The performant estimate system of safety supporting the frontal coal face through the mining pressure monitoring to the coal exploitation using undermined coal bed

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Abstract: - In nowadays coal exploitation conditions from Jiu Valley coal undergrounds taking into account the safety requests for adequate support and for assuring the stability for coal face due to extending the coal fields necessary to be uncover and undermined to coal bed method impose to forecast the manifestation and estimation intensity mode of mining pressure system is considered more important for knowing the actual situation and to apply the imposed measurements.
The evaluation system which is presented in the paper suppose the pressure from hydraulic pillars using individual timber monitoring from undermined coal bed is necessary for estimate the exploitation safety.

Key words: - coal exploitation, undermined coal bed, monitoring, hydraulic pillars, mining pressure, exploitation safety.

1. Introduction
The actual activity in Jiu Valley is an important source for providing energy to the economy of coal. The operating efficiency for mining the 3rd coal layer depends on the complex operations consuming labor and cycle time of the undermining production method. Thus, to increase the production would increase the labor productivity at the same time reducing the production costs, reducing effort and increasing work health and safety, gradually eliminating aid, investment recovery and achieving profit.

In that conditions for obtaining the high technical-economical indicators at the coal face level it is necessary to find optimal solutions for stability assuring using frames with a high safety degree and with easy maintenance.

Taking into account the diversificated exploitation conditions from Jiu Valley, the adequate types of supporting which will be used have to base on the permanent monitoring of mining pressure through the adaptable processes in dependence with the pressure manifestation the used frames.

A kind of evaluation system which supposes the monitoring of pressure from hydraulic pillars used for supporting the frames from undermined coal bed will be present in the following pages.

2. The actual conditions for applying the undermined coal bed method
In comparison with the traditional exploitation methods used in the Jiu Valley undergrounds, the undermined coal bed registers a continuous development and in 2009 this method registers the most participation of coal basin production (ca 65%) [3],[4].

Depending on the coal layer configuration, namely its bed slope, the exploitation method is applied in three technological variants, namely: 1st variant, up to 25° prevalent for 28% (Livezeni, Paroşeni, Lupeni, Uricani mines); 2nd and 3rd variants – medium slope layers (25° – 45°), respective high slopes (higher than 45°) which is applied in a proportion of about 37% (Lonea, Petrila, Lupeni mines).

Indifferent of the applied technological variants, the particularity of the exploitation method consists in using of individual support columns and articulated beams SVJ 2500 (maximum 5 pillars/frame) and GSA 1250(maximum 3 beams/frame) and short beams GS 570, mounted in cross system on hanging roof [4], [5], [6]. On the coal face level, the cutting of coal is made using classic perforation – blasting process and mechanical hewing method and high maintenance.

The undermined coal bed method has some disadvantages:

• high timbering density using hydraulic pillars which determs a heavy work on the coal face level and a high degree for disaster risks;
using the articulated support beams mounted on network it is necessary supplementary work volume as in the supporting phase of new cutting layer even as in the mining pressure leading phase when the coal is gravitational unloaded from undermined coal bed. Due to the fixing wedge - arch stone system between beams, the coal face cycle duration is growing till 20 shifts, respectively 5 days/4 shifts/6 hours each which involve unsatisfactory results and huge work consumptions.

- a big duration of coal face cycle favor the manifestation of maximum pressure vector which work above the frame, the hydraulic race is made with difficulty for assuring convergences of 300 - 400mm and forces about 300kN/pillar. Through the uncontrolled hydraulic courses appear some shortcomings in the supporting pillar operate which involve the shutting off and stiffing them, or losses under control of race through the destroying of hydraulic elements.

The importance of using in this case of some performing mining pressure monitoring processes from undermining coal face become as so warrant taking into account the rational mode to occur in prevention and control of drawbacks as to repair or replacing total or partial the damaged frame’s elements. On the other hand the approaching is important for necessity to find new types of frames based on reducing the number of elements and the mechanization of mounting - demounting operation.

3. The describing and presentation of monitoring system

The monitoring system proposed take into account an electronic equipment for information acquisition and a program for PC for memorized data process and take the results under diagram’s form.

Between the acquisition system and PC appear a serial adaptor [1],[2],[3],[5].

3.1. The data acquisition system

The data acquisition system foresees an adaptor block for electrical signal level given by the pressure transducer, an adaptor block for serial communication block and submits detection PC, a supply block and a microcontroller (fig. 1).

For taking an analogical signal with a resolution less 8 bits, it is proposed to use a microcontroller as ATMEGA 128 L, with 4 Kocteți RAM and 4 Kocteți memory EEPROM. This type of microcontroller is made by ATMEL and is optimized for a low own consumption.

The serial adaptor between the acquisition system and PC contain a driver TTL/RS 232 (fig. 2).

![Fig.1. Block scheme for acquisition system](image1)

**Fig.1. Block scheme for acquisition system**

**Fig.2. The electronic scheme of serial adaptor**

3.2. The PC program achievement

The program for PC contains a main window (fig. 3), which overtakes the application name and able to choose three based functions: data discharge, data viewing and clock synchronization/memory initialization.

Using the Diverse menu (fig. 4) it can select the serial port which realizes the serial communication between PC and acquisition system (fig. 5) or it can identify the program references (fig. 6).
The pick out of Descarcare date function has the effect to initiate the data transfer between the acquisition system and PC. The transfer state can be shown as in percents or as the graphics form.

After the acquisition turn off it can realize the equipment preparing for a new acquisition through the pick out of Sincronizare ceas/ INITIALIZAREA memoriei function. In this case the operator is supplementary asked above his intention because the begun operation has an effect like the irrecoverable data losses from equipment.

The most important part of application is the part which request the viewing the transfer data from the acquisition system. This is possible through activating the function Vizualizare date. In this case, the program is able to activate of some slider for reading the accurate acquainted values. The program also is able to dilatarea on horizontal or vertical register for overtake as true as possible the interesting aspects.

For the operator has a global view for the monitored phenomena evolution the program is able for a strong ‘compression’ of whole register. The evolution diagram for dependence of pressure from hydraulic pillars and time is shown in figure 7.

The monitoring system through the electronic data acquisition system and PC program allow overtaking a good precision for pressure evolution from hydraulic pillars for take rapidly measurements for stopping the possible instabilities for coal face.

4. Conclusions
In nowadays coal exploitation conditions from Jiu Valley coal undergrounds taking into account the safety requests for adequate support and for assuring the
stability for coal face due to extending the coal fields necessary to be uncover and undermined to coal bed method impose to forecast the manifestation and estimation intensity mode of mining prevention state is considered more important for knowing the actual situation and to apply the imposed measurements.

Taking into account the diversificated exploitation conditions from Jiu Valley, the adequate types of supporting which will be used have to base on the permanent monitoring of mining pressure through the adaptable processes in dependence with the pressure manifestation the used frames.

A kind of evaluation system which supposes the monitoring of pressure from hydraulic pillars is used for supporting the frames from undermined coal bed.

Reference:


