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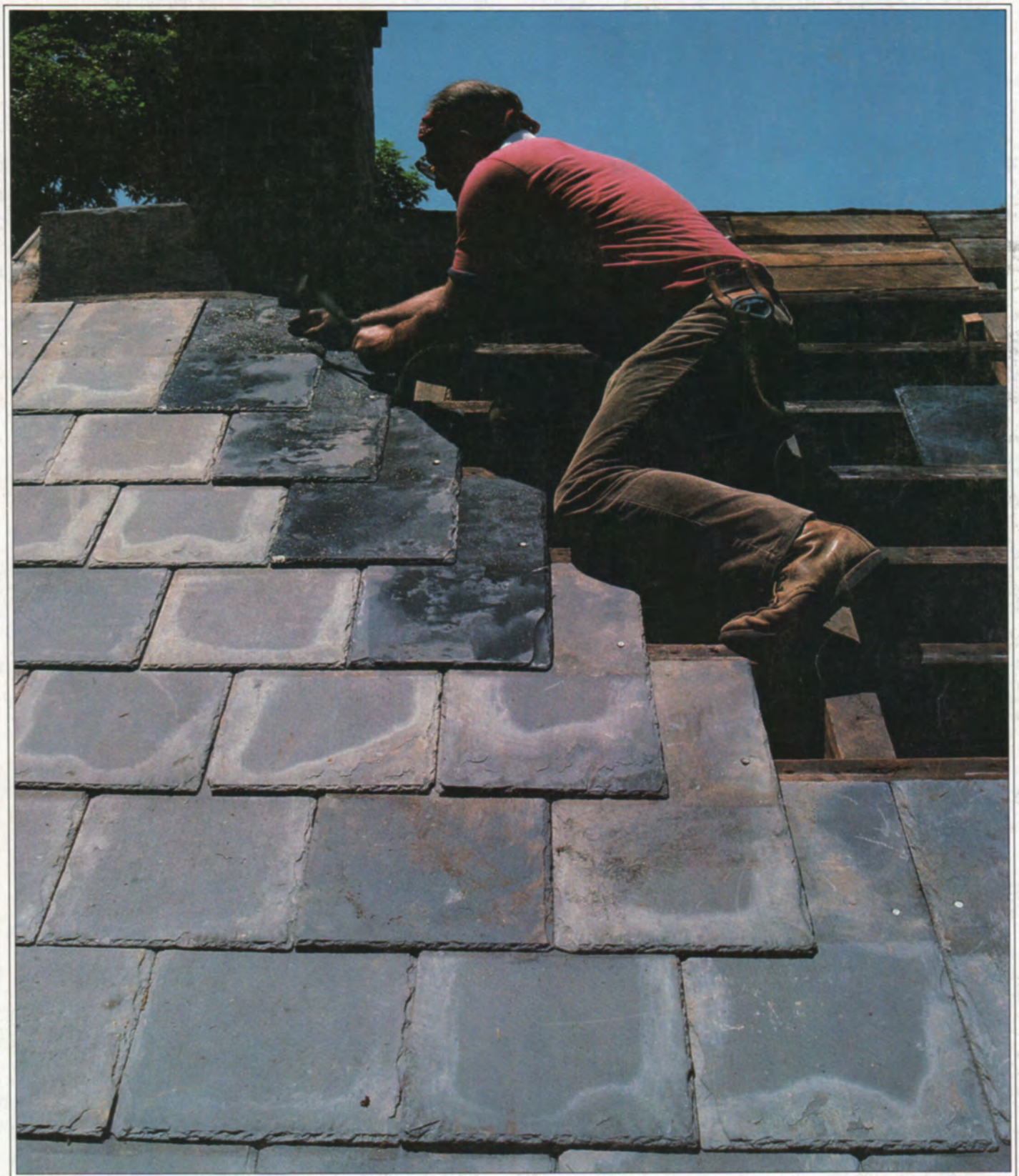

Roofing with Slate

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Roofing with Slate

Shingling with stone will give you a roof that lasts for generations

by David Heim

When my wife Katie and I bought a farmhouse in northeastern Pennsylvania a few years ago, we weren't surprised that it had a slate roof. Built sometime before 1860, the house is close to several slate quarries. Here and in other parts of the Northeast (photos below), slate roofs are common on old houses.

After more than 120 years, the original slate on our roof was suffering from age and neglect. But it was one of the most attractive features of the house, so our plan from the outset was to repair or replace it. The roof didn't leak when we bought the house, although it had in the past. Previous owners had smeared tar in between the slates in several places, and some of the slates had been replaced with pieces of tin. Many slates were soft to the touch and crumbled readily.

Over time, even slate yields to the intrusion of water; and once this happens, freeze-thaw cycling causes it to delaminate along its cleavage planes (sidebar, facing page). Cracks in the surface (called crazing), flaking (spalling) and chalky deposits around the edges and unexposed face of the slate are signs that slate has reached the end of its useful lifespan.

We could have patched the roof to make it last a few more years, but we decided instead to add a new roof to the list of improvements we had planned for the house. Our first inquiries into re-roofing with slate didn't bring very positive responses. Slate is prohibitively expensive, we were told; it's too hard to work

with, and there aren't any good slate roofers around any more.

After some persistent investigating, though, we realized that what we'd been told wasn't entirely true. In my area, slate isn't much more expensive than other good roofing materials—particularly not in the long run. And we found a contractor, Jim Hilgert, who knows slate work backwards and forwards. Having seen how Hilgert's crew handled our roof, I'm convinced that roofing with slate isn't much harder than roofing with other shingles. It's in cutting, hole punching and handling that slate work differs. Though the job shown here is a re-roof, you would use the same tools and techniques to put on a new slate roof.

Selecting the material—Slate comes in a wide variety of colors, depending on where it is quarried. For our re-roofing job, Hilgert used #1 clear Pennsylvania blue-grey slate, salvaged from a barn in New Jersey that was about to be torn down. The pieces were 24 in. by 12 in. (with an exposure of 10½ in.), the same size as our originals. The slate was in good condition and only about 20 years old—not yet middle-aged, as slate goes. Pennsylvania slate is reputed to last for at least 75 years. Slate quarried in Vermont and Virginia can last 150 years or more on a roof.

Including removal and transport, we paid $100 a square (enough to cover 100 sq. ft.) for our slate, or about half the local quarry price at the time. Vermont slate can sell for up to $300 a square, but even at that price it's not a bad deal when you consider the longevity of the material. Fiberglass shingles, which cost about $60 a square in our area (including roof sheathing and felt underlayment), would have to be replaced three or more times within the lifespan of a single slate roof.

Recycled slate isn't always the bargain it appears to be. Usable old material can often be impossible to find, even in an area where slate is commonly used. For example, four months after Hilgert bought our slate, he was unable to find more second-hand slate for another job. When you do come across salvageable material, it takes time and experience to cull out the bad slate.

To be sure that none of our slates had hairline cracks or delaminations, Hilgert "rang" the slates as he pulled them off the barn roof, much as you'd ring a china cup to check its soundness. If you hear a faint echo when you tap the slate—something like the sound your knuckles make when they rap a solid plank of wood—the slate is all right. A dull thud with no resonance indicates unsound stone that's best rejected. Hilgert also rejected "ribbon" slates—pieces that have a pale streak running through them. This impurity in the stone is a weak spot that won't weather well and will crack prematurely. Slates without ribbons are called "clear."

Once he'd found enough material, Hilgert hosed the slates down to remove the accumulated stone dust. Dipping salvaged slate in a solution of oxalic acid and water (wear rubber gloves) will remove weathering marks and restore the slate surface to good-as-new condition, but it takes a lot of time. Hilgert trucked the cleaned slates to our house and stacked them on edge, like large, thin dominoes.

Preparing the framing—Like many other houses in our area, our roof has almost no sheathing. The slates were fastened to roof

From quarry to roof

In terms of composition, slate is little different from the clay deposits you might find in a river bed. It's the geological forces of pressure, temperature and time that transform clay into shale and slate. Both are sedimentary rocks, but shale is softer and less dense because it hasn't been cooked or compressed as much as slate. When slate forms, tremendous temperatures and pressures cause the mineral grains to align so that they're parallel to each other. This granular alignment creates the cleavage planes that enable quarry workers to split out thin, flat sheets of stone.

Splitting slate along its cleavage plane reveals the surface texture, or grain, of the slate. On premium-quality slates, the grain should run lengthwise, as it does on a cedar shingle. Grain can vary from smooth to coarse, and a rough surface doesn't mean that the slate is poor-quality material. Smooth slates are easier to work with, however.

Slate color depends on chemical and mineral makeup, and can vary from the grey stone quarried in eastern Pennsylvania to the red and green tones found along the Vermont-New York border. Other standard colors established by the Department of Commerce are black, blue-black, blue-grey, purple, mottled green and purple. *Ribbon* slates are streaked because of impurities in the original clay deposit. In some cases, this ribbon can weather prematurely, so slates classified as *clear* are a safer bet for a long-lasting roof. Color is further qualified as either *unfading* or *weathering*. Some slates change color over time, but those designated as unfading will not.

Standard roofing slate is 3/16 in. thick and can be ordered in a number of sizes, from 10 in. by 6 in. to 24 in. by 14 in. These slates are fairly uniform and usually have their holes (two per slate) machine-punched at the quarry. To install what is known as a *textured* slate roof, you'd use slates that vary in thickness from 3/16 in. to 3/8 in. The *graduated* slate roof is another variation involving slates of different sizes and thicknesses. Usually the larger, thicker (sometimes up to 2 in.) slates are located near the eaves, with thinner slates and less exposure used near the ridge. These roofs allow considerable aesthetic expression on the part of the slater, and no two are the same, as the photos at left, taken in New England, show. Most of the slate work done today, however, is with standard slates.

Ordering slates—Like other roofing materials, slates are sold by the square. A square of slates should cover 100 sq. ft., with the standard 3-in. lap. Slate size determines the number of slates in a square, and the exposure to the weather. Exposure is easily figured with a simple formula: Subtract 3 in. from the length of the slate, and divide by 2. The 24-in. by 12-in. slates used for Heim's roof come 115 to the square; 12-in. by 8-in. slates come 400 to the square.

Slate prices can vary a great deal, depending on size, thickness and color. Quarry prices start at $300 to $400 per square. Unless you're near a supplier (see the list of operating quarries below), freight charges may end up determining what your best delivered price is. Most quarries don't have a full range of sizes in stock. Special orders can be cut, but you'll have to wait for them. And remember that the smaller size slate you use, the longer it will take to nail up. Larger slates—18 in. or longer in standard or random widths—can really go up quickly. What this boils down to is that a little phone work can go a long way toward saving time and money.

If you're new to slate roofing, there's a good book available from Vermont Structural Slate Co., Inc. (Box 98, Fair Haven, Vt. 05743; $7.95 postpaid). Entitled *Slate Roofs* and originally published in 1926, the book provides a detailed, state-of-the-art look at slate work in its heyday.

Below are names, addresses and telephone numbers of four major slate quarries that operate on a year-round basis.

Buckingham Virginia Slate Corp., Box 11002, 4110 Fitzhugh Ave., Richmond, Va. 23230; (804) 355-4351.

Rising and Nelson Slate Co., West Pawlet, Vt. 05775; (802) 645-0150.

Structural Slate Co., 222 E. Main St., Pen Argyl, Pa. 18072; (215) 863-4141.

Vermont Structural Slate Co., Inc.; Box 98, Fair Haven, Vt. 05743; (802) 265-4933. —*Tim Snyder*

Traditional tools. **The slater's stake is T-shaped, and its sharp end can be driven into a rafter or other wood work surface. Its horizontal edge supports the slate while it's punched, cut and smoothed. The hammer, which is made from a single piece of drop-forged steel, is designed to drive and pull roofing nails, to punch holes and smooth the rough edges of cut slate.**

laths (purlins) of 4/4 by 2-in. hemlock that had been nailed across roughsawn 4x6 rafters.

The roof lath on our house is 10½ in. o. c., the spacing required to give our 24-in. by 12-in. slates a 3-in. lap (drawing, facing page). (Lap refers to the required triple overlay of slates on three consecutive courses.) Roofs pitched shallower than 6 in 12 should have a 4-in. lap. Very steep roofs, like mansards, can get away with a 2-in. lap.

Hilgert framed the roof of the new bathroom we added in the same manner as the house. Instead of 4x6 rafters, he used standard 2x8s; and for roof lath he used 4/4 by 2-in. white pine. Only along the ridge and the eaves do you have to sheathe the rafters. On our roof, Hilgert used wide 4/4 boards.

As a rule, you can get by with conventional framing if you're installing a standard slate roof like ours. But increasing rafter size by one nominal dimension (from 2x8 to 2x10, for example) would reduce the deflection of these members over the years, particularly with a snow load. We used standard ³⁄₁₆-in. slate, which weighs between 750 lb. and 850 lb. per square, depending on where it was quarried. If you're planning what's known as a textured or a graduated slate roof, you will need to beef up your framing considerably. These two roofing styles call for slate that's ⅜ in. to 2½ in. thick, which translates into loads of 1,500 to 6,000 lb. per square.

Though some slate roofers prefer to use conventional sheathing beneath a slate roof, we decided to stay with the original 4/4 lath, since most of it was in good shape. Hilgert also believes that an airspace directly underneath the slate allows it to dry out more thoroughly after a storm.

If you decide to install a slate roof over sheathing, the sheathing should be covered with overlapping layers of 30-lb. asphalt felt before the slate goes on. The felt protects the roof from weather while the slate is being laid, and also forms a cushion for the slates.

The rafters in the main part of our house were in excellent condition, and I knew that they could carry the weight of the new slate with no problem. After removing the old slate, however, we found that some of the old hemlock roof lath would have to be replaced, along with a few of the wide boards at eaves and ridge. Some of this old hemlock had become so hard and brittle over the years that you couldn't drive a nail into it without causing entire runs of lath to vibrate. This, in turn, caused already installed slates to shake and pull free from their nails. So this old wood was replaced with new white pine.

Cutting and hole punching—The traditional tools for these tasks are a slater's hammer and stake (photo left). You probably won't find them at your local hardware store; I got mine at a flea market. New tools are available from John Stortz and Son, Inc., (210 Vine St., Philadelphia, Pa. 19106).

The hammer is made from drop-forged steel and has a leather handgrip. Between handgrip and head, the handle is flat, with one edge beveled sharp, so that the tool can be used to smooth rough edges of trimmed slate. Where the handle joins the head, there's a stubby pair of claws for pulling nails. The striking face of the head is small—about the size of a nickel—to minimize the risk of damaging the slate when nails are driven home. The other end of the head tapers to a fairly sharp point. This sharpened end is used to punch nail holes in the slate, and to perforate slate along a scribed cutting line. Once perforated, the slate can be broken, and the resulting jagged edge can be smoothed with the beveled edge of the handle.

The technique for punching and perforating takes time to master. It's a short, quick, well-aimed stroke that stops just after the hammer's metal point strikes stone. Smoothing a cut edge with the beveled handle is easier: just chisel the slate smooth. It's not a bad idea to practice your technique on a few broken pieces of slate before working on slate to be nailed up.

An alternate hole-punching method is to drive a nail through the back of the slate. Always work on the face that won't be exposed to the weather. This way, the slightly broken or beveled slate surface will face up.

Another important thing to remember is that there are right-handed and left-handed slater's hammers. You can tell the difference immediately if you hold the hammer in the wrong hand and try to trim a slate—the nail-pulling claw will get in the way.

The stake, a T-shaped piece of steel, supports slate when it's being trimmed. The short leg of the T comes to a point, so the stake can be driven into a rafter. For our roof, though, Hilgert drove the stake into a stump beneath a shade tree and did his cutting there. And to make simple, straight cuts, he often used a non-traditional tool that most slaters consider indispensable today—a tile cutter. The score-and-break technique used for straight tile cuts works fine for slate too.

Nailing it up—Roofing with slate doesn't differ fundamentally from roofing with other kinds of shingles. Overlap from one course to the next should cover the nail holes of the lower course by at least 3 in., and the joints in one course should be staggered by at least 3 in. from those in adjacent courses. This means that you've got to cut some slates to keep the joints sufficiently staggered. If one course begins at the gable with a full (12-in. wide, in our case) slate, the next course will have to begin with a partial slate. Try not to use partial slates that are extremely narrow (3 in. or less), since these are especially prone to breakage.

Once the framing had been repaired, Hilgert's crew nailed a starter course of slate directly to the wide sheathing along the eaves, overhanging the framing by about 2 in. As shown in the drawing and photos on the facing page, this starter course is laid horizontally, with its length running parallel with the eave. It's best if the starter-course slates are installed face down. This way, the slightly beveled, chipped edge faces downward, creating a better drip edge. After the starter course, all slates should be installed vertically, with their beveled edges facing up.

Proper nailing technique is the most important part of applying a slate roof. If you're used to nailing wood or fiberglass shingles, you'll have to go easy when working with slate for the first time. You're pounding a nailhead that's surrounded by fairly delicate stone, and a single miss can ruin a good slate. A carpenter's hammer can be used, but the narrow head on a slater's hammer is less likely to break the slate surrounding the nail hole.

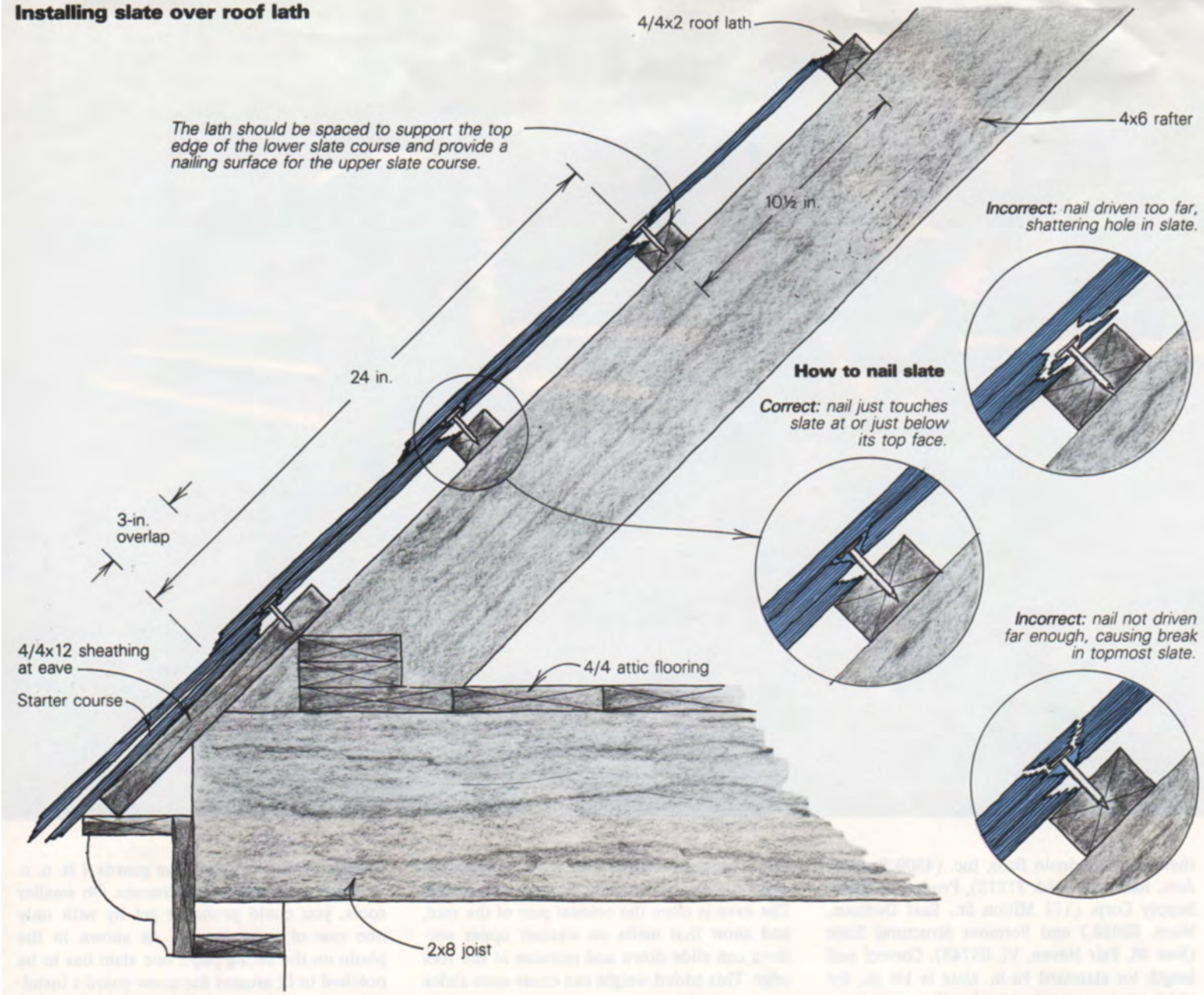
Nail holes are typically machine-punched at the quarry, but you'll have to hand-punch the slates that are used for hips, valleys and ridges. As shown in the drawings on the facing page, the nail head should sit just below the top surface of the slate. If it's driven too far, the slate around the hole will crack. If it's not driven far enough, the protruding nailhead will crack the slate that overlaps it.

The original slate on our roof had been nailed down with iron cut nails, most of which were in good condition when we removed the slate. Because of this, we decided to use galvanized roofing nails rather than copper nails. Copper is definitely the best choice for slate work because its longevity better matches that of the slate. But copper nails are also a lot more expensive (about $3.00/lb., compared with $.90/lb. for galvanized), so we're hoping that our hot-dipped galvanized nails will last as long as the iron cut nails did. If you want to use copper nails, the sources I've found for

Framing. **You can use solid sheathing beneath a slate roof, or roof lath, which was used on the roof shown here. Lath spacing is important, as shown in the drawing opposite, and the eaves and ridge require solid sheathing. Facing page, left: a rotten eave board in the old roof is replaced with new wood.**

First courses. **The starter course is nailed horizontally to the eave sheathing (facing page, right); then the first vertical course follows. Adjacent slates should be butted together without overlapping. Vertical joints in successive courses should be staggered at least 3 in.**

Installing slate over roof lath



them are Glendenin Bros, Inc. (4309 Erdman Ave., Baltimore, Md. 21213), Prudential Metal Supply Corp. (171 Milton St., East Dedham, Mass. 02026.) and Vermont Structural Slate (Box 98, Fair Haven, Vt. 05743). Correct nail length for standard 3/16-in. slate is 1½ in., for either copper or galvanized nails.

As shown in the drawing on the previous page, each run of roof lath supports the top edge of the slate course below and also serves as the nailer for the following course. To line up successive courses, Hilgert's crew snapped a chalkline down the center of each strip of lath. The upper edge of the next slate course was then laid to this line, leaving about 1 in. of nailing space in the same piece of lath for the following course.

Until the first half-dozen courses of slate had been laid, the crew members could reach the work from the scaffolding under the eaves, or simply by standing on the attic floor. Reaching the higher sections of the roof was more difficult, because they couldn't walk on the installed slates without the risk of breaking them. To reach upper roof sections, they worked from a ladder that they built from 1x4s. The ladder rails are a pair of 1x4s positioned with their broad faces against the roof surface. This provides more even weight distribution than a conventional ladder. A 4x4, cleated across the top of the ladder, holds it in place against the ridges.

Snow guards—Snow and ice accumulation along the eaves can really damage a slate roof. The eave is often the coldest part of the roof, and snow that melts on warmer upper sections can slide down and refreeze at the roof edge. This added weight can cause eave slates to crack and break.

One way to prevent eave icing is to flash the eave with a continuous strip of metal, usually aluminum. The first slate course overlaps the top edge of the flashing by at least 3 in. Only a little snow or ice will stick to the metal before additional accumulations cause the icy mass to slide off and fall to the ground.

The more common approach to eave protection in our area is to use snow guards in above-eave areas of a slate roof. A snow guard (photos above and facing page) is a right-angled metal cleat that is nailed to the lath between slates. Its working edge sticks up above the slates, and is designed to hold snow in place on the roof, minimizing slide-down accumulations along the eaves.

Like our slate, the snow guards we used were recycled. We bought them from another local contractor who had salvaged them when he re-roofed a church in a nearby town. The cast-iron snow guards were at least 75 years old, very rusty, and spotted with roofing tar. We had them cleaned and hot-dip galvanized. All told, they cost us about $6.50 apiece.

On the main roof section shown in these photos, Hilgert installed the guards 4 ft. o. c. in the second and fourth courses. On smaller roofs, you could probably get by with only one row of snow guards. As shown in the photo on the facing page, one slate has to be notched to fit around the snow guard's installation strap. The following slate course then covers this strap.

Flashing and ridge details—As roofs go, the one shown here is simple—no hips, dormers or valleys to contend with, only a couple of chimneys. Because of this, installing the slate was fairly straightforward. But a more complex roof wouldn't be a problem for anyone who's familiar with the hip, valley and flashing details used with wood shingles (see *FHB* #9, pp. 46-50). Chimneys, dormers, skylights and sidewalls that penetrate or intersect with a slate roof should be step-flashed. Hilgert used copper flashing on our roof (with copper nails to avoid any problems with galvanic action), but aluminum, tin, lead and zinc have also been widely used.

Though closed and even round valleys are found on some slate roofs, the open valley is the most common. Install metal valley flashing for a slate roof just as you would for wood shingles. Standards set by the National Slate Association back in 1926 call for open flashing to be slightly wider at the bottom of the valley than at the top to handle the increasing vol-

Snow guards. **Nailed to the roof lath between slates, these aluminum or cast-iron elements are designed to hold snow on upper sections of the roof, preventing damaging ice and snow accumulation at the eaves. One slate should be notched to fit around the mounting strap, as shown above. The following course covers most of the strap (facing page). Once you master the nailing technique, a roof with no hips or valleys can be slated quickly.**

ume of runoff. Adding about ⅛ in. to valley slates in each succeeding course should create sufficient taper in the open valley.

There are also several options when you come to the ridge. The major ones are shown in the drawing at right. Hilgert finished off our roof with a strip saddle ridge. As the drawing shows, the final full course of slate on one side of the roof extends so that the upper edges of its slates are even with the solid sheathing at the ridge peak. Then these edges are overlapped by the final full course of slate on the opposite side of the roof. The final step is to nail down a second pair of overlapping courses, using partial slates that run lengthwise along the ridge. Nails in this last layer of "combing" slates are positioned so that they fall in the seams between the slates in the course below.

As with a wood shingle or shake roof, detailing at hips can get complicated. Saddle and flashed hips are popular, but you can also use a Boston hip (see *FHB* #12, p. 56).

Hilgert used no roofing cement to point the seams along the ridge or to cover the exposed nails in final combing courses. Like many slaters, he believes that cement isn't a requirement if a slate roof is installed properly. But in very rainy territory, or if you want to be doubly sure of your roof's weathertightness, use a high-quality silicone caulk to cover exposed nails and to point ridge-course seams. I had some doubts about leakage through the ridge, but the main roof of our house passed its first test for water-tightness the day after it was finished. A driving rainstorm, one of the last in an altogether too-wet spring, hit our part of Pennsylvania. Flashlight in hand, I went up to the attic to look for leaks. I could hear the rain pelting the roof, but not one drop of water found its way through. □

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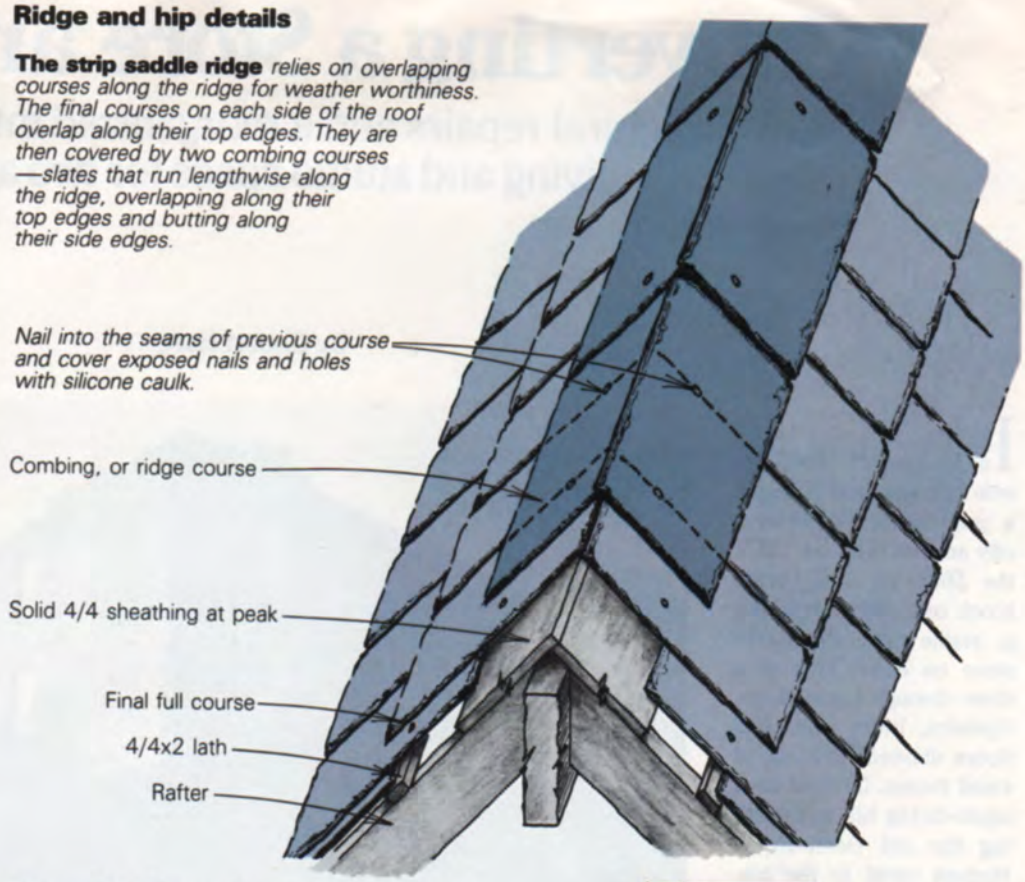
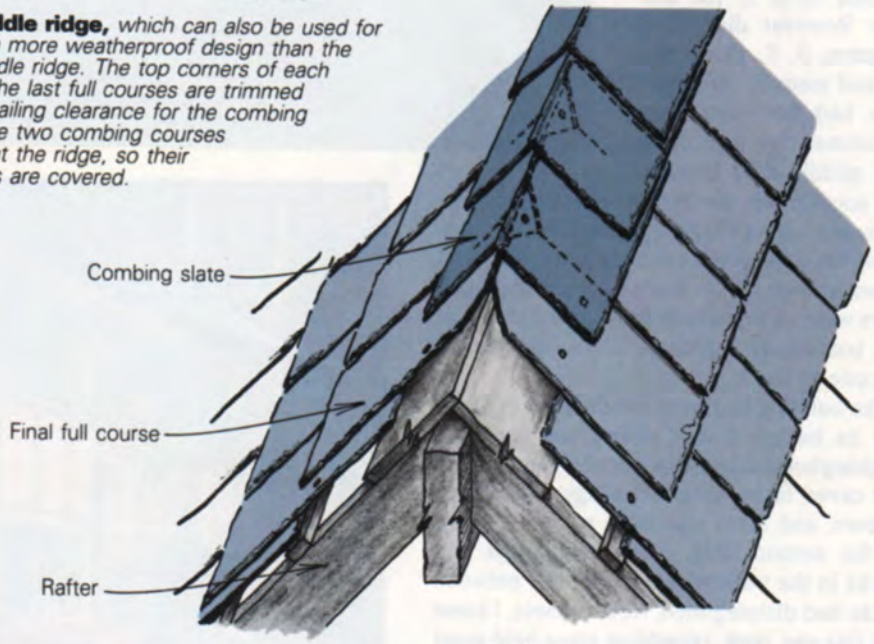
Ridge and hip details

The strip saddle ridge *relies on overlapping courses along the ridge for weather worthiness. The final courses on each side of the roof overlap along their top edges. They are then covered by two combing courses —slates that run lengthwise along the ridge, overlapping along their top edges and butting along their side edges.*



The saddle ridge, *which can also be used for hips, is a more weatherproof design than the strip saddle ridge. The top corners of each slate in the last full courses are trimmed to give nailing clearance for the combing slate. The two combing courses overlap at the ridge, so their nail holes are covered.*



The flashed ridge *is well suited to severe weather conditions or to irregular slates that can't be tightly overlapped at the ridge. It's also suitable for hips.*