

FOUR WHEELER MULTI NUT WHEEL CHANGER

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ABSTRACT

Essentially, most of cars use 4 to 5 lug nuts to fix wheels on cars. The traditional way to change a car's wheel tire is to unscrew the locking lug nuts one by one using a lug wrench. However, sometimes it can be so exhausting and time consuming.

In this project our aim is to design and fabrication of four wheel nut removing hand operated tool for tightening and removing of four nuts in one stroke. With the increment of number of car on the road, the number of cars problem due to tyre failure has increased. Often, the car is provided with tyre wheel nuts remover and jack for instance spare tyre replacement. Nevertheless, due to difficulty in applying torque to remove nut and to save a time. We develop tool having a gear planetary mechanism. In our project we are tried to focus on the minimization of human effort for fixing all for nuts of 120mm PCD wheel in one time. The main objective of work is to develop a single tool, which can be made use during assembling and disassembling of wheels in automobiles. It can be successfully used as standard tool irrespective of the model of the vehicle. Also it can be used garages, workshops and service stations. The remover is designed to be ergonomic to be used, easy maintenance, easy storage, easy to handled and able to remove all nuts at once.

Keywords: Automotive, wheel nuts, torque, torque wrench, tyre, wheel PCD, gear mechanism

1.INTRODUCTION

The main objective of this project is to atomize the labour work in tightening or loading the nuts one by one. This project focuses on the minimization of human effort and time consumed for fixing all four nuts of the four wheeler tire with a single stroke of lever by using multiple operated spanners. This is achieved by developing a planetary gear mechanism as such occurs which reduced the time and effort for the above mentioned task that is losing or tighten the nut of the car wheel. To avoid time wasting and a lot of energy used to change the tyre, a special Hand operated tool is designed and fabricated to allow driver or machine to remove four nuts of wheel at once with less energy consumption. The design is based on standard PCD of 120mm for most of cars available. In this type of tire nuts car, the nut removal steps, type tools needed, basic gear theory, spur gear terminology, standard gear calculation, standard spur gear tooth, the project calculation, and material specification will be

analysed and shown. This information has been collected from books, journals, company's websites, and market survey.

An automobile is one of the most basic and fascinating things that one could own. Cars have now become a need and it is not only the symbol of luxury anymore. Car maintenance, for example, is one of the key factors in determining its life span. This includes a basic knowledge of changing the car's tyre. But replacing a punctured tyre has always been a difficult task. Every car manufacturer provides tools such as L wrench and jack but easy and fast removal of nuts using these tools requires a skilled person. We designed a remover as shown in Fig.1 in 2013 with 120 pitch circle diameter to replace L-shaped nut removers and jack which allows driver to remove all nuts at once with less energy consumption and save time. Several static load analyses were performed in order to find safety factor of design. Here, torque applied was reduced by **33%** and also reduction in time taken is **53%**. The fabrication of all wheel nut removers tool was completed by milling, welding and fitting process. With support, impact wrench can also be used of 5.5 HP air compressors.

II.PROBLEM STATEMENT

During tyre removing Operation the person was supposed to remove individual nuts to remove the tire which has very high fatigue level.

So Our Intention was to remove all nuts at a time, to reduce human fatigue level.

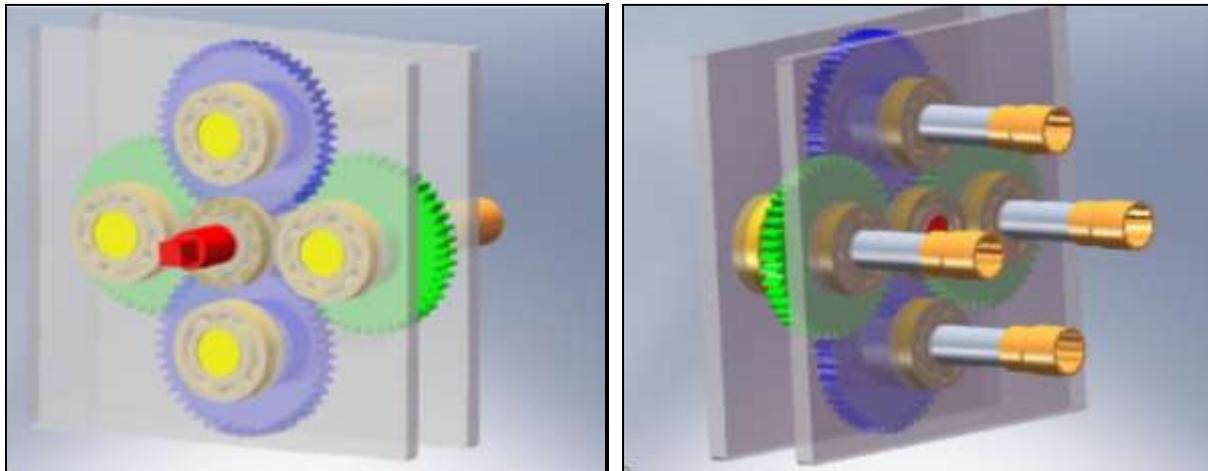
Multi-nut opener is a device designed at developed for loosening or tightening of wheel hub nuts for

1. Tata Indigo – most common car used in India
2. And Similar PCD wheels

III.DESIGN PARAMETERS

- PCD (Pitch Circle Diameter) = 120mm
- Common nut sizes = M18
- Torque required, $T = 130 \text{ Nm}$ (4 nuts).
- Average force by human, $F = 500\text{N}$.
- Length of handle, $LH = 500 \text{ mm}$.
- Gear material = EN8 (Mild steel)
- Module, $m = 2.5 \text{ mm}$.
- Pressure angle = 20°
- $Dp+Dg=120\text{mm}$

CAD MODEL



COMPONENTS

- ✓ Gears
- ✓ Bearings
- ✓ Shaft
- ✓ Plates
- ✓ Hand Lever

Gears:



A gear or cogwheel is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape. Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, called a rack, producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a crossed, belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

Bearings



A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least three races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other. Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races

Base Plate



Steel is an alloy of iron and carbon and other elements. Because of its high tensile strength and low cost, it is a major component used in buildings, infrastructure, tools, ships, automobiles, machines, appliances, and weapons. Iron is the base metal of steel. Iron is able to take on two crystalline forms (allotropic forms), body centered cubic (BCC) and face centered cubic (FCC), depending on its temperature. In the body-centred cubic arrangement, there is an iron atom in the centre of each cube, and in the face-centred cubic, there is one at the center of each of the six faces of the cube. It is the interaction of the allotropes of iron with the alloying elements, primarily carbon, that gives steel and cast iron their range of unique properties.

Shaft



A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it. The material used for ordinary shafts is mild steel. When high strength is required, an alloy steel such as nickel, nickel-chromium or chromium-vanadium steel is used. Shafts are generally formed by hot rolling and finished to size by cold drawing or turning and grinding.

Following operations were performed to develop the project -

- ✓ Cutting
- ✓ Finishing
- ✓ Welding
- ✓ Polishing

IV. TESTING

In order to analyse the efficiency of manufactured all-wheel nut remover, testing was performed using the various available nut remover tools such as Lug wrench, Pneumatic gun and Four wheeler multi nut wheel changer

Procedure to be followed during testing -

1. Firstly, the torque required for each nut using lug wrench will be tabulate using the torque measuring equipment. Now, the time taken for removal of all nuts using each of equipment will not down.
2. Then, the nuts are again re-tightening using all the tools mentioned tools and time required for the same was noted.
3. Finally, all the results were analysed and conclusion was drawn. The results of test proved that the “**Four wheeler multi nut wheel changer**” could efficiently remove all the nuts simultaneously. Also, the tool is efficient and with some required modifications could be efficiently used in future.

V. FUTURE SCOPE

It act as a convenient and simple method for tyre replacement process thus It is more suitable in using this setup for tyre removal in every vehicles for reducing the time consumed and for reducing the man power wasted for the tyre replacement and to overcome the emergency situations. Thus the vehicle multi wheel nuts remover and tightener can be used in all automobile shops and can be carried in each vehicle for instant tyre replacement which saves lot of time and energy for every person.

VI. CONCLUSION

The design and fabrication of nut removing tool is proposed. The static load analysis is performed. The fabrication of tool is completed by Shaping, welding and fitting processes. The tool is successfully

manufactured and fully functional either tested manually using lever. From the results of analyses and experiments, the tool is possible to be improved and prototyped for mass production. For future development and improvement of the tool, light and strong material is expected to be available and applied.

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