

SOLAR POWERED HACKSAW MACHINE WITH SAFETY FEATURE

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Abstract: *The project aims at designing a system which makes the Wood, PVC pipes and metal cutter (hacksaw) based DC motor running through solar energy. The operation of the unit is simplified to a few simple operations involving the DC motor and reciprocating motion arrangement system. There are so many types of cutting machines are used in engineering field, which can fulfil the requirements of the industry. We are interested to introduce solar powered hacksaw machine. Solar energy can be used to charge the battery and it also a renewable form. We collect energy from the sun by using the Solar panel and stored the electrical energy in the battery. This electrical energy is used to work the hacksaw machine.*

Keywords: *Hacksaw, Solar Energy, Battery, Cutting machines.*

1. INTRODUCTION

A solar panel connected to power hacksaw is considered as a solar operated power hacksaw in which sun's energy is used to drive the hacksaw in order to cut wood, metal rod, pipes etc. A solar connected to the hacksaw converts the solar energy into electrical energy which is stored in a 12 v battery as a direct current(DC) to run the motor connected to the hacksaw. A DC motor is connected to the hacksaw which is used to give the rotary motion to the pulley connected to the shaft of the dc motor .The energy stored in battery is supplied to the dc motor which rotates the pulley connected to the shaft of motor and other pulley connected to the crankshaft. The rotary motion of the crankshaft is converted to reciprocating motion which gives reciprocating motion to hacksaw blade by a mechanism known as reciprocating mechanism. The reciprocating motion of the hacksaw reciprocates the blade on the work piece which performs the cutting action. The work piece is feed by using feeder mechanism with the help of Micro controller. A solar power hacksaw is a cheap and environmental friendly device that is operated without the consumption of any energy other than the solar energy .Solar energy is cheap and easily available on the earth. No heavy machines or devices are required for energy conservation. Solar Powered Hacksaw Machine can be used in work shop, Industries, and many other fields where requirement of hacksaw.

2. LITERATURE REVIEW

The study of many literatures about design, construction and working of solar power hacksaw machine, some of them describe the methodology of solar power hacksaw. Lots of factor have been consider for the design, construction and working of solar power hacksaw machine such as cutting speed, cutting material, cutting time ,power ,efficiency etc. So, lots of literatures have been found which gives the relevance information and methodology of constructing a solar power hacksaw machine.

[1] Anna Mickiewicz, Dominika Knera, Dariusz Heim [2015]

The aim of this investigation is to determine the transition temperature of PCM layer that allows avoiding rapid temperature fluctuations on the PV back surface. To meet the stated goal, dynamic simulations of thermal and electrical performance of PV/PCM panels were carried out using ESP-r software. Based on the obtained results, it can be concluded that additional PCM layer on the back side of PV panel can effectively increase the efficiency of Electricity production with PCM transition temperature about 20 °C.

[2] Rok Stopnik, Uros Stritih [2016]

The article presents how to increase electrical efficiency and power output of photovoltaic (PV) panel with the use of a phase change material (PCM). The focus of the work is in Experimental setup and simulation heat extraction from the PV panel with the use of TRNSYS software. A modification of PV panel Canadian Solar CS6P-M was made with a Phase change material RT28HC.

[3] Pascal Henry Biwole, Pierre Eclache, Frederic Kaznik [2013]

This paper investigates the use of phase-change materials (PCM) to maintain the temperature of the panels close to ambient. The main focus of the study is the computational fluid dynamics (CFD) modelling of heat and mass transfers in a system composed of an impure phase change material situated in the back of a solar panel (SP).

[4] Nam Gyu Park [2015]

Perovskite solar cells based on organometal halides represent an emerging photovoltaic technology. Perovskite solar cells stem from dye-sensitized solar cells. In a liquidbased dye-sensitized solar cell structure, the adsorption of methylammonium lead halide perovskite on a nanocrystalline TiO₂ surface produces a photocurrent with a power conversion efficiency (PCE) of around 3–4%, as first discovered in 2009.

[5] Kshirsagar Prashant, Rathod Nayan, Rahate Prashant [2015]

This paper proposes the model of hacksaw machine which is able to cut pieces without any jerk and minimum vibrations. The model implies conversion of rotary motion into the reciprocating motion for proper working of hacksaw.

[6] Bijay Lipcha, Amar Kadam, Sachin Gadakh [2016]

The research work is on the rectification of a power hacksaw machine for cutting of metal to different size and length with the help of a hacksaw and a coolant. It is a cutting machine with blades used specially for cutting metals and driven by 2hp and 1440 rpm electric motor. The aim of this research is to save man power and time in cutting metals in order to achieve high productivity.

[7] DipakPatil, SwapnilRaut, ShrikantJadhav [2016]

The main objective of this work is to perform cutting operations with the help of motor. For a developing industry the operation performed and the parts (or) components produced should have it minimum possible production cost, and then only industry runs profitability.

[8] Essam Ali Al Bahkali, Adel Taha Abbas [2016]

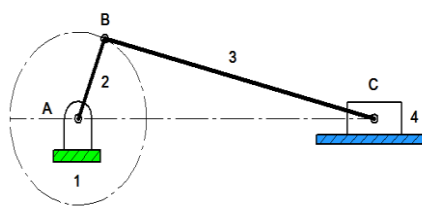
The aim of study is the Failure analysis in mechanical components has been investigated in many studies in the last few years. Failure analysis and prevention are important functions in all engineering disciplines. Materials engineers are often the lead role in the analysis of failures, where a component or product fails in service or if a failure occurs during manufacturing or production processing.

3. EXPERIMENTAL WORK**3.1 Solar panel**

Fig (3.1): Solar Panel

Solar panels are those devices which are used to absorb the sun's rays and convert them into electricity. A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect. These cells are arranged in a grid-like pattern on the surface of solar panels.

As per the motor power we can decide the no of cells and the allowable solar area per Winston rules. These cells should be in series connection and need to be connected in different Jones. This will be useful when one of the zone fails other zone will work so we can assure the continuous power supply the solar array voltage and system voltage of the motor need not be equal. Power trackers are used for equalizing the system voltage and solar array voltage. Solar panel refers to a set of solar photovoltaic (PV) cells electrically connected in series and placed on a supporting structure. This PV module is used for producing the required power.

3.2 SLIDER CRANK MECHANISM

Slider-Crank Mechanism

Fig (3.2): Slider Crank Mechanism

A slider-crank linkage is a four-link mechanism with three revolute joints and one prismatic, or sliding, joint. The rotation of the crank drives the linear movement the slider, or the expansion of gases against a sliding piston in a cylinder can drive the rotation of the crank.

3.3 DC motor

Fig (3.3): DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motor possible in many applications.

3.4 BATTERY



Fig (3.4): Battery

Nearly all large rechargeable batteries in common use are Lead-Acid type, although there are three variations, flooded, gelled electrolyte ("Gel Cells") and absorbed glass matt ("AGM"). Flooded is the oldest and cheapest technology used but can be dangerous, in case of a malfunction acid can spill. Gel Cells contain acid that has been "gelled" by the addition of Silica Gel, turning the acid into a solid mass, therefore even if the battery were cracked open, no acid would spill. Gel batteries need to be charged at a slower rate (capacity / 20) but this is not a concern in the PV setup as the panels will not be outputting nearly this much current. AGM batteries are the newest technology and have all the advantages of Gel Cells without the charging limitations. All deep cycle batteries are rated in amp-hours. An amp-hour (Amps x Hours) is one amp for one hour, or 10 amps for 1/10 of an hour and so forth. The accepted AH rating time period for batteries used in solar electric and backup power systems is the "20 hour rate". This means that it is discharged down to 10.5 volts over a 20 hour period while the total amp-hours it supplies is measured

3.5 IR SENSOR

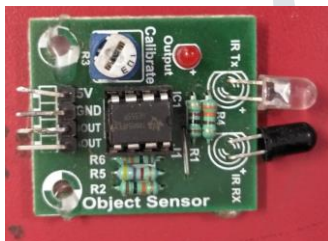


Fig (3.5): IR Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

3.6 Charging controller

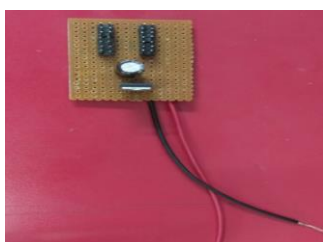


Fig (3.6): Charging controller

5. WORKING PROCEDURE

A solar panel connected to power hacksaw is considered as a solar operated power hacksaw in which sun's energy is used to drive the hacksaw in order to cut wood, metal rod etc. A solar connected to the hacksaw converts the solar energy into electrical energy which is stored in a 12 v battery as a direct current to run the motor connected to the hacksaw .A DC motor is connected to the hacksaw which is used to give the rotary motion to the pulley connected to the shaft of the dc motor .The energy stored in battery is supplied to the dc motor which rotates the pulley connected to the shaft of motor and other pulley connected to the crankshaft. The rotary motion of the crankshaft is converted to reciprocating motion which gives back-forth motion to blade of the hacksaw by a mechanism known as reciprocating mechanism. The reciprocating motion of the hacksaw reciprocates the blade on the work piece which performs the cutting action. The work piece is feed by using feeder mechanism with the help of Micro controller. A solar power hacksaw is a cheap and environmental friendly device that is operated without the consumption of any energy other than the solar energy .Solar energy is cheap and easily available on the earth. No heavy machines or devices are required for energy conservation. SOLAR POWERED HACKSAW MACHINE can be used in work shop, industries, and many fields where requirement of hacksaw.



Fig (5): Solar Powered Hacksaw Machine

CALCULATIONS

Motor Pulley diameter= 0.065 m
 Driven Pulley diameter= 0.08 m
 Therefore, Reduction Ratio= 1.23:1
 Speed of motor, N (driving) = 100 rpm
 Driven speed N (driven) = 81.25 rpm
 Power = 0.25 hp = 0.186 kW ;

Power = $2\pi NT/60$
 $0.186 = 2 * \pi * 100 * T / 60 * 1000$
 Torque T (Driving) = 17.76 Nm
 Therefore, Torque T (Driven) = 21.86 Nm

6. RESULT AND DISCUSSION

SL No.	Materials	Diameter in mm	Cutting Time(seconds)
1	PVC Pipe	19	32
2	PVC Pipe	25	46
3	CPVC Pipe	22	101

Test were carried out on this machine using different sizes of PVC pipes to cut the entire diameter using a working hacksaw blade. The cut was observed to be neat and straight with smooth surface of cut. The IR Sensor working properly to reduce the accidents during working of Hacksaw Machine.

CONCLUSION

1. The major advantage of this machine is that operates through solar power energy.
2. By implementing IR sensor in the work, manual accidents can be eliminated as the machine will get stopped if any objects comes near to the blade during working condition.
3. The movement of the work piece in a machine during processing has been enabled through using of rack & pinion mechanism by using IR sensor.

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