Resharpening of the twist drill bits

To get a good performance from a drill bit the sharpening must be done correctly, this means that all the angles and the lengths of the edges must be exactly as established and will not occur during the grinding edge of the material structural modifications.
To execute the correct sharpening are therefore required special equipment and dedicated grinding machines.
The geometric elements to consider are:

- *Point angle* φ
- *Lip relief angle* α
- *Length of cutting edges*

The control of the angle φ and of the length of the cutting edges is done with a small and simple gauge such as shown in figure N° 1 or with a precision optical equipment.
In many cases, however, these equipments are not sufficient, for example, when the diameter is very small.
Just think that there are twist drill tips with a diameter from 0.1 to 0.2 mm, where it is difficult to see with the unaided eye the helical flutes. In these cases are required special microscopes equipped with measuring reticle.
During the construction phase, which is normally done by automatic machines, the control of these little points, is done automatically by passing the drills under a microscope that sends the image to a computer that does the comparison between the theoretical and the actual shape , rejecting those tools that are out of tolerance.

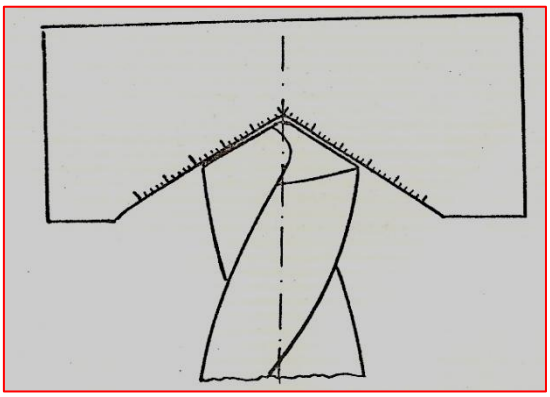


Fig.N°1 – *Small and simple gauge for to check the resharpening of twist drill bits*

If the cutting edges have different lengths or inclination, there are anomalies on the bore shown in figure N° 2.

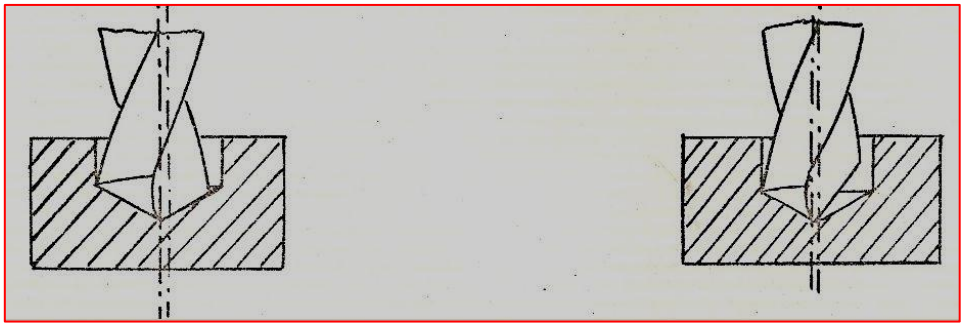
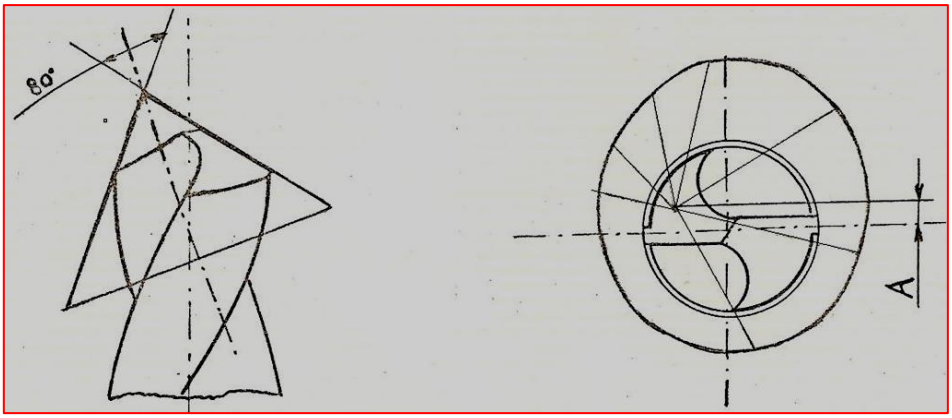


Fig.N°2- *Errors on the bore caused by resharpening irregularities*

Order to give a lip relief angle a growing trend towards the center are used sharpening machines Cawi Spiral.

In this case the re-sharpening cone has the axis that does not coincide with the axis of the drill.



N°3 – *Scheme of sharpening by method Cawi-Spiral*

The distance "A" between the axis of the cone and the one of drill is almost always equal to 1/10 of the nominal diameter of the drill.

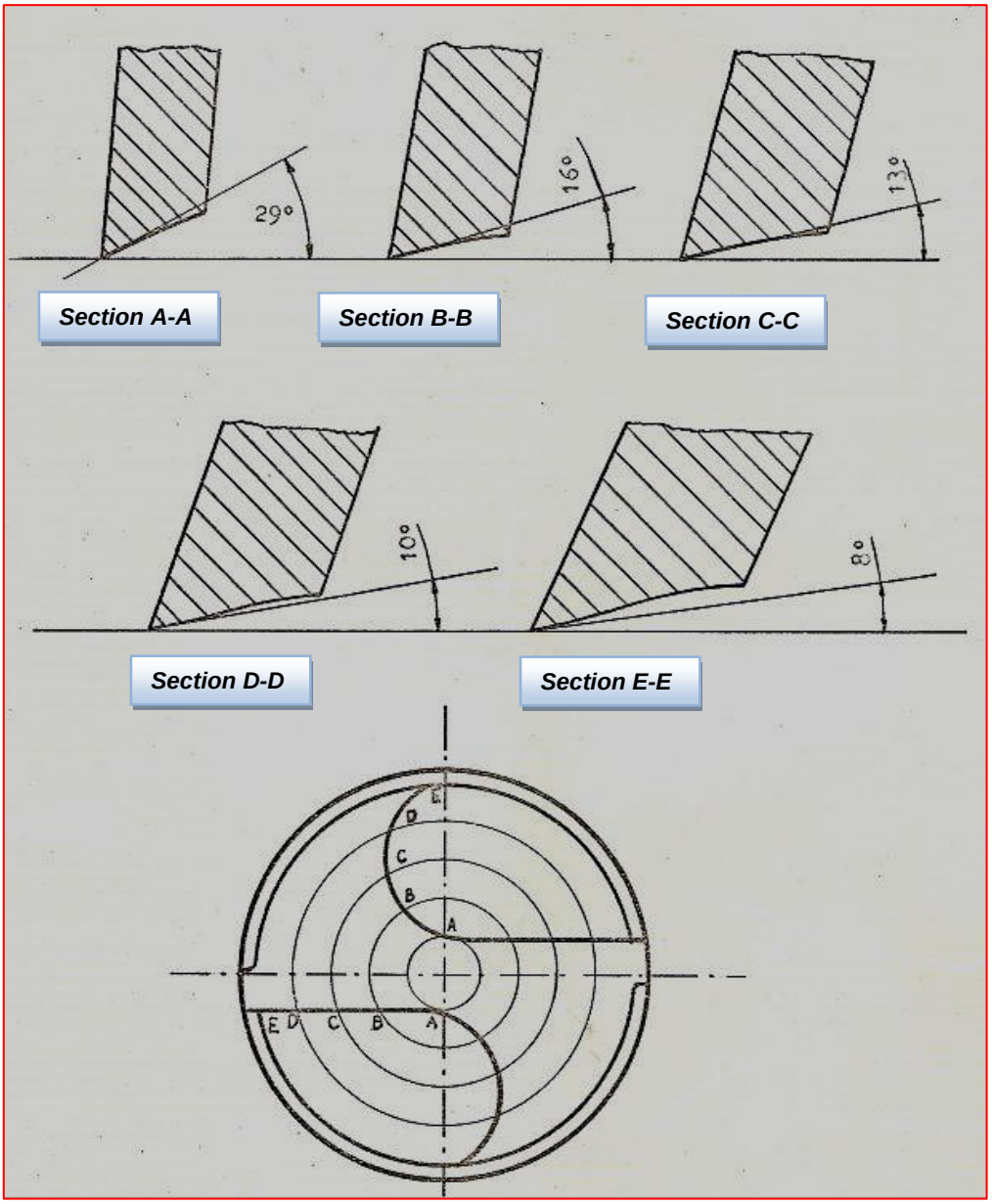


Fig. N°4- *Variation of lip relief angle achieved with the sharpening method Cawi-Spiral*

During re-sharpening is necessary to observe certain precautions to prevent structural changes , or other incidents at material of the tool.
Very often, especially if it sharpen by hand, is heat and cool the cutting edges irregularly. This system causes the thermal shock on the cutting edges that are therefore subject to considerable internal stresses with consequent danger of cracks causing breakage. The cooling so it must be continuous or lacking completely.
You do not have to heat the surface to be sharpened, always to avoid the danger of small cracks and lose their initial hardness.
To limit the heating the obvious recommendations are:

- remove small stock removal each pass;
- use a appropriate grinding wheel (not too hard and with medium grain size) ;
- sharpen the drill to the first signs of wear, this also to avoid breakage during processing due to the increase of torsion effort and to the reduced capacity of penetration.

Special sharpening

In many cases it is necessary to use special types of sharpening to get a better performance of the drill , both in terms of its life and better quality of the bore.
The simplest and most common variant of the normal sharpening is to reduce the thickness of the web.
This precaution is necessary when, after repeated sharpening, the web in the area of the cutting edges has become too large, or if you have twist drill tips with reinforced web.
This modification, shown schematically in figure N°5, must be done with a machine tool specially equipped to ensure the symmetry and centering of the cutting edges.
In the drills with a diameter larger than 20 - 25 mm, the thinning of web is almost always done.

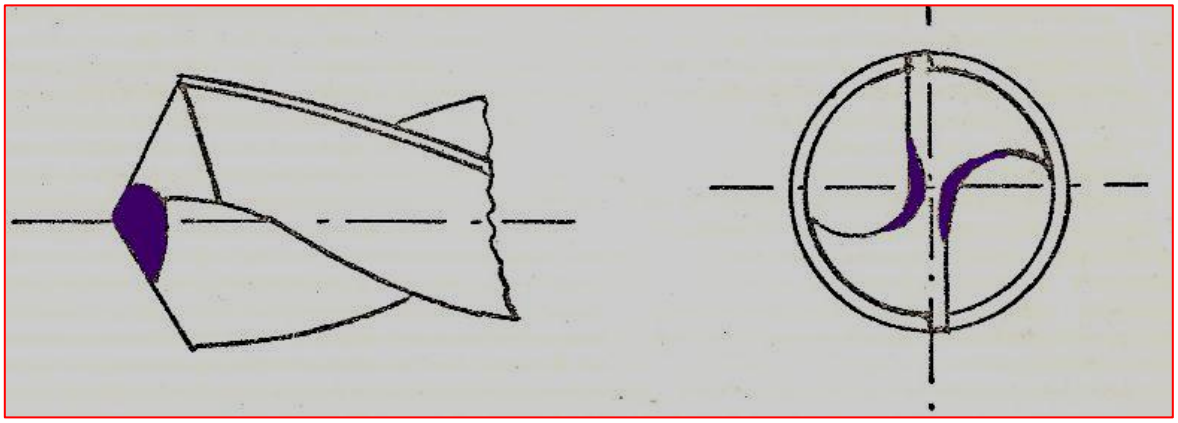


Fig.N°5- *Scheme of web thinning*

A second type of sharpening called "*cross sharpening*" applies to drill with reinforced core that need to perform very deep holes on hard materials. This type of sharpening has the following characteristics (figure N° 6).

- The point angle **φ** is 118 ° - 130 °
- The lip relief angle **α** is, on the periphery, 7° - 9° (ie, less than normal)
- The chisel edge angle **σ** is around 10° - 20°
- On the back of each lip it's made an inclined plane of 40° - 50° in order to sharpen the core and create two secondary edges instead of a single edge. Also this operation must be done with the aid of special device.

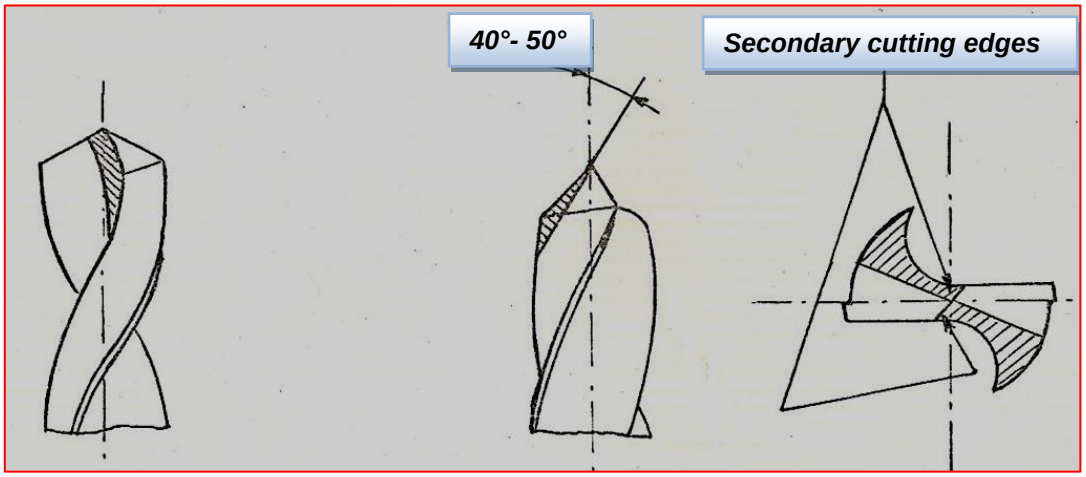


Fig.N°6- *Scheme of sharpening cross type*

A third type of sharpening is carried out on grinding machine Spiro-point that can make a lip relief angle variable from the periphery to the center.
The result is a very pointed edge that has the property of self centered and so to produce holes with limited axial errors.
This type of sharpening is done while keeping the drill firm and giving to the grinding wheel a circular movement around the axis of the drill. The grinding wheel is shaped according to the profile to obtain. Its movement also generates the lip relief angles.
Actually this type of drill is not very common, mostly because this method need for a specific machine. In other words, to grind the few drills that should be sharpened in this way, you should make the investment to purchase special machine.

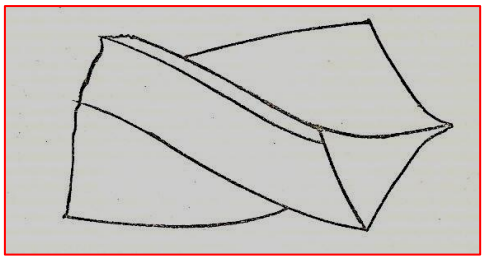


Fig. N°7 – *Scheme of Spiro-point sharpening*

Finally, we can sharpen the tip with a lip relief angle constant, instead of growing towards the center, this is achieved with a simple universal sharpener that works according to the diagram in figure N°8. This type of sharpening is particularly suitable for drills with reinforced core and with sharpening cross type.

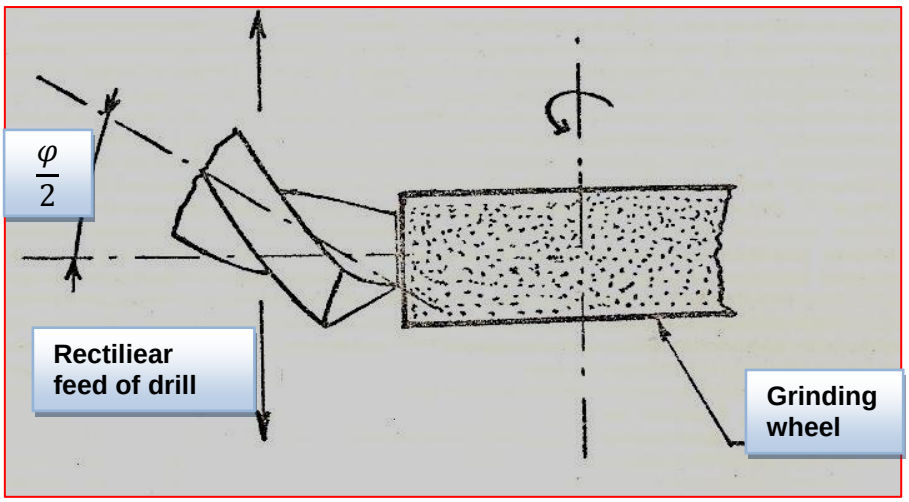
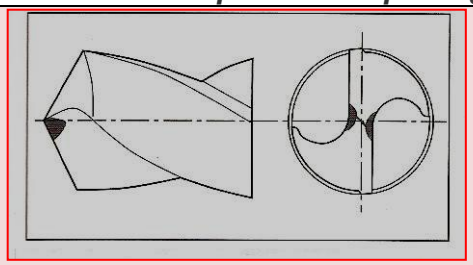
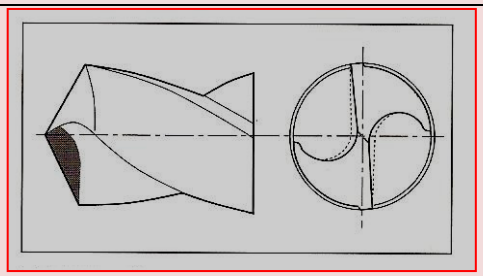
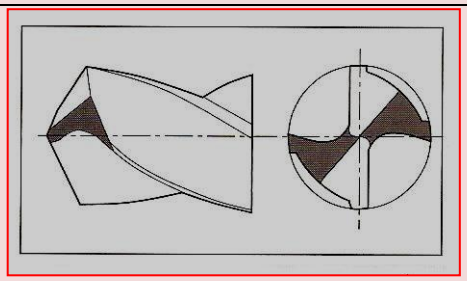
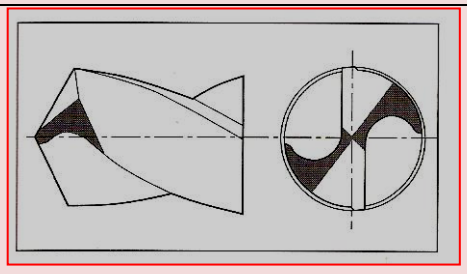
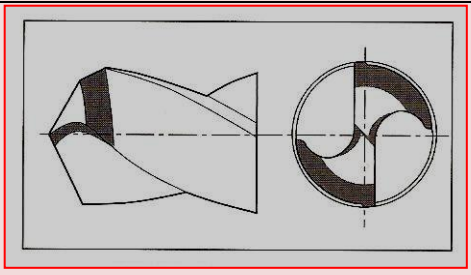


Fig. N°8- *Scheme of sharpening with constant lip relief angle*

Often the margin shows weld material in the initial section.
During sharpening is necessary to remove this material attached to the cylindrical section because it would increase the friction and why would produce deep scratches on the surface of the hole, so deep scratches that can persists even after a reaming operation.
The removal of the material can be done with grinding operation, when the diameter is not so important, or scraping lightly with abrasive stone, being careful not to round off the cutting edge.
Often, if the tract damaged is not too long it's better to cut the drill and remake the sharpening cone.

Special sharpening example *(courtesy : Cerin)*

	***Reduced cross cutting edge (web) DIN 1412 A*** *Common drilling works with strong core bits and large diameter to drill full material.* *Advantages: good centering thanks to reduced cross cutting edge (web)*
	***Reduced core DIN 1412 B*** *For all common drilling works on steel, non-ferrous metals and synthetic materials. This sharpening angles depend on the properties of machined material.* *Advantages: strong cutting edges, resistant to impact and relative stress.*
	***Self centering sharpening with 4 point of contact. (Art.164 Cerin)*** *Suitable for drilling all types of metallic materials*
	***Cross sharpening DIN 1412 C*** *Suitable for drilling alloy steel.* *Advantages: good centering , low feed*
	***Sharpening DIN 1412 D*** *Suitable for drilling gray cast iron, malleable cast iron and forget workpieces.* *Advantages: better centering. Less machining power*