

DEVELOPMENT OF BLOCK-MODULAR CUTTING TOOLS FOR CNC MACHINES

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Modular tool systems, including the types of tool modules, mechanisms for fastening of modules, tool systems for multi-purpose processing have been analysed, which has allowed us to determine current trends in the design and production of tool systems. The design schemes of various types of block-modular cutting tools are considered and the designs of a cutter and countersink for their application on CNC machines "Robodril" are proposed.

Introduction. A large reserve for improving the efficiency of mechanical engineering is put in creating a rational system of tool support for domestic enterprises based on the experience of leading foreign companies, such as Sandvik Coromant (Sweden), Mitsubishi (Japan), Iscar (Israel), Hertel (Germany), and others.[1] The systems proposed by the companies provide for the design of a wide range of cutting tools with unified design elements for each type of tool, the use of advanced technologies for their production, including the application of wear-resistant coatings on the blades, development of recommendations for the operation mode of cutting tools taking into account the properties of processed and tool materials, diagnostics and repair of tools during operation. This approach to the tool supply of enterprises allows to reduce the range of cutting tools, to increase their service life and, ultimately, to reduce material and financial costs for the design, production and operation of cutting tools. [2, 3]

Main part. Currently, the Department of Technology and Equipment of Machine-building Industry is working on the design and manufacture of block-modular cutting tools for CNC milling machines of the company Fanuc.[4, 5].

Distinctive features of the tools for these machines are the use of cone shanks of the Japanese standard JIS B6339 and limited overall dimensions of housing modules.

Figure 1 shows the design diagram of the end mill for a CNC milling machine. The tool blocks 1 are installed in the holes of the housing module 2. The blocks are attached to the housing module using a clamp consisting of a thrust pin 3 and a threaded pin 4. The housing module with attached tool blocks is mounted on a shank 5 and clamped with a screw 7. Face keys 6 prevent the housing module from turning and make it rigid. The cap fitting 8 is screwed into the shank to tighten the cutter into the machine spindle.

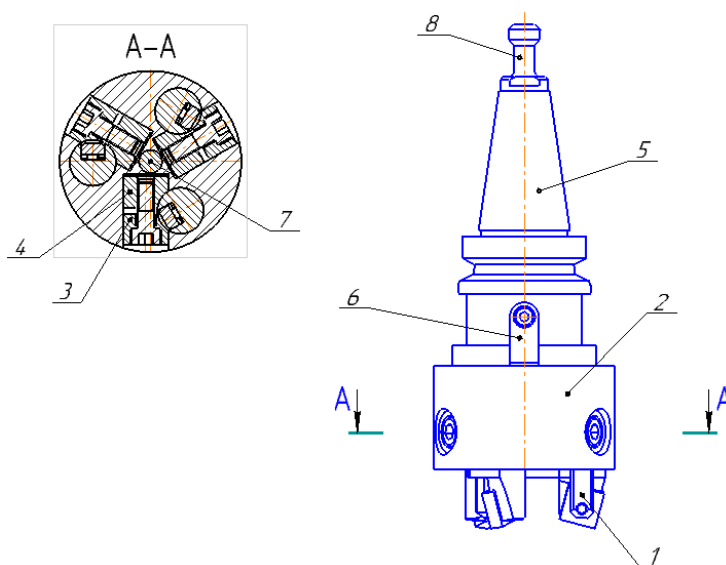


Figure 1. – Design diagram of the end mill

Fig. 2 shows a 3D model of the end mill design.

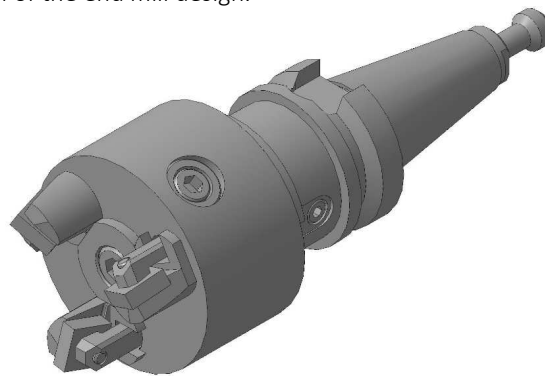


Figure 2. --3D model of the end mill design

A design diagram of a countersink for a CNC milling machine (Fig. 3) includes tool blocks 1, which are installed in the holes of the housing module 2. The tool blocks are installed in the housing module at an angle of 15° , which allows you to process blind holes and get a groove with a 90° angle. The blocks are fixed in the housing module using a clamp consisting of a thrust pin 3 and a threaded pin 4. The housing module with fixed tool blocks is mounted on the shank 5 and clamped with a screw 7. Face keys 6 prevent the housing module from turning and make it rigid. The cap fitting 8 is screwed into the shank to tighten the countersink into the machine spindle.

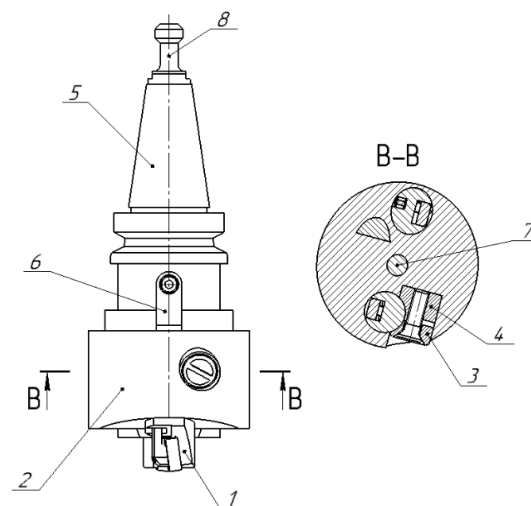


Figure 3. - structural diagram of the countersink

Fig. 4 shows a 3D model of the countersink design.



Figure 4. – 3D model of the countersink construction

Conclusion. The considered construction diagrams of various types of block-modular cutting tools and the proposed design of the cutter and countersink for their application on CNC machine tools "Robodril", the distinctive features of which are: shank B30, and the minimum possible size of the tool blocks, which made it possible to produce a face mill and countersink $\varnothing 63\text{mm}$ in diameter and the number of tool blocks equal to 2-3 pieces.

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