

RESEARCH OF COMBUSTION SYSTEM WITH SEMI-OPEN COMBUSTION CHAMBER IN A COMMERCIAL SPARK IGNITION ENGINE

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Abstract

During the research of a new combustion system with semi-open combustion chamber for SI engines with use of the rapid compression machine (RCM) and visualisation experimental engine (VEE) it was proved that the application of this system results in shortening of the combustion time, increasing of the maximum cycle pressure and, in effect, increase of the combustion efficiency. The aim of the research using a commercial spark ignition engine was to prove that the similar results (as in RCM and VEE) could be obtained in a wide range of automotive engine operating parameters. In this research the two cylinder, four-stroke air-cooled SI engine, with volume displacement 650 cm³ from Fiat 126 motorcar was used. This engine was fitted with a modified cylinder head and ignition distributor. Two types of prechamber with different shape were installed in different locations into the cylinder head but the ignition distributor had fixed, preadjusted, ignition advance angle in the full range of engine speed. The wide-open throttle characteristics including power, specific fuel consumption and exhaust emission versus engine speed and load characteristics including: specific fuel consumption and exhaust emission versus engine torque were determined for different ignition advance angles. In the lower range of the ignition advance angle the engine showed stable operation at lower speed but unstable at high speed and, inversely, if the ignition advance angle was high the engine operation was stable at the higher speed and unstable at the lower. The engine characteristics during unstable operation were deteriorating. The research results show that improvement of the engine characteristics can be obtained in the full range of operating parameters if the ignition advance angle is varied continuously with the variation of engine speed. The ignition advance angle for the engine fitted with the new combustion system, which was subject of this research, was different form the ignition advance angle for standard engine.

Keywords: *SI engines, combustion, combustion chamber of piston engines, exhaust emission*

1. Introduction

Despite the fact that the development of internal combustion engines lasts a hundred years, there are still opportunities to improve their performance and constantly new ideas to improve engine operation [1, 3, 4, 5, 7]. In addition, combustion system presented in this publication, designed for spark ignition engines, although it could also be used in diesel engines, brings a new idea to intensify the combustion process in the engine, which should ultimately lead to a reduction in specific fuel consumption and the reduction of toxic exhaust components [9, 10, 11, 12]. The combustion system, which is the subject of research, were divided combustion chamber in the cylinder head a standard petrol engine to the pre-chamber and the main by a partition. Both the pre-chamber and the fundamental are supplied with the same mixture of fuel and air. The mixture contained in the pre-chamber is ignited by the spark plug, and when the differential pressure between the precombustion chamber and the substance, because of combustion in the pre-chamber reaches the desired value to flow out through the opening in the partition, the burning mixture and products of an incomplete combustion chamber substantial [13, 15, 16, 17, 18]. This stream quickly, dynamically moves through the chamber principal, the more rapidly than the combustion velocity of the mixture, causing successive layers of the ignition chamber and a substantial