



Finger Joint Tools Set Up & Maintenance

AceCo Finger Joint Heads



- ▶ 2 to 20 bolt heads. AceCo offers the widest selection of standard and custom finger joint tools.
- ▶ Precision machined from hardened alloy steel.

AceCo Finger Joint Heads



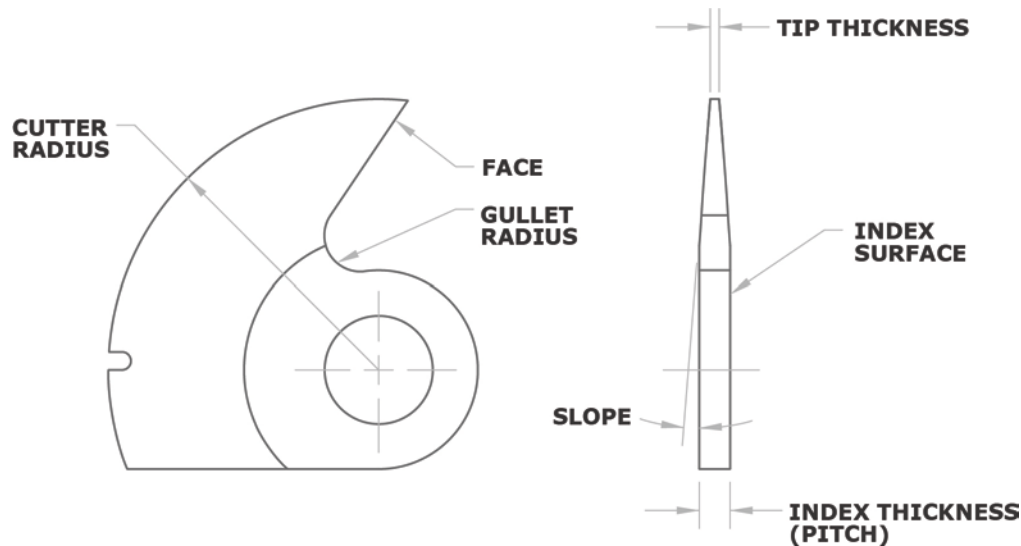
- ▶ High Tensile Alloy Steel: 4150 Heat-treated steel for maximum durability.
- ▶ Hardened Steel Nuts and Bolts: Grade 8 - High Strength.

AceCo Finger Joint Heads



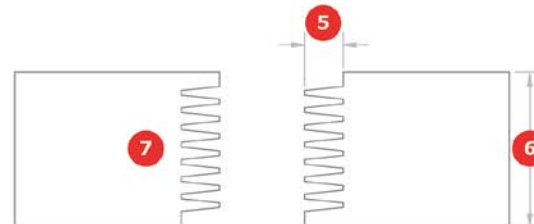
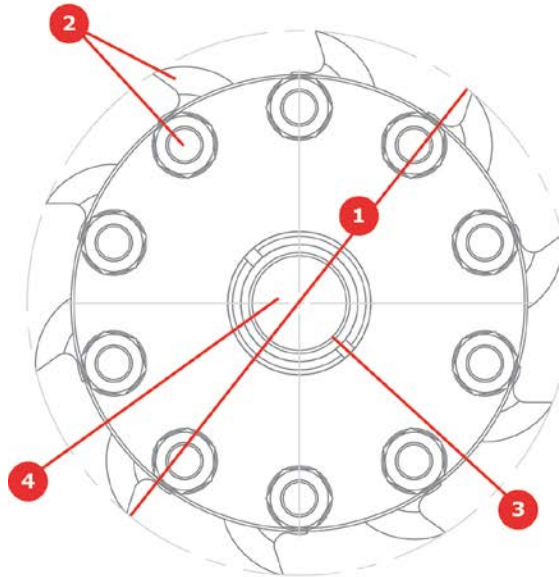
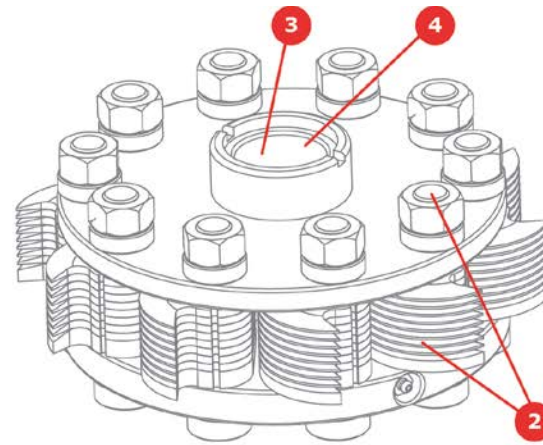
- ▶ Ace-Loc hydraulic sleeves ensure repeatability, accuracy, and balance.
- ▶ Class II Option: .0005" (.0127mm) Bore to Bottom Plate (knife face) Perpendicularity.
- ▶ Balanced to 7200 RPM

FJ Cutter Terminology



- Finite Finish™ is a combination of thickness accuracy and flatness. This process is what makes our finger joint cutters the best in the world.
- Finite Finish™ guarantees thickness accuracy tolerances to be held to under $\pm.0001''$ or $\pm.0025\text{mm}$.
- Finite Finish™ eliminates tolerance accumulation problems associated with stacked cutters.
- Flatness tolerances below $.00005''$ (50 millionths of an inch) ($\pm.0012\text{mm}$).

Finger Joint Head Terminology



To order or request a quote, please specify the following:

1	EXTREME SWING (Cutting Circle) Diameter across head from cutting tip to tip.
2	NUMBER OF BOLTS (or WINGS) 4 Knife 6 Knife 8 Knife 10 Knife Custom Size
3	SPINDLE DIAMETER 1.500" 1.813" 50mm 2.125" Custom Size
4	CENTERING TYPE Ace-Loc Hydraulic* Straight Bore Collet
5	JOINT LENGTH
6	MATERIAL THICKNESS
7	JOINT TYPE (see page 6) Reverse Male / Female Feather Other
<i>Additional Options:</i> *Heat Treated Sleeves for Keyed Spindles	



Recommended Tool Maintenance

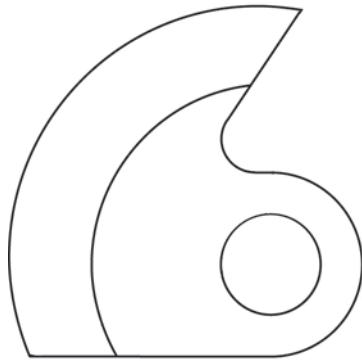
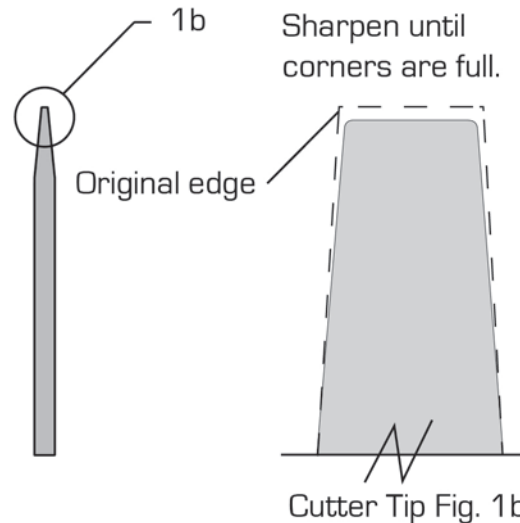


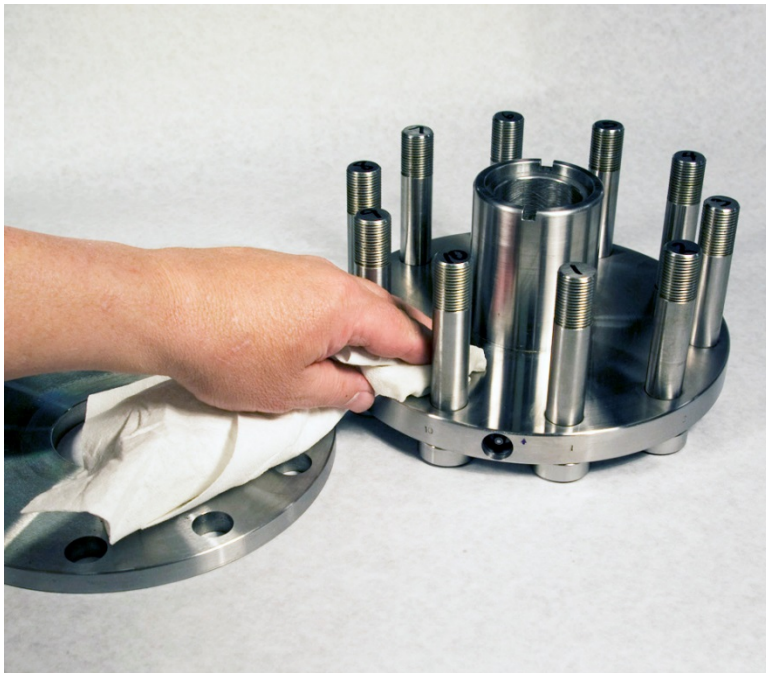
Fig. 1a



- ▶ Sharpen Cutters: Every 1 to 3 shifts, or as needed depending on conditions.
- ▶ Align Grinding Machine: Once every ten uses.
- ▶ Balance Cutter Stacks: Once a month, or every 5 postings.
- ▶ Post on Setup Stand: After every 3-4 resharpenings, or when the cutters are 0.025 inches away from the alignment post.
- ▶ Torque Head: Every time the head is loosened or disassembled.

Finger Joint Head Set-Up

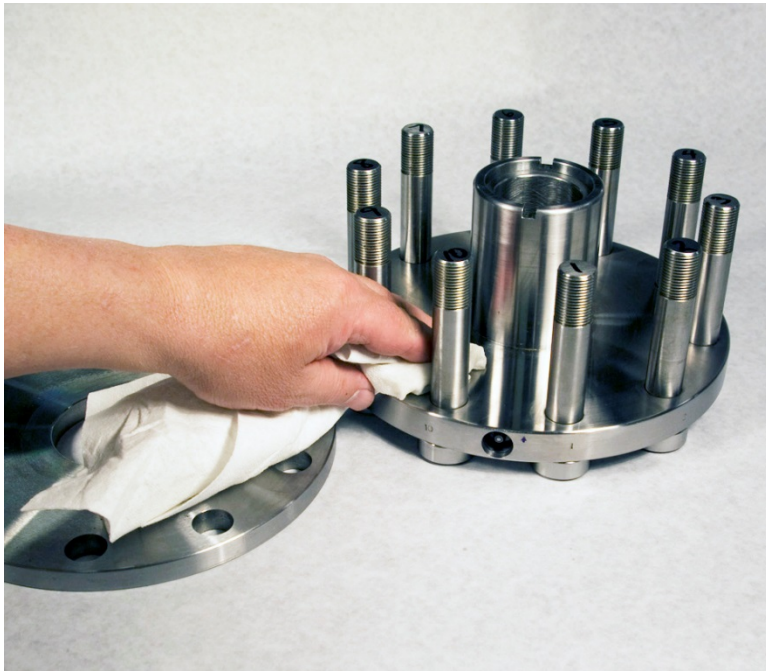
NEW CUTTERS/HEAD:



- ▶ Stone both index surfaces of each new cutter with a hand held India stone (fine grit) using a circular motion.
- ▶ Clean the inside bore of the hole with a Q-Tip (cotton swab).
- ▶ Remove any oil with a shop towel and Isopropyl alcohol from both index surfaces.

Finger Joint Head Set-Up

USED CUTTER/HEAD:



- ▶ When removing used cutters from a head, keep each bolt stack together and label with the bolt number removed from.
- ▶ Soak cutter stacks in a non corrosive solution (BLADE CLEAN) to remove any pitch / sawdust buildup.
- ▶ Stone both index surfaces of each cutter with a hand held India stone (fine grit) using a circular motion.
- ▶ Clean the inside bore of the hole with a Q-Tip (cotton swab).
- ▶ Remove any oil with a shop towel and Isopropyl alcohol from both index surfaces.

Finger Joint Head Set-Up



HEAVY PITCH BUILD-UP:

- ▶ For heavy pitch buildup, use medium grade Scotch-Brite and WD40 to clean.
- ▶ Never use abrasives to clean cutters or the cutter head.

Balance Cutter Stacks

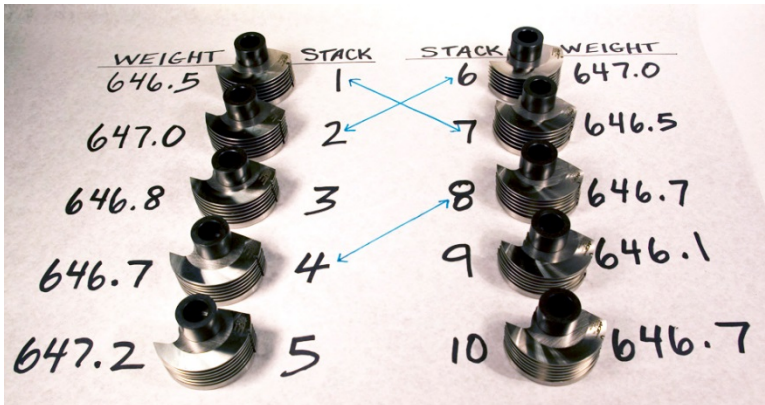


- ▶ Balancing is critical to the smooth performance of your finger joint head. In order to maintain an equal balance, cutter stacks must be cross-balanced to within 0.1 of a gram.

WEIGHT	STACK	STACK	WEIGHT
646.5	1	6	647.0
647.0	2	7	646.5
646.8	3	8	646.7
646.7	4	9	646.1
647.2	5	10	646.7

- ▶ Number each cutter stack 1 thru 10.

Balance Cutter Stacks

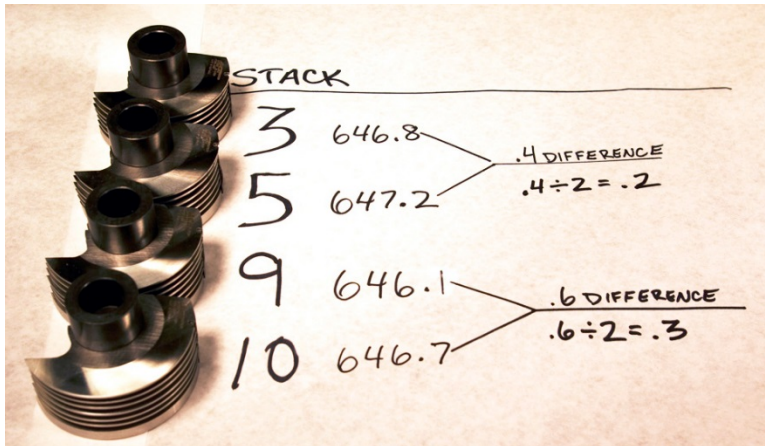


- ▶ Compare stack weights and pair any stacks that have weights within the +/- 0.1 gram limit.



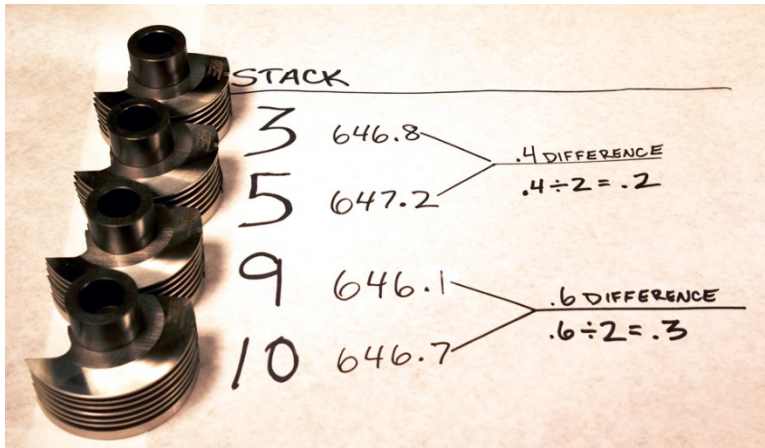
- ▶ In this example: Six of the ten stacks matched to be counter balanced on the head.

Balance Cutter Stacks



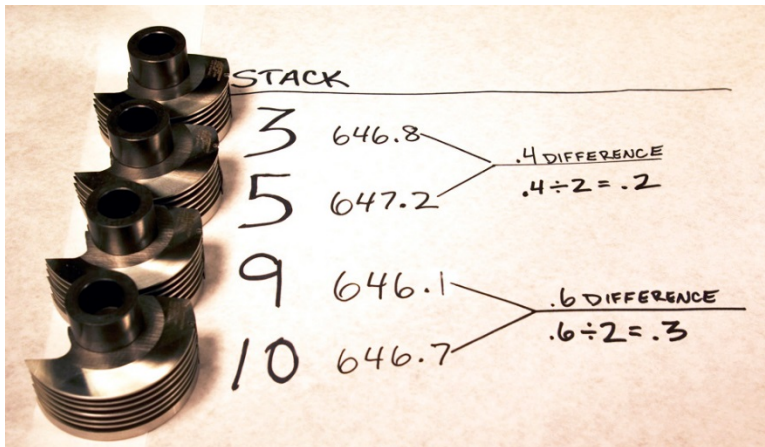
- ▶ These four stacks did not have a match within +/-0.1 gram.
- ▶ Divide the four stacks into pairs that are closest in weight.

Balance Cutter Stacks



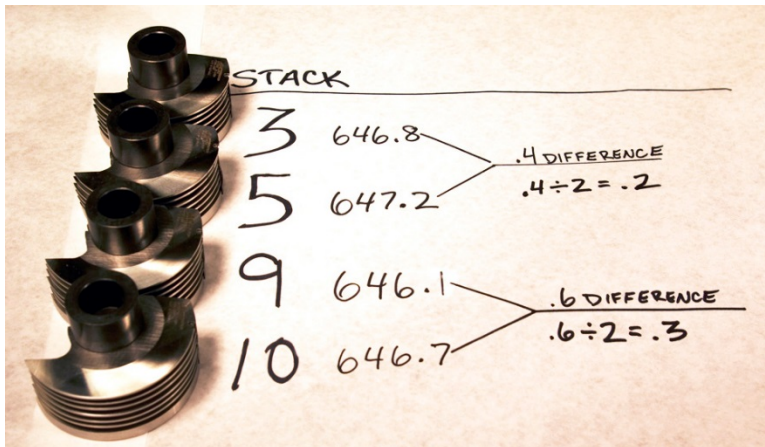
- ▶ Place the lighter stack on the scale and set scale to zero.
- ▶ Remove the lighter stack and replace with the heavier stack of cutters. Note the number displayed on the scale.

Balance Cutter Stacks



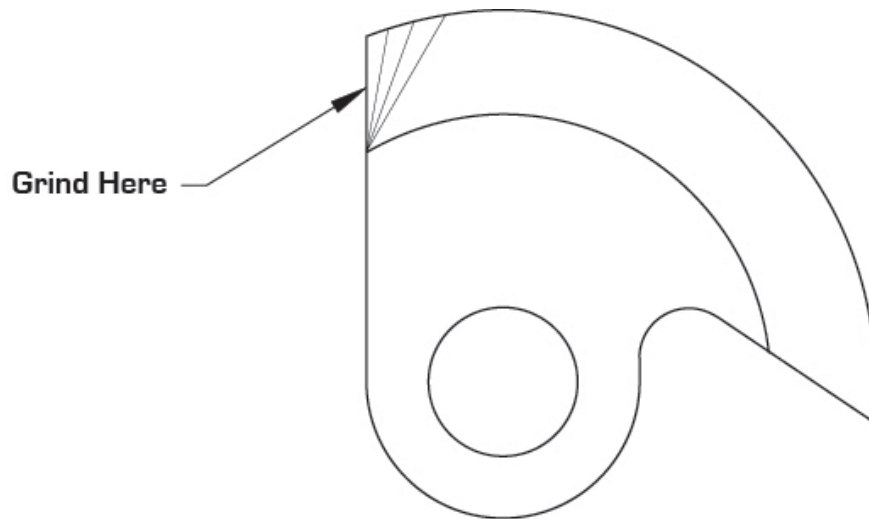
- ▶ Remove a cutter from the heavy stack and replace with a cutter from the lighter stack.
- ▶ Repeat this procedure until the weight difference has been reduced by exactly half.

Balance Cutter Stacks



- ▶ Both cutter stacks should now be within 0.1 gram of each other. Reset scale to zero and verify weight of each stack.
- ▶ Repeat this procedure on the remaining stacks.

Balance Cutter Stacks



- ▶ Only grind from the lower back corner of a cutter if balance cannot be obtained using the previous procedure.
- ▶ Grind the shoulder cutter to minimize the amount of material removal.

Assemble Finger Joint Head



- ▶ Cutter Stacks are counter balanced and ready to install on head.



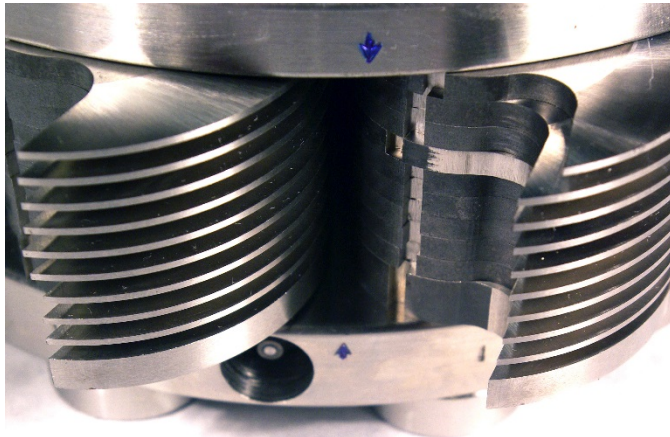
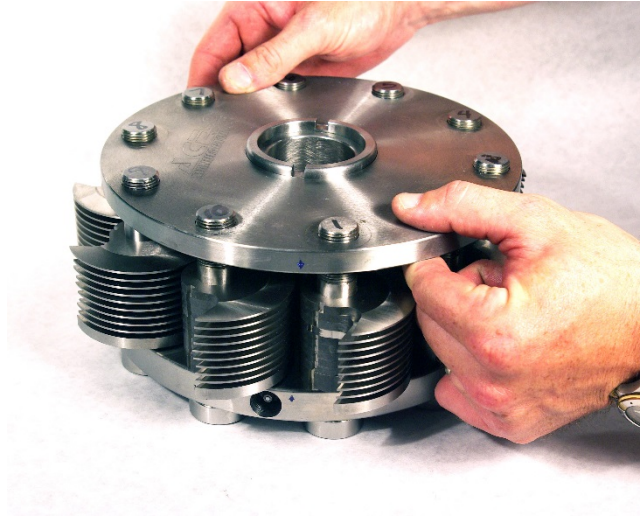
- ▶ Write bolt numbers on top of head. These bolt numbers also correspond to the cutter stack numbers.

Assemble Finger Joint Head



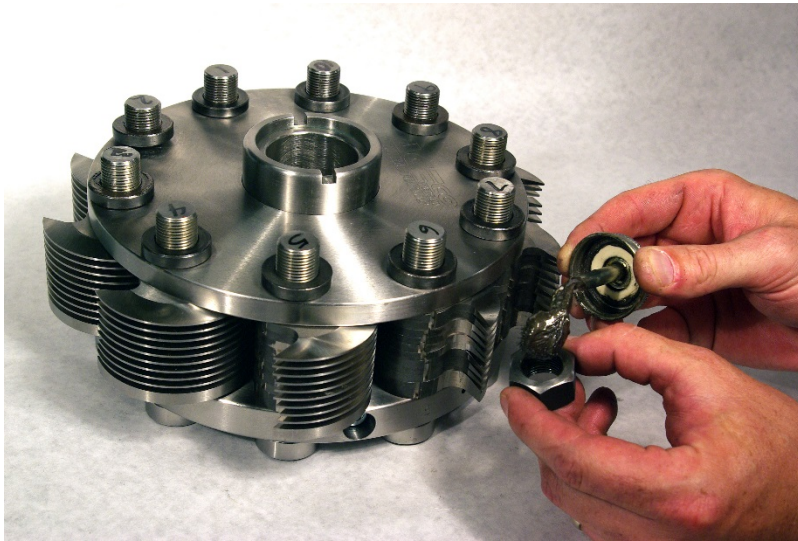
- ▶ Install cutters on appropriate bolts.

Assemble Finger Joint Head



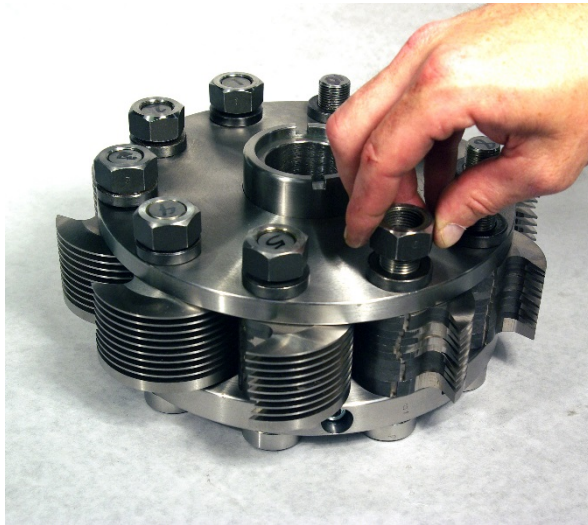
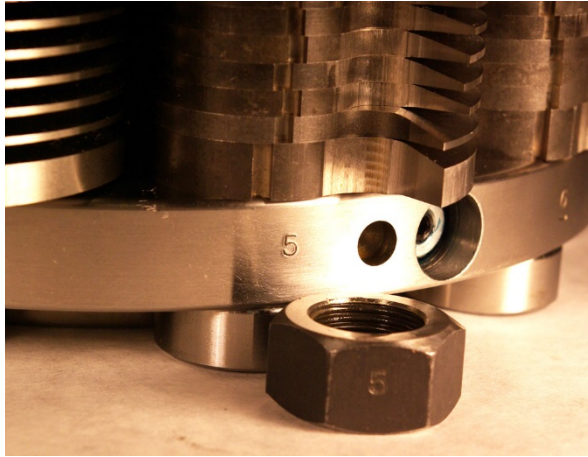
- ▶ Install the top plate. The arrows stamped on the side of the top plate and bottom plate are to be lined up.

Assemble Finger Joint Head



- ▶ Apply anti-seize to bolt threads, underneath each washer & in the bottom side of the nut.
- ▶ Install washers. Washers are to be balanced with the stacks so be careful to keep them on the correct bolt.

Assemble Finger Joint Head

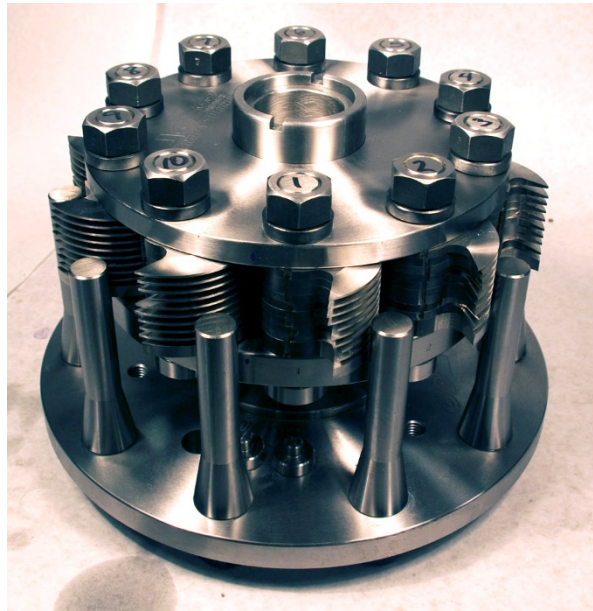


- ▶ Install nuts. It is also important to mate the corresponding nut.
- ▶ The bottom plate of cutter head is stamped adjacent to the bolt and the nut is stamped.
- ▶ Inspect the bolt threads. If more than .250" (6.35mm) is sticking up through the nut, you should add additional washers.
- ▶ Always put washers under the nut on the outside of the top plate.

Assemble Finger Joint Head



- ▶ Secure the set-up stand by bolting to a bench, table or stand.



- ▶ Place the torqueing pin in the correct offset hole depending on the rotation of the head.
- ▶ Roll the cutters back for easy clearance and carefully slide the head onto the center post of the set-up stand.

Assemble Finger Joint Head



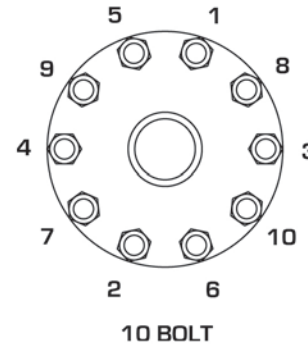
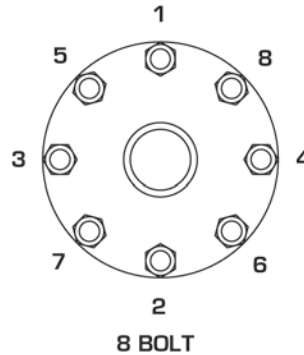
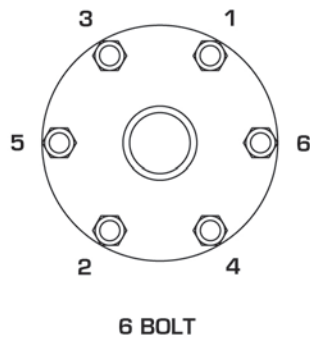
- ▶ Lift the head and rotate to slip the bolt onto the center posting pin.
- ▶ Pull forward the first stack of cutters. Hold all cutters tightly against the setup post and hand tighten the nut on top of the stack. Repeat this process for each cutter stack.

Assemble Finger Joint Head



- ▶ Lift the head up and rotate back to slip the bolt onto the torquing pin.

Torque Cutter Heads



- ▶ When torquing, you must tighten the nuts in a crisscross pattern to ensure level tension is maintained on the top plate.
- ▶ Repeat this sequence increasing torque in 50 foot-pound (68 Nm) increments each time, until the ideal range is reached.

Key Points

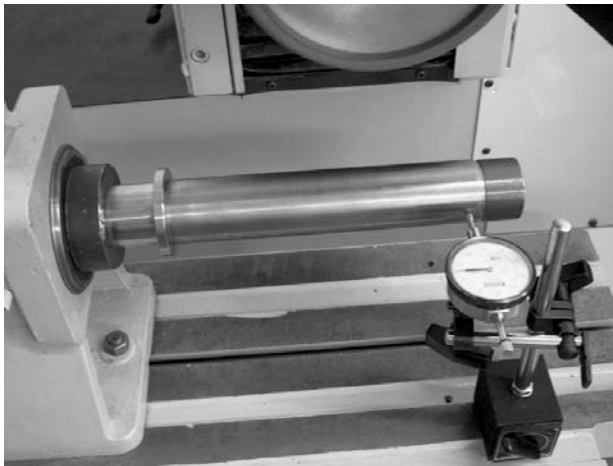


- ▶ Always have your torque wrench calibrated at least once every year.
- ▶ Never use a torque wrench to break loose a tightened nut.
- ▶ Always use a breaker bar to loosen the nuts.
- ▶ When loosening nuts to replace or repost cutters, loosen in gradual increments using the same sequence as torquing.

Grinding Machine Alignment

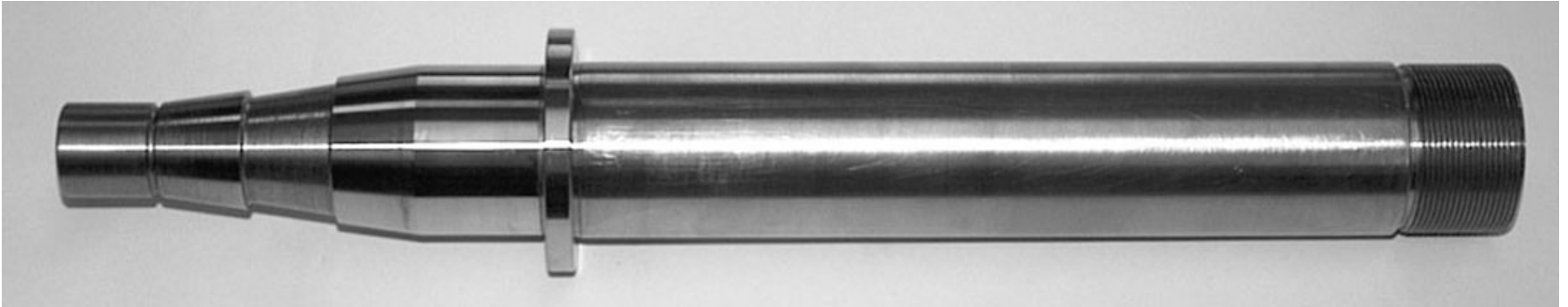
- ▶ It is important to maintain grinding machine alignment to ensure properly ground finger joint cutters.
- ▶ The tight tolerances that AceCo holds in the manufacture of finger joint tooling can be compromised if your grinder tolerances are not maintained.
- ▶ Use a magnetic base dial indicator .001" (.0254mm) for the following tolerance checks.

Grinder Work Head Run-Out Alignment



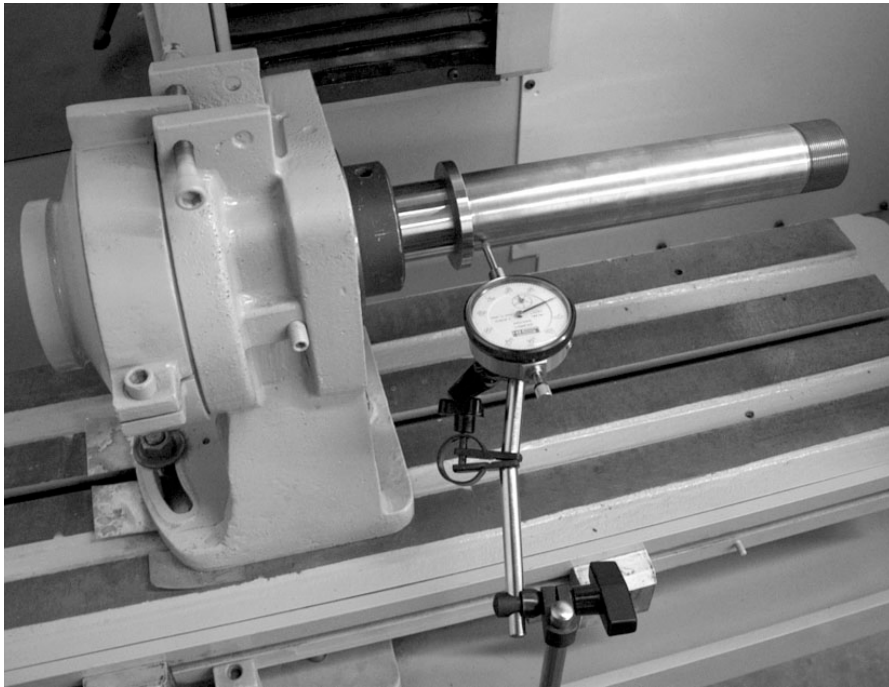
- ▶ Check the run-out on the arbor end nearest the work head base first.
- ▶ Zero the indicator, then rotate the arbor one full turn (360 degrees) - it should be within $\pm .001$ " (.0254mm).
- ▶ Repeat the measurement on the other end of the arbor - again it should also be within $\pm .001$ " (.0254mm).

Grinder Work Head Run-Out Alignment



- ▶ If run-out is more than $\pm .003$ " (.0762mm), most likely the tapered mating surfaces are dirty or have burrs or scratches. Remove the arbor from the work head; clean the male taper of the arbor and check for any burrs.
- ▶ Do a final cleaning of both surfaces with WD-40 and a clean rag and carefully reinstall the arbor.
- ▶ Repeat the run-out inspection steps in the previous slide.

Grinder Work Head Vertical Alignment



- ▶ Mount the dial indicator mag base, to a stationary position on the machine, so the table can pass freely.
- ▶ Align the dial indicator needle on the side of the arbor.
- ▶ Pass the arbor across the stationary indicator. The reading should be no more than $\pm .003$ " (.0762mm) over a 6" (15 centimeter) length of the arbor.

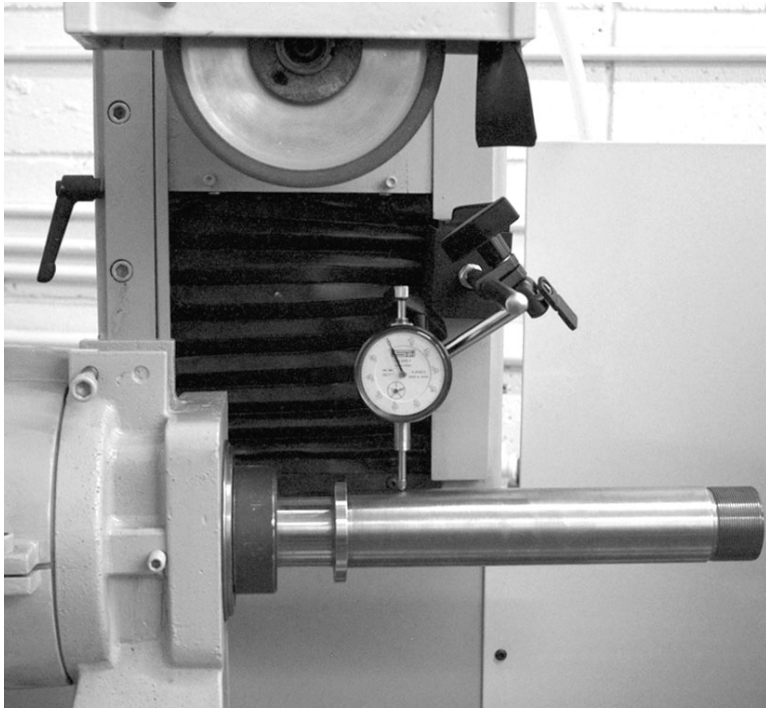
Grinder Work Head Vertical Alignment



- ▶ If found to be out of alignment, work head bolts must be loosened and the work head shifted into alignment on the table.

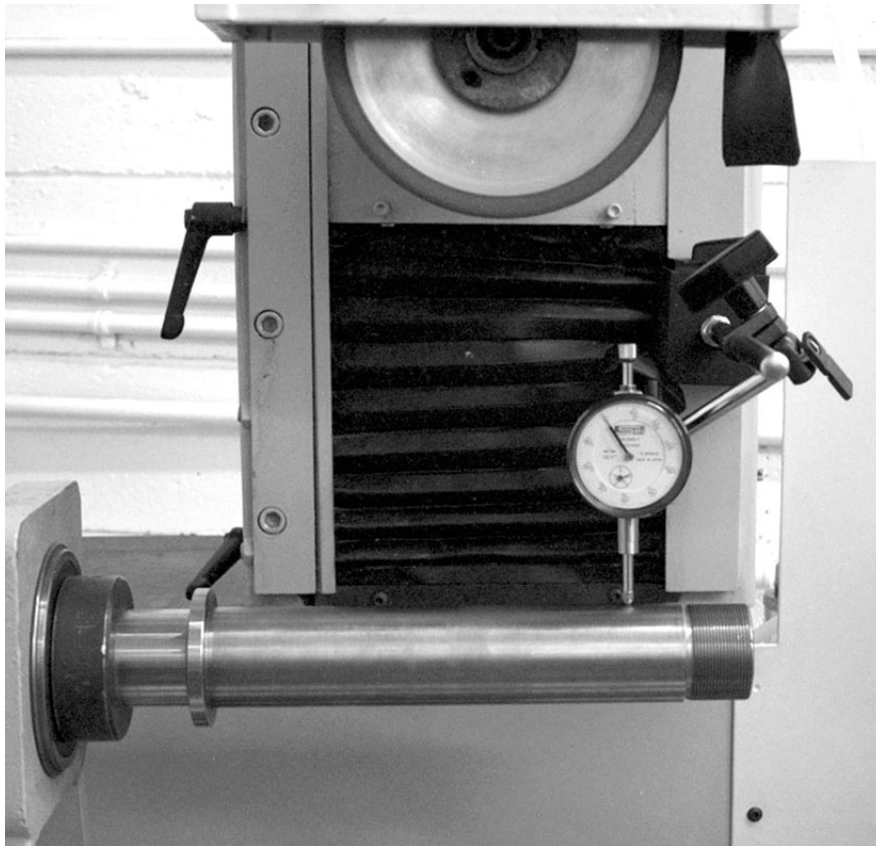
- ▶ Repeat the measurements in the previous slide until the arbor is within the $\pm .003$ " (.0762mm) tolerance.

Grinder Work Head Horizontal Alignment



- ▶ Similar to the Vertical Alignment procedure, the dial indicator needle is aligned on the top of the arbor and mounted to a stationary position so the arbor can pass freely.
- ▶ Pass the arbor across the stationary indicator. This reading should also be within $\pm .003$ " (.0762mm) over a 6" (15 centimeter) length of the arbor.

Grinder Work Head Horizontal Alignment



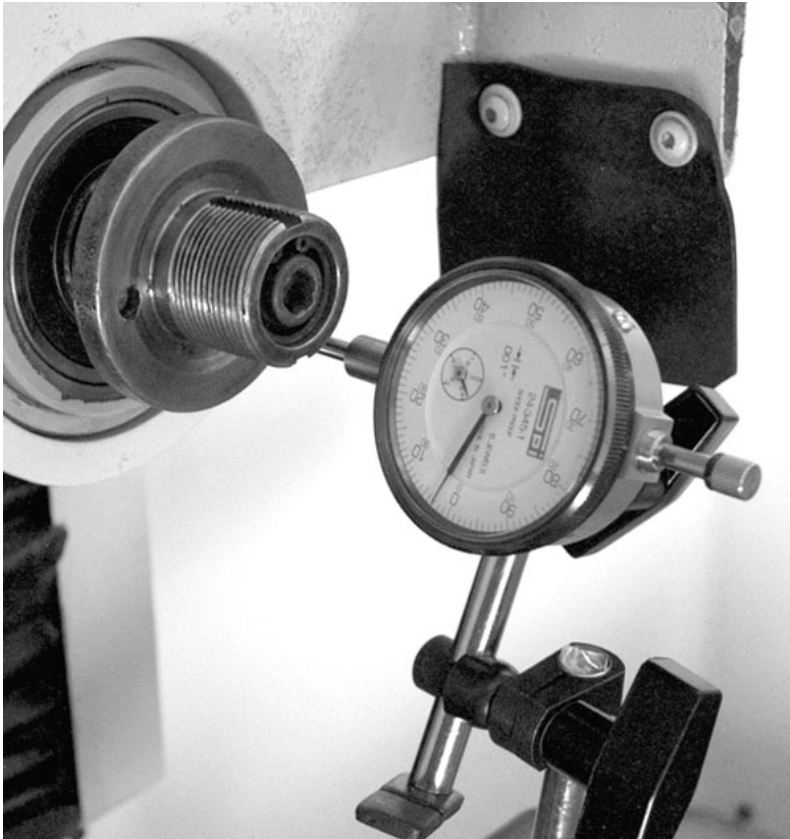
- ▶ If found to be out of alignment, the top half of the work head must be shimmed into alignment.
- ▶ Repeat the alignment measurement with the indicator and continue the fine shimming adjustment process until the arbor is within the $\pm .003$ " (.0762mm) tolerance range.

Grinding Wheel Alignment



- ▶ Mark a starting point on the flat surface of the spindle collar (wheel sits flush against this surface).
- ▶ Align the dial indicator with the starting point and rotate the spindle 360 degrees. This run-out should be within $\pm .001$ " (.0254mm).
- ▶ If spindle run-out is out of tolerance then 1) the spindle may need to be faced, 2) the spindle may be bent or 3) the spindle bearings may be worn.

Grinding Wheel Alignment



- ▶ The grinding wheel must be adjusted to have a lead of .003" to .005" (.076 to .127mm) on the front of the wheel.
- ▶ Mount the dial indicator on the grinding table and zero indicator on the trailing side of the spindle collar with enough clearance for the indicator needle to pass below the wheel mounting shaft of the spindle.

Grinding Wheel Alignment

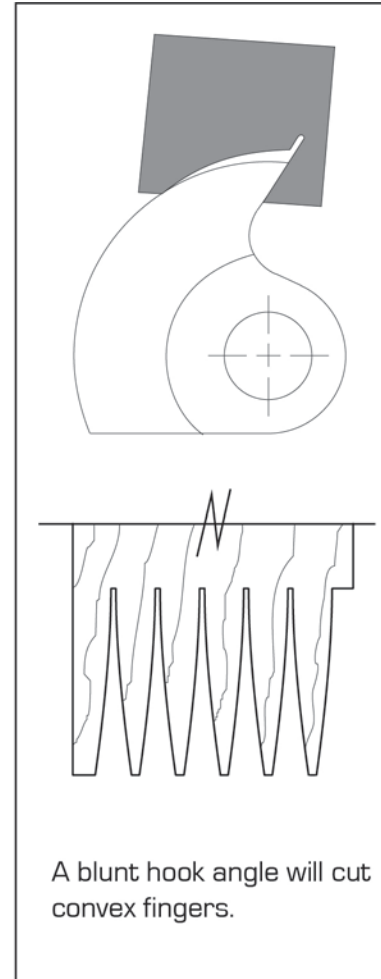
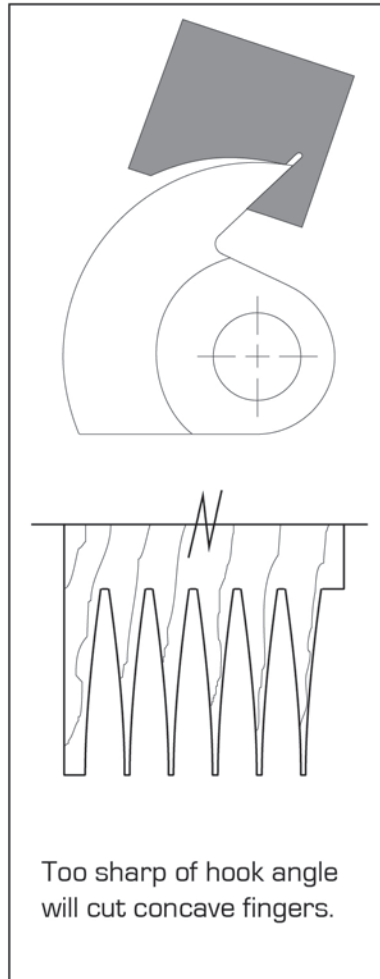
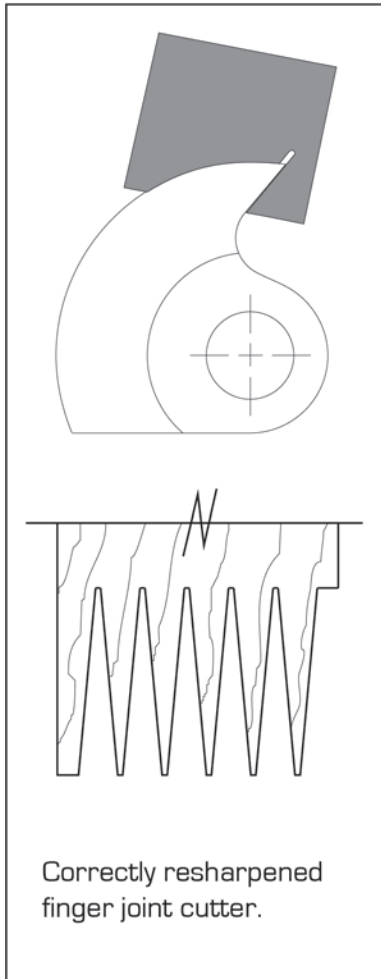


- ▶ Carefully slide the table and take the indicator reading on the opposite side of the spindle collar. The lead side should be at $+0.003''$ to $+0.005''$ (.076 to .127mm) of the trailing side.
- ▶ To adjust lead, the headstock bolts need to be loosened in order to move the whole headstock.
- ▶ Retighten bolts when correct lead is obtained. It may take several attempts to get the correct lead adjustment.

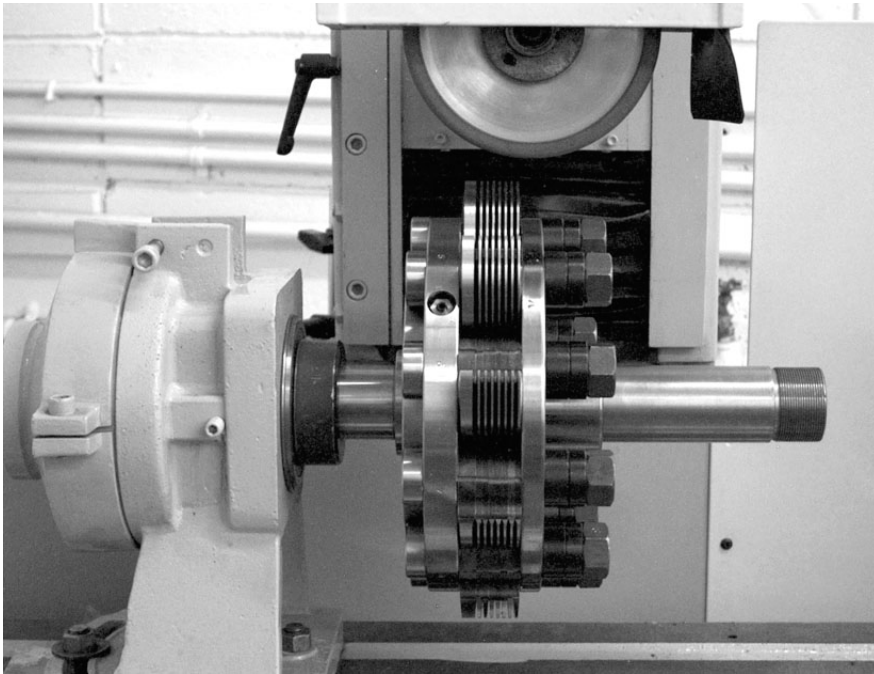
Hook Gauge Use



Hook Gauge Use



Sharpen Cutter Heads



- ▶ Mount the cutter head on the work head arbor as close to the work head mast as possible for the best rigidity.
- ▶ Secure head to the arbor by pumping the head up the specified pressure stamped on the head.

Sharpen Cutter Heads



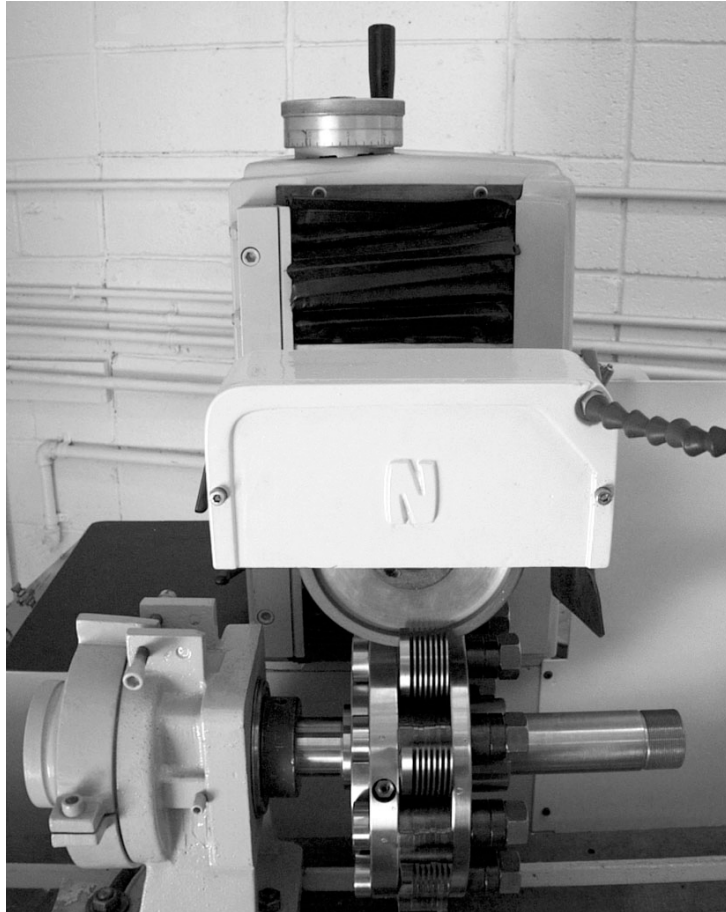
- ▶ Select a stack of cutters as a starting point.
- ▶ Using a felt tip marker, color each knife face of each stack - this enables you to see how flush your grinding is.

Sharpen Cutter Heads



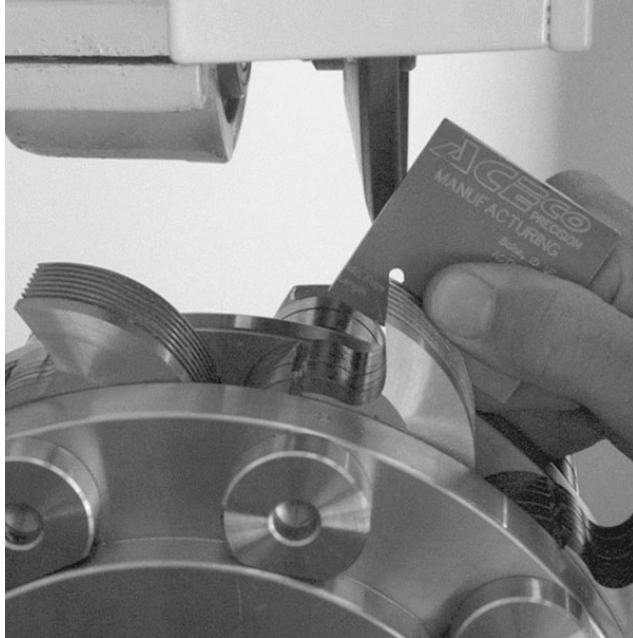
- ▶ Align the cutters with the grinding wheel by rotating the spindle and head to line up the wheel to the face of the cutters.
- ▶ Fine-tune the alignment with the VERTICAL (Z) head stock adjustment (located on top of the machine) and the HORIZONTAL (X) head stock adjustment.
- ▶ Grinding wheel should be perfectly aligned with the properly posted cutters, giving a very accurate starting point to maintain proper hook angle.

Sharpen Cutter Heads



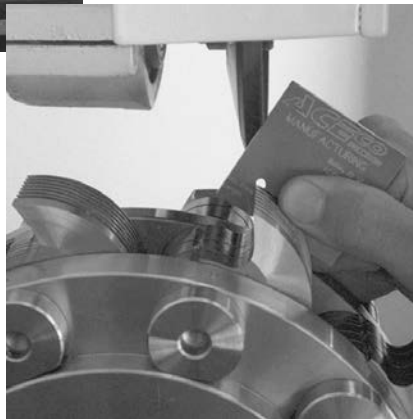
- ▶ Perform set-up pass by dusting cutters only remove 0.0005" (.0127mm) of material, 2 to 3 passes on first stack.
- ▶ Inspect the cutters and see if the ink from the marker was removed uniformly across each knife in the whole stack. If not, make required alignment adjustments and perform 2 to 3 more passes with no more than 0.0005" (.0127mm) of material removal.

Sharpen Cutter Heads



- ▶ Once the grind is uniform, use the hook gauge to ensure a good starting point.
- ▶ Leave the adjustments set at this point and zero mag base indicator on the rear of the machine.
- ▶ Grind each cutter stack on the head at this zero point.

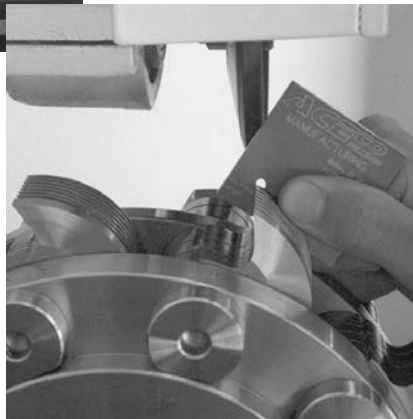
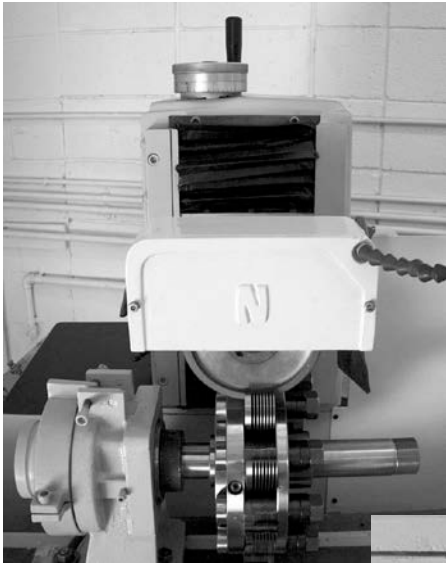
Sharpen Cutter Heads



First set of passes:

- ▶ Advance the wheel to remove .0015" (.0381mm) of material.
- ▶ Allow the machine to cycle until you cannot hear the wheel grinding.
- ▶ Check with hook gauge*. Adjust if needed.

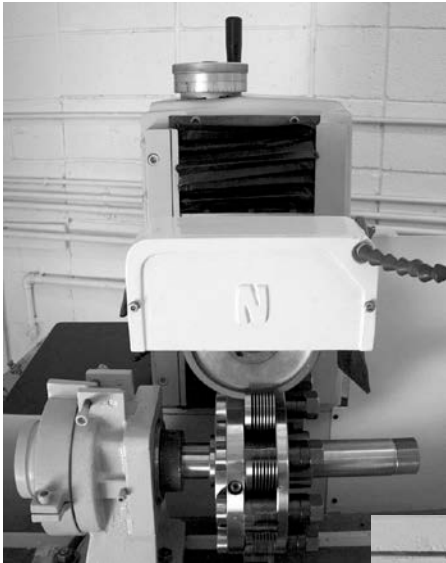
Sharpen Cutter Heads



Second set of passes:

- ▶ Advance the wheel to remove .0015" (.0381mm) of material.
- ▶ Allow the machine to cycle until you cannot hear the wheel grinding.
- ▶ Check with hook gauge*. Adjust if needed.

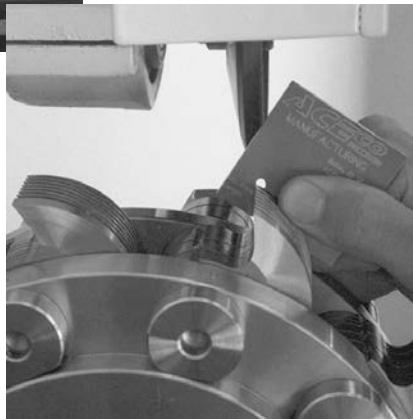
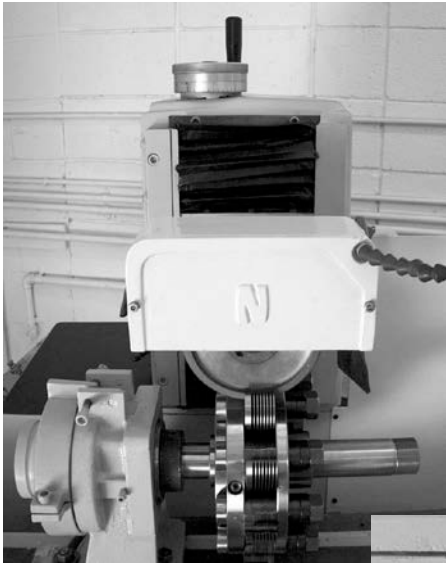
Sharpen Cutter Heads



Third set of passes:

- ▶ Advance the wheel to remove .0015" (.0381mm) of material.
- ▶ Allow the machine to cycle until you cannot hear the wheel grinding.
- ▶ Check with hook gauge*. Adjust if needed.

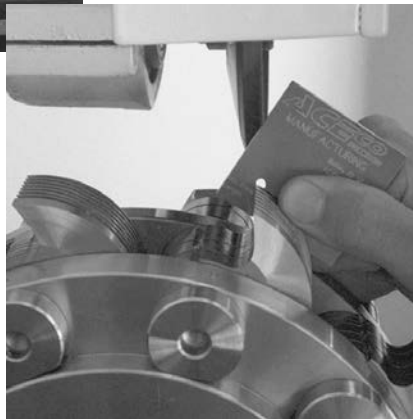
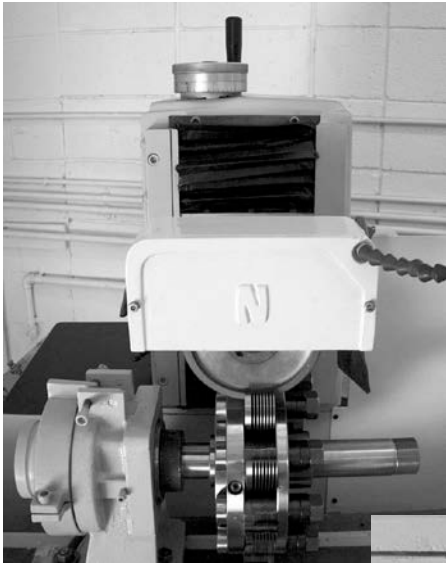
Sharpen Cutter Heads



Fourth set of passes:

- ▶ Advance the wheel to remove .0015" (.0381mm) of material.
- ▶ Allow the machine to cycle until you cannot hear the wheel grinding.
- ▶ Check with hook gauge*. Adjust if needed.

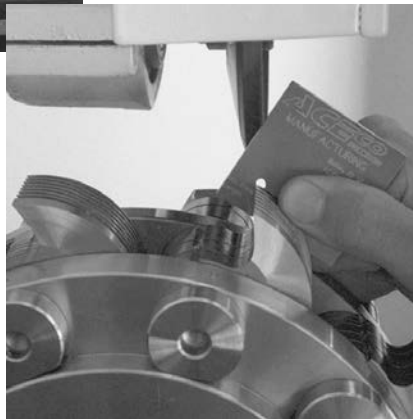
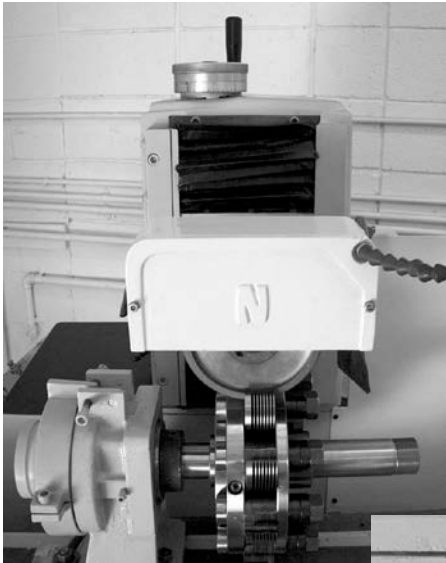
Sharpen Cutter Heads



Fifth set of passes:

- ▶ Advance the wheel to remove .0010" (.0254mm) of material.
- ▶ Allow the machine to cycle until you cannot hear the wheel grinding.
- ▶ Check with hook gauge*. Adjust if needed.

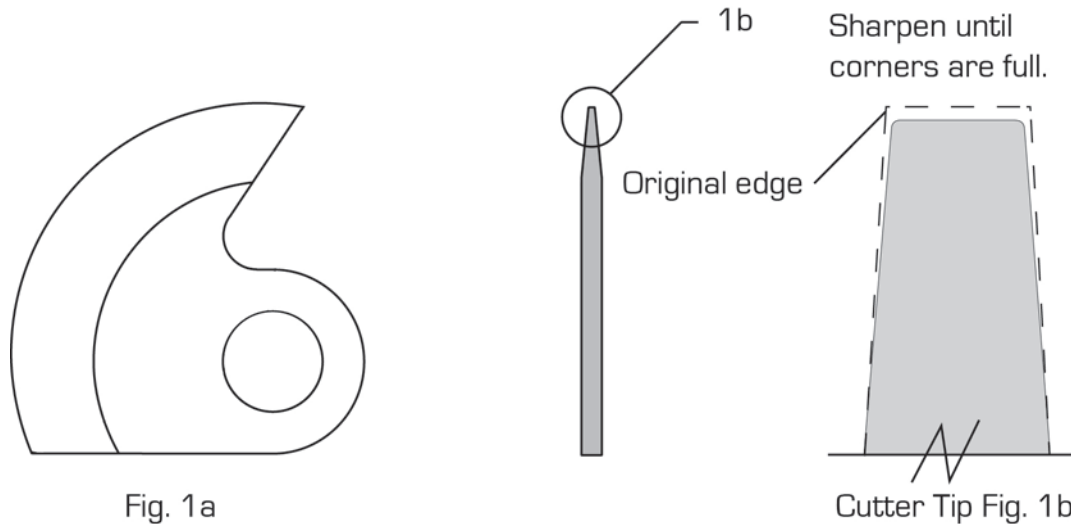
Sharpen Cutter Heads



Sixth set of passes:

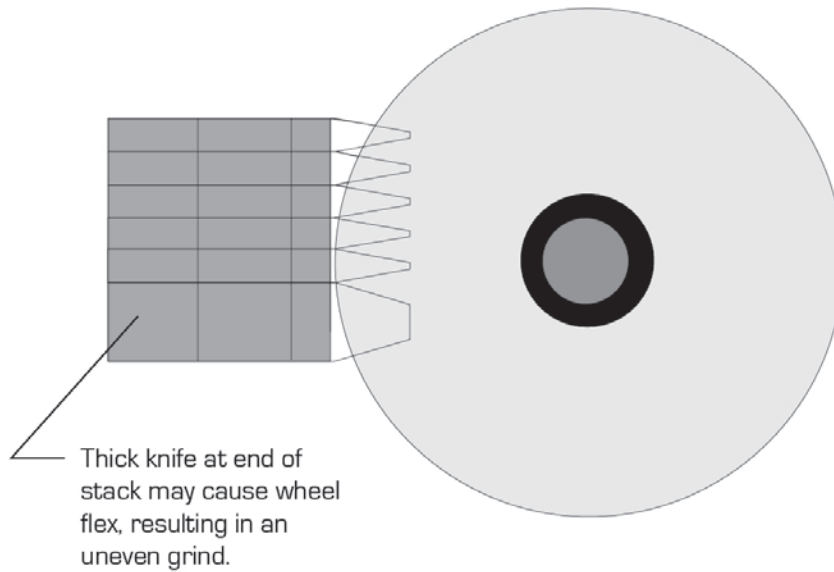
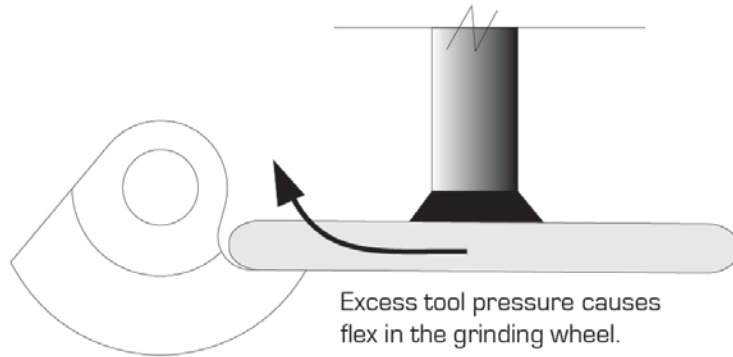
- ▶ Advance the wheel to remove .0005" (.0127mm) of material.
- ▶ Allow the machine to cycle until you cannot hear the wheel grinding.
- ▶ Check with hook gauge*. Adjust if needed.

Sharpen Cutter Heads

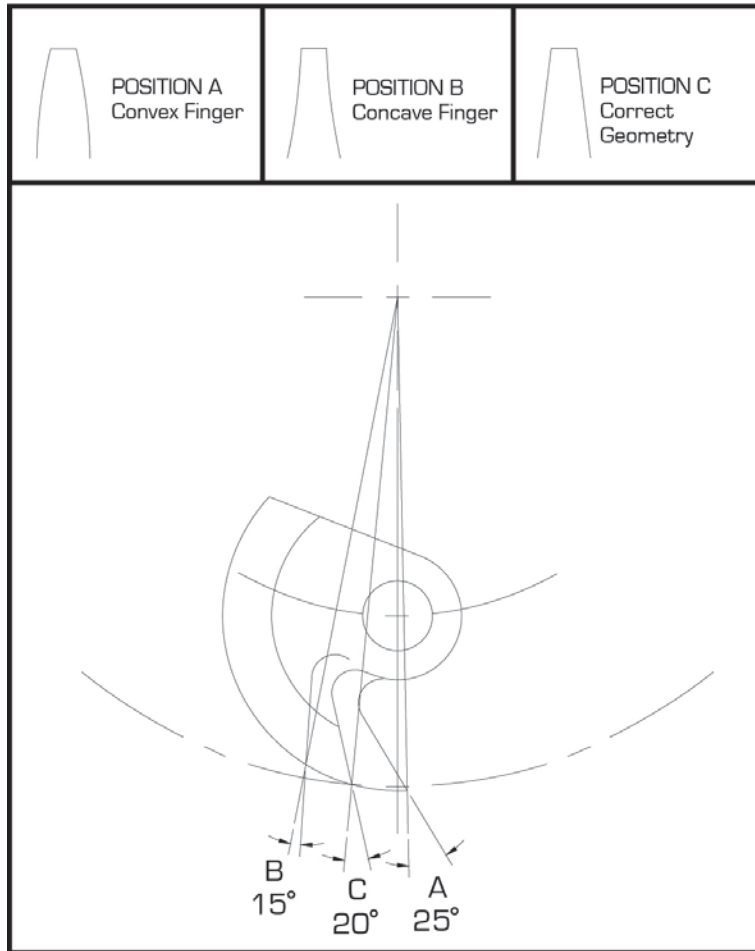


- ▶ Inspect the entire cutting edge of the face of the cutter under 10x or 20x magnification to ensure that the corners are full and the edges are sharp.
- ▶ Don't remove any burrs on the cutter face by buffing, stoning, or filing. This will dull the cutting edge and produce a ragged joint.

Grinding Wheel Information



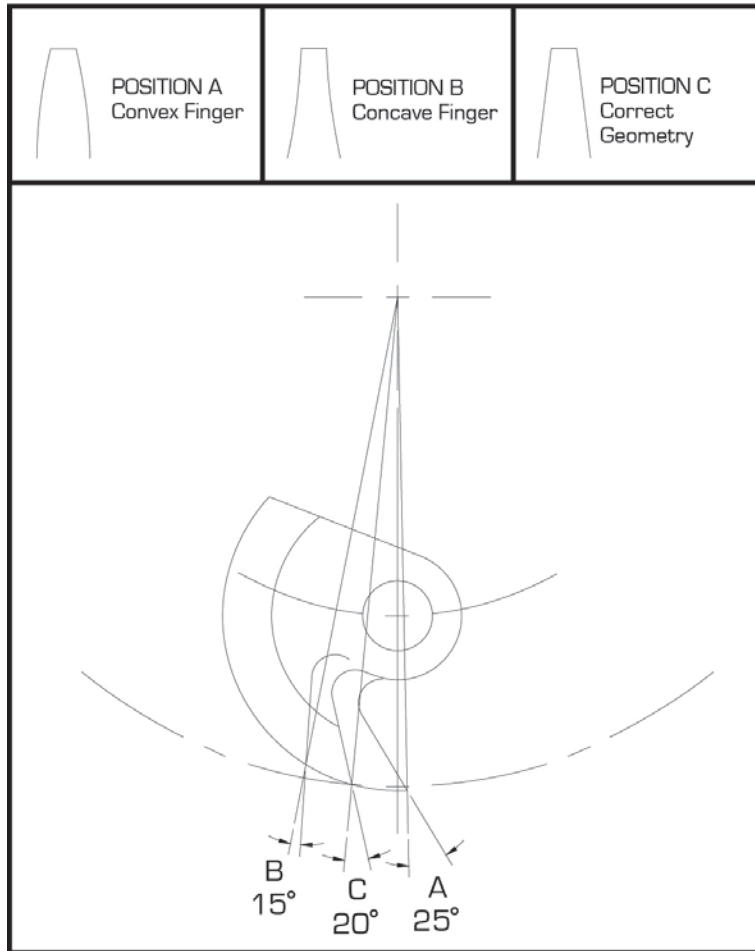
Cutting Angle



Position A: Angle too steep

- ▶ Insufficient back clearance causes cutters to rub instead of cut, resulting in dulling from heat
- ▶ Diameter of cutting circle increased causing cutters to cut excessively into lugs or to interfere with housing.
- ▶ Geometry of joint will change resulting in convex fingers or joint length inconsistency.

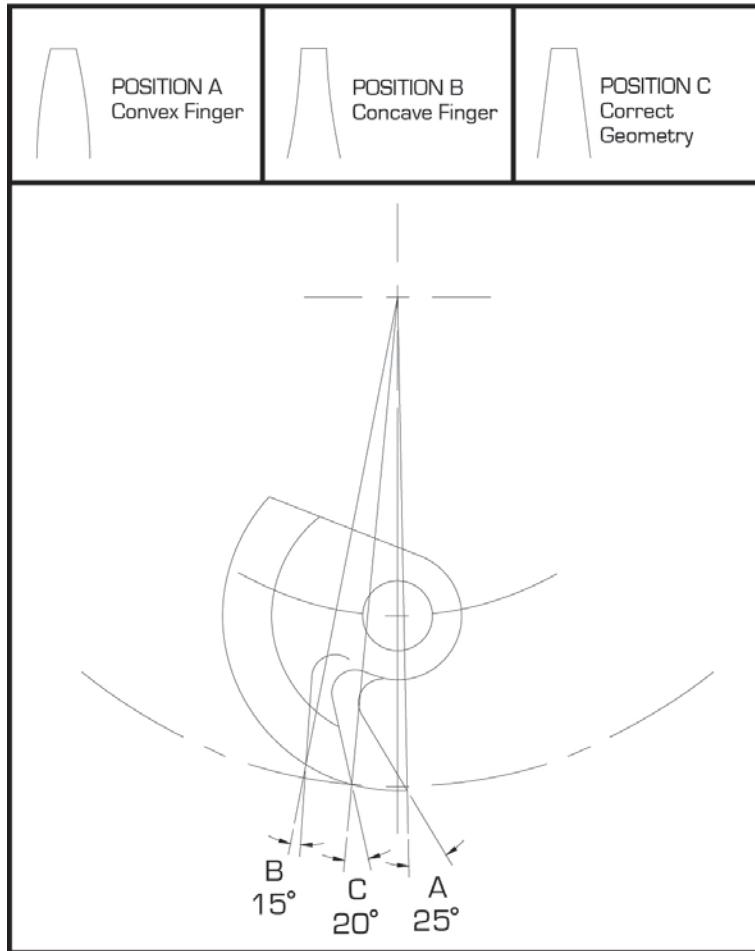
Cutting Angle



Position B: Angle too shallow

- ▶ Insufficient shear cut causes increased tool pressure and tool wear.
- ▶ Diameter of cutting circle is decreased leaving cutters unsupported by lugs when exiting wood and causing tear-out.
- ▶ Geometry of joint will change resulting in concave fingers or joint length inconsistency.

Cutting Angle



Position C: Correct cutting angle

- ▶ Accomplished by using a setup stand, hook gauge and proper grinding techniques.

Gullet Maintenance

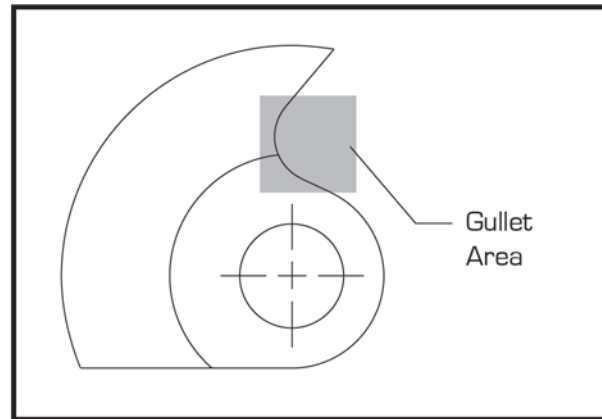


Figure 1

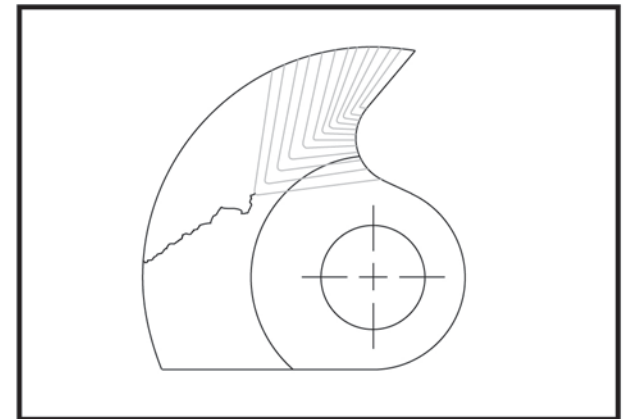


Figure 2

- ▶ It is important to maintain the gullet radius of the cutters using a radius grinding wheel.
- ▶ Failure to maintain the radius in the gullet can lead to cutter breakage, improper chip removal and/or fiber buildup which can negatively affect cutting and balance.