Justification of the expediency of using the combustion chamber with a toroidal recirculation zone in the small GTE

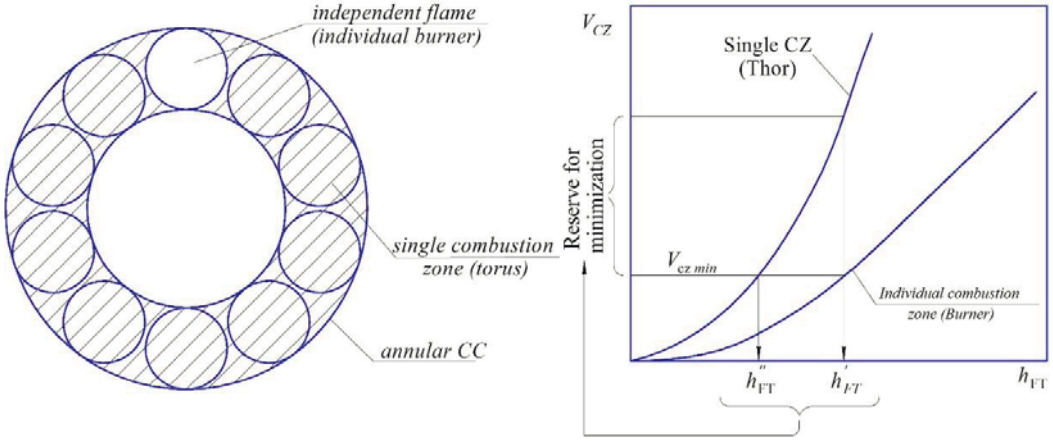
Orlov M.Y., Anisimov V.M., Kolomzarov O.V., Gurakov N.I., Mironov N.S.

Samara National Research University, Samara, Russia

At present, the use of small-size gas turbine engines (SGTE) in various sectors of the national economy and in the interests of the Ministry of Defense is constantly increasing. Accordingly, the number of requirements put forward for these engines is increasing: mass-dimensional, ecological, resource, etc. The fulfillment of most of these requirements is related to the design and the combustion chamber (CC) of the engine implemented in its framework.

One of the main requirements, associated with the provision of specified dimensions and engine mass, is directly determined by the dimensions of the compressor.

However, the reduction in the size of the combustion chamber in each particular case has its limits, determined by the type of diffuser, the design of the front-line device, the space necessary for organizing the combustion and burnout of the fuel. In many combustion chambers SGTE, for the organization of the working process, variants are used for front-end devices with spatula swirlers, evaporative fuel tubes, rotating nozzles and other technically difficult to implement elements. Many of these methods of preparing the fuel-air mixture and the formation of the combustion zone have a significant disadvantage - a volume is formed between the injectors, which is not used for combustion. In turn, combining the combustion zone would reduce the dimensions of the CC (Figure 1).



a) b)

Figure 1 - Comparison of the volume of combustion zones

In this paper, the theoretical foundations of the organization of the working process using the toroidal recirculation zone with the help of which the combustion chamber of the SGTE was designed, which was then made in the form of a real sample using prototyping technology, is considered.

The results of numerical simulation on a computer using a proven method showed the operability of this combustion chamber while respecting and meeting the basic requirements of the Technical Task. At present, the experimental debugging of this combustion chamber is taking place.

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