



GEOTHERMAL HEATING OF A SINGLE-FAMILY RESIDENTIAL BUILDING

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Annotation

This article discusses the geothermal heating system used in a single-family residential building: its maintenance, installation, advantages and disadvantages.

Keywords: Geothermal heating, engineering systems, soil heat exchanger, heat pump, energy-safe house

ГЕОТЕРМАЛЬНОЕ ОТОПЛЕНИЕ ОДНОСЕМЕЙНОГО ЖИЛОГО ДОМА

Аннотация

В данной статье рассмотрена система геотермального отопления, используемая в односемейном жилом доме: её содержание, установка, преимущества и недостатки.

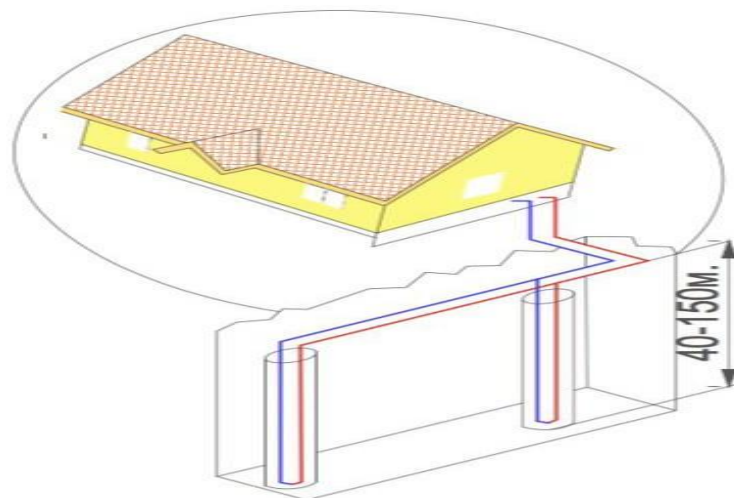
Ключевые слова: Геотермальное отопление, инженерные системы, почвенный теплообменник, тепловой насос, энергопассивный дом

To date, there are a huge variety of ways to heat residential premises. Of course, the most profitable of them is heating using natural gas. But due to the complexity of the installation, the insecurity of the equipment, as well as the rapid decrease in the volume of gas remaining in nature (the place of birth remained for 40-60 years of intensive use [1]), this heating system ceases to be ideal and comfortable.

Also, the largest part of indoor climate systems uses non-renewable energy sources, which does not correspond to the current vector of their development. These sources are not only finite in volume, but also harmful to the environment. This problem forces us to look for and invent alternative sources and methods of heating, ventilation and air conditioning in the premises.

This article will consider the geothermal heating system of a single-family residential building, which at the moment is the most efficient and economical of alternative systems for creating a microclimate..

Despite these advantages and due to the status of a "novelty", this system is still only being developed in our country. But this method is not new in itself, it is the principle of the heat pump available in every refrigerator. The principle of operation of this heat pump is based on the "Carno cycle" [2]. Soil or water acts as a heat source, and water or antifreeze acts as an intermediary. The mediator circulates through a liquid circuit that interacts with a heat source. The geothermal heating system can be used in three variations: with a vertical or horizontal contour.



1. Example of vertical occurrence of pipes in a geothermal heating system

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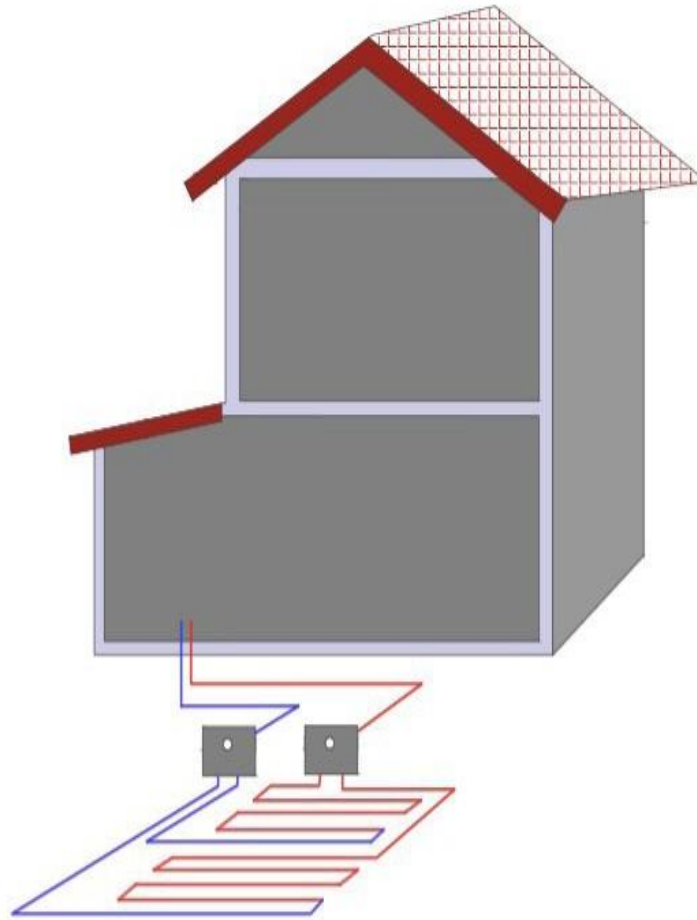


Fig. 2. Example of horizontal occurrence of pipes in a geothermal heating system

The first option does not require a large area, but is the most difficult to perform, since the pipes must be lowered into wells from 40 to 150 meters deep.

The horizontal contour has two versions. Pipes can be laid "snake" in the ground. It is important that the depth of laying is below the depth of freezing of the soil. This method requires more space than the vertical one, but it is not difficult to install.

In addition, the pipes can be laid in a spiral at the bottom of the reservoir, if there is one closer than 100 meters from the house. This method of laying pipes is the most economical of the listed and, perhaps, the easiest to install.

In addition, there is a fourth type of contour, which is called "combined". It is an average between the first two options. In this case, the pipe is laid into the ground not with a "snake", but in the form of

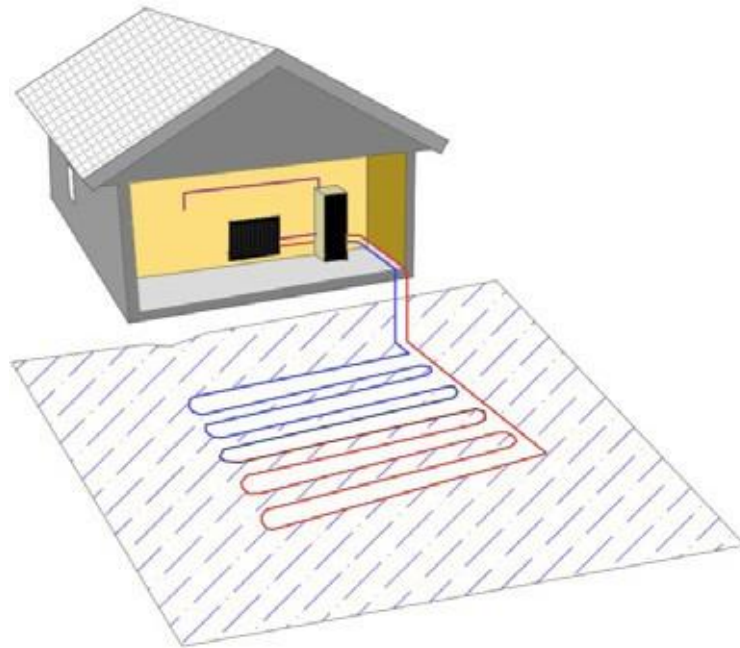


Fig. 3. Example of a water-displaced occurrence of pipes in a geothermal heating system

cylindrical spring, which allows you to save on the area of the soil heat exchanger [3]. If we compare it with a gas boiler, then the coolant does not need to be heated by a pump to a high temperature, because there is no occurrence of condensate during the return passage [4]. In this case, energy will save at low temperatures. It follows from this that the best option for distributing the heat received in the room is a warm floor, because heat loss is minimized (dependence on the temperature difference is not terrible, since in this case the difference will be small) and the air rising from the underfloor heating does not come into contact with the walls.

Advantages:

1. An environmentally friendly way of heating for humans and the environment.
2. The soil "stores" about 90% of solar energy. In winter, there is also a fairly large supply of heat, it is only necessary to transfer it to the house with the help of specific equipment (heat pump and heat exchanger).
3. The possibility of installing this type of energy everywhere and low costs for its operation.
4. It is possible to obtain free heat, that is, at the cost of 1 kW of electricity, you can get an average of 3, and sometimes 5 kW of heat.



Disadvantages:

1. Quite a high cost of equipment and its installation (payback period of about 5 years).
2. It is impossible to work without electricity.
3. Bulkiness of the outer contour.

Despite the title of an alternative system, geothermal heating can already rightfully compete with traditional systems for creating a microclimate in the room. It works on a fairly simple principle, it is not difficult to maintain. The appearance of such a system is a huge contribution to the future of energy-safe houses, because it is efficient, uses a renewable energy source and is profitable, even considering its long payback period.

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