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Energy Saver Solar Room Cooler

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***Abstract*- The paper proposes a solar cooler which is used to cool a specified area without use of main electricity. This cooler works on non conventional source of energy i.e solar energy. This solar cooler can easily work in day time as sufficient energy is stored in the battery connected to the solar plate via charge controller.**

***Keywords*- Solar cooler, cooler, economical cooler, battery operated solar cooler, global warming.**

I. INTRODUCTION

Solar cooler is a very nice and useful concept for today's generation. It is a device which is able to cool a room without using electricity, as the energy source which is used by solar cooler is specified by its name i.e. solar energy. As this energy is never going to an end, and it is costless also so it would come as a boom for technology sector in the future when the electrical grids would fail to provide sufficient amount of electricity in houses. Solar cooler is a based on a simple scientific concept, i.e. solar energy can be converted in to electrical energy by the use of solar panel, which makes the motor ability to move and rotate the fans [1].

Coincidence of solar energy supply and demand in many cases - when it is the hottest and most cooling is demanded; usually the most sun is shining as well. The aims or benefits of solar cooler over conventional cooler are listed as:

- It is applicable to save electricity and thus conventional primary energy sources.
- It is a durable and money saving, as the only cost is installation cost of the whole setup.
- Solar energy does not fabricate the excessively injurious pollutants that are liable for green house effect which is known to lead to global warming.
- Solar power use reduces the quantity of contamination and toxic waste.
- Maintenance is not a major issue but only the general cleaning steps would be followed.

The solar cooler is successful idea at the dry areas not only in the houses but in companies also it is beneficial because goals of zero-energy buildings include sustainable, green building technologies that can significantly reduce, or eliminate, net annual energy bills which can be promoted by the use of solar cooling.

II. LIST OF COMPONENTS

A. 1.10w, 12v polycrystalline solar panel features

1. High cell efficiency with quality silicon materials for long term output stability
2. Strictly quality control ensure the stability and reliability, totally 23 testing procedures to do quality control.
3. High transmittance low iron tempered glass with enhanced stiffness and impact resistance.
4. PET sheet imported from Tokyo Japan with advanced encapsulating material.
5. Excellent performance in harsh weather.
6. Outstanding electrical performance under high temperature and low irradiance.
7. For small home lighting system, for RV, for cabin, for telecom station, for any 12V DC load [2].

Fig.1 Solar Panel

B. Battery

Battery of rating 12V,7.5Ah is used to convert chemical energy directly into electrical energy. Battery is an assembly of two or more galvanic cells capable of such energy conversion, it is commonly applied to a single cell of this kind.

Fig.2 DC Battery

Every battery or cell has a cathode, or positive plate, and an anode, or negative plate. These electrodes must be separated by and are often immersed in an electrolyte that permits the passage of ions between the electrodes. The electrode materials and the electrolyte are chosen and arranged so that sufficient electromotive force (measured in volts) and electric current (measured in amperes) can be developed between the terminals of a battery to operate lights, machines, or other devices. Since an electrode contains only a limited number of units of chemical energy convertible to electrical energy, it follows that a battery of a given size has only a certain capacity to operate devices and will eventually become exhausted. The active parts of a battery are usually encased in a box with a cover system (or jacket) that keeps air outside and the electrolyte solvent inside and that provides a structure for the assembly [3].

Commercially available batteries are designed and built with market factors in mind. The quality of materials and the complexity of electrode and container design are reflected in the market price sought for any specific product. As new materials are discovered or the properties of traditional ones improved, however, the typical performance of even older battery systems sometimes increases by large percentages.

Types of battery

1. Primary battery: Primary batteries are designed to be used until the voltage is too low to operate a given device and are then discarded.
2. Secondary or storage battery: Secondary batteries have many special design features, as well as particular materials for the electrodes, that permit them to be reconstituted (recharged). After partial or complete discharge, they can be recharged by the application of direct current (DC) voltage. While the original state is usually not restored completely, the loss per recharging cycle in commercial batteries is only a small fraction of 1 percent even under varied conditions.

C. Dc motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

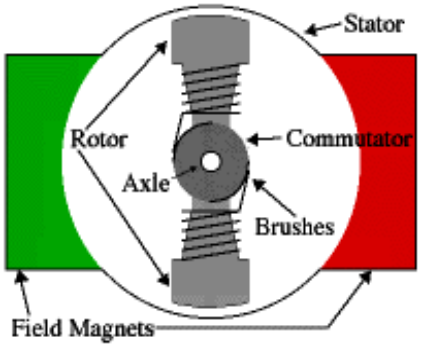


Fig.3 DC Motor

Every DC motor has six basic parts -- axle, rotor, stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets [4].

The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

Armature conductors under N pole are assumed to carry current downwards and those under S pole to carry current upwards. By applying Fleming left hand rules the direction of the force on each conductor can be found. Each conductor experiences a force F which tends to rotate the armature in anticlockwise direction. These forces produce a driving torque which sets the armature rotating [5].

D. Charge controller

A solar charge controller or regulator is a small box consisting of solid state circuit which is placed between a solar panel and a battery. Its function is to regulate the amount of charge coming from the panel that flows into the battery bank in order to avoid the batteries being overcharged.

Solar charge controller has mainly three basic functions:

1) To limit the voltage from the solar panel and regulate the same so as not to overcharge the battery.

2) Not to allow the battery to get into deep discharge mode while dc loads are used

3) To allow different dc loads to be used and supply appropriate voltage.

Simple controllers contain a transistor that shunt the PV charging circuit, terminating the charge at a pre-set high voltage and, once a pre-set reconnect is reached, opens the shunt, allowing charging to resume.

A charge controller limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may prevent against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. It may also prevent completely draining ("deep discharging") a battery, or perform controlled discharges, depending on the battery technology, to protect battery life.[6]

A solar charge controller is needed in virtually all solar power systems that utilise batteries. The job of the solar charge controller is to regulate the power going from the solar panels to the batteries. Overcharging batteries will at the least significantly reduce battery life and at worst damage the batteries to the point that they are unusable.

Solar charge controller specifications

a. Solar panel rating: 10W (4A, 12V nominal) (open circuit voltage:15V)
b. Output voltage range: 7 to 14V (adjustable) (not recommended for 6V applications)
c. Max power dissipation: 16W (includes power dissipation of D3)
d. Typical dropout voltage: 1.25V @ 4A
e. Maximum current: 4A (current limiting provided by solar panel characteristics)
f. Voltage regulation: 10mV (no load to full load)
g. Battery discharge: 1mA (Chinese controls discharge at typically 5mA)

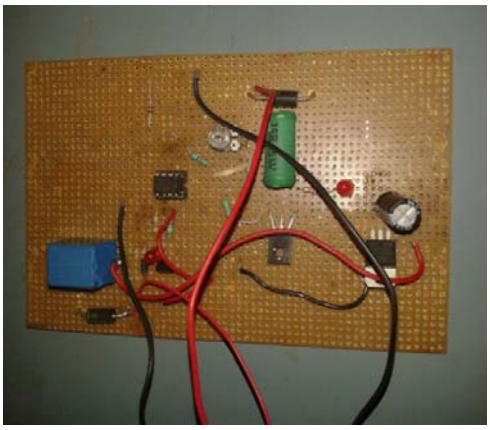


Fig.4 Charge Controller

- LED indicators:
  - RED1: Solar panel active
  - RED2: Series regulator limiting current (fully charged or topping off)

h. Reverse battery protection: Control shuts down if battery is inadvertently connected reverse [6].

E. D.C pump:

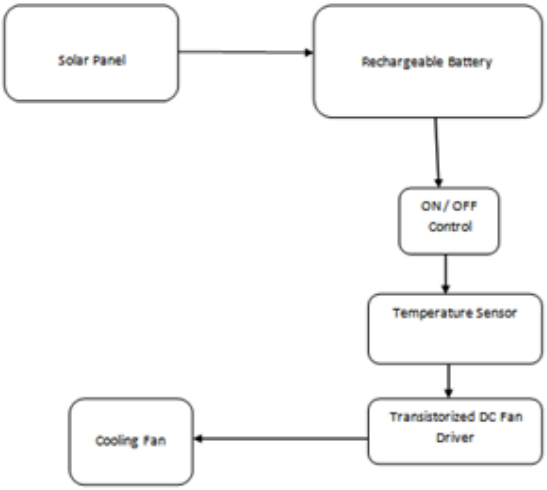
12volt 300mA dc portable pump has been used to pump the water to the cooler pads to make the pad wet.

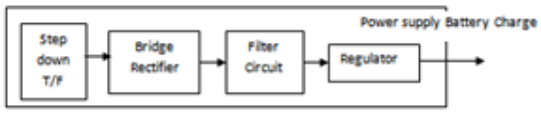
Fig.5 DC Pump

Fig.6 Solar Cooler

III. WORKING OF SOLAR COOLER

Actually the thing is, when sun light falls on the solar panels then the solar panels using their control system converts that energy in to electrical energy, this electrical energy is absolutely free. Now, this electrical energy is passed to the Lead-acid battery for storage. Thereafter this DC is passed to a DC motor to which a fan is connected for rotation and also to the pump. Finally, when this electrical energy is in sufficient amount then the fan rotates and the pump runs and wet the cooler pad. The storage capacity makes the cooler to work in night also and when the sunlight is not present.





IV. CONCLUSION

In this proposed work, a solar based cooler has been developed which can work in day as well as night time. A battery is attached with the solar plate and to avoid any overcharging charge controller is also placed in the project. This solar cooler will provide support to electrical grid as solar energy is present in abundance. It will also help to improve the problem of global warming.

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