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Design and Fabrication of Solar Pesticide Sprayer

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ABSTRACT: Energy demand is one of the major threads for our country. Finding solution to meet the energy demand is great challenge for Scientist, Engineers. Now a day pesticide sprayer is operated based on fuel engine. This operation is more economical. In order to overcome this we found the new concept known as "Solar Pesticide Sprayer". In this pesticide sprayer is operated mainly based on solar energy and hence there is no need of any kind of alternative source. It has many advantages such as cost of spraying and also saving on Fuel/Petrol. There is less vibration as compared to the petrol sprayer. Hence the system can be easily operated there is no need of labors which increases the efficiency of farmers.

KEYWORDS: Solar panels, solar pumps, Sprayer.

1. INTRODUCTION

Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Since ancient times, solar energy has been harnessed for human use through a range of technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydroelectricity and biomass account for most of the available flow of renewable energy on Earth. Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes. Sunlight can be converted into electricity using photovoltaic (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array. The term "photovoltaic" comes from the Greek (*phos*) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after whom a unit of electrical potential, the volt, is named. A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Fritts in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery.

II. LITERATURE SURVEY

Solar cell

A solar cell or photovoltaic cell is a wide area electronic device that converts solar energy into electricity by the photovoltaic effect. Photovoltaic is the field of technology and research related to the application of solar cells as solar energy. Sometimes the term solar cell is reserved for devices intended specifically to capture energy from sunlight, while the term photovoltaic cell is used when the source is unspecified. Assemblies of cells are used to make solar modules, or photovoltaic arrays.

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A. First Generation

Crystalline Silicon and Vacuum Deposition

First generation cells consist of large-area, high quality and single junction devices. First Generation technologies involve high energy and labor inputs which prevent any significant progress in reducing production costs. Single junction silicon devices are approaching the theoretical limiting efficiency of 33% and achieve cost parity with fossil fuel energy generation after a payback period of 5-7 years.

B. Second Generation

Thin-Film Cell

Second generation materials have been developed to address energy requirements and production costs of solar cells. Alternative manufacturing techniques such as vapor deposition and electroplating are advantageous as they reduce high temperature processing significantly. It is commonly accepted that as manufacturing techniques evolve production costs will be dominated by constituent material requirements, whether this be a silicon substrate, or glass cover. Such processes can bring costs down to a little under but because of the defects inherent in the lower quality processing methods, have much reduced efficiencies compared to First Generation.

The most successful second generation materials have been cadmium telluride (CdTe), copper indium gallium selenide, amorphous silicon and micromorphous silicon. These materials are applied in a thin film to a supporting substrate such as glass or ceramics reducing material mass and therefore costs. These technologies do hold promise of higher conversion efficiencies, particularly CIGS-CIS, DSC and CdTe offers significantly cheaper production costs. In CdTe production represented 4.7% of total market share, thin-film silicon 5.2% and CIGS 0.5%.

C. Third Generation

Third Generation Solar Cell

Third generation technologies aim to enhance poor electrical performance of second generation (thin-film technologies) while maintaining very low production costs.

Current research is targeting conversion efficiencies of 30-60% while retaining low cost materials and manufacturing techniques. They can exceed the theoretical solar conversion efficiency limit for a single energy threshold material; which was calculated in 1961 by Shockley and Queisser as 31% under 1 sun illumination and 40.8% under maximal concentration of sunlight (46,200 suns, which makes the latter limit more difficult to approach than the former).

III. CONSTRUCTION

In this project an aluminum frame is constructed using aluminum bars to keep the weight of the frame low. In this frame a retractable link is fixed to the top end of which a solar photovoltaic panel is fixed that converts solar power into electricity. This electricity is then provided to battery via a charging circuit and is used for charging the battery. Electric power from this battery is given to an electric motor via control switches, by controlling which entire device can be operated. To the shaft of this electric motor a blower fan is connected. The blower blows high speed air into the blower pipe. The blower pipe is held with hand by the device operator and is directed into the area where we wish to spray the pesticides/insecticides. The insecticide reservoir is connected to the blower pipe.

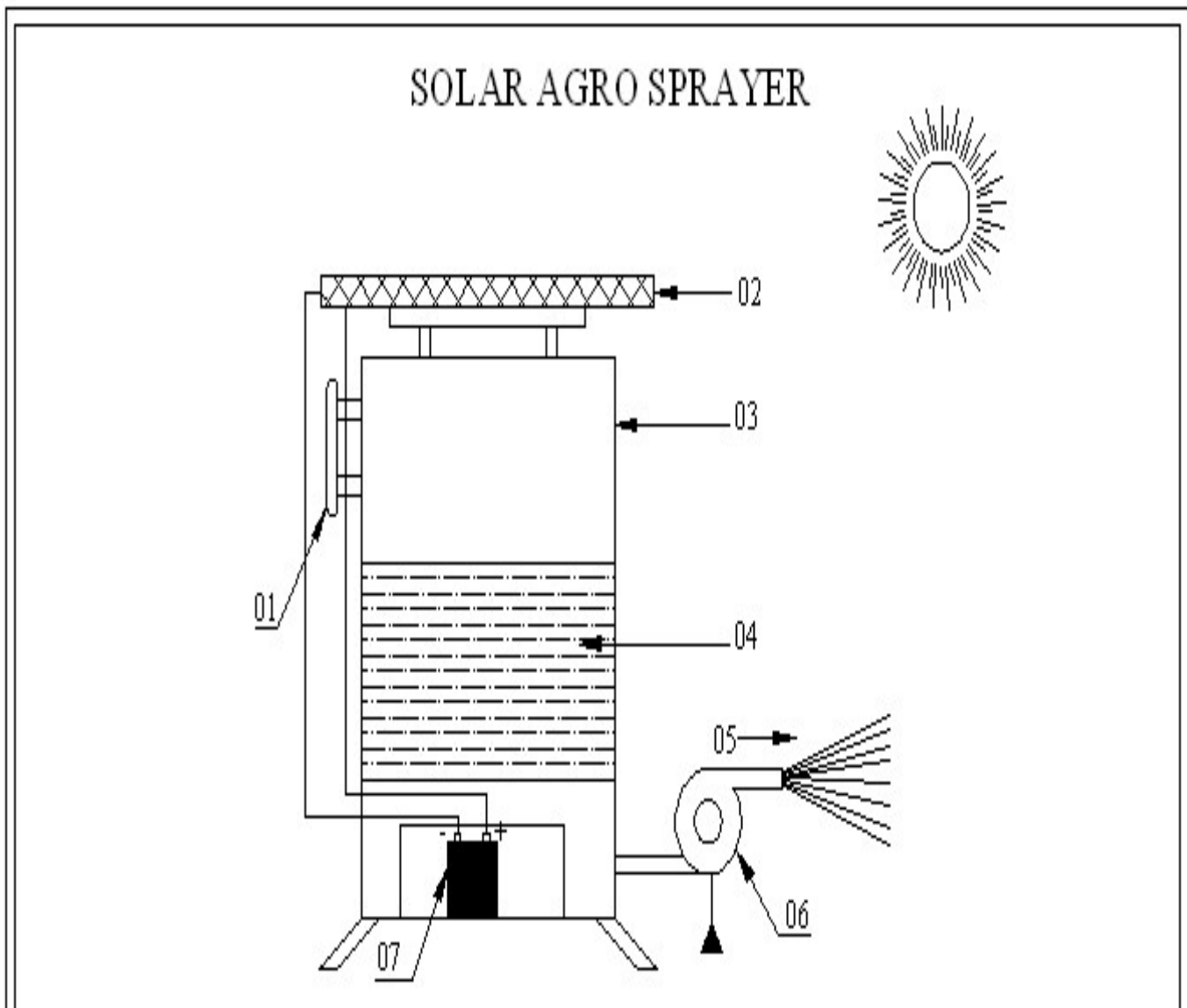
By continuously feeding the insecticide to the blower pipe the same is spread or sprinkled where we wished. Liquid insecticide is sprayed on the crops using spray pipe which receives liquid from a reservoir with the help of a pump. This pump is driven by another DC motor that receives power from the same battery. Thus insecticide in liquid form is sprayed where we wished.

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IV. LAYOUT



S.NO	PART NAME	S.NO	PART NAME	S.NO	PART NAME
01	HANDLE	04	WATER	07	BATTERY
02	SOLAR PANEL	05	WATER OUT LET	▶	FROM BATTERY
03	TANK	06	D C PUMP		

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V. GENERAL MACHINE SPECIFICATIONS:

A. Solar Panel

Material =silicon semiconductor
Type =dark blue
Voltage = 0.5v (each silicon cell)
Quantity =1

B. Battery

Voltage =12v dc
Material =plastic
Type =lead acid battery
Quantity 1

C. Base

Length of the base = 520mm
With of the base = 200mm
Height of the base = 80mm
Material = M.S
Quantity = 1

D. Cylinder

Inner diameter if the cylinder = 65mm
Outer diameter of the cylinder = 215mm
Length of the cylinder = 50mm
Material = M.S
Quantity = 1

E. Funnel

Length of the funnel = 180mm
Diameter of the funnel = 185mm
Material = M.S
Quantity = 1

F. Supporting Angle

Length of the angle = 25mm
Height of the angle = 60mm
With of the angle = 25mm
Material = M.S
Quantity = 2

VI. WORKING

Solar radiation can be converted directly into electricity using semiconductor devices , which are known as Photovoltaic (PV) cells. When sunlight falls upon the solar cell a part of the light is absorbed and it is converted into Electrical Energy by means of Electron Movements. This Solar Panel is connected to 12V lead acid battery for storing the electrical energy. A 12V DC motor is connected to these lead acid battery to convert the electrical energy into mechanical energy.

Operating System of Solar Panel

Charging can be done using a solar panel. Battery can be charged continuously during discharge itself , by attaching the Panel on the sprayers. Without Panel on the sprayers , discharge can be done for a minimum period of 4 to 5 hours . By changing the battery , discharge can be continued for further more hours.

Working of Solar Sprayer

The solar agro sprayer consists of three main parts namely,

- ❖ Solar panel unit
- ❖ Storage battery unit and

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❖ Rotating motor.

In the solar agro sprayer the two stroke petrol engine component of the power sprayer has been replaced with a combination of storage battery and rotating motor. The action of the rotating motor could be controlled by a switch attached with it in the assembly. Solar panel arrangement has been provided at the top of the unit to charge the storage battery. The units of solar panel, storage battery and a rotating DC motor were mutually attached with one another. A solar panel of size of 1m^2 area with an output power of 75 watt has been mounted on a circular metal frame which is enclosed over the cylindrical chemical tank. The solar panel arrangement was made at an angle of 45 to the vertical so that it should not create any trouble to the person. Moreover it is able to receive maximum solar radiations continuously. electrical energy from the panel. The 12 V battery is properly connected with a 12 V DC motor attachment on the frame. The operation of the motor is controlled by a press type switch attached on the assembly. Energy received from the solar cell is stored in a storage battery unit for application. This stored electrical energy can be converted into mechanical energy by rotating the motor. For this mechanical operation there is no need of conventional fuel like petrol. Motor attached to the bottom of tank sucks the liquid from tank and deliver it. A switch is given there to operate this function. As the handle is pushed, the valve of gun is released and at the same time the switch is pushed which supplies the current to motor. Thus motor sucks liquid and deliver it through delivery pipe.

VII. CALCULATIONS

Analytical calculations of current and charging time of the battery:

The current produced by the solar panel (I) was calculated by knowing the maximum power (P) of the solar panel and the voltage rating (v) of the battery that is given by

$$I = P/V$$

Therefore, $I = 10/12 = 0.83$ Ampere

Charging time (T) was computed by taking the ratio rating of battery in ampere hour (Ah) to the total current consumed by the solar panel.

$$T = (\text{battery rating in ampere hour}) / (\text{total current consumed by the solar panel})$$

Therefore, $T = 12/0.83 = 14.45$ hours

VIII. MERITS

- Cheapest method
- Usage of solar energy
- Low power consumption
- Available source

IX. CONCLUSION

As we know 70% of population of our country lives in village & their main occupation is agriculture. The prominent aim of this project is to fulfill the tasks like hand spraying, IC engine spraying, and leg pump spraying etc. using non-con energy sources. Thus solar operated spray pump will help the farmers of those remote areas of country where fuel is not available easily. Thus saving revenue of government & also most demanded fuel. This project will reduce the cost involved in the concern. Project has been designed to perform the entire requirement task at the shortest time available.

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