

Design and Fabrication of Fins by using Different Materials and Geometries

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ABSTRACT: Today the need of development and design of fins are very essential to obtain the optimum heat transfer for many engineering applications. In this work, Convective heat transfer is the mode is consider for addressing heat transfer through fins. Since the contact surface area conducts the heat through fins therefore design of fins plays an important role. Recently fin design is considered for improving the heat transfer and many investigations have been done and in this work design of fins created by considering different materials and geometries. Different types of fins are used along with different shapes and various materials to understand the effect of heat transfer and to improve it for better shape and material for greater rate of heat transfer. In this experiment we studied the rate of heat transfer and flow characteristics and compared the results with experimental analysis..

KEYWORDS: Fluid Flow, Heat Transfer Rate, Pin Fin, Mass flow rate.

I. INTRODUCTION

Heating of components in different engineering applications is a challenge to increase the efficiency and life cycle. Also, optimum heat transfer from heated surfaces, reducing cost and material weight has turned into major challenge for heat transfer. Pin fins are broadly utilized as a part of heat exchanging body which result in enhancing the heat exchange between the surface of the body and ambient fluid by doing thermal analysis on the fins, it is helpful to know the heat dissipation. A fin is a surface that extends from an object to increase the rate of heat transfer to or from the environment by increasing convection. It is well known fact that by increasing the surface area of pin configuration we can increase the heat dissipation rate of this process. By knowing the mode of heat transfer and its influence through principle of conduction, convection, radiation which determines the amount of heat transfer increasing the temperature difference between the fin configurations. Therefore the effectiveness of fin is very essential characteristic for design and optimum heat transfer in a component. Pin fin is majorly used for heat transfer results in the heat exchange between the surface of the body and the fluid flow through it. There are various types of fins for a heat transfer. In this work we manufactured pin fin of various geometry and materials like, copper fin of circular slotted shape, aluminium fin of rectangular bar shape, composite fin of aluminium and copper.

II. DESIGN AND FABRICATION OF FINS:

1. SQUARE THREADED PIN FIN:

In his experiment Square threaded pin fin is used which is having three screw at the top face of the pin fin which is use for the connecting thae thermocouple which is use for measuring the temperature at various point at pin fin. We made models of the fin by using CATIA software by using sketch command , pad , pocket commands etc. The fin having a dimension of side 20 mm length and height 125 mm.

2. CIRCULAR THREADED PIN FIN:

In this type of pin fin we consider circular which is having square threaded on outer surface of pin fin. This pin fin is made up of copper material. We make models of these fin with the CATIA software by using the various command in software like pad , pocket, mirror etc. these commands are use for making the models with software. The pin fin having diameter of 20 mm and height of 125 mm with square threaded on its circumference with height of 2.5 mm .

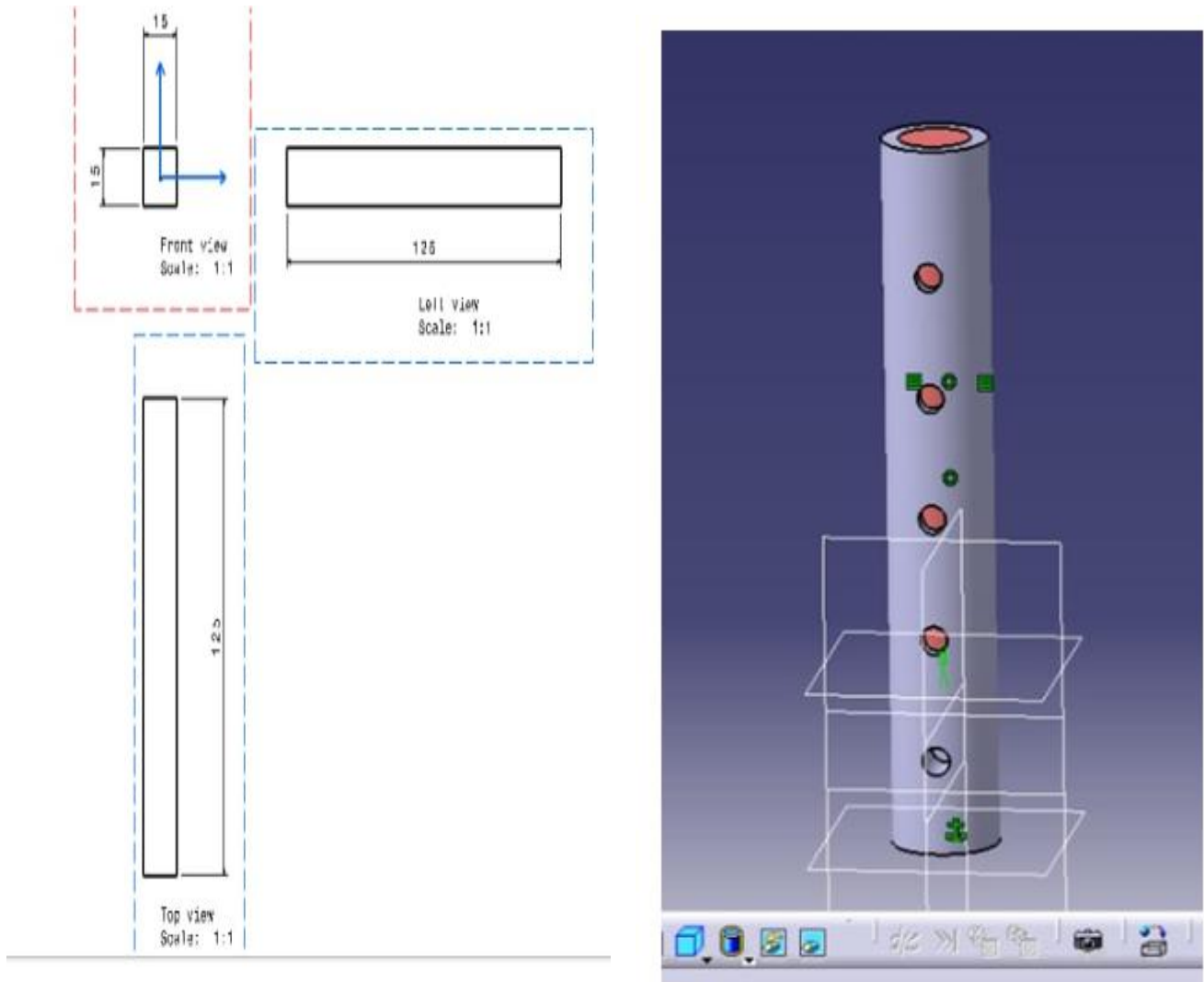


Fig1: Square Threaded Fin

3. CIRCULAR COMPOSITE PIN FIN

In this type of pin fin we consider the two types of materials are copper and aluminum. This type of pin fin is manufactured by placing a copper rounded bar inside the aluminum rounded bar. On the outer periphery of rounded bar there is five holes are for the thermocouple which gives us temperature at various of point of fin. The dimension of the fin is having outer material is of aluminum having diameter 20mm and hollow diameter which is outer diameter of copper rounded bar 13mm. On the outer surface of the aluminum rounded bar there is five screw are situated for thermocouple to know the temperature at various point.

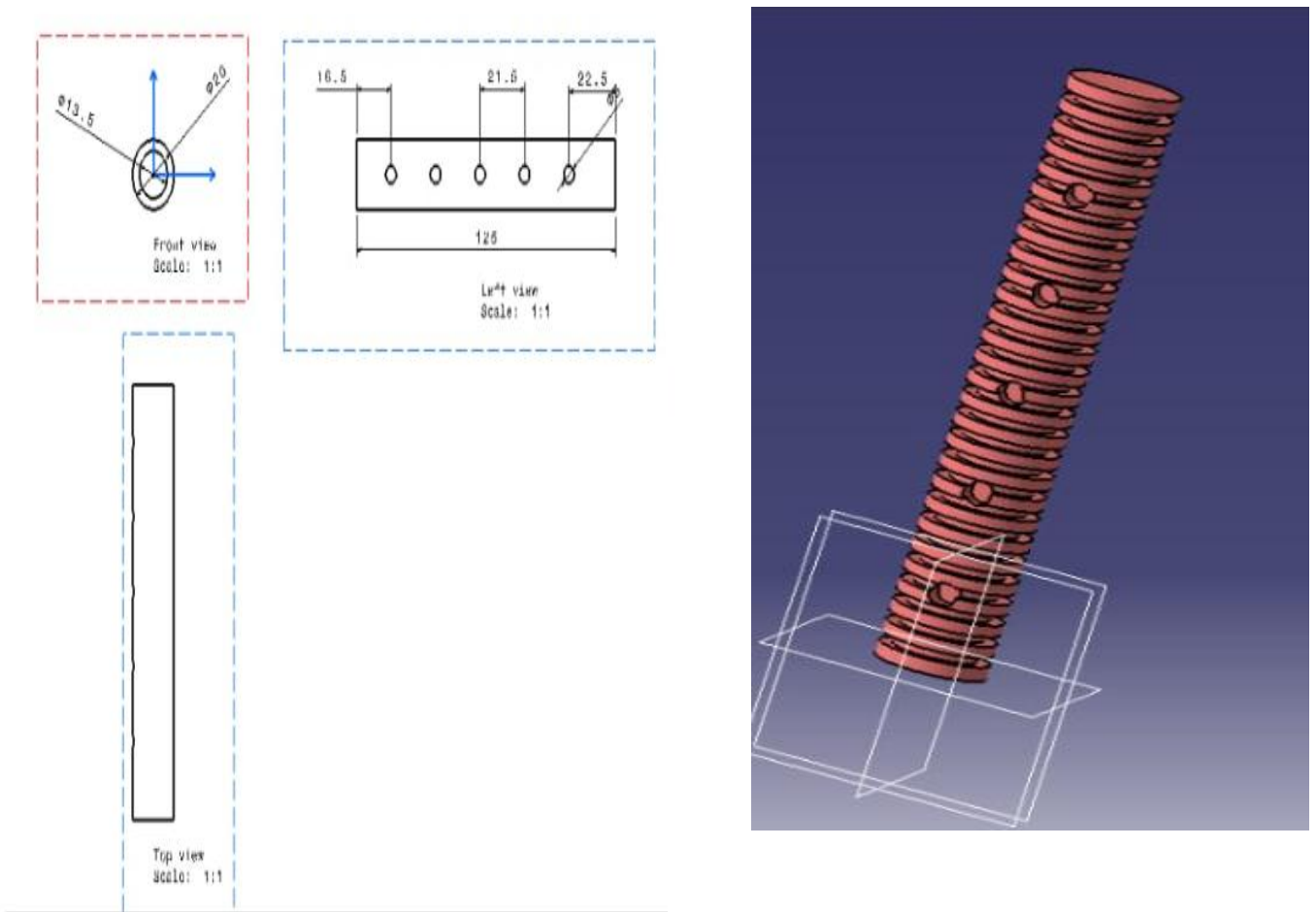


Fig 2: Circular Threaded Fin

III. MANUFACTURING OF FINS

NAME OF GEOMETRY	MATERIAL USED	DESCRIPTION	DIMENSIONS	IMAGE
SQUARE	Aluminium	In this we have manufactured fin having rectangular cross section to judge its heat dissipation capacity.	15mm*150mm	
SPIRAL	Copper	In this we have manufactured fin having spiral cross section to judge its heat dissipation capacity.	15mm*150mm	
CIRCULAR	Composite(Cu + Al)	In this we have manufactured fin having circular cross section to judge its heat dissipation capacity.	20mm*12mm*150mm	

IV. CONCLUSION

In the work the fins were designed by using an important graphical user interface to analyse and design fins for optimum heat transfer. Three case studies with different design and materials were created. The temperature profile of different fins as a function of length for different materials, and the effect of thickness on the proper length of the fin and the heat transfer rate for copper and aluminium were considered. The best working material was copper with the highest thermal conductivity (395W/mk). Low thickness involves low temperature in the extreme of the fin resulting in a low heat transfer in that zone. Between copper and aluminium, the best material for the same thickness is aluminium because it has the shortest proper length. Though, it is necessary to see the amount of heat remove as, Aluminium having lesser thermal conductivity than copper. The composite fin were manufactured and design to have the optimum heat transfer as well to reduce the cost.

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