himself says, he must wait, sometimes for years, until he sees those patterns and forms in the tree, the log, the raw timber; and then evokes them.

It is a quiet enterprise, and Nakashima is an extraordinarily quiet man. He is one of the quietest and most serene persons I have ever known. So-called quietism is something else, meaning passivity. But Nakashima's is the Karma Yoga, the yoga of action. He is the creator, the builder, the comrade of hills and streams and woods. They speak only to the silent, the attentive listener. Nakashima's silence goes with his wisdom of things. Even among persons, the most important communications are wordless. When Nakashima talks, it is quietly, spaced with silences, translated out of a greater, endless, wordless conversation.

As he says, he makes the dead wood live again in new ways. I am reminded of a story told me by my Northern Cheyenne friend, Hyemeyohsts Storm, who wrote the great "Seven Arrows." He said that once, when he was a boy of twelve, his uncle let him drive the tractor, pulling a mower. He was going along, feeling proud and grown-up, when suddenly he realized that he had run over a nest of rabbits. The older rabbits had been spry enough to get away; but when he got down to see what had happened he found that the mower had cut off the legs of a baby rabbit. As he held the little corpse, feeling a bit sick, his uncle came up and said, "Ah! I see you have cut off *your legs!* Now you must eat that little rabbit, *so that it can run again!*"

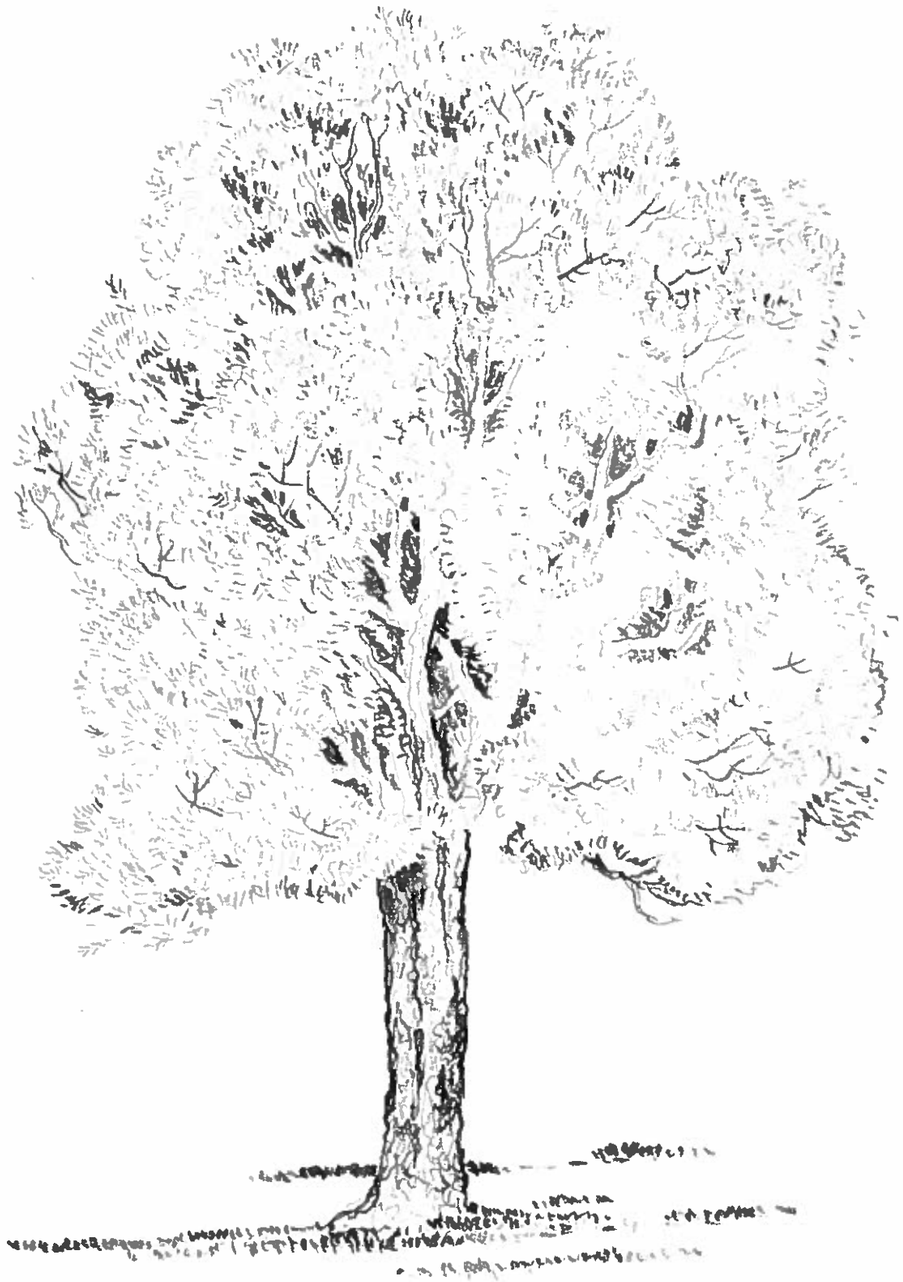
In this century it has become commonplace to declare that everything is relative. Not so, either in science or in art. The important thing is to know which things are relative, which universal. In all this Universe there are no further chemical elements than those we know or can prepare synthetically here. In the same sense, I think that good art is universal. It knows no barriers of space, time or culture. We recognize it at once in cave paintings of 12,000 B.C., in the tribal sculptures of Africa, New Guinea or the American Northwest Coast; in the pottery of ancient Peru, Mexico, China, Crete and Persia. We, as undoubtedly our forebears, have produced, along with the good, much bad art. In the long run, we recognize that too.

Nakashima says that we have not made a great building for two hundred years That is just the age of the Industrial Revolution. For a time, the Industrial Revolution promised humanity endless leisure and abundance; but in one massive convolution which has been gathering momentum throughout the past century, it is spreading a pervasive ugliness wherever it reaches, is devastating the planet, and now, in the suicidal preparation for nuclear war, is threatening the human species with self-extinction.

If that ultimate disaster should come—and it may, as Nakashima knows and we are both in the struggle to prevent—and some human beings survive, they will find again in time the beautiful and meaningful things their forebears fashioned, and will be proud again of what it most means to be human, to be on this planet the singular animal that knows and creates, *Homo sapiens* and *faber*, man the scientist and artist.

It is people like Nakashima who in every age realize that human promise, who construct our abiding human heritage. For things made of stone, and clay and wood endure, even as the generations come and go and cities and civilizations rise and fall. And the trees will be there as always, watching in silent witness as they have done throughout the ages.

George Wald
Cambridge, Mass.



The European walnut is called variously English, French, Italian, Circassian, Persian, and Kashmiri walnut, depending on where it is found growing. The bark is usually gray. The wood is also a shade of gray but varies considerably from tree to tree. Some walnut wood has areas that are almost black. The grain, in general, is extremely well figured, sometimes burled. The sapwood from a healthy tree is almost white, maturing to a warm gray when properly cured. Seen in profile, the European walnut, like its American cousin, is easily recognizable because of its rich, heavy branching.

Introduction

A tree provides perhaps our most intimate contact with nature. A tree sits like an avatar, an embodiment of the immutable, far beyond the pains of man. There are specimens, like the Yaku *sugi*, a type of Japanese cedar, which in their single lives have spanned the entire history of civilized man. These specimens were already substantial trees when Mohenjo–Daro was in flower and Europe lived in caves. Hundreds of generations have marched past. Civilizations much greater than ours have risen and turned to dust.

We woodworkers have the audacity to shape timber from these noble trees. In a sense it is our Karma Yoga, the path of action we must take to lead to our union with the Divine. Each tree, each part of each tree, has its own particular destiny and its own special relationship to be fulfilled. We roam the world to find our relationships with these trees.

There was a cedar from the Island of Yaku with a rotted-out core as large as a small cottage. Hundreds of years before it had been cut down for timber, some thirty feet above ground level. Now, its remains stood, surrounded by a crown of small trees which sprang from its living cambium, or outside layer.

There are also examples of such cuttings in the Ho River rain forest in the Pacific Northwest, with fantastic burls and figures, slowly crumbling to dust.

It is sad that some of these noble trees, awesome cathedrals of the forests, are debauched by the greed, insensitivity and gracelessness of man.

We work with boards from these trees, to fulfill their yearning for a second life, to release their richness and beauty. From these planks we fashion objects useful to man, and if nature wills, things of beauty. In any case, these objects harmonize the rhythms of nature to fulfill the tree's destiny and ours.

Each flitch, each board, each plank can have only one ideal use. The woodworker, applying a thousand skills, must find that ideal use and then shape the wood to realize its true potential. The result is our ultimate object, plain and simple.

The bitterbrush, similar in general appearance to the sagebrush but very slow-growing, is found in the Idaho Desert and other harsh Western environments. The bush shown here is about two hundred and fifty years old; it is four inches wide at the base and two and a half feet high.

6

The Pith Center

My kinship with the tree dates from the day I first stood among the great forest giants in the rain forest of Washington's Ho River valley. Later, in Japan, my meeting with the twelve-hundred-year-old *keyaki*, an oriental elm, in a temple garden in Takamatsu—with only one living branch left—heightened my sense of wonder and spurred me in my search for the origin of the noble tree.

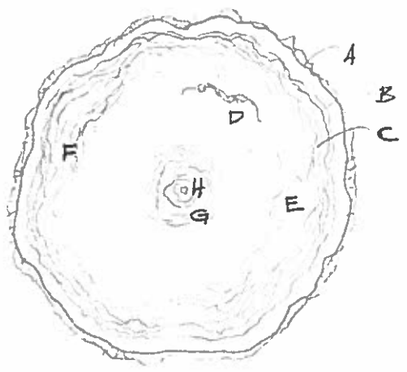
Trees spring from tiny seedlings only two hands tall. From such small beginnings, great trees can develop. Consider the Yaku *sugi* which may attain a diameter of forty feet and an age of five thousand years. The pith may still be there, although often it has rotted away. Should the center still remain, it still has the same diameter and height that it had in the beginning of its life. It experiences an existence unknown in the animal world. The seedling of this ancient tree germinated many millennia ago during the age of the Vedic spiritual poets. The seedling then started the process of life and growth which continues to this day. It is hard to perceive the destiny of the genes in this small bit of life. There must have been some relationship with a greater spirit.

The pith could easily have been reduced to dust during this long period of life, since the core of a tree, botanically dead, has a tendency to deteriorate. But the tree lives on, producing an infinity of new cells year after year.

Over the millennia the continuous living juices have risen on the inner side of the cambium layer, the xylem, to the peak of its leafing, returning on the outer side of the cambium, the phloem, with its sugars to produce the body, the structure of the tree.

The cambium layer houses the tree's living tissue. Each cell carries on its task of transporting vital fluids until new growth takes over its duties. The cell passes into the core, the heartwood. The staggering total of fluids rising and falling in the trees around the world constitutes a veritable Niagara.

The roots of a tree, too, have vital functions to perform. They anchor the tree. They search for water, without which the tree cannot survive. In dry areas, roots range far and wide, hunting water. Many hardy trees like the oak have a main root, called a



A BARK
B CAMBIUM LAYER
C HEART WOOD BEGINS
D WIND SHAKE (year of the storms)
E WET YEARS (open fast growth)
F DRY YEARS (Tight slow growth)
G EARLY FAST GROWTH
H PITH

This cross section of a tree shows how much trees develop around the pith. Each concentric layer of wood indicates a year's growth in temperate climates. Trees of the tropics don't always have such annual rings, but where they do appear they represent extreme contrasts between wet and dry.

The older, inactive, central wood of a tree, called the heartwood, is usually darker and harder than the newer growth, the light, sometimes even white, sapwood that lies just inside the cambium layer of a tree.

taproot, which plunges deep into the earth. Others like the beeches and willows have instead many smaller roots which reach in all directions, fairly close to the surface.

In the leaves of a tree, that marvel called photosynthesis takes place. Water and minerals from the soil, carbon dioxide from the air and light from the sun combine in mysterious ways to produce the very substance of a tree's life. Without this miraculous process there would be no flora, no fauna, no man.

In each growing season in temperate zones, a tree adds on a layer of wood—a growth ring. If you examine the cross section of a tree trunk, you will see a number of these rings circling the pith. These annual rings vary in width, reflecting changes in rainfall and climatic conditions. In tropical areas, where growth is continuous, trees sometimes don't form discernible rings.

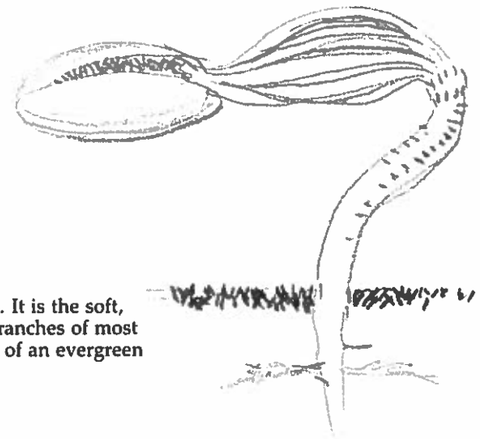
The record of all that the average tree has witnessed and endured is written in its growth rings. They tell by their number how old the tree is. They help to pinpoint when droughts, floods, fire and insects ravaged the land and when life-giving rain fell in abundance. During difficult growth periods, the rings of some trees are so narrow and close together that it is almost impossible to count them.

The cells in the pith center do not grow appreciably. Even after the formidable spread around the center, the center itself has not become taller. With the patience of God, the cells have developed, billions of them, on all sides of the pith center, producing the body of the tree.

If this seemingly eternal life, as eternal as any life can be, were ultimately to drop, it should be the hand of man which gives the tree a new existence, shaping its body for use and beauty. The ultimate form the trees may assume is unknown. Bit by bit, as the sculptor creates, the revelation continues.

If, by the greed or needs of man the tree is felled, decay sets in, and the pith rots away. But there remains an urge to live. A circle of offspring can grow from the

The bitterbrush is unusual in that starting from the pith it grows out only in one direction. The cambium layer is at the outermost edge of the growth. This bush endures strong winds, intense heat and winter cold reaching thirty degrees below zero.



The pith is the first material to sprout from a seed. It is the soft, spongelike substance in the center of stems and branches of most vascular plants. Sketched here is the early growth of an evergreen from a pine nut.

cambium layer, forming what are sometimes called "crown trees." The pith is gone, but a new generation springs up in its place.

In trees that resist decay, large sections can die, leaving small areas still living, hanging on to life. The dead parts of trees like the bristlecone pine can become weather-beaten over centuries of harsh climate. The desert bitterbrush can grow out horizontally from the center, dying as it grows, while the cambium layer, a half circle, remains the only living tissue. This small, brave bush can grow this way for hundreds of years. The manzanita and the sagebrush grow in a similar way. This is a type of life adapted to the harshness of the western desert where climate ranges from extreme cold to great heat with very little rainfall.

We are left in awe by the nobility of a tree, its eternal patience, its suffering caused by man and sometimes nature, its witness to thousands of years of earth's history, its creations of fabulous beauty. It does nothing but good, with its prodigious ability to serve, it gives off its bounty of oxygen while absorbing gases harmful to other living things. The tree and its pith live on. Its fruits feed us. Its branches shade and protect us. And, finally, when time and weather bring it down, its body offers timber for our houses and boards for our furniture. The tree lives on.

The Yaku *sugi*. This noble tree has grown for millennia on Yaku Island, off the south coast of Japan's southernmost major island, Kyushu.

7

The Yaku Sugi and Other Trees

On the mountainous island of Yaku, off the coast of Kyushu, grow old *sugi* trees, or cedars, that seem eternal. They are among the grandest gifts of nature, and have spanned perhaps the whole history of civilized man.

They are great trees, their bodies the cathedral of all time. Specimens stand over many millennia, the wood resistant to decay, the nemesis of most trees.

There are Yaku *sugis* that are over forty feet in diameter at the base, their gnarled trunks reaching a hundred and thirty feet into the air. While not as tall as the California sequoia, they are larger in diameter. It is the diameter that indicates their age. These cedars, like most old evergreens, rise from a single stalk, but branch at random. Some are said to be over five thousand years old. Others were cut down hundreds of years ago for timber. Out of their stumps, which rise about thirty feet above the ground, have grown new trees which are the crown trees. The center of the stump has rotted out, leaving a huge cavity, large enough to hold a small house. How the original tree was cut without modern equipment is a mystery.

Some Yaku *sugis* less than a thousand years old are not honored with the title, but must humbly accept the name of *ko sugi*, or "small cedar." The cedars of Yaku normally produce annual rings about 1/32-inch wide, many times the growth of the bristlecone pines of California, which may grow only a few inches in a thousand years.

It is strange that on this small, typhoon-swept island, where the natives speak of thirty-five days of rainfall a month, there should grow one of the oldest residents on earth. Actually, there are over four hundred inches of rainfall per year, or almost double the rainfall of the Ho River rain forest in the state of Washington. As with people, adversities in nature often produce great character. Yaku is located in the Ginza belt of typhoons, making life there hazardous for flora and fauna as well as people. While heavy rainfall is favorable to the growth of cedars, the high winds of Yaku would be fatal to the trees, if it were not for their root structure with a great

Looking heavenward through the center cavity of a Yaku *sugi* felled centuries ago. The outline of a figure in the lower right indicates the scale. Along the rim grow crown trees.

spread at ground level. Without that support the wind would topple the Yaku cedars, as it does so often most giants of the forest. Nature is a great engineer.

The island of Yaku is quite small, about seventy miles in circumference. It consists of numerous peaks, the highest rising 6,300 feet. Because of its terrain, the island has three climatic zones: subtropic, temperate and fairly cold. These cedars grow in the temperate zone. How this tree has managed to exist for so long in this unfriendly land—fighting typhoons that can throw a twenty-thousand-ton ship onto the beach—remains a mystery.

It is possible these very trials that have produced the "grape" burls, fantastic patterns, striations following the growth rings, an esteemed quality of grain. All of these characteristics are evident in the Yaku *sugis* along with the venerable quality of having lived long and witnessed much. The wood and the tree are now classified as national treasures, guarded closely by government control, difficult to buy and extremely expensive.

The Yaku *sugi* is awesome indeed, as perhaps every piece of wood is awesome, for it contains the majesty of all the divine forces that exist on the plane of nature's own objects. The Japanese have a reverence for this tree, for its eternal quality, for the wood itself, for its karma. Its wood was used in the new palace in Tokyo.

The wood is quite distinctive and can be recognized at once. The grain is more pronounced than in most cedars. One can muse on what became of the wood cut from the Yaku cedars centuries ago. Perhaps precious boards cut from it by hand still grace temples or shrines in parts of Japan, especially on the island of Yaku, or in Kyushu.

The Yaku cedars have spent their lifetime witnessing the long and awesome march of generation after generation of the human race, the march of nation after nation. They have seen cultures, civilizations, one after another rise and fall. By human inspiration, or by sheer egotism, great cities were constructed, finally to return to dust. Some are no longer remembered even as names. Pataliputra flowered, the Chou

Tule cypress. The figure in the outline shows the enormous scale of "El Tule," a Mexican swamp cypress, perhaps the largest in girth of all the great trees. The oldest may never be definitively known. This tree is also known as *sabino* or *arhue huete*.

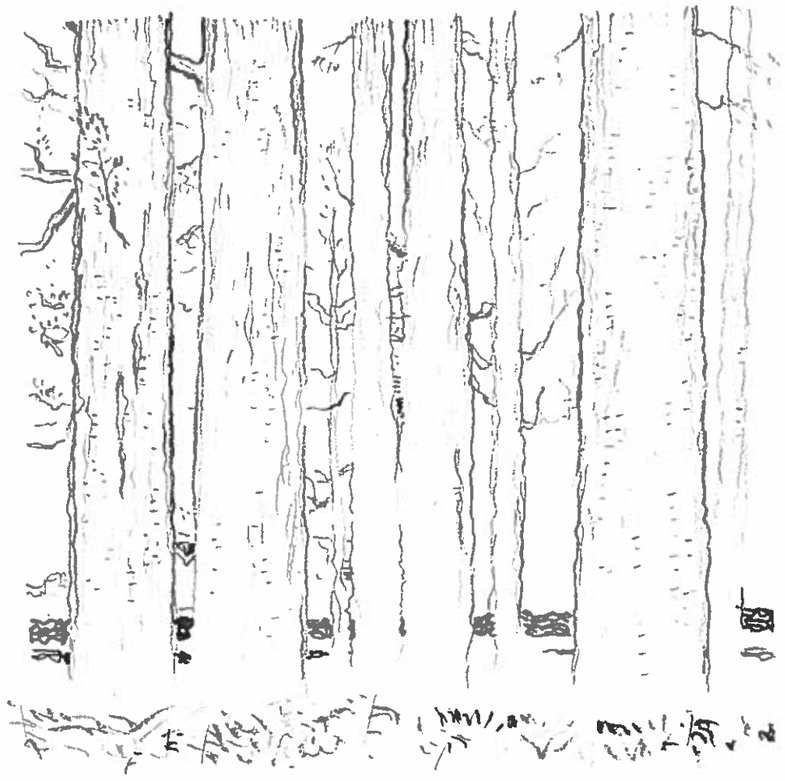
became great; and Sanskrit, the greatest of all human tongues, recorded the Vedas, the Upanishads and the Bhagavad Gita.

Conquerors conquered, vast armies trudged across endless lands with the goal of domination. Men in unbelievable numbers died to impose their egos, while masses of humanity perished to defend themselves. Heroic monuments were built commemorating these events. Architecture, art, music and poetry flourished. Epic literature was written to describe these happenings. In the end, it all dies. Some thoughts, ideas and inspirations from earlier cultures are still with us, but there are few continuous threads throughout the history of man.

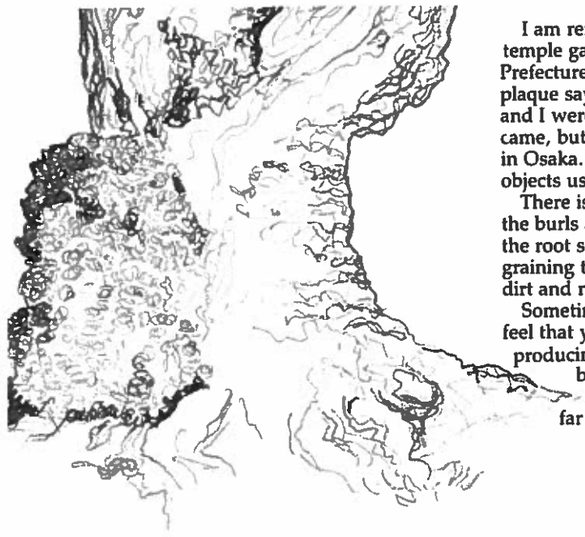
The cedar of Yaku stands, and man's petty turmoils wash about its feet. Throughout the millennia its life juices have flowed and will continue to flow, while our civilization goes to dust.

In other parts of the world there are similar trees which have witnessed these movements of history. In Taiwan there is a specimen five or six thousand years old, which is similar to the Yaku cedar. The red-barked cedar of the Ussuri Taiga in Siberia is said to be about the same age. "El Tule," also called "El Gigante," in Oaxaca, which inspired the building of the church of Santa Maria del Tule, is also about that age and may possibly be the largest in diameter. How the tule cypress, a tree that requires considerable rainfall, took root and survived in the dry climate of that area of Mexico is one of nature's wonders. Perhaps its roots have reached some underground well-spring. The life span of the bristlecone pine of the High Sierras in the Inyo National Forest is on a par with the others. It, too, lives in a hostile environment: its rate of growth over the centuries has been minute. It survives near the timberline where most leafy plant life ends and the snows begin.

The baobabs stand apart. Although they are huge, sometimes reaching almost a hundred feet in girth, their ages are obscure, for they do not have annual rings like most trees which grow in temperate climates. What sometimes pass for annual rings in



Sugi, or Japanese cedar, or cryptomeria. Long, straight, taut trunks. Very resistant to rot and decay. Temples and shrines, some comparable in scale to the European cathedrals, often had cryptomeria pillars which were dressed to perfect cylinders. Since the *sugi* grows in tight stands, each tree shares nourishment with its neighbors.

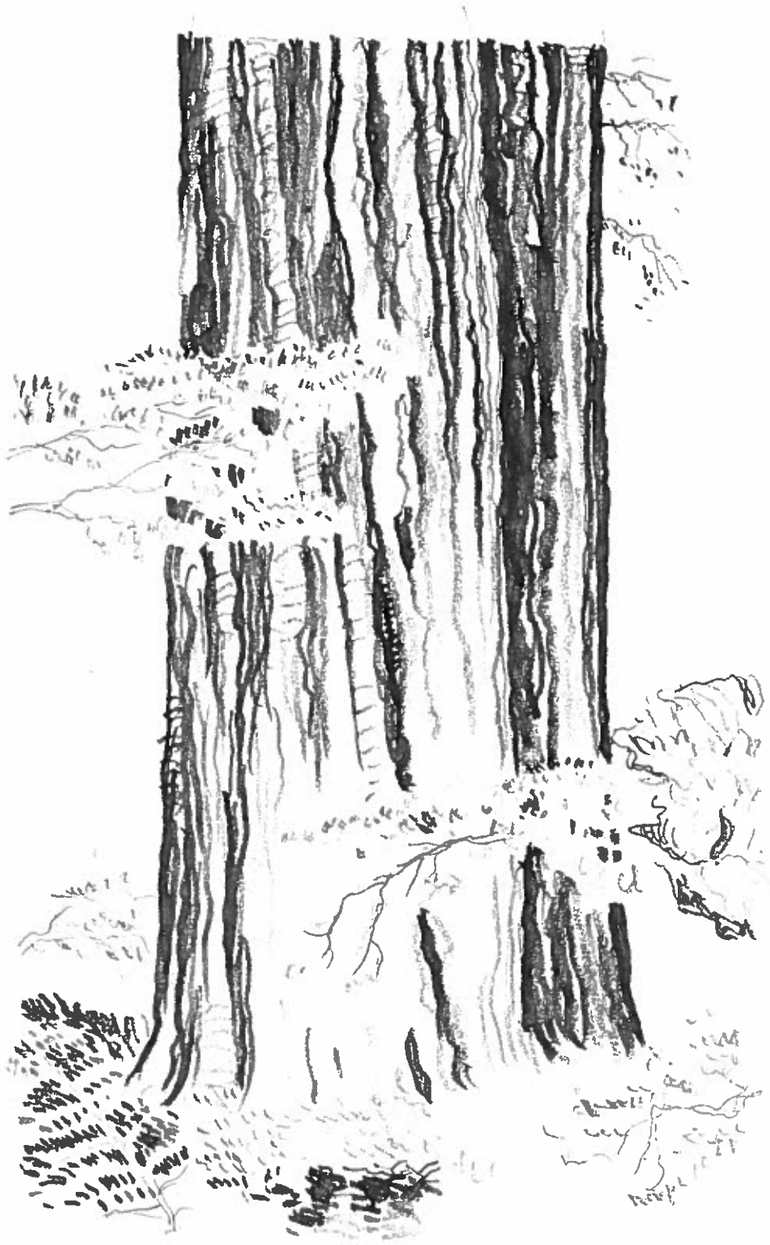


I am reminded of a great *keyaki*, or oriental elm, which I saw in a temple garden outside Takamatsu City, the capital of Kagawa Prefecture. It measured about ten feet in diameter. On it hung a plaque saying that the tree was twelve hundred years old. My friends and I were interested in buying the tree when the proper moment came, but, unfortunately, the tree was felled and went to somebody in Osaka. I feel sure its full potential, its resurrection as wooden objects useful and beautiful to man, was never realized.

There is great excitement in opening a great tree, especially when the burls and the intense figuring of the log converge as they meet the root system. The roots themselves are usually much richer in graining than the trunk, and if one has the patience to dig out the dirt and rocks from the roots, the effort is usually well rewarded.

Sometimes old trees are almost a total loss, however, making one feel that younger, more vigorous trees offer better possibilities for producing extraordinary lumber. These are chances one takes in buying logs. Over the years of buying, though, one gains astuteness in judgment, and good wood from older trees far surpasses losses from them.

The *hinoki*, or Japanese cypress. This particular specimen grew in the open, hence the heavy branching and short butt. Usually, the *hinoki* grows in woods where it develops a long, cylindrical trunk with very little taper. The wood is highly esteemed in construction and for interiors. It works well and polishes to a high sheen if dressed with a sharp plane. It is highly resistant to decay. For this reason, it is used in the construction of the Ise Grand Shrine, the primary place of Shinto worship in all Japan. The *hinoki* is usually considered the source of the best cypress wood. The Taiwan cypress is second and the American cypress, third.



A redwood tree. The sequoia and the redwood are related to each other, but are, strictly speaking, entirely different species. The redwood grows along the coast of California while the sequoia is an upland tree that grows on the western slopes of the Sierra Nevada range, also in California. Another relative, the metasequoia, once thought to be extinct, has been discovered in the interior of China. Roots from these trees, left from logging operations over a century ago, can be dug out today; they produce extraordinary slabs of wood with spectacular figuring and great interest.

Baobab

the baobab are hard growths caused by unusual weather conditions or severe storms. The wood of the tree is quite pulpy. In some of the trees, room-sized openings, large enough to sleep a number of men, have been carved out. One specimen is said to be over four thousand years old. The rate of growth varies and the tree can actually reduce in girth during periods of drought. The wood, which is as much as 60 or 70 percent moisture, can be sucked like a cactus to quench a thirst. The trunk is extraordinarily large in relation to the limbs, making it appear that the tree has been turned upside down so that its roots stick up into the air. Although a native of Africa, it has been known to grow in Australia, India and England.

Trees contribute much to the development of areas where they grow. Lumber from the cedars of Lebanon undoubtedly helped to shape the ancient cities of the Middle East. The Japanese cedar, *sugi*, and the Japanese cypress, *hinoki*, supplied beauty and needed strength to the great wooden temples and shrines of Japan, where round columns, two to three feet in diameter and great in length, were used to support these magnificent Japanese structures. The evergreens of the American West Coast helped make possible the rapid growth of that area and of America as a whole.

All of these trees started life somewhere near the dawn of civilized man. It matters not which is the oldest or the largest. The wonder is in their being.

The bristlecone pine, claimed by some to be the oldest living tree on earth. It is certainly one of the slowest growing. With many examples of this species, large sections of the tree die while a lesser part with its cambium layer, a mere fragment really, continues to live. This is a remarkable example of nature's tenacious fortitude. The bristlecone pine grows principally at an altitude ranging from seven to ten thousand feet.

In America called "oak burl" and in England called "burry oak," this species should be cut when the last of its life juices are ebbing, when its only future is decay. The wood is usually burled, but the extent varies from tree to tree. Sawing this "treasure" calls for the precision of a diamond cutter. We have sawn boards from these burls as large as five feet in width by twelve feet in length. Each of these oak burls can occur only once, in a never-to-be-repeated design. The burry oak's root structure can be every bit as spectacular as what is above ground.

The great Douglas fir which covers a large part of the western slopes of the United States is not a fir at all, but a false hemlock. Its fibers are long, straight and strong. Its heavy, scaly bark is a natural protection against forest fires. This venerable tree has been much used and has contributed greatly to the development of American civilization, just as the *hinoki* did in Japan, and the Lebanon cedar did in the Near East.

This venerable English oak in Sherwood Forest, Nottinghamshire, England, is at least four hundred years old and has a diameter of about ten feet. This oak seems to have started life in the open. A forest tree has a longer butt since, when young, it must stretch for sunlight. Many nations designate trees like this one as special natural monuments, but perhaps they should go further and call them "National Living Treasures." These treasures should be cut with reverence when their life span has been fulfilled. Their aged beauty and great character must be preserved in objects built of their wood to provide a record of their heritage and history.

8
Timber

When trees mature, it is fair and moral that they are cut for man's use, as they would soon decay and return to the earth. Trees have a yearning to live again, perhaps to provide the beauty, strength and utility to serve man, even to become an object of great artistic worth.

Each tree, every part of each tree, has only one perfect use. The long, taut grains of the true cypress, so well adapted to the making of elegant thin grilles, the joyous dance of the figuring in certain species, the richness of graining where two large branches reach out–these can all be released and fulfilled in a worthy object for man's use.

How to acquire logs and what to do with them calls for creative skill. There is so much that is wasted and unrealized. Consider the great timbers, some ten feet in diameter, piled across slopes and gulleys to make railroad beds in the early days of this country. Or the magnificent zebrawood log, from which boards fully four feet wide and eight feet long could be cut, but which instead is cut into pieces three-eighths inch thick, six inches wide! What a waste of a majestic opportunity! This is the psychology of match-stick manufacture. And the tragedy of once-in-a-lifetime timbers cut into veneers so thin the light can shine through. What a waste, simply for money!

Logs from all over the world make their way to my storehouse. Some are of great value, some quite inexpensive but with interesting possibilities. There is need always to select and to search, even to look underground where the most fantastic grains can often be found.

Each species of tree has its own characteristics. Extremely long fibers and resistance to rot are characteristics of the cedar, the cypress, and, in a way, the spruces and hemlocks, the firs, and the other evergreen trees. These characteristics are important where tautness and resistance to weather are necessary. The woods from these trees often have beautiful, very straight graining and are useful in architecture for grilles like the starburst *asa-no-ha*, and even musical instruments. One of the finest

Deciding how to cut this great walnut log—with a crotch at one end—about nine feet long and four feet in diameter (note the scale)—was quite a challenge. Seven limbs had been cut from it and the general configuration, contour and characteristics gave promise of spectacular, "once-in-a-lifetime" graining.

The judgments in sawing must be swift and exact. Thickness, trimming and direction of the cut are vital considerations that ultimately determine whether you produce magnificent lumber or firewood.

perhaps is the Japanese cypress, and not far behind are the Port Orford cedar and the Alaska cedar, neither of which, incidentally, is a true cedar at all, but a cypress.

The European walnut, whether from Kashmir, the area around the Caspian Sea, southern Russia, northern Iran or eastern Turkey, or from western Europe, is among the finest of furniture woods, and one I use with frequency. American walnut, a different species, is also greatly admired, especially by Europeans at this time.

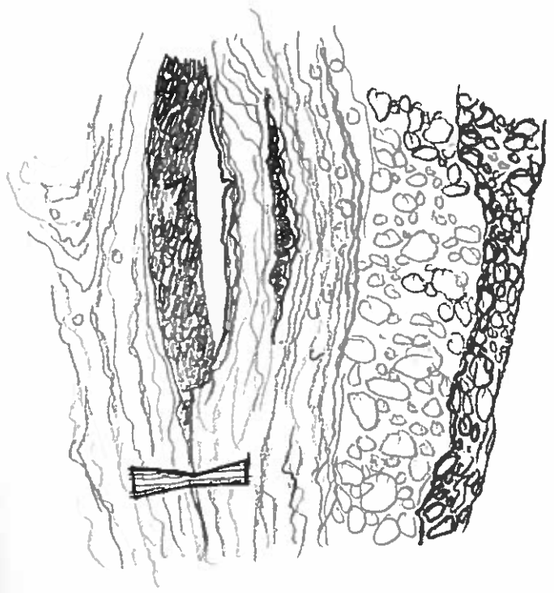
Cherry and other fruitwoods produce material of great quality. Black persimmon, often considered the finest of Japanese woods, is now extremely rare.

All woods have graining—patterns created by the trunk fibers. However, the grain of many woods, pine and maple for instance, is regular and comparatively uninteresting, while that of walnut, cherry and other fruitwoods is intricate and exciting.

Quite often the finest of grains exist underground in the root structure of many fine trees that are condemned to rot. The roots are difficult to pull out, and often are deeply imbedded with stones which can be the nemesis of a sawyer. Some roots preserve their great beauty even if left underground for a hundred years, for example, those of the California redwood.

Burls, growths on the trunks of many trees, in the shape of flattened hemispheres, are also very much esteemed. Sometimes they grow in a single clump, but at other times they may cover most of a tree. They do not seem to be particularly harmful to the health of the tree, and seem to have a joy and exuberance that greatly enhances the tree's charm.

The sawing of logs is of prime importance. Each cut requires judgments and decisions on what the log should become. As in cutting a diamond, the judgments must be precise and exact concerning thickness and direction of cut, especially through "figures," the complicated designs resulting from the tree's grain. If a figure is cut properly, the beauty locked in the tree will gradually emerge. If cut improperly, most is lost. Gradations in color, owing to the chemical composition of the soil in which a tree



Butterfly-shaped inlay of rosewood reinforces the area below an opening, most likely a "wind-shake" in highly figured English walnut. The separated fibers have weathered as they heal.

Some of the finest, most interesting grains are found underground, in the massive roots of trees. Here the richness of the soil seems to have been absorbed. This sketch shows a detail of an English walnut root end that has been sawed into a slab; I used it for an end table.

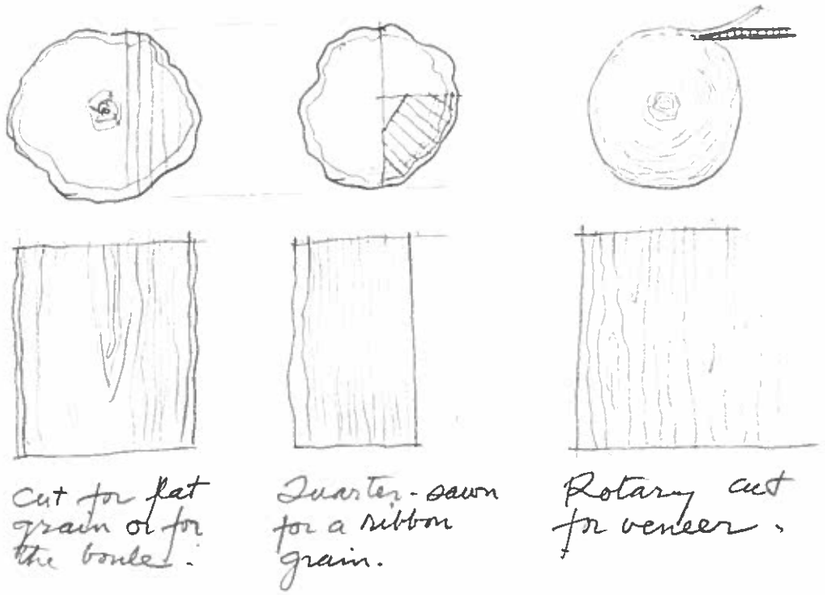
grows, as well as the sharp contrast between dark heartwood and light sapwood, will add their charm.

There is drama in the opening of a log–to uncover for the first time the beauty in the bole, or trunk, of a tree hidden for centuries, waiting to be given this second life. There are fine surprises, but also disappointments.

A great walnut, about five and a half feet in diameter, was once given to me. It seemed to have great character. A small limb pocket was filled with concrete at the top but neither a tree expert nor I imagined that the whole center had rotted out and was filled with concrete! There was only about a foot and a half of wood around the circumference. The tree had not fallen because it was a concrete column! We were finally able, with great effort, to take it down. The wood was interesting, but like many aged logs it had a tendency to be soft and weak.

I recall another instance when two logs were on the platform ready for sawing. They were English walnut. At first, there was only a suspicion that we were in the presence of a great natural wonder. The saw was a large, commercial band saw. The logs were close to six feet in diameter. They were too large! The only recourse was to hack off protrusions and excess width with a chain saw and an ax. It was devastating to see this magnificent wood handled in such a fashion, but there was no other way. Even before the log was opened up, the experienced eye could see the incredibly lovely grain, figuring and color where a bit of bark had been knocked off. Here indeed was precious timber.

The revelation in the opening of the log with the first cut or two was amazing. Sensitivity, instinct and long experience came to the fore at this point. The graining and the quality of the slabs made them an English treasure. One wonders why the English timber merchants allowed these logs to leave the country. Not being able to cut the full width of the prime boards was a disappointment. I even considered calling several hand sawyers from Asia to execute the sawing.



These simple sketches show ways logs are commonly cut into lumber, and the effect the sawing method has on the grain. I prefer sawing "through and through"; with this method the cut is tangential to the annual rings and lets us see the fullest range of graining and figuring that the log offers. Quartersawing does produce solid lumber, but since only a quarter of the log is used for each series of passes through the saw, the boards are not as wide as they might be. Since the cut is made at ninety degrees to the growth rings, the grain seen on the board is parallel—what we call "ribbon grain."

With rotary veneering, the entire log is "peeled" into a single thin sheet of veneer. Thin plies or veneers are glued together with the grains at right angles to make plywood. Beautiful hardwoods are often wasted this way to make thin surface veneers.

Although we could not realize the full potential of these logs, they were of amazing quality, with a graining that would never happen again. We were able to cut boards about four feet wide and seven feet long, each board unique, each board magnificent.

The key man in the process of cutting logs is the sawyer, one of the great craftsmen of our age with steady nerves and experienced judgment. It is necessary to have an almost silent dialogue with this sawyer. Few words are spoken, but thickness, the direction of the cut, the positioning of the log—all must be decided with precision.

During a day we saw perhaps thirty logs, some giant in size, each different from the others. Each must be analyzed to produce its full potential. As the hours pass, a silent symphony of visual tones unfolds, the beautiful expressions of nature's treasures, an occasional crescendo where the beauty touches one's heart. There is nothing like it. The workday finally ends. I am exhausted, but happy to have witnessed this unfolding spectacle.

How thick a plank should be depends chiefly on the diameter of the log. To avoid splitting, wide planks are cut relatively thick. Trees usually grow vertically without twisting, but sometimes they grow in a spiral. Some trees change direction, twisting a few years clockwise and then counterclockwise, making a natural plywood. A tree that grows in a spiral must be cut extra thick to prevent warping. Sometimes outside cuts are thicker still to prevent cupping.

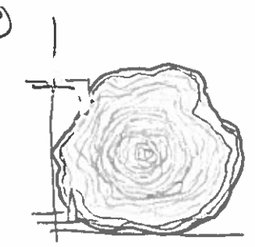
Cutting logs entails a great responsibility, for we are dealing with a fallen majesty. There are no formulas, no guidelines, but only experience, instinct and a contact with the divine.

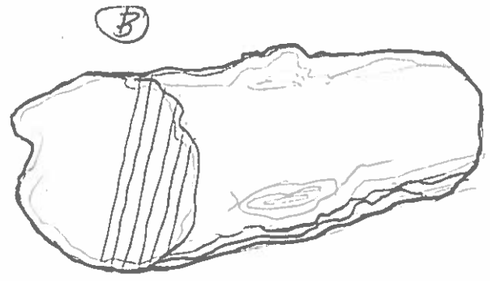
Commercial "grade" sawing by "rolling the log," the method used with almost all hardwoods in this country, is one of the most barbaric of practices. No attempt is made

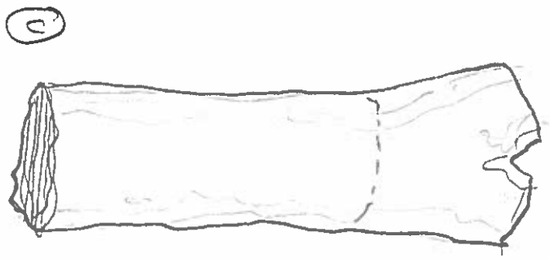
Whichever name it goes by—plainsawing, "sawing for the *boule*", or sawing "through and through"—this method is by far the best way of realizing the full potential of a log in terms of graining and figuring. If the timber is fairly even and round, lumber may be sawed from the log consecutively, without any interruptions. Top and bottom "dogs," as seen in "A", bite into the log after it has been mounted on the saw and guide it through the saw blade or band.

If the log is uneven, with many knots, as in "B", it is usually better to saw lumber only to the middle of the log, as shown, and then swing the remaining half-log 180 degrees and "re-dog" it, with the flat side flush against the saw guide.

For the best figuring, the log should pass through the saw with the crotch upright as in "C." This produces rich graining at the intersection of the trunk and branches. Large knots should be placed at the top, however, so that most of the boards can be cut "clear," that is, without having the knot appear in the center of the plank.







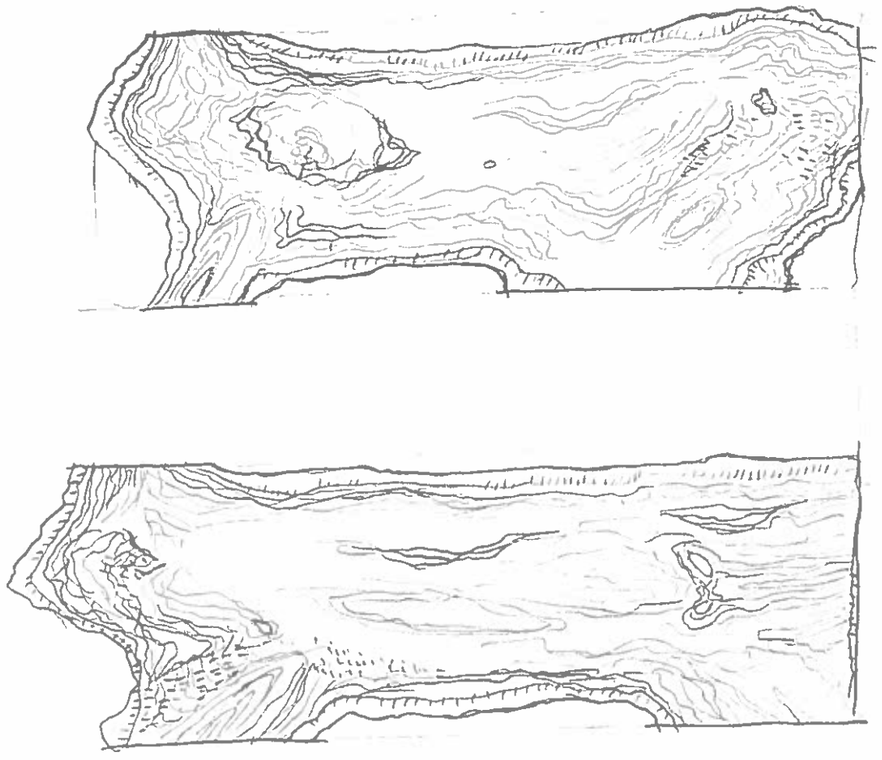
to bring out the log's inherent beauty. No slice is wide enough to do justice to the tree's figures and graining. The potential of the log is lost, and it ends up only as expensive yet uninteresting lumber. Quartersawing—sawing parallel to the rays which radiate from the log's center—is also popular. And it too is undesirable since it is wasteful and also fails to make full use of the log's width with its great potential for spectacular figuring.

The proper way to treat fine timber is to cut for the *boule*, starting from one side of the log and cutting through it without slabbing or squaring the log. This method of sawing is also known as "sawing through and through." If the log is a proper shape, with no unusual branching, and the equipment appropriate, this can readily be done.

Some trees in particular should be cut at the precise moment of maturity. Then the curing and drying should begin. The sapwood of American walnut is quite white when freshly sawn. A gradual process of graying takes place in the weathering until only a thin strip of white is left next to the heartwood. This is the moment for the most gracious of grains. A short while later the white is gone, and all becomes gray and less interesting. For some woods, like cherry and ash, the air drying should last only a few months, as after that an unattractive blue stain sets in. Other species are almost indestructible. I recently cut a magnificent rosewood which must have been left out to weather for about a dozen years.

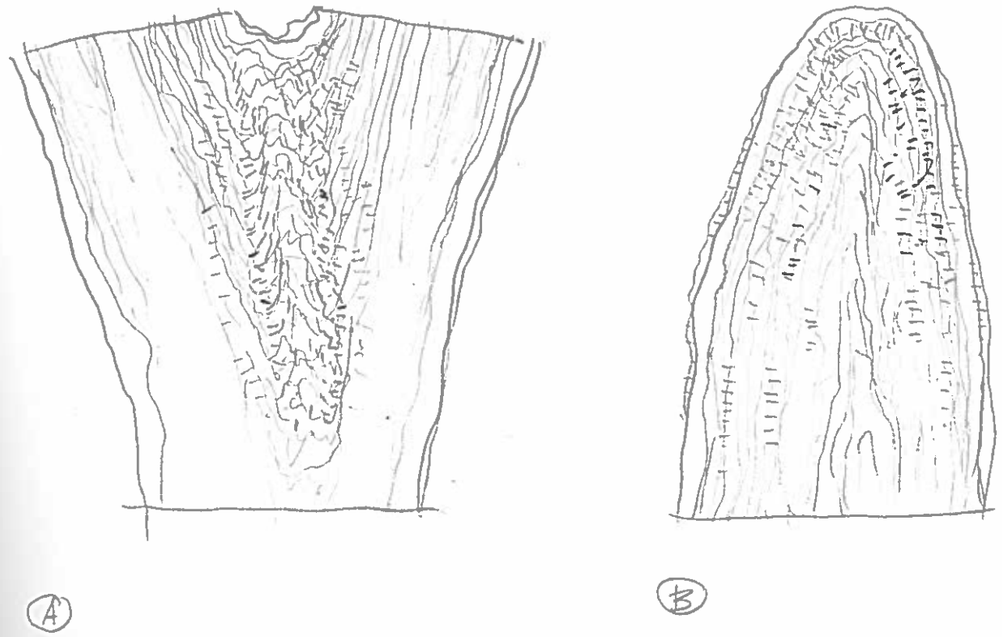
The best lumber should be air-dried for one or two years, the rate of drying depending on factors such as the species, the season and the climate. In India, where it is dry and hot, the drying time can be short.

The best time to log and saw is during the fall and winter, when the weather is cool and the sap is not rising. The final process is to kiln dry, which removes the excess



These sketches show two pieces of lumber sawn from one of our "once-in-a-lifetime" logs, American black walnut, about two hundred years of age. The tree was well past its prime when it was cut since we could see much dead wood in the log; the sap had been flowing only in a restricted part of the bole; it had only patches of living sapwood. This sapwood was almost stark white, a nice contrast with the warm gray of the rest. The log was roughly five feet in diameter and eleven feet long. The estimated weight was over ten tons. The lumber I've sketched here, though taken from near the outside of the tree, is still quite wide.

Our problem was how to saw the log. Most band-saw mills in this country do not have the capacity to handle this wood. To cut a full-width flitch would require an "Alaska mill," a long two-motor chain saw riding on a frame. Using this kind of saw would have been a tedious operation, time-consuming and expensive. The saw kerf loss would be close to one-half inch for each cut and, including the hand inaccuracy, the loss could be close to an inch. If we were to use a precision band saw, the saw kerf would be only a one-eighth inch per cut, and the alignment would be almost perfect.



Methods of cutting when there is a crotch in a log. Usually, cutting across the crotch produces the finest figuring as in "A." This cut also provides the greatest usable width. Cutting along the crotch, as in "B," results in a somewhat triangular piece of lumber with less surface area to work with. The figuring is less intense too. At the point where a tree branches freely, three or more crotches may be found. The result in the lumber can be truly extravagant figuring.

moisture and "sets" the grain. Kiln drying of raw lumber produces unnatural-looking lumber. To rectify the "raw" look of kiln-dried lumber, it is often steamed with sawdust to produce a "mature" appearance. More often than not this process "kills" the grain and produces a dead-looking wood.

Planks and boards are the stock of the woodworker's trade. We store them in sheds in *boule* form, all the planks cut from a log grouped together. We memorize the qualities and potential uses of all of them. Planks are best stored upright, since it is easier to leaf through them. Selections are made as required and taken to the shop.

These rough but majestic "bodies" go on to be made into objects to enhance the lives of men.