THE STUDY OF THE MILLING HEADS ROMASCON BY 3D MODELING

GHEORGHE-BOGDAN URDEA[1], VLAD-ALEXANDRU FLOREA[2], IOSIF DUMITRESCU [3]

Abstract: The milling heads with cutting teeth in the form of tools are used only for front milling. A larger use have the milling heeds having metal carbide plates, The Romascon willing heeds are based on the idea that by different positioning, the cutting edge for cutting and sharpening, avoiding sharpening tooth by tooth and is replaced by cylindrical, conical or helical grinding, made continuously, with large diameter abrasive discs. The positioning of the tools with the conical tail for cutting or for sharpening is done by rotating theme in the body of the milling. In the paper it is presented the construction of the willing head Romascon, their 3D modeling and the positioning of the tools for sharpening.

Keywords: milling heads Romascon, 3D modeling, sharpening

1. INTRODUCTION

The milling heads are large mills, with removable tooth, used in the processing of the flat surfaces. They can be have different constructive forms, depending on their destination, consisting of a basic body, made of steel for construction of molded from steep, possibly from light alloys, in the case of very large dimensions a not removable cutting teeth, with cutting edges from rapid steel, meted carbrides or mineral- ceramic materials.

The milling heads work with higher productivity than the other types of milling and in parallel it has the advantage that only the cutting teeth are made of special materials, which can be changed very easily after wear.

From a constructive point of view, the willing, heads can be:

- with rapid steel blades or reinforced with metal carbide plates;
- with rapid steel tools or reinforced with metal carbide plates;

[1] *Lecturer, Ph.D. Eng., University of Petroşani,urdeagh@yahoo.com*
[2] *Lecturer, Ph.D. Eng., University of Petroşani, vladalexandruflorea@gmail.com*
[3] *Assoc.prof., Ph.D. Eng., University of Petroşani, iosif_dumi@yahoo.com*

- with metal carbide plates directly brazed to the body or mechanical fixed;
- with mineral-ceramic materials plates by mechanically fixed.

At the milling heads with cutting teeth in the joke of a blade, the active part of the tool (the blades) is fixed in the base body by serrated, conical nails of pressing pieces in the force of pressing parts at the cutter body to close with one or two screws.

The milling heads with cutting teeth in the force of tools are used only for front milling. The tools can have a prismatic or circular section. A larger use have the milling heads having tools reinforced with plates metal carbides plates. Mills, with removable teeth reinforced produced by specialized companies, have the advantage of a large number of resharpening, but they have the disadvantage that the sharpening is done with specialized equipment, tooth by tooth, restoring the cutting qualities requires 4-5 hours.

Mills with metal carbide plates, directly brazed to the body eliminate the disadvantage, but they have the disadvantage of a reduced member uses and an irrational consumption of hard alloy.

2. CONSTRUCTION OF MILLING HEADS ROMASCON.

The milling heads Romascon, the name originating from the words Romania, sharpening and continuous, combines the advantages of the two classes of mills presented previously (with removable teeth and plates directly brazed to the body), in that the sharpening and restoring of the cutting qualities are realized on universal sharpening machines, with a maximum duration of 30 minutes, the large number of resharpening ensuring a rational use metal carbide plates. These mills were first manufactured in our country by a team for the Technical University, „Gheorghe Asachi" from Iași, under co ordination of Professor Dr. Eng. V. Belousov.

The milling head Romascon shown in figure 1 consists of a revolution body 1 provided with the positioning - fixing part (Morse con, ISO cone, bore), in the front of the body are practiced a member of truncated grooves, in which mount the tools with the conical tail 2 (fig. 1,a) fixed by nuts 3 and washers 4. On the front of the milling body there are channels, in which the pins 5 are positioned pressed in the body of the tools, corresponding to the position of the face that is sharpened or for work.

At the Romascon front milling head, the axis of the conical tail tool can be parallel (fig. 1.b) or inclined to the axis of the milling body with an angle (15-20^o) to inward (fig 1.c). In the case of the Romascon corner milling head the axis of the tool with conical tail is inclined to the axis of the body with an angle (15- 45^o) to outside.

The milling heads Romascon are used to the processing of open plan surfaces and the Romascon corner milling Heads for the processing of plan surfaces intersected under an angle of 90^o (thresholds). The constructive geometric parameters are defined in relation to the constructive reference trihedron, composed of:

- the basic plane which is on axial plane passing through the point considered M, on the cutting edges;

- the place of the cutting edge, tangent plane to the cutting edge and perpendicular to basic plane;
- the normal plane, perpendicular plane both on the base plane and on the plane of the cutting edge and passing through the point by considered on the cutting edge.

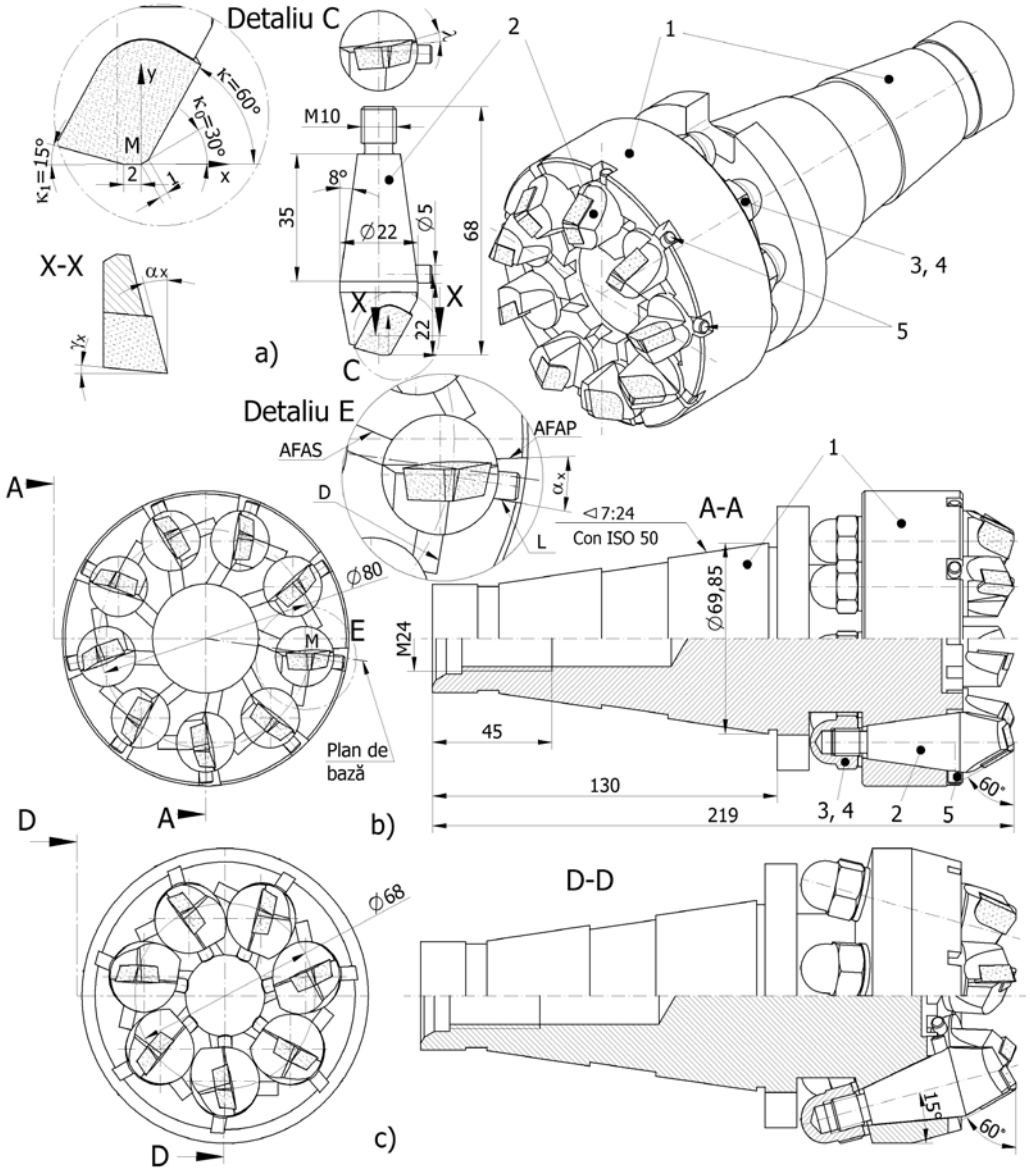

Fig. 1. The milling heads Romascon

The angles of a tool, are the obtained:

- the main attack angle κ and the auxiliary attack angle κ_0 (fig.1, detail C) are obtained from the correct positioning for beating the plate on the body of the removable tool and sharpening with the pin in the AFAP position (fig. 1, Detail E);

- the rake angle γ_x and the angle of inclination of the cutting edge λ and obtained by the correct positioning with respect to the base plane of the plate in order to brazing on the body of the removable tool and sharpening with the pin, in position D (fig.1 Detail E);

- main settlement angle α_x and auxiliary settlement angle at obtained after sharpening the main and auxiliary settlement faces, with the pin in the AFAP in the working position, and after-sharpening them the tool will rotate with are α_x angle, in the working position L (fig. 1, Detail E);

- the secondary angle of attack κ_1 and the corresponding angle of position on this cutting edge are obtained by positioning the pin when sharpening in the AFAS position.

The setting angle on the cutting edges is obtained by sharpening the positions: AFAS, at the milling heads with the axis of the toot inclined to the axis of the body; AFAP, at the milling heads with the axis of the tool parallel to the acts of the body; AFAP, at the corner milling heads.

3. 3D MODELING THE ROMASCON MILLING HEADS

For 3D modeling of the body of the milling head Romascon with the help of the solid Edge software was made the sketch of figure 2.a, with the dimensions of a tool cone 7:24-50, STAS 7381- 81, on the left and on the right the shape and dimensions of the active part are presented. At the small end of the cone is made the M24 threaded hole with a depth of 45 mm for axial clamping in the main shaft of the milling Machine, (fig. 1.b and fig. 2.b), At the big base of the cone is the disc with the diameter of 100 mm and the thickness of 12 mm, which is provided with two recess with the width of 25,7 mm and the depth of 15 mm for transmitting the drive moment from the main shaft to the milling head.

In the front part of the milling head body are made nine conical bores with the 8^o semicircular bores arranged the equidistant on a circle of 80 mm(fig, 1.b).

At each conical bore, there are provided three recess for positioning the tool pin at the cutting and sharpening.

Figure 2.c shows the development for 3D modeling of the body of the milling head Romascon.

Figure 3.a shows the sketch for making the body of the tool with the conical tail, having half-angle of 8^o, the threaded and of M10 for tightening in the body of the milling head.

On the cylindrical end of the tool are make the surfaces of fir active part of the foot body and the hole for positioning the metal carbides plate. (fig. 3.b) On the side of

hole is positioned the bore for mounting the tool positioning gain in the body of the milling head.

The position of the axis of the bore for the pin must be correlated with the position of the hole of the plate to achieve the constructive angles of the tool (fig. 1.a).

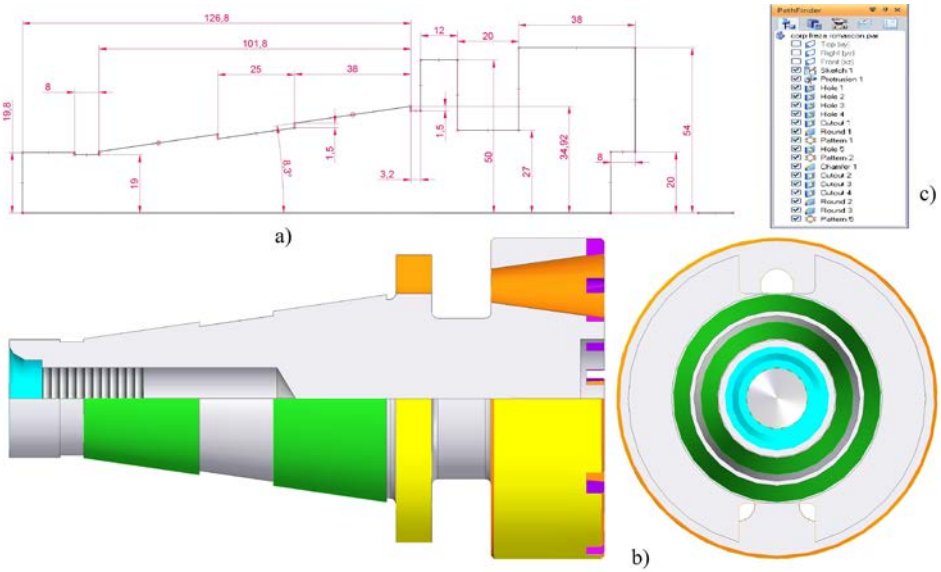

Fig. 2. 3D modeling of the body of the Romascon milling head with the axis if tools parallel to the axis of the body

Figure 3.c shows the development for 3D modeling of the body of the tool with conical tail.

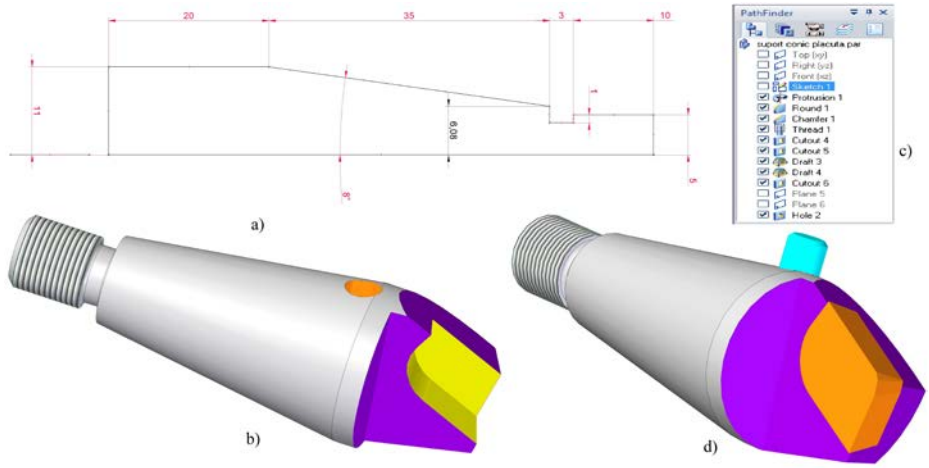

Fig. 3. 3D model of the tool reinforced with metal carbide plate and conical tail

Figure 4 shows the 3D model of the Rovascon milling head with the axes of the tools parallel to the body axis, where they were noted: 1 - the body of the welding head; 2 - tool with comical body and metal carbide plate; 3 - plane washer; 4 - blind nut M10.

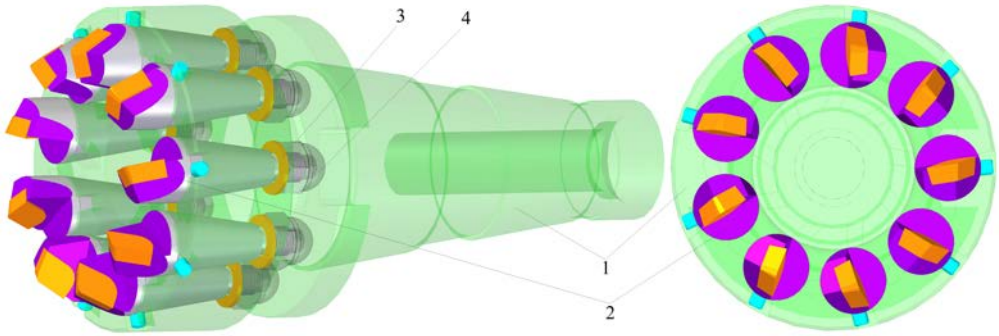

Fig. 4. 3D model of the Romascon milling head with the axes of the looks parallel to the body axis

4. SHARPENING MILLING HEADS ROMASCON.

Romascon milling heads wear occurs in the form of variable length wear facets on the faces of the main settlement, auxiliary and passage (Rivkin-Kolesov) respectively, the recess surfaces.

The resharpening must be performed when the maximum width of the wear face reaches 1 mm on any cutting edges.

The resharpening consists in removing the wear faces from it all surfaces. In order to sharpen it is necessary to position the pins (pressed into tools) in the front channels of the milling body, corresponding to the surface that is sharpened. Sharpening of the milling begins or ends with the equalization of the recess faces continuing with the other surfaces depending on the type of the Romascon milling head, namely:

a) Romascon milling heads with tool axis inclined to body axis (fig. 1.c): sharpening the main settlement face; sharpening faces sitting on the cutting edges of passage; sharpening faces auxiliary sitting: sharpening faces secondary settlement.

b) Romascon milling heads with tool axis parallel to body axis of the milling head (fig. 1.c): sharpening the settlement faces on the cutting edge of passage; sharpening the main settlement faces; sharpening the auxiliary settlement faces, sharper ring the secondary settlement places.

c) Romascon corner milling heads: sharpening the secondary settlement pices; sharpening the main settlement faces, sharpening faces on the cutting edge of passage, sharpening the auxiliary settlement faces.

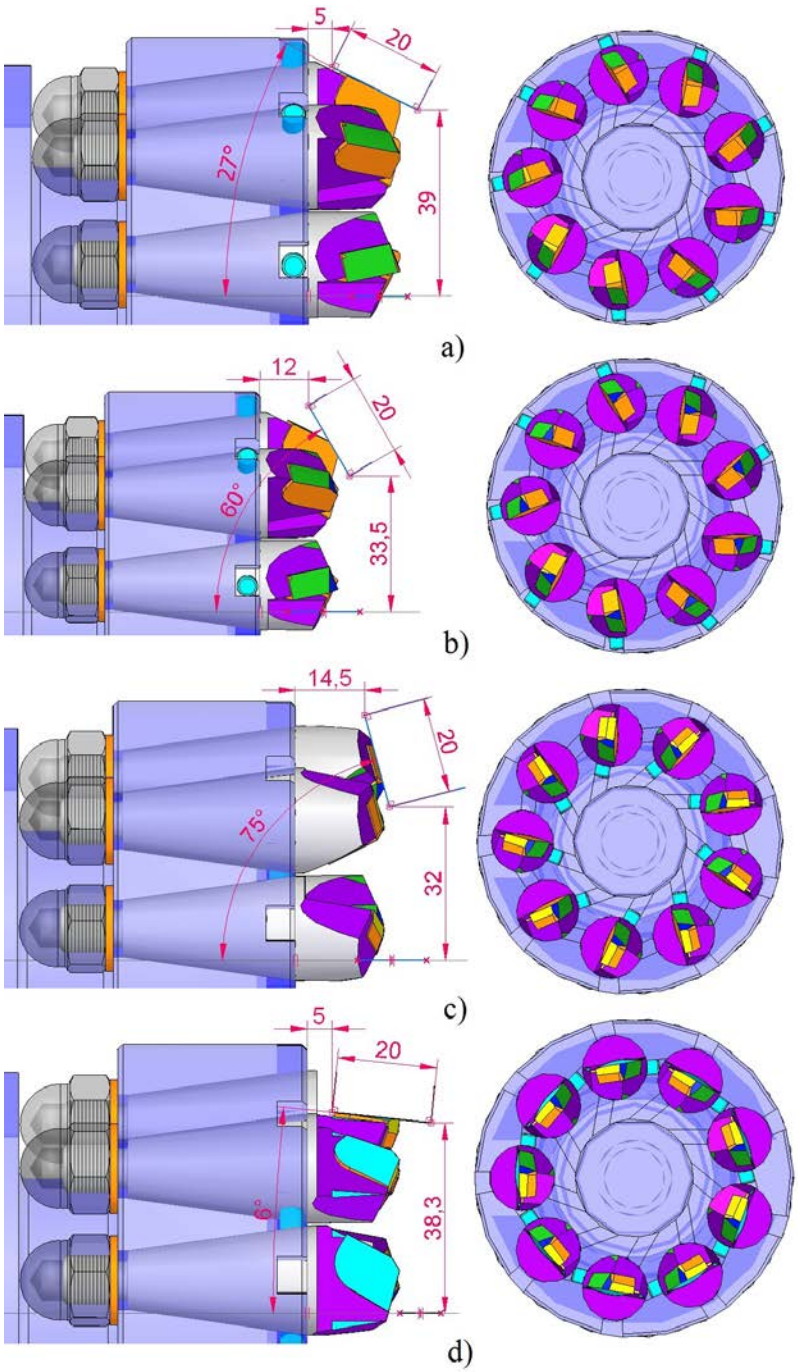

Fig. 5. Sharpening schemes for the Romascon milling heads with the axis of the tool parallel to the axis of the body of the milling head

The sharpening can be realized on universal machines for sharpening, equipped with a device to realize the rotational movement of the mill, on universal machines for grinding or on semi-automatic machines for sharpening milling heads.

In order to obtain the corresponding quality of the surfaces of the sharpened hard plates, abrasive discs of black carbide or green carbide of silicon, of the hardness girls K40 - K60 will be used.

The cutting regime at the sharpness is as follows: peripheral speed of the abrasive disk (20-30) m/s; tangential speed of the milling cutter (30-40) m/min, advance (60-200) mm/min; depth of the out layer 0,1 mm.

Next we will present the sharpening schemes for the Romascon milling heads with the axis of the tool parallel to the axis of the body of the milling head, which are shown in figure 5.

After adjusting the parameters of the sharp sitting regime, it is checked that the rotational directions, the milling head and the abrasive disc are selected so that the abrasive disc rotates to cover the surface of the recess or settlement from the main cutting edge in back, and the mill rotates according to the same rule, which is necessary to avoid the prejudice of the main cutting edge of the hard plates.

For the sharpening of the main settlement faces, the pins are positioned in contact with the AFAP (sharpening of the main settlement faces) wall in the front of channel of the milling head body (fig.1, Detail E). For achieving the main attack angle $\kappa = 60^o$ it is necessary that the generator of the abrasive disk to form with the axis of the milling head an angle of 27° and the positioning of the abrasive disk to have the dimensions from figure 5.a. on the left, and after the sharpening result the main settlement faces, presented in the figure 5.a. right.

The sharpening of the auxiliary settlement faces are made with the pins also in the AFAP position, the angle between the abrasive disk generator and the milling head axis being 60°, and the abrasive disk positioning is made according to the dimensions the figure 5.b. left and after sharpening the result settlement faces auxiliaries shown in figure 5.b. right.

The sharpening of the secondary settlement faces is achieved by positioning the pins in the channel market with AFAS (sharpening the secondary settlement faces) in the body of the milling head (fig.1, Detail E). For achieving the secondary attack single of $\kappa_1 = 15°$ it is necessary that the generator, of the abrasive disc to form an angle 75° with respect to the axis of the milling head, and the positioning of the abrasive disc is made according to the dimensions of figure 5.c. left, and after sharpening the secondary settlement faces result, shown in figure 5 right.

Sharpening of the recess faces is done by positioning the pins in the channel market with body of the milling head (fig.1, Detail E). For a corresponding sharpening the generator of the abrasive disc makes with the axis of milling head an angle of 6°, and the positioning of the abrasive disc is made according to the dimensions of figure 5.d left, and after the sharpening results the recess faces shown in figure and right. The sharpening is completed when all the cutting recess are cut on a minimum width of 2 mm, the width measured starting from the main cutting edges.

5. CONCLUSIONS

Today it is unanimously recognized that the production of material goods quality at the parameters prescribed by the designer and requested by the user is possible only through a joint effort of the producers, who must have advanced technological equipment, of high precision.

By excellence, the milling tools are part of the technological systems for mechanical cutting and equip all types of machine tools, from the universal to specialized and with numerical control. The quality and accuracy of the cutting tools depends directly on the quality of the products made by these technologies, their precision of execution, the productivity and the cost price, in a word the performances and the competitiveness of the products.

By using the 3D modelling at the study of the milling heads Romascon is achieved an easy understanding of the constructive solution, of the use of the milling head and of the and of the way of sharpening them. It also, allows to establish the geometric shape of the active part of the tool with the cylindrical tail and the rapid design of the different dimensions of milling heads and cutting geometric according to the technological cutting requirements.

By simulating the sharpening milling heads Romascon it is possible to determine precisely the position of the locking channels of the tool pin for achieving the required geometry for the active part of the tool. Also, the technical characteristics dimensions, positioning angles, etc. can be established for the design of devices for gripping and positioning the milling heads on the universal grinding machines or on the universal sharpening machines.

REFERENCES

[1.] **Dumitrescu, I.** (2016) *Proiectarea sculelor aşchietoare, Îndrumător de laborator*, Editura Universitas, Petroşani.

[2.] **Dumitrescu, I., Florea V.A.** (2018) *Desen tehnic industrial, utilizând soft-uri CAD*, Editura Universitas, Petroşani.

[3.] **Jula D., Urdea G.B.** (2017) *Toleranţe, ajustaje şi starea suprafeţei: teorie şi aplicaţii*, Universitas Petroşani,

[4.] **Mihailide M., Croitoru I., Cozmîncă M.,** *Scule aşchietoare. Concepţie, proiectare, utilizare***,** format pdf, disponibil la http://www.musif.mt.tuiasi.ro/echipa/mmihailide/mmihailide.html

[5.] **Minciu, C., ş.a.** (1995) *Scule aşchietoare, Îndrumar de proiectare, vol. 1*, Editura Tehnică, Bucureşti.