Design and Analysis of Trestle Hydraulic Jack

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Abstract— The trestle hydraulic jack is a device which is used to lift the vehicle with heavy load and unload condition. The new trestle hydraulic jack setup is fix the jack to the axle of the vehicle keep the correct position and avoid the slippage. Hydraulic cylinder have hand lever. Jack have curved surface. when the vehicle move reverse the curved is used to lift the vehicle smoothly. The trestle hydraulic jack is suitable for lifting the heavy load around 50,000N. The new model designed by using solid work software. The Ansys 15.0 software is used to analyse the model

I. INTRODUCTION

Hydraulic Jack is a term used to describe a device that is used to lift A hydraulic jack is a heavy-lifting equipment. The device is small, light, and portable, but it is powerful. Pressure is produced in the jack's container when the gadget pushes liquid against a piston. The jack is based on Pascal's law, which states that the force of gravity equals the force of gravity multiplied by the force of gravity multiplied by The consistency of a liquid in a container is constant. Mechanical or hydraulic force is used to classify jacks. Heavy and small loads are both lifted by mechanical jacks. vehicles and are classified according to their lifting capabilities (for instance, the number of people they can raise).It has a maximum lifting capacity of a certain number of tonnes). Hydraulic jacks, which are classed as bottle jacks and floor jacks, are stronger than mechanical jacks and can lift bigger loads with less effort. Hydraulic jacks rely on the force created by pressure, which follows Pascal's law. It asserts that when a fluid is at rest, the intensity of pressure at any location in the fluid is the same in all directions. When two cylinders (one large and one tiny) are connected and a force is given to one of them, the pressure in both cylinders is equal. However, because one cylinder has a bigger surface area, the force produced by the larger cylinder will be greater, despite the fact that the pressure in the two cylinders will stay constant. Gurudev Mute et al. (7) created a 1000 kg capacity telescopic hydraulic cylinder with appropriate design parameters and base wheels, concluding that the design is adequate for lifting the big weight. K.sainath et al (3) designed a mechanical hydraulic jack with a capacity of 6 tonnes.

II. LITERATURE REVIEW

If the phrase hydraulics is thought to intend the usage of water for the gain of mankind, then its exercise need to be taken into consideration to be even older than recorded records itself. Traces of irrigation canals from prehistoric instances nevertheless exist in Egypt and Mesopotamia; the Nile is know Into had been dammed at Memphis a few six thousand years ago to provide the vital water supply, and the Euphrates River turned into diverted into the Tigris even in advance for the equal purpose. Ancient wells nevertheless in existence attain to extraordinarily splendid depths; and underground aque ducts were bored significant distances, despite the fact that bedrock. In what's now Pakistan, homes had been furnished with ceramic conduits for water supply and drainage a few 5 thousand years ago; and legend tells of big flood-manage initiatives in China slightly a millenium later. All of this clearly demonstrates that guys need to have began to address the flow of water endless millenia earlier than those instances.

Working of Trestle hydraulic jack Hydraulic jack has been advanced for small and medium automobile automobiles additionally its required semi-professional labor's for operating this

device. Because of solving the axle and retaining accurate position for averting slippage. In order to keep away from such dis blessings the new model Trestle hydraulic jack has been advanced. The current trestle jack was designed without hand lever however the new trestle jack designed with hydraulic cylinder with hand lever protected with trestle future. Normally hydraulic jack is running method, while the deal with is operated like up and down motion of the piston so the car lifts from the ground. In the trestle jack the curved floor used to raise the car with small opposite motion of car as proven with inside the hydraulic jack and trestle jack has a few dis blessings. In order to conquer such disadvantages this trestle hydraulic has been designed in this type of way that it may be used to raise the car very easily with none effect force
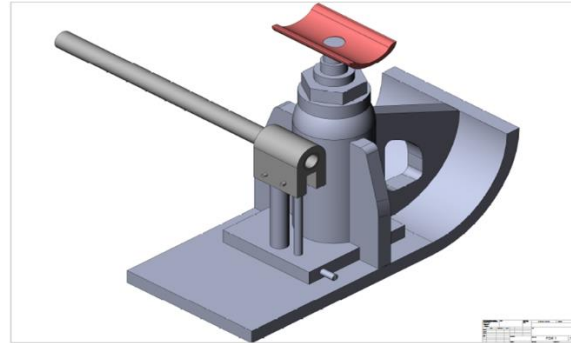

- A-Hydraulic Jack:

In this gadget a reservoir and a system of valves has been added to Pascal's hydraulic lever to stroke a small cylinder or pump continuously and lift a big piston or an actuator a notch with each stroke. Diagram A indicates an consumption stroke. An outlet take a look at valve closes by strain below a load, and an inlet take a look at valve opens in order that liquid from the reservoir fills the pumping chamber. Diagram B indicates the pump stroking downward. An inlet take a look at valve closes through strain and an outlet valve opens. More liquid is pumped below a big piston to elevate it. To lower a load, a 3rd valve (needle valve) opens, which opens an area under a big piston to the reservoir. The load then pushes the piston down and forces the liquid into the reservoir

- CAD version of Trestle Hydraulic Jack

The new version trestle hydraulic jack CAD version proven . It has piston and ram cylinder with deal with additionally with trestle future. Trestle Hydraulic Jack Assembly and Disassembly Process The jack meeting is portable, self-contained unit with a single velocity

operated by hand pump on the elevate unit together with three rams and on extension screw or cased inside an anchored cylinder installed at the base. A stamped shell enclosed the ram and cylinder to form the fluid

Assembly manner
The following steps will assist us to collect the hydraulic bottle jack.
First placed all additives of HBJ so as pair and perceive the measurement of all additives.

i. Put the bottom at the at the flat table.
ii. Assemble the cylinder with the bottom collectively with the bottom plate.
iii. Assemble the reservoir to base collectively with sealing part.
iv. Insert O-ring and seal of nut to piston.
v. Assemble piston to the piston.
vi. Assemble nut to piston.
vii. Insert adjusting screw and adjusting screw socket to piston avenue to get ram.
viii. Assemble O-ring (pump, plunger).
ix. Assemble plunger, spring bolt, brief pin, hyperlink plate, and swing socket.
x. Assemble oil fill plug, pin, launch valve seal, boll, and spring with base.
xi. Install rubber cope with holder onto the pinnacle nut & slide down ward till it rests upon the reservoir of the jack.
xii. Finally collect the cope with phase via way of means of lining up the spring detent withinside the rubber grip phase with the slot withinside the different phase.

Disassembly manner
1. Clean table (preserve the paintings place smooth and properly it)
2. Use manuals

3. Open the jack base.
4. Drain the hydraulic oil.
5. Open the bottle jack unit.
6. Safely over load the take a look at valve.
7. Disassemble the plunger.
8. Clean the bottle jack unit passage ways.
9. Release the valves (O-ring).
10. Check valves & protection over load valve.
11. Disassemble the ram seal.

- Analytical Analysis of Trestle Hydraulic Jack using FEM

The FEA model of trestle hydraulic jack was drawn using Solid works software and it's imported to FEA code ANSYS software
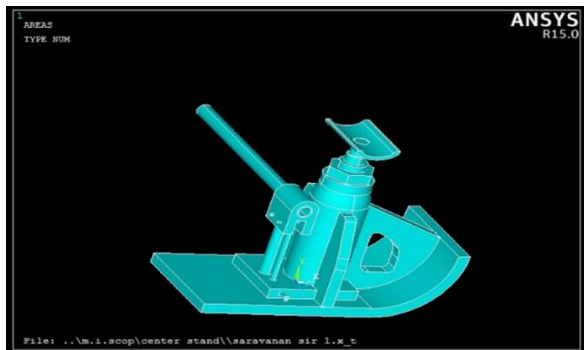
The Non-misses stress value was obtained using FEA code ANSYS, it's shown . it's observed that the maximum stress area in jack is very less. Its reveled that this model has withstand that amount of load.
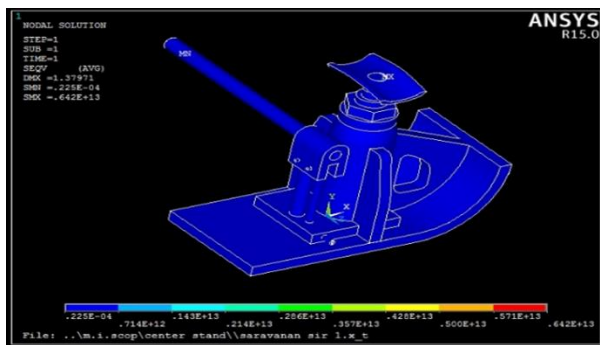

RESULT AND DISCUSSION

- Result (Analytical value)

The analytical value of displacement, stress and strain values are taken from FEA and tabulated

| S. NO	LOAD	ANALYSIS	ANALYTICAL VALUE
1		Deflection	1.32 mm
2	50.000 N	Stress	64.68 Mpa
3		Strain	49.42 mm

- DSV, stress and strain values of Trestle Hydraulic Jack (Analytical Method)

Based on FEA results the various value of Deflection and load are taken and curve drawn
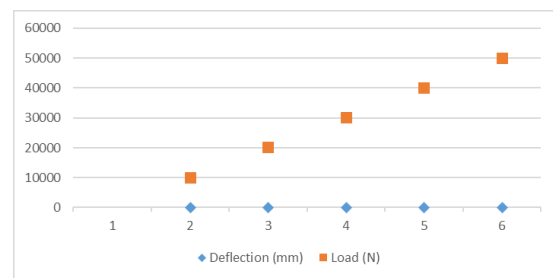
Load vs. Deflection curve

Based on FEA results the various value of stress and load are taken and curve drawn its shown
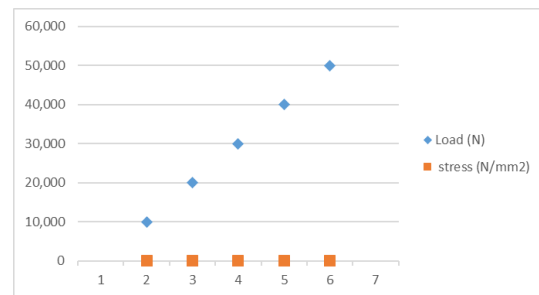
Load vs. stress curve

From the FEA result in table induced deflection and compressive stresses are less than permissible valve. Hence the design is safe.

CONCLUSION

The following consequences may be investigated from the above evaluation As consistent with the Numerical cost of strain cost of Trestle Hydraulic Jack beneathneath loading situation is much less than the layout cost. The Analytical cost of strain and pressure and deflection values of Trestle Hydraulic Jack is much less than the layout cost. From that it is able to be concluded that the designed Trestle Hydraulic Jack is beneathneath protection place whilst it's in beneathneath loading situation.Numerical end result and analytical end result each are similar. So the layout parameters are demonstrated numerical and analytically from that it concluded that layout is safe.From that above Numerical and Analytical (FEA) evaluation concluded that Trestle Hydraulic Jack is appropriate for heavy load (as much as 50,000 N) lifting Application.

REFERENCES

[1] A.Saravanan, P.Suresh, Static Analysis and Weight Reduction of Aluminum Casting Alloy Connecting Rod Using Finite Element method. International Journal of Mechanical and production Engineering Research and Development (IJMPERD).Volume no: 08, Issue: 3, ISSN: 2249-8001

[2] Ashby, M. F., Material Selection in Mechanical Design, 3rd Edition, Elsevier, 2005.

[3] "Design of mechanical hydraulic jack" By K. Sainath, Mohd.Salahuddin Mohd. Jibran Baig, Ali Farruky, Mohammd Siddique Ahmed, Mohd. Riyazuddin, Faraz Ur Reham Azahr, Md Saffi, „IOSRJET|Volume:04 issue|07 july-17"pp15-28|ISSN (e):2250-3021, ISSN (p):2278-8719.

[4] "Design and analysis of hydraulic jack for sugar mill setting" By Rohit M. Chavan, M. M. Mirza, R. Biradar, „IRJET|Volume:04 issue|05 may-17"e-ISSN: 2395-0056, p ISSN: 2395-0072.

[5] "Design and analysis of Telescopic hydraulic jack" By Ashish Patil, Sangam Patil, Sachin Wangaikar, Rajashekar M.S.IRJET|Volume:03 issue: 07 July-16"e-ISSN: 2395-0058, p-ISSN: 2395-0072.

[6] "Design of toggle jack considering material selection of screw- nut combination" By Prof.Nitinchandra R. Patel et al IJIRSET|Volume:02 issue: 05 May-13" p-ISSN: 2319-8753.

[7] "Design of lifting device using Hydraulic telescopic jack" Gurudev mute et al IJAERD , vol:05 issue:02 Feb-18" p-ISSN-2348-6406

[8] "Selection of Telescopic jack with mechanical synchronization EC-TCS", GMV.

[9] "Design and analysis of Telescopic hydraulic jack for increase load capacity" By Jignesh Vasava Prof. Hitesh Raiyani, „IJSRD|Volume:04 issue|03 may-16"ISSN: 2321-0613.

[10] https://www.e4training.com/hydraulic_calculators/hydraulic1.php

[11] https://www.e4training.com/hydraulic_calculators/hydraulic1.php

[12] https://www.hydraproducts.co.uk/hydraulic-calculators/oil-pipe-diameter.aspx

[13] Periyakgounder Suresh1, Rajamanickam Venkatesan, Tamilperruvalathan Sekar, Natarajan Elango, Varatharajan Sathiyamoorthy. Optimization of Intervening Variables in MicroEDM of SS 316LUsing a Genetic Algorithm and Response-Surface Methodology. Journal of Mechanical Engineering 60(2014)10, 656-664.DOI:10.5545/sv-jme.2014.1665

[14] http://www.valvehydraulic.info/hydraulic-circuit-design/hydraulic-systems-components.html.

[15] Suresh P, Venkatesan R, Sekar T, Sathiyamoorthy V (2014), Study of microEDM parameters of Stainless Steel 316L: Material Removal Rate Optimization using Genetic Algorithm. International Journal of Engineering and Technology (IJET) ISSN: 0975-4024 Vol 6 No 2.

[16] A.Saravanan, P.Suresh, Investigation of Diesel Tank Pressure Using Numerical and Analytical Methods. International Journal of Mechanical Engineering and Technology (IJMET).Volume no: 08, Issue: 12, ISSN: 0976-6359.

[17] Fluid Power with Application, Anthony Esposito.4th edition, Publisher-Pearson education.

[18] Manoj R. patel , S.D.Kachave, Design and analysis of scissor jack, IJMERR vol:04 Issue no: 01, ISSN:2278-0149(2015).