

Analysis of the State of Raise Drivings at Krivbas Mines

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There are presented results of analysis of the state of raise drivings at Krivbas mines. Applied methods of rock mass destruction are discussed. Trends of perfection of the given kind of mine jobs are shown.

Keywords: RAISE, HOLE BREAKING, SECTIONAL BLASTING OF HOLES, COMBINE DRIVING

Raise driving is one of the most expensive and labor-intensive kinds of mining. At Krivbas mines labor-intensity and spending of sources raising are 30-40% of the total labor-intensity and costs of the production blocks to the abrasion works.

Today, in Krivbas at the opening of occurrence, preparation of new horizons and cutting blocks, about 27 thousand meters of raise drivings are used. Volume of raise driving, its distribution to the destination, height, cross-sectional area, fortress of rocks and methods of driving are shown in the **Table 1**.

The **Table 1** shows that raise driving spassing the rocks and ores with a strength factor f from 3-6 to 16-18, the predominant volume (72.8%) are in the mountain range with a strength factor f 5-9. Depending on the purpose, raise driving shave cross-sectional areas from 1.44 to 4.0 m², and the predominant area is 2.25 m² (73%). Height of raise drivings varies from 10 to 80 meters, and dominated raises with 10-40 m high (62.3%). The share of raise cuttings is 90.5% of the total volume. The most quantity of raises (96.7%) are making with blast-hole drilling method. By the nature of the explosive destruction of the array they are separated by a raise with borehole breaking and deep charges wells.

Raise driving with borehole method works with temporary hobs device (78.9%) and the using of self-mobile systems (17.8%).

Driving with using temporary hobs describes by a low-security, high labor intensity of technological operations, low monthly rate of driving, poor sanitary conditions, due to the difficulty of materials' delivery, tools and equipment, significant labor spending, need frequent repair embossed lining and communications.

The advantages of this method are its simplicity and versatility, light weight of the used equipment, the relative efficiency of a low height of the raise. Using raise with self-mobile systems provides mechanization of delivery sinker, equipment and materials in the bottom hole zone. During raise driv-

ing self-mobile systems practice has shown that rate of driving and productivity increase, but the cost of driving on direct costs reduced. The disadvantage of this type of driving is a fact, that sinker is always at the bottom of the raise, subjected to the vibration, and most of the business operations, does with large manual labor. An exception is a set of CVP-6, which is equipped with manipulators for drilling bore holes and device for loading and installation sections monorail. Complex CVP-6 may produce raise drivings with cross-sectional area at least 6.0 m², which makes it difficult to use in rocks and ores of the weak and medium strength. The use of self-mobile systems is economically feasible at the height of raise driving at least 60-80 meters [1].

It should be noted that the raise driving bore-hole's method with a retractable stairs, marching hobs and shields, and also with suspended cages were not used because of lack of simple reliable and safe equipment [2].

Today, raise driving sectional blasting of deep isn't used at Krivbas mines. This method differs from the previously discussed lack of human in the slaughter of the elaboration. All drilling and breaking carried out near to the raise horizontal drivings. L.I. Baron proposed to call this kind of mining like deserted driving [2].

Height of blasted section is in the range of 2-3 m. This method doesn't fit for deadlock raisedriving [2].

At mines basin, 3.3% of the total length of the raise use machine (combine) method. In Krivbas, studies of the possibility of a rising machine in the 50 years of the twentieth century made NIGRI [4]. Later, in Krivbas, it was designed and constructed several types of machines for drilling raise - such combines as: 1KB, 1KB1 and 2KB. In the 80 years of the twentieth century at mines basin, worked 10 combines, including 3-1B, and 7-2KB. Nowadays, it's involved 2 combines Rino-400 made by "Sandvik" (Sweden).

Table 1. The annual volume of raise drivings at Krivbas mines

Characteristics of rock, elaboration, methods of driving and elaboration assignment		The total length and specific weight of elaboration	
		m	%
Rock's strength factor	3-6	5879	21,8
	7-9	13754	51,0
	10-12	5583	20,7
	13-15	1726	6,4
	16-18	54	0,2
Cross-sectional area of elaborations, m ²	1,44-1,8	1616	6,0
	2,25	19713	73,1
	3,2	2940	10,9
	4,0	2697	10,0
Height of elaboration, m	10-20	5528	20,5
	20-40	11273	41,8
	40-60	3075	11,4
	60-80	7092	26,3
Driving methods	Borehole with temporary hobs and stairs device	20649	78,9
	Borehole with using of self-mobile systems	4707	17,8
	Sectional with deep wells blasting	0	0,0
	Combine	900	3,3
Elaboration assignment	Capital	1497	5,6
	Preparatory	477	1,8
	Rifled	24428	90,5
	Exploration	566	2,1
Total		26968	100,0

It should be noted, that in foreign countries have developed a range of machines intended for the raising drilling method. The biggest manufacturers of combine are the firms: "Robbins", "Dresser", "Ingersoll-Rand", "Kennametal", "Dzharva", "Subterainan" (USA), "Atlas Copco", "Sandvik" (Sweden), "Wirth" "Mannesmann Demag", "Turmag" (Germany), "Tamrock" (Finland), "Koken" (Japan). Installations of these firms have a microcomputer to determine the mode of operation (frequency of speed, rotation torque and pressure force), depending on the strength and type of rock. National and international experience shows that the cost of raise driving combine depend on the height of driving and rocks strength. It was proved, that machine method is competitive with the blasting only for raising driving with great height (80 m) [4]. The need for such raising in Krivbas is 12-14% of the total driving. The main volume of raising is from 10 to 40 m in height. Such raise drivings are useless for combine method because of the high cost of manual labor in the construction of drilling cameras and beton bases in them, high labor intensity assembly, disassembly and transport of combines. On some horizons of mines, especially at the mining capacity up to 1-1.5 million tons per year, tunneling combines will be useless, so that such mines do not have a lift to transport combines from horizon to horizon. Remember about the high cost of

combines and rock cutting tools, their complexity and large mass, limitations on the strength of rocks and high consumption of expensive carbide tools, so it is clear that using of combines for raise driving can't solve the problem in general.

The great length of raising, which are at the Krivbas mines, difficult work conditions for driving, determines the need for new, simple, available in modern conditions of production, technological and technical solutions in the rocks destruction, in relation to the driving. Perspective in terms of technology, reducing the complexity and cost of driving works is a process of breaking blasting hole charges at one time for uncharged hole with larger diameter (the compensation cavity). The essence of this method is in fact that in the range of project outline they drill a set of wells on its full driving height. And also, one well expands. It serves as a compensatory cavity. The last wells of set fill with BB and explosive slowdowns [5].

Using this method would exclude repetition of drilling cycles, charging, blasting, ventilation and cleaning rocks, it is possible to organize an interchangeable equipment work and stuff, which reduces the unit costs of time on unproductive set-up operations and increases the factor of equipment using. The method can be used for driving as between adjacent above and the underlying horizons so deadlocks. This

technology allows to increase the amount of work done per cycle, provides the mechanization of basic operations, such as: drilling, expanding, and loading, makes it possible to reduce the share of heavy manual labor and increase work safety. Besides the increased diameter wells can be widely used for ventilation, bypass various materials, drainage, route power communications and other industrial purposes.

The analysis indicates that the development of effective methods of raise drivings at a time of detonation, the rational explanation of technological parameters such driving, creating for this type of tunnel works best technology for separation breed from the array, means one of the current and future trends in technological progress in underground mining Krivbas enterprises.

Conclusions

1. Today, there are annually about 27 thousand meters of raising drivings at the Krivbas mines.

2. The most amount of drivings (96.7%) are blasting way to the destruction of the rock mass by borehole charges.

3. Raise driving with borehole charges is mainly with the device temporary hob sand 78.9% of the total drivings.

4. Driving with using temporary hobs characterizes by a low-security, high labor intensity of production operations, low monthly rate of drivings, poor hygienic conditions.

5. At mines basin, 3.3% of the total length of the raise use machine (combine) method which is competitive with the blasting only for raising driving with great height (80 m) [4]. The need for such raising in Krivbas is 12-14% of the total driving. The main volume of raising is from 10 to 40 m in height. Such raise drivings are useless.

6. The great length of raising, which are at the Krivbas mines, difficult work conditions for driving, determines the need for new, simple, available in modern conditions of production, technological and technical solutions in the rocks destruction, in relation to the driving.

7. Perspective in terms of technology, reducing the complexity and cost of driving works is a process of breaking blasting hole charges at one time for uncharged hole with larger diameter (the compensation cavity).

8. The analysis indicates that the development of effective methods of raise drivings at a time of detonation, the rational explanation of technological parameters such driving, creating for this type of tunnel works best technology for separation breed from the array, means one of the current and future trends in technological progress in underground mining Krivbas enterprises.

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Анализ состояния проходки восстающих выработок на шахтах Кривбасса

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Приведены результаты анализа состояния проходки восстающих выработок на шахтах Кривбасса. Рассмотрены применяемые способы разрушения породного массива. Показаны направления совершенствования данного вида горных работ.