# INCREASING THE ENERGY EFFICIENCY OF A ROTOR-PULSED CAVITATION HEAT GENERATOR USING THE ELECTROHYDRAULIC EFFECT

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***Abstract* – The current stage of energy development is characterized by the desire to increase energy efficiency and reduce losses during energy transmission. In this regard, it is necessary to single out a stable trend - the use of energy systems as close as possible to energy consumers. A promising topic is a combined heat generation system based on the principle of rotary-pulse or vortex cavitation using the Yutkin electrohydraulic effect.***

Keywords – cavitation, Yutkin effect, heat, discharge, pressure, temperature.

## Introduction

The use of the electro-hydraulic Yutkin effect in combination with the generation of heat based on rotary pulse or vortex cavitation causes a sharp transition of the liquid from a state of high pressure to a state of low pressure and again to a state of high pressure, following the example of a Laval nozzle.

The cavitation bubbles formed in the liquid during the passage of the Laval nozzle from the area with low pressure to the area with high pressure collapse, form a shock wave, as a result, a large amount of thermal energy is generated.

In order to improve the conditions for the collapse of cavitation bubbles in the developed rotary-pulse heat generator, the Yutkin electrohydraulic effect is used, which consists in the formation of a short-term high-voltage electric spark discharge in a liquid medium, as a result, an electrical breakdown occurs, a powerful hydraulic shock occurs with a large local pressure (according to some sources, more than by $10^3 \div 100 \cdot 10^3$ atm), which contributes to the collapse of the cavit.

In this case, the duration of the leading edge of the discharge current pulse varies from fractions of a microsecond to several microseconds.

An important aspect of the proposed technology is the generation of heat from environmentally friendly sources with high energy efficiency.

On Fig. Figure 1 shows a structural diagram of the application of the Yutkin electrohydraulic effect in the developed rotary-pulse heat generator [1, 2].

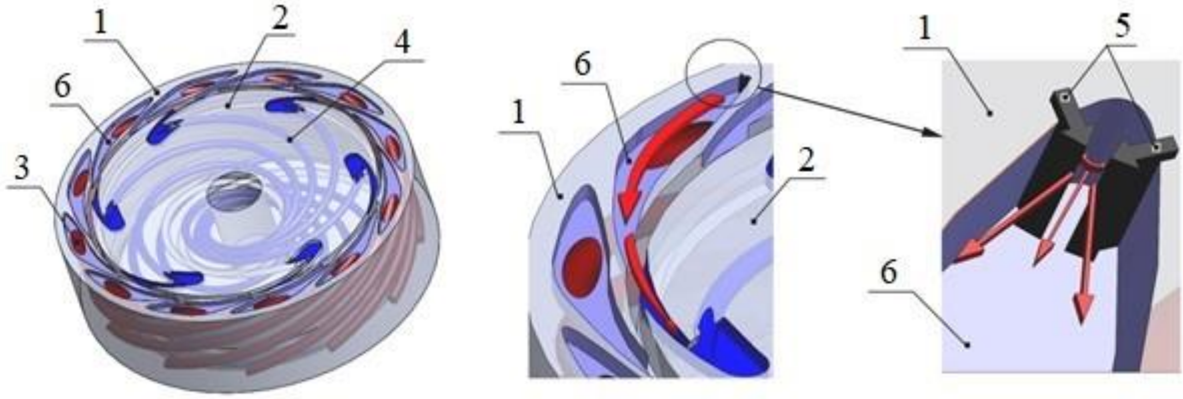


Fig. 1. Constructive diagram of the application of the electro-hydraulic effect of Yutkin in the developed rotary-pulse heat generator: 1 – stator; 2 – rotor; 3 – system of internal cavities of the stator; 4 – system of internal cavities of the rotor; 5 – arrester; 6 – working chamber

When a spark electric discharge occurs in the arresters installed around the perimeter of the stator 1 in the expanding cavities of the rotor 2, the pressure instantly rises, a cumulative effect occurs, which significantly improves the conditions for the collapse of cavitation bubbles generated during the operation of the rotary-pulse heat generator.

As a result, thermal energy is released, the liquid is heated and fed into the heat supply system [3].

For a uniform supply of electro-hydraulic impulses, the distribution of electric arresters into groups with serial connection is provided, in accordance with the system of spark distribution of internal combustion engines (Fig. 2).

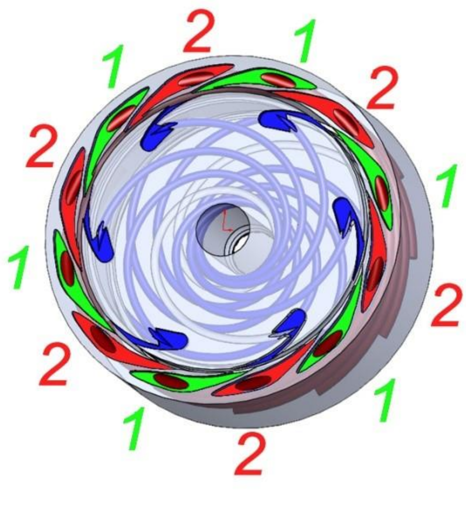


Fig. 2. Scheme of series connection of a spark discharge: group 1 – green; group 2 – red

As an example in Fig. 2 shows the inclusion of a spark discharge in groups: group 1 (green) and group 2 (red), which are switched on sequentially.

An important aspect of understanding the proposed technology is the fact that, as a result, there is an environmentally friendly analogue of an internal combustion engine (ICE). Just as in an internal combustion engine, the source of useful work is excess pressure, which in the case of an internal combustion engine is formed during the ignition of gasoline vapors (or analogues), and in the described case is formed in a liquid during spark action.

**Results**

According to the results of the experiments performed in the real process, the average temperature at the outlet of the cavitation chamber of the heat generator reaches 355÷360 K, $\eta = 0.86 \div 0.89$.

The proposed technology and device has a wide range of applications: in the heat and power industry, as well as in various industries and other engineering applications.

### References


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