Chainsaws Come Out of the Woods

A log builder tells about chainsaw safety, maintenance and how he uses chainsaws to work logs and timbers

by Larry S. Young

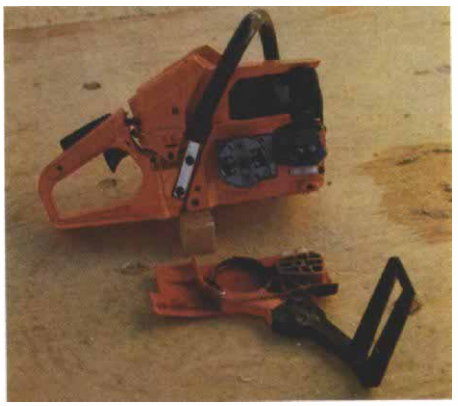
Today's light and powerful chainsaws are a surprisingly recent development. Saws that could be carried and operated by one man didn't appear until the mid-1930s, and for the following three decades their use was limited almost exclusively to the logging industry. By the mid-60s, chainsaws had become light enough and affordable enough to interest those with lighter chores, and ten years later the wood-heating boom caused huge increases in demand.

At the same time the crafts of log and timber building experienced a revival. In both, chainsaws play an essential role. The axes and adzes that traditionally did all the time-consuming work of log-notching are now museum pieces, along with two-man crosscut saws and other muscle-powered wood-cutting tools.

Andreas Stihl, a German who grew up near the Black Forest in the early decades of the century, is generally credited as the inventor of the chainsaw. Legend has it that Stihl was a dreamy tinkerer who came up with the idea for a gas-powered, portable saw as he strolled through the Black Forest, observing loggers struggling with crosscut saws.

By the late 20s, Stihl had managed to hook up a gasoline engine with a loop of wood-cutting chain that ran in the grooves of a guide bar—a basic idea that hasn't changed much. In 1930, he started manufacturing a 127-lb. two-man behemoth which he called—in all seriousness—"The Midget." This machine revolutionized woodcutting despite its weight and bulk, and inspired Stihl to perfect his invention. Six years after The Midget was introduced, Stihl was manufacturing a 47-lb. saw. Many more subtle refinements have been made to Stihl's basic idea, and I'll talk more about them as I review the features of high-quality contemporary gasoline-powered chainsaws (drawings below).

While electric chainsaws are useful tools for light-duty work (especially indoors where exhaust fumes are deadly), I haven't found an electric chainsaw that is powerful enough for the kind of log work done by our crews. This article focuses on engine-driven saws, but the safety, maintenance and basic cutting proce-



With the bar and cover plate removed from this Husqvarna Model 242, you can see the centrifugal clutch just below the handle on the powerhead. The handguard on the cover plate in the foreground activates the clutch-drum brake if kickback should occur. Moving this handguard away from the operator tightens the ring in the cover plate, which in turn grips the clutch, bringing it to a stop.

Parts of a contemporary chainsaw

dures described here can be applied to electric chainsaws as well.

Safety–The first thing to know about chainsaws is that they are potentially the most dangerous wood-cutting machines in existence. A medium-size saw has up to 40 in. of unguarded cutting edge capable of lightning-fast kickbacks toward the operator. And for log builders, who everyday put their saws to uses that would horrify safety-manual writers, conventional chainsaw-safety wisdom is inadequate.

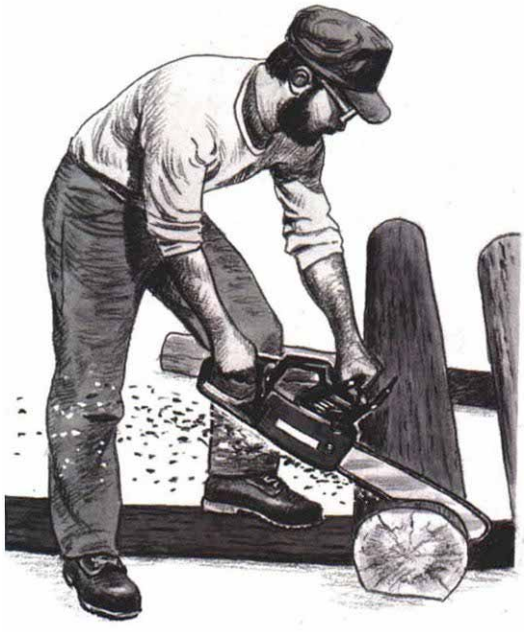
To build a log house, it's necessary to do some sawing from scaffolding and while perched on building corners. Sometimes saws are used overhead and in other awkward positions, and at least half of our operations involve the use of the guide-bar tip (see the sidebar at the right).

When you add to the above all the distractions that exist on a typical construction site, it's a wonder that our log crew and many others have managed to rack up thousands of hours of chainsaw use without serious accidents. I think the reason for this is that chainsaws inspire respect and alertness like no other tool does.

There are, of course, any number of ways a moving chain can be brought into contact with flesh and bone. But most accidents happen when the saw makes an unexpected jerk through a cut or back out of a cut, or when a person gets feet or legs too close to the work.

The unexpected jerk back out of a cut is called ***kickback,*** the most common (and dreaded) cause of chainsaw injuries. Most kickbacks occur when the top half of the bar tip comes in contact with the work or with anything else (bottom drawing, previous page). The chain is moving downward over the arc of the tip at this point, so the natural reaction of the bar is upward and back–toward the operator.

For their part, saw makers have responded to the problem with a variety of anti-kickback devices that have helped reduce kickback occurrence. By far the most effective of these devices is the handguard/chain brake, now standard equipment on all saws.



The handguard is forward of the saw's front handle and is affixed to a lever that activates a clutch-drum brake (photo previous page). The force of a kicking bar brings the left hand into contact with the guard, tripping the brake and stopping the chain. The best chain brakes are sensitive enough to activate the brake at the first hint of a kickback, even before the left hand trips the lever.

Other significant kickback deterrents are asymmetrical bar tips, screw-mounted tip guards, and the "safety chain." An asymmetrical tip has a wide radius at the bottom of the tip and a narrow radius at the top, thus reducing the area of the tip's kickback zone. Tip guards eliminate the cause of most kickbacks, but also eliminate the ability to use the tip, which makes these guards useless for some purposes.

Safety chains have additional prongs that reduce the ability of the cutters to bite when they are passing over the tip, but not when running along the top or bottom of the bar. I have tried Oregon's safety chain (Oregon Cutting Systems, Blount Inc., 4909 SE International Way, Portland, Ore. 97222) and it works. This type of chain is now standard on most saws sold for nonprofessional use. Unfortunately, the kickback-reducing prongs make the chain about half as effective for scooping and scoring cuts (more on these later) so we only use it for awkward cuts where kickback is likely.

Proper grip and body position, awareness of the cause of kickback and the path a kicking bar will follow are the first defenses against kickback injury. The basic grip (drawing below left), well illustrated in all saw-owner manuals, is the safest; beginners should never deviate from it. The main thing to remember is that the left hand, whether gripping the top or side of the saw's front handle, is the hand that will counteract kickback should it occur and is the hand that has the best feel for the bar's levering forces. The left hand is where awareness of the "kickback plane" starts. A bar will kick back in a plane that is more or less opposite the direction the bar is being pushed. It's almost always possible to assume a position that will keep the head and torso out of this plane, and doing so should become second nature.

No one should be near a running saw without eye and ear protection. For the eyes, regular safety glasses are usually adequate, but sometimes it's hard to keep your face out of the chip spray. That's when a full face shield is desirable. For hearing protection we use foam ear plugs. They seem to be the best for dampening chainsaw noise and are more comfortable and convenient than muff-type ear protectors.

Saw sizes and features–There are three generally recognized categories of saw size, based on engine displacement: lightweight saws, which have from 20 to 50 cubic centimeters (cc) of displacement; heavyweight or "production" saws, which start at about 80 cc and range to 100 cc, and medium weight saws, which cover everything in between.

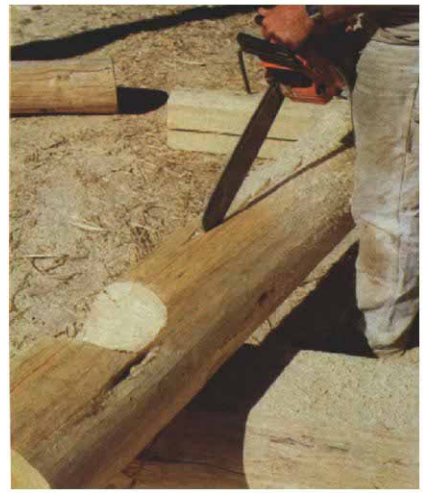
The only ones who will need a production saw are loggers who fell very large trees and

Log-building cuts

In the course of constructing a house out of logs, we use our chainsaws to perform a variety of cutting operations. We build log houses using the "Swedish Cope" method, which requires the cutting of irregular notches in the bottoms of logs so that they conform to the log beneath them in the wall (for more on this style of log building, refer to my article in *FHB* #53, pp. 80-84).

Scoring cut–We cut scribed notches in two steps. The first pass is a shallow scoring cut, in which the saw is *pushed* alongside the cut line (photo 1). This method keeps the chain cutters from obliterating the line. The next pass is a deeper cut in which the bar is pulled through the kerf, resulting in a V-shaped notch along the length of the log.

Scoop cut–To make the saddle cope notches at corners, we first make a V-shaped cut in the log. Then we use the tip of the bar to make a series of shallow scoops by lowering the bar into the wood while pulling back on the saw (photo 2).



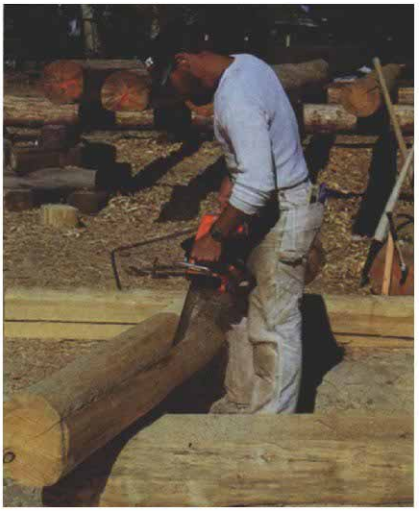
1. Scoring cut

2. Scoop cut

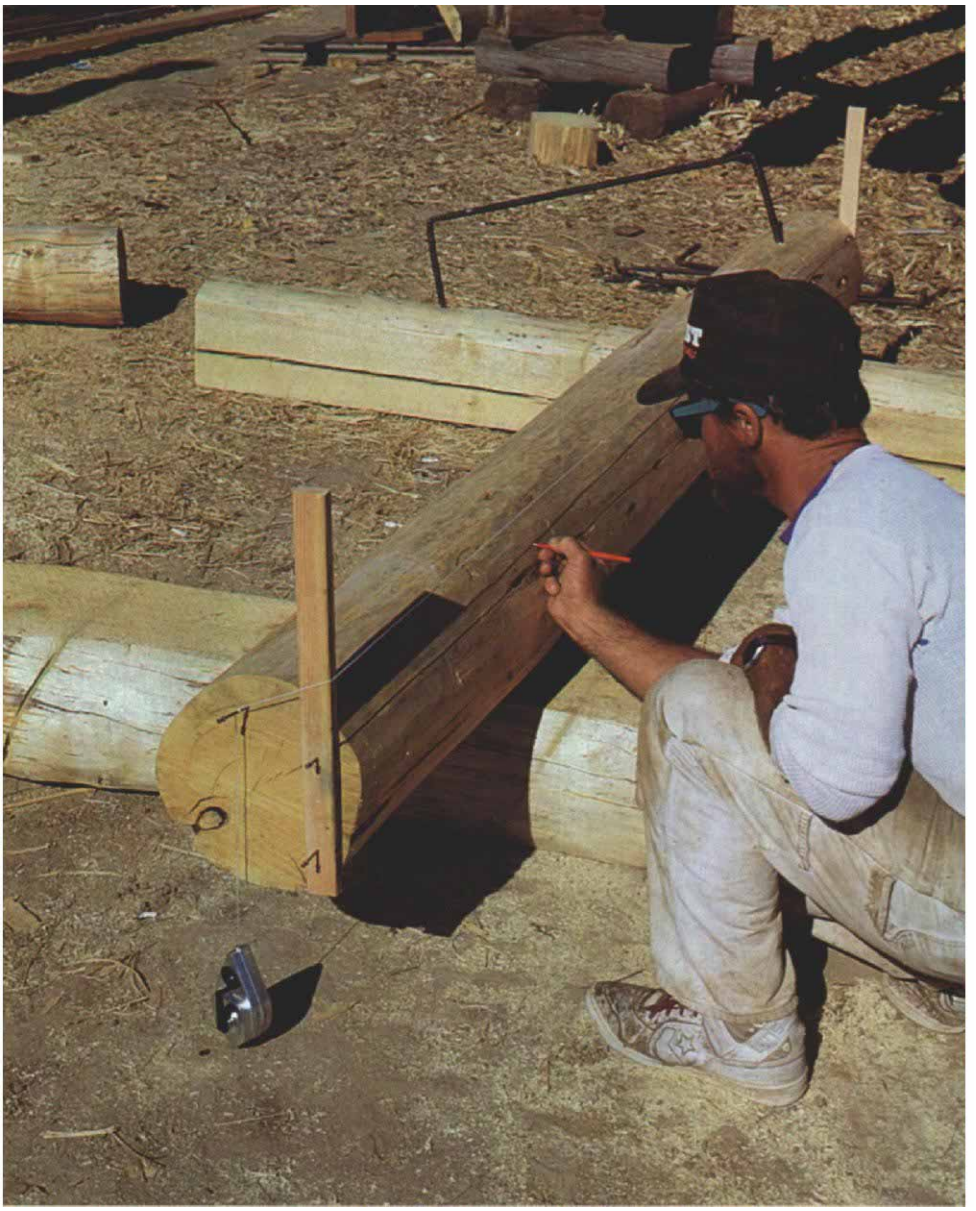
Drawing: Mark Hannon

Plunge cut—We sometimes need to make plunge cuts in timbers for mortises. We always start them with the bottom of the tip (photo 3), and gradually bring the bar into alignment with the plunge as the bar penetrates the work (photo 4).

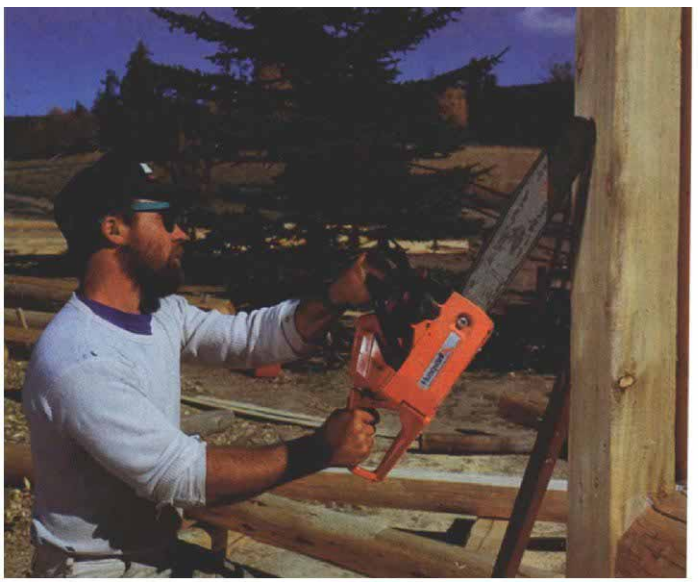
Sun-lining—We need logs with flats sawn on them for plates or purlins, and it used to be tough to mark a straight line on an irregular log. But Peter Koedt of Wilson, Wyoming, solved the problem by coming up with a system he calls sun-lining. We orient the log toward the sun, and tack plumb sticks to both ends. When a string between the two sticks casts a shadow that is parallel to that of the leading stick, it describes a straight line on the log that can quickly be marked onto the log with a felt-tipped pen (photo 5). We then use a chainsaw fitted with a small bubble level on the engine housing to guide a plumb cut through the log (photo 6). The bubble reads level when the bar is plumb. During the cut, the bubble atomizes. But it coalesces when the saw is idling, telling us what adjustments to make. —*L. S. Y.*



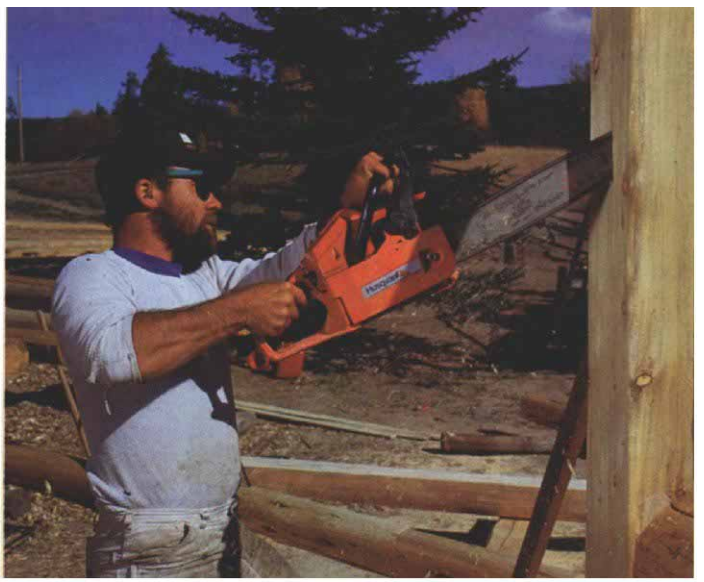
6. Sun-lining



5. Sun-lining



3. Plunge cut



4. Plunge cut

high-volume log builders who do a lot of rip cuts. Lightweight saws handle 90% of our log-notching work. A good medium-size saw is adequate for most crosscutting, light ripping, and miscellaneous jobs such as trimming window openings and gable ends.

Quality saws manufactured today are far less tiring to use for prolonged periods than those of even 20 years ago. Improved vibration-dampening systems have eliminated the numb and tingling sensation in the hands that used to go along with continuous sawing. Very reliable automatic bar-oil pumps—now standard equipment on all saws worth having—have made prematurely burned bars and tedious thumb-pump bar oilers things of the past. Constant improvements in weight reduction and balance have also helped to reduce fatigue. Today's largest production saws weigh around 20 lb., and the better lightweights average around 11 lb.

For most of our purposes, high rpm capability is an advantage. Lightweight saws are available now that turn an incredible 13,000 to 15,000 rpm. These saws are very smooth and quick-cutting for scooping and scoring work. We also prefer vertically oriented cylinders to horizontal (as determined when the saw is in an upright position). Vertical cylinders allow for narrower power heads, which gives a better view of the work, and the vertical piston action seems to give a saw better balance.

The best saws are compact, easy to break down and clean, and have all the preferred design features mentioned above. All these factors being equal, the final choice of a saw will rest on how it "feels" while it's cutting. This is subjective and can only be settled by taking different saws out and cutting with them—something any good saw retailer will let you do.

It's no secret that European saws (primarily Husqvarna, Jonsered and Stihl; see sources of supply, above) are almost universally preferred by those who make their living using chainsaws. The reason for this, in my opinion, is that European saw makers have concentrated on refining the technology, while domestic saw makers have concentrated on building inexpensive machines for the larger homeowner's market. Whatever the reason, European saws generally have better balance and vibration-dampening systems, higher power-to-weight ratios and better chain brakes. Also, the Europeans make the best chrome-impregnated cylinders, which gives their engines longer life.

Chainsaw bars—Bars come in a variety of widths, lengths and tip styles. Most saw shops will offer a choice of bars when you buy a saw (and some will throw in an extra bar as incentive). Good-quality bars will have sprocket tips, where the chain rides over a sprocket at the tip instead of on the bar rails. The sprocket greatly reduces friction and wear at the tip, and for this reason it has replaced the "hard-nosed" bar. A small grease gun is used to keep the sprocket lubricated, and this should be done at every refueling, especially when tip-cutting.

Sources of supply

Husqvarna Forest and Garden Co.
907 W. Irving Park Rd.
Itasca, Il. 60143
708-773-2777

Jonsered
Scotsco
9160 SE 74th Ave.
Portland, Ore. 97206
503-777-4726

Stihl Inc.
P. O. Box 2015
Virginia Beach, Va. 23450-2015
804-486-9100

Mail-order safety equipment
Bailey's
44650 Highway 101
P. O. Box 550
Laytonville, Calif. 95454
800-322-4539

The best bar widths and lengths will depend on the sawing operation and the operator. Generally, the shortest bar that will fit a particular saw is best, simply because it reduces the amount of leverage out in front of the saw. Taller people, however, usually prefer longer bars so they don't have to stoop so much to reach the work.

For most log notching with lightweight saws, we use 16-in. and 18-in. bars. We fit our medium saws with 20-in. bars, which are usually adequate for most crosscutting and ripping. For the deep ripping cut required to Swedish cope, a medium or heavy saw with the shortest bar that can be had works very well.

For scooped notches such as saddle and end copes and for general crosscutting, conventional wide-profile bars are best. Narrow-profile bars are available and are better for scoring and plunging cuts. Because of their smaller tip radii, narrow bars seem to wear out faster.

Log work is very hard on bars, so careful attention to chain lubrication and tension is vital. There's a lot of debate over which brands of bar oil are best, but one thing is certain—always use specially formulated bar oil. Good bar oil should be thick and "stringy." It will become noticeably more viscous in cold weather, so warm the oil in the saw's reservoir by idling the saw for a few minutes before cutting.

A bar that's not getting enough oil will overheat and begin to blue in a matter of minutes. A well-oiled bar will sling oil off the tip when the saw is revved. Another way to check for oil flow is to stop the saw and lift the chain out of the bar groove—there should be a noticeable film of oil on the drive links. Better saws have adjustable oilers that allow you to fine-tune the oil flow and minimize excessive slinging. If a saw starts spitting out a lot of oily wood, it's time to clean the area behind the clutch cover.

Snugly tensioned chain is a must for log notching. To test for proper chain tension, pull the chain away from the top of the bar (photo facing page) and release it. You should be able to pull it out of the bar groove just enough to allow a pencil's diameter to pass through the notch formed by two drive links and the top of the bar, but it should be tight enough to snap back into the bar groove when released.

New chain tends to stretch and has to be retensioned several times during the first hour or so of use. All chains will loosen some as they warm up, so cold adjustment should allow for this.

Chain and chain sharpening—Prior to 1950, the cutting teeth on saw chain looked and functioned like those on a crosscut saw. This was called "scratcher" chain, and was notoriously rough-cutting and difficult to sharpen.

About 1948 an Oregonian named Joe Cox got some ideas for a new type of cutter that were at least partly inspired by his observations of timber beetles. He noticed how efficiently the insects' curved, hook-shaped mandibles severed the wood fibers, and also how one mandible would act as sort of a depth gauge, limiting the amount of bite the cutting mandible could take. Cox applied these observations to the design of a new depth-gauge controlled cutter, which came to be known as "chipper" teeth. Chipper chain was much faster and smoother cutting than scratcher chain, and was easy to sharpen in the field. Cox's chain caught on, and he co-founded Oregon Cutting Systems, now the world's largest manufacturer of saw chain and accessories.

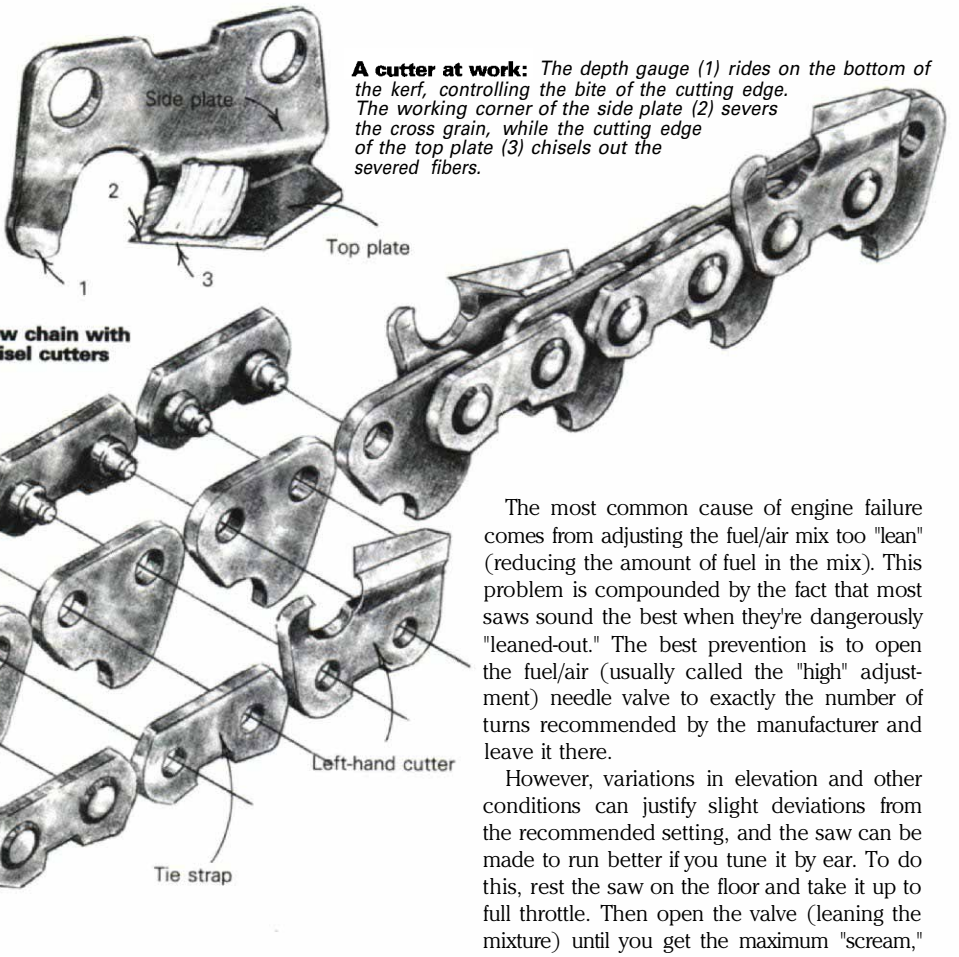
Chipper chain and its refined cousins, "semi-chisel" and "full-chisel" chain, sever wood fibers much the same way that chisels and gouges do (drawing facing page). As shown in the drawing, the cutters alternate, one carving the right side of the kerf and the other the left. The depth gauges determine the amount of wood the cutters can bite (detail drawing, facing page), and the drive links, as the name implies, engage the saw's drive sprocket to power the chain. There are at least five different sizes of chain available, and these sizes are distinguished by referring to their "pitch" and "gauge."

Pitch is a measurement of the drive-link spacing, determined by measuring the distance between three drive links and dividing by two. The pitch of a chain must match the saw's drive sprocket and the bar's tip sprocket. Gauge is the thickness of the drive link where it rides in the bar groove. For obvious reasons, the drive link's gauge has to be the right size for a particular bar groove. Overall chain length is specified by the number of drive links, or by referring to bar length. All bars have a series of numbers stamped near the butt end, and it's useful to know what they mean. Here's a typical example: 380-72-88 means the chain has ⅜-in. pitch, its thickness is 72 gauge, and it has 88 drive links.

On chipper-type cutters, the corner formed by the side and top plates of the cutter is rounded. Chisel-type cutters have a sharp, square edge. Properly sharpened chisel chain

Drawings by Bob Goodfellow unless otherwise noted

A correctly tensioned chain will be loose enough so that you can pull it out of the bar's groove far enough to allow a pencil to pass through the space between the drive link and the bar. It should then snap back when you release it.



A cutter at work: *The depth gauge (1) rides on the bottom of the kerf, controlling the bite of the cutting edge. The working corner of the side plate (2) severs the cross grain, while the cutting edge of the top plate (3) chisels out the severed fibers.*

(Adapted from Oregon Cutting Systems' Maintenance and Safety Manual)

is the fastest cutting chain available and is what we use exclusively. Its drawback is that it will dull somewhat faster, especially if it hits anything abrasive. This is because the sharp angle between the plates forms a fragile point at the cutter's leading edge. If a chisel chain is filed with too much "hook" (the result of filing too deeply into the tooth's gullet, or of using too small a file), it will dull almost instantly. Chipper chain and semi-chisel chain are more forgiving of filing error and are recommended for sawing in dirty wood. You can purchase specially ground ripping chain if you're planning to do a substantial amount of ripping.

Dull chain has caused more grief to chainsaw users than any other single problem. Eventually one learns to stop and sharpen rather than to apply more and more force on the bar. Forcing dull chain is dangerous, and it decreases the life of a saw and a bar. Chain sharpening is somewhat tricky, and getting consistent good results does take practice. But the basics are simple and can be condensed as follows: know when to sharpen, use the correct filing angles, take care to file uniformly.

The sharpness of saw-chain cutters can be judged visually by the standards that apply to any wood-cutting edge: nicked and damaged teeth are obviously not cutting well, and shininess just behind the cutting edge always indicates dullness. On the average, I file about every other time I fill the fuel tank, which can amount to several times a day on a log-building project. But natural dulling from use probably ranks second behind misfiling as a cause of poor cutting chain.

Printed instructions for chain filing—which contain all the information needed to do the job right—can be had anywhere saws are sold, so I won't duplicate them here. You can get a comprehensive manual on chain and bar maintenance from the Oregon Cutting Systems.

Powerhead care—Chainsaws have a reputation for being cantankerous, high-maintenance machines. This reputation may have been deserved by the saws of 30 years ago and is still deserved by poor-quality saws built today. The best modern saws, however, will start easily all the time and run under demanding loads for a thousand hours or more without needing major repairs. Most saw makers do a good job of providing thorough maintenance instructions in their owners' manuals, and they are the best authority for information about specific saws.

Even the best saws can be ruined in a short time by ignoring tuning and maintenance basics (I've learned this the hard way). This is because the core of a chainsaw is a high-rpm two-cycle engine where lubrication and cooling are critical factors. Two-cycle engines get their only lubrication from oil mixed with the gas they burn, so it's essential to use only specially formulated two-cycle oil mixed in the right proportions.

The most common cause of engine failure comes from adjusting the fuel/air mix too "lean" (reducing the amount of fuel in the mix). This problem is compounded by the fact that most saws sound the best when they're dangerously "leaned-out." The best prevention is to open the fuel/air (usually called the "high" adjustment) needle valve to exactly the number of turns recommended by the manufacturer and leave it there.

However, variations in elevation and other conditions can justify slight deviations from the recommended setting, and the saw can be made to run better if you tune it by ear. To do this, rest the saw on the floor and take it up to full throttle. Then open the valve (leaning the mixture) until you get the maximum "scream," or highest rpm, then back it off (enriching the mixture) until the saw starts to "blubber" noticeably. For most high-rpm saws, the blubber should smooth out when the saw is put under a substantial load, but most low-rpm saws should blubber a lot, even when under load. If in doubt, run it rich—fouled plugs are a lot cheaper to replace than scored cylinders and burned bearings. Running at the right mix, the plug's electrodes will be the color of milk chocolate.

After proper tuning, the best way to get maximum life from a saw is to get in the habit of performing a cleaning routine often—about every other refueling. A basic routine should include the bar groove, the area behind the clutch cover, the air filter and carburetor area, and the cylinder cooling fins and flywheel fins.

Using a compressed-air blowgun is by far the best way to get the oily crud off the saw surfaces, but lacking this, a toothbrush or a small brush dipped in a bit of gas will do the job. Avoid the temptation to douse the saw with gas—it will deteriorate the rubber components of the vibration-dampening system.

Breaking down a saw for cleaning and putting it back together again will seem like a big job at first, but after some practice you'll be able to do it blindfolded in five minutes. Besides, on a log-building job, saw cleaning is a great way to dodge work while making yourself look like a fastidious person. □

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