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INCREASING THE EFFICIENCY OF GENDER CRUSHING EQUIPMENT ON THE BASIS OF ELIMINATING THE PRODUCTION OF SLIMMING REGIME AT THE BOTTOM OF THE WELL

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Abstract

In the process of drilling, in case of untimely lifting of cuttings from the bottom of the well, i.e. when the particles of the destroyed cuttings linger on the surface of the bottom of the well and under the action of hydrostatic pressure, a decrease in the efficiency of the rock cutting tool is observed.

This article discusses the movement of broken cuttings at the bottom of the well, its impact on the efficiency of the drilling process, and presents the results of experimental work to prevent the cuttings regime at the bottom of the well based on the improvement of the design of the rock cutting tool.

Keywords: drilling, boreholes, rock-breaking tools, sludge, sludge regime, rock, power, mechanical drilling speed, bit durability.

Introduction

The preservation of shattered rocks in the form of sludge under the rock breaker during drilling, their granulometric composition, shape and size, the movement under the rock breaker after separation from the borehole and its interaction with the body is called sludge regime.

The formation of a sludge regime at the bottom of the well results in the use of a portion of the energy transmitted to the rock crusher to re-disintegrate the sludge, which increases the energy consumption of the decomposition process and decreases the well depth. In addition, the retention of the sludge regime at the bottom of the well accelerates the erosion of the matrix and teeth of the rock breaker.

The formation of the sludge regime has a negative impact on the durability of the rock crusher and the mechanical speed of drilling.

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The relevance of the sludge regime study is confirmed by the analysis of the body condition of several types of rock-breaking devices. Analysis of the condition of the matrix of drill bits and drill bits shows that the trace of the grooves formed around the surface of the die and the depth of the grooves correspond to the dimensions of the sludge. [1].

The retention of the slime regime under the body of the rock-breaking tool accelerates the erosion of its matrix, leading to the loss of teeth. It also causes cavities and scratches on the teeth of the rock breaker, causing them to erode. In addition, the formation of a sludge regime reduces the mechanical speed of drilling as a result of the repeated decomposition of the rock separated from the massif, and leads to an increase in the energy consumption of the rock decomposition.

The performance of the drilling process is significantly affected by the condition of the body of the rock crusher and its teeth, and the condition of the rock crusher depends on the movement of sludge particles under its body [1]. Based on the above idea, it is important to study the dynamics and balance of the movement of sludge particles formed during the drilling process.

Materials and Methods

The number of sludge particles formed during the drilling process is as follows:

$$Б_{ш} = \frac{V_{п}}{V_{ш}}; \qquad (1)$$

here, $V_{п}$ – the size of the crushed rock under the rock breaker, $V_{ш}$ – the size of a slime particle.

Then,

$$V_{п} = S_{з} \cdot h_{айл} \cdot К_{р} \cdot К_{т}; \qquad (2)$$

here, $S_{з}$ – slaughter surface; $h_{айл}$ – deepening in circulation; $К_{р}$ – coefficient of fracture of the rock; $К_{т}$ – the coefficient of reduction of the volume occupied by the sludge as a result of the protrusion of the teeth in the body of the rock-breaking tool.

if anything,

$$h_{айл} = \frac{v_{м}}{n}; \qquad (3)$$

here, n – number of turns; $v_{м}$ – mechanical speed, if

$$Б_{ш} = \frac{S_{з} \cdot v_{м} \cdot К_{р} \cdot К_{т}}{\overline{V}_{ш} n Z}; \qquad (4)$$

here, Z – number of sectors.

The following figure 1a, b shows a diagram of the movement of sludge particles under the body of a diamond-toothed crown and the body of the balls of a spherical dolota.

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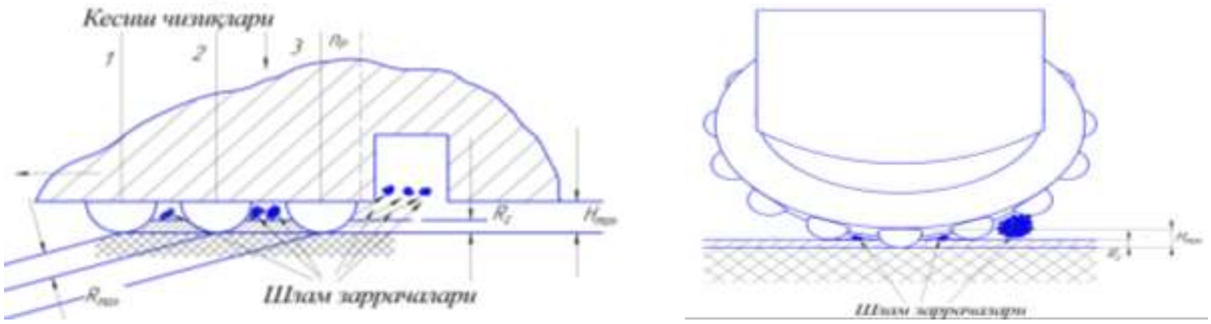

a b

Fig. 1 The movement of sludge particles under the body of the diamond-toothed crown and the spherical dolota and between the teeth.

When the shape of the sludge particles is spherical

$$\overline{V}_{\text{ш}} = \frac{3}{4}\pi\frac{D^3_{\text{ср}}}{8} = \frac{1}{6}\pi D^3_{\text{ср}}; \qquad (5)$$

$$\text{Б}_{\text{ш}} = \frac{6S_{\text{з}}\cdot v_{\text{м}}\cdot \text{К}_{\text{р}}\cdot \text{К}_{\text{т}}}{\pi D^3_{\text{ср}} Zn}; \qquad (6)$$

here, $D^3_{\text{ср}}$ – the average diameter of the mouth.

These sludge particles, formed at the bottom of the well, are in the process of absorbing the material of the rock-breaking tool during drilling. The amount of drilling mud between the rock breaker and the bottom of the well will depend on the size of the protrusion of the teeth from the body of the die, the richness of the body of the rock breaker on the volume teeth, the roughness of the rock and so on.

In the general case, the amount of drilling mud is for the hole being built per unit volume [2]:

$$\text{Б}_{\text{з}} = \frac{\text{Б}_{\text{ш}}}{V_{\text{з}} - V_{\text{т}} - V_{\text{в}}}; \qquad (7)$$

here, $V_{\text{т}}$ – the size of the teeth protruding from the body; $V_{\text{в}}$ – the size of the rock at the bottom of the well.

if anything,

$$V_{\text{з}} = S_{\text{к}}\left(\overline{H}_{max} - \frac{R_z}{2}\right); \qquad (8)$$

$$V_{\text{в}} = \frac{R_z}{2} S_{\text{к}}; \qquad (9)$$

$$V_a = n_s V_{as} S_{\text{к}}; \qquad (10)$$

here, $S_{\text{к}}$ – the working surface of the dolota body; $\overline{H}_{max}$ – the average size of the maximum height of the teeth at the cutting line; R_z – an indicator of the ugliness of the slaughter (GOST 2789-72); n_s – the number of diamond teeth in the working body of the dolota; V_{as} – матрицадан чиқиб турган тишларнинг ҳажми.

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Thus, the concentration of sludge between the bottom of the well and the body of the rock crusher isи [2]:

$$К_з = \frac{V_п}{(V_з - V_т - V_в)} = \frac{S_з \cdot h_{айл} \cdot К_р \cdot К_т}{Z\left[S_к\left(\overline{H}_{max} - \frac{R_Z}{2}\right) - \frac{R_Z}{2} S_к - n_s V_{as} S_к\right]} = \frac{S_з \cdot h_{айл} \cdot К_р \cdot К_т}{Z S_к\left(\overline{H}_{max} - R_z - n_s V_{as}\right)}; \quad (11)$$

that is,

$$К_з = \frac{V_п}{(V_з - V_т - V_в)} = \frac{S_з \cdot h_{айл} \cdot К_р \cdot К_т}{Z S_к\left(\overline{H}_{max} - R_z - n_s V_{as}\right)}; \quad (12)$$

Thus, 12 – it can be seen from the expression that the concentration of the sludge between the rock-breaking tool and the zaboy depends on the depth of the dolota during a single rotation, the performance of the dolota and the roughness of the zaboy. The size of the sludge particle is of great importance in the decomposition of the matrix of the rock crusher. The interaction of the minimum size of the sludge particle with the matrix material is as follows [3]:

$$D_{min} = \overline{H}_{max} - R_{max}; \quad (13)$$

here, R_{max} – the maximum protruding height of the rock in the basin.

During the drilling process, the sludge particles directly affect the toothless part of the rock crushing tool body matrix, the surface of which is as follows:

$$S_м = S_к(1 - n_s S_a); \quad (14)$$

Thus, the matrix of the rock crusher is abrasively eroded by the drilling mud particles, the absorbing effect of the sludge particles depends on the design and technological performance of the rock crusher.

Under the body of the rock crusher, sludge particles are separated as a result of each rotation, and as the number of revolutions increases, the number of sludges separated increases, so that the volume of sludge formed at the bottom of the well is equal to the volume between the working body of the dolota and the manhole. must be able to lift the sludge particles upwards, which is the main condition to prevent abrasive erosion of the rock breaker and re-disintegration of the separated sludge.

Three-ball drills are widely used in the construction of production wells, and diamond-toothed ring crowns are widely used in exploration and prospecting.

During the drilling process, changes were made to the design of the three-ball drill and the diamond-toothed ring crown to eliminate the formation of a sludge regime at the bottom of the well. In this case, paddles were placed on the paw of the three-spherical dolota and on the upper body of the crown along the curved line, these modified structures are shown in Figures 2 a, b.

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a

b

2- Picture. An improved three-ball dolota (a) and a diamond-toothed crown (b).

Placement of rollers on the claw of the three-ball drill and on the body of the diamond-toothed crown (Figures 2a, b) creates a rolling force as a result of rotation of the drill during drilling, which effectively cleans the bottom of the well from sludge. increases the mechanical speed of drilling and the durability of the rock crusher.

In order to study the effectiveness of the above-proposed improved three-ball dolota and diamond-toothed crowns, experimental work was carried out in the party "Central Uzbekistan" of the State Unitary Enterprise "Regionalgeologiya" (Figure 3).

During the experimental work, the mechanical speed and durability of the proposed three-ball drill and diamond-tipped crown with improved design were compared with traditional drills of the same type in different drilling modes.

3- Picture. Experiments with a three-ball dolota and a diamond-toothed crown with an improved design.

Experimental work was carried out in the following drilling modes: axial pressure (Pos) applied to the drill 5, 10, 15 kN, number of revolutions of the drill (n) 103, 200, 300 rpm, flushing fluid consumption (G) 110 l / min., rock hardness f = 8, 9, and 10 categories.

Conclusion

The results of experimental work confirmed that the application of the proposed design with an improved three-ball drill and diamond-tipped crown increases the

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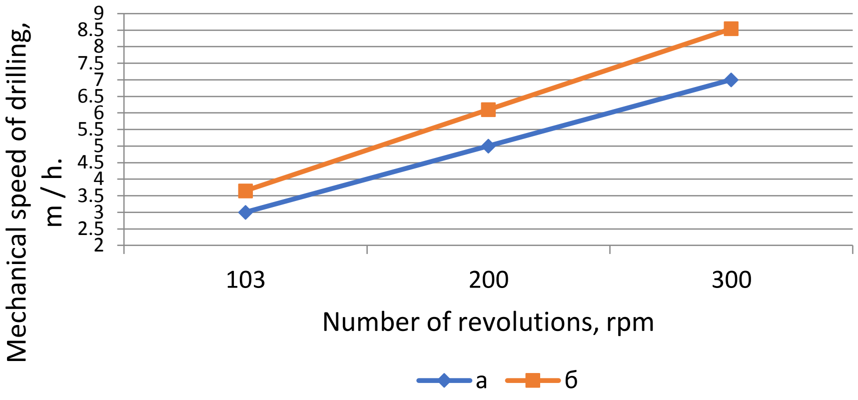
mechanical speed of drilling the well and the durability of the rock-breaking tool.
Figure 4 shows a graph of the mechanical speed of drilling a well, depending on the number of revolutions of the drill when the axial pressure is 10 kN.



4- Picture. Dependence of the mechanical speed of drilling on the number of revolutions of the drill.

a) traditional three-ball dolota, b) three-ball dolota with improved design.

As can be seen from the graph of the mechanical speed of drilling shown in Figure 4 above, which depends on the number of revolutions of the dolota, the mechanical speed of drilling increased by 20-22% compared to the conventional dolota due to the proposed three-ball dolota.

The permeability and durability of the developed dolota and diamond-toothed ring crown were also investigated during the drilling of several wells with rock hardness categories of 8 and 9.

As a result of the research, the durability of the three-spherical blades and crowns increased by 16-17%, the throughput increased by 20%, and the endurance of the diamond-toothed crown increased by 20% and 22%, respectively. observed.

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