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FEATURES OF THE FLOW OF A COMPRESSBLE LIQUID IN FLOWING PARTS OF CONTROL VALVES OF STEAM TURBINES

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ABSTRACT

The control valves of steam turbines providing change of the discharge of steam through the turbine, work in extremely wide range of pressure differences and thus, depending on the load of the turbine, the form of the valve's channel varies from convergent tube at the maximal discharge of steam to especially diffusor at small discharges.

Thus, in the valve's channel both supersonic modes of flow with complex wave structure, and subsonic are realized.

Features of a compressable liquid flow in the profiling axis-symmetric valve's channel of variable geometry, which is widely used in the new valves developed by ENTEK Ltd company, together with the Moscow Power Engineering Institute, are considered. Also it is given a comparison with flow character in standard the poppet-valve.

The specified valves were investigated as with application of optical device "Toepler" (on 2D models), and also on specially created test bed intended for air tests of models of control valves of all types. Research were spent in the field of self-similar to Reynolds's number at subsonic and supersonic stream in a flowing part of valves.

The basic purpose of the research was to get of discharge, strength and vibrating characteristics of the new control valves designed for perspective steam turbines of new generation.
It is shown, that at small loadings of the turbine the most dangerous modes of supersonic flow in the valve's channel are realized with pressure jumps inside the ring axial-symmetric channel. In order to prevent self-oscillatory processes at such modes it is suggested to replace smooth streamline surfaces with the punched surfaces providing dispersion and clearing of complex wave structure, inherent in supersonic streams.

Results of physical modelling of supersonic flow in poppet-valves’ and profiling valves’ channels

which have completely confirmed high aerodynamic characteristics of new valves are given. These results have shown extremely low level of dynamic loadings on all elements of these valves that provides their reliable operation on all power turbines.

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