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GAS-WIND ENERGY CONVERTERS

V. Biryuk, R. Serebryakov, Y. Tsibizov, L. Cheludko

To ensure its own electrical needs of each of the hundreds of compressor stations (CS), equipped with pumping units (GPU), spent about 1.5 - 2.5 MW of electrical power. Power supply is made by the COP high voltage transmission lines (PTL), remote from them tens or even hundreds of kilometers. At the same time losses during the transport and transformation of centrally supplied electricity are generally from 10 to 15% of the electricity consumed for own needs of the COP, and reach significant quantities in the country.

To improve the reliability and the possibility of providing emergency power to all of the COP established a special emergency reserve gas turbine power units.

With the continued rise in prices for centrally supplied electricity and increase the cost of gas transport advisable to seek to reduce or even elimination, depending on the supply of foreign COP expensive electricity.

This is one of the possible directions - equipment KS highly economical gas turbine combined-cycle gas turbine power plants and their own needs with the rejection of economical emergency power plants. But this way will require large capital expenditures.

The second way - generate electricity for their own needs of the COP using wind energy. But most of bladed wind turbines installed on the tower height of 30-40 m with a length of 4-5 meters propeller blades and the horizontal axis develops power of about 800-1000 kW at an average wind speed of 5-7 m / s. Specific capital investments in the installation of wind generator located at 1200 - 1400 $ / kW. The high cost and the ability to obtain the required power only in areas with high wind loads define their low efficiency for the own needs of the COP.

Significantly lower cost of wind power have a vortex. These hyperbolic housing (stator) the formation of swirling air flow like natural tornado, has significant reserves of kinetic energy.

At the axial central region of the vortex formed in the stator, the pressure is reduced relative to the external atmospheric pressure. With this in ascending tornado sucked an additional pillar of the mass air flow. The wind wheel of the wind generator apparatus having a vertically extending axis, the kinetic energy of the air flow is converted into mechanical work used to generate electricity.

Vortex installation, at a much lower wind speeds (2-3 m / s) and the same area, the sweeping wind wheel, can develop about five times more power than bladed wind turbines with a horizontal axis.

Because the waste pipe of gas pumping units of compressor stations every second emitted into the atmosphere millions of kilograms of exhaust gases at about 20 m / s and temperatures up to 400 ° C.

At the same time, the kinetic energy of the flue gas compressor unit is relatively small and practically does not allow the direct use of their considerable energy potential for the generation of electricity and satisfy the needs of the COP. As speed increases the kinetic energy of exhaust gases occur increasing resistance of the exhaust duct and reducing the effective efficiency of gas pumping units.

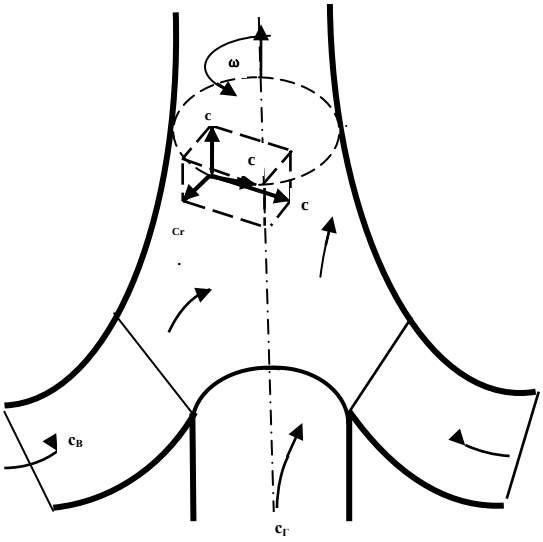
The purpose of research - the creation of power plants for own needs of the COP through the development of new types of combined gas-wind-electrical aggregate vortex type with a vertical axis, and the ability to effectively use their energy potential of waste gas flows GPA and the kinetic energy of the incoming flow of wind.

Materials and methods of research. Depending on the flow rate and temperature of the exhaust gas turbine compressor units gas-electric capacity of wind power plants, even in calm weather can range from 80 to 200 kW. Moreover, with increasing wind velocity in them is an increase in the effect of the vortex and, consequently, the power plant.

The results of research. Figure 1 is a schematic diagram of motion in the vortex gas flow windmill flue gas compressor unit and air. This type of installation is provided with a swirler inlet air flow, causing its swirling motion with increasing tangential velocity, creating a vacuum in the axial part of the vortex motion and

acceleration of waste gas flow GPA. Previously a recycled gas stream exiting the tailpipe SBS enters the central part of the cylindrical stator installation and mixed with the air stream being accelerated with it.

Due to the fact that the axial portion of the stator windmill gas develops a slight negative pressure relative to atmospheric pressure, in the output path of the installation will not be larger flow resistance of the exhaust duct, effectively reducing the gas turbine efficiency and reducing the power of HPA.



Ris.1.Shema-gas flows in the stator installation:

CB, SG - speed of the air and gas flows entering the gas wind turbine; C - the absolute velocity of the air-gas flow at the walls of the stator; CZ, Cr, Sφ - With projection speed on the coordinate axes; and ω z - tangential and axial velocity of the gas-air flow.

If the periphery of the stator hyperbolic predominant velocity component tangential swirling flow of air-gas, in its central part there is a significant increase in the axial velocity.

It is important that with the increase of wind speed in the wind power installation of gas increases the vortex effect, accompanied by an increase in the flow rate and gas mixture and causing the increase of its capacity.

The construction scheme of gas-wind power plant is shown in Figure 2. Position housing has a hyperbolic shape, and is installed with an air gap above the exhaust pipe SBS.

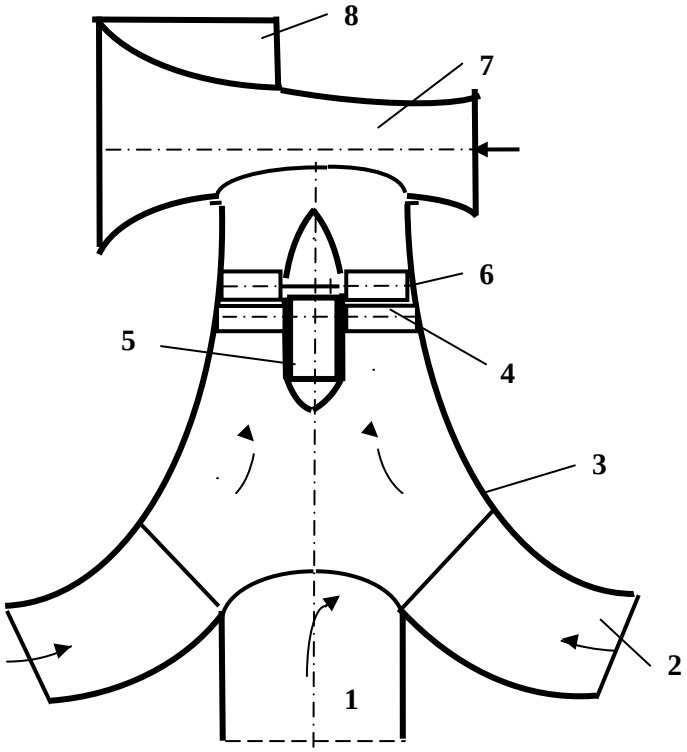


Fig.2. Schematic diagram of the wind energy plant gas compressor unit:

1 - tailpipe GCU; 2 - curvilinear air passages; 3 - hyperbolic stator; 4 - guiding device; 5 - an electric generator; 6 - axial turbine blades; 7 - Venturi tube; 8 - vane

Air wind flow with the help of curved vanes 2 swirl with increasing tangential velocity and enters the hyperbolic stator system 3, where it is mixed with the pre-twisted gases coming out of the exhaust pipe 1 GPA. Rapid installation in the hyperbolic case air-gas flow via guide vanes 4 is supplied to the vane axial turbine 6, resulting in the rotation of the generator 5. On the output side of the stator 3 on bearings installed Venturi tube, which creates an additional depression in the top of the housing unit. With the help of a guide plate 8 (weathervane) Venturi tube is installed on the wind direction and increases the power axial turbine power generator 6 and 5.

Conclusions

Consideration of principles and constructive scheme of gas-wind power plant was allowed to be used quite effectively for power generation energy of the exhaust gas flow of GPA and the kinetic energy of the incoming air flow.

At the same time it is characterized by the following positive features:

- Increasing the velocity and kinetic energy of the gas-air flow;

- Increase in mass flow through the axial turbine;

- Dilution of the hot exhaust gases SBS air flow temperature drop of gas-air mixture and a decrease in their concentration of harmful substances, which allows to reduce the height of the exhaust tubes GCU;

- As a result of the Venturi tube in the exhaust pipe SBS creates a slight negative pressure, which leads to a reduction of hydraulic losses in the output path and improve the effective efficiency of the gas turbine at the same power GCU;

- By providing an autonomous auxiliary power supply will increase the reliability of the CS trunk gas pipelines is a principal positive factor;

- In the case of installation of gas-compressor units of wind power units and maintaining centralized power, significantly reduce the cost of purchasing electricity from external suppliers, or will be able to reduce the consumption of fuel gas emergency reserve gas turbine power units.

Basically, the gas-wind power plant of this type can be equipped with a large part of the GPA of the COP, at greater distances from the transit stations and high-voltage lines.