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Design & Fabrication of Pedal Operated Thresher Machine

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Abstract: *This Paper Aims at Designing and Fabricating a pedal operated thresher machine for threshing separating and cleaning rice paddies. The Major components of the machine include threshing, separation and cleaning unit .The threshing operation was achieved by rotational motion of a flywheel fitted with beater pegs above a stationary grid which results in the removal of the paddies from the bulk straws*
After being beaten out, the grains fall into the cleaning unit which consists of a sieve that undergoes a Quick return mechanism. The machine is simple, less bulky and the ergonomic consideration in the design would allow for its comfortable use for it can easily be operated by either male or female. The thresher can help to substantially reduce the human labour involved in threshing at an affordable cost and also reduces the time used for threshing operation on small farms.
Key words: *Thresher, Design, Fabrication, Rice.*

I. Introduction

The discovery of wild rice in the Fogera plain in the early 1970s was the basis for rice introduction in Ethiopia. Rice is becoming one of the important staple foods and its production area has been increasing over the years in Fogera and other parts of Ethiopia. The Fogera plain alone contributes 32% of the national rice production . Rice production and consumption is increasing owe to various reasons. The compatibility of rice for various traditional food recipes is one that surged its demand. Farmers use rice to prepare injera, bread and alcoholic drinks like Tela and Arekie. It is used as cash crop, source of feed (rice straw and bran) and house construction. The country has vast suitable ecologies for rice production of about 30 million ha in the rain fed system. The comparative advantage of producing rice due to the availability of huge and cheap rural labor is another opportunity for producing rice. The importance of rice as a food security crop, source of income and employment opportunity due to its relative high productivity as compared to other cereals is recognized by farmers. Rice is also considered as an optional crop by private investors who frequently request for improved varieties for different ecosystems. National demands are not currently being satisfied by local production even if the trend is increasing. Even the local rice produce is low quality. The poor quality is due to fracturing and stickiness attributed to poor agronomic practices, post-harvest handling and low standard rice processing. In consequence, the government is spending large amounts of money on importing rice. In order minimize imports wise utilization of available produce is critical. Proper post harvest handling and avoidance of premature harvesting are potential interventions. Pre mature harvesting and low quality production may continue at least in the short run owe to the production system in the areas that mostly follow double cropping systems. Hence, it is decisive to increase the production and improve market competitiveness’ by proper post harvest management. Such initiatives if successful will contribute to achievement of national food security and increase household income. Rice has one of the highest post harvest losses among.

Fig: Project Diagram

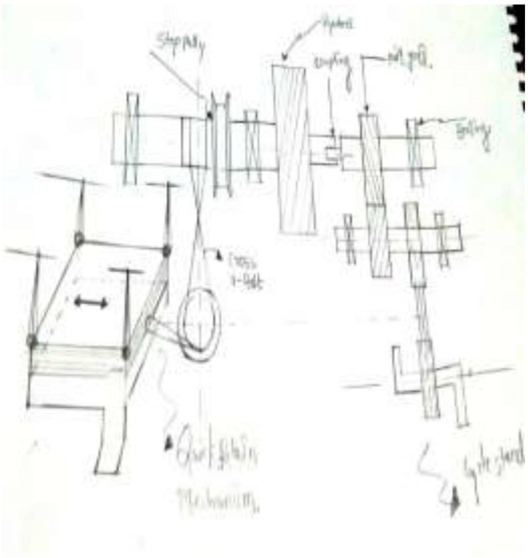

Fig: Line Diagram

II. Aim And Objectives

The main aim of this project is to overcome the traditional method

1. To increase the efficiency.
2. To reduced the hard work.
3. To develop a low cost machine which can be used by farmer to convert their semi-finished (CORN) into finished product (Corn).
4. Save electricity.
5. Reduce human effort.
6. Ease of Handing

III. Literature Survey

1. **Modak, J. P. and Bapat, A. R., "Development And Performance Evaluation Of A Human Powered Flywheel Motor Operated Forge Cutter", INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 2, ISSUE 3, MARCH 2013**

This paper addresses the development and performance of a Human Powered Flywheel Motor (HPFM) operated forge cutter. This set-up is used to cut crop residues like maize stovers, sorghum stovers in dry condition. This cut stovers can be fed to cattle directly. The current practice by small livestock farmers is to cut stover manually by axe or machetes. The mechanized cutters also available which are hand operated as well as electric motor driven. But today there is severe power shortage in country like India, particularly in rural and remote area. It is convergent to the fact that the hand muscles are weaker than leg muscles. The concept of human powered flywheel motor is used to develop the pedal operated forge cutter. In this set-up flywheel is used as a motor or a store for energy. The operator pumps the energy into flywheel by pedaling bicycle-drive mechanism with a speed rising gear pair. After a one minute pedaling is stopped, and then flywheel shaft is connected to cutter shaft. The stored energy is enough to operate cutter effectively and efficiently. The test performance of developed cutter shows the remarkable improvements over hand operated forage cutter

2. **Y. M. Sonkhaskar , Swapnil S. Asati , Abhinav M. Purohit Faculty, Dept. of Mech. Engg., Ramdeobaba College of Engg. and Mgmt., Nagpur, Maharashtra, India "ISSN(Online): 2319-8753 ISSN (Print): 2347-6710 International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization)Vol. ,Issue 11, November2015 Copyright to IJIRSET DOI:10.15680/IJIRSET.2015.041113210944 Human Powered Flywheel Motor Driven Process Units: A Review**

In the age of fossil fuels, human power was neglected but hazardous environmental pollution caused by fossil fuels again brought the human power in the main stream of renewable power resources. So in recent past, vast research has been taking place to harness human power for energizing various process units. This review paper reports the various process units energized by Human Powered Flywheel Motor (HPFM), in the literature published between the years 2010 to 2015, to provide an up- to - date scenario of the HPFM driven applications

3. **K.K. Padghan , Prof. A.K. Pitale , Prof J.P.Modak, P.Narkhedkar"HUMAN POWERED FLYWHEEL MOTOR BY USING QUICK RETURN RATIO ONE MECHANISM", International Journal of Advanced Technology in Engineering and Science Volume No.02, Issue No. 05, May 2014**

In these days of energy crisis bicycle has remained the only resort as a means of personnel transport in under developed and developing countries. Every effort should be made in improving the performance of the bicycle. There is another reason to improving the performance of the bicycle drive is that, the bicycle drive mechanism is used as a means for converting human energy in the form of mechanical energy in the case of cycle rickshaw and in the case of some manually driven process machines. Flywheel is used in manually driven machines, mainly as flywheel motor. Flywheel is pedaled to a higher speed to store kinetic energy. This K.E. is drained out in a short period to accomplish a desired process which needs process power beyond human capacities. The pedal operated flywheel provides a wide aspect of living in a different way. It gives us a way to produce energy by the use of human effort. The following report proposes the use of a pedal operated flywheel to maximize K.E. gain and its optimization .The report firstly defines the problems associated with maximizing the K.E. gain and its use. Subsequent section will compare different types of bicycle mechanism and describe it briefly. The remainder of the report will focuson the optimization of human powered flywheel motor to maximize K.E. gain. To have increased efficiencies, flywheel motors have some special arrangements of inputting power. They are, 1) Quick return ratio one, 2) Elliptical chain wheel, and 3) Double lever inversion. Hence in this paper arrangement and testing values of Quick return ratio one is presented on flywheel motor.

4. **SIRGI REDDY, CHINNAANKI REDDY, N.KEERTHI "Design Modification and Analysis of Flywheel Using in Thresher Machine International Journal of Engineering and Techniques - Volume 2 Issue 5, Sep – Oct 2016**

A flywheel is a mechanical device with a significant moment of inertia used as a storage device for rotational energy. Flywheels resist changes in their rotational speed, which helps steady the rotation of the shaft when a fluctuating torque is exerted on it by its power source such as a piston-based engine, such as a piston pump, is placed on it. The flywheel are different types such as solid disk, Spoke type, rim type, tapered type. In solid disk flywheel type it is provided with hub and disk. Solid disk flywheels are less capable of storing energy. Then spoke type flywheel are capable of storing more energy with greater moment of inertia than any other type of flywheel. In this work solid disk,spoke type flywheel are designed by using CATIA software. The spoke type flywheel is modeled with 6 spokes and 5 spokes with and without taper. Structural analysis and Modal analysis by using ANSYS software is done to determine the stresses and frequencies respectively by considering the

COMPONENTS AND PARTS :

- Bicycle
- Large sprocket and small sprocket
- Chain drive
- flywheel
- Transmission Unit
  Gear box
- Spur Gear
- Spider Jaw Coupling
- Bearing
- Ball Bearing
- Roller Chain

DESIGN AND CALCULATION:

1.DIMENSIONS

1. CHAIN LENGTH = 2000mm
2. LARGER SPROCKET:

   Diameter = 155mm

   Teeth = 44
3. SMALLER SPRCKET:

Diameter = 45 mm
Teeth = 22

4. FLYWHEEL:

Outer diameter = 400 mm

Hub diameter = 38 mm

Width = 40 mm

Weight =60 Kg.

5. Spider Jaw Coupling :

Outer diameter = 83mm

Inner diameter = 25 mm

6. Speed raising gear

Weight = 6kg

Pitch circle diameter = 300mm

Face Width =25mm

Teeth =80mm

7. Pinion :

Weight = 1.8kg
Pitch circle diameter =50mm
Face Width =25mm
Teeth =20

8. Shafts :

Shaft 1 :

1. Diameter =30mm
2. Length =283mm

Shaft 2 :

1. Diameter =40mm
2. Length =290mm

Shaft 3:

1. Diameter =30mm
2. Length =280mm

Shaft 4 :

1. Diameter =38mm
2. Length =555mm

2. FRAME DIMENSIONS:
To ensure the safety of the user and promote efficient operation, the dimensions of various units must be taken into account, along with the amount of lateral and vertical clearance needed, in the planning and design of each working unit. The dimensions of the frame of a typical human powered machine model are as follows:

Height of 615 mm (2.5 - 3.5 ft.), width of 867mm (2 ft.), and length of 1018mm (5 - 6 ft.).

The general dimensions adopted for the design was (1018*615*867) mm.

3. SYSTEM FORCE TORQUE AND POWER INPUT

This system is designed assuming the average mass of 65kg and pedaling time as 60mins. From reviewed literatures, the pedal input force, torque and power can be computed as below:

Input force

F = 01

Input Torque

T = F x R

Input Power

P = $2\pi NT/60$

4. GEAR RATIO

Khurmi and Gupta (2012) stated the gear ratio is also known as its speed ratio, is the ratio of the angular velocity of the input gear to the angular velocity of the output gear. The gear ratio can be calculated directly from the number of teeth on the gears in the system. This system is made up of 2 stage gear systems. The teeth on gears are designed so that the gars can roll on the chain link smoothly without slipping. The number of teeth on gear is proportional to the radius of its pitch circle, which means that the ratios of the gears' angular velocities, radii and number of teeth are equal. Mathematically,

$WaWb=RbRa=NbNa=DbDa$

Where Wa, Wb = angular speed of sprocket A and B respectively

Ra, Rb= Radius of sprocket A and B respectively

Na, Nb = Number of teeth on sprocket A and B respectively

Da, Db = Diameter of sprocket A and B respectively 26

5. FLYWHEEL DESIGN:

Flywheels are designed to store and release kinetic energy. A Flywheel is disc-shaped, and true to its weight on all sides and locations of the disk. The flywheel is designed to provide a more steady flow of momentum. The size and weight of the flywheel will determine the amount of energy that can be produced from peddling the bike. The mechanical advantages of using a flywheel is that its energy output is consistent and, depending on the size of the flywheel, it is able to store and release great amounts of energy even after the peddling has ceased. The kinetic energy stored in the flywheel is given as:

K.E = $1/2*I*w$

M=I/ K^2

K=$D/4$

I=$\pi/D^4 64$

Where I = polar moment of inertia

w = angular velocity of the flywheel

M= Mass of Flywheel

K= radius of gyration

D= Diameter of Flywheel

6. CHAIN DRIVES SELECTION:

In order to select a chain drive, the following essential information must be known:

- The power to be transmitted;
- The speed of the driving and driven

To calculate the:

.Pitch of the chain

P = $2\pi(R+r)/T1+T2$

.Centre distance

D = $D+d/2 + 30$

.Length of chain

L=$P/2+(T1+T2)+2X+P/2cosec(180/T1)-P/2cosec(180/T2)/X$

This can further be simplified as:

L = Y + 2X + Z
Where:
T1 = Number of teeth on the driver sprocket
T2 = Number of teeth on the driven sprocket
P = Pitch of the chain
X = Center distance
Y = $P/2+(T1+T2)$
Z =$P/2cosec(180/T1)-P/2cosec(180/T2)/X$

7. SHAFT DESIGN:

The shaft used for this design was designed based on a shaft subjected under combined bending and twisting moment. The following parameters were assumed for the design: Maximum allowable working stress = 63Mpa;
Maximum shear stress = 42Mpa (Rajput, 2010). Torque on the flywheel is equal to that on the small sprocket.
Horizontal load on shaft due to flywheel = 0
Horizontal load due to sprocket = 0

8. BEARING SELECTION:

Bearing dimensions have been standardized on an international basis. The dimensions are a function of the bearing bore and the series of bearing: Extra light (100); Light (200); Medium (300); Heavy (400). In order to select the correct bearing for the design, the basic dynamic radial load was calculated, multiply by the service factor. The bearing is then selected from the basic static and dynamic capacity table (Khurmi and Gupta, 2010).
The following considerations are of importance in bearing design: Finish precision of bearing shaft, fillet radii of corners of shaft and the height of shoulder.

Table 4.1 Bearing Selection

Bearing No.	Bore (mm)	outside diameter (mm)	Width (mm)
UCP 210	38	70	48
UCP 210	25	45	34

IV. Conclusion

1. Due to ever increasing energy crises the use of human energized machine are increasing day by day
2. In this paper the human powered flywheel motor quick return as well as elliptical sprocket mechanism is proposed as well as the reading of kinetic energy developed for limited period weight wise and age wise tabulated.
3. In this paper the human powered flywheel motor with quick return ratio for weight wise maximum K. E. is 12.15 & age wise maximum K. E. 7.57 & elliptical sprocket for weight wise maximum K.E. is 8.45 & age wise maximum K.E. is 7.22.
4. Quick return ratio one is always more than the elliptical sprocket.

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