

## **Automotive engine camshaft**

### **Brief introduction**

The camshaft is a part of the piston engine. Its role is to control the opening and closing operation of the valve. Although the camshaft rotational speed in a four-stroke engine is a half of the crankshaft (the same as the camshaft rotational speed in a two-stroke engine with the crankshaft), but usually it is still very high speed, but also need to withstand the large torque, so the design right demanding camshaft in terms of strength and support material is generally a special cast iron, occasionally using forgings. Valve motion law related to engine power and operation characteristics, the design in the design process of the engine camshaft occupies a very important position.

### **Structure**

The main body of the camshaft is the same as the one with the cylinder length of the cylindrical rod. The above sets have several cam for driving the valve. One end of the camshaft camshaft bearing support and the other end is connected to the drive wheels.

Cam side was egg-shaped. The design aims to ensure the the cylinder sufficient air intake and exhaust, specifically, within the shortest possible time to complete the valve opening and closing movements. In addition, taking into account the durability of the engine and the smoothness of operation, the valve can not be generated due to the deceleration process of opening and closing movements too much too large the impact of serious wear and tear of the valve, otherwise it will cause an increase in noise or other serious consequences. Therefore, the cam and the power of the engine torque output as well as the operation of the ride there is a direct relationship.

Generally inline engine, a cam corresponding to a valve V-type engine or horizontal opposed type engine, every two valves share a cam. The rotary engine the valveless with gas engine because of its special structure, does not need to cam

### **Position**

In the long period of time, the bottom-mounted camshaft in an internal combustion engine is most common. Typically such engines, the valve is located in the top of the engine camshaft machine, i.e., so-called the OHV (Over Head Valve, OHV) engines. Usually camshaft located on the side of the crankcase, through the gas distribution agencies (such as tappet, push rod, rocker, etc.) valve control. Bottom-mounted camshaft general also called side-mounted camshaft. Far distance valve, and each cylinder is usually only two valves in such an engine camshaft, so the speed is usually slower, ride comfort is poor, the output power is also relatively low. However, the engine output torque and low-speed performance of this structure is relatively good, relatively simple structure and easy maintenance.

Now most of the production car's engine is equipped with overhead camshaft. The overhead camshafts structure closer to the camshaft valve, to reduce the kinetic energy of the waste caused

by the bottom-mounted camshaft due to the larger distance between the camshaft and the valve shuttle. Overhead camshaft of the engine valve opening and closing action is relatively rapid, and hence higher speed, and the smooth running is also better. The engine of the the overhead camshafts structure appeared earlier the SOHC (Single Over Head Cam, overhead single camshaft) engine. This engine is only installed at the top of a camshaft, and therefore generally only two to three valves of each cylinder (the intake air a to two exhaust), the high-speed performance has been limited. Technology updates DOHC (Double Over Head Cam, double overhead camshaft) engine, this engine with a two camshafts per cylinder can be installed four to five valves (intake two to three, Pai gas two), high-speed performance significantly improved, but at the same time the low-speed performance will be affected to some degree, the structure will be complicated and difficult to repair.

## **Classification**

According to the the camshaft number of how many, can be divided into single overhead camshaft (SOHC) and double overhead camshaft (DOHC), two kinds. The single overhead camshaft camshaft is only one camshaft, double overhead camshaft is two, this is too straightforward explanation.

The single overhead camshaft with a camshaft in the cylinder head, direct drive into the exhaust valve, it has a simple structure, suitable for high-speed engine. Generally used in the past side camshaft, the camshaft in the cylinder side, is driven directly by a timing gear. The valve lifter to the rotation of the camshaft is converted into reciprocating motion of the valve must be used to transfer power. Thus, more parts of the reciprocating motion, the inertial mass, is not conducive to high-speed movement of the engine. Moreover, the slender tappet has a certain degree of flexibility, prone to vibration, accelerated component wear, even the valve control is lost.

DOHC cylinder head equipped with two camshafts, one is used to drive the intake valve, the other for driving the exhaust valve. Double overhead camshaft camshaft and valve spring design less demanding, especially for the hemispherical combustion chamber of the valve V-shaped configuration, but also facilitate and used in conjunction with four-valve gas distribution agencies.

## **Fault**

Camshaft common faults including abnormal wear and tear, abnormal wear of the symptoms often first appear before the occurrence of abnormal sound as well as fracture, abnormal sound and fracture.

(1) Camshaft almost at the end of the engine lubrication system, lubrication situation is not optimistic. If the oil pump is too long and so insufficient oil pressure or the lubricants Road blockage caused by lubricating oil can not reach the camshaft bearing cap fastening bolts tightening torque caused by excessive oil can not enter the the camshaft gap will causing abnormal wear of the camshaft.

(2) the abnormal wear of the camshaft causes the gap increases between the camshaft bearing, the camshaft movement occurs when the axial displacement, resulting in abnormal noise. Abnormal wear will lead to increased gap between the drive cam with hydraulic tappets, cam

combined with hydraulic tappets will collide, resulting in abnormal noise.

(3) camshaft sometimes fracture and other serious fault, common causes of hydraulic tappet cracked or severely worn, serious poor lubrication the camshaft poor quality and camshaft timing gear rupture.

(4) In some cases, the failure of the camshaft is man-made causes, in particular the maintenance of the engine camshaft not correct disassembly. Such as demolition of the camshaft bearing caps with a hammer strength knocking or prying with a screwdriver, or install the bearing cap installed the wrong position does not match the result in the bearing cap and bearing, or bearing cover the fastening bolt tightening torque is too large. Install bearing cap should pay attention to the direction of the arrow and the position number marked on the surface of the bearing cap, and in strict accordance with the provisions of torque using the torque wrench tighten the bearing cap fastening bolts.

## **Refit**

In order to enhance the power of the engine, some converted stores a modified camshaft engine face lift high angle camshaft (Hi-camshaft CAM) is a common form of modified method. This modification operation is not complicated, but because of the lack of understanding of some modification cam on the camshaft angle and works so that the modified effect is not obvious even lead to the deterioration of the performance of the engine.

High angle camshaft relative to ordinary camshaft cam angle of about  $240^{\circ}$ , high angle camshaft cam angle can often reach over  $280^{\circ}$ . The large angle of the camshaft can extend the valve open time, increase the valve lift, the intake valve and the exhaust valve open as early and late off, so that more air into the cylinder, in order to improve the engine, the power of the high speed output. Should choose for civilian vehicles, modified cam camshaft angle  $278^{\circ}$ , will be a significant increase in working an angle greater than  $278^{\circ}$  camshaft valve overlap angle, so that the power of the engine high speed improve a lot, but engine cylinder seal is not good at low speed and cause the idling serious jitter or even turn off, so that the vehicle can not adapt to everyday use, and can only be used for competition purposes.

## **Production technology**

The camshaft is one of the key parts of the engine, the hardness of the camshaft peach apical and white layer depth is to determine the key technical indicators camshaft life and engine efficiency. , Should be considered to ensure that the cam has a sufficiently high hardness and a fairly deep white layer premise journal does not appear high carbide, so that it has a better cutting performance.

Currently, the main method of domestic and foreign production camshaft: steel forging blank by cutting the cam peach tip martensitic layer formed some of the high-frequency quenching process. The end of the 1970s, Germany and France have developed a new camshaft argon arc remelting process; hardened cast iron camshaft otherwise dominated by the United States; chilled cast iron camshaft mainly to Japan and France; well cam parts of the Cr-Mn-Mo alloy coatings casting surface alloying production.