International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 4, Issue 6, June-2018

Design, Development And Analysis Of Lifting Mechanism For Car

Prof. Sachin R.Jadhav[1],Mr. Shubham Wankhade[2], Mr. Suhas Chopade[3], Mr. Pravin Gurav[4], Mr. Abhishek Sukhadeve[5]

1,Assistance Professor Department of Mechanical Engineering, TSSM, PVPIT, Pune, Maharashtra.
sachinjadhav.srj@gmail.com
2,3,4,5,Student in Department of Mechanical Engineering, TSSM, PVPIT, Pune, Maharashtra.
shubhamwankhade123@gmail.com,suhaschopade777@gmail.com,guravpravin.773@gmail.com, abhisheksukhadeve393@gmail.com
Padmabhushan Vasantdada Patil Institute of Technology, Pune, Maharashtra

Abstract :In our project we solve the major problem of the parking arises. To overcome this problem we invented the mechanism which is useful for parallel parking. As will as it is use to move vehicle in showrooms, garages, with the lesser human force. A miniature working model of mechanism we were developed. The mechanism developed is affordable and it can be used in different car models with small modification in it . In this project Maruti Suzuki Swift is considered as a benchmark vehicle. The main aim of this project is to move vehicle in lateral direction. This mechanism was modeled using ANSYS R15.0 software.

keyword:- Parallel parking, ANSYS R15.0.

i. INTRODUCTION

In today's world the population of INDIA increase day by day that arise lots of problem. India is facing a new problem nowadays lack of sufficient parking space. With families getting smaller and the total number of motor vehicles exceeding the total number of heads per family, the parking scenario is woefully falling short of the current requirements in the country. The situation is such that on any given working day approximately 40% of the roads in urban India are taken up for just parking the cars. The problem has been further exacerbated by the fact that nowadays even people from low income group are able to own cars. The number of families with cars has become much more than what the country is able to manage .As it is, the cities in India are highly congested and on top of that the parked cars claim a lot of space that could otherwise be used in a better way.

ii. DISCRIPTION

- **Croft tow dolly :-**

Use a 2‖, 6000 lb. (or greater) capacity ball for a tow dolly Make sure towing vehicle's parking brake is fully engaged before starting hookup, loading, unloading, or unhooking of Tow dolly. Do not load towed vehicle onto tow dolly until tow dolly is completely and properly hooked up to towing vehicle and Setting on a level surface. Tail lights and stop lights must be hooked up and operating properly at all times. Do not load a towed vehicle that exceeds weight or size limits of tow dolly.

.

Fig 1: Croft tow Dolly

- **Heavy duty wheel dolly:**

Set emergency brake, chock tires of diagonally opposed wheel(s) in both directions AND take every precaution necessary to ensure set up is stable and prevent inadvertent vehicle movement. When tire & wheel assembly are ready to remove, position wheel dolly to accept tire & wheel assembly and secure load with restraint. Use jack handle to turn release valve clockwise until tight. DO NOT OVERTIGHTEN. Insert jack handle into handle sleeve of hydraulic unit and pump until lifting arms reach desired height. Do not use wheel dolly to free a seized up wheel assembly. For typical practice of taking out a seized up wheel assembly, a long metal bar can be used to pry the wheel assembly from the stuck wheel axle.

Fig. 2. Heavy duty dolly

Very common throughout the world, screw jacks are found wherever there is a need to lift, position, align and hold load. Their high reliability and synchronization makes Screw s suitable for a wide variety of muses that alternative methods of handling cannot achieve.[3] This spectrum of applications reaches across market sectors and includes Steel Works Equipment, Water Processing, Pharmaceutical, Medical and Laboratory Equipment, Packaging Equipment, Nuclear and Aerospace and General Mechanical Handling.

- **Screw jack**

Fig. 3. Screw Jack

Additionally, screw jacks are increasingly finding uses as alternatives to conventionally pneumatic and hydraulic systems. A Screw Jack (also known as a Jack Screw, a Worm Screw Jack, a Machine Screw Jack or a Lead Screw Jack) is a devise used to convert rotational motion into linear motion. It utilizes the property of a screw thread providing a mechanical advantage i.e. it can be used to amplify force.

iii. LITERATURE SURVEY

G.K.Anantha suresh explains the rack and pinion mechanism is a versatile mechanism because it can perform path and function generation simultaneously and it has good transmission characteristics since the transmission angle is always equal to 90 deg minus the pressure angle of the rack.

S.N.Kramer states the general procedure for synthesizing the rack and pinion mechanism up to seven precision conditions is developed. To illustrate the method, the mechanism has been synthesized in closed form for three precision conditions of path generation, two positions of function generation, and a velocity condition at one of the precision points. This mechanism has a number of advantages over conventional four bar mechanisms.

Adolph A. Thomas explains this invention relates to automobiles and its object is to provide practical means for lifting and/or driving a car sideward in either direction. The need of a lateral drive for auto 5 mobiles has long been recognized, but as far as I know all previous attempts to solve that problem have been impractical. For example, it has been proposed to lift a car on small parking wheels geared to the engine shaft for lateral 1e propulsion of the car.

iv. METHEDOLOGY

Consideration of weight & forces

The basic start of any design or the analysis of object we need to consider the weight which will be going to act upon that object. As for our project we consider the vehicle TATA NANO. This vehicle carries weight up to 630 kg. so we consider the weight as approximately 700 kg.

Design

Design consist of applications of scientific principles ,technical information and imagination for development of new or improved machine or mechanism to perform a specific function with maximum economy &efficiency.

Hence a careful design approach has to be adopted . The total design work has been split into two parts ;

v. DESIGN CALCULATIONS

Design of rollers

Material used:- Mild steel

Quantity:- 2

Dimension:- length = 275mm

Diameter = 45mm

Total force on roller = 250kg

$= 250 \times 9.81$ N

$= 2452.2$ N ≈ 2500 N

Bending moment = M = (W×L)/4..............(1)

$= (2500 \times 457)/4$

$= 285625$ Nmm

Moment of inertia = I =(BD3- bd3)/12..............(2)

=(D4-d4)/12

=39852 mm4

As we know

$$\frac{M}{I} = \frac{\sigma}{Y}$$

σ = (M × Y) / I..............(3)

Y = 15

σ = (28562×15) / 39852

= 107.50 N/mm2

As the force is applied in a contact

$\sigma t = \sigma c$

Ultimate tensile stress for mild steel = σt = 370 Mpa

Factor of safety f.o.s = 2

$\sigma all = \sigma t / f.o.s$

$\sigma all = 370/2$

$= 185$ n/mm2

As $\sigma < \sigma all$

$107.5 < 185$

Design is safe

Design for rack tooth

Available data (square bar)

A = 5mm

B = 20mm

Material used = M.S

Syt = 370 Mpa

Ssy = 0.5Syt

$= 0.5\times370$

= 185 N/mm2

τall = Ssy/ f. o. s

=185/2

τal = 92.5 N/mm2

But

τ = F/A......................(5)

$A = a \times b$

$= 5\times20$

= 100 mm2

$\tau = 200\times9.81/100$

$\tau = 25.506$

$\tau < \tau$ all

$25.506 <$ 92.5 N/mm2

Design of rack tooth is safe

Design of lever

Available data

$F = 200\times9.81 = 1962$ N

L1 = 530mm

L2 = 60mm

P = ?

Since

$F \times L2 = P \times L1$..........................(6)

$1962 \times 60 = P \times 530$

$P = 1962 \times 60/530$

P= 111.056 N

P= 11.32 Kg

Required force for lever is 11.32 Kg

Design for pawl

Available data

D = 8 mm

L= 60 mm

$2550.6 = P \times 8 \times 60$

P = 5.31 N/mm2

$\tau = F/A$..................(7)

$A = \pi/4 \times d2$

A = 50.265 mm2

$\tau = F/A$

$\tau = 2550.6/50.265$

τ = 25.37 N/mm2

τ is < τ all

25.37 is < 92.5 N/mm2

Design of pawl is safe.

Design of spring

Available data

D = 2.5 mm

C = 6

G = 81370 Mpa

P = 288.7 N

Syt = 0.75 Sut

$= 0.75 \times 1500$

= 1125 Mpa

K = 4C-1 /4C-4 + 0.615 / c...................................(8)

= 24-1 / 24-4 + 0.615/6

K = 1.2525

$\tau = K \times (8 \times 288.74 \times 6 /\pi \times d2)$..................(9)

$= 1.2525 \times (8 \times 288.74 \times 6 /\pi \times d2)$

= 5525.55 / d2

= 884 N/mm2

$\tau < \tau$ all

= 884 < 1125 N/mm2

Design of spring is safe

Design of welding

Available data

Square bar = 30 × 30 mm

T = 8 mm

Primary shear stress

Total area of horizontal and vertical is given by

A = 2 [30 t + 30 t]

= 2 [30 × 8 + 30 ×8]

= 960 mm2

τ = P/A

= 2000 / 960

= 2.08 N/mm2

Check for Bending Failure

Bending stress

σ b = Mby / I

Ixx = 2 (bt3 / 12) + bt × (d2/2) + 2 (td3 / 12)

= 2 (30×8 3 /12) + 30×8× (302/2) +2 (8×303/12)

= 146560 N/mm4

Y = 15 mm

Mb = 1000× (305/2)

= 1000 × 152.5

= 152500 Nmm

σ b = Mby / I

= 152500×15 /1650

σ b = 15.60 N/mm2

σ b < σ b all

Bending failure has not to occur.

Check for shear failure

Maximum shear stress

The maximum shear stress in the add is given by

τ max = σ b2 / 2 + τ 2...........(10)

= 15.60 2 / 2 + 2.08 2

= 8.0725 N/mm2

τ max < τ all

Shear failure is not occurred

Design of welding is safe.

Design of caster wheel

We select caster wheel from manufacturing catalogue

Specification:-

Diameter= 3 inch

Width = 1.2 inch

Material = hard rubber

Bearing type= ball bearing

Capacity = 250 kg

vi. RESULT AND DISCUSSION

- By applying 110N effort, the load of 200kg can be easily lifted with design system.
- With this design system the TATA NANO can weighing of 700kg is lifted and move.
- The maximum lift is upto 36mm.
- The lift can sustain upto250kg, i.e vehicle weighing 1000kg.

vii. CONCLUSION

Hence we have concluded that how to lift car in better way. we have solve the problem coming between lifting the car and also it reduces the time taken for lifting a car and we can move the car easily to desire place.

viii. ACKNOWLEDGEMENT

It is a genuine pleasure to express my sense of thanks and gratitude to my mentor, Mr.S.R.Jadhav His dedication and keen interest above his entire overwhelming attitude to help his students had solely and mainly responsible for completing my work. His timely advice, meticulous scrutiny, scholarly advice and scientific approach have helped me to a very great extent to accomplish this task.

iX REFERENCES

A.A.Thomas ―Lifting And Sideward Driving Mechanism For Automobiles‖, Page 119, Aug 1937

R.W.Shay ―Moving Dolly‖, U.S.Patent , Page 1-6, Jul 1981

Mitsuhiro Kishi ‖Laterally Movable Mechanism Of A Vehicle‖, Page 1-11, Sep 1995

Anthony Ronca ―Dolly For Moving Large Sheets‖, Page 1-11, Sep 2002

G.K.Ananthasuresh & S.N.Cramer ―Kinematic Synthesis & Analysis Of Rack And Pinion Multipurpose Mechanism‖, Page 1-5, Sep 1992

Ivan Sunit Rout & Dipt iRanjan Patra ―Design & Fabrication Of Motorized Automated Object Lifting Jack‖, Page 1-7, May 2014

Martin Philip Bendose. ―Optimization of Structural Topology, Shape and Material‖ Springer Verlag Berlin Heidelberg1995.

Anton Olason& Daniel Tidman.―Methdology for Topology & shape optimization in the Design process‖ Master‘s thesis, Chalmers University of Technology, 2010.

Department of Applied Mechanics, Division of Dynamics, CHALMERS UNIVERSITY OF TECHNOLOGY, Goteborg, Sweden 2010,Master‘s Thesis 2010:11.