Air Cooler Operate with the help of Solar Cell Panels

Abhishek Yadav[1], Ankit Malviya[2], Deepak Kumar Sahu[3], Dheeraj Kumar Raja[4], Jai Singh Yadav[5], Krishna Sharma[6],Aseem Aryan[7],Chandan Kumar[8],Gulsan Kumar[9]

[1,2,3,4,5,6,7,8,9]*Mechanical Engineering Student in Mechanical Engg. Department, Oriental Group of Institute, Bhopal*

Abstract-Our basic motive is to regulate the operating power in solar cooler. This project presents the results of an experimental investigation carried out to minimize the power consumption of a solar cooler running at various speeds. The experiments have been carried out for a total of three speeds that is low, medium and high. We carried out speed control by minimizing the input current at multiple speeds with the help of resistors. For high speed, we have connected a couple of resistors in series whereas for medium speed a couple of resistors were connected in parallel and for low speed a single resistor was used. We have replaced DC motor which is traditional coolers with Permanent Magnet DC motor. PM DC motor is highly efficient since no electrical energy is used or losses incurred for developing or maintaining motor's magnetic field. Its size is more compact and a better dynamic performance can be expected due to higher magnetic flux density in air gap.PM DC motor has an essentially simplified construction and it is maintenance free. We even tried to replace the concept of pump by including cotton to the cooler setup. Water is made to flow from a higher potential to lower potential making the grass and cotton wet. Even if the potential of water becomes lower, it does not create any hindrance to the function of cooler. Elimination of pump reduces the expenses in addition to lowering the overheads caused while lifting the water.

Keywords - Erogonimics,Workshop.

I. INTRODUCTION

Our project "Air cooler operate with the help of solar cell panels" is based on the concept of harvesting solar energy. It is easily interpretable from the name of the project that it is based on the solar energy for satisfying its need of power source. The functionality of Solar Cooler is dissimilar as that of the traditional coolers. The solar energy is harvested and stored in a battery. This battery is in turn connected to the solar cooler for the power source. The concept of solar cooler sounds good and economical hence almost every class of our society can bear its expenses. The best part is that, it can be used even in rural areas where there will be no supply of electricity.

Some following Points are:

- Saving power and electricity
- Minimizing season wise servicing
- Varying power consumption at various speeds
- To enable people of those rural areas which do not have electricity supply to have cool air during summer.
- Reduce the maintenance cost by replacing the concept of pump.

II. SYSTEM MODEL

1. Solar panel
2. Battery
3. Charge controller
4. PPM DC motor
5. Centrifugal DC pump
6. Cooler body.

2.1 Solar Panel

2.1.1 Introduction

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and

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

2.1.2 Electrical Characteristics

Electrical characteristics include nominal power (PMAX, measured in W), open circuit voltage (VOC), short circuit current (ISC, measured in amperes), maximum power voltage (VMPP), maximum power current (IMPP), peak power, Wp, and module efficiency (%).

PMAX = 75W

VOC = 21V

VMP = 17.4/16.2 V

ISC = 4.3 AMPS

IMP = 3.8 AMPS

Module efficiency = 2%.

2.2 BATTERY (12 V 7.2 AH)

2.2.1 Introduction

The common battery (dry cell) is a device that changes chemical energy to electrical energy. Dry cells are widely used in toys, flashlights, portable radios, cameras, hearing aids, and other devices in common use. A battery consists of an outer case made of zinc (the negative electrode), a carbon rod in the center of the cell (the positive electrode), and the space between them is filled with an electrolyte paste. In operation the electrolyte, consisting of ground carbon, Manganese dioxide, Sal ammoniac, and zinc chloride, causes the electrons to flow and produce electricity.

2.2.2 Working

Electricity is the flow of electrons through a circuit or conductive path like a wire .Batteries have three parts, an anode (-), a cathode (+), and the electrolyte. The cathode and anode (the positive and negative sides at either end of a smaller battery) are hooked up to an electrical circuit.

2.3 Charge Controller

2.3.1 Introduction

A charge controller, charge regulator or battery regulator limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may protect 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. The terms "charge controller" or "charge regulator" may refer to either a stand-alone device, or to control circuitry integrated within a battery pack, battery-powered device, or battery recharger.

2.4 PMDC MOTOR (35W-> 30 W for fan + 5 W for pump)

2.4.1 Introduction

Permanent magnet (PM) DC motors were introduced in the 19th century but did not earn widespread acceptance due to the poor quality of magnetic materials (e.g., steel and tungsten steel) that were then available. So, early motor designers turned to electromagnetic field excitation, which became the standard until recently. Advances in magnetic technology, such as rare earth magnets, demonstrated improvements in a PM motor's steady state performance and power density. As a result, the permanent magnet DC motor has seen broad adoption in today's global marketplace. PM motors are used by vendors of computer peripherals, office equipment, medical instruments etc.

2.4.2 Advantages over Dc Motor

The benefits 4 of PM field-excited motors over electromagnetically-excited motors include:

Higher efficiency since no electrical energy is used or losses incurred for developing or maintaining the motor's magnetic field.

- Higher torque and power density.
- Linear torque speed charcteristics.
- 5 that are more predictable.
- Better dynamic performance due to higher magnetic flux

density in air gap.

- Simplified construction and essentially maintenance-free.

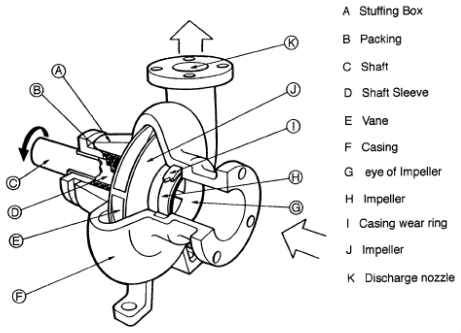
More compact size

2.5 Centrifugal Dc Pump

2.5.1 Introduction

Centrifugal pumps are a sub-class of dynamic axisymmetric work-absorbing turbomachinery. Centrifugal pumps are used to transport fluids by the conversion of rotational kinetic energy to the hydrodynamic energy of the fluid flow. The rotational energy typically comes from an engine or electric motor. The fluid enters the pump impeller along or near to the rotating axis and is accelerated by the impeller, flowing radially outward into a diffuser or volute chamber (casing), from where it exits.

Common uses include water, sewage, petroleum and petrochemical pumping. The reverse function of the centrifugal pump is a water turbine converting potential energy of water pressure into mechanical rotational energy.



2.5.2 History

According to Reti, the first machine that could be characterized as a centrifugal pump was a mud lifting machine which appeared as early as 1475 in a treatise by the Italian Renaissance engineer Francesco di Giorgio Martini. True centrifugal pumps were not developed until the late 17th century, when Denis Papin built one using straight vanes. The curved vane was introduced by British inventor John Appold in 1851.

2.5.3 Working

Like most pumps, a centrifugal pump converts mechanical energy from a motor to energy of a moving fluid. A portion of the energy goes into kinetic energy of the fluid motion, and some into potential energy, represented by fluid pressure (hydraulic head) or by lifting the fluid, against gravity, to a higher altitude. The transfer of energy from the mechanical rotation of the impeller to the motion and pressure of the fluid is usually described in terms of centrifugal force, especially in older sources written before the modern concept of centrifugal force as a fictitious force in a rotating reference frame was well articulated. The concept of centrifugal force is not actually required to describe the action of the centrifugal pump.

Problems of Using A Pump

- Cavitation
- Wear of the impeller
- Corrosion inside the pump □
- Overheating due to low flow
- Leakage along rotating shaft
- Surge.

Theory of Operation of Resistor

Ohm's law

The behavior of an ideal resistor is dictated by the relationship specified by Ohm's law

V=I \cdot R.

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I),

where the constant of proportionality is the resistance (R).

Equivalently, Ohm's law can be stated:

I = \frac{V}{R}.

This formulation states that the current (I) is proportional to the voltage (V) and

inversely proportional to the resistance (R). This is directly used in practical

computations. For example, if a 300 ohm resistor is attached across the terminals of a

12 volt battery, then a current of 12 / 300 = 0.04 amperes (or 40 milliamperes) flows

through that resistor.

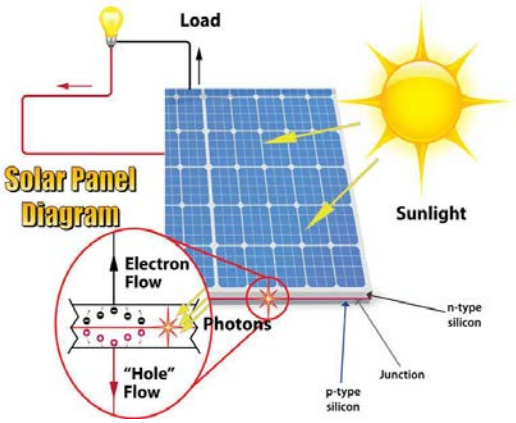
Advantages of Using Resistors for Speed Control

- Circuits are less complicated
- Cost is less
- The values obtained are precise.
- Significant decrease in power consumption is observed with decrease in speed.

2.6 cooler body

- Cooler body is made up of plastic
- Plastic avoids corrosion and is durable
- Cooler body includes fan,water storage tank & aspen pads
- Aspen pads are soaked in the water making the air cooler.

III. PREVIOUS WORK



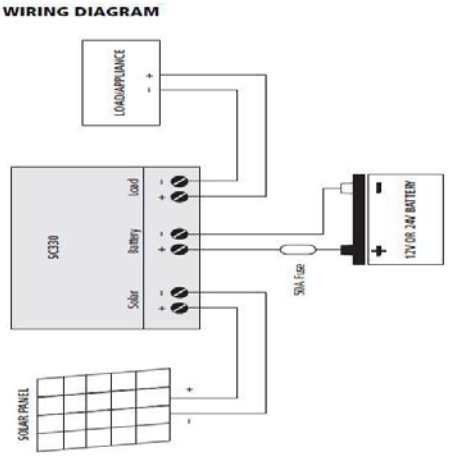
- Payback is defined as the amount of time in which our product becomes free
- We have replaced the input power source with a solar panel
- The solar panel that we used is of capacity 75 Pw
- Cost per watt =Rs 65. So, the total cost of solar panel is Rs 4850
- 1000 watts= 1unit of power
- The amount charged for 1 unit of power is Rs 6
- For a panel of 75w capacity, 1 unit is charged for an usage of 13.3 hours (since 1000/75=13.3)
- After using the cooler for 1075 days at an average usage of 10 hours per day,

we can expect a return of investment.

- So, the payback period is approximately 2 years 343 days.

IV. PROPOSED METHODOLOGY

- Saving power and electricity
- Minimizing season wise servicing
- Varying power consumption at various speeds
- To enable people of those rural areas which do not have electricity supply to have cool air during summer.
- Reduce the maintenance cost by replacing the concept of pump.



V. SIMULATION/EXPERIMENTAL RESULTS

VI. CONCLUSION

In traditional coolers a chopper is used for reduction of speed whereas in our cooler we have used resistors which

reduce the power consumed along with the variation in speed.

VII. FUTURE SCOPES

- The DC motor has been replaced with the highly efficient PMDC motor, which is maintenance free and simplified in construction.

- Though our intent to replace the concept of pump was unsuccessful, it leaves a lot of scope for future batches to find out a way for eliminating the defects of pump's usage by using an alternative that works in a better way than the cotton.

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AUTHOR'S PROFILE

- Abhishek Yadav is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.
- Ankit Malviya is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.
- Deepak kumar Sahu is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.
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- Krishna Sharma is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.
- Aseem Aryan is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.
- Chandan Kumar is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.
- Gulsan Kumar is done his Bachelor of Engineering degree in Mechanical Engineering from Oriental College of Technology, Bhopal in the year 2014-2018.