Sharpening Handbook

Because *sharp enough* … usually is not

Chapter 7
Drills

Auger Drills	7-2
Brad Point Drills	7-3
Forstner Drills	7-5
Masonry Drills	7-7
Spade Drills	7-8
Twist Drills	7-9

SharpeningHandbook.info

The full handbook, and the latest version of this chapter, are on the web at **SharpeningHandbook.info**. This chapter: November 2026.

Auger Drill Bit

The absolute best source for sharpening this tool is Leonard Lee's book, The Complete Guide to Sharpening, Chapter 15. (This is a must-have for any sharpener's library.)

Other notes:

- Lead screw must extend beyond any spurs or shoulders on the perimeter of the bit..
- DO NOT change
  1. the center point of the drill bit, or
  2. the diameter of the drill bit (only file the inside of the spurs / shoulders).
- Grind the minimum off the bit.



Auger Drill

I should make something with the fancy new tools I just bought.
Unknown

Notes & Comments

Probably best to stay with the drill bit's geometry as supplied by the manufacturer.

More Information

Books & Papers

- "The Complete Guide to Sharpening", by Leonard Lee
- TM 9-867 Maintenance and Care of Hand Tools (on the web site), from the U.S. War Department

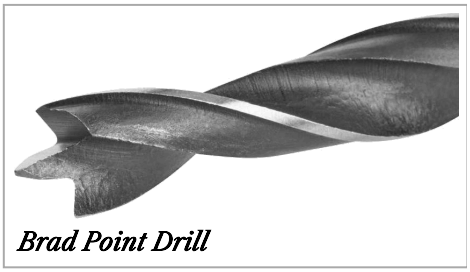
Web Sites

- Nick Engler's Workshop Companion (workshopcompanion.com) page on Sharpening Drill Bits (workshopcompanion.com).
- If you have a Fine Wood Working (finewoodworking.com) membership, the are good instructions (finewoodworking.com) from Vic Tesolin (victesolin.com).

Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Woodworking Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

Brad Point Drill Bit

The absolute best source for sharpening this tool is Leonard Lee's book, The Complete Guide to Sharpening, Chapter 15. (This is a must-have for any sharpener's library.)



Brad Point Drill

Other notes:

- Ensure both shoulders are the same height.
- Ensure both spurs are the same height.
- Ensure brad point extends beyond the spurs.
- DO NOT change
    1. the center point of the drill bit, or
    2. the diameter of the drill bit.
- Grind the minimum off the bit.

> *A handmade wooden object can't be mass-produced.*
>
> Unknown Old Woodworker

General Guidelines	
Point Angle	Sharpness
40°	5

Notes & Comments

Probably best to stay with the drill bit's geometry as supplied by the manufacturer, though furniture maker Michael Fortune does advocate changing it. His recommendations are referenced in the Videos & Presentations, below.

More Information

Books & Papers

- "The Complete Guide to Sharpening", by Leonard Lee
- TM 9-867 Maintenance and Care of Hand Tools (on the web site), from the U.S. War Department

Videos & Presentations

- Sharpen Your Own Hybrid Drill Bits (finewoodworking.com) - Furniture maker Michael Fortune (michaelfortune.com) demonstrates his homegrown method for sharpening a brad point bit (he calls them *hybrid twist drill bits*; this is a web page with an embedded FineWoodworking video).

  This is an interesting video, but one needs to be very careful when using such hand sharpening approaches and ensure that the rules noted above are not violated.

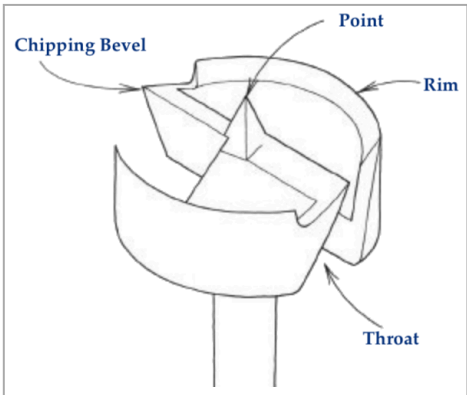
Web Sites

- Nick Engler's Workshop Companion (workshopcompanion.com) page on Sharpening Drill Bits (workshopcompanion.com).

Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Woodworking Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

Forstner Drill Bit

The absolute best source for sharpening this tool is Leonard Lee's book, The Complete Guide to Sharpening, Chapter 15. (This is a must-have for any sharpener's library.)



Forstner drill bit edges

Other notes:

- **Rims**
  - Ensure both rims are the same height.
  - Rims can be sharpened using a round or half-round file. I have also used a small sanding drum in a Dremel-style device when the drill bit was badly dulled.
  - Sharpen the inside of the bevel (nearest the point), and not the outside. Sharpening the outside would reduce the bit's overall diameter.
- **Chipping Bevels**
  - Ensure both chipping bevels are the same height.
  - The chipping bevels should be at the same height as the rims. If there is a significant gap, the drill bit should be replaced.
  - Sharpen the throat of the bevel using a flat file, and not the other side. Sharpening the side opposite the throat would reduce the chipping bevel's height.
- **Point**
  - DO NOT change the center point of the drill bit.
  - Grind the minimum off the point.
  - Ensure the point extends beyond the rims by at least 0.005".
- DO NOT change the diameter of the drill bit.

> *It's the little details that make something look handmade.*
> Unknown

General Guidelines		
Point Angle	Chipping Bevel Rake Angle	Sharpness
30-40°	10°	5

Notes & Comments

Probably best to stay with the drill bit's geometry as supplied by the manufacturer.

More Information

Books & Papers

- "The Complete Guide to Sharpening", by Leonard Lee
- TM 9-867 Maintenance and Care of Hand Tools (on the web site), from the U.S. War Department

Videos & Presentations

- "Drilling on the Lathe" (YouTube video), by Dennis Belcher. This session deals with how to sharpen Forster drills bits, replace a damage MT2 shank on a drill chuck, and choosing a drill

chuck.

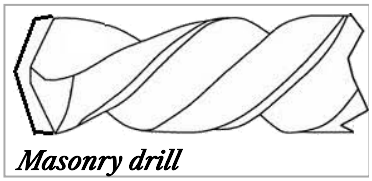
Web Sites

- Nick Engler's Workshop Companion (workshopcompanion.com) page on Sharpening Drill Bits (workshopcompanion.com).
- If you have a Fine Wood Working (finewoodworking.com) membership, the are good instructions (finewoodworking.com) from Roland Johnson (finewoodworking.com).

> **Sharpness Scale** - see Chapter 1.
> **Ongoing maintenance** - see Chapter 4, *Woodworking Tools*.
> **Grindstones and Other Sharpening Media** - see Chapter 2.

Masonry Drill Bit

Sharpen the insert so the point angle is as noted below.


Masonry drill

> *No one wants a drill. What they want is a hole.*
> Unknown

General Guidelines		
Point Angle	Clearance Angle	Sharpness
130˚	0˚	3

Notes & Comments

Grind the bit so that it has a 2-facet grind (the primary facet). No secondary facet is needed, and would probably weaken the bit's insert.

The Tormek DBS-22 Drill Bit Sharpening Attachment can be used to sharpen this drill.

Probably best to stay with the drill bit's geometry as supplied by the manufacturer.

More Information

Books & Papers

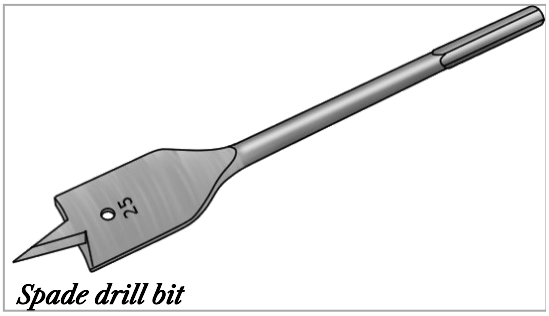
- U.S. War Department's TM 9-867 Maintenance and Care of Hand Tools (on the web site)

Videos & Presentations

- **Tormek Live Sharpening Class - Part 6 - Drill bit sharpening** (YouTube video). It's time for drill bit sharpening! Learn how to sharpen your drill bits with maximum precision, to the greatest sharpness. We will show you how to create a 4-facet point which gives the ideal cutting performance.
- **Sharpen drill bits with Tormek Drill Bit Sharpening Attachment** (YouTube video)
- **Tormek DBS-22** (YouTube video)
- **Tormek Drill Bit Sharpening Attachment** (YouTube video)

Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Metalworking Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

Spade Drill Bit



Spade drill bit

The absolute best source for sharpening this tool is Leonard Lee's book, The Complete Guide to Sharpening, Chapter 15. (This is a must-have for any sharpener's library.)

Ensure both shoulders are the same height. A jig is highly recommended (a good example is shown on Nick Engler's web site, including instructions for making one).

> *Removing wood doesn't show your skill, adding wood does.*
> Unknown

Grind the minimum off the bit.

DO NOT change the center point of the drill bit, or the diameter of the drill bit.

General Guidelines		
Point Angle	**Rake Angle**	**Sharpness**
40°	0° - 10°	5

Notes & Comments

Probably best to stay with the drill bit's geometry as supplied by the manufacturer.

More Information

Books & Papers

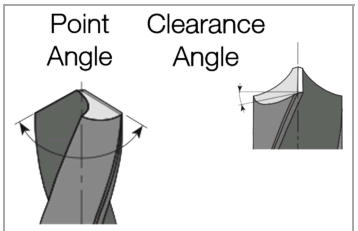
- The Complete Guide to Sharpening, by Leonard Lee
- TM 9-867 Maintenance and Care of Hand Tools (on the web site), from the U.S. War Department

Web Sites

- Nick Engler's Workshop Companion (workshopcompanion.com) page on Sharpening Drill Bits (workshopcompanion.com).

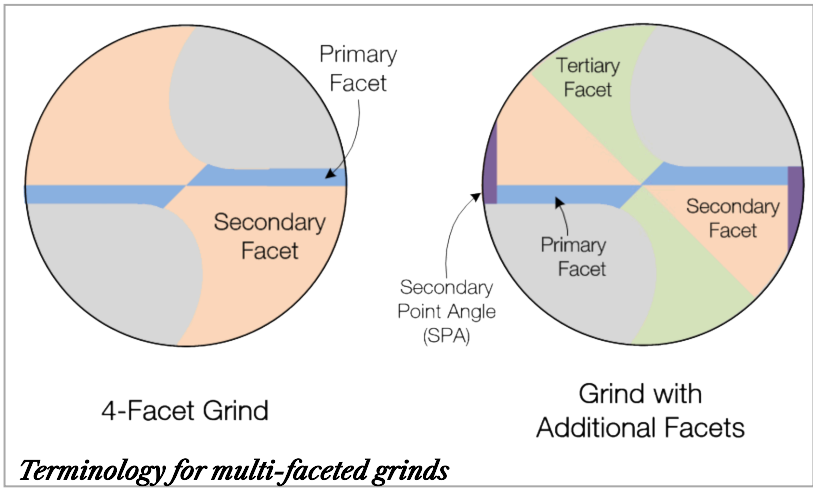
Sharpness Scale - see Chapter 1.
Ongoing maintenance - see Chapter 4, *Metalworking Tools*.
Grindstones and Other Sharpening Media - see Chapter 2.

Twist Drill Bit



Key Angles

Twist drill bits are sharpened according to the table below.



Terminology for multi-faceted grinds

The Tormek DBS-22 Drill Bit Sharpening Jig works very well for those drill bits. That jig can hold bits in the range of 0.125" - 0.875" (3 - 22 mm).

No matter how many times I cut this, I can't get it long enough!
Unknown Old Machinist

General Guidelines for 4-Facet Grind

Drill Bit Size					Point Angle	Clearance Angle		Sharpness
Inch Decimal	Inch Fraction	Metric (mm)	Wire Number	Letter		Mild Metal or Wood	Hard Steel	
< 0.125	< 1/8	< 3.0	> 31		118°	14°	11°	
0.125 - 0.250	1/8 - 1/4	3.0 - 6.0	31 - 1	A - E	118°	14°	11°	
0.250 - 0.500	1/4 - 1/2	6.5 - 12.0		F - Z	118°	11°	9°	5
0.500 - 0.875	1/2 - 7/8	12.5 - 22.0			118°	9°	7°	
> 0.875	> 7/8	> 22.0						

Notes:

① One sharpener has used a precision pen vice (like the Starrett 166B or 166C) with the Tormek DBS-22 to hold bits as small as wire number 61 (= 0.0390" ≈ 1 mm).

The Starrett 166s have an octagonal handle so they are easy to be held in the Tormek DBS-22.
- The 166B holds items in the range of 0.030" - 0.062" (0.8 - 1.6mm).
- The 166C holds items in the range of 0.050" - 0.125" (1.3 - 3.2mm).

② I like the Starrett 166D as it holds items in the range of 0.115" - 0.187" (2.9 - 4.8mm).

General Guidelines for 4-Facet Grind				
Material Type	Point Angle		Clearance Angle	
	Recom.	Range	Recom.	Range
Aluminium	118°	90° - 130°	*(as above)*	12° - 15°
Armour Plate	135°	135° - 140°	7°	6° - 9°
Brass	118°	118°	*(as above)*	12° - 15°
Bronze	118°	110° - 118°	*(as above)*	12° - 15°
Bronze, High Tensile	105°	100° - 110°	*(as above)*	12° - 15°
Cast Iron, Soft	95°	90° - 100°	*(as above)*	12° - 15°
Cast Iron, Medium	105°	100° - 110°	*(as above)*	12° - 15°
Cast Iron, Hard	110°	100° - 118°	9°	8° - 12°
Cast Iron, Chilled	118°	118° - 135°	7°	5° - 9°
Copper	118°	100° - 118°	14°	12° - 15°
Iron, Malleable	95°	90° - 100°	14°	12° - 15°
Magnesium and Alloys	95°	70° - 118°	14°	12° - 15°
Monel Nickel	120°	118° - 125°	11°	10° - 12°
Nickel Alloys	135°	135° - 140°	7°	5° - 7°
Plastic, Hot Set	90°	60° - 90°	11°	10° - 12°
Plastic, Cold Set	125°	118° - 135°	14°	12° - 20°
Steel, Low Carbon	118°	110° - 118°	9°	7° - 9°
Steel, Medium Carbon	118°	118° - 125°	9°	7° - 9°
Steel, High Carbon	130°	118° - 145°	9°	7° - 9°
Steel, Forged	130°	118° - 145°	11°	7° - 12°
Steel, Alloy	118°	118° - 125°	11°	10° - 12°
Steel, Stainless	115°	110° - 118°	11°	8° - 12°
Steel, Stainless, Hard	125°	118° - 135°	7°	6° - 8°
Steel, Manganese	145°	140° - 150°	9°	7° - 10°

Notes & Comments

< 0.125 Grind
Can't use the Tormek DBS-22 Drill Bit Sharpening Attachment with these bits -- they are too small. (See also, note ①, below)

0.125 - 0.250 Grind
Bits as small as ⅛ inch can be held in the Tormek DBS-22, but they can flex easily. A pin vice can assist with reducing this flex. (See also, note ②, below).

> 0.875 Grind
Cannot use the Tormek DBS-22 Drill Bit Sharpening Attachment with these bits -- they are too large

---

Aluminium
Clearance angles based on drill bit size should be used.

Brass
Clearance angles based on drill bit size should be used.

Bronze
Clearance angles based on drill bit size should be used.

Bronze, High Tensile
Clearance angles based on drill bit size should be used.

Cast Iron, Soft
Clearance angles based on drill bit size should be used.

Cast Iron, Medium
Clearance angles based on drill bit size should be used.

Plastic, Hot Set
Minimum point angle on the Tormek DBS-22 Drill Bit Sharpening Attachment is 90°.

Grindstones Which Work Best

Primary Facets	1. DC-250 Diamond Wheel Coarse (*if reshaping is needed*) - or - SB-250 Black Grindstone, graded rough 2. DF-250 Diamond Wheel Fine - or - SB-250 Black Grindstone, graded smooth 3. DE-250 Diamond Wheel Extra Fine (*if necessary*) - or - SJ-250 Japanese Waterstone
SPAs	1. DF-250 Diamond Wheel Fine - or - SB-250 Black Grindstone, graded smooth 2. DE-250 Diamond Wheel Extra Fine (*if necessary*) - or - SJ-250 Japanese Waterstone
Secondary Facets	1. DC-250 Diamond Wheel Coarse - or - SB-250 Black Grindstone, graded rough
Tertiary Facets	1. DC-250 Diamond Wheel Coarse - or - SB-250 Black Grindstone, graded rough

Jigs of Note
These jigs make sharpening twist drills significantly easier:

- Tormek DBS-22 (goes without saying)
- USB Spacer for the DBS-22 (see Chapter 3) - used to set the USB' distance from the grinding stone.
- Setting Templates for the clearance angle on the DBS-22 (see Chapter 3) - used to easily set the DBS-22 for secondary and tertiary facets.

Small Bits
If you pursue sharpening small bits (< ⅛" / < 3.0 mm),

- A pin vice like the Starrett 166B or 166C is recommended. Having the pin vice's handle being larger than the knurled area allows the Tormek DBS-22 to hold the pin vice without it shifting. (Yes, that is something I learned the hard way.)
- You will need a good magnifying glass and good light. These are difficult to see with the naked eye (especially in poor light).
- Care must be taken when grinding the secondary facet on bits this small. It is very easy to over grind this. Check after each pass on the grindstone.
- Consider honing the primary grind with a high grit stone (e.g., Tormek SJ-250 Japanese Waterstone). There is no need to hone the secondary facet as it is merely to allow space for chip evacuation.

Tertiary Facets
Addition of a tertiary facet can be useful for helping to remove waste as the hole is drilled. There is no guidance on the angle for these; only that they need to be greater than the secondary facets. If an an-

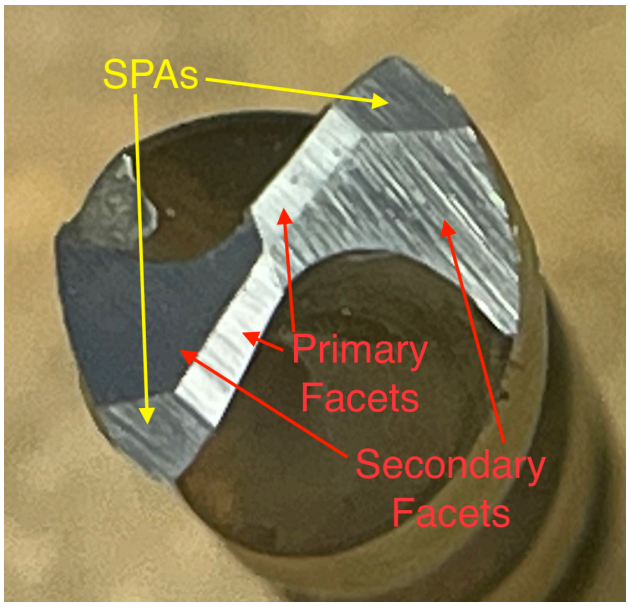
gle is needed:

- Secondary Facet = 20°
- Tertiary Facet = 45°

The Tormek DBS-22 Drill Bit Sharpening Attachment is not designed for a 6-facet grind, so values are not shown for it. A modification to the DBS-22 was made by Janne for 6-facet grinding, and more information can be found on the Tormek Forum.

Secondary Point Angles (SPA)

For tougher materials, an SPA is useful for reducing the stress on the outside cutting lip corners. (This is well outlined in Joseph Mazoff's document {see below}.)



SPAs - ground on the Tormek

Experience in using larger drill bits shows that SPAs help to reduce wander when drilling deep holes. On GadgetBuilder's web site (referenced below), it was noted:

> *These extra facets cause the drill to have a stronger self centering action and the sharp outer point on the cutting lip is eliminated so the drill remains sharp longer. The chip is weakened by the difference in cutting action between the primary and SPA facets so long spirals are less common because the chips are prone to break. (...) When through drilling the SPA reduces or eliminates the exit burr on most materials.*

Again, on GadgetBuilder's web site, it was noted:

> *Secondary Point Angles (SPAs) can be added to extend drill life, improve hole finish and minimize the exit burr on through-drilled holes.*

It is generally believe that the Tormek DBS-22 Drill Bit Sharpening Attachment is not designed for a grinding SPAs, however Dan Heil sent me an eMail saying that it is possible by setting the DBS-22 with a point angle of 90°.

The picture above and to the right shows SPAs which I ground onto a ½ drill bit using the DBS-22 on my Tormek grinder. You can also see that the secondary facets are quite a bit rougher than the primary facets. This is due to using a different grinding wheel, making this a faster process.

By using the Tormek DBS-22 to add the SPA grinds, both sides are consistently ground. Also, as the point angle is all that was changed on the DBS-22, the clearance angle remains the same.

Once finished, **remember to set the DBS-22's point angle back to 118°**. You would hate to start a new drill bit with a 90° point angle when you want 118°.

Notes:

- As symmetry of the grind would dramatically affect the use of the drill bit, be very careful to make them consistent.
- SPAs are not terribly useful on smaller drill bits.
- Addition of SPAs to a drill bit does not make this a 6-point grind; only adding tertiary facets does that. This may seem like a bit of a nomenclature thing, but it is important to be clear.

More Information

Books & Papers

- Drill Bit Geometry (on the web site), by Joseph Mazoff. This is a truly great reference about drill bit geometry and is cited often.
- Drill Bit Sizes (on the web site) (Metric, Fractional, Letter, & Number)
- The Drill Press: Its Use and Application (on the web site) from Walker-Turner.
- TM 9-867 Maintenance and Care of Hand Tools (on the web site) from the U.S. War Department.
- Metal Cutting Tool Handbook (archive.org)
- Tap & Clearance Drill Sizes (littlemachineshop.com) (Metric & Fractional)
- Tormek's "User Manual for the DBS-22 Drill Bit Jig" is quite useful.
- The Use and Care of Twist Drills (on the web site), from the Cleveland Twist Drill Company (gfii.com). This small booklet (58 pages) is a great read, especially the part starting on pg. 54: "Common Drill Troubles and Causes".

Videos & Presentations

- Sharpen drill bits with Tormek Drill Bit Sharpening Attachment (YouTube video) - a video from Tormek
- Tormek Live Sharpening Class - Part 6 - Drill bit sharpening (YouTube video) - a video from Tormek. It's time for drill bit sharpening! Learn how to sharpen your drill bits with maximum precision, to the greatest sharpness. We will show you how to create a 4-facet point which gives the ideal cutting performance.
- Tormek DBS-22 (YouTube video) - Jeff Fischer prepared this presentation. Sharpening bits with this jig could not be easier. Takes a little bit of getting used to, but then it is very simple to do a drill bit in a matter of minutes.
- Tormek Drill Bit Sharpening Attachment (YouTube video) - This short demonstration by Alan Holtham shows the set up and use of the Tormek DBS-22 Drill Bit Sharpening Attachment. One Tormek user noted that he reviews this video each time he uses the DBS-22 (as he does not use it often).

Web Sites

- Jigs, Fixtures, & Modifications for the Tormek (see Chapter 3)
  - Some DBS-22 Drill Bit Sharpener Modifications (indexjigs.html) are outlined.
  - Mica Schmid posted a nice USB spacer jig (indexjigs.html) which makes it easer and faster to set the USB relative to the grindstone, and it also helps ensure the stone is consistently flat relative to the USB.
- GadgetBuilder.com (gadgetbuilder.com) - has a page for building drill sharpening jigs.
- Viking Drill and Tool - Drill Bit Anatomy (vikingdrill.com)

> **Sharpness Scale** - see Chapter 1.
> **Ongoing maintenance** - see Chapter 4, *Metalworking Tools*.
> **Grindstones and Other Sharpening Media** - see Chapter 2.