Crop Cutting and Threshing Machine

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***Abstract*— Today, agriculture especially in India need to concentrate in some situation such as how to increase the productivity and profit, how to reduce the cost and labor efforts. To overcome these, a new manually operated cutter and threshing machine is fabricated specially for cutting various crop varieties and removal of seeds. The major components of the machine include cutting, threshing, separation and cleaning units. The threshing operation is achieved by rotational motion of a cylinder fitted with beater pegs above a stationary grid which results in the removal of the seeds from the panicles and their separation from the bulk of the straw.**

***Index Terms*— cutter, conveyor, thresher, cylinder, collector etc**

I. INTRODUCTION

Agriculture is the main field in India on which total 70 %economy depend on it. It is main source of India most of the people depend on agriculture for their income purpose. Agriculture has facing serious challenges like deficiency of agricultural labour, in working seasons but also in normal time. Generally cutting crop manually using labour but this method is very lengthy and take more time to complete our tasks. Therefore we are constructed small scale harvester thus we can done multiple operation like cutting, threshing, collecting. By using this harvester we saving our time as well as labour cost finally we increasing our overall outcome in agriculture. This harvester is helpful for the both the small as well as big farm.

Identification of Problem

Crop cutting and threshing is time consuming process and also requires higher man power. There is no any small machine available in agricultural sector for cutting and threshing. This machine is a simple and efficient solution to the problems faced by small scale farmers as it reduces the cost of harvesting to a considerable amount as compared to that of manual harvesting. The machine developed is small, compact and at very reasonable cost. Also, it is easy to maintain as it is made up of local spare parts which are easily available.

II. DESIGN OF MACHINE COMPONENT

A. Frame

The frame is made of square pipe of mild steel. The frame takes a rectangular shape include elements to fix (a spindle transports the vibrating movement to a cam at the end of it and vibrating system). The digger frame is carried by two tire wheels. The frame takes a rectangular shape with dimension of 760*610*50 mm

B. Belt

A belt is a loop of flexible material used to mechanically link two or more rotating shafts, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel.

$P= (T1-T2)\ v/1000$

Where, T1 and T2 are tensions in the tight side and slack side of the belt respectively. They are related as:

$T1/T2=e^{\mu\alpha}$

Where, μ is the coefficient of friction, and α is the angle subtended by contact surface at the centre of the pulley.

C. Design of shaft

The shaft is made up of MS material. The diameter of the transmission shaft was calculated according to design of shaft for transmit the power considering the bending moment, axial load, and the torque acting on shaft.[5]

Power = 90W

Speed (N) = 60rpm

Assuming factor of safety = 2

Yield strength Syt = 36 N/ mm^2

Shear Force of the shaft $Fs= S\times y\times t/2n$

$= 36/(2\times2)$

$F= 9\ N/mm^2$

$Power = 2\pi NT/60$

$90 = 2\pi\times60\times T/60$

$T = 14.33\ N\text{-}m= 14.33\times10^3\ N\text{-}mm$

$Torque\ (T) = (\pi/16)\times Fs\times d^3$

$14.33\times10^3 = (\pi/16)\times9\times d^3$

$d^3 = (14.33\times10^3\times16)/(\pi\times9)$

$d =15mm$

Now,

Torque = Load x distance moved

Weight of the machine= 13 kg

Distance moved = 0.1 m

$Torque= 13\times9.81\times0.1$

$T=1.3\ N\text{-}m$

D. Bevel Gear

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves

are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone.

Number of teeth = 17 – 3 Nos.

Large diameter = (N + 2) / D.P
= 43.87 mm
Pitch angle = 45 º
Pitch cone radius = (PCD)/ (2 SIN Φ)

Where,

Sin Φ - Pitch angle
∴PCD = N / DP
= 17 / 11
= 1.545”
= 39.255 mm

Therefore,

Pitch cone radius = 39.255 / 2 Sin45
Dedendum Angle= Tan^{-1}{(Dedendum / Pitch cone Radius)}

Where,

Dedendum = 1.157 / DP
= 1.157 / 11
= 2.672 mm
∴Dedendum Angle = Tan^{-1} {2.672 / 27.749)
= 5º 30”
Cutting Angle = Pitch angle – Dedendum angle
= 45º - 5º30” = 39º 30”

E. Spur Gear

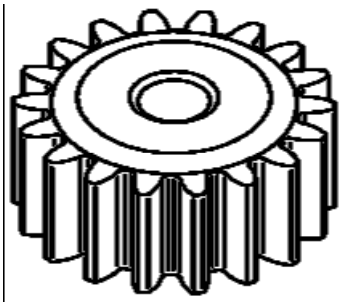

Fig 1. Spur Gear

1. Determine Horse Power based on Lewis Formula

W = S×F×Y. 600 / (P. [600 + V])

Where,

W = Tooth Load, Lbs
S = Safe Material Stress (static)Lbs per Sq.in
F = Face Width, In.
Y = Tooth Form Factor
P = Diametral Pitch
Dp = Pitch Diameter
V = Pitch Line Velocity, (in fpm) =[π. (Dp /12)*RPM] fpm
For Non-Metallic Gears: W = S.F.Y. {(150 /[200 + V]) + 0.25} / P
Horse Power Rating
(HP_L) = W .Dp. RPM / 126000.

F. Wheels

Wheels are used to support and carry the load of whole body of project. The wheels are used of diameter 360 mm for reduce height of project from ground level & project can work properly

G. Bearings

Bearings are machine elements that allow components to move with respect to each other. Bearings are used to support large skyscrapers to allow them to move during earthquakes, and bearings enable the finest of watches to tick away happily. Compare the load capacity of a roller of length and diameter equal to the diameter of a ball.

Fig 2. Bearing

Selected Bearing as per Standard Table [5]
Dia of shaft = Bore Dia. (D) = 15mm.
Bearing No. = 6202t
Outside Dia. Of Bearing (D) = 35 mm
Width of Bearing (B) = 11mm
Static Capacity of Bearing (Co) = 3.28KN
Dynamic Capacity of Bearing (C) =5.98 KN
Maximum Speed=16000 rpm

H. Blade

The blade attached at an angle of 15-20 degrees depending upon the depth needed with thickness of 8 mm. The material used for blade is MS.

III. CONSTRUCTION

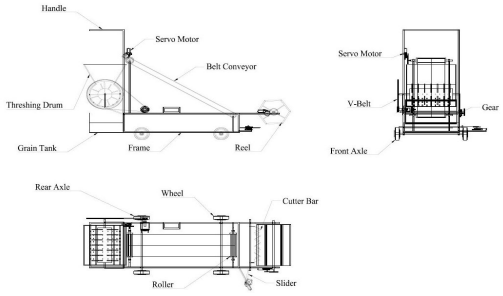

Fig 3. Crop cutting and threshing machine layout

IV.WORKING

This is simplest mechanism can used in project. The basic concept is that power transmission from one shaft to another shaft using belt .A mechanical reaper or reaping machine is a mechanical, semi-automated device that harvests crops. Mechanical reapers are an important part of mechanized agriculture and a main feature of agricultural outcome. Threshing is the process of loosening the edible part of cereal grain (or other crop) from the scaly, inedible chaff that surrounds it. It is the step in grain

preparation after harvesting and before winnowing, which separates the loosened chaff from the grain. Threshing does not remove the bran from the grain.Winnowing can also describe the natural removal of fine material from a coarser sediment by wind or flowing water, analogous to the agricultural separation of wheat from chaff.

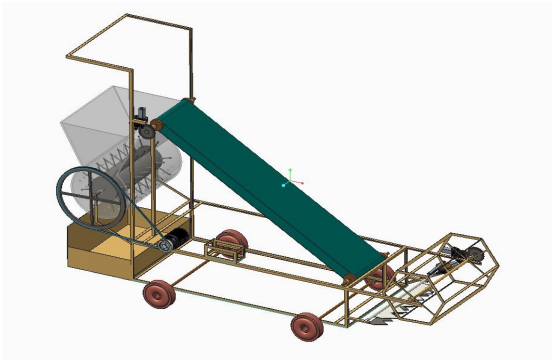

Fig 4. Crop cutting and threshing machine

Safe use of crop cutting & threshing machine

Crop cutting and threshing aimed at operators of crop harvesters. It describes typical hazards from the use of crop harvesters and gives guidance on how to minimize the risks to operators and others during harvesting work. It does not cover other health or safety issues there might be when cutting, conveying, threshing the crops.

There are particular features of different types of cutting harvester, which you should take into account when considering the hazards, risks and precautions.

V. CONCLUSION

The machine developed will be of effective use to the farmers to overcome many of the problems faced by them during the maximum requirement time of season of harvesting. After using we are concluding that the harvesting process faster hence reduce the time required to harvest the same amount of crop which will reduce the labour cost thus leading to the economic development of farmers. As compared with manual harvesting only 20% of labors are required after the implementation of this machine This machine is small, compact and is easily available. In this paper to design and analysis different cutting equipment like as roller crop cutting and cutting blade.

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