

## **Nozzle Vent: A Simpler Approach to Laptop Cooling**

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**Abstract:-** Laptops are the miniature versions of professional computers and are globally used. They are smaller, smarter and expensive equipment with high processing capacity, memory, and performance etc. They are the device from global technology. Vast technology revolution has advanced laptops to today's position but, laptop overheating is a problem which emerge without any occasion. Generally laptops heat during playing high graphic usage games, rendering videos, using multimedia programs etc. Though various solutions from software's to liquid cooling have been developed nothing seems to be a feasible and reliable one. The main source of cooling laptop is air. Conventional cooling system uses air to cool laptops, they suck the air with the help of small fans and circulates to the heat pipe to cool the processing and control systems of laptop, and thus somehow heating problem is reduced but with greater effort. The temperature of air at the input of the suction vent plays a vital role in cooling process. If any means are utilized that could reduce the temperature of incoming air the efficiency of cooling can be increased. Thus in this project the nozzle vents are purposed. According to the law of ideal gas the pressure and temperature are directly proportional to each other. Nozzle is a device which can decrease the pressure of gas increasing the velocity thus as the pressure of air decreases, temperature decreases. Hence implementing tiny convergent nozzles at the inlet of vent can decrease the temperature of the incoming air which, directly or indirectly increases the cooling efficiency in laptops.

**Keywords:-** Nozzle, Laptop heating, Cooling effect, Vent, Temperature.

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### **I. INTRODUCTION**

Laptops are mobile computing devices used in the field of education, business work, multimedia etc. Laptops are in existence from early 1980s. Through several decade of revolution in technology laptops are decreasing in size and increasing their performance. Laptops are classified based on their applications, size and performance. More and more advanced technology such as high definition display, touch screen, finger print etc. are implemented in laptops used today. Thus in coming future it is a well-known fact that the processing and performance capacity of the laptop should be increased to considerable extent. Increasing in these capacity states that the laptop should be assisted with highly efficient power source and system cooling units. Laptops used today are facing a lot of problems among which overheating is a considerable one.

Overheating of laptops gained excess attention from the year 2006. scroching heat is a bad trait for something that sits on the lap. An overheated laptop is a bad one. Over heat production causes malfunction crashes, damage of hardware components. Cooling a laptop is directly dependent to the ventilation system. Laptop cooling system should be designed in such a manner that hot air should escapes through the system quickly and replaced with cool air. Cooling also depends on the temperature of the air entering the inlet vent and it should be of low temperature which can be achieved with the help of nozzle vents.

A nozzle is a device which accelerates fluid. During this process, velocity of fluid increases with decreasing pressure. Nozzles are of varying cross-section in area and they are widely classified as convergent, divergent and convergent divergent (De Laval) nozzle. Convergent nozzle accelerates subsonic fluid, divergent decelerates subsonic fluid.

### **II. METHODOLOGY**

#### **A. Designing cooling system with nozzle vents**

For this project cooling system for a laptop from the manufacture of sony vaio E-series was taken and the specifications of the conventional inlet vent was considered for the same as shown in table 1. Specifications for the inlet vent with nozzle is shown in the table 2. There are 23 vents in series out of which only one is taken and designed for the demonstration of this project.

**Table 1: specification of conventional inlet vent**

S.NO	PARTICULARS	DIMENSION
1.	Length of the inlet vent	16.5mm
2.	Breadth of the inlet duct	2mm
3.	Thickness of the inlet duct	1mm
4.	No. of inlet ducts	23

Table 2: Specification of inlet vent with nozzle

S.NO	PARTICULARS	DIMENSION
1.	Length of the inlet duct	16.8mm
2.	Breadth of the inlet duct	3mm
3.	Total thickness of the inlet duct	3mm
4.	Diameter at the inlet of nozzle	2mm
5.	Diameter at the outlet of nozzle	1mm

Conventional inlet vents for cooling system in laptops are designed in different shapes, The widely used shape for the inlet vent is shown in the figure1.Design of cooling system with nozzle vents replaces the conventional type of inlet vents as shown in the figure 2.

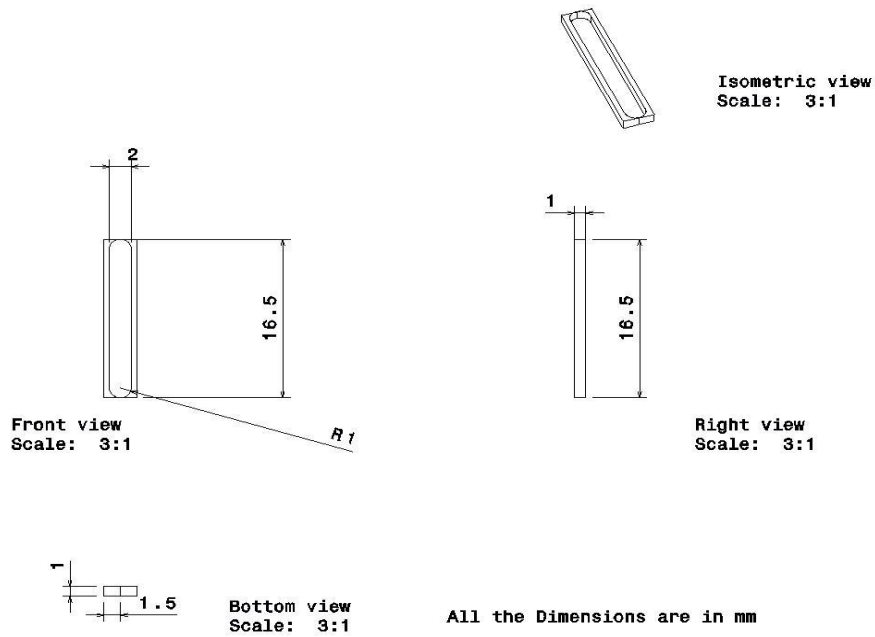


Fig. 1: Conventional inlet vent used for laptop cooling

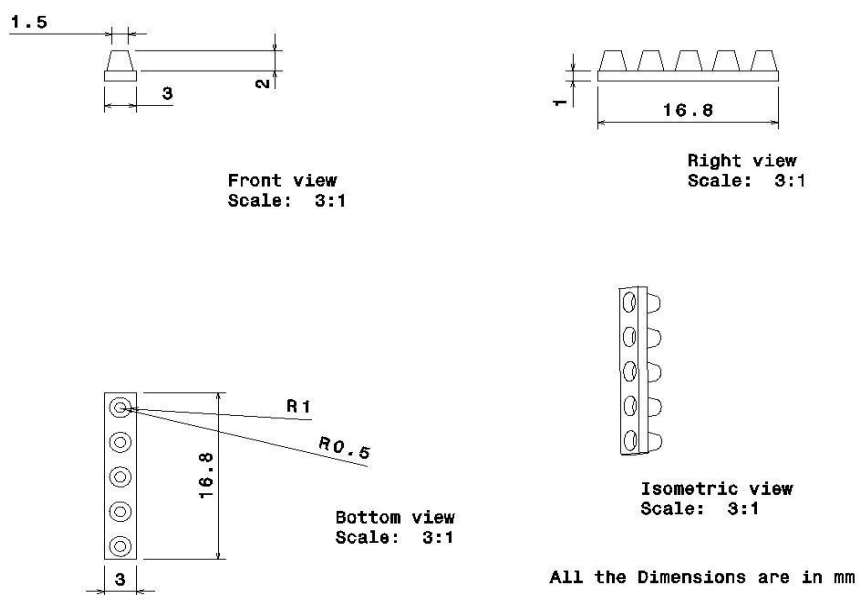


Fig. 2: Inlet vent with nozzle.

The 3D view of conventional inlet vent is shown by the figure 3. and figure 4. Shows the inlet vent with nozzles.

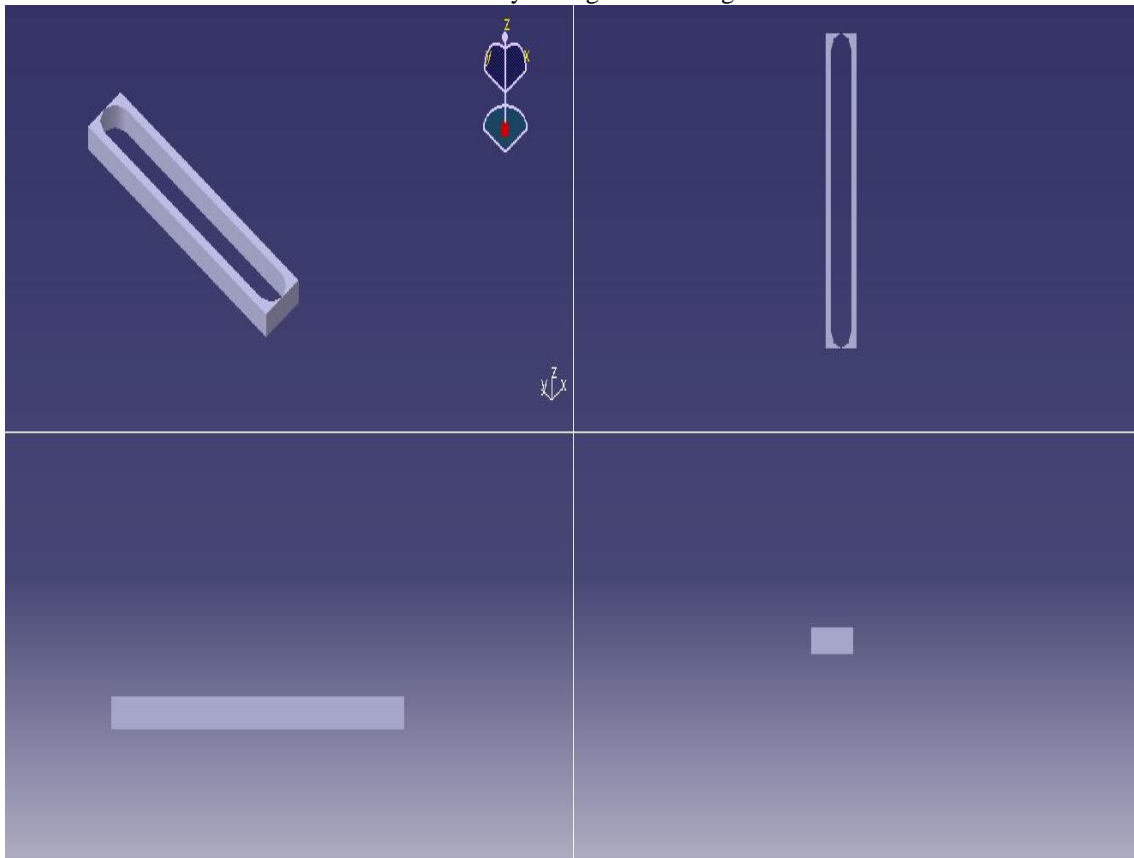


Fig. 3: 3D view of conventional inlet vent

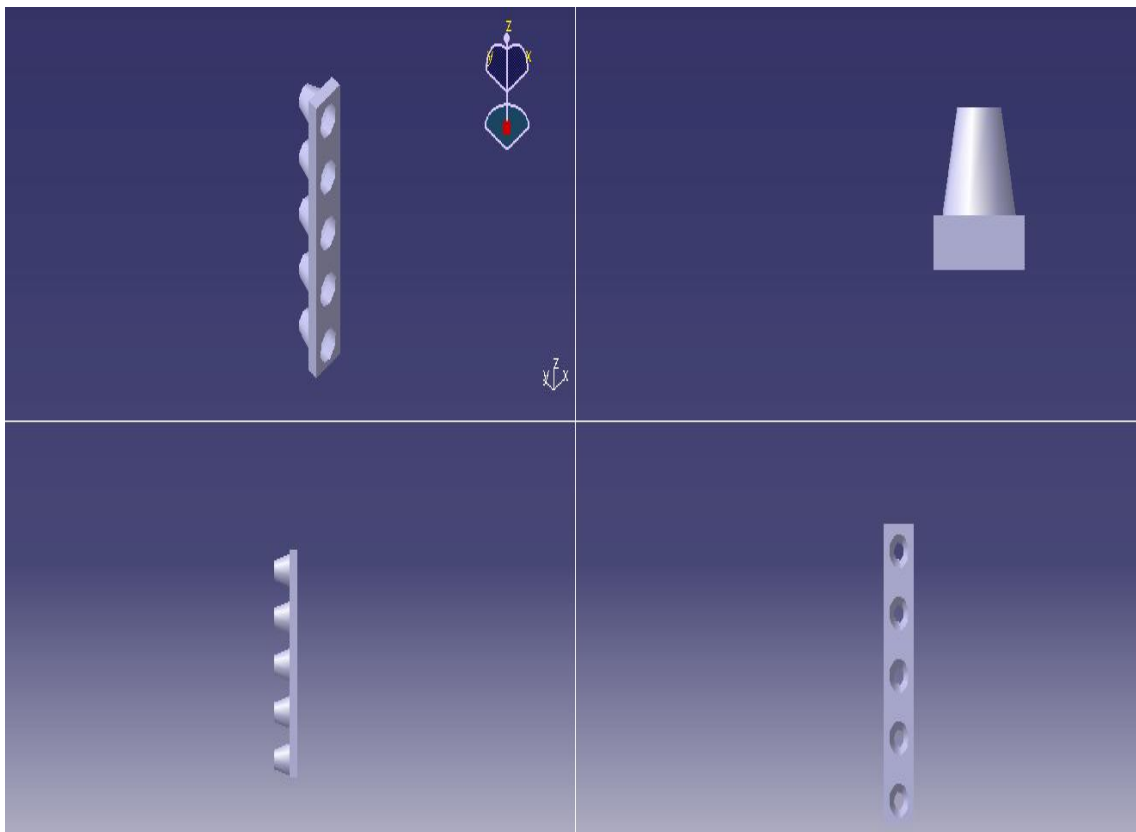


Fig. 4: 3D view of inlet vent with nozzle

### III. WORKING PRINCIPLE

According to the law of ideal gas, pressure is directly proportional to Temperature.

$$p = \rho \cdot R \cdot T$$

Where

- p=pressure
- R=specific gas constant
- T=temperature

The working principle and arrangement for cooling laptop by using nozzle vents is schematically represented in the figure 5. When the laptop is switched ON the small fan intakes the air from the environment through the series of convergent nozzle vent which is situated just below the fan location. Thus air entering the nozzle have ambient pressure and ambient temperature at the inlet but due to the effect of nozzle the air at the outlet which is also the intake of the suction fan will have considerably less pressure and temperature compared with that of the inlet condition, this also increases the velocity of the air which will increase the mass flow air ratio. Further process will be similar to that of conventional laptop air cooling system except the replacement of conventional inlet air vent with air vents having nozzle. Hence the cooling efficiency can be increased by using this technique.

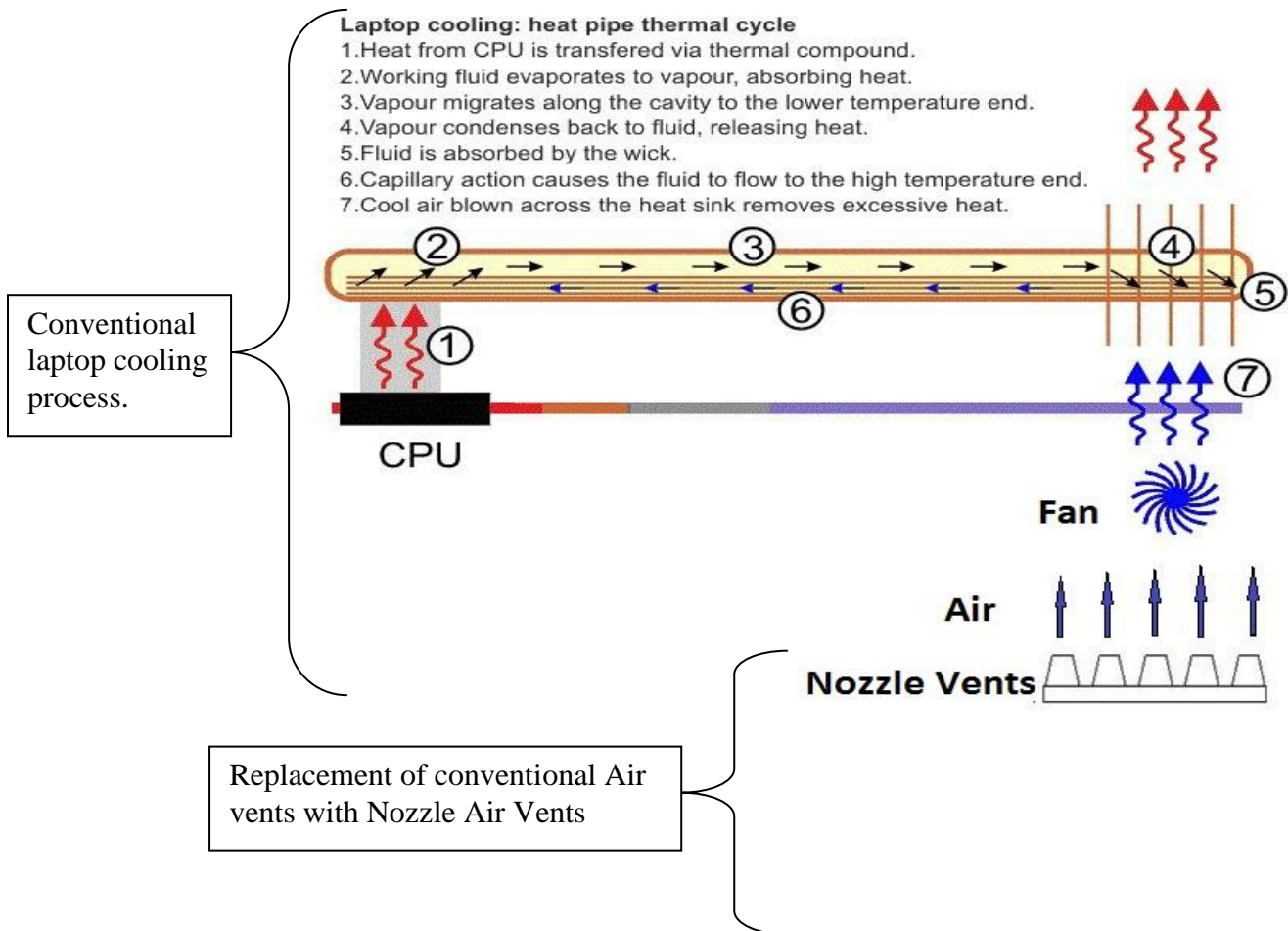


Fig. 5: Principle of Laptop Cooling

### IV. CONCLUSIONS

This paper gives the idea of design of the inlet vent in laptops for increasing the cooling efficiency along with the advantages like no nets are required for filtering the air, prevents laptops from dust, battery performance can be increased etc. Nozzle vents can also be utilized in other components such as air conditioning system. Finally we conclude that this technique could be used to solve the heating problem of laptops to the considerable extent.

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