

POPPET VALVE

A poppet valve is a valve consisting of a hole, usually round or oval, and a tapered plug, usually a disk shape on the end of a shaft also called a valve stem. The shaft guides the plug portion by sliding through a valve guide. In most applications a pressure differential helps to seal the valve and in some applications also open it.

Other types

Presta and Schrader valves used on tires are examples of poppet valves. The Presta valve has no spring and relies on a pressure differential for opening and closing while being inflated.

Uses

Poppet valves are used in most piston engines to open and close the intake and exhaust ports.

Poppet valves are also used in many industrial process from controlling the flow of rocket fuel to controlling the flow of milk[[1]].

The poppet valve was also used in a limited fashion in steam engines, particularly steam locomotives. Most steam locomotives used slide valves or piston valves, but these designs, although mechanically simpler and very rugged, were significantly less efficient than the poppet valve.

A number of designs of locomotive poppet valve system were tried, the most popular being the Italian Caprotti valve gear[[2]], the British Caprotti valve gear[[3]] (an improvement of the Italian one), the German Lentz rotary-cam valve gear, and two American versions by Franklin, their oscillating-cam valve gear and rotary-cam valve gear. They were used with some success, but they were less ruggedly reliable than traditional valve gear and did not see widespread adoption.

In internal combustion engine



poppet valve

The valve is usually a flat disk of metal with a long rod known as the valve stem out one end. The stem is used to push down on the valve and open it, with a spring generally used to close it when the stem is not being pushed on.

Desmodromic valves

Desmodromic valves are closed by positive mechanical action instead of by a spring, and are used in some high speed motorcycle and auto racing engines, eliminating 'valve float' at high RPM.

Metallurgy

For certain applications the valve stem and disk are made of different steel alloys, or the valve stems may be hollow and filled with sodium to improve heat transport and transfer.

How operates

The engine normally operates the valves by pushing on the stems with cams and cam followers. The shape and position of the cam determines the valve lift and when and how quickly (or slowly) the valve is opened. The cams are normally placed on a fixed camshaft which is then geared to the crankshaft, running at half crankshaft speed in a four-stroke engine. On high performance engines e.g. used in Ferrari cars, the camshaft is moveable and the cams have a varying height, so by axially moving the camshaft in relation with the engineRPM, also the valve lift varies. See variable valve timing.

Designs

In very early engine designs the valves were 'upside down' in the block, parallel to the cylinders - the so called L-head engine because of the shape of the cylinder and combustion space, also called 'flathead engine' as the top of the cylinder head is flat. Although this design makes for simplified and cheap construction, it has two major drawbacks; the tortuous path followed by the intake charge effectively prevents speeds greater than 2,000-2,500 RPM, and the travels of the exhaust through the block lead to excessive overheating under sustained heavy load. This design therefore evolved into 'Intake Over Exhaust', IOE or F-head, where the intake valve was in the block and the exhaust valve was in the head; later both valves moved to the head.

In most such designs the camshaft remained relatively near the crankshaft, and the valves were operated through pushrods and rocker arms. This led to significant energy losses in the engine, but was simpler, especially in a V engine where one camshaft can actuate the valves for both cylinder banks; for this reason, pushrod engine designs persisted longer in these configurations than others.

More modern designs have the camshaft on top of the cylinder head, pushing directly on the valve stem (again through cam followers), a system known as overhead camshaft; if there is just one camshaft, this is a single overhead cam or SOHC engine. Often there are two camshafts, one for the intake and one for exhaust valves, creating the dual overhead cam, or DOHC. The camshaft is driven by the crankshaft - through gears, a chain or in modern engines with a rubber belt.

Manufacture

In the early days of engine building, the poppet valve was a major problem. Metallurgy was not what it is today, the rapid opening and closing of the valves against the cylinder heads led to rapid wear. They would need to be re-ground every two years or so, in an expensive and time consuming process known as a valve job. Adding tetra-ethyl lead[[4]] to the petrol reduced this problem to some degree as the lead would coat the valve seats, hardening the metal. Valve seats made of improved alloys such as stellite have generally made this problem disappear completely and making leaded fuel unnecessary.

Source : http://engineering.wikia.com/wiki/Poppet_valve