

# 21<sup>st</sup> Century Innovation

## NECK TURNING LATHE



USER MANUAL

**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.

## TABLE OF CONTENTS

<b>BEFORE OPERATION</b> .....	3
<b>SETUP</b> .....	3
I. REMOVING THE NECK TURNING TOOL BODY .....	4
II. REMOVING CUTTING TOOL ASSEMBLY/CHANGING THE CUTTING TOOL .....	5
III. REMOUNTING NECK TURNING TOOL BODY .....	6
IV. CASE HOLDER AND DRIVER DISSASSEMBLY AND REASSEMBLY .....	7
V. INSTALLING THE TURNING ARBOR .....	8
<b>CALIBRATION</b> .....	9
I. SELECTING A CASE FOR CALIBRATION .....	9
II. SET CUTTING LENGTH .....	10
III. SET CUTTING DEPTH .....	11
IV. FINE TUNE CUTTING LENGTH AND DEPTH .....	12
<b>OPERATION</b> .....	14
<b>PREVENTATIVE CARE AND MAINTENANCE</b> .....	15
<b>TROUBLESHOOTING</b> .....	15

## BEFORE OPERATION

- **Ensure cases have been de-capped.** Primer pockets should be clean and free of debris.
- **Run case necks through a 21<sup>st</sup> 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. 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.** These components are cartridge specific. Using the wrong components can compromise the structural integrity of your cases and result in case ruptures or worse. Refer to the chart that came with the lathe or at the online ordering page for more information.

## SETUP

**NOTE:** The Neck Turning Lathe comes pre-assembled with the components you need for your neck turning operation pre-installed. If you have ordered additional cutting tools, case holders or drivers, follow the instructions below to set up your Neck Turning Lathe to when you are ready to turn a different cartridge. If you are only going to turn the case necks for one kind of cartridge, or your Neck Turning Lathe is already set up with the correct components, skip to step V. See FIG 1. for examples of these components.

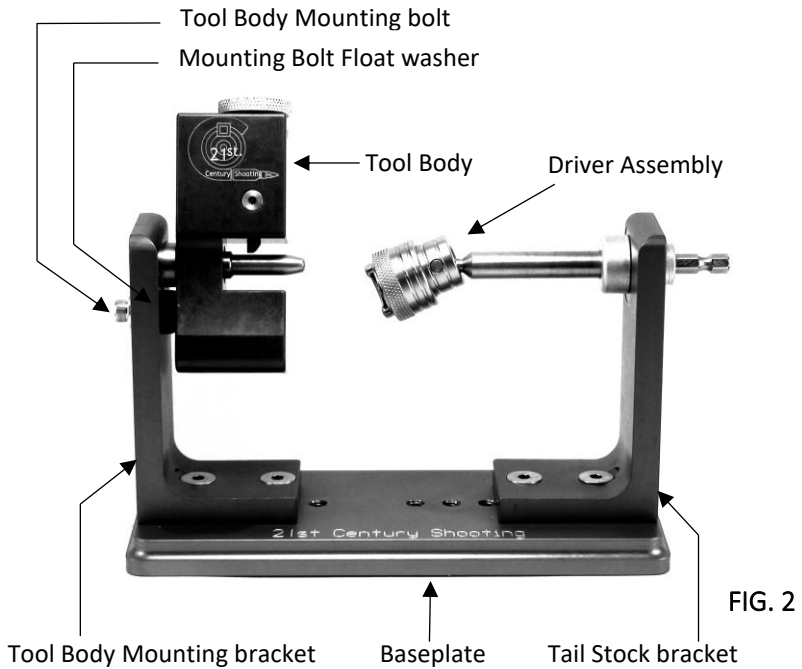
### CARTRIDGE SPECIFIC COMPONENTS



FIG. 1

**TIPS & TRICKS:** The baseplate is designed to be bolted to any flat surface. Remove the tail stock and mounting brackets to reveal two countersunk mounting holes.

## NECK TURNING LATHE



### I. REMOVING 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 bracket. Be careful not to lose the mounting bolt float washers.

## II. REMOVING CUTTING TOOL ASSEMBLY/CHANGING THE CUTTING TOOL

### NECK TURNING TOOL BODY

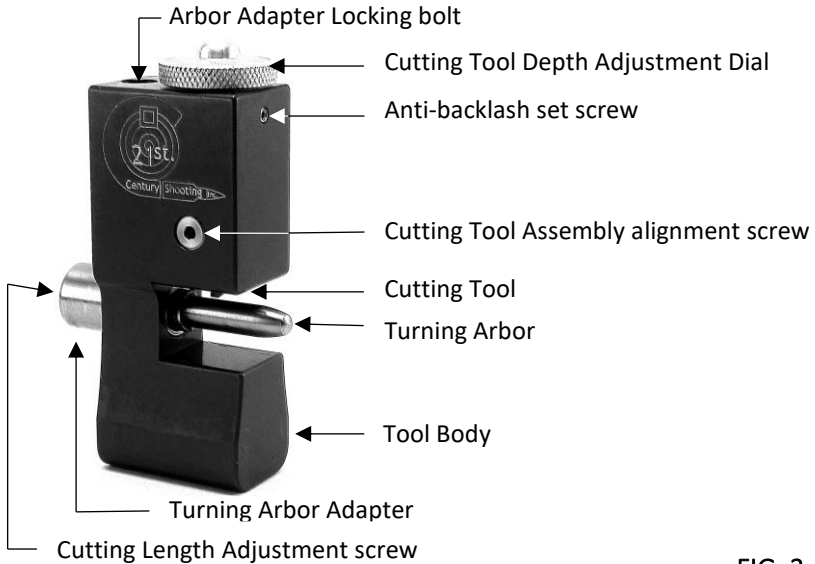


FIG. 3

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

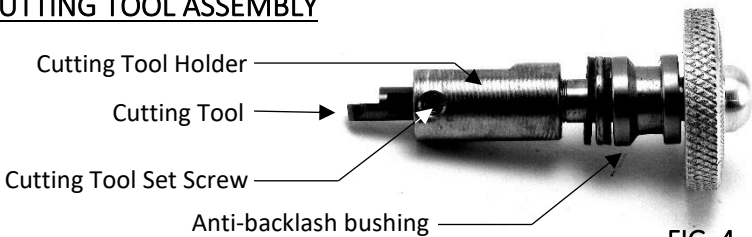
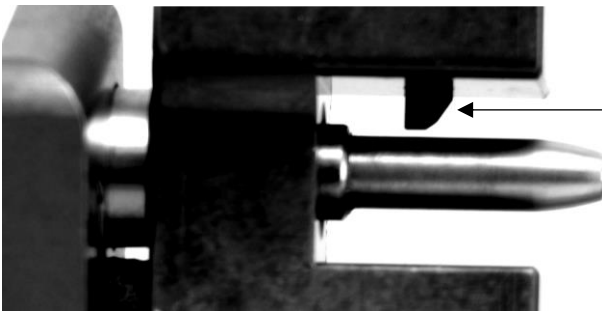


FIG. 4

3. Loosen cutting tool set screw and remove cutting tool from the cutting tool holder (FIG. 4)

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



Cutting tool angles out and away from arbor as shown. Flat part of cutting blade faces the front of the tool body.

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.

### III. REMOUNTING NECK TURNING TOOL BODY

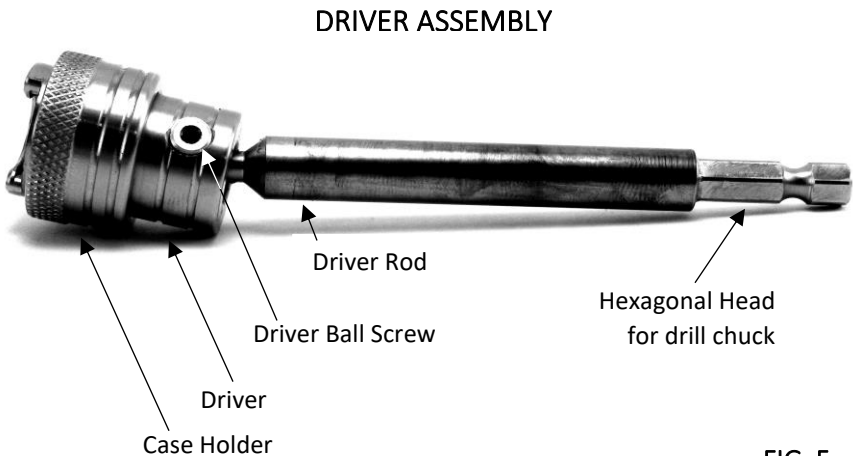
**NOTE:** The neck turning tool body is designed to be free floating with ample side-to-side play and should rotate freely. This allows it to self-align with the driver during operation.

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.

#### IV. CASE HOLDER AND DRIVER DISSASSEMBLY AND REASSEMBLY

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



**FIG. 5**

1. Unscrew case holder from driver
2. Remove ball screw from driver and slide driver off of driver rod.
3. Assembly is the reverse of disassembly.

**NOTE:** Some drivers have an extra hole. This hole will accept a retaining screw used to hold a shorter driver rod (sold separately). Do not insert a set screw into this hole while using the stock driver rod as it will impede the free-floating capability of the driver.

## V. INSTALLING THE TURNING ARBOR

**NOTE: BE CAREFUL NOT TO HIT THE CARBIDE CUTTING TOOL WITH THE TURNING ARBOR.** The stainless steel turning arbor can chip the cutting tool if care is not taken to avoid contact during installation and operation.

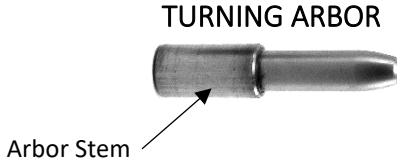


FIG. 6

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.

## I. SELECTING A CASE FOR CALIBRATION



FIG. 7

1. Select five to six cases. 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.

**NOTE:** 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," pg. 14.

## II. 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 die wax (or equivalent) 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:**

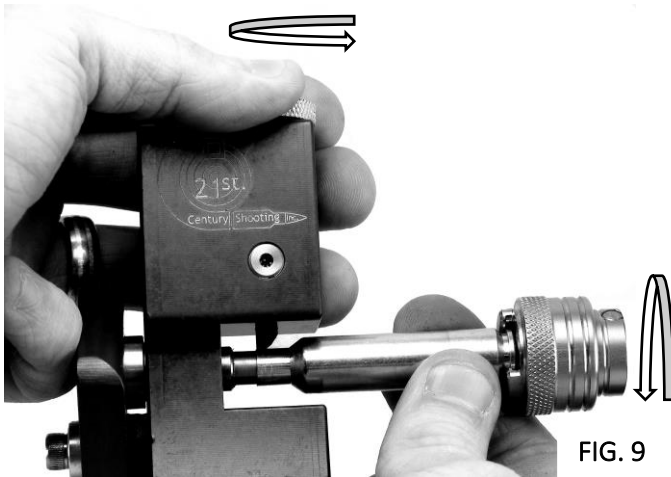
1. turning arbor is fully seated within the arbor adapter,
2. case mouth is fully seated against the arbor stem
3. case shoulder is resting against the cutting tool.

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

### III. 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.

#### ZEROING THE CUTTING TOOL



#### IV. 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. Chuck drill (300 rpm or less) over end of driver rod.
2. Place a small amount of lube on the outside of the case neck and along the turning arbor.
3. Use the drill to turn the driver rod and guide the case mouth over the turning arbor. Slowly push the case into the cutting tool while running the drill.

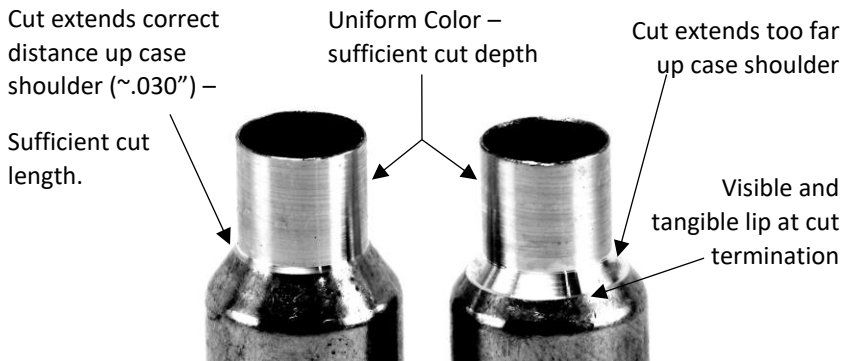
**NOTE:** The cutting tool will only cut cases that are turning clockwise. Make sure the drill is set properly when attempting to turn your first case. Do not attempt to turn driver rod more than 300 rpm.

**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. Once the turning operation is complete, continue to rotate the drill and back the case off of 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  $1/16^{\text{th}}$  to  $1/8^{\text{th}}$  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 with die wax (or equivalent lubricant) during operation.
- **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 fire-formed. 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  $\pm 0.0001$ " (or outside case neck diameter uniformity within  $\pm 0.0002$ "). For best results, we recommend using 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

- Ensure driver rod has a medium to heavy coating of lubricant. Recommended lubricants include any natural or synthetic grease.
- Ensure ball screw has a light coating of lubricant.
- Check cutting tool for nicks or damage prior to operation and replace if necessary
- Ensure that a light coating of die wax is present on the turning arbor during operation.

## TROUBLESHOOTING

### **Some factors that will negatively affect case neck uniformity include:**

- Turning primed cases (see “BEFORE OPERATION” pg. 3 for more info).
- Not using a 21<sup>st</sup> Century Innovation Expander Die and Mandrel (see “BEFORE OPERATION” pg. 3 for more info).
- Using the wrong components (see “BEFORE OPERATION” pg. 3 for more info).
- Worn out driver clutch 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” pg. 5 for more information).
- Impeded self-aligning feature due to degradation of free floating ability. Ensure driver floats freely on driver rod. 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” pg. 12 for more information).
- Drill chuck is not concentric or poorly aligned with drill.
- Drill speed is over 300 rpm
- Driver rod is not sufficiently lubricated

Thank you for purchasing your 21<sup>st</sup> Century Innovation Neck Turning Lathe. For ordering information, questions, comments or concerns, please visit [www.21stcenturyinnovation.com](http://www.21stcenturyinnovation.com) , email us at [sales@21stcenturyinnovation.com](mailto:sales@21stcenturyinnovation.com) or call us at (260) 273-9909



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