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REVIEW: STEADY AND TRANSIENT ANALYSIS OF ENGINE CYLINDER HEAD WITH FINS AT 300⁰C AND 500⁰C

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ABSTRACT

Heat is created when gasoline is consumed in an engine. Friction between the changing pieces generates extra heat. Around 30% of the power emitted is converted into usable work, while the other 70% must be withdrawn from the engine to keep the components from melting. Long surfaces called fins are installed at the perimeter of the engine cylinder in air-cooled I.C engines to increase heat switch charge. That is why fin evaluation is critical for increasing heat transfer fee. The major purpose of this work is to review previous research done to increase heat transfer charge of cooling fins by modifying cylinder fin form and fabric.

Keywords*: IC Engine, Fins, Engine performance, Efficiency , Heat Transfer, Thermal Analysis, Steady State Analysis.*

1. INTRODUCTION

The internal combustion engine is a type of engine in which a fuel is burned with an oxidizer (usually air) in a combustion chamber. The expansion of high-temperature and high-pressure gases produced by combustion gives direct force to a few components of an internal combustion engine, such as pistons, turbine blades, or a nozzle. This force propels the aspect forward, generating valuable mechanical electricity. Most modern-day internal combustion engines are cooled using a closed circuit of liquid coolant flowing through channels within the engine block, where the coolant absorbs warmth, to a warmth exchanger or radiator, where the coolant releases warmth into the air.

As a result, even though they are ultimately cooled by air, they are referred regarded as water-cooled due to the liquid-coolant circuit. In comparison, heat created by an air-cooled engine is released directly into the air. Typically, this is helped by metallic fins overlaid on the exterior of the cylinders, which increase the surface area on which air may act. In all combustion engines, a large proportion of the heat generated (approximately forty four%) leaves via the exhaust, not via a liquid cooling mechanism or the metallic fins of an air-cooled engine (12%). Approximately 8% of the heat electricity finds its way into the oil, which, while generally intended for lubrication, also plays a role in heat dissipation via a cooler.

There are three types of heat transmission. The first is conduction, which is defined as heat transmission via a medium.

Without bulk motion of the substance, intervening should be counted. A stable has two floors, one at high and one at low temperatures. This type of heat conduction can occur in a jet engine, for example, through a turbine blade. The outside floor, which is exposed to gases from the combustor, is hotter than the inside floor, which has cooling air following it. Convection, or heat switch due to a flowing fluid, is the second heat transmission system. The fluid can be a gas or a liquid, and both have uses in aircraft generation. The warmth is transferred by bulk transfer of a non-uniform temperature fluid in a convection warmness switch. The 0.33 process involves the transport of electrical through space without the presence of matter. Radiation is the most effective heat switch technique in the area. Even when there is an intervening medium, radiation can be critical; a common example is heat transfer from a gleaming piece of metal or from a fireplace.

Convective heat transfer between surfaces and surrounding fluid can be improved by introducing slender strips of metallic known as fins. Extended surfaces are another name for fins. When available surfaces are insufficient to transmit the needed amount of heat, fins can be employed. Fins are synthetic and come in a variety of sizes and shapes depending on the use. Air cooling for an integrated circuit The engine is a well-known example of an air cooling system in which air serves as a medium. Heat generated in the cylinder can be dissipated into the environment via conduction mode via the fins or extended surfaces used in this device, which can be included around the cylinder.

Figure 1 [12]

2. LITERATURE REVIEW

Pulkit Agarwal etc. [1] simulated the heat transfer in motor cycle engine fan using CFD analysis. It is observed that ambient temperature reduces to the very low value; it results in over cooling and poor efficiency of the engine. They have concluded that over cooling also affects the engine efficiency **Magarajan U et.al. [2]** have studied heat release of engine cylinder cooling fins with six numbers of fins having pitch of 10 mm and 20 mm, and are calculated numerically using commercially available CFD tool Ansys Fluent. The engine was at 150 C and the heat release from the cylinder was analyzed at a wind velocity of 0 km/h. Their CFD results were mostly same as that of the experimental results. So, they concluded that, it is possible to modify the fin geometry and predict those results, changes like tapered fins, providing slits and holes in fins geometry can be made and the optimization of fins can be done. **A.K. Mishra et.al. [3]** carried out transient numerical analysis with wall cylinder temperature of 423 K initially and the heat release from the cylinder is analyzed for zero wind velocity. The heat release from the cylinder which is calculated numerically is validated with the experimental results. To increase the cylinder cooling, the cylinder should have a greater number of fins. However, the cylinder cooling may decrease with an increased number of fins and too narrow a fin pitch. **G. Babu and M. Lavakumar [4]** analyzed the thermal properties by varying geometry, material and thickness of cylinder fins. The models were created by varying the geometry, rectangular, circular and curved shaped fins and also by varying thickness of the fins. Material used for manufacturing cylinder fin body was Aluminum Alloy 204 which has thermal conductivity of 110-150W/mk and also using Aluminum alloy 6061 and Magnesium alloy which have higher thermal conductivities. They concluded that by reducing the thickness and also by changing the shape of the fin to curve shaped, the weight of the fin body reduces thereby increasing the efficiency. The weight of the fin body is reduced when Magnesium alloy is used and using circular fin, material Aluminum alloy 6061 and thickness of 2.5mm is better since heat transfer rate is more and using circular fins the heat lost is more, efficiency and effectiveness is also more. S.S. **Chandrakant et.al.[5]** conducted experiments for rectangular and triangular fin profiles for air velocities ranging from 0 to 11 m/s. Experimental and CFD simulated result proves that annular fins with rectangular fin profiles are more suitable for heat transfer enhancement as compared to triangular fin profiles. Surface temperature of triangular fin profile is higher than rectangular fin profile at different air velocity. Heat transfer coefficient increase with increases with increases in velocity in both profiles. In comparison of both profile rectangular fin profile have higher heat transfer coefficient than triangular fin profile.

3. PROBLEM FORMULATION

There are many demands on a cooling system. One key requirement is that an engine fails if just one part overheats. Therefore, it is vital that the cooling system keep all parts at suitably low temperatures. Liquid-cooled engines are able to vary the size of their passageways through the engine block so that coolant flow may be tailored to the needs of each area. Locations with either high peak temperatures (narrow islands around the combustion chamber) or high heat flow (around exhaust ports) may require generous cooling. This reduces the occurrence of hot spots, which are more difficult to avoid with air cooling. Air cooled engines may also vary their cooling capacity by using more closely-spaced cooling fins in that area, but this can make their manufacture difficult and expensive. Conductive heat transfer is proportional to the temperature difference between materials. If engine metal is at 300 °C – 500 ^{0}C and the air is at 20°C, then there is a 230°C temperature difference for cooling. An air-cooled engine uses all of this difference.

4. CONCLUSION

A brief summary of the work completed and significant conclusions derived from this investigation are : – Models for different shapes of Fins were developed and effects of wind velocity and heat transfer coefficient values were investigated. – Heat transfer rate increases after changing fin geometry. – Because of non-uniformness in the geometry of Fins turbulence of flowing air increases which results in more heat transfer rate. The shape and thickness along with material plays an important role in defining the amount of heat transfer from the fins. Also, thickness of the fins plays an important role in heat transfer. As we keep reducing the thickness, heat transfer rate is shooting up for a defined shape and material. But while reducing the thickness, we should consider the strength of the fins to understand that till which thickness fins can withstand the working temperatures

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