FABRICATION OF SOLAR REFRIGERATOR

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ABSTRACT

A solar refrigerator is a refrigeration system that uses sun energy to operate. The solar panel provides the electricity, rather than the residential electrical supply system. The solar refrigerator's solar system consists of a solar panel that gathers solar energy. Photovoltaic cells are installed on the solar panels, which convert solar energy into electrical energy and store it in the battery. The power is supplied directly by the solar panel during normal operation of the solar refrigerator, but when the output power of the solar panels is insufficient, the additional power is supplied by the battery. When the solar panels create an extra quantity of power, the battery is recharged.

KEYWORDS- *Peltier module, Solar energy, Thermoelectric refrigeration*

1. INTRODUCTION

Increased demand for refrigeration in many industries resulted in more power being produced and, as a result, more hazardous gases such as CO2 being released all over the world, leading to global warming and climate change. This is mostly owing to the fact that, as the world's population grows, we are in quest of additional energy sources that are both reliable and long-lasting. The concept of using a photovoltaic-driven refrigeration system with a battery backup was born. Because of the strain that an ever-increasing global population places on our natural energy supplies. These two facts lead to the conclusion that the existing natural energy supplies will not continue eternally.

1.2 PROBLEM DESCRIPTION

Refrigeration, in general, necessitates the use of electric energy, which is in short supply in most of our country's rural areas. Sun energy, which is also known as green energy and a renewable energy source, is widely available. Here, too, we try to save energy. Since the previous century, refrigeration has been one of the most important components of our everyday life. As a source of energy, the world is now moving toward renewable energy supplies. This is done for two reasons: first, because air pollution lowers the quality of life; and second, because an ever-increasing global population puts a burden on our natural energy supplies.

2. LITERATURE REVIEW

M.M.HUSSAIN et al (1): Researches HVAC systems' thermal energy systems. It was discovered that when there is no load on the storage system, the temperature drops.
V. Mittal et al.(2): A solar air-conditioning system that can chill and heat would be more cost effective.
V.K.Bajpai and colleagues (3) set out to build and test an ecologically friendly unit-capacity vapour absorption refrigeration system using R 717 (NH3) and water as working fluids.
Lim Chin Haw (Lim Chin Haw)[4]:Conventional cooling systems (VCR) are used in most small office buildings nowadays, and they have high energy consumption, high electrical peak load demand, and, in general, employ refrigerants that have a lot of negative environmental consequences.
The separation of water vapour increases simpler, enhancing the absorption chiller's efficiency, as N. Hatraf et al[5] examined the coefficient of performance COP.

3.EXPERIMENTAL SETUP

SOLAR REFRIGERATION consists of following important apparatus;-

- Peltier unit
- Cooling Fan
- Insulation Material
- Battery
- Solar panel
- Temperature display Sensor
- Charge controller
- Fins
- Thermistor
- Exhaust fan
- Circuit kit
- Thermoelectric module.

- PELTIER UNIT: The TIC 12073 peltier unit was employed in this refrigerator. At full load, this machine runs on 5 volts DC and draws a maximum current of 4 amps. This device has a 20-watt power rating.
- COOLING FAN: In our refrigerator, we have two cooling fans, each of which is positioned on one heat sink. A cooling fan's primary function is to dissipate heat from a heat sink by drawing in fresh air. The fans on this refrigerator run on 12 volts DC and consume 0.18 amps. Each fan consumes 2.16 watts of electricity.
- INSULATION MATERIALS: In order to create the body of the refrigerator, two materials were employed as insulators. Air leaks have been properly repaired. As we all know, ice vendors use thermocol because of its inexpensive cost and excellent insulation properties, which prevents the chilling medium's internal temperature from dropping. As a result, it's a cost-effective insulating option.
- BATTERY: The battery in this refrigerator meets the following criteria: 12 volts, 7.5 amps/hour One battery is employed as a timer for the refrigerator's operation in this refrigerator. If more chilling is necessary, there are also extra connections for the second battery in the fridge.
- SOLAR PANEL: The refrigerator's solar panel is rated at 12V. It's a gadget that captures the sun's rays and converts them into electricity.
- Temperature Sensor: A temperature sensor detects and measures hotness and coldness and converts the information into an electrical signal.
- EXHAUST FAN: To boost the cooling action's efficiency, a fan is used to blow heat away from the peltier module. It's used because one of the sides that isn't the cooling side becomes heated and has to be cooled. By distributing heat into the environment, the fan cools the opposite side.
- A thermistor is a temperature-dependent resistor or a resistance thermometer. The terms "thermal" and "resistor" combine to form this phrase. Metallic oxides are crushed into a bead, disc, or cylindrical shape before being enclosed in an impermeable substance like epoxy or glass.

4.MANUFACTURING PROCESS:

The interior walls of the box are coated with aluminium sheet, and the exterior walls with chart paper, after which a box of thermocol is created to the specified dimensions. The box is taped from the outside in order to give mechanical support and air blocking. The two Peltier units are well positioned in the two holes drilled in the box and placed on the heat sink, with the hot side facing the heat sink surface and the cold side facing inside the box. The heat sink is connected to a fan that dissipates the heat from the heat sink into the atmosphere, or out of the thermocol box. As a result, the temperature within the box is unaffected by the hot side of the peltier unit. All of the electrical connections are completed, including an on/off switch and an LED that indicates whether or not the refrigerator is operational. Two 12 Volt DC 7.5 Ah batteries are linked in parallel with the peltier units, which are connected in series, and the two cooling fans. All electrical connections are strengthened by soldering**.**

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5.PERFORMANCE ANALYSIS

The COP of the unit is found out during experimental analysis is 0.86.

5.1 CALCULATION OF COP

(Q)max=21 W	(T)hot = 28°C	(I)max =4.0 A
m =1.3	(V)max =10 V	(Th)max=60° C
(⊿Tmax) =54° C	Tc=12°C	dt = 9.6 J/S

i. **Seebeck voltage of device = 0.263**

ii. **Thermal conductance of device = 0.008W/K**

iii. **COP =**(R)m={(⊿Tmax) -(T)hot}/(T)hot
{327-301}/301 = **0.86**

6.APPLICATIONS

- Peltier refrigerators are widely used in several western countries.
- Serum cooler for preservation of blood plasma and serums.
- Photo multiplier cooler.
- Dew point hygrometer for determining absolute humidity.
- Constant low temperature bath and chambers.
- The fishermen use it keep fishes fresh.

7.RESULTS AND CONCLUSION

The designed thermoelectric refrigeration device could be used to store and transport life- aiding pharmaceuticals and biological objects in distant places of the country where power is not easily accessible.

8.FUTURE SCOPE

To increase the efficiency we can do it by increasing number the peltier module . Increase size of module by manufacture can help to increase cooling effect for more area. Effective wire with low resistance can improve peltier effect.

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