New type of turbines with small flow rate for conversion heat energy into mechanical

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Worked out on the basis of extensive theoretical and experimental researches the principles of projection have allowed to develop a new class of turbine stages.

The basic distinctive features (in comparison with traditional turbines), which shows scientific and engineering novelty, of turbine stages of an LPI design are:

- Small angles of flow output from nozzle vane (NV), $\alpha_{1g} = 3…9°$;
- Large angles of turn of a stream in impellor (I), $\theta_2 = 160…170°$;
- Small angles of an input in I, $\beta_1 = 6…14°$;
- Small quantity of nozzle and working blades in comparison with traditional blades;
- Large relative step of nozzle (t/b > 1.0) and working (t/b > 1.2) blades;
- Small volumetric flow rate of a working body;
- Opportunity of operation of significant heat drops of enthalpies at rather high efficiency;
- Supersonic flow in NV and I;
- Heightened erosive resistance of nozzle and working lattices.
- The basic areas of application of a new class of turbine stages of an LPI construction:
- The turbines with small flow rate for the micro-turbine generator;
- Power and transport installations of small and medium capacity (up to 5MWt) with steam and gas turbosets;
- Control stages and pressure stage of steam multistage turbines of small and medium capacity;
- First stages of high-temperature gas turbines (cooled or with ceramic blades):
- Turbines working on a two-phase working body (wet steam or a working body, containing hard particles);
- Autonomous one- or double-wheel stages with significant heat drops of enthalpies (up to 1000 … 1200kJ/kg) at rather high profitability;
- Small-sized steam turbines of the combined gas-steam installations of small and medium capacity.

Guarantee of successful introduction of a new class of turbine stages of an LPI design are the methods of optimum projection and profiling, designed on the basis

of generalization of results of theoretical and experimental researches more than 70 profiles of nozzle and working blades and more than 100 turbine stages of an axial and radial type in a wide interval of change of geometrical and regime parameters. On the basis of these methods the program complexes one and multimode optimization of such turbines, including on the given graphs of loadings, are created.

It is experimentally proved on full-size and modeling stands the opportunity of operation by stages of an LPI design of the large heat drops at saving high profitability by lowering losses at supersonic and transonic speeds of a stream, and also losses from output speed.

The scientific novelty is confirmed by the copyright certificates of the USSR. Joint manufacturing and licensing in foreign countries of described turbine stages is possible.

The given class of turbine stages has found wide application in Russian Federation in autonomous power installations of special assignment. Their successful use confirms efficiency of the applied engineering decisions. The biggest world manufacturers of the power equipment, such as Siemens (Germanium), GE (USA), Hitachi (Japan), etc., show the great interest to the given development.