CUSTOMIZED SOLAR SPRAYER

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Abstract — Sprayers are mechanical devices that are specifically designed to spray liquids quickly and easily. They come in a number of different varieties. In this project we’ll take a look at solar operated mechanical boom sprayers. A sprayer of this type is a great way to cover large areas such as lawns quickly and easily. A sprayer typically consists of a tank for carrying the liquid to be sprayed, a solar panel, a motor (19 W) for pumping out this liquid, spray nozzles on a boom that automatically disperse the liquid in a downward direction over an appreciable area (say 5 or 6 feet), ball valves, a chassis with wheels on which the sprayer is mounted, and a hose attachment for spraying.

The device is mechanically pushed from behind and as the supply to the pump is switched on, the liquid is sprayed. This type of sprayers is typically used for spraying lawn chemicals such as pesticides including herbicides, insecticides and fungicides.

Keywords — sprayers; solar panel; motor; spray nozzles; liquid tank.

I. INTRODUCTION

From time immemorial, the sun has been the prime source of energy for life on earth. The solar energy was being used directly for purposes like drying clothes, curing agricultural produce, preserving food articles, etc. Even today, the energy we derive from fuel-wood, petroleum, paraffin, hydroelectricity and even our food originates indirectly from sun. Solar energy is virtually inexhaustible. The total energy we receive from the sun far exceeds our energy demands. It is probably the most reliable form of energy available everywhere and to everyone, unlike other sources. With dwindling supplies of petroleum, gas and coal, tapping solar energy is a logical and necessary course of action. Ever since the industrial revolutions human have been dependent on fuels, electricity and wind energy. For human development in many countries there is research and trials are going on the Solar energy and the wind energy, but in our country, manpower is available in large proportion, so we make our new concept solar operated mechanical boom sprayer in these concept we lifts water in tank for spraying on the agricultural products or on small plants in lawns and gardens.

Along with proper plant selection and care, controlling pests in your lawn or garden is an important part of maintenance. Many cultural practices complement IPM control methods, such as: efficient and appropriate watering practices and judicious use of pesticides.

Pesticide should be limited where possible, but when necessary, use them responsibly. Always read and follow the pesticide label instructions before applying, such as with insecticides or herbicides, to reduce the risk of exposing humans or non-target animals. Take care to protect the environment, which includes the proper use of pesticides to prevent contamination of water resources.

II. LITRATURE AND SURVEY

1] In this paper, the design and implementation of multiple power supplied fertilizer sprayer has been presented. The proposed system is the modified model of the two stroke petrol engine powered sprayer which minimizes the difficulties of the existing power sprayer such as operating cost, changing of fuel etc. The two stroke petrol engine has been replaced by a direct current motor and operated by the electrical energy stored in the battery attached to the unit. The battery can be charged by solar panel during the presence of sun. It could also be operated on direct current during rainy and cloudy weather conditions. This system can be used for spraying pesticides, fungicides, fertilizers and paints. The proposed system has been tested and compared with theoretical values of current and charging time. From the results it is found that the time taken to charge the full battery of capacity 12V, 7Ah has required 16.67 hours. The fully charged battery could be used to spray 575 litres pesticides. Which is approximately covers 5-6 acres of land. It is also found that, if we charge the battery for a day, then it covers approximately 200 litres of pesticides which in turn covers 2 to 2.5 acres of land. The developed systems initial cost is little more as compared to conventional sprayer but the running cost of the system is all most zero in other words minimum.
There are various non-conventional energy sources from which the power can be generated. Solar energy, Wind energy, Tidal energy, Biogas energy, these are various non-conventional energy sources. Solar energy is widely available in nature throughout the year. So it can be utilized in miscellaneous applications like spraying, drying, and cooking, etc. In agricultural areas, spraying is one of the essential tasks. This paper gives the information about solar powered pesticide sprayer in a cost-effective manner. Solar pesticide sprayer has various advantages over conventional sprayers. It also gives information about various components used in sprayer. As it has various advantages, it will become popular in the agricultural field.

Science is basically "passive" observation of the universe, as it exists to generate knowledge. Engineering is making use of that knowledge to meet human needs by creating machines, systems, processes, and technologies that have not previously existed. Design and manufacturing are the synthetic part of engineering practice. Manufacturers have received a lot of attention recently for very good economic reasons. In Indian farms, generally two types of spray pumps are used for spraying: hand-operated spray pumps and fuel-operated spray pumps. Of which, the hand-operated spray pump is most popular. At the same time, it exhausts carbon dioxide as a pollutant, which is harmful to our environment. In such situations, we should think about moving towards some non-conventional energy. Considering it, solar energy would be one of the solutions. This paper emphasizes on the spraying of pesticides using solar power as energy. It can be most often used at various locations such as farms, gardens, although it can become more popular in rural areas as well. The additional advantage of this project is it can be used as a home lighting system as its battery can be used at night too.

### III. COMPONENTS

**Frame:**

*a) Material used – UPVC Pipe 3/75”*

![Fig.Frame](image)

**Water Pump:**

a) Supply – 12 V DC supply  
b) Current – 2.1 amp  
c) Liquid Discharge – 3.1 Lit/min  
d) Gas Discharge – 0.8 GPM  
e) Pressure – 5.5 bars
Solar Plate:

a) Power: 10 watt.
b) Supply: 16.4 volts/min
c) Current: 0.6 amps
d) Material: Silicon

Tank:

a) Length 534 mm
b) Breadth 305 mm
c) Height 260 mm
d) Area = 305 x 260 x 534
   = 42.34 x 10^6 mm^3
Fig. Tank

Nozzle:

a) Output is 0.9 lit/min
b) No. of nozzle 2 boom rod
c) Total Output = 2 x 0.9
   = 1.8 lit/min
   = 108 lit/hr.

Fig. Nozzle

Wheel:

a) Material of wheel- PVC
b) Material of wheel holder- Iron
T & Elbow Joints:
   a) Material- UPVC
   b) Size- 3/75”

IV. DESIGN AND CALCULATION

1. SOLAR PLATE
Solar plate can supply the 14 voltage to the reciprocating pump. Specification are:

i. 10 watt
ii. 16.4 voltage/min
iii. Silicon plate
iv. Current 0.6 amps

2. RECPROCATING WATER PUMP

The pump is directly run by the solar energy which is produce 12-14 voltage to the pump and the discharge of pump is 3.1 lit/min.

Specification are

i. 12.4 DC voltage
ii. 3.1 lit/min
iii. 5.5 bar pressure
iv. 2.1 amps
v. Flow = 0.8 gas/min

3. TANK

Tank can be stored up to 35 lit. pesticide as per requirements

Specification are:

i. Length 534 mm
ii. Breadth 305 mm
iii. Height 260 mm
iv. Area = 305 x 260 x 534
    = 42.34 x 10^6 mm^3

4. NOZZLE

The nozzle is used to spray the pesticides on Plant or Lawns

Specifications are:

i. Output is 0.9 lit/min
ii. No. of nozzle 2 boom rod
iii. Total Output = 2 x 0.9
    = 1.8 lit/min
    = 108 lit/hr.

5. BATTERY

Battery is used for when the intensity of light is low then battery is used as a backup purpose

Specification are:

i. Input = 230 v/ac
ii. Output = 12 dc
iii. Back for running pump (12 w) = 1 hr. 30 min

6. FRAME

Frame is used for mounting of the all compontans on the frame.

Specification are:

i. UPVC Pipes
ii. UPVC Tees
iii. UPVC Elbows
iv. Plywood
v. Nut & Bolts
vi. Scre
CALCULATION

Load i.e. pump = 10 w
Battery considered = 7.1 amps x hr.
For backup,

\[ 7.2 \times 12 = 86.4 \text{ w x hr.} = 86.4 \text{ w x hr}/10w \]

Let considered charging efficiency of battery is 10-15 %
We considered, 13 %

i.e. \[ \frac{13}{100} = 0.13 \]
Therefore, \[ 7.2 \times 0.13 = 0.936 \text{amps.} \]

Hence, current required for our pump is 0.936 amps similarly 1 amp.

[1 amps current is useful to drive the reciprocating pump]

V. FABRICATION

Component: Water tank

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Description of operation</th>
<th>Machine used</th>
<th>Cutting</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cutting the pipes into the length as per drawing</td>
<td>Hacksaw machine</td>
<td>Hacksaw</td>
<td>Steel rule</td>
</tr>
</tbody>
</table>

Material: PVC.
Quantity: 1

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Operation</th>
<th>Machine</th>
<th>Tool/gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Joining of the tank connection</td>
<td>Manpower</td>
<td>Spanner</td>
</tr>
<tr>
<td>2</td>
<td>Connecting the reducer to the G.I. tee</td>
<td>Man power</td>
<td>Spanner</td>
</tr>
</tbody>
</table>

Component: Frame

Material: Plywood / Pipes
Quantity: 1
INTRODUCTION TO SOLAR POWER

From time immemorial, the sun has been the prime source of energy for all life on earth. The solar energy was being used directly for purposes like drying clothes, curing agricultural produce, preserving food articles, etc. Even today, the energy we derive from fuel-wood, petroleum, paraffin, hydroelectricity and even our food originates indirectly from the sun. Solar energy is virtually inexhaustible. The total energy we receive from the sun far exceeds our energy demands. It is probably the most reliable form of energy available everywhere and to everyone, unlike other sources. With dwindling supplies of petroleum, gas and coal, tapping solar energy is a logical and necessary course of action.

FROM SUNLIGHT TO ELECTRICAL CURRENT

Photovoltaic cells are able to turn the energy in solar radiation into electricity due to an energy transfer that occurs at the sub-atomic level. Solar energy comes in small packages called photons. These photons hit the outer level electrons in the photovoltaic cells like the flappers hit the metal ball in the pin ball machine. The dislocated electrons form the electrical current. Silicon is one of the elements used as a base material for the production of photovoltaic cells. A silicon atom has four valence electrons which are shared with adjacent silicon atoms in covalent bonding.

To produce the positive-charged side of a photovoltaic cell, boron atoms which have only three valence electrons are introduced into the lattice structure of pure silicon. The boron atoms occupy a lattice position within the silicon structure, and a positive-charged hole forms in place of the missing fourth electron (Figure 1b). Silicon material with boron impurities is called a positive or p-type semiconductor. To produce the negative-charged side of a photovoltaic cell, phosphorus atoms which have five valence electrons are introduced into the pure silicon structure. The phosphorus atoms occupy a lattice position within the silicon structure and form a negative or n-type semiconductor.

Photovoltaic cells are made by putting a layer of n-type and a layer of p-type semiconductor material together. When the photons in solar radiation strike a photovoltaic cell, the kinetic energy of the photons is transferred to the valence level of electrons. The freed electrons and positive-charged holes attract each other and create positive-negative pairs. The formation of these pairs creates electricity (Garg, 1987).

SOLAR POWER

Put most simply, Solar Power is a way of converting sunlight into a useful energy source. There are two ways of using solar energy: as heat and as electricity. Devices like solar water heaters, driers and solar cookers use the heat to produce hot water, to dry grains or to cook food respectively. This way of using solar energy is called solar thermal. On the other hand, solar panels use the light to produce electricity, which can then be used for a multitude of purposes.

VII. CONCLUSION OF PROJECT
We have made such a project which is light in weight. Its cost is less. It does not require any additional energy rather than solar energy. It is a free play mechanism. This project is one time investment project and it can last for many years with less maintenance.

Hence we conclude that this project is convenient for farmers to use in their farms.

VIII. REFERENCES


