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Design and Analysis of I.C Engine Cam Shaft

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Abstract – *A camshaft is a shaft to which a cam is fastened or of which a cam forms an essential component. He project is directed towards the modelling of cam shaft in a 3-d cad tool referred to as stable works. Once the CAD model is received, the thermal evaluation is done the usage of three substances Ductile iron, 6061-alloy and alloy metallic material. The camshaft is optimised by way of growing the cam profile radius to 40mm.Finally the thermal evaluation is executed for optimised cam shaft. The current cam shaft the results temperature difference is greater for Alloy metallic compared to Ductile iron and Alloy steel cloth .Also the heat flux is likewise greater for the alloy metallic material in comparison to final substances. The optimised cam shaft the effects temperature difference is extra for Alloy metal as compared to Ductile iron and Alloy steel fabric .Also the heat flux is also more for the alloy metallic fabric compared to remaining materials. Therefore first-class cloth for Camshaft is Alloy metal some of the 3 materials*

Key Words: *Camshaft, optimised, Alloy metal Ductile iron and Alloy steel cloth*

1. INTRODUCTION

Cam: A projection on a rotating component in machinery, designed to make sliding contact with another component whilst rotating and to impart reciprocal or variable motion to it. Cams are used to convert rotary motion into reciprocating movement Camshaft: A shaft with one or greater cams attached to it, e.G. Operating of valves in an inner combustion engine is managed by using camshaft. Cam shaft is known as the "mind" of the engine.

1.1 Cam Terminology

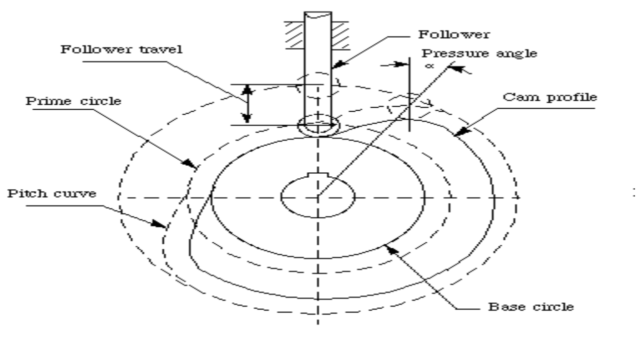


Fig: 1.1 the smallest circle cantered on the cam rotation axis.

2. LITERATURE REVIEW

According to A. Rivola, M. Troncossi, [1]G. Dalpiaz and A. Carlini, in "Elastodynamic analysis of the desmodromic valve train of a racing bike engine by a combined lumped/finite element model" if a rocker has a ratio of 1.Five:1, it have to open the valve 1.5 times the amount of the cam elevate.[2] Almost all manufacturing facility type rockers fall short in their claims. Chevy claims a 1.5:1 rocker ratio on small-blocks, I located that maximum are 1.Forty four:[3] and below. In a healthful street motor .020" less valve lift ought to mean a ten to 15 hp power loss. So make certain that the rockers that you choose are from a reputable agency. I've had correct good fortune with Crane Cams, Iskenderian, and Competition Cams.[4] Also in evaluate proven in www.Grapeaperacing.Com/tech/ Valvetrain & consistent with A. Rivola, M. Troncossi, G. Dalpiaz and A. Carlini, in "Elastodynamic analysis of the desmodromic valve train of a racing motorcycle engine, the centre pivot point isn't at the same aircraft as the valve touch factor.

3. SOLID MODELING

Solid modeling in widespread is beneficial due to the fact this system is frequently capable of calculate the dimensions of the object it is creating. Many sub-styles of this exist. Constructive Solid Geometry (CSG) CAD uses the identical primary good judgment as 2D CAD, this is, it makes use of organized stable geometric items to create an item. However, those sorts of CAD software frequently cannot be adjusted once they are created.

DESIGN OF I.C ENGINE CAMSHAFT

Engine specification Power = 35 H.P. (for two cylinders)

Speed = 2200 rpm Torque (max) = 10.2 kgm

Cylinder volume = 1.96 lit. (1960cc)

Max. Pressure = one hundred forty bar at 2 hundred of crank angle from TDC

Bore = 102 mm

Stroke = a hundred and twenty mm

Compression ratio = 17:1

Inlet valve opens = 100

BTDC Inlet valve closes = 460 ABDC

Exhaust valve opens = 460 BBDC

Exhaust valve closes = a hundred ATDC

Firing order = 1-2 5.1.2

Camshaft dimensions:-

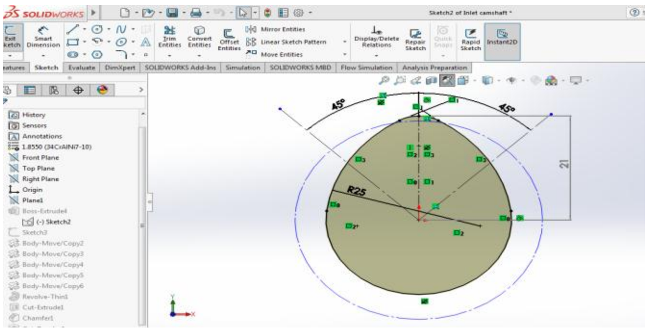
Camshaft diameter = eighty mm

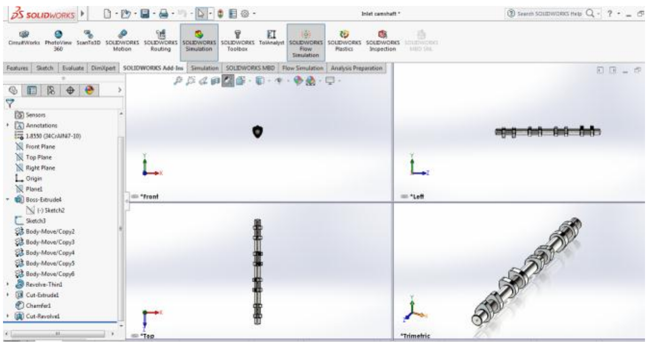
Journal diameter = 50 mm

Cam peak = 21 mm

Total lift of cam = 7.65 mm

three.3 Sketch of CAM profile:





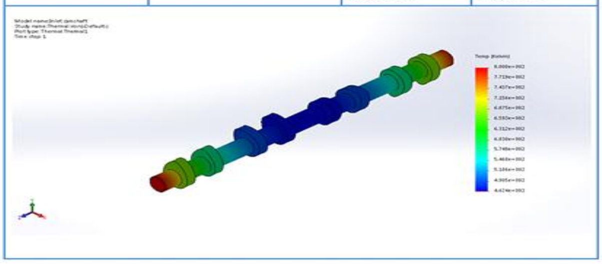
4. THERMAL ANALYSIS OF I.C ENGINE CAM SHAFT USING DUCTILE IRON MATERIAL

4.3 Material Properties

Model Reference	Properties
	Name: Ductile Iron Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Thermal conductivity: 75 W/(m.K) Specific heat: 450 J/(kg.K) Mass density: 7100 kg/m^3

4.8 Study Results

Name	Type	Min	Max
Thermal1	TEMP: Temperature	462.355 Kelvin Node: 831	800 Kelvin Node: 262



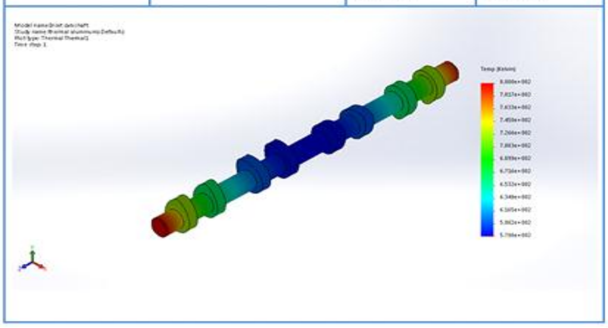
4.1 THERMAL ANALYSIS OF I.C ENGINE CAM SHAFT USING 6061-ALUMINUM MATERIAL

4.9.3 Material Properties

Model Reference	Properties
	Name: 6061 Alloy Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Thermal conductivity: 170 W/(m.K) Specific heat: 1300 J/(kg.K) Mass density: 2700 kg/m^3

4.9.7 Study Results

Name	Type	Min	Max
Thermal1	TEMP: Temperature	579.84 Kelvin Node: 831	800 Kelvin Node: 262



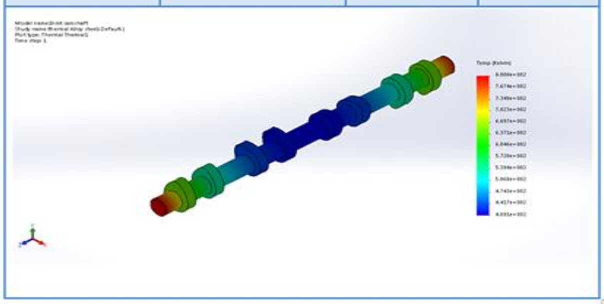
4.2 THERMAL ANALYSIS OF I.C ENGINE CAM SHAFT USING ALLOY STEEL MATERIAL

4.10.3 Material Properties

Model Reference	Properties
	Name: Alloy Steel Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Thermal conductivity: 50 W/(m.K) Specific heat: 460 J/(kg.K) Mass density: 7700 kg/m^3

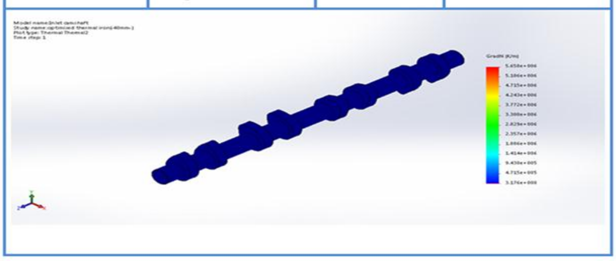
4.10.7 Study Results

Name	Type	Min	Max
Thermal1	TEMP: Tmperature	409.123 Kelvin Node: 831	800 Kelvin Node: 262



4.3 OPTIMISATION OF CAMSHAFT PROFILE BY INCREASING THE CAM PROFILE RADIUS TO 40MM

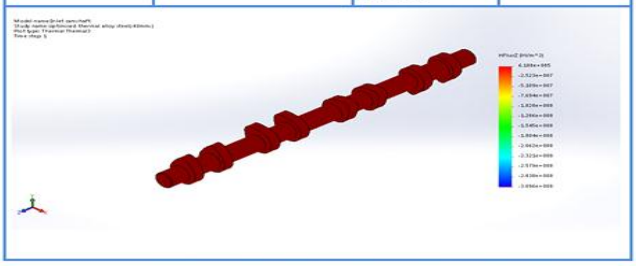
Name	Type	Min	Max
Thermal2	GRADN: Resultant Temp Gradient	3.17642 K/m Node: 2234	5.65784e+006 K/m Node: 139



4.14.6 Mesh information - Details

Total Nodes	18268
Total Elements	11261
Maximum Aspect Ratio	14.687
% of elements with Aspect Ratio < 3	90.3
% of elements with Aspect Ratio > 10	0.00888
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:03

Name	Type	Min	Max
Thermal3	HFLUXZ: Z Heat Flux	-3.09619e+008 W/m^2 Node: 139	618780 W/m^2 Node: 267



5. RESULTS AND DISCUSSIONS

5.1 From thermal analysis the results are tabulated as below:

	EXISTING				OPTIMISED			
	MAX TEMP.	MIN. TEMP	TEMP. GRADIENT (K/m)	Heat Flux(W/m2)	MAX TEMP.	MIN. TEMP	TEMP. GRADIENT (K/m)	Heat Flux(W/m2)
DUCTILE IRON	800	462.3	36764	2.22E+06	800	463.72	5.66E+06	436213
6061-ALUMINUM	800	579.8	22291.3	3.06E+06	800	581.26	3.88E+06	572472
ALLOY STEEL	800	409.13	44944.6	1.81E+06	800	410.2	6.27E+06	618780

From the above consequences we will infer that temperature distinction is more for Alloy steel in comparison to Ductile iron and Alloy metal material .Also the heat flux is likewise more for the alloy metal cloth as compared to closing two materials.

Also from the optimized cam shaft the consequences temperature difference is extra for Alloy metallic compared to Ductile iron and Alloy metallic material .Also the warmth flux is also extra for the alloy metal cloth in comparison to remaining materials.

Therefore satisfactory fabric for Camshaft is Alloy metal among the three materials.

6. CONCLUSIONS

A camshaft is a shaft to which a cam is fastened or of which a cam forms an essential component. Camshafts are chargeable for the appropriately-timed gas injections required through inner combustion engines.

Camshafts have a couple of cams on them, which are used to open valves via both direct contact or pushrods.

A camshaft is immediately coupled to the crankshaft, so that the valve openings are timed thus.

Then with using stable works 3-dimensional version of the cam shaft is received. Once the CAD version is acquired, the thermal evaluation is achieved the use of 3 materials Ductile iron, 6061-alloy and alloy metallic fabric.

The camshaft is optimised via increasing the cam profile radius to 40mm.

Finally the thermal evaluation is carried out for optimised cam shaft.

The present cam shaft the effects temperature distinction is extra for Alloy metal in comparison to Ductile iron and Alloy metal material .Also the heat flux is also extra for the alloy metallic cloth as compared to ultimate two substances.

The optimised cam shaft the consequences temperature difference is greater for Alloy metallic in comparison to Ductile iron and Alloy metallic fabric .Also the heat flux is also more for the alloy metal material in comparison to remaining substances.

Therefore quality material for Camshaft is Alloy metal among the 3 materials.

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[3]. Gunter Knoll, Adrian Rienäcker, Jochen Lang, "Lehrstuhl für Maschinenelemente und Tribologie Universität Gh Kassel Germany", McGraw-Hill Book Company, p. 700 f.

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