

The Belt Sharpening Revolution!

Grinding wheels played a big part in the manufacture of cutlery even before the Industrial Revolution, as depicted in the Diderot Encyclopedia. Note the position of the workers at the grinding wheels.



he start of the 21st century has brought with it the leading edge of a revolution that will overturn the 1,200 year reign of grinding wheels and replace them with abrasive belts for sharpening woodworking tools. There is more to this than simply substituting belts for wheels. The ideology of the revolution is that sharpening should be fast and easy and therefore entirely mechanized.

HOW TO JOIN THE REVOLUTION

To become part of the belt sharpening revolution, you will have to give up certain sharpening procedures you have used in the past, and change to a new method. Change is always hard, but I assure you that for each of the following things I am asking you go give up, I am offering an alternative that you will like more than what you had.

- 1 Give up grinding wheels
- 2 Give up hand honing
- 3 Give up hollow grinding
- 4 Give up the “two tiered” system

These four points are discussed in detail below.

#1 Grinding Wheels

Grinding wheels were invented in the 9th century. To overturn 1,200 years of tradition is, to say the least, a challenge. To state that grinding wheels are now obsolete for the purpose of sharpening woodworking tools is nothing less than revolutionary, but over the last 100 years, abrasive belts have steadily improved to the point where their performance and versatility make them superior for sharpening.

After the revolution, grinding wheels will still have plenty of work to do—for example, when rough grinding with a

coarse grit, when a large amount of metal needs to be removed such as when a chisel has been dropped on a concrete floor, or when the angle or shape needs changing. But for routine maintenance of the edge, belts are better. Of course grinding wheels will always be employed in machine shops for surfacing, forming and sharpening machine cutters, but this has little to do with how woodworkers maintain their chisels.

#2 Hand Honing

Hand honing is not accurate because it is done by hand. It requires *feel*, skill, and visual observation, and thus it is time-consuming. By comparison, the *belt and buff* routine is mechanized, can be done by rote, resulting in a better job done faster. I compare this to sharpening a pencil with a pocket-knife instead of a pencil sharpener.

After the revolution, hand hones in the

Eight Reasons Why Belts are Better Than Wheels

Wheels

- 1 The typical grinding wheel runs at 4,000 to 6,000 surface feet per minute (about 60 mph), making the process very aggressive, intimidating to beginners, and causes overheating of the edge.
- 2 Grinding wheels can jam the tool and cause extremely serious accidents. (See December, 2009 *American Woodturner* magazine)
- 3 When you need coarser or finer grit, it is very time-consuming to change grinding wheels.
- 4 Grinding wheels get smaller with time, so the jig needs to be readjusted to compensate.
- 5 Skew chisels must be jigged from two different positions because of the curvature of the wheel.
- 6 Grinding wheels must be dressed periodically, creating harmful abrasive dust and wearing down the wheel.
- 7 After dressing the wheel, the grains are dull and may overheat the tool, because they do not cut effectively until the outer layer breaks away.
- 8 It is difficult to set up and measure the angle of the chisel to the curved surface of the wheel.

Belts

The ideal belt machine running at 1,000 surface feet per minute is much more controlled and runs cooler than a wheel.

Belts cannot jam the tool because the belt moves UP, away from the edge. [Fig. 1]

Belts can be changed in a few seconds. Grits are available from 40 to 400, and are low cost.

Belts do not get smaller so the jigs remain consistent.

Both sides of the skew can be ground on a belt from a single position of the jig, because the platen is flat.

Belts never need to be dressed, because they can't get out of shape, out of round or out of balance.

Belts run cooler than wheels because the abrasive grains are sharper and of higher quality. The abrasive grains are electrostatically applied to the belt so the sharpest edges point up.

It is easy and intuitive to set the angle of the chisel to the vertical flat platen. [Fig. 2]

form of round edge slip stones will still have a function for refining the inside of the flute of a gouge. [Fig 3]

#3 Hollow Grinding

The purpose of hollow grinding is to facilitate hand honing. Therefore hollow grinding is no longer necessary, because

there is no need for hand honing of the bevel after the revolution.

Belt grinding can be a rough process when called upon for that purpose, but the *belt and buff* method, when used for routine maintenance, is a finishing process, and as such it replaces honing or can be seen as a type of mechanized honing.

#4 The Two Tiered System

The traditional sharpening method used by woodworkers involves roughing on the grinder (the *first tier*), and finishing by hand honing (the *second tier*).

In this old system, when the chisel becomes dull, it must be honed again. After a certain number of hand honings,

(about three) you have to go back to the grinding wheel. [Fig 4] The flaw in this *two tiered* system is that the process of repeated honing is not sustainable because it adversely affects the geometry of the edge. Eventually you find that two things are happening to the edge that cannot be repaired by further honing without going back to the *first tier*—the rough grinding. First, the hollowness is being diminished each time you hone, so the surface area that must be honed keeps increasing. Thus the time it takes to restore the edge increases dramatically. Second, the shape of the bevel becomes convex. This is inevitable because no hand process can be accurate. As this happens the angle and the feel of the bevel change, and thus the edge is not consistent. This deteriorating condition is something you must keep track of, and at some point you must *decide* that it is time to go back and grind again, or deal with the consequences of procrastination.

For cabinet chisels and plane irons, honing involves placing the stone on the bench and rubbing the chisel against it. Woodturners however, due to the long length of the tools, generally hold the stone in one hand, and the chisel in the other. Over time, we have seen the transition from natural stones to synthetic, water stones, abrasive paper, and finally to diamond hones. Each of these improvements allow honing with less pressure, but essentially this process has not changed for thousands of years. It is time for something faster and better.

BELT, BUFF, TURN

When you join the revolution, you will mechanize this whole process to make it fast, accurate, easy and repeatable. Go from belt-to-buff-to-wood with a single routine, and THERE IS NO “SECOND TIER.” You do exactly the same thing every time you sharpen, so there is nothing to decide, nothing to procrastinate, and the edge is perfectly consistent. [Fig 5]



Fig 2—It is simple and intuitive to set the angle of the bevel with the flat vertical plane using either a bevel square or a protractor as shown.

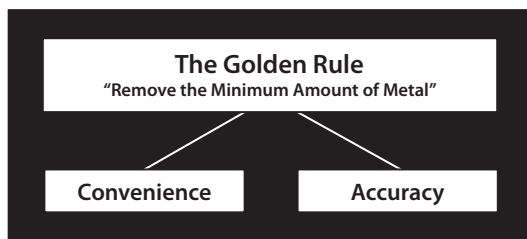


Fig 1—There is some argument over the best direction of belt travel for sharpening machines, but the consensus for belts is that it should go up. This is the precedent set by the Woodcraft machine, and in this way the belt acts like a grinder and also like a strop. It completely eliminates any possibility of jamming the tool, even at very flat angles.



Fig 3—Often the surface of the flute needs to be refined. No wheel or belt can do this job easily, so round edge slip stones are used. Abrasive paper wrapped on a wooden dowel can also be used.

THE SHARPENING PYRAMID AND THE GOLDEN RULE



The Golden Rule of Sharpening—*Remove the Minimum Amount of Metal.* There are six benefits to following the Golden Rule:

- 1 Saves time—Speed is the main factor contributing to convenience. This is one of the foundations of the “Sharpening Pyramid”, because convenience is the antidote to sharpening procrastination. Saving time increases productivity and enjoyment, because turning is more fun and more profitable than sharpening.
- 2 Reduces the possibility of overheating—The removal of 0.001” of metal only takes a few seconds. Can you overheat your chisel in a few seconds? Of course not! Overheating is a non-issue.
- 3 Conserves the tool—The chisel can be sharpened 1000 times before one inch of blade has been consumed. So an average chisel can be sharpened five thousand times!
- 4 Conserves grinding media—Grinding more than necessary wears out (consumes) the grinding media and is wasteful.
- 5 Reduces dust—Grinding more than necessary produces excess amounts of harmful abrasive dust.
- 6 Reduces the burr left on the edge—Whether you remove the burr or ignore it, having a smaller burr on a cutting tool always leads to a sharper edge.

To completely revolutionize the sharpening process, we need to do more than just change from wheels to belts, but also accept that only a jig can be accurate or repeatable enough to satisfy *The Golden Rule of Sharpening*—REMOVE THE MINIMUM AMOUNT

OF METAL. In the new sharpening world, we need to study the variety of jigs available, how they work, why they work, and the geometry they produce on the edge of the chisel. It is very important to understand how changes in the geometry affect the way the chisel behaves when used at the lathe.

Convenience is the antidote to *sharpening procrastination*. The principal factor contributing to convenience is *speed*. Typically a sharpening operation involves three steps: (1) set up, (2) grinding and (3) deburring. On a belt/buff machine the TOTAL combined time for all three steps is TEN SECONDS. [Fig 6]

Other factors affecting convenience are: difficulty, skill or focus required by the sharpening process that interrupts the rhythm of work.

Accuracy is achieved through *repeatability*. Jigs precisely bring the surface of the bevel against the belt, and 0.001” can be removed from the entire surface of the bevel in a few seconds. This method restores the edge without altering the geometry. [Fig 7, 8, 9]

GRITS

Anyone who has sanded wood—on a lathe or otherwise—knows that the success of an abrasive process depends on using the correct grit for the job at hand, and/or progressing through a sequence of grits from coarse to fine. Unfortunately, when we use a grinding wheel, we cannot apply this principle because of the inconvenience of changing wheels. We tend to use one wheel for every job. The most transformative feature of the belt sharpening revolution is the FIVE SECOND BELT CHANGE. Combined with the low cost of belts, this means you will always have the right grit for the job or sequence desired.

BUFFING

Buffing has the same effect as stropping, except it takes two seconds instead of two minutes. Buffing has a bad reputation in some circles, because many people buff too much, causing a

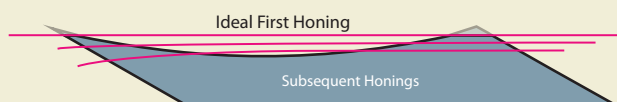


Fig 4—**THE OLD WAY.** This drawing shows the deteriorating condition of the bevel caused by repeated hand honing of a hollow ground bevel using the old “two tiered” system.

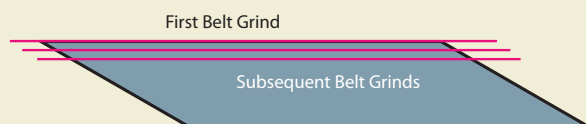


Fig 5—**THE NEW WAY.** The belt grinds the bevel straight. The geometry is identical every time, because there is no “second tier”.

10 Seconds to Sharpen a Chisel

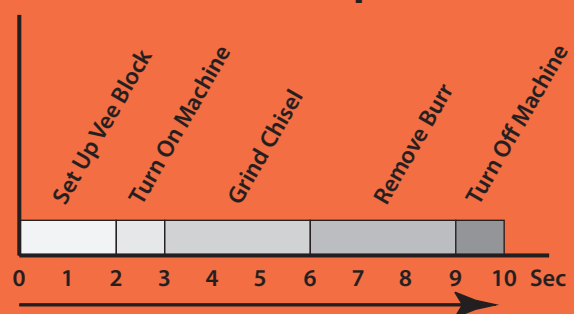


Fig 6—This chart shows the elapsed time for each of the steps in the “belt & buff” process. The total time is 10 seconds. The two second setup refers to the incremental vee-block—other jigs take longer.

rounding of the edge. In the *belt and buff* system, the purpose of buffing is simply to wipe away the burr left by grinding. If you grind carefully—observing the Golden Rule—there will be very little burr, and it only takes a few seconds to remove it by buffing, or for many applications you can just ignore the burr. [Fig 10]

With a new gouge, it may be necessary to refine the surface finish of the flute. This can be done with a round edge slip stone, then buffed to a high finish. After this degree of buffing, it is then necessary to grind a significant amount (about 0.01") to remove the rounding of the edge. Over time, the light buffing that occurs with each sharpening will have the accumulated effect of polishing the flute.

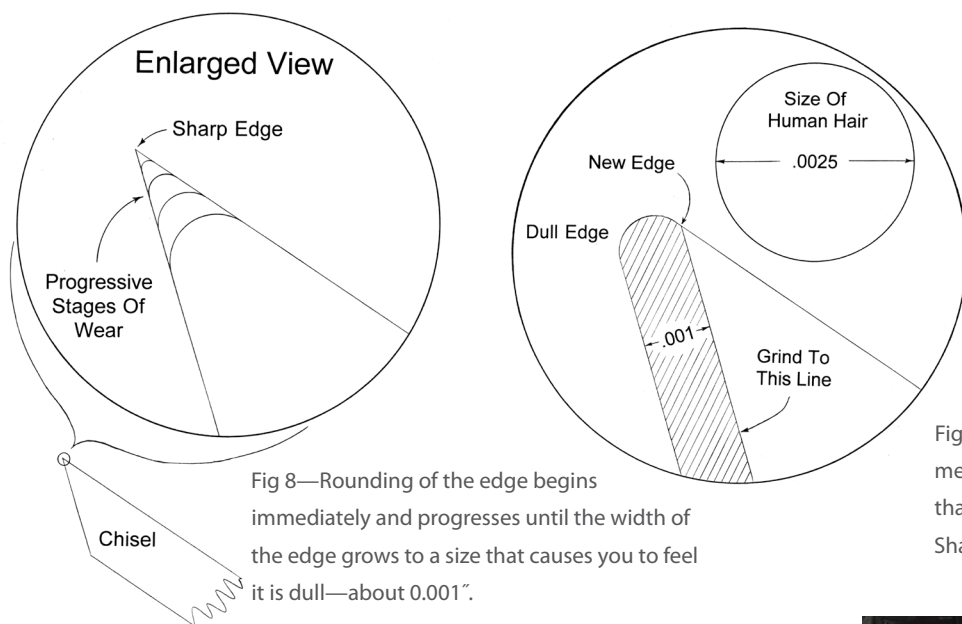


Fig 8—Rounding of the edge begins immediately and progresses until the width of the edge grows to a size that causes you to feel it is dull—about 0.001".

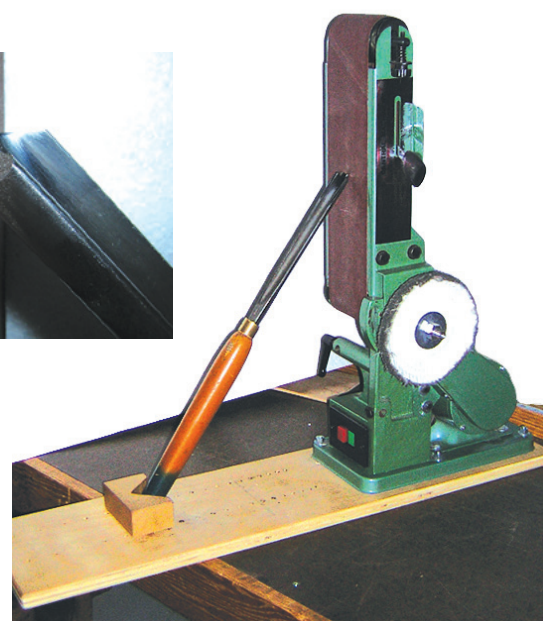


Fig 7—The jig brings the bevel into contact with the belt in precise alignment.

Fig 9—It is only necessary to remove 0.001" of metal to restore the edge. If you grind more than that you are violating the Golden Rule of Sharpening: *Remove the Minimum Amount of Metal.*

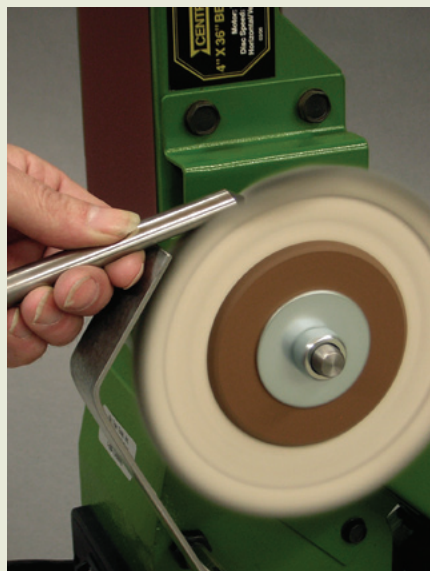


Fig 10—Buffing does the same thing as stropping—except it does it in two seconds instead of two minutes. In this photo the buffing wheel fits into the flute of a gouge where a strop could not reach.

Fig. 11—The *Woodcraft Mark II* was the first belt & buff machine made for woodworkers, and this started the revolution 35 years ago. →

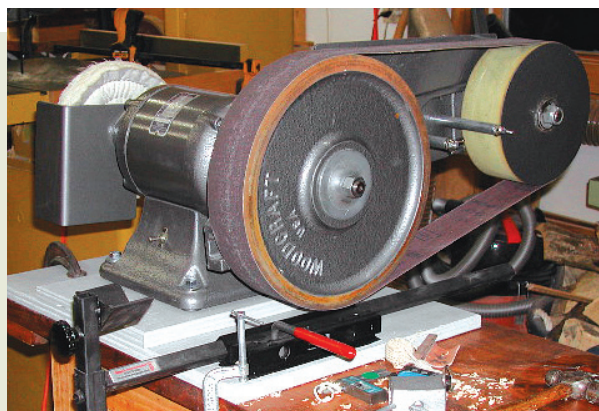
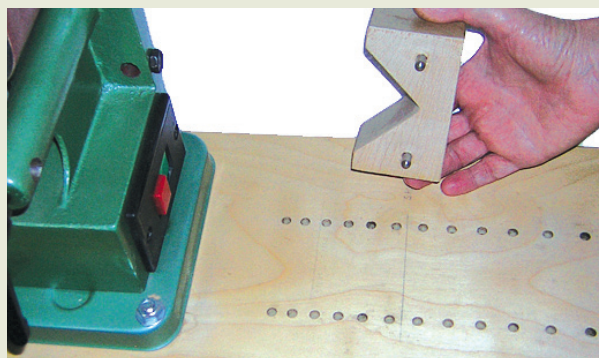


Fig. 12—The incremental Vee-block is a big improvement over the sliding type of pocket jig (or handle jig), because it gives repeatable precision and two second setup time. →



HOW THE REVOLUTION STARTED

In 1977 I worked in a shop where they used a belt and buff machine made by Woodcraft Supply called the *Mark II Sharpening System*. [Fig 11] Although I had seen belts used in metal shops for deburring and surfacing, I had never heard of using belts for sharpening. The literature from Woodcraft claimed that the belt was less likely to overheat the tool than a grinding wheel. I found that was true, but the thing I really liked about the belt system was the ability to change the belt in a few seconds to utilize the fineness of grit that was best for the job, or in some cases a sequence of grits. The Woodcraft machine was only made for a few years.

The belt on the Woodcraft machine moved UP, away from the edge, and this established an important feature for belt machines to follow. By moving up, the belt works as a grinder, but also like a strop—and this makes it impossible for the tool to jam against the belt, even at very flat angles. In spite of these apparent advantages, people have successfully used belts for sharpening in both directions.

Another thing about the Woodcraft machine that opened my eyes was the sliding pocket jig, or handle jig. This evolved into the Wolverine and similar jigs so popular today. The Woodcraft machine had no platform jig, which suited me just fine because I had been quite frustrated trying to sharpen gouges and skewers on a platform jig. After 45 years of sharpening woodworking tools, I have concluded that platform jigs are only good for scrapers.

The final thing I learned from using the Woodcraft system is the convenience of having the belt and the buff on the same machine. The system embodies a two-step routine contained in a single machine.

The Woodcraft machine brought into the woodworking world a whole new way to sharpen—belts instead of wheels, easy change of grit, and a belt and buff sequence that ELIMINATED HAND HONING. When I got back to my shop, I began to think about how I could devise a belt & buff machine for my own purposes; one that was specially configured for woodturning chisels. Over time I made the following changes:

- 1 A much slower speed (about 5 times slower)
- 2 An extremely common belt size (4 x 36) that is available from literally hundreds of sources.
- 3 A flat platen instead of a contact wheel.
- 4 An incremental vee-block instead of the sliding bar.
- 5 Compact and portable (40 pounds, 18 kilo)
- 6 Additional jigs for cabinet chisels, carving chisels, plane irons and a round bar to receive the Tormek type of jigs.

THE INCREMENTAL VEE-BLOCK (aka pocket jig or handle jig)

When I was using the Woodcraft machine with the sliding bar pocket jig, I started putting marks on the bar to facilitate replacing the jig to exactly the same place later when I wanted to sharpen the same chisel again. To some degree it was possible to achieve repeatability this way, and I was trying to eliminate the trial and error and fine adjusting that I found so frustrating.



In 1996 my wife, Patrice Martin, and I started *Big Tree Tools* to manufacture my patented spur center and other wood lathe accessories. About the same time, I was helping other woodturners convert 4 x 36 sanders into sharpening machines like the ones you see in the photographs that accompany this article. Soon we were producing complete machines for sale, and to date we have sold nearly 300 machines. Currently (October 2010), we have suspended production and are reorganizing.

In fact this fuss usually took longer than the sharpening process itself. So when I built my machine, I invented the incremental vee-block. [Fig 12] This has discrete positions so it is quick and easy (about two seconds) to replace the jig in exactly the same position as it was before with no trial and error adjusting. After many sharpenings (about 1,000), the chisel becomes shorter, and needs to be moved up one position. The incremental vee-block is a critical feature that makes the machine fast and convenient.■