

Modification of Electrically Operated Pallet Truck

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Abstract: This paper gives a detailed description of Modification of Lifting rod Electrically Operated Pallet Truck. It also gives information about numerous advantages. Electrically Operated Pallet Truck is a mechatronic machine used in industries to lift and displace heavy objects and machines. This pallet truck can be used in places where there is less space between transfer lines and aisles. This paper deals with decreasing failure of this machine by increasing its capacity with new innovative ways. The force acting on various parts are calculated and new way to make its failure less is been enhanced.

Index terms: Pallet, Electrically operated, Aisles, Transfer Line, Failure, Capacity.

1. INTRODUCTION

Electrically operated pallet truck are the machine used to lift heavy materials. They are used for loading and unloading purposes of medium sized loads. They are good substitutes for forklifts. Most pallet trucks use hydraulic cylinders for lifting loads and carry it to their proper position.

They use Battery as their power source and is only source of power for Electrically Operated Pallet Truck. Recharging of battery is done by the help of attaching cables that connect the battery pack to a power source. By using battery, they can also be used at places where there is sudden breakdown of power, as they can be easily charged. We use electrical plugs in industries for charging it. As it uses electric power packs, use of Gasoline is reduced as seen in Forklifts Operation of electric pallet jacks is much quieter than gasoline-powered alternatives. It proves its importance in smaller warehouses and spaces. Also the pollution due to fumes from use of gasoline is eliminated.

Some types of pallet truck include walkies, single- or double-pallet jacks, or power jacks. They use an operator area on which operator can easily stand and handle loads.

2. MAJOR PARTS OF PALLET

Operator Area : The area on which the operator stands and operates pallet truck. This area is mostly an overhung part on the backside of pallet. Its a square platform area made of steel or Cast Iron.

Drive : Drives consist of a motor basically of range from 1.5 to 2.5 kW . It has a gear box consisting of two stage Helical Gear with low noise and efficient speed reduction.

Chassis : It is robust construction on which whole system is mounted. It is made up of Cast Iron and steel depends on work standard.

Wheels :Wheels are made up of Cast Iron coated with castors for smooth ride over surfaces which causes less damage to floorings.They have ability to withstand loads and provide less jerk while been driven. They also do not damage floors or any surfaces in their way.

Tiller Head :Tiller Head consists of a drive control used to displace pallet truck.

Hydraulic System :Compact power pack unit is used to with high pressure pump driven by 0.8 Kw sturdy compound wound motor operates the lifting mechanism comprising of low lift hydraulic cylinder and load wheel linkages for jerk free lift of the loaded pallet for the required ground clearance. The compact

system consumes less battery power and is designed with very little scope for hydraulic losses.

Forks :They are normally steel fabricated steel parts used for lifting racks or materials. They are fabricated such that there should be minimum failure of these parts. This forks consists Lifting rod covered by plates on its above surface. This rod is of major design.

3. RESEARCH OR WORK DESIGN

The Rod which usually fails under sudden load lies under forks of pallet and its cad model is given by:-

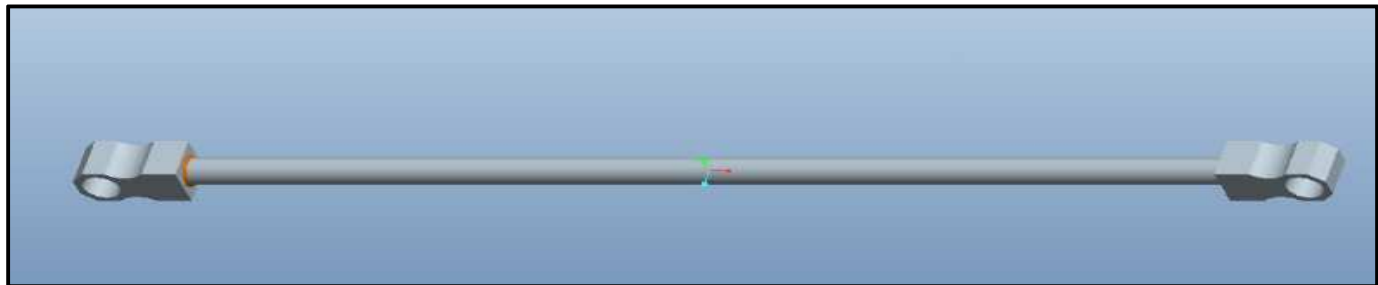


Fig 1:- PRO/E Model of Rod

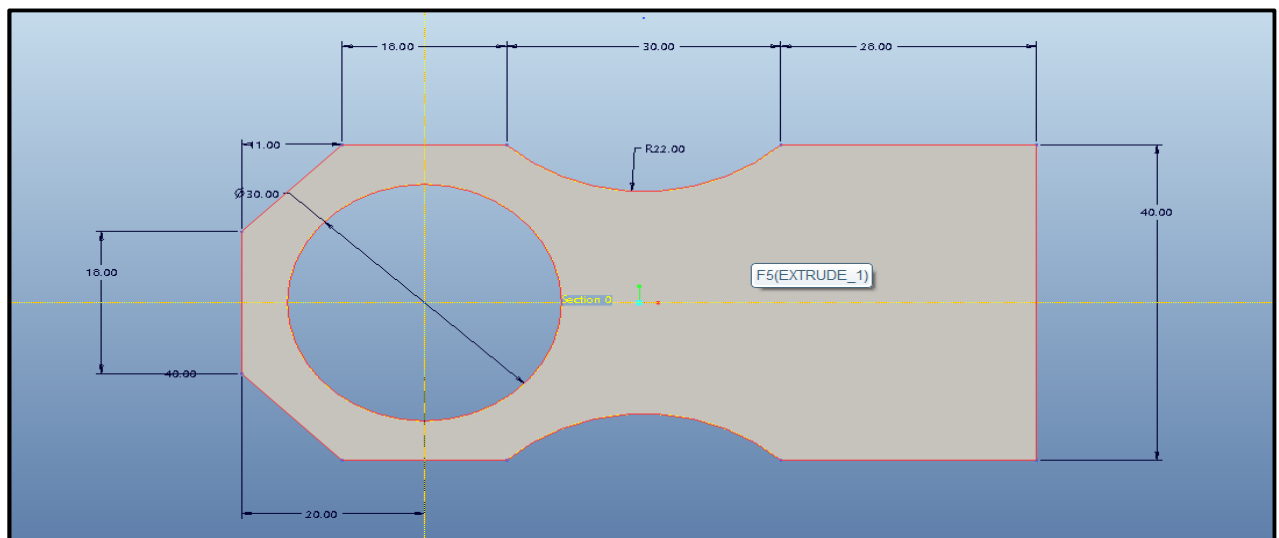


Fig 2:- Rod end of pallet lifting rod.

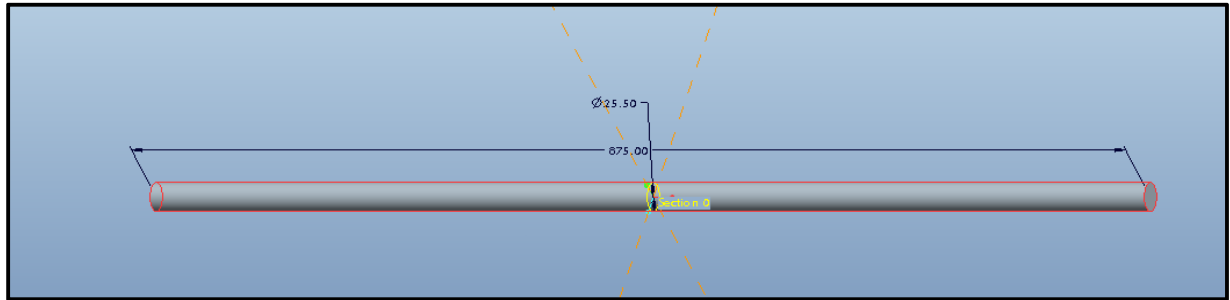


Fig 3 :- Rod shaft

The material used for making this Rod is M.S.

Theories of failures

- Sudden load or Impact load Failure
- Bending Failure
- Fatigue Failure

It is been seen that failure does not occur suddenly but it occurs gradually by showing fatigue changes.

By Soderberg criteria

Fmax=3500kg Fmin=0kg d=25.5

Syt= 248MPa Sut=330MPa

Se=Ka*Kb*Kc*Kd*Ke*Kg*Se'

Se'=Sut/2=165

Ka=4.5(Sut)-0.265=0.808

Kb=1.2857*d-0.113=0.872

Kc=Kd=Ke=Kg=1

Se=0.808*0.872*165=116.25MPa

$$\frac{Sm}{Sy} + \frac{Sa}{Se} = \frac{1}{Nf}$$

$$Sm = \frac{3500 * 9.81}{2 * \pi * 12.75^2} = 33.61 \text{ MPa} = Sa$$

$$\frac{33.61}{248} + \frac{33.61}{116.25} = \frac{1}{Nf}$$

Nf=3.35≈4

We are taking as 5 for more safety

Sf = Nf * Sm=169.76Mpa

$$\frac{\log(0.9Sut) - \log Se}{6 - 3} = \frac{\log Sf - \log Se}{6 - L}$$

L=4.25

L=17783cycles

Material used in new analysis is Stainless Steel U.T.S is 460Mpa

Fmax=3500kg Fmin=0kg d=25.5

Syt= 303MPa Sut=460MPa

Se=Ka*Kb*Kc*Kd*Ke*Kg*Se'

Se'=Sut/2=230

Ka=4.5(Sut)-0.265=1.065

Kb=1.2857*d-0.113=0.872

Kc=Kd=Ke=Kg=1

Se=1.065*0.872*230=213.59MPa

$$\frac{Sm}{Sy} + \frac{Sa}{Se} = \frac{1}{Nf}$$

$$Sm = \frac{3500 * 9.81}{2 * \pi * 12.75^2} = 33.61 \text{ MPa} = Sa$$

$$\frac{33.61}{303} + \frac{33.61}{213.59} = \frac{1}{Nf}$$

Nf=3.72 ≈ 4

For more safety we are taking as 6

Sf = Nf * Sm=240Mpa

$$\frac{\log(0.9Sut) - \log Se}{6 - 3} = \frac{\log Sf - \log Se}{6 - L}$$

L=4.568

ν (Poisson ratio) = 0.27

L=36982cycles

U.T.S=460MPa

Improvement

So Failure of material will be less than ever.

The material used for making this Rod is M.S.

Y(modulus of elasticity)=248 GPa

ν (Poisson ratio) = 0.3

U.T.S=330MPa

Changing material from M.S. To Stainless steel

Y(modulus of elasticity)=303 MPa

4. HANDLING

As seen, the operators were certainly using the pallet properly but there were some misfunction while handling the spool. The large problem was they some times elevated the spool without taking the whole spool rack. This greatly affected the pallet lifting rod.

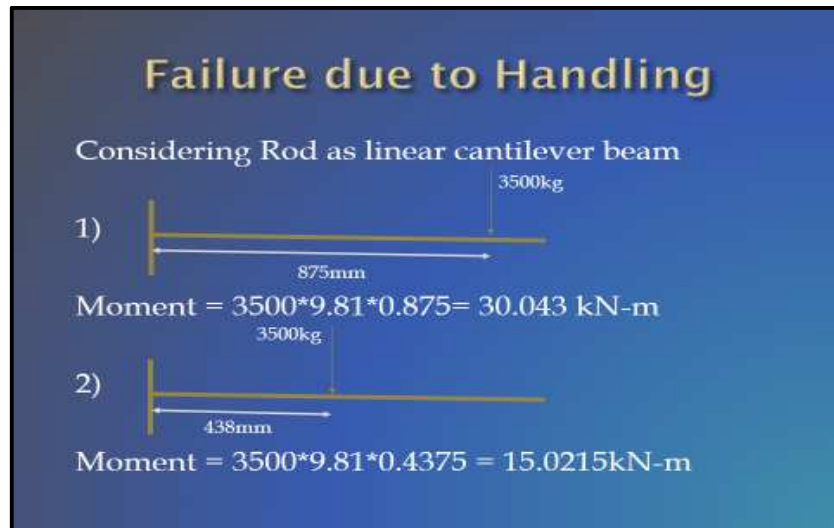


Fig 4:- Moment force in Rod due to improper handling.

Provision for Proximity sensor proved beneficial in case of Handling. Proximity sensor is a sensing device which detects metal when it comes in contact with its sensing range. It is an inductive sensor mainly used to sense metals.

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