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DESIGN AND FABRICATION OF TROLLEY BASED SOLAR POWERED PESTICIDE SPRAYER

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Abstract:
Now a days, human life is completely dependent on Energy. Without energy human cannot survive. But energy producing Conventional sources are becoming extinct and also causing harmful effects to environment. In order to overcome this problem an alternative solution identified that is producing energy from nonconventional sources such as Solar Energy, wind Energy, Tidal Energy, Biomass Energy and so on .These are all clean sources which causes no bad effects such as pollution, global warming, ozone layer depletion to the environment. So these are Eco-Friendly sources and also free at cost The main purpose of this paper is utilization of power which is produced from solar energy for the agricultural activities.

Keywords: Solar Panel, Battery, DC pump, Sprayer

1. INTRODUCTION

Agriculture plays an important role and farmers are treating as a back bone in India. But farmers are facing so many problems right from preparation of soil, sowing, plant protection, weeding and harvesting. In protecting plants from pests and insects, pesticides are used and for spraying pesticides to the plants different sprayers are used. Generally farmers use hand operated and fuel operated sprayers. But these sprayers causes fatigue to the operators because of their bulky construction. Hand operated sprayer cannot able to use more than 5-6 hours because it is operated by hand whereas fuel operated sprayers are very expensive, availability is difficult and also pollutes environment. So, the aim of this project is to overcome all these problems and the concept is to design and fabricate a trolly based solar powered pesticide sprayer. As it is trolly type there is no need to back mount the heavy equipped spraying machine thereby it relieves operator from fatigue and it is powered by solar energy i.e the main power required to spray the pesticide is collected from sun by solar panels and then stored in batteries. As it is a clean source there is no pollution and also available freely from sun which is a renewable source of energy.

2. EXISTING MODELS

2.1 Hand Operated Pesticide sprayer:

The name itself tells about that it is operated by hand , it consists of tank containing liquid pesticide. The pressure inside tank is maintained with the help of lever attached to it and discharge of pesticide through nozzle is controlled by trigger.So, it is completely manually operated pesticide sprayer.

Fig-1:Hand Operated Sprayer

2.2 Engine Operated sprayer:

Engine operated sprayer is a semi automated sprayer and fuel is the main power source by which the spraying machine can be driven.The main components are fuel,tank,dc motor,nozzle.

Fig-2:Engine Operated Sprayer

3. MODIFIED MODEL

Solar Powered Pesticide Sprayer:

The modified model of pesticide sprayer is shown in the fig below.It is a trolly type thereby back mounting is avoided and the energy required for spraying is collected by solar panel placed at the top.Batteries are used to store the collected solar energy.A DC pump is connected between pesticide tank and nozzle .

Fig-3 Solar powered pesticide sprayer

The block diagram of solar powered pesticide sprayer is shown in the fig below.

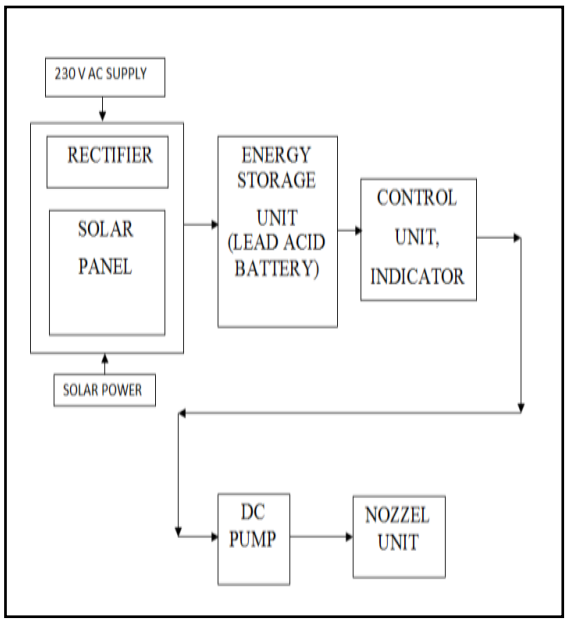

Fig-4:Block diagram of solar powered pesticide sprayer

The main components of solar powered pesticide sprayer are
1.Solar panel
2.Batteries
3.DC pump
4.Tank
5.Nozzle

4. SPECIFICATIONS & CALCULATIONS

1. **Specifications of solar panel**
It is the basic component used to collect solar energy.
Panel Size : 355×295×20mm
Weight of the panel : 1.306 kg
Maximum Power : 10 W
Voltage @max. Power : 16.5 V
Current @max. Power : 0.61 A
Open circuit Voltage : 20 V
Short circuit current : 0.7 A

Fig-5:Solar panel

2. Specification of Battery
Weight of the battery : 2.5kg
Operating voltage : 12v
Rated current :8 Ah

Fig-6:Battery

3.Specification of DC Pump
Weight of the motor : 500 gm.
Liquid Discharge : 1ltr/Min
Operating power required : 10 W
Operating voltage : 12 V
Operating current : 0.8 A
Motor speed : 1500 RPM
Maximum Pressure : 0.15-0.4 Mpa

Fig-7:DC Pump

4.Tank-The capacity of pesticide tank is 20 litres and the material of tank is PVC

Fig-8:Tank

5.Nozzle-Adjustable,Double swirl,Flat fan,hallow cone,flood jet type nozzles used.

Fig-9Nozzle

Time Measurement:
When the Solar radiation is between
200 to 300 mW/CM2 : 3 to 4 hrs.
When the Solar radiation is between
300 to 400 mW/CM2 : 2 to 3 hrs.
When the Solar radiation is between
400 to 600 mW/CM2 : 1 hour.
Running period : 3 to 4 hours.
Operating cost : Nil

Theoretical calculation of current and charging time of the battery

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

$$I=\frac{P}{V}$$

Therefore $I=\frac{10}{12}=0.8A$

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

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

Therefore,$T=\frac{8}{0.8}=10$ hr

Practical measurement of current and charging time of the battery.
Experimentally the current produced by the solar panel can be measured by connecting ammeter in series with supply. The charging time of the battery using solar panel has been measured by continuously charging battery and it is found that 12.5 hours for two days.

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. Charging can be done by separate Solar panel attachment. Note: During Rainy Season charging can be done by electrical devices

4.Result:
The desired objective of solar powered pesticide sprayer is making easy,comfortable and economical procedure for spraying pesticides to the plants has been obtained

CONCLUSION

The trolley based Solar powered pesticide sprayer has been fabricated according to design parameters and it is tested according to standard conditions. The main purpose of this project i.e eliminating back mounting and pollution free spraying is successfully accomplished.The farmer has to afford only installation cost,there is no need to bear maintenance cost.It is easy to operate there by we can reduce operational cost also.It is very much useful to the farmers in remote areas because there is unavailability of fuels.

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