

“Fabrication of Peltier Cooling System: Alternative for Refrigeration”

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ABSTRACT

In this paper aims towards developing a system which will produce cooling effect without the use of mechanical devices and also refrigerant. Thermoelectric cooling system does not require working fluids or any moving parts. Thermoelectric refrigeration devices have a distinct place in medical applications, electronic applications, scientific equipment and other applications.

The difference between the existing methods and this model is that a thermoelectric cooling system refrigerates without use of mechanical devices (Conventional Condenser fins and Compressor) and without refrigerant.

Key Words: Thermoelectric cooling, medical applications, refrigerant.

1. INTRODUCTION

“We have pleasure in introducing our idea “FABRICATION OF PELTIER COOLING SYSTEM”, which is equipped by heat sinks, peltier (thermoelectric module) element, etc.

It is the system which is designed to produce cooling but the main objective behind the project is that the thermoelectric module (peltier module) to produce cooling effect. This means that food stub cooling is done without the use of greenhouse gases which would ultimately reduce the global warming which is usually caused by other refrigeration system.

Thermoelectric cooling, also known as "The Peltier Effect", is a solid-state method of heat transfer through dissimilar semiconductor materials. Thermoelectric cooler (TEC), or Peltier Cooler uses the Peltier effect for the exchange of heat.

The modern commercial TEC consists of a number of p- and n- type semiconductor couples. The heat pumping direction can be altered by altering the polarity of the charging DC current. Heat will be rejected through the module from inner side to the outer surface. Inner module face will be cooled while the outer face is simultaneously heated.

Current Contribution:-

This paper aim is to investigate the feasibility and produce a prototype of a rapid cooling device using peltier technology with the intention of introducing this technology in the consumer market in future.

2. OBJECTIVES

The material used to fabricate the model is lower graded and economical because the cost of product will less as possible as, which will play an advantage should this product be rolled out in large numbers into the market.

The discussion of this report will include the positive aspects of the project and its flaws, and will explain how the latter can be overcome should this project continue in the future.

- To provide cooling system in rural area.
- To reduce the overall cost of refrigeration to cool water.
- To investigate methods to increase the efficiency in order to conserve power.

3. Working principle

The working principle of the peltier cooling system as follows:-

Peltier effect thermoelectric coolers operate by the Peltier effect (which also goes by the more general name thermoelectric effect). The device has two sides, and when DC current flows through the device, it reject heat from inner side to the outer, so that inner side gets cooler while the outer gets hotter. The hot" side is attached to a heat sink so that it remains at ambient temperature, while the cool side goes below room temperature. In some applications, multiple coolers can be arranged for lower temperature.

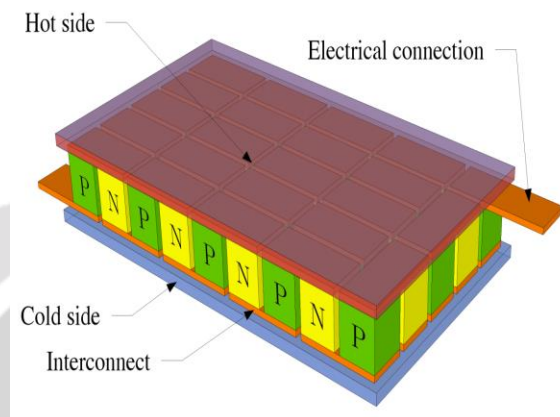


Fig. 1 "Working principle of thermoelectric module"

Figure no. 1 The diagram shows Working principle of thermoelectric module shows a simple diagram of peltier. Two elements of semiconductor, primarily Bismuth Telluride, heavily doped to create either an excess (n-type) or deficiency (p-type) of electrons.

If the peltier module gets cooled on one side it transfers it's cooling to the heat sink used on that same side. Due to this transfer of cooling, the fans provided to the heat sinks spread the cool air and gives out to the required place needed for cooling.

On the other hand another fan on opposite side of the peltier module draws the hot air from the heat sink and expels out to the atmosphere in order to decrease the temperature of the peltier module.

In this way the whole system works.

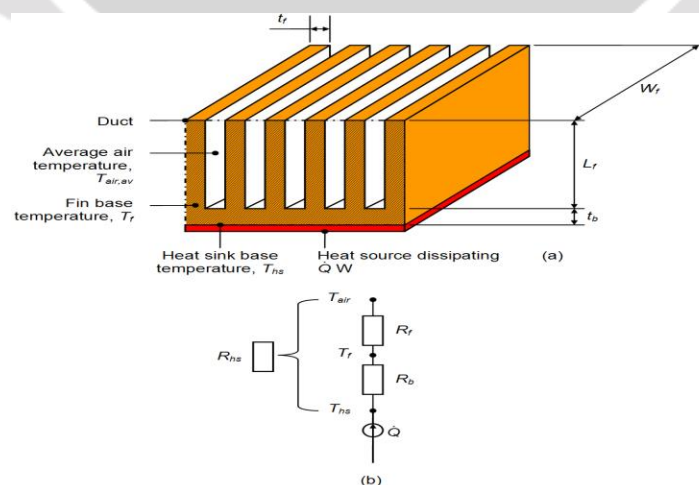


Fig. 2 Heat sink showing thermal resistances along with circuit diagram.

4. Cabinet

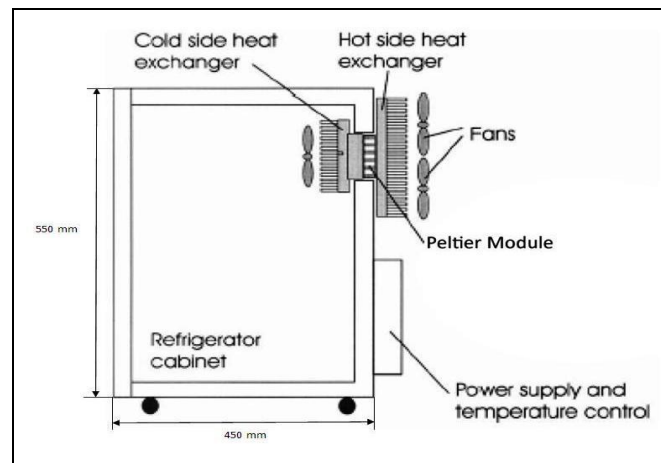


Figure No. 3 “Schematic diagram of Peltier Cooling System”

Figure no. 3 picture is schematic diagram of peltier cooling system which shows all the components required to the cooling system. Before going to fabricate actual cooling system this line diagram help to arrangement of the components at their positions so that it is easy to design CAD model.

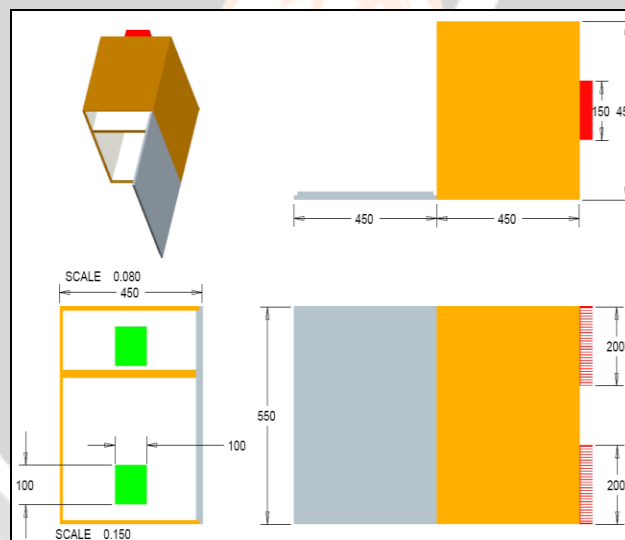


Figure No. 4 “CAD Model of Peltier Cooling System”

Figure No. 4 shows the CAD Model of Peltier Cooling System with different views. In this figure the view gives the idea of various side of Peltier Cooling System. CAD software increase the accuracy and productivity of the design, also with the help of CAD software we can improve the performance of cooling system. CAD is used to create the model and take the advantage of its application in fabrication.

CAD software used graphics to shows the real product in nature. It provides the document of information for required properties of material, processes, and design. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information.

CAD is used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) model.



Figure No.5 “Peltier Cooling System”

Figure No. 5 shows the actual fabricated Peltier Cooling System. The purpose of this figure is to explore ideas, not to provide detailed step-by-step instructions on how to create an actual curriculum design, let alone an actual curriculum. It is way of analogy, the figure deals with how general design principles may seem to apply to designing any kind of buildings, but not to how to produce detailed engineering plans for use in constructing actual buildings. To make the argument easy to follow, the this work.

Purpose of insulation

The insulation is used to protect the absorption of heat from the outer environment. Heat is rejected from the inner surface and rejected to the surrounding but if the heat from the surrounding will get absorbed in inner side the performance of the system will poor. Insulation material also protects the human being from the accident. Such materials are porous, containing large number of dormant air cells. Thermal insulation delivers the following benefits:

1. Energy consumption will reduces.
2. Offers better process control by maintaining process temperature.
3. Corrosion of the system get protected.
4. Provide the heat absorption barrier.
5. Vibration will reduce.

5. CONCLUSIONS

The “**PELTIER COOLING SYSTEM**” is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impressive project work.

The portable refrigerator has no moving parts, fluid, or refrigerants. In particular, its size is very small so it is convenient for travelers to store the medicine. Temperature was controllable via changing the input voltage/current so we can maintain the medicine as desired level of temperature and the cost of the device is very low. This system achieves 40% to 60% of cooling effect compare to conventional refrigerator. For the above reasons this is most effective for poor people (by the cost) and travelling people (because of size).

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