A LESSON FROM NATURE:

JOE COX AND HIS REVOLUTIONARY SAW CHAIN

by Ellis Lucia

American ingenuity, enhanced by freedom of enterprise, is credited with much of the mechanical, industrial, and scientific progress of the United States. Amateur inventors working anonymously in drafty barns, garages, and basements have launched everything from the gasoline engine and the horseless carriage to the first flying machine, electric light bulbs, automobile turn signals, and even spray nozzles for home plumbing. Some inventions, like the typewriter and television, brought on great social upheavals. Others were merely for the sake of convenience or amusement, and appealed to Americans' intense love of gadgetry.

If any single group could be classed among the world's leading inventors, however, the title might very well go to the loggers and their first cousins, the sawmill workers. Before the development of modern power equipment (and probably even now) loggers and lumberjacks were constantly on the lookout for any shortcut—a better way of doing things—that would make the job easier and faster and save their aching backs. Dreams of such fantastic gear inspired the legend of Paul Bunyan. Fame and fortune weren't the primary objectives, and education had little to do with it; in fact, book learning might even prove a hindrance.

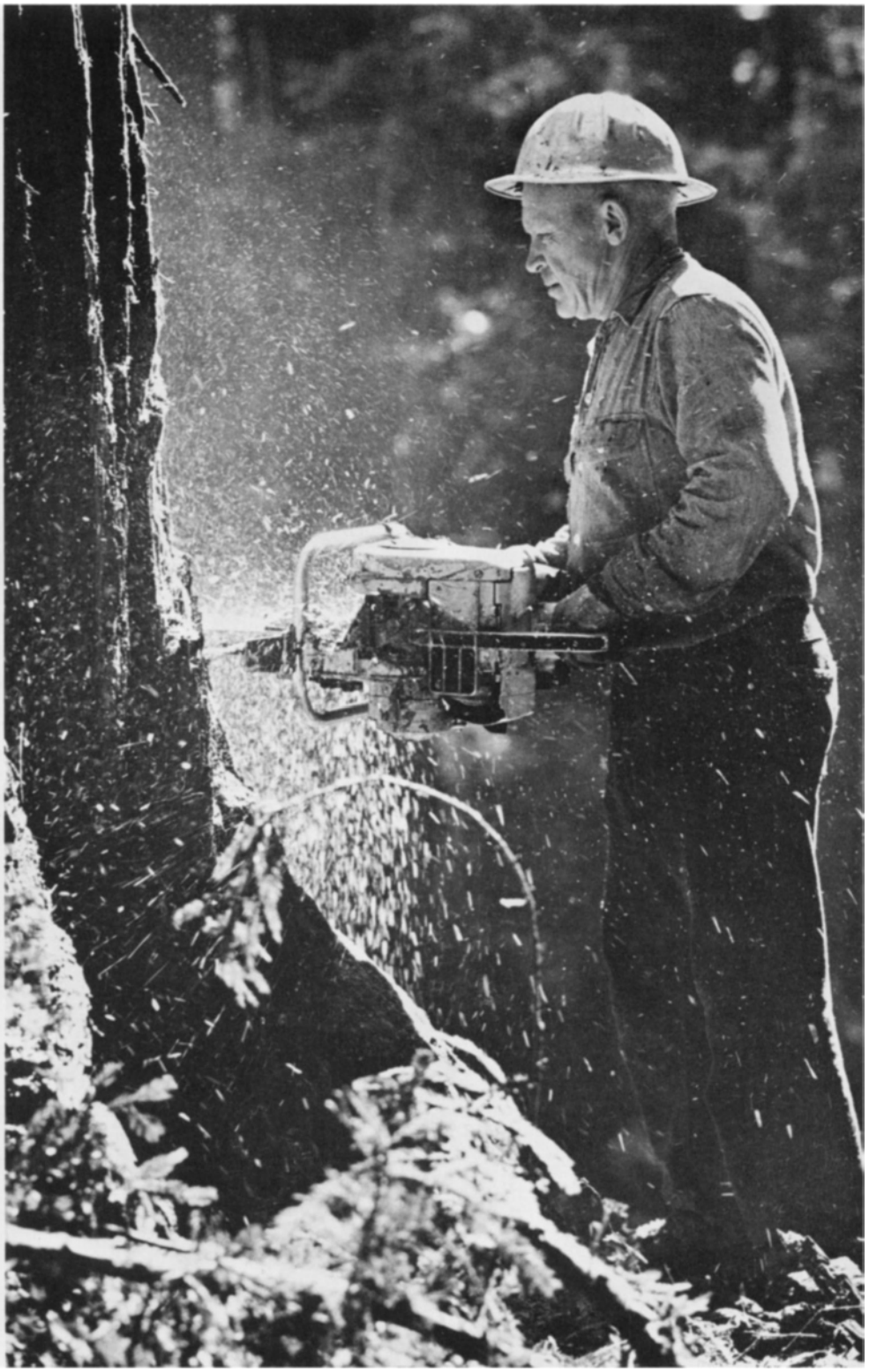
While some "good ideas" might be patented, loggers and sawmill men generally "borrowed" from each other, freely and good-naturedly. My paternal grandfather, a French Canadian, designed and built sawmills in Michigan and Wisconsin. Along the way he developed a number of devices still in use today, including a log roller for handling the big stuff on its way to the head rig, and a fire hydrant to protect company towns against the rapidly spreading blazes so common to the industry. Both were widely copied, and he never got rich from them, save for his own personal pride and self-esteem. If he did, he must have buried the loot, for none of the family ever found it.

Loggers of yesteryear are often portrayed as ignoramuses who spent their free time in skid-road dives, fighting and carousing. Yet more than a few of them helped improve their own industry with their tinkering, and some changed the world. Consider John Dolbeer who grew tired of wrestling bull teams in the redwood country of northern California. He worked out a system of snaking logs from the woods with steam power. Up on Puget Sound, author Archie Binns's father did something similar, but maybe because his back didn't hurt enough, he let the idea go, seeing little sense in it. Dolbeer envisioned the potential and created the first woods engine to revolutionize logging. He called it a donkey, and it turned bull teams into lumber camp meals.

Then there was Ephraim Shay of Michigan, who grew equally irritated that conventional-drive steam locomotives hadn't been adapted to backwoods logging operations. Shay built a geared locomotive that was flexible enough to climb steep grades with heavy loads. Thereafter, railroads reached deep into the backcountry, where loggers found other uses for the lokies in idle moments—hot water for baths and steam to fumigate the bunkhouses. Nobody should ever sell short the ingenuity of loggers.

When the gasoline or internal combustion engine promised another wholesale upheaval in the woods, Henry Ford made a special trip to the Pacific Northwest "to see what they're doing with my trucks." The loggers were at it again, giving birth to the first gasoline-powered log haulers that would eventually replace steam power and railroads.

And then there was Ed Stamm of Portland, Oregon, a logging superintendent for the Crown Zellerbach Corporation. Legend has it (but it's well substantiated) that Stamm's mind was never far removed from the tall and uncut. On a fateful vacation trip to Chicago, Stamm happened onto a municipal dump. He watched with fascination as a tractor rig spread out the refuse with a huge sheet-metal plate bolted to the front end. By then, gasoline-driven tractors were already in the Pacific Northwest woods, but this was something new. Stamm envisioned such a machine for building railroad



As late as the mid-1940s, loggers were still cutting timber with muscle-power—the falling ax and the crosscut saw—much as they had done for decades. Shortly after the war, however, the development of lightweight power saws and much-improved cutting chain combined to ease the logger's physical burdens. At right, a veteran faller cuts a redwood for the Santa Cruz Lumber Company in 1971.

Top left—Ellis Lucia Collection; bottom left—FHS Collection; right—Vester Dick Photography, FHS Collection

grades and roads, rather than dragline scrapers and steam shovels.

Returning to Portland, Stamm approached his friend, Ernie Swigert, who was nursing a new heavy-equipment company called Hyster. Would Swigert build him such a rig? He would, and did, and soon a pilot bulldozer was introduced to the woods. Naturally, before long others were hollering "me too." And yet from this logger's idea evolved the tough, powerful, and versatile earthmover (loggers called them "cats" or "dozers") that became the basic tool of heavy construction worldwide, and has been in the front lines of Uncle Sam's military efforts since the Pacific island-hopping days of World War II.

Despite all the mechanical and technological changes in the timber industry during the first half of this century, one key activity remained almost as primitive as the day man cut down the first tree. It was the first act—the felling and bucking of timber—that challenged Joe Cox to save his fellow loggers some muscle power. His native ingenuity, together with some inspiration from lowly wood worms, led to the invention of a saw chain that accelerated another fundamental change in the forest—the widespread use of labor-saving power saws.

The unhappy chore of cutting down trees and slicing them into manageable logs hadn't changed much in decades. Crosscut saws, those cursed misery whips, were the lone holdout of an age that was almost gone. It wasn't simply a reluctance on the part of fallers and buckers to modernize, although that was part of it, for loggers didn't appreciate the smell of petroleum and carbon monoxide. It was, first and foremost, that many early power saws were not only cumbersome but also simply didn't do the job. In a way, it was strange, for mechanization had come to the woods as it had to the lumbering end of the game, and power rigs were being constantly changed and improved. The advent of the gasoline engine and then the diesel caused another "revolution" in getting sticks to the mills, so that steam power was bulldozed out of the woods. Logging outfits were ripping up their railroads and junking their proud locomotives in favor of the internal-combustion engine, turning railroad beds into roads for wheezing trucks, and even replacing steam donkeys with gas engines to yard the sticks and load them onto trucks or railroad cars.

The changeover to gasoline-driven power was the beginning of the final chapter of the timber industry's great industrialization, a revolution that is still going on today. Yet while all else—save perhaps for the poor choker setter—was being mechanized, the felling and bucking of trees remained stagnant. Lumberjacks still stood on springboards and leaned into the great crosscuts, even though they were beginning to live in towns with wives, families, and home comforts, commuting each day in their own private cars to the woods.

There had been many attempts to develop some kind of power saw, but mostly these were unwieldy tools, difficult to handle and move from tree to tree, and often undependable, breaking down under the rugged demands of dropping the hefty giants. Visions of a practical, portable power saw extended back generations, and the dreams were vivid among the older fallers who were beginning to feel their years as they fought the thick hides and inner fibers of the big trees, and came home with aching backs. The power saw had been considered for at least a century, but just what form such a rig should take was a matter of debate and rough opinion among loggers, dreamers, and would-be inventors. There was a definite leaning toward some kind of "chain" saw that would link saw teeth into an endless belt to be powered through the saw kerf to make the cut, rather than the style of rig where the motor would drag a saw blade across the wood in the manner of the timber fallers.

There were numerous experiments with power saws. James Shand, a Manitoba farmer and millwright, patented his "endless chain" saw in 1918 and took a gasoline-powered model to British Columbia, hoping to interest the lumber industry in its production. Failing to do so, Shand allowed his patent rights to lapse in 1930.

History Division, British Columbia Provincial Museum

In 1858 the U. S. Patent Office issued the first chain saw patent to Harvey Brown of New York City for an "endless sectional sawing mechanism" of insert saw teeth. In reality, it was a band saw with a series of hinged sections riding on hexagonal pulleys and operating in a slotted guide plate. Five years later, a second patent was issued to George Kammerl, also of New York, under the title "Improvements of Endless Saws." Kammerl described his invention as "a saw blade that is formed of an endless chain, the outside edge of which carries the required teeth adapted to cutting wood or other material, this whole chain or chain saw blade moving continuously in one single direction over a system of grooved pulleys, one or more of which receive the required motive power. . . ." Unlike its predecessor, the Kammerl rig had no guide plate, relying instead upon pulley tension, and this arrangement was concluded to be fundamentally unsound.

Apparently neither of these ideas got off the drawing board, although the basic principle of today's power saws was very evident. The vision of drawing some kind of linked teeth through the saw kerf was there from the beginning, and certainly others had the idea before 1858, for it seemed the natural thing to anyone

bent on the agonizing task of sawing wood. The chain idea may have been conceived abroad. But in the latter half of the nineteenth century, at least a dozen patents were issued in the United States, although none of them considered the matter of power nor was clear as to whether the saw would be stationary or portable. And no chain saw was manufactured. Ironically, too, the sawmills had long since found methods to power circular saws for cutting lumber, through water and then steam and electrical energy, where once they, too, had been hand and muscle operations. But the system used by the mills wouldn't work in the brush—at least not for a long time.

All the while, there were constant efforts to develop other kinds of power saws, many of them extensions of the sawmill style. An old print, first published in 1871, showed operation of a steam-powered portable rig employing a saw blade similar in shape to the regulation misery harp, which was attached to a power wheel drawing it back and forth through the kerf, with steam power furnished from a portable boiler. The "Ransome Steam Tree Feller and Log Cross-Cutting Machine" was shown in the sketch being used for both felling and bucking. The efficiency of the drag saw had long been accepted, but this huge and obviously cumbersome rig apparently didn't fill the bill, although one group of visionaries maintained that the nucleus was there—that this was the obvious route to follow in developing a workable, portable power saw for the woods. Others contended that a full break should be made with the saw, that some new kind of cutting tool needed to be developed, such as a high-speed cutter head or boring machine. A third group favored the chain as the way to ease one of the most physical jobs in the woods. As for the power, it could come from steam, gasoline, or maybe even air.

In England a hand-operated chain saw was patented in 1900 by a William Stanley of South Norwood. But the real thrust of chain power saw development came in the big woods of the Pacific Northwest and in the northern California redwood empire, where dreams were replaced with stark realities, as in the case of the mythical loggers' skyhook, which would one day become the reality of balloon and helicopter logging.

Communications weren't what they are today, so that new ways of doing things could take a long while spreading from camp to camp, perhaps first carried by transient loggers. The exchange of ideas was one of the prime purposes of the Pacific Logging Congress and similar gatherings of loggers and lumbermen. In the summer of 1905, an experiment was made in the redwood forests of northern California. At Eureka, near Sequoia Park, the first chain power saw operating from a gasoline engine on the West Coast (perhaps the first in the country) was tested. The name of the inventor is lost, but a number of lumbermen witnessed the event. The chain saw rig, a strange-appearing contraption, was powered by a two-cylinder, water-cooled, marine-type motor, with fuel and water coolant provided from tanks suspended on a tree high above the engine level. And it worked; the saw cut through a ten-foot log in four and a half minutes, which in itself was something of an achievement.

The following year the Potlatch Lumber Company of Idaho developed a crude log-deck chain saw operation, which again was strictly a local contraption. It was noted by Charles Wolf, however, who improved upon the idea in 1908 for the Blackwell Lumber Company of Coeur d'Alene, Idaho. Still, nobody took the trouble to patent these machines and promote the equipment for widespread sale, although the Blackwell saw was later manufactured in limited quantity by the Union Iron Works. The problem remained the terrible size and weight of the power equipment.

Others got into the act; any number of hard-bitten practical lumberjacks tried their hands at developing a workable chain saw, alongside logging machinists, mechanical engineers, and backwoods inventors, of which the industry spawned so many. Charlie Wolf wasn't finished by any means. He spent a decade studying the chain saw problem from every angle, and then in 1920, under his own patents, he introduced what ranks as the first successful portable chain saw, putting it into production at his own Peninsula Iron Works in Portland. He called it the "Wolf Electric Drive Link Saw," powered by an electric motor driven off a portable generator and, amazingly, manufactured in three sizes, which weighed from seventy to ninety pounds.

The power saw complication was a dual one—the development of a small yet powerful motor, and the manufacture of a stout and effective cutting chain. The Wolf equipment dealt with both basic factors in an effective manner, at least for the time and place. The saw chain was similar to the conventional two-cutter-tooth crosscut, with its cutters and rakers on separate links that could be easily replaced, and also could be filed and set in the same manner as a standard crosscut. The Wolf saw operated in either direction, a distinct advantage, for when cutters and rakers were dulled from moving in one direction, the drive could be reversed, bringing the opposite cutters into action. Another innovation was that the cutters and rakers played in opposition to each other, thus offsetting the bucking tendency that plagued other pioneer chain saws. This improvement also made it possible to employ shorter chain lengths and smaller sprockets, thus eliminating the need for tension, which resulted in excessive wear.

The Wolf saw was certainly a huge step forward, and, with a few modifications, it might have put the industry of the twenties well in advance of the power saw revolution that eventually came about. But the Wolf saw was too far ahead of its time, for suddenly the manufacturer was square against an unanticipated problem. Many loggers balked, setting their calked boots solidly against using these mechanized gadgets. What had been good enough for their fathers

Later experiments included the cumbersome Wade drag saw, ca. 1930, which was a gasoline-powered rig used to buck logs. Since it pushed a crosscut blade back and forth, it shared little in concept with the chain saw at right, which was described in 1943 as an "electric tree felling machine." Drawing power from a portable generator, this saw permitted two loggers of the St. Paul and Tacoma Lumber Company to drop a mature noble fir in twelve minutes.

Left—Oregon Historical Society, courtesy of author; right—U. S. Forest Service photo, FHS Collection

and grandfathers was good enough for them! As they were doing with the early foresters, the loggers sneered at the power saws and ran the salesmen from the woods. There was also the age-old fear that the power saws would eliminate jobs. And any failure of the gear, such as a lost nut or bolt, a power failure, or a general breakdown, was seized upon by the timber beasts as ample demonstration that the new rigs were nothing more than nuisances.

The adage that "a prophet is not without honor, save in his own country" held special meaning for Charlie Wolf. Ironically, with this vast timber industry at his doorstep, for which he built and was manufacturing this saw, Wolf was forced to turn to other markets—the construction trade, general contractors, the military, railroads, pole yards, mines, and shipbuilders. Between the two world wars, the Wolf saw enjoyed virtually an international monopoly, although there were potential competitors in the United States and abroad who were attempting to enter the business, believing that eventually the power saw must be accepted in the woods.

Much of this latter-day pioneering took place in Europe. Smaller gasoline engines were being developed successfully, especially in Germany where Andreas Stihl was finding ways to reduce the cumbersome size of stationary deck and pond chain saws for loggers' use in the Black Forest. In 1925 Stihl managed to develop a two-man chain power saw weighing 140 pounds, which was nevertheless "portable." His first one sold quickly after a demonstration. He built another and another, and at the Leipzig Fair of 1929, two saws brought eager orders from neighboring countries, opening the way for Stihl's company to develop a healthy export business, which turned it into one of the largest chain saw manufacturers in the world. Yet, as in the United States, his salesmen were confronted by the same kind of opposition that Wolf met; the loggers chased them off and wouldn't consider anything to replace the misery whips. Germany too was in economic straits, and the loggers feared for their jobs.

The Europeans' small gasoline engine was a threat to the Wolf saw. To keep pace, Wolf offered the saw with either a pneumatic motor or gasoline engine, as well as the electric unit. Beyond this, most American manufacturers were dragging far behind, for they were still hung up on the matter of weight. In about 1933, for example, the Dow Pump and Diesel Engine Company of Alameda, California, made a gasoline-driven saw mounted on bicycle wheels. The saw weighed 490 pounds, much too heavy for easy maneuvering, and was also unwieldy for shifting from location to location in the forests, and therefore was a magnificent failure. There were more attempts to develop an acceptable machine, even a throwback to the original Kammerl idea, but nothing worked, and there actually seemed to be both a lack of demand and enthusiasm, which left little room for progress, since a dire necessity and a mounting demand are what spark American inge-

nuity. Meanwhile, as lumberjacks continued pulling the primitive crosscuts, the forest industries were making amazing progress in getting out the logs, in fire fighting and prevention, and even in living conditions. But if the lumberjack cared about power saws, he didn't exhibit much interest.

Then, in 1936, the H. A. Stihl Company of Germany began exporting a unique forty-six pound chain saw with an excellent lightweight engine, which immediately caught the eye of the Depression-ridden timber industry. The saw was exported first to the pulpwood areas of eastern Canada, to be purchased and tested by a cautious few. It drifted west to the timberlands of British Columbia, and by the following year an ambitious agent was exporting the saw to a Seattle mill and mining supply company. A few were sold, but there was still that hanging back.

At the same time, however, the U. S. Forest Service launched an "equipment development laboratory" in Portland under the direction of T. P. Flynn. One of the laboratory's first projects was to test, rebuild, and modify chain saws for application in the big woods. Demonstrations were held at the logging congresses and wherever else large numbers of lumberjacks and lumbermen were likely to congregate. The Stihl saw was now being vigorously promoted. The upshot of all this, along with the investigation by the forest laboratory, spurred interest in the new saws, at long last improving the climate for acceptance in the woods.

But just as things were beginning to take hold, Hitler marched into Poland and the Stihl supply was cut off, perhaps forever, from the American market. When Pearl Harbor brought the United States into the global war, many loggers left the woods for the armed forces or for higher-paying jobs in the shipyards. Lumber became a critical war material, and, as in World War I, the military demand was mounting just as the woods felt the pinch of the labor shortage. Suddenly, power saws were in great demand by the timbermen, and at the same time, the army and navy were also calling for them.

Stihl was completely out of the picture, being on the side of the enemy, so that the D. J. Smith Equipment Company of Vancouver and the Mill and Mine Supply Company of Seattle, which were marketing the saws, had to begin manufacturing them to stay in business. In 1938-1939 there was only the Wolf saw being made on the North American continent, by the Reed-Prentice Corporation of Worcester, Massachusetts, under the Wolf patent and an agreement with the Portland firm, which couldn't contend with economic production problems. But by late 1941 there were a half-dozen outfits producing power saws, mostly gas-driven and patterned after the Stihl rigs, which no longer enjoyed patent protection. Americans were not only interested in the power unit but also copied the Stihl chain, which had several advantages: it could be manufactured cheaply and was reasonably tough and rugged; the logging industry was somewhat familiar with it, making it most readily acceptable; and, in character with the American business mind's tendency to cut costs wherever possible, the Stihl chain was up for grabs, with no royalty payment required. Thus, after almost a century, the power saw became light enough and dependable enough, especially under wartime pressures, to be acceptable to the American lumberjack.

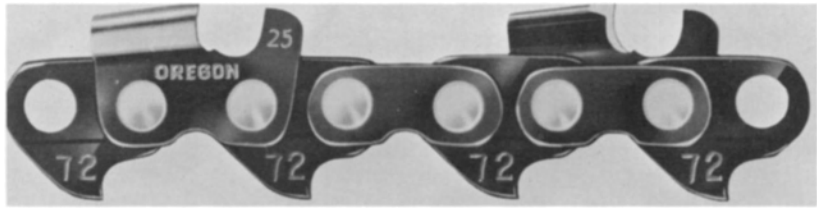
Power saws needed to be tough to withstand the rigors of the Northwest forests and those huge trees. Gradually, improvements were made in sprockets and bars, the latter needing a tough, light metal to keep them in true line during the cutting process. But there was also dissatisfaction with the cutting chain, which clung to the traditional approach of the old crosscut's teeth being dragged through the saw kerf, tearing and ripping at the wood fibers, on the principle of running a sharp nail over the surface of a piece of wood. The principle worked, but the cutting action was very rough, and there was a lot of waste. Also, the saw chains didn't hold up too well, and as much time was lost in resharpening the cutting chains as was spent in actually felling the big stuff. Some concluded that the old crosscuts were more efficient and hence returned to them.

Along came Joe Cox, a thin-faced logger with a sharp jaw who had knocked about the West for a number of years and finally wandered into the forests of the Pacific Northwest. Cox, born in Oklahoma, wasn't strictly a lumberjack; he'd left home at age sixteen to work in the railroad shops of the Denver and Rio Grande Western at Grand Junction, Colorado, where he stayed two years. By the time he came to the Northwest, he had served a solid apprenticeship, self-made, as a machinist. Following the railroad stint, he and his brother-in-law began an automobile agency at Fruita, Colorado, and then a bus line. In those enterprises he learned a lot about mechanics, motor repair, and welding, which landed him a job building a new gas line to San Francisco. Then he worked on the construction of powdered-milk processing plants for the Golden States Milk Company, an intricate and complicated project. Cox didn't have a college degree but he was an engineer in every sense, typical of his generation, which learned the tough way how to make things work through hard-bitten trial and error; and he had an unbridled ingenuity and the willingness to attempt anything that might provide an answer to a mechanical problem.

Cox moved to Arizona, where he and a brother set up a small welding shop. They repaired cars and wired many homes. He also designed and manufactured a highly successful water heater for home use. When things slowed down, Cox shifted to Texas, where he welded oil-drilling equipment. Then the brothers decided to try Oregon; they were suddenly confronted by a new world of logging and lumbering.

Of course, most manufacturers are still trying to develop better saw chains, and it may be that someone will come up with a superior chain of radically different design. Since the saw chain is the most important element in any chain sawing apparatus, he who develops the best chain should dominate the entire field, and he who dominates the field will find himself in a multimillion dollar business.

Charles I. Miller, "History of Chain Saws," *Southern Lumberman*, April 15, 1949.



The real breakthrough in chain saw efficiency came with development of a unique type of saw chain by Joe Cox, logger and sparetime inventor. Cox took a lesson from nature by watching the destructive larvae of the timber beetle (Ergates spiculatus) for many hours. The wood worms' cutting action was left and right, side to side, rather than scratching or burrowing straight ahead. Cox (here photographed in 1974) adapted the concept to a chain of his own design. Put into production in the late 1940s, Cox's Oregon brand saw chain was an immediate success and the foundation of Omark Industries, a Portland-based corporation that still dominates a worldwide market.

"We felled, limbed, and bucked small frozen knotty pine timber in three feet of snow our first winter here," Cox remembered. "We were paid fifty cents a thousand. We earned about four dollars for ten hours of hard work, and it was hard."

Cox "went through the chairs" in the woods, learning every job. He couldn't help noticing that there was a decided movement in logging toward mechanization, and this sent the inventive wheels spinning in his own mind. One morning near Chiloquin, east of the Cascades, the brothers were asked to try out a strange contraption. It was a power stump saw, driven by a motorcycle motor and mounted on wheels, like a push-cart. The power saw used a laminated bar about a foot wide but was quite inefficient. The rig just didn't cut very well.

"We couldn't fall a tree as quick as we could with a hand saw," Cox recalled. "This seemed strange to me because the power saw had plenty of stuff. I was a pretty fair filer at the time and figured that if I could make a power saw cut as efficiently as a crosscut, it should practically fall through the wood. It just made sense, and with such a cutting tool, sawing timber would be a lot easier."

Filing the notion in his mind, Joe began trying to come up with something that would do a better job than the scratcher chains. Somehow he felt the answer would be found in Nature herself. One day while cutting firewood, he laid his ax into an old stump. Suddenly he stopped, for he'd cut into a small tunnel of our most celebrated and destructive "woodsawyer," the timber beetle, or scientifically, *Ergates spiculatus*. The larvae of this beetle, cursed in the kind of verbiage formerly applied to oxen by the old bullwhackers, have an amazing ability for cutting and destroying huge quantities of timber, although the busy grub is hardly the size of a stout man's finger. The hated grub turns good timber into sawdust, and it doesn't matter whether the trees are alive or sound snags and windfalls that might be salvaged. The winged adult beetle deposits its eggs beneath the bark of a dead tree, or when faced with an overpopulation problem, under the bark of living trees. The vast Tillamook Burn and other regional forest disasters promised feasts that would last the timber beetle and his offspring many generations, although the way they worked, wholesale destruction of salvageable timber might be accomplished in a few brief years.

Logger Cox, hoping that none of his lumberjack friends were watching, suddenly asked himself, "How do they do it?" as he bent over the tiny tunnel of that hollow stump. Although he was readily familiar with the cursed beetle, he'd never thought about them before in the terms now coming to his mind. What amazed Joe was the force with which the grub bored through sound timber, either with or across the grain, at its own will, leaving an astounding pile of sawdust in its wake. He observed that the grub's head was armed with two sharp, tough woodcutters. Securing a magnifying glass, Cox spent many hours studying the boring action of *Ergates spiculatus*. He put the sawdust left in its wake under a microscope. He was most intrigued by the grub's cutting action—left and right, side to side, rather than scratching or burrowing directly ahead. It was an amazing technique that started to haunt Joe Cox. Something began germinating in his mind.

In the basement of his two-story frame house in

Portland, Cox designed a different kind of cutting chain, applying the principle learned from the timber beetle, of cutting left and right and to the sides, rather than scratching away at the wood. The result was a revolutionary chain that not only cut faster and better but also could be used longer without resharpening.

Cox patented his idea, but it was some time before he could get his chain onto the market. He worked as a blacksmith and sold saws as a fieldman to make a living. In 1947 he established his own company, called Oregon Saw Chain Corporation, and continued his testing on various kinds of timber, including two giant sequoias felled at Forest Grove. His small manufacturing "plant" was the basement of his house, where he set up two assembly tables and had a payroll of four. The first year, the firm sold $300,000 in saw chain, for the Cox product apparently really worked and thus cleared the last remaining hurdle for efficient use of power saws in the woods. Cox couldn't keep up with the demand from his Portland home. The following year, he moved the operation into an old converted repair garage. The payroll jumped to twelve persons, one of them a personable twenty-eight-year-old graduate of the Harvard Business School. As assistant general manager, John Gray was given a keg of nails to sit on at a big worktable, which he shared with the general manager. And Joe Cox was running around in coveralls, sweatshirt, and baseball cap, supervising everything and projecting his ideas for the machinery that was turning out this unique saw chain.

Cox's jackpot idea forced them to move again two years later into a building that could accommodate some seventy workers, and by 1955, with sales reaching $7 million, into a permanent location on the southeast edge of Portland. The company continued growing, for the demand for Cox's bug chain became worldwide. Entry into the foreign market caused a name change in 1957. At the urging of the sales force, "Omark" was derived from the phrase "Oregon mark," using the letter "O" and the latter half of "trademark." "Omark" was far easier to pronounce and understand in lands abroad. But the chain itself continued to carry its original brand, Oregon Saw Chain. Manufactured in several dozen sizes, the total production over thirty years would doubtlessly stretch around the world a good many times. Although the firm left the chain saw power units to others, it did branch out into the manufacture of saw accessories and to allied equipment, such as hydraulic log loaders, fasteners, cutting tools, sporting ammunition, and assorted items for do-it-yourself firewood consumers. By 1980 Omark Industries employed 4,400 people, manufactured products in seventeen plants in five countries, and reported annual sales of more than $250 million.

The power saw today has worldwide acceptance. There are photographs of Africans and South American Indians in loincloths using the chain saws deep in their own tropical jungles. But they're more than logging equipment now. Countless thousands of private citizens consider them a necessary tool for homes and yards, for the second property in the mountains or at the coast, for keeping down the brush, clearing the land, cutting winter's firewood from logs cast upon the beaches, and for a dozen other uses. Many fire departments have added chain saws to their fire-fighting equipment. Counties, municipalities, and other public agencies have arsenals of power saws for rapid cleanup following such disasters as ice storms and windstorms. Most of them use Joe Cox's bug chain. And the old weight problem has been licked, too, with power units that weigh slightly less than seven pounds and will cut through a five-inch log in six seconds. You can't do much better than that.

As for Joe Cox, he became wealthy, went on to other inventive glories, turned things over to John Gray and sought a warmer climate in California, where I wonder if he ever thought about that fateful day when he swung his logger's ax into that hollow stump and his eye lit on the tunnel of *Ergates spiculatus*. □