

# DESIGN & FABRICATION OF HAND OPERATED SCREW JACK

Prof. Gaurav Nagdive <sup>1</sup>, Dipak Sonwane <sup>2</sup>, Anil Bodkhe <sup>3</sup>, Omesh Lilhare <sup>4</sup>  
Atul Bhandari <sup>5</sup>, Premshankar Mohabe <sup>6</sup>, Nikhil Gedam <sup>7</sup>

<sup>1</sup> Author Professor, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India <sup>2</sup> Author Student, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India <sup>3</sup> Author Student, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India <sup>4</sup> Author Student, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India <sup>5</sup> Author Student, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India <sup>6</sup> Author Student, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India <sup>7</sup> Author Student, Department of Mechanical Engineering, AGPCET, Nagpur, Maharashtra, India

## ABSTRACT

With the increasing level of technology, researchers all over the world are working continuously to improve and implement better and robust design of materials at workplace for productivity, efficiency and effectiveness. Detailed design procedure of a quick lifting screw jack is presented in this paper. The design is fundamentally a modification of the conventional scissor jack. The problems associated with the conventional jacks are the ergonomic snags experienced by operators due to prolonged bending or squatting positions during operation. These problems of waist pain and backaches are as a result of continuous turning of the wrench or crank shaft in an uncomfortable position for a long period. These led to the design and modification of quick lifting screw jack with gear arrangements that are safe, reliable and capable of raising or lowering heavy load with little effort. The results showed that the introduction of the crank and gear mechanism would help reduce difficulty in operation, reduce time, increase efficiency and effectively control the difficulties concomitant with Ergonomics - which is an ultimate sensitivity in design process

**Keyword:** Bevel gear, bolt, Handle, stand etc.

## i. Introduction

screw jack (scissors jack) as being very efficient, yet continue to seek new designs to increase reliability and reduce its shortcomings and maintenance costs. Screw application is used in the elevation of vehicles or objects. The operation of the screw jack is such that it comprises a handle for driving a bolt element (Lead Screw) manually to adjust the height of the jack to elevate a vehicle or an object. Existing jacks are of great disadvantage to elderly women especially under unfavorable weather condition [

1]. A mechanical jack is a device which lifts weighty or heavy equipment Over the years, engineers, scientist and ergonomist have extolled the conventional automobile and vehicles so that maintenance can be carried out underneath at workplace or manufacturing setting [2]. A jack screw is a type of jack which functions by turning a lead screw. It

is commonly used to lift heavy load to a height. A good example is the car-jacks. In the case of a screw jack, a small force applied in the horizontal plane is used to raise or lower large load [3]. A good number of operational staff in manufacturing, bottling, oil and gas and other multi-national companies perform task in a squatting or cowering position for a long period. These results to inefficiency at workplace due to ergonomically imbalance position they encounter which often times give rise to back ache and poor body architecture in the future. These present available jacks further require the operator to remain in prolonged bent or squatting position to operate the jack. Due to its difficulties, body pains, back ache and others can emerge as a result of continuous turning of the wrench or crank shaft in an uncomfortable position for a long period. The statement of problem has led to the motivation of designing a modified quick lifting screw jack with gear arrangement. The introduction of the bevel gear will help reduce difficulty in operation with a handle incorporated in the design and also reduce time spent to a very minimum.

## ii Problem definition

In screw jack, a small force is applied in the horizontal plane, used to raise or lower a large load Generally, human effort is required to rotate the screw; sometimes it becomes difficult to move the screw jack from one place to another due to its heavy weight

## iii Design analysis

Material Selection of Parts:

The choice of material is very important in the design of an automobile jack as in the case of other engineering designs. It is one of the most important decisions a designer is called to make. The decision is usually made before the dimensions of the part are established. One very important factor in material selection is the strength. Other factors include wear, corrosion, weight, noise, lubrication, marketability, manufacturability, safety, functionality, cost, etc. Some aforementioned have to do unswervingly with the dimensions, the material, the processing, and the joining of the element of the system. For effective performance of jack, mild steel is majorly used because of its strength, toughness and low cost. It provides material properties that are acceptable for the application. Finally, the selected material of mild steel gives a reduced weight of the jack.

## iv Working principle

A screw jack (also known as a jack screw, a wormscrew jack, a machine screw jack) is a device use to convert rotational motion into liner motion. It utilizes the property of screw thread providing a mechanical advantage i.e. it can be use to amplify force.

## v Conclusion

In this research, a novel design for a lifting jack driven by a quick-return crank mechanism and gear drive has been designed and fabricated. The design equations for gear selection, gear drive ratios and mechanism forces have been derived from its geometry. Kinematic analysis has been performed. A design example has been given for illustrating the design process. The detailed working diagram has been explicitly explained equally.

To verify the feasibility and accuracy, a prototype has been made, and then an experiment has been conducted. The proposed mechanism is capable of increasing capacity; reducing input effort; saving cost of operation and requires simple maintenance compared to conventional lever lift mechanisms of lifting jacks. The experimental result shows that Very little effort (5.280N minimum and 102.76N maximum) and torque (0.597Nm

and 51.38Nm maximum) is required to lift a load using the modified screw jack compared with the classical method which requires effort of 127.4N and torque of 135.04Nm. Also, the time required to lift a car using the modified method is lesser (2.025s) compared to the time required to lift same weight of car using the traditional method (4.094s). Conclusively, the modified design provides a good alternative to the lever lift mechanism as other existing conventional lifting jacks require more effort, capacity, power generating sources and maintenance cost. The proposed quick lifting jack prototype was made up of a gear drive and a quick-return crank mechanism.

## vi. Reference

- [1] A.S. Akinwonmi, A. Mohammed, Modification of the existing design of a car jack, *Journal of Emerging Trends in Engineering and Applied Sciences*. 3(4) (2012) 581-588.
- [2] R.G. Budynas, J.K. Nisbett, *Mechanical engineering design and advanced strength and applied stress analysis*, McGraw-Hill, Vol. 10, 2008, pp. 925-1055.
- [3] R.S. Khurmi, J.K. Gupta, *Textbook of Machine Design*, Eurasia Publishing House, Ram Nagar, New Delhi, India, 2005.
- [4] I.S. Rout et al., Design and fabrication of motorized automated object lifting jack, *IOSR Journal of Engineering*. 04(05) (2014) 6-12.
- [5] K.R. Mounika, C.H. Priyanka, Design and fabrication of motorized screw jack for four wheeler, A Project Report, Department of Mechanical Engineering, Gokaraju Rangaraju Institute of Engineering and Technology, 2011.
- [6] C.A. Okoronkwo et al., Design of a hand water pump using a quick-return crank mechanism, *African Journal of Science, Technology, Innovation and Development*. 8(3) (2016) 292-298.
- [7] S. Chaudhary et al., Development of motorized car jack, *Journal of Applied Mechanical Engineering*. 5 (2016) 216.
- [8] M.N. Kumar et al., Design and fabrication of screw jack using worm gear, *International Conference on Systems, Science, Control, Communication, Engineering and Technology*, 2016, pp. 794-798.
- [9] R.K. Rajput, *A textbook of engineering thermodynamics*, Firewall Media, 2010
- [10] M.A. Parker, F. Pickup, *Engineering drawing with worked examples*, Third Edition, Vol. 1, Hutchinson, New Delhi, 1976, pp. 690-699.
- [11] J.M. Gere, *Mechanics of materials*, Thomson, 6th Edition, 2006.
- [12] R.K. Rajput, *Thermal engineering*, Laxmi Publications, 2010. ISBN: 8131808041.
- [13] C.W. Ham, D.G. Ryan, Experimental investigation of the friction of screw threads, *Bulletin 247*, University of Illinois at Urbana Champaign, College of Engineering, *Engineering Experiment Station*, 1932.