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Rotating Trolley with Lead Screw Mechanism

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ABSTRACT: The function of rotating trolley with lead screw mechanism is to rotate the trolley 360 degree about it's own centre and can load / unload in congested area. It consists of several mechanical component like worm gear worm wheel, bearing, lead screw, universal joint. The trolley is free to rotate about its centre with the help of worm and worm wheel. The trolley frame if mounted on the worm wheel.
The trolley can lift at any particular angle for unloading of the things with the help of lead screw, for providing an angular motion universal joint are use. Lead screw which consist of square thread which convert the rotary motion into linear motion and trolley lifting take place.

Keywords: Universal joint, Lead screw, Worm, Worm wheel, Ball bearing.

I. INTRODUCTION

The rotating trolley with lead screw mechanism is a system through which we can unload the trolley in congested area by rotating the trolley 360 degree about its own centre with the help of worm and worm wheel. The trolley can lift at any particular angle for the unloading of trolley with the help of lead screw and universal joint. In the modern age the trolley lifting process is pressure system but here in this project the trolley lifting take place with the help of lead screw by rotating shaft connect with universal joint which provide the motion at any angle. The universal joint is connect with the lead screw.

II. RESEARCH METHODOLOGY

In India there are generally using a pressure trolley or simple trolley. For the unloading of such trolley we require a large space for turning of trolley with tractor. But here in this project there are no such problem creat because the trolley can rotate 360 degree about its own centre and can unload in any direction although in congested area.
The pressure trolley have leakage problem of fluid but in rotating trolley with lead screw mechanism this problem can overcome.

III. METHODOLOGY

- To the formation of this project first of all we purchases the mechanical component like- Wheel, Worm Gear, universal joint , lead screw, bearing etc.
- Draw the rough sketch in creo parametric software for overview of project.
- Form the frame of trolley in workshop by metal sheet.
- Fit the frame on wheel axel.
- Assemble all components of trolley.

IV. LITRATURE SURVEY

Y. Yavin September 2003 Mathematical and Computer Modeling, This work deals with the modeling and control of the motion of a trolley moving on a plane with a time dependent inclination.
Improvement –trolley have rotational motion about own centre.
George J. Beneck February 2017 To transport school materials, trolleys have been proposed for children as an alternative to carrying a backpack. This study compared the effects of carrying a backpack and pulling a trolley on gait kinematics in children.
Improvement –trolley pooling or pushing by hand or by using machine.
Kam Wai Kuen 2015, Force evaluation on supply trolley was conducted based on the different mode of handling to assess the suitability of use. Result of this study was used to develop a guideline to set the requirement for future purchase of trolley and to improve features of existing trolleys.
Improvement –trolley can lift with any particular angle with the help of lead screw.

V. COMPONENT OF PROJECT

1-WORM & WORM GEAR

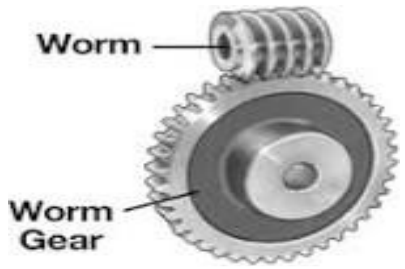

Fig. 1. Worm & worm gear.

1-The gear material is cost iron.
2-The number of teeth on worm gear is 26 and the number of teeth on worm is 3.
3-The worm is a single point starting teeth .
4-The trolley is mounted on worm gear.

2- LEAD SCREW

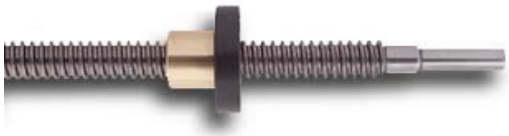

Fig. 2. Lead screw.

1-Lead screw is use in this project for lifting purpose of the trolley.
2-Lead screw also known as power screw or translation screw.
3-Larg load carrying capability and compact.
4-Simple to design and easy to manufactured.
5-Large mechanical advantage and precise and accurate linear motion.

3-UNIVERSAL JOINT

Fig. 3. Universal joint.

1-Universal joint is a type of mechanical component which provide the motion at any angle.
2-Universal joint is generally made up of stainless steel.
3-Universal joint is connected with the lead screw.

4-ROLLER TYPE BALL BEARING

Fig. 4. Ball bearing.

1-Bearing is a mechanical element use for the carrying load under the action of rolling motion by placing some rolling element.
2-The rotating shaft is fitted in the hole of the bearing tightly.
3-The bearing is generally use for reduce the friction between two mating part having relative motion between each other.

VI. POWER TRANSMISSION SYSTEM

There are two power transmission system consist in this project. The first is lead screw which convert rotary motion into linear motion. The universal joint is connected with the lead screw which provide motion at any angleof the lead screw.
The other power transmission system is worm and worm gear. The axis of worm and worm gear is intersect at 90 degree with each other and transmit power. The trolley is mounted on the worm wheel and motion provide by worm to rotate the trolley 360 degree about its centre.
The power provide to run the system by manually.

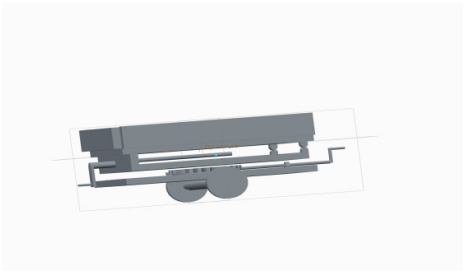

Fig. 5. Assembly of project.

VII. ADVANTAGES

The general advantage of the rotating trolley is as listed below-

1- The trolley can rotate 360 degree about its own centre.
2- The trolley can unload in congested area.
3- The cost of the formation is low.
4- Maintenance cost is low.
5- The efficiency is high because of warm and worm gear use.
6- Less skill person can also work on this rotating trolley.
7- The problem of leakage is remove as in pressure lifting trolley.

VIII. DESIGN OF SYSTEM

Worm teeth (Z1) = 3
Worm wheel(Z2) =26
(1)-centre distance (a) =1/2*m*(q+Z2)
Where
Module(m) = D/T
=220/26
=8mm
Diametral quotient (q) =d1/m
d1= pitch circle dia. Of the worm
q=60/8=7.5

a = 1/2*8*(7.5+26)
=134mm

(2) Speed reduction =Z2/Z1
=26/3
=9

(3) Dimension of worm
d1 = q*m
=7.5*8
=60mm
d a1 = m(q+2)
=8*(7.5+2)
=76mm
tan λ = z1/q
=3/7.5
λ = 21.8^0

where
λ = lead angle

d f 1 = m(q+2-4.4cos21.8)
= 43mm

Circular pitch (Px) = π*m
= 25.132mm

(4) Dimension of worm wheel
d2 = m*z2
= 208mm

da 2 = m(z2+4cosλ-2)
= 221.71mm

df 2 = m(z2-2-.4cosλ)
= 189.02mm

Where
da1= outside dia. of worm(mm)
df1 = root dia. of worm(mm)
da2= outside dia. of wheel(mm)
df2 = root dia. of wheel(mm)

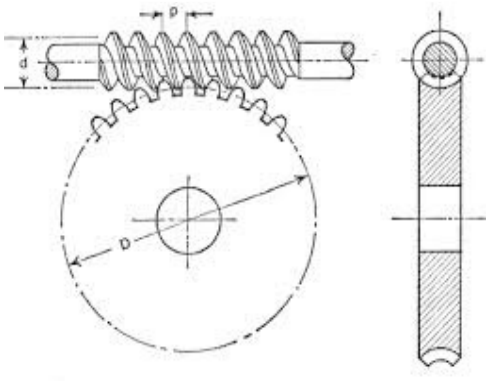

Fig. 6. Layout view of warm and warm gear.

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