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# Design And Manufacturing Of Camless Engine

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***Abstract***

*As we all know that the automobile basically deals with the engine manufracturing and the working of the engine. The weight of the engine is the issue while designing the automobile. So as to reduce the weight of the automobile here is the new concept of (CLE) Camless Engine. The main objective of the project is manufacture a camless engine. We are using the electro/hydraulics/pneumatic forces to run the engine. Main objective is to control the valve timing of the engine. The goal of maximum displacement and frequency is 10mm and 50Hz respectively. The hydraulics spool and the piezoelectric stack are the basic main component of the engine.*

*The project was divided into 3 phases,*

1. *Conceptual development*
2. *Design and Manufacturing*
3. *Testing and Analysis*

*Keywords—(CLE) Camless Engine, Piezoelectric stack, Pneumatic*

## I. INTRODUCTION

The automobile manufacturer have recognised that the engine is runnedon the concept of camshaft. The speed of the engine is dependent on the rotation of the camshaft. If the decision are taken before then there will be saving of the economy. And they will be able work on the powerful performance and to increase the fuel economy. There are many devices which helps to regain the variable valve timing for the engine.

As we know that the concept of variable valve timing is existing for sometime . This concept has made an evolution in the field of automobile. The engineers use to only deal with the testing and the virtual design of the engine. This camless engine allows to choice the best cams for the engine but this are very less energy efficient. Many attempts were made by the ford motors to develop the engine using the solenoid. Solenoids where use to control the hydraulics fluids while the opening and closing of the valves. The solenoid is a binary control device they are ON or OFF. So the fluid floe is either flowing or blocked by the solenoids. This design allows some of the variance but is still limited by response capabilities. So it cannot directly address valve velocity and the valve displacement .

Although the original objective of the project was to develop a system that could actuate an engine valve at 50 Hz, this system has reached 500 Hz. The 50 Hz target was selected because it is the equivalent of an engine speed of 6000 rpm. The second aim of the project was to overcome the piezoelectric stacks limited displacement. The stacks used currently have a maximum displacement of 30 µm, but engine valve displacement must approach 10 mm. This task is accomplished through two distinct multipliers. First, the movement of the stack is multiplied by a 5:1 solid hinge and lever. This creates 150 µm of movement and is sufficient to actuate the hydraulic spool valve. The slight movement of the spool valve redirects hydraulic fluid, pressurized at 50 bars, to either the top or bottom of a piston.

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## II. DESCRIPTION

The camless engine was created on the basis of an existing four-cylinder, four- valve engine. The original cylinder head with all the valves, springs, camshafts, etc. was replaced by a new cylinder head assembly fully integrated with the camless valve train. The camshaft drive was eliminated, and a belt-driven hydraulic pump was added. There was no need for lubrication, and the access for engine oil from the engine block to the cylinder head was closed off. No other changes to the engine have been made.

## III. DESIGN OF COMPONENTS

**Calculations for Motor:**

N=30 rpm
V=12
I=1.5
Here,
Power,
P=V*I
P=12*1.5
P=18 watt
Hence for torque T,
P=2πNT/60*1000
T=P*60*1000/2π*30
T=18*60*1000/2π*30
T=5.29*10^3
Now for Motor diameter.
T=π*d^3*Syt/16
Syt=210Mpa
F.O.S=2
σ(all) =Syt/F.O.S
=210/2
=105N/mm
5.29*10^3=π*d^3*105/16
d=6.03 mm
Therefore we consider d=6mm.

**Calculations for Shaft:**

Bending Moment,
m=force*perpendicular distance
m=200*100
m=20000.

Now, for diameter of shaft
m=π*d^3*σ(all)/32
20000=π*d^3*105/32
d=12.47 mm (by calculations).
d=10 mm (by assuming standards)

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Therefore the diameter of shaft=10 mm.

**Calculations for Bearing:**

p=v*fr + y * fa
Where,
p=Equivalent dynamic load
v=Radial load constant
fr=Radial load
y=Axial load constant
fa=Axial load
p=v*fr+y*fa
p=1*200+0…..(v=1 standard value ref DME-2)
p=200N

Now for life of bering,
L=(C/P)^a
( Where , C=Dynamic Load
a=3 (for ball bearing) P=Equivalent dynamic load)
a=1/3(for roller bearing)
Therefore we know that,
L=60*N*Ca/10^6
Where,
N=rpm
Ca= Capacity of bearing (Maximum load that can safely be applied)which is 4000 mpa .
Therefore,
L=60*N*Ca/10^6
L=60*1000*4000/10^6
L=240
Now,
L=(C/P)^a
L=(C/P)^a
240=(C/200)^3
C=1243.89N
C=1.2KN
Therefore the life of bearing is 240 million revolutions.

## IV. RELEVANCE

In actual the project deals with study which is related to engineering. In four years of engineering course one of the subject from each semester is related to this project. A subject like Thermodynamics and Automobile Engineering gives a fair idea related to Engine. The subject like Material Science gives the deep idea about the proper material selection and its relevant properties. The subject like Metallurgy gives idea about the defects occuring while casting and subject like Metrology and Quality Control helps in finding out results. As the project basically deals with Engine working has main role in this project. In short the total project is based on whole study of Mechanical Engineering.

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## V. MOTIVE

Firstly by minimizing the friction losses occurring during the mechanical working if the engine. This will increase the efficiency of the engine. We will also increase the actuating timing of the inlet and exhaust valves. Air fuel mixture will increase properly.

## VI. SUMMARY

An electro pneumatic camless valve train was developed for a camless engine. Initial development confirmed its functional ability to control the valve timing, lift, velocity, and event duration, as well as to perform selectively variable deactivation in a four-valve multi-cylinder engine.
The electro pneumatic valve train is integral with the cylinder head, which lowers the head height and improves the engine packaging. The benefits expected from a camless engine points to substantial improvements in performance, fuel economy, and emissions over and above what is achievable in engines with camshaft based valve trains.

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