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Contributions to the Improvement of the Method for the Evaluation of Mining Systems Based on Consumption of the Work

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Abstract

This work paper describe the front parameters (length, height), the technology adopted (step/cycle, technological limitations of implementation of complex operations, technical security restrictions). Mathematical model graphics default is much simplified but with organizational parameters, namely the number of workers, duration and default cycle determined by the speed of their production and promotion on exchange and day.

Key words: *complex operations, primary, secondary and repeated operations.*

For the development model is started from an analysis of the simple process on complex operations are divided into primary, secondary, and repeated and unrepeated using the following assumptions and simplifications:

Complex operations of the simply process can operate relatively independently, as compared to one another and in relation to the cutting equipment (combines equipments, plough).

Combine the operation is not described by a space-time relationship but is considered a complex manuals operation to be granted a full working band working on the combine equipment.

For complex operations repeated and unrepeated assumes that the consumption of work for is directly proportional to the volume of work and the number of people employed in complex operations, respectively. In many cases this does not correspond with reality.

The number of people employed in complex operations is introduced in model "for experience" and not to obtain the solution to solve the model, but appears as a date of entry.

Analysis of simple process to complex operations is set for a technology. For working with a longwall face, with combine equipment that cut into a sense and support and complex equipment analysis simple process contains the following complex operations:
1. Cutting niche in the basic gallery with the combine equipment;
2. Cutting of the strips with combine;
3. Cleaning of the strips with combine;
4. Manual cleaning strips (loaded manually load of coal combine equipment);
5. Advance wards support;
6. Transverse move short distances on transporter;

7. Punching niche in the gallery's head;
8. Loading with explosives and shooting niche;
9. Evacuation of coal niche;
10. Supporting niche;
11. Supporting the intersection working with pre-longwall face;
12. Shortness transporter collector;
13. Assembling / to take down related facilities; Montarea/demontarea instalațiilor conexe;
14. Entry in the workplace;
15. Control front and methane;
16. Front air vents;
17. Exiting the front work.

The first twelve complex operations are primary and repeated; the following is secondary and repeated and last are considered secondary unrepeated. For complexes of primary and secondary operations repeated, without exception, author set the rules of employment and for secondary unrepeated granted a fixed time.

For the development model to determine the quantities of work for the implementation of each complex operations thus:

1. for complexes of primary and secondary operations repeated:

$$M_s = Q_s m_s \ [man\ min/cycle]$$

where: M_s – amount of work required to enforce complex operations s; Q_s – volume of physical works for complex operations s. Physical volume of work is determined for all the complexes of primary and secondary operations repeated, according to the parameters longwall face, which is to optimize (front length, height longwall face and working on the jump course). It is understood that for situations in which they were adopted in an earlier phase. Physical volume of work is expressed in units of physical product to be developed at the complex operations cycle.

For example, for complex operations "with ribbon cutting combine" physical volume of work is determined as follows:

$$Q_{02} = (L - l)hP_{\gamma}\left[t / ciclu\right]$$

L - length of the front, *m*; *l* - length of the niches, *m*; *h* - the height of the front, *m*; *P* - depth to a cutting cycle, m/cycle; γ - volumetric weight coal, t/mc.

In physical volume relationship works for the situation when the front and working technology was not adopted in a stage prior to longwall face organization, can be kept as variable length front (L), front height (h) and step cycle (P).

ms - consisting of standard work for complex operations s. It is expressed in units of consumption per unit of work product developed in the complex operations s. Composed of labor rules are determined on the basis of production which can be found in books of rules and normative. Where the known elementary rules on operations, analysis can be made up at this level, the consumption of work for complexes of primary and secondary operations can be determined by the relationship:

$$M_s = Q_s \sum_{i=l}^{P} m_{si} + n_s \sum_{j=p+l}^{u} t_{sj} \ \text{[units of work/cycle]}$$

where: m_{si} - - basic standards of labor for repeated operations; *ns* - the number of workers who work at the operations *s*; t_{sj} - fixed time grant unrepeated operations side of complex operations it s;

2. for complex secondary operations unrepeated side:

$$M_r = nt_r \ [man\ min/cycle]$$

where: M_r - consumption work for complex operations side unrepeated r; n - the number of workers in front of work; t_r - fixed time that is given complex secondary operations unrepeated r, during a cycle. In labor relations consumption for complex operations unrepeated kept as variable number of workers n.

With the above data can be written mathematically model proposed de.C. Luca, with the condition of equality between the front of work available and the amount of work required. The model is called "balance the equation of consumption work."

The equation of balance of consumption of the work is:

$$M = n \cdot t = \sum_{s=l}^{q} M_s + \sum_{r=q+l}^{v} M_r$$

or

$$n \cdot t = \sum_{s=l}^{q} Q_s m_s$$

or

$$n \cdot t = \sum_{s=l}^{q} Q_s \sum_{i=l}^{p} m_{si} + \sum_{s=l}^{q} n_s \sum_{j=p+l}^{u} t_{sj} + n \sum_{r=q+l}^{v} t_r$$

Entering into specific volume relationship works:

$$v_s = \frac{Q_s}{Q}$$

the production:

$$Q = L \cdot h \cdot P \cdot \gamma \quad \text{[t/cycle]}$$

to obtain general pattern:

$$n \cdot t = L \cdot h \cdot P \cdot \gamma \sum_{s=l}^{q} V_s \sum_{i=l}^{p} m_{si} + \sum_{s=l}^{q} n_s \sum_{j=p+l}^{u} t_{sj} + n \sum_{r=q+l}^{v} t_r$$

In addition notes presented relatively contains: t - the duration cycle; nt - fund work available. Analyzing mathematical model state that is a function of several variables:

$$M = F(n, t, L, h, P)$$

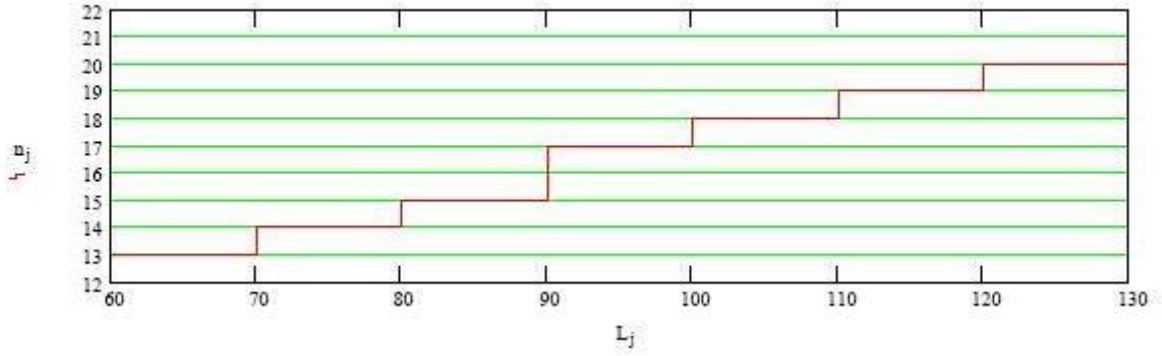
If the front is working at the design stage model allows the study of the consumption of work according to all the remember parameters. If the front is already prepared and adopted the machinery can study changes in the consumption of work instead of depending only on n, t, P, for work contrast, the relationship became the model:

$$n \cdot t = L \cdot h \cdot P \cdot \gamma \sum_{s=l}^{q} V_s \sum_{i=l}^{p} m_{si} + \frac{P}{B} \sum_{s=l}^{q} n_s \sum_{j=p+l}^{u} t_{sj} + n \sum_{r=q+l}^{v} t_r$$

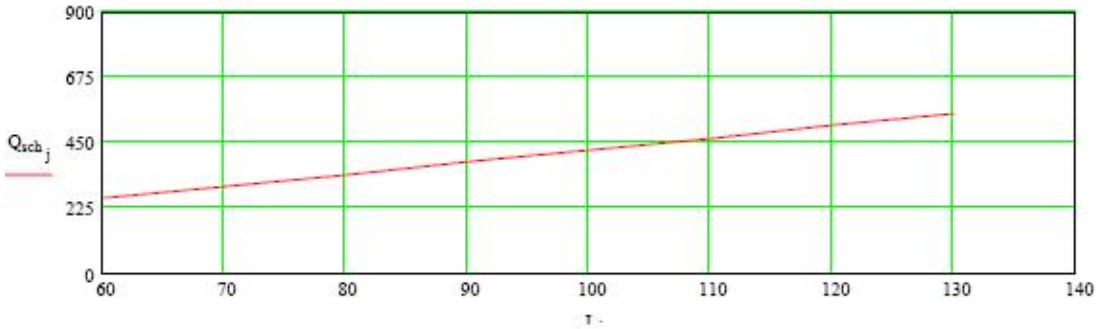
where: B - is the depth of cutting combine. In this relationship variables are only the number of people, the duration of the cycle and the jump rate (P).

Based on the specimen can draw diagrams which contain dependence of model parameters, and changes in production, the cost of production, the rate of advancement in relation to the parameters of the model or dependency between them. Based on these parameters are chosen main solution for the organization, meaning specify the length of the longwall face working height front, the production rate and daily, number of workers on the exchange and daily, duration of the cycle, advancing front rate and the daily. If the front parameters (length, height), the technology adopted (step/cycle, technological limitations of implementation of complex operations, technical security restrictions) are set in advance, and mathematical model

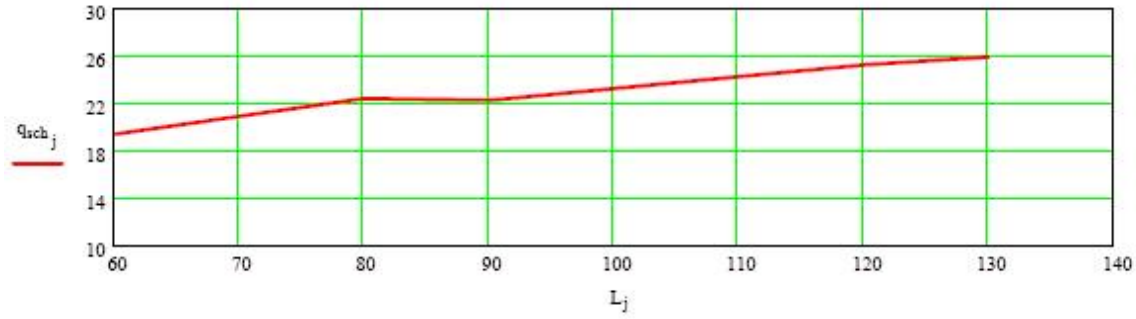
graphics default is much simplified but with organizational parameters, namely the number of workers, duration and default cycle determined by the speed of their production and promotion on exchange and day.



a)



b)



c)

Fig.1. The variation of number of workers (a), of production (b) and productivity (c) with the exchange and daily with length front for $h = 2{,}5\ m$, $V_f = 1{,}2\ m/sch$, and lenght front ,*m*.

Conclusions

This work paper was describe the front parameters (length, height), the technology adopted (step/cycle, technological limitations of implementation of complex operations, technical security restrictions). Mathematical model graphics default is much simplified but with organizational parameters, namely the number of workers, duration and default cycle determined by the speed of their production and promotion on exchange and day.

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Contribuţii la perfecţionarea metodei de evaluare a sistemelor miniere pe baza consumurilor de muncă

Rezumat

Perfecţionarea metodei de evaluare pe baza consumurilor de muncă prezentată în aceasta lucrare s-a realizat ţinând seama de dependenţa dintre parametrii modelului, precum şi variaţia producţiei, a costului de producţie, a vitezei de avansare în raport cu parametrii modelului sau dependenţa dintre ei. Pe baza acestora se aleg parametrii principali ai soluţiei de organizare, adică se precizează lungimea frontului de abata,j înălţimea frontului, producţia pe schimb şi pe zi, numărul de muncitori pe schimb şi pe zi, durata ciclului, avansarea frontului pe schimb şi pe zi.