

DESIGN OF EFFICIENT POWER SCREW ROLLER LIFT

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ABSTRACT

In this world of emerging new technologies; it is very important to do work speedier, convenient, and economical as well as efficiently. This project reflects lifting equipment which has a mechanism which provides easier way to transfer goods especially in form of Sack, Barrels, and other Packaging Units from dock of truck up to ground level and vice versa with negligible amount of man power. The equipment could find its use mainly in ware-house/go downs. It can also be used significantly in logistical material handling applications. Components consist of efficient use of automated Power Screw transmission system with the help of DC motor and appropriate battery. On conclusive remark, the aim of this project is to remove the problems faced in conventional transferring equipment's used for material handling.

KEYWORDS: *Packaging units, Material handling, and Conventional transferring equipment.*

1. Introduction to Project:-

We have observed that while transferring of goods in form of sack, barrel, and containers, requires complete human effort for transferring them from height of the dock up to ground level. This field requires a portable lifting device which holds goods and transfers it to require place with ease and convenient way. Problems such as inconveniency, failure, fatigue, decrease in human efficiency, overall decrease in productivity, are faced while transfer of goods packed in from of sack, barrel and other packing units from dock of truck up to ground level. The aim of this project is to make a lifting device which easily holds sack, barrel and other containers with negligible human effort including its mobile application and hence, by it increasing productivity for sectors performing the functions like loading and unloading of heavy material and therefore better experience in Material Handling.

2. Mechanism:-

The principle used in this project is

“Conversion of Rotary motion developed by DC motor to linear motion with the help of appropriate Gear arrangement and Power Screw”

The product can be defined as a Lifting Equipment which lifts goods from ground level to dock of truck and vice versa. It consists of components like DC motor run by battery, a Transmission system, Gear Arrangement, Torque transmission system with proper distribution of load. It has properties like mobility, safety consideration of human life and problems arising during related work, also it can be operated also by unskilled worker etc.

Lifting equipment in following sectors:

- Agriculture.
- Industrial.
- Ware houses/go downs.
- Transportation.
- Medical.

3. Engineering Economics and Design:-

Advantages of design and material methodology:

The material deciding technique used by us is based on purely mechanical means of transferring stress in different parts of our product.

Each and every part has different kind of stress applicable on it and hence the material should also be different according to kind of stress. We have designed this product in such a way that different materials are used in different places of product which help in working efficiently even in heavy stressed conditions.

Materials used by us make our product design more robust and reliable. Materials are easily available in market as well as easily replaceable. They are designed to achieve more life span

Kept in mind the keen needs of workers activity. Design made to work in any possible environment.

Design of product is made such that it has multiple uses such as sack, barrel, raw cast materials, and many more.

Eco-friendly and Ergonomics were two important terms kept in mind while deciding and finalizing the design. Design directly will save time, money, power, human effort, and ultimately increase productivity.

Design so as operator does not feel fatigue and does not undergo any health issues. Accidents are eliminated by using design. Design is made possible by transferring stress at each level directly to ground hence the life of components is increased.

Designed for Reusability:

The life span of ball screw in heavy conditions is 2 years as a result the design of chassis is made such that ball screw element can be replaced or can be re-maintained easily by removing it from the lift.

If the pallet undergoes any issues it can also be replaced. Same is applicable for Rod, Battery, and Gear arrangement and hence, we can say that the design is built for great sustainability.

4. Sustainability:-

The proof of validation was necessary to be conducted through working prototype or by means of software simulation process.

Hence, with the immense effort we found a software testing unit specially designed for testing loads on ball screw either vertical or horizontal means.

Software: MISUMI CORPORATION TECHNICAL CALCULATION.

It is a US based MNC company which also has one of the branch in India.





Ball Screws calculation

Mounting Direction: Type / Shaft diameter:
 Mounting Method: Lead / Precision grade:

Conditions

Table+Work Weight (W) Kg

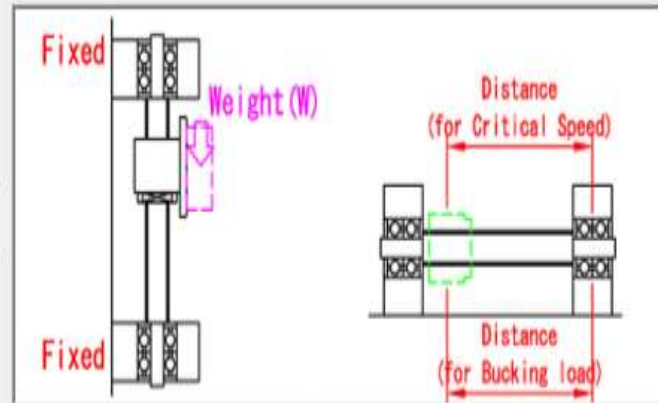
Maximum Stroke (S Max) mm

Friction coefficient of slide

Driving Motor Revolution Freq. (N Max) r/min

MISUMI product

Product	Catalog No. ^
Rolled Ball Screw -Shaft diameter 32	BSSZ3210
Rolled Ball Screw -Shaft diameter 32	BSSZK3210 v



Checking for Bucking load

Distance (for Bucking load) mm Safety factor (Alpha)

Distance (for Critical Speed) mm Safety factor (fa)

Result

Calculation

	Result	^
Revolution Frequency	900	
Allowable Revolution Frequency	DN= 30420	C
Critical speed	Nc= 1843.5(r/min)	C
Allowable bucking	Pk= 3.372 1/(daN)	C v

Operating conditions

Threading Speed (V) mm/s

Acceleration Constant (t1) s

Cycle times per 1 sec. (n1) min-1

Work factor (fw)

Operating conditions

When Ball screw is selected the page opens for intake values of ball screw specifications,

Load, rotation, cycle per min, etc.

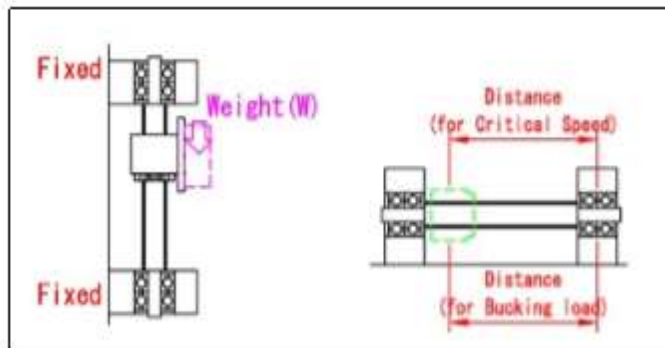
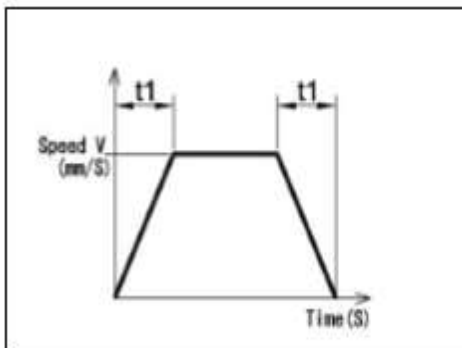
After the completion of the following process we get the final result.



Result of calculation

Conditions

Mounting direction	Vertical	Table+Work Weight	800(Kg)
Mounting type	Fixed - Fixed	Threading Speed	150(mm/S)
Product	RolledBall screw/Shaft diameter32mm	Friction coefficient of slide	0.03
Lead	10	Driving Motor Revolution Freq.	1000(r/min)
Precision grade	C10	Distance (for Bucking load)	1800(mm)
Basic dynamic load rating C	3280	Distance (for Critical Speed)	1800(mm)
Basic static load rating Co	8670	Maximum Stroke	1800(mm)
Thread Minor Diameter d	27.2	Acceleration Constant	0.15(S)
Ball Diameter dp	6.35	Input the cycle time	0.33(min-1)
Thread External Diameter	32	Work factor	1.2



Result

Mean axial load	588.1(daN)
Mean Revolution Frequency	888.9(r/min)
Revolution Frequency	900(r/min)
Allowable bucking load	3372.1(daN)
Critical speed	1843.5(r/min)
DN	30420
Actual life span (Lh)	1882.7(Hr)
Life span including down time.	14086.7(Hr)

Comment

DN	OK
Allowable bucking load:	OK
Critical speed:	OK

MISUMI Slide Guides/Ball Screws calculation Program Ver3.0 2016-09-22

5.FUTURE SCOPE:-

The lift can be controlled using Remote measures.

More Sensors can be deployed which track activity of pallet in terms of movements, weight, Automatic switch for stop/resume.

Mechanism can be deployed above pallet which directly attaches with the material which has to be pulled and pushes it onto pallet without human interference.

6. CONCLUSIONS:-

Specialized design found for loading and unloading material in agricultural sector directly from the surface of Dock in Trucks to ground level effortlessly.

Efficient working devices provide less human effort for stability of material on lifting table or pallet design. Human effort needed in many such cases observed in barrel handling, sack handling and much other material which requires manual effort for shifting material from dock of truck to transferring equipments was minimized.

Human safety assured due to heavy transferring of goods and material with the use of human body parts such as shoulder and forearm. Accidents are now absent through existing shifting techniques. With some of equipments such as forklift; skilled labors are required to operate and have many possible chances of accidents was eliminated.

Many equipments running cost is high due high maintenance of hydraulic / pneumatic systems and due to this project the cost is minimized.

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