ISSN: 2278-0181
NCRAIME-2015 Conference Proceedings

Experimental Heat Transfer Analysis On Wavy Fin In Four Stroke Petrol Engine

Sathish.P
PG scholar .
(Department Of Mechanical Engineering)
Kumaraguru College Of Technology,

Ayyappan .PR
Assistant Professor (SRG)
(Department Of Mechanical Engineering)
Kumaraguru College Of Technology,

Abstract— **The engine head is one of the major IC engine part, which is subjected to high temperature . To cool the head, fins are given on the surface of the head to increase the rate of heat transfer. By doing experiment on the heat transfer on the engine head, it is helpful to know the heat dissipation inside the head. By the way of wavy shape fin structure put into use in the project is to increase the heat transfer rate by using invisible working fluid of air we know that by increasing the surface area we can increase the heat transfer rate.The main purpose of using these cooling fins is to cool the engine engine head by air. The main aim of the project is to study the heat transfer rate by different geometry with the same material figure out difference variation in temperature distribution over time**

Keywords—heat transfer, wavy fins, cylinder head.

I. INTRODUCTION

An IC engine is one in which the heat transfer to the working fluid occurs within the engine itself , usually by the combustion of the fuel with the oxygen of air. Internal combustion engines use heat to convert the energy of fuel to power.In IC engine all of the fuel energy is converted to power. And after converting the heat to power excess heat must be removed cycle .The heat is moved to atmosphere by fluids low temperature due to combustion process engine temperature is not consistent throughout the power .If the excess heat is not removed, engine component fail due to excessive temperature .Heat moves from areas of high temperature to areas of low temperature area . In engine when fuel is oxidized (burned) heat is produced. Additional heat is also generated by friction between the moving parts. Only approximately 30% of the energy released is converted into useful work. The remaining (70%) must be removed from the engine to prevent the parts from melting

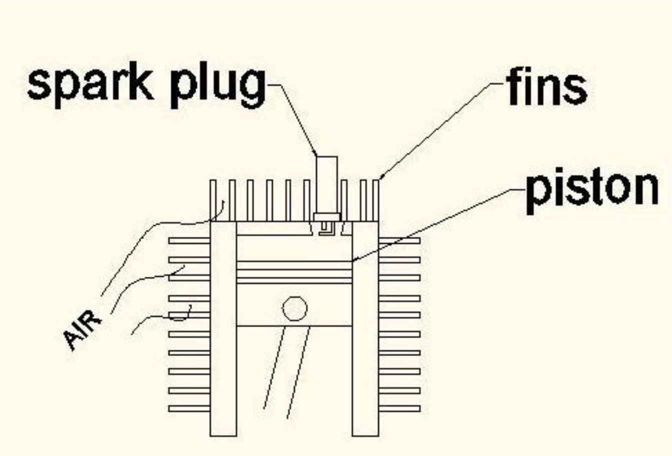


Fig .1 four stroke SI engine cylinder with straight fins

IC ENGINE CROSS SECTION

Peak burned gas temperature in engine is near about 2500 K and during combustion period heat fluxes may reached to 10 MW/m^2, during other parts of the cycle it is essentially zero .The maximum metal temperature for the inside of the combustion chamber is much lower values due to cracking on materials aluminum alloys 400 ^{o}c prevent deterioration of lubrication oil (keep below 180 C) also spark plugs and valves

Must be kept cool to avoid knock and pre ignition problem basically we should maintain the combustion temperature to achieve high heat transfer reduce the engine efficiency

Extended fins are well known for enhancing the heat transfer in ic engine. However liquid cooled system is better than air cooled system but in SI engine air cooled system is better than liquid cooled and simpler also. Therefore it is very important for air cooling system to utilize extended surface fins effectively to obtain uniform temperature in cylinder periphery

LITRATURE REVIEW

"Thermal Analysis Of IC Engine Cylinder Fins Array Using CFD"

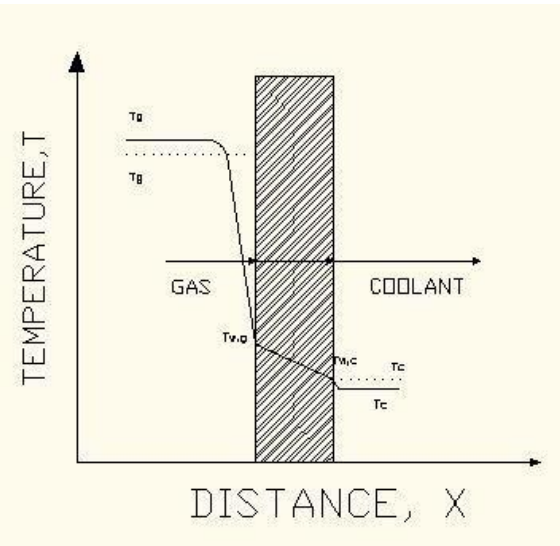
Thermal analysis of various geometry and materials in engine cylinder fin Comparison of engine heat loss, effectiveness and efficiency Specific power and efficiency are affected by the magnitude of engine heat transfer .This paper focuses on a substantial difference of heat flux exists for various places in the cylinder of an engine

"Thermal Analysis Of IC Engine Heat Transfer Rate To Improve Engine Efficiency"

Paper focuses on varying geometry,material.Aluminium alloy 6061 is having better heat transfer rate .efficiency and effectiveness of fins.

"Thermal analysis and optimization of engine cylinder fins by varying its geometry and materials"

Thermal analysis of various geometry and materials in engine cylinder fins. Comparison of engine heat loss, effectiveness and efficiency .The principle implemented in the project is to increase the heat dissipation rate by using the invisible working fluid, nothing but air. We know that, by increasing the surface area we can increase the heat dissipation rate,



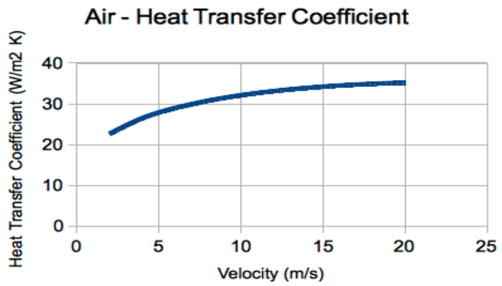
OVERALL HEAT TRANSFER FROM SI ENGINE

An air cooled motor bike engine dissipates waste heat from the cylinder through the cooling fins to the cooling air flow created by the relative motion of moving motorbikes. The cooling system is an important engine subsystem. The air cooling mechanism of the engine is mostly dependent on the fin design of the cylinder head .it also depends on the velocity of air and the ambient temperature

$$Q = h_c A\,(T_{sur} - T_{amb})$$

For force convection ,convective heat transfer coefficient

$$h_c = 10.45 - v + 10\,v^{1/2}$$



EXISTING MODEL SPECFICATION

Greaves Mk25 Portable Engine

Engine type	Four Stroke , Air Cooled.
Displacement Volume	256 cc
Cylinder Head Material	Aluminum Alloy Adc 12
Fin Shape	Rectangular
Rated Power	2.2 kw
Speed	3000 rpm
Fuel	Petrol
No Of Cylinder	1
Bore X Stroke (mm)	70 x 66.7
Continuous Hp	3.4 hp
Max.Torque (Nm)	14 @ 1700 rmp
No Load Min Rpm	1700
No Load Max Rpm	4000
Compression Ratio	4.67
Weight	26
Iginition Timing	28 deg btdc
Ignition System	electronic
Spark Plug	mico w95t2/m45z8
Fuel Capacity	4.5
Lubrication Method	splash type
Engine Oil	20 w 40
Sump Capacity (ml)	1100
Governor Type	centrifugal fly
Starting Method	rope and pully

CYLINDER HEAD WITH STRAIGHT FINS

fig 1.1

ISSN: 2278-0181

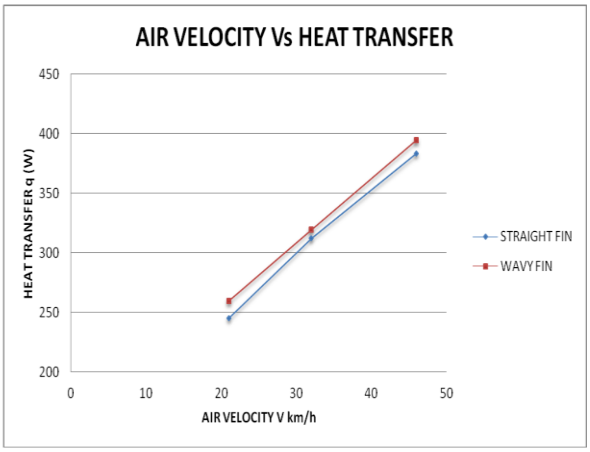
HEAT TRANSFER CALCULATION

\

Heat release , Q=mcΔT

Where ,

Q=heat released by cylinder in watts



m= mass of the heat storage liquid ,in kg,

C=specific heat capacity j/kg k

ΔT=change in temperature at inlet and outlet,in K

BOUNDARY CONDITIONS ARE MENTIONED IN THE TABLE BELOW

1	ENGINE LINEAR SPEED	50
2	TEMPERATURE OF SURROUNDING (AMBIENT)	30 ^{O}C
3	GEOMETRICAL ALTITUDE	ABOVE SEa LEVEL
4	HEAT TRANSFER COFFICIENT W/M^2 K	**10**
5	THERMALCONDUCTIVITY W/M^2 K	**92**
6	NOMINAL WIND SPEED	**10.4**

CYLINDER HEAD WITH WAVY FINS 3D MODEL

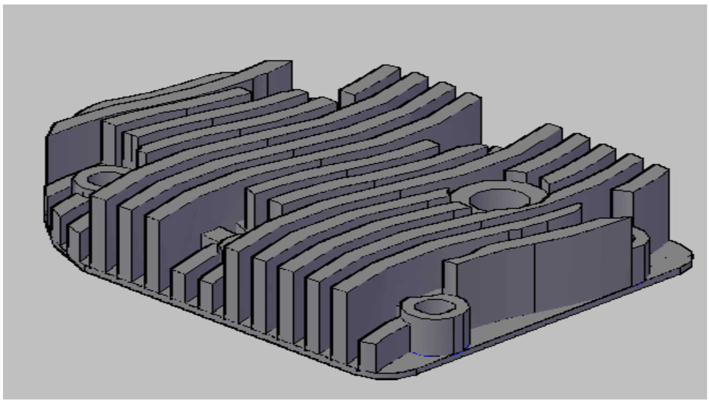


fig 1.2 Cylinder Head With Wavy Fins 3D Model

CYLINDER HEAD WITH WAVY FINS IN IC ENGINE

fig 1.3 Cylinder Head With Wavy Fins In IC Engine

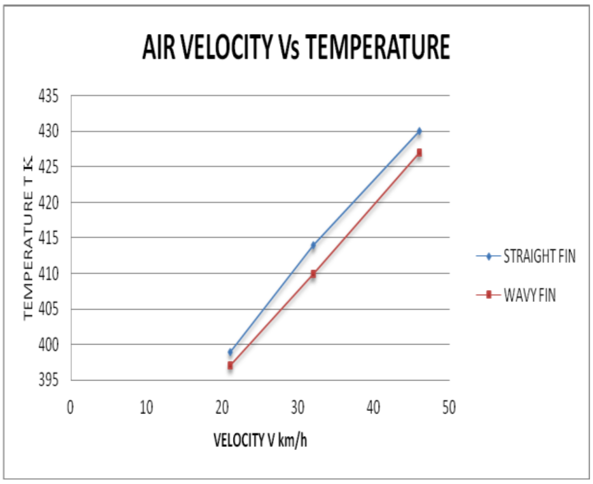
RESULT AND DISCUSSION

Base Temperature 415^{o} c

AIR VELOCITY Vs HEAT TRANSFER IN FIN

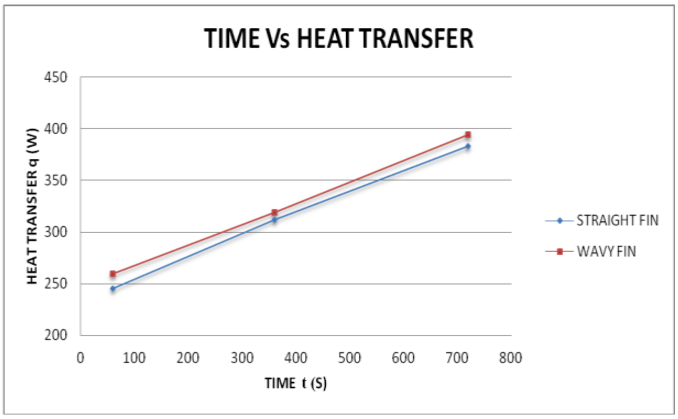
This graph represents the air velocity Vs heat transfer rate in fin with different profile

AIR VELOCITY Vs TEMPERATURE IN FIN



This graph represents the air velocity Vs temperature rate in fin with different profile

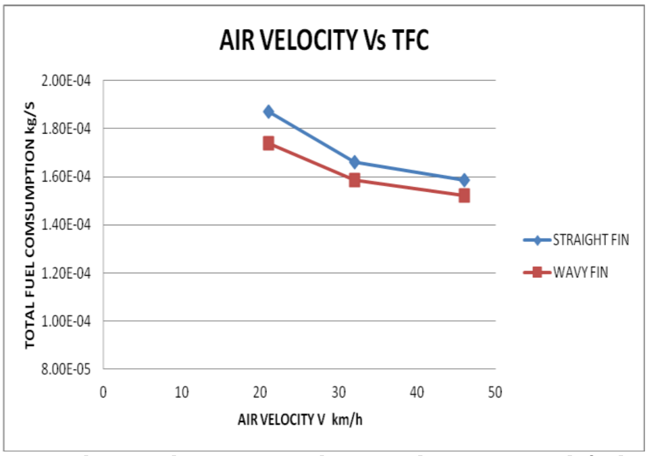
TIME Vs HEAT TRANSFER IN FIN



This graph represents the time Vs heat transfer rate in fin with different profile

PERFORMANCE OF IC ENGINE

AIR VELOCTY Vs TOTAL FUEL CONSUMPTION



This graph represents the air velocity Vs total fuel consumption rate in fin with different profile

COMPARISON OF HEAT TREANSFER ON FINS

SNO	Velocity Km /h	STRAIGHT Fin Heat transfer rate q (w)	WAVY Fin Heat transfer rate q (w)
1	21	245	259
2	32	333	342
3	46	387	402

CONCULSION

We have done experimental heat transfer analysis on wavy fins .The fin geometry and cross sectional area affects the heat transfer coefficient . During vehicles travelling high speed and distance wavy fins provide better efficiency. Wavy passage between the fins resulted in swirl being created it helps to increasing the heat transfer .Thick fins with less numbers as it helps inducing greater turbulence and hence higher heat transfer .

ACKNOWLEDGEMENT

We would like to sincerely acknowledge the en courageous effort of mechanical engineering department of kumaraguru college of technology, Coimbatore. Our heart full Thanks to faculty members who helped us in prepare this and give direction with their precious suggestion and rich experience.

REFERENCES

1. Pratima S.patil, S.N.belsare, Dr.s.l.borse. **“Analysis of internal combustion engine heat transfer rate to improve engine efficiency’’.**International journal of mechanical engineering and technology .Volume 3 issue 2,May 2012 pg 447-452 .
2. G.Raju, Dr.Bharamarapanitapu, S.C.V RamanamurthynaiduOptimal. **“design of an ic engine cylinder fin array a binary coded genetic algorithm’’** International journals of modern engineering research vol 2 issue 6 Nov-Dec 2012 pg 4516-4520.
3. Magarajan U.Thudilkarruparaj, Elango .T **“Numerical study on heat transfer ic engine cooling by extened fins using CFD ”** Research journals of recent science vol 1 issue 6 June 2012.
4. Mr .N. Phani Raja Rao, Mr.T.Vishnu Vardhan. **“Thermal analysis and optimization of engine cylinder fins by varying its geometry and materials”** International journals of engineering research sciences. Vol2 issue 8 Aug 2013.
5. Mishra A.K. Nawal.S and Thundilkaruppa Raj R “**Transfer augmentation of air cooled internal combustion engine using fins through numerical techniques”**. Research journal of engineering science vol 2 Aug 2012 pg 32-40.
6. G Babu, M.Lavakumar . **“Heat transfer analysis and optimization of engine cyinder fins of varying geometry and materials”** IOSR Journals of mechanical and civil engineering vol 7 issue 4 Jul-Aug 2013 pg 24-29.
7. Mohsin A Alil Dr Sm kherde **“Design modification and analysis of two wheeler cooling fins”** International journals of engineering and applied science. vol 5 June 2014.
8. N.Nagarani and k .Mayilsamy **“Experimental heat transfer analysis on annular circular and elliptical fins”** International journals of engineering sciences and technology vol 2 issue 7 pg no 2839-2845 .
9. A.Mohammadi M.Yaghoubi **“Estimation of instantaneous local heat transfer coefficient in spark iginition engine”** International journals of thermal science 49 2010 pg 1309-1317.
10. R.Arularasan,p Hemanandhan.T Thamizhselvan **“Modeling and simulation of engine cylinder fins by using FEA”** International journals of engineering and applied science vol 2 issue 4 Apr 2014.