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PASS-THROUGH PEAKLESS SABER CUTTER

The disadvantage of the processing method on existing machines by traditional processing is the lack of a design of a pass-through lathe with a weak point – the top, which is a source of instability of the shape properties and surface quality of the shaft being processed.

Finishing with a pass-through peakless reciprocating cutter on a machine with an inclined axis, provided by the use of a device for transmitting rotation to an intersecting axis, thereby achieving efficient high-performance processing of shaft-type workpieces with a reciprocating cutter. The result is achieved by adopting a special processing scheme with an axis tilt. During the grinding process on the proposed lathe, the contact point of the cutter and the workpiece is constantly moving along the cutting edge of the cutter, which reduces the roughness of the surface to be processed, reduces the heating of the cutter, increases the heat sink from the cutting zone. The proposed turning method and cutter will improve processing performance and tool durability. The use of finishing turning of workpieces of the «Shaft» type with an inclined axis is economically profitable in mass and large-scale production.

Keywords: processing, turning, quality, cutter, peakless tools, through, saber.

Introduction

One of the directions is the development of scientifically-based methods to improve the productivity and accuracy of processing, including the design of metal-cutting tools [1–4].

Cutters are the most common type of metal-cutting tool. They are used on lathes, boring, carousel, revolver, planing machines, semi-automatic machines.

Depending on the type of machine and the work performed, various cutters are used, which are classified by:

- type of processing;
- the nature of processing;
- installation is relatively;
- feed direction;
- head designs;
- body cross-section;
- constructions;
- the material of the working part.

The disadvantage of the processing method on existing machines by traditional processing is the lack of a design of a pass–through lathe with a weak point – the tip,

which is a source of instability of the shape properties and surface quality of the shaft being processed, low productivity when grinding workpieces such as shaft, rod, sleeve due to increased wear of the tip of the cutter with the concentration of mechanical and thermal stresses near the top of the lathe through-pass incisor [5–13].

Materials and methods

It is proposed to carry out processing on a metal-cutting machine with adjustable or inclined axes of the spindle and tailstock for processing through-through with a peakless reciprocating cutter [14] parts of the «Shaft» type in serial and large-scale production. When processing with a reciprocating cutter, the point of contact of the cutter and the part during the longitudinal movement of the reciprocating cutter is constantly changing, which helps to reduce the processing error and increase accuracy.

The proposed design of the machine [15], the turning method and the proposed cutter allow to increase the productivity and durability of the tool. The machine contains a calculated eight-speed gearbox, the range of which is from 220 to 2500 rpm, with additional cylindrical and conical gears for changing the angle of inclination of the spindle axis in the range from 0° to 15°, a modified tailstock design, the tilt of the axis of which is adjustable in the range from 0° to 15°, a modified design of the tool holder for fixing a special saber cutter at an angle of 45°, a special leash chuck for transmitting rotational motion to the intersecting axis and at the same time to eliminate the difference in the angles of inclination of the axes of the spindle and the workpiece.

At the same time, the smooth operation of a special leash chuck is provided by a toothed coupling with barrel–shaped teeth, and self–installation is due to the introduction of a spherical carbide center, which is installed in the machine spindle (Figure 1), where 1 is the workpiece; 2 is a peakless saber cutter; 3 is a special leash chuck.

Efficient high-performance processing of «Shaft» type workpieces with a reciprocating cutter is provided. As a result of the fact that a special processing scheme with an axis tilt has been adopted, in which, during the grinding process on the proposed lathe, the contact point of the cutter and the workpiece constantly moves along the cutting edge of the cutter. This is done at the expense of the proposed processing scheme with a pass-through peakless saber cutter. The constant change of working sections of the cutting edge of the cutter reduces the roughness of the treated surface, reduces the heating of the cutter, increases the heat sink from the cutting zone.

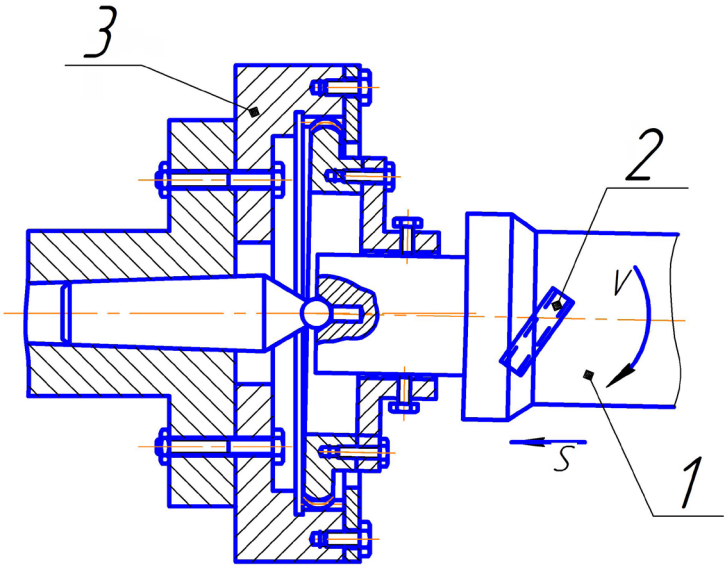

Figure 1 – Motion transmission device on the intersecting axis

As a result, it is possible to increase some parameters of cutting modes. The use of a turning method and a lathe with an adjustable tilt of the spindle axis and the tailstock allows for high-performance processing of workpieces with an inclined axis with a reciprocating cutter, increase the cutting speed, durability of the cutters, and reduce the roughness of the surface to be processed.

Results and discussions

The main features of the processing method are as follows: the workpiece on the machine is installed at an angle to the horizontal axis; the tilt of the workpiece axis is achieved by using a gearbox with an adjustable position of the spindle axes and tailstock; the tilt of the spindle axis is achieved by using a spindle position adjustment unit in the gearbox; in the spindle axis position adjustment unit, conical gears with perpendicular axes of rotation are used; changing the position of the tailstock pinole axis is achieved using a special bracket; to transfer rotation to the intersecting axis, a leash chuck with a toothed coupling is used; the position of the workpiece axis and its self-installation in the leash chuck is ensured by the use of spherical centers; a special tool holder is used to secure the saber cutter.

Figure 2 shows a diagram of turning a long shaft 1 with a through-hole reciprocating cutter 2, moving along the axis of the workpiece 3, performs a lightweight sliding (the effect of moving the saber) cutting with an axis tilt at an angle of τ and the point of contact with the workpiece is moved along the cutter blade, which improves the durability of the cutter and the quality of processing.

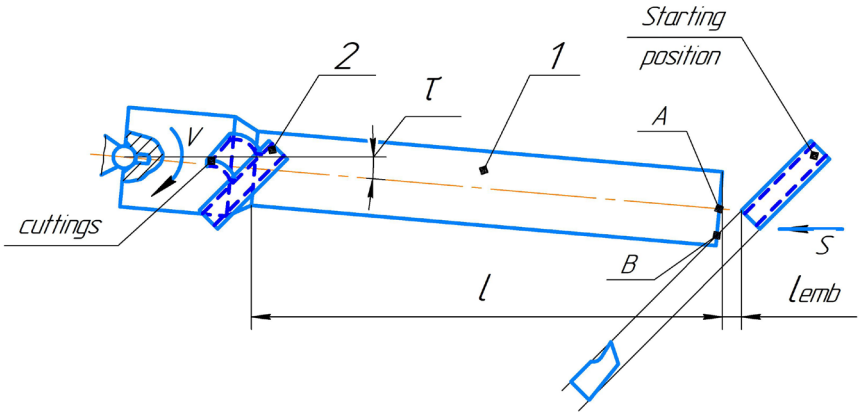

Figure 2 – Processing scheme of a long shaft with a through-hole reciprocating cutter

Figure 3 shows the design and geometric parameters of the turning through–hole reciprocating cutter in projections and indicates: 1 – through–hole reciprocating cutter; 2 – cutting edge; 3 – carbide plate; 4 - front surface; L - length of the cutter; B – width of the cutter; H – height of the cutter; a – width of the rear surface; b is the width of the front surface; α is the rear angle; γ is the front angle; τ is the angle of inclination of the incisor base.

The design of the through-hole reciprocating cutter and the processing scheme provide a significant reduction in the heating of the cutter in the cutting zone, increasing the durability of the cutter and cutting speed. The lower heating of the cutter of the proposed design is ensured by the fact that the working section of the cutting edge constantly moves along the length of the cutting blade (cutting edge); the main and auxiliary cutting edges form a half–space–they are located at an angle of 180°, i.e. they form one line - the cutting edge; in the cutting process, due to the curvature (cylindrical surface) of the cylinder being processed, the cutting edge on the incoming section plays the role of the main cutting edge, on the descending one – the auxiliary cutting edge (Figure 3).

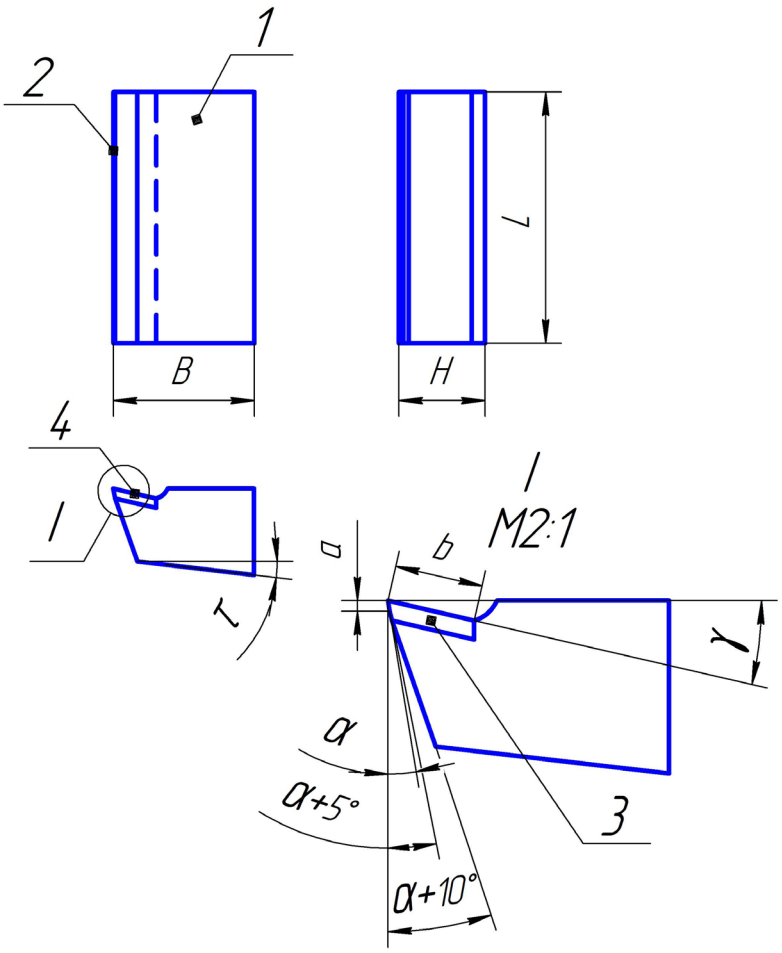

Figure 3 – Design and geometric parameters of a rotary through-hole reciprocating cutter

The inclination of the main cutting edge in the range from 0° to 90° allows you to reduce the height of the micro-dimensions on the treated surface due to the effect of a «cleaning blade» in projection on the forming part of the treated cylinder. The cutter has a cutting and fixing parts. The fixing part in the cross section has the shape of a wedge.

Conclusions

The rotary reciprocating reciprocating cutter does not have a prototype among the turning cutting cutters, since it is designed so that its cutting edge is located not in the transverse, but in the longitudinal direction, i.e. along the holder. This arrangement of the (main) cutting edge dramatically increases the cross-sectional area for heat removal from the cutting zone, which helps to reduce the level of thermal stress in the working area of the cutter, and also increases the strength of the cutting wedge (reduces the level of mechanical stress) and the reliability of the cutter.

Thus, the finishing treatment of the outer surfaces with a pass-through peakless reciprocating cutter provides:

1 During the grinding process on the proposed lathe, the contact point of the cutter and the workpiece is constantly moving along the cutting edge of the cutter.

2 Constant change of working sections of the cutting edge of the cutter reduces the roughness of the treated surface, reduces the heating of the cutter, increases the heat sink from the cutting zone

3 The use of finishing turning of workpieces of the «shaft» type with an inclined axis is economically justified in mass and large-scale production.

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ӨТПЕЛІ ТӨБЕСІЗ ҚЫЛЫШТЫ КЕСКІШ

Дәстүрлі өңдеу арқылы қолданыстағы машиналарда өңдеу әдісінің кемшілігі – өңделген біліктің пішіні мен бетінің сапасының тұрақсыздығының көзі болып табылатын әлсіз нүктесі – шыңы бар өтпелі жону кескіш конструкциясының болмауы.

Қиылысатын оське айналуды беру үшін құрылғыны қолданумен қамтамасыз етілетін көлбеу осі бар станокта жоғары білікті кескіш кескішпен әрлеу, осылайша білік түріндегі дайындамаларды жоғары өнімді қылышты кескішпен тиімді өңдеуге қол жеткізіледі. Нәтижеге осьтің көлбеуі бар арнайы өңдеу сұлбасы қабылдангандығымен қол жеткізіледі. Ұсынылған жону білікте тегістеу кезінде кескіш пен дайындаманың түйісу нүктесі кескіштің кесу жиегі бойымен үнемі қозғалады, бұл өңделетін беттің кедір-бұдырын азайтады, кескіштің қызуын азайтады, кесу аймағынан жылу шығаруды арттырады. Ұсынылған жону әдісі және кескіш өңдеу өнімділігі мен құралдың төзімділігін арттыруға мүмкіндік береді. Көлбеу осі бар «Білік» түріндегі дайындамаларды түпкілікті өңдеуді қолдану жаппай және ірі өндірістерде экономикалық тұрғыдан тиімді.

Кілтті сөздер: өңдеу, жону, сапа, кескіш, төбесіз кескіш, өтпелі, қылыш.

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ПРОХОДНОЙ БЕЗВЕРШИННЫЙ САБЕЛЬНЫЙ РЕЗЕЦ

Недостатком способа обработки на существующих станках путём традиционной обработки является недостаток конструкции проходного токарного резца со слабым местом – вершиной, которая является источником нестабильности свойств формы и качества поверхности обрабатываемого вала.

Чистовая обработка проходным безвершинным сабельным резцом на станке с наклонной осью, обеспечиваемый применением устройства для передачи вращения на пересекающуюся ось, тем самым достигается эффективная высокопроизводительная обработка сабельным резцом заготовок типа вал. Результат достигается тем, что принята специальная схема обработки с наклоном оси. В процессе обтачивания на предлагаемом токарном станке точка контакта резца и заготовки постоянно перемещается вдоль режущей кромки резца, что снижает шероховатость обрабатываемой поверхности, уменьшает нагрев резца, увеличивает теплоотвод из зоны резания. Предлагаемые способ точения и резец позволят повысить производительность обработки и стойкость инструмента. Применение чистовой токарной обработки заготовок типа «Вал» с наклонной осью экономически рентабельна в массовом и крупносерийном производствах.

Ключевые слова: обработка, точение, качество, резец, безвершинные инструменты, проходной, сабельный.

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