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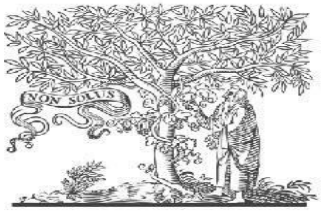

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Solar Powered Agricultural Sprayer

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ABSTRACT

In this project a Solar Powered Agricultural Sprayer was fabricated which replace the conventional agricultural sprayer. Main aim of this work is to make the conventional fuel-based agricultural sprayer to a solar-based one by equipping an electric motor pump. In this work a solar panel and a battery was installed to supply power to DC motor pump. This reduces the wage fossil fuels. The spraying of pesticides and insecticides is traditionally done by farm worker carrying backpack type, engine driven sprayers and hydraulic sprayers. All these are costlier and somewhat harmful to environment. Skills of labor required depend upon the complexity of the equipment machinery used. To eliminate these problems, solar based sprayer pump is one of the improved versions of petrol engine sprayer pump. It is vastly used in the agriculture field & also used for many purposes. This is having more advantages over petrol engine sprayer pump. It uses the solar power to run the motor. So it is a pollution free pump compared to petrol engine sprayer pump.

Keywords- Sprayers, DC Pump, Pollution Free, Solar Powered Agricultural Sprayer, Solar Panel

INTRODUCTION

1. Problem Statement

Modern day fungicide sprayers calculate on conventional sources of energy. This makes them expensive as well as damaging to the terrain. Owing to the unreliable nature of power in pastoral India, it's also a cause of great vexation. The ministry is back- mounted which also makes is physically trying for the driver.

2. Objectives

We've decided on this design with the purpose to achieving these varied pretensions which we feel are veritably necessary to be addressed in this day and age.

1. To Cover A Maximum Area In A minimum quantum Of Time:

For an agronomist, it's veritably important to manage time as to efficiently manage the whole field which is generally over a large geographical area. Such a large area can not be handled if proper styles aren't in place. The wide content span of the sprayer arm ensures that a larger area is covered as compared to the conventional sprayer.

2. Save Electricity :

Since the sprayer is mechanically operated and no form of electricity is used in its operation it doesn't increase the electricity operation of the agronomist. An asset which is relatively scarcely available in utmost agrarian areas.

3. Reduce mortal trouble :

Since the entire outfit is relatively light unlike the conventional sprayer the driver doesn't need to ply as important trouble as the driver would using the conventional system and also has a wheel which is much more accessible to pull push as opposed to carrying the heavy weighted sprayer tank.

4. Easy To Handle :

As mentioned above the wheel and light weight of this outfit makes its running relatively easy.

5. No Skilled Labour needed :

No previous knowledge of the device is needed to operate it as it just requires to be pushed and the liquid is scattered consequently, so much so that if it were suitably attached to cattle they could perform the entire operation with minimum supervision. The conventional system, on the other

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hand, requires the system of operation of the sprayer to be known.

6. To give An Indispensable:

To give an volition to the preexisting performances of the sprayer- bone that operates on solar energy. To relieve the planter of the dependance on conventional sources of energy, therefore reducing the cost of operation and general vexation faced as a result of frequent power outages**.** .

2. CLASSIFICATION OF SPRAYING SYSTEMS

In India there are different types of sprayer can be used according to the growth of different types of crops as fallow:

1) **Hand operated sprayer**.

Hand operated sprayer Hand operated sprayer is operated by hand so that the discomfort occur while spraying. Hand operated sprayer cannot be use continually spraying. We can say that it cannot be used for long time.

2) **Engine operated sprayer/fuel operated sprayer**

Engine operated sprayer/fuel operated sprayer as we know that engine operated sprayer is working on petrol. Petrol is costly fuel so in farmer economical point of view it is not good.Engine operated sprayer can be operated on petrol so it is not possible to use every farmer

3) Electric motor pump sprayer.

Electric motor pump sprayer. Electric motor pump sprayer is used electricity for charging battery. In this way the pump can drive according to battery charging, in the above sprayer there are some drawbacks such as

Here 70% of people can be live in rural areas. In rural areas there are insufficient electricity. So it is not possible to use electric motor pump for spraying

3. PROBLEM IDENTIFICATION

In India, 73 of population is directly or laterally dependent upon the husbandry. Hence India is now an agrarian grounded company. But till now growers face multitudinous problems.

A. Pests:

Pests Farmer's productivity is hovered by pests. Pests are a major trouble to food product. Climate change produces warmer temperatures and increases CO2 feasts, downfall and failure that enhance complaint, pests and weeds. More knowledge and understanding of pest geste under different projected scripts is needed to borrow and develop new technologies to respond to pitfalls performing from climate change.

B. Lack of Mechanization:

In malignancy of the large- scale robotization of husbandry in some corridor of the country, utmost of the agrarian operations in larger corridor are carried on by mortal hand using simple and conventional tools and tools like rustic plough, sickle, etc. This is especially the case with small and borderline growers. Due to poor robotization and crude agrarian ways the growers do n't get a good value for their yield. emphatic sweats are being made to encourage the growers to borrow technically advanced agrarian outfit.

C. Short supply of electricity

Short force of electricity pastoral areas face serious problems with the trustability of power force. In a country like India utmost of the people in pastoral areas depend on husbandry. They also face a problem of erratic and arbitrary electricity force in townlets. Because of this, growers have to make multiple visits to the granges at odd timings just to turn on the pumps

4. COMPONENTS

Several components and materials are required for assembling the final model.

A. Solar Panel: Solar power is arguably the cleanest, most reliable form of renewable energy available, and it can be used in several forms to

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help power appliances. Solar-powered photovoltaic (PV) panels convert

Fig 4.1 Solar Panel

the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply renewable energy to battery. By lowering utility bills, these panels not only pay for themselves over time, they help reduce air pollution caused by utility companies. We chose a solar panel of 20w

B. Battery:

In the modern era, electrical energy is normally converted from mechanical energy, solar energy, and chemical energy etc. A battery is a device that converts chemical energy to electrical energy. This is a 12V/7.2Ah lead acid battery. 12V is one of the most diverse of all batteries. The sizes of 12 volt batteries vary widely based on the amp hours they are designed to produce. This battery is charged using solar panel to provide electrical charge when needed to run the pump.

Fig. 4.2: Battery

C. Pump:

A pump is a device that moves fluids, by mechanical action. Pumps operate by some mechanism consume energy to perform mechanical work by moving the fluid. We selected a pump with the flow rate of 4.5lpm according to the calculations of pump capacity. This pump has two outlets. It develops suction when connected to a battery and lifts the pesticide from the tank via one outlet and supplies to the nozzle through the other outlet.

Fig. 4.3: Pump

5. LAYOUT OF THE SYSTEM

The first unit of proposed system is energy conversion unit. Solar energy attained by the sun is converted into electrical energy using solar panel by photovoltaic effect. The affair of the energy conversion is given to charge a deep cycle supereminent acid battery through a charge regulator. The charge Thereby, precluding overcharging and guarding against over voltage. It employs the palpitation range Modulation(PWM) fashion which gradationally stops charging the battery, when it exceeds a set high voltage position and gradationally re-enables the charging, when the battery voltage drops back below the safe position. The main advantage of PWM is that the power loss in the switching device is veritably low. This circuit is designed to control the RPM of the motor by controlling the quantum of resistance between the motor and the battery while contemporaneously furnishing a charging force for the battery.

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6. CALCULATIONS

According to spraying capacity & discharge capacity of spray pump is selected:

Type : Diaphragm Pump.

Liquid Discharge : 5 Lit/min.

Speed : 1500 rpm.

Suction Head (hs) = 0m.

Discharge Head (hd)= 0.45m.

Suction pipe Diameter : 8mm =8×10^-3m.

Discharge pipe Diameter : 8mm =8×10^-3m

Overall Efficiency Of The Pump : η= W*Hm 1000/S.P.

Where,

S.P = Power Required To Drive The Pump.

Hm = Manometric Head (in m)

η= Overall Efficiency Of The Pump (Assume it is 60%)

η=d*g*Q*Hm /1000/ S.P.

η=d*g*Q*Hm /1000* S.P.

Where, Q= 5lit/min =8.33×10^-5 m^3/sec

• Assume Overall Efficiency of Pump η=60%

Hm= Manometric Head.

Hm=(Po / d*g + Vo^2/ 2*g + Zo) – (Pi /d*g + Vi^2/ 2*g + Zi)

Where ,

Po / d*g = Pressure head at outlet of pump (hd) = 0.45m.

Vo^2/ 2*g = Velocity head at outlet of pump = Vd^2/ 2*g

Pi/ d*g = Pressure head at inlet of pump (hs) = 0m.

Vi^2/ 2*g = Velocity head at inlet of pump = Vs^2/ 2*g

Hm =(Vd^2/ 2*g + 3) – (0.5 + Vs^2/ 2*g)

Vd(Velocity at Discharge)= Discharge/Area of Delivery pipe =

(8.33*10^−5)/(π/4 *8*10^−3)

=13.25×10^-3 m/sec

Vs(Velocity at Suction) = Discharge/Area of Suction pipe

(1.66*10^−5)/(π/4 *8*10^−3)

=13.25×10^-3 m/sec

Hm = 0.45+ ((13.25*10^−3)^2 /2*9.81) - 0 +((13.25×10^−3)^2)/ 2*9.81)

Hm =0.45m

• **Battery Type : Lead Acid Battery**.

Voltage : 12 V

Current : 7 Amp

Power = Voltage*Current = 12×7 = 84 Watt (Maximum power when

the circuit is open)

When the circuit is short then,

Voltage: 12 v

Current: 1.5 Amp

Amp Power = Voltage*Current = 12×1.5 = 18 Watt

According to Battery Output Power Solar Panel Is Selected

Solar panel Power = 40w

Voltage =21V

Then current produced by the panel is given as

I = P/V

I = 40/21 = 1.9Ah

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Battery Voltage = 12v

Current =7.5Ah

Then power of battery is given as

P = VI

P =12×7.5 = 90W

Pump Power = 30w

Voltage = 12v

Flow rate =5lit/min

Then current required for the pump is given as

I = P/V

I = 30/12 = 2.5Ah

Charging time of the battery

T=(battery rating in ampere hour)/ (total current consumed by the solar panel)

T=7.5/1.9= 4hrs (during mean time).

Discharging time

T=(battery rating in ampere hour)/ (total current required for the pump)

T=7.5/2.5 = 3hrs

When battery is discharging for 3hrs simultaneously it will charge that can work for 1.5 more hrs.

Total discharging time T= 3+1.5 = 4.5hrs

7. WORKING PRINCIPLE

The system consists of Solar panel, charging unit, battery, pump and sprayer. The solar panel delivers an affair in the order of 12 volts and 20 Watts power to the charging unit. The charging unit is used to strengthen the signal from the solar panel. The charging unit delivers the signal which charges the battery. According to the charged unit, the pump operates, similar that the sprayer works. Then toxin can be stored in tank. When the sun shafts are falling on the solar panel electricity will be generated through the solar cells and stored in the battery. By the electric power in the battery the pump operates and thus diseases from the tank is scattered out through the sprayers. There's no conservation cost and operating cost as it's using solar energy and no pollution problem. Its working principle is veritably easy and it's provident for the growers, which has one further advantage that it can also induce power that power is saved in the battery and it can be used for both for scattering and well as to light in the houses when there's no current force

8. RESULT&CONCLUSIONS

[A] RESULT:

The performance evaluation of the sprayer gives an effective field capacity to be 0.14 ha/h which amounts to nearly 1ha/day given an 8 hours operation day. The equipment doesn't require any external power, thus helping the farmer save the cost of external electricity. Additionally, the usage of solar power makes it an eco-friendly proposition. This is an affordable, low-maintenance equipment that can prove to be beneficial for poor and marginalized farmers living in remote areas with an unreliable access to electricity.

[B]ADVANTAGES:

- The prepared solar operated sprayer is environment friendly and cost efficient.
- The prepared solar operated sprayer can be used largely in agriculture field effectively.
- The prepared solar pesticide sprayer is the best option to farmer who economically challenged and facing electrical problems like load shedding etc.
- It does not create air pollution and noise.
- It does not require fuel hence it is a zero fuel operated equipment.

- It can use in municipality for killing insects and mosquitoes.
- It is maintenance free device.
- It is easy to operate and portable. The solar operated sprayer will help the farmers of those remote areas of country where fuel is not available easily.
- They can perform their regular work as well as saves fuel up to large extent. At the same time they can do their pesticide spraying work with very less environment pollution.

[C] CONCLUSION:

In conclusion, this is an eco-friendly, cost-effective, low conservation outfit that will prove to be profitable to this agricultural country as we move towards a more mechanized interpretation of husbandry. The proposed system is veritably effective and can be used in agrarian field veritably effectively. This technology is most suitable for Energy Alternate Device for power sprayers. This system is stoner friendly and also terrain friendly as it does n 't produce any pollution. As this sprayer is provident than that of the conventional machine operated sprayers. also the same fashion and technology can also be extended for all types of power sprayers.

[D] FUTURE SCOPE:

Battery capacity can be increased in the future depending upon the requirements.

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