High-Speed Sanding

by Bill Neddow

There is no way around it, I am basically lazy—and I hate sanding! This generally results in a strange phenomenon: Nobody works as hard as a lazy man trying to get out of something he really dislikes. And this is what happened to me.

Finding a way to reduce my sanding time has become a real obsession. I have spent far too much time and money buying power tools, abrasive paper, sanding pads, and other toys, and have spent far too much time at the computer doing research. I have filled many garbage bags with worn-out sanding disks, burned or bent sanding pads, and even one annoying drill. The dust extractor has created a plume of dust that the rain has stuck to the outside of my shop. But it has been worth it, because I have developed a sanding technique that dramatically cuts the time I spend sanding bowls, while maintaining the high standard of finish expected by galleries.

I make large bowls—in the 14" to 18" range most of the time. Many of them are even larger—with some over 24"—and the sanding time increases almost exponentially with the size of the bowl. It was taking me up to two hours to sand out one of these really big bowls using *Velcro* pads and regular abrasive paper.

My solution came from an unexpected source—one I tried and abandoned at the beginning of my search. In the past, I worked on antique and racing cars, and had several of the 4-1/2" angle grinders used in most metal-working shops. I tried them early in my sanding career and quickly abandoned them because all they did was burn the wood.

Fig. 1

This ash bowl is very hard to sand without getting a "starved horse" effect caused by soft sanding pads scooping out the soft wood between each growth ring, leaving the hard part sticking out. This is particularly true under the rim where you have the "eye," and on the bottom where the growth rings are far apart.

> "Finding a way to reduce my sanding time has become an obsession."

After many experiments with drills and various sanding pads that left me frustrated, I returned to the 4-1/2" angle grinder. Obviously, it was burning the wood because the speed—10,000 to 11,000 RPM—was just too fast. I slowed it down, adapted it to use the 2" and 3" sanding pads and abrasive papers found in metal shops, and *voilá*, I had my solution!

I could sand out one of these big bowls in about twenty minutes, and even better, my system worked on smaller bowls too. The amount of time saved was not as great on a small bowl (6" in diameter), because this exponential thing also works in reverse—the smaller the bowl, the less time saved. But I still find it worthwhile. I even use the technique on spindle work, such as bottle stoppers, when doing coarse sanding (180 grit).

Another advantage of using this system is that you can almost completely eliminate the "starved horse" effect you get when sanding woods such as ash, or any other wood that has distinct soft and hard bands within each yearly growth ring. Because the pad does not flex as much as the softer *Velcro*-based ones, it does not dig down and remove the softer part of the growth ring (see **Fig. 1**). Soft pads have their use, but I use them only for the very fine grits.

A third advantage is that details such as beads are not obliterated when you are sanding with the hard rubber pads. The sanding disk is mechanically attached dead-on center each time, which means you can get right up to a bead, saving a lot of hand sanding. With the *Velcro*-based system, you guess at center when sticking on the sanding disk, and there is always a bit of abrasive paper flying out on one side like a little propeller, obliterating anything it gets near.

The fourth advantage is a better finish. When you sand down to 320 grit, it actually looks like 400 grit. As a result, my practical bowls get sanded only as far as 400 grit, and competition pieces up to 600 grit. I have not yet figured out why I get this extrafine finish. As I will explain in detail later, I use my system of high-speed sanding only up to 320 grit, because this is the finest abrasive paper you can get in these types of disks. The fine sanding is done with good, regular abrasive paper on a *Velcro* backing pad, mounted in a regular drill. So the idea that the speed is causing the abrasive paper to "float" (and give a finer finish) does not stand up. I can only think that it is the better preparation of the *sub strata* that is showing through.

> "In order to function properly, the "sand" crystals have to break down or fracture at a controlled rate."

THE BURNING QUESTION

Many people have avoided using the grinders because of the burning mentioned earlier. They were afraid that heat buildup in the wood would cause cracking. But there were other reasons too. The abrasive paper available simply could not take the abuse and would disintegrate. Very stiff sanding pads and paper could make cut marks in the bowl. And it created a lot of dust.

First, let us tackle heat buildup: This is caused by two factors—the main culprit is the pressure you put on the pad. Most people lean far too heavily on the pad, compressing it significantly. This does speed up the sanding a bit (with that particular grit), but it also does several other things. First, it pushes the sanding grit way down into the wood, creating "grand canyons" that are difficult to remove with the next finer grit of abrasive paper. All this extra stress dulls the "sand" crystals, and causes more heat buildup and cracking. The extra sanding you are doing to get rid of scratches simply adds to the time actually spent sanding. This applies to any sanding process. So the lesson here is don't lean on the sanding pad; all you need to do is gently "kiss" the wood.

The other factor is speed. The angle grinder is meant for sanding or grinding steel, auto body filler, and paint. Most run at 11,000 RPM, and this is far too fast for wood. It will cause scorching, even if you use a light touch. The secret is to turn down the speed to between 6,000 and 8,000 RPM. Doing this is easy on variable-speed grinders, but these grinders are costly. (I will explain how to reduce the speed on regular grinders later in the article.) I also increase the speed of the lathe slightly. On a 12" bowl, I would increase the speed from 500 to 800 RPM. Big bowls would go from 250 to maybe 350 RPM. This seems to help dissipate the heat significantly. But don't overdo it. If the bowl is warped, you may not be able to get anywhere near these speeds without the sanding pad bouncing. Go as fast as you reasonably can—safely.

PAPER AND PADS

I use two different sanding systems: one adapted from the metalworking industry, and the other an adaptation of the *Velcro*-based sanding system with which we are familiar.

First, let us deal with the sanding pads meant for metalworking. Roloc pads from *3M* are relatively stiff, solid rubber pads (Part No. 05114-05540) and are available off the Internet for about $16.00. Even less expensive, and just as good, are the Power Lock pads, available from most major retail woodturning outlets. Just remember when buying sanding disks that the two systems are not interchangeable. The Roloc pad uses a centered threaded stub on the disks to hold them on; the Power Lock system uses a series of bayonets that lock into the sanding pad (see **Fig. 2**).

The metal sanding papers I get are also made by *3M* (called Roloc disks) or by *Merit* (part of the Power Lock system). The Roloc disks are available from most auto parts suppliers and the Power Lock disks are available from most retail woodturning outlets. Both come in the range of sanding grits—up to 320 grit.

In order to function properly, the "sand" crystals have to break down or fracture at a controlled rate. This keeps

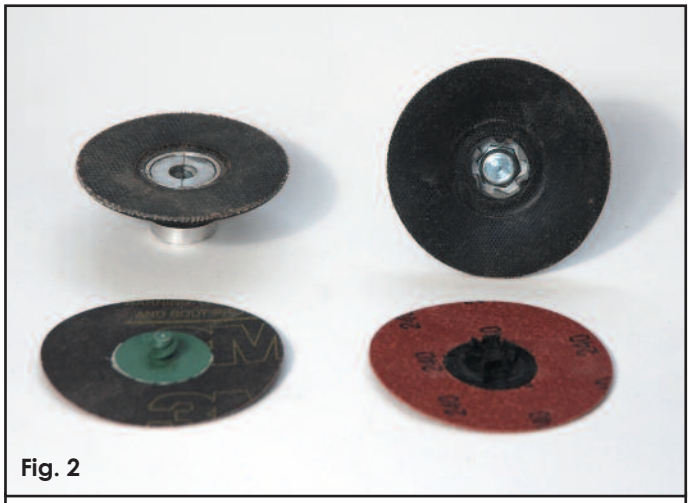

Fig. 2

These are the two hard rubber sanding disks from the metal industry that I use. On the left is the *3M* Roloc disk with the sandpaper disk below that has a screw-in tab in the center. On the right is the Power Lock pad with bayonet tabs to lock on the abrasive paper. Obviously, the systems are not interchangeable.

the abrasive paper sharp. These abrasive papers are meant for making sparks fly off steel, so they are designed to fracture differently than the papers normally used for wood. The papers will simply go dull if used at the usual drill speed of 800 to 1600 RPM. However, at higher speeds (6,000 RPM), the crystals fracture as they should and stay sharp four or five times longer than regular abrasive paper.

I use this system up to 320 grit, then shift over to a *Velcro*-backed system for the finer grits. This seems to be most efficient, but some people may want to use the *Velcro*-based system for the coarser grits too. This also works if you use the right abrasive paper and it saves buying an extra backing pad.

The most durable *Velcro*-based pads I've found are the Tim Skilton pads. These are available from many suppliers and will last for years...even in my shop. Some may think the *Velcro* would not stand up, but if the *Velcro* starts melting, you are pushing far too hard on the pad and are creating "grand canyons"—plus extra work for yourself. Remember, just kiss the wood. I have pads with the original *Velcro* still on them that are several years old and are in constant daily use.

The abrasive papers I recommend for the *Velcro* pads can be used for regular low speed sanding and are excellent. They are even more amazing at high speed. They will stand up as well as the Roloc/Power Lock system disks.

> "Holding the sanding disk as flat as reasonably possible is very important to sanding efficiency."

Two of these abrasive papers are ceramic based. One is made by *3M* and is sold by *The Sanding Glove* (www.thesandingglove.com) and other major retail woodturning outlets. The grit stands up well, but the abrasive paper has a sticky (PSA) backing, which means you either need a conversion pad to put on the *Velcro*-based pad, or you need yet another pad with an adhesive backing. I suggest going for the new pad. The conversion pad works fine, but your work habits will have to change. It sticks to the PSA glue on the sanding disk and then you attach it to the *Velcro* disk. If you take it off, both the abrasive paper and the conversion pad come off. I am so accustomed to ripping the abrasive paper off the *Velcro* pad and throwing it away that I inevitably do it with a conversion pad attached. I have bought batches of conversion pads on several occasions and managed to lose them all.

This abrasive paper is available up to 220 grit, so be prepared to use a different paper if you go beyond this.

Fig. 3

Holding the sanding disk as flat as reasonably possible is very important to sanding efficiency. Also make sure to use good face and lung protection.

Bruce Hoover of *The Sanding Glove* introduced a new abrasive paper to woodturners last fall called "Dry Ice." This has only been available to the commercial market in the past and is a favorite in commercial operations. Like the *3M* ceramic, it is more expensive than most other abrasive papers, but commercial users have found it lasts so long it is actually less expensive to use in the long run. It is available in all the grits we use—and has a *Velcro* back. This is the paper I have favored for several years for both regular and high-speed sanding. In the past, I bought it from a wholesaler in 6" disks and cut my own 3" disks. Bruce is supplying it precut in the size desired for less money than it was costing me to buy it wholesale—and then I had the job of cutting it myself. These are the ceramic papers I know and can recommend. There are other companies making similar products, but I have not been able to get my hands on any of these.

There is one other I use regularly, called "Astra Dot." It is made in Japan, and the sole North American distributor is *WoodChuckers Supply* in Toronto, Ontario (call 800-551-0192 and ask for John). It has a *Velcro* backing and is available in 2" and 3" disks in all the grits we use. You can also buy it in 6" x 39" rolls and cut the disks yourself. This bit of work, again, reduces the price to that of regular abrasive paper. I have not been able to discover what kind of grit is used on this paper, but it appears to be similar to the grit on papers designed for sanding metal. The

Fig. 4

My workhorse is a *Walter* variable-speed grinder. The variable-speed dial is at the tail end, near the power cord.

grit is also electrostatically placed for maximum performance.

All these papers have flexible backings (which I referred to earlier as "paper," but are actually made from many compounds). They will not rip unless severely abused, and will stand up for a long time.

The other problem (mentioned earlier) that people run into is that the paper cuts the wood. This applies to both the hard Roloc/Power Lock pads as well as the softer *Velcro*-based pads. The problem here is that people are tipping the pad on too much of an angle (see **Fig. 3**). If it is being used on a 45° angle, it will cut the wood. Keep it flat and you will not have this problem. If you can cut a new 2" pad from the center of old 3" pads, the pad is being held on way too much of an angle.

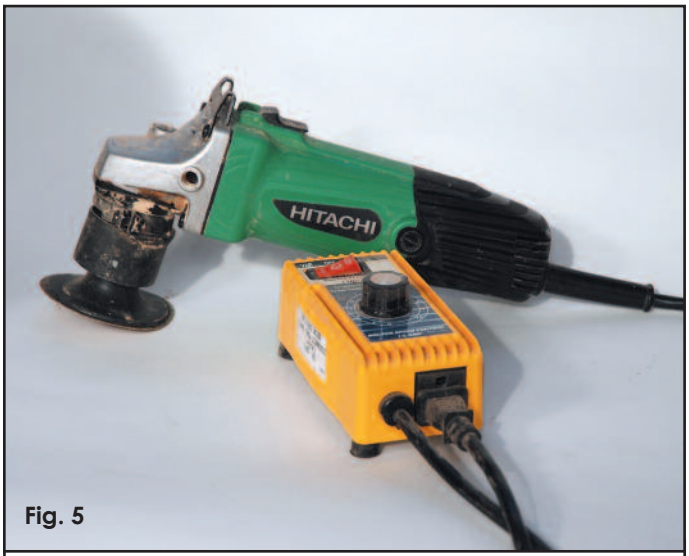

Fig. 5

This is a medium-cost grinder (in the $60.00 to $100.00 range) without built-in variable speed. The variable speed comes from the router variable-speed switch I have attached to it. These switches can cost anywhere from $7.00 to about $40.00.

TOOL CONVERSION

There is almost no conversion required if you can stand working with air-driven equipment. Get a drill that accepts a 1/4" shaft in its collet or chuck. Figure out when (while pressing the trigger) it is running at about 6,000 to 8,000 RPM, and measure the gap between the trigger and the housing. Cut a block of wood or aluminum to fill this gap, and glue it into place. This will keep you from sanding at too high a speed. You are now ready to mount a pad into the collet and start sanding.

I cannot stand the noise made by the compressor. That is partially because my 3 hp compressor, with a 60-gallon tank, is literally two feet from the end of my lathe with no room for me to add any sound baffler. It drives me nuts.

I also cannot understand how using the compressor can save money, as some claim, because the motor is running almost all the time. I would rather run a 1/4 hp (or less) electric motor in my drill or grinder than the 3 hp one on the compressor. As you sand, the air pressure goes down, and eventually the speed also starts dropping. This makes it hard to keep the tool running at a consistent 6,000 RPM. Also, the compressor will keep its pressure up automatically, and I often forget to turn it off—only to discover this when I am in bed and half asleep.

Thus, I use electric angle grinders.

First, let us deal with slowing the angle grinder down. If you are going to adopt this system for regular use, it is probably worthwhile investing in a variable speed grinder. I use *Walter* (*Metabo*) grinders, but they are professional machines and expensive (see **Fig. 4**). *Makita* and *Bosch* make good grinders for less money, and there are others on the market. Search the Internet to see what is currently available. You might even be able to pick up a factory reconditioned model with a full warranty.

When you get it, read the instruction manual—I know, this goes counter to most male instincts. In it, there will likely be a chart telling you what the little numbers (1–10) actually mean in terms of revolutions per minute. Try the machine at about 6,000 RPM, and if it works well, increase the speed to a maximum of 8,000 RPM. This will give maximum productivity. Anything faster, and you start running into heat problems.

Another option is to try a less expensive machine that does not have a variable-speed option. Get a good one costing about $90.00 to $100.00, plus a router rheostat for adjusting the speed. These generally cost from $10.00 to $40.00. Set the dial at about the halfway point, and you should be close to 6,000 RPM (see **Fig. 5**).

Even cheaper would be to get one of the grinders imported from China, selling from $10.00 to $40.00. You still need a rheostat to adjust the speed, but you can make one from an extension cord and a light dimmer switch. Get a friend to make this if you are not accustomed to dabbling with electricity—a mistake can be rather shock-

Fig. 6

For those wanting to try this sanding technique for minimum cost, this could be a solution. Shown here is a *Harbor Freight* grinder I bought for $14.00. The variable-speed switch is made up of an extension cord, light switch dimmer, box, and cover. The plug is not necessary (I found after I made it). You can simply cut the dimmer switch into the middle of an extension cord, then plug one end into the wall and the other end into the tool.

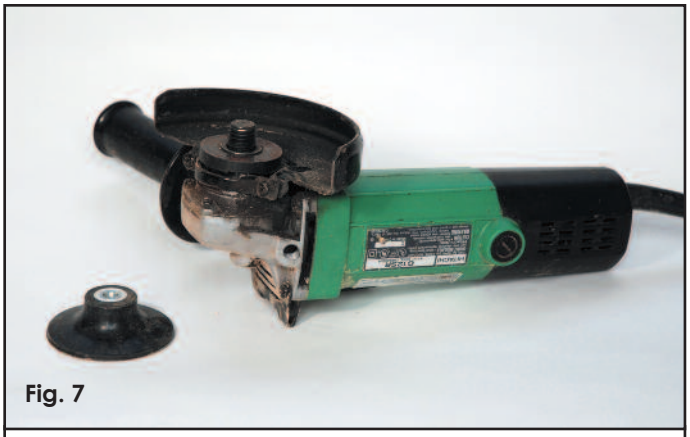

Fig. 7

The problem is getting the sanding pad with its 1/4" x 20 TPI thread onto the 5/8" x 11 TPI arbor of the grinder.

ing! Put the light dimmer (properly mounted in an electrical box) in the extension cord and dial up the speed you want (see **Fig. 6**). Do not use this switch on a tool that you really want to keep. I have had mixed reactions from people who know something about electricity. Some say the dimmer switch will burn out the grinder. Others say that was true in the past, but it is safe with the modern dimmer switches. My personal experience is that the bearings will wear out on less expensive grinders before they burn out. The particular grinder in **Fig. 6** has been in daily use for over six months and is still running perfectly. I would not try this on a more expensive grinder, however.

ADAPTATIONS

These machines come with a 5/8" x 11 threads per inch (TPI) arbor. Somehow, you have to get from this thread size to a 1/4" x 20 TPI arbor onto which you can thread both the Roloc/Power Lock and Tim Skilton pads. Everybody who has tried this seems to have come up with a different solution; here's mine (see **Fig. 7**).

The simplest solution is to buy the adaptor for the Roloc and Tim Skilton pads. *Walter* (*Metabo*) sells one (Walter 13D-005). I have also bought a different brand from *Air Tool Services Ltd.* in Burlington, Ontario (call 905-639-5821). The part number is AT-AE-120 x 3/8" x 24 TPI. Both of these adaptors cost about $30.00 apiece. A company called *Sandmate* (www.sandmate.com/en/acc_adaptor.php) makes what they call an adaptor mandrel for $3.50—but you have to buy a bag of 25 at $3.50 each. Similar adaptors should be available from air tool suppliers across the country. The *Walter* has a 5/8" x 11 TPI male thread and requires a 5/8" x 11 TPI long coupling nut to act as a sleeve to connect it to the grinder. The *Air Tool Services* and *Sandmate* adaptors have a 5/8" x 11 TPI female thread and screw directly onto the grinder (see **Fig. 8**).

As you have probably guessed from that last part number, the smaller (male) end is not the right size. In both cases, they are too large—3/8". Just mount them in the chuck, file them down (it only takes a few minutes), and then put a 1/4" x 20 TPI thread on them.

However, there is a cheaper way—make your own (see **Fig. 9**). Get a 5/8" x 11 TPI long nut (coupling nut) and a bolt to fit that has over half an inch of thread on it. Also buy a 1/4" x 20 TPI bolt. Thread the long (coupling) nut

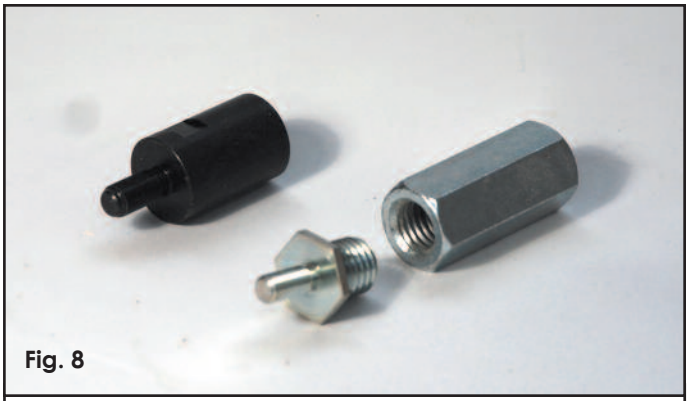

Fig. 8

This is the expensive but easy solution. The top adaptor is from an air tool supply company and the bottom adaptor is from *Walter*. The *Walter* requires a nut to serve as a sleeve to attach to the grinder. The small ends of both adaptors are slightly oversized and have to be filed down (on the lathe) and rethreaded with a 1/4" x 20 TPI thread.

Fig. 9

This is the homemade, much less expensive version. The finished adaptor is on the right.

onto the grinder. Measure how much of the nut this takes, and add about half an inch. Using the cut-off grinding wheel that comes with the grinder, cut the nut off at this point. Using the grinder, cut the bolt so there is just slightly less than half an inch. Thread this into the piece of nut you are using and lock it in with some *Locktite*. Mount the nut-bolt unit in a chuck on the lathe. Put the cheap center drill in a drill chuck in the tailstock, and start drilling a hole in the nut/bolt unit. Once there is a good dimple, change over to a No. 7 drill and drill a hole a little over 1/4" deep. Thread it to 1/4" x 20 TPI with a threading tap, and screw in the 1/4" x 20 TPI bolt. Cut it off so about 3/8" is showing—just enough to give a good grip on the sanding pad. The shoulder of the sanding pad must rest against the shoulder of your adaptor. Cut the 5/8" coupling nut in half and use it as a sleeve to mount the sanding pad adaptor onto the grinder.

I like to keep a guard on the tool to protect my fingers from contacting the hexagonal nut. You cannot protect yourself from the sanding disk if it is going to cut wood, so keep your fingers back. To make the guard, use the cut-off grinding disk that comes with the grinder to cut the existing guard off its retaining ring. Then I take the retaining ring and a piece of exhaust pipe that is the same diameter down to my local garage man and have him tack-weld the two pieces together (see **Fig. 10**).

There is a little trick to drilling the 1/4" hole. It is hard to center the hole for the 1/4" x 20 TPI bolt, because the regular drill bit (mounted in the tailstock) tends to flex. You can pick up a fat countersink, a pointed grinding stone meant for a drill, or a center drill for a few dollars. (A center drill is the short, fat drill meant for drilling the center in a piece of metal so it can be held by the tailstock.) Use this, mounted in the tailstock, to get a centered dimple in the bolt. Then change over to a regular drill to make the actual hole.

> *"You cannot protect yourself from the sanding disk if it is going to cut wood, so keep your fingers back."*

For the Power Lock system, making an adaptor is almost the same. The difference is that you cannot use any old piece of 1/4" x 20 TPI threaded rod as an arbor. The arbor that comes with the pad has a round end on the pad end that helps keep the bayonets on the back of the disk in place. You have to keep this. So simply thread the 1/4" arbor that comes with the pad and use it instead of the 1/4" bolt that I recommended for the Roloc/Tim Skilton pad adaptor.

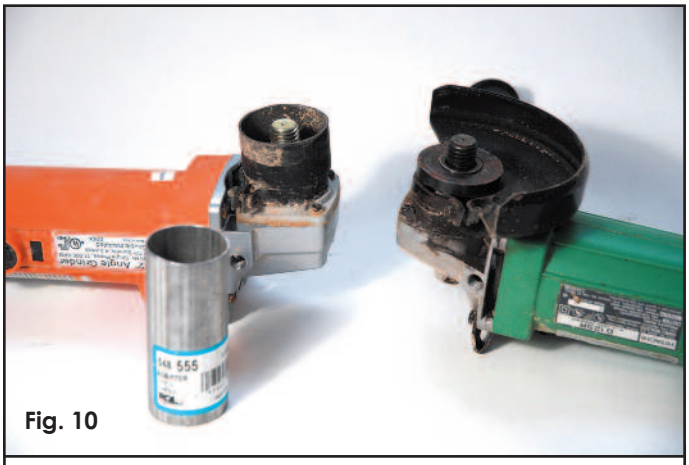

Fig. 10

I fabricated a guard to protect my fingers.

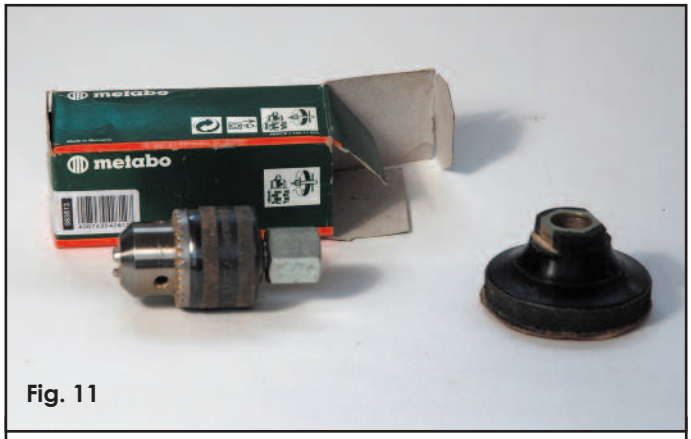

Fig. 11

I can get you one of the drill chucks, but only if you are willing to buy an entire container...

These are alternative solutions. You can buy a drill chuck that will screw on the arbor. These are about $50.00. Simply mount the sanding disk in it and start sanding. But I found the drill chuck made the "working" end of the tool too long. I like to have my hand on the end of the tool, near the sanding pad, to give maximum control. Because my hand was farther away, I had less control. If you can find one, the sanding pad in **Fig. 11** is the easiest solution. It has a 5/8" x 11 TPI thread and mounts directly on the grinder arbor. I bought this at a clearance sale and have never seen another one. There are a few companies on the Internet that would be happy to supply me—but they are in China and the minimum purchase is a container load.

> *"No matter what system is being used, make sure to have a good personal air filtration system on your face."*

EXCUSES, EXCUSES

Now, to go back to the last excuse for not using this system—it creates too much dust. This is not really true. What it does is it concentrates the period during which dust is created. If a bowl is being sanded out, you will always create a fixed amount of dust to get to the same goal, no matter what technique you use. Just because you are creating dust over a two-hour period rather than a twenty minute one may make it look safer. There is not so much dust in the air at any given time, but it is there, and you are breathing it. No matter what system is being used, make sure to have a good personal air filtration system on your face and extract as much dust as you can from the shop with a good vacuum cleaner or an air extractor.

Wet sanding with either oil or a wax will help dramatically in reducing dust in any sanding operation. I have not adopted this, because of the mess involved. I tried it and ended up having to repaint the lathe, even though I thought I had protected it well with plastic. I don't like making extra work for myself, and I still have not painted the wall behind the lathe...or the ceiling.

All this may seem complicated, but it is not. I have given you at least three different ways to tackle each step. Just sort out which way you want to go, and forget about the rest. I wish I could say that about every project I tackle. That would really warm a lazy man's heart.

Bill Neddow

Bill Neddow spends his "retirement" creating bowls for seven galleries, and taking part in studio tours and several arts and crafts shows each year. He also does some demonstrating. Bill considers himself a semi-production turner, following themes in his bowl designs, but trying something different with each one. Thus, he is on a constant, exciting learning curve. He is fascinated not only by how to do something, but why it works—a by-product of thirty years as a writer, editor, and publications manager. His website is www.billneddow.com. Bill welcomes your questions and comments, and can be contacted by e-mail at bill.neddow@sympatico.ca.