Marking Tools for Exacting Joints

By Ian Kirby

Author Ian Kirby has taken us through his process of squaring up stock. Now he shows us how to use marking tools to lay out precision joinery.

The tools and methods described here are used when marking out solid wood to be cut by hand. I know that many woodworkers — beginners and old hands alike — will mark and cut wood by other methods. There's nothing wrong with that. However, I believe that knowing the hows and whys of hand work provides a solid foundation for quick and precise machine work.

Broadly speaking, solid wood joints come in three types: butt joints, mortise and tenon joints and dovetail joints. Don't be intimidated by what at first may seem to be an overwhelming range of possibilities. Closer inspection reveals that butt joints are simple and straightforward. The remaining two, despite many design variations, follow a common marking out theme. Once that theme is understood, the presumed complexity of marking joints fades away. Further proof of underlying simplicity is that you need only five marking tools and they, too, are relatively simple: a pencil, a marking knife and three gauges — marking, cutting and mortise. You also need two measuring tools — try square and sliding bevel — to guide your pencil and marking knife.

First I'll introduce the tools and explain how to use them. Then I'll show them on the job, marking out the typical parts of a mortise and tenon joint and a through dovetail joint.

Marks are divided into two categories: surface lines made by pencil and incised lines made by knife or gauge.

From left to right, a cutting gauge, mortise gauge, marking gauge (above), marking knife and pencil (below) are the tools author and master craftsman Ian Kirby uses to mark out precise joinery.

Pencil

The most universal marking tool is the pencil. The pencil makes two specific types of lines: orientation marks and cutting guidelines. Face side and face edge marks are orientation marks, which I discussed in a previous article (see *Marking Up for Success: Preparing the Stock*, February 2001). Use a sharp B pencil to mark cutting guidelines on dovetail joints. On a dark wood such as walnut a white pencil makes a more visible line.

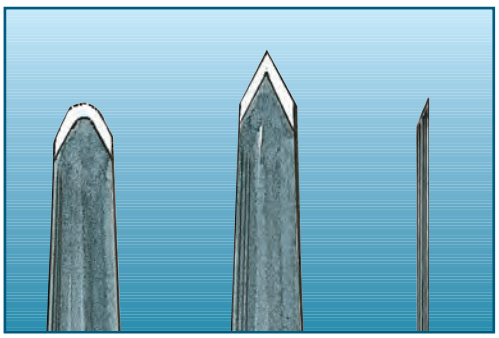
Marking Knife

Too often regarded as a low-status tool, the marking knife is essential for the exacting job of marking the shoulder lines of tenons and marking the dovetail pins from the tails.

Because the marking knife cuts the outside fibers that form the visible part of the shoulder line, it determines the final fit and appearance of the joint. What's more, it does so at the marking out stage, not the joint cutting stage — a heavy responsibility for a mere knife!

The blade of a marking knife should be thin in section and sharpened to a slim V. In side elevation the end of the knife should be rounded rather than pointed. A pointed knife is liable to produce a ragged cut because of the pressure concentrated at the point. A rounded edge, with pressure distributed over a curved edge, will produce a smooth cut. I use a Swiss Army knife. It suits my hand, pocket and wallet perfectly.

A rounded knife produces a smooth cut because pressure is distributed over a curved edge rather than concentrated at the point.



The cutting gauge knife is sharpened to a point by the manufacturer (center). It works better if you reshape it to a semicircular profile (left). Sharpen the knife with a flat face and a bevel on one side, like a chisel.

Gauges

Gauges are simple tools that exist in all of the world's woodworking traditions. Their wide use underscores the fact that they perform an essential function that no other tool can: they cut a fine line parallel to a board's straight edge or squared end — quickly and accurately. Such a line precisely divides the waste from the work, which is one of several critical steps on the path to clean, accurate joints.

A gauge line, however, can only be as accurate as the face — edge, side or end — that guides the fence. *You cannot make accurate joints with inaccurately prepared stock.*

All gauges have three major parts: fence, stock and knife or spur. A spur is designed to mark with the grain; a knife is designed to cut across the grain. Tying to make one gauge do work best done by the other results in poorly made lines and badly made joints.

Marking Gauge

The marking gauge has a steel spur sharpened like the point of a pencil. The spur incises a line by parting the fibers of the wood. It's a perfect shape for working with the grain but totally unsuitable for working across the grain because it tears the fibers.

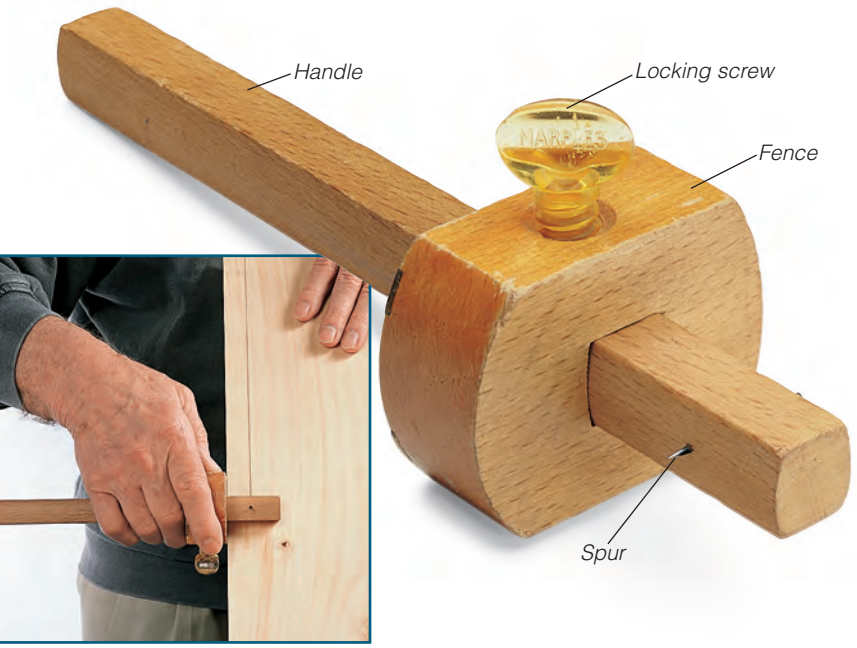
The spur is made of steel that's too hard to sharpen or reshape with a file, so you have to use a small sharpening stone.

A new marking gauge usually comes ready to use, but a used one bears inspection. Make sure the spur fits tightly and that it hasn't been replaced with a nail, which is too soft to hold a sharp point. If the spur is loose, drill a new pilot hole and tap the spur in with a hammer.

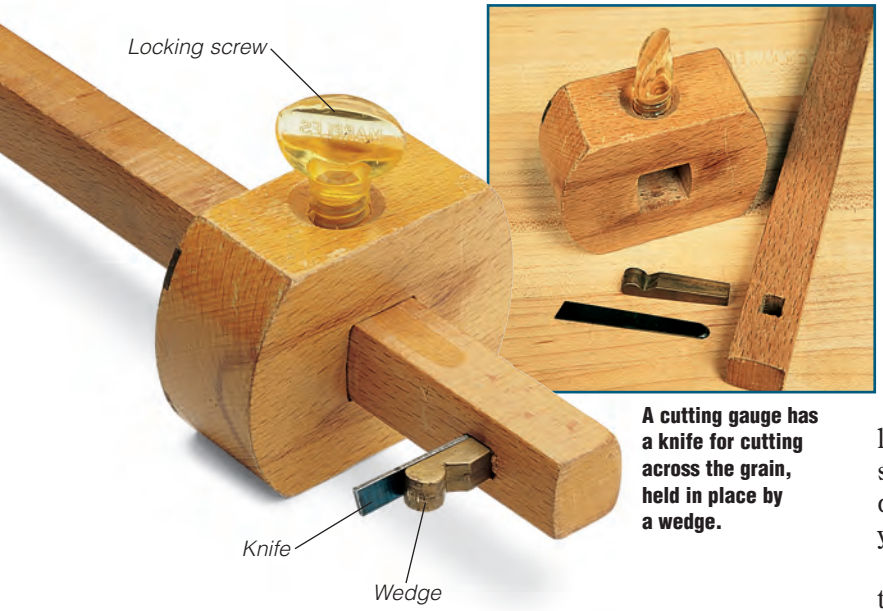
The spur should stick out 3/16" from the stock. To adjust the spur, clamp the blunt end of the spur in a machinist's vise and and tap the gauge up or down.

Cutting Gauge

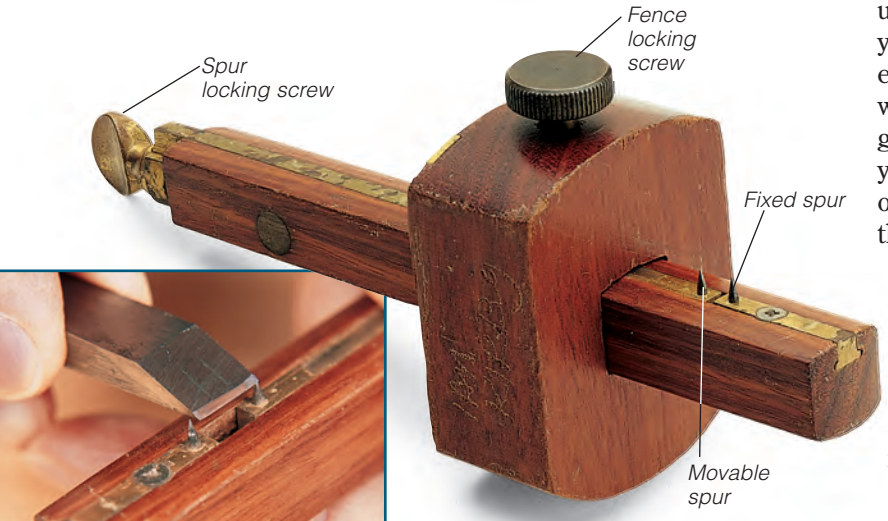
The cutting gauge has a small steel knife, which is held in its mortise by a wedge of cast brass. The knife incises a line by cutting across the fibers of the wood. Don't use the cutting gauge to cut with the grain. The mark is difficult to see and difficult to



A marking gauge cuts with the grain. Note the basic gauge grip — thumb behind the fence, index finger over the fence, three fingers grip the stock.



A cutting gauge has a knife for cutting across the grain, held in place by a wedge.



A mortise gauge incises both sides of the mortise and the tenon — with the grain. The setting is determined by the width of the mortise chisel.

keep straight because it tends to wander with the grain.

The knife usually comes from the manufacturer with a sharp point, but it works better rounded. (See the drawing on page 29.) Grind and sharpen it like any other cutting edge. There's a flat side and a bevel side — just like a chisel. The bevel always faces the waste side of the line. Remove the wedge to change the orientation of the knife. Tighten the wedge when you replace it by tapping with a hammer.

The knife must be parallel to the face of the fence. If necessary, re-align the square hole with a narrow chisel so that knife and wedge seat snugly and accurately. If the wedge is a rough casting, file it smooth for a better fit. If the wedge gets lost, make a new one out of hardwood.

Mortise Gauge

The mortise gauge has a fixed top spur and a moving bottom spur.

If the moving mechanism is binding, disassemble the gauge and clean the parts. That usually solves the problem.

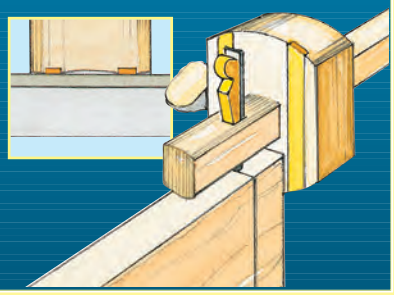
When you disassemble the mortise gauge, look out for a little metal disc that sits under the stock's locking screw. It keeps the screw from damaging the brass strip. If you lose the disc, you must replace it.

Some mortise gauges have a third spur on the back side of the stock. The idea is that by using this spur like a regular marking gauge, you get two tools for the price of one. The economy is false because regular marking just wears out the fence of the expensive mortise gauge sooner than necessary. What's worse, you will likely one day puncture your thumb on one of the spurs. My solution is to grind off the third spur.

Brass Doesn't Always Shine

Expensive gauges feature brass strips let into the face of the fence. The strips are intended to extend the life of the tool by retarding wear on the fence. In fact, you may introduce error because the strips stand proud

The gauge lines will not connect if the end of the workpiece falls between the brass strips when gauging across the thickness but contacts the strips when gauging across the width.



of the fence surface when the wood shrinks or due to sanding during manufacture. The error equals the distance they stand proud.

The performance of a cutting gauge is more likely to be compromised by this error than a marking gauge. For example, when setting a measurement using a rule, you determine the knife position by measuring from between the strips, yet the actual position of the marked line is determined by the strips that contact the workpiece.

A similar problem occurs when gauging around squared-off stock, such as the tail piece of a dovetail. When gauging across the thickness of the piece, the strips are often further apart than the thickness of the wood and the end grain falls between the strips. When gauging across the width of the piece, the strips ride on the end grain. The knife line is therefore further from the end of the piece on the edges than it is on the faces. When making through dovetails, this slight difference will cause a gap in the shoulder lines on the tail piece. Check the strips with a straightedge. If they are not flush with the surface of the fence, reverse the fence on the stock and use the opposite face.

Using the Gauges

Despite the nuances of each gauge, all require the same grip and operate much the same way. The following instructions assume you are right-handed.

Practice the basic gauge movements first without the added complication of making a mark. Set the fence of the marking gauge 3/4" from the spur. Hold one end of the practice workpiece in your left hand, trapping the ends between your chest and a bench stop or vise. Press the gauge against the face side and rotate it forward, like a throttle on a motorcycle, raising the spur above the workpiece. Press the fence against the face edge and push the gauge down the workpiece. Apply pressure inward at 90° to the edge of the workpiece and forward down its length parallel to the

Understanding shoulder lines

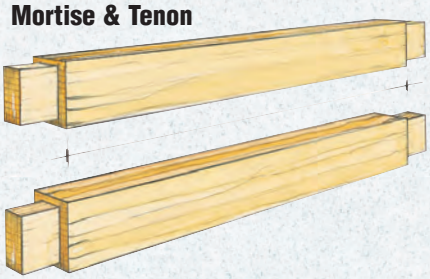
Mortise and Tenon Shoulder Lines

Imagine you are making a square four-legged, four-rail table. On the cutting list, the rail length includes the material for the tenons. On the working drawing, the distance between shoulders (BS) is clearly stated. Mark the first shoulder by measuring the length of the tenon from the end of the rail, then squaring round using try square and marking knife. Next, measure off the distance between shoulders and square round the second shoulder line the same way. This first rail is the measuring stick used to measure and mark out all subsequent rails of the same length. Accuracy of the BS dimension determines the accuracy of the piece. Neither the end of the rails nor the length of the tenons are factors.

Dovetail Shoulder Lines

When you make a dovetailed box or drawer, the important dimension is the overall length of the parts, not the BS dimension. You prepare opposite sides to the same length and square the ends. Then you mark the dovetail shoulder lines with a cutting gauge riding on the end grain of the sides. Accuracy is determined by the ends of each piece and the length of the sides.

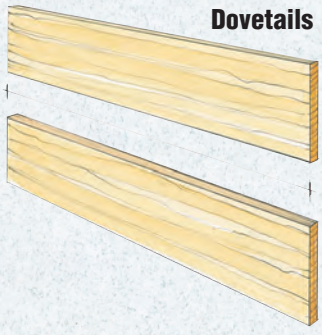
Mortise & Tenon



In mortise and tenon joinery, the distance between shoulder lines determines the squareness of the work, the accuracy of the rails and ultimately the dimension of the piece of furniture.

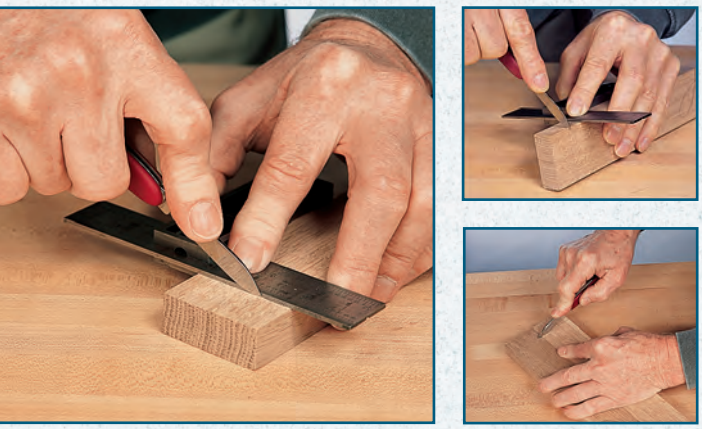
In dovetail joinery, squareness, accuracy, and dimension are determined by the ends of each piece and the length of the sides.

Dovetails



Marking out a typical mortise and tenon joint

Mortise and tenon joints are used to connect parts which undergo stress — chair legs and rails, table legs and aprons, bed parts and doors are some examples. The aim is to design the joint to be as strong as possible. A rule of thumb is to equalize the size of the tenon with the cheeks of the mortise. I refer to this as balancing the tissue.



Knife the tenon's first shoulder. Use the face side and face edge to continue squaring round. For the second cut, rotate workpiece 90°. Mark the second set of shoulders from the first set.

Set the mortise gauge with the chisel you'll to chop the mortise (top right), then mark the tenon edges and end with your mortise gauge (above). Turn to the marking gauge (bottom right) to mark the tenon sides and end.

edge. Once the movements become fluid, rotate the gauge backward until the spur touches the workpiece.

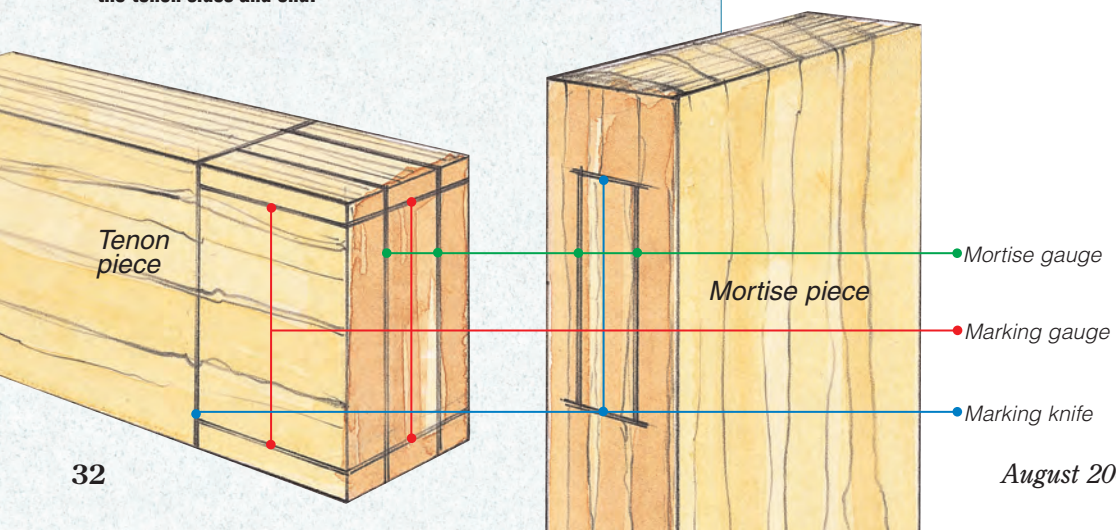
Initially, especially if the wood is hard, make several passes, strengthening the mark by increasing the rotation with each pass. Once proficient, you will make a crisp mark in a single pass.

Once you get the hang of it, avoid clamping the stock you are marking to a bench or table, in order to save time and fuss. It's possible to do this even when you must mark the workpiece's full length. Tilt short workpieces slightly on edge so the gauge rides on the high side and clears the bench at the end of the cut. Long boards hung over the edge of a table or your bench are usually heavy enough so that clamping is unnecessary.

When marking out joints, you often need to stop the gauge line at a given point. Before marking the line, position the gauge so that you can drive the spur deeply into the workpiece about 1/8" from the stop point. When you mark the line, the spur will drop into the hole and stop the travel of the gauge.

Mortise and Tenon Joint

With these simple steps in mind, now you're ready to start marking up joints on an actual project. You mark the shoulder lines of a tenon with marking knife and try square. First measure the length of the tenon from the end of the rail. Register the stock of the try square against the face edge and lay the blade on the face side. Hold the try square in place by pressing down with the index finger and squeezing it between your thumb on the stock and three fingers on the far edge of the workpiece. Hold the knife vertical to the try square blade and incise the line.



The rail and stile pieces of a mortise and tenon joint showing the lines lines made by each of the marking tools.

Before making the second cut, rotate the workpiece 90°. It doesn't matter whether you mark the face edge next or the opposite edge. It *does* matter that you reference the stock of the try square against the face side. Insert the knife in the nick of the first line and slide the try square to it. Using the knife to position the try square is much easier and more accurate than guessing the try square position by eye and then moving the knife to the square.

To mark the shoulder at the other end of the rail, you must know the between shoulders (BS) dimension. See the sidebar *Understanding Shoulder Lines* on page 31.

To cut the joint, chop the mortise with chisel and mallet. Cut the tenon with a back saw. Clean up the tenon shoulders with a chisel guided by the marking knife line.

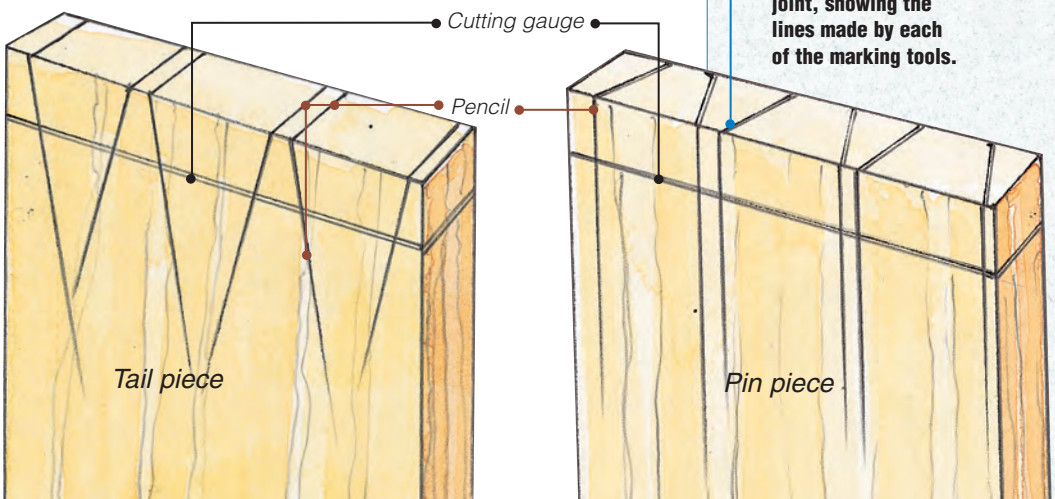
Dovetail Joint

A dovetail joint has two parts, a tail piece and a pin piece. The tail piece is made first and the pin piece is marked from it.

Knife the shoulder lines on both pieces with a cutting gauge. Set the cutting gauge to just less than 1/32" of the thickness of the stock. Knife around the pieces with the cutting gauge fence riding on the end grain.

To cut the joint, cut the sides of the tails and pins with a dovetail saw. Cut out the waste with a coping saw. Finish by cleaning up the shoulders with a chisel guided by the cutting gauge line.

Ian Kirby is a master of the British Arts & Crafts tradition as well as a designer, wood scientist and master woodworker. Look for his continuing articles in upcoming issues of Woodworker's Journal.

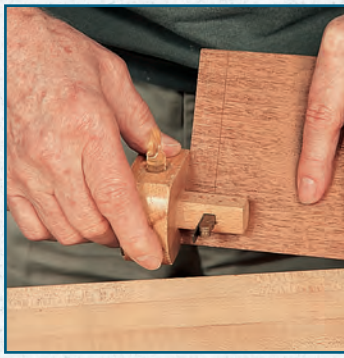


The tail and pin pieces of a through dovetail joint, showing the lines made by each of the marking tools.

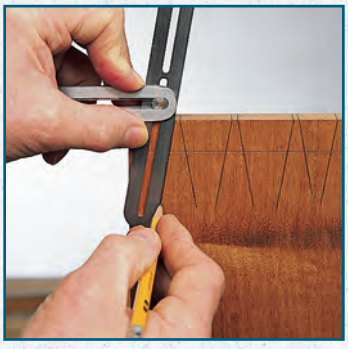
Marking out a typical through dovetail joint

Through dovetails are used to connect wide boards to make storage boxes, and they're plenty strong for this purpose. The aim is to design the joint to look as elegant as possible. You need to decide on the slope of the tails and the size of the tails to the pins. I refer to this design process as the layout.

Set the cutting gauge 1/32" less than the thickness of the pin piece.

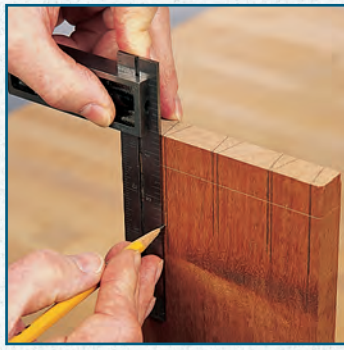


Knife all the shoulder lines with the cutting gauge.



Lay out the tails by squaring across the top with pencil. Mark the slope with pencil and sliding bevel. Extend the pencil guidelines well below the shoulder lines to help guide the dovetail saw.

Mark the pins from the tails with a marking knife.



Square down cutting guidelines from the pin marks with pencil and try square.