VAPOUR CHAMBER COOLING TECHNOLOGY

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Introduction:

In the present time of scientific era, the rapid development of electronic technology, devices and appliances takes an important place in our daily lives. However, as the component size shrinks there is a dramatic increment in the heat flux per unit area, due to which the working temperature of the electronic components may exceed the desired temperature level. And therefore, by promoting the heat transfer rate and maintaining the die at the desired operating temperatures, the condition for a reliable electronic component can be made into existence. A vapor chamber, sometimes called a planar heat pipe or a vapor chamber heat spreader, is a two-phase device used to spread heat from a heat source to a heat sink. For electronics cooling applications, the heat transfer is usually to a heat sink in very close proximity to the heat source; a local as opposed to a remote heat sink. The use of vapor chambers has increased markedly as both the total power and, as a result of shrinking die sizes, the power density has skyrocketed.

A numerical study was presented on six CPU heat sinks of a model, namely a copper heat sink, aluminium heat sink to analyse the temperature distribution and thermal resistance (Liu et al., 2012) and was concluded that the heat dissipation effect of copper heat sink is far better than that of aluminium one, which on further come to the final conclusion that a reasonable design need to consider material and thickness of the base, height and thickness of the chamber along with the heat transfer area of sink. It was the basis of the references for the design of CPU heat dissipation and some necessary theoretical basis for the cooling design of the electronic equipment's

Objectives:

- This project aims to achieve high heat dissipation where the heat is efficiently distributed over more convection surface area (radiator) than pure conduction.
- The project focuses on eliminating the unpleasant sound developed in the air-cooled systems by carrying out silent operations and most efficient cooling by providing a temperature gradient of about 3-8 degree of Celsius in the processors.

- This project keeps safety as its priority and does not use any harmful elements nor any kind of substances that are toxic to the environment.
- This project allows better value for the price and gives an outstanding cooling to the electronic device, which in return elevates the performance of the processors

Methodology:

Every electrical component in a circuit or processor chips generates some amount of heat as it is executed by power supply. Due to this heat of processor chips there by leads to pre-mature failure reduce the efficiency and performance of the system. So, to conquer these negative aspects heat sink must be provided for cooling purpose.

This project aims to use the vapour chamber which happens to be the liquid cooled system in order to stop the processor chips from being over heated and to act as heat sinks. Discussing about the material and the components -

COPPER - this vapour chamber is made of pure copper material. The reason behind choosing copper is because of efficient heat transfer comparatively better thermal conductivity.

HEAT SPREADER - Copper Heat spreader is used to make a proper contact with heat source and heat sink. These are used also provide better thermal conductivity.

RADIATOR FINS - The radiator fins help to dissipate or direct into the atmosphere. i.e., helps in heat exchange.

WATER - The ideal working fluid for this copper chamber is water which is more efficient than any other coolant to be used.

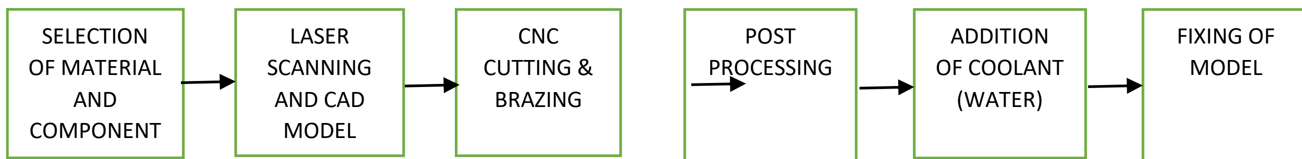
THERMAL PASTE - It is used to eliminate air gaps or spaces from the interfere area in order to maximize heat transfer and dissipation.

DESING AND FABRICATION

This vapour chamber is designed for the laptops where the present air-cooled system is been replaced to liquid cooled system. It is designed for Lenovo Legion Y540 (81SY00CKIN-cr). First of all, the laser scanning process is done in the order to receive the CAD model of the object. i.e., the reverse engineering method is used in order to obtain the CAD model of previous air-cooled system and its dimensions. This is CAD model obtained from the LASER Scanner is checked and then necessary changes or correction are carried out in order to obtained the flawless desired model.

Later after this the G and M codes of the CAD model is obtained with the help of Master-Cam Software. These G codes and M codes are used for the CNC Machining of the model developed with the accuracy of around 0.01mm. This desired cut piece model from the copper slab is subjected to fine filling in the order to remove surface roughness and for proper adjustment. This copper chamber is then brazed in order to seal the boundaries. By the use of proper filing tools, the surface roughness and the black spots which is obtained from brazing is removed. This copper chamber is then coated with black paint in order to trap the heat inside the chamber and also to avoid short circuiting between the electronic components. Finally, this vapour chamber is fixed to the laptop with the help of screw and clips.

PROCESS FLOW CHART

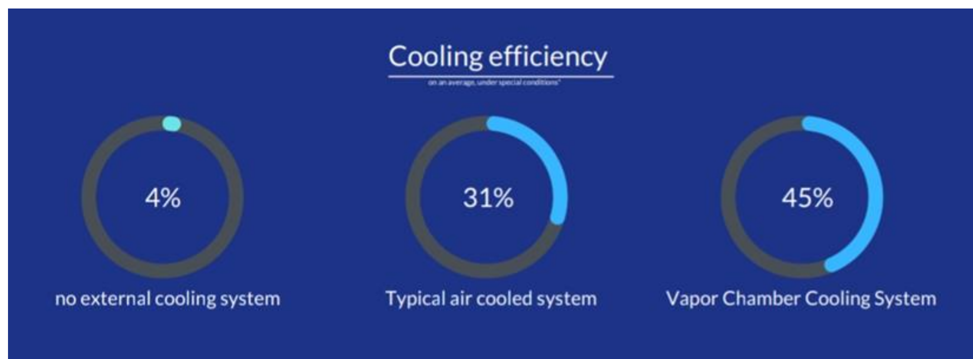


Conclusion:

From all the keen observations and scientific case studies, it is clear that vapor chamber cooling technology if not just efficient in cooling the microprocessors and processors, it is even way more ideal when compared to conventional methods of cooling systems used in consumer electronics. After many observations, it is also found that vapor chamber cooling technology is 10-30% efficient than that of the conventional cooling methods or technologies.

Using of a vapor chamber cooling system in consumer electronics will-

- Reduce heating of processing units and avoid burning of them
- Boost performance of processors
- Increase life span of micro chipsets
- Provide optimum temperature to the system



Scope for future work:

HIGH CONFIGURATION LAPTOPS

Advancements with regard to design in the vapour chamber/liquid cooling technology can bring better performance and increase the service life of the processor chips and other electric components. It (vapour chamber) can be made more reliable, compact, less costly in order to embedded in the laptops. This mode of cooling becomes a need of the hour for the high configuration laptops (e.g., Gaming laptops) as they dissipate more heat where conventional cooling system are not much effective as compared to vapour/liquid cooling system. Therefore, it is very necessity to keep the laptop cool in order to attain better performance.

DATA CENTER/SEVERS

In order to maintain optimal performance of the computing infrastructure the data center must maintain and optimal room and sever hardware temperature. In that case this vapour cooling technology can bring a better result with regards to the maintenance and efficiency of the server