JUSTIFICATION OF THE VALUE OF WELL DRILLING DURING EXPLOSION OF LEADS

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Abstract: The article considers the influence of the strength of rocks, the type of explosive height, the diameter and length of the charge in the drilling of wells on the quality of crushing rocks. It has been established that about 50% or more of the length of the drilled well is used irrationally, and only 50% is used for its intended purpose for destroying the explosive charge in order to destroy the massif by explosion. To determine the effect of the distance between the charges on the value of the resistance overcome along the sole, industrial experiments were carried out at the quarries of the NMMC and AGMK.

Keywords: drilling and blasting, downhole charges, explosives, redrilling, specific consumption of explosives, average piece size, rock collapse, blasted rock mass, emulsion explosives.

1.Introduction

The main task of drilling and blasting in rock quarries of complex structure deposits is to ensure the highest technical and economic efficiency of technological processes of excavation and transportation of blasted rock mass. In recent years, from the standpoint of the ultimate goal of mining, explosive crushing of ore is considered not only as a process of preparing rocks for excavation and loading operations, but also as the initial stage of the ore processing process, preceding mechanical crushing and grinding, that is, explosive destruction is one of the stages of disintegration along with coarse and medium mechanical crushing and is included in the mining technology[1-8].

Explosive breaking, crushing and grinding are elements of a single process for preparing the ore mass, called ore preparation. In this case, one of the main tasks of the problem of improving ore preparation is to improve the quality of preparation of the ore mass by explosion, since it is the qualitative characteristics of the ore beaten by the explosion that determine the indicators of its mechanical crushing and grinding, as well as the extraction of useful components in the process of ore beneficiation. At the same time, ore preparation as a sequence of operations "explosive crushing - mechanical crushing - ore grinding" is

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characterized by an extremely uneven distribution of energy costs [Rubtsov, Shemetov].
The destruction of rocks by an explosion along the bottom of a ledge depends on their strength, the type of explosive height, the diameter and length of the charge in the drilling of wells. The use of explosive technology for the destruction of rocky rocks with significant specific consumption of explosives in open-cast mining entails the problem of assessing the quality of crushing rocks in the collapse. To determine the optimal parameters of drilling and blasting, a study was carried out in the Muruntau quarry, carried out using both emulsion explosive compositions of our own production and industrial explosives (Grammonit 79/21).

2.Results and discussion

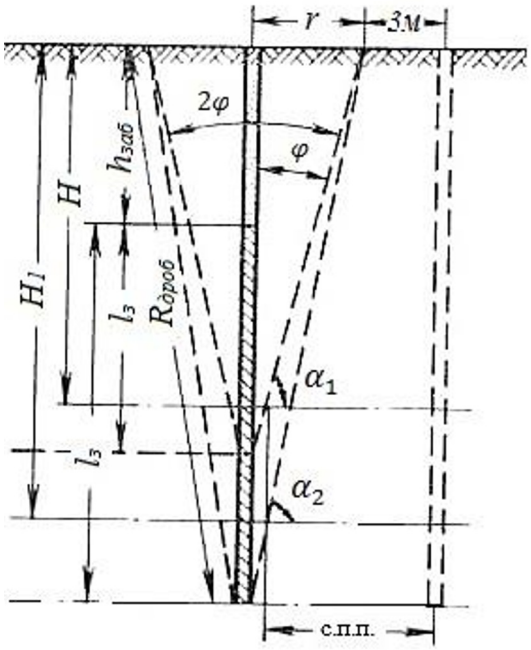
A comparative analysis of the results of mining blocks No. 72/81 and No. 49, represented by almost the same type of rocks and blasted at equal specific explosive costs, showed a decrease in the average size of the blasted piece (14.5 cm versus 16.8 cm), surveying measurements did not establish an overestimation of the ledge foot. When blasting with EVV charges, a slightly higher yield of fine and medium fractions is observed, which is explained by a higher detonation rate of these charges (Nobelite 2030 + Nobelan 2080) compared to combined charges of grammonite 79/21 and igdanite. At the same time, the prime cost of self-produced explosives is, on average, 2-3 times lower than the cost of industrial explosives [9-15].
Based on the results of pilot-industrial explosions, a rational range of explosive explosives for the rocks of the Muruntau quarry has been developed, based on the condition for the optimal performance of the SPM. For loading dry wells in medium and hard-to-blast rocks - Nobelan 2070, which is a mechanical mixture of 70% granulated AS and DT, 30% emulsion matrix; Nobelan 2080 (80% ASDT, 20% emulsion); dry wells in easily explosive rocks - igdanite and Nobelan 2080; flooded wells - Nobelit 2030, which is a mechanical mixture of 30% ANFO and 70% emulsion matrix, sensitized with gas-generating additives of sodium nitrite and acetic acid solutions [16-25].
One of the most important requirements for the parameters of the drilling and blasting is to provide up to 80% fraction content of +100 mm in the blasted ore, which optimizes the self-grinding process at the hydrometallurgical plant. In this regard, the blasting technology is needed in the open pit, which ensures the intensification of the explosive effect on the crushing of the ore. As a result, the oversize yield in the ore zone decreased from 1.5 to 0.9+0.02%. The technology increases the efficiency of the subsequent stages of ore preparation - mechanical crushing and grinding. The parameters of drilling and blasting at the deep ore quarry Muruntau, which ensures the intensification of the explosive impact on the rock mass, are presented in Table 1.
Table 1

Coefficient crepe on the scale of M.M. Protodyakonov	Ledge height, m	Charge diameter, mm	Well depth, m	Well grid, m	Specific consumption, kg/m		
					Nobelan	Nobelite	Igdanit
13-14	10	215	11.5	5.6x5.6	0.92-1.06	1.12-1.20	-
	15	215	17.0	5.6x5.6	0.99-1.08	1.16-1.22	-
	10	244	11.0	5.6x5.6	1.10-1.21	1.28-1.34	-
	15	244	16.5	5.6x5.6	1.23-1.30	1.23-1.38	-

11-13	10	215	12.0	6.5x6.5	0.74-0.84	0.90-0.95	-
	15	215	17.5	6.5x6.5	0.76-0.84	0.85-0.90	-
	20	215	23.0	6.5x6.5	0.76-0.82	0.86-0.92	-
	30	215	33.5	6.5x6.5	0.78-0.84	0.84-0.96	-
	10	244	11.5	6.5x6.5	0.99-1.04	1.05-1.10	-
	15	244	17.0	6.5x6.5	1.00-1.06	1.06-1.14	-
	20	244	22.5	6.5x6.5	1.01-1.08	1.10-1.18	-
	30	244	33.0	6.5x6.5	1.02-1.10	1.12-1.20	-
10-11	10	244	12.0	7.0x7.0	0.90-0.94	0.95-1.03	0.75-0.85
	15	244	17.5	7.0 x 7.0	0.92-0.96	0.97-1.05	0.71-0.80
	20	244	23.0	7.0x7.0	0.92-0.98	0.99-1.06	0.68-0.73
	30	244	33.5	7.0x7.0	0.94-0.98	1.00-1.06	0.67-0.70
9-10	10	244	12.5	8.0x8.0	0.75-0.84	0.85-0.87	0.65-0.70
	15	244	18.0	8.0x8.0	0.75-0.81	0.80-0.85	0.62-0.68
	20	244	23.5	8.0x8.0	0.74-0.80	0.78-0.82	0.64-0.68
	30	244	34.0	8.0x8.0	0.68-0.76	0.76-0.79	0.6-0.64

It is known that the speed of the deepening is directly proportional to the productivity of the excavators, the angles of the direction of the deepening and the slope of the working side of the quarry or the area of intensive work, the height of the blasted and worked out ledges, and inversely - to the height and length of the excavator block. Therefore, in order to reduce the time for preparation of horizons and increase the rate of lowering of mining operations, it is necessary to use more productive equipment, to minimize the width of working platforms on the lower horizons, and to concentrate as many excavators as possible on blocks of minimal dimensions. All these technical measures to intensify mining operations in deep ore open pits are possible only with the transition to the method of drilling and blasting high ledges [26-31].

The height of the ledge affects the re-drilling of wells indirectly, through the value c. p.p., which does not change with the height of the ledge. Value s. p.p. is determined by the action of the charges of the last row of wells, which forms the slope angle of the ledge for the subsequent block being prepared for the explosion [3]. During the explosion of borehole charges towards the upper platform, a funnel is formed, the angle of which 2φ is determined by the properties of the rock, the diameter of the explosive charge, the value of its penetration from the surface, and also the length of the cylindrical charge column l_z. Obviously, the length of the charge affects the size of the crushing funnel up to a certain limit, after which an increase in the length of the charge does not affect the value of 2φ. This is due to the fact that, due to the distance from the surface, the effect of the buried part of the charge is insignificant. The formation of the slope angle of the ledge at different heights H is shown in Figure 1, where the solid line shows the well of the last row of the blasted block and the dotted line shows the well of the first row of the newly drilled block, which should be drilled no closer than 3 m from the upper edge of the ledge



If l_z>(40÷60)d and the value of s.p.p. does not depend on the height of the ledge. Usually l_{zab}=(20÷30)d; h_{trans}=(10÷15)d, *then the ledge height* $H=l_z+l_{zab}-h_{trans}$=(50÷70)d.

Fig. 1. Scheme of the formation of the slope angle of the ledge with a change in its height.

The determination of the rational value of the overdrill should be based on the mechanics of the action of an explosion on the medium. During the explosion of a charge in a well, as a result of the impact of gaseous explosion products, a cylindrical stress field arises in the massif, which subsequently causes the crushing of the medium. In that part of the charge, which is in the overburden, the voltages propagate according to the same law. This leads to the fact that the energy in the drill is used unsatisfactorily, since the stresses that arise in the drill area produce only an insignificant part of the useful destruction, ensuring the normal state of the bottom of the bottom after the explosion. Despite this, there are quarries in the mining industry where the overdrill value is 3-5m [32-45].
From the point of view of drilling and blasting technology, with a 15-meter height of ledges in a well with a diameter of more than 200 mm, the height of the charge column is from 5-8 to 8-10 m, as a result, the stemming share is 30-40% of the well length. Thus, taking into account over drilling, about 50% or more of the length of the drilled well is used irrationally, and only 50% is used for the purpose of destroying the explosive charge in order to destroy the massif by explosion.

3.Conclusions

Improving the use of the length of drilled wells will reduce the cost of drilling, which ranges from 30 to 50% of the cost of drilling and blasting. One of the advantages of using high benches is to reduce the amount of drilling on the drills. If, for example, when developing a field with 5-10 ledges 10 m high, it is required to have a redrill of 1.5-2 m on

each ledge and their total length will be 10-20 m, then under the same conditions, when working with one or two ledges, the length of the redrill will be only 2-4 m respectively .
With an increase in the height of the ledge, the volume of the massif exploded from each well increases significantly, and therefore the mass of the charge in each well also increases, with an increase in the length of the column, the explosive charge is more evenly distributed over the block being exploded, which improves its crushing and, as a result, , increasing the degree of useful use of the energy of the explosion.
In this case, the number of cycles of drilling and blasting operations is reduced, one place in the vertical plane. And also, this method of conducting drilling and blasting operations provides for the reduction of harmful seismic effects during mass explosions in the near-contour zone of the quarry, and the reduction of toxic emissions into the working area of the quarry and the atmosphere.

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