# ROUTING IN WOODTURNING

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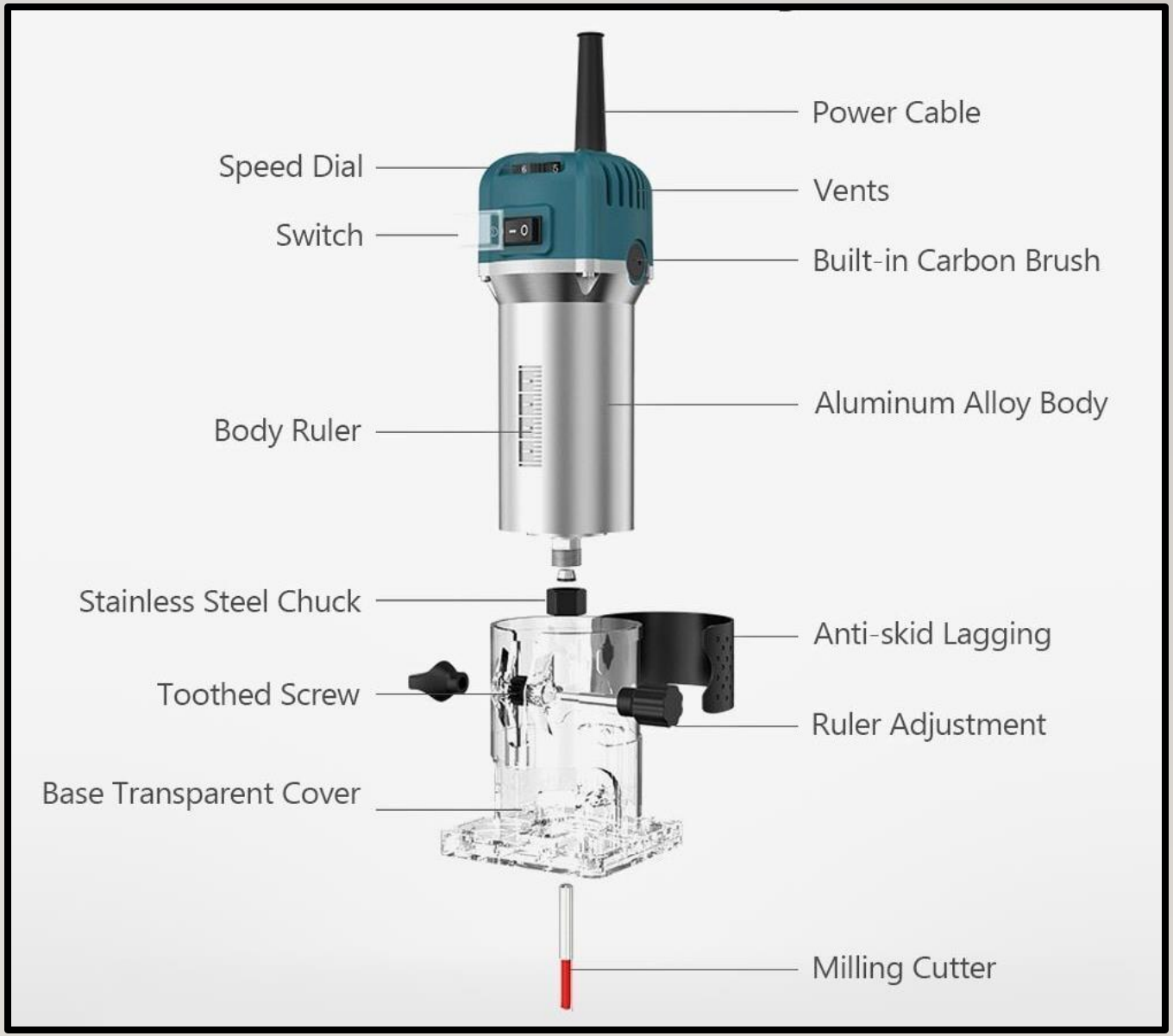
# ROUTING IN WOODTURNING

- 3 Key Components:
  - Router
  - Router Jigs
  - Indexing

# ROUTING IN WOODTURNING

- Router:
  - Various Types:
    - Fixed vs Plunge
    - Fixed vs Variable Speed
    - Collett size: ¼” vs ½”

# Router Components



# Router Safety

1. Unplug the router before changing the bit
2. Make sure the bit is tightly secured
3. Wear hearing, eye, and dust protection
4. Make sure the work is secure (turning is chucked properly)
5. Do not start the router with the bit in the wood
6. When in doubt, take light cuts
7. Feed the router in the appropriate direction

# Which Direction to Feed the Router

- The correct direction of cut is against the rotation of the bit. The bit rotates clockwise, so pushing against it helps maintain control and prevents the bit from acting like a wheel and driving the router.
- In woodturning, this is typically left to right.

# Embellishing in Woodturning

| Power Carver | RPM's |
|---|---|
| Foredom | 18,000 |
| Dremel | 4,500 – 30,000 |
| Variable Speed Router | 10,000 – 35,000 |
| Micro Motor | 45,000 |
| NSK high speed carver | 320,000 |

# Router Bit Speed

RIM Speed = Circumference X Router Speed (RPM'S)

If one assumes a router speed of 20,000 rpm's:

1" diameter router bit rotates at **59.5** mph
2" diameter router bit rotates at **119** mph
3" diameter router bit rotates at **178.5** mph

# GENERAL GUIDE TO MAXIMUM ROUTER BIT SPEED

| DIAMETER | MAX RPM +/- 10% |
|---|---|
| Up to 1-inch | 22,000 |
| 1- to 2-inches | 20,000 |
| 2- to 2.5-inches | 18,000 |
| 2.5- to 3.5-inches | 10,000 |

# Routing in Woodturning

## Tips to Avoid Tear Out and Burning:

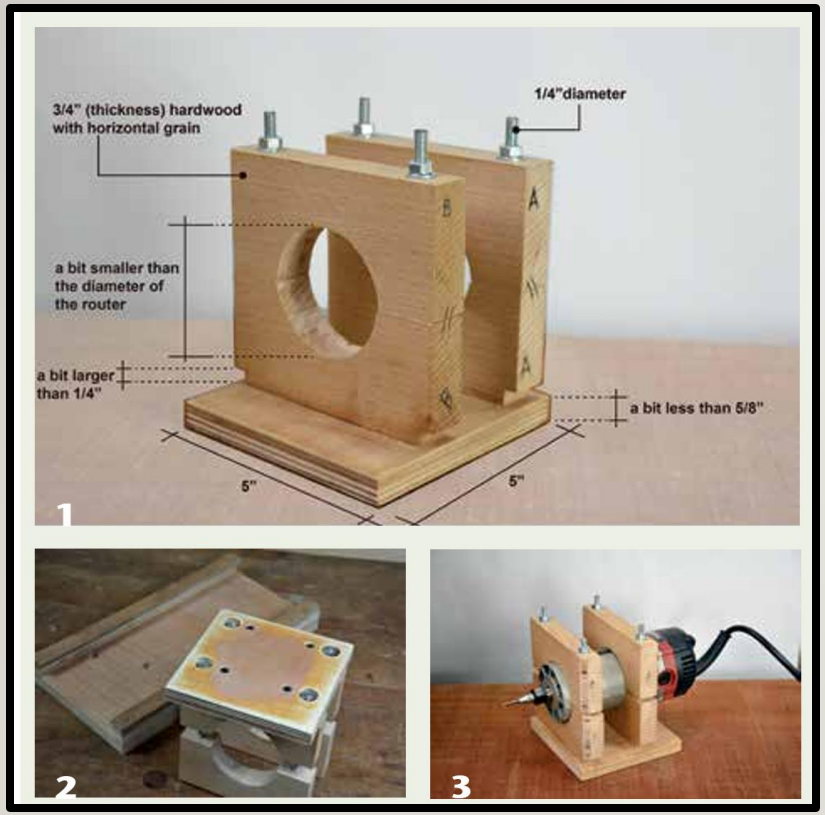
1. Bigger the bit, the slower the speed.
2. Use paste wax or lubricant on the bit.
3. When routing cherry, hard maple or highly figured wood, slow the bit down.
4. Maintain a constant feed rate with the router.

# Routing Jigs

- Why Use Jigs:

1. Safety! Router is secure.
2. Allows reproducible cuts

# Router Holder




Cindy Pei-Si Young, AAW Oct 2023

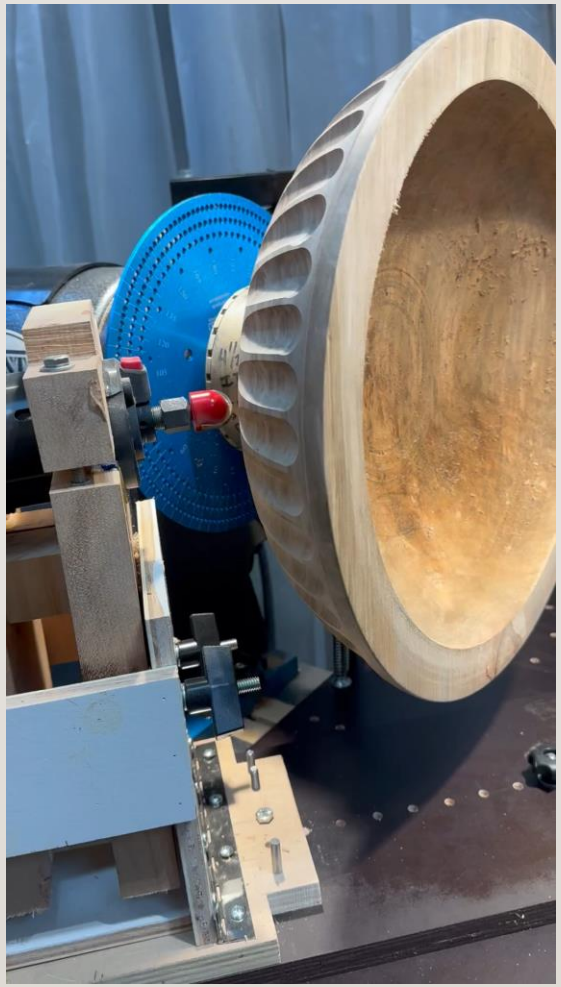
Paul Howard Jig

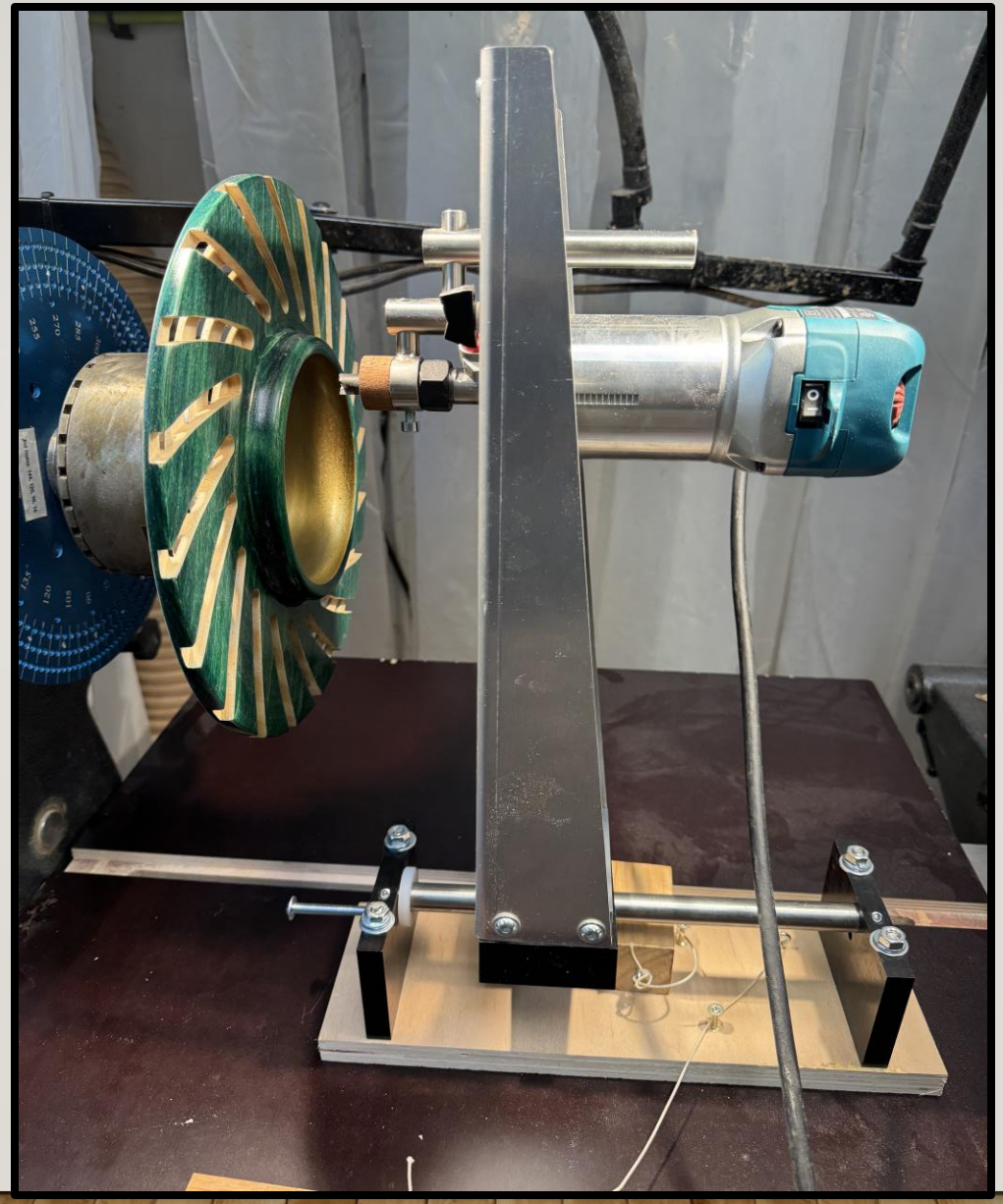
# Router Jigs

In general, there are two types of jigs:

1. Jigs based off the ways/lathe bed rails.
2. Jigs based off the banjo.

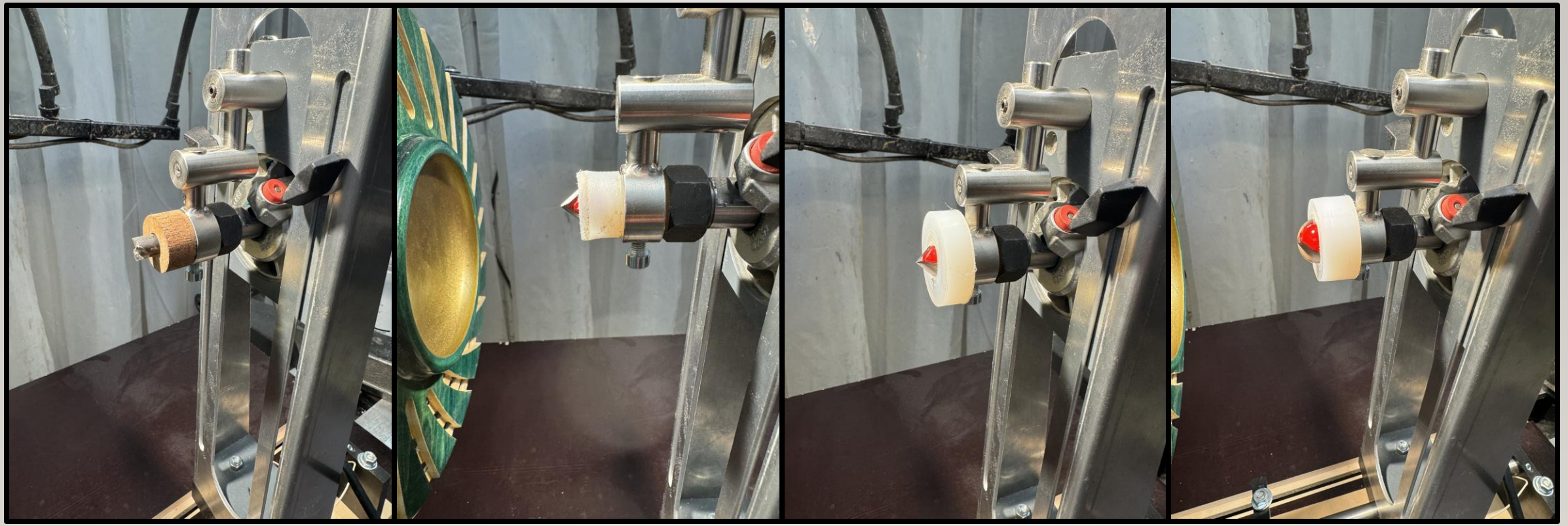
# Routing Jig Based Off the Ways/Lathe Rails



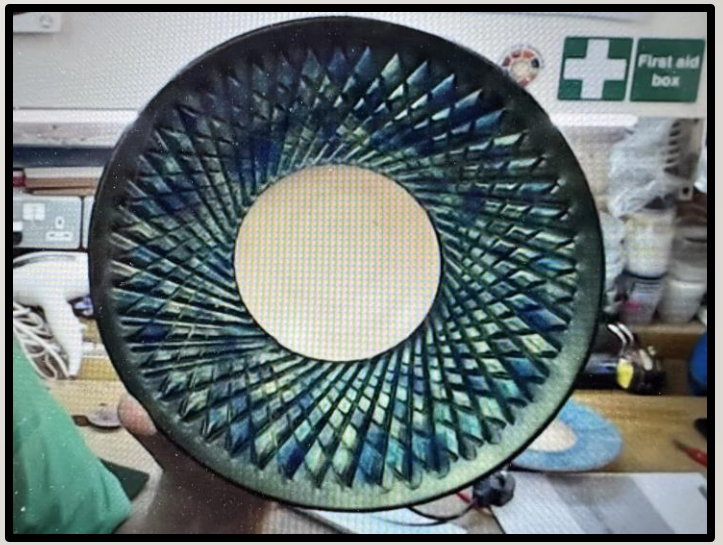


# Guide Bushings

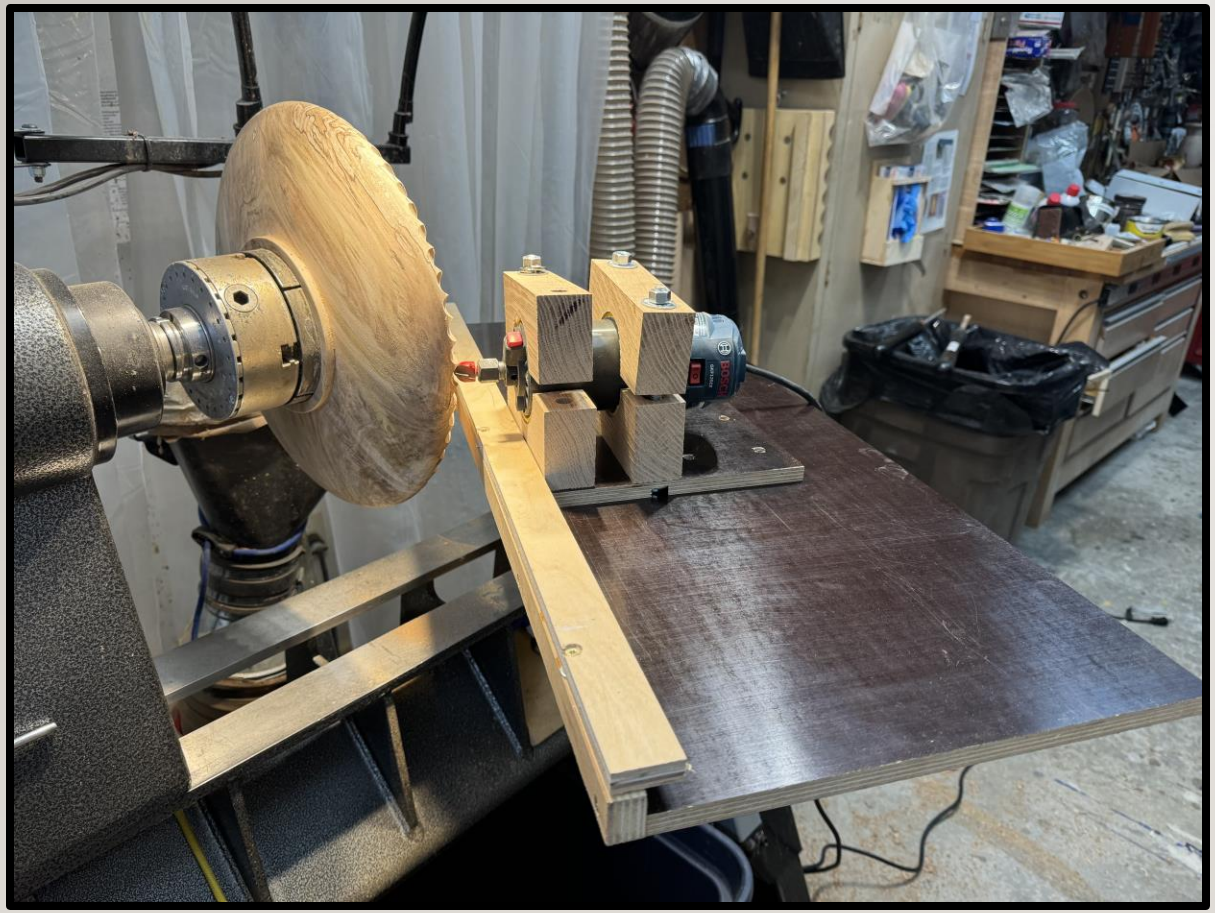
# Guide Bushings

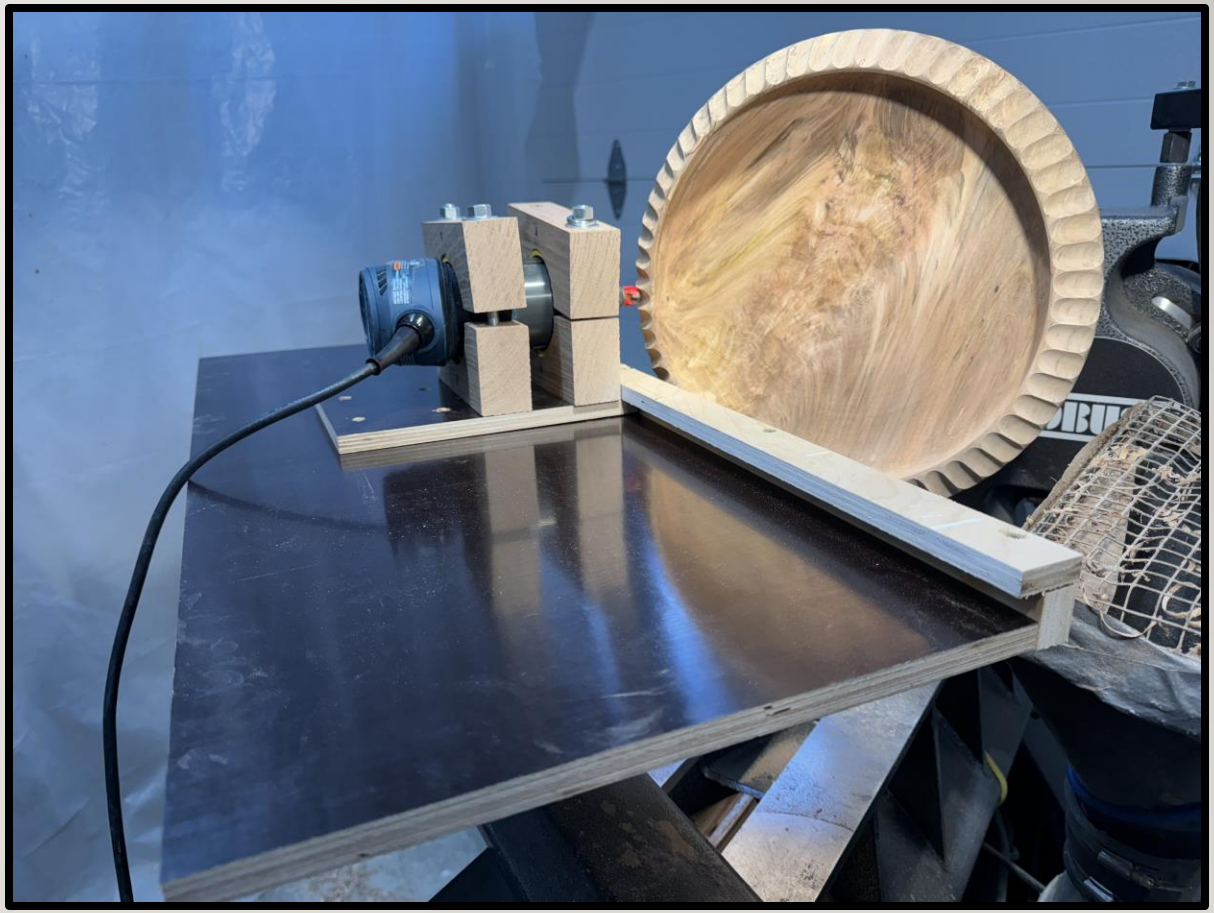


1. Using different diameter bushings allows adjustment of the amount of relief from the edge.
2. Also allows adjustment of the depth of router cut.

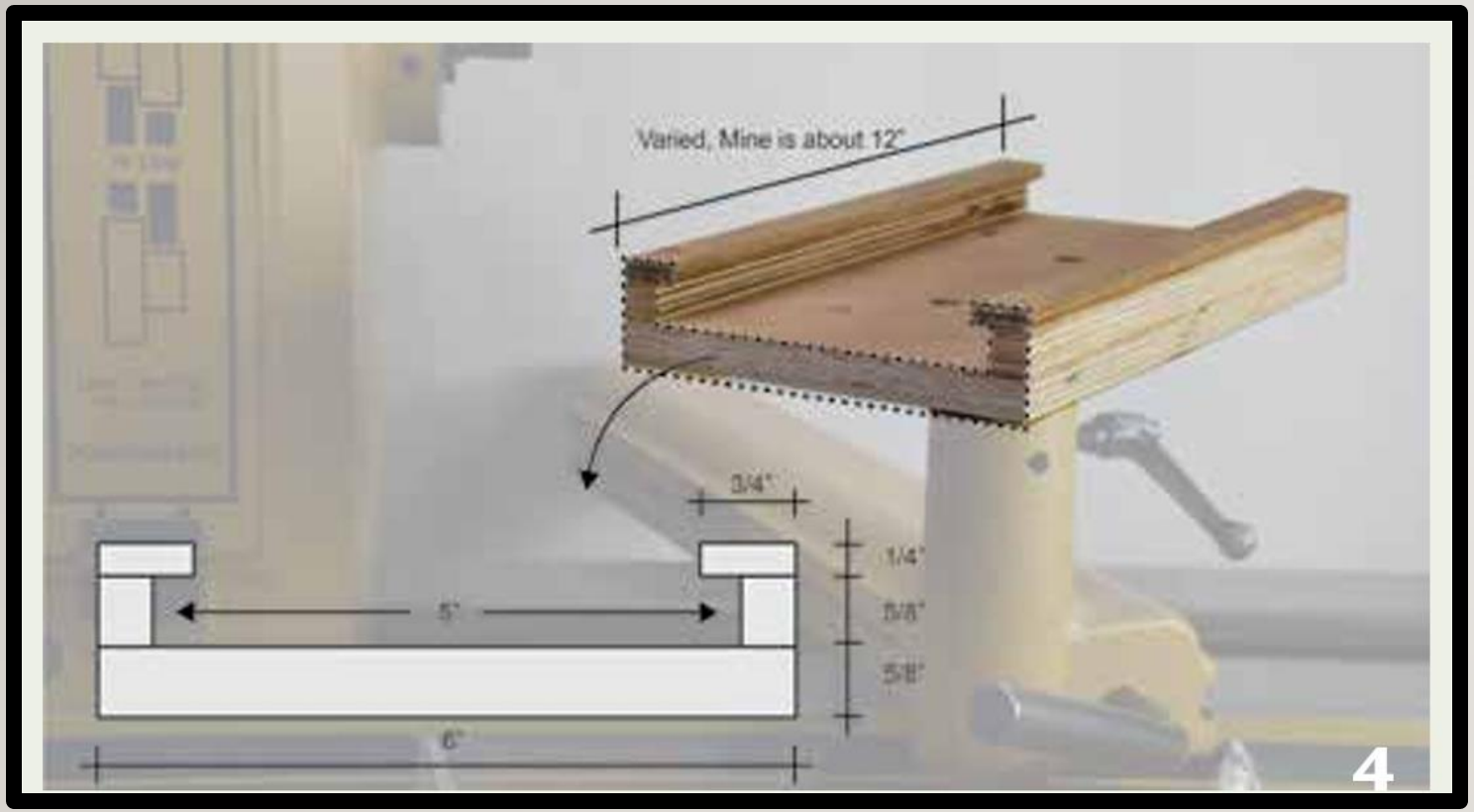

First aid box

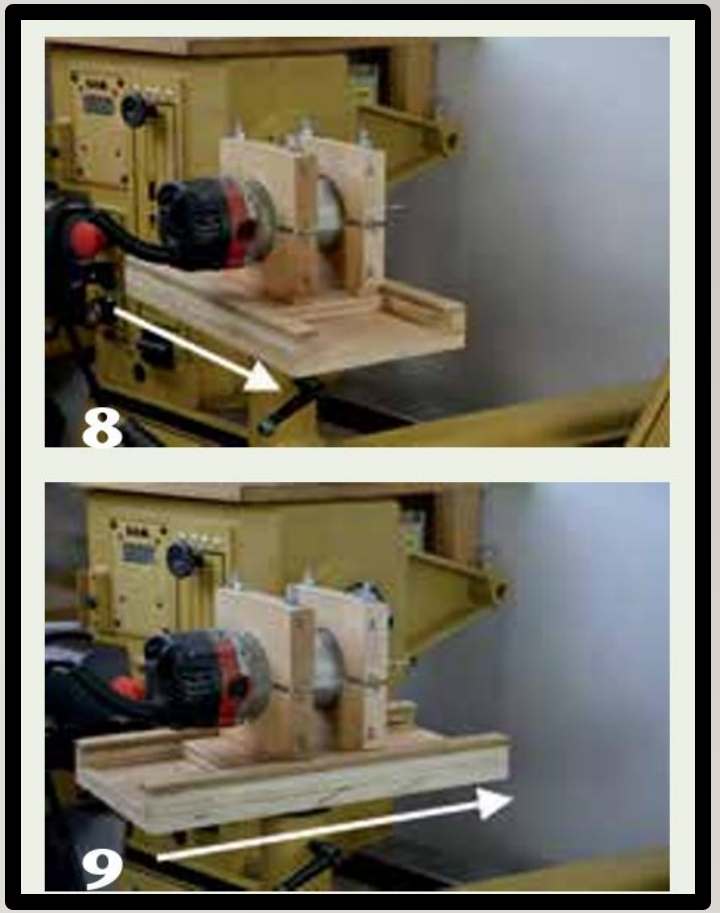
# Router Jig Based Off the Banjo





# Router Sled

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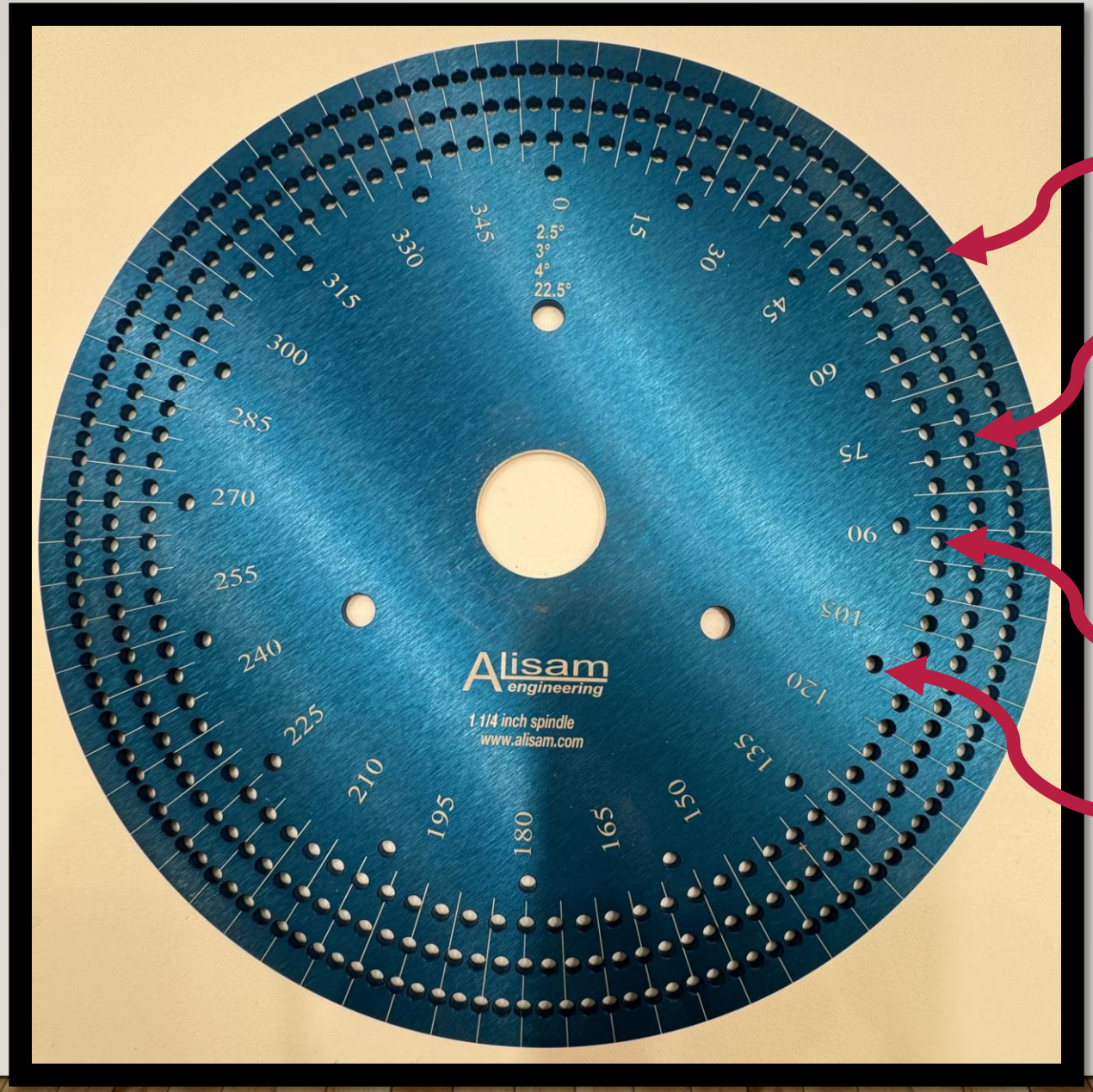
# Indexing

Indexing in woodturning is the process of dividing the circumference of a cylindrical workpiece into equal parts.

An indexing wheel, which is attached to the headstock of the lathe, provides the ability to lock the spindle of the lathe at any of those positions.

# Indexing Wheel

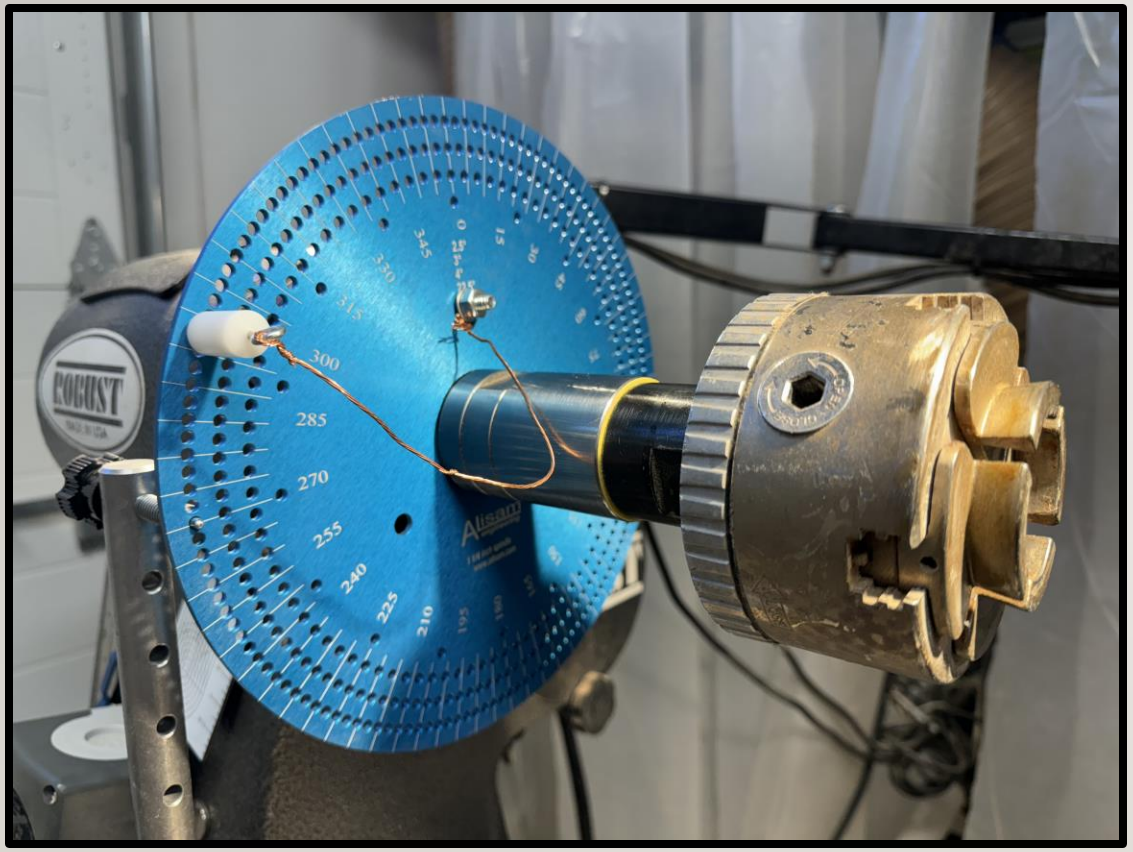


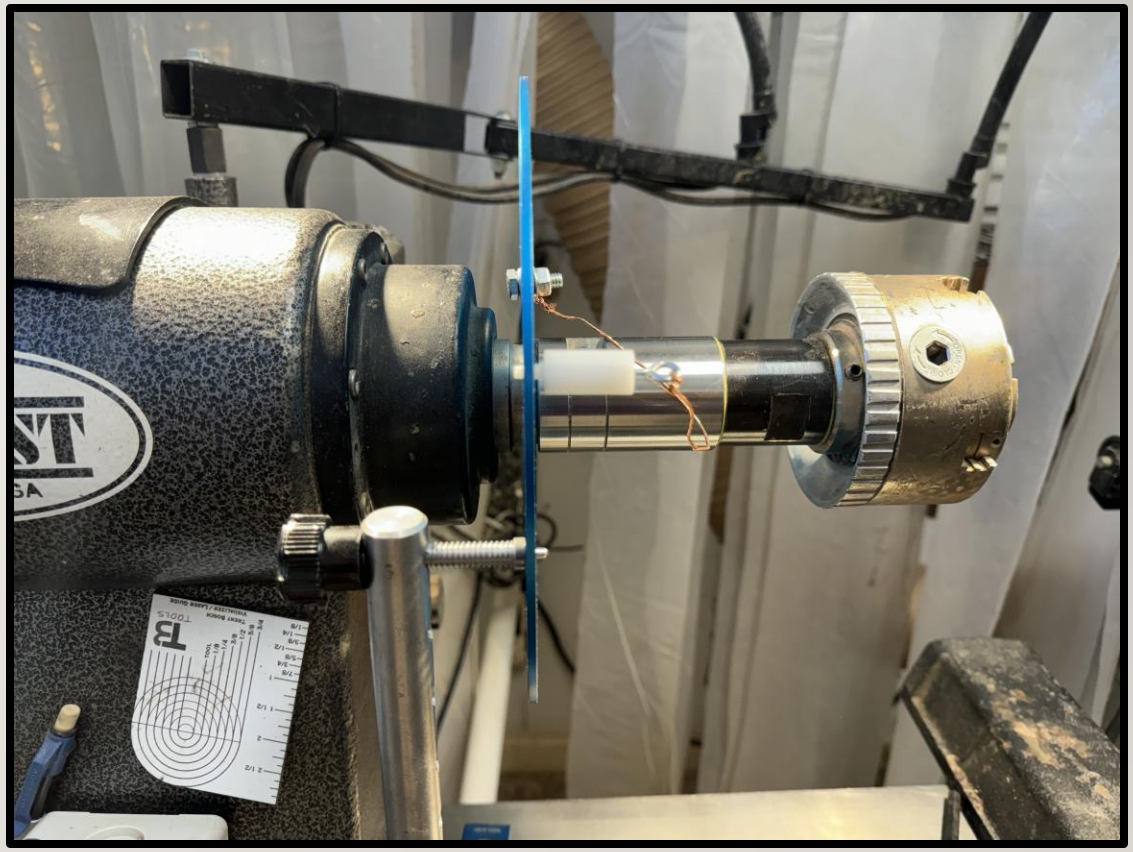

144 holes = 2.5 degrees

120 holes = 3 degrees

90 holes = 4 degrees

16 holes = 22.5 degrees


ROBUST
345
0
15
30
300
285
270
255
240
225
210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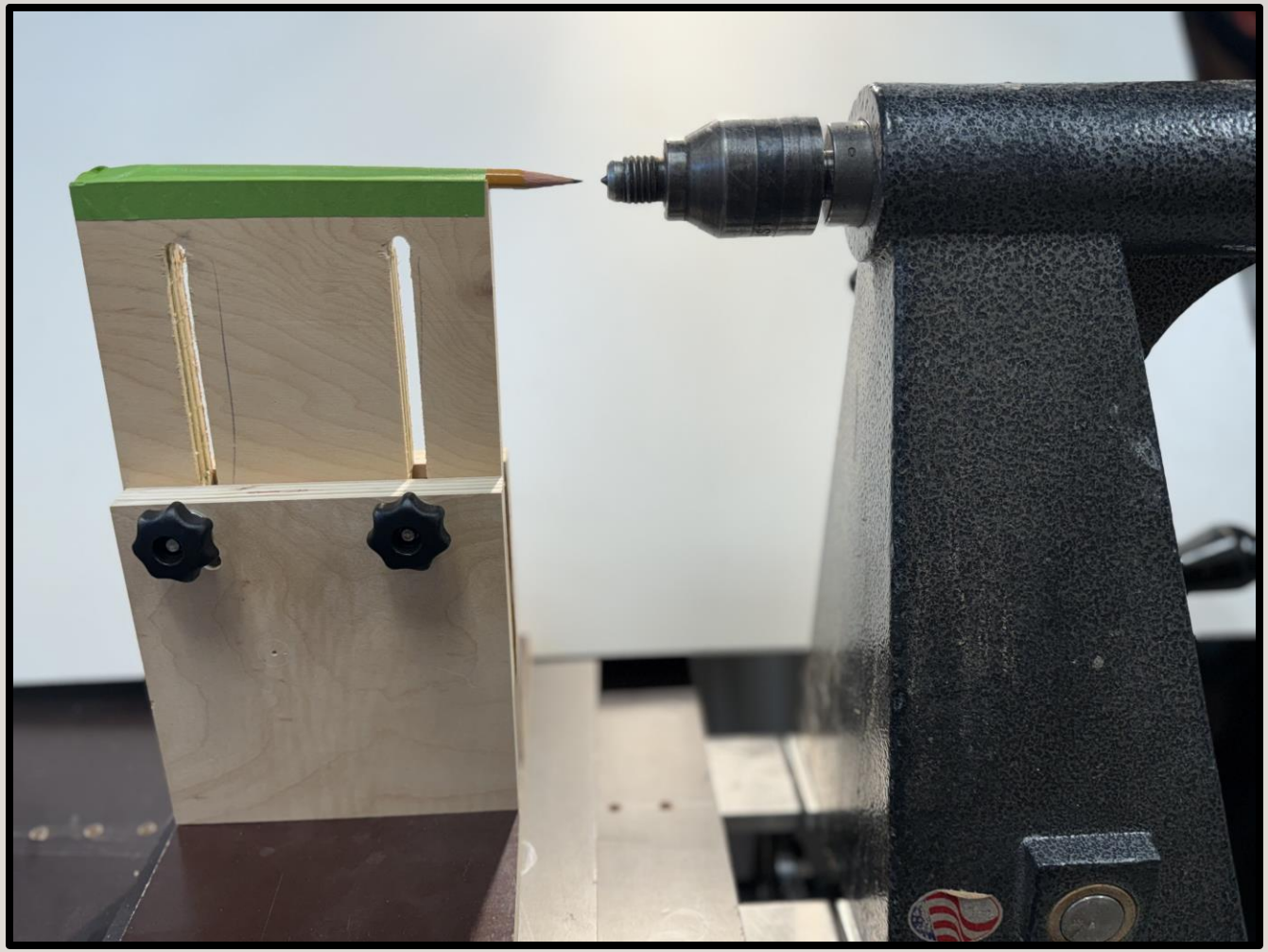


# Indexing

*How do you determine how to evenly space your embellishments?*

1. Measure the diameter of the bowl/platter/spindle turning where the closest embellishments will be.

2. Circumference = Diameter x 3.1416($\pi$) or
   Radius x 2 x 3.1416 ($\pi$)

3. Take the width of the router bit + any spacing and divide into the circumference = Maximum number of embellishments

# Indexing

To determine the positioning of any embellishment you wish to add to your turnings divide 360(the number of degrees in a circle) by the number of embellishments you want (X).
This will equal the number of degrees you need between embellishments.

$$360/X = \frac{\text{number of degrees you need between embellishments}}{}$$

# Indexing

Depending on your indexing wheel you can determine how many degrees are between holes.

(ie. Alisam indexing wheel has 4 rings of holes)

| # of Holes | # of Degrees Between Hole |
|---|---|
| 144 | 2.5 |
| 120 | 3 |
| 90 | 4 |
| 16 | 22.5 |

# Indexing

*How do you determine how to evenly space your embellishments?*

***Example:*** **12 embellishments ➢ 360/12 = 30°**

Use the row of holes that allows 30 degrees to be divided equally by the degrees per hole.

In this case, 30 degrees can be divided evenly by 2.5, 3, 5, or 6

# Indexing

## *The Answer(s):*

On the 120 hole ring (3 X **10** = 30) ➡ Every 10th hole

or

On the 144 hole ring (2.5 X **12** = 30) ➡ Every 12th hole

| # of Holes | # of Degrees Between Hole |
|---|---|
| 144 | 2.5 |
| 120 | 3 |
| 90 | 4 |
| 16 | 22.5 |

# Routing Fluting Planning Worksheet(Excel)

**Definitions:**

**Working Circmference** = $2\pi R$

**Maximum Iterations** = Working Circumference ÷ Router Cutter Diameter(D)

**Cutter Space** = Cutter Diameter x Iterations

**Gap Space** = Circumference - Cutter Space

**Gap Size** = Gap Space ÷ # of Iterations

# Routing Fluting Planning Worksheet(Excel)

# Indexing

## Key Points to Remember:

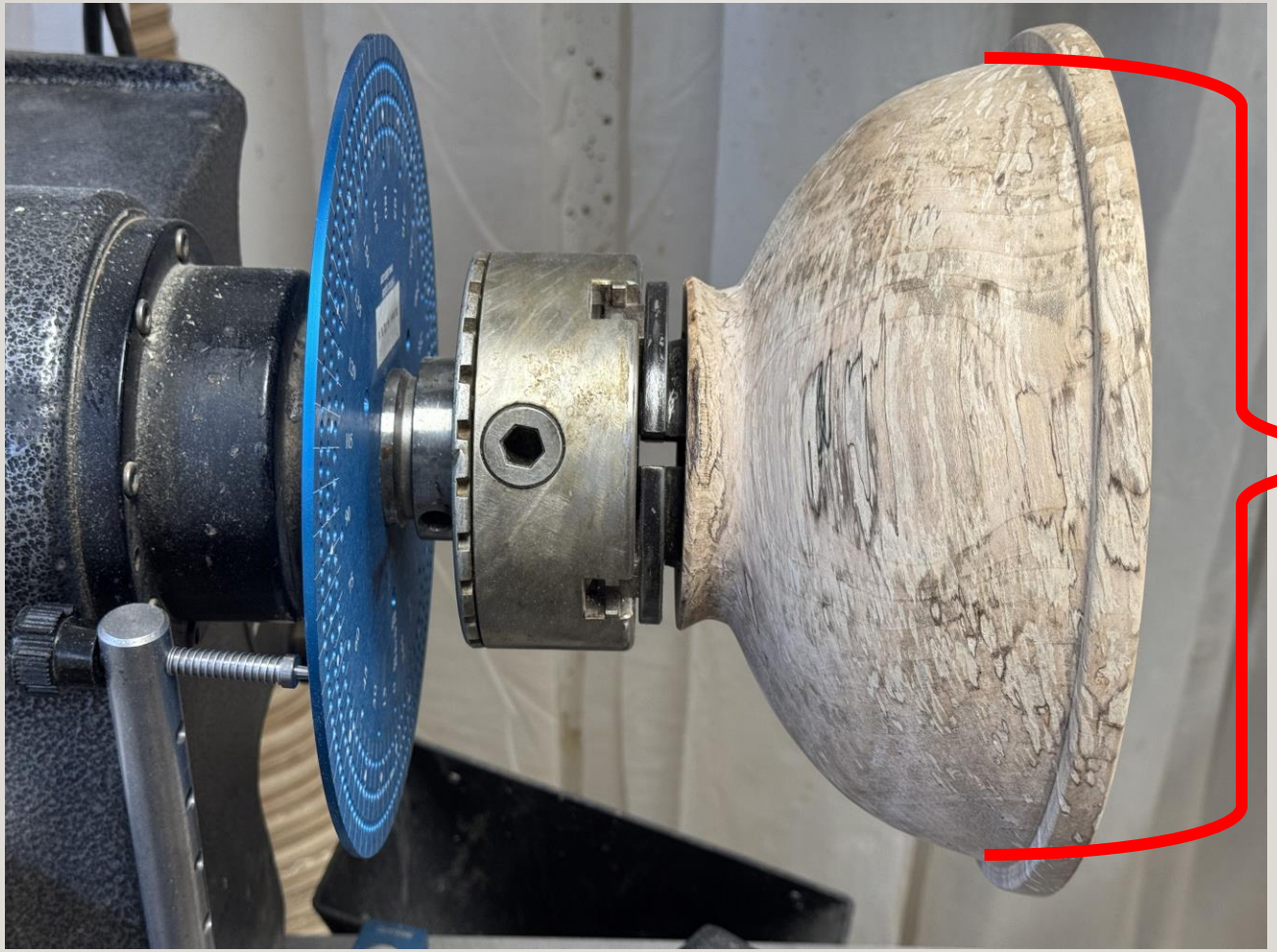
1. When buying an indexing system, the upfront cost difference is minimal for more resolution
2. Use the "locking" positions
3. Develop your own method of counting skipped positions to reduce error (mark or peg)
4. Do all of your marking in one session as repositioning or remounting introduces positional errors
5. ***Never turn the lathe on while indexing! (unplug the lathe)***

# Routing in Woodturning

## Final Thoughts:

- When deciding to embellish, pick wood that is relatively unexciting. Embellishing becomes an enhancer.
- Make sure the wood is dry.
- Design the shape based on using the router.
- Make sure to leave the wall of the woodturning thick.
- Make sure that the surface is sanded to its final grit.

# Demo #1



D = 185 mm's

# Demo #1

Measure the largest diameter of the object to be embellished = 240mm(Radius = 120mm)

Circumference (A) = 2 X $\pi$(pie) x radius

2 X 3.14 X 120 = 753.6mm

Diameter of router head = 25mm

Maximum number of embellishments = A/B = **753.6**/25 = **30.14**

Number of degrees between embellishments = **360/30 = 12 degrees**

**Indexing wheel spacing:**

144 = 2.5 degrees between holes
120 = 3 degrees between holes
90 = 4 degrees between holes
16 = 22.5 degrees between holes

12 degrees/2.5 = 4.8
12 degrees/3 = 4
12/4 = 3
12/22.5 = .53

# Demo #1: Routing Fluting Planning Worksheet(Excel)

| 0 | Data | Constant | Formula |
|---|---|---|---|
| Router Cutter Diameter(D) | 25 | | |
| Radius(R) | 92.5 | | |
| Working Circumference(C) | 92 | 6.28 | 580.9 |
| 6.282 | | | |
| Maximum Iterations | 23.236 | | |
| | | | |
| | | | |
| Iteration Quick Guide | | | |
| | Cutter Space | Gap Space | Gap Size |
| 10 | 250 | 330.9 | 33.09 |
| 20 | 500 | 80.9 | 4.045 |
| 30 | 750 | -169.1 | -5.63666667 |
| 40 | 1000 | -419.1 | -10.4775 |
| | | 50 | 1250 |
| | | 60 | 1500 |

# Demo #1: Routing Fluting Planning Worksheet(Excel)

144 Position Holes:

| | Cutter Space | Gap Space | Gap Size | # of Spaces Between Holes: |
|---|---|---|---|---|
| 144 | 3600 | -3019.1 | -20.9659722 | 1 |
| 72 | 1800 | -1219.1 | -16.9319444 | 2 |
| 36 | 900 | -319.1 | -8.86388889 | 4 |
| 18 | 450 | 130.9 | 7.272222222 | 8 |
| 9 | 225 | 355.9 | 39.54444444 | 16 |
| 6 | 150 | 430.9 | 71.81666667 | 24 |
| 4 | 100 | 480.9 | 120.225 | 36 |
| 2 | 50 | 530.9 | 265.45 | 72 |

90 Position Holes:

| | Cutter Space | Gap Space | Gap Size |
|---|---|---|---|
| 90 | 2250 | -1669.1 | -18.54555556 |
| 45 | 1125 | -544.1 | -12.09111111 |
| 30 | 750 | -169.1 | -5.636666667 |
| 15 | 375 | 205.9 | 13.72666667 |
| 10 | 250 | 330.9 | 33.09 |
| 9 | 225 | 355.9 | 39.54444444 |
| 6 | 150 | 430.9 | 71.81666667 |
| 5 | 125 | 455.9 | 91.18 |
| 3 | 75 | 505.9 | 168.6333333 |

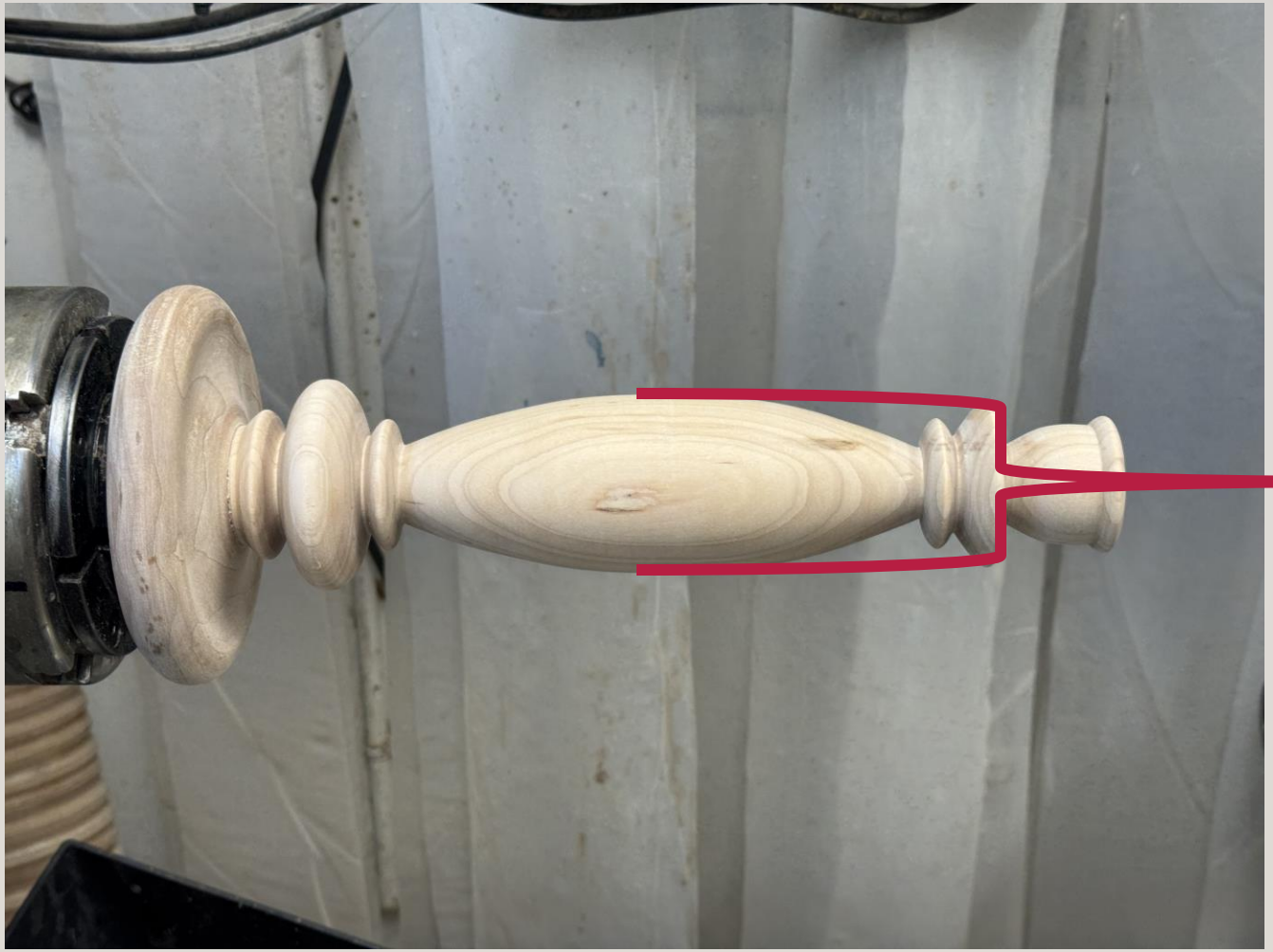
120 Position Holes:

| | Cutter Space | Gap Space | Gap Size | # of Spaces Between Holes: |
|---|---|---|---|---|
| 120 | 3000 | -2419.1 | -20.1591667 | 1 |
| 60 | 1500 | -919.1 | -15.3183333 | 2 |
| 40 | 1000 | -419.1 | -10.4775 | 3 |
| 30 | 750 | -169.1 | -5.63666667 | 4 |
| 20 | 500 | 80.9 | 4.045 | 6 |
| 10 | 250 | 330.9 | 33.09 | 12 |
| 5 | 125 | 455.9 | 91.18 | 24 |
| 4 | 100 | 480.9 | 120.225 | 30 |
| 2 | 50 | 530.9 | 265.45 | 60 |

16 Position Holes:

| | Cutter Space | Gap Space | Gap Size |
|---|---|---|---|
| 16 | 400 | 180.9 | 11.30625 |
| 8 | 200 | 380.9 | 47.6125 |
| 4 | 100 | 480.9 | 120.225 |
| 2 | 50 | 530.9 | 265.45 |

# Demo #2



D = 55mm's
R = 27.5 mm's

# Demo #2

Measure the largest diameter of the object to be embellished = 55mm

Circumference (A) = Diameter X $\pi$ (pie) = **172.788**

Diameter of router head + spacing between embellishments (B) = 10mm +1 = 11

Maximum number of embellishments = A/B = **172.788**/11 = **15.7 (Round to 15)**

Number of degrees between embellishments = **360/15 =24 degrees**

**Indexing wheel spacing:**

| | | |
|---|---|---|
| 144 = | 2.5 degrees between holes | 24 degrees/2.5 = 9.6 |
| 120 = | 3 degrees between holes | 24 degrees/3 = 8 |
| 90 = | 4 degrees between holes | 24//4 = 6 |
| 16 = | 22.5 degrees between holes | 24/22.5 = 1.07 |

# Demo #2: Routing Fluting Planning Worksheet(Excel)

| 0 | Data | Constant | Formula |
|---|---|---|---|
| Router Cutter Diameter(D) | 10 | | |
| Radius(R) | 27.5 | | |
| Working Circumference(C) | 172.755 | 6.28 | 172.7 |
| 6.282 | | | |
| Maximum Iterations | 17.27 | | |
| | | | |

| | | | |
|---|---|---|---|
| Iteration Quick Guide | | | |
| | Cutter Space | Gap Space | Gap Size |
| 10 | 100 | 72.7 | 7.27 |
| 20 | 200 | 27.3 | -1.365 |
| 30 | 300 | -127.3 | -4.24333333 |
| 40 | 400 | -227.3 | -5.6825 |
| | | 50 | 500 |
| | | 60 | 600 |

# Demo #2: Routing Fluting Planning Worksheet(Excel)

144 Position Holes:

| | Cutter Space | Gap Space | Gap Size | # of Spaces Between Holes: |
|---|---|---|---|---|
| 144 | 1440 | -1267.3 | -8.80069444 | 1 |
| 72 | 720 | -547.3 | -7.60138889 | 2 |
| 36 | 360 | -187.3 | -5.20277778 | 4 |
| 18 | 180 | -7.3 | -0.40555556 | 8 |
| 9 | 90 | 82.7 | 9.188888889 | 16 |
| 6 | 60 | 112.7 | 18.78333333 | 24 |
| 4 | 40 | 132.7 | 33.175 | 36 |
| 2 | 20 | 152.7 | 76.35 | 72 |

90 Position Holes:

| | Cutter Space | Gap Space | Gap Size | # of Spaces Between Holes: |
|---|---|---|---|---|
| 90 | 900 | -727.3 | -8.081111111 | 1 |
| 45 | 450 | -277.3 | -6.162222222 | 2 |
| 30 | 300 | -127.3 | -4.243333333 | 3 |
| 15 | 150 | 22.7 | 1.513333333 | 6 |
| 10 | 100 | 72.7 | 7.27 | 9 |
| 9 | 90 | 82.7 | 9.188888889 | 10 |
| 6 | 60 | 112.7 | 18.78333333 | 15 |
| 5 | 50 | 122.7 | 24.54 | 18 |
| 3 | 30 | 142.7 | 47.56666667 | 30 |

120 Position Holes:

| | Cutter Space | Gap Space | Gap Size | # of Spaces Between Holes: |
|---|---|---|---|---|
| 120 | 1200 | -1027.3 | -8.56083333 | 1 |
| 60 | 600 | -427.3 | -7.12166667 | 2 |
| 40 | 400 | -227.3 | -5.6825 | 3 |
| 30 | 300 | -127.3 | -4.24333333 | 4 |
| 20 | 200 | -27.3 | -1.365 | 6 |
| 10 | 100 | 72.7 | 7.27 | 12 |
| 5 | 50 | 122.7 | 24.54 | 24 |
| 4 | 40 | 132.7 | 33.175 | 30 |
| 2 | 20 | 152.7 | 76.35 | 60 |

16 Position Holes:

| | Cutter Space | Gap Space | Gap Size | # of Spaces Between Holes: |
|---|---|---|---|---|
| 16 | 160 | 12.7 | 0.79375 | 1 |
| 8 | 80 | 92.7 | 11.5875 | 2 |
| 4 | 40 | 132.7 | 33.175 | 4 |
| 2 | 20 | 152.7 | 76.35 | 8 |