

THE PROBLEMS OF UTILIZATION OF THE METALLIC CARBIDES AT THE TAMPING TOOLS

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Abstract: In the actual stage the main factor which has the primordial influence for the lastingness of the tamping tools is the wear of active part of these. It is necessary to concentrate the study and the research to find some ways, materials and technical processes for utilization of these, in the purpose of increasing the lastingness of active part of the tamping tools and the research of the behavior of these in exploitation. One example in this case is the usage of the hard materials like the plates of metallic carbides.

Keywords: tamping operation, tamping tools, wear, lastingness, metallic carbides, tungsten carbides

1. INTRODUCTION

Increasing the lastingness of the tamping tools is a primordial factor in the efficient exploitation, having in view technological and economical criterions and is an important process for the tamping tools and for the tamping machines as well.

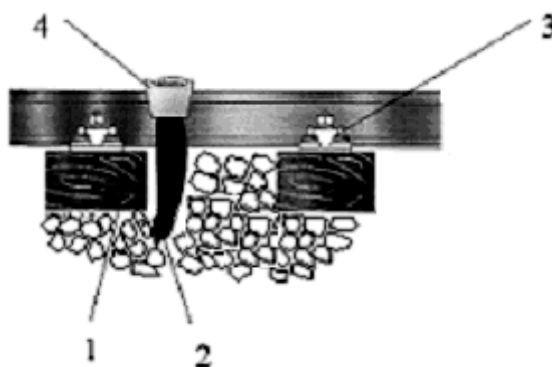


Fig. 1 The basic scheme for the tamping operation of the sleeper: 1 – the sleeper; 2 – the tamping tool; 3 – fixed spare parts; 4 - port tool [1]

Tamping is the technological operation to realize a support of ballast under the inferior part of the sleeper, with the main purpose to assure a specific geometry [1] and resistance of the railway (Fig. 1). Tamping is being executed with the help [2] of the tamping tools. Tamping operation consists in the vibration (oscillation) and squeeze of the ballast under the inferior part of the sleeper, at frequencies by 35 Hz, amplitude of the oscillation is 3÷5 mm and the force is 1000 kf (10 KN).

2. THE EXPERIMENTAL RESEARCHES

The researches in specialized literature regarding the actual stage of the researches, design, manufacture and exploitation of the tamping tools have showed a low level of information and technical details regarding these types of tools.

The wear and lastingness of the tamping tool are influenced by many factors. In the actual stage, from the determined factors, we have established that the main factor that has the primordial influence in the lastingness of the tamping tools is the wear of active part of these [3]. In literature and technical practice are known materials and technical processes to obtain a satisfactory wear for a specific type of tool, which works in a specific technical system (the work regimen, the work environment). In the case of the tamping tools, the using of some materials (alloys) having in their composition in different percents Cr, Mn, Mo, W and some adequate technical process, like forging in the matrices to maintain the materials fibers and thermal or thermo-chemical treatments, offers special mechanical properties (breakage resistance, shock resistance, wear resistance).

Worldwide using of some hard or extra hard materials and technologies to increase the wear resistance of the active part (tine) of the tamping tools is less known and spread, one example in this case is the usage of tungsten carbides.

The experimental researches regarding the lastingness of the tamping tools were concentrated at the active part (tine) of the tamping tools, having in view the evolution of the wear depending by the quantity (the length) of tamping accomplished, identification the factors and elements that influences the lastingness, also the solutions for increasing it.

In the course of researches we have been in view [3] the assemble of factors that influence the lastingness of tamping tools, from manufacturing, exploitation and reconditioning of these, also the advantages and disadvantages which appear in the case of using some hard or extra hard materials like metallic carbides (tungsten carbides) and the technological processes for application of these like hard paste process (brazing), on the active part of the tamping tool.

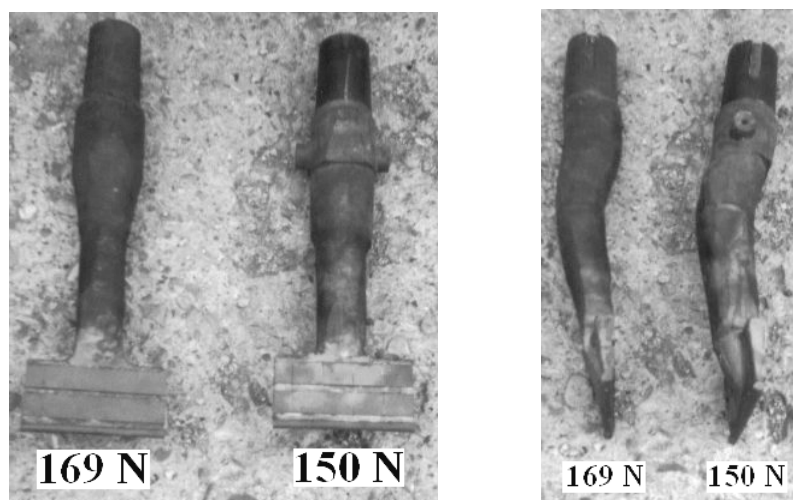


Fig. 2 Tamping tools type P & T 09 – 32 CSM – curved nr. 169 N, 150 N plated (armed) on the active part with plates by metallic carbides

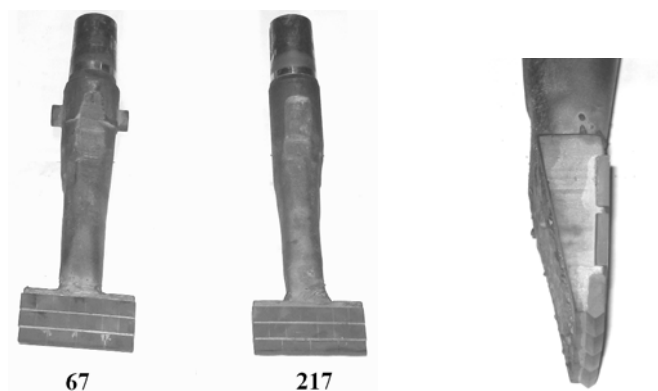


Fig.3 Tamping tools type P & T 09 – 32 CSM – curved nr. 67, 217 plated (armed) on the active part with plates by metallic carbides

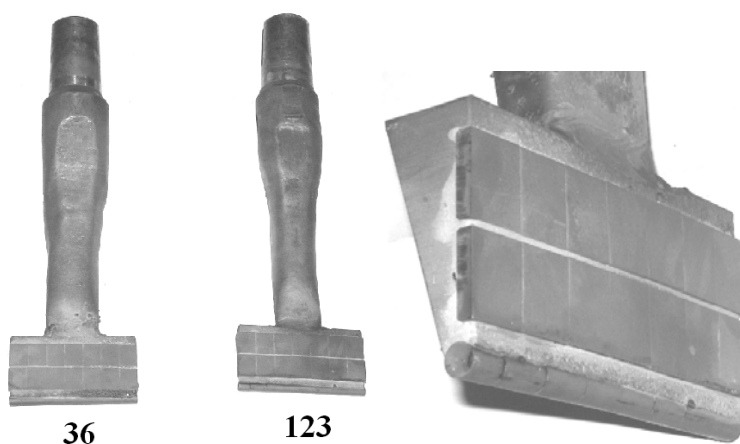


Fig. 4 Tamping tools type P & T 09 – 32 CSM – curved nr. 36, 123 plated (armed) on the active part with plates by metallic carbides

In the course of the experimental researches and testing made in the real conditions, on field, with the tamping tools type P&T 09-32 CSM curves, plated (armed) on the active part with plates from metallic carbides (tungsten carbides type G 40) – Fig. 2, 3, 4.. The tools were mounted and used on the tamping machine P&T type 09 – 32 CSM nr. 2755 from SIMC Buzau, we have come to the conclusions of the following problems:

a) The identification and selection of the type of metallic carbides (CMS) which can be utilized (group, subgroup). The establishing of the type of metallic carbides (CMS) it can be made on the material mechanical properties, on the eventual indications of usage and the correlation with the parameters and working conditions for tamping tools. We have in view, especially, the vibration (oscillation) movement of the tools, the solicitation to impact at the penetration of the tools into the ballast, the solicitations directions, the intensive abrasive wear phenomenon which leads to the different solicitations like directions, size, discontinuous with variable parameters. We have selected and tested the plates from tungsten carbides type (group) G subgroup G 40 – STAS 6374 which have following properties: chemical composition 80 % WC, 20 % Co; density 13,67 [g/cm³], hardness 920 [50HV], bending resistance 2903 [N/mm²], elasticity module 500000 [N/mm²], compression resistance 3800 [N/mm²]. They have good properties for shock and bending.

b) The selection of the type of assembling between the active part of the tamping tools and the plates from CMS. We have in view the known assembly methods. The dismountable assembling (with thread, with cotter, with

groove s.a.) with plates of CMS removable or irremovable assembling like rivet presents as main disadvantages in this case to the decreasing of the mechanical resistance of the plates of CMS and the active part of the tamping tools because it is necessary to realize the canals, release, groove, holes s.a. and the other specific elements necessary to assembling (threads, holes, canals, groove s.a.). These elements can lead to the tension concentrators and to decrease of the mechanical resistance. Also this types of assembling necessity a certain volume (space) which needs provides (enclosed) in the dimensions (volume) of the active part of the tamping tools. These disadvantage lead to the solution of using the irremovable assembling through hard paste process (brazing) putting in value the advantages of this type of assembling.

c) The selection of a technological process of assembling through hard paste process (brazing), between the technological paste process known. The selection of the technological paste process is made depending on several criterions: the type of stuck alloy; the type, shape, dimensions, precision and quality of the assembling through hard paste process; physics and mechanicals properties required to the assembling through brazing; the technological capabilities of the producers (equipments, machines, tools, organizational capability, qualified personnel, experience s.a.); the type of production; economical efficiency. We have selected the hard paste process (brazing) through induction with currents by high frequency (10^5 Hz).

d) The establishing of the shape and dimensions of the bodies from metallic carbides which can be used for plating (arming) of the active part of the tamping tools. At the establishing of the shape and dimensions of the body from metallic carbides they have in view some important factors like: the method of enclosing as much as possible of the volume and shape of the bodies from metallic carbides into the volume and shape of the active part of the tamping tools; the utilizing of a large surface of the body from metallic carbides for assembling through hard paste process, so that it can be ensured the mechanical resistance of the assembling; the ensuring of a enough mechanical resistance of the bodies from metallic carbides at solicitations (stress) which are operated on the tine of the tamping tool; the establishing (choosing) of some bodies from metallic carbides which are easy to technologically made or as much as is possible the establishing of these bodies among the types made from producers, in the purpose to decrease the production cost; making of some minimal technical operations for processing of the bodies from metallic carbides for assembling of these. We have selected and tested some shapes and dimensions of the bodies from tungsten carbides G 40 which are presented in Fig. 2, 3, 4.

e) The identification and selection of the type of the hard paste alloy. The hard paste alloy for hard paste assembling is selected depending on: physical and mechanical properties of the paste alloy, in correlation with the requirements and solicitations (stress) from the hard paste assembling; indications and recommendations for use which are given by the producers; the technological hard paste process; the capacity for paste of the material tine of the tamping tool; the flowing and moistening properties of the hard paste alloy; the melting temperature; the reactivity toward the material tine of the tamping tool; the technological capacities of the producers; cost price. It can be use the paste alloy based on Ag like B Ag40ZnCdCu, B Ag45CuZn, B Ag70Cu Zn or B Ag48CdNi – STAS 8971. We selected and tested the paste alloy B Ag40ZnCdCu ($\sigma_r = 300 \div 400$ MPa, $\tau_r = 150 \div 280$ MPa). The flow for pasting is borax.

f) The disposing and positioning of the bodies from metallic carbides on the tine surfaces. The disposing and the positioning of the bodies from metallic carbides must be in accord with: the zones and surfaces which are most exposed to the wear, especially the abrasive wear; the covering a large part of the active surfaces of the tine which are stress at the wear solicitation; the obtaining of some efforts by shredding, torsion or compression in the paste assembling as a result of the solicitations on the bodies from metallic carbides; it must has in view that the bending or stretching solicitations are to be avoided (or reduced) in the case of paste assembling; the realizing of some minimum spaces between the adjoining bodies from metallic carbides, so as it can be reduced the additional solicitations, some of them with high values, because of penetration of some foreign bodies in these spaces, which are leaded to detaching; in the case of using a plane surface for paste it is recommended the positioning of the body from metallic carbides with the big side of the paste surface on the predominant direction of the solicitation (stress). We have used several constructive solutions which are presented in Fig. 2, 3, 4.

g) The utilization of some constructive solutions in the purpose to reduce the solicitations (stress) towards the assembling with hard paste alloy through realizing of some canals, holes, grooves s.a., in the body of the tine

(active part of the tamping tool), for to support the bodies of the metallic carbides on the directions of solicitations (stress) and taking over a part of the solicitations from assembling by the material of the tine (Fig. 5)

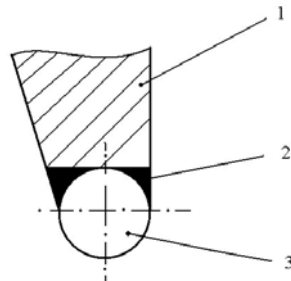


Fig. 5 1 – the base material of the tine (active part of the tamping tool; 2 – shoulders (thresholds) for support which are realized from material tine; 3 – cylindrical bolt from tungsten carbides

h) The utilization of some constructive solutions for to increase the surface of the assembling with hard paste alloy, in the purpose to increase the mechanical resistance of the assembling through the utilization of some geometrical shapes more complex than plane surface (cylindrical, cone, shaped forms s.a.).

i) In the some zone of the assembling with hard paste alloy because of technical difficulties or mistakes, it is possible to missing the hard paste alloy and it can lead to decreasing the mechanical resistance of the hard paste assembling and it can produce the detaching the bodies from metallic carbides.

j) For to increase the mechanical resistance of the hard paste assembling it is also necessary to paste the lateral surfaces of the bodies from metallic carbides which are in connection with the tine material of the tamping tool. It is also necessary to paste (to complete with hard paste alloy) the contact surfaces of the bodies from metallic carbides between them (Fig. 6).

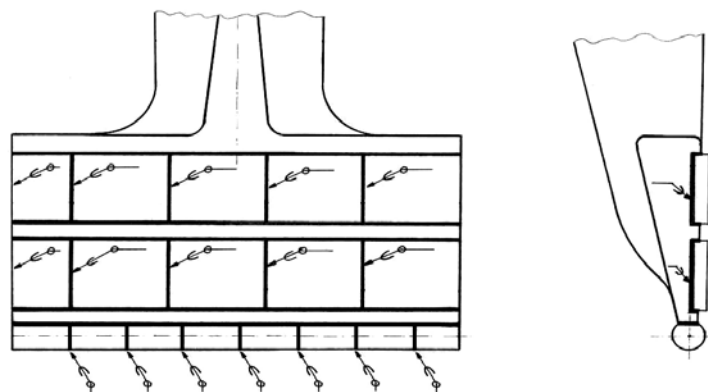


Fig. 6

With hard paste alloy it can also completed the adjoining spaces and zones between the bodies from metallic carbides and tine material of the tamping tool (Fig. 7). For to realize these objectives it is necessary in the course of the technological hard paste process to put the paste alloy below, between the bodies from metallic carbides and the tine material and also above the bodies from metallic carbides, so that through melting in the course of

the paste operation, the paste alloy is running and is filling all the emptiness and the adjoining zone of the paste surfaces.

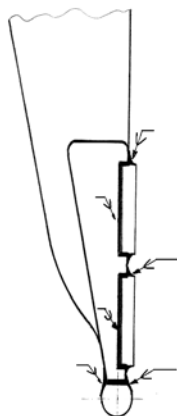


Fig. 7

k) the quality of the paste assembling is depending by the spade operations of the paste surfaces (mechanical operations for ensuring the precision of the dimensions, shapes, positions and the quality of the surfaces, cleaning and scaling the surfaces), utilization the flow for paste, accurate positions of the bodies from metallic carbides, the thickness of the paste alloy in the paste assembling, the conscientiousness of the operator s.a.

3. CONCLUSIONS

By experimentally covering with plates from metallic carbide of the tamping tools type P & T 09 – 32 CSM, using hard paste process (brazing), the obtained lastingness is until 270 % higher than the lastingness obtained in the present.

For the first time in Romania, we have obtained the first tamping tools having the active part (tine) plated with plates of metallic carbide through brazing [3].

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