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Research Article

DEVELOPMENT OF TECHNICAL SOLUTIONS FOR FAVORABLE USE OF THE HEAT OF DRILLING EQUIPMENT WHEN CLEANING WELLS WITH WASHING LIQUIDS

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ABSTRACT

Reducing the time of prospecting and exploration of mineral deposits and the beneficial use of heat from drilling equipment in geological exploration, analysis of energy production and its consumption, and reduction in fuel and energy consumption has great scientific and practical importance.

This article presents the valuable use of energy in the form of heat released during the operation of the internal combustion engine of a diesel power plant used in drilling operations, and its consumption.

KEYWORDS

Diesel power plant, heat, thermal energy, internal combustion engine, fuel energy, energy losses, drilling, heat consumption, energy losses.

INTRODUCTION

Today, at a time when the cost of energy resources is rising all over the world, the exception is that secondary energy resources in the form of flue gases from internal combustion engines used in technological processes are emitted into the atmosphere without valuable use. Internal combustion engines that do not use secondary energy resources in the form of heat are economically inefficient and wasteful machines, since the thermal energy released from the internal combustion engine to the atmosphere can be usefully reused through a number of systems.

It is possible to reduce the cost of energy resources by using the heat generated from the

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exhaust gases of the internal combustion engine and the radiator of the cooling system for heating technological and utility buildings, hot water supply and other needs.

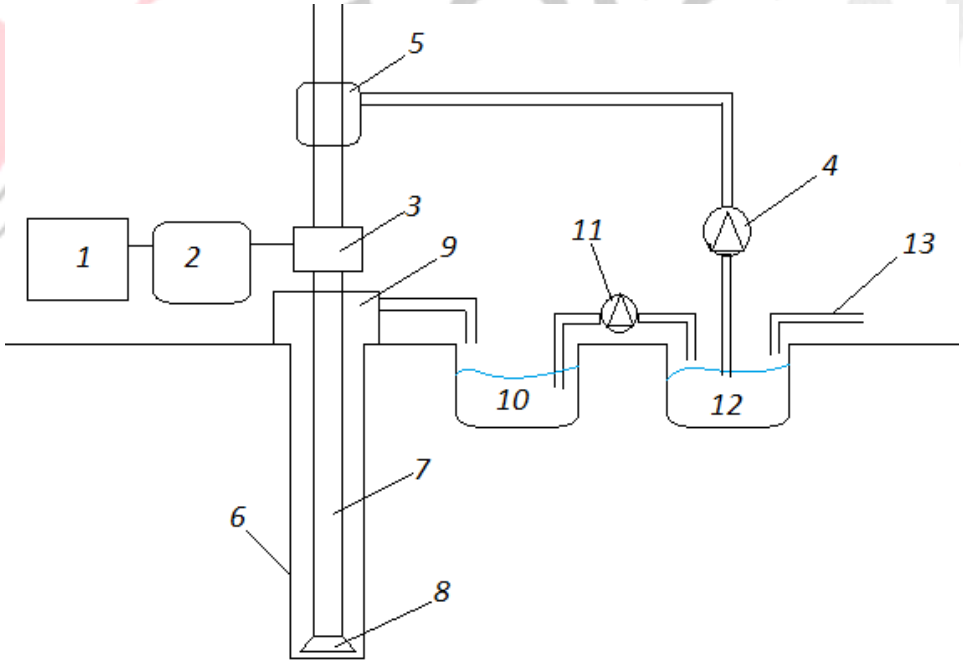
When carrying out drilling operations, it is required to maintain optimal operating modes of drilling equipment, a diesel power plant or other equipment while utilizing the heat of the cooling system of internal combustion engines, the heat of flue gases from engines and other energy sources that are lost in the form of heat. That is, when using useful heat recovery systems, this should not affect the operation of technological equipment, but, on the contrary, should facilitate the operation process and reduce energy consumption.

Today, drilling organizations in our country carry out drilling operations mainly in two different areas, the first direction is cleaning wells with flushing fluids, the second is cleaning wells with compressed air.

The method of drilling wells by cleaning them with a flushing liquid is widespread and accounts for an average of 65% of the total drilling work in our country. The method of cleaning and drilling the formation with the help of air is used in complex mining, geological and technological conditions and is 30-35%.

In the following, we have developed a device for efficient use of the heat of the internal combustion engine of a drilling rig for both drilling methods, i.e. fluid drilling and air drilling.

To begin with, consider the process of cleaning and drilling the tank using flushing fluid, this process is shown in Figure 1.



1-drilling equipment, 2-drilling equipment guide, 3-rotor, 4, 11-pump, 5-swivel-stuffing box, 6-well, 7-drill pipe, 8-chisel, 9-hermitizer, 10, 12-sump, 13-additional water pipe.

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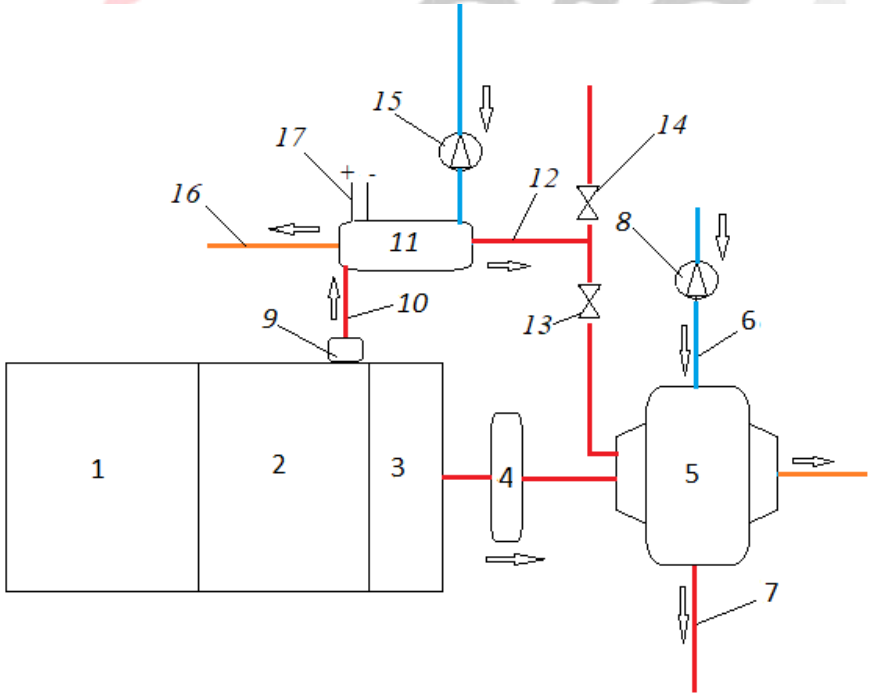
Figure 1. The process of drilling wells by cleaning them with drilling fluid.

After starting the drilling equipment (1), the pump (4) with the help of a rotary valve (5) pumps the flushing fluid through the drill pipe (7) into the reservoir, and the drive (2) drives the rotor (3). . The flushing liquid cools the drill bit (8) and moves up along the annulus between the wellbore (6) and the drill pipe (7), and the hermitizer (9) directs the liquid to the settling tank (10), liquid sludge settles in the settling tank, then the pump (11) pumps liquid into the second sump (12). The pump (4) pumps liquid from the sump (12) to the swivel-stuffing box. During the drilling process, 12-15% of the drilling fluid volume is lost, so the fluid volume is constantly provided with the help of an additional water supply (13).

The drive of the drilling rig consists of a diesel power plant and electric motors, a large amount of energy is released in the form of heat from the internal combustion engine of the diesel power plant with flue gases and through the radiator of the cooling system, that is, 55-65% of the fuel is thermal energy emitted into the atmosphere.

In the process of drilling a well with flushing fluid, we have developed a device, a schematic view of which is shown in Figure 2, for the beneficial utilization of heat generated from the internal combustion engine of drilling equipment. The electrical energy generated in the thermoelectric generator set is used by wires (14) to accumulators or for other economic and technological needs.



1. Drilling equipment, 2. Internal combustion engine, 3. Engine cooling radiator, 4. Fan, 5. Heat exchanger, 6. Cold water pipeline, 7. Hot water pipeline, 8. Pump, 9. Muffler, 10. - flue gas transfer pipe, 11-thermoelectric generator set,

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12- flue gas transfer pipe, 13 and 14-valves installed in the chimney, 15-pump, additional water supply (sub-feed) transferred to the sump 16, 17-thermoelectric generator set connected wires.

Figure 2. A device for the useful recovery of heat from an internal combustion engine of drilling equipment.

The device for useful heat recovery of the internal combustion engine of drilling equipment (Fig. 3.5) works as follows. After starting the drilling equipment (1), the flue gases of the internal combustion engine (2) are transferred from the muffler (9) through the pipe (10) to the thermoelectric generator unit (11) and heating the thermoelectric generators through the pipe (12) from the valve (13) is transferred to the heat exchanger (5), while the flue gases from the thermoelectric power plant are not connected to the heat exchanger and are released into the atmosphere through the valve (14). In the block of thermoelectric generators, thermoelectric generators operating on the basis of the Seebeck effect are installed, and when one side of them is heated, and when the other is cooled, they generate electricity due to the temperature difference.

The pump (15) pumps cold water from the sump to the block (11) for cooling the two sides of thermoelectric generators, and then the heated water is sent through the pipe (16) to the sump. Cold water is supplied by a pump (8) to cool the heat exchanger (5), and heated water is sent through a branch pipe (7) for use for household and technological needs.

During drilling operations in aggressive conditions, the heat exchanger (5) has a shell-and-tube design, which facilitates its operation. That is, they are easy to manufacture, easy to operate and repair, and cleaning and repair are not difficult in conventional workshops. In such heat exchangers, heat transfer is carried out by separating the primary and secondary heat carriers separately, a general view of which is shown in Figure 3.

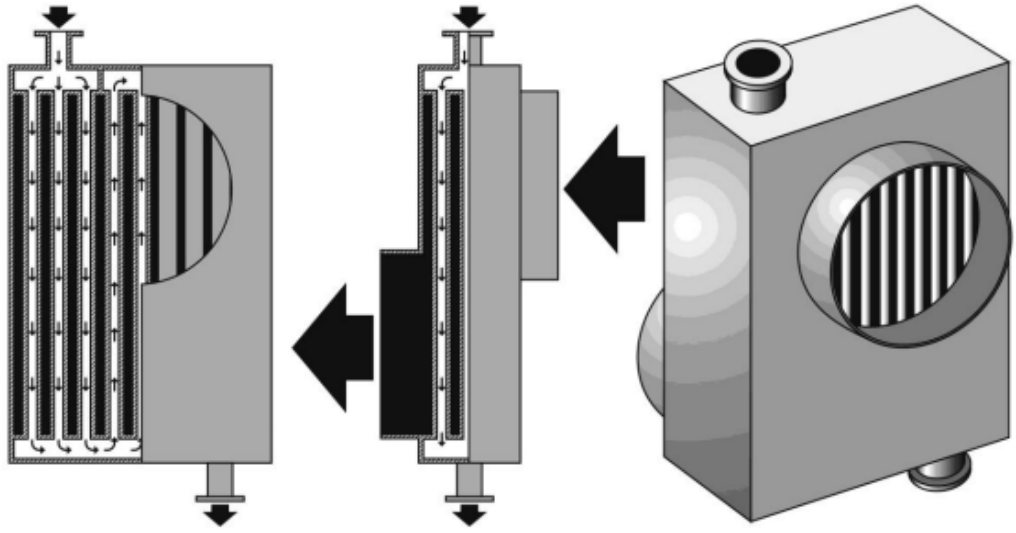

Figure 3. Shell and tube heat exchanger

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The Seebeck effect used in the thermoelectric generator block can be explained with Figure 4 below, in which an electrical force is generated when one side of the ceramic plates is exposed to high temperature and the other side to low temperature.

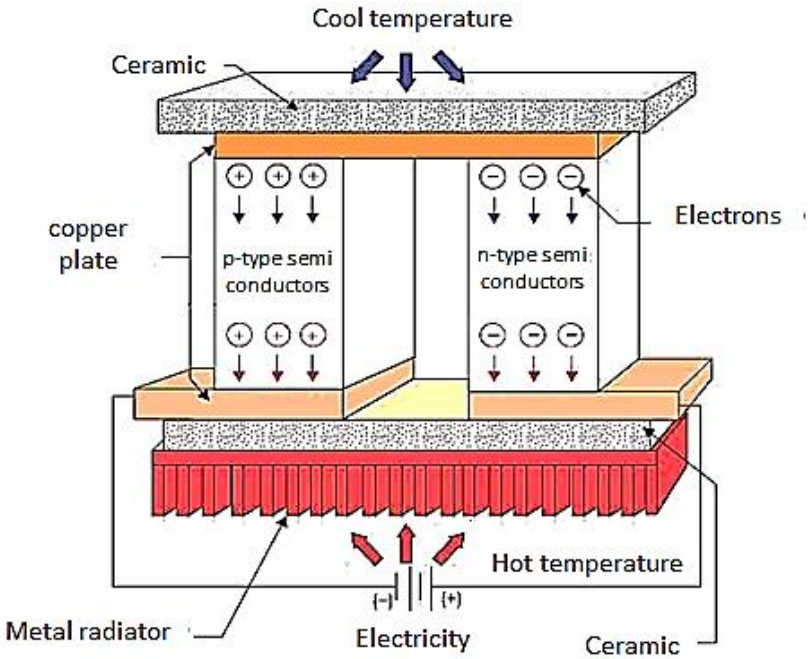

Figure 4. Seebeck effect.

In the block of thermoelectric generators used in the device for useful heat recovery of the internal combustion engine of drilling equipment, the Pelte module is used, its view is shown in fig. 5.

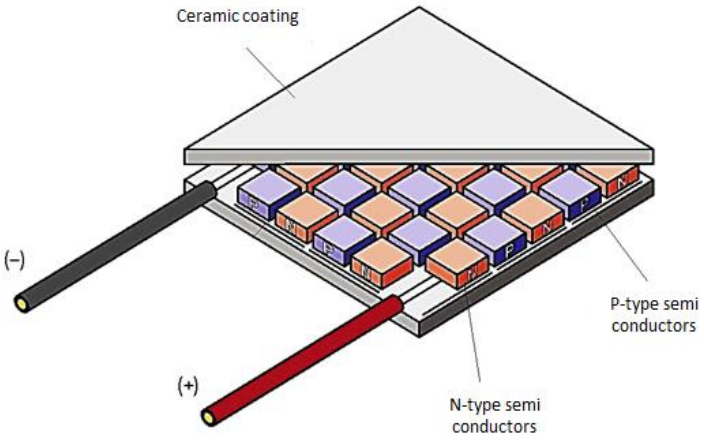

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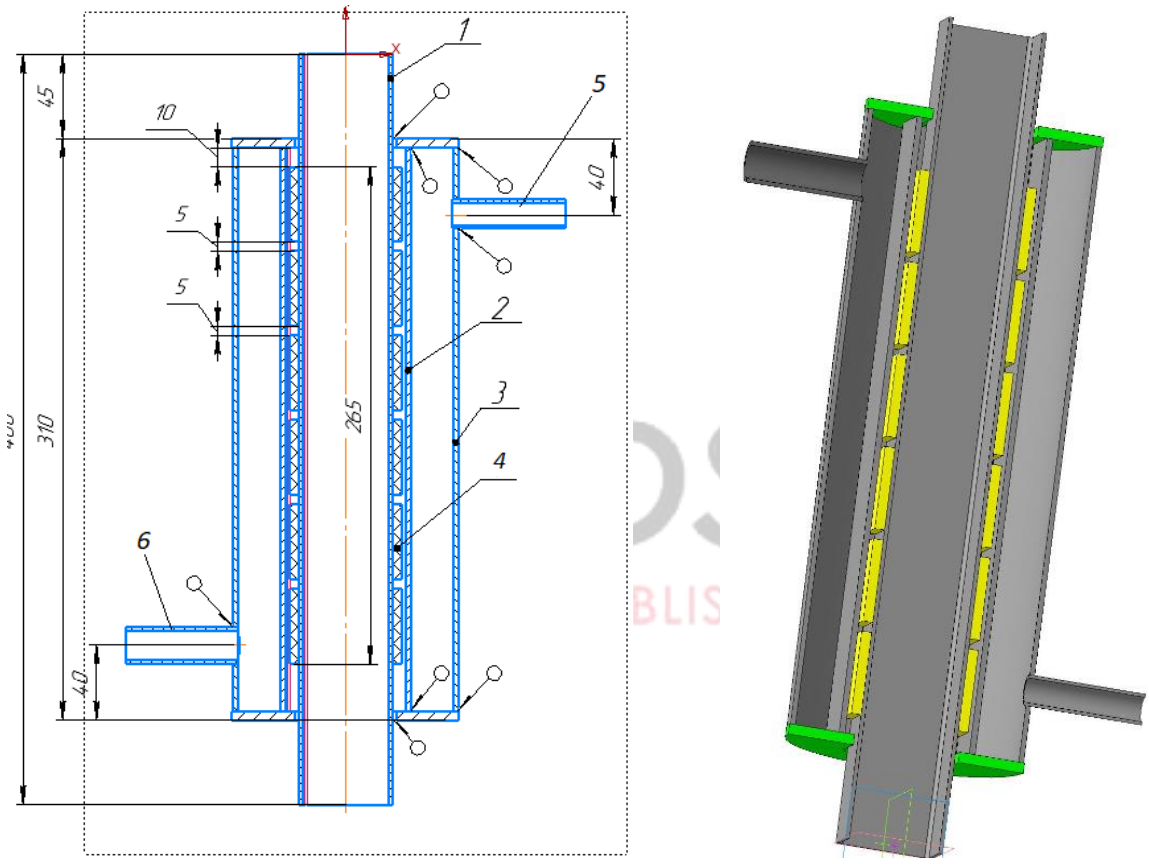
Figure 5. Pelte module.

The effective use of thermoelectric generators in the proposed device for useful utilization of the heat of the internal combustion engine of the proposed drilling equipment presents some technical difficulties, i.e. heating one side due to the secondary energy of the internal combustion engine and cooling the other side without the use of additional energy requires the development of new technical solutions. Therefore, the design of the thermoelectric generator block was developed, shown in Figure 6.



A B

1. Pipe, 2. Hermitizing plate of thermoelectric generators, 3. Shell, 4. Thermoelectric generator, 5. and 6. Inlet and outlet pipes of cooling water.

Figure 6. Constructive structure (A) and general view (B) of a thermoelectric generator.

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The thermoelectric power plant is arranged in the following order: there is a pipe (1) for the movement of flue gases, thermoelectric generators (4) are installed on the pipe, it is sealed from above with a round tubular plate (2) and a shell of a large diameter pipe (3) is enclosed in it. An annular gap is left between the plate (2) and the shell (3) for the movement of water. Branch pipes 5 and 6 are installed in the body to ensure the movement of cooling water. This unit operates in the following order, when the flue gases move through the pipe (1), it heats the thermoelectric generators installed on it, the cooling water is transferred from the pipe (5) to the space between the shells (3). and the plate (2), after the thermoelectric generators are cooled, the heated water is discharged through the pipe (6), so that the circulation of the cooling water continues continuously during operation.

A distinctive feature of the heat recovery device of the internal combustion engine of drilling equipment shown in figure 2 above is that the activation of the thermoelectric generators used in it requires exposure to different temperatures on both sides, which leads to a large consumption of thermal energy, so their efficiency is low. However, in the proposed device, the secondary energy of the internal combustion engine, i.e., the energy lost to the atmosphere, is used to heat the thermoelectric generator.

The water used to prepare and consume the drilling fluid is also used for cooling. This, in turn, makes it possible to save energy spent on cooling and receive hot water for preparing and maintaining the temperature of the drilling fluid in the cold season.

The electrical energy generated in the thermoelectric generator can be used to illuminate areas where drilling is being carried out, to provide energy for measurement and control devices, and also to accumulate the generated energy. This, in turn, leads to a decrease in the energy intensity of drilling operations and an increase in work efficiency.

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