

Chinkless Log-Building

Coping logs with chainsaw and scribe

by Larry S. Young

For years log builders have been experimenting with ways to join logs lengthwise to eliminate the need for chinking—the practice of filling the gaps between adjacent logs with wood or caulking compounds. Chinkless log construction goes by many names. In our part of eastern Idaho, it is known as "Swedish coping," presumably because a group of Swedish immigrants first did this type of work around nearby Dubois and Jackson Hole, Wyoming. "Fully scribed" and "Scandinavian scribe-fit" are other common names for the chinkless method.

Difference in names aside, the idea is generally the same: a scribed notch, usually V-shaped in section, is cut lengthwise into the underside of a log (top photo facing page) to allow it to conform to the log below it in a wall. In conjunction with the lengthwise notch, a rounded hollow called a "saddle cope" is used where the logs intersect at building corners.

A Swedish cope wall is an attractive wall inside and out, and the maintenance that goes with chinking, is eliminated. But until recently, builders and homeowners have usually found this practical advantage of chinkless log-building to be more theoretical than actual.

In the real world logs shrink, twist and settle, and it takes more than a wrinkle of the nose to cut the half-mile of V-notch and the hundred or so saddle copes required in even a modest-size house. Traditional methods for scribing and hand-cutting these notches are very time-consuming. This fact, combined with structural nuisances caused by log movement, have given the Swedish cope a reputation for being-beautiful, yet expensive and unpredictable.

But all this is changing. Streamlined approaches to joinery and modern insulation techniques have led to a rebirth of this fascinating style of log work in our part of the country. In this article I'll talk about how our crew uses contemporary methods and tools to build Swedish cope walls for log homes.



Like a pair of calipers, a scribe has adjustable arms. On the lower arm, a steel tip rides along the lower log, feeling its contours and marking them on the log above by way of the pen affixed to the upper arm.

About logs—Our local log builders have been supplied with an abundance of ideally seasoned material by a wood parasite called the mountain pine beetle (*Dendroctonus Ponderosae*). As though created and turned loose in the woods by a mad geneticist/log builder, the beetles attack only mature lodgepole pines. The adult beetles fly from tree to tree, burrow into the bark and deposit eggs. Feeding on the inner bark, their larvae tend to burrow horizontally, and in so doing, girdle the tree and kill it.

The trees usually remain standing for years after death, and thus are air-dried to perfection. Two side effects of beetle infestation add to the beauty of the logs: the marks left by burrowing create intricate patterns on the logs that can often be preserved if a light touch is used in bark peeling. Also, the beetles carry with them a blue-stain fungus that spreads throughout the sapwood, creating varied coloration in the logs.

Mature lodgepoles tend to be relatively straight and branch-free, and are of diameters well suited for Swedish cope building. We use logs with butts ranging from 11 in. to 16 in. in diameter, which produce a mean wall thickness of about 10 in. Large logs are best because the height of a wall increases quickly with each log.

Each course will add an average gain of about 1 in. less than the mean diameter of the log used. Large logs also provide the greatest wall mass for strength and R-value. But very large logs, (over 16 in. in dia.) are difficult to handle, increase joinery problems, decrease interior space and are out of proportion in all but huge structures.

Straight and smooth logs with minimal tapers are preferred, but it's not necessary to obtain only flawless logs. Many short sections will be needed between openings, and crooked logs can be cut into usable lengths for this purpose. And with good scribing tools and techniques, twisted and bumpy logs can be fit with precision, adding character and interest to the walls.

Fitting the walls—With saddle copes, it is necessary to establish a stagger of one-half a log diameter between perpendicular walls. This is the reason for the half sill log, which is laid on the foundation to start a wall (bottom photo facing page). Next, the whole sill logs, which are slabbled (flattened) on their undersides for uniform contact with the foundation, are saddle-coped over the half logs. We use rebar dowels, embedded in the footings, to anchor sill logs to the foundation. To cut down on air and moisture infiltration, we place two layers of closed-cell polyethylene foam between the sill log and the subfloor. The foam is ¼ in. thick by 6 in. wide, and we get it at our local building supply.

When the sill logs are in place, Swedish cope fitting can begin. To simplify the following explanations, I'll refer to the log that is raised onto the building for scribing as the "new log," and the log upon which it will rest as the "log below." A new log is raised onto a given wall after the logs on perpendicular walls have been fitted.

Positioning the new log for scribing is the first and most important step and is the key to good scribe-fit log work (bottom photo facing page). Remember that a log's position during scribing is the position that it will assume forever in the assembly. There are four basic positioning considerations: taper alter-

nation, rotation, elevation and alignment.

Taper alternation is the most obvious requirement—the butt of the new log must be over the tip of the log below so the walls will rise more or less evenly.

Rotation is the next thing to consider. When the new log is raised onto its respective wall, it rests on the tops of the intersecting logs so there is a gap roughly one-half the log's diameter between it and the log below. The shape of this lengthwise gap is the main concern of Swedish cope positioning. The goal of rotation is to get the gap between the two logs as uniform as possible before scribing. This results in consistent V-notch widths. Achieving an even gap between the logs is like fitting a jigsaw puzzle together: the contours along the bottom of the new log should match the contours of the log below. We use peavey poles to rotate the logs, and we chock the log against its neighbor with small, rough-textured stones while we examine various rotations.

Usually one end or the other of the new log will be raised slightly to make the lengthwise gap more even, and this is done in conjunction with the testing of different rotations. This is the elevation part of the process. Because the log is tapered, its top and bottom profiles will not be level. Ideally, the center line along its horizontal axis should be level, but the evenness of the gap is more important than level logs. Typically, log crowns should be rolled 90° left or right of top center, so the straightest sides of the logs face each other where the V-notch joins them. During scribing, long logs will often sag in the middle, and strategically placed blocks are necessary to correct this. Sometimes logs can even be bent into more favorable positions by blocking them in the middle and forcing them down on the corners by the use of stout webbing wrapped around the log tails below. These blocking procedures, however, are not actually used until the new log has been "rough-notched," a step I'll explain in a moment.

After the new log's rotation and elevation are satisfactory, its alignment with the wall is finalized. Ideally the centers of all logs should be in the same vertical plane. The new log's actual alignment, however, will be a compromise between its ideal position and how well it aligns with the log below.

When the best compromise between rotation, elevation and alignment has been worked out, the new log is secured in place with rebar "log dogs" at both corners (photo 1 following page). This step is essential because if the log shifts during scribing, the scribe lines will no longer be accurate.

Openings greater than 4 in. between logs make for awkward and imprecise scribing, so the new log is lowered in two stages. The first stage is accomplished by making shallow "rough notches" in the new log where it sits atop the intersecting logs (photo 2 following page). Notches should be deep enough to reduce the lengthwise gap be-



In the photo above, the author uses a chainsaw to cut a V-shaped notch in the underside of a log. The deep gouge in the log near the bottom of the photo is a saddle cope.



Because log walls overlap at corners, it is necessary to begin some of the walls with half-logs, such as the one at the base of this wall. Young's crew slabs them with a chainsaw, and anchors them to the foundation with rebar dowels. At the top of this wall, a new log is being positioned. The log is blocked in the middle to keep it from sagging.

tween logs to between 2 in. and 3 in. If we need to make further elevation adjustments, the rough notches can be different depths.

Scribing the logs—To make sure that a rough-notched log is realigned correctly, we make repositioning marks on the intersecting logs by turning the scribers upside down. By tracing the feeling point of the scriber along the cutline on the new log, the pen will mark the new log's footprint on the log below.

When the rough notches have been cut and the log repositioned, the ends (tails) of the logs are trimmed flush with those below. Next it's time to determine the scriber gap setting. This is the vertical distance between the scriber's feeling point and marking point (sidebar facing page), and it represents the distance the log will drop vertically from its rough-notch position. The scriber gap will affect two things: the width of the Swedish cope and the depth of the saddle cope.

The ideal Swedish cope width is a little more than one-third of the log's mean diame-

ter. If the cope is too wide, the log loses strength, and the height gain per course is reduced. Also, the Swedish cope notch is V-shaped, so copes that are too wide may cause fitting problems if the walls of the notch touch the log below. If the Swedish cope is too narrow, the V-notch will be too small for good sealing and R-value.

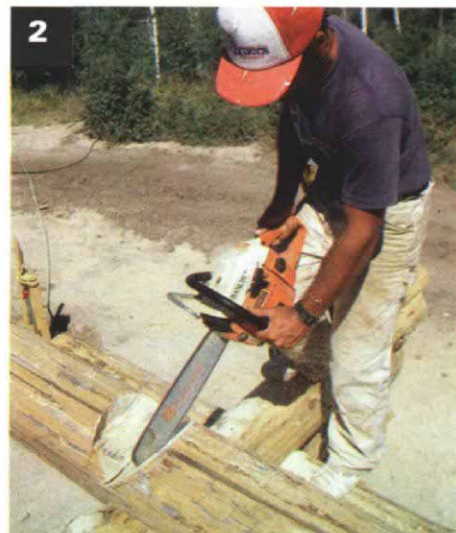
Begin scribing with a test setting about 1 in. greater than the average gap between the rough-notched new log and the log below. Find the widest part of the gap between logs (where the Swedish cope will be narrowest), and make test scribe lines on both sides of the new log. The distance between the two scribe lines at this part of the gap should be at least 1½ in.

The ideal saddle-cope depth should roughly *bisect* the diameter of the new log. This will avoid or minimize "over-round," the bane of saddle cope joinery. Over-round occurs if, when scribing the lower parts of the saddle cope on the new log, the scriber's feeling point drops under the "cheek" (wid-

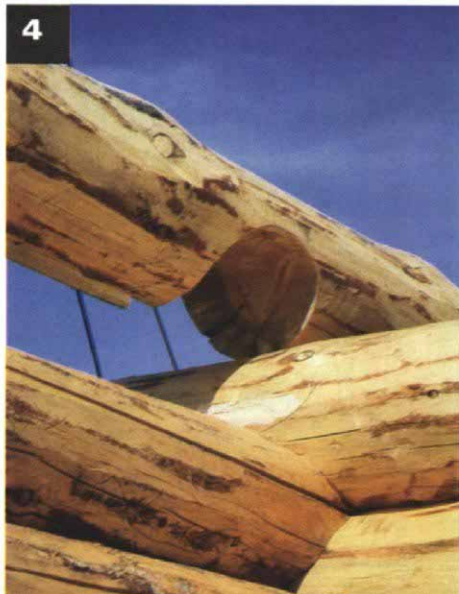
est part) of the log below. This means that the opening at the bottom of the saddle notch in the new log will be narrower than the diameter of the intersecting log. How then, is the new log to be lowered down over the intersecting log of an over-round fit?

Some builders simply eliminate over-round by power-planing down the cheek of the intersecting log before scribing the saddle notch onto the new log. Beside the fact that it can be considered cheating in scribe-fit log work to alter the natural shape of the log in such an obvious way, there is an easier way to deal with over-round saddle copes, which gives a more pleasing result. When it becomes evident that a saddle cope will be over-round, turn the scribers upside down and mark the shape of the new log onto the intersecting log (photo 3 below). These lines will define the area that will be buried under the new log's saddle cope. Now the cheek of the intersecting log can be pared down with a chisel so that the saddle cope of the new log will fit over it (photo 4 below).

Scribing. Using his homemade scribers, Young marks a cutline for a rough notch on a new log (photo 1). The new log is anchored to the one below it with a rebar "log dog" at each end. The log is then rolled back, and Young scoops out a rough notch (photo 2), using a chainsaw with a wide-profile bar. This notch will lower the log 2 in. to 3 in. in the wall, allowing it to be marked its full length for final scribing.



Dealing with over-round. A rough-notched log has been scribed for its saddle cope (photo 3), and the log below is too wide for the saddle cope to fit the log properly. The solution is to turn the scribers upside down and to draw a cutline on the log below that shows where to chisel away the "cheek" of the log (photo 4). If the ends of the logs are to be exposed, they are finished with a chisel-cut tail scribe (photo 5).



Because all the criteria for positioning and determining scribe settings are interrelated, all the steps involved will not necessarily occur in the pat sequence I just described. A good positioner must know the rules, and how joinery problems can be avoided by following them, but his art lies in knowing which way to bend the rules in particular situations. It will take a lot of trial and error to develop an eye for positioning, but once the objectives are understood, logs can be positioned quickly and with a minimum of fuss.

Chainsaw cope-cutting—For our crew, chainsaws have replaced axes and adzes as the workhorses for cutting copes and flattening surfaces on logs. The only hand tools we use now (outside of the drawknives used for bark-peeling) are chisels and gouges. We use them for scoring saddle-cope lines and trimming awkward spots that chainsaws can't reach, such as tail-scribe notches (photo 5 facing page) and cutting tail notches. We've used both traditional tools and chainsaws for

cooping, and we estimate that chainsaw methods are twice as fast. Also, it takes far less practice to achieve accuracy with chainsaws than it does with hand tools.

Chainsaws can be very dangerous. The uses to which they are put in log work create some potential dangers that are not encountered in tree felling or firewood cutting. Log builders have had to create their own systems for safety.

Dull and underpowered saws require more force from the operator and are therefore more dangerous. For this reason, the \$150 saws at the hardware store will not do for this kind of work. We use Husqvarna saws exclusively because of their high power-to-weight ratios, their ability to work long hours under demanding loads, their excellent balance and their reliable chain-brake devices (Husqvarna Power Products, 907 W. living Park Rd., Itasca, Il. 60143).

We always lower scribed logs to the ground for V-notch cutting because that's where the operator has plenty of room to ma-

neuver. Just as whittlers have safeties built into all their knife strokes, we incorporate safety measures into each sawing procedure. These are mostly a matter of common sense: for each particular type of cut, we anticipate what can go wrong and develop postures that keep us well out of the way should the saw kick or drop through a cut unexpectedly. Finally, we wear foam ear-plugs to protect our hearing and safety glasses to shield our eyes.

We use a variety of saw sizes, bars and chains for different purposes. For scooping saddle copes we use a small saw (such as the Husqvarna 44) with a wide-profile 16-in. bar. We use the same saw for the Swedish cope "scoring cut," but with a narrow-profile bar. We have also found that a *slightly* dull chainsaw runs smoother for this cut. Hogging out the bulk of a ripped cope cut (photo p. 81) is best handled by a medium-size saw such as the Husqvarna 262, with a 20-in. bar. It doesn't seem to make much difference if either a ripping or a conventional chain is

A precision log scribe

The odd-looking tool illustrated below was developed to meet the demands of Swedish cope scribing, and it is the crucial ingredient for precision log fitting. When this tool is used properly, notches scribed with it fit perfectly—first try every time—and time-consuming test fitting is eliminated.

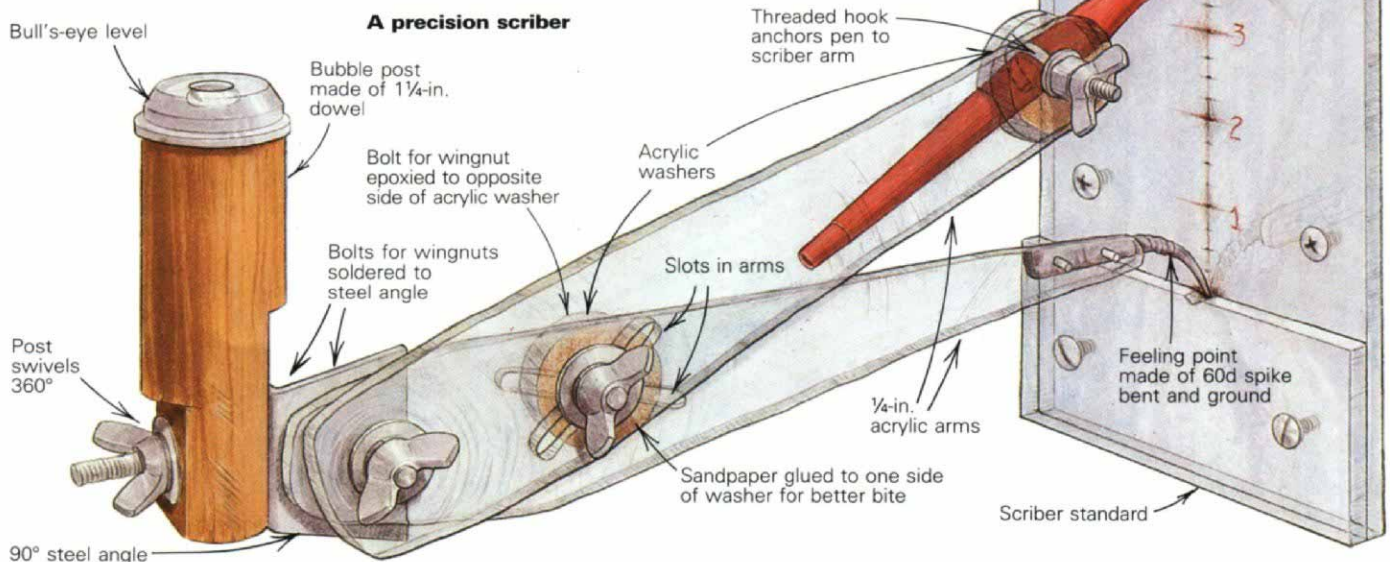
The vertical distance between the points is set and the points are plumbed by using the scribe standard. The standard is mounted somewhere on the job out of harm's way, and its vertical scale is carefully plumbed on both axes. The scribe's feeling point is then rested in the V-slot at the bottom of the scale, and the scissoring arms of the scribe are opened until the marking point reaches the desired point on the scale. When the gap is set, the scribe's bubble is centered by adjusting the "bubble post."

scriber gap or the angle of the marking point is changed, the bubble level is readjusted by using the standard.

By keeping the bubble centered while scribing, the marking point is kept in a true vertical relationship to the feeling point. This way, the shape of the log being "felt" is accurately transferred onto the log being marked.

The drooped feeling point and adjustable marking point give this scribe great versatility. These features allow the points to reach into hollows and checks and ride over bumps while still maintaining the correct vertical relationship.

The scribe is easy to build, and all its parts can be found at a good hardware store. We use medium-point felt-tip marking pens when log surfaces are dry, and indelible pencils when they are damp. —L. Y.



Drawing: Bob LaPointe

used for this cut. Big saws fitted with ripping chains are best for cutting slabs, along with long bars that allow the operator to assume a more comfortable position.

Two significant innovations have greatly increased speed and accuracy in log work. The first is called the "pushed-bar" scoring cut. The common practice of ripping the V-notches by pulling the saw toward you has always created a problem—when you get close to the scribe line, the action of the chain splinters it into oblivion. Peter Koedt of Wilson, Wyoming, solved this problem by *pushing* the bar along the scribe line, making a shallow scoring cut. By keeping the saw running smoothly at near full throttle, a Swedish cope scribe line can be followed as closely as a bandsaw can follow an irregular line on a board.

The second innovation is the level-governed slabbing method, which we call "bubble-slabbing." We affix a mason's line level to an adjustable base, and mount this assembly to the body of the saw between the two handles so that the level is perpendicular to the bar. Then we adjust the bubble to read dead-level when the bar of the saw is plumb. Because the governed bar cuts in a consistent vertical plane, only one cut line is needed on the log. The level bubble will atomize while the saw is cutting, but it reforms when the saw is idling. Therefore, the procedure is to rip a foot or two, then stop to allow the bubble to compose itself. You can make slight adjustments to the bar to recenter the bubble, and then resume sawing. With a little practice, flats can be sawn on bumpy, 40-ft.

logs that are within ¼ in. of true plane. When the slab is completely ripped, the log is rolled so the slab is face up, and the surface can be dressed by "sweeping" it with a smaller saw.

After we've cut the notches and carefully inspected them for any internal bumps or ridges that may obstruct the fit, we use a truck-mounted boom to raise the log back onto the building. If the rules of scribing and sawing have been followed, the new log will seat onto the log below with a satisfying thump—break time. Sometimes, however, a little twisting with peaveys and some sledgehammer persuasion will be necessary to fully settle the log onto the log below. Swedish-coped logs with saddle-coped corners may be the ultimate in interlocking joinery, and except where joists or purlins serve as structural cross ties, no fasteners are needed. As a construction convenience, however, 8-in. to 12-in. spikes are useful for snugging logs together and for keeping the logs in place while working above them. Spikes should be used sparingly: usually one at each corner and one where logs end at openings. Be sure to keep spikes well back from door and window openings—they have a nasty tendency to dull chainsaws. Always counterbore a pilot hole the same size as the spike shaft all the way through the new log, so the log can settle around the spike shaft. A few taps with a sledge and punch will countersink the spike and snug the new log down.

Levelness between corners will usually take care of itself if tapers are alternated and logs of similar diameter are used in the same

course. But it is still a good idea to check the corners with a transit every three or four courses or by measuring off the foundation. When comparing corner elevations, remember that a corner whose topmost log is a tip will likely be lower than a corner that has a butt on top. If, after compensating for tapers, the corners are within an inch of each other, there is no problem. If the difference is greater, compensate by choosing larger logs for the low corners and vice versa. Levelness is most important in the upper courses; plate logs are difficult enough to lay without having to use them to make up large variations in levelness.

Foam injection—Site-injectable urethane foam is an ideal solution to the long-standing problem of filling Swedish cope and saddle cope voids (photo below). Foam-injected voids seal drafts, and have a higher R-value than the thickest parts of the log wall. In addition, the foam-to-wood adhesion is strong enough to reduce twisting and shifting of logs after construction. The foam does seem to compress somewhat under settling pressure, but as long as the assembly settles as a unit, the logs stay tight.

The time to inject foam is after the log work is complete, but before openings are trimmed and readied for doors and windows. To accommodate the foamer's nozzle, we drill ¾-in. holes 2 ft. apart along the outside of the Swedish copes, and at opposite angles into the saddle cope voids. It is important to keep the Swedish cope holes at least 1 in. above the lines where the logs meet to allow clearance for the foam gun. Average-size houses can be drilled in a day, and the injection itself is complete in a matter of hours.

The foam is injected at 700 psi and flows rapidly to either side of the injection, expanding as it goes. This makes it very effective at filling and sealing the voids, but is also responsible for unpleasant side effects: the foam will ooze out of the tiniest gaps in the log work and will also spit back out of the injection holes. We are experimenting with ways to reduce this "overspray," but for now, a good deal of cleanup is necessary and should be factored into the cost of the foaming job. Of the several tools we've tried for cutting the blobs of cured foam from the logs (don't attempt to clean uncured foam), a kitchen knife with a 6-in. to 8-in. blade seems to work best.

To hide injection holes, we have gone to the trouble of pounding in short lengths of dowel and chiseling them off flush. But since the foam cures to a golden yellow that is very close to the color of aged pine logs, we have found that just scraping off the excess and leaving the hole plugged with foam is cosmetically acceptable. After the logs have aged for a few months and have received a coat or two of preservative, an unsuspecting eye will never notice the injection holes. □

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Freshly injected urethane foam fills the voids inside the coped walls and oozes from the tiny cracks between logs. Once it cures, Young's crew trims away the excess with a sharp knife. Note the ends of the logs near the center of the photo. They have been finished with chisel-cut "tail scribes," while the ends of the logs to their right show the V-shape of the chainsaw-cut scribes. The latter will be hidden behind door jambs.

Photo: Stacy Hastings