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New Methodology Selection of Drilling Machines

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Abstract: Of necessity, the first unit operation conducted during the exploitation phase in surface miming is production drilling. The purpose of production drilling is to provide the cavity for placement of the explosives. So far, no alternative to blasting has been devised for fragmentation very resistant rock in-situ, although some forms of excavation are suitable without prior blasting for softer rock. Actually, different type of drilling machines can be available in the field. This study will present some actual measurements illustrating the variations of drilling parameters and proposes a practical method for an optimum selection. There is a great deal of overlap between the drilling machines available and, in order to confine this work to a reasonable length, it is proposed to consider only which are most widely used by mining engineers.

Key words: Drilling machines, model, cost, selection

INTRODUCTION

The exploitation of any layer requires very significant investments whose prices and volume are always in increase. The choice of the equipment has a direct incidence on the production, the output and the costs. With regard to the national production, the objective that must set our companies is that of an exploitation optimal of the resources taking into account their various design features, economic and human[1]. This, gives to reflect on work to carry out and among them the process of drilling which is the prevalent factor in the development of an exploitation.

Everywhere when the problem of extraction arises, the drilling rigs are necessary to face the various conditions of operating as follow[2]:

- Rock properties
- Profile of the ground
- Mode of excavation
- Climatic conditions

In a mining, significant expenditure is intended for the mechanization of work of demolition. The efforts mentioned and made for the improvement of the process of drilling must be optimized. The diversity of the ground does not make it possible to keep the same drill continuously, for that we propose a new methodology making it possible to implement the most effective machine.

Methodology selection of the drill: The selection of the machines and their rational operation remains the paramount objective at the time of an exploitation[2,3]. The solution with this problem can be obtained by the analytical method with the use of criterion making it possible to evaluate the effectiveness of these machines. By taking account of the factors which influence the choice of the machine, we worked out a model Fig. 1 which makes it possible to select best the machine.

The index of the effectiveness which is taken as criterion must take into account the factors which influence the operation of the machine such as:

- Production
- Rock properties
- Characteristic of the machine

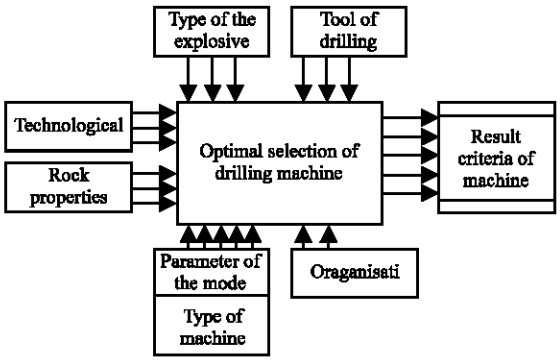

Fig. 1: Model selection of drilling machine[2]

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- Operation
- Type of tool
- Work organization

The selection criteria of drilling machines are as follows:

- Production of the machine
- Cost of one meter drilled
- Cost of one cubic meter cut down rock
- Total expenditure

The present methodology makes it possible to optimize the process of drilling while being based on the economical-mathematic model of optimization[4]. Criterion which gives the quantitative connection between the constructive and technological economic parameters of the system "coal face-tool of drilling-drill»

$$S=\left[\frac{1}{V(\omega,F,d,f)}+t_{aux}\frac{Z_a+Z_e+K_u(Z_m+Z_s)}{Ku.Tp.Cu}\right]+\frac{Pt}{l_t(\omega,F,d,f)}+$$
$$+E_c\left[\frac{\sum N(\omega,F)}{V(\omega,F,d,f)}+K_{ch}(K_x+\frac{t_{ch}}{l_t}).\sum N_{m.d}+\frac{\eta t_d K_s N_d}{L}\right]$$

where :

V : Progress drilling
ω : Rotational frequency of the tool
d : Diameter of the edge
lt : Duration of the tool for drilling
Pt : Cost of the tool
Tp : Duration of a station
Cu : Load factor of the drill
t_{aux} : Waste of time on a cycle
Za : Cost of damping
Ze : Cost on the power
Zs : Cost of the wages by team
Zm : Cost of maintenance
Ku : Load factor over one year
Kch : Load factor of the engines
Kx : Coefficient taking account of the wastes of time
Tch : Duration of loading of the tool
Nmd : Summary power
Ks : Coefficient of overload of the engines
Nd : Summary power of the engines of the travelling gear

This technico-economic model presented in informative form, allows us the selection of the drill optimal. This model includes the basic variables of the process of the destruction of the rocks, those depend on the physico-mechanical mode of drilling and the properties of the rocks.

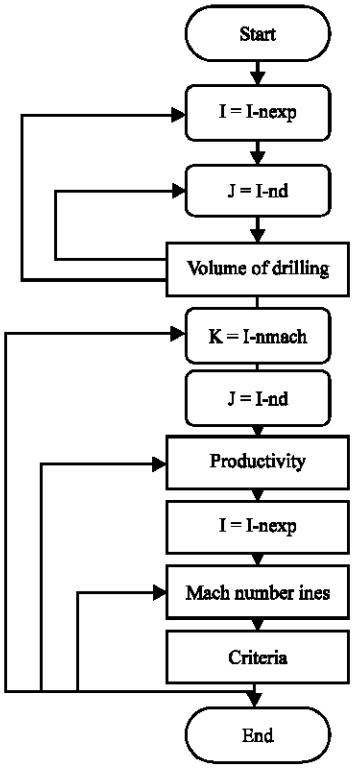

Fig. 2: Flow chart selection of drilling machines

Model application: The implementation of this methodology suggested by the development of a program whose flow chart is presented Fig. 2 was made within several careers. An example is presented in the case of a limestone quarry, basic element for the manufacture of cement.

- Annual productivity : 550000.00 m3 an^{-1}
- Granulometry of the rock : 104.00 125.00 mm^{-1}
- Height of the step : 12.00 m
- rock properties :
  - Hardness : 7.00
  - Fissurity : 3.00
  - Density of the rock : 2.65 t $m3^{-1}$
  - Moisture : non humide
  - Abradibility : non abrasive

COMPUTATION RESULTS OF THE SELECTION

Type of machine	Hole size (mm)	Height of the step (m)	Expenditure (DA)			
INGERSOLL-RAND RP	104	12	4573524	9528	10620	4593673
INGERSOLL-RAND RP	125	12	3185956	6637	10620	3203214
HOLMAN RP	104	12	548063	11417	11870	5503651

Continue

Type of machine	Hole size (mm)	Height of the step (m)	Expenditure	(DA)		
HOLMAN RP	125	12	3863762	8049	11245	3883057
ATLAS-COOPCO RP	90	12	6081278	12669	10620	6104569
ATLAS-COOPCO RP	80	12	7673301	15986	10620	7699908
INGERSOLL-RAND M	160	12	1958852	4080	10620	1973554
INGERSOLL-RAND M	180	14	1547736	3224	10620	1561581

CONCLUSION

The technical index of effectiveness of drilling machines in the Algerian careers is conditioned primarily by their choice non in conformity and in certain cases by the exaggerated reserve. Under the conditions of Hadjar-Soud, having the coefficient of reliability of about 0,7 the machines of drilling are characterized by the general load factor which does not exceed 0,28.

The methodology recommended selection has through the technico-economic model allows the best alternative, of or the assertion which the Ingersoll-rand machine is better than ATLAS COOPCO under the real conditions of the career.

We also noted that the mode of drilling influenced the properties physico-mechanical of the solid mass such as the fissurity, abradibility and hardness, which will be the subject of the continuation of this research.

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