The maturation of the workflow of combustion chamber with toroidal recirculation mixing zone

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The construction of a serial airborne auxiliary power was used as a prototype during the design of new engine. A scheme solution of the air inlet duct and the radial-flow compressor was saved in new project. The inward flow turbine was meant to be an axial turbine. This required a change in the design of the combustion chamber (CC). After the consideration of a number of possible schemes, it was decided to choose a straight-flow annular CC with toroidal recirculation-mixing zone which has significant reserves of minimization in size with relative simplicity of technological execution. A feature of a particular combustion chamber is its diagonal arrangement relative to the axis of the engine. The working process of the CC has a number of problems, which arise due to the lack of experimental and calculated data.

The aim of the study is the maturation of the design of the CC with toroidal recirculation-mixing for the workflow optimization.

The first step of maturation involved the organization of swirl structure at primary zone by means of changing the diameters and number of dilution-closing holes and by means of adding a “springboard” on the inner shell of the flame tube. On the second step there were conducted the maturation of the flame shape in primary combustion zone. The nozzle was replaced with an ink jet and blade vortexers were added to the channel between the deflector and the wall of the flame tube. The third step was devoted to the formation of the necessary temperature field at the exit from the combustion chamber. To this end, work has been done to refine the necessary penetration depth of the jets, the number and location of the mixing holes.

As a result of the maturation, an acceptable design of the combustion chamber of the engine was obtained, in which it was possible to achieve flame stabilization in the primary combustion zone, distribution of the temperature field inside the chamber, eliminating its burnout and reducing the unevenness of the temperature field at the outlet.

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