How to Make a Molding Plane

Sticking with an 18th-century tool

by Norman Vandal

You still can spot old molding planes in antique shops or junk shops, but they aren't as common as they used to be. Prices can be as low as $8 to $15, so people snap them up to use as decorations. I can see displaying these old tools because they are aesthetically pleasing, but it's really a shame not to fix them up and use them. They were fine tools once and can work just as well again.

I make a lot of period furniture, and I can't get along without my set of old planes. When I needed a reverse ogee molding with cove for a cornice on a cabinet, I decided to make a plane to do the job, designed around an old iron I'd found that had become separated from its original block.

I'll describe how to make such a plane from scratch, so that if you come across an old molding plane or iron you will be able to get it working again, regardless of its condition. Whether you are starting with an old plane block or an old iron, or from scratch, this is the general scheme: First you must know the molding profile, which will determine the width of the iron. Next you must shape the sole of the plane to the reverse profile of the molding. Then you can true the iron to the sole and start making molding.

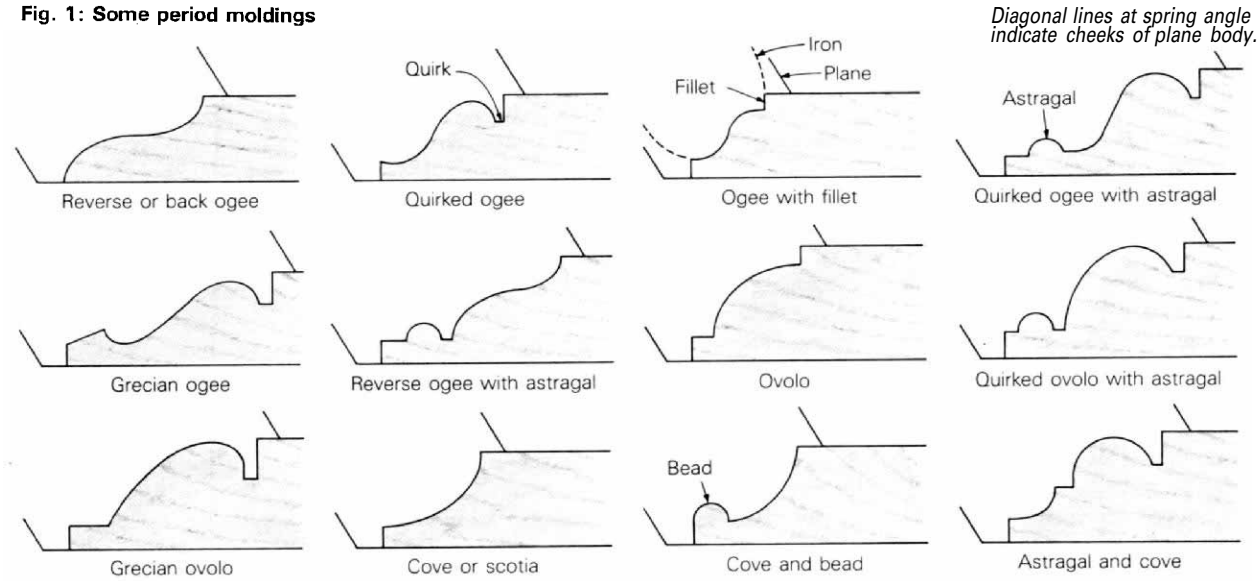
If you come across a plane with a poorly shaped iron, don't change the shape of the sole to conform. The contour of the sole represents the molding the plane was designed to make. A poorly matched iron is usually the result of inept sharpening or grinding. Recondition a damaged iron by annealing it (softening it by heating), filing it to fit the sole and then retempering it.

The style of plane I've chosen is based on the finer 18th-century examples, and all the standard dimensions discussed are characteristic of this period. You may, of course, alter the design, but this pattern is a good starting point.

Molding shapes—Planes with an average length of 9 in. to 10 in., a height of 3 in., a thickness of from 1 in. to 2½ in. and no handle have erroneously been accepted as "molding planes." Many of these planes are for rabbeting, tongue-and-grooving, dadoing and other purposes that have nothing to do with making moldings. Molding planes produce moldings on the edges of frame members called sticks, hence the process is called sticking. Figure 1 shows some standard moldings, and the bibliography at the end of this article includes books that contain full-size drawings.

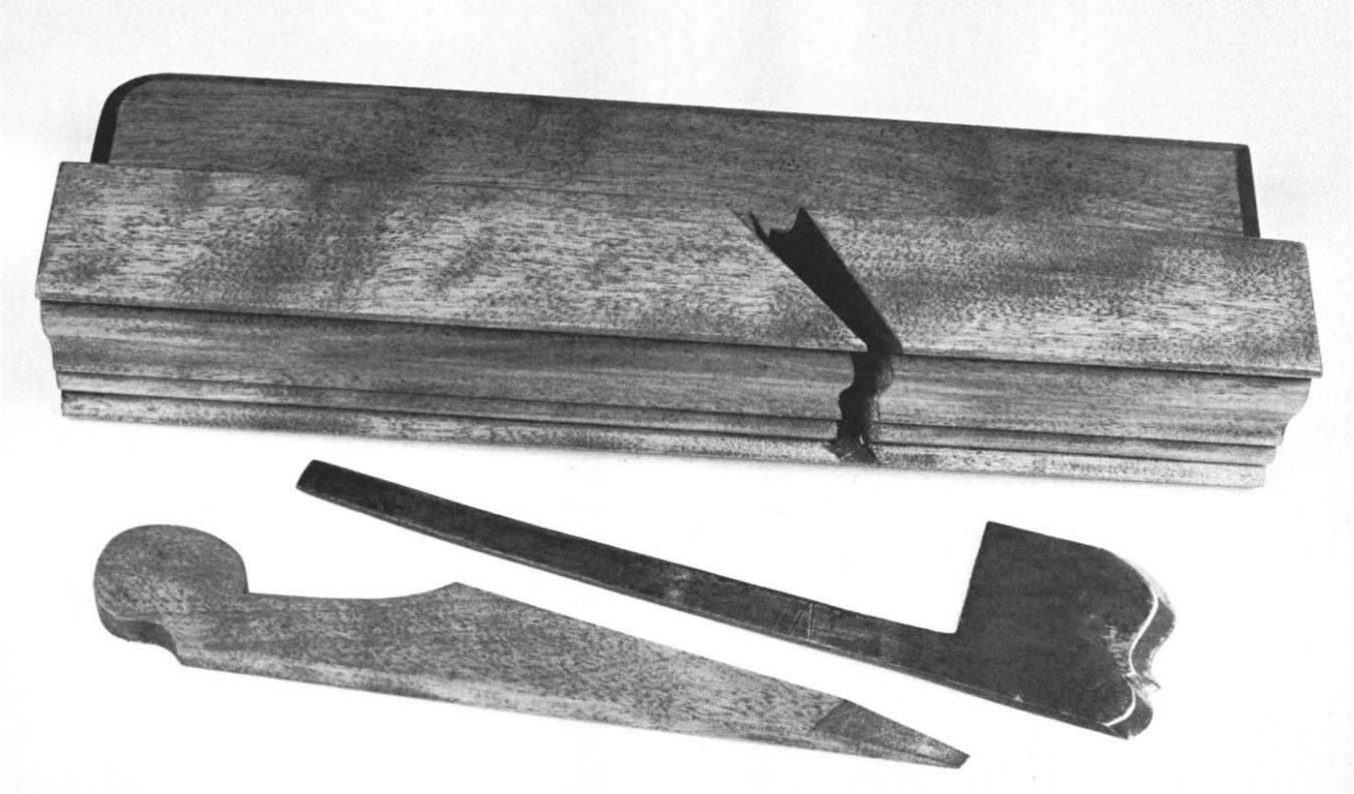
Simple moldings (composed of segments of circles or ellipses) are beads, quarter rounds, hollows and rounds, coves or scotias, and astragal beads. Planes for making these profiles are called simple molding planes. Complex moldings, often broken up or set off by flats or fillets, are ogees, reverse ogees, ovolos or compositions of various curves. Planes to stick these shapes are called complex molding planes. There is another

Fig. 1: Some period moldings

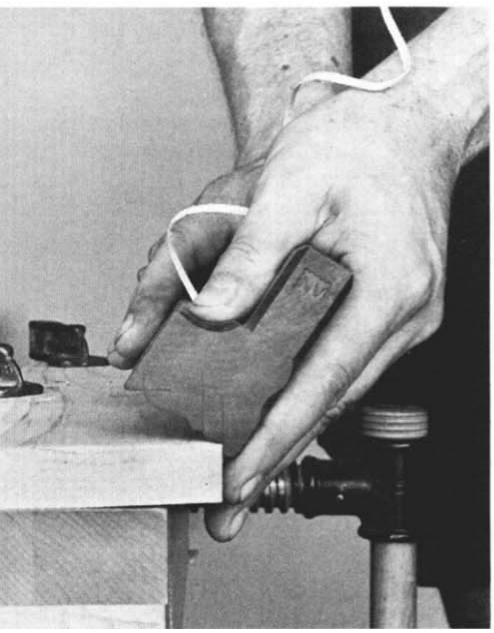


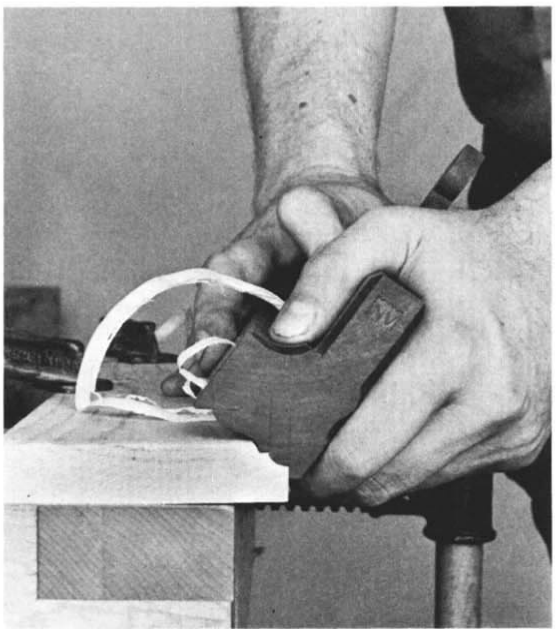
These molding shapes, based on sections of a circle or an ellipse, date back to a classical revival that began in Renaissance Europe, and before then to Greece and Rome. They have been the stock-in-trade of cabinetmakers, architects, builders and designers, and they can be seen everywhere—from cornices on buildings to trim on cabinets. Some period furnituremakers make do by shaping the moldings with scratch-headers, but the king of tools for day-in and day-out precision work is the molding plane.

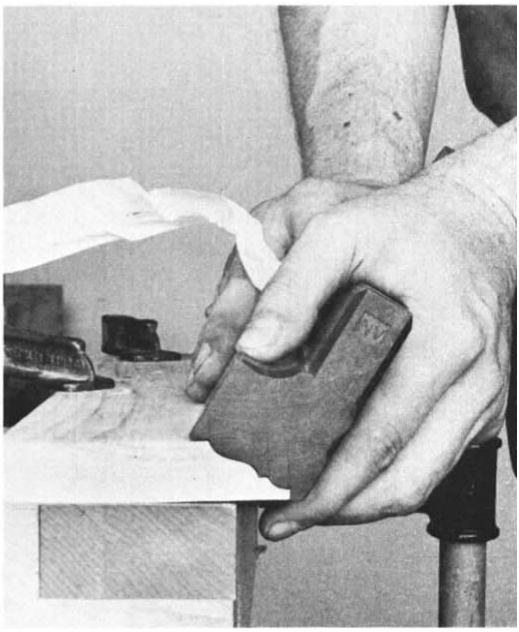
Drawings: David Dann



The plane shown above began with an old iron. Vandal annealed and reshaped the iron, then made a yellow-birch block to suit. In the photo sequence below, the plane is tilted, or sprung, so the fence will be pressed against the work. A series of passes then takes progressively wider shavings, until the depth stop contacts the work, and the plane ceases to cut.







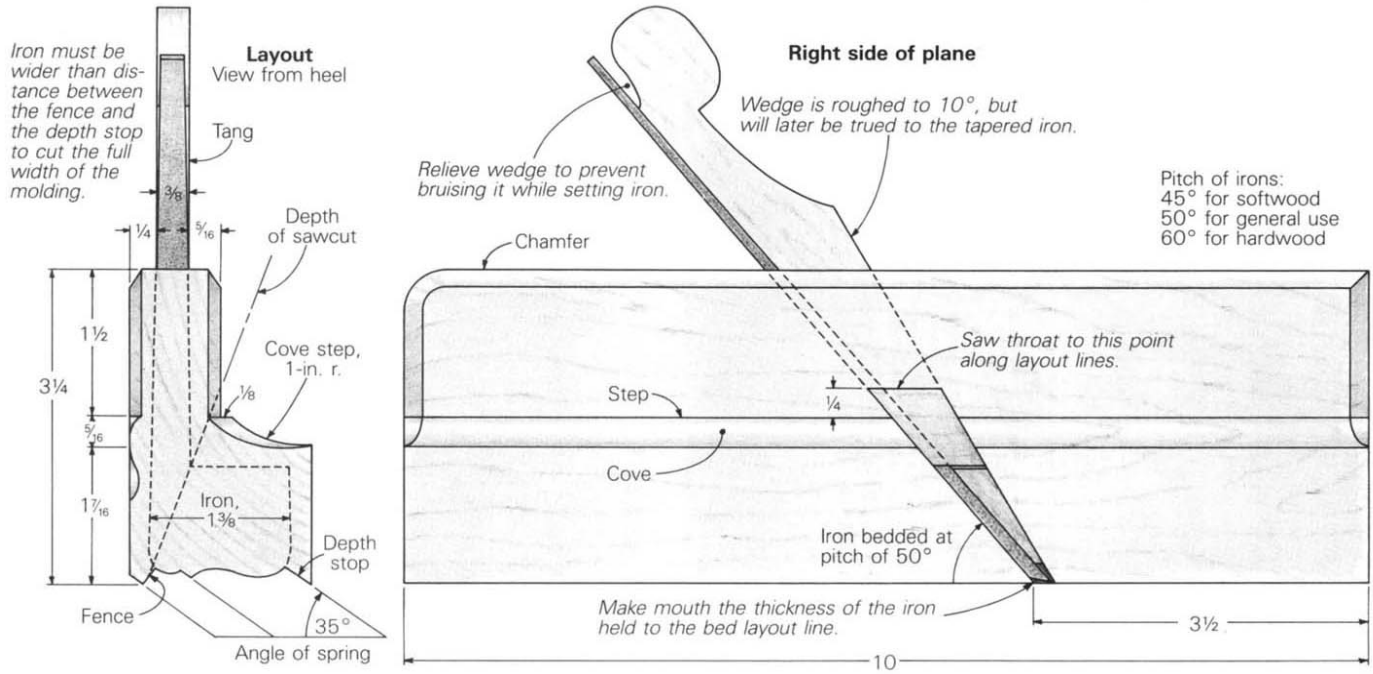
class of planes generally used to cut wider moldings. These planes are from 12 in. to 14 in. long, and have a throat, wedge system and handle similar to common bench planes. They have been dubbed "crown molding planes," though this type of plane cuts many sorts of moldings other than crowns or cornices.

The design—The first step in making any molding plane is choosing the molding. Draw its section full-size, and refine the drawing before beginning the plane. Simple planes can make moldings up to about 2½ in. wide. Wider moldings will have to be made with more than one plane, or with a crown molding plane.

Use the molding section to construct a full-size drawing of the heel, or rear, of the plane, as this will settle the size of the block needed. The sole of any molding plane is the reverse profile of the molding it cuts, plus the integral fence and the depth stop. Looking at my plane from the rear, the fence is on the left and the depth stop on the right (figure 2, top of next page).

In use, the stock is fastened horizontally to the bench and the plane is tilted, or "sprung," so that the fence is vertical and the depth stop horizontal, as shown in the photos above. An unsprung plane can wander, but a sprung plane gives greater control because the guide fence is pressed against the stock. The plane, even though tilted, cuts straight down the side of the work, gradually taking a wider and wider shaving until the full profile has been stuck. When the depth stop contacts the top of the work, the iron stops cutting. Not only is a sprung plane easier to use, but its geometry will also

Fig. 2: 18th-century molding plane **Based on examples of Jos. Fuller, who worked in late 18th-century Providence, R.I.**



allow its mouth to be more uniform in width (figure 3, top of facing page). Not all 18th-century molders were sprung, however, and a sprung plane won't cut some molding shapes.

Draw the molding with the appropriate spring, which can vary—good working angles are shown in figure 1. Then add the fence and depth stop to the molding profile. I allow ¼ in. on the fence side, and 5/16 in. on the depth-stop side. Your drawing now shows the total width of the plane.

The top of a molding plane is stepped down in thickness. The width of the stepped portion will be the width of the iron's tang plus ¼ in. at the left and 5/16 in. at the right. The extra width makes up for the wood that will be cut from the throat. You can judge from figure 2 the height of a typical step.

The stock—Yellow birch was used by 18th-century planemakers, but by the turn of the 19th century beech had become the wood of choice. I prefer quartersawn yellow birch, but beech, maple or cherry will work as well. Select as fine a block of wood as you can—straight-grained and consistent throughout. Avoid figured wood, or you'll have problems shaping the sole.

My rough block length for a 10-in. long plane is 12 in., which gives me an inch at each end to experiment with when shaping the sole profile, and also allows for cutting off bruises inflicted during shaping. The finished height of most blocks is about 3¼ in. Standard dimensions meant planes could be stored and transported in fitted boxes without rattling around.

The iron—Since I figure that I'll use any molding shape sooner or later, I frequently buy old irons that have lost their blocks, then make new blocks to fit. I've had some good luck, but looking for a usable iron that's also a shape you need can be futile, so I recommend that you make your own.

The easiest way to make an iron is to start with a piece of dead-soft sheet tool steel, work it with a file and hacksaw, and then temper it after shaping. Alternatively, you can have a blacksmith forge an iron out of spring steel, which can be annealed and shaped, then tempered as a last step. Hayrake tines and old buggy springs forge into excellent irons.

Iron thickness can be from ⅛ in. to 3/16 in. The thicker irons will chatter less, but will be more difficult to shape. Old plane irons were tapered in thickness. A light tap on the end of the tang would loosen a tapered iron slightly while driving it deeper into the block. Then a sharp tap on the wedge could secure the iron without altering the set. The tapered iron, while nice to have, is not a necessity. And a uniformly thick iron is much simpler to make. Keep in mind that the iron must be wider than the cutting portion of the sole—if the profile ends at the side of the iron, you won't be able to set the iron deep enough to cut the full width of the molding.

Layout—When your block is planed and trued square, lay out the cuts and mortises. Start by making a full-size template of the sole profile, directly from the full-size drawing of the molding. To make the template, I use aluminum flashing. It is easy to work, and the edges of the template remain crisp during tracing. Position the template in the same place on each end of the block and trace the sole profile.

Next, lay out the throat, mouth and wedge slot using the dimensions given in figure 2. I suggest a 50° pitch for the iron—a compromise for cutting either hard or soft woods. The wood which the iron rests against is called the bed. The opposite side of the mortise will be cut at an angle 10° greater, to allow for the wedge taper. Carry the layout lines all around the body of the plane to define the mouth opening and the tang mortise on top of the block. Lay out the mortise width according to the width of the tang.

Last, use a marking gauge to scribe the step. The step makes the plane easier to handle, helps the shaving out of the throat, and makes cutting the mortise for the wedge and iron

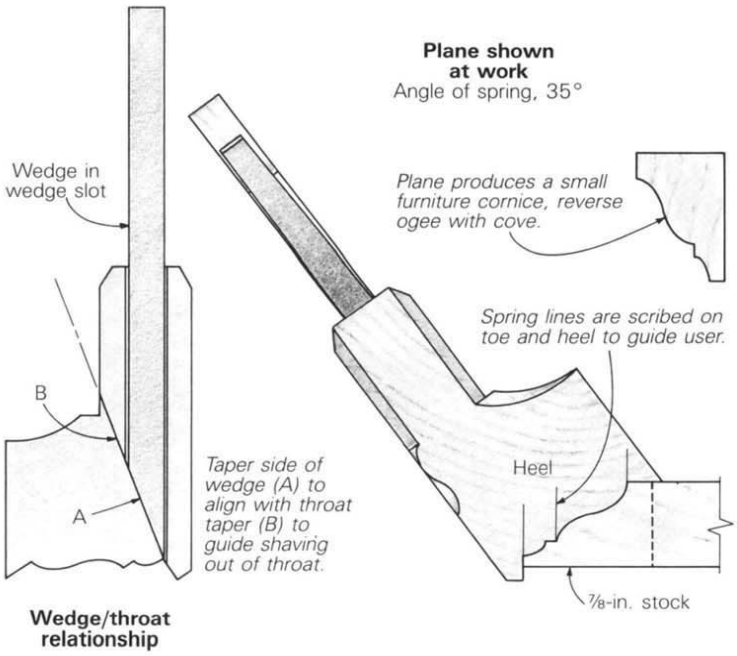
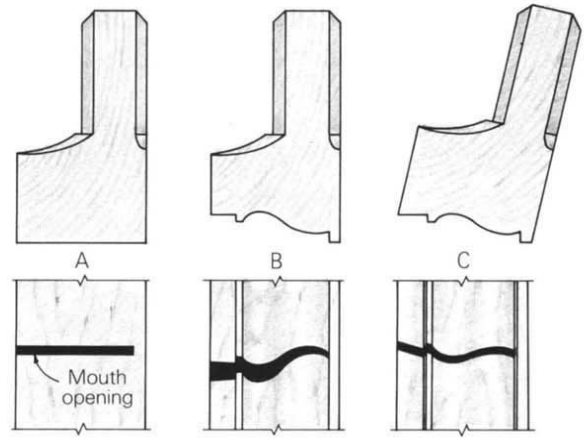


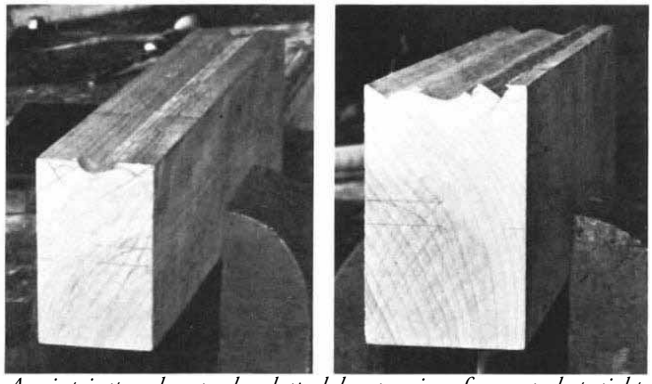
Fig. 3: Spring allows uniform mouth



A. Rabbet plane shows uniform mouth.

B. Ogee molding plane, unsprung, shows irregular mouth because sole must be cut up the side of the plane.

C. Ogee molding plane, which cuts the same molding as in B, shows that mouth of sprung plane remains uniform. This plane must be a bit wider than plane B to cut the same contour.



An intricate sole can be shaped by a series of cove and straight cuts on the tablesaw, and then sanded with shaped blocks.

Boxing the sole

Slivers of Turkish boxwood can be let into the sole of a plane to reinforce it at points where use would wear it down. Boxwood—the familiar yellow wood used in old Stanley folding rules—is dense, tight-grained and extremely wear-resistant.

Planemakers plowed narrow grooves into the sole of the plane, inserted thin slips of boxwood, then trued up the sole. In order to make the slips even more wear-resistant, makers set the grain of the boxwood nearly at right angles to that of the plane body, so that the tougher end grain was exposed to take the abuses.

Boxing was not common in 18th-century planes, but it caught on fast—it is found in almost all molding planes produced after the turn of the 19th century. —*N.V.*

easier, as we shall see. The edge of the step can be decorated in a number of ways—molded with ogee or quarter-round profiles, chamfered, or simply beveled off. I decorate my steps by cutting a cove the full length of the plane. Lay out the decoration now, too.

Shaping the sole and step—Period planemakers duplicated many profile molders. Instead of shaping each sole with files and gouges, they devised a "mother plane," made in reverse profile, to stick each profile. The mother plane saved time, and it ensured that all the planes for a specific molding would be the same, at least those from any one workshop. I've never bothered to make a mother plane, though, because I've never needed more than one plane of each shape.

Cut the sole and the step decoration prior to sawing out the mouth and throat—these gaps would interfere with the shaping. It's vital that the sole be uniform from end to end, or you won't be able to set the iron properly. Various tools and techniques can be used to shape the sole. For the fence and depth stop, or any other flat portions of the profile, I use the tablesaw to make cuts the full length of the sole.

The concave areas can be gouged and filed, or cut on a router table using various cove or fluting bits. By making a number of repeated cuts, not quite to the layout line, you can remove most of the material. The sole can then be scraped or sanded smooth, with the sandpaper wrapped around a dowel. For shaping convex areas I generally use hollow planes, but other methods work too. Again you can remove most of the material using router or tablesaw, then clean up with chisels, scrapers and a shaped sanding block.

Check the sole with a straightedge, and then true any hollows or high spots.

The steps on period planes were probably cut with a large rabbet or fillister plane—chatter marks from the iron are often visible. I cut the step on the tablesaw and scrape the surfaces

smooth, saving the waste to make the wedge. At this point you can cut the decoration on the step.

Sawing out the mouth—Surprisingly, a good deal of the mouth and wedge slot can be made by simply sawing out the area between the layout lines. Mark out how far up the body of the plane you wish to saw. This cut is a compromise between leaving enough wood above the step for strength and providing a gentle angle to guide the shaving out of the throat. I usually stop the sawcuts ¼ in. above the step.

Figure 2 shows how deep to cut across the sole. I use a miter box to start the cuts at the proper angles for the blade and the wedge—the miter box also ensures that the throat will begin straight across the sole. I use the backsaw freehand to finish the cuts.

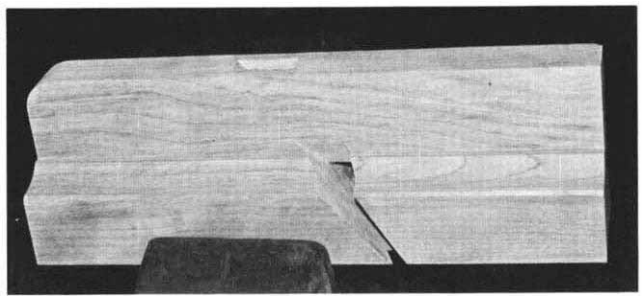
The wood between the kerfs can now be chiseled out, and pared as smooth as possible. You will find that a ⅛-in. chisel is a great help in clearing out the mouth.

Mortising the wedge slot—The angled mortises in period planes were, I believe, chopped out without pre-boring—production planemakers of yesteryear had plenty of practice. I find it a lot safer to pre-bore the wedge slot with a bit slightly smaller than the width of the mortise, using a guideblock bored at the correct angle. A drill press could be used, or any number of jigs worked out. It's important to bore accurately, without cutting into either the bed or wedge ends of the mortise. Bore all the way through to the throat.

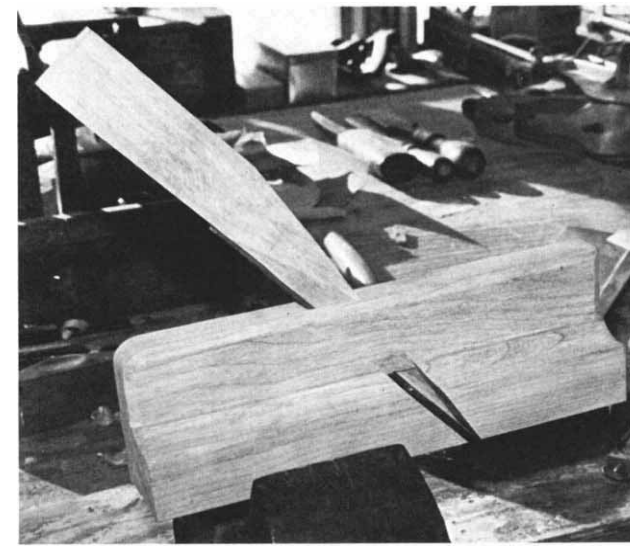
Now pare the sides and ends down to the layout lines. Some chopping is required, but don't rush it—many a plane has been spoiled at this point. You have to chisel the wedge end of the mortise into end grain at a 40° angle. Patience and an absolutely sharp chisel will prevail.

After my wedge-slot mortise has been cut, I use a set of planemaker's floats *(FWW* #30, p. 63) to true up the bed and the mortise. Floats are single-cut files of various shapes and sizes with widely spaced teeth, each of which functions like a tiny chisel. Original floats are extremely scarce, and command high prices. I have a set that a friend made me on his milling machine, and I value them highly. Although they make truing up a lot easier, floats aren't strictly necessary—careful paring with a chisel can produce as good a result.

The width of the mortise isn't crucial, just make sure there is adequate clearance for the iron without removing too much wood. The bed, however, must be perfectly flat—or the iron will chatter. For the final fitting, use your iron to check out the bed surface, the mortise width and the mouth. But check the iron itself for flatness first. The wedge end of the mortise must also be flat, and square to the plane's sides.



Much of the angled mortise can be started with a backsaw and then pared away, but the inside should be drilled and chopped.



The plane's wedge is made from the scrap left over when the step was cut. Its lower end will be tapered to guide the shaving out.

Making the wedge—Take the cutoff you saved when you made the step, and thickness it to the width of the tang. Taper it to 10° so it will fit the mortise. I make the angled cut with a fine-tooth handsaw and plane it true and smooth with a block plane. Now set the iron in the plane and insert the wedge against it with the grain of the wood parallel to the iron. The wedge must fit tight to hold the iron firmly against the bed, and to prevent shavings from catching between the wedge and iron, jamming up the mouth and throat. Carefully pare away wood from the mortise until you get a perfect fit.

Shaping the iron—The blank has to be annealed, so that it can be worked to shape, then rehardened. To anneal the iron, you can use a propane torch, or better yet a hotter MAPP gas torch, heating the iron to a dull red glow, then letting it cool slowly for an hour or two. If the steel is properly annealed you should be able to cut it with a file or hacksaw.

Once you've shaped the tang so the iron fits neatly in the plane, the cutting edge can be laid out to the shape of the sole. This must be done while the iron is set flat on the bed. I make a full-size template of the iron out of aluminum flashing. Place the template in the plane as a substitute iron, holding it tightly in place with the wedge and making sure that its full width protrudes slightly beyond the sole. Using a sharp marking awl, scribe the contour of the sole on the underside of the template. Remove the template and cut out the traced profile with a tin snips or knife. The line of the cutting edge must pass into the body of the plane at the fence and depth stop—carry this line out to the sides of the template. This will not give you an entirely exact profile for the cutting edge, but it's as close as you can come at this point.

Next, paint the bottom inch of the wedge side of the iron with either machinists' blue layout dye or flat black paint. When this is dry, lay the aluminum template on it and, using the awl, scribe the cutting edge's contour. You can use a grinder for roughing out, but a file will give you the greatest accuracy for the final cuts to the scribed line. Place the iron in a vise, paint side toward you, and go at it. Don't worry about the bevel of the iron yet, just file square to the contour.

Now turn the underside of the iron toward you to file the

bevel: all but the cutting edge itself must clear the sole. Thus the bevel angle is dependent upon the angle at which the iron is bedded, the pitch. For a plane with 50° pitch I give the iron at least a 55° bevel (a 5° clearance angle), which usually proves sufficient. Set a bevel square to the bevel angle and file up to the cutting edge.

When the edge is formed, position the iron with the wedge in the plane, so that the iron protrudes about 1/32 in. Check for clearance, and sight down the sole of the plane from toe to heel to see that the iron protrudes uniformly. Remove the iron and touch it up with a file where necessary.

When everything is right, remove all traces of the paint or layout dye. File all parts of the bevel as smooth as you can, because once the iron is tempered, a file will not easily cut the steel. Next, polish the iron. I use a muslin wheel charged with gray compound (tripoli). The shiny, buffed surface will allow you to see the colors of the steel—your clue to the correct temperatures—while you temper the iron.

Tempering—I confess I have little scientific knowledge of tempering. I learned from a local blacksmith who was even less scientific than myself. I don't have my own forge, but a MAPP gas torch works quite well on small pieces such as plane irons. Heat the iron until it glows dark cherry red in dim light. This is about 1550°F to 1600°F. Don't direct the flame at the cutting edge—the edge reaches a hotter temperature anyhow, and there's no sense in burning it. When the color is right, plunge the iron vertically into a pail of cool, salted water. When cool, the iron will be in the hard state. Buff it until it shines again, and test it with a file.

Next, temper the iron by heating it until the polished surface turns a light straw color. This will be about 500°F to 600°F—nowhere near as hot as when heating to harden. When the color is right, plunge the iron into the water. Then check it for hardness with a file, which should be barely able to cut. If it isn't hard enough, start over.

Buff the tempered iron clean, and use a set of Arkansas slip stones to hone the tricky spots. Use plenty of lubricating oil until the entire bevel gleams.

Finishing the wedge—With the tough wedge against the iron in the plane, mark the wedge's decorative profile. Then shape the wedge on the bandsaw or scroll saw, and sand the edges smooth. The wedge in figure 2 is typical of a prolific 18th-century planemaker, Joseph Fuller, of Providence, R.I.

Taper the tip of the wedge to allow the shaving to escape the mouth and be directed up and out of the throat. The tip will sometimes have to be cut back a little. Taper from the end up to the bottom of the angled mortise—if the taper extends into the mortise you will trap shavings.

After chamfering and carving some decoration on the block, I stain the yellow birch and apply three coats of Minwax antique oil as a sealer and final finish. The plane is now about ready to go to work.

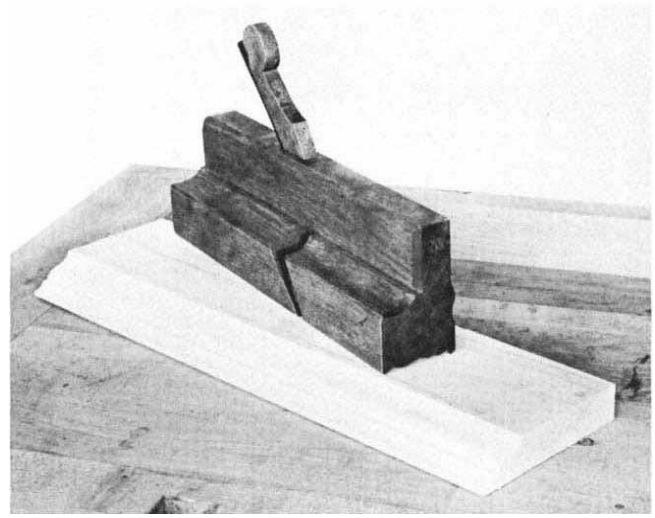
Setting the iron—Place the iron in the plane and insert the wedge loosely. Sighting down the sole from the rear of the plane, set the iron so the cutting edge is just shy of the mouth, and drive the wedge, but not as tight as it will be during use. It helps to have a light positioned behind you, to reflect off the bevel as it protrudes. Get the final set by tapping the end of the iron, then drive the wedge tight. Use a mallet on the wedge and a ball peen or other small hammer on the iron. To loosen the wedge, hold the plane in your left hand and give the heel a sharp blow with the mallet. Be careful the iron doesn't fall out of the mouth of the plane.

Lubricate the sole to minimize friction and to prevent pitch buildup. Cabinetmakers used to use tallow, kept in cups fastened beneath their benches. I use paste wax, and sometimes mineral oil, though mineral oil tends to darken the sole.

Depending on the wood and the amount of set, it might take twenty to forty passes to stick your molding. Start with the plane sprung so the fence is flat against the edge of the board. Keep pressure against the fence with each pass, and be sure to keep the spring lines vertical, otherwise the molding may end up with a tilt.

Making wooden planes in the old manner is an all-but-forgotten trade. I hope you will be inspired to give it a try—to experience the immense pleasure of using a tool you have restored or, better still, designed and built on your own. □

Norman Vandal, of Roxbury, Vt., makes period architectural components in the summertime and period furniture during the winter. He wrote about panel planes in FWW *#18. For more on tempering, see* FWW *#4, pp. 50-52.*



A molding plane can yield a crisp, traditional molding, free of machine-tool marks and needing no sanding.

Further reading

Wooden Planes in 19th-century America, Kenneth Roberts, Kenneth Roberts Publishing Co., Fitzwilliam, N.H., volume one. Note: Volume two, available soon, features the most comprehensive material ever published on making wooden planes.

Dictionary of Tools Used in the Woodworking and Allied Trades, R.A. Salaman, Charles Scribner's Sons, New York, 1975. Includes planemakers' tools and the processes involved.

Alex Mathieson & Sons, 1899 Woodworking Tools, a catalog reprint, Kenneth Roberts, Kenneth Roberts Publishing Co., Fitzwilliam, N.H. Many full-size drawings of period moldings.

Chapin-Stephens Catalog No. 114, 1901, a catalog reprint, Kenneth Roberts, Kenneth Roberts Publishing Co., Fitzwilliam, N.H. Molding planes in sticking positions; useful for designing.

Explanation or Key, to the Various Manufactories of Sheffield, Joseph Smith, 1816, a reprint by Early American Industries Assn., South Burlington, Vt., 1975. Historical information.

Woodworking Planes, a Descriptive Register of Wooden Planes, Alvin Sellens, Augusta, Kans., 1978. A valuable compilation.