

Installing a Plank Floor

Wide boards demand careful persuasion

by Don Bollinger

It wasn't until the end of the 19th century that the wind stopped blowing through the cracks in wood-plank floors. Prior to that time nearly every type of house, from log cabin to saltbox, had floors made out of square-edged planks. They were milled from whatever wood was available, and builders used cut nails or dowels to affix planks directly to the joists. The planks were wide, up to 14 in. in some cases, and as they expanded and contracted with seasonal changes, so did the cracks between them. That all changed with the industri-

al revolution, when kiln-dried planks with T&G edges began to emerge from lumber mills.

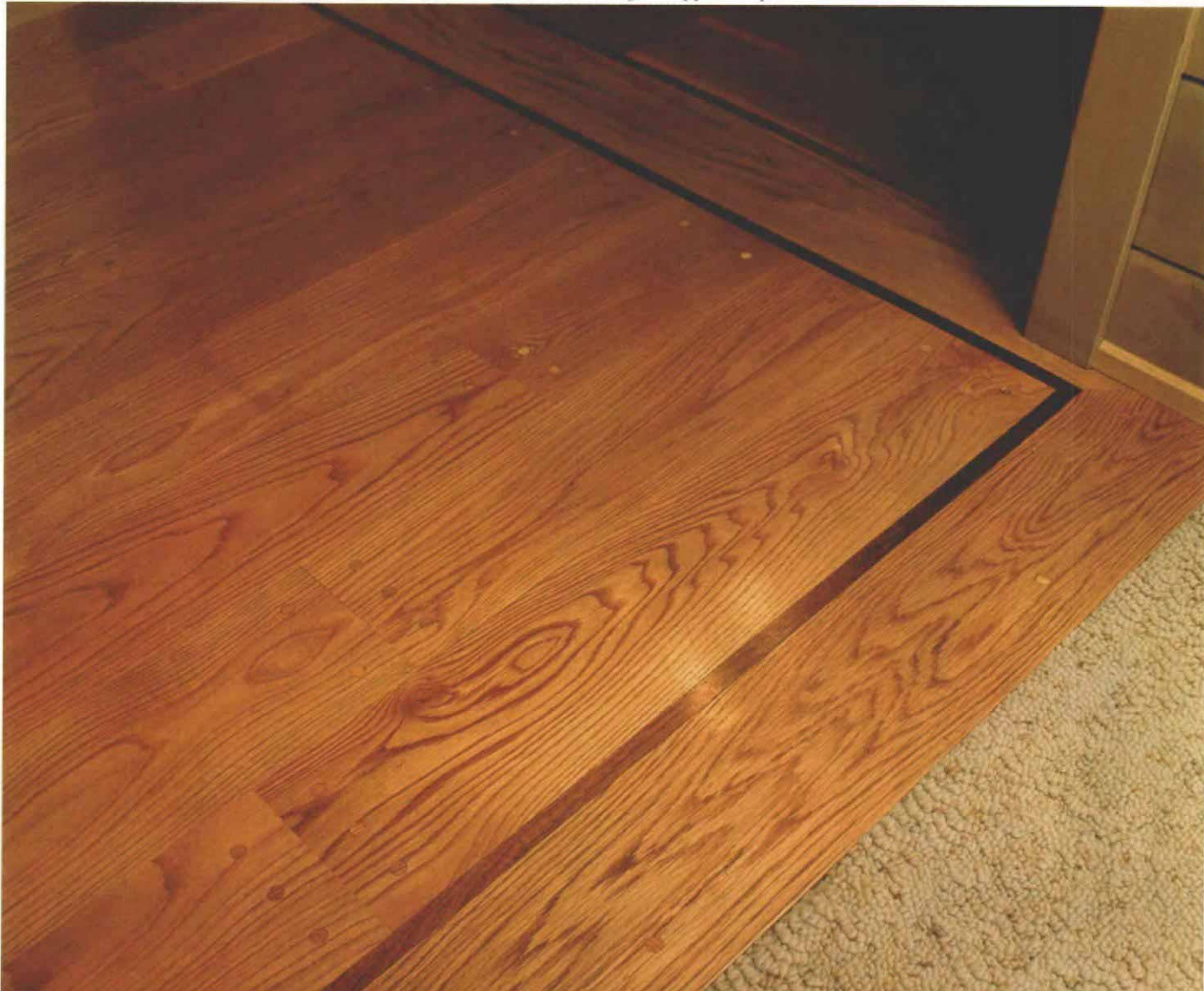
Most of the hardwood floors that my company installs are made of slender T&G strips. But some of my customers still prefer the traditional look of the wide floorboards and decorative plugs that characterize a plank floor (photo below).

There is a price to pay for this tradition. On the average, the materials to do a plank floor cost about 50% to 75% more than they do for a strip floor of a comparable grade of materi-

al. Plank floors are also harder to install than strip floors because the material is less forgiving. But if you like broad expanses of wood grain underfoot, nothing compares with the look of a plank floor.

Those of you who read my article on strip flooring (*FHB* #13, pp. 42-47) will recognize the similarities in the work that has to occur before installing either a plank floor or a strip floor. The layout, framing, underlayment and barrier requirements are the same. But coaxing the planks into place and affixing them to the sub-

Hardwood floors are typically laid out so the planks or strips follow the long dimension of the room. When they change direction, a header board makes an attractive transition. Spanning a doorway, the header board is a good opportunity to add a decorative strip of contrasting wood.



floor takes another set of solutions. In this article I'll talk about plank floors made of unfinished oak, but these techniques can be used for floors made of other species of wood as well.

Dimensions, grading and ordering—The typical plank floorboard is ¾-in. thick, 3 in. to 8 in. wide, and it's tongue-and-grooved along edges and ends. This is called end-matched flooring. The wider the plank, the more likely it is to cup when the humidity goes up. Because of this, I avoid installing planks more than 8 in. wide.

Oak flooring comes in four basic grades. The best is called *clear*, and it contains flat-sawn and quartersawn boards. Most will be hardwood of uniform color. The next grade is called *select*. It includes clear boards with sound sapwood. *Numbers 1* and *2 common* are the lowest grades. They are variegated in color, with character marks such as knots and worm holes.

Quartersawn hardwood is especially good for plank floors because the dimensional changes in wood are greatest tangential to the growth rings. Flatsawn hardwood expands and contracts substantially across its width as humidity levels change. This can result in ugly gaps, cupping or even buckling. Quartersawn planks confine most of their dimensional changes to variations in thickness. The face of quartered planking also resists compression and abrasion. Today, quartersawn flooring is expensive and hard to find in widths over 5 in., but it's commonly available in lesser widths.

Flooring planks come in lengths from 9 in. to 8 ft. in nested, fixed or random-length bundles: *nested* means a fixed-length bundle made up of random-length boards; *fixed* means the bundle contains boards of exactly the same length and width; *random-length* means the bundle is made up of boards of approximately the same length (plus or minus 4 in. or 6 in.). In clear grade, the average board is 8 ft. 9 in. long, while the average #2 common plank is 2-ft. 3-in. long. So the better the grade, the longer the average board.

You can find wood flooring at vendors who specialize in supplying the hardwood flooring trade. Lumber yards with extensive inventories sometimes carry hardwood flooring, or they can special order it. When I order floorboards for a simple floor, I allow 10% for waste. If it's a complicated floor with diagonally-installed boards, for example, I allow at least 15% waste.

A popular way to install planks for a traditional look is to combine different widths in a repetitive pattern. This is called variable-width planking. You simply begin with a row of one width, then shift to the second width for the next row and to the third width for the following row. Then the pattern starts over again. I typically combine these widths: 2¼-in., 3¼-in. and 4¼-in.; 3-in., 5-in. and 7-in.; and 4-in., 6-in. and 8-in. If you do a variable-width floor, be sure to base your material order on the number of *lineal feet* of planks that it will take to cover the floor.

Methods of installation—End-matched T&G flooring can usually be secured to the subfloor by blind nailing through the tongue at a 45° angle. In regions of the country that experience wide humidity swings, or with planks that aren't end-matched, I recommend that planking 5-in. or wider be face-nailed or screwed at the ends. If you don't restrain these planks, they're inclined to flex, bow or cup. I usually blind nail planking even when I plan to screw and plug the ends.

Hand nailing through the face of the plank can give a floor a traditional look. I use wedge-cut or screw-shank nails for this, but there are many decorative nails and fasteners that can add a note of authenticity. The Tremont Nail Co. (48 Elm St., Box 111, Wareham, Mass. 02571) makes a variety of decorative nails. Drive face nails at a 30° angle away from the center of the plank to minimize cupping. Group nails on 16 in. to 24 in. centers—two to three nails per group for 5-in. planks, three to four for 7-in. planks.

Some precautions—Properly seasoned wood flooring has a low moisture content, and subjecting it to a damp environment will give you no end of headaches. New structures or those that have been unoccupied for a while can spell trouble for wood floors. At least three weeks before the flooring is to be delivered, set the thermostat to a level that keeps the interior at a temperature and humidity level normal for the area. All doors and windows should be in place, and masonry, plaster, drywall and other wet-process work must be completely dry.

Moisture can also come through the subfloor. The best defense against it is a dry, well-ventilated crawl space. Be sure floor insulation is properly installed, enclosing a dead-air space between it and the subflooring. Ideally, you should have the flooring delivered to the site three days prior to installation and break open the bundles so the flooring can acclimate. But in the real world, this doesn't always work out, so as an alternative, allow an extra three days of acclimation between installation and finishing.

Beneath it all—If a hardwood floor conceals an inadequate subfloor, it will soon begin to squeak and its finish will start to crack. For years I've encouraged owners, architects and builders to provide 1½-in. plywood or equivalent subflooring on joists set 16 in. o. c. This limits flex and provides a sound anchorage for the fasteners. Such a subfloor is especially desirable if you're planning to secure wide planking solely by blind nailing or if you intend to install planks parallel to joists. At the very minimum, make sure a plywood subfloor is ¾-in. thick on joists spaced 16-in. apart.

Plywood or solid planking can be used as a subfloor for hardwood flooring, but don't use particleboard. Nails don't hold well in it and water makes it fall apart. The National Oak Flooring Manufacturer's Association currently recommends against the use of wafer-

board or oriented strand board as well. Glue down plywood sheets with panel adhesive and nail them with either hot-dipped galvanized nails or ring-shanked nails. If solid wood planking is used for subflooring, the wood should be 6 in. to 8 in. wide and at least ¾ in. thick. Wood can be either square-edged or shiplapped, but shouldn't be T&G unless it's at least 1½ in. thick. Anything less will flex and squeak.

Leave ⅛-in. gaps between subflooring planks unless you're sure they will shrink once installed. Be certain all planks or plywood sheets butt end-to-end over a joist or over blocking, and that they are firmly attached. Whatever subfloor you use, be sure that its moisture content has stabilized before you install hardwood over it. Stay away from used plywood—especially plywood previously used for concrete forms—to avoid any possible problems of delamination. Using a belt sander, level any ⅛-in. or greater differences in adjoining pieces of underlayment. Clean up any globs of joint compound or glue and vacuum the floor. Make a final check for movement or noise in subflooring or underlayment and fix squeaks with ring-shanked nails or drywall screws. Finally, mark the locations of all joists at the base of room walls.

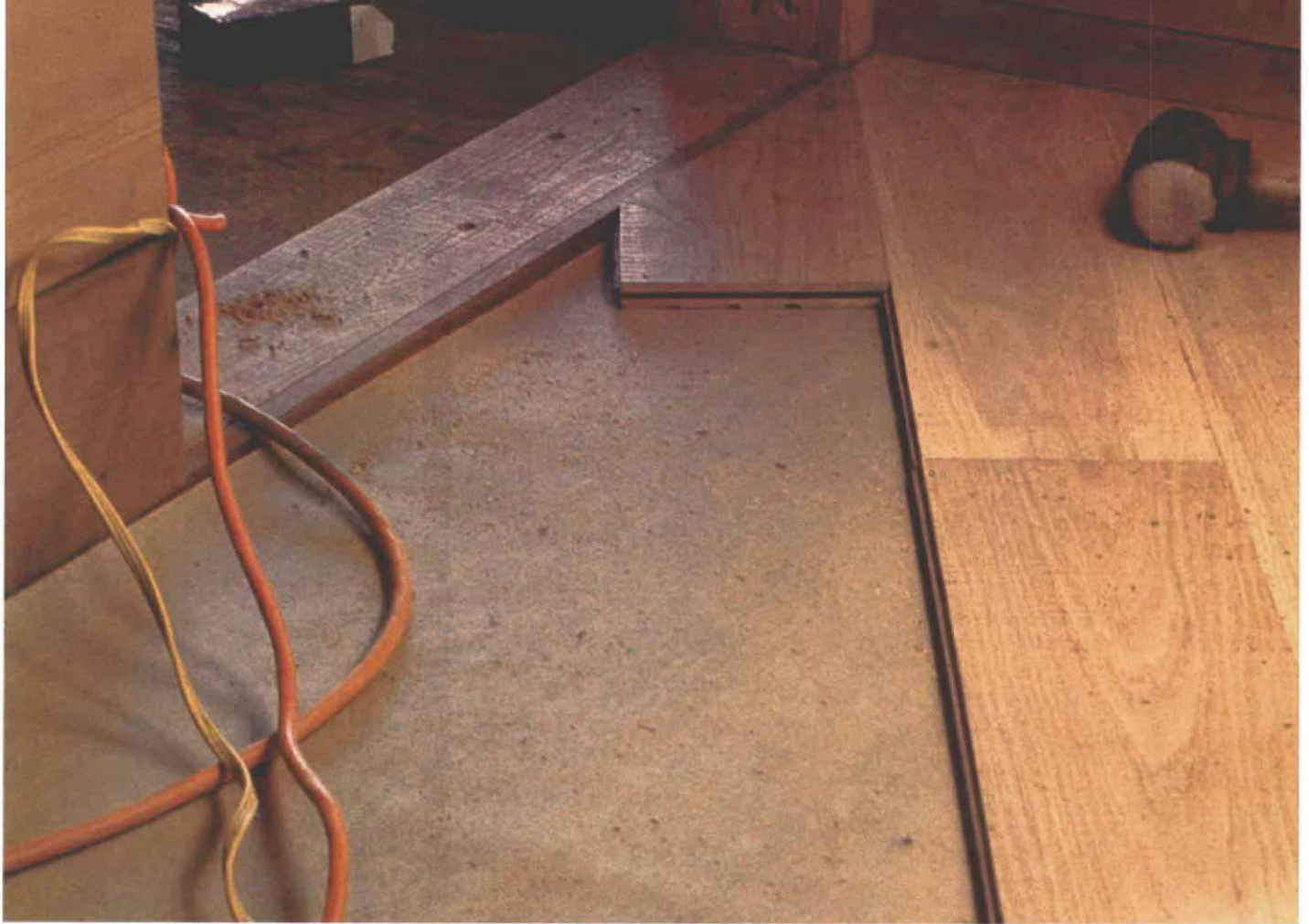
The layout—Think about the overall installation before you start nailing down planks. In most cases you should run the planking parallel to the longest wall in the room. This usually looks best and will reduce the area over which the flooring will do most of its seasonal expansion and contraction.

Square rooms begin and end on the architect's drawing table. Even carefully constructed rooms are predictably askew by ½ in. to ¾ in. Most out-of-squareness can be concealed in expansion gaps under baseboards and shoe moldings. If all else fails, you could install the floor diagonally.

Go over the entire area to be floored and try to identify locations where flooring will have to look square or parallel. Long hallways, for example, can look really awful if the wall and flooring rows are out of alignment. Consider the location of doorways, stairs or border work in highly visible places (top photo, facing page). Remember this rule of thumb: Do the more difficult areas first and work away from them. Finishing up a floor while tight-fitting to a fixed condition can be a real nightmare.

Floor alignment problems are most perceptible relative to wall lines. Measure the distance between parallel walls. Always get at least two measurements and take them about a foot from the corners. Measurements taken right at the corners are usually not accurate due to the way drywall is taped. Don't try to solve a major out-of-squareness problem in one place. A balanced approach will usually disperse most misalignment problems.

Moisture control and expansion gaps—A barrier between subfloor and finish flooring will combat dust, moisture and unwanted air-



The rule in wood flooring is to work away from difficult areas. As shown in the photo above, the flooring must change direction at a doorway. Rather than work toward this condition and fill it with a plank that needs two accurate ends, you should start the row with this complicated piece.

A tongue-and-groove flooring nailer sets a barbed fastener at a 45° angle through a floor-board tongue. At the same time, it forces the board tight against its neighbor (photo below). Warped planks can be tough to bend into place. When all else fails, use a pair of beefy screwdrivers as levers (photo right). This can damage the tongues, so make sure this method doesn't interfere with nailing down the next row.



flow through solid-wood subfloors. I use three-ply kraft paper, but 15-lb. asphalt-saturated roofing felt works, too. Roll out the barrier in the direction you'll be running the plank. Cover the entire floor, overlapping the edge of each row 3 in. to 6 in., and staple the barrier in place. If you're working over uninsulated heating ducts, put down an extra layer of paper to help keep the finish flooring from drying out. Snap chalk lines between the points marked on the walls to indicate the location of joists.

You can expect a flatsawn plank floor to move more than a strip floor, so expansion gaps are critical. A good rule of thumb is to expect $\frac{1}{16}$ -in. expansion/contraction for each running foot of cross grain. In other words, allow for at least 1 in. of movement between summer and winter in a 16-ft. wide room covered with flatsawn planking. Wood movement parallel to the grain is negligible, but I allow a $\frac{1}{2}$ in. or so gap at each end wall for fitting boards and promoting air circulation beneath the flooring. Wood flooring needs to "breathe" and will cup or gap if prevented from doing so. In fact, the grooves on the underside of the planks are for ventilation.

Lining up and laying out—The baseline is a reference that aids in aligning the rows of flooring. Its location varies, but it usually parallels the longest wall or longest uninterrupted run of flooring in the room. Given a choice between two walls of equal length, establish the baseline near the most prominent wall. If laid out on a diagonal, the baseline should parallel a line connecting the opposite corners of the room.

If you are doing only one room and you know it to be fairly square (say $\frac{1}{2}$ -in. out), you can use the simple baseline method. Begin at one end of the longest wall. Add the width of the starting row of plank and the expansion gap that you've decided to allow. For instance, if you are using a 5-in. plank and a $\frac{1}{2}$ -in. gap, mark a point on the barrier $5\frac{1}{2}$ in. away from the wall. Go to the opposite end of this wall and repeat the process.

Chalk a line between these two points, and you've got your baseline. The first row of planking will be installed with its bottom edge on this line and the tongue facing into the room. From this point forward, all references should be taken from this baseline.

Professional installers will sometimes simplify this process by temporarily placing lengths of flooring on edge against a wall as spacers. Any difference in squareness is then made up on the opposing wall. If you do this, sight along the leading edge of the flooring to make sure any depressions or bulges in the wall aren't transferred to the planks. Once several rows have been installed, remove the boards to create the expansion gap.

When the opposing walls are more than $\frac{1}{2}$ in. out-of-parallel, the difference is distributed over both sides of the room. I call this the balanced baseline method. Let's assume you are installing 3-, 5-, and 7-in. variable-width

planking in a 16 by 20 room. In the drawing on the facing page, one wall is 16-ft. long and the opposite wall is 16-ft. 1-in. Start at point A and measure out $15\frac{1}{2}$ -in. to find point B. This dimension is the total of the expansion gap ($\frac{1}{2}$ -in. per side for 16 ft. of cross-grain floor) plus the first row's face width (3-in.) plus 1-ft. Measuring from point C, add $\frac{1}{2}$ -in. to the measurement to account for half of the 1-in. discrepancy in wall length. Mark point D. This total measurement is 16 in. Now snap a chalk line between point B and point D. Measure back 1 ft. to locate the leading edge of the first piece of flooring and refer to the chalk line to make sure the first row is straight.

Before the first board goes down, scrutinize the planks. You will need enough straight ones for several starting and finishing rows. Sight down their length as if you were sizing up a straightedge. Measure their widths. As you'll soon see, some will be a little wider or narrower than others. These probably contain a lot of sapwood, which is less stable dimensionally than heartwood. You can usually spot them because they are lighter in color. Segregate them for use in the same rows in the middle of the room (they're easier to hide there). Crooked pieces are difficult to pull tight, especially near a wall.

Headers—When flooring runs into doorways, passages or features such as fireplace hearths, I install header boards. Sometimes they're wider planks than the rest of the flooring, and I typically secure them with screws. Most are mitered instead of blended into the flooring with a butt joint. Most often I fill the countersunk screw holes with the same wood as the planking. I often set off these boards with a narrow inlay of contrasting wood. There's no room for an expansion gap around header boards. So I allow an additional 50% to the minimum gap at the opposite wall or use quartersawn material for the field plank.

Striking the first blow—Begin installing planks mid-wall along the baseline and work toward each end. The first row has to be face-nailed, unless you're using spacers that bear against the framing to back up the angled blows required for blind nailing. I use 8d flooring nails or 2-in. power-driven fasteners to blind nail $\frac{3}{4}$ -in. planking. I like to use a tongue-and-groove flooring nailer (photo previous page, bottom left) for this chore because it makes quick work out of a tedious job and minimizes errant hammer blows.

The snout of a tongue-and-groove nailer fits over the leading edge of the board, and with one blow of the mallet to the nailer's plunger, the tool shoves the board tight against its neighbor while simultaneously setting a barbed fastener through the tongue and into the subfloor at a 45° angle. In tight spots near walls, I use a nailer designed for face-nailing. If you don't care to buy one of these tools, you can often find them at tool-rental yards or

flooring-supply centers. Two companies that make them are Porta-Nails, Inc. (Box 1257, Wilmington, N.C. 28402) and Pownail Co. (Rte. #22, Prairie View, IL 60069).

Nails should be spaced 8-in. o. c. Follow your chalk lines to get as many nails as possible into the joists. Splits in narrow fill-in planks and near board ends can be avoided by hand-nailing. Use some of the barbed fasteners driven into $\frac{1}{16}$ -in. pilot holes.

As the rows start to go down, select planks for each succeeding row so that butt ends overlap those of previous rows by at least 3 in. (6 in. is better). Stagger butts so they don't line up, even with a board between them. Pros call these "H's" and work hard to avoid them. They look especially obvious when highlighted by plugged screw holes.

Picking up speed—I "rack" a floor prior to nailing it down. Racking is simply the act of loosely laying out several rows of floor boards to assess their spacing. I shuffle the pieces around, placing the long planks across doorways and down halls.

Most planks will need to be coaxed into place prior to nailing. For gentle persuasion, our installers use the soft end of the nailer mallet. For greater emphasis, they use a scrap piece of flooring between the hammer and the planks to cushion the blows lest the tongues be damaged by heavy pounding. When a bowed plank requires brute force to get it to conform, they use prybars or screwdrivers as levers (photo previous page, bottom right).

If there is no apparent reason why a board won't draw tight to its neighbor, check for an unset nail, a broken or out-of-line tongue or a piece of debris between planks. You can use a short-handled screwdriver to sink unset fasteners.

Boards that are a little wide can be narrowed by trimming their leading edge with a rabbet plane. This works because the leading edge protrudes a bit beyond the base of the plank. Sometimes a plank will have a bulge in its leading edge. You can trim it back with a utility knife and a straightedge.

I find I have to cull up to 25% of *select* planking to achieve a tight-fitting floor. I don't throw wood out—I use it in closets, dark hallways or in places that I know will be covered by rugs.

If you're right-handed, you'll probably find it easiest working from left to right. Initially you'll want to keep your saws in front of you along the wall to your right. I use circular saws for cuts that are hidden under baseboards. If I need an accurate cut, I use a radial-arm saw or a power miter box.

When you have enough rows installed to hold the equipment, move it all behind you. Unless precision is called for, I don't measure cutlines at the end of a row. Instead, I hold the board against the wall so that its tongued edge faces the nailed-down rows. Then I eyeball a cutline and turn the board around. When the board is drawn tight into its end-matched groove, there is a $\frac{1}{2}$ -in. gap

at the wall that gets covered by a baseboard.

To reduce waste, try to keep your cuts to under 1 in. or over 4 in. Cut ends of 4 in. or more can be taken to the opposite end of the row and used as starter boards. As the successive rows are nailed off, check their leading edges to make sure they are equidistant from the row that represents the baseline. If they aren't, find out why and correct it.

Hitting the wall—When you reach the opposite wall, you'll need to face-nail or screw-and-plug the last few rows while they're held tightly in place. You'll have to pry these last few rows into place, so reach for those straight boards you've been saving. Several of my installers force them into place by using a piece of flooring held flat against the wall as a fulcrum, and another piece used as a lever. With this method, be sure to span several studs or you'll end up punching a hole in the drywall. Once the last full row has been nailed down, you'll probably need to rip one last course to finish the floor.

Occasionally a ripped piece will be too narrow to nail without splitting. In such a case, glue the narrow piece to the last full strip with yellow glue and temporarily wedge it in place until the glue dries.

Screws—I recommend screwing and plugging, or face-nailing, the ends of planking that is more than 4-in. wide. Even if the material is end-matched, screwing and plugging will help to restrain the wider planks. If the planks are square cut, it's essential.

First I mark all the board ends, using a template (photo below left). If I'm working with variable widths, I make a template for each size plank. Screws and plugs look and work best when they are equal distance from the edges and ends of planking. If you are fortunate enough to be working with long

planking (over 6 ft), position some screws and plugs midway down the boards.

Use a combination tapered bit, countersink and stop ring to speed the process. My favorite is the Fuller "Type C" bit (Fuller Tool Co., 152-35 10th Ave., Whitestone, N.Y. 11357). I've found 2-in. #12 square-drive flathead screws to be the best for anchoring $\frac{3}{4}$ -in. planks. Common plug sizes for flooring are $\frac{1}{2}$ -in., $\frac{3}{8}$ -in. and $\frac{3}{4}$ -in. I prefer to use $\frac{1}{2}$ -in. plugs that I cut in my shop. I avoid dowels for plugs. I'm not a real fan of end grain, and the inevitable peaks in the finished floor surface annoy me.

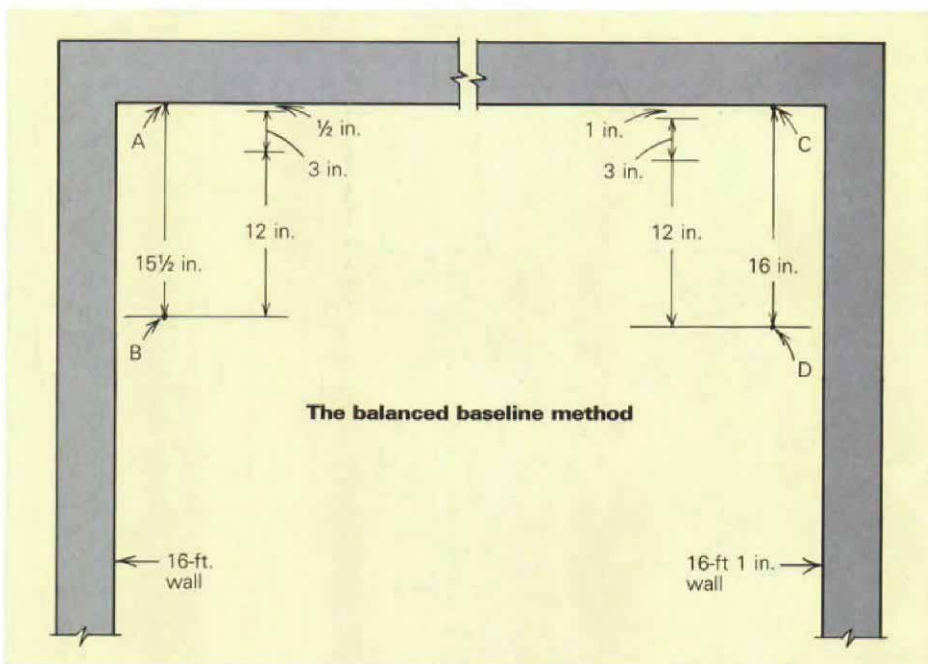
Finishing up—Vacuum the shavings out of the screw holes and put a dab of yellow glue along one side of each hole (photo be-

low center). Don't overdo the glue—too much will make it tough to tap the plugs into their holes.

Inevitably there will be slight gaps in a floor that need to be patched. I use a lacquer-based filler that I get from our flooring supplier to pack the gaps that occur at butt ends (photo below right) and along irregular edges, knots and pinholes.

Once installed, a plank or strip floor will move around a bit getting accustomed to its environment. I wait a minimum of one full week before sanding and finishing a new one. □

Don Bollinger owns and operates Oak Floors of Greenbank in Seattle, Wash.



For speed and accuracy, use a template made from an offcut to mark board ends for drilling (photo below left). Use a small dab of yellow glue (photo below center) to affix plugs to the floor and tap them home with a light hammer. Inevitably, a new floor will have some pinhole knots and some cracks between planks. You can patch them with a filler made specifically for the job (photo below right).

