ANNOTATION

dissertation work on the topic: "Improving a hydraulic ram pumping installation for the development of a hydraulic shock device to increase the efficiency of irrigation of land in watercourse zones" Yusupov Zhenis Emilevich for the degree of Doctor of Philosophy (PhD) in the specialty 6D080500 -Water resources and water use.

Relevance of the topic and research. In the Address to the people of Kazakhstan "Unity of the people and systemic reforms are a solid basis for prosperity" dated September 01, 2020, the President of the Republic of Kazakhstan K. Tokayev noted that technologically outdated irrigation systems remain a serious barrier. In Kazakhstan, in recent years, 1.3 million hectares of irrigated land have been used for their intended purpose, which includes about 500 irrigation systems with a total length of the irrigation network of about 30 thousand km of channels of 3-5 orders with a throughput capacity of 0.1 to 5 m3/s .

To fully provide the current livestock population with drinking water and fodder, it is necessary to put into circulation about 30 million hectares of natural and cultivated pastures by watering them by using predominantly water to drive pumping units from renewable energy sources.

Agricultural producers located in watercourse zones, due to the lack of alternative pumping units on the market, are forced to use traditional centrifugal pumping units (AH-2K-9-M1 and ANS-60D) driven by internal combustion engines with a power of 1.5 and 5.9 kW, which require significant operating costs and fuel.

The problem of efficient water supply using natural energy resources of water in modern conditions is promising and relevant, the solution of which can be rationally achieved with the required standard sizes of a hydraulic ram pumping unit, the design of which, according to the technical solution, is simple and reliable in operation and does not worsen the environment.

In this regard, for a practical solution to the problem, an improved hydraulic ram pumping installation for collecting water from watercourses is proposed, as well as recommendations for its implementation at agricultural facilities of the Republic of Kazakhstan. The implementation of the proposed design of the gas pumping unit will eliminate the existing technological and technical shortcomings of analogues and improve the main indicators of the required standard sizes. The use of an improved hydraulic ram pumping unit in practice will ensure an increase in flow and efficiency by 20-30%, increased reliability and simplified operation, and compared to basic pumping units, a reduction in operating costs by 8-11 times is achieved.

The operating principle of a hydraulic ram pumping unit for lifting water to a great height and creating the necessary supply is based on the use of the kinetic energy of the moving water flow of the watercourses themselves using the simplest technological process - obtaining pressure and supply due to the periodic hydraulic shock created inside the supply pipeline by automatic closing and opening of the hydraulic shock valve At the same time, energy-saving water lifting technology is used, which increases the efficiency of irrigation and watering of pasture areas, as well as facilitating the work of the main consumers of the agro-industrial complex - peasants and farms.

Today, there are no alternative pumping units on the Kazakhstan market that operate using energy-saving and environmentally friendly technology for lifting water from watercourses. Therefore, research on the development of the necessary standard sizes of improved models of hydraulic ram pumping installations for irrigated agriculture and watering of pasture areas is an urgent problem.

Water resources in the zones of adjacent watercourses of the agro-industrial complex of the Republic of Kazakhstan have a significant reserve of 8643 watercourses,

Most of the rivers in Kazakhstan are located in the southern zones. For example, in the territory of the Almaty region there are 496 rivers with a length of 10 thousand km, Natural and economic factors and parameters of watercourses in terms of flow rate, water flow speed and depth can be successfully used as a natural energy source to drive alternative pumping units, the water lifting technology of which is environmentally friendly and energy-saving.

The main idea of the dissertation work is to substantiate effective technology and technical means of irrigation when introducing new lands and watering pastures in watercourse zones using an improved design of a hydraulic ram pumping unit. The patent for the invention of KazNAIU KZ №34027 was adopted as the basis for the technical solution.

The purpose of the dissertation research. The main goal of research on the topic of the dissertation is to increase the efficiency of irrigation, including when introducing new lands and watering pastures in the watercourse zones of Kazakhstan using a hydraulic ram pumping unit, which reduces operating costs by 8.8-11.4 times. Improving the hydraulic ram pumping installation with improving the properties of the hydraulic shock device, reducing operating costs by 3 - 5 times, increasing the efficiency of irrigation and watering of pastures located in watercourse zones.

Research objective. Justification of the direction of research, literature review and patent research on the technology of lifting water from watercourses using a hydraulic ram pumping unit;

- development of an improved design and technological scheme of a hydraulic ram pumping installation that uses the kinetic energy of watercourses when withdrawing water for irrigation and pasture water supply;
- development of theoretical prerequisites for the technological process of the proposed water lifting technology and the ongoing processes in the hydraulic shock device;
- development of a methodology, justification of the required sizes and parameters of a hydraulic ram pumping unit that uses the hydraulic energy of a watercourse when withdrawing water for irrigation and pasture water supply;
-development of an experimental model of an improved design of a hydraulic ram pumping unit, conducting experimental studies, laboratory and field tests with subsequent refinement;
- determination of the economic efficiency of the research performed and proposals for their implementation.

Research methods: The way to achieve the goal is to select and justify the technology and technical means of irrigation and watering of pastures in the watercourse zones of Kazakhstan, develop an experimental model of an improved hydraulic ram pumping unit, conduct theoretical and experimental studies, laboratory, field tests and develop recommendations for its implementation at sites Agroindustrial complex of the Republic of Kazakhstan.

Basic provisions (proven scientific hypotheses and other conclusions that are new information).

1. a water lifting technology has been proposed using an improved design of a hydraulic ram pumping unit with improved characteristics, ensuring ease of maintenance;
2. The theoretical prerequisites for an improved hydraulic ram method for lifting water from watercourses have been developed and the basic initial data of technological and technical parameters have been substantiated;
3. a new technical solution has been proposed for the design of a hydraulic ram pumping unit, which reduces operating costs by 3-5 times, increases the efficiency of irrigation and watering of pastures located in watercourse zones.

Description of the main results of the study. As a result of the design of the pumping unit, its reliability is increased, ease of maintenance is ensured, compliance with safety regulations and improvement of basic parameters compared to analogues. According to our calculations, the economic effect from the introduction of one hydraulic ram pumping unit for watering pastures in comparison with the prototype can be up to 324 thousand tenge, and for the industry as a whole, an effect of 3308 million tenge can be obtained. The economic effect from the introduction of one hydraulic ram pumping installation for land

irrigation in comparison with the prototype can amount to 941 thousand tenge, while the total effect can reach 9604 million tenge.

Justification of the novelty and significance of the results obtained. Improving the efficiency of water supply to rural consumers. Agro-industrial complex in market conditions can be achieved by the right choice and
the use of new generation water-lifting equipment, including pumping units driven by the kinetic energy of a moving water flow in watercourses.

Practical significance. The improved design and technological scheme of the hydraulic ram pumping unit, in comparison with analogues, has new features of technical novelty, which make it possible to increase the flow rate, the generated pressure and the efficiency of the pumping unit.

The initial, technological and technical parameters and the necessary standard sizes of the proposed improved hydraulic ram pumping installation for land irrigation and pasture watering are substantiated, which made it possible to develop samples for experimental studies, laboratory and field tests, which are necessary to confirm the reliability and clarify the basic formulas for determining the parameters of a hydraulic ram pumping plant installations.

Calculations performed to substantiate the economic efficiency of the research have shown that the use of the required standard sizes of an improved hydraulic ram pumping unit for irrigation of land and water supply to peasant farms in Kazakhstan located in zones in comparison with the basic pumping units AN-2K-9-M1 and ANS-60D reduces operating costs 8.93 and 11.2 times, respectively, the annual effect from its use can be 540,918 tenge and 1,324,841 tenge per installation. The payback period is no more than a year. The total effect of development in the Republic of Kazakhstan can reach up to 5, 5 and 13.5 billion tenge.

The use of an improved hydraulic ram pumping unit will solve the problem of increasing the efficiency of land irrigation and water supply to peasants and farms through energy-saving and environmentally friendly technology for lifting water from watercourses.

Compliance with the directions of scientific development and government programs. The research results are competitive, they were used in the educational process when drawing up a lecture course in the discipline NNS 3212 - “Pumps and pumping stations” for undergraduate studies in the field of study 5B0808500 - “Water resources and water use”, as well as for doctoral students in the specialty 5D080500, in the discipline of the special course IVIES - “Renewable energy sources”. The completed work was included in the project under program 019 for the introduction of the necessary standard sizes for experimental demonstration farms in the Turkestan region.

Justification and development of energy-saving technology and technical means of water lifting using watercourses for hydropower: Research report (final) / state registration number 0112PK00178. Head E. Sarkynov. – Almaty, 2014-159p. Based on the work completed, a grant was won for the commercialization of the results of scientific and (or) scientific and technical activities for 2023-2025. No. IRN-DP21682075 “Pumping units for lifting water from watercourses driven by water energy.”

Description of the doctoral student's contribution to the preparation of each publication. The main results of the dissertation work were reported at International scientific and practical conferences: “Sustainable development: regional aspects” conference of young scientists (Belarus, Brest, April 24-26, 2019); at the conference on energy, civil and agricultural engineering (Republic of Uzbekistan, Tashkent October 14-16, 2020).

The main results of the research were published in works, including publications recommended by KKSON included in the international information resource Q1 Scopus (Elsevier) with a 97 percentile.

Structure and scope of the dissertation. The dissertation consists of an introduction, five sections, a conclusion, a list of used sources of 76 titles, 2 appendices; contains 113 pages of computer text, illustrated with 32 figures and 5 tables.