Design and Analysis of Engine Cylinder Fins of Varying Geometry and Materials

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Abstract- **The Engine cylinder is one of the significant automobile components, which is subjected to high temperature varieties and warm burdens. Keeping in mind the end goal to cool the cylinder, balances are given on the cylinder to build the rate of warmth exchange. By doing warm examination on the engine cylinder blades, it is useful to know the warmth scattering inside the cylinder. The standard executed in this venture is to build the warmth dissemination rate by utilizing the imperceptible working liquid, only air. We realize that, by expanding the surface region we can build the warmth dispersal rate, so outlining such a substantial complex engine is extremely troublesome. The fundamental reason for utilizing these cooling blades is to cool the engine cylinder via air. Directly Material utilized for assembling cylinder balance body is Cast Iron. In this postulation, utilizing materials Copper and Aluminum alloy 6082 are additionally dissected. Warm examination is finished utilizing all the three materials by evolving geometries, remove between the balances and thickness of the blades for the real model of the cylinder balance body.**

Index Terms- **Engine cylinder fins, CATIA, FEM.**

1. INTRODUCTION

In Internal Combustion engines, burning of air and fuel happens inside the engine cylinder and hot gases are produced. The temperature of gases will be around 2300-2500°C. This is a high temperature and may come about into consuming of oil film between the moving parts and may come about it seizing or welding of same. Thus, this temperature must be lessened to around 150-200°C at which the engine will work generally proficiently. An excessive amount of cooling is likewise not alluring since it diminishes the warm productivity. Along these lines, the question of cooling framework is to keep the engine running at its most productive working temperature. It is to be noticed that the engine is very wasteful when it is icy and thus the cooling framework is outlined such that it avoids cooling when the engine is warming up and till it accomplishes most extreme proficient working temperature, at that point it begins cooling. Warmth engines create mechanical power by separating energy from warm streams, much as a water wheel separates mechanical power from a stream of mass falling through a separation. Engines are wasteful, so more warmth vitality enters the engine than turns out as mechanical power; the distinction is squander warm which must be evacuated. Internal burning engines expel squander warm through cool admission air, hot fumes gases, and unequivocal engine cooling. heat engines produce mechanical power by separating vitality from warm streams, much as a water wheel extricates mechanical power from a stream of mass falling through a separation. Engines are wasteful, so more warmth vitality enters the engine than turns out as mechanical power; the distinction is squander warm which must be expelled. Internal burning engines expel squander warm through cool admission air, hot fumes gases, and express engine cooling. Engines with higher productivity have more vitality leave as mechanical movement and less as waste warmth. Some waste warmth is fundamental: it guides warm through the engine, much as a water wheel works just if there is some leave speed (vitality) in the waste water to divert it and account for more water. In this way, all warmth engines require cooling to work.

Cooling is in like manner required in light of the way that high temperatures hurt engine materials and salves. Internal-start engines devour fuel more bursting than the melting temperature of engine materials, and adequately hot to set fire to oils. Engine cooling empties imperativeness adequately brisk to keep temperatures low so the engine can survive.

Fig.1 Engine cylinder fin

Most internal ignition engines are liquid cooled utilizing either air (a vaporous liquid) or a fluid coolant go through a warmth exchanger (radiator) cooled via air. Marine engines and some stationary engines have prepared access to a huge volume of water at an appropriate temperature. The water might be utilized specifically to cool the engine, yet regularly has silt, which can obstruct coolant sections, or synthetics, for example, salt, that can synthetically harm the engine. Hence, engine coolant might be gone through a warmth exchanger that is cooled by the waterway.

COOLING SYSTEMS

Liquid cooling system

There are numerous requests on a cooling framework. One key necessity is that an engine fizzles if only one section overheats. Subsequently, it is indispensable that the cooling framework keep all parts at reasonably low temperatures. Fluid cooled engines can fluctuate the measure of their paths through the engine square with the goal that coolant stream might be customized to the necessities of every zone. Fluid cooled engines more often than not have a flow pump. The primary engines depended on thermo-siphon cooling alone, where hot coolant left the highest point of the engine piece and go to the radiator, where it was cooled before coming back to the base of the engine. Dissemination was controlled by convection alone. Different requests incorporate cost, weight, dependability, and toughness of the cooling framework itself.

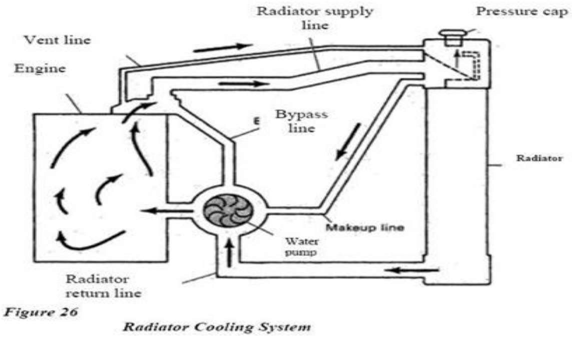

Fig.2. Water cooling system

Conductive warmth exchange is corresponding to the temperature distinction between materials. Air cooled framework is for the most part utilized as a part of little engines say up to 15-20 kW and in aero plane engines. In this framework blades or expanded surfaces are given on the cylinder dividers, cylinder head, and so on. Warmth created because of ignition in the engine cylinder will be directed to the balances and when the wind streams over the blades, warmth will be disseminated to air.

The measure of warmth scattered to air relies on:

(a) Amount of air coursing through the balances.

(b) Fin surface zone.

(c) Thermal conductivity of metal utilized for balances.

Most present day internal ignition engines are cooled by a shut circuit bringing fluid coolant through directs in the engine piece, where the coolant retains warm, to a warmth exchanger or radiator where the coolant discharges warm into the air. Along these lines, while they are at last cooled via air, in light of the fluid coolant circuit they are known as water-cooled. Conversely, warm created by an air-cooled engine is discharged specifically into the air. Regularly this is encouraged with metal balances covering the outside of the cylinders which increment the surface territory that air can follow up on.

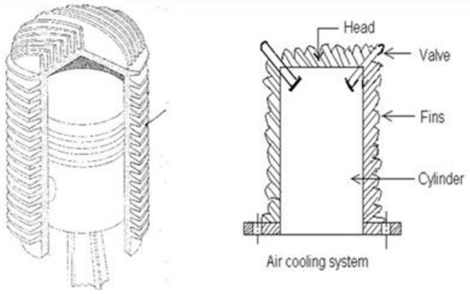

Fig.3. Air cooling system

2.MODELING OF FIN THROUGH CATIA

Model are prepared by using CATIA V5

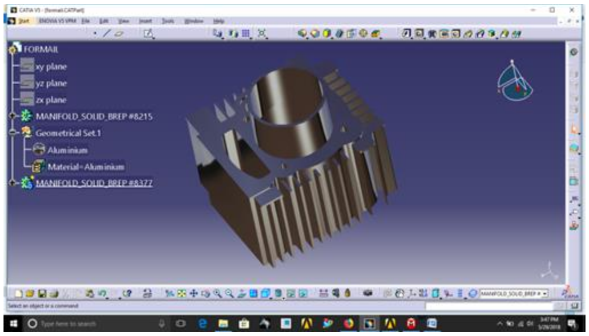

Fig.3 engine fins of 2mm thickness

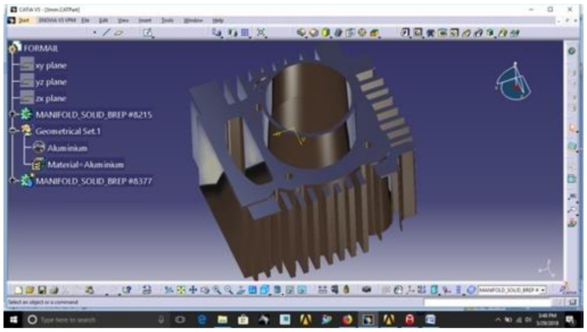

Fig .4 engine fins of 3mm thickness

3. ANALYSIS BY ANSYS

analysis of engine fins with the thickness of 2mm

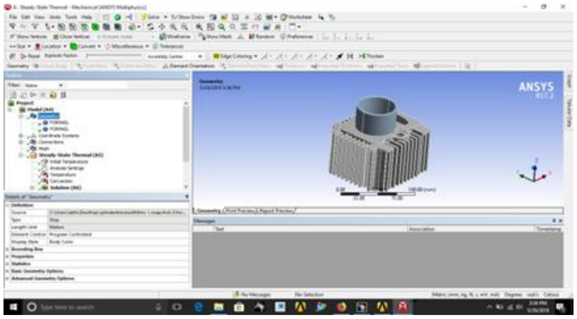

Fig 5 engine fin geometry in ansys work bench

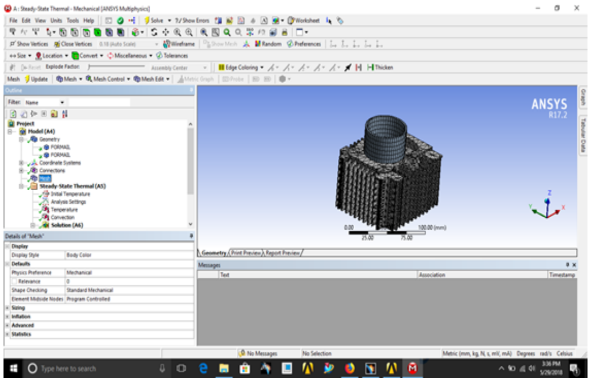

Fig 6 mesh model in ansys

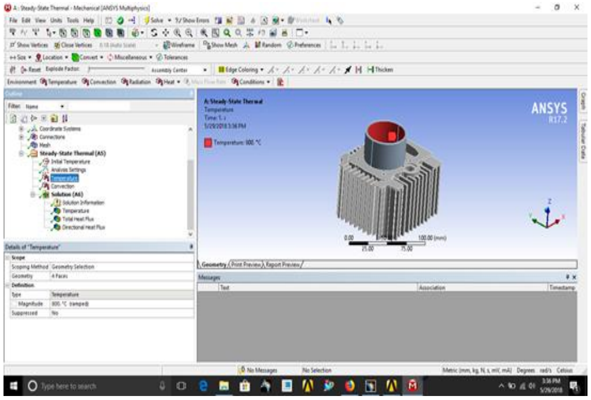

Fig 7 input temperature

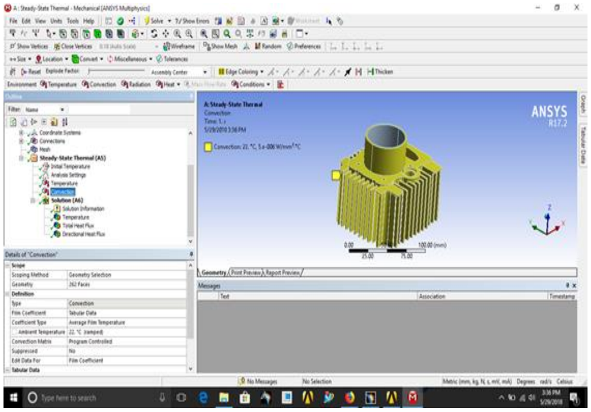

Fig 8 convection

Result of engine fins with 2mm with the material of al6061

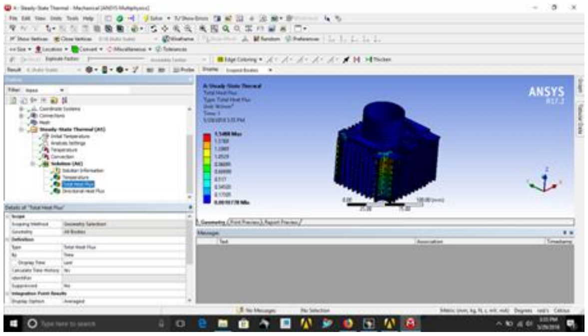

Fig 9 total heat flux

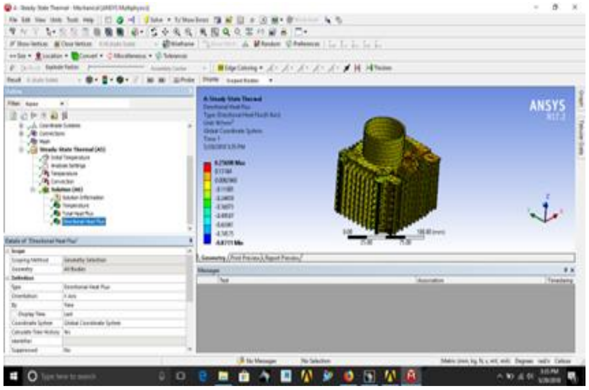

Fig 10 directional heat flux

Al204

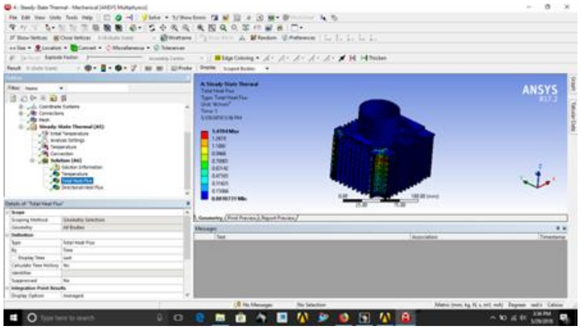

Fig 11 total heat flux

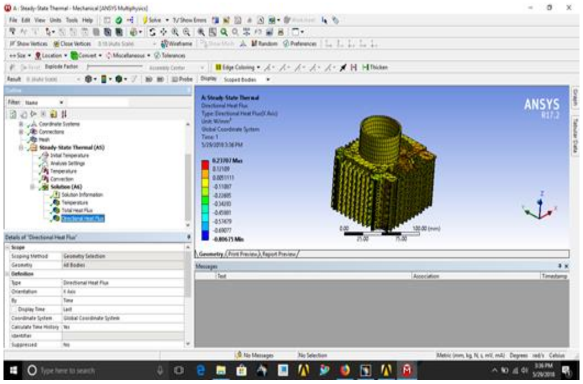

Fig 12 directional heat flux result of engine fins with 3mm thickness

Al 6061

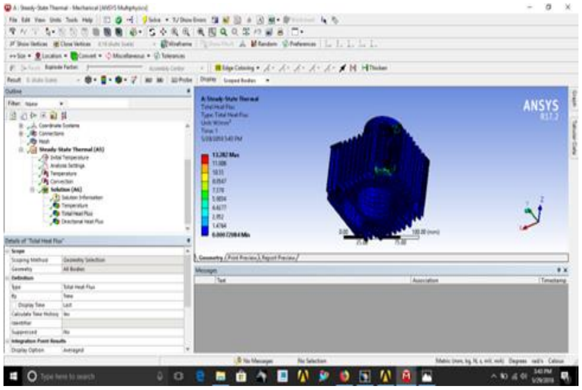

Fig 13 total heat flux

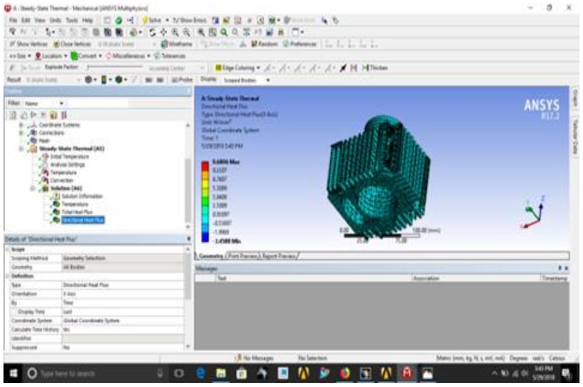

Fig 14 directional flux

Al204

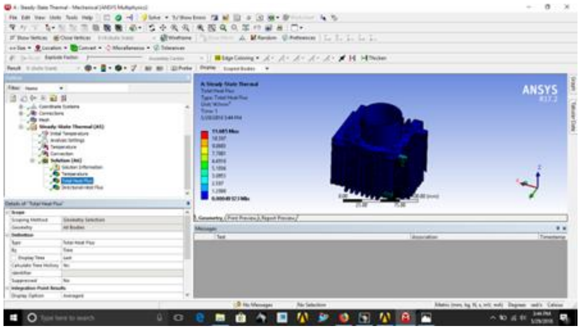

Fig 15 total heat flux

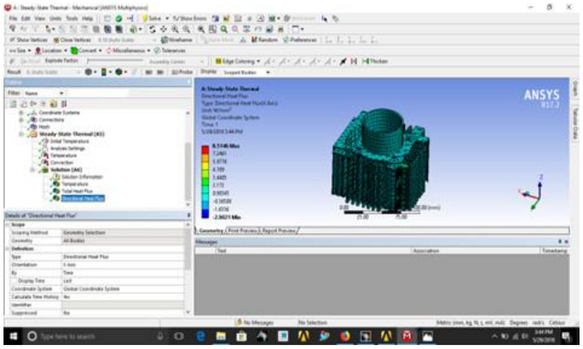

Fig 16 directional heat flux

4.RESULT AND DISCUSTION

s.no	Material name	Thickness	Heat flux (W/mm^2)	Directional heat flux (W/mm^2)
1	Al-6061	2mm	1.15488	0.25698
2		3mm	13.282	9.6806
3	Al-204	2mm	1.4194	0.23703
4		3mm	11.685	8.5146

5.CONCLUSION

Extracting maximum amount of energy from the flue gases at high temperature to improve efficiency of an ic engine. In this project, thermal behavior on engine fins are analyzed.The design of engine finis generated by using CATIA V5 design software. thermal analysis is performed on the engine fin by applying temperature.

The engine fins are subjected to high thermal values, elevated temperatures and are operated in aggressive environments.The engine fins are made of exotic materials to survive in this environment. Three materials such as used for manufacture of engine fins of a ic engine.

Study on different materials which are suitable for the improvement of engine fins. The best material has been suggested for engine fin by analysis on different materials.

Maximum elongations and temperatures are observed at the tail portion of the fin and minimum elongation and temperature variations at the root of the blade are observed. Maximum defletionsare found at the root of the engine fin and upper surface.by comparing in above result aluminium alloy is better when we increase the fin thickness the heat flux of the engine fin increase so by thermal we are concluding that 3mm thickness with Al-204 is better then the Al-6016

REFERENCES

[1] IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p- ISSN: 2320-334X, Volume 11, Issue 6 Ver. I (Nov- Dec. 2014), PP 37-44

[2] Thermal Engineering by I. Shvets, M. Kondak

[3] Thermal Engineering by Rudramoorthy

[4] Thermal Engineering by R.K. Rajput

[5] Thermal Engineering by Sarkar

[6] Online Materials

[7] Gibson, A.H., The Air Cooling of Petrol Engines, Proceedings of the Institute of Automobile Engineers, Vol.XIV (1920), pp.243–275.

[8] Biermann, A.E. and Pinkel, B., Heat Transfer from Finned Metal Cylinders in an Air Stream, NACA Report No.488 (1935).

[9] Thornhill, D. and May, A., An Experimental Investigation into the Cooling of Finned Metal Cylinders, in a

[10] Free Air Stream, SAE Paper 1999-01-3307, (1999). (

[11] 4) Thornhill, D., Graham, A., Cunnigham, G., Troxier, P. and Meyer, R.,

[12] Experimental Investigation into the Free Air-Cooling of Air-Cooled Cylinders, SAE Paper 2003-32-0034, (2003). (5) Pai, B.U., Samaga, B.S. and Mahadevan, K., Some

[13] Experimental Studies of Heat Transfer from Finned Cylinders of Air-Cooled I.C. Engines, 4th National Heat Mass Transfer Conference, (1977), pp.137–144.

[14] (Nabemoto, A. and Chiba, T., Flow over Fin Surfaces of Fin Tubes, Bulletin of the Faculty of Engineering, Hiroshima University, (in Japanese), Vol.33, No.2 (1985), pp.117–125.

[15] Nabemoto, A., Heat Transfer on a Fin of Fin Tube, Bulletin of the Faculty of Engineering, Hiroshima University, (in Japanese), Vol.33, No.2(1985),pp.127–136.

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