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Design and Implementation of solar fertilizer broadcaster

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Abstract— In India 73% of population is directly or indirectly depends upon the farming. Hence it is said that India is an agricultural based country but till now our farmers are doing forming in same traditional way. They are doing seed sowing, fertilizers and pesticide spraying, cultivating by conventional methods. There is a need of development in this sector and most commonly on fertilizer broadcaster technique, because it requires more efforts to spread uniformly over the entire field.

The main objective of fertilizer broadcaster at sowing time is to uniformly distribute the fertilizer over entire field. The present trend in fertilizer broadcaster in India is based on manual method. It's time to replace the manual method by the motorised. It will decrease the manual effort and time to spread the fertilizer over the entire field.

The present project work is concentrated on design and fabrication of fertilizer broadcaster which will uses the solar energy to run the motor. This makes the work is easier, more efficient and less time to spread the fertilizer on farms.

Keywords— solar panel, charging circuit, battery, speed controller, wiper motor, pedal

INTRODUCTION

Rural energy is generally recognized as an important element of rural socio-economic development, not as an end in itself, but through the demand for the services made possible through energy inputs, such as potable water pumping, extension of the day by lighting and cooking. As a general trend, an increasing energy demand - both in quantity and quality is highly correlated with socio-economic development.

In general, PV technology is reaching commercial maturity and the growing investments in new production capacity are expected to create the conditions for further price drops and higher competitiveness. Programmers and studies now address the issues related to large-scale market development in rural areas, access to affordable credit, local market infrastructure for installing and servicing PV systems, and mechanisms for conducive local policy-making. Most of the attention is directed towards the So-called Solar Home Systems as the most proven PV application, but with uses limited to lighting and audiovisual media. Continuing advances in PV technology and decreasing prices are creating new opportunities for other applications of PV with a greater and more sustainable impact on rural development. On the basis of anecdotal information, it can be concluded that a rising number of such applications are being used, but little systematic information on this is available, especially concerning income generating activities.

I. FERTILIZER BROADCASTING

2.1 Introduction **Broadcasting:**

Even and uniform spreading of manure or fertilizers by hand over the entire surface of field while cultivation or after the seed is sown in standing crop, termed as broad casting. Depending upon the time of fertilizer application, there are two types of broadcasting.

CONVENTIONAL FERTILIZER BROADCASTING

Fig 2.1: Conventional fertilizer broadcasting

- The conventional fertilizer broadcasting is refers to spreading fertilizers all over the field by using a human hand.
- Farmers are using to spread the fertilizers directly using their hands.
- They may not spreading process properly are accurate in a fertilizer spreading process.
- In a Spreading process may cause and leads to crop over yielding or May sometimes crop damaged.
- Fertilizer chemical may affect a farmer's health due to continuous spreading of fertilizer with their bare hands.
- Spreading of fertilizer may not be uniform and cannot perform well work in their field.
- It may increases the usage of fertilizer quantity to a field.
- Large quantity of yield growing field may require a more number of human labors.
- Conventional spreading may leads to usage of fertilizer while broadcasting process.

2.2 Manually Operated Fertilizer Broadcaster

Fig 2.2: Manually Operated fertilizer broadcaster

India is agriculture based country. Near about 70% people of our country are farmers. Our economy also depends on agricultural products. Nowadays tremendous changes have occurred in conventional methods of agriculture like seed plantation, irrigation system, pesticides and spray used. For developing our Economic condition, it is necessary to increase our agricultural productivity and quality also. Farming process includes many stages, out of which fertilization is one of the important stages and which is not exploded up to the mark up till now. Now-a-days, we are used to do spreading of fertilizer in traditional way which is time consuming, costlier as well as not provide comfort to the labor. Also, some tractor operated machines for spreading of fertilizer are available. So, what we need is an alternative to the traditional as well as tractor operated fertilizer spreading machine which will full fill all the requirements.

A method was generated to spread the fertilizer uniformly over a fallow land by dropping the fertilizer over the impeller disc. The system consists of a three wheels, two at the front and one at the back. These two wheels at the front are used to impel the fertilizer. The two hoppers are used to store the fertilizer; these hoppers are placed at some height from the wheel axle so that the fertilizer falls on to the impeller. The hopper is provided with flow control mechanism. In fertilization, the flow maintenance is necessary. Generally every crop should get sufficient amount of fertilizer. This condition is satisfied by Spring Mechanism. In normal conditions spring is not in tension and hopper is closed. As operator apply tension on the spring, controlling plate moves backward and hopper is open. Below this system there is an impeller. It is mounted on output shaft. Hooper opens on Impeller eccentrically and due to centrifugal action fertilizer spreads in the farm. This high value of centrifugal force is generated by the help of proper gear reduction ratio. The gears are coupled to the shaft of wheel. With this machine, percentage reduction in time required for Fertilization was observed to be 50% and reduction in labor cost as compared to conventional method was 80%. It has solved the problem of traditional way of Fertilization.

Fertilizer broadcaster helps you distribute seed, fertilizer, and pesticides (granular) etc., over the farmland. Sturdy & light in weight makes it easier to handle and its also gender friendly.

This product has 3 E Advantages:

- Economy
- Efficient
- Effective

Fig 2.3: Working of Manually Operated fertilizer broadcaster

Features

- Fertilizer broadcaster helps you distribute seed, fertilizer, and weedicides etc., over the farmland.
- Chemical reaction of fertilizer, weedicide which occurs by hand broadcasting can be prevented by using this fertilizer broadcaster.
- Sturdy, Light in weight, easy to handle, gender friendly. Fertilizer Broadcaster covers a lot of acreage quickly.
- The material drops from the hopper onto a spreading disc that disperses it uniformly over the farmland thereby increasing the yield.
- No Technical Guidance/Knowledge is required to operate it.
- Hopper made of Plastic. Capacity 13 Liters.
- Spreading Disc made of High Quality Plastic. Belly Mounted with two nos. of adjustable carry straps.

SOLAR FERTILIZER BROAD CASTER

3.1 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. Fuel operated spray pump exhaust carbon dioxide as pollutant which has a detrimental effect on our environment. Hence, these conventional sprayers are not very efficient. The main aim of this project is to fabricate a model that utilizes solar energy for spraying pesticides. In this project, the hand lever will be eliminated to reduce the user's 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. In order to overcome all the problems we are employing motor to rotate the pedal and thereby pesticide can be sprayed on the crops.

A solar cell or photovoltaic cell is a device that converts solar energy into electricity by the photovoltaic effect. Sometimes the term solar cell is reserved for devices intended specifically to capture energy from sunlight, while the term photovoltaic cell is used when the source is unspecified. Assemblies of cells are used to make solar panel, solar modules, or photovoltaic arrays. Photovoltaic is the field of technology and research related to the application of solar cells for solar energy.

Solar panel converts the solar energy into electricity and supplies it to battery. Battery uses this electricity to charge itself. This battery is used to operate the motor. The speed of the motor is controlled with the help of voltage controller. Motor supply is used to rotate the pedal and the pesticide is sprinkled on the crops.

3.1.1 Hardware Description about Solar Fertilizer Broad Caster

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in fig: 2.1

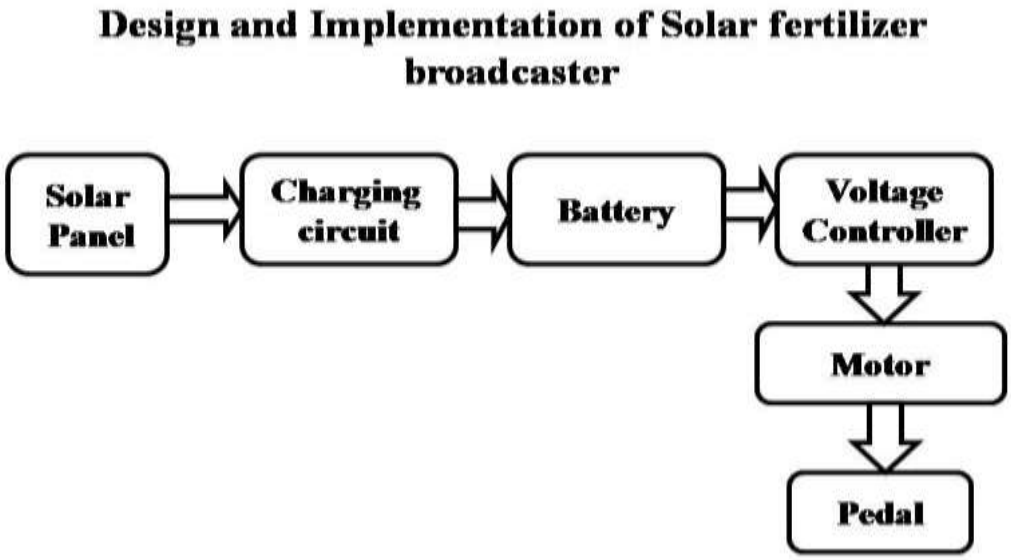

Fig 3.1(a): Block diagram of Design and Implementation of Solar Fertilizer Broadcaster

Fig 3.1(b): Photograph of solar fertilizer broadcaster

The major building blocks of this project are:

1. Solar panel.
2. Charging circuit.
3. Battery.
4. Speed controller.
5. Motor.
6. Pedal.

3.2 Transformers

The process of transforming energy from one device to another is called transformation. For transforming energy we use transformers.

Transformers:

Fig 3.2.1: Transformers

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors without changing its frequency. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core, and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the secondary winding. This effect is called mutual induction.

If a load is connected to the secondary, an electric current will flow in the secondary winding and electrical energy will be transferred from the primary circuit through the transformer to the load. This field is made up from lines of force and has the same shape as a bar magnet.

If the current is increased, the lines of force move outwards from the coil. If the current is reduced, the lines of force move inwards.

If another coil is placed adjacent to the first coil then, as the field moves out or in, the moving lines of force will "cut" the turns of the second coil. As it does this, a voltage is induced in the second coil. With the 50 Hz AC mains supply, this will happen 50 times a second. This is called MUTUAL INDUCTION and forms the basis of the transformer.

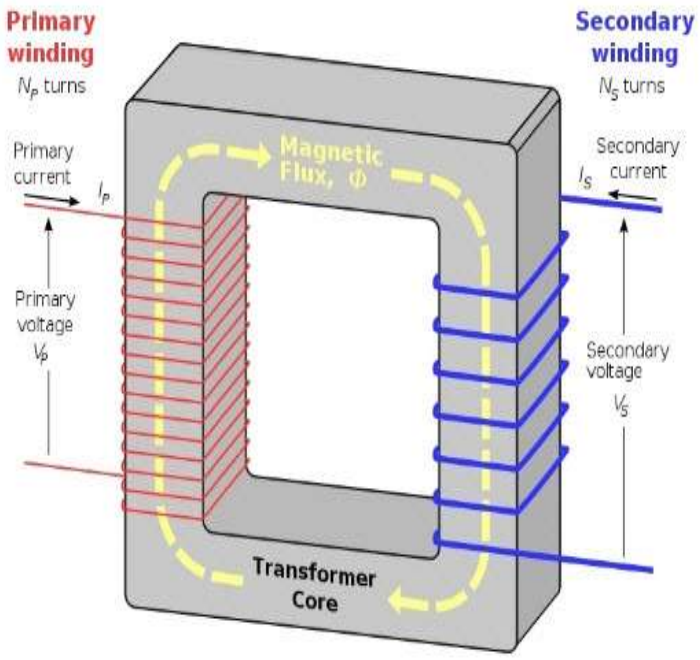

Fig 3.2.2: Transformer Core

The input coil is called the PRIMARY WINDING; the output coil is the SECONDARY WINDING.

Fig: 3.5 shows step-down transformer.

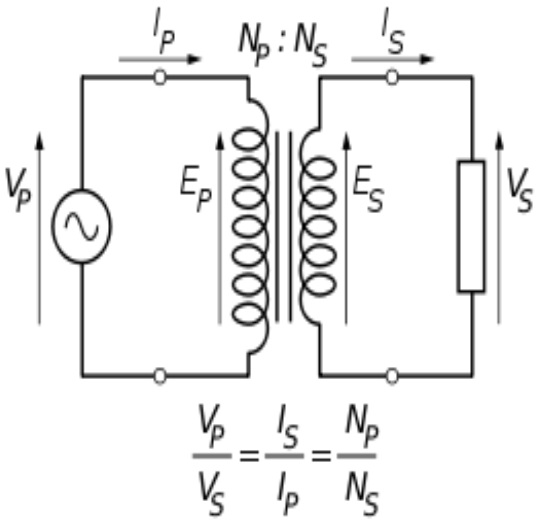

Fig 3.2.3: Step-Down Transformer

The voltage induced in the secondary is determined by the TURNS RATIO.

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

For example, if the secondary has half the primary turns; the secondary will have half the primary voltage.

Another example is if the primary has 5000 turns and the secondary has 500 turns, then the turn's ratio is 10:1.

If the primary voltage is 240 volts then the secondary voltage will be x 10 smaller = 24 volts. Assuming a perfect transformer, the power provided by the primary must equal the power taken by a load on the secondary. If a 24-watt lamp is connected across a 24 volt secondary, then the primary must supply 24 watts.

To aid magnetic coupling between primary and secondary, the coils are wound on a metal CORE. Since the primary would induce power, called EDDY CURRENTS, into this core, the core is LAMINATED. This means that it is made up from metal sheets insulated from each other. Transformers to work at higher frequencies have an iron dust core or no core at all.

Note that the transformer only works on AC, which has a constantly changing current and moving field. DC has a steady current and therefore a steady field and there would be no induction.

Some transformers have an electrostatic screen between primary and secondary. This is to prevent some types of interference being fed from the equipment down into the mains supply, or in the other direction. Transformers are sometimes used for IMPEDANCE MATCHING.

We can use the transformers as step up or step down.

Step Up transformer:

In case of step up transformer, primary windings are every less compared to secondary winding. Because of having more turns secondary winding accepts more energy, and it releases more voltage at the output side.

Step down transformer:

In case of step down transformer, Primary winding induces more flux than the secondary winding, and secondary winding is having less number of turns because of that it accepts less number of flux, and releases less amount of voltage.

3.2.1 Working Principle of Transformer

The** working principle of transformer **is very simple. It depends upon Faraday's law of electromagnetic induction. Actually, mutual induction between two or more winding is responsible for transformation action in an electrical transformer.

Faraday's Laws of Electromagnetic Induction

According to these Faraday's laws, "Rate of change of flux linkage with respect to time is directly proportional to the induced EMF in a conductor or coil".

3.2.2 Basic Theory of Transformer

Say you have one winding which is supplied by an alternating electrical source. The alternating current through the winding produces a continually changing flux or alternating flux that surrounds the winding. If any other winding is brought nearer to the previous one, obviously some portion of this flux will link with the second. As this flux is continually changing in its amplitude and direction, there must be a change in flux linkage in the second winding or coil. According to Faraday's law of electromagnetic induction, there must be an EMF induced in the second. If the circuit of the later winding is closed, there must be an current flowing through it. This is the simplest form of electrical power transformer and this is the most basic of **working principle of transformer**. For better understanding, we are trying to repeat the above explanation in a more brief way here. Whenever we apply alternating current to an electric coil, there will be an alternating flux surrounding that coil. Now if we bring another coil near the first one, there will be an alternating flux linkage with that second coil. As the flux is alternating, there will be obviously a rate of change in flux linkage with respect to time in the second coil. Naturally emf will be induced in it as per Faraday's law of electromagnetic induction. This is the most basic concept of the **theory of transformer**.

3.3 Solar Panel

3.3.1 Solar Energy Basics

Renewable energy sources are beginning to play more role, in urban areas such as building integrated photovoltaic, as well as in rural areas where wind, solar, biomass, and geothermal are gaining in popularity. When it comes to replacing the mass energy production of fossil fuels, renewable energy has not yet proven to be practical. However, renewable energy sources do excel in local applications where there is limited or no access to an electricity grid, or where access to conventional energy is prohibitively expensive. They are most efficient in local applications because the energy production is at the same location as the end-use, thus minimizing the need for energy storage and transport. Of the energy consumers within agriculture, the timing of irrigation requirements conveniently coincides with an increase in insulation or intensity of solar radiation, creating great potential for the union of irrigation and solar energy, specifically photovoltaic.

Fig 3.3.1 Photograph of solar panel

3.3.2 Photovoltaic Cells and Modules

Much like other active solar energy technologies, Photovoltaic use the sun's energy to complete a task that would otherwise require the use of conventional electricity. Photovoltaic (PV) technology directly converts sunlight into electricity using semi conducting PV cells. Photovoltaic or solar cells are composed of semiconductor materials, such as silicon, mono-crystalline thin films, and polycrystalline thin films. A key feature of solar cells is the built-in electric field. This is formed due to the differing semiconductor materials placed in contact with each other within the cell. One semiconductor is n-type that has an abundance of electrons, which have a negative charge, while the other semiconductor is p-type that has an abundance of "holes" with a positive electrical charge. Both semiconductors are neutral overall, but when placed in contact with each other a p-n junction is formed creating an electric field. It is this electric field that facilitates the flow of current.

PV technology is based on the photoelectric effect as discovered by physicist Edmond Becquerel in 1839. The photoelectric or PV effect is the process through which a solar cell is able to convert sunlight, which is made up of photons, into electricity. Photons contain varying amounts of energy corresponding to the different wavelengths of light. The photons strike the solar cell and are either reflected, absorbed, or pass through. Those with a certain amount of energy are absorbed, enabling an electron to jump from the tightly bound valence band to the conduction band, where it is able to move around within the semiconductor.

The electron will move from the n-type semiconductor toward the p-type side, thus forming part of the current in an electrical circuit. The built-in electric field provides the voltage required to drive this current through the external load. Individual PV cells are assembled into PV modules of varying capacity.

PV modules are often combined to form PV arrays. They are combined in series to increase supply voltage, and combined in parallel when the application requires an increased current.

3.3.3 Balance of System (BOS) Components

The electrical power from PV modules must be controlled and sometimes modified. PV modules are commercially available unregulated. This means that a rated 12V panel will more typically give an output of 20V on a sunny day, as indicated by the manufacturers. Included in this group of controllers, but not limited to, are battery charge controllers, which regulate the charge and discharge cycles of batteries; maximum power point trackers, which maintain the operating voltage of the array to a specific value that maximizes the array output; inverters, which convert the direct current output of the array to alternating current that is required by many loads, such as AC motors and utility grids; and linear current boosters, which convert any excess voltage, over the rated value, into increased current at an efficiency of approximately 95%, as indicated by the manufacturers.

Another important BOS component of the PV system is energy storage capacity. Often, the application will require electrical energy on demand so that the solar panels are used to charge batteries (during sunlight hours), in turn, the batteries then provide electricity when required. Deep-cycle batteries are most appropriate for PV application as they can withstand cycles of up to 80% discharge.

3.3.4 Different types of Solar Cells

There are three main types of solar cells, which are distinguish by the crystal used in them. They are monocrystaliine, poly crytalline and amorphous. To produce a monocrystalline silicon cell, absolutely pure semiconducting material is necessary. Monocrytalline rods are extracted from melted silicon and then sawed into thin plates. This production process guarantees a relatively high level of efficiency. Different types of solar cells is shown in table 2.1.4.

Material	Efficiency in lab (%)	Efficiency of production cell(%)
Monocrytalline silicon	About 24	14-17
Polycrytalline silicon	About 18	13-15
Amorphous silicon	About 13	5-7

Table 3.3.4: Types of solar cell

The production of polycrystalline cells is more cost-effective. In this process liquid silicon is poured into blocks that are subsequently sawed into plates. During solidification of the material, crystal structures of varying sizes are formed, at whose borders defectsemerge. As a result of this crystal defect, the solar cell is less efficient.

If a silicon film is deposited on glass or another substrate material, the result is so called amorphous or thin layer cell. The layer thickness amounts to less than 1µm the thickness of a human hair for comparision is 50-100µm. The production costs of this type are lower because of lower material costs. However, the efficiency of amorphous cells is much lower than that of the other two cell types. As a result, they are used mainly in low power equipment, such as watches and pocket calculators, or as façade elements.

3.4 Lead-Acid Battery

3.4.1 Introduction

Much of the perceived confusion among battery users of all types, and in particular for power sports enthusiasts, is largely due to the wide variety of construction methods used in making lead acid batteries. Although for the most part, the electro- chemical working of these differently constructed lead acid batteries is very similar, manufacturers recommend that these batteries be used in different applications and that they are charged by slightly different methods.

What is a battery?

A battery is a device that stores energy. The way that it stores energy is by holding different electro-chemically active materials together is such a fashion so that they can generate and store free electrons (electrical potential energy) for long periods of time and only deliver that energy when the battery user demands it.

What exactly is in a battery?

Battery must have a case that is electrically insulated and mechanically strong enough to support the weight of its component parts. All batteries are composed of individual cells. A cell might be considered the smallest unit of a battery that is capable of generating a voltage and performing the functions of a battery on its own. Many combinations of chemical compounds can be put together to create an electric charge generating battery cell. Once the electric charge is generated, it must have a conductive path to escape to the outside world. Those conductive paths are provided by the grids and the electrodes. In the strictest sense of the word, the grids are actually part of the electrodes, because an electrically conductive welding process mechanically bonds them.

The individual battery cells are composed of plates and insulators. The plates are composed of the conductive grid and the active material. There are two polarities of plate, both positive and negative. One pair of opposite polarity plates is sandwiched around some type of insulator, called a separator. The composition of the separator varies. For the AGM battery, this separator is some type of poly-fiber Glass Matte material, hence the letters GM. This combination is called a couple. Depending on the Amp-Hour rating of the cell, the plates will be physically larger to deliver more Amp-Hours or a greater number of smaller plates could be put in a cell to have the same effect.

The last piece of the puzzle is the electrolyte. This is a source of free electrons; actually the captive electrons within the electrolyte are waiting to be liberated as a result of a chemical reaction. In the AGM style battery, the bulk of the electrolyte is Absorbed in the separator material, hence the letter A. So AGM stands for Absorbed Glass Matte.

hat's in a Lead Acid Battery?

Since we are most interested in lead-acid batteries, let's talk about that one. In a lead acid battery, the electrodes and grids are made from lead. Usually there is some other additive mixed in with the lead, like calcium to give it mechanical strength. The polarity of the plate is determined by the active material that is placed in physical contact with the grid. The active material is some formulation of lead oxides. Every battery manufacturer has its own proprietary formulation, usually optimized for one performance characteristic or another. The electrolyte is sulfuric acid. Hence the name "Lead-Acid". The basic lead acid battery chemistry has been the workhorse of the automotive engine start and traction vehicle industries for a long, long time. When used in engine start applications, the batteries are referred to by the acronym SLI, which stands for Starting Lighting & Ignition. Even with all the new, exotic developments in battery technology within the last decade, lead acid still offers one of the most economic alternatives for many applications.

What can a battery do?

A battery can do one or more of three things. First, and most common in the minds of the general public, is to start an engine. Here, the battery delivers a short burst of high amplitude electric current to energize the starter motor that turns the crankshaft on an internal combustion engine. In general, these types of batteries are called SLI, which stands for Starting Lighting & Ignition.

Second, the battery can sit for months or years in a stand-by mode waiting to provide backup power when there is a power outage from the utility company. When the battery supplies its power as a backup, it may discharge completely or only very slightly. Then it is recharged when the power comes back on, and then it again sits idle for long periods of time. Actually, this application is very common, particularly now with the literal explosion (not to be confused with rapid disassembly) of new applications within the telecommunications industry. Third, the battery can deliver the majority of its capacity repeatedly, possibly on a daily basis. This is called a deep-cycle application. Typical examples of this type of use are electric vehicles: cars, busses, golf carts, bicycles, and scooters; industrial applications like electric forklifts (also an electric vehicle); and marine applications like running trolling motors. Deep cycle applications where the battery supplies electric power to portable equipment include medical equipment like EKG machines and respiratory monitors, electronic test and data collection equipment used in industrial settings, telecommunications equipment and a wide range of other types of equipment.

Repetitive deep-cycle discharges are, in all likelihood, the most strenuous application for a battery. Very often, the recharge power requirements for this type of use are extreme, particularly in the eyes of those who have to pay for the battery charging equipment. A good rule of thumb to gauge the price that consumers would have to pay for charging equipment is that on average, for equipment with reasonable electronic control, one would expect to pay about $1.00 per watt. For chargers with more sophisticated electronic controls and display devices, the price can be as high as $3.00 to $3.50 per watt.

3.4.2 Different types of lead-acid batteries

Flooded: This is the traditional engine start and traction style battery. The liquid electrolyte is free to move in the cell compartment. The user has access to the individual cells and can add distilled water as the battery dries out.

Sealed: This term can refer to a number of different constructions, including only a slight modification to the flooded style. In that case, even though the user does not have access to the cell compartments, the internal structure is still basically the same as a flooded battery. The only difference is that the manufacturer has ensured that a sufficient amount of acid is the battery to sustain the chemical reaction under normal use throughout the battery warranty period. Other types of lead acid batteries are also sealed, as explained below.

VRLA: This stands for Valve Regulated Lead Acid battery. This is also a sealed battery. The valve regulating mechanism allows for a safe escape of hydrogen and oxygen gasses during charging.

AGM: As stated earlier, the Absorbed Glass Matte construction allows the electrolyte to be suspended in close proximity

with the plate's active material. In theory, this enhances both the discharge and recharge efficiency. Actually, the AGM batteries are a variant of Sealed VRLA batteries. This particular style has recently become very popular in many engine start and power sports applications.

GEL: The gel cell is similar to the AGM style because the electrolyte is suspended, but different because technically the AGM battery is still considered to be a wet cell. The electrolyte in a GEL cell has a silica additive that causes it to set up or stiffen, first like Jell-O, then after subsequent discharge/charge cycles more like peanut brittle. Micro cracks form in the gelled electrolyte that provides paths for the oxygen recombination reactions between the positive and negative plates. The recharge voltages on this type of cell are lower than the other styles of lead acid battery. This is probably the most sensitive cell in terms of adverse reactions to over-voltage charging.

Maintenance Free: This term is very generic and refers to basically all of the battery types except flooded batteries that have accessible individual cells so that the end user can add water. Since any sealed construction prevents the user from adding water to the individual cells, then by default it becomes maintenance free.

Rechargeable battery

A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used, including: lead–acid, nickel cadmium (NiCd), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer).

Rechargeable batteries have lower total cost of use and environmental impact than disposable batteries. Some rechargeable battery types are available in the same sizes as disposable types. Rechargeable batteries have higher initial cost but can be recharged very cheaply and used many times.

3.4.3 Charging and discharging

During charging, the positive active material is oxidized, producing electrons, and the negative material is reduced, consuming electrons. These electrons constitute the current flow in the external circuit. The electrolyte may serve as a simple buffer for internal ion flow between the electrodes, as in lithium-ion and nickel-cadmium cells, or it may be an active participant in the electrochemical reaction, as in lead–acid cells.

The energy used to charge rechargeable batteries usually comes from a battery charger using AC mains electricity, although some are equipped to use a vehicle's 12-volt DC power outlet. Regardless, to store energy in a secondary cell, it has to be connected to a DC voltage source. The negative terminal of the cell has to be connected to the negative terminal of the voltage source and the positive terminal of the voltage source with the positive terminal of the battery. Further, the voltage output of the source must be higher than that of the battery, but not much higher: the greater the difference between the power source and the battery's voltage capacity, the faster the charging process, but also the greater the risk of overcharging and damaging the battery.

Chargers take from a few minutes to several hours to charge a battery. Slow "dumb" chargers without voltage- or temperature-sensing capabilities will charge at a low rate, typically taking 14 hours or more to reach a full charge. Rapid chargers can typically charge cells in two to five hours, depending on the model, with the fastest taking as little as fifteen minutes. Fast chargers must have multiple ways of detecting when a cell reaches full charge (change in terminal voltage, temperature, etc.) to stop charging before harmful overcharging or overheating occurs. The fastest chargers often incorporate cooling fans to keep the cells from overheating.

Charge Mode
Constant voltage charge (constant voltage and constant resistance charge) is recommended. Charging current is limited, so be sure to charge via a charge-limiting resistor. The specified charge voltage must also be observed.
* If you are considering adopting constant current and constant voltage charge mode, contact SII.

Charge Voltage Range
Observe the specified charging voltage range.
* Charging at a voltage higher than the upper limit may degrade the electrical characteristics or lead to leakage or bursting.
* Charging at a voltage lower than the lower limit significantly reduces discharge capacity.
Charging circuit example

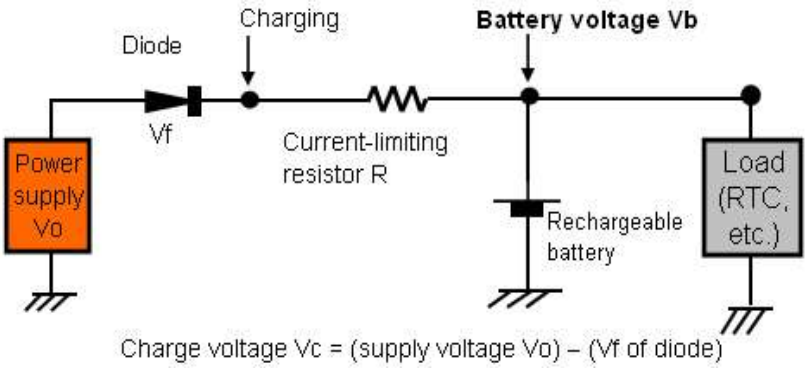

Fig 3.4.1: 12V Battery Charging Circuit

3.5 Wiper Motor

Fig 3.5.1: wiper motor

Wiper Operation
There are three major components to a wiper motor:

- Motor
- Rotary to linear motion converter mechanism
- Parking switch

The mechanism to convert rotary motion to linear motion is very straight forward, and its functionality is apparent from a visual inspection of a disassembled motor assembly. This article, therefore, will discuss only the operation of the motor and the park switch. Although written specifically for a TR6, it is typical for many later model British cars. A separate description is provided below for earlier models -- TR2, 3, 4, etc.
Normal operation
Refer to Figure 1. In this mode of operation, the dash switch is in the normal or low speed, position, and internally, terminal 2 of the switch is connected to terminal 3. Current flows through the motor as shown by the dotted red line. The operation of the parking switch has no effect in this mode, as terminal 4 of the dash switch is not connected to any other terminal.
High speed operation
Refer to Figure 2. In this mode, the dash switch is in the high speed position, and current flow is as shown. This is basically the same configuration as the normal mode, except the power flows through the high speed brush rather than the normal speed brush. Internally, terminal 2 of the dash switch is connected to terminal 1.

The working principle of the wiper motor

Wiper Motor, the power source of the wiper blade, is the core of the whole wiper system. Therefore, the quality of the wiper motor must be guaranteed to ensure its performance. The wiper motor is a permanent-magnet direct current (DC) one. It is equipped on the front windscreen glass with the mechanical parts of the worm gear. The worm gear functions to slow down and increase torque. Its output shafts spur four-bar linkage, by which the movement is changed from rotary to swinging. Three-brush structure is adopted to make speed change more convenient. The intermittent relay, by which the interval is controlled, utilizing the return of switch contacts and the charge-discharge function of the resistor-capacitor in the relay, drives the wiper to wipe in a certain cycle. The wiper blade tape, the tool to clean the rainwater and the filth on the glass, presses the surface of the glass with springs. Only when the tip of the blade is in a certain angle with the glass, can the required function be realized.

Generally speaking, there is a wiper control knob, with stalls of low peed, high speed and intermission, on the handle of auto combination switch. The top of the handle is the key switch, after pressing which water will erupt to wiper blade, of the scrubber. The scrubber system, consisting of plastic water tank (1.5—2 liters), micro-electric centrifugal water pump, pipes, spray nozzles, is very ordinary equipment in automobiles. Water in the tank is supplied through the pump to 2—4 spray nozzles, by which it is extruded into trickles. Then the trickles are sprayed onto the windshield glass, to clean the glass with the wiper blade.

Monster Guts 12VDC Wiper Motors have been the most widely used electric motors for any Halloween prop builder ever since we started Monster Guts! As a matter of fact, 80% of all Halloween props with electric motor use Monster Guts 12VDC Wiper Motors!

TECHNICAL SPECIFICATIONS

- Rated torque: 53 in-lb
- Stall torque: 177 in-lb
- Unload high speed: 50rpm, 1.5A (12VDC)
- Unload low speed: 35rpm, 1.0A (12VDC)
- Maximum wattage: 50W/12VDC
- Motor noise: <45dB
- Spindle/Post thread size: M-6
- Spindle rotates 360 degrees
- Motor weight: 2.7 lbs
- Approx size: 7.25"x4"x3.5"

3.6 Spur Gear

Spur gear mechanism

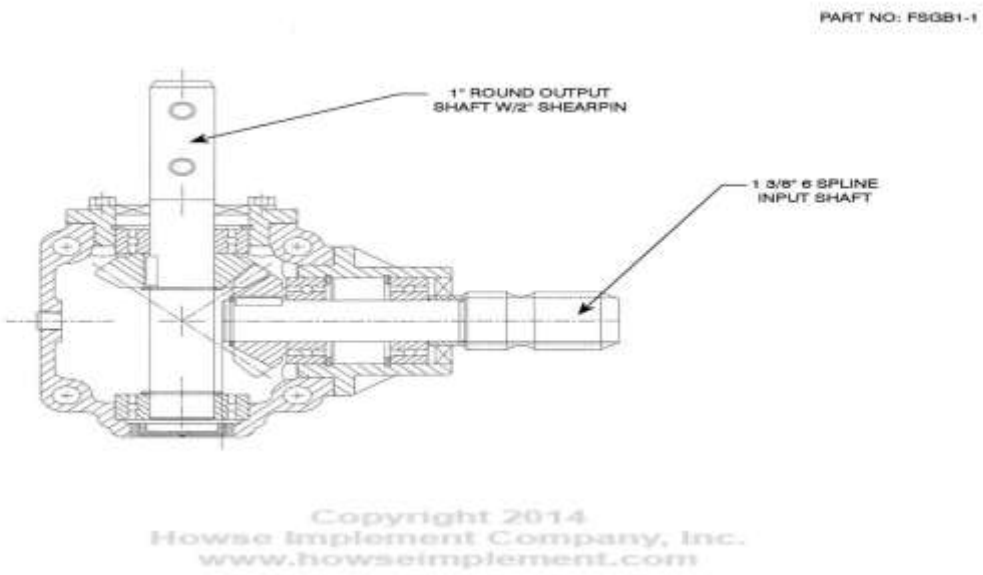

Fig 3.6.1: Spur Gear

Contact Ratio

The gear design is such that when in mesh the rotating gears have more than one gear in contact and transferring the torque for some of the time. This property is called the contact ratio. This is a ratio of the length of the line-of-action to the base pitch. The higher the contact ratio the more the load is shared between teeth. It is good practice to maintain a contact ratio of 1.2 or greater. Under no circumstances should the ratio drop below .A contact ratio between 1 and 2 means that part of the time two pairs of teeth are in contact and during the remaining time one pair is in contact. A ratio

between 2 and 3 means 2 or 3 pairs of teeth are always in contact. Such as high contact ratio generally is not obtained with external spur gears, but can be developed in the meshing of an internal and external spur gear pair or specially designed non-standard external spur gears.

Spur gear Strength and durability calculations

Designing spur gears is normally done in accordance with standards the two most popular series are listed under standards above:

The notes below relate to approximate methods for estimating gear strengths. The methods are really only useful for first approximations and/or selection of stock gears (ref links below). — Detailed design of spur and helical gears is best completed using the standards. Books are available providing the necessary guidance. Software is also available making the process very easy. A very reasonably priced and easy to use package is included in the links below (Mitcalc.com)

The determination of the capacity of gears to transfer the required torque for the desired operating life is completed by determining the strength of the gear teeth in bending and also the durability i.e of the teeth (resistance to wearing/bearing/scuffing loads) .. The equations below are based on methods used by Buckingham.

3.7 Fertilise Discharge Valve

Discharge valve regulates or closes off the flow of a fertilizer in a spreading process. Discharge valves are devices that make it possible to monitor and flow of a fertilizer from a hopper and through discharge to rotating plate in fertilizer broadcaster.

The idea behind the discharge valve is that it provides that to ability to adjust the flow in order to respond situations that requires a change in the volume of speed or flow of the solid fertilizer.

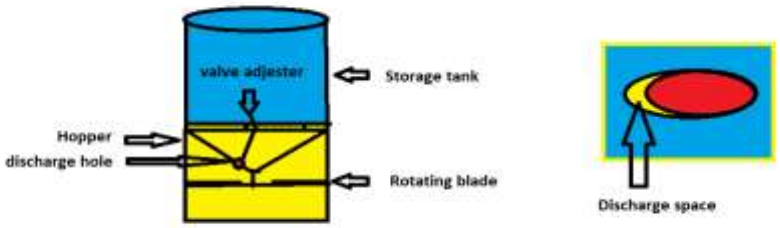

Fig 3.7.1 Fertilize Discharge Valve

Depending upon the type of spreading application, a discharge valve may be manually operated in a solar power based fertilizer broadcaster. In this broadcaster we have one special quality is to adjust the discharge valve, we can fix before going to spread the fertilizer how many kilograms of fertilizer want to spread for one acre is estimated .For Example i) 10 Kg per 1 acre. ii) 20 kg per 1 acre.

3.8 Fertilizer Spreader Rotating Plate

Fig 3.8.1: Fertilizer Spreader Rotating Plate

Gravity feed consisting of a series of adjustable openings in the bottom of a hopper, above which a reel type agitator rotator

A material hopper is positioned over a horizontal spinning disk, the disk has a series of 3 or 4 fins attached to it which throw the dropped materials from the hopper out and away from the seeder/spreader. Alternately a pendulum spreading mechanism may be employed; this method is more common in mid-sized commercial spreaders for improved consistency in spreading

Rotating plate is commonly made of plastic, painted steel, or stainless steel. Stainless steel is usually used in large commercial units for strength and because granular fertilizer is often quite corrosive.

On hand carried units, a hand crank spins gears to turn the disk. , the handle spin a shaft that turns gears which, in turn, spin the disk. Solar fertilizer broadcaster/spreaders made for uniform distribution that use a 12 volt motor to spin a shaft that turns gears which in turns spin and dispersing disk and yaw.

3.9 Difference Between Fertilize Spreading Process

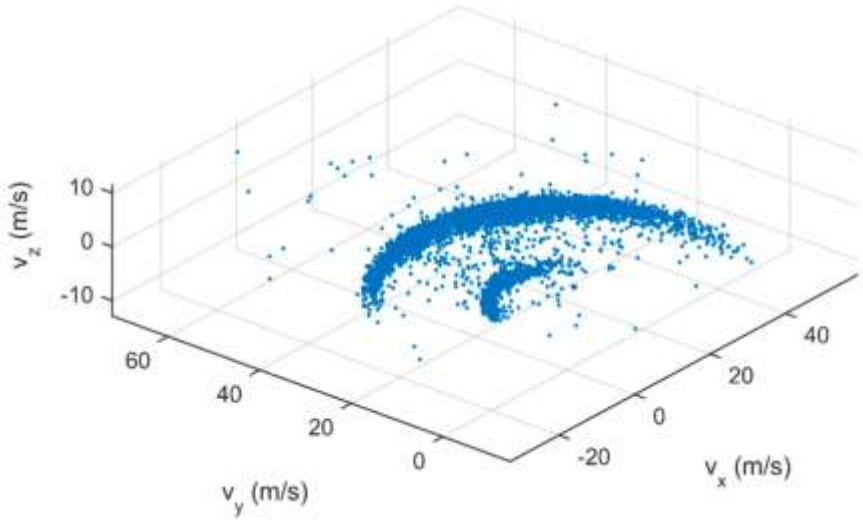

Fig 3.9.1: Conventional Broad Casting

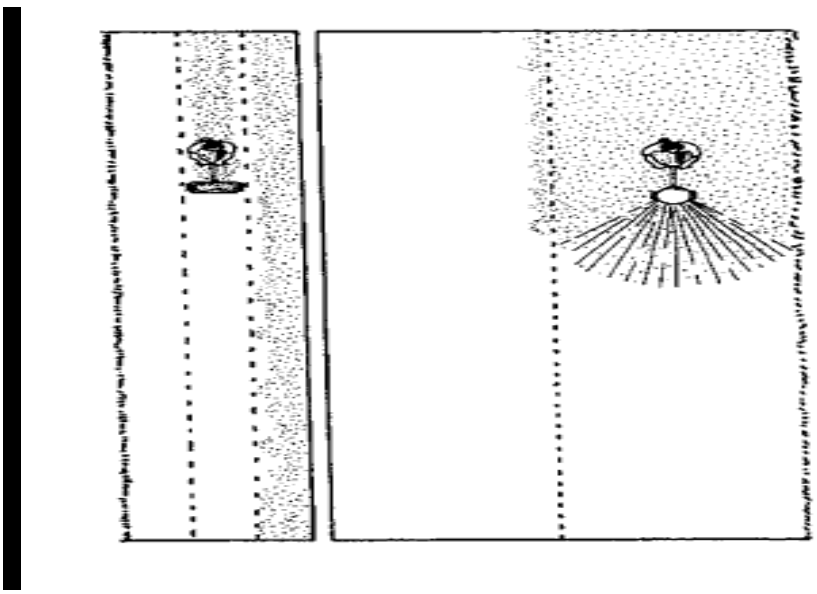

Fig 3.9.2: Solar Fertilizer Broad Casting

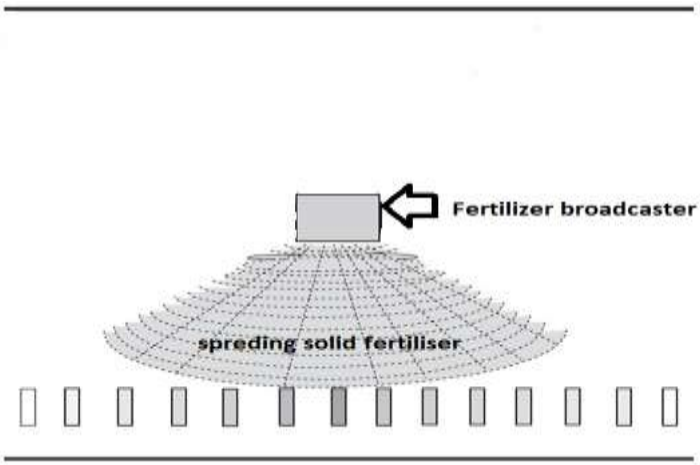

Fig 3.9.3: Uniform distribution in solar fertilizer broadcaster

Conventional fertilizer broadcaster	Solar fertilizer broadcaster
Fertilizers spreading by using human hand	Fertilizers spreading by fertilizer broadcaster machine using solar power
Traditional application	Implemented working Model
Un-uniform distribution	Uniform distribution
Required more time for spreading	Required less time for spreading
Health problems occurred in conventional broadcasting process	Less health problems occurred when compare with conventional broadcasting process
Skilled persons are required to spreading	No need to required skilled persons for operating

Table 3.9: Difference Between Conventional Fertilizer And Solar Ferilizer

ADVANTAGES AND DISADVANTAGES

Advantages:

1. Zero operating cost.
2. Pollution free.
3. Maintenance free.
4. Low weight (50% less compare to conventional one).
5. It is more reliable.
6. It doesn`t affect farmer health by any means.
7. It doesn`t contribute to greenhouse gas emission.
8. It requires no fuel.
9. We can use different types of fertilizes and seeds for easy to spread with less time.
10. It uses renewable source of energy.
11. Usage of solar energy for its operation.
12. Pedal based operation.
13. Low power consumption.
14. No need of training for the operating solar broadcaster.

Disadvantages:

1. Highly sensitive

2. The system uses solar energy is based on atmosphere.

Applications:

Power generation using Solar powered on motorized can be used in most of the places such as

1) College gardens.
2) Parks
3) Irrigation fields
4) Seed sowing and spreading solid fertilizers
5) Rural agricultural applications

v. RESULT AND CONCLUSION

5.1 Result

The project "**Design and Implementation of Solar Fertilizer Broadcaster** "was designed the solar energy into electricity and supplies it to battery. Battery uses this electricity to charge itself. This battery is used to operate the motor. The speed of the motor is controlled with the help of voltage controller. Motor supply is used to rotate the pedal and the fertilizer is sprinkled on the crop.

5.2 Conclusion

- A solar fertilizer broadcaster has been fabricated from locally available materials and tested under real climatic conditions. The experiments performed show that the solar fertilizer broadcaster is cheaper than existing vehicle broadcaster models. The main significant advantage is that it has nil operating cost, which makes its maintenance free and also consumes lesser weight than the other spreader with machines. The whole set-up can be made easily from existing materials at a cost of Rs.5000 approx. Also, since it is a closed chamber, fertilizes from outside can hardly affect the electronic equipment. The result is a uniform, clean and efficient spreading. This developed model reduces the weight and also eliminates the harms to the farmers. It proves to be an efficient and thus it is a step forward to enrich our rural agricultural sector. The main advantage of this developed protocol is, it does not affect farmer health by any means and also it does not contribute to greenhouse gas emission. By encouraging conservation, increasing the investments in clean and renewable sources of energy, we can build a more secure future for our country.

VI.REFERENCES

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