



DESIGN AND PRODUCTION OF A MULTI-NUT REMOVING AND TIGHTENING TOOL FOR A CAR WHEELS

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Abstract: The purpose of this project is to design and construct a four-wheel nut removing tool capable of tightening and removing four nuts without the usage of human energy. As India's standard of living has risen, the majority of families now own at least one automobile, allowing them to move quickly and easily. It is a basic prerequisite in today's world. When a tyre needs to be replaced, the car comes with a jack and a tyre wheel nut remover. The primary purpose of this project is to easily remove and tighten vehicle fasteners with minimal effort and in less time. In this paradigm, the primary gears are the secondary gears. The main gear is in the model's middle.

The secondary gears are linked to the primary gear. The primary gear is known as sun gear, while the secondary gear is known as planetary gear. The power source is supplied from the battery, and a switch is provided to allow the tool to move clockwise and anti-clockwise for tightening and loosening the car power driven bolts.

Keywords: loosening and tightening nut, tedious operation, and so on....

I. INTRODUCTION

A vehicle is an essential machine in most people's daily life. Every family now possesses at least one car to facilitate and speed up mobility. Each vehicle has a T-nut wrench and a car jacker, which is tough for a lady or a teen to use to open the nut on their automobile. Tire difficulties are among the most common automotive issues. If a problem occurs with the car tires, the user must remove them and rectify the problem. It is also difficult for a car user, particularly a woman, to remove the tire's nut.

The downsides are the waste of time and the required force. There is no simple tool for removing nuts in the Indian or other countries' vehicle markets. The time it takes to open a car tire nut is excessive, and the car user's time is lost due to the use of excessive force, which is especially difficult for female drivers. To save labor and time, a tool that removes four tire nuts in one motion with decremented force applied has been developed. CAR is no longer an expensive icon.

It is required in every family. Automobiles are required by people for a variety of reasons. Some of them are going somewhere traveling easily, and so forth. A tire puncture is the most common problem faced when driving. To replace the punctured tire, a spare tire was necessary. As a result, if such a situation develops, drivers must be familiar with tire replacement techniques.

To change a tire, only a few abilities are required. Almost every car comes equipped with tire replacement tools, such as an L-shaped nut remover and a jack supplied by the manufacturer.

II. AIM OF PROJECT

This paper describes how to design and construct a multi-nut remover utilizing a lathe, grinding wheel, drilling machine, and taps.

- The material used will be reliable for an excellent result.
- To make it simpler and easier to machine the parts. - Because the construction and mechanism are basic, attachment with wheels is easy to understand.

III. LITERATURE REVIEW

Sr.no	Title of Paper	Author	Work	Result
1	Development of an adjustable multi nut tighter or remover for car tyre	Oluwole Timothy OJO, Temitope Olumide OLUGBADE,	This study was aimed at designing and fabricating a device that will remove and tighten four-wheel nuts of car tyre simultaneously. Sometimes the vehicle tyres develop some problems and there is the need for the driver to remove the tyres and fixes the problem.	To eliminate the time waste and high force needed, a device that is manually operated by hand due to the epileptic supply of electricity have been devised to remove four-wheel nuts at a time with reduction in the force applied for the operation.
2	The Detachment of Wheels from Commercial Vehicles	John A. Searle,	Author of this paper focuses on the forces imposed by cornering reduce the compressive forces under the wheel nuts. In-plane forces, such as the ground reaction, may then be sufficient to overcome the frictional hold.	The reduction of clamping force is larger when the stud is stiff. Dimensional inaccuracies make a key contribution to the problem. They arbitrarily change the designed flexibilities, they introduce fitting stresses and they create the difference in perimeters necessary for wheel nut loosening.
3	Design & Fabrication of Four Wheeler Opening Spanner	Nitesh L. Gomase Pankaj R. Chawhan Abhishek V Thakre Ravindra T	study of this paper is four wheeler opening spanner. known torque-responsive power screw drivers which are driven by electric motors or pneumatically have a relatively high speed of rotation in order to obtain a short screwing in time	The limitation of the degree of tightening of the screw is usually effected by means of ratchet couplings or striking mechanism. When screwing in expansion screws, this degree of tightening must be kept constant within very narrow, since these screws, are stressed almost to their yield point during screwing in.
4	Design and Fabrication of Car Wheel Multi Nut Remover	Mohammed Abdul Junaid, Mohd Yousuf Ahmed, Mohammad Abbas Khan, Syed Hyder	In this Paper authors said about that the virtually every car has a tire replacement tools such as the L-shaped nut remover and jack supplied by the manufacturer Multi nut remover is a special purpose tool used to screw and unscrew the four nuts of tire in one time less effort	With the help of multi nut remover we can screw and unscrew all the nuts simultaneously by applying minimum torque. Gears are arranged for sprockets in such a manner that when torque is applied at main Gear, we will get the same torque as output for combined operation

IV. MATERIALS LIST

Sl. no	Name of the parts	Type of Material	Quantity
1	Gears	Mild steel	5
2	Shafts	Mild steel	5
3	Bearings	Mild steel	10
4	Nut bits	steel	4
5	stand	Cast iron	1
6	wheel	Rubber & aluminium	1
7	Metal plates	Iron	2
8	Bolts	Cast iron	4
9	Hand operated lever	Iron	1

Diameter of the pinion (D_p) = 54mm

Number of teeth's on pinion (T_p) =22

Diameter of the gear (D_G) =64 mm

Number of teeth's on gear (T_G) =24

Bearings:

Type of Bearing = Ball bearing

Bore diameter = 16mm

Diameter of the bearing =40mm

Shaft:

Shaft type =solid shaft

Diameter of the shaft =16mm

Length of the shaft = 150mm

Metal plates:

Shape of the plate

= Square

Size of the plate =300*300mm

Thickness of the plate=10mm

Wheel:

Pitch circle of the wheel = 112mm

Nut to nut distance = 80mm

Nut size =19mm

Stand:

Height of the stand = 170 mm

Length of the stand = 300mm

Width of the stand =150 mm

V. CALCULATIONS

All engineering efforts must begin with some concepts, whether they are original or not, which are then converted into specific plans for their execution in the form of goods. This is what design engineering is all about. The ultimate success is dependent on careful consideration of how the product will be created and used, as well as the design engineering's attention to detail. This applies equally to a small redesign of an existing product as it does to the most revolutionary one. The project model was created using UNIGRAPHICS. This is also known as NX software. It is CAD/ CAM software.

A. Linkages

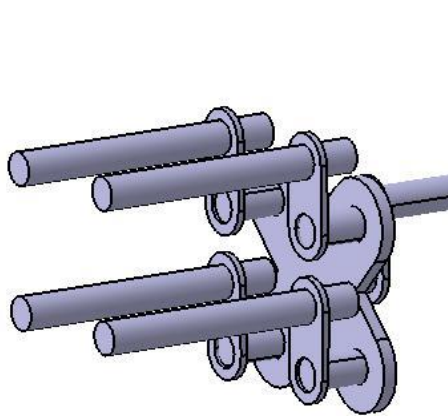


fig .1

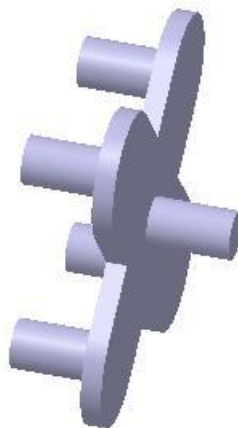


fig.2

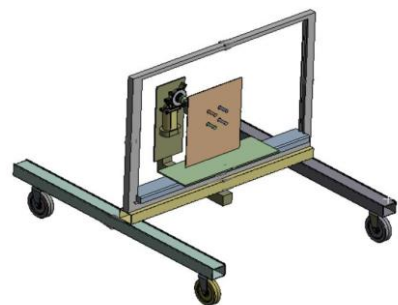


fig.3

Properties of Outline Row 3: Structural Steel			
	A	B	C
1	Property	Value	Unit
2	Material Field Variables	Table	
3	Density	7850	kg m ⁻³
4	Isotropic Secant Coefficient of Thermal Expansion		
6	Isotropic Elasticity		
7	Derive from	Young's Modu...	
8	Young's Modulus	2E+11	Pa
9	Poisson's Ratio	0.3	
10	Bulk Modulus	1.6667E+11	Pa
11	Shear Modulus	7.6923E+10	Pa

fig.4

VI. DESIGN FOR COMPOUND SHAFT

Normal load acting on pinions tooth (W_n) = $WT / \cos\Phi = 3070 / \cos 20 = 7522$

Weight of gear (W_g) = $0.00118 * T_g * b * m^2 = 0.00118 * 24 * 10 * 2.452 = 1.7 \text{ N}$

Therefore, resultant load on gear (W_R) = $(W_n^2 + W_g^2 + 2 * W_g * W_n * \cos\Phi)^{0.5} = (7522^2 + 1.7^2 + 2 * 7522 * 1.7 * \cos 20)^{0.5} = 7523 \text{ N}$

Assuming pinion is overhung on shaft at 30 mm Bending moment on shaft due to W_R is M Then we take $M = W_R * 30 = 7523 * 30 = 225707 \text{ N-mm}$

And twisting moment on shaft due to W_T is $T = W_T * D_g / 2 = 3070 * 59 / 2 = 90565 \text{ N}$

Equivalent twisting moment is $T_e = (M^2 + T^2)^{0.5} = (225707^2 + 90565^2)^{0.5} = 243198 \text{ N-mm}$

D_g be the diameter of gear shaft Then

$T_e = \pi * \tau * d_g^3 / 16$ (τ is taken from data hand book)

$d_g = 243198 * 16 / (\pi * 250)$

$d_p = 18 \text{ mm}$

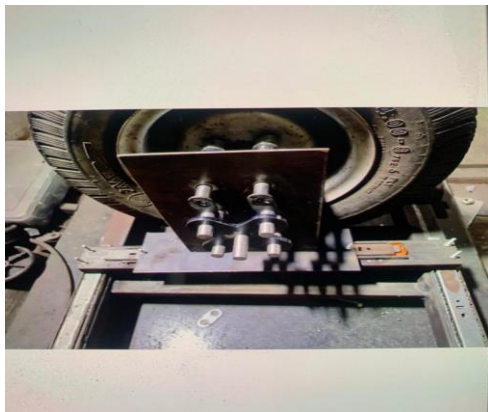


fig. a



fig. b

fig .5 final part of fabrication

VII. RESULT

Each vehicle manufacturer gives equipment like a L wrench and a jack, but using these tools to remove nuts quickly and easily requires skills. But a vehicle all-wheel nut remover and tightener enables the driver to quickly and efficiently remove all nuts at once while using less energy. It will take a long time to remove the nuts in the case of an emergency puncture in the ambulance's tires. In these situations, a vehicle multi-wheel nut remover will be more helpful. All of the nuts are torque-removed by the vehicle's multiple wheel nut remover and tightener.

VIII. CONCLUSIONS

All and all we have concluded that, The multi-nut tightener is used to tighten multiple nuts in a single use. They are mostly used to tighten and remove the wheel nuts and hence, the effort required for removing/tightening the wheel is very less. The Multi-nut tightener can be used in automobile units and manufacturing units. The weight of the model can be reduced by using a light weight material base plate.

IX. FUTURE SCOPE

- i. Because the multi nut remover is specific to a specific model of car, we will modify the tool to be adjustable and suitable for any model of car in the future.
- ii. In future development, we will aim to lower the cost of the model.
- iii. Because the model is hefty, we will endeavor to lower its weight in the future by fabricating it using other lightweight materials.
- iv. Because the model's operational energy is mechanical energy, we will try to arrange a motor to rotate the tool in the next phase.

X. REFERENCE

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