

FABRICATION OF MODERN SOLAR AIR COOLER

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ABSTRACT: Air-conditioning is one of the major consumers of electrical energy in many parts of the world today and already today air-conditioning causes energy shortage in for example China. The demand can be expected to increase because of changing working times, increased comfort expectations and global warming. Air-conditioning systems in use are most often built around a vapor compression system driven by grid-electricity. However, most ways of generating the electricity today, as well as the refrigerants being used in traditional vapor compression systems, have negative impact on the environment

KEYWORDS

1. Solar energy
2. Photovoltaic cells
3. Centrifugal fan
4. Charge controller
5. Storage and conversion

1. INTRODUCTION

Energy is the primary and most universal measure of all kinds of work by human beings and nature. Energy is a crucial input in the process of economic, social and industrial development day by day the energy consumption is increasing very rapidly. The rate of energy consumption is increasing. Supply is depleting resulting in inflation and energy shortage. This is called the energy crisis.

According to law of conservation of energy "energy can neither be created nor be destroyed but can be transformed from one form to another form. Energy can be transported from one place to another place." Alternative or non-conventional or renewable energy resources are very essential to develop for future energy requirements. The energy demand increases day by day because of population increasing industrialization increases and transportation increases etc.

1.2 SOURCES OF ENERGY

There are two main sources of energy. They are conventional and non-conventional sources of energy.

1.3 TYPES OF ENERGY SOURCES

1. Conventional sources of energy.
2. Non-conventional sources of energy.

1.4 CONVENTIONAL SOURCES OF ENERGY

Conventional energy sources are wood, flowing water and fossil fuels (coal, petroleum, natural gas).the conventional sources of energy are generally non-renewable sources of energy, which are being used since a long time.

1.5 NON CONVENTIONAL SOURCES OF ENERGY

Non-conventional energy sources are solar energy, wind energy, biomass energy, ocean energy (tidal energy, wave energy, and ocean thermal energy), geothermal energy, nuclear energy etc.

in future non-conventional energy sources are the best source of energy.

2. LITERATURE REVIEW

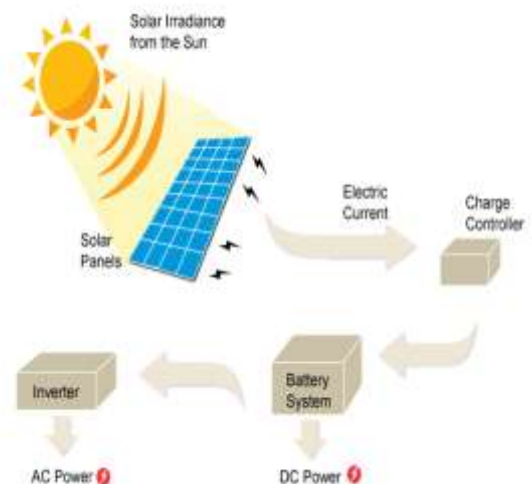
Kotresh.H.M,Kallesh.H.C,2017,solar power is stored in a battery. This power is used to run the air cooler whenever required. Solar energy means all the energy that reaches the earth from the sun. it is based on photo-voltaic or solar modules, which are very reliable and do not require any fuel or servicing.

Prakash.R, 2014, Solar power systems being considered as one of the path towards more sustainable energy systems, considering solar-cooling systems in village would comprise of many attractive features. this technology can efficiently serve large latent loads and greatly improve indoor air quality by allowing more ventilation while tightly controlling humidity.

Mr.Devesh kumar,2016,Solar energy is the world's most rich.Stable and clean source of energy having a large potential.The total energy emitted from the sun is around 5200 times that of the global energy requirement. According to international institute of Refrigeration, air conditioning and refrigeration consumes around 15% of the total worldwide electricity and also contributes to the CO₂, CFCs etc. To overcome the problem of emission and fulfill the mismatch between the demands and supply of energy consumption the interest in utilization of solar based Air conditioning / refrigeration systems has increased gradually.

Ashwani Sharma, air cooler gives the cool and humid air. Humidity of air can be absorbed by cooling coil which is cheap and effective design conceptualization in comfort application.

2.1 SOLAR POWER SUPPLY



2.2 COMPONENTS OF THE MODERN SOLAR AIR COOLER SYSTEMS

The main components that are used in the fabrication of our project is listed in below.

1. Solar panel

2. Storage tank
3. Centrifugal fan
4. Dc motor
5. Battery
6. Inverter.

2.3 PHOTOVOLTAIC CELLS

Photovoltaic simply means they convert sunlight into electricity.

Solar panel works by allowing photons, or particles of light, to knock electrons free from atoms, generating a flow of electricity. Solar panels actually comprise many, smaller units called **photovoltaic cells**.

2.4 SOLAR CELLS

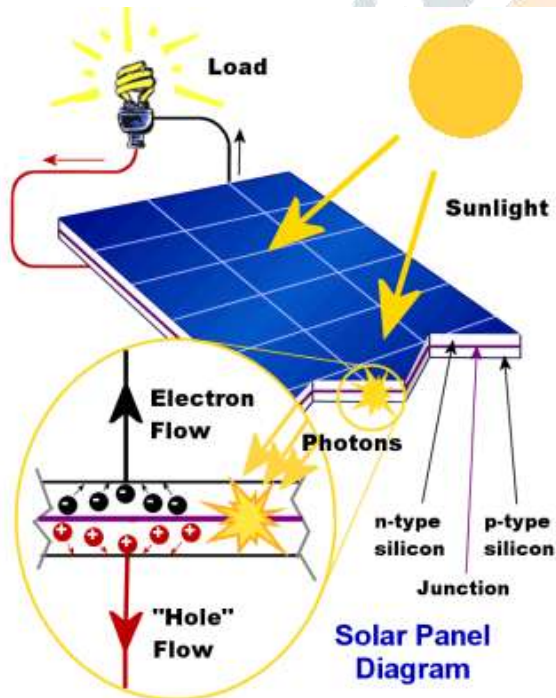
A solar cell, made from a monocrystalline silicon wafer.

The most commonly known solar cell is configured as a large-area p-n junction made from silicon. As a simplification, one can imagine bringing a layer of n-type silicon into direct contact with a layer of p-type silicon. In practice, p-n junctions of silicon solar cells are not made in this way, but rather, by diffusing an n-type doping into one side of a p-type wafer (or vice versa).

2.5 SOLAR PANEL

A solar panel is a collection of solar cells. Lots of small solar cells spread over a large area can work together to provide enough power to be useful. The more light that hits a cell, the more electricity produces.

2.6 DIAGRAM

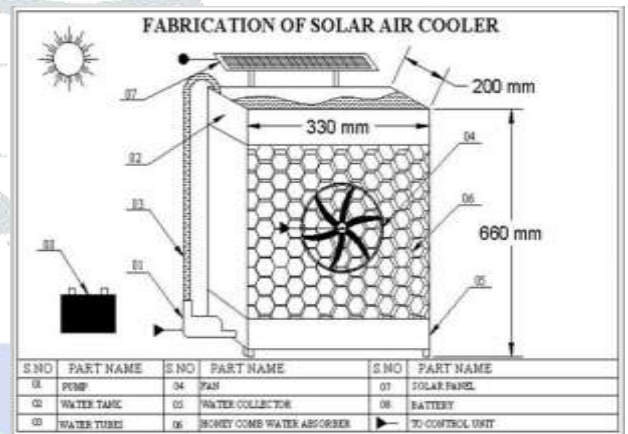


The basic processes behind the photovoltaic effect are:

1. Generation of the charge carriers due to the absorption of photons in the materials that form a junction
 2. Subsequent separation of the photo-generated charge carriers in the junction
 3. Collection of the photo-generated charge carriers at the terminals of the junction
- That Is the process of the photovoltaic effects

2.7 DRAWING AND WORKING

Solar panel consists of number of silicon cells, when sun light falls on this panel it generate the voltage signals then these voltage signals are given to charging circuit. Depending on the panel board size the generated voltage amount is increased. In charging circuit the voltage signal from the board is gathered together and stored in the battery. There are two tanks provided one at the top and another one at the bottom. The water from the top tank is made to pass through the tubes which are fixed between the two tanks. A fan is provided at the centre of the tank in such a way that the supply for the fan is coming from the battery which stores the current from the solar panel. When the water falls from the top tank to the bottom tank due to gravity, the fan is made to run, so that the cool air will be supplied all the way through. At the bottom of the tank, there will be a DC pump which pumps the water again to the top tank. The power for the DC pump is coming from the battery connected to the solar panel. The fan and pump is controlled separately with help of manual operated switch.

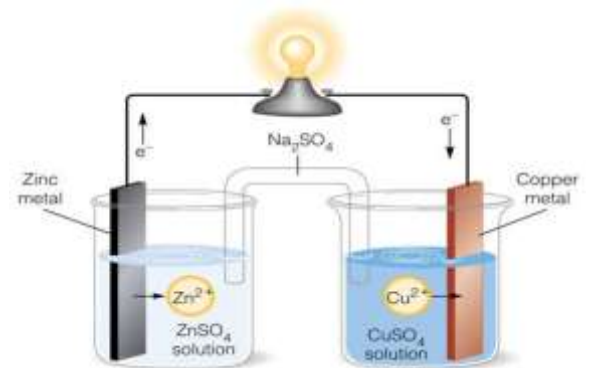


2.8 BATTERY

Despite having a very low energy-to- weight ratio and a low energy to volume ratio, their ability to supply high surge currents means that the cells maintain a relatively large power to weight ratio.

2.9 BATTERY RATING

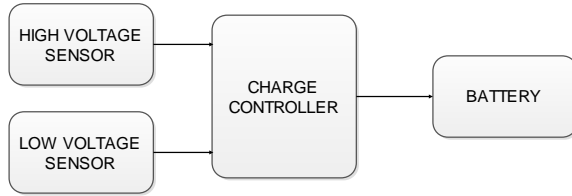
12V Lead acid battery are used which are connected in series. They could deliver 7Amps.(sealed lead acid battery)



2.10 CHARGE CONTROLLER

Most stand-alone solar power systems will need a charge controller. The purpose of this is to ensure that the battery is never overcharged, by diverting power away from it once it is fully charged. Only if a very small solar panel such as a battery saver is

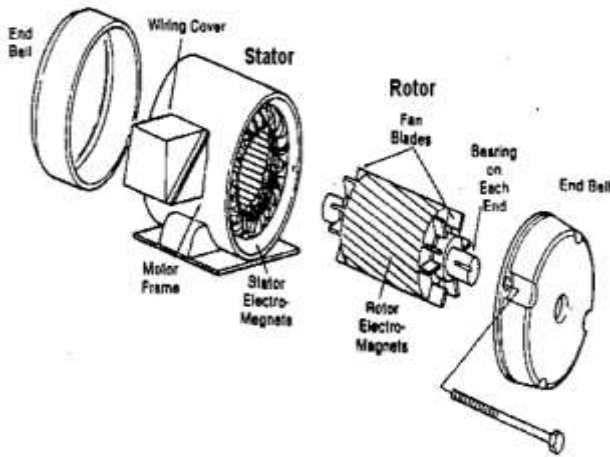
used to charge a large battery is it possible to do without a controller.



2.11 INVERTER

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source. A power inverter can be entirely electronic or may be a combination of mechanical effects (such as a rotary apparatus) and electronic circuitry. Static inverters do not use moving parts in the conversion process.

2.12 DC MOTOR DESIGN



2.13 POWER SUPPLY CHARACTERISTICS

There are various factors that determine the quality of the power supply like the load voltage, load current, voltage regulation, source regulation, output impedance, ripple rejection, and so on. Some of the characteristics are briefly explained below:

2.13.1 Load Regulation

The load regulation or load effect is the change in regulated output voltage when the load current changes from minimum to maximum value.

$$\text{Load regulation} = \frac{V_{\text{no-load}} - V_{\text{full-load}}}{V_{\text{full-load}}}$$

$V_{\text{no-load}}$ – Load Voltage at no load

$V_{\text{full-load}}$ – Load voltage at full load .

From the above equation we can understand that when $V_{\text{no-load}}$ occurs the load resistance is infinite, that is, the out terminals are open circuited. $V_{\text{full-load}}$ occurs when the load resistance is of the minimum value where voltage regulation is lost.

$$\% \text{ Load Regulation} = \left[\frac{V_{\text{no-load}} - V_{\text{full-load}}}{V_{\text{full-load}}} \right] * 100$$

2.13.2 Minimum Load Resistance

The load resistance at which a power supply delivers its full-load rated current at rated voltage is referred to as minimum load resistance.

$$\text{Minimum Load Resistance} = \frac{V_{\text{full-load}}}{I_{\text{full-load}}}$$

The value of $I_{\text{full-load}}$, full load current should never increase than that mentioned in the data sheet of the power supply.

3.CONCLUSION

It reduces the cost of air conditioning compare to normal air conditioner. It is eco-friendly. It is efficient for cooling in small area. Initial cost of its installation is high but on long run it proves eco-friendly. We got lot of knowledge regarding our field which is not available in the book. We learnt how to work in team by dividing the load and work with team spirit.

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