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IMPROVING CLIMATE CONTROL EFFICIENCY BY MEMRISTOR AIR CONDITIONERS

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Relevance and problem statement.

In existing air conditioners there is widespread use of semiconductor devices and electronic devices: rectifier diodes, zener diodes, bipolar and field effect transistors, thyristors, amplifiers of electrical signals, harmonic oscillators and pulse signals, rectifiers, smoothing filters, voltage stabilizers, controlled rectifiers, converters [1]. At the same time, new electronic products appear expanding the possibilities of their application, one of them is a memristor.Memristor (memory resistor) is a new element in microelectronics, capable of changing its resistance depending on the charge flowing through it. It can be described as a two-terminal with a non-linear current-voltage characteristic, with hysteresis.

Air conditioners usually include a compressor, a condenser, a thermostatic valve, an evaporator, an electric motor, a control unit, and a sensor unit [2]. However, well-known air conditioners require periodic shutdown of the compressor, which leads to additional energy consumption, a high controlled amount of cooling support is not provided, and its design is complicated.All this together, leads to additional energy consumption, reducing the efficiency and reliability of the air conditioner.

The main research materials.

The research were carried out on to improve the air conditioner, in which, by modifying the design, it functions as a memristor air conditioner, which allows to reduce energy consumption, provide a high controlled amount of cooling support, simplify the design, increase the utilization rate, and ensure the reliability of the memristor air conditioner.

In our patented memristor air conditioner [3], which contains an electric motor, a compressor, a condenser, a thermostatic valve, an evaporator, a control unit, a sensor block, in accordance with the proposed utility model, an inverter and a memristor are introduced into the system with the ability to change the compressor flow and switch the four-way valve depending on temperature and season.

The scheme of the proposed memristor air conditioner is shown in Figure 1.

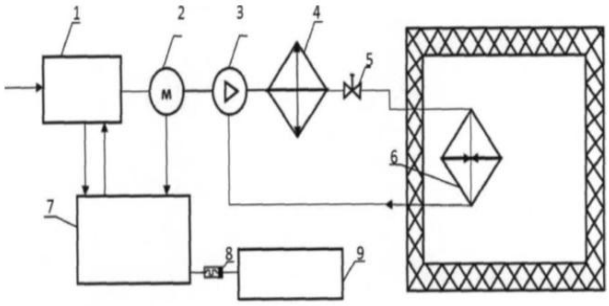

Figure 1. The scheme of the memristor air conditioner: 1 - inverter, 2 - electric motor, 3 - compressor, 4 - condenser, 5 - thermostatic valve, 6 - evaporator, 7 - control unit, 8 - memristor, 9 - sensor block

The principle of operation of the proposed memristor air conditioner is as follows. Electric energy is supplied through the inverter 1 to the electric motor 2, which drives the compressor 3, the compressor 3 compresses the refrigerant vapors and delivers them to the condenser 4, the condensed refrigerant reduces the pressure to the thermostatic valve 5, after which it evaporates in the evaporator 6 and reduces the temperature in a room that is cooled.

When the set temperature in the room is reached, the sensor unit 9, through the control unit 7, gives a signal to the inverter 1, which changes the frequency of the electric current, and thereby the supply of compressor 3. When the temperature rises, thanks to this control chain, the productivity of the compressor 3 increases. When changing the season, memristor 8, due to its properties, gives a signal to switch the four-way valve from cooling to heating. Next, the cycle repeats. The memristor's work takes place in three stages. At the first stage: unconditionally open state, it is set to open state by applying a high impedance to the input — the first memristor and negative voltage to the input of the second memristor. For the full replacement of semiconductor devices with memristor devices, it is necessary to implement the simplest function of storing values in addition to the ability to calculate these values. At low voltage values, memristor switches behave like stable non-linear resistors in both open and closed state. Switching is achieved by applying an offset greater than the positive or negative threshold for opening or closing the switch. In this case, the memristor works as a universal element of an electronic device that allows you to perform logical functions, in this case, switching the air conditioner from cooling to heating mode: winter-summer, and the storage function, forming a closed system for controlling the operation of the air conditioner.

Conclusions. The proposed design of a memristor air conditioner, where an inverter is introduced into the system, which allows you to change the compressor flow if necessary and does not need to be interrupted periodically, which significantly reduces energy consumption and provides a high controlled amount of cooling support, and the introduction of a memristor allows you to automatically switch the four-way valve depending on season for cooling or heating, this allows to simplify the design, increase the utilization rate, ensure the reliability of the memristor air conditioner.

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