Torsional Vibration In Engine and use of viscous damper.

V.R.Navale [1], Dr. C.L.Dhamejani[2]

[1]V.R.Navale Department of Mechanical Engineering, Jaihind college of Engineering, Savitribai Phule Pune University,pune[MS] INDIA

[2]Dr. C.L.DhamejaniDepartment of Mechanical Engineering, Jaihind college of Engineering, Savitribai Phule Pune University,pune[MS] INDIA

ABSTRACT

Aim is takespart in torsional vibration theory and their practical experiences used in dampers which are widely used in automobile application & civil applications. This report paper highlights a number of important considerations for the torsional viscous damper system as well as design philosophies to assess and mitigate the risk of torsional failures. Damping properties are of significant importance in determining the dynamic response of structures, and accurate prediction of them at the design stage, especially in the case of light-weight, wind-sensitive buildings, is very desirable. Unfortunately, damping parameters cannot be deduced deterministically from other structural properties and recourse is generally made to data from experiments conducted on completed structures of similar characteristics. Such data is scarce but valuable, both for direct use in design and for furthering research into the phenomenon of damping.So use of damper is very much useful to reduce the torsional vibration.So viscous damper is mostly use for this purpose.

Keywords- *torsional, vibration, damper etc.*

I. INTRODUCTION

Crankshafts are applied everywhere it is necessary to convert reciprocating motion into rotational one or inversely. In engines and compressors they are commonly used.
Piston combustion engine in operation generates vibrations which result from occurrence of periodically varying gas and inertia forces. The forces generate the following kinds of vibrations:

- bending vibrations,
- axial vibrations,
- torsional vibrations.

The first two kinds of vibrations occurring in car combustion engines do not constitute any great danger for life time of their crankshafts but for ship large-power engines axial vibrations of crankshafts are a serious problem. Such vibrations cause that the entire system consisted of engine crankshaft, flywheel, shaft line and screw propeller displaces periodically along its axis. Axial vibration amplitude of the system practically depends on a design solution of screw propeller, namely, number of its blades.

In many mechanical systems such as reciprocating systems e.g. IC Engines, compressors etc. rotary systems, system experiences torsional oscillations to some degree during operation. The torsional response of the rotary and reciprocating equipment should be analyzed and evaluated to ensure the system reliability. Excessive torsional vibration often occurs with the only indication of a problem being gear wear; gear tooth failures, key failures and broken shafts in severe cases.

In the civil engineering field, fluid viscous dampers, applications, have found commercial applications on buildings and bridges subjected to seismic and/or wind storm inputs. Because fluid damping technology was proven thoroughly reliable and robust, implementation on footbridges to suppress undesirable pedestrian-induced vibrations is taking place.

Resonant torsional vibrations are most dangerous for engine's crankshaft, as - in contrast to transverse and axial vibrations - they do not propagate to other parts of the engine, e.g. bearing casings, and in many cases they also do not generate noise which is a factor informing engine's operator on an incorrect work of the engine.

II. LITERATURE REVIEW

A. *Won-Hyun Kimand Soo-Mok Lee* Relatively abundant references are found about the identification of damping in crankshaft torsional vibration system of the reciprocating engines in the earlier studies of engine development. However there are few recent documents about practical investigation of engine crankshaft damping, but yet more reliable method about modeling of the damping is still required in the crucial situation of field application and development

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B.*Farzin H. Montazersadgh and Ali Fatemi* (2007)an extensive literature review on crankshafts was performed by Farzin H. Montazersadgh and Ali Fatemi (2007). Their study presents a literature survey focused on Dynamic loading analysis of the crankshaft results in more realistic stresses whereas static analysis provides an overestimate results.

C.Boysal and H. Rahnejatare say The complex orbit obtained is as a result of the motion of a forward synchronous component (i.e., the crankshaft speed) plus a non synchronous component rotating backward at nearly half the angular velocity of the synchronous component

IV. PROBLEM DEFINITION AND SCOPE

A. *Problem Definition:*

Use of viscous damper to reduce the torsional vibration. and different static ,dynamics consideration to reduce it.

B. *Description of problem*

There are not possible methods to reduce thevibration in engine so we have considering use of damper and absence of damper in engine.

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C. *Objectives*

1. Detailing the theory and experimental investigation of techniques for torsional vibration analysis.
2. Identifying inherent limitations and factors which directly influence experimental studies of this nature.

III.THEORY

A. Damping

The resistance to vibration is nothing but the damping. Going back to physics, the simplest equation of a damper is,

$$F = CV$$

Where,
F is the force exerted by the damper,
C is the damping coefficient,
V is the velocity of the damper.
Types of Torsional Dampers Used
- Rubber damper
- Torsional viscous damper.

Rubber Dampers

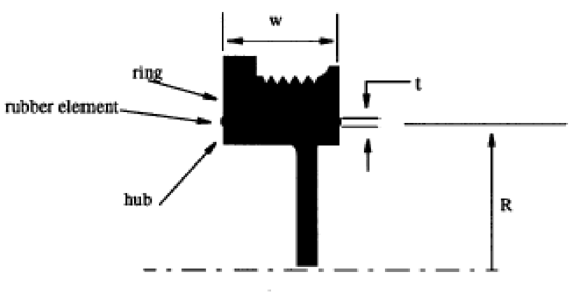

Fig 1.Typical Rubber Damper Configuration

A crankshaft rubber damper is an example of a damped, tuned absorber. The damper is composed of an inertia ring, rubber element, and a hub, such as shown in figure below. The inertia ring is connected to the hub through the rubber element. The rubber element converts torsional energy into heat through shear forces.

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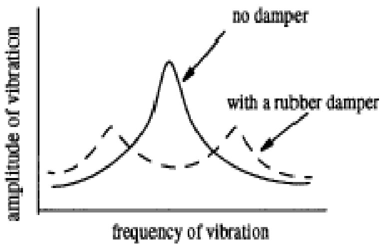

This example is for a 6.0 order crankshaft nose angular displacement.

Fig.2 Typical Rubber Damper Influence On Torsional Vibration

Rubber dampers are typically effective for engines with a total engine displacement of less than 7 liters (427 cubic inches). They are limited by their capacity to dissipate heat and rubber stress.

B. Viscous dampers

Typically, it is not possible to remove all of the crankshaft's unacceptable critical speeds from the engine's operating range. Thus, a vibration damper is needed to reduce the amplitudes of these resonances to acceptable levels. The damper should be located at the point on the crankshaft with the highest angular displacement; this is typically the crank nose, or the free end of the crankshaft. Many styles of vibrations dampers exist: rubber, viscous, pendulum, spring and friction. The two most commonly used vibration dampers are rubber and viscous.

A.Selection of damper-

In advance of commencing design of a viscous torsional vibration damper its designer should obtain, from engine producer, an appropriate set of necessary data.
The data should contain the information on:
-kind of fuel (petrol, diesel oil),
-number of cylinders,
-type of engine (two-stroke, four-stroke),
-Minimum rotational speed of engine,
-maximum rotational speed of engine,
-range of operational speed of engine (if not constant),
- ignition sequence,
-main journal diameter,
-crank journal diameter,
- cylinder diameter,
-mean indicated pressure,
-total weight of masses in reciprocating axial motion,
-torsional stiffness of shaft between cylinders,
-permissible value of twist angle of shaft,
-limitations for damper gabarites.

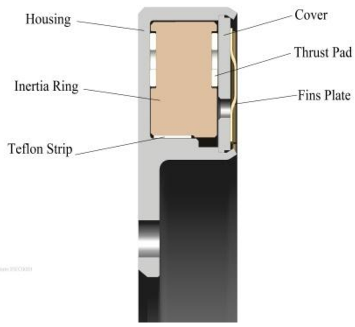

Fig-3 Viscous Dampers

Engines with a total cylinder volume of greater than 7 liters (427 cubic inches) generally require viscous dampers. Viscous dampers are composed of an inertia ring floating in a silicone fluid within a case (See Figure: A Typical Viscous Damper Configuration). The silicone fluid converts torsional vibration energy into heat through shear forces. The damping characteristics of the viscous damper can be optimized by varying the clearances between the hub and ring, as well as by selecting particular silicone fluids. Unlike the rubber damper, the viscous damper does not split the crankshaft mode into two separate modes. The viscous damper attenuates the torsional vibrations of the crankshaft mode for which it is tuned. See Figure typical viscous damper influence on torsional vibration.

Working-Viscous damper operates totally on shear force. silicone fluid having high viscosity so it will develops the resisting force to the torsional vibration. and its viscosity property leads to change or reduce the vibration.

V.MATERIAL USED AND THEIR PROPERTIES

A. Introduction

Material selection is one of the foremost functions of effective engineering design as it determines the reliability of the design in terms of industrial and economical aspects. A great design may fail to be a profitable product if unable to find the most appropriate material combinations. So it is vital to know what the best materials for a particular design are. How we are going to get an idea about the best materials for a design? In this aspect engineers use several facts of materials to come to the most reasonable decision. They are mainly concentrated on the properties of the materials which are identified as the potential materials for that specific design

B.Factor Which Are Considering To Selection of Material

When a certain design is going to be actually produced it must be subjected to a number of manufacturing practices depending on the material and the design process. At the completion of production it must be totally fit for the service phase, too. In order to predict the reliability of both of these requirements, the materials must be able to withstand a certain load. Therefore the material must possess a certain strength and stiffness. Selected materials are examined for strength and stiffness values, and then potential materials are further inspected for other desired properties.

Material selection is one of the prime concerns in mechanical engineering design as mechanical engineers possess great deals with various loads and temperature variations. Material selections in engineering designs such as civil engineering structures also are very crucial.

C.Silicone fluid used in damper?

The silicone is a gel more than 45,000 times thicker (more viscous) than 30 weight motor oil and is proven to be an excellent damping medium. How much silicone is in the damper? The silicone fills the shear gap, the space between the inertia ring and housing which is measured in thousandths of an inch. The silicone is engineered and precisely metered for the specific requirements of an engine.

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D.Material Used For Damper

Dampers are usually manufactured from cast iron. Not all cast iron is created equal and to save cost some aftermarket balancers use regular “grey” cast iron which has limited strength and is prone to cracking. all power bond street series dampers are manufactured exclusively from high strength S.G. iron (also known as nodular iron) which is the same material used in most crankshafts. This high-grade iron has much greater resistance to cracking than the cheaper grey iron.

VI. CONCLUSION

From the above theory and observation its very much useful to damper assembly in engine to reduce the vibration..The absence of damper most is needful to improve the engine life & reliable system.
Again say that viscous damper is best solution for damping and to absorb the vibration.

ACKNOWLEDGEMENT

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