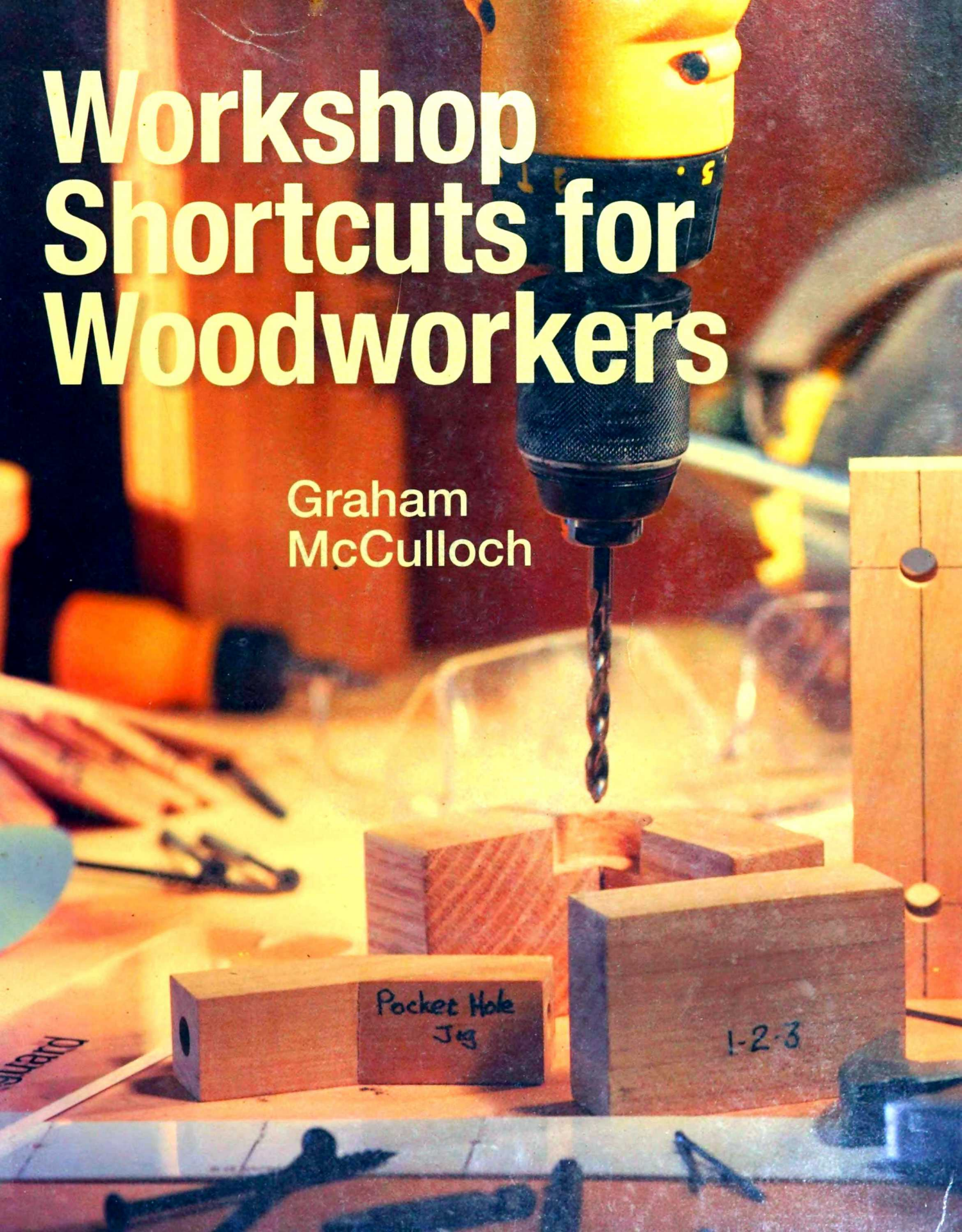


Workshop Shortcuts for Woodworkers



Graham
McCulloch

Pocket Hole
Jig

1-2-3

Workshop Shortcuts for Woodworkers

**Graham
McCulloch**



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Dedication

*To my wife
Gwen
and to my grandchildren,
Jeremy, Meagan, Ryan, Serena, and Chiara.*

Acknowledgments

My sincere thanks to Dylan Edwards for his masterful control of the computer. Dylan did all of the computer-generated illustrations in the book and, as you can see by just thumbing through it, it was a formidable task. Dylan owns Rootwood Studios in Halifax, Nova Scotia, and you can see more of his work at <http://www.geocities.com/rootwood>.

I would also like to thank the inventors of digital photography. Twelve years ago, I started working on my first book *Ingenious Shop Aids & Jigs*. Wilf "Woody" Woods and I spent hundreds of hours doing the black-and-white photography for it. We would shoot a couple of rolls of film, get the negatives processed, and then go to the lab and start printing them. We would then review them, accept or reject them, and then it was back to the shop for reshooting. This process was repeated 20 or more times. The editors at Sterling wanted some changes, so back to the shop and lab we would go.

The photography that you see in this book was done in a tenth of the time using digital photography. My shop is just downstairs from my computer, so I walk down to the shop, set up a shot or two, and almost immediately I can review it, crop it, adjust the color tones, and save it on a disc. What a timesaver!

DISCLAIMER: The text, photographs, and drawings in this book may show and describe methods and procedures that could be injurious if common safety precautions are not adhered to. The author strongly suggests that you comply with all safety standards before undertaking any of the techniques appearing in this book.

Some of the tools depicted here are shown with the safety guards removed. This is done only for the clarity of either the photographs or the drawings and must not be construed as the recommended procedure.

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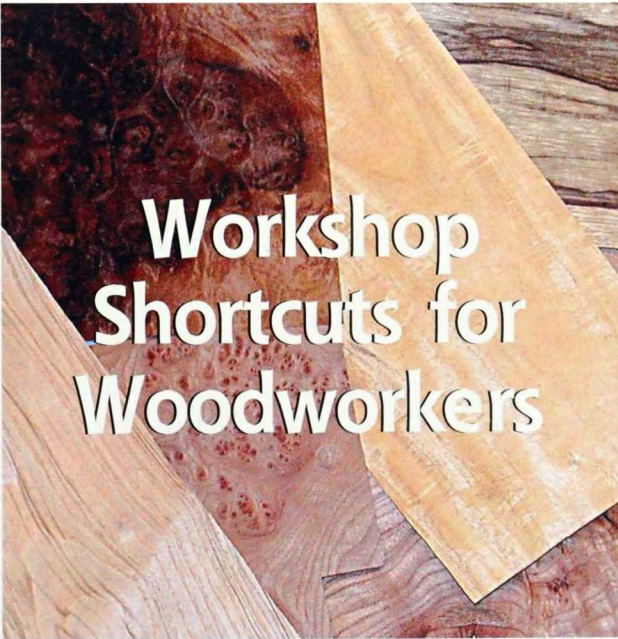
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Workshop Shortcuts for Woodworkers



Introduction

I cannot remember when I did not love working with wood. Oh, there are times after a bit of a screwup when I wished, for the moment at least, that I had another hobby. On the whole though, woodworking is my second love.

Over the years I have had many woodworking shops and have had the good fortune to work with some of the finest and most talented woodworkers. My profession as an interior and architectural designer has helped me appreciate the beauty and versatility of wood. And, after designing projects and then seeing them through to the finished product, I gained a great deal of respect for the woodworkers who did the actual work.

In my later years I became involved in the design of trade show exhibits and decided that I wanted to have a “hands-on” feel of the work rather than have the work contracted out. This became my first commercial workshop. It grew over the years until I decided that it was time to make woodworking a hobby and give up the commercial part of it. My shop is now considerably smaller and in my basement, so the sawdust is closer to home.

In the 60 or so years that woodworking has been a part of my life, I have always searched for a better and easier way of doing things around the workshop. This book is a culmination of my search. Many years before the advent of the desktop computer, I used to write the various shop tips that I had learned on small recipe-like cards and file them alphabetically. They were filed according to the tool that they were used for, and that is how this book is written: in an encyclopedic style for quick and easy referencing.

This book won't show you how to build an entertainment center or new kitchen cabinets. It will, however, show you how to build those projects easier, quicker, and better. At least that is my aim.

I hope that you will keep this book on or near your workbench and that you find it useful in your workshop.





1

Planning A Basic Workshop

The best workshop is the one that works best for you. You are the one who will be spending hours of leisure time in it, and you must feel comfortable. This chapter deals with time-tested methods of setting up a home woodworking shop that will prove helpful to first-time practitioners and more-advanced woodworkers.

The first step is to decide where to put your new workshop and then draw up a plan using one of the simple computer-aided design programs available. The first criterion is that there must be easy access to the outside. A window or windows for outside ventilation and exhaust is also a must.

The most efficient workshops are those built to work in a U-shaped configuration as this allows the raw material to enter the area and then proceed around the U in a natural progress of production. Using this proven layout, you would start with lumber storage being close to the door. A table or radial arm saw would be next, followed by a large workbench for layout and construction, and then an auxiliary bench to place the bench-top tools such as a drill press, band saw, router table, scroll saw, etc. A thickness planer on a mobile base will prove to be a money saver, as rough lumber costs less than dressed wood.

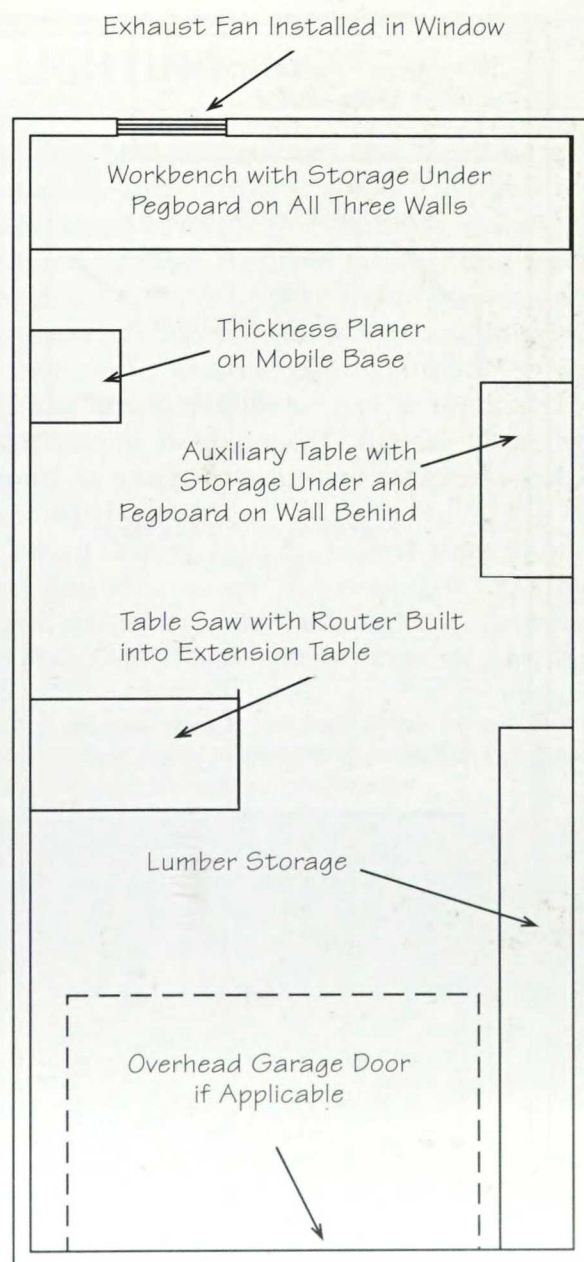
Placement of the stationary tools is important, as you will probably be working with eight-foot-long material. To do this efficiently, you will require at least an eight-foot clear space on either end of the tool. Having your workbenches all at the same height as the table saw is important, as these surfaces can be used for either an in-feed or out-feed table for the various stationary tools that you may acquire.

The basic home workshop as seen in 1-1 is a 10 x 20-foot space that can occupy a basement or a single-car garage and can work quite efficiently if properly laid out. Utilizing the walls by installing pegboard, installing a router under the table-saw extension table, or by putting stationary tools on mobile bases will all make your home workshop work.

Sawdust is a major factor that has to be addressed in any workshop but more importantly in a home

shop. There are several ways to exhaust the dust and to prevent it from entering the living space. An efficient exhaust fan installed in the window area is one solution; a mobile dust collector is another. The latter can be moved from machine to machine as they are being used.

One other dust alleviator that should be con-



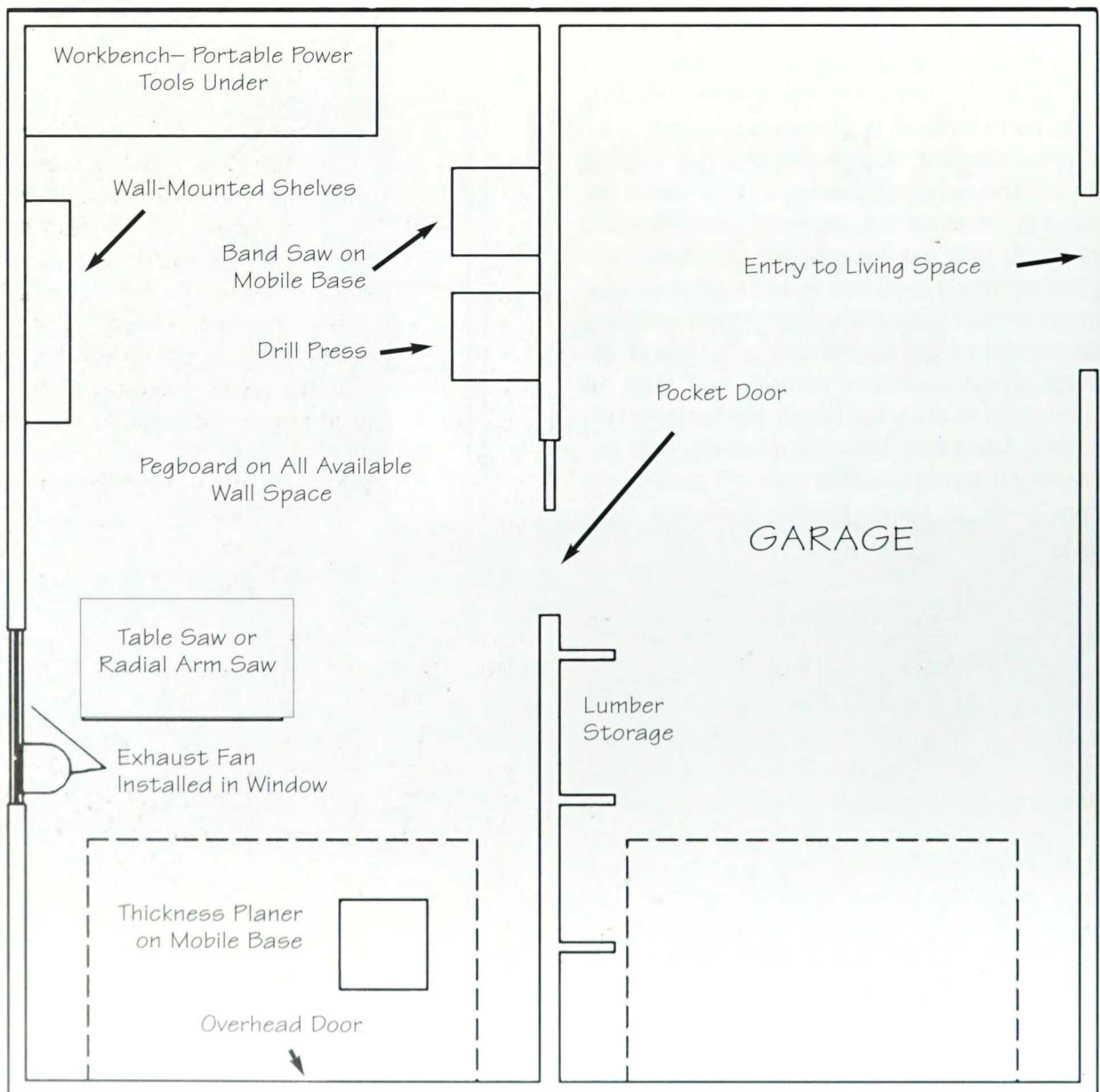
1-1. The layout of a basic workshop.

sidered is to have an overhead dust filtration or air cleaner unit installed. (See Air cleaners on page 165.) This unit will remove about 99 percent of the airborne dust, but don't stop there. If there is a doorway to the living space, make sure that there is no gap when the door is closed. Install a door sweep and foam tape around the perimeter of the doorjamb. Check the walls and seal any gaps that dust can go through.

Forced-air heating or air-conditioning systems

can present another problem in a home workshop. Chances are that there will be an air return in your shop area and, of course, this will bring sawdust back into your furnace or air-conditioner's filter. You can easily adapt a workshop air cleaner's filter to the return vent to prevent this.

Before moving any of the tools or benches into the space, give the entire area—including the floor—several coats of paint.



1-2. A two-car garage makes use of one side and part of the other as a workshop. Wood storage takes little space in the garage side.

THE TWO-CAR-GARAGE-WORKSHOP

The double garage is perhaps the ideal situation for a home workshop if you are willing to leave one of your vehicles parked outside (1-2). It does, however, mean that some preparatory work will have to be done. For example, a floor-to-ceiling wall will have to be built to divide the area. A pocket door between the two spaces will conserve space and, as referred to previously, the area should be sealed and painted prior to moving in.

Wood storage can be set up in the garage area, as it probably will not interfere with parking. I purposely made the plan with the workshop on the far side of the double garage to further alleviate the possibility of sawdust entering the living space. Needless to say, an air cleaner and a dust-collection system should be installed. As a matter of fact, you may want to exhaust the air cleaner out of the window. This has two benefits: it will clean the air in the workshop and will not disturb the dust inside the shop. Of course, in either of the two plans it is assumed that in the warm summer months the overhead garage door will be open—and that will almost totally eliminate the dust problem.

FLOORS AND CEILINGS

Almost any type of standard flooring will suffice for a workshop provided it is solid and will support the heavy machinery without flexing. From years of experience however, I have found that a concrete floor is best; it is solid and, when painted, will provide a smooth surface for easy scrap and dust cleanup. Any good floor paint will do, but I have found that a paint containing epoxy is the best because it will wear like iron.

In the event that you do not have a full ceiling in your garage, I strongly suggest that you install one. A ceiling of either gypsum (plasterboard) or acoustic tiles will help keep both noise and dust out of the living space. It is best if you insulate with

fiberglass between the joists and then install a polyethylene vapor barrier to further negate dust and noise infiltration.

If you are heated (or cooled) with forced air and there are heating ducts in the new workshop area, they should be wrapped in fiberglass and a flapper installed in the ducts to help prevent both the noise and dust entering the system. The air return should be relocated or an efficient filter installed at the intake.

LIGHTING

Lighting, both ambient and task, is crucial in the workshop. Two or three 2 x 4-foot fluorescent fixtures should be ample in most home workshops as ambient lighting. However, task lighting is really important both as a safety factor and for project accuracy. It is very difficult to see those pencil lines if they are in shadow. Task lighting is the direct lighting of a workspace or tool in the form of an incandescent or fluorescent fixture. These lights should be placed above every stationary tool and your workbench.

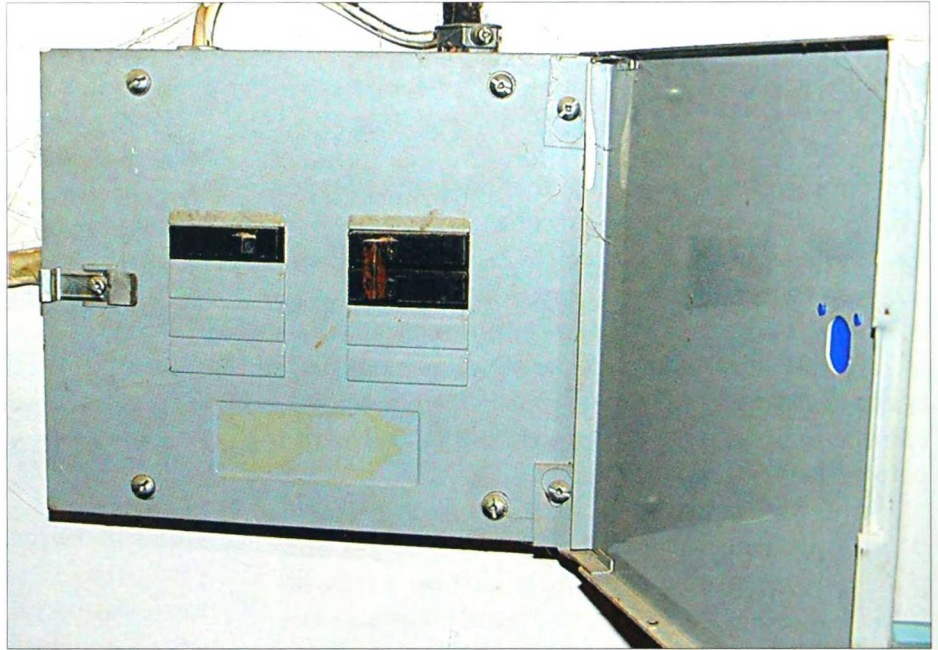
I used drapery track to suspend three incandescent fixtures over my bench so that I can move them directly over the project that I am working on (1-3). Individual light switches are fine, but it

1-3. A drapery track is installed on the ceiling with incandescent lights suspended from it. The lights can be moved to concentrate on your work.





1-4. A gooseneck lamp such as this will help in wood finishing as well as bringing more light to the job at hand.



1-5. Surprisingly, it is not that expensive to add a new panel to your existing electrical service. This would give you separate circuits for those stationary tools and additional outlets for your hand power and bench-top tools. Some stationary tools will require a dedicated circuit because of the power they draw, and some tools require a 220-volt outlet. This additional circuit-breaker panel will solve all of these problems.

will be more convenient to have a separate power supply with circuit breakers to turn on the power in the shop.

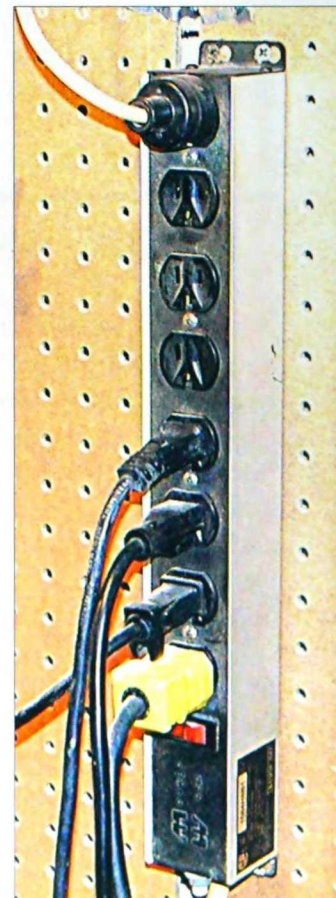
A couple of gooseneck-type task lights will prove to be extremely handy around the shop (1-4). In addition to supplying more light to the immediate task, they can be very useful in the final finishing process. Angle the light low across your work to identify areas on the workpiece that need additional sanding, stain, or finishing. A halogen bulb will provide truer (whiter) light for finishing work.

ELECTRICAL SYSTEM

There is nothing more frustrating than turning on a machine in your workshop only to find that the circuit breaker has tripped because your spouse is using a vacuum cleaner that happens to be on the same circuit. Adding new panels to your electrical service will prove helpful (1-5).

Hand power tools are generally used throughout the shop and there should be power outlets placed to look after this. Some shops that I have visited have outlets suspended from the ceiling on some sort of spring that raises them when they are not in use. Most of these have individual circuit breakers on them (1-6), and this is a major convenience if your electrical panel is not handy. Get power bars with at least six outlets, especially when installing them near your

1-6. At the workbench there is nothing more convenient than a power bar with a built-in circuit breaker.





1-7. This exhaust fan is in a window well; a lever raises the well cover when the fan is turned on. I have found that this type is the most efficient in the moving of air. The other advantages are that they are relatively quiet and restrict pests from entering through the opening.

workbench. You will probably want to keep battery chargers plugged in for those cordless tools that you acquire.

VENTILATION AND SAWDUST COLLECTION

Clean air in a workshop is extremely important. Sawdust could have the same effect on your lungs as cigarette smoking. There are many ways to ventilate the workshop and most can be done at bargain prices.

There are a large number of building-supply companies that deal in recovered and surplus products, and they would be a good source for "squirrel-cage"-type fans (1-7).

Sawdust collection is so economical these days, a dust-collection system should be one of the first things to buy. The small home workshop does not



1-8. This two-stage dust collector will control sawdust in most small workshops.

require a major installation of pipes and gates; a small two-stage dust collector on wheels is usually sufficient (1-8). You simply connect it to the stationary tool that you are using.

You can add adapters to fit almost any tool and even add a "floor sweep" to your workbench. The floor sweep is a wide attachment that you can screw



1-9. An air cleaner such as this will rid your home workshop of airborne sawdust.

to the bench where you do your sanding; this will help keep the air clean.

One other solution for the workshop is the overhead air cleaner (1-9). These are available at most home improvement centers, and they will filter and clean the air many times in an hour. If you plan to

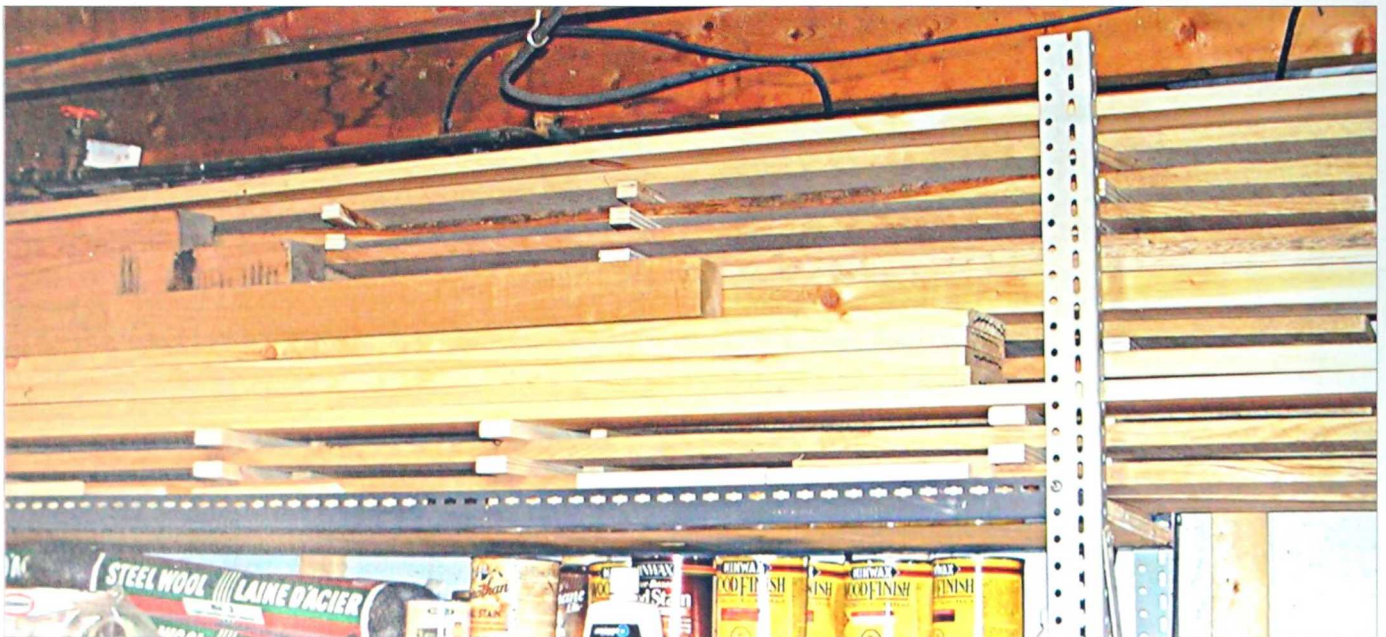
do any finishing within the shop area, then you will soon find out that keeping a sawdust-free shop is most important.

LUMBER STORAGE

One of the biggest problems with a small home workshop is the storage of lumber and sheet goods such as plywood and paneling. In the illustrations above, I have shown that the storage should be close to the main door of the shop. You will find that this is most convenient, especially when unloading it and when starting a project. If your tools are laid out as suggested, the lumber will be right at the beginning stage of your project.

Plywood and other sheet goods should be stored on their long edges and kept vertical. Cantilevered supports can then be mounted on the wall above and should be spaced every 16 inches. Lumber can be very heavy, so there should be as much support as possible.

Lumber should be stored flat and, as long as it is dry, may be normally stacked. If the wood has a moisture content between 10 and 25 percent, the boards should be stickered (1-10). This is done to



1-10. Lumber should be stored flat, and those boards that are not quite dry or need acclimatizing should be spaced to allow for air circulation.



1-11. Hand tools can be stored in a shop-built cabinet.

most important thing about tool storage is knowing where that specific tool is when you need it. You may choose one or more ways such as a toolbox, metal tool cabinet, shelves, a home-built cabinet, or pegboards.

The best way I have found of storing tools is through the use of a home-built tool cabinet (1-11) and plenty of pegboard walls (1-12). Pegboard is a great way to cover up concrete foundation

allow air to circulate through the boards to hasten the drying process. Stickers are simply strips of $\frac{3}{4}$ x 2-inch wood that are placed between the boards at 24-inch intervals. The stickers should all be in a vertical alignment in the stack.

Lumber that is still “wet” or “green” should *not* be brought into the workshop. Find a sheltered area outside, sticker the boards, and let them dry outside. Normally it will take one year per inch of thickness to bring the wood down to a 15 percent moisture-content level. A workable moisture content for say, interior furniture work, should be 7 to 8 percent.

Wood is in a constant state of movement due to the moisture it expels or absorbs due to changes in its environment. Therefore, buy lumber for a furniture project several weeks in advance of the actual construction to allow it to acclimatize in your shop environment; this is especially true if your lumber supplier keeps its material in an outside yard.

TOOL STORAGE

There are so many ways to store hand tools, and believe me when I say that you want to choose the most flexible method for the way you work. Whether you are starting your hobby workshop early in life or as a way of keeping busy in later years, you *will* accumulate more hand tools. The



1-12. Pegboard walls are an effective way of storing tools.

walls, but there should be a vapor barrier placed on the interior foundation walls first. This will minimize rust-creating moisture in the shop. Pegboard should be installed before you position your stationary tools.



1-13. This strobe light flasher will alert you in a noisy workshop.

TELEPHONE

If a telephone in your workshop is important, one of the most effective additions to it is known as a Shop Flasher (**1-13**), available at woodworking tool shops. The Shop Flasher has a microphone that attaches to your existing phone. When the phone rings, the Flasher amplifies it and activates a strobe light to get your attention.

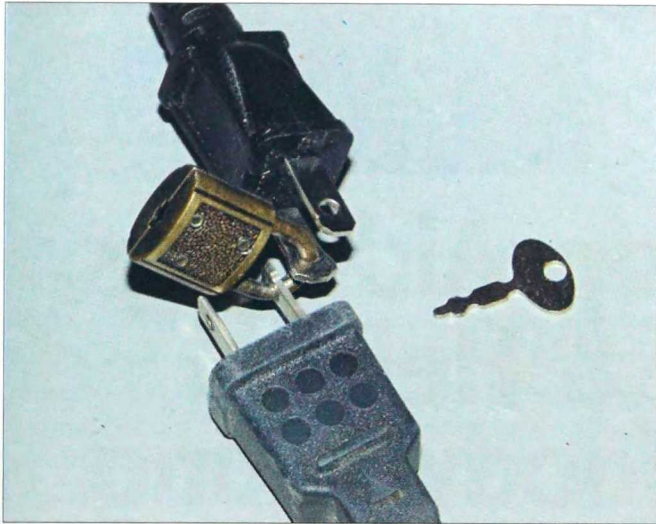
SAFETY GUIDELINES

In a millisecond you can lose a finger, eye, or hand in a workshop. Sadly, I have seen it done. In each case, it was through the negligence of the woodworker. The main causes of workshop injury are lack of attention and haste. Do not rush that job and pay very close attention to what you are doing. Follow these instructions:

- Do not go into your workshop or operate power tools while under the influence of drugs (prescription or not) or alcohol.
- Know and fully understand the operation of the tools that you are using (this includes familiarity with the owner's manual) and make sure that all of the tool safety devices are working and in place.
- Avoid distractions while working with power tools. Even a slight distraction can be extremely dangerous. In the split second that your eyes leave the work, a disaster could occur. In a home workshop, members of your family should be aware of the dangers of entering the shop when tools are operating. A simple sign saying **DO NOT ENTER IF TOOLS ARE RUNNING** on the entry door will help as a reminder.
- Wear the correct safety equipment, glasses or goggles, dust mask, and hearing protection (**1-14**). Remember that some wood species may be highly toxic and could affect the respiratory system, eyes and/or skin. Some of the subject matter in the following chapter addresses safety concerns.



1-14. Use the appropriate safety equipment when working.



► If there are children around, take special precautions. Young children are a curious lot. They love to experiment and play and do not realize that a sharp chisel or saw blade will quickly remove a finger or worse. Keep your workshop locked when not working there. Disconnect all of your stationary power tools; remove and hide the safety switch that most

1-15. This simple padlock will prevent unsupervised use.

are equipped with. Having your shop on a separate circuit-breaker panel that can be locked is another deterrent. Portable power tools are easy to plug in and all children seem to learn this very quickly. A simple inexpensive padlock can be fed through the plug prongs to prevent unsupervised use (1-15).

While on the subject of children, one of the greatest things you can do is pass on your knowledge of woodworking to them. Encourage them to work with you in the workshop. First and foremost, teach them to respect the inherent dangers involved in the handling of all tools and other materials. Teach them to respect the tools and appreciate their usefulness and emphasize to them that adult supervision is required (1-16). With proper guidance, you'll have your child making compound miters and dovetail joints in no time at all.



1-16. Kids love to follow their parents' examples. Teach your children the proper woodworking safety techniques and maybe start them off with a tool kit like this.



2

Shop Aids, Jigs, & Helpful Woodworking Techniques

ABRASIVES

(Also see Belt Sander, Random Orbital Sanders, Sanding Belts and Drums, and Sanding Techniques)

The term “abrasives” is a generic one that covers a wide variety of products that remove material (2-1). These include powders such as pumice, emery, and rottenstone. The term also includes sandpaper in all of its various forms: sheets, discs, drums, pads, and belts. The sheets and discs can be adhesive-backed or hook-and-loop discs that are more conveniently installed. (See page 30.)



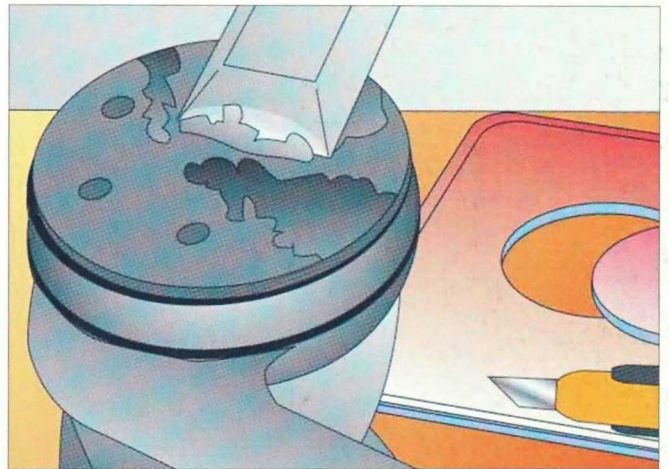
2-1. A wide variety of products can remove material and smooth wood.

Steel wool is also a form of abrasive and available in seven grades from coarse to extra fine. (See pages 35 and 36.) The grades start from #4 (coarse) to #0000, which is extra-fine. Synthetic materials have all but replaced steel wool because the residue from it will leave rust spots in water-based wood stains and finishes. Synthetics do the work of steel wool more efficiently and last longer. These synthetics are available in either sheets or in wool form. (See pages 36 and 37.)

Sander Pads

Replacing Sander Pads (#1)

The pads on some sanders that accept sticky-back sanding sheets can eventually get gummed up and will no longer accept the sandpaper. Rather than going to the repair shop, go to a computer store and pick up a mouse pad. Cut it to fit your sander and glue it on with rubber cement (2-2).



2-2. A mouse pad makes a good sander pad.

Replacing Sander Pads (#2)

The hook portion of the Velcro pad on sanders often wears out and becomes ineffective. Replacement pads are available that simply stick on (2-3).



2-3. Replacement pads are available for hook-and-loop sanders.

The old pad must, however, be removed and this can be done *very carefully* with a utility knife or with an adhesive solvent (2-4).



2-4. Either a utility knife or a solvent can remove the old pad.

Sanding Discs

Hook-and-Loop Sanding Discs

The hook-and-loop sanding disc has all but superseded the adhesive-backed sandpaper (2-5). The reason is simple. Hook-and-loop sanding discs can be used over and over again, whereas the adhesive-backed products get contaminated with sawdust quite quickly and the backing loses its stickiness.



2-5. Hook-and-loop sanding discs can be reused more readily than adhesive-backed discs.

Maintaining Sanding Discs and Belts

Most woodworkers use crepe rubber blocks to clean sanding belts and drums to extend their life. These same crepe rubber blocks can also be used on sanding discs. Apply the block to the moving sanding disc or belt to more than double the abrasive life (2-6).



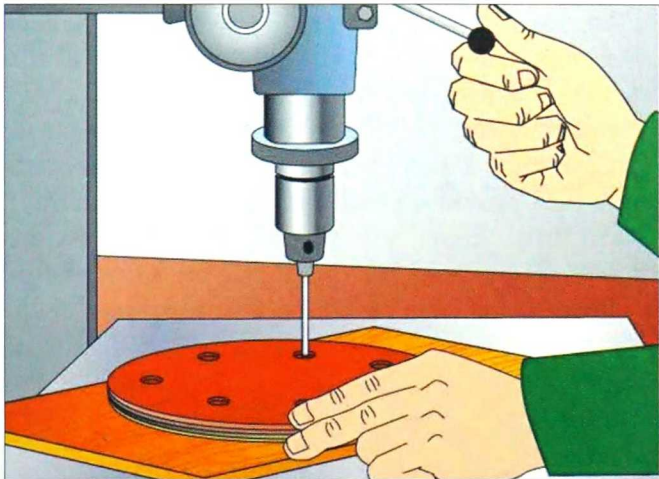
2-6. The crepe rubber block cleans this sanding belt and will more than double the life of abrasives on all types of sanders.

Perforating Sanding Discs

Perforated sanding discs are more expensive than the plain ones. You can do your own perforations. A template made from a scrap of plywood to indicate where the holes should be for your sander will suffice. Clamp the discs between the template and a piece of scrap and drill with the appropriate drill bit (2-7).

Removing Sanding Discs

Those pressure-sensitive adhesive-backed sanding discs go onto the sander quite easily, but are tough to remove. No matter how careful you are, they



2-7. Nonperforated sanding discs are less expensive. Doing your own perforations on these sanding discs will save money.

always seem to tear and leave little bits stuck to the surface.

Next time you have to replace one of these sanding discs, turn your machine on and sand a couple of scraps of wood. This will heat up the disc. Turn off the machine and unplug it. Now, peel off the disc. You will find it a much easier and neater task when the adhesive is warm (2-8). Another way to warm up the adhesive is to use a heat gun.

Before placing a new disc on the wheel, use a little solvent to clean the wheel first. Make sure that the wheel is metal and not a plastic substance. Otherwise, the solvent may eat or melt the plastic.



2-8. Adhesive-backed sanding discs can be removed more easily and cleanly when the adhesive is warm.

Storing Sanding Discs

Most random orbital sanding discs sold these days are the ones that are perforated for sawdust removal. The $\frac{3}{8}$ -inch-diameter holes in them fit nicely around a dowel, and the dowels can be screwed to a scrap piece of plywood with the dowels spaced to hold several different grits (2-9). If the dowel gets too full, put a nail or a screw on an angle in the end of it. Use a felt marker to indicate the grit size on each peg.



2-9. Storing perforated sanding discs on dowels keeps them in order and makes it easier to find the right grit for the job at hand.

Here's one more way to store those 5-inch sanding discs. Office supply stores sell plastic storage boxes for storing CD-ROMs; these boxes usually

come complete with index tabs. You can fit several hundred sanding discs in one box and you can mark the tabs with the grit numbers (2–10).



2–10. CD-ROM storage boxes are a convenient way of storing sanding discs.

Sandpaper

Close-Coat and Open-Coat Abrasives

Modern coated abrasives (sandpaper) have a flexible or semi-rigid backing to which abrasive grains are bonded by an adhesive. The usual backings used in the manufacture of sandpaper are cloth, paper, vulcanized fiber, polyester film, or a combination. The most common abrasives being used today are zirconia alumina, ceramic aluminum oxide, aluminum oxide, silicon carbide, garnet, emery, crocus, diamond, and chrome oxide.

Coated abrasives are generally made in two levels of abrasive grain surface density: close coat and open coat. A close-coat product is one in which the grains completely cover the surface of the backing. The greater number of abrading points per square inch normally results in a large amount of material being removed before the product becomes worn and unusable.

An open-coat product is one in which the abrasive grains cover about 50 to 60 percent of the backing. Open-coat products offer greater flexibility, but may not provide as good a finish as close-coat products. Open-coat sandpaper frequently cuts faster and provides greater resistance to “loading.” Wood finish coats, soft metals, and fiberglass are typical applications for open-coat products. Power sanders, with their high speeds, generate heat, and open-coat sandpaper dissipates heat faster. Sandpaper used for power sanders should be the open-coat type.

Grades of Sandpaper

Sandpaper may be graded in one or all of three ways. This grading system can confuse the home woodworker. The information provided in this section will help clarify this system.

The grading of a sheet of sandpaper is found on its back and has either one of two numbering systems or a word description. **Table 2–1** presents a sampling of these systems.

Table 2–1

GRIT NUMBER	DESCRIPTION	O/O NUMBER
50	very coarse	1
60	very coarse	1/2 to 0
80	coarse	1/0
100	coarse	2/0
120	medium	3/0
150	medium	4/0
180	medium	5/0
220	fine	6/0
260	fine	7/0
280	fine	8/0
320	very fine	9/0
400	very fine	very fine

The grits increase in numbers up to 1,200. Sandpaper that is 1,200 grit is considered ultra-fine. Thirty-six-grit sandpaper is industrial-grade sandpaper.

The 0/0 numbers are called “oughts.” This is an old system of rating sandpaper. For example, a fine grade of sandpaper is called eight-ought paper.

Jigs for Cutting Sandpaper

With these jigs, you will save a lot of time cutting sandpaper. To make them, cut a piece of hardwood or plywood to the exact size of your orbital sander. Miter the long side. Drill a hole at the top center for pegboard hanging, and you now have a jig for cutting sandpaper to fit your sander (2-11).



2-11. Using these jigs will simplify the cutting of sandpaper for your one-quarter-, one-third-, or one-half-sheet orbital power sanders.

Sandpaper Workshop Guidelines

You should rarely use coarse sandpaper in your workshop. These types of sandpaper cut too deeply into the wood, and the cuts are extremely difficult to remove. If your tools are kept sharp, your first sanding should be with a medium (120 to 180)-grit sandpaper.

If you are using an orbital sander, run the sander in the direction of the grain and use nothing lower than a 120-grit sandpaper.

A high-speed orbital or palm finishing sander should not be used with anything lower than a 180-grit sandpaper, as it will slow the machine down and work it too hard, resulting in a possible motor burnout. Generally, if there are "swirls" on the stock after sanding, you have probably applied too much pressure on the sandpaper.

Types of Sandpaper and General Applications

In addition to the various grit numbers on sandpaper, there are a number of different sandpaper types, as previously mentioned. A general rule of thumb for the various grit types and their common applications is shown in **Table 2-2**.

Table 2-2.

GRIT TYPE	GENERAL APPLICATION
Aluminum oxide	Softwoods and hardwoods
Emery paper (wet or dry)	Between finish coats or on soft metals such as aluminum
Flint paper	Softwoods
Garnet paper	Soft to medium hardwoods

Used-Sandpaper Applications

Don't throw away those used sandpaper sheets, pads or discs; save them, as they can be used for hand-sanding jobs. After they have been used on power sanders, they become more pliable and can be used in tight corners and for lathe work.

Sandpaper Belts and Drums

Cleaning Sandpaper Belts

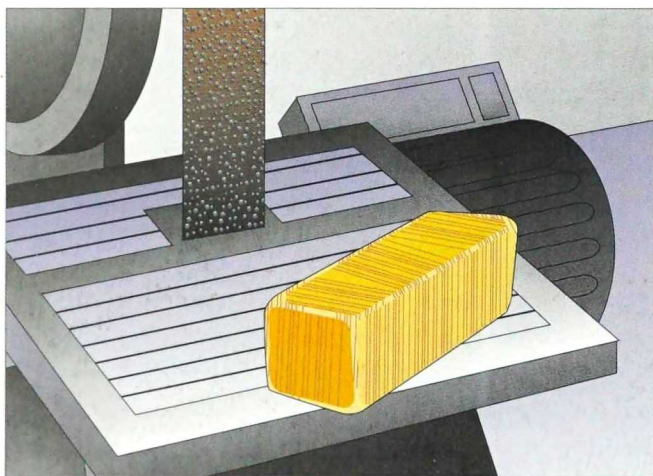
If your sanding belts look like they are on their last legs, there might still be some life left in them. Use a brass brush with some oven cleaner to remove the tar and resin that builds up on the belts (2-12). The oven cleaner will not harm the abrasive or the adhesive.



2-12. Oven cleaner will dress up an old sanding belt.

Maintaining Sandpaper Belts and Drum Tubes

Sandpaper belts and drum tubes are expensive and you want to get as much use out of them as possible. To do so, here are a couple of ideas: crepe rubber blocks are inexpensive and using them to clean the belts or tubes will greatly extend their lives (2-13). With the tool running, carefully press the block against the abrasive and watch the burnt-in sawdust and wood resins disappear.



2-13. A crepe block can be used to remove all of the residue that has built up on the sanding belt.

A further sandpaper belt lifesaver is to remember to release the pressure on the belts when you have finished using the belt sander. If you leave the pressure on them, they will soon stretch to their maximum and will cause both tracking problems and tightness at the platen. Uneven sanding could be the result.

With sandpaper drum tubes, it is best to loosen up the nut that compresses the rubber drum after each use. The heat buildup created by the spinning tube will bond it to the rubber drum and make removal difficult.

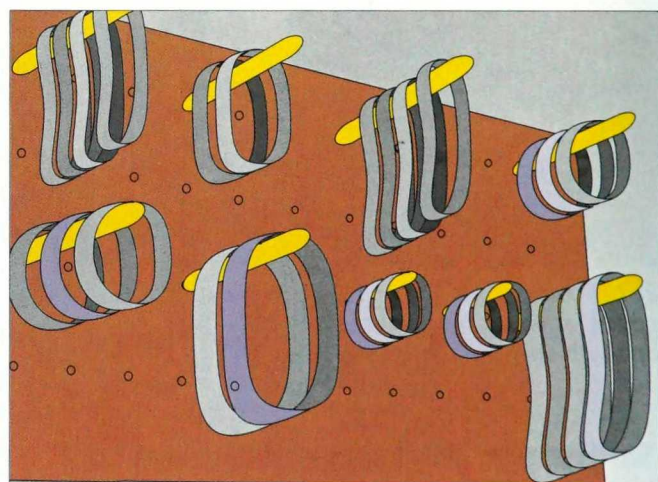
Purchasing Sandpaper Belts and Drum Tubes

The best type of sandpaper to use in belt or drum form is open-coat zirconia alumina. Open-coat aluminum oxide is also good. The same rules for pur-

chasing sheets of sandpaper apply to purchasing sandpaper in belt and drum form. (See below.)

Storing Sandpaper Belts and Drum Tubes

Sandpaper belts and drum tubes need to be stored properly. Throwing them into a drawer or bin may crack the adhesive holding the grit and will shorten their lives. I cut some dowels (broom handles will do as well) and screw them through the back of pegboard. The belts can be interstacked to save space; the tubes require more lengthy dowels. Keep the belts arranged by grit and length (2-14).



2-14. Hang sandpaper belts and tubes on dowels screwed to pegboard to prevent them from being flattened out.

Sandpaper Sheets

Purchasing Sandpaper Sheets

The biggest problem that the home woodworker has when purchasing sandpaper by the sheet is determining which type of sheet to buy. First, do not buy sandpaper that does not have a grade number; for example, 120, 240. There does not seem to be an industry standard as to what grits are being used when the paper is labeled "Fine," "Medium," "Coarse." A "medium" sheet of sandpaper can have grits ranging from 36 to 1,200. Quality products have the company's brand name on them, a grit number, a label (for example, medium), and a brief

description of the product and what the product is recommended for. The woodworker should avoid purchasing unlabeled sandpaper. It is very difficult for the untrained eye to determine the difference between some grit sizes and types.

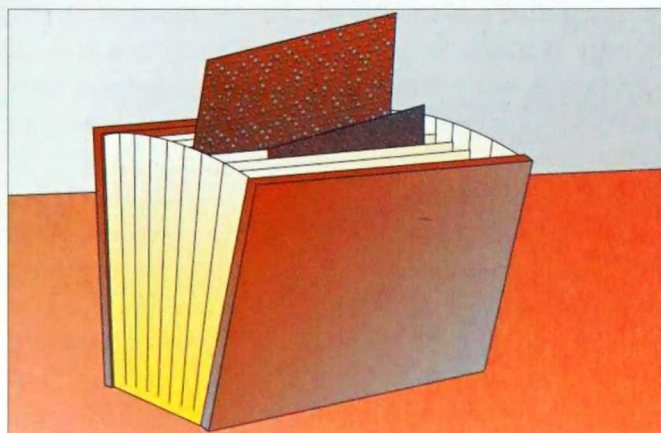
For woodworking and treated (primed, sealed, lacquered, or painted) surfaces, two good types of sandpaper to use are open-coat garnet and open-coat silicon carbide. The *best* types to use are open-coat aluminum oxide and open-coat zirconia alumina.

The weight of the paper backing also is a factor when selecting sandpaper. Both have to be durable. For example, thin backing would not last long in a high-speed palm sander.

Every abrasive manufacturer has a different name or code to identify its vast array of backings. The best way to determine if sandpaper has a suitable back is through trial and error. If you find that the paper tears or breaks down prematurely, make note not to buy it again. Also, be aware that sandpaper that is slightly more expensive, such as Norton or 3M sandpaper, will generally last considerably longer than less expensive sandpaper if it is used correctly.

Storing Sandpaper Sheets (#1)

Sandpaper sheets are prone to curling, and then they are difficult to manage. A simple way of storing them and preventing the curling is to put the sheets in one of those “accordion” files (2-15). The

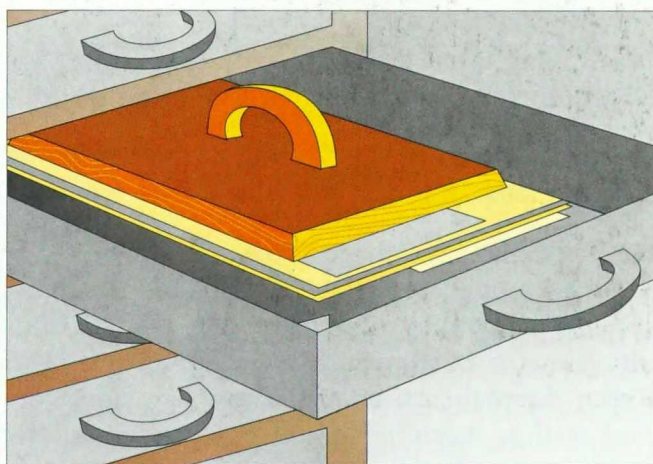


2-15. An accordion file is a great place to store sandpaper sheets. It not only sorts them, but prevents them from curling as well.

other benefit is that you can label the tabs to indicate the grit size of the sheets.

Storing Sandpaper Sheets (#2)

Sandpaper sheets have a tendency to curl when left on a shelf or in a drawer. To properly store sandpaper, leave it in its original package, unless it comes in a wrapping of paper or plastic. If it does, remove the paper or plastic because humidity will build up and cause curling. The best way to store all sandpaper, though, is to lay it flat, abrasive side down, on a shelf or in a drawer with a weight on it (2-16). Sanding belts or drums should be stored either on edge or hanging from a dowel.



2-16. The best way to store all sandpaper is to lay it flat on a shelf or in a drawer with a weight on it.

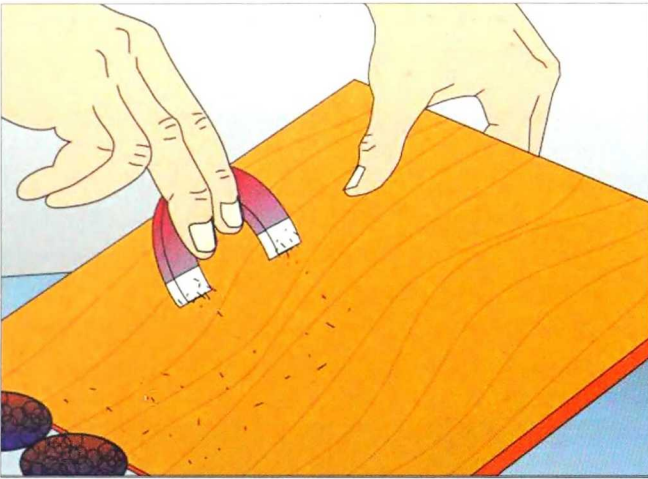
Steel Wool

Removing Specks from Steel Wool

Steel wool is great for cleaning projects between finishing coats, but it does leave little specks of steel behind. To make sure you have got all of them, cover a magnet with a piece of felt and lightly wipe the surface down (2-17).

Using Steel Wool

Although steel wool will leave rust marks on water-based stains and finishes, there are still plenty of applications where this inexpensive abrasive can be used—for example, finish removal (coarse grades)

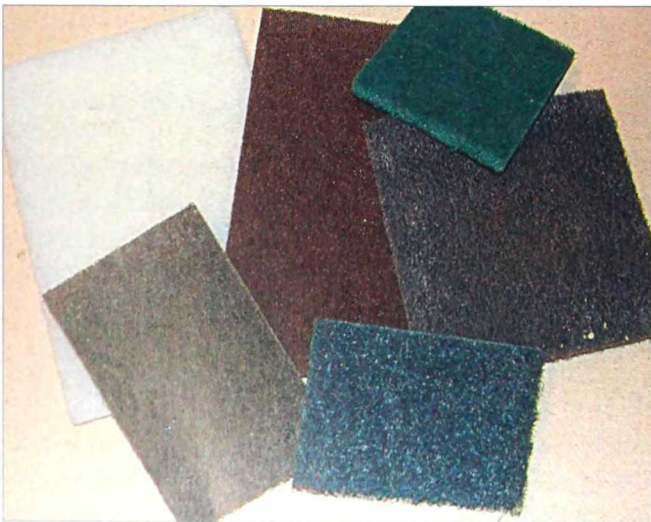


2-17. A magnet wrapped in felt will remove the fine metal left by steel wool.

in stripping applications and, with the finer grades, smoothing when using solvent-based finishes.

Synthetic Abrasives

Synthetic adhesives have taken over the roles of sandpaper and steel wool for finishing and between-coat sanding (2-18). Among many brands are Bear Tex by Norton and Scotch-Brite by 3M. These materials resemble pot scrubbers and work very well as finishing abrasives. There's very little residue to worry about. They do a clean job, especially between finishing coats, and do not leave any rust or black spots. These synthetics are *not*



2-18. An array of synthetic sanding pads.

designed for heavy stock removal; they are *finishing* abrasives only.

Bear-Tex consists of a nonwoven web of nylon fibers that are impregnated with an abrasive grain (either silicon carbide or aluminum oxide) and then bonded with synthetic resins. The main advantage here is that Bear-Tex may be used in either *wet* or *dry* sanding situations.

These products are available in a wide range of grades. Norton uses two grading systems. The more accurate one uses the actual mesh number and grit size impregnated into the pad. The finest grit size is 1,000 and the coarsest 40, a system not unlike normal abrasive (sandpaper) grading. Remember, though, a number 40 Bear-Tex pad will be considerably *less* abrasive than number 40 sandpaper.

The other system that Norton uses is a simplified grading system: Micro-Fine (MF), Ultra-Fine (UF), Very Fine (VF), Fine (F), Medium (M), and Coarse (C).

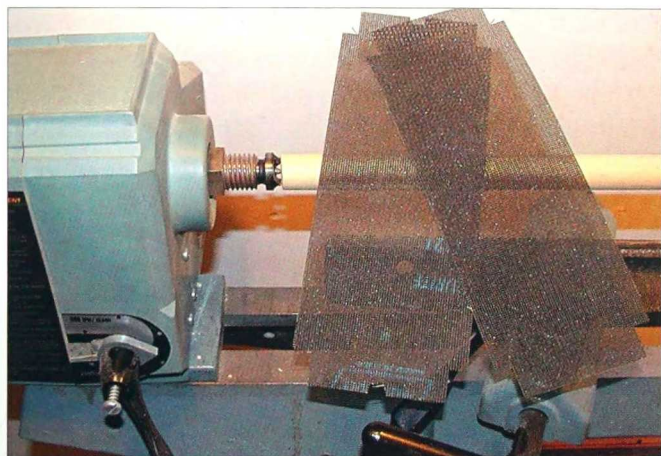
Bear-Tex is available in $\frac{3}{8}$ -inch-thick sheets of various sizes. A utility knife or scissors will easily cut the product to the size desired.

One major advantage is the fact that these products will work on a sander equipped with a hook-and-loop-type pad without any modification to the machine. Another plus is that they will work well in sanders that have "through-the-pad" dust pickups.

Another type of synthetic abrasive on the market is Durite screen by Norton. This is a product that is primarily designed for the drywall and plaster trades for smoothing out joints. The substrate (backing) is a synthetic screen. The screen is impregnated with a 120- or 150-grit abrasive. Durite is only available in a die-cut form that fits a drywall sander. However, this happens to be about one-third of a normal sheet of sandpaper, so it will fit many orbital sanders.

The main advantage of this product is that it is a screen and is therefore extremely porous. As a result, when the screen is used with a very hard abrasive, it will last about five times as long as sandpaper. Try it on your finishing sander. Durite is particularly effective on lathe work (2-19).

Synthetic wool has replaced steel wool for use with water-based finish products because synthetic wool prevents the steel/water/rust problems (2-20). Synthetic wool is more efficient in that it leaves lit-



2-19. Durite Screen is a very aggressive abrasive.



2-20. Steel wool is safe to use with solvent-based finishes. Synthetic wool and abrasives should be used with water-based finishes.

tle, if any, residue and is cooler to use in lathe work. Synthetic wool is not available in as many grade delineations as steel wool, but the coarse, medium, and fine grades are generally sufficient for most woodworkers.

ADHESIVES

(Also see Caulk, Epoxy Glue, Glue, Rubber Cement, and Tape)

There are a wide variety of adhesives available for woodworkers and for other applications (2-21):

Acrylic solvent is a clear liquid that is used for bonding Plexiglas to other plastics such as polystyrene and acrylics. It is applied sparingly and carefully because it will readily run. It is generally applied with a hypodermic needle. This unites the molecules of the two pieces and creates a very strong joint. Curing takes about an hour.

Carpenter's glue is an aliphatic resin emulsion adhesive, yellow in color, that is designed for high-quality woodworking. It has a good initial tack, is quick-setting, and has a high shear strength. Assembly time is 15 to 20 minutes, and clamping time is one hour.

Contact cement (see pages 40 and 41) adheres instantaneously upon contact. It is available in a regular form or as a water-based product. Water-based contact cement is used on plastics. Regular contact cement is used for applying wood veneer, wood joints, and plastic laminates. You apply the contact cement to both surfaces, let it semi-dry, clamp the surfaces together, and let them dry overnight.



2-21. There are adhesives for just about any situation in the workshop.

Epoxy resin comes in two parts that have to be mixed in equal amounts. It has excellent strength qualities. It will fill gaps and is waterproof. Though it is not usually considered a woodworking glue, it will make strong repairs to such things as chair and table legs. (Refer to Epoxy Glue on pages 94 and 95 for more information.)

Hide glue is an adhesive from days of yore, but there are still some woodworkers that use it primarily in furniture making. It is an animal product sold in flakes that have to be melted and applied hot. Liquid hide glue eliminates the mixing and heating problems associated with the age-old traditional hide glue.

Hot glue is sold in sticks for use in a hot-melt glue gun. There are different types of glue sticks available, so read the container labels carefully. If the label does not describe a specific use, it is probably a general-purpose glue. There is even a caulking stick available for small jobs. This is a good repair adhesive that sets up quickly and is excellent for tacking things together.

Marine glue is a plastic resin powder adhesive with a chemical hardener to improve water resistance. As its name implies, it is used for boats. It is also used for any exterior projects such as outdoor furniture. This product is mixed with water to a syrup consistency. Mix only that amount which you will use in a couple of hours. It has a clamping time of six hours.

Polyurethane adhesives (2-22) are waterproof (above the water line) and are excellent for outdoor projects. Any seepage can be simply scraped off with no damage to the finish.

Polyurethane adhesives draw moisture from the air to the work. Misting the wood surfaces with water before applying the glue will promote a stronger joint. Gorilla Glue is a form of polyurethane adhesive, but has additional bonding agents that have been kept secret. Gorilla Glue bonds almost anything to anything and is claimed to be waterproof as well, even below the waterline (2-23).

Rubber cement is excellent for paper materials and for tacking materials together for making dupli-

cate patterns such as on a band saw. For permanent paper or cardboard adhesions, apply the rubber cement to both surfaces, let it semi-dry, and then press the surfaces together. For tacking wood together, apply rubber cement in small spots to one side and then hold the two pieces together for a few moments.



2-22. Polyurethane adhesives come in liquid form or as hot-melt tubes. They are excellent glues to use on outdoor projects.



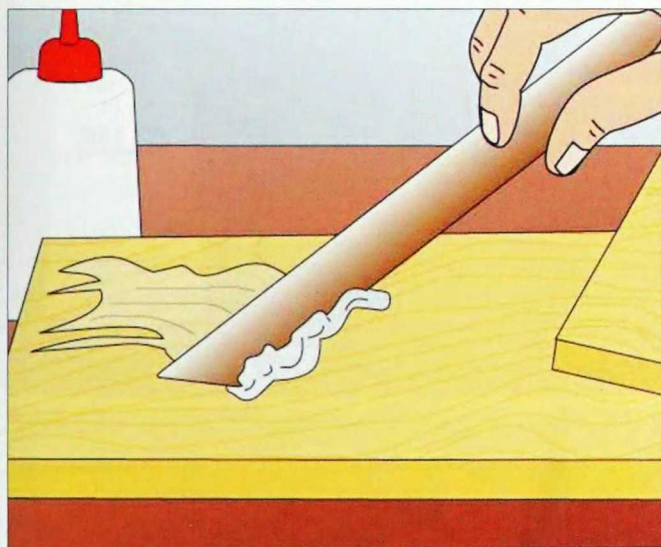
2-23. This brand of glue is waterproof and will bond to almost anything.

Urea resin comes in a powder form and has to be mixed with water to a syrupy consistency. It does not stain the wood and is not affected by solvents or thinners. The pieces being joined must be fitted together tightly.

White glue is a general-purpose woodworkers' glue that sets up fairly quickly, but requires clamping. Clean up the seepage with water immediately.

Applying Adhesives (#1)

Old venetian blind slats make excellent glue spreaders; just cut them into manageable pieces (2-24).



2-24. A piece of blind slat makes a great glue spreader.

Applying Adhesives (#2)

Make friends with your doctor. He/she works with tools everyday that can be helpful in your workshop. For example, when the doctor tells you to say aah, ask if you can keep the tongue depressor (and maybe a few more) to use for mixing two-part epoxy glue and for spreading it (2-25).

Doctors also use syringes—some with large-diameter needles and some with plastic tips (2-26). These work well for applying glue in difficult-to-get-at areas and especially for doing furniture repair.



2-25. Tongue depressors are useful for mixing two-part epoxy and for spreading glue.



2-26. Syringes of various types are excellent tools for applying glue in tight spaces.

Cleaning Glue Squeeze-Out

The next time you visit your dentist, get real friendly with him or her. Some of the tools that they use are really great for removing excess glue either wet or after it has dried. The tools that he/she uses for scraping the tartar off your teeth work really well for glue removal (2-27). Your dentist usually tosses these out after several uses, so they might as well end up in your workshop. The various shapes of these stainless steel tools can be used in a multitude of other situations as well—for example, removing a paint ridge when you have spray-painted and used masking tape, cleaning tar and pitch off saw blades and router bits, cleaning out fine detail work when stripping the finish from furniture, applying

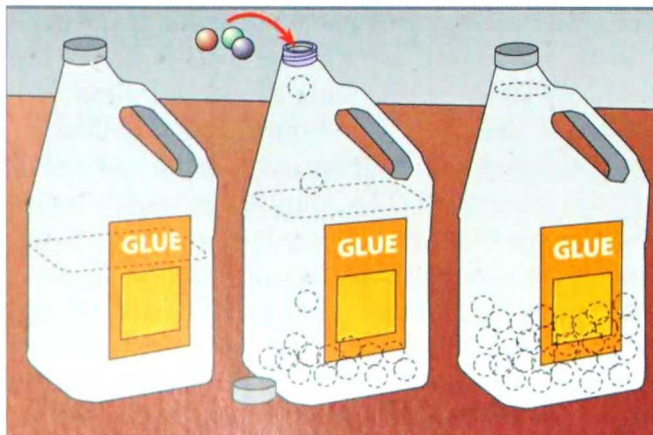


2-27. These various-shaped dental picks can remove dried glue squeeze-out and even apply wood filler in some spaces.

wood filler in small areas, etc. As you see the various shapes of these tools, you will appreciate their possibilities even more.

Extending Adhesive Effectiveness

The reason that most adhesives lose their effectiveness is the air that gets into the glue bottle as the quantity is decreased. To keep the bottle full and displace that air, drop some glass marbles into it until it fills back up (2-28). Keep the cap tight.

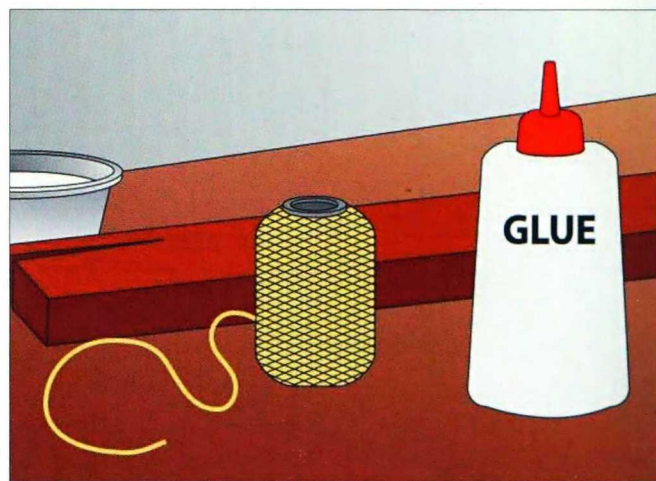


2-28. Marbles in a glue bottle will displace the air and extend the glue's shelf life.

Getting Adhesives into Workpiece Cracks

Sometimes a crack or split will occur in your workpiece when it is least expected. Getting glue in the crack to repair it can be a problem. This idea may help (2-29).

Dip a length of string in your glue container and then lay the string on the crack. Using a putty knife or other thin tool, force the string down into the crack; then slowly pull out the string. Clamp the piece and wipe up the excess glue.

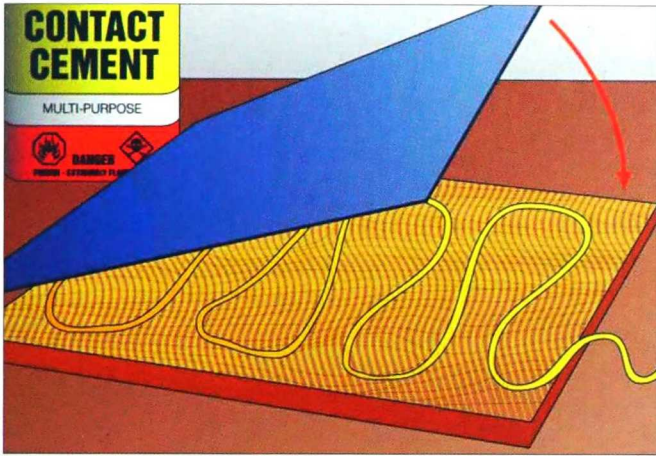


2-29. A piece of string soaked in glue will repair a wood split.

Laminating with Contact Cement (#1)

When laminating with contact cement, dowels are usually used between the substrate and the laminate for alignment. This is done to keep the two pieces apart until you are ready to join them.

Don't go out and buy dowels especially for this; use a length of rope and wind it on the substrate. (2-30). When ready, simply start pulling on the rope.

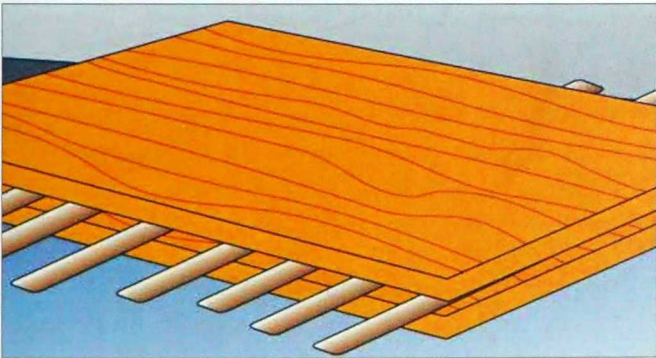


2-30. A length of rope will work between the substrate and laminate if you don't have any dowels.

Laminating with Contact Cement (#2)

Don't throw away that old venetian blind just yet; save a dozen or so slats.

When you are applying contact cement for laminating, use the slats as spacers to manipulate the top piece into position (2-31). Remove them one by one in sequence as you press the two glued pieces together.



2-31. Old blind slats work as spacers when joining parts that have been glued with contact cement.

Small Glue-Up Jobs

Buying adhesive in larger containers is much more economical, but it has its drawbacks. The containers or plastic bottles are too large to use on individual glue-up jobs.

Here's a way of making it easier. Those small

pop or soda bottles will contain enough glue to do several small glue-up jobs, but their mouths are too big. Keep the caps; drill holes in them and insert one of those used caulking tube tips through the holes (2-32). Make sure the tube tip fits snugly so there are no leaks. A nail, spike, or electrical marette will seal the open top of the tip. (A marette is an electrical wire connector.)



2-32. A soda bottle is just the right size for small glue-up jobs if you put a caulking tube tip through the bottle cap.

Spray-On Adhesives

Spray-on adhesives are available in many forms. There are types that are permanent such as contact cement and there are types that can easily be released. The latter are best used for adhering paper patterns to wood.

Sticky-back sanding discs can get contaminated with sawdust in a workshop, and they lose their adhesion. Spray-on adhesives are perfect for getting

these discs to work again (2-33). There are specific types of adhesive for this purpose, and it is wise to buy a solvent for them at the same time as purchasing the adhesive.



2-33. Spray-on adhesive may be used to restore the adhesion of sanding discs on portable or stationary disc sanders.

Spreading Adhesives

When those foam paintbrushes are worn out, don't throw them away. Cut off the foam portion and keep the handle with that plastic insert. It makes a good glue spreader (2-34).



2-34. The flexible plastic insert in an old foam paintbrush makes an excellent glue spreader.

AIR COMPRESSORS

Compact air compressors (2-35) are now quite common in home workshops and they require regular maintenance to keep them working safely. The tank(s) should be drained on a regular basis to prevent internal rust. Spraying the inside of the tank of a new compact compressor with a rust preventative will extend the life of the air tank (2-36). To spray the interior, insert the plastic tube that comes with the spray can into the drain valve. Let the product sit for 24 hours and then drain it thoroughly.

The air tank should be periodically checked externally for any signs of rust.

The compressor has an air filter to keep dust out of the piston chamber, and the filter should be checked and cleaned on a regular basis (2-37).

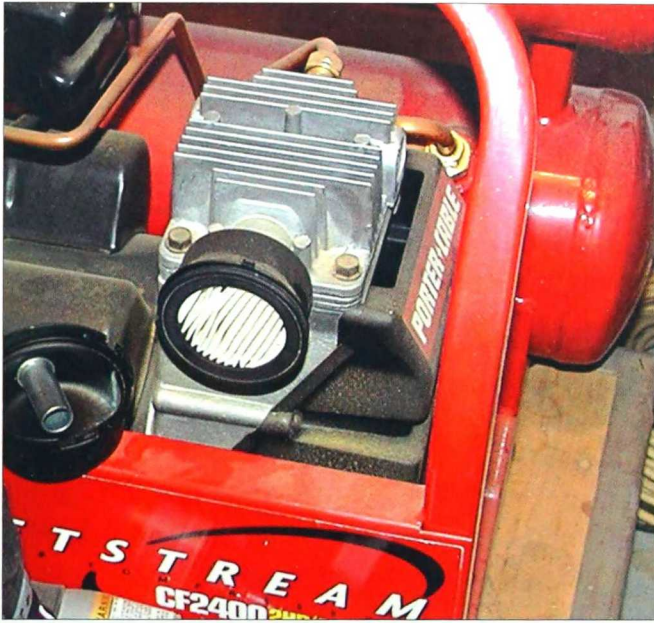
When using an air compressor, it is wiser to use long lengths of air hose to get to a remote work area



2-35. Compact air compressors can be frequently found in home workshops.



2-36. Adding a rust preventative to the compressor tank can extend its life. Allow it to sit for a day or two and then drain it completely before using the compressor.



2-37. Keeping the filter in your compressor clean should be a regular maintenance project.

rather than electrical extension cords. If you must use an extension cord, make sure that it has the correct rating. An incorrect wire gauge will put a strain on the electric motor and cause it to prematurely fail. See Extension Cords (pages 94 and 95).

Air Compressor Mobility

You will want to make the best use of the space in a small workshop. I use my air tools on a regular basis in mine, and I like to keep them all together. I built the compressor cart on wheels shown in 2-38 so that it will fit under a workbench. The cart moves out when required; it contains all of the air nailers, and the nails are kept in order of their type and size for easy selection. The air hose is stored on a fixed reel for easy unwinding and will reach any area in my shop and, in fact, anywhere within my house.



2-38. This compressor cart is mobile and contains all of the nailers, nails, and accessories.

drive the brads or nails are metal, and they also slide on metal. Oil is the answer, and you should make it a habit to add oil to the compressed air intake fitting every time you put a new strip of nails into the breech (2-39). A couple of drops of compressor (light) oil will suffice and will keep the nailers working for a long time.



2-39. Adding oil regularly to the air nailer will help preserve its parts.

AIR NAILER MAINTENANCE

What most woodworkers seem to forget is that the parts of an air nailer—be it a brad, finishing, or framing nailer—need lubrication. The parts that

In addition to the regular addition of oil to the air intake, you should open the nail jamb release and check it for excessive wear (2-40). If the parts seem to be in good order, add a couple of drops of compressor oil and close it up.



2-40. Check the jamb release for excessive wear and add some oil to the moving parts.

ALLEN KEYS

Many tools that you buy require assembly, and the manufacturers usually include the tools to do it. The tools will no doubt include an Allen key



2-41. A straight Allen key can be chucked into a drill for more torque.

(wrench) or two. These Allen keys are usually “L”-shaped and the “L” can get in the way.

Cut the “L” out of it (pun intended). The straight shaft will fit nicely into a portable drill and will give you that much more torque for assembly (2-41).

ALUMINUM (GRINDING AND FILING)

Aluminum can make a mess out of a file or a grinding wheel. The tools are usually used to remove the burr that is left after the aluminum has been cut. The metal is soft and the shavings tend to stick in the crevasses of the files. When a grinding wheel is used, because of the heat buildup when grinding, the aluminum will accumulate and stick to the grinding wheel. When the latter happens, a good wheel dresser is required. As for the files, a lot of tedious work with a wire brush is required.



2-42. Spraying your files and grinding wheel with nonstick cooking oil before using them will help prevent the aluminum from sticking to the files and grinding wheel.

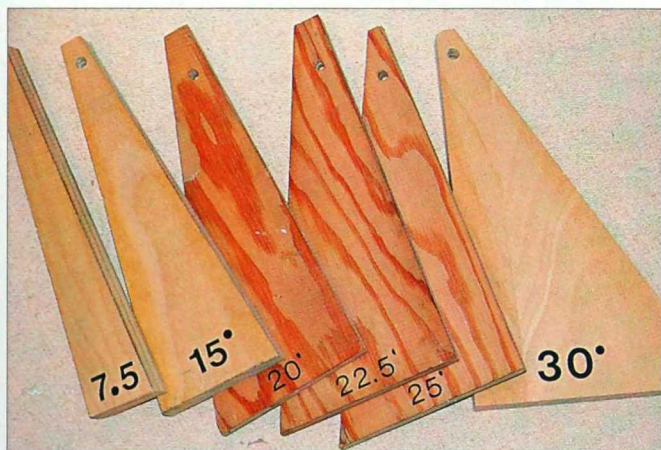
Save your money and your time. Your local supermarket sells cans of nonstick cooking spray. A couple of squirts on your grinding wheel and your files before using them will help prevent clogging (2-42).

ANGLES

(Also see *Rafter Angles*)

Angle Jigs

Precise angles such as $7\frac{1}{2}$ -degree angles are sometimes difficult to set on various tools such as compound miter saws, radial arm saws, etc. Making a set of angle jigs out of $\frac{3}{4}$ -inch plywood and keeping them handy will save a lot of work and calculations later (2-43). These jigs can be used with a drill press, belt sander, table saw, band saw, and even some portable tools.



2-43. These plywood angle jigs will save a lot of set-up time on both portable and stationary power tools.

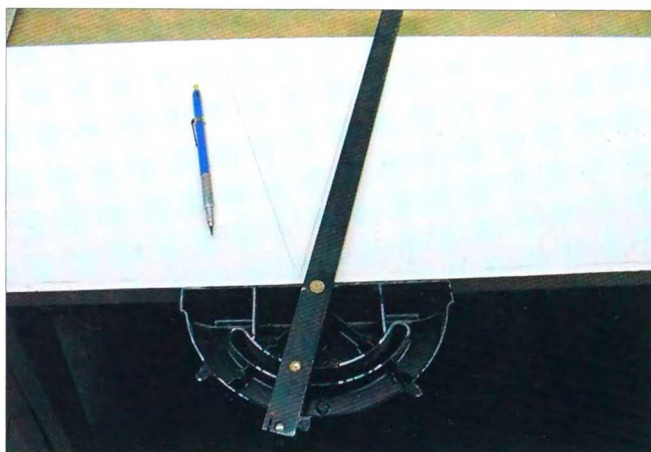
Drawing Angles (#1)

No protractor? No problem. Use your table saw's miter gauge. Line up the gauge with the edge of the board that you want the angle drawn on. Set the angle and then simply flip the gauge over to mark the line (2-44).

Tip: If you want your angle sloped to the left, set the miter gauge to the right. When you flip it, the angle will be correct.

Drawing Angles (#2)

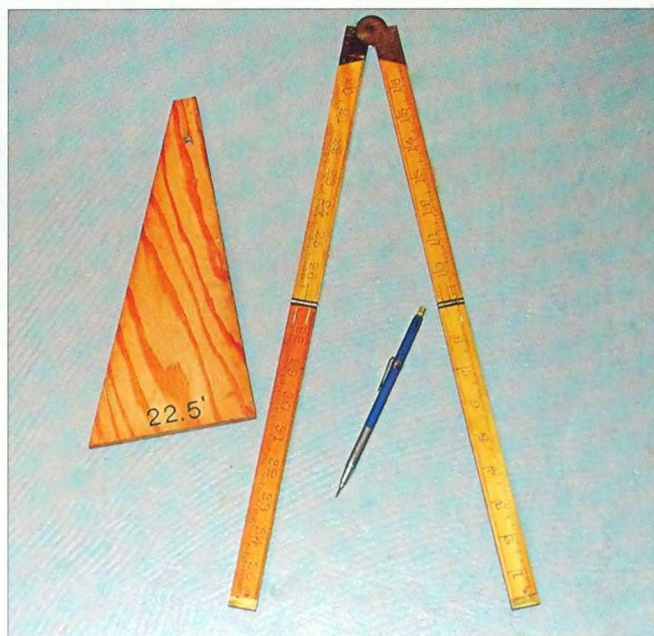
Lets suppose that you have to draw a 22.5-degree line across the face of a 2 x 12-inch board. Here is a



2-44. You can use your table saw's miter gauge as a protractor when drawing angles.

simple solution using the angle jig shown in 2-45. You place the jig against the edge of the workpiece and draw a line. Use a straightedge to complete the line across the full width of the board if the board is wider than the jig.

A second solution is to use a 2-, 3-, or 4-foot folding rule. If you lay the rule flat on your workbench and open it scissor style, you can use the table below to determine various angles as you open or close the wedge. The figures in **Table 2-3** are based on the measurement at the inside corners of the blades.



2-45. Drawing a 22.5-degree angle on a 12-inch-wide board.

Table 2-3

2-FOOT FOLDING RULE	3-FOOT FOLDING RULE	4-FOOT FOLDING RULE
7.5°/1½"	7.5°/2½"	7.5°/3½"
15°/1½⅙"	15°/4¾"	15°/6¾"
20°/3¾"	20°/6⅛"	20°/8"
22.5°/4¼"	22.5°/7"	22.5°/9⅛"
25°/4¾"	25°/7⅞"	25°/10¾"
30°/5⅛⅙"	30°/9¾"	30°/12½"
45°/6¾"	45°/13¾"	45°/18¾"

Finding the Centers of Angles

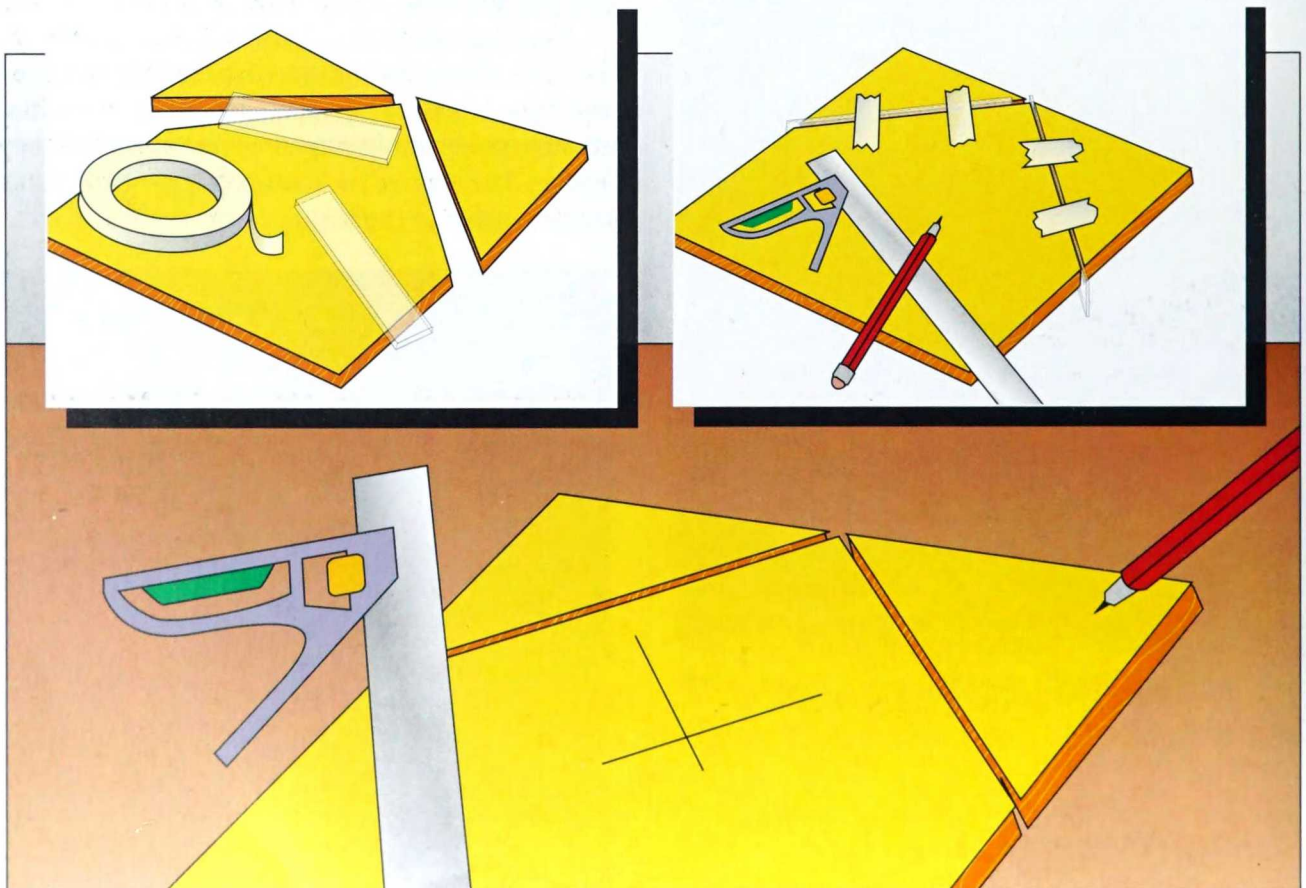
Here is a technique for finding the centers of angles. When cutting out triangles, hexagonals, octagonals, etc., don't throw away the cut-offs.

For example, if you want to drill a hole in the middle of a triangular piece of wood, use double-faced or masking tape to reattach a cut-off to one or more sides of the triangle (2-46 and 2-47), so that when you are using a square, one side will be "true." Now, draw a line vertically across the piece. Move the cut-off to another side of the triangular piece and repeat the process. Now repeat this process one more time and you will end up with converging lines. Where they converge is the center point, as shown in 2-48.

I use a piece of ⅛-inch Plexiglas to fill in the saw kerf, and then tape the pieces together.

AUGER BIT

(See Drill Bits)

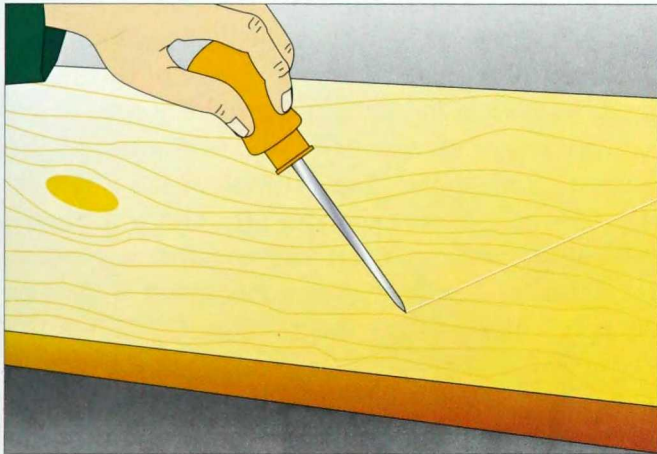


2-46 to 2-48. Top left: The cut-offs and the triangle. Top right: The cut-offs reattached to the triangle with double-faced tape. Note the Plexiglas that fills in the saw kerf. Bottom: The center point for the lines.

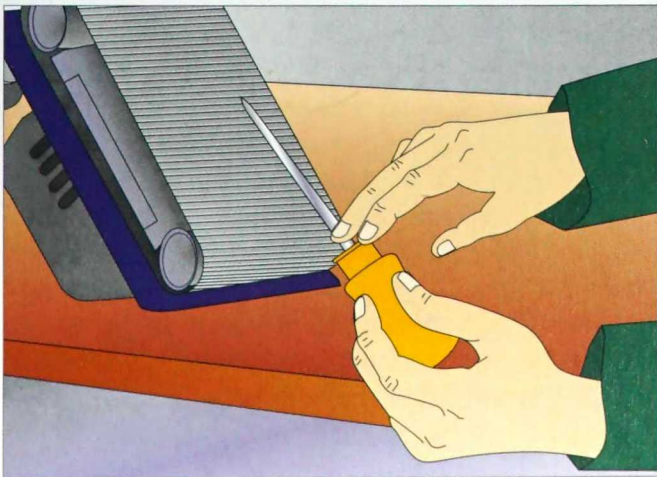
AWL

The awl, also known as a scratch awl, is a tool that no home workshop should be without. This tool has many uses. It can be used in lieu of a pencil for drawing or scribing lines on wood, plastics, and metals. On darker woods such as mahogany or rosewood, a scribe stands out better than a pencil line.

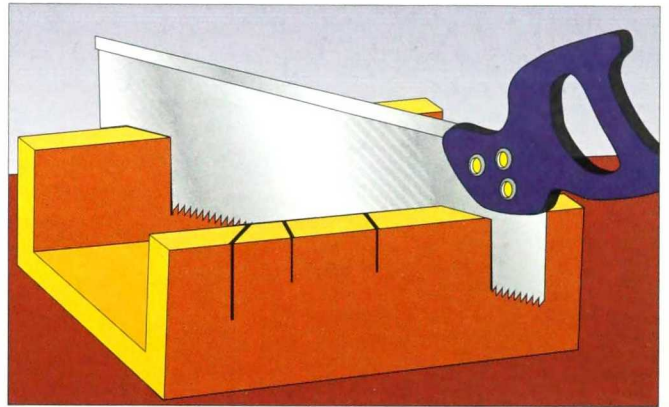
Check the point of the awl from time to time, especially after using it on metals, to make sure that it is sharp (2-49). The awl can be easily sharpened on a belt or disc sander using a fine-grit sandpaper (2-50). Be careful, though: don't let it get too hot when sharpening it because it will lose its temper and will not be as effective when scribing metals.



2-49. Check the point of the awl occasionally to make sure it is sharp.



2-50. The awl can be sharpened on a belt sander.



2-51. Using a backsaw.

BACKSAW

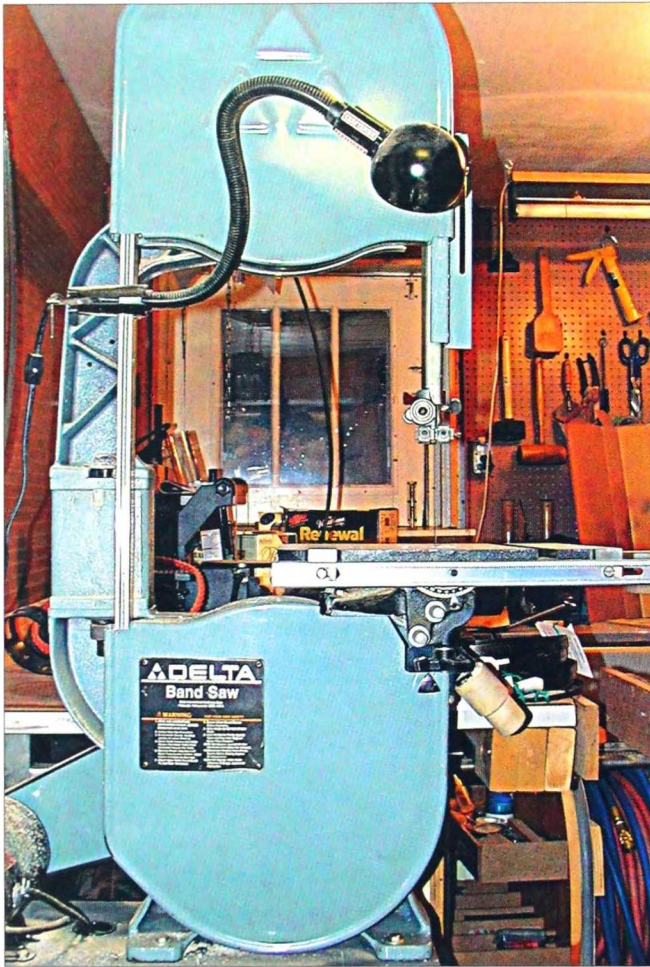
The backsaw, also known as the miter saw, is generally used in the miter box. It is also used to cut tenons, dovetails, and most other wood joints (2-51). Although its teeth are set for crosscutting, it is used with the grain as well. The heavy spine across the top keeps the saw rigid when being used to make a more accurate cut. Backsaws come in various sizes, but their tooth spacing generally runs between 12 and 14 tpi (teeth per inch). When some types of miter boxes are used, the spine of the backsaw slides across or is clamped to an adjustable rail to provide more accuracy.

BAND SAW

The band saw is essential for any well-equipped home workshop (2-52). A band saw is basically an "endless" steel band with teeth on one side that rotates around two or three wheels. They can be used to make a variety of straight and curve cuts.

Band saws are sized according to the distance between the frame and the blade, the most common being 14 inches. These band saws will generally cut material up to 6 inches thick, but many can be adapted to cut up to 12 inches with the addition of a riser block. This is a worthwhile addition for resawing thick boards into thinner ones.

Most band saws will accept a rip fence and a



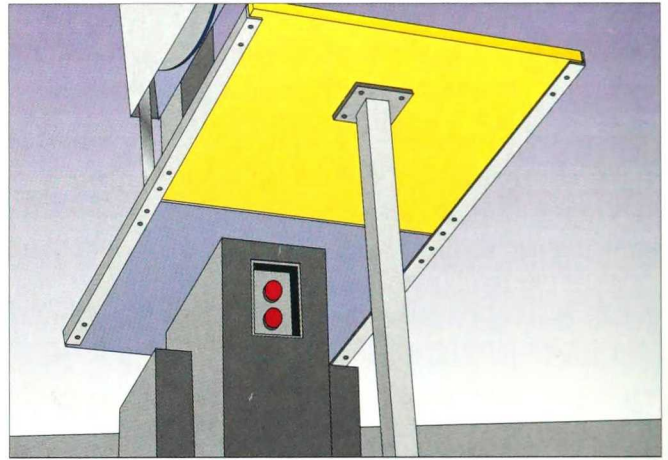
2-52. A band saw can be used to make a variety of straight and curved cuts.

miter gauge for more accurate sawing. The majority of band saws are two-wheel machines, but some of the bench-top models have three wheels. These make wider cuts for a relatively small machine, but they have their drawbacks. The third wheel makes blade changing a little more difficult and if all of the wheels are not precisely in line, blades will slip off more easily.

Some band saws have more than one speed, and this is convenient for metal-cutting. However, a single-speed saw can cut through soft metals like aluminum as easily as wood.

Auxiliary Tables for a Band Saw

An auxiliary table for a band saw, especially a removable one like the one shown in 2-53, is a



2-53. An auxiliary table for a band saw.

great advantage to the woodworker. It is particularly useful for cutting large circles for tabletops, etc.

One way to make an auxiliary table is to laminate two pieces of $\frac{3}{4}$ -inch-thick plywood to make a $1\frac{1}{2}$ -inch-thick slab and screw a piece of aluminum angle to both sides. Drill holes into the edge of the saw table castings and make slots in the aluminum angle to correspond. You can also make a slot for the band-saw table expander pin, and put hinged legs on the table so it can fold up when not in use. It only takes a couple of minutes to set it up with $\frac{1}{4}$ -inch bolts and wing nuts.

Backtracking with a Band Saw

Let's say, for example, that you are going to cut the outside of the letter U with a band saw. You know that you are going to have trouble making the turn because of the width of the blade that you have in the saw. There are three ways of making the cut: making three straight cuts and then going back and nibbling at the rounded corners; cutting straight down the sides and backtracking out so you can make a straight cut across the bottom, and *then* nibbling at the rounded corners (2-54); and the easiest way, which consists of making your first cut straight down the side, backtracking about an inch, and slowly starting to nibble away at the rounded corner (2-55). Repeat at the next turn and you have a perfect U.

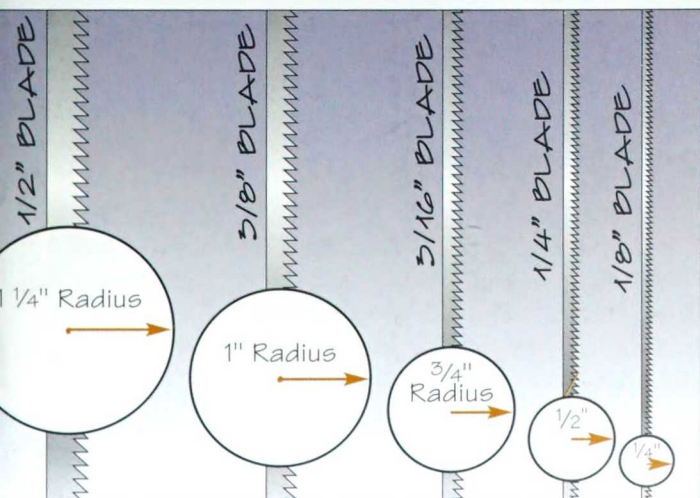
Backtracking out of a cut can be difficult. What usually happens is that the kerf closes up, binding



2-54. This way of cutting rounded corners on a band saw is difficult.



2-55. The easiest and best way to saw rounded corners is to nibble away at each curve.



2-56. The cutting limitations of band-saw blades.

the blade, and you end up pulling the moving blade out of the guide blocks. You will also move the blade off the crest of the tire and loosen the tension of the blade, probably causing it to come off the wheels altogether and, at worst, breaking the blade. So, it is best to backtrack only when necessary.

Band Saw Blade-Cutting Limitations

Band saws are great tools for cutting circles, but the radius of the circle to be cut is limited to the width of the blade that you are using (2-56).

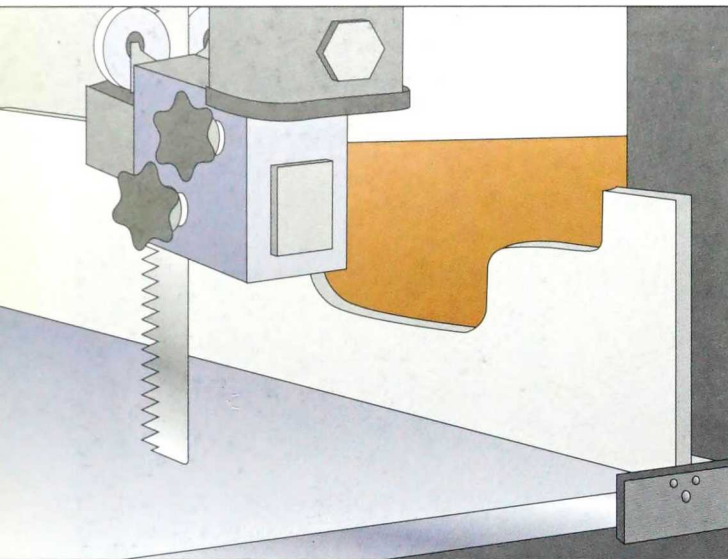
Band Saw Blade Types

Band-saw blades come in a variety of lengths, widths, and tooth counts (2-57). They range in width from $\frac{3}{32}$ to 24 inches. The latter can be found at some sawmills. The minimum and maximum blade widths will depend on the specifications for your band saw. The type of blade to use will depend on the type of work that has to be done. A narrower blade will cut smaller diameters. A $\frac{1}{2}$ - to 1-inch-wide blade will be best for resawing.



2-57. Band-saw blades.

Blade lengths also vary, depending on the make and type of saw. If you are buying new blades for a saw that uses a 97-inch-long blade, a 96- or 98-inch blade will probably work. The blade tension can be adjusted to make up the difference.



2-58. A shop-made band saw rip fence.

The tooth count is another factor. The tooth count is the number of teeth per inch on the blade. The more teeth, the fine and slower the cut. Less teeth will give a faster but rougher cut. A skip-tooth blade is used for ripping. It is best suited for cutting soft metals such as aluminum.

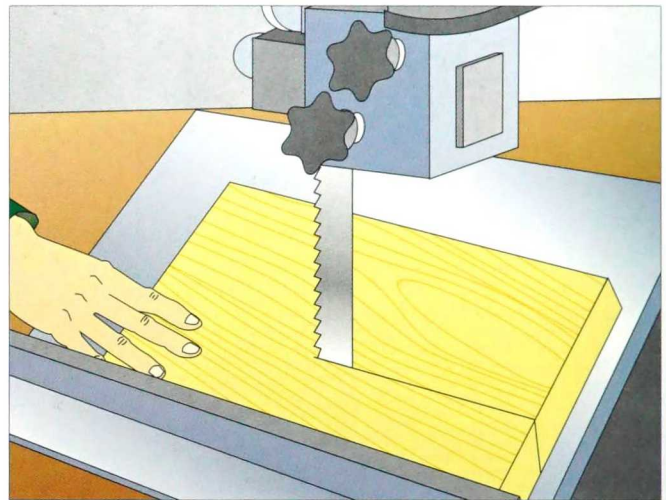
Band Saw Rip Fence

I made the band saw rip fence shown in 2-58 out of $\frac{3}{4}$ -inch-thick plywood, an aluminum angle bracket, and a long carriage bolt with a wing nut. Though I had to cut out an area for the blade guard, the fence works well and took an hour to make. Before ripping, make sure the fence is square to the table.

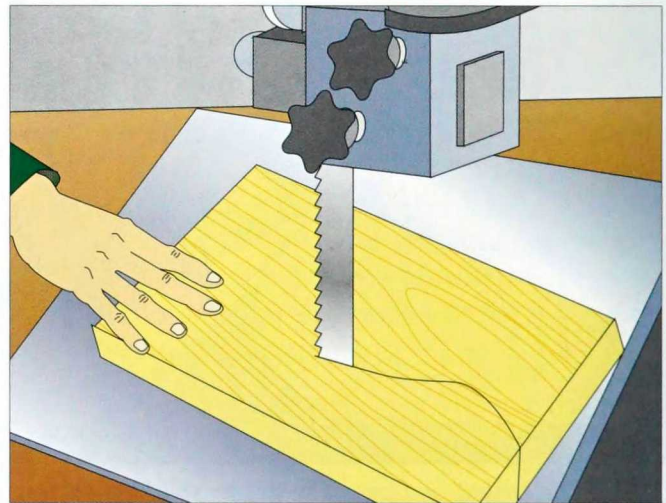
Bevel-Cutting with a Band Saw

Whenever you are making any bevel cuts on a band saw, use a fence. It does not matter if you use one that comes with the machine (2-59) or if you make one out of $\frac{1}{2}$ -inch plywood. The important thing is that a fence should guarantee a straight and true bevel cut. Needless to say, if you are beveling a scroll cut, the fence will be useless (2-60).

If your tool does not have a fence, the easiest way of making a temporary one is to use a narrow piece of straight-edge plywood clamped to your saw's table when required.



2-59. Making a beveled cut with the fence in place.



2-60. Cutting an irregular beveled pattern without the fence.

Crosscutting Dowels with a Band Saw

The problem with crosscutting dowels on a band saw is that they have a tendency to roll with the downward motion of the saw blade. Because of this, it is difficult to get a square crosscut even if you are holding it against the fence. Use the following technique: Make a V block and screw it to a strip of hardwood that will fit snugly into the tool's miter-gauge groove. Extend the block about two inches beyond the blade as shown in 2-61. I used a piece

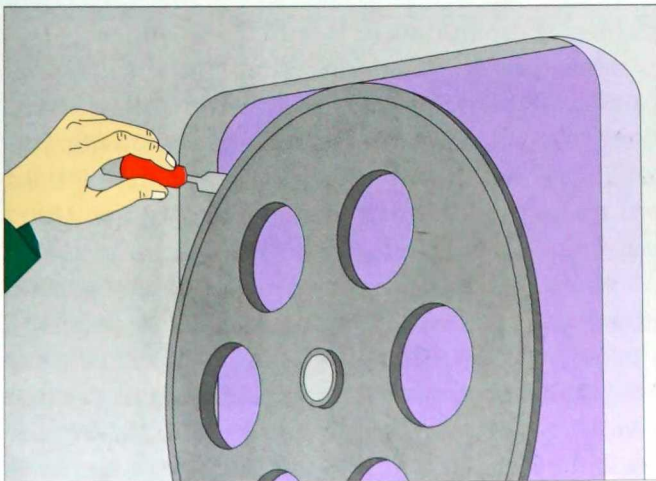


2-61. Using the V block to crosscut dowels.

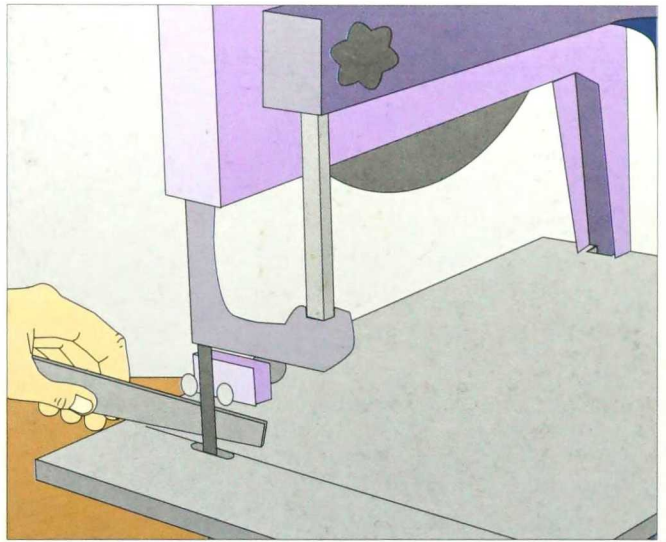
of thick Plexiglas for the miter bar, because I had some scrap pieces lying around that just happened to fit. If everything is square, you'll get perfect cuts every time.

Cutting Accurately with a Band Saw

Like many power tools that you buy, you can't just open the box the band saw comes in and use it. The band saw is a tool that will give precision cuts if tuned and adjusted properly. Follow the manufacturer's instructions precisely when set-



2-62. Checking for roundness of the tires with a sharp chisel.



2-63. Grinding off the welding flaws at the saw-blade joint.

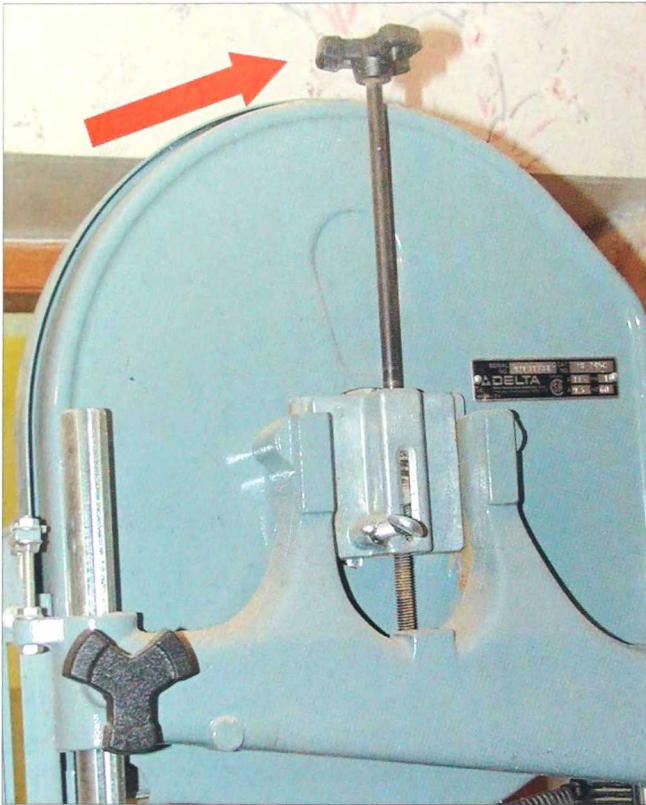
ting it up. By doing this, you will ensure accurate cuts.

The simple procedure of changing a blade could have an effect on the saw's accuracy. So, there are six very important steps that you should perform after every blade change. *The following must be done with the tool unplugged:*

1. With a sharp wood chisel braced on the upper frame, check for roundness of the upper wheel (2-62). Doing this will also remove any sawdust buildup on the wheel's tire. Any unevenness may be marked and sanded down with fine sandpaper. Repeat the process for the bottom (drive) wheel. A light sanding with 180- to 220-grit sandpaper should remove any sawdust or other adherents.

2. Check the new blade for any defects, especially at the welded joint. If there are any high spots or roughness at the weld, grind them down (2-63). This will save wear and tear on the rubber tires and the guide blocks.

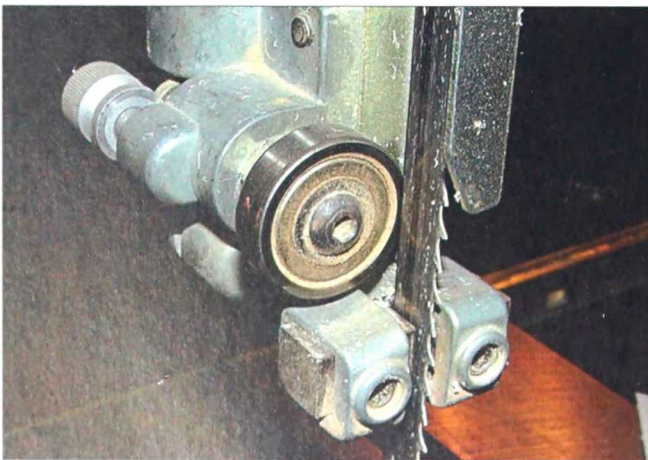
3. Install the blade and adjust the tension just enough to hold the blade in place. Rotate the upper wheel to be certain that the blade is riding dead center on the tires. Adjust the upper wheel pivot accordingly. Tighten up the tension screw for the blade to the appropriate mark (2-64).



2-64. Adjusting the blade tension according to the tension scale on the saw.

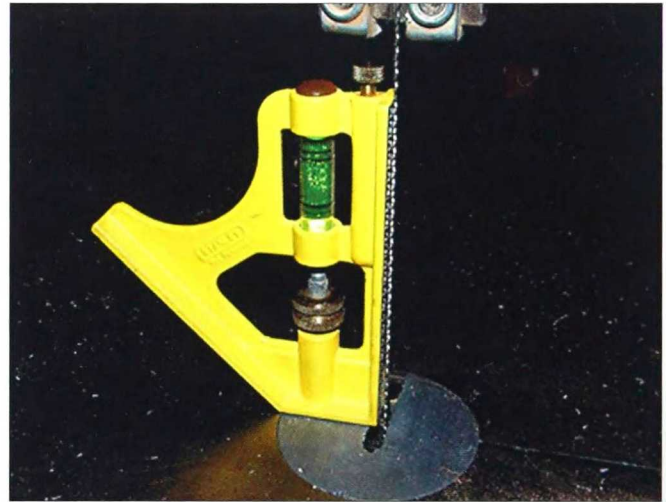
4. Adjust the guide blocks so that they sit *just* behind the gullets of the blade and don't make contact with the teeth.

5. Adjust the bearing wheels so they *just* touch the back of the saw blade (2-65).



2-65. The bearing wheels just touch the back of the saw blade.

6. Raise the blade guide to its uppermost position. Using a try square, verify the squareness of the blade to the saw table. Adjust the table accordingly and reset the table stop if required (2-66).



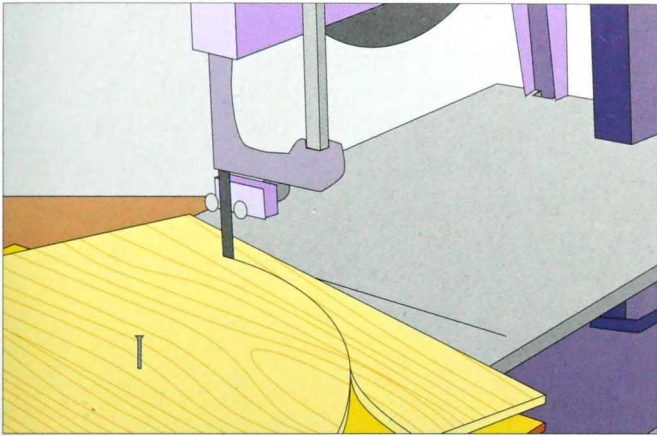
2-66. The saw blade must be square with the saw table. Check this with a try square.

Cutting Circles with a Band Saw

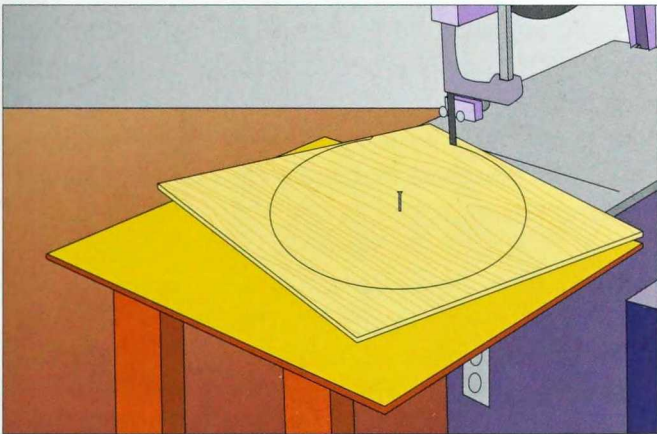
When cutting large circles with a band saw, look at your squared piece of stock carefully. If, for example, you are using softwood and there are lots of knots in it, choose another piece. If the wood is relatively unblemished, make sure that you start your cut on about a 45-degree angle and into a *cross-grain* area. The reason for this is that the blade may pull slightly if the initial cut is *with* the grain.

More important, don't skimp on the material (2-67). If you want to cut a 12-inch-diameter circle, your stock should be at least 13 inches square. This will allow for a continuous cut, rather than a tight cut that will leave you flat spots that require a later sanding.

When cutting large circles such as tabletops with your band saw, use an auxiliary table (see page 48), find the center of your stock, and drill a small hole into it. Start your cut and then drive a nail through the hole and into your auxiliary table. Make sure that the nail is in perfect alignment with the teeth of the saw blade and proceed to cut carefully (2-68).



2-67. Don't skimp on the stock when cutting circles on the band saw. The workpiece should be an inch or so wide than the circle diameter.



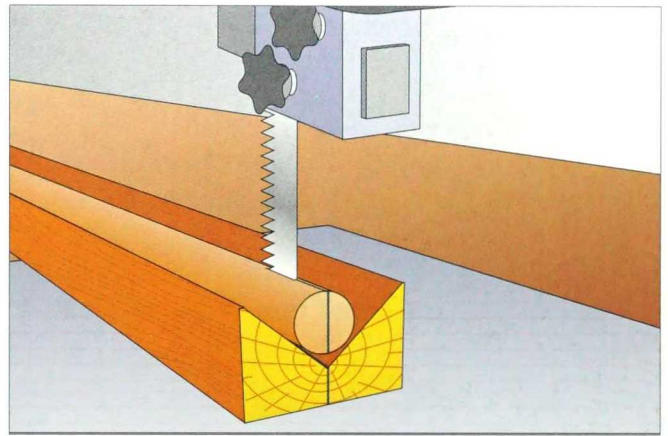
2-68. An auxiliary table can be used to cut circles on a band saw.

Cutting Dowels with a Band Saw

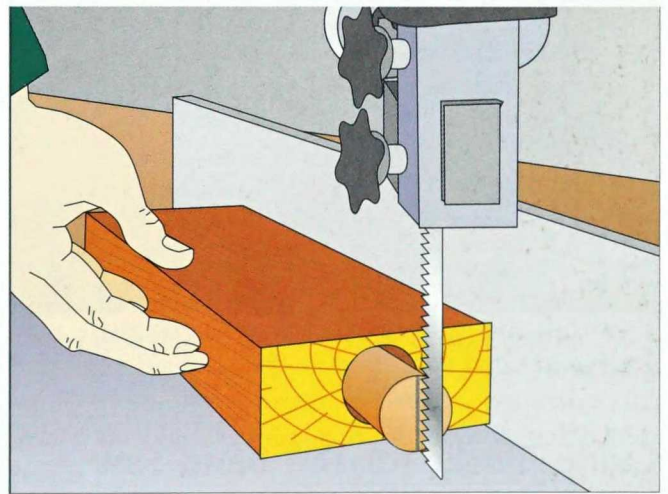
To split a short length of dowel with your band saw, cut a V block as shown in **2-69**, set your dowel into it, and carefully push the V block and dowel into the blade. After you have cut about 1 inch, push a small finishing nail through the kerf to keep the dowel vertical. Now, push only the dowel into the blade.

Another method for cutting or splitting dowels is to square off a piece of scrap and drill a hole in it that is just slightly larger than the dowel. Hold the scrap tightly against the fence and slowly push the dowel through the hole until you have cut about an inch into the dowel (**2-70**).

Now, withdraw the dowel, turn it around, and



2-69. Cutting a V block on a band saw.



2-70. A method of splitting dowels.

reinsert it into the scrap. Tap a small nail (the size of the kerf) through the stock into the hole. This will prevent the dowel from twisting. Continue the cut up to the nail, being careful not to strike the nail with the blade.

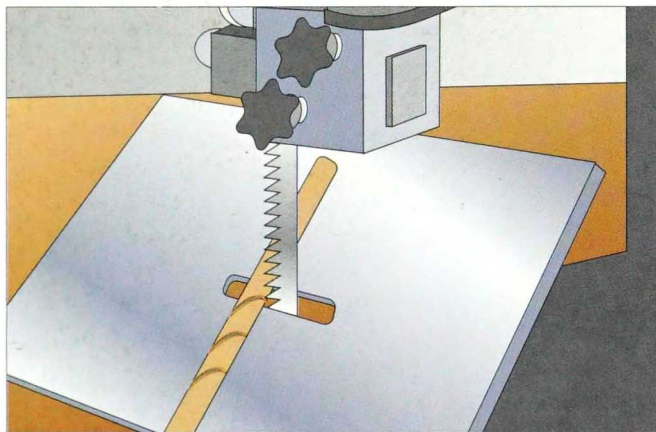
Note: Make sure that the dowel you are splitting is a couple of inches longer than required.

Cutting Spiraling Dowels with a Band Saw

Spiraled or fluted dowels are required when making doweled glue joints because they hold the glue better and thus make a stronger joint. Invariably, however, your toolbox or drawer won't have the type or size of dowel required. If you have a fluting chisel,

you can easily make the type of dowel required. If not, try this technique that I learned a few years ago:

Tilt the table of your band saw 15 to 20 degrees, use your miter gauge to hold the dowel at a right angle to the saw, and turn on the saw. The amount of pressure that you apply toward the blade will determine the depth of the cut. The saw-blade motion will automatically make the spiraling. A little practice and you'll have it down pat (2-71).



2-71. An easy way to make spiraling dowels with your band saw.

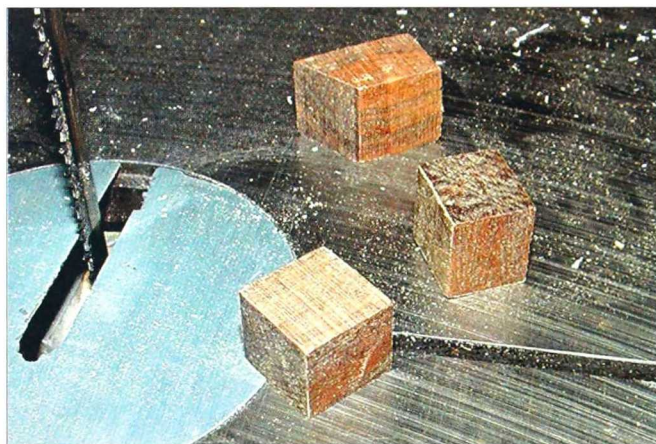
Guide Blocks for the Band Saw

The standard guide blocks that are usually supplied with a band saw are generally made of metal and they do show signs of wear in time. Do not throw them out. First do the obvious: Turn them around and use the other ends. When the other ends show signs of wear, use a bench-top disc or belt sander to redress them.

Another approach is to use Cool Blocks. Cool Blocks are made from a graphite-impregnated phenolic resin material (2-72). They create a lot less heat than conventional guide blocks, so add to the life of the saw blade. The big advantage is that these blocks can be closed up tighter to the blade, and thus give greater accuracy to the saw cut.

Cool Blocks have one other advantage. When you are using a blade narrower than $\frac{1}{4}$ inch, the blocks can be adjusted to cover *all* of the blade width without damage to it.

If you happen to live in a coastal area where



2-72. Cool Blocks will extend the life of the saw blade.

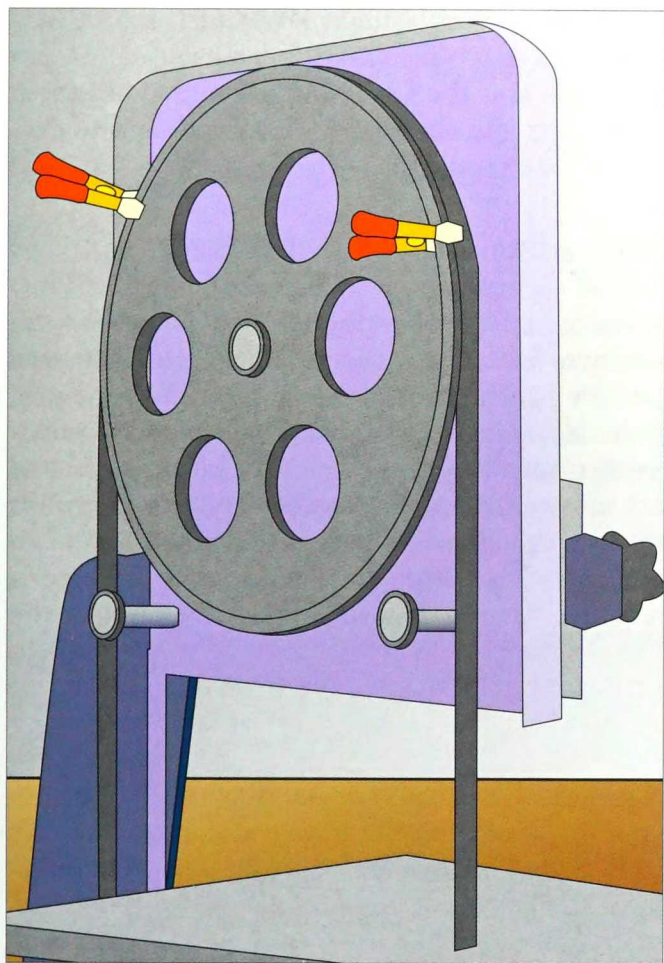
there are some shipbuilders, boatbuilders, or shipwrights, make use of these resources to make your own Cool Blocks. A lot of these trades use what they call "iron wood." Its proper name is *lignum vitae*. A couple of scrap pieces of this very expensive wood are all that you need to make your own guide blocks.

There are guide blocks available that are cut on a 45-degree angle. The advantage of having these on hand is that they can be installed to make cuts wider than the saw's throat. That is, if you install these blocks angled so that the teeth of the saw blade are aimed to the right, they will twist the blade to allow a workpiece that is wider than the saw throat. Caution, however, is required. Make absolutely sure that the blade guard is in its uppermost position.

Installing Band-Saw Blades

Installing a band-saw blade was difficult for me until I discovered the method shown in 2-73. Place the blade on the top wheel first. Next, using small spring clamps or clothespins, hold the blade secure. Feed it through the guides and over the bottom wheels. Adjust the blade tension, remove the clamps, and check for blade centering. The blade is now installed.

For optimum performance from a band saw, the blade must be centered on the wheels. The wheels on the band saw have rubber tires in them and these tires are crowned. The blade must ride on the crowns or the center of the tires. The saw has a control (usually on the back of the saw) that will alter



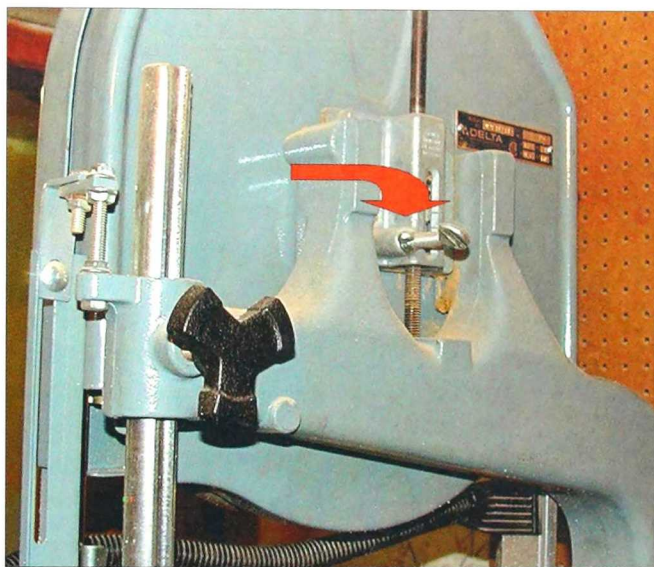
2-73. An easy method for installing band-saw blades.

the alignment of the top wheel by tilting the wheel in or out. Rotate the top wheel by hand to see how the blade sits. Adjust the control accordingly (2-74).

Making Long Crosscuts with a Band Saw

Somebody ought to impeach Mr. Murphy and repeal his laws. They always seem to come up in wood-working. For example: You have a band saw with a 14-inch throat and, of course, the workpiece that you want to crosscut is 15 or 16 inches wide. Well, Mr. Murphy, we have a method of solving this problem. Hold one end of the stock against the support post, line up the back of the cut line with your blade, and pivot the cut through. Then trim off the waste.

This shortcut is usually limited to workpieces that are from three to six inches in width. If the

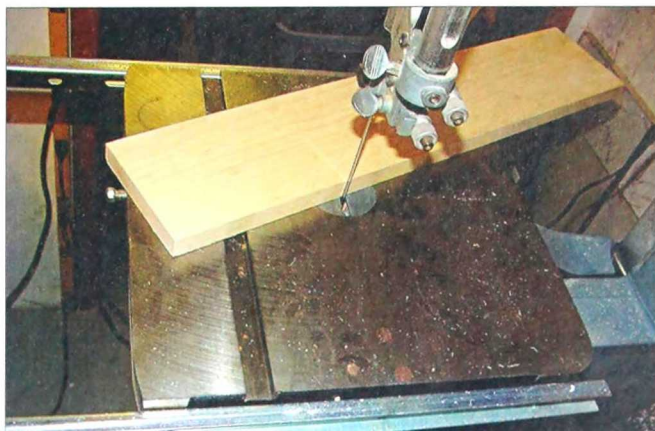


2-74. Adjusting the wheel tilt control will ensure that the band-saw blade is centered on the wheels.

stock is wider, simply turn it over and repeat the procedure. This will save a lot of scrap that would normally be thrown away.

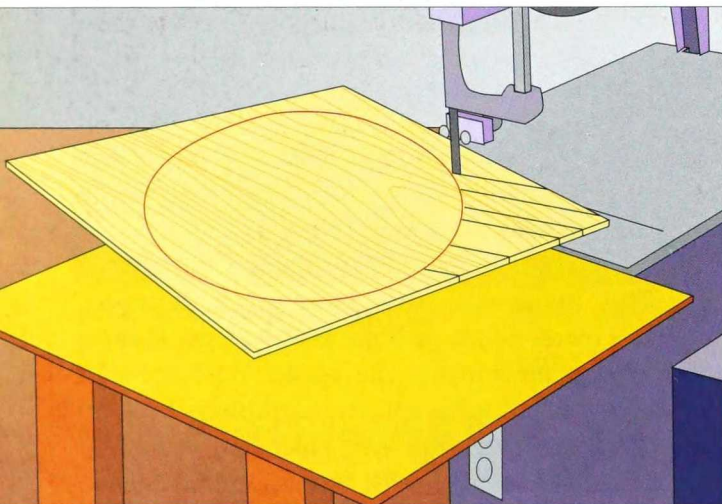
There is another method of making long crosscuts. This involves a little more work, however. Raise the blade guard as high as it will go. Relieve some of the tension on the blade. Start the cut. When the blade is fully into the workpiece, back up just a little. Turn off the saw. Place the workpiece kerf into the blade and twist the workpiece so that the blade is cutting off square (to the right) (2-75). The blade should follow the line. The wider the blade, the better. Without question, this method will put extra strain on the blade and the guide blocks, so don't do it too often.

2-75. Twisting the workpiece so that the blade is cutting off square to the right is a good method of making long crosscuts on a band saw.

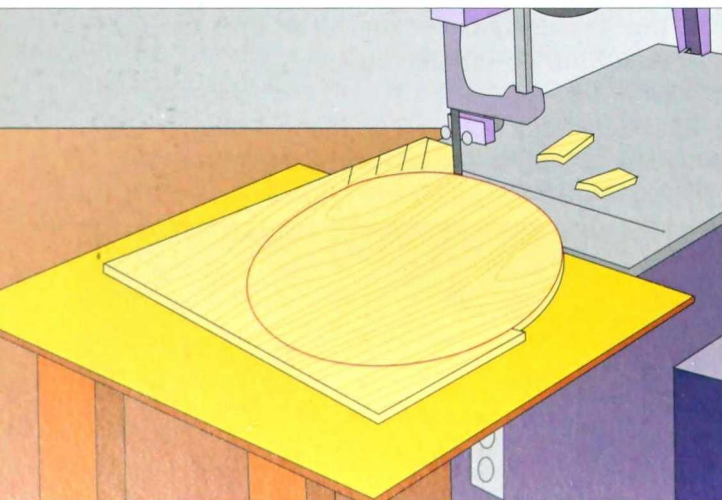


Relief Cutting with a Band Saw

Making tight turns when cutting with a band saw is easy to do if the right blade is installed. There are times, however, when we get lazy and try to make cuts with a blade that is too wide. For example, you may want to cut an oval (ellipse) and know the blade that is in the saw will easily cut the sides, but will not be able to turn tight enough to cut the top without binding. This shortcut will save some time, irritation, your saw guide blocks, and probably the blade: Before starting to cut the ellipse, make some relief cuts right up to the pattern line at the top and the bottom of the pattern (2-76). The



2-76. Making relief cuts prior to cutting an ellipse on the band saw.



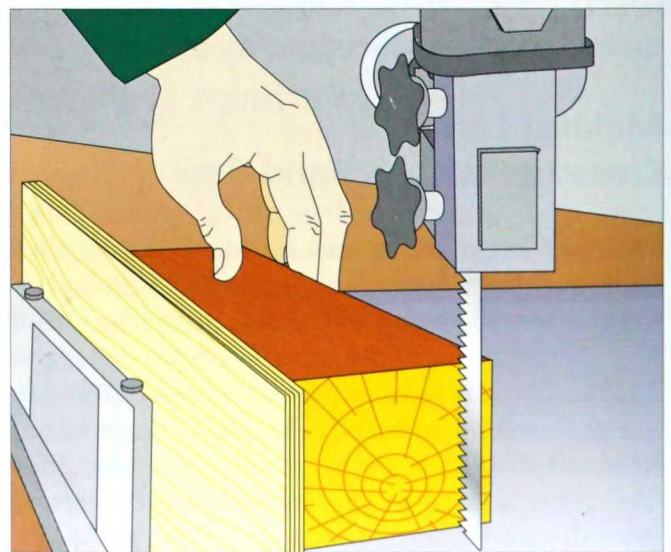
2-77. Relief cuts ease the pressure on the saw and its blade.

cuts should be at a slight angle to the line. The more cuts that you make, the easier it will be on the blade and the saw. Now, when making these tight turns, the scrap will just break away and ease the tension on the blade (2-77).

Resawing with a Band Saw

Resawing in woodworking terms is considered the ability to cut a 2 x 4 (nominal measurement) into four 2 x 2-inch pieces. This is done on the band saw. It can also be a precision technique in which woodworkers slice a piece $\frac{1}{32}$ inch wide off the surface of a 1 x 8-inch board. Needless to say, to accomplish this both the table and the blade must be accurate and the widest blade possible for your machine is required. After you have checked the level of the table and the plumb of the blade, the next thing is to make sure that your rip fence is square to the table.

There may be times when you want to resaw a piece that is 4 inches high and your rip fence is only 2 inches high. This shortcut will help: Either use your thickness planer or have your lumberyard mill a piece of elm or maple to precisely $\frac{3}{4}$ inch in thickness. Failing this, a piece of plywood will do. This stock should be six inches wide and at least twice the length of your saw table. Affix the stock to your existing fence with nuts and recessed bolts (2-78). The reason for using stock $\frac{3}{4}$ inch thick is

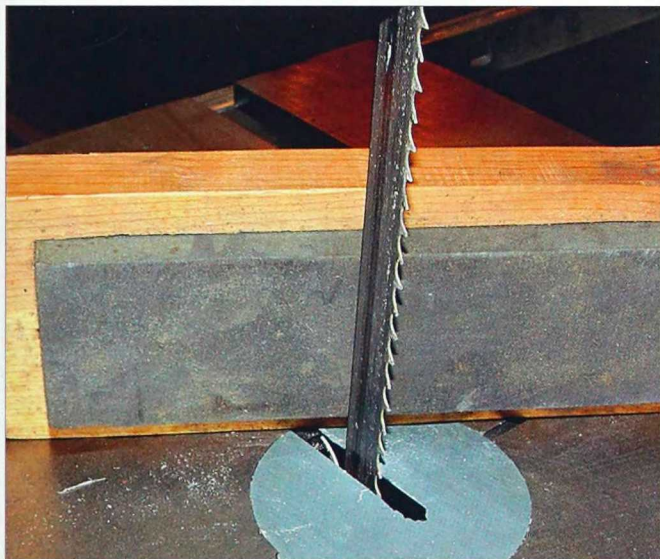


2-78. Resawing a piece of cedar 4 x 6 inches with the auxiliary fence in place for additional stability.

to ensure its rigidity. If the measurement scale on the rip fence is accurate, subtract the $\frac{3}{4}$ inch from the indicated mark.

Rounding Band-Saw Blades

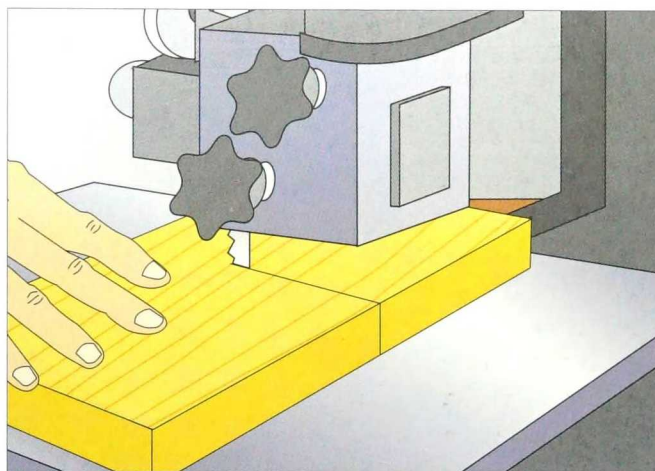
Rounding the back edges of your band-saw blades will help to make the blades cut smoother, reduce the wear on the guide blocks, and extend the life of the blades. This is easy to do. With the machine turned on, carefully apply a sharpening stone to the back edges of the blade in a rounding motion (2-79). With narrower blades, slowly feed a piece of scrap wood into the blade while you are rounding them. This will prevent the blade from twisting.



2-79. Using a sharpening stone to round the back edges of a band-saw blade for smoother scrolling cuts.

Safe and Accurate Cutting Techniques

Many woodworkers I know tend to discount the band saw as being a dangerous tool to work with. Do not be so blasé when using yours. The band saw can nip off the end of a thumb in a flash. These same woodworkers are probably the ones who have problems cutting a straight line without the blade wandering. Both safety and straight-line cutting can be addressed with this rule of thumb: Always

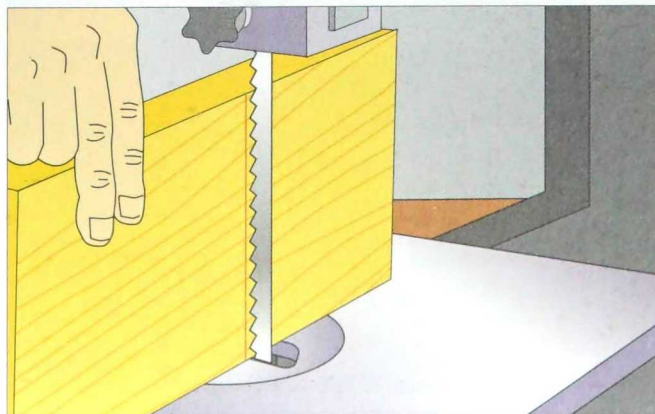


2-80. The upper blade guard should be no more than $\frac{1}{4}$ inch above the workpiece. This will increase the accuracy of your cut and will keep the fingers away from the moving blade.

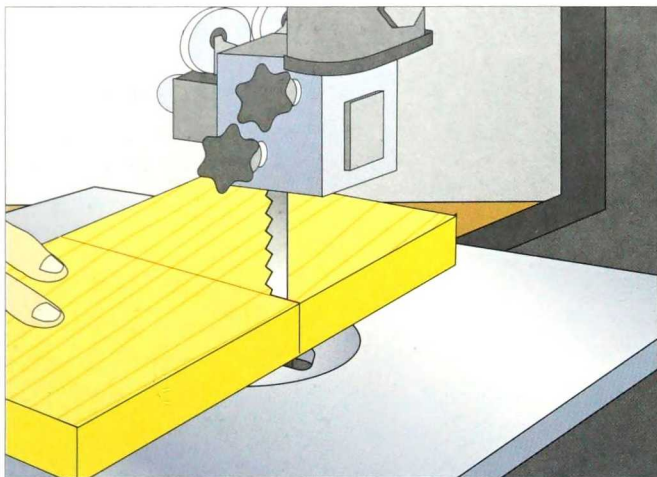
place the upper blade guard no more than $\frac{1}{4}$ inch above your workpiece (2-80).

Scoring for a Straight Line

How often have we taken out the tape measure to make a mark, say $6\frac{1}{2}$ inches on a 1 x 4-inch piece of stock? Well, we make the mark, find our try square, draw a line, and then proceed to make the final cut. This technique will save you from having to root around your toolbox or going over to your pegboard to find the try square. Simply make your measured pencil mark at the top edge of your workpiece and advance the piece into the moving band-saw blade, just enough to score it (2-81). Now, turn it up so that the score line is on



2-81. Scoring the workpiece with the band-saw blade.



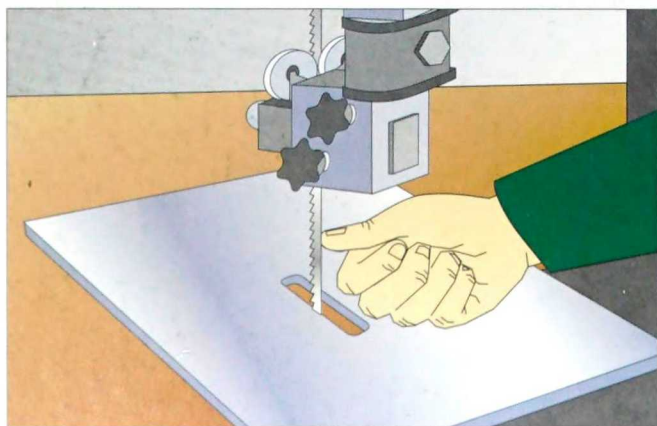
2-82. Using the saw cut as a guideline for a square cut.

top and proceed to follow that line with your cut (2-82). If your saw is properly set up, you will end up with a perfectly square end.

Tensioning Band-Saw Blades

A properly tensioned blade will give a more accurate cut and last longer than an improperly tensioned one. Most band saws have a scale either printed or molded right by the blade-tensioning screw. In most cases, this scale gives only a good general indication of the tension of the blade. A good industrial-type blade will usually take considerably much more tension than what the scale indicates.

So, if you want to ensure straight and accurate cuts without the blade wandering or following the



2-83. Plucking the blade to hear its note for proper tensioning.

wood grain, tighten up your blade. If, for example, you have installed a $\frac{1}{4}$ -inch blade, try tightening it up to the $\frac{3}{8}$ -inch mark on the scale. If the blade still wanders, tighten it up a little more. When you are satisfied, pluck the stationary blade and listen to its tone (2-83). If you have any musical inclination, you might even be able to identify the note. If you can, write it down for that size blade and continue testing for other sizes as well.

BAR CLAMPS (GRIPPING)

The conventional 6- to 12-inch bar clamps usually have smooth wooden screw handles on them. The manufacturers seem to forget that when someone works with wood, sawdust is created, and that sawdust will absorb the moisture in your hands. Therefore, when you try to tighten the handles, they slip. Here are two methods that will alleviate the problem. Locktite has a product on the market called Color Guard (2-84). This is a liquid latex type of material that can be applied by dripping or brushing. It dries in about a half an hour. At least two coats should be applied, according to the manufacturer's instructions. Color Guard is available in half a dozen opaque colors as well as a clear application and it really works well.

The other method of improving your grip on



2-84. Color Guard by Locktite has been applied to the bar clamp handles.



2-85. An old inner tube cut in strips will give you a better grip on your clamp handles.

bar-clamp handles is to use an old bicycle or car inner tire tube (**2-85**). The bicycle tire tube may, in fact, fit tightly over some of the handles without being glued. If not, cut a strip about ½ inch wide off the tube. Apply some rubber cement to the handles and then wrap the strip around them.

You might want to look at some of your other wooden-handled tools and apply either one of the above methods to them.

BELT SANDER

The portable belt sander (**2-86**) is a powerful tool that can be used to smooth rough-cut lumber, to name just one task. Safety should be foremost in your mind when working with this tool. Do not



2-86. The portable belt sander can be a very helpful tool in the workshop.

apply pressure to it, as it generally has enough pressure to do the job at hand. Applying too much pressure will result in gouges in the wood surface.

Belts are available in various grits, the most common being coarse, medium, and fine. This is not a finishing sander, so a fine-grit belt has approximately 80 to 120 grits.

Most belt sanders now come equipped with dust-collection bags. Make sure the dust-collection bag is emptied often, because it fills up quickly. Some belt sanders have threaded holes on the top so that they may be inverted and bolted down to be used as a fixed belt sander. A fence is sometimes available as an accessory.

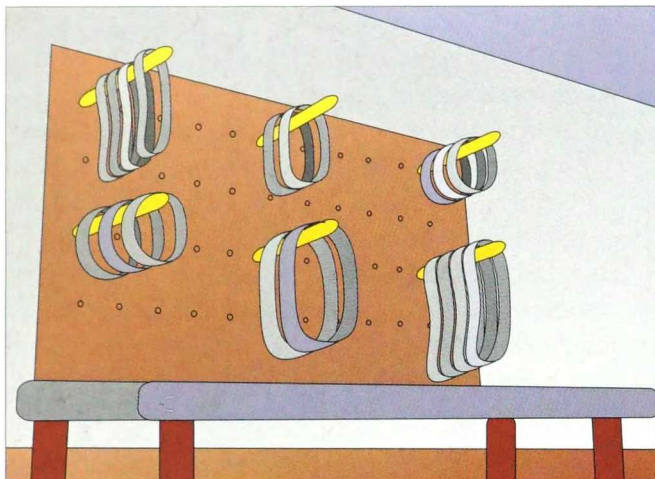
Safety Guard for Belt Sanders

One of the handiest sanding machines that I have seen is the one shown in **2-87**. It's made by Delta and has a 1-inch-wide belt. The table tilts for angle sanding and sharpening. I have found, however, that because of the opening at the top wheel, some devices will come flying out. There is a vacuum port that will pick up most of the dust, but there is still a risk.

I solved this problem by making a small curved Plexiglas flap that I simply taped on with fiberglass tape. The flap directs the debris down toward the table. Should I want to use this upper portion of the sander for rounding off, I simply flip the guard up and out of the way.



2-87. The shop-made Plexiglas guard will deflect sanding debris on this Delta 1-inch belt sander.



2-88. Store belt sander belts on a pegboard with belts of similar grits.

Using the Belts

Always loosen the pressure release on your belt sanders when they are idle; doing this will greatly extend the life of the belt. Better yet, remove the belt and store it on a pegboard nested with other belts of the same grit (2-88).

See also Sanding Belts under Abrasives.

BENCH DOGS

(See Workbench)

BENCH VISE

Normally, one would think of a bench vise as a bulky cast-iron device that is screwed to the corner of a workbench. It is not necessarily so anymore. Vermont American sells a Bench Vise that you can roll out on the surface of the workbench (2-89). It looks like a pad that goes underneath a carpet, and works very well. It is used primarily for holding the workpiece for routing, but it works equally well for sanding, planing, and some carving.



2-89. The Bench Vise by Vermont American will hold most workpieces securely to the workbench.

BISCUIT JOINERS

The biscuits used in biscuit joinery expand in the joint when glue is added, and that, in conjunction with the glue, helps to make a tight joint. To help expedite this, make sure that your sealed biscuits remain dry. Keep them in a sealed container with a pack of desiccant (2-90). Desiccant packs are used in electronics and camera shipping packages and if you talk nicely to your local camera dealer or electronic equipment dealer they will probably give you a couple.



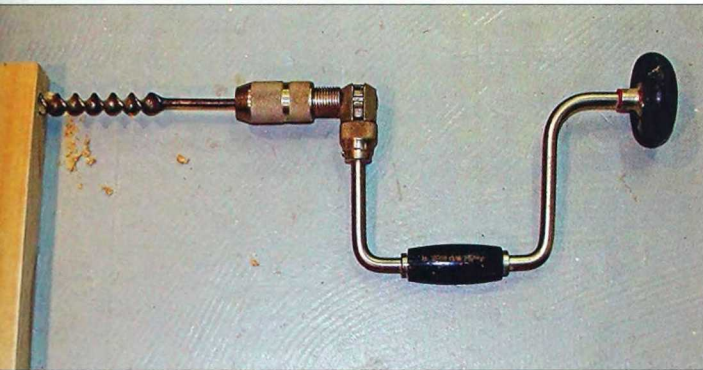
2-90. Keep a pack of desiccant in a sealed jar with your biscuits.

BLADES

(Refer to the appropriate tool)

BRACE

The brace is a tool that you don't often see around a workshop anymore because it is outdated, but surely some of you out there remember it and, hopefully, still use it. Usually referred to as a "brace and bit," it is a marvelous tool. With a sharp bit, extremely clean holes are accomplished. The one shown in 2-91, a relatively modern one, has a ratchet and a reverse gear. The ratchet allows you to get the best leverage out of the tool.



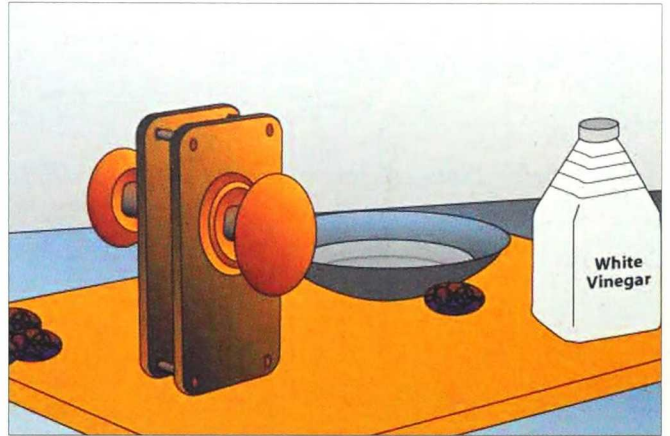
2-91. The brace and bit in use. The ratchet indicates that this tool is a relatively new model.

BRADS

(See Nails)

BRASS (REMOVING TARNISH FROM)

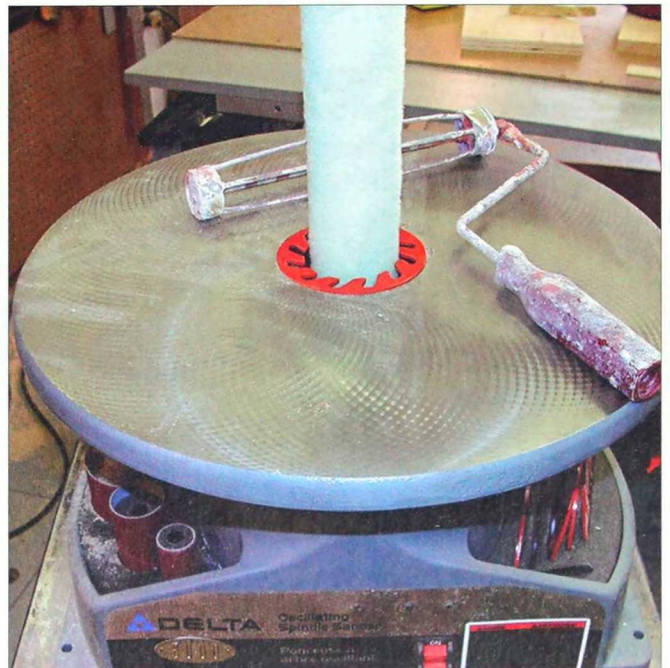
To remove tarnish from brass, dip #0000 steel wool into white vinegar and scrub the brass clean (2-92).



2-92. White vinegar and steel wool will remove the tarnish on brass.

BUFFING

A paint roller makes an excellent buffer for wood or metal projects (2-93). You can cut it to size to fit on a sanding drum and then mount it in a drill press or you can leave it the way it is and use it on an oscillating sander.



2-93. A paint roller fitted on a sanding drum and then mounted in a drill press or oscillating sander makes an excellent buffer.

CAULK

The following are general guidelines concerning what type of caulking compound to use and where to use it (2-94):



2-94. Caulk.

Acrylic caulk should be used on exterior surfaces only. It is sold in a wide range of colors, but it should not be painted. Acrylic has a life exceeding 20 years.

Acrylic latex has interior and exterior applications around windows, doors, wood siding, etc. It can be painted and cleaned up with soap and water.

Butyl/rubber caulk is used on concrete block, brick, gutters, flashing, chimneys, etc. It may be used below grade (that is, on foundations that have been backfilled) and in high-moisture areas. It is available in different colors and can be painted. It has a fairly high shrinkage rate.

Silicone caulk is used on metal, glass, tile, and other nonporous surfaces. It is good for joining dissimilar materials, such as mounting mirrors on walls. It is also very flexible, and will last 20 to 50 years.

Caulking Around a Bathtub, Etc.

To do an effective job of caulking around a bathtub, sink, window, or door frame, place a small bead of silicone caulk or other type of caulk around the



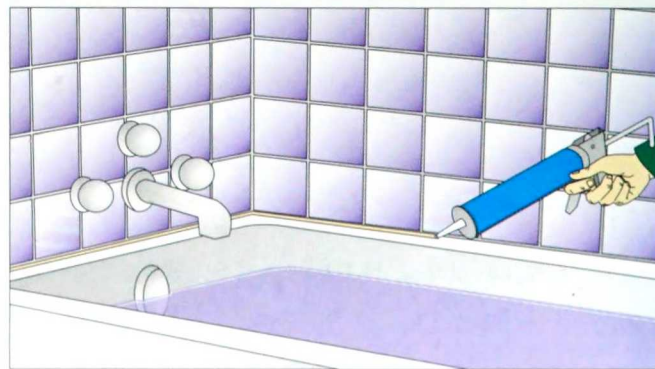
2-95. Dip your thumb frequently into a dish of detergent liquid when applying caulk in corners.

perimeter (2-95). Pour a small amount (about 1 ounce) of dish detergent liquid into a glass or plastic cup along with an equal amount of water. Carefully force the caulk into the corners with your thumb or middle finger, making sure to frequently dip the thumb or middle finger into the liquid.

When recaulking around the inside of a bathtub, make sure that the tub is full of water (2-96). Keep the water in it until the caulk has dried to the touch. This will give the caulk a better seal and further ensure that there will be no leaks. Conversely, when removing the old caulk, filling the tub with water will make the job easier and ensure that you get all of the old caulk out.

Preventing Caulk from Drying Out

There is nothing more annoying than having the caulk in a previously opened caulking tube dry up.



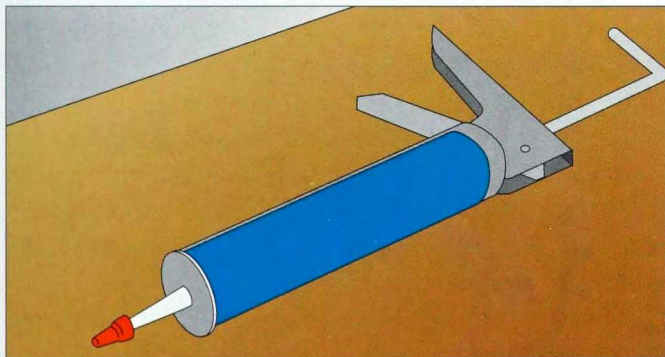
2-96. Recaulking around the inside of a bathtub.

You place the half-full tube in your gun and discover that nothing will come out.

To prevent this, next time you open a tube of caulk and have finished using it, take a large pan-head wood screw, one that is large enough to fit on the inside of the nozzle, and screw it into the nozzle (2-97). You can also screw a large electrical wire nut onto the head of the nozzle (2-98).



2-97. Screwing a pan-head wood screw into the nozzle of a tube of caulk.



2-98. A large electrical wire nut has been screwed onto the end of this caulk nozzle.

Preventing Caulking Tubes from "Running On"

To prevent caulking tubes from "running on" after you have released the trigger, tightly wrap the tube in duct tape before inserting it into the gun (2-99). This deters the expansion of the tube that occurs because of the pressure exerted on the back of the tube when the trigger is released. To make doubly sure the tube does not run, also release the trigger catch when releasing the trigger.

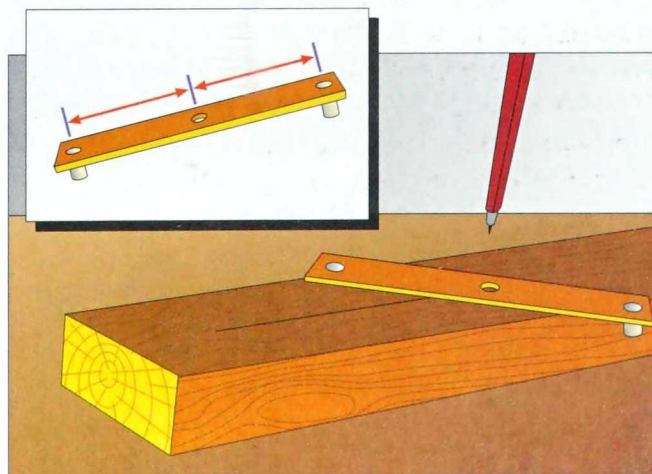


2-99. Wrapping duct tape around the caulk tube.

CENTER-FINDING JIG

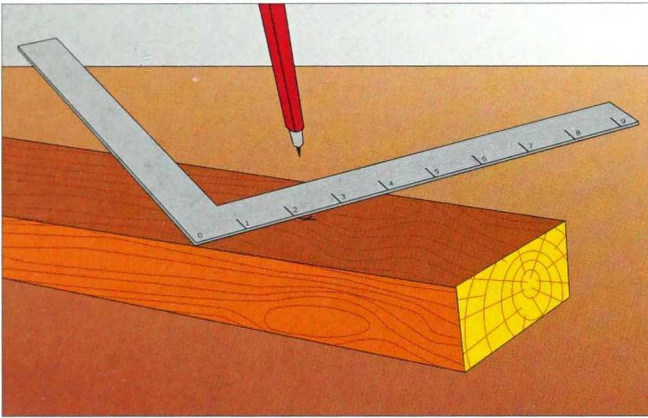
As an example, let's assume that you want to work on a piece of stock that is $5\frac{13}{16}$ inches wide and you have to find the center of it. One way to do this is to cut a 10-inch length of $\frac{3}{4} \times \frac{3}{4}$ -inch stock. Make a mark exactly 1 inch from each end and in the exact center of the stock. With your drill press, drill $\frac{1}{4}$ -inch holes into the marks at both ends. Glue a $1\frac{1}{4}$ -inch-long dowel with a $\frac{1}{4}$ -inch diameter into each end. Now, check the diameter of the pencil that you usually use, and drill a hole precisely into the center of the stock.

Now, simply place your pencil in the hole, slide the jig down the stock, and you have a centerline (2-100).



2-100. One way of finding the center of stock.

There is another method for finding the centers of stock. Let's assume that you have a board that is $11 \frac{3}{8}$ inches wide and you want to find its center. Take your builder's square, place the bottom corner of the long side at one edge of the stock, and move it up on an angle until the other edge of the stock joins a whole number, i.e., 14 inches (2-101). Then simply divide the whole number by two.

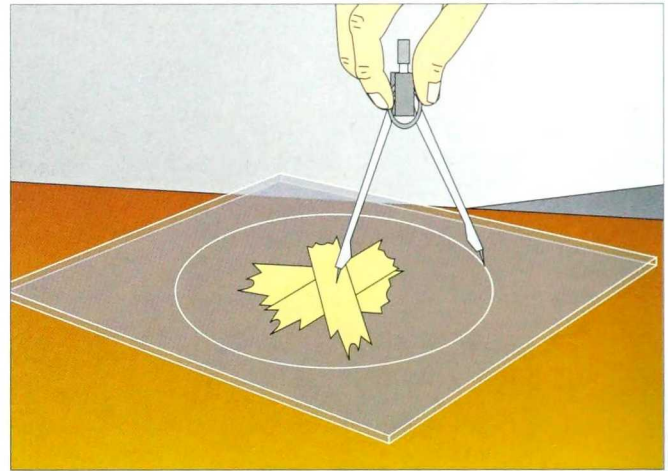


2-101. Another method for finding the center of stock.

CENTERS (DRAWING)

The next time you use a compass to draw a circle on wood or plastics and you don't want to see that hole in the middle that a compass usually makes, this technique will help.

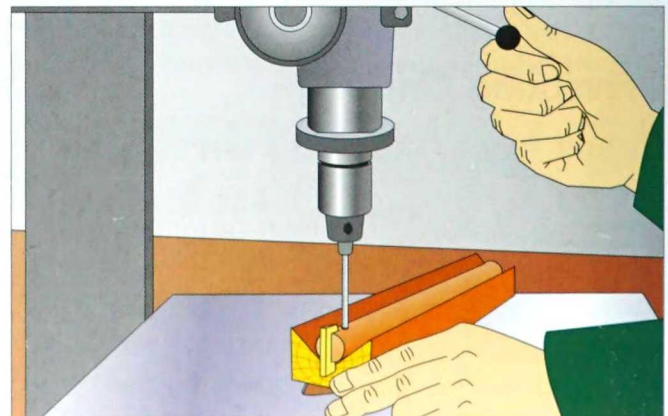
First, find your approximate center. Next, lay two or three strips of masking tape across the workpiece, to form an X. Measure to find your exact center and use the masking tape to support your compass point (2-102). Because plastics scratch so easily, you may want to put five or six layers of tape down.



2-102. The several layers of masking tape on the Plexiglas will protect it when the circles are drawn on it.

and/or the glue. To repair the loose legs, most of us remove them, clean them off, and reinstall them with new adhesive. Maybe the following is a better method: Run a band-saw cut the length of the dadoed end. The kerf is usually $\frac{1}{16}$ inch, so drill a hole at the end of the kerf that is $\frac{1}{8}$ inch in diameter. The purpose of this is to relieve the kerf and deter the leg from splitting further. Before reinstalling the leg, insert a small wedge into the kerf and trim the edges flush (2-103). Leave $\frac{1}{4}$ to $\frac{1}{2}$ inch sticking out on top. Add the glue and hammer the leg home. The wedge will spread the kerf when the leg is hammered all the way in.

This, by the way, is a good way of installing legs on a new project as well.



2-103. A small hole drilled at the end of a saw kerf will help prevent splitting. The wedge in the kerf will ensure a tight fit.

CHAIR AND TABLE LEGS (FITTING)

Round, dadoed, or tapered legs for tables or chairs often become loose due to the drying of the wood

CHALK LINE

Most people think of a chalk line as a tool that should only be in a house builder's toolbox (2-104). Not so. The chalk line can be used for a multitude of things in the home workshop. For example, the chalk line is a quick and easy way to make a line for ripping a 4 x 8-foot sheet of plywood. It will also make a clear vertical line for nailing in those first and subsequent studs against a foundation wall, and can be used on the end gables of a bookcase to give you a straight line for screwing in shelves. You don't have a plumb bob? The chalk line works just as well. And the list goes on.



2-104. A typical chalk line and a bottle of powdered chalk.

Use the chalk line correctly, though. First, make sure that your measurement is accurate, and then set the hook of the line precisely so that the chalked line is on your measurement mark.

Use a steel square to true the line and then pull it taut and hold it at the reel end.

Now, grasp the middle of the line and pull *straight up*. Let go and the line will snap down and leave a definitive and straight chalk mark on your workpiece. The important point to remember is to pull the cord straight up or the resulting line will be distorted.

A rainbow of powdered chalk is available so that

the line will stand out on a wide range of materials. I prefer blue, as it seems to have an iridescent glow that makes it visible on almost any material. A damp cloth will wipe away any traces of the line.

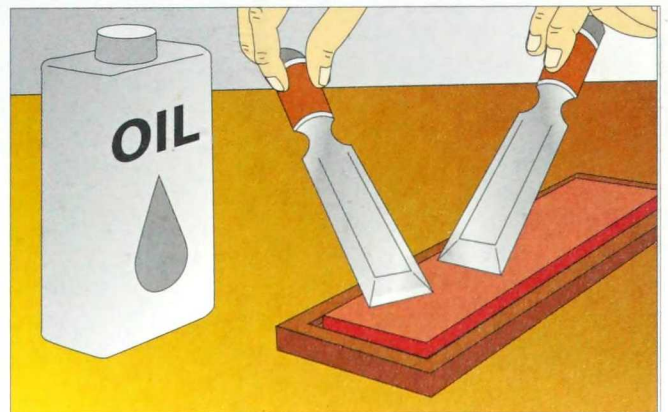
CHIPBOARD

(See Plywood)

CHISELS (MAINTAINING)

Some of the better manufacturers of wood chisels suggest that you put an additional two-degree edge on their chisels before using them because it gives a sharper edge for the blades. Don't stop there. When you are chiseling mortises, it is imperative that all sides are flat and parallel. This can be achieved *only* if the chisel backs are also flat. Verify this by laying the chisel blade flat on an oilstone and rubbing it on the oilstone a few times (2-105). The high spots will show the grinding marks. If the gaps are serious, the blade will have to be flattened. Start with a coarse stone and work up to a fine stone until all the high spots are removed.

Oh, one thing more. An often neglected area on chisels is the edges. Using the above method, check for high spots and grind them down as well.



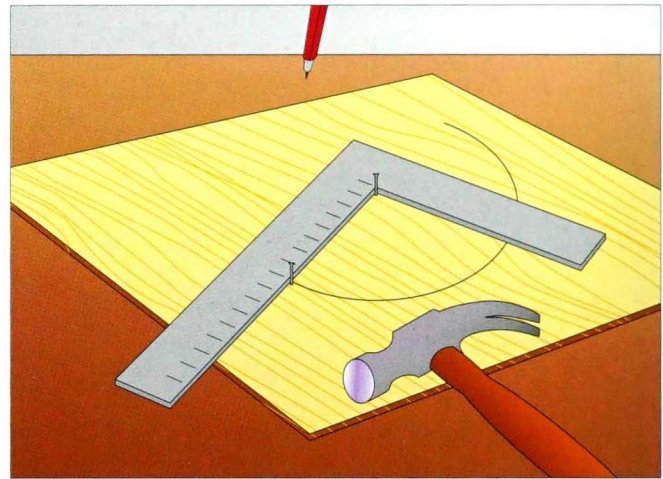
2-105. A new chisel on the right and a newly honed one on the left.

CIRCLES

(Also see *Band Saw, Drill Press, Radial Arm Saw, and Table Saw*)

Drawing Circles

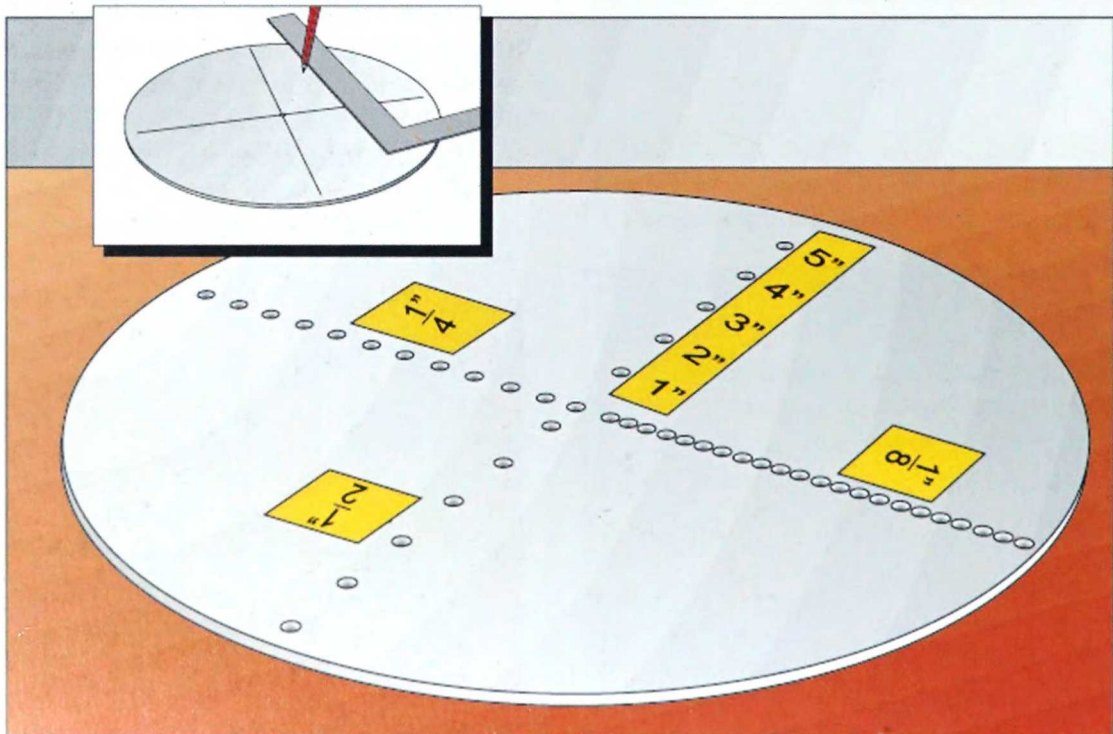
There will be times when you will want to draw circles and do not have a circle compass available. Here's a simple method for drawing circles up to 24 inches without one. Let's assume that you want to draw an eight-inch radius. With your builder's square, draw a straight line across your stock. Then drive two small nails along the line, eight inches apart. Lay your builder's square flat on the stock, with the inside corner around the first nail. Put your pencil in the corner of the square and simply move the square and your pencil up and over to the next nail. This will produce an arc (2-106). Repeat the procedure for the next half.



2-106. An easy method for drawing circles.

Patterns for Circles

This technique will save you a great deal of time in the future when you want to make circles for wheels, etc. Cut a 12-inch-diameter piece of $\frac{1}{32}$ -inch-thick polystyrene (see *Plastics* on page 143) and find and mark its center. Draw a line completely up the center (2-107). Mark the line exactly every



2-107. Draw a line completely up the center of the pattern.

inch from the center to one outer edge. On the other half of the line make a mark every inch, skipping the whole numbers. Start at the $\frac{1}{2}$ -inch mark ($\frac{1}{2}$ inch, $1\frac{1}{2}$ inch, $2\frac{1}{2}$ inch, etc.).

Now, draw an intersecting line completely across the circle and on the left. Mark it every $\frac{1}{2}$ inch. Begin at $\frac{1}{4}$ inch, and skip the $\frac{1}{2}$ inch and the whole numbers ($\frac{1}{4}$ inch, $\frac{3}{4}$ inch, $1\frac{1}{4}$ inch, $1\frac{3}{4}$ inch, etc.). On the right side, make a mark every $\frac{1}{4}$ inch. Begin at the $\frac{1}{8}$ -inch mark, eliminating the $\frac{1}{4}$ - and $\frac{1}{2}$ -inch marks and the whole numbers.

Drill a $\frac{1}{16}$ -inch hole at each of these marks, including the center. Drill a $\frac{1}{4}$ -inch hole in a blank space near the top for hanging, sand off the burrs on the back, and, with a felt-tip marker, mark a $\frac{1}{16}$ inch on that line, etc. Finally, use a compass to draw a circle only at the inch line holes.

To use this device, place it on your workpiece, tap in a finishing nail in the center, put a pencil point in the desired hole, and rotate it. The whole numbers on the jig shown in 2-107 represent the radii, not the diameters.

CIRCULAR SAW (PORTABLE)

The portable circular saw (2-108) is a handy tool in the workshop. It can be used when the stock is too large to be cut with a table saw or radial arm saw. In use, the stock remains stationary and the saw is fed into the stock.

Plywood-Cutting Jig for a Circular Saw

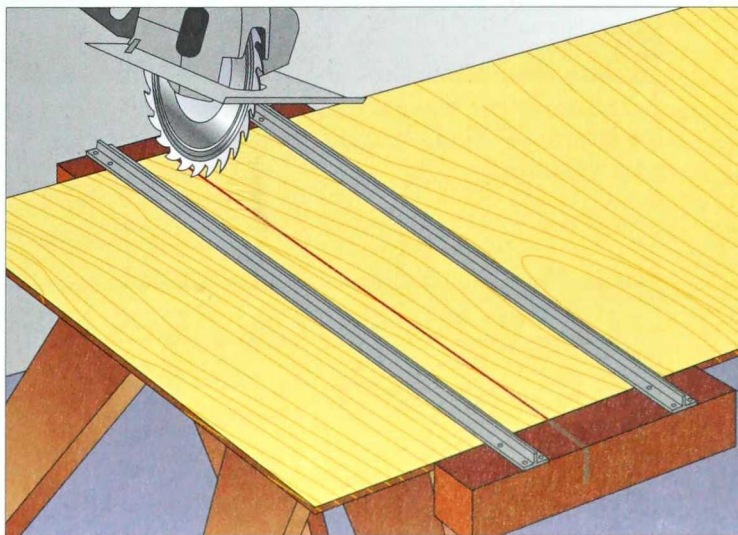
The plywood-cutting jig in 2-109 is made from two-inch-square aluminum tube and a one-inch angle. It's about five feet long overall, with the tube crosspieces set $48\frac{1}{4}$ inches apart. It is of proper width so that my portable circular saw can fit snugly in the channels. The jig is perfectly square, so it will fit across the width of a 4 x 8-foot sheet of plywood or similar type of stock.



2-108. A portable circular saw.

Proper Circular Saw Cutting Techniques

Tear-out or ragged edges won't be a problem on your finished work if, when cutting with your circular saw, you make sure that the good side of your material is always facedown and that you are using the correct blade.

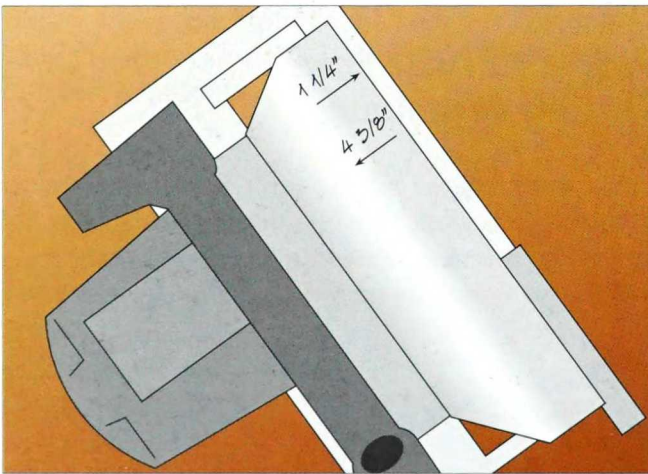


2-109. Pop rivets hold this aluminum plywood-cutting jig together. The shoe of the saw rides in the angles like a sled.

Using a Straightedge

When using a straightedge as a guide for your portable circular saw, you usually have to add the distance from the blade to the edge of the saw shoe to your measurements. If you are a weekend woodworker, you probably have to verify this measurement with a measuring tape each time you use the saw.

To save some time when you use the saw next, write the measurements from both sides of the blade to the shoe edges on the motor housing of your saw (2-110). Write these measurements on a sticky label or use a soft-tip marker. Most saw blades cut a $\frac{1}{8}$ -inch kerf, but make a test cut with your blade and add its kerf measurement on the motor housing with the other measurements.



2-110. Write the measurements from the blade edge to the shoe edge on the housing of your circular saw for easy reference.

CIRCULAR SAW BLADES

(Also see Radial Arm Saw and Table Saw)

Buying Circular Saw Blades

One type of circular-saw blade is the carbide-tipped blade. This blade has a wide range of prices, and can be bought for as little as five dollars. It is

much more durable than a high-speed steel blade. Purchase your blade from a reputable dealer. Select only brand-name products.

One basic rule that should govern your blade selection is that the more teeth, the finer the cut. The number of teeth is proportionate to the size of the blade. For example, an 8-inch blade with 35 teeth will give about the same cut as a 10-inch blade with 50 teeth. Some blades, such as planer blades, tend to wobble slightly, and this will affect the cut. Therefore, a set of stabilizers is recommended. These stabilizers are like large washers that are slightly concave and fit on both sides of the blade to stabilize it.

There are also blades, generally 10 or 12 inches in diameter, which have a very shallow cutting sequence. These blades are very thin for the first $1\frac{1}{2}$ inches or so, and then become thicker up to the arbor hole. They are meant for cutting thin materials such as plastic laminates, etc. There is a group of specialty blades that are designed to be used in particular woodworking situations. Included in this group are blades with 200 teeth that are used for plywood and give an extremely smooth cut. Unless you are in the woodworking business and set up for production, they probably won't concern you.

Following are some types of blade that are recommended for use in the workshop (2-111). A *combination* blade is a general-purpose blade that will give fairly clean crosscuts and rip cuts. The



2-111. A selection of circular saw blades.

more teeth it has, the finer the cut. A *crosscut* blade, as its name implies, is the blade best suited for crosscutting. It generally has more teeth to provide a smoother cross-grain cut. A *planing* blade gives an extremely smooth crosscut, but is very thin and should not be used for ripping or for very thick material. A *rip* blade generally has fewer teeth than other types of blade, because it faces less resistance as it is used to cut with the grain of the wood.

There are special blades for cutting plywood, plastics, laminates, particleboard, Masonite, nonferrous metals, etc. For information on these types of blades, consult a tool-shop specialist or mail-order catalogues.

Also see Radial Arm Saw and Table Saw for additional information about circular-saw blades.

Cleaning Circular Saw Blades

If your saw blades aren't cutting properly, it may not be because the blade is dull. The blade may just be dirty.

Pine, spruce, and other soft woods are the materials most likely to clog up a blade. They will leave a residue of tar and gum on your blades that will slow down the cutting rate or leave burn marks on your wood. They will also speed up the dulling process on the teeth.

One method of cleaning is to spray on some oven cleaner. Let the oven cleaner remain on the blade for a couple of hours, and then brush the blade clean (2-112). Another cleaning method is to use washing soda.

Check your circular saw blades often, and keep them clean. The same rule applies to your other blades and bits. Use the same cleaning methods.

One final note: After the blades are clean, give them a shot of silicone spray. This will help retard the buildup of tars, resins, and rust.

Containers for Circular Saw Blades

Many circular-saw blades come with a plastic container. Save these containers. They are very handy for cleaning blades and for spraying them with silicone. (Refer to inset in 2-112.)

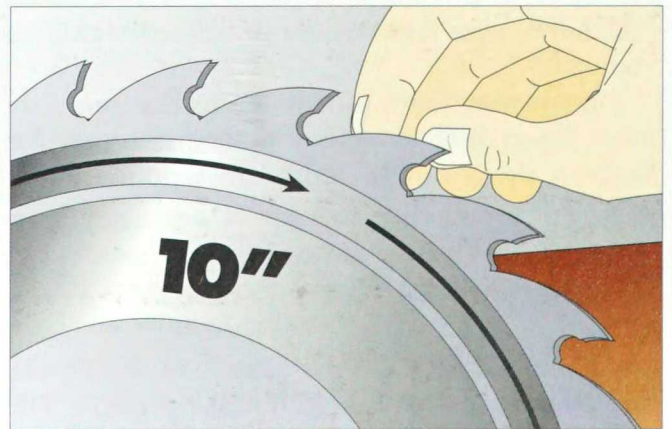


2-112. One method of cleaning circular saw blades is to spray on oven cleaner and to brush the blades clean. The inset shows one of many types of circular saw containers.

Determining the Sharpness of Circular Saw Blades

The easiest way to determine whether or not your saw blades are sharp is to simply use your thumbnail on the tip of a randomly selected tooth (2-113). If the tooth leaves a scratch mark on your thumbnail, the blade is sharp. If it doesn't, have it sharpened.

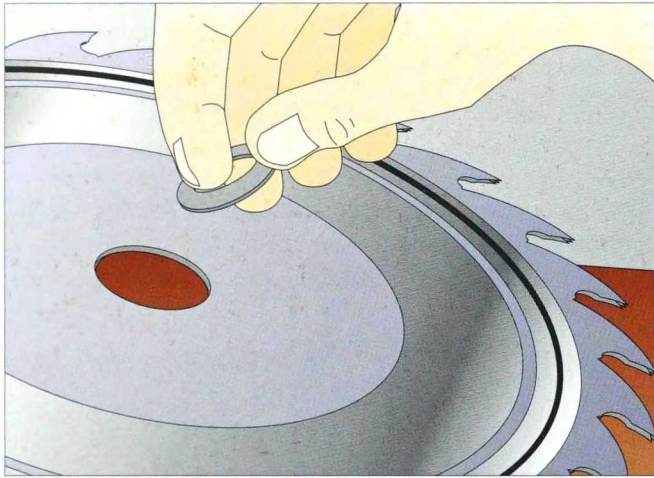
Never use a dull saw blade. Dull blades can cause excessive strain on your saw's motor and thereby severely shorten its life.



2-113. To determine whether or not your saw blade is sharp, run your thumbnail on the tip of a tooth. If the tooth leaves a scratch mark on your thumbnail, the blade is sharp.

Fitting Circular Saw Blades

If you have a circular saw blade with an arbor hole that is too big for the saw arbor, don't throw it away. Most hardware or tool stores and flea markets carry reducing washers for just this purpose (2-114).



2-114. This washer will reduce the size of the arbor hole on the blade.

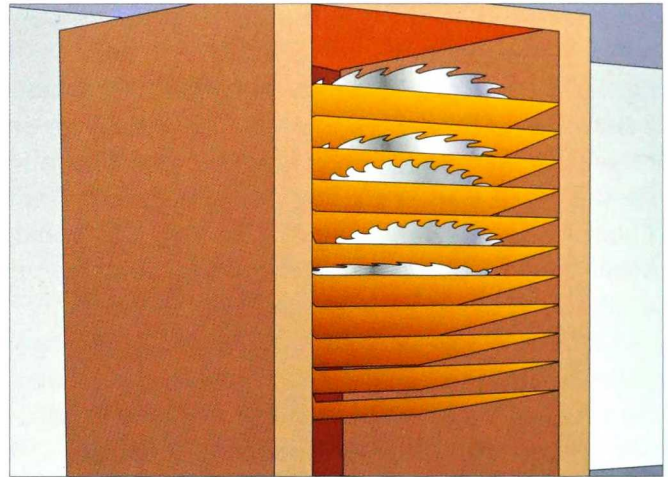
Safety Techniques for Circular Saw Blades

Always make sure that there are no teeth or tips missing on your saw blades before starting up your saw. Make it a habit to check, just as you would look out of your rearview mirror before backing up your car.

One missing tooth usually means that more are loose. If you discover a tooth missing, don't use the blade. A flying carbide tooth can seriously injure you.

Storing Circular Saw Blades

The simple storage cabinet shown in 2-115 was built to store all my 10-inch circular saw blades. The shelves are made of scrap $\frac{3}{16}$ -inch paneling, while the top, sides, and bottom are made of $\frac{1}{2}$ -inch plywood. When putting my blades away, I slip a piece of Styrofoam packing underneath the blade.



2-115. A simple storage cabinet for storing circular saw blades.

CLAMPS

(Also refer to Bar Clamps)

There are clamps available for just about every situation that requires one (2-116). These include clamps to hold oblique angles; pipe clamps; bar

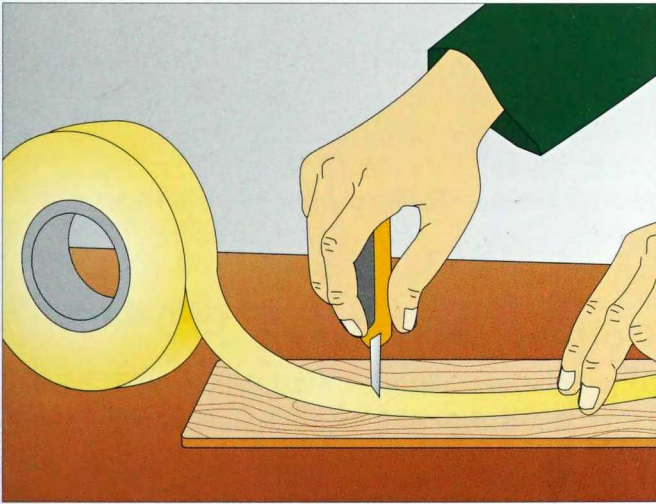


2-116. A variety of clamps that will prove helpful in the workshop.

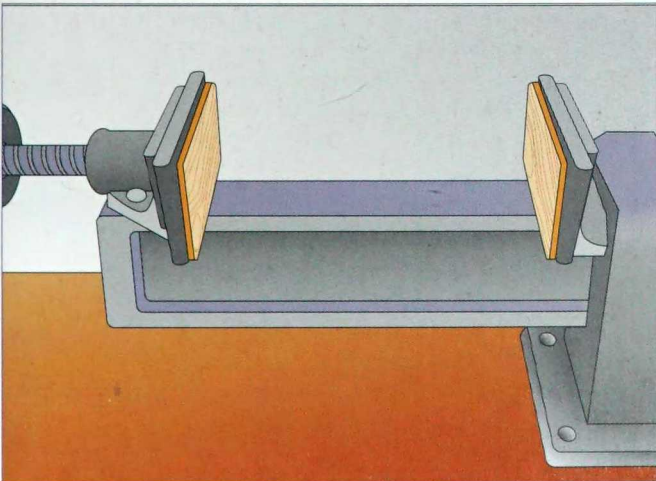
clamps; C-clamps, F clamps; K clamps; band or strap clamps; spring clamps; and vises. Even clothespins and paper clips will help keep wood in position for gluing.

Clamping Aids

There is a simple technique that will help you hold a project with one hand, slip a piece of scrap wood into the clamp jaws, and tighten the clamp all at the same time. Simply use double-faced tape on the wood scraps to adhere them to the clamp jaws (2-117 and 2-118). Double-faced tape can be found at art supply houses or carpet dealers.



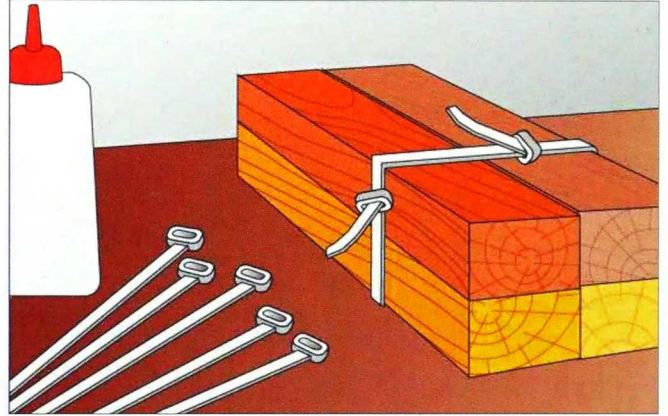
2-117. Cutting double-faced tape to fit on the wood scraps.



2-118. The wood scrap is adhered to the clamp.

Clamping Odd Shapes

Nylon tie wraps can be used in lieu of a strap clamp for clamping odd-shaped workpieces. Link them together and then pull them all tight (2-119).



2-119. Nylon tie wraps can replace a strap clamp when linked together.

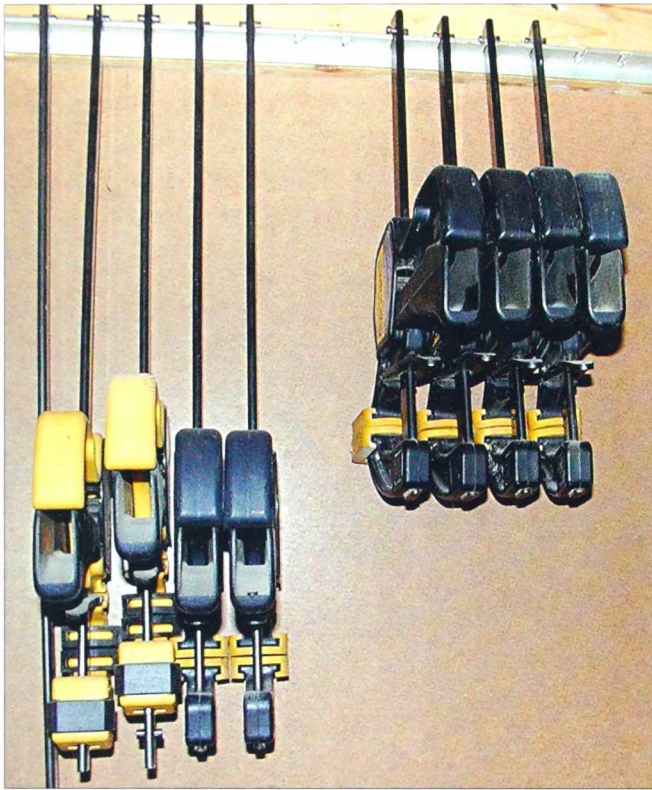
Clamp Storage (#1)

Bar clamps can be stored on hooks on a pegboard, but they take up a lot of room. The method described here is more efficient. I have found a nook in my shop for the rack.

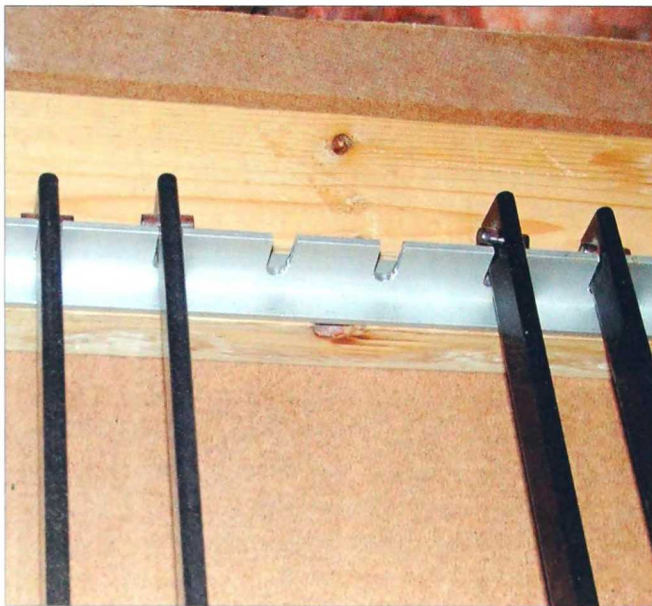
Using aluminum angle, I drilled holes in one side of the rack and then cut into the holes to make slots. The angle was mounted on a board and the board was screwed into the concrete wall (2-120 and 2-121). I can get 29 clamps in a 40-inch length of angle.

Clamp Storage (#2)

Sometimes the clamps that you need for that glue-up project are on the other end of your workshop. Here's a convenient way of keeping them closer to your work. Cut some short lengths of PVC (polyvinyl chloride) or ABS (acrylonitrile-butadiene-styrene) pipe and put them in one of those old plastic buckets. Place your clamps into the pipe tubes, making sure that you keep the bucket handle in the 12 o'clock position. The bucket makes it easy to move the clamps to the workplace.

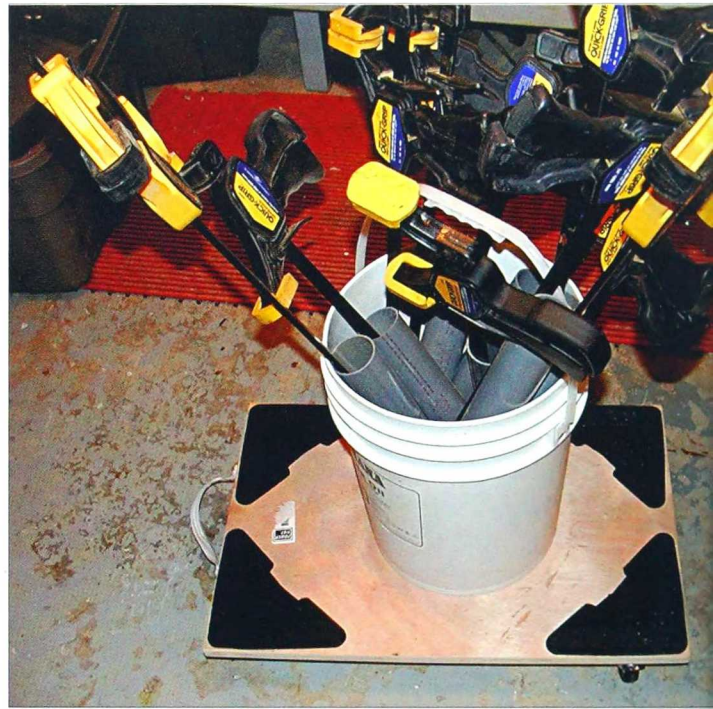


2-120. Aluminum angle keeps my bar clamps convenient.



2-121. A closer look at the detail of the bar clamp rack.

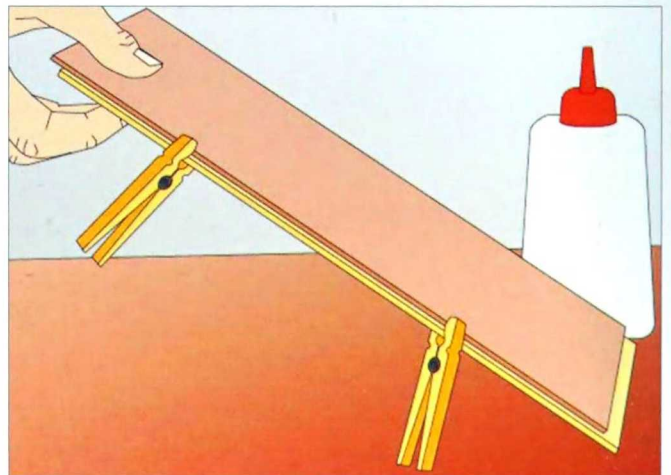
To make the bucket even more mobile, screw the bottom of it to a small dolly. Now you can roll the clamps to your work (2-122).



2-122. Placing clamps into a bucket that is screwed to a dolly makes moving them to your work assembly easier.

Clothespins as Clamps

Looking for a clamp to hold that small project while the glue is drying? Check the laundry room. A spring clothespin is ideal for just this kind of situation (2-123).



2-123. A spring clothespin can be used to hold a small project.

Emergency Clamps

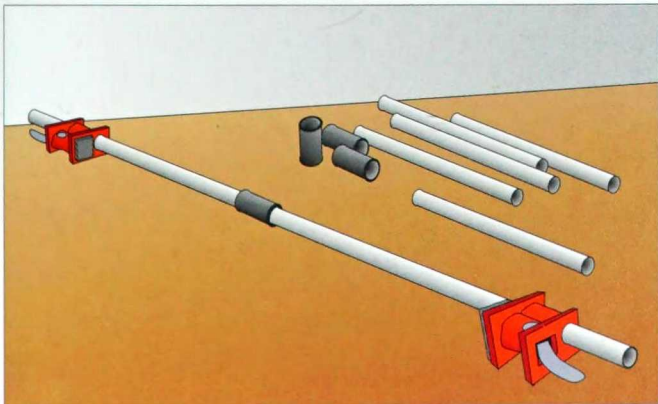
Need one more clamp? Maybe a caulking gun will help (2-124). It may be crude, but it will work in some circumstances.



2-124. A caulking gun can be used in an emergency as a makeshift clamp.

Pipe Clamps

I am sure that there have been times in your workshop when you have wanted to clamp something with pipe clamps that were too short. In preparation for just such an occasion, the next time you are at your neighborhood plumbing shop, pick up half a dozen one-foot lengths of threaded pipe and about the same amount of nipples (couplers) (2-125).



2-125. Pipe clamps.

Protecting Workpieces from Clamps (#1)

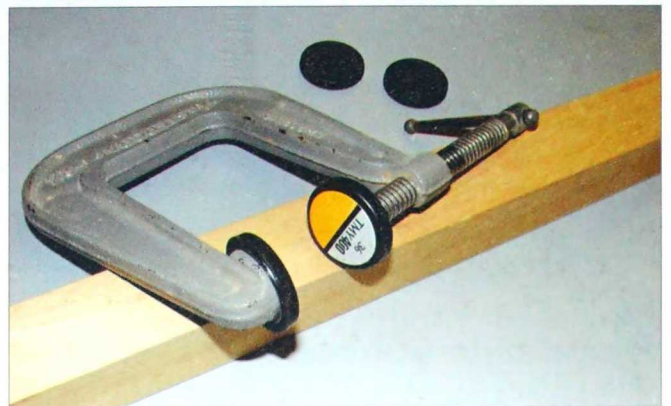
The pipe in pipe clamps can leave stains on the workpiece. To prevent this, wrap short lengths of foam pipe insulation around the pipe to keep it off the surface of the project (2-126).



2-126. Foam pipe insulation will protect your workpiece.

Protecting Workpieces from Clamps (#2)

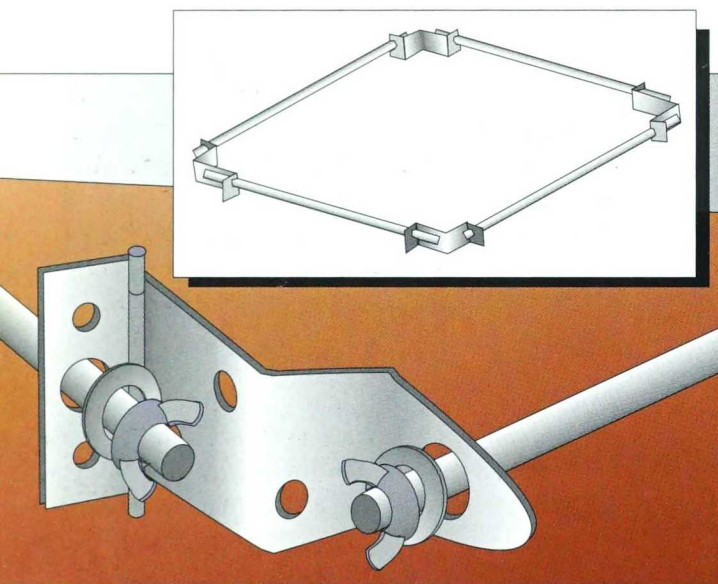
Here's a new twist on how to protect your workpiece when gluing it up. If you or your friends are into photography, save the plastic canisters that 35mm film comes in. The plastic caps make great pads for clamps (2-127). There are a number of ways that you can apply the covers to the clamps. The easiest would be to use double-faced tape. Use the thin-foam type.



2-127. The canister covers that 35mm film comes in make great protectors that prevent clamps from damaging workpieces.

Shop-Made Framing Clamps (#1)

Make your own framing clamps easily and inexpensively by using four cabinet strap hinges (2-128). First, bend the tails back to 90 degrees. Next, drill holes in the tails to facilitate $\frac{3}{16}$ - or $\frac{1}{4}$ -inch threaded rod. Use washers and wing nuts on the threaded rod.



2-128. A framing clamp that is shop-made. The close-up in the foreground shows the threaded rod on the framing clamp.

Shop-Made Framing Clamps (#2)

Four blocks of hardwood scraps such as elm or oak and some hooks are virtually all that is needed to make the framing clamps shown in 2-129. After they are made and the hooks are in place, go out to your car roof rack or into your camping gear and pick out one long or four equal-sized bungee cords. If using four equal-sized pieces of cord, connect each piece to a hook and attach the hook to one of the blocks of hardwood. There you have it.

Shop-Made Rubberband Clamps

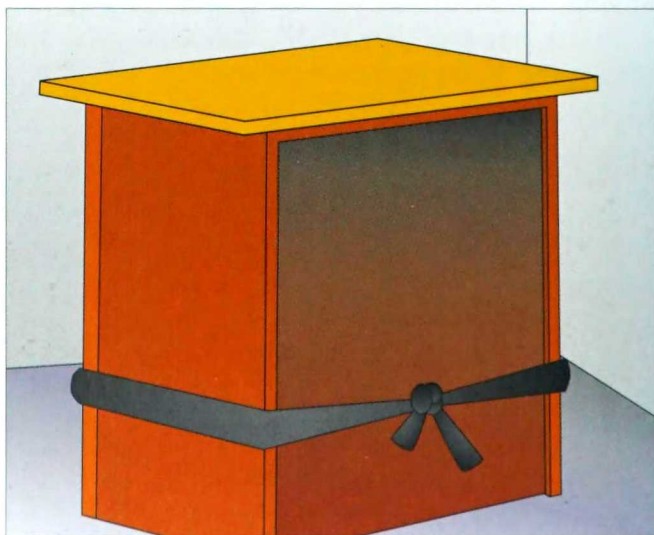
Got a bicycle that's building up a coat of rust in the back of your garage? I thought so. Remove the tires and pull off the inner tubes. Make two crosscuts,



2-129. The bungee cords from your camping gear can be used to make these framing clamps.

one on either side of the valve stem. Now, with a pair of sharp scissors, start to make a continuous cut, about an inch wide. Do this through the entire length of the tubes. You now have a handy clamp.

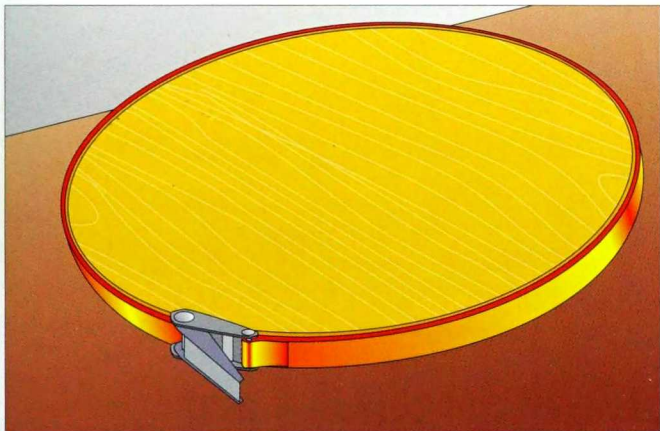
When gluing up projects such as chair legs and rungs, wrap the rubber-band clamp around the workpiece a couple of times and tie it tight (2-130). An added benefit: Take the rubber bands with you next time you go to the lumberyard. They are great for tying material to your car's roof rack.



2-130. The rubber inner tube clamp can be used when gluing up chair parts, etc.

Strap Clamps

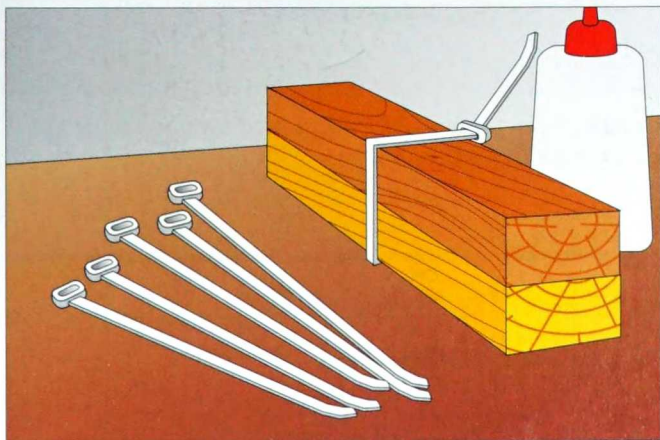
A nylon web hold-down strap, available at automotive accessory dealers or truck rentals, is the ideal clamp to use for gluing veneer edges to a round surface such as a tabletop (2-131). The web strap is also a great clamp for use on loosened chair rungs and legs.



2-131. A nylon hold-down strap is ideal to use for gluing veneer edges to a round surface.

Tie Wraps as Clamps

A broken chair leg or arm spindle is sometimes difficult to clamp until the glue sets. There are a number of ways to do it, but in most cases the clamp ends up sticking to the workpiece after the glue has dried. One way to prevent this is to use tie wraps instead. Keep a number of tie wraps in different sizes on hand for such occasions (2-132). These



2-132. Tie wraps can be used as clamping devices.

tie wraps are made of a nylon material and won't stick after the glue has dried. A pair of wire cutters is all that's needed for removal. Tie wraps are available at most hardware stores, probably in their electrical department.

COMPASS CUTTER

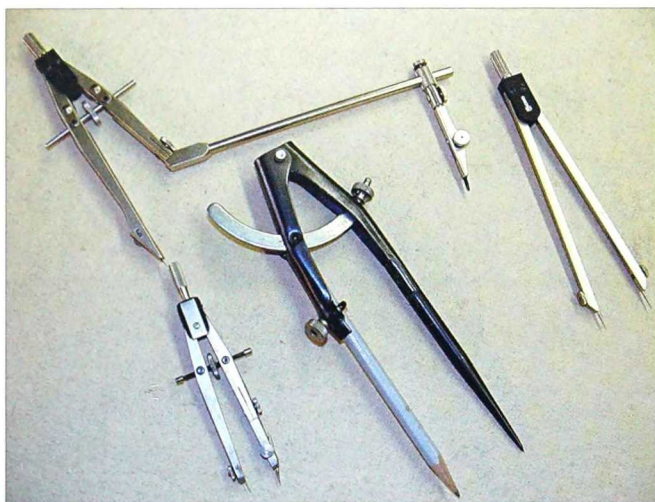
Cutting small circles accurately in veneer has been a difficult task at the best of times, until now. Olfa, a knife manufacturer, has come out with a helpful tool that makes the job easier. The tool, as seen in 2-133, comes equipped with five spare blades. It will cut diameters of approximately 1/2 to 6 inches. A pencil lead may be substituted for the blade to convert the tool to a beam compass.



2-133. This circle cutter makes it easy to cut circles in veneer.

COMPASSES

The compass I'm referring to here is the architect's or draftsman's compass that is used to make circles (2-134). Mind you, I've seen people go around in circles using a magnetic one. However, the circle compass has been used and abused for eons now and this astounds me.



2-134. A variety of compasses.

The usual type of compass will accurately draw a radius of about three inches. This is accomplished with both arms of the compass at about 15 degrees off the vertical. I have seen woodworkers stretch this to 45 and 60 degrees and expect to get a perfect circle. They are really surprised to see that the finish line does not meet the start line.

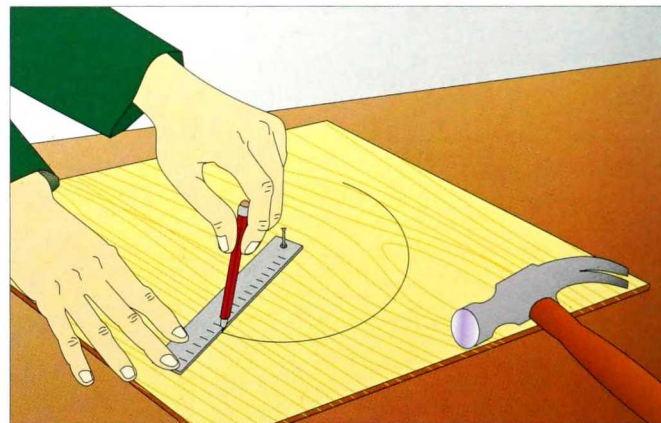
Some compasses are called “free arm” because they can be opened up until they are almost flat. Other types have a screw mechanism that restricts the opening to allow for an accurate circle. The free-arm types sometimes have “elbows” in them to allow for accurate stretched circles, while the ones with the screw gears accept extension arms (beams) to stretch their reach.

To draw an accurate circle, make sure the lead pencil point is sharp and that the pin side of the compass is close to the midpoint of the radius, that is, midpoint between the pencil point and the pin. This is *very* important. If the pin is not close to vertical, it has more of a chance to slip and also it will make an eccentric circle.

Shop-Made Compass (#1)

Here is a technique for making a compass that will create circles up to 72 inches in diameter. Get hold of a wooden or aluminum yardstick. Drill holes precisely on the top of the 1-inch marks. And at the same position on the width of the ruler, cut a small

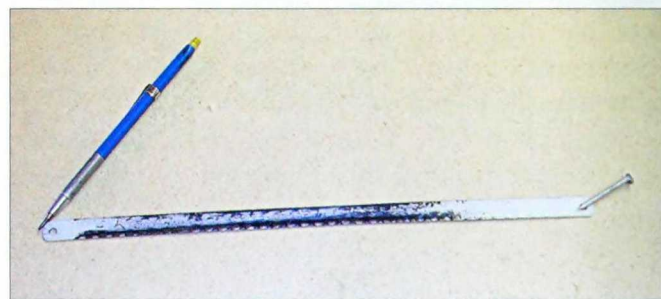
notch on the ends. Tap a nail into the cutter of your project. With a ruler notched against the nail, insert a pencil into the desired hole and rotate it (2-135).



2-135. With this technique, you can create circles up to 72 inches in diameter.

Shop-Made Compass (#2)

If you happen to mislay your compass and you urgently have to draw a circle, try this: Use either a hacksaw blade or a reciprocal saw blade (2-136). A nail through the hole in the blade will hold it on its axis, and the blade teeth should hold your pencil. It works.

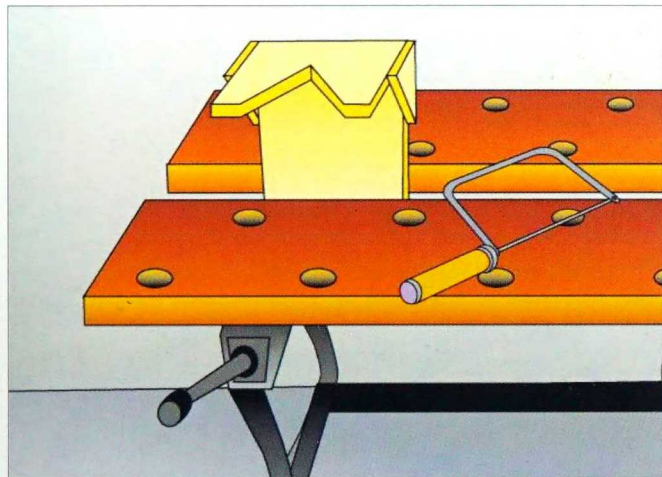


2-136. A hacksaw or reciprocal blade will work well as an emergency circle compass.

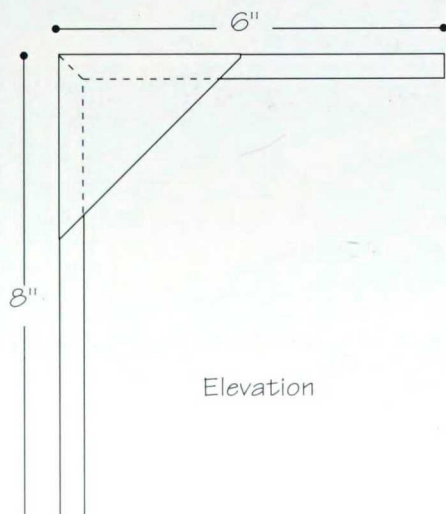
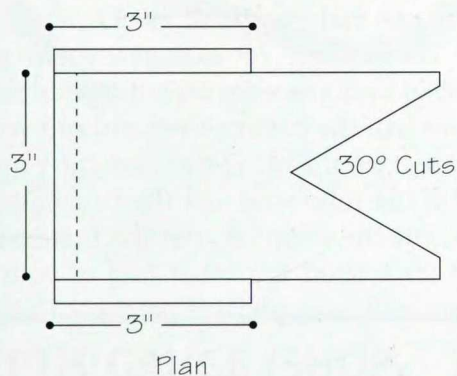
COPING-SAW JIG (SHOP-MADE)

The coping saw—also referred to as a fretsaw—is used for fine and delicate cutting of the softer

woods. The shop-built coping saw jig shown in 2-137 and 2-138 is easy to make and an indispensable tool if you are doing any fretsaw work.



2-137. The coping saw jig in use.

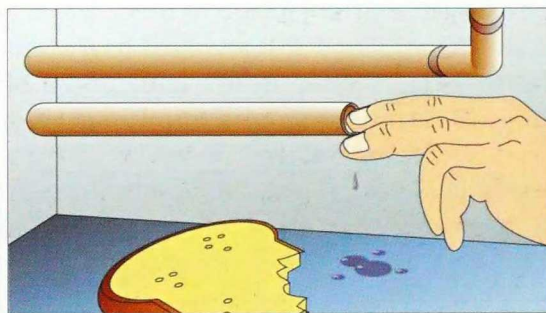


2-138. How the coping saw jig is constructed.

COPPER PIPE (RESOLDERING)

I put this great resoldering tip in the book because many of us woodworkers own homes and plumbing is usually the number one repair problem.

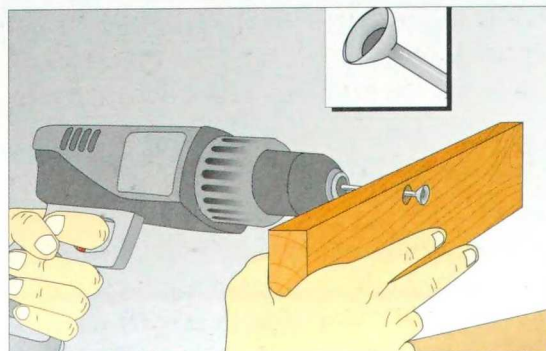
If you have to repair a joint in copper pipe and the water continues to drip while you are trying to solder it, plug the dripping pipe with bread. Push the bread up beyond the joint (2-139). When the joint is repaired and the water turned back on, the bread will dissolve.



2-139. Bread stuffed into a copper pipe will stop it from dripping.

COUNTERSINKING

To countersink for a screw that has to be placed in tight quarters, use a common nail. Hammer its head until it forms a U shape. Put the nail through the screw hole, tighten it in the chuck of your portable electric drill, and then pull it toward you until the desired depth is attained (2-140).



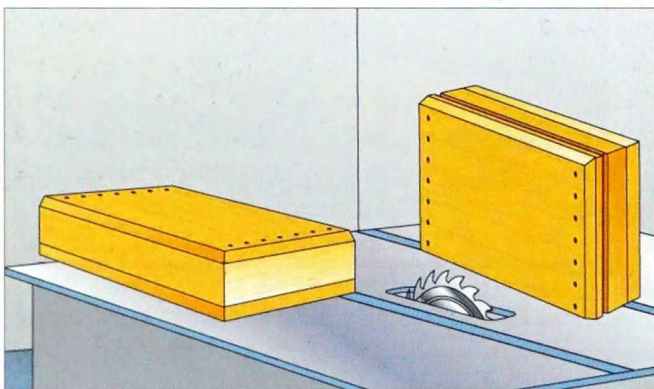
2-140. Using a common nail to countersink for a screw.

COVERED BOXES

Cutting Technique (#1)

When making covered boxes, it is best to make them in one piece as a closed box. Once built, it is easier to then cut the top portion off to use as a cover. This will not only make the job easier, but will match the grain for the cover.

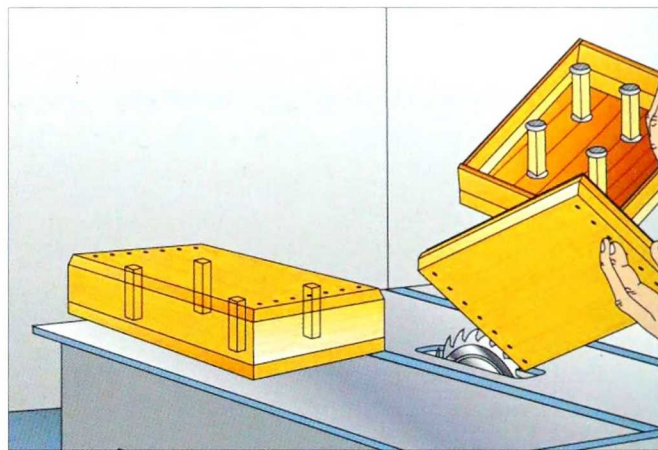
The problem with doing this on a table saw is that the final cut for the top portion will “bind” in the saw blade. Here’s a way to prevent it from happening. Adjust your saw blade to leave $\frac{1}{16}$ or even $\frac{1}{32}$ of an inch of wood still attached to the box all around (2-141). A sharp utility knife and a bit of sanding will clean it up.



2-141. Do not cut all the way through the box cover; leave about $\frac{1}{32}$ of an inch to keep the box intact.

Cutting Technique (#2)

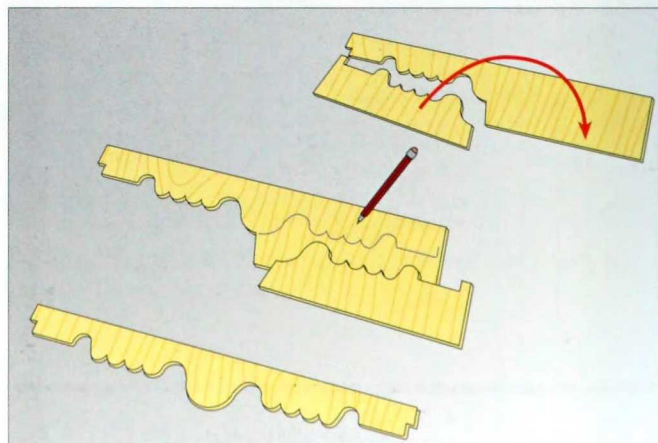
One other way to safely cut the cover off a box is to glue some interior supports with a hot-melt glue gun (2-142). After cutting the cover, the supports are easily removed and will prevent any binding when cutting.



2-142. Gluing interior supports with a glue gun will prevent binding when cutting off the cover.

Duplicating Curves

Freehand scalloping or decorative scroll work is great if you can make both halves of a piece of work the same. Let’s assume, for example, you’re making the scalloped back piece for an antique dresser. You have drawn half the pattern freehand and you have to duplicate it for the other half, but can’t quite get it right. Do the following: cut the first half on the band saw, cut the scrap off, flip the first-half piece over, and trace it on the other half of your stock. The pattern will be duplicated precisely (2-143).



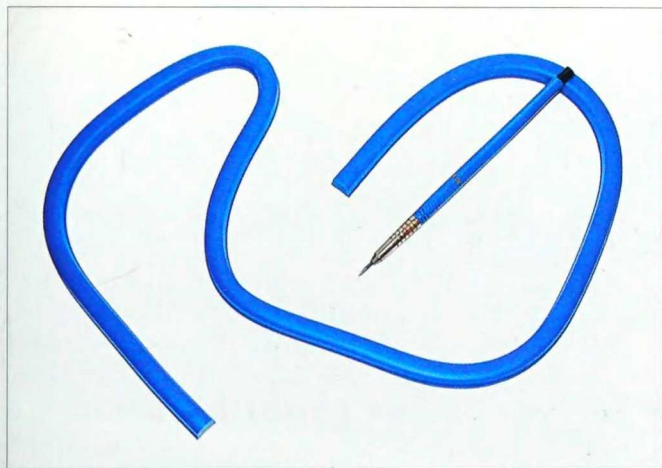
2-143. Tracing the pattern on the stock.

CURVES

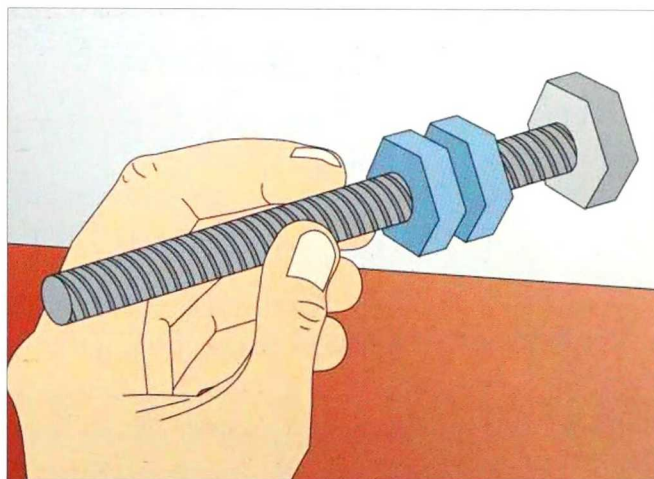
(Also see Circles)

Making Freehand Curves

Making freehand curves for scalloped edges, etc., is now an easy task. A flexible curve is available at a reasonable price from most art supply dealers (2-144). The flexible curve is made of vinyl, and has material inside that makes it flexible on the horizontal plane and allows it to retain its shape. Get the longest flexible curve (36 inches) if you are making furniture. You'll find it really handy.



2-144. A flexible curve is helpful when you are making freehand curves.

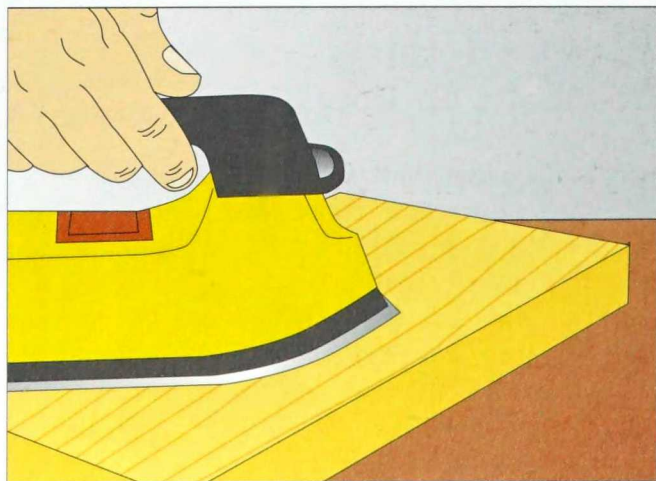


2-145. A carriage bolt or a threaded rod will make an efficient depth gauge.

made by the slip of a hammer or the dropping of some heavy object on your workpiece.

There are two methods for removing these dimples. The first is to place a wet rag on top of the dent and let it stay there for a few hours. If that doesn't work, try using a steam iron (2-146). Apply lots of steam and heat, but be careful that you do not scorch the wood.

Both of these methods should work, but they will raise the grain on the wood. After the area has dried out, a little sanding with a very fine-grit sandpaper will bring it back.



2-146. Using a steam iron will swell the dented area and make the dimples disappear.

DEPTH GAUGE (SHOP-MADE)

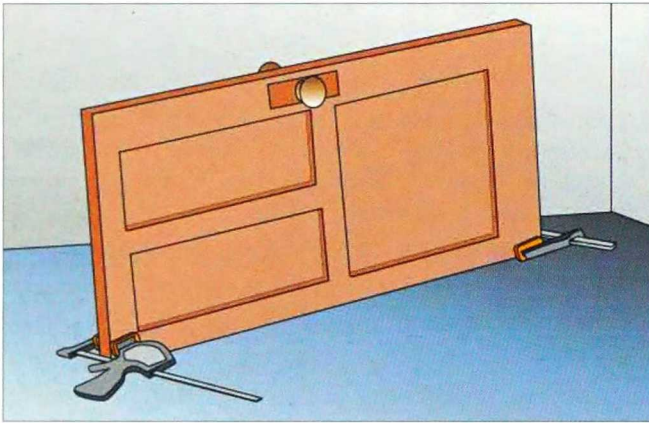
A simple but efficient depth gauge for setting table-saw blade heights or router-bit depths can be made from either a carriage bolt or even a length of threaded rod (2-145). Two bolts can be used, one to set the depth and the other to lock it.

DIMPLES (Removing)

Trust me, this technique has nothing to do with cosmetics or facials. The type of dimples that I am referring to are the ones that are inadvertently

DOOR EDGES (SANDING AND PLANING)

Sanding or planing door edges can be a frustrating experience. The doors have a tendency to wobble, making the job somewhat difficult. A pair of squeeze-type bar clamps placed at the door ends will help stabilize the door (2-147).



2-147. Bar clamps will stabilize the door while you are sanding or planing the edges.

DOORS

Installing Locksets and Deadbolts on Doors

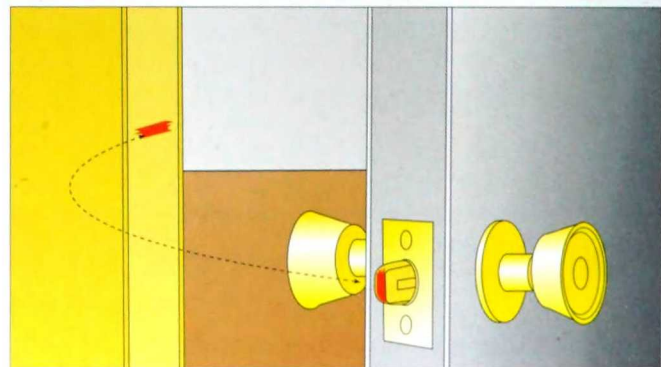
Installing locksets or deadbolts on doors can sometimes be a problem. Those long screws that go through the door to connect the two parts usually wobble around for awhile before they reach the target. An easier way of ensuring that they get that target the first time is through the use of ordinary drinking straws. The best ones to use are the “milkshake” type because they have a wider diameter. Slit them so that they will fit through the screw holes and they will act as channels to guide the screws. You can then tighten up the lockset; the straws will crush themselves and will not interfere with the lockset operation (2-148).



2-148. Drinking straws will help in aligning the screws when installing locksets or deadbolts on doors.

Installing Striker Plates on Doors

Installing the striker plate when hanging doors has always been a little difficult, until now. Next time you are hanging doors, be they cabinet or entry doors, try this: After the doors are hung, rub a little lipstick on the latch and close the door. The lipstick mark will transfer onto the frame and indicate exactly where to place the striker plate (2-149). In the event that you don't have lipstick, you might try chalk-line powder or tape a piece of pencil carbon paper to the latch. Double-faced tape will work best.



2-149. A little lipstick on the door latch will tell you where to position the striker plate.

DOWELS

Dowel Joints (#1)

Dowel joints can be the most secure joints if properly used. The glue with dowel joints must be allowed to spread, and this can't be done with a solid dowel. Special glue-joint dowels are considerably more expensive than just straight dowels.

Make your own custom-fitted glue-joint dowels. With a triangular steel file, etch a "thread" into your full-length dowel and then cut it to size for your project (2-150). The "thread" allows the glue to spread throughout the joint, and a slight rounding off of the ends makes it even better.



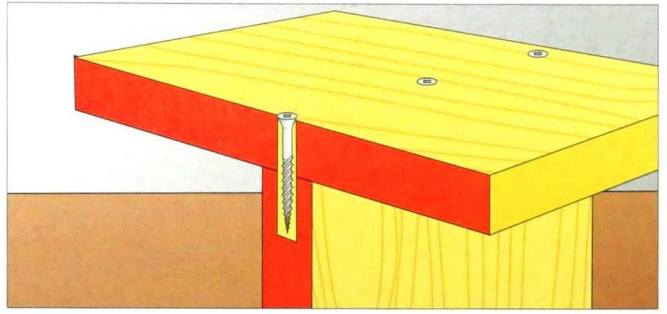
2-150. Save money and custom-cut your own dowels for dowel glue joints.

Dowel Joints (#2)

The Scandinavians are big exporters of knockdown furniture. As a result, the joint connectors in their furniture have to be easy to assemble and secure. Here is a variation of one of the butt joints that they use, but without the expensive metal hardware. Half-inch dowels are positioned one inch in from the ends on the horizontal members. Two holes are drilled into the vertical pieces. Pilot holes are drilled through and into the dowels. The screws must be long enough to go through the dowel. The end result is a very secure wood joint (2-151). For added strength, a little glue will help.

Finding the Centers of Dowels

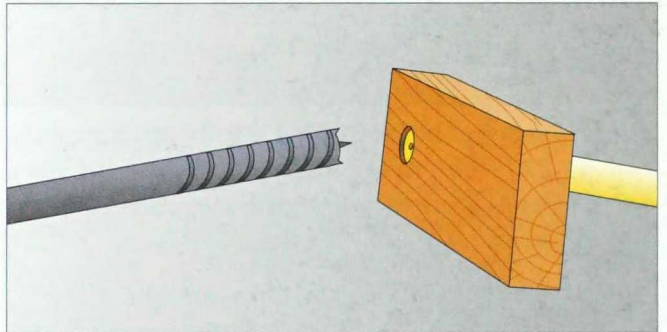
One simple way of finding the center of a dowel is to drill a hole the size of the dowel into a piece of



2-151. This modified dowel joint is very tight.

scrap wood. Push the dowel partway into the hole and then, with a wooden mallet, tap a Forstner or brad-point bit into the top of the hole (2-152). The drill bit should be the same size as the dowel.

Another easy way to find the center of a dowel is to use a center finder (2-153). This device has a blade set at 45 degrees that cuts a line into the end of a dowel. Hold the dowel tight in the corner, tap it with a hammer, rotate it 90 degrees, tap again, and you will have located its center. It can also be used for 2 x 2s or smaller pieces of wood.



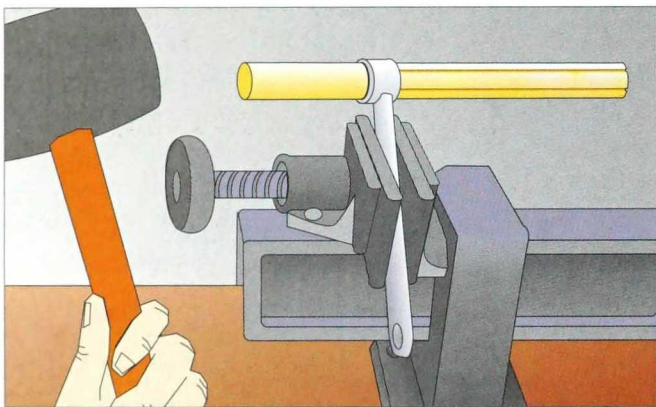
2-152. Finding the center of a dowel.



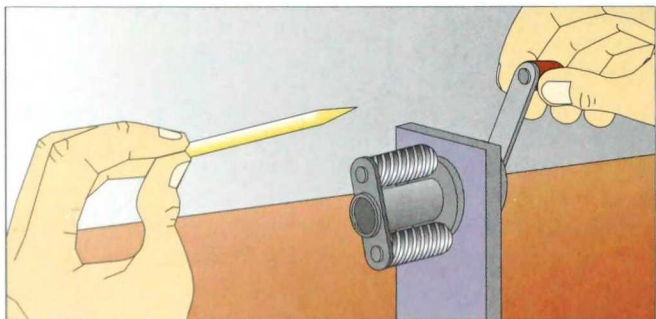
2-153. This Veritas center finder makes it easy to mark dowel centers.

Fluting Dowels

You may have been in a situation when you're about to glue up your project, the holes are drilled for the dowels, and you realize that you have no fluted dowels. In such a case, simply take ordinary doweling approximately a foot long, find a box wrench that is $\frac{1}{32}$ or $\frac{1}{16}$ inch smaller than the dowel, and, with a wooden mallet, tap the dowel through the wrench (2-154). Cut your dowel to size, and you have a fluted dowel ready for use. If you have a pencil sharpener and the dowel will fit into it, slightly sharpen one end (2-155). This will make it easier to put it in the hole.



2-154. Tapping a dowel through a box wrench.

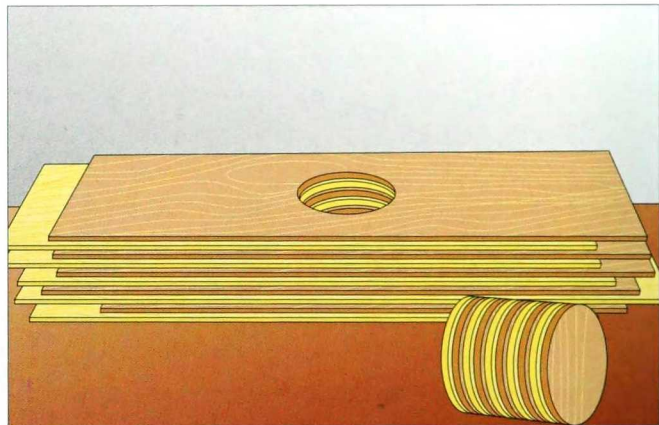


2-155. Sharpening one end of a dowel.

Plugs

There are times when a commercial "hardwood" dowel does not look right when being used as a screw-hole plug. In such a situation, try using a contrasting wood to highlight the plugs (2-156). This will work quite well in contemporary furniture.

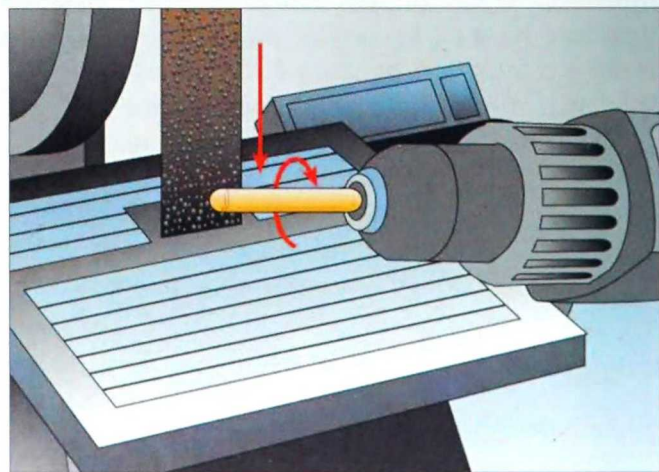
Another approach is to use a dowel with contrasting layers in it. To make such a dowel, glue the veneer cut-offs until they are sufficiently thick to form a plug. These cut-offs can be of similar or contrasting colors. When they are glued together, use a plug cutter to make the plugs.



2-156. Using contrasting wood to highlight the plugs.

Rounding Off Dowel Ends

Rounding off dowel ends usually takes specialized tools, but you can do it with your own. Chuck the dowel into your portable drill and put the drill in reverse. Turn on your belt sander and start rounding off; it's that easy. The drill should rotate against the rotation of the sander (2-157).



2-157. A drill and a belt sander will round off dowel ends.

Storing Dowels

Use ABS or PVC plastic pipe to store your dowels. Use whatever diameter you think you will need and then add an inch. Plumber's steel strapping can be used to mount the pipe on a wall (2-158).

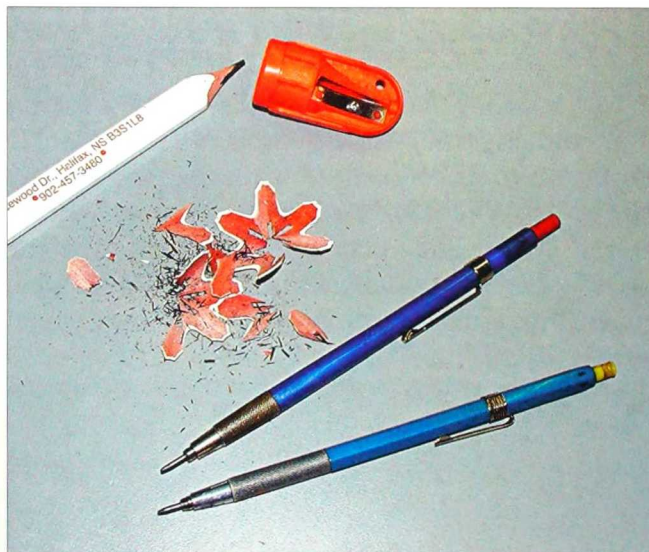


2-158. Keep your dowels in order. Put them in a plastic pipe and use steel strapping to mount the tube on a wall.

DRAFTING PENCILS

The problem with carpenters' pencils—those round, thick pencils that can leave a mark on virtually any material—is that they are too big, especially when you are marking measurements in increments of $\frac{1}{16}$, $\frac{1}{32}$, or $\frac{1}{64}$ inch. A regular lead pencil always breaks the minute you hit a knot or some cross-grain wood.

A drafting mechanical pencil will prove much more helpful (2-159). These pencils are inexpensive and can be bought at an art-supply dealer. The advantage of this type of pencil is that if the lead breaks, you press the button for more. Also, the lead can be sharpened to a fine point. Buy one with the built-in lead pointer on the top. Also buy a package of "n2" leads. These leads are blacker, stronger, and will stand out better than regular leads when you are making lines on darker woods.

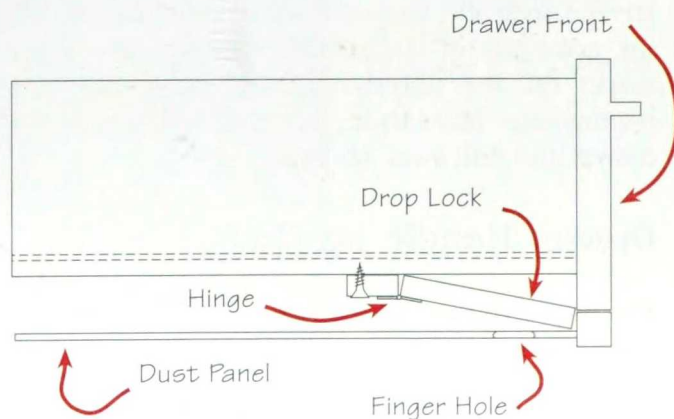


2-159. Drafting mechanical pencils.

DRAWERS

Childproofing Drawers (#1)

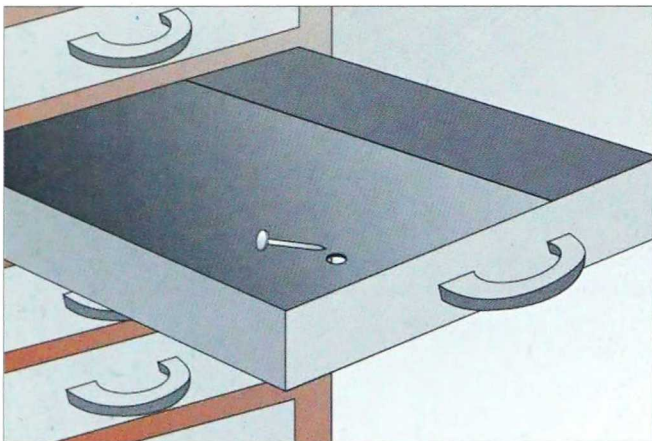
Young, curious hands always seem to wander into things that they are not supposed to, like a drawer that contains sharp tools. To prevent this, make a lock for the drawer that doesn't look like a lock (2-160). Hinge a narrow strip of wood to the bottom front of the drawer so that it drops down just behind the front drawer frame. Drill a finger hole into the dust panel below, so the lock can be released.



2-160. Drawer lock.

Childproofing Drawers (#2)

A simple way to keep tiny hands out of a drawer that contains things that you don't want them to get into is to drill a small hole through the bottom of the drawer (2-161). Drill the hole near the front of the drawer and then drop a nail through the hole. The drawer underneath will allow you to push the nail up to release the drawer.



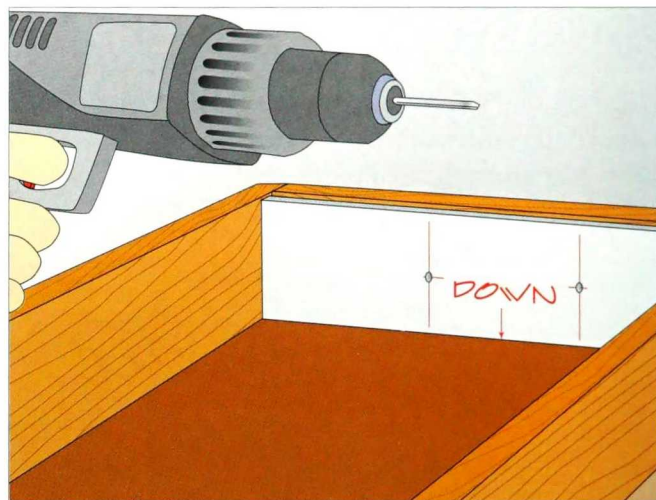
2-161. A nail through the bottom of a drawer will keep prying little hands out of it.

Drawer Handle Jig (#1)

It's an old story. You are putting handles on that twelve-drawer dresser that you just built and you realize that measuring, drawing lines, and punching starter holes on each and every drawer is a very tedious job. Try this technique: Cut a piece of polystyrene, available through a plastics wholesaler, to the exact size of your drawer. Measure and place marks on the polystyrene and then drill the required-size holes in it. Tape this template to the drawer and drill away (2-162).

Drawer Handle Jig (#2)

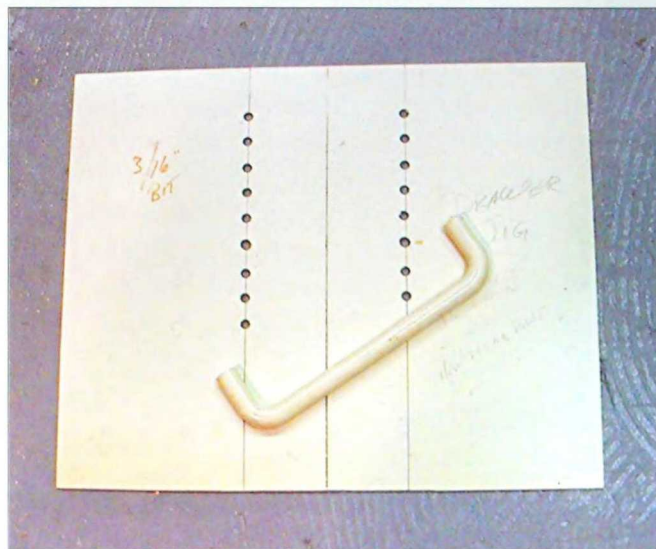
The above drawer handle jig will work if all the drawers are the same size and the handle positions are in the same place on each drawer. If this is not the case, however, try this template: Again using polystyrene, cut a piece that is 12 inches wide x the



2-162. Using the drawer handle jig to mark the positions of the holes for drilling.

height of your highest drawer. Find the middle of the plastic and draw a line from top to bottom. Now, find the spacings of the drawer handles. If all the handles are going to be one inch down from the drawer top, for example, drill holes in the plastic accordingly. If some are going to be centered, repeat the above procedure.

I drilled holes on $\frac{1}{2}$ -inch centers so that the jig can be used on almost any drawer face using the standard 3-inch handle spacings (2-163). Now all I have to do is to line up the centerline with the drawer, make my mark with an awl, and proceed to drill the holes.



2-163. Drawer handle jig.

DRILL BITS

There are a variety of drill bits available that will prove helpful to woodworkers (2-164):

An **auger bit** is used in a brace, which is a hand-held drill. It is helical and has a lead screw that makes it easy to start a hole. The shank is usually triangular and tapered so that it won't fit in power drills.

Brad-point bits have a spur on their tips to prevent wandering, especially on odd shapes.

Fly (circle) cutters are expandable bits that are used on a drill press *only*, and only at low speeds. Depending on how the cutter is set, it can cut clean holes or circles. Be extremely careful when using this bit. (Refer to Circle-Cutter Safety on page 90.)

Forstner bits are extremely effective bits. They cut very clean holes with very little tear-out. A hole

partially drilled with a Forstner bit will have a flat bottom.

High-speed steel bits (often abbreviated as hss) are excellent general-purpose drill bits.

Hole saws have serrated edges like a saw blade and are used for cutting larger-diameter holes that are fairly clean.

Self-feed bits are available in larger sizes. They have a lead screw and a bottom cutting blade set at an angle. They cut a clean hole, but must be used with a slow, high-torque drill.

Spade bits are sharp, flat bits. They are used in rougher hole-cutting applications like drilling through studs and joists for wiring and plumbing.

Unibits are used mainly for drilling into sheet metal, because they are stepped in increments, with each increment being a different diameter.

Note: A drill bit will only drill well if it is well-sharpened.

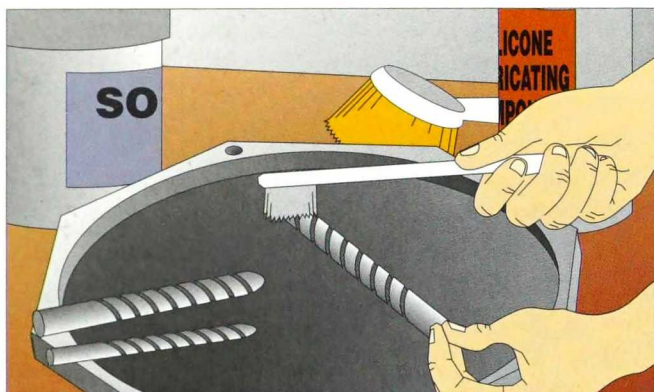


2-164. An assortment of drill bits that will prove helpful to the average woodworker.

1. Ship's auger
2. Self-feed drill bit
3. Cabinet hinge drill bit
4. Unibit stepped drill bit
5. Forstner bit
6. Counterbore, countersink bit
7. Countersink bit
8. Adjustable drill bit
9. Spade bit
10. Circle- or fly-cutter bit

Cleaning Drill Bits

Drill bits tend to accumulate a buildup of tar and gum after extended use. To remove this residue, soak them for approximately 15 minutes in a solution of washing soda and water. Use an old toothbrush to scrub them clean (2-165). Wipe them dry and spray them with silicone.



2-165. One way of cleaning drill bits is to soak them in a solution of washing soda and water, and then scrub them with an old toothbrush.

"Truing" Drill Bits

The tip of a high-speed-steel drill bit is set at a particular angle for the most efficient cutting. Sometimes after sharpening, whether you do it yourself or have it done professionally, you may want to verify the angle. The following technique will make it simple: Go to your parts bins and pick out a couple of hex nuts, place them side by side, and hold them with either a pair of slip-joint pliers or a pair of Vise-Grips. The tip of the bit should fit between the two nuts without any visible air space (2-166).



2-166. You can use a couple of hex nuts to determine whether the tip of a high-speed-steel drill bit is at the correct angle.

DRILLING TECHNIQUES

Depth Stop (#1)

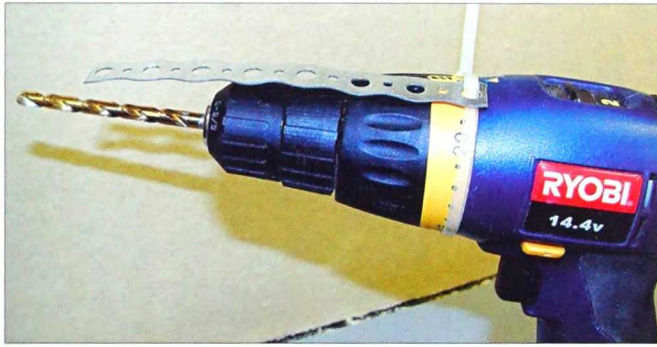
Neoprene tubing is inexpensive and a couple of inches of it makes for a great depth stop for either your portable drill or even your drill press. Cut the right diameter tube to length and slide it on your drill bit (2-167).



2-167. Neoprene tubing makes an efficient depth stop for your drill.

Depth Stop (#2)

Most portable 1/2-inch electric drills are equipped with a side handle that just screws into position. Some 3/8-inch drills have them as well, or at least the holes are there to accommodate one. If you are hand-drilling holes where the depth of the hole is critical, the depth stop shown in 2-168 might work for you. Simply cut a length of perforated steel strapping and install it between the side handle and the drill housing. Measure the strapping for the depth of cut with the appropriate bit in the chuck and cut it off with tin snips. If your drill does not have a threaded hole for a handle, use a nylon tie wrap, cord, or piece of elastic to secure the strapping.



2-168. Perforated steel strapping makes an ideal drill depth stop.

Depth Stop (#3)

When using your portable drill to make repeated holes that must be a specific depth, this shop-made jig will help. Use a piece of 1 x 1-inch hardwood. Cut it to the length of the drill bit that you plan to use. Using that same drill bit, bore down the center of the 1 x 1 (2-169). Hold the jig on the drill to determine the depth you want and cut the 1 x 1 accordingly (2-170).

Drilling Perpendicular Holes

The electric drill was probably the first portable power tool invented. I am not sure when this tool was first put on the market, but it still has major drawbacks that have not been improved on. It is difficult to drill a truly perpendicular hole in a workpiece with a portable drill. Oh, many manufacturers have come up with myriad ideas that would “guarantee” perpendicular holes everytime, but most of these ideas have meant either dismantling the drill chuck or attaching (with straps, screws, nuts, and bolts) some elaborate gizmo or some sort of flimsy drill-press type of attachment.

Here’s a technique that won’t take long, costs very little, and does not require any elaborate installation (2-171). It’s a V block. The block is made from a piece of scrap hardwood and can be clamped to your workpiece. All you have to do is make sure that the drill bit is kept snug in the wedge.

2-171(right). A V-shaped jig ensures perfectly perpendicular holes when using an electric drill.



2-169. Bore down the center of a 1 x 1 to make a depth gauge for drilling.

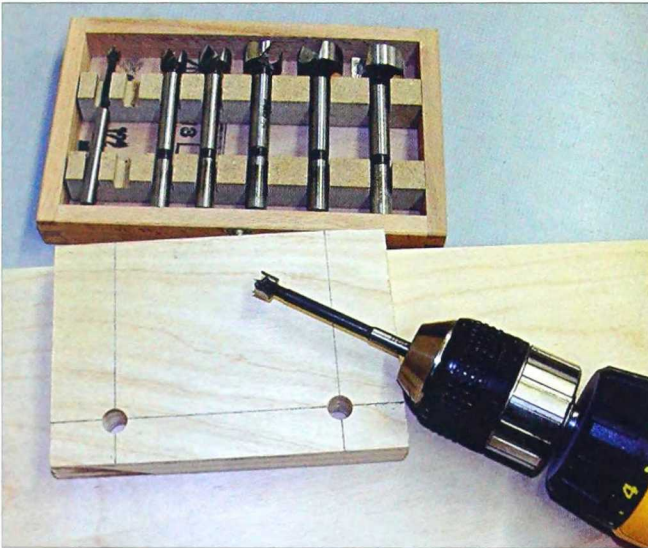


2-170. Cut the 1 x 1 to the required length and put it on your drill bit to use as a depth gauge for repeated holes.



Making Repeat Holes with a Portable Drill

Making a series of equally spaced holes in, say, shelf gables is easy using the jig shown in 2-172. Let's assume that the required holes are $\frac{1}{4}$ inch in diameter and spaced 3 inches apart. Take a piece of scrap $\frac{1}{2}$ -inch-thick plywood and cut it 1 inch wide x 4 inches long. Make a mark $\frac{1}{2}$ inch in from either end and $\frac{1}{2}$ inch across. This will give you 3-inch centers. Drill a $\frac{1}{4}$ -inch hole at these marks. A Forstner bit works best because it produces very clean cuts. Insert a $\frac{1}{4}$ -inch dowel into one of the holes. The length of the dowel should be about inch. You may have to glue it in position on the scrap.



2-172. A series of equally spaced holes are easy to make with this jig.

Determine where your first hole is going to be and drill it. Place a straightedge on the gable and clamp it. Place the dowel of the jig in the hole and tight against the straightedge and drill the second hole through the hole in the jig. Repeat as necessary.

"Parking" Portable Drills

Keep your corded or cordless drill "parked" for readily convenient use; to do this, screw a scrap of 2 x 4



2-173. This shop-made drill "parking" station will keep your portable drills handy.

to the back of your workbench. Drive a nail or nails into the piece and cut the head(s) off. The drills can now be chucked onto the headless nails to keep them handy (2-173). If they are corded, simply leave a little more space to allow the wires to run around the back and hang over the bench edge.

DRILL PRESS

The drill press makes an effective workshop companion, and is found in many workshops. Although its primary purpose is to drill holes, it can be used for other operations (2-174).

The drill press is often thought of as a simple woodworking machine to use and, as a result, a lot of users take it for granted. The drill press, like any piece of machinery, is a dangerous tool if safety pre-

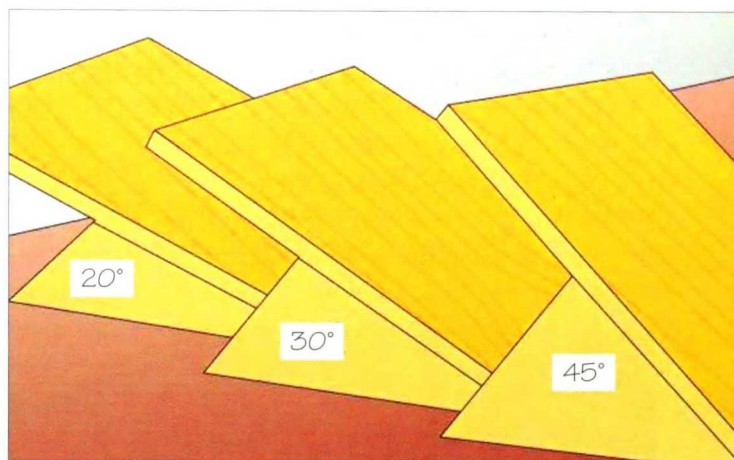


2-174. Drill press.

cautions are not followed. You should securely clamp *all* work to be drilled, wear safety goggles, and be sure that you are using the correct speed for the type of drill bit or other equipment that you have installed. It is important to remember that a drill press does not have a brake on it, and the spindle will continue to rotate quite a bit after turning it off.

Angle Jigs for the Drill Press

Drilling a 30-degree hole in a small workpiece takes a lot of time, especially when you have an auxiliary table attached to your drill press. A lot of us lazy people look at what's involved and then resort to the portable drill and hope for the best. Here's an easier way: Build yourself a set of ramps, six in all (2-175). Build them at 15, 20, 22.5, 25, 30, and 45 degrees. Drill holes in them and hang them up on



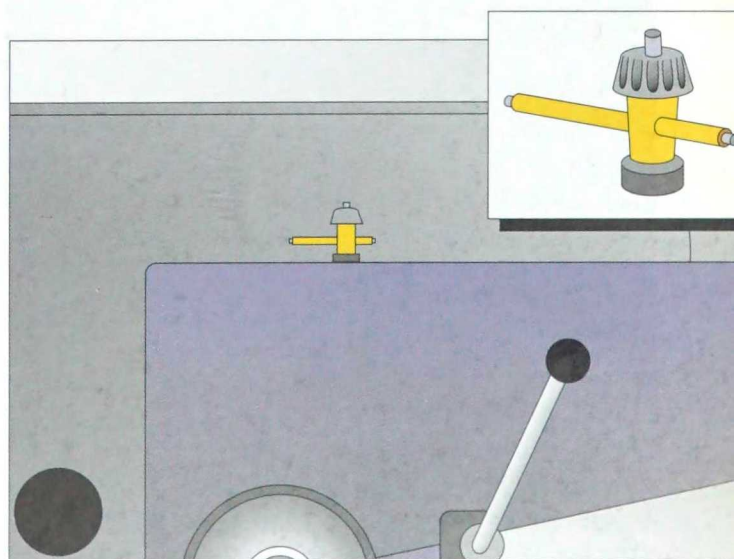
2-175. A set of angled shop-made jigs for use on the drill press and other stationary tools.

a pegboard located near your drill press. You'll find that this will be a real timesaver for those angled holes.

Chuck Keys

The chuck key on a drill press can often be difficult to locate. One way to solve this problem is to paint the chuck key a bright yellow. This will make it easy to spot under all that sawdust.

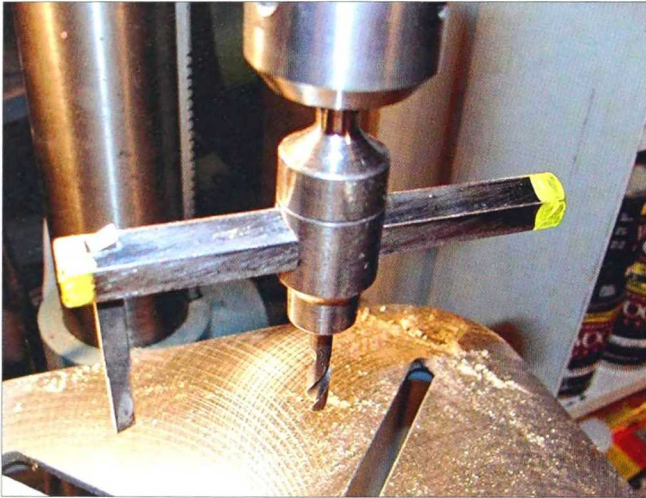
To make sure that the chuck key will not be misplaced, glue a magnet to it using epoxy (2-176). This will make it stick to the drill-press housing.



2-176. This chuck key is stuck to the drill press with a magnet.

Circle-Cutter Safety

Circle cutters, sometimes known as fly cutters, can be downright dangerous to use. The arm and the bit are rotating at high speeds, and it is difficult to see them. To make them more visible, I painted the ends a bright yellow (2-177 and 2-178). It helps.



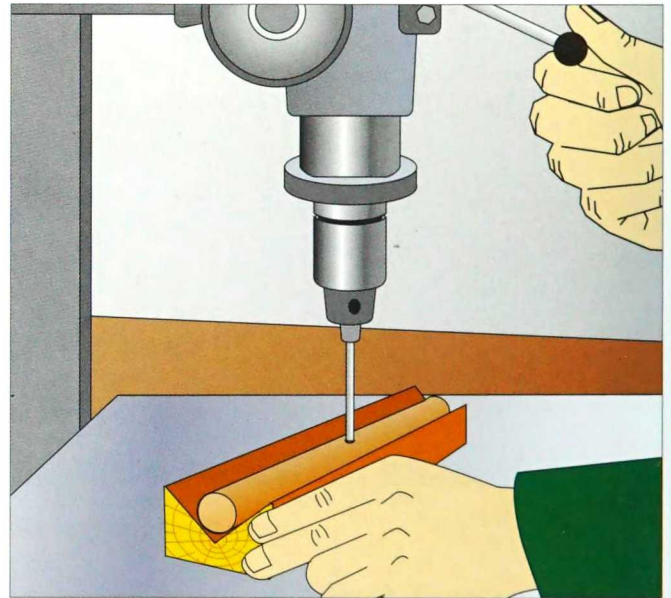
2-177. The ends of a circle cutter are nearly invisible when they are spinning. A bright yellow paint on the ends will help you see them.



2-178. The ends are much more visible when the cutter is in motion.

Drilling into Dowels with a Drill Press

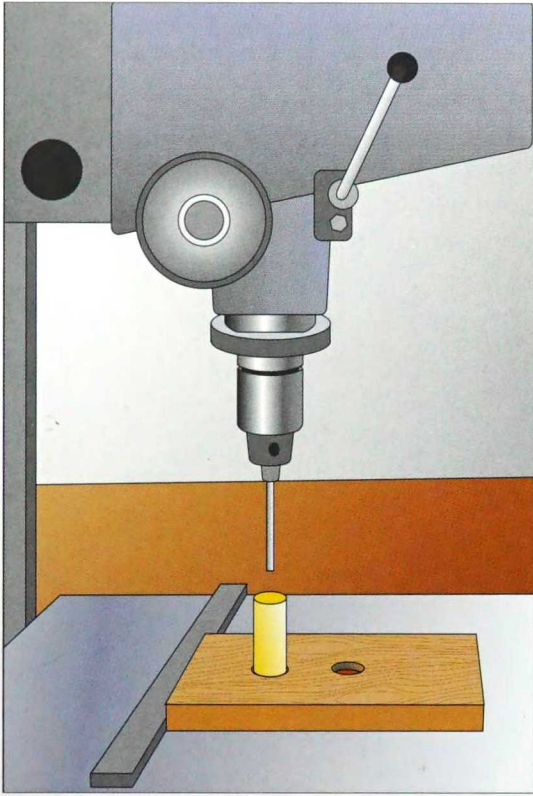
Take a piece of wood 2 inches wide, 2 inches thick, and about 12 inches long, and cut a V down the middle of it. Drill a $\frac{1}{4}$ -inch hole into one end. You have made a simple jig for drilling holes into the edge of a dowel, chair leg, etc. (2-179). The hole is used to hang the jig on that pegboard right next to the drill press.



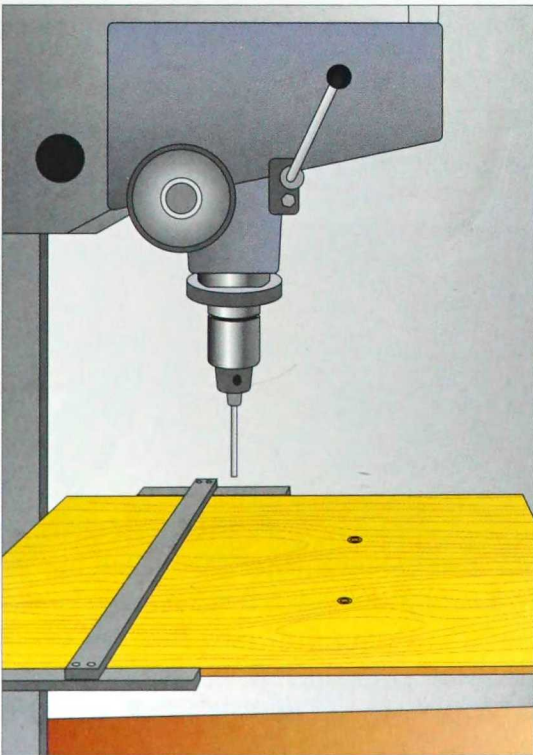
2-179. This simple jig will help you to use the drill press to drill the edges of dowels.

Drilling the Ends of Dowels with a Drill Press

Illus. 2-180 shows a simple jig that can be clamped onto a drill press auxiliary table. To make this jig, take stock 1 x 4 x 8 inches, find its center along its length and drill a hole with any Forstner bit you have. Other types of drill bits can be used, but the Forstner cuts a cleaner hole. Drill the hole through the stock. After you have marked the center of your dowel end, fit it into the appropriate hole and drill it. If the dowel is too long, swing the table and clamp the jig so that the dowel is off the edge of the table.



2-180. This simple jig will help you use the drill press to drill the ends of the dowels.



2-181. Auxiliary table and fence for the drill press.

Drill Press Auxiliary Table and Fence

I made the auxiliary table for my drill press shown in 2-181 out of $\frac{3}{4}$ -inch-thick plywood and securely bolted it to the base table with carriage bolts, washers, and wing nuts. Wing nuts make it easy to remove if I want to do any metal drilling. I can also leave it in place and put another surface under the metal workpiece. I made my table 24 inches wide, but you can make yours to whatever size is needed.

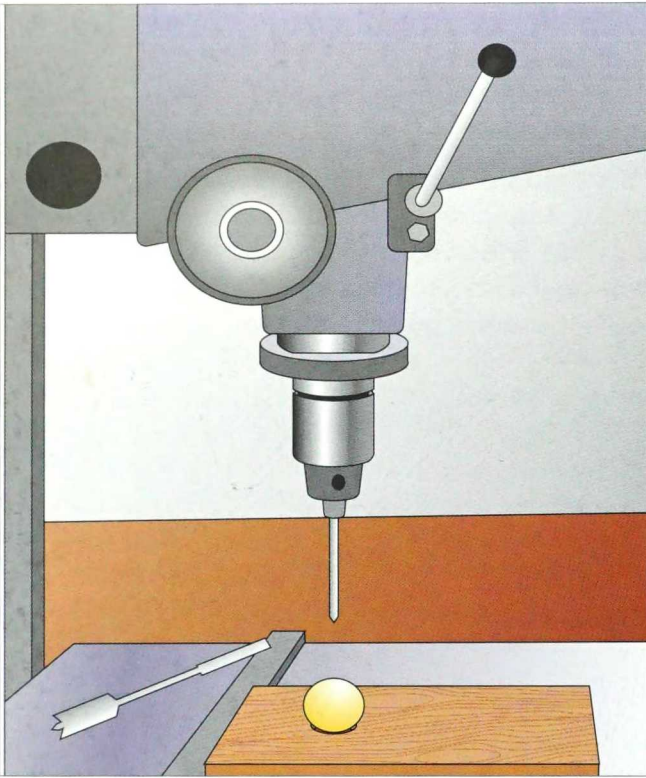
The adjustable fence shown in 2-181 is made from 2-inch-square aluminum tubing and an angle that is 1 inch wide and $\frac{1}{8}$ inch thick. Although the fence fits tightly, I still use clamps to make sure that it doesn't move when I'm using it. I also make sure that it is square to the table before clamping it.

Drilling into Spheres with a Drill Press

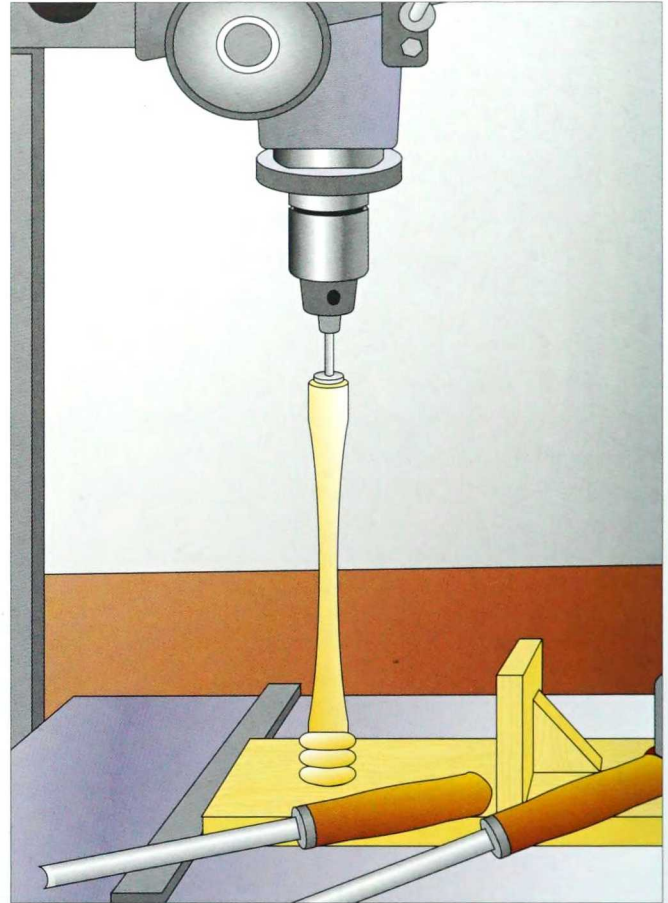
Wooden balls or spheres are used a lot in toy-making and don't usually come predrilled. To drill them precisely through the middle can be very frustrating and wasteful. Here's a technique that works for me: Let's say you have a 2-inch-diameter wooden ball that you want to drill through. Clamp a piece of 2-inch-thick scrap to your drill-press table and, using a Forstner or a spade bit, drill a 1-inch hole through the stock. Remove the bit, but do not move the stock or reset the drill press. Now, install the desired size of drill bit into the chuck, place the ball in the hole, and drill. By preventing movement of the scrap piece, you are assured of drilling into the middle of the sphere (2-182).

Drill Press as a Lathe

A drill press can be used as a lathe for simpler jobs where an actual lathe is not available. Using $\frac{1}{2}$ x 3-inch hardwood stock, cut an L shape with a tail on it. The tail is for firmly clamping the piece to the drill-press table. A wedge is glued and screwed to the upright for stability, and the upright may be used as a tool rest. The base of the L-shaped piece becomes the lathe *tailstock*. Holes are centered on



2-182. This method will make drilling into spheres easy and accurate.



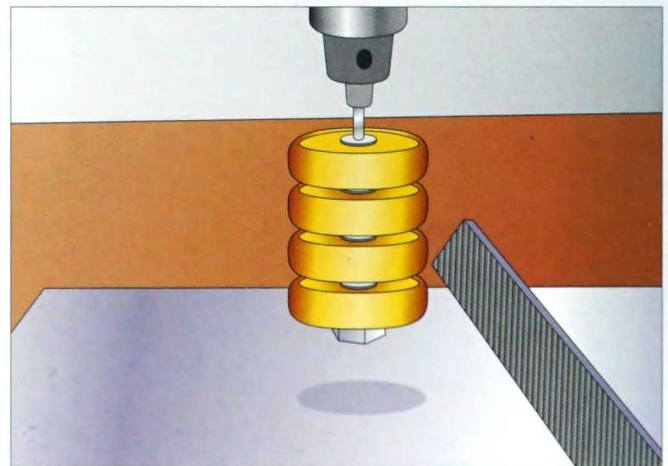
2-183. A drill press can be used as a lathe for some tasks.

the base to accommodate pointed dowel markers. The *headstock* is the appropriately sized Forstner drill bit (2-183).

The three important things to be done here are to make sure that the middle of the stock is turned, the tailstock is regularly oiled, and the drill press is operated at a slow speed. *Extreme care should be used during this operation and all safety measures should be adhered to.*

Sanding Wheels with a Drill Press

If you are into toy-making, this technique will expedite the process if your toys require wheels (2-184). After your wheels are cut, insert a hex bolt of the required length and diameter through the centers. Use a flat washer between each wheel. Next, lock them on tight with a hex nut, being sure to place a washer between the bolt and the last wheel. Insert the tail end into the chuck of your drill press and tighten it. Turn your drill press on to a medium speed.

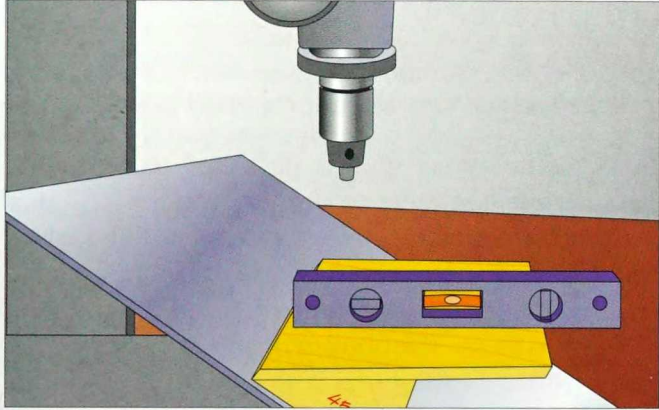


2-184. Sanding wheels with a drill press.

A strip of sandpaper is all that is required to round off the edges. The washers allow you to get between the wheels so that you can do all of the edges in one operation.

Setting Angles on a Drill-Press Table

The drill press angle jigs described on page 89 can also be used to set the angle of your drill-press table if you prefer. The method is simple. Loosen the adjustment screws on the table, set a level on the required angle jig so that it is horizontal, and tighten up the screws (2-185).



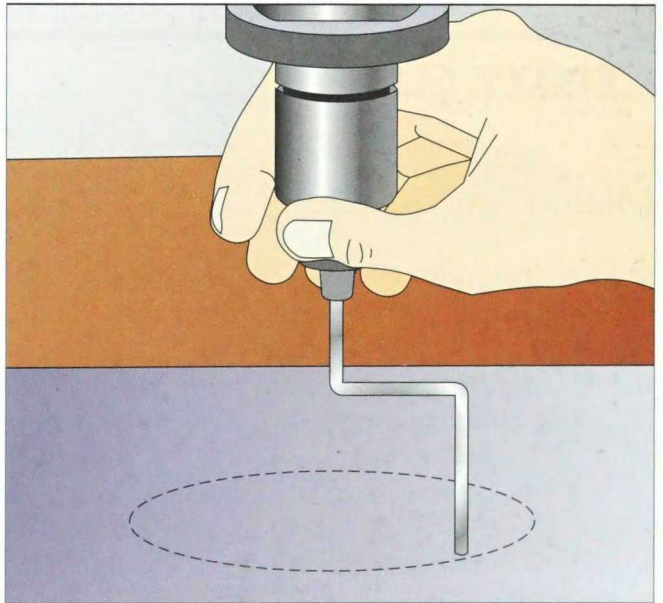
2-185. *Adjusting the drill-press table to the desired angle using an angle jig and a level.*

Tightening Bits in a Drill Press

After removing a drill bit from your drill press, if you notice some scraping of the bit shank take another look at how you installed the bit. The scraping of the shank is usually caused by a loose chuck; the bit is losing its grip. To prevent this, make it a habit to tighten all three holes in the drill chuck (2-186).



2-186. *Tightening all three holes in the chuck will prevent scraping and slipping of the drill bit.*



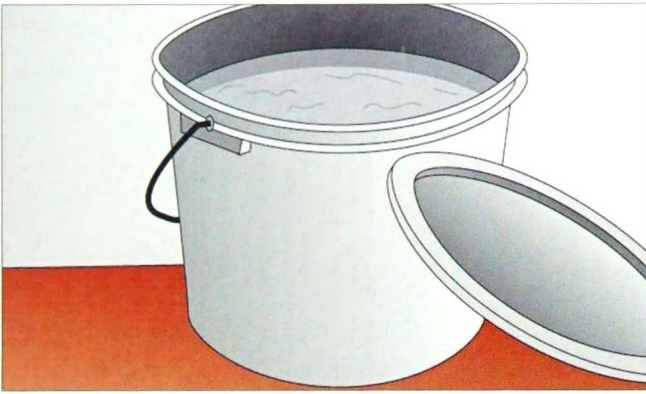
2-187. *Lower the shaft of the drill press until the coat hanger just touches the table.*

Truing-Up a Drill-Press Table

A drill press will not be effective if the chuck is not perfectly perpendicular to the table (unless, of course, you are angle-drilling). An easy way to true-up your table is to do the following: Take a wire coat hanger and make two 90-degree bends in it so that it is shaped like a Z. Then tighten one end into your chuck. Do *not* turn your drill press on. Lower the shaft until the coat hanger just touches the table (2-187). Now, lock the shaft and slowly hand-turn the chuck. If you see a gap between the table and the hanger, adjust your table accordingly.

DRYWALL

The “mud” used for joint-filling drywall (plaster-board) can dry out quite quickly. If you want to save the remaining mud for later use, level off the remaining amount in the container and then add some



2-188. Cover unused drywall mud with water for later use.

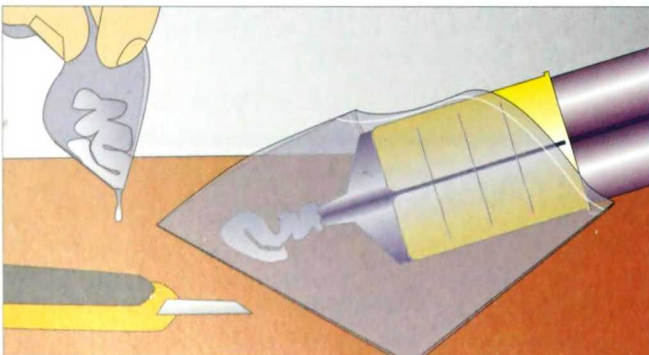
water. Add about two inches of it to cover the mud (2-188). Reseal the container and store it. When you plan to reuse it, simply pour off the water.

EPOXY GLUE

Mixing Epoxy Glue

Most people squeeze out a blob each of hardener and resin when making a batch of epoxy glue, to approximate a 50/50 mix. Not having the mix in the right proportions can result in a weak glue and reduce its holding power.

An easy solution to get a more accurate mixture is to squeeze a line out of the hardener and then a line of equal length from the resin (2-189). Now when you mix them, they will be of equal propor-



2-189. Squeeze a line of glue from the hardener and then a line of equal length from the resin.



2-190. Use the bottom of an unopened can of soda to mix the hardener and resin for the epoxy glue.

tions. Some epoxy glue is packaged in a double-hypodermic container to simplify this.

Another problem sometimes encountered when mixing the hardener and resin is finding a clean, small suitable surface on which to mix them. One solution is to use the bottom of an unopened can of soda (2-190). It provides a shallow depression for easy mixing and is heavy enough so that it won't readily tip. Also, on hot days when epoxy tends to set up faster, you can cool the can in the refrigerator first. This will delay the setting.

One final note: When you have finished with the glue, don't set the can down on anything you might need. You might not be able to remove the can.

Retarding Epoxy Glue Setup

Epoxy glue will set up faster in warmer weather or in a warm environment. This may not be desirable in some situations. To retard this, mix your epoxy on top of a soda can as in 2-190, but refrigerate the can first. Another approach is to mix the glue on the lid of a jug filled with ice water (2-191).

EXTENSION CORDS

Selecting Extension Cords

Care should be taken when using an extension cord for your portable or stationary power tools (2-192).



2-191. Mixing epoxy glue on the lid of a jar filled with ice water will help retard its setup time.

Selecting a cord of the wrong length or gauge could put excessive strain on your tool's motor or possibly heat up and burn the wire.

Table 2-4 indicates the wire gauge to be used



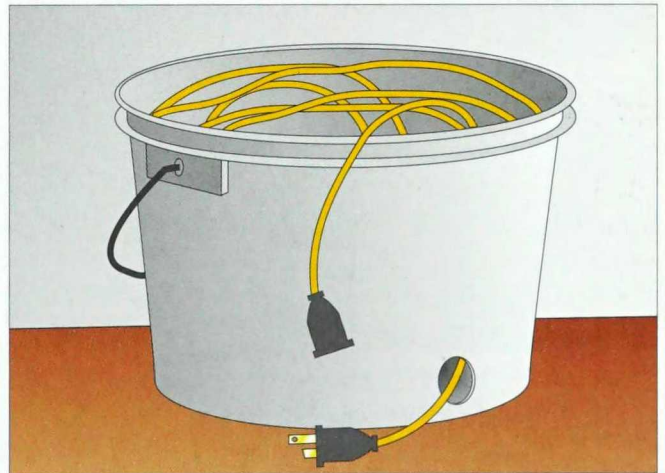
2-192. Make sure that you select an extension cord of the proper length of gauge.

for the ampere rating of the tool that you are using and the length of the extension cord recommended.

Storing Extension Cords

Most woodworkers have to rummage through a box or drawer to find that 50- or 100-foot extension cord. Once found, it takes a half-hour or so to disentangle it.

There is an easy way to store extension cords so that they are readily accessible. Drill a hole in the side of a cheap plastic pail, close to its bottom. Make the hole large enough for the plug end of the extension cord to just fit through. With the plug end sticking out of the hole, coil the rest of the cord into the bucket. Plug in the end from the hole into an outlet and simply reel out the amount of cord needed (2-193).



2-193. This plastic pail provides an excellent storage bin for long extension cords.

Table 2-4.

CORD LENGTH	AMPERE RATING				
	0 TO 5	10	12	15	20
FEET					
25	18 gauge	18 gauge	16 gauge	14 gauge	12 gauge
50	18 gauge	18 gauge	16 gauge	14 gauge	12 gauge
75	18 gauge	16 gauge	16 gauge	14 gauge	12 gauge
100	18 gauge	16 gauge	16 gauge	14 gauge	12 gauge

EXTENSION LADDER

Carrying an Extension Ladder (#1)

An extension ladder will be easier to carry if you hold it at the balance point. Finding that point will be easier if you paint the spot with red paint (2-194).



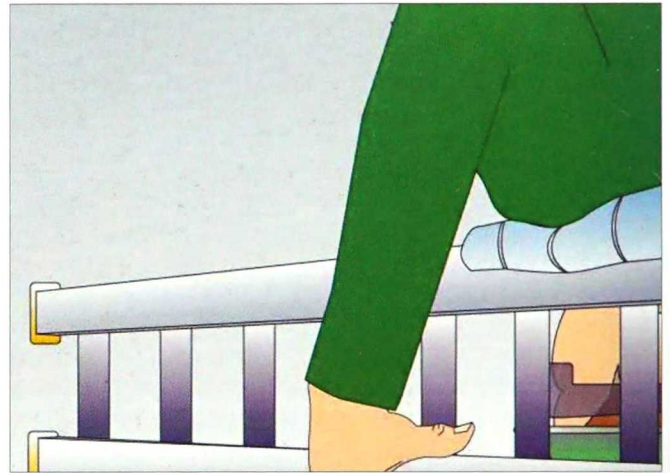
2-194. Paint the balance point of your extension ladder to make carrying it easier.

Carrying an Extension Ladder (#2)

Foam pipe insulation wrapped at the balance point of your extension ladder will make hauling it around a little easier on your hands or shoulders (2-195).

Clamps for Paint Cans

Squeeze-type bar clamps can be used to hold a gallon of paint on an extension ladder while you are painting (2-196).



2-195. Pipe insulation makes carrying an extension ladder less painful.



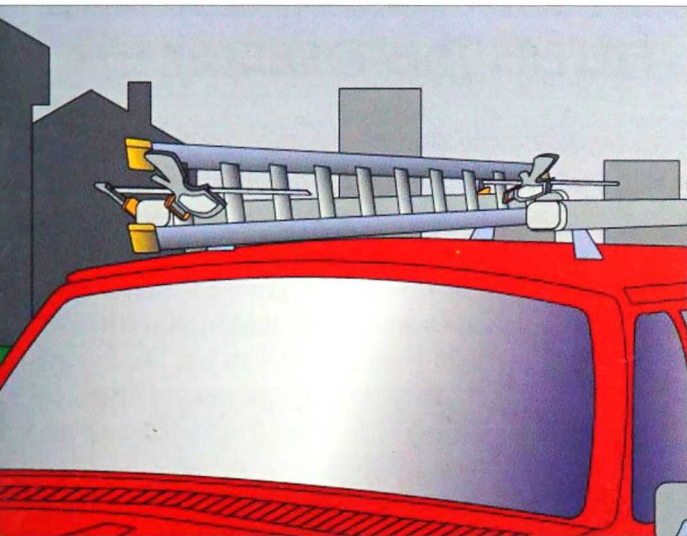
2-196. Squeeze-type bar clamps will hold that gallon can of paint on your ladder.

Transporting an Extension Ladder

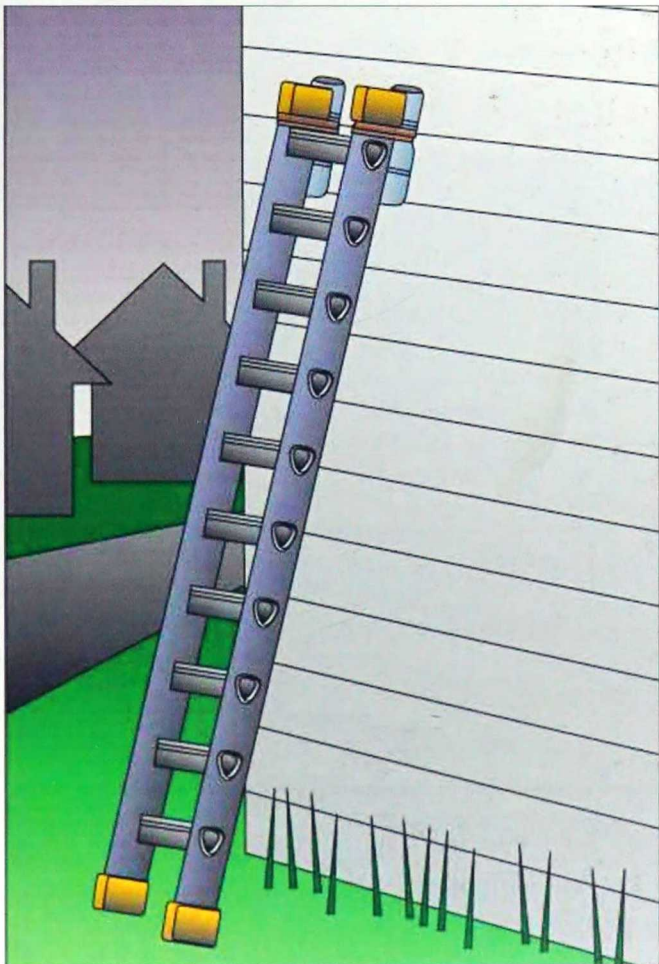
Transporting an extension ladder on your car's roof rack can be made easier if you clamp it down with squeeze-type bar clamps (2-197).

Wall Protection

Tape a few pieces of foam pipe insulation to the top of your extension ladder to protect the walls and siding of your house (2-198).



2-197. Squeeze-type bar clamps can secure your ladder for transporting.



2-198. Foam pipe insulation will prevent marring of your siding when using an extension ladder.

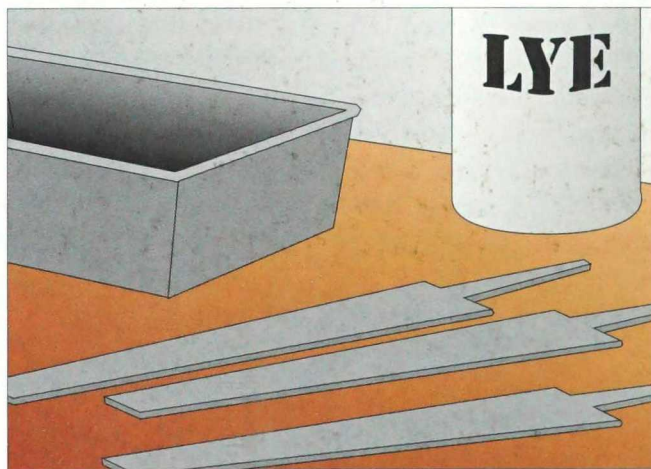
FILES

Cleaning Files

Files and rasps tend to accumulate the materials you have tried to grind away. The materials seem to build up in the crevasses of the tool. The biggest culprit is aluminum. For some reason, aluminum builds up quite readily in a file and soon renders the file useless. Until now.

Laying the file(s) in a warm solution of water and lye will quite quickly melt and eject any traces of aluminum (2-199). *Be very careful when using lye. Wear thick rubber gloves, face and eye protection, and follow all safety instructions for use. This is very caustic material. If you spill any lye, immediately dilute it with water.*

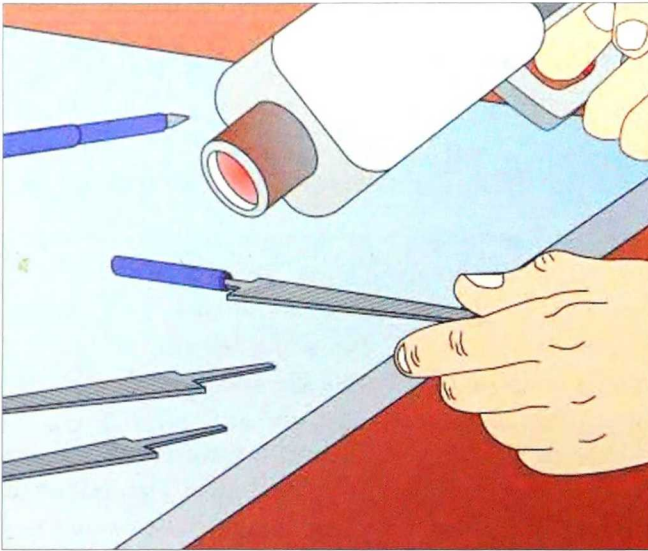
After cleaning the file or rasp, rinse it well in cold water, wipe it dry, and then coat the tool with a light oil.



2-199. Soaking your files and rasps in a lye solution will remove aluminum shaving buildup. Wear the proper safety equipment and follow all safety instructions when doing this.

Making File Handles

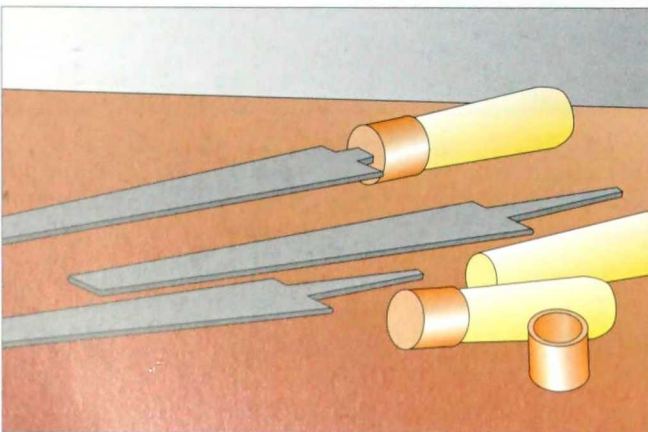
Most files have sharp steel tangs that can be uncomfortable to use. Old ballpoint pens with the ink tube removed can be used for handles on these



2-200. Old ballpoint pens can be heated to form new handles for files.

files. A heat gun will soften the plastic to mold onto the tang (2-200).

Another approach taken by many woodworkers is to turn their own wooden handles on their lathe, and then drill out for the tang and make a slice (kerf) across the end. This is done so that some sort of binding can be wrapped around the end to tightly secure the file on the handle. Ferrules can serve as this binding. Ferrules can be found at your local plumbing supply store. Ask for copper pipe end caps. These can be drilled and filed to fit the tang and then force-fitted over the end of the turned handle (2-201).



2-201. Copper pipe-end caps make great ferrules for shop-made file or rasp handles.

FILTERS (DISPOSABLE)

Don't throw away that paper dust mask just yet; it can be reused. Simply vacuum the outside surface and then use it for filtering paint thinners or other lightweight liquids (2-202). If the dust mask remains clean and the product it was used to filter was clear, the dust mask can be reused as a filter.



2-202. A paper dust mask makes a great filter for paint thinners, etc.

FINISHING WOOD

(See Wood Finishing)

FLY CUTTER

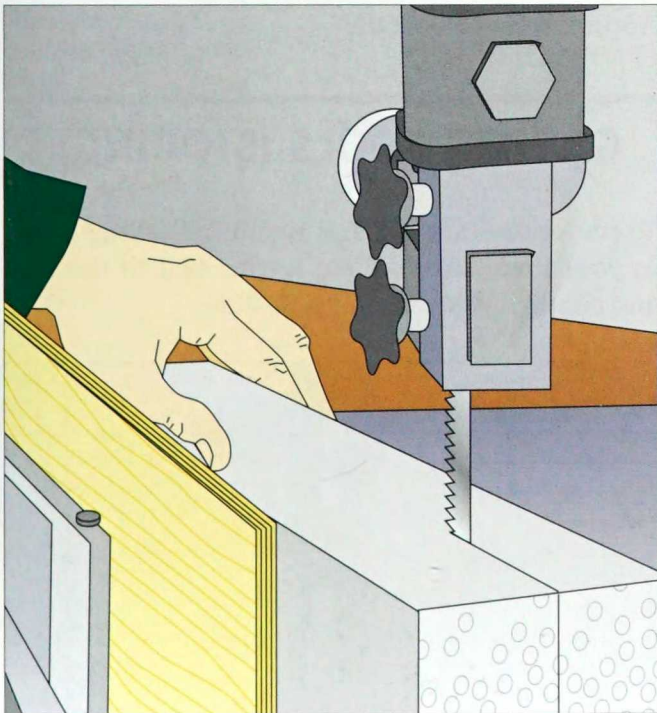
(See Drill Bits)

FOAM (CUTTING)

Cutting the rigid types of foam, such as Styrofoam (2-203), or the types of foam that you find in chair seats, can be done easily. Both types can be easily cut on a band saw. Most types of band-saw blades will work. The exception would be a skip-tooth blade, which will give a rougher cut. The best blades to use are the ones with the most teeth per inch. And, of course, the tighter the scroll pattern, the narrower the blade that is used.

Freezing the rubbery type of foam overnight will make for a cleaner cut. Another method is to use an electric carving knife. Although I haven't used this method, people have told me that it works just fine on larger radii patterns and straight cuts.

The ideal way of cutting foam is with a hot wire. This is the way professionals do it, but the setup is specialized.



2-203. Cutting rigid foam on a band saw.

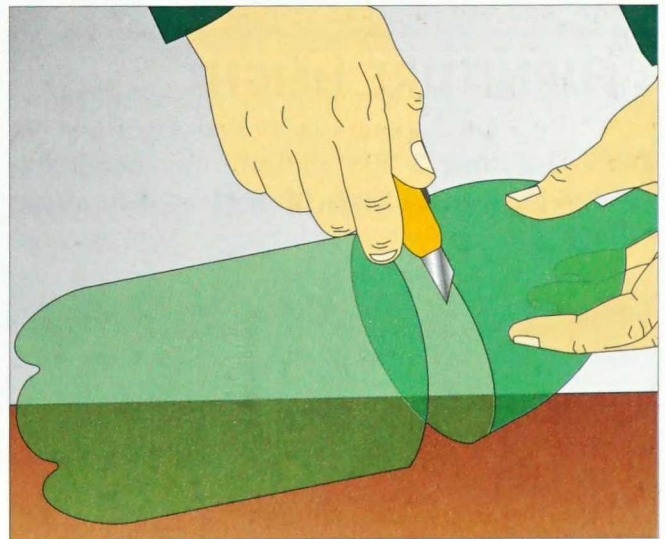
FRETSAW

(See Scroll Saw)

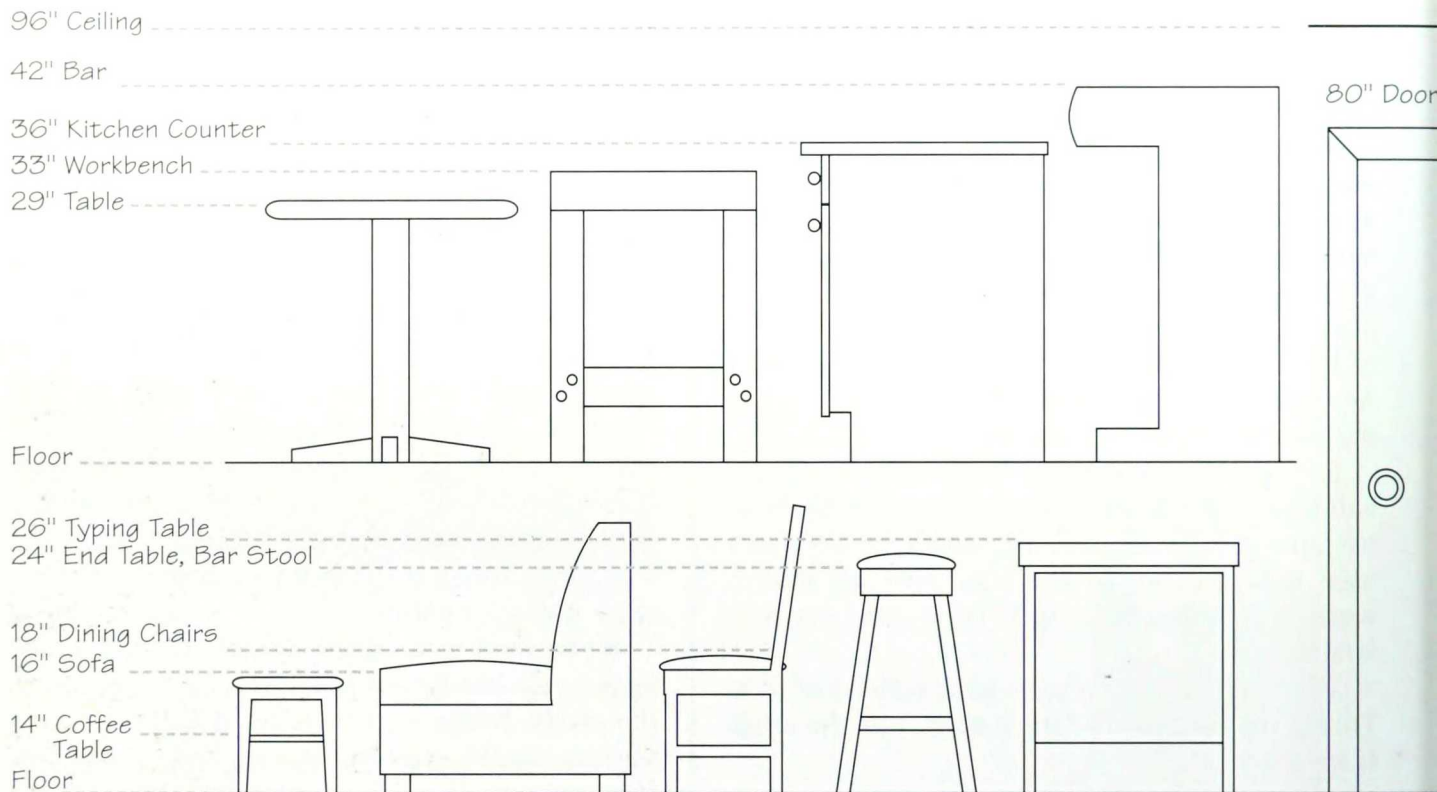
FUNNELS (MAKING)

You can never find a funnel when you need one. Here's an easy and quick solution for making one. Simply cut the top off a two-liter plastic bottle of soda carefully on a band saw or by using a utility knife (2-204). Make the cut 3 to 4 inches below the top. While you're at it, cut several bottles and keep them near your paint.

If you want to hang the funnels up, drill a hole in one side just below where you are going to cut the plastic bottle, and then cut the bottle. Don't throw away the caps on the soda bottles. The funnels make good mixing containers; the caps will seal the ends.



2-204. Cutting the top off a plastic bottle of soda. This is an easy way to make a funnel.



2-205. Relationship of heights of various pieces of furniture.

FURNITURE HEIGHT

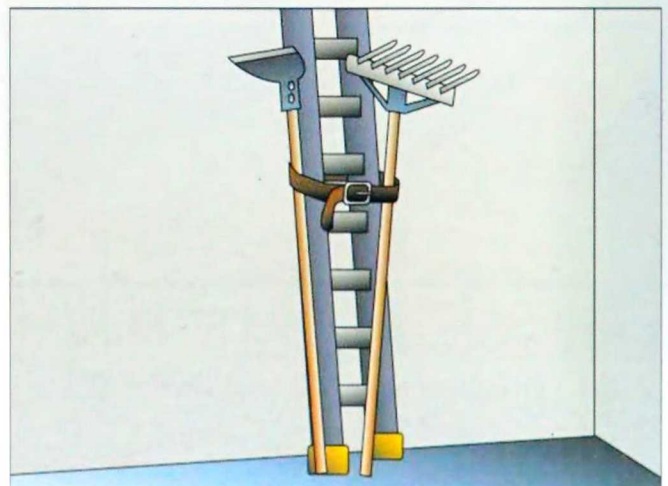
Table 2-5 and 2-205 indicate the acceptable heights for various items of residential furniture, ceilings, etc.

Table 2-5.

Bar	42 inches
Bar Stool and End Table	24 inches
Ceiling	96 inches
Coffee Table	14 inches
Dining and Kitchen Chair Seats	18 inches
Door	80 inches
Kitchen Counter	36 inches
Kitchen Table, Dining Table, and Desk	29 inches
Sofa and Easy Chair Seats	16 inches
Typing Table and Word Processor	26 inches
Workbench	33 inches

GARDEN TOOLS (STORING)

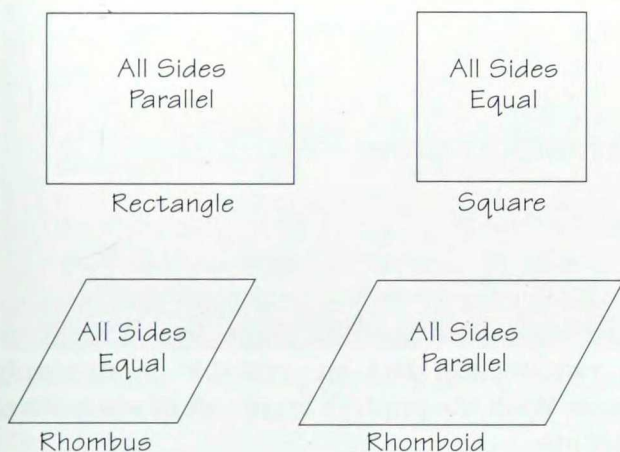
To prevent hoes, rakes and such from falling down in your shed, screw an old leather belt to the wall and simply buckle them up (2-206).



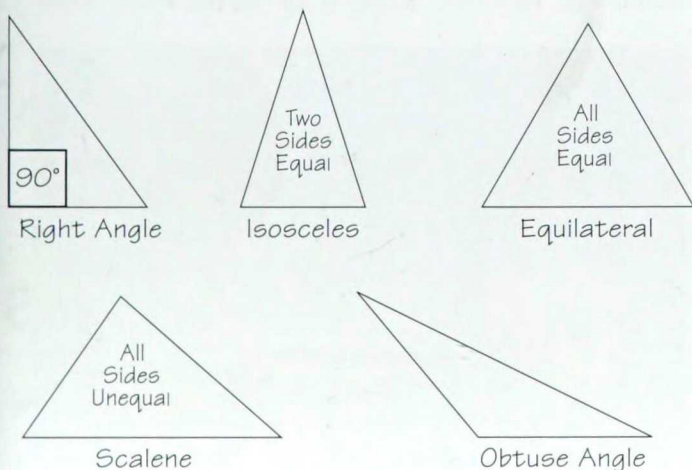
2-206. An old belt will keep your garden tools in check.

GEOMETRY

No, we are not going back to school. This is just a reference for some of the geometry terms that you may have forgotten and that you may find useful while working in your workshop. Illus. 2-207 shows the various shapes of rectangles. Illus. 2-208 shows the various shapes of triangles.



2-207. Various shapes of rectangles.



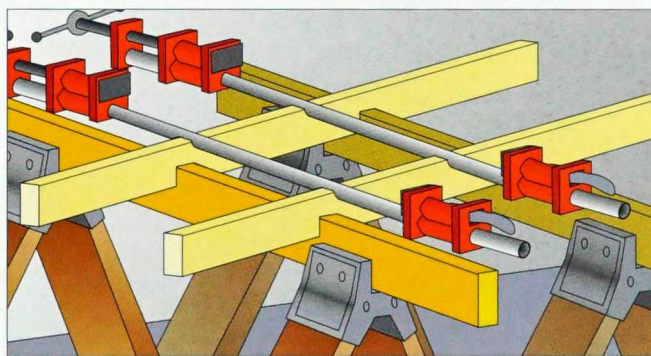
2-208. Various shapes of triangles.

GLUE

(See also Adhesives and Epoxy Glue)

Gluing Racks

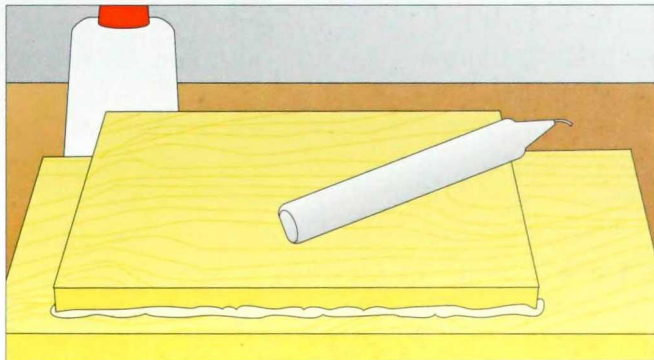
You can fit scrap pieces of 2 x 4 stock over your sawhorses to make a gluing rack. The slots on the bottom of the gluing rack should be cut so that they fit snugly on top of your sawhorse (2-209). The upper slots will hold your bar or pipe clamps, depending on the cut. The big advantage of this gluing rack is that it will not take up space on your workbench while you are waiting for glue to dry.



2-209. Fit the slots on the bottom of the sawhorse gluing rack so that they fit over the sawhorse.

Protecting the Finish from Glue

Before gluing your project together, try lightly rubbing a wax candle on the edges where glue may ooze out and stain your finish (2-210). The dried



2-210. Lightly rubbing a wax candle on the edges of a project will help protect the project finish from glue.

glue should just peel off, and a light sanding will remove any traces of the wax.

Removing Glue

You've just glued up a small project with white or yellow glue and discovered some seepage on the joints. Try this: If the glue is fresh, some water-moistened Q-Tips will clean it up. If the glue has been there for a half hour or so, sharpen the end of a 1/4-inch dowel to 45 degrees and proceed to clean it up (2-211). Then use moistened cotton swabs in warm water to wipe up the residue.



2-211. A sharpened dowel and some moistened Q-Tips will remove excess glue.

For the conventional solvent-based contact cement, there is a contact cement thinner available from LePage. A Q-Tip dipped in this will work well. If you don't have any of the solvent on hand, try nail polish remover, the non-oily type. Be sure to wipe the area clean after use.

Epoxy-type adhesives should be carefully cut away with a utility knife or a well-sharpened scraper.

Next time, before gluing up a project, adhere masking tape to the joint edges. Any seepage that occurs should run onto the tape and not cause damage to the workpiece. After clamping the workpiece and after the seepage seems to have stopped, remove the tape.



2-212. A printer's brayer can be used to spread white glue on larger surfaces.

Spreading Glue

One method of spreading white glue on larger surfaces is to use a printer's brayer (2-212). These are normally used for spreading printer's ink, but they work very well with white glue as well. They come in various sizes and are available at art-supply stores. Wash the printer's brayer off in warm water after use.

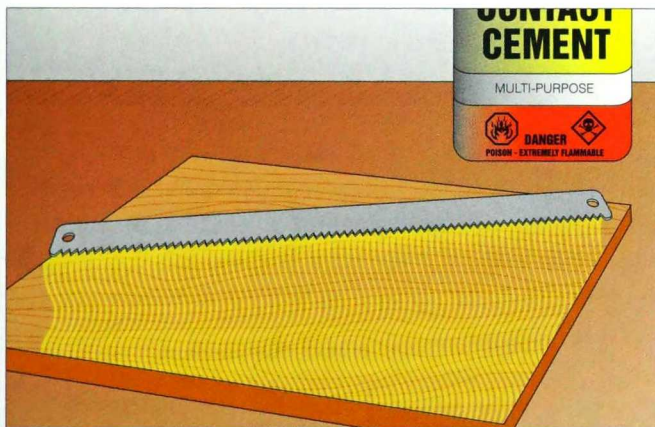
Another method of spreading glue is to use a glue spreader (2-213). These are inexpensive and available at both flooring or ceramic tile dealers. Get the type of glue spreader with the most and the shallowest notches. Rinse it in warm water after



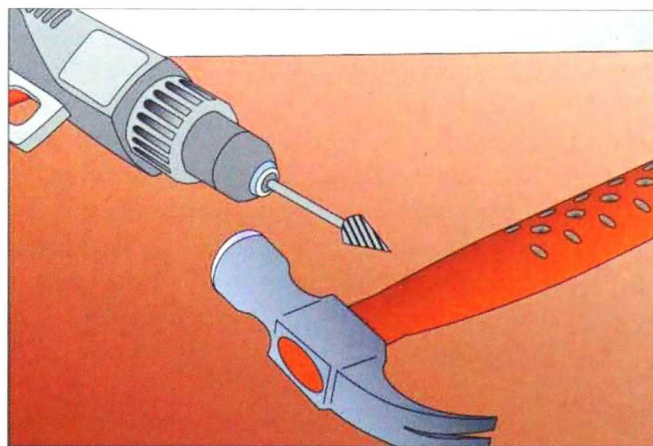
2-213. A typical glue spreader. Inset shows shallow notches.

using white glue, or with a suitable solvent if using other types of glue.

Glue can also be spread with old hacksaw blades (2-214). Carefully break one in half. Cut six inches or so off an old broom handle. Saw a slot on the end of it on your band saw, mix up some epoxy glue, and glue the top edge of the hacksaw blade into the slot. The result is an effective glue spreader.



2-214. Another method of spreading glue is to use an old hacksaw blade.



2-215. Drilling dimples into an old wooden hammer handle will give it a better grip.



2-216. Dozuki saws.

HAMMER HANDLES (RENEWING)

A wooden hammer handle can get pretty slippery after many years of use. Most woodworkers have their favorite hammer and they hate to give it up even if unsafe. To renew the grip of the wooden hammer handle, use a countersink bit to drill dimples into the grip portion (2-215). A little sanding and you will get a better grip on it.

HANDSAW

Japanese Handsaw

The Japanese handsaw, usually referred to as a Dozuki saw (2-216), is much different from the tra-

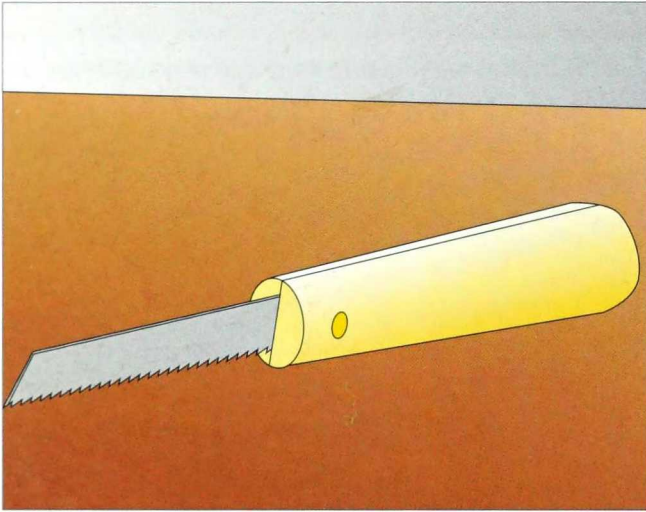
ditional back or tenon saw. In the traditional saws, the teeth are set in a crosscut configuration and are meant to cut on the push stroke. Because of the pushing action, the blades must be very rigid, and therefore must be thick.

The Dozuki saw, on the other hand, has teeth that are set to cut on the pull stroke. This results in a more accurate cut. Also, because of the pulling action, thinner steel is required, resulting in a narrower kerf. The finer steel allows for the finer cutting of the teeth. The traditional Dozuki saw has 22 to 26 teeth per inch (tpi).

Dozuki saws are now readily available in most home renovation stores. Generally, the blades of these saws are not meant to be resharpened; they are disposable. However, when dull they can be used as glue spreaders or scrapers.

Shop-Made Handsaw

Often, I have required the use of a small, fine-toothed saw to clean out cuts that are in tight locations. A hacksaw blade would sometimes suffice, but then I thought of using a jigsaw blade. I started with a $\frac{3}{4}$ -inch dowel for the handle and cut a slot in the end with the band saw. I then drilled two small holes on the blade like the ones on the tail of the jigsaw blades. I flared the holes with a



2-217. This shop-made mini-handsaw is great for getting into tight spots.

countersink and put them into the slot. I installed the blade with a couple of $\frac{5}{8}$ -inch #4 wood screws (2-217).

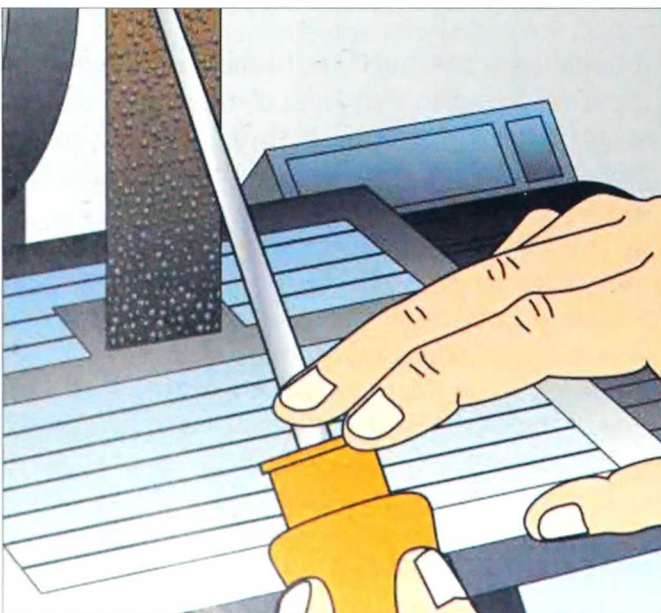
HAND TOOLS

Cleaning Hand Tools

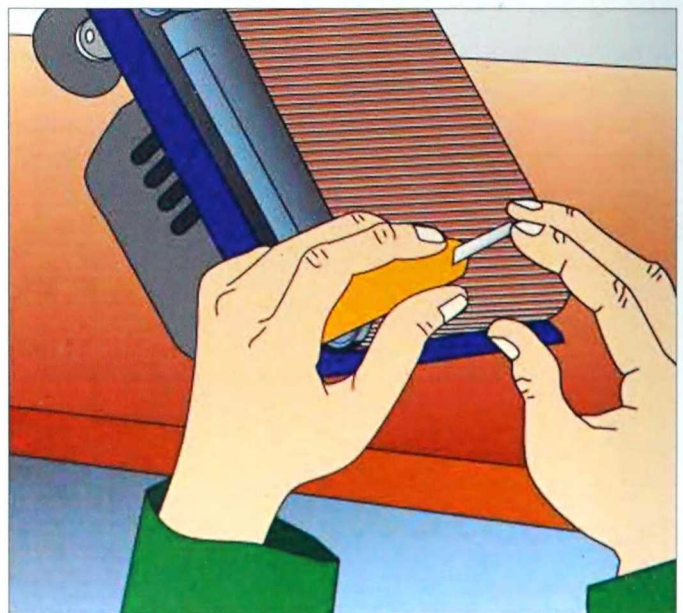
A bench-type belt sander will help to take dirt and goo off tools like awls, knives, putty knives and chisels. An inverted portable belt sander clamped in your bench vise will work as well (2-218). Be careful not to leave the tools on the sanders too long as they could heat up and destroy the temper of the cutting edges.

Covers for Hand Tools

A length of old garden hose will come in handy in the woodshop. Cut short pieces off it to cover the jaws of tools like Vise-Grips and slip-joint pliers to protect your projects (2-219). Slice the pieces laterally if necessary to fit.



2-218. A bench-top or portable belt sander will remove goo or dirt from your hand tools.





2-219. Pieces of old garden hose will protect your projects from the steel jaws of pliers, etc.

Mending Hand-Tool Handles

Hand tools, like pliers, wire cutters, etc., are bought with plastic-coated grips. After a lot of use, these grips either break or wear off. Here's an easy way to mend them. Cut heat-shrink tubing, available by the foot at most electrical supply shops in various colors and sizes, to the size of your particular handle(s). Now, keep a hair dryer or a heat gun nearby, ready for use. Coat the handle(s) with contact cement, and, while the glue is still wet, slip on the heat-shrink tubing and shrink the tubing with the hair dryer (2-220). The result is new handle grips.



2-220. Mending the handles on cutters with heat-shrink tubing and a heat gun.

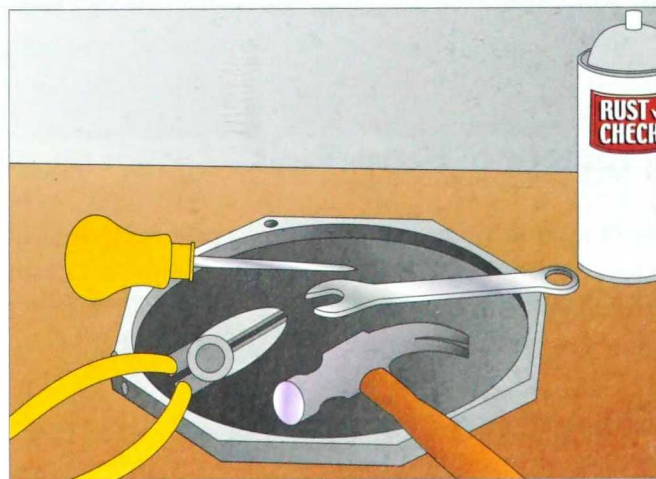
Another way of mending the handles of your hand tools is by dipping them in a product called Color Guard, made by Lockite (2-221). This is a thick-liquid, rubbery material that semi-hardens. It softens the grip on the tools. Color Guard is available in about six colors, so it makes tools easily identifiable.



2-221. Color Guard can also be used to mend the handles of tools.

Preserving Hand Tools

You can preserve your hand tools and keep them rust-free by using a product called Rust Check (2-222). Rust Check prevents rust from forming. It



2-222. Use Rust Check on your tools to prevent rust from forming.

is used by automobile dealers, and they should be willing to sell you or maybe even give you some.

A plastic spray bottle makes Rust Check easy to apply. To use it, soak your (metal) hand tools in it for a couple of days, and then wipe them off. Repeat this once a year.

Protecting Hand-Plane Blades

When storing your favorite hand plane, use a flat plastic refrigerator magnet to cover the exposed blade to save it from damage (2-223).



2-223. Plastic refrigerator magnets will protect hand-plane blades.

Protecting Hand-Tool Edges

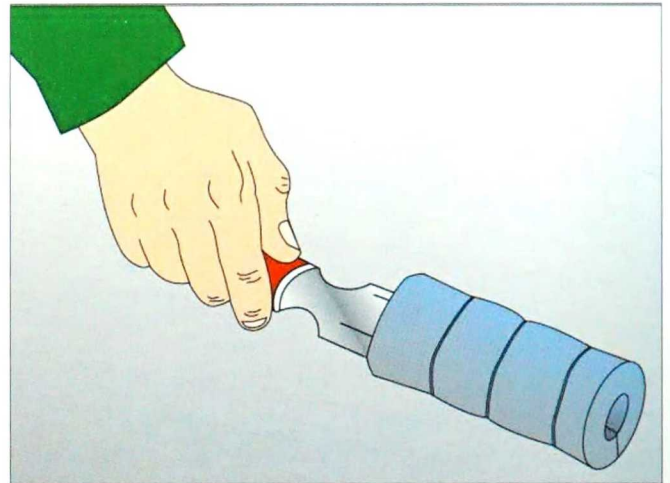
Tools like chisels have very sharp edges and carrying them can either cut you or damage the edge. Foam pipe insulation will protect both (2-224).

Protecting Hand Tools

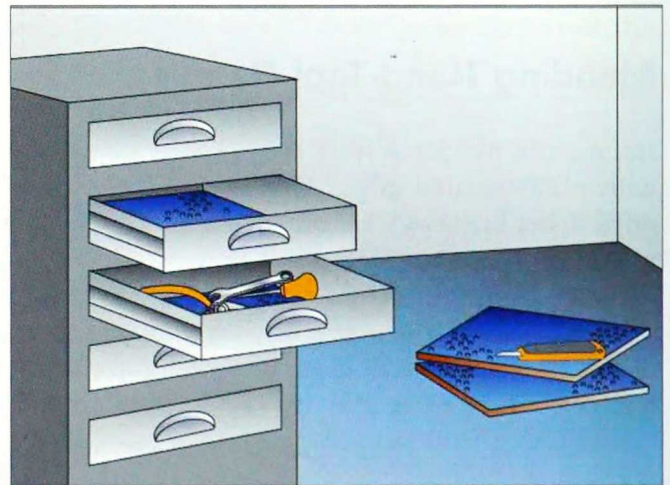
Spot-glue some indoor/outdoor carpet remnants to the bottoms of your tool drawers. It will stop them from bouncing around and rattling if your toolbox is being transported (2-225).

Sharpening Hand Tools

Maybe I've bitten off more than I can chew on this very important subject. I'm sure that volumes have



2-224. Foam pipe insulation will protect you and the sharp edges of tools.



2-225. Carpet remnants will prevent tools from rattling in the tool drawers.

been written about it. I am going to try to condense the important material into a few paragraphs.

First and foremost, if a blade isn't sharp, it won't cut. It may appear to, but it is probably cutting with friction and heat. The first sign of a dull blade (powered or otherwise) is that more effort is required by either the tool's motor or by you. The other sign is frayed edges. If you can see any reflected light off the edge of the blade, it's time to get out the sharpening gear. Believe me, there is a lot of gear. I don't want to scare you off, but there are specially shaped sharpening stones for just about every type of blade in existence.

Let's start with the sharpening stones needed to meet the basic requirements. You will need a combination India or Crystalon bench stone that is medium on one side and fine on the other. These bench stones are usually about 3 inches wide x 6 inches long. They are oilstones, which means that a very light oil should be used when using them to sharpen tools. The oil prevents a buildup of metal particles in the pores of the stone. A larger stone is preferable, but a 3 x 6-inch stone is a good and inexpensive starter for sharpening chisels, plane blades, scrapers, and knives.

Other special stones are slip stones and files. Slip stones are specially shaped (usually one-half round, oval, or round) stones that are used for curved blades. A lathe gouge is one example. Files are similar in shape, but are more often square, rectangular, or triangular. A stone file would be used in sharpening the cutting edge of an auger bit.

Now, we get into the fun part—the actual sharpening. Let's use a 1-inch wood chisel as an example. First, look at the blade. If it is badly damaged, set it into a bench vise and carefully file down the *angled* side with a bastard-cut steel file. Be sure to maintain the same angle, usually 25 degrees. Remove the chisel from the vise and get out your bench stone and the oilcan. Wet the stone with oil on the medium side. Grasp the blade of the chisel with both hands and hold the blade at its 25-degree angle (2-226). Use long, firm strokes the length of the

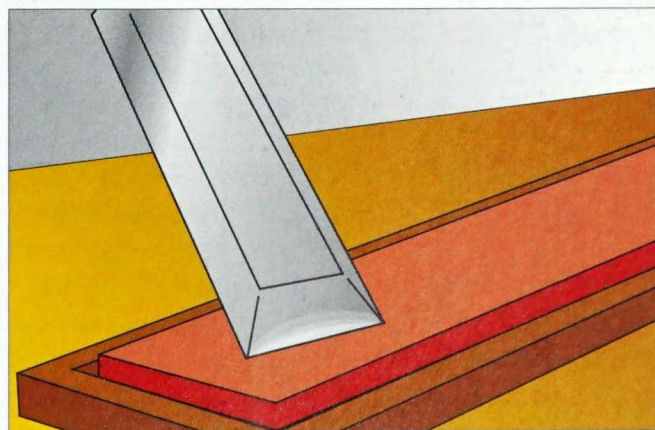


2-226. The correct way of holding a chisel blade for sharpening on a bench stone.

stone. Check the blade often to make sure that the angle is correct. If not, it will be obvious by a deviation on the surface area. Continue this until all file markings are eliminated and the blade edge is getting sharp. Remember, though, to keep the stone wet with oil.

Now, repeat the process on the fine side of the bench stone. This should give you a razor-sharp edge, but you are not done yet. Raise the blade just a little and continue sharpening. This angle should be 27½ degrees (2-227). The angle change will show up on the blade as a straight or slightly arced line across it. The change should be about ⅛ inch in width across the blade. The purpose of this is to remove any burr that may be on the blade and to give it a truly razor-sharp edge. If there is any burr left, slide the blade along a piece of hardwood to remove it.

The above process can be repeated for bench plane blades, knives, and other similar flat-bladed tools. Be absolutely certain to follow the blade's original angle.



2-227. This close-up shows the angle change for a razor-sharp edge.

HARDWOOD

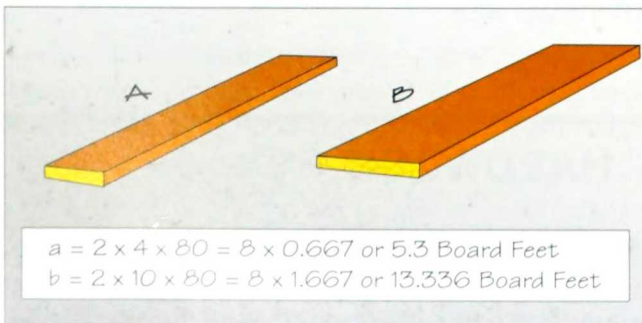
Hardwood is the wood of broad-leaved dicotyledonous trees (as distinguished from the wood of conifers, called softwood). It includes oak, maple, walnut, etc. Softwood includes pine, spruce, etc.

Hardwood Board Foot Chart

To determine the quantity of board feet in a piece of dimensioned lumber or hardwood, find the dimensions in **Table 2-6**, and then multiply the length of that dimension by the factor number. For example, if you want a 2 x 4-inch piece of wood that is 8 feet long, multiply 8 by the factor in the chart opposite 2 inches thick and 4 inches wide. This factor is 0.667, so you would multiply 8 feet x 0.667 to arrive at 5.3 board feet (2-228).

Table 2-6.

THICKNESS	WIDTH	FACTOR
1"	2"	0.167
1"	3"	0.25
1"	4"	0.333
1"	5"	0.147
1"	6"	0.5
1"	8"	0.667
1"	10"	0.833
1"	12"	1.0
1 1/4"	4"	0.417
1 1/4"	6"	0.625
1 1/4"	8"	0.833
1 1/4"	10"	1.041
1 1/4"	12"	1.25
2"	2"	0.333
2"	4"	0.667
2"	6"	1.0
2"	8"	1.333
2"	10"	1.667
2"	12"	2.0



2-228.

Hardwood Designations

Table 2-7 lists the designations given when ordering hardwood, and the nominal (described) thickness of each designation. It was supplied courtesy of the Canadian Wood Council.

Table 2-8 provides information on sizes, standard grades, and cutting requirements for hardwood. It was provided courtesy of the Canadian Wood Council.

Table 2-7.

NAME	NOMINAL THICKNESS
Board	1 to 2 inches
Four-quarter (4/4)	1 inch
Five-quarter (5/4)	1 1/4 inches
Six-quarter (6/4)	1 1/2 inches
Eight-quarter (8/4)	2 inches
Plank	3 inches or more
Timber or post	3 inches square or more

Grades and Cutting Requirements

Hardwood lumber is graded according to NHLA (National Hardwood Lumber Association) rules to evaluate the quantity of clear or usable wood in each piece, based on cutting requirements (**Table 2-8**). This method assumes that the lumber will be further sawn to lengths and widths, so that knots and other characteristics can be removed. Hardwoods are usually graded on the poorer side of the board.

The top grades of hardwood lumber contain high percentages of clear or knot-free wood in relatively long, wide cuttings; however, no grade calls for completely clear lumber. The top grades are "Firsts and Seconds," usually marketed together as one grade and often marketed with the next lower grade, Selects, as "Selects and Better." These grades are sometimes sold with yet a lower grade, No. 1 Common, as "No. 1 Common and Better." No. 1 Common yields a minimum of about 65 percent clear cuttings (compared with about 80 percent for Firsts and Seconds).

Generally, the upper grades should only be specified for applications where appearance is critical. Knots and other characteristics may be acceptable in some locations. It may be most economical to order a large quantity of lower-grade material to obtain an equal amount of clear-face cuttings, if long cuttings are not a requisite.

No. 2 Common grade can be used for a variety of applications. Typical uses are for furniture and flooring; occasional uses are for pallets and containers. Generally, No. 2 Common yields a minimum of 50 percent clear-face cuttings, and even more if only small clear pieces are needed.

No. 3A Common allows pieces yielding one-third clear-face cuttings with no limit to the number of cuttings. No. 3B Common admits pieces yielding 25 percent sound cuttings. These grades are frequently used in pallets or frame stock for upholstered furniture.

The proportion of hardwood grades varies from mill to mill, depending on log quality. The upper grades of No. 1 Common and Better, however, are normally about one-third to one-half of mill production. The user can economize by selecting grades wisely. One should determine average width, length, and percentage of pieces longer than 12 feet for higher grades before ordering.

Hardwood lumber is graded in the rough and is not grade-marked unless specifically requested. For a large order, the buyer can engage an independent NHLA grader to undertake a grade inspection and provide a certificate. It is usually sufficient to specify the desired grade or grade combination.

There are special grading rules for some species, such as walnut and butternut, in the standard grading rules. There are also special production grades, such as "hardwoods for construction" (blocking, planking, mine lumber, and sheet piling).

Cutting Sizes

Hardwood lumber is normally sold in rough form, within given manufacturing tolerances (Table 2-9). Surfaced lumber is also subject to tolerances; the manufacturer can provide details. Widths and lengths are generally random, but are related to grades through the cutting unit and

minimum grade requirements. Thus, the desired size can affect grade selection as much as aesthetic factors.

Certain products have preferred sizes and lengths. Pallet stock is sometimes cut about 24, 40, and 48 inches long, with specified widths and thicknesses. Precut sizes eliminate waste at the pallet factory. The mill can usually find a use for its waste materials, such as pulp chips.

Moisture Content

Hardwood used for furniture and other home workshop projects should be kiln-dried to a moisture content of 6 to 8 percent for best results. This is the average equilibrium moisture content indoors in most North American climates. The wood should be allowed to acclimatize in your shop for a week or two before working with it. Some hardwood lumber is kiln-dried at the lumber mill or by custom kiln driers or users prior to use. In some other cases, mills may be integrated with secondary manufacturers, such as flooring mills, which do their own kiln-drying. Moisture content should be specified by the buyer. Most low-grade pallet stock is shipped green for economic reasons.

After drying, the lumber is stored in a protected area at the kiln, or shipped directly to the user. Under normal conditions of transport, the outer portion of some boards may pick up moisture, but this should be quickly lost indoors.

Generally, a charge of lumber can be expected to downgrade during kiln-drying (from 5 to 10 percent). Beech particularly is susceptible to warping and checking during kiln-drying.

To avoid staining during warm and humid weather and to aid drying, undried lumber should be stacked in well-spaced piles, preferably with "stickers" (narrow strips of hardwood) between layers. Stickers are removed immediately after drying, although some stickers are left in the pile, at least every 10 inches in depth, for ventilation. If stickers are too wide, they can impede drying and lead to staining where they are in contact with lumber. The proper size is $\frac{3}{4} \times 1\frac{1}{2}$ inches, kiln-dried prior to use. Anti-stain treatments are sometimes applied to the lumber before drying.

Table 2-8. Standard Grades and Cutting Requirements

GRADE	FIRSTS	SECONDS	SELECTS	NO. 1 COMMON	NO. 2 COMMON
Cutting Requirements	Widths: 6" and wider Lengths: 8 to 16 feet *S.M. % Clear Face Cuts	Widths: 6" and wider Lengths: 8 to 16 feet *S.M. % Clear Face Cuts	Widths: 4" and wider Lengths: 6 to 16 feet *S.M. % Clear Face Cuts	Widths: 3" and wider Lengths: 4 to 16 feet *S.M. % Clear Face Cuts	Widths: 3" and wider Lengths: 4 to 16 feet *S.M. % Clear Face Cuts
	4' to 9' 91⅔ 1 10' to 14' 91⅔ 2 15' and up 91⅔ 3	4' and 5' 83⅓ 1 6' and 7' 83⅓ 1 8' to 11' 83⅓ 2 12' to 15' 83⅓ 3 16' and up 83⅓ 4 6' to 15' S.M. will admit 1 additional cut to yield 91⅔% Clear Face.**	2' and 3' 91⅔ 1 Reverse side-cutting sound or not below No. 1 Common. 4' and over shall grade on one face as required in Seconds with reverse side of board not below No. 1 Common or reverse side of cuttings sound. See Rule (Par. 70) defining edges of boards 4" and 5" wide.	1' Clear 2' 75 1 3' and 4' 66⅔ 1 5' to 7' 66⅔ 2 8' to 10' 66⅔ 3 11' to 13' 66⅔ 4 14' and up 66⅔ 5 3' to 7' S.M. will admit 1 additional cut to yield 75% Clear Face.	1' 66⅔ 1 2' and 3' 50 1 4' and 5' 50 2 6' and 7' 50 3 8' and 9' 50 4 10' and 11' 50 5 12' and 13' 50 6 14' and up 50 7 2' to 7' S.M. will admit 1 additional cut to yield 66⅔% Clear Face.
Minimum Cutting	4" x 5' or 3" x 7'			4" x 2' or 3" x 3'	3" x 2'

Notes: *Surface Measure

**Admits also pieces 6" to 9" wide of 6' to 12' surface measure that will yield 97 percent in two clear-face cuttings of any length, full width of the board.

Source: National Hardwood Lumber Association Rules
National Hardwood Lumber Association
Box 34518
Memphis, TN, USA 38134

Hardwood lumber can be end-coated to prevent excessive end-checking, using proprietary materials, or paraffin with a minimum melting point of 140 degrees F. Unless preventative measures are taken, end checks can develop into end splits, lowering the lumber grade. Red oak is particularly vulnerable to end checking, especially if it is dried unevenly or too rapidly.

Little shrinkage occurs unless the lumber is green or partly air-dried. Contracts for green lumber should have shrinkage allowances (Table 2-9).

The "Standard Kiln Dried Rule" in the NHLA rules states that the grade and measurement of lumber before kiln-drying shall be the basis of the seller's invoice. Inspection could be ordered after

lumber has been kiln-dried, however, in which case buyer and seller should agree upon an allowance for shrinkage in the total measurement (5 to 8 percent, depending on species). The "Standard Kiln Dried Rule" gives allowances for scant thicknesses and widths. Checks and warp are not considered defects. A "Special Kiln Dried Rule" allows kiln-dried lumber to be graded and measured as such on the seller's invoice, with the same restrictions on checks and warp as for green or air-dried lumber.

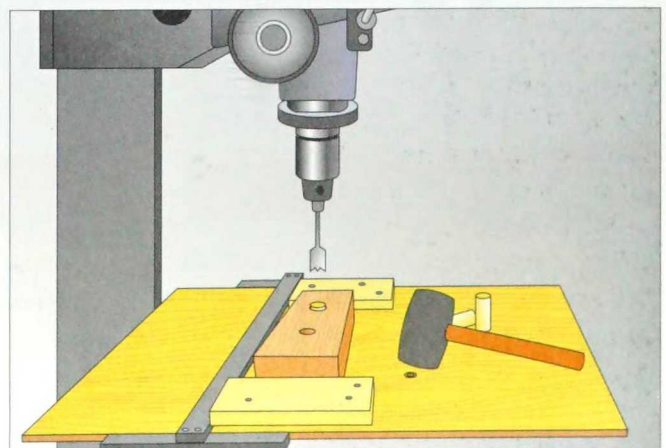
Table 2-9. Hardwood Lumber Sizes

DIMENSION	ROUGH SIZES (STANDARD)	SHRINKAGE ALLOWANCE (KILN-DRIED LUMBER)	ALLOWANCE FOR STANDARD SIZES	TOLERANCES
Thickness (Specified in inches, or in fractions: $\frac{1}{4}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", etc.)	$\frac{3}{8}$ " to 1", increments of $\frac{1}{8}$ " 1" to 2", increments of $\frac{1}{4}$ " 2" to 6", increments of $\frac{1}{2}$ " Rough Lumber having greater variations than tolerances in last column is measured for thickness at thinnest cutting and classed miscut. Special tolerances are allowed for "hit or miss" lumber.	Allow about $\frac{1}{32}$ " for each inch of thickness. Contracts for green lumber should specify dimensions required to provide for shrinkage allowance. Ten percent of a shipment of dry quartered lumber can be $\frac{1}{16}$ " scant on one edge if other edge is full thickness ($\frac{1}{8}$ " scant for 2" and thicker lumber); this is not included in measurement of tolerances.	For kiln-dried lumber, surfaced two sides (S2S), allow: $\frac{3}{16}$ " for thickness of $\frac{3}{8}$ " to $1\frac{1}{2}$ ", $\frac{1}{4}$ " for thickness of $1\frac{3}{4}$ " to 4" (Note: S1S lumber is subject to special contract.)	Maximum variation, except for wane, is $\frac{1}{8}$ " for thickness of $\frac{1}{2}$ " or less, $\frac{3}{16}$ " for thicknesses of $\frac{5}{8}$ " and $\frac{3}{4}$ ", $\frac{1}{4}$ " for thicknesses of $\frac{1}{4}$ to $\frac{7}{4}$ ", $\frac{3}{8}$ " for thicknesses of 2" to $3\frac{1}{2}$ ", $\frac{5}{8}$ " for thicknesses of 4" to 6"
Width (Specified in inches)	Standard sizes depend on end use. Hardwoods are often shipped random-width, and minimum widths depend on grades. Allowance must be made for edge-jointing and waste in flooring.	Allow about $\frac{1}{16}$ " for each inch of widths. Contracts for green lumber should specify dimensions required to provide for shrinkage allowance.	If widths are specified, and lumber is surfaced one edge (S1E) or two edges (S2E), allow $\frac{3}{8}$ " for lumber less than 8" wide and $\frac{1}{2}$ " for lumber 8" wide and wider. Surfaced sizes could be subject to contract.	Shipment of stock widths or specified widths must be at least 90 percent full widths; 10 percent can be up to $\frac{1}{4}$ " scant in width (except for sill stock).
Length (Specified in feet)	Standard lengths depend on end use, but are generally 4' to 16' inclusive. Even lengths (4, 6, 8, etc.) should make up at least 50 percent of a shipment. Bundles include pieces up to 6" over and 6" under standard lengths.	None (wood shrinks very little lengthwise).	None (lengths are not surfaced).	Percentages of short lengths are defined in rules for specified grades; if an average length or percentage of lengths is required, the contract should so specify.

HOLES (ENLARGING)

(Also See Drill Press and Drills)

To enlarge a hole that you have already drilled, find a dowel or a square piece of scrap that is the size of the drilled hole. Find the center of it and then cut it off to the thickness of your workpiece. Insert it into the hole and then proceed to drill with the correct size bit (2-229). Make sure that your workpiece is well secured to your table.

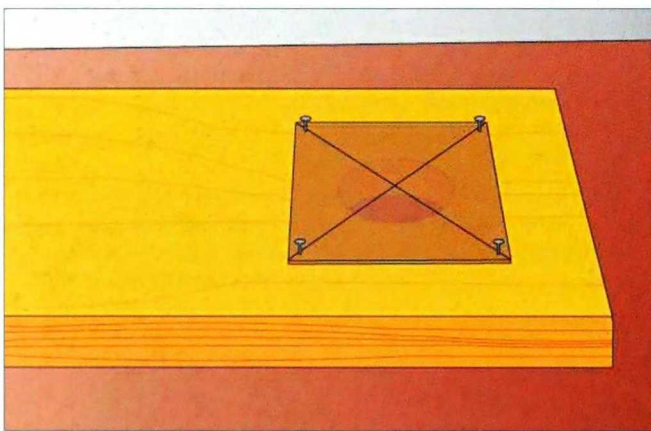


2-229. Enlarging a drilled hole.

HOLE SAW

Enlarging Holes Made By a Hole Saw

To enlarge a hole already made with a hole saw, try this (2-230). Cut a square piece of Masonite or thin plywood and make an "X" to find the center. Use the existing hole saw to penetrate the square with the pilot bit just enough to "scratch" it with the outer blade to show the diameter. Flip the piece over and looking through the hole, line it up, and then nail the piece down. The larger bit and pilot will enlarge the hole. Hole saws are always easier to use in a drill press. They do not tend to wander or kick back.



2-230. A thin piece of material overlaid on the existing hole will help to enlarge the hole.

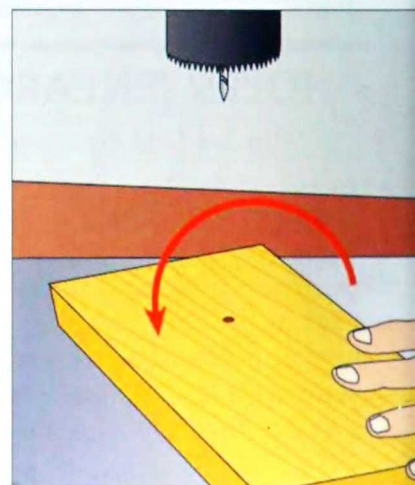
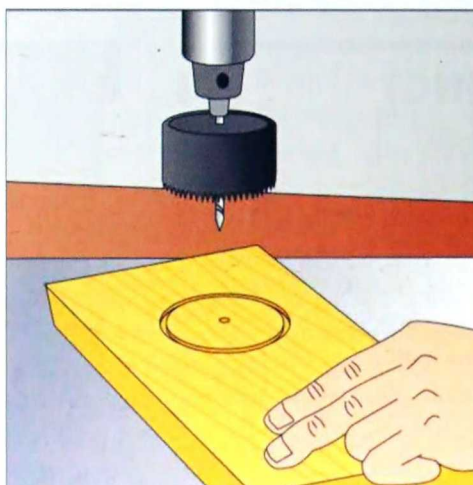
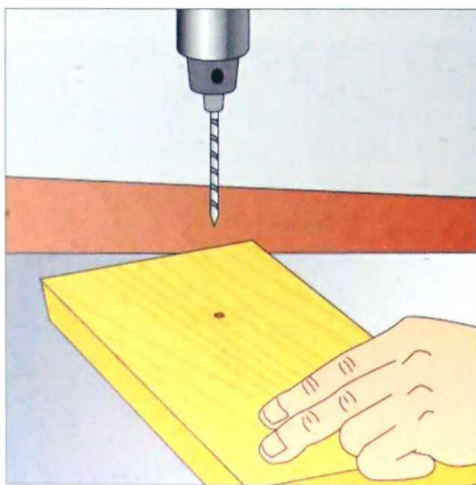
Increasing Hole Saw Cutting Depth

The usual cutting depth of a hole saw is $1\frac{1}{16}$ inches, enough to penetrate the wide side of a 2 x 4. To double the cutting depth, extend the length of the pilot bit or use a longer drill bit so that the bit will penetrate through the thicker piece. Once the bit has poked through, use the hole saw on the other side (2-231). You should now be able to cut to a depth of $3\frac{1}{8}$ inches.

Releasing Drilled-Out Plugs

It's always a problem when using a hole saw to release the drilled-out plug. These techniques may ease the problem. For the first method, spray the inside and the outside of the saw with silicone or cooking spray (2-232). Then drill about three-quarters of the way into the stock or until the pilot bit goes right through the stock (2-233). Flip the workpiece over and drill from the other side (2-234). You will find that the plug will then drop out of the hole saw quite easily and will not be marred (2-235), as would happen if you attempted to pry it out.

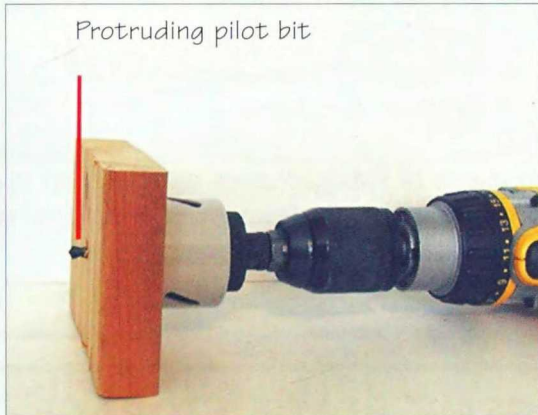
Or, try this method if the plug is really stuck in the hole saw: Remove the saw from the drill press, unscrew the mandrel nut, and gently tap the mandrel out. The plug should come out with it (2-236). All that's left to do is "unscrew" the plug off the pilot bit.



2-231. Using a longer pilot bit will allow your hole saw to double its depth.

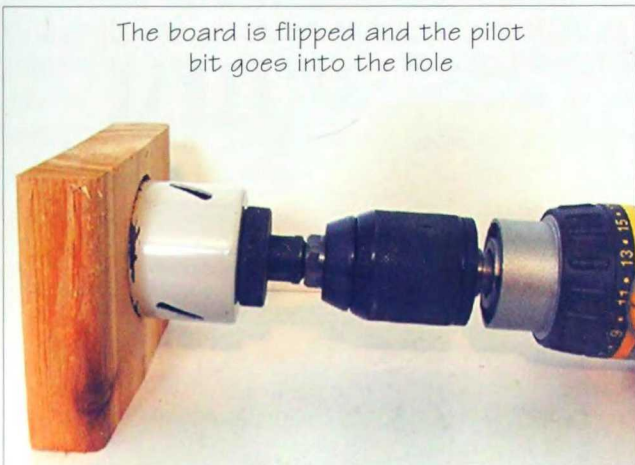


2-232. To facilitate easy release of the wheel from a hole saw, spray the inside with silicone or cooking spray.



Protruding pilot bit

2-233. To release a plug that will be drilled out by a hole saw, drill about three-quarters of the way into the stock or until the pilot bit goes through the stock.



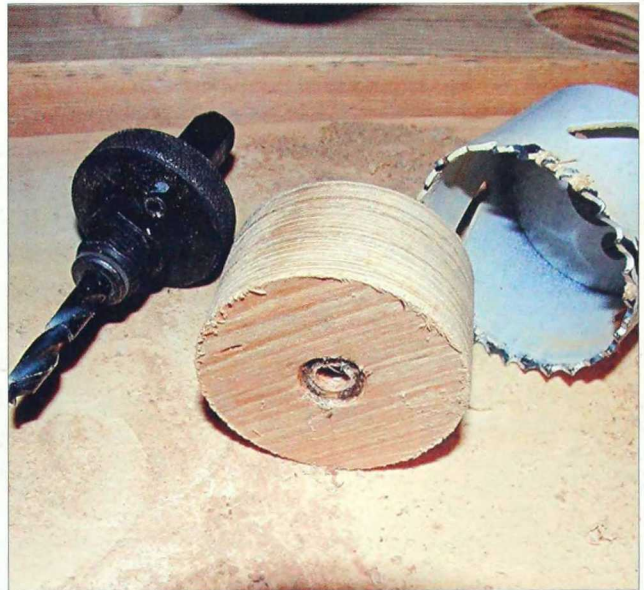
The board is flipped and the pilot bit goes into the hole

2-234. Then flip the workpiece over and drill from the other side.



The plug is now easy to remove from the drill

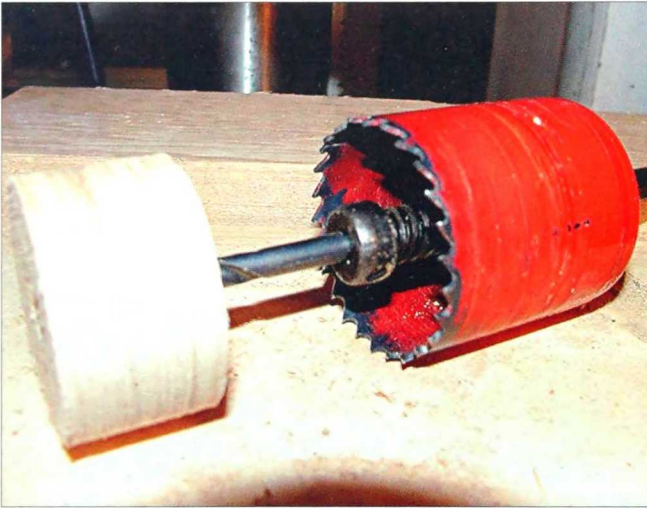
2-235. The plug will drop out of the hole saw quite easily.



2-236. The plug can also be removed by disassembling the bit and the mandrel.

For really tough plugs, here's a third way: Drill a couple of holes on either side of the pilot bit. Screw in a couple of screws that are long enough to force out the plug. Do both sides a little at a time, or you may force the plug into the hole saw.

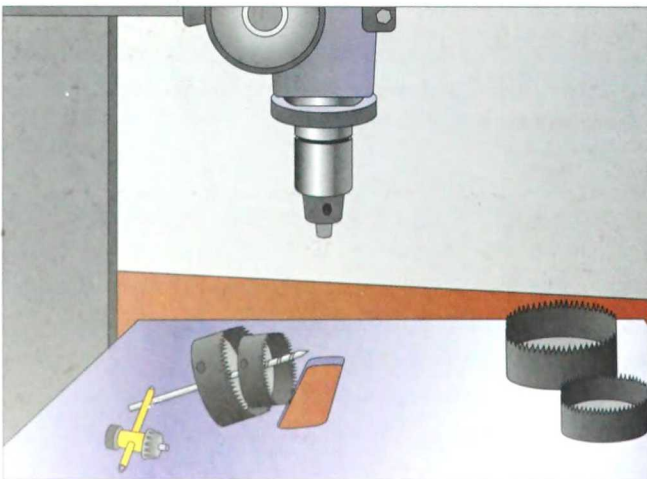
Vermont American sells a hole saw that self-ejects (2-237). The mandrel is threaded into the hole saw itself. You drill the hole and then tilt the saw so that it is tight against the hole walls. Now, put the drill into reverse and out pops the plug.



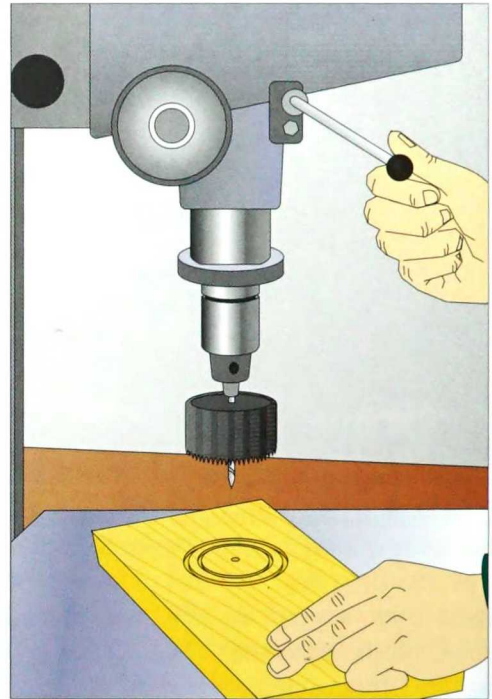
2-237. The self-ejecting hole saw by Vermont American.

Using Hole Saws to Make Rings

There are a number of ways to make various-diameter rings, but the easiest that I have found is to “double stack” a couple of hole saws (2-238 and 2-239). Say, for example, you want a ½-inch-thick ring that is 2 inches on the outside and 1½ inches on the inside. Take your hole-saw mandrel and put a 2⅞-inch hole on it along with a 1½-inch saw. The ⅛-inch difference is to compensate for the blade thickness. Line them up in the mandrel, tighten the nut, and proceed to drill on the drill press. When finished, disassemble the saws and you will have your ring. A number of



2-238. Setting up the hole saws to make wood rings for toys, etc.

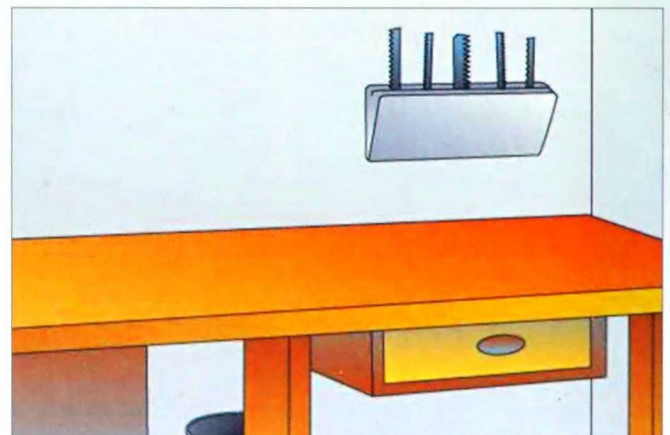


2-239. Cutting the ring.

combinations of hole-saw sizes may be used in this manner as long as the hole saws will fit onto the mandrel and the mandrel nut is secure.

JIGSAW BLADE STORAGE

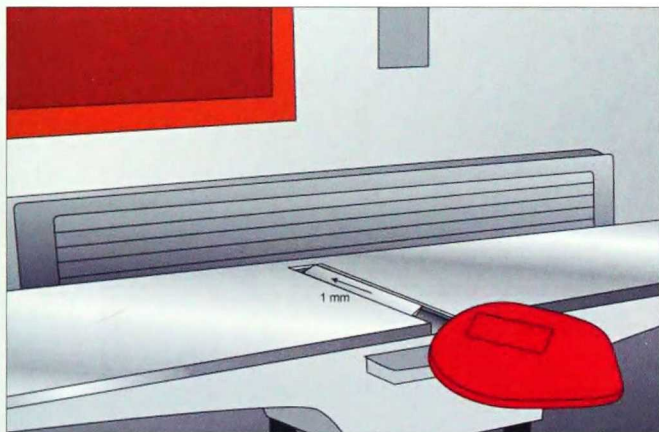
A magnetic kitchen knife holder will hold your jigsaw and reciprocal saw blades together (2-240).



2-240. A knife holder keeps your jigsaw blades together.

JOINTER KNIVES

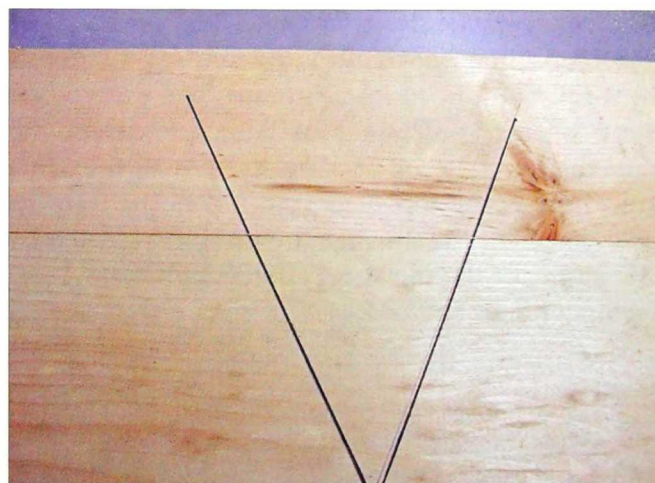
A nick in a jointer knife blade can ruin a joining operation; it will leave a raised stripe on the board. A quick fix before resharpening all of the knives is to slightly shift one of the knives to the left or the right (2-241). The nick will then cancel out.



2-241. Repair nicked jointer knives by moving one of them slightly.

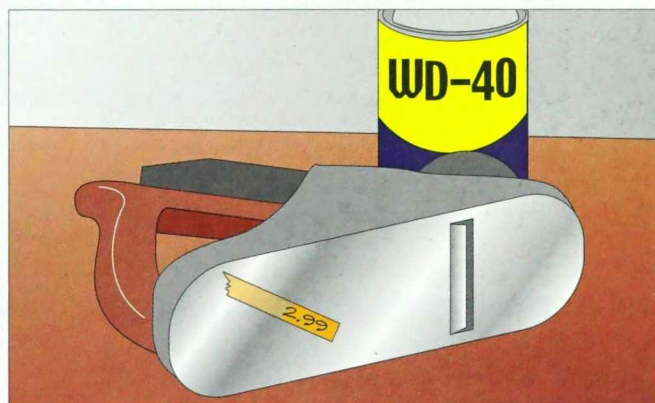
JOINTS (IDENTIFYING)

Suppose you are working on a butcher-block-type table. The thickness planer has been turned off and you are setting up your pieces for gluing. *Before* you dismantle the setup, get out your pencil. Mark a large V across the setup pieces (2-242). Now, if the phone rings and your youngster decides to play with the blocks while you are talking, reassembly will only take seconds.



2-242. A large V drawn across your workpieces will ensure that they are repositioned properly for later gluing.

ple of squirts of WD-40 oil (2-243). Let the WD-40 soak for a few minutes, and then rub off the label and the WD-40 with a paper towel.



2-243. One way to remove a price sticker from a tool is to squirt it with WD-40 oil and then rub it off with a paper towel.

LABELS (REMOVING)

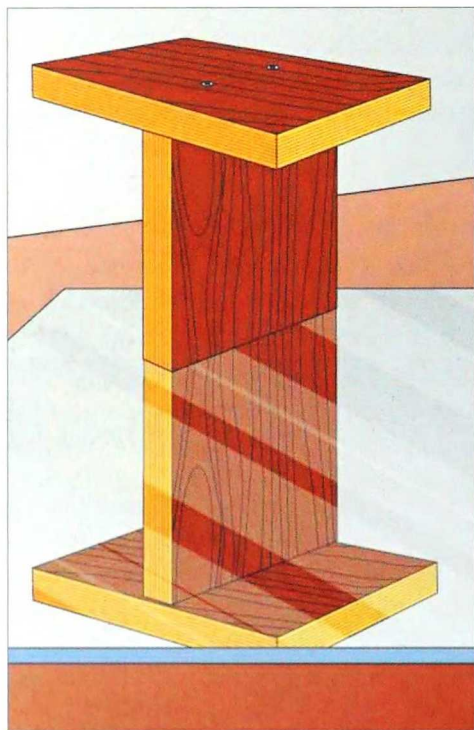
You've just bought a shiny new bench plane and you are ready to use it, but the price sticker you want to remove seems as if it's welded to the base plate. A simple way to remove it is to give it a cou-

LAMINATING

(Also See Adhesives and Veneers)

Plastic laminate such as Arborite and Formica is easy to put on surfaces such as tabletops or countertops, but they can create problems later on that are not immediately apparent when you apply them. Changes in temperature and humidity react on both the glue and the plastic laminate, with the

result that the plastic laminate causes stress on the substrate (the piece that it is glued to) and causes it to warp, twist, or to lose its bond. The way to prevent this is to purchase a backing sheet when you buy the laminate. A backing sheet is of the same thickness as the top sheet, but has no pattern. Its sole purpose is to equalize the pressures created by the gluing of the top sheet and thus give the countertop a longer life (2-244).

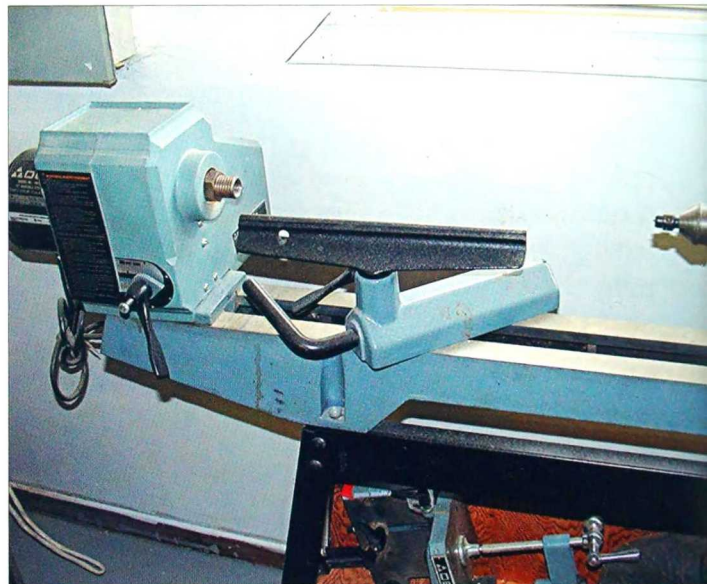


2-244. A properly laminated table or countertop has a backing sheet on its underside.

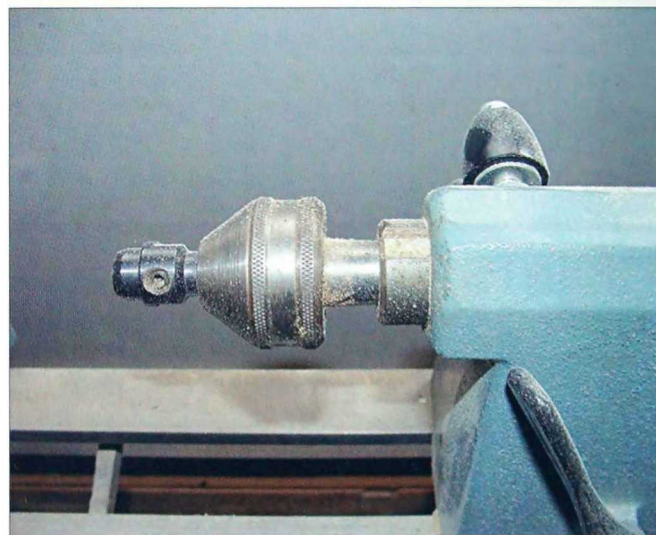
LATHE

Description and Use

The wood lathe (2-245) is used primarily for wood turning. The length of the stock that can be turned is determined by the distance between the *headstock* (the motor end) and the *tailstock* (the support end) (2-246). This is called the lathe bed. The diameter



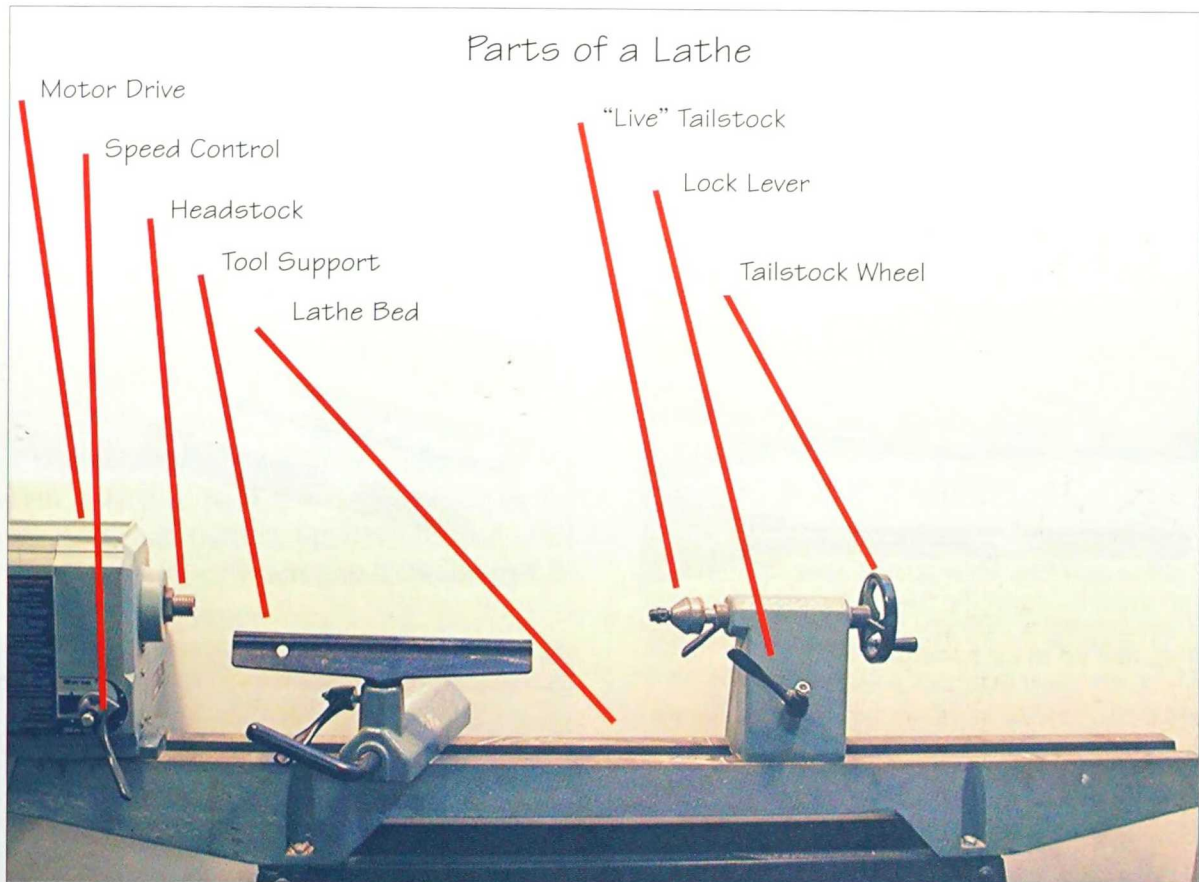
2-245. The wood lathe is a power tool used primarily for wood turning. It can be used to turn table or chair legs or wood bowls.



2-246. The tailstock is the end of the lathe that supports the object being turned.

or radius of the stock that is being turned is set by the distance from the middle of the headstock to the bed of the lathe. For turning bowls and wheels, etc., some lathes have a cutout in the bed to accommodate a larger radius. Some others have a motor housing that swings 90 degrees.

The stock to be turned is held in position by a *spur center* at the headstock and a *plain spur* at the tailstock. The tailstock (2-247) is then tightened to



2-247. A look at the parts of a lathe.

secure the workpiece and further tightened by the adjustable wheel. Be sure to put a drop of oil on the tail end of your workpiece before putting it into the tailstock, because it will prevent the workpiece from burning and the spur from overheating.

The *tool rest* is the T-shaped device that slides along the lathe bed. It should be placed parallel and close to the workpiece but never come in contact with it. Two types of motors are used on lathes. Belt-drive motors have a combination of pulleys. The second type of motor is a variable-speed one.

A lathe *faceplate* is mounted to the headstock and screwed to the middle of the workpiece for bowl- or wheel-turning. Some advance planning should be done here, to ensure that your chisels or gouges do not come into contact with the screws. For faceplate turning, the tool rest is turned to face either the edge or the front of the workpiece and locked on the bed.

Different tools have specific lathe applications.

Gouges are tools that look like wood chisels but have longer blades and handles (2-248). Gouges are usually cupped in shape and are used for the first rough cutting in wood turning.

Wood-turning *chisels* (2-249) are also available in various widths and shapes and are also longer than the conventional wood chisel. They are used for final close cutting, parting, and shaping.

Calipers (2-250) are the essential tool for lathe work. They allow you to accurately measure the various diameters of your workpiece.

A *drill chuck* (2-250) is another convenient accessory. If the drill chuck is fitted in the headstock, the lathe can be used as a boring tool. Don't rush out and buy one just yet. You may have one and not even know it. Check your drill press. The chuck may fit your lathe.

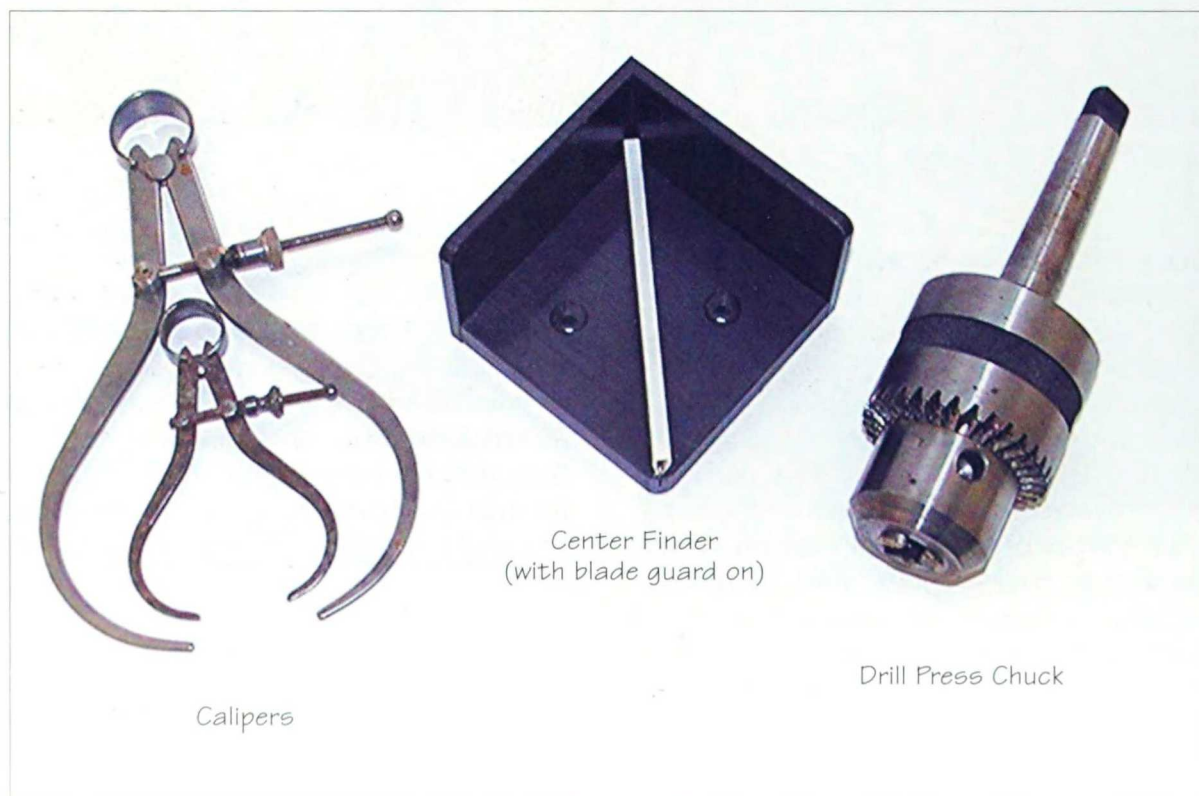
A *center finder* (2-250) is an indispensable tool for the wood turner. It will accurately find the centers of stock for positioning on your lathe.



2-248. There are many different sizes and types of gouges available for wood turning.



2-249. Wood-turning chisels.



Calipers

Center Finder
(with blade guard on)

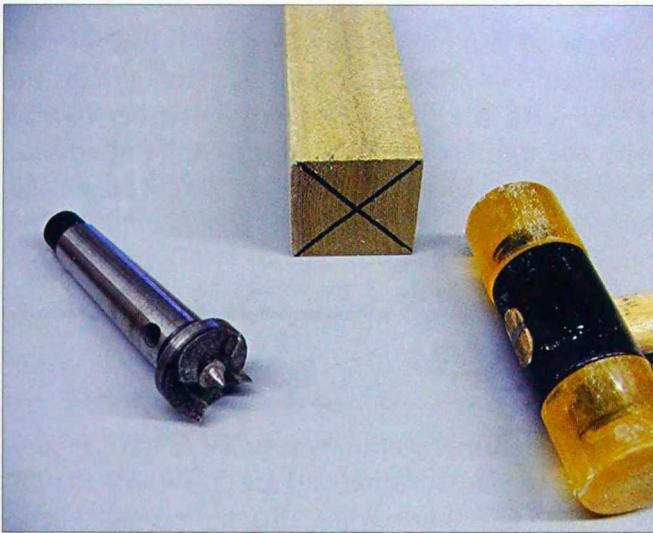
Drill Press Chuck

2-250. Calipers, a drill press chuck, and a center finder.

Prolonging the Life of a Lathe

Most wood turners whom I have seen set up their workpiece right on the lathe. They either tap the piece into the headstock spur or they force it in by screwing in the tailstock. The problem with doing it this way is that it either jolts or puts pressure on the motor bearings. This will, of course, shorten the life of even the best of lathes.

On your next wood-turning project, try this: Remove the spur from the headstock and tap the spur itself into the end of the workpiece with a wooden mallet (2-251). Once your marks are made and the cut is deep enough, put the spur back in the headstock and *then* tighten up the tailstock. You will find that a lot less pressure is put on the motor.

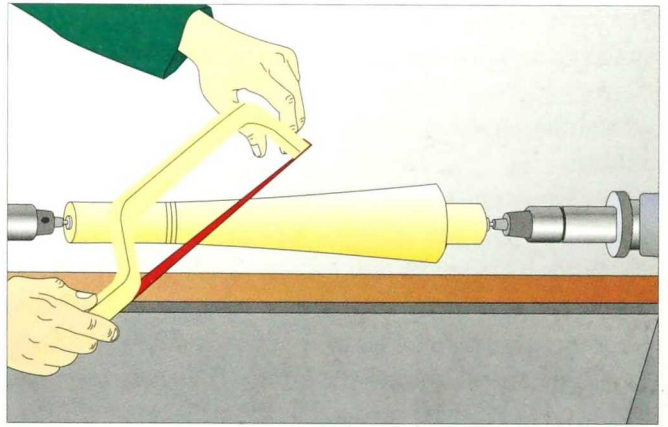


2-251. The proper way to install the headstock spur to prolong the life of the lathe motor.

Sanding with the Lathe

Sanding your workpiece on the lathe while it is turning is an efficient way of getting a smooth finish. However, it has its drawbacks. The sandpaper can get pretty hot, sometimes too hot.

Illus. 2-252 shows a shop-made tool that allows you to sand a workpiece on a lathe without heating it up. It takes about half an hour to make, and is made from 4/4 (1-inch-thick) hardwood or two pieces of 1/2-inch-thick plywood glued together.

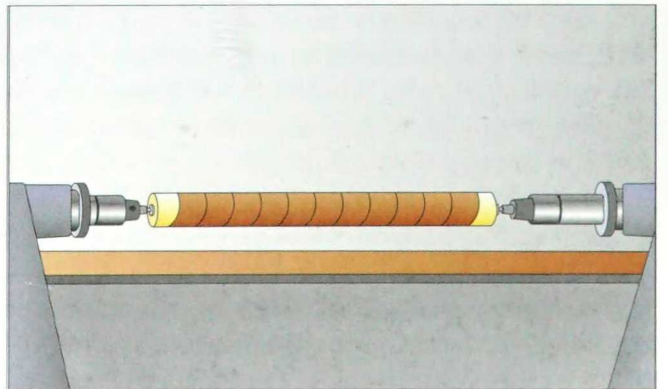


2-252. This shop-made sanding tool is ideal to use to sand a workpiece on the lathe.

The tool uses 1-inch-wide sanding strips that are sold in rolls of varying lengths and grits. The strips are held in the slots with small wedges. If you plan it right, you can turn the strip end over end to make use of the unused portion. After you have determined the length of the sanding strip and cut it, cut several others of various grits to save time later.

Shop-Made Lathe Sanding Drums

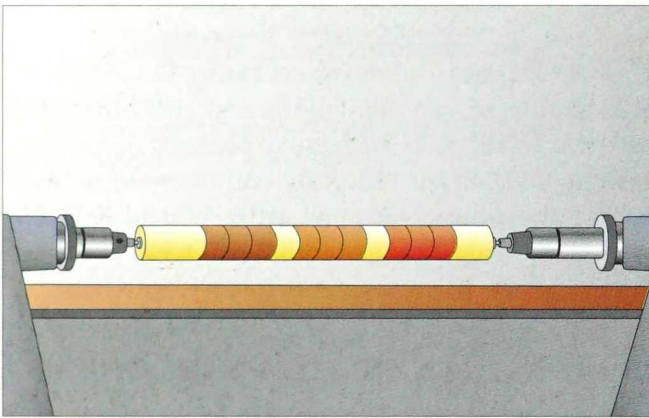
There are two ways that I know of to make a long sanding drum that fits on your lathe. The first is to turn the drum yourself using a piece of hardwood of the desired length (2-253). The diameter of the drum is also optional, but two inches is a handy size. First, apply a coat of contact cement to the dowel. Then apply contact cement to the back of a roll of 1-inch-wide sanding strips; the grit size of



2-253. This shop-made lathe drum sander is handy for sanding concave surfaces.

the sanding strips is up to you. Start applying the sanding roll to the dowel on an angle (10 to 15 degrees is fine). When done, trim off the ends. Be certain to make a mark where the headstock end will be.

In the second method, make or buy a dowel, but divide it in three. Apply a coarse sanding strip to the piece on the left, a medium sanding strip to the piece in the middle, and a fine sanding strip to the piece on the right. Pieces of tape with the various grits written on them will divide the sections. This will improve the drum's versatility and save you the time of changing drums (2-254).

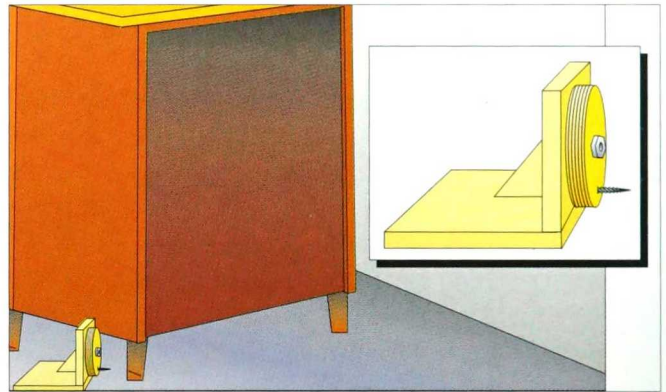


2-254. A long sanding drum that has three different grits of sandpaper is very versatile.

LEVELING SCRIBE

Does anyone remember the dining table that ended up being a coffee table? You know what happens; you keep cutting a piece off one leg to make it level. Well, never again should this happen. Here's a shop aid to eliminate the wobble in tables and chairs (2-255). It takes less than an hour to make. Better yet, you can use up some of that scrap 3/4-inch plywood that's lying around.

Glue and screw a couple of pieces that are about 3 inches square, so they form an L shape. Cut a 3-inch-diameter wheel. Drill a hole in the middle of the wheel and a corresponding hole in the middle of the vertical part of the L. Drill a counter bore at 1/4 inch in from the edge of the wheel. Install a dry-wall (gyproc) screw in this so that about 1/8 to 1/4



2-255. An adjustable leveling scribe will take the wobble out of tables and chairs.

inch of the screw protrudes. Now, recess a carriage bolt through the center holes and fasten it with a washer and a wing nut. Your leveling jig is ready for use.

How do you use this leveling jig? It's simple. Set your table or chair on a level surface. Rotate the wheel until the protruding screw (scribe) is level with the shortest leg. Tighten the wing nut and use the scribe to mark the other legs for cutting. *Voila*, no more wobble.

LUMBER

The terms in this section will prove helpful to anyone working with wood, and are applicable to both softwoods and hardwoods. They are provided courtesy of the Canadian Wood Council. Also refer to Hardwood and Softwood.

Annual Growth Ring The ring seen on a traverse section of a piece of wood composed of contrasting springwood and summerwood and denoting one year's growth.

Broad-Leaved Trees Trees that shed their leaves in the autumn. Most broad-leaved, or deciduous trees are hardwoods.

Cambium The one-cell thick layer of tissue between the bark and the wood in a tree. It repeatedly subdivides to form a new wood and bark cells.

Cell General term for the minute units of wood structure, including wood fibers, vessel segments, and other elements.

Cellulose The carbohydrate that is the principal constituent of wood. It forms the framework of wood cells.

Characteristics Distinguishing features which by their extent, number, and character determine the quality of a piece of lumber.

Check A lengthwise separation of the wood that usually extends across the rings of annual growth, commonly resulting from stresses set up in wood during seasoning.

Decay The decomposition of the wood substance caused by the action of the wood-destroying fungi, resulting in softening, loss of strength and weight, and often in change of texture and color.

Density Weight per unit volume. In the case of wood, density is usually expressed as kilograms per cubic meter or pounds per cubic foot at a specified moisture content.

Equilibrium Moisture Content The moisture content at which wood neither gains nor loses moisture when surrounded by air at a given relative humidity and temperature.

Extractives Substances in wood (not an integral part of the cellular structure) that can be removed by solution in hot or cold water, benzene, or other solvents that do not react chemically with wood components.

Fiber Saturation Point The stage condition of wood in which the cell walls are saturated and the cell cavities are free of water, at approximately 25 to 30 percent moisture content.

Fiber, Wood A comparatively long, narrow, tapering wood cell closed at both ends.

Grain The direction, size, arrangement, appearance, or quality of the fiber in wood or veneer. To have a specific meaning, the term must be qualified:

Cross-grain: A pattern in which the fiber and other longitudinal elements deviate from a line parallel to the sides of the piece. Applies to either diagonal or spiral grain or a combination of the two.

Diagonal Grain: A pattern in which the longitudinal elements form an angle with the axis of the piece as a result of sawing at an angle with the bark of the tree or log; a form of cross grain.

Edge grain (also referred to as rift-sawn, vertical grain, quarter-sawn, and quarter-cut): Lumber or veneer cut in a plane approximately at right angles

to the annual rings, and a condition in which the rings form an angle of 45 degrees or more with the face of the piece.

Flat Grain (also referred to as flat-sawn, plain-sawn, slash-grain): Lumber or veneer cut in a plane approximately tangential to the annual rings, and a condition in which the rings form an angle of less than 45 degrees with the face of the piece.

Spiral Grain: An arrangement of the fibers in a piece of lumber or veneer which results from their growth in a spiral direction around the bole of a tree.

Straight Grain: A condition where the fibers of the wood run parallel or nearly parallel to the edges of the piece.

Green or Unseasoned Freshly sawed lumber, or lumber that has received no intentional drying. The term does not apply to lumber completely wet because of water-logging.

Hardwoods Generally one of the botanical groups of trees that have broad leaves in contrast to the conifers or softwoods. The term does not necessarily refer to the actual hardness of the wood.

Heartwood The inner core of a woody stem entirely composed of nonliving cells and usually differentiated from the outer enveloping layer (sapwood) by its dark color. It is usually more decay-resistant than sapwood.

Knot That portion of a branch or limb that has been surrounded by subsequent growth of wood of the trunk or other portion of the tree.

Loose Knot: A knot that is not held firmly in place by growth or position and which cannot be relied upon to remain in place.

Sound, Tight Knot: A knot so fixed by growth or position that it will retain its place in the piece.

Spike Knot: A knot sawn in a lengthwise or a nearly lengthwise direction.

Lignin The second most abundant constituent of wood; the thin cementing layer between the wood cells.

Modulus of Rupture A measure of a beam's ability to support a slowly applied load for a short time. It is an accepted criterion of strength, although it is not a true stress, since the formula by which it is computed is only valid to the proportional limit.

Moisture Mass of water in wood expressed as a percentage of weight of oven- (kiln-) dried wood.

Pitch Accumulation of resin in wood.

Pitch Pocket An opening between growth rings that usually contains or has contained resin or bark or both.

Pith The small cylinder of primary tissue of a tree stem around which the annual rings form.

Rays Strips of cells extending radially within a tree and varying in height from a few cells in some species to four inches or more in oak. The rays store food and transport it horizontally in the tree.

Relative Density The ratio of the mass of a body to the mass of an equal volume of water.

Sap The watery fluid circulating through a tree that carries the chemical food that enables the tree to grow.

Sapwood The wood of pale color near the outside of the log. Under most conditions, sapwood is more susceptible to decay than heartwood.

Seasoning The processing of drying lumber to a moisture content appropriate for the conditions and purposes for which it is to be used.

Air-Drying: Drying lumber by exposing it to air, usually in a yard, without artificial heat.

Kiln-Drying: Drying lumber in a kiln with the use of artificial heat.

Shake A separation along the grain, the greater part of which occurs between the rings of annual growth.

Shrinkage The decrease in the dimensions of wood owing to a decrease of moisture content.

Slope of Grain The angle between the direction of the grain and the axis of the piece, expressed as a slope and measured over a distance that will ensure the determination of the general slope of the grain, not influenced by short local deviations.

Softwoods Generally, one of the botanical groups of trees that in most cases have needlelike or scale-like leaves, the conifers. The term does not refer to the actual hardness of the wood.

Species A distinct sort or kind of tree. A class of trees having some characteristics or qualities in common that distinguish them from other similar groups.

Split A separation along the grain, forming a crack or fissure that extends through the piece from one surface to another.

Springwood The portion of the annual growth ring that is formed during the early part of the season's growth; it is usually less dense, lighter in color, and weaker mechanically than summerwood.

Stain A discoloration on or in lumber other than its natural color.

Summerwood The portion of the annual growth that is formed after the springwood formation has ceased. It is usually more dense and stronger mechanically than springwood.

Texture The relative size and arrangement of the wood cells.

Vessels (Hardwoods Only) Wood cells of comparatively large diameter that have open ends and are set one above the other so as to form continuous tubes. The openings of the vessels on the surface of a piece of wood are usually referred to as pores.

Wane The bark or lack of wood from any cause on the face of a piece.

Warp Any deviation from a true or plane surface. Warp includes bow, crook, cup, and twist, and any combination thereof.

Bow is a deviation flatwise from a straight line (a curve along the face of the piece) from end to end of a piece, measured at the point of greatest deviation.

Crook is the deviation of the edges of a piece from a straight line drawn from end to end of the piece, and is measured at the point of greatest distance from the straight line.

Cup is a deviation flatwise from a straight line (a curve across the face of a piece) across the width of a piece measured at the point of greatest deviation.

Twist is warping in which one corner of a piece twists out of the plane of the other three; amount of twist is determined by measuring the normal distance of one corner of the piece from the plane of the other three.

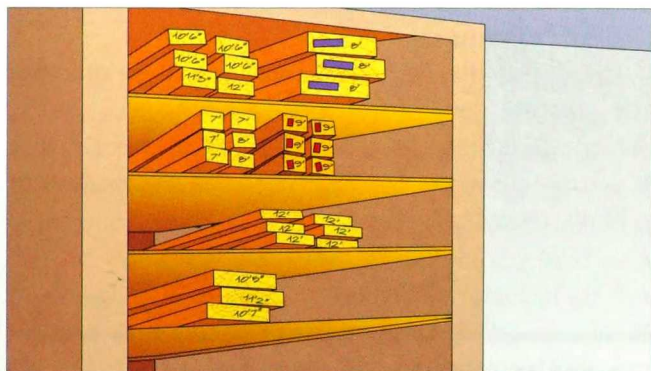
Wood Substance The solid material of which wood is composed.

Storing Lumber

If you are storing your pieces of lumber on top of each other on a rack where only the ends or the edges of the lumber are visible, it is usually difficult to determine what kind of wood it is (for example, pine, spruce, walnut) and how long it is.

Here is a simple solution: First, use colored plastic tape to identify the type of wood. For example, use yellow plastic tape for oak, blue for pine, etc. Your local hardware store sells plastic tape in packages of five or six colors.

Second, to determine the length of each piece, write its length on the end of the board with a dark pencil or a felt marker (2-256). If you end up cutting a piece off a board, write in the new length.



2-256. Write the length of a board on its end with a dark pencil or felt-tip marker.

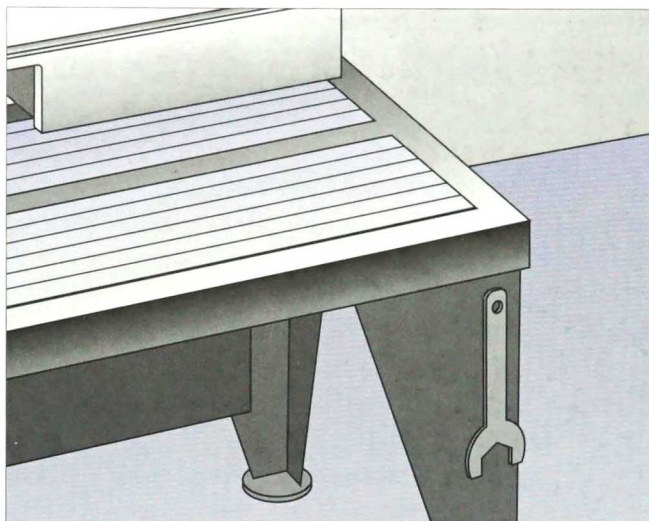
MAGNETS

Magnets are real handy in the workshop; they will keep saw blade wrenches, router wrenches (2-257), drill-press chuck keys, and other accessories connected to the tool that they belong to. The best types to use are the rare earth magnets (made of neodymium iron boron), because they have the strongest pull. Using a steel washer between the magnet and the tool surface will increase the pull by a factor of four.

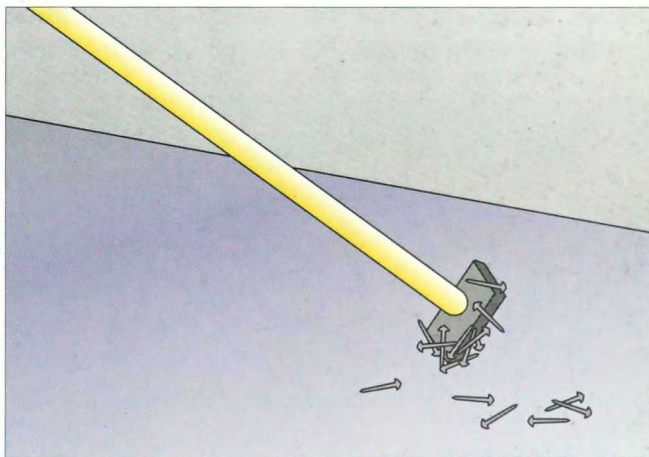
Another way to use magnets is to attach one (any type will do) to the end of a broom handle with epoxy glue. You can use this magnet to pick up those small screws, finishing nails, and staples that drop on the floor (2-258). Next time you visit your local hardware store, pick up a dozen or so of these magnets.

MASKING TAPE

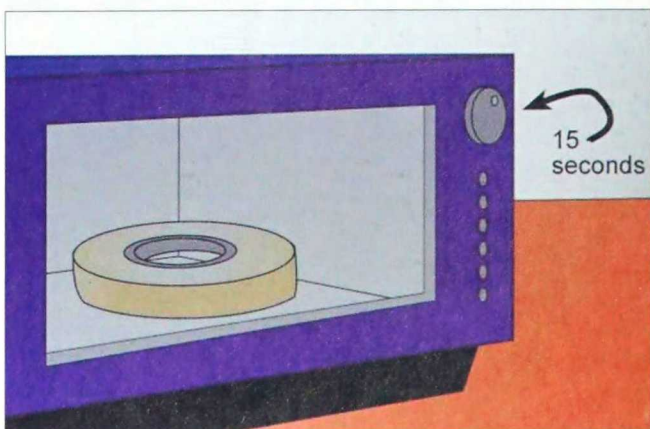
The adhesive on masking tape sometimes dries out and just seems to tear off when you are looking for a long strip of it. Don't despair; put the roll in your microwave oven for about 15 seconds (2-259). That will soften the adhesive and make it stick once more.



2-257. This wrench is attached to the router table with a magnet.



2-258. Picking up nails with a magnet attached to the end of a broom handle.



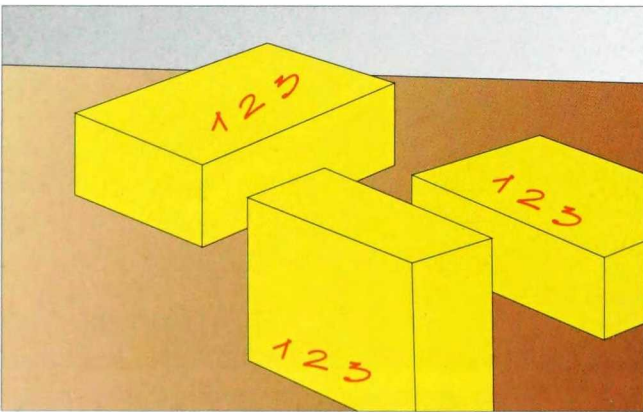
2-259. Fifteen seconds in the microwave oven will restore the adhesive on dried-out masking tape.

MEASURING TECHNIQUES

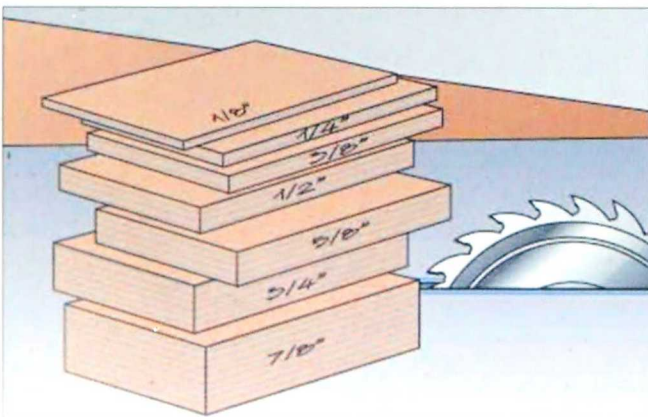
Setting the depth, width, and even the length of a cut can be extremely easy. A set of three shop-made wooden blocks called one-two-three blocks can be used alone or in various combinations to give accurate measurements from 1 to 9 inches (2-260). The blocks, usually made of a kiln-dried hardwood, are made precisely 1 inch thick x 2 inches wide x 3 inches long. They *must be square* all around and their dimensions must be *precise*.

One-two-three blocks have been used for years in the machining industry. These blocks are precision-cut and made out of steel.

When you use one-two-three blocks with the fractional plywood blocks (2-261), you have an almost infinite number of measuring possibilities without even touching your tape measure. Also,



2-260. A set of one-two-three blocks will quickly help in measuring the depth, width, and length of a cut.



2-261. Fractional plywood blocks.

they are high enough to include any out-set teeth on a table saw, radial arm saw, or band-saw blade and thus will give an accurate measurement every time. One other benefit is that if your blocks are truly square, you can use them to determine the accuracy of your saw blades.

Drill a hole in the blocks and hang them up close to your stationary power tools.

Canadian and European readers should be aware that some plywood producers use the metric system in thickening plywood.

MINI-POWER TOOLS

Mini-power tools have become quite popular in recent years (2-262). These power tools will grind, cut, drill, polish, sharpen, sand, and carve. There are a number of manufacturers producing them, with Dremel, Sears, and Black & Decker being the most prevalent. The attachments and accessories available for them will allow you to cut openings in drywall for power outlets, cut ceramic tile, carve wood, and much more. The hand-held motor is usually a variable-speed unit that rotates at 30,000 RPM. One other useful accessory is a flexible shaft to get into tight spaces.



2-262. These are just two of the many mini-power tools available.

MITER GAUGE

Fitting a Miter Gauge

Occasionally, the miter gauge on your stationary power tools should be checked for snugness in the table slot. If you find that the gauge is loose, try the following: With the bar of the miter gauge on its side, place it in a steel vise or on a block of scrap hardwood. Take a pointed metal punch and peen the bar (2-263). Peening makes the steel of the bar expand and will therefore make the gauge fit tighter. It's best to tap the punch lightly at first and do it to *both* sides of the bar.

While we are on the subject of miter gauges, you may have noticed that the slots on your table saw or band saw are a little lower than the thickness of the bar. This sometimes makes the gauge "catch" on the edge when it is used with larger pieces of wood. Preventing this is easy: Simply grind or file a 45-degree angle on the edge of the metal saw table. This will ease the miter gauge up to the table level without disturbing your workpiece.

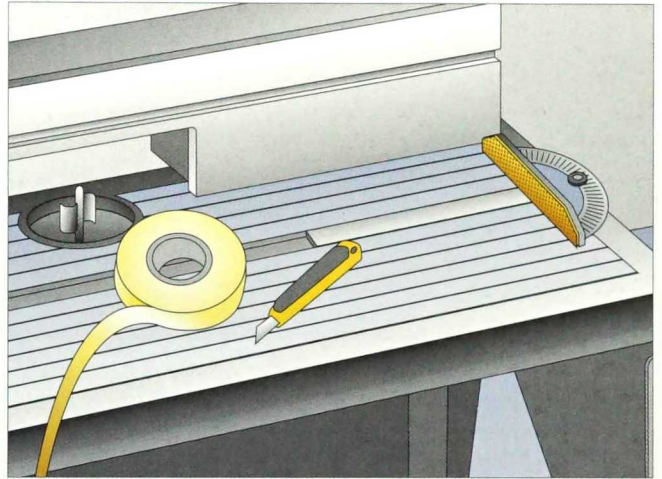
Gripping a Workpiece with a Miter Gauge

Your miter gauge will better grip the workpiece if you adhere a piece of emery cloth or sandpaper to



2-263. Peening the bar of a miter gauge makes it fit tighter in the saw table slot.

the face of the gauge with double-faced tape (2-264). It will prevent your workpiece from slipping while you are cutting or routing.



2-264. To prevent your workpiece from slipping when you are cutting or routing, adhere a piece of sandpaper to the face of the miter gauge with double-faced tape.

Squaring a Miter Gauge

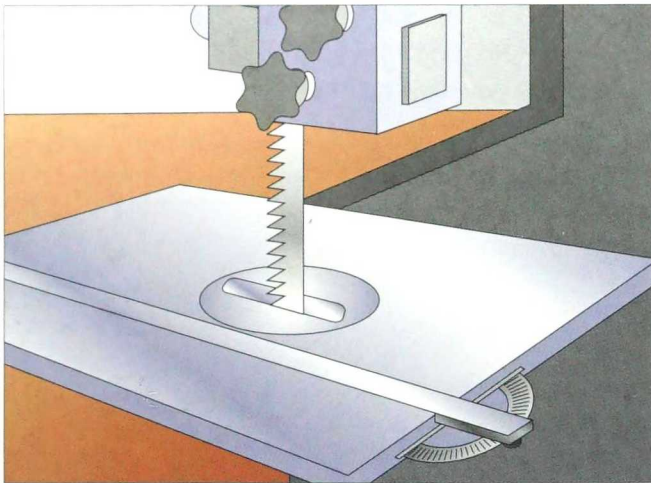
The screw-down pointer on your miter gauge can sometimes be knocked out of alignment if you happen to drop or hit the gauge. To ensure a true miter every time, check the accuracy of the miter gauge occasionally.

The easiest way to ensure an accurate alignment is to turn the miter gauge upside down, loosen the adjusting knob, slide it into the groove on the tool table, and press it against the table edge (2-265). Now, tighten the knob and adjust the pointer if necessary.

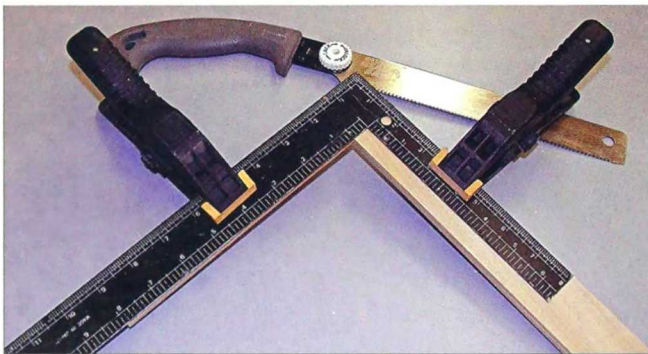
MITERS (HAND-CUTTING)

Tight-fitting miters for picture frames are usually cut in a miter box. The problem with a lot of the inexpensive miter boxes is that their sides wear out, which affects the accuracy and the tight fit of the miters.

Don't throw the miter box out just yet. Make



2-265. To determine that the miter gauge is accurately aligned, turn it upside down, loosen the adjusting knob, slide it into the groove on the tool edge, and press it against the table edge.



2-266. To cut accurate miters by hand, clamp the two pieces together with a steel square under them.

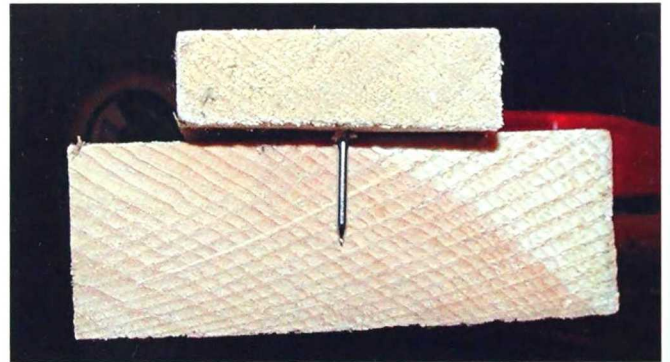
your cuts in it. Remove the pieces and clamp them to a builder's square (2-266). Using a backsaw, carefully saw through the joint and stop just before touching the square. Remove the builder's square and saw the rest of the joint.

Be sure to mark the corners of the pieces, because your handsaw cut may not have been truly perpendicular and that joint may not fit in another position. This may seem like a lot of trouble to go through, but the end result will be a miter joint without any gaps.

MOLDING HEAD

(See Shaper Head)

NAILING TECHNIQUES



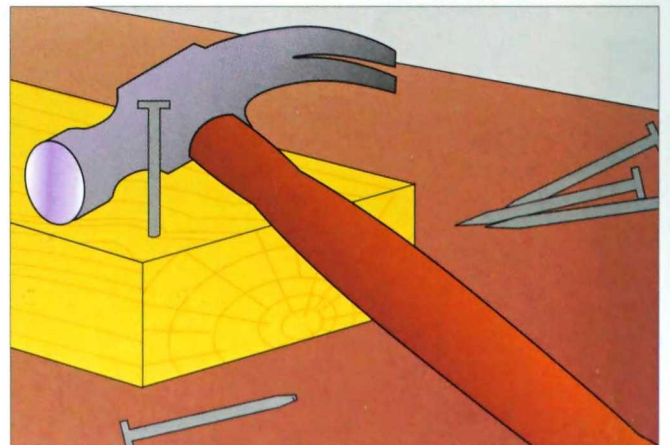
2-267. For a secure joint, the nail must penetrate at least two-thirds into the second piece.

Correct Nail Sizing

Before you drive that nail into your project, think about the size of the nail you are using. To achieve the strongest joint, the nails should penetrate about two-thirds to three-quarters into the lower piece (2-267).

Nailing Close to the Edges

You have to drive a nail through a board and you are only a 1/2 inch or so away from the edge. You know that the board is going to split. As a matter of



2-268. Flattening the tip of a nail helps prevent splitting when you are nailing close to the edge of a workpiece.

fact, you can probably sense it before you even put the hammer to it. I'm not guaranteeing this technique will work all the time, but it's worth the risk: Before driving the nail (s), flatten the point with a hammer and then place the nail with the flattened end across the wood grain (2-268). The same applies when nailing into the end grain of a piece of wood such as a 2 x 4.

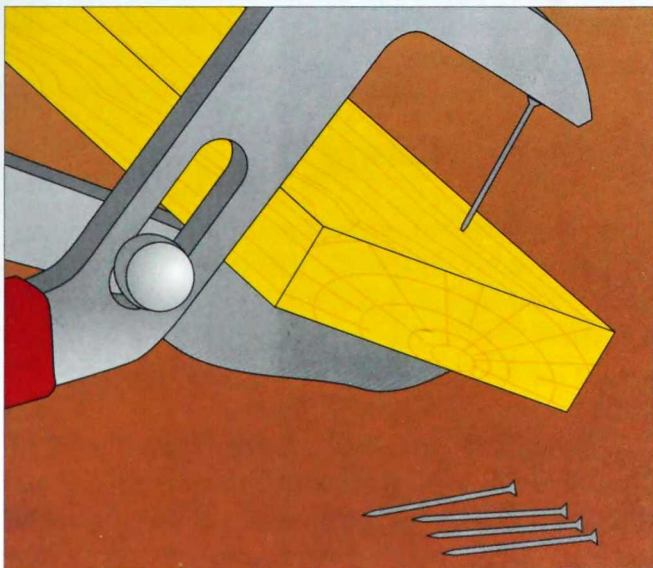
Nailing in Close Quarters

That last nail is always the most troublesome one to nail in. It usually has to be located in some tight spot. And, of course, it's difficult to get the hammer in there.

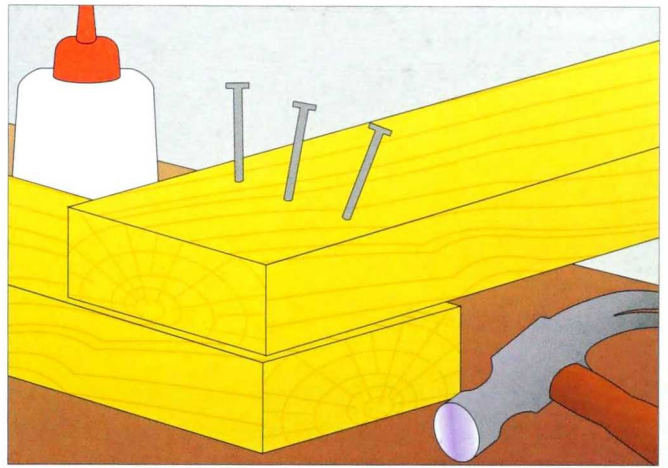
Here is an effective technique involving using either a C-clamp or slip-joint pliers to "squeeze" a nail in (2-269).

Nailing the Correct Way

To obtain a tight nail joint, there is a correct way of driving nails. Let's assume that you want to join a 2 x 4 to the end of another 2 x 4, to make a right angle. First, select a nail that is a length three times the thickness of the board, in this case, a 3-inch finishing nail. A 4-inch-wide board should take three nails, equally spaced. Drive the nail until it just pro-



2-269. A C-clamp or slip-joint pliers can be used to squeeze a nail that is in a tight position.

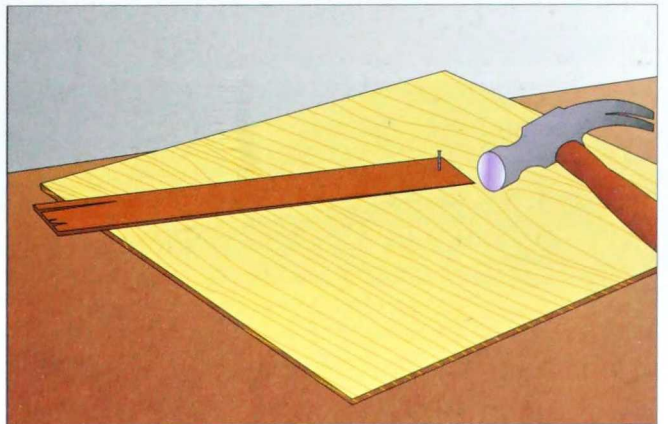


2-270. The correct way of nailing two boards for a secure joint.

trudes from the underside, making sure that the nail is perpendicular to the work. Now, line up the two boards and finish driving in the nail. The remaining two nails should be driven in on opposing angles of about 15 degrees. The result will be a secure joint (2-270). Of course, a little glue before nailing is added security.

Nailing into Finished Wood

Sometimes finishing nails are required for the final assembly of your finished project. Hammering in finishing nails can be hazardous in that one slip of the hammer can result in a dimple that is very difficult to repair.



2-271. When using finishing nails on your finished project, place a shim on the part to be nailed and then simply drive the nail through the shim and into the workpiece.

This technique will prevent a lot of frustration: Place a shim or a piece of wood shingle on the part to be nailed and then simply drive the nail through the shim and into your workpiece (2-271). When the nail is driven into the workpiece, just break off the shim and use a nail set to complete the job.

Nailing Guards

Illus. 2-272 shows a helpful little nailing guard that you can make in a couple of minutes. It will safely prevent inadvertent dings in your workpiece and help you to keep your nails straight.

Cut a piece of 1/8-inch-thick Plexiglas or Lexan 2 inches wide x about 8 inches long. Sand the edges and slightly round off the corners. Make a slot about halfway up the middle of the guard with your band saw. That's all there is to it. Place your nail in the slot, line it up on your workpiece, and hammer it in. *Do not* hammer it all the way in; keep the head just above the Plexiglas, to allow you to remove it. Continue nailing with a nailset.

There is another method of protecting your workpiece. Do not throw those scrap pieces of pegboard into the kindling bin just yet, especially if you are doing some finish-nailing. Pegboard strips are ideal makeshift nailing protectors. Simply start your nail, hang the pegboard strip on it, and then drive it home. The remaining 1/4 inch should be driven in with a nailset. Don't try this with common nails unless you can fit the nail head through the pegboard hole.



2-272. A shop-made Plexiglas nail guard will protect the surface of the workpiece from hammer marks.

Nail Sets

Nail sets can be found in a variety of sizes, but are generally used to set finishing nails below the surface. It is important to select the right size for the nail length that you are using (2-273); otherwise, the nail set may leave a larger hole than desired or, if the nail set is too small, it could slip off the nail and also cause damage.



2-273. The nail set at the top of the photo is for setting nails in cramped quarters. The middle tool is for finishing nails of 2 inches or larger. The lower nail set is used for 1 1/2-inch nails or smaller.

Nailing Thumb Savers

Small alligator clips available at places like Radio Shack can be used to hold small finishing nails when there is a fear of hitting your thumb with the hammer (2-274).

Removing Nails (#1)

Removing different types of nails safely takes a variety of methods for specific nail types. For example, some common and spiral nails should be pulled by the head with a hammer claw. A scrap of wood placed under the hammerhead will protect the surface.

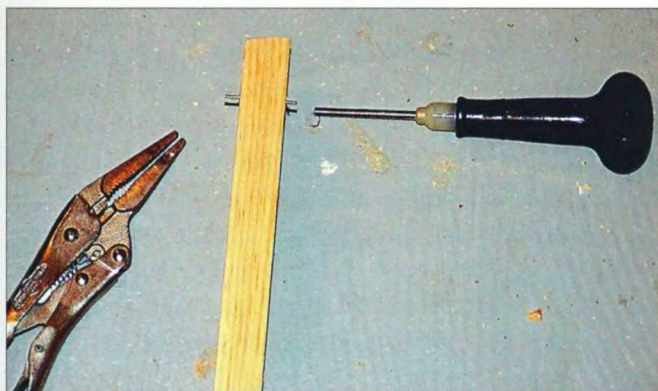
If you have to remove a nail from a piece of molding, you should remove the entire piece and pull the nails through the underside of the molding. This prevents tear-out on the surface.

Air nailers pose another problem. The heads are so small that a hammer claw won't grip them and if



2-274. Alligator clips to hold small nails will save your thumbs.

you try to hammer them out from underneath, they are sure to bend. A brad pusher will keep the nails straight and push them through (2-275). A pair of Vise-Grips will then pull the nail out.



2-275. A brad pusher will push air-driven finishing nails out of wood without bending them.

Removing Nails (#2)

Those spiral and ring-type nails can be a problem to remove because of their grip in the wood. Use a pair of Vise-Grips to grasp the nail and pry it out. Use a piece of scrap to protect the piece (2-276).

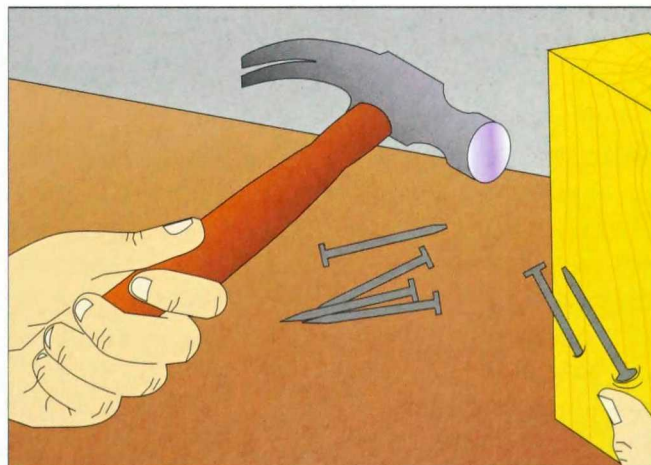
Toenailing Technique

Toenailing a 2 x 4 stud into the soleplate usually makes the stud slip out of position a little. The reason for this is that it takes a few hits with the hammer for the nail to bite. Here's a trick of the trade I



2-276. Vise-Grips will make pulling ring or spiral nails easier.

learned while visiting a jobsite: If you turn the nail upside down and hit it on the edge of its head, the result will be a "pocket." Now, turn the nail the right way and drive it home (2-277).



2-277. The nail head will make a pocket that makes toenailing easier.

NAILS

Brads

Brads are similar to finishing nails, but are thinner and have smaller heads (2-278). Brads are referred to by the inch size rather than by pennyweight. Brads are difficult to find these days, because most

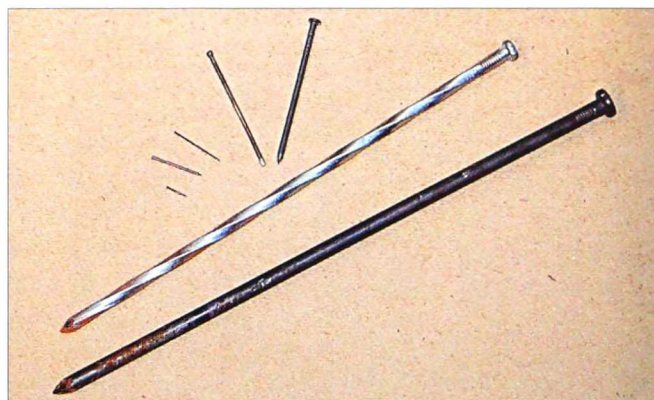
woodworkers are using finishing nails. Common brad sizes are $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, 1, $1\frac{1}{4}$, and $1\frac{1}{2}$ inches.

Common Nails

Table 2-10 indicates the length and quantity per pound for different sizes of nails. *Note:* A 10-pennyweight nail is referred to as ten-penny nail and is written 10d. The quantity/pound figures in the chart are approximations. There is no pennyweight reference after 60. In most areas, common nails six inches and longer are referred to as spikes.

Table 2-10.

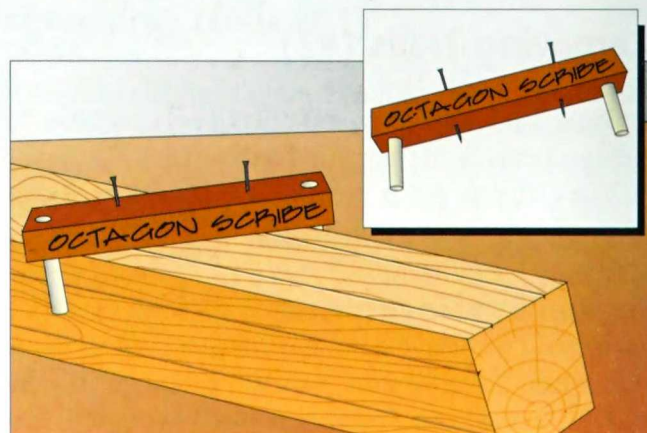
PENNYWEIGHT (SIZE)	LENGTH	QUANTITY/POUND
2	1 inch	850
3	$1\frac{1}{4}$ inches	540
4	$1\frac{1}{2}$ inches	290
5	$1\frac{3}{4}$ inches	250
6	2 inches	165
7	$2\frac{1}{4}$ inches	150
8	$2\frac{1}{2}$ inches	100
9	$2\frac{3}{4}$ inches	90
10	3 inches	65
12	$3\frac{1}{4}$ inches	60
16	$3\frac{1}{2}$ inches	45
20	4 inches	30
30	$4\frac{1}{2}$ inches	20
40	5 inches	17
50	$5\frac{1}{2}$ inches	13
60	6 inches	10
	7 inches	7
	8 inches	5
	9 inches	4
	10 inches	3
	12 inches	3
	14 inches	2



2-278. An assortment of workshop nails, including brads and finishing nails.

OCTAGONS

As defined by Webster's dictionary, an octagon is an eight-sided object with parallel sides that are equal. To make an octagonal chair or table leg, try using the following method: Take a piece of $\frac{3}{4} \times \frac{3}{4}$ -inch scrap and cut it just slightly longer than the width of your table leg. Drill and then insert dowels in the ends as shown in 2-279. Divide the space between the dowels into thirds and drive two-inch finishing nails through the piece so that the points just protrude. You may want to use the drill press with a bit just slightly smaller than the nail. Hold the jig on your stock so that the dowels are firm against the sides and proceed to scribe down the length of the stock. Now you can plane or cut along the lines to make your leg.



2-279. This jig can be used to scribe lines on stock or make octagonal chairs or table legs.

PAINT

There are a variety of paints available for many different situations (2-280). *Glossy paints* have traditionally been oil-based and include a resin to give them a hard wearing quality. Some are still oil (solvent)-based paints, while water based gloss paints are now available.

An alternative to ordinary gloss, *non-drip paint* is of a jelly-like consistency and is easier to use if not overloaded onto a brush and adequately "laid off" on the surface. It is ideal if you have difficulty in painting without drips falling from the brush, as its consistency allows a "blob" of paint to be picked up by the brush and then applied to the surface where it is spread out normally. Non-drip paint will produce runs if too much paint is applied and not adequately laid-off. This is especially true when painting in corners (such as at the bottom of panels in panel doors).

Modern *emulsion paints* are water-based, with vinyl or acrylic resins added to make them more hard-wearing than traditional emulsions. This results in varying degrees of sheen in the finish; as the shine increases, the paint tends to be more hard wearing. The ranges usually include matt, eggshell, silk, satin and full gloss.

Although normally thought of as used for inter-



2-280. A variety of paints that could be found in the average workshop.

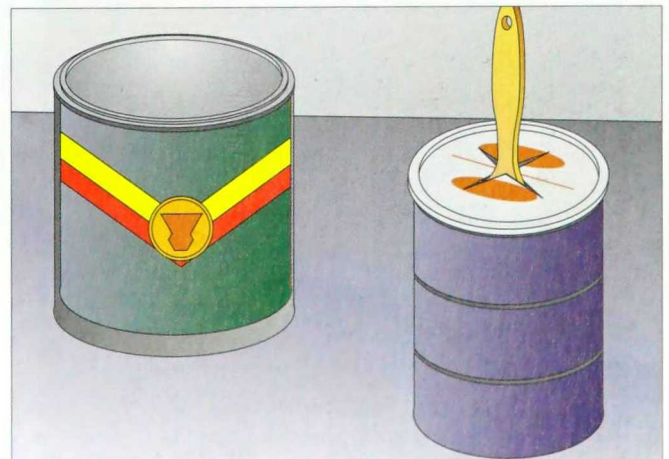
nal walls and ceilings, there are water-based types of emulsion paint specially produced for woodwork. These are easy to apply but do not give the same hard-wearing qualities as oil-based paints. Emulsion paint is the most popular paint for walls and ceilings due to the fact that it is water-based and has less smell, dries comparatively quickly, and is easy to apply.

Primer is the first coating of paint applied to a surface. Primer paints may be oil- or water-based and are used to seal unpainted surfaces to prevent covering coats of paint from soaking in. The appropriate type of primer should be used for the surface being painted, that is, if the surface is wood, metal, plaster or tiles. There are some "all-purpose primers" available that are designed for two or more of these surfaces.

An *undercoat* is applied on top of the primer. It is usually oil-based, and should be of the correct color to provide the right color base for the finishing coats.

Cleaning Paintbrushes (#1)

There are several methods of easily and effectively cleaning your paintbrush. In the first method, cut an X in the plastic top of a coffee can. Force the paintbrush handle through the cut. Half fill the empty coffee can with the appropriate brush cleaner or solvent and then put the cover back on (2-281). Now, the brush will stay suspended and



2-281. Cut an X in the top of the plastic top of a coffee can and fit your brush through this cut. This will suspend your brush in the cleaner in the can.

you can swish the brush back and forth without worrying about splashing.

Cleaning Paintbrushes (#2)

The second method involves an economical way of cleaning your paintbrush after the paint has hardened. Usually, cleaning paintbrushes after the paint has hardened on them means using a fair quantity of brush cleaner. You pour the cleaner into an old coffee can or similar-sized container. Then you let the brush soak overnight. The next day you end up disposing of the used cleaner.

This more economical way of doing it consists of using old, small oval-shaped glue bottles (2-282). They are usually just big enough for most paintbrushes to fit into. Cut the top off just below the shoulder. Now, set the brush in the container and *then* pour in your brush cleaner until it covers the bristles. A lot less cleaner is required.

Most paintbrushes have a hole in the lower part of the handle for supporting the brush so that the bristles don't touch the bottom of the container. If yours doesn't, drill one. A 1/4-inch hole will do nicely. A small dowel or a piece of coat hanger will



2-282. An old plastic glue bottle with its top cut off makes an ideal paintbrush-cleaning container.

support the brush. By doing this, you will double or even triple the amount of brushes that can be cleaned with a standard container of brush cleaner.

Cleaning Paintbrushes (#3)

Don't go to a hardware store and buy any of those expensive paintbrush cleaners that promise to restore your brushes and make them look like new. Instead, purchase a pound or so of trisodium phosphate (TSP) at the same hardware store.

A solution of one pound of TSP mixed in a gallon of water will melt any caked-on paint and soften the brush bristles (2-283). For easy reference, here are the rough solutions: 1 pound TSP and 1 gallon of water; 12 ounces TSP and 6 pints of water; 6 ounces TSP and 3 pints of water; 3 ounces TSP and 1½ pints of water; 1½ ounces TSP and 1 pint of water. A little more or less is not crucial. Warm water will work best. The brushes should be left to soak in the solution and should be checked from time to time. The amount of time will depend on just how saturated the brushes are. A second cleaning may be necessary.



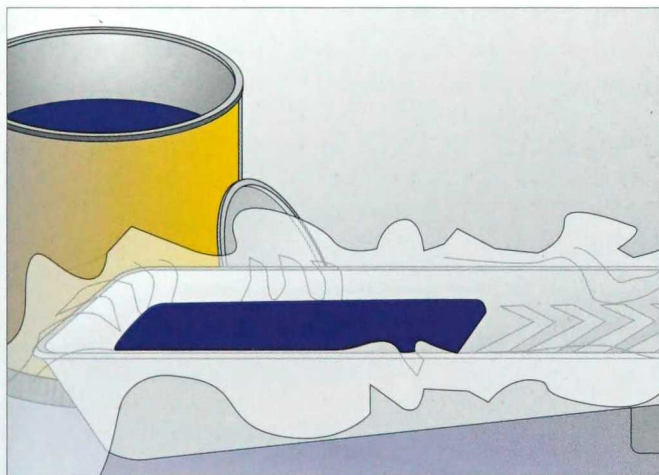
2-283. Trisodium phosphate (TSP) mixed with water is a less-expensive way of cleaning old paintbrushes.

Cleaning Paint Roller Trays

Most of a painter's time is spent in preparing the surfaces for paint and then cleaning up the tool afterward. This technique will save time and money when cleaning up the tools: Plastic roller tray

inserts are fairly expensive. A pack of three is about the same price as a new tray.

Your dry cleaner has the answer. The plastic bags that they wrap suits and dresses in make ideal tray covers (2-284). Slip the tray halfway into the bag, set it on the floor, and pour in the paint. When you are finished, pour any excess carefully back into the can, roll up the plastic inside-out and toss it away or recycle it.



2-284. A plastic dry-cleaning bag makes an ideal paint-tray liner with which to clean up paint easily.

Cleaning Paint Spray Cans

When you have finished with a can of spray paint and there is still some left in it, remove the spray tip and put it on a can of WD-40 lubricant. Give it a squirt and then replace it on the paint can (2-285). This will keep the nozzle clean for later use.

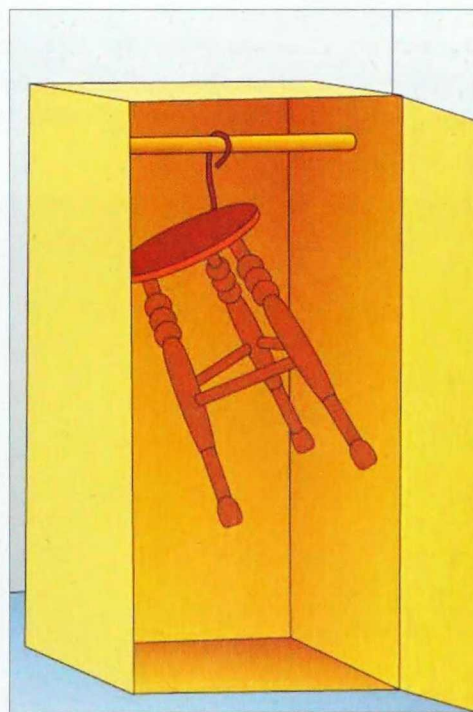
Dust-Free Paint Drying

If you are doing a lot of small part painting or finishing in your shop, get yourself a used wardrobe moving carton (2-286). These are available at moving companies, and the used ones are much less expensive. The boxes fold for easy storage after use.

Hang those painted small parts from the included hanger bar and then close the box. It will keep the items relatively dust-free while they dry.



2-285. WD-40 lubricant will clean your paint-can nozzle. Replace it on the paint can for later use.



2-286. A used wardrobe box will keep painted parts dust-free while they dry.

Estimating the Amount of Paint

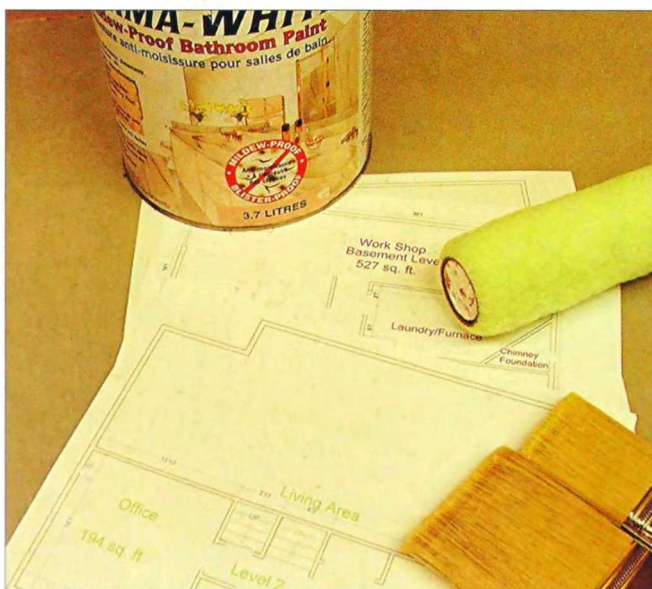
It's spring and you and your spouse have decided to repaint the living room. Don't go blindly to your neighborhood paint store and ask for a couple of gallons. You know that if you do, one of two things is going to happen: You will either end up with too much or you will end up with too little. The former

is not so bad; it's the latter that will end up being a problem, especially if you have a custom color mix. One little drop of the color tint could make a *big* difference.

To properly estimate the paint requirement, do the following: Multiply the length of each wall by the height of the wall in feet (2-287). Ignore the doors and windows. Add up the totals. This will give you the total number of square feet for the room. Add 10 percent to the figure. This will take into account those little touch-ups and leave a little left over.

Now, it's time to go to the paint store. You have the information that they require and they will tell you the quantity needed of the type of paint that you want. Be sure to tell them what the wall texture or material is as well.

After painting is done, pour the leftover paint into an airtight container that will just hold what's left. Mark it with the paint mix number and the room that it was used on.



2-287. When you're buying paint, make sure that you are armed with the dimensions of the room that you plan to paint.

Filtering Paint

From your handy hardware store buy a yard or two of nylon window screening like the kind you find on those aluminum storm doors. Cut a piece

just a little larger than your paint can, cut it in half, remove the lid, and tape the piece to the can (2-288). An alternate method is cut a piece to fit over the deep end of your roller tray. Now, pour the paint into the tray. If the screen is on the paint can, leave it there but put the cover back on to prevent the paint from drying out. If the screen is on the roller tray, carefully remove and dispose of the screen. This will ensure that any skin or blobs of paint don't get on your brush or roller. It's not necessary to do this with a new can of paint, just with the ones that have been sitting around the basement for a year or two and are only partially full.



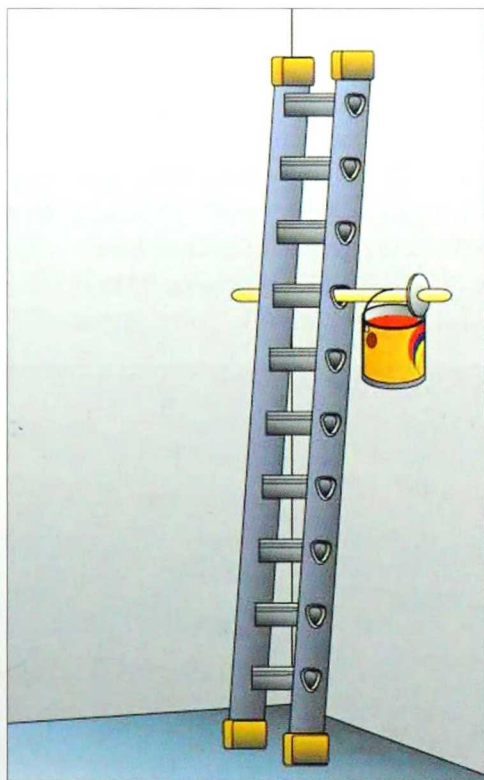
2-288. This piece of nylon window screening, taped to the can, can be used to filter paint.

Going Up a Ladder with Paint

Up a ladder with a gallon of paint? You know how precarious that can be. Get hold of a dowel or broomstick and put it through the aluminum ladder rung. A large washer forced onto the end of the dowel or even a notch cut into the dowel will hold the wire handle of the paint can relatively secure (2-289). Use a bent coat hanger to hold the brush or roller as well.

Keeping Paint Cans Clean

Hammering a lid back on a paint can usually splatters the paint all over the place. When you open up



2-289. A dowel or broomstick will hold a gallon of paint securely on a ladder.



2-290. A bit of masking tape around the rim of a paint can will stop the splatter when closing it.

that can of paint next time, put a six-inch strip of masking tape over the groove on the inside and outside of the lip (2-290). Use this area to scrape the excess paint off the brush and the paint will go back into the can, not the groove. Remove the tape before resealing the paint can.

Mixing Paint (#1)

Although there are many different types of paint mixers on the market, this method is equally effective. I use an old beater from a Mix-Master (2-291). This beater is installed in my portable variable-speed drill. Starting off very slowly, I gradually increase its speed until the paint is mixed thoroughly. Let the paint drip off the beater, put the beater in thinner or water (depending on the paint), and turn it again for cleaning.

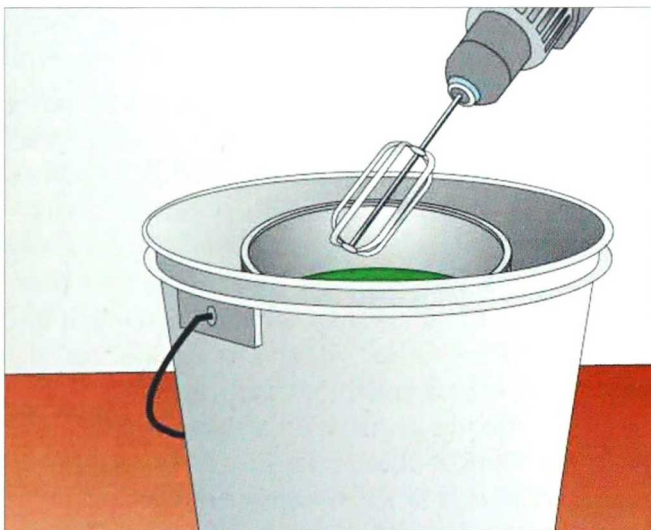
When mixing paint with your portable drill, get a lid from a plastic ice-cream or margarine container that is large enough to cover the top of your paint can. Drill a hole large enough for the beater shaft to fit through, cover the paint can, and start mixing. This will prevent any chance of splattering.



2-291. This old beater makes an effective means of mixing paint

Mixing Paint (#2)

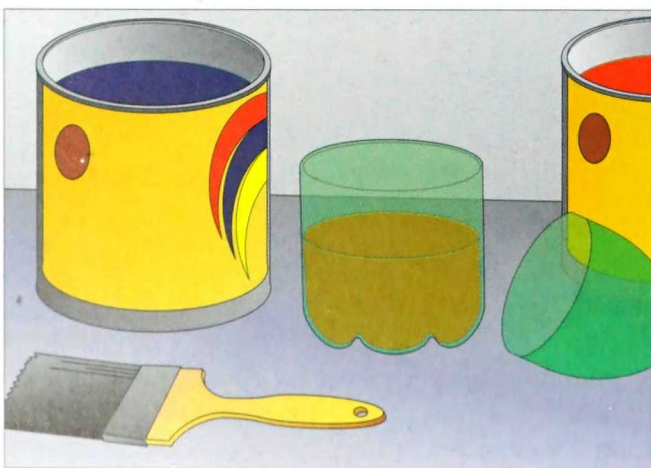
If mixing paint with a mixer or an old eggbeater that fits on a power drill, invariably the paint will spatter. Put your paint can in a plastic bucket that is taller than the can (2-292). It will save a lot of clean-up.



2-292. Putting your paint can in a bucket when mixing will contain the spatter.

Mixing Paint (#3)

Before recycling those plastic soda pop bottles, cut the tops off them and put the remaining section on your paint shelf. These small “bowls” will make great disposable containers for mixing small amounts of touch-up paints and finishes (2-293). If you drill a couple of small holes up near the top of the bottle, a bent coat hanger will hook it onto a ladder. Oh, save the top section. It makes a handy funnel.



2-293. Use small plastic soda-pop bottles for mixing smaller amounts of paint.

Painting Drawer Handles

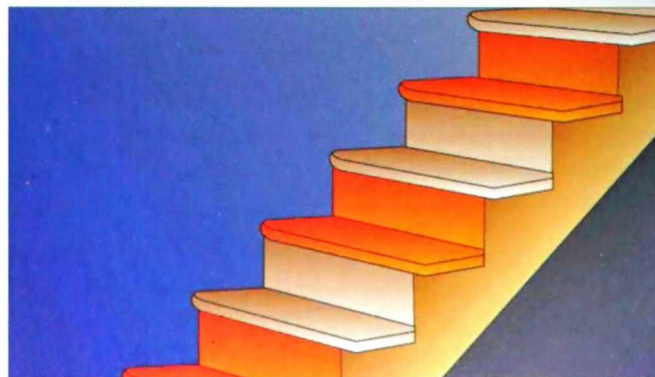
It is almost impossible to paint a small drawer handle without getting paint all over your hands. To prevent this from happening, place a piece of double-faced tape on your paint table and then stick the small parts (drawer handles, knobs, etc.) onto the tape (2-294). This will prevent them from moving around as you carefully paint them.



2-294. To prevent small parts from moving while you are painting them, stick them to double-faced tape on your paint table.

Painting Steps

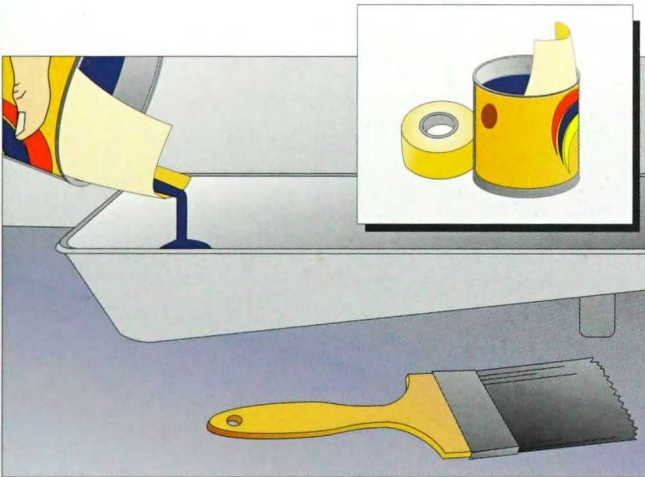
Don’t get trapped when painting steps. Some people paint one half of the step first and then the second half, but then overlapping will show. Instead, paint every second one on the first day and then the remaining steps on the next day (2-295). If they require a second coat, repeat the process but place a flat board on the dry ones as an indicator.



2-295. Alternate the steps when painting them; it will eliminate overlaps.

Pouring Paint

Stick a piece of wide masking tape to the inside of the inner rim of a new can of paint. (You may have to wipe it dry first.) The tape should be about 4 inches long and 2 inches wide. This will make a spout that will keep the inner rim and the outside of the can nearly paint-free (2-296).



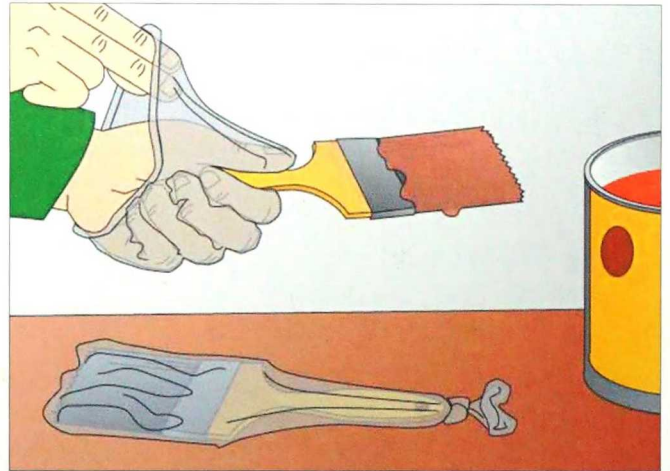
2-296. The piece of masking tape fixed to the inside of the rim of the paint can (see close-up inset) makes a good spout.

Preserving Paintbrushes

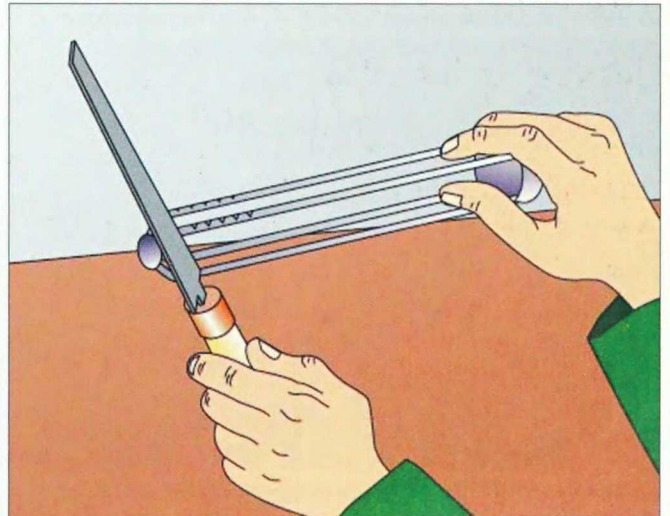
To preserve your paintbrush for recoating in the next day or two, freeze it. If you are using disposable vinyl gloves while painting, simply grasp the bristles, pull your glove off your hand and over the brush, and put it in your freezer (2-297).

Preventing Paint Rollers from Sliding

Paint rollers sometimes slide laterally on the roller frame, and that can be annoying. To prevent this, use a file to "score" the wires on the frame (2-298). This should keep the roller in place.



2-297. Freeze that paintbrush for next day recoating. Cover it in your vinyl glove.



2-298. Scoring the frame will prevent the paint roller from sliding

Removing Paint

Here's a quick tip: Trisodium phosphate mixed with water (1 pound to 1 gallon) will remove a coat or two of old paint on furniture (2-299). Brush a generous amount of the solution on and allow it to soften. A scraper or dull putty knife will remove the softened paint quite readily. Rinse the cleaner surface immediately afterwards with water and then wipe it dry. A stronger solution may be required for areas with more paint. *Rubber gloves and safety goggles should, of course, be worn when working with these materials.*

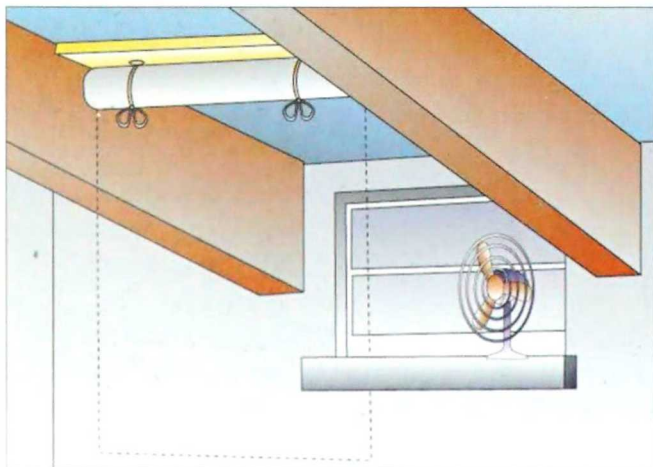


2-299. Trisodium phosphate (TSP) is an inexpensive substitute for commercial paint removers.

Shop-Made Spray Booth

Plastic can be used to make a temporary spray-paint booth. Staple the plastic to the ceiling joists and to laths at the floor level. The laths can float free. Make a three-sided "tent" with the plastic at a window opening. An exhaust fan in the window will help dissipate the overspray (2-300).

A word of caution: Use only water-based paints in this shop-made booth, as solvent-based fumes and lacquers could be both explosive and toxic.



2-300. A shop-made temporary spray booth can be made by draping plastic from the ceiling. Use this for water-based finishes only.

Spray Paint Aid

Using a lazy Susan is one of the best ways of making sure all areas are covered when spray-painting smaller items. To make the lazy Susan, purchase a 12-inch bearing plate at your home improvement center and install it on a piece of ½- x 24-inch-diameter plywood. Drive some 2-inch finishing nails into the plywood to keep your project raised to prevent paint buildup at the bottom of it (2-301).



2-301. A lazy Susan will help in spray painting.

Storing Paint

Partially empty paint cans should be stored upside down. This way, any skin that forms will be on the bottom when you next open the can. The skin will usually support the weight of the paint on top of it, so mix it thoroughly but avoid breaking the skin. Also, make sure that the lids are on tight before inverting the paint cans.

There is another way to store partially empty cans of paint. Place a plastic shopping bag over the can. Put the top on over the plastic and hammer it on tight. Then, with a pair of scissors or a utility

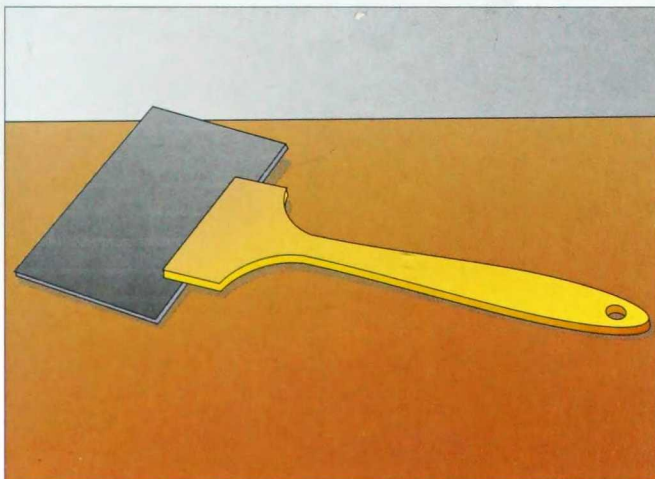
knife cut away the excess bag (2-302). This will not only make a better seal, but it will prevent the paint from splashing on you when you hammer on the cover.



2-302. An effective way to store partially empty cans of paint.

Using Old Paintbrushes

You can make use of old paintbrushes by removing their bristles and metal casings. You are now left with a handle that can be used to spread glue or, if you insert a piece of sheetmetal, as a scraper or spatula (2-303). Some imagination is all that is required.



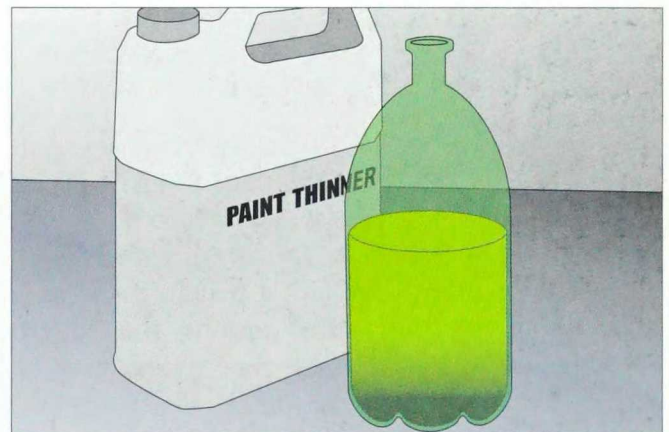
2-303. By inserting a piece of sheetmetal into an old paintbrush handle, you have a tool that can be used to spread glue or as a scraper or spatula.

PAINT THINNER (RECYCLING)

Pour your used paint thinner into clear-plastic containers such as soda bottles. Label the containers and cap them.

After a while, you will find that the paint or other materials will have settled to the bottom of the bottle and that the rest of the bottle is now clear (2-304). Carefully pour this paint thinner into another clearly marked container. This paint thinner can be used again.

Some words of caution: Don't mix these fluids together and, if you have kids around, lock these chemicals up.

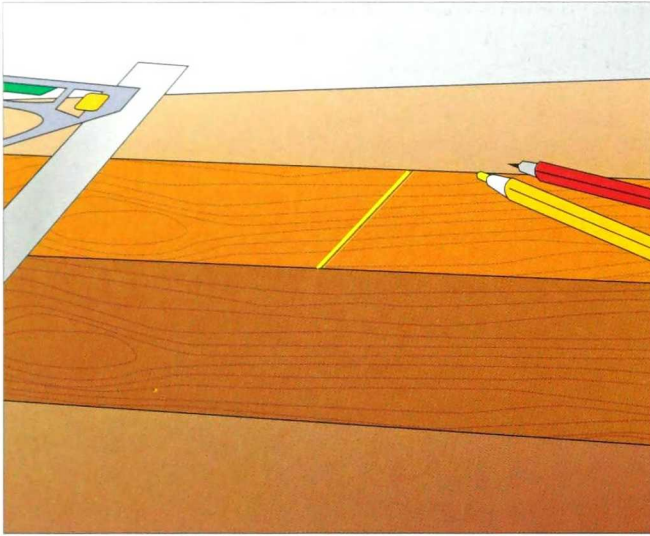


2-304. Note the used paint thinner in the clear-plastic container. The paint and the other materials will settle to the bottom, allowing you to reuse the paint thinner.

PATTERNS

Drawing Patterns

Drawing a pattern for cutting on pine, spruce, or oak with a lead pencil makes it easy to see. Drawing a pattern on walnut or rosewood with the same pencil makes it a lot more difficult to see. To make the pencil line easier to see, outline it with a yellow wax pencil (2-305). This will highlight the pencil line, make it much more visible, and will not damage the wood.



2-305. Outlining your pencil line with a yellow wax pencil will highlight it.

Enlarging Patterns

A fender washer can be used to enlarge a wood pattern by say, a half inch all around. Fender washers are those large diameter washers with the small holes in them. Use a fender washer butted up against the pattern edge and a pencil in the hole and simply roll the washer around the pattern (2-306).



2-306. Enlarging a pattern with a fender washer.

Transferring Patterns (#1)

One way to transfer a pattern to the workpiece is to cut it with a utility knife and scissors and then trace it on the workpiece using a sharp pencil (2-307).

Instead of transferring patterns from a project book onto paper or even directly onto your workpiece, buy a couple of sheets of white polystyrene from your local plastics dealer. They come in various thicknesses (gauges), so buy a thickness that can be easily cut with a pair of scissors or a utility knife.

Now, photocopy your pattern and stick it onto the polystyrene with double-faced tape or rubber cement (2-308). Then cut it out with a utility knife.

Lightly sand the rough spots off the edges with very fine sandpaper. Adhere the pattern to your workpiece with double-faced tape and trace around it with a sharp pencil.

When you are done, write a description of the pattern on the pattern itself with a soft-tip marker, drill a hole in the pattern, and hang it up for future use.



2-307. Cut your pattern with a utility knife or scissors and then trace the pattern on your workpiece with a sharp pencil.



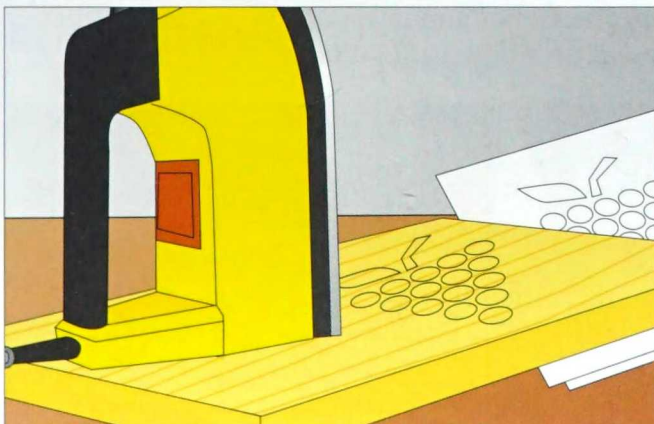
2-308. Cut out the pattern with a utility knife.

Transferring Patterns (#2)

Transferring the patterns from the pattern book to your workpiece can be a tedious operation. The usual method consists of dividing the pattern into, for example, 1/2-inch squares and then doing the same on your stock. To double the pattern size, you use 1-inch squares on the stock.

Now there is an easy way: photocopying. You simply make a high-contrast photocopy of the pattern, reducing or enlarging as required. Most libraries, post offices, and drugstores have coin-operated machines available.

Once the photocopy is done, place it upside-down on the workpiece and, using an iron that is not too hot, press it onto the wood (2-309).

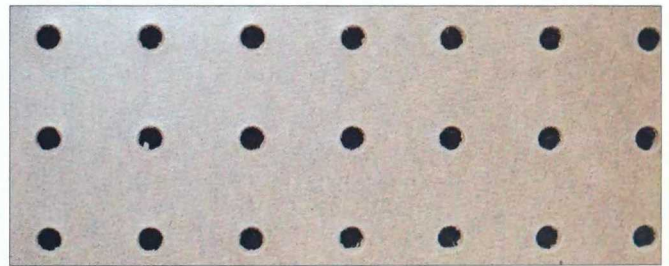


2-309. A warm iron applied to the back of a photocopied pattern will transfer the pattern onto your workpiece.

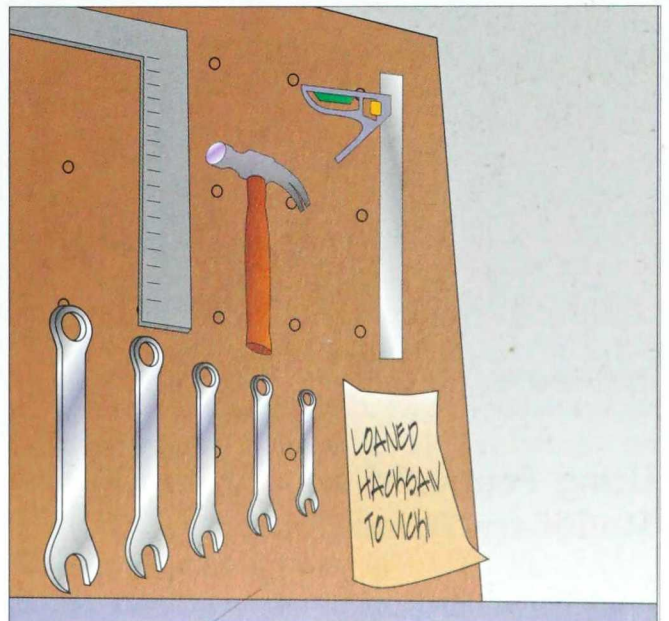
PEGBOARD

Pegboard is an absolute must for every home workshop (2-310). After securing your pegboard to a frame of 1 x 2s to keep it away from the wall, nail or screw the panel in its desired place. Using the appropriate hooks, start hanging your tools (2-311). Do *not* consider your first setup to be your last. You will find after a couple of days, or even weeks, that the positioning of the various tools is not convenient or to your liking. Only after you have become accustomed to the layout and can easily locate that particular tool you need can you consider the layout final.

Now, using a black (or any color) soft-tip marker, trace around all the tools and other paraphernalia.



2-310. A close-up of pegboard.



2-311. Hang your tools on pegboard. When someone borrows a tool, hang a note on the hook of the borrowed tool to remind you who has it.

By doing this, it will become obviously apparent if something is missing on the board.

If your friends, neighbors, and family members are quick to borrow tools but slow to return them, hang a little note on the hook of the borrowed tool to remind you who has it. If the paper starts to turn yellow, it's time to go looking for the tool.

Securing Hooks on Pegboard

One of the most annoying things about pegboard is the way that the hooks keep falling off when you remove a tool. A number of companies that make the hooks also make clips that go around the hooks and fasten into the holes. The problem is, I can never seem to find them in the store.

Here's an easy and inexpensive way to solve the problem: Plug in your glue gun. When it's hot, squirt a little hot glue in the hole where you intend to put the hook. While the glue is still hot, install the hook (2-312). For longer hooks, repeat the above but also place some glue into a lower hole. Be sure that the glue goes into the hole *and* around the shaft of the hook.



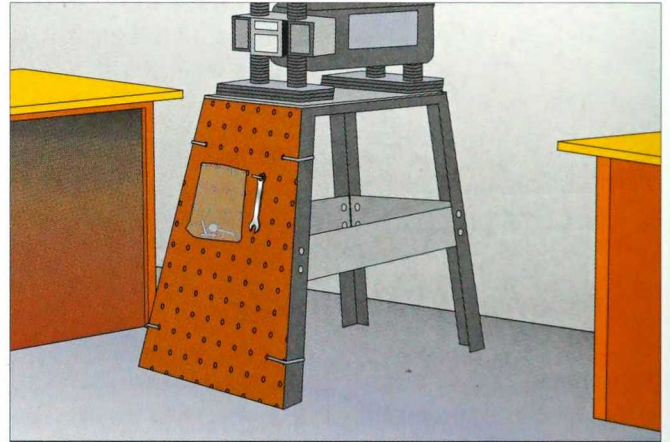
2-312. To keep the hooks on pegboard secure, apply a little dab of hot-melt glue.

Using Pegboard on Stationary Power Tools

In addition to the obvious use on the wall for tool storage, pegboard has many more uses. Here's one. Most stationary power tools come equipped with an open sheet-metal stand. Try covering one, two,

or three sides of the stand with pegboard (2-313). It also makes a great place to hang saw blades, miter gauges, and other accessories.

Don't stop there. Make a shelf out of pegboard that will fit on the stretchers that support the base. The pegboard's holes will let most of the sawdust run through, and the shelf will come in handy.

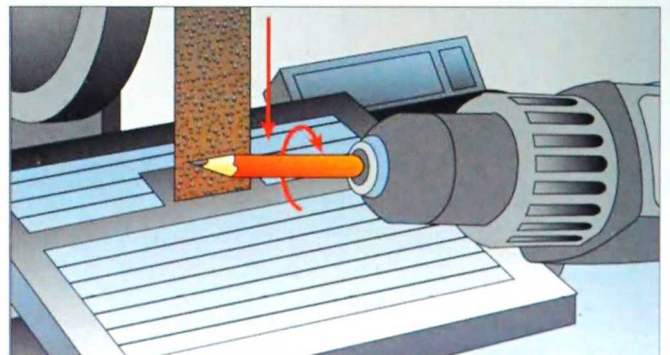


2-313. Attaching pegboard to sheet-metal tool stands will keep the tools' accessories in a convenient place.

PENCILS (SHARPENING)

Sharpening a shop pencil is usually done with a utility knife and that can be a hit-or-miss situation. Invariably when you get close to a sharp point, the lead breaks off.

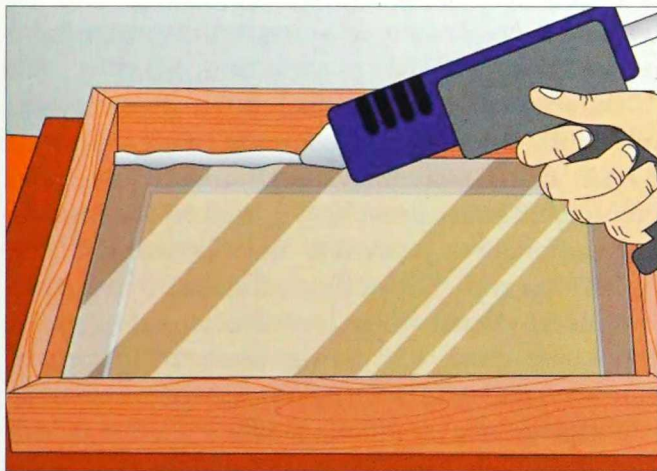
If you have a small belt sander, chuck the pencil in a portable drill and put the drill in reverse. Turn on the sander and in moments you have a perfect point on the pencil (2-314).



2-314. A small belt sander and a portable drill will produce a sharp point on a shop pencil.

PICTURE FRAMES

Occasionally we are asked to make a picture frame or two, and they are generally easy to do. However, they usually require those special diamond-shaped “points” to keep everything within the frame. Trying to squeeze these into hardwood such as oak can be a problem. An easier way is to use hot-melt glue. Run a tiny bead around the perimeter and everything will be nice and snug (2-315).



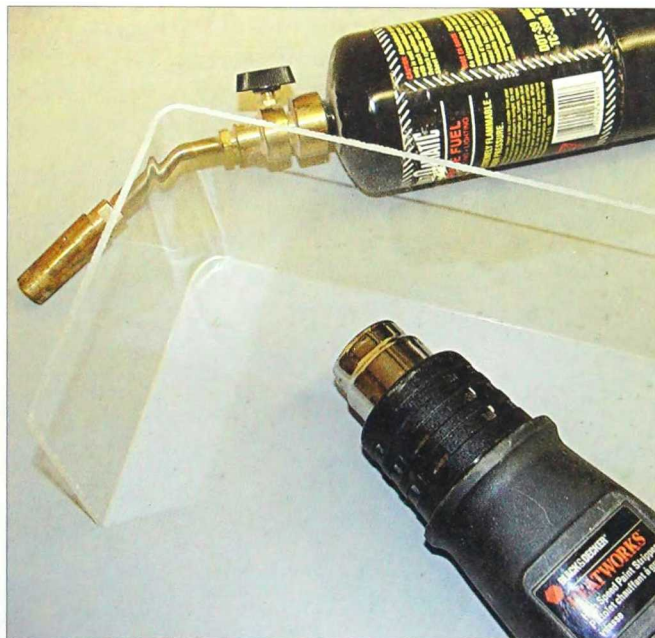
2-315. You can use hot-melt glue to keep the picture, matt, and glass tight in a picture frame.

PLASTICS

Bending Plastics

Acrylics or styrenes can be bent in many ways. Here are three. In the first method, using a propane blowtorch with a pencil-thin flame aimed at the desired crease will soften $\frac{1}{8}$ - or $\frac{1}{4}$ -inch acrylic or styrene enough to make a bend in the material (2-316). Do not concentrate the flame in one spot, but wave it back and forth across the workpiece and do both sides. The workpiece should be hanging over a straight edge at the bending point.

The heat gun or hair dryer is another method to use for bending, but it will take longer to bend acrylics or styrenes of any thickness over $\frac{1}{8}$ inch.



2-316. A blowtorch, a heat gun, and oven-baking are three ways to bend acrylics or styrenes.

The third method involves baking (that's right, baking) the plastic. Use a clean cookie sheet. Lay the workpiece on it, turn up the oven to about 200 degrees, leave the oven door ajar, and turn on the exhaust fan. The workpiece will soften into a rubbery state that should be placed into a precut mold. Oven mitts are a *must* in this operation.

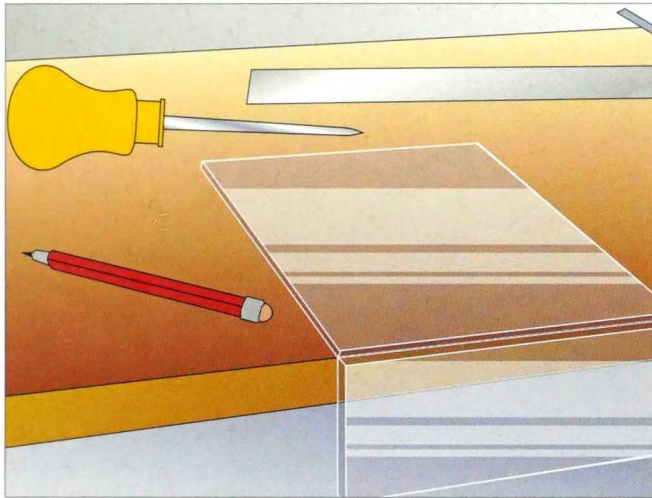
Cutting Techniques

To cut Plexiglas, polystyrene, and most other plastics up to $\frac{1}{4}$ inch thick, score the plastic lightly at first with a scratch awl or other sharp-pointed tool. Repeat the scoring a couple of times using progressively heavier pressure. Align the scribed mark on the edge of your workbench with the scribed face up. Now, holding it securely, bend the material down until it snaps (2-317). Practice this a couple of times on some scrap material before trying it on your workpiece.

Safety Techniques

Working with plastics poses the same safety hazards as working with wood. When sawing, you must use a dust mask because the dust is extremely fine and

is an irritant to the mucous membranes, and some forms of plastic could be toxic (2-318). *Do not smoke or allow sparks or an open flame anywhere near your work.*



2-317. To cut plastics up to 1/4 inch thick, score the plastic with a sharp-pointed tool, align the scribed mark on the edge of your workbench, and bend the material down until it snaps.



2-318. Some of the safety gear that should be used whenever plastics are being worked with.

Types of Plastic

ABS is a tough, rigid plastic primarily used for sewer and water pipes.

Acrylic, most commonly known as Plexiglas, a trade name, is available in sheets, tubes, rods, and

blocks. It is used in a multitude of products such as windows, tabletops, etc.

Epoxy is a chemical-resistant material used in adhesives.

Melamine is usually available in sheets as a surface veneer that is resistant to scratching and heat, and has been more recently available as a paint-on material for kitchen counters and concrete floors. It has been successfully used to refinish rusted bathtubs and sinks.

Nylon, aside from its obvious use in panty hose, is also used for gears, cams, and other small parts. It is extremely durable and self-lubricating. Wire tie wraps are made of a type of nylon that makes them extremely strong.

Polycarbonate is a clear Plexiglas-like material (available through the common trade name of Lexan) that is extremely tough and is sometimes considered bullet-proof in its thicker dimensions. Polycarbonate is available in sheets, rods, and tubes. However, like Plexiglas, it is easily scratched.

Polyethylene is most commonly used in paper-thin sheets as a vapor barrier or in the making of garbage bags.

Polystyrene is similar to acrylic in that it is clear and is available in sheets, rods, and tubes. It is very brittle and is not resistant to ultraviolet rays. Exposed to the sunlight, it will discolor and crack.

Polyurethane is a tough material that is resistant to chemicals but is *highly flammable and gives off toxic fumes when burning*. It is used as insulation and foam in products such as molded chairs.

Polyvinyl acetate is a major component in paints, adhesives, and wood fillers.

PVC (polyvinyl chloride) is most commonly found in the manufacture of piping.

Silicone is a very elastic material that can be found more readily in caulk and adhesives.

PLEXIGLAS

Plexiglas is fun to work with. You can saw, drill, rout, bend, and sand it. Here are a few tips that you may want to follow when working with this material:

1. Never store Plexiglas in direct sunlight. The protective paper that's on it will dry up and become difficult to remove.

2. Leave the protective paper on until your project is finished. This will help prevent scratches to the surface.

3. Almost any drill bit may be used on Plexiglas, as long as it is sharp. Make sure, though, that you have a piece of scrap wood under it and that you drill *very* slowly, using light pressure.

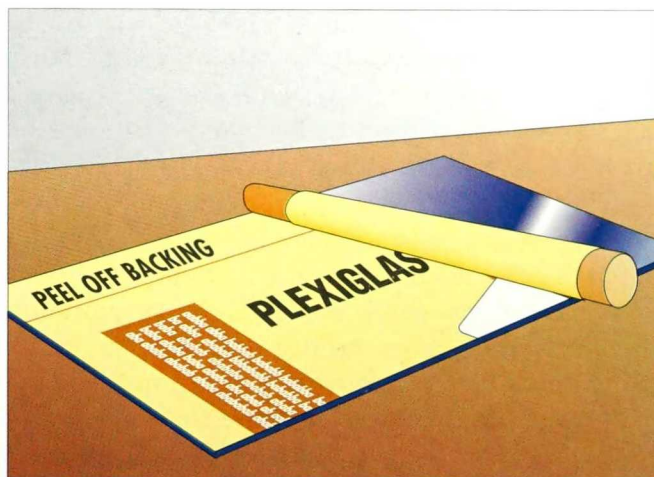
4. You can cut Plexiglas with a band saw, but use a blade with the most teeth to the inch. When using a circular saw, also use a blade with the most teeth.

5. Plexiglas can be bent in boiling water, in an oven set at low heat, or with an electric bender. An electric bender is a tool with two heating elements. Place the Plexiglas between the two heating elements, wait a moment, and then bend the Plexiglas. Plexiglas gets very hot when the above methods are used, so be very careful when handling it. The protective paper should be removed before heating.

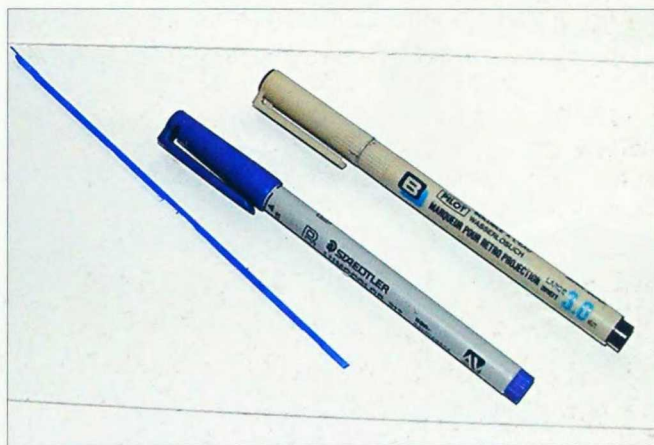
6. Sand the edges of Plexiglas with fine sandpaper or emery cloth. To get a clear edge on the plastic, sand the edge and then run a flame over it. Do this with a propane blowtorch. Make light, frequent passes along the edges. Try this out on scrap before doing your workpiece. If the Plexiglas starts to ignite, blow it out immediately or douse it in water. *This operation should be performed outdoors or in a well-ventilated area!*

An easy way to remove the protective paper is to start at one corner. Then start rolling the paper off with a broom handle or a dowel, depending on the size of the piece (2-319). If the material has been cut, the edges of the paper may tend to stick, so proceed slowly.

Sometimes when you work with Plexiglas you will find that the protective paper has been removed or that the supplier has used a blue polyethylene protector. How do you mark the Plexiglas for measuring? A pencil won't do, and an awl will



2-319. Removing the protective paper on Plexiglas with a broom handle.



2-320. Use a water-soluble overhead projection marker to mark Plexiglas.

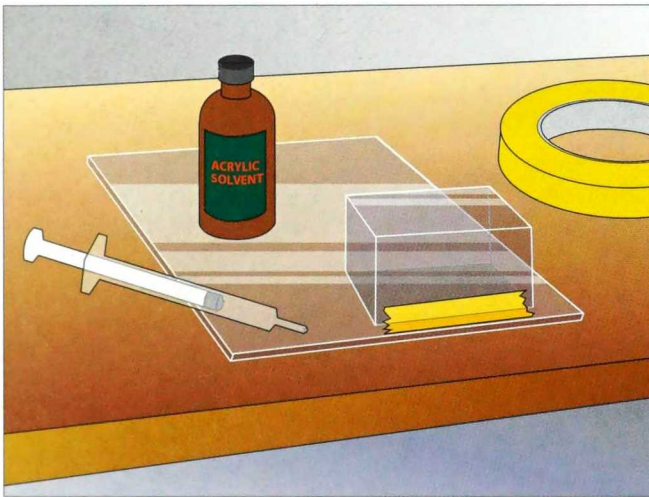
leave a scratch right where you don't want it. Try this technique: Your stationary store or art-supplies dealer has water-soluble overhead projection markers in a rainbow of colors and a variety of point sizes. Get a couple of dark-colored ones with fine points. Now, make your lines (2-320). A little Windex and a soft cloth will wipe away any errant marks.

Welding Plexiglas

Hold on! Don't put a match to that acetylene torch just yet. The Plexiglas, a trade name for acrylic, will be cold-welded; that is, a liquid acrylic solvent is used to bond the pieces together and the solvent is

applied with a hypodermic syringe (2-321). *Extreme* care should be taken when doing this operation because the needle is very sharp. Use safety gloves and glasses. The pieces to be "welded" should be clamped or taped together and must be close-fitting. Any gaps will weaken the joint.

Inject the solvent into the joint only until you see it fill the seam, because any surplus will leak out and permanently damage the surrounding area. Once it is done, let the workpiece sit for an hour or so before removing the clamps or tape. When the job is completed, store the solvent and the hypodermic needle in a safe place, preferably under lock and key.



2-321. Welding Plexiglas with a hypodermic needle filled with acrylic solvent. Note the use of masking tape to maintain the position of the joining pieces. When you have finished welding the Plexiglas, store the solvent and the needle in a safe place, preferably under lock and key.

PLYWOOD

Plywood is probably the most versatile wood product ever produced. It can be used indoors, outdoors, and even submersed in water or other liquids. It is extremely strong due to its cross-grained laminations. The surface laminations can be either non-specific wood species or specific ones such as oak, birch, walnut, and the like for furniture construction. In the construction of the material, close

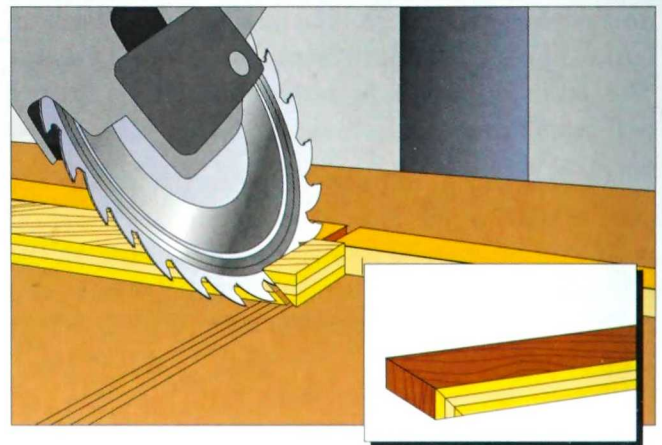
attention is paid to tolerances in dimensions. A $\frac{3}{4}$ -inch-thick sheet of plywood is exactly as advertised. In Canada and some other countries, a metric equivalent is used.

Plywood should be cut with care to prevent splintering on the face surface. If the user is cutting with a table saw, the face surface should be up. If you are using a portable circular saw, the face should be down. To further ensure a splinter-free cut line, it would be wise to apply masking tape along the cut line.

There are many by-products that have derived from the invention of plywood such as particle-board, oriented strand board, etc., but these are used primarily in construction.

Adding Edging to Plywood

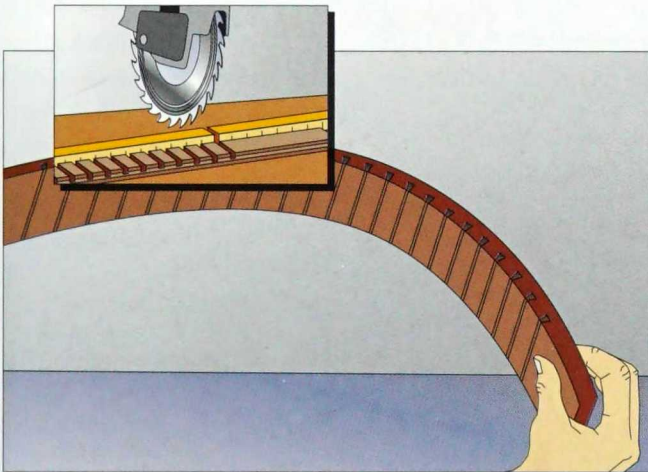
Here is a way to add edging to plywood. Let's assume, for example, that you want to add edging to a bookcase top that is 12 x 36 inches. Cut your piece $12\frac{1}{4}$ x $36\frac{1}{4}$ inches to compensate for a $\frac{1}{8}$ -inch saw kerf. Now, using a radial arm saw, set your blade at a 45-degree angle and rip your top full length, making sure that you are cutting the full thickness (2-322). Do the same thing to the ends. Save the cut-offs. Turn them over and glue them back on in their respective positions. You now have veneered edges on four sides. A little practice on some scrap pieces will help.



2-322. Using a radial arm saw, set the blade at a 45-degree angle and rip your top full length. The inset shows the plywood with veneered edging.

Bending Plywood

Bending plywood, to use as edging for a round table for example, can be done quite easily, even with $\frac{3}{4}$ -inch-thick material. Cut the piece to the desired length and width, being sure that the surface grain runs lengthwise on the strip (2-323). On the reverse side of the outer surface, start making crosscuts with your table saw, radial arm saw, or compound miter saw. Make the cuts down to the outer surface ply and make them about a $\frac{1}{2}$ inch apart. This distance will have to be by trial and error and will depend on the thickness of the plywood and the radius of the bend.



2-323. As shown in the insert, the crosscuts are made in the edging strip the full length of the strip. Shown in the foreground is the bent plywood.

Clamps for Carrying Plywood

Squeeze-type bar clamps can be used as handles for carrying plywood sheets or any other type of flat material (2-324).

Jig for Carrying Plywood

I don't know just how much a 4 x 8-foot sheet of $\frac{3}{4}$ -inch-thick plywood weighs, but it's difficult for an old guy like me to carry, so I came up with the carrying jig shown in 2-325.

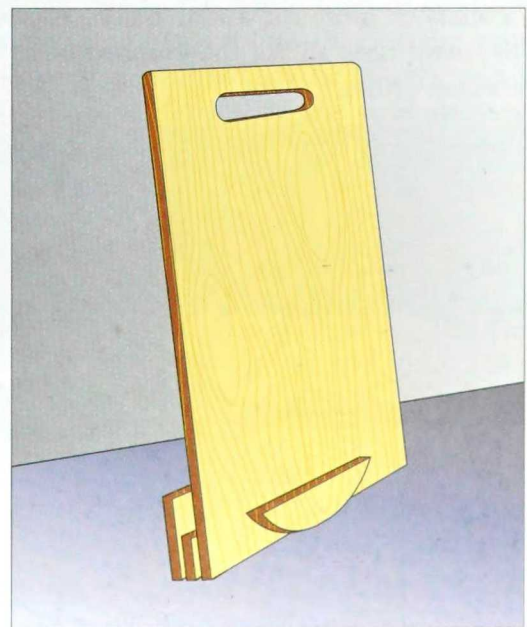
Take a piece of $\frac{1}{2}$ -inch-thick plywood that is 12



2-324. A squeeze-type clamp can help with toting sheet goods.

inches wide. Put one end of it on the floor and lean it against your leg. Put your arm down and close your hand. Get someone to make a pencil mark on the plywood where your knuckles are. With your square, draw a line three inches below that mark. This will be the top of the handgrip, so the full length of the board will be a couple of inches above that. Drill a starter hole and use a jigsaw to cut out the hand grip.

On the bottom of one side, glue and screw two pieces of $\frac{3}{4}$ -inch-thick plywood that are 2 inches



2-325. A jig for carrying plywood.

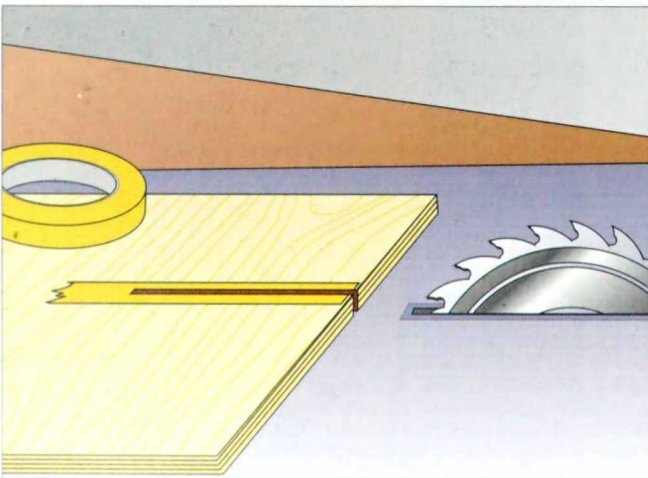
wide x 12 inches long. On the bottom of the other side, glue and screw one piece that is also 2 x 12 inches. On top of that piece, place another. Sand off the rough edges and you've got yourself a carrying jig.

On one side of the jig, you can carry a $\frac{3}{4}$ -inch-thick sheet of the plywood 3 inches wide x 12 inches long. On the other side, you can carry two $\frac{1}{2}$ -inch-thick sheets. Just make sure that the sheets are centered on the jig to make it balanced.

Preventing Tear-Out in Plywood

Crosscutting plywood with less than an 80-tooth, carbide-tipped saw blade will invariably cause tear-out (rough edges), but not all of us have or can afford an 80-tooth, carbide-tipped blade. Here is a technique that will save you both time and money the next time you are crosscutting a piece of plywood. Run a strip of masking tape across the width of the workpiece, where your cut will be (2-326). Make your line *on* the masking tape and then make your cut, also cutting the masking tape. The result will be a nice, clean cut.

The downside to this technique is that you will probably have to clean your saw blade more often, but if you are making a lot of these crosscuts, it's worth it. You won't have to run out and spend 50 to 75 dollars or more for a new blade. You won't have to spend time filling the chipped areas with plastic wood, either.

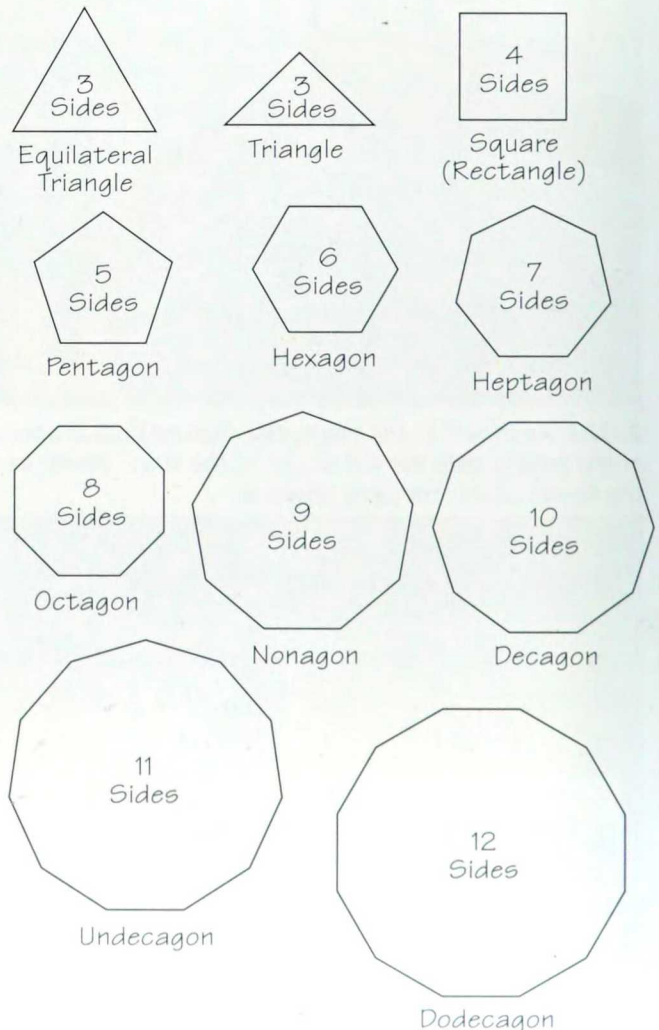


2-326. Applying masking tape to plywood to ensure a tear-out-free crosscut.

POLYGONS

By definition, a polygon is a geometric figure having three or more equal sides (2-327). Most of these shapes have names. Here they are:

Triangle:	3 sides
Square:	4 sides
Pentagon:	5 sides
Hexagon:	6 sides
Heptagon:	7 sides
Octagon:	8 sides
Nonagon:	9 sides
Decagon:	10 sides
Undecagon:	11 sides
Dodecagon:	12 sides

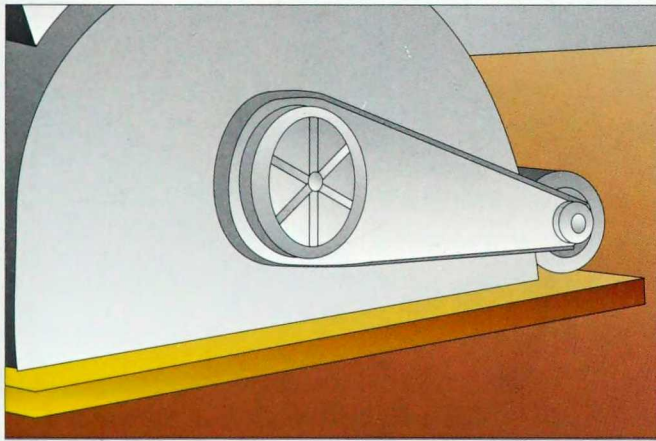


2-327. Polygons

PULLEYS (SIZING)

Sizing pulleys has always been a trial-and-error situation for most woodworkers (2-328). The math grads probably find it a snap. For the rest of us, this may help. Let's suppose you want to build your own bench grinder. You have an electric motor and the speed is marked on it in rpm (for example, 1,725). The grinder has a 2½-inch pulley already on its shaft. You want to increase the speed of the grinding wheel to around 4,000 rpm. What size should the pulley be on the motor shaft?

The formula is easy with a calculator. Multiply 4,000 by 2½ and then divide by 1,725. You end up with a calculation of 5.797. This is the diameter of the pulley required to attain the desired speed. A 6-inch pulley will do just fine.



2-328. As described in the text, it is easy to calculate the right-size pulley to use for a given speed.

RADIAL ARM SAW

(See Also Angle Jigs)

I consider the radial arm saw to be one of the most important tools in a home workshop (2-329). It is an extremely versatile tool in that it can be readily converted to a router, disc sander, drill press, boring tool, shaper, and planer with very little fuss.

Many detractors of the tool claim that it is inac-



2-329. The radial arm saw is a very versatile power tool. It can be used to cut boards to length, make rip cuts, and for mitering and dadoing.

curate; this may have been true 30 years ago, but radial arm saws built today are as accurate as fine table saws. Like any stationary power tool, regular maintenance is required to ensure its alignment.

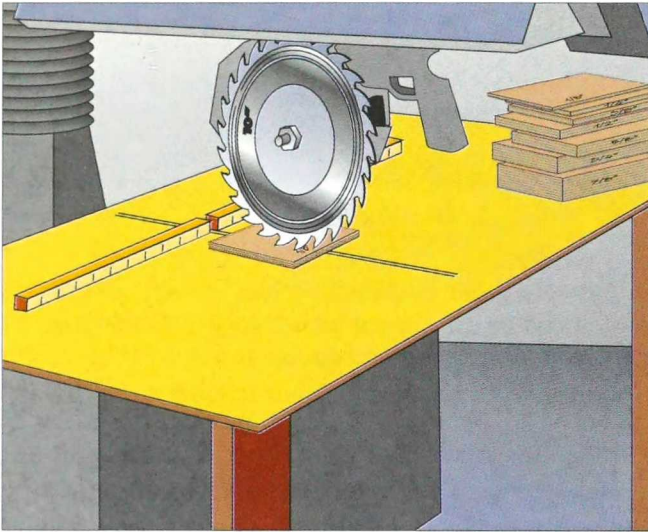
The radial arm saw should be treated with great respect, as it can be a dangerous tool to work with. Ripping wood with a radial arm saw is particularly dangerous due to the possibilities of kickback. The operator should make sure that he/she stands to one side when feeding material into the saw. When crosscutting, be sure that the workpiece is held firmly against the fence. The operator should be thoroughly familiar with the instructions as laid out in the owner's manual.

Many woodworkers are apprehensive when it comes to ripping wood on a radial arm-saw due to the possibility of kickback. However, this can and does occur with table saws as well. Care and safety must be observed in operating this and any other power tool.

One nice feature on a radial arm saw is the power take-off on the motor that allows you to add such things as a drill-press chuck for horizontal or vertical boring, a drum sander for edge sanding, and many other tools.

Adjusting the Depth of Cut on a Radial Arm Saw

Specifically marked 2 x 4 pieces of 1/8-, 1/4-, 3/8-, 1/2-, 5/8-, 3/4-, and 7/8-inch plywood can be used to set the height of your radial-arm-saw-blade (2-330). They can be used alone or in any combination to give you the desired depth of cut.



2-330. You can use this set of shop-made blocks alone or in various configurations to adjust the height of your saw blade.

These jigs can also be used for setting the height of your table-saw blade, the depth of your router and drill press, and to set the cut for myriad other tools. The one-two-three blocks (see page 124) used in combination with these will give you the whole numbers with fractions as well.

Drill 1/4-inch holes in the top center of these jigs and hang them on a pegboard near your saw.

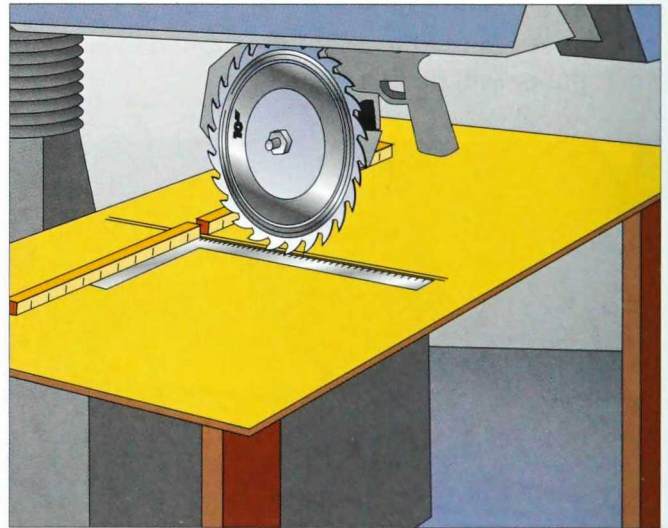
Checking a Radial Arm Saw for Square

At least once a month or more, depending on use, check the accuracy of the saw, particularly in the crosscut position. It's easy to do and only takes a few minutes.

First, with the *power plug removed and the saw switched off*, as in all operations like this, remove the blade. Now, remove the inside washer (the first

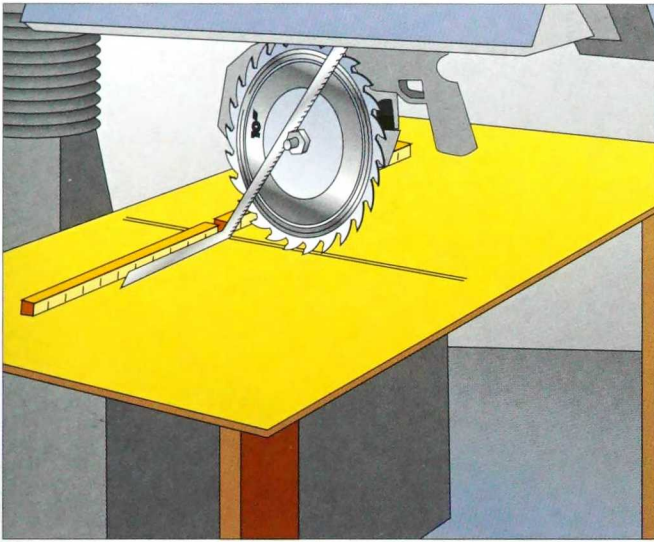
came off with the blade and nut). Check the washer's surfaces for flatness. If there are any little bumps, grind them off on a *flat* oilstone. A small bump or flaw will make the blade wobble. Check the sharpness of the blade and then reinstall it, but do not overtighten the nut.

Now, for the squaring. First, butt the tail of a steel square against the fence and line its body along the kerf (2-331). Pull the carriage (*with the motor off, the key out, and the saw unplugged*) toward you. Use one tooth of the blade as a guide; the tooth should just touch the square equally on the full pull of the crosscut. If you can do this, the saw is cutting at 90 degrees horizontal. If you have to adjust the saw, loosen the Allen bolts on the rear post.



2-331. Checking the horizontal plane of the radial arm saw blade with a steel square held firmly against the fence.

With the blade guard off, lift the body of the square about 30 degrees so that the square rests against the full surface of the saw blade and is not touching any teeth or the arbor. If the square is flat against the saw blade and the tail of the square is tight against the fence, the saw is cutting at 90 degrees vertical (2-332). To make an adjustment, you will have to loosen the bevel screws.



2-332. Checking the vertical plane of the saw. Be sure to keep the steel square in the gullets of the saw blade.

Cutting Circles with a Radial Arm Saw

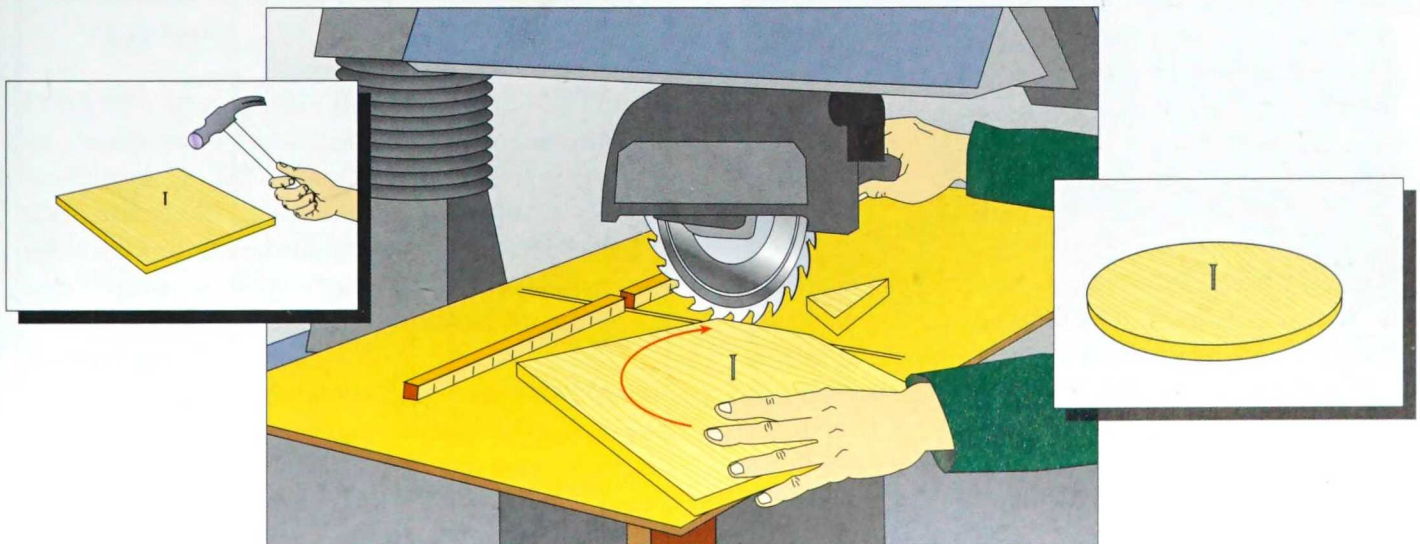
Making wheels or small, round tabletops on your radial arm saw is easy and fun (2-333). First, make as many angle cuts as you safely can, to get your workpiece close to round. Place your workpiece on the saw table so that it will clear the back

fence. If you want an 18-inch-diameter table, for example, the radius will be 9 inches. Therefore, measure 9 inches from the edge of the extended blade and about 10 inches out from the fence. Drill a nail through the middle of the workpiece and into the saw table (**left insert in 2-333**). Make sure it rotates freely. Now, holding the stock securely at the extreme left of the blade, start cutting a little bit at a time (2-333, **center**). *Note: Do not attempt this procedure unless you are very familiar with the tool.*

Extension Table for a Radial Arm Saw

I've expanded my workshop and now I finally have enough room there to be able to move around. I can remove the wheels from the stationary power tools, and the workbench can be used solely for what it was intended.

A problem still exists, however. When I moved my radial arm saw, I moved the out-feed table with it but then realized that a fixed in-feed table would also be desirable. The in-feed table (assuming that the ripping is done from left to right) should be 6 to 8 feet long to handle 8-, 10-, and 12-foot stock. This, of course, would take up a lot



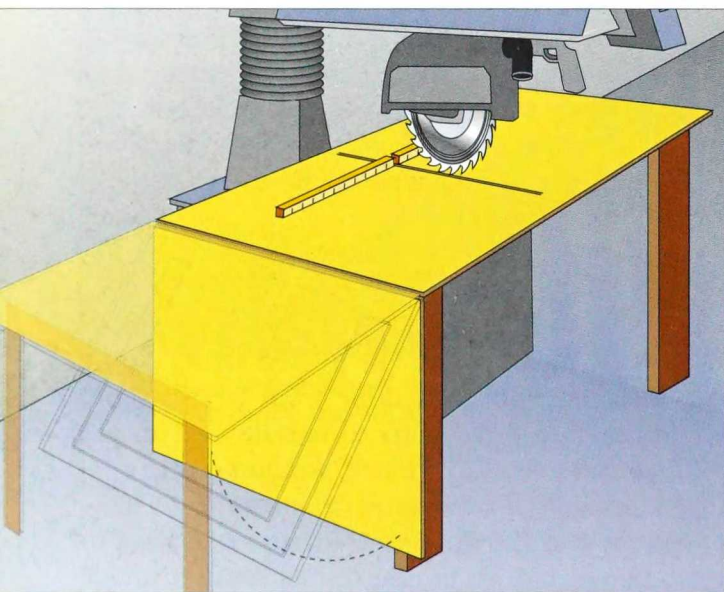
2-333. Left insert: Driving a nail through the middle of the workpiece and into the saw table. Center: Cut a little bit at a time, holding the stock securely at the left of the blade. Right insert: The finished round shape.

of space in the shop and would probably alter the work flow.

The solution was to split the hinged in-feed table in two, as shown in 2-334. Half of it drops down out of the way. The fixed portion will handle 8-foot stock quite easily. I raise the other half for longer stock and for sheets of plywood.

The fixed portion has a slot in it to allow for a longer fence, but the table itself is as wide as the saw's table. The table can now rip a 4 x 8-foot sheet with ease.

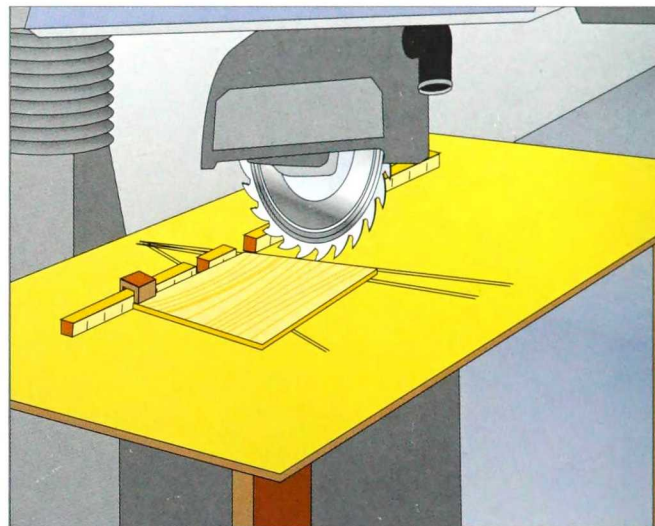
With some modifications, this extension table can be adapted to your table saw as well.



2-334. The in-feed table is hinged to take up less shop space when not in use.

Stop Block

The stop block shown in 2-335 has been modified to increase its usefulness twofold. Rather than putting a T nut in the middle of the block, as is normally done, I installed it closer to the bottom. By making this simple modification, the stop block can be raised, tightened, and used as a hold-down for ripping or for mitered cuts.



2-335. This modified stop block can now be used as a hold-down for ripping or mitering. A T nut and a hex bolt secure it to the saw's fence.

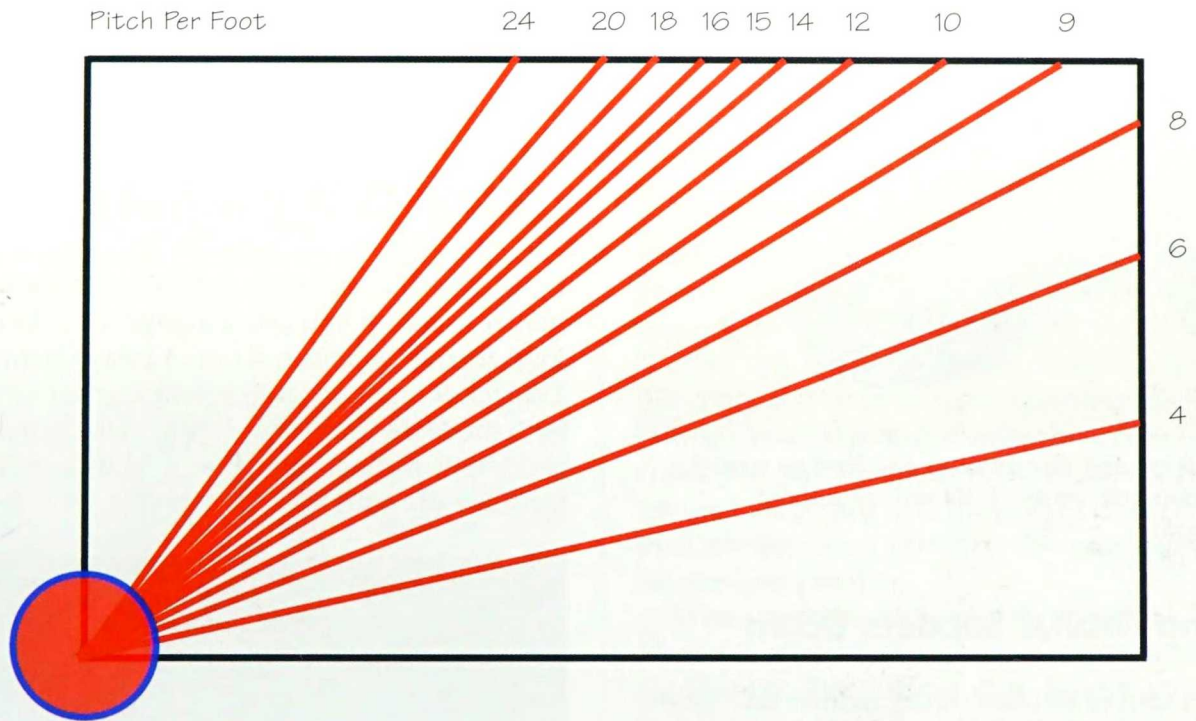
RAFTER ANGLES

Table 2-11 and 2-336 will eliminate the need to calculate angles when making rafters. This will be very helpful when you are building that backyard shed or even that dream house.

Table 2-11.

RISE PER FOOT	ROOF PITCH	ANGLE OF CUT
4 inches	$\frac{1}{6}$	$18\frac{1}{2}$
6 inches	$\frac{1}{4}$	$26\frac{1}{2}$
8 inches	$\frac{1}{3}$	$33\frac{3}{4}$
9 inches	$\frac{3}{8}$	37
10 inches	$\frac{5}{12}$	$39\frac{3}{4}$
12 inches	$\frac{1}{2}$	45
14 inches	$\frac{7}{12}$	$49\frac{1}{2}$
15 inches	$\frac{5}{8}$	$51\frac{1}{4}$
16 inches	$\frac{2}{3}$	53
18 inches	$\frac{3}{4}$	$56\frac{1}{4}$
20 inches	$\frac{5}{6}$	59
24 inches	FULL	$63\frac{1}{2}$

Standard Rafters



2-336. Standard rafter angles.

RANDOM ORBITAL SANDERS

(Also See Abrasives and Sanding Techniques)

Random orbital sanders are probably the best power sanders to have come along since the invention of sandpaper (2-337). Random orbital sanders vary the pattern of their sanding in random circular motions and, therefore, the user is not restricted to sanding wood with the grain. Very seldom are swirls detected as sometimes occurs in orbital in-line sanders.

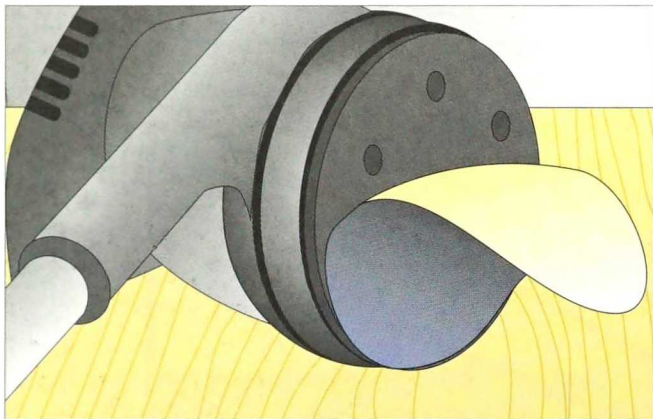
Most random orbital sanders are of the “palm” type and these are usually 5-inch-diameter pad types. Some use sanding discs that have holes in them to facilitate the exhaust of sawdust through the sander itself. The sawdust is collected in a built-in receptacle or through the attachment of a shop vacuum.



2-337. Random orbital sanders.

Other types of random orbital sanders are available that are usually similar to right-angle grinders and use 6-inch-diameter sanding discs. They are available in single- and variable-speed models, and the majority accept hook-and-loop sanding discs

(2-338). Some of the older types still use the adhesive-backed discs, but aftermarket hook-and-loop pads can convert them.



2-338. Hook-and-loop sanding discs can be reused many times and are available with or without perforations.

Setting Orbital Sanders Down

Older models of random orbital sanders take several minutes to stop turning. This means waiting to set them down on a workbench. The Sander Sitter shown in 2-339 solves that problem. It is built on a

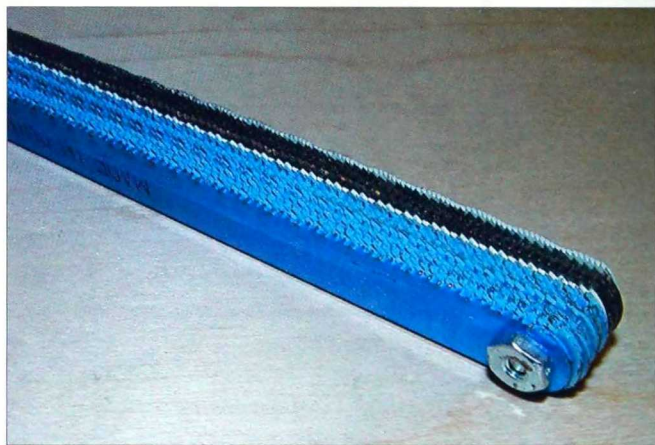


2-339. This Sander Sitter allows you to set your sander down while it is still running and cleans the sanding disc at the same time.

lazy Susan-type base and even allows you to keep the sander running while you turn your workpiece over to sand the other side. In addition, it has a crepe rubber piece inside that will clean your sanding disc at the same time.

RASP (SHOP-MADE)

Don't throw away those old hacksaw blades. As a matter of fact, if you can scrounge some from your local friendly plumber, do so. A pile of them about 1½ inches high will suffice. Make a stack and alternate the tooth direction of each blade. Install a nut and a bolt through the holes at each end and you have a really efficient rasp (2-340).



2-340. This efficient shop-made rasp utilizes old hacksaw blades.

REFINISHING FURNITURE

Refinishing Techniques

Your spouse has just come back from a flea market with an "antique" table in the back of the station wagon. It has 10 or 12 coats of paint and varnish on it, so you know what he/she has in mind. Off you go to the workshop.

The first thing to do is to get a scrap piece of plywood or paneling that is two feet larger all around

than the table. Set the table on it and move all your refinishing paraphernalia so that it's close at hand (2-341). With conventional strippers, the area should be well ventilated. 3M's product Safest Stripper does not require such a high degree of ventilation, though some is needed. This product cleans up with water, has high penetration strength, and gives off little odor or toxic fumes. The area temperature, though, should be around 21 degrees Celsius or 72 degrees Fahrenheit for the most effective penetration of this or almost any stripper.



2-341. A refinishing project ready for stripping and sitting on a scrap piece of plywood.

Rubber or latex gloves are mandatory when you are restripping furniture, as are safety glasses. If conventional strippers are used, I recommend the use of any approved respirator. *Proper ventilation is also required.*

Let's assume that you are using the Safest Stripper product. The materials required are as follows: old clothes; a selection of 3M's or Norton's finish removal pads (coarse, medium, and fine); a bucket of clean water or easy access to a laundry tub and faucet; a couple of rolls of paper towels; some pieces of scrap foam rubber; a wide putty knife; a copper wire brush; an old toothbrush; mineral spirits (varsol or paint thinner); screw-

drivers; a small pry bar; a utility knife; and an old plastic pail.

Before starting, I suggest you take a couple of photos with a Polaroid camera of the piece for both later comparison (it's nice to get a pat on the back once in a while) and to know where all those little pieces of hardware go. Remove *all* of the hardware pieces and set them in the plastic pail. A mini wonder bar can be used here to carefully remove those parts that are glued on with paint. Use the utility knife to carefully score around some parts to break the paint seal. Pour a little Safest Stripper over the parts in the bucket and put them aside.

Now, go to work. Follow the manufacturer's directions to the letter when applying the stripper. Use the removal pads and rinse them often in clean water. The putty knife, wire brush, and toothbrush are used for getting into those tight corners and the intricate details or carvings. The paper towels are for the final cleanup.

When applying this stripper, try this technique: Place a used plastic ice-cream container under each leg (2-342). The stripper that doesn't adhere will collect in the containers and can be reused.



2-342. Placing plastic containers under the legs of your refinishing project will allow you to collect the stripper drippings and reuse them.

When brushing on the stripper, do it in one direction only and do not go over the preceding strokes. This will weaken the penetration.

To determine if all the old finish and oils are removed when you are done, go over the entire piece with mineral spirits and clean paper towels. If there is any trace of the old finish on the paper towel, try one more application of stripper.

The tedious part is removing the paint from all of those little hardware parts. The copper brush should speed things up for you.

When you have finished stripping the project, you can see what it looked like when it was originally built. However, there are some unusual dark-stained rings on the top as well as what looks like a cigarette burn. Don't fret. Go into the laundry room and get a bottle of laundry bleach. Apply some to the spots (2-343). Usually, the rings will disappear, but the burns may only lighten up. But, as the antique dealers say, this will give character.



2-343. Household bleach will usually remove dark rings and some burn marks.

Now the fun begins. You are getting close to realizing what a bargain you got at that flea market. It's time to start the final finish.

* Determine the type of wood that the table is made of. If you don't know or can't identify it, take a sample to a lumberyard, cabinetmaker, or antique dealer. If you don't particularly like the natural color, then stain is the answer. My choice is the Diamond Finish stains by Flecto. These are water-soluble and easily cleaned with a damp cloth.

Before applying the stain, however, try this: Moisten the end of your finger and press it on the

top of the wood. The moistened area will be close to what the unstained color will be with an oil finish. If you are still convinced that the piece needs stain, start applying it. The easiest way that I know of applying stain is to use a scrap piece of foam rubber. Here's another technique: To increase the brown shades, use dark walnut. To increase the yellow shades, use oak. To increase the orange shades, use maple. To increase the red shades, use mahogany or cherry.

Apply your stain lightly and then use a clean soft cloth and wipe *diagonally* across the wood grain to help fill in the areas that are missed. Add more coats until the desired density is achieved. A light buffing with a synthetic sanding pad between coats will ensure a smooth finish.

If the natural wood is to your liking, then all that's left to do is apply a protective finish. Let's deal with this now. There are a number of options that you have. You can use the methods of the old-school wood finishers and start with fillers, conditioners, etc., or you could use the new methods, which I prefer. Whichever you choose, do the insides, edges, and underneath parts as well. This will help prevent the wood from expanding or contracting, which will cause warping and splitting later.

Using a high-speed palm sander and 240-grit and finer sandpaper, sand the entire piece. Vacuum the dust off it: *all of it*. Then use a tack cloth to wipe up any remaining dust. Apply water-soluble polyurethane (varathane) with a fine brush or a piece of scrap foam rubber. Use a synthetic (plastic) finishing pad between coats.

Note: Never use steel wool with these products. They are either water-based or have water in them. Any residue from the steel wool may leave rust spots.

After the third and final coat, I like to use boiled linseed oil rubbed in with a very fine finishing pad. I let it stand overnight and then wipe it off with a soft cloth dampened with mineral spirits.

One important point: Water-soluble polyurethane will lighten the finished product and will *not* darken the grain of the wood. The polyurethane product will tend to yellow the workpiece, but *will* enhance the grain. Staining the project will compensate for the color differentials.

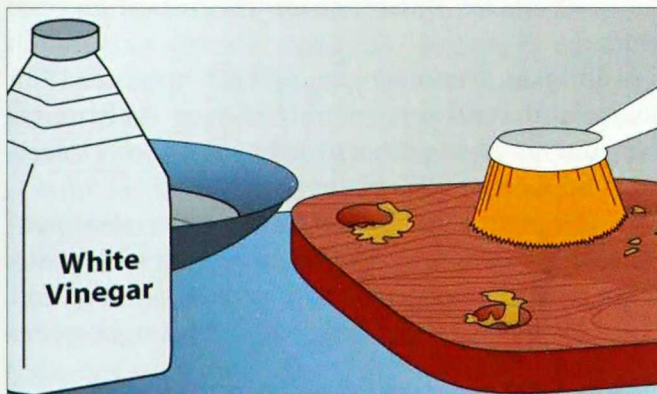
Should you want to change the natural color of the piece before finishing, you could select from some pastel shades of stain that look like milk paint.

If you are going to use an oil-based stain, the final finish should be a varnish, lacquer, or polyurethane. A water-based stain should be followed by a water-soluble polyurethane. Read the instructions on the labels.

A very important note: Do not just throw your old saturated rags away in a pile. They will probably self-combust. Put them outside or lay them flat over a clothesline until they are absolutely dry.

Removing Old Glue from Furniture

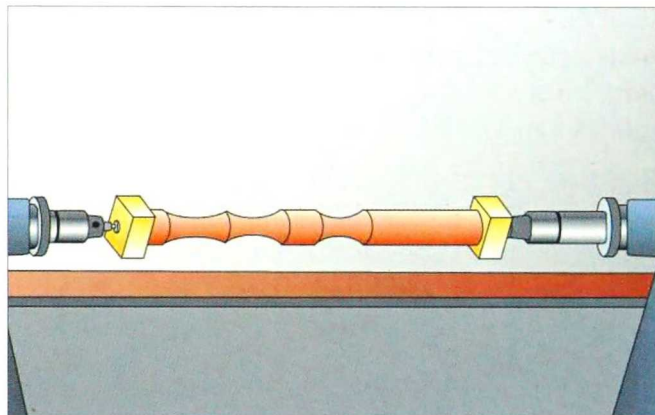
White vinegar will soften most hardened glue and make disassembly of furniture easier. Use a wire brush to remove most of it (2-344), but be careful as the vinegar may leave a stain where you don't want one. Try it on a test area first.



2-344. Vinegar will soften hardened glue and make it easier to remove.

Stripping Spindles

Spindles are always a problem when refinishing furniture. The intricate shapes are difficult to get into without distorting them with scrapers or even sandpaper. The easiest way of stripping them is to put them back into a lathe. Cut a couple of square pieces of scrap wood and attach them to the ends with hot-melt glue; then remount the spindle in the lathe (2-345). Sandpaper or even gouges or chisels will make quick work of the old finish.



2-345. Remounting spindles in a lathe makes stripping of an old finish easier.

ROUTERS

The router is one of the most frequently used and versatile tools in any workshop (2-346). It can make moldings, fancy edges, and dadoes and even cut circles and lettering. Many books have been written on this versatile tool, most notably *The New Router Handbook* by Patrick Spielman.

The router can be used freehand or mounted upside down in a router table to give the tool even more versatility. The table-mounted router can be used as a shaper to make custom moldings, raised panels, and the stiles and rails that go with them.

There are a variety of accessories available for the router that will further increase its versatility. For



2-346. A variety of routers.

example, a dovetail jig will allow you to make a wide selection of dovetail joints (2-347). Letter templates will help you make router signs. Edge guides (usually an option from the router manu-



2-347. One of the many commercially available dovetail jigs.



2-348. A typical router edge guide.

facturer) (2-348) help you keep the router straight. Circle guides (compasses) allow you to cut or rout circles for picture frames, etc. Bench-top router tables are available from a number of manufacturers, and router table tops with fences (2-349) are also available to fit on your shop-built base.

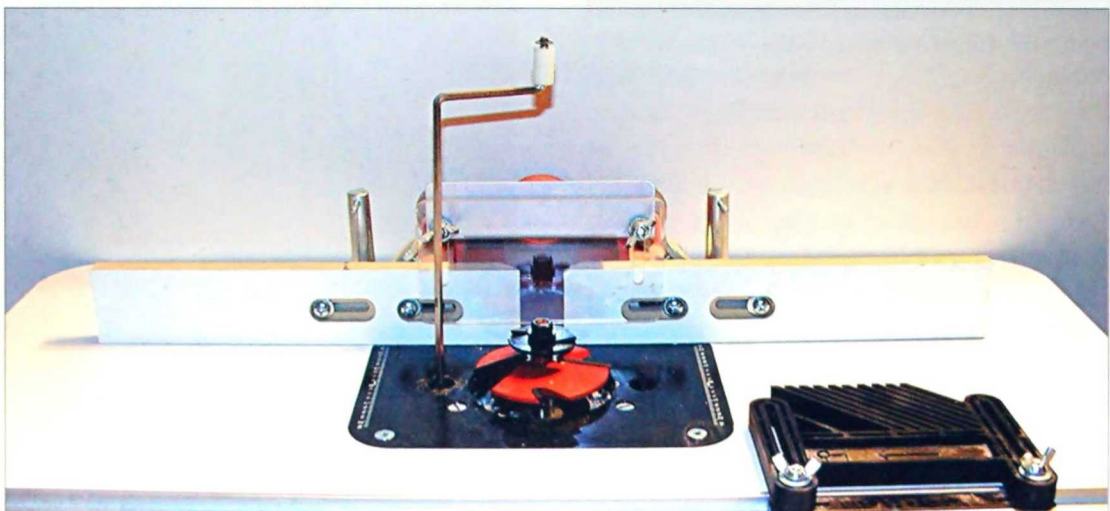
A well-equipped workshop will have at least two routers on hand. One of them should be permanently mounted under a router table, while the second can be used for edging, shelf dados, and other projects that require a portable machine.

There are many types and styles of routers available; before purchasing one, consider what you are going to be doing with it. If you were going to make cabinet doors, for example, one of the more powerful variable-speed routers mounted under a router table would be desirable. A less-powerful tool would be used for edging and trim work.

Plunge routers have the advantage of being able to commence routing in the center of a workpiece more accurately. Fixed-base routers are best for edge work.

Laminate trimmers are smaller versions of a router and generally use only 1/4-inch shaft router bits, but may be suitable in light routing work such as moldings and dados for shelving.

If you plan to do large projects such as raised panels for cabinet doors, you should select a router with a fairly high horsepower rating of 2 or more and with a variable-speed control (2-350). Larger router



2-349. A typical router table top and fence.



2-350. A variable-speed router is best if using large-diameter router bits.

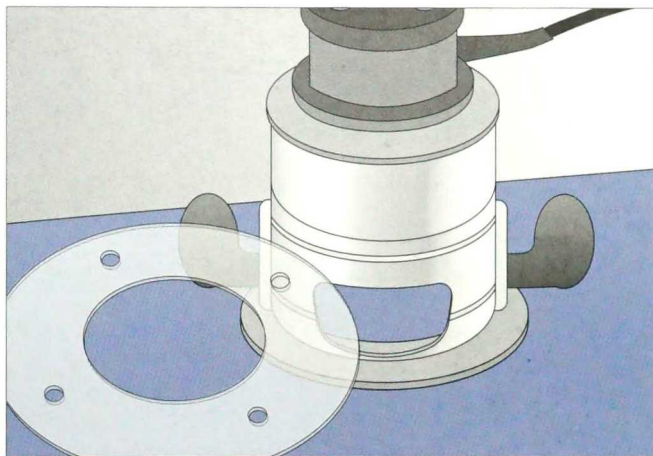
bits require a much slower speed than single-speed routers that typically run at 23,000 rpm or more.

The router can be a dangerous tool and you should be familiar with the manufacturer's owner's manual. Hearing and eye protection should be worn when using the tool. It is very important to either push the router or feed material against the rotation of the router bit. Kickback and possible injury could occur if this is not followed. Also, make a few shallow cuts rather than one deep cut.

Auxiliary Base

Using your existing base as a template, make two or three spare router bases out of 1/8-inch-thick clear Plexiglas (2-351). Make the center hole of the bases slightly larger than your biggest bit. Round off the outer edges with a piece of fine sandpaper. A clear base makes freehand routing a lot easier because you can see much more of the surface you are working on.

Leave the protective paper on the spare bases until you are ready to use them. Do not store the bases where direct sunlight will come into contact with them.



2-351. This router base has been made out of 1/8-inch-thick Plexiglas.

Measuring Router-Base Radius

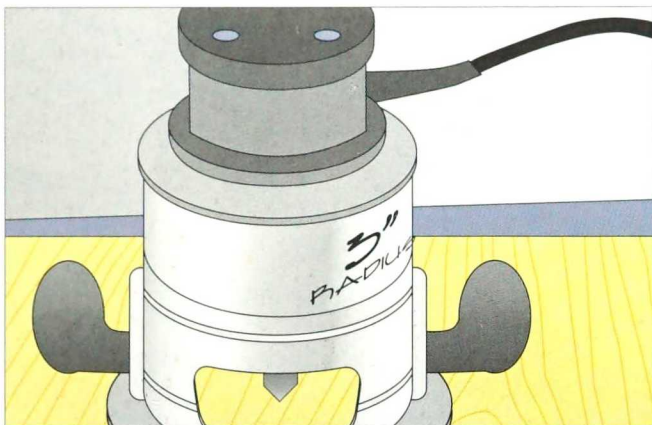
Knowing the radius of your router beforehand will be helpful when routing dadoes for shelves, for example. Write the measurement on a sticky label and put it on the base (2-352).



2-352. Write your router base radius on a sticky label.

Measuring Router Cutting Radius

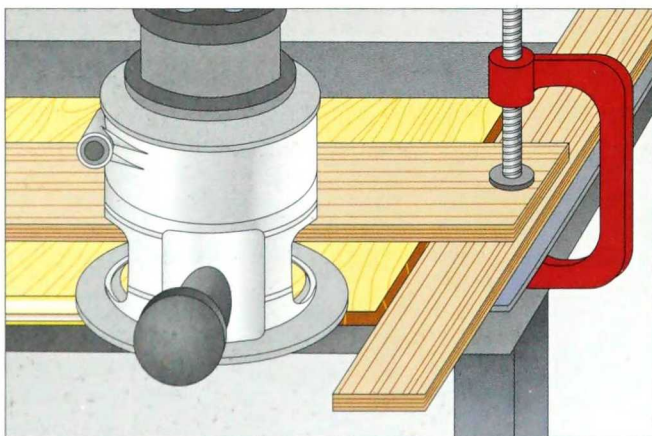
Measure the distance from the center of your router collet to the outer edge of your router base plate. Write this distance with a soft-tip marker on a sticky label and adhere it to the motor housing for future reference (2-353). This will save repeated measurements later.



2-353. Note that the router's cutting radius is written on the label adhered to the motor housing.

Molding Jig

A router table is not required if you make a straight-edge T-shaped jig out of $\frac{3}{4}$ -inch plywood (2-354). Clamp the jig to a fairly wide board, rout the molding edge, and rip the piece to the desired width on your table saw.



2-354. Use this shop-made, T-shaped straightedge for accurate edge moldings.

Router Bit Storage

Router bits should never be stored loose in a drawer or box; the bit edges can easily chip, and a chipped carbide bit can be dangerous to use.

I built a mobile router table and I like to keep the bits handy with a simple storage panel made from $\frac{1}{4}$ -inch plywood (2-355). You can mount it on your

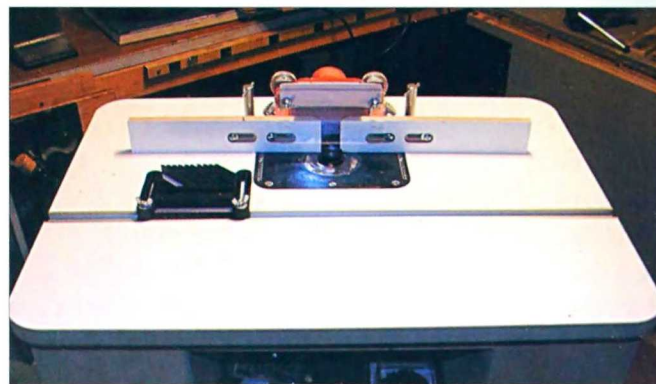


2-355. Router bit edges are quite fragile. This storage panel keeps the bits apart and safe from damage.

router table base or drill some through holes to hang it from pegboard.

Router Tables

Routers are made more versatile when they are mounted under a router table. Router tables of many types are available for sale as complete units, or you can buy the principal parts separately such as the tabletop or a fence unit. Some woodworkers prefer to make their own router tables, and these components make the work easier (2-356). There

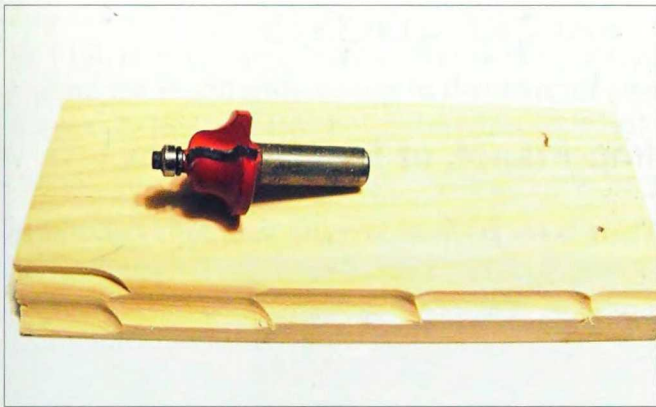


2-356. A router table.

are many sources of plans for building your own router table on the Internet.

Testing Router Bits

Many router bits will produce different shapes just by raising or lowering them. Before determining the edge pattern, test your router bit on a scrap piece first to determine if that is the pattern you are looking for (2-357).



2-357. Raising or lowering your router bit will provide an assortment of edge patterns.

RUBBER CEMENT

Rubber cement, sometimes called paper cement, makes an excellent temporary adhesive (2-358). Use it for stacking stock together for multiple pattern-making or to adhere paper patterns for use in scroll-sawing. The cement won't stain the wood and is easy to remove. For stacking wood pieces together, it should be applied to both surfaces much like contact cement. A little prodding with a putty knife will separate the pieces when the cutting is done.

To adhere paper patterns, glue only the wood surface and apply the pattern while the glue is still wet. When done, the pattern will peel off easily and any residue can be rubbed off with your fingers.



2-358. Rubber cement works well for sticking paper patterns on wood surfaces.

RUST (PREVENTING)

Graham's law: Tools will rust. Unused tools will rust faster. Well, it's not really *my* law; Mother Nature has followed it long before me.

There are a number of ways to sidestep this law. Here are two:

Get friendly with your neighborhood electronics dealers, the ones who sell televisions and stereos. Ask them to save the little packs of "silica gel" that are usually packed with the new equipment that they get. Throw a couple of these in each of your tool chest drawers (2-359). They will absorb a lot of the moisture that causes your tools to rust.



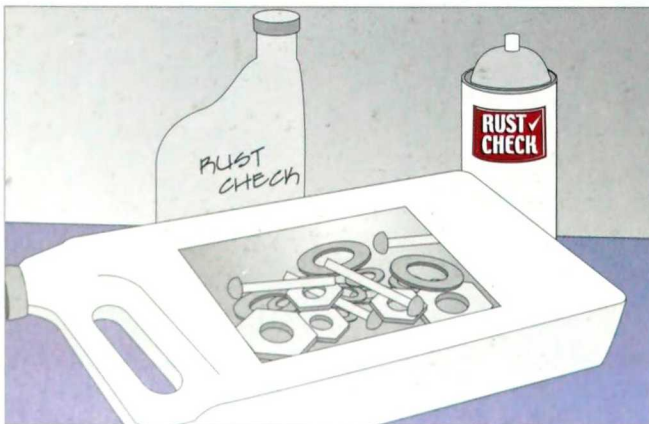
2-359. Silica gel packs placed in your tool drawers will absorb moisture and help prevent rust. Spraying your tool drawers with silicone will also prevent the tools from rusting.

Another way to prevent your tools from rusting is to spray silicone on the drawer bottoms of your tool chest. Do not do this with the tools in place. Spraying the tools will also prevent rust, but it will also make the handles and grips very *slippery*. Make sure that the silicone has dried before placing the tools back in the drawers. Before using the tools, check the handles to make sure that there are no traces of the silicone on them. Any residue may be removed with mineral spirits.

RUST CHECK

Rust Check is a rust-inhibiting, oil-like substance that is usually used on automobiles, but works equally well on tools. There is usually a Rust Check dealer in every town and city, so obtaining the product will not pose a problem.

Somewhere in your workshop is a container full of rusty nuts, bolts, and screws, and probably a screwdriver as well. Now's your chance to make use of them. Take an old windshield-washer fluid container and cut a rectangular piece out of one side. Leave the cap on. Dump the rusted parts in it and then pour either paint thinner or engine cleaner on them. Let them sit for a couple of days; then drain the paint thinner or engine cleaner and wipe the parts. Dry them off, clean out the container, put the parts back in, and pour Rust Check over them (2-360). After a day or so, drain but don't discard



2-360. Rust Check will clean up rusty parts when left to soak in it for a while.

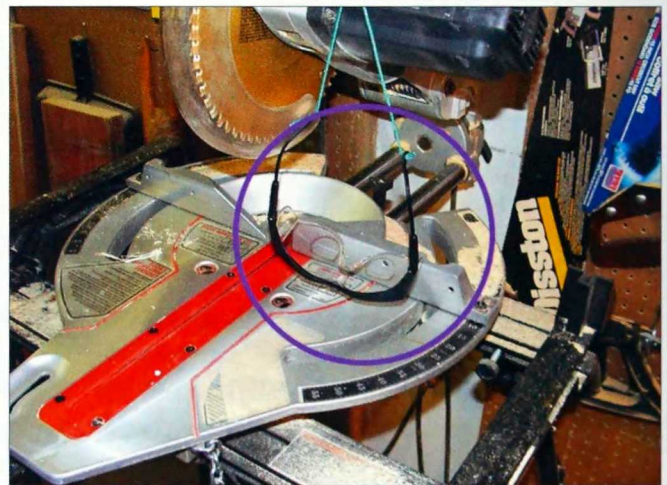
the Rust Check. The used Rust Check can be used again for a few more applications.

Use Rust Check on such things as band-, table-, or circular-saw tables, hand plane and planer bases, or any other metal surface that may have a tendency to rust. Simply wipe it on generously, let it sit overnight, and then wipe it off. Spills can be cleaned up with dish detergent and water.

SAFETY GLASSES

Importance of Safety Glasses

There is no point to keeping your safety glasses in your tool drawer as the old adage “out of sight, out of mind” will probably apply. I like to keep mine attached to one of the tools that I frequently use—in this case, my compound miter saw (2-361). The location almost forces me to put them on.



2-361. I attach my safety goggles to my compound miter saw—the tool I use most frequently in the workshop.

Keep a few extra pairs of safety goggles around the shop. They will come in handy when visitors are working with you. Don't allow anyone near your tools without goggles or a safety visor on. Don't go near a tool without wearing some form of eye protection.

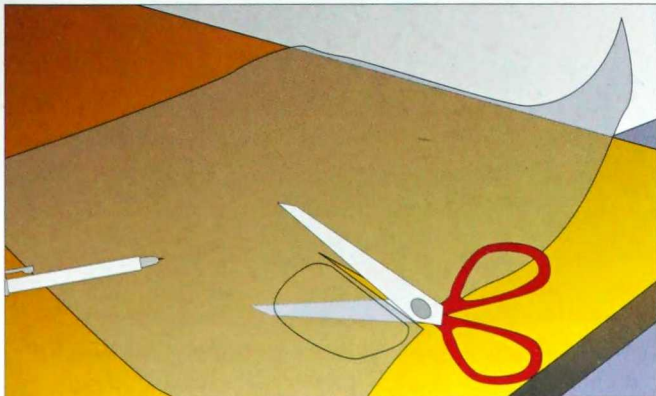
Types of Safety Glasses

There are different types of safety glasses, face shields, and goggles available, but before buying any you should make sure that they are safety-certified. The best types are those that protect the temples as well as the eyes (2-362). If you wear glasses, there are types that will fit over them. There are also safety glasses that have bi-focal lenses and are available in various strengths.

You can extend the life of safety glasses, goggles, and face-shields by purchasing an inexpensive sheet of thin Lexan polycarbonate. The Lexan polycarbonate can be cut with scissors to the shape of your glasses (2-363) and taped over the edges of them.



2-362. Safety glasses should protect both the eyes and the temples.



2-363. Lexan can be used to make spare lenses for safety glasses.

SANDERS

(See Belt Sander, Random Orbital Sanders, Sanding Belts and Drums, and Sanding Techniques)

SANDPAPER

(See Abrasives)

SANDING TECHNIQUES

Preventing Marks When Sanding

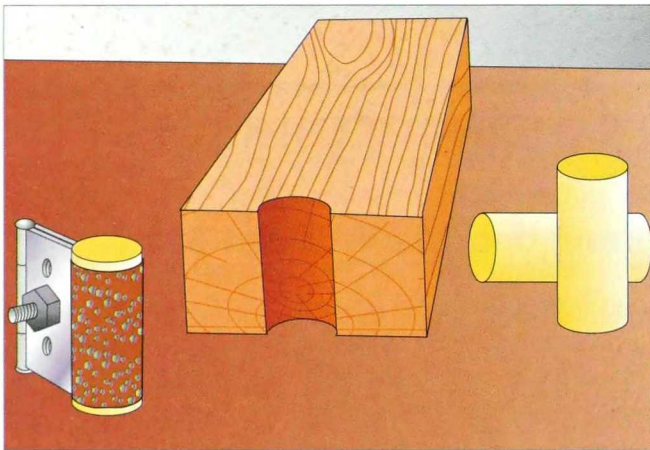
When sanding a horizontal surface close to vertical edges, a random orbital sander can leave deep marks when you sand too close. A thin piece of cardboard taped to the vertical edge will prevent this (2-364).



2-364. Cardboard taped to the vertical sides of the workpiece will prevent the sander from marking it.

Sanding Concave Surfaces

Hand-sanding concave surfaces can be difficult because it is difficult to maintain the flat shape of the edge with your finger wrapped in sandpaper, as one would normally do. Try this shortcut the next time: Take a piece of dowel as close as possible in diameter to what you want to sand. Wrap a piece of sandpaper around it, grit side out, and leave a “tail” at each end so that they may be clamped together. Close the plates of an old butt hinge over the tails and tighten the hinge with a small bolt and wing nut (2-365).

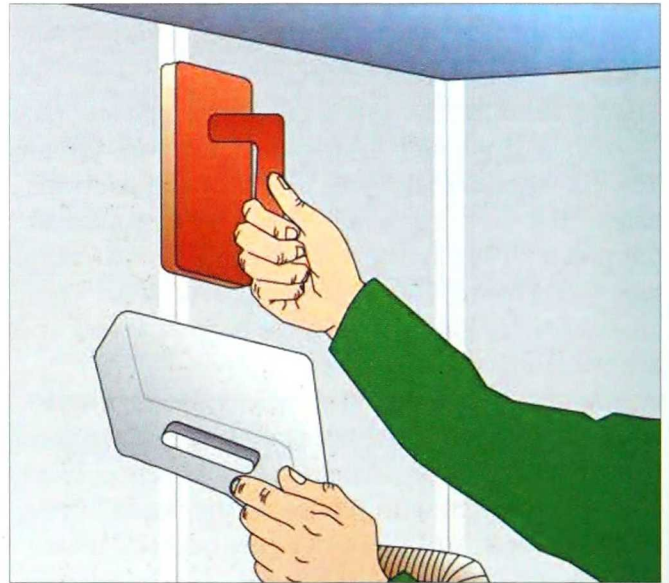


2-365. This shop-made aid can be used to sand concave surfaces.

Sanding Drywall Joints

When sanding drywall joints either by hand or with a sander, a lot of dust is created. To keep the dust down to a minimum, cut the bottom of a plastic windshield-wiper fluid bottle. Remove the cap and use duct tape to attach the cap end to a shop vacuum. Hold the bottle just below the area that you are sanding (2-366).

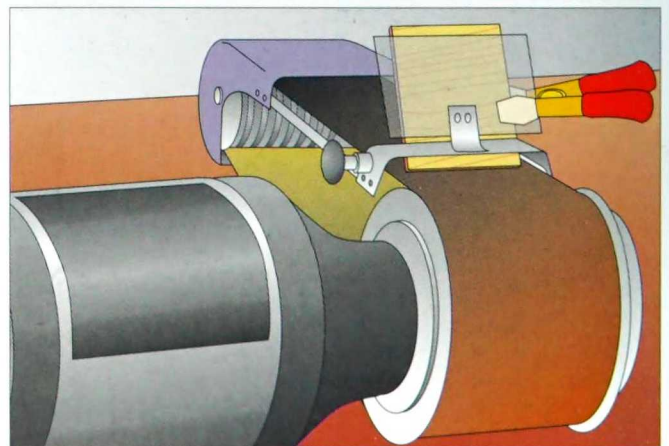
Note: Gypsum board (gyproc) dust can be very damaging to a vacuum, so do not use your home vacuum cleaner for this.



2-366. A windshield washer bottle makes a great funnel for controlling dust when sanding gypsum plasterboard.

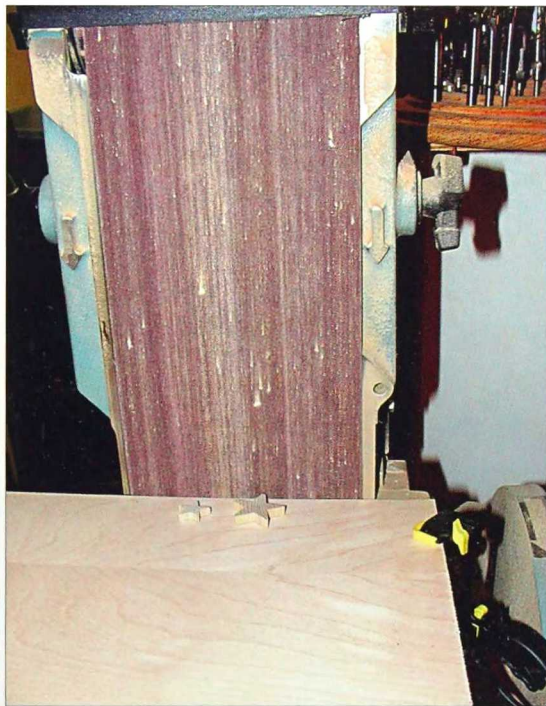
Sanding Small Parts

There are times when you have to use your stationary belt sander to clean a small part. These little parts have a tendency to slip between the fence and the sanding belt. To prevent this, clamp a piece of $\frac{1}{4}$ -inch-thick plywood that is as wide as the belt to the sander's fence. Clamp it so that it is snug against the sanding belt (2-367). Then carefully proceed to sand your small workpiece (2-368). The



2-367. The fence/table on most stationary belt sanders does not get close enough to the belt and will allow small parts to slip through the space. Clamping a thin piece of plywood to the fence/table will prevent this.

additional fence will prevent your workpiece from sliding under the metal fence.



2-368. The sanded pieces.

SAWDUST

Sawdust has hazards. In addition to the fact that some species of wood can be toxic, a sawdust-filled workshop can be highly flammable. Dust that is floating in the air can be easily ignited by a spark or a flame. *Do not* smoke or allow any open flames in your workshop.

Leaving sawdust on the shop floor is like putting powdered wax on a dance floor. It makes it very slippery. A fall on a dance floor is embarrassing. A fall on your shop floor could be fatal. I vacuum my workshop at least once a week and I recommend you do the same (2-369).

Air Cleaners

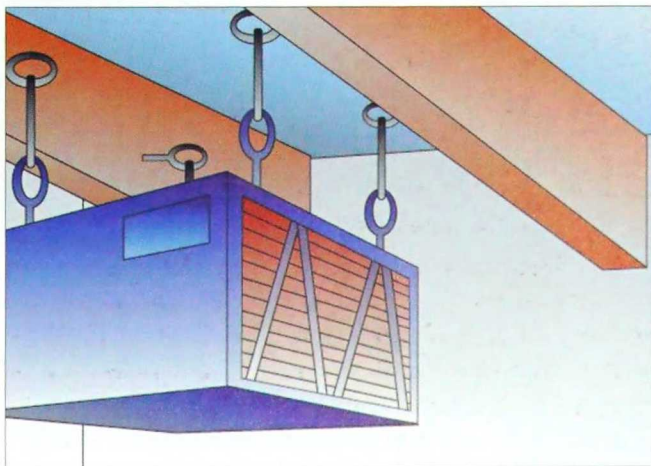
Shop air cleaners are really efficient in removing floating sawdust from your shop. They are, however,



2-369. Vacuuming your shop at least once a week will remove hazards like slippery floors and combustible sawdust.

noisy. They are really noisy in home workshops because they are usually suspended from the overhead joists and when turned on they reverberate through the floor above.

To avoid this, hang the unit with large rubber O rings, or even springs, between the air-cleaner hooks and the support hooks (2-370). These will "dampen" the vibration.



2-370. When hanging an air cleaner, use rubber O rings or springs between the air-cleaner hooks and support hooks. They will cut down on the noise transmitted through the joists.

Clearing Sawdust Blockage

If you are using ABS or PVC piping for your central sawdust collection unit, here is a way to ensure that any clogging of the pipes can be readily cleared. Most fittings such as elbows, "Ts," "Ys," and connectors fit tightly without the use of a solvent glue (2-371). Leave them just that way. There will be very little air or pressure loss and you will be thankful if there is a blockage in the line.

Flexible hoses can be easily dismantled because of the screw-type fastening clamps (2-372). However, you should not make the runs too long. You may have to get inside them for cleanout.



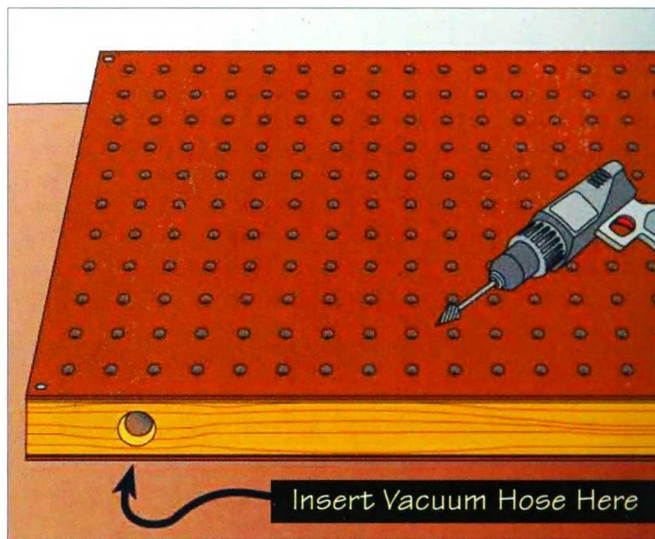
2-371. Do not use glue with these types of dust collector fittings. They will fit tightly and then may be opened to remove any blockages.



2-372. Flexible hoses allow easy access for the removal of sawdust blockages.

Down-Draft Collection

A down-draft table is a sanding table with a perforated top surface and a fan underneath that sucks the sawdust down and into a dust bag. It has the advantage of lowering the level of airborne sawdust. Down-draft sanding tables are quite expensive and generally made for commercial workshops. You can make your own on a smaller scale with pegboard (2-373).



2-373. A shop-made down-draft table will greatly reduce sawdust in the home workshop.

Build a frame of 1 x 4s about 12 inches wide x 24 inches long and cut a slot around the perimeter to accommodate a piece of pegboard to fit. The slot should be about $\frac{1}{4}$ inch below the top edge. Cover the bottom of the frame with a solid piece of Masonite or thin plywood and then drill a hole in the center of one end to the size of your shop vacuum nozzle.

To further improve the dust collection, use a countersink drill bit to chamfer each of the pegboard holes.

Dust Collection with Portable Tools

Most portable power tools made today have some sort of accommodation for the collection of sawdust. This is usually in the form of a tube near the

rear of the tool; the sawdust is collected into a supplied cloth bag or a container of sorts. The amount of sawdust collected is much less than 100 percent. Most of these tubes, though, are readily adaptable to shop vacuum cleaners, but that is not a sure thing. There apparently is no standard outlet size at this writing.

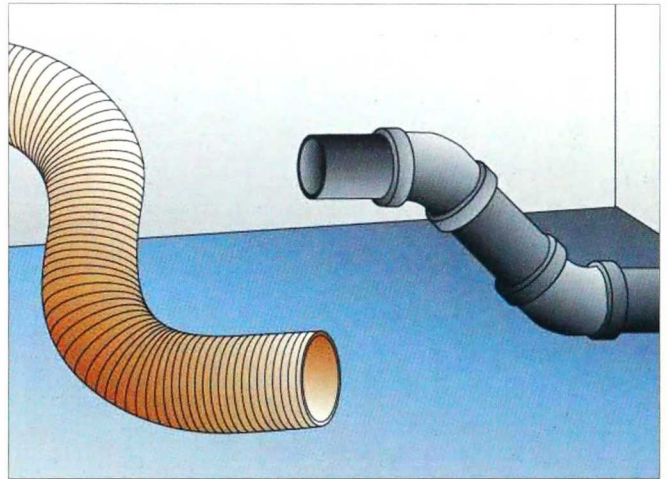
There is an answer, however, and that is through the use of a heat gun. As these tubes are made of a type of plastic, they can be reshaped to fit the nozzle of your shop vacuum quite easily (2-374). Some of the tubes, though, are rectangular and a short length of PVC or ABS plastic pipe can be shaped to fit.



2-374. A heat gun will soften the dust-collection connectors found on most portable tools so that they can connect to a shop vacuum.

Installing Dust-Collection Systems

When installing dust-collection systems, try to avoid the use of “flexible” hose in long runs. The flexible hose will reduce the efficiency of the system. In addition, at corners, use what are called “sweeps” or a pair of 45-degree elbows with a short pipe between (2-375). Ninety-degree elbows are more apt to clog the system.



2-375. Use long sweeps in corners for your dust collection system. Avoid flexible pipe.

Metal Straps on Dust Collectors

Getting the metal strap around the lower dust bag of a dust collector can be frustrating. Using strong magnets like rare earth magnets can make the job easier (2-376). Place two or three around the bag and frame to hold the empty bag in place and then fasten the metal strap.



2-376. Rare earth magnets help in replacing the dust-collection bag.

Preventing Sawdust Blockage

When installing ABS or PVC pipe for a central dust collection system, avoid the use of 90-degree

elbows as these can quickly clog up and invariably they will (2-377). Use what are called "sweeps" (2-378), which have a more gradual 90-degree turn. If these are not available, use two 45-degree elbows with a 3-inch length of pipe between them (2-379).



2-377. Do not use tight 90-degree elbows.



2-378. A "sweep" such as this has fewer tendencies to block up.



2-379. An alternative to a "sweep" is the use of two 45-degree elbows with a 3-inch pipe between them.

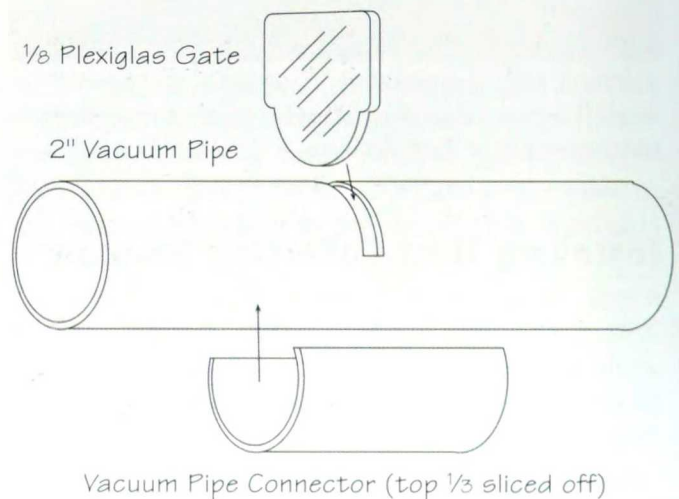
Removing Sawdust

The most efficient way to remove sawdust is in the area where it is being produced, and the best way to do this is to install a commercial dust-collection system. However, these can be very expensive. If you are a pack rat like I am, you probably have most of the parts necessary to make your own. I used a 45-gallon plastic drum and installed a vacuum power head (motor) to the top of it. I then drilled a hole to accept a 2-inch hose and connected the hose to some PVC vacuum piping. I connected the pipes in a series of T, L, and Y shapes to my stationary power tools.

The next thing I made was the gates. Gates serve the purpose of closing the sections of pipe that are not being used so that the vacuum suction is more efficient on the tool that you are running (2-380). The gates should be conveniently close to each tool.

To make the gates, I made a cut halfway into the pipe with my radial arm saw. I then made a U-shaped piece out of $\frac{1}{8}$ -inch Plexiglas. Using a connector, I first cut partway into it, and then sliced about 40 percent off it. Now, when the gate is out, I rotate the connector over the open slot to prevent any air loss.

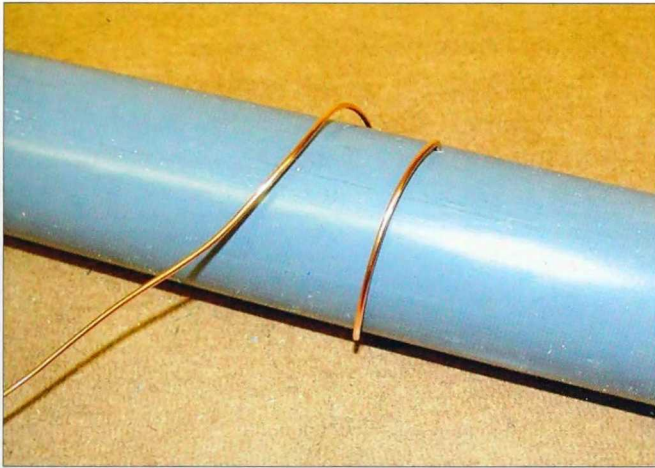
Shop-Made Vacuum Gate



2-380. Construction of the shop-made vacuum gate.

Sawdust Static

Static can build up in sawdust collection systems that use PVC (polyvinyl chloride), ABS (acrylonitrile-butadiene-styrene), or metal pipes. Although there have not been many reports of explosions due to this, you can get quite a shock if you touch the pipe. To avoid this, wrap some copper wire around a section of it and connect the wire to the ground on an electrical outlet (2-381).



2-381. A copper wire wrapped around your dust-collection pipe will prevent static build-up.

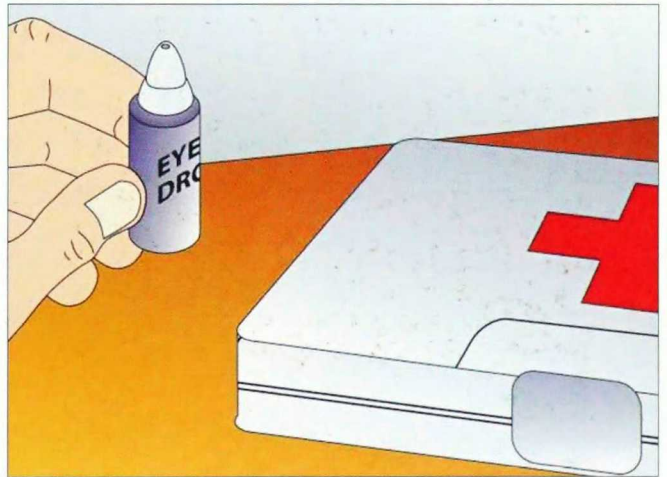
Static Control

Most safety glass is made of plastic, and plastic attracts sawdust. Many times, I have put on a safety shield covered in sawdust, only to think that maybe somebody turned off the lights.

To help minimize sawdust buildup on your safety glasses, wipe them occasionally with a used sheet of fabric softener (2-382). It will stop static cling.



2-382. One way to control sawdust buildup on safety glasses is to wipe them occasionally with a used sheet of fabric softener.



2-383. Artificial tears will rinse away a dust speck in your eye.

Treating Sawdust in the Eyes

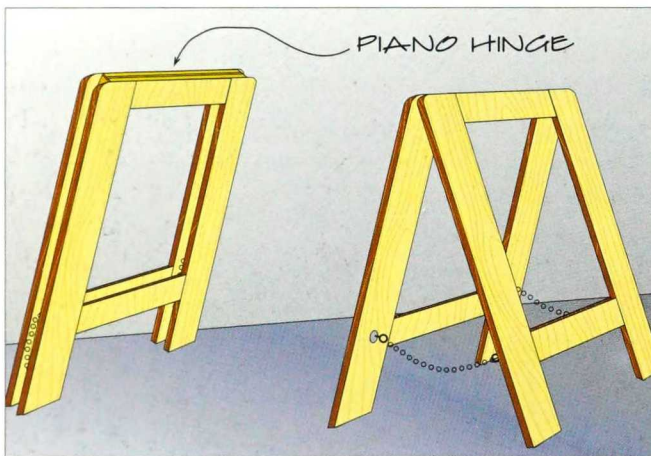
With sawdust ever present in the workshop, invariably at some point in time you will end up with a speck in your eye, and that is annoying. Don't rub it; instead use a drop or two from a bottle of artificial tears. I think that this is a saline solution, and it will wash that dust speck away. Keep a bottle of it in your first-aid kit (2-383).

SAWHORSES

Sawhorses in some form or other have been around since woodworking was invented. Although they are easy enough to build, they are cumbersome to handle and take up valuable space in a home workshop. Sawhorses are invaluable tools and any well-equipped shop should have at least two of them.

Folding Sawhorses (#1)

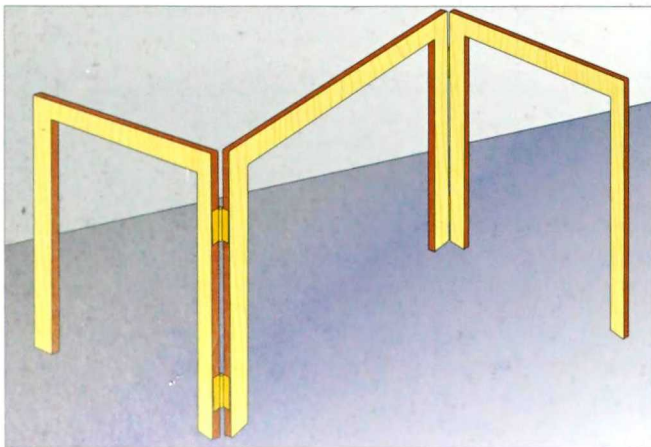
Most sawhorses take up a lot of room in a small workshop. An easy way of keeping them out of the way is to build them so that they fold up. Instead of using one 2 x 4 for the top piece, use two of them and run a piano hinge down the center to connect them. A chain and a couple of hooks attached to the legs will keep them from opening too far (2-384).



2-384. This folding sawhorse takes up very little space and is easy to build.

Folding Sawhorses (#2)

The sawhorse pictured in 2-385 is a different style of folding sawhorse. I came up with this idea when I had a bunch of cabinet carcasses to build. My shop



2-385. This type of folding sawhorse is helpful when you are working on cabinet carcasses.

was not big, so the sawhorse had to fold up when not in use. You can use 1 x 4s or 2 x 4s to make it; the joints are half-lap and the main beam is six feet long. The swing-arms are 30 inches long; they can be attached with either butt hinges or piano hinges. This is a surprisingly steady rig that worked well for me.

Padding Sawhorses

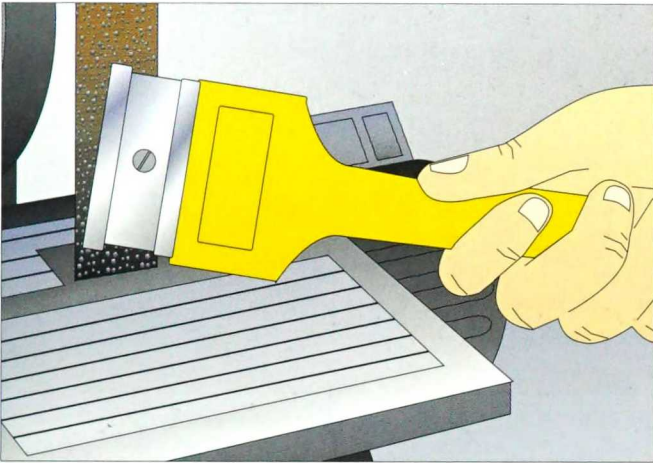
Sometimes you have to put finished pieces on sawhorses and there is always the danger that they can get scratched. Keep a couple of 2 x 4s wrapped in inexpensive carpet remnants on hand. Stapling will keep the carpet secure and clamps will hold the pads to the sawhorses (2-386).



2-386. Carpet remnants make inexpensive pads for working on finished furniture pieces.

SCRAPERS (HONING)

A quick and easy way to hone your scraper is the method shown in 2-387, using your stationary belt sander. Do this in short bursts, though, because you don't want to destroy the blade's temper.



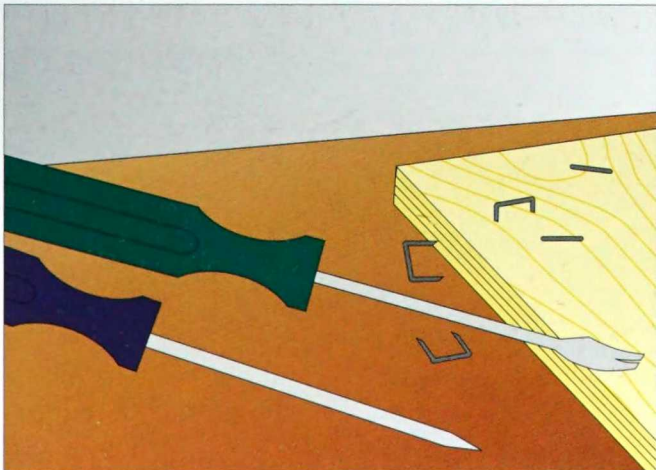
2-387. Honing a scraper with a stationary belt sander.

SCRATCH AWL

(See Awl)

SCREWDRIVERS (REUSING)

Never throw old screwdrivers away unless they are really bent out of shape. They can be reground to become a very useful tool (2-388). For example,



2-388. These "new" tools were made from old screwdrivers that would normally be thrown out.

grinding them to a point will turn them into a useful scratch awl. Grinding an old flat-headed screwdriver to give it a razor-sharp blade will turn it into a chisel. Cut a thin V slot in the blade and then bend it. You now have a brad or staple remover. Other uses include a punch, a nailset, etc.

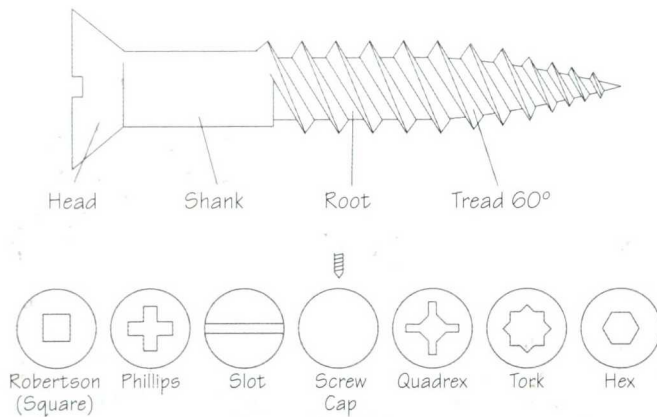
SCREWS

Wood screws consist of a head and shank (2-389), with most or all of the shank being threaded. Wood screws come in a variety of different shapes. Each one is designed for a specific purpose. These shapes range from flat head to round head to pan head to bugle head. Most screws come in lengths starting at $\frac{1}{4}$ inch and go up to 6 inches or more. The diameter of the screw is called the *gauge* and is usually expressed in whole numbers, i.e., #7 x $1\frac{1}{4}$ inches long.



2-389. Wood screws.

The drive of the screw can vary as well, as can be seen in 2-390. The Robertson, or square-drive screw is very popular in Canada and is becoming popular in the United States. This is my personal favorite because the drive will take more torque than a slot drive. Another advantage is that a Robertson screwdriver will hold the screw so that you can reach those difficult corners. The Quadrex screw will accept a Robertson and a Phillips screwdriver. The slot-drive screw is becoming obsolete.



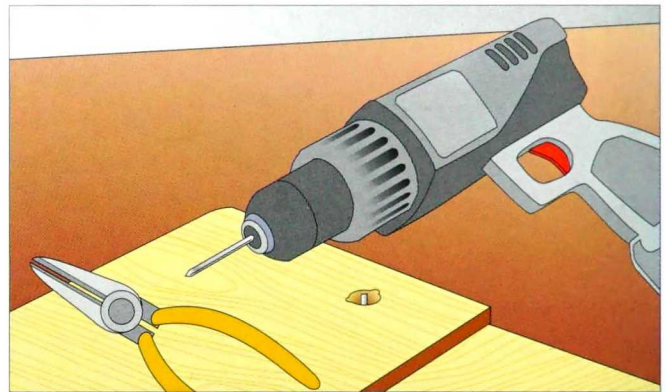
2-390. Anatomy and shapes of screws.

The bugle-head screw (also known as a drywall screw) is now regularly used in woodworking, especially for fastening plywood and other softwoods. These screws are often available in the Phillips drive, but I have seen them in square drives as well. The advantage is that they do not require a pilot hole. When using them, though, make sure that the two pieces of stock are held tightly before screwing, because there is no unthreaded shank to pull the pieces together. Another advantage is that the dry-wall screw is self-countersinking.

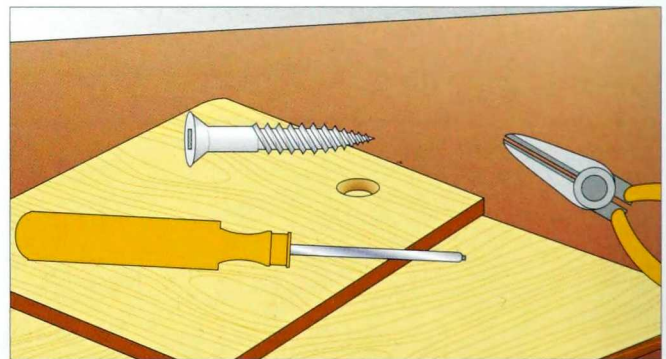
Broken Screws

When a screw breaks off just as you are assembling your finally completed project, you count to ten, curse anyway, and then take your portable drill and carefully drill a $\frac{1}{16}$ -inch hole on an angle through the edge of the wood and into the screw. Do this a couple of more times in different positions. Now, use a pair of needle-nose pliers to grip and remove the screw remains (2-391).

The next step is to repair the hole. Drill a hole slightly larger than the existing one by using a bit that is equal in size to a dowel that you have on hand (2-392). Cut the dowel to its proper length and glue and insert it into the hole, making sure that the grain in the dowel runs in the same direction as your workpiece. Select a screw larger in gauge than the one removed, drill a new pilot hole, and countersink and carefully drive the screw home.



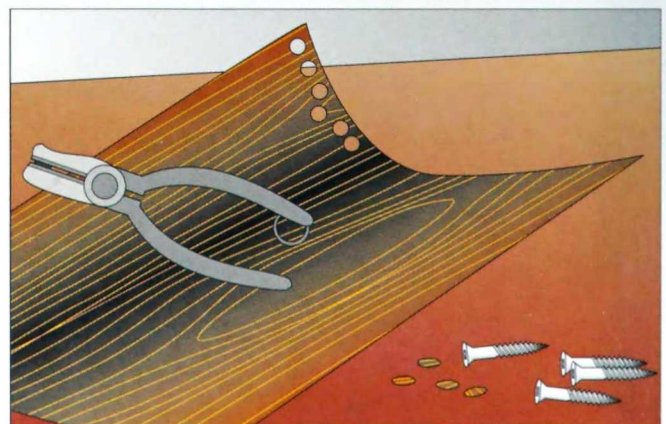
2-391. Using a pair of pliers to remove the screw remains.



2-392. Drill a hole slightly larger than the existing one.

Countersink Covers

Try this technique for making countersink covers: Buy a common paper-hole punch from a stationary store. This tool is great for punching out "dots" in veneer (2-393).

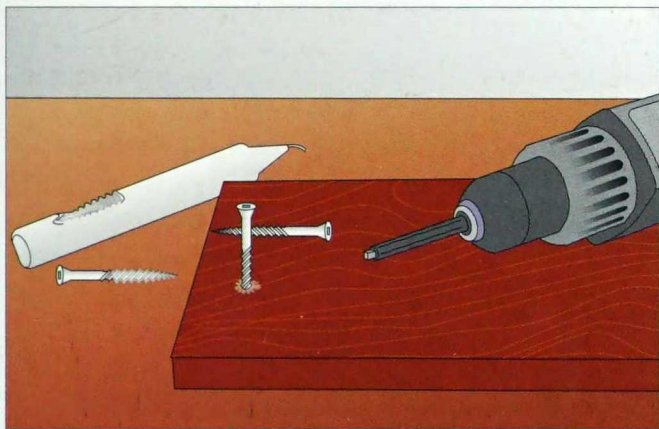


2-393. A paper-hole punch can be used to punch out dots in veneer.

Put a little contact cement on the screw head and the veneer, and you have a perfect screw cover.

Driving Screws into Hardwood

Driving screws into hardwood can be difficult at the best of times, even with a pilot hole drilled. This technique will make things a little easier for you: Keep a wax candle, some beeswax, or a block of paraffin wax near your screw cabinet. After you have drilled your pilot hole, apply any of the above to the screw threads and proceed to drive the screw (2-394). You will find a big difference in the effort required.



2-394. If you apply wax to the screw threads after drilling a pilot hole in hardwood, it will be much easier to drive the screw.

Driving Screws into Wood in Tight Spots

Those short five-sided bits that come with cordless screwdrivers will fit nicely into a 1/4-inch socket (2-395). A socket wrench is just the thing then if you are working in tight corners or where the height is restricted. Drill pilot holes from underneath, or, if this can't be done, use drywall screws.

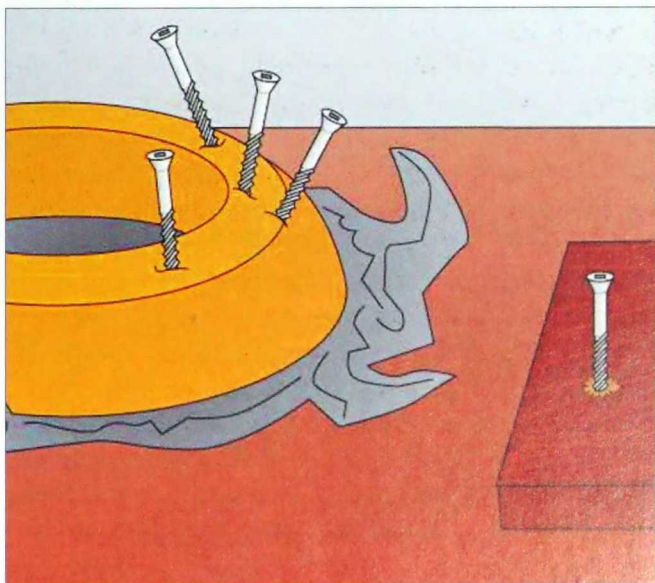


2-395. A socket wrench with a 1/4-inch socket will hold a screwdriver bit for placing screws in a restricted area.

Lubricating Wood Screws

Wood screws will go into hardwoods much easier if they are lubricated. An easy way of doing this is to buy a toilet bowl wax seal.

When you are ready to assemble that project, put the screws into the wax to keep them handy for use and lubrication at the same time (2-396). Keep the wax seal in a closed container for future use.

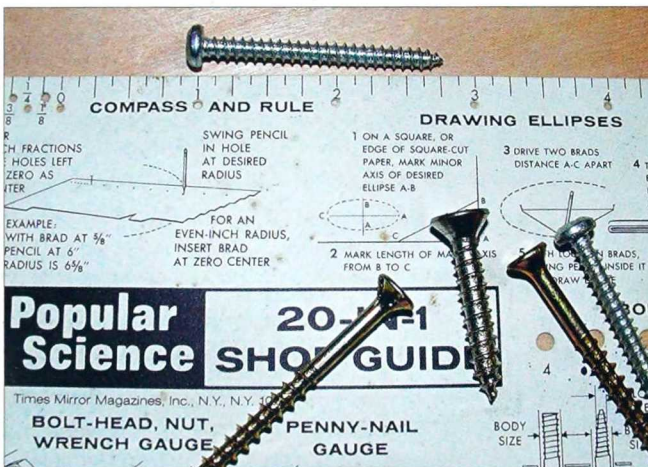


2-396. Keeping screws in a wax toilet-bowl seal lubricates them for screwing into hardwoods.

Measuring Screws

When is a 2-inch screw *not* a 2-inch screw? When it's a pan-head screw.

Care should be taken when using a tape measure to verify the length of screws because the measurements vary with the type of screw being measured (2-397). As an example, a roundhead screw is measured from the under portion of the head, while a flathead screw is measured from the top surface of the head.



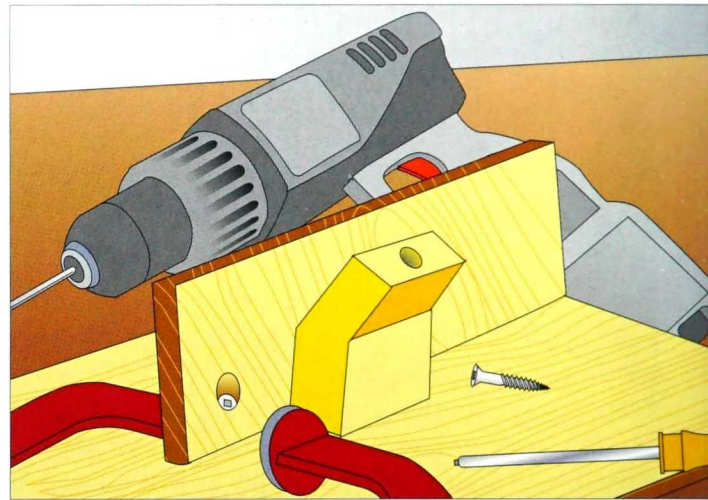
2-397. The measurements of screws vary depending on the type of screw being measured.

Pocket-Hole Jig for Screws

Pocket holes are an exceptionally good way to join cabinetry components because the screws are completely hidden. Commercially made hole jigs can be very expensive. Here's a way to get professional-looking pocket holes with a simple shop-made jig.

Use a 1 x 1-inch piece of maple or similar hardwood and cut it to a 3-inch length. The usual angle for pocket holes is 15 degrees, so cut one inch off the maple at a 15-degree angle. Rotate the pieces and glue them back together as shown in 2-398.

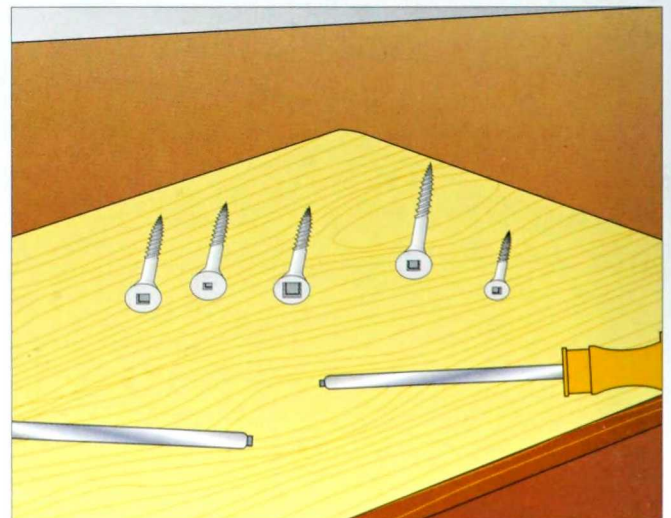
Using a $\frac{3}{8}$ -inch drill bit, drill a hole through the center of the longer piece, all the way through. That's the jig. To use it, simply clamp it to your workpiece and use the same $\frac{3}{8}$ -inch drill bit to drill a shallow hole into your workpiece. A smaller drill bit is used to counterbore. Some testing on a scrap piece will be required to get it just right.



2-398. This shop-made pocket hole jig will do the job of an expensive commercial jig.

Purchasing Screws

The next time you are in your local hardware store to pick up some screws for your project, buy square-drive screws, also known as Robertson screws. These screws have a square hole in their tops and will take more torque than the conventional slot- or Phillips-head screws (2-399). Another advantage is that the screwdriver will actually hold the screw so it can be placed in vertical or overhead positions. These screws cost about the same as the other types of screws.

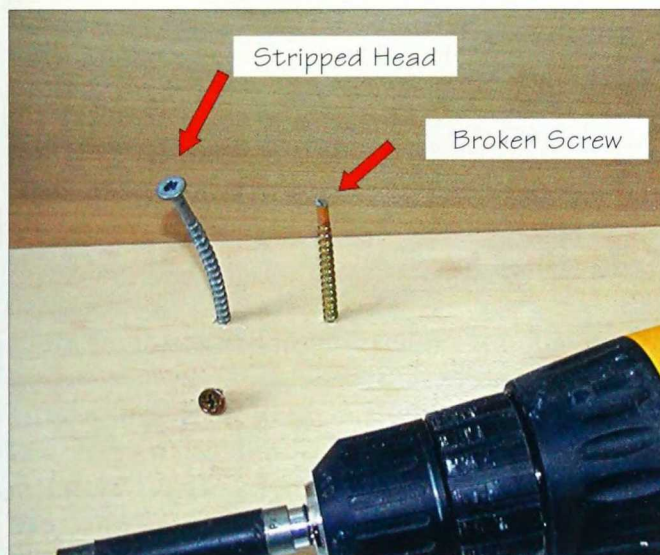


2-399. Examples of square-drive screws.

Removing Broken Screws

A bent or broken screw is always a woodworker's nightmare, especially in a nearly finished project. A screw with a stripped head is just as annoying (2-400). Don't get upset about it, as this workshop technique may solve the problem.

The drill/driver that you used to install the screw in the first place is probably the best tool for removing the damaged screw. Remove the screwdriver bit from your drill and then set the drill chuck over the screw. Tighten the chuck real snug and then put the drill in reverse (2-401). This should do the trick.



2-400. Screws that are broken or have the head stripped are a nightmare for woodworkers.



2-401. Damaged screws can be removed by putting your drill chuck on them, tightening them up, and then putting your drill in reverse.

Repairing Broken Screws

It can be very annoying when a screw breaks off when a project is being assembled. The removal of it can cause a lot of damage to the project.

Here's a way of removing the screw and causing minimal damage (2-402). Drill small diagonal holes around the perimeter of the screw so that you can get a pair of needle-nose pliers in there to grip and remove the broken screw. Once the screw is out, enlarge the screw hole to the diameter of a small dowel. Cut the dowel to a length that fits flush with the surface and then glue it into position.

When the glue dries, use a countersink bit to recess the new screw and then counterbore for a larger screw. Once the new, larger screw is set, use a plug cutter on a piece of similar scrap wood and cover up the screw with the plug.



2-402. A broken screw can be repaired with little damage to the finished workpiece.

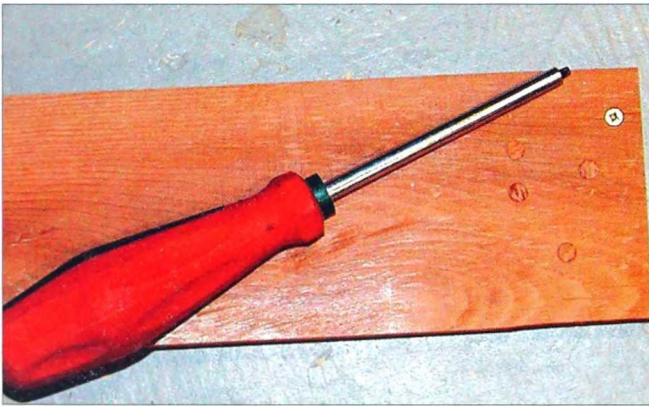
Screw "Covers"

Cabinetry screws can be ugly or attractive depending on what the woodworker envisions for the cabinet's final appearance. Some commercial woodworkers place rounded "buttons" on top of the recessed screws to both hide the screws and accent the connection. Some use fancy screws to accent the connection, and others use wood filler to hide

the screws. Here are a couple of ways to completely camouflage them.

Edge-banding veneer is available in most common wood types (2-403), and it usually has hot-melt-glue backing. If you are using a #4 or #5 screw, you can “punch” out circles with a standard office hole punch (2-404). Using an edge veneer that matches your project, place these circles over the recessed screws; they will virtually disappear. A heat gun will keep the circles in place.

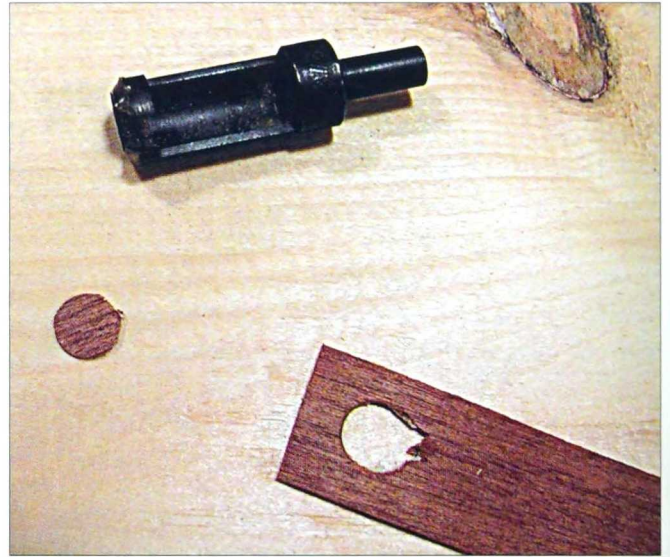
For larger screws, you can use a standard plug cutter to make the circles. This way, the circles can be made from a scrap piece that matches your workpiece and then sliced off with a fine-toothed saw to fit (2-405). Although a plug cutter can be used in a portable drill, it is best to use a drill press. A drill press will give a cleaner circle.



2-403. Screw covers made from edge-banding matching veneer will nicely hide screws on the exterior of cabinetry.



2-404. For smaller screws (#4 or #5), an office hole punch will make clean circles in edge-banding veneer.



2-405. A plug cutter can be used to match the screw head hole size. Your countersink bit can be used to match the hole and you can make the covers from a matching scrap from your workpiece.

Selecting Screws

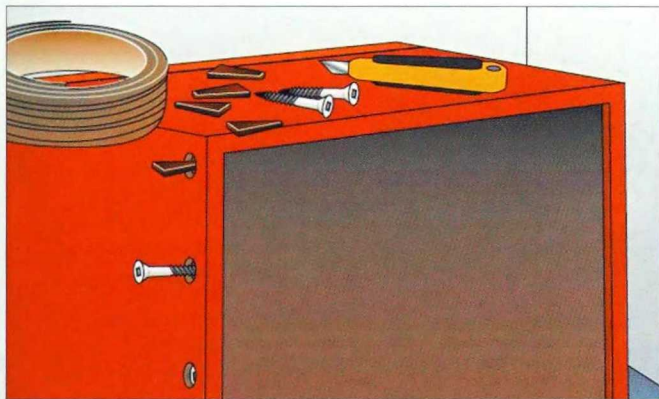
When building projects out of oak and some other hardwoods, do not use the common steel screw. Over a period of time, the metal will react with the natural acids of the wood and black rings will appear around the screw holes. Select stainless steel or brass screws when working with oak (2-406). They are more expensive, but they are worth it.



2-406. Use brass or stainless steel screws when working with oak.

Tightening Screws

It is easy to repair a project that has loose screws. A roll of edge veneer—the type with the hot-melt glue on the back—will do the trick nicely. Cut a few wedge-shaped pieces off the roll and insert them into the screw hole. Driving the screw back in will soften or even melt the glue and hold the screw firmly (2-407).



2-407. Inserting edge veneer into screw holes will tighten the screws.

SCROLL SAW

The scroll saw is a great addition to any home workshop (2-408). In addition to cutting intricate patterns and having the ability to make 90- or even 360-degree cuts, it can be used to cut inside pieces. To do this, you would first drill a small hole (the diameter of the width of the scroll-saw blade you are using), release the top clamp of the blade, and then feed the blade up through the drilled hole.



2-408. A scroll saw.

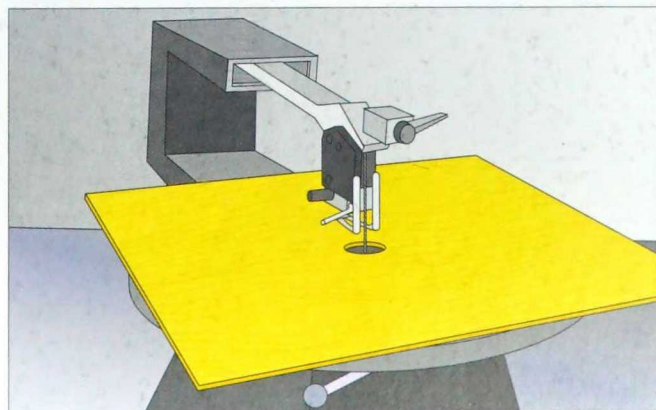
Reclamp the blade and proceed to cut. Some intricate scroll-work requires over 3,000 of these inside cuts—a tedious but rewarding job. Scroll-sawing is an art form and if you are interested in learning it, there are many informative books on the subject, not least being one by Patrick Spielman.

There are many scroll saw types on the market and purchasing one can be quite confusing. You can pay anywhere from \$150 to over \$1,500 for one, and the difference in cost is because of the quality of the machines. Higher quality scroll saws will operate with little or no vibration to make intricate work easier; they will allow you to make three-dimensional projects because of truly vertical cutting; and they will have large and tilting tables. A scroll saw with variable-speed control is a plus and tools with controls (on/off, speed control, work light) up front are an asset. Blade-changing can be tedious, so look for tools that have a simple changing system.

Extending Blade Usage

Most scroll-sawers use thin wood for their intricate scroll-work. Doing so will wear out the bottom portion of the saw blades, leaving the top portion virtually unused. There is a way to use this unused area that will not compromise your work.

A supplemental table made of $\frac{3}{4}$ -inch plywood can be cut to fit the top of your existing saw table, and when affixed to the table with double-faced tape, will make use of the still-sharp scroll-saw blade area (2-409).

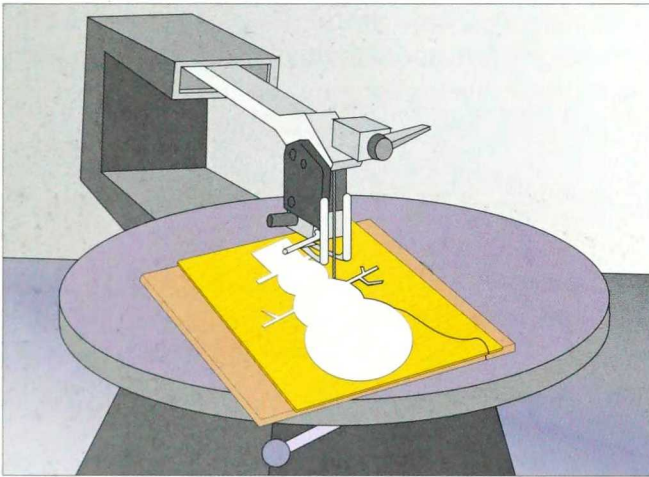


2-409. Adding a $\frac{3}{4}$ -inch plywood auxiliary top to your scroll-saw table will make use of the upper area of your blades.

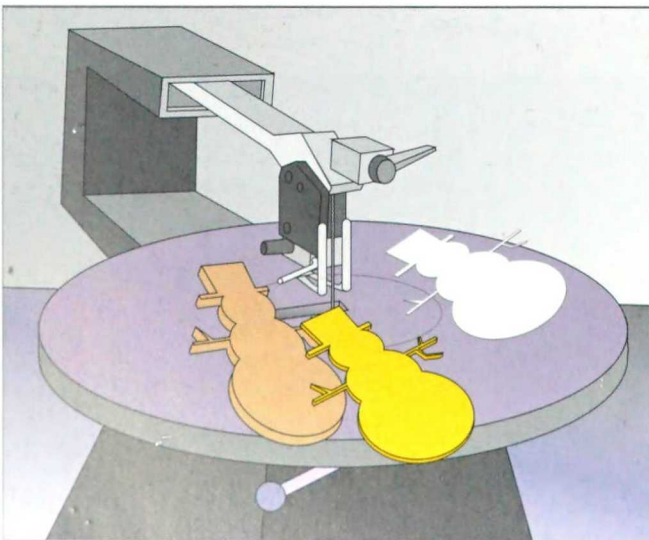
Scroll-Sawing Thin Material

Using your scroll saw to cut thin materials can prove to be a difficult task. The thin material has a tendency to ride with the blade and do a lot of flapping. Double-faced tape to the rescue. Tape your thin material to a thicker piece of scrap material, being sure to keep the tape away from the cutting area (2-410).

Doing this will have an added benefit; it will become a template for future work (2-411). Also, do not remove the scrap piece until you have done any necessary edge-sanding. The scrap will make this job easier as well.



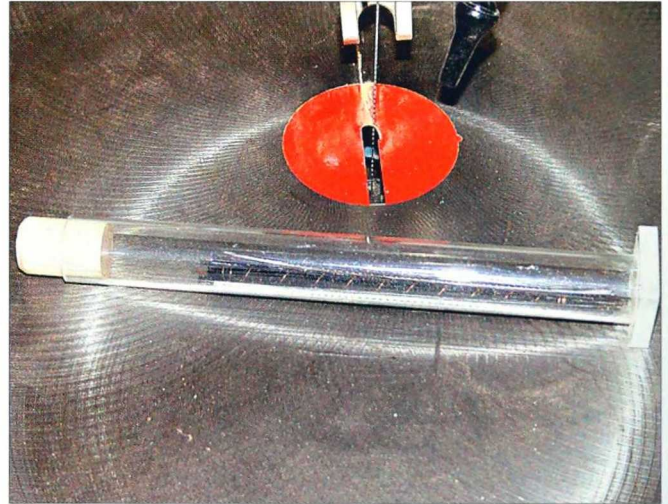
2-410. Backing thin material with a thicker scrap piece will make scroll-sawing an easier task.



2-411. This template can be used for future work.

Storing Scroll-Saw Blades

Scroll-saw blades are easily lost in tool drawers because they are so thin. A good way of keeping track of them is to store them in either plastic tubes or cigar tubes (2-412). Use masking tape to mark the type of blade inside.

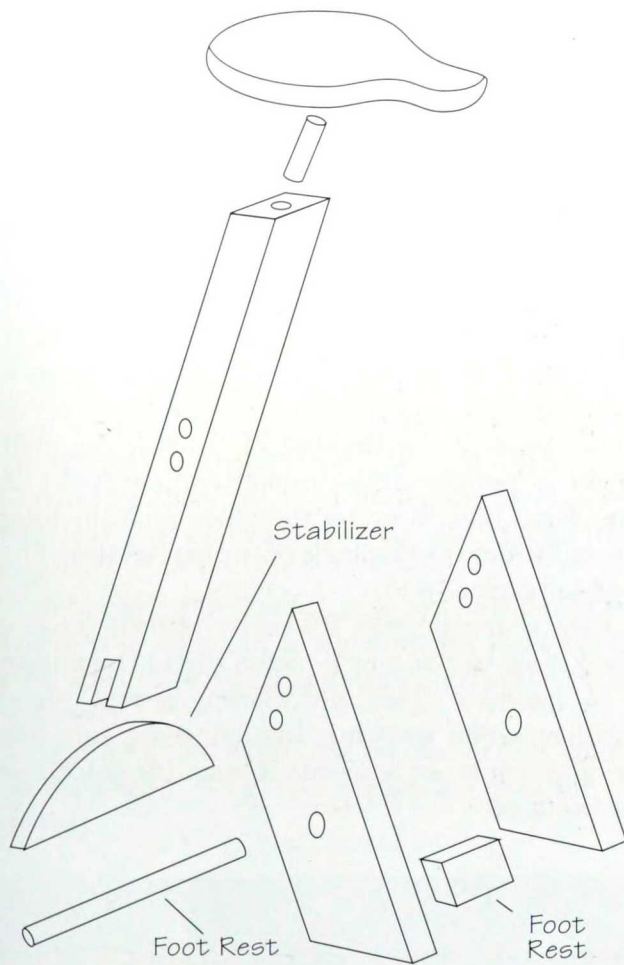


2-412. Plastic tubes or cigar tubes will keep your scroll-saw blades organized.

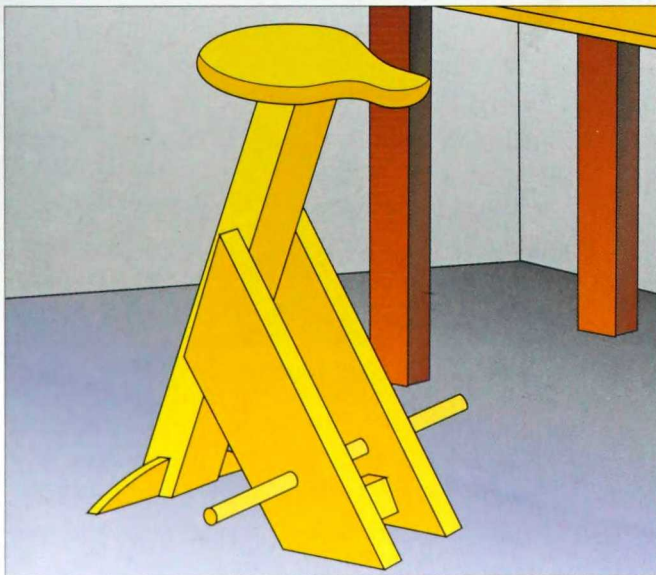
SEAT (SHOP-MADE)

Standing on a hard wooden or cement floor for long periods of time is eventually going to take its toll on your back. Precisely for that reason, I designed and built the high stool shown in 2-413 and 2-414. The stool is made of scrap pieces of spruce and other softwoods. The foot rest is from an old broom handle. The stool works well, although I find that the seat (made from glued-up plywood) is a little hard. Someday, I'll put some foam on and maybe cover it with a vinyl or cloth material.

I made the stool high enough so that I can sit comfortably at the workbench or the scroll saw to do carving and other relaxing things. The foot rest brings my knees up and makes for a more comfortable sitting position. The stool is an important tool around the shop.



2-413 and 2-414. This shop-made stool is great for relieving the strain of standing on a hard floor.

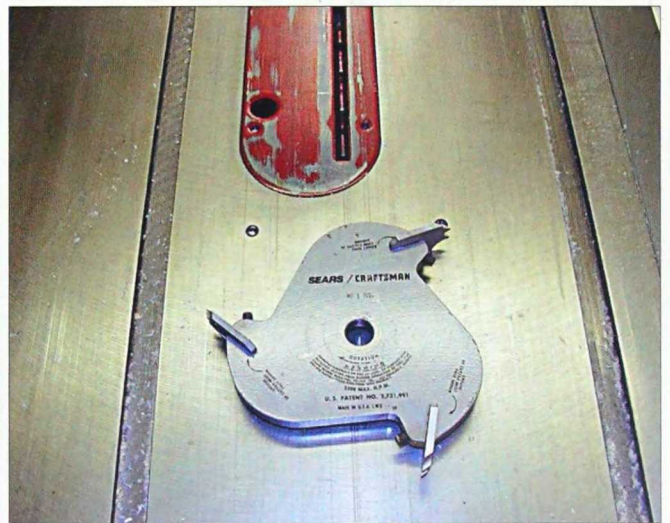


2-414.

SHAPER HEAD

A shaper head (also known as a molding head) is a heavy steel disc into which variously shaped blades or knives are fitted (2-415). It is used on a table saw or radial arm saw. The most common use of the shaper head is for making long lengths of molding such as baseboard and window or door trim or for furniture. The most commonly used is the one from Sears Craftsman, and they have about 24 different knife sets for the tool.

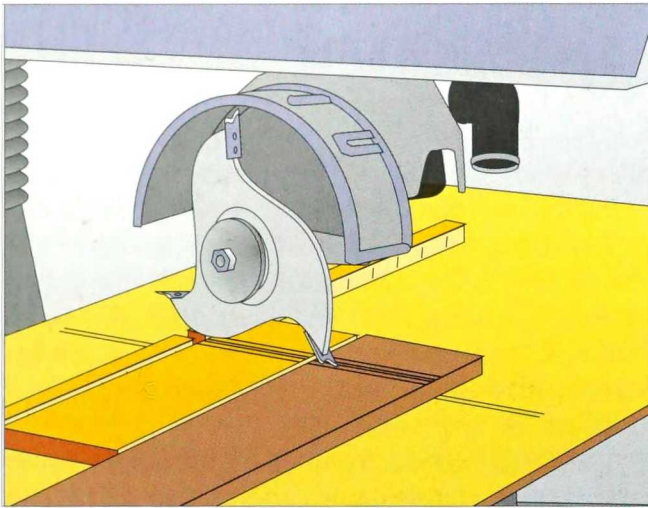
The shaper head is installed on the arbor of your table saw or radial arm saw and the head is designed to take off a little at a time, so several passes will usually have to be made. Shaping is usually done with the wood grain. To vary the shape of the finished product, you simply move your saw fence, install a different set of knives, and proceed again.



2-415. With a shaper head installed on your table or radial arm saw, you can make a wide variety of complex moldings.

Crosscutting with a Shaper Head

Although not a common procedure, you can use a shaper head in crosscutting operations (2-416). Some of these may include making dados for shelves or for rabbet joints. The problem that occurs is "tear-out" at the end of the cut. To avoid this, you can take one of two precautionary steps.



2-416. A sacrificial scrap of wood fastened to your workpiece will prevent tear-out with a shaper head.

If your finished piece is to be 12 inches wide, make it 13 inches before using the shaper head and then trim it down to cut out the tear-out area. The other method is to fasten a piece of wood scrap to the exiting edge of your workpiece.

Sharpening Shaper-Head Blades

Don't let the complex shapes of shaper head blades confound you. Generally, it is only the edge that needs honing, and this can be done on an oilstone. Oil the stone liberally and hone only the flat side. Be sure, however, that the stone is flat (2-417). Check it out with a straightedge.



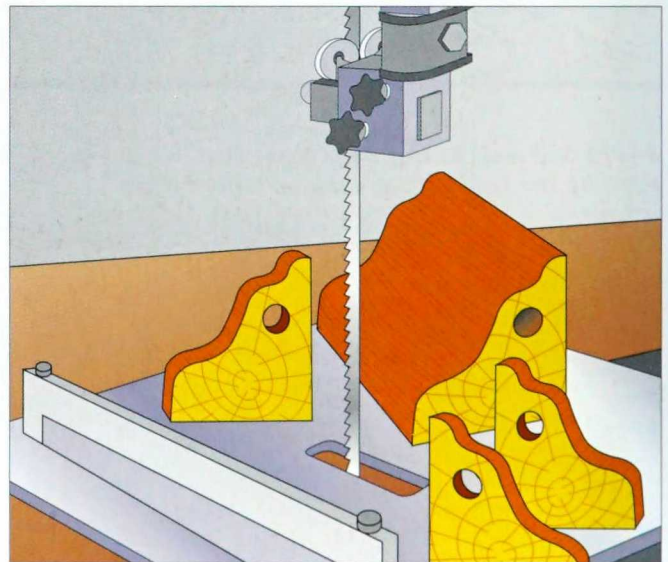
2-417. Always hone only the flat side of shaper blades and be sure that your oilstone is flat.

SHELF BRACKETS (MAKING)

Making fancy scroll-sawn shelf brackets is easy if you are just making one. Unfortunately, most shelves require at least two.

There might be the occasion when you want to make a set of shelves all with the same style brackets. Here's how it's done. Use a thick piece of stock. The thickness is determined by the thickness of each bracket x the number of brackets required. Draw the pattern on the surface and cut it out on your band saw. Now, set the fence on your band saw to the desired thickness of the brackets and proceed to resaw (2-418).

Here is another tip. It's pretty difficult to find wood stock that is 6 or 8 inches thick. The answer is to laminate (glue and clamp) several pieces together. When resawing, though, make sure that the glue joints are somewhere near the middle of the brackets.



2-418. Making several shelf brackets by resawing thick stock on the band saw.

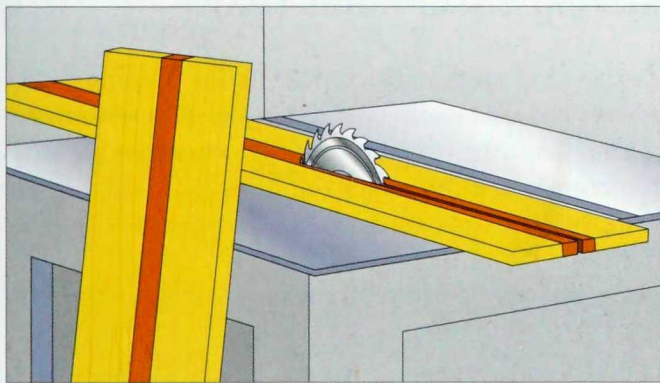
SHELVES

Making Shelves

The next time you are making shelves for that bookcase that your spouse wants, this technique will save you time, energy, and clamps. Let's say the shelves are made of pine and you want to have a 1/2-inch solid walnut nosing on them. Try this: Cut your solid nosing stock 1 1/8 inches wide x whatever thickness your shelves are. Lay your shelves flat, face to face. Place the solid stock between the front edges of the shelves and glue and clamp them together.

When the glue has set, gear up your radial arm saw or your table saw to rip down the *middle* of the solid stock (2-419). That extra 1/8 inch protects the saw's kerfs.

Normally, you would use two bar or pipe clamps on each shelf. Now, two clamps are used for two shelves.



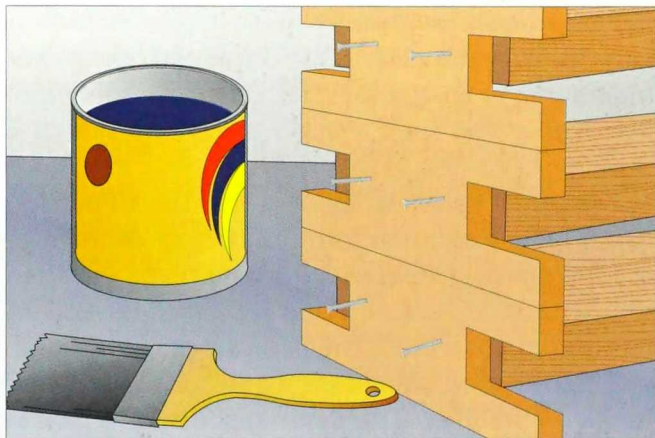
2-419. Ripping the shelves apart with the table saw.

Painting and Finishing Shelves

You can easily paint, stain, or apply polyurethane (varathane) to your newly made shelves if you have a dozen or so stacking bars on hand. What are stacking bars? They are H-shaped pieces of wood that are cut from 1 x 2s and are 10 to 12 inches long (2-420). Before using them, drill holes to facilitate a 2 1/2-inch finishing nail.

Now, when you are ready to finish the shelves, nail a stacking bar to each end. When you have finished one side, just turn it over and do the other.

Two additional bonuses: You can now stack your freshly finished shelves horizontally to take up less space when drying, and by stacking them horizontally, you lessen the chances of paint drip or runs.



2-420. The stacking bars in place on the ends of the shelves prior to painting.

SIGNING YOUR WORK

Some woodworkers go to some expense to buy branding irons or some other paraphernalia to proudly sign and date their work. Here's an easier way to date the work. A 3/4-inch Forstner bit will do to drill a shallow hole in the base of the piece. Take a currently dated penny (or other coin) and insert it into the hole (2-421). Now you know when the project was built. An indelible marker can be used to sign it.



2-421. A penny or other coin imbedded in your workpiece will date the project.

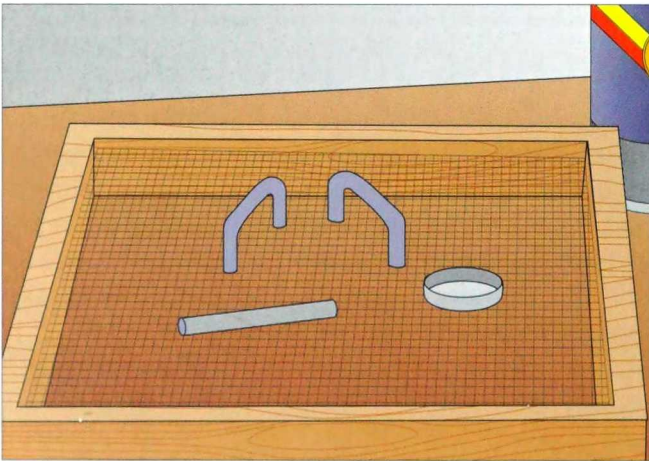
SMALL ITEMS

Spray-Painting Small Parts

The problem with spray-painting small parts is that the air pressure behind the spray tends to blow the parts all over the place. This usually happens with a spray gun *or* an aerosol spray can. The other problem is that you usually have to do one side at a time.

Next time you have some of these small parts to paint, tap a small nail into the bottom of them or use their packaged screws to secure them and then set them on a piece of nylon fly screen (2-422). A pushpin might work if the parts are made of wood.

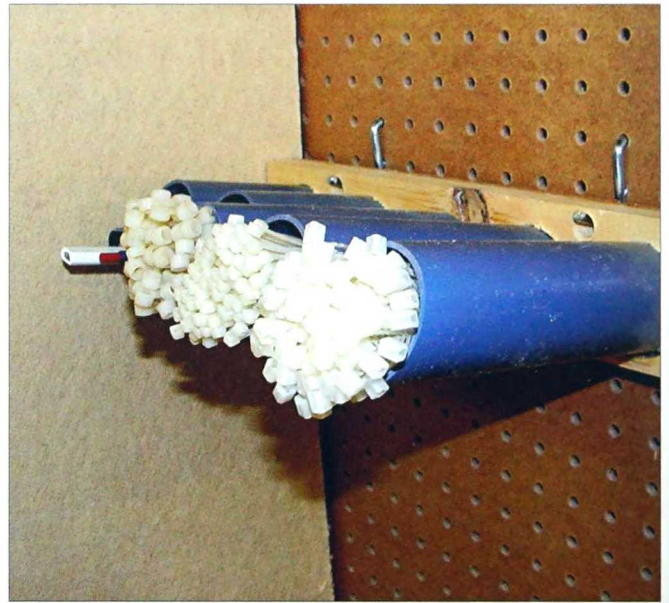
The fly screen should be stapled to some sort of frame for stability. The advantage of the screen is that you don't get the usual accumulation of paint that sticks under the sprayed part.



2-422. Spraying paint on small parts is easier when they are sitting on a piece of fly screen.

Storing Small Items (#1)

To store items like tie wraps, pencils, tongue depressors, etc., use PVC pipe lengths. Cut one end at 90 degrees and the other at 15 degrees. Use the appropriate-sized hole saw to drill holes at a 15-degree angle into a length of 1 x 4. Insert the pipe and mount the piece on a wall (2-423).

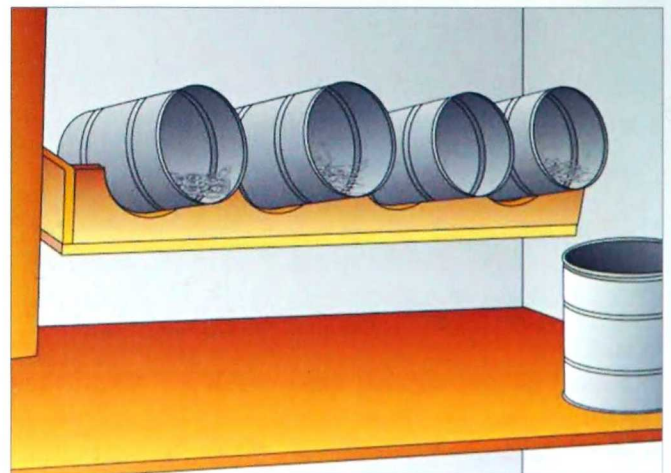


2-423. PVC pipe is a great way of storing small items.

If you don't have the exact size hole saw, use one a little larger; put a screw in the bottom gap and use Gorilla glue to hold the pipe in position.

Storing Small Items (#2)

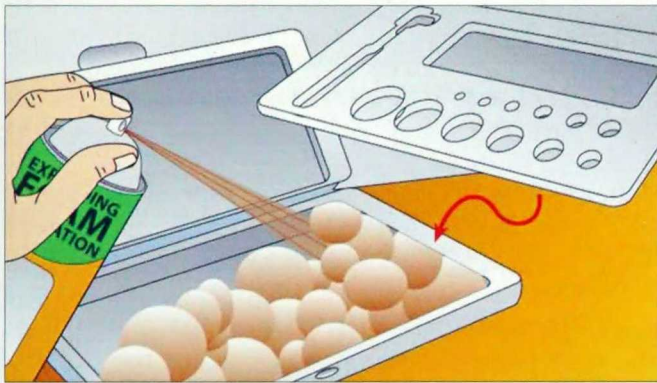
Coffee cans are handy containers for keeping nails, screws and odd small parts. The problem with them is that you can't readily see into them to identify the contents. Build a rack out of scrap wood and do it so that the cans are on a 45-degree angle (2-424).



2-424. Build an angled rack for coffee cans. They make convenient containers for nails and small parts.

SOCKET WRENCHES

Some socket-wrench sets are sold in rather flimsy plastic-molded containers that can fall apart pretty quickly. To make these containers more rigid and retain their shapes, spray the back of them with a can of low-expansion spray-foam insulation (2-425). While the insulation is still expanding, place the plastic back into the original box and place the sockets in it. The foam will harden and hold those sockets for quite some time.



2-425. Spray-foam insulation will make those flimsy socket-wrench containers more rigid.

SOFTWOOD

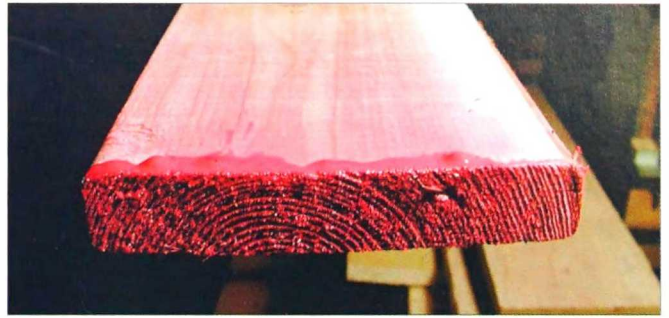
Softwood is considered any wood yielded from a coniferous tree.

Checking Checks in Drying Softwood

When air- or kiln-drying softwood lumber, there is a tendency for the ends of the boards to check (split). To help deter this, a couple of coats of an exterior latex paint on the board ends may do the trick (2-426).

Softwood Buying Guidelines

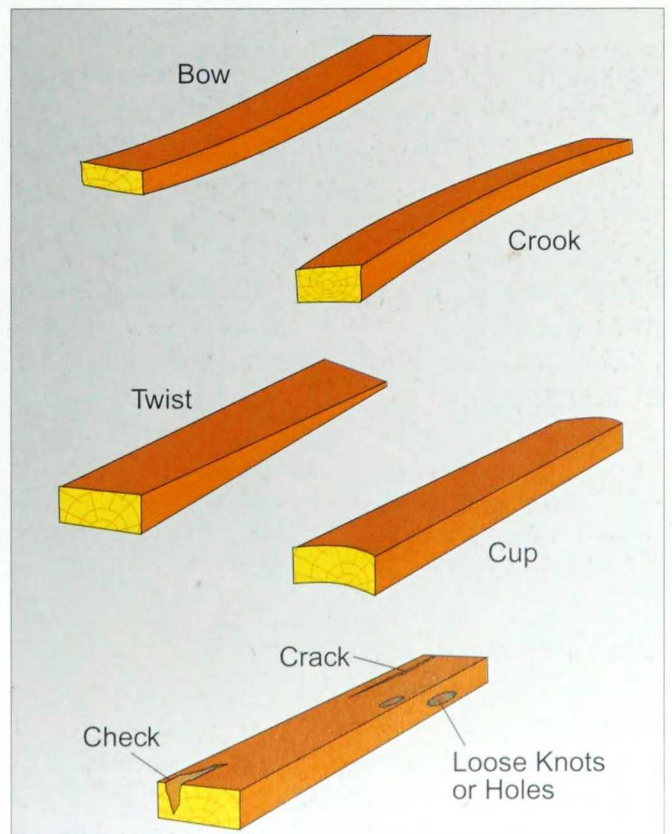
Most lumberyards sell their softwood by the board foot (refer to board foot chart on page 108), but



2-426. Use exterior latex paint to coat the ends of boards when they are air-drying.

some retail it by the running foot. It is best to determine which method your lumberyard uses for budgeting purposes.

Never purchase lumber over the telephone; it is best to hand-pick the lumber to avoid defects that could affect your project. Look for boards that are straight and true. Look for knots that are loose or for checks (splits) in the ends of boards and avoid these. Boards that are cupped, twisted, or warped should be avoided as well (2-427).



2-427. These are some of the more common defects to avoid when buying softwood lumber.

Home woodworkers have a tendency to buy clear pine when in fact they can spend a lot less on knotty pine. First-grade knotty pine will have tight knots; simply coating the knots with shellac will prevent “bleed-through” into a painted finish.

If you own a thickness planer, you will save money by purchasing rough lumber and dressing it yourself.

For interior projects, never buy lumber on the same day that you plan to use it. Wood has to acclimatize to its surroundings for several days or even more, depending on the moisture content of it. Most lumberyards will have a moisture meter on hand for you to use. Lumber will shrink as it dries and, if wet, it should be stored flat in a warm, dry area and have stickers (equal-sized strips of wood placed every two or three feet) between the boards to allow air to circulate.

SOLVENTS (DISPOSING OF)

It's so easy to go into your local paint or hardware store, order a gallon or so of paint thinner or the like, use it, and then dump the used material down the drain. Right? Wrong. Please do *not* do that. Pour the waste into an empty plastic container, save it until it is full (store it outside), and then call your local environmental agency and ask them how to dispose of it. This applies not only to solvents, but to paint, lacquer, varnish, contact cement, thinner, wood filler, paint remover, or any other product that is labeled *toxic* or *hazardous*.

I don't want to get on my soapbox here, but I do want to point out that as responsible woodworkers the only assurance that we and our children have to continue in business or hobby is to look after our environment. Sounds trite? Maybe so, but let's continue our enjoyment of woodworking, and let's make sure that there are enough healthy trees to do so.

Now, here are a couple of techniques to temporarily dispose of some of those hazardous materials. Pour your used material in a container of cat litter (2-428). Let it dry. When you have a sufficient quantity, then call the agency for safe disposition



2-428. You can safely dispose of most toxic shop liquids by pouring them onto cat litter and then bagging the litter, storing it outside, and calling your local hazardous waste agency.

instructions. Oh, by the way, *do* not use sawdust as an absorbing agent. Sawdust could spontaneously combust.

Another solution is to “paint” the material on the walls of an old barn or shed and let the sun dispose of it.

Probably, however, the best solution is to give consideration to the “environmentally friendly” materials that are safe and water-soluble.

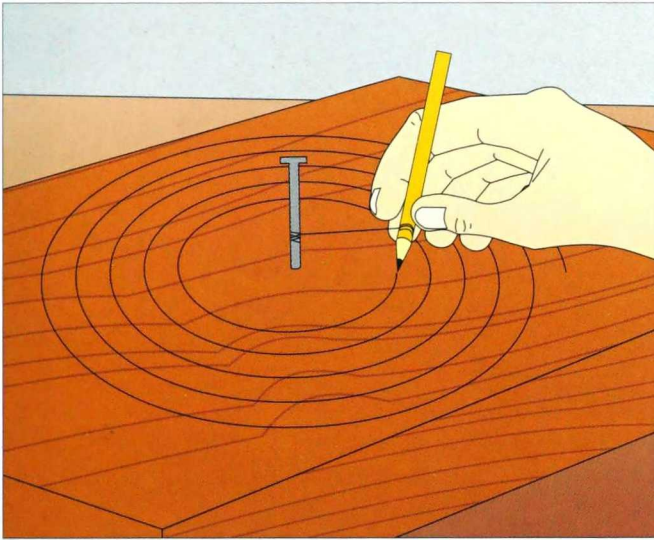
SPADE BITS

(See Drill Bits)

SPIRALS (MAKING)

Some neat things such as salad bowls, decorative cones, etc., can be made from spirals, but laying out the design and cutting them until now has been somewhat difficult.

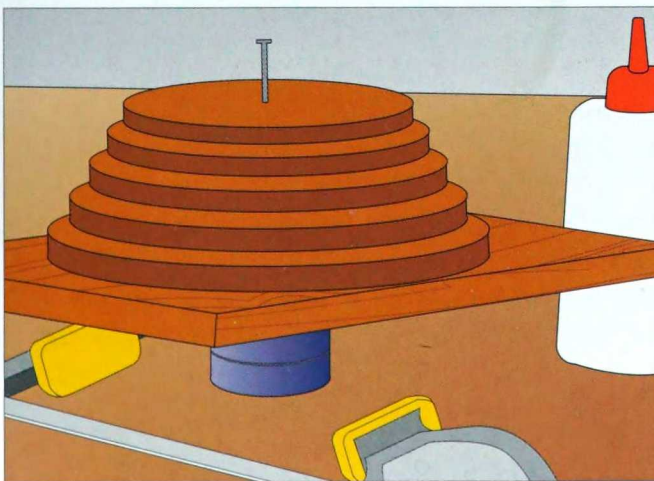
To draw a spiral, wrap a piece of string around a nail and tie the loose end to a pencil. Using the pencil, start drawing a circle from the nail that is fixed to the middle of your workpiece (2-429).



2-429. Drawing spirals for bowl-making on the band saw.

These are the cutting lines. Select the proper band-saw blade, tilt your table to the desired angle that you want the bowl or cone to be, and proceed to cut from the outside line.

Once the cut is complete, turn off the saw and slowly start to retract the blade by backing up through the cut. Place a dowel or a tin can under the center of the workpiece and carefully pull the coil down, clamping it to a secure surface (2-430). A little glue before clamping will hold it together.



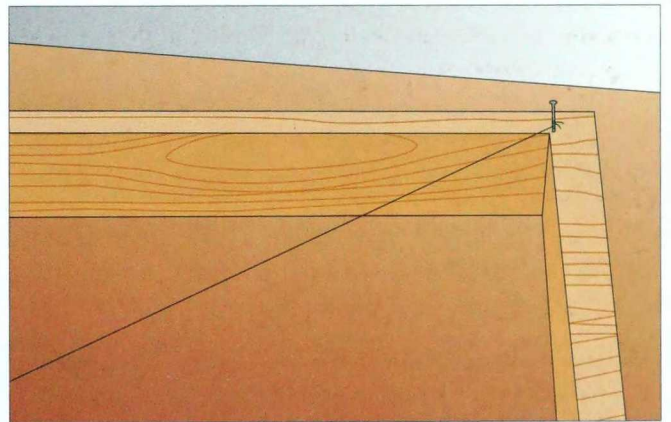
2-430. When the cut is complete, place the workpiece over an appropriate size tin can. Stretch the piece over it, and then glue and clamp it.

SQUARING PROJECT CORNERS

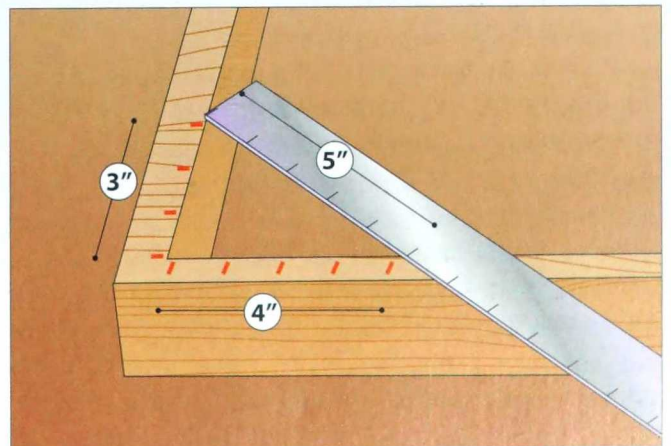
Here are a couple of techniques to determine whether or not your project corners are square and true. These methods will mostly apply to larger projects where a builder's square won't reach.

In the first method, with a tape measure or a string, measure diagonally across two opposite corners (2-431). Mark the string and measure the other two corners. The measurements should be identical.

The second method is called the 3-4-5 method and it is really very simple (2-432). Start at one corner of the piece. At the right of the corner, make a mark *exactly* at 3 inches. At the left of the corner, make a mark exactly at 4 inches. Now, measure



2-431. Using a length of string to verify squareness.

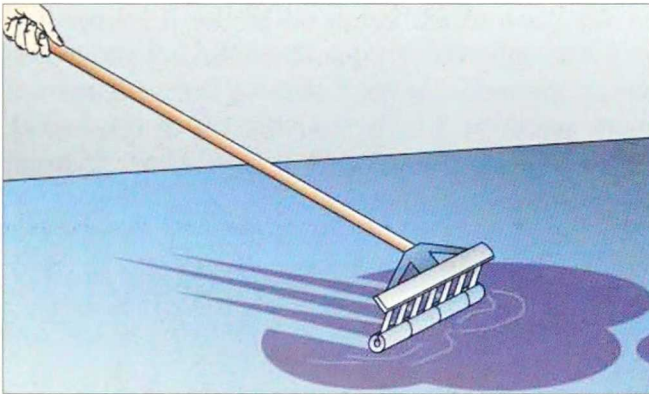


2-432. The 3-4-5 method being used to check for square.

diagonally across to the two lines. This measurement should read 5 inches exactly. Double-check by repeating this at the opposite corner.

SQUEEGEE

In the event of a wet basement or garage floor, you can make an emergency squeegee by putting a length of foam pipe insulation on the tines of a garden rake (2-433).



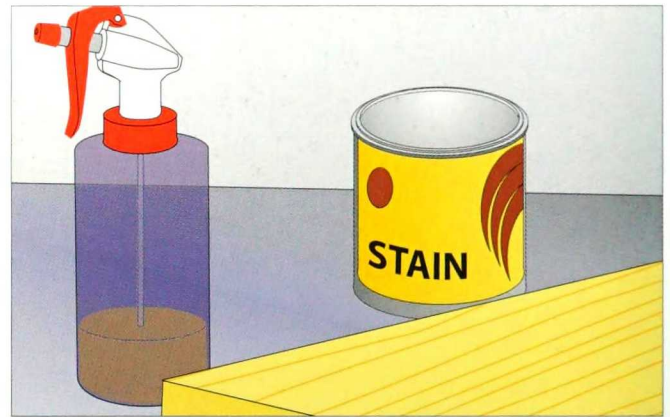
2-433. Foam pipe insulation makes an emergency squeegee.

STAINS (APPLYING)

A quick and easy way to evenly apply an oil-based or water-soluble wiping stain is with a pump-type sprayer (2-434). They are usually available at your local hardware stores for a few dollars.

The beauty of these sprayers is that the stain is applied uniformly. If properly applied, there will be no overlapping or dark spots to worry about. And there's a bonus: You will use a lot less stain.

Before using the sprayer on your workpiece, try it on a piece of scrap so that the nozzle can be properly adjusted. What you want is a fine mist that will spread evenly. Hold the sprayer 12 to 15 inches away from the surface. Do about one square foot at a time. Spray it and then wipe it down. A slight overlap on the next section will blend the stain. Do



2-434. Applying stain with a plastic spray bottle will ensure an even application and the use of less stain.

not saturate the board with the spray. Very thin applications are better. This will give you a better idea as to the density and coverage for the desired end result.

A word of *caution*: Do this in well-ventilated areas and wear the recommended safety gear.

STEEL SQUARE

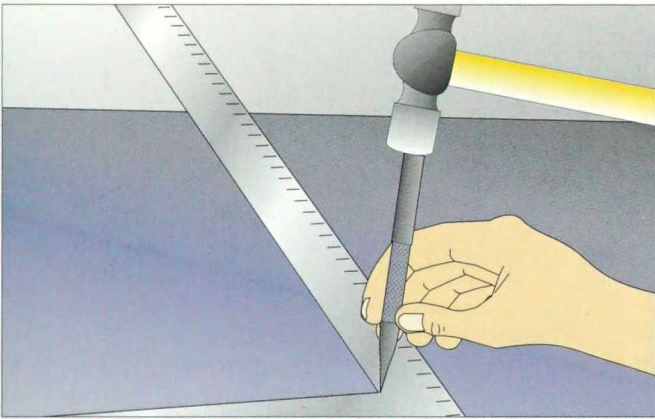
The steel square or builder's square is an invaluable tool in any workshop. Usually, the body, as the long side is called, is 24 inches long and the tongue is either 12 or 16 inches long. These measurements conform to the standard stud and joist placements. The body is generally 2 inches wide and the tongue 1½ inches wide. The outside corner is called the heel.

A framing square differs from a steel square in that it has a number of scales printed or etched on the body, the tongue, or both parts (2-435). These scales usually consist of a scale which tells how long a 45-degree brace should be to support a given shelf size, a board measurement scale; an angle-cut scale, and a rafter scale. There are a number of books available to explain the various use of these scales and how to read the scales on the square.

If, after testing your steel square, you find that for some unknown reason it is not true, there are a number of options, the last of which is to junk it. First, though, try this technique: After checking the square and determining that it is on the high side



2-435. The builder's square has etched scales and data on it.



2-436. Truing up the steel square by peening on either the inside or outside corner.

(for example, 90.5, 91, or 92 degrees), draw a straight line from the heel to the inside corner of the square (2-436). With a pointed punch, and a fairly heavy steel mallet, hit a spot on the line close to the heel. Check the square for accuracy. Hit it again in the same spot if it needs it.

Conversely, if the square is on the low side (for example, 89.5, 89, or 88 degrees), do basically the same as above, *but* use the punch close to the inside corner.

STEEL WOOL

(See Abrasives)

TABLE SAW

(Also See Radial Arm Saw)

What is a workshop without a table saw? Every shop has one in some form or other. They can be stationary floor-model tools (2-437) or bench-top tools. There are combination tools like the ShopSmith that adapt to a table saw. Some woodworkers prefer using a radial arm saw as the basic wood-cutting tool.

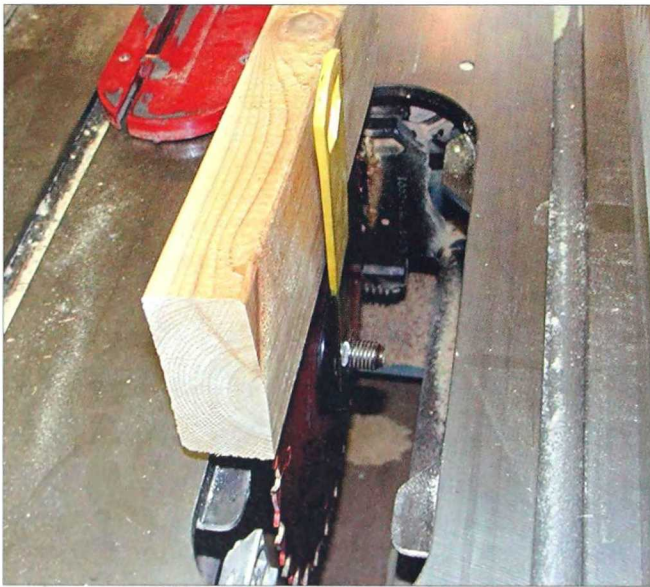
Whichever tool you have, the most important thing to remember is to routinely check the components of the saw for proper function and accuracy. The tilting arbor on the table saw must be accurate to provide precise bevel-cutting. This should be checked at both the 45- and 90-degree positions.



2-437. A floor-model table saw.

Changing Blades (#1)

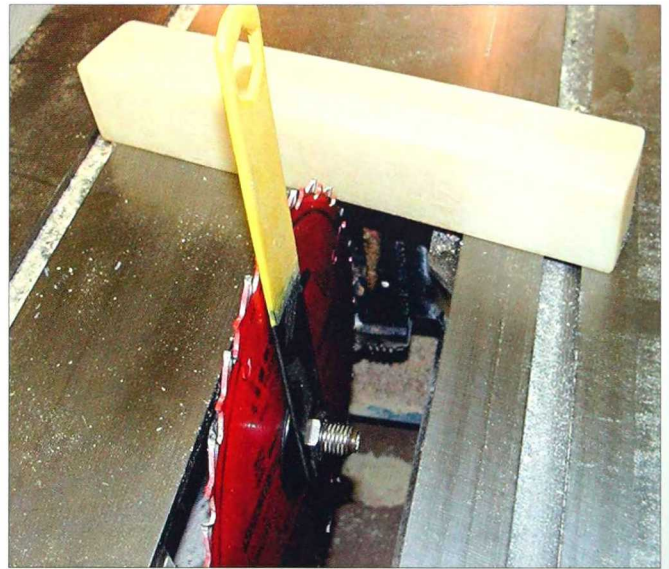
Changing saw blades on a table saw could be risky; the teeth are sharp and could cause severe injury. Here's a safe way of doing it. Cut a piece of 2 x 4 about 12 inches long. Place the piece on your table saw directly over the completely lowered blade (2-438). The top center of the blade should be mid-way on the length of the piece. Set your fence for a 1/2-inch cut. Clamp the 2 x 4 securely to the fence, turn on the saw, and slowly raise the blade into the 2 x 4. Raise the blade to a height of 2 1/2 inches. Lower the saw blade and turn off the saw. The result will be a slot in the 2 x 4 that can be used to brace the saw blade when you are removing or installing it. The blade is normally fully raised for this. Keep the 2 x 4 for future use.



2-438. This is a safer way to change a table-saw blade.

Changing Blades (#2)

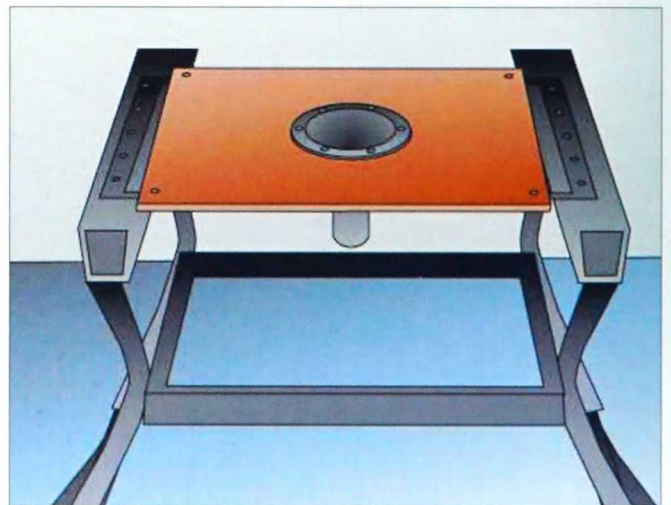
To safely (for your hands and the blade teeth) remove a table-saw blade from the arbor, use a crepe block. These are the blocks that are used to clean sanding belts. Wedge the crepe between the table and the blade and loosen the arbor nut with a wrench (2-439). The crepe block can also be used to put a new blade on the saw.



2-439. A crepe block will protect hands and blade teeth when you are removing the blade from a table saw.

Dust Collection

Mounting a piece of plywood or MDF (medium-density fiberboard) between your contractor's saw and the steel base will help with sawdust collection. Drill a hole in it and install a 4-inch plumbing flange. The opening should hold a standard 4-inch dust-collection hose (2-440).



2-440. A piece of plywood between the table saw and the base will help with dust collection.

Ensuring Accurate Angles When Using a Table Saw

When crosscutting angles on your table saw, you want to be absolutely certain of their accuracy. A protractor will help you attain this. Set the miter gauge to 45 degrees. Use the protractor against the saw blade, making sure that it does not come in contact with any teeth. Adjust and lock the miter gauge and then use an awl to scribe a line across the saw table. Now you have a permanent reference line for future alignment (2-441).



2-441. Use a protractor to align your miter gauge.

Link Belts

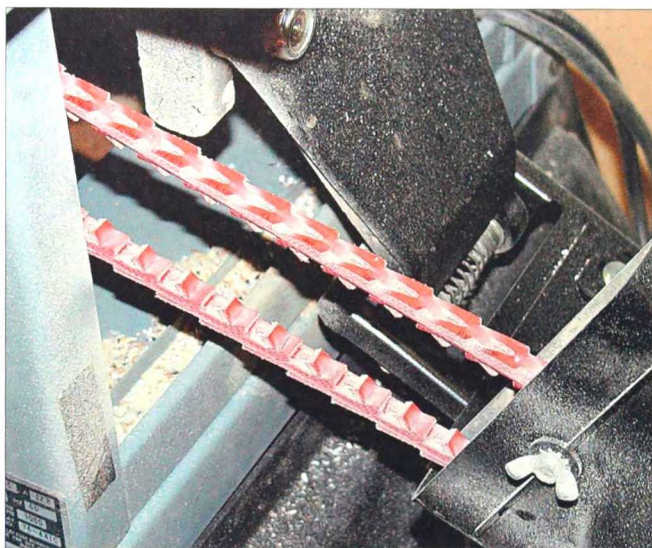
The regular V belts that drive your saw's arbor can sometimes cause vibration. Although this does not usually impair the accuracy of the saw, the constant vibration can put stress on both the arbor and the tilt mechanism.

Link belts are made from a heavy-duty material and are infinitely adjustable by simply removing or adding a link (2-442). The main advantage of using them is that they are virtually vibration-free and will greatly extend the life of your saw.

Miter Gauge

Adjusting the Miter Gauge

You can't get square crosscuts on a table saw if your miter gauge is out of whack! Here are a



2-442. A link belt will retard vibration and extend the life of your table saw.

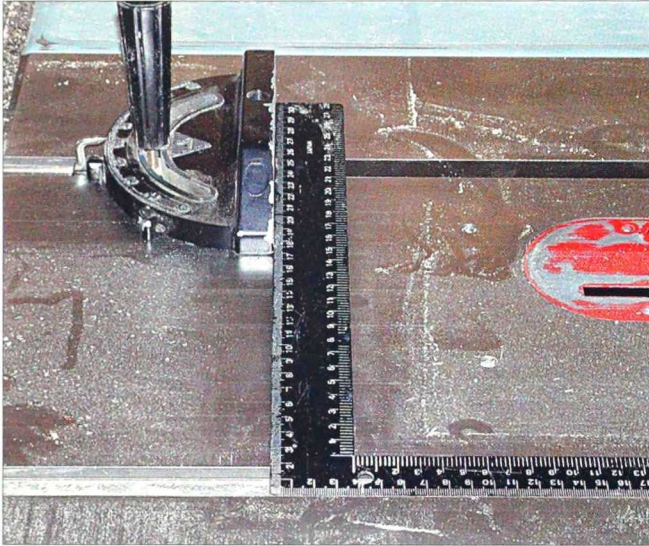
couple of quick ways to make sure it is perfectly square.

The first way can be done in a jiffy; you simply turn the gauge upside down and slide it into the saw's miter slot. Where the edge of the gauge meets the table-saw edge, it should sit flush. If you see any light between the two edges, it's time to adjust the miter gauge (2-443). Loosen the gauge handle, fit the gauge tight against the saw table, and tighten the handle. Flip the miter gauge over and adjust the pointer accordingly.



2-443. If you see light between the inverted miter gauge and the table saw edge, the gauge needs to be adjusted.

The second method is just as easy, but uses a builder's square (2-444). Set the miter gauge in the left table-saw slot and your builder's square tail in the right-hand slot. Use the long side of the square to true-up the gauge.



2-444. A builder's square can be used to square up your miter gauge.

Preventing Miter-Gauge "Catch"

You may have noticed that the slots on your table saw or band saw are a little lower than the thickness of the bar. This sometimes makes the gauge "catch" on the edge when it is used with larger pieces of wood. Preventing this is easy: Simply grind or file a 45-degree angle on the edge of the metal saw table (2-445).

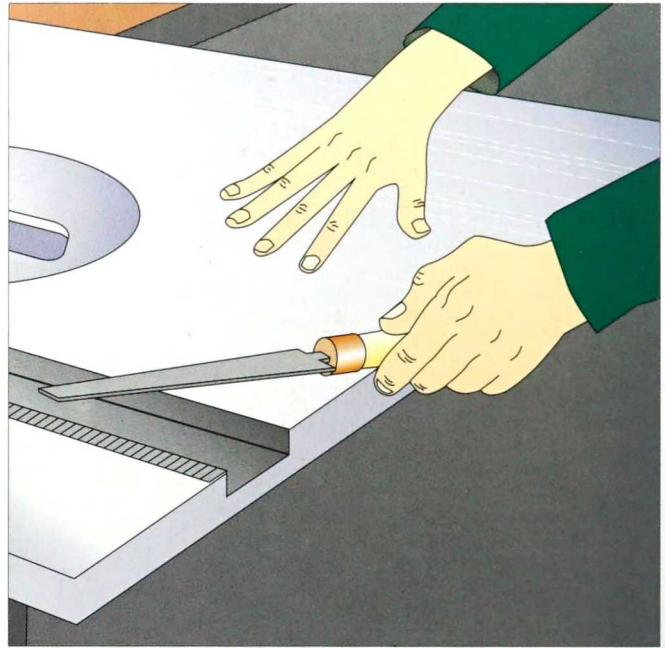
Smoothing the Edges of Miter-Gauge Slots

The miter-gauge slots on table saws and other power tools are machined very precisely (or at least they should be) and the edge can be quite sharp to the touch. Take a moment to use a file or some emery cloth to remove the sharpness (2-446). You'll be glad you did.

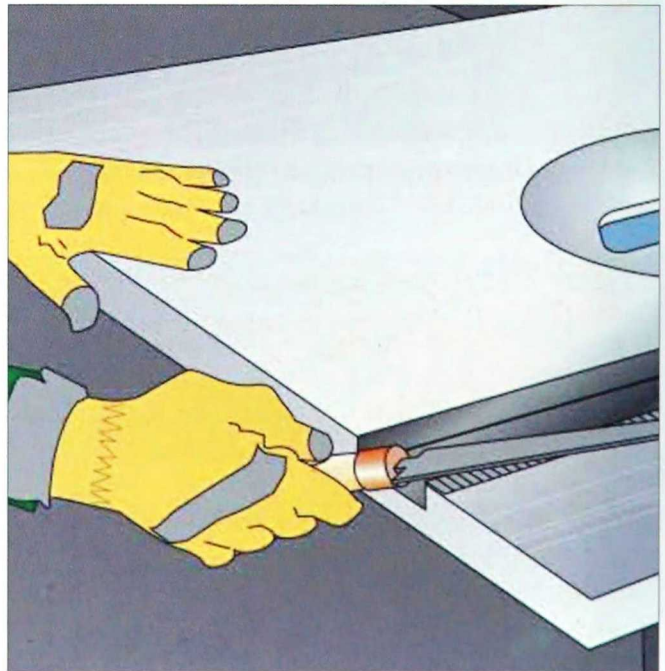
Repairing Miter Gauges

As miter gauges are used, they may tend to get sloppy in the tracks and therefore lose their accuracy. There are a couple of ways to correct this.

You can "peen" the gauge with a steel pointed



2-445. Grinding the saw's table edge to 45 degrees prevents the miter gauge from catching on the edge.



2-446. A file will remove that sharp edge on the miter-gauge slot of the table saw and other tools.

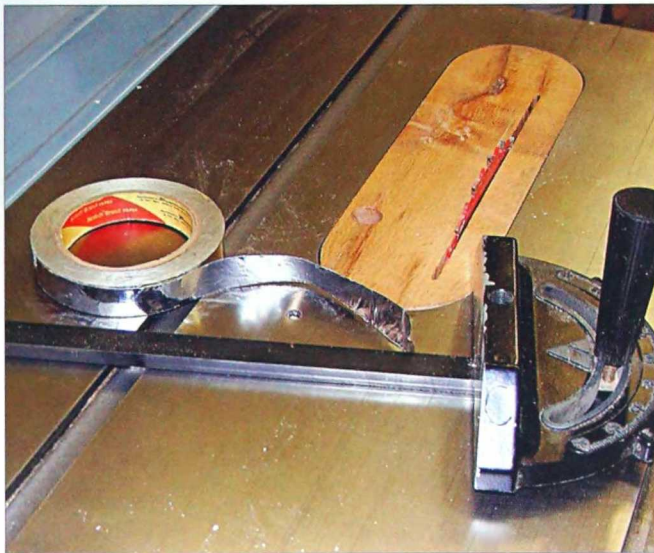
punch (2-447). This is done by putting small dimples in the bar of the gauge very close to the edges. At least four dimples should be made, two in front and two at the back of the gauge. Hammer the



2-447. Peening dimples in a miter gauge will take out any play in it.

punch lightly at first to determine the “feel” or tightness of the bar.

The second method of removing play in the miter gauge is to use strips of aluminum duct-sealing tape. Run a strip down both edges of the miter-gauge bar (2-448). Add more if required.

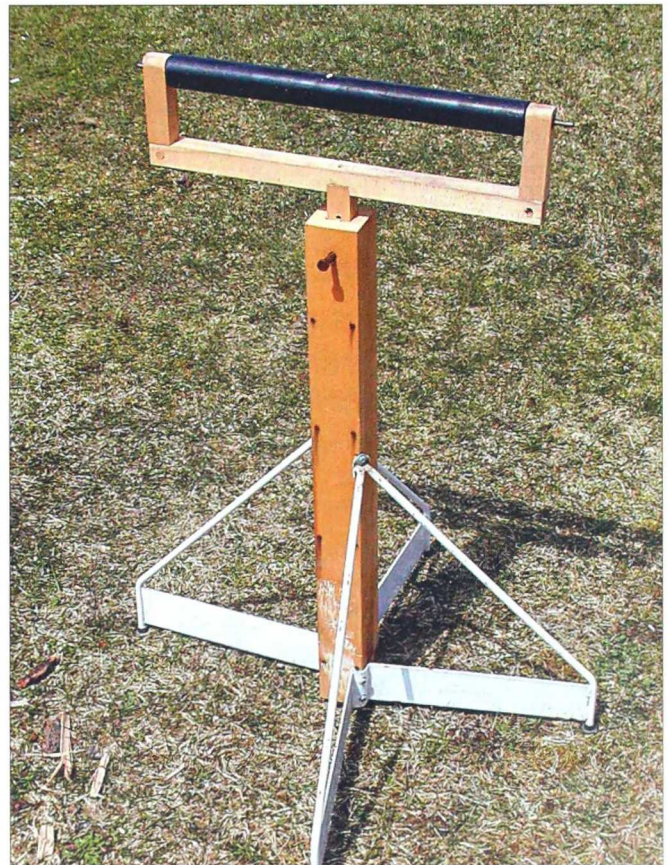


2-448. Running strips of aluminum duct-sealing tape down both edges of the miter-gauge bar is another way of removing play in the miter gauge.

Out-Feed Roller

The shop-made out-feed table-saw roller shown in 2-449 was built from some hardwood scrap pieces. The center post rides in a sleeve and is tightened in position with a hex bolt and a “T” nut. The roller itself is from an old typewriter (remember those?). The base on mine was made from an old store display stand, but you can use plywood in a similar fashion.

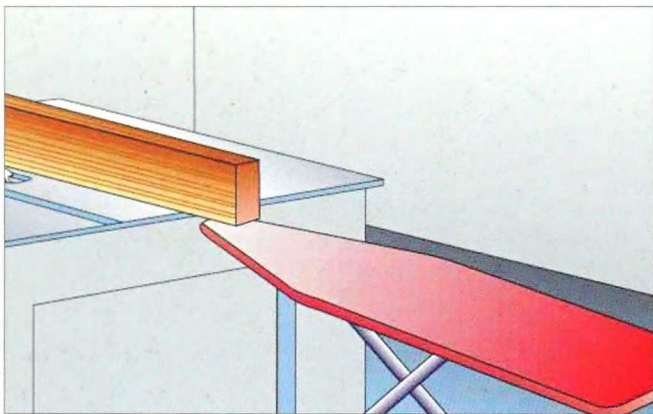
The post will elevate high enough to work with my band saw and low enough for my thickness planer. I made reference marks on the post for the various tools to make adjustments quicker. Because it is a single roller, it is important that it be perpendicular to the tool to prevent pulling to one side.



2-449. This shop-made out-feed roller is made from hardwood scraps and an old typewriter roller and is used for many tools. A hex bolt and “T” nut lock the post to the desired height.

Out-Feed Table

In a pinch, you might look in the laundry room for a temporary out-feed table. An ironing board will do, and they can usually be adjusted to any height (2-450). Check with your spouse first and make sure you remove the ironing pad before using it.



2-450. An ironing board can be used as an out-feed table in a pinch.

Table Maintenance

A clean saw table will produce easier and more accurate cuts. Steel tabletops are susceptible to rust and, as a result, pitting and even warping. To prevent this from happening, a good table maintenance program is in order. Every six months or so, use paint thinner or even WD40 oil and very fine steel wool to clean the top surface (2-451). Wipe the surface clean and then generously apply a coat of Rust Check and let it sit overnight. Wipe it all off and then apply a coat of paste wax and buff it to a shine.

Zero-Clearance Insert (#1)

A zero-clearance saw table insert has the advantage of reducing tear-out and deflects a lot of sawdust on the material that you are cutting on your table saw. Shown in 2-452 is a temporary one made (front to back) of your saw table. Lower the saw blade below the table surface and use double-faced tape to adhere the plywood to the saw top. Adjust your



2-451. Clean the top surface of a saw table every six months with paint thinner or WD40 oil and very fine steel wool.

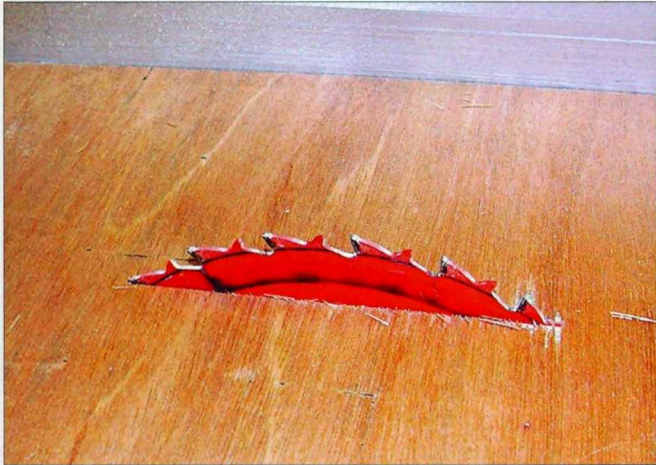


2-452. A piece of 1/4-inch plywood will serve as a temporary zero-clearance jig for your table saw.

fence and turn the saw on. Slowly raise the blade to the desired height for the workpiece you want to cut.

Zero-Clearance Insert (#2)

The zero-clearance table-saw insert can be made from hardwood or plywood (2-453). Simply trace your metal insert on the wood and cut it out. Drill a finger hole to make it easier to remove. Once you have cut it to shape, lower your table-saw blade below the table surface, turn on the saw, and very carefully position the insert into the opening. Holding the insert in position with a push stick, slowly raise the saw blade to cut through the insert. When finished, turn off the saw and remove the insert. Use a permanent marker to indicate the type of saw blade that you used. A separate insert may be required for specific types of blades.



2-453. A zero-clearance table saw insert will give you cleaner cuts and reduce sawdust from flying in your face.

TAPE (DOUBLE-FACED)

Double-faced tape can prove to be an invaluable tool in the workshop (2-454). The tape comes in many forms, but cloth, paper, or the no-substrate types are best.

The paper type is best used in pattern duplication where you want to stack several thin pieces together and make only one cut, say, on a scroll saw. The tape without any substrate can be used here as well.

Cloth tape such as that used for carpeting can be used for thicker stock duplication.

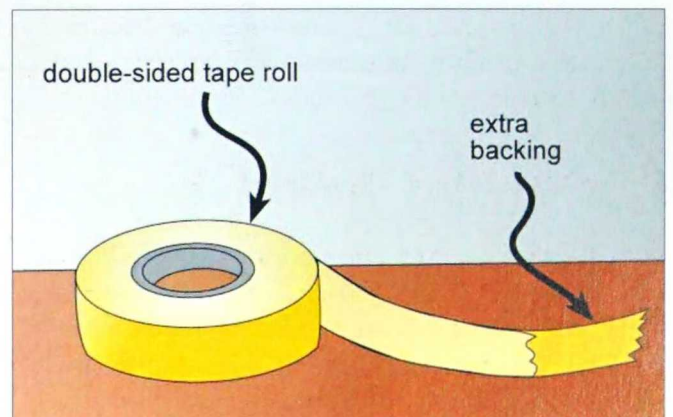


2-454. These varieties of double-faced tape are great for duplicating patterns.

When using double-faced tape for project duplication, it is important not to adhere any over a cut line. The tape will bind to the saw blade and will make cutting difficult.

Backing "Leader"

Double-faced tape has a lot of uses around the shop, but if you just tear a length of it off the roll, separating the tape from the backing strip can be a problem. Next time that you need a length of it, peel the tape of the backing first and then tear off *only* the tape portion. Leave a "leader" of the backing in place (2-455). By making this a routine, future strips will tear off easily.



2-455. Leaving a "leader" of the backing on the roll will make it easier to use double-faced tape.

TAPE (STICKY)

Sticky tape and labels can be a real pain to remove and for some unknown reason, retailers and manufacturers always seem to place them where they shouldn't be.

WD-40 oil to the rescue! Once you get the paper or plastic part of the labels off, a couple of squirts of this product will either melt or dissolve the adhesive (2-456). Be sure to wipe all of it off, though.



2-456. WD-40 oil can dissolve the adhesive on sticky tape and labels, making them easier to remove.

TAPE MEASURE

Ensuring Tape-Measure Accuracy

Tape measures can vary in accuracy by as much as a 1/2 inch in 8 feet from one manufacturer to another. It is important to use the same manufacturer's tape measure when transferring dimensions (2-457).



2-457. Use the same tape measure to transfer dimensions.

Making Precise Inside Measurements with a Tape Measure

I have a problem when it comes to making precise inside measurements with a tape measure. Most tape measures have "Add 3 Inches" printed on the case, some use 2 1/2 inches, and some others have a small window on the top. When I look down on the tape measure, either the window always seems to be dirty or scratched or the cases seem to protrude to make accuracy difficult.

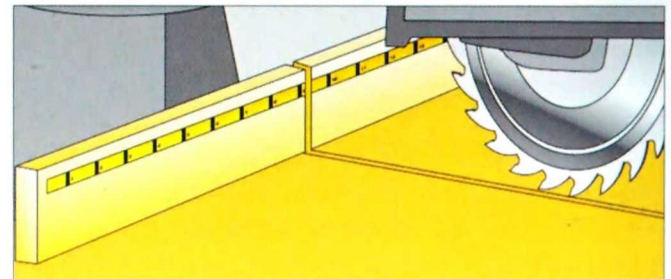
I've found a solution that works. I lay a combination square down, inside the area to be measured. I know that the blade is exactly 12 inches long. Then I measure up to the blade and add the 12 inches (2-458). It works every time.



2-458. Using a combination square and a tape measure will give you more accurate inside measurements. The measurement shown is 14 inches.

Stick-On Tape Measures

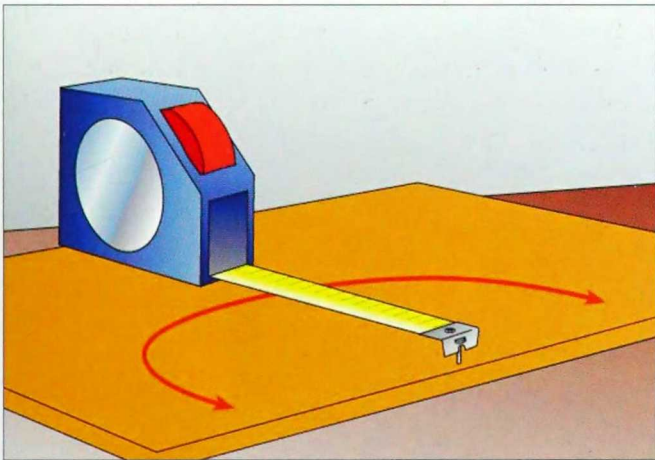
Sticky-backed tape measures work well on your radial arm saw or compound miter saw. Stick a strip an inch or two above the table, on the fence (2-459). They are available to read in both directions.



2-459. Stick-on tape measures can be handy on your radial arm saw.

Using Tape Measures as a "Compass"

Most compasses have a slot on the tang or hook end; this slot allows a common nail head to fit right into it. If you want to draw a circle for a pattern, drive a common nail into the center of the proposed circle (2-460). Hook the slot of the tape measure tang on the nail head, set the tape measure to the correct radius, and hold a pencil against the body of it. Make sure you compensate for the pencil thickness and the offset for the nail head.

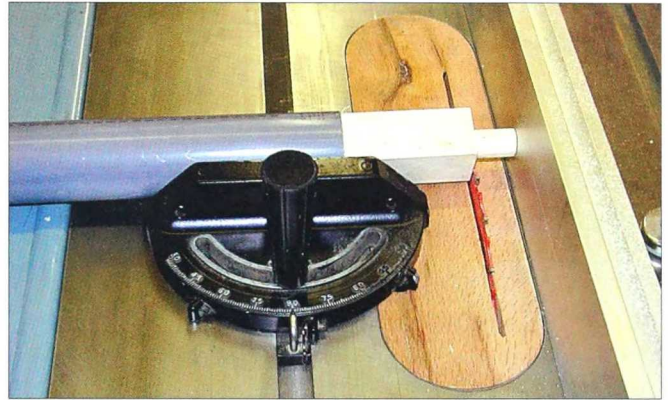


2-460. The tang of a tape measure can be used as a compass to draw circles.

TENONS (MAKING ROUND)

Making round tenons from square stock on either a table saw or a radial arm saw would seem to be quite a challenge. Here is an easy way of doing it.

Insert the square stock into an appropriately sized PVC or ABS pipe so it fits snugly. Leave the desired tenon length, plus an inch, exposed. Raise the table-saw blade to the appropriate height and, using your miter gauge as support, butt the piece up against your fence (2-461). That extra inch will keep the saw blade away from the fence, and it can be cut off later. Now, you can make your cuts, but do not rotate the piece into the moving saw blade; back it off the blade and then rotate it. Move the fence accordingly for each successive pass.



2-461. Round tenons can be made on a table saw by inserting stock into a PVC or ABS plastic pipe.

THICKNESS PLANER

Knife Repair

Once in a while the inevitable happens and you hit a piece of metal that leaves a small nick in your thickness-planer blades. Every piece of wood that you plane after that will have a small raised stripe on it. Don't fret; there is a quick fix. You don't have to dismantle the entire tool and have all of the knives resharpened just yet.

With the power cord unplugged, open the knife access panel and loosen one knife only. Slide the knife just slightly to the left or right and then rein-

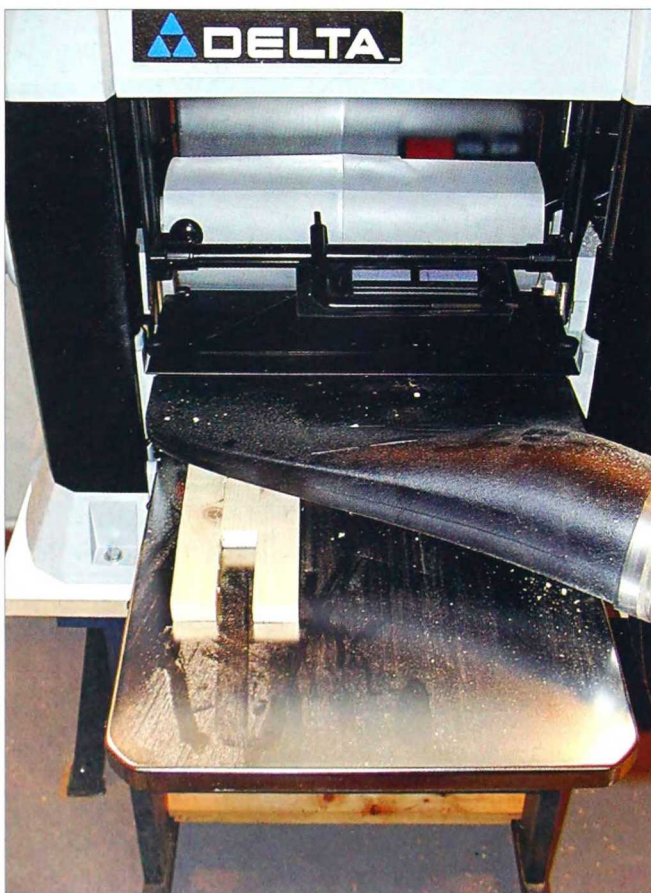


2-462. Moving only one knife slightly on a thickness planer will correct a nick in a knife.

stall it (2-462). This will alter the track and the one knife will erase that raised area.

Planing Small Pieces

Sometimes workpieces are just too small to safely place in a thickness planer. Here is a safe way of handling small workpieces: Spot-glue or nail two long strips of wood of the same thickness as your workpiece to its sides to form an H (2-463). Slowly feed this H-shaped jig through the planer, and then remove the scraps.



2-463. Fastening two strips of wood to the sides of your workpiece will produce a jig that safely allows small workpieces to be planed in a thickness planer.

TOOL KIT

Those canvas-type inserts for plastic buckets are a great way to lug tools around. What they don't provide for, however, is a convenient place to keep an extension cord.

Drill a hole near the bottom of the bucket for the cord. Coil the cord inside the bucket and feed the male (plug) end out of the hole (2-464). That can be fed to an outlet, and the remaining wire inside can be uncoiled for your power tools.



2-464. An extension cord coiled in the bottom of a bucket tool kit will add to the convenience.

TOOTHBRUSHES IN THE WORKSHOP

Don't throw away those old toothbrushes; keep a couple in your tool drawer. An old toothbrush can be used to clean pitch build-up on your blades and bits, clean files and rasps; clean small metal parts; and, when stripping furniture, a toothbrush will get the stripper into intricate carving details (2-465).



2-465. An old toothbrush will help clean intricate carving details.

VACUUM IN THE WORKSHOP

This technique of picking up nails with a vacuum is effective and saves me a lot of bending and stooping. I came up with the idea when I was tearing down walls to build my new workshop. I was trying to be economical by saving the 2 x 4s, so, needless to say, I had to remove the nails from them. Being lazy, I just let the nails drop on the floor, thinking that I would sweep them up later. Well, a push broom doesn't work. All it does is make dust and hardly moves the nails.

Then I had a brilliant idea. Using some epoxy glue, I glued a fairly strong magnet to the suction part of my vacuum cleaner. I positioned it about ½ inch above the bottom of the vacuum cleaner so that it would lift the nails off the floor and not jam them under it (2-466). Now, I occasionally lift the wand, pluck off the nails, and continue to vacuum.



2-466. A strong magnet attached near the bottom of the shop vacuum will pick up nails, screws, etc.

VENEER

The Random House dictionary defines veneer as a thin layer of fine wood used to cover a cheaper, thicker wood. This definition is somewhat simplistic.

Veneer is a very thin (1/64 inch or so) panel of wood that is shaved off a log with a very sharp knife (2-467). The panels are called flitches. These flitches vary in width and thickness depending on the type of cut and the type of wood that they are cut from. A wood like pine, for example, is soft and relatively pliable and can be cut very thin, whereas oak is harder and more brittle and must be cut thicker.

The width of the flitches depends on the diameter of the tree and the type of cut. **Rotary-cut veneer** will be wider because the knife slices off a thin layer while the log is being rotated. **Flat-cut veneer** is narrower because the knife slices off a flat section of the log. **Rift**, more commonly known as **quarter cut**, is produced from a log that has been cut in quarters lengthwise. **Half-round veneer** is produced in the same manner as quarter-cut veneer. These four methods of producing veneer result in four dramatically different effects in the grain figuring.



2-467. Veneer.

The following is a brief description of most of the veneers (2-467) that are available in the United States and Canada. The definitive source of information on veneer and wood species can be found at <http://www.woodsoftheworld.com>, a service by the University of Vermont.

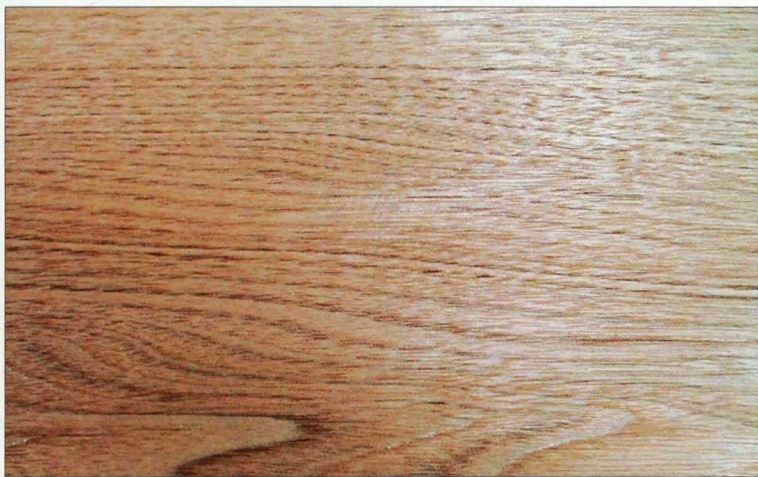
African mahogany (2-468) is imported from West Africa. It ranges in color from light pink to reddish brown. The wood produces a very pleasing and distinct grain. The trees are found up to 4 feet

in diameter with heights of up to 70 feet clear of limbs, so very wide veneer flitches may be had. Mahogany is used almost exclusively in boatbuilding and furniture-making.

African rosewood, also known as bubinga, akume, and kevazinga, is imported from West Africa. Red, with streaks of dark purple, this highly figured wood is in much demand for rich, dark furniture and as wall paneling in formal dens and libraries. African rosewood is not a true rosewood.



2-468. African mahogany. The photographs of veneer in this section may not truly depict the species shown due to lighting conditions and other circumstances beyond the author's control.



2-469. Butternut.



2-470. East Indian rosewood.

American cherry grows in the eastern half of North America. Primarily used for furniture, its light-red to light-brown natural color is preferred by the connoisseur, even though it accepts stains quite readily. It is elegantly figured.

American elm grows in the American Midwest. It is a heavy, hard, strong, and very coarse-grained wood that is light brown in color.

Avodire is imported from the Gold and Ivory Coasts of Africa. It is one of the main "blond" cabinet woods. It ranges in color from cream to pale yellow and is moderately figured.

Brazilian rosewood is a true rosewood. True rosewood, as known to cabinetmakers, comes from Brazil, Central America, Asia, and the Malagasy Republic. It has excellent technical properties, an attractive appearance, and is usually quite fragrant. The wood is fairly easy to work and finishes to a smooth, high polish that holds well over a long period of time. Another asset is that it is dimensionally stable. Unfortunately, almost all of the mature trees have been used up and thus it is very expensive. The smaller trees are now being harvested and used mainly for flat-cut veneer.

Butternut (2-469) is wood from the northeast United States. It is a pale, satiny brown with a leafy grain and occasional dark streaks. It is used mainly in furniture because it ages beautifully and takes on a mellow patina.

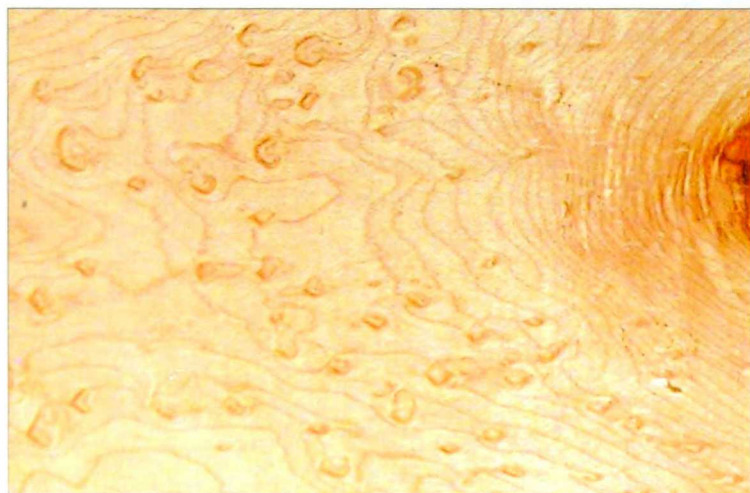
East Indian rosewood (2-470), also known as Bombay rosewood, is imported from Sri Lanka and southern India. It ranges in color from dark purple to ebony and has streaks of red and yellow. When the veneer is cut on the quarter, it is dramatically figured.



2-471. *English brown oak.*



2-472. *Lacewood.*



2-473. *Sugar maple.*

English brown oak (2-471) is white oak that has been turned brown by a harmless fungus. If harvested healthy, the wood is like white oak. But if it has been pruned or damaged, the fungus will develop in the tree. The result is a rich-brown color. The density and the highly figured grain make it particularly desired for furniture-making.

Figured red gum, also known as sweet gum, grows in the moist lands of the lower Ohio and Mississippi basins. The heartwood of the gum tree, it has a reddish-brown tone. It is used mostly for cabinetry.

Lacewood (2-472), sometimes referred to as Australian silky oak, is imported from Australia. Its flaky grain pattern turns a pinkish-red when finished.

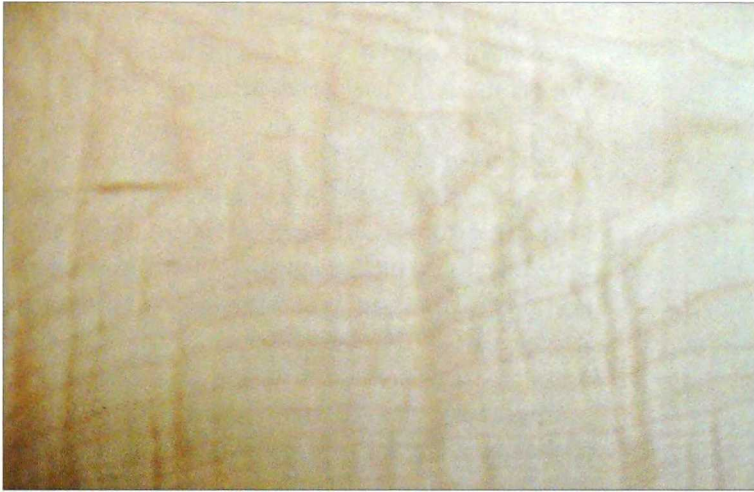
Limba, also sold as Korina in the United States, has a grain of medium texture and hardness and good woodworking properties. A graceful, delicate figure is exposed when this wood is finished.

Lignum vitae is the hardest wood in the world. It will not float. It is also known as ironwood and is still used as propeller shaft bearings in shipbuilding.

Macassar ebony is imported from the West Indies. The logs vary in size up to 16 inches, with some reaching 30 inches. It ranges in color from dark brown to black with streaks of golden yellow. It is a very dense and heavy wood and is considered quite rare.

Makori is a Nigerian wood that is also called African cherry, baku, and cherry mahogany. Makori is dense and hard and ranges in color from pinkish to blood red. It is similar to closed-grained mahogany.

Maple (*Acer* genus) is a wood that is cherished by turners and fine furniture



2-474. Curly maple.



2-475. White oak.



2-476. Primavera.

woodworkers. Black, big leaf, red, and silver maple are the most notable subspecies and are found in the eastern United States and Canada. Sugar maple (*acer saccharum*) (2-473), also known as rock maple, produces a bird's-eye grain pattern. Curly (2-474), fiddleback, and tiger are also grain patterns produced by the species. The bark of the maple tree must be stripped to determine if it has these much desired patterns.

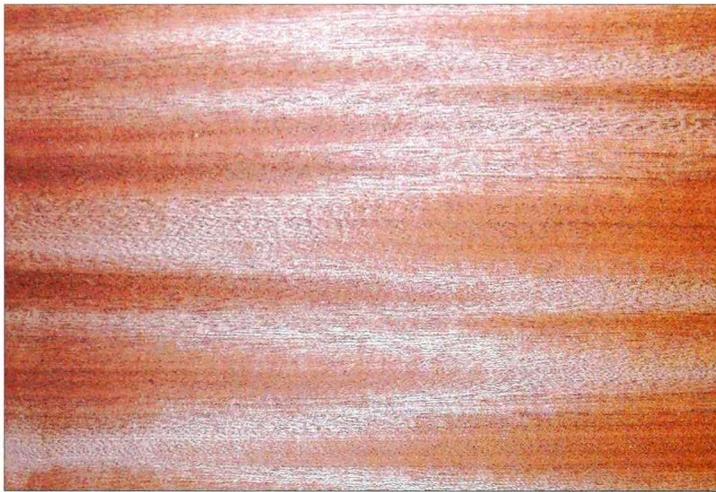
Mountain tulip, more commonly referred to as yellow poplar, is a large tree found from Canada to the Gulf of Mexico. A greenish-yellow wood with dark streaks, it is a great surface for stains and paints. Tulip is used in furniture construction such as drawer parts.

Oak grows in the entire eastern United States and Canada. White oak (2-475) is slightly lighter than red oak, but, when finished, they are difficult to tell apart. The properties of the wood make it particularly suitable for watertight containers.

Orientalwood is imported from Australia. It is somewhat similar to American walnut in both color and grain, but is not related. The tree is huge, often reaching heights of 190 feet with a diameter of 6 feet. As a veneer, it is usually cut on the quarter to produce a strong stripe-like effect.

Paldao, a native of the Philippines, is a large tree with a base of three to four feet. The wood is fairly hard with large pores and is grey to reddish-brown with irregular stripes and a varied grain. Used for architectural woodwork and furniture, paldao finishes very well.

Pine is most prevalent on the east and west coasts of North America. It is a softwood that is used in construction, furniture, paneling, and for a myriad of other products. As a veneer, it is cut very thin because



2-477. *Sapele*.



2-478. *Teak*.



2-479. *Walnut*.

it is very pliable and soft. As a result, veneered surfaces should only be lightly sanded before finishing.

Primavera (2-476) is a Central American tree that has a cream-to-yellow brown color and a mahogany-like grain that makes it very suitable for furniture and fine cabinet work. When finished, it has a high-golden satin luster.

Red birch is grown in the eastern United States and Canada. It is the heartwood of the birch tree and is reddish-brown in color. The wood is heavy, hard, and closed-grain and is one of the principal woods used to produce wood alcohol, charcoal, tar, and oils. Stained, it is sometimes used to simulate other, more expensive woods.

Sapele (2-477) is a reddish-brown wood that is grown in Ghana and Nigeria. It has a very strong stripe and is reminiscent of African mahogany, but is harder and heavier. Fine cabinetmakers make good use of this beautiful wood.

Satinwood originates in southern India and Sri Lanka. It is a pale-gold wood that is nearly always found with a rippled figure and a prominent straight stripe. The wood is hard and dense with an interlocking grain.

Teak (2-478) is a rare wood that originates in Burma, East India, and Southeast Asia. It is very expensive. The sap in this wood is left to drain for about five years before the tree is cut down, and the sap leaves an oily substance in the pores that makes the wood highly water-resistant. It varies in color from golden yellow to dark brown, and usually has dark streaks in it. Teak is much in demand by boatbuilders. The oil in the wood and its density make it very hard on woodworking tools.

Tigerwood, or Congowood, is a West African wood. It ranges in color from greyish-

brown to gold with black markings, and has an excellent ribbon effect. These characteristics make tigerwood a desired wood for cabinetmakers.

Walnut (2-479), better known as American black walnut, is found generally throughout the southeastern United States. It ranges in color from light grey to greyish-brown to dark-purplish-brown. The figured effect as seen in some veneers is a result of the half-round slicing. Some other interesting veneers are sliced from the stump, crotch, and burls.

White ash is a large tree found mainly in eastern Canada and the United States. It is a tough, heavy wood that is used for baseball bats and the bent parts of furniture. It ranges in color from a creamy white to a dark brown and sometimes has a red tinge to it. Its pattern is prominent and is used for rustic effects.

White birch is from the same tree as red birch, but it is the sapwood. It has little or no grain pattern and is usually found only in flat-cut veneers.

Zebrawood (2-480) originates in the Cameroon and Gaboon, West Africa. It is a wood with highly contrasting stripes that is very heavy and hard and is often used as inlay. The stripes alternate from a straw yellow to a dark brown.

Applying Veneer

A quick and easy way to apply veneer to *small*, flat workpieces is to use adhesive fabric (2-481). This is available at most fabric shops. Simply lay it between the veneer and your stock, place a piece of brown paper on top, and use a hot, dry iron to press it all in place.

Make sure, though, that the *center* of the iron face covers all of the edges.



2-480. Zebrawood.



2-481. Use adhesive fabric to apply veneer to small, flat workpieces.

Cutting Veneer

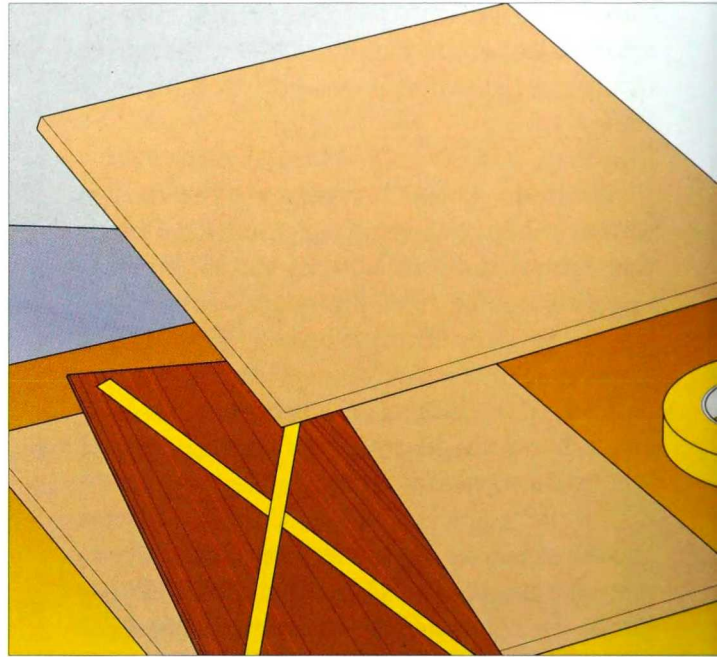
Wood veneer is much too thin to cut on a power saw, but sometimes this has to be done. Here is a shortcut: Sandwich the veneer between a couple of scrap pieces of $\frac{1}{8}$ - or $\frac{1}{4}$ -inch plywood using double-faced tape to adhere them (2-482). Draw your pattern on the top surface and proceed to saw. Carefully separate the pieces when they are completed.

Gluing Veneer

Gluing veneer is a slow process if you are gluing both sides of the workpiece, unless you have a commercial veneering press. You have to glue one side of the veneer and then one side of your workpiece, let them dry, and then repeat the process for the other side. The following shortcut will help expedite the gluing process: Tap a 1-inch finishing nail into each corner of your workpiece and apply your contact cement to this side. Flip it over so that is resting on the nails and glue this side (2-483). Glue up your veneer pieces. When they are tacky and ready to apply, adhere them to the top surface, flip it over, remove the nails, and do that side.

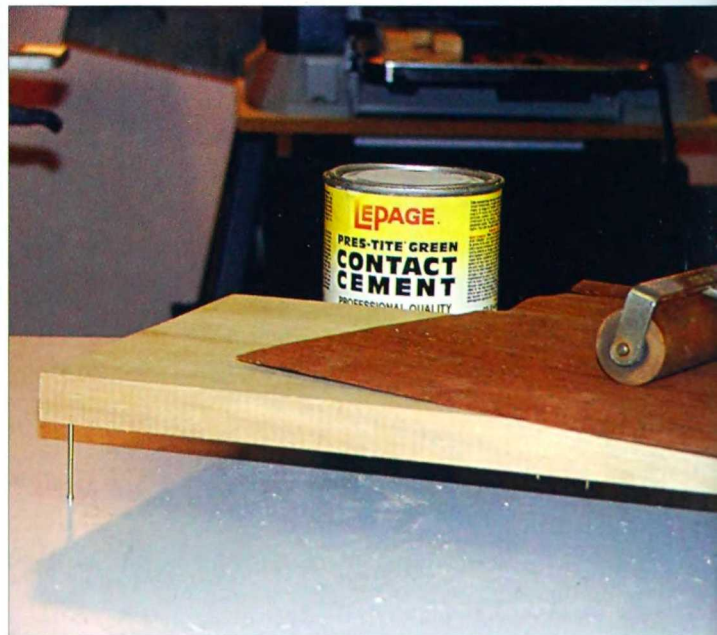
Repairing Veneer

Occasionally a bubble will appear on a piece that you have recently veneered. Most likely, this is due to an absence of glue beneath that spot, or the glue in that spot was too dry to adhere. If the latter is true, apply some heat to the area with a hair dryer or heat gun. Be careful not to burn it; get it just hot enough so that you can still touch it. Now, place a heavy weight on top of the area to compress the bubble onto the heated surface. Let it stand for a few hours. If this doesn't work, it's because there was no glue to adhere to, so try the following technique: Your doctor or your pharmacist will give or sell you a hypodermic needle, after you explain what it is for. Get one that is fairly large, large enough to allow woodworking glue to pass through with some pressure. Put a few drops



2-482. Use double-faced tape to adhere scrap pieces to veneer.

of the glue into the syringe and inject it into the bubble. Clamp the spot down. The bubble will disappear (2-484). Rinse the syringe out thoroughly in warm water, replace the safety cap, and lock it away for future use.



2-483. Gluing both sides for applying veneer can be done by raising one surface with finishing nails.



2-484. To eliminate a bubble on veneer, inject a few drops of carpenter's glue into the bubble.

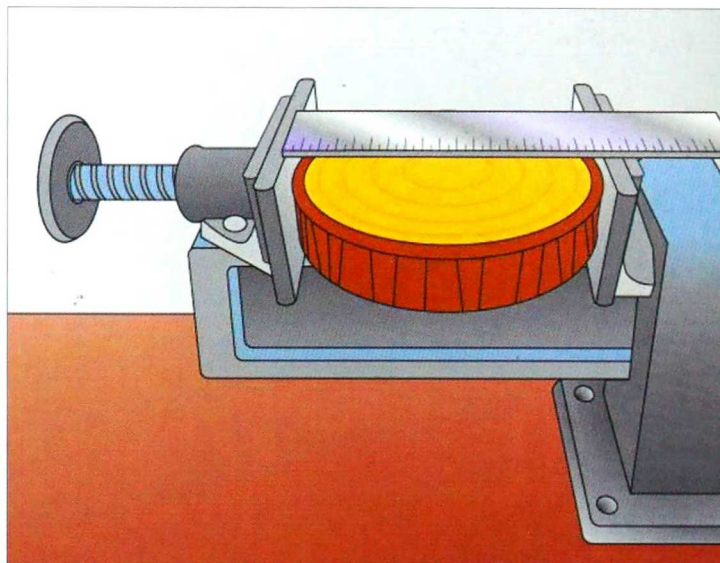
VICE

Determining Workpiece Thickness with a Vise

Determining the diameter or thickness of a workpiece can be done even if you don't have calipers. Put the piece in either a bench vise or a bar clamp. Slightly tighten the vise or clamp and then measure the opening with a ruler or tape measure (2-485).

Vertical Planing Vise

The shop-made vertical planing vise shown in 2-486 and 2-487 (shown on page 206) is a great tool to have around the shop. It allows you to secure your workpiece so that you can work on its edge. The one that I have seen on various jobsites is made primarily for the planing of door edges. I modified this one by making it a sliding jig. This allows you to clamp workpieces of varying thick-



2-485. A bench vise or a clamp can be used as a caliper to measure thickness or diameter of the workpiece.

ness. The wing nuts and washers ensure that the workpiece is held firmly.

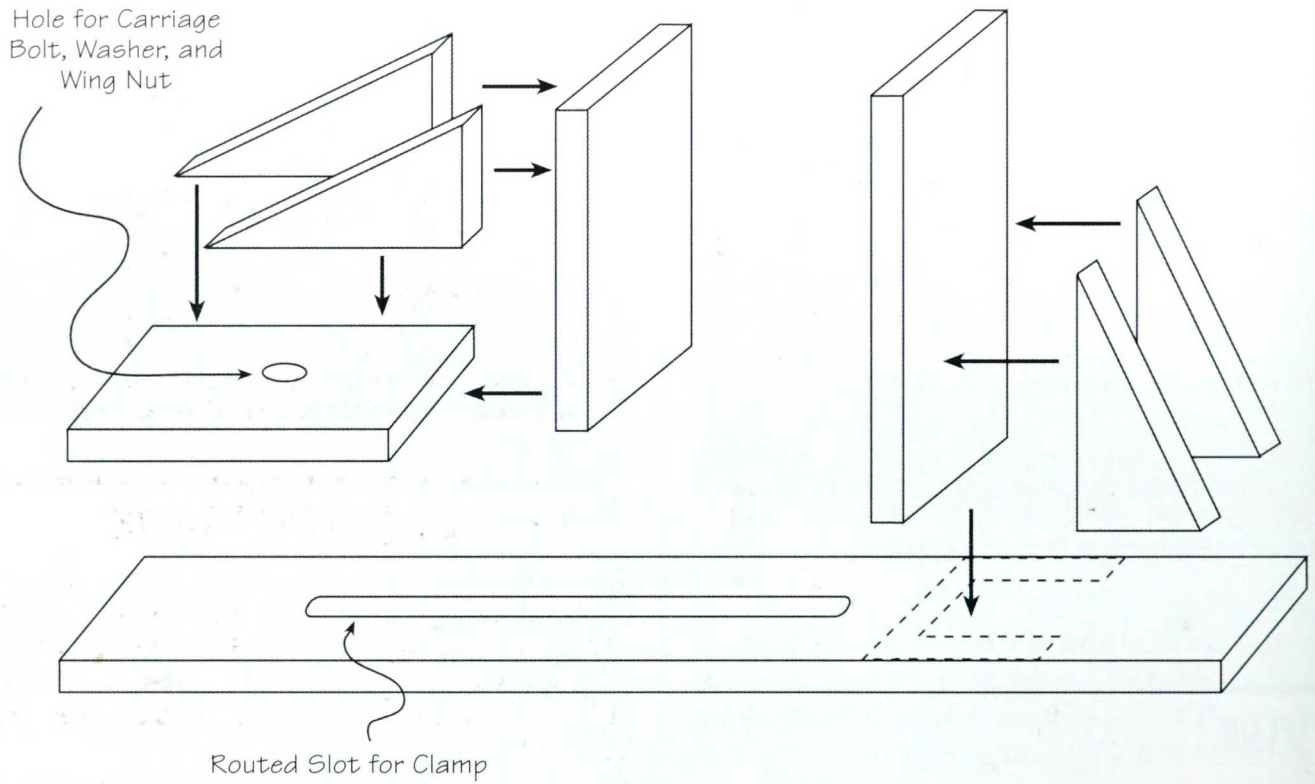
Using two of these vises will keep your larger workpieces secure for planing or sanding.

WALL-CABINET BRACKETS

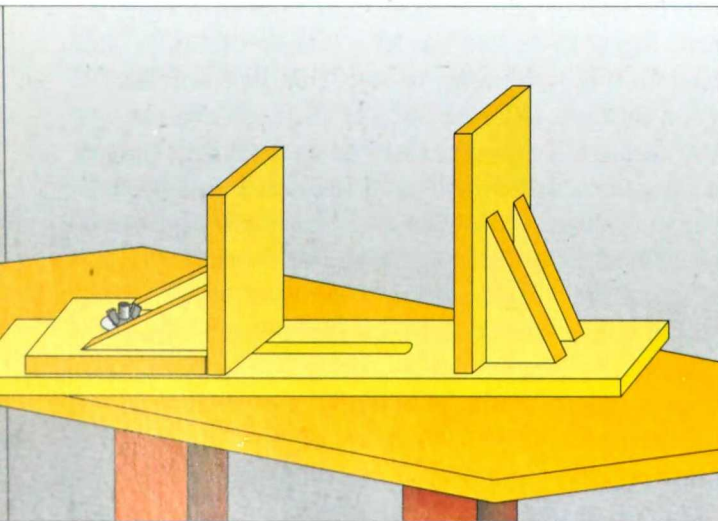
Here's a dandy idea for hanging those tool cabinets on the wall of your workshop. It's not only easy, it's fast. Rip a 45-degree cut in a couple of 1 x 2s, full length. Cut two pieces to size, that is, the width of your cabinet. Glue and screw them to the back of the cabinet at the top and the bottom. Cut two or more pieces the same length and screw one piece to the wall where you want the top of the cabinet to be (2-488). Hang the cabinet and mark where the bottom bracket should be. Remove the cabinet, secure the bottom rail, and rehang the cabinet.

Save the leftover pieces. Once you see how easy it was to make these brackets, you'll find more cabinets to hang this way.

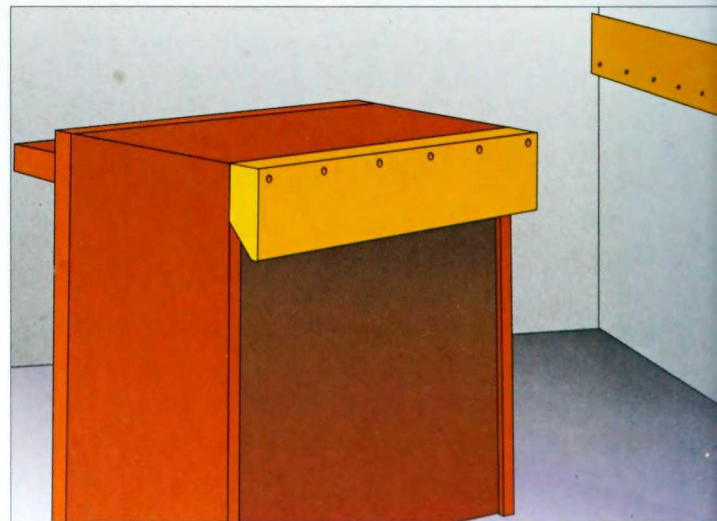
Vertical Planing Vise



2-486. Construction of vertical planing vise.



2-487. This vertical vise will keep your workpiece secure and steady while you are working on its edges.



2-488. These shop-made wall brackets make it easy to hang wall cabinets.

WATER STAINS

Removing Water Stains on Finished Wood

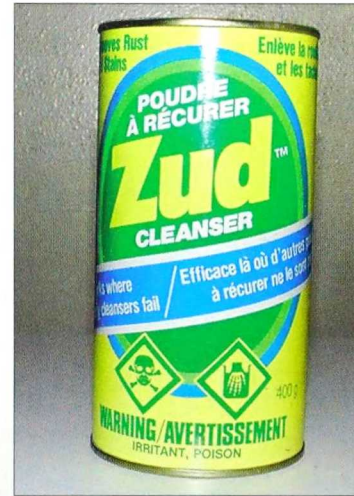
To remove water stains from finished wood, try a little oxalic acid mixed with water (2-489). Use a Q-tip to apply it *only* to the stain area. Try it on a sample piece first to see if you have the right water/acid strength. When the spot is removed, rinse the area with washing soda and water. Wait for a day or two before refinishing the piece to match the original finish.



2-489. Oxalic acid will remove stains from finished wood.

Removing Water Stains on Unfinished Wood

Dark water stains on unfinished wood can easily be removed with oxalic acid stain remover compounds (2-490). Allowing it with a wet sponge will restore the wood to its original condition.

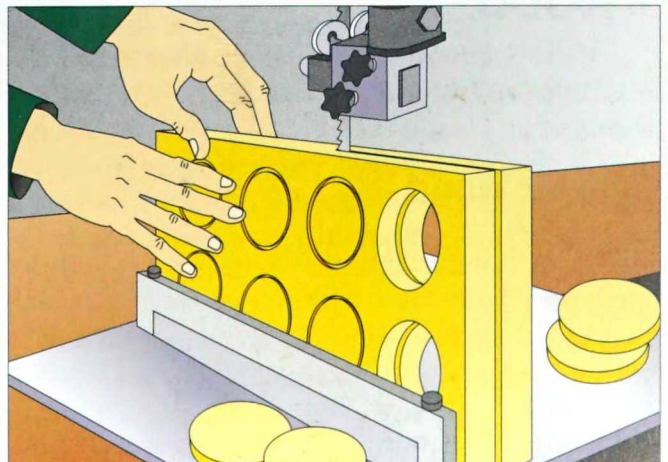


2-490. A oxalic acid stain remover compound such as this will remove water stains on unfinished wood.

WHEELS (SHOP-MADE)

Here is a quicker way for making a dozen or so toy wheels. Select a piece of wood stock that is about $\frac{1}{4}$ inch thicker than the wheels you want to produce. It should be long enough to accommodate the required quantity.

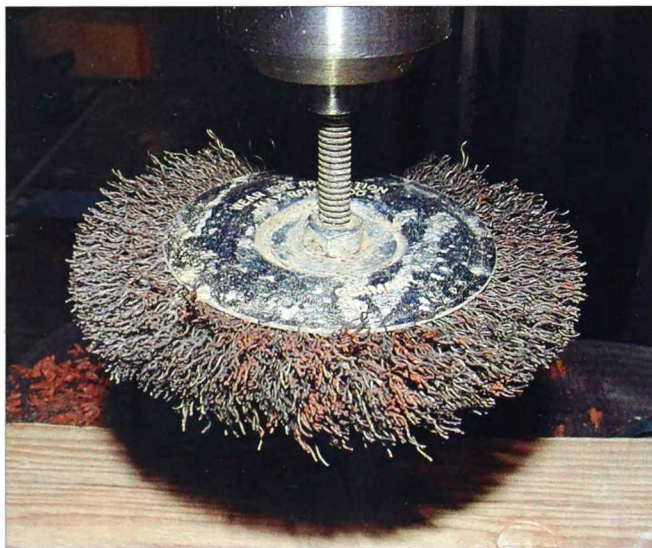
Set up your drill press with the appropriate hole saw and set your depth adjustment to stop the drill press $\frac{1}{8}$ or $\frac{1}{4}$ inch from the top side. Clamp this to your workbench and install your wheels (2-491). An orbital sander will do a fine job of finishing the surfaces, all at the same time.



2-491. Resawing releases these toy wheels for later finishing.

WIRE WHEELS (EXTENDING THE LIVES OF)

After a wire wheel has been used to remove rust or paint, the wires seem to all be running in the same direction and the wheel tends to lose its effectiveness. Extend the life of the wheel. After every use, remove it from the arbor and reverse it (2-492). You'll probably double its life.



2-492. To extend the life of a wire wheel, remove it from the arbor and reverse it.

WOOD

(Also See *Hardwood, Lumber, Plywood, Softwood, and Wood Finishing*)

Storing Wood

There is a right and a wrong way to air-dry lumber or hardwood. The wrong way is to haphazardly stack the wood in the lumber rack. This will usually result in warped, twisted, or crooked material.

Try this technique to store lumber properly. Next time you are out making a purchase at your favorite lumberyard, buy a bundle of laths. When your lum-

ber arrives, lay out three laths (assuming that they are 8-foot-long lumber) and place a layer of lumber perpendicular on top of them. Place three more laths on top of the first layer, etc. There should be a lath in the middle and one about a foot from each. Use more than three laths if your stock is longer than 8 feet.

Now, the important part. The laths should all be in the same position; that is, if you are looking at a stack of lumber, the laths should form a straight vertical line. If the laths are not straight up and down, the result may be kinks in the boards.

Also make sure that the annual rings on the lumber arch upward (2-493). It will allow moisture to drain down, rather than form a pocket that will result in a cup.

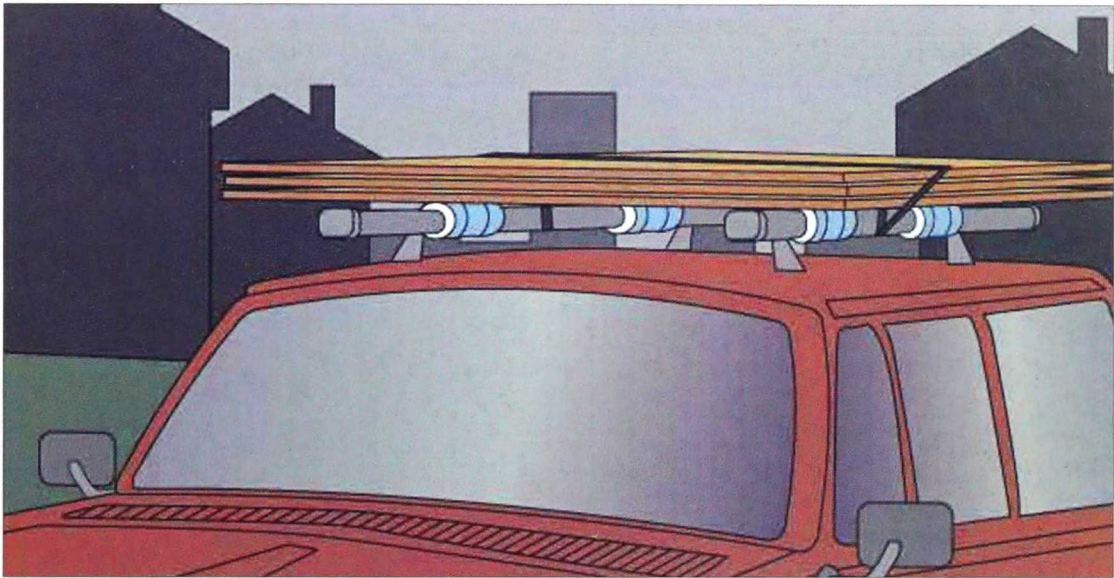
The reason, of course, for doing any of the above is to ensure free air circulation while acclimatizing the material and to further ensure that your material stays straight and true.



2-493. When air-drying lumber, the annual rings on the lumber should arch upward to prevent cupping and warping.

Transporting Wood

Protect your car's rooftop luggage rack when you visit your home renovation center to pick up a load of lumber. Use a couple of foam water-pipe insulation tubes and wrap them around the crossbars first (2-494).



2-494. Foam water-pipe insulation will protect your luggage rack when transporting lumber.

Wood Filler (Applying)

Most woodworkers are quite familiar with the application of the various types of wood filler. We all have little accidents or make mistakes that we have to hide. To make that joint look perfectly mitered, we fill in the cracks with wood filler.

The toughest mistakes to fix on the surface are dings or dents made by a hammer. It seems that wood filler just won't stay put, no matter what you do. Here's the answer: Use your electric drill with a $\frac{1}{16}$ -inch bit and drill a couple of shallow holes in the dent (2-495). These holes will allow the wood filler to grab onto something.



2-495. Drilling a couple of shallow holes in the dents will allow the wood filler to grab hold.

WOOD FINISHING

There are a variety of wood finishing materials that have uses in the workshop (2-496):

Lacquer is available as a brushing or spraying compound, and has much the same characteristics as shellac. Lacquer is, however, faster drying, and therefore coats of lacquer can be built up much more quickly. It does take many more coats of lacquer to build it up to a thickness similar to that achieved with shellac or varnish. If you are going to brush it on, use only the very best brushes because it easily leaves brush marks.

Linseed oil is available either raw or boiled. Do not use raw linseed oil. Boiled linseed oil was used for many years because it was cheap and readily available. It leaves a solid, but not too hard film on wood that is easy to repair, but is not recommended as a final *finish*.

Polyurethane (also known as varathane) is a synthetic material that is more properly called a plastic finish. It's available in high-gloss, medium, or satin finishes. Polyurethane is easily applied, dries quickly, and can be used to smooth out brush marks. This is certainly my choice for a durable finish.



2-496. Wood-finishing materials.

Sanding sealers are fast-drying solvent-release compounds that are used on raw wood to fill in between the raised grain of the wood prior to the application of a finish product. Do not use varnish or oils on top of sealers. If the sealer is sanded after it is applied, it will produce a very fine surface. Sealers are excellent for fine-grained woods, but not for open-grained woods such as oak.

Shellac is a natural resin that is available in flakes for mixing with alcohol or as a ready mix in either clear (white) or orange. There is very little difference between clear and orange, except that the orange will leave the wood slightly colored, will keep a little longer, and is slightly more resistant to moisture.

Shellac bonds to itself readily and will accept lacquer quite well, though oils and varnish will not adhere to it. It can be polished to almost any sheen, from satin to French polish. It is only used for finishes for interior use and should not be used for bar or countertops or any surface that is susceptible to alcohol spillage.

Traditional varnish, which is made from natural resins, is now very difficult to get. Today's varnish is much different in that it contains synthetics and hardeners. If it's a hard, durable finish that you want, consider using polyurethane.

Tung oil dries to a harder film than linseed oil and is more moisture-resistant. There seems to be some debate over its usefulness as a final finishing product. I generally reduce it with mineral spirits, apply several coats, and then sand it with 0000 steel wool. This gives it more body and depth.

"Aging" Wood

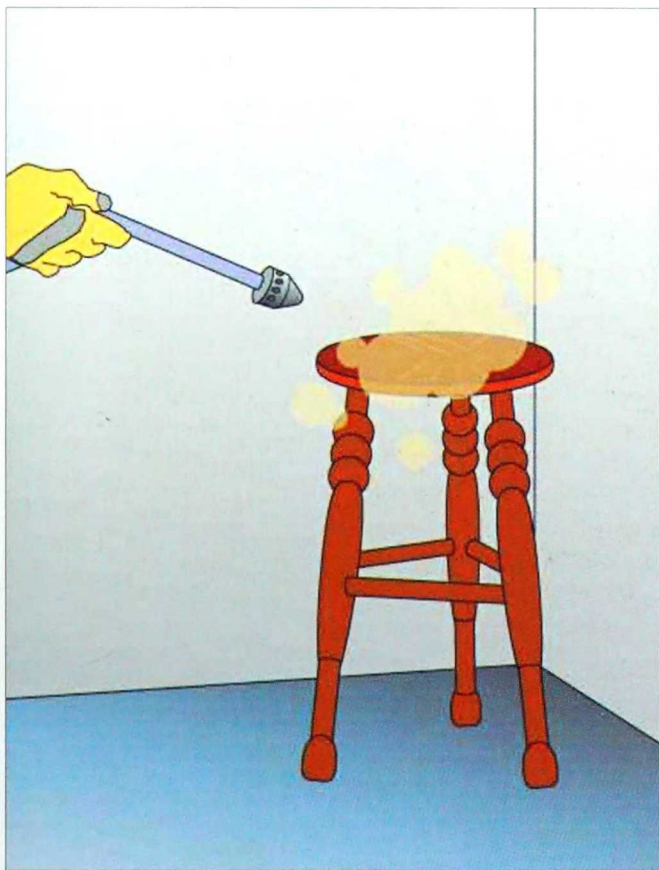
To give wood that "aged" look, sandblast it (2-497) and then stain it with a product like MinWax's Driftwood oil stain. If you already have a compressor, a sandblasting attachment is an inexpensive option.

Ensuring a Smooth Finish

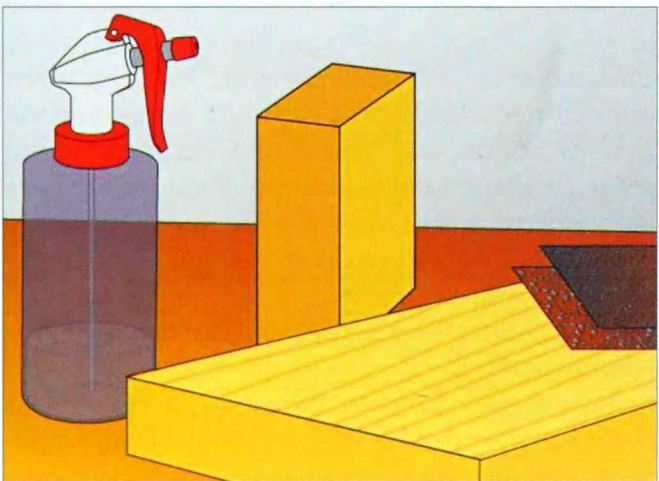
To ensure a smooth finish on your wood project, spray a fine mist of water on the wood before the final sanding (2-498). This will raise the grain and the final sanding will smooth it out. The wood is now ready for staining and the stain will penetrate more evenly.

Filling Spray Guns

Filling a spray gun pot from a gallon finish or paint container can be a messy job at best. Using a

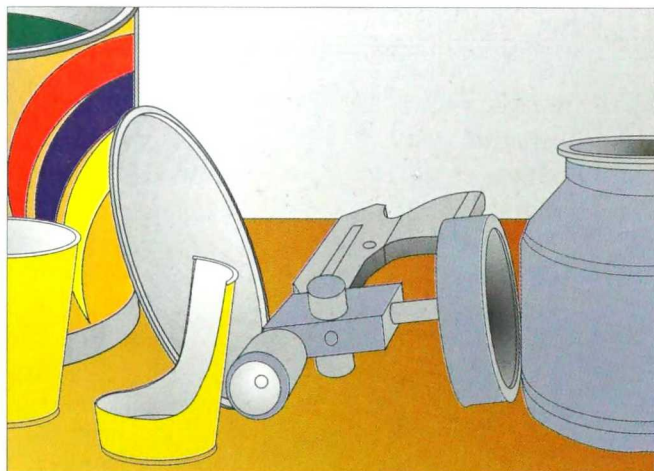


2-497. Sandblasting will “age” wood and a Driftwood stain will turn it grey.



2-498. A fine mist of water will raise the grain for final sanding. The stain will then penetrate more evenly.

trimmed plastic or paper drinking cup will make it less so. Use a sharp knife or a pair of sharp scissors to make the cut on the cup as shown in 2-499.



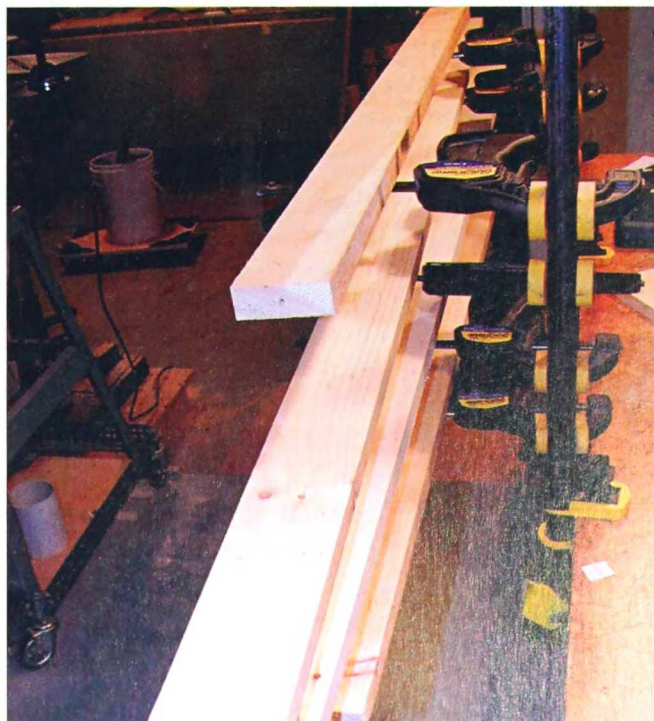
2-499. A trimmed plastic or paper drinking cup will make it easier to fill a spray gun pot from a finish or paint container.

Finishing Long Workpieces

When finishing or painting long pieces like moldings and such, storing them for drying can be a problem in a small shop.

Tighten a couple of pipe clamps to the edge of your workbench. Use some small bar clamps and tighten them on the pipes. You now have a makeshift drying rack (2-500).

2-500. A makeshift drying rack can be made with pipe clamps and bar clamps.



Hiding Knots

Knots in pine or spruce have a tendency to “bleed” through paints and other finishes. To prevent this from happening, brush or spray a few coats of shellac on the knots (2-501). The shellac will seal the knots and prevent the resin from bleeding through.



2-501. A coat or two of shellac will prevent knots from bleeding through the finish.

Preventing Hardened Residue on Cans

Some finishes and paints can leave a hardened residue in the lip of the can that makes reopening a sometimes difficult task. This can be solved by putting plastic food wrap over the top of the can before sealing (2-502).

Safety Procedures When Using Finishing Materials

Most wood-finishing materials are either flammable or toxic. Extreme care should be exercised when working with them. Never use them near sparks or open flames, and always use an appropriate respira-



2-502. Plastic food wrap will make it easier to open used finish or paint cans.

tor, one that is rated for toxic fumes or odors. Use these materials only in well-ventilated areas.

There are two very important points that aren't usually addressed on the containers of finishing materials. The first is concerned with the empty containers of these materials. Call your city waste disposal department and they will advise you on how to dispose of these containers. The second point concerns how to dispose of the rags you've been working with. *Never* toss the used rags into a waste bin. *Always* hang them, fully open, up to dry in a cool, well-ventilated area, as, for example, on the clothesline. Used rags left in a pile will spontaneously combust.

Laws passed in both Canada and the United States seriously restrict the toxicity and flammability of consumer products such as these. There are a number of wood-finishing products already available that address these concerns. There are water-based contact cement, wood stains, and varnishes on the market that are safer to use than the older materials.

Spray Finishing and Painting

Newspaper or brown paper is usually used along with masking tape to mask off areas that you don't want to paint. Newspaper is sometimes difficult to shape to some areas.

Here's an easier method. Use plastic wrap because it will mold better to intricate shapes (2-503). You will still need to use the masking tape, but the plastic wrap will cling and the tape will be easier to apply.



2-503. Plastic wrap makes better masking material than newspaper or brown paper; it molds to odd shapes more readily.



2-504. Wood stains.

Water-Soluble Wood Stains

Kiss the oil- and solvent-based inflammable, toxic stains goodbye. The water- or latex-based stains work beautifully (2-505). What's more, they don't overly raise the grain, contrary to expectations. These stains go a lot further than the oils and may be mixed with one another to produce more subtle shades. They can also be mixed with water-based polyurethanes (varathanes) for a one-step finish or you can mix them with compatible latex paints to give a translucent pastel finish. All in all, these stains are a great breakthrough in finishing.

The big advantages of these stains, though, are the water cleanup and the ease of application. You can brush them on, roll them on, wipe them on with a damp cloth, or even spray them on. The method that I prefer is to use a scrap of foam rubber as an applicator. It applies the stain evenly and it's disposable.

A typical water-soluble wood stain is the Flecto Diamond stain that is compatible with Flecto's Diamond polyurethane (varathane) finishes. Trust me, these water-soluble stains and finishes work well and, in most cases, better than the old traditional finishes.

WOOD STAINS

Applying Wood Stains

Instead of using a paintbrush to apply wood stains (2-504), which you will have to clean afterwards, use scraps of foam rubber or pieces of an old sponge. When you are done, just throw them away.



2-505. A selection of water-based wood stains.

One word of caution, however: *Do not* use steel wool to smooth between coats. Remember, you are working with a *water-soluble* material and it will react with the steel wool. The black flecks or rust spots will prove this to you.

WORKBENCH

Bench Hooks

Here's a tool that I haven't used since my days in grade school, but it's still useful to have around the shop when you can't find elusive bench dogs.

Using a good grade (clear) of $\frac{3}{4}$ -inch plywood, cut a piece 8 x 12 inches and sand its surfaces and edges smooth. Cut two pieces of $\frac{3}{4}$ -inch scrap plywood 8 inches long x $1\frac{1}{4}$ inches wide. Glue and screw one piece flush along the short edge of the plywood, turn it over, and do the same thing on the other side and the opposite end. Now you have a bench hook (2-506).

"What do I use it for?" you ask. Well, you put it on your workbench with the bottom $1 \times 1\frac{1}{4}$ -inch

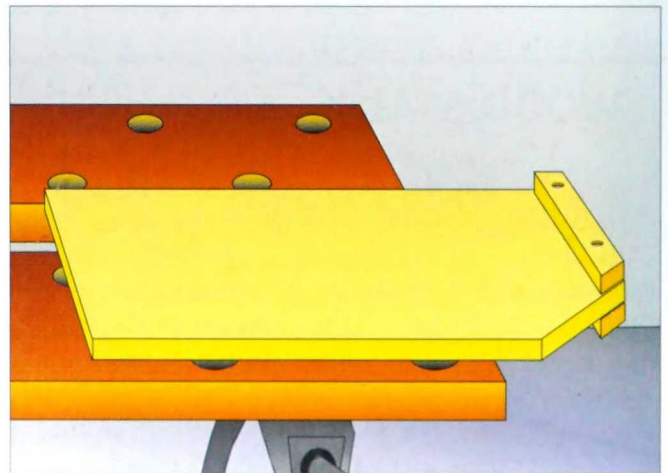


2-506. The bench hook is an extremely handy jig for square-cutting, planing, or carving.

piece hooked against the edge of the bench. Thus the name bench hook.

Now, you can use it for miter- or square-cutting with your backsaw, or as a brace for chisel work or planing. Like most of my jigs, I drill a hole in it near the top so I can hang it up on a pegboard.

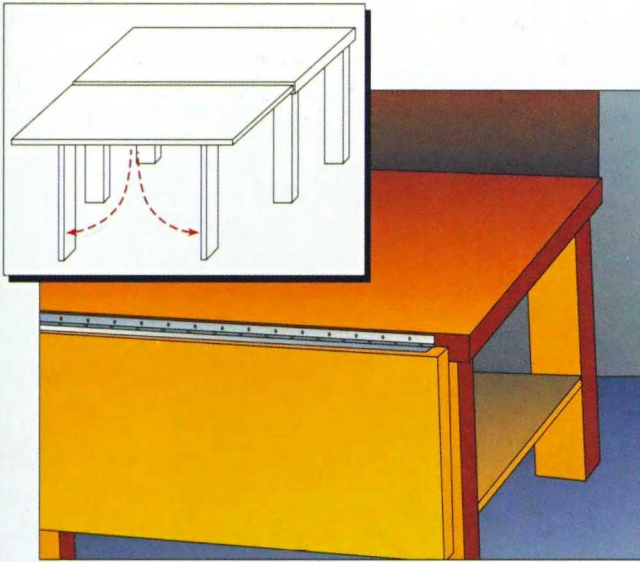
Here are instructions for building another type of bench hook (2-507). Follow the above directions, but on one side, or edge, make a 45-degree cut near the corner. Right-handers should make the cut on the right side of the boards, and left-handers on the left side. This will not give you a perfectly mitered cut, but it will be close enough for those workpieces that don't have to be precise.



2-507. A bench hook with a 45-degree corner cut.

Expanding the Surface of a Workbench

An old hollow-core interior door can be used to greatly extend the surface of your workbench (2-508). Use a piano hinge to fasten it to the edge of your bench so that it will swing down and out of the way. Hinge a couple of 2 x 4s under the door for support when it is in use. Flip the supports in and drop the door to get it out of the way.



2-508. Fasten an old door to your workbench with a piano hinge to expand the surface. A couple of 2 x 4s will support it in the up position.

Light for a Workbench

To add more light to your workbench, do the following: Install a drapery I-beam above and running through the length of your workbench. Run a lamp wire through the roller loops, attach a lamp socket and shade on one end and a plug on the other, and gently squeeze the loops so that they grab the wire (2-509). Be careful: Don't break the outer cover of the wire.

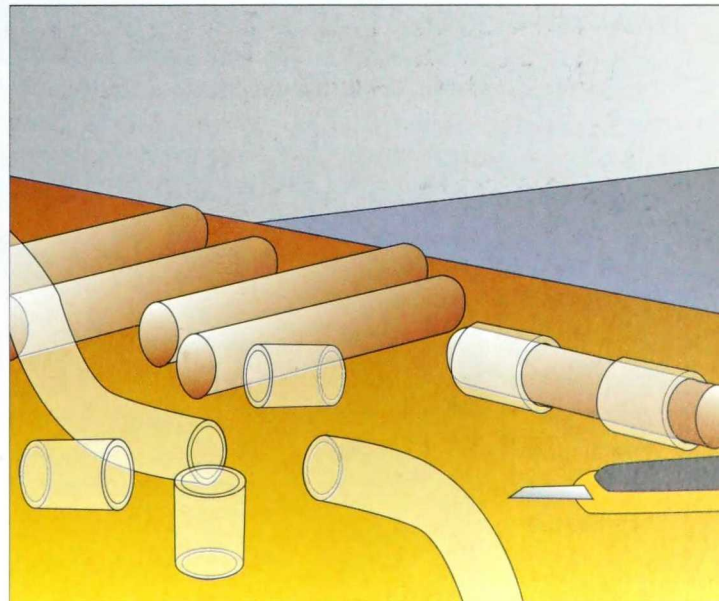
Workbench Dogs

Workbench vise dogs can sometimes mar a workpiece. To help prevent this from happening, cover



2-509. Lighting for the workbench.

the ends of the dogs with neoprene tubing (available at your plastics dealer) or other resilient material such as foam rubber, Styrofoam packing, flat wood scraps, etc. (2-510).



2-510. To prevent dogs from marring a workpiece, cover the ends of them with neoprene tubing or other resilient material.

WORKMATE PORTABLE PROJECT CENTER

Extenders for Workmate (#1)

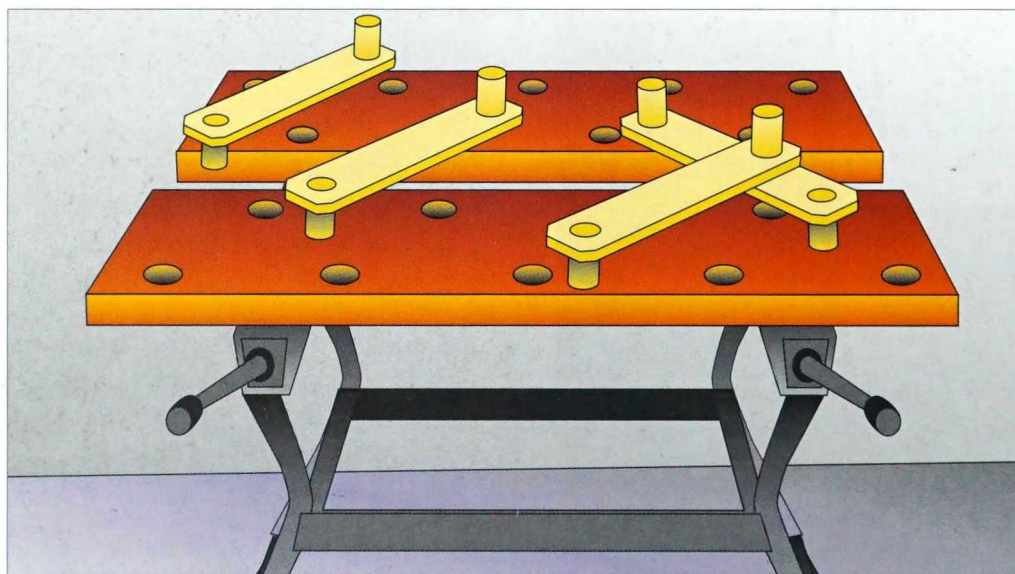
The Workmate has been used by do-it-yourselfers and woodworkers for many years and has become a great substitute for a full-blown workbench. Although a really versatile tool that should find a place in any workshop, it does have its limits.

The illustrated Workmate extenders are easily shop-built and will give it a larger holding capacity. Build them to a length that suits you (2-511).

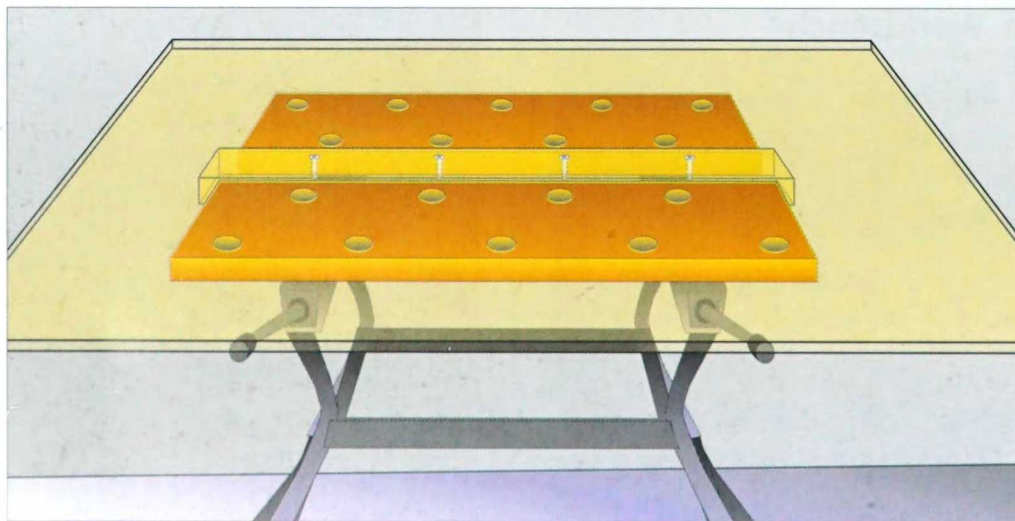
The extenders use $\frac{3}{4}$ -inch plywood and dowels or even pieces of an old broomstick.

Extenders for Workmate (#2)

In this second version, also use a piece of $\frac{3}{4}$ -inch plywood; it should be approximately 30 x 30 inches. This would make a good-sized work surface (2-512). On the underside of the plywood, glue



2-511. These shop-built Workmate top extenders will greatly increase its holding capacity.



2-512. This plywood work surface is easy to build and adds to the versatility of the Workmate.



2-513. This nail-bin hanger bracket is riveted to the Workmate with a cross-brace. Storage containers can be hung on it.

and screw a strip of $\frac{3}{4}$ -inch plywood that is 4 inches wide x 30 inches long. Run it down the middle. Cut one more piece of $\frac{3}{4}$ -inch plywood that is 5 inches wide x 30 inches long. Before gluing and screwing it onto the narrower piece, check the thickness of the Workmate's jaws. Mine are made of $\frac{7}{8}$ -inch plywood, so I had to shim my work surface with a piece of $\frac{1}{8}$ -inch plywood. This T-shaped piece will now hold the work surface securely in the jaws of the Workmate. Sand and finish the top surface, and you have a portable workbench.

Nail Support Bin for the Workmate

Many manufacturers sell clip-on containers that fit onto brackets. These brackets hook onto pegboards. This is very convenient when you are working within the confines of your workshop. However, during the warm months you may have several wood-working projects to do out of doors. Running back and forth to your workshop to get six or more screws or nails is not my idea of a good time.

The solution is to bring them with you. The storage containers have a built-in clip on their backside, for hanging. Here's a way for hanging them on the cross-brace of your Workmate: Purchase aluminum angles from hardware stores or your local aluminum distributor (you might also try an aluminum window and door retailer). The 1 x 1 x $\frac{1}{8}$ -inch angles are sold by either the weight or the foot and range in length from 8 to 20 feet or more. Rest assured, the unused portion will not be wasted.

Cut a length equal to the crossbar on your Workmate. Turn your Workmate upside down. Set the aluminum angle on the underside of the crossbar. Drill 3 or 4 holes that are the size of your pop rivets (blind rivets) and install the angle. When you turn the unit upright, you now have a bracket on which to install your nail or parts bins (2-513). This will save a lot of time when using your Workmate away from your shop.

Tool Rack for the Workmate

The tool rack shown in 2-514 is an easy-to-make accessory for your Workmate. The rack is made of ½-inch plywood. Appropriate-sized holes are drilled to facilitate your selection of tools. The beauty of it is that it can easily be lifted off when not in use.

WORKSHOP CLEANING

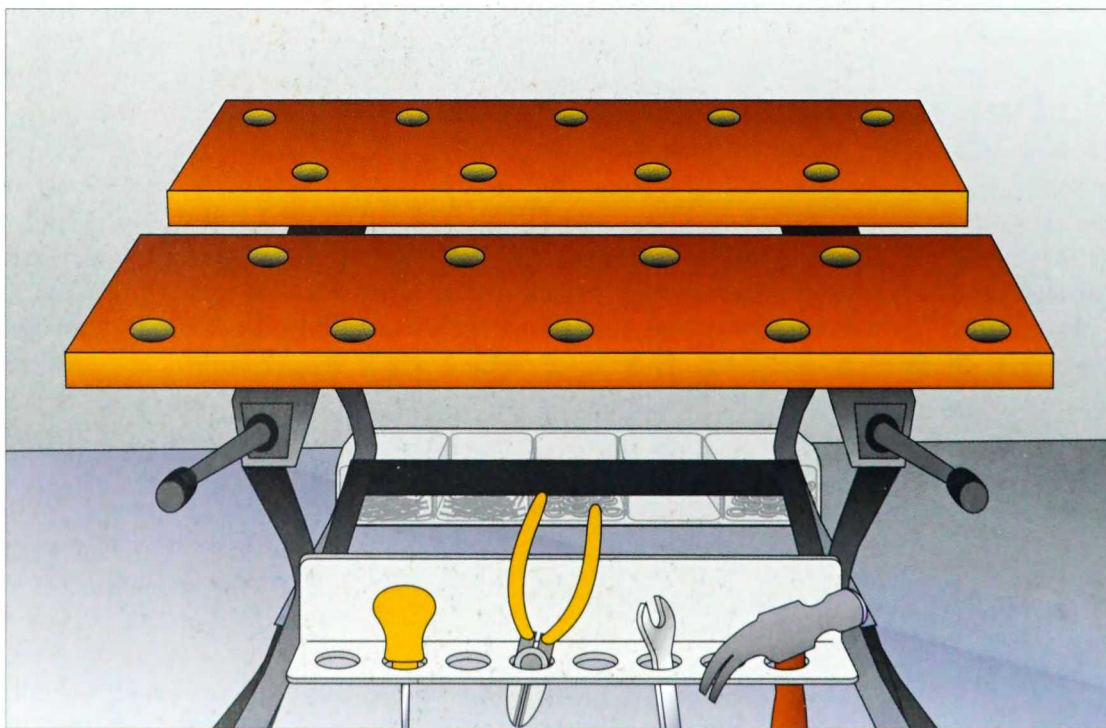
Cleaning a Workshop (#1)

Using an old leaf rake with a shortened handle will gather pieces of wood on your shop floor so they don't clog your shop vacuum (2-515).

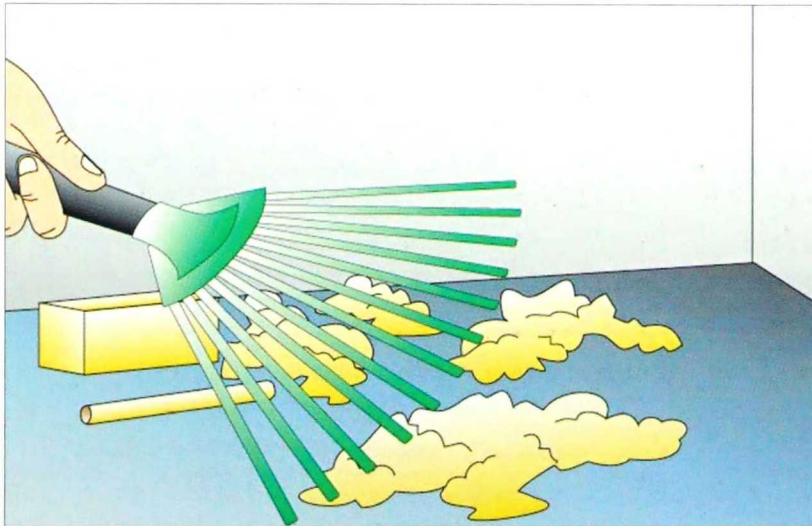
Cleaning a Workshop (#2)

A good shop-type vacuum is the best way to clean up your shop. Unlike a push broom, it creates no dust and, of course, can get into those little nooks and crannies that a broom can't. I am usually in my shop six days a week, so I generally dedicate my Sunday mornings to cleaning up.

One of what I consider the most important cleanup jobs is the cleaning of my power tools (2-516). It is amazing how much damage sawdust can do to your tools. You will probably extend the life of these tools threefold by giving them a regular vacuuming. Pay particular attention to the motor housings. Put the vacuum nozzle up tight to the openings to clean out the dust and debris.



2-514. To add versatility to your Workmate, add this clip-on tool rack.



2-515. An old leaf rake will gather up those wood scraps that block your shop vacuum.



2-516. A regular vacuuming of your shop is a safety factor. Regular vacuuming of your tools and their motors will prolong their lives.

Metric Equivalents Chart

INCHES TO MILLIMETERS AND CENTIMETERS

MM—Millimeters CM—Centimeters

Inches	MM	CM	Inches	CM	Inches	CM
$\frac{1}{8}$	3	0.3	9	22.9	30	76.2
$\frac{1}{4}$	6	0.6	10	25.4	31	78.7
$\frac{3}{8}$	10	1.0	11	27.9	32	81.3
$\frac{1}{2}$	13	1.3	12	30.5	33	83.8
$\frac{5}{8}$	16	1.6	13	33.0	34	86.4
$\frac{3}{4}$	19	1.9	14	35.6	35	88.9
$\frac{7}{8}$	22	2.2	15	38.1	36	91.4
1	25	2.5	16	40.6	37	94.0
$1\frac{1}{4}$	32	3.2	17	43.2	38	96.5
$1\frac{1}{2}$	38	3.8	18	45.7	39	99.1
$1\frac{3}{4}$	44	4.4	19	48.3	48	101.6
2	51	5.1	20	50.8	41	104.1
$2\frac{1}{2}$	64	6.4	21	53.3	42	106.7
3	76	7.6	22	55.9	43	109.2
$3\frac{1}{2}$	89	8.9	23	58.4	44	111.8
4	102	10.2	24	61.0	45	114.3
$4\frac{1}{2}$	114	11.4	25	63.5	46	116.8
5	127	12.7	25	66.0	47	119.4
6	152	15.2	27	68.6	48	121.9
7	178	17.8	28	71.1	49	124.5
8	203	20.3	29	73.7	50	127.0

Weights and Measures

UNIT	ABBREVIATION	EQUIVALENTS IN OTHER UNITS OF SAME SYSTEM	METRIC EQUIVALENT
WEIGHT			
<i>Avoirdupois</i>			
ton			
short ton		20 short hundredweight, 2000 pounds	0.907 metric tons
long ton		20 long hundredweight, 2240 pounds	1.016 metric tons
hundredweight	cwt		
short hundredweight		100 pounds, 0.05 short tons	45.359 kilograms
long hundredweight		112 pounds, 0.05 long tons	50.802 kilograms
pound	lb or lb av also #	16 ounces, 7000 grains	0.453 kilograms
ounce	oz or oz av	16 drams, 437.5 grains	28.349 grams
dram	dr or dr av	27.343 grains, 0.0625 ounces	1.771 grams
grain	gr	0.036 drams, 0.002285 ounces	0.0648 grams
<i>Troy</i>			
pound	lb t	12 ounces, 240 pennyweight, 5760 grains	0.373 kilograms
ounce	oz t	20 pennyweight, 480 grains	31.103 grams
pennyweight	dwt also pwt	24 grains, 0.05 ounces	1.555 grams
grain	gr	0.042 pennyweight, 0.002083 ounces	0.0648 grams
<i>Apothecaries'</i>			
pound	lb ap	12 ounces, 5760 grains	0.373 kilograms
ounce	oz ap	8 drams, 480 grains	31.103 grams
dram	dr ap	3 scruples, 60 grains	3.887 grams
scruple	s ap	20 grains, 0.333 drams	1.295 grams
grain	gr	0.05 scruples, 0.002083 ounces, 0.0166 drams	0.0648 grams
CAPACITY			
<i>U.S. Liquid Measure</i>			
gallon	gal	4 quarts (2.31 cubic inches)	3.785 liters
quart	qt	2 pints (57.75 cubic inches)	0.946 liters
pint	pt	4 gills (28.875 cubic inches)	0.473 liters
gill	gi	4 fluidounces (7.218 cubic inches)	118.291 milliliters
fluid ounce	fl oz	8 fluidrams (1.804 cubic inches)	29.573 milliliters
fluid ram	fl dr	60 minims (0.225 cubic inches)	3.696 milliliters
minim	min	1/60 fluidram (0.003759 cubic inches)	0.061610 milliliters
<i>U.S. Dry Measure</i>			
bushel	bu	4 pecks (2150.42 cubic inches)	35.328 liters
peck	pk	8 quarts (537.605 cubic inches)	8.809 liters
quart	qt	2 pints (67.200 cubic inches)	1.101 liters
pint	pt	1/2 quart (33.600 cubic inches)	0.550 liters
<i>British Imperial Liquid and Dry Measure</i>			
bushel	bu	4 pecks (2219.36 cubic inches)	0.036 cubic meters
peck	pk	2 gallons (554.84 cubic inches)	0.009 cubic meters
gallon	gal	4 quarts (277.420 cubic inches)	4.545 liters
quart	qt	2 pints (69.355 cubic inches)	1.136 liters
pint	pt	4 gills (34.678 cubic inches)	568.26 cubic centimeters
gill	gi	5 fluidounces (8.669 cubic inches)	142.066 cubic centimeters
fluid ounce	fl oz	8 fluidrams (1.7339 cubic inches)	28.416 cubic centimeters
fluid ram	fl dr	60 minims (0.216734 cubic inches)	3.5516 cubic centimeters
minim	min	1/60 fluidram (0.003612 cubic inches)	0.059194 cubic centimeters
LENGTH			
mile	mi	5280 feet, 320 rods, 1760 yards	1.609 kilometers
rod	rd	5.50 yards, 16.5 feet	5.029 meters
yard	yd	3 feet, 36 inches	0.914 meters
foot	ft or '	12 inches.0.333 yards	30.480 centimeters
inch	in or"	0.083 feet, 0.027 yards	2.540 centimeters
AREA			
square mile	sq mi or m ²	640 acres, 102,400 square rods	2.590 square kilometers
acre		4840 square yards, 43,560 square feet	0.405 hectares, 4047 square meters
square rod	sq rd or rd ²	30.25 square yards, 0.006 acres	25.293 square meters
square yard	sq yd or yd ²	1296 square inches, 9 square feet	0.836 square meters
square foot	sq ft or ft ²	144 square inches, 0.111 square yards	0.093 square meters
square inch	sq in or in ²	0.007 square feet, 0.00077 square yards	6.451 square centimeters
VOLUME			
cubic yard	cu yd or yd ³	27 cubic feet, 46,656 cubic inches	0.765 cubic meters
cubic foot	cu ft or ft ³	1728 cubic inches, 0.0370 cubic yards	0.028 cubic meters
cubic inch	cu in or in ³	0.00058 cubic feet, 0.000021 cubic yards	16.387 cubic centimeters

Glossary

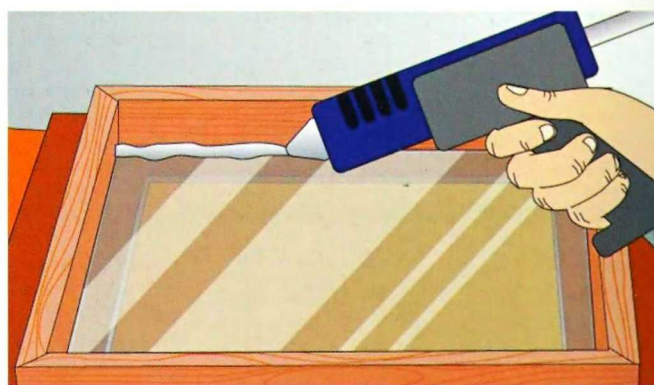
Abrasive This term is generally used to refer to sandpaper. However, it is an all-encompassing term that may include sharpening stones, pumice powder, rottenstone, steel wool, synthetic pads, or any product used to abrade, smooth, or polish.



A variety of useful workshop abrasives.

Adhesive A general term referring to a material that will bond, either temporarily or permanently, two or more pieces of wood. Some types of adhesives used in woodworking are glue, double-faced tape, rubber cement, hot-melt glue, contact cement, epoxy cement, etc. The terms adhesive and glue are synonymous.

Air-Dried Wood Hardwood or softwood that has been naturally dried by exposing it to outside air.



Hot-melt glue being used to secure the picture, matt, and glass in a picture frame.

The wood is usually stacked with spacers between each piece to allow air to circulate.

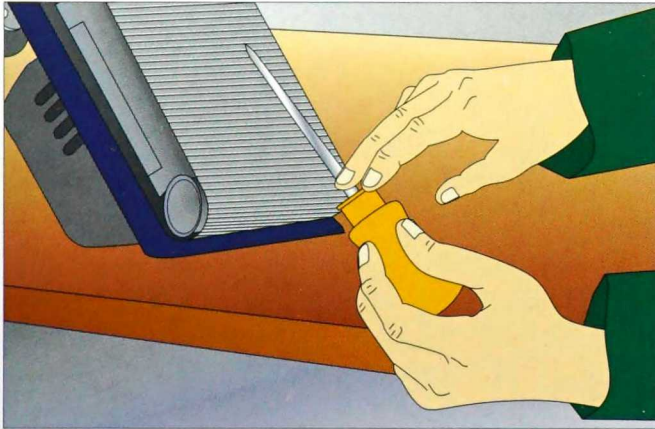
Annual Rings or Growth Rings These are the rings as seen in the cross-section of a tree. They represent the new annual growth of a tree.



Lumber that is being air-dried. Notice that its annual rings arch upward, to prevent cupping and warping.

Astragal A small molding that can be flat or T-shaped, plain or ornamented.

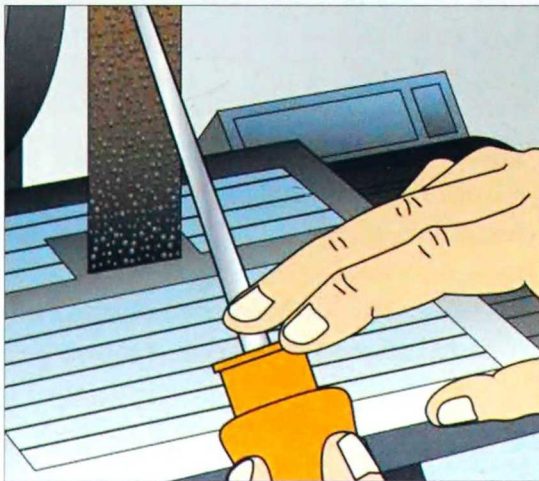
Awl A pointed tool that can be used in the workshop in lieu of a pencil for drawing or to scribe lines on wood, plastics, and metals.



An awl makes a good substitute for a pencil when scribing lines. Here it is being sharpened on a belt sander.

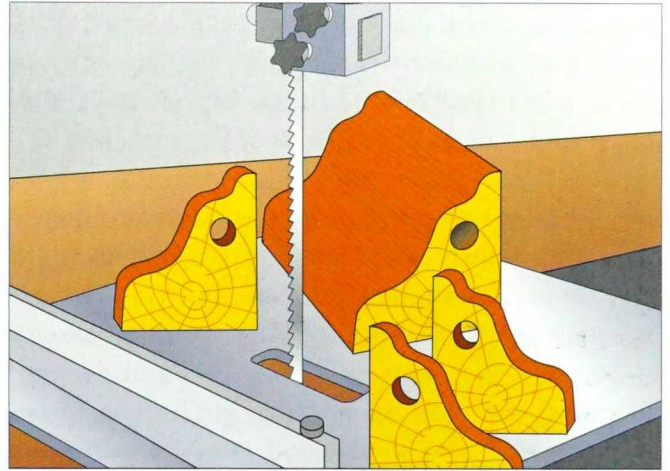
Backing or Balancing Sheet Material that is equal in thickness and nature to the face sheet. It is applied to the back of the core material to promote stability and prevent warping.

Banding This is a relatively thin material, generally matching the face surface, which covers the exposed edges of a table, shelf, gable, etc.



Removing residue from hand tools with a portable belt sander.

Band Saw A saw blade in the form of an endless steel blade or band with teeth on one side that rotates around two or more wheels.

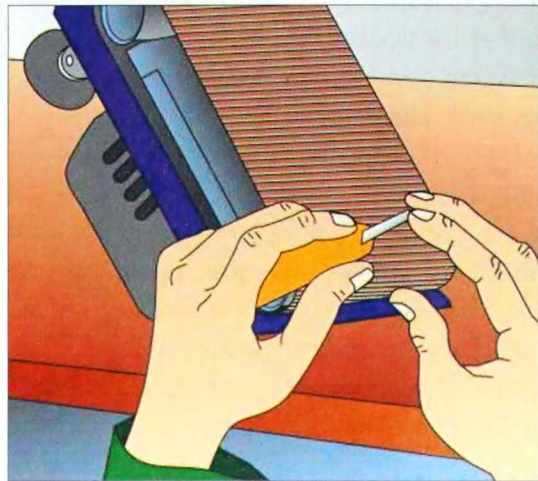


Making shelf brackets on a band saw by resawing thick stock.

Batten A strip of wood placed over joints for added strength and/or appearance.

Bead A small, half-rounded plain or ornamental molding that is used for decorative purposes.

Beam Compass A tool used for drawing or measuring larger circles. The two points of the compass are usually adjustable and connected by a solid piece of material such as a dowel.



Belt Sander A power tool that has a continuous abrasive belt stretched between two rollers, and that is used for initial sanding.

Bird's-Eye Wood Wood with circular or elliptical areas that resemble the eyes of birds. This is sometimes a desirable feature in hardwoods. It is most often found in sugar maple (bird's-eye maple).

Biscuit Joiner A tool used to cut slots into which elliptical-shaped wood biscuits are inserted. The biscuits expand in the joint when glue is added, creating a tight, durable joint.

Bleeding A condition in which gum, resin, or creosote exudes from some woods, usually softwoods. It is most prevalent in spruce.

Blemish Any undesirable mark on the faces of wood.

Blind Dovetail (See Dovetail, Blind.)

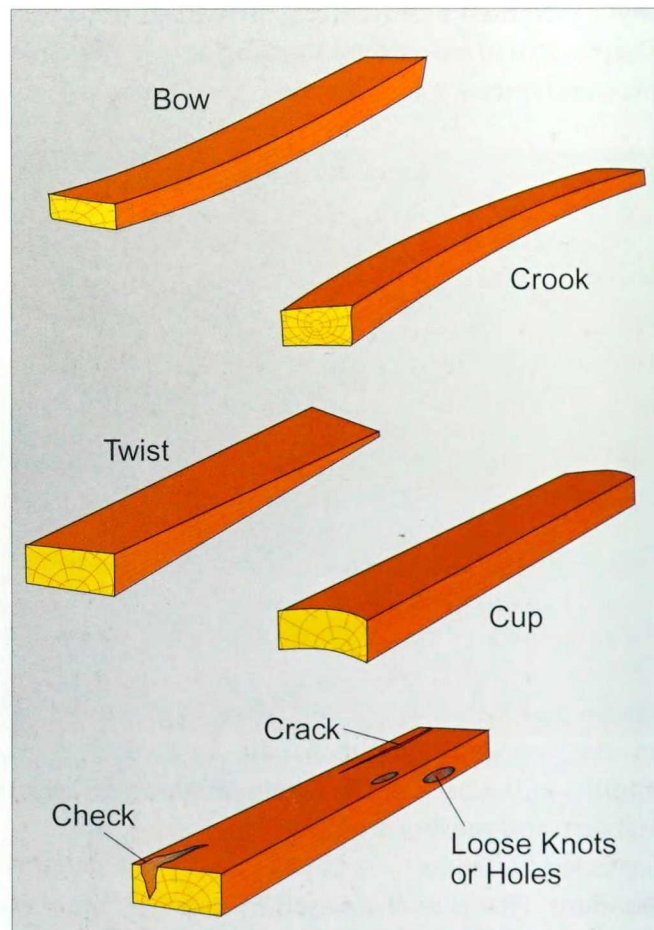
Board Foot The term used for the measurement of hardwoods and softwoods. A board foot (bf) is 12 inches wide by 12 inches long x 1 inch thick. This term is used for unfinished (undressed) wood. If this term is used for dressed lumber, it will be based on the undressed dimensions.

Bole A trunk or branch that is large enough to be used for lumber for veneer.

Bolt A threaded metal, or other material, device that is usually used with like-size nuts to complete the fastening procedure.

Book-Matching Generally, a term used with reference to veneers. Book-matching is a flitch or set of veneer sheets that are cut sequentially from the same log. When laid out side by side or end to end, a repeated grain pattern is produced.

Bowing The warping of wood. Bowing refers to a bend in the horizontal plane of the board.



Some common defects in softwood lumber include bowing, which is warping in the horizontal plane of the board.

Box Nails Small fine, common nails used in rough box- or crate-making.

Brad A very fine wire nail, generally thinner than a finishing nail, that is used in cabinetry and picture-framing.

Bullnose The rounded edge of stair threads or the rounded edge of a surface in cabinetry.

Burl A distortion of the wood grain caused by dead branches. It is often a desirable trait in some woods because it adds to the figuring.

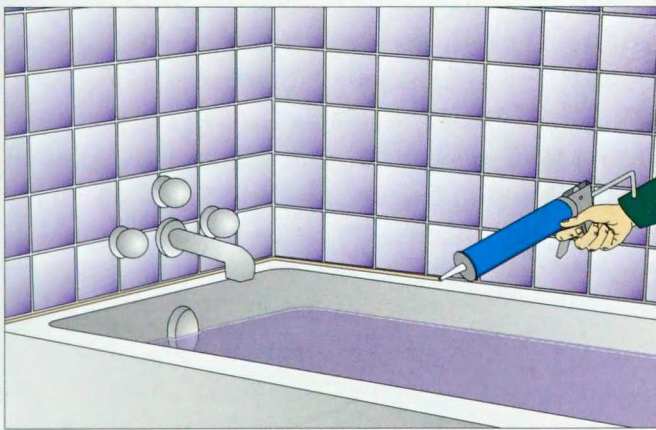
Butt Hinge The type of hinge that is usually found on interior or exterior doors. The hinge is square or rectangular in shape, the plates require recessing into the frame, and the door and the hinge pin are exposed.

Butt Joint The weakest of all wood joints. The two ends, faces, or sides of the mating workpieces are simply glued together without any other form of fastening.

Carcass The framework of a cabinet, including the top, side, back, and end panels, not including drawers, etc.

Casing The interior framework of a cabinet.

Caulk A variety of materials or compounds that are used to seal joints in cabinetry or construction. The toothpaste-like material is squeezed into and around the joints, usually to prevent moisture or air from entering.



Recaulking around the inside of a bathtub.

Chamfering Rounding off the sharp edge of wood. This can be done with a router bit or with sandpaper.

Check A lengthwise split in a board, usually across the growth rings.

Circumference The distance around the outside line of a circle.

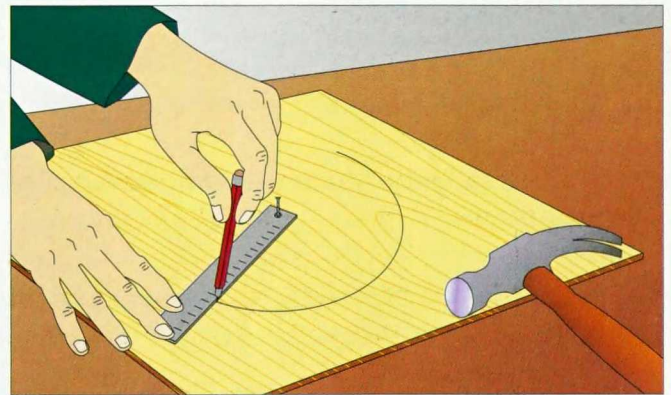
Closed-Coat Sandpaper Sandpaper that has the entire surface of the backing covered with abrasive particles. It cuts fast but clogs easily.

Closed Grain Grain usually found in slow-growing hardwoods. The term refers to woods that have rather indistinguishable growth rings.

Coarse Grain Grain usually found in faster-growing softwoods. The annular rings of these woods are highly distinguishable.

Coarse Texture This refers to wood having large pores. Some forms of oak would be considered coarse-textured.

Compass A tool, either commercial or shop-made, used to either measure or draw a circle.



You can create circles up to 72 inches in diameter with this shop-made compass.

Cope Cutting away of one piece of wood to receive the molded portion of another.

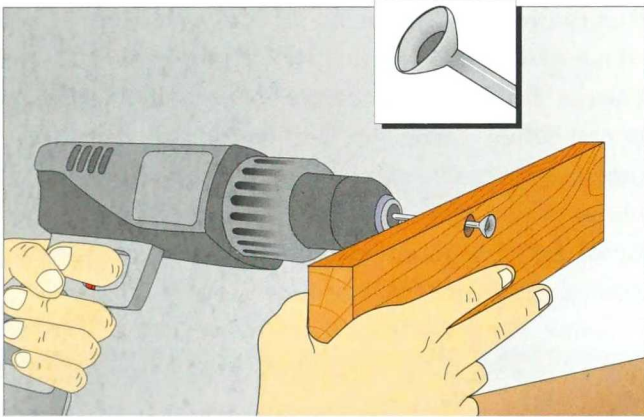
Cord The measurement of (usually) logs or firewood. A cord of wood is a stack that measures 4 feet high x 4 feet wide x 8 feet long.

Core The inner piece of wood between veneers or laminates. (See also Substrate.)

Cornice The horizontal top molding in cabinetry, furniture, and architecture.

Counterbore To drill a screw hole that is slightly smaller in diameter than the screw. This allows the screw to enter the wood and secure it without splitting the wood.

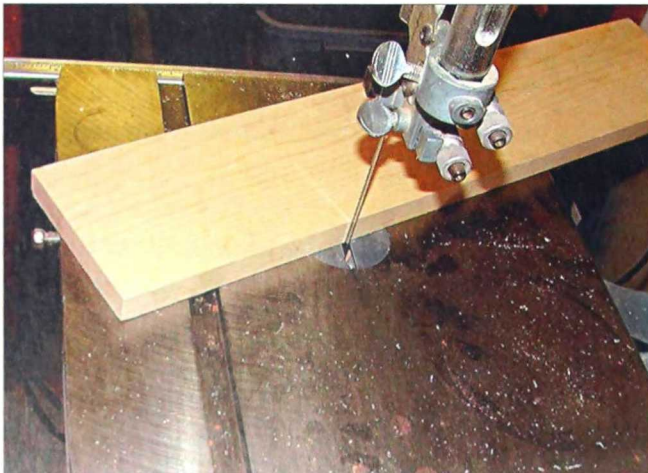
Countersink Usually a shallow, tapered hole that will allow a wood screw to sit flush with the surface. A flat-bottomed countersink is used to recess a roundhead screw or bolt head.



Countersinking for a screw using a common nail.

Crook A deviation in the trueness along the edge of a board.

Crosscut The cutting of wood perpendicular to the grain.



Making long crosscuts with a band saw. Twisting the workpiece ensures that the blade cuts off square to the right.

Dado In woodworking, a flat-bottomed cut in wood that is lower in depth than the surrounding area.

Deciduous The term used to describe trees that shed their leaves seasonally.

Delamination The separating of veneers or other laminates from their core or substrate.

Dimension Lumber The dressed size of softwood or hardwood.

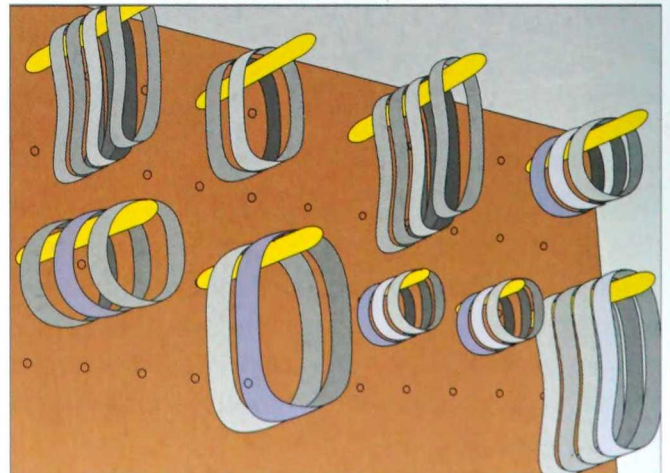
Dovetail An extremely strong two-part joint that consists of a tail and a mating pin.

Dovetail, Blind Similar to the regular dovetail joint described above, but the tails (dovetails) are not cut deep enough to be exposed on the outside edges.

Dovetail Jig A jig or tool that sets up the proper, balanced spacing to make dovetail joints with a router.

Dowel A cylindrical length of wood.

Dowel Joint A short piece of dowel that is used to pin two pieces of wood. Identical holes are drilled



Sandpaper belts and tubes are being hung from dowels screwed to pegboard to prevent them from being flattened out.

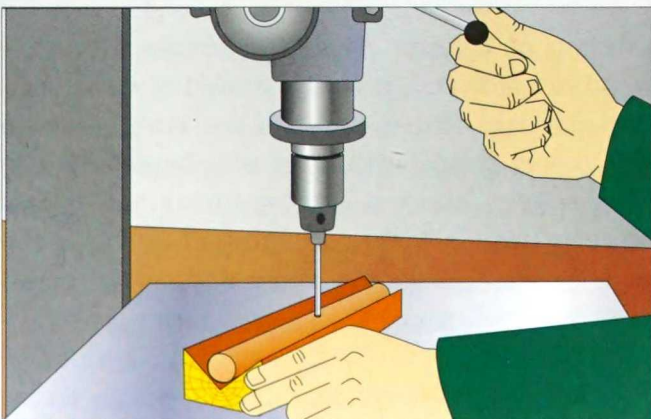
in each joining piece. The dowels are inserted in the holes, glue is added, and the pieces are clamped together until set.

Dozuki Saw A Japanese handsaw that differs from traditional backsaws in that the teeth are set to cut on the pull stroke. This results in a more accurate cut and a narrower kerf.



Dozuki saws are saws that cut on the pull stroke. They have thinner steel than traditional backsaws and disposable blades.

Dressed Wood Wood that is rough-cut from a tree and is cut into various thicknesses. The wood is then rough-cut into various standard widths. The wood is then finally dressed, that is, put through a thickness planer to make it relatively smooth on one, two, or four sides. The rough dimensions of the board are referred to, not the dressed dimensions.



Drilling the ends of dowels on a drill press using a simple jig.

Drill Press A power tool used in the workshop primarily to bore holes, but which can also be used to rout, mortise, sand, and make plugs.

Dry Rot Decay caused by a fungus. This usually starts in moist wood. The fungi then supply their own moisture and proceed into the dry areas of the wood.

Drywall A paper-covered sheet of a mineral called gypsum. The sheets are more commonly seen in 4 x 8-inch dimensions. There are standard thicknesses. Drywall is generally used in place of plaster for the surfacing of interior walls. Drywall is also known as plasterboard, GWB, gyproc, gypsum board, and wallboard. Gypsum board is the accepted generic term in the United States: gyproc in Canada.

Eased Edges These are the slightly rounded edges that you find on common lumber. The purpose is to remove the sharp edges that are normally produced in milling.

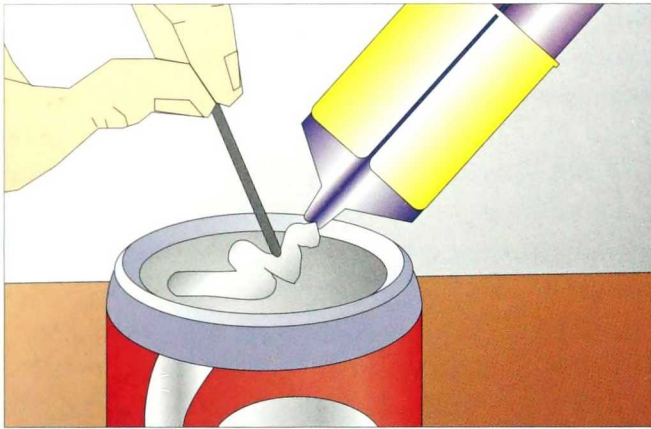
Enamel An oil-based paint that was usually available only in a high-gloss finish that was opaque but today is available in finishes from gloss to matte. Clear and semiclear densities are also available. Enamels may be thinned and cleaned up with turpentine.

Epoxy An extremely versatile adhesive that has high shear strength. Epoxy is a two-part adhesive (a resin and a hardener) and must be mixed 50/50 just prior to use.

Epoxy Paint A very hard, durable paint finish for both interior and exterior use. It is an excellent finish for concrete or wooden floors.

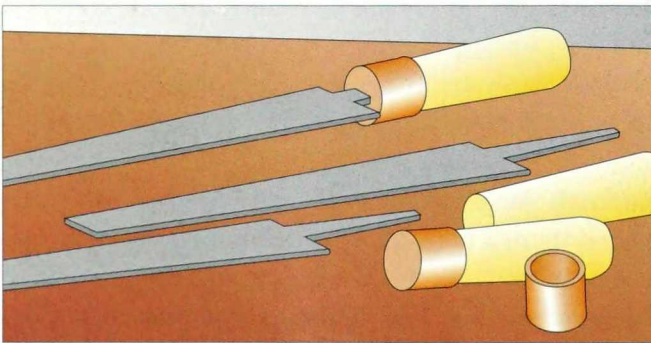
Face The side of a board that shows the most desirable surface for its intended purposes.

Figure The pattern produced naturally in the grain of the wood.



Mixing the hardener and resin for epoxy glue using the bottom of a soda can.

File A metal, serrated tool used to remove material (wood, metal, plastics, etc.). The serrations vary in depth and closeness depending on the intended use of the tool.



Files with shop-made handles made of copper pipe-end caps.

Filler (See Wood Filler.)

Finger Joint A series of deep grooves cut into the edge of a piece of wood to receive similar grooves in the piece to be joined. The purpose of this type of joint is to provide a large surface area for better glue adhesion.

Flat Cut The method of cutting logs into boards. The log is cut lengthwise into the desired board thickness. This method wastes more wood than the conventional quarter-cutting method. However, it does produce a more attractive figure in the wood grain. Flat cut also refers to the type of veneer cut.

Flat-cut veneer usually produces a more highly figured strip.

Flitch Generally used in referring to sheets of veneer that are cut and stacked in a set to produce book-matching. (See Book-Matching.) In fact, a flitch is the squared or rounded pieces of wood that veneer is cut from.

Flute A hollow or a groove that is cut longitudinally for decorative purposes.

Formica A brand name that refers to various laminated plastic products. (See Plastic Laminate.)

Full Sawn Lumber that is cut to full size, for example, 2 x 4 inches.

Gable The side and back panels of a cabinet or bookcase.

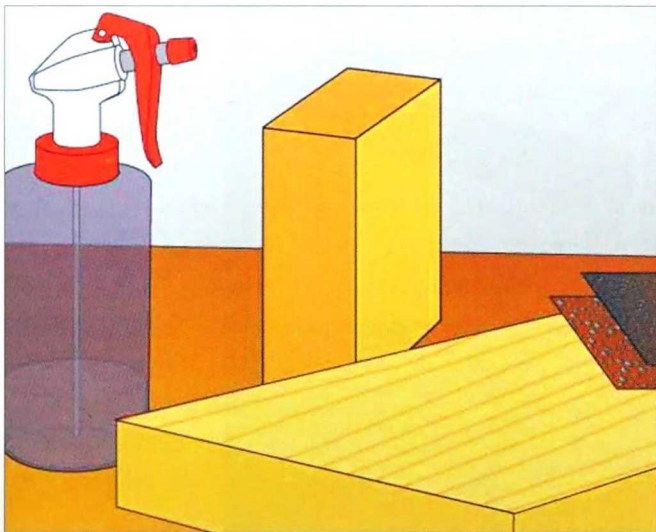
Gateleg This usually refers to a type of table that has legs and their supports hinged to the basic table frame. The leg swings out horizontally (like a gate) to support a vertically hinged tabletop extension.

Gel Stain A wood stain with a jelly-like consistency. According to manufacturers, it is easier to apply and does not need mixing or stirring.

Glue (See Adhesives.)

Grading of Lumber Lumber, whether it be softwood or hardwood, is always graded to an association standard. This guarantees the purchaser that any lumber bought within a particular grade will be consistent. A stamp or seal-type mark will appear on every board, which will indicate the name of the mill, the local association, and the type quality, and dryness of the material.

Grain The lines in wood that seem to indicate layers. They are the edges of the annual rings that run longitudinally because of the way that the board is cut.



The grain on this board has been sprayed with a fine mist of water so it will be raised for final sanding.

Green Wood Freshly cut wood that has no intentional drying and has a high moisture content, usually 25 to 35 percent.

Grit This may refer to the grit of sandpaper or the grit of sharpening stones. The lower the number, the more coarse the grit. The numbers may run from 30 to 4,000.

Growth Rings (See Annual Rings.)

GWB An abbreviation used by architects, designers, and engineers for gypsum wallboard. (See also Drywall.)

Gypsum Board (Gyproc) (See Drywall.)

Hardwood The botanical term for broad-leaved, flower-bearing trees that has, in fact, nothing to do with the density or hardness of the wood.

Heartwood The middle or core of the tree. The wood from this area is generally darker and more figured than the sapwood.

Inlaying A technique in which the surface is recessed to accept a thin piece or pieces of wood

that are usually different than the under-surface.

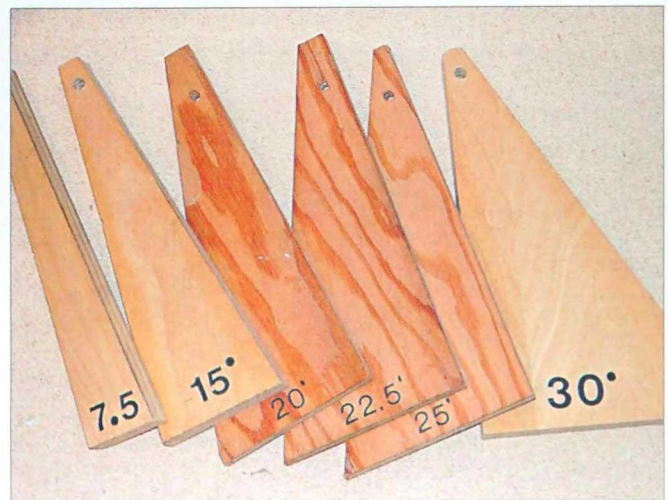
Intarsia A technique in which two different solid-wood designs are used next to each other as a decorative motif.

Jig A commercial or shop-made tool, aid, or accessory that will help in performing a woodworking operation faster and more accurately. It can be designed to be used only once or repeatedly.

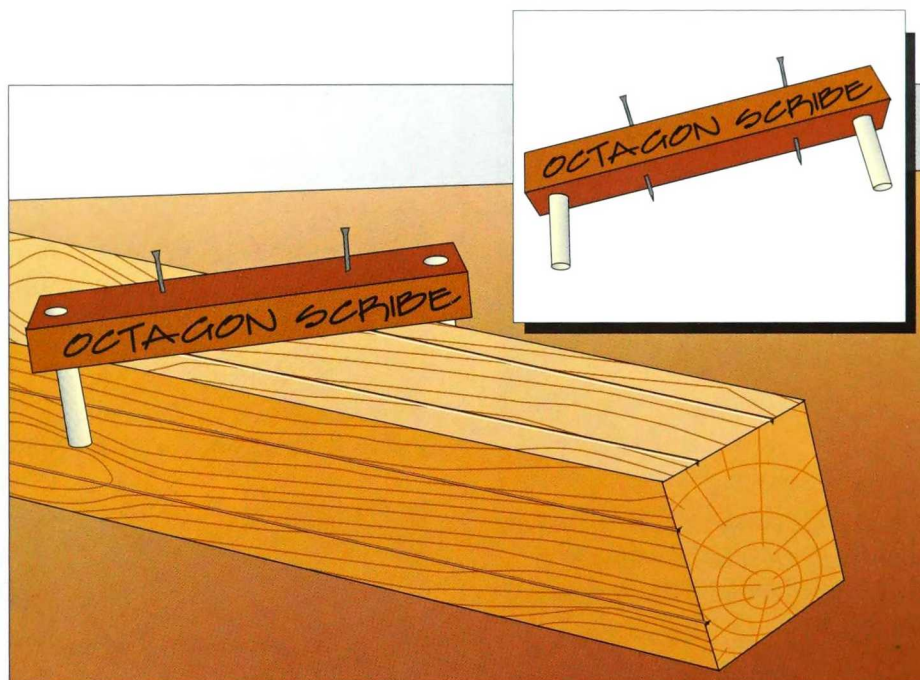
Joint When two pieces of wood are permanently



These shop-made jigs simplify the cutting of sandpaper for one-quarter-, one-third-, or one-half-sheet orbital power sanders.



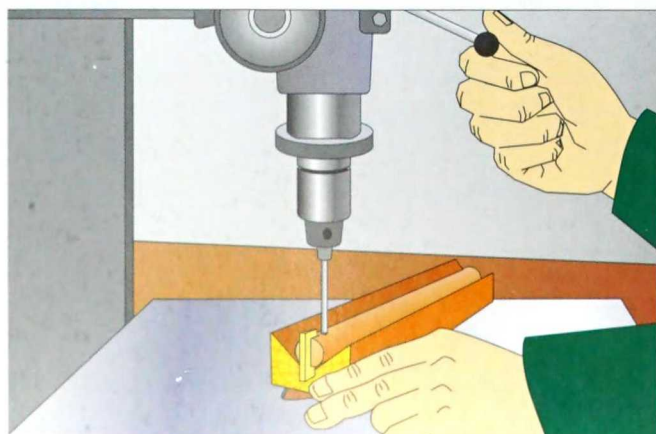
These shop-made plywood angle jigs will save set-up time on both portable and stationary power tools.



This jig can be used to scribe lines on stock or make octagonal (eight-sided) chairs or table legs.

connected, the point of connection is called the joint. There are many different types of joints, for example, dovetail, mortise-and-tenon, and dado joints.

Kerf The space made by the thickness of a saw blade after cutting (for example, a circular-saw blade's kerf is $\frac{1}{8}$ inch).



A small hole has been drilled at the end of the saw kerf to help prevent splitting of this chair leg. The wedge in the kerf will ensure a tight fit.

Key Joint A mitered joint that has a kerf cut into the fitted edges. A spline is then fitted and glued into the kerf.

Kiln An oven in which lumber is dried to reduce its moisture content. This stabilizes the lumber dimensionally.

Kiln-Dried Lumber that has been placed in a kiln to remove a large percentage of its water content. The result is a more stable board that is less apt to warp or twist.

Knot A knot on a board indicates that a tree branch was growing in that location.

Lacquer A resinous or synthetic finish for wood that has a very high gloss surface. Lacquer may be clear or colored. True lacquer is a resin-based material. Today, though, there are a number of synthetic lacquer-like materials that are far more durable and easier to repair if damaged.

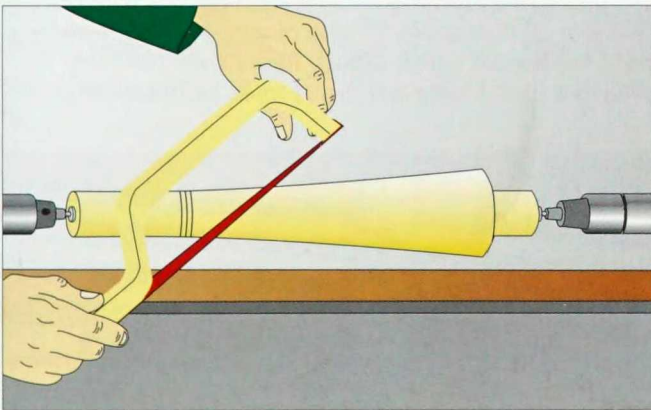
Laminate This refers to wood that is thicker than veneer and is fastened together usually with glue. True lamination has all the wood grain running parallel to each laminated piece.

Laminates The term laminates usually refers to plastic laminates such as Formica or Arborite. The term in its true sense, however, describes a material that consists of many layers, for example, plywood.

Lamination The joining together (by the use of glue or other fastening devices) of two or more thicknesses of wood.

Lap Joint A wood joint wherein one or both mating pieces are dadoed to fit. The purpose of the lap joint is to provide a larger area for gluing, and a stronger joint.

Lathe A power tool used in the workshop primarily for wood turning, but which can have other applications.



Sanding a workpiece on a lathe using a shop-made sanding tool.

Laths Strips of unfinished wood, commonly 1/2 inch wide x 1/2 inch thick, that are commonly used to support a plaster wall. The laths are nailed horizontally or diagonally to the wall studs and spaced about an inch apart.

Lead A blade's tendency to pull to one side.

Marquetry The art of inlaying wood strips, squares, or other shapes into the surface of a substrate.

Measuring Lumber Lumber thickness is usually measured by the four system. For example, a 1-inch-thick board is called four/four lumber and written 4/4. Lumber that is 1 1/2 inches thick is written 6/4.

Medium-Density Fiberboard A common man-made panel made from wood-based material.

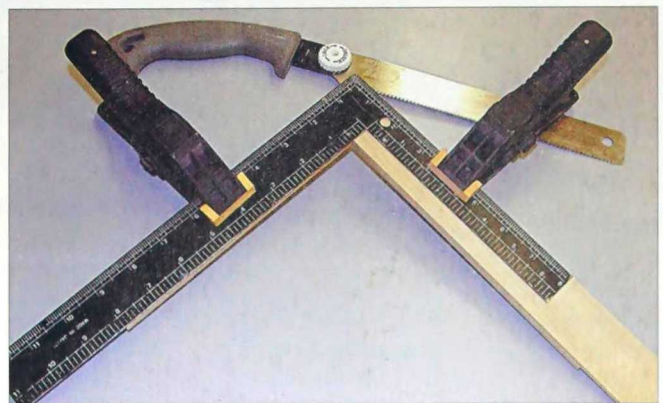
Melamine (*See also* Plastic Laminate.) Melamine is a very thin plastic laminate that is generally used only on vertical surfaces or other areas that are not subject to a lot of hard use.

Melamine Paint A very durable paint that uses the same plastic materials as those found in melamine. This paint can be used to restore plastic laminate countertops, etc.

Micarta (*See* Arborite, Formica, and Laminates.)

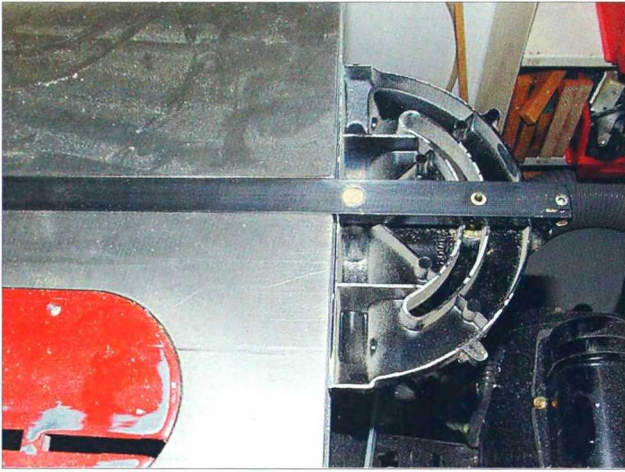
Mil A diameter measurement usually for determining the thickness (diameter) of wire. One mil is 1/1000ths of an inch.

Miter In joinery, this refers to the ends or the edges of two pieces of wood that are cut at an angle (usually 45 degrees) for the purposes of joining.



Hand-cutting miters by clamping the two joints together with a steel square under them.

Miter Gauge A device on tools used to control stock when it is being cut. The miter gauge travels in a slot in the tool's table.



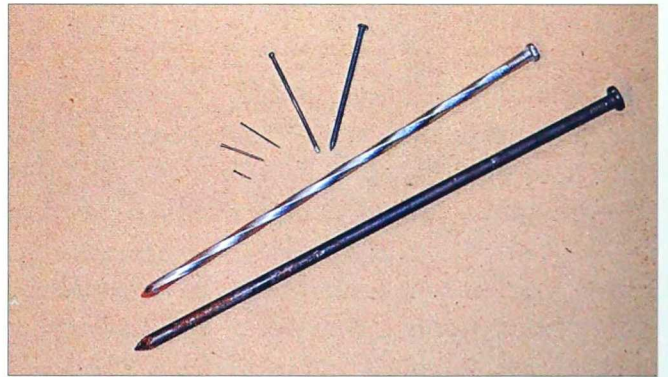
Squaring up a table saw's miter gauge using a steel square.

Moisture Content The water content of wood in terms of weight, usually expressed in percentages, for example, a 30 percent moisture content.

Molding Wood that has been shaped along its edges or face to give it an ornamental appearance.

Mortise This is a recess of a particular shape that is cut into a board to receive a tenon from another board to form a mortise-and-tenon joint.

Nails Metal fasteners used in woodworking. They are usually made of steel wire that is cut and formed. One end is pointed, the shape of which is determined by its intended use. The other end may have a range of shapes that vary with the application. The thickness and length are expressed in inches, penny size, or millimeters.



Among the nails that will have workshop applications are brads and finishing nails. Brads very fine wire nails that are used in cabinetry and picture-framing. Finishing nails have small heads slightly larger than the body. They are used where nail heads must be hidden.



If lumber in the workshop has a moisture content of between 10 and 25 percent, the boards should be stickered; that is, strips of wood should be placed between the boards at two-foot intervals. This allows air to circulate through the boards to quicken the drying process.

Nominal Size The dimensions of a board that has been cut, but before it has been planed or shaped.

Nosing A board that has had its edge shaped for a particular use, such as a stair tread. (*See also* Bull Nosing.)

Nut A threaded metal (or other material such as plastic, nylon, etc.) fastener of various shapes and sizes. It is usually used in conjunction with a *bolt*.

Old Growth The term old growth usually refers to trees harvested from naturally established stands where the trees had to compete with each other for nourishment. These trees usually have long knot-free trunks and are highly desired by woodworkers.

One-Step Finishing (*See* Varnish Stain.)

Open-Coat Sandpaper Sandpaper that has empty space surrounding each abrasive particle, as opposed to closed-coat, which has the backing surface completely covered with grit. It doesn't cut as fast as close-coat initially, but it will last longer when used on materials that tend to clog up the sandpaper.

Orbital Sanders Portable sanders with sanding pads that move in an elliptical pattern. This is an advantage in that the user is not restricted to sanding wood with the grain.

Paint Thinner A term that usually refers to mineral spirits such as turpentine.

Panel A term usually used in furniture-making that refers to a thin sheet of wood that is set or recessed into a frame.

Particleboard Sheet material made from wood chips.

Pitch An accumulation of resins in wood. These may be in the form of pockets, streaks, or seams.



Paint thinner can be used to clean the top surface of a table-saw table every six months.

Pitch (blade) The size of the teeth on a blade, usually given as a number that indicates how many teeth are in one inch of blade.

Plain-Sawn Lumber Wood that has been cut so that the annual rings make an angle of less than 45 degrees with the surface of the board. Also called flat-grained or plain-sawn.

Plaster A mixture of either lime or gypsum that is mixed with water to form a thick paste, and then applied to walls. The plastic is laid on top of lathes and is troweled to a smooth finish.

Plasterboard (*See* Drywall.)

Plumb Truly vertical, 90 degrees off horizontal.

Plumb Line Usually a strong cord attached to the middle of a weight. The cord is held or fixed to a horizontal member so that the weighted end hangs down, thus indicating a vertical line.

Plywood Plies of wood glued together in a sandwich-like fashion that are used for general and furniture construction.

Pocket-Screwing A method of fastening a table or cabinet top to the horizontal support rails. A hole is drilled into the inside edge of the rail. The hole is drilled on an angle (usually about 15 degrees) so that the screw will go through the rail and into the under surface of the top.

Polyurethane A synthetic, plastic-based varnish or lacquer that is used as a finishing material for wood. It is available as a solvent or water-based and in a variety of textures. Polyurethane is an extremely durable wood finish that avoids most of the problems generally associated with varnish or lacquer.

Primer A special coat of paint or other material that is used to bond subsequent coats to the substrate.

Pumice A light volcanic glass that, in powdered form, is used for rubbing a finish.

Putty A pasty substance used for filling gaps or flaws in wood.

PVA (Polyvinyl Acetate Adhesive) Commonly known as white glue, this adhesive is suitable for most woodworking joints.

PVC (Polyvinyl Chloride) Pipe A plastic extruded pipe used for some plumbing applications and built-in workshop dust-collection systems.

Quarter Sawing This is a method of cutting logs into boards that is generally thought to be less wasteful than flat-cutting. The log is cut through its diameter twice to produce four quarter logs. The boards are then cut from each quarter. This method is usually reserved for the utilitarian types of wood because it does not enhance the grain figure. It is also known as rift-cutting.

Rabbet As used in wood joinery, a rabbet is a notch in the edge or a slot in a piece of wood that is made to receive another piece.



PVC pipe, which is used sometimes in plumbing and in dust-collection systems, is also a great way of storing small items.

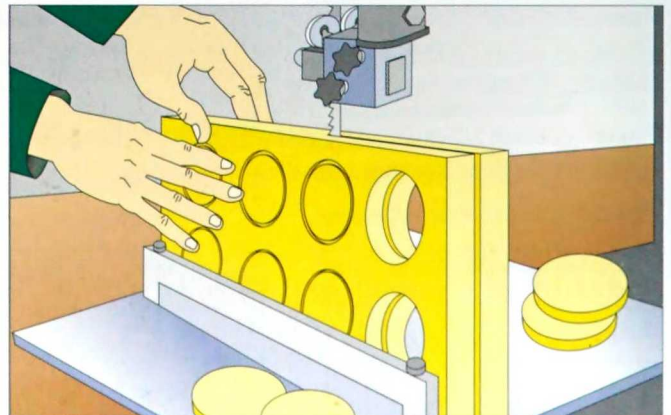
Rail A cross member used in cabinetry as part of the framework.

Raised Panel A panel that is usually of equal thickness to the frame that it sits on. However, the panel edges are tapered inward to allow the panel to be rabbeted into the frame.

Rasp A very coarse-toothed file that is used for very rough removal of material.

Recess (See also Rabbet.) A slot or groove cut into wood. It can be either a rabbet or a dado joint.

Resawing A process in which the thinner pieces are cut from a larger piece of wood. As an example, let's



Resawing on a band saw to release toy wheels.

assume you have a 4 x 4-inch piece of hardwood and need four pieces of wood that are 1 x 1 inch. A wide blade in a band saw would accomplish this.

Resin A thick, sticky liquid found in pockets of some softwood trees. B: A synthetic material used in the production of some adhesives.

Reveal A recess that is intentionally made to show the division of two or more planes of wood.

Rip Cut A cut made with the grain of the wood.

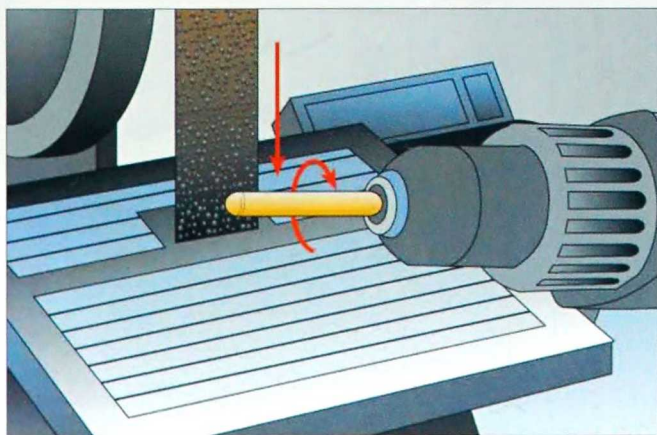
Rod A measurement of distance that equals 5 $\frac{1}{2}$ yards or 16 $\frac{1}{2}$ feet.

Rotary Cutting The cutting of veneer by rotating the log against a knife. The knife is set in a way that peels a continuous strip from the log.

Rottenstone A natural abrasive made from powdered limestone. It is finer than pumice and is often used for a final rubbing of a finished surface.

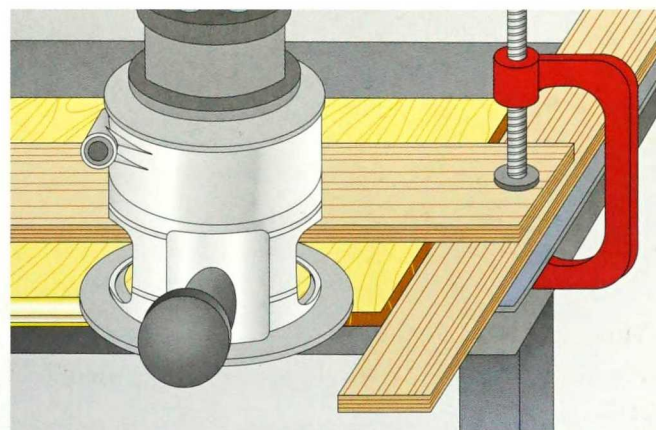
Rough Lumber (See Nominal Size.)

Rounding Off (See also Chamfering.) A method of removing the sharp edges from cut wood. Rounding off can be achieved by means of a router with the appropriate bit installed. It may also be done with a power sander or by hand sanding.



Rounding off dowel ends with a drill and a belt sander.

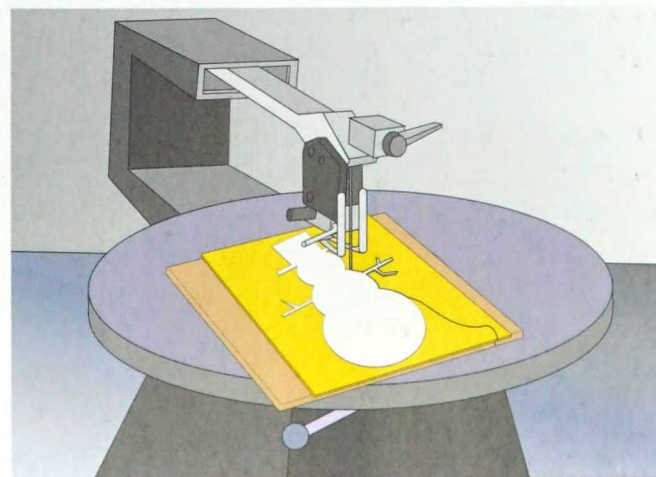
Router A power tool which can be used freehand or in a table to make moldings, fancy edges, dados, and cut circles and letters. It is arguably the most versatile woodworking tool because it can make a wide variety of cuts.



Making edge moldings with a router and a shop-made straightedge.

Sandpaper A coated abrasive with a paper backing. Originally the term applied only to flint paper, but now is applied to any type of abrasive paper.

Scroll Saw A power tool used to cut wood, plastic, metal, and other material, usable for a wide range of cuts from simple outlines to intricate fretwork, inlays, intarsia, and marquetry.



Scroll-sawing a pattern. Notice that thin material backs up the thicker scrap piece. It is taped to the thicker piece with double-faced tape.

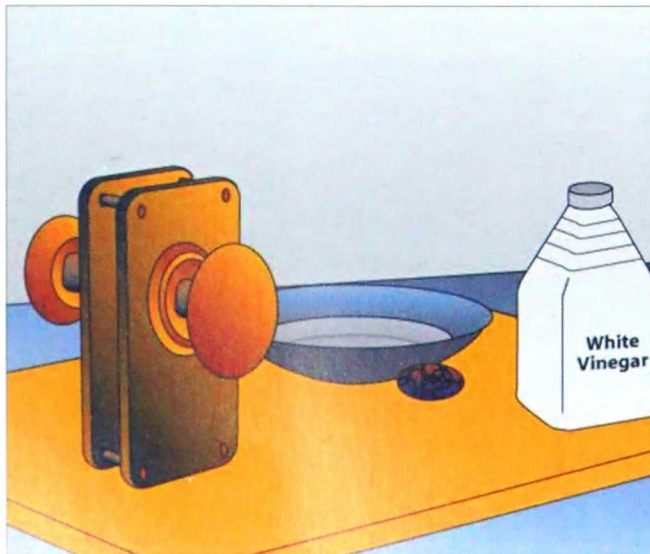


The correct way of holding a chisel blade for sharpening on a bench stone.

Sharpening Stones Hand-held abrasive stones used to hone cutting edges.

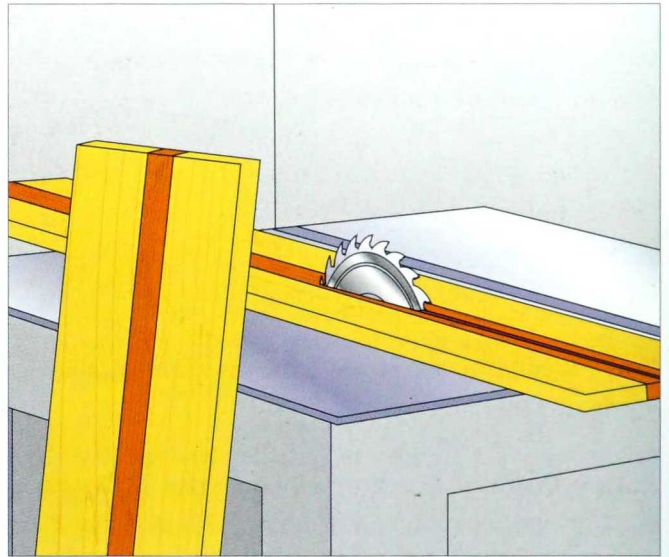
Silicon Carbide One of the hardest synthetic abrasives used for wood finishing. Its most common use in wood finishing is in wet-or-dry sandpaper.

Steel Wool An abrasive material composed of long, fine steel shavings that is used to smooth wood and finish layers. It should not be used with water-based finishes because the steel particles left on the wood can react with water to cause a dark spot.



Steel wool is still a helpful workshop aid. Here it is being used with white vinegar to remove the tarnish on brass.

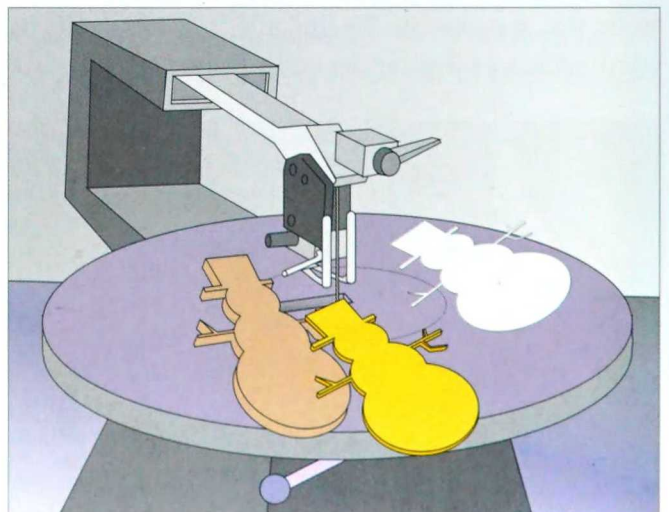
Table Saw A stationary power tool with a circular-saw blade that can be used to cut boards to size, make joinery cuts, and shape decorative molding.



Using a table saw to rip bookcase shelves apart.

Templates Patterns made out of durable material such as plywood, plastic, or Masonite.

Tenons Projections, about one-half the thickness of a member, designed to fit into a matching recess, called a mortise, for the purpose of joining the two parts.



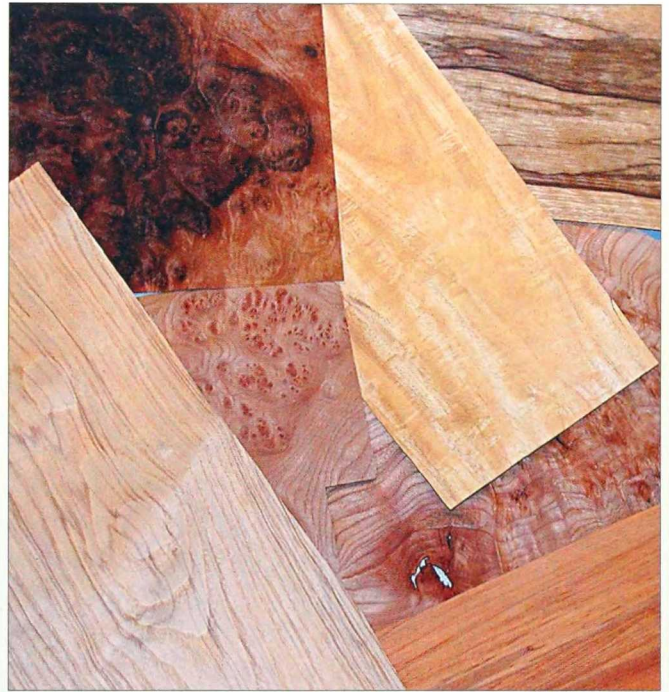
This template cut on a scroll saw is durable and can be used for future use.

Thrust Bearings Round bearings on the wall of a band saw that are used to stop the rearward movement of the blade.

Tracking The act of positioning or balancing the blade of a band saw on its wheels. There are two types of tracking: Center-tracking and coplanar-tracking. Center-tracking consists of tilting the top wheel, usually rearwards, until the blade tracks in the center of the top wheel. Coplanar tracking consists of balancing wider blades by aligning the wheels.

Veneer A very thin wood panel that is sawed off a log with a sharp knife.

Wet-or-Dry Sandpaper Sandpaper that uses waterproof glue to attach the abrasive particles to a water-resistant paper backing.



A sampling of veneer.

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ABOUT THE AUTHOR

Graham McCulloch has been working with wood for over 60 years. He was first introduced to it in public school in Canada, where it was known as Sloyd or Manual Training. Back then, you learned some basic woodworking rules pretty quickly. Before you even got to smell wood, you were taught how to safely handle woodworking tools and to give the tools the respect that they deserve. For example, if you laid a hand plane on a workbench with the blade down, you would be disciplined. For the rest of the 40-minute period, you would have to hold that hand plane elevated over your shoulder. Once was enough.

Later in life, Graham became an architectural designer; many, if not all, of his designs emphasized the warm textures and feel of natural wood. "There are tens of thousands of wood species in the world, and each has its own beauty and characteristics. What a shame it is then to hide this beauty under a coat of paint," says Graham.

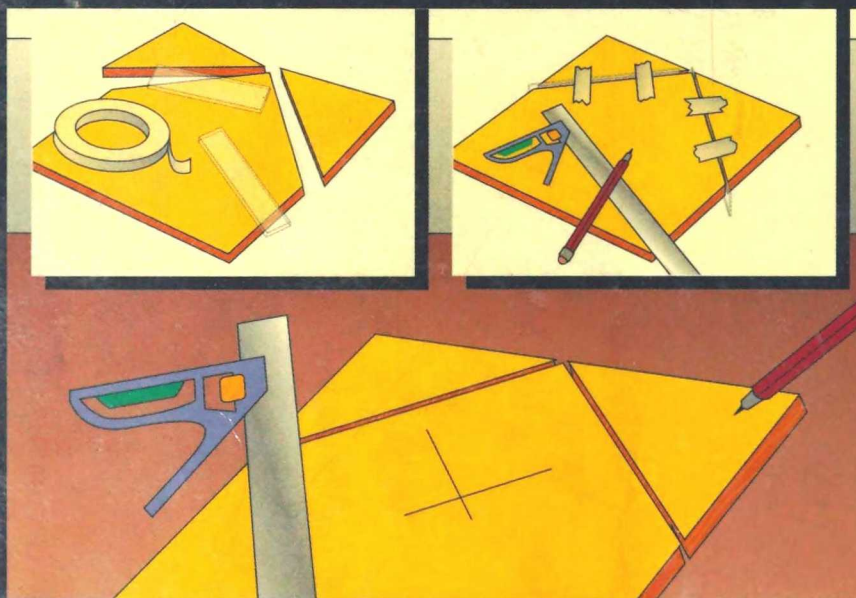
Trade-show exhibit design became a specialty for Graham because of the tremendous freedom allowed in the designs. Materials could be used in areas where one would never think of using them. Wrapping various species of wood veneer over clear plastic tubes with interior lighting produced an incredible translucent effect that enhanced the granular beauty of wood.

After several years of subcontracting the manufacture of these exhibits, Graham decided it was time to cut out the middleman and open a manufacturing shop of his own. This move satisfied Graham's wish to get closer to the building of the exhibits and to finally have his own woodworking shop.

The trade-show exhibit business slowed with a downturn in the economy and Graham decided to retire. It was time to share his knowledge of woodworking with others. Graham is now a full-time woodworking columnist with a Nova Scotia newspaper. He also writes regular columns for two trade magazines, and *Canadian Woodworking Magazine*, the leading Canadian woodworking publication, features Graham's writings. Graham is also an occasional contributor to *Family Handyman* magazine.

"I have been pretty successful in my varied careers during my lifetime," says Graham. "As a retiree, however, I am a total failure." Graham continues to look for new and interesting endeavors in woodworking.

Every dedicated craftsman will want to regularly check this handbook to find quicker, easier, and better ways of doing things around the shop. It's filled with proven shortcuts learned by an expert who has spent time with many of the finest and most talented woodworkers. These are the best shop aids, jigs, and techniques to get any job done, whether it's with a band saw or router, using hand tools, or while painting and finishing—and that's just the beginning. Keep this unique guide near your workbench because you'll refer to it often.



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