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Design & Development Of Sunflower Seeds Extraction Machine

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Abstract— *Sunflower is cultivated all over the world. It is one of the important crops. The seeds of sunflower are very useful. Extraction of seeds, sunflower are dried in sunlight after they are rubbed over each other, the seeds that with which waste material are collected & separated wind in over, which is manual operation*

So we can develop new machine which reduces human efforts. The sunflower is held on rim which is rotated by vertical shaft because of rubbing of flower with rim the seed extracted from flower & collected in tray. Extracted seed are drop in front of fan which blows air due to weight of seed it get fall down & husk are separated from the seed. This paper reports the results of failure analysis of a two high gearbox shaft of a gearbox in a hot steel rolling mill in Thailand which fail prematurely after about 15,000 hours of service. Standard procedures for failure analysis were employed in this investigation. The results showed that the shaft failed by fatigue fracture. Beach marks on the fracture surface were clearly visible. Fatigue cracks were initiated at the corners of the wobblers. Relatively small final fracture area of the fracture surface indicated that the shaft was under a low stress at the time of failure.

Keywords— Fan, Frame, Gearbox, Rim, Shaft.

I. INTRODUCTION

Sunflowers are cultivated all over the world. It is one of the important crops. The seeds of sunflower are very useful. Extraction of seeds, sunflowers are dried in sunlight after they are rubbed over each other, the seeds that with which waste material are collected and separated wind in over, which is manual operation. This is time consuming and laborious process.

For extraction of seed from the sunflower ,The farmer should pay large amount of money for labor so, first machine was made which having wooden disk & disk mounted number of nails on its surface. Purpose of this machine seed which are extracted mixed with husk & it require again cleaning. It gives more effort to human being.

II. PROBLEM STATEMENT

We discuss with the regional farmers about the seeds extraction methods & problems during the operations. We found that conventional methods of extraction are very laborious, time consuming, & damage to the seeds, and costly as well. So we decided to design & fabricate such a machine which will reduce above disadvantages in a best possible way.

III. METHODOLOGY

We use the DC motor & transmit this power vertically by using gear arrangement. This power is transmitted to rim on which flowers are splashed flowers with husk & seeds. The fan is provided for cleaning husk from seeds. Only seeds are obtained with minimum effort & in less time.

Shafts are extensively used in machines and numerous engineering components including gearboxes. Failures of shafts not only result in replacement cost, but also in process downtime. This could have a drastic effect on productivity and, more importantly, late delivery. In the case being investigated, for example, the downtime was 3 days, and 1,800 metric tons of steels were lost before the failed shaft could be replaced. Shaft failures may result from many causes including faulty designs, improper applications or manufacturing errors. Design errors include such things as improper gear geometry, wrong materials, poor materials quality, inappropriate lubrication system, and several others. Application errors include things such as improper mounting and installation, poor cooling, inadequate lubrication, and poor maintenance. Manufacturing errors could be poor machining or faulty heat treatments. A gear shaft is usually subject to a high torsion and a bending moment as. An important characteristic of production processes is the process reliability. This includes achieving the required quality of each individual work piece during single or multiple batches. The most common method for rough machining of external gears is hobbing.

IV. PROPOSED WORK

- Conventional extraction methods analysis.
- Search for the alternative types of seeds extraction methods.
- Selection of the conveying method.

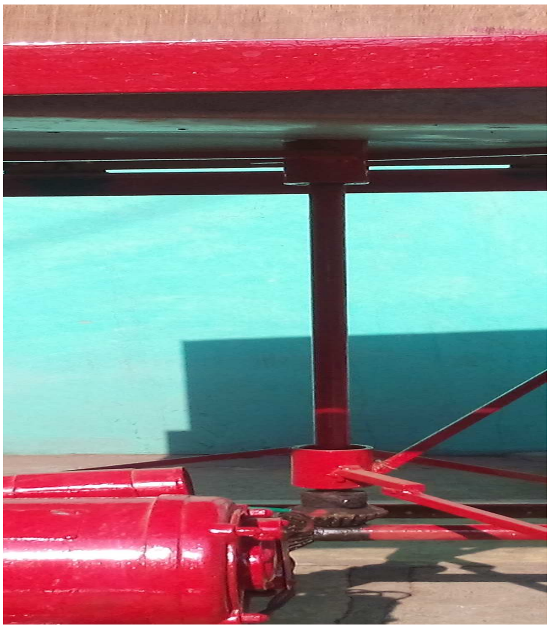
- Design of parts.
- Fabrication of components.
- Study the performance of machine.
- Differentiating the both cases.
- Final Result and conclusion.

V. CONCEPT

This is semi operated type of machine. An operator switch on the electric supply, as the motor start rotating its motion transferred to horizontal shaft with help of motor pulley by means of V-belt then, horizontal shaft motion transfer through vertical shaft from coupled right angle bevel gears. At bevel gear motion goes both directions first goes to at the end of vertical shaft to rim which having 40 spokes & then, fan pulley to fan from coupling of horizontal shaft so, machine running uniformly. Machine start completely running that time the dried sunflower held by hand & it held on rotating rim then rubbing of flower on spokes the seeds get extracted with husk (waste material) & these are collected in box or tray & to avoid of splashing of seed to provide enclosed box. The tray having slope & machine vibrating due to seeds & waste materials path provided in front of fan, this mixture of seeds& waste material falls front of the fan, which is belted with pulley mounted on horizontal shaft s.fan blows air due to weight of seeds, these seeds down& get collected at bottom of the tray & light material of husk thrown out & process completed. In these process at time 4-5 sunflower held on rotating rim & seeds get more collected in tray in less time.

VI. DESIGN OF PARTS

1) VERTICAL SHAFT:-



It is middle part of the machine. It is made of steel. It supported by means of two bearings. The shaft is supported with the square bar. At lower end of this shaft a bevel gear fitted which is receives motion from horizontal shaft. The upper end of this shaft rim is fitted so, it gets motion from that shaft.

Diameter of driven Pulley = D1 = 75

Diameter of driven Pulley= D2 = 230

R1 = 37.5mm

R2 = 115mm

Shear Stress = τ= 45N/mm²

Bending Stress = 75N/mm²

Speed of Motor Shaft = 1440rpm

Speed of Horizontal shaft= ?

We know that,

Power of motor = 1 HP = 746.54 watt

Find rotational speed of horizontal shaft

N2/N1 = D1/D2

N2/1440 = 75/230

N2 = 469.56rpm

We know that,

Torque transmitted by shaft,

P = 2πNT/60

746.54 = 2*π*1440*T/60

T = 4947N-mm

Considering power transmitted by motor

Theoretically, P = 75% motor power

Actual power

P (act) = 0.75*746.54

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P (act) = 554.5 watt

2) DESIGN OF BELT

Angle of contact of belt

Θ = π+2α

To Find α,

α = sin-1 (r1*r2/x)

α = sin-1(37.5-15/310)

α = 14.47®

Therefore,

Θ = (π+2

= 180+2*14.47

Θ = 208.95®

Belt tension ratio,

T1/T2 = e μ Θ

T1 = e (0.12*3.64)

T2 = 1.547*T2

Torque transmitted by driven pulley,

T = (T1-T2)*r

4947 = (1.54*T2-T2)*115

4947 = 62.99T2

T2 = 78.53N

Therefore,

T1 = 1.54*T2

T1 = 1.54*78.53

T1 = 121.49N

Maximum bending moment,

M = (T1+T2)*x

M = (212.49+78.53)*310

M = 62.0006*10^3 N-mm

Torque equivalent,

Te =

Te = 2+(4947)2

Te = 62.203*10^3 N-mm

Shearing stress subjected on driven shaft,

Te/Ip = τ/d/2

Te = π*d2/32=τ/d/2

16Te/πd3 = τ

7039.96 = d3

D = 19.16mm

To find equivalent B.M

Me = ½ (M + Te)

= ½(62.006+62.203)*103

Me = 62.10*10^3 N-mm

We know that,

Bending stress subjected on driven shaft,

M/I = Bending stress/y

32* Me /π*705 = d3

32*62.10*103/π*705 = d3

8433.93 = d3

D = 20.35mm

Therefore,

We select maximum diameter of shaft

d = 20.35mm

3) DESIGN OF BEVEL GEAR

Speed ratio = 1

Zg = Zp

Given rpm = 1440

Hp = 1 =0.75Kw

Assume,

Material = 40C8 (Sut=600 N/mm^2), 400 BHN

Pressure angle =20°……..as full depth system.

Number of teeth =25

Zg =25

Zp =25

Factor of safety =2

As driving motor is uniform OR working characteristics of driven machine is uniform.

Service factor is 1.

Mt =

=4976.11 N/mm^2

Now, Dp = 2Tp = m *25

Pt =

Initially for generating the teeth.

Consider V= 5m/s

Therefore for gear below 10m/s.
v< 10m/s.
Cv = = 0.71

Peff =

For bevel gears,

b/A_0= 1/3 and b =10m

tan = tan-1 =45

Pitch angle = 45

Z'p = =35.35 =35

From table levis form factor Y=0.373

Sb= m*b*b*Y(1-b/A_0)

=m (10m)(600/3)0.373(1-1/3)

=497.33 m^2

Sb= Peff * fs

497.33 m^2=(560.68/m)*2

m=

m=1.311.5………..preffered choise.

But the module here choosen is 2.

Main gear dimensions,

Dg = Dp = 25*2=50

A_0= 35.35

For face width=

b = 10m OR b/A_0=1/3

b= A_0/3

b = 10*2

= 20

OR

b = 35.35/3

= 11.78

= 12 mm

Smaller value of width is choosen.

Therefore take b = 12 mm.

Correct factor of safety = Pt = 199.64N

Error for module up to 4mm class 3 grade, = 0.0125mm

V = 0.003768 m/s

From table, deformation factor C = 11400 N/mm².

Now, Pd =

V = 0.0037 m/s

e= 0.0125mm

b = 12mm

Pt = 199.64N

Pd = 160.409/43.7 = 3.66

Peff = Cs*Pt + Pd

= 1*199.64 + 3.66

= 203.09N

Beam strength =

Sb = m*b*b*Y (1-b/A_0)
= 2*12*200*0.373(1-12/35.35)

= 1182.62N

Therefore factor of safety for bending consideration,

Fs = Sb/Peff

= 1182.62/203.09

Hence the design is safe as Sb>Peff.

Wear strength

Sw =

K = 0.16(BHN/100)

= 2.56N/ mm².

Q = 1

Sw = 1129.174N

FACTOR Of safety against wear strength

= Sw/Peff

= 1129.174/203.09

Sw < Peff

Design is safe.

Forces on bevel gear

•Rm = ()

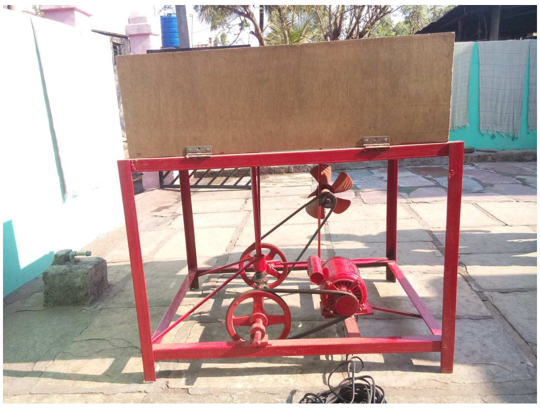
•Pt = Mt/Rm = 239.81N
•Ps = Pt tan = Pt tan20 = 87.28N

Ps = separating force.

•Pr = Ps cos = 61.71N

•Pa = Ps sin = 61.71N.

VII. FABRICATION OF MACHINE



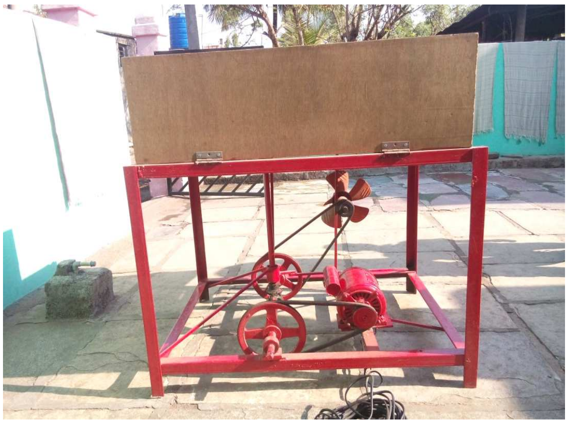
- In every machine or any assembly is main important thing that, it is rigid in construction with minimum cost. In our project we give more importance to the fabrication.
- We used 12 angles are welded together to form rigid rectangular stand as supports to the machine from the bottom.
- The angle of M.S. Square bar are used to support the pipe in which vertical shaft is mounted.

- The rim is mounted on vertical which gives the extraction of sunflower seeds.
- The cover is provided to avoid the splashing of seeds outside the box.
- The fan is fixed at angle behind the tapered opening of seeds from the tray to separate seeds from husk.
- The pulley is provided for the rotating the fan, which is driven by V-belt, which is driven by horizontal shaft.
- The tray is made of sheet metal which is mounted of at the top of the machine used for purpose of collecting seed.
- The box is made up of plywood to avoid the splashing of seed.

VIII. PERFORMANCE OF MACHINE (Result)

The result of seed extraction machine is that the efficiency of machine is considerable higher than that of manual extraction method.

Sr. No.	Quantity of seeds	Traditional method	Using seed extractor m/c
1	Quality of seeds	5% to7% seeds are damaged	No damage of seed
2	Quantity of seeds in 1 hr	5 kg without husk	20 kg without husk
3	Person required	Minimum four person required	Only one person required



Actual Machine.

IX. COST ESTIMATION

Part Name	Material	Size	Quantity	Cost
Bevel gear	M.S	25 teeth	2	2200
Horizontal shaft	M.S	24*750	1	530
Vertical shaft	M.S	24*750	1	580
Fan shaft	M.S	25*210	1	250
Bushing	M.S		1	200
Ball bearing	M.S		6	800
Hub	M.S		2	600
Fan	Plastic		1	80
Pulley	C.I	7.62 cm	2	500
Fan Pulley	C.I			100
Motor Pulley	C.I			150
Plane sheet				600
Angle				1000
V-belt	Rubber	B 52,B-45	2	200
Rim	Stainless steel	40 spokes	1	250
Bolt	M.S	24	20	100
Welding rod			30	150
Paint			1lit.	100
Square bar			6	200
Fan bushing	G.M			200
Motor		1Hp	1	1200

Total				10990 /-

X. CONCLUSION

While concluding this report we feel quite contended in having complete the project assignments well on time we had enormous, practical experience on fulfillment of manufacturing schedule of working project model.

The credit goes to healthy coordination of our batch collages in bringing out resourceful fulfillment of our assignments which prescribed by university.

Needless to emphasis here that the we had left no stone unturned in our potential effort during machining fabrication and assembly work of project model to our entire satisfaction.

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