

# **RADFORD'S MANUAL TRAINING**

OR

## **Home Furniture Maker and Amateur Craftsman**

BY

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A Collection of more than 145 attractive Furniture Pieces Suitable for Hand-made Construction; the Design, Proper Method of Making, and of Finishing each Piece Being Clearly Shown Through Numerous Actual Photographs of the Finished Pieces, Complete Working Drawings, Bills of Material, and Accurate Descriptions of the Processes required to do the Work. Other Popular Handcraft Work such as Stenciling, Art Leather, Hammered Metal, etc., Briefly yet Practically Presented.

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**A TEXT BOOK FOR SCHOOLS AND SHOPS, AND AN INSPIRATION AND  
GUIDE FOR ALL HOME CRAFTSMEN**

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Edited under the Supervision of

**WILLIAM A. RADFORD**

President of the Radford Architectural Company, Editor-in-Chief of "Radford's Cyclopedia of Construction", "Radford's Architectural and Mechanical Drawing" (2 vols.), "Radford's Details of Building Construction", etc.

Assisted by

**BERNARD L. JOHNSON, B. S.**

Editor "American Carpenter and Builder"

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IN TWO VOLUMES; VOLUME TWO

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photographs, Plates 76, 77 and 78, can be used.

Frequently the background is worked down only about the design. To aid in raising the design modeling wax is sometimes placed under it as the tooling proceeds. Again, stamps of different designs are used which, when properly combined, produce beautiful effects.

A word of caution is necessary. All kinds of calf skin will not model. Some colors work better than others. The safest way is to order of those who make a business of supplying this trade.

### HOW TO BUILD A CANOE

To the average boy or young man there are few enterprises more fascinating than the building of a canoe. Our innumerable small inland lakes and rivers furnish the required watery setting for this sport in almost every locality; and with the natural love of boating that every young fellow has, it is not strange that the building of boats and canoes should be such a popular undertaking for both the amateur and skilled workman during the dull winter season.

Carpenters, especially, take to this kind of work, building canoes sometimes for their own use, sometimes for others; their skill with fine tools and the care they are accustomed to use in their work making it very easy for them to turn out canoes to be proud of. The methods for

canoe building here presented are those employed in the manual training work of a well-known eastern preparatory school, and are to be recommended. It is through the courtesy of the Manual Training Magazine that both the illustrations and the text of this article are presented here.

Mr. Egbert S. Cary in describing the methods used writes as follows:

Our construction is quite different from that usually seen in that we use a narrow three-ply rib instead of the thin broad rib of the common type. This makes a light and exceedingly rigid boat, but is open to the objections that better wood must be used and that a grating in the bottom is more necessary than in the usual form.

The following specifications cover the most important features of our canoes:

Length, 15, 15½, and 17 feet; beam, 31 inches; depth amidships, 12 inches; planking, 3/16-inch white cedar; ribs, 3-ply, 2 cedar, 3/16-inch by ½-inch, 1 elm, ¼-inch by ½-inch, half round; stem and stern pieces, ¾-inch by ½-inch, elm; nails, 1-inch, No. 15, copper; inwale, 1-inch by ¾-inch, spruce; canvas, No. 10, finished with one coat filler, two enamel, one spar composition; woodwork finished one coat oil, one No. 1 preservative, two spar composition; decks and seat frames, oak or mahogany; rubbing and cap strips, 1¼-inch by ¼-inch, spruce; bang irons, ⅜-inch, half round, brass; keel, flat, ½-inch by 3 inches at center, tapering to 1 inch.

We use the lines as shown in the drawing (Fig. 209) for all lengths of canoes, spacing the patterns proportionally. The following table gives the dimensions for making full-size drawings in the different sizes:

Table of Offsets

	1	2	3	4
2"	$1\frac{1}{8}$	$7\frac{1}{8}$	$11\frac{3}{4}$	$12\frac{1}{8}$
4"	$4\frac{1}{8}$	$10\frac{1}{8}$	$14\frac{5}{8}$	$15\frac{1}{8}$
6"	$5\frac{3}{8}$	$11\frac{1}{8}$	$15\frac{5}{8}$	$16\frac{5}{8}$
8"	$5\frac{7}{8}$	$12\frac{1}{8}$	$15\frac{1}{8}$	$16\frac{3}{4}$
10"	$5\frac{1}{8}$	12	$15\frac{1}{4}$	$16\frac{3}{8}$
12"	$5\frac{7}{8}$	$11\frac{7}{8}$	$14\frac{5}{8}$	$15\frac{3}{4}$
Sheer	$5\frac{1}{4}$	$10\frac{7}{8}$	$14\frac{1}{4}$	$15\frac{3}{8}$
	1	2	3	4
Keel	$1\frac{1}{8}$	$1\frac{3}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
Sheer	$17\frac{1}{4}$	$13\frac{1}{2}$	13	13

The patterns are made by drawing the cross-section lines full size and then making a com-

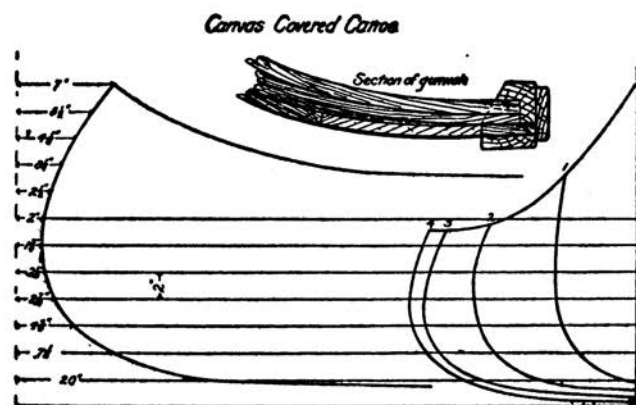


Fig. 209. Pattern Chart for Canoes of Any Length

panion line inside of each at a distance depending upon the thickness of the planking, ribs and mold battens. In our case, using  $\frac{3}{4}$ -inch battens, this distance is  $1\frac{5}{8}$  inches. These lines are then transferred to the boards that are to form the pattern, taking off both the curved and the vertical line, and some arbitrary point, at which a  $\frac{3}{4}$ -inch hole is to be bored.

The patterns are mounted on a heavy plank as shown in Plates 79 and 80 and accurately lined by sighting through the holes and adjusting to the vertical with a plumb-line. When fastened firmly in place the battens, which are free from knots to insure smooth curves, are nailed on. If there is difficulty in bending them to the sharper curves at the bow and stern, the battens are sawed lengthwise for a few feet at the ends. One batten is nailed on the patterns following the sheer line or top edge of the canoe and another about two inches below this. The others are spaced about 6 inches apart on the center pattern except at the bilge or turn where they are not more than 3 inches apart. At this turn the battens have their projecting corners shaped down to the contour of the mold.

The pattern of the bow and stern is made in the same manner as the above, allowing for the thickness of the stem and stern pieces and is split vertically so that the canoe can be lifted off the molds.

We buy white cedar in 1 $\frac{1}{4}$ -inch plank, re-sawed to 3-16-inch S-2-S, and crated for shipment. From these boards we cut strips 3 to 4 inches in width and use the waste for ribs. The elm ribs are worked at a nearby planing-mill from stock grown on our farm.

The three-ply rib as specified gives a very strong and light rib that requires only soaking before bending. The half-round elm strip on the inside takes the wear and firmly holds the clinched nails. As the ribs are bent on to the molds in planes parallel to the patterns, they are nailed to the middle and to the lower battens and at such other points as may be necessary to make them fit snugly to the mold.

The stern pieces are steamed before bending and when dry they and the ribs are shaped down so that a batten placed along the mold will bear against a flat surface at every contact. Also the outside strip of each rib is beveled down for about 4 inches so that at the sheer line there are but two strips. This is done to avoid using an excessively thick inwale. Allowance is made on the pattern for this bevel which is shown in the section drawing of the gunwale.

The following points are observed in putting on the boards:

1. Use full length strips when possible.
2. Splice under ribs using  $\frac{1}{2}$ -inch bevel joint. (With wide construction use butt joint.)
3. Do not force boards to position. Cut them to fit.

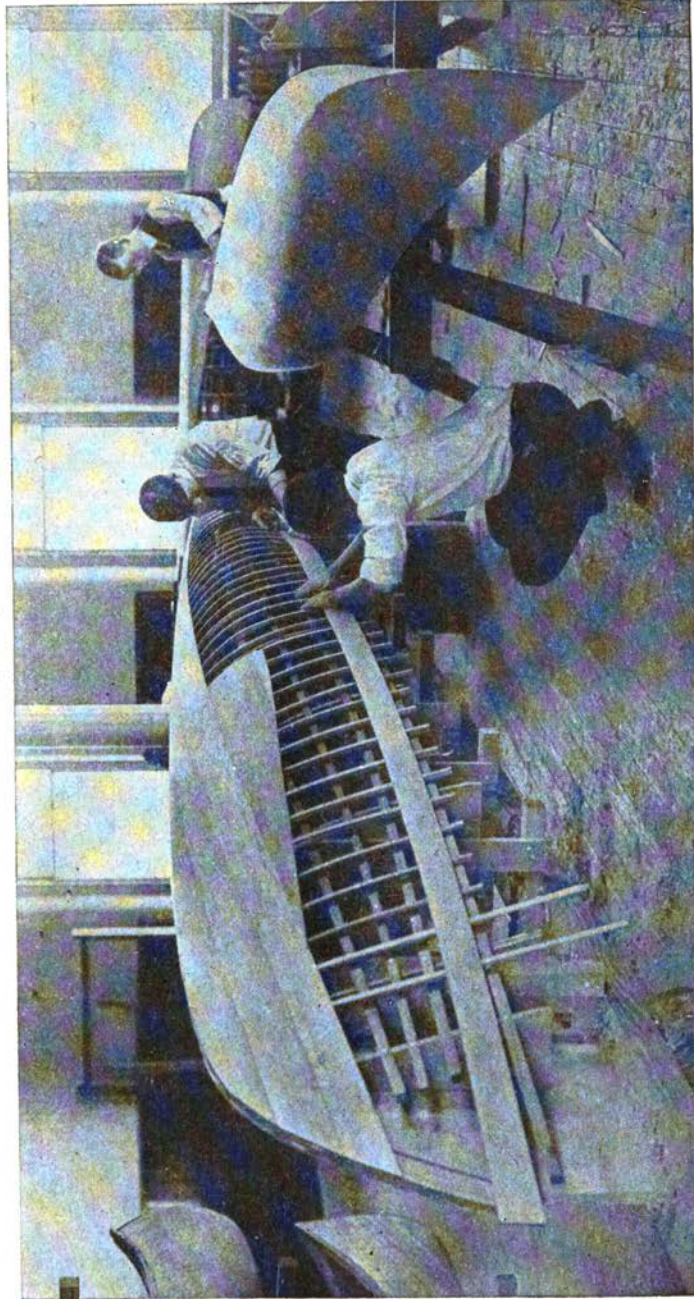
4. Remember that it is the inside that shows when done.
5. Drill holes for all nails with a drill but little smaller than the nail and space about 1 inch apart.
6. Fasten boards to the stern pieces with  $\frac{5}{8}$ -inch F. H. brass screws.
7. Most important of all, as the planking proceeds remove the nails with which the ribs were fastened to the battens.

It is our practice to use an oak strip,  $1\frac{1}{4}$  by 3-16 inches, for the last board or sheer strake, which is soaked and bent into place. This makes a strong and neat finish and gives a hard wood into which to drive the tacks for the canvas. There are no nails placed below the middle of this strip because the ends of the ribs are cut off at least  $\frac{1}{2}$  inch below the top edge of the completed canoe. (See gunwale section, Fig. 209.)

After the sheer strake is in place the ribs are sawed off below it and a little careful effort, pulling outward and upward at successive points, lifts the canoe from the mold. To prevent spreading, the gunwales are tied across in a few places and as soon as possible, the nails, beginning at the center, are clinched with light strokes turning the points along the grain of the rib.

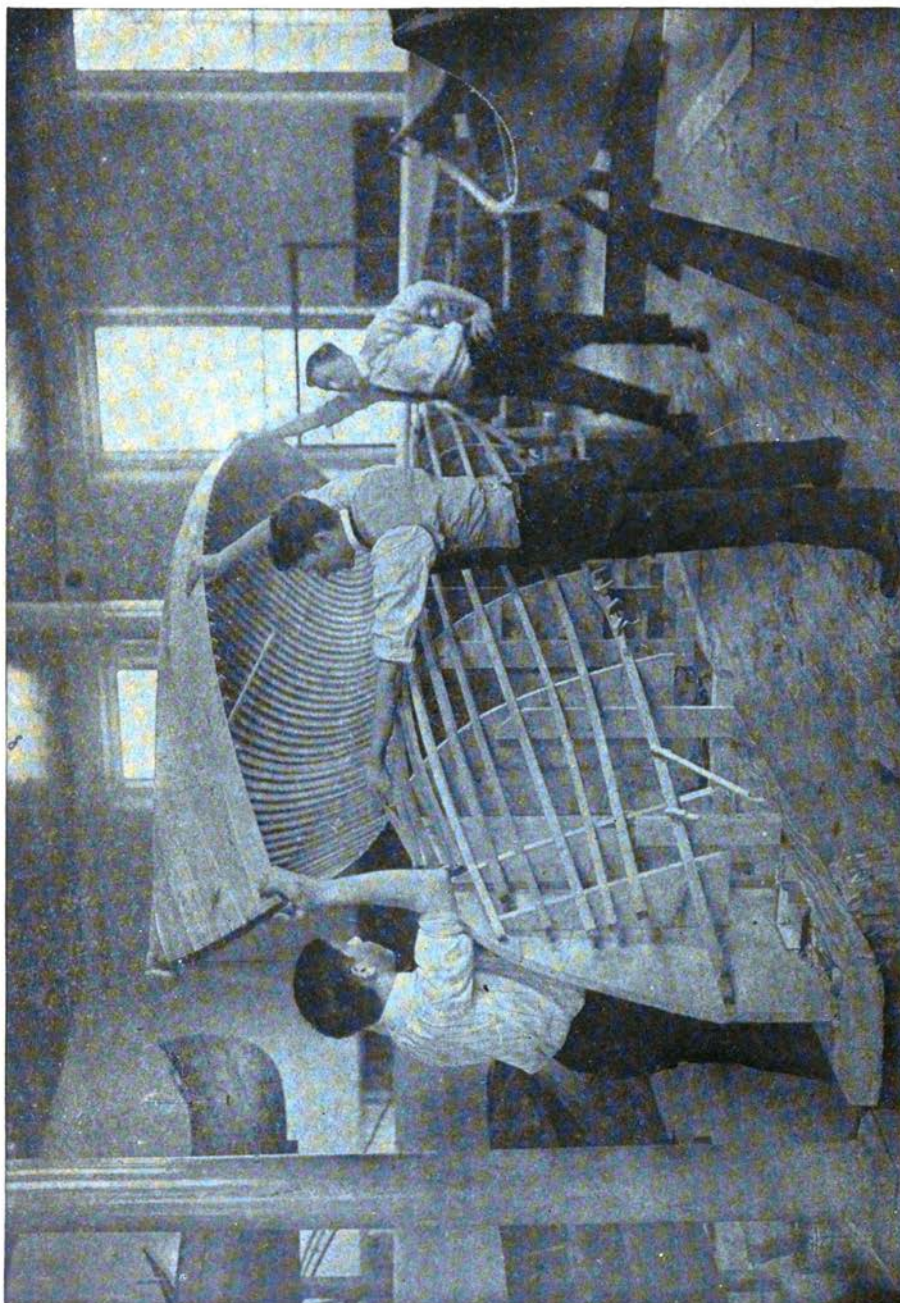
Two extra ribs are now put in at each end where there is quite a space, the ribs for which could not easily be bent on to the mold.





HOW TO BUILD A CANVAS CANOE

Plate 79—Manual Training, Vol. II



CANVAS CANOE MAKING—REMOVING THE CANOE FROM THE MOLD, FORMS—NOTICE HOW THE PATTERNS ARE MOUNTED AND THE BATTENS NAILED ON

Plate 80—Manual Training, Vol. II



The inwale, which is usually put in before stretching the canvas, is made of straight-grained spruce soaked and bent on a form. When dry it is clamped in place while the positions of the ribs are marked, after which the holes are bored and cut out "U"-shaped and the strips beveled so that water and dirt will run out freely from the completed canoe.

A cap strip of  $\frac{1}{4}$ -inch elm is next bent around the stem and stern to give a good holding for the canvas tacks; then the outside is rasped to remove all inequalities and the boat is given a coat of raw oil.

#### Stretching on the Canvas

The canoe is now ready for the canvas which is first stretched lengthwise as much as possible and kept under tension while stretching and tacking the sides. With carpenter's pincers and the edge of the canoe as a fulcrum the canvas is stretched to its limit and fastened with  $1\frac{1}{2}$ -ounce tacks spaced  $\frac{3}{4}$  inch apart. Beginning in the center, a few inches on each side alternately are tacked until near the ends there develops a tendency to wrinkle. The canvas is then cut on the middle line from the end to the point where it is under tension and after coating the surfaces to be joined with white lead, it is pulled around the end and tacked. Alternately working at the end and edge completes the stretching without a wrinkle.

**Filling and Painting Canvas**

After many experiments we have settled upon the ordinary quartz paste as a canvas filler, although, if properly seasoned, white lead putty does very well. The filler is mixed with oil and japan drier to a consistency that will work easily with a brush, and a heavy coat is applied to the canvas. After standing for an hour or more the excess of oil is absorbed and the filler can then be rubbed down with a leather glove to a smooth finish.

Canoe enamel can be purchased at sporting goods stores, but we make our own by straining through cheesecloth a mixture of japan, ground color, and spar varnish.

No description of the finishing touches seems necessary except to mention that the rubbing strip is soaked and bent on the form used for the inwale, and that the keel is fastened from the inside with R. H. brass screws in copper washers, all holes through the canvas being treated with white lead.

A few years ago we made a small canvas-covered motorboat which proved quite satisfactory in spite of its rather crude design. Profiting by this experience we have obtained from the board of G. F. Crouch, naval architect, plans for an 18-foot runabout. These are well adapted to our construction, and the two boats in course of building give promise of being staunch and speedy little craft.