A NOVEL APPROACH FOR DESIGN AND ANALYSIS OF CRANKSHAFT

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ABSTRACT

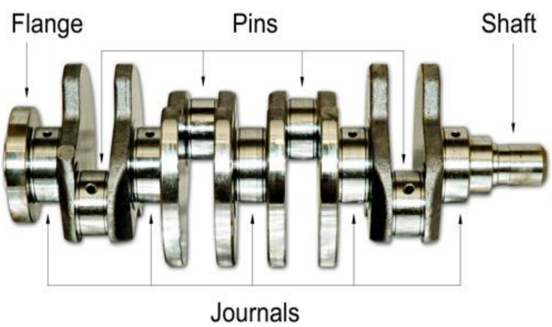
Crankshaft straightness measurement is still used in ways quite simple and yet there is certain equipment that is used to measure the straightness of the crankshaft with accuracy and speed. This often resulted in inaccuracies in measuring the crank shaft, crank shaft so that conditions cannot be optimally detected during the measurement. Manufacture of measuring instruments is done by creating a buffer construction crankshaft that has been calibrated and is supported by a digital measuring tool allowing crankshaft can be measured with precision. While the materials used in the manufacture of this measuring instrument such as ST 37 steel plate, ball bearing, roller pen, etc., which increased access to the milling machine, grinding, drilled and welded. Crankshaft straightness measuring device is operated by placing the crank shaft that has been marked with measurements, on the part of the buffer plate. Then put the needle on the dial indicator of the main axis of the crankshaft and rotate the shaft using threads. And then analyze the deflection of the shaft on the results of these measurements have been performed.

This tool is the equipment of the facility motor fuel equipment in the workshop, which was previously not there a special tool that is used as a measure of expected straightness crankshaft with this tool will make it easier for future generations of students in measuring straightness crankshaft during combustion practices.

INTRODUCTION

Crankshaft (i.e. a shaft with a crank) is a central component of ainternal combustion engine and is used to convert reciprocating motion of the piston into rotatory motion or vice versa. Crankshafts come in many shapes and sizes from small ones found in two-stroke small engines to giant ones found in diesel engines in ships. Crankshafts in automotive engines also vary, each one unique to its engine type and make. The crankshaft main journals rotate in a set of supporting bearings ("main bearings"), causing the offset rod journals to rotate in a circular path around the main journal centers, the diameter of which is twice the offset of the rod journals.

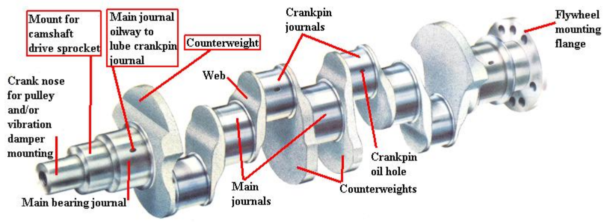
The diameter of that path is the engine "stroke": the distance the piston moves up and down in its cylinder. The big ends of the connecting rods ("conrods") contain bearings ("rod bearings") which ride on the offset rod journals.



The crankshaft consists of the shaft parts which revolve in the main bearings, the crankpins to which the big ends of the connecting rod are connected, the crank arms or webs (also called cheeks) which connect the crankpins and the shaft parts.

In the world of component design, there are competing criteria, which require the engineers to achieve a perceived optimal compromise to satisfy the requirements of their particular efforts. Discussions with various recognized experts in the crankshaft field make it abundantly clear that there is no 'right' answer, and opinions about the priorities of design criteria vary considerably.

CRANK SHAFT NOMENCLATURE



Crank- throw

This is the distance from the main-journal centers to the big-end-journal centers. It is the amount the cranked arms are offset from the center of rotation of the crankshaft. A small crank-throw reduces both the crankshaft turning-effort and the distance the piston moves between the dead centers. A large crank-throw increases both the leverage applied to the crankshaft and stroke of the piston.

Crank-webs

These are the cranked arms of the shaft, which provide the throws of the crankshaft. They support the big-end crankpin. They must have adequate thickness and width to withstand both the twisting and the bending effort, created within these webs. But their excessive mass causes inertial effect, which tends to wind and unwide the shaft during operation.

Main-bearing Journal

Main-journal is the parallel cylindrical portions of the crankshaft, supported rigidly by the plain bearings mounted in the crankcase. The journals diameter must be proper to provide torsional strength. The diameter and width of the journal should have sufficient projected area to avoid overloading of the plain bearing.

Connecting-rod Big-end (Crankpin) Journals

These journals have cylindrical smooth surfaces for the connecting-rod big-end bearings to rub against.

DESIGN PROCEDURE

Bearing Pressures and Stresses in Crankshaft

The bearing pressures are very important in the design of crankshafts. The maximumpermissible bearing pressure depends upon the maximum gas pressure, journal velocity, amount and method of lubrication and change of direction of bearing pressure. The following two types of stresses are induced in the crankshaft.

1. Bending stress; and
2. Shear stress due to torsional moment on the shaft

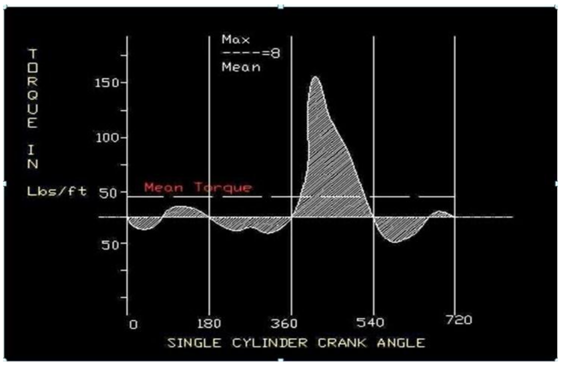
The following procedure may be adopted for designing a crankshaft.

1. The crankshaft must be designed or checked for at least two crank positions. Firstly, when the crank-shaft is subjected to maximum bending moment and secondly when the crankshaft is subjected to maximum twisting moment or torque.
2. The additional moment due to weight of flywheel, belt tension and other forces must be considered.
3. It is assumed that the effect of bending moment does not exceed two bearings between which a force isconsidered.

BALANCING OF CRANKSHAFT

The crankshaft and the connecting-rod convert the reciprocating motion of the piston into one of rotation. The crankshaft is made very stiff, since it is subjected to severe and varying twisting and bending stresses, due to the combustion pressures and also to the “inertia” effects of the reciprocating parts. The latter effects are the forces due to the acceleration and deceleration of the piston and connecting-rod in their strokes. The twisting or turning action on the crankshaft, which is generally spoken of as the Torque, is constantly changing; this fact necessitates a stronger shaft than for a steady motion.

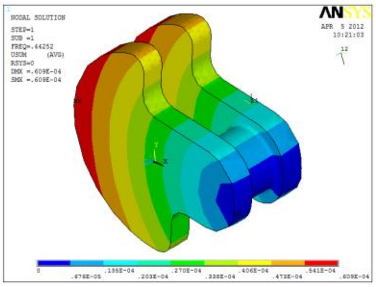
The manner in which the torque varies in the case of a single cylinder engine is as shown in below graph.

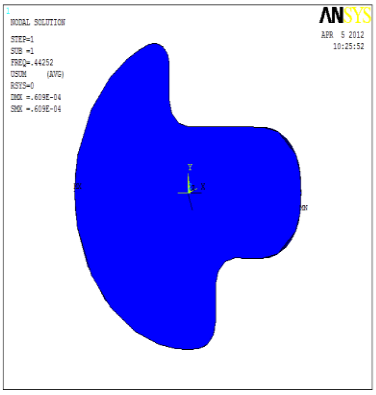


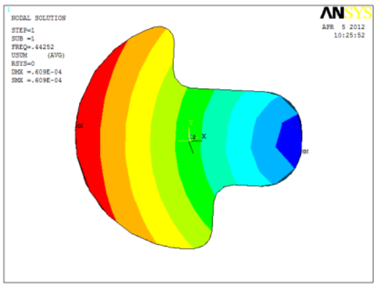
DRAWBACKS OF CRANKSHAFT:

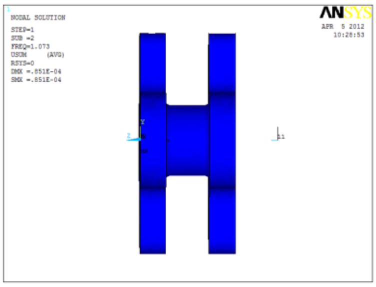
- Since the crankshaft is the main reciprocating part of an engine, its movement creates an imbalance. This imbalance generally manifests itself as a vibration, which causes the engine to be perceivably harsh.
- The friction between the walls of the cylinder and the piston rings eventually results in wear, reducing the effective life of the mechanism.
- The sound generated by a reciprocating engine can be intolerable and as a result, many reciprocating engines rely on heavy noise suppression equipment to diminish droning and loudness.
- To transmit the energy of the piston to the crank, the piston is connected to a connecting rod which is in turn connected to the crank.
- Because the linear movement of the piston must be converted to a rotational movement of the crank, mechanical loss is experienced as a consequence. Overall, this leads to a decrease in the overall efficiency of the combustion process.

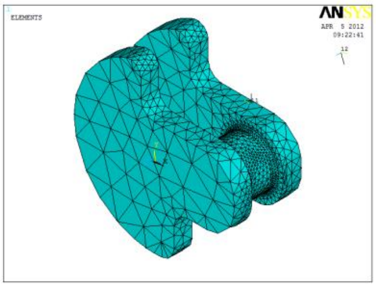
ANSYS ON CRANKSHAFT

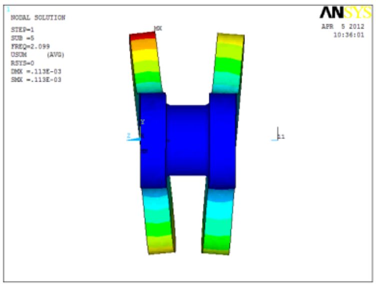


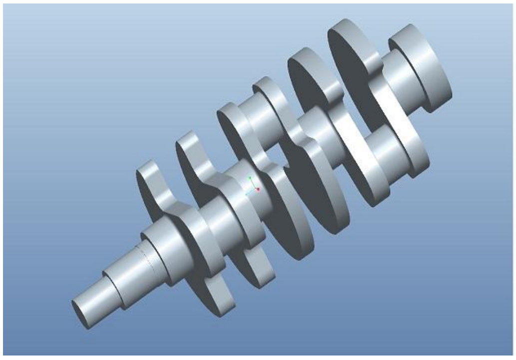












CONCLUSION

The model that is created in Pro/Engineer wildfire 5.0 and analyzed in Ansys V12.1. The model created in Pro/Engineer is transferred to Ansys through iges (initial graphics exchange specification) format.

The structural analysis has been performed on the model by applying the proposed material properties, boundary conditions and loads. By viewing the results that has been discussed in the early chapter, it can be said that the crankshaft model can withstand the proposed loads with considering a factor of safety as 1.2. So, thereafter the designed model can be manufactured or fabricated with extensive testing.

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