Mechanized underground coal mining to increase safety and productivity

NICOLAE ILIAS, IANAS ANDRAS, SORIN RADU, ADRIAN PETRAR, MARCEL HOARA, GEORGE TESLEANU
Department of Machines, Installations and Transport
University of Petrosani
332006, 20, Universitati str., Petrosani
ROMANIA
iliasnic@upet.ro http://www.ime.upet.ro

Abstract: The paper deals with a new underground, full mechanized technology for coal mining in Lupeni colliery from Valea Jiului coalfield. The new, up-to-date method has been implemented in order to increase performances and safety in work. In the paper, after a short description of the mining conditions and equipment characteristics, the results obtained are presented, in terms of advancement, productivity and safety indicators.

Key-Words: coal mining, powered support, shearer loader, productivity, safety

1 Introduction
Valea Jiului (Jiu Valley) is the largest coal basin in Romania, where energetic bituminous coal is mined out. Lupeni Colliery is a subunit of CNH-SA Petrosani (National Hard Coal Company), its object being exploitation of Jiu Valley’s bituminous coal reserves, the exploitation perimeter being in the western part of the valley, mining out the seam 3, which in the area of blocks IV and IV west is 25 m thick as an average, 10° gradient, with no complicated tectonics, thus the mine can be mechanically mined out.

Considering the programme of modernization and restructuring of CNH-SA Petrosani the main direction is continuous development of technologies, exploitation methods and high productivity equipment in order to improve coal extraction in long powered faces.

In the year 2007 a Polish production Tabor type powered support was mounted in block IV, panel 1C and panel 2C (Fig. 1) to mine out the seam 3 by inclined slicing method.

The equipment complex includes 3 main components: the support sections, the cutting machine – shearer loader and the scraper conveyor.

2.1 The face support
The elements of the face support(Fig. 2), related to its supporting capacity, are: beam as part of the support, individual or compound, that takes over the pressure of the rock in the roof to the section, the foot one of the main subassemblies of the support, transmitting the pressure of the roof to the floor, by hydraulic props articulated lemniscates, posterior framing shield, meant to process, totally or partially, horizontal forces stressing the support, as well as framing and isolating the support’s workspace, from the relaxed rocks as a result of roof collapse, coupling parts of articulated lemniscates representing construction elements used to longitudinally stabilize the support, by which the framing shield is connected to the foot.

Fig.1 Lupeni Mine field, block IV, panel 1C and C

Fig.2 TAGOR-18/37- Poz type powered support section
They represent integrating elements of the support directing system, providing a correct monotonous
trajectory (permanently in parallel with the roof surface), the beam, during changing the height of the section.

2.2 The cutting machine
The powered face support is envisaged to be working with a machine of 0.8 m undercut, a 750 mm wide trough face conveyer, type KSW-460NE, Fig.3, with electric advance drive, with two booms working on the face conveyer in the Eicotrack type system without traction bar.

![Fig.3 KSW-460NE type machine](image)

It is a two-way extraction with loading the material extracted in the stop of 25° transversal inclination upwards and up to 20° downwards with an up to 35° longitudinal inclination. For the entire inclination range the machine meets the stability requirements both stalled and during operation. Due to high technical parameters the machine is intended to operate in high efficiency complexes. It is a self-portent machine of a compact design.

The advance of the machine is actuated by two assemblies, each being driven by an asynchronous tri-phase motor. The motors are supplied from the frequency converter in the machine. The frequency converter provides the possibility of fluent regulation of the machine’s advance speed, in the range of 0 and 50 Hz, the constant value of the motor couple being maintained (nominal moment of the motor0, as well as in the range 50-120Hz of the constant propulsion power.

The double system of the advance drive wheel, used by the machine, protects the tool against uncontrolled movement in the case of losing the gear of one of the toothed wheels and dividing rule. The un-graded regulation of the height of the extraction facilitates the extraction of wrinkled seam with the variable thickness of the seam.

The machine is equipped with shoes adjusted to the cam profiles (trough with cams), shoes that support it and which glides on the cam of the face conveyer.

The machine is equipped with upper shield with hydraulic control. The supply conductors of the machine are fixed to a suspension device by shoes. During the machine’s normal operation the position of the suspension device is established by a safety wedge.

2.3 The scraper conveyer
The Tagor type face conveyer is an iron-cased conveyer with 1 x 65 / 200 KW installed power at the dump point and 1 x 65 / 200 KW at the return point, the supply voltage is 1000V, with lateral(right, left) or front dumping version, ± 35° maximum longitudinal inclination, ± 25° maximum transversal work inclination, forged-welded troughs, 1000 t/h conveyer discharge.

Four hydraulic units with T-125/32 type pump situated in PTS Cpx transformation post provide hydraulic agent (high pressure) for powered support.

The machine, chain conveyer and belt conveyer are supplied with 1000 V electricity from EH 1250/6/1/3 transformers situated in PTS Cpx.

The powered unit is equipped with a monitoring-dispatching system providing monitoring and displaying the position of the face machine and its working parameters, monitoring and displaying operating parameters for the sections, the hydraulic agent’s pressure, the water spraying pressure, the state of the tools.

3 Results obtained
The powered complex was commissioned in panel 2 of block IV of Lupeni Colliery, seam 3, length of the face line 100 m, maximum 10° seam inclination, length of direction of the stope field 250 m. Movement of the complex to the next face panel 2 first slice was made transporting the sections without being dismounted in subassemblies with the help of a monorail and of a device including entire sections.

Thus the time required for commissioning the face was reduced by 30 % compared to the classical mounting-dismounting method with special rooms of mounting-dismounting, shortening by 20 days the movement meaning an additional 24000 tons.

The geometrical elements of panel 1C first slice are 100 m face line, 250 m on the advance direction with 10° inclination descending. After the extraction of the first slice, at the stop line, the advance sense was reversed by reversing the powered sections one by one and their depressing in the second slice. At the level of the second slice the face line reached 94 m to achieve at the face end.
the advance direction being 450 m, with 10° ascending.

The developments will be presented in the following
and analysis of indicators obtained at the exploitation of
the three previously mentioned faces, that is:

- Advance in the direction expressed in meters
done on direction per month, in fig. 4. ;
- Efficiency or productivity, showing the
relationship between production obtained and
number of shifts, tons per shift;

![Fig.4. –Advance per month in meters](image)

![Fig.5. –Productivity in tonnes/shift](image)

Analysis of the above mentioned indicators are results
obtained in the exploitation of the Tagor powered
complex in the exploitation of the abovementioned faces
for 24 months.

For a comparative analysis of the behavior of the
Tagor powered complex in the exploitation of the three
to faces, considering that for each of them the exploitation
conditions are different, a diagram will be presented for
each and every indicator with the note that in the fifth
and the sixth month the complex was stopped.

The analysis of fig. 4 advance on direction of
powered complex shows an average advance of
37,91min the extraction of slice 1 panel 1 and 26,06m for
the extraction of slice two of the same panel. This
significant difference in advance is largely due to the
artificial roof from two layered wire gauze plus a third
one at the second slice.

The fig. 5 shows that productivities obtained in the
exploitation of the three faces re lose to each other, panel
2C first slice 13,61 ton/post, panel 1C first slice 14,37
ton/post, panel 1 second slice 13,39 ton/post, these being
less that productivities from EU due to seam conditions,
namely short face line, exploitation on reduced
direction(less than 450 m),slice height maximum 3,5 m,
high labor consumption in execution of face joints as well
as artificial floors.

4 Conclusion

In conclusion, in order to increase performances for
Tagor powered complex in Lupeni Mine a number of
minimum posts are required to cover the labor
consumption to execute the intersection of the face and
the artificial floor or finding solutions to mechanized
intersections of faces and finding solutions to replace
wire gauze with synthetic resins which should provide
compact covering rocks as well as a resilience required
for the exploitation of the following slices(Fig. 6).

![Fig.6 Tagor powered complex Lupeni Mine](image)

References:

subterane, vol. II, Editura Corvin, Deva 1999
susţinerea abatajelor, Editura Universitas, Petroşişani 2001
[3] N. Iliăş, I. Kovacs, I. Gruneanş – Maşini miniere,
curs subteran, Litografia IMP, Petroşişani 1989
susţinerea abatajelor, Editura Eniversitas 2001