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THE OPERATING PRINCIPLE OF THE RADIATOR IS JUSTIFIED THEORETICALLY WITH AI

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Annotation: This article analyzes the operating principle of radiators from motor vehicles and its theoretical foundations. thermal processes, radiator production and operation, and heat dissipation mechanisms under various conditions are described. Thermal power through radiators, their scientific fields and technical parameters. based on thermal power, the efficiency of the radiator is highlighted.

Keywords*:* vehicle, radiator, cooling system, thermal process, efficiency, technical parameters, infrastructure.

Introduction. Today, the world's largest automakers are trying to improve the cooling system of their cars year after year. For example, the world's largest manufacturers include Volvo, Audi, Chevrolet, Daimler-Benz, Iveco, MAN, Opel, Citroen, Ssania, Fiat, Volkswagen, Ford, Honda, and Toyota. In Uzbekistan, in this regard, the demand for improving the refrigeration system of our national car manufacturer JSC "UzAuto Ichki yonuv dvigatelis" LLC "UzERAE Climate Control," which supplies parts used in the car cooling system, is increasing year by year.

As a result of the implementation of such reforms in many spheres in our country, along with qualitative changes in the economy, processes of socio-economic development, liberalization of the economy, and further deepening of these reforms are taking place.

The next long-term priority, which is of decisive importance in increasing the potential, strength, and competitiveness of our country's economy, is the implementation of an active investment policy for the implementation of strategically important projects aimed at modernizing, technically and technologically upgrading key sectors, and developing transport and infrastructure communications.

Now, a comparative study of the components of various sectors of our national economy with the world market is of great importance. The national economy of Uzbekistan is the totality of all spheres, associations, enterprises, and organizations, which are united into an economic system based on common laws and development goals.

In the current socio-economic and political development of our republic, one of the most important directions of the development of the automotive industry and the transport system, as well as the transport infrastructure, is the development of the automotive industry, and the second important task is the improvement of the engine cooling system for these cars in the near future.

Substantiation of the topic and its relevance. Improvement of vehicle designs is determined by the requirements formed by the growth rates of economic and social conditions. Modern vehicle designs must be equipped with information technologies installed on the vehicle to control the operating processes of units and systems. Control of the cooling system will be equipped in the same way

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Statistical data indicate that passenger car drivers face problems with cooling internal combustion engines on hot and cold days and heating internal combustion engines on cold days to restore the vehicle to working condition.

Media outlets and bloggers are reporting this. Therefore, conducting new research on improving the cooling system and increasing the efficiency of passenger cars equipped with internal combustion engines is an urgent task.

Large-scale research is being conducted worldwide to increase the service life of radiators widely used in the manufacturing industry. In this direction, in particular, the use of resource-saving technologies in the production of radiators, ensuring high efficiency of the main working parts and product quality, is of great importance.

Car radiators are an integral part of the engine cooling system. During the combustion of the working mixture, the temperature in the engine cylinder reaches 2000°C, with an average temperature of 800-1000°C. Under such conditions, the engine cannot operate for a long time due to overheating and subsequent failure of its metal parts.

The engine cooling system serves to ensure optimal engine thermal conditions. The efficiency and reliability of the engine largely depend on the normal operation of the cooling system [1].

When the engine overheats, its power decreases, fuel consumption increases, lubricants burn out, which leads to cracking and melting of the shells of the friction surfaces of the parts, piston clogging, and other problems[2].

Engine hypothermia also leads to malfunction. To eliminate increased friction due to thicker lubrication, engine power losses increase, the working mixture condenses, washes off the oil film from the cylinder walls, and increases the number of piston group parts. As a result of the formation of sulfur compounds, the corrosive state of the cylinder walls increases [3].

Another function of this system is to accelerate the heating of the cold engine. Modern cars are manufactured with liquid cooling systems. As a cooling element, they use water, antifreeze, or antifreeze. There are cars with an air cooling system, for example, the Zaporizhzhia, but most modern cars, as a rule, use a liquid cooling system.

It was established that the best conditions for engine operation (minimum wear of parts, good efficiency, etc.) are created when the liquid in the cooling system is heated to a temperature of 75-105°C. The thermostat is designed to maintain the specified temperature in the system.

The fan is driven by a shaft and belt drive. The fan is additionally controlled by an electric motor, which is turned on and off via a sensor or electronic control unit. The fan drive can be controlled by an electromagnetic clutch or a hydraulic clutch[4].

The thermostat controls the fluid through a large or small circulation ring - depending on the current operating mode and operating conditions, this ensures the optimal thermal regime of the engine. The small rotation circle is used for quick heating of the cold engine, as well as to prevent vehicle hypothermia during the cold season.

The radiator is designed for cooling cooling water, which removes heat from engine parts. The liquid is cooled at the base of the radiator, which consists of copper, aluminum, or brass pipes. The pipes have cooling fins made of steel or brass. The radiator body connects the radiator ribs.

In addition, aluminum radiators are installed in modern cars, which guarantees the necessary heat exchange, while they operate in extreme conditions. Considering that the cooling radiator in cars is located in front of the engine, it is subjected to a strong airflow. These and

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many other factors can lead to a violation of the integrity of individual components of the radiator.

Two types of radiators are mainly used in the cooling system of passenger cars - metal and combined.

Metal radiators are made of non-ferrous metals with high thermal conductivity, the base of the radiator and its ribs are bonded with glue.

The combined ones have plastic ribs, which are attached to the base of the barrels by clamping them with specially packaged gum.

The design of the radiator differs in the location of the ribs, depending on the type of material used in its manufacture, the shape and arrangement of the pipes.

The radiator contains two ribs, which can be located on the sides (Fig. 1) or in the upper and lower parts (Fig. 2). Radiator bases are divided into brass and aluminum. Radiators based on aluminum alloys can be pre-prepared and welded. The ribs are interconnected by numerous pipes. The tubes can be round or oval-shaped, arranged in parallel or sequentially. To enhance heat transfer and increase the hardness of the radiator base, the pipes consist of a large number of ultra-thin plates. Such radiators are called tubular lamels. A thin tape can be laid between the radiator tubes in the form of an accordion. Such radiators are called ribbon-tube. To increase the radiator's thermal conductivity and rigidity, tapes and plates are glued to the pipes. In the production of tubular plate cooling radiators for some aluminum alloy engines, plate adhesion to pipes is not used. In this case, fixing is carried out by argon welding.

The base of ribbon-tube radiators includes high mechanical stresses. Belt-pipe and plate-pipe radiators are also used in passenger cars.

The most suitable materials for the production of radiators are copper and aluminum. Radiator products made from copper alloys used in the production of radiators have a small thickness, as a result of which a rational design is achieved not only for cooling surfaces, but also for the entire radiator. However, aluminum alloys have a number of advantages over copper alloys: low structure weight, high anti-corrosion properties of the material, good conductivity between pipes and fins.

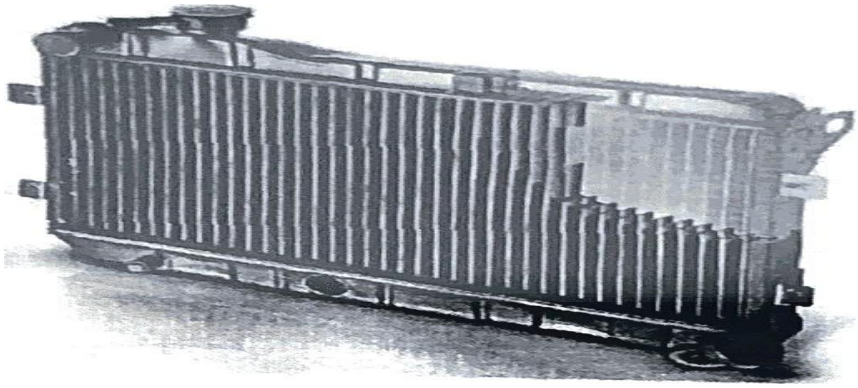

Figure 1. Cooling radiator with brass side ribs.

Mechanical prefabricated aluminum systems are manufactured with round and oval cross-section pipes, and argon welding is used in welded aluminum radiators to ensure contact between the wings and pipes.

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Figure 2. Brass cooling radiator with upper and lower ribs.

Analysis of the designs showed that the radiator design is constantly changing. Competition forces manufacturers to reduce the costs of radiator production. Manufacturers don't worry about the stability of radiators; prefabricated radiators are in the past. As a rule, they are made non-separable, which makes repairs difficult.

The radiator is one of the main elements of the liquid cooling system and serves to distribute heat released from the internal combustion engine to the external environment through the coolant.

The radiator's function is to distribute heat from the engine into the atmosphere and cool the liquid passing through it. To ensure the best heat dissipation, the radiator in the front of the car is usually installed behind the grille, where the car moves best with the incoming airflow. Although the car's internal combustion engine is located in the rear, the radiator is usually installed as in conventional cars and extended to the engine of the cooling water circulation system. There are alternative mounting locations - for example, in a rear-mounted engine. Often, these are installed along the rear side wall of the car (or along two walls if there are two radiators). In this case, the incoming airflow is formed from the air intake points installed on the side walls of the main road at the rear of the vehicle.

The radiator consists of two tanks with connected cooling system pipes, upper and lower and main heat exchange elements. Tanks can be made of plastic or metal. The main part of the radiator is a set of seamless pipes made of brass or aluminum with a wall thickness of up to 0.15 millimeters, connecting the upper and lower pipes. Each tube - a thin corrugated "accordion" tape made of copper or aluminum - is covered with radiator ribs. Aluminum radiators are lighter, but this leads to faster failure due to welding difficulties or mechanical stress. For compliance with the heat exchange properties of the brass radiator, the aluminum radiator must be larger and thicker. Previous cars used radiators made of pieces of brass pipes with a pentagonal cross-section in the form of a "honey beehive." There was no circulation of the liquid inside the pipes, and cooling was carried out only by contact of the radiator walls with air.

The main function of maintaining a constant temperature in the cooling system is carried out by a thermostat, which distributes its motion along circuits, usually called small and large circles. However, in hot weather, when the flow occurs in a large circle, this liquid is cooled by one or more fans so that it passes through the radiator and cools faster.

With the advent of engines operating in various modes, including forced, there was a need for additional cooling equipment. Some car manufacturers have found a way to install an

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additional radiator with their own separate electric fan. A common mistake of many drivers is to confuse the additional radiator with the intercooler, which is used to cool the air in the turbo system. An additional cooling radiator can be seen in the engine compartment of the turbocharged Audi 200.

In conclusion, based on the results of the conducted theoretical research, the following conclusions can be drawn:

1. The importance and function of the cooling system of passenger cars shows that it is one of the main systems for the internal combustion engine. It should be noted that defects in these systems have a significant impact on engine performance.

2. Antifreeze and taosol, which are currently used as cooling fluids, have shown significantly greater effectiveness compared to previously used water. Because the efficiency of air-cooled internal combustion engines is lower than that of liquid-cooled systems, many car manufacturers rely on liquid-cooled systems. This, in turn, means that the liquid cooling system is currently the most efficient.

3. In the improvement of parts in the internal combustion engine cooling system, the radiator occupies a special place in terms of price and quality indicators. The economical and technical convenience of improving radiators due to their relatively inexpensive materials and ease of operation can be seen from numerous experiments and the evolutionary history of radiator improvement.

4. The environment is now of great importance not only for humanity, but also for one of its greatest inventions - cars. Studying it will be necessary to extend the service life of cars and ensure their safe use during operation.

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