

Design & Fabrication of Human Hoist with Screw Jack for Mechanic

Jayant Krishnaji Nalawade¹, Priyanka Chavan², Sham Mankar³

Jayant Nalawade¹, Assistant Professor, Department of Mechanical Engineering, Sm. Kashibai Navale college of Engineering Pune, Maharashtra, India

Priyanka Chavan² Assistant Professor, Department of Mechanical Engineering Pimpri Chinchwad College of Engineering and Research, Pune, Maharashtra, India

Dr. Sham Mankar³ Assistant Professor, Department of Mechanical Engineering Pimpri Chinchwad College of Engineering and Research, Pune, Maharashtra, India

Abstract

This paper describes the novel approach of Human hoist using power screw. Generally Automobile mechanic have to work under the car chassis and it becomes very painful to work under such situations. Though there are many inventions and mechanism to help the car mechanic to work in such situations, they are very costly. The paper includes the design and analysis of Human Hoist system which is not only affordable but also very easy to use. The results display the improvement in comfort and efficiency of mechanic. Main advantage is it very cheaper than other hoists in the market.

Keywords— Human Hoist, Power Screw

I. INTRODUCTION

The Human Hoist is essential instrument for Mechanic. It's fundamentally a change of creeper which can be utilized to work under a vehicle effectively to do the necessary tasks without exhaustion. This Human Hoist framework empowers a Mechanic to go from a sitting position right to laying on the ground with few moments and revert back whenever task is over [1]. The mechanic can save the time and accelerate the work which required awkward positions. The Human Hoist framework assembled with power screw mechanism can be utilized to work at any level. In spite of the fact that this Human Hoist is proposed to back out crafted by Automotive repairman yet the concept also can be effectively useful for relevant industrial work, to increase the productivity and easing out manual efforts.

Modern ergonomics dictate that the employee should be able to do their assigned work activity while operating within prescribed ranges of motion to avoid injuries and fatigue [2]. Traditional ergonomic strategies typically centre around alterations of the workstation or work space to permit the worker appropriate access [2]. In some cases, this adjustment of the workspace is not cost effective, or seems impossible to do without compromising physical comfort like under car maintenance. In previous work for proper work positioning, make shift devices are constructed to allow the employee to prop, roll, or otherwise rig themselves into a position in order to finish the task. Moreover such measures gives limited access with poor positioning that requires over extension or other trauma to joints of worker in order to do the task. Also when tasks done in such manner, often finished quickly so as to minimize discomfort, resulting in work that may not be in correct with quality standards [2]. If worker works like this for long time then he may endure an intense physical issue, and over the time could endure total injury requiring time off, medical treatment, and even disability, but most importantly affecting the quality of the worker's life [2]. The Human Hoist Chair is a personal positioning device simply designed for lifting and supporting the worker's body for under hood activities. This Human hoist chair is supported with 4 point caster wheels to glide horizontally. Human Hoist easily floats from position to position vertically, and can be tied down with anchored with the wheel locks as needed. Human Hoist can be halted at any position in its movement to work similarly well as a chair, a customizable stool, or a creeper [2]. Most importantly it is designed very cheaper than any Human Hoist in the market.

II. DESIGN AND ANALYSIS OF HUMAN HOIST WITH SCREW JACK

Human Hoist with Screw Jack is a novel approach that could come across over the above discussed difficulties which often occurs in car maintenance and other relevant Industrial activities. Basically in certain conditions where Mechanic has to work from sitting to total laying down condition. So either he has to position himself as per the condition which might affect his body to work under such prolong condition. The condition is shown in fig 2.1. It's just like a creeper to get under vehicle but along with adjustable height positioning system. It is designed with simple screw Jack system located under the seat grill and having support with flexible four bar mechanism as shown in the figure 2.2. Design must support the weight of worker on this hoist so material selection is done as follows

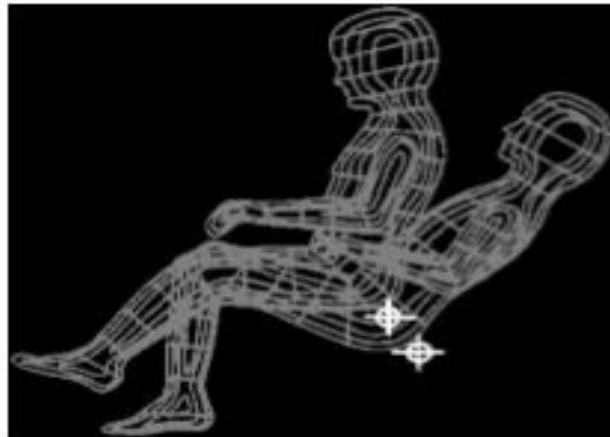


Fig 2.1 shows relative motion of body in sitting & laying down [1]

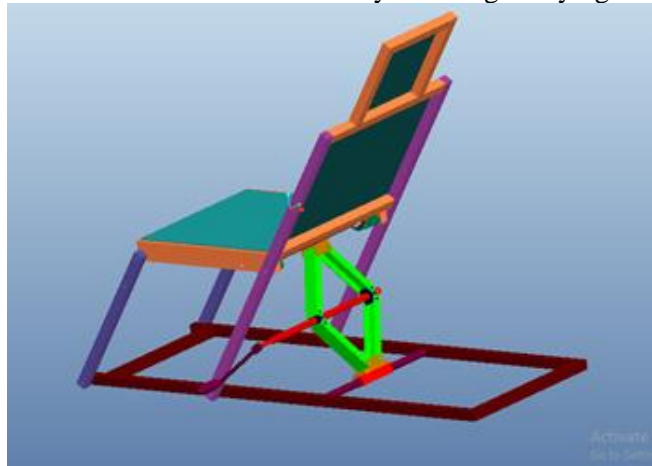


Fig 2.2 Assembly of human hoist with Screw Jack

2.1 Selection of Material

ASTM A36 is chosen here as it is generally accessible and ordinarily utilized mild and hot rolled steel having excellent welding properties and furthermore simple for crushing, punching, tapping, penetrating and machining tasks [5]. Yield quality of ASTM A36 is not as much as that of cold roll C1018, thus enabling ASTM A36 to bend more promptly than C1018 [5]. This is utilized for bracket configuration as appeared in figure. Basic screw jack is cut as appeared in the figure 2.2. Screw Jacks usually use mechanical advantage to permit a human to lift a vehicle by manual power alone [5]. Mechanical jacks are usually rated for a maximum lifting capacity (for example, 1.5 tons or 3 tons). The material for screw is Plain carbon Steel and design is done as per standard theories. Screw Jacks have the property of self locking which means that it will stay at the position where it was left and won't turn reverse no matter how much load they are imposed with. This property is most important and because of which it is selected for this mechanism out of the all types of Jacks.

2.2 Analysis of Human Hoist

Static deformation analysis is done with the help of analysis software supplying it with 3D model as shown in figure to ensure the models safety.

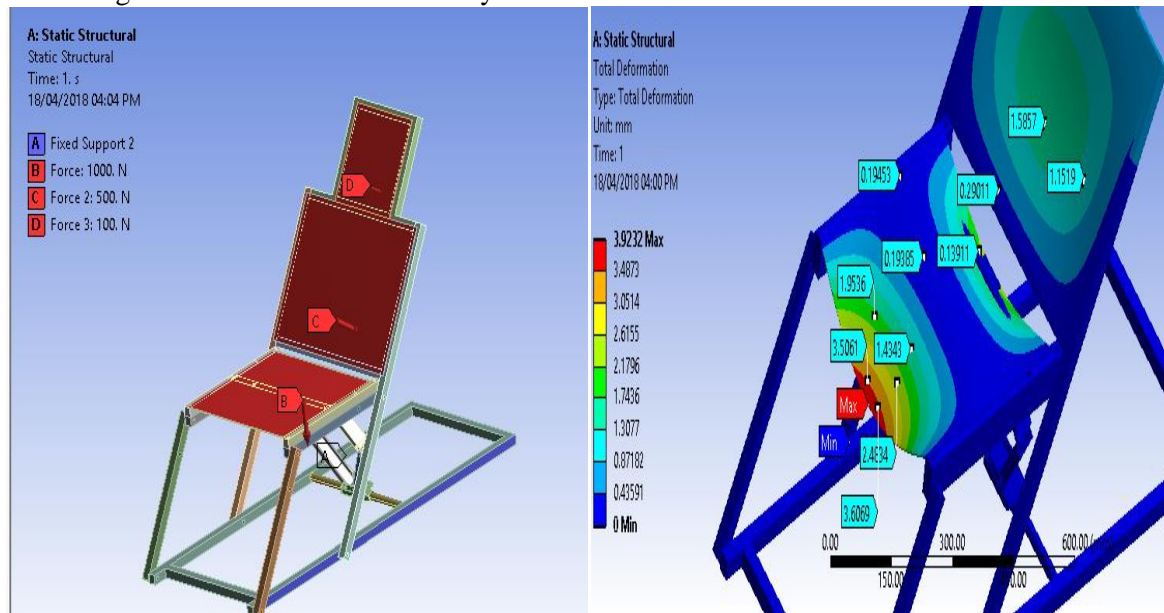


Fig 2.3 Static Structural Total deformation

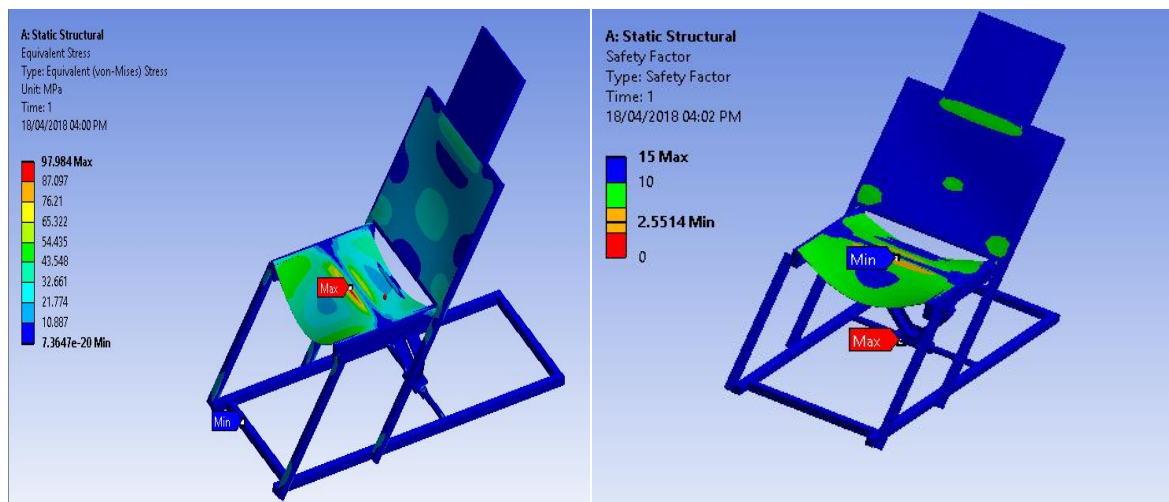


Fig. 2.4 Equivalent stress Structural

III. RESULTS AND DISCUSSION

The above analysis shows that this System is safe for a worker as it is showing negligible deformation for 1000 N force. So, it is safe for workers having weight less than 100kg and only in exceptional conditions human weighs more than 100kg. Workers had to work on card board or creepers and some transportation and miscellaneous cost. and now they can use this work platform of “ Human Hoist with Simple screw Jack” which moves in any direction and also can be adjusted at any vertical position. It will make their work easy and comfortable. Mostly peoples working in such field are getting affected by back pain But with the help of human hoist they can work easily, comfortably and also increase their work speed . This will also help them to work for more time and accurately. The design, construction as well as working of this "Human hoist with Screw Jack" is very simple.

In the appendix the cost report of this novel Human Hoist System is mentioned. The total cost includes raw material, machining charge, cost of purchased parts and miscellaneous cost including transportation and labour charges. As per this report the cost of Human hoist is 12,760 INR. It may be reduced when applied with mass production and other cost reducing techniques. So, It is very low cost as compared to any other Human Hoist in the market. It might be less comfy and convenient as compared to advanced Human Hoist but can fulfil the demands of Mechanics who needs affordable solution with minimum and low cost maintenance.



3.1 Prototype of Human Hoist with Screw Jack

IV CONCLUSION

The novel Human Hoist with Screw Jack proves that it is safe to use and ergonomically good for Mechanic to work under car hood. Its design is simple and cost is less.

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Appendix

Cost Report of Novel Human Hoist System with Screw Jack

1. Raw material

Sr. No.	Description	Quantity	Cost (INR)
1	Square pipe	40(ft)	1980
2	Sheet metal	2x6(ft)	1000
3	Shaft	6(ft)	600
Total			3580

2. Machining cost

Sr. No.	Operation	Rate (per hrs.)	Time (hrs.)	Total Cost (INR)
1	Cutting	200	8	1600
2	Drilling	100	5	500
3	Welding	300	6	1800
4	Grinding	100	5	500
Total				4400

3. Cost of purchase parts

Sr. No.	Description	Quantity	Cost (INR)
1	Jack	1	800
2	Nut	15	300
3	Washer	15	30
4	Torque wrench	1	450
5	Caster wheel(lockable)	4	1400
6	Grinding wheel	8	400
7	Cutting wheel	10	200
8	Drill	2	200
Total			3780

Total cost= Raw material cost + Machining charges + Miscellaneous cost & Transport charges + Cost of purchased parts
 =3580+4400+1000+3780
 =**12760 INR**