

HIGHLY EFFICIENT PRODUCTION AND SIMULTANEOUS USE OF ENERGY IN LOCAL WATER SOURCE

ВЫСОКОЭФФЕКТИВНОЕ ПРОИЗВОДСТВО И ОДНОВРЕМЕННОЕ ИСПОЛЬЗОВАНИЕ ЭНЕРГИИ НА МЕСТНЫХ ВОДОИСТОЧНИКАХ

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Abstract: We offer decentralized unpowered water lifting, using devices that are installed below a water source, such as a spring. The most promising of the water lifting devices of impulse type is a hydraulic ram. If the hydraulic ram is equipped with a suction tube, it is possible to increase the height difference between the source and the lowest point to the most possible value. If the hydraulic ram is equipped with a torque converter it allows: 1) to adapt optimal operating mode of a hydraulic ram to particular geodesic conditions; 2) to create in advance large-scale hydraulic rams and torque converters and to unitize them for each urgent order 3) in the second circuit, i.e. in the torque converter, any medium may be used as the working fluid: water, oil, coolant, air and so on., that helps produce energy and then transform it into useful function at maximum efficiency ($\approx 90\%$) due to the minimal number of the energy conversion forms.

Keywords: ENERGY, PRODUCTION, USE, EFFICIENCY, SPRING, HYDRAULIC RAM, TORQUE CONVERTER, MULTIFUNCTIONALITY, BANK, RIVER

1. Introduction

The energy efficiency of the majority of technological processes is very low:

- metal processing efficiency does not exceed 5-7%;
- efficiency of gasoline transport - 15-20%;
- efficiency of pumping equipment - 10 - 15% due to many forms of energy along the chain from its obtaining to implementation.

Consequently, more than 65% of the world energy goes to heating the atmosphere, greenhouse effect, climate change.

However, the costs of energy production by a centralized method are increasing steadily and this requires not only money. Water reservoirs of hydropower stations are flooded, their capacity has decreased, and soon the reservoirs may turn into smelly sumps filled with sediment. The disaster at Chernobyl, Fukushima also occurred due to the increased energy demand. Moreover, 80% of the world's energy is used for pumping water, while the cost of the pump does not exceed 1-3% of the total costs, the major share is made by maintenance costs (fig. 1).

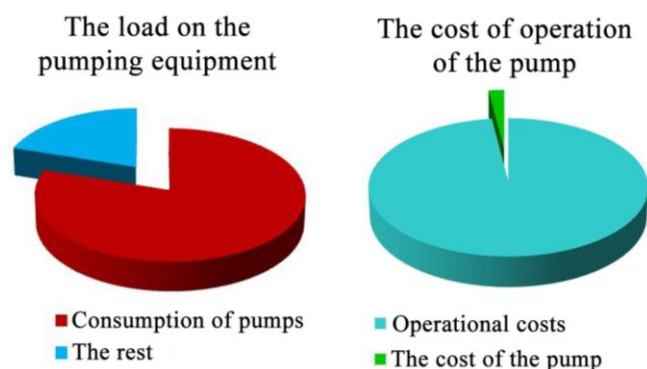


fig. 1. The cost of water supply

2. Preconditions and means for resolving the problem

To partially solve this problem, motorless (and practically cheap) technical means for lifting water are offered, such as hydraulic ram. Hydraulic ram is an end of a supply pipe with impact and discharge valves, air cap and discharge line. The beginning of a supply pipe is connected to the natural water sources (fig. 2).



fig. 2. View of the experimental device

The principle of operation is based on the separation of the water flow from an upper source into two parts, one of which is reset and transfers energy to the second part, providing water lifting on a height greater than the source location. Impulse work of a hydraulic ram allows to get excellent performance indicators (we obtained water lifting height of 180 meters) [1] with high efficiency. It works day and night, winter and summer, and requires no maintenance costs (fig. 3).

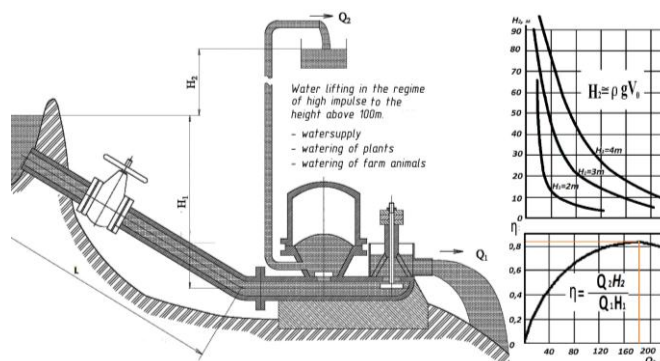


fig. 3. The scheme of work of a hydraulic (water) ram

The efficiency of a hydraulic ram can reach 93%, which is several times higher than the efficiency of electric pumps.

3. The problem solution

Although this device is known since the time of the brothers Montgolfier, it like any technical system has been developed. Our team has done the following operations:

- To make better use of geodesic water source conditions, we offer to equip the hydraulic ram with a suction tube, which will increase the height difference and allow to use the maximum amount of energy. [2] The hydraulic ram may be situated in the place convenient for maintenance and be protected from the spring floods (fig. 4).

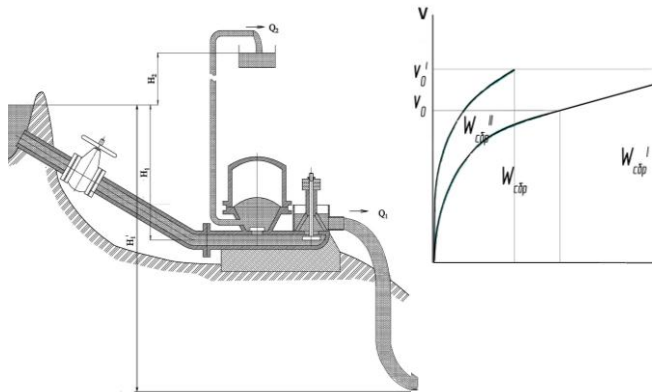


fig. 4. Increasing the efficiency of energy use of water source

- Development of river hydraulic rams allows to get much greater capacity limited only by river location and hydraulic rams can be placed anywhere along the riverbed. To increase speed which is expressed in pressure we propose:
 - use a pulse movement of the hydraulic ram's body;
 - create a local flow acceleration in the river (fig. 5); [3]

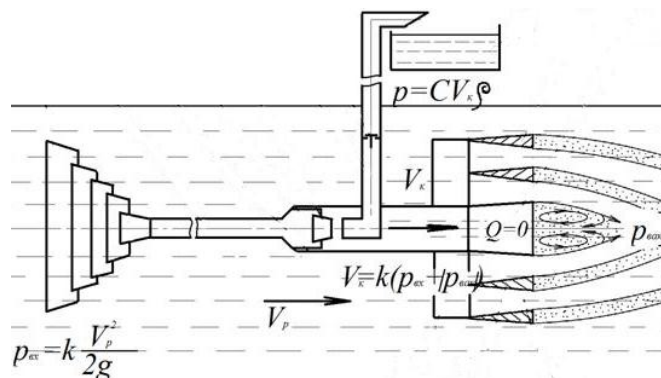


fig. 5. Local speed increase in the river

- equipment of a hydraulic ram with a torque converter improves the efficiency of its work on inefficient modes and expands its functionality (fig. 6). [4]

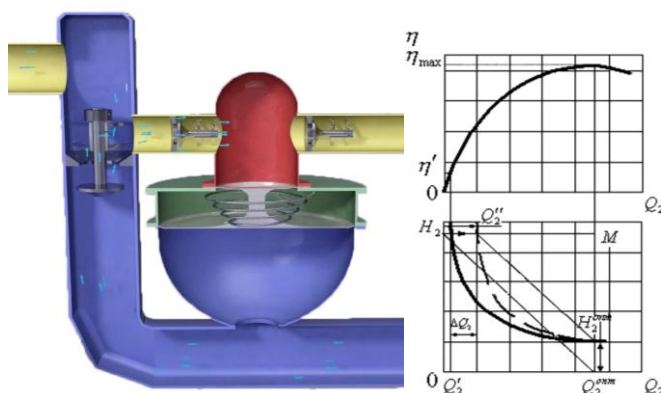


fig. 6. Hydraulic ram with torque converter

In this case, the torque converter converts the best indicators of a hydraulic ram work in ratio of expenditure and pressure required by the consumer.

Construction of a hydraulic ram in two stages-modules allows to create type series of an advanced design:

- hydraulic rams to parameters of input power;
- torque converters to the operating conditions, which makes it possible to choose the best sets. In addition, the second circuit of a hydraulic ram enables to take energy from a water source by the first step (actually hydraulic ram), and the second circuit serves as:

- a compressor (fig. 7);

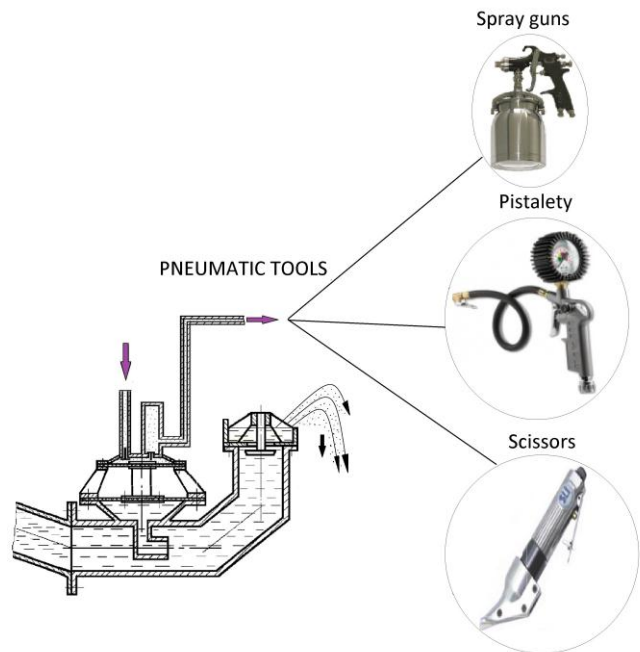


fig. 7. Hydraulic ram with air working medium

- a vacuum pump;
- a milking machine (fig. 8);

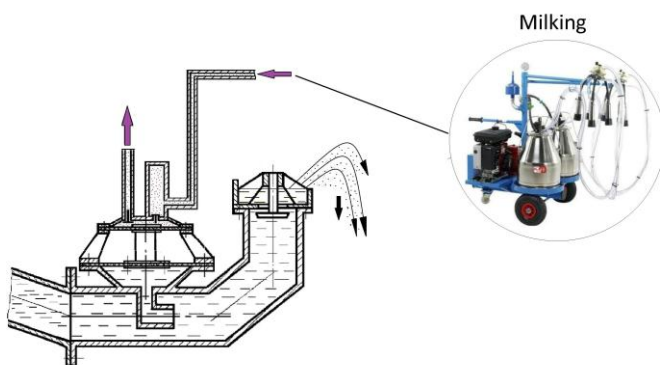


fig. 8. Hydraulic ram combined with milking machines

- a hydraulic drive (fig. 9);

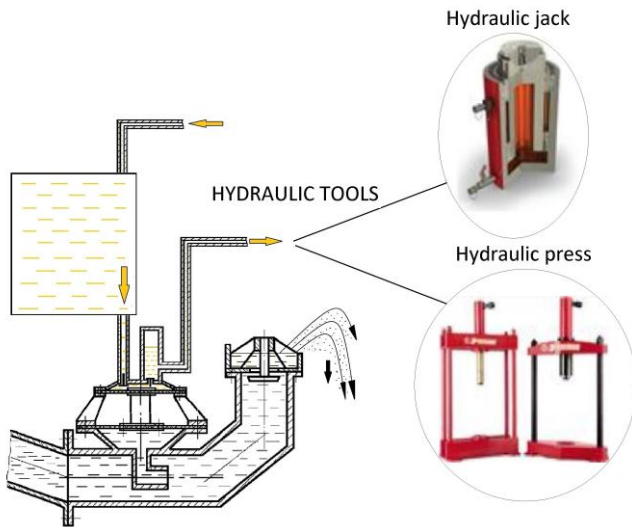


fig. 9. Hydraulic ram with oil working medium

- a refrigerator (fig. 10); [5]

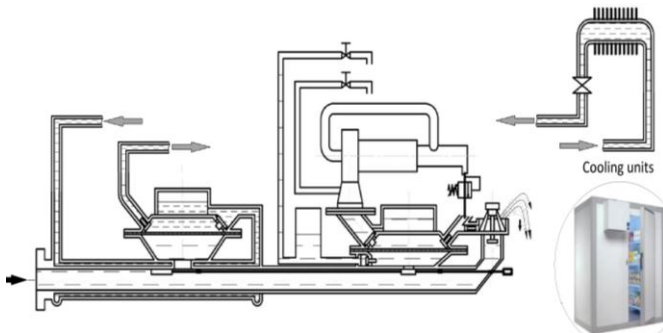


fig. 10. Hydraulic ram with refrigeration and heating installations

- an electric generator (fig. 11), etc., using different working fluids (water, oil, coolant, air).

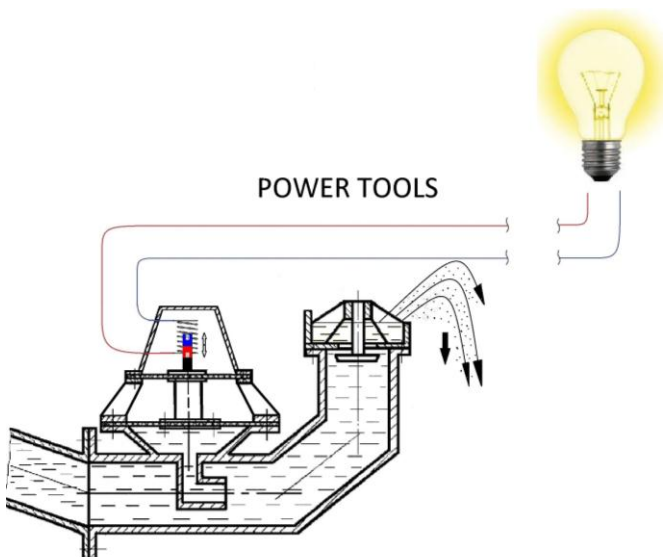


fig. 11. Hydraulic ram for electricity generation

4. Conclusion

Unitization of a hydraulic ram with an electric pump allows to get cheap water and at the same time to ensure the reliability of water supply in peak hours of water consumption.

Our team as well studied and improved unpowered (motorless) water lifting devices of different principles of working: water lifting device of replacement, siphon water lifting device (without movable parts) and also designed a lifting device of rotary type.

This set is one of the methods for decentralized energy production and simultaneous high performance of its use. Potential customers are rural settlements, farms, garden associations, reserve water supply, companies involved in water supply in Africa, as well as the states to facilitate the industrial production of energy - it is more profitable than solar panels and wind turbines.

5. Literature

1. Ivanov. E. G. The results of experimental investigations of hydraulic ram with gravitational shock valve. - Materials of the regional scientific-practical conference of the faculty of engineering NGSHA. Nizhny Novgorod, 2000, p. 188-199.
2. Ivanov. E. G. Improving the efficiency of hydracarina by installing a draft tube. - Modern state and prospects of development of hydraulic engineering in the 21st century. Proceedings of International scientific-technical conference. St. Petersburg, 2003, p. 258-260.
3. Useful model patent №2015111378 RU, F04F7/02. Hydraulic ram for lifting water from rivers / E. G. Ivanov, S. V. Terehov. - stated 30.03.01.
4. Useful model patent № 40411 RU, F04F7/02. Gidrotaran / E. G. Ivanov, V. E. Skokov. - stated 19.03.04; published 10.09.04; bulletin № 25.
5. Useful model patent № 38204, F04F7/02. Gidrotaran / E. G. Ivanov, V. E. Skokov. - stated 22.12.03; published 27.05.04.