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Rotary Engine

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In piston engines, the energy of the combusted fuel is taken up by the piston, which transfers it through its reciprocating motion to the crankshaft, rotating it.

In the case of rotary engines, the energy is directly transformed into the rotation of the shaft, bypassing the reciprocating motion. This translates into lower friction losses, less metal consumption and simpler construction. This increases the efficiency of the motor considerably [1].

Instead of pistons the combustion energy of this engine is taken up by the rotor. The rotor takes the form of an equilateral triangle (Reuleaux triangle). The rotor rotates in a planetary pattern about a central axis, the stator. Each side of the triangle acts as the piston.

To enable the combustion process to take place, the rotor is housed in an enclosed space consisting of three elements – two lateral housings, and one central housing, called the stator. The space in which the combustion process takes place is made in the stator, the side housings only provide a seal for this space. The stator itself has windows on one side for the intake of fuel-air mixture or air, and the outlet of the exhaust gases. Opposite to these is a hole for the spark plugs.

The peculiarity of rotor movement in the stator cylinder is that its tops are in constant contact with the surface of the cylinder, its movement is made according to the eccentric type. It not only rotates around its axis, but also moves relative to it. For this purpose, a large hole is made in the rotor, and there is a

toothed sector on one side of this hole. On the other side, an eccentric shaft is inserted into the rotor.

In order to ensure the rotation, a fixed pinion is fitted into the side housing, meshing with the toothed sector of the rotor, it is the fulcrum for the rotor. In its eccentric movement it rests on the stationary pinion and the meshing provides it with a rotary movement. As it rotates, it also provides rotation of the shaft with the eccentric on which it is clamped.

Doing a certain amount of work with the piston inside the cylinders is called a stroke. A classic piston engine has four strokes:

• *intake* - the combustible mixture is fed into the cylinder;

• *compression* - increasing the pressure in the cylinder by reducing the volume;

• *overrun* - energy released during combustion is converted into shaft rotation;

• *exhaust* - exhaust gases are discharged from the cylinder [2].

As the cylinder of a rotary engine has inlet and outlet ports, there is no need for a timing gear, but the process itself retains all four strokes separately.

The corners of the rotor are in constant contact with the stator cylinder, providing a sealed space between the rotor sides. The oval shape of the stator cylinder ensures that the space between the cylinder wall and the two nearby rotor vertices changes. As the rotor rotates, one of its vertices, passing the narrowing of the cylinder oval, opens the intake window and combustible mixture or air begins to enter the cavity between the rotor triangle side and the cylinder wall. With this movement continuing, this apex reaches and passes the high part of the oval and goes on to taper. Continuous contact of the rotor apex is ensured by its eccentric movement.

Air is drawn in until the second rotor apex overlaps the intake window. At this time the first apex has already passed

the height of the cylinder oval and gone into contraction, with the space between the cylinder and the rotor side starting to shrink considerably in volume – the compression stroke occurs.

A feature of the rotary engine is that the ignition is not ignited before passing the so-called "dead point" side, as is done in a piston engine, but after it has passed. This is done so that the energy released by the combustion acts on the part of the rotor that has already passed TDC (upper dead centre). This ensures that the rotor turns in the correct direction. Once the spark plug has passed, the first apex of the rotor starts to open the exhaust port, and gases are gradually exhausted until the second apex covers the exhaust port [3].

If you compare a rotary engine with a piston engine, the power output from one section, which consists of one rotor and stator, is equal to that of a 3-cylinder engine. And if you consider that Mazda installed two-section rotary motors on its cars, they are as powerful as a 6-cylinder piston engine.

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