SOLAR POWERED SPRAYER FOR AGRICULTURAL USE

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ABSTRACT

A Solar Powered Sprayer is a pump running on electricity generated by photovoltaic panels or the thermal energy available from collected sunlight as opposed to grid electricity or diesel run water pumps. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine (ICE). Solar pumps are useful where grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy. The solar panels make up most (up to 80%) of the systems cost. The size of the PV-system is directly dependent on the size of the pump, the amount of water that is required (m^3/d) and the solar irradiance available. The solar sprayer has Many advantages. Besides reducing the cost of spraying, there is a saving on fuel/petrol. Also, the transportation cost for buying petrol is saved. The solar sprayer maintenance is simple. There is less vibration as compared to the petrol sprayer. The farmer can do the spraying operation by himself without engaging labour, thus increasing spraying efficiency.

Keywords: Solar Panel, DC Motor, Microcontroller, Sprayer.

INTRODUCTION

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 sprayers. A sprayer of this type is a great way to use solar energy. Solar based pesticides sprayer pump is one of the improved version of petrol engine pesticide 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. I this charged battery can also used for home appliances like glowing of CFL bulbs, mobile charging etc.., 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.

LAYOUT OF THE SYSTEM

The first unit of proposed system is energy conversion unit. Solar energy obtained by the sun is converted into electrical energy using solar panel by photovoltaic effect. The output of the energy conversion is given to charge a deep cycle lead acid battery through a charge controller. The charge controller limits the rate at which electric current is added to the battery.

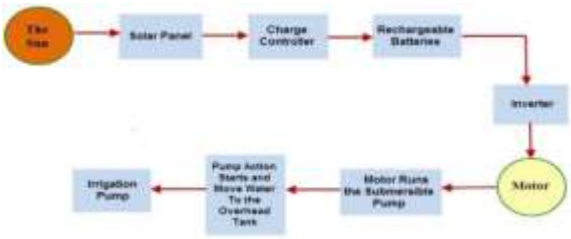

Fig. 1 Block diagram of spraying system

Thereby, preventing overcharging and protecting against over voltage. It employs the Pulse Width Modulation (PWM) technique which gradually stops charging the battery, when it exceeds a set high voltage level and gradually re-enables the charging, when the battery voltage drops back below the safe level. The main advantage of PWM is that the power loss in the switching device is very low. The output from the charge controller is given to the battery by a 3 pin socket through an electrical network as shown in Fig. 2. This circuit is designed to control the RPM of the motor by controlling the amount of resistance between the motor and the battery while simultaneously providing a charging supply for the battery. The circuit has 3 states.

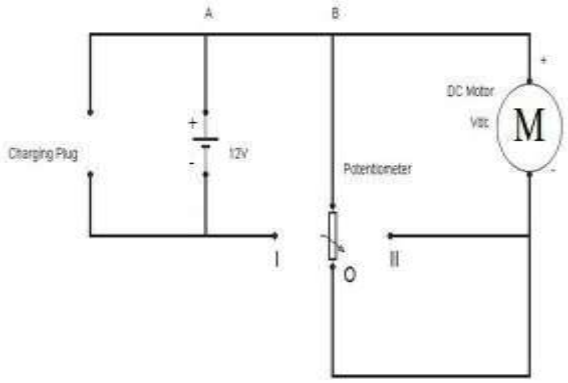

Fig. 2 Electric circuit for seed control of motor

The output of the dc motor is used to actuate the diaphragm of the diaphragm pump for pumping the fluid as shown in Fig. 3 The diaphragm pump is a positive reciprocating displacement pump. When the diaphragm is pulled back a vacuum is created in the chamber in front of the diaphragm. This vacuum cases the discharge valve to be forced against its seat.

The vacuum allows atmospheric pressure to push the fluid up against outside of the suction valve, opening the valve and filling the chamber. When the pressure is returned to the diaphragm forcing it towards the front of the chamber, the increased pressure causes the suction valve to be forced closed and discharge valve to be forced open. The fluid is push out of the chamber and the pumping cycle starts over.

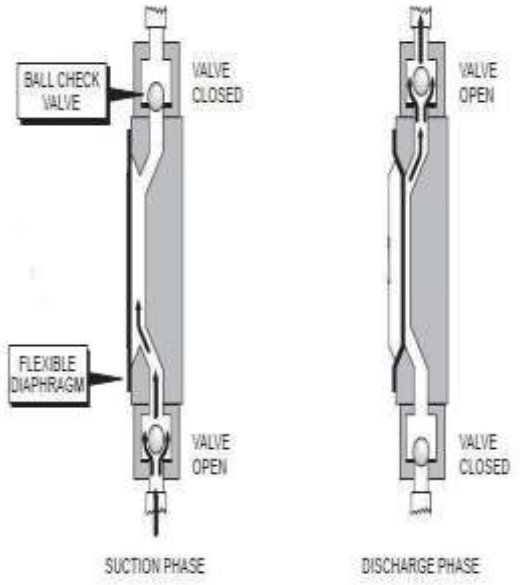

Fig.3 Working of water diaphragm pump

WORKING PRINCIPLE AND OPERATION

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. Charging can be done by separate Solar Panel attachment.

WORKING OF SOLAR SPRAYER

- Solar panel unit
- Storage battery unit and
- 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 in the assembly.

continuously from the sun during the operation of the unit in the field. The output of the panel is connected in parallel with the 12V storage battery to store the electrical energy from the panel. The 12V battery is properly connected with a 12V 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 in to mechanical energy by rotating the motor. For this mechanical operation there is no need of conventional fuel.

Fig.4 solar powered sprayer

Working of this pump is simple. Solar panel collects the solar energy into electricity and supplies it to battery. Battery uses this electricity to charge itself. This battery next is used to operate motor and lighting system. Motor attached at the bottom of tank sucks the liquid from tank and deliver it. The 'ON' and 'OFF' of motor is controlled with handle attached to spray gun. A switch is given there to operate its 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.

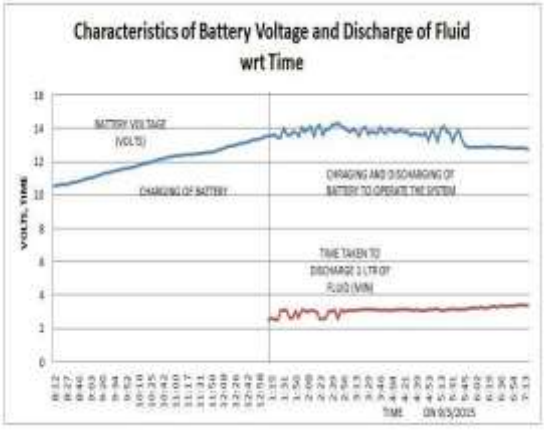

Fig.5 characteristics of battery voltage and fluid

CONCLUSION

The output of a solar pumping system is very dependent on good system design derived from accurate site and demand data. It is therefore essential that accurate assumptions are made regarding water demand/pattern of use and water availability including well yield and expected drawdown.

With a solar pump, energy is not available on demand, and the daily variation in solar power generation necessitate s the storage of a surplus of water pumped on sunny days for use on cloudy days, solar energy needs to be reserved in the form of either electricity in batteries of lifted water in a storage tank.

APPLICATIONS

- Mainly used in agriculture sectors for spraying chemicals on the plant.
- It is also used automotive industry for spraying paint.

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