,000 pounds 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 the electric Car jack will prove to be beneficial in lifting and lowering of loads. And here in this electric car jack the driving mechanism is replaced with bevel gears as the chain and sprocket mechanism has many disadvantages.

4. References

1. Design and Manufacturing Electrical Bottle Car Jack D.C. 12 volt. ISSN 0976-6359.
2. Modification of the Existing Design of a Car Jack. ISSN: 2141-7016.
3. Automated Car Jack. ISSN 2277 – 4106.