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Solar Operated Pesticide Sprayer For Agriculture Purpose

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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 sprayers. A sprayer of this type is a great way to use solar energy. Solar based pesticides sprayer pump is one of the improved versions 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. In this charged battery can also use for home appliances like glowing of CFL bulbs, mobile charging etc 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 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 as compared to the petrol sprayer. The farmer can do the spraying operation by himself without engaging labour, thus increasing spraying efficiency.

Key words: solar energy, petrol engine, PV-system, sprayer pump, CFL bulb, IC engine.

CHAPTER 1

INTRODUCTION

Spraying of pesticides is an important task in agriculture for protecting the crops from insects. Farmers mainly use Hand operated or fuel operated spray pump for this task. This conventional sprayer causes user fatigue due to excessive bulky and heavy construction. This motivated us to design and fabricate a model that is basically solar sprayer In our design, here we can eliminate the back mounting of Sprayer ergonomically it is not

good for farmer's health point of view during spraying.in this way here we can reduce the users fatigue level. There will be elimination of engine of fuel operated spray pump by which there will be reduction in vibrations and noise. The elimination of fuel will make our spraying system eco-friendly. So with this background, we are trying to design and construct a solar powered spray pump system.

Now days there are non-conventional energy sources are widely used. The energy which is available from the sun is in Nature at free of cost. In India solar Energy is available around 8 months in year .so it can be used in spraying operation. Solar pesticide sprayer can give less tariff or price in effective spraying. Solar energy is absorbed by the solar Panel which contains photovoltaic cells. The conversion of the solar energy into electrical energy is done by these cells.

This converted energy utilizes to store the voltage in the DC Battery and that battery further used for driving the spray Pump. Solar spray are the ultimate cost effective solution at the locations where spraying is required. This solar-powered spray pump system uses solar energy as source. Solar energy is first used to charge a storage battery. The solar energy stored in the battery is utilized to operate motor which functions as pump. As the name of the paper suggests, it deals with the constant discharge of pesticide, compress air control system, solar power, battery charging, monitoring as well as timer and non-conventional power controlling techniques. As far as controlling is concerned, it include the parameters such as pressure, pesticide level, battery voltage, current, solar cell and discharge condition.

In this paper we are trying to make unique equipment for cultivation users. Mostly in the forming process pesticide spray is taking a critical role due to poison properties of chemical. So, in this paper we have committed to do something unique and useful equipment with nonconventional source technique. Also reduce the weight of unique solar spray jet as compare to diesel spray jet.

CHAPTER 2

LITERATURE SURVEY

Abhishek Jivrag et al [1] describes invention and operation of multiple granulated pesticides duster with the use of solar energy. The concoction is accomplished by the use of solar panel, impeller type centrifugal blower, gear reduction mechanism, dispensers, D.C motors and batteries. In addition, the duster has been equipped with a facility to operate on an electric supply, which serves beneficial in the absence of sunlight. The device essentially works for disbursing solid granulated (powder) form of pesticide. The operator controls the rate and discharge of different pesticides by means of push buttons and toggle switches. The technical specifications of the device are worked and examined in a way to minimize the weight of the device and deplete the feeder unit dispenser in a span of three hours.

R. Joshua, V. Vasu et al [2] "Energy demand" is one of the major problems for our country. Finding solutions, to meet the "Energy demand" is the great challenge for Social Scientist, Engineers Entrepreneurs and Industrialist of our Country. According to them application non-conventional energy is the only alternate solution for conventional energy demand. Now-a- days the concept and technology employing this nonconventional energy became very popular for all kinds of development activities. Solar energy plays an important role in drying agriculture products and for irrigation purpose for pumping the well water in remote village without electricity.

B. Van Campen D et al [3] Solar photovoltaic (PV) systems have shown their potential in rural electrification projects around the world, especially concerning Solar Home Systems. With continuing price decreases of PV systems, other applications are becoming economically attractive and experience is gained with the use of PV in such areas as social and communal services, agriculture and other productive activities, which can have a significant impact on rural development. There is still a lack of information, however, on the potential and limitations of such PV applications. The main aim of this study is, therefore, to contribute to a better understanding of the potential impact and of the limitations of PV systems on sustainable agriculture and rural development (SARD), especially concerning income-generating activities.

R. Rajesh et al [4]. 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. Solar based pesticide sprayer is one of the improved model of pesticide sprayer pumps. Sun is the source of all energy on the earth. It is most abundant, inexhaustible

and universal source of energy. All other sources of energy draw their strength from the sun. India is blessed with plenty of solar energy because most parts of the country receive bright sunshine throughout the year except a brief monsoon period

J. V. Bhanutej et al [5]. In India, agriculture has a predominant role in our day to day life. The crops that come as yield decides the total production, adds to the economy of our country. The yield decreases due to the presence of pests, insects in the farms. To kill the pests, insect's pesticides, fertilizers are sprayed either manually or by using sprayers. Earlier, the pesticides and fertilizers were sprinkled manually, but they will result in harmful effects on farmers. In order to overcome this problem, Different spraying techniques have been developed. These sprayers consist of different mechanisms and the cost of equipment is generally high. We developed a mechanism in which we tried to minimize the equipment cost by removing the pump to spray. This Sprayer works on Bernoulli's principle, in which the spraying action of the sprayer is due to the head developed and mechanical linkage. The model is developed mathematically for the major components like tank, required head and the spring mechanism

CHAPTER 3

METHODOLOGY

Design and fabrication of solar powered pesticide sprayer has following steps, Selection of components. The selection of component has been done according to the requirements. 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 hence preventing overcharging and protecting against over voltage. It employs the Pulse Width Modulation (PWM) technique which gradually stops charging the battery; 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.

CHAPTER 4

SYSTEM OVERVIEW

4.1 BLOCK DIAGRAM AND WORKING:

The system consists of solar panel, charging unit, battery, pump and sprayer. The solar panel delivers an output 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, such that the sprayer works. Here fertilizer can be stored in tank. When the sun rays 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 therefore fertilizers from the tank is sprayed out through the sprayers. The block diagram of solar sprayer is shown in fig.4.1.1. There is no maintenance cost and operating cost as it is using solar energy and no pollution problem. Its working principle is very easy and it is economical for the farmers, which has one more advantage that it can also generate power that power is saved in the battery and it can be used for both for spraying and well as to light in the houses when there is no current supply.

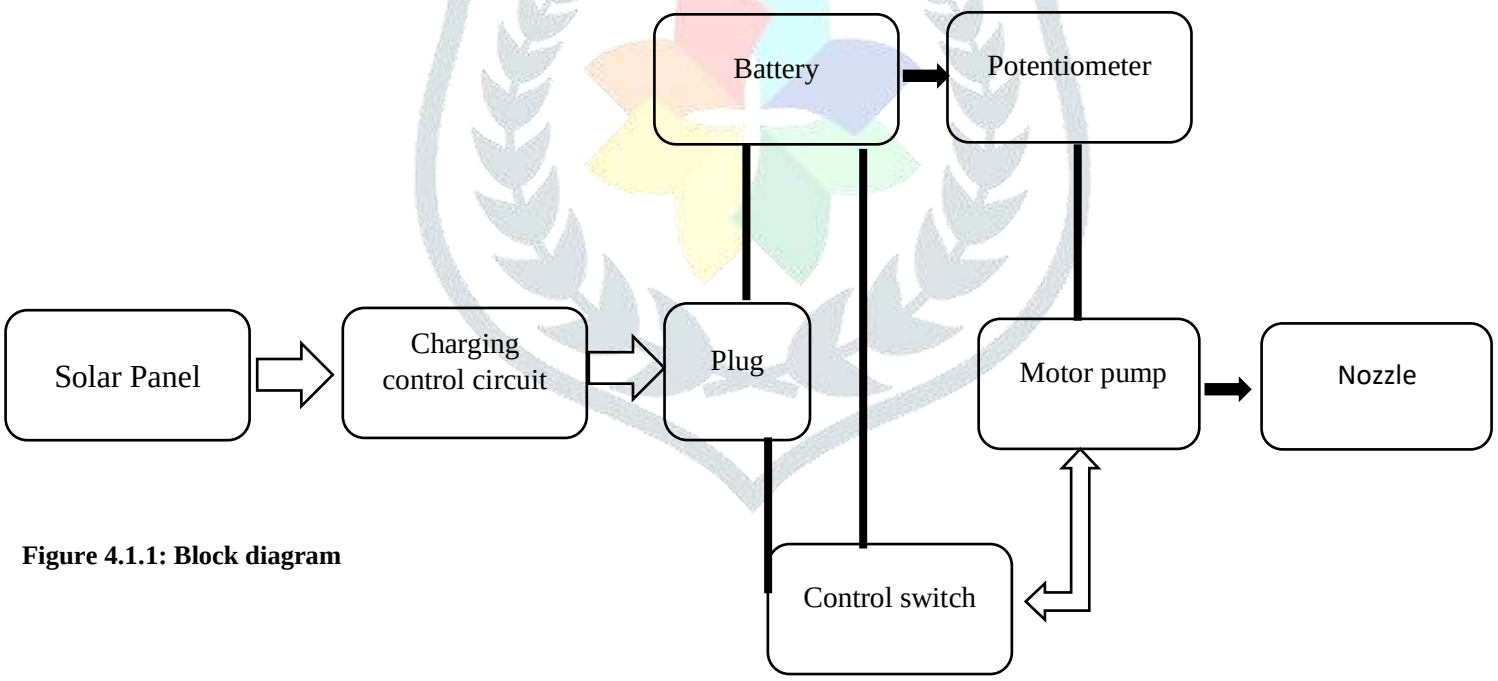

Figure 4.1.1: Block diagram

4.2 FUNCTIONAL UNIT DESCRIPTION:

The main components used to fabricate the model are:

- Solar panel
- Pump
- DC motor
- Battery
- Tank
- Nozzle
- Bevel gear.

4.3. SOLAR PANEL

A solar panel (also solar module, photovoltaic module or photovoltaic panel) is a packaged, connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each panel is rated by its DC output power under standard test conditions, and typically ranges from 100 to 320 watts. The efficiency of a panel determines the area of a panel given the same rated output - an 8% efficient 230-watt panel will have twice the area of a 16% efficient 230-watt panel. Because a single solar panel can produce only a limited amount of power, most installations contain multiple panels. A photovoltaic system typically includes an array of solar panels, an inverter, and sometimes a battery and or solar tracker and interconnection wiring.

4.4 PUMP

For people living in remote areas, solar water pumps are usually the only solution as there is no access to diesel. If there is diesel, Solar Water Pumps are the only solution or an excellent alternative for diesel as the cost of running power lines or diesel pumping may be too great. A solar powered water pump differs from a regular water pump only in that it uses the sun's energy to supply electricity for the pump. The solar panels absorb the sun's energy and convert it to electrical energy for the pump to operate. All the pumped water is stored in a water tank so that there is constant supply even in bad weather conditions and during night time where there is insufficient power to generate the solar water pumps. Solar powered water pumps represent a higher initial

investment, however, over a period of 5 years they represent a cost benefit due to minimal maintenance costs compared to AC pumps run with a generator.

4.5 BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work.

4.6 TANK STORAGE

Tanks are containers that hold liquids, compressed gases or mediums used for the short or long term storage of fluids or gases. The term can be used for reservoirs. Storage tanks are available in many shapes: vertical and horizontal cylindrical open top and closed top flat bottom, cone bottom, slope bottom and dish bottom. Large tanks tend to be vertical cylindrical, or to have rounded corners transition from vertical side wall to bottom profile, to easier withstand hydraulic hydrostatically induced pressure of contained liquid. Most container tanks for handling liquids during transportation are designed to handle varying degrees of pressure

4.7 NOZZLE

A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe. A nozzle is often a pipe or tube of varying cross-sectional area and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy

CHAPTER 5

HARDWARE IMPLIMANTATION

5.1 Regulated Power Supply Unit

A power supply (sometimes known as a regulated power supply unit or RPSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

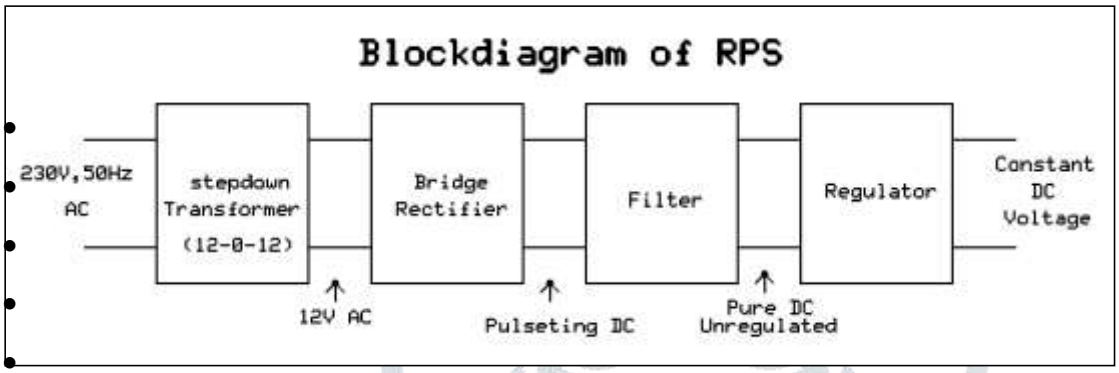

Figure 5.1.1: Block diagram of RPS

- The first section is the transformer. The transformer steps up or steps down the input line voltage and isolates the power supply from the power line.
- The rectifier section converts the alternating current input signal to a pulsating direct current. However, as you proceed in this chapter you will learn that pulsating dc is not desirable.
- For this reason a filter section is used to convert pulsating dc to a purer, more desirable form of dc voltage.
- 78xx chip family gives different output voltage as regulator. The last numbers in the chip code tells the output voltage.

5.1.1 Output Current

If you need more than 150 ma of output current, you can update the output current up to 1A doing the following modifications:

- Change the transformer from where you take the power to the circuit to a model which can give as much current as you need from output.
- Put a heat sink to the 7805 regulator (so big that it does not overheat because of the extra losses in the regulator)

5.1.2 Output Voltages

If you need other voltages than +5V, you can modify the circuit by replacing the 7805 chips with another regulator with different output voltage from regulator 78xx chip family. The last numbers in the chip code tells the output voltage. Remember that the input voltage must be at least 3V greater than regulator output voltage to otherwise the regulator does not work well.

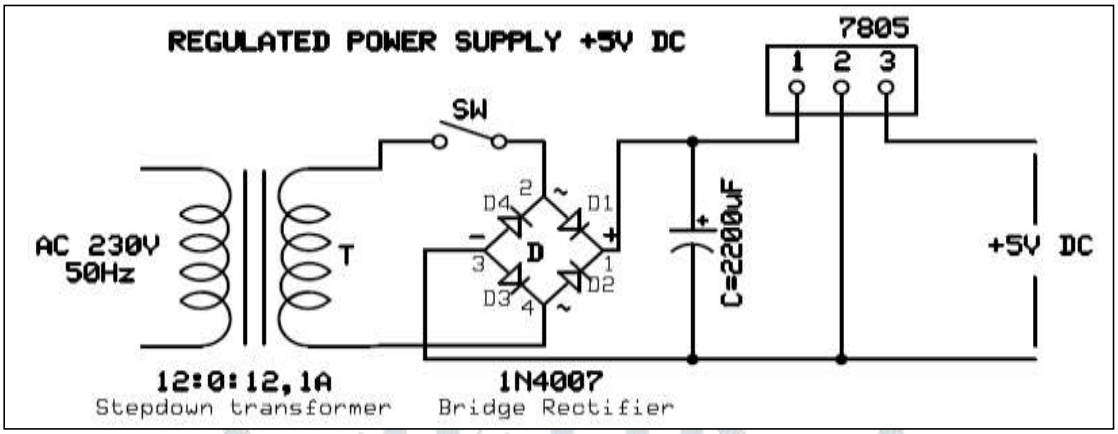

Figure 5.1.2.1: Circuit diagram of +5V RPS

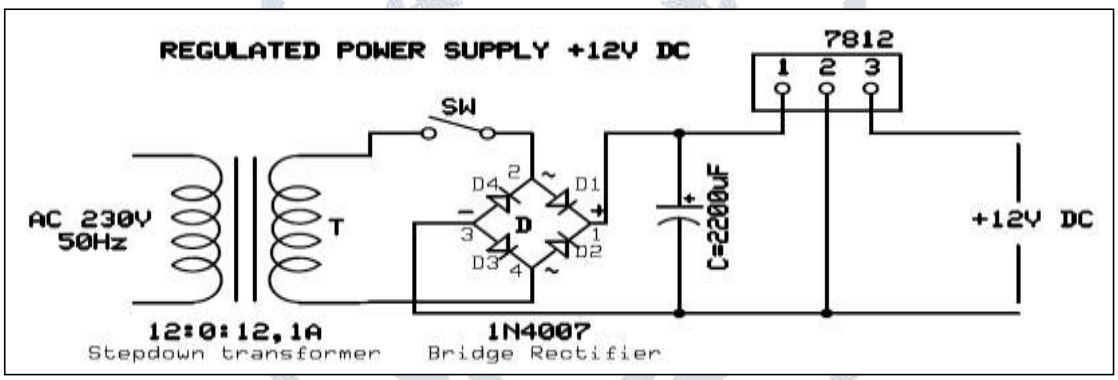

Figure 5.1.2.2: Circuit diagram of +12V RPS

- Output Voltages: Gives out well regulated +5V output, output current capability of 100 ma
- Circuit protection: Built-in overheating protection shuts down output when regulator IC gets too hot
- Circuit complexity: Very simple and easy to build
- Circuit performance: Very stable +5V output voltage, reliable operation
- Availability of components: Easy to get, uses only very common basic components
- Design testing: Based on datasheet example circuit, We used this circuit successfully as part of many electronics projects
- Applications: Part of electronics devices, small laboratory power supply
- Power supply voltage: Unregulated DC 8-18V power supply
- Power supply current: Needed output current + 5 ma

5.2 TRANSFORMER:

A step-down type transformer is used to reduce the mains voltages to a suitable low voltage. It is a device, which transforms the 230 volts 50 Hz, A.C mains voltage, to required small voltages. Our design uses a full wave bridge rectifier with a center-tapped transformer, to obtain dual-tracking voltages i.e., to get +Ve and – Ve voltages with respect to ground. A transformer with a power output rated at at-lest 15 VA should be used. If the transformer is rated by output RMS-current then the value should be divided by 1.2 to get the current, which can be supplied. For example, in this case a 1A RMS can deliver 1/ (1.2) or 830 ma.

5.3 RECTIFIER:

The rectifier is built using power diodes. For the maximum efficiency and low ripple, a full wave or a bridge configuration is always preferred. The diodes chosen should have a peak inverse voltage of at-least 200 volts. For safety, the diode voltage rating should be at-least 3 to 4 times that of the transformer secondary voltage. The current rating of the diodes should be twice the maximum load current.

5.4 FILTER:

The purpose of the filter is to eliminate the ripple from the rectified D.C voltage. Capacitor filter has been used in this design from the viewpoint of compactness and economy. Though very simple, capacitor filters provide excellent filtering action. The residual amount of ripple is determined by the value of the filter capacitor: the larger the value the smaller is the ripple. The 2200 µf is a suitable value for most of the requirements. The other consideration in choosing the correct capacitor is its voltage rating. The working voltage of the capacitor has to be greater than the peak output voltage of the rectifier. For example, for an 18 V supply, the peak output voltage is 1.4 X 18V =25V. So a capacitor with working voltage greater than 25V is required.

Filter design equations:

V_{rms}= RMS voltage

V_{dc}= Direct current voltage

V_m= Peak voltage

F = Frequency of ac signal

η = Efficiency of bridge rectifier

γ = Ripple factor

I_{dc} = Direct current

$$\gamma = \frac{1}{4\sqrt{3} \times F \times C \times R_L}$$

$$V_m = V_{rms} \times \sqrt{2}$$

$$R_L = \frac{V_{dc}}{I_{dc}}$$

$$V_{dc} = V_m + \frac{I_{dc}}{4fc}$$

5.5 REGULATOR:

There are many designs possible for a voltage regulator. Many conventional regulators are best suited for constant voltage supply, but the number of discrete components and circuit design makes it not much an attractive choice, especially for the dual tracking type power supplies.

Fixed voltage regulator, which are very much efficient, compact and economic are available as three terminal regulator chips. These chips needs no external components and provide up to 1A current and operate well, even under worst situations of line, load and temperature. The 78XX series are the positive fixed voltage regulators, with its output voltage specified by the last two digits. Similarly the 79XX series are the negative fixed voltage regulators.

5.6 BATTERY

A battery stores electricity for future use. It develops voltage from the chemical reaction produced when two unlike materials, such as the positive and negative plates, are immersed in the electrolyte, a solution of sulfuric acid and water. In a typical lead-acid battery, the voltage is approximately 2 volts per cell, for a total of 12 volts. Electricity flows from the battery as soon as there is a circuit between the positive and negative terminals. This happens when any load that needs electricity is connected to the battery. It also supplies additional current when the demand is higher than the alternator can supply and acts as an electrical reservoir.

In this solar powered project, a pair of Flooded Led acid batteries have been used which is shown in below figure.

Fig. 5.6.1: Led acid battery

Flooded lead acid battery develops voltage from the chemical reaction produced when two unlike materials, such as the positive and negative plates, are immersed in the electrolyte, a solution of **sulfuric acid** and water. In a typical lead-acid battery, the voltage is approximately 2 volts per cell, for a total of 12 volts. Batteries in solar applications have to meet the demands of unstable grid energy, heavy cycling (charging and discharging) and irregular full recharging. There's a variety of battery types fitted for these unique requirements.

5.6.1 Basic Operation of Lead acid Battery

Lead-acid battery operates in a constant process of charge and discharge.

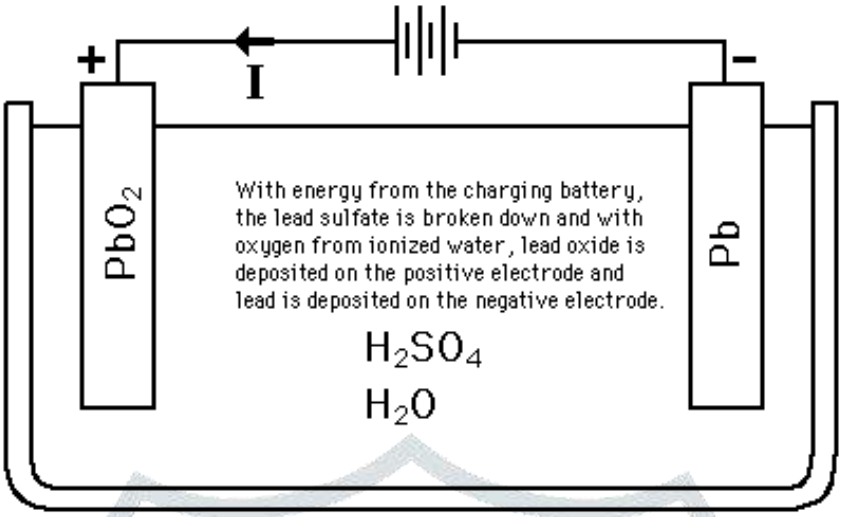

Fig. 5.6.1.1: Operation of Lead acid battery

Discharging:

When a battery is connected to a load that needs electricity, current flows from the battery. The battery begins to be discharged. In the discharged state both the positive and negative plates become lead (II) sulfate (PbSO4) and the electrolyte loses much of its dissolved sulfuric acid and becomes primarily water. The discharge process is driven by the conduction of electrons from the negative plate back into the cell at the positive plate in the external circuit.As a battery discharges, the lead plates become more chemically alike, the acid becomes weaker, and the voltage drops. Eventually the battery is so discharged that it can no longer deliver electricity at a useful voltage.

Due to the freezing point depression of the electrolyte, as the battery discharges and the concentration of sulfuric acid decreases, the electrolyte is more likely to freeze during winter weather when discharged.

Charging:

In the reverse process, a battery becomes charged when current flows back into it, restoring the chemical difference between the plates and battery then delivers its full power. This happens when you're driving without any accessories and the alternator puts current back into the battery.In the fully charged state, the negative plate consists of lead, and the positive plate lead dioxide, with the electrolyte of concentrated sulfuric acid.

Overcharging with high charging voltages generates oxygen and hydrogen gas by electrolysis of water, which is lost to the cell. The design of some types of lead-acid battery allow the electrolyte level to be inspected and topped up with any water that has been lost.

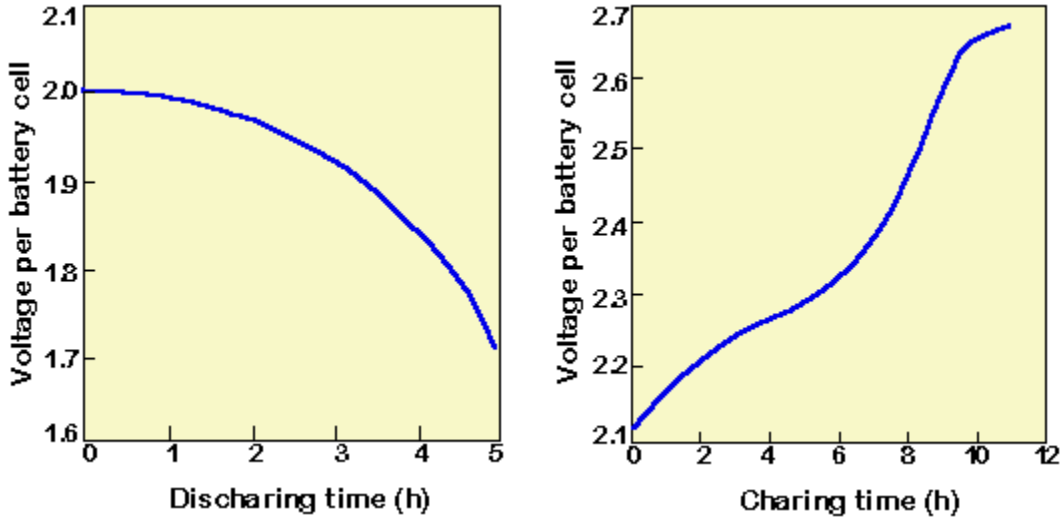

Fig. 5.6.1.1: Voltage of lead acid battery upon charging

This unique process of discharge and charge in the lead-acid battery means that energy can be discharged and restored over and over again. This is what's known as the **cycling ability** in a battery.

5.6.2 Features of Solar Tubular Battery

- Low antimony selenium lead alloy is used to minimize water consumption
- High porosity glass and fiber is used to avoid cell short circuit.
- Heat sealed PPCP tower gives extra large acid volume.
- Heavy duty L shape double hole terminal is used to avoid in-service expenditure.
- Double nylon rope is used for safety handling.
- PVC terminal shrouding cap is used for electrical safety.
- Ceramic vent plug is used to arrest acid fumes and reduce topping up.
- Water topping up frequency is done once in 5 months.
- Its life expectancy is more than 3 yrs.
- Factory charged and wet shipped is an assured performance.

5.6.3 Considerations for choosing battery

- Considerations for choosing a battery include cost, cycle life and installation and maintenance. Deep-cycle, lead-acid batteries have been employed in renewable energy and reliably used in off-grid applications globally for decades
- ***Cost:*** Typical deep-cycle, lead-acid batteries cost about half as much as lithium-ion.
- ***Cycling:*** Valve-regulated lead-acid (VRLA) batteries include absorbed glass mat (AGM) and gel models. Many AGMs batteries available in the market are primarily built for dual-purpose or standby applications like emergency backup, but not deep cycling. However, new deep-cycle AGM designs have increased

performance and total energy output making them a good choice for renewable energy applications at a lower price point than gel batteries.

- ***Replacement/maintenance:*** Many factors including initial design and ongoing maintenance influence battery life so it's difficult to put a time frame on when the batteries will need replacement. Flooded lead-acid batteries have to be refilled regularly because the electrolyte that fully submerges the battery plates evaporates during charging. The battery enclosure needs ventilation to keep hydrogen gas from accumulating to dangerous levels.
- AGM and gel technologies, however, are recombinant, meaning they internally convert hydrogen and oxygen into water and do not require maintenance. As there is no free acid inside these batteries, they can be installed in any position other than upside down. Because solar applications can be in hard-to-reach or remote areas, the ability to install the batteries and let them operate over long periods without maintenance is a benefit.
- ***Disposal:*** Proper disposal of lead-acid batteries is important because they are toxic. Thankfully, the automotive industry organized to recycle lead early on. Plastic containers and covers of old batteries can also be neutralized, reground and used in new battery cases. In some cases, the electrolyte is cleaned, reprocessed and sold as battery-grade electrolyte. In other instances, the sulfate content is removed as ammonium sulfate and used in fertilizers. The separators are often used as a fuel source for the recycling process. Old batteries may be returned to the battery retailer, automotive service station, a battery manufacturer or other authorized collection centers for recycling.

5.6.4 Battery Care, Installation and Maintenance Tips

- New Batteries should be given a Full Charge before use.
- Install batteries on an Insulated surface like wooden planks or Rubber sheet or Thermo Cole Sheet or in a painted and properly earthed MS Angle Rack.
- Select the battery capacity Properly as per your Invertor and UPS design and back-up required.
- Take care not to offer much load on battery terminals while tightening also avoid the shorting of terminals.
- Keep the top surface of the battery clean, dry and tidy.
- Use only proper current carrying cables and cable connectors and check for it's proper connection to prevent sparking and melting of terminals.
- Applly petroleum jelly or Vaseline to terminals to prevent corrosion but Do Not Use Grease.
- Ensure polarity of the battery that is connect positive cable to positive (red) terminal of battery and negative cable to negative (blue) terminal of battery.
- Ensure that batteries are kept in well ventilated place with adequate shelter and check that battery is not exposed direct to sunlight.
- Keep the vent plug tight and clean.

- Top up the battery with DM Water after 6 months intervals.
- Never Use Tap Water, Bore water even mineral water as it can reduce your battery life.
- The Water used to replenish batteries should be distilled or de-mineralized (DM) Water. Particular Care should be taken to avoid mentallic Contamination (Iron).
- Never Add Acid in the battery otherwise it will damage your battery.
- Fully charged battery have the acid gravity in between 1245 to1250. If more then reduce it by adding little DM Water as required.
- Excessive consumption of water is an indication of Overcharge it can kill the battery. Check up charger of your UPS or Invertor.
- Keep away Flames cigarettes etc from the battery, as the gases evolved are Inflammable.
- Avoid Mixed Battery state that is of different capacities, makes and ages.
- Protect battery from Metallic Objects like spanner, watch, etc. coming in contact with battery terminals.
- Battery contains lead which is Hazardous so return the old used up battery to the dealer or battery manufacturer.
- Periodic Battery Testing is an important preventive maintenance procedure.
- Always use a matched voltage charger and battery pack systems. An undersized charger will never get the job done, no matter how long you let it run. An oversized charge will cause excess gassing and heat; this situation could cause Explosions or other Damage.
- The Battery storage area must be properly Ventilated.Battery emits gases like hydrogen and oxygen. Concentration of 4% hydrogen are explosive, and recommended maximum concentration of 2% are required for battery storage area.

5.7 SOLAR PANELS

Figure 5.7.1: Solar panel

Solar energy is quite simply the energy produced directly by the sun and collected elsewhere, normally the Earth. The sun creates its energy through a thermonuclear process that converts about 650,000,000 tons of hydrogen to helium every second. The process creates heat and electromagnetic radiation. The heat remains in the sun and is instrumental in maintaining the thermonuclear reaction. The electromagnetic radiation (including visible light, infra-red light, and ultra-violet radiation) streams out into space in all directions.

Only a very small fraction of the total radiation produced reaches the Earth. Much of the world's required energy can be supplied directly by solar power. More still can be provided indirectly. The practicality of doing so will be examined, as well as the benefits and drawbacks. In addition, the uses solar energy is currently applied to will be noted.

Photovoltaic cells, by their very nature, convert radiation to electricity. This phenomenon has been known for well over half a century, but until recently the amounts of electricity generated were good for little more than measuring radiation intensity. Most of the photovoltaic cells on the market today operate at an efficiency of less than 15%; that is, of all the radiation that falls upon them, less than 15% of it is converted to electricity. The maximum theoretical efficiency for a photovoltaic cell is only 32.3%, but at this efficiency, solar electricity is very economical. Most of our other forms of electricity generation are at a lower efficiency than this. Unfortunately, reality still lags behind theory and 15% efficiency is not usually considered economical by

most power companies, even if it is fine for toys and pocket calculators. Hope for bulk solar electricity should not be abandoned, however, for recent scientific advances have created a solar cell with an efficiency of 28.2% efficiency in the laboratory. This type of cell has yet to be field tested. If it maintains its efficiency in the uncontrolled environment of the outside world, and if it does not have a tendency to break down, it will be economical for power companies to build solar power facilities after all.

Solar power has two big advantages over fossil fuels. The first is in the fact that it is renewable; it is never going to run out. The second is its effect on the environment.

As the primary element of construction of solar panels, silicon, is the second most common element on the planet, there is very little environmental disturbance caused by the creation of solar panels. In fact, solar energy only causes environmental disruption if it is centralized and produced on a gigantic scale. Solar power certainly can be produced on a gigantic scale, too.

Size of Solar Panel

Electrical Load Detail:

- 1 No's of 100W Computer use for 8 Hours/Day
- 2 No's of 60W Fan use for 8 Hours/Day
- 1 No's of 100W CFL Light use for 8 Hours/Day

Solar System Detail:

- Solar System Voltage (As per Battery Bank) = 48V DC
- Loose Wiring Connection Factor = 20%
- Daily Sunshine Hour in Summer = 6 Hours/Day
- Daily Sunshine Hour in Winter = 4.5 Hours/Day
- Daily Sunshine Hour in Monsoon = 4 Hours/Day

Inverter Detail:

- Future Load Expansion Factor = 10%
- Inverter Efficiency = 80%
- Inverter Power Factor =0.8

Calculation:

Step-1: Calculate Electrical Usages per Day

- Power Consumption for Computer = No x Watt x Use Hours/Day
- Power Consumption for Computer = 1x100x8 =**800 Watt Hr/Day**
- Power Consumption for Fan = No x Watt x Use Hours/Day
- Power Consumption for Fan = 2x60x8 = **960 Watt Hr/Day**
- Power Consumption for CFL Light = No x Watt x Use Hours/Day
- Power Consumption for CFL Light = 1x100x8 = **800 Watt Hr/Day**

- Total Electrical Load = 800+960+800 =**2560 Watt Hr/Day**

Step-2: Calculate Solar Panel Size

- Average Sunshine Hours = Daily Sunshine Hour in Summer+ Winter+ Monsoon /3
- Average Sunshine Hours = 6+4.5+4 / 3 =**8 Hours**
- Total Electrical Load =2560 Watt Hr/Day
- **Required Size of Solar Panel = (Electrical Load / Avg. Sunshine) X Correction Factor**
- Required Size of Solar Panel =(2560 / 4.8) x 1.2 **= 635.6 Watt**
- **Required Size of Solar Panel = 635.6 Watt**

Step-3: Calculate No of Solar Panel / Array of Solar Panel

If we Use 250 Watt, 24V Solar Panel in Series-Parallel Type Connection

- In Series-Parallel Connection Both Capacity (watt) and Volt are increases
- **No of String of Solar Panel (Watt) = Size of Solar Panel / Capacity of Each Panel**
- No of String of Solar Panel (Watt) = 635.6 / 250 = 2.5 No's Say **3 No's**
- **No of Solar Panel in Each String= Solar System Volt / Each Solar Panel Volt**
- No of Solar Panel in Each String= 48/24 =**2 No's**
- Total No of Solar Panel = No of String of Solar Panel x No of Solar Panel in Each String
- Total No of Solar Panel = 3×2 =**6 No's**
- **Total No of Solar Panel =6 No's**

Step-4: Calculate Electrical Load:

- Load for Computer = No x Watt
- Load for Computer = 1×100 =1**00 Watt**
- Load for Fan = No x Watt
- Load for Fan = 2×60 = **120 Watt**
- Load for CFL Light = No x Watt
- Load for CFL Light = 1×100 = **100 Watt**
- Total Electrical Load = 100+120+100 =**320 Watt**

Step-5: Calculate Size of Inverter:

- Total Electrical Load in Watt = **320 Watt**
- **Total Electrical Load in VA= Watt /P.F**
- Total Electrical Load in VA =320/0.8 = **400VA**
- **Size of Inverter =Total Load x Correction Factor / Efficiency**
- Size of Inverter = 320 x 1.2 / 80% **=440 Watt**
- Size of Inverter =400 x 1.2 / 80% **=600 VA**

- **Size of Inverter = 440 Watt or 600 VA**

Summary:

- Required Size of Solar Panel = 635.6 Watt
- Size of Each Solar Panel = 250 Watt. 12 V
- No of String of Solar Panel = 3 No's
- No of Solar Panel in Each String = 2 No's
- **Total No of Solar Panel =6 No's**
- **Total Size of Solar Panel = 750 Watt**
- **Size of Inverter = 440 watt or 600 VA**

CHAPTER 6

RESULTS AND ANALYSIS

After analysis of the result after completing the solar powered pesticide sprayer, the discharge rate of pesticides from the tank is high and by this farmer can save time for spraying pesticides and since it is having wheels is very much easy to move it. It uses solar energy which is renewable source of energy so there will be no pollution and it saves energy for future generation. Since India is an agricultural country so we need a pesticide sprayer which works on solar energy which does not cause any pollution and gives high output that saves money, time for farming. When we compared with the existing system, we got that the system that we are using provides the required operation in less time and in large quantity without failure.

CHAPTER 7

ADVANTAGES

The advantages are as follows:

- Solar-powered pesticide Systems are practical in flat terrain where the sun shines.
- Solar-powered pesticide pumps can be placed in or next to the pond or other source of pesticide and the pesticide can be pumped where it is needed.
- Solar pesticide pumping is clean and efficient.
- Solar electric water pumping cuts down on waste because it's based on natural cycles. Your panels give the most pumping power on the sunniest days---when you need the most pesticide.
- Solar power is clean. You never have to worry about polluting
- Solar-powered pesticide systems take very little maintenance because they only have a few moving parts. They have long life---usually 20 to 40 years. And solar pesticide systems never run out of fuel as long as the sun is shining.

CHAPTER 8

CONCLUSION

The method used here to build solar powered pesticide pumping system is cost effective comparatively to an electrically operated hydraulic pump. Since here non-conventional energy is used to achieve the required head. Discharge obtained from the observations is 5 liters per minute. The reciprocating pump built by us is built with the help of simple and easily available materials still we have successful to demonstrate the worth of a reciprocating pump. This device serves its purpose to some extent, but with proper course of actions, it can perform still better

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