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# Method of Improving the Flushing Units of Rock-Cutting Drill Bits

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**ABSTRACT:** The paper presents a methodology for improving the flushing units of rock-cutting drill bits and establishes criteria for assessing the performance of drilling tools in the process of rock destruction. A scheme of movement of heavy particles in a swirling fluid flow is given and substantiated, which makes it possible to combat the negative process of bit balling on the effectiveness of the drilling tool and carried out in the over-bore annulus of drilling wells.

**KEY WORDS**: drilling, drill bit, energy costs, well, oily formation, sealing of supports.

## I.INTRODUCTION

The economic development of Uzbekistan is directly related to the extraction and processing of the richest mineral reserves and is largely determined by the efficiency of the open-pit mining method. The main trends in the development of the open-pit mining method are the involvement in the development of deposits with altered mining and geological conditions and the growth of the open-pit mine. Drilling wells as a process of destruction of rocks during the formation of round mine workings in mountain ranges is not so simple as it was previously thought when drilling relatively not deep wells of the most diverse purposes and in very different rocks.

The main tool in this process is rock cutting drilling tools - drill bit. The effectiveness of the entire drilling process depends on its effective-ness.

The effectiveness of the drill bit is determined by the dynamics of the armament of the working surfaces of the bit, the dynamics of the sealing assemblies (if it is a roller bit of the type) and the dynamics of the cleaning of the bottom hole of the drill cuttings with flushing fluid [1].

### A. MODES OF MOTION TRANSMISSION

Theoretical analysis Particles (sludge) separated from the rock mass at the bottom of the well, entering the stream of flushing fluid are removed along with this stream from the bottomhole area and carried to the surface. In practice, this picture was not confirmed: as the depth of the wells increased, the mechanical drilling rates began to decrease. The cause of this phenomenon was explained by the ineffective dynamics of armaments, and drill bits with jetting nozzles appeared, which, according to the re-searchers' plan, along with their direct affiliation — removal of cuttings from the bottom of a well — were designed to provide an additional missing mechanism for rock destruction at the bottom. The effect was obtained, and in some cases, significant, but with an excessive expenditure of energy re-ported to the flushing flow in the jetting nozzles.

Currently, the cleaning of the bottom of a well from sludge and its removal to the outside surface accounts for 70-80% of the total energy expended in drilling wells. The deeper the drilled wells, the more paradoxical are the picture. Dozens, hundreds of inventions to improve the washing units did not lead and do not lead to the desired result. At the same time, the jet nozzles were lengthened in order to bring the output jets closer to the face of the well: they were directed at different angles, asymmetric with respect to the cones, combined in the direc-tions and diameters of the outlet holes, and used in combinations with the ejection effect. But the de-sired effect was never obtained. In addition, the reason here is the lack of a fundamental scientific basis.

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In the 1970s, when jetting drill bits appeared, they were considered to be adopted. However, in those years, deep wells were drilled exclusively by the turbine method, with 600 or more turbines per minute. The results were very controversial. So-called oil seals were wound on the pipes in the overhead space, because of which accidents be-came more frequent due to sticking of drilling tools at the bottom of a well. In other words, the use of jetting bits in the turbine drilling method led to opposite results.

In order to eliminate this situation, weighed boring pipes with a helical shape appeared, which also did not solve the problem of “winding up” bit balling. Meanwhile, the laws of hydrodynamics did not explain these paradoxical phenomena. The only exceptions were the so-called hydrodynamic effects - Segre- Zilberberg, early and late turbuli-zation, the wall effect, etc., but their physical na-ture was not explained until recently. Therefore, the question of the nature of the glands was not posed within the framework of hydrodynamic laws and was not studied on a solid scientific basis.

## II. DISCUSSION

All technical solutions appeared to be a struggle against balling, and not with the very process of their formation. A jet of the jetting nozzle was brought closer to the face of the well: if the glands were formed on the cones between the rims, then the rims of the adjacent cones between its rims (self-cleaning cones) were directed and if the momentum was formed above the bit, then one or two jets were directed upwards, etc.

The effect of these innovations was minimal or even negative, as in the process of using jetting bits in the turbine drilling method.

The formation of seals is based on the pattern of energy expenditure from the forces of resistance to movement [2]. The provisions of this pattern are as follows:
1. Any dynamic system, including the washed particle, is closed in three energetically variable cost and constant in form: centric, eccentric and bicentric motion modes.
2. The minimum energy cost is in the bicentric mode of motion with an eccentricity within $0 < \varepsilon < \varepsilon k$ .
3. The smaller the eccentricity $\varepsilon$, The less will be the costs.

By definition, washed slag particles are dynamic systems and, therefore, in swirling flows (and there can be no other in the area of the bottom hole), they will tend to the center of these flows, i.e. to a minimum of eccentricities: to the center of the bottom hole (slurry pad); to the axes of cones at the tri-cone bits; to the center of a spherical roller cutter in single-bit chisels (gland on roller cones); to the well axis, i.e. to the axis of the pipe ( overdlot gland). Recall that this desire is due to the principle of Maupertuis- Lagrange [3].

After all, these now scientifically based conclu-sions were obvious with examples of the formation of sandy streamers on rivers, during the formation of anticyclones at the poles of the Earth and, most interestingly, at the formation of sugar cones at the bottom of a glass in untwisted water. Take the last - the formation of sugar cones at the bottom of the glass.

Obviously, if the water with sugar in the glass is unwound with greater speed, then the sugar parti-cles will rush to the center of the bottom (to the axis of the glass) faster, and if instead of the glass you take dishes of the same diameter but different heights, then at constant angular speeds of the unwinding water the speed of the sugar cones will be more if the vessel is the higher, i.e. if the more pressure there is.

From this it follows that the jetting nozzles, cre-ating more speed of swirling flows at the bottom of the wells and high pressure in the washing liquid, contribute to the process of bit balling. In other words, struggling with glands by introducing jet-ting nozzles into the bit design, more favorable conditions for their formation are created. That is why excessively large volumes of washing liquids are becoming popular. Paradoxically, but a fact: at first, difficulties are faced, and then they have to be overcome by excessive expenditure of energy, which sometimes does not lead to a positive effect. Evidence of this is the frequent sticking of drilling tools at the bottom of a well.

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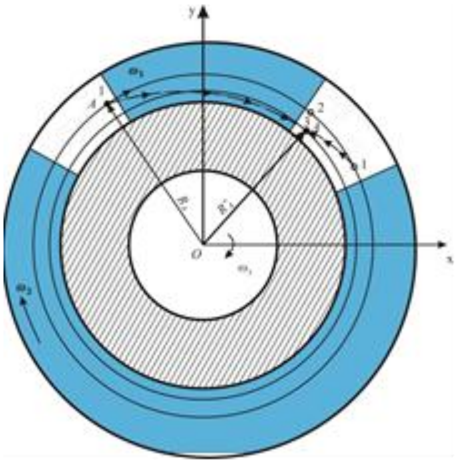
It is known that single-cone chisel with the possi-bility of rotation in a clockwise direction consists of a cutter equipped with teeth, mounted on the trunnion of the body with a system in its diamet-rical cross section of the flushing channels, which consists of the main passing through the body and the trunnion with an exit through the top of the roller cone.

Moreover, containing extra flushing channels directed counterclockwise relative to the axis of the bit, while the outputs of the extra channels made in diametric and tangential sections of the body of the bit mated respectively directly with the main channel. With the help of a trans-verse hole passing through the main channel with plugs on the ends it is directed upwards from the cone [4].

The disadvantage of this solution is that the control of negative balling process on efficiency of drilling tool made above-bit annulus, whereas in the wellbore space, the process of bit balling does not interfere.

The closest in technical essence to the claimed technical solution is single-cone drill bit of the "Kingdream" company, which in addition to the channel formed in the bit body with access to the surface of the cone, the main flushing channel is formed through the housing body and the spigot, and the channel outlet conjugates with flushing grooves, made in the meridian directions along the body of the roller cone [5].



It is extremely important that heavy particles in the loaded stream will tend to the axis of rotation. A diagram of such a dynamics of heavy particles is shown in Figure 1.

$$( \omega 1 > \omega 2 > \omega 3 )$$

Fig. 1. The movement of heavy particles in a swirling flow of fluid

## III. CONCLUSION

In practice, this phenomenon can be observed on the formation of sugar cones at the bottom of the glass in a swirling flow. This also indicates the nature of relief formation in rivers. Moreover, what is especially important for us is that this phenomenon is the reason for bit balling in spherical drilling tool, including on the surfaces of cones of other designs of drill bits, on the surfaces of the bodies, over-bit expanders, calibrators and weighted drill pipes.

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