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DESIGN AND DEVELOPMENT OF SUGAR CANE SPROUT CUTTER MACHINE BY HUMAN POWERED FLYWHEEL MOTOR CONCEPT

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Abstract- *Sugarcane is a vegetative propagated Crop. In India, for conventional system of sugarcane cultivation, about 6 – 8 tones seed cane is used as planting material. This large mass of planting material poses a great problem in transport, handling and storage of seed cane and undergoes rapid deterioration .One alternative to reduce the mass and improve the quality of seed cane would be to plant excised auxiliary buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily transportable and more economical seed material. The bud chip technology holds great promise in rapid multiplication of new cane varieties. The left-over cane can be well utilized for preparing juice or sugar or jiggery. The existing (traditional) tools used for bud chipping of sugar cane are unsafe, messy and need skill and training. But our research in this direction, literature survey, patent search, market survey and concept generation was carried out. Among the different concepts developed, we are using to the best concept was selected based on concept selection strategy. The punch torque tube was swaged to reduce the cross section of the tube. The punch tool was machined using lathe. The prototype was tested and the initial results indicated that equipment is complicated, as required for generating the sugarcan buds as compared traditional tools. In this arrangement we are using crank rocker mechanism and cam follower. The cutter works in reciprocating motion. The whole equipment is very compact and simple with additional safety measures. Since there are many cutting techniques in India which are used in our life. The main problems with these machines are that they are not affordable to farmers who are having acreage farms and which they do not require these machines. Many farmers in India are not affordable to use these machines because of their cost. So these farmers resort hand operated tools which gives low output, more damages of sugar cane, which is monotonous work. Since inventions of sprout cutting by machines reduced the hectic work for farmers but these machines never provided the cost saving, accident precautions. These machines are semi-automatic operated. So as man machine system can be established these machine provides simple mechanical design. This literature report is review on human powered machine, the survey proved to system which shows cost effective and functional viable.*

Key word: Human Power, Fabrication, Pedal Power, Flywheel Motor, Crank Rocker Mechanism

1.INTRODUCTION

It is well understood that hand operated sugar cane sprout cutter is a very time consuming. A common to solve above problem is made by motor operated cutter machine to cut sprout in minimum time. But again it's a bulky, complicated to required electricity, to cut the whole sugar cane can't remaining into single piece. Hence it is important to study a very new true mechanism known as Design and

Fig -1: Sprout

Development of Sugar Cane Sprout Cutter Machine by Human Powered Flywheel Motor Concept in which there will be very less friction and wear during its operation. Any machine, to power it by human energy, the maximum power requirement should be 75 Watts. Any machine or process requiring more than 75 Watts and if process is intermittent without affecting and product, can also be operated by human energy. This is possible with the provision of intermediate energy storing unit which stores the energy of human and supply periodically at required rate to process unit.

In today's developing world human being's innovative ideas had taken the world in all direction concerning about the production and safety in industrial establishments. Sugar cane cutting is the process of removing the sprout from the sugarcane. It is the process of harvesting because the sugarcane when harvested are attached to the sugarcane which is hard. Most of the farmers who are having low acreage. Some machines are of good qualities but more costly where are other somewhat hazardous methods, but it is not, the amount of time and money spend in the invention of device or the sophistication of its operation is important, but its convenience, utility and operational efficiency that are important in considering the device. Sugarcane is another world's most Versatile crop .The techniques used previously were by using the process of cutting the sugarcane sprout against one another by hand or by direct removal of sprout with low shelling rate. This method causes damage to the sprout. Thus, the quest for a satisfactory cheap effective means of detaching the sprout from the cob is important to the small and even medium size farmers in the country. Nowadays a few motorized, PTO operated machines have come into market but the prices of machines are not affordable to peasant farmers. Also some designs of hand operated Sheller's have been designed, which have been developed, which shelled many corn with the help of drum. The main problem of these drums was wastage of sprout and detaching process was in less percentage and we have to remove the remained one with help of hand, which was more tedious work. Therefore, the aim of this investigation was to built and develops a sugarcane Sheller using locally available material so that the machine will be operated continuously for a longer period of time with high rate of shelling without causing damage to the sprout.

2.DESIGN AND ANALYSIS

2.1Design of first shaft

Assume Man Power = 1.8 HP = 1342.8 W
N = 140 rpm
$\tau = 55.57\ N/mm^2$

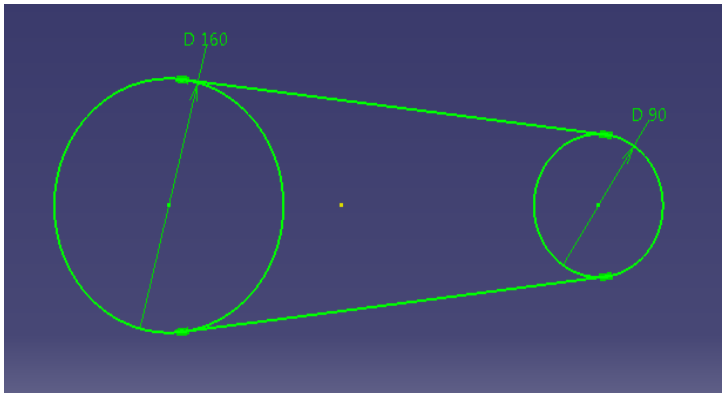

Fig -2: First Chain Drive

Fig. 2 First chain drive
Driving Gear:
Z1 = 36
N1 = 140 rpm
Driven Gear:
Z2 = 18
N2 = 250 rpm
Pitch Diameter: D = P/sin(180/Z)
P = 160*sin(160/36)
Pitch P = 13.94
V =Z1*P*(N/60)
V = 36*13.94*10^-3*(140/60)
V = 1.1 m/s
Centrifugal force is very low
F total =P/V
F total = 1342.8/1.1
F total = 1220 N
F tension = 1220 N

2.2Flywheel

M = 20 kg
R = 0.22 m
k = 0.2 m
N1 = 250
N2 = 280
N = N1+N2/2
N=250+280/2
N=260 rpm
$\omega = 2\pi N/60$
ω = 12 rad/s
Cs = (N2-N1)/N
Cs = 0.1
$\Delta E = M*k^2*\omega^2*Cs$
$= 20*(0.2)^2*(27)^2*0.1$
ΔE = 60 N.m
T = F*R

F =60/0.22 = F = 272 N_(the flywheel this force acts on shaft)

2.3Second Chain Drive

Z = 38, P = 13.21 mm, N = 260 rpm
V = Z*P*(N/60)
V = 38*13.2*10^-3*(260/60)
V = 2.17 m/s
Assume P = 3.5 H P = 2611W
F = P/V
F = (2611/2.17)
F = 1300 N

F.B.D

Vertical Force

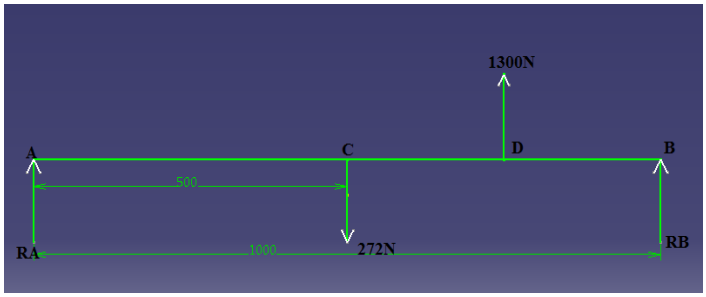

Fig -3: Vertical force analysis

∑ MA = 0
- RB*1-1300*0.75+272*0.5=0
RB = -839 N
∑Fy = 0
-RA*1-893-272+1300 = 0
RA= -190 N
Maximum moment
MA = 0
MC = -190*0.5 = 95 N.m
MD = -893*0.25 = 209.75 N.m

Horizontal Force

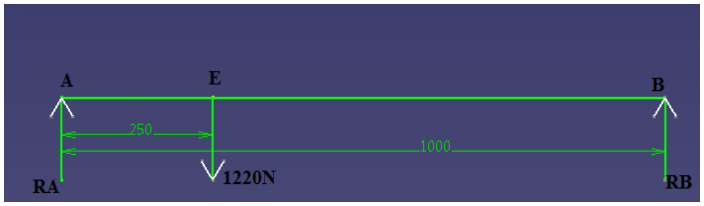

Fig- 4: Horizontal force analysis

RB = 305N
RA = 915 N
ME = 915*0.25
ME = 228 N.m
Maximum Moment = 228 N.m
Maximum Torque
P =2πN*T/60
T = (3.5*746*60)/(2*π*240)
T = 100 N.m
Diameter of Shaft

$\frac{\pi}{16} * \tau * d^3 = \sqrt{(Kb\ M)^2 + (Kt\ T)^2}$

$\frac{\pi}{16} * 55.57 * d^3 = \sqrt{(1.5 * 228 * 10^3)^2 + (100 * 10^3)^2}$

d = 31.96 mm

Diameter of first shaft = 32 mm

2.2Design of Spur Gear Drive

V = π*d*(N/60)
V = π*80*10^{-3}*(280/60)
V = 1.2 m/s
F =P/V
F = 1291 N
N = 280, T = 40
G = 133.33N/mm^2
Fb = 133.33*10*m^2*0.4172
Fb = 556.25 m^2
Ft = P/V
V = (π*20*m*280)/(60*1000)
Ft = 1500/0.2932*m
Ft = 5115.6/m
F_{eff} = (2*1/(6/6+0.2932*m))*5115.6/m
= 2*5115.6*(6+0.2932*m) /6m
3337.5*m^3= 61387+2999.8*m
m = 1.37 ~ 2 mm
dg = 2*40 = 80 mm
dp = 2*20 = 40 mm
Ft = 1500/0.5864
= 2.55 mm

Ft = 2557 N
Fr = 931 N

3.Literature Review:

Mr. Lende A. (2013)[4] As per geographical survey of India about 65% of human population is living in rural areas where urban resources like electricity, employment accessibility, etc are very deprived. The country is still combating with fundamental needs of every individual. The country with immense population living in villages ought to have research in the areas which focuses and utilizes the available human power. Some Authors of this paper had already developed a pedal operated human powered flywheel motor (HPFM) as an energy source for process units.

Mr. Ghuge V. ,Mr. Modak J. (2014)[5] Use of fossil fuels has increased environmental pollution, which is posing a threat to the environment. So research is going on for harnessing human power because it is one of the resources of renewable energy. This research paper presents

mathematical modelling of a novel gearbox for the human powered flywheel motor for total time required to exhaust energy stored in a spinning flywheel

Mr. Mali P. (2015)[1] Since there are many maize threshing techniques in India which are used in our life. The main problems with these machines are that they are not affordable to farmers who are having acreage farms and which they do not require these big threshing machines. Many farmers in India are not affordable to use these machines because of their cost. So these farmers resort hand operated tools which gives low output, more damages of kernel threshed from cob, which is monotonous work. Since inventions of maize threshing by machines reduced the hectic work for farmers but these machines never provided the cost saving, accident precautions. These machines are automatic operated, fuel operated. So as man machine system can be established these machine provides simple mechanical design. This literature report is review on human powered machine, the survey proved to system which shows cost effective and functional viable.

Mr. Patil Sir, Nikhil Nangare (2016)[7] In today's world, the entire requirements are being fulfilled through automatic system. The demand for reducing the wastage of sugarcane .So the search of automatic system is completed by our project. One alternative to reduce the mass and improve the quality of seed cane would be to plant excised auxiliary buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily transportable and more economical seed material. The bud chip technology holds great promise in rapid multiplication of new cane varieties. The problem of establishment and initial growth could be addressed by application of appropriate plant growth regulators and essential nutrients.

Mr. Moghe S. (2016)[8] In the present investigation, the operator uses the pedal power to operate the machine and transmit this power through crank chain to free wheel to the working unit. This human powered flywheel motor concept (HPFM) provide new era in the human powered agriculture processing, harvesting, post harvested operations equipment's. Considering social, cultural and environmental factor as well as in many rural operations utilizing unskilled worker and in Vidharbha rejoin there is more problem of electricity so this kind of HPFM concept is helpful in driving various rural machines. The machine is economically viable, can be adopted for human powered process units which could have intermitted operation without affecting the end product.

4. Proposed solution:

The main objective to design and develop a machine, which uses the Pedal, operated energized flywheel motor as an energy source, consisting of a bicycle mechanism, use of non-conventional energy as source Non availability of power in Interior areas and large scale unemployment of semi-skilled worker. In the context of the present condition in India of Power shortage and exhaustion of coal reserves and unemployment. This machine is environment friendly i.e. non-pollutant. It will bring innovation and mechanization in agricultural engineering. Unskilled women may also get employment. Development of such energy source which has tremendous utility in energizing many rural based process machines in places where reliability of availability of electric energy is much low .The average work rate of a Any manufacturing process requiring more than 75W and which can be operated intermittently without affecting end product can also be man powered. Such man powered manufacturing process can be based on the following concept. In this processes a flywheel is used as a source of power. Manpower is used to energize the flywheel at an energy input rate, which is convenient for a man. After maximum possible energy is stored in flywheel it is supplied through suitable drive and gearing system to a shaft, which operates the process unit. The flywheel will decelerate at a rate dependent on load torque. Larger the resisting torque larger will be the deceleration. Thus theoretical a load torque of even infinite magnitude could be overturn by this man-flywheel system. Pedal driven sugar cane sprout cutter machine operates on the basis of above principle. If such machine is developed it will be great help to farmers of rural area because it does not need conventional energy. It is environment friendly machine.

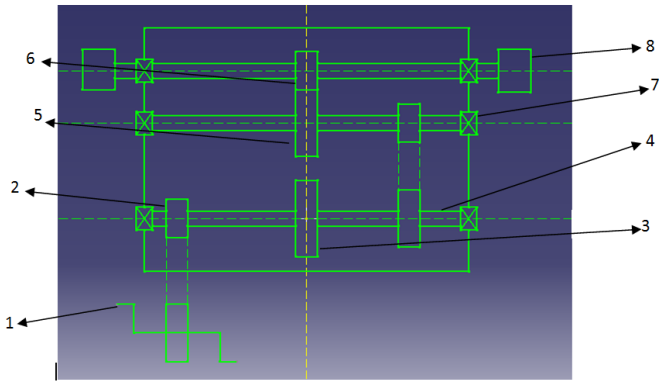

Fig- 2: Schematic arrangement sugar cane sprout cutter machine

1. Pedal
2. Chain wheel
3. Flywheel
4. Shaft
5. Gear
6. Pinion
7. Bearing
8. Process unit

Working Principle of the of the pedal operated sprout cutter

Our machine is use to cut the sugarcane bud which is useful to sown of sugarcane .As convention process of sowing the whole sugarcane is put underground. But whole sugarcane goes under waste therefore to reduce financial harm and human effort. Our machine is semiautomatic with pedal operated. The sugarcane is cut in curve shape i.e. only bud is cut. Therefore remaining sugarcane is reuse. When man operates pedal the front sprocket is rotates the rear sprocket through chain drive. That rear sprocket is connected to the shaft which having flywheel. The shaft is supported by the bearings. The flywheel is use to store the energy and provide the energy when require by the system. The flywheel is also used for balancing of the system. That the shaft also carries chain drive which transfers the power from the this shaft to next shaft in upward direction .The second shaft is also supported by the bearing .The second shaft having spur gear to obtain the torque . The spur gear transmit a power to the pinion of the main shaft. The main shaft carries the cam for the motion of the cutter. Follower is use in roller type follower. Speed of the second shaft is more than first shaft. Main shaft having more speed than first two shaft.

The cutter is of elliptical shape which cuts the sugar cane in curve shape. The power produced by the machine is more than man power .Therefore it reduces the human effort. The growth of the sugarcane because of curve shape Is quick. Before 30 to 45 days the sprout of sugarcane grown out.

In this machine we using more human effort therefore low noise produce. There is no slipping problem by using chain drive .Therefore efficiency of these sprout cutter machine is more.

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