RESEARCH HEAT EXCHANGERS OF THE GAS TURBINE WITH AN EXTERNAL SUPPLY OF HEAT IN THE UTILIZATION SCHEME OF SEWAGE SLUDGE

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Biomass as a low-calorie solid fuel has a number of negative characteristics that hinder its use: low energy density; high humidity, which reduces the calorific value; heterogeneity on the fractional and chemical composition makes it difficult to automate and fuel. Also, due to the use of low-calorie fuel the temperature potential flue gas decreases, which impairs the heat transfer in power plants and increases their cost.

Proven and the most common technology for the construction of a small combined heat and power for local fuels is Steam-power technology at organic coolant with direct fuel combustion in the boiler unit and intermediate coolant (high-temperature oil) to transfer heat from the combustion products to the organic working fluid. The maximum temperature of the organic working fluid in the existing plants, as a rule, does not exceed 250 ... 300 ° C. Given that the temperature potential of the combustion products from the combustion of biomass can be 900 ... 1000 ° C, from a thermodynamic point of view to improve the medium-integrated temperature of the heat supply is useful to consider the application of the superstructure of the gas turbine with an external supply of heat.

Analysis schemes of combined cycle power plants with an external supply of heat in the gas turbine parts showed that the important question of the application of the scheme are heat exchangers. And when you consider that steam power plant heat exchangers on the organic coolant already used modularly as standard equipment, the choice of high-temperature heat exchanger for a gas turbine with an external supply of heat is still problematic because world have the small production and use experience of this heat technologies. Highest demands are placed to heat exchangers such as: oxidation resistance, corrosion resistance at high temperatures, erosion resistance, resistance to thermal stress and so on. A view of the fact that both working fluids in the heat exchanger are gaseous, heat exchanger has large dimensions.

For research as the main structural elements for design high temperature heat exchanger was chosen the loop heat exchanger out of stainless steel pipes. Its advantages are high temperature resistance, high gas tightness, the use of pressurized working environments and ease of fabrication, installation and repair; relatively small size.

Was analyses methods of heat transfer enhancement for reducing the size of the heat exchanger. As a result, it was selected fin fins as the most easy to produce, not to clog the soot particles of flue gases, and having a low aerodynamic drag.

After calculations the high-temperature heat exchanger of smooth pipes heat output is 2,2 MW have heat transfer coefficient k = 69,4 W/(m^2•K) and the area of 250 m^2, the heat exchanger with fin had a heat transfer coefficient k = 113,3 W / (m^2 • K) and the area of 153 m^2, it is possible to reduce its size by about 40 percent.

Numerical analysis showed that for the conditions of treatment facilities of Minsk city water utility plant for waste disposal by combined-cycle scheme can have electrical power of 1,75 MW. At the permissive temperature of heating the air in the two heat exchangers up to 840 °C, the degree of compression in the compressor $\beta = 6$ and excess air coefficient $\alpha = 3$, the efficiency reached of 33,5 percent, which is a good indicator for this type of installation.