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METHODS OF MINING AND EXTRACTION TECHNOLOGICAL SCHEMES WITH ROADHEADERS

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ABSTRACT

Transfer of extraction works from seam "B" to seam "A" of central section of coal mine "Bela Voda" requires change of method of mining and coal winning technological scheme. Taking into account the big difference between mining and geologic conditions in the above- mentioned seams and gathered experience and qualification of usage "4 flV" road heading machine in coal extraction operations, in the report are presented for discussions and recommended for application rational method of mining and coal extraction technology. Special attention is paid to working scheme of the roadheader when operating in different extraction workings in connection with support erection and roof control.

Application of hand or semi hand technologic schemes of coal extraction is typical when mining and geologic conditions are not favorable. The main problems upraise as a result of complicated hypsometry of coal seams, weak coal and host rocks, tectonic disturbances, high water and gas inflow, e. t. c.

When such conditions are at present, coal getting districts are with small dimensions and highly mechanized technologies are ineffective. For this conditions technologies must by highly productive too and with enough good standards of safety and appropriate level of mechanization of basic processes.

On this base before (Стоянчев, Анастасов, 1999) and after coal mine "Bela Voda" privatization, short wall method of mining with usage of "4 ПУ" road heading machine for development and extraction operations was applied in district "Central", seam "B".

In accordance with the Total Design for Coal Mine "Bela Voda" 2002, it is foreseen during the next two years extraction works to be transferred to seam "A" of the district with the same name.

Seam "A" has small occurrence and the productive section is 300 m long to the strike and 100 m to the depth. Its inclination is about 8°, it form is irregular. The thickness of the seam varies between 1,7 and 1,8 m and is intersected by thin clay bands. The immediate and nether roof is presented by clays and marls with enough good stability. Immediate bottom of the seam is presented by weak clays and their thickness is about 0, 8 m, and they cover thin not commercial coal seam with 0,35- 0,4 m. thickness.

Analysis of gathered experience with the appropriated method of mining and coal extraction technology proved, that "4 ny road-heading machine is worthy for the purpose. The machine is with small outer dimensions, good maneuverability and productivity, low energy consumption, requires low maintenance cost (see table 1). The previous estimations showed, that to begin work in seam, must be decided the problems as follows: to reduce length of development workings, coal losses for pillars; to reduce support costs and to arrange steel support for multiple usage; to find an appropriate decision for roof control with enough good synchronization between coal winning and strata control operations.

At extraction works in seam "B" blind breast workings are with defined form and dimensions. In this conditions the only limiting factor for roadheder is seam thickness. Such limitation could be avoided by some technological actions made in the mine pit.

Having in mind the thickness of seam "A" and technical parameters of coal winning machine (table 1) it is evident that it can take coal of all seam thickness in different kind of mine workings.

Table 1.

NO	Main technical parameters of "4 nV" roadheader	Dimensions	Values
1	Width at the loading platform	m	2,350
2	Maximal height	m	1,500
3	Reloading height	m	1,300
4	Length	m	5,900
5	Speed of movement	m/min	2,24
6	Parameters of mine workings in which machine can operate		
	Width	m	2,6-3,3
	Height	m	1,5-2,85
	Inclination	₀o	±8
7	Total power installed	kW	63

So discussed problems could be decided by application of short wall method of mining with blind or open working faces. But at those methods of mining, working places directly contact with caved zones and the main requirement is to support minimal roof area. This area must correspond with parameters of coal getting machine, area for its maintenance and support structures placement. Parameters

of this area at high degree define technological operations in the working, kind and support parameters, way of strata control, dynamics of main face processes and safe and economically effective coal extraction.

The passes of "4 ПУ" road heading machine and dimensions of working zone are graphically presented as plan and sections on fig.1. Dimensions are in centimeters and they correspond to technical parameters of the roadheader. For safe and free operation of workers, working zone with 0,7 m width is foreseen. Width of support zone is 0,2 m. On the figure is seen, that minimal width of the roadheader pass is 2,6 m and of the supported zone is 6,5 m.

Minimal working area for machine normal operation is 17 m^2

Within the boundaries of one pass (for a blind working) or split (open short wall face) the main processes are coal extraction, support of worked out area and roof control. These processes can flow consecutively or in parallel only in strictly defined conditions and its fulfillment in time and place is required by the technological scheme. For the coal mine "Bela Voda" the both, consecutive or in parallel technological flow sheets could be applied. But having in mind geometric conditions and district development, some limitations are defined.

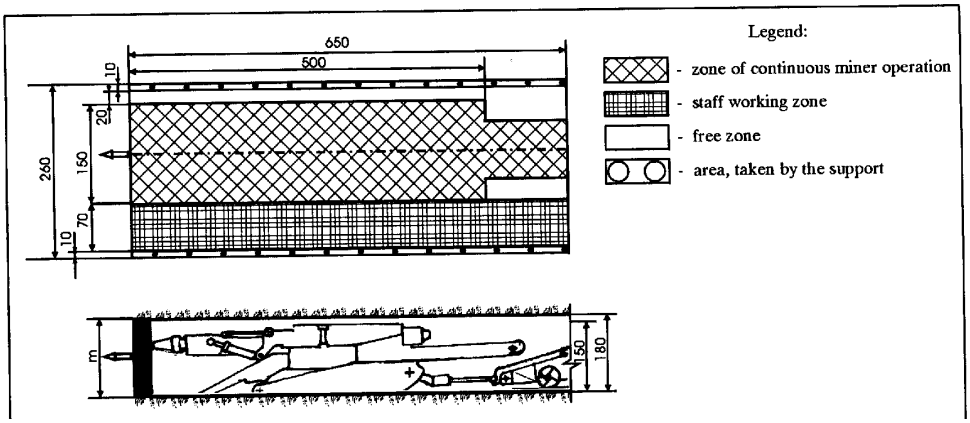

Figure 1. Determination of gabarits of roadheader working zone

Technological schemes discussed are for one sided machine operation without any turns. The mine working for coal transportation is one. Retreat order of district exploitation is appropriate in two variants: by blind workings and open ones, ventilated by main ventilation.

On the base of appropriate kind of extraction working, getting machine possibilities and above mentioned limitations on fig. 2 and 3 are presented discussed for application technological schemes. On them are pointed directions of extraction works, coal getting machine maneuvers, way of roof control, coal transportation, ventilation of the district and extraction workings.

On fig.2 are presented consecutive technological schemes of extraction works: a) with separate passes; b) with splits of the wall. On fig. 3 are presented technological schemes of extraction in parallel in three base variants: a) extraction and simultaneous caving of neighboring splits; b) extraction and simultaneous caving of neighboring splits behind a safety strip; c) extraction and simultaneous caving of neighboring splits behind a limited safety strip.

The consecutive technological scheme possesses some advantages: independence of extraction and caving operations. Supported area is small. But it has serious disadvantages too- complicated ventilation and coal transportation scheme, mounting and dismounting of supports and transportation means. Some of the work time is not productive and maneuvers of coal getting machine must be made.

Technological scheme with passes is with trough ventilation, but much bigger area must be supported for longer time, some greater is unproductive time in the extraction mine working.

Technological schemes in parallel assure reduction of unproductive period of time by overlapping extraction works and roof control. Working face is not blind and this requires support sets with three legs and two ceiling girders.

Three schemes discussed differ one another generally by the magnitude of supported area and degree of overlapping of extraction and strata control times.

From the three schemes the most advantageous is scheme "c", presented on fig. 3.

In accordance with the parameters of technological schemes discussed supporting plans and roof control designs were elaborated. Main variants were grouped in two groups. Support plans for support sets with one steel ceiling girder and two hydraulic legs and sets with two steel ceiling girders and three hydraulic legs. This support plans can be seen on fig. 4 and fig 5

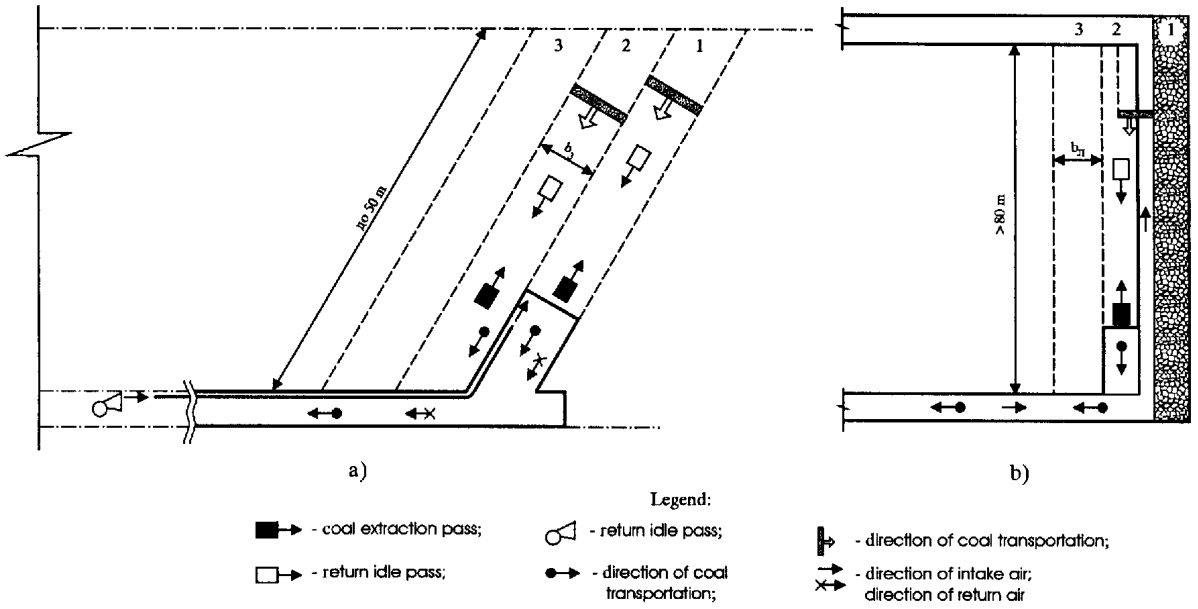

Figure 2. Consecutive technological extraction schemes: a) with separate passes; b) with splits of the wall

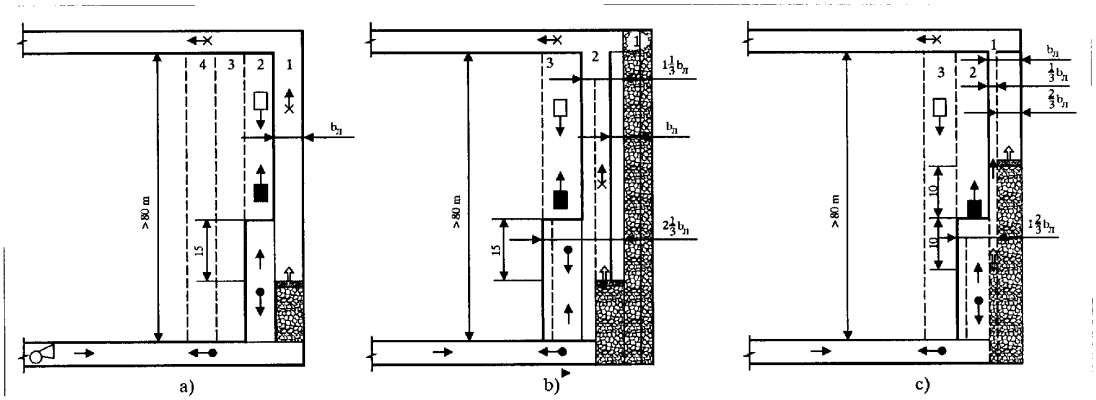

Figure 3. Technological schemes for extraction in parallel: a) strip to strip b) extraction and caving behind a safety strip; C) extraction and caving behind a safety strip with limited length.

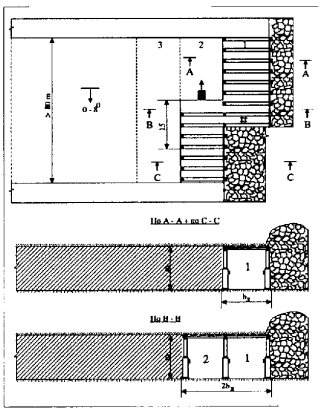

Figure 4

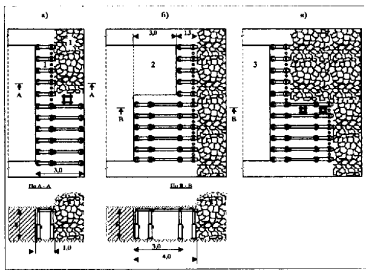

Figure 5

Analysis of all technological schemes and support plans show, that all of them are applicable in seam A extraction and could be tried in underground condition in coal mine "Bela Voda". The choice and its introduction in practice of the best of them will be made after analysis of results obtained.

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