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Design and fabrication of seed rice separation machine

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ABSTRACT

In this project Portable Paddy Cleaning Machine is designed to remove foreign materials and impurities such as sand particles, stones, paddy straws and foreign seeds from paddy. This machine provides farmers an alternative replacement of current conventional method should the farmers want to extract the paddy seed in small scale amount. Currently, they only use a traditional winnow technique as to obtain the seeds to be used next season or before processing paddies to become rice. The performance of this machine is very efficient where the percentage of clean paddy is observed to be at 95%. It helps farmers improvise their traditional method, reduces purchasing cost of paddy seed and utilizes the cleaning process at low cost and less maintenance. Generally, the hand threshing and the traditional handling used in most developing countries case a larger percentage of foreign matter with the paddy. Thus, more efforts is required. At this point a rice mill separator removes any remaining foreign material that could damage the milling machinery and eliminates foreign material from the milled rice

Keywords: paddy separation, paddy seeds, eliminates foreign material, paddy straws.

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I. INTRODUCTION

Rice is one of the most important grain in India. It is the staple food of the people in the eastern and southern parts of the country. India is one of the world's largest producer of white and brown rice and produces 20% of the world rice production. As rice is the basic food crop and being a tropical plant, it flourishes comfortably in hot and humid climate. It is mainly grown in rain fed areas that receive heavy annual rainfall and thus it is fundamentally a Kharif crop in India. It demands temperature of around 250 Celsius and above and rainfall of more than 100 cm. Rice is used in manufacturing of alcohol, starch, glucose, acetic acid, vinegar, acetone, oil and pharmaceutical products and diet foods.

Rice Dehusking Process:

Rice Dehusking is a process of removing the husk and bran from the paddy rice and producing head white rice grains that are sufficiently milled, free from impurities and contains minimum number of broken grains. First process is of Harvesting. It is a process of cutting and gathering of ripened rice crops. The rice crops are generally cut with the help of sickles and are then stacked at one place so as to allow them to dry in the sun for some days. The next step is separating the grains from the stock(culm). This process is called as Threshing. Threshing is done by beating the crop with the sticks so as to separate the grains from their stock or the straw. In big fields, it is done with the help of threshers.

This work aims at determining a new method for sorting pure seeds and red rice seeds. Spectral analysis of pure and red rice seeds has demonstrated that they can be sorted according to their structural properties.

II. WORKING PRINCIPLE

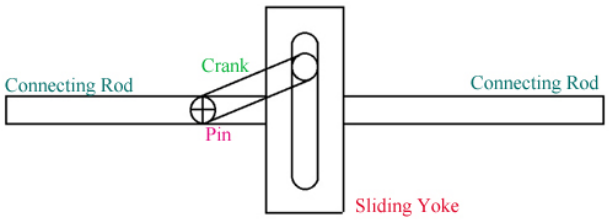


Fig: Scotch Yoke Mechanism

It is a simple mechanism; the rotary motion of pin converts into linear motion. First, the power supplied to be connected in DC motor, when the shaft to start in rotation moment, now the crank rotates the pin slider inside of yoke part and also move in forward direction. When the Crank will be rotate in clockwise direction and yoke will be getting displacement moment at forward. The maximum displacement of yoke depends upon the length of Crank.

The crank is completed the clockwise Revolution at the same time the Yoke sliding completely moved in forward. When this position takes more time to start return stork. After spent time, the crank will be rotate in continuously it to be come back in initial position of rotation. So, the Yoke move in backward direction and come back for initial position. Therefore, the crank has full Revolution to be completed, At the same time the Yoke will be complete the forward and backward movement of Sliding. By means of the full revolution of Crank, the Yoke will be sliding through equal of double length of Crank. The Yoke displacement can be controlled by varying of crank length.

III. MANUFACTURING PROCESS

Operations used for fabrication:

Raw materials:

A raw material is the basic material used in the productions of the goods, finished products. The term "raw material" is used to denote material which is unprocessed.

Marking:

Marking is the process of making visible impressions on the metal surface so that required operations can be carried out as per the dimensions

Cutting:

The raw material cut into the required dimensions using a grinding wheel cutter. Metal cutting is done by a relative motion between the work and piece and the hard edge cutting tool, which is multi point cutting tool.

Welding:

The assembly of base table is done by the process of welding. In this case the process is done by "Arc Welding". Arc welding is type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metal at the welding point. They can use either direct or alternating current, and consumable or non-consumable electrode.

Drilling:

Drilling is easily the most common machining process. Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using the twist drill. The chips must exit through the flutes to the outside of the tool. The cutting front is embedded within the work piece, making cooling difficult. The cutting area can be flooded, coolant spray mist can be applied, or coolant can be delivered through the drill bit shaft.

Hand Grinding:

Hand Grinding is the finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on the flat and cylindrical surface by removing the small amount of material. In grinding the abrasive material rubs against the metal part and removes the tiny pieces of material. The abrasive material is typically on the surface of the wheel or belt.

IV. METHODOLOGY

The main components in this model are scotch yoke mechanism, pulley, belt, shaft, bearing, collecting tank and supporting frames. the rotating shaft is placed in the first compartment and the seed separating net is placed in second compartment. the shaft and separating net are coupled with the scotch yoke mechanism, and both of them are moving at a time as well as the husk separating fan is placed in second compartment. the collecting tank is placed in the third compartment.

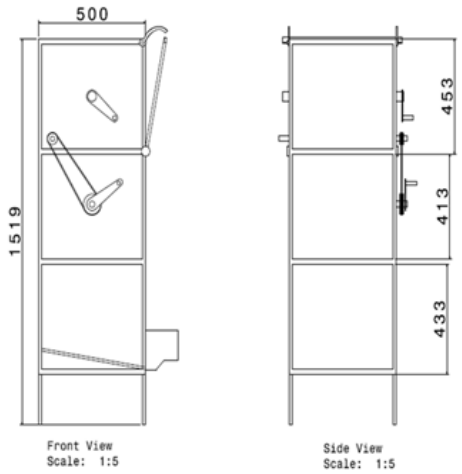


Fig: Model of seed rice separation machine

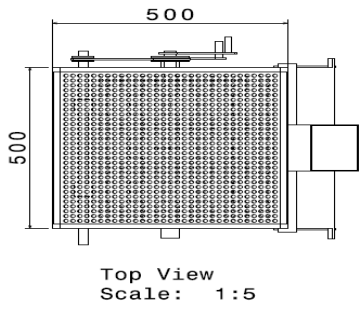


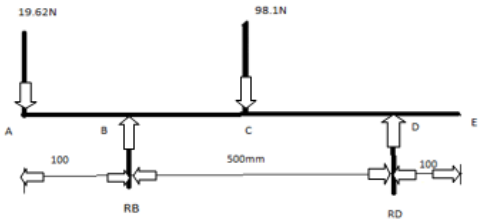
Fig: Separation net

V. DESIGN CONSIDERATION

- Maximum force applied on shaft
- Standard size of rice paddy
- Material of machine components

DESIGN CALCULATIONS

Design of shaft



Design of shaft by distortion energy theory:

Mass (m) = 10 kg

Length (L) = 700 mm

Stress on material (σ) = 100Mpa

Maximum bending moment about RB

M = -(19.62*100) + 98.1*250

M =22563 N.mm

Input power = 12 watt

$$P = \frac{2\pi NT}{60}$$

$$12 = \frac{2*\pi*30*T}{60}$$

T = 3.8197 N.m

Von mises stress

$\sigma v = \sqrt{\sigma b2 + 3\tau 2}$

$$\sigma v = \frac{32}{\pi d3}\,[\sqrt{(KbM)2 + 0.75(KtT)2}]$$

……. (since for rotating shaft Kb = 1.5, Kt = 1.0)

d = 15 mm

$$\sigma all = \frac{Syt}{Nf}$$

$$Nf = \frac{250}{100}$$

Nf = 2.5

Design of Belt:

We have selected open belt drive,

D = diameter of longer pulley

d = diameter of smalll pulley

Input speed = 45-60 rpm

Output speed = 70-90 rpm

Center distance = 450 mm

Assume belt velocity = 0.50-1 m/s

Diameter of pulley

$$V = \frac{\pi dn}{60*1000}$$

$$0.95 = \frac{\pi*d*80}{60*1000}$$

d = 220 mm.

$$\frac{D}{d} = \frac{n}{N}$$

$$\frac{D}{220} = \frac{80}{50}$$

D = 352 mm

Design factor

Pd = Fa * P

Fa = 1 ……(for light load)

Pd = 12 w

Angle of contact

α = sin-1[D-d/2*c]

α = sin-1[352-220/2*450]

α = 0.147 Rad

θ = π-2α

$\theta = \pi - 2*0.147$

$\theta = 162.72$ deg

Length of belt

$$L = 2C + \frac{\pi(D+d)}{2} + \frac{(D-d)2}{4*C}$$

$$L = 2*450 + \frac{\pi(352+220)}{2} + \frac{(352-220)2}{4*450}$$

$L = 1808.17$ mm

VI. CONCLUSION

The Above design procedure is been adopted for the fabrication seed rice separation machine which will make the product durable for long time as well as make it efficient also helps to understand the concept of design. Thus, with help of these design we can fabricate seed rice separation machine to simply achieve high volume of profit as well as to reduce the human fatigue.

REFERENCES

(1) Y.V. Mahatale and V.P. Pathak "Physiological evaluation of different manually operated corn shelling methods"

(2) Ilori T. A. Raji A.O and O. Kilanko, "Modelling some ergonomic parameters with machine parameter using hand powered corn sheller.

(3) B. Ashwin Kumar and Shaik Haneefa Begum, "Design development and performance evaluation of hand operated maize sheller

