Special reamers

There is a wide category of special reamers, ie non-standard, that are suitable to address particular problems encountered in the finishing holes, both for maintenance of individual pieces and for mass production.

Reamer with descending cutting edges

This type of reamer is used quite often in the finishing holes. They are characterized by a strong helix angle left (for right-reamers cut) that can be as high as 60° and 2 cutting edges.

The stock removal to leave by these reamers is about 0.2 mm to diameter 10 mm and 0.3 mm to diameter 18 mm.

With this type of reamer it's possible to maintain tolerances of 0.01 mm and to obtain a surface like a mirror.

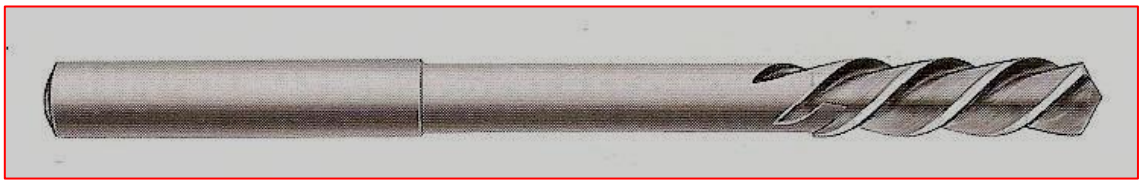

Figure N°1 – *Reamer with descending cutting edges in carbide (Cerin)*

Usually these reamers, which can be in high speed steel or carbide, have a slightly conical chamfer long about as a pitch of the helix. The sharpening is done on the front face for almost the entire length of the helix.

The front clearance angle varies depending on the material being processed. For soft materials such as aluminum and soft steel angle may be 5 ° - 10 °, while for cast iron the angle is reduced to 0° or some degree negative.

Working conditions strongly influence both on the level of surface finish of the hole and is on its accuracy.

Generally you can have the following results:

- *With the refrigeration with oil emulsified surface is not good, that is more opaque.*
- *Cast iron is machined with a jet of air.*
- *Soft steel is a material difficult to work, and if the surface is wavy, or not good, you can gradually reduce the front rake angle until it becomes negative of 2° - 3°.*

Refrigeration affects not only the level of the roughness of the surface but also the diameter of the bore. For example, we have the following trends: emulsified oil produces a smaller diameter, while pure cutting oil increases the diameter of 0.005 to 0.01 mm.

This phenomenon also occurs with changes of the processed material: working soft steel the dimension is increased, working on certain types of aluminum, size will be reduced .

The reason for this lies is in the structure of the material and its more or less pronounced tendency to deform elastically. So, in some case you need to find the exact diameter of reamer through some preliminary tests.

Adjustable reamers

The use of standard rigid reamers forces the companies to have a special tool for each diameter and each tolerance.

In addition, the recovery of a reamer worn out it's possible only by use of a lower diameter, which is not always easy and convenient.

For this reason, the workshops that are dedicated mainly to various processes, not standard, they feel the need to keep in stock a limited range of tools adjustable to cover the full range of dimensions and tolerances.

The adjustable reamers, according to the constructive criterion, are distinguished: expandable reamers solid construction and adjustable reamers with inserted blade.

In any case, the edges are straight for the construction problems that have helical ones, at most can have a very small helix angle.

Expandable reamers

They consist of a piece with a cavity made elastic by longitudinal grooves.
The expansion is achieved with a taper pin screwed axially and, depending on whether you want to work through holes or blind holes, you can take the two solutions schematically in figure # 2 and # 3.

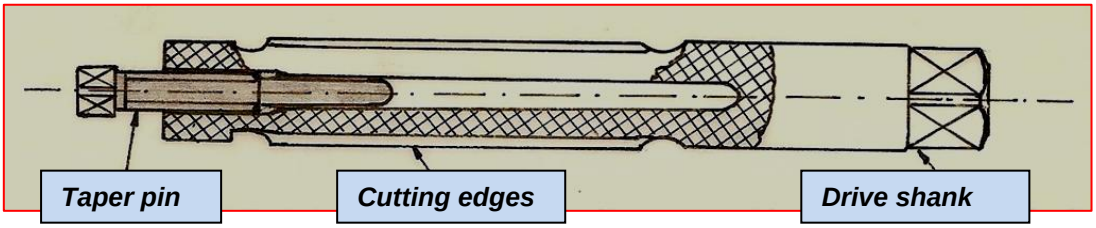

Figure N°2- *Expandable reamer for through holes (manual)*

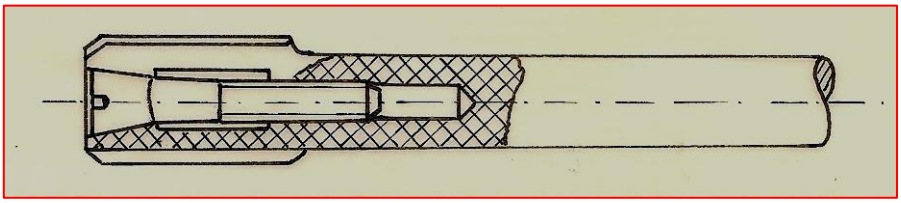

Figure N° 3 - *Expandable reamer for blind holes (usable on machine tools*)

This type of reamer has the advantage of a relatively cheap price and is used primarily for rework in the assembly and repair work which needs to increase the hole of a few hundredths of a millimeter. In fact they can make adjustments only to the order of a few hundredths of a millimeter.
The range of diameters can be from 5 mm to about 50 mm for larger diameters using reamers expansion sleeve, similar in concept to those described. The expansion is controlled by two that put forward a internal cone.
This last type of reamer is used more and more frequently

Figure N°3 - *Some adjustable expansion reamers (Polytool - Ridix)*

Adjustable blade reamers

The adjustable blade reamers are made up of a body carrying a series of blades and its clamping parts.

The blades slide on the guides inclined from the axis so that sliding determines the variation in diameter.

Also in this case there are two solutions: with shank (cylindrical or conical) and sleeve with a tapered bore of 1:30.

The solution with shank is suitable for diameters up to 50 mm, while the sleeve goes up to 100 mm.

The range expansion in these types is much higher than the elastic expansion type : the expansion can be 1 mm for 10 mm diameter, and up to 4 mm for 50 mm diameter of the reamer.

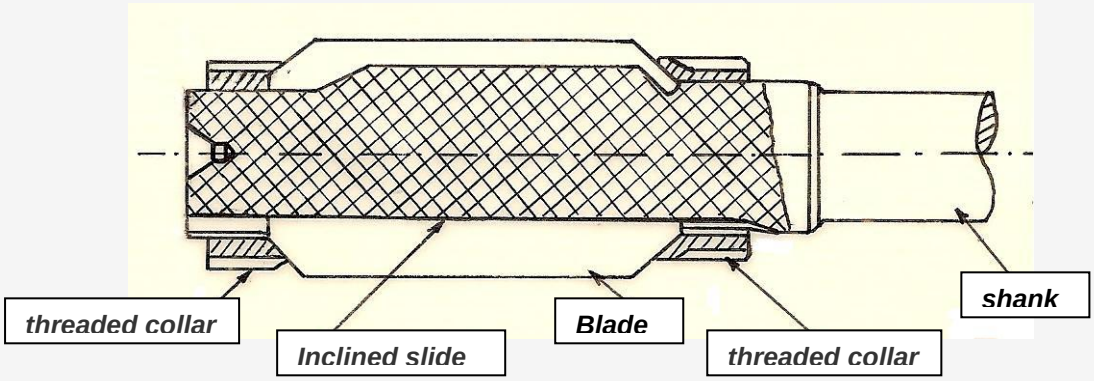

Figure N°4- *Adjustable blade reamers shank type*

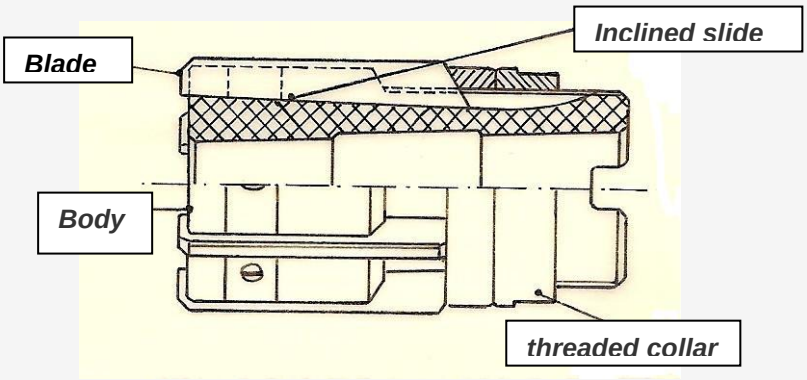

Figure N°5- *Adjustable blade reamers sleeve type*

Oscillating assembly for reamers

To allow some lateral movement and swing in order to promote alignment spontaneously in the hole or bush driving, we sometimes take the so-called floating (oscillating) assembly. The reamer can work well without suffering any alignment errors due to not correct centering of the workpiece or the wear of certain parts of the machine.

This type of assembly is required in particular for finishing on the turret lathes or multi-spindle lathes, where the natural wear that occurs in slides or guides may, after a certain time, to vary the position of the reamer spindle which needs to be coaxial with the bore. Without the use of oscillating spindle hole would get a larger diameter at the entry of the bore.

To achieve the same results have been designed the oscillating reamers.

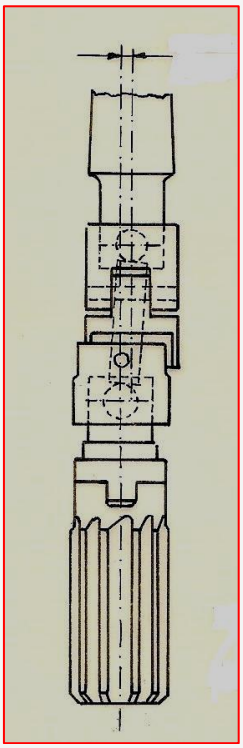

Figure N°6- *Oscillating assembly for reamers*

Oscillating reamers

The edges of these reamers are two and they can be adjusted in the sense that the diameter can be increased or decreased within certain limits (approximately 1 mm for diameters up to 19 mm). Moreover, they are not rigidly fixed to the body but can move freely in the direction perpendicular to the axis.

The use of this type of reamer is particularly suitable when you want to get reamed holes that have the highest roundness and cylindricity of the hole and high degree of surface finish.

They also have peculiarity of a fine enough adjustment of the diameter that compensates the wear of the blades and also working with a single type of reamer for different diameter that would otherwise require more reamers with fixed blades type.

Another great advantage is that you can replace the blades when they are worn.

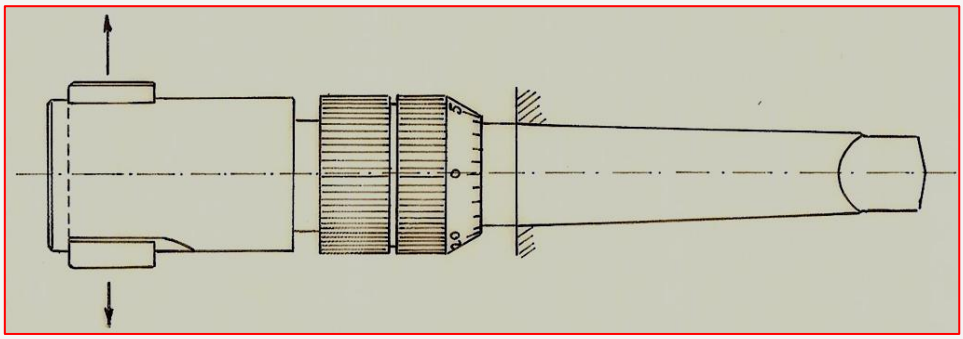

Figure N°6 – *Oscillating reamer*

The blades can be in high speed steel or carbide. The blade adjustment is made by turning the graduated ring that screws on a fine pitch thread obtained on the reamer body. This adjustment can be performed with tool mounted in the machine tool.

Single cutrting edge reamers

These reamers, made entirely of carbide (diameter up to 10 to 12 mm) or with only the front part of carbide (for larger diameters), they differ considerably in terms of operations, from conventional reamers.

They are based on the principle of ensuring maximum possible guide at reamer in order to avoid deflection, ovality, etc..

They are designed with only one edge while the rest of the body is cylindrical with the same diameter as measured on the cutting edge.

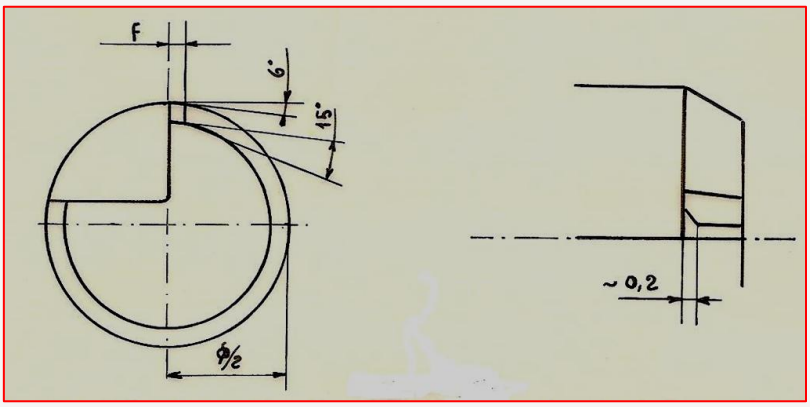

Figure N°7 - *Rake angles of a single cutting edge reamer*

The cutting edge is formed by a main edge in the chamber f large from 0.3 to 0.5 mm with a relief angle of 6 ° followed by another secondary relief angle of about 15 ° which serves to pass on the bevel of the guide. In this way the area immediately rear of the chamfer is in a lower position compared to the cutting edge of about 0.2 mm.

Thus the only point with an effective relief is the cutting edge of the chamfer, while the rest of the body, entering into the bore, has a great guide action.

A major advantage of these reamers than multi edge reamers, is also in ease of re-sharpening because this operation can be performed even in an approximate way, without danger of run-out or other anomalies of the bore.

There is also the advantage of having a constant diameter even after a lot of sharpening, something not possible with standard reamers, because the main small cylindrical edge , is subject to rapid wear.

The single edge reamers also allow to obtain diameters strictly constant operating also on different materials.

The angle of chamfer and working conditions (cutting speeds, feeds, stock removal etc..) are about the same as those for the normal reamers.

A very big limitation, and you can tell the only one, derived from the guide area so extensive (about 3 / 4 of the entire circumference) ie the possibility of easy welding material in this area. The cooling and lubrication should be abundant, well managed, abundant and uninterrupted, preferably carried out with internal ducts carrying the coolant in the cutting area.

If you even briefly interrupted the flow of oil there would be an increase of temperature across the initial part of the reamer, due to the heat generated by the cutting action and by friction between the cylindrical body and bore.

This increase of temperature causes an increase of the reamer's diameter and then a further increase of temperature, until you reach the real-fitting hole with the reamer break some.

If you even briefly interrupted the flow of oil there would be an increase in temperature across the initial part of the reamer, due to the heat generated by the action of cutting and by friction between the cylindrical body and bore.

This increase in temperature causes an increase in the diameter of reamer and then a further increase in temperature, until we reach the breaking of the tool.
It remains to say that, as the undercut lower than overall capacity of the flutes of a normal reamer, there is a danger, especially on blind holes and rather deep, which the chips obstacle cutting action and the passage of the lubricant, facilitating the breakage of the edge .
For diameters over 10 to 12 mm the cylindrical guide is divided into two or more longitudinal grooves that serve to facilitate cooling and lubrication.

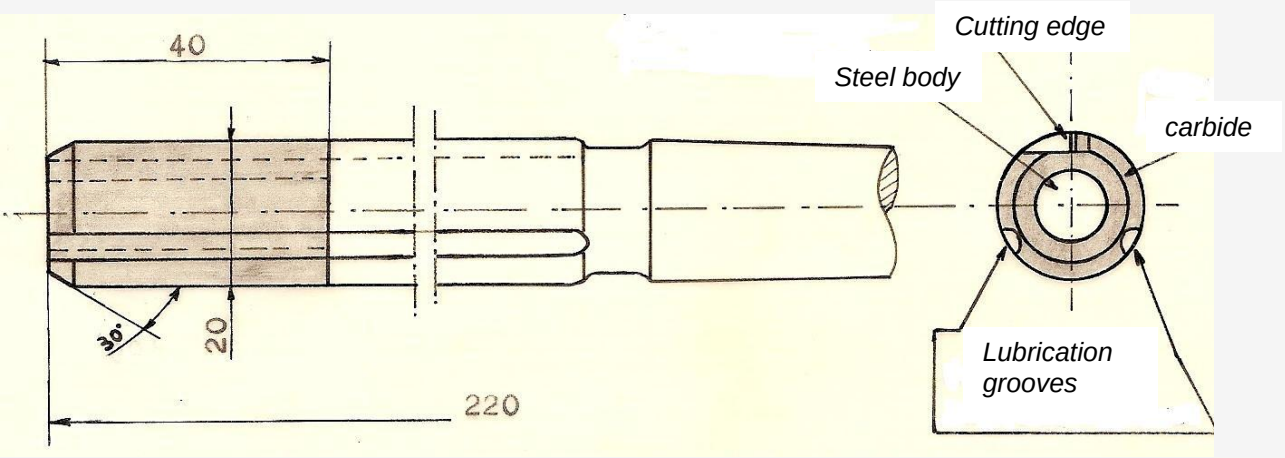

Figure N°8- *Single cutting edge reamer*

This category includes also insert reamers. The cutting insert is clamped mechanically in the body. In this case, the guide action is ensured by two or more carbide segments welded to the body . Of course, the cutting blade is almost in carbide and coating by TiN or others types of films. One of the leading companies in this sector is Mapal (Germany).
Figure N° 9 shows some types of special reamers including single cutting edge type.

Figure N° 9 - *Selection of special reamers manufacturing by Mapal*

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