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TYPE OF HEATING RADIATORS, PRINCIPLES OF OPERATION AND THEORETICAL ANALYSIS OF THEIR TECHNICAL AND ECONOMIC CHARACTERISTICS

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ABSTRACT:

The article describes the main types of heat exchangers in the central heating system and the principles of their operation. Despite its shortcomings and low thermal efficiency, thousands of types of this equipment are not only in operation, but also produced by many manufacturers, and also provide accurate information about existing cast iron and panel radiators and convectors.

Keywords: Radiators, panel radiators, convectors, decomposition, shell-and-tube, convection, light heat transfer processes.

INTRODUCTION:

Radiators are currently the most common and economical space heating equipment. Usually such radiators are called heating system radiators. As a result of the movement (circulation) of hot water or other coolant inside the fins of the radiators, it transfers its heat to the room and cools, thereby causing heat exchange. Currently, manufacturers are trying to use different types of metals in order to improve the appearance of radiators and improve heat transfer. As a generation of cast iron radiators, modern radiators also consist of fins, but the more the number of fins, the lower the efficiency can be and this will lead to unnecessary costs.

MAIN BODY:

Today, aluminum and bimetallic radiators are widely used among all heating radiators, which are gradually being phased out from the outdated batteries of the previous generation. Each radiator has its own advantages and disadvantages. One of the most important characteristics of a quality radiator is its weight. Light radiator - means that not all production standards were observed during its manufacture. According to the international certificate of conformity, the weight of each section of aluminum and bimetallic radiators ranges from 1.2 kg to 1.8 kg. However, the ribs must be at least 1.2 mm thick and 80 mm wide on the front and rear walls.

Figure 1. Structural design of aluminum radiators.

The disadvantage of aluminum radiators is that the metal is fragile, because aluminum is soft metal in terms of content, so it is very easy to cause mechanical damage. In addition, the effect of these radiators on erosion depends on the pH of the water - this indicator should be in the range of 7-8%, because at other levels this metal often fails, erosion occurs, which ultimately leads to the destruction of the radiator failure.

As the name suggests, bimetallic radiators made of two metals were first produced in European countries. They quickly became popular due to their reliability and speed when installed in any heating system. This type of heating radiator consists of two main parts, made of different metals. Internal air ducts are made of stainless steel, the outer casing of the heat exchanger is made of aluminum.

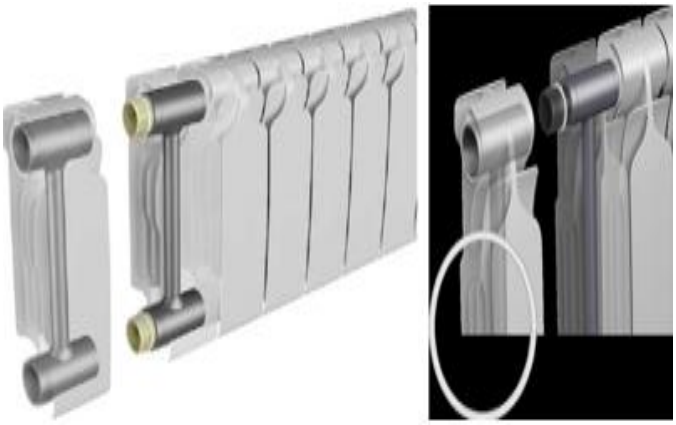

Figure 2. Structural design of bimetallic radiators.

This design is a serious disadvantage of partial batteries, as these connections can be damaged, for example, by a poor-quality cooling device, which significantly reduces their service life until the next preventive intervention. In addition, leaks often occur at the joints of elements under the influence of high temperature and high pressure in the system. To prevent this from happening, another technology for the production of bimetallic radiators was invented. Initially, the collector was made of hard-alloy copper or steel, which was given a special shape and filled with aluminum under pressure. Such bimetallic batteries are called monolithic.

Figure 3. Structural design of monolithic and partial bimetallic radiators.

Steel panel radiators: These types of radiators are mainly composed of a block of finned metal sheets. Steel panel radiators are distinguished by their durability and efficient use of the hot air flow. Radiators of this type have the simplest design; inside the panel there are several vertical elongated channels through which cooling water circulates. The heat carrier heats the entire surface of the panel. To provide more efficient thermal conductivity, the structure is equipped with U-shaped, cold-formed fins that are attached to the back of the panel. This part of the structure provides convective heating of the room, where the high sensitivity of panel models to water hammer in the welded areas can lead to cracking or deformation of the radiator. [1]

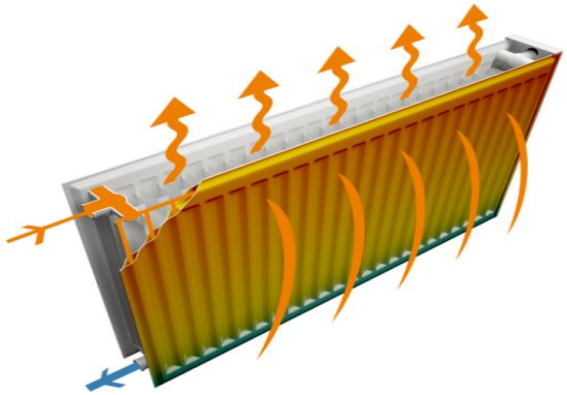

Figure 4. Structural structure of steel panel radiators.

The inability to "contain" the water hammer makes it difficult to install steel panel radiators in multi-storey buildings. They are mainly installed in private houses and cottages. Often they are resistant to corrosion, if the painting work is not done well, and the battery is not made of high-quality metal or high-quality welding, then after a few years of operation it will become a invalid or completely out of order.

Technical characteristics of cast iron radiators: The service life of cast iron heating radiators is calculated in decades. Once the installation is complete, there is no need to think about replacing the batteries for the next 20-25 years. The working pressure of cast iron appliances is 9 atmospheres, which allows them to be used in autonomous systems and central heating systems.

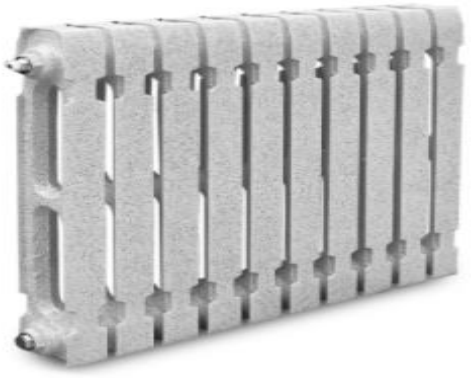

Figure 5. Structural design of cast iron radiators.

The height of this type of radiator never exceeds 1 m. Most often this value is 0.96-0.98 mm, and this includes the dimensions of the legs. The main disadvantages of cast iron or cast iron radiators are the large weight of these types of radiators and the complexity of maintenance, since the number of radiator fins increases and its weight increases.

Convectors used in heating systems: such devices are mainly used in the case of natural air circulation, and the method of operation is that cold air masses descending into the device heat up and leave it at the top, thus quickly mixing with the contact environment and the batteries are quiet. The operation of convection equipment depends on the temperature of the coolant and the intensity of the air flows created around the heat exchanger.

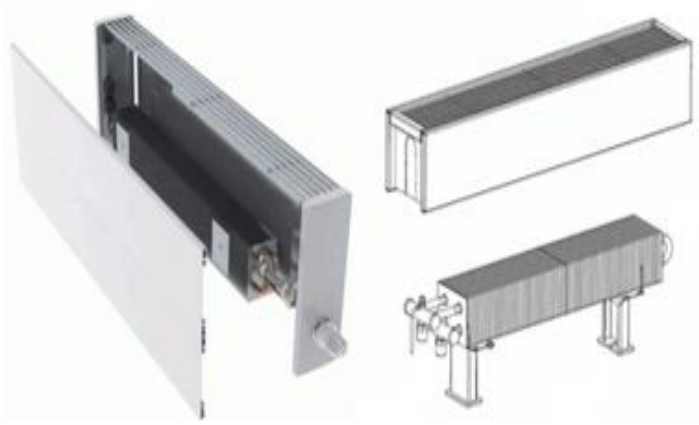

Figure 6. Structural device of convector type heaters.

Wall-mounted water heating convectors are similar to radiators, but unlike cast-iron radiators, in which air convection is very insignificant, their design allows them to receive cooled air and quickly heat it up. Convection radiators are installed in the same place as radiators, often under windows. It is important to maintain the correct distance between the elements - incorrect calculation can lead to a decrease in turbulent air flows inside the housing. [2] Forced ventilation accelerates the circulation of air masses and makes it smooth, increases the efficiency of the device and reduces the time for heating the room, however, forced convection is especially important for rooms with high humidity and heating of large areas. They are safe and almost never dry the air and never heat up to a high temperature - its temperature averages 40-50 degrees. It leads directly from the convector to the convector and from the convector to the air. In addition, the fragility of the plate in convectors makes them resistant to mechanical stress.

From the above, it can be seen that radiators and convectors are used as the main heating means in the heating system.

Summarizing the type of heating means, at the same time it is possible to increase the heat transfer capacity and reduce energy consumption by using renewable energy sources. energy sources.

One way to increase the heat transfer coefficient is to convert natural convection to forced convection. This can be done in the following way: it can be done by combining the radiator and the air intake chamber (fig. 1a), and this is called a "ventilation radiator" [3], or it can be done by installing several small fans under the radiator. and this is called an additional ventilated ventilation radiator [4] (Fig. 1b).

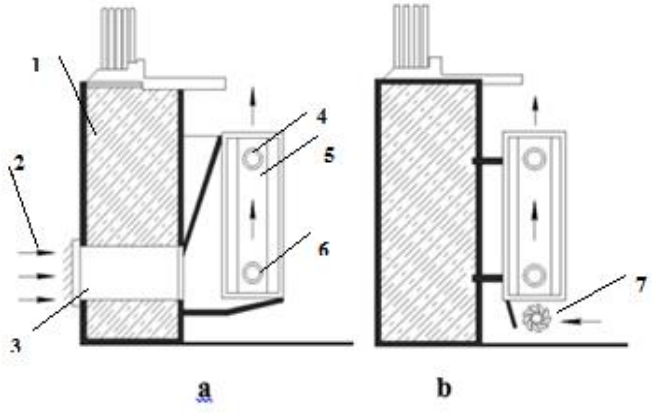

Figure 7. a - ventilation radiator, b - fan with an additional fan 1 - outer wall, 2 - heated air coming out of the solar collector, 3 - heated air pipe, 4 - water supply pipe, 5 - radiator, 6 - supply return pipe water, 7- small fan installed under the radiator.

Ventilation radiator: The entrance to the ventilation radiator is located behind the radiator, this combination increases the heat dissipation of the radiator and preheats the air before entering the room. Preheating the air also eliminates the flow of cold air in the room. [6.7.8.9] Additional heat is supplied to the radiator by air heated by the solar air collector through an air hole connected to the radiator. [10.11.12.13.15] An outdoor ventilation radiator is thermally more efficient than conventional radiators. This suggests that by heating the supply air temperature, it is possible to increase the surface temperature of the radiator without increasing the heat output of the radiator on cold days, since previous studies [3.14] showed that a ventilation radiator operating at 35 °C operating at 55 °C showed that ordinary aluminum has the same heat output as a bimetallic radiator.

Radiator with additional fan: Additional radiator fans are located under the heating panel. Previous studies [4, 5] have shown that a radiator with 5 small fans mounted underneath the heating panel is twice the height of traditional radiators. This, of course, is due to the intensification of the process of convective heat transfer that occurs on the surface of the radiators. It is possible to reduce the temperature of the radiator by installing additional fans, but the heat transfer from the radiator does not decrease, it should be noted that if we install a fan under the radiator, the amount of heat on the heated surface of the radiator decreases, the light reduces the heat transfer process. [13]

CONCLUSION:

Thus, each of the heat transfer devices used in the heating system has its own advantages and disadvantages, and the main heat transfer devices considered include aluminum, bimetal, cast iron and convectors. The proposed technology involves the general connection of the ventilation duct to a traditional heating radiator, the main task of which is to reduce the flow of cold air in the room due to convection of hot air from outside through the radiator panel and heat to the radiator. Increase thermal efficiency by directing more heated air. Using this type of technology, it is possible to provide the required room temperature of 20-15-16 °C instead of 90 °C instead of 55 °C and 60 °C, which in turn reduces energy consumption together, we can conclude that this allows us to reduce the level CO_2 emissions into the environment.

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