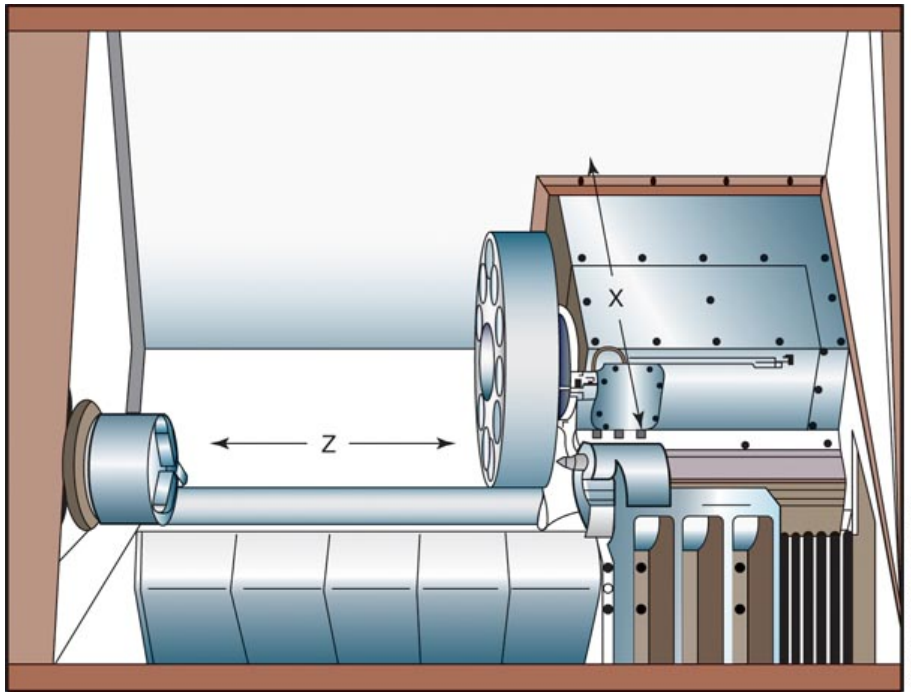
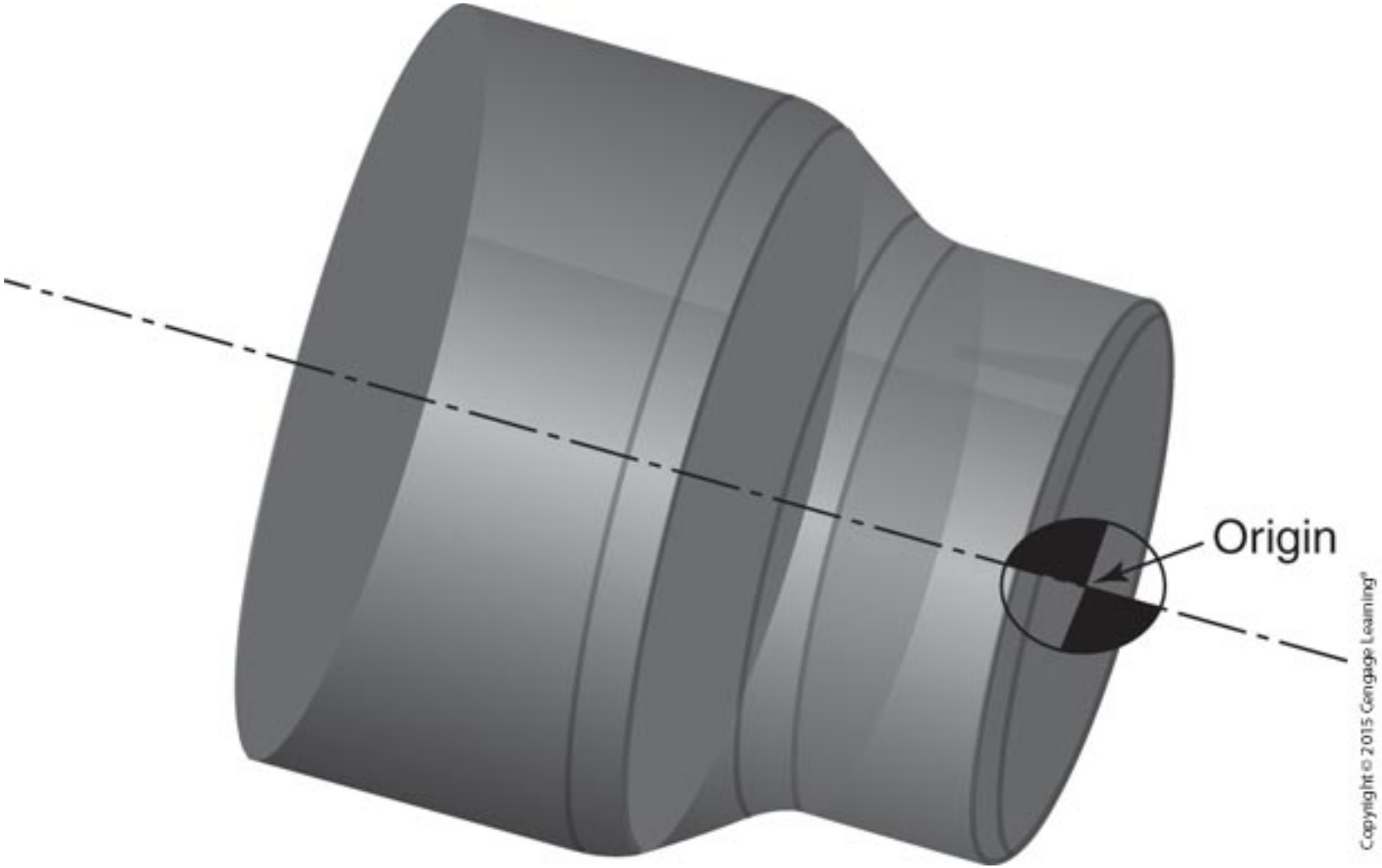
CNC Turning Basics

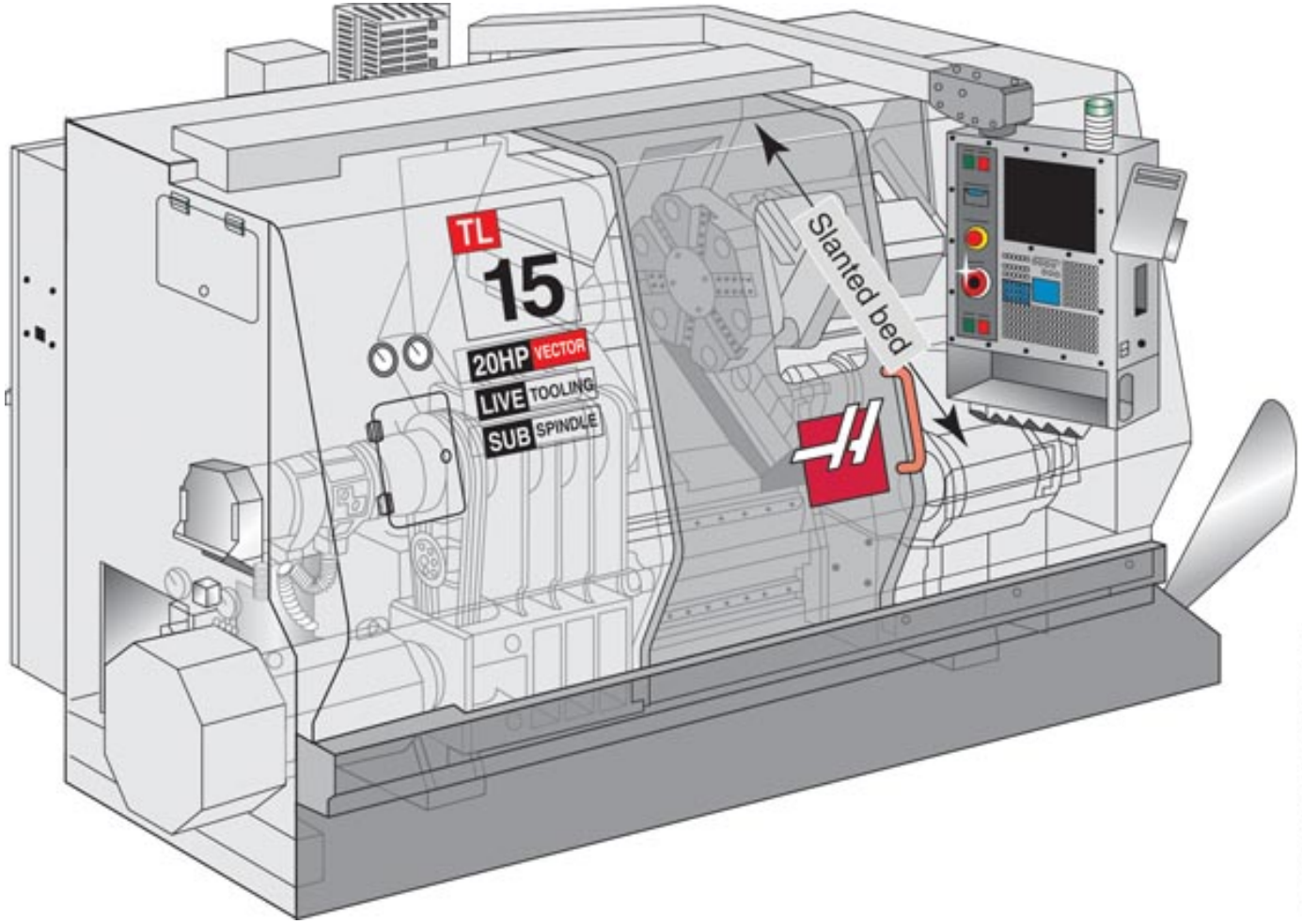
- CNC turning like manual lathe or milling machine
- Z-axis = motion along slide, X-axis = perpendicular



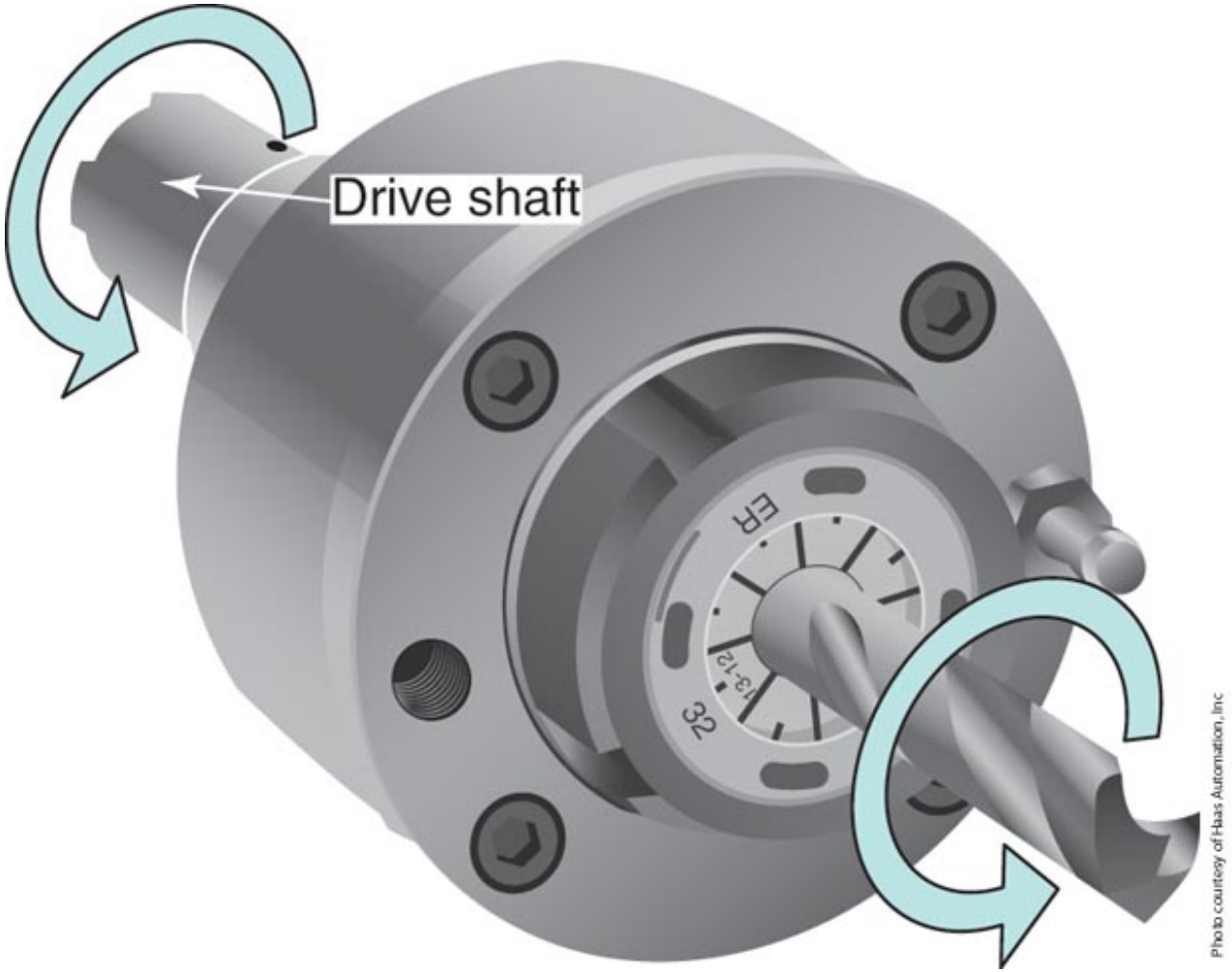
The coordinate system for CNC turning and the relationship of the axes.



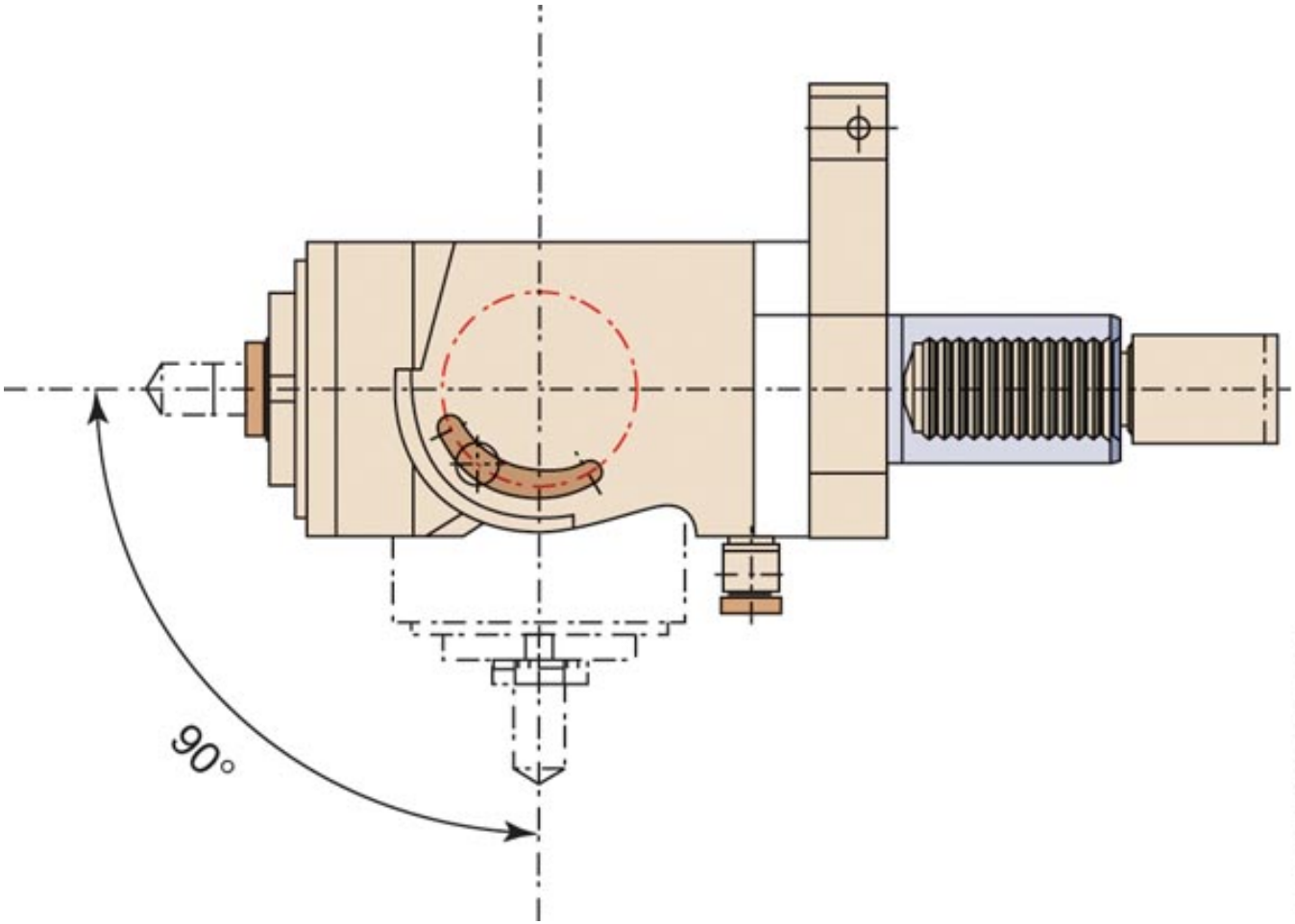
The origin for turning is usually located on the workpiece face on the part center line.



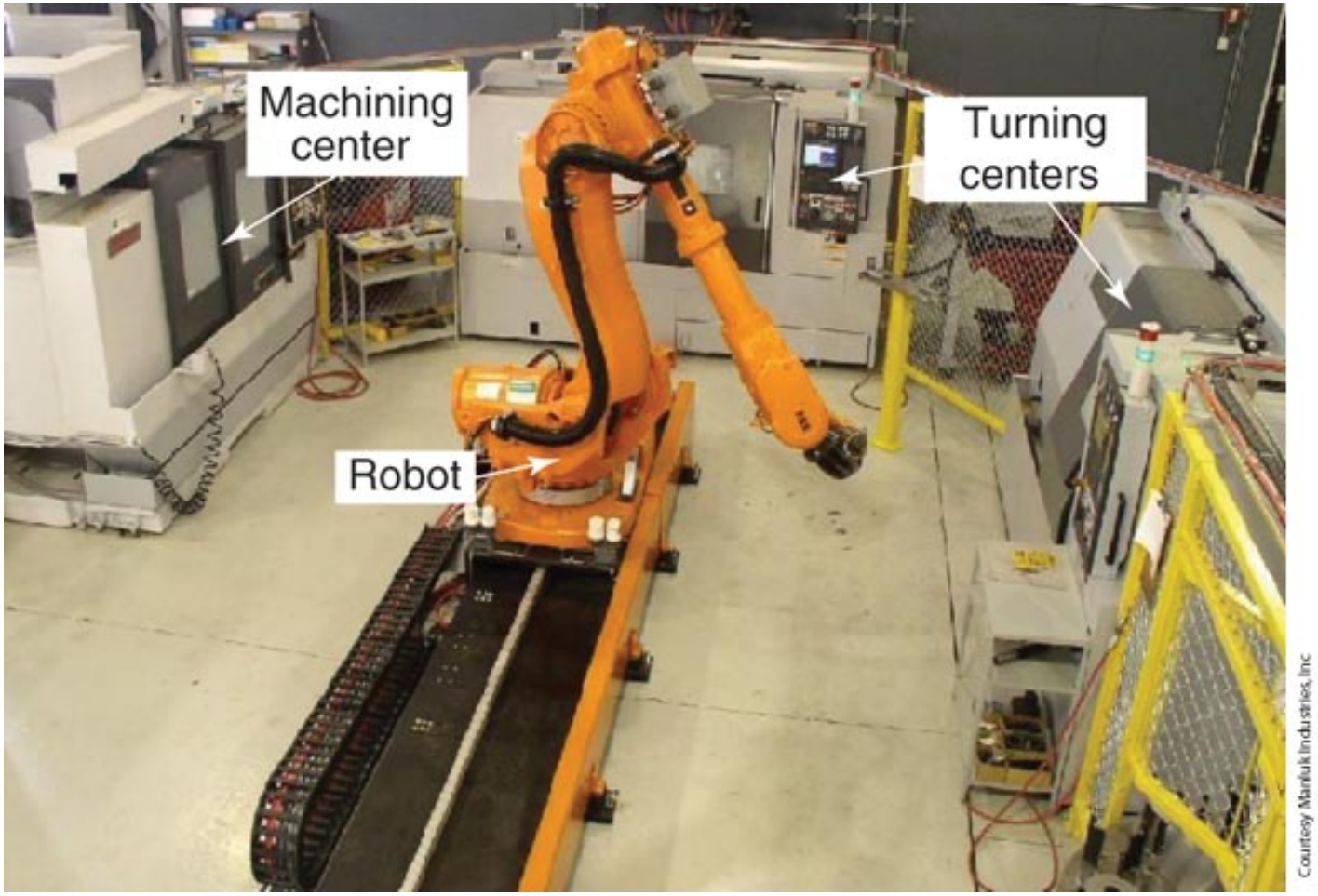
A slant-bed turning center has an inclined bed.



An end-working live tooling attachment for milling and performing holemaking operations on the face of a part.

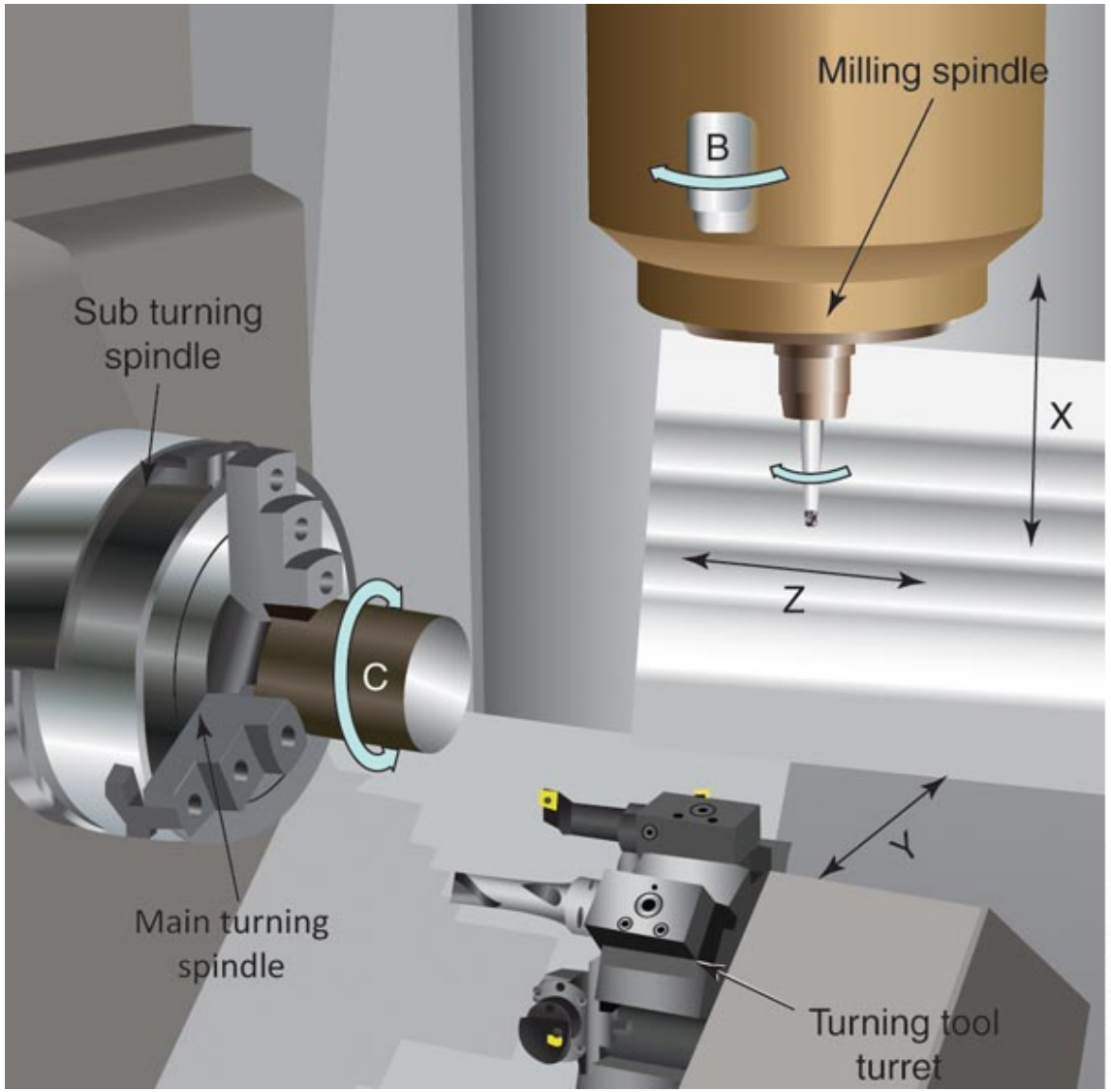


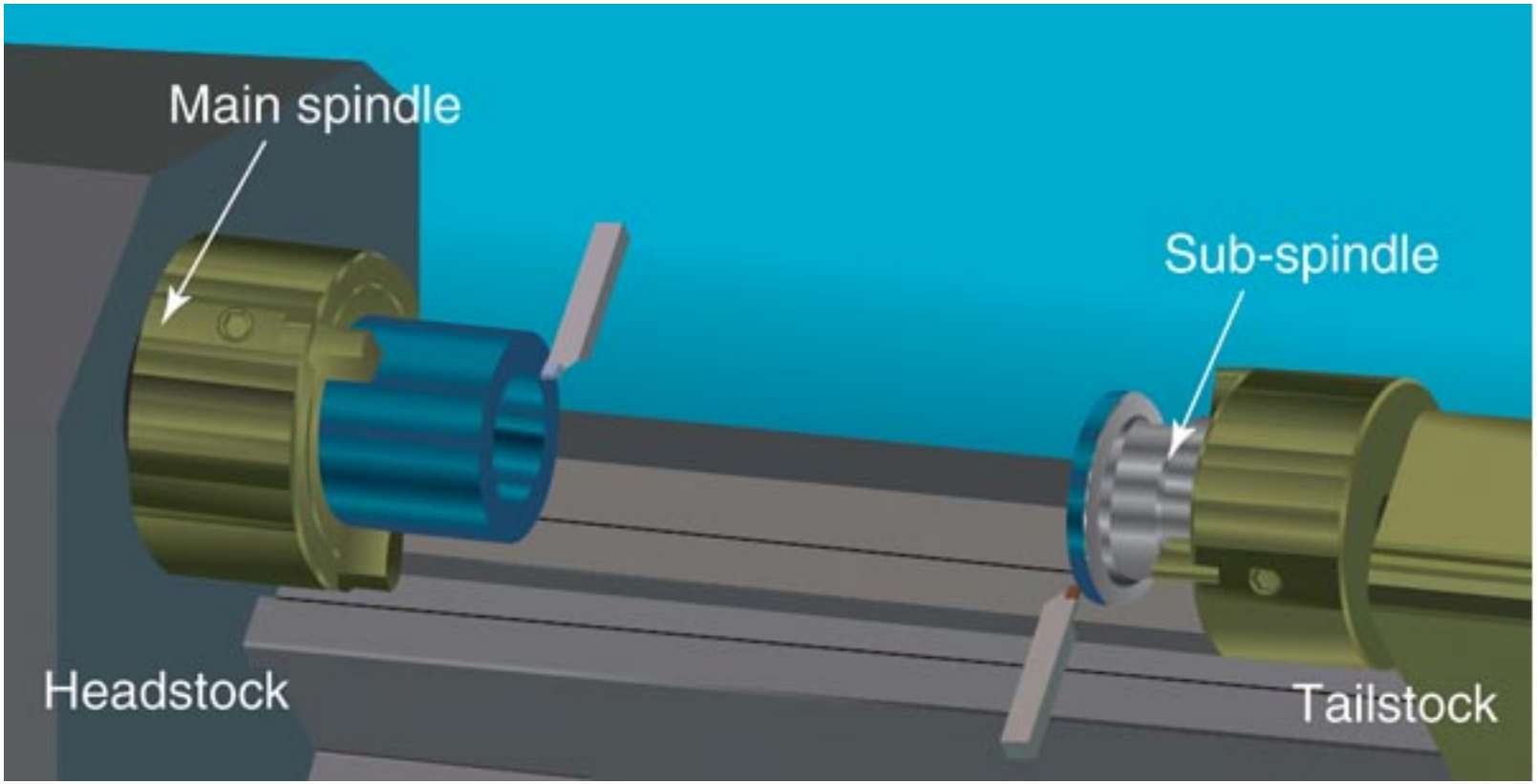
An adjustable angle-head live tooling attachment allows angular milling to be performed on the turning center.



A robotic manufacturing cell can enhance productivity by minimizing operator intervention. The workpiece is transferred between machines by the robot.

A specialized mill/turn machine that can perform heavy milling and turning operations.



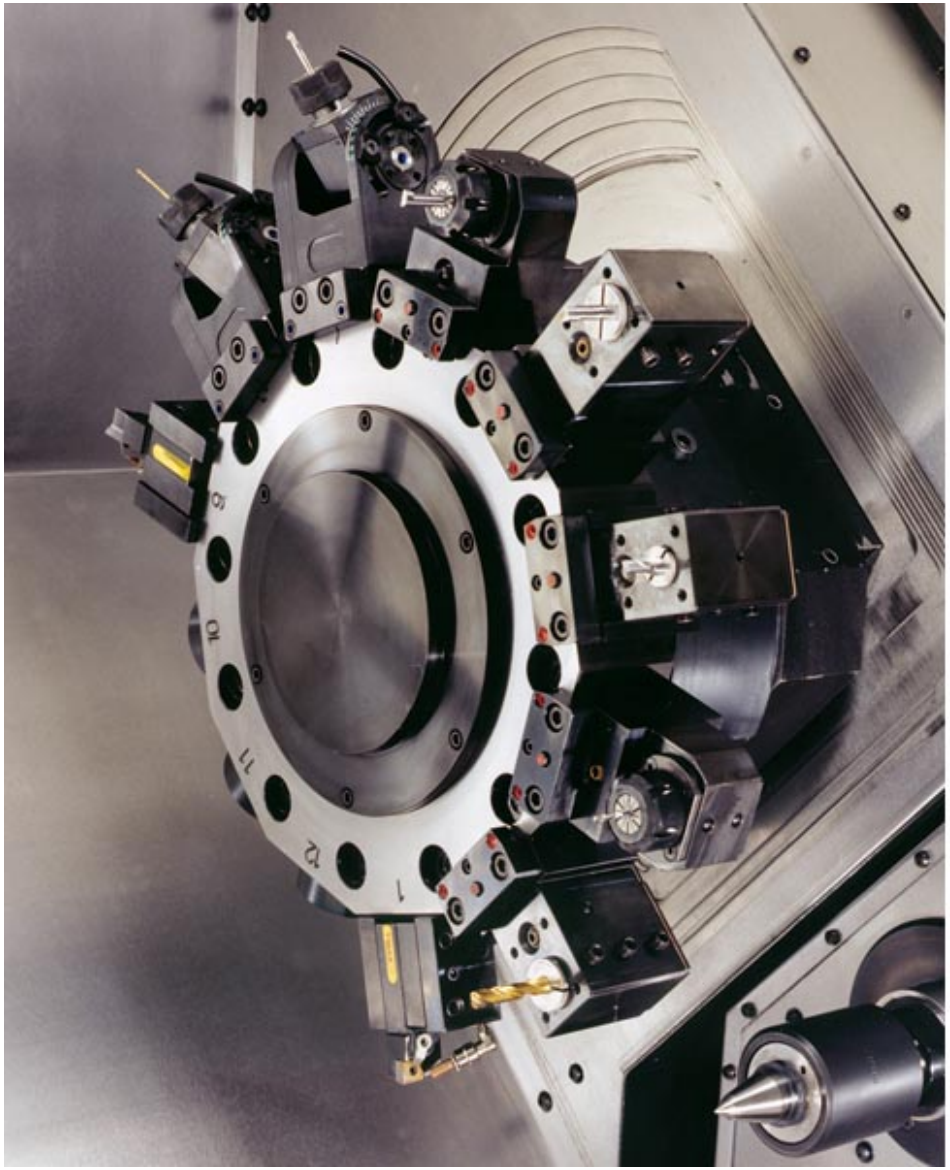


A sub-spindle opposes the machine's main spindle. The workpiece can be transferred from the main spindle to the sub-spindle so that the backside of the workpiece can be machined.

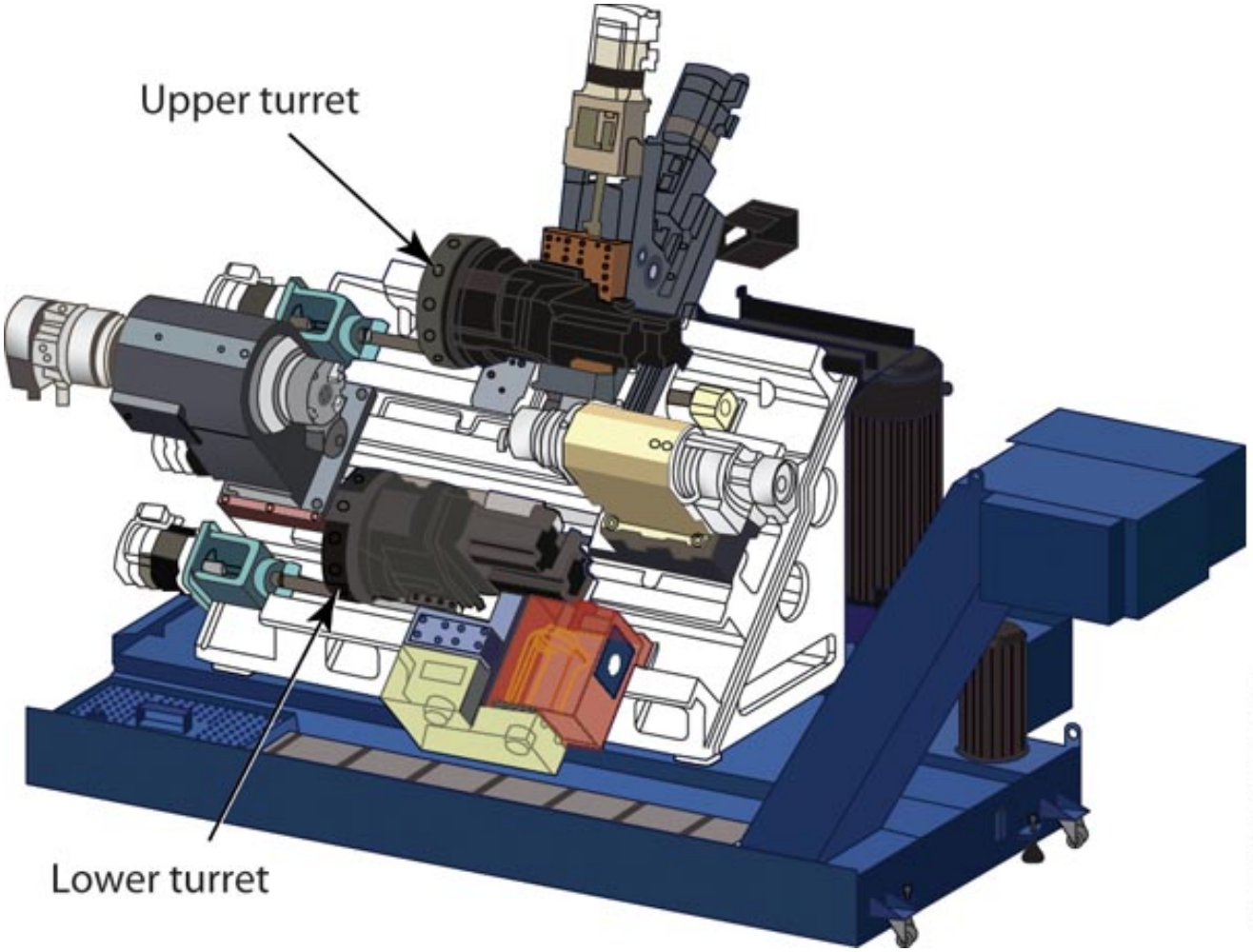
Types of Turning Machines

- Turret-type machines, gang-tool-type machines, CNC lathes, Swiss-type turning centers

A circular turret holds multiple tools and can index to any one of them with a program command.



Courtesy of Hardinge, Inc.



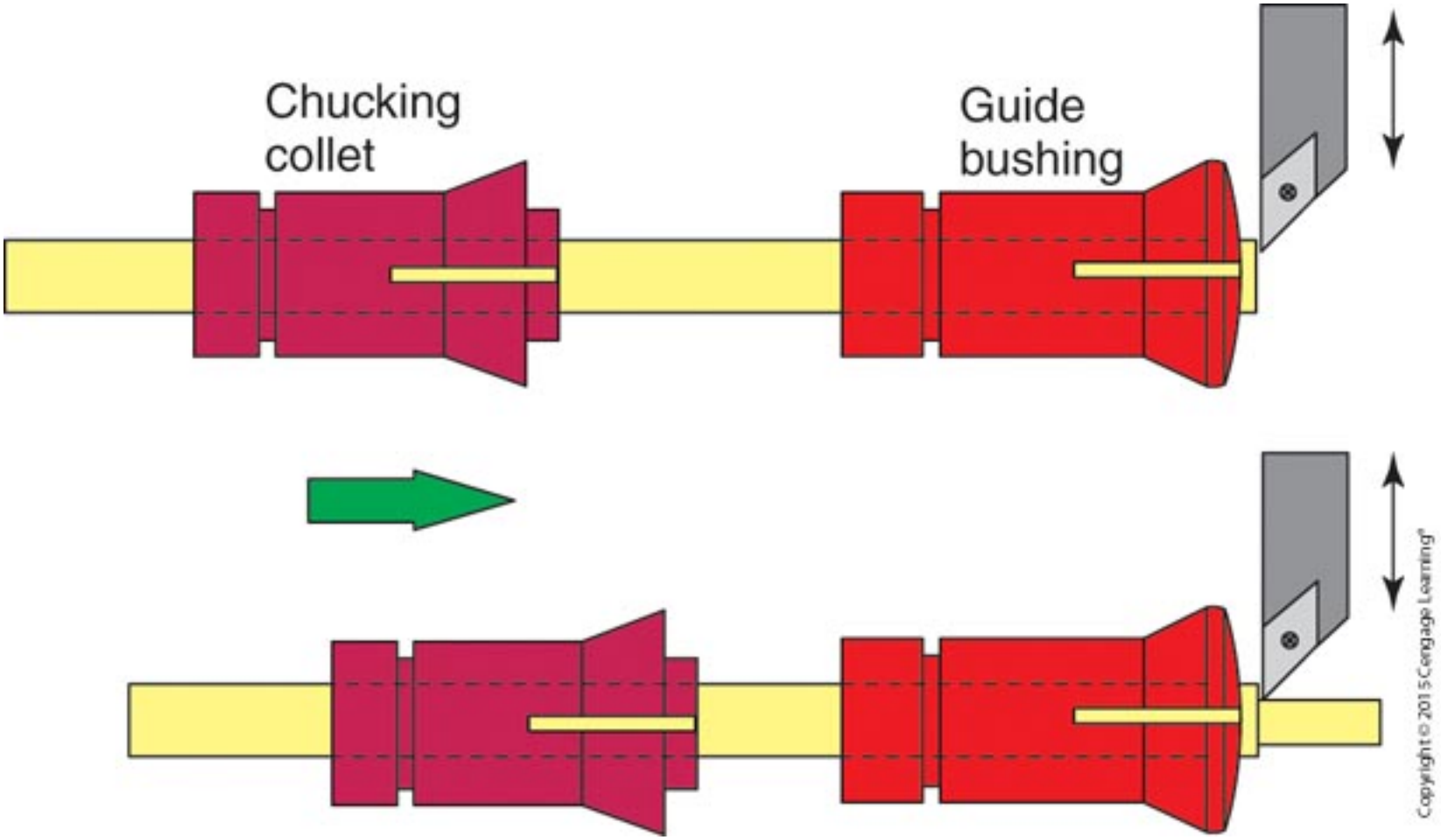
A twin turret machine can move both turrets independently for machining.

A gang tool machine top plate with the tools arranged in a row.

A gang tool turning center.

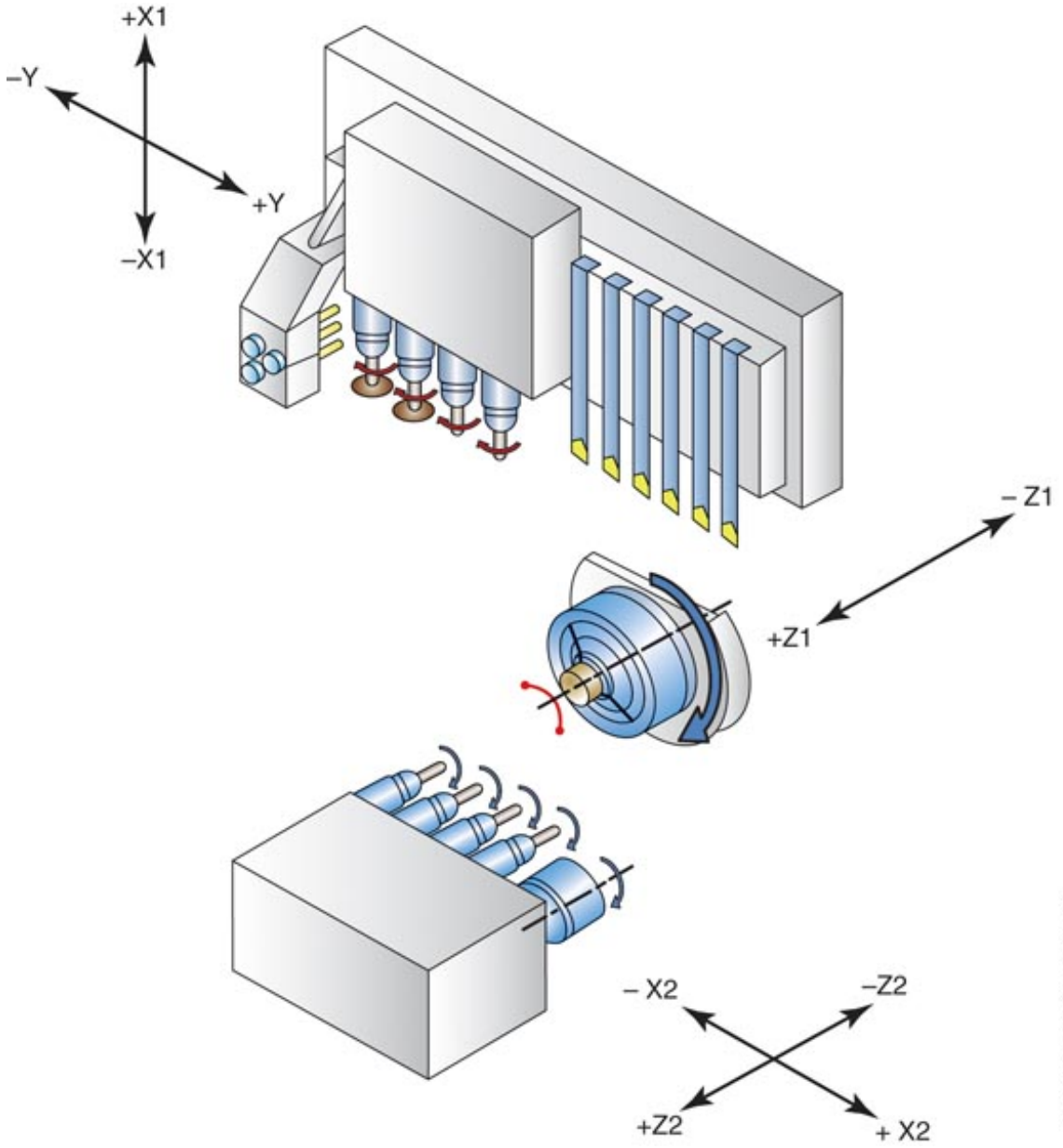
A CNC lathe holds cutting tools with a tool post similar to that used on a manual lathe.

Photo courtesy of Haas Automation, Inc.



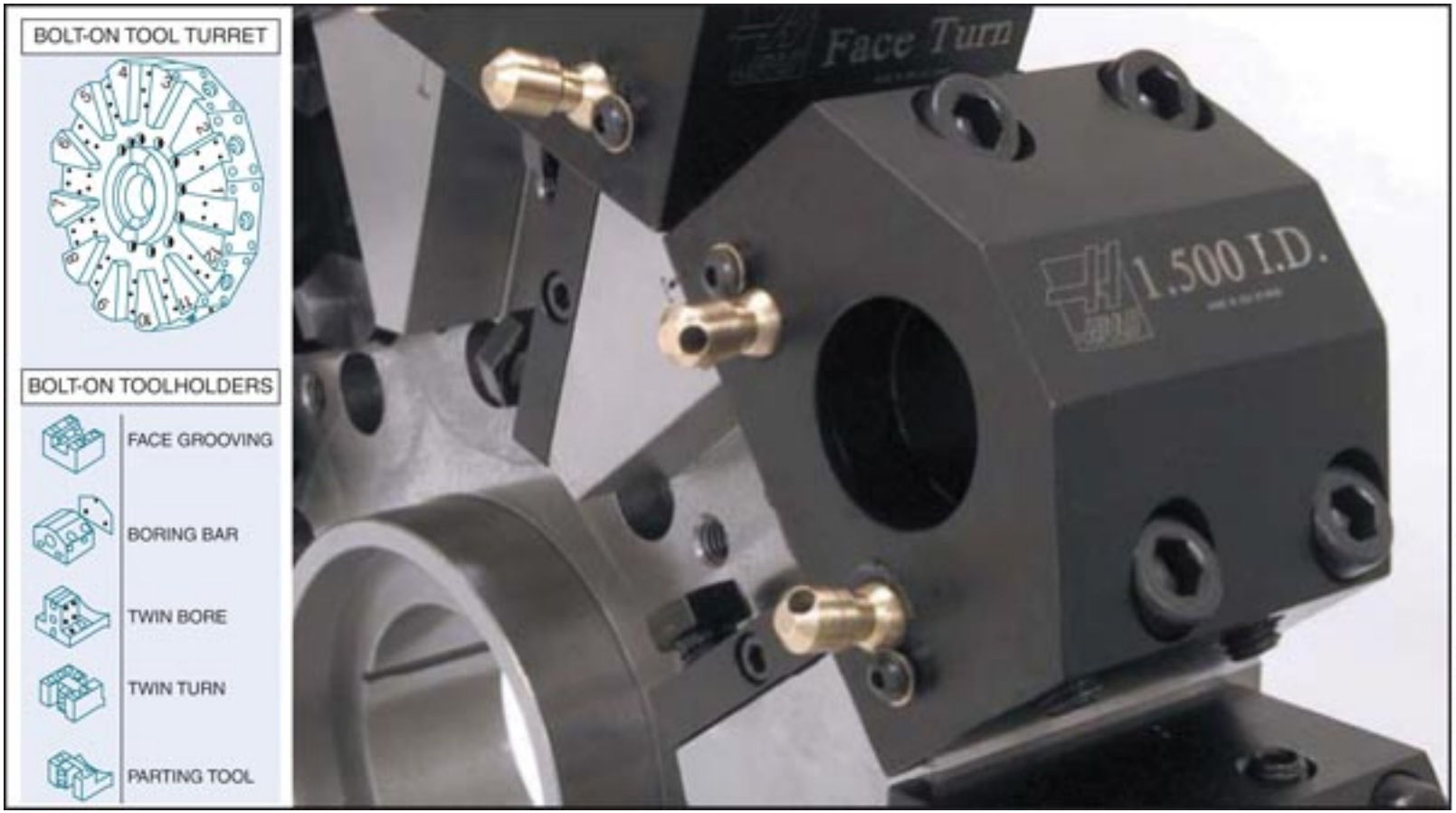
A Swiss turning machine moves the entire workpiece in the Z-axis instead of moving the cutting tool.

A typical tool arrangement on a Swiss turning machine.

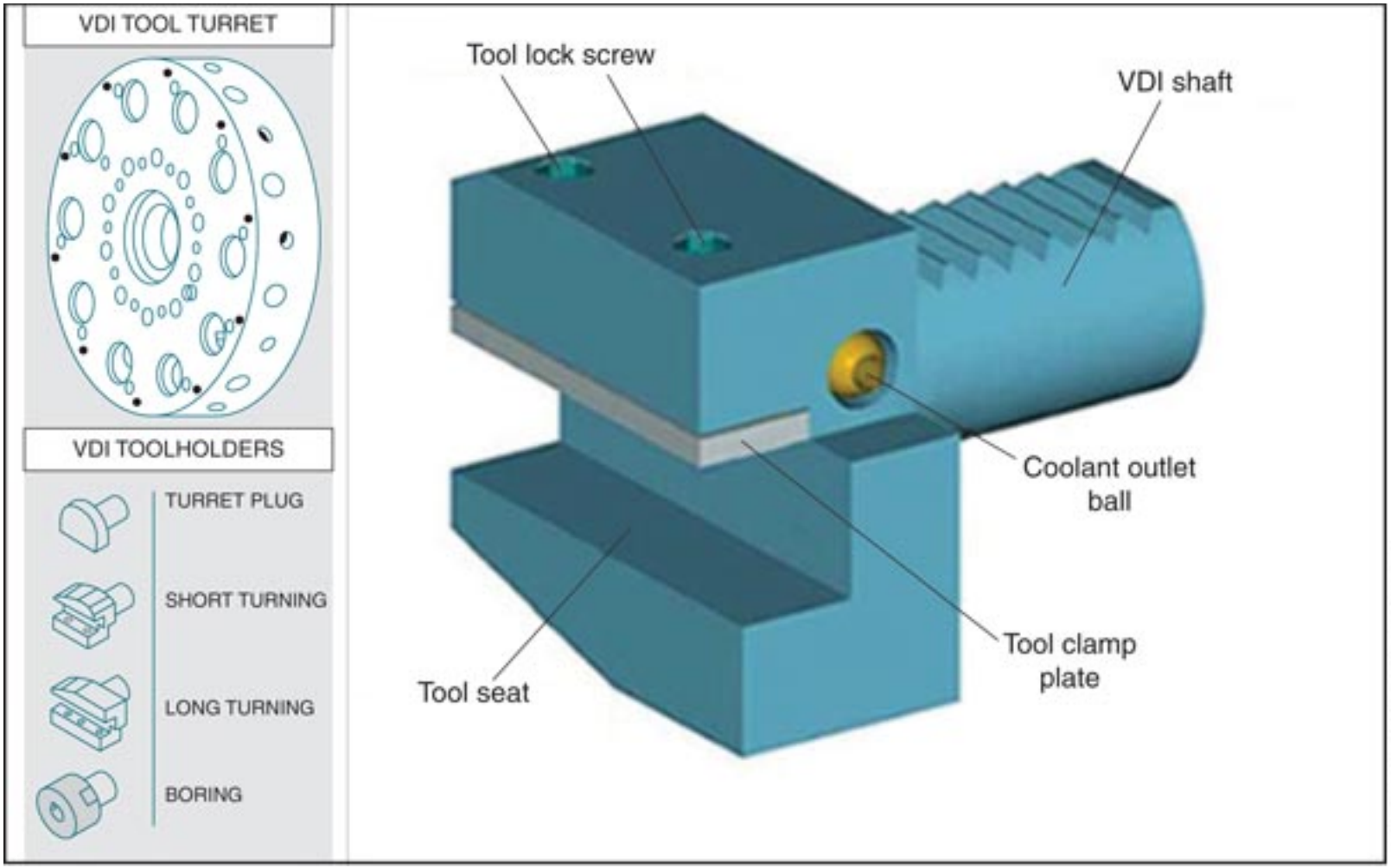


Tool-Mounting Adapters

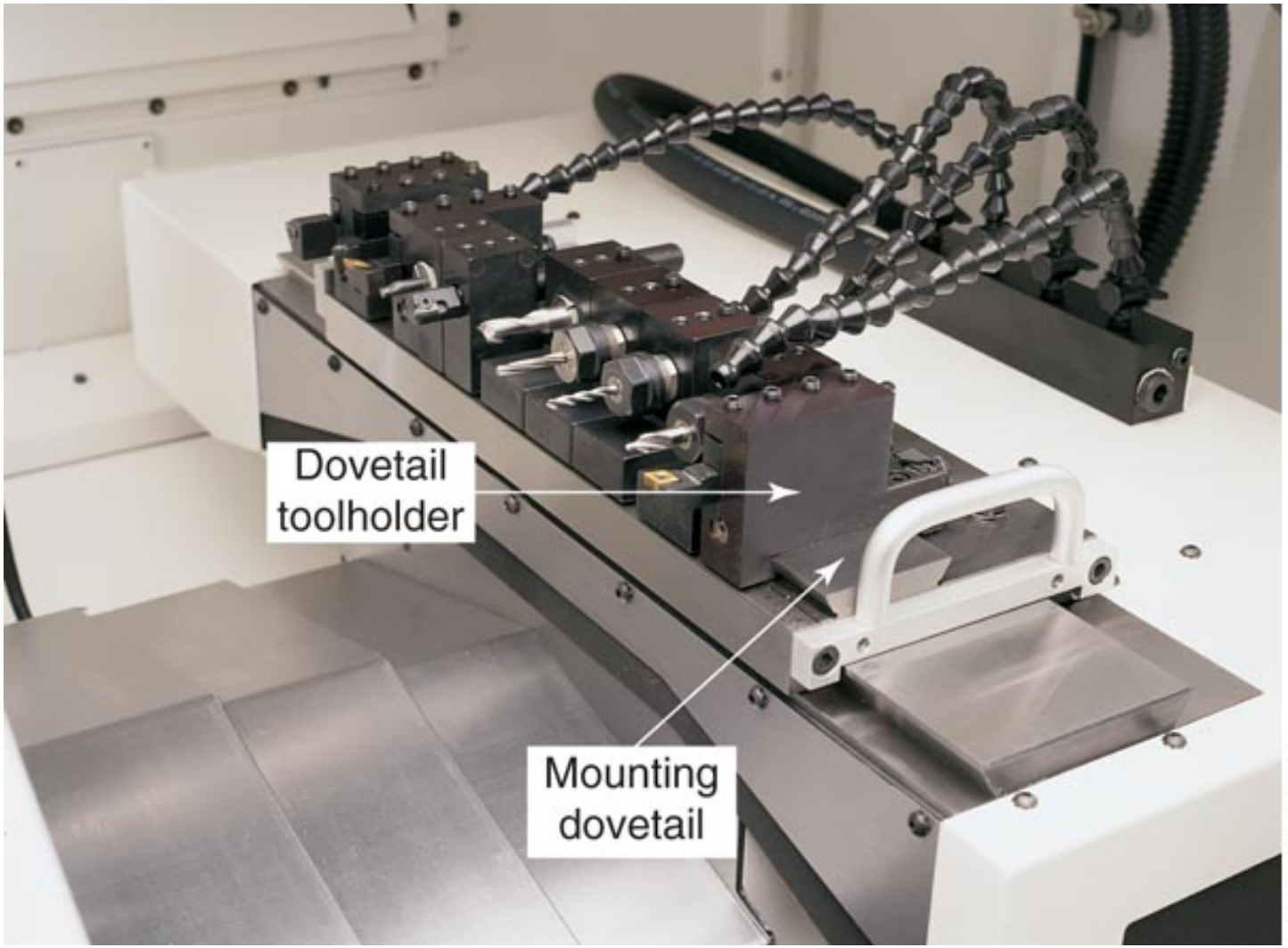
- Styles of tool-mounting adapters for different machines
  - Each accepts tools differently
  - CNC machines use same types of cutting tools as non-CNC, but different holding methods



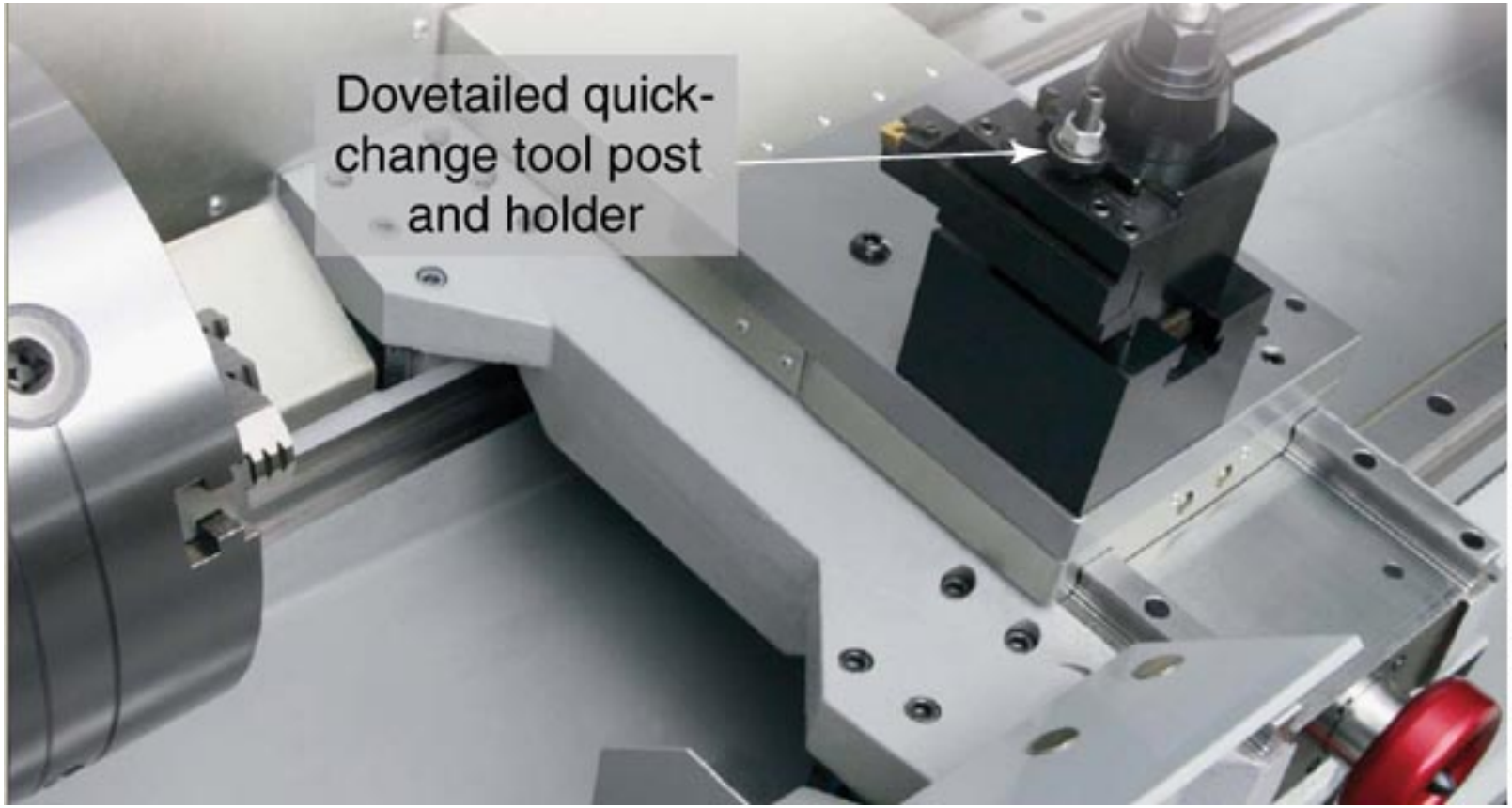
This type of toolholding adapter bolts directly to the turret with cap screws..



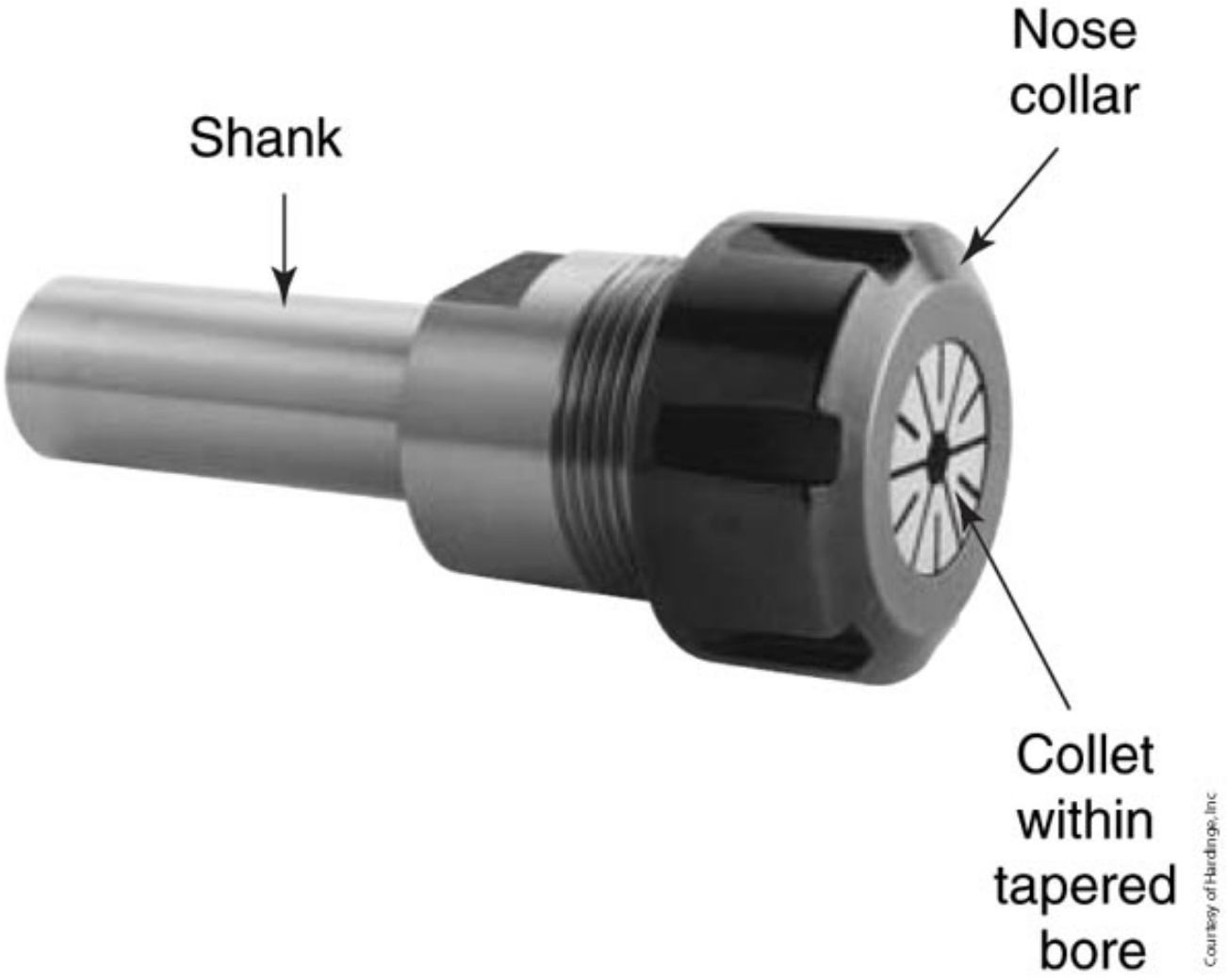
A VDI toolholding adapter mounts to the turret with a VDI shank. The adapter is drawn tight to the turret with the serrated teeth.



A dovetail mounting system used on a gang tool machine.

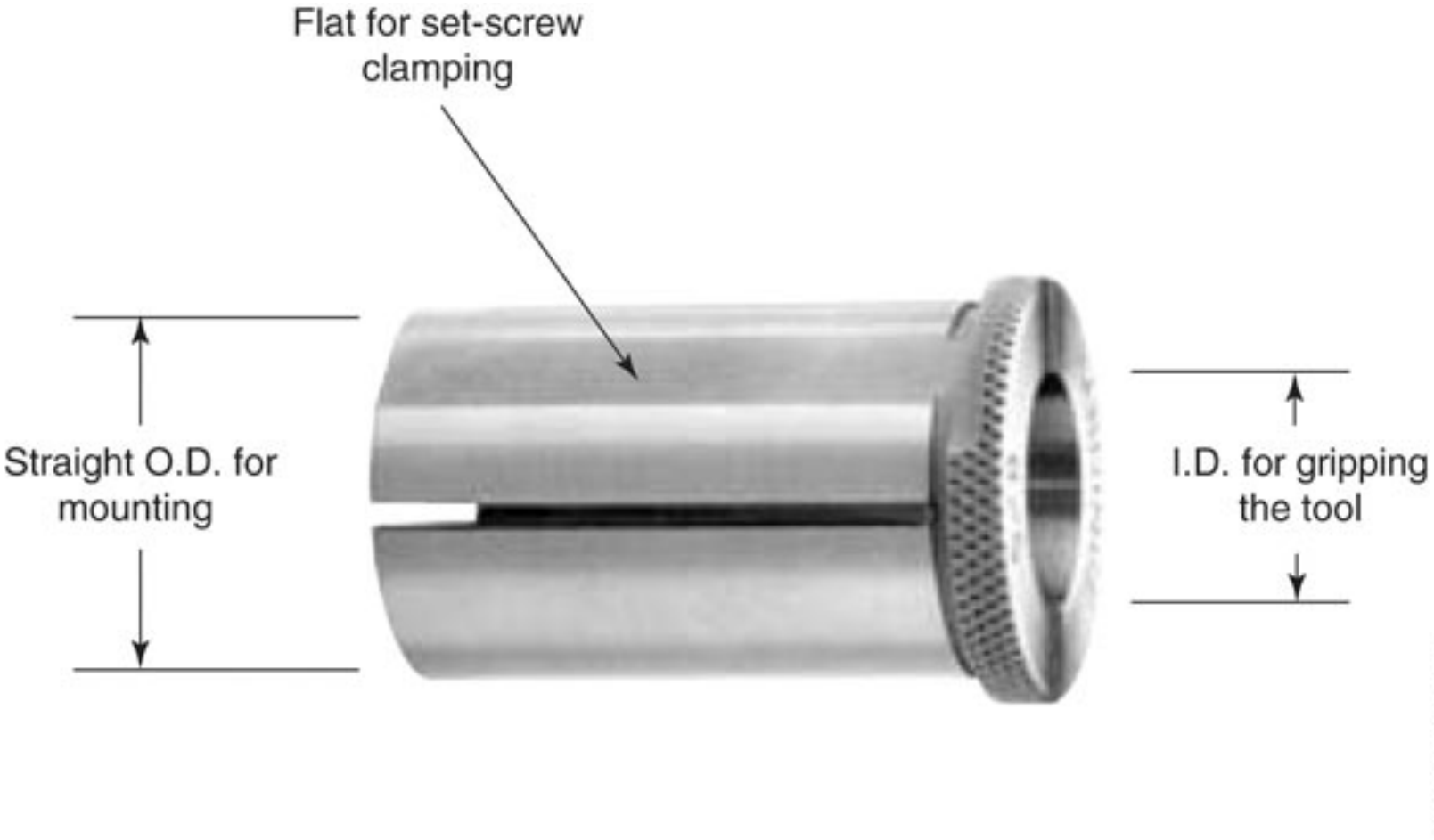


Quick-change toolholders used on a CNC lathe.

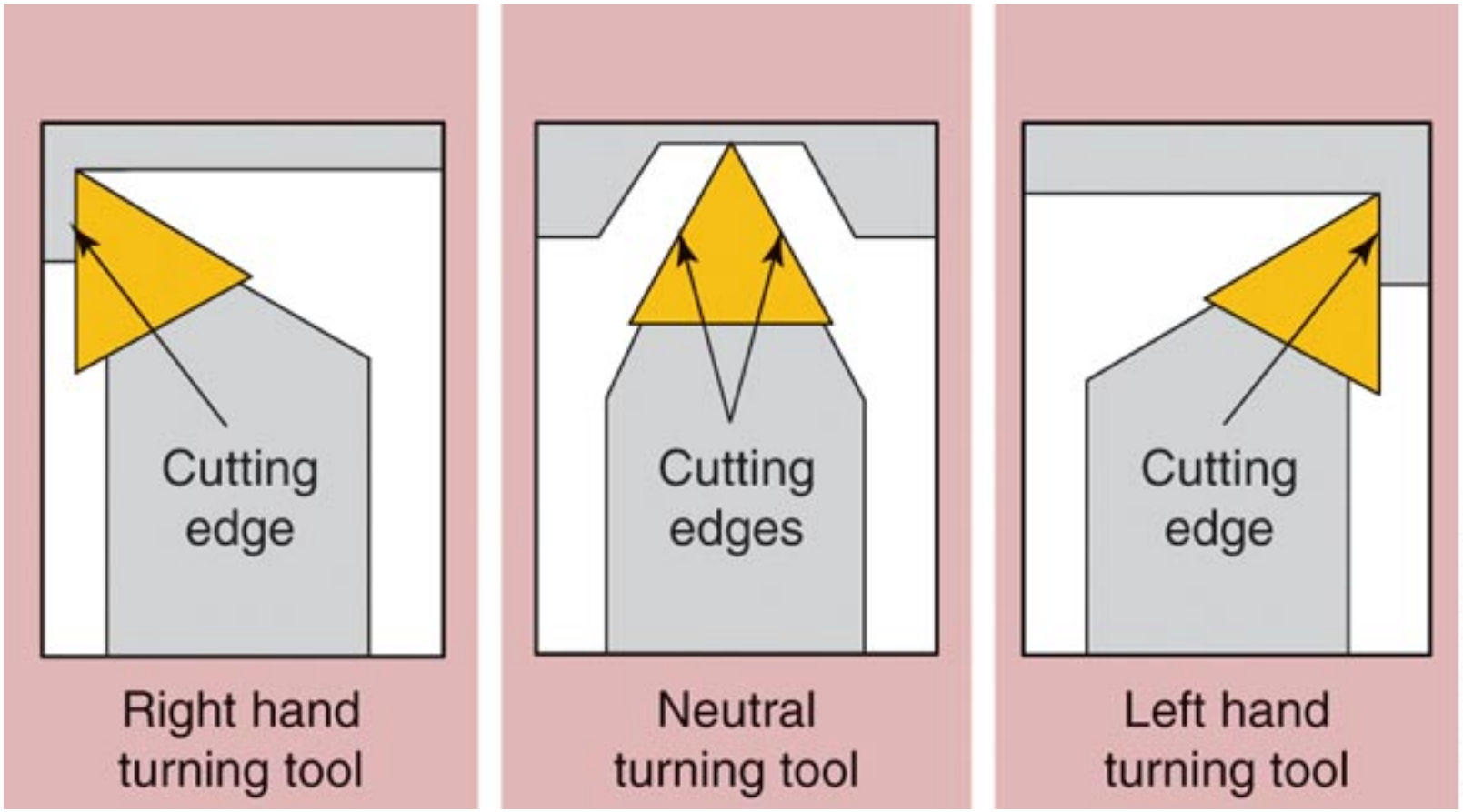


A CNC collet chuck for holding holemaking tools.

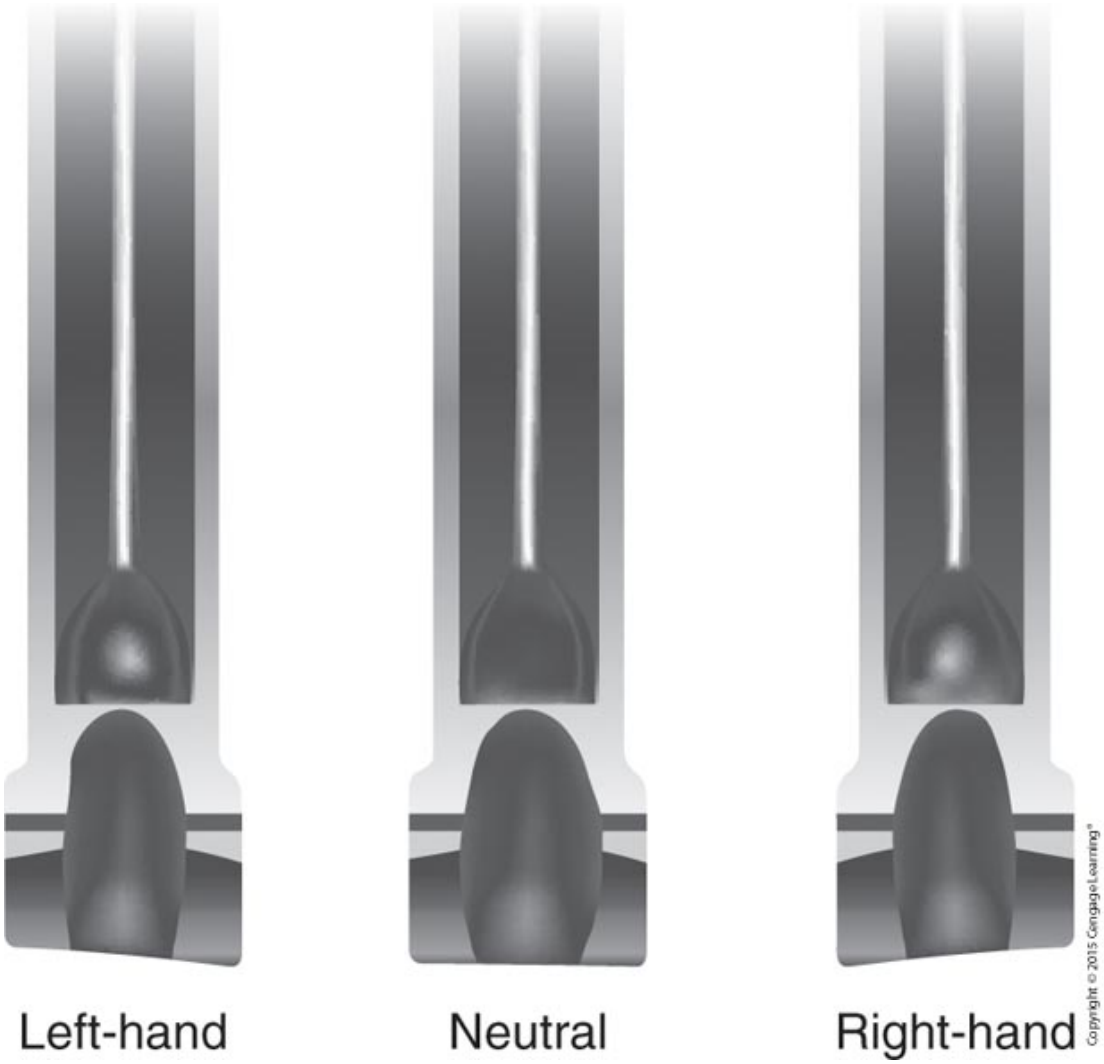
The collet types shown from left to right are the ER series, DA series, and TG series.



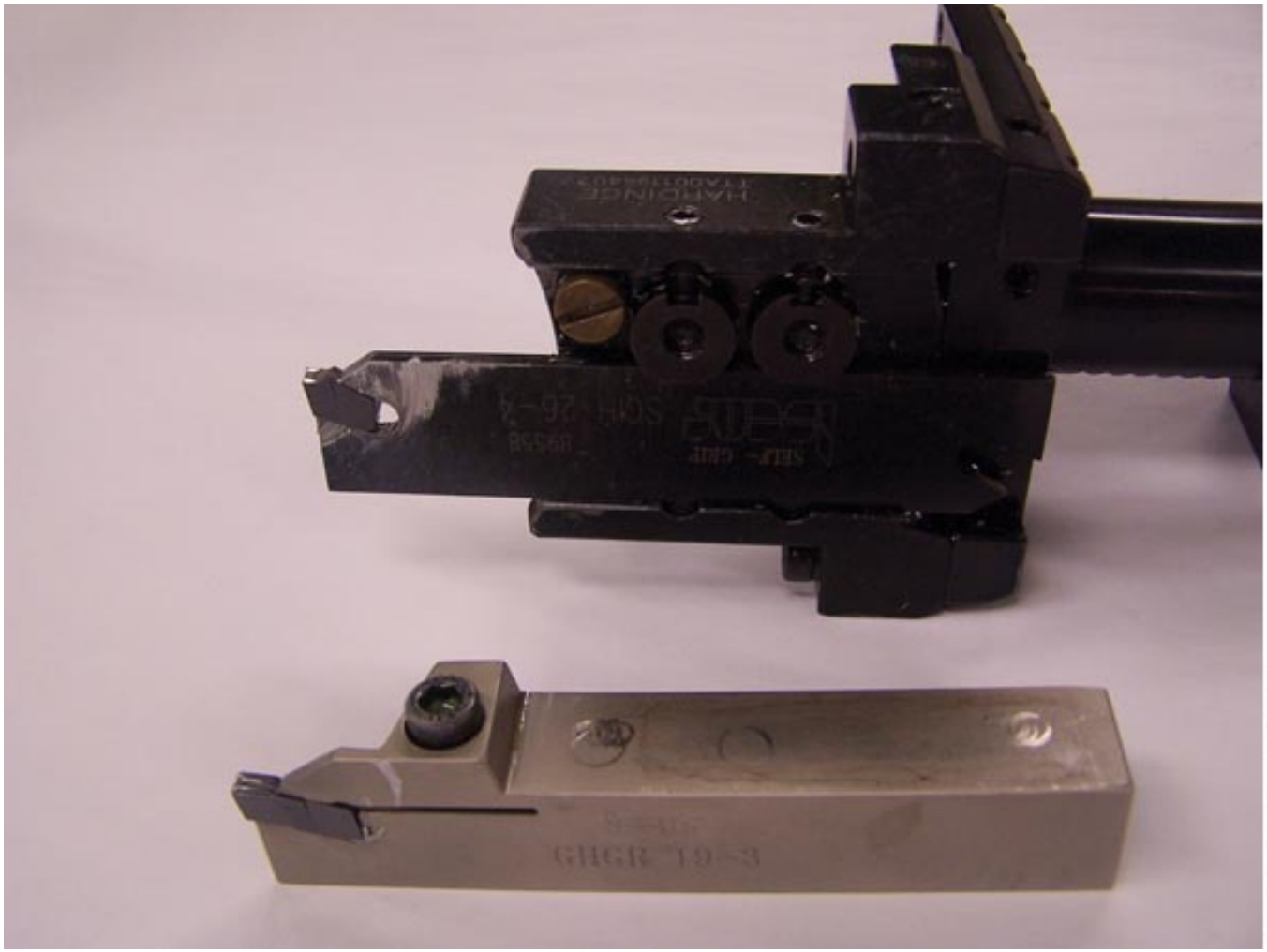
A Hardinge HDB drill bushing used to hold holemaking tools.



The turning tool orientations shown are right hand, neutral, and left hand.

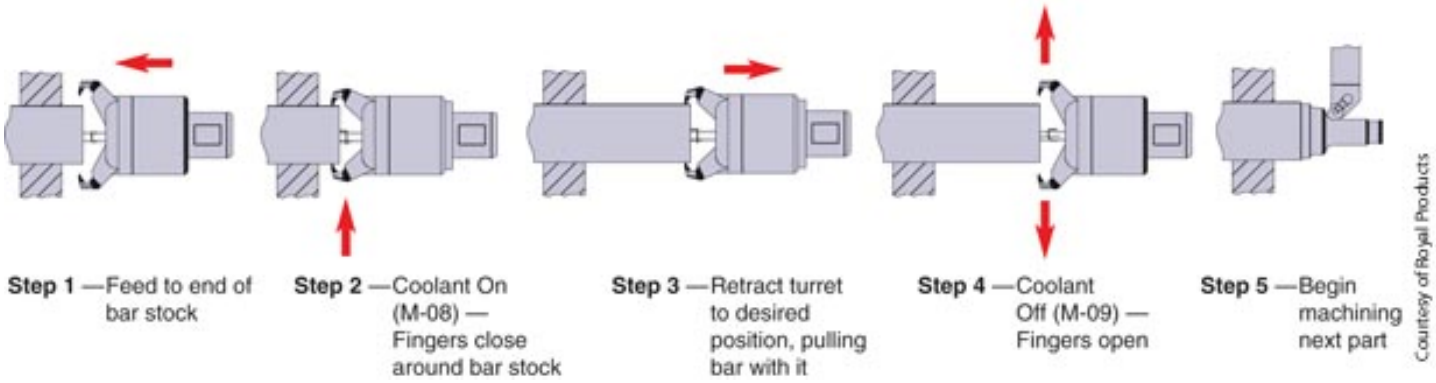


Cutoff inserts are available with a biased cutting edge to minimize burrs on the part being cut off.



A grooving tool is in the foreground and a cutoff tool is in the background.

A gripping-ring-type bar puller grips the bar end by sliding a ring of spring-steel teeth over the perimeter of the bar.

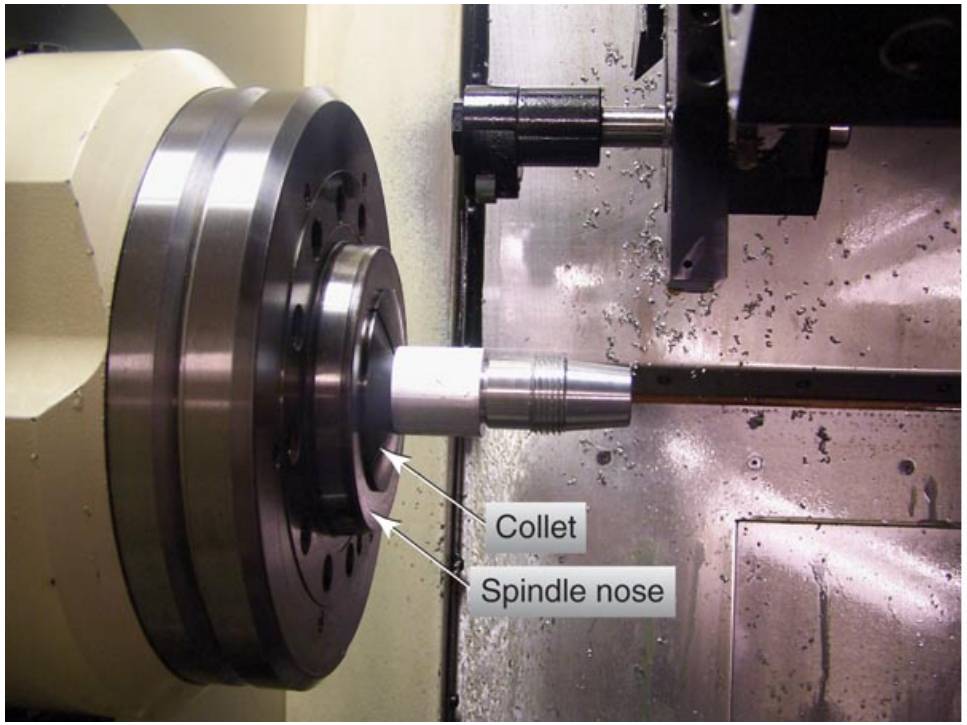


This coolant-actuated bar puller's jaws grip the stock using the hydraulic pressure of the machine’s coolant system.

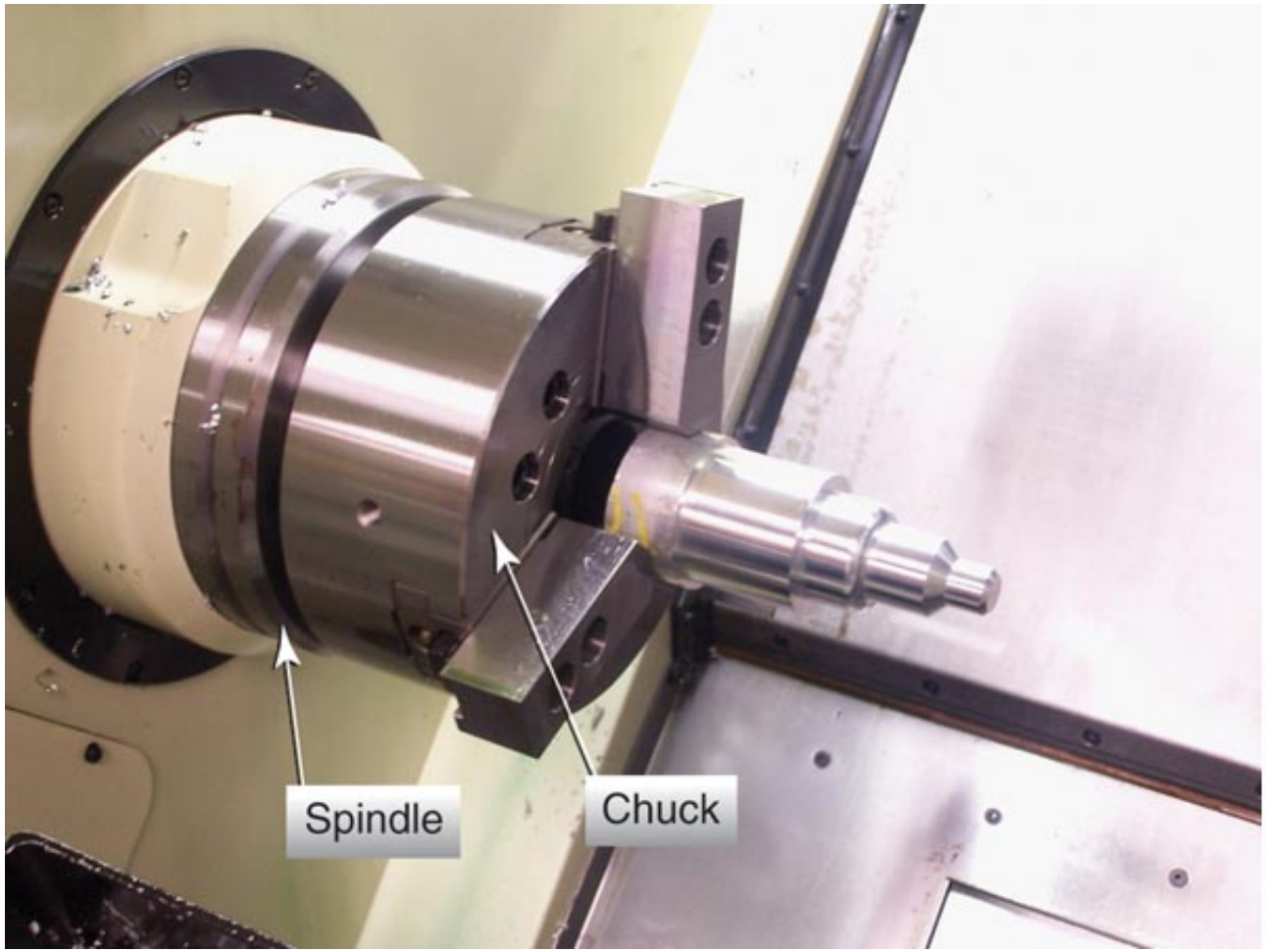
A CNC turning center equipped with an automatic bar feeder.

Workholding

- Workholding devices for CNC like those for manual lathes
  - Types: workholding collets, workholding chucks



collet for workholding.



A three-jaw power-actuated chuck in a CNC turning center. This setup is using soft jaws that were machined to match the outside diameter of the workpiece.

Process Planning

- Manufacturing process: all operations required to machine a part
- Process plan describes all steps in detail
  - Includes a description of each operation, the tools required, speed and feed data, workholding information, other notes and comments, and often a sketch depicting the part orientation