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Development of Solar Heat Supply Systems

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Abstract: *In this article will spend a significant part of the fuel energy resources consumed by everyone for the heat supply (heating) of buildings. The use of solar energy for this purpose makes it possible to economy a large amount of energy. In the solar heat supply of buildings, active and passive systems and methods of their application are presented.*

Keywords: *Solar energy, heating systems, building, absorber, Solar water heater.*

Introduction.

For the heat supply (heating) of buildings, a significant part of the fuel energy resources consumed by everyone is spent. The use of solar energy for this purpose makes it possible to economy a large amount of energy. In the solar heat supply of buildings, active and passive systems are distinguished. Characteristic differences of active systems are that they will consist of a solar energy collector, heat accumulators, additional energy sources, pipe conductors, heat exchangers, pumps or fans, and Automatic Control and control devices. In passive systems, the function of the solar collector and heat accumulators is usually due to natural convection without the use of a fan, the movement of the heat carrier (Air), acting as a blocking building Con-structure. At the time of creating the development of the building structure, the requirements for pouring into the decrease in thermal energy are taken into account, so that the heat supply consisting of an effective heliotype works well. This can be achieved especially in energy-efficient or (externally insulated) houses, in houses with walls with good thermal insulation, roof, floor and external fences with a maximum hermetic structure. In such houses, the heat transfer coefficient of the walls is 0.15 W/m^2 ºC in total, and the penetration of outside air into the building is reduced.

It should be noted that it is advisable to use one of the other aspects, for example, polymer planks located between 2 bottles or windows with a high-performance coating specially coated on glass. It is also necessary to use coatings that provide high transmittance compared to solar energy and coatings with low irradiation for thermal radiation. When applying such ROMs, the temperature on the inner surface rises, due to which of water vapor in the bottle decreases, and the feeling of comfort increases. The use of a vacuum hermetic rom, a special window, between two glass cases reduces heat transmission and simultaneously reduces the noise level of. Thus, it is necessary to ensure a high level of energy storage in the effective use of solar, especially in cold climates. In this case, the capacity of the energy sources, it is necessary that their dimensions and cost are minimal

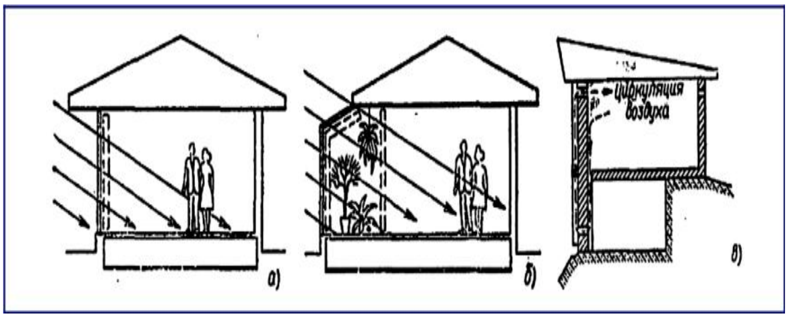

Fig.1. Solar passive types of building heating:

In ensuring the efficient use of solar energy for heating, passive systems are needed, forming part of the building project. In order to capture solar radiation, the south facade has a glass surface and frame as well as a glass projection on the roof and an additional window at the top of the building that raises the level of human comfort and prevents direct solar radiation from falling on the face. One of the important conditions for the effective functioning of passive heliosystems is the correct choice of building orientation and location in order to capture solar radiation during the winter months and get the maximum fall [1-8].

Passive systems are quite simple, but for their effective operation, a device that controls the state of thermal insulation of light transparent surfaces, shutters, heat accumulator will need a pump in the holes for air circulation in the wall. Complete capture of solar energy can be carried out efficiently when the following conditions are fully observed:

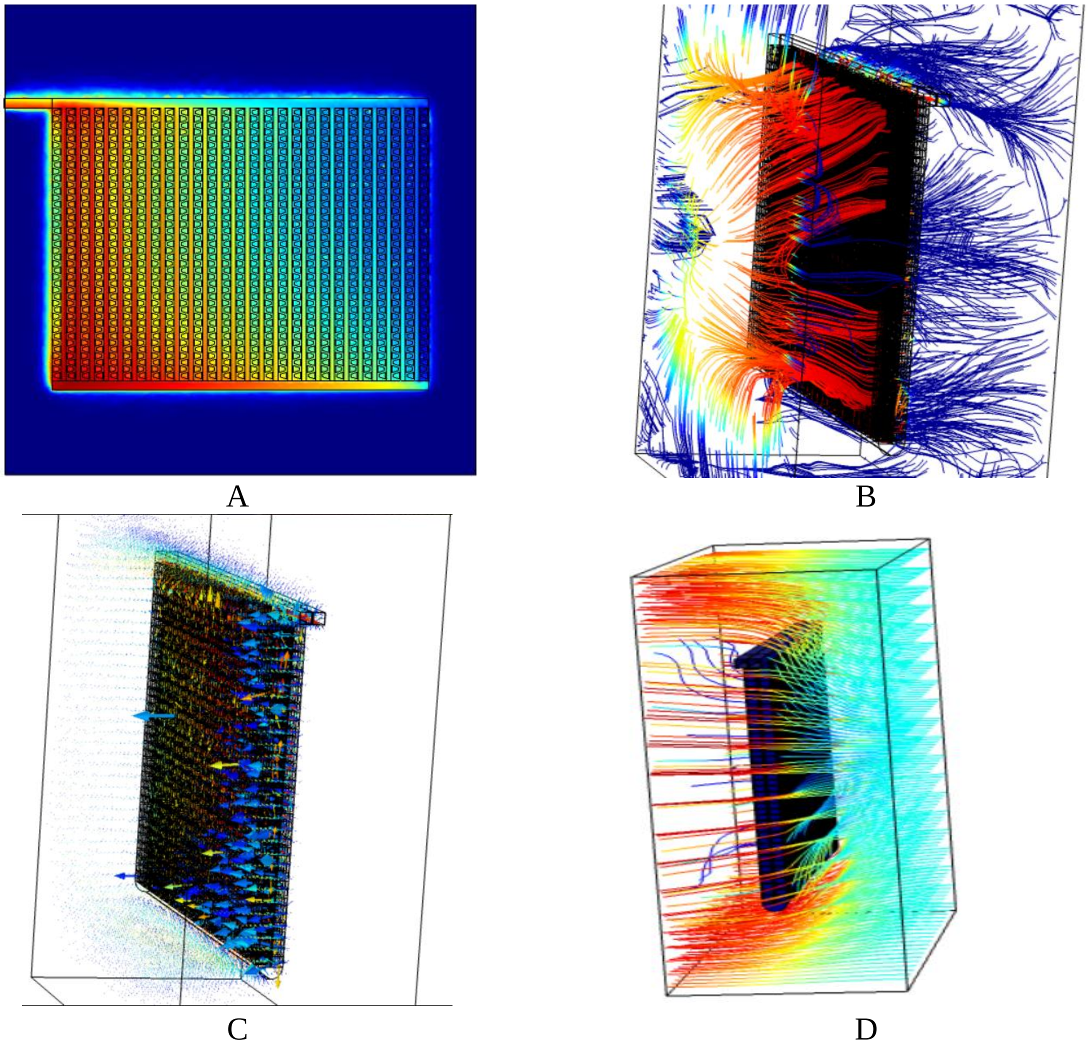

Fig.2. Simulation the operation of a copper radiator of the solar heater

The model you described simulates the operation of a copper radiator with ethylene glycol fluid in the wind path. It aims to analyze how the radiator transfers heat to both the copper metal and the surrounding air. The geometry of the radiator is designed using Comsol, allowing for flexibility in adjusting properties and geometry as needed. The simulation results will provide insights into the heat transfer process within the radiator [9-14].

Determine the collector efficiency factor (η): -

1. This factor represents the ability of the collector to convert solar energy into usable heat.

- It is typically provided by the manufacturer or can be estimated based on the collector type and design.

2. Calculate the solar radiation incident on the collector (Qsolar):

- This can be obtained from local weather data or solar radiation maps.
- It is usually expressed in terms of kilowatt-hours per square meter per day (kWh/m²/day).

3. Determine the effective collector area (A):

- This is the actual area of the collector that is exposed to solar radiation.
- It is typically provided by the manufacturer or can be measured directly.

4. Calculate the heat energy collected by the solar collector ($Q_{collected}$)-$Q_{collected} = \eta * Q_{solar*} A$ This equation represents the amount of heat energy transferred from the solar radiation to the collector [15-19].
5. Consider any heat losses: - Heat losses can occur due to factors such as conduction, convection, and radiation. - These losses can be estimated based on the collector design and operating conditions.
6. Calculate the useful heat output (Q_{output})-$Q_{output}=Q_{collected}$-Heat losses

- This represents the amount of heat energy that can be utilized for hot water purposes.

It is important to note that the specific calculations and formulas may vary depending on the type and design of the solar collector. It is recommended to consult the manufacturer's documentation or seek professional assistance for accurate calculations tailored to your specific collector system.

The Newton-Richmann equation, also known as the Newton's Law of Cooling, is used to describe the rate at which an object cools or heats in a surrounding medium. The equation can be written as:

$$Q = h \cdot A \cdot (T_{object} - T_{surroundings}) \quad (1)$$

Where:

- Q represents the rate of heat transfer (in watts or joules per second)
- h is the heat transfer coefficient (in watts per square meter per Kelvin or joules per second per square meter per Kelvin)
- A is the surface area of the object in contact with the surrounding medium (in square meters)
- Tobject is the temperature of the object (in Kelvin)
- Tsurroundings is the temperature of the surrounding medium (in Kelvin)

The equation states that the rate of heat transfer is proportional to the temperature difference between the object and the surroundings, with the proportionality constant being the heat transfer coefficient multiplied by the surface area.

It's important to note that the heat transfer coefficient (h) depends on various factors such as the nature of the object's surface, the properties of the surrounding medium, and the flow conditions. The specific value of h needs to be determined based on experimental data or theoretical calculations for a given system.

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