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Zina Rabbouche, Lakhdar Khochemane, Ouafae Bennis. Study of the determination of the rational operating regime of percussion drilling machines. *International Journal of Engineering Science and Technology*, 2017, 9 (2), pp.1068-1083. 10.21817/ijet/2017/v9i2/170902114 . hal-02455426

**HAL Id: hal-02455426**

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Submitted on 26 Jan 2020

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# Study of the determination of the rational operating regime of percussion drilling machines

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**Abstract**— The aim of presented research is to develop methods of determining the parameters of rational control of machine operation of percussion drilling during its operation in geological and mining conditions defined.

To set the goal of empirical research, it is based on the literature search in which several researchers have studied the mode of percussion drilling with different methods based on the physic mechanical properties of the rock, setting parameters of the machine, geometric parameters of tool. The literature has shown us that there are now some methods of determining the dependencies of the drilling speed, and height of penetration is a function of the energy of a piston stroke and the drilling speed is a function of the height of penetration into the rock and the rotational speed, The analysis shows that these methods are based on knowledge of the peculiarities of the interaction of the tool against the rock. Each time, we take into account the parameters mentioned above.

**Keywords**- Forces applied, properties of the rock, progress drilling, the height of penetration.

## I. INTRODUCTION

In the world the consumption of the raw materials did not cease growing. The rich countries would carry out some such as iron, the copper for which the exploitations must significant, be very mechanized and to produce in very great quantities to be profitable.

The choice of mechanization has a direct incidence on the costs and the outputs. The objective of very undertaken is to ensure an optimal exploitation of its resources taking account of their various design features, economic and human [1].

One cannot speak about drilling without considering the properties physico rock mechanics to be cut down and the methods of their determination. Some are the conditions of operating have open sky or in the underground mines, drilling can be carried out by various machines, that we can join together in two large groups: hammer drills and the drills [2].

Drillability studies are mainly based on the empirical approach. There are different ways to define rock drillability. The concept of specific energy was proposed by Teale [3], Miller [4] and Pathinkar and Misra [5] as a guide to assess rock drillability. Rabia [6] stated that specific energy in terms of either unit volume or new surface area is not a fundamental intrinsic property of rock.

Percussive drilling is used extensively in mining and construction as a means for making holes in rock. Usually, the rock drill, containing a reciprocating hammer, is placed outside the hole, The percussive drilling mode is very widespread when mining ore deposits [7].

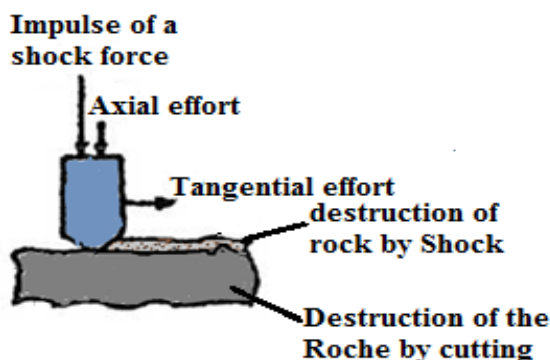


Fig 1. Destruction of the Rock during Percussion Drilling [8].

The appearance of the first perforator dating from 1839 made it possible to dig a well 20 m deep. In 1857, the French engineer Somelier modified a steam engine in a drilling machine which operates with the aid of compressed air. The great productivity achieved by perforators accelerated their improvement; towards the 1880s the hammer drill had almost the same pace as the current hammers.

## II. NOMENCLATURE

$a_a$	acceleration of the piston at the distance, $L_1$ , $m/s^2$	$d$	diameter of the trepan , m
$a_r$	acceleration of the piston at the distance, $L_2, m/s^2$	$d_1$	diameter of the piston rod , m
$C_a$	The cost of the deadened machine ; DA/post.	$d_2$	diameter of the helicoid stem, m
$C_e$	Coefficient of émoussement; $C_e=1.2-1.3$	$E_{ou}$	energy of a blow of the piston, kgfm
$C_{eng}$	The cost of energy by station; DA/post	G	weight of the piston, kgf
$C_{mach}$	Cost of the machine ; DA	g	acceleration of gravity, $g = 9.61 m/s^2$
$C_{ma}$	The material cost ; DA/post	H	measuring of the boreholes referring to a tool;(m)
$C_{ou}$	Price of the tool ;( DA)	h	step of the threading of the helicoid stem, $h=0.8 \text{ à } 1.0 \text{ m.}$
$C_p$	Price of a working station of puncher; (DA/post)	$k_1$	coefficient taking account of the losses by friction enters the piston and the cylinder,
$C_{rép}$	The cost of repair ; DA/post.	$k_2$	coefficient taking account of the losses by friction and rotation of the foil, $k_2=0.5-0.7$
$C_s$	Wages of the workman by station;DA/post	$K_{exp}$	operating ratio
D	diameter of the piston, m	$K_f$	coefficient taking account of the number of Punchers under operation ; if $m_p=2 \Rightarrow K_f=0.7$
		$k_f$	coefficient of reliability ; $k_f=0.8-0.9$
		$K_{rep}$	coefficient taking account of the rest of the workmen; $K_{rep}=1.12$ for puncher with hand ,

	$K_{rep} = 1.05$ for puncher with column.	$t_{dépl}$ time of displacement or operation of the puncher, mn/m
L	total measuring of the boreholes, (m).	
m	mass piston, Kg	$t_{in}$ time of the inactive race of the drill rod, mn/m (according to the design features)
$m_p$	number of punchers under operation	
$N_a$	Year numbers referring to wear total of the tool.	$t_n$ time of blowing and cleaning of the hole, mn/m
$N_j$	Working day numbers per annum	$T_{org}$ wastes of time because of the organization of work, mn
$N_p$	Numbers of station per day	$T_{pr}$ make-ready time per station, mn
$P_a$	pressure of compressed air in the room of admission of the cylinder. It is equal to the pressure in the feeder system, $kgf/cm^2$	$t_r$ journey time return, s
$P_e$	pressure of air in the room of exhaust	$t'_a, t'_r$ duration of the displacement of the piston under the action of the force $F_a$ et $F_r$ respectively at the distances $l_1$ et, $l_2$ sec
$P_e = 0.8 - 1.2$	$kgf/cm^2$	$t''_a, t''_r$ duration of the displacement of the piston by inertia respectively at the distances $l_3$ et $l_4$ , sec
q	specific consumption of the tool for drilling, pièces/m	$\alpha$ grinding angle, degree
$Q_{exp}$	Productivity by station of puncher during drilling;(m/post)	$\mu_1$ coefficient of friction enters the edge and the rock;
T	duration of a working station of the puncher ,h	$\mu_1 = 0.3-0.5$
$t_a$	journey time outward journey, s	$\sigma_{comp}$ compressive stress of the rock ; MPa
$T_{aux}$	downtime of the puncher due to technical causes, mn	
$t_{ch}$	time necessary to change the tool for drilling, mn/m	

### III. PREVIOUS STUDIES

Many researchers have investigated (theoretically or experimentally) the percussion drilling; the researchers carried out tests of exploitation and laboratory tests for the goal to determine the indices of exploitation and the design features. Among researchers A.SEMENTCHENKO, A.KARBACHEV, M.OUADI studied the operation of the mining machinery R.PODERNI I.RAKOV, J.RADKEVITCHE calculation and choice of the mining machinery G.NANAIEVA, I.BEGAGOENE .The methodological base of the research task consists in finding the combination of the parameters of adjustment of the machine meeting the requirements enumerated under the concrete conditions, and to exploit the machines in the rational mode [9] - [13].

### IV. CLASSIFICATION OF PNEUMATIC HAMMER DRILL

The classification of the mining machines is carried out according to energy used, the type of travelling gear, the weight and characteristics of construction. One meets part of this classification in the contents of this work, which is devoted to the study of the machines of drilling. The hammer drills or punching are intended for the drilling of the blast holes in the very hard, hard and average formations. One often uses them in the underground

mines, the exploitations with open sky and the field of construction. The use of the pneumatic punchers is very widespread in mining work, considering the advantages which they have, such as: the simplicity of construction in comparison to the other types, an output raised enough and a safety during operation.

#### V. CONSTRUCTION OF PNEUMATIC HAMMER DRILL

The pneumatic puncher is a percussion machine made up of a cylinder, of a ratchet wheel, a device of distribution of compressed air, of a piston, of a casing, a helicoids stem and a chuck. The compressed air inlet is carried out through the ratchet wheel and the distributor of compressed air. The displacement of the piston of left on the right constitutes the working stroke and is carried out using the pressure of compressed air. The cylinder being separated by the piston in two rooms, one under pressure (left room), the other in depression (right room) that during drilling; at the time of the empty run, the role of the two rooms is reversed.

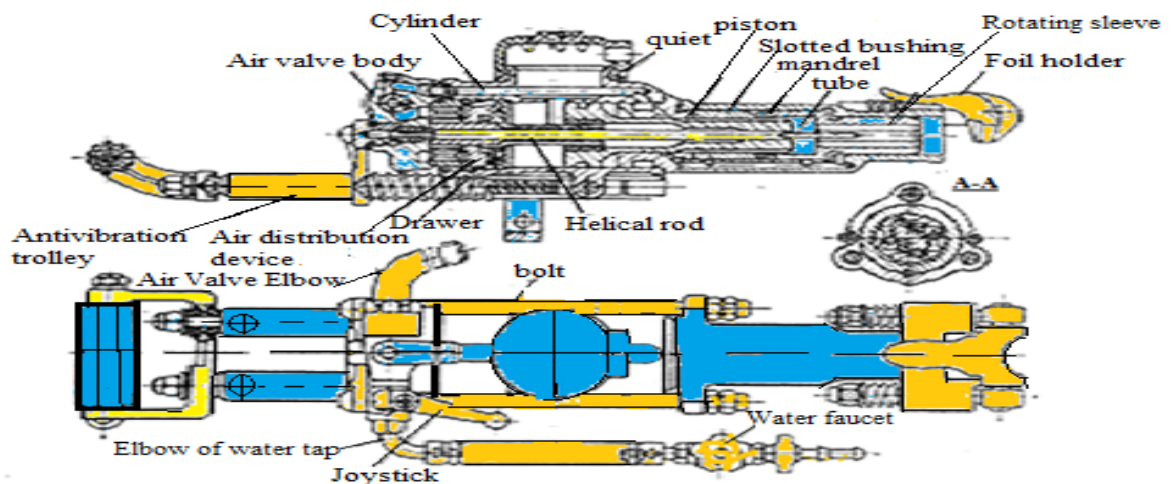


Fig 2. General Sight of the Standard Puncher URSS (PR-24LU)

The compressed air which penetrates in the right room is distributed using the mechanism of distribution. The piston starts to move at the end of its race, it strikes the hafting of the foil without any rotation because the head of the helical rod turns freely in the ratchet wheel. During the empty run of the piston, the head of the helical rod and fixed in the ratchet wheel by the pawls; the piston turns of a certain angle while being screwed to the helical rod, this rotation of the piston is transmitted to the foil through the casing with grooves and the revolving casing.

The ordering of the pneumatic puncher is ensured by a lever four positions:

- blowing of the hole ;
- stop;
- Operation on average power;
- Operation into full power;

The greasing is ensured by an automatic greasing device assembled on the body of the hammer.

#### VI. THE BASIC PARAMETERS OF THE PNEUMATIC PERFORATOR

It is supposed that the pressure of compressed air in the rooms of the cylinder at the entry and during its exhaust is constant.

The basic parameters of the puncher are as follows:

- A number of blows of the piston per minute,  $n_c$  blows /min;
- A number of turns of the foil by minute,  $n_t$  tr/mn ;
- Torque of the foil ,  $C_r$  N.m ;
- Energy of a blow of the piston,  $E_c$  J.

- Power of the puncher,  $P$ , KW ou ch. ;
- Specific consumption of the compressed air,  $C_{air}$ ;  $m^3/mn$

A. *determination of the forces applied to the piston*

The geometrical parameters of the puncher are indicated one Fig3

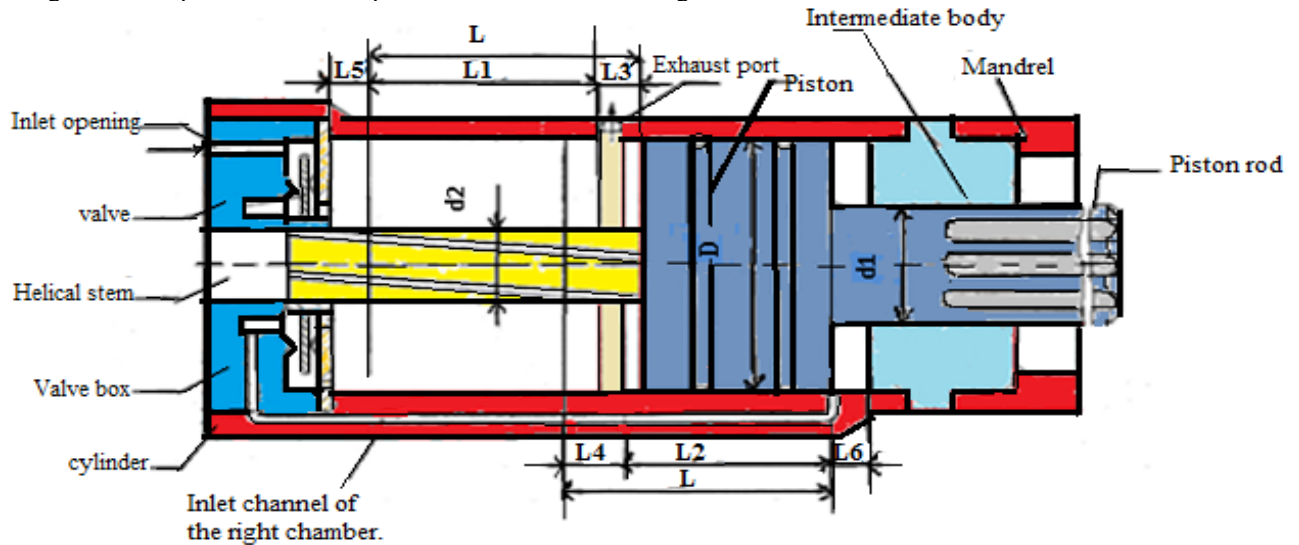


Fig 3. Diagram of determination of basic parameters of perforators

The useful surface area of the piston to carry out the way outward journey in (m<sup>2</sup>) is :

$$S_a = \frac{\pi}{4} (D^2 - d_2^2) \quad (1)$$

And for the way return:

$$S_r = \frac{\pi}{4} (D^2 - d_1^2) \quad (2)$$

The force applied to the piston during the way outward journey in (kgf) is equal to:

$$F_a = (S_a \cdot p_a - S_r \cdot p_e) \cdot k_1 \quad (3)$$

And during the way return:

$$F_r = (S_r \cdot p_a - S_a \cdot p_e) \cdot k_2 \quad (4)$$

B. *Determination maximum speeds of the piston*

To simplify the determination speeds we admit that the movement of the piston to the opening of the exhaust port (under the action of the force  $F_a$  is uniformly accelerated. This is why the maximum speed of the

piston at the distance  $l_1$  in (m/s) is determined by:

$$V_a = \sqrt{2a_a \cdot l_1} \quad (5)$$

.And that, at the distance  $l_2$  during the way return:

$$V_r = \sqrt{2a_r \cdot l_2} \quad (6)$$

As according to the second law of mechanics, one knows that:

$$a_a = \frac{F_a}{m} \quad \text{and} \quad m = \frac{G}{g} \quad (7)$$

According to formulas' (5) and (7), the speed of the piston during the way outward journey will be equal to:

$$V_a = \sqrt{\frac{2F_a \cdot l_1 \cdot g}{G}} \quad (8)$$

And for the way return:

$$V_r = \sqrt{\frac{2F_r \cdot l_2 \cdot g}{G}} \quad (9)$$

c. *Determination of the number of blows of the piston:*

$$T_c = t_a + t_r \quad (10)$$

But:

$$t_a = t_a' + t_a'' \quad (11)$$

$$t_r = t_r' + t_r'' \quad (12)$$

To determine the components  $t_a'$  and  $t_r'$  one uses the law of impulse of the force and the momentum of the mass:

$$F_a \cdot t_a' = m \cdot V_a \quad (13)$$

Then, according to formulas' (13) and (7) we can have :

$$t_a' = \frac{G \cdot V_a}{g \cdot F_a} \quad (14)$$

At the distance  $l_3$  the piston moves by inertia, this is why:

$$t_a'' = \frac{l_3}{V_a} \quad (15)$$

According to the diagram (Fig 3):

$$l_3 = L - l_1 \quad (16)$$

$$l_4 = L - l_2 \quad (17)$$

According to the formulas (11), (14), (15) and (16) the journey time outward journey will be:

$$t_a = \frac{G \cdot V_a}{g \cdot F_a} + \frac{L - l_1}{V_a} \quad (18)$$

And that of the way return :

$$t_r = \frac{G \cdot V_r}{g \cdot F_r} + \frac{L - l_2}{V_r} \quad (19)$$

The number of blows of the piston by minute in (blows /min) is:

$$n_c = \frac{60}{T_c} \quad (20)$$

the number of revolutions of the foil by minute in( tr/mn):

$$n_t = \frac{L}{h} \cdot n_c \quad (21)$$

The number of blows of the piston by a turn by a foil in (blows /tr) is equal to:

$$n_c = \frac{n_c}{n_t} \quad (22)$$

One can determine the swing angle of the foil by a blow in (degree) according to the expression:



$$\varphi = \frac{360^{\circ}}{n_c} \quad (23)$$

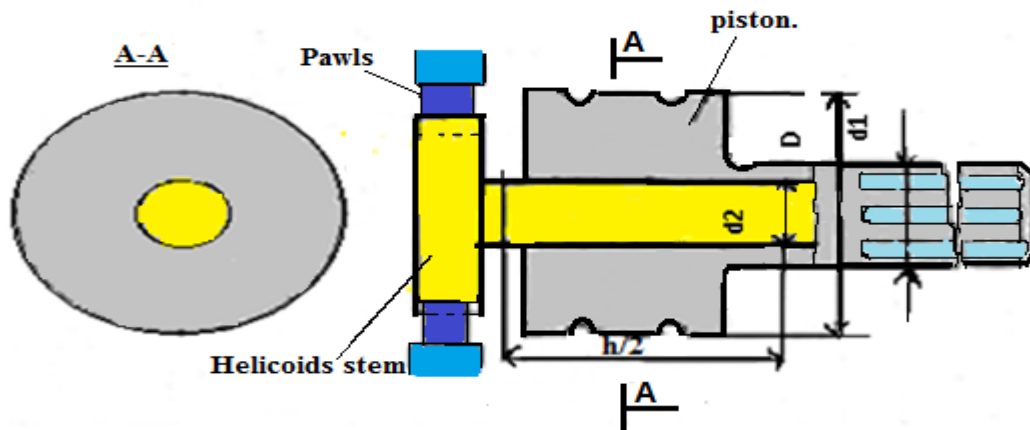


Fig 4. Longitudinal section of the perforator piston

## VII. CHOICE OF THE RATIONAL OPERATING MODE OF THE PERCUSSIVE DRILLING MACHINE

During the choice of the punches, the principal question which worries us was always the productivity that the puncher under the well defined conditions can ensure, but this factor remains related to the operation of the machine, which in its turn depends on the properties of the rock, of the type of the tool and the parameters of the puncher without neglecting the factors which can have an influence on the choice of the operation, such as: maximum power, rate of advance maximum which can ensure the puncher, the height of penetration of the tool at the time of the destruction of the rock according to parameters' of the tool and the torque [14].

### A. Height of penetration of the trepan

The height of penetration is a function of the energy of a blow of the piston:

$$h = \frac{4 \cdot n_c \cdot E_{ou}}{\pi \cdot d^2 \cdot \sigma_{comp} \left( \operatorname{tg} \frac{\alpha}{2} + \mu_1 \right) \cdot c_e \cdot z} \quad (24)$$

### B. Progress drilling:

The progress drilling is a function height of penetration in the rock and number of revolutions,

$$V = h \cdot \frac{n_c}{n_c} \cdot Z \quad (25)$$

### C. Perforator productivity:

The theoretical productivity is the number of meter of hole drilled during the unit of time; m/hour

$$Q_{theo} = 60 \cdot V \quad (26)$$

Technical productivity is the number of meters drilled during the unit of time, taking into account the programmed stops of the perforator: m/post

$$Q_{tech} = \frac{T - T_{pr}}{\left( K_f \cdot m_p \cdot V \right)^{-1} + \left( t_{depl} + t_{in} + t_n + q \cdot t_{ch} \right)} \cdot K_{rep} \quad (27)$$

Operational productivity is the number of meters drilled during the unit of time, taking into account the actual use of the perforator; m/post

$$Q_{exp} = Q_{theo} \cdot K_{exp} \cdot T_p \quad (28)$$

$$K_{exp} = \frac{T_f}{T_f + T_{org} + T_{aux}} \quad (29)$$

Simplified by  $T_f$  we are getting:  $K_{exp} = \frac{1}{1 + \left(\frac{T_{org} + T_{aux}}{T_f}\right)}$

Knowing that:  $T_f = \frac{L}{V}$ . Therefore:  $K_{exp} = \frac{1}{1 + \left(\frac{T_{org} + T_{aux}}{L}\right) \cdot V}$

### VIII. CRITERIA AND MODEL OF CHOICE OF RATIONAL OPERATING REGIMES

The cost structure of one meter of the borehole consists of two parts: Time-dependent expenditures related to the productivity of drilling works and the metering of a tool. It should be said that the cost of one meter of the borehole is the criterion that takes into account the technical level of the machines used and of the organization of work.

In the case of the operation of the drilling machines selected to drill holes of specified diameter. The most accurate criterion for determining the parameters of the rational drilling regime will be the cost of one meter of drilled hole.

The latter may be determined by the following formula (DA/m):

$$C = \left(\frac{C_p}{Q_{exp}}\right) + \left(\frac{C_{ou}}{H}\right) \quad (30)$$

It follows that in the formula, Q depends on the mechanical drilling speed and consequently the number of the piston and the energy of a stroke of the piston the problem posed consist in determining the values of the parameters or the minimum cost of one meter of the drilled hole.

$$C_p = c_s + c_{eng} + c_a + c_{rép} + c_{ma} \quad (31)$$

$$c_a = \left(\frac{C_{mach}}{N_j \cdot N_p \cdot N_a}\right)$$

### IX. RESULTS AND DISCUSSION

TABLE I

Technical Characteristics of Pneumatic Perforator of Type URSS (PR-24LU) [15].

Parameters	Indices	Values
Diameters of the piston	D,mm	85
Diameter of the piston rod	$d_1$ ,mm	36
Diameter of the helicoid stem	$d_2$ ,mm	21
Weight of the piston	G,kgf	2.4
Travels of the piston	L,mm	40
Mass puncher	M,kg	23
pressure of the compressed air	Pa ;kgf/c m <sup>2</sup>	5

From the TABLE II, it is possible to calculate the basic parameters of the following pneumatic perforator:

TABLE II  
 Basic Parameters of the Pneumatic Perforator:

$S_a$ (m <sup>2</sup> )	53.25x10 <sup>-4</sup>	$T_c$ (s)	0.03
$S_r$ (m <sup>2</sup> )	46.54x10 <sup>-4</sup>	$n_c$ (blows/min)	2000
$F_a$ (kgf)	178.84	$n_t$ (tr/mn)	80
$F_r$ (kgf)	118.16	$n_c'$ (blows/tr)	25
$V_a$ (m/s)	6.62	$\Phi$ (degree)	14.4°
$V_r$ (m/s)	5.20		

The results of the experimental study carried out in the quarry conditions of fila fila:

TABLE III  
 Variation of the Energy of Blows of the Piston as a function of the Pressure of Compressed air in the intake Chamber of the Cylinder

<b>N<sup>DTE</sup></b> <b>Test</b>	<b>Pa</b> (bar)	<b>Eou</b> (kgfm)
Test 1	2	3.96
Test 2	2.5	5.00
Test 3	3	6.04
Test 4	3.5	7.08
Test 5	4	8.12
Test 6	4.5	9.16
Test 7	5	10.20
Test 8	5.5	11.24
Test 9	6	12.28
Test 10	6.5	13.32

We apply the Matlab software to the results of the experimental study, we obtain: The curve  $E_{ou} = f(p_a)$

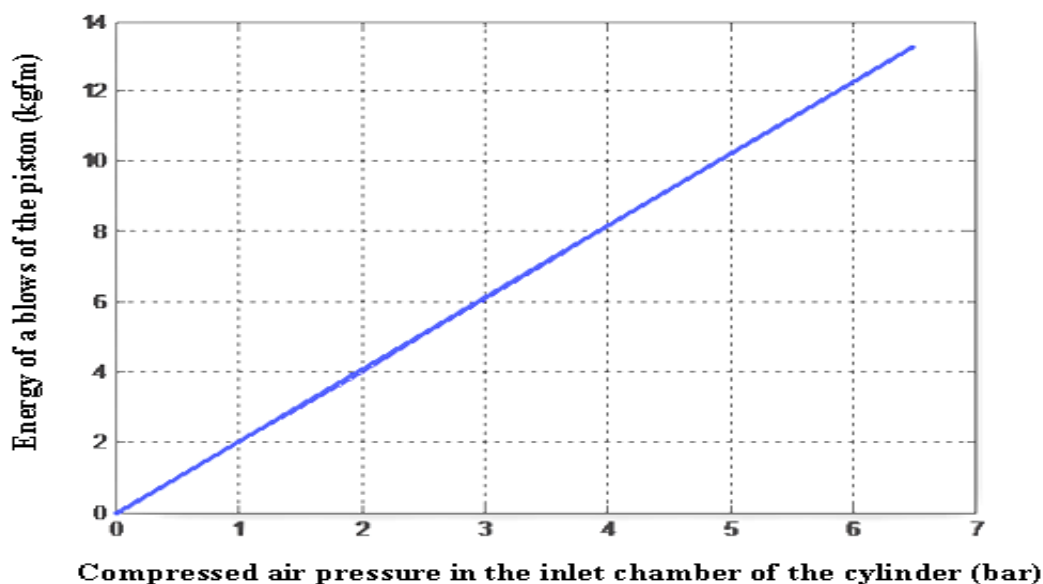


Fig 5. Energy of blows of the piston as a function of the pressure of compressed air in the intake chamber of the cylinder

Note that the penetration height increases as the energy of a blows of the piston increases. Thus the relation between the penetration height and the energy of a stroke of the piston is a proportional relation.

The results obtained from the drilling speed as a function of the penetration height represent in the table IV:

TABLE IV  
 The Variation of Progress Drilling according to the Height of Penetration

h ; m/tr	With $n_{c1} = 2000$ ; blows /min		With $n_{c2} = 2100$ ; blows /min		With $n_{c3} = 2200$ ; blows /min	
	V1 ; m/min	H ; m	V2 ; m/min	H ; m	V3 ; m/min	H ; m
0.2503	0,0200	191	0,0210	220	0,0220	124
0.3816	0,0304	185	0,0320	204	0,0335	113
0.4472	0,0357	183	0,0375	202	0,0393	110
0.5785	0,0462	153	0,0485	172	0,0509	101
0.6441	0,0515	148	0,0541	167	0,0566	99
0.7097	0,0567	143	0,0596	162	0,0624	87
0.8409	0,0672	118	0,0706	137	0,0739	62
0.9066	0,0725	101	0,0761	120	0,0797	52
1.2347	0,0987	27	0,1037	46	0,1086	25

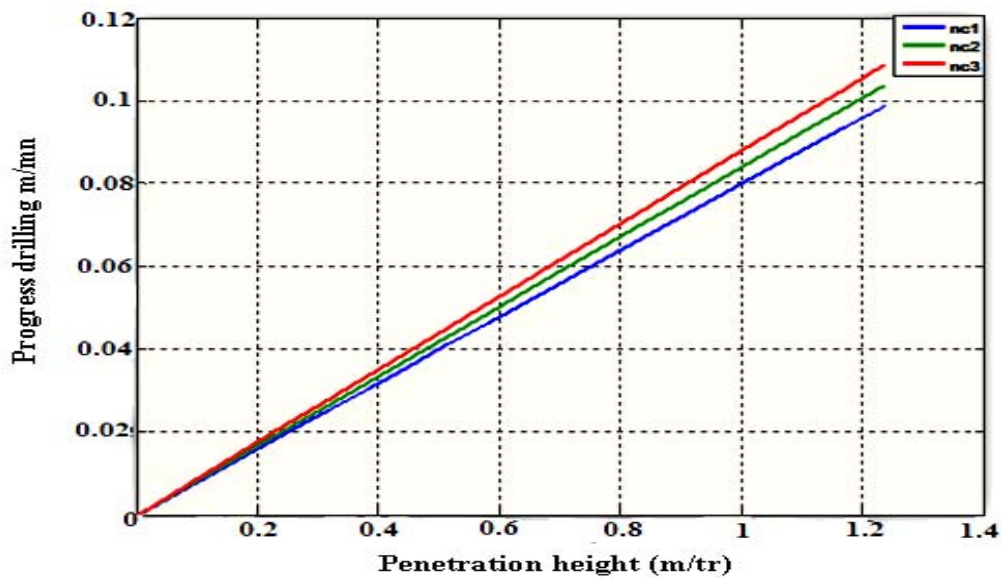


Fig 6 . The drilling speed as a function of the penetration height

Note that the variation in drilling speed increases as the penetration height increases. So the relationship is proportional.

The results obtained from the productivity of the perforator as a function of the drilling speed under the conditions of the filfila quarry represent in the following tables.

TABLE V: The Productivity of the Perforator as a function of the Drilling Speed V1

Test	V1 ; m/mm	H ; m	<u>Qthé</u> m/h	<u>Qtech</u> m/p	<u>Kexp</u>	<u>Qexp</u> m/p	C ; DA/m
Test 01	0.0200	196	1.200	1.137	0.787	0.894	919.12
Test 02	0.0252	192	1.512	1.430	0.762	1.089	755.65
Test 03	0.0304	190	1.824	1.721	0.739	1.271	648.32
Test 04	0.0357	188	2.142	2.017	0.716	1.444	571.41
Test 05	0.0410	160	2.460	2.274	0.695	1.580	523.75
Test 06	0.0462	158	2.772	2.562	0.676	1.731	478.75
Test 07	0.0515	152	3.090	2.836	0.657	1.863	445.59
Test 08	0.0567	148	3.402	3.034	0.639	1.938	428.83
Test 09	0.0620	146	3.720	3.242	0.622	2.016	412.62
Test 10	0.0672	123	4.032	3.366	0.607	2.043	408.68

TABLE VI: The Productivity of the Perforator as a function of the Drilling Speed V2

TABLE VII: The Productivity of the Perforator as a function of the Drilling Speed V3

Test	V2 ; m/mm	H ; m	Qthé m/h	Qtech m/p	Kexp	Qexp m/p	C ; DA/m
01	0.0210	173	1.260	0.875	0.782	0.684	1200.32
02	0.0265	179	1.590	1.102	0.756	0.833	986.54
03	0.0320	193	1.920	1.319	0.732	0.965	851.99
04	0.0375	187	2.250	1.540	0.709	1.091	754.44
05	0.0430	166	2.580	1.755	0.687	1.205	684.36
06	0.0485	160	2.910	1.966	0.667	1.311	629.81
07	0.0541	155	3.246	2.181	0.648	1.413	585.06
08	0.0596	150	3.576	2.363	0.630	1.488	556.17
09	0.0651	147	3.906	2.562	0.613	1.570	527.65
10	0.0706	124	4.236	2.647	0.597	1.580	525.75

Test	V3 m/mm	H ; m	Qthé m/h	Qtech m/p	Kexp	Qexp m/p	C ; DA/m
01	0.0220	197	1.320	1228	0.777	0.954	861.63
02	0.0278	196	1.668	1.547	0.750	1.160	709.64
03	0.0335	187	2.010	1.856	0.725	1.345	613.07
04	0.0393	188	2.358	2.169	0.702	1.522	542.43
05	0.0451	162	2.706	2.755	0.680	1.666	496.99
06	0.0509	160	3.054	3.046	0.659	1.780	465.67
07	0.0566	158	3.396	3.339	0.640	1.900	436.79
08	0.0624	154	3.744	3.633	0.621	2.000	415.48
09	0.0682	153	4.092	3.852	0.604	2.194	379.31
10	0.0739	134	4.434	3.870	0.587	2.271	367.61

We apply the Matlab software to the results of the experimental study, we obtain:

Curves:  $Q = f(V_1)$ ;  $Q = f(V_2)$ ;  $Q = f(V_3)$

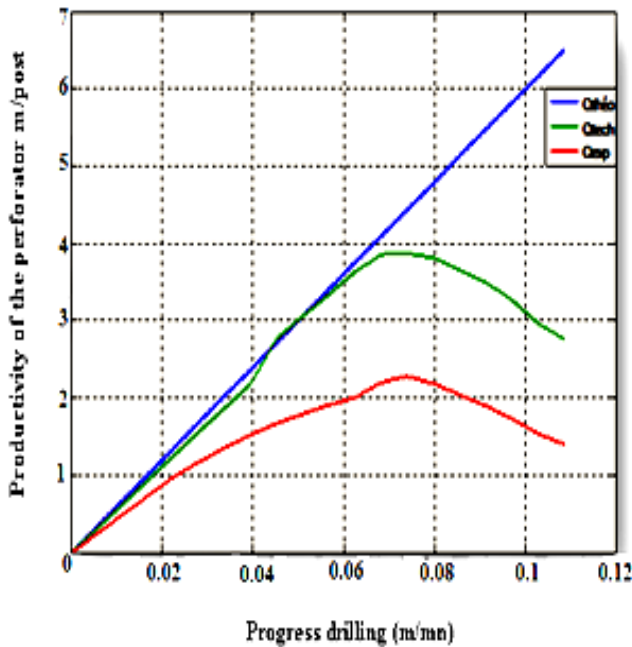


Fig 7 . The Productivity according to the drilling progressV1

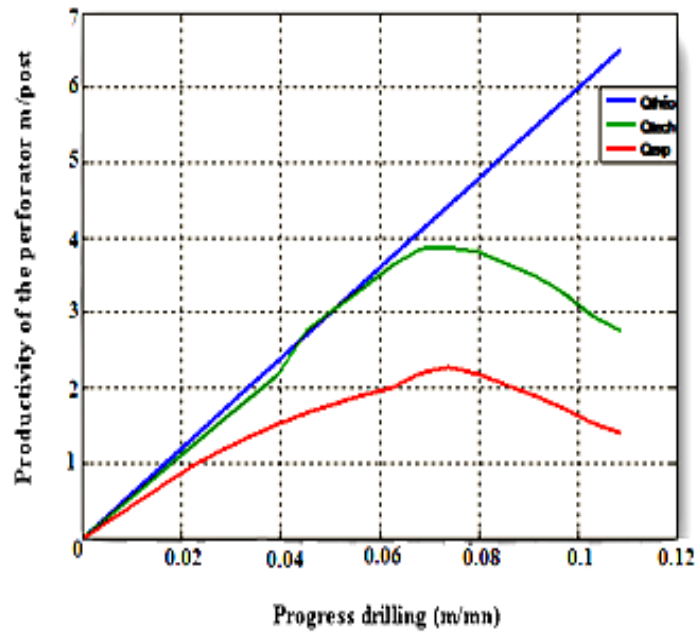


Fig 8. The Productivity according to the drilling progressV2

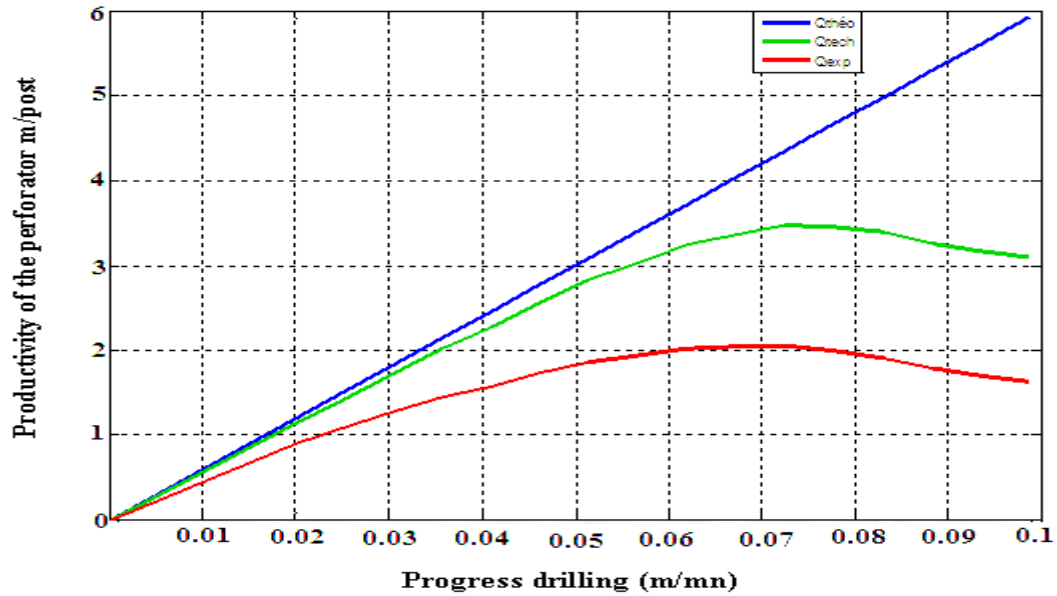


Fig 9. The Productivity according to the drilling progress V3

Note that the productivity of the pneumatic perforator increases as the drilling speed increases to improve the work organization. The productivity of the pneumatic perforator depends primarily on the parameters of the drilling regime because the latter determines the value of the drilling speed. The study of the curves presented leads to a recommendation on improving work organization, which gives us the opportunity to increase the operating productivity of the pneumatic puncher.

The following table shows the costs of the machine:

TABLE VIII: Costs of the machine

$C_{ou}$ (DA)	1100
$C_{mach}$ (DA)	785000
$C_a$ (DA)	309.06
$C_p$ (DA)	816,68

TABLE IX: The drilling Speed and the Cost price of one meter of Drill hole as a function of the Energy of a Blow of the Piston

<b>Eou</b> <b>(kgfm)</b>	<b>Vf</b> <b>(m/min)</b>	<b>C</b> <b>(DA/m)</b>
3.96	0.03	616.07
5.00	0.04	542.43
6.04	0.06	496.99
7.08	0.07	465.67
8.12	0.08	436.79
9.16	0.09	415.48
10.20	0.10	379.31
11.24	0.11	367.61

We apply the Matlab software to the results of the experimental study, we obtain:

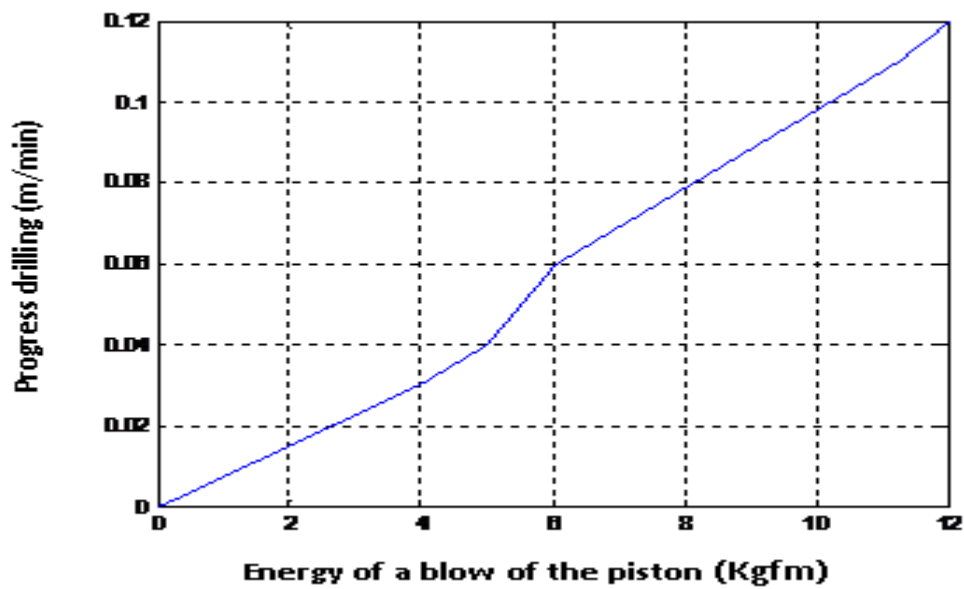


Fig 10. Progress drilling according to the energy of a blow of the piston.



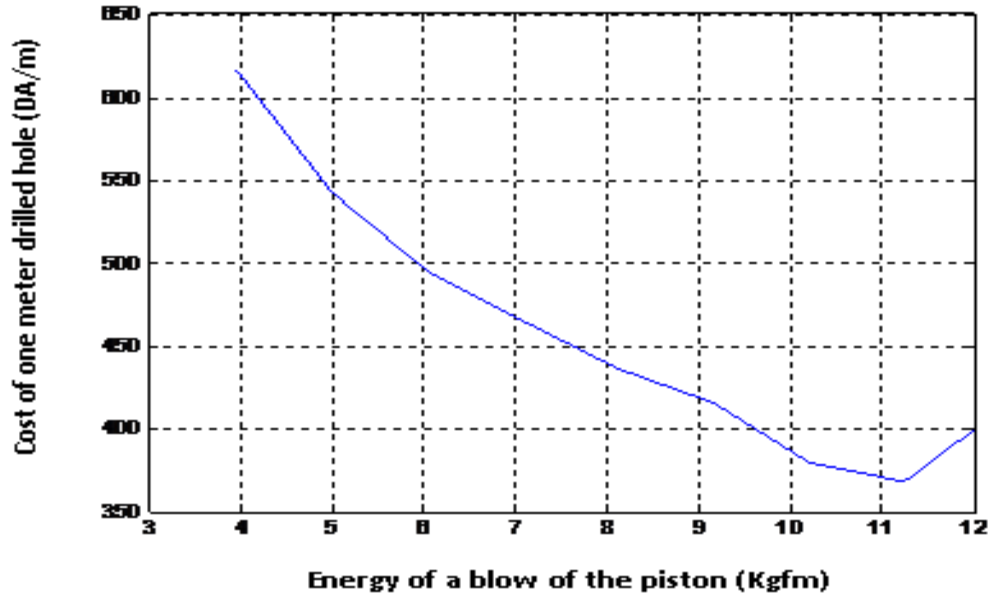


Fig 1 1. The Cost of one meter drilled hole according to the energy of a blow of the piston.

According to the preceding curves, it is noted that the drilling speed increases when the energy of a blow of the piston increases therefore the relation is proportional, and the cost of one meter drilled hole decreasing as long as the energy of a blow of piston increases thus an inverse relation.

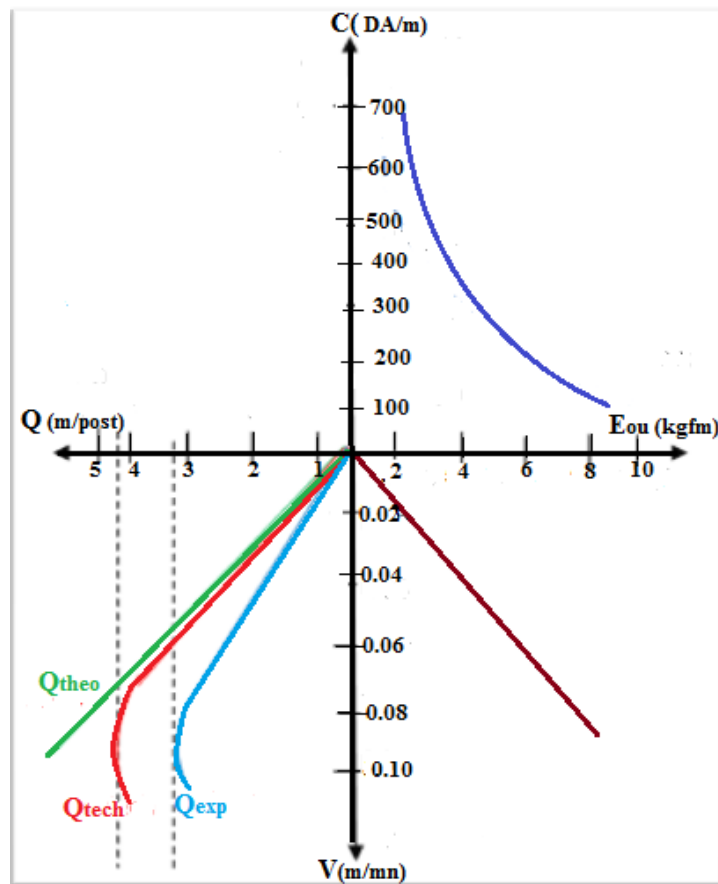


Fig 12. Nomogram for determining optimum values of the operating regime of percussion drilling machines.

## X. CONCLUSION

In the experimental part, we studied the influence of the drill hole measurements on the drilling speed. Knowing that the setting parameters considerably influence the output parameters; the factors studied represent the values of the variables in the field at which the drilling process begins with the aim of obtaining the optimal values of these factors. The factors studied (number of blows of the piston, the energy of a blow of piston represent variables that is to say during the experimental drilling, we can give them determined values.

The productivity of the perforator depends on the parameters of the drilling regime. The graphical comparison of the results obtained theoretically with those obtained experimentally showed that the method closest to the actual results is that the theory of destruction of the rock.

As a result of the research carried out, it has been concluded that in the quarry conditions using the defined drilling means it is preferable to use the price criterion of one meter of drilled hole to determine the regime parameters of rational operation.

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