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Short Communication

Analytical Solution of the Problem of Stationary Subcritical Flow of a Gaseous Heat Carrier in the Branches of Pipelines of Heat Exchangers

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The choice of the model of the flow of gaseous coolant in the heat exchanger tubing and the proper discharge of the equality of similarity criteria for physical modeling due to the complexity of design and choice of model for the computational method is due to the allowable degree of proximity to the real ones-the value and complexity of necessary calculations. In this study, the flow of a gaseous coolant in the branches of pipelines of heat exchange devices is considered as subcritical and stationary. The actual stationary flow of a gaseous heat carrier in heat exchangers is not one-dimensional and is accompanied by losses of mechanical energy, so the calculations use a flow coefficient less than one, which takes into account the narrowing of the flow and the loss of mechanical energy. Depending on the ratio of pressures and cross-section areas, the flow coefficient can be determined from experimental static purges. The flow of the gaseous coolant in the branches of the pipelines of heat exchangers is accompanied by turbulence and the generation of separation zones, which causes significant losses of mechanical energy. Qualitative and quantitative estimates of losses, as well as the flow structure, in stationary flows in the branching pipelines of heat exchangers are most often established on the basis of an experiment. In this paper, we solve equations for an energy-isolated isentropic flow in which the thermodynamic parameters of a gaseous coolant are related in a certain way. The paper substantiates the choice of a theoretical model for mathematical modeling of the flow of a gaseous coolant in the branches of pipelines of heat exchangers with a permissible degree of approximation to the real flow and the complexity of the necessary calculations - a thermodynamic model of a subcritical stationary flow of a compressed gas. Analytical solutions to the problem of flow in the branches of fluxes of gaseous coolant in the pipelines of heat-exchange devices were obtained, whereas previously only numerical solutions to this problem took place [1-10].

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