FABRICATION OF SOLAR AIR COOLER

A Project Report submitted to
Jawaharlal Nehru Technological University, Kakinada
In the partial fulfillment for the award of degree of

BACHELOR OF TECHNOLOGY
IN
MECHANICAL ENGINEERING

Submitted by

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DEPARTMENT OF MECHANICAL ENGINEERING

PACE INSTITUTE OF TECHNOLOGY & SCIENCES

(Approved by AICTE, New Delhi & GOVT. of Andhra Pradesh, Affiliated to JNTU, Kakinada)

An ISO 9001: 2008 Certified Institution

NH-5, ONGOLE-523272, Prakasam Dist., Andhra Pradesh.

2011 - 2015

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CERTIFICATE

This is to certify that this entitled " FABRICATION OF SOLAR AIR COOLER " is the bonafide work carried out by

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ACKNOWLEDGEMENT

We are extremely beholden and own an irredeemable dept, of gratitude to our guide**Mrs. R.SAI LAVANYA** **M.Tech..** For his valuable guidance and help extended to us throughout our project.

We also thank our Head of the Department **Dr. Y. SESHA RAO** **M.Tech., Ph.D.** for his patiently hearing and making arrangements for our project and his continuous guidance given by him.

We would like to thank our Principal **Dr. C.V. SUBBA RAO** **M.Tech., Ph.D., MISTE** for his continuous encouragement in completing the project in time.

We would like to thank **Sri. M. SRIDHAR** **B.E.** Secretary & Correspondent of our esteemed organization for providing good environment for completing our project work.

We also thank that Lecturers and Lab technicians of our **MECHANICAL ENGINEERING DEPARTMENT.**

We also express our thanks to all the staff of**PACE INSTITUTE OF TECHNOLOGY & SCIENCES** for their help and moral support extended by them throughout the course.

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ABSTRACT

Mechanical Engineering without production and manufacturing is meaningless. Production and manufacturing process deals with conversion of raw materials inputs to finished products as per required dimensions, specification and efficiently using recent technology. The new developments and requirements inspired us to think of new improvements in air conditioning Engineering field.

In our project, solar power is captured and stored in a battery. This power is used to run the air cooler whenever required.

Solar energy means the radiation energy that reaches the earth from the sun. It provides daylight makes the earth hot and is the source of energy for plants to grow.

Solar electric systems are suitable for plenty of sun and are ideal when there is no main electricity.

Solar electricity is the technology of converting sunlight directly in to electricity. It is based on photo-voltaic or solar modules, which are very reliable and do not require any fuel. Our objective is to design and develop a solar electric system namely **“FABRICATION OF SOLAR AIR COOLER”.**

CHAPTER-1

1. INTRODUCTION

The human body considered as thermal machine with 20% thermalefficiency. The remaining 80% heat must be disposed of from the body to the surroundings otherwise accumulation of heat results and causes discomfort. The human body works best at a particular body temperature like any other machine but cannot tolerate wide range of variation in environmental temperature like thermodynamic machines.

NEED FOR AIR COOLER:

Human beings give off heat, around an average of 100 kcal per hour per person, due to what is known as 'metabolism'. The temperature mechanism within the human body maintains a body temperature of around 36.9^0 C (98.4^0 F). But the skin temperature varies according to the surrounding temperature and relative humidity. To dissipate the heat generated by metabolism in order to maintain the body temperature at the normal level, there must be a flow of heat from the skin to the surrounding air. If the surrounding temperature is slightly less than that of the body, there will be steady flow of heat from the skin. But is the surrounding temperature is very low, as on cold winter day the rate of heat flow from the body will be quite rapid, thus the person feels cold, on the other hand on a hot summer day, the surrounding temperature is higher than that of the body, and so there cannot be flow of heat from the skin to the surroundings, thus the person feels hot. In such a situation water from the body evaporates at the skin surface dissipating water from the body evaporates at the skin surface dissipating the heat due to metabolism. This helps in maintaining normal body temperature. But if the surrounding air is not only hot but highly humid as well, very little evaporation of water can take place from the skin surface, and so the person feels hot and uncomfortable.

NEED FOR NON-CONVENTIONAL ENERGY

Fuel deposit in the will soon deplete by the end of 2020, fuel scarcity will be maximum. Country like India may not have the chance to use petroleum products. Keeping this dangerous situation in mind we tried to make use of non-pollutant natural resource of petrol energy.

The creation of new source of perennial environmentally acceptable, low cost electrical energy as a replacement for energy from rapidly depleting resources of fossil fuels is the fundamental need for the survival of mankind. We have only about 25 years of oil reserves and 75 – 100 years of coal reserves. Resort to measure beginning of coal in thermal electric stations to serve the population would result in global elemental change in leading to worldwide drought and decertification. The buzzards of nuclear electric-stations are only two will. Now electric power beamed directly by micro-wave for orbiting satellite. Solar power stations (s.p.s) provide a cost-effective solution even though work on solar photo voltaic and solar thermo electric energy sources has been extensively pursued by many countries. Earth based solar stations suffer certain basic limitations. It is not possible to consider such systems and meeting continuous uninterrupted concentrated base load electric power requirements.

CHAPTER-2

2. LITERATURE SURVEY

2.1 MAN AND ENERGY:

Man has needed and used energy at an increasing rate for its sustenance and wellbeing ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by eating plants or animals, which he hunted. Subsequently he discovered fire and his energy needs increased as he started to make use of wood and other bio mass to supply use of energy by domesticating and training animals to work for him. With further demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say that the sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy.

The industrial revolution, which began with the discovery of the steam engine (AD 1700), brought about great many changes. For the first time, man began to use a new source of energy, viz. coal, in large quantities.

A little later, the internal combustion engine was invented (AD1870) and the other fossil fuels, oil and natural combustion engine extensively. The fossil fuel era of using non-renewable sources had begun and energy was now available in a concentrated form. The invention of heat engines and then use of fossil fuels made energy portable and introduced the much needed flexibility in man's movement. For the first time, man could get the power of a machine where he required it and was not restricted to a specific site like a fast-running stream for running a water wheel or a windy hill for operating a windmill. This flexibility was enhanced with the discovery of electricity the development of central power generating stations using either fossil fuels or waterpower.

A new source of energy-nuclear energy-came on the scene after the Second World War The first large nuclear power station was commissioned about 40 years ago, and already, nuclear energy is providing a small but significant amount of the energy requirements of many countries.

Thus today, every country draws its energy needs from a variety of sources. We can broadly categorize these sources as commercial and noncommercial. The commercial sources include the fossil fuels (coal, oil and natural gas), hydroelectric power and nuclear power, while the non-commercial sources include wood, animal wastes, geothermal energy and agricultural wastes.

In an industrialized country like USA, most of the energy requirements are meant from commercial sources, while in an industrially less developed country like India, the use of commercial and noncommercial sources is about equal. In the past few years, it has become obvious that fossil fuel resources are fast depleting and that the fossil fuel era is gradually coming to an end. This is particularly true for oil and natural gas. It will be use full therefore to first examine the rates of consumption of the different sources of energy and to give some indication of the reserves available this study will be done for the world as a whole and then for India in particular with the help of these figures it will be possible to form estimates of the time periods for which the existing source will be available. The need for alternative energy options will thus be established and these options will then be briefly described.

Before passing on to these topics, it is worth noting that while man's large-scale use of commercial energy has led to a better quality of life it has also created many problems. Perhaps the most serious of these is the harmful effect on the environment. The combustion of the fossil fuel has caused serious air pollution problems in many areas because of the localized release of large amounts of harmful gases into the atmosphere. It has also resulted in the phenomenon of global warming, which is now a matter of great concern.

Similarly the releases of large amounts of waste heat from power plants have caused thermal pollution in lakes and rivers leading to the destruction of many forms of plants and animals life.

In the case of nuclear power plants there is also concern over the possibility of radio activity being released into the atmosphere in the event of an accident and over the long term problems of disposal of radioactive wastes from these plants. The gravity of most of these environmental problems. Now however, as man embarks on the search for alternative sources of energy, it is clear that they would do well to keep the environmental in mind. So here we take solar air cooler as a project and discussed below.

2.2 THERMAL EXCHANGE IN HUMAN BODY

The human body works best at certain temperatures like other machines, but it cannot tolerate with range of variations. The human body maintains its thermal equilibrium by three modes of heat transfer i.e. evaporation, radiation and convection.

A human body feels comfortable when the heat produced by metabolism of human body is equal to the sum of heat dissipated to the surroundings.

The normal temperature of the human body is 37^0c or 98.6^0F. But, if this level goes below 36.5^0F or 98^0 F and exceeds 40.5^0 C or 105^0F, the conditions become dangerous for human existence

2.3 FACTORS EFFECTING HUMAN COMFORT

The important factors while designing any system of comfort are

- Effective Temperature
- Heat Production & Regulation In Human Body
- Heat And Moisture Losses From Body
- Moisture Content Of Air
- Quality And Quantity Of Air
- Air Motion
- Air Stratification

Physiological Hazards Resulting From Heat and Extreme Cold Are

- Heat Exhaustion
- Heat Cramp
- Heat Stroke
- Frost Bites
- Hypothermia

CHAPTER-3

3. UTILIZATION OF SOLAR ENERGY

3.1 METHODS OF UTILIZATION OF SOLAR ENERGY

1.DIRECT METHOD

a. Photo Voltaic Method

b. Thermal Method

2.INDIRECT METHOD

a. Water Power Method

b. Wind Power Method

c. Bio Mass Method

d. Wave Energy Method

e. Ocean Power Method

DIRECT METHOD OF UTILIZATION OF SOLAR ENERGY:

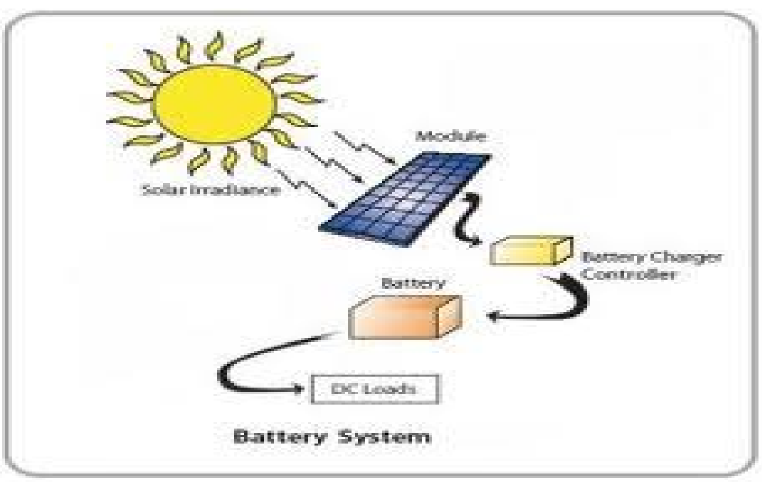


Fig 3.1 Utilization of solar energy.

The most useful way of harnessing solar energy is by directly converting it into electricity by means of solar photo-voltaic cells. Sunshine is incident on Solar cells, in this system of energy Conversion that is direct conversion of solar radiation into electricity.

In the stage of conversion into thermodynamic form is absent. The photo-voltaic effect is defined as the generation of an electromotive force as a result of the absorption of ionizing radiation. Energy conversion devices, which are used to convert sunlight to electricity by use of the photo-voltaic effect, are called solar cells.

In recent years photo-voltaic power generation has been receiving considerable attention as one of the more promising energy alternatives. The reason for this rising interest lie in PV's direct conversion of sunlight to electricity, the non-polluting nature of the PV widespread are of PV generation has been hampered by economic factors. Here to force, the low cost of conventional energy sunlight has obviated the development of a broad-based PV technology. At the present time, PV generation can be justified only for special situations mostly for remote areas.

3.2 PHOTO VOLTAIC METHOD:

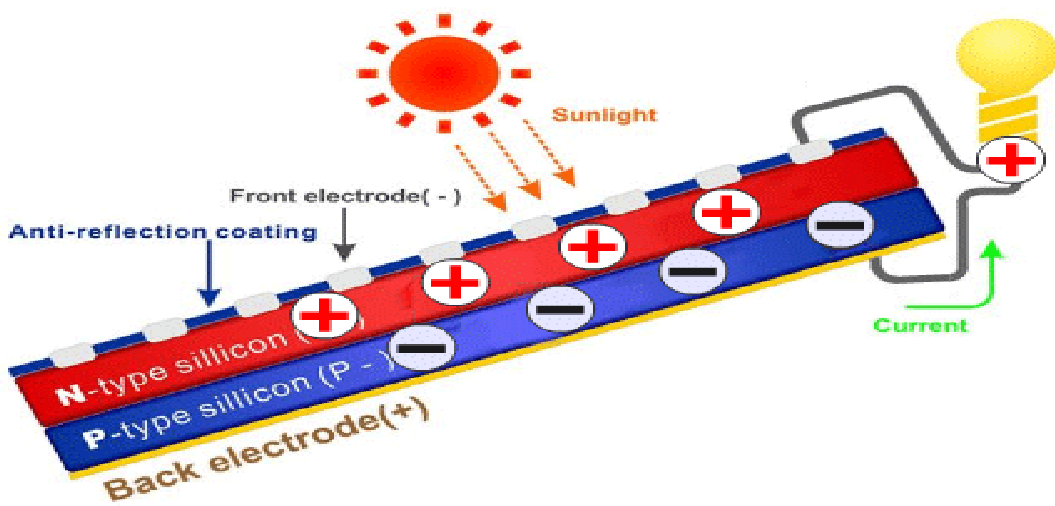


Fig 3.2 Photo Voltaic power generation

3.2.1 PHOTOVOLTAIC PRINCIPLES:

The photo-voltaic effect can be observed in nature in a variety of materials that have shown that the best performance in sunlight is the semiconductors as stated above. When photons from the sun are absorbed in a semiconductor, that create free electrons with higher energies than the created there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells.

To obtain a useful power output from photon interaction in a semiconductor, three processes are required.

1) The photon has to be absorbed in the active part of the material and result in electrons being excited to a higher energy potential.

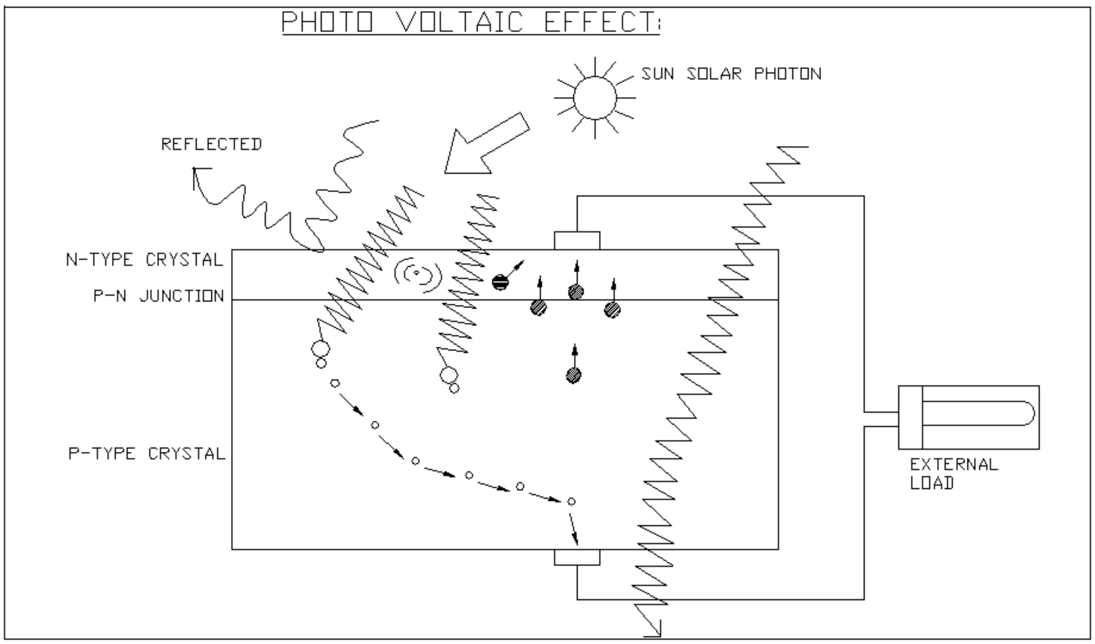


Fig 3.3 Photo Voltaic Effect.

2) The electron hole charge carriers created by the absorption must be physically separated and moved to the edge of the cell.

3) The charge carriers must be removed from the cell and delivered to useful load before they lose extra potential.

For completing the above processes a solar cell consists of:-

a) Semi-conductor in which electron hole pairs are created by absorption of incident solar radiation.
b) Region containing a drift field for charge separation
c) Charge collecting fronts and back electrodes.

The photo-voltaic effect can be described easily for p-n junction in a semi-conductor. In an intrinsic semi-conductor such as silicon, each one of the four valence electrons of the material atom is tied in a chemical bond, and there are no free electrons at absolute zero. If a piece of such a material is doped on one side by a five valance electron material, such as arsenic or phosphorus, there will be an excess of electrons in that side, becoming an n-type semi-conductor.

The excess electrons will be practically free to move in the semi-conductor lattice. When a three valence electron material, such as boron dopes the other side of the same piece, there will be deficiency of electrons leading to a p-type semi-conductor. This deficiency is expressed in terms of excess of holes free to move in the lattice. Such a piece of semi-conductor with one side of the p-type and the other, of the n-type is called p-n junction. In this junction after the protons are absorbed, the free electrons of the n-side will tends to flow to the p-side, and the holes of the p-side will tend to flow to the n-region to compensate for their respective deficiencies. This diffusion will create an electric field from the n-region to the p-region. This field will increase until it reaches equilibrium for V, the sum of the diffusion potentials for holes and electrons.

3.3 COMMISSIONING:

During the day time the battery gets charged and when the intensity of light decreases, the LDR makes the light to gets ON and the light glows by using the stored charge in the battery.

Thus the given project is completed and commissioned.

P-N JUNCTION BIAS:

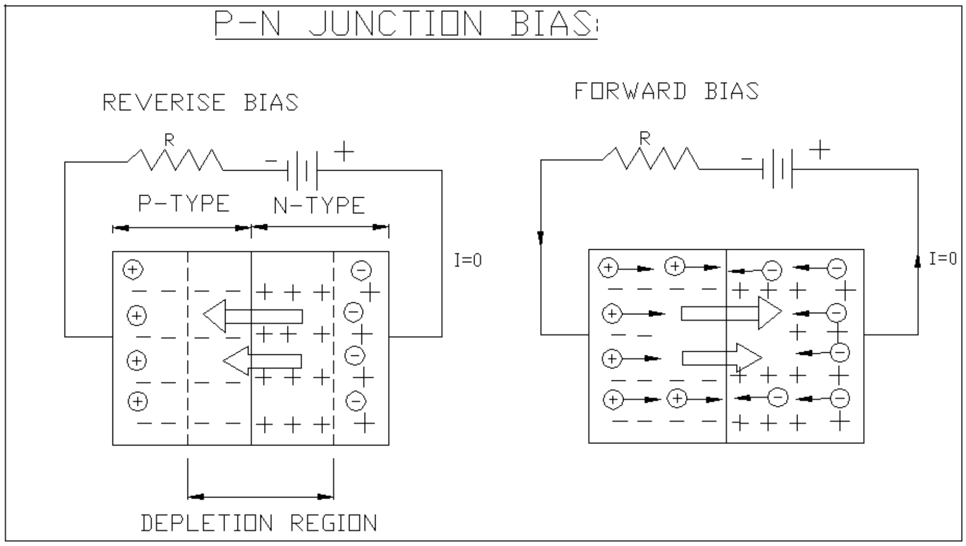


Fig 3.4 P-N Junction BIAS.

If electrical contacts are made with the two semiconductor materials and the contacts are connected through an external electrical conductor, the free electrons will flow from the n-type material through the conductor to the p-type material (see). Here the free electrons will enter the holes and become bounded, electrons thus both free electrons and hole will be removed. The flow of electrons through the external conductor constitutes an electric current, which will continue as long as movement of free electrons and holes being formed by the solar radiation. This is the basis of photo-voltaic conversion that is the conversion of solar energy into electrical energy. The combination of n-type and p-type semiconductors thus constitutes a photo-voltaic cell or solar cell. All such cells some rate direct current that can be converted into alternating current as desired.

The photo-voltaic effect can be observed in almost any junction of material that have different electrical characteristics, but the best performance to date has been from cells using semiconductor materials especially all of the solar cells used for both space and terrestrial applications have been made of the semiconductor silicon. Future cells may use such materials as the Semiconductors like Gallium arsenate, copper sulfate, cadsulphide etc.

CHAPTER-4

4. COMPONENTS AND DESCRIPTION

The physical setup of this project are given below and it is been explained as follows

1. Solar Panel
2. Battery
3. Dc motor
4. Water Pump

1. SOLAR PANEL:

Fig 4.1 Solar Panel

A solar cell works on the principle of photo-voltaic principle, the photo-voltaic solar energy conversion is one of the most attractive non-conventional energy sources of proven reliability from the micro to the Megawatt level.

Its advantages are:

1. Direct room temperature conversion of light to electricity through a simple solid state device.
2. Absence of moving parts,
3. Ability to function unattended for long periods as evidence,
4. Modular nature in which desired currents, voltages and power levels can be achieved by mere integration,
5. Maintenance cost is low as they are easy to operate,
6. They do not create pollution,
7. They have a long effective life, and
8. They are highly reliable.

Disadvantages are:

1. Distributed nature of solar energy,
2. Absence of energy storage.

While the first disadvantage can be party overcome by concentration, the second is an inherent disadvantage overcome in PV systems by the use of conventional storage batteries. Efforts are being made worldwide to reduce costs per watt through various technological innovations.

4.1 SOLAR CELL MODULES (SOLAR PHOTO VOLTAIC ARRAYS):

In actual usage, solar cells are interconnected in a certain series and parallel combinations to from modules. These modules are hermetically sealed for production against corrosion, moisture, pollution and weathering combination of suitable modules constitutes on array.

One square meter of fixed array kept facing south yields nearly 0.5 kWh of electrical energy on a normal sunny day if the orientation of the array is adjusted to face the sun's rays at any time, the output can be increased by 30% solar PV system can and produces output only if sunlight is present.

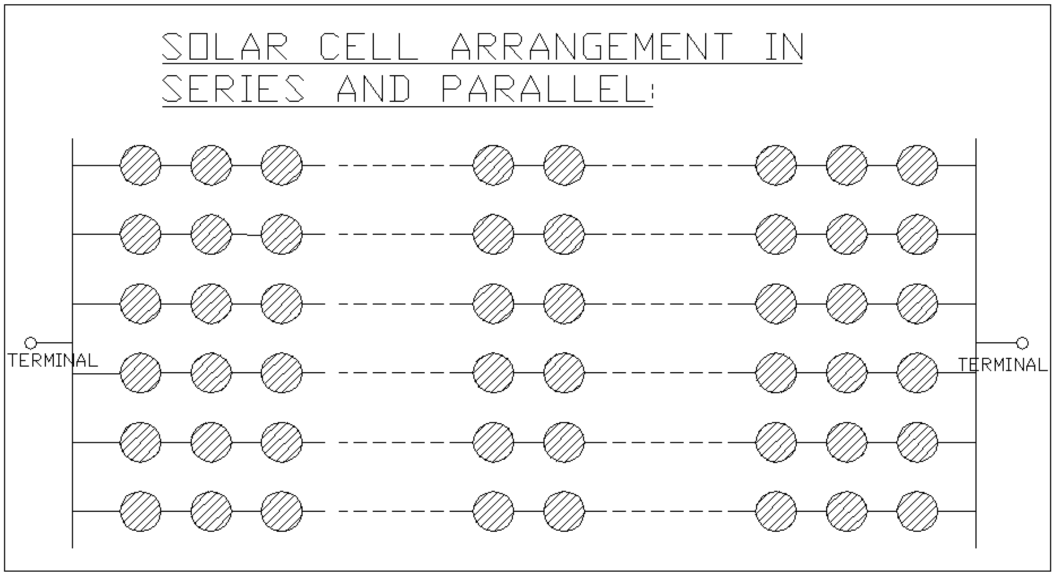


Fig 4.2 Solar Cell Arrangement in series and Parallel.

- **FLAT-PLATE ARRAYS:**

Where in solar cells are attached with a suitable adhesive to some kind of substrate structure usually semi rigid, to prevent cells from cracking.

This technology springs from the space related photo-voltaic technology, and, many such arrays have been built in various power sizes.

- **CONCENTRATING ARRAYS:**

Where in suitable optics example Fresnel lenses, parabolic mirrors, compound parabolic concentrators (CPC), and others are combined with photo voltaic cells in an array fusion. This technology is relatively new to photo voltaic in terms of hardware development, and comparatively fewer such Arrays have actually been built.

SOLAR CELL CONNECTING ARRANGEMENTS

Cells may be connected in parallel to achieve the desired voltage. The optimum operating voltage of a photo voltaic cell is generally about 0.45 volts at normal temperatures, and the current in full sunlight may be taken 0.270 amperes / sq. mm.

If the exposed area of the cell is 40 square cm (6.2sq.in) or 40*10^-4 sq. m, the current and power are decreased or increased proportionately. By combining number of solar cells in series that is in a string, the voltage is increased but the current is unchanged. In this case, if one cell get damaged then the whole string would become inoperative, similarly by combining number of solar cells in parallel, the current is increased but the voltage is unchanged, in this change one cell get damaged than it does not affect the other cell in the string.

To get a voltage of 0 to 36 V we require 72 cells to be connected in series so that we connected 72 cells in series to a required voltage, this connecting module is shown in the above fig.

CONSTRUCTION OF A PHOTO-VOLTAIC CELL:

The construction of the photo-voltaic cell is also known as the barrier layer or rectified cell as shown in figure. It consists of a base plate made of either steel or aluminum and carries a layer of metallic selenium, which is light sensitive. An electrically conducting layer of cadmium oxide is applied by sputtering over the silicon layer.

The layer is sufficiently thin to allow light to reach the selenium and is electrically continuous as it acts as the negative pole. The negative contact is formed of a strip of woods metal sprayed on to the edge of the top surface. The base plate forms the positive contact. A transparent varnish protects the front surface of the cell.

When light falls on the upper surface of the selenium, electrons are released from the surface, a flow of current through the external circuit passes between the positive and negative contacts.

In the current output of a photocell there should be some proportionality to the illumination, which is achieved by keeping the external resistance at a low value. Also if greater accuracy is required then illumination should not be allowed to exceed 25 lumens/feet^2. The smaller the size of the cell, of course compatible with obtaining sufficient current to properly measure a linear relation is between current and illumination.

This is because, for such a cell, the resistance of the electrically conducting film is at minimum. Also, since the current is small, the voltage drop due to the circuit resistance will be kept low.

Limitation of the photocell is that if the light is incident at the angle of 60º or above, the lacquer tends to reflect a significant amount of light which, therefore, does not reach the selenium layer.

Thus the current is less than what it should be, according to the cosine law of illumination. Using a Matt lacquer can make some compensation for this. A better method is to omit the lacquer and cover the cell with a hemispherical dome of transparent plastic. The equivalent circuit of a photo-voltaic cell is shown in figure.

TYPES OF SOLAR CELLS

Apart from the differences in the nature of the semiconductor used, the following different cell configurations have been used:

(1) p-n homo junction
(2) p-n hetro junction
(3) Scotty barrier
(4) Homo junction and hetro structure
(5) MIS (Metal Insulator-Semiconductor cell)
(6) SIS (Semi-Conductor-Insulator semiconductor cell).

Over 95% of cells in commercial production are silicon p-n junction while consumer items are now using amorphous Si cells. While the former has been used in space ventures and terrestrial PV arrays generating 1MW, Si cells are used under low illuminating intensities, since they deteriorate under high intensities. Their low cost advantage is yet to be realized.

In these varieties of cells, we use “MONOCRYSTALLINE CELL” for getting the power and its production is been explained below.

4.2 BATTERIES

INTRODUCTION:

In isolated systems away from the grid, batteries are used for storage of solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact, for small units with output less than 1KW. Batteries seem to be the only technically and economically available storage means. Since both the photo voltaic system and batteries are high in capital costs, it is necessary that the overall system be optimized with respect to available energy and local demand pattern. To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties:

(1) Low cost

(2) Long life

(3) High reliability

(4) High overall efficiency

(5) Low discharge

(6) Minimum maintenance

(a) Ampere hour efficiency

(b)Watt hour efficiency

We use lead acid battery for storing the electrical energy from the solar panel for lighting the street and so about the lead acid cells are explained below.

4.2.1 LEAD ACID WET CELL:

The lead-acid cell is the type most commonly used,where high values of load current are necessary. The electrolyte is a dilute solution of sulfuric acid (H_2SO_4). In the application of battery power to start the engine in an automobile, for example, the load current to the starter motor is typically 200A to 400A. One cell has a nominal output of 2.1V, but lead acid cells are often used in a series combination of three for a 6V battery and six for a 12V battery.

The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents shortens the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.

4.2.2 CONSTRUCTION

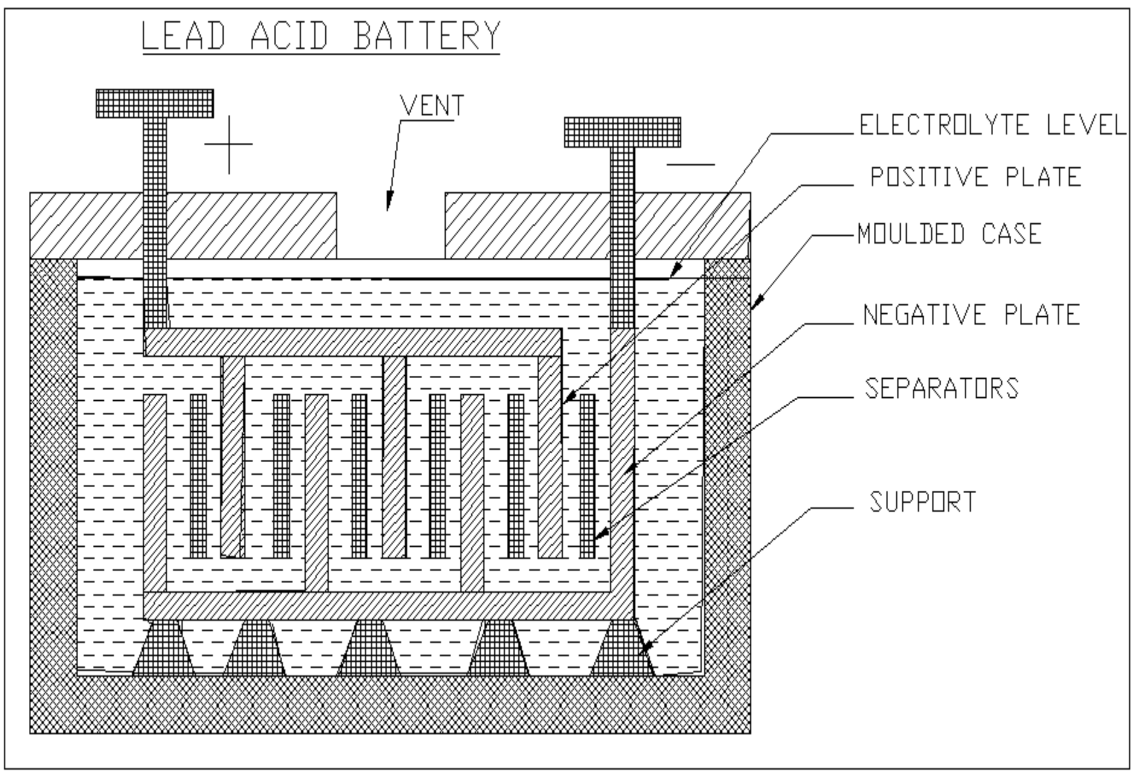


Fig 4.3 Lead Acid Battery

Inside a lead acid battery, the positive and negative electrodes consists of a group of plates welded to a connecting strap. The plates are immersed in the electrolyte, consisting of 8 parts of water to 3 parts of concentrated sulfuric acid. Each plate is a grid or framework, made of a lead-antimony alloy. This construction enables the active material, which is lead oxide, to be pasted into the grid. In manufacture of the cell, a forming charge produces the positive and negative electrodes. In the forming process, the active material in the positive plate is changed to lead peroxide (pbo_2). The negative electrode is spongy lead (Pb).

Automobile batteries are usually shipped dry from the manufacturer. The electrolyte is put in at the time of installation, and then the battery is charged from the plates. With maintenance free batteries, little or no water need to be added in normal service. Some types are sealed, except for a pressure vent, without provision for adding water.

The construction parts of battery are shown in figure.

4.2.3 CHEMICAL ACTION:

Sulfuric acid is a combination of hydrogen and sulfate ions. When the cell discharges, lead peroxide from the positive electrode combines with hydrogen ions to form water and with sulfate ions to form lead sulfate. Combining lead on the negative plate with sulfate ions also produces lead sulfate. Therefore, the net result of discharge is to produce more water, which dilutes the electrolyte, and to form lead sulfate on the plates.

As the discharge continues, the sulfate fills the pores of the grids, retarding the circulation of acid in the active material. Lead sulfate is the powder often seen on the outside terminals of old batteries. When the combination of weak electrolyte and sulfating on the plate lowers the output of the battery, charging is necessary.

On charge, the external D.C. source reverses the current in the battery. The reversed direction of ions flows in the electrolyte resulting a reversal of the chemical reactions. Now, the lead sulfate on the positive plate reacts with the water and sulfate ions to produce lead peroxide and sulfuric acid. This action reforms the positive plates and makes the electrolyte stronger by adding sulfuric acid.

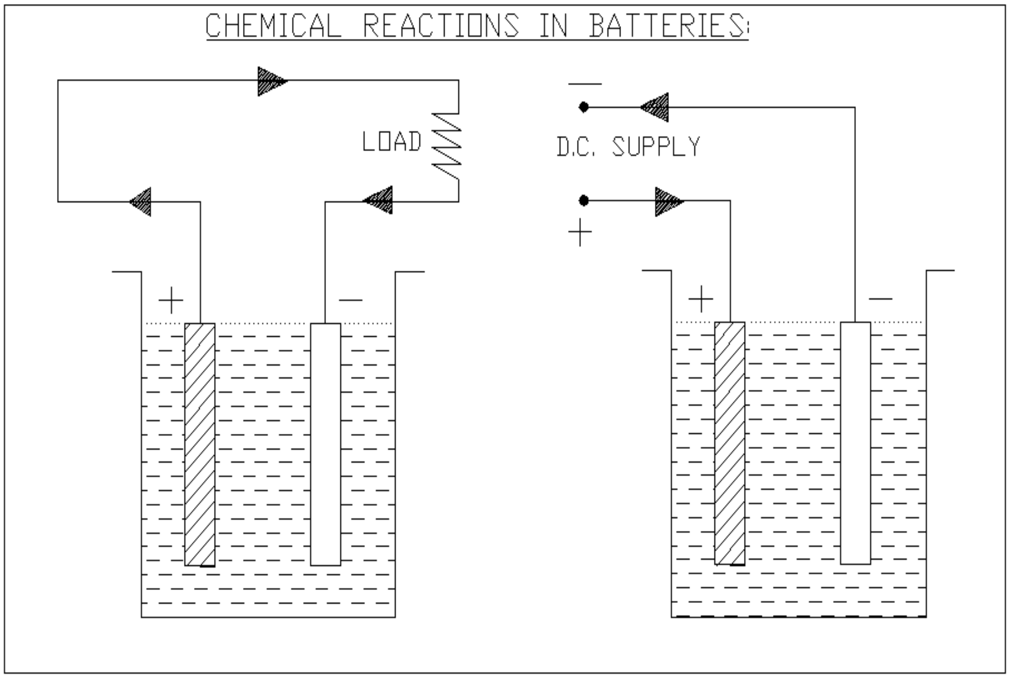


Fig 4.4 Chemical Reactions in Batteries.

At the same time, charging enables the lead sulfate on the negative plate to react with hydrogen ions. This also forms sulfuric acid while reforming lead on the negative plate to react with hydrogen ions. This also forms currents that can restore the cell to full output, with lead peroxide on the positive plates, spongy lead on the negative plate, and the required concentration of sulfuric acid in the electrolyte.

4.2.4 CURRENT RATINGS:

Lead acid batteries are generally rated in terms of how much discharge currents they can supply for a specific period of time. The output voltage must be maintained above the minimum level, which is 1.5V to 1.8V per cell. A common rating is ampere-hours (Ah) based on a specific discharge time, which is often 8hours. Typical values for automobile batteries are 100 to 300 (Ah).

As an example, a 200 (Ah) battery can supply a load current of 200/8 or 25A, used on 8hours discharge. The battery can supply less current for a longer time or more current for a shorter time. Automobile batteries may be rated for “cold cranking power”, which is related to the job of starting the engine. A typical rating is 450A for 30seconds at a temperature of 0 F.

Note that the ampere hour unit specifies coulombs of charge. For instance, 200 Ah corresponds to 200A*3600s (1h=3600s). They equals 720,000 A.S or coloumb's. One ampere second is equal to one coulomb's. Then the charge equals 720,000 or 7.2*10^5ºC. To put this much charge back into the battery, it would require 20 hours with a charging current of 10A.

The ratings for lead acid batteries are given for a temperature range of 77^0F to 80ºF. Higher temperature increases, the chemical reaction, but operation above 110ºF shortens the battery life.

Low temperatures reduce the current capacity and voltage output. The ampere hour capacity is reduced by approximately 0.75% for decrease in each of 1ºF below normal temperature rating. At 0ºF, the available output is only 60 % of the ampere-hour battery rating.

4.3 FAN

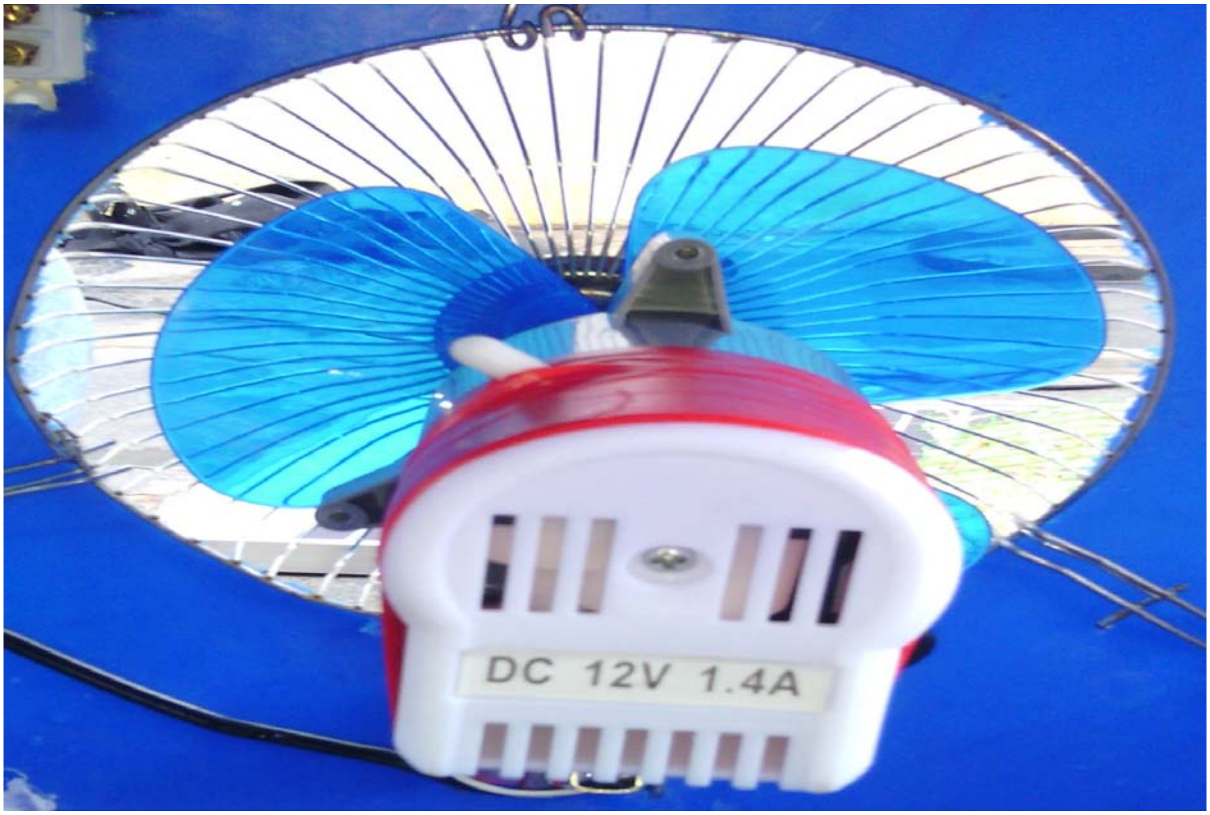


Fig 4.5 Fan

The fan (impeller) rotates inside the shell. The shell is so designed that the air is rushed out forcibly. The blower consists of two main parts. They are

- D.C motor
- Blades(fan)

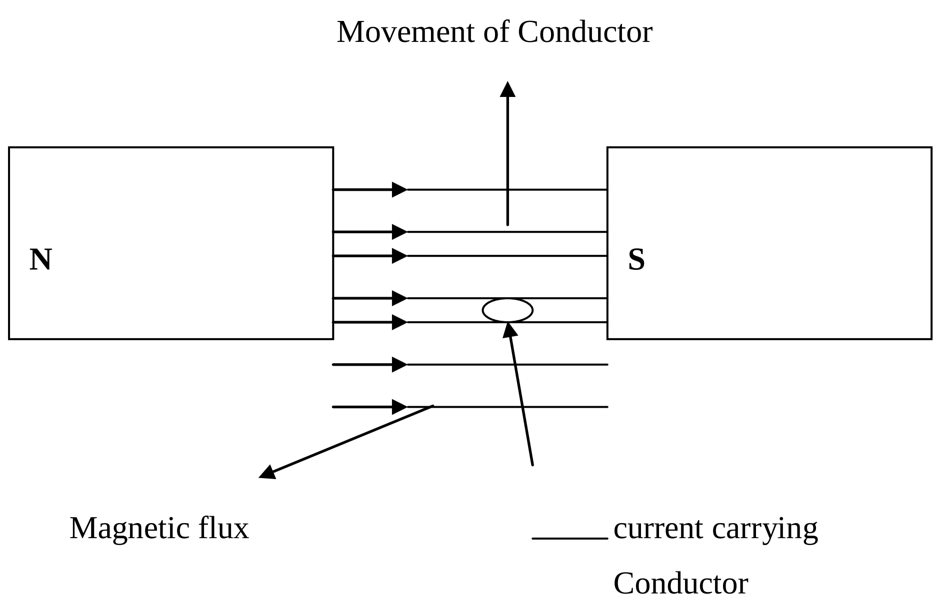
The D.C motor is directly coupled with Impeller blades. The water pump is used to circulate the water to the blower. The cool air is rushed out forcibly. The battery is connected to the D.C motor, so that the D.C motor runs directly. The switch is connected to disconnect the water pumping system when the time of water heater is ON. The water heater has drawn the power from the single phase power supply. The blower runs both the time of operation (i.e., air cooler and heater).

4.4 D.C MOTOR

The D.C motor is used to control the direction of hot air flow. In our project, the hot air is distributed in all directions with the same rate by using D.C motor tilting mechanism.

PRINCIPLE OF OPERATION:

The basic principle of motor action lies in a simple sketch. The working principle explains that, when a current carrying conductor is placed in a magnetic field, a force is produced to move the conductor away from the magnetic field.



The force given by the equation,

$$F = B\ I\ L \text{ Newton's}$$

Where,

B = Flux density in WB/sq.m

I = Current passing through the conductor

L = Length of the conductor

Let us consider a single turn coil. The coil side A will be forced to move downward, whereas the coil side “B” will be forced to move upward. Due to this movement, the coil is made to rotate.

IMPELLER:

Impeller consists of more number of blades. The number of blades increases the amount of cold air rushed out forcibly. The impeller blades are slightly bended.So that the cold air is forcibly transmitted to the outside.

WATER PUMP:

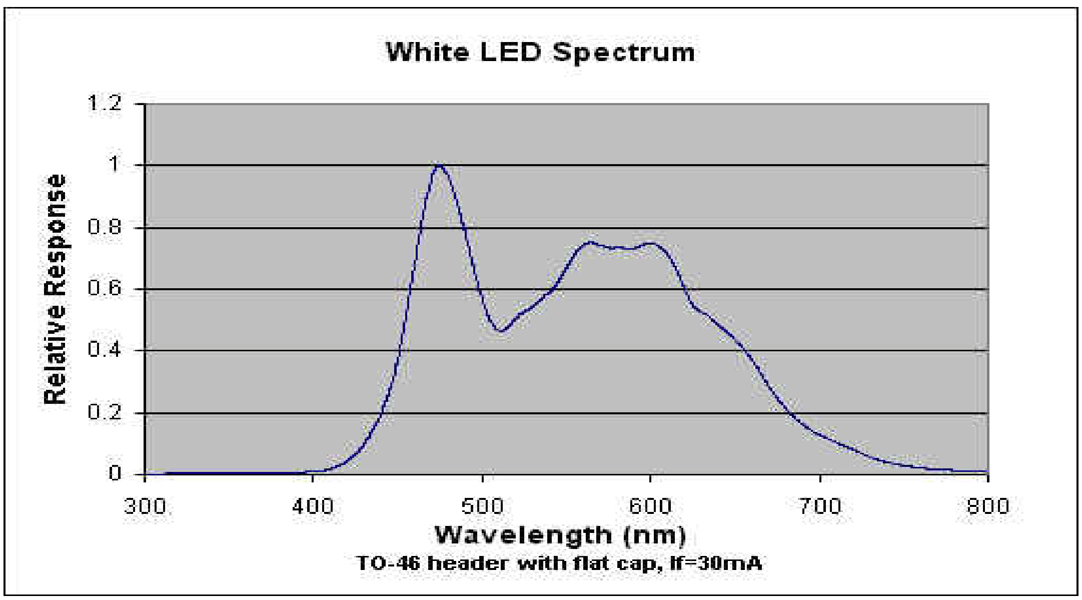
Water pump is used to circulate the water. In our project, the 12 V D.C water pump is used. The battery is connected to the D.C water pump, so that D.C water pump runs directly.

4.5 LED LIGHT

Light Emitting Diodes (LED) have recently become available that are white and bright, so bright that they seriously compete with incandescent lamps in lighting applications. They are still pretty expensive as compared to a GOW lamp but draw much less current and project a fairly well focused beam.

The diode in the photo came with a neat little reflector that tends to sharpen the beam a little but doesn't seem to add much to the overall intensity.

When run within their ratings, they are more reliable than lamps as well. Red LEDSare now being used in automotive and truck tail lights and in red traffic signal lights. You will be able to detect them because they look like an array of point sources and they go on and off instantly as compared to conventional incandescent lamps.



ig 4.6 wavelength of LED.

LED's are monochromatic (one color) devices. The color is determined by the band gap of the semiconductor used to make them. Red, green, yellow and blue LEDs are fairly common. White light contains all colors and cannot be directly created by a single LED. The most common form of "white" LED really isn't white. It is a Gallium Nitride blue LED coated with a phosphor that, when excited by the blue LED light, emits a broad range spectrum that in addition to the blue emission, makes a fairly white light.

There is a claim that these white LED's have a limited life. After 1000 hours or so of operation, they tend to yellow and dim to some extent. Running the LEDs at more than their rated current will certainly accelerate this process.

There are two primary ways of producing high intensity white-light using LED'S. One is to use individual LED'S that emit three primary colors—red, green, and blue—and then mix all the colors to form white light. The other is to use a phosphor material to convert monochromatic light from a blue or UV LED to broad-spectrum white light, much in the same way a fluorescent light bulb works. Due to metamerism, it is possible to have quite different spectra that appear white.

LEDs are semiconductor devices. Like transistors, and other diodes, LEDs are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride.

When current passes through the LED, it emits photons as a byproduct. Normal light bulbs produce light by heating a metal filament until it is white hot. LEDs produce photons directly and not via heat, they are far more efficient than incandescent bulbs.

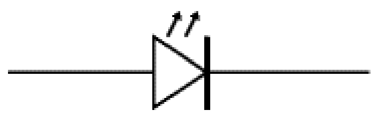


Fig 3.1(a): circuit symbol

Not long ago LEDs were only bright enough to be used as indicators on dashboards or electronic equipment. But recent advances have made LEDs bright enough to rival traditional lighting technologies. Modern LEDs can replace incandescent bulbs in almost any application.

Types of LED'S:

LEDs are produced in an array of shapes and sizes. The 5 mm cylindrical package is the most common, estimated at 80% of world production. The color of the plastic lens is often the same as the actual color of light emitted, but not always. For instance, purple plastic is often used for infrared LEDs, and most blue devices have clear housings. There are also LEDs in extremely tiny packages, such as those found on blinkers and on cell phone keypads. The main types of LEDs are miniature, high power devices and custom designs such as alphanumeric or multi-color.

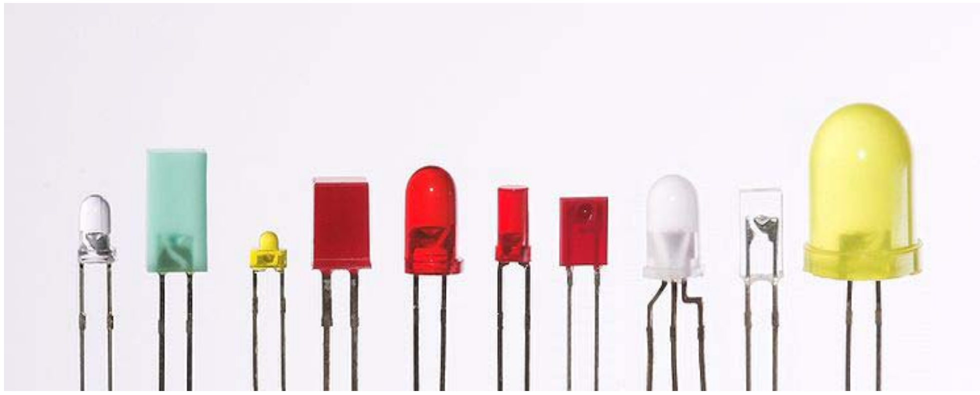


Fig 4.7 Different types of LED'S

CHAPTER-5

5. WORKING PRINCIPLE

The solar panel is converting sun rays to the Electricity by "Photo-Voltaic Effect". This electrical power is stored in a 12 V battery. Battery D.C power is used to run the D.C motor and D.C water pump.

Block diagram, Photo-voltaic Effect and major components of our project are already discussed in the above chapters.

The D.C motor is coupled with impeller blades. The D.C motor runs when the air cooler button is ON, the impeller blades starts rotating. The water pump is used to circulate the water to the blower unit.

The forced air flows through the water which is sprayed by water pump, so that the cold air is produced. The switch control is used to ON/OFF the solar air cooler circuit and the heater circuit.

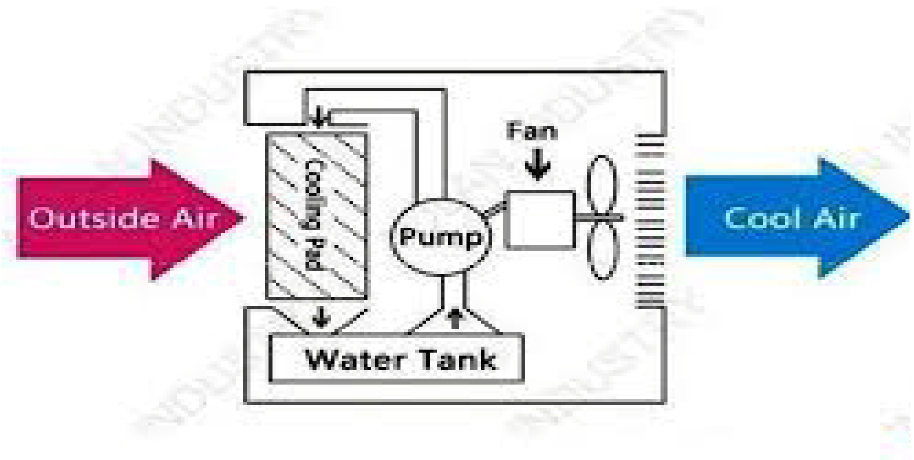
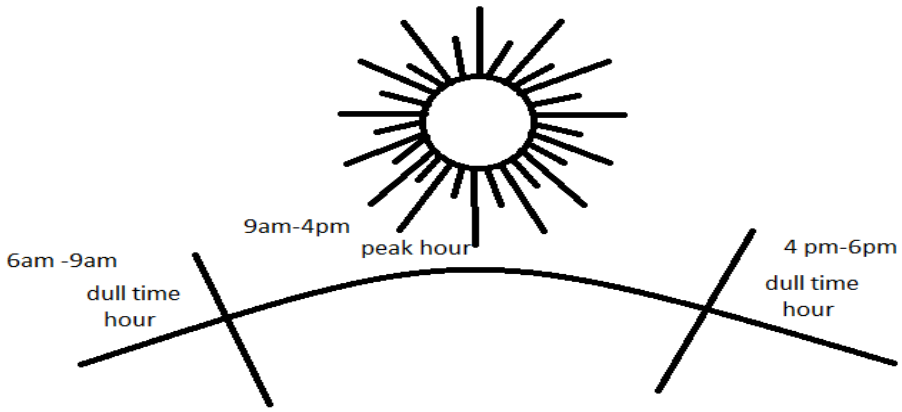


Fig 5.1 Circuit connection of air cooler

5.1 Sun radiation time:



During dull time hours, solar panel can produce 1 amp current.

- **Power produced from solar panel = 20 watts**
- **Battery storing capacity = 7 amps**
- **Motor capacity =1.4 amps**
- **Pump capacity =1.4 amps**
- **Average working time =5 hrs per day**
- **Voltmeter shows 16 volts in stationary condition.=20watts/16volts**

  =1.25amps/hr.

- **Formula :**

  P=V X I

  Where P=power

  V=volts

  I=current

- **P=16volts X1.25amps =20Watts per hour.**

5.2 ADVANTAGES AND DISADVANTAGES

5.2.1 ADVANTAGES

- This system is ecofriendly in operation.
- It is portable, so it can be transferred easily from one place to other place.
- Non conversional source as fuel.
- Maintenance cost is low.
- More amount of energy is capture by auto tracking.

5.2.2 DISADVANTAGES

- It does not purify air.
- Initial cost is high.
- Solar panel saves the energy during day only.

5.3 APPLICATIONS

The solar air cooler is used in

- Home
- Industries
- Meeting halls
- Seminar halls
- By adding control circuit, we can maintain the room temperature at required level.

CHAPTER-6

6. CONCLUSION AND SCOPE FOR FUTURE WORK

CONCLUSION:

By completing this project, we have achieved clear knowledge of comfort cooling system for humans by using non-conventional energy. This project would be fruitful in both domestic and industrial backgrounds.

We also learned about non-conventional energy sources and utilization.

SCOPE OF IMPROVEMENT

This project although fulfilling our requirement has further scope for improvements. Some of the improvements that could be made in this solar air cooler unit are listed.

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