Sborník vědeckých prací Vysoké školy báňské – Technické univerzity Ostrava
Řada hornicko-geologická
Volume XLIX (2003), No.1, p. 137-140, ISSN 0474-8476

Viktor SHEVTSOV[*], Alexander SHKUMATOV[**], Konstantin LABINSKIY[***], Oleg MOROZ[****], Daniel PROSKURENKO[*****]

NEW TECHNICAL SOLUTIONS IN CONDUCTING MINING EXCAVATIONS

NOVÁ TECHNICKÁ ŘEŠENÍ PŘI VEDENÍ DŮLNÍCH PRACÍ

Abstract

In the article you can find the research of distribution of explosion gases. The construction of bush in a blast-hole changing the direction of movement of gases was described here. The most effective ways of increasing the efficiency of explosive works was underlined in that work.

Abstrakt

V tomto článku jsou uvedeny výsledky výzkumu v oblasti šíření plynů při trhací práci. Je popsána konstrukce vrtu včetně ucpávky a směr pohybu povybuchových plynů. V práci jsou zdůrazněny nejefektivnější způsoby zvyšování účinnosti trhací práce.

Key words: explosion gases, hydrotamping, detonating products,blast-hole changing.

Introduction

The analysis of indexes of the development of mining industry in Ukraine within the next 20 years shows that the size of explosive works remains relatively high.

In the nearest future more than 60% of the total volume of conducting preparatory excavations will be conducted using drilling and blasting technologies. That's why it is vitally important to decide basic questions of rising the effectiveness of explosive works nowadays.

One of the ways of rising effectiveness of explosive work is using a hydrotamping and a bush.

Status of Researches of the Hydrotamping

Hydrotamping in the form of polyethylene ampules full of water doesn't have any advantages of hydroexplosions, especially in the form that it is used in conducting explosive works in our time. Firstly, the diameter of ampules (37 mm) is less than the diameter of the blast-hole (42 mm). It causes the loss of the influence of air-blast waves on the rock surrounding this hydrotamping. Secondly, as a rule hydrotamping is situated at the well-head. The air-blast influence on it under the direct initiation of explosives is less favourable as the detonational front is moving from the hydrotamping.

The scheme of the situation of the hydrotamping in the back of blast-hole was examined in a number of works. In this case the effectiveness of a hydrotamping was increased. The model of interaction between the products of detonation and hydrotamping in the form of converging streams was suggested in one of those works.

The continuation of works in this line of investigation was the definition of the length of a hydrotamping that conditionally divided into two parts. The first part is the length that can be defined starting from the collision of streams of products of detonation and water in a hydrotamping. The second part is the length

[*] Engineer, Donetsk National Technical University, Donětsk, Ukrajina, Artemya street 58, 83000
E-mail: odm@mine.dgtu.donetsk.ua
[**] Associate Prof., Donetsk National Technical University, Donětsk, Ukrajina, Artemya street 58, 83000
[***] Assistent, Donetsk National Technical University, Donětsk, Ukrajina, Artemya street 58, 83000
[****] Associate Prof.,Ph.D., Donetsk National Technical University, Donětsk, Ukrajina, Artemya street 58, 83000
[*****] Donetsk National Technical University, Donětsk, Ukrajina, Artemya street 58, 83000

that can be defined starting from the pressure of the hydroblow at the back of blast-hole, that is sufficient for the destruction of the rock.

The Laboratory Experiments of the Hydrotamping

The laboratory experiments, conducting in DonNTU, confirm this way of calculation of the effective length of the hydrotamping (fig. 1).

The highest level of effectiveness of using a hydrotamping is achieved when it is situated as at the back of a blast-hole as in its well-head. Hydrotamping in a blast-hole makes the explosion more effective under the back initiation of explosives.

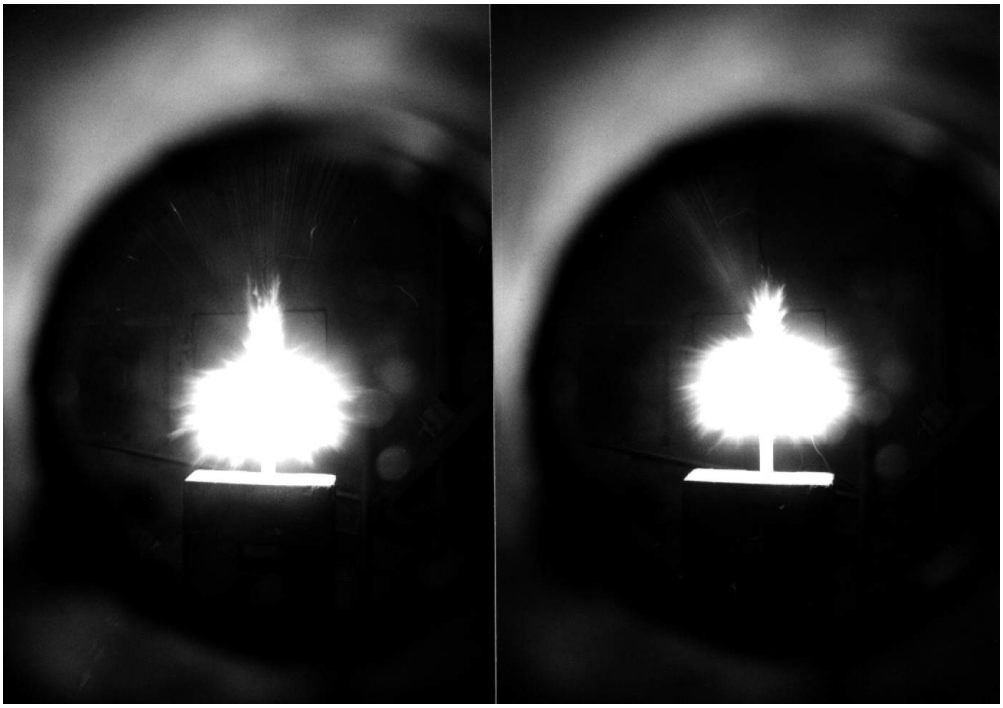

Fig. 1. The flying of the detonation products with the different length of hydrotamping

The Laboratory Experiments of the Bush

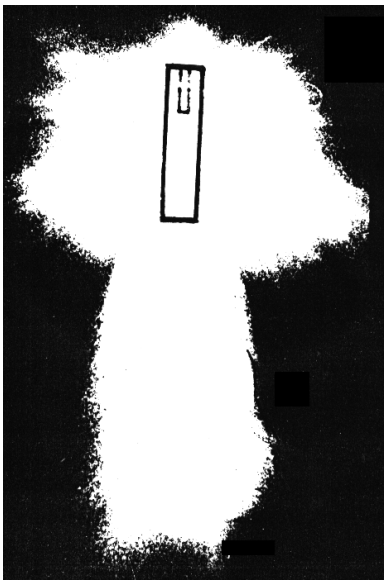

Fig. 2. The distribution of gases of explosive with the cumulative cavity

One more way of raising of effectiveness of explosive works is using the bush [1]. The moving-image photography was used in laboratory to determinate conditions the direction of movements of gases under the explosion of explosives. The explosives (ammonite T-19) with electrodetonator (EDKZ-PM) were hang up to the bracket on the flexible wire.

For the comparison was held two explosions. In the first case in the butt-end of explosives was a cumulative cavity, in the second it was not. The analysis of results showed that gases after the explosion were not spread equally. In case of cumulation nearly 40% of products of detonation were moving along the axle of the explosive, and the rest of them were directed to it under the angle of 80^0 (fig. 2). In case of explosion without cumulation the distribution of gases changed. The basic volume (nearly 90%) was directed under the same angle to the axle of explosive and the rest of it (nearly 10%) was directed

along it (fig. 3). In the blast-hole this part of detonating products was reflected from the back of the blast-hole and moved gases of detonation directed to the walls of the blast-hole and pushed out the tamping. Blast-holes "shot". In order to avoid such position towards tamping we had to have very high demands. This part of qualitative energy was spent for the useless oscillation of the massive. The suggested technical solution is directed to the rising of the coefficient of using a blast-hole.

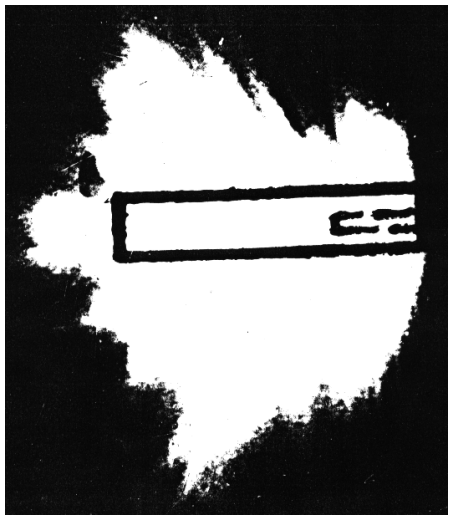

Fig. 3. The distributions of gases with standard explosives

The Experiments of the Bush in Real Conditions

A blast-hole charge includes sandy-argillaceous tamping 5, ampule, full of water 4, primer 3 with electrodetonator 2 and explosives 1 (fig. 4) that are situated in succession one by one from the well-head to the back of blast-hole.

The bush is situated between the well-head and explosives. It is used for changing the direction of the motion of detonation products to 90^0. The wave of detonation is moving to the side of the back of blast-hole after the explosion consolidating shock wave flows around the bush. In this case the form of a stream of explosion products changes. the bush From a cylindrical form it turns to a flat form stream, the parts of which are moving perpendicularly of the axle of a blast-hole and cutting the rock in the back of a blast-hole.

One of the basic parameters of the bush is radius of curvature of it side surface. You can see a general form of the bush in the fig. 5. The curved surface of the bush can be described with the help of equations of circle, ellipse and others.

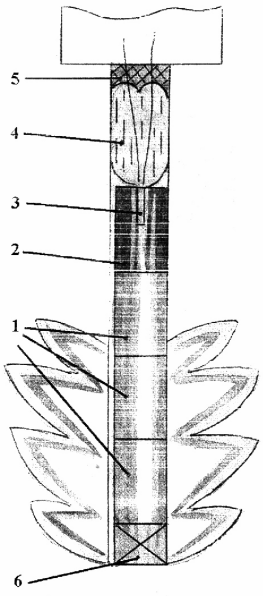

Fig. 4. The construction of the blast-hole charge with

The Results of the Researches

The bushes and the hydrotamping were produced and used in working conditions. New passport of explosive works was worked out with the help of analysis of the proceeding passport. The coefficient of using a blast-hole was raised to 0,89..0,99 in the result of improvement of the construction of blast-hole charge and raising of the length of cut from 1,3 to 1,5 m. The "glasses" practically disappeared. The number of blast-holes was decreased by 60% (from 76 to 66), the expenditure of explosives was decreased by 9% (from 27,46 to 25,38 kg) and the effectiveness of explosive works was increased by 32% in the whole.

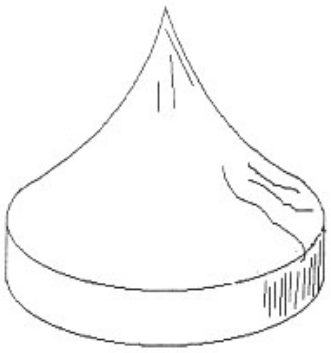

Fig. 5. General form of the bush

Conclusion

The effective way of rising of the effectiveness of explosive works is using a hydrotamping and a bush in blast-hole charges. But it is necessary to determine a functional dependence of hydrotamping from the weight of blast-hole charge and from the hardness of rocks

Literature

[1] Guzd,A., Shkumatov,A., Kubishkin,A. and others: Positive solution of the inventors certificate No 460 1032/03/153659, 01.11.1988, (Blast-hole charge).

Resumé

Článek je zaměřen na výzkum problematiky distribuce výbušných plynů. Byly zkoumány účinky hydraulické ucpávky. V rámci výzkumu byla navržena nová funkční metodika a popsán současný stav laboratorního výzkumu v oblasti hydraulické ucpávky. Rovněž je naznačen směr laboratorní výzkum detonačních produktů. V článku je uveden schématický popis vrtu včetně konstrukce náloží a ucpávky, mající vliv na zvýšenou účinnost výbuchových plynů. Byla navržena nová konstrukce nálože vývrtu. V tomto příspěvku byly zdůrazněny nejúčinnější způsoby zvyšování efektivity trhacích prací. Jsou zde nastíněny výsledky aplikace vodní ucpávky v konkrétních podmínkách dolu.

Recenzent: Prof. Ing. Jiří Horký, CSc., VŠB-TU Ostrava