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Development of a new front heat generator device and results of numerical simulation on Comsole Multiphysics

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GOAL OF THE STUDY

The goal of the study is to create a simple, non-labor-intensive burner device for a heat generator with low specific fuel consumption and low-toxic emissions.

METHODOLOGY OF THE INVESTIGATION

To develop a heat generator with improved technical, economic, and environmental characteristics based on the experience of creating low-toxic burners and front devices, we made changes to the front with an air nozzle.

MAIN RESULTS FROM THE STUDY

It was decided to use the software package for numerical modeling of physical processes and devices COMSOL Multiphysics The simulation domain consists of a fuel tube, a Venturi tube, and inlet and outlet swirlers. The purpose of the simulation is to determine pressure and velocity contours, determine recirculation zones, and their effect on the aerodynamics of air flow.

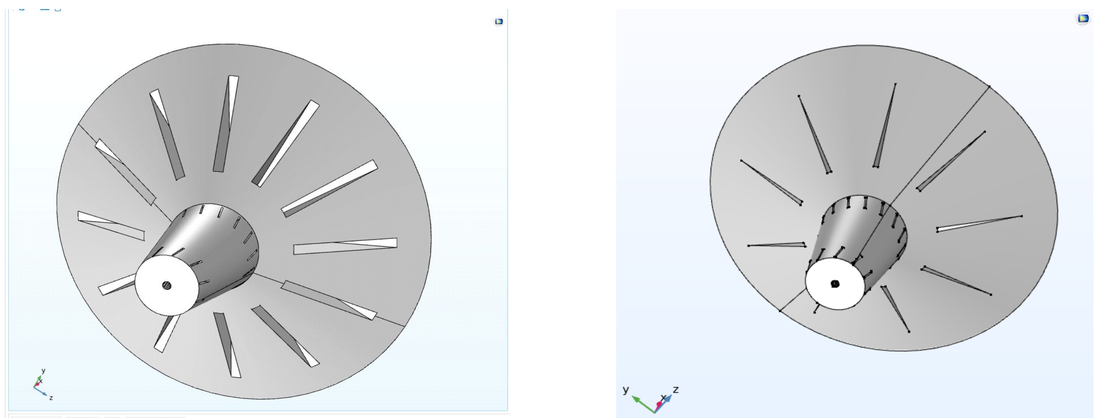
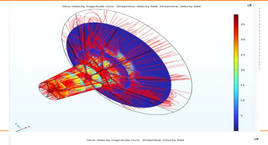
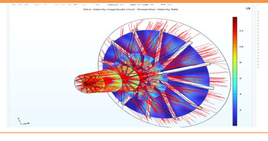
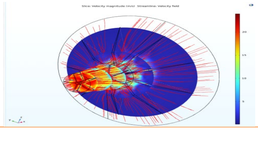
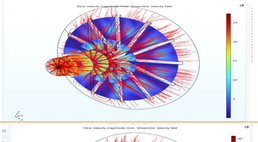
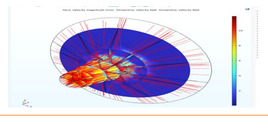
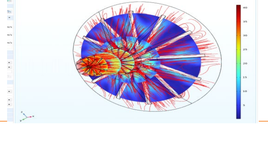


Fig. 1. Figure caption

Table 1. Table caption

Air speed	Triangular	Rectangular
10 m/s		
20 m/s		
30 m/s		

In the figure, the initial speed of the air entering the burner is characterized by acceleration in the Venturi tube, and then decreases when it comes to the expanding part of the fuel tube.

It can be seen that at an initial air velocity of 10 m/s and in all slot swirlers, an uneven swirl zone is formed. At initial speed values of 20, and 30 m/s, it is clear that a stable vortex zone is formed. As can be seen from the model, the velocity zone is very uneven, namely in the inlet conical part in some zones there are high velocities (~ 40 m/s), which are shown in red, which behind the front device suddenly drop (to ~ 5 m/s), shown in blue. At the exit from the conical part to the front device with rectangular slots, a relative equalization of velocities is also observed (up to ~ 15 m/s), shown in sky blue. At the same time, separate zones of fields with speeds from 35 m/s (shown in red) to 15 m/s are also observed

CONCLUSIONS

In order to ensure microflare during combustion, we changed the angle of inclination of the front surface to 60° and introduced secondary air through radial slots at the front. Based on the consideration of the model performed using the COMSOL Multiphysics program, it can be assumed that the obtained results of the distribution of pressures and velocities allow us to judge the possibility of improving the characteristics of the heat generator.

ACKNOWLEDGMENT

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