Chapter Two

MATERIALS and TOOLS

BARK OF THE PAPER BIRCH was the material preferred by the North American Indians for the construction of their canoes, although other barks were used where birch was not available. This tree (*Betula papyrifera* Marsh.), also known as the canoe birch, is found in good soil, often near streams, and where growing conditions are favorable it becomes large, reaching a height of a hundred feet, with a butt diameter of thirty inches or more. Its range forms a wide belt across the continent, with the northern limits in Canada along a line extending westward from Newfoundland to the southern shores of Hudson Bay and thence generally northwestward to Great Bear Lake, the Yukon River, and the Alaskan coast. The southern limits extend roughly westward from Long Island to the southern shores of Lake Erie and through central Michigan to Lake Superior, thence through Wisconsin, northern Nebraska, and northwesterly through the Dakotas, northern Montana, and northern Washington to the Pacific Coast. The trees are both abundant and large in the eastern portion of the belt, particularly in Newfoundland, Quebec, the Maritime Provinces, Ontario, Maine, and New Hampshire, in contrast to the western areas. Near the limits of growth to the north and south the trees are usually small and scattered.

The leaves are rather small, deep green, and pointed-oval, and are often heart-shaped at the base. The edges of the leaves are rather coarsely toothed along the margin, which is slightly six-notched. The small limbs are black, sometimes spotted with white, and the large are white.

The bark of the tree has an aromatic odor when freshly peeled, and is chalky white marked with black splotches on either side of limbs or where branches have grown at one time. Elsewhere on the bark, dark, or black, horizontal lines of varying lengths also appear. The lower part of the tree, to about the height of winter snows, has bark that is usually rough, blemished and thin; above this level, to the height of the lowest large limbs, the bark is often only slightly blemished and is thick and well formed. The bark is made up of paper-like layers, their color deepens with each layer from the chalky white of the exterior through creamy buff to a light tan on the inner layer. A gelatinous greenish to yellow rind, or cambium layer, lies between the bark and the wood of the trunk; its characteristics are different from those of the rest of the bark. The horizontal lines that appear on each successive paper-like layer do not appear on the rind.

The thickness of the bark cannot be judged from the size of a tree and may vary markedly among trees of the same approximate size in a single grove. The thickness varies from a little less than one-eighth to over three-sixteenths inch; bark with a thickness of one-quarter inch or more is rarely found. For canoe construction, bark must be over one-eighth inch thick, tough, and from a naturally straight trunk of sufficient diameter and length to give reasonably large pieces. The "eyes" must be small and not so closely spaced as to allow the bark to split easily in their vicinity.

The bark can be peeled readily when the sap is flowing. In winter, when the exterior of the tree is frozen, the bark can be removed only when heat is applied. During a prolonged thaw, however, this may be accomplished without the application of heat. Bark peeled from the tree during a winter thaw, and early in the spring or late in the fall, usually adheres strongly to the inner rind, which comes away from the tree with the bark. The act of peeling, however, puts a strain on the bark, so that only tough, well-made bark can be removed under these conditions. This particular characteristic caused Indians in the east to call bark with the rind adhering "winter bark," even though it might have been peeled from a tree during the warm weather of early summer.

Since in large trees the flow of sap usually starts later than in small ones, the period in which good bark is obtainable may extend into late June in some localities. Upon exposure to air and moisture, the inner rind first turns orange-red and gradually darkens with age until in a few years it becomes dark brown, or sepia. If it is first moistened, the rind can be scraped off, and this allowed it to be employed in decoration, enough being left to form designs. Hence winter bark was prized.

To the eastern Indians "summer bark" was a poor grade that readily separated into its paper-like layers, a characteristic of bark peeled in hot weather, or of poorly made bark in any season. In the west, however, high-quality bark was often scarce and, therefore, the distinction between winter and summer bark does not seem to have been made. Newfoundland once had excellent canoe bark, as did the Maritime Provinces, Maine, New Hampshire, and Quebec, but the best bark was found back from the seacoast. Ontario and the country to the immediate north of Lake Superior are also said to have produced bark of high quality for canoe building.

The bark of the paper birch was preferred for canoe building because it could be obtained in quite large sheets clear of serious blemishes; because its grain ran around the tree rather than along the line of vertical tree growth, so that sheets could be "sewn" together to obtain length in a canoe; and because the bark was resinous and not only did not stretch and shrink as did other barks, but also had some elasticity when green, or when kept damp. This elasticity, of course, was lost once the bark was allowed to become dry through exposure to air and sunshine, a factor which controlled to some extent the technique of its employment.

Many other barks were employed in bark canoe construction, but in most instances the craft were for temporary or emergency use and were discarded after a short time. Such barks as spruce (*Picea*), elm (*Ulmus*), chestnut (*Castenea dentata L.*), hickory (*Carya* spp.), basswood (*Tilia* spp.), and cottonwood (*Populus* spp.) are said to have been used in bark canoe construction in some parts of North America. Birches other than the paper birch could be used, but most of them produced bark that was thin and otherwise poor, and was considered unsuitable for the better types of canoes. Barks other than birch usually had rough surfaces that had to be scraped away, in order to make the material flexible enough for canoe construction. Spruce bark had some of the good



Figure 5

Ojibway Indian carrying spruce roots, Lac Seul, Ont., 1919. (*Canadian Geological Survey photo.*)

qualities of the paper birch bark, but to a far less degree, and was considered at best a mere substitute. Non-resinous barks, because of their structure could not be joined together to gain length, and their characteristic shrinkage and swelling made it virtually impossible to keep them attached to a solid framework for any great length of time.

The material used for "sewing" together pieces of birch bark was most commonly the root of the black spruce (*Picea mariana* (Mill.) B.S.P.), which grows in much of the area where the paper birch exists. The root of this particular spruce is long but of small diameter; it is tough, durable, and flexible enough for the purpose. The tree usually grows in soft, moist ground, so that the long roots are commonly very close to the surface, where they could easily be

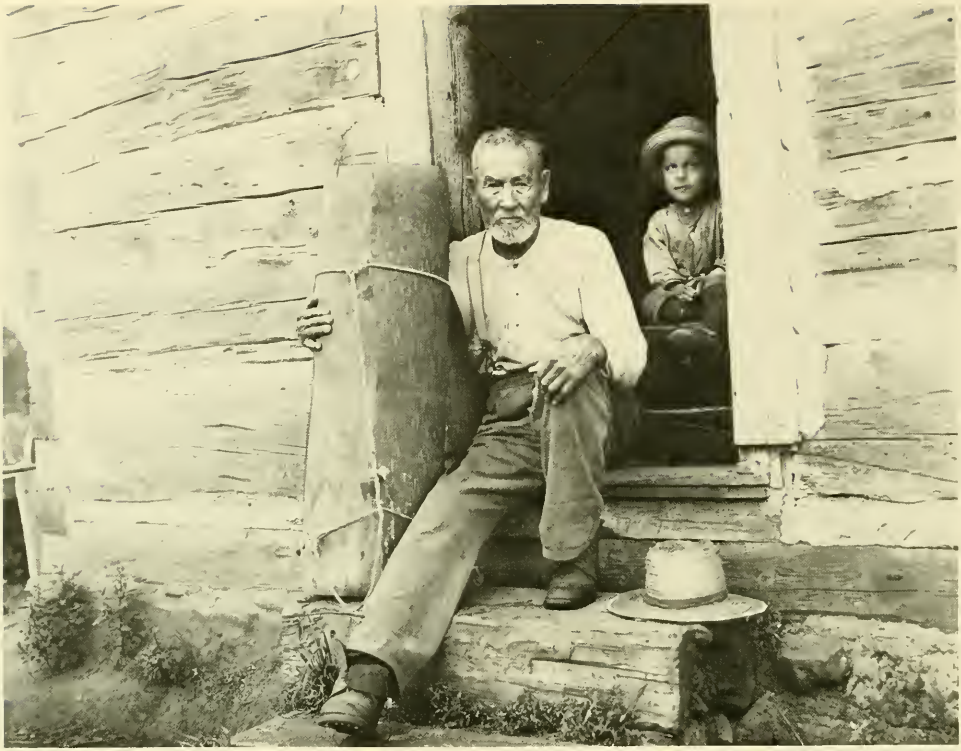


Figure 6

ROLL OF BARK FOR A HUNTING CANOE. Holding the bark is the intended builder, Vincent Mikans, then (in 1927), at age 100, the oldest Indian on the Algonkin Reserve at Golden Lake, Ont.

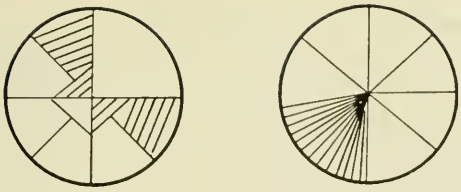
dug up with a sharp stick or with the hands. In some areas of favorable growing conditions, the roots of the black spruce could be obtained in lengths up to 20 feet, yet with a maximum diameter no larger than that of a lead pencil.

Other roots could be used in an emergency, such as those of the other spruces, as well as of the northern white-cedar (*Thuja occidentalis* L.), tamarack (hackmatack or eastern larch (*Larix laricina* (Du Roi) K. Koch) and jack pine (*Pinus banksiana* Lamb.), the last named being used extensively by some of the western tribes. Although inferior to the black spruce for sewing, these and other materials were used for sewing bark; even rawhide was employed for some purposes in canoe construction by certain tribes.

Canoes built of nonresinous barks were usually lashed, instead of sewn, by thongs of such material as the inner bark of the northern white cedar, basswood, elm, or hickory, for the reason stated earlier. Spruce root was also used for lashings, if readily available. Since sheets of birch bark were joined without employing a needle, the sewing actually could more correctly be termed lacing, rather than stitching. But for the nonresinous barks, which could stand little sewing or lacing, perhaps lashing is the better term.

Before steel tools became available to the Indians, the woodwork required in constructing a birch-bark canoe represented great labor, since stone tools having poor cutting characteristics were used. Selection

Figure 7



Wood-splitting techniques

of the proper wood was therefore a vital consideration. In most sections of the bark canoe area, the northern white cedar was the most sought-for wood for canoe construction. This timber had the excellent characteristic of splitting cleanly and readily when dry and well-seasoned. As a result, the Indian could either utilize fallen timber of this species, windblown or torn up in spring floods; with the crude means available he chould fell a suitable tree well in advance of his needs; or he could girdle the tree so that it would die and season on the stump and then fell it at his convenience. If split properly, ribs of white cedar could be bent and set in shape by the use of hot water. In many areas the ribs, sheathing, and the gunwale members of bark canoes were made of this wood, as were also the headboards and stem pieces.

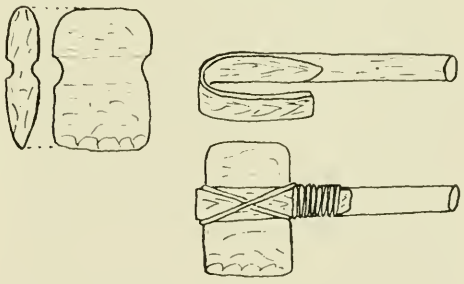
Black spruce was also employed, as it too would split well, although only when green. This wood also required a different direction in splitting than the white cedar. Ribs of black spruce could be bent and set in shape when this was done while the wood was green. In some areas black spruce was used in place of white cedar for all parts of a bark canoe structure.

Hard maple (usually either *Acer saccharum* Marsh. or *A. nigrum* Michx.), can be split rather easily while green; this wood was used for the crosspieces or thwarts that hold the gunwales apart and for paddles. Larch, particularly western larch (*Larix occidentalis* Nutt.), was used in some areas for canoe members. White and black ash (*Fraxinus americana* L. and *F. nigra* Marsh.), were also used where suitable wood of these species was available. In the northwest, spruce and various pines were employed, as was also willow (*Salix*). It should be noted that the use of many woods in bark canoe construction can be identified only in the period after steel tools became available; it must be assumed that the range of selection was much narrower in prehistoric times.

To make a bark cover watertight, it is necessary to coat all seams and to cover all "sewing" with a waterproof material, of which the most favored by the Indians was "spruce gum," the resin obtained from black or white spruce (*Picea mariana* or *P. glauca* (Moench) Voss). The resin of the red spruce (*Picea rubens* Sarg.) was not used, so far as has been discovered. The soft resin was scraped from a fallen tree or from one damaged in summer. Spruce gum could be accumulated by stripping a narrow length of bark from trees early in the spring and then, during warm weather, gathering the resin that appeared at the bottoms of the scars thus made. It was melted or heated in various ways to make it workable and certain materials were usually added to make it durable in use.

The most important aids to the Indian in canoe construction were his patience, knowledge of the working qualities of materials, his manual skill with the crude cutting, scraping, and boring instruments

Figure 8



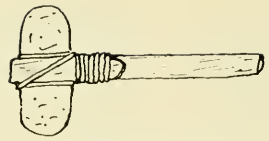
Stone axe

known to him, and of course fire; time was, perforce, of less importance. The canoe builder had to learn by experience and close observation how to work the material available. The wood-working tools of the stone age were relatively inefficient, but with care and skill could be used with remarkable precision and neatness.

Felling of trees was accomplished by use of a stone axe, hatchet, or adze, combined with the use of fire. The method almost universally employed by primitive people was followed. The tree was first girdled by striking it with the stone tool to loosen and raise the wood fibers and remove the soft green bark. Above this girdle the trunk was daubed all around with wet earth, or preferably clay. A large, hot fire was then built around the base of the tree and, after the loose fibers were burned away and the wood well charred, the char was removed by blows from the stone tool. The process was repeated until the trunk was cut through enough for the tree to fall. The fallen trunk could be cut into sections by employing the same methods, mud being laid on each side of the "cut" to prevent the fire from spreading along the trunk. Fire could also be used to cut down poles and small trees, to cut them into sections, and to sharpen the ends into points to form crude wedges or stakes.

Stone tools were formed by chipping flint, jasper, or other forms of quartz, such as chalcedony, into flakes with sharp edges. This was done by striking the nodule of stone a sharp blow with another stone held in the hand or mounted in a handle of hide or wood to form a stone hammer. The flakes were then shaped by pressing the edges with a horn point—say, part of a deer antler—to force a chip from the flake. The chipping tool was sometimes fitted with a hide or wood handle set at right angles to the tool, so that its head could be hit with a stone or horn hammer. The flake being worked upon, if small, was often held in the hand, which was protected from the slipping of a chipping tool by a pad of rawhide. Heat was not used in chipping, and some Indians took care to keep the flake damp while working it, occasionally burying the flake for a while in moist soil. The cutting edge of a stone tool could be ground by abrasion on a hard piece of granite or on sandstone, but the final degree of sharpness depended upon the qualities of the stone being used as a tool. Slate could be used in tools in spite of its brittleness. In general, stone tools were unsuitable for chopping or whittling wood.

Figure 9



Stone hammer



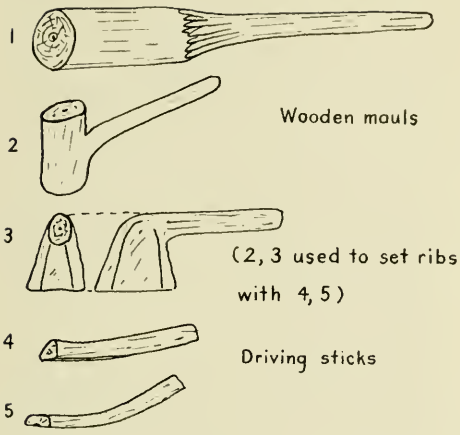
Stone wedge



Stone knife with rawhide thong handle

Splitting was done by starting the split at the upper, or small end, of a balk of timber with a maul and a stone wedge or the blade of a stone axe, hatchet, or knife. The stone knives used for this work were not finished tools with wood handles, but rather, as the blade was often damaged in use, selected flakes fitted with hide pads that served as a handle. The tool was usually driven into the wood with blows from a wooden club or maul, the brittle stone tool being protected from damage by a pad of rawhide secured to the top, or head, of the tool. Once the split was started, it could be continued by driving more wedges, or pointed sticks, into the split; this process was continued until the whole balk was divided. White cedar was split into quarters by this method and then the heartwood was split away, the latter being used for canoe structural members. From short balks of the length of the longest rib or perhaps a little more, were split battens equal in thickness to two ribs and in width also equal to two, so that by splitting one batten two ways four finished ribs were produced. The broad faces of the ribs were as nearly parallel to the bark side of the wood as possible, as the ribs would bend satisfactorily toward or away from the bark side only. Black spruce, however, was split in line with the wood rays, from the heart outward toward the

Figure 10



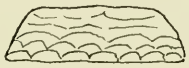
bark, so that one of the rib's narrow edges faced the bark side; only in this direction would the wood split readily and only when made this way would the ribs bend without great breakage.

Long pieces for sheathing and for the gunwale members were split from white cedar or black spruce. The splitting of such long pieces as these required not only proper selection of clear wood, but also careful manipulation of wood and tools in the operation. Splitting of this kind—say, for ribs in the finish cut—was usually done by first splitting out a batten large enough to form two members. To split it again, a stone knife was tapped into the end grain to start the split at the desired point, which, as has been noted, was always at the upper end of the stick, not at the root end. Once the split was opened, it was continued by use of a sharp-pointed stick and the stone knife; if the split showed a tendency to run off the grain as it opened, it could be controlled by bending the batten, or one of the halves, away from the direction the split was taking. The first rough split usually served to show the worker the splitting characteristics of a piece of wood. This method of finishing frame members in bark canoes accounts for the uneven surfaces that often mark some parts, a wavy grain producing a wave in the surface of the wood when it was finished.

If it were desired to produce a partially split piece of wood, such as some tribal groups used for the stems, or in order to allow greater curvature at the ends of the gunwale, the splitting was stopped at the desired point and a tight lashing of rawhide or bark was placed there to form a stop.

The tapering of frames, gunwales, and thwarts and the shaping of paddles were accomplished by splitting away surplus wood along the thin edges and by abrasion and scraping on all edges. Stone scrapers were widely employed; shell could be employed in some areas. Rubbing with an abrasive such as soft sandstone was used when the wood became thoroughly dry; hardwood could often be polished by rubbing it with a large piece of wood, or by use of fine sand held in a rawhide pad. By these means the sharp edges could be rounded off and the final shaping accomplished. Some stone knives could be used to cut wood slowly, saw fashion, and this process appears to to have been used to form the thwart ends that in many canoes were tenoned into the gunwales. A stone knife used saw fashion would also cut a bent sapling easily, though slowly. To cut and trim bark a stone knife was employed; to peel bark from a tree, a hatchet, axe, or chisel could be used.

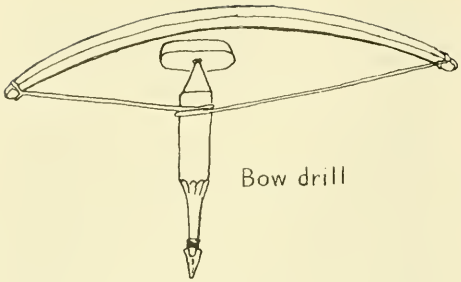
Figure 11



Stone scraper

Drilling was done by means of a bone awl made from a splinter of the shank-bone of a deer; the blade of this awl had a roughly triangular cross-section. The splinter was held in a wooden handle or in a rawhide grip. The awl was used not only to make holes in wood, but also as the punch to make holes for "sewing" in bark. Large holes were drilled by means of the bow-drill, in which a stone drill-point was rotated back and forth by the bow-string. Some Indians rotated the drill between the palms of their hands, or by a string with hand-grips at each end. The top of the drill was steadied by a block held in the worker's mouth, the top rotating in a hole in the underside of the block. With the bow-drill, however, the block was held in one hand.

Figure 12



Peeling the bark from roots and splitting them was done by use of the thumbnail, a stone knife, or a clamshell. Biting was also resorted to. The end of a root could also be split by first pounding it with a stone, using a log or another stone as an anvil, to open the fibers at one end. Splitting a root was usually done by biting to start the split. Once this was done, half was held in the mouth and the other half between the thumb and forefinger of the right hand. Then the two parts were gradually pulled apart with the right hand, while the thumbnail of the left was used to guide the split. If the split showed a tendency to "run off," bending the root away from the direction of the run while continuing the splitting usually served to change the course of the split. If a root was hard to split, the stone knife came into play instead of the thumbnail. When the split reached arm's length, the ends were shifted in hand and mouth and the operation continued.

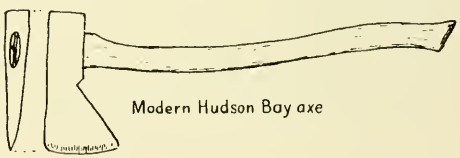
The use of hot water as an aid in bending wood was well known to some tribal groups before the white man came. Water was placed in a wooden trough, or in a bark basin, and heated to boiling by dropping hot stones into it. Some Indians boiled water in bark utensils by placing them over a fire of hot coals surrounded by stones and earth so that the flame could not reach the highly inflammable bark above the water-level in the dish. Stones were lifted from the fire with wooden tongs made of green saplings bent into a U-shape or made into a spoon-like outline. A straight stick and a forked one, used together, formed another type of tongs. The straight stick was placed in and under the fork; then, by forcing the latter under the stone and bringing the end of the straight stick hard against its top, the stone was held firmly, pincer-fashion.

The wood to be bent was first soaked in the boiling water, or the water was poured over it by means of a birch-bark or other dipper. When the wood was thoroughly soaked with boiling water, bending began, and as it progressed boiling water was almost continuously poured on the wood. When the wood had been bent to a desired form, it was secured in shape by thongs and allowed to cool and dry out, during which it would take a permanent set. Hard bends, as in gunwale ends and stem-pieces, were made by this means, usually after the wood had been split into a number of laminations in the area of the greatest bend. When the piece had been boiled and bent to its required form, the laminations were secured by wrapping them spirally with a thong of inner bark (such as basswood), of roots, or of rawhide.

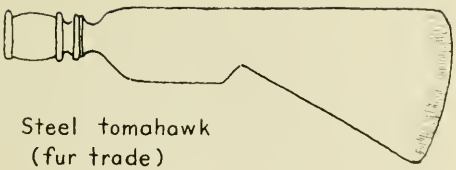
Flat stones were used to weigh down bark in order to flatten it and prevent curling. Picked up about the canoe-building site, they had one smooth and fairly flat surface so that no harm came to the bark, and were of such size and weight as could be handled easily by the builder. Smooth stones from a stream appear to have been preferred. In preparation for building a canoe, the pins, stakes, and poles which were of only temporary use were cut or burned down in the manner mentioned and stored ready for use. Bark containers were made and filled with spruce gum, and the materials used in making it hard and durable were gathered. The building site was selected in the shade, to prevent the bark from becoming hard and brittle, and on ground that was smooth, clear of outcroppings of stone, and roots, or other obstructions, and firm enough to hold the stakes driven into it. The location was, of course, usually near the water where the canoe was to be launched.

When steel tools became available, the work of the Indian in cutting and shaping wood became much easier but it is doubtful that better workmanship resulted. The steel axe and hatchet made more rapid and far easier than before the felling and cutting up of trees, poles, and sticks; they could also be used in peeling bark. The favored style of axe among Cana-

Figure 13



F gure 14



Steel tomahawk
(fur trade)

dian Indians was what is known as the "Hudson Bay axe"; it is made as a fairly large or "full-axe," as a lighter "half-axe," and as a large hatchet, or hand-axe. The head of the blade is very narrow, the front of the blade vertical, while the back widens toward the cutting edge and the latter stands at a slightly acute angle to the front of the blade. This style of axe seems to follow the traditional form of the tomahawk and is popular because it cuts well, yet is lighter to carry than the other forms of axe. It is also called a "cedar axe" in some localities. In modern times, Indian hatchets are of the commercial variety, the "lathing" form being preferred because it holds somewhat to the old trade tomahawk in form of blade and weight. The traditional steel tomahawk, incidentally was an adaptation of one of the European forms of hatchet, sold in the early days of the fur trade.

Figure 15

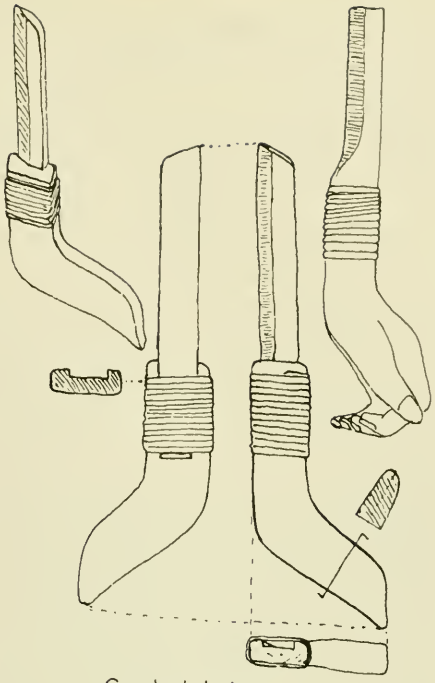


Steel canoe awls

The "canoe awl" of the fur trade was a steel awl with a blade triangular or square in cross-section, and was sometimes made of an old triangular file of small size. Its blade was locked into a hardwood handle, and it was a modern version of the old bone awl of the bark canoe builders, hence its name.

The plane was also used by modern Indians, but not in white man's fashion, in which the wood is held in a vise and smoothed by sliding the tool forward over the work. The Indian usually fixed the plane upside down on a bench or timber and slid the work over the sole, much as would be done with a

Figure 16



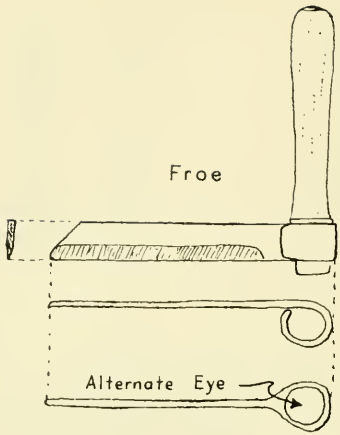
Crooked knives

power-driven joiner. However, the plane was not very popular among any of the canoe-building Indians.

The boring tool most favored by the Indians was the common steel gimlet; if a larger boring tool was desired, an auger of the required diameter was bought and fitted with a removable cross-handle rather than a brace.

One steel tool having much popularity among canoe-building Indians was the pioneer's splitting tool known as the "froe." This was a heavy steel blade, fifteen to twenty inches long, about two inches wide, and nearly a quarter inch thick along its back. One end of the blade ended in a tight loop into which a heavy hardwood handle, about a foot long, was set at right angles to the back edge of the blade, so that, when held in the hand, the blade was cutting edge down, with the handle upright. The froe was driven into the end of a balk of timber to be split by blows

Figure 17

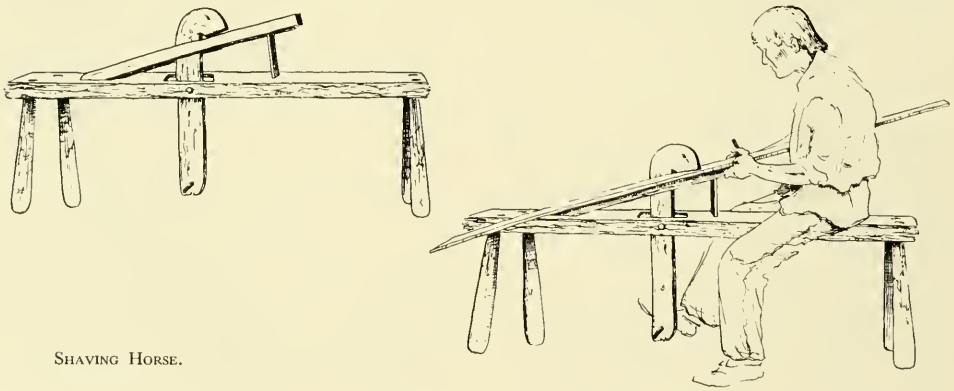


from a wooden maul on the back of its blade. Once the split was started, the maul was dropped and the hand that had held it was placed at the end of the blade away from the handle. By twisting the blade with the two hands the split could be forced open. The froe was a most powerful and efficient splitting tool when narrow, short plank, or battens, were required. The balk to be split was usually placed more or less end-up, as its length permitted, in the crotch of a felled tree, so as to hold it steady during the splitting. The pioneer used this tool to make clapboards and riven shingles; the Indian canoe builder found it handy for all splitting.

Another pioneer tool that became useful to the Indian canoe builder was the "shaving horse." A sort of bench and vise, it was used by Indians in a variety of forms, all based on the same principle of construction. Usually a seven-foot-long bench made of a large log flattened on top was supported by two or four legs, one pair being high enough to raise that end of the bench several feet off the ground to provide a seat for the operator. To the top of the bench was secured a shorter, wedge-shaped piece flattened top and bottom, with one end beveled and fastened to the bench and the other held about 12 inches above it by a support tenoned into the bench about thirty inches from the high end. Through the bench and the shorter piece were cut slots, about four feet from the high end of the bench and alined to receive an arm pivoted on the bench and extending from the ground to above the upper slot. The arm was shaped to overhang the slot on the front, toward the operator's end of the bench, and on each side. The lower portion of the arm was squared to fit the slot, and a crosspiece was secured to, or through, its lower end.

The worker sat astraddle the high end of the bench, facing the low end, with his feet on the crosspiece of the pivoted arm. Placing a piece of wood on top of the wedge-shaped piece, close to the head of the pivoted arm, he pushed forward on the crosspiece with his feet, thus forcing the head down hard upon the wood, so that it was held as in a vise. The wood could then be shaved down to a required shape with

Figure 18



Shaving Horse.

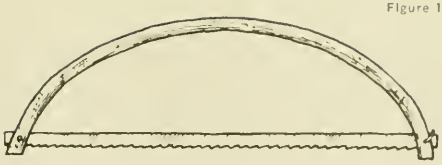
a drawknife or crooked knife without the necessity of holding the work. A long piece was canted on top of the bench so that the finished part would pass by the body of the worker, and, if it were necessary to shape the full length, it could be reversed.

Nails and tacks eventually came into use, though they were never used in all phases of the construction of a particular canoe. In the last days of bark canoe construction, the bark was tacked to the gunwales and, in areas where a gunwale cap was customarily employed, the cap was often nailed to the top of the gunwales.

The "bucksaw" also came into the hands of the Indians, but the frame of this saw was too awkward to carry, so the Indian usually bought only the blade. With a couple of nails and a bent sapling he could make a very good frame in the woods, when the saw was required. The ends of the sapling were slotted to take the ends of the blade and then drilled crosswise to the slot, so a nail could be inserted to hold the ends of blade and sapling together. With the end of the nail bent over, the frame was locked together and the tension was given to the blade by the bent sapling handle.

The "crooked knife" was the most important and popular steel tool found among the Indians building bark canoes. It was made from a flat steel file with one side worked down to a cutting-edge. The back of the blade thus formed was usually a little less than an eighth of an inch thick. The cutting edge was bevel-form, like that of a drawknife or chisel, with the back face quite flat. The tang of the file was fitted into a handle made of a crotched stick, to one arm of which the tang was attached, while the other projected at a slightly obtuse angle away from the back of the blade. The tang was usually held in place by being bent at its end into a slight hook and let into the handle, where it was secured with sinew lashing; wire later came into use for this lashing. The knife, held with the cutting edge toward the user, was grasped fingers-up with the thumb of the holding hand laid along the part of the handle projecting away from the user. This steadied the knife in cutting. Unlike a jackknife, the crooked knife was not used to whittle but to cut toward the user, and was, in effect, a one-hand drawknife. This form of knife is so satisfactory that it is to this day employed instead of a drawknife by many boat-builders in New Brunswick and Quebec. A variation in the crooked knife has the tip of the blade turned upward, on the flat, so that it can be used in hollowing out a wooden bowl or dish. The blades of crooked knives seen are usually about five-eighths inch wide and perhaps five or six inches long. Some are only slightly beveled along the cutting edge; others show this feature very markedly.

Figure 19



Bucksaw

Awls, as well as chisels and other stone or bone blades, often had handles on their sides to allow them to be held safely when hit with a hammer. Some of the stone blades and chisels thus took the form of adzes and could be used like them, but only, of course, to cut charred or very soft wood. The sharpening of stone tools followed the same methods used in their original manufacture and was a slow undertaking.

To some Indians an efficient wood-cutting chisel was available in the teeth of the beaver. Each tooth was nearly a quarter inch wide, so two teeth would give a cut of nearly half an inch. The usual practice appears to have been to employ the skull as a handle, though some beaver tooth chisels had wooden handles. As used in making tenons in the gunwales, two holes, of a diameter equal to the desired width, were first drilled close enough together to make the length of the desired tenon, after which the intervening wood, especially if it was white cedar or black spruce, could be readily split out by means of either a beaver tooth or narrow stone chisel.

The maul was merely some form of wooden club; the most common type was made by cutting away part of the length of a small balk to form a handle, the remainder being left to form the head. The swelling of the trunk of a small tree at the ground, where the roots form, was also utilized to give weight and bulk to the head of a maul. It could be hardened by scorching the head in a fire. Another method of pounding and driving was to employ a stone held in one hand or both. Stone hammers were rarely employed, since the maul or a stone held in the hand would serve the purpose.

The birch tree that was to supply the bark was usually selected far in advance of the time of construction. By exploring the birch groves, the builder located a number of trees from which a suitable quantity of bark of the desired quality could be obtained. Samples of the bark of each tree were stripped from the trunk and carefully inspected and tested. If they separated into layers when bent back and forth, the bark was poor. If the "eyes" inside the bark were lumpy, the bark in their vicinity would split too easily; this was also true if they were too close together, but if the eyes on the inside of the bark appeared hollow there was no objection. Bark that was dead white, or the outer surface of which was marked by small strips partly peeled away from the layer below, would be rejected as poor in quality.

Preferably, bark was stripped from the selected trees during a prolonged thaw in winter, particularly one accompanied by rain, or as soon as the sap in the trees had begun to flow in early spring. If this was not possible, "winter" bark, as described on page 14, was used as long as it was obtainable. Only dire necessity forced the Indian to use bark of a poor quality. Fall peeling, after the first frosts, was also practiced in some areas. The work on the tree was done from stages made of small trees whose branches could be used in climbing, or from rough ladders constructed of short rungs lashed to two poles. When steel axes and hatchets were available the tree could be felled, provided care was taken to have it fall on poles laid on the ground to prevent damage to the bark in the fall and to keep the trunk high enough to allow it to be peeled. Felling permitted use of hot water to heat the bark, and thus made peeling possible in colder weather than would permit stripping a standing tree. Felling by burning, however, sometimes resulted in an uncontrolled fall in which the bark could be damaged.

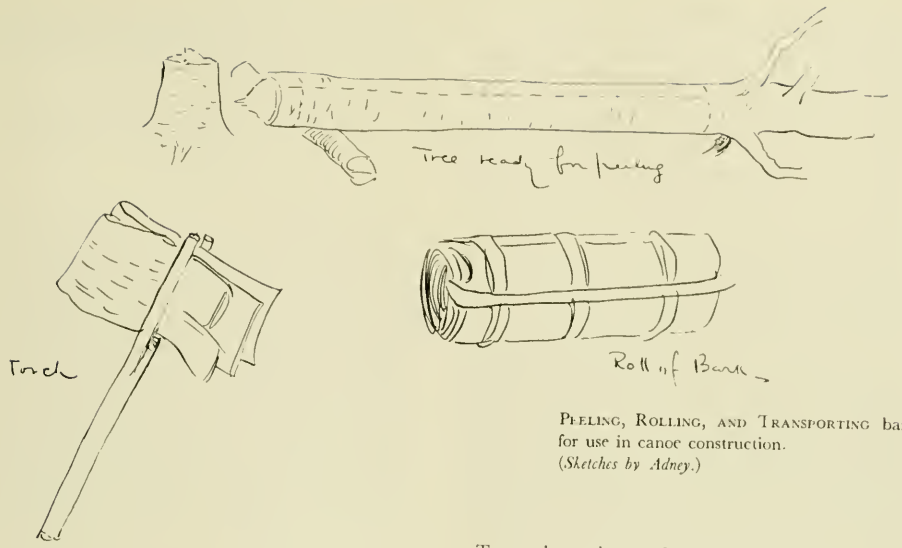
Whether stone or steel knives were used, the bark was cut in the same manner, with the blade held at an angle to make a slashing cut; holding a sharp knife upright, so as to cut square to the surface of the bark, makes the tool stick and jump, and a ragged cut results. A stone or steel axe blade could also very readily be used in cutting bark; with such tools, it was customary to tap the head with a maul to make the cut. It was necessary to make only the longitudinal cut on the trunk of the birch tree, as the bark would split around the tree with the grain at the ends of this cut. Spruce and other barks, however, required both vertical and horizontal cuts.

Once the vertical cut was made to the desired length, one edge of the bark was carefully pried away from the wood with the blade of a knife. Then the removal of the bark could proceed more rapidly. Instead of starting the bark with a knife blade, some Indians used a small stick, one end of which was slightly bent and made into a chisel shape about three-quarters of an inch wide. This was used to pry the bark away, not only along the edge of the vertical cut, but throughout the operation of peeling. Another tool, useful in obtaining "winter" bark, which was difficult to strip from the tree, was a piece of dry, thick birch bark, about a foot square, with one edge cut in a slight round and beveled to a sharp edge. The beveled side was inserted beneath the bark and rocked on its curved cutting edge, thus separating the bark from the wood with less danger of splitting the bark. Spruce and other barks were removed from the tree with the same tools.

After the bark had been removed from the tree, it was handled with great care to avoid splitting it along the grain. Even in quite warm weather, the bark was usually heated slightly with a bark torch to make it flexible; sometimes hot water was applied if the inner rind was not to be used for decoration. Then the sheets were rolled up tightly in the direction of growth of the tree. This made a roll convenient for transporting and also helped to prevent the bark from curling. If the bark was not to be used immediately, it was carefully submerged in water so that it would not dry out before it was fitted to the canoe. Spruce and other resinous barks, which could not be stored, were used as soon as possible after they were stripped from the tree, the rough exterior surface being removed by scraping.

Roots for "sewing" were also gathered, split, and rolled up, then placed in water so they would remain flexible. Sometimes they were boiled as well, just before being used.

The spruce gum was gathered and tempered. Before metal kettles and frying pans became available to the Indians, it was heated in a number of ways. One method was to heat it in a wooden trough with hot stones. As the spruce gum melted easily, great temperature was not required. Stone and pottery containers were also used. Another method was to boil water in a bark container and drop in the spruce gum, which melted and floated on top of the water in such a consistency that it could be skimmed off with a bark spoon or dipper. Chips and dirt were skimmed off the hot gum with a strip of bark or a flat stick.



Peeling, Rolling, and Transporting bark for use in canoe construction.
(*Sketches by Adney.*)



Figure 20

Tempering, done after the gum was melted, consisted of adding animal fat and a little finely powdered charcoal. The mixture was then tested by dipping a strip of bark into it and then into cold water. The strip was bent to see if it cracked the spruce gum; if it did, too much tempering material had been added and more gum was required. If no cracking occurred, the gum on the strip was held in the hand for a few moments to see if it became tacky or could be rubbed off the strip; if either occurred, more tempering was needed. The method of tempering had many variations. One was to remelt the gum a number of times; this darkened it and made it harder. Red ochre or vermillion were sometimes added, often together with charcoal made from the willow. Instead of spruce gum, in some areas, pine resin was used, tempered with tallow and sometimes charcoal. The Indians in the East sometimes used remelted spruce gum to which a little tallow had been added, making a light brown or almost transparent mixture. Most tribal groups used gum that was black, or nearly so.

For repair work, when melted spruce gum could not be procured in the usual manner, hard globules and flakes of gum scraped from a fallen spruce tree were used. These could not be easily melted, so they were first chewed thoroughly until soft; then the gum was spread over a seam. This type of gum would

not stick well unless it were smoothed with a glowing stick, and hence was used only in emergencies.

It is believed that before steel tools were available birch-bark canoes were commonly built of a number of sheets of bark rather than, as quite often occurred in later times, of only one or two sheets. The greater number of sheets in the early canoes resulted from the difficulty in obtaining large sheets from a standing tree. Comparison of surviving birch-bark canoes suggests that those built of a number of sheets would have contained the better bark, as large sheets often included bark taken from low on the trunk, and this, as has been mentioned, is usually of poorer quality than that higher on the trunk.

It is known that the early Indians carried on some trade in bark canoe building materials, as they did in stone for weapons and tools. Areas in which some materials were scarce or of poor quality might thus obtain replacements from more fortunate areas. Fine quality bark, "sewing" roots, and good spruce gum had trade value, and these items were sold by some of the early fur traders. Paint does not appear to have been used on early canoes, except, in some instances, on the woodwork. This use occurred mostly in the East, particularly among the Beothuks in Newfoundland. Paint was apparently not used on birch bark until it was introduced by white men in the fur trade.

Summary

It will be seen that the Indian gathered all materials and prepared them for use with only a few simple tools, most of which could be manufactured at the building site and discarded after the work was completed. The only other tools he usually brought to the scene were those he normally required in his everyday existence in the forest. Some instruments used in canoe building, however, might be preserved; these were the measuring sticks on which were marked, by notches, certain measurements to be used in shaping a canoe. Also, some Indians used a building frame that shaped the bottom in plan view. These are best described when the actual building methods are examined.

Building Frame for a Large Canoe. Dotted lines show change in shape is caused by omitting cross-bars or by using short bars in ends. Note lashing at ends and method of fastening thwart with a thong.

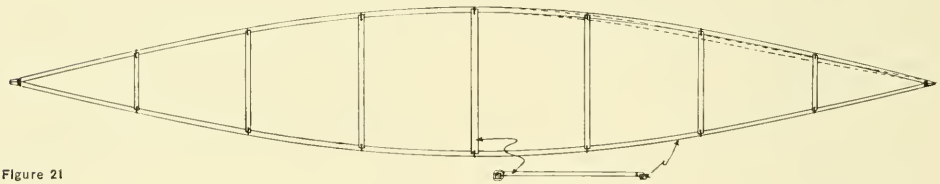


Figure 21