Stud-Wall Framing

With most of the thinking already done, nailing together a tight frame requires equal parts of accuracy and speed

by Paul Spring

I spent much of my former career as a carpenter building a reputation for demanding finishwork, but some of my best memories center around the sweaty satisfaction of slugging 16d sinkers into 2x4 plates as fast as I could feed the nails to my hammer.

The emphasis in framing is on speed. A lot has to happen in a short time. Accuracy, however, is no less important. The problems created by sloppy framing—studs that bow in and out, walls that won't plumb up and rooms that are out of square—have to be dealt with each time a new layer of material is added.

The fastest framing is done using a production system. But these techniques have long been the domain of the tract carpenter, and bring to mind legendary speed coupled with a legendary disregard for quality. However, production methods don't have to dictate a certain level of care. Instead, they teach how to break down a process into its basic components and how to economize on motion.

Done well, production framing is a collection of planned movements that concentrates on rhythmic physical output. It requires little problem-solving since most of the head-scratching has been done at the layout stage. As long as the layout has been done with care, a good framer can nail together and raise the walls of a small home in a few days, and still produce a house in which it's a pleasure to hang doors and scribe-fit cabinets. And this pace will give both the novice and the professional builder more time on the finish end of things to add the finely Crafted touches that are rare in these days of rising costs.

If you know what the basic components of a frame are, nailing the walls together is simple. If not, you'll need to read the article on layout in *FHB* #21. After figuring out which walls get built first, you will separate the bottom and top plates (which were temporarily nailed together so that identical layout marks could be made on them); fill in between with studs, corners, channels, headers, sills, jacks and trimmers; and then nail them all together while everything is still flat on the deck or slab. The next step is to add the double top plate and let-in bracing. Finally you'll be able to raise the wall and either brace it temporarily or nail it to neighboring wall sections at corners and channels. Before joists or rafters are added, everything has to be *plumbed* and *lined*—this means racking and straightening the walls so that they are plumb and their top plates exactly mimic the layout that was snapped on the deck—but that subject will be covered in another article.

Walls can be framed with surprising speed if they're laid out well. The pace isn't frantic—it's rhythmic, and based on coordination, economy of motion and anticipation.

For the sake of simplicity, I have stuck largely to giving directions for nailing together a single exterior 2x4 wall with most of the usual components. I have tried to mention how this process would be different under different circumstances, and how each section of the wall is part of a larger whole. If you are using 2x6s or have adopted less costly framing techniques, such as the ones suggested by NAHB's OVE (Optimum Value Engineering), you'll have to extrapolate at times from the more traditional methods explained here.

Getting things ready—The carpenter I apprenticed to would begin wall framing on a Thursday so he could recover over the weekend from those first two grueling days of keeping up with the hot young framers. You don't need to plan things to this degree, but you do need to make sure that the right tools and materials are at hand. Leave the detailed plates tacked in place on the deck for the moment (or up on foundation bolts in the case of a slab). Make sure the deck is clean; if it's not, sweep it. This surface is going to be the center of your universe for the next few days, so keep it spotless and plan how you will use each inch of it.

While you are setting up on the deck or slab, a helper can be cutting headers to length if this hasn't already been done. If the ground is flat, set up on sawhorses; if not, use one corner of the deck or slab. A cutting list can be made directly from the layout on the plates. I usually number each door or window opening sequentially around the deck with keel (lumber crayon) on the top plates, and then use these numbers to identify the headers as I cut them. This way I can easily find the piece I need for a particular wall and snake it out of the pile of corners, trimmers, channels and headers stacked on the deck. The information for cutting rough sills, sill jacks, and blocking is right there on the layout too, and your helper can make up a package for each opening.

If you're working by yourself or with only one other carpenter, it's just as easy to cut this 2x material in place when you're framing. The only exception is trimmers, which can be counted up and gang-cut if the headers are all to be at the same height. If you aren't using standard 92¼-in. precut studs, now is also the time to cut studs to length. Gang-cutting them is easiest, but precision at this stage is still important. If a few studs cut short of the line happen to get nailed next to each other in a wall, a dip will be left in the floor above.

You should also count up the total number of corners and channels you will need, and nail these together up on the deck or slab. Many framers don't bother with this step. They nail their corners and channels together when they're framing, but pre-assembly avoids having to sneak edge nails into a channel that faces down and is crowded by a regular layout stud.

Before you litter the deck or slab with any more material, you first must figure out how much of the frame you are going to nail together before you raise some walls, and where you are going to begin framing. On some second-floor or steep-site jobs where the plan is very cluttered, it pays to stack the frame. This

means nailing together all of the walls and then raising them at one time. But this requires a lot of planning since the walls literally have to be built on top of each other (often three walls deep), and a big enough crew to lift and carry the walls into place. Big production jobs use framing tables—essentially huge wall jigs—or the flat ground around the house to complete all of the walls on one level before raising them. But usually it's best just to frame as many walls as your deck or slab will accommodate (figure that you can frame an 8-ft. wall if you've got at least 100 in. of room on the deck for its height), and then raise them, repeating this procedure until there aren't any sets of plates left.

The layout will have a lot to say about which walls get framed first. Exterior walls get priority, so you can save the precious working room near the center of the deck as long as possible. Of the exterior walls, you will be framing the by-walls first and then the butt-walls so that you can build as many walls in place as possible. Pick one of the longest exterior by-walls to begin; the back wall of the house is the traditional place to start.

Studs and plates—The best place for a lumber drop is right next to the slab or deck. This way you can literally grab a stud when you need one. But on a steep site or second story you'll need to pack the lumber to the deck as you need it. A laborer will help in this situation, but don't give in to the temptation to stockpile studs on the deck—you'll only end up having to move them again. You can keep plate stock handy, though, by leaning it up against first-story framing. Spot two or three bunches of 10 to 20-footers around the building for double top plates. It's pretty easy to take the bows and crooks out of a double top plate when your'e nailing it, but if it's real bad, cull it out and start a pile that you can cut up into blocking and short jacks.

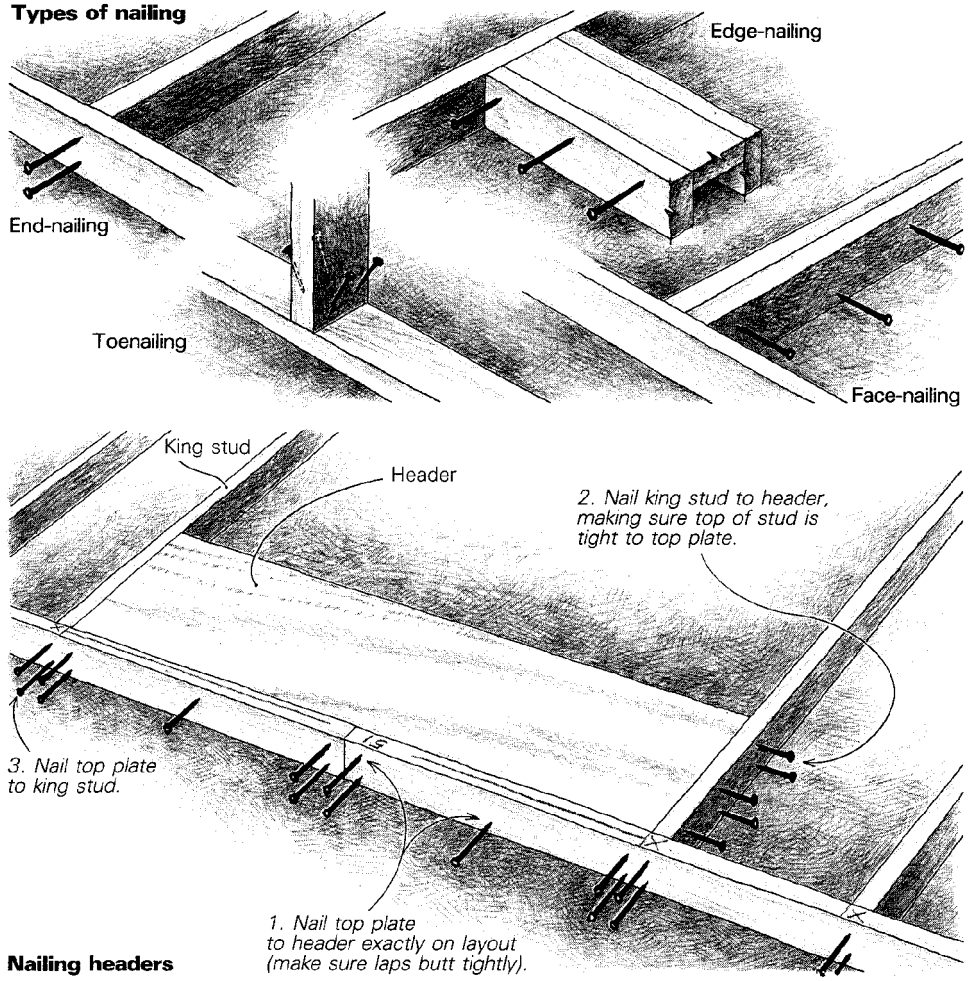
Nails—The only other items on the deck should be a skillsaw and a 50-lb. box of nails. The size and kind of nails a framer chooses seem largely regional. The allowable minimal size depends on whether you are *face-nailing* (through the face of one board into the face of another, such as nailing down the double top plate), *end-nailing* (through a board face into the end of board, such as nailing through the bottom plate into the studs) or *edge-nailing* (through the face of a board into the edge of another, such as a channel)—see the drawing, facing page, top. But rather than carry 8d, 10d, 12d, and 16d nails, it's easier just to carry a handful of eights in the small pocket of your nail bags for 1x let-in bracing and toe-nailing, and sixteens in the big pocket for everything else.

There are lots of choices when it comes to nail coatings. Brights (regular steel nails without any coating) and even galvanized nails are okay, but I like *sinkers*. Sixteen-penny sinkers are a hybrid nail made in heaven (actually in Asia) for framers. Because of their coating, it takes half as many swings to drive one as an uncoated nail, and they don't crumple when you take a healthy swat. Their shank diameter is larger than a box nail, but not as thick as a common, which will split the ends of dry plate stock. They are also slightly shorter than 3½ in. (the length of the usual 16d nail), and have a thicker head. Sinkers can be either cement coated or vinyl coated.

In much of the far West, green vinyl (sold as g.v.) sinkers have become the predominant framing nail in the last five years. Although the vinyl does reduce the friction when they are being driven, these nails don't seem to offer much resistance on their way back out compared with other varieties. They're not nearly as bad, however, as nails that have had a treatment tract piece-workers affectionately call "gas 'n' wax." This is a coating made from kerosene and beeswax that is applied on site away from the eyes of building inspectors. You can whisper to these nails and they will drive themselves, but they unfortunately withdraw with the same ease.

My favorite nails are cement-coated (sold as c.c.) sinkers. The resin coating heats up from the friction of entering the wood and

Stocking the wall. **Some framers stock the wall with studs before they split the plates apart (facing page), so they know how far back to carry the top plate. But separating the top plate and stocking it with headers first will define the openings right away and save having to flop heavy headers down in a sea of 2x4s. Either way, crowning the studs pays off.**



makes the nail slippery. But unlike the green vinyl sinkers, once the nail is in place, the coating bonds with the surrounding wood, and holding power increases several times over brights. The disadvantage of c.c. sinkers is that the black resin accumulates on your fingers, nailbags and hammerhead. If you're nailing finish boards with these sinkers (such as 2x tongue-and-groove roof decking over exposed beams), coat your hands with talcum powder before starting to keep from leaving black fingerprints all over the ceiling.

Building the walls—Unlike Jud Peake, who details plates flat in his system (see *FHB* #21, pp. 69-77), I'm used to detailing plates up on edge. To frame a wall in place, I take the tacked-together plates and lay them just inside the snapped layout (wall) line with their inside edges down. Then I drive a 16d toenail through the bottom face of the bottom plate into the deck every 10 ft. or so. This way, when the top plate is separated, the bottom plate is already in position for framing. And once framed, the wall can be raised in place as if it were hinged to the floor.

Using this system, I separate the top plate with my hammer claw, walk it back on the deck and stock it with its headers first thing. This sets the location of wall openings early so you don't stud over one by mistake. It also means you don't have to flop a long, heavy header down in a sea of studs. But lots of other framers like to stock the wall with studs before separating the top plate so they know how far back to lay it (photo facing page).

Whichever order you use to stock the studs, cull the ones that are really crooked, and make sure that you lay all of the keepers crown up. Do this by sighting along each one before laying it down. Once you've got a stud on every layout mark, you can add corners and channels if you've made them up as units. Make doubly sure that the flat stud in each channel is facing as it should by looking at the layout on the floor as well as at the marks on the plate.

So far you haven't driven a nail, but soon that's all you'll be doing. If I'm using 4x12 headers and don't have to deal with head jacks, I like to nail the top plate to the top edge of the header first thing. This adds a lot of weight to the top plate and keeps it from moving around. Also, top-plate splices often come in the middle of a header, and you can begin making the wall a single unit by connecting the top plate to the header. Make sure the plates butt tightly so you don't lengthen the wall, and drive two nails into each plate end. At each end of the header, you'll also need two sixteens. In between, you should stagger the nailing to each side at 16-in. centers. If the plate runs through without a splice, use two 16d nails at each end of the header, and then stagger nails every 16 in. in between, as shown in the drawing above).

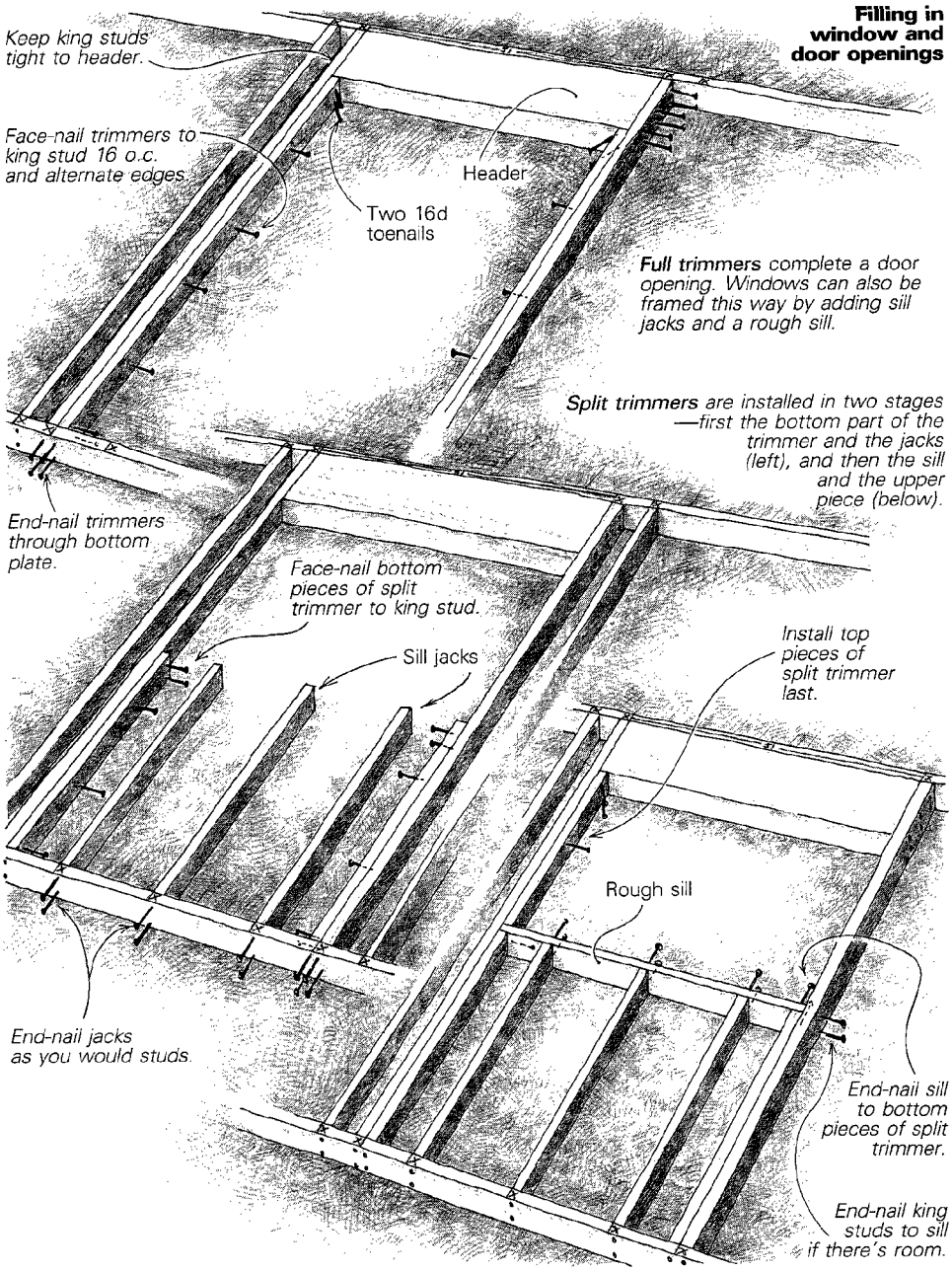
Next, you should take care of the king stud to make sure that you have room to swing your hammer. Drive at least four nails through the face of each king stud into the end of the header. With a 4x12 header I use six 16ds. This is an important intersection. If the king stud doesn't stay tight to the header, it will pop sheetrock nails and leave a crack radiating away from the corner of door and window openings. Last, end-nail the top plate to the king stud with two nails. If you are using a header that doesn't reach the top plate and therefore requires head jacks, you can drive two nails into the top of each one through the top plate as you would a regular stud, and then toenail the bottoms to the top of the header with four 8d toenails each.

Now you can start nailing off everything that you've laid between the plates. Stay with the top plate and begin nailing at one end or the other. If you are right-handed, you'll find that working from left to right will probably be most comfortable and help you establish a rhythm. You'll be working bent over from the waist—one foot up on the edge of the plate, and the other foot nudging the stud onto the layout line and bracing it from twisting (photo next page). Each 2x4, whether it's a layout stud or part of a corner or channel, gets two 16d nails driven into it through the plate.

Your first nail should be near the top edge of the plate, where the pencil layout line is marked. Set the nail with a tap of your hammer, then line the stud up on the mark and drive the nail through the plate and into the stud with your next couple of blows. Be careful to split the difference if the stud is narrower or wider than the plate to which you are nailing it. This may mean having to hold the stud up with your nail hand until you get the first nail in. Pay close attention to the layout; it's surprisingly easy to lose your concentration and begin nailing on the wrong side of the line despite the *X* on the edge of the plate that indicates the stud location. The only trick to the second nail is to make sure the stud is square to the plate. Judge this by eye.

Production framing requires a strong hammer arm and a dexterous nail hand. The only way to develop your arm is to drive a lot of nails, but there are some tricks to fingering the nails. With 16d nails, you need to orient the heads all in the same direction. I like to do this when I'm over at the nail box to refill my bags. This way, each time that you reach down you can pull out a large handful of nails ready to drive. Then, without dropping the nails cradled in your hand, use your index finger and thumb to reach into your palm to

Illustrations: Christopher Clapp



Framing. **The top plate being nailed at left is a splice over a stud, which requires four nails driven on a slight angle. When space gets tight on the deck, two framers often end up working on the same wall. One should take the entire top plate; the other, the bottom plate. If they are both right-handed, they will begin on opposite ends of the wall since they will be moving left to right for comfort and speed.**

pinch a single nail. Extend the nail and rest it point down on the plate for the hammer while your other fingers regrip the nails in your palm. This should all happen while you are backswinging your hammer.

The first swing should be just a tap to start the nail. All carpenters hit their fingers occasionally, but you learn to keep your fingers out of the way when you are swinging hard enough to do any damage. This is particularly important with framing hammers, which can tear as well as bruise.

Once you've finished nailing off the top plate, move to the bottom plate and do the same thing all over again. You may want to reverse this process if you're framing exterior walls on a slab. The big problem here is that the anchor bolts invariably fall on the stud layout, and this requires chopping out some of the stud bottom. This is a lot easier if the top of the stud isn't already nailed.

When you are nailing the end studs on walls that butt by-walls on both ends, hold this last stud back from the end of both plates about ¼ in. This way if the stud bows out slightly, it won't prevent the wall from being raised. You can drive it back to its proper position when you nail the intersection together.

Another potential trouble spot is plate splices. If they come at a stud, you will need four 16d nails in the end of that stud—two from each plate end (photo below left). The other place that plates often join is in a doorway. Although the bottom plates will eventually be cut out, on long, heavy walls make sure that they stay butted by nailing a block on top of the plates at the joint.

Windows and doors—Once all of the headers, studs, corners, and channels are nailed in, you can complete the openings. Doors are easy. Fill in under each header with one trimmer on each side (two on each side if the opening is 8 ft. wide or more), as shown in the drawing at left. Trimmers need to fit snugly between the header and the bottom plate. You shouldn't have to pound the plate apart to get them in, nor should they be short. At its bottom, nail the trimmer like a stud. Then face-nail it to the king stud at 16 in. o. c., with the nails alternating from edge to edge. At its top, drive two 16s up at an angle to catch both the king stud and the corner of the header.

Taking some care with the trimmers will really pay off when it conies time to hang and case the doors. Make sure that the bottom of the trimmer is nailed right on its line—this will ensure a plumb and square opening. Also make sure that the edges of the trimmer and the king stud are even—this means that the

mitered door casing will sit on a flat surface instead of a hump or dip. When you're finished nailing the trimmers, go back to the top of the king stud with your hammer and give it a bash or two so that it isn't separated at all from the end of the header.

Windows are a bit more complicated than doors because you've got the rough sill to contend with. Here you've got a choice. The sill can be cut to butt against both king studs, with *split trimmers* nailed up above and below it, or you can nail up full trimmers and toenail the sill into them. I was taught to use the split-trimmer method (see *FHB* #15, p. 43), and prefer it because you can end-nail the sill into the lower trimmers and even end-nail through the king stud for a very solid connection.

If you're using split trimmers, begin by cutting the rough sill to length. Instead of measuring between the king studs, hold your sill stock up to the bottom of the header and mark it. Here the framing will be tight, so you'll get an accurate measurement even if the studs bow out down where the sill will be installed. Next, cut the sill jacks if their length is given in the layout, nail them at the bottom plate and drop the rough sill on top. If the sill-jack measurement isn't given, the size of the rough opening will be, and you can use your tape measure to mark the top of the rough sill. Allow 1½ in. for the sill, strike a line, and use this lower mark to cut in the sill jacks.

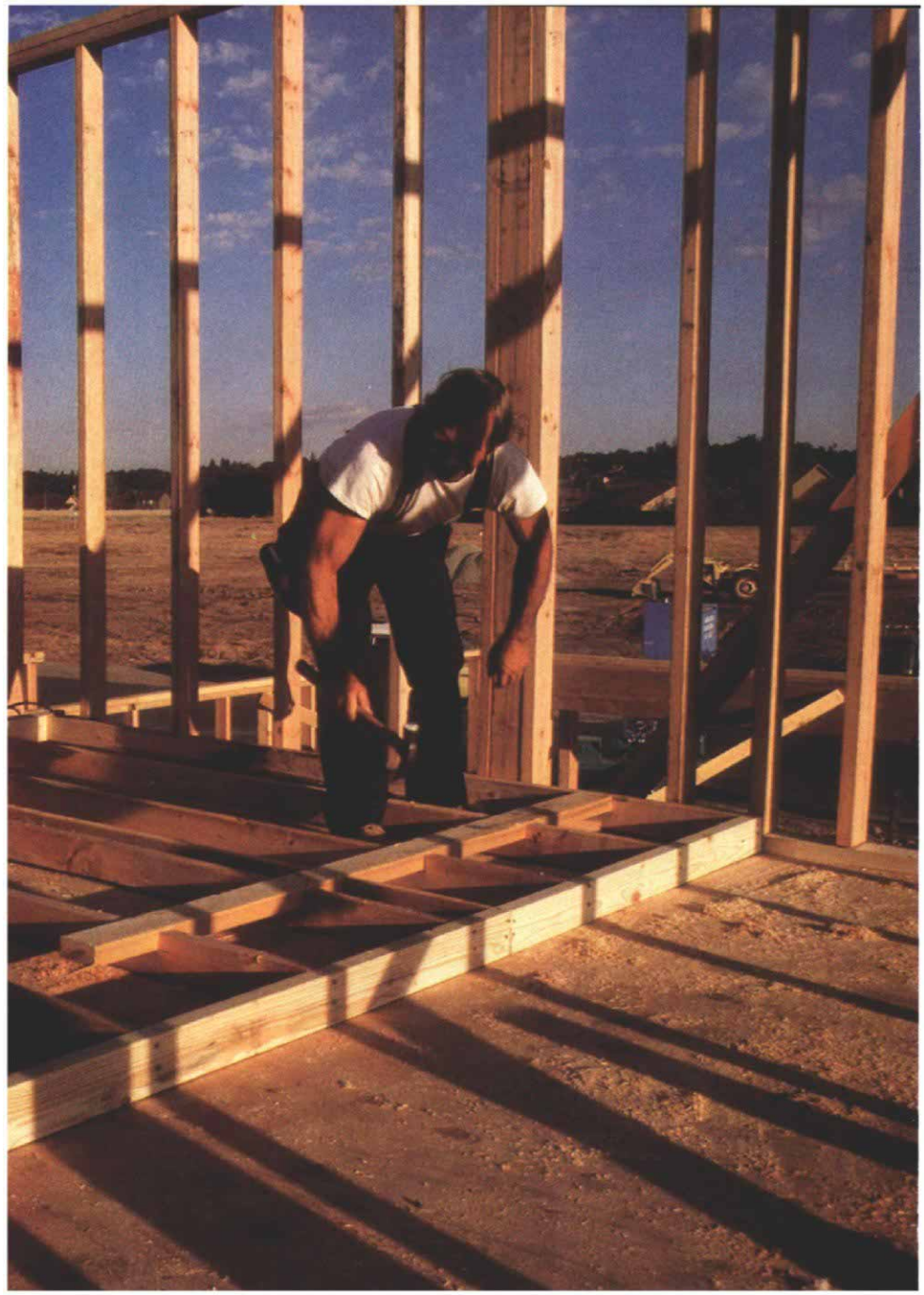
Remember that the lower part of a split trimmer is just another sill jack except that it also gets face-nailed to the king stud using 16d nails on alternating edges at 16 in. o. c. (drawing, facing page). Once all the jacks and lower trimmers are installed, you can end-nail the rough sill to them with two 16d nails at each intersection. If there's room, drive a couple of end nails through the outside of the king studs into the sill. If you can't do this, drive a 16d nail at a slight angle down through each end of the sill to catch the king stud.

The last step is to cut the top half of the split trimmer and face-nail it in. The only other complications are double sills and trimmers for very wide windows. In this case, install the first trimmer on each side full, and split the inside one around the doubled sill.

If you're not using split trimmers, you can treat the opening as you would a door at first by installing the trimmers full length underneath the header. Then mark the sill for length, and cut it. Follow the same procedure that was outlined above to set the sill and its jacks. But when you set the sill, use at least four toenails from the sill into the trimmer, along with a 16d toenail through the thickness of the trimmer into the end grain of the sill.

Rake walls and specials—Rake-wall (gable-end wall) framing is a little different because the tops of the studs have to be cut at the roof-pitch angle. But if the wall has been laid out right, cutting shouldn't slow you down too much. Mark the studs in place and cut their tops with the shoe of the saw set at the roof-pitch angle.

The bottom plate nails to the stud normally.



Blocking. **Horizontal blocking for tubs and showers on interior walls goes faster if you let it in rather than cutting and nailing short blocks in the stud bays. Make sure to set your saw depth accurately to ensure that the blocking ends up in the same plane as the rest of the wall.**

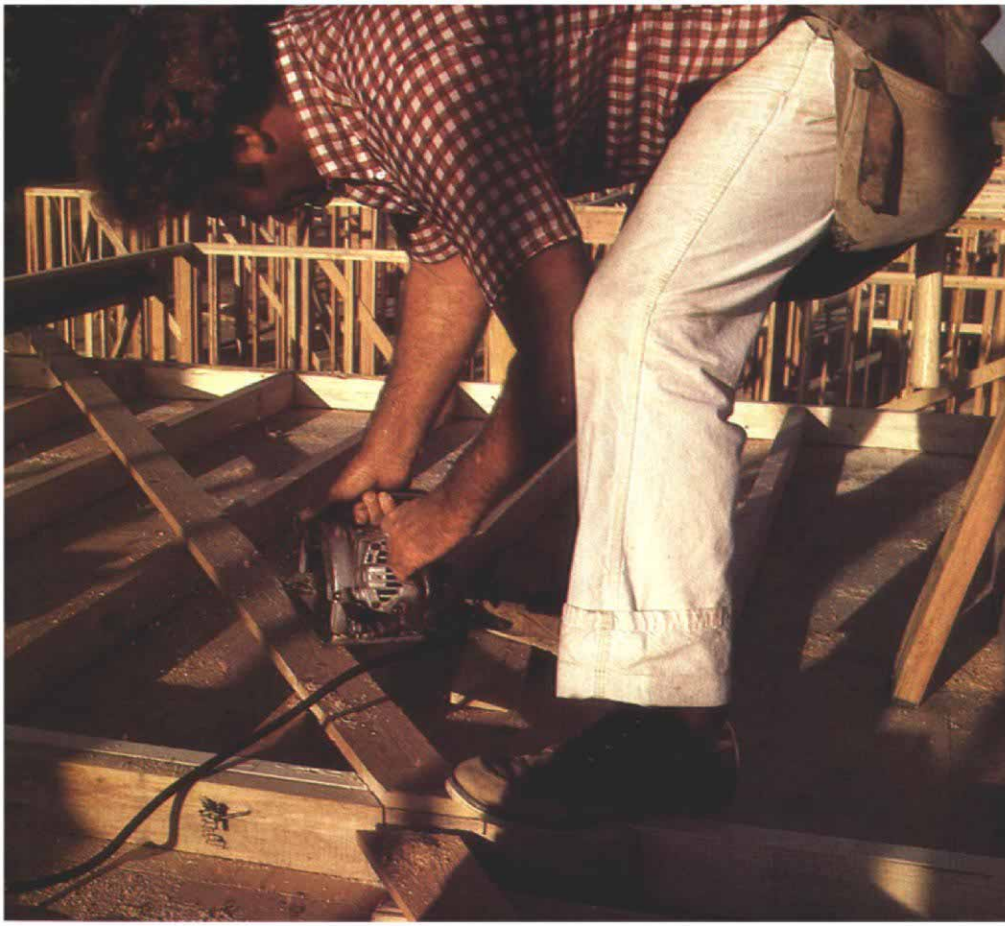
At the top plate, I usually drive a toenail through the toe (long point) of the angle at the top of the stud into the plate to hold the stud on the line. Then I drive two 16s down through the top plate into the stud, as you would in a standard wall.

The last step before double top plating any wall is to take care of the specials, which usually means different kinds of blocking. Interior soffits (drop ceilings) and walls over 10 ft. high will need fire blocking or stops—horizontal 2x4s nailed between studs to delay the spread of fire up the wall. Chalk a line across the studs and stagger the blocks on either side of the line with two 16d nails driven through the studs into each end of the block.

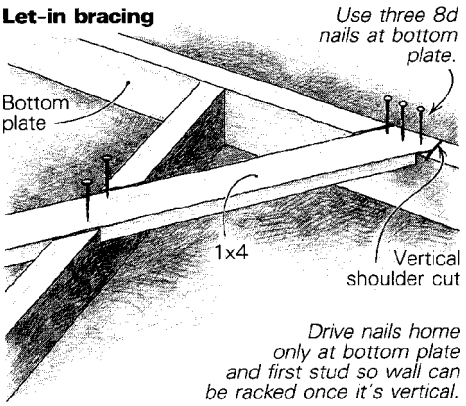
Mid-height flat blocking may also be required on exterior walls that will be covered with stucco. Production framers often raise this blocking a few inches on 8-ft. walls to 51 in. or 52 in. off the floor. This makes it easier to duck through the stud bays when working, more convenient as a shoulder support for lifting the wall onto foundation bolts on a slab, and keeps the blocks just slightly higher than electrical switch boxes.

Blocking for tubs and showers is a bit easier since it is usually installed with the face of the blocking nailed flush with the edges of the studs. It can either be cut in short blocks (14Ⅶ in. for 16-in. centers), or a length of 2x can be let into the studs (you can do this only on interior walls where the side that requires blocking is facing up). To let in blocking (photo above), position the 2x4 on the wall where the blocking will be needed and scribe

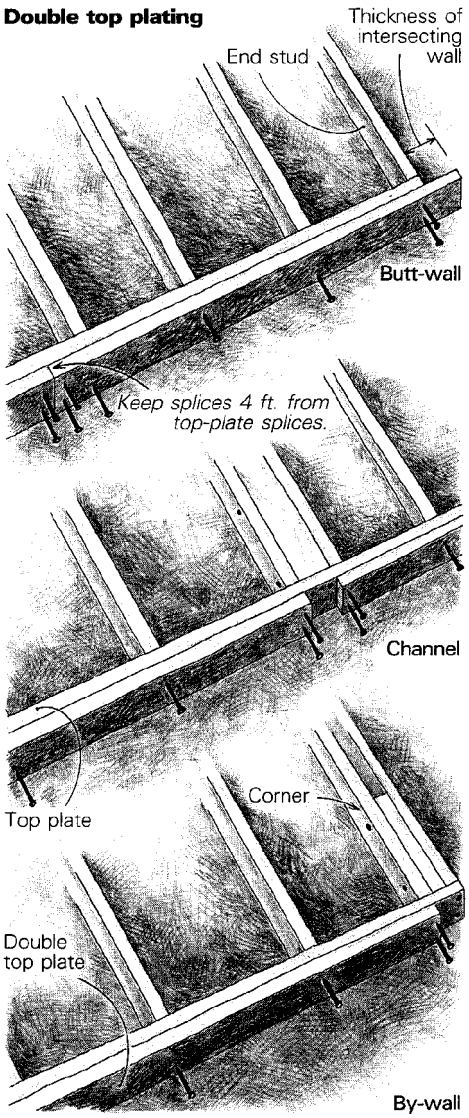
Bracing and raising. **Let-in bracing can be cut into the top edges of the studs by setting the saw depth to 1½ in. and letting the shoe ride on the bracing (photo right). This procedure is not without risk of kickback. The safer alternative is scribing against the brace and cutting to the pencil mark. Facing page: The let-in brace in the foreground of the photo shows a forest of 8d nails that will be driven once the wall is raised and plumbed. Two keys to raising walls safely are even distribution of the weight and vocal coordination of effort.**



Let-in bracing



Double top plating



a pencil line on either side. Cut to the inside of each of these lines with your saw set at 1½ in., remove the resulting scrap and nail the 2x4 in place.

Double top plate—The key to double top plating is the channels and corners. When two walls intersect, one of the double top plates acts as a tie between them. The double top plate on a butt wall will overhang its end stud 3½ in. for a 2x4 wall, and the double top plate of the corresponding by-wall will be held back 3½ in. to receive it. Double-plate splices should be held back at least 4 ft. from the end of a wall or from splices in the top plate.

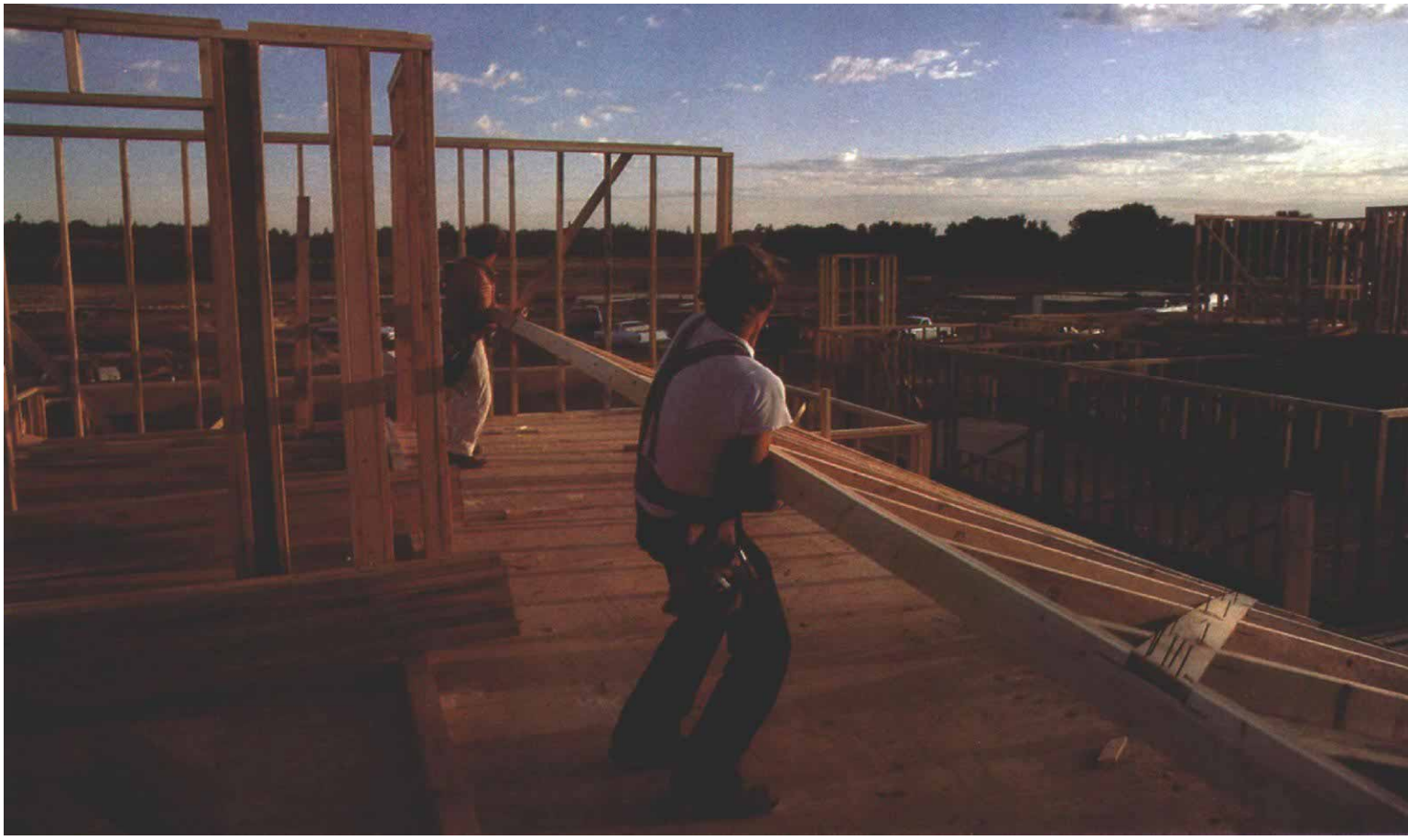
Pull your plate stock up on the deck and lay it down where it will go. You may be tempted to use a tape measure to mark the overhang or hold-back on butt-walls. Instead, hold the stock to the far side of the channel and scribe the other end of the stock with your pencil held against the end of the wall. As long as the walls are all the same thickness, you will get a double top plate that's the right length by cutting at the pencil line.

Double top plating can go very fast. The ends of each piece require two 16d nails (drawing, left). In between you'll want to drive a 16d at every stud, alternating sides of the plate. Hitting the stud layout with these nails allows you to let in bracing in any of the bays without worrying about hitting a nail with your saw. You will only get to nail double top plates on butt-walls that are built out of place, since this plate has to project beyond its end stud by the thickness of the by-wall it will intersect. If it's easier to build the wall in place, cut the plate anyway and nail it once the wall is raised.

Accuracy in cutting and nailing double top plates is essential. A double top plate that projects a little beyond a corner will drive you bananas when you're out on the scaffolding later nailing the sheathing. Be careful with the width of channels too—as soon as you leave a 3½-in. slot for the double top plate of an intersecting wall, it will invariably be cut from dripping wet stock and measure 3⅝ in. You can trim the double top plates on each side to make it work as it should, but you'll have to lay the wall back down to do it.

There's another precaution you should take just before raising a butt-wall that has been framed out of position. Give the overhanging double top plate a couple of blows from your hammer to drive it up off the top plate a half inch or so. This way when you are sliding the butt wall into place, the projecting double top plate won't hang up on the top plate of the already standing by-wall.

Bracing—All walls need some kind of corner bracing to prevent them from racking. There are lots of ways to get this triangulation. Sheathing and finished plywood siding provide excellent resistance if the nailing is sufficiently close. Cut-in bracing (flat blocks cut at an angle and nailed into each stud bay along a diagonal line) and metal X-bracing (long 16-ga. sheet-metal straps that are nailed to the studs under siding) are both quite effective. But for maximum strength when you are not using plywood, let-in bracing is usually specified. This 1x4 brace is mortised flat into



the exterior edges of the studs. It should extend from near the top corner of the wall down to the bottom plate at about 45°. In an 8-ft. wall with studs at 16 in., the brace will cut across six stud bays. You can get one into five bays by increasing the angle a bit.

Not every stud space needs to have a brace; the minimum standard for exterior walls and main cross stud partitions is one brace at each corner, and one at least every 25 lineal feet in between. But the more braces you use, the easier the wall will be to plumb and line, which in turn will create square rooms with plumb door jambs. And each wall that gets a let-in brace will act as a single unit, which in turn will increase the strength of your frame when it's subjected to wind or seismic loads. On a quality house, the small price you pay for 1x4 and the couple of minutes it takes to let it in allow you to brace even short walls. This goes for interior partitions as well. I even like to shear panel (⅜-in. plywood with close nailing) long cross walls.

A typical medium-length wall (say 30 ft. long) contains two let-in braces. These should form a V with an open bottom, since the tops of the braces start high on each corner. Of course it's not always this simple, because most walls contain window and door openings that have to be dodged.

These braces are best let in before the walls are raised, but you must make sure that the wall is close to being square. If you're framing the wall in place on the deck, it should be okay. But if it's been moved around some and is visibly racked, then you need to rough-square it by getting the diagonal measurements approximately the same. Then lay a 1x4 across the top edges of the studs at an approximate 45° angle. Both ends should overlap the plates between studs. On an 8-ft. wall this will require a 12-footer. Now scribe each side of the 1x4 on every stud and at the top and bottom plates. Cut on the outside of each of these lines with your saw set at a fat ¾-in. depth. This will produce a slot about ¼ in. wider (two saw kerfs) than the brace—the extra width will accommodate the racking of the wall left and right during plumbing and lining. Remember, it's the number of nails and their shear strength that will keep the wall square eventually, not the fit of the brace in its slot.

Production framers eliminate scribing by cutting with the 1x4 in place (photo facing page). This procedure works best with a worm-drive saw, and requires a lot of experience with the saw because of the danger of kickback. Even then, safety takes a back seat to speed here. The brace is held down in place with one foot, and the saw is run along one side of it set to a depth of 1 ½ in. The shoe of the saw rides right on the brace. The framer will then change directions and saw back along the other side of the 1x4. The ends of the 1x4 are cut off in place at the bottom of the bottom plate and about ¼ in. shy of the top of the double top plate. The last step is to chop out the little blocks of wood between the saw kerfs.

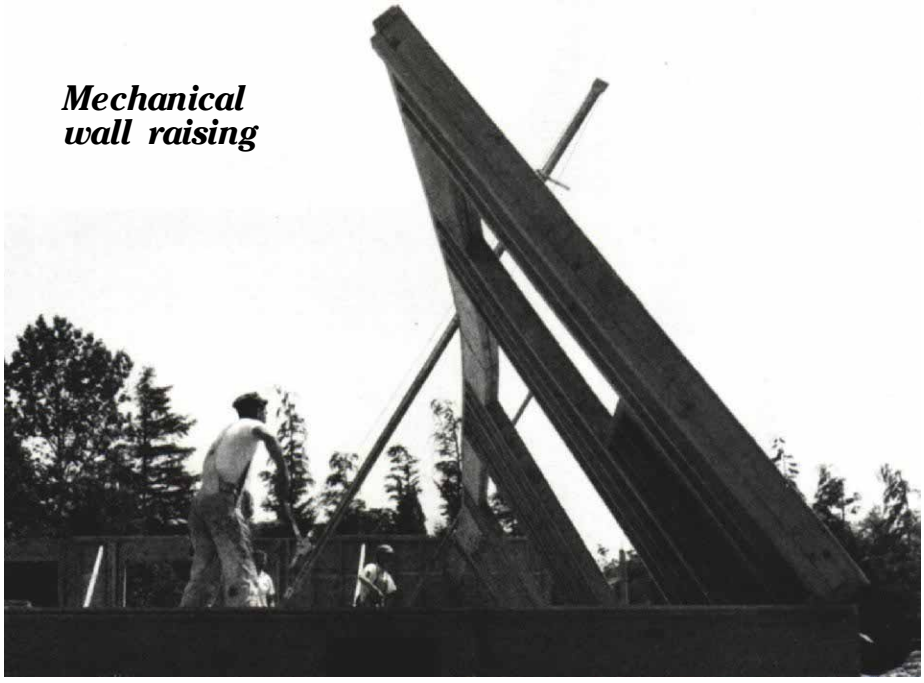
Install the brace while the wall is still flat on the deck. Drop the brace into its slot, holding it flush with the bottom of the bottom plate, and drive three 8d nails there. You can also nail it to the first stud since this is still low enough that it won't interfere with racking the top of the wall during plumbing and lining. You should also start two nails in the face of the 1x4 for each stud so that they can be easily driven home with one hand later. Start a total of five nails at the top of the brace—two into the double top plate and three just below this at the top plate. A lot of framers also start a nail in the top plate and bend it over the brace to keep it from flopping around when the wall is being racked.

Let-ins are most effective if they have a vertical shoulder at the bottom plate rather than coming to a point. This means making a plumb cut on the last inch or so of the brace measured along the angle, and a corresponding slot in the bottom plate (top drawing, facing page). Not all building inspectors will insist on this, but it's a good idea anyway.

If you're building on a slab, don't allow the let-in brace to sit on the concrete. End the brace in the middle of the 1 ½-in. thickness of the redwood or pressure-treated bottom plate.

Raising the walls—This is the best part, but also the point at which a lot of backs get wrecked (for the mechanical alternative, see the sidebar on the next page). Move anything you could possibly trip over out of the area. If the wall is a rake or is particularly tall or heavy, toenail the bottom plate to the wall line if it isn't already, or use lumber strapping (see *FHB* #8, p. 12). For a standard 8-ft. wall, nail stops—short lengths of 2x4—to the joist just below the deck every 6 ft. to 8 ft. so that they stick up where the wall is going to be raised, preventing it from skidding over the

Mechanical wall raising



Nailing off the laps of the double top plates at corners and channels (facing page) ties the walls together. This doesn't prevent racking and bracing the walls plumb later.

Every carpenter has at least one story about a former partner or laborer who was 6 ft. 4 in. and immensely strong. However, being able to lift twice your body weight is of little consequence when you consider the weight of construction materials and the power of machines. While hiring a crane or forklift is usually not an economical option on small jobs, using simple mechanical advantage is, and it can change the way you work.

Wall jacks are a good example. With a pair of them, two people can easily raise a long wall full of solid headers weighing 2,000 lb. From there, the logical step is to sheathe exterior walls—and even add windows, siding, trim and paint—down on the deck before they arc raised.

There are two kinds of wall jacks, but they work similarly. The first looks and operates much like a scaffolding pump jack. By pumping the handle of its ratchet winch (the same mechanism a car jack uses), the jack walks up a 2x4 (or 4x4), carrying the top of the wall to be raised with it on its horizontal bracket. In fact, these devices are often called walking jacks. The 2x4, which begins in a vertical position, is held from skidding by a block nailed to the deck. As the jack makes its way up, the 2x4 is allowed to get less and less vertical so that the wall will continue to bear on it. These jacks are relatively inexpensive, ranging from $60 to $125 apiece. Two brands I know of are Hoitsma walking jacks (Box 595, River Street Station, Paterson, N. J. 07524) and Olympic Hi-jacks (Olympic Foundry, Box 80187, Seattle, Wash. 98108).

The other kind of wall jack (the one that I've owned) is manufactured by Proctor (Proctor Products Co., 210 8th St. South, P. O. Box F, Kirkland, Wash. 98033). It consists of a metal boom that is fitted to a hinged plate at the bottom that nails down to the subfloor and joists below. What amounts to a ¾-ton come-along is mounted on the boom just below waist height. The 5/32-in. galvanized aircraft cable is threaded through a sheave (pulley) at the end of the boom and is fitted with a nailing bracket that attaches to the double top plate of the wall to be raised. The boom begins in a vertical position, and begins to lean as soon as the ratchet winch is put to use and the wall begins to come off the deck. An adjustable stop prevents the wall from going beyond vertical. Proctor wall jacks come in three lengths (16 ft., 20 ft. and 23 ft.) and all of them telescope for carrying or storage. Although this system is more expensive—the smallest pair of jacks retails for $445—it's very safe and can handle walls as long as 75 ft. with just two carpenters on the job.

The real advantage to wall jacks is that they give you the freedom to finish a wall completely while it's flat on the ground. This means money saved even if you're building a one-story house on a fiat lot. On high work, you often can eliminate the cost of scaffolding and speed the usually slow progress of sheathing, windows, siding, trim and paint by doing most of the work right where the frame sits on the deck. On the houses where I've chosen to do this, I've also been able to use less skilled labor to complete the walls. For instance, any careful person can apply a full-bodied stain with a roller when the wall is flat and accessible. It doesn't have to be sprayed by a painting sub. Trimming out windows can be left to an apprentice, since having to recut a piece for fit isn't a big deal when you're not climbing down off scaffolding to do it.

Tilting up finished walls isn't for every bouse. It is best used on modest rectangular plans with long walls where the siding and the trim detailing are simple. In any case, corners have to be finished off from ladders or simple wood scaffolding suspended from nearby window sills.

The only real trick to completing a wall on the deck is to rack the framing so it's exactly square before you sheathe it. This is worth checking several times. The alternative is spending half an hour with a cat's paw removing all that shear nailing so that the ends of the wall will sit plumb once in place. To check for square, toenail the bottom of the bottom plate of the wall to the deck right on the snapped wall line and then use a sledgehammer to bump the top of the wall until the diagonals measure the same. The only other complication is with butt-walls once the by-walls are up. Butt-walls have to be finished slightly out of position (left and right) to buy clearance for the sheathing or siding that will overlap the corner framing of the by-wall, or the end panel will have to be left off until the wall is raised. ***—P. S.***

edge. Also nail a long 2x4 with one 16d nail high up on each end of a by-wall. The single nail will act as a pivot so that the bottom of the brace will swing down and can be angled back to about 45° alongside the deck. It can then be nailed to the rim joists when the wall has been raised to approximately plumb. More brace material should be stacked nearby so that it can be grabbed quickly.

To get the wall in a position where you can get your hands under it, lean short lengths of 2x against the face of the double top plate every 12 ft. or so. Then, standing inside the wall itself, bury your hammer claw in the double top plate with a healthy swing. When you lift the top of the wall just a few inches, the blocks will fall beneath the top plate and you'll have enough room to get a grip.

Now it's time to gather your crew. Most carpenters can lift a good 12 lineal feet of 2x4 framing—more if there aren't a lot of 4x12 headers, less if the wall is 2x6 or framed with very wet lumber. Spread people out along the wall according to where the weight is. Headers are the worst because the weight is all at the top. The ends of the wall are almost always the lightest. The first maneuver in lifting the wall (photo previous page) is called a clean and jerk in weightlifting. If you don't bend your legs it's a sure road to a hernia or a bad back. The second stage—where you've got the wall to your waist and you are pushing with the palms of your hands—is basically a press and should be done with your legs braced behind you. Don't make it a contest. Raising a heavy wall requires staying in sync with everyone else.

If you're raising a by-wall, at least one of the crew should let go once it's up—with fair warning—and nail the outside braces. The wall should lean out slightly at the top to leave a little extra room for the butt wall that will intersect it.

Raising walls on a slab is slightly different. Here you've first got to raise the wall to a vertical position, and then lift and thread the bottom plate onto the foundation bolts. Long 2x4s on edge can be used effectively as levers under the bottom plate to lift the wall up above the bolts, as long as you have someone steadying the top of the wall. End braces can be nailed off to stakes driven in the ground right next to the slab. Once the wall is steady, beat on the sill at several spots to make sure that it's down, then put washers and nuts on the foundation bolts and screw them down finger tight.

If you're raising an exterior butt wall on either a slab or a deck, you'll be nailing the end stud to the corner of its corresponding by-wall, rather than using a brace. Make sure that the bottom plate is flat on the deck and that the two top plates match in height. Also align the outside face of the corner and the edge of the end stud so that they are in the

same plane all the way up. Alternate 16d nails on each side of the end stud every 16 in. If you are raising a partition or interior wall, nail its end stud to the channel in the same way, with the same kind of care.

Long walls may require an intermediate brace or two before everyone can let go. How much bracing you need to add depends in part on how soon you'll be going home for the day. Braces take up a lot of space on the deck when you're trying to frame the rest of the walls. But when you leave the site, it's a whole different story. Figure that a hurricane will strike that night and brace everything off accordingly, especially if you have already sheathed your walls.

If you're bracing off walls on a concrete slab for the night or weekend, you can use a "tepee" on exterior walls. To make one, take a 14-ft. piece of plate stock and run it through a stud bay of the wall to be braced so that half of the plate stock is cantilevered out beyond the building, and the other half is on the inside of the slab. Then nail a 2x4 brace from the top of the wall down to the end of the plate stock on both the inside and outside. This kind of brace allows a little give, but the wall won't go anywhere.

A precaution you want to take on a plywood deck is to nail down the bottom plate. First make sure that the ends of the wall are where you want them—on a layout mark, flush with the perimeter of the deck, or butting another wall. Then use a sledgehammer to persuade the bottom plate into a straight line that sits just at the edge of the wall line established in chalk during layout. After that, drive one 16d nail per bay to keep it there.

The last thing that you have to do to connect the walls is to nail down the double top plates that lap over intersecting walls. Remember that the walls don't have to be plumb; you'll take care of that later. You are just making sure that the walls are nailed together exactly as they were laid out from the bottom plate all the way up.

To nail off the double top plates that lap, you can claw your way up a corner and walk the plates between channels. But you'll probably get it done more safely by moving a 6-ft. stepladder around. First, make sure that the walls are driven together tightly all the way up, and that they are aligned with each other vertically. Then you can finish off the double top-plate nailing using four 16d nails for each 2x4 plate lap.

When all the plate pairs are nailed down, your frame will be complete. Plumbing and lining it will make it ready for joists or roof rafters. The feeling at the end of a day of this kind of work is unparalleled. You are surrounded by the tangible evidence of your progress and the worth of your labor. □