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Application of Explosive Technology in Poland

Andrzej MARANDA, Jerzy NOWACZEWSKI, Ryszard REKUCKI

(*Military University of Technology, Warsaw, Poland*)

Abstract: Some practical applications aiming at explosive technology in civil industry of Poland, such as strengthening surface layer of metallic products, clamping rings on steel cables and demolition of frame construction are presented in this paper.

Key words: explosive technology; explosive strengthening; explosive demolition

1 Introduction

Investigations aimed to apply the explosive technology in the national economy have been performed in the Military University of Technology for ten years[1~6]. The research work includes all basic explosion methods: strengthening, cladding, forming, and cutting metal elements, the synthesis of superhard materials (dense forms of boron nitride, diamond), demolition etc.

In this paper some practical applications of the explosive technology are presented, such as strengthening surface layer of turnouts, hardening elements of hammer crushers and track links of machinery used in surface mining, clamping rings on steel cables, and the demolition of frame construction.

2 Strengthening the surface layer of metallic products

2.1 Turnout of railway

The intensive transportation of the railway system causes the turnouts quickly worn away and frequently renewed. To prolong the service life of turnouts, the frogs made of 72P or 90PA grades of steel (Fig.1) were explosively strengthened. Their hardness increases about 10% ~15%. These hardened frogs and the non-hardened frogs were simultaneously built up in the switch yard of ⌉azy of high freight traffic. It is shown that the service life of the former is two times longer than that of the latter.

2.2 Hammers of model 40/80 crusher

The crushers of model 40/80 with hammers made of 40HNMA grade steel are applied to crush silica and other solid materials in cement and limestone industry. To increase the hammer life, its surface layer was strengthened by explosion method. 1 kg charges of 10 mm in thickness were detonated on the hammer surface (Fig.2). The explosion was loaded two times. The hardened hammers were installed in the crusher and its wearability was measured while the crusher was working. The life-time of these hammers increases about three times as compared with that of non-hardened hammers.

2.3 Track links

The main working element of a carrier system in the basic machinery applied in opencast mining is a crawler tread with track link welded on it. The track links are consumed quickly. Five new track links made of the Hadfield steel, L120G13, were explosion strengthened. Both the raceway of track wheel (Fig. 3) and the surface of shelves (Fig. 4) were hardened explosively. The layer charges of thickness of 2 mm were made of plastic explosive named Hardex-SA. Particular surfaces were hardened one after another, but the raceway was loaded two times. The increase in hardness is about 50%.

3 Clamping rings on steel cables

The steel cable of 40 mm in diameter with hemp core is a conductor grounded the electric traction in coal mine. This cable is connected with the flats of 4 mm thickness, which are welded on rails. To improve the quality of joint and decrease the loss of electric energy, it was proposed to clamp a ring on the cable. The plastic explosive charges with U-shape were used (Fig.5). The quality of the joint (Fig.6)

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was checked by measuring the electric conduction. The results show that high quality of connection is achieved despite the cables have impure surface (grease, rust).

4 Demolition of frame construction

The old houses and factory buildings built in the early twentieth century were demolished recently by means of explosion methods. The factory buildings usually have monolithic or prefabricated frame construction. Sometimes, the building to be demolished is near the other. In this case it should be done by directional blasting. The great quantity of fragments of reinforced concrete gives rise to much difficulty. Additionally, the seismic waves are generated in the ground by the fragments falling down from high level.

The hall destined to demolition with dimension 23 m × 38 m × 21 m contains the frame construction made of reinforced concrete. The external walls are filled with bricks of 38 cm in thickness. It also has a five-storey stairway and a solid slab floor at a level of 5.3 m inside the frame construction.

To demolish the hall said above the charges with 50g of hexogen (RDX) were used. To fall down the building in the expected direction, we destroyed the columns at different levels and the half-second delay fuses were used to initiate the RDX charges.

The construction fell down in the right direction and broke down to pieces which could easily be taken away by machines. The diameter of debris is 2 m to 3 m. The wall of the near building is not damaged. There were no debris on the road along the building demolished. The roof structure collapsed at a distance of 5 m from the road edge.

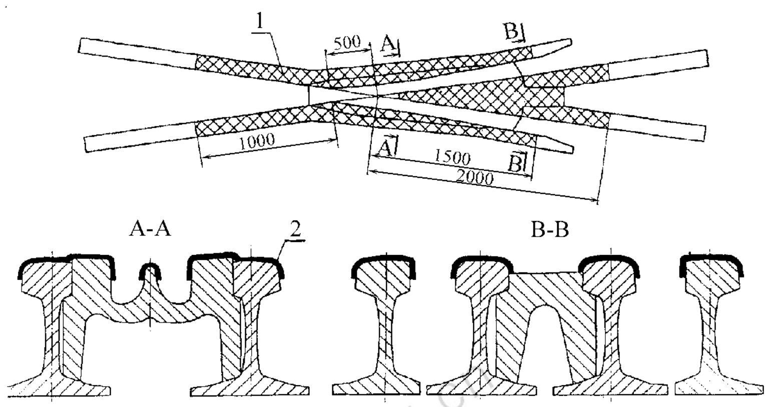

Fig. 1　Diagram of a turnout and its cross-section, the hardened zone (1) and the distribution of explosive charges (2)

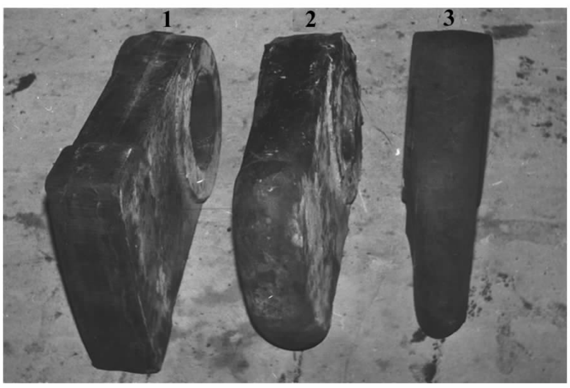

Fig. 2　General view of hammers: 1—new hammer; 2—hardened hammer used after one year; 3—non-hardened hammer used aftter one year

Fig. 3　Track link with a layer of plastic explosive stuck to the surface of rolling track wheel

Fig. 4 Track link with layers of plastic explosive stuck to the lateral surface of the shelf

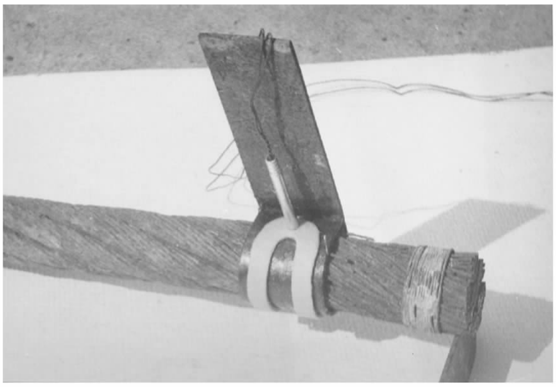

Fig. 5 Charge ready for explosion

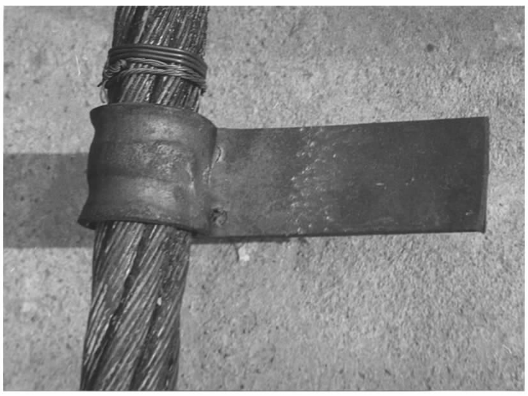

Fig. 6 General view of the ring clamped on steel cable by explosion method

The use of delay-action fuses significantly decreases the seismic waves because the following fragments of the building collapsed on the debris just like on a damping layer.

5 Summary

The practical applications of explosive technology in civil purposes presented above are examples which give not only real profits to the national economy, but also to the reuse explosives recovered from the ex-service munition.

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爆炸技术在波兰的应用

摘要：简要介绍了爆炸技术在波兰的应用，如金属部件表面的强化，钢览上环形箍的紧固，建筑物框架的拆除等。

关键词：爆炸技术；爆炸强化；爆炸拆除

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