MEASURES TO REDUCE THE CAMSHAFT WEAR ON INTERNAL COMBUSTION ENGINES

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ABSTRACT: This paper presents aspects related to the quality of the camshaft. The measures that reduce the camshaft wear on internal combustion engines have been identified and classified. The authors present the use of a modern quality management tool - tree diagram. A shaft diagram has been developed which gives a suggestive picture of the measures to be applied to reduce the camshaft wear on internal combustion engines.

KEY WORDS: internal combustion engine, camshaft, failure, tree diagram

1. INTRODUCTION

Camshaft - ensures during the rotation, through the shape and position of the cams, the functioning of the distribution organs at the appropriate times and for the required duration. Camshaft - ensures during the rotation, through the shape and position of the cams, the functioning of the distribution parts at the appropriate times and for the required duration. It is made from alloy steels by molding or by casting from alloy casting.

The camshaft (figure 1, [1]) is responsible for the air and fuel mixture quality in the combustion chamber and for their evacuation. The opening and closing of the valves is determined by the dimensions and shape of the lobes on the camshafts. By modifying these lobes, the actuation times of the valves can be optimized and implicitly the amount of air or mixture introduced into the combustion chamber.

For maximum power, the camshaft must ensure a maximum advance and delay of opening/closing the valves, a maximum allowed height of their opening, a higher opening speed and a longer opening opening.

A used camshaft can no longer ensure inlet and outlet under normal parameters, thus resulting in poor engine operation and consequently greater fuel consumption.

The literature offers many works that address the issue of camshaft wear on internal combustion engines. Of these we will refer only to a few articles recently published.

Paper [2] presents a new concept for the mechanical and automotive industry, it deals with the problem of the cam design which leads to a very small wear. Cam failure is a major issue and this failure is also known as the lobe failure.

Figure 1. The camshaft, [1]

It is known that the camshaft is generally manufactured by casting. There are concerns about finding design and manufacturing solutions to reduce camshaft defects.
In the paper [3] are given methods that solve the bent camshafts.
The crankshaft is an important component of the internal combustion engine, which often has fatigue failures.
Paper [4] presents an investigation of the crankshaft by which the hardness of the camshaft is studied, the bending test, the microstructure by scanning electron microscopy.
Several studies have been conducted on the factors that determine defects in the camshaft.
The paper [5] presents a number of factors such as: material properties, engine speed, engine loading, lubricant properties, etc. (material properties, engine speed, load on engine, lubricant properties).
This paper presents the results of a study regarding the identification of the measures needed to reduce the camshaft wear on internal combustion engines. The tree diagram is elaborated corresponding to the studied problem. The tree diagram is a modern quality management tool that is applied to improve the quality of many technological products and processes in industrial engineering as well as in many other fields of activity.
In the last decades many studies have been published dealing with the use of quality management tools for the evaluation and resolution of quality/non-quality problems. Such studies on some machine parts are also given in the papers [6, 7]. Also, Luca, co-author of this paper, also published other papers (as single author or first author) in which presented the use of quality management tools for evaluating and solving quality problems in different fields [8, 9, 10, 11, 12].

2.MEASURES TO REDUCE CAMSHAFT WEAR ON INTERNAL COMBUSTION ENGINES

The main factors that determine the camshaft wear on internal combustion engines have been studied. Camshaft wear on internal combustion engines is a common problem and the main causes that cause their wear are:
- Improper design and manufacture of the camshaft (incorrect design conditions - cam stresses, cam tilting angles, incorrect sizing of the supports, poor quality material, non-compliance with the manufacturing technology, measurement errors over the allowed limits, etc.);
- Problems of the lubrication system (defective oil pump, obstruction of lubrication paths through various deposits, use of an inadequate lubricant, failure to observe the lubricant exchange interval, loss of lubricant which makes it impossible to maintain an oil film between the camshaft and the supports him and tacheti);
- Problems of the lubrication system (defective oil pump, clogging of lubrication through various deposits, use of

an inadequate lubricant, failure to observe the lubricant exchange interval, loss of lubricant which makes it impossible to maintain an oil film between the camshaft and its support and follower) ;
- Mechanical problems (locking the followers, the rockers, the valves, the bearing deterioration in the camshaft supports).
It transforms the problems mentioned above into desirable and achievable positive situations. Thus, the necessary measures have been established that determine positive situations. A Brainstorming session was held with specialists in the field of motor vehicle engineering and several papers were consulted in the specialized literature. At the end of the study, a number of measures were identified. Then the corresponding measures were grouped and 3 specific objectives were defined:
1. the proper design and manufacture of the camshaft,
2.providing an adequate lubrication system,
3. elimination of mechanical problems.
Proposed measures for the fulfillment of the objective 1- the design and the corresponding manufacture of the camshaft:
- Correct identification of the tasks and efforts that will act on the camshaft,
- The correct calculation of the dimensional parameters of the camshaft,
- Respecting the quality of the material and the prescribed treatments,
-Compliance with the prescribed manufacturing process,
-Use of appropriate measurement techniques, methods and equipment.
Proposed measures for the fulfillment of objective 2- ensuring an adequate lubrication system:
- Oil pump to ensure the necessary projected oil flow,
- Avoiding the various deposits caused by the inadequate quality of the oil,
- Replacing the oil at intervals much longer than prescribed,
- Using a good quality oil filter,
Proposed measures for the achievement of objective 3 - elimination of mechanical problems:
- Use of suitable bearings for supports and tightening the covers from the supports to the manufacturer's prescribed torques,
- Proper maintenance and operation of the engine,
- Respecting the exchange interval of the distribution and periodic verification of the noxious.
- When mounting the cam shaft, an initial lubrication of all moving metal elements must be ensured.
Based on the data obtained, a three-level tree diagram is drawn (figure 2).
The level I of the diagram is represented by the problem under analysis: the reduction of camshaft wear on internal combustion engines. The level II of the diagram is given by the three specific objectives: the proper design and manufacture of the camshaft, ensuring an adequate lubrication system; elimination of mechanical problems. The diagram also has a level III represented by a total number of 13 proposed measures.

3. CONCLUSION

The tree diagram is a graphical tool that shows in detail all the components of the proposed problem to be solved.
The tree diagram presented in this paper helps to choose the optimum solutions for reaching.
The diagram gives a complete picture of the achievable measures that can be taken to reduce the camshaft wear on internal combustion engines.
For the proposed solutions and measures, the study can be continued with an assessment of the level of feasibility. The tree diagram can be used to evaluate the solutions and measures in relation to their importance to the proposed problem and to establish the measures to be applied when there are several immediate possibilities for solving the problem.

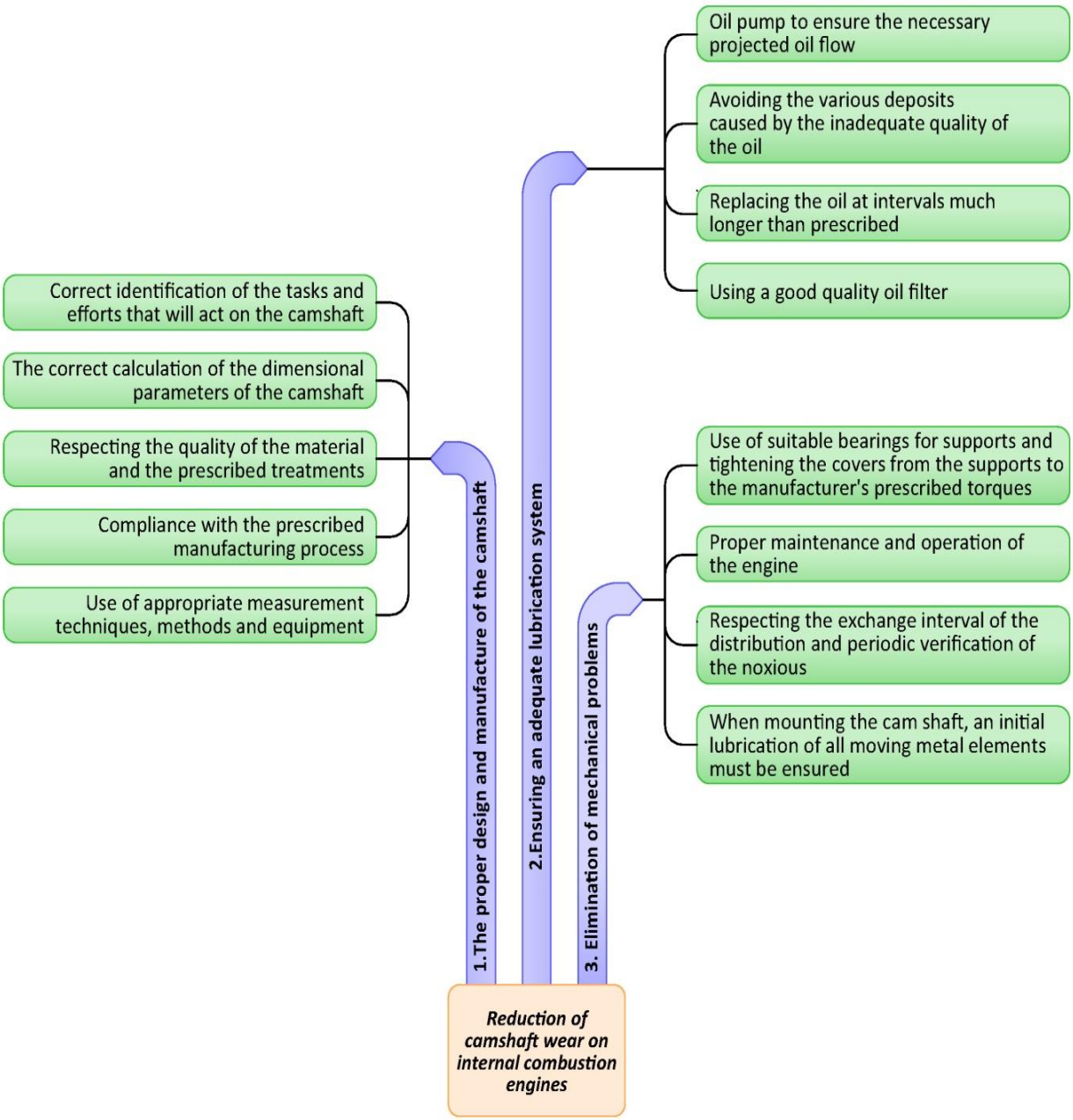

Figure 2. The tree diagram

REFERENCES

[1]https://help.summitracing.com/app/answers/detail/a_id/4698/~/what-camshaft-should-i-buy%3F

[2] Y. Lethwala, Rishabh Jain, Modification and Analysis of Groove Type Camshaft With Ball Type Lifter , International Journal of Engineering Development and Research, Volume 7, Issue 3, pp.765-771.

[3] Amol Sanjeev Kulkarni, Study of remedies on the reasons of the bending of camshafts, International Journal of Innovation in Engineering, Research and Technology (IJIERT), National Conference on Innovative Trends in Engineering & Technology-2016.

[4] Abd Halim Bin Mahat, Mohamad Hafiz Bin Saleh, Mohd 'Akashah Bin Fauthan, Investigation and Failure Analysis for Camshaft, Advanced Journal of Technical and Vocational Education, 2 (3), 23-27, 2018.
[5] R. V. Wanjari, T. C. Parshiwanikar, Failure of Camshaft, International Journal of Innovative Technology and Exploring Engineering (IJITEE) , Volume-2, Issue-6, 2013, pp.248-250.
[6] Ghimisi S., Nicula D., Actions to increase the reliability of chain transmissions, 22nd International Conference on Innovative Manufacturing Engineering and Energy - IManE&E 2018, Issue MATEC Web Conf. Volume 178, article number 06002, 2018.
[7] Ghimisi S., Measures for correct design, manufacturing and exploitation of gear transmissions to increase the reliability, Scientific Bulletin of Naval Academy, vol 21, Constanta, 2018, pp. 103-108.
[8] L Luca, A.V. Todorut, T.O. Luca, Quality management applied to analyze the reduction of the pollution which is generated from road transportation in agglomerated urban areas, Scientific Bulletin" Mircea cel Batran" Naval Academy, Vol 21, nr. 1, 2018, pp.1-8.
[9] Liliana Luca, Minodora Maria Pasare, Ruxandra Elena Luca, Amalia Venera Todorut, Study on a Determination of Measures Needed to Improve the Quality of Analyzes Performed in a Chemical Laboratory, Revista de Chimie, Volume 70, Issue 6, 2019 , pp. 1975-1978.
[10] Luca L., A study on quality analysis measuring process, Fiability & Durability, no.2, 2016, pp. 68-72.
[11] Luca L.,Pasăre M., Stăncioiu A., Study to determine a new model of the Ishikawa diagram for quality improvement, Fiability & Durability, no.1, 2017, pp. 249-254.
[12] Luca L., A new model of Ishikawa diagram for quality assessment, IOP Conference Series: Materials Science and Engineering, Volume 161, Issue 1, 2016
[13] Ionita I., Managementul calitatii si ingineria valorii. Editura ASE Bucuresti, 2008.
[14]Dmitri Kopeliovich, Camshaft bearings, Engine Professional, jan-mar 2015, pp. 82-86.
[15]http://www.cpgnation.com/top-10-cam-failure-culprits/