

ANNOTATION
of the dissertation thesis of the PhD doctoral on the specialty
6D071200 «Machine building» Assan Aigerim Erzhankyzy "Technological
and constructive perfection of diamond drill bits"

The relevance of research. In recent years, there are a number of trends that require development and modernization of infrastructure in Kazakhstan. In conditions of transition period from planned to the market economy Kazakhstan's mineral resources become essential. In the face of fierce international competition, the President of Kazakhstan set the task of diversification of the national economy.

The most important task in solving the problems of assessment of the resource potential of the territory of Kazakhstan in the solid minerals is to improve the geological and technical- economic efficiency of drilling, which is impossible without modern technical and technological support of these activities.

Well drilling is the main way of exploration of mineral resources. The most effective current and foreseeable manner future construction of wells in hard rock is a diamond drilling using diamond rock cutting tool designed for coring advanced technical means in complex geological conditions. A significant increase in geological information content of drilling and efficiency of technology construction of boreholes for various purposes in complex geological conditions depends on the level of scientific substantiation of main parameters of a special diamond rock cutting tool, the technology of its manufacture and use (crowns, bits, reamers, etc.) and differs from the standard diamond tools both structurally and production technology. The questions to improve productivity, quality and efficiency of drilling through creation, implementation and improvement of diamond cutters tools have continued relevance.

The aim of the work is technological and constructive perfection of diamond drill bits for drilling exploration wells.

The idea of the work is the selection and justification of parameters of diamond drill bits allowing increasing their wear resistance and work resources.

In connection with the intended purpose, following research objectives were formulated:

- analysis of the mechanism of destruction of rocks diamond auger bits and the direction of its development;
- study of structural parameters of diamond drill bits for drilling exploration wells and ways to improve them;
- constructive-technological study of wear resistance parameters of diamond crown and development of new construction with high service life;
- research and an experimental drilling of rocks on the models of drill bits with modified geometry of the end part and development of recommendations on their use.

Scientific novelty:

- analytical dependences of the wear rate of the diamond drill bit $w = \frac{W}{A}$ representing a mathematical model of interaction of diamond crown with rock

bottom of the well and the rate of mass wear diamond in time $q = 0,065 \cdot$

$$10^{-12} \frac{A_{yD} d_K^2}{D_{cp} n}$$

- impact of the destruction process of rocks during drilling with diamond crowns on design parameters are characterized by the following analytical functions - volume of drilling $Q_p = \pi \cdot (R^2 - r^2) \cdot V_B$ volume of rock removed from the slaughter $Q_y = V_n \cdot S_{uu}$ and total cross section sludge removing grooves $S_{uu} = \frac{\pi(R^2 - r^2)}{\bar{\omega} \rho} \varphi$.

- it was found that the strength of rocks in array is easier than all it is broken at separation and shift, so the creation of stress-strain state in the zone of influence of destructive instrument in which the tensile stress $\sigma_p \geq \sigma_{nped}$ and shear stress $\tau_{co} \geq \tau_{nped}$ can be realized in the form of a stepped bottom.

- depending on the height of the ledge H_c separation of the rock slaughter at the end of the protrusion sector crowns face occurs as clean, when the number of free-surface outcrop of at least 2, and locked chips, when the size of the height of the second free surface of the ledge should not be less than the value of minimum cleavage - C, these surfaces must be mutually orthogonal.

Practical value of the work:

- it was experimentally established that the stepped shape of the crown without overlapping diamond sector provides a 1.5-2 fold increase in drilling speed by reducing the contact area with slaughter, reduction of the specific load on the slaughter, increasing the durability of the crown.

- it was developed at the level of single-stage design of the invention, a diamond drill bit, which implements in its construction blocked cleavage fracture mechanism of rock and allowing to improve drilling speed and reduce unit load to slaughter.

- production technology offered new models of diamond drill bits makes it possible, at no additional cost, to master a wide release of industrial design crowns and effectiveness of the proposed drilling technology and development of new designs of drilling core bits, will provide economic benefit of more than 5 000 tenge per one drilling core bit and, when drilling program is of 10,000 meters, the economic impact will be 50 million tenge.

The scientific provisions submitted for protection:

- selection of basic geometric parameters of a single stage of the diamond drill bit - staggered crown on its inner and outer sides with no overlap, rational height of placing the slaughter of the crown and width and breadth of flushing grooves, allows to develop rational design parameters single slaughter diamond drill bit, affecting the increase in the rate of drilling and its durability by reducing the contact area from the ledge of the crown;

- acting in the contact zone of the diamond tool with rock the actual tensile stress and chip determined with stepped shape of the ledge, imitating the design parameters of the diamond drill bit and realizing stress-strain state in the zone of

influence of destructive instrument in which the tensile stress $\sigma_p \geq \sigma_{npe\delta}$ and shear stress $\tau_{c\delta} \geq \tau_{npe\delta}$ may be carried out at the step shaped of the ledge;

- separation of the rock ledge at the end face of the protrusion sector crowns occurs as clean, when the number of free-surface outcrop of at least 2, and locked chips, depending on the height of the ledge H_C where the size of the height of the second free surface must be not less than the value of minimum cleavage - C, these surfaces must be mutually orthogonal.

Validity and reliability of scientific positions, conclusions and recommendations are supported:

- analysis of large volumes of production data and empirical materials on the geological enterprises of Kazakhstan and CIS countries on drilling diamond drill bits;

- using basic terms and techniques of engineering technology, theoretical mechanics, theory of elasticity and plasticity, and solution of problems on computer;

- carrying out mathematical modeling and experimental laboratory study of technological parameters of the wear resistance of diamond drill bits with tasks on computer;

- establishment of the convergence of theoretical and experimental research.

Implementation of the work.

The study results are submitted for introduction into production ZAO "Mining Group" EZTAB ", St. Petersburg (Russia) and are used in the educational process in the preparation of bachelors on the specialty 5B071200 -" Machine building" at KazNITU named after K.I.Satpayev.

Work approbation. Key provisions of the thesis and results of the study were presented and discussed at the International scientific conference "Engineering Education and Science of the XXI Century: Problems and Prospects", dedicated to the 80th anniversary of KazNTU named after K.I. Satpayev readings "The role and place of young scientists in the implementation " Kazakhstan-2050 ", devoted to the 80th anniversary of K.I.Satpayev (Almaty, 2014), XXII International Scientific and Technical Conference "Mechanical Engineering and Techno sphere of the XXI century" (Donetsk 2015).

Publications. The main results of the thesis are published in 11 publications, including 3 articles in journals recommended KKSON of MES of RK; 7 publications in international conferences, including 1 - foreign; 1 paper in the database Scopus. 1 positive solution for patent for invention, 2 -registered patent applications for inventions.

The structure and volume of the work. The thesis consists of an introduction, four chapters and conclusions contained in the 165 pages, contains 69 pictures, 7 tables, 102 bibliographies and applications.