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SOLAR STOVER CUTTING MACHINE

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ABSTRACT

This paper is mainly proposal to reduce the man power and usage of electricity. The whole system is working on the solar energy obtained by using solar panel. The solar energy is stored in the form of DC voltage in a battery. A DC motor provides the power to drive system and DC motor operates on the energy stored in a battery. Open belt drive is used in power transmission system. A cutting action takes place by use of curved shaped blades mounted on the pulley of larger diameter. Due to this small pieces of corn stover or grass are obtained from long and straight corn stover.

Keywords: Battery, DC Motor, Open Belt Drive, Solar Energy, Solar Panel

I. INTRODUCTION

This project is a proposed model of the stover cutting machine by using the renewable energy (i.e. solar energy). The stover cutting machine is a machine which is going to perform the stover cutting operation by its own which means no manpower is required.

Almost 70% of India's population depends on agriculture either directly or indirectly [1]. But in India peoples are doing herding as a side business. And for herding some of the pet animals are used. For these pet animals stover and grass are used as a food. But appropriate cutting of stover and grass is required to avoid wastage of stover or grass. Nowadays there are various methods which are used for stover cutting but they works on either manpower or electrical power supply which increases daily cost. But there is tremendous amount of solar energy present on the earth so we can use this energy for stover cutting purpose. So there will be no running cost for this process. Also it can be used for biomass production.

Every day, the sun radiates an enormous amount of energy called solar energy. It radiates more energy in one day than the world uses in one year. This energy comes from within the sun itself. Only a small part of the visible radiant energy that the sun emits into space ever reaches the Earth, but that is more than enough to supply all our energy needs. Every hour enough solar energy reaches the Earth to supply our nation's energy needs for a year. Solar energy is considered a renewable energy source due to this fact. Today, people use solar energy to heat buildings and water and to generate electricity. Solar energy is mostly used by residences and to generate electricity.

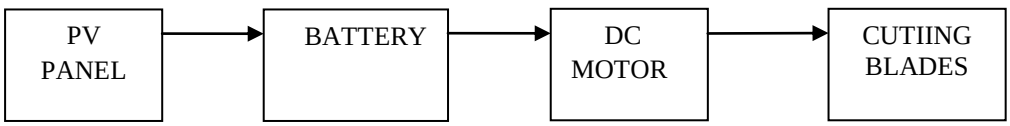
II. CONSTRUCTION OF MACHINE

This machine consists of the photovoltaic cell, DC motor, a battery, open belt drive and cutting blades. The photovoltaic cell is used to receive the solar energy from the sunlight and output of the photovoltaic panel is varying. In this project is only concentrated on the cutting action of corn stover or grass.

The machine has rigid base so that it can resist shock and vibration. Now the connection is made between DC motor and battery. Battery is used to store energy which is generated by using photovoltaic cell. There are two pulleys which are driven by means of belt drive. From two, one which is smaller is mounted on the motor shaft and another which is bigger is mounted on the cutter shaft. When motor starts rotating, the first pulley rotates and due to belt drive second also rotates. At the same time corn stover is passed to the cutter by means of conveyor. Corn stover is passed through a pair of rollers which holds the stover at appropriate position without any disturbances. As cutter is mounted on bigger pulley, cutter also starts rotating and cutting action takes place.

Fig.1- Fabrication of machine

2.1 Block Diagram Of Working



III. VARIOUS COMPONENTS OF MACHINE

There are various components like solar panel, battery, DC motor, pulleys, belt, shafts and keys.

3.1 Solar Panel

Solar energy is generally present in the form of solar irradiance. The PV cell works in the principle of Photoelectric effect; light striking on solar cell is converted to electric energy. These cells are made by silicon or other semiconductor materials. A typical silicon solar cell generates about 0.5 volts in normal operation. Large number of solar cells is connected in series, forming a module to meet the voltage requirement of the system [5]. Large number of solar modules is connected to make arrays. The rating of a solar module is given by the maximum output or maximum power it can deliver [6].

3.2 Battery

The batteries are used as a storage device for solar energy which can be further converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage, for small units with output less than one KW. To be economically attractive the storage of solar electricity requires a battery with following particular combination of properties:

(1) Low cost

(2) Long life

(3) High reliability

(4) High overall efficiency

3.3 Dc Motor

This is a relatively new class of motors whose application have been increasing at a rapid rate each year, due to both declining costs as well as increasing functionality. Linear speed v/s torque curves which are well suited for speed and position control and high starting torque.

3.4 Power Transmission System

Various components like shafts, muff coupling, keys, pulleys, belt and bearings are used in power transmission system. Also proper design of individual component is necessary according to their failure condition like bending failure, twisting failure, etc.

3.4.1 SHAFTS

The term transmission shaft usually refers to rotating machine element circular in cross section which support transmission element like gear, pulley and sprocket. Use of shaft is to transmit power from motor to pulley for rotation. Generally shafts fails under twisting failure due to rotational motion or bending failure due to gradually applied load.

Therefore appropriate diameter of shaft is selected from design data book such that it should transmit power without occurrence of failure.

3.4.2 MUFF COUPLING

A muff coupling is a basic type of coupling. Muff coupling is generally used because of its simplicity in construction, simple and easy maintenance, no lubrication, low operational cost, smooth and quiet operation. Based on the usage of the coupling a keyway is made in the shaft.

3.4.3 KEY

A key is a machine element used to connect rotating machine element to a shaft. The key prevents relative rotation between the two parts and may enable torque transmission. Key seating is the creation of the slots in the mating items.

3.4.4 OPEN BELT DRIVE

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiency, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not to be parallel. In a two pulley system the belt can either drive the pulleys normally in one direction or the belt may be crossed so that the direction of the driven shaft is reversed.

For this machine we are using V-belt .V-belts solved the problem of slippage and alignment problem. They provide the best combination of traction, speed of movement, load of the bearings and long service life.

3.5 Cutting Blades

A blade is that portion of a tool, weapon, or machine with an edge that is designed to cut and/or puncture, stab, slash, chop, slice, thrust, or scrape surfaces or materials. A blade may be made from a flaking stone, such as flint, metal (usually steel), ceramic, or other material.

Fig 2- Cutting blades

Design parameters:- [2][3][7]

Sr. No.	Part Name	Material	Size	Other Specifications
1)	Pulley	Cast Iron	D=150 mm, d=75 mm	N=100Rpm
2)	Belt	Leather	Lp= 1430 mm	A-Type cross-section
3)	Dc motor	-		Power= 220 W Speed= 230 rpm

4)	Bearing	Steel	d= 9 mm D= 27 mm	Bearing no.- 629
5)	Shaft	Mild steel	d= 10 mm	-
6)	Key	Mild steel	W=h= 3mm L= 16 mm	-

IV. RESULT AND DISCUSSSION

In this chapter the testing of solar panel and solar stover cutting machine is done, where for testing of the panel the intensity and power from the solar panel is tabulated and results are discussed. Same way the charging time for battery, speed of solar stover cutting machine is obtained and results are discussed.

Experimental Reading

TIME	VOLT (V)	AMPERE (I)	POWER P=V*I	SOLAR INTENSITY (LUX)	TEMP (°C)	SPEED OF PULLEY
10.30AM	36	4.88	175.68	977	62	230
11.00AM	36.5	4.91	179.215	970	65	230
11.30AM	34.1	4.63	157.883	970	68	240
12.00AM	35.2	4.91	172.832	969	63	280
12.30PM	35.8	5.02	179.716	972	68	340
01.00PM	36.9	5.12	188.928	977	68	385
01.30PM	38	5.07	192.66	980	66	375
02.00PM	37.8	4.98	188.244	983	63	380
02.30PM	37.5	4.58	171.75	830	60	280
03.00PM	37	3.95	146.15	667	53	285

The payoff time for such kind of a machine can be calculated as,

- Prototype model cost – Rs. 17000/-
- Electric machine of high power cost – Rs. 28000/-
- Solar operated machine of same power – Rs. 67000/-
- For cutting of 50 kg corn = 1 electric unit = Rs. 6
- If we need to cut 500 kg per day
- Monthly running cost = Rs. 1800/-
- Payback time = 39 months or more than that according to requirement

V. CONCLUSION

From above we can conclude that solar energy can be used for stover or grass cutting. There is tremendous amount of solar energy available which we are going to use run the machine. Also the areas where there is lack of electricity we can use this machine. Generally In rural area there is shortage of electricity. And also we require the grass cutting at same areas. So it is preferable to use this machine which works on the solar energy. Also this machine is pollution free. It has low running cost.

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