WOODCRAFT

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way of carrying an ax.

SNOWSHOES—HOW TO MAKE THEM

My first efforts at snowshoe making came about through trying to repair the broken filling of a pair of Indian made snowshoes. In removing the winding from the toe cord I accidentally discovered the place where the filling had been tied at the finish of the last round. This filling was badly worn and I reasoned that if I could remove it in the reverse order from that in which it had been strung I would know how to weave the intricate web of a snowshoe. I tried it out, successfully filling the old frames, and while it was far from perfect work I had at least learned the secret of snowshoe weaving.

Removing the stringing from a pair of snowshoes, carefully noting every turn, twist and loop, is the best way to learn how the filling is strung, but not every person who has ambitions along this line has a pair of snowshoes so much worn that he would care to risk removing the rawhide strands. Clearly written instructions, supplemented with working drawings, are the next best.

When a pair of snowshoes are to be made the first thing is to plan the size, shape and general character of the shoes. The frames, or bows, are the first step of the actual making.

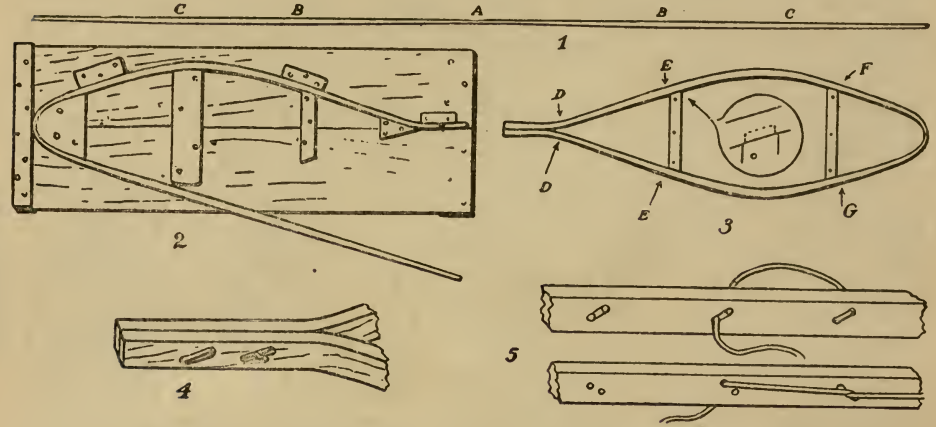
Snowshoe frames are made of tough, light wood. Many kinds of wood are used, and while I am not prepared to say positively which kind is best I believe that young, straight grained white ash is about as good a wood as can be found. But my experience has been mostly with white birch, and my instructions for making the frames apply to the use of this wood in particular, for it is peculiar in many ways, and cannot be split and worked as freely as certain other kinds of wood.

To find a suitable tree for this purpose is sometimes difficult. I once went into the bush a distance of seven miles to get a tree which I had found, split it, and carried one half home. I surely earned that wood, but I made from it a pair of frames which were so light that old bushmen said I would break them on my first trip; however, I used them all winter, then gave them to an old German who wore them until the filling was completely gone, yet the frames were still good.

The tree from which the frames are to be made should be not more than eight inches in diameter, and one of six inches is better. It should have drooping branches, and must have eight or ten feet of the trunk straight and clean, free of limbs, and absolutely without a particle of twist to the grain. Such trees may be found occasionally growing along the edge of a swamp.

After the tree has been felled and a section of the proper length cut off, a groove about one and a half inches deep is carefully cut the entire length along one side, care being used not to strike hard, as that would injure the wood. When the groove is finished a similar one is cut on the opposite side. The stick should be split with wooden wedges, and if it is properly done the split will follow the grooves. The best half should then be chosen for the proposed snowshoe frames, and this should be ripped lengthwise with a saw, or split, as desired. Each of the pieces will make a frame or bow.

One side of the stick is then cut and planed until it is perfectly straight, and its face at a right angle to the bark side, or at least it must be so in the middle, which forms the toe of the snowshoe, for there should be nothing taken off the bark side, not even the bark, until after the wood is bent into shape for the snowshoe frame. It is best if the entire stick is worked out from the bark side, but the wood may be planed straight at all parts except in the middle, where the greatest strain comes. Then the



MAKING A SNOWSHOE FRAME. 1. THE STICK BEFORE BENDING. 2. BENDING ON THE FORM. 3. THE FINISHED FRAME. 4. THE END FASTENING. 5. THREADING THE LANYARD—INSIDE AND OUTSIDE OF FRAME.

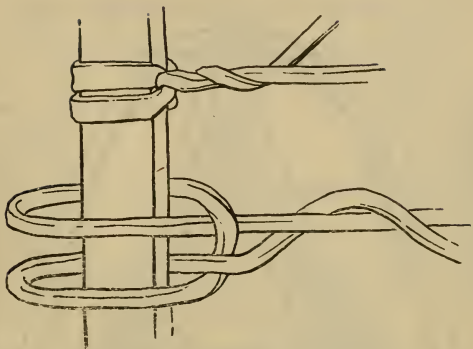
third side of the stick is marked off with a marking gauge and either cut or sawed to the mark. The fourth side, the inside of the stick, which will be the inside of the finished frame, is then cut down to the proper dimensions, but on this side an even thickness is not maintained, the toe portion being cut thinnest, with the heel—ends of the stick—coming next. For a snowshoe of average size, say 44 inches in length and 14 inches wide, the stick should measure eight and a half feet in length, one inch in width, seven-eighths inch thick at the parts which will become the middle of the shoe (B to C in figure one), one-half inch at A, and about five-eighths inch at the ends.

Before anything more can be done with the wood a form for bending the frames must be made. A convenient form is shown in figure two. For steaming the wood properly it is necessary to have a steaming box, which is merely a long case made of narrow boards, open at both ends. The stick is placed in this case and the steam from a boiling tea kettle turned in one end so that the hot steam travels the entire length. The wood should be steamed thus an hour and then it is ready for bending.

Figure two shows how the wood is bent and secured on the form. The toe must be formed very carefully, bending only a little at first, then releasing, then bending a little more, and so on until the wood can be seasily and safely bent to complete shape and secured by nailing blocks to the form. The form should be made from two- inch planks, so that it will accommodate the two frames. The wood is allowed to dry thoroughly on the form before filling, and this will require at least two weeks.

After the frames are dry they may be taken from the form, the tail end of each fastened and the crossbars fitted into place. The ends may be secured with a wood screw until after the frames have been strung, but the screw should then be removed and the ends tied with rawhide, through gimlet holes, the part between being counter sunk so that the thongs will be protected from wear. This is shown in figure four.

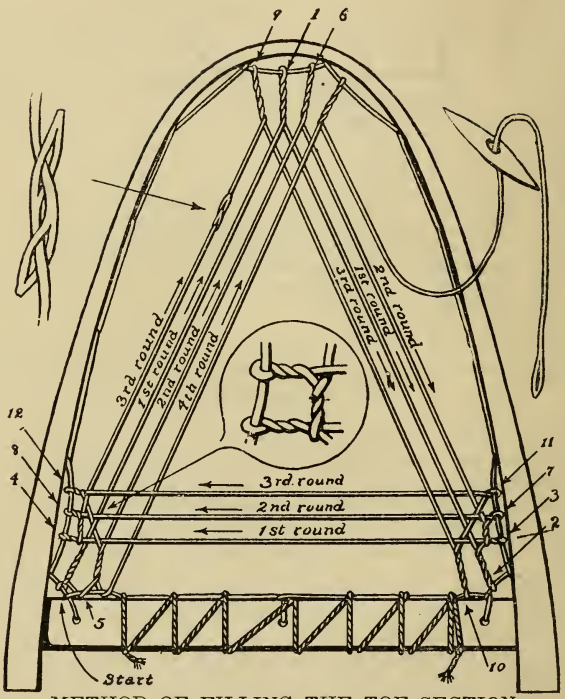
The crossbars are pieces of flat, strong wood, about one and a fourth inches wide and nearly a half inch thick, with rounded edges. These should be placed about 16 or 17 inches apart, measuring from center to center, and so placed that when the frame is supended on the hands midway between these two sticks the tail will outweigh the toe by just a few ounces. These crossbars should be carefully mortised into the frame as shown in the small diagram in center of figure three.



THE LOOP BY WHICH THE THONGS ARE FASTENED TO THE FRAME.

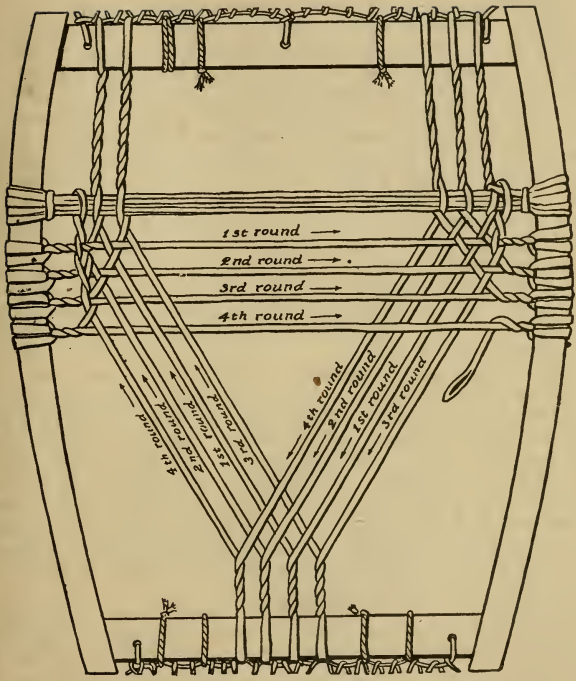
In both sides of the frame from D to E, also from F to G, gimlet holes are bored through the bows from outside to inside at intervals of two inches, or a little more, the holes being in pairs obliquely placed, and countersunk between. Three holes are also bored through each crossbar, as shown.

The frames are now ready for filling. Regarding material for filling, for ordinary use, there is nothing equal to cowhide, a fairly heavy skin. The green hide should be placed under running water for a week or more, until the hair can be pulled out easily. The hair should then be pulled, or scraped off, but care must be used that the grain of the skin is not broken or scraped away. The hide should then be thoroughly stretched and dried in an airy but shady place. When dry it may be cut into strands. A whole hide will fill several pairs of shoes. The portion along the back is best and this should be used for filling the middle section. The lighter parts from the edges of the skin will answer for stringing the heels and toes. All strands should be cut lengthwise of the skin, and full length. Their width will depend on the thickness of the skin, the weight of filling desired in the snowshoe, the general character of the snow in which they will be used, and the size of mesh in the web. If cut while dry, then soaked, stretched, and again allowed to dry, as they will be when strung into the frames, it will be found that the length of the



METHOD OF FILLING THE TOE SECTION.

strands will be increased greatly, while the thickness will be much decreased. It is well to cut several trial widths, so that the proper weight of strand may be determined. For a coarse webbed shoe the thongs, after being stretched and dried, should be about five-sixteenths of an inch wide for the middle portion of the shoe; for the ends an eighth inch is sufficiently heavy. These strands of hide should all be soaked and stretched thoroughly, allowed to dry while stretched, and then soaked again just before using, and strung into the frames while wet.



FILLING THE MIDDLE OF THE SNOWSHOE.

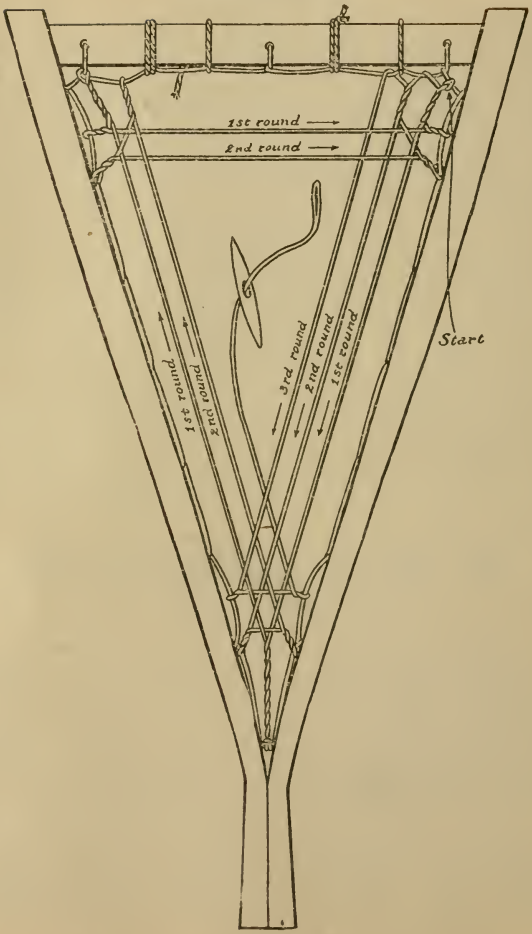
The ends are filled first and as I always commence with the toe I will describe my method of stringing that part first. A strand of the water-soaked rawhide is stretched tightly around the inside of the toe portion through the little gimlet holes, as shown in figure five, starting and finishing at one of the holes in the forward crossbar. This thong is called the lanyard, and its purpose is to hold the filling which is woven into the toe.

A small needle of very hard wood, or bone, is used for filling the ends. I have shown in the drawing how the filling runs. Starting in the lower left-hand corner it goes up to the part marked 1, passes around the lanyard, twists back around itself about an inch and then goes down to 2, there passing around the lanyard and again twisting around itself, then around the lanyard at 3, a single twist, and then across to 4, where it again turns around the lanyard, then twists down around the first strand to the starting point, under the lanyard at 5 and up to 6. From there the strand loops and twists the same as in the first round, except that at the lower corners it loops back around the first round, then twists around itself, then around the lanyard, and on the same as before. This looping back of every second round is continued until the filling extends across the entire forward part of the toe, when it is discontinued, and each round is made like the first. This looping back throws the filling alternately from side to side.

The filling must be stretched in very tightly and must not be allowed to slip. When one strand is used up another is joined on in the manner shown. Care must be used to see that every round crosses the others in the proper way, and all the twists must be made alike. The amateur should keep these pictures before him for a guide. Occasionally he should look his work over carefully, and if an error is discovered the stringing should be removed and made right. It will be necessary to straighten out the completed portions occasionally, and for this purpose I use a round-pointed hardwood stick. The weave will finish at the center of the crossbar.

The filling in the tail end or heel is very simple and is shown so plainly in the diagram that I think a description superfluous. It starts at the upper right-hand corner and finishes in the middle of the crossbar. I again advise that great care be used to get the twists and loops right, and to see that the thongs cross in the proper way.

Filling the middle section is also more simple than it appears at first glance, for it is practically a repetition of the system used in the toe portion. The edges of the wood should be rounded slightly to prevent them cutting the thongs. The Northern Indians wind this part of the frame with a strip of cloth, to make a sort of cushion for the tightly stretched thongs. This cloth winding serves its purpose well, but in a country where wet snows are common its use is not advised, for the cloth holds the dampness and causes the rawhide to rot.



HOW THE HEEL SECTION IS STRUNG.

While the system of stringing this part may appear quite intricate it is in reality simple, and it is the more elaborate arrangement of the forward portion that makes this section appear so complicated. The stout bunch of thongs shown in the drawing, known as the toe cord, is strung in first, the rawhide strand being tightly stretched and crossing the frame some four or five times, a loop being thrown around the whole on the inside of the frame on both sides in the last round. This should be so executed that the last loop will be on the right-hand side. The thong then loops around this bunch of cords again about an inch from the frame, from there being strung up around the crossbar, then twisting around itself back to the starting point, from there passing down diagonally to the center of the rear crossbar, where it loops and twists again, then up to the upper left-hand corner, where it twists up the same as on the opposite side. From here it will be noted the thong runs down a short distance and loops around the left side of the frame. The simple loop used for this purpose is clearly shown in a small drawing. From this loop the rawhide strand twists back about an inch, then runs straight across the shoe to the right, where the loop is repeated. This completes the first round of the filling. The second round starts in about the same way as the first, goes up to the crossbar at the left of the first round, twists back to the toe cord, from there to the rear crossbar, then up to the left-hand corner. Here the system changes, for the strand is run up and twisted around the toe cord and first round of filling before it is looped to the frame. After looping it is brought across to the right, where it again loops and twists, and then twists around the toe cord and first round of filling exactly as on the left, after which it is run down to the rear crossbar. In this way the stringing continues, every second round twisting forward around the preceding two. This binds the filling firmly and, it will be noted, also alternates the successive rounds from side to side. When the process of filling has progressed so far that there are four twists around the forward crossbar, on each side, this twisting should be stopped and the remainder of the forward portion left open, for this is where the foot of the wearer works through when walking. This open space should measure about four and a half inches in width, and if it does not the filling must be shifted. In very coarse meshed shoes three twists on each side will be all that can be given. An extra turn around the toe cord should also be made on each of these two twists of the filling, for consider-

able strain is thrown onto this portion. From this point on, instead of running forward and twisting around the crossbar, the filling simply twists around the toe cord. But here care must be used to keep the filling smooth and the toe cord flat, otherwise sore feet will result from wearing the shoes. The weave finishes in the center of the toe cord and there the end of the thong should be securely and neatly fastened. The last touch is to wind a strand of rawhide about the twisted thongs on each side of the foot opening and around the toe cord, to make these parts smooth and protect them from wear.

In the drawings of the heel and toe sections it will be noted that I have shown the web tied to the crossbars with twine. This is not a permanent feature, for when the center of the shoe has been filled these strings may be removed.

After making one pair of snowshoes the workman will undoubtedly see wherein he can improve on the design of the shoe, on the style of filling, or in the method of making. There are many labor-saving devices and ways of handling the material that make the work easier. But these the amateur snowshoe maker will learn in time and I believe I have now given all the instructions necessary for those who want to make their own snowshoes.

SNOWSHOES—HOW TO USE THEM

Snowshoes of one kind or another are used in all northern countries, for they are a necessity to those who live in the snowy north, and earn their living by outdoor work. Where or when they originated would be hard to say, definitely, but since it is in America that they have been perfected and were used by the Indians when this country was first visited by white men, it seems reasonable that the snowshoe is an invention of the early North American savages, and probably was first used many thousands of years ago.

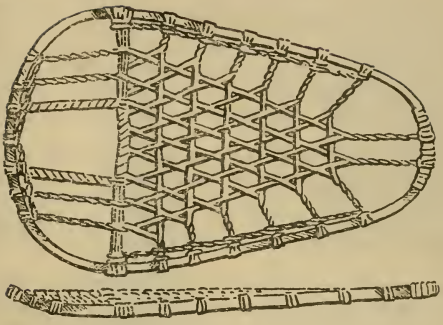
The snowshoe is copied from one of Mother Nature's many unpatented inventions. She is the inventor of the snowshoe, for she gave this gift to many of the northern animals, for instance the marten, the snowshoe rabbit, and even the caribou. The marten and the rabbit have large heavily furred feet, especially large

and furry during the winter, and because these feet cover a large area of snow in proportion to the animals' weight, they support their owners where animals unprovided with a "snowshoe" would sink, and would have great difficulty in traveling. The caribou has a highly split foot of large size; its spreads gives down under the animal's weight until the dew claws also help in supporting it, and thus cover so much surface that this big deer can walk on a snow crust that would not carry a man.

As a further illustration of nature's use of the snowshoe principle, compare the foot of a Canada lynx with that of a bobcat or bay lynx. The former animal, meant for an existence in the North and the high altitudes where deep snows prevail, has a very large, furry paw that supports the animal wonderfully on the loose snow, whereas the more southern wildcat, a very closely related species, has a foot relatively small and with shorter fur. The snowshoe therefore was merely copied from nature by mankind and no doubt it was a study of the natural animal snowshoe that gave the early-day savage the great idea and set him to work on a scheme by which he could increase the size of his feet in a convenient and practical manner, and thus be able to walk on the snow instead of wading through it.

Whatever may have been the style of the first snowshoes or the material used in them, the first white visitors to the American continent found the Indians using snowshoes with frames of wood, strung with rawhide, in fact, exactly the same as are being used to-day. While the white men may have sought to improve on materials and general form, it is certain that they could find nothing better or even as good, for the Indians' snowshoe was adopted and is being used in its original form to-day where serious use is required. Snowshoes are often modified in form for the use of the white people in and near the settlements, but for the rough, wild country the Indians' snowshoes cannot be surpassed, unless it be in the selection of materials and in workmanship.

Everybody knows that snow is not always of the same nature. The character of the snow depends on weather conditions. Cold weather causes it to remain loose and fluffy; warm days and cold nights settle the snow and form a crust, while during midday it becomes wet and packy; wind following a snowstorm makes drifts of more or less solidity. These are all very different conditions of snow and a snowshoe that is perfect in form for one kind of travel or one kind of snow cannot be per-



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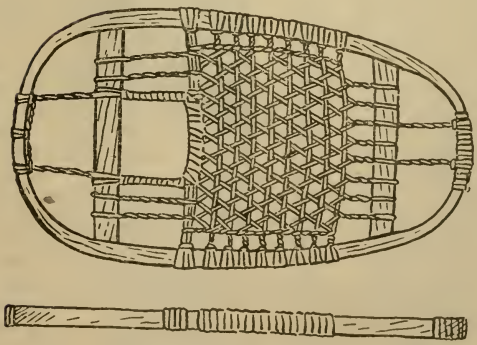

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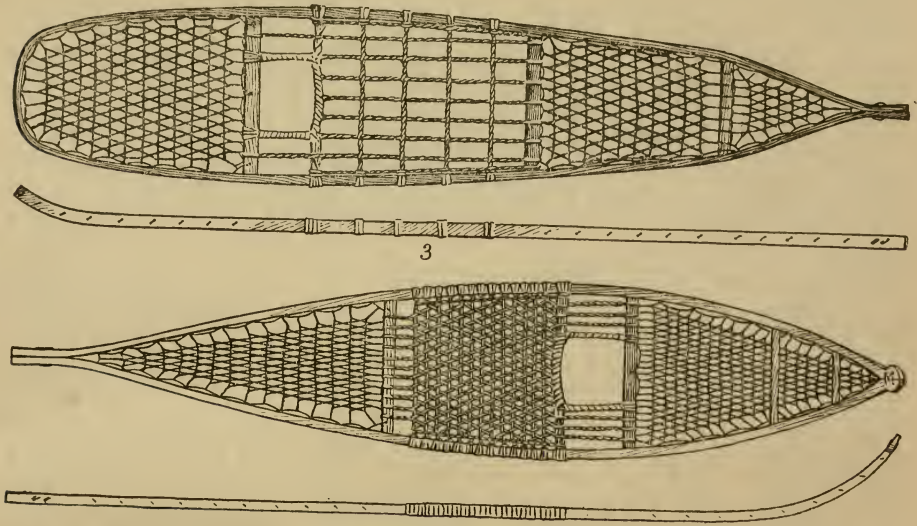
BEAR PAW SNOWSHOES. No. 1, WESTERN; No. 2, EASTERN.

fect for another, although it may answer for all kinds of use. In widely separated districts the prevailing weather conditions may cause one or another condition of snow to predominate the season through, and as a consequence the proper snowshoes to use in any particular place are the ones adapted to the prevailing snow conditions. Likewise the nature of the country with respect to surface and vegetation greatly influence the styles of snowshoes.

The sporting goods catalogues show snowshoes of very different forms and proportions, and the extreme conditions, not for general use. But the catalogues seldom give any information on this subject that will aid the tyro in selecting snowshoes adapted to his use, and if uninformed on the subject he is all at sea.

Long, narrow snowshoes are used for fast travel in open, fairly level country. In general, they are not good on rough ground, in brushy districts, or where the snow does not fall to a good depth. If the toes are turned up somewhat and more or less pointed they are better for travel in loose, powdery snow. But the upturned toes render the shoes worthless for hill climbing, as the frames will not take a grip on the snow, while on hard trails or crusted snow, such as we sometimes find on the frozen lakes, they make the wearer's feet sore through lack of spring in the frames.

The most perfect type of snowshoes for general use is that shown in figure five. It has the average dimensions and proportions, all extremes being avoided. It measures about 44 inches in length by 14 inches in width at the widest place, and this is the proper size for the average person and general conditions. A heavy man, if of average height, or taller, can use larger shoes to advantage, while for a smaller and lighter man slightly smaller snowshoes are better adapted. The toe is round and flat. It slips easily through the brush, takes a good grip on the hard snow of the hillsides and covers enough snow to keep it up near the surface while the narrow heel cuts down. The tail is short, which adapts the shoe better for turning in brushy places and reduces liability of breakage when crossing logs. The stringing, it will be noted, is heavy and coarse, which makes the shoe better for damp, sticky snow. A fine mesh filling is all right where the snow is always in a loose, dry condition, but when the snow becomes packy it closes up on the web and makes continuous trouble. The ends are filled with a finer material, for here the stringing is subject to less strain.



NORTHERN SNOWSHOES.
No. 3, ALASKA PATTERN; No. 4, THE CREE.

The Indians of Canada frequently fill the heel and toe of their snowshoes with fine twine instead of rawhide. This material wears much better than would be expected, providing the snow is deep and the snags well covered, as they are up there in winter. But a twine filling is not nearly as good as rawhide and is used only because it is a more convenient material.

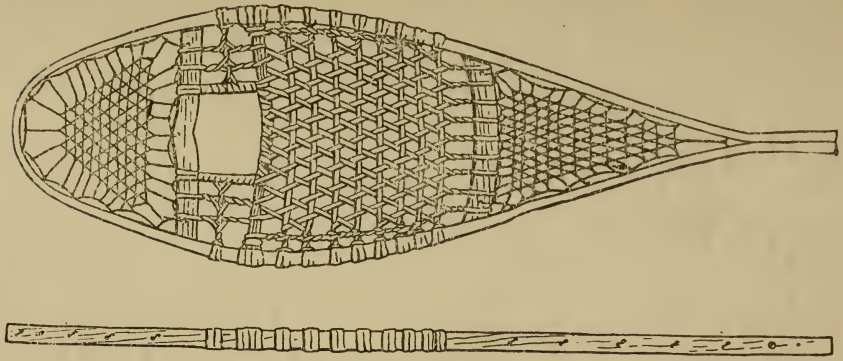
Many kinds of raw skins are used for filling snowshoes, but there is nothing better than cowhide. Horsehide is said to wear very well. Calfskin is a good material for stringing light shoes, for use on broken trails or for women and children. Moose and caribou skin are much used in the North, but are not as durable as cowhide. Except that the hair is removed from the hide it undergoes no other preparation for snowshoe filling, no oiling nor tanning being permissible.

In the frames also various kinds of wood are used, this depending partly on the woods obtainable where the snowshoes are made. A tough, light wood is required. White men usually make use of white ash, a very good material for the purpose. Black ash is also used, but is a poor wood for snowshoe frames. The Canadian Indians use white and yellow birch, both very good if good judgment is used in selecting the trees. In the far Northwest snowshoe frames are sometimes made of spruce, while in the West service wood is frequently employed. There are many other woods that will answer very well.

In the illustration are shown two patterns of long, narrow snowshoes. One has a pointed, upturned toe, the frame being made in two pieces, fastened together with rawhide at heel and toe. This style of shoe I think originated in Northwestern Canada, anyway it is used there by Indians and whites alike. Snowshoes of this pattern are usually made five feet long and 12 inches wide. The toe curves up seven or eight inches and the length from the toe cords on which the wearer's foot rests to the point of the upturned toe must exceed the length from the ball of his foot to his knee; if it is not so, the toe of the snowshoe will strike his knee when he lifts his foot.

The other long pattern is a style used in Alaska and Yukon. It is so shaped that it gives the maximum of surface covering qualities for a shoe of that length and a practical width. The stringing is very open and is put into the frame by a peculiar system, quite unlike that used in other snowshoes. This is an excellent snowshoe for fast travel in deep, loose snow.

Very short snowshoes made without tails are known as the



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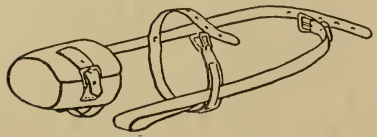

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A SNOWSHOE OF STANDARD SHAPE, AND A FOOT HARNESS FOR SAME.

"bearpaw" pattern. I have shown two of these. The one made without crossbars is used by the Indians of Washington. It is a very simple, easily made snowshoe, and is especially useful in the rough, brushy ground. It works nicely in the mountains of Pennsylvania and is probably as good for use in that place as in the Northwest. The other bearpaw shoe illustrated is a style that originated in the Adirondack Mountains. It was designed for the use of the spruce gum hunters, its short length making it a perfect snowshoe for use in gumming, walking around trees, turning and zigzagging here and there. This pattern is one of the best for very brushy ground, where rocks and fallen trees abound, and it is the best shape for use in the North when the first snows come and the small underbrush, snags, rocks and logs are not yet deeply buried. A pair of snowshoes like this may be carried in a packsack if the trapper is making a journey over his line when the first deep snow is due, and he will not then be caught without snowshoes when a day's journey or two from camp. This has happened to me, so I can now see the importance of carrying a pair of snowshoes at that time.

Snowshoes of all types have an opening in the forward part of the central section through which the wearer's toes move as he walks. At the rear edge of this opening are the toe cords, a bunch of five or six strands of rawhide, and when in use this part is beneath the ball of the foot. A toe-strap passes over the foot at this point. There is always some other form of fastening used, but this may be anything from the Indian's hitch of soft caribou skin or lamp wicking to the harness leather fastening of the white man, which buckles across the instep and above the heel. In all cases the fastening must pass around the foot above the heel, for it is this strap that supports the weight of the snowshoe as the foot is lifted; it is moved forward by the toe strap, and this piece also holds the foot in place on the shoe.

The Indian's method of tying a snowshoe to the foot has some advantages over the white man's harness fastening, but in other ways it is imperfect. The principal advantage is that the fastening need not be opened for removing the snowshoes or attaching it. I have used snowshoes a week at a time without opening the knot. A simple twist of the foot with bended knee will serve to free the snowshoe from the foot and it is just as easily replaced. But it does not hold the shoe as rigidly with respect to side motion as the strap and buckle adopted by white men generally, and I think it is more likely to cause soreness of

the feet. The harness shown is one of the best styles and is easily made and adjusted.

For snowshoeing in Northern districts, where the weather is cold all through the winter and the snow remains in a loose, dry condition, buckskin moccasins are the best footwear. By this I mean moccasins of any kind of deerskin, tanned by the Indian method. Such moccasins are not waterproof, but that makes little difference, for the dry snow never makes wet feet. Buckskin is soft and light and if the moccasins are large, plenty of warm, woolen socks may be worn. For spring wear, when the snow is more or less damp, or for use anywhere when the snow is in this condition, oil tanned moccasins or rubber overshoes may be worn. Rubber is somewhat hard on the filling of the snowshoes, but if this is heavy and of good material it will stand a lot of wear. Ordinary rubber shoes should not be worn, however, without first removing the heels.

When walking the entire snowshoe is never lifted clear of the snow; the tail always drags. It is easy to learn to use them. I walked 12 miles the first day I tried snowshoeing. My greatest trouble was in keeping one shoe clear of the other, but this is soon learned. There may also be trouble in learning to turn, especially in brushy places, and in attempting to cross logs. When crossing a log the foot itself must be placed on the log and the next step must be of sufficient length for the snowshoe to clear it, or the foot must be turned sideways.

To get satisfactory service from a pair of snowshoes necessitates proper care. The wearer should always avoid walking over snags, or little hummocks, which are certain indications of objects barely covered and which may injure the web of the shoes. Do not step on a place which will support one or both ends of the shoe solidly unless the middle portion is also thus supported, for if the frames do not break the strain they will be weakened and will sooner or later take on a curved shape. Never step down from a high place with all of your weight on the snowshoes, for the strain on filling and frame is great.

Snowshoes require care, not only while in use, but at other times as well. Being strung with rawhide, this material is very susceptible to heat and moisture. If the shoes are not dried thoroughly after becoming damp or wet the stringing will rot, while if dried too rapidly the filling becomes brittle and breaks when put to a strain. In camp snowshoes should be suspended from the ceiling by a wire, for mice will eat the filling if they

can reach them. Shoes should be watched closely also for worn strands and when a string looks dangerously weak the shoe should be repaired at once.

It cannot be expected that after the most exhaustive book study the novice will know enough about snowshoes to discriminate between the ordinary bad and those without fault. But there are points that if kept in mind will aid greatly in selecting snowshoes that will not only be desirable, but also satisfactory in regard to size, proportions and pattern. The extreme styles, as already pointed out, are not for the use of the beginner, for his snowshoeing is generally of the regulation kind. The snowshoes which he should buy, and which he will find in stock with most dealers, are more or less on the lines of the pattern shown in figure 5. The standard size, or about 14x44 inches, will answer well in nearly all cases. If the country is not too rough and hilly they may have the toes turned up an inch or two, but otherwise they should be flat, as shown. It matters little whether the toe be round, square or quite pointed, but it should be rather large in area while the heel end should be narrow. The long tail usually found on stock snowshoes is a nuisance and may as a rule be cut off to advantage, for usually the balance of the snowshoe is improved by so doing.

A snowshoe should almost balance when suspended midway between the two cross-bars, the tail end being just a little the heavier. Very few stock snowshoes are so made, most of them being too heavy in the rear.

When buying snowshoes examine the frames with care, for if they are not made of good, straight grained wood they are apt to break. The wood should be heaviest at the sides and thinnest at the toe. There must be no knots, cuts or other defects. Sometimes in bending the frames the makers split slivers loose and afterwards glue them down, so look carefully for such places.

The filling should be clear and yellow. It should be of almost equal thickness and there should be no splices close to the frame or in the centre. See that the thongs are thoroughly stretched, for poorly stretched filling is sure to stretch and sag the first time the shoes are used on damp snow. If the thongs do not run perfectly straight across the shoe, reject it, for this is a sure sign of poorly stretched filling.

What are sold as first-class snowshoes bring prices ranging roughly from five to ten dollars per pair. Good snowshoes can-

not be made and sold at less than five dollars, and if they are large or have much work about them they cannot be made for this price. I do not find any material difference between snowshoes of Indian make and those made by white men. The very best snowshoes I have ever found being made for sale are those made by a friend of mine living in the Adirondacks. He uses the best of material throughout and the stringing alone used in a pair of his best shoes will cost him as much as the price at which oridinary snowshoes are sold. The best possible snowshoes are not available to many readers of this article unless they have learned to make them, in which case they can use as much care and as good material as desired.