A Review Paper on Heat Transfer Rate of Fins with Blind Holes in Natural Convection

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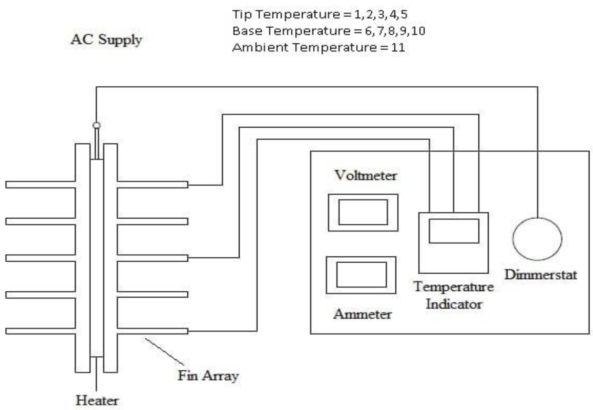
Abstract: **Many mechanical systems are facing the problem of overheating due to internal heat generation of the system Though there are solutions like fins, cooling systems but still there is need of more effective solution. . The main purpose of this experimental study is increasing the heat transfer rate of the fin array with minimum weight of the fin. The surface modification in the form of the perforations and blind holes is passive method of increasing heat transfer rate with the additional benefit of weight reduction. This study includes comparison of natural convection heat transfer of solid , perforated and fins with blind holes at various inclinations(0 to 90^0) of the fins. Experimentation is to be done by taking different configurations of fins and different inclination of fins. Comparison will be done by taking differentiating coefficient of heat transfer and Heat transfer rate.**

I. INTRODUCTION

Free convection cooling by air is extensively used in industries as it is cheap, light weight, easy to manufacture and reliable. The fins are extended surfaces which increase the heat transfer rate by increasing the area of heat transfer. Fins are widely used in heat exchangers, refrigerators, automobile engines, transformers and electronic devices etc. As the heat transfer coefficient for natural convection is low as compared to forced convection, it is required to increase the heat transfer rate. Increasing the fin area enhances the heat transfer rate at the cost of increased weight, bigger size and higher cost of fins. Performance of the fins in terms of heat transfer rate with reduction in size, cost and weight of fins can be achieved making certain changes in the geometry. Though the heat transfer rate can be increased by forced convection, the manufacturing and operating cost will increase remarkably with more weight and noise. Hence, free convection is better for many applications. Among the various types of fins, rectangular fins are used most extensively for heat transfer enhancement because they are simple in design, cheap and easy to manufacture.

II. LITERATURE REVIEW

In the literature, it has been found that many studies have been performed in order to determine the optimum fin configuration which provides higher heat transfer through the rectangular fins by changing the geometry under free convection. Huang et al. [1] studied numerically the overall convection heat transfer enhancement for long horizontal rectangular fin array with perforations through the fin base. they found that the perforations improved the performance remarkably and the overall heat transfer coefficients improved by two folds.Shaeri et al. [2] investigated numerically the performance of a heated array of rectangular perforated and solid fins and found that perforated fins give better performances and effectiveness with the increase in number of perforations. Awasarmol et al. [3] experimentally investigated the heat transfer enhancement of perforated fin array with different perforation diameter and at different inclination angles in free convection. They found that perforated fins provide more heat transfer and saving in material as compared to solid fins. It was observed that increase in the heat transfer coefficient for 12 mm perforation diameter at the angle of orientation 45°, was about 32% as compared to solid fin array, with about 30% saving in material by mass. Damook et al. [4] experimentally determined the effect of perforation on heat transfer and pressure drop characteristics. They found that the Nusselt number increases with increase in number of pin perforations while the pressure drops across the heat sink and fan power needed to pump the air through them decreases. Shaeri et al [5] numerically investigated the effects of size and number of perforations on laminar heat transfer characteristics of an array of perforated fins with the maximum perforations and concluded that in a laminar flow and at a constant porosity, a fin with fewer perforations is more efficient to enhance the heat transfer rate compared with a fin with more perforations. Ismail et al.



Block dig. of Propose approach

Where,
Tip Temperature=1,2,3,4,5
Base Temperature=6,7,8,9,10
Ambient Temperature=11
In This Paper the rate of heat transfer can be maximum
With Blind hole than complete holes it can be calculate with the help of fin array, Voltmeter, Ammeter, Temperature Indicator, Dimmer stat and AC supply. When the current is pass through the Array the it will be heated and the

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temperature of Fins will be increasing the temperature of Fins will be indicated with the help of Temperature Indicator. In between two Fins the Heater will be fix for no heat loss from the Fins Array. Then it will be found that the rate of Blind hole is maximum than complete hole on Fins Array.

III. INSTRUMENTATIONS

A digital watt meter and a variable transformer with the input of 220 V and 50–60 Hz and output of 0–240 V, 4 A was used to supply regulated power to the heater. A 450 W heater was fixed between the base plates of two identical fin arrays. Four thermocouple wires were used to record the base and tip temperatures of the fins and one to record the ambient temperature. A temperature indicator was used for the display of temperatures. A stand was designed and fabricated to hold and rotate the fin array blocks were used. In the present study, three fin array blocks with 4mm, 6mm and 8mm perforation diameter and 6mm fin spacing were used.

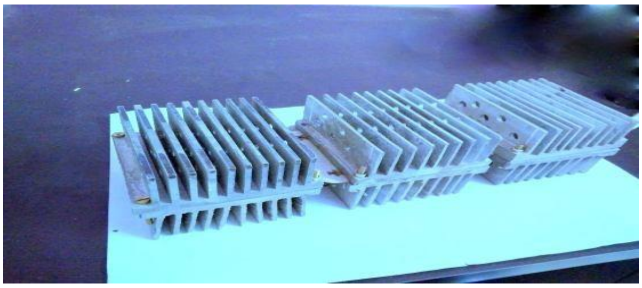

Fig. 2 Fin Array Block

VOLTMETER

Voltmeter is a voltage meter. Which measures the voltage between the two nodes. We know the unit of potential difference is volts. So it is a measuring instrument which measures the potential difference between the two points.

Fig. 3 Voltmeter

AMMETER

As we know a word “meter” is associated with the measurement system. Meter is an instrument which can measure a particular quantity. As we know, the unit of current is Ampere. Ammeter means Ampere-meter which measures ampere value. Ampere is the unit of current so an ammeter is a meter or an instrument which measures current.

Fig.4 Ammeter

DIMMERSTAT

Dimmerstat is a controlling device used in electrical circuit. It is used to adjust the output voltage to an electrical circuit.

Fig.4 Dimmerstat

CONCLUSION

In this paper will be conclude that the heat transfer rate of Fins with Blind holes will be maximum as the surface area of fins will be maximum as compare to complete holes on Fins That is Heat transfer rate is depends upon the surface area of Fins.

Following conclusions are drawn from the study.

A. An increase in heat transfer from perforated fins was observed as compared to solid fins.
B. Heat transfer coefficient was found to be increased with the increase in the diameter of the perforated fins.
C. convection heat transfer coefficient increases with the increase in fin inclination from 0 to 90°.
D. The perforated fins enhanced the heat transfer rates as well as decreased the fin materials, weight and cost.

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