ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2023-5.384 ResearchBib IF: 8.848 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-4, ISSUE-5

DEVELOPMENT OF A 3D MODEL OF ARCHIMEDES SCREW WATER TURBINE

Yusupova Feruza Turdaliyevna
Nishonova Minavorxon Mamasoliyevna
Fergana Polytechnic Institute,

Annotation. Water turbines are considered important for producing electricity from water energy. The article develops a 3D model of an Archimedean screw turbine. Based on this model, it was possible to develop the design of a screw turbine.

Key words: flow, water flow, screw diameter, external parameter, internal parameter, spiral blade, deflection angle, internal radius, external radius, screw.

Аннотация. Водяные турбины считаются важными для производства электроэнергии из энергии воды. В статье разработана 3D-модель архимедовой винтовой турбины. На основе этой модели удалось разработать конструкцию винтовой турбины.

Ключевые слова: расход, расход воды, диаметр шнека, внешний параметр, внутренний параметр, спиральная лопасть, угол отклонения, внутренний радиус, внешний радиус, шнек.

The Archimedes screw is an ancient hydraulic machine first used as a turbine in the 20 th century. Archimedean screw turbines are used in small (1–10 MW) or mini (<1 MW) hydroelectric power plants. Typically its height is 1–10 m, and the flow speed is 1–10 m^3/s. The screws rotate obliquely around an axis at an angle from 22^0 to 35^0 relative to the horizon.

The maximum flow rate in an Archimedes screw is determined by the diameter of the screw. The smallest augers have a diameter of 1 meter and can flow 250 liters per second; with a diameter of 5 meters and a pitch of 25 cm, the maximum water flow is about 14.5 m^3/s. The length of the Archimedean screw turbine is 1-10 m, water flow rate is 0.1-15 m^3/s, installed at an inclination angle of 22^0-40^0 relative to the horizontal plane, designed for low pressures.

The Archimedes screw water turbine is simple in design, easy to install and maintain, and does not require special equipment to rotate it. Compared to other water turbines, it has the following advantages:

- the turbine is designed not only for rivers with high flow rates, but also for ditches with low flow rates (height 1 meter).

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2023-5.384 ResearchBib IF: 8.848 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-4, ISSUE-5

- no control system is required, like other turbines.
- due to the high efficiency of the low-pressure turbine, it lasts a long time.

Material and methods

The parameters of the Archimedean screw turbine have external and internal parameters. External parameters include the outer radius of the screw turbine cylinder R_0, the length of the screw turbine L, the deflection angle or inclination of the turbine includes b. When developing the turbine design, all external parameters were taken into account. The internal parameters are of three types: the internal radius of the screw turbine R_i, the period or pitch of one blade and the number of blades (Fig. 1) [10-11].

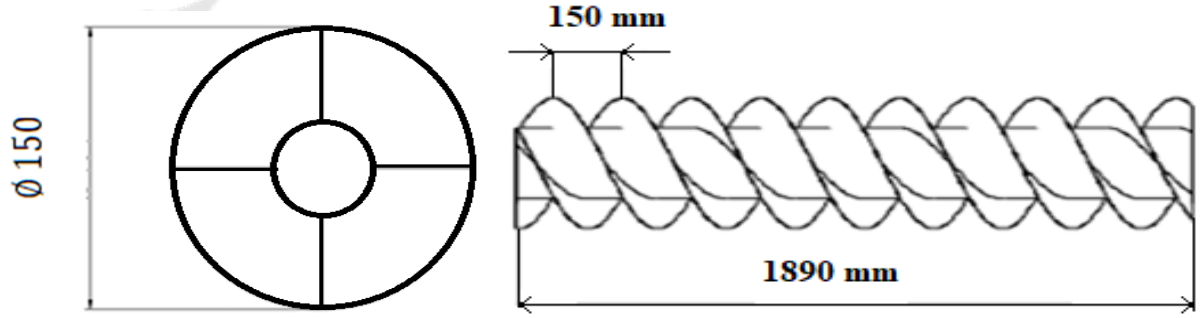

Figure 1. Turbine side view

The parameters and dimensions of the Archimedean screw water turbine model are given in Table 1.

Options	Value	Unit
Turbine length, L	1,89	m
Outer shaft radius, R_0	0,34	m
Inner shaft radius, R_i	0,08	m
Period or step of one hair, S	0,15	m
Number of wings, n	13	piece
Frame length	2	m
Frame width	0,5	m

Table 1. Parameters and dimensions of the Archimedes screw turbine model

Experimental results and discussion

First, an object was selected and a turbine cylindrical propeller was manufactured according to the dimensions given in Table 1. During the manufacturing process of the blade model, the shaft radius and the inner radius of

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2023-5.384 ResearchBib IF: 8.848 / 2024

the blades were prepared to be the same size.

Turns corresponding to the length of the screw were wound around it in the form of a spiral. The manufacturing process of a model of an Archimedean screw turbine is shown in Fig. 2.

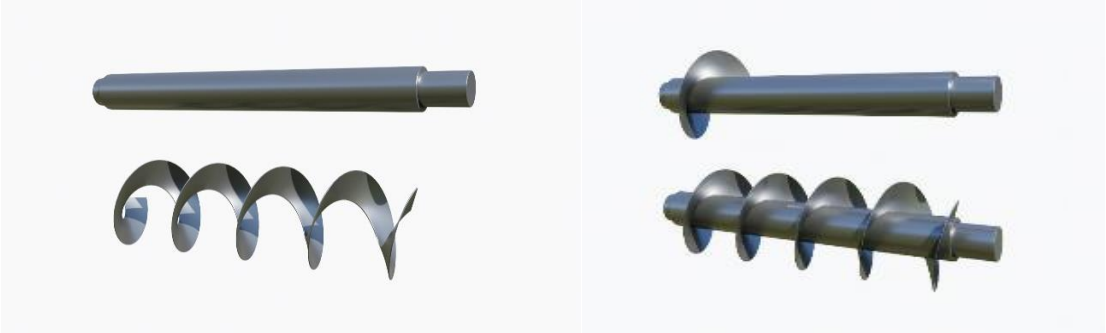

Figure 2. Processes for preparing a 3D model of an Archimedes screw turbine

To prevent water from flowing between the blades, a container was placed, and the four sides of the screw turbine were reinforced with frames. A large pulley was installed on the top of the shaft, and a small pulley was installed on the generator shaft. Scythians were carved around, and a belt was attached to them. An image of an Archimedean screw turbine mounted horizontally at a deflection angle is shown in Fig. 3.

Figure 3. Archimedes screw turbine model

When conducting research, the main attention depends on its internal parameters, that is, on the change in the number of revolutions of the blades and vanes of the screw turbine, as well as on the efficiency of electricity generation. An asynchronous generator is installed on the support frame of the upper part of the screw turbine shaft; the hydrostatic forces of water falling on the screw blades at an angle turn the turbine. The turbine transmits rotational motion to the generator through a belt stretched over a large and small pulley, resulting in the generator producing electricity.

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2023-5.384 ResearchBib IF: 8.848 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-4, ISSUE-5

Conclusions

A model of an Archimedean screw turbine for low-pressure water sources has been developed. 3D software was used to develop the model. The parameters and dimensions of the Archimedean screw turbine are given. Based on these dimensions, we will be able to manufacture the design of an Archimedean screw turbine.

Foydalanilgan adabiyotlar

1. Lashofer A, Hawle W, Pelikan B. State of technology and design guidelines for the Archimedes screw turbine // Conference Paper October 2016, pp 1-9. https://www.researchgate.net/publication/281347248.

2. Simmons S, Lubitz W.D. Archimedes screw generators for sustainable energy development // In 2017 IEEE Canada International Humanitarian Technology Conference (IHTC), pages 144–148. IEEE, 2017.

3. Christos Charisiadis. An introductory presentation to the "Archimedean Screw" as a Low Head Hydropower Generator. 2017, pp 1-72.

4. Yusupova Feruza Turdaliyevna. Prospects for the use of micro hydro power stations. ACADEMICIA: An International Multidisciplinary Research Journal Year: 2020, Volume: 10, Issue: 11. Article DOI: 10.5958/2249-7137.2020.01400.7

5. Kasimaxunova A.M., Yusupova F.T. Arximed vintli mikro-GESning ekspluatatsion parametrlarini tadqiq qilish natijalari // O‘zbekgidroenergetika jurnali. 2022 y. №4(16), 31-34 b.

6. Юсупова Ф.Т. Паст босимда ишлайдиган Архимед винтли сув турбинасини ишлаб чиқиш ва унинг самарадорлигини баҳолаш // Ўзбекгидроэнергетика илмий техник журнали. 2023 й, №2(18), 31-33 бетлар.

7. Kasimahunova A.M, Yusupova F.T. Rationale for the relevance and results of the creation of a hybrid microGES with a solar installation in the Fergana valley // Journal of Engineering and Technology (JET). India. 2023year, Volume 13, Issue 1, pp 143–154.

8. Feruza Yusupova, Nomonjon Sultanov. Development of an combined energy complex consisting of a micro-hydroelectric power plant and a solar photoelectric plant for the conditions of Uzbekistan. BIO Web of Conferences 84, 05027 (2024) AQUACULTURE 2023, pp 1-10. https://doi.org/10.1051/bioconf/20248405027.

9. Хайдаров, З., Хайдаров, Б.З. теоретические основы работы фотоприемников в газоразрядной ячейке с высоким уровнем оптического возбуждения // orienss. 2023. №5. URL: https://cyberleninka.ru/article/n/teoreticheskie-osnovy-

ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2023-5.384 ResearchBib IF: 8.848 / 2024

raboty-fotopriemnikov-v-gazorazryadnoy-yacheyke-c-vysokim-urovnem-opticheskogo-vozbuzhdeniya (дата обращения: 13.05.2024).

10. Хайдаров, З., Хайдаров, Б. З. ФИЗИЧЕСКИЕ СВОЙСТВА ПЛАЗМЕННОГО КОНТАКТА ПРИ СТАБИЛИЗАЦИИ РАЗРЯДА В ГАЗОРАЗРЯДНОЙ ЯЧЕЙКЕ // ORIENSS. 2023. №5. URL: https://cyberleninka.ru/article/n/fizicheskie-svoystva-plazmennogo-kontakta-pri-stabilizatsii-razryada-v-gazorazryadnoy-yacheyke (дата обращения: 13.05.2024).