ANALYSIS OF THE ACTUAL CYCLES OF AUTOMOTIVE INTERNAL COMBUSTION ENGINES

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Annotation. The article outlines the implementation of four tactics in automotive internal combustion engines, the main factors affecting the compression process, the type of combustion chamber, the pressure and temperature at the end of the compression process, and the work on calculating the compression process.

Keywords: engine, takt, cycle, compression process, pressure, analytical study, cylinder China group, Operation, disassembly, Assembly.

During the compression process, the pressure and temperature of gases in the iodine cylinders begin to rise, as a result of which the ignition and combustion of fuel are improved. The compression process occurs in four-stroke engines (albeit with and without ignition) after the inlet valves are sealed. In two-stroke engines, however, the gas exchange process is completed in a porcelain cylinder yu.ch.n.ga the compression process occurs from the moment the look moves. In carburetor engines, the degree of compression is limited by the possibility of detonating combustion, while in diesels, the temperature of self-ignition of diesel fuel before the specified time. Therefore, at the end of the compression process, the temperature and pressure of the working charge should not exceed the specified limits.

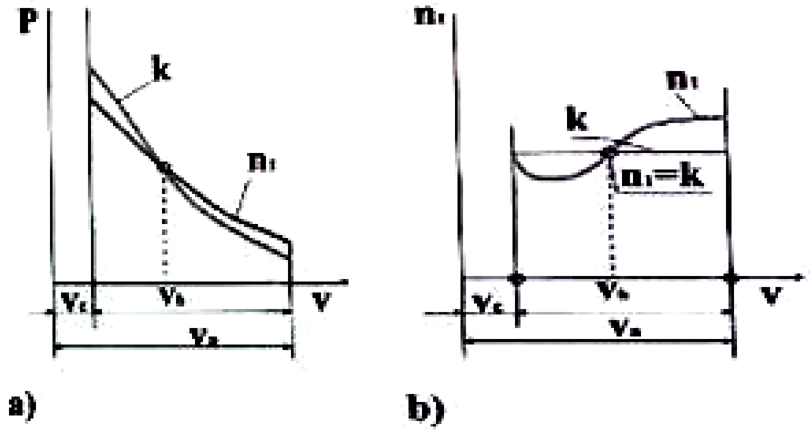
In order to increase the flammability and combustion quality of the fuel, it is advisable to accelerate the grinding motion of the working charge in the cylinder. In the case of such a heap of charge, the quality of air mixing and evaporation with fuel increases sharply. The higher the quality of the working mixture, the higher the combustion effect of the fuel. That is why the combustion chamber, inlet valves are made in different forms in order to organize the grinding movement of the working charge in the engines.

The course of the compression process.

The compression process is of a very complex nature, and a state of heat exchange occurs between the working body and the details around it, which has a continuous, variable value and orientation. There will also be cases where some of the heat is released through the slits between the cylinder piston group and the flare of the fuel in the drop position in the cylinders.

Various factors affect the course of the compression process, which include: the number of revolutions of the crank shaft, loading, cylinder dimensions, compression level, material type of details, thermal state of the engine, etc.

During the course of the compression process, the temperature of the working charge heats up by colliding with the details of the cylinder piston group. During the movement of the piston to the y.ch.n. side, the working charge will go to tight compression, its temperature and pressure will increase. Figure 1 below shows a graph of the change in pressure and polytropa (n1) indicator relative to cylinder volume (V)during compression:



a) compression pressure b) polytropa indicator

Figure 1. Graph of the change of the polytrope of the compression process with respect to the volume of the cylinder.

The main factors affecting the compression process.

With an increase in the frequency of revolutions of the crankshaft, the amount of heat supplied to the cylinders increases in the unit of time, and accordingly the temperature of the Engine Details Also Rises. But with that, the contact (collision) time of the working body with the cylinder walls during each cycle is also reduced, and the state of leaving part of the charge from the slits between the details is also reduced. Hence, under the influence of the above factors, the polytropic indicator of the compression process increases with an increase in the frequency of revolutions of the elbow shaft.

With an increase in loading in carburetor engines, the temperature of the details and the amount of the working body increases. As a result, the average of the engine compression polytrope also increases.

In diesel engines, the change in load does not affect the amount of the working body. Therefore, the average of the polytrope is represented in this case only by the temperature of the details and the volume of the charge exiting the detail slits. Based on the experimental results, the average value of compression polytrope in diesels is almost constant and does not depend on engine load.

During the compression process, the heat exchange State is primarily influenced by the contact (collision) of the working body with the relative surfaces of the details around it. In this case, an increase in working volume (V_h) due to a change in the piston Path (S) with a cylinder diametric (D) reduces heat loss in the engine. Therefore, in engines with large values in V_h, D and S, the relative collision surfaces of gases with details are reduced, and as a result, the heat loss is also reduced. Therefore, large-scale cylinder-piston group engines have higher average values of compression polytropes. For this reason, cylinder diesel engines with a small measurement value have lower polytropa averages (n1), making it more difficult to fire the engine during colder times of the day.

The type of combustion chamber also has a significant effect on the contact surfaces of the working mixture with details. If the shape (shape) of the combustion chamber is compact (Crescent, pona appearance, etc.), the collision surfaces of the working body with the detail surfaces also decrease, the heat transfer through the details decreases, and the average values of the compression polytrope (N_1) increase.

The type of material from which the detail is made. When aluminium alloys are used instead of cast iron in the preparation of cylinder-porcelain group details, the average value of the compression polytrope decreases. Because aluminum alloys are difficult to absorb heat, but due to their high heat transfer capacity, their total temperature is low, as a result of which the heat transfer outside the working body increases. Because of this, the average value of the compression polytrope is lowered.

As the compression level of the engines increases, at the end of the compression process, the pressure and temperature are higher, and part of the working body is lost (through scratches, nogermetic surfaces). But, therefore, the surface of the combustion chamber becomes smaller, and the relative collision surfaces of the working body with the details are also reduced. As a result of the overall effect of these factors, the average value of the compression polytrope practically does not change.

The degree of absorption of the engine cylinder-piston group details strongly affects the quality of the compression process. When the details of this group are eaten, the amount of gases passing into the engine crankcase increases. The engine works by holding, the value of the compression polytrope decreases sharply. This results in the engine becoming more difficult to fire.

Pressure and temperature at the end of the compression process.

At the end of the compression process, the composition of the working charge changes relative to the initial state, and this state is expressed through the following indicators.

The position of the working body at the end of the compression process:

Working body pressure, P_c;

Working body temperature T_c.

The pressure at the end of the compression process is determined by the following formula:

$$P_c = P_a \left(\frac{V_a}{V_c}\right)^{n_1} = P_a^{\varepsilon n_1} \qquad (1)$$

here: $P_a -$ initial air pressure;

$n_1 -$ average polytropic indicator.

The temperature of the charge at the end of the compression process:

$$T_c = T_a^{\varepsilon^{n_1 - 1}} \qquad (2)$$

The values of the indicators determining the working charge state at the end of the compression process are given in the table below.

The working charge at the end of the compression process is the values of the indicators

№	Engine type	ε	Specification		
			Average polytropa	Pressure at the end of	Temperature at the end of

			indicator,	compression P_c, MPa	compression Tc, K
1.	Gasoline	6-10	1,34...1,37	0,9...1,8	600-750
2.	Diesel fuel Diesel fuel	16-17 18-21	1,34...1,38 1,32...1,38	3,5...5,5 4,5...7,5	700-900 800-1050
3.	Fizzy	5-10	1,30...1,37	1,0...1,8	480-650

In diesel engines, the type of combustion chambers has different effects on the parameters of the compression process. For example the combustion chamber in isolated diesels, if the pressure at the end of the compression process changes in the range of P_c=30-45 kg/cm^2, the temperature is T_c=700...900 K. While non-separated combustion chamber diesels have Pc=40...60 kg/cm^2, the TC varies between=850...1050 K.

Calculation of the compression process.

The calculation of the compression process is brought to determine the compression polytrope mean p_1, the parameters at the compression end (r_s and T_s), and the heat capacity ($mc_v^i)_{t_0}^{t_c}$ of the working body at the compression end (t_c-mixture temperature ^oC at the compression end).

The compression polytropic average p_1 value is set in terms of experimental data on the frequency of engine crankshaft rotations, compression rate, cylinder sizes, piston and cylinder materials, heat exchange, and other factors.

Due to the fact that the compression process is fast enough (0.015-0.005 S in nominal mode), during the compression process, the summar heat exchange between the working body and the cylinder walls is very low, so the value can be estimated on the average of adiabata.

- from the nomogram depicted in the figure, the value k_1 is determined for the corresponding values of ε and T_a. The nomogram is constructed $(mc_v)_{t_a}^{t_c}$ by jointly solving two equations connecting k_1 with T_a, T_s, ε and the heat capacity of air:

$$k_1 = 1 + (\lg T_c - \lg T_a)/\lg \varepsilon \quad (3)$$

$$k_1 = 1 + 8{,}315/(mc_v)_{t_a}^{t_c} \quad (4)$$

$$(mc_v)_{t_a}^{t_c} = \left[(mc_v)_{t_a}^{t_c} t_c - (mc_v)_{t_c}^{t_a} t_a\right]/(t_c - t_a) \quad (5)$$

If in Formula (4) the heat capacity of the $(mc_v)_{t_a}^{t_c}$ air is replaced by the heat capacity of the mixture $(mc_v)_{t_a}^{t_c}$ to work, the nomogram will be built more accurately.

The values of the compression polytropic average p_1 can be obtained at the following intervals:

for gasoline engines....................(k_1-0.00) ÷ (k_1-0.04);

for diesels..................................(k_1+0.02) ÷ (k_1-0.02);

for gasoline engines at the same values of k and T_a, the p_1 value is usually smaller than for diesels, as the fuel evaporates when the fuel-air mixture is compressed, while heat is absorbed when evaporating. In addition, the presence of fuel vapors increases the heat capacity of the mixture. Both of these factors reduce the p_1 value.

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