

Analysis Of Pawl Ratchet Mechanism In Heavy Vehicles

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Abstract – The Ratchet And Pawl, a very simple device which allows a shaft to turn only one way. The Pawl and Ratchet mechanism plays a vital role in providing one way transmission and safety against heavy loading conditions. Antiroll back mechanism has been analyzed using ANSYS software. The analysis results are concluded in detail.

Key Words: Pawl, Ratchet, ANSYS, Antiroll back system.

1.Introduction

The paper provides systems and methods for preventing a vehicle from reverse movement on a slope and hill. The system comparison of a heavy commercial vehicle. A ratchet and pawl device connected to at least one wheel of the vehicle. And mechanism i.e Actuator which will control the movement of the pawl while engaging or disengaging the mechanism where in the system may be engaged using an engaging mechanism when reverse motion is undesirable or to be restricted, and may be disengaged when the reverse motion is desirable and is to be.

2. Components

Ratchet and Pawl:

A ratchet consists of a round gear tooth, and a spring loaded pin called pawl that engages the teeth. when the ratchet are moving in the forward direction the pawl easily slides over, the tip of each tooth. When ratchet move in the opposite or backward direction, pawl is locked between the teeth and prevents the backward motion. The ratchet wheel widely used in mechanical field. The materials consider for ratchet wheel and pawl pin are plain carbon steel and structural steel respectively. Both surfaced are considered to be hardened. The number of teeth on ratchet wheel is assumed as 15. The solid works CAD three dimensional model of pawl and ratchet shown in figure 1 and figure 2.



Fig -1.Ratchet Wheel

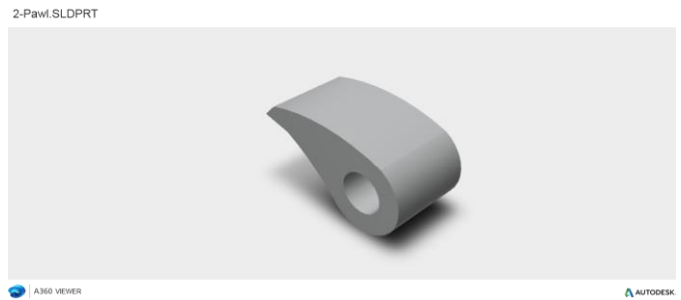


Fig-2.Pawl

3. Properties Of Materials

* Part Name: Ratchet Wheel

*Material Name: Plain Carbon Steel

- 1) Tensile Strength: 650 Mpa
- 2) Poisson Ratio : 0.29
- 3) Modulus of elasticity: 2.1e+005
- 4) Shear Modulus: 81395 Mpa
- 5) Density: 7.86e-006 Kg/mm³
- 6) Bulk Modulus: 1.667e+005
- 7) Yield Strength: 380 Mpa
- 8) Hardness: 400 BHN
- 9) Elongation%: 30%

***Part Name : Pawl**

*** Material Name: Structural Steel**

- 1)Tensile Strength: 460 Mpa
- 2)Yield Strength: 250 Mpa
- 3)Young’s Modulus : 2e+005 Mpa
- 4)Poisson’s Ratio :0.3
- 5)Bulk Modulus: 1.667e+005 Mpa
- 6)Shear Modulus: 76923 Mpa

4. Working Of Mechanism

Mechanism consists of a ratchet and pawl arrangement which will be mounted on the front axle of the vehicles. In this work, ratchet and pawl mechanism is identified to prevent the backward motion to the car. one push button is provided , on pushing the button the pawl will came in engage position with the ratchet and will prevent the reverse motion of the vehicles.

4. RESULTS

ANSYS Results are shown below.

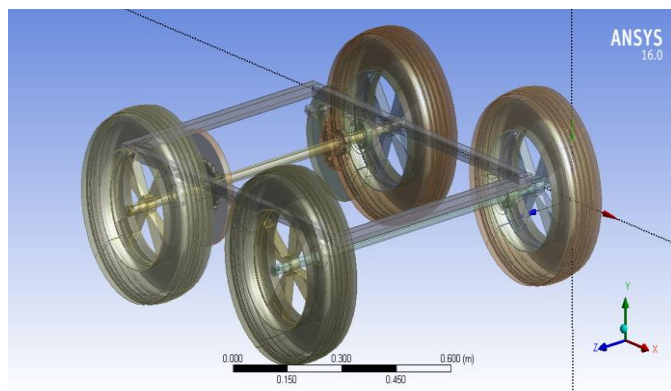


Fig-3:Working Mechanism of Model

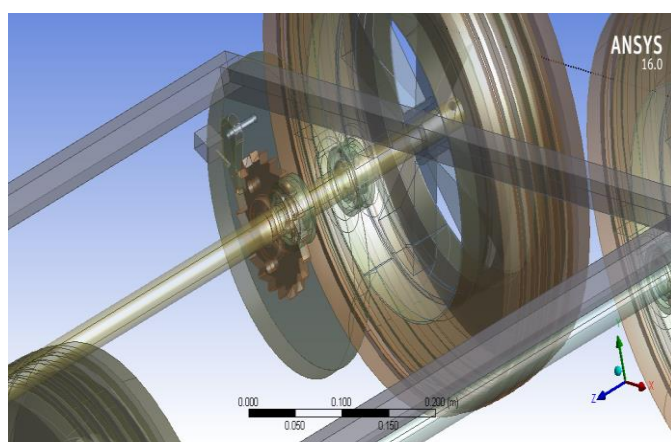


Fig -4: ANSYS Model Of Pawl And Ratchet

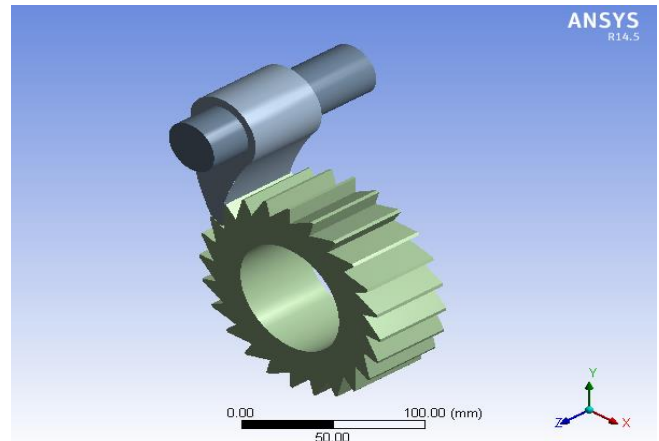


Fig-5.Geometry

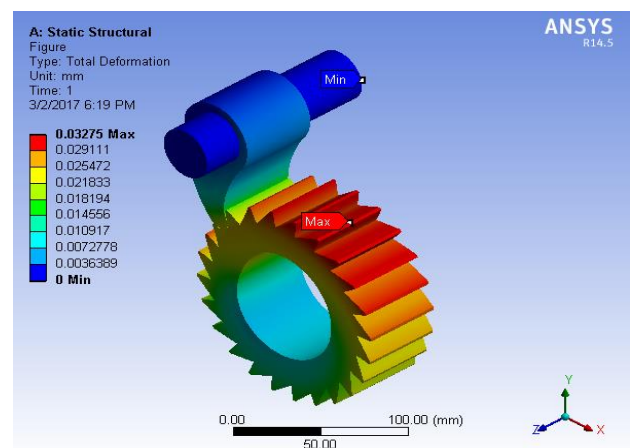


Fig-6: Total Deformation

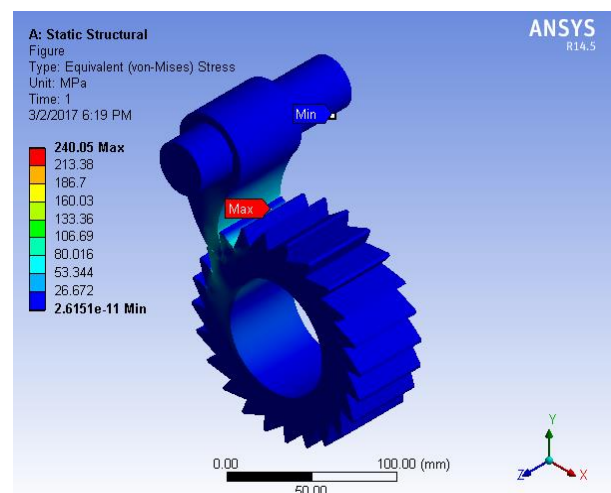


Fig-7: Equivalent Stress

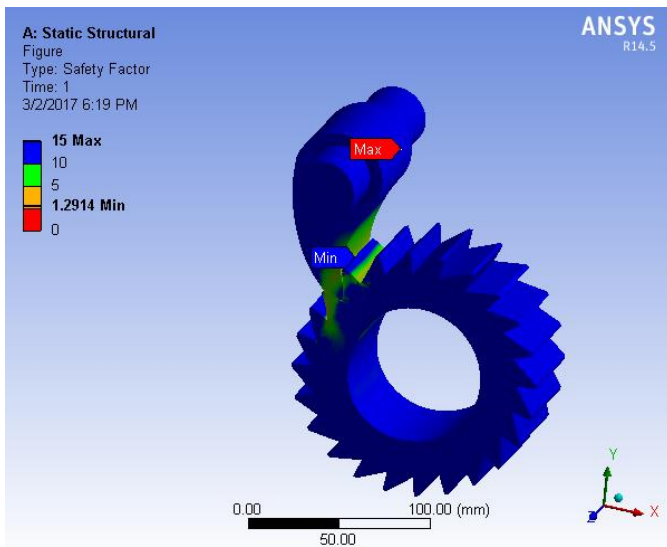


Fig-8: Factor Of Safety

3. CONCLUSIONS

The ANSYS results shown on pawl ratchet mechanism

- 1) maximum factor of safety: 15
 - 2) total deformation : 0.03275 mm
 - 3) Equivalent (von-mises) stresses : 240.05 Mpa
- Above 240.05 Mpa is a maximum stress above that stress mechanism will fails. Mechanism hoist capacity of 6 Tonne Maximum Factor of safety for mechanism is 15. When factor of safety is greater than 15 mechanism fails. Minimum factor of safety is 1.294. The antiroll back mechanism design and analysis in ANSYS Software was able to fulfils all results and give better solution for heavy loading conditions.

REFERENCES

- [1] J.A.Kennedy,L.L.Howell,“The Ratchet And Pawl Ring Mechanism,” 12th IFTOMM World Congress,Besancon(France)June 18-21,2007.
- [2] Prof.Harshal Ahire, “Automoblile Reverse Locking Different Mechanism”.(IRJET)volume:03 Issue:03|March 2016
- [3] A.ArunKumar,T.Muthumani,V.Balasubramani, “Design And Fabrication Of Antiroll Back System In Vehicle Using Ratchet And Pawl Mechanism”.(IJET CSE)ISSN:0976-1353 volume 12 Issue 3 JAN. 2015.
- [4] Hariyali patil, P.A.Chandak, “Stress analysis of Ratchet pawl design in hoist using finite element analysis”. IJERGS Volume 3,issue 4, part- 2,july –august,2015.
- [5] Mahesh Shahapuri, “Antiroll Back System For Manual Trasmission Vehicles”.(WO2013024491 A2).