

POWER OPERATED AUTO MULTI NUT OPENING MACHINE

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ABSTRACT

This project aim is to design and fabrication of four-wheel nut removing tool for tightening and removing for four nuts without human energy. As the standard of living in India has increased, most of the families have at least one automotive, car to move quickly and easily. It has been basic need of today's world. Car has been provided with tire wheel nuts remover and jack for replacement of tire when needed. The Remover is design for commercial and domestic use as well. It is easy used, easy maintenance, easy storage, easy handle and can remove all nuts simultaneously.

The Main purpose of this project is to easily loose and tight car nuts simultaneously many efforts and in less time. In this model, the primary gears are the secondary gears. The primary gear is mounted at the centre of the model. The secondary gears are meshed with the primary gear. The Primary gear is known as sun gear and secondary gear are known as planetary gear.

The Power resource is obtained from battery and in addition to it switch is provided to obtain clockwise and anti-clock wise motion of the tool for tightening and loosening the nuts of the car power operated auto multi nut loosening and tightening machine' is the machine which is generally used to open and close the wheel nut of four-wheeler. By using this machine, we can reduce our time required for opening and closing application of wheel nut. This machine is also helpful to reduce human effort for opening and closing application. This machine also operated on a car battery power if use D.C. motor in this machine.

The Electric power can be given by the battery. The operator should lift the model and place at the appropriate place to tighten or lose the nut. The motor can be operated so, this machine is more economical. This kit can be used to remove nut of PCD 114.7mm. The Torque which is needed to apply remove one nut can be used to remove all nut using planetary gear arrangement.

Keyword: - *loosing and tightening nut, Time consuming Operation, etc....*

1. INTRODUCTION

'POWER OPERATED AUTO MULTI NUT OPENING MACHINE' is easy to use and is designed and developed to reduce the time required in opening and closing the applications of wheel nut. It is the machine which is generally used to open and close the wheel nut of four-wheeler.

This machine can be operated on a car battery power if use D.C. motor in this machine. So, this machine is more economical and helpful to reduce human efforts in opening and closing the application. It is portable and easy to handle. The weight of this machine is less so we can easily lift the machine.

To avoid time wasting and lots of energy used to change the tire, a special tool is designed and fabricated to allow machine to remove four nuts of wheel at once with less energy consumption. The design is based on the standard PCD 114mm for most cars available.

A lot of research activities have been carried out on gears mechanism since very first gear was manufactured.

The tool used is the mild steel. The design of this product is demanded to be smaller and compact to make it easy and comfortable for the users.

The New gear ratio has converted the torque to 3.45 Nm that can be supported by power windows motor that can be used to help the 114 PCD car users.

The time to open a car tire nut is too long and has waste car users time with utilization of high force that is hard for women users. Car is not a luxury symbol. It is a need for every family. People need car due to several specifications.

2. OBJECTIVES OF THE PROJECT

‘POWER OPERATED AUTO MULTI NUT OPENING MACHINE’ is intended to perform the following function:

1. Improve and optimize the tire nut removal with 114PCD cars.
2. To replace the mild steel material to other material
3. New gear ratio and smaller square design of product

3.ACTUAL PROJECT DIAGRAM

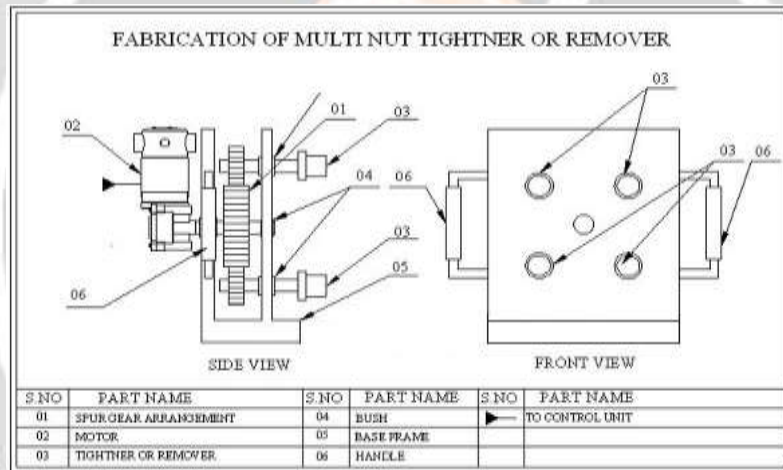


Fig -1: Actual Project Diagram

4. WORKING

This machine is used to open and close the nut of four-wheeler simultaneously. In this machine, DC motor is used which run on battery power. When battery supply mode is on then motion of motor is given to the worm and worm wheel. At worm wheel the speed of motor is controlled and controlled speed is passed towards the sun gear through the main shaft. Planet gear which is mounted on sun gear gets rotational motion from sun gear and is also gets rotated and due to this wheel socket gets mounted on planet gear. When socket rotates clockwise and anti-clockwise the nut of wheel gets tight or close.

It works on the principle wheel is a very frequent job performed by the operator. Normally each of the four nuts is losing/tighten individually by simultaneously applying Rotary motion with gear arrangement either with the help of mechanism developed that one can loosen or tight all four nuts at a time with motor operated multi nut spanner. This is done by adjusting the five gears between two side plates operated only motor or input pinion shaft.

4.1Working Diagram Of Motor :

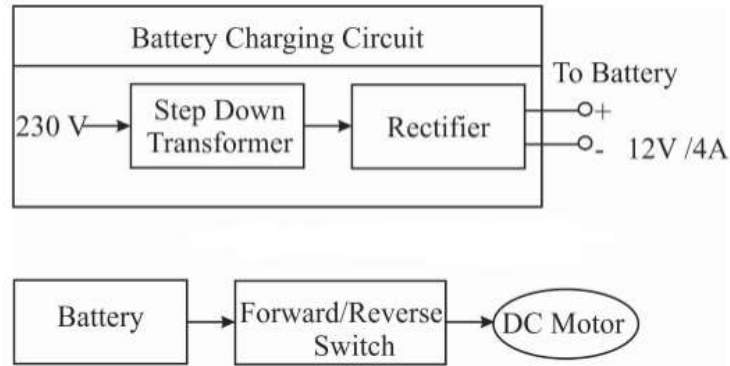


Fig -2: Working Of Motor

5. DESIGN PROCEDURE

5.1 DESIGN OF DRIVER HANDLE:

Material selection:

Ref: PSG (1.10 & 1.12) + (1.17)

Table 8.1 Design Of Driver Handle:

Designation	Ultimate tensile strength N/mm ²	Yield strength N/mm ²
EN 9	650	480

Cross section of link may be determined by considering lever in bending;

The linkage has a section of (32 x 10) mm

Let,

t- Thickness of link

B- Width of link bending moment

Section modules, $Z = 1/6 tB^2$

$$FB = m/z = \frac{PL}{1/6tB^2} = 6PL/ tB^2$$

Maximum effort applied by hand (P) = 100 N

$$FB = 6 * 100 * 120/ 10 = 322$$

$$FB = 7.03 \text{ N/mm}^2$$

As $F_{Bac} < F_{Ball}$

Thus, selecting an (32*10) cross section for the link.

5.2 DESIGN OF DRIVER SHAFT:

Material selection:

Ref: PSG (1.10 & 1.12) + (1.17)

Table 8.2 Design Of Driver Shaft

Designation	Ultimate Tensile Strength N/mm ²	Yield strength N/mm ²
EN 24	800	680

ASME code for design of shaft

Since the loads on most shafts in connected machinery are constant, it is necessary to make proper allowance for the harmful effects of load fluctuations

According to ASME code permissible values of shear stress may be calculated from various relations.

$$= 0.18 * 800$$

$$=144 \text{ N/mm}^2$$

OR

$$F_{\text{max}} = 0.3 \text{ fyt}$$

$$= 0.3 * 680 = 204 \text{ n/mm}$$

Consider minimum of the above values

$$F_{\text{max}} = 144 \text{ N/mm}^2$$

Shaft is provided with the key way; this will reduce its strength. Hence, reducing above value of allowable stress by 25%.

$$F_{\text{max}} = 108 \text{ N/mm}^2$$

This is the allowable value of shear stress that can be induced in the shaft material for safe operation.

5.3 TO CALCULATE DRIVER SHAFT TORQUE

It is driven by means of handle 120mm long and maximum effort applied at the end of handle is 100N, hence torque is given by the relation,

$$T = F * r$$

$$= 100 * 120$$

$$= 12000 \text{ Nm}$$

$$\text{Design} = 12 \text{ Nm}$$

6. ADVANTAGES

1. Multiple nuts are tightened and loosened at a time.
2. Low time is required for operation.
3. Power operated function, reduces human efforts.
4. Motor can be DC, thus, car battery can be used as source of power.
5. Portable, hence is to use.
6. Low cost of manufacturing.

7 LIMITATION:

1. The power of battery varies speed of this machine.

8.APPLICATIONS:

Application of this machine is simultaneous loosening and tightening of wheel bolts of the following cars,

1. Maruti Suzuki Alto
2. Maruti Suzuki Zen
3. Maruti Suzuki Versa
4. Maruti Omni
5. Toyota Innova
6. Toyota Corolla

9.CONCLUSION

'POWER OPERATED AUTO MULTI NUT OPENING MACHINE' is generally used to open or close nuts of wheel of our vehicle simultaneously. By using this machine, we save our time for opening and closing purpose of wheel nut.

The design and fabrication of nut removing tool is proposed. The static load analysis is performed. Shaping completes the fabrication of tool. 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 for future development and improvement of the tool, light and strong material is expected to be available and applied.

This machine is also having less weight so operating purpose of this machine is easy and simple. The motor is used for operations so by using this machine human efforts can be reduced by some percent and operations made easier by other conventional operating machines. We can also use battery power for carrying this operation and use our AC supply for this operation.

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