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POSSIBILITIES AND RESULTS OF STUDIES FOR INCREASING THE EFFICIENCY OF DRILLING EQUIPMENT ON THE BASIS OF USEFUL UTILIZATION OF SECONDARY ENERGY RESOURCES

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Annotation

Improving the operational energy efficiency of drilling equipment, reducing the time for exploration and exploration of mineral deposits, and reducing fuel and energy costs for exploration has great scientific and practical importance.

This article presents ways for the beneficial use of energy losses in the form of heat released during the operation of the internal combustion engine of a diesel power plant used in drilling operations and ways to reduce fuel and energy consumption.

Keywords: Diesel power plant, heat, utilization, internal combustion engine, fuel-energy, energy losses, drilling, thermoelectric generator, flue gases, energy losses.

An analysis of energy resource costs for drilling shows that the cost of operating drilling equipment is greatly influenced by the consumption of fuel and energy resources. Over the past few years, as a result of a sharp rise in the cost of fuel and energy resources, the cost of drilling has increased.

A sharp increase in energy consumption for drilling operations is mainly noticeable during cold periods, for example, an increase in the consumption of thermal energy required for drilling operations in the autumn-winter period significantly increases the overall energy consumption.

The amounts of thermal energy required for drilling operations are given, it can be seen that 25-30 kW of energy per hour is spent on drilling operations in the cold season. This, in turn, leads to an increase in the cost of drilling due to an increase in energy costs.

The cost of drilling can be significantly reduced by reducing the energy consumption for heat extraction during drilling. In this case, it will be possible to use secondary energy resources with benefit, i.e. heat released from the internal combustion engine of drilling equipment and an autonomous power system. Figure 1 below shows the heat balance of an internal combustion engine.

Q_T-the thermal equivalent of the chemical energy of fuel combustion; Q_i–the thermal equivalent of indicator work; Q_e–the thermal equivalent of the effective operation of the engine; Q_{COOL} -heat loss in the cooling system; Q_G-heat loss with flue gases; Q_{UL}–unaccounted losses; Q_W– engine wall heating; Q_F - friction losses of pistons and rings; $Q_{TL.}$ - total loss of gases in the chimney; Q_M - mechanical losses; $Q_{IN.C}$-losses due to incomplete combustion of fuel; $Q_{K.EN}$ -losses with gas kinetic energy; Q_L -is the loss due to light scattering; Q_{COL} - losses at the transition from the exhaust manifold to the cooling medium.

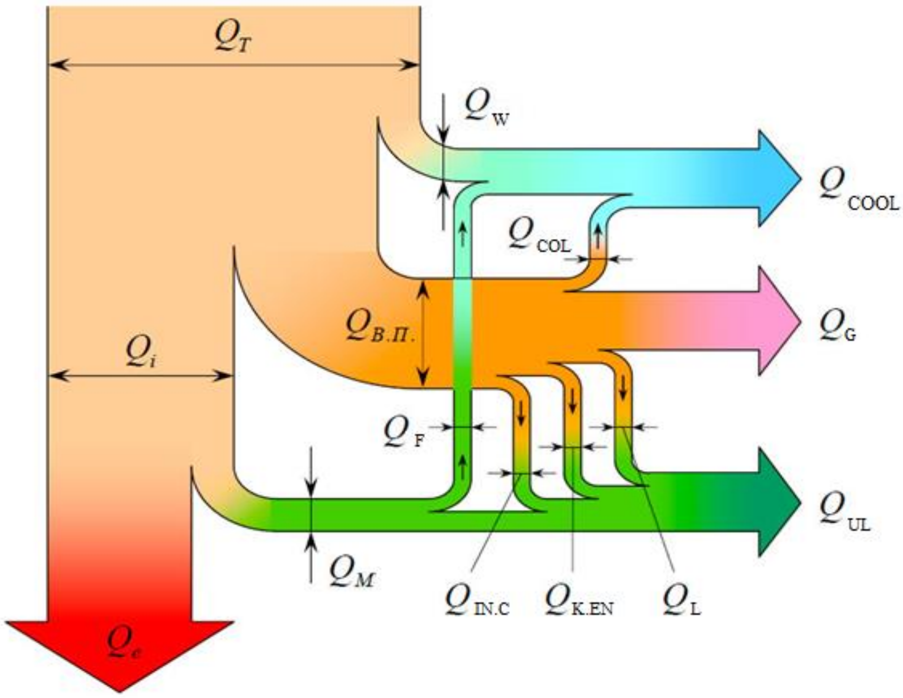

Figure 1. Thermal balance of an internal combustion engine.

The efficiency of internal combustion engines and their energy losses differ depending on the type of engine, so table 1 shows the energy losses of various types of engines.

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Table 1

	Engine energy losses and useful work, %.			
	Q_{COOL}	Q_G	Q_{UL}	Q_e
Low speed engine	14÷17	28÷32	2÷8	45÷50
Medium speed engine	14÷20	30÷35	2÷10	40÷46
High speed engine	14÷22	32÷40	2÷12	35÷40

All energy losses of an internal combustion engine can be divided into two large groups: 1-mechanical losses, 2-thermal losses.

The energy expended on the mechanical losses of internal combustion engines is the largest part, mechanical losses are the energy expended on the friction of all moving parts.

Heat losses of internal combustion engines include heat transferred to the cooling system, heat lost with flue gases and unaccounted for heat losses.

As can be seen from the above, with useful utilization of heat losses from internal combustion engines with a nominal power of 100 kW used in drilling operations, an average of 35-45 kW of energy can be used for heat extraction, which means that energy costs can be reduced.

Another major expense in drilling operations is the cost of electricity. Electricity in drilling equipment is mainly used for the following purposes:

- in the power supply system;
- in the system of launch operations;
- for lighting work areas;
- in various types of alarms;
- in instrumentation and for other purposes.

In some cases, as a result of an increase in the consumption of electricity for lighting, instrumentation and other purposes during drilling operations, there are large loads on the autonomous power supply system.

It will be possible to reduce the operating costs of drilling equipment by reducing the consumption of electricity in drilling equipment and during drilling operations.

In order to reduce the cost of electricity consumption, the conversion of secondary energy resources in the form of heat generated by internal combustion engines into electricity through a thermoelectric generator or other devices can compensate for a certain amount of electricity consumption.

Fuel consumption of diesel power plants is reduced by 8-10% due to the use of a nozzle that reduces the resistance of flue gases in the chimney of the internal combustion engine of diesel power plants.

The design of the developed thermoelectric generator unit was also experimentally studied; the proposed thermoelectric generator unit makes it possible to obtain 0.9 kW / h of electricity with a voltage of 24 V when an internal combustion engine of a diesel power plant the brand of DES-100.1 is installed in the chimney.

The introduction of the developed device for useful removal of heat generated by a diesel power plant, a nozzle that reduces the resistance of flue gases, and the design of a thermoelectric generator device into the drilling equipment made it possible to reduce the consumption of heat, fuel and electricity during drilling operations, which made it possible to increase work efficiency.

The developed block device of a thermoelectric generator can be used for power consumption of low-voltage lighting systems or control and measuring instruments.

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