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THE TECHNOLOGICAL PROCESS OF THE CRANKSHAFT

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Аннотация: Коленчатый вал - одна из важных деталей, используемая в судовом и автомобильном двигателе. Он имеет сложную форму, поэтому трудно получить точные размеры детали. Производство коленчатого вала очень трудное, так как используется много станков для его изговления. В результате в процессе механической обработки возникают дефекты, что снижает надежность. В этой статье мы рассмотрим технологический процесс и различные методы, улучшающие качество коленчатого вала.

Introduction

The crankshaft is one of the most important parts in the automobile and marine engine. It serves to transfer movement from the piston to the axis of the car and for receiving, converting and transferring engine energy to the propeller. Its technological process is complex, thus we will try to research the ways to improve its production.

Technological process

Crankshafts are classified into two types: built-up type crankshafts and solid type crankshafts.

Here are the stages of manufacturing a built-up type crankshaft:

1) Casting design. Casting is the most important technological process of crankshaft production.

2) Patternmaking. One of the main tasks of designers is Patternmaking.

3) Molding. This process is similar to casting.

4) Steel making and pouring. Such important characteristics as toughness, hardness, strength and wear resistance depend on the material.

5) Riser cutting. This is a rather complex process of machining the production of a crankshaft.

6) Annealing. For this purpose, extremely high heating furnaces are used to increase the hardness and other important characteristics of the metal.

7) Rough machining. Basic mechanical processing of absolutely any workpieces.

8) Hot rolling on pin and fillet.

9) Heat treatment.

10) Preliminary final machining.

11) Cold rollingon fille.

12) Final machiningfor shrink fitting.
13) Shrink fitting.
14) Final machining.

Built-up type crankshafts are made by shrinkfitting journals to crankthrows for the numbers of cylinders with cylinder bore-diameters larger than approximately 400 mm. Thetechnical trend in the low-speed engine requiresthe built-up type crankshafts to have higherstrength and higher reliability.[1]

Manufacturing sequence of solid type crankshaft is the following:
1) Melting (Electric furnace).
2) Refining (Vacuum holding furnace).
3) Ingot making.
4) Forging.
5) Machining.
6) RR forging.
7) Heat treatment.
8) Mechanical propertytest.
9) Final machining.
10) Non-destructivetests.

Solid type crankshafts are press-formed fromsteel ingots and are used for mid- to high-speed,four cycle, engines with cylinder bore-diametersof less than 600 mm. As in the case of built-up type crankshafts,longer strokes and down-sizing are required forsolid type crankshafts. An important requirementfor solid type crankshafts is strength.[1]

Based on these facts, we can say that the crankshaft goes through a large number of processing stages. Therefore, the crankshaft is very difficult to manufacture. Due to this fact, an extremely large number of machines, time and manual labor are used.

This issue has been researched by various scientists from different countries. Some scientists and their proposed methods for improving the technical process are considered in more detail below.

Jasiulewicz-Kaczmarek and Gola introduced the opportunity of using Maintenance 4.0 to incorporate new approach in various production systems in development, implementation, and monitoring the manufacturing processes in modern producing companies. This research concentrated on supporting the maintenance system through Maintenance 4.0, which substituted the ancient ways to support the production process, increase dependability, decrease downtime during the production process, improving security, and lower costs. The findings showed the Maintenance 4 technologies can be used to reduce downtime, maintenance, and aftersales to build a close relationship with clients and reduce failures.[2]

Soltanali et al. considered the dependability evaluation through failure action of the automobile production line. Accuracy analysis consisted statistical research and Monte Carlo modeling, and the process of analysis was conducted after collecting data and assessing the influencing quantity. The statistical dependability evaluation demonstrated that the narrowest place was one of the precedence influ-

encing the manufacturing process. The results proved Monte Carlo simulation and predicted reliability with senior accuracy.[3]

Zhang looked into the piston manufacture line's accuracy by statistically analyzing the repair and failure data. The processing line data was measured for fifteen months. A refusal losses-based significance measure way was proposed to define reliability flaw that depended on the refusal measure of the production line.[4]

Conclusion

We have researched the technological process of such a complex part of the crankshaft and also studied various methods to develop its quality. Scientists from different countries use completely different methods of optimizing and improving production. We are confident that our study will further help our scientists and engineers improve this vital part in the automobile engine.

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