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Research Article

MODERN TRENDS IN IMPROVING THE FUEL SUPPLY SYSTEM FOR VEHICLES WITH A DIESEL ENGINE

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ABSTRACT

By reducing time, production and financial costs in the implementation of maintenance and repair based on the development and application of diagnostic, scientific substantiation, operational and informational methods of modern diesel engines and their fuel supply systems significantly increasing the efficiency of the operation of vehicles is an urgent scientific problem that limits the progress in the industry.

KEYWORDS

Fuel, injector, supply, gasoline, diesel, piston, gasoline pump, car, engine.

INTRODUCTION

In order to meet the strictest requirements for exhaust gas toxicity, it is necessary to grind the fuel injected into the internal combustion engine of the car based on the specifics of the mixture formation process in the diesel engine. To do this, manufacturers must significantly increase the injection pressure and reduce the diameter of the EHF spray holes. In addition, the injection process itself should be fractional, i.e. fuel is distributed to the cylinder at fixed moments according to the angle of rotation of the crankshaft (and, therefore, the stroke of the piston) [1-7].

The main part

Fulfilment of this requirement is possible only through the presence of electronic control of the fuel supply process, turbocharging, particulate

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filters, exhaust gas recirculation and their catalytic treatment, Fig. 1.

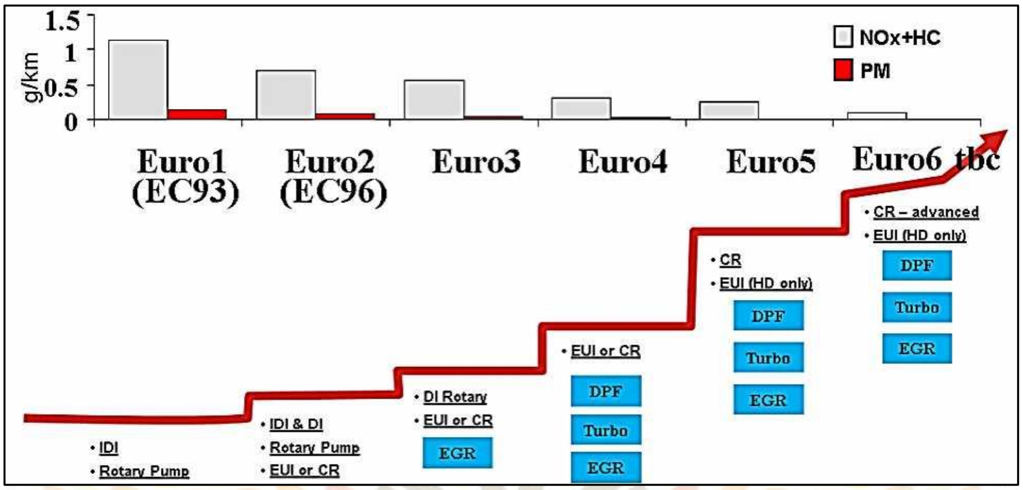

Figure 1. Trends in the technological development of fuel supply systems in relation to standards limiting the amount of harmful emissions from exhaust gases

Almost all known modern fuel injection systems for cars with a diesel engine can be functionally divided into groups: direct injection systems with a mechanical drive; systems with high-pressure fuel accumulators; direct drive systems with hydraulic control [8-13].

The first group includes fuel supply systems of the "pump-injector" type and individual high-pressure fuel pumps with electronic control. The second - system is called Sottop KaP (English General highway). The third is the combined type of system called a pump-injector with a hydraulic drive.

Currently, several types of mechanically controlled pump injectors are known. All of them can generate high injection pressures and have relatively high hydraulic and mechanical efficiencies. This is one of the most important advantages of pump injectors over high-pressure flow systems.

All of the above also applies to systems with individual injection pumps, which, in addition, have high maintenance capabilities and low maintenance labour intensity. The tightening of legislation in the field of emissions of harmful substances in exhaust gases has led to the improvement of fuel supply management processes for unit injectors and separate high-pressure fuel pumps. Structurally, additional valves were included in these systems, and the electrical outlet began to include four contacts [14-27].

Another advantage of mechanically controlled injectors and individual injection pumps is their much higher durability compared to systems with high-pressure injection pumps. Many heavy-duty

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diesel engines use these systems. In particular, this is due to the fact that one of the leaders of the diesel segment for commercial vehicles - 1) e1p1n company did not produce systems with high-pressure fuel pressure engines for heavy trucks and special equipment until recently. However, stricter environmental requirements (transition to Euro-6 standards) led to the need to produce systems combined with a common high-pressure fuel injection pump, where the pressure is created by pump injectors, but high-pressure and high-pressure pumps are created. Injection time is allocated due to battery availability [28-35].

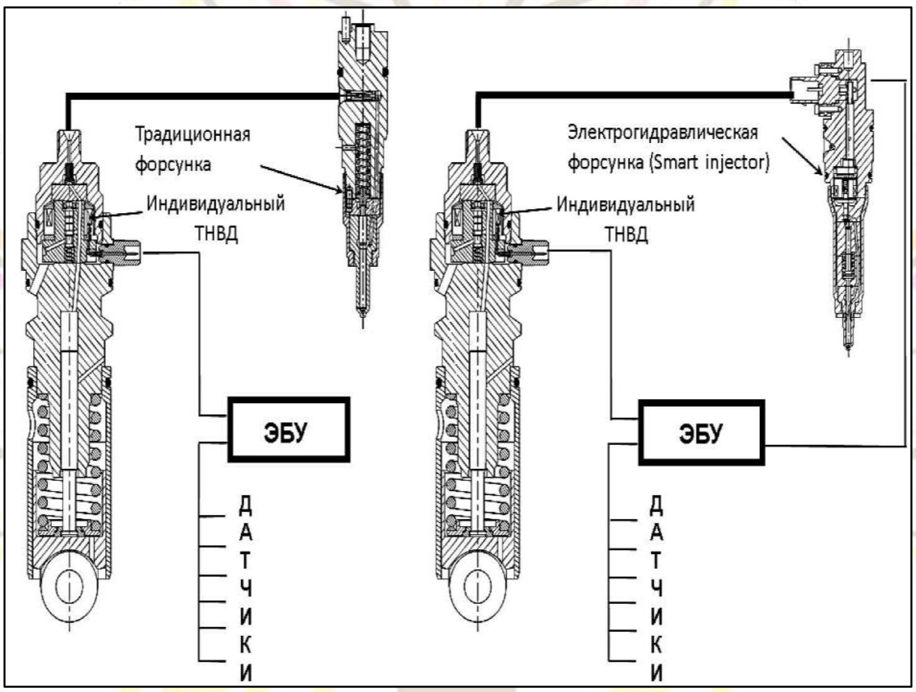

Figure 2. Scheme of the fuel supply system with injection pumps

Such capabilities of ATPS are becoming especially important in connection with the introduction of various exhaust gas cleaning systems in vehicles with diesel engines and the development of alternative fuel combustion processes.

In mechanically controlled injection systems, the use of a cam to drive a piston pump significantly limits their ability to provide the necessary control of the injection process and make multiple injections. Another advantage of a high-pressure fuel injection system over mechanically controlled injection systems is the ability to precisely control the timing and volume of fuel injected, especially at idle and part loads [36-41].

High pressure in the fuel system is created regardless of the engine speed and the amount of fuel injected. The amount of injected fuel (cyclic delivery) is determined by the actions of the

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driver, and the advance angle and injection pressure are determined by the electronic control unit (EBB) based on the characteristics of a programmable matrix stored in the memory of the microprocessor. The EBB provides start control signals to the respective solenoid valves, resulting in injection by the injectors into each cylinder. The SC storage fuel system includes the following electronic controls:

EBB; crankshaft speed sensor; gas distribution shaft speed sensor; pedal position sensor; pressure increase sensor; fuel tank pressure sensor; coolant temperature sensor.

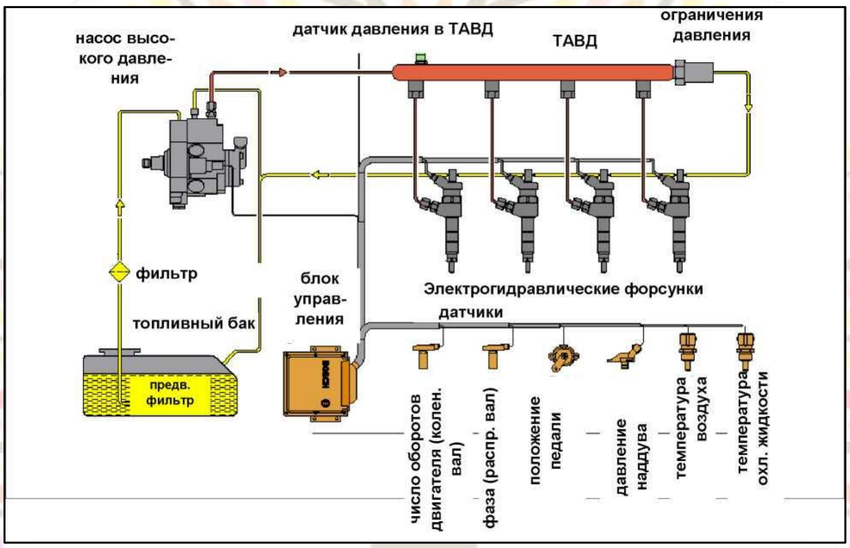

Figure 3. Scheme of the fuel storage system

Using the input signals from the above sensors and based on the received data, the EBB controls the actuators. Engine speed is measured by a frequency sensor and the flash sequence is measured by a camshaft position frequency sensor. An electrical signal from the gas pedal position sensor informs the EBB of the driver's depression level, in other words, the operating mode of the installed engine. The mass airflow (pressure boost) sensor provides the EBB with information about the amount of air to correctly calculate the fuel cycle. Fuel pressure regulation in HPT is carried out using measuring devices based on ensuring that the pressure measured by the pressure sensor in the common line is equal to the pressure set by the computer [42-44].

Sottop KaP fuel injection systems for passenger cars and light commercial vehicles use electric or geared fuel pumps to deliver fuel to a high-pressure pump. Heavy commercial vehicles use only gear pumps.

Let's take a look at the design differences between battery fuel systems.

They can be classified according to the following functional characteristics:¬

With the high-pressure regulation method:

- releasing excess pressure through the high-pressure line;
- flow control at the entrance to the high-pressure part of the injection pump;
- combined (both options are used).
- According to the type of drive for control valves of electro-hydraulic injectors:
- with the electromagnetic drive;
- with piezo drive.

Regulation of fuel pressure by the method of bypassing the high-pressure line at high speed has a significant drawback - strong heating of the fuel and reduces the efficiency of the driver, so it is not used at the moment. In order to eliminate the above drawback, the arrangement of filling piston pairs at the inlet is used. But for high-speed passenger car engines, unified regulation applies. On the one hand, this helps to change the pressure faster if it is necessary to increase it, on the other hand, it prevents the engine from working hard in temporary conditions.

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