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Design and Analysis of Manually Operated Screwjack for Light Vehicle

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Abstract: Control screws are utilized to change overturning the movement into translatory movement. A screw jack is a case of a power fasten which a little constrain connected on a flat plane is utilized to raise or lower a huge load. The rule on which it works is like that of a slanted plane. The favorable mechanical position of a screw jack is the proportion of the heap connected to the exertion combined. The screw jack is worked by turning a lead screw. The stature of the jack is balanced by rotating a lead screw and this alteration should be possible either physically or by coordinating an electric engine.

Key words: Coordinating, rotating, alteration, overturning, translatory, constrain

INTRODUCTION

Screw jack: A power screw is a mechanical gadget utilized for changing overturning the movement into straight action and transmitting power apparatus and method for an electric jack design, development and analysis of electrically operated toggle jack using a power of car battery in those studies we have explained from Razzaghi (2007) and Udgirkar *et al*. (2014). A power screw is additionally called interpretation screw. It utilizes helical translator movement of the fasten string transmitting power as opposed to cinching the machine segments. Control pin gives substantial mechanical preferred standpoint. A heap of 15 kN can be raised by applying an exertion as little as 400 N. Therefore, the vast majority of the power tightens utilized different applications like screw-jacks, clasps, valves and indecencies are generally physically worked design and standardization of scissor jack to avoid field failure designing and calculating the stresses induced in scissors jack for three different materials is illustrated by Dhamak *et al*. (2015) and Chitransh and Hussain (2016). Square strings are utilized for screw-jacks, presses and cinching gadgets. Trapezoidal and top lines are used for lead-screw and other power transmission gadgets in machine devices (Reddy, 2011) describe the design and fabrication of motorized screw jack for a four wheeler (Fig. 1). Brace strings are utilized as a part of indecencies where constrain is connected just in one heading. Support lines are preferably suited for interfacing tubular elements that must convey great strengths for example associating the barrel to the lodging in hostile to air-make firearms Department of Mechanical and Manufacturing Engineering describes the studies (Jack, 2016; Bloem *et al*., 2010).

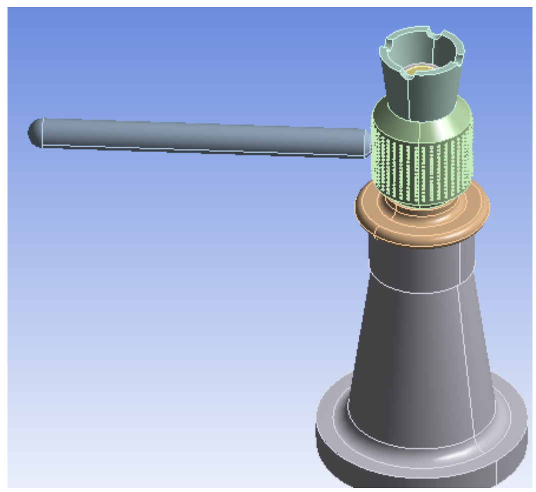

Fig. 1: Screw jack

Evaluation of machining parameters influencing thrust force in the drilling of Al-SIC-Gr metal matrix composites using RSM is discussed by Raj (2014). The thermal properties of polypropylene/montmorillonite in nanocomposites are presented by Selvakumar and Manoharan (2014). The controllability of second order impulsive neutral functional integrodifferential inclusions with an infinite delay is discussed by Subramaniyan *et al*. (2015). Investigations on the mechanical and electrical properties of an L-cysteine nicotinamide monohydrate single crystal are considered by Azeezaa *et al*. (2015).

MATERIALS AND METHODS

Operation: A scissor jack is worked basically by transforming a little wrench that is embedded into one end of the scissor jack. This wrench is generaly "Z" molded. The end fits into a ring gap mounted on the finish of the screw which is the protest of drive on the scissor jack. At the point when this wrench is turned, the screw turns and this raises the jack. The screw demonstrations like a rigging system. It has teeth (the screw string) which turn and move the two arms, delivering work. Just by turning this screw string, the scissor jack can lift a vehicle that is a few thousand pounds.

Construction: A scissor jack has four principle bits of metal and two base closures. The four metal pieces are altogether associated at the corners with a jolt that enables the corners to swivel. A screw string keeps running over this get together and through the corners. As the screw string is turned, the jack arms traverse it and fall or meet up, shaping a straight line when shut. At that point, moving back the other way, they raise and meet up. Whenever opened, the four metal arms contract together, meeting up at the center, raising the jack. Whenever shut, the arms spread back separated and the jack finishes or levels off once more.

Design and lift: A scissor jack utilizes a basic hypothesis of apparatuses to get its energy. As the screw area is turned, two finishes of the jack draw nearer together. Since, the riggings of the botch are pushing the arms, the measure of compel being connected is duplicated. It takes a little measure of constrain to turn the wrench handle yet, that activity causes the prop arms to slide crosswise over and together. As this happens the arms broaden upward. The auto's gravitational weight is insufficient to keep the jack from opening or to prevent the screw from turning, since, it is not holding a candle to the current situation compel straightforwardly to it. If you somehow managed to put weight straightforwardly on the wrench or lean your weight against the wrench, the individual would not have the capacity to turn it, despite the fact that your weight is a little level of the car's (Table 1 and 2).

Load condition of Screw Jack: The design is imported to the ANSYS Software as a step file, the load conditionand supports are applied. The base is applied with the fixed support and load is applied on the leaver (Fig. 2).

Meshing of screw jack: Meshing is the process of subdividing the part or assembly in to infinite num of nodes. Meshing is done with the use of ANSYS Software. The analysis is done in the nodes and the cumulative result is displayed with the colour codes (Fig. 3).

Analysis of screw jack: Figure 4 shows the total deformation of the screw jack according to the load conditions these results are obtained from the ANSYS Workbench Software.

Table 1: Existing properties of screw jack

Properties	Values
Volume	874.02 mm^3
Material, cast iron	
Coordinates, type	Cartesian
Mass	4.321e-003 kg
Nodes	741
Elements	364

Table 2: Properties of proposed material

Material	Steel 4340
Density	13.17 g/cm^3
Yield strength	19mpa
Compressive strength	3162 MPa
Modulus of elasticity	356 GPa
Vickers hardness	2130
Thermal conductivity	1.06

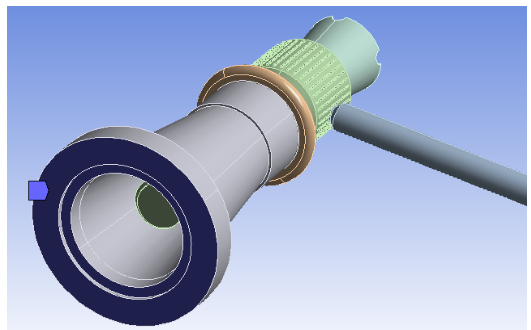

Fig. 2: Applying load and support conditions

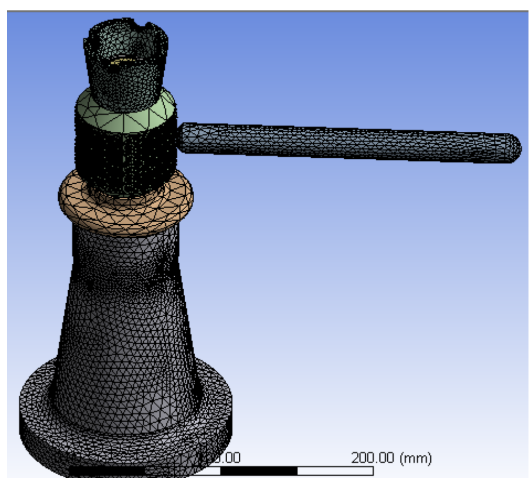

Fig 3: Fine meshing of the model

Stress and strain deformation: This image shows the shear stress of the screw jack (Fig. 5). This image shows the factor of safety for the screw jack (Fig. 6).

Steel: Figure 7 denotes the total deformation of the steel screw jack. The deformation value is taken from the ANSYS Workbench Software according the load conditions.

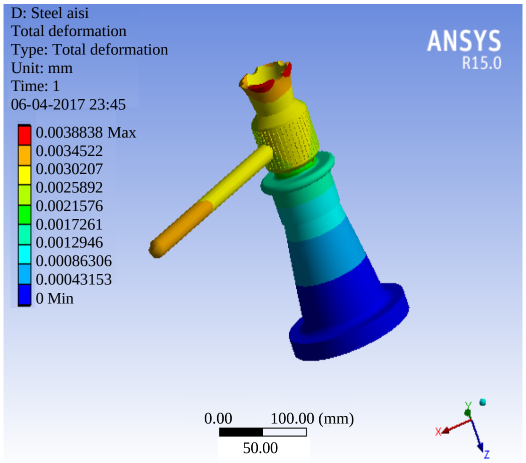

Fig. 4: Result for total deformation

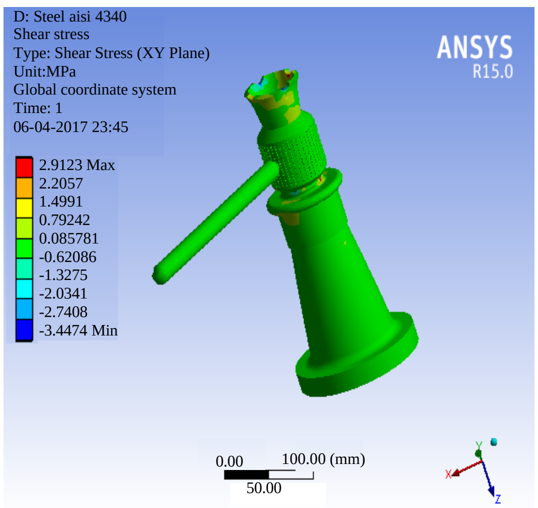

Fig. 5: Analysis result for shear stress

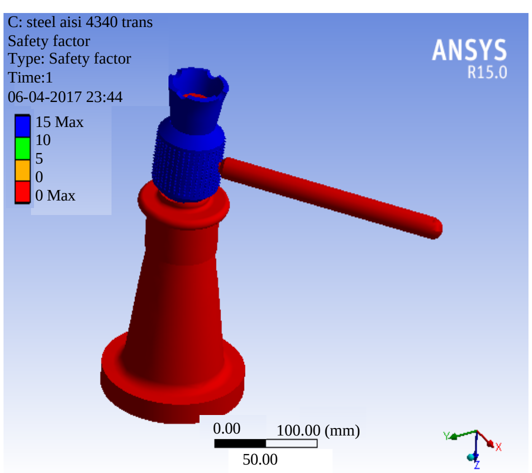

Fig. 6: Analysis result for safety factor

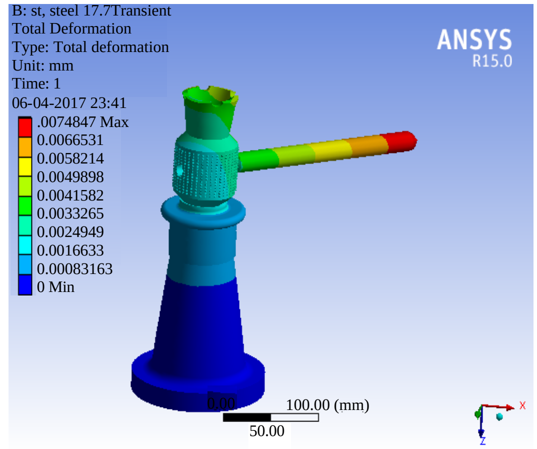

Fig. 7: Analysis result for total deformation

Table 3: comparison of analysis results

	Results		
Material	Stress	Displacement	Sliding contact
Cast iron	12.41	0.12e-3	0.138e-5
Steel 4140	8.44	0.23e-3	0.119e-4
Stainless steel	9.23	0.65e-3	0.109e-4

RESULTS AND DISCUSSION

From the result of static analysis screw jack, it can be observed that the cast iron have higher stress compared to the steel 4140 and stainless steel. And also have less displacement. The steel 4140 have lesser displacement when compared to the stainless steel but it doesn't have strength as much as the cast iron. The sliding contact of the steel 4140 and stainless steel are with the negligible variation but the cast iron has the lover sliding contact. From the Table 3, it is clear that the cast iron is the suitable material for the analysed screw jack model.

CONCLUSION

Thus, the analysis and modelling describe the stress and strain constrain in the element of research and the derived values are plotted.

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