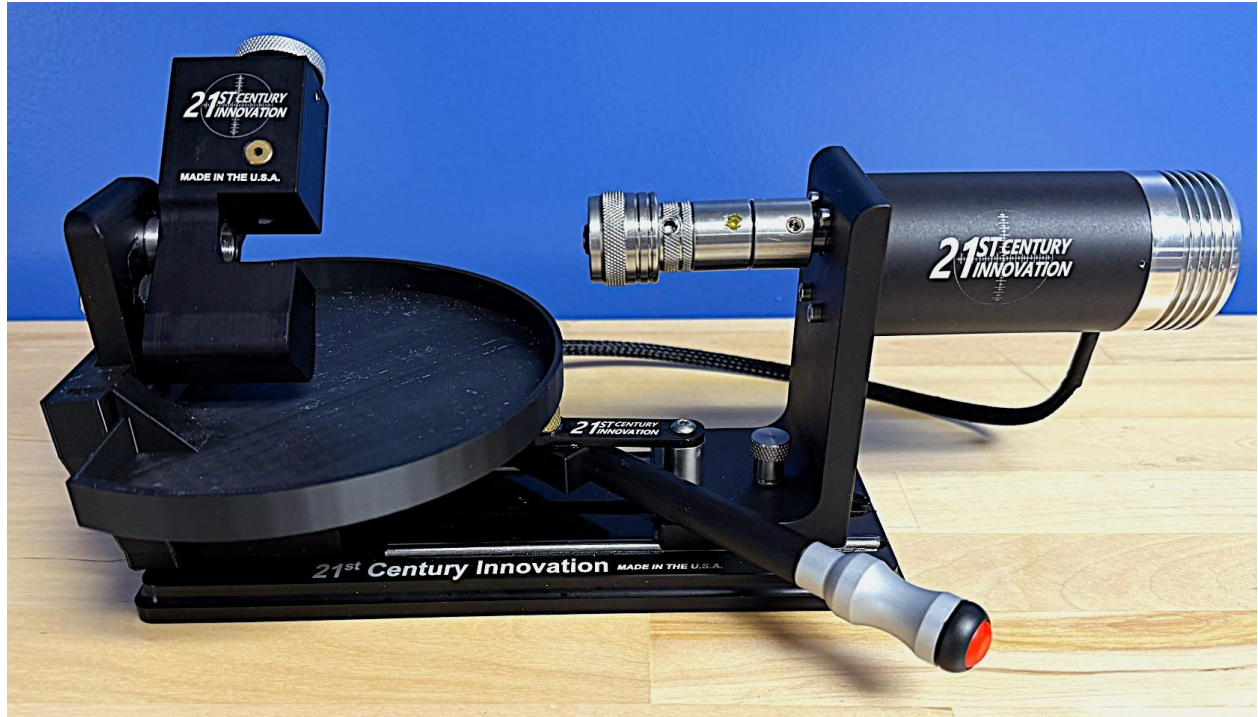


21st Century Innovation Power Lathe Instructions



Thank you for the purchase of a 21st Century Innovation Power Lathe! With proper setup and technique, you should be able to turn necks down with a variance around .0001" that have a beautiful finish. This guide has everything you need to know about the Power Lathe and its features. If you ever need questions answered, please feel free to contact us at sales@21stcenturyinnovation.com or 260-273-9909.



WARNING: FAILURE TO FOLLOW THESE INSTRUCTIONS CAN CAUSE CATASTROPHIC CASE FAILURE RESULTING IN DAMAGE TO YOUR FIREARM AND SEVERE INJURY OR DEATH. Precision hand loading is an inherently dangerous hobby. Wear proper safety equipment when shooting.

What is neck turning?

Neck turning removes material from around the case neck in order to create uniformity in concentricity and thickness. It is a critical aspect of case preparation used to improve accuracy, extend the life of your cases, and to control the clearance between the case neck and the rifle chamber. It is recommended by champion precision rifle shooters from around the world. While it is an essential operation for shooters looking to maximize the accuracy of their firearms, even recreational target shooters and hunters may benefit from turning their case necks.

The “case” for neck turning

Factory brass is not always perfectly uniform in neck thickness, and these imperfections can become worse the more a case is fired and reloaded. Deviations in thickness effect neck tension. Any variance in neck tension between rounds will subsequently affect the chamber pressure and muzzle velocity of each shot—sometimes dramatically. Therefore, the accuracy of the load will suffer if the neck thickness is not uniform around the circumference from the case neck, differs from one case to another, or both. Additionally, neck turning can be used to prevent the formation of so-called “donuts” on the inside of the case neck. These hardened ridges can form through repeated firing and resizing of brass at the junction of the shoulder and neck, impeding bullet seating. The process that leads to their creation is not well understood, but it has been proven that neck turning will prevent their formation. Finally, it can be used to control the case neck to chamber clearance for a given rifle, which is particularly useful in rifles with custom chambers. Every cartridge has a minimum recommended case clearance so that the case neck has room to expand and release the bullet when the round is fired. In some extreme cases, if the case neck is too thick it may not be physically possible to chamber the cartridge at all. Neck turning allows the hand loader to decrease the outside diameter of the neck to improve functionality and accuracy.

What sets our Neck Turning Lathe apart

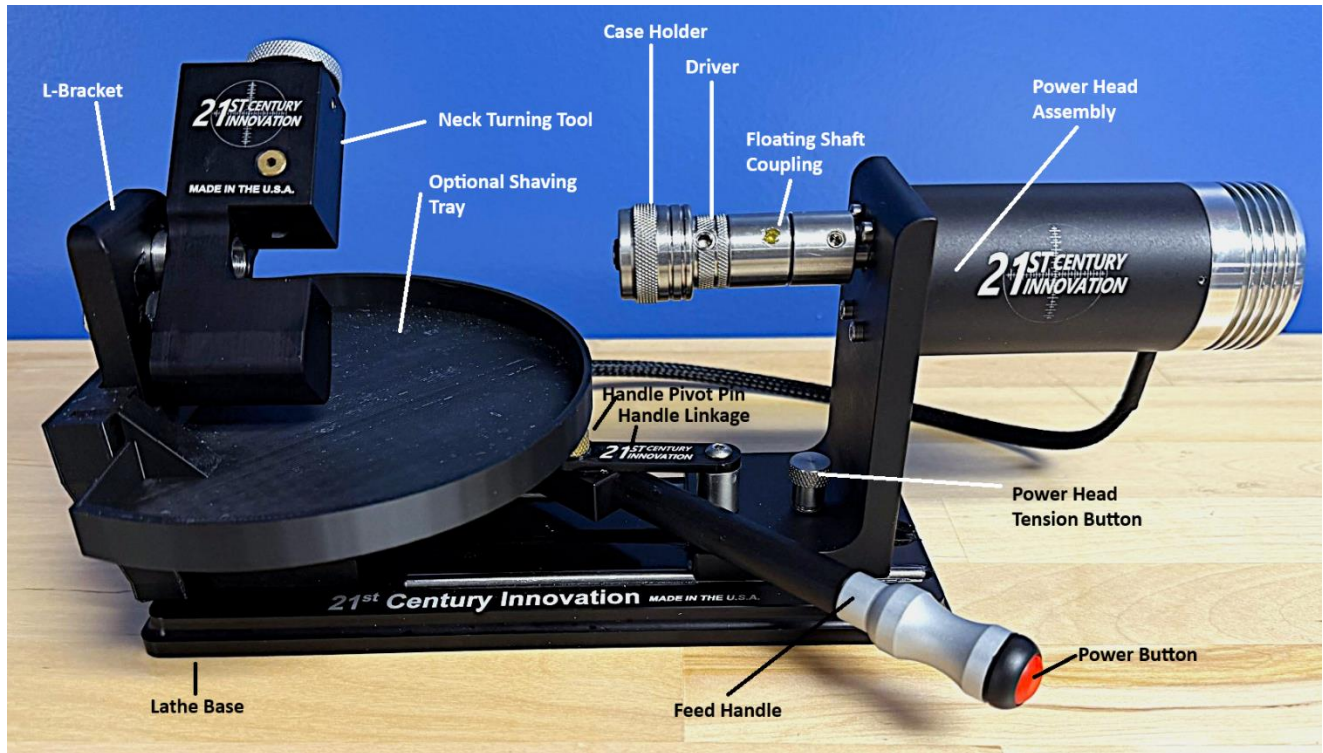
Having become frustrated with neck turning tools that were sloppy, tedious and difficult to use, we set out to design and provide a tool that is consistent, precise, flexible and downright fun. The result was our Neck Turning Lathes, capable of attaining near perfect uniformity in the thickness of your case necks. Featuring a specially engineered cutting tool and an extremely fine cutting depth adjustment mechanism, the Neck Turning Lathe is able to obtain case neck thickness uniformity to within .0001”. The knurled aluminum cutting depth adjustment knob is marked in .0002” graduations, allowing for precise calibration and control of the cutting depth. The cutting mechanism features an anti-backlash set screw which eliminates any travel in the cutting assembly, prevents the cutting depth from creeping during operation, and ensures that the first case you turn will be uniform with the last. Cutting length is controlled by the turning arbor. The arbor shoulder functions as a case stop and the lateral position of the arbor can be adjusted via a large set screw. This stop allows you to run the lathe through the full length of the cut while ensuring that all of your cases are turned to the same length. Hand held tools used to have an advantage over fixed, bench mounted lathes in their ability to achieve and preserve concentricity by self aligning during operation. We have eliminated this advantage by floating the tool body in the mounting bracket and floating the driver assembly. As a result,

the driver and the tool body have the freedom of movement to self-align during operation, resulting in perfectly concentric case necks.

BEFORE OPERATION

- **Ensure cases have been de-capped.** Primer pockets should be clean and free of debris.
- **Run case necks through a 21st Century Innovation expander die.** We highly recommend that you use our expander mandrel and die body, because the expander mandrel is machined to exactly match the diameter of the neck turning arbor. The standard Expander Mandrel to be used prior to Neck Turning is sized .0008" below caliber diameter. This should provide a nice "slip" fit over the Turning Arbor. Sometimes there are cases that a larger expander mandrel may be needed due to excessive brass spring-back. Utilizing a different expander may result in significant inconsistencies in case neck thickness after the turning operation.
- **Ensure you have properly sized turning arbor (sold separately), case holder, driver, and cutting tool.** The Turning Arbor is sized at .002" below caliber diameter. It is important to use a proper expander mandrel to provide a "slip" fit. The Case Holder and Driver and Cutting Tool are components that are cartridge specific. Using the wrong components can compromise the structural integrity of your cases and result in case ruptures or worse. Refer to our chart on our website for more information.
- **Have a good turning lubricant available.** Many different lubricants/oils can be used. Lubricant helps minimize galling, smooth cutting, and cools the arbor and cutting surface during turning. A good lubricant that we have found is Delta Carbon No Oil Turning Lube found on our website. Simply put some in a bottle cap and dip the case in and immediately turn. It lubricates the inside and outside of the neck. It is easily removed with water. Oils work fine as well and may be a bit more messy. A good gun oil with no Teflon works well. Shooter's Choice Fire Power 10 is a good one if you choose that route.
- **Have a proper measuring tool.** Calipers are not going to give you good results while measuring neck wall thickness. The best tool for the job is a 1" Tube (Ball) Micrometer. We offer these on our website.

Key Parts to the Power Lathe

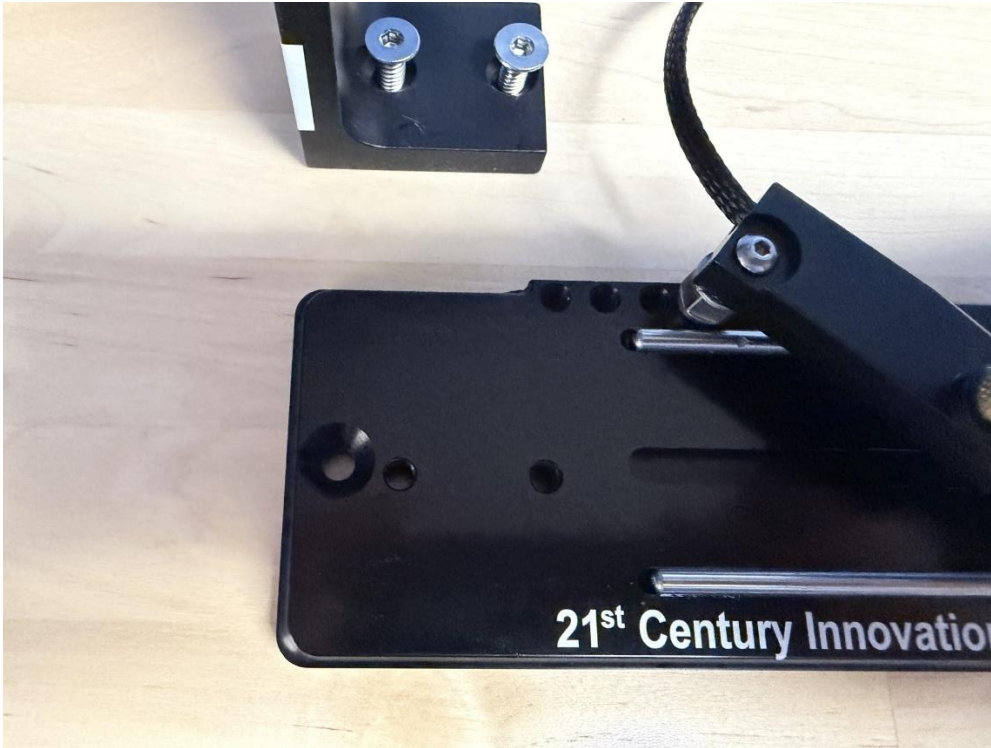


Mounting the Power Lathe

Mounting your power lathe on a solid surface is a must for proper function. Mounting hardware is included (2-Philips Head Wood Screws) in with the lathe accessories. The Power Lathe can be mounted directly to your bench, or to a wooden or Delrin block (some have found cutting boards to work). The block should be larger than the base so it can be clamped to the work surface. If you have an Inline Fabrication mounting system, they do make a plate to work on their system. Keep in mind that you will want to be close to a power source to plug this in.

To mount the lathe follow these steps:

- 1.) On the Left Side of the Lathe, remove the L Bracket with the 2 Allen Screws on the bottom of the bracket. You can leave or remove the Neck Turning Tool Body if you wish. On the base beneath the L-Bracket there is a counter-sunk hole for a mounting screw. When you have lined up the base where you want it, drill a 5/32" pilot hole into the mounting surface in the center of the counter-sunk hole. Do not tighten the screw fully yet.



L-Bracket Removed on Left Side

- 2.) Once you have secured the left side of the lathe, using the feed handle, push the Power Head Assembly in full forward position as pictured below. There is a counter-sunk hole for the second wood screw. With the base still loose move it to the desired position. With a marker, mark the center of the counter sunk hole. Swing the lathe out of the way and drill another 5/32" pilot hole where you marked. Push the lathe back into proper position with power head fully forward and secure the second screw. You may tighten this all the way. The placement of the Motor Housing is right above the mounting hole. You will have to come in at an angle to tighten this screw.



Mounting Hole with Power Head Assembly Pushed full forward.

- 3.) Once Mounted replace the L-Bracket on the Left side and Return the Power Head back to original position.

Setting Up the Power Lathe

Plugging In- Using the supplied Power Supply push the end of the power supply cord into the receptacle on the end of the Motor Housing of the Power Head Assembly. The plug may not go in completely. Stop pushing when it stops. Do not force the plug. Then plug in the power supply to the wall. For International users of this product the power supply converts from the 110 to 240v, but a proper wall adapter will be needed to put a North American plug into your receptacle. Power Supply is Input: 100-240V 1.5A 50-60 Hz Output:24V 4A.

Powering up the lathe- To power up the lathe, simply depress the red button on the end of the feed handle. The driver assembly will spin. Let go of the button to stop.

Feed Control- The “feed” of the lathe is controlled with the feed handle. To feed “forward” move handle left. To reverse move handle left. Feed rate (the speed) is very important in neck turning under power. The configuration of the handle makes this easier.

Choose the Correct Case Holder and Driver- The Case Holder and Driver are what hold the case during operation. The Case Holder is machined to hold the case as an ordinary shell-holder. It tightens down on the driver, which has a machined end with a rubber O-Ring to center the case on the primer pocket. The Driver also connects to the Floating Shaft Coupling. To determine the required case holder and driver needed for your application, please visit our site and find the chart which lists many popular cartridges and what parts are required to turn them.



Case Holder with Driver



Driver

Installing the Case Holder and Driver- Using the ¼”-20 Driver Set Screw that was supplied with the lathe put it in the threaded hole on the side of the driver and start it. Push the driver onto the Shaft Coupling until it stops and secure the set screw.

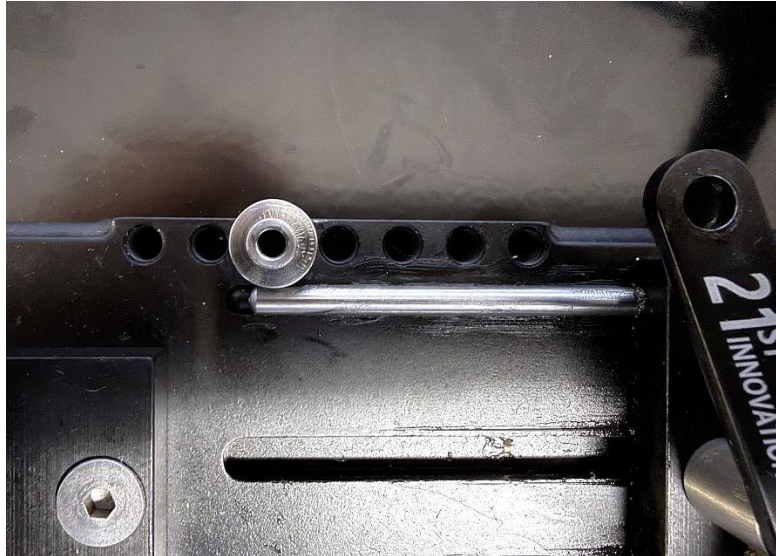


Installing the Case Holder and Driver on the Shaft Coupling.

Setting Overall Feed Length- This is the overall length that the lathe will travel during feeding. This can be set by moving the Handle Stud. There are 7 positions that the handle stud can be set at. These are numbered Left-to Right 1 through 7. Most standard cases can be trimmed at the #4 (middle hole) setting. Shorter cases may have to be set to the #3 hole, while longer magnum cases may have to be set at #5 to #6. The Lathe comes configured with the Handle Stud in the middle (#4) hole.

To remove the stud the Feed Handle must be removed. Pull the brass Pivot Pin from the linkage and set aside. Using a 3/32" Allen Wrench remove the screw that holds the Feed Handle to the stud. Carefully remove the handle. This leaves the stud by itself. Remove the stud with a 7/16"

wrench, and place in the desired hole and tighten. Replace the handle and secure it with the screw. Line up Linkage with handle and replace the brass Pivot Pin.



The 7 Positioning Holes in the Lathe Base with Handle Stud in hole 3.

NECK TURNING TOOL BODY

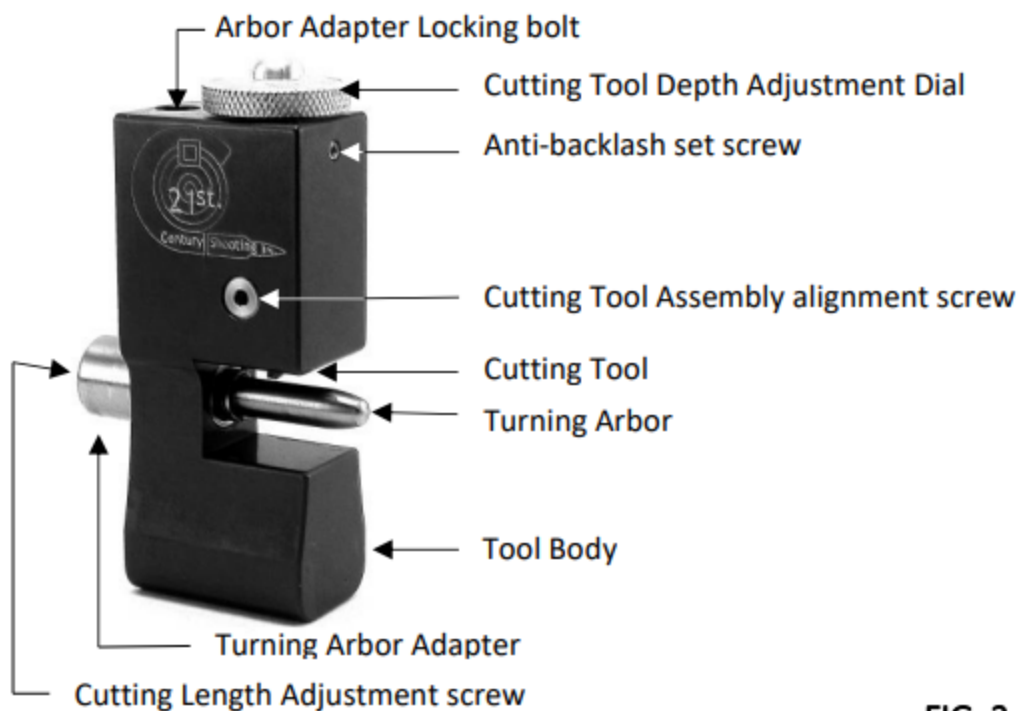


FIG. 3

Removing the neck turning tool body Using the 5/32" Allen wrench, unscrew the tool body mounting bolt from the tool body. Remove the tool body from the mounting L-bracket. Be careful not to lose the mounting bolt float washers.

Removing cutting tool assembly/changing the cutting tool

1. Loosen the set Cutting Tool Assembly alignment screw and the anti-backlash set screw (FIG. 3)
2. Remove Cutting Tool Assembly through the top of tool body

CUTTING TOOL ASSEMBLY

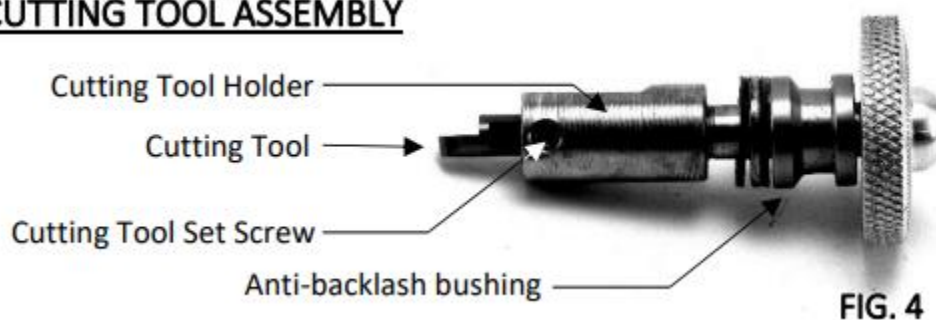


FIG. 4

3. Loosen cutting tool set screw and remove cutting tool from the cutting tool holder (FIG. 4)
NECK TURNING TOOL BODY Anti-backlash set screw Cutting Tool Assembly alignment screw
Cutting Tool Turning Arbor Turning Arbor Adapter Tool Body FIG. 3 Cutting Length Adjustment
screw Arbor Adapter Locking bolt Cutting Tool Depth Adjustment Dial Cutting Tool Cutting Tool
Set Screw Cutting Tool Holder CUTTING TOOL ASSEMBLY FIG. 4 Anti-backlash bushing
4. Fully insert the new cutting tool. Ensure the flat on the shaft of the cutting tool (not the flat part of the blade) faces the set screw on the cutting tool holder.
5. Tighten cutting tool set screw.
6. Reinsert Cutting Tool Assembly into tool body. Ensure the flat on the cutting tool holder faces the Cutting Tool Assembly alignment screw on the front of the tool body (FIG. 5).
7. Retighten Cutting Tool Assembly alignment screw and anti-backlash set screw.

PROPER CUTTING TOOL ALIGNMENT

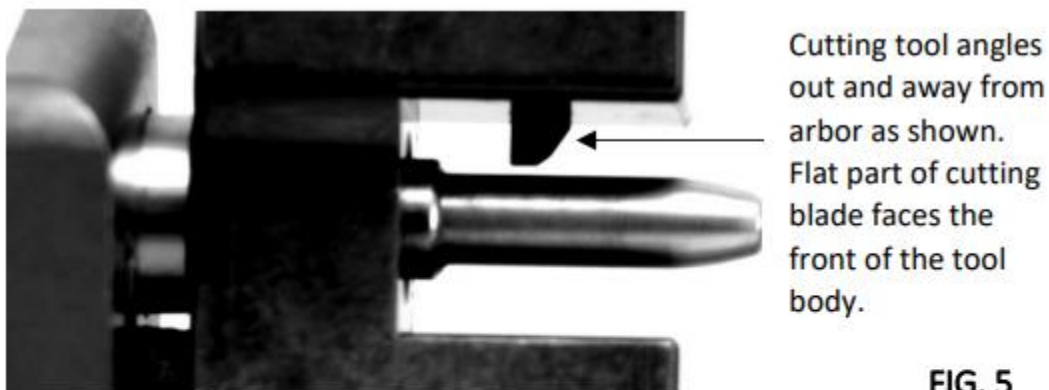


FIG. 5

NOTE: The anti-backlash set screw should be snug, but be careful not to over-tighten the alignment screw. When properly installed, the action of the adjustment dial should be tight but smooth.

REMOUNTING NECK TURNING TOOL BODY

NOTE: The neck turning tool body is designed to be free floating with ample side-to-side play and should rotate freely. This allows it to self-align with the driver during operation.

1. Slide the back of the arbor adapter into the hole on the mounting bracket
2. Line up mounting bolt with hole on the side of the tool body and screw bolt in. The mounting bolt should not be excessively tight.

NOTE: Ensure proper placement of rubber float washers while reinstalling tool body. DO NOT OVERTIGHTEN. Overtightening the mounting bolt will defeat the tool body's ability to self-align with the driver, potentially damaging and compromising case necks and shoulders.

INSTALLING THE TURNING ARBOR

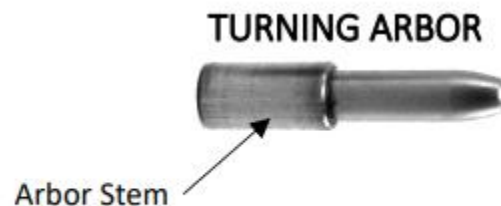


FIG. 6

1. On the tool body, rotate the Cutting Depth Adjustment Dial counter-clockwise to provide enough clearance for the turning arbor.
2. With the flat on the arbor stem facing upwards, slide the turning arbor past the cutting tool and into the arbor adapter. If the arbor won't slide into the adapter, unscrew the arbor locking bolt a few turns to ensure clearance inside the arbor adapter.
3. Tighten the arbor locking bolt a few turns, but do not lock it down onto the arbor. The arbor should only be able to rotate a few degrees within the adapter and should slide in and out easily.

CALIBRATION

NOTE: The following procedures will allow you to precisely calibrate your Neck Turning Lathe and requires the use of a tube micrometer (not included). If you do not have a tube micrometer, you may skip step I, but understand that you may have to make further cutting depth adjustments after calibration and during your turning operation. You may then need to rerun any cases already turned prior to making the depth adjustment.

SELECTING A CASE FOR CALIBRATION



FIG. 7

1. Select five to six cases. Using a tube (ball) micrometer (FIG. 7) Measure the neck thickness at four to five locations around the circumference of each case mouth and record the minimum values for each case.
2. Select the case that has the thinnest case neck based on the values you measured in step 1. This will be the case you use to calibrate the Neck Turning Lathe. Set the other cases aside

The intention of this procedure is to calibrate your Neck Turning Lathe to cut at a depth that will completely turn the lowest spots on your cases. If this procedure is not done properly, you will find some cases with low spots that will not be cut, and you may end up having to recalibrate your tool or fire form those pieces of brass. See “Operation”.

SET CUTTING LENGTH

1. Screw the length adjustment nut in completely.

2. Unscrew the case holder from the driver a few turns and slide the case rim into the case holder. Tighten the case holder back down against the driver.
3. Place a small amount of lubricant (we like Delta Carbon “No Oil” turning lube) on the turning arbor.
4. Guide the case over the turning arbor until the case mouth contacts the front of the arbor stem.
5. Rotate the Cutting Depth Adjustment Dial clockwise until the bottom edge of the cutting tool approaches the case neck.



FIG. 8

6. Cut out a thin strip of paper. Gripping it lightly between two fingers, slide it between the case neck and the cutting tool.
7. Slowly turn the depth adjustment dial clockwise while moving the paper back and forth under the cutting tool.
8. If you grip the paper gingerly, the cutting tool will lightly pinch the paper against the case neck, pulling it from your fingers as you try to move it. Stop rotating the depth adjustment dial and remove the strip of paper. The lathe should still turn freely.
9. Turn the length adjustment screw counterclockwise and maintain slight forward pressure on the driver rod.
10. The case will slowly move forward under the cutting tool. Continue to turn the length adjustment screw until the case shoulder contacts the angled edge of the cutting tool.
11. Secure the turning arbor by tightening the arbor locking bolt

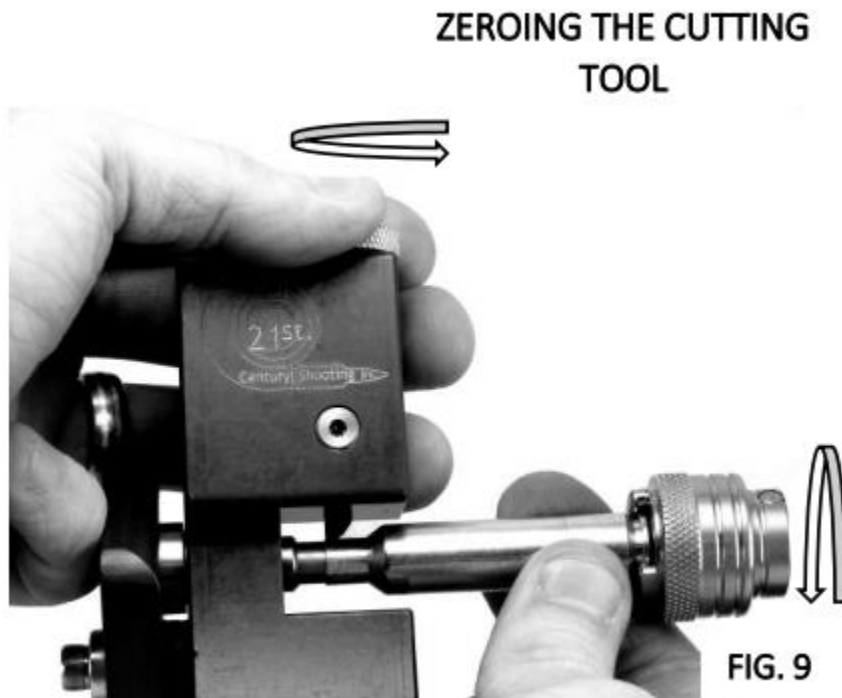
NOTE: Ensure the following conditions are present before proceeding:

1. turning arbor is fully seated within the arbor adapter,
2. case mouth is fully seated against the arbor stem
3. case shoulder is resting against the cutting tool.

If necessary, loosen the locking bolt and play the length adjustment screw in and out until you are certain that these conditions are met.

SET CUTTING DEPTH

1. Back the case mouth to the rear edge of the cutting tool.
2. Using your right hand, grab the case and slowly rotate it.
3. Using your left hand, rotate the cutting depth adjustment dial clockwise until the cutting edge begins to contact the case and you feel resistance in the hand rotating the lathe (see FIG. 9).
4. Back the case neck fully off of the turning arbor.



FINE TUNE CUTTING LENGTH AND DEPTH

NOTE: The small indicator lines on the cutting depth adjustment dial indicate a .0002" change in cutting depth. Cutting depth is *increased* by rotating the depth adjustment dial *clockwise*.

NOTE: *Increasing* cutting length is performed by turning the length adjustment screw *counter-clockwise*. Conversely, to *shorten* the cut length, rotate the length adjustment screw *clockwise*.

1. Put a case onto case holder and driver. Make sure that case is secure but not too tight.
2. Place a small amount of lube on the outside of the case neck and along the turning arbor.
3. While depressing power button, move handle to the left and at the same time guide the case mouth over the turning arbor. Slowly work the case into the cutting tool while depressing the power button.

NOTE: Mediate insertion rate based on material removal. Advance the case forward under the cutting tool only when the tool is no longer removing material from the case neck. DO NOT FORCE CASE INTO CUTTING TOOL. DO NOT ATTEMPT TO MOVE CASE FORWARD WHEN THE LATHE IS NOT ROTATING.

4. Ensure case neck is seated fully over the turning arbor and the case mouth contacts the arbor stem.
5. **We like to make two slow full passes.** A slow and steady feed-rate is important to consistency and finish. Once the turning operation is complete slowly pull the case off the arbor.

6. Visually inspect the case for the following qualities:

- i. Uniform color. Any remaining areas of darker oxidized brass indicate low points or thin spots along the case neck. Turn the adjustment dial clockwise one to two small indicator lines and re-run the turning operation to ensure complete uniformity.
- ii. Case shoulder cut length and cut terminator. The cut terminator should be smooth and flush with uncut portion of brass. The cut should reach about .030" up the shoulder.

There should be no gouge or visible lip on the case shoulder at the end of the cut. A fingernail run over the case shoulder should not catch on anything. If the cut is more than .030" up the shoulder or there is a gouge or lip, loosen the turning arbor locking bolt and then rotate the length adjustment clockwise 1/16th to 1/8th of a revolution. Retighten the arbor locking bolt, turn another case and reevaluate.

NECK TURNING RESULTS



7. **ANTI-BACKLASH FEATURE**: The cutting tool assembly features an anti-backlash bushing that removes any play which would otherwise be present from the cutting tool assembly during operation. This bushing is engaged by the anti-backlash set screw on the side of the cutting tool body just below the dial. This feature is defeated when you turn the dial counter-clockwise (to decrease cutting depth), and can only be reengaged by rotating the dial about a full turn clockwise. If you find that your cut depth is too deep, you won't be able to adjust it back without degrading the effectiveness of the anti-backlash bushing. To get around this, make a note of the reading on the dial. Rotate the dial counter-clockwise one full revolution, and then back clockwise, standing off the original cut depth dial reading by one full number (major indicator line). Then, using the trial & error method, adjust the dial down until you achieve the desired cut depth.

OPERATION

- **Ready to begin.** With the Neck Turning Lathe properly calibrated to the case with the smallest neck thickness, you are ready to begin turning the rest of your cases. - Continue to lubricate the turning arbor. Ensure that the turning arbor remains lubricated during operation. Depress the power button while feeding and taking off the case.

- **Visually inspect each case after turning to ensure uniformity.** If any case necks have low or thin spots as indicated by oxidized spots of uncut brass, these flaws can be remediated by fire-

forming. The cases will not need to be turned again after they have been fireformed. Alternatively, you may increase the cut depth to fully turn these cases, but you will also want to rerun any cases you have already turned prior to making the cutting depth adjustment.

- **Quality Control.** When configured properly, the Neck Turning Tool is capable of yielding case neck thickness uniformity within $\pm.0001$ " (or outside case neck diameter uniformity within $\pm.0002$ "). For best results, we recommend using a tube micrometer to perform quality control on your cases during your turning operation. If significant variations in case neck thickness are observed, consult the troubleshooting section below.

PREVENTATIVE CARE AND MAINTENANCE

-Check cutting tool for nicks or damage prior to operation and replace if necessary

-Ensure that a light coating of **lubricant** is on the case, and arbor before operation.

-If needed, apply a small amount of white synthetic grease to the stainless rails and slot that the Power Head Assembly rides in. We use and recommend Superlube grease.

-Adjusting the tension of the sliding Power Head Assembly- Your lathe came with the Power Head Assembly tension set optimally. If for some reason feeding becomes too loose or too tight, this can be adjusted with the Tension Button on the base of the Power Head Assembly L-Bracket. The tension button is spring-loaded, and can be tightened or loosened accordingly. Too tight and the assembly will not slide, too loose will result in inconsistencies. It should be tight enough to allow for smooth operation without binding up. This button can also be used to remove the power head assembly completely from the base. Depress the button and slide the assembly to the right until it comes off the base. To replace depress the button and slide the assembly back into place via the "T"-slot on the base. Grease the T-Slot and rails if needed.

-Keep shavings under control- Shavings are a part of the process. Using canned or compressed air, blow off shavings from the lathe surface, rails, cutting tool, and turning arbor. A brush works fine as well. We now offer a lathe shaving tray that helps contain most of the shavings and lubricant that you will come across.

TROUBLESHOOTING

Some factors that will negatively affect case neck uniformity include:

-**Turning primed cases.** Cases will not align properly with a spent primer in the pocket. The driver aligns the case via the primer pocket.

-Not using a 21st Century Innovation Expander Die and Expander Mandrel. Using the proper mandrel for the process provides a slip-fit over the arbor. Some cases that have excessive spring-back may require a larger expander mandrel. We offer many sizes of Expander Mandrel on our website.

-Worn out driver o-ring. Install a new o-ring with one of the replacement o-rings included with your purchase.

-Damaged cutting tool. Visually inspect cutting tool for chips or nicks.

- Improperly Installed Cutting Tool or Cutting Tool Assembly (see “REMOVING CUTTING TOOL ASSEMBLY” for more information).

-Uneven cut at neck shoulder junction. The neck turning tool body bolt is too tight or loose. Adjust the tension to allow the tool head to float during operation. The Rubber washers between the tool body and the L-Bracket may be worn/hardened. Replace if this is the case. You want the tool loose enough that it floats but does not spin on the L-Bracket during use.

-Impeded self-aligning feature due to degradation of free-floating ability. Ensure driver floats freely. Ensure Cutting Tool Body rotates freely and has ample back-and-forth play. Check for worn out o-rings or rubber washer on Tool Body mounting bolt.

- Anti-Backlash Bushing improperly engaged (see “FINE TUNE CUTTING LENGTH AND DEPTH” for more information).

-No Power. Ensure the power supply is plugged in and all connections are secure.

-Dull or Swirled Finish- Slow down the feed rate and make 2 passes with the neck while turning. Check edge of cutting tool for nicks or chips.

-Inconsistent results in neck wall thickness- There are a few factors that can cause this. The most common are the following:

- Too fast or a jerky feed rate. Practice keeping the speed of feed steady and consistent.

- Lack of lubricant. Using a generous amount of lubricant on the inside and outside of the case will minimize friction, which causes heat build-up. Heat build-up can cause variances in results.

- Loose set screws. Ensure all of the set screws holding components are tight and not loose.

- Loose Cutting Tool. Ensure cutting tool is tight.

-Loose Turning Arbor. Ensure Turning Arbor is tightened and the flat on the stem of the arbor is in contact with the set screw.

-Galling of inside of neck.

-Lack of lubricant.

-Case too tight on arbor. Ensure the case slips over the Turning Arbor without play. If too tight step up the expander mandrel.

-Build-Up on Arbor. Brass can build-up over time on the Arbor causing a rougher surface. Remove the Arbor and soak it in a copper removing solvent such as BoreTech Eliminator for 15 minutes. Chuck the arbor stem (shank) in a drill and spin the arbor while polishing it with 0000 steel wool. This will remove the deposits. Stubborn deposits may need more soaking time. This is also a great way to clean Expander Mandrels.

Thank you for purchasing your 21st Century Innovation Power Neck Turning Lathe. For ordering information, questions, comments or concerns, please visit www.21stcenturyinnovation.com , email us at sales@21stcenturyinnovation.com or call us at (260) 273-9909



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