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ACCURACY OF MACHINING BORE BY END CUTTING TOOL

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Abstract

An axial tool in a real process makes a complex movement relative to the workpiece. Additional relative tool movements associated with deviations from the kinematic cutting pattern are the main factor determining the error of the machined hole. The deviation of the real axis of rotation of the tool from the axis of rotation defined by the machine spindle represents a precession, and the deviation of the diameter of the real hole from the size of the tool is a breakdown.The hole breakdown can be represented as the result of the complex effect of the precession of the tool axis and the natural vibration of the tool relative to its axis.The study showed that with an increase in cutting speed, the size of the breakdown of the hole first increases and then falls, both in the case of a spiral drill and in the case of a new one. In all cases, the size of the hole breakdown after drilling with the developed drill is less than after spiral processing in the entire studied range of speeds. This is due to the absence of a transverse edge and, as a consequence, a sharp decrease in axial forces of the projected drill. Axial forces, especially their difference, have a rather large impact on the accuracy of the resulting holes. The study of the effect of feed on the accuracy of the obtained holes showed that when processing all materials with increasing feed, the size of the hole breakdown also increases. In general, the size of the breakdown of the hole after applying the developed drill is less than that of the spiral. This difference increases with increasing feed and reaches 2 times when reaching a feed of 0.17 mm / rev.The article considers the issues of ensuring the accuracy of holes machined with a special drill and presents the results of studies with a standard drill.

Keywords: Spiral, drills, hole, axial tools.

1. Introduction

In general, the accuracy of machining is understood as the degree of correspondence of the machined part to its geometrically correct prototype or sample.Considering the accuracy of processing a particular part, distinguish:

1) the accuracy of the dimensions of the surfaces of the part in relation to the processing of holes, this corresponds to the size of the diameter of the hole and its depth;
2) the accuracy of the shape of the surfaces, for holes, by this we mean the degree of their correspondence to the geometrically regular surface of a circular cylinder, and in the cross section to a geometrically regular circle;
3) the accuracy of the relative positioning of the surfaces of the part when processing holes, it includes coordinate errors characterizing the location of the hole, the removal of the axis of the hole, deviation from the alignment of the location of sections of stepped or intermittent holes, etc. [3].

2. Materials and methods

Drilling relatively small holes in sheet materials is associated with certain difficulties that arise when inserting and exiting the drill from the material [1, 10-14]. When drilling, the sheet material experiences significant deformations along the axis of the drill and for processing a quality hole, it is necessary to choose the type of drill used and the shape of the sharpening of the cutting part.

Spiral drills are considered the most used tool for drilling. However, the most common among them are twist drills of small diameters, which are most widely used when drilling holes in sheet materials. The company National Twist Drill Co (USA) found that on average 90% of drills are in the diameters of 1.25 ... 12.0 mm and only 5% in dimensionally higher or lower than this interval. Characteristically, drills with a diameter above 19 mm made up only 1% of the total number of drills.

Although spiral drills are manufactured within fairly tight tolerances, they are not an accurate tool and are intended, in essence, for pre-machining holes. If we consider the working conditions of a spiral drill, then its cutting part consists of two elements that differ in the nature of the work - two main cutting edges and one transverse cutting edge. If the work of the main cutting edges is, in general, similar to the work of the cutting edges of other metal cutting tools, then the mechanism for removing material with a transverse edge is extremely complex [1]. As you approach the center of the drill, the work of the transverse edge becomes more like the work of a blunt wedge-shaped indenter, pressed into the material being processed. In this small area, severe deformation of the material displaced into the chip grooves takes place. As a result of this, almost half of the axial force of the drill with diameters up to 12 mm falls on the transverse cutting edge, the length of which is determined by the thickness of the core of the drill.

3. Results of study

A design of a spiral drill with a special sharpening of the cutting part (Patent the Republic of Uzbekistan No. 0595. Drill. BI №. 2, 2002) for the conditions for drilling holes in sheet materials [2] was developed at the Department of Engineering Technology of Tashkent State Technical University. The dynamics of drilling with drills with a special V-shaped sharpening of the cutting part due to the absence of a transverse cutting edge is determined by the gradual incision of the peripheral part of the drill with the formation of a truncated cone in the center of the hole. The uniform distribution of the radial components of the cutting forces holds the drill stem in the strictly axial direction, which ensures the conditions of self-centering after several revolutions of the tool.

Based on geometric analysis and experimental studies, it was found that with a V-shaped sharpening of the cutting part of the drills, the effective rake angle is significantly improved even compared to V.I.Zhirov's undercut.

V-shaped sharpening of drill bits improves hole accuracy and reduces vibration. The construction of the drill is shown in fig.1. [4]

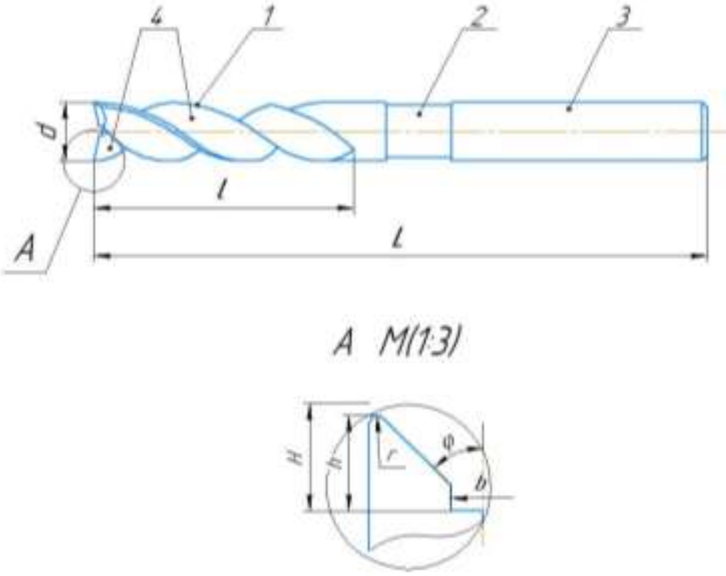

FIGURE 1. Drill for processing holes in sheet materials: 1-working part, 2-neck, 3-shank, 4-chip cutting grooves, 5-two grooves.

In order to determine the possibilities of using the developed drill, we studied the accuracy of hole machining when drilling sheet materials of steel - 3, with a thickness of t = 1 mm and duralumin grade - D16 with a thickness of t = 5 mm with drills from high-speed steel P6M5, with diameters of 9, 13 and 22 mm and compared with hole accuracy with machined standard drills.

Drilling was carried out on a model 2P135 vertical-drilling machine with cutting conditions: n = 1200 rpm S = 0.12 mm / rev, for all drill diameters. After drilling the holes, a measurement was made along the x n y axis in two sections using a Vernier caliper with a division value of 0.01 mm. Then determined the average error of the hole for each investigated diameter of the holes.

FIGURE 2. Shown a diagram of measuring the accuracy of holes in two mutually perpendicular diameters. [1].

The average hole error was determined by the formula:

$$\Delta d = ld_y - ld_x \tag{1}$$

The results of the study showed that when drilling with a newly developed drill, the process is more stable (without burrs and residual burrs, when the drill leaves the hole) and the manufacturing accuracy is increased compared to standard drills (table 1,2).

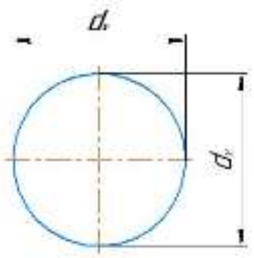

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FIGURE 2. Diagram for measuring the hole after drilling: d_x-deviation from the correct cylindrical shape: in the horizontal direction, in mm; d_y- deviation from the correct cylindrical shape in the vertical direction, in mm.

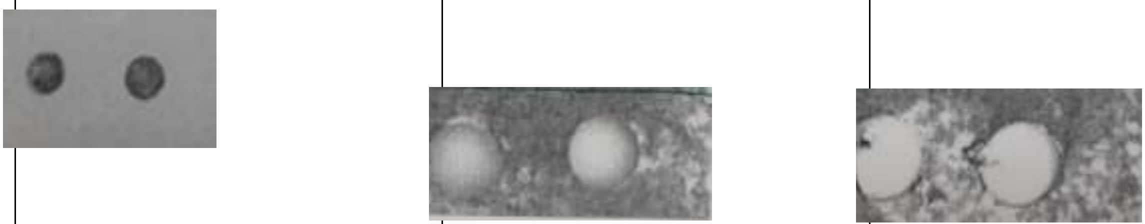
The research results are shown in table 1 and 2.

№	Processed material	Drill diameter in mm	Special drill				Standard drill			
			d_y1	d_x1	d_y2	d_x2	d_y1	d_x1	d_y2	d_x2
1	Duralumin D16	22	21.90	21.95	21.89	21.96	22.15	22,20	22,18	22,25
	Steel-3		21.95	21.96	21.98	21.94	23,72	23,99	24.09	23,50
2	Duralumin D16	13	13.10	13.12		-	13,21	13.51	13,0	12,95
	Steel-3		13.08	12.95	12.93	13,05	12.88	12,91	12,71	12,92
3	Duralumin D16	9	9.53	9.30	9.40	9.35	9,47	9.36	9,50	9.39
	Steel-3		9,25	9,15	9.20	9.16	9.45	9.42	9,43	9,42

TABLE 1

Diameter Ø	Special drill		Standard drill	
	Δd1	Δd2	Δd1	Δd2
9	0.23	0.05	0.11	0,11
13	0,02	-	0.30	0,05
22	0,05	0,07	0,05	0,07
Average	0.10	0,06	0,153	0,076
Total average error Δ	0.08		0.115	

TABLE 2



a) b) c)

FIGURE 3. General view of the “heel” (a); the appearance of the hole at the exit of the drill (b) after drilling with a special drill; (c) a standard drill. The processed material is sheet steel D16, a drill Ø 13 mm from P6M5.

Figure 3 shows photographs of the shape of the holes at the inlet (Fig. 3, a) and at the outlet (Fig. 3, b) of a new drill and at the output (Fig. 3, c) of a standard drill.

In view of the foregoing, drilling holes in sheet materials is associated with certain difficulties when inserting and exiting the drill from the material. Significant deformations along the axis of the drill (buckling of the material to be processed when the drill exits the hole, burrs and burrs, etc.) do not allow a quality hole to be obtained, and require additional processing, such as locksmithing. Fig.3 a shows the “heel” obtained when a special drill emerges from the hole, and in Fig. 3 into the external view of the hole when drills exit the holes made with special and standard drills, respectively.

4. Conclusion

1 Analysis of the schemes, sharpening of drills showed that the design of drills with a V-shaped cutting part can be operated according to traditional schemes on existing equipment.

2 The process at the beginning of hole processing with new drills is more stable and occurs without deformation of the workpieces.

3 The accuracy of hole processing with new drills is 40-60% higher than with hole processing with traditional drills.

5. Referances

[1] Denisenko V.I. The study of the geometry of the drill in the area of the transverse edge and its effect on the drilling process. Abstract of thesis M., 1966

[2] Alikulov D.E., Umarov T.U. RUz patent No. 0595. Drill. BI No. 2, 2002

[3] KholmogortsevYu.P. Optimization of hole processing processes.
M.: Engineering, 1984. -1 84 p., Ill.

[4] Umarov T.U., Alikulov D.E. Improving the quality of processing holes in thin-sheet composite materials. Composite materials, 2002, No. 2. with. 42-43.

[5] Bashkov V.M., Katsev P.E. Testing the cutting tool for durability. Moscow, Mashinostroenie 1985 year.-135 page.

[6] Reliability and efficiency in technology. Handbook in ten volumes. T. 7 Quality and reliability in production. Ed. Acad. Appolonova I.V.- M. Engineering, 1985 year.-280 page.

[7] Reference technologist-machine builder. In two volumes, vol. 2, ed. 4 break and add. under the editorship of Kosilova A.G. and Mescheryakova R.K. M., Mechanical Engineering, 1985 year.-495 page.

[8] Umarov T. Improving the efficiency of hole machining with drill bits with mechanical fastening of carbide inserts: Abstract. Dis. non search.Degree Cond. tech. sciences. - Kiev, 1990

[9] Reichmist R.B. Function Charts. M., Higher School.-1991.

[10] Khaet G.L. Reliability of the cutting tool.M., Mechanical Engineering, 1968.

[11] Sultanova, Sh. A.,Safarov, J. E. Experimental study of the drying process of medicinal plants. International Journal of Psychosocial Rehabilitation. Volume 24, Issue 8. 2020. P.1962-1968. DOI: 10.37200/IJPR/V24I8/PR280216

[12] Sultanova, Sh. A.,Safarov, J. E. Development of a solar water heating convective unit for drying medicinal plants. International Journal of Psychosocial Rehabilitation. Volume 24, Issue 8. 2020. P.1956-1961. DOI: 10.37200/IJPR/V24I8/PR280215

[13] Safarov J.E., Sultanova Sh.A., Aït-Kaddour A., Samandarov D.I., Jumayev B.M. Optimal option drying silkworm cocoons with preserving qualitative indicators. International Journal of Advanced Science and Technology.Volume 29, №9s. 2020. pp.2099-2104.

[14] Safarov J.E., Sultanova Sh.A., Samandarov D.I., Jumayev B.M., ZulpanovSh.U.Analysis of drying equipment for drying products.International Journal of Advanced Science and Technology.Volume 29, №9s. 2020. pp.2105-2109.