"TIME REDUCTION IN WHEEL CHANGING ASSEMBLY"

Anand patel[1], Mahipat Padhiyar[2], Madhvesh Nariya[3].

[1]Student, Mechanical department, Vadodara Institute of Engineering, Gujarat,
India
[2]Student, Mechanical department, Vadodara Institute of Engineering, Gujarat,
India
[3]Student, Mechanical department, Vadodara Institute of Engineering, Gujarat,
India

ABSTRACT:

Today's young generation feels crisis of time. There are thousands of resources available for transports. Four wheeler vehicles are most popular among all. With growth of usage and technologies, it is usual that there must be problems too. One of the issues is the "Tire Failure". Right now, to replace a wheel is a tedious manual work. One has to open all the nuts of wheel. For that operation lots of force are required and normally women and incapable persons avoid this operation and tow the car to the nearest mechanics. And this process consume lots of time. So here we are designing a device to solve this problem (Ø100mm). Car Manufacturer Company can provide this mechanism as a tool with. We can open easily all the nuts at a single time and effort with the use of this tool. So finally workshop time is all reduce after use of this tool in operation of opening the entire nut turn by turn. The tool is designed to be ergonomic to be used, easy maintenance, easy storage and easy to handle.

Keyword: *tire, opener, nuts remover, multi nut.*

1. INTRODUCTION

Four wheelers are not only symbol of luxurious thing. There are several uses of four wheelers. Tire failure problem occurs in most of the vehicles during travelling. Drivers need to know basic knowledge of Wheel replacement procedure if such problem occurs. In order to change the flat tire, one requires minimal skills. While operating this procedure with the help of simple L wrench there are lots of thing to be remember. Like, one need to open and fit tire with opening opposite side nut (crossed bolts) and apply same force for all the nuts. But using this tool driver simply needs to apply this to nut and apply force on input point. Other removing tools are also available for same process but they have not control on force applying even after nuts exceed the perfect tightness. This over tightening can be reason for thread problem in nut – bolt assembly. So, to reduce this problem here we are using engaging and disengaging pin that transfers the rotational force to the nuts until it is tightly fit. Then after it will disengage from input shaft so power cannot transfer to the nut and it will not harm to any thread system. The main function of our system is to open the all nuts at a time by single effort to reduction in time of operation. So the heart of the system is engaged and disengaged assembly which is used on output shaft.

2. PARTS

- Spur gear (P.C.D=60)
- Pinion gear(P.C.D=37.5)
- Spring(Ø 35)

- Notch(No.19)
- Bearing
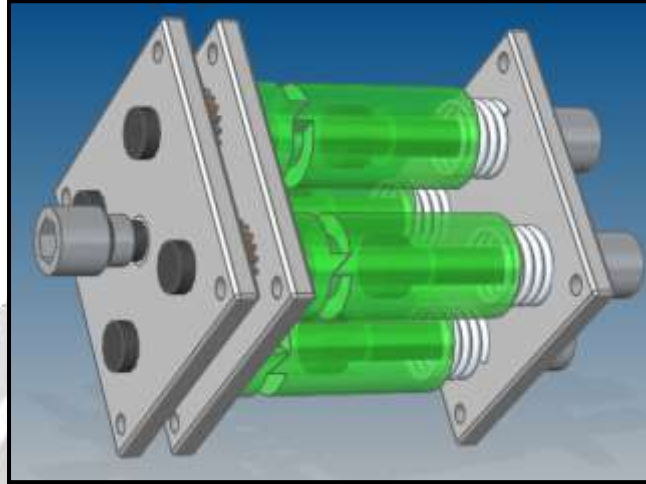- Engage disengaged pin.

3. CAD MODEL

Fig- 1 : Cad model of mechanism.

4. WORKING PRINCIPLE

Normally each of the four nuts is losing/tighten individually by simultaneously applying the spanner/lever, Either with the help of mechanism developed that one can loosen or tighten all four nuts at a time and at the single stroke of the hand operated or motor operated lever. This is done by single effort. Working steps are as below:

1. When we apply the tool to the wheel, all nuts fit in the notches of tool located at the end. Applied rotational force on the input shaft rotates the spur gear and due to engaging position, pinion gear also rotates. Power will transfer to the input shaft to output by engaging and disengaging pin.
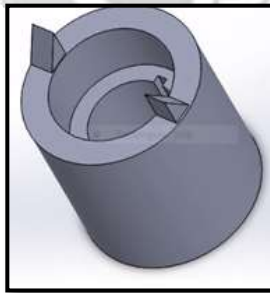
2.

Fig- 2: Female part of lock pin.

Fig – 3: Male part of lock pin.

3. Engaging-disengaging pin consists male female parts as shown below in fig. Female part engages with male part due to spring force. Spring constant is calculated with respect to force required for nut tightening because it depends on nut-bolt assembly. Until the nuts reaches tighten position on bolts, rotational power will transfer to the nuts. When nuts exceeds right position with full tightness it will resist the rotation force comes in output shaft and will compress the spring after achieving the spring constant. Later pin will not allow rotational force to be transferred on output shaft and notch will not rotate.

4. In reverse procedure, first of all process notch fits on the nuts and rotational power is transferred on shaft and it will loss. Above problem is not considered in this process.
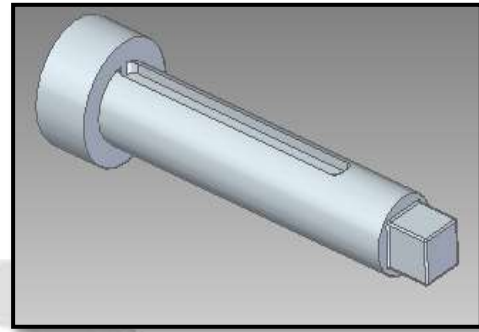

Fig- 4: Gear & pinion arrangement.

Fig- 5: Output shaft.

5. DESIGN CALCULATIONS

5.1 Design Parameters:

- PCD (Pitch Circle Diameter) = 100 mm.
- Nut sizes = M18.
- Gear material = Mild steel.
- Pressure angle = 20˚

5.2 Gear Parameters:

Table- 1 : Gear parameters

SPECIFICATIONS	GEAR (MM)	PINION(MM)
Module	1.5	1.5
Pitch circle diameter	60	37.5
Outer diameter	63	40.5
Number of teethes	40	25
Addendum height	1.5	1.5
Dedendum height	1.875	1.875
Bore diameter	14	14

5.3 Engaging Pin Parameters:

- Outer diameter= 50mm
- Bore diameter =19mm
- Key dimensions=6*6*70mm
- Slope angle=45degree

5.4 Spring Parameters:

- Wire diameter meter=4mm

- Spring inner diameter=23mm
- Numbers of turns=5
- Material= spring material
- Ground ends & open coiled.
- Spring force =Tighten torque= 85 Nm.

6. ACTUAL MODEL

Fig- 2 : Actual model with carrying handle

Fig- 3 : Top view actual model

7. RESULTS

1. The design calculation of multiple operation spanners for four wheeler vehicle with Ø100mm PCD is done efficiently.
2. Nuts will be replaced on the faster rate compared to any conventional spanners. The human effort required for operating the spanner is relatively same or even reduced.
3. Can be successfully used as a standard tool irrespective of the models of the vehicles. .
4. It is recommended that the multiple operated spanners, if fabricated will prove more beneficial for installation of wheels while assembling or replacement in four-wheelers on road and workshops also.

8. CONCLUSION

1. The multi nut remover is used to remove multiple nuts in a single effort. These are commonly used to remove the wheel nuts and hence the time required for replacement of the wheel is very less.
2. With the help of this design we can reduce the nut-bolt thread failure.
3. The Multi nut remover 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. The wheel nuts can be easily removed using the multi nut remover.

9. FUTURE SCOPE

The modification in the existing set up for multi operated spanner may be carried out by the following ways.

1. Improvement in the system by making automatic operation with the help of electric motor system which is faster and smooth.
2. To design and fabricate the complete assembly of the multiple operated spanner to be fitted to all vehicle wheels by adjusting pitch circle diameter by making pinion gear small or large as per wheel's pitch circle diameter.
3. By adding different gear arrangements in such a manner that it can be operated manually by hand lever with lowest power requirement. The weight of the model can be reduced by using a light weight material of base plates.
4. It is also suggested to design it with some other mechanism to reduce the noise.

10. REFERENCE

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