Making and Using Reamers

part 1

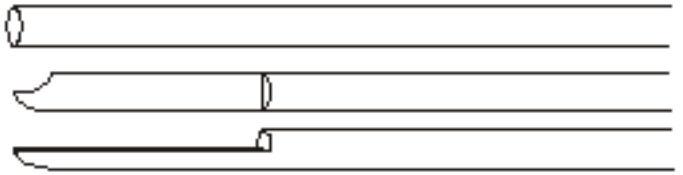
Bill Haneman

D bits

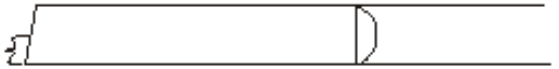
- if end is formed properly, they are self-centering
- require frequent chip clearing
- use relatively slowly
- relatively easy to keep sharp

simple boring tools

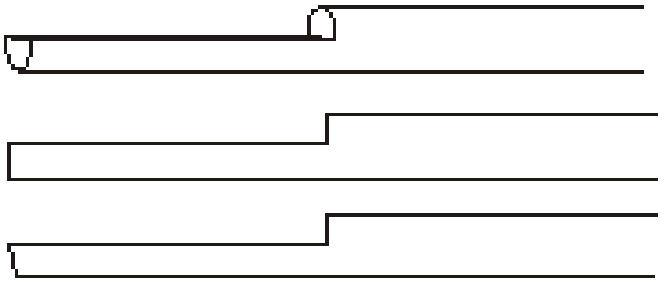
- see D.M.Quinn, “Low tech bits”, *Pipes and Pipemaking CD-ROM*



  - *parrot-nose bit*
  - *D bit*



    - *angled nose, relief in cutting edge*



gun drills

- fast, self-centering and cool running
  - still, better finish and centering if not pushed
- chip clearing is automatic
  - ideally want 90-110 psi
  - 3 m3/hr if using larger bits, large reservoir helpful
  - not all the same; get 'modified highland' profile
- different couplings available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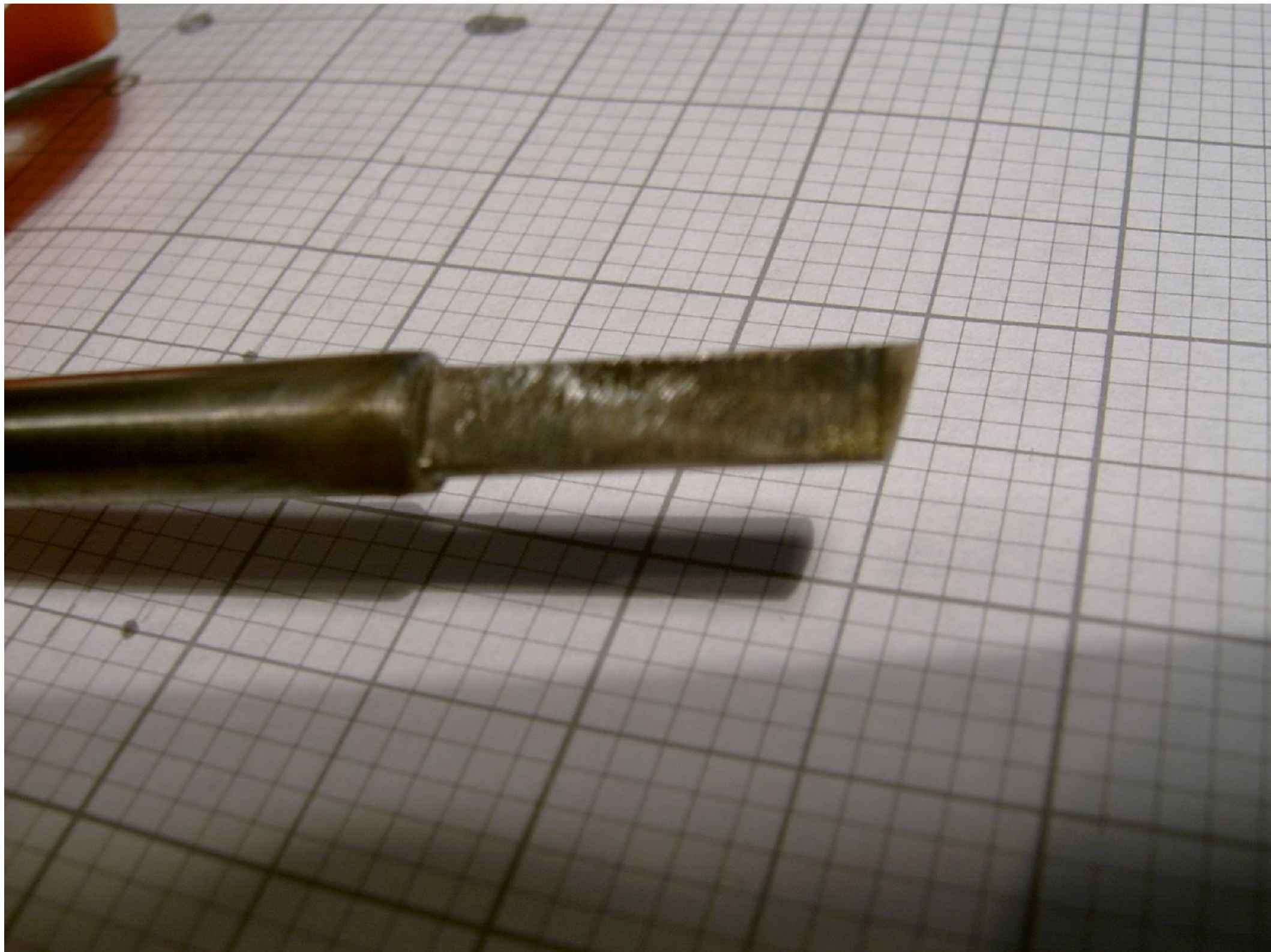
using gun drills to step-bore

- bore from large to small
  - small-to-large causes drift, as larger hole tends to run tangent to previous hole
- piloting bits are important
  - there are reports of specially-profiled gun drills that self-pilot large-to-small (pilot on nose)
- remember, speed is overrated
  - even though surface finish for step-boring probably is not important



step drilling (cont.)

- allow for any non-concentricity
  - my approach is to step drill with 0.5mm clearance on sides

fixed steady

socket reamers

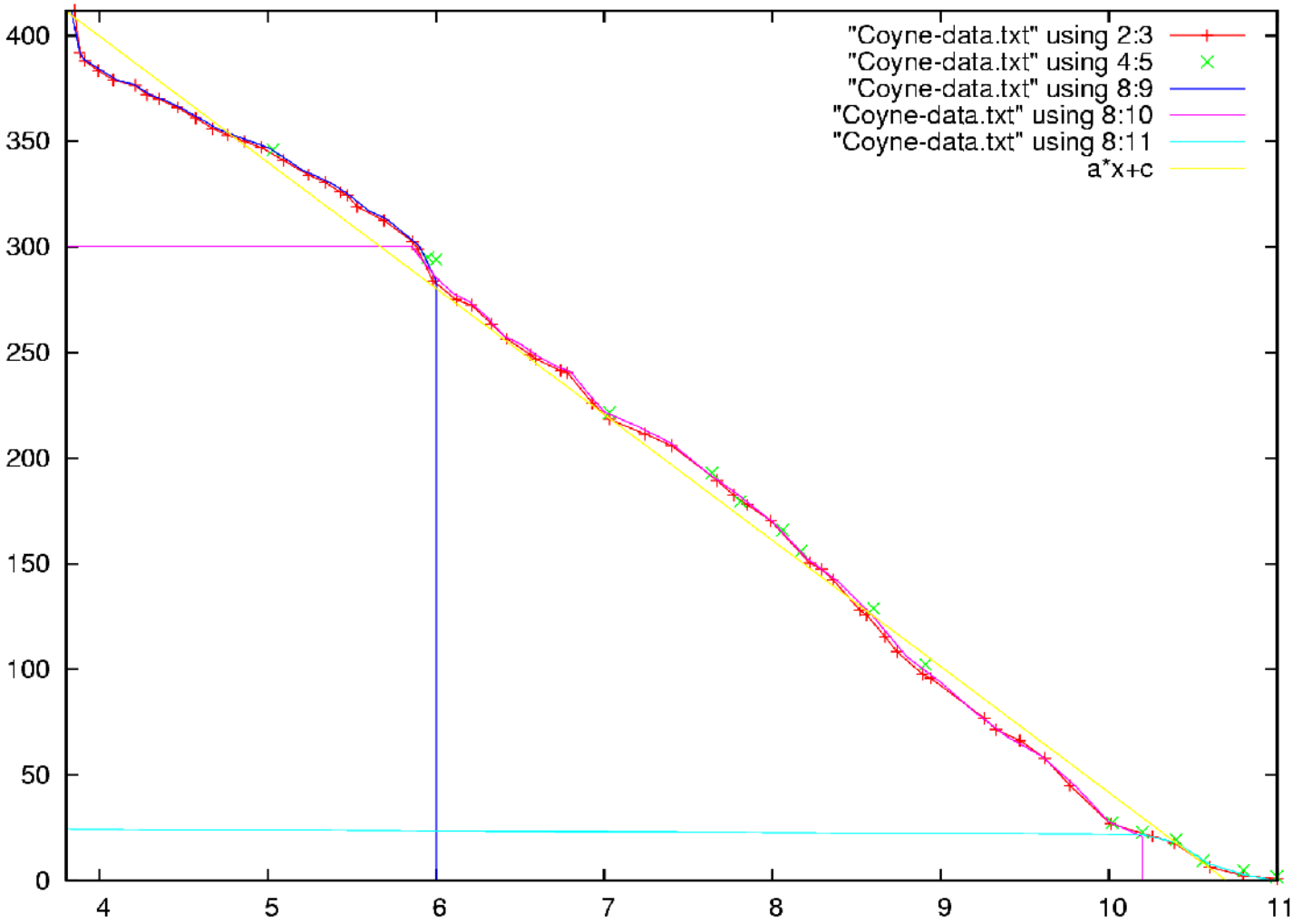
- I use commercial left-hand-spiral fluted straight reamers for final reaming of drone sockets and in a few other places
  - hole is pre-bored to at most 1mm undersize
  - only the first mm or so actually cuts
  - reamer should spin slowly, with frequent chip clearing
  - when boring drone sockets, I guide the slide with the tailpiece, onto the reamer (aids parallelism and concentricity)

Making conical reamers

- first decide what your reamer profile(s) should look like
- multiple reamers give flexibility, also solve problem of different tool edge speeds
  - on narrower parts of bore, reamer moves more slowly
  - also easier to correct for a mistake, less work to discard if you screw up

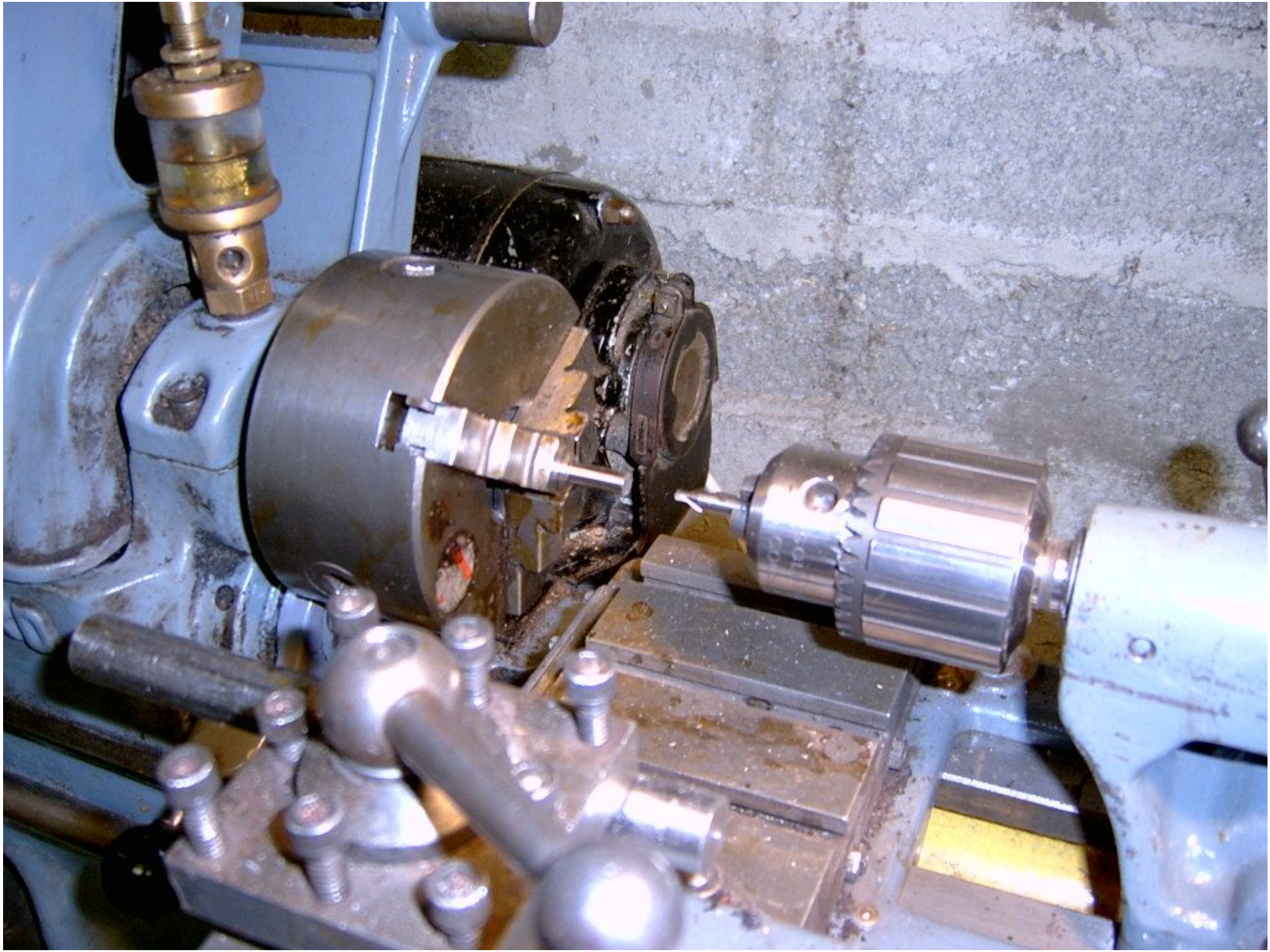
A sample reamer plan

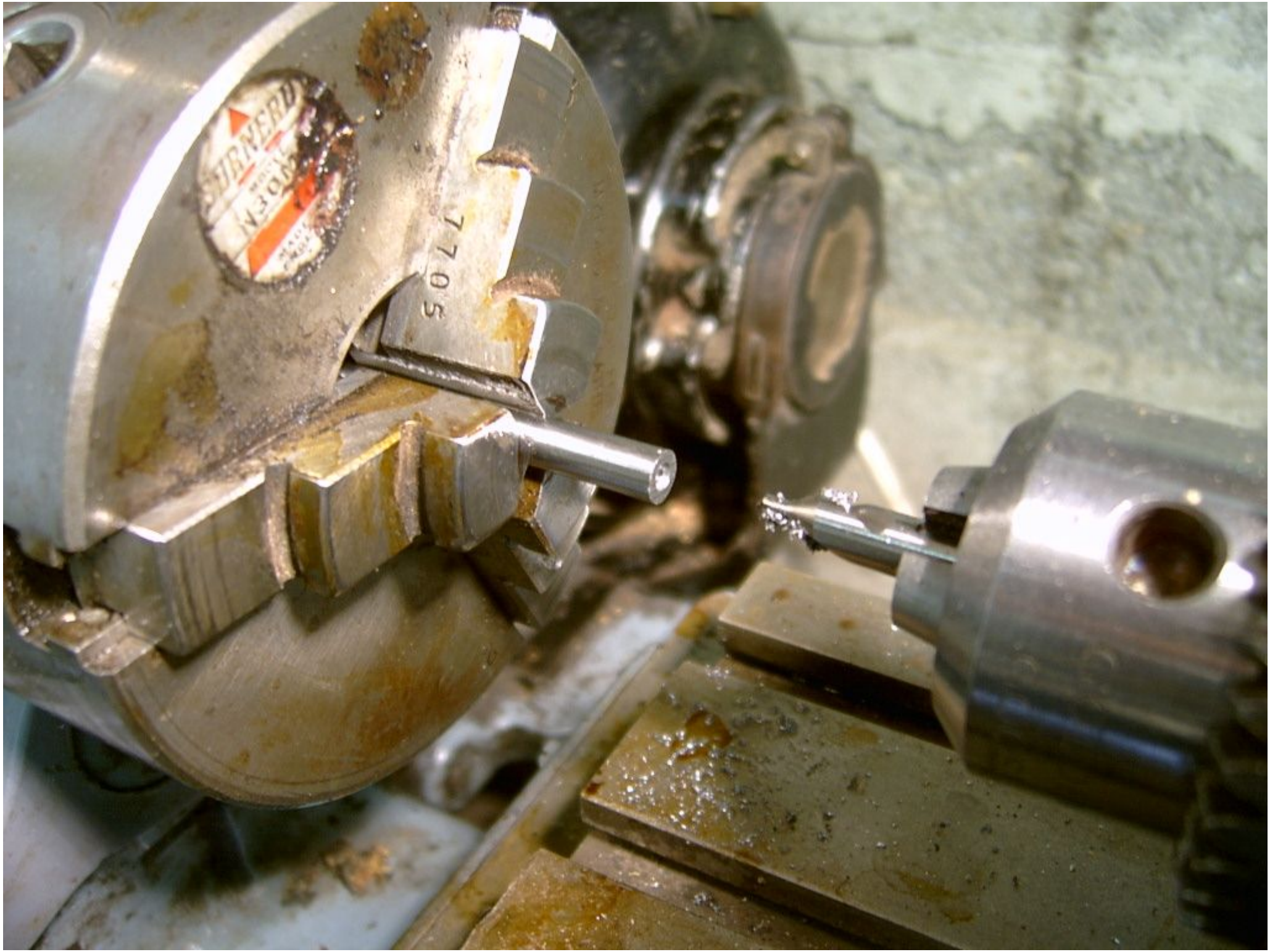
- plan for reamer “steps” of 5-10mm length
  - 'fit' this to your target bore(s)
  - check length to allow adjustment, perhaps allow for re-use on a longer chanter?



turn suitable tool steel rod in 'steps'

- chuck securely with minimum overhang
  - collet chucks are ideal, an independent, hand-centered 3-jaw is fine but slow, self-centering 3-jaw probably OK
- first “step” may be a cylindrical 'nose'
  - must be undersize to avoid higher parts of bore
  - helps when clamping piece for milling
- bore pilot hole for tailstock
- nose may need to be turned without tailstock support

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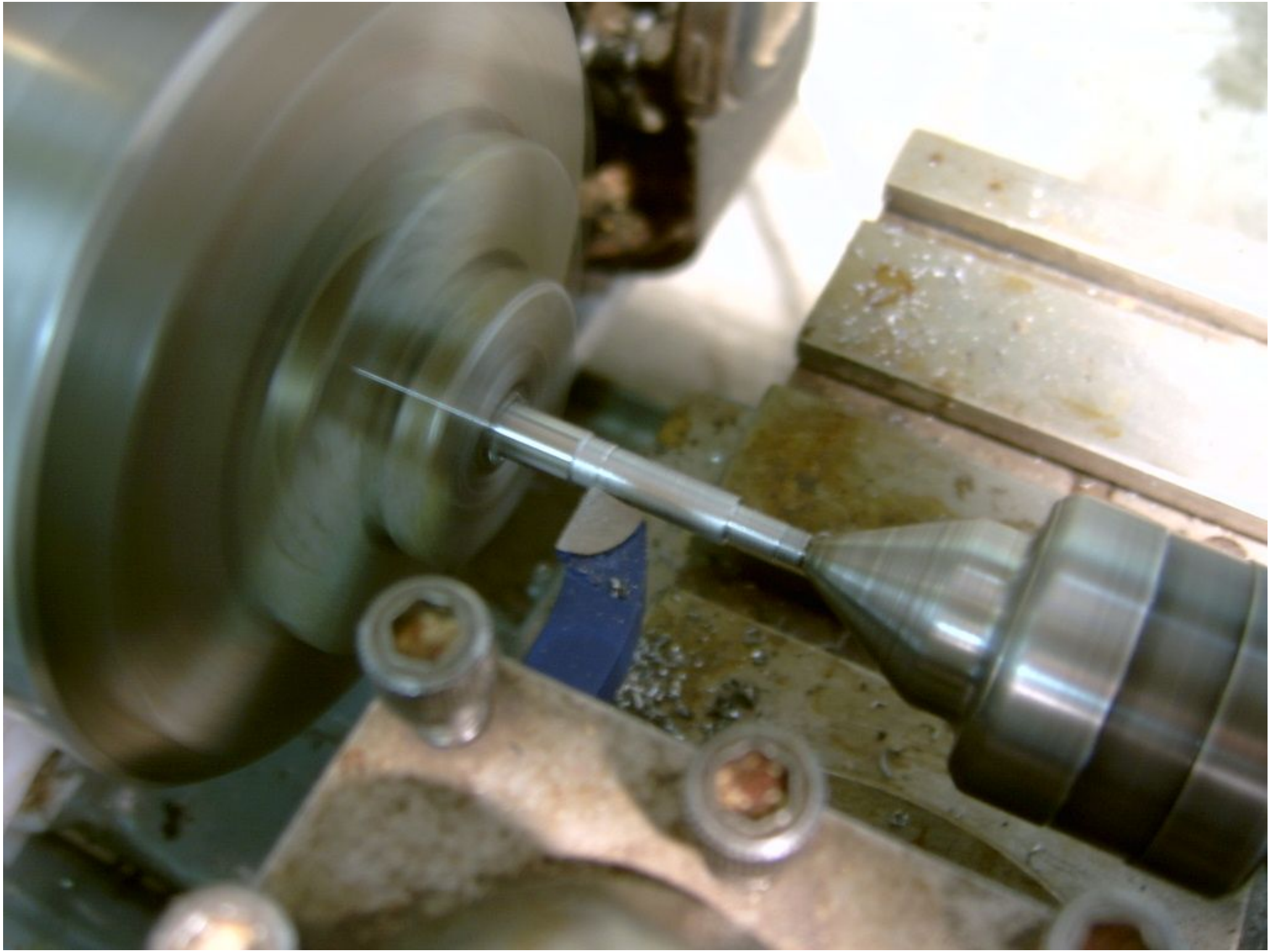
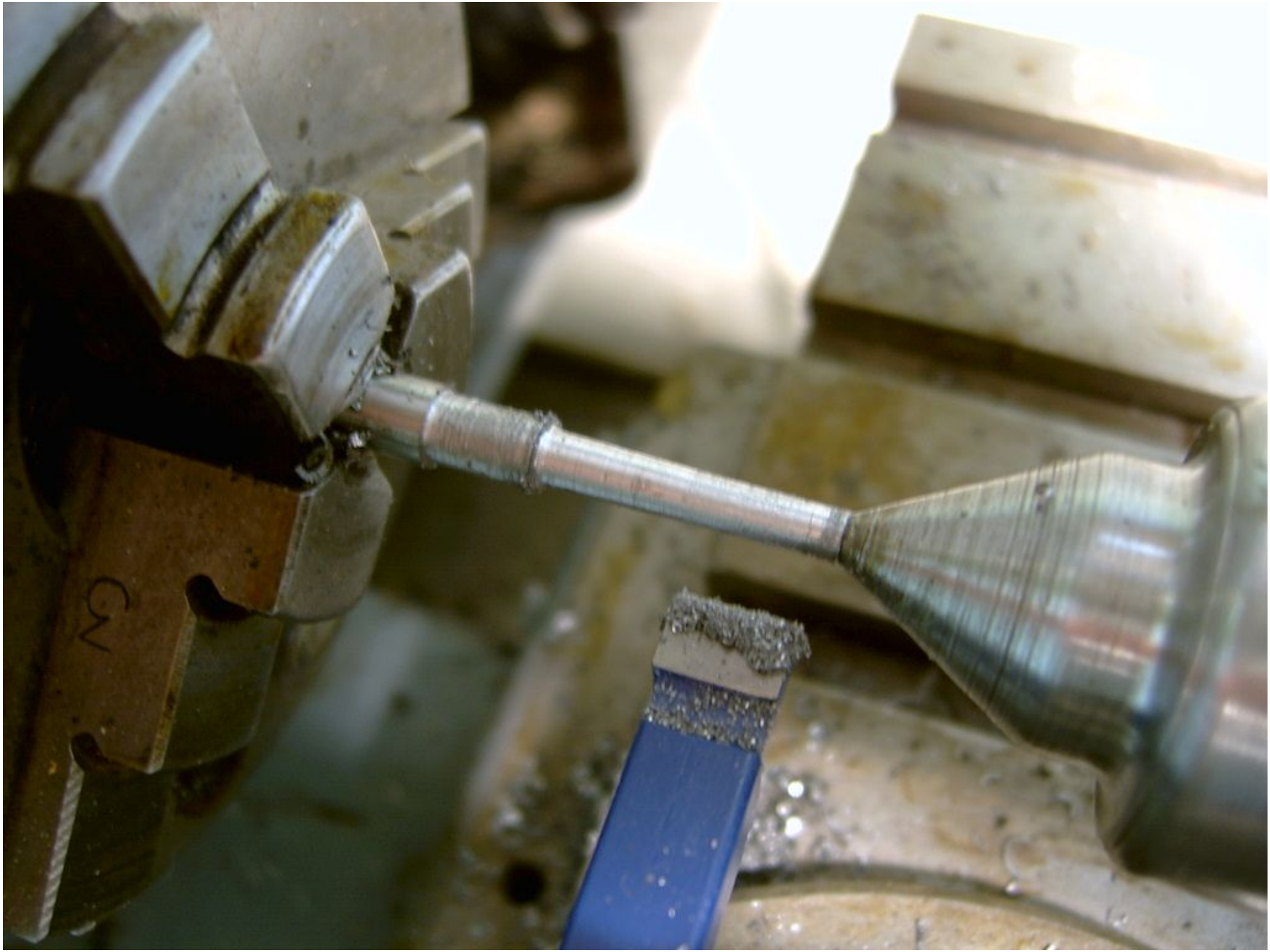
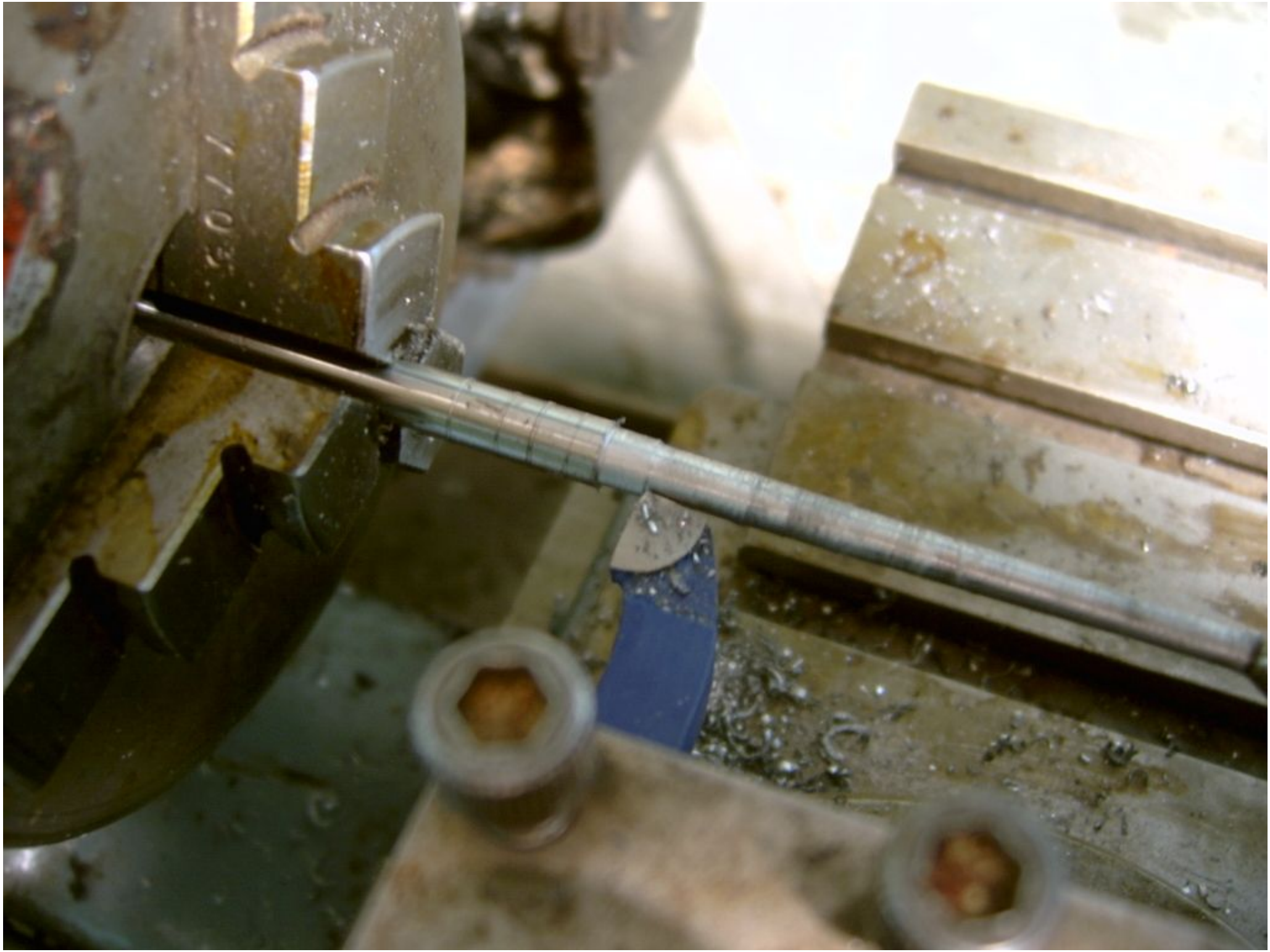
one step at a time

- turn each step to the 'maximum' size for the segment, or ~0.001”/0.03mm oversize
- carbide is OK but decent tool steel seems even better, for cutting non-heat-treated rod
- check with micrometer as you go
  - stop the lathe of course

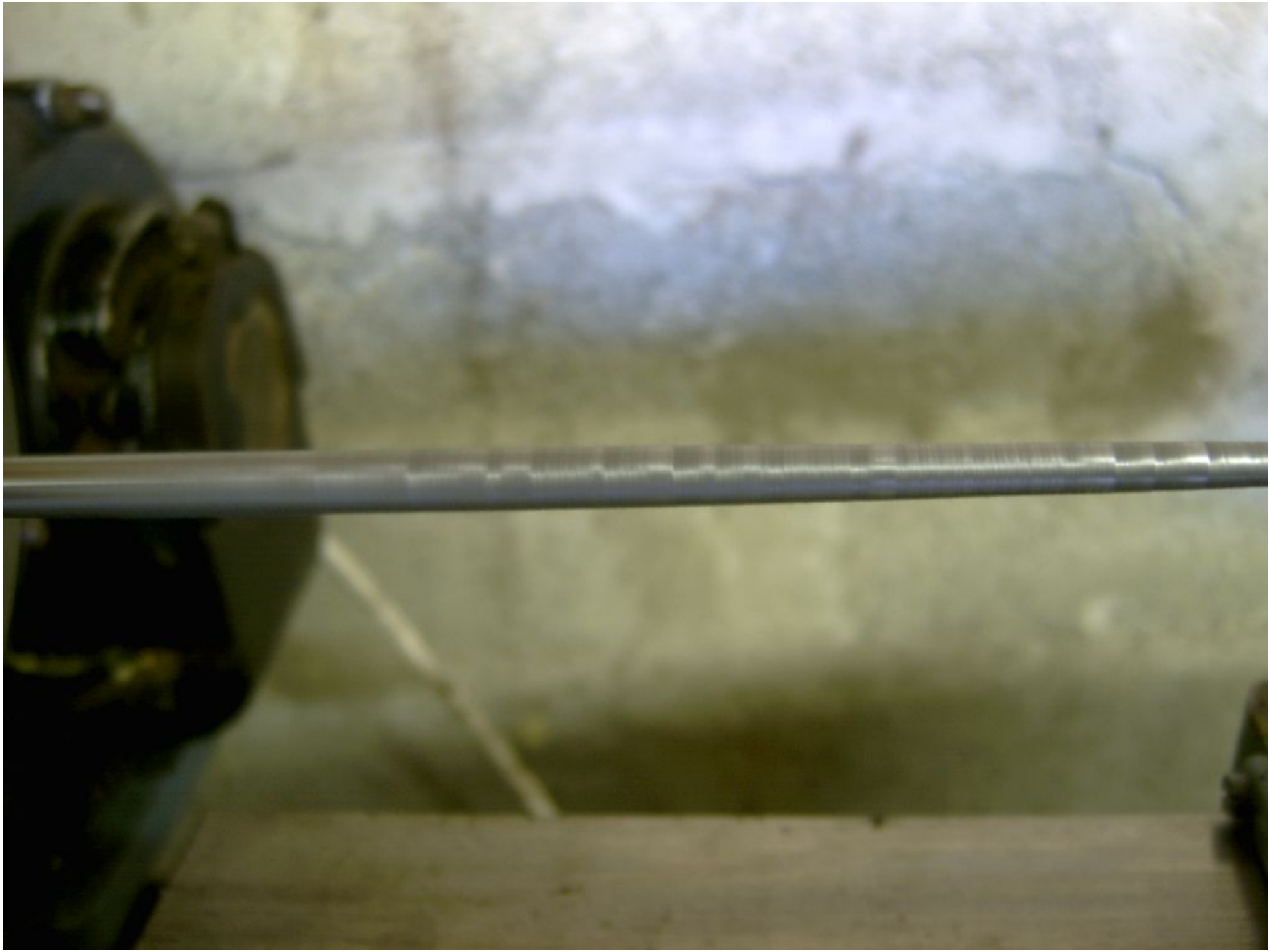


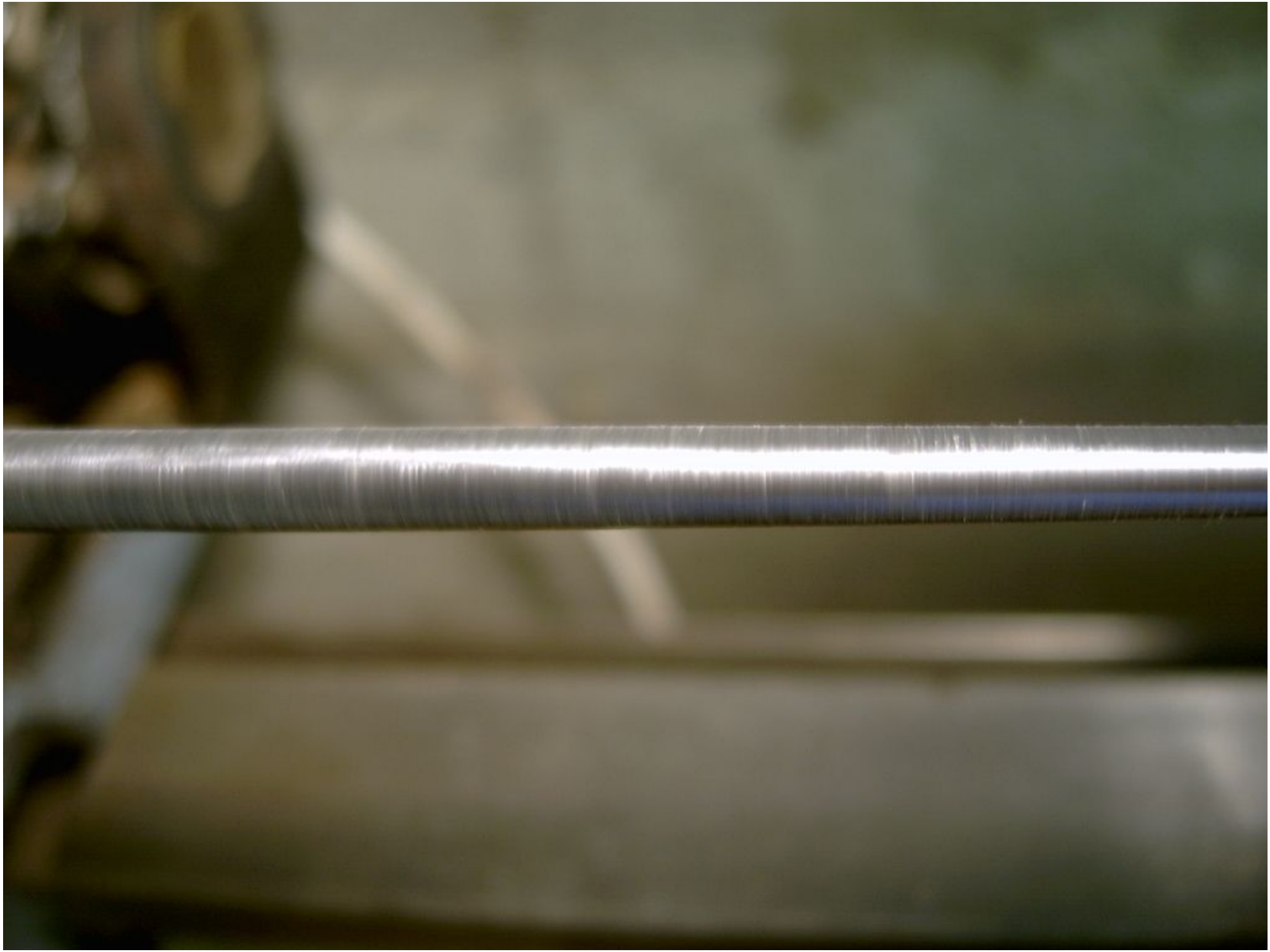




take off the 'steps'

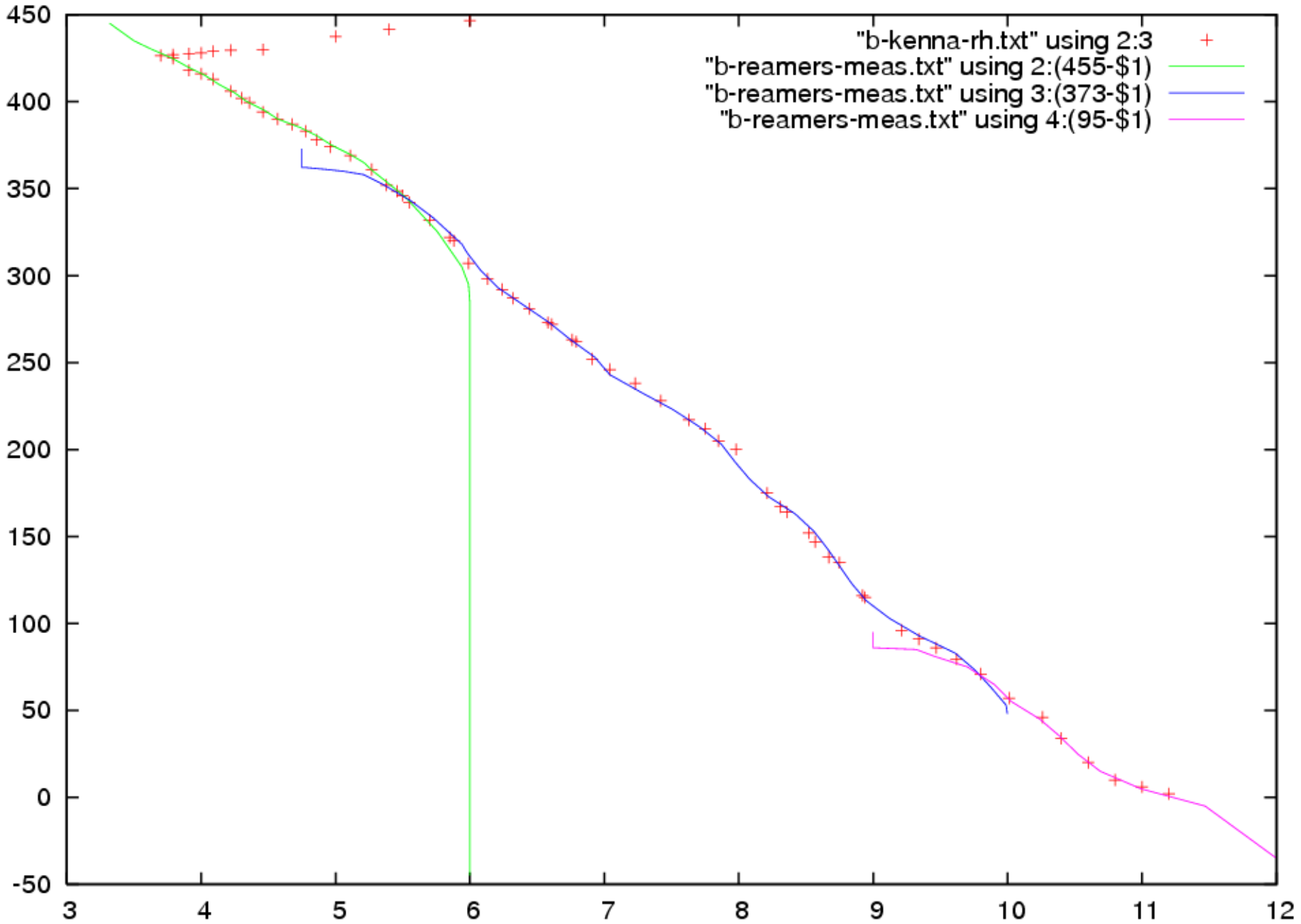
- engineer's bluing is good
- careful not to go undersize
  - can be corrected, painfully, by moving your target diameters laterally
- go slow when only lines remain – abrasives are best at this point
- accuracy will improve with practice, but is limited mostly by your patience





re-measure and fine-tune

- re-measure with micrometer – one with a ratchet is a good idea
  - best is one with flat anvils, but can make do with round ones if you are careful
  - mark the distances from the tip with a thin indelible marker
- check against your target bores, looking for best insertion depth
- you can put back on lathe and adjust with files/abrasives if you don't like the results
  - this is the last chance to fix this, as you can't really do it once the reamer has been milled down to a D profile


"b-kenna-rh.txt" using 2:3
"b-reamers-meas.txt" using 2:(455-$1)
"b-reamers-meas.txt" using 3:(373-$1)
"b-reamers-meas.txt" using 4:(95-$1)
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200
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100
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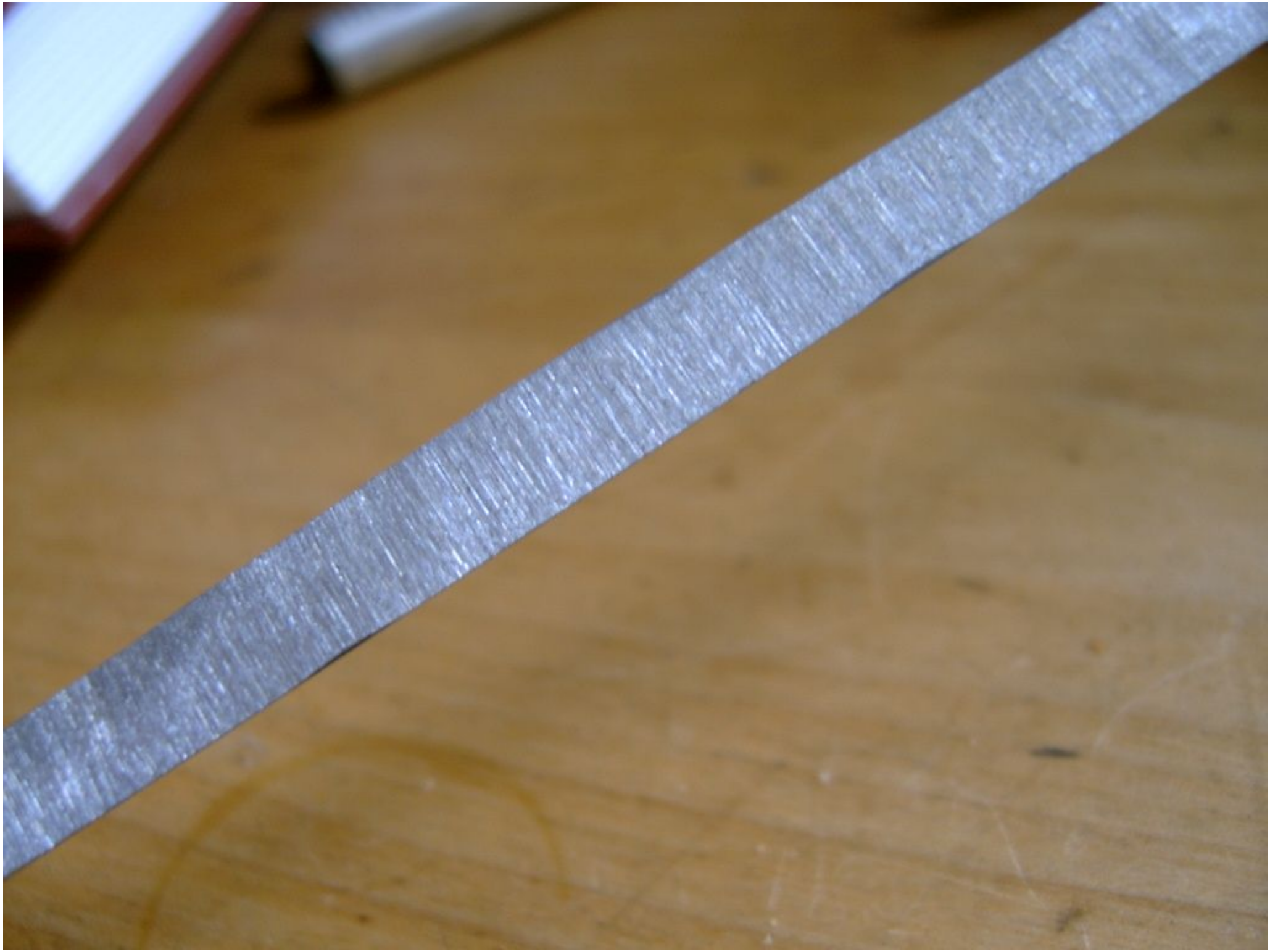
12

(calibrated) vernier micrometer, 0.001mm increment with ratchet

from 'cone' to reamer

- milling operation only needs to be approximately midline
  - but not over midline!
  - just over 50% thickness allows for sharpening
- initial clamping is tricky, but shims of soft metal should do it
  - there shouldn't be much lateral force on the blank anyway, since cutting speeds and depths should be modest

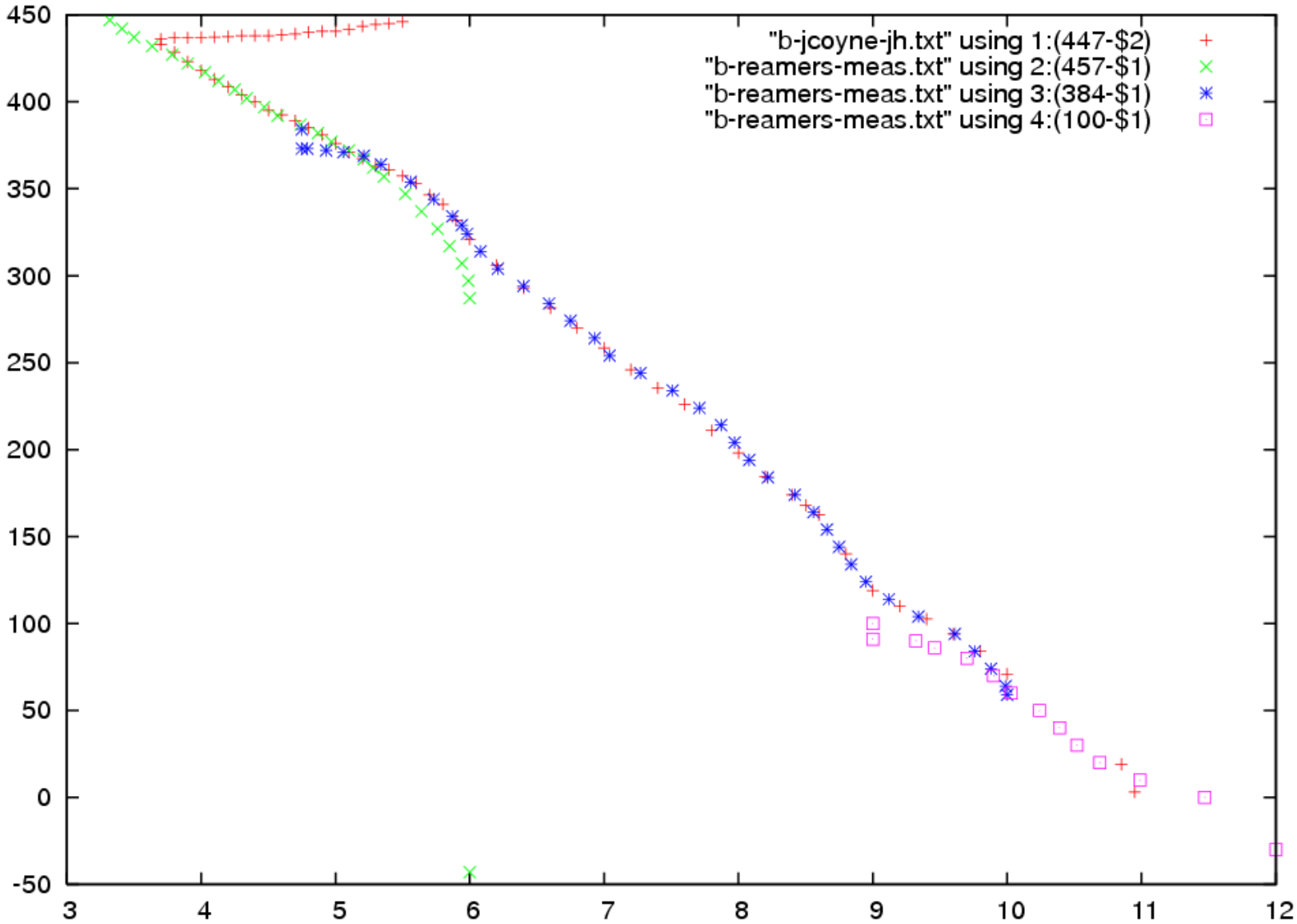

Vätslipmaskin för eggverk
Made in Sweden by TORMEK AB



a “micro-mill” is enough

- or you can use hacksaw (ugh!)
- small throat reamers can be ground on a wet grinder
  - this tends to be hard on wet grinding wheels
- then the result can be filed more flat, if uneven
- then inside can be hollow-ground on wet grinder and dressed with fine stone/hone

with luck, you can re-use reamers for another design...



there are other forms of reamers

- for instance flat reamers
- 'bayonet' reamers
- 'square section' reamers
- fluted reamers
  - spiral fluted reamers that aren't straight are very hard to sharpen
- 'spoon' reamers

John Hughes reamer – 4 straight flutes

- as described in 'A Method of Making Reamers', *Sean Reid Society Journal* v. 2, Mar. 2002

Michael Carney tools


INCHES
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Hamilton Bell Co., Inc.
MONTVALE, N.J. 07645
METRIC 1
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flat reamers

- used to good effect by some makers
- resharpening changes their dimensions
- may be prone to chatter or create 'lobes'
- dimensioning them in the first place can be difficult
  - they cut on the diagonal, which changes with thickness/width ratio

initial reaming a blank

- I like to hold the reamer in the lathe at slow speed (125 RPM or less)
- allows control over blank
- go slow
  - avoid overheating
- clear chips often
  - ditto
- use non-water-bearing lubricant
  - I like linseed oil, have used paste wax

finish reaming

- check bore with gauges to judge final reaming depth
  - reamer insertion depth can be misleading, due to wood movement and elasticity
    - some thermal movement, remember
    - most billets will shrink a bit
  - give some time to settle – months ideally
- hand-ream until spot checks match up
  - you may wish to reduce lubrication at this step, to avoid build-up


340 350 360 370 380 390 400 410 420 430 440 450 460


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cautions

- careful with billets that may have warped
  - ream too gently, and your bore may not match reamer profile
  - use enough pressure, if practical, that the reamer flexes when necessary
  - too much pressure or speed can cause overheating, or even with hand-reaming can cause uneven results due to timber elasticity
    - oval bores can result