THE MEANS OF ADJUSTING OF THE TEMPERATURE STATE OF A COMBUSTION CHAMBER SURFACE UNDER A FUEL FILM

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The organization of the workflow of engines with mixed volumetric and film mixture forming implies that part of the fuel supplied to the combustion chamber in the piston, is sprayed and evaporated in the volume, and part reaches the walls of this chamber with the formation of fuel film that also evaporates.

Analysis of known research results shows that contact of the fuel portions with the combustion chamber wall is accompanied by a significant decrease in the temperature of the surface and subsequent forming on it of carbon deposit layer. It is linked with the effect of breakages of chain reactions of combustion in the wall zone of the chamber and, as a consequence, excess of free fuel molecules' residue. The equilibration of the processes of buildup and burnout of the deposit becomes balanced at a certain thickness of the deposit, which determines the temperature of its surface layer. To a large extent, these effects are inherent in pistons made of aluminum alloys.

The depositing on the walls can be made impossible by applying to the surfaces a catalytic coating of aluminum or zirconium oxide. But coatings of that kind have low heat conductivity, and because of it inflict the surface temperature decrease themselves.

The changes of the conditions of formation of the fuel film and its evaporation in both cases degrade the fuel economy and emissions of harmful substances.

The temperature of these zones can be increased by two opposite ways. The first one implies avoiding of coating the surface and using the traditional materials for them. Thus the fabrication of pistons out of low-conductive materials, such as cast iron or steel, leads to an increase in the temperature of the wall of the chamber and reduce the deposit formation on its surface. But this measure, in turn, due to the occurrence of the regenerative heat exchanger effect, reduces the filling of the cylinder with air, what worsens the engine's fuel efficiency and environmental performance.

On the basis of the performed analysis, it is proposed to refine the piston design by using an embedding made of low heat conductive material to combustion chamber surface in zones where the fuel sprays contact it, where the temperature state adjustment is needed. A patent of Ukraine was obtained for the proposed design decision.

The other mean to reach higher temperatures of the combustion chamber surface under the fuel film is applying the coating with increased local thickness. As soon as the coating layer thickness transcends the penetration depth of the temperature wave induced by the cycle changing of heat transfer boundary conditions, the average cycle temperature begins to rise quickly. At some point it reaches value that can be compared with the one proper for zones of the combustion chamber free of fuel film.