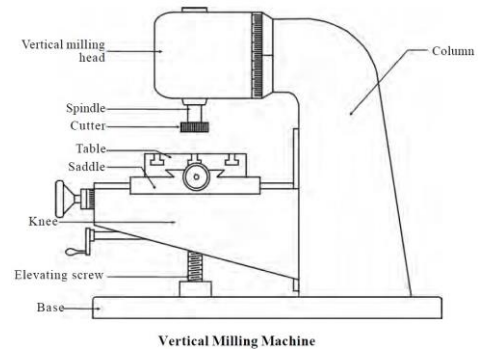


# Machining

## *Vertical Milling (Metal):*

1. Material is clamped into place
2. Cutter is selected and RPM is chosen
3. The material always remains stationary while your machine's cutting tool rotates.
4. As the cutting tool moves, it presses against the workpiece and shapes the material.

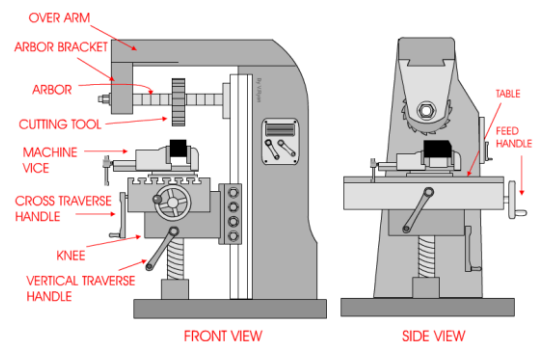


<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Visibility</li> <li>• Cost effective to run</li> <li>• Ease</li> <li>• Precision</li> </ul>	<ul style="list-style-type: none"> <li>• Uses a lot of electricity</li> <li>• Expensive to buy machines</li> </ul>

Uses: Cutting gears, produce slots, drilling

## *Horizontal milling (Metal):*

1. Material is clamped into place
2. Cutter is selected and RPM is chosen
3. The material always remains stationary while your machine's cutting tool rotates.
4. As the cutting tool moves, it presses against the workpiece and shapes the material.

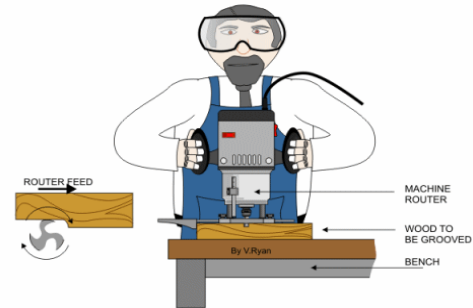


<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Run faster than vertical milling</li> <li>• Capacity</li> <li>• Durable</li> <li>• Precision</li> </ul>	<ul style="list-style-type: none"> <li>• Not good at doing radial cuts</li> <li>• Machinery takes up lots of space</li> <li>• Uses a lot of electricity</li> <li>• More expensive machinery than vertical milling</li> </ul>

Uses: Cutting gears, produce slots, drilling

## Routing (Wood):

1. Material is clamped into place
2. Cutter is selected and RPM is chosen
3. The material always remains stationary while your machine's cutting tool rotates.
4. As the cutting tool moves, it presses against the workpiece and shapes the material.



Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Quick</li> <li>• Low skilled</li> <li>• Can be CNC- safer etc</li> </ul>	<ul style="list-style-type: none"> <li>• Uses electricity</li> <li>• Can be dangerous</li> </ul>

Uses: Cabinets, doors

## Drilling:

1. Drill bit is selected and holes are marked up
2. Drill bit is fixed in the chuck and tightened using a chuck key
3. The table is set at a certain height and the RPM of the drill bit is chosen
4. The hand wheel is lowered to drill the hole.

**Note:** Parallel shanks are held in by a chuck and key and Taper shanks are held in by friction

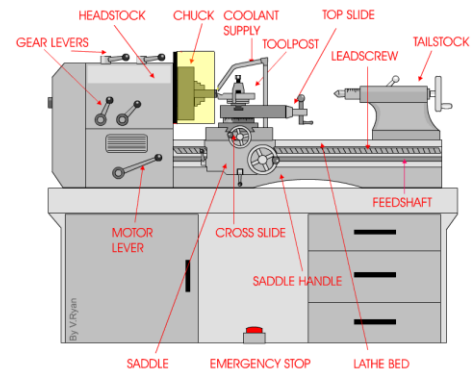


Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Quick</li> <li>• Cheap</li> <li>• Can be automated easily</li> <li>• Low skilled</li> </ul>	<ul style="list-style-type: none"> <li>• Drill can overheat if drill bit isn't sharp or at correct rotational speed</li> <li>• Wood can become burnt</li> <li>• Hole finish can be poor</li> </ul>

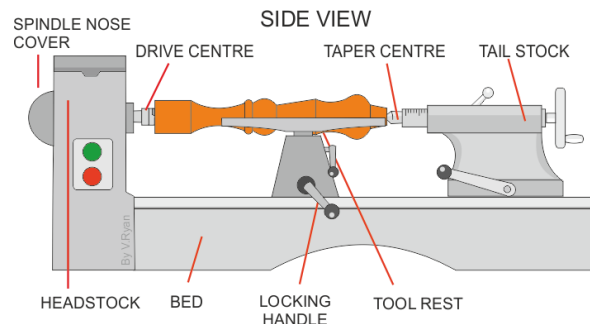
Uses: Separating pop rivets, drilling holes for products

## Turning:

1. Begin by placing a circular-, square- or rectangular-shaped piece of metal/wood into the CNC lathe's drive area.
2. The metal/wood piece is typically secured using a pressure pad.
3. Once in place, the CNC lathe is activated to rotate and press the mould against the metal/wood piece.
4. The rotational force of the CNC lathe then deforms the metal/wood piece to achieve the same shape as the mould.
5. When metal/wood spinning is performed by hand, a worker manually presses the mould against the metal/wood piece.



Note: If using Metal, you would use a Metal working lathe whereas if you were using Wood you would use a Woodturning lathe, as shown by the images.

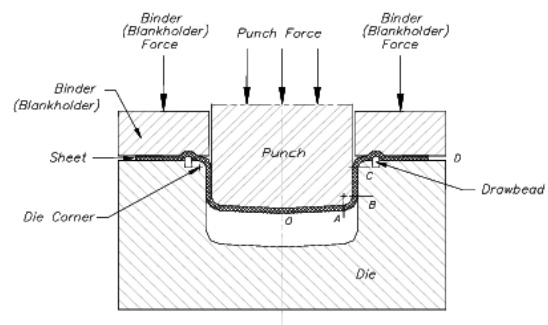


Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Complex designs/shapes can be made</li> <li>• Energy efficient</li> <li>• Good surface finish</li> <li>• Can be computer controlled</li> </ul>	<ul style="list-style-type: none"> <li>• Dangerous pieces ejected from machine</li> <li>• Some materials are very hard to turn</li> </ul>

Uses: Table legs (wood), Table lamp (wood), engine parts (metal), handles (metal)

## Stamping:

1. Process is usually done via a CNC
2. The CNC program moves the platen carrying the sheet metal



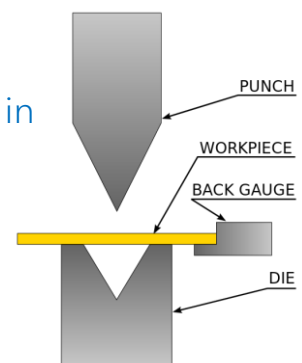
3. Once the sheet metal is under the stamp the die is punched against the sheet metal
4. The waste material is then recycled and the stamped metal is collected

<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Economical</li> <li>• Can be done many times very quickly</li> </ul>	<ul style="list-style-type: none"> <li>• Residual cracks appear along the edges</li> <li>• Hardening along the edges</li> <li>• Burrs can be created if clearance is excessive</li> </ul>

**Uses:** Shape sheet metal into shapes with holes, washers, cog, tin can pull tab

### *Pressing:*

1. A sheet metal is clamped over the die and held in the correct position using the back gauge
2. A hydraulically operated punch is then pushed into the sheet metal
3. Once the desired shape is formed the punch is retracted and the sheet component is ejected



<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• High strength in pressed parts</li> <li>• Can be mass produced</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive set up cost</li> <li>• Large runs needed to be economical</li> <li>• Can make product heavy</li> </ul>

**Uses:** Shaping sheet metal, patterns on metal trolley bases