PROCESS AND UNCONVENTIONAL METHOD OF MARKING OR STAMPING OF HARD METAL

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Abstract: *The authors present in this work a new unconventional technological way of marking or stamping of very hard metals from tempered steel with help of explosives. Even this method is in experimental stage, it can became an object for study in another related domains.*

Keywords: marking, stamping, explosives, explosive's force, excavations, dynamic wave of shock, hard metal.

1. Introduction

The operations of marking or stamping are the technological operations of pressing which help to execution of a convex-concave relief on the pieces' surface through change the thickness of material in different sections.

To make excavations or reliefs on surface of a very hard metal can be used the force of a explosive load.

The explosive's force f is defined like mechanic work which can be made by bases which are resulted from explosive transformation of a mole or of a mass unity of explosive if these are let to relax at a normal atmosphere pressure and temperature T_o [2]. It is express by relation:

$$f = n \cdot R \cdot T_e \quad \text{[J/Kg]}, \tag{1}$$

where:

- n - moles number of gaseous products which are resulted from decomposition of a mole or of a mass unity explosive;
- R - the universale constant of gases;
- T_e - temperature of explosion.

2.The experimental pattern proposed and materials used

To make excavations on the plane surface of a small plate by tempered steel ***4***, we made a stall of trials presented in figure1, [1,2] . The detonators ***1*** were made in accordance with
STAS 8136-88 having a suplementary speed of detonation between 8100 m/s and 8200 m/s.

The protection tube of detonators was mode by electrolytical copper through the cool extrusion with and outside diameter by 8 mm. The bottom of tube was made in two ways:

- With plate bottom and a thickness between 0,3 and 1 mm;

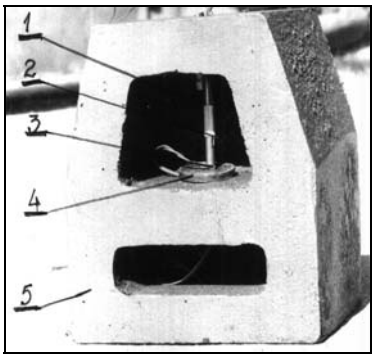

Fig.1. *The test stand.*

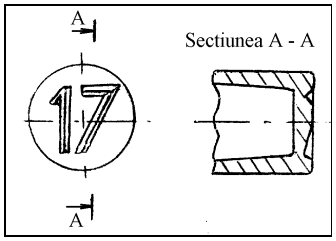

Fig. 2*. Marking on the bottom of the tube.*

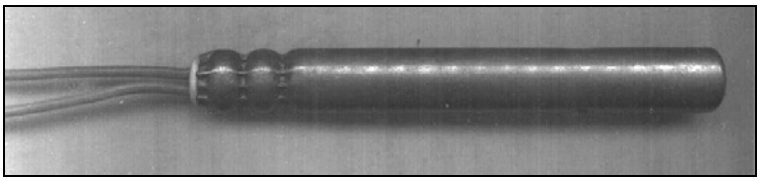

Fig.3. *The detonator completely equiped.*

- Whith a bottom by 0,8 mm marked by engraving/poansoning in a depth by 0,5 mm, in accordance with figure 2.

In figure 3 is presented a detonator completely equiped.

The experiences was performed for many types of metals:

- small plates by 5 mm thickness by tempered steel OSC 10, returned to 62 HRC and rectified after tempere;
- small plates by 5 mm thickness by untreated steel OL 37;
- small plates by 5 mm thickness by brass Cu-Zn 63;
- small plates by 5 mm thickness by lead with a purity by 98%.

The experiments conditions was the same for all types of plates.

2. The result of experiments

For each type of plates was performed ten experiments using the same type of detonators. The bottom of detonators was set straight on the surface of metal plates like in figure 1.

After all these experiments was obtained the next results [1]:

a. In casse of lead plates. All detonators with the bottom's thickness of protector tube less than 0,8 mm and no matter of brisant charge they bored completely the plate of lead, and diameter of hole created was biqqer than 8 mm (figure 4).

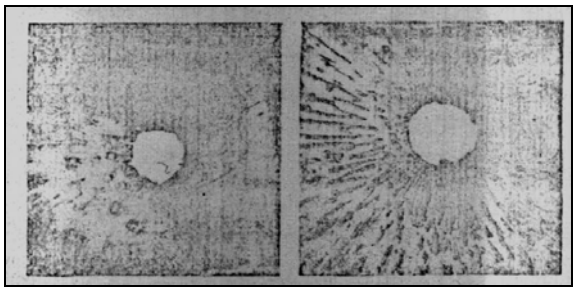

Fig.4. *Hole made.*

Fig. 5. *Excavation done.*

b. *In case of steel OL 37 plates* . For all type of detonators used, was obtained a gently stamp in shape of on irregular excavation with a depth which is variable between 0,1 and 0,3 mm (figure 5).

c. In case of Cu – Zn 63 plates. For all types of detonators used was obtained a pronounced stamp with finished aspect with a variable depth between 1 and 3 mm, in inverte proportion to depth of tube's bottom (figure 6).

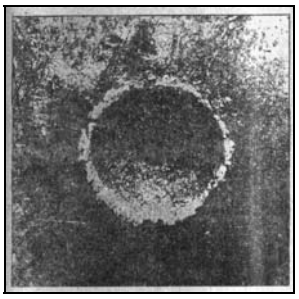

Fig.6. *Excavation done.*

Fig.7. *Excavation done.*

d. In case of plates by steel OSC 10 tempered-returned to 62 HRC. For all types of detonators with plate bottom . wasn't obtained any stamp or excavation.

For thase detonators with bottom marked by engraving some numbers, was obtained on the plate by tempered steel on excavation in shape and dimensions of numbers which was printed on the bottom of tube with a depth between 0,2 and 0,6 mm, (figure 7).
The last result we wanted to know with such a perfect border.

In this sense, we extended researches to direction of propagation of dynamic wave of shock through the explosive string of detonators with bottom plate (unmarked through engraving) and detonators with bottom marked by engraving. Through engraving we realised that the material is leaking axially in cavity of engraver (poinson) and the thickness of bottom is making thin in the aria of number about 0,3 to 0,2 mm. This is possible because the engraving is made with against-engraver.

We detonated such as detonators in a dark room, taking photos in the same time to this phenomena. After the photos was processing it comes out that:

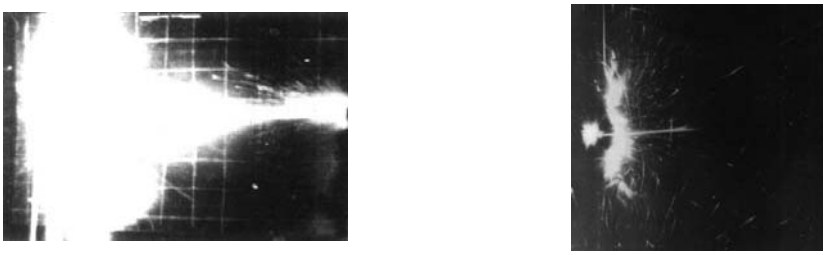

Fig.8. *The shape of dynamic wave of shock.*

- at detonators with bottom marked by engraving the shape of dynamic wave of shock is mainly axially (figure 8);
- at unmarked detonators (with plate bottom) the shape of dynamic wave of shock is mainly lateral function of thickness of bottom of tube, like in figure 9.

3. Conclusions

The experimental researches performed lead us to the next conclusions:

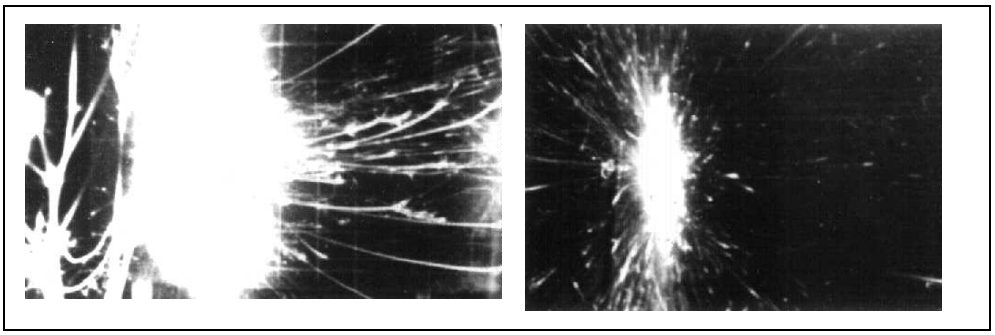

Fig.*9. The shape of dynamic wave of shock.*

- The dynamic wave of shock can be led to obtain some marks or stams on a hard metal through perform some marks or different outlines on the bottom of a detonator;
- The surface on which the marking or stamping can be made is determinated by diameter of tube of detonated charge;
- The cality of processed surface by marking and stamping using explosion depends by the properties of material used;
- This process can't be used for metalic material with low harduess;

References

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