STANDARDIZATION OF STRENGTHENING OF THE INTERNAL SURFACE OF CYLINDRICAL PARTS USING THE METHOD OF PLASTIC DEFORMATION

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ABSTRACT

Among the types of strengthening processing of details with a flat external, internal and external cylindrical surface, complex technological surface shape in mechanical engineering, the technological processes of plastic deformation are presented. The effect of plastic deformation on metals and the change in structure and increase in the strength of the detail have been theoretically studied.

Keywords: deformation, compressible surface, static impulse.

A number of research works [1] summarize the main processing methods and give examples of their effective use.

Basic information and classes of processing methods are given in works [2;7] about methods of reinforcing machine details. The parameters of the real crystal state of the surface layer structure of the processed surface, information about the formation and development of dislocations are given.

The description of the scheme of deformation strengthening of internal cylindrical surfaces with a diameter of no more than 100 mm is described in works [3]. In this case, the surface layer of the detail is treated in a static-impulse (wave) method, and an impact pulse is used as a stretching or pushing force. Its technological capabilities and performance evaluation method and energy requirements are presented. The turning method was used in static pulse processing of bushings made of steel 45 with technological parameters, and the technological possibilities of this method are presented.

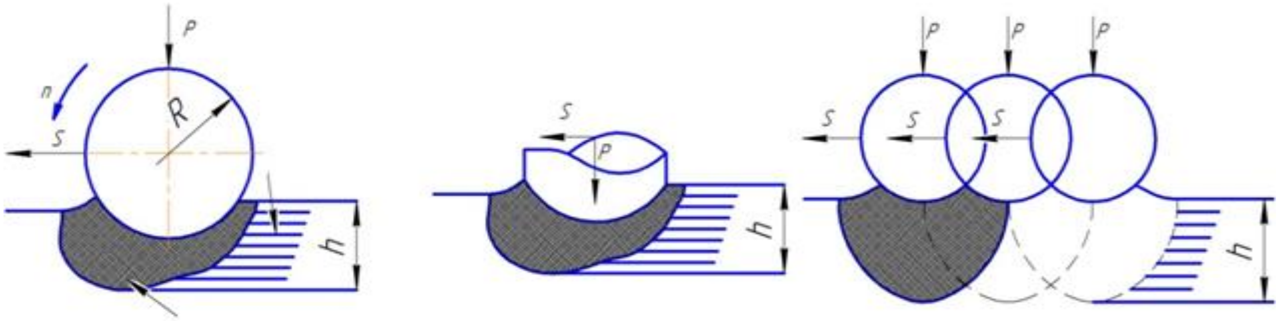
Final processing with pressure and adjustment of the surface microrelief of machine details, processing methods, research results are given, the equipment and tools used, the theory of the process of creating an orderly microrelief is considered, and the calculation of microrelief parameters is presented [4;6].

All available strengthening treatment methods are presented in the form of classification tables for the convenience of analysis. There, each method and its corresponding methods are sequentially arranged depending on the conditions of the process. Depending on the specific classification, they can be divided into two main groups depending on the purpose of use (Fig. 1). The first group includes methods that characterize the deformation of the surface microplane when tools move under friction and sliding conditions. This includes the methods of turning holes (smoothing, turning), grinding (with diamond, ruby, hard alloy plates) and electromechanical grinding methods, and works [5;3] are devoted to them. The methods of the second group are characterized by the deformation of the surface layer formed during the friction of surface micro-unevenness, forward-reciprocating movement, processing with continuous vibrating tools, and processing in the conditions of surface contact.

The roller and ball (beard) leveling method is most widely used in multi-series and mass production enterprises in the conditions of continuous connection of the surface to be processed with the tool [6;7].

The process carried out in the conditions of the connection of the tool and the processed surface is one of the most promising processes [6]. The additional movement of the tools on the normal and longitudinal processing surface is created with the help of ultrasonic, pneumatic and electromagnetic vibrators, eccentric mass, centrifugal force, etc. [7]. The reciprocating movement of deformable elements leads to the intensification of the machining process and the improvement of the quality of the processed surface in all cases of processing. Among the first methods, the most widely used in industrial enterprises are turning holes using a drill or lathe, grinding using diamond, ruby, and hard alloy plates.

The tapping method is mainly used for calibrating and reducing burriness of end-to-end and deep-cut cylindrical holes with a diameter of 50 mm and a length of up to 100 mm. During the plastic deformation of the surface, the metal is affected by the tool, its deforming elements (spindles, rollers, lathes, grinders) interact with the processed surface with the help of vibrations and displacements.



a) **b)** **v)**

Figure 1. Interaction between the processed surface and deforming elements: a - vibration, b - displacement, v - insertion.

During the vibration of the deforming element pressed against the surface with a force R, the surface of the oscillating body forms a local contact with the surface being processed. This leads to the formation of a center of plastic deformation transmitted by the tool (Fig. 2, a). At this time, the surface layer is deformed to a depth h, the spread and size of the deformation center depends on R - power, S - transmission, n - frequency of rotation, as well as the hardness of the processed surface material and other factors. During plastic deformation of the surface layer, surface roughness decreases, microhardness increases, residual compressive force is formed in metal surface layers. According to the displacement scheme (Fig. 2, b), deforming elements are used for grinding and turning.

Under the dynamic influence of the tool on the surface of the detail (Fig. 2, c), the deforming part (indenter) is inserted into the metal surface layer. The impact with the tool leaves a large number of local plastic marks on the surface, which gradually cover the entire treated surface.

Taking into account the above, all methods of processing with surface plastic deformation can be divided into three groups:

- based on grinding surfaces using a working tool;
- based on (static) rotation of the surface using a tool, with the tool in continuous contact with the detail;
- the detail is based on impact (dynamic) on the working part or tool.

We will fully consider the main technological methods of plastic deformation of the surface. The smoothing method is used for processing external and internal cylindrical surfaces. Grinding of the outer surface is done with grinders, and the inner surface is done with lathes or chisels. Consists of a grinder, a holder and a deforming element, which can be made of hard alloy plates or diamond. The best quality is achieved when grinding with a diamond. Diamond crystals are attached to their surroundings mainly by welding. Crystals weighing 0.08...0.18 g are used. The working surface radius of the diamond is 0.5...5.5 mm. The working surface of the field is smoothed. The grinder is pressed against the surface layer with a certain force R and causes friction on the surface to be processed, and performs a longitudinal movement with a transmission S, while the part rotates.

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