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# GAS TURBINE UNITS HYDRAULIC POWER STATIONS

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**Annotation**
This article provides ideas and feedback on gas turbine and steam-gas installations, hydraulic power plants.

**Keywords:** Gas turbine units, internal combustion engines, power, steam-gas unit, hydraulic power plant.

Gas turbine units (GTQs) are widely used in IEMs. They use fuel combustion products, heated air at high pressure and temperature as the working fluid. In GTQ, the heat of the gases is converted back to the kinetic energy of the turbine rotor conversion. In terms of design and energy conversion, gas turbines are no different from steam turbines. But gas turbines are more compact than steam turbines. Gas turbines are mainly used in transportation. The use of gas turbines in the engines of the main part of modern aviation has allowed them to increase speeds, payload capacity and flight altitudes. Gas turbine locomotives compete with diesel locomotives equipped with internal combustion engines.

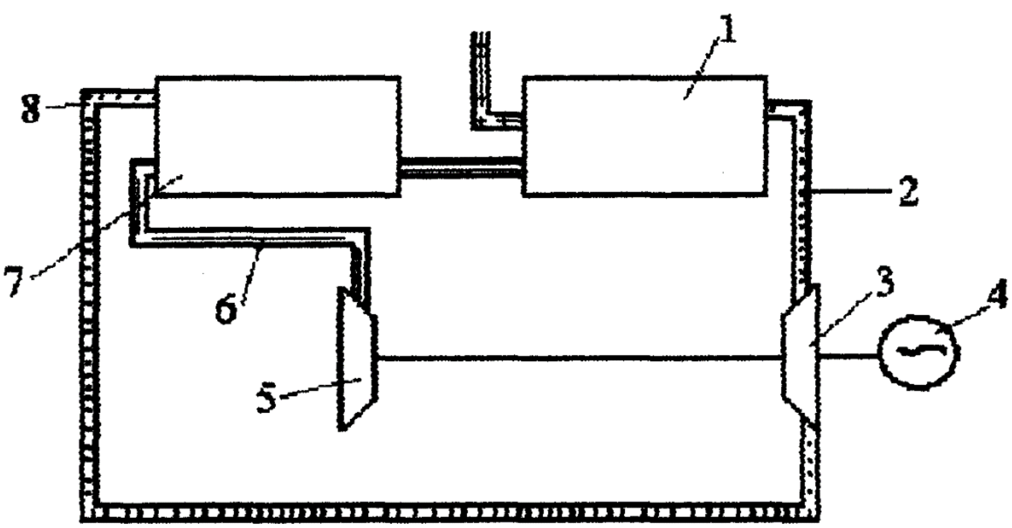


Figure 1. Schematic diagram of a gas turbine unit

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It is of practical importance to use coal by burning it underground. Here, the required amount of underground air is supplied by means of a compressor, the coal is specially burned to form combustible gases underground, and the gas is conveyed to the turbines by means of pipes. The first such experimental device was built in the Tula region.

The gas turbine unit works as follows. 1 liquid or gaseous fuel and air are supplied to the combustion chamber. The high-temperature and high-pressure gases generated in the combustion chamber are sent to the turbine working blades 3. The turbine rotates the electric generator 4 and the compressor 5. The compressor in turn supplies large compressed air to the 6 combustion chambers. Before supplying the compressed air in the compressor to the combustion chamber, the gases used in the turbine 8 are heated in the regenerator 7. Heating the air increases the efficiency of fuel combustion.

The gases used in the GTQ have a high temperature, which has a negative effect on the FIK of the thermodynamic cycle. Combining gas and steam turbine units increases the efficiency of the working unit by 8-10% and reduces the cost by 25% due to the total use of heat generated by the combustion of fuel.

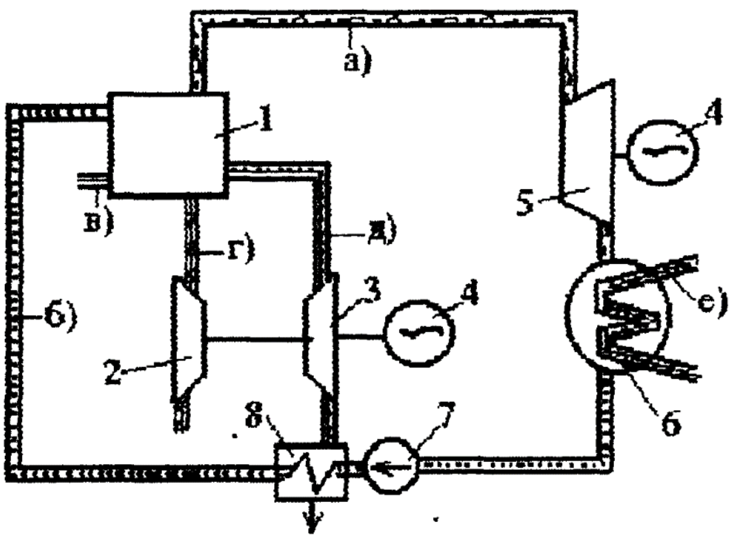


Figure 2. Schematic diagram of the steam-gas device:
1 steam boiler; 2-compressor; 3 gas turbines; 4-generator; 5 steam turbines; 6-capacitor; 7-pump; 8-economizer; a) steam; b) water and condensate; c) fuel; g) air; d) combustion products; e) cooling water.

Steam and gas appliances use a combination of steam and gas working bodies.

Gases cooled to 650-700 ° C are fed to the working blades of the gas turbine. The gases used in the turbine are used to heat the drinking water, which reduces fuel consumption and allows the unit to increase the FIC to about 44%.

The diagram below shows the gases used in a gas turbine, which can be used to heat the steam boiler.

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The gas turbine is in this case considered as part of the steam unit. The gas turbine unit burns 30-40% of the fuel in the combustion furnace, while the rest of the fuel is burned in the steam boiler.

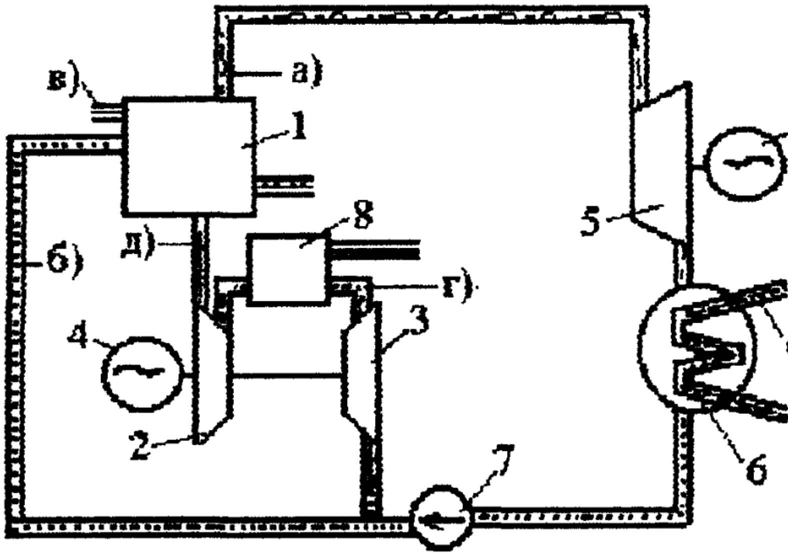


Figure 3. Scheme of processing of combustion products of the steam-gas device in the steam boiler: 1 steam boiler; 2-compressor; 3 gas turbines; 4-generator; 5 steam turbines; 6-capacitor; 7-pump; 8-economizer; a) steam; b) water and condensate; c) fuel; g) air; d) combustion products; e) cooling water.

Only liquid or gaseous fuels can be used in gas turbines. Ash and mechanical mixtures in solid fuels can cause significant damage to turbine blades. In gas turbines, like conventional steam devices, heat energy is converted into mechanical energy by the turbine and then into electrical energy. This power scheme requires the use of materials resistant to large mechanical stresses and high temperatures. Due to the limited strength of the material, the steam does not exceed 600 ° C. At the same time the combustion temperature of the fuel reaches 2000 ° C. Reducing this temperature difference allows heating devices to increase FIC.

Hydroelectric power plants convert water energy into electricity. The science that studies the basics of its work is called hydraulics, which includes hydrostatics (fluid equilibrium states) and hydrodynamics (fluid motion), the shear water flow rate is the high flow height and low flow height of a dam water basin built through a specific layer, water flow Q represented by. The difference between the levels of the upper and lower basins is called the slope. We can calculate the power of the current in the layer (kW) by consumption ($m^3$ / s) and pressure (m).

$$P = 9.81 \cdot QH$$

Due to the power losses that occur in HPP engines, hydraulic devices, turbines and generators, the water flow can be used only in part, taking into account the FIK. Approximate capacity of GES

$$P = 9.81 \cdot QH\eta$$

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In mountainous areas, which is carried out by means of a dam on the rivers of the N-plane of the basin, the concept is used, which are called diversions.

In hydraulic turbines, water energy generates mechanical energy by rotating the turbine shaft, which in turn generates electrical energy. If the turbine uses dynamic water pressure, it is called an active turbine, if static pressure is used, it is called a jet turbine.

In the shrinking clutch in the active turbine bushing - in the nozzle, the potential energy of the hydrostatic pressure is completely transferred to the kinetic energy of the water movement. The working wheel of the turbine is made in the form of a disk, around which are placed paddle blades.

The water passes through the surface of the shovels and changes the direction of movement. Here, centrifugal forces acting on the surface of the shovels are generated, and the kinetic energy of the water is converted into energy that rotates the turbine wheel.

In a jet hydraulic turbine impeller, both the kinetic and potential energies of water are converted into the mechanical energy of the turbine.

The water coming to the turbine impellers is overpressured and decreases as it passes through the impeller track. Here, the water acts on the turbine blades with reactive pressure, and the potential energy of the water is converted into the mechanical energy of the turbine impeller. The working wheel of a jet turbine, unlike an active one, is fully immersed in water.

In power stations, the turbine and generator are connected by a common shaft. Their rotational frequencies cannot be chosen arbitrarily. They must correspond to the number of pole pairs of the generator rotor and the standard frequencies of the alternating current.

The cost of rotating turbines at low frequencies is expensive, and they must also take into account the large space they occupy. To obtain aggregate velocities close to acceptable values, a turbine with a small coefficient of rapid rotation at high pressures and large values of this coefficient at high pressures are used.

The turbines of hydropower plants, which are built in different natural conditions, are different in terms of design performance. Turbine power ranges from a few kilowatts to 500 MW, with a rotational frequency of 16 2/3 to 1500 min-1.

Recently, horizontal aggregates (capsules) have been used, in which the generator is housed in a watertight hermetic capsule.

These aggregates have a high FIK (95-96%) due to the good hydraulic properties.

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