Design and Fabrication of Weight Operated Material Handling Device

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Abstract— Material taking care of hardware is the media of transportation of material starting with one area then onto the next in a business space. Each material dealing with framework requires some sort of outer vitality for its working; while some customary material taking care of gadgets require labor for its activity. As per mechanical survey the force which has been used for creation out of which 32 to 35% of intensity is just used for material taking care of during the creation which is superfluously squandered and thus the all-out expense of definite item increments. So on the off chance that we need to diminish the all-out expense just as the superfluous force utilization, it is possible that we need to lessen material taking care of or pursue elective material dealing with. As the primary choice has a few constraints we are going after for elective material dealing with framework so we have built up this material taking care of gadget which acquires the drive to push ahead by the possible vitality of the heap to be conveyed.

Keywords: Weight Operated Material Handling Device

I. INTRODUCTION

Material dealing with framework includes development of material, machine starting with one spot then onto the next. It is method used to convey the correct merchandise securely, to the ideal spot and time and at the correct expense. Fundamentally material taking care of hardware is utilized to move an item starting with one area then onto the next. Present material taking care of activities include a type of cost which is later added to the last expense of item in this manner an improvement of material dealing with framework is important to control the expense of the item. Additionally the determination of material dealing with framework ought to be finished by the plant format or probably the plant design ought to be as indicated by the material taking care of framework to be actualized.

II. PROBLEM STATEMENT

To provide the effective material handling system for machine shop in minimum cost, which doesn't require any external power or manpower for its working.
Which doesn't require any external power or manpower for its working?

III. CONSTRUCTION

Following is the list of components:

1) Tray
2) Inner pipe
3) Rack
4) Compound gear train
5) Outer pipe with Spring
6) Chain drive
7) Base frame
8) Wheel

At the point when we put the weight as far as employments and machined segments on plate at stacking point, it goes about as a working burden for the gadget. This heap follows up on the spring, causing its pressure. The inward funnel is mounted on the spring. Pressure of the spring causes descending movement of a channel on which the plate rests. Simultaneously rack moves vertically descending as it is likewise joined to the internal channel. The pinion networks with the rack henceforth the vertical descending development of rack causes the rotational movement of the pinion. In this manner it causes forward movement of the gadget.

IV. METHODOLOGY

1) Manual support trimmers (some of the time additionally called fence shear or support scissors) are planned as huge scissors or enormous pruning shears. They needn't bother with anything to work and are least expensive/most earth amicable.
2) Need of minimal effort mechanized material dealing with framework Most of the enterprises confronting the issue of power, cost, labor and time in material taking care of framework. A portion of the traditional types of gear require abundance labor to work them for example hand streetcars, and so forth while some profoundly robotized frameworks require overabundance power just as more expense. So as to take care of the issues of future vitality emergency and to expand the benefit of the organization (decreasing the expense of material dealing with), our point is to give the minimal effort computerization hardware to tackle these Problems.

V. OBJECTIVE

1) To The model is a four-wheeled carrier that has the ability to move along a straight line. There are four wheels including two driving wheels driven by a chain drive and two free wheel in front that are constrained to move in one direction.
2) Various studies have been made in different industries to indicate that the cost of handling alone accounts for about 20-25% for the total manufacturing cost.
3) Minimal labor cost.
4) Less environmental problems.
5) No power consumption required.

VI. WORKING:

When force is applied on the plate the rack reciprocates. This reciprocating motion of rack is converted into rotary motion by the pinion which is mesh with rack. This rotary motion is transmitted to wheel with the help of chain drive. The rotary motion of pinion is transmitted to axle shaft of trolley. When the rack moves downward it allows to

movement of rack downward & rotation of pinion which is given to the wheel and trolley moves.

When the load is remove due to spring force trolley moves in upward it allows to movement of rack upward & rotation of pinion in reverse which is given to the wheel and trolley moves reverse.

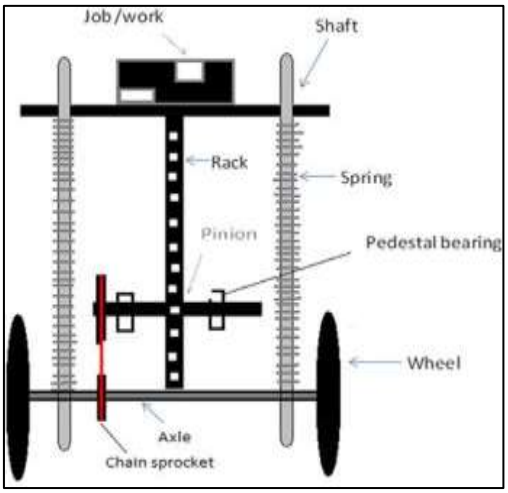

Fig. 1: Working

VII. SELECTION OF MATERIAL

The choice of best material in one which serve the ideal target at the base cost.Factors which ought to be considered for the choosing the material .

1) Availability of the crude material
2) Suitability of the material for the working condition in administration
3) The expense of materials

In our endeavor to plan a pneumatic lift, we have received a cautious methodology. Complete plan work has been partitioned into two sections chiefly,

1) System Design
2) Mechanical Design

Framework configuration fundamentally worry with the different physical concerns and ergonomics, space necessities, courses of action of different parts on the principle edge of machine, number of controls, places of this controls, simplicity of upkeep, extent of further enhancements, tallness of machine segments starting from the earliest stage. In mechanical plan, the segments are sorted into two sections.

1) Design Parts
2) Parts to be bought

For configuration parts, nitty gritty plan is done and measurements subsequently got are contrasted with next most elevated measurements which are promptly accessible in the market. This disentangles the get together just as after creation adjusting work. The different resiliences on work pieces are determined in the assembling drawing. The procedure sheets are arranged and given to the assembling stage. The parts are to be bought straightforwardly are determined and chosen from standard indexes.

VIII. TRANSMISSION SYSTEM

The mechanical force created by prime over I used to drive different machines in the workshop and industrial facilities. A transmission framework is the instrument, which manages transmission of the force and movement from main player to shaft or from one shaft to the next. The machine instrument drive is a total of system that transmits movement from an outer source. To the employable components of the machine apparatus. The outside wellspring of vitality is commonly a three stage A.C. engine, which has a rotational movement at its yield shaft. The rotational movement of the engine is transmitted to the employable component to give a usable working or assistant movement. At the point when the necessary movement is rotational; the transmission happens through instruments that move Rotary movement starting with one shaft then onto the next. Transmission of the movement from the outer source to the employable component can occur through Mechanical components, for example, belts,Gears, chains and so on.

Mechanical Transmission and its elements: -

1) Belt Transmission
2) Gear Transmission
3) Chain Transmission

1) Belt Transmission: -

Belt drive is one of the most widely recognized compelling gadgets transmitting movement and force from one shaft to the next by methods for dainty inextensible belt over coming up short on pulleys. This to a great extent utilized for universally useful on plants and processing plants particularly when the separation between the Shafts isn't extremely extraordinary.

At the point when the middle separation between the two shafts is huge than the tight side of the belt ought to be the lower one the pulley called driver is mounted on the driving shaft while the pole while the other, which is mounted on the pole to which force is to be transmitted is known as the determined pulley or supporter.

At the point when the belt moves over the pulleys there is consistently the chance of slipping between the belt and pulley and hens the character of the movement transmitted isn't certain when positive activity is required. Apparatuses and chain must be utilized.

2) Gear Transmission: -

Effectiveness of intensity transmission in belt and rope drives is less. The force might be transmitted from one shaft another by methods for mating gears with high transmission Efficiency and an apparatus drive is additionally give when the among driver and devotee is little.

Chains are utilized for high transmission number. They are for the most part utilized when separation between focus is short however the middle separation is as much as 8m. They are currently commonly utilized for transmission of intensity in cycle, engine vehicle, and agribusiness hardware in workshops.

It is general prerequisite for any machines that they should arrangement for controlling velocity of movement

The guideline might be accessible in discrete advances or it might be steeples for example persistent. The configuration are known as ventured drives Ex. Machine, processing machine, printing machine and so on.

IX. DESIGN OF TRANSMISSION OF SYSTEM:

Calculation of torque indused on shaft,

In our project load is applied on shaft. Minimum load applied by is 30 kg and maximum 150 kg. Take load 150 kg.for safe design,
Load= 150x9.81
=1471.5N
Diameter of gear =48mm
So Torque transmitted
T = F x R
T = 1471.5x 24
T = 35316 N-mm
For applied torque we first design diameter of shaft

A. Design of Gear Shaft:

SAE 1040 SAE (SOCIETY OF AUTOMOBILE ENGENEERING)
10=Plain carbon steel
40 = 0.4 % of carbon
Following stresses are normally adopted in shaft design
Max^m shear stress = 170 N/mm^2
Max^m bending stress = 200 N/mm^2
The shaft is subject to torque and bending moment,
To calculate R_A and R_B,
Resolve all forces vertically,
$\sum Fy = R_A + R_B - 3 - 4$
But $\sum Fy = 0$
$0 = R_A + R_B - 7$
$R_A + R_B = 7$
Taking moment about A,
$M@A = 3x43 + 4x73 - R_B x100$
$0 = 421 - R_{Bx} x100$
$R_B = 421/100$
$R_B = 4.21N$
Put R_B=4.21N in equation
$R_A + R_B = 7$
$R_A = 7 - R_B$
$R_A = 7 - 4.21$
$R_A = 2.79N$
Taking bending moment about C,
$M_C = R_A x43$
=2.79x43
=119.97N.mm
Taking bending moment about point D,
$M_D = RBx27$
= 4.21x27
=113.67N.mm
For safe design take maximum bending moment,
Mc =119.97 N mm,
We know,
The equivalent Twisting Moment.
$Te = [(km \times M)^2 + (kt \times T)^2]^{1/2}$
Where,
Km = Combined Shock and Fatigue factor for bending = 1.5
Kt = Combined Shock and Fatigue factor for torsion = 1
For Rotating Shaft

Nature of load	Km	Kt
Gradually Applied Load	1.5	1.0
Suddenly applied load with minor shock	1.5 to 2.0	1.5 to 2.0
Suddenly applied load with Major Shock	2.0 to 3.0	1.5 to 3.0

Table No.4.1:.combined shock and and fatigue factor

$Te = [(km \times M)^2 + (kt \times T)^2]^{1/2}$
$Te = [(1.5 \times 119.97)^2 + (1 \times 35316)^2]^{1/2}$
Te= 35316.45 N.mm
Torque transmitted by shaft,
$Te = 3.14 / 16 \times fb \times D^3$
Te =35316.45
$D^3 = (Te \times 16) / (3.14 \times 170)$
D = 10.18 mm
For safe design and available diameter of shaft kept,
D= 16 mm
The same torque is transmitted to gear.
So we selected shaft diameter is16mm

B. Design of Spring:

The spring is mounted on segment to make starting situation of rack. The external width of spring is limited because of size of segment which is 16 mm. We take the external distance across of spring thinking about the freedom among section and spring to stay away from jam of spring.
D = 16 + clearance between spring &column
= 16 + 2mm
D = 18 mm
For avg service life 422N/mm².
Wire diameter range =2.5 to 8 mm
We get wire diameter d = 3.5mm from range
Calculating the load bearing capacity of spring
Spring index = C = D/d = 18.5/2.5= 8.2
C = 8.2
K = [4C – 1 / 4C-4] - 0.615 / C
For C=8.2 K= 1.03
We know
Shear stress = $(8KFD_m)/ 3.14d^3$
$F = fs \times 3.14\ d^3 / 8KD_m$
$F = (422 \times 3.14 \times 3.5^3 / (8 \times (1.04) \times 21.5)$
F = 317.60N.
Applied load is minimum to 300N
No of turns = 60
We know
$\delta = (8\ P\ Do^3N) / (G\ d^4)$
$\delta = (8 \times 317.60 \times 21.5^3 \times 60) / (80 \times 10^3 \times 3.5^4)$
δ = 126.20 mm
As we required deflection of spring in the of 126.20 mm
Spring rate = P/δ = 317.60 / 126.20= 2.51 N /mm
K = 2.51 N/mm.
Solid length of spring Ls = N x d
= 60x 3.5
= 210 mm
Free length of spring = Ls + δmax + 0.015 x δ
600 = 210 + δmax+ 0.15 x 126.20
δmax= 371.17 mm
Pitch of spring = free length
N =600/60
Pitch = 10 mm

1) Summary of spring

Wire diameter d = 3.5 mm
CoildiameterD = 21.5mm
Solid length = Ls =210mm
Free length = Lf = 600 mm
Pitch = P = 10 mm
No of turns = 60

Deflection δ = 127 N / mm

C. Design of Pinion:

Selecting the module of pinion gear
m = 3.5 mm
For m = 3.5 mm we take
Pressure angle Φ = 28^0
Addendum = m = 3.5 mm
Dedendum = 1.25 m = 4.375 mm
Working depth = 2 x m =2 x 3.5 = 5 mm
Min depth = 2.25 x m = 2.25 x 3.5 = 7.875 mm
Thickness of tooth = 1.5708 x m=1.5708 x 3.5 = 5.4978 mm
Fillet radius = 0.4 m =1.4 mm
Min no of teeth of pinion is 45 as per requirement.
Selecting no of teeth on pinion gear Np = 45teeth
Checking beam strength of pinion using

D. Lewis Equation for Gear Teeth

Wt = fw.b.3.14.m.y
Where,
Wt = beam strength of pinion tooth
b = width of gear = 26mm
fw = working stress = 210 N / mm^2
m= module of gear = 3.5mm
y= tooth form factor
y= 0.154 – 0.912/T
y= 0.154 – 0.912/45
y= 0.13
Wt= 210x 26 x 3.14 x 3.5 x 0.13

Wt = 7800.7N

Induced load coming on gear teeth is
T = F X D/2
T = F X D/2
35316.45 = F X 48/2
F =1471.2 N
As applied load on gear teeth is less than beam strength of gear so selection of gear is safe.

E. Design of Rack:

specification:-

- RAKE SIZE:
  L = 700 mm,
  B = 16 mm,
  H = 16 mm.
- TOTAL TEETH : 224
- MATERIAL : M.S.

F. Selection of Bearing:

Bearing no.	a (mm)	D1 min (mm)	B (mm)	D2 max (mm)	C(mm)
6200	10	14	30	26	9
6201	12	16	32	28	10

Table: 4.2: dimensions and static and dynamic load capacity of single row deep groove ball bearings

Where,
D1=abutment diameter on shaft,
D2=abutment diameter on shaft and housing

G. Design of Welded Joint:

Checking the quality of the welded joints for security
The transverse filet weld welds all the point and the edge, The most extreme burden which the weld can convey for transverse filet weld is,
P = 0.707 x S x L x ft
Where, S = size of weld ,
L = contact length = 35mm (10 mm for starting & stopping of weld)
The load of shear along with the friction is 200 kg = 1962N
Hence,
1962 = 0.707 x 3.5 x 30 x ft
Hence let us find the safe value of 'ft'
Therefore,
ft = (1962)/(0.707 x 3.5 x 30)
ft = 26.42 N/mm^2

Since the calculated value of the tensile load is very smaller than

The permissible value as ft=56 N/mm^2. Hence welded joint is safe.

X. RESULT:

As a heap is applied on the table the streetcar pushes ahead course and when burden is evacuate it returns into unique position. The weight is applied close around 30 kg and streetcar moves upto 2m.

XI. DISCUSSION:

Material taking care of activities include crude material developments, work-in-process, subassemblies, completed items, devices, and other help materials starting with one point then onto the next in the plant. As a less weight applied on the streetcar in moves less separation which is relative to the weight. As weight is increment streetcar moves more prominent separation at certain breaking point after if weight is included its separation not increment.

XII. FUTURE SCOPE

In future, the interest of appropriate material taking care of expanding each second in less process duration. . Much time is squandered in such things yet we can't get that what we need. In any event, by this thought we should begin to contemplate to spare time . .this task can likewise be adjust so that on the off chance that we increment the length of rack, at that point the streetcar will be move all the more deftly . it likewise lessen the working exertion of work required for material dealing with . Subsequent to expanding the length of rack and expanding the length of spring it will supplant the transport line. Which is financially and adaptable.

XIII. CONCLUSION

In this project less weight when applied the trolley does not move efficiently but when weight is added it moves more distance but at certain limit. The minimum 30 kg load can be applied to move the trolley. The applied load can be overcome the spring force then the trolley moves. As the spring get change the operating condition should be change as well as loading conditions should be change. The weight of the trolley's table is less than the spring force.

REFERENCES

[1] Abhijeet R. Maske, Mahadhan M. Jadhav, Laximan B.Shinde and Yogesh N. Sule-Patil, "Design and Fabrication of Spring Operated Material Handling Equipment", International Journal of Trend in Research and Development, Volume 3(2), ISSN: 2394-9333
[2] Surinder Kumar, Tilak Raj, "Selection of Material Handling Equipment For Flexible Manufacturing System Using Fahp" Department of Mechanical Engineering, Ymca University Of Science And Technology, Faridabad, Haryana, India
[3] Bandebuche V. A. & Tidke D. J. "Parts Handling Systems for Machine Shops of Small and Mediumm Enterprises",International Journal of Engineering Research and General Science Volume 1, Issue 2, December 2013 ISSN 2091-2730
[4] V. B. Bhandari, "Design of Machine Elements 3rd edition";Tata McGraw Hill Education Private limited,(2010) 402-407

