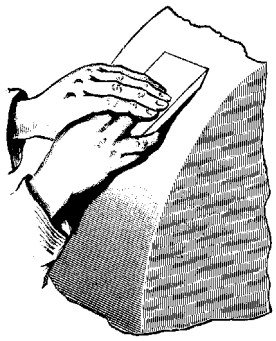
From Crosscut – www.wwa.org.za November 2001 to April 2002



Keen Edges

©Trevor Pope (tpope AT iafrica.com) Nov 2001

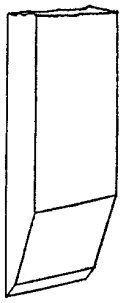
An Introduction

Sharp tools are fundamental to fine woodworking. Without keen edges you will probably see torn grain, overheated tools, burn marks and a great deal of unnecessary effort. Experienced woodworkers know this, and sharpening usually becomes second nature, but even they sometimes have to take stock and remember to pause to touch up an edge. One of first things apprentices learn, after how to clean up, is how to sharpen. With a demanding master, this could take some time, but once internalized, it becomes second nature.

Much has been written on sharpening, even complete books such as the one by Leonard Lee. In a series of articles, I will give only a brief overview of the principles and some of the products available locally that I have used.

If you speak to different people, you will find different approaches to sharpening, usually influenced by how they were taught. I will try to mention some of these, but as my own experience is limited, some contributions here will be welcome.

In principle, an edge is formed by the intersection of two surfaces. Obviously, the shape of the edge is dictated by the shape and angle of the surfaces as they intersect. Also, the quality of the edge is affected by the smoothness of the surfaces. Usually, smoother surfaces give a better edge, and a better finish, but there are exceptions, as we shall discover later. The main bevel is usually formed on a grindstone, such as the old-fashioned one shown above. A common angle is 25º. Each time the edge needs to be touched up, it is ground at a slightly larger angle such as 30º, on a flat stone, by hand. This is shown in the diagram to the right.



The durability of the edge is influenced by the design of the tool and the angles between the two planes as they intersect. Narrower angles tend towards sharper edges and easier cutting, but are less durable and more inclined to chip. The metallurgy of the blade is the other main influence. More expensive tools tend to have more complex alloys, which are more carefully processed, and hence stay sharp longer and are less inclined to chip. Classical tools usually come with a high carbon blade of so-called cast steel derived from the crucible process. Such blades usually have about 1% carbon. When correctly manufactured, this is fine-grained steel that is capable of excellent edges and is often preferred over more modern steels. However this steel is less durable and more inclined to chip than modern alloys. It depends on how you use your tools as to which is best.

It is rare that a tool comes to you with a keen edge. When new, the edge is usually roughly machined. Second hand, you get the tool as it was last used, and often abused. You can tell a lot about the last user of a tool when you pick it up and examine the edge remaining. On a plane iron,

check the back of the iron close to the edge – if it is smooth and flat, even polished, then you have someone who knew something about sharpening who used this blade. Remember, I said that an edge is the intersection of two surfaces? Well the starting point on a plane iron or any flat-backed blade is to flatten the back and hone it to a fine finish – a finish at least as fine as you will be putting on the other surface. This fine finish will be there for the life of the blade with only attention to remove a wire edge or burr needed. The other edge or the bevel is where metal is removed to recreate the edge each time you sharpen. To tell more about the skill of the person look at the quality of the surface of the bevel – is it a rough surface or has it been honed to a fine edge? How accurate or symmetrical is the bevel? Most traditional craftsman sharpened freehand, so you will see a curved bevel, possibly in two directions. There is nothing wrong with that in the right tool.

Any discolouration of the metal around the edge means that it was probably overheated on the grinder. Oh dear! The hardness at the edge may have been lost. The softer metal will probably need more frequent sharpening until the softer part is gone. You could grind the blued part away, but you can also just use the tool and put up with more frequent sharpening, until you have worked past the softer part. One of the advantages of modern high-speed steels is that they are resistant to tempering at normal grinding heats, which is a great advantage for hardworking turning tools. If you do happen to overheat a high-speed steel tool, don't quench the edge as you would for a high carbon steel tool, as it is likely to crack – just let it air cool slowly.

Continuing your inspection, hold the edge towards you with a good light behind you. Can you see the edge? Even just slightly? Then it is probably blunt and needs touching up. A few strokes with a very fine stone or a strop should bring the edge back to razor keenness. Only the smallest amount of metal will have been removed and the edge will be nearly invisible again. If you resume using the tool, you should notice a reduction in force needed to make a cut, with less tear-out and, if you look carefully, better clarity on a freshly planed surface. Compare this almost transparent look to the slight muddiness of a sanded surface, where the sanding grit has torn each wood fiber and clogged the grain with dust. Edge tools are best!

Keen Edges - The Basics

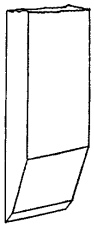
Sharpening is simple – define the shape of the edge and then hone it to a fine finish.

Initially to define the shape of the edge, use a coarse abrasive for rapid removal of metal without overheating the steel. (If you overheat the steel, you run the risk of ruining the desired hardness that was carefully quenched and tempered into the steel at manufacture.) To hone the edge, use progressively finer abrasives until the surface finish is fine enough to give the desired edge quality. There are different ways to achieve this in practice, which I will discuss later.

In use, the edge will loose its keenness as a minute amount of metal is worn away. To restore the edge, it is only necessary to remove only the smallest amount of metal. A few light strokes with the finest abrasive are all that is required. If a burr or wire edge forms on the edge, even lighter strokes on alternate sides will break it off. And then it is back to work.

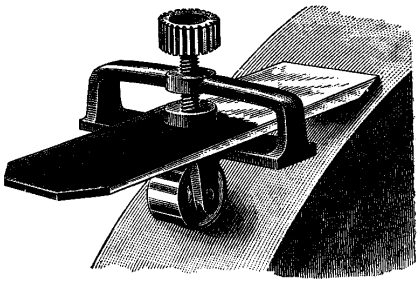
If you are unlucky, the edge will be nicked in use – when using a plane, you can feel slightly raised ridges left on a planed surface a nick. Then more work will be needed to remove the nick and restore a fine surface, but the principle is the same. Use a coarser

abrasive to remove more metal until the nick is gone. Then progress through finer abrasives until you finish with the finest grit needed to define the edge you want.



Usually, the edge is defined at one angle to start, at say 25º for a plane iron. Then a slightly steeper angle, at say 30º, is honed to refine the edge. Only a small amount of metal need be removed at a 30º angle each time the edge is restored, which is a lot less effort than removing all the metal at the 25º angle each time you need to resharpen. This principle applies to most edges.

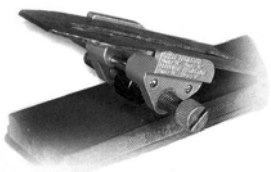
A traditional craftsman will usually judge the angles by eye, grinding the initial edge and honing it freehand. This is OK for a traditional smoothing plane, where a slight curvature is wanted to stop the corners digging in and the blade need not be absolutely square. For some planes, such as rebate planes, the blade must be straight and square to function correctly. Then a honing guide is vital to sharpen the blade quickly and accurately. The picture on the right shows how a guide may be used to grind a plane blade on a large old-style grinding wheel.



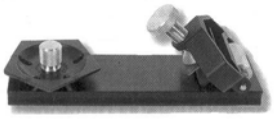
There are several honing guides on the market, varying in features. They all allow you to set and hold a consistent angle while grinding or honing the edge by hand on a flat abrasive surface. The angle of the blade to the flat surface is set by how much the blade projects beyond the front. They have a roller that contacts the abrasive surface to maintain the distance and corresponding angle of the blade to the surface.

- Stanley offers a guide that retails for about R150-R160. It clamps the blade between the flat faces. It has an in-built gauge that allows you to set the angle to 20º, 25º or 30º. The angle is set by how much the blade projects against a graduated plastic strip that is folded out to set the length. (It is shown folded away in the picture.) It copes with a variety of unusual blade shapes, although some care is required to keep the edge parallel to the guide edge. A ruler or square may help to set the blade square.

- The Eclipse honing guide is cheaper, albeit slightly less versatile, as it is limited to square edges. It clamps the blade from the sides so the edge must be square to the sides to use this guide. It will cope with most plane blades and chisels except for a few odd sizes. I find it quicker to use for most blades and straight chisels as you don't have to check the squareness of the blade each time, but you do need a ruler to set the distance the blade projects and the hence the angle. Markings on the side give you the distances for the 25º and 30º angles most commonly used.



- Veritas also make a honing guide. Veritas is made by the reputable Lee Valley. I haven't used one of these, so I can't comment from experience. The blade can be preset to different angles against the provided angle jig (15º,



20º, 25º, 30º, and 35º) and can also be incrementally adjusted for putting a micro-bevel onto a blade. (A micro bevel is a slightly (one or two degrees) steeper bevel from the main bevel that some people prefer to use.) This guide is available from Hardware Center.

None of these guides is foolproof – but you can expect more repeatable results than judging the angles free hand. A benefit of using a guide is that you can set the angle at the start and then rapidly move from coarse to finer grits in succession, with no extra fiddling.

Abrasives for Keen Edges

In the introductory sections above, I explained the principles behind sharpening. I mentioned different grits without going into details. In this article, I will introduce you to some of the abrasives available locally.

Oil Stones. Probably most of you are familiar with the double-sided oil stone. Usually, one side is a medium grit and the other a fine grit. The material is man-made Carborundum (aluminium oxide), which is moderately hard. These vary in quality, but a reasonable one could cost you about R100-. To prevent them from clogging, they need to be coated with oil. A light honing oil will do. Initially, to define the edge of the blade, start with the medium side. Then for the final bevel, move to the finer side. I dislike the oil as it needs to be wiped off the blade each time you want to check progress and I find my fingers get coated with it. Also, with frequent use, even with good habits of using the whole surface area, the stone becomes dished. If you are only sharpening the iron of a smoothing plane, this is OK, as it needs to be slightly rounded. Otherwise, you will need to flatten the stone against another. I found that this dulled the surface on the stone I have, making it cut more slowly. As I became more aware of what a really good edge was, I found the quality of the edge produced by the fine grade was still too coarse, so I changed to some the alternatives listed below.

Ceramic, natural and Japanese water stones. These have their fans. I can't comment from personal experience on them, but they obviously work. They suffer from some of the same disadvantage listed above – they need flattening periodically. An advantage is that most of them can be used with water, instead of oil. They are available in much finer grits down to 4000 grit, which will produce a very fine edge. Japanese water stones are available from Hardware Centre.

Using sandpaper for sharpening. This is the so-called "Scary Sharp" technique. (See: http://www.shavings.net/SCARY.HTM#original for more info) Strips of different grades of wet/dry paper are glued to a sheet of glass. Edges can be shaped using the technique, but it is most effective for the periodic touch-up that edges need in use. A piece of 6mm glass is most effective to provide a hard flat surface to glue the paper grits onto. The paper can be glued with spray adhesive to the glass. I use 360, 600 and 1200 grit paper lubricated with water to provide excellent edges that will pass the hairy arm test. (Can you shave off a few hairs?) To restore an edge, just ten strokes on 360, then 600, and

finally 1200 grit will return an excellent edge. Depending on the steel of the blade, you may feel a wire edge form. Use one or two light strokes alternating front and back, until it breaks off. If you are really fussy, you can finish off with a strop. I recently found some 2000 grit paper (at Main Hardware just off the Harrow Road or Mooi St off-ramp on the M2) but I haven't tried it in place of stropping. Sometimes the paper is inclined to tear when pushing the blade against it, so care is needed. As value for money, this is the cheapest route to excellent edges. To retouch an edge, a few strokes on the 1200 grit paper may be all that is needed. If you are fussy such as for carving tools, then progress to 2000 grit or a strop.

Stropping. If you have visited a barber with a cut-throat razor, then you will have seen the barber refining the edge on a strop. Stropping is defined as the use of an abrasive embedded into a soft backing. A very fine abrasive is spread onto a backing such as leather or canvas. The edge is repeatedly drawn along the strop, away from the edge to avoid slicing the backing. If you have properly progressed from coarse to fine grits in sequence as described above, then final attention with a strop will give you an edge that easily passes the hairy arm test. Sometimes, as with the razor, all that is required to restore an edge is a few passes over the strop. Next door to Sharprite in City and Suburban, Johannesburg is a leather shop that sells off-cuts of good thick pieces of cow hide that I found make an excellent strop when rubbed with some honing compound such as the white compound suited for harder steels.

The "Scary-sharp" technique gives excellent results for little money, but as you spend more time sharpening, you may want to spend more money on more durable hardware.

Next on the hardness scale are synthetic and natural stones that are significantly harder than the basic oilstone. They can usually be used with water as a lubricant and anti-clogging agent, so they are less messy. Being harder, they require flattening less often, and come in very fine grades if required.

Diamonds. At the top of the hardness scale are the diamond stones. These are made from synthetic diamond grits that are nickel plated onto a steel substrate. Apparently the diamond grits are sourced locally and the plating is also done locally in South Africa, although DMT is based in the USA. Four grades are available: Coarse (black), Medium (blue), Fine (red) and Extra Fine (green) that correspond roughly to 220, 325, 600 and 1200 grits. Diamond, being the hardest material known to man, leads one to expect these stones would last a lifetime of normal use. Apparently, the nickel plating needs to be protected against corrosion and can be damaged by very hard, sharp edges so reasonable care is required in use – they are not indestructible. DMT diamond stones are available from a several sources such as Hardware Center and Sharprite. For the bench-sized whetstones, the best prices I have seen are from The Wood Craftsman in Edenvale (Scott and Caroline Myles) where they range from R400- to R800-. There are normal and super-flat stones available – the latter are guaranteed to a close tolerance such as for planer blades and are much more rigid. There are no worries about the flatness of your sharpening stone here – in fact diamond stones can be used to flatten other lesser stones.

I have a 12" coarse (black) super-flat diamond whetstone that I have used for purposes such as flattening the bottoms of cast iron planes and smoothing the edges of ceramic tiles, as well as the usual sharpening duties.

Planer blades. I recently replaced the blades on my planer/thicknesser. It is an Elektra Beckum HC 260K, fitted with the resharpenable High Speed Steel (HSS) 260mm blades. When I bought the machine, I bought a spare set of blades, which I recently fitted. I have wondered how to know when to replace the blades – I think I now know the answer: If it is still easy to cut yourself on the blades, then they are sharp enough (Don't ask me how I know this.) I compared the edges of the old and new, and there was a small but noticeable difference. I wouldn't say the new blades passed the hairy-arm test, but they were close. Once correctly adjusted, there was a noticeable improvement in the quality of the finish on a piece of pine with the new blades.

I had a go at sharpening the old blades. I used a DMT planer blade jig (R400- from the Woodcraftsman) to accurately reproduce the 40° angle. I checked the straightness of the jig against my super flat stone, and it was near perfect, within the tolerance of the thickness of the anodizing.

I used my coarse super-flat diamond stone, but it was slow going – the HSS seemed to work harden, developing a shine. I managed to get the one blade perfect, but the other had a small nick and after an hour of effort, I still hadn't fully flattened the edge, let alone removed the nick, so I gave up and took them to Austro. In future, if there are no nicks, then I will try to touch up the blades myself, but it is apparent that more than this is beyond hand sharpening.

Gouges and other strange shapes. Not all chisels have flat edges, particularly carving tools, which are available in a wide variety of shapes. If the bevel is on the outside, then, with care a conventional flat whetstone can be used, however you may find that a wire edge forms and needs a shaped stone for the opposite side to work it off. I spent an educational time watching Ken Bullivant show me how to sharpen a gouge with his collection of natural stones. His stones are fine-grained white pieces in a selection of shapes that are used to touch up edges for carving tools. Carving is one of Ken's particular interests, and sharp tools are vital, so he has stones and hones to keep them razor sharp. As Ken demonstrated, a good test of sharpness is a cross grain cut in some pine – if there is any tearing of the grain, then the edge is not sharp enough! He starts off with a coarser stone to shape the edge, progressing to his fine stones, and lastly to shaped leather strops to work on both the inside and outside edges. He uses a light honing oil with his stones.

An alternative to shaped stones, is to wrap fine wet/dry paper around a wooden former such as a cone, matching the shape of the edge you need to sharpen – not as durable, but quite workable. A shaped strop can be formed in the same way – Ken has a conical leather strop that will cope with different gouge sizes by using the appropriate cross section to match the gouge.

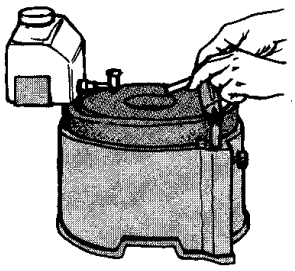
Machines for Sharpening

There are a number of machines on the market for sharpening, ranging from simple bench grinders to the more specialized slow running whetstone grinders. These are great labor savers – you can manage without, but depending how you value your time and how much you hate manual sharpening, you may want to spend money on a grinder.

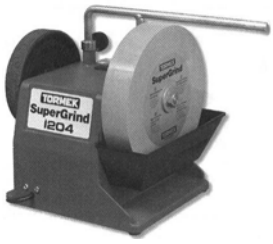
The most common and general-purpose grinder is the double-ended bench grinder, typically fitted with 60 and 80 or 100 grit grey alumina wheels. These have a multitude of uses in the workshop. With care, most sharpening tasks can be accomplished with the finer wheel, particularly if you take care not to overheat the edge.

There are a variety of bench grinders to choose from. I recommend at least a 6" (150mm) wheel size, with 25 mm wide wheels, if possible. For sharpening, power output doesn't seem to be an issue – if you are demanding too much from the grinder, then you are probably about to burn the edge anyway, so a lighter touch is required. The model I chose is the Ryobi with 150mm x 25mm wheels. It has a built in lamp, which is useful when trying to grind accurately (particularly as few of us have the eyesight we once had). It was R400- from Makro when I bought mine, but last time I looked they were over R700-. One of the wheels supplied is a 100 grit grey wheel, which is fine for defining edges, prior to moving to finer grits and hand sharpening. I fitted a grinding jig, which is adjustable for angle, by bolting the grinder and the jig to a small sheet of melamine-coated chipboard. The jig lets me make a more consistent edge without having to squint from the side while grinding to check the angle between the edge and the stone. The jig I have is from Axminster (£18-) (see right). It is a bit flimsy for grinding wide blade edges, but fine for turning tools. Lionel Soekoe is offering one that he makes for sale. It appears to be more rigid than the one I have and looks a good buy.

More specialized are the whetstone grinders with a horizontal wheel (see right) or a vertical wheel such as the Tormek (see below). These are specially designed for sharpening. A whetstone grinder turns slower and cools the tool to prevent overheating of the edge. The Tormek has an array of jigs to help with sharpening a variety of edges – I can't report from personal experience on the Tormek. Record Tools are the importers and our club chairman will be able answer any questions that you may have.



Sharpening of turning tools tends to be a cursory affair. Frequent resharpenings are usually required, so a quick pass over the grinder is usually all that is required. When you feel a tool requires more pressure than usual to make a cut, it is probably blunt – time to step over to the grinder.



Many turners sharpen free hand, although a jig can help to keep consistent angles. A basic grinder with a grey wheel somewhere between 60 and 100 grit can achieve perfectly acceptable results with care.

In the first section I referred to the case where coarser edges are sometime preferred – turning tools are one case. Also, a slight burr as left by a grinder seems to work better on a scraper. This sort of coarse edge has the cabinet maker reaching for a slip stone to hone off the burr and fettle it to a smooth, keen edge - the better to leave bare patches on forearms. This turns out to be unnecessary in most cases – the amount of material removed on a lathe quickly blunts this fine edge. Only for a final finishing cut may a fine edge be worthwhile, and by then most turners have reached for the sandpaper.

With modern high-speed steel turning tools, the danger of turning the edge blue and consequently reducing the hardness is much reduced. With the older or cheaper tools (carbon steel), this still needs to be guarded against when using a high speed grinder – as the edge becomes sharper, the amount of metal available to conduct away the grinding heat becomes too little. It is then easy to overheat the edge and lose the hardness on tools not made with high-speed steel. You will see that this has happened by the blue oxide discoloration at the edge. If you decide to use a wet grinder such as a Tormek, then this is not usually a problem because the wheel is turning more slowly and it is wet, which cools down the edge. Another alternative is to fit a white or pink wheel to a conventional bench grinder. These wheels are slightly softer than the grey wheels, giving a finer finish with less risk of “burning” the edge. Due to their softness, they are less suited for use for general workshop grinding, as they will need truing more often.

If you do accidentally overheat the edge, thereby losing some of the hardness in conventional steel, you could carefully grind away the blued part to return to harder steel. Alternatively, you could just accept that this part of the edge will need more frequent resharpening, until it has been ground away in normal use.

There is a knack to sharpening turning tools quickly. You will get plenty of practice, so it is worth devoting a little thought beforehand to getting it right. It is worth watching experienced turners to see how they do it. Like any aspect of woodworking, sharp tools are essential for turning.

With the horizontal whetstone, or the Tormek and the appropriate jig, hand plane and mechanical planer blades can be accurately sharpened when needed. For a blade for use in a machine, the resulting edge is probably good enough, but for a hand plane blade, some attention with a finer grit afterwards, such as 1200 may be needed to produce a very fine edge.