OBTAINING ELECTRICAL ENERGY USING DEVICES COLLECTING SUNLIGHTS

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Abstract: Today, the demand for electric energy is increasing, and traditional fuels are not inexhaustible. That is why we are trying to find different ways to get electricity from renewable energy sources. One of these methods is to obtain electricity through solar concentrators. Using theoretical data, we can see the possibilities of obtaining electricity from solar concentrators.

Key words: solar concentrators, temperature, radiation, parabolic concentrators, Stirling engine, electric current, voltage.

Recently, the energy sector is facing a number of important problems. More specifically, the ever-increasing demand for energy [1] due to new lifestyles and population growth [2]. In addition, climate change is mainly related to CO_2 emissions, as a result of which the events of sudden changes in the weather have increased, the temperature has increased around the world, and changes in the sea level and ecosystem [3] have started to occur. Many studies aimed at preventing these incidents are being carried out.

Currently, the use of renewable and alternative energy sources is one of the ways to solve problems in energy systems. One of these sources of energy is the sun, and the use of highly efficient methods for the effective use of its energy leads to achieving high results in the field [4-6].

Solar concentrators are one of the main devices in the use of solar energy. The advantage of solar concentrators is that they collect the rays from the sun and create a high temperature at the focus of the device. This helps to increase the efficiency of the system. The analysis of articles on solar concentrators shows that the research conducted in this field is increasing year by year, and at the same time good results are being achieved [7-9].

At the moment, as a result of the increasing need for electricity, humanity is becoming dependent on alternative energy sources. In order to meet these needs, a cheap, high-quality, low-cost energy source is necessary. Due to the scarcity and high

cost of non-renewable resources, many countries are trying to ensure their energy consumption through renewable resources. Therefore, the development of solar energy remains one of the urgent issues. About 120000 TW (terawatt, 1012 w) of energy from the sun enters the Earth's atmosphere annually. True, not all of this energy can be absorbed, but even 0.002% of it is enough to completely cover the world's energy needs [10-12].

Figure 1. Solar concentrator

The use of solar energy is beneficial for countries in many ways. First, this type of energy is absolutely free. Secondly, energy from the sun can be obtained both by building large stations and by creating small economic networks. Thirdly, obtaining solar energy is absolutely harmless, it does not harm the atmosphere and hydrosphere at all. Fourthly, solar energy can be used not only for obtaining electricity, but also for utility services (home heating or hot water supply). That is why many countries are trying to use solar energy in a comprehensive way.

Solar concentrators receive the sun’s rays and concentrate them into a single point of energy. A parabola is the ideal shape for a solar concentrator. This is familiar to us from when we tried to heat paper and small wooden children as children. It is a simple biconvex lens. This device is capable of concentrating a part of the diffuse radiation that increases the light energy to a high level and is resistant to fire [13].

The net efficiency of converting solar energy into electricity for the Stirling generator system reached 29.4% in 1984. Additionally, in 1984, two 17m diameter Stirling dish systems (capacity =50kW each) were installed and commissioned in Riyadh, Saudi Arabia. The systems achieved an electrical output of 53 kW and a net conversion efficiency of 23%. A large Stirling plant was recently built in Arizona, USA. The construction of a station consisting of 60 engines with a capacity of 25.0 kW each is included in the plan. When using solar energy, a temperature of approximately 600-750°C is collected in the focus of the solar collector. The ability to use the Stirling engine as a hybrid makes it a more efficient form of energy [14].

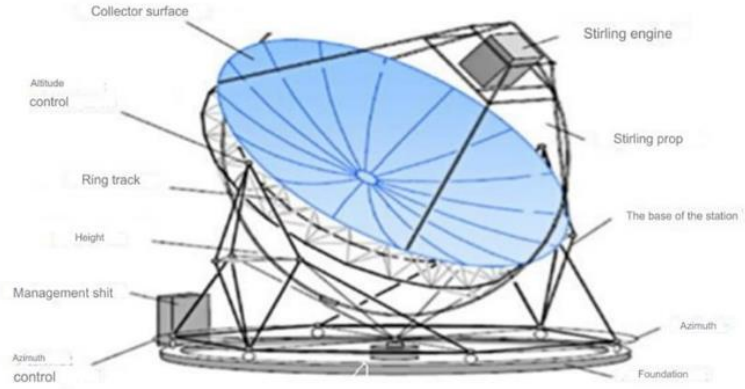

Figure 2. Solar concentrator construction

Solar energy is lost before it reaches the collector and receiver. Most of the thermal losses of a Stirling engine occur in the receiver of the system. Heat losses of the receiver are distributed through the receiver body and through the convection cavity to the environment. Conduction losses are relatively small and can be effectively reduced by proper application. About 40% of the total is lost by the receiver through natural convection and can be significantly reduced by placing a glass or quartz mirror.

A Stirling engine is a heat engine, a type of external combustion engine, in which the working fluid in the form of gas or liquid moves in a closed volume. The principle of operation is based on the periodic heating and cooling of the working fluid, releasing energy as a result of pressure changes due to heat. It can work not only from the combustion of fuel, but also from any heat source [15].

In the Stirling engine, a Stirling cycle is used, which in terms of thermodynamic efficiency is not inferior to the Carnot cycle and even superior. The fact is that the

Carnot cycle consists of isotherms and adiabats that are not very large from each other. The Stirling cycle consists of four phases and is distinguished by two transitions: heating, expansion, transition to a cold source, cooling, compression and transition to a heat source. Thus, the gas in the cylinder expands and contracts during the transition from a warm source to a cold source. At the same time, the pressure changes, as a result of which useful work can be obtained.

Heating and cooling of the working fluid is carried out by the regenerator. Ideally, the amount of heat released and received by the regenerator is the same. Useful work is done only due to isotherms, that is, it depends on the temperature difference between the heater and the cooler, as in the Carnot cycle. An external heat source heats the gas at the bottom of the heat exchanger cylinder. The created pressure pushes the working piston up (displacement, i.e. displacement) the piston does not fit tightly against the walls). The flywheel pushes the displacement piston downwards, thereby transferring the heated air from below into the cooling chamber. The air cools and contracts, the working piston falls. The displacement moves the piston upwards, thereby transferring the cooled air to the bottom, and the cycle repeats.

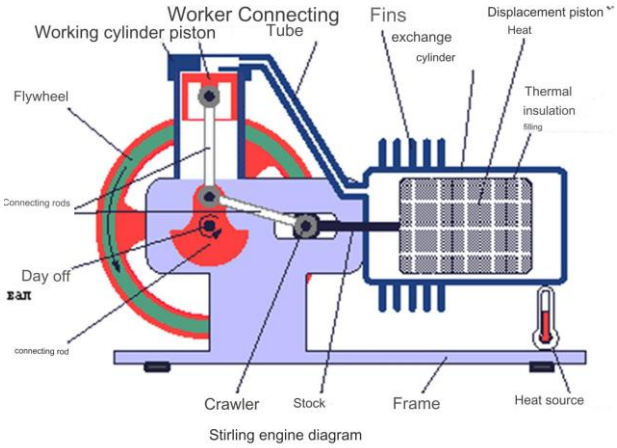

Figure 3. Stirling engine structure

In a Stirling engine, the working piston motion is offset by 90° relative to the displacement piston motion. Depending on the sign of this displacement, the machine can be a motor or a heat pump. With a 0° shift, the machine does no useful work.

In conclusion, it can be said that in order to bring the work activity of the structures of the entire world energy system to a higher level, further reforming of energy systems, obtaining alternative energy sources, facilitating people's life is an important cross-cutting task. In this regard, large-scale work is being carried out all over the world. We can save millions of dollars in solar energy alone. Increasing the

number of solar furnace power plants and increasing their efficiency is one of the priority areas before us.

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