

COMPRESSORLESS SOLAR REFRIGERATOR USING PELTIER PLATE

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Abstract:

In the past few years environmental degradation due to increase in emission of harmful gases and ozone layer depletion has become a point of concern. Solar refrigeration using Peltier module is going to be one of the most cost effective, clean and environment friendly system. Cooling can be done in a single system which is possible due to the thermoelectric effect. The main purpose by this method is to provide refrigeration system to the remote areas where power supply is not possible

Key words : Peltier device , solar refrigeration , thermoelectric effect , ozone layer .

I. INTRODUCTION

Refrigeration has been one of the most important factors of our day to day life. The current tendency of the world is now to look at renewable energy resources as a source of energy. This is done for the following two reasons; firstly, the lower quality of life due to air pollution; and, secondly, 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.

The basic idea is implementation of photovoltaic driven refrigerating system powered from direct current source or solar panel (when needed) with a battery bank.

II. LITERATURE SURVEY

SOLAR-POWERED REFRIGERATION

PATENT NO. US 6,253,563 B1

A Solar powered vapor compression refrigeration System is made practicable with thermal Storage and novel control techniques. In one embodiment, the refrigeration System includes a photovoltaic panel, a variable speed compressor, an insulated enclosure, and a thermal reservoir.

PELTIER COOLER INTEGRATED WITH ELECTRONIC DEVICE :

PATENT NO. US20040155251A1

A Peltier effect cooling device is formed in combination with an electronic device to form a unique thermal and electrical relationship.

PHOTOVOLTAIC MODULE COOLING DEVICE APPLIED TO SOLAR ENERGY CONVERSION:

PATENT NO. WO2014003334A1

The present invention relates to a photovoltaic module cooling device applied to a solar energy conversion apparatus.

LIST OF JOURNALS :

1. JIRST –International Journal for Innovative Research in Science & Technology| Volume 1 | Issue 9 | February 2015
2. HYBRID-SOLAR PANAL PELTIER MODUE SYSTEM
3. Solar Refrigerator For Vaccines In Rural Areas (Vol 4)(ISSUE 3)

CONCEPT:

Refrigeration is the branch of science that deals with temperature below ambient temperature and above 123K. The Peltier device works on the principle of Seebeck effect .The Seebeck coefficient is the ratio between the electric field and the temperature gradient or the ratio between the voltage difference and temperature difference between the ends of the sample .The Peltier coefficient of the junction is a property depending on both materials and is the ratio of the power evolved at the junction to the current flowing through it.

III. CONSTRUCTION

The construction setup of the refrigerator is as follows,

- a) Thermo-electric module
- b) Refrigeration chamber
- c) Battery
- d) Solar cell
- e) Charge controller

A. Thermo-electric module (Model no. – TEC1-12706)

A thermo-electric module (TEM) is a solid state current device, which, if power is applied, move heat from the cold side to the hot side, acting as a heat exchanger. This direction of heat travel will be reversed if the current is reversed. Combination of many pairs of p and n semiconductors allows creating cooling units - Peltier modules of relatively high power [5]. As shown in the model no. there are 127 number of p-n coupling Specification,

- 1) Material used- Silicon - Bismuth 2) $A = 0.04 * 0.04 = 0.0016 \text{ m}^2$



Fig 1. Peltier module

B. Refrigeration chamber

The chamber used is same as that of the chambers used in conventional refrigeration. The chamber can be of any

volume, shape and size. We have used 5L capacity cooler box. For experimentation purposes the volume of the chambers is kept low. Insulation provided to the chamber is done by thermocol.

C. Battery

The battery is an electrochemical converting chemical energy into electrical energy. The main purpose of the battery is to provide a supply of current for operating the cranking motor and other electrical units [2].

Specification,

- 1) Voltage 12 V
- 2) Current 7Ah

D. Solar cell

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

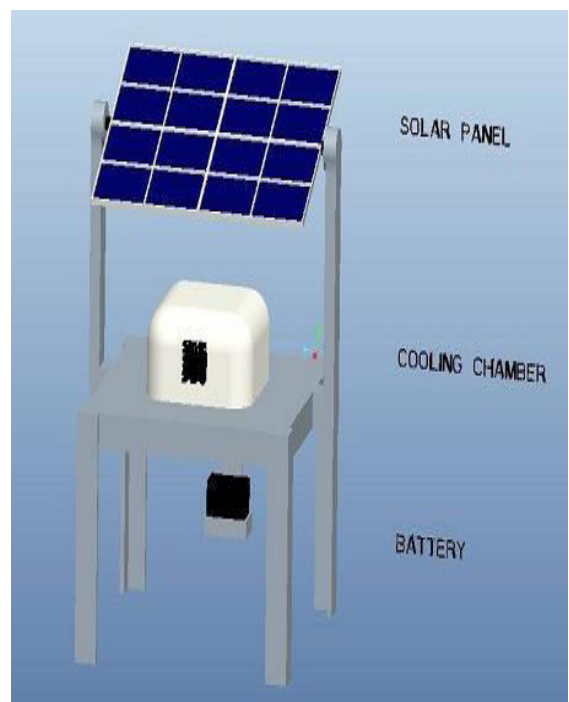
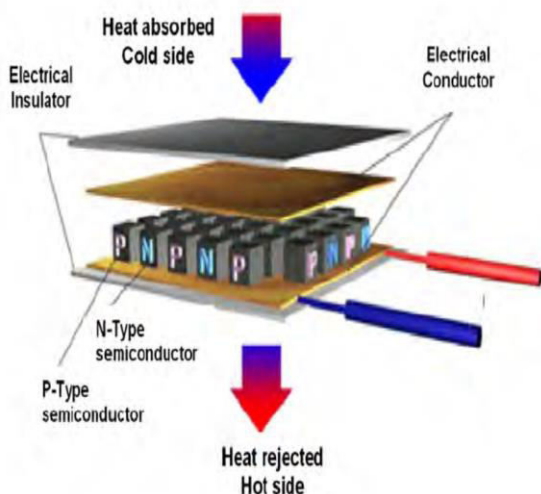
Power - 50 W

E. Charge controller

A charge controller is an essential part of solar refrigeration system that charge battery. Its purpose is to keep a battery properly fed and safe for the long term. The basic function of a controller are quite simple. Whenever the sunrays fall on a solar panel then there is a fluctuation of solar rays on solar panel. To avoid the fluctuation of sunrays on solar panel, we use charge controller in solar refrigeration system. Also, charge controller prevent battery overcharge and electrical overload.

WORKING OF THERMOELECTRIC COOLER:

Here we are using peltier device to generate the cooling effect with the help of rechargeable battery which will be charged by solar panel. The peltier plate which we are using is tec 12706 it works on 12v and 7amp so cooling effect it can produce of 56 watt and this plate will be run by a 12v 7amp rechargeable battery as one battery will not be sufficient therefore we will be using two batteries of same specification so that it can cool in one hour these batteries will be charged by solar panel which will be kept in sun for whole day the 50watt solar cell will generate enough energy to charge both the batteries through out the day. then we will also need one solar charge controller so that the batteries does not get overcharged and damage. then will also need one heat sink attached to the peltier plate so that it can effectively transfer the inner heat to outside.



Advantages:

- No moving parts, eliminating vibrations, noise and problems of wear.
- No Freon's or other liquid or gaseous refrigerants required.
- High reliability and durability.
- Compact size and light weighted.
- Relatively low cost and high effectiveness.
- Eco-friendly C-petance, CFC free insulation.
- Reversing the direction of current transforms the cooling unit into a heater.

Disadvantages:

- C.O.P is as less compared to conventional refrigeration system.
- Suitable for low cooling capacity.

Conclusion:

From our project we can say that it is possible to cool the system without the use of Refrigerant and compressor. There are several cooling devices but small scale , portable and customized cooling device are not available . So, such type of cooling devices are need of hour in rural areas .

References:

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3. Anuj Shukla , Madhvendra Kumar Dwivedi , Namrta Dubey , Ajeet Kumar Yadav " study of performance of a household refrigeration system with different refrigerant " volume 07 , issue 06 (June 2018)

