Making and Using Reamers

part 1

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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
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
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
(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
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
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
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