



Negative-Rake Scraper

A finishing tool that's up to the challenges of dense woods, end grain, and thin walls

By Stuart Batty

Scraping with a negative angle on a blade is not a new technique. It was originally developed centuries ago for turning ivory and blackwood. However, my technique is slightly different: A burr does the cutting. See what this tool and grind can do for your woodturning.

For those of you who do not know, I am a time-served, apprenticed spindle turner and trained in the art of cutting wood. I served my apprenticeship under

my father, Allan Batty (I am sure you all remember him. He is the old one).

When I spindle turn, I do not scrape. However, when I started making more artistic pieces, it became necessary to use some scraping techniques simply because a gouge cannot cut in restricted areas. A prime example is cutting deep in a narrow bowl or inside an end-grain box.

The usual technique of scraping is to grind a shape suitable for the form you intend to cut. The dry grinding wheel creates a burr at the front top edge of the tool, pushing some of the excess metal over the cutting edge. This burr is what does the cutting. However, because a traditional scraper does not have a negative-rake angle,

it is often far too aggressive and almost impossible to use on dense exotics—especially on end grain.

In the past, I would hone off the burr, leaving a smooth surface at the top of the scraper. This would make the tool less aggressive. By using a long tool handle, I would have enough control to ensure the tool did not get a catch on the end grain. But, this technique has some limitations.

Deflection problems

If the piece is not extremely secure in the chuck, dense woods will pull themselves onto the scraper and rip out of the chuck. When the wood is thin (example: cutting end

Opposite: Cocobolo and Western Australian thin-walled bowls; 10×4×5". **Below:** Western Australian sheoak; 10×5". Stuart used a negative-rake scraper on only the inside walls. The wall thickness of each piece is $\frac{7}{64}$ ".

grain inside a bowl) and you turn with a traditional scraper with or without the burr, the wood will try to climb onto the edge of the scraper. A burr only compounds the problem.

Deflection is like a clock pendulum: As the wood deflects from the very small grab on the cutting edge, it will bounce away and then travel back at the cutting edge the same distance it deflected. This means the wood will now climb even further onto the cutting edge and cause a slightly larger grab on the cutting edge. While the piece is turning at 30 to 60 mph, rapid wood deflection accelerates. Each deflection will be around $\frac{1}{8}$ " to $\frac{1}{4}$ " apart, which means the wood will have grabbed and deflected some 24 to 48 times in 6" of rotation. This all occurs in less than one-tenth of a second—far too fast to pull the tool out. The biggest catch is the last one that caused the wood to fail.

BANG! There goes the thin-walled bowl. If you pick up the pieces from the floor, examine the increased catches. You will see a series of progressively deeper and deeper catches in the end grain.

A different problem

As the tool starts to cut the wood, which does not flex, it will pull the thin blade into the end grain, causing a small catch. This will cause the blade to deflect (slight bend); it will then rebound back into the wood but even deeper, causing a larger deflection and rebound. This happens many times in a fraction of a second—far too fast for you to react in time before the big catch, which will pull a very large chunk out of the wood and kick the tool away from the work. This will give you a big



A narrow blade like on this negative-rake scraper is ideally suited to turn tall, narrow exotic bowls. The negative-rake angle is first ground on the 10V steel so the tool can be touched up many times with a new burr before requiring you to grind the negative angle again.

fright and make you very nervous about putting the tool to the surface. Therefore, you will hold the tool more firmly and when you put it to the wood surface again, it will just catch the tool even harder.

This is the time to try negative-rake scraping.

Goldfield burls lead to negative-rake solution

I have been making square bowls since 1982; this is a style I pioneered, which stems from being a spindle turner. As a spindle turner, I cut a lot of pommels for both balusters and newel posts. (A pommel is the square shoulder cut at either end of the baluster or newel post.) Therefore, when I started turning square bowls, I found it easy to cut through the square corners or any broken surface, including natural edges.

Until recently, I always cut the corners of all the types of square bowls with a bowl gouge because the technique is very similar to cutting a pommel. I turned over

Photos: Don Dafoe

THE CHALLENGES OF IVORY AND BLACKWOOD

Ivory has a grain like a dense exotic and will grab on any type of scraper that does not have a negative angle. However, because of its extreme density and 1.84 specific gravity (50 percent greater than any wood known to man), you can turn it with a negative-rake scraper without a burr.

Before mass production, ivory billiard and snooker balls were turned on the lathe. To get extreme accuracy, scraping was essential, and a negative angle on the scraper was required to avoid the ivory grabbing at the tool.

Blackwood is one of the densest woods, with a 1.2 specific gravity (20 percent heavier than water). It is one of the best woods for woodwind instruments due to its harmonics and resistance to absorbing moisture from the breath of the instrument player.

Blackwood is used for the majority of high-quality bagpipes. One essential part of the bagpipe is the chanter; this is the section of the instrument that controls the sound. The chanter is approximately 15" long and tapered along its length—it has a wall thickness of less than $\frac{1}{8}$ " (3mm) along its full length. This piece of the instrument is by far the hardest part to turn and requires scraping to achieve the accuracy in wall thickness on the outside. The inside is drilled and reamed with a modified World War I French bayonet, which has a three-edge long blade ideal for this purpose.

It is almost impossible to scrape blackwood with a regular scraper blade either with or without the burr. Using a regular blade will cause the wood to grab at the tool and shatter the chanter. Instead, a negative angle is required for the blade to prevent any grabbing.

Due to blackwood's high density, it is not always essential to have a burr. Because the outside is all side-grain turning, the negative-angle tool without a burr will peel off wood fibers.



Photo: Stuart Batty

"Off-Center Square Bowl," Western Australian sheoak; 14 × 5 × 3 $\frac{1}{2}$ ". "I used negative-rake scraping for the finish cuts on the wing sections of the piece."

250 species of wood in a square bowl format before my spindle-turning technique ran into a wall and would not produce an acceptable finish. Not even my dad could solve this one!

No matter how I sharpened my gouge, the turned surface of Australian goldfield burls was always torn or chipped. Indeed, the damage to the surface was too deep to sand out. My wall thickness was approximately $\frac{1}{8}$ " (3mm), and the damage was up to $\frac{1}{16}$ " on both surfaces of the square bowl.

I knew that goldfield burls are some of the densest burls in the world, with specific gravities from 1.1 to 1.3. These members of the eucalyptus family grow in an arid region of Western Australia. They are one of the few woods that do not cut cleanly with any gouge cut—the surface always chips out.

I had over 20 types of these eucalyptuses to turn and was unable to get a good end result. I knew that it was not possible to scrape it with a regular scraper for two reasons—they were too dense, and the surface I was cutting was a natural edge. This combination would make a regular scraper grab and add to the fact that the surface I was cutting was only $\frac{1}{8}$ " thick.

It was at this point that I considered the density of the wood and the fact that the surface was an intermittent cut and only $\frac{1}{8}$ " thick. I decided to try the old ivory technique of grinding a negative angle (see sidebar at left.) However, after the briefest cut, the tool required a lot of pressure to remove any more wood, and at $\frac{1}{8}$ " thick, it flexed too much.

As I resharpened the tool and left the burr on it, I found out that the finish was exceptional. The tool I was using was a $\frac{3}{8}$ " beading and parting tool. However, I was using an M2 steel that had an extremely short life—the burr would only stay on the tool approximately 15 seconds. Since I have the luxury of a lot of tools from teaching spindle classes, I applied the burr to all of them; this way I reduced my trips to the grinder. As one tool dulled, I would simply put it down and pick up the next, which allowed me to focus on the surface and concentrate on the cut.

Because maintaining a burr is critical, I no longer use M2 steel due to its short cutting life. I've switched to 10V (also known as A-11) because it has the ability to maintain the burr four or five times longer for this cutting. This is a 10 percent vanadium steel, more wear resistant than any cobalt steel. (Vanadium is the most wear-resistant alloy that can be

SCRAPER PROFILES

REGULAR SCRAPERS w or w/o a BURR,
DEPENDING on the WOOD.

REGULAR SCRAPER

USABLE ANGLES:
• 50° in SOFTER WOODS
• up to 80° in DENSE WOODS.

NEGATIVE ANGLE
need not be LONG

OPTION #1

NEGATIVE RAKE

USABLE ANGLES:
45° thru 75°
The LOWER the ANGLE
the BIGGER the BURR.

OPTION #2

NEGATIVE RAKE

BURRS are MADE BY
DRY GRINDING, not BURNISHING.
The COARSER the GRINDING WHEEL,
the BIGGER the BURR.

Illustrations: Angelo lafrate



Photo: John Hetherington

The burr produced on the edge of this scraper was ground with a 46-grit seeded gel (SG) wheel. "You must be able to feel the burr before you can use the tool," Stuart recommends.

WHY THE BURR IS SO IMPORTANT

Negative-rake scraping as I define it relies on one essential element: the burr. When scraping ivory and blackwood, the burr is not necessary, mainly due to the densities and structure.

When the blade is ground on the top at an angle and then ground from beneath to produce a burr on the upward edge, the burr does all the work. This is an excellent way to refine shape and remove small tool marks.

This is an easy technique to learn and a great way to get accurate shapes or thickness. Unlike a traditional scraper with a burr, negative-rake scraping is not an aggressive cut—even on dense end grain. However, this is not a bulk-removing technique, as the cutting life of the tool edge is short.

It is essential that there is a burr present on the cutting edge. Once the burr has been worn off, the scraper will not work well and will usually start tearing the grain. This is because you have to apply too much pressure to keep it cutting.

Negative-rake scraping does not require the handle to be higher than the blade like regular scraping or tilted/trailing like shear scraping. However, do not drop the handle too low or it will catch.

Negative-rake scraping is most suited for medium to extremely dense woods. It is not suited for spalted or soft woods. For example: It does not work well on redwood or some types of spalted maple. You can achieve better results for these woods by using a regular scraper with a burr.

added to steel, including tungsten.)

Working with these ornery goldfield burls opened my eyes to other opportunities. Now, I grab my negative-rake scraper for all my thin-walled cocobolo bowls and goblets. I also find it ideal for dense exotic woods and oak, yew, cherry, and ash.

Here are a few turning tasks that I've found ideally suited for negative-rake scraping:

- finishing the end grain on the inside of a bowl or goblet
- finishing the end grain on the inside of a box
- finishing the outside of a bowl with side and end grain

- turning where space is restricted
- turning square bowls

Try this technique with a negative angle on top of your scraper. Just remember the burr has a very short cutting life. If you can't feel the burr on top of the edge, it is time to grind the tool again.

As long as you don't point this tool uphill, you'll find this a user-friendly grind.