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QUALITY OF THE SURFACE LAYER IN BURNING DEEP HOLES OF SMALL DIAMETER

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Annotation
In presenting the results of a study of the effect of two-cycle flashing on the quality of the hole surface, the flashing efficiency is shown in comparison with other processing departments.

Keywords: mandrel, two-cycle mandrel, drilling, hole, roughness, qualities.

Annotasiya: В приведении результаты исследования влияния двух циклового доринвания на качествя поверхности отверстий показано эффективность дорнования по сравнению с другими ведали обработки.

Ключевой слова: дорн, двухциклавойдорн, сверления, отвертие, шереховатность, качества.

Introduction

The studies were carried out during the processing of holes with a diameter of 5 mm in blanks 20 mm thick, made of steels 10880 (HB = 1200 MPa) and 45 (HB = 2070 MPa) [4, 5], as well as holes with a diameter of 2 mm and a depth of 100 and 200 mm, which were performed in cylindrical blanks of steels 20X (HB = 1500 MPa) and 40X (HB = 2200 MPa) with an outer diameter of 40 mm (Figure 1.2) . Thus, blanks with D / d > 3 were used in all cases. Holes with a diameter of 1.2 mm (L / d ≈ 4) were obtained by drilling with standard twist drills on a 2G106P vertical drilling machine. Drilling was performed at a cutting speed of ~ 20 m/min with manual tool feed, which was approximately 5...10 mm/min . Holes with a diameter (L / d =50...100) were drilled with special twist drills on a screw-cutting lathe model 16B05AF10. To reduce the drift of the axis of the hole, the workpiece was centered , and drilling was carried out with a successive increase in the drill overhang [1] at a cutting speed of 20 m/min

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with manual feed equal to 4–8 mm/min. To lubricate and cool the drill, MP-7 liquid was used.

Hole burnishing was performed with single- tooth piercings made of VK8 hard alloy fig. 3. Processing was carried out using a device. The burnishing speed was 0.1 m/min. MP7 liquid was used as a lubricant for burnishing .

The mandrel tensions were adopted on the basis of the results of preliminary experiments and ensured hole accuracy close to the maximum achievable.

Measurements of the hole surface roughness parameters were made on an ISHP -210 profilometer after cutting the workpieces.

The diameter of the holes of the samples was d = 5 mm, the outer diameters samples D were 25 mm, which corresponds to the degree of thickness D/d=5. The length of the samples L was equal to 20 mm. The size of the chamfers f at the input and output ends of the samples was taken the same and changed from 0.25 to 1.5 mm, the chamfer angle was 45⁰ and 60⁰ for the experimental samples of the first batch and 45⁰ for the samples of the second batch.

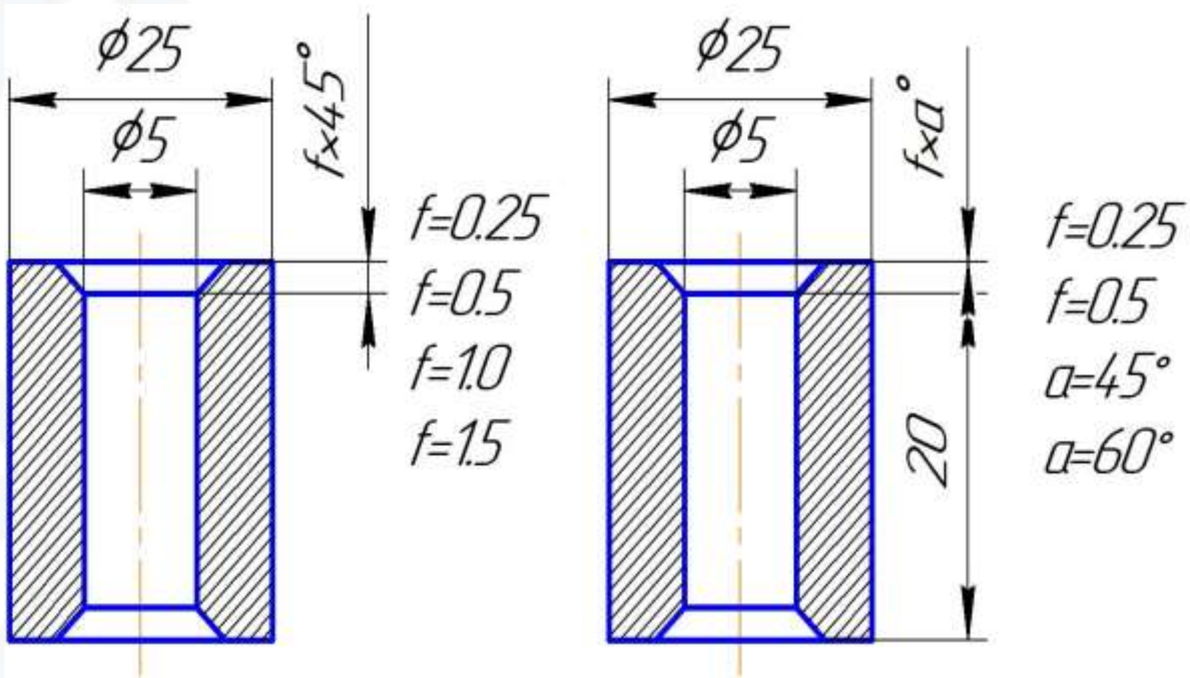

Figure 1 - Samples for the experiment

The samples were made on a DMG CTX 310 lathe. Holes were drilled in the samples using standard cylindrical shank twist drills of the medium series with a ground profile (GOST 10902-77). Drill diameter Ø5 mm, cutting material R6M5K5 [6 ,7],.

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Figure 2. - Experimental samples

were burnished with single-tooth mandrels made of VK8 hard alloy with an angle of working and reverse cones of 6° and a width of a cylindrical ribbon connecting them of 3 mm. This processing was carried out on a special device according to the compression scheme on a UME-10TM universal testing machine at a speed of 0.008 m/s.

Burnishing was carried out in one cycle with a relative interference a/d equal to 1.2% and 5.3% for the first experiment and 1.5% and 5.2% for the second experiment.

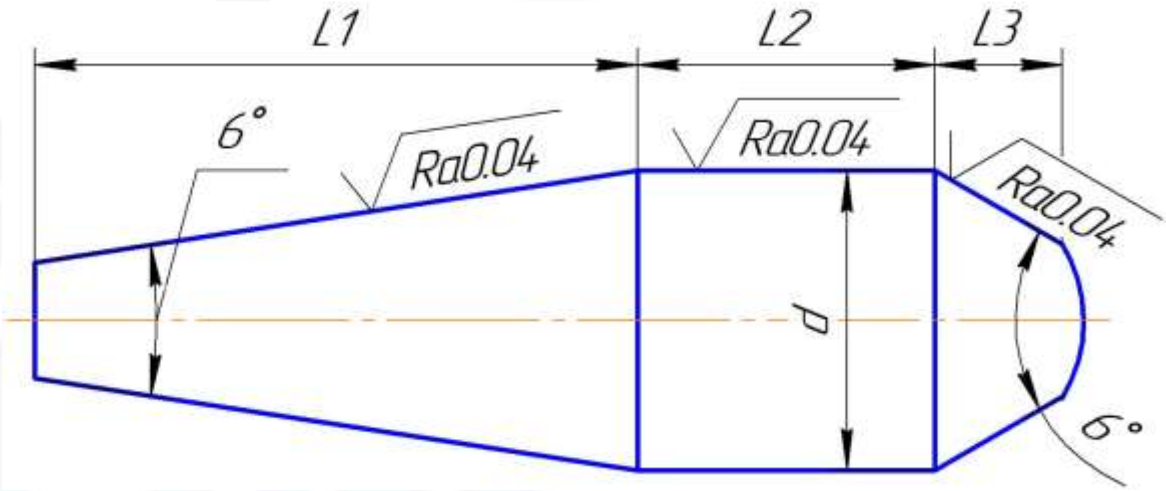

Figure 3 - Carbide Mandrel for Deep Hole Machining small diameter

As lubricants for burnishing holes liquid MP-7 was used.

Table 5.1

The values of the parameters of accuracy and surface roughness of the holes (d = 5 mm, L = 20 mm)

Material blanks	Operations	Average value of average diameter, mm	Standard deviation of average diameter, mm	Roughness parameter Ra , μm
Steel 10880	Drilling*	1.1758	0.01043	1...2
	Burnishing ** single- cycle	1.2213	0.00065	0.3...0.6
	Burnishing *** two-cycle	1.2387	0.00069	0.1...0.3
Steel 45	Drilling****	1.117	0.00615	1...2
	Burnishing ***** two-cycle	1.1735	0.0009	0.1...0.3

* - with a twist drill with a diameter of 1.17 mm;

** - diameter of the first firmware 1.221 mm;

*** - diameter of the first firmware 1.221 mm, diameter of the second firmware 1.2385 mm;

**** - with a twist drill with a diameter of 1.1 mm;

***** - diameter of the first firmware 4.9 mm, diameter of the second firmware 5 mm;

Chiseling , providing high hole accuracy (d = 1.2 mm), also allows to reduce the height of microroughnesses (roughness parameter *Ra*) by an order of magnitude. In this case, roughness is formed with a large relative profile reference length (Fig. 4), which has a high bearing capacity [2]. So, if after drilling holes in blanks made of steel 45, the relative reference length of the profile was about 5 %, then after a two-cycle burnishing with a total interference of 0.04 mm, it increased to 40%.

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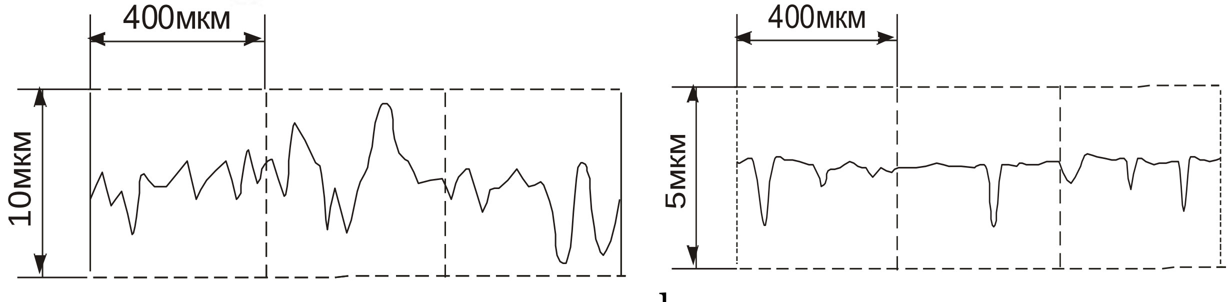

Rice. 4 . Surface roughness profilograms of holes with a diameter of 1.2 mm in blanks made of steel 45: a - after drilling; b - after two- cycle burnishing with a total interference of 0.04 mm

The results of studying the accuracy and surface roughness of holes with a diameter of 2 mm and a depth of 100 mm in blanks made of steels 20X and 40X after drilling and subsequent burnishing are given in Table. 2 . As follows from Table. 5.3, burnishing makes it possible to ensure high accuracy of the diameter of these holes - it increases from 11 *Ra*... R $_{max}$. At the same time, there are no traces of contact between the pusher of the firmware and the surface of the holes processed by burnishing .

T a b l e 2 hole surface roughness parameters
(d = 2 mm, L = 100 mm) after various operations

Workpiece material	Operations	Hole diameter, mm	Roughness parameters, microns	
			Ra	Rmax _
Steel 20X	drilling	2.03...2.12	3.4...11.5	28.9...71.0
	Dornovation four-cycle *	2.158...2.167	0.1...0.52	1.7...11.3
Steel 40X	drilling	2.02...2.07	0.54...2.5	3.3...27.0
	Dornovation three- cycle *	2.138...2.146	0.14...1.0	3.0...6.3

* diameter of the first, second, third and fourth insertions - 2.116, respectively; 2.136; 2.166 and 2.18 mm.

At the same time, it should be noted that the coarse and irregular surface roughness formed during drilling with a twist drill, large deviations from the roundness of the holes cause relatively high values of the height parameters of the surface roughness of the holes and their deviations from roundness after mandrelling . So, after drilling, deviations from the roundness of holes in workpieces made of 40X steel reach 40 µm, and after mandrelling - 7 µm and make up the majority of the error in the hole

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diameter. Therefore, in order to ensure higher accuracy and lower surface roughness of the holes during mandrelling , it seems advisable to drill them with single-cut carbide drills with internal coolant supply.

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