Parameter calculation and design of an autonomous thermal cutting machine based on the combustion chamber of a low-thrust rocket engine

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As part of rocket engine development conversion we designed a metal cutting installation based on an oxygen/kerosene low-thrust rocket engine (LTRE). We solved the problem of cooling the combustion chamber and nozzle without involving a third component, i.e. water, strictly by means of employing regenerative cooling of the combustion chamber walls by kerosene supplied through pipes into the inter-jacket space, flowing from the injector head to the nozzle and subsequently returning to the combustion chamber head through adjacent pipes. By computing the LTRE thermal state we validated the feasibility of using regenerative kerosene cooling to sustain desired operational thermal conditions in the LTRE combustion chamber. We used computation results and experimental data to develop the design and documentation for a general-purpose thermal cutting machine UTR-2S. Experimental testing results in the case of this thermal cutting machine confirmed the validity of the mathematical model and correctness of our assumptions.

Keywords: *conversion, rocket engine, thermal cutting machine, heat transfer, mass transfer, diffusion coefficient, coolant, combustion chamber specific impulse, propellant mixing, enthalpy*

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