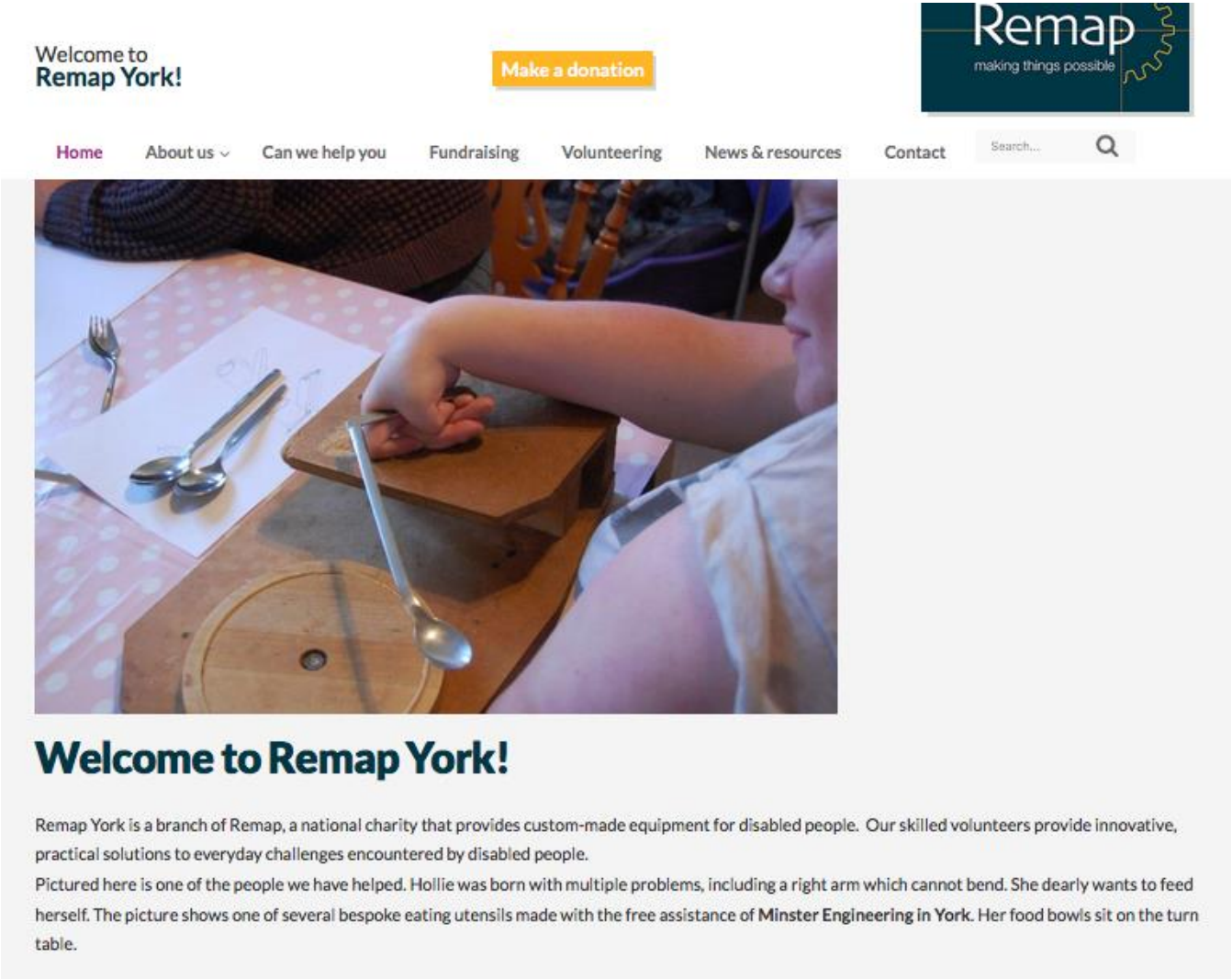
Using the Router on the Lathe.

Mike Leadbeater.

Just a little of my background



Before we start, just a “plug” for our charity, are you interested in joining us?, please have a chat with Stuart or myself if so.

OR, GO TO OUR WEBSITE

york.remap.org.uk

- Woodturning is a tactile craft

  - The wood lathe is a power tool, but with a high degree of hand/eye coordination.
  - power tools generally detract from the tactile element of woodworking.

I don't want to detract from this pleasurable activity,

  - *But* there are occasions when using a router on the wood lathe is beneficial :
    - **safety issues,** e.g. truing out-of-balance logs
    - where **repetition** is involved, e.g. making 50 identical rings
    - where **precision** is required, e.g. making a parallel bore, or indexing a workpiece
    - where other methods require **high degree of skill**, with likelihood of failure.
      e.g. hand-chasing screwthreads

Cutting screw threads using a router:

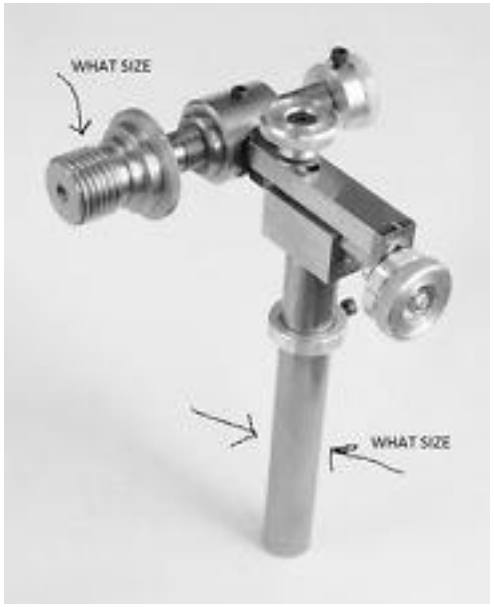
- WHY?
  - high success rate
  - lower skill level compared to hand-chasing
  - low cost, assuming you have a router
    - only purchase is suitable cutter
    - mounting can be made from scrap materials

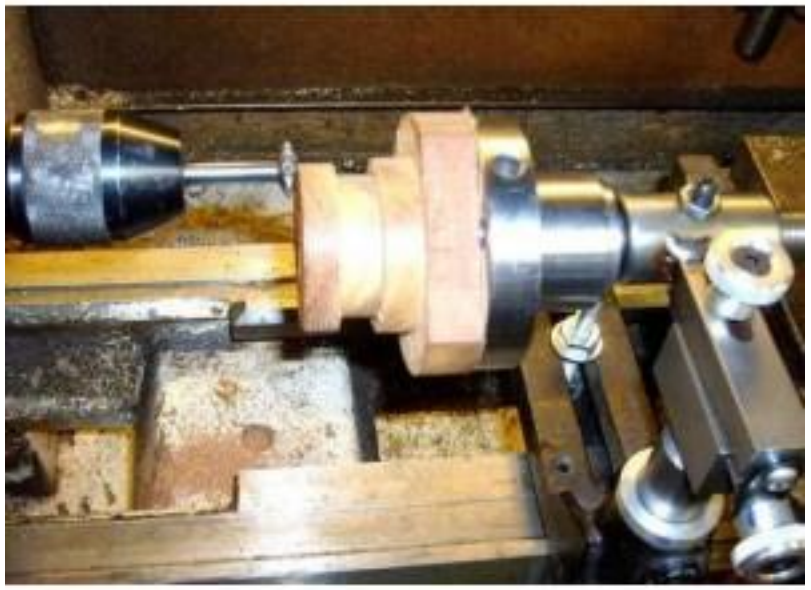
Cutting screw threads using a router:

How?

- inspired by

commercial system:





Cost £125

Cutting screw threads using a router:

- How?

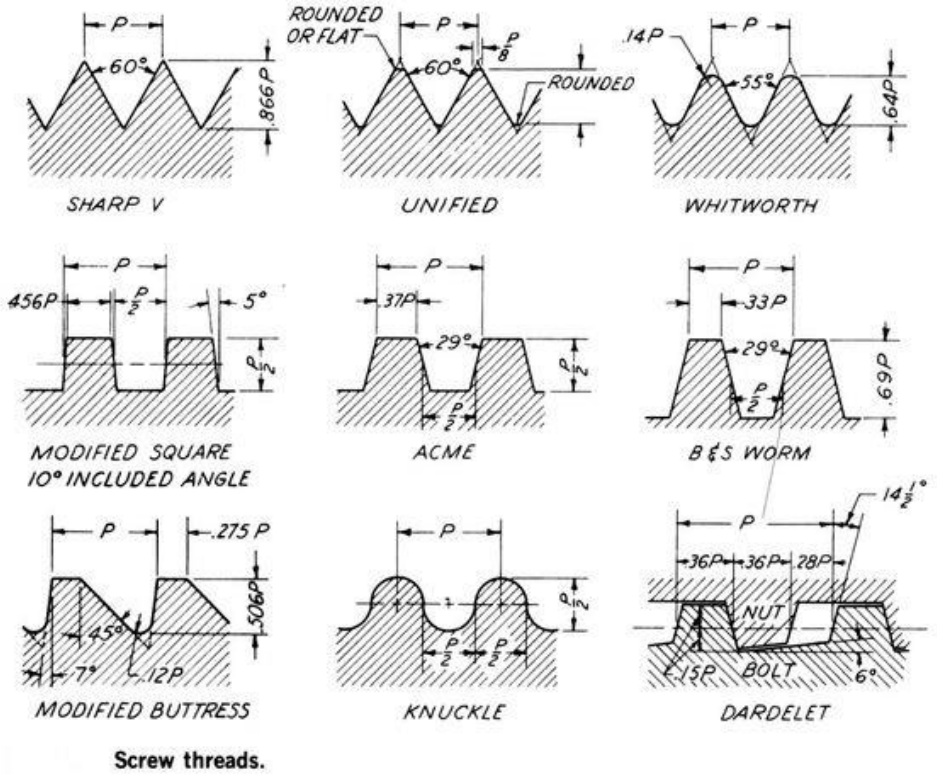
-thread is generated by partially unscrewing the chuck

-effectively duplicates the spindle nose **thread pitch**

-but not thread form, or diameter.

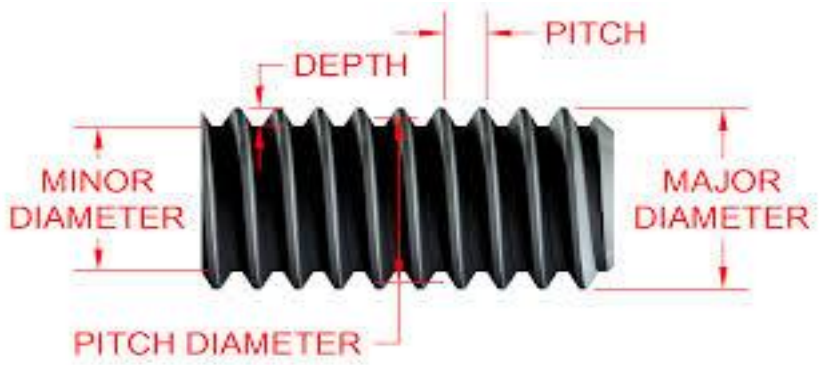
Screw threads:

- Thread defined by **form:**



Screw threads.

- and **pitch:**



Our main concerns are:

- depth of thread (cut)

and

-major & minor diameters

Screw threads (cont) :

- Most wood lathes will be either

  -Metric, expressed by diameter and pitch, e.g.

  M33 x 3.5mm (Warco, Record, Hegner)

  OR

  – Whitworth (B.S.W.), expressed by Diameter & Threads Per Inch, e.g.

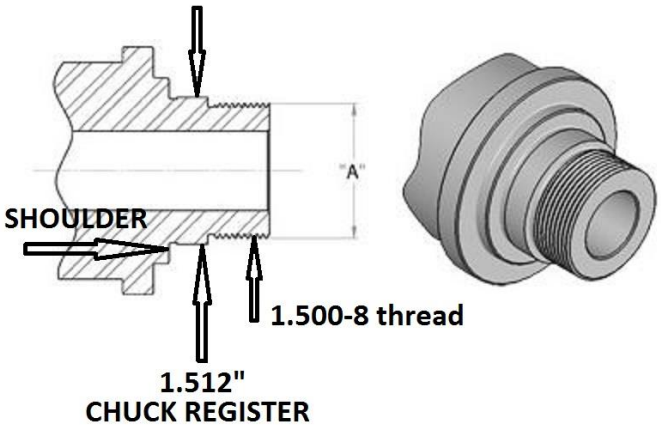
  -1.5” x 6 TPI (Harrison Graduate) or
  - 1” x 12 TPI (Myford)
  - 1” x 8 TPI (Axminster)

Screw threads (cont) :

To determine your lathe spindle thread, either:

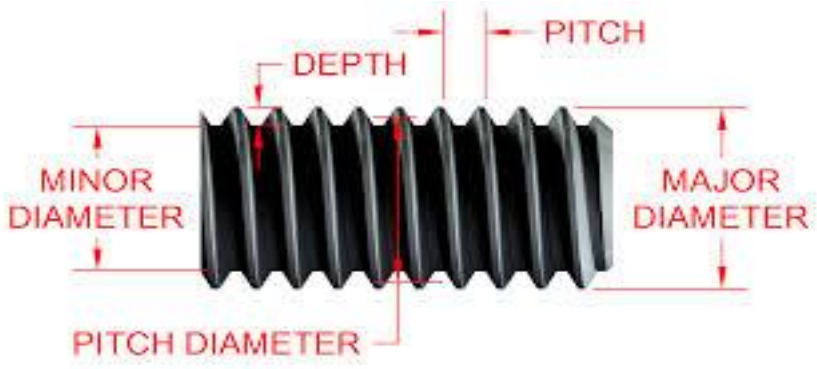
- use digital calipers to measure pitch
- or thread gauges:

and measure thread diameter ‘A’ with Calipers, e.g. 1.5”x 8 :

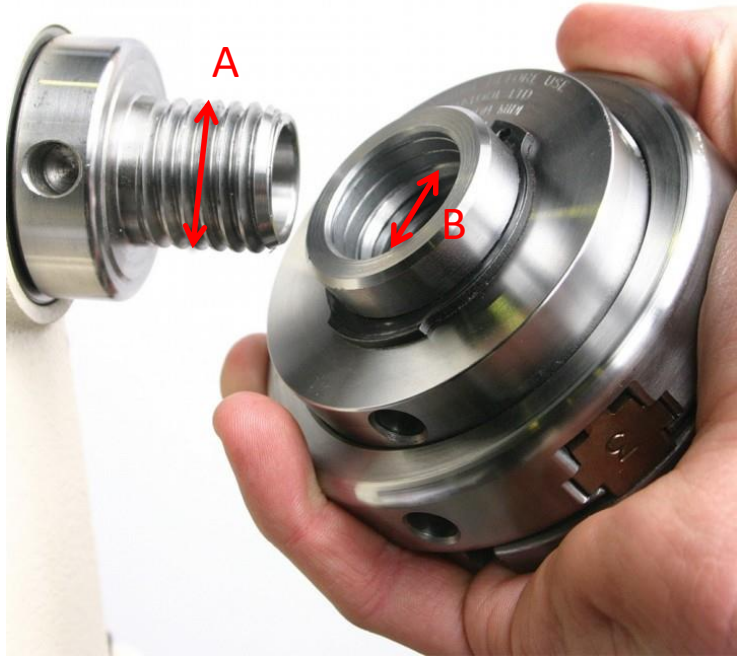


Screw threads (cont) :

- Then determine (approximate) thread depth by measuring inside diameter of chuck thread ‘B’, subtract from ‘A’, and divide by two



i.e. (MAJOR – MINOR DIA) / 2



Club Hegner lathe has M33 x 3.5 thread

From thread tables:

Core diameter of this thread is 29.771

difference is 3.23mm, so thread depth is

3.23/2 = 1.61mm

For us a thread depth of 1.7mm should be fine.

And all you need to know is:

- The depth of thread to cut, (always the same)

And

- the difference in diameters between the male thread and bore of female thread you wish to cut.
- This is the thread depth x two

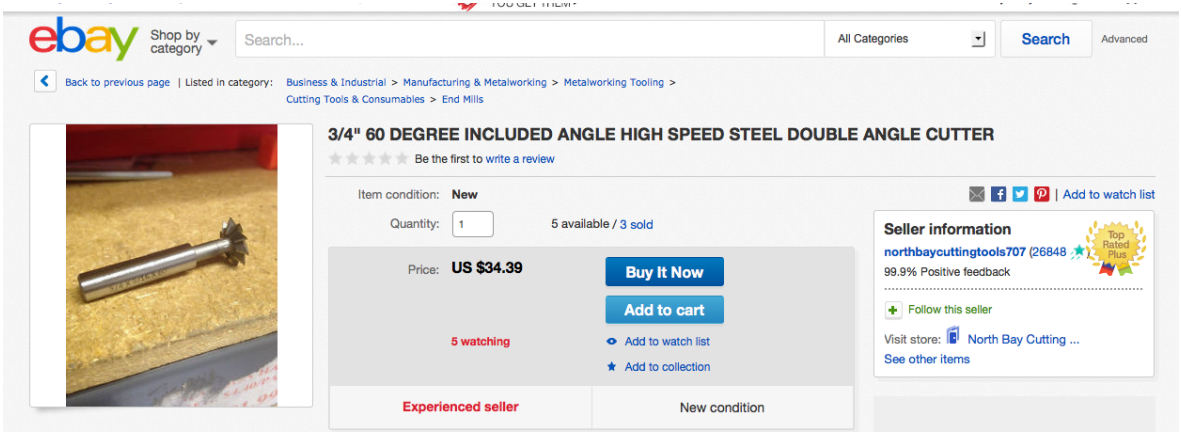
Screw Thread Cutter

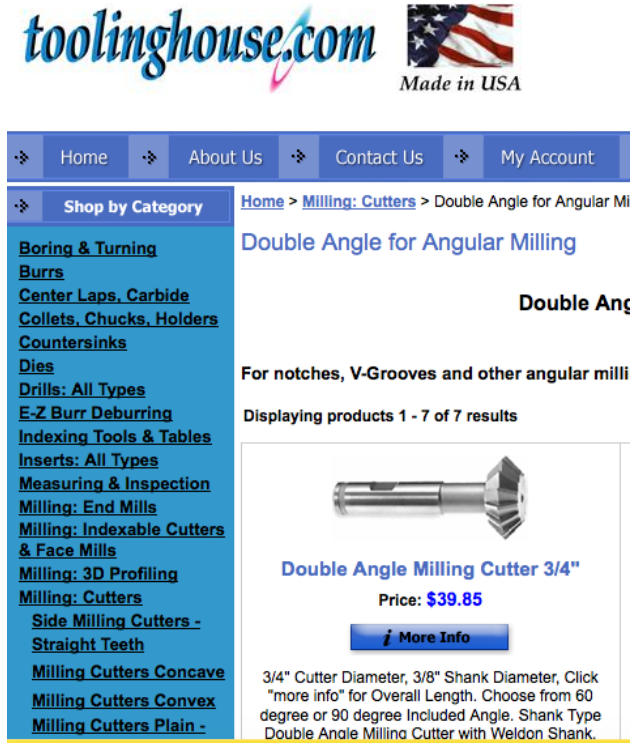
- Standard router cutters not available for 60 deg thread.
- Cutter sourced from metal milling machine cutter suppliers:

Called: "60 degree double angled milling cutter"

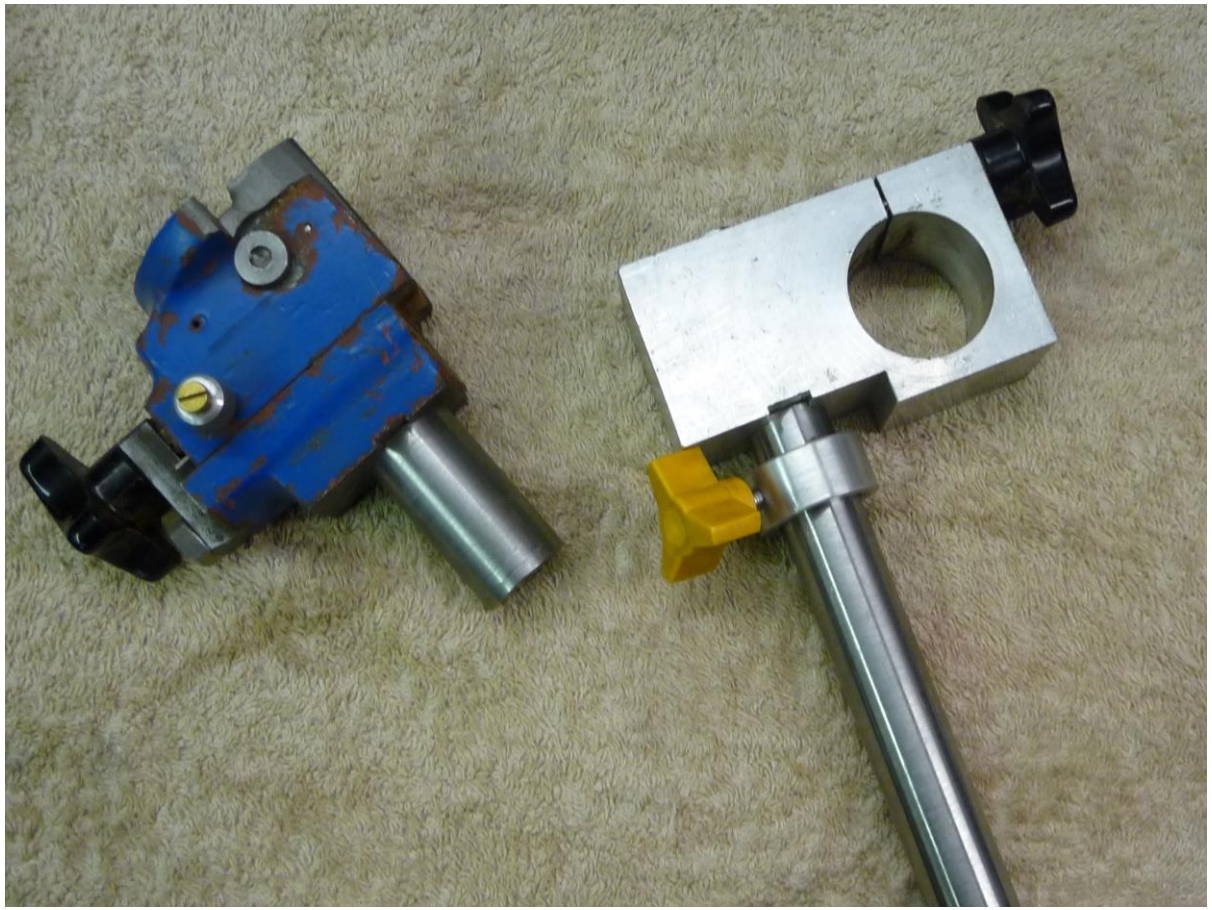
May require shank reducing to 6mm, or special collet making.

OR regrind dovetail router cutter





Router mounting fixtures



Mounting the Router

- Needs length of steel bar of same diameter as tool rest.
- Mounting arm with clamp, square and true to lathe axis (or plate/bracket to suit router).
- Extreme robustness of mounting not required, but firm enough to avoid slop, flexing or movement under cutter load, not high as cutting action very gentle.
- Convenient to have toolpost height stop for easy replacement of router to correct height.

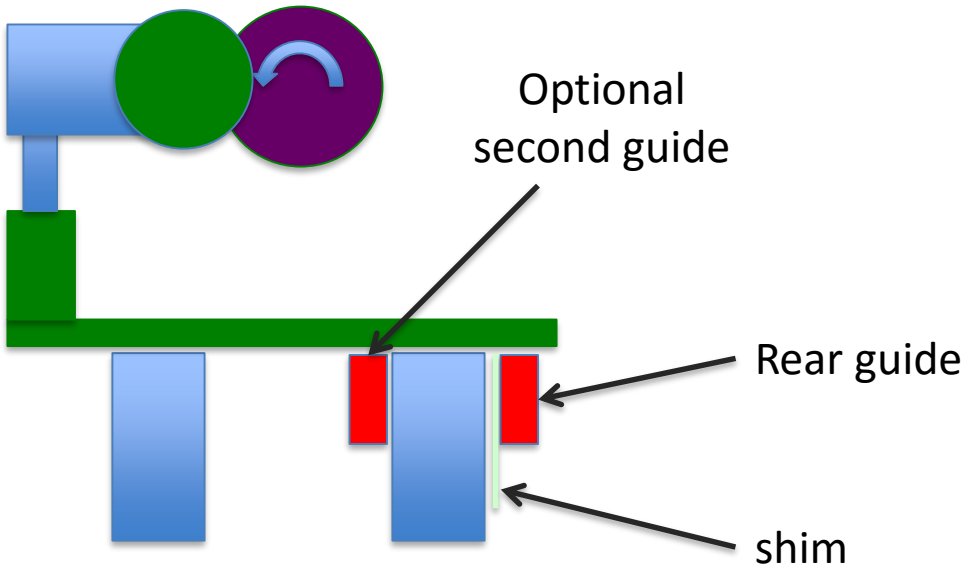
Mounting the Router (cont'd)

Recommend use of plastic knobs rather than spanners or keys to tighten clamps etc. Obtain from ebay, also threaded bar for longer thread.

Guide for ‘Banjo’ tool rest

- Used to keep Banjo square to lathe bed
- And to set and control depth of cut by router

  -using removable shim



Limitations of Router Thread Cutting

- Pitch of thread same as lathe spindle.
- Thread length limited to safe number of turns of unscrewing chuck. This should be determined in advance of operation.

But OK for lids etc. and joining with 3 or less thread turns.

Both can be overcome if adaptor bush and spindle made with desired screw profile.

(similar to commercial unit)

Method of Screwcutting- Female

- For female thread, cut recess in work piece to desired diameter (thread diameter less 2x thread depth if precise size required). Make a note of diameter, measuring accurately with digital calipers.
- Position router with cutter axis at centre-height and parallel to lathe axis, with cutter just entering recess and cutter tip just touching inside of bore. Tighten banjo clamp.
- Set banjo guide up to rear of lathe bed, including shim of thread- depth thickness, tighten guide.
- Remove shim, loosen clamp, slide banjo slightly to right and forward until guide moves up to rear of bed, tighten clamp.
- The cutter is now in a position to cut the thread to full depth, with router running, and lathe spindle locked, slowly unscrew chuck a safe number of turns, say 3, or until cutter bottoms out in recess. Stop router and withdraw.
- Finally, gently sand tops of threads with suitable paper, say 180 grit

Method of Screwcutting- Male

- Turn spigot for male thread to required length, diameter to be previously noted female thread recess diameter plus 2 x thread depth.
- Position router as before at center height and parallel, with cutter tip just contacting OD of spigot and at start of RH end.
- Tighten banjo clamp, adjust rear guide to contact lathe bed, tighten guide.
- Loosen clamp, move banjo slightly to right, insert shim as used for female thread, re-tighten clamp. This has moved the cutter forward by the desired thread depth.
- With router running, and lathe spindle locked, slowly unscrew chuck by safe number of turns, say 3, to cut male thread, stop and withdraw.
- Test fit of thread with female, sand or file if tight, recut if too tight.

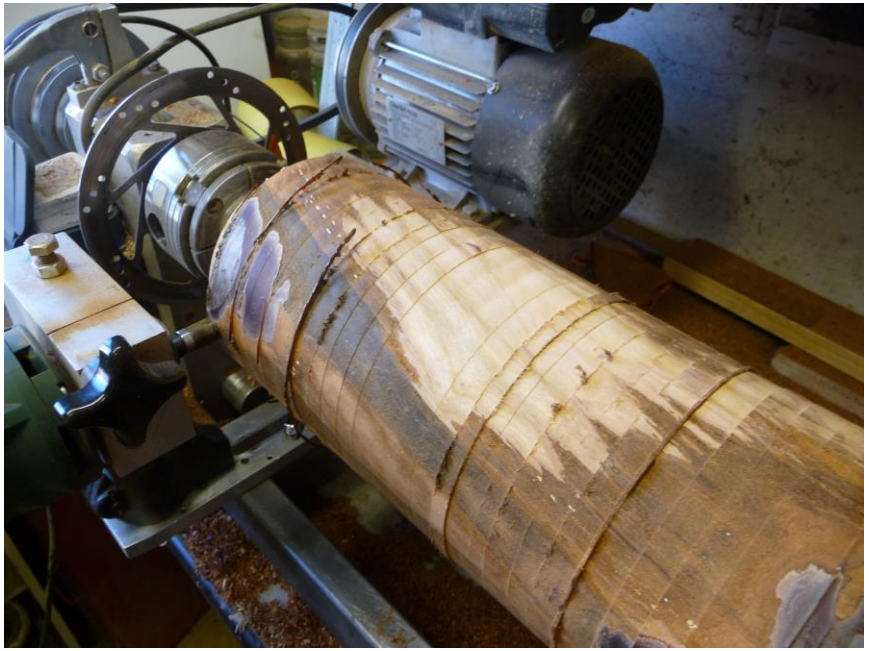
Truing out of balance logs and wood.

- Router use square-on to lathe, with end-cutter, for cylindrical work.
- Lathe turned by hand with router cutting, avoids out-of-balance forces and hazards
  - ALSO:
- Router used inline for facing operations of irregular wooden pieces

Truing out of balance logs and wood. (cont'd)

Start of truing

Truing completed



- That’s all from me
- Any questions????
- Next is Stuart’s turn

How to make and use your own hollow-ground scraper.

Stuart Thomson

- JUST A LITTLE OF MY BACKGROUND

Work holding

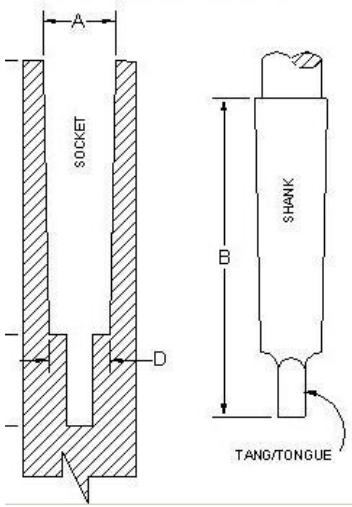
- Chuck types – supernova
- Very flexible

- Multi star with indexing holes
- Limited range with each jaw-set, but repeatable

Morse taper sizes/Zeus tables

- MT1 Small morse taper often on wood lathes
- MT2 Medium morse taper on more HD lathes
- MT3 Usually on Metal-working lathes

MORSE TAPER DIMENSION REFERENCE (inches)



Taper#	A	D	K	L	B
0	0.3561	0.2520	1.9375	0.5625	2.3438
1	0.4750	0.3690	2.0625	0.7500	2.5625
2	0.7000	0.5720	2.5000	0.8750	3.1250
3	0.9380	0.7780	3.0625	1.1875	3.8750
4	1.2310	1.0200	3.8750	1.2500	4.8750
5	1.7480	1.4750	4.9375	1.5000	6.1250
6	2.4940	2.1160	7.0000	1.750	8.5625
7	3.2700	2.7500	9.5000	2.6250	11.6250

Zeus tables – the engineers mini bible!


MT 1 With
adapters for
MT2/MT3
MT2 with
Adapter for MT3
MT3
Morse Taper Sizes

Heat Treatment of Carbon Steel

- Mild steel 0.05 to 0.32% carbon
  - not heat treatable
  - can be Case Hardened by heating in contact with carbon

    but hardening very thin layer

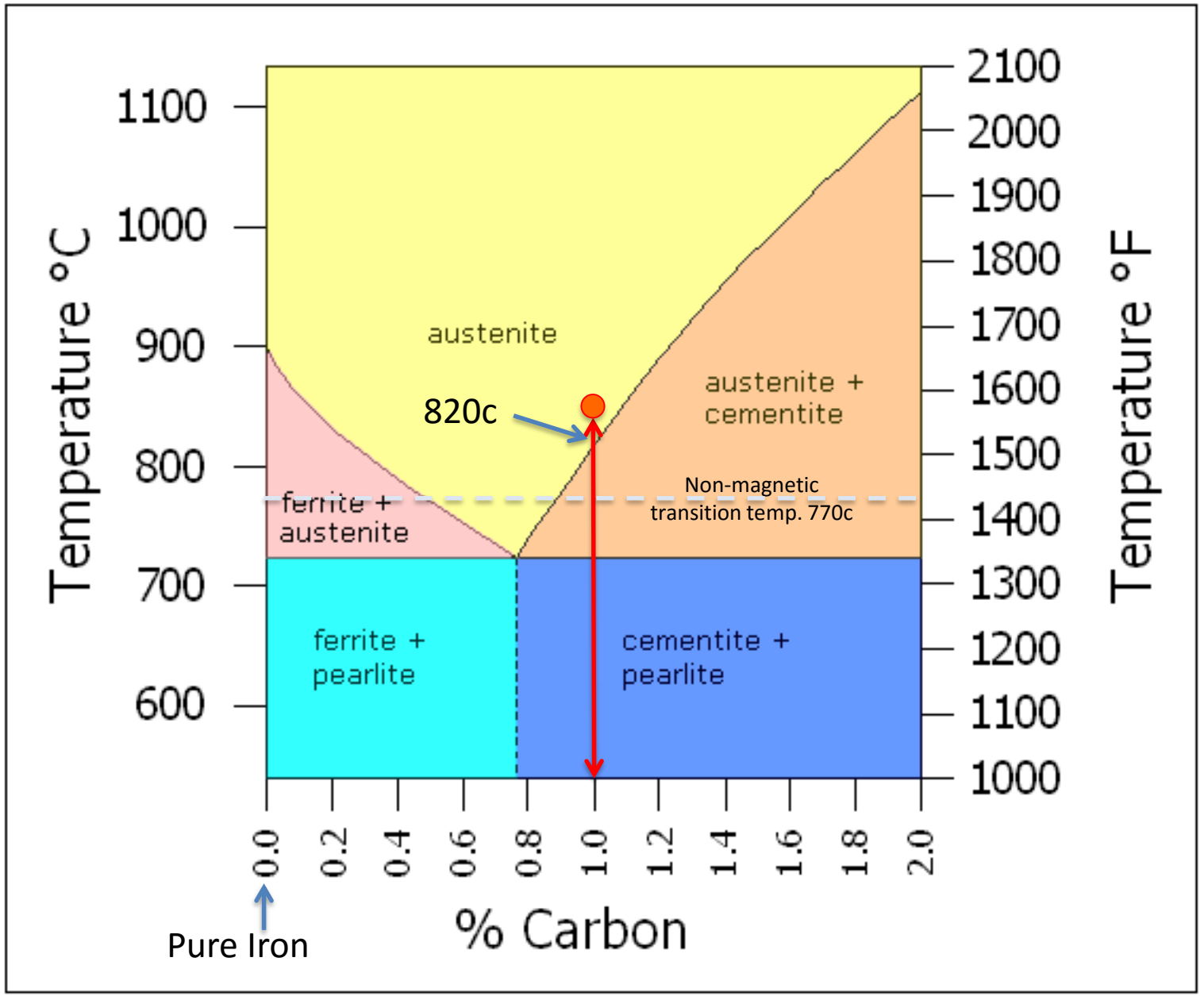
- Carbon steels 0.32 to 1.7% carbon
  - Can be hardened and tempered.

3 Heat treatment “states”:

-heat & cool slowly = Annealed (soft/workable)

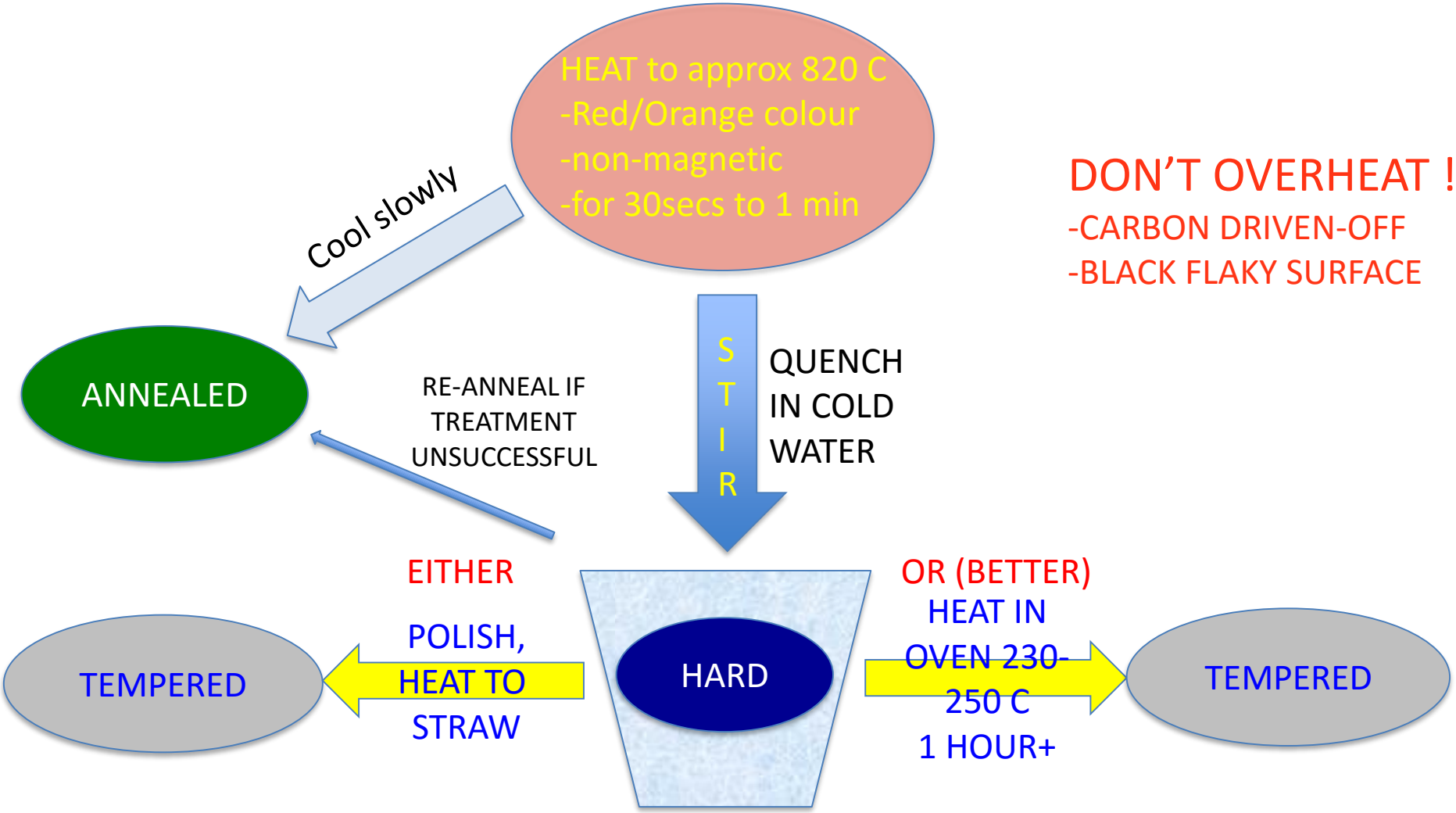
-heat & cool rapidly = Hardened (brittle)

-re-heat slightly = Tempered (tough, slightly less hard)



Simplified Fe-C Phase Diagram (Steel Portion)

Typical Heat-treatment of Steel



Check hardness with file-scratch test, then finally sharpen.

Tool Steel Color vs Temperature

When heated for hardening

2000°F	Bright yellow	1093°C
1900°F	Dark yellow	1038°C
1800°F	Orange yellow	982°C
1700°F	Orange	927°C
1600°F	Orange red	871°C
1500°F	Bright red	816°C
1400°F	Red	760°C
1300°F	Medium red	704°C
1200°F	Dull red	649°C
1100°F	Slight red	593°C
1000°F	Very slight red, mostly grey	538°C
0800°F	Dark grey	427°C
0575°F	Blue	302°C
0540°F	Dark Purple	282°C
0520°F	Purple	271°C
0500°F	Brown/Purple	260°C
0480°F	Brown	249°C
0465°F	Dark Straw	241°C
0445°F	Light Straw	229°C
0390°F	Faint Straw	199°C

Colours when reheating for tempering,
n.b. surface needs polishing
before heating

Increasing temperature

TEMPERING COLOUR	TEMPERATURE °C	TEMPERING COLOUR
PALE YELLOW	230	LATHE TOOLS FOR BRASS
DARK YELLOW	240	LATHE TOOLS FOR MILD STEEL
BROWN	250	WOOD TURNING TOOLS
BROWN/PURPLE	260	WOOD WORKING TOOLS
PURPLE	270	AXES
DARK PURPLE	280	COLD FORGING TOOLS
BLUE	300	SPRINGS

Portable gas welding/brazing kit cost

About £100

Turning Tools : Files

Concerns of using files for wood turning tools

Files are very hard but brittle, and can fracture easily under shock loading.

The Tang, where the handle is attached, is not strong, easily bent,
and the taper does not retain handles securely.

The teeth must be removed on at least the underside before use on the tool rest

BUT

They are a cheap source of carbon steel

Can be tempered; heat in oven for several hours at 280c (SHMBO permitting)

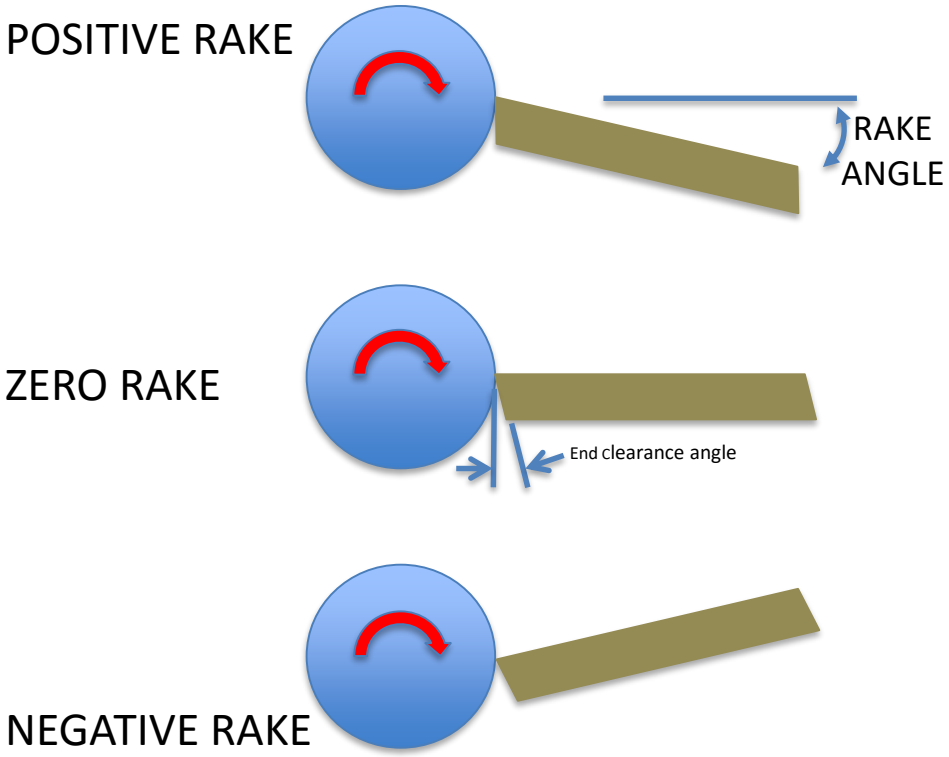
OK to use for negative rake tools with scraping action.

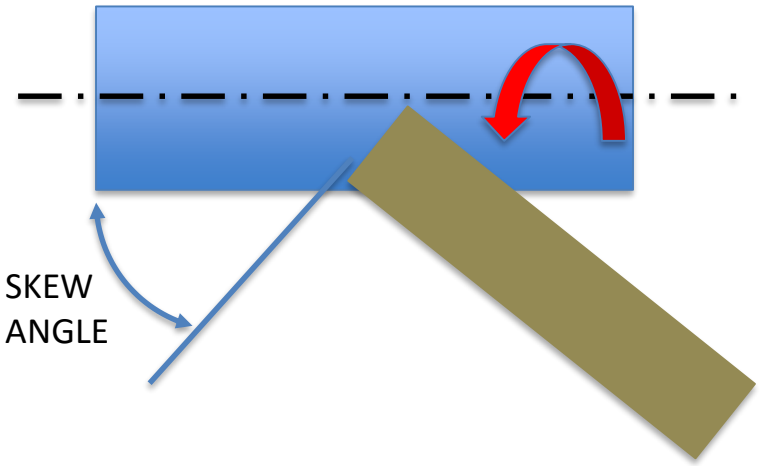
- -Good for making form tools: beading and coving etc
- -will hold an edge well

And – ideal for making hollow-ground scrapers

Form-tools from Files

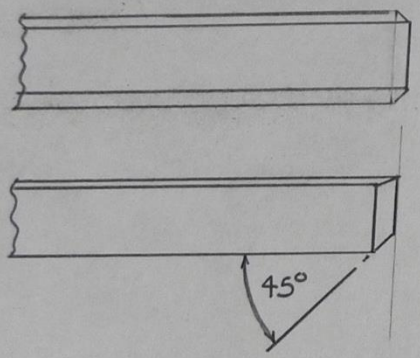
Tool Geometry: Rake and Skew



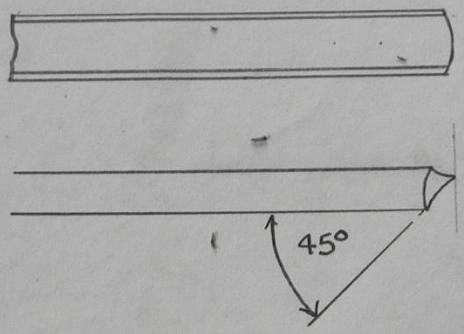


WOODTURNING TOOLS

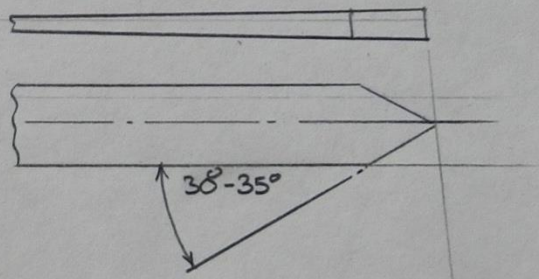
ROUGHING & BOWL GOUGES

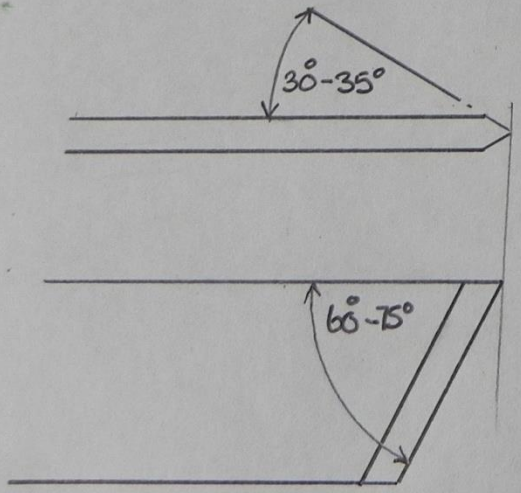


SPINDLE GOUGE

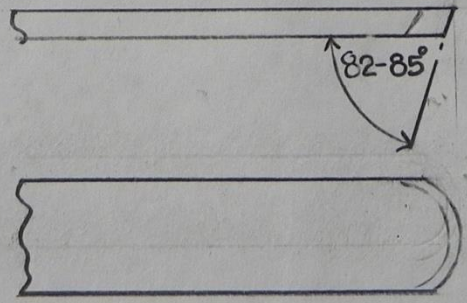


PARTING TOOL

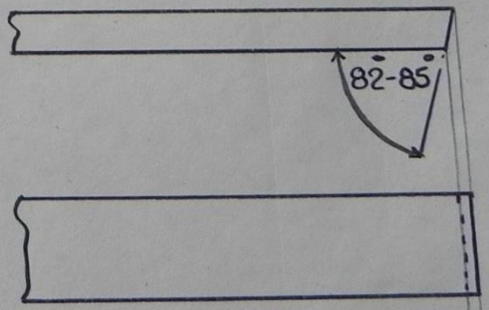




SKEW CHISEL



ROUND SCRAPER



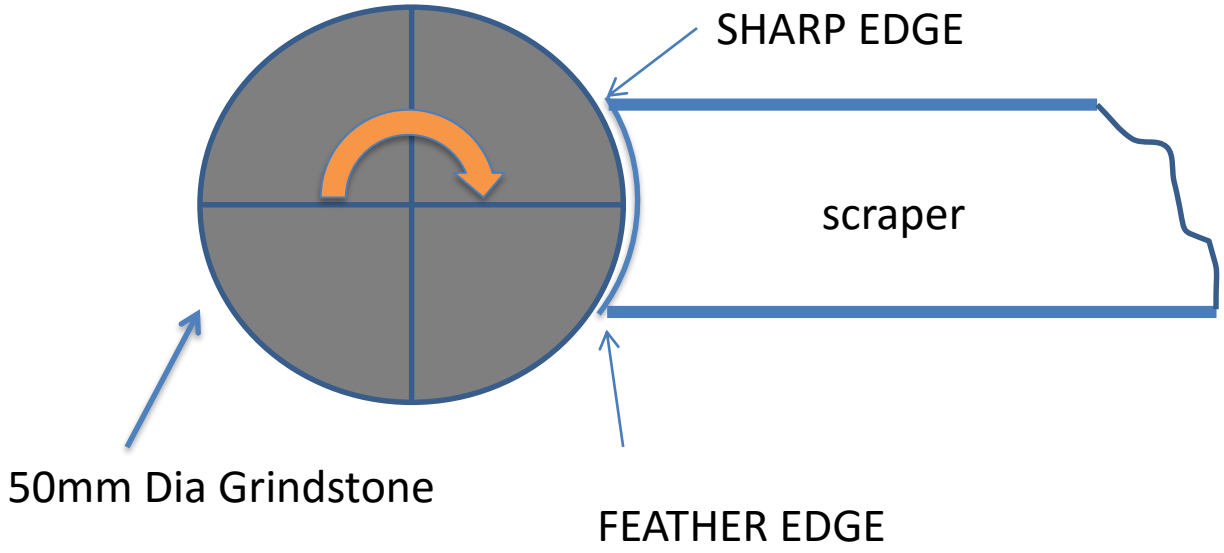
FLAT SCRAPER

- Design of scrapers; food for thought…….

- When using 'scraping' tools, keep the **point of cutting below the centreline** of the workpiece when working on the **outside,**
- and **above the centreline** when turning the **inside of**, for instance, a bowl.

- These tools are always used trailing slightly (aprox 5 degrees negative rake) below the horizontal, in side elevation, and flat on the toolrest in section/end elevation.

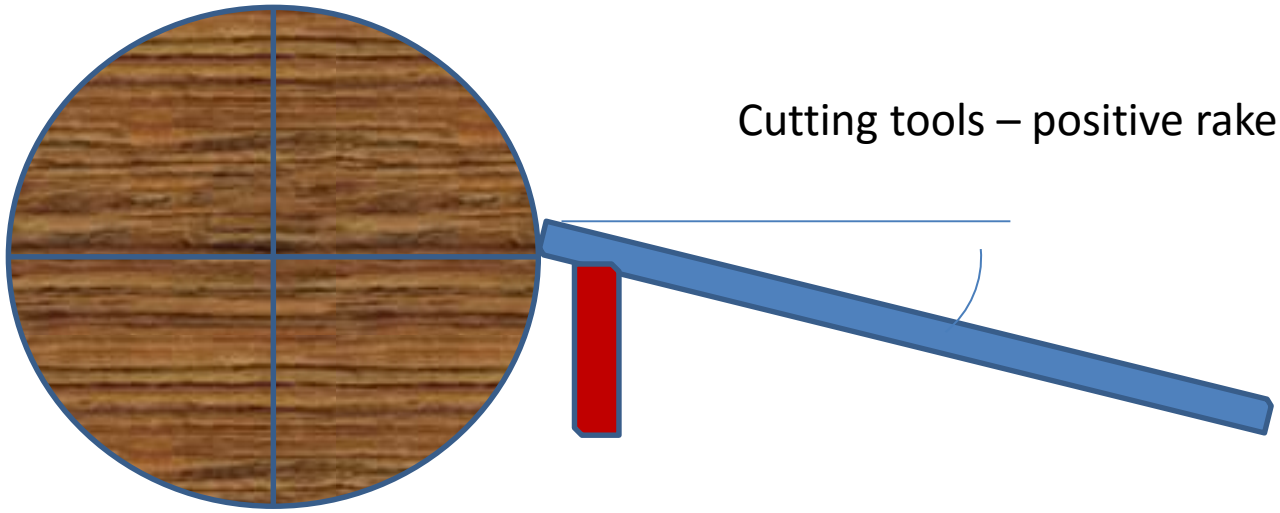
Scrapers normally have a single cutting edge like cabinet scrapers
How about two cutting edges on each scraper? One coarse and one fine……..



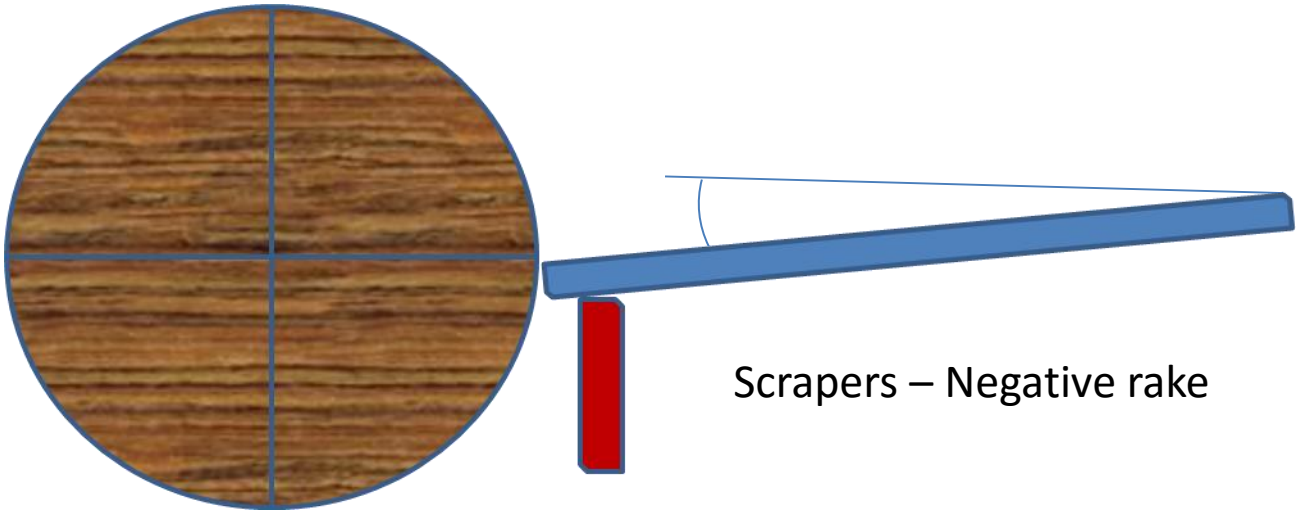
- This means that the standard scrapers can be modified to give two cutting edges, a heavy scraping edge and a light scraping edge.

Grinding a double-edged scraper

Cutting tool angles



Cutting tools – positive rake



Scrapers – Negative rake

Demo of grinding and use

Over to you, come and try,
Have a go, don’t be shy……

That’s All!

- We hope you have enjoyed our presentation as much as we have making it.

N.B. all this will be on the club web site, soon.

Happy Turning, and Goodnight.