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Design and Detail of Telescopic Material Unloader

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ABSTRACT: In industries reducing Manpower cost, Space, Money and Time saving purpose every one preferring simple equipments for loading and unloading materials. For the past decade, material handling organizations has been introduced and applied as an option for different types of Unloaders. It is a simple yet effective means reliable and cost - effective manner.

Our present work deals with utilization of telescopic material unloader for reduces the Manpower cost, time saving and safe loading and unloading the materials in industries. Our current attempt is towards fabricating an economical telescopic material unloader by adopting the exiting simple design procedure.

I. INTRODUCTION

Purpose:

Numerous different methods exist for loading and unloading material, all with the same intended result: to reduce manpower cost, safely to unload the material with in less time period. Some of the most common methods are loaders. Initially loader is used for loading materials it will not successes for loading and unloading purpose. By using loaders function and some of implementations Telescopic Material Unloader designed.

General Description:

It is a hydraulic & Chain drive Movable equipment for unloading heavy materials like Tobacco bales, High weight Bundles and Bags loading and & unloading purpose it is used, it will lift up to 2mtr height with the help of hydraulic cylinders & it will move to and flow direction up to 5mtr with the help of chain drive this is working with the help of Geared motors. The capacity of this equipment is up to 2.5 ton as per our design it will vary. By using this equipment material unloading and loading capacity is 15 to 20 tonns/hr. The name of this equipment is Telescopic Truck Unloader.

Easy to shift it from one place to another place with the help of trolly wheels with in plant and tranportion is also easy for one location to other.

Materials : MS grade IS:2062, Cast steel.

Processing Methods: Fabrication, full weldings, Pre assembly, Quality Checking, BOT's assembly, electrical connections, No load trails & load trails.

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PREVIOUS INVENTION:

LOADER:

By using loaders we are unload and load the material in small scale industries but these are not suitable for heavy industries in less time period to unload and load the material. The equipment will run with the help of geared motor chain drive and it will move from one place to other with the help of tyres. It will lift upto 18 degrees.

Loader Draw Backs:

1. By using loader we load the bag type material only.
2. Above 18 degree the material or bags connot withstand on belt it will fall downwards.
3. This is not suitable for present available transport vehicles to load and unload the material.
4. Above 75kg maerial cannot load and unload.
5. For operation purpose continuous man power required.
6. This is suitable only for small scale industries.

II. TELESCOPIC MATERIAL UNLOADER

Description:

It is a hydraulic & Chain drive Movable equipment for unloading heavy materials like Tobaco bales, Bags, High weight Bundles and raw materials loading and unloading purpose it is used. In receiving side it will lift up to 1.9mtr height and in discharge side 0.76mtr with the help of hydraulic cylinders & it will move to and flow directions like 4.5mtr in receiving side and 2.1mtr in discharge side with the help of geared motor chain drive. The capacity of this equipment is up to 2.5 ton as per our design it will vary. By using this equipment material unloading and loading capacity is 15 tonns/hr. This is used for unloading Tobaco bales. The name of this equipment is Telescopic Material Unloader.

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Tobaco Bale specifications:

Bale sizes : 1m X 1m X 1m

Bale weight : 100 kg

Construction Plan:

The intension is to improve upon the existing design, utilize more affordable, durable materials, and research additional methods for increasing efficiency. Portabilit is not a consideraion with this prototype design. Modification include: substitution of the Hydraulic cylinders, Geared Motor with chain drives, trally wheels. This unit will easily operate in any industry for unloading material safely with less manpower and with in less time period.

In this telescopic material unloader we are using 5 geared motors for Feeding & Discharge Conveyor purpose those are

1. Geared motor for Belt rotaion = 2.2 kw = 2 no's
2. Geared motor for conveyor to and flow rotaion = 2.2 kw = 2 no's
3. Geared motor for Trolley moment = 5.5 kw = 1 no

And 1 motor for Hydraulic power pack purpose means to lift the hydrulic oil from commpressed tank to cylinders supply purpose 5.5 kw motor used.

Structural Components & Bought outs:

These are the requirements for manufacturing the Telescopic Material Unloader.

a. MS Materials
b. Casting
c. Pulleys
d. Idlers
e.Plummer Blocks & Bearings
f. Belt
g. Scapers
h. Safety switches
i. Couplings like High speed and low speed
j. Electricals
k. Motors
l. Gearbox
m. Hydraulic cylinders

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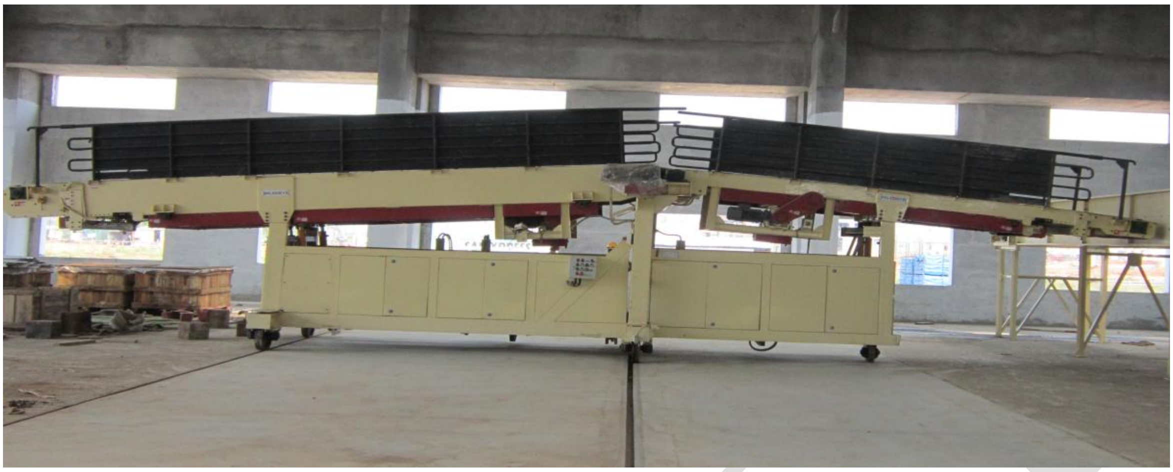

Advantages:

1. Unload above 75kg weight material in safe unloading.
2. It is suitable for all transport vehicles to unload and load material.
3. It is suitable & useful in small, medium and large scale industries.
4. Unloading capacity is high compare to loader.
5. More man power not required for unloading and loading material purpose.
6. Maintaness is very easy.
7. Skilled manpower not required.
8. It will operae and work in any climating condition and any unloading material purpose.
9. Material unloading in safe manner.

Disadvantages:

1. Construction is difficult compare to loader.
2. Cost of the equipment is high.
3. Hydraulic clinder maintanence is difficult.

III. CALCULATIONS

BELT CONVEYOR CAPACITY :

Material to be handeled		= Tobaco Bales
Capacity	C	= 15 TPH
conveyor speed	V	= 0.25 m/sec
Bulk Density	D	= 0.48 t/cu m
conv inclination		= 12 deg
Conveyor incl.Factor	Fncl	= 0.85
Conveyor Filling Factor	Ffl	= 0.8
Conveyor Filling Factor	W	= 1200 mm
Trough angle		= 0
Surcharge angle		= 30

As per IS11592 Table 7. Area for 1200 mm belt = 0.06 sq.m

Conveyor Capacity = 0.06 * 0.25 * 3600 * 0.48 * 0.85 * 0.8
= 17.6 TPH

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Design of belt K.W:

Length in Meter $l = 22$
lift in Meter $h = 1.9$
Capacity (Designed T/hr) $C = 15$
Density in T/M3 for tabaco $P = 0.48$
Volume capacity M3/sec $Q = 15/(0.48*3600) = 0.00087$
Velocity in M/sec $V = 0.25$
Art Frictional Coefficient $f = 0.025$
Belt width in Meter $b = 1.2$
Mass of the Carrying idler in Kg/m $mc = 20$
Mass of the Return idler in Kg/m $mr = 12$
Mass of the Belt in Kg/m $mb = 16$
Mass of the material in Kg/m mg = (Capacity X 1000)/(3600 X Velocity)
= (15 *1000)/(3600*0.25)
= 16.67
Conveyor Inclination, $d = 12$
No. of Tail & Take up pulleys = 2
No. of snub & bend pulleys = 4
No. of Head pulleys = 1
Length of the skirt board in ' M' $Lsk = 0$
Friction Coeff. u1 = 0.6
Friction Coeff. u 2 = 0.6
Friction Coeff. u3 = 0.65
Sag factor (for 2%) = 6.25
Idler spacing in ' M ' = 1.1
Helical Gear Box efficiency = 0.95
Main Resistance **R** in 'N ' (With out 'α' value) = f * L * g [mc + mr + (2mb + mg) cosd]
= 0.025*22*9.81[20+12+(2*16 + 16.67)cos 12]
= 429.51 N
Slope Resistance of Material **Rs**l in 'N ' = mg * g * h
= 16.67 * 9.81 * 1.9
= 310.71
Internal Resistance **Ra** in ' N ' = Q*1000*p*(v-v0)(v0=0 assumed)
= 0.00087 *1000*0.48*0.25
= 0.1044N
Acclr'n Length **La** in ' M ' $= (v^2 – v0^2) / (2g \times u1)$
$= (0.25^2 - 0^2) / (2 * 9.81*0.6)$
= 0.0212
Ext Resistance **Rska** in ' N $= (u2 \times Q^2 \times 1000 \times p \times g \times Lsk)/[((V+V0)/2)^2 \times b^2]$
(b= 2/3rd of B.W) $= (0.6*0.00087^2*1000*0.48*9.81*0)/[(0.25/2)^2 * (0.66*1.2)^2]$
= 0
Wrap Resistance **Rw** in ' N ' = 175x2+3x140 = 770 N
(for non drive pulleys assume slack side=175, other=140)
Pulley bearing resistance **Rb** in ' N ' = 75x2+50x3 = 300 N
(Tail pulley=75N, Snub/Bend = 50 N)

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(secondarey head pulley=100N)

Secondary Resistance **Rs** in ' N ' = Ra + Rska + Rw + Rb
= 0.1044 + 0 + 770 + 300
= 1070.04

Idler Tilt Resistance **Ri** in 'N' = 0

Skirt board Resistance **Rsk** in ' N ' = 0

Belt Cleaner resistance **Rbc** in ' N ' = A1 x p x u3

(Pressure p = 3x104 to 105 N/m2 , therefore average pressure is 65000 N/ m2)

External Scraper resistance Scr1 = 2*1.2*0.01*65000*0.65
= 1014 N

Internal Scraper resistance Scr2 in ' N ' = 2*(1.2/Sin 45)*0.01*65000*0.65
= 1434 N

Rsp in ' N ' = Rbc + Rsk

(Rbc = Scr1 + Scr2) = 1434+1014+0
= 2448 N

Effective Tension **Te** in ' N ' = R + Rs +Rsp +Rsl
= 429.52+1070.04+2448+310.71
= 4259.27

Calculating the Numerical co efficient 'α' = (Te-Rsl-Rsp)/R
= (4259.27-310.71-2448)/429.52
= 3.49

Corrected Main Resistance **R** in 'N ' = α x f x L x g [mc + mr + (2mb+ mg)cosd]
(With α value) = 2.61*0.025*22*9.81[20+12+(2*16 +16.67)cos12]
= 1121.04

Corrected Effective Tension **Te** in ' N ' = R + Rs +Rsp +Rsl
= 1121.04 + 1070.04+2448+310.71
= 4949.79

Actual Power (Pal) in KW (for head pulley Rw=230N,Rb=300N) = (Te/1000) x v +(Rw+Rb) x v/1000)]
=(4949.79/1000)*0.25+(230+300)*0.25/1000
= 1.369

Power at motor **Pm** = 1.369/0.95

(Helical GB efficiency 0.95) = 1.44kw

Considered 15% safety factor = 1.658 kw

Selected Motor Rating = 2.2kw

Therefore Selected Motor Power is 2.2 KW , 1440 rpm .

HELICAL GEAR BOX SELECTION :

Head pulley Dia = 315 dia

Speed = IIDN/60

Rpm of pulley = (60*0.25) / (II*0.315)
= 15.15

Gear box ratio = 1440/15.15
= 95.05

Service factor = 1.5

Mechanical Kw = 3.3
Hp= 4.43

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IV. CONCLUSIONS

* By using 2.2kw low capacity motor we designed and implemented 15ton/hr capacity Telescopic Material Unloader.
*. The efficiency of Telescopic Material Unloader is higher than the Loader efficiency by design parameters.
* The average unloading capacity of this equipment is 18.5tonn/hr in the interval of 24hrs.

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