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Automated heat pump heating system using non-traditional energy sources

Heating systems are one of the most expensive to use fuel and energy resources (not less than 30% of total consumption). This leads to a constant search for various solutions to increase the energy efficiency of heating systems [1,4]. In addition, air conditioning systems have become widespread. A large amount of thermal energy, calculated in millions of GJ, is wasted into the environment through the outdoor units of air conditioners [2-3]. This leads to the search for new ways to increase the energy efficiency of heating and air conditioning systems.

In the developed system, based on the use of heat accumulators, solar collectors, and heat pumps for heating and air conditioning systems, the average value of the energy conversion factor is 6..7 units, and the peak values reach 15 units. While classic heat pump systems have an energy conversion factor of only 3..4 units, which is a common value for this parameter in standard heat pump heating systems. This is due to the temperature difference between the soil / water evaporator and the condenser in the heating system. This system is already patented by the author [5].

The developed model is based on the problem of improving the heating and air conditioning system in which the introduction of new structural elements and their combination achieves the possibility of a different nature of thermal energy circulation, and the ability to adjust heat flux parameters without energy loss, and thus expand the scope of cost reduction. The problem is solved by the fact that in the known heating and air conditioning system of the building, including the heat source, the heat pump and the radiator heating element are connected to the main heat exchanger, according to the utility model, the heat source is made in the form of a solar collector and heat accumulator associated with the introduced additional heat pump. Figure 1 shows a simplified diagram of the developed system.

1 - heat accumulator, 2 - solar collectors, 3 - heat exchanger of air conditioning system, 4 - heat pump of heating system, 5 - radiator system of the building.

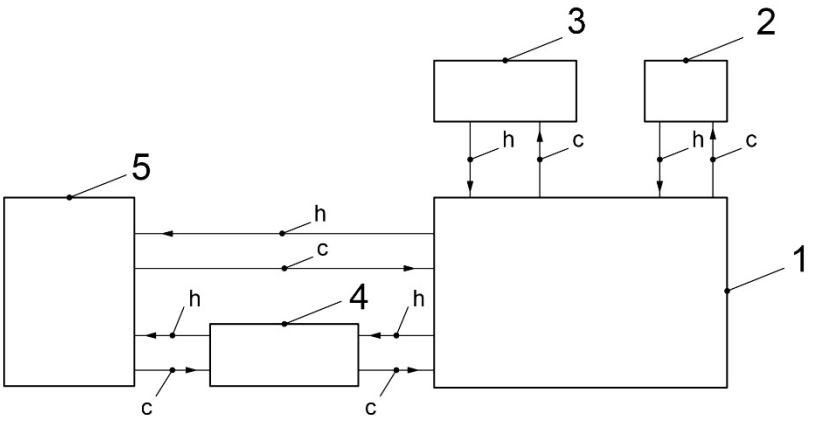

Figure 1 - Simplified scheme of the proposed heating and air conditioning system

This preserves the possibility of direct supply of water from the heat accumulator to the heating system of the building, as the estimated value of water temperature at the beginning of the heating period reaches 45-47 degrees Celsius. And this temperature is enough to cover the heat load in October for the climatic zone of Dnipro. Thus, it is possible to eliminate the cost of electric drive of the heat pump for 2-3 weeks, which gives additional savings of energy and money.

After the heat load starts to require higher values of the coolant temperature in the heating system – the heat pump 4 is switched on. The heat pump evaporator removes heat from the heat accumulator 1, which is a source of high potential energy compared to soil and reservoirs. Due to which, more efficient operation of the heat pump heating system is achieved.

According to the results of calculations, we get the value of savings from the use of the developed system - up to 35% of energy per year, compared to conventional heat pump heating and air conditioning. Currently, the study of ways to improve the efficiency of the proposed system by implementing an automated control system for the parameters of this system.

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