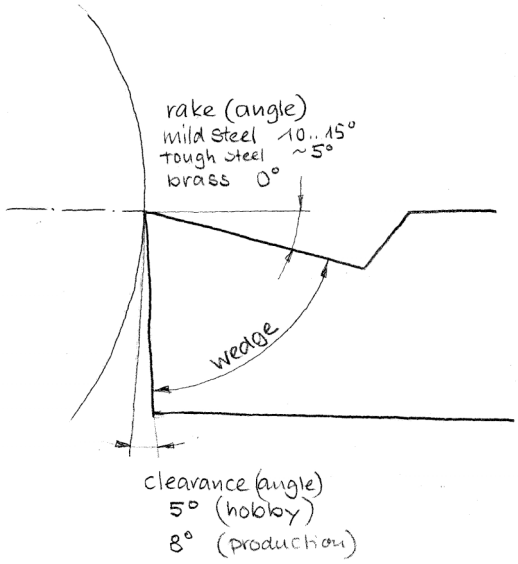
Economical Micro Lathe Tooling

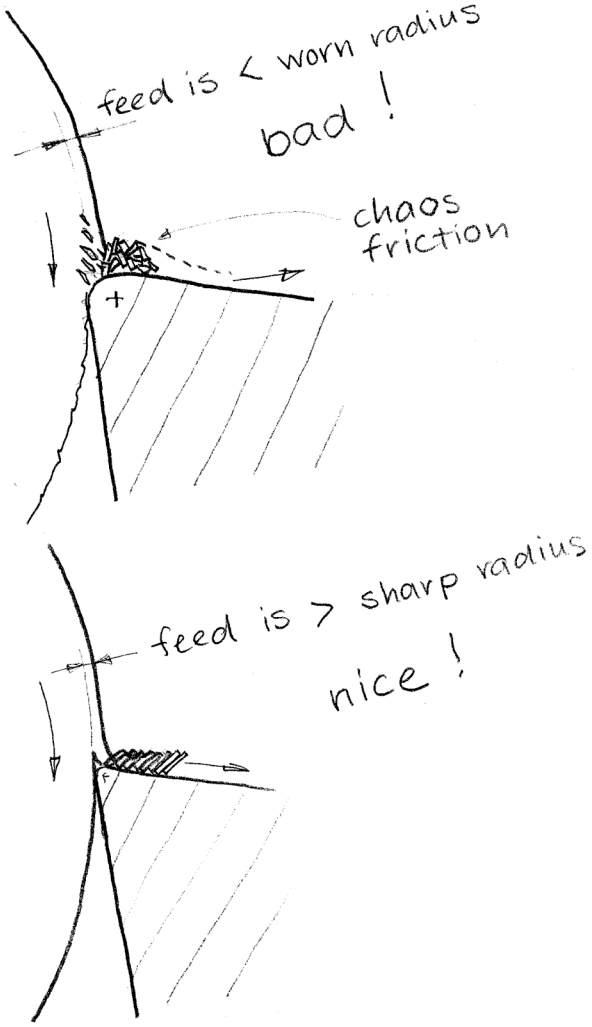
by Ulrich Viebahn

Sept 16th 2021

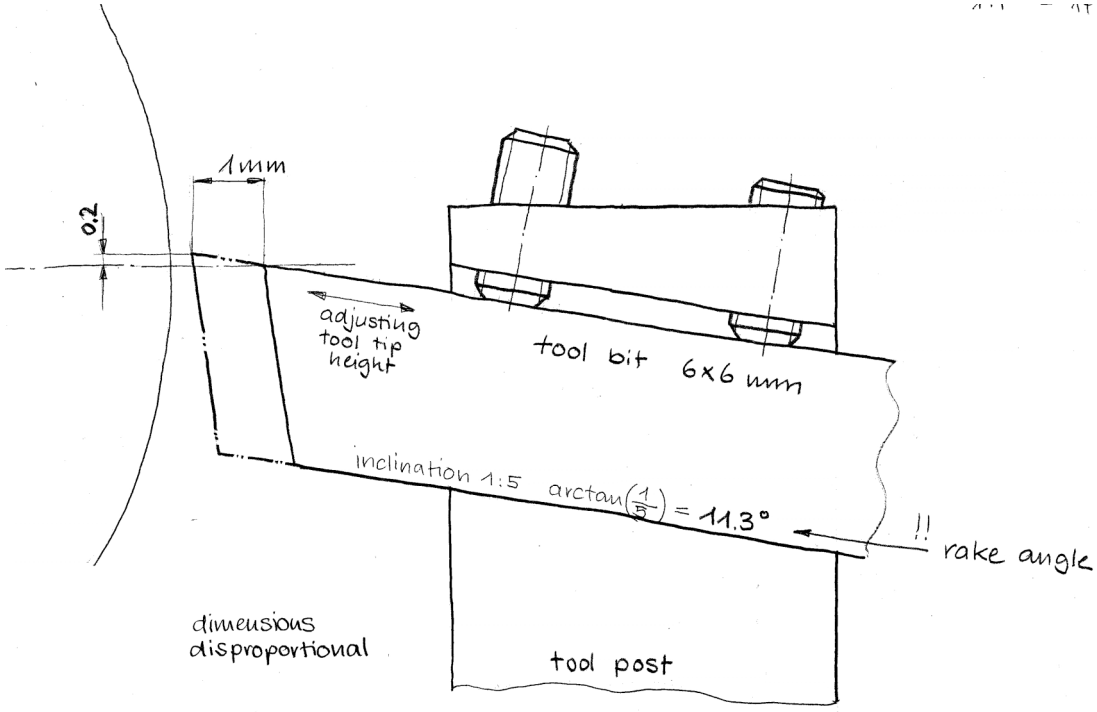
After several years of constant use of my TAIG lathe I had a collection of over 30 odd shaped tool bits; these were ground from square ¼“ or 6 or 8 or 10mm blanks. The main nuisance was the ground rake angle which allowed just 5 or 6 re-grinds; after this the tool tip had to be cut off and to be ground anew.



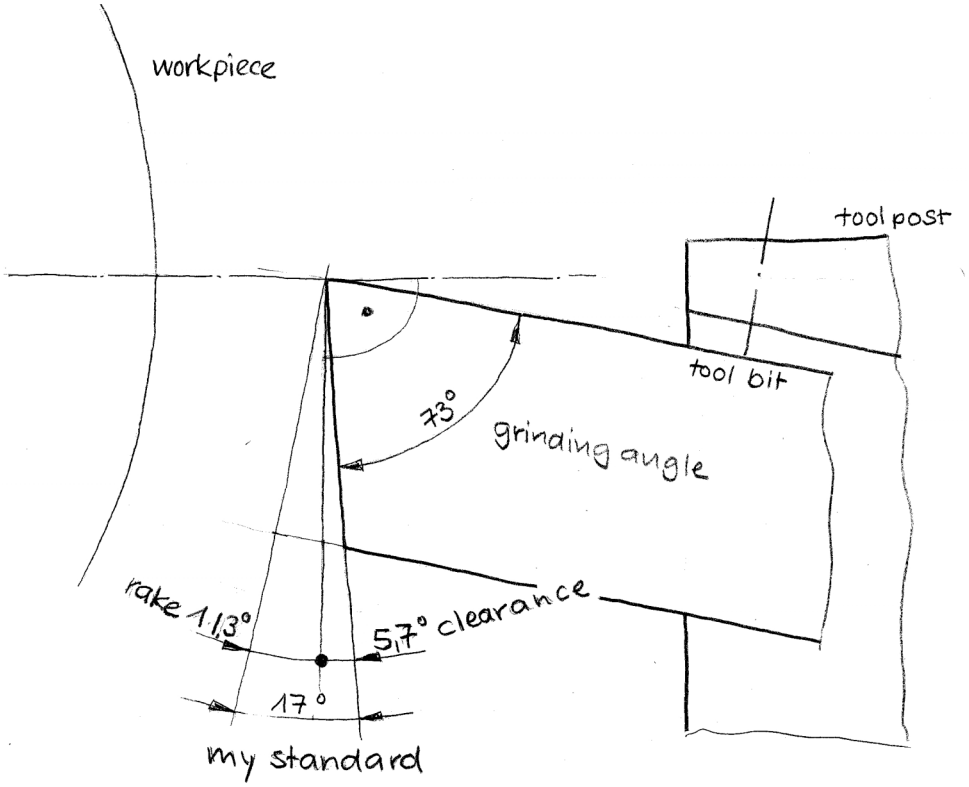
Precision work on a TAIG needs very well ground bits as fine feeds need even more ‚fine’ cutting edges. And: A fine cutting edge means low cutting forces, leading to small deflections of the TAIG components. Low cutting forces are desirable in much bigger machines anyhow.



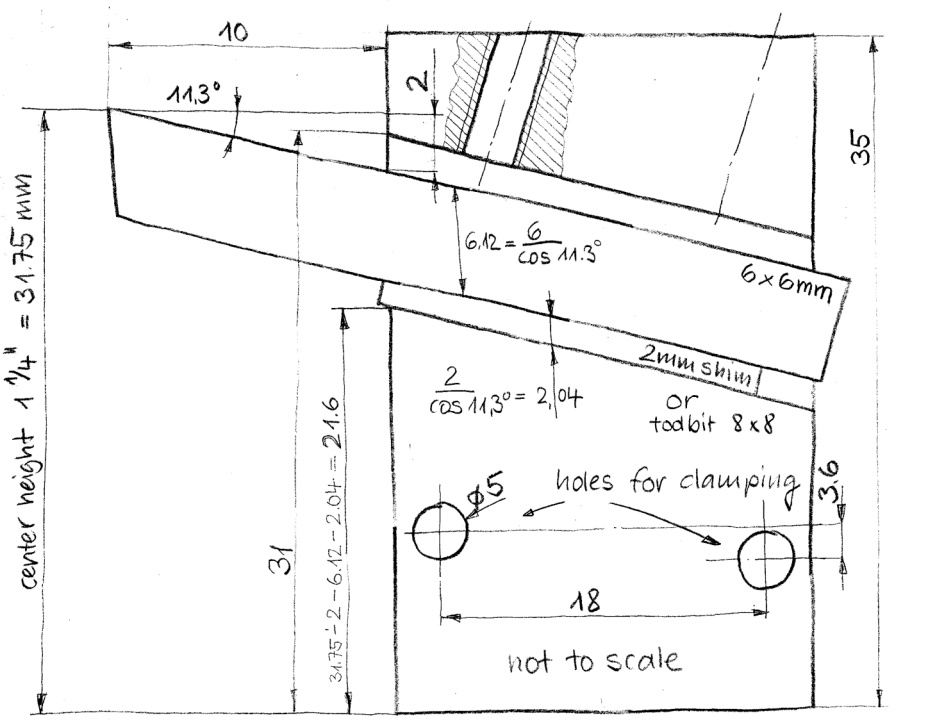
Some day I made a parting tool bit holder for 1.5 x 5 mm blanks mounted in a toolpost with an 11° inclined groove. The (known) idea was to adjust the tool tip height by shifting the toolbit - with a ratio of 1:5.

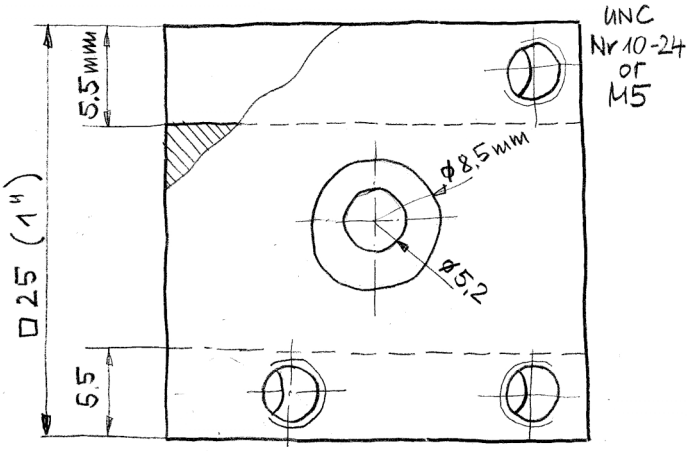


An additional benefit is the rake without grinding. The only angle to grind is the 11.3° (arctan for a 1:5 ratio) + 5.7° clearance. Clearance is to avoid friction between tool and part. Normal value: 5°. Industrial applications used their tools until a quite heavy wear limit; so they were using 8° as clearance.
(Today all this is built in thousands of carbide inserts. Carbide inserts have rather coarse rounded cutting edges; don't scare the little big TAIG.)



How to design a suited toolpost? Observing the shown principles you can design a tool bit holder for many other, bigger toolposts. Drawing means TAIG scale.





These dimensions are thought for the use of 6x6 or 8x8mm blanks. A 2mm shim allows you to mount both sizes.

Material can be free-cutting steel (see SAE 1213 or 1215) or hard Aluminum (2000 series, AlCuMg)

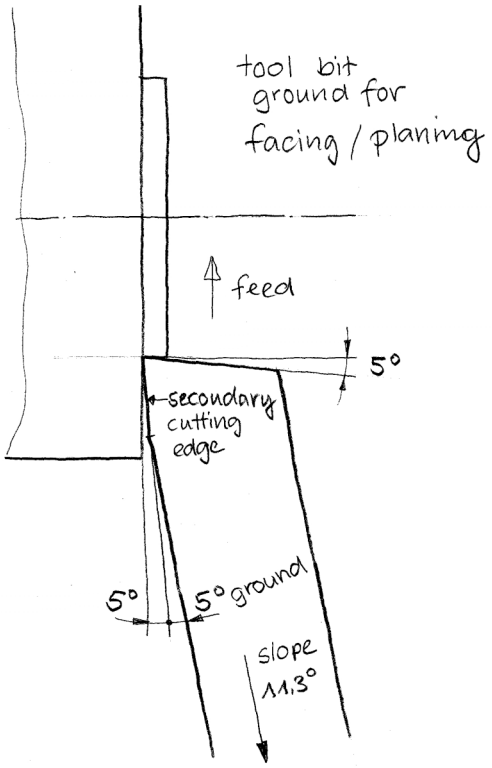
‚Worm' screws M5 or UNC Nr. 10-40. (In a Technische Hochschule you get raised eyebrows if you say ‚wormscrew')

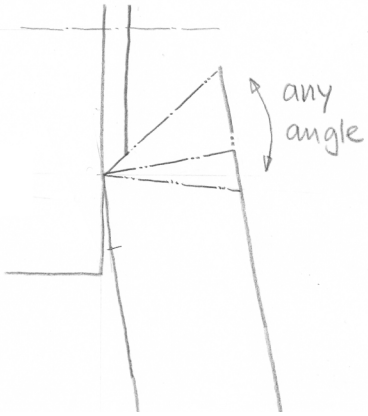
Two bores of ø5 help to clamp the thing in an angle of 11.3°. (More often than not clamping bores are stronger and cheaper than any clamps / prisms / jacks.)

Planing or facing operation:
The tool bit doesn't need a ground rake anymore because it is already inclined by 11.3°. It needs a primary cutting edge (which profits from the rake) and a secondary cutting edge with no rake (a so-called ‚wiper', which leaves a clean, smooth surface).

You need to grind the horizontal angles 5° and 10° (I don't give a term - to avoid the collision with the ‚clearance angle' I treated 2 pages before). The angle at the tool tip has to be less than 80° if you want turn inner rectangular corners;

if not, the angle can be made bigger.



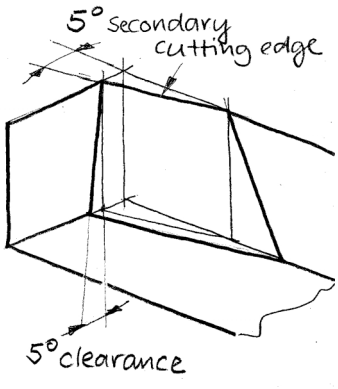


The tool blanks have to be ground in a certain manner:

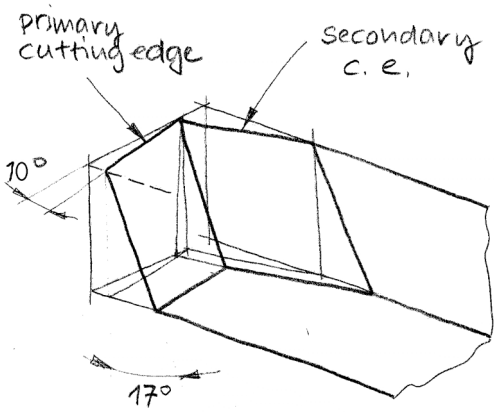
First: the secondary cutting edge with a clearance of 5° and a horizontal angle of 5°. The width of the ground zone can be as little as 1...3mm. (left)

Second: The primary cutting edge with a rake&clearance of 17° and a horizontal angle of 10°. (middle)

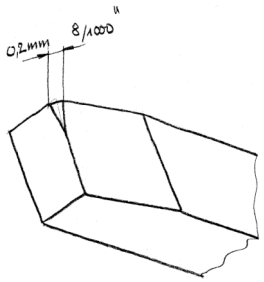
The vertical edge should be broken with a diamond file (right)



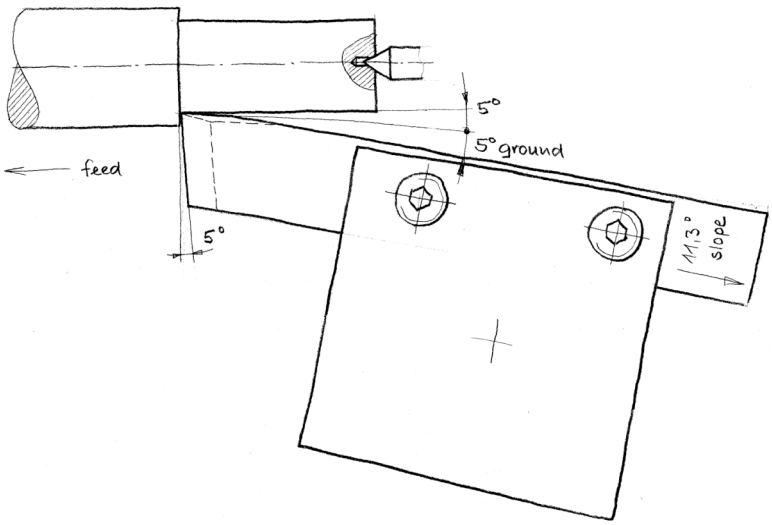
grinding simultaneously
two 5° angles
View from below

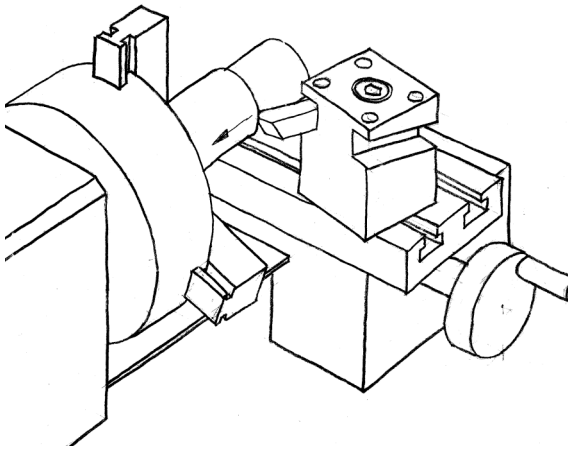


not to scale
View from below



What about longitudinal turning? With the same grinding principle faces mirrored / symmetrical.

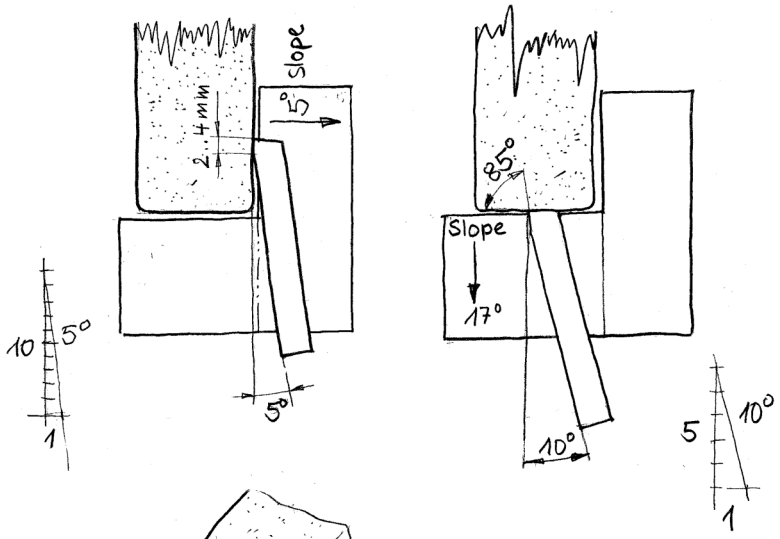




Grinding technique:
Most convenient is a tool rest with a 5° incline filed – see fig. below.

That allows you to grind simultaneously the two 5° angles
of the secondary cutting edge.

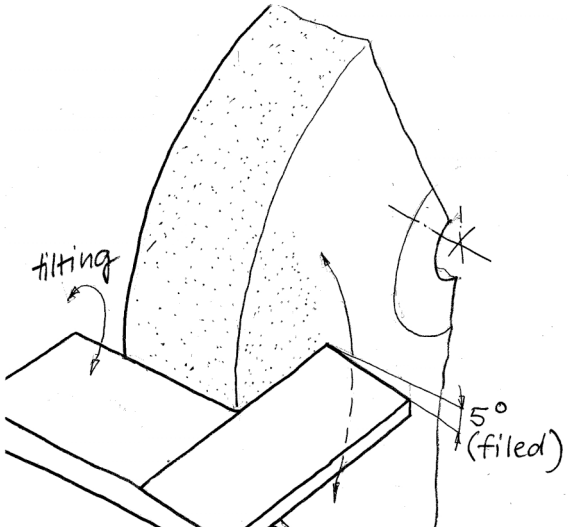
The ‚main' toolrest can be tilted to any degree. Here to 17° to produce the primary cutting edge.



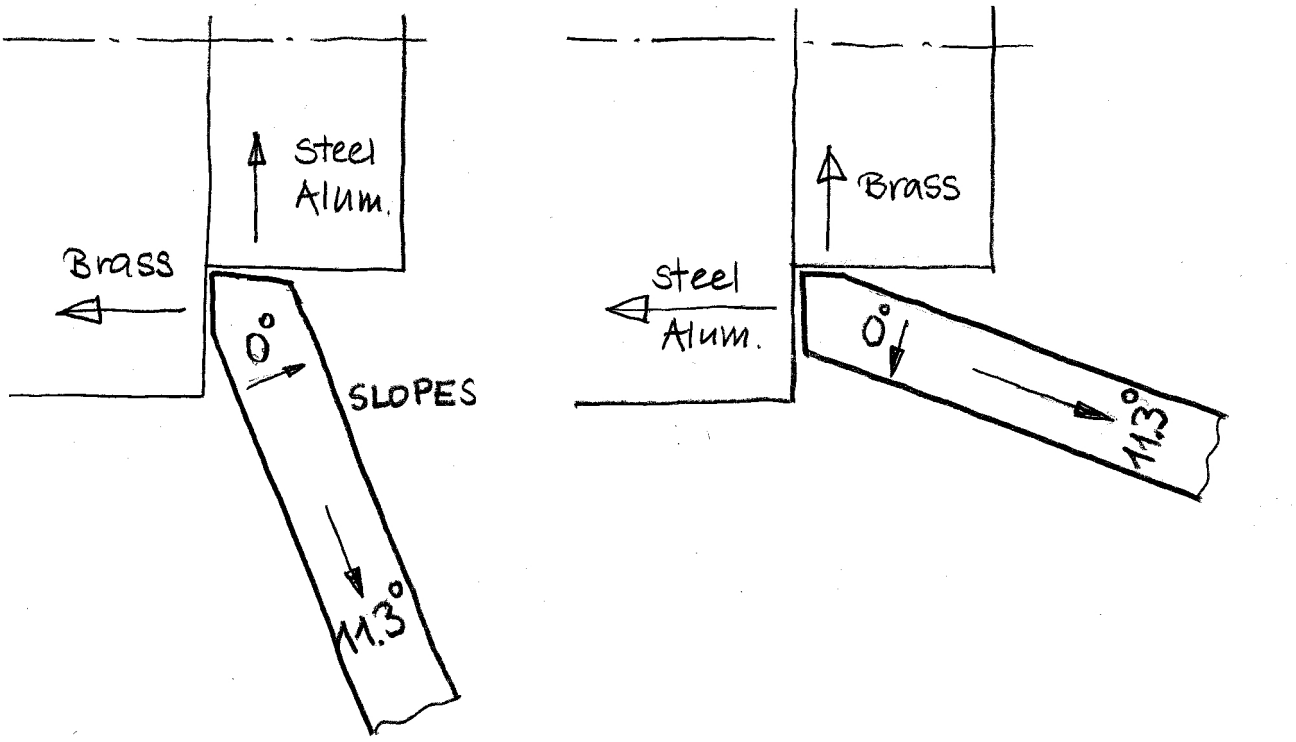
How to estimate 5° and 10°?

5° is equivalent
to a slope of 1:10
(guess 2 mm of a line of 20)

10° is equivalent
to a slope of 1:5
(guess 4 mm of a line of 20)



The width of chips of a small lathe is limited by the stiffness of the bed or the frame and the play in all sliding components. In most cases the chips are narrower than 1.5 mm (1/16“). Chatter tells you. Therefore a cutting edge of 2.5 mm (3/32“) is sufficiently wide.
That gives you the possibility to use both cutting edges of the toolbit – one has a rake of 11.3° and the other has a rake of approx. 0°. Steel and Aluminum need a rake of 10...15°: Use the edge with the large rake. Brass tends to ‚bite' into the tool and needs a rake of 0°. Use the edge with the small (zero) rake.



To maintain the sharp cutting edges you give both faces of the tool bit a very gentle ‚shave' of the bench grinder. 2...4 thousanths is sufficient. Don't forget to break / round the tip with the diamond file. The tool bits will last a long time.