Experimental mining of three coal seams by transportless technology

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Abstract. In conditions of market economy and competition it is of great importance to reduce the cost of coal mining. It is especially important when mining coal at the complicated deposits of Kuzbass. In these conditions it is important to choose the technology of stripping and winning works, providing a minimum cost for them. There are two essential factors for achieving this goal: reduction of expenses on transportation of overburden and expenses connected with alienation of lands for external dumps and their reclamation. Therefore, promising technologies are those that ensure the placement of the maximum amount of overburden in the internal dump. This condition sets the task of expanding the scope and boundaries of application of transportless technology, which is used in Kuzbass both independently and in combination with transport technology. In particular, the combined technology is used at Chernigovets open pit mine, where the upper part of the quarry field, containing Kemerovsky seam, is mined using transport technology. The lower part up to 70 m high, which includes three flat seams: Volkovsky, Podvolkovsky I, Podvolkovsky II, on an experimental basis is mined by transportless technology (the volume of stripping works is 5-10 % of the total volume). A distinctive feature of the experiment is the performance of stripping and winning operations with a single dragline excavator, which eliminates the cost of maintaining the rope shovel and bulldozer. Therefore, the experience of using this technology is of practical interest for other open pits in the basin, as well as for any other quarries with similar mining and geological conditions.

1 Introduction

The technology is used in the Novokolbinsk site. Here, the Volkovsky seam (coal grade «Coke low-caking low-metamorphized») is 2.5 m thick, the Podvolkovsky I seam (coal grade «Coke low-caking low-metamorphized») is 4.2 m thick, the Podvolkovsky II seam (coal grade «Low-caking») is 5.1 m thick [1-8].

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Overburden rocks are represented by fine- and medium-grained sandstones (52-60%), siltstones (25%) and interbedded siltstones and mudstones (15-23%).

The dip angle of the deposit does not exceed 10-15°, which makes it possible to place overburden rocks in the mined-out space.

The length of the work front from north to south is 200 m. The entire rock formation is developed by a single excavator-dragline ESh 10.70A [9-17].

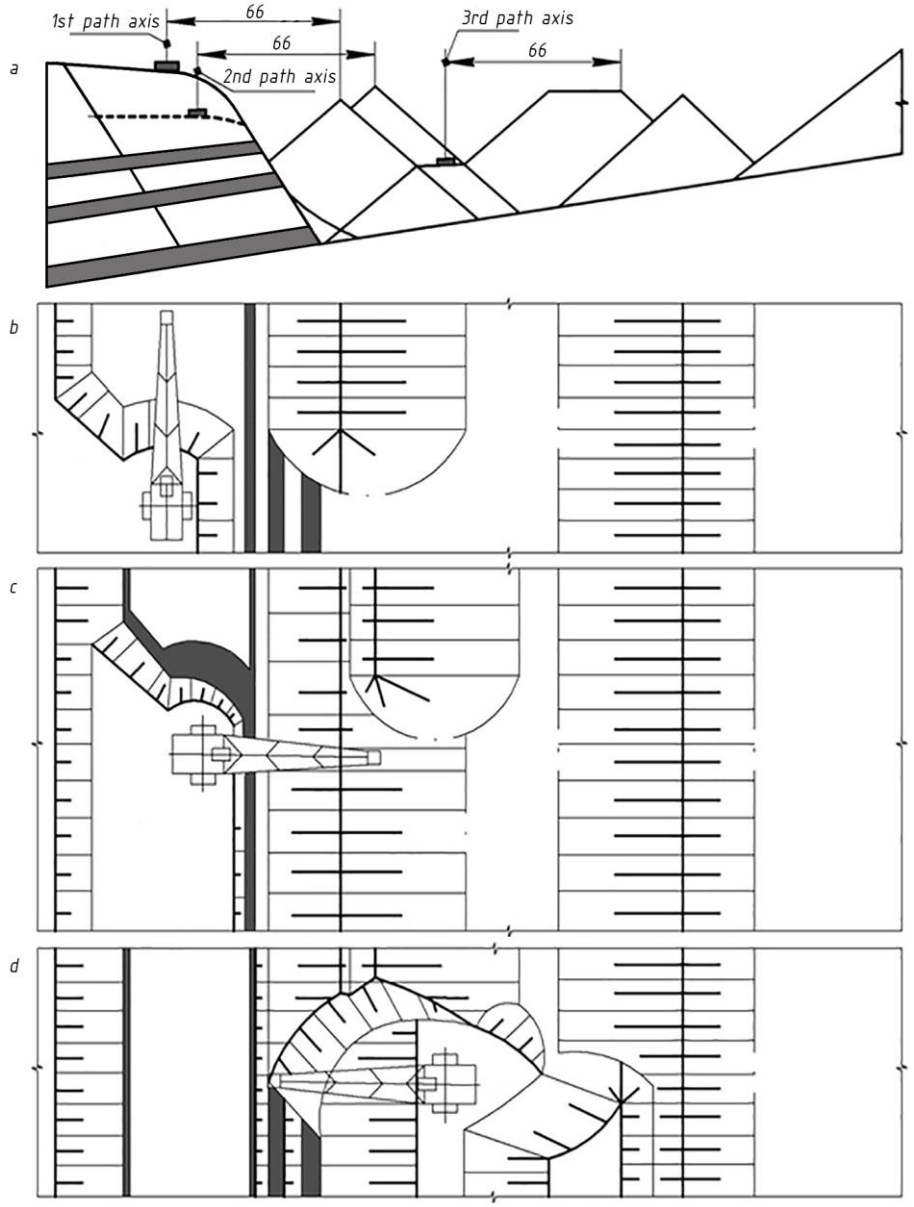

Fig. 1. Technological scheme of Volkovsky seam mining: a – mining position in the profile; b, c, d – plan of mining operations during the first, second and third working moves of draglines ESH 10.70, respectively.

2 Materials

The general order of mining of the formation consists of consecutive top-down excavation of overburden by partings and by seams.

Fig. 1a, b, c, d shows the technological scheme of mining the overburden and the Volkovsky seam. For the drilling and blasting operations on the benches, a horizontal platform is prepared using the transport technology [18-20].

The average height of the bench is 30-31 m. It is excavated in two stages. At the first stage the upper part of the bench to a depth of 15 m is drilled with vertical boreholes on a grid of 5x5 m (Fig. 1a). The charging of the boreholes is made on the basis of specific consumption of explosives 0.55-0.57 kg/m³.

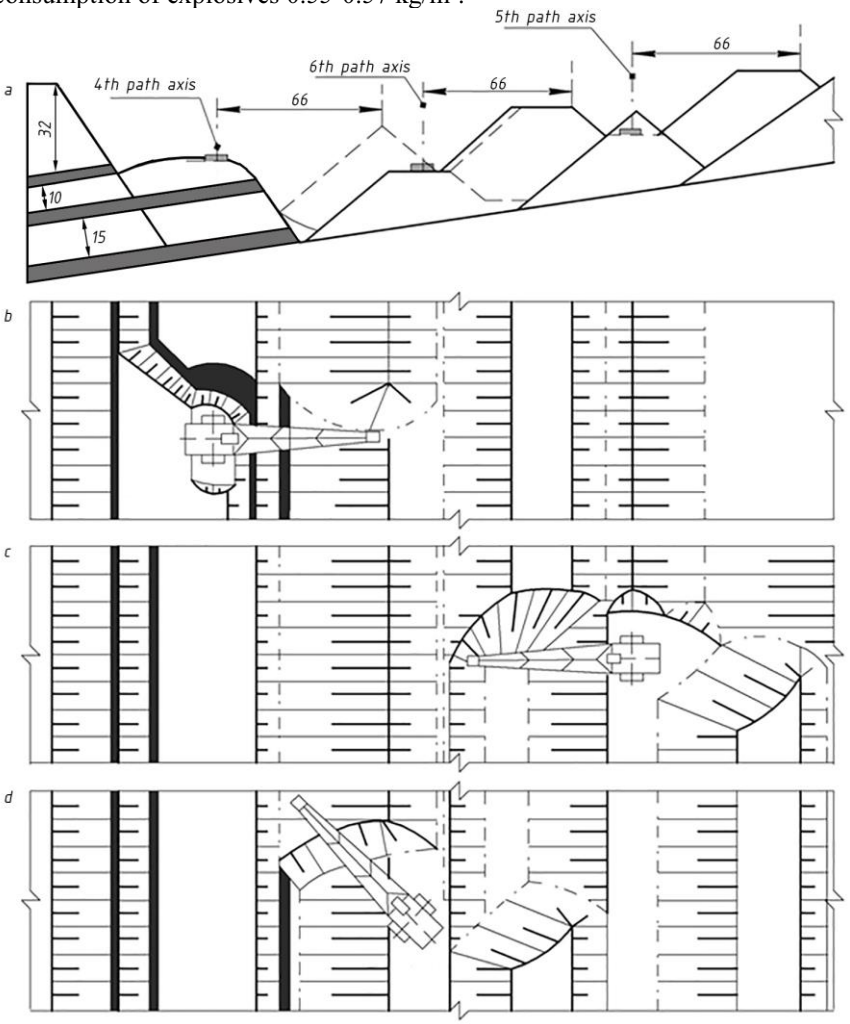

Fig. 2. Technological scheme of Podvolkovsky I seam mining: a – mining position in the profile; b, c, d – plan of mining operations during the fourth, fifth and sixth working moves of draglines ESH 10.70, respectively.

After blasting, the dragline develops the overburden in the south by the first working move (Fig. 1b) with filling the rock to the maximum parameters of the dragline dumping

radius, in the worked-out space. The volume of overburden, mined by the first excavator move, is 160 thousand m³.

Having reached the northern boundary of Volkovsky seam, the excavator returns by idle running to make the second move (Fig. 1c), mining the rest of the parting of Volkovsky seam (167600 m³) and loading coal from Volkovsky seam (26.4 thou. tons) into quarry dump trucks that are placing on the excavator horizon.

The total volume of rock mass above Volkovsky seam is 327600 m³.

3 Results

After extracting the coal of the Volkovsky seam, the excavator runs to re-excavate the temporary dump in order to prepare the capacity for placing the overburden between Podvolkovsky I and Podvolkovsky II seams (third excavator move, Fig. 1d). The volume of re-excavated rocks is 200 thousand m³.

After the third move, the excavator moves to the blasted parting of Podvolkovsky I seam (fourth move, Fig. 2a,b). Moving from the south to the north, the excavator opens and simultaneously wins Podvolkovsky I seam (coal volume 45.36 thous. tons). The volume of overburden above Podvolkovsky I seam is 91000 m³.

In order to extract coal from the Podvolkovsky II seam it requires re-excavation of overburden. Dragline is set in position of the fifth working move (Fig.2c) and creates a capacity in the dump for stockpiling overburden with the volume of 210000 m³.

After creating this capacity, the excavator sets in position of the sixth working move (Fig. 2d), re-excavates the stockpiles and opens the Podvolkovsky II seam. The volume of re-excavation is 91000 m³.

Then for the seventh working move (fig.3a,b) the dragline is positioned on the blasted parting of the Podvolkovsky II seam and opens (156000 m³) and excavates it (55080 tons).

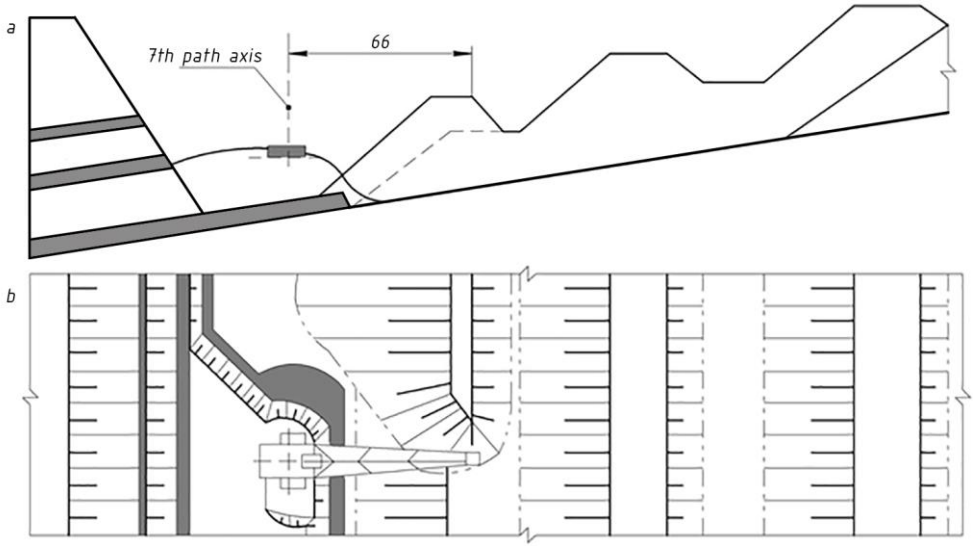

Fig. 3. Technological scheme of Podvolkovsky II seam mining: a – mining position in the profile; b – plan of mining operations during the seventh working move of dragline ESH 10.70.

The mining of three seams formation is characterized by the following indicators: the period of excavation of the block – 6 months; volume of overburden – 574600 thous. m³;

volume of extracted coal – 126840 tons; total volume of re-excavation – 501000 thous. m³; the re-excavation ration is 0.87.

The experience of applying this technology has the following advantages:

Coal cost decreases at the expense of excluding the use of rope shovels in winning operations.

During the winning operations with dragline the participation of bulldozer is excluded, which also improves economic indicators.

Conclusion

Summarizing the experience of applying the technology, it should be noted that the working space under the dragline boom is limited. Therefore, in order to apply the technology, it needs certain mining and geological conditions of the coal seams and a thoughtful approach to choosing the location of draglines for winning operations.

In other mining and geological conditions of the seams, it is possible to create conditions for using any model of dragline by changing the sequence of cuts in partings or the dragline installation place (if the sequence is the same).

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