FABRICATION SOLAR REFRIGERATION SYSTEM BY PELTIER EFFECT

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ABSTRACT

In The Recent Years We Have Seen Many Environmental Degradation Due to Increasing of CO_2 and Ozone Layer Depletion Has Become Major Problems in Both Developed and Developing Countries. It Can Reduces the Chloro Floro Carbon (CFC). This project does not need any kind of refrigerant and mechanical device like compressor, prime movers, etc. the main purpose of this project is to provide refrigeration system to the remote areas where power supply is not possible and also to study the cooling effect on DC as well as AC supply and compare the results coming out and determining the coefficient of performance of the system.

Keywords: *Peltier, Chloro Floro Carbon, Refrigeration system*

1.INTRODUCTION

Due to the increasing demand for refrigeration in various fields led to production of more electricity and consequently more release of harmful gas like CO2 all over the world which is a contributing factor of global warming on climate change. This is mainly due to the reason: as the population is increasing we are in search of other dependent and long lasting energy resource. the idea to implement photovoltaic driven refrigeration system powered from solar panel with a battery backup. due to the pressure of the ever increasing world population puts on our natural energy resources. From these two facts comes the realization that the natural energy resources available will not last indefinitely.

2. LITERATURE REVIEW

Review of a number of patented thermoelectric refrigerator designs, a photovoltaic-direct/indirect thermoelectric cooling system, and research studies from the literature are described in the following section. A simple design was proposed by Beitner in 1978 consisting of thermoelectric modules directly powered by an external DC source and an external thermal sink to dissipate heat to ambient by using natural convection cooling. Reed and Hatcher in 1982 proposed an effective way to increase the heat dissipating capability at the hot end of thermoelectric modules by using the cooling fan. Park et al. in 1996 introduced the new design of thermoelectric refrigerator by combining the benefits of super insulation materials with thermoelectric system and phase change materials to provide an environmentally benign system that was energy efficient and could maintain relatively uniform temperature for the extended periods of time with relatively low electrical power requirements. Gallery and Tex in 1999 proposed the design of a thermoelectric refrigerator by employing evaporating/condensing heat exchanger to improve heat dissipation at hot end of thermoelectric modules.

3.OBJECTIVES

1. To make use of environmentally friendly refrigeration system.
2. To investigate the cost and effectiveness of the design or TE module.
3. To identify the improvements on the experiment.
4. To study the results coming out from this project.
5. To compare results with theoretical result.
6. To look at commercially available 12V DC cooler boxes.

7.To construct a test on the behavior and specifications of a TEC heat exchanger operating in a cooler box environment.

4.PELTIER EFFECT

- Thermoelectric cooling is worked on the principle of peltier effect.
- The peltier effect is a temperature difference created by applying a voltage between electrodes connected to a sample of semiconductor material.
- This phenomenon can be useful when it is necessary to transfer heat from one medium to another.

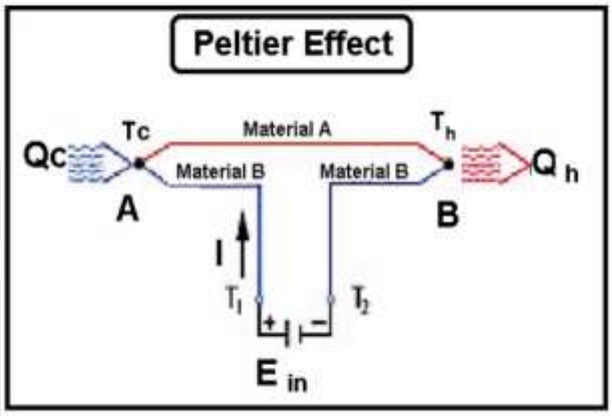

Fig. 4.1 peltier effect

5.CONSTRUCTION

1. Cooling chamber
2. Solar cell
3. Battery
4. Frame

5.1. Cooling Chamber

The chamber is used at conventional refrigeration. The chamber can be of any volume, shape and size. For experimental purpose of the volume chamber kept is low. Insulation provide to the chamber is done by polystyrene and aluminium casing is done in the inner side of the insulation to provide better cooling.

1.Size of the cooling chamber,

Width -28.7cm.

Height -33.7cm,

Length -31.8cm.

2. The power capacity is 60w.

3. The capacity of cooling chamber is 7.8L.

4. The voltage is 240 to 220v AC and 12v DC.

5.2. Solar Cell

The direct conversion of solar energy is carried out into electrical energy for conversion of light or other electromagnetic radiation into electricity.

1. The dimensions of the panel are,

   Length-48.5cm,

   Width -35cm,

2. The number of sub cells used in 72.

3. Dimension of the sub cell is,

   Length-4.8cm,

   Width -4cm.

4. Maximum power is 20W.

5. Voltage is17V.

6. Current is 1.16A.

5.3. Battery

The battery is a electrochemical converting chemical energy into electrical energy. this main purpose of battery is providing a supply of current for operating the cranking motor and other electrical units.

1.voltage-12v

2.current-7.2Ah

5.4. Frame

Fig.5.4.1 frame setup

6.WORKING

The thermoelectric module consist of pairs P-type and N –type semiconductor thermo element forming thermocouple which are connected electrically in series and thermally in parallel. The module is considered to be highly reliable component due to their solid state, for most application they will provide long, trouble free service, in cooling application, an electric current is supplied to the module and the result is that one side of the module becomes cold and other side hot.

Working principle of thermoelectric module,

1.Cold side Temperature (Tc)

2.Hot side Temperature (Th)

3.Temperature difference (ΔT).

COLD SIDE TEMPERATURE: -

If the object to be cooled is in direct contact with cold surface of the TEC's, the required temperature can be considered the temperature of the cold side of TEC. In this project the object is air, which has to be cooled when passing through aluminium heat sink, the aim is be cooled the air flowing through the heat sink, when this type of system is employed the cold side temperature of the TEC is needed to several time cooler than ultimate desire of temp of the air.

HOT SIDE TEMPERATURE: -

The hot side temperature (Th) is mainly based on the two factor. first parameter is the temperature of the ambient air in environment to which the heat is been rejected and second factor is the efficiency of heat sink this is between hot side of TEC on ambient.

TEMPERATURE DIFFERENCE: -

The two temperature TC and Th and difference between them are ΔT is very important factor; the following equation shows actual ΔT.

7.PELTIER MODULE

Peltier is semiconductor module, the module material chosen is bismuth telluride. The peltier is module which is cooling and heating system work at a time. It is work as dc supply, when dc current flows through the system then got the two sides, one is cooling side and other is heating side. Cooling side is used for refrigeration system and other side is removed from the system by the used for heat sink. The cold side also made of Aluminum is in contact with the cold side of a thermoelectric module, when the positive and negative module leads are connected to the respective positive and negative terminals of a D.C. power source, it will be absorb by the module's cold side.

8.WORKING DESIGN

This project's aim is to investigate the feasibility and produce prototype of a rapid-cooling device using Peltier technology. As project is based on peltier effect our first main step is selection of right peltier module. For selection of module following factors should be consider,

1. Its operating temperature must be within required limits.

2. Heat rejected by hot side of module should be less than its total power capacity. 3. For desired cooling proper heat sink should be provided on hotter side.

4. Peltier module should be selected according to the volume which has to be cooled.

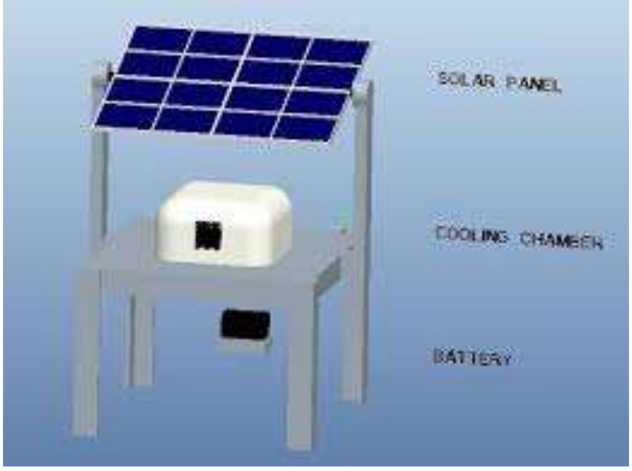

Fig.8.1. Model of the project

9. ADVANTAGES

1. Light weight and compact for very small heat loads.

2. No moving parts, eliminating vibration, noise, and problems of wear.

3. Reversing the direction of current transforms the cooling unit into a heater.

4. Operates in any orientation. Not affected by gravity or vibration

5. Very low cost device for cooling in small appliances.

6. Precision temperature control capability

10.DISADVANTAGES

1. Limited to very small refrigeration volume.

2. Compared to conventional refrigerators cooling achieved is less.

3. Heat sinks required to conduct heat to and from the thermoelectric modules become very heavy and bulky as the refrigeration capacity increases.

11. APPLICATIONS

1. Medical field- Pharmaceutical industry, medicine and medical equipment storage, etc.

2. Military- storing of consumable goods in war affected zones, rural area, etc.

3. Dairy (milk) industry.

4. Mechanical industry.

5. Scientific and Laboratory Equipment— cooling chambers; freezers; cooling incubators; temperature stabilized chambers; cold laboratory plates and tables; thermo-calibrators; stage coolers; thermostats; coolers and temperature stabilizers for multipurpose sensors

6. Restaurant and hotel.

7. Vegetable, fish, fruit, beverage, etc. storage.

8. Electronic miniature cooling units for incoming stages of highly sensitive receivers and amplifiers; coolers for high power generators, laser emitters and systems, CCD cameras, parametric - amplifiers, vaccum and solid-state photo detectors and CPU coolers.

12. CONCLUSION

The TE devices can act as coolers, heat pumps, power generators, or thermal energy sensors and are used in almost all the fields such as military, aerospace, instrument, biology, medicine, industrial or commercial products. The major challenge faced in TE cooling is lower COP especially in large capacity systems. However, as the energy costs are elevating and environmental regulations regarding the manufacture and release of CFCs have become more firm with time, the scope of TE effect has revived, especially in the developing countries or the third world where the energy is not surplus. TE chilling of beverage can be done at the farm level to inhibit any enzymatic or microbial change in quality of the beverage. Research in `the field of thermoelectricity and experimentation with different materials is required to improve the COP of the TE cooler. In the coming years thermoelectricity has a lot of potential to create energy saving and effective solutions for the industry and commercially as well. The minimum temperature achieved was found to be 15◦c for cooling and the maximum temperature was 65◦c for heating in this experiment.

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