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Peltier cooling and mass airflow based laptop cooling device

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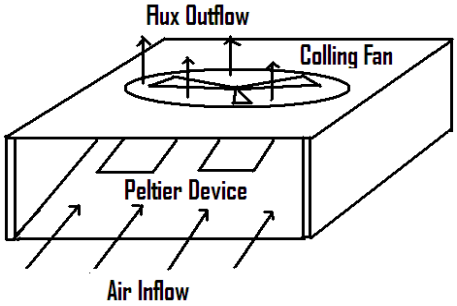
Abstract
Power consumption in running a laptop device is mainly due to the integrated circuits and core processors. Due to very compact arrangement of billions of semiconductors in a tiny space the loss due to heat is huge and lethal for the components. As working properties of a semiconductor highly depends on the temperature so the surrounding, the system needs to be cooled. Cooling of multicore processors is achieved by providing with radiator and cooling fans for an optimum air flow over the large surface area of the radiator. This method is sufficient but not fully efficient in providing with long term safety of components and high reliability. The proposed design is of an external cooling device with peltier cell cooling mechanism for a provision of cold air flow in the laptop to drain out the heat energy.

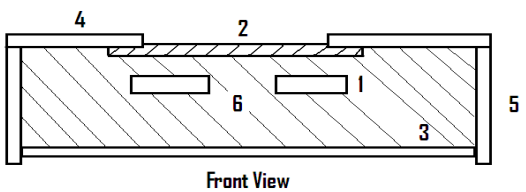
Keywords: Peltier Device/Cell, Laptop Cooler, External Cooling, Mass Airflow, Heat Sink, External Cooling.

1. Introduction



Above device shown represents the proposed cooling device with air inflow at room temperature but cooling and heat loss at contact of peltier devices. The output flux contains the cold air flow that is diverted by a cooling fan and transferred into the heat radiating laptop device. The mechanism behind the cooling down the air at room temperature is simple transfer of energy in the form of convection and radiation between the air and the front of the peltier cell and the heat sink behind the peltier cell and the air discarded, respectively. The peltier cell consist of two sides with two DC input terminals. When DC current is applied than the two terminals get a temperature difference with one end with hot and side with cold temperature.

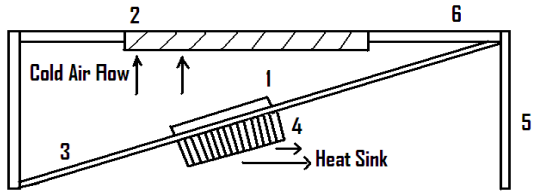
2. Design Specifications



1-Peltier Cells
2-Cooling Fan
3-Bottom Structural Beam

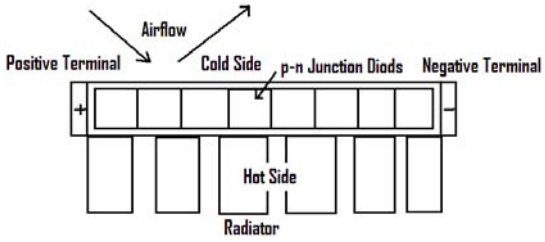
4-Canilevered Laptop Base Support
5-Flat Side Supports
6-Diagonal plate supporting peltier cells.
The base of laptop device is to be placed on the top of the cooling device with end supported cantilever flat slabs are provided. The load from the top slabs is transferred to the vertical flat supports. To maintain structural stiffness the diagonal element is provided to join the top flay slab and the bottom beam to counter any bending Moments. The peltier cells are fit on the diagonal plate with cold side on above and hot side at the bottom.

3. Side Sectional View



1-Diagonally Mounted Peltier Cell
2-Cooling Fan.
3-Diagonal plate support separating the heat sink and cold side of peltier device.
4-Radiator with large surface area acting as a hat sink.
5-Back support flat plate.
The diagonal plate is acting as a barrier between the cold air and the hot air. This diagonal support provide a support for the peltier and an ease in mounting just below the cooling fan. The provision of heat sing in the form of heat radiator is providing the hot side of the peltier device to cool faster and preventing it from temperature failure. Maintaining a temperature range suitable for working range of peltier device is essential in its reliability and overall efficiency of the system.

4. Working Mechanisms



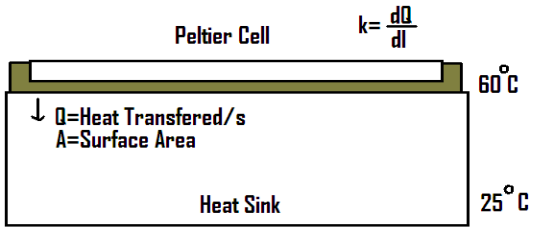
The peltier cells works on the principle of the p-n junction diodes. When a suitable arrangement of p-n junction diodes is made with alternate connections to get a two surface flat surfaces. When an electrical charge in the form of DC current is applied to the device them the one side drops in temperature while the other side heats up. Converse is also true but inn design of the cooling device the electrical energy is provided to cool down the air in contact with the cold side of the peltier device and then transferring that cold air to cool down the laptop system.

5. Design Assumptions

The peltier cells are powered with battery system or the laptop device itself. The control of peltier device is manually operated. When needed then only it is switched on by the user depending on the requirement. The cooling fan is powered mainly by the laptop system. Operational control of the peltier device and the cooling fan are separate. The Heat sink is made up of an aluminum based allow with projected grooved plates to increase the surface area for more amplified heat radiation. The heat sink is fit with the peltier with special thermal glue for a proper heat transfer.

6. Heat Transfer and Formulation

The application of thermal glue for proper lubrication of the heat side of the peltier and heat transfer to the heat sink.



Q=Heat transferred per second through the thermal glue.
K=Coefficient of heat transfer for glue.
A=surface area of the peltier cell.
t=Thickness of the thermal glue.
The rate of hat transfer can tell us the proper selection of the thermal glue to be used for peltier device. Varying the thickness can also help in setting the rate of hat transfer under safe limits or working limit of temperature for peltier cell.

Amount of heat transfered
$Q = k.A.t.(T1-T2)$
$(T1-T2)$ = temperature diference
$=(60-25)$
$=35^{\circ}C$

7. Acknowledgment

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