Environmentally-Friendly Energy Conversion Systems with Hydroelectric Power Plant for Low Stream

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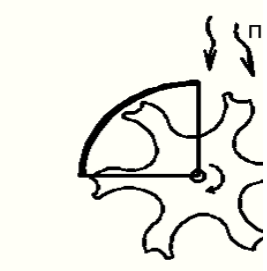
problems of hydroelectric power plants:

- series of negative unavoidable events;
- dams destroy rivers and their surroundings;
- contribute to biodiversity loss substantially;
- interrupt the natural flow of the river;
- block fish migration;
- intercept sediments that protect river banks and deltas from flooding and rising sea levels;
- the changes in the groundwater because of the dam;
- the changes of the water level in reservoirs

The idea:

to create low-flow hydro installations,
which can often be found in firebreaks and other zones,
to provide energy for small-scale,
time-fed farms, camps, temporary events and similar meetings



Damp-free hydro-installation, developed by the authors, is designed for the transformation of the river's flow energy and can be used on various types of rivers and work all year round, as it is not exposed to ice floes.

The main scientific goal is to eliminate the impact of hydro-installations and their construction on the natural environment of rivers and streams

Theoretical description

A small dam may be used to ensure enough water goes in the penstock, and possibly some storage. Run-of-the-river systems are ideal for streams or rivers with consistent water levels or minimum loss of water flow during the dry season and for rivers with large fluctuations in levels.
In streams without a derivation channel energy is:

$$P = 9{,}81*Q*H, \text{ kW} \quad (1)$$

Only a part of this capacity, equal to the efficiency of the installation, can be used in the power generators of the hydroelectric power station. Therefore, the power of the power plant with a head H and a water flow through the turbines Q is:

$$P = 9{,}81*Q*H*\text{efficiency, kW} \quad (2)$$

Therefor, the majority of hydropower plants are small (less than 10 MW) and 91% of the plants produce only 13% of total hydropower production in Europe. But they do not have structures for water containing ice and sludge.

The task which the authors set themselves is the possibility of more efficient use of the river flow, regardless from the width and depth of the river, across the all depth and all year long.

In the case of low-power hydroelectric power plants, it is better to use the principle of active turbines instead of reactive turbines, because active turbines have a higher hydraulic efficiency and the problem of water impact in pipes is solved.


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ПОЛЕЗНУЮ МОДЕЛЬ

№ 185644

Бесплотинная гидроэлектростанция

The authors proposed and patented a version of the hydroelectric power station, which excludes negative impacts. Patent № 185644

The hydropower plant comprises a structure installed in the river bed, consisting of a wheel with a vertical axis, a gear block and an electric current generator with a sealed underwater structure. The foundation is equipped with a vertical pointed bar that allows the structure to be fixed in the required place on the river bottom. A wheel operates on the principle of an active turbine with a vertical axis, coupled with a rotating construction. On the circumference of this construction a bent grooves were made. Each groove is made in the form of rounded plates, thanks to which the flowing stream enters the structure at right angles and then bends along the channel, turning the turbine wheel. The rotor has a protective plate that guides the water flow. In order to protect the device from freezing, there are inclusions in the form of spheres made of a phase transiting material, which ensures a smooth cooling, because this material contains latent heat, which can be transformed with average temperature fluctuations under natural conditions.

After simulation results, a prototype was created.

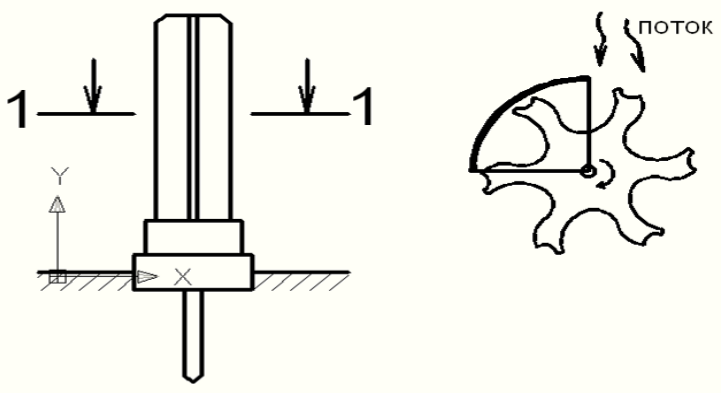


Figure 1. The draft of the low-flow hydro-installation structure, shown in the Invention Patent.

Results

As a result of tests and operation of the experimental model, the influence of the hydroelectric station and its construction on the ecology of rivers and streams was excluded. Also, the efficiency of the hydraulic unit has been increased in a given range of changes in the rotor speed by changing the height of the hydraulic turbine. Use is possible with quick assembly and disassembly in a fairly short period of time, receiving energy from any hydraulic and even aerodynamic flows.