

Tire Multi Axial Nut Setter

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Abstract - Many Female drivers, physically challenged people and elders face a problem in opening/tightening the car wheel when it is punctured. In order to overcome this problem a very simple product can replace the whole tool kit which is used for tire replacement. Today's world is of the fast and rapid process. Everybody wants to save time and effort by inventing some newer technique or mechanism and implement them in the daily life. The objective of this paper is to atomize the labor work in tightening or losing the nuts one by one. This is achieved by developing a planetary gear mechanism as such ours which reduced the time and effort for the above mentioned task that is losing or tighten the nut of the car wheel. If we consider a four wheeler remove and replace the car wheel is a very frequent job performed by the worker. Normally each of the four nuts is removed/tightened individually by simultaneously applying the spanner/lever, most of the families have at least one vehicle, typically, car, to move easily and quickly. With the increment of the number of cars on the road, the number of car problem due to tire failure has increased. Often, the car is provided with tire wheel nuts remover and jack for instance spare tire replacement. The obstacles are time waste and force needed. Based on the capability of torque application by these drivers, a vehicle all-wheel-nuts remover is designed. This wheel nut removal is working with a gear system usage to reduce the force needed to remove a one nut and directly remove all four nuts At same time. This paper may be has solved the four nut removal problem and force usage utilization..

one by one. This paper 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 ours which reduced the time and effort for the above mentioned task that is losing or tighten the nut of the car wheel.

1.3 Working principle:

Planetary gear box works on the principle of planetary movement. Each stage planetary gear box consists of a central Sun gear in gearing with exactly those three satellites around him, which in turn engaged with internal teeth of the external ring gear. As a rule, the ring gear is stationary and forms part of the Corps, the entrance shows the Sun gear and the output obtained from three planetary gears through the led. However, of these three members can be permanently, the second is controlled by the input and output can be obtained from the third element. Because of this flexibility, the planetary gearboxes have a wide variety and countless applications. As the total load is distributed on three planets, the treatment time of power of this type of transmission is very high compared to all other types of transmissions. Construction Planetary gear box works on the principle of planetary movement.

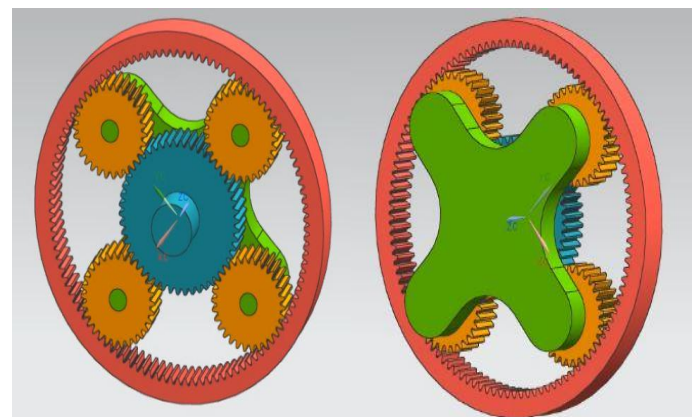
Key Words: CAD,GEAR,FEM & ANSYS.

1.INTRODUCTION

Design :

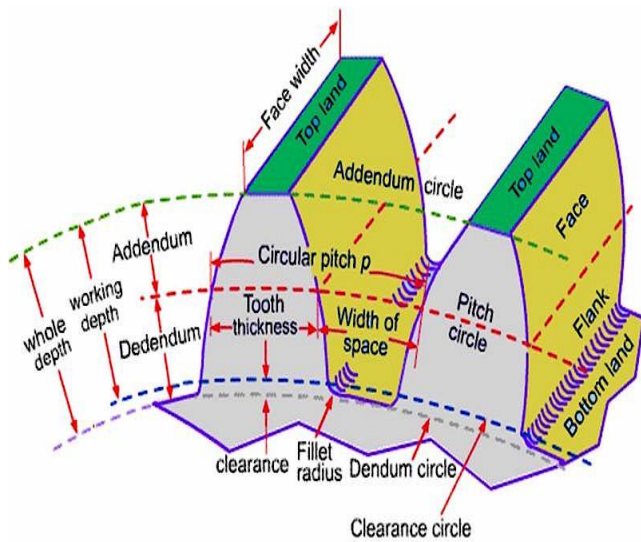
1.2 Need:

Many Female drivers, physically challenged people and elders face a problem in opening/tightening the car wheel when it is punctured. In order to overcome this problem a very simple product can replace the whole tool kit which is used for tire replacement. Today's world is of the fast and rapid process. Everybody wants to save time and effort by inventing some newer technique or mechanism and implement them in the daily life. The objective of this paper is to atomize the labor work in tightening or losing the nuts

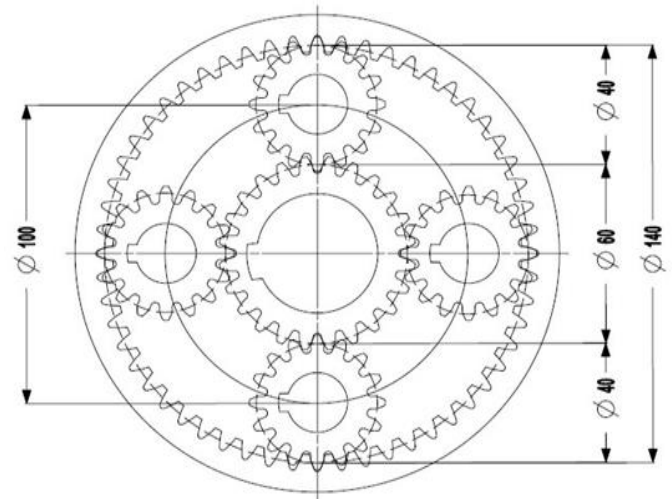


Planetary arrangement view-1
Planetary arrangement view-2

1.4 Calculation:

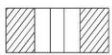


Ring gear

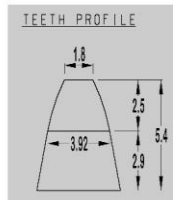
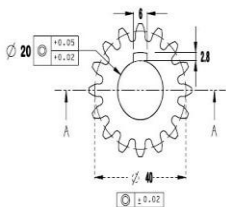


PLANET GEAR

SECTION A-A



PCD = 40
 MODULE = 2.5
 TEETH = 16
 OUTER DIAMETER = 45
 ADDENDUM = 2.5
 DEDENDUM = 2.89
 CIRCULAR PITCH = 7.85
 TOOTH THICKNESS = 3.92

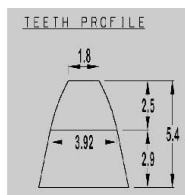
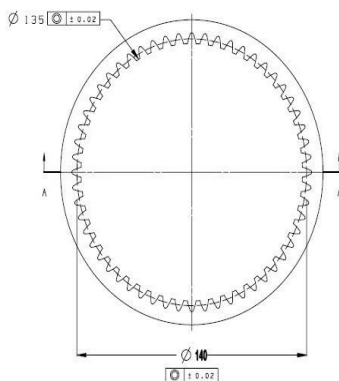


Planet gear

SECTION A-A



PCD = 140
 MODULE = 2.5
 TEETH = 56
 INNER DIAMETER = 135
 ADDENDUM = 2.5
 DEDENDUM = 2.89
 CIRCULAR PITCH = 7.85
 TOOTH THICKNESS = 3.92



1.5 P.C.D Calculation

- ✓ Maximum torque required for safe tightening of the Bolt/Nut for a car tire wheel as per standards = 90 Nm
- ✓ Length of handle = 720mm = 0.72m

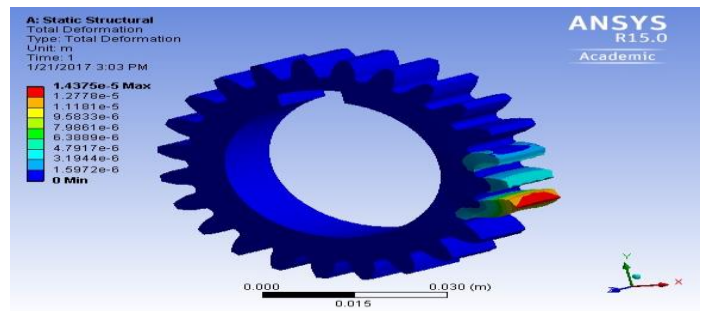
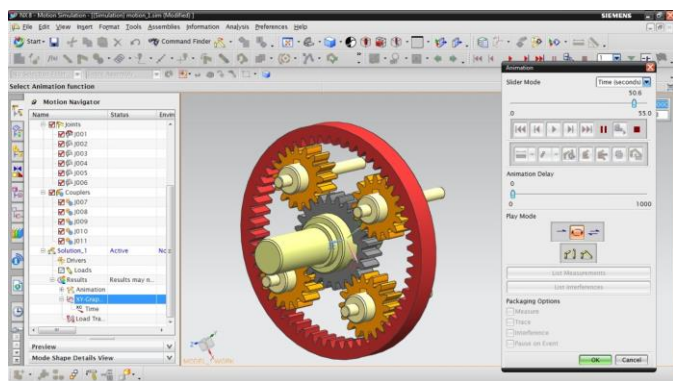
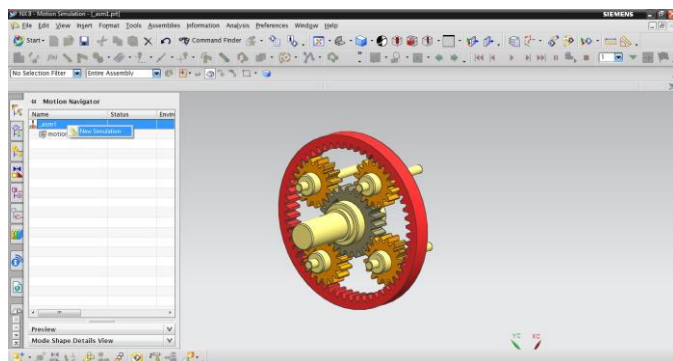
TIRE WITH 3 LUG NUTS:

- ✓ Here we are considering tightening of three Nuts simultaneously = $3 \times 90 = 270$ Nm
- ✓ Total Torque = Weight x Gravitational constant x Handle length
 $270 = \text{Weight} \times 9.81 \times 0.72$
 Weight = 38.2 Kgs
- ✓ Weight to be applied per hand = 19.1 Kgs

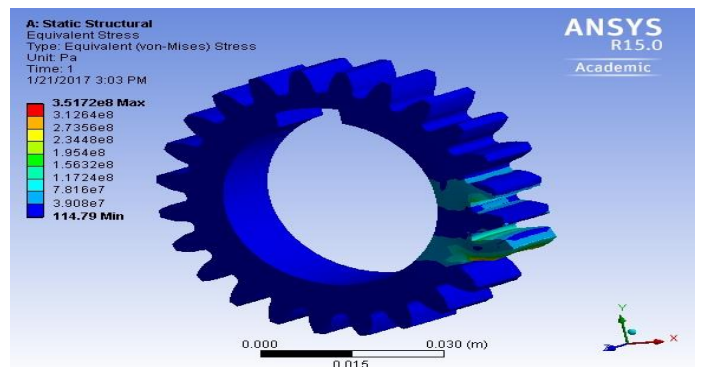
○ TIRE WITH 4 LUG NUTS:

- ✓ Here we are considering tightening of four Nuts simultaneously = $4 \times 90 = 360$ Nm
- ✓ Total Torque = Weight x Gravitational constant x Handle length
 $360 = \text{Weight} \times 9.81 \times 0.72$
 Weight = 50.9 Kgs
- ✓ Weight to be applied per hand = 25.45 Kgs

2. Motion Simulation



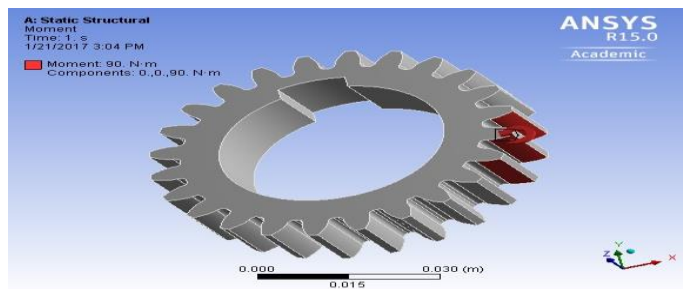
Sun gear deform in Ansys



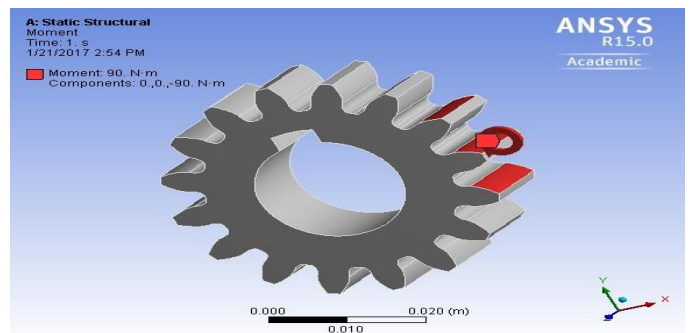
Sun gear stress in Ansys

2.2 FEM for PLANET gear:

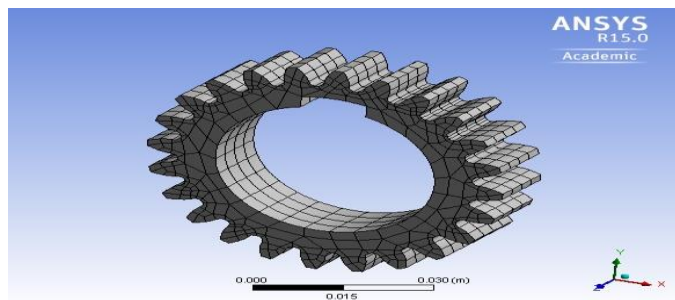
2.1 Analyzing:



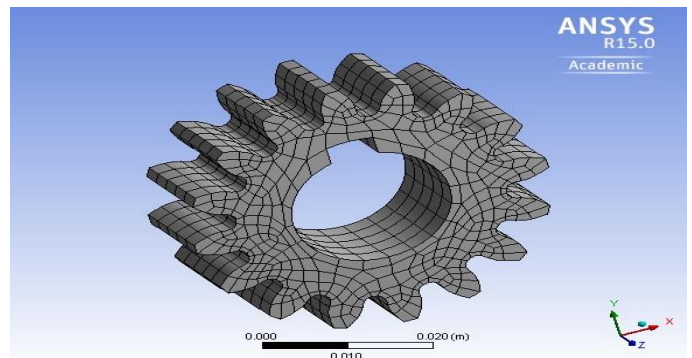
Sun gear forces in Ansys



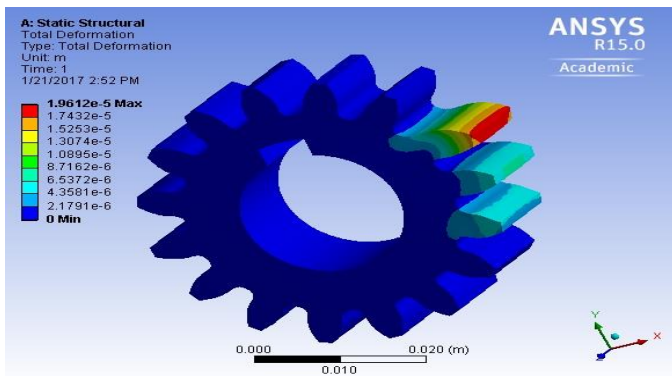
Planet gear forces in Ansys



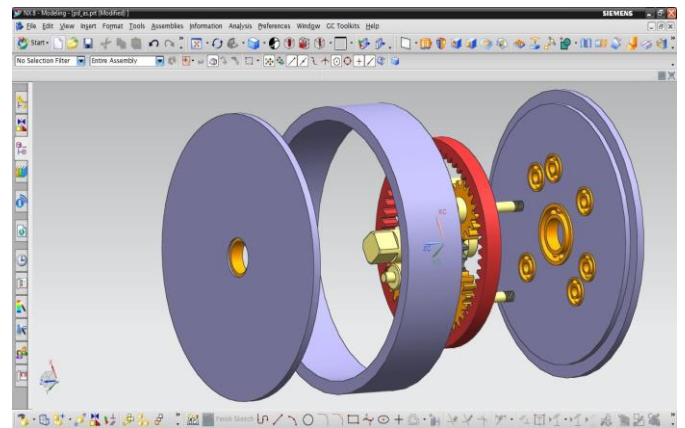
Sun gear mesh in Ansys



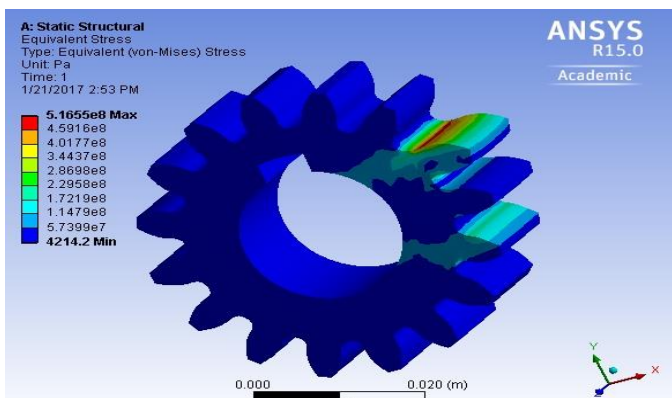
Planet gear mesh in Ansys



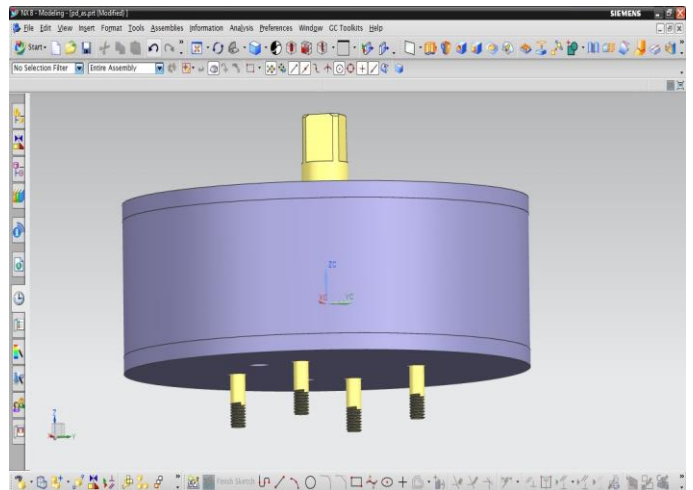
Planet gear deform in Ansys



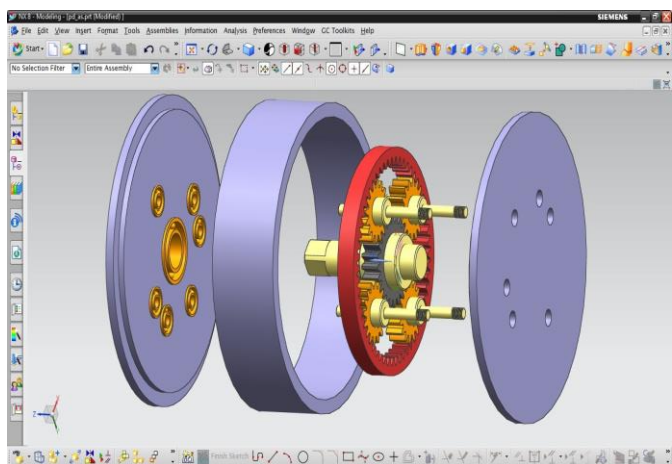
Exploded view-2



Planet gear stress in Ansys



Assembled view



Exploded view-1



Product image-1


Product image-2

Product image-3

3. CONCLUSION

Many Female drivers, physically challenged people and elders face a problem in opening/tightening the car wheel when it is punctured. In order to overcome this problem a very simple product can replace the whole tool kit which is used for tire replacement. Today's world is of the fast and rapid process. Everybody wants to save time and effort by inventing some newer technique or mechanism and implement them in the daily life. The objective of this project is to atomize the labor work in tightening or losing the nuts one by one. This paper 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 ours which reduced the time and effort for the above mentioned task that is losing or tighten the nut of the car wheel. As the standard of living in India has increased, most of the families have at least one vehicle, typically, car, to move easily and quickly. With the increment of the number of cars on the road, the number of car problem due to tire failure has increased. Often, the car is provided with tire wheel nuts remover and jack for instance spare tire replacement. Based on the capability of torque application by these drivers, a vehicle all-wheel-nuts remover is designed. This componet is working with a gear mechanism usage to reduce the efforts needed to remove a wheel nut and straight remove all four nuts in one time. This paper maybe has solved the four nut removal problem and force usage operation. The remover is designed to be ergonomic to be used, easy preservation, easy storage, easy to handle and able to remove all nuts at once. The design of the detacher is based on standard pitch circle diameter (PCD) of 100 mm and 4 numbers of nuts for most of the cars available.

REFERENCES

1. <https://books.google.co.in/books?id=n1gQNGa2qMIC&integralapproach=machine+design> Machine design – An Integral approach.
2. <https://books.google.co.in/books?id=liiv2KcJBjwC&q=standards+compendium+engineering> Hand book of engineering standards compendium.
3. <https://books.google.co.in/books?id=NugApZsiaMc> C=machinedesignCAD Computer- Aided Kinetics for machine design.
4. https://en.wikipedia.org/wiki/Assembly_line#Concepts Assembly line concepts and detailing.
5. www.mdesign.ftn.uns.ac.rs/list2011_2.php?aac=on Machine design, Vol.3 Prashant PATIL.
6. <https://books.google.co.in/books?id=PGrgDQAAQB> AJ&motion+simulation Motion simulation and design mechanisms.
7. www.engineershandbook.com/tables/graycat.htm properties of gray cast iron publication TENTE.
8. <https://books.google.co.in/books?id=1vvJCGAAQBA> J&Steel_properties+material-requirements Toughness requirements for Steels.
9. <https://books.google.co.in/books?id=b813CgAAQB> AJ&ansys+workbench Simulations with ansys workbench 16.
10. <http://asaha.com/.../machine-design-ii-prof.-k.gopinath-prof.-m.m.m> Machine Design II Prof. K.Gopinath & Prof. M.M.Mayuram.