

INSTRUCTIONS FOR BUILDING THE SCALE MODEL LIGHTNING SAILBOAT

The DUMAS LIGHTNING SAILBOAT is a scale model (1 in. = 1 ft.) of the very popular Lightning Class Sailboat. Over 11,800 of the full size boats have been registered by the International Lightning Class Association since it was first designed by Sparkman Stevens in 1938. The Lightning is 19 feet long, with a 6 foot 6 inch beam and waterline length of 15 feet 3 inches. The sail area is 177 square feet. Most Lightnings are of wood - built with frames and planking similar to your model. However, some are made of fiberglass and plywood. At present there are over 420 individual fleets actively operating in the United States, Canada, South America, Europe and Australia. North American championships have been held annually without a break since 1939, so you can see the Lightning is quite a well known boat.

Now to build your model - PLEASE READ THE INSTRUCTIONS COMPLETELY BEFORE STARTING TO BUILD.

You will need the following tools and supplies:

Flat building surface, 12" x 24"	Sharp knife
Sandpaper and sanding block	Masking Tape
Needle and thread	Razor saw
Small clamps or spring clothes pins	Pins
Epoxy or wood model cement	Small file
3/32" drill and small drills	Weights
Paint, enamel, or varnish	Wood filler
Pliers and cutting pliers	Wax paper

NOW TO START BUILDING!

1. Place the lower portion of the plans showing Fig. 1 and 2 on the flat building surface and cover with wax paper.
2. Remove K1, two K2, and K3 from die cut sheets by pushing out the parts. Lay K2 on Fig. 1, cement K1 and K3 to K2 in area between dotted lines and solid lines. Place scrap piece of 1/8" plywood under ends of K1 and K3. If you plan on sailing your boat, the ends of K1 and K3 toward the center of the boat, and the inside of the K2 which will be cemented on next should be coated with waterproof cement or varnish to seal the wood as these parts will be in the water. Cement the second K2 to K1 and K3, lining it up with the first K2. This will make the centerboard well or the slot for the centerboard. Allow to dry. To cut building time to minimum use 5 minute epoxy. Do not get excessive cement in the opening between K2 and K2 or it will have to be removed late, see Fig. 2. Drill 3/32" dia. hole through both pieces K2 for centerboard pin - location is marked by punch mark.

3. Now to make the framework, see photo in Fig. 3. Remove from die cut sheet frames number 1 through 6 marked by the dots shown on the drawing of the parts layout on the die cut sheets, Assemble frames into notches in keel made in #2. Slide sheers (S) into notches in ends of frames. The notches can be enlarged if necessary with a file or sandpaper. Make sure the frames line up with the edge of sheer (S) and top of keel K1, K2 and K3. Take apart and reassemble framework, cementing parts together. Place on Fig. 2, and make sure the sheer and frames 1 to 6 match with the drawing. Place weights on top of keel to keep all frames touching the building board - allow to dry. If some of the pieces are warped, they should all be straightened out by fitting all these parts together into the notches.

4. Before removing from board, cement two chines, $1/8 \times 1/8 \times 22\frac{1}{2}$ balsa, into notches in frames, one on each side, see Fig. 5. Cut chines at angle to fit at front (or bow). Also at bow sand notch in keel at angle to match angle of chine. Cement to frame 1 and 2 - let dry. Cement chines to frames, 3, 4, 5, and 6, hold with pins or masking tape. If balsa is hard to bend, it can be dampened with hot water and allowed to soak for 10 minutes before bending. Hold in place and allow to dry before cementing.

5. With sandpaper on a sanding block, sand off any glue or high spots where the bottom will fit. Fit one half of bottom (B) - sand center edge so that it covers $\frac{1}{2}$ of keel K1 and K3, cement in place, hold with pins and masking tape or small clamps around the edge. Cut out portion of bottom covering opening for centerboard between K2 and K2. Fit by sanding edge of other bottom piece and cement on second half of bottom - allow to dry. Saw out frame 3 that goes across centerboard well opening, see Fig. 2.

6. Trim off excess wood on bottom down to chine, $1/8 \times 1/8$ balsa. Remove ends of each frame (shaded portion) by sawing on dotted line as shown in Fig. 5 - these were needed when making the framework only. Cut and cement stringer "X" $1/8 \times 1/4$ strip in notches on top center of frame 5 and 6 and stringer "Y" $1/8 \times \frac{1}{4} \times 7$ strip, from bow in notches on top of frame 1 and 2. These will be for supporting the center of the deck. Sand frames to curve from edge of sheer to center.

Now fit the sides (H), sand front of side piece at an angle to fit K1 at the bow where side joins K1. Cement on sides - hold with masking tape and clamps.

7. Cement piece of $1/8 \times \frac{1}{2} \times \frac{1}{2}$ mahogany plywood block (M) to stringer and to frame 6 so deck can be cemented to it. This is to hold screw eye for back stay, see Fig. 5. Also cement 2 strips $1/8 \times 3/8 \times 2$ mahogany plywood (N) (cut from scrap) to front of frame 2 at top each side of center. These are for holding screw eyes. Cement transom (T) on frame 6 to cover frame 6 and give finished appearance. Only one transom (T) is used - wood from second is used to make the rear seat. Paint the inside of the boat and both sides of the two deck pieces with several coats of clear sealer or varnish. This will prevent the wood from warping if the front and rear of the boat aren't completely sealed and water enters these

areas. Sand deck pieces (D) to fit at center if needed. Cement on both halves of deck.

8. Sand off edge of deck that extends beyond the sides and cement on rub rail, $1/16 \times 1/8 \times 24$, the length of the boat to cover joint between deck and sides on both sides and across the transom at stern. To bend the wood to fit the transom, soak it in hot water for 15 minutes - bend it to shape, hold with pins until dry, then cement. Cement on outer keel strip, $1/20 \times \frac{1}{2} \times 20$ mahogany to cover joint in bottom, see Fig. 6. After it is dry, cut out the slot for the centerboard. Cement skeg on top of outer keel strip at stern, Fig. 7. Cement cockpit trim (C) on deck at sides of cockpit. Cut a piece from scrap mahogany to fit across rear of cockpit, see Fig. 5.

9. Sand angle on front of splash board (E), sand bottom to fit the deck and cement in place. The splash boards are tilted forward, see photo of finished boat. Cover the top edge of centerboard well sides with scraps of thin mahogany to cover edge of plywood - helps improve the appearance.

10. Cut two pieces, $1/8 \times \frac{1}{4} \times 10$, spruce and cement together to form a "T" cross section to make boom, see Fig. 8. Cut small spacers $1/16 \times 1/8 \times \frac{1}{4}$ from spruce and cement to mast, $3/16 \times 5/16 \times 26$ spruce, and boom approx. 2" apart. Cut stainless wire, .041 dia. $\times 24$ ", to length to fit on mast and boom, wipe clean with solvent to remove grease and cement to top of $1/16 \times 1/8 \times \frac{1}{4}$ blocks. Epoxy cement is best for this. The wire is held away from the mast and boom so the sail can be hooked onto the wire. Bend a "U" piece of wire for end of boom to fit around wire on mast. Slip around wire on mast and cement to end of boom as in Fig. 8. Cement in extra wood spacer to keep boom from going up the mast wire, see Fig. 8. Varnish mast and boom with several coats of waterproof varnish.

11. Lay sail along mast and boom and mark spots for hooks to be sewn on sails. Sew dress hooks on edge of sails with light thread approx. 2" apart, see Fig. 8 & 10. Cut red lightning bolts out of red vinyl self-adhesive material. Cut one using pattern Fig. 13 for the right or starboard, side of the sail. Turn the pattern over and cut a second one. Remove paper backing and locate on sail as shown in Fig. 10. Cut white plastic strips for battens, two 2" long and one $2\frac{1}{2}$ " long locate on sails as shown in Fig. 9. You can cut another set for the other side if you want.

12. Bend $1/16 \times 1$ wire for rudder mount. Drill or slot rudder and cement in wire. Cement $1/16 \times \frac{1}{2}$ tubing on transom for rudder mount. The rub rail will have to be notched for rudder. Cut notch in tiller, $1/8 \times \frac{1}{4} \times 4$ spruce, to fit rudder. Drill and insert piece of wire or a straight pin - hold with cement, see Fig. 7.

13. Fit the floor board (A) in place, see Fig. 5. They rest on frame 3 and 4 - DO NOT CEMENT. Cement front seat (F) to side seat (G). Cement piece of scrap mahogany across the bottom of the joint for extra strength - let dry. Place side seats in place in boat.

The end of the front seat will have to be trimmed to fit against the centerboard well. Now cut the rear seat from the second transom (T). It should be 1" wide and fit between the two side seats. Cement together with glue blocks from scrap under the joint. DO NOT CEMENT IN PLACE.

14. Sand boat with fine sandpaper. Paint with several coats of wood sealer, fill the wood with wood filler and sand smooth. Apply several coats of enamel, sanding between coats. Color scheme is up to you. The bottom is usually a different color from the sides with a narrow stripe at the water line, see Fig. 9. This could be a narrow strip of tape from your hobby shop. The deck and inside can be varnished with the seats colored. Paint the rudder and centerboard. Mount the centerboard with a $\frac{1}{2}$ " piece of brass rod through the centerboard well, $\frac{3}{32}$ " dia. holes drilled in Paragraph #2, so it can swing up and down.

15. Drill hole in deck and bottom of mast for .041 wire. Insert $\frac{1}{2}$ " long piece of wire used on boom. This allows mast to be removed and is not easily broken.

NOW TO RIG THE BOAT:

16. Drill hole $\frac{3}{32}$ " dia. through the mast for spreader - hole is $12\frac{1}{2}$ " from top of mast. Center brass tube, $\frac{3}{32}$ dia. x $4\frac{1}{2}$, in hole and cement. Also cement screw eye into each end, see Fig. 10.

17. Make 9 bowsers from white plastic strip, see Fig. 11.

18. Cut and bend two jack stays from stainless steel wire to match Fig. 14. Drill $\frac{1}{16}$ " hole into mast and cement into mast. Cut two pieces of brass rod, $1\frac{3}{8}$ " long, and epoxy rod to mast and wire (if you plan to sail the boat, it will sail better without all this weight at the top of the mast). Instead of mounting mast through the deck as on the full size boat, insert a piece of wire $\frac{1}{2}$ " long into bottom of mast and into hole drilled in deck about $\frac{3}{4}$ " forward of edge of deck, Fig. 8. This system will keep the mast from being broken.

19. Screw screw eyes into deck at bow on centerline - at stern $\frac{1}{4}$ " from centerline into block (M) so it does not interfere with tiller, and for shrouds $\frac{1}{4}$ " from edge of deck, see Fig. 5 & 9. Screw screw eyes into both sides and rear of mast approx. $\frac{1}{4}$ " from top, Fig. 10. Don't have screw eyes in a line or the points may hit. Also screw screw eyes into front of mast 7" from top and 13" from top and in sides of mast just under spreader. Using nylon line (note: all rope or string on a sailboat is called a "line") install back stay, tie to screw eyes at top rear of mast. Insert through 2 top holes in bowser, then through screw eye on deck at stern and tie in bottom hole of bowser, see Fig. 9 & 11. Repeat for shrouds. One shroud runs from the top of the mast through the screw eye at the end of the spreader and attaches to the forward screw eye on side of deck. The other shroud is from the screw eye on mast under the spreader to the other screw eye approx. $1\frac{1}{4}$ " behind the other shroud. The jib stay is run in the hem of the jib

sail by tying the line to a small safety pin and working the pin up the hem of the sail. Tie the bottom end to the screw eye at the bow and run the other end through the upper screw eye on the front of the mast and attach to the lower screw eye on front of mast using a bowser, Fig. 10. Tie the lower front corner of the jib sail to the screw eye with needle and thread, sewing through the sail. Attach nylon line to top of sail through top screw eye, same as for jib stay, and anchor at bottom screw eye on the side of the mast with a bowser. This is called the jib halyard. This makes both of these lines adjustable so the mast may be raked or slanted toward the stern by adjusting the jib stay and back stay.

20. Attach mainsail to mast and boom with the hooks and tie sail at the 3 corners with several threads. With a needle, you can sew through the sail and then around the wire or screw eye. At the end of the boom, drill a small hole through the boom for the thread to hold the sail and also a hole for the line used as main sheet, Fig. 8.

21. With nylon line and bowsers, screw eyes and chain links, install the main sheet and jib sheet as shown in Fig. 8. These are used to adjust the position of the sails. For jib sheet sew small chain link to corner of jib, slide one chain link onto line and tie both ends to the link on the sail. Install line to screw eye on the bow using a bowser to make adjustments. For the main sheet, install 2 screw eyes in the deck edge about $\frac{1}{2}$ " behind cockpit edge and $\frac{1}{4}$ " from edge of boat. Also one on side of boom almost to the mast, Fig. 8. Tie the line to the boom, then run it through both screw eyes and through the hole in the boom. Attach it to the screw eye with a bowser so it can be adjusted.

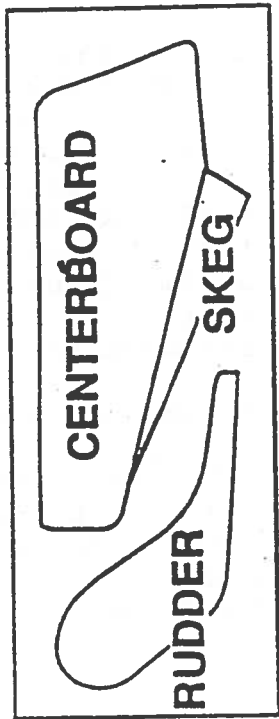
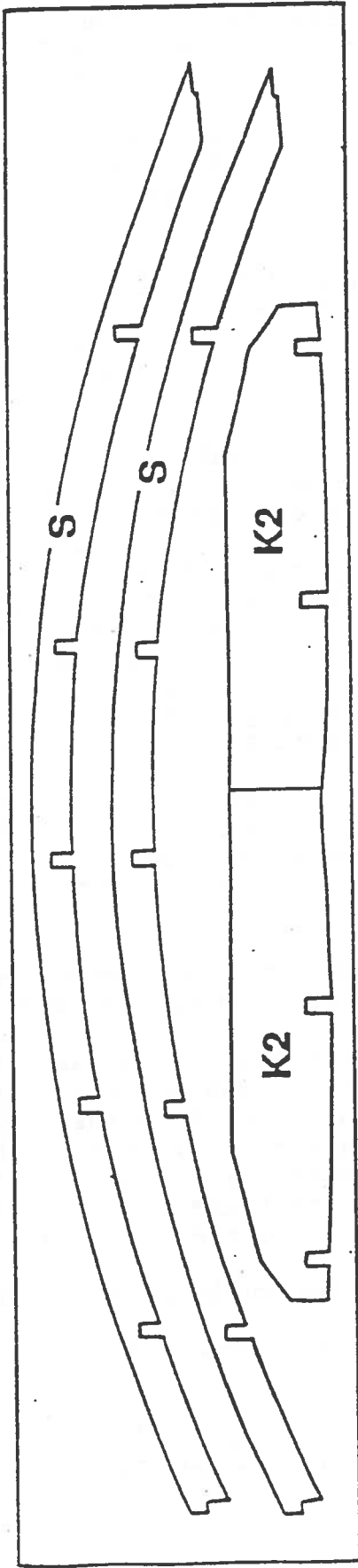
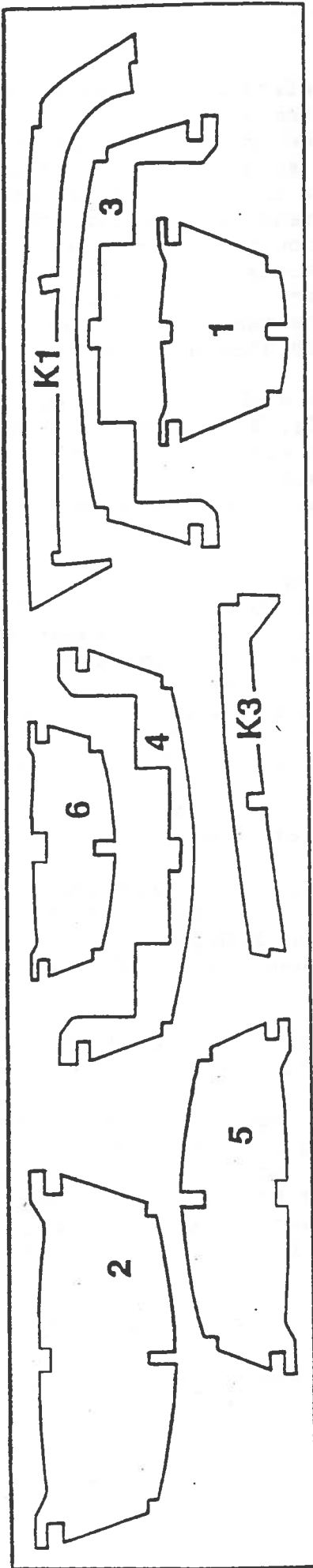
22. The Lightning does not have a weighted centerboard, but if you want to sail it you will need to bolt the weights to the very bottom of the centerboard. Drill one hole through the lead weights and centerboard and bolt on weights, one on each side of centerboard, see Fig. 9.

23. Install line, screw eye, and cleat to make centerboard move up and down for a scale model, see Fig. 5.

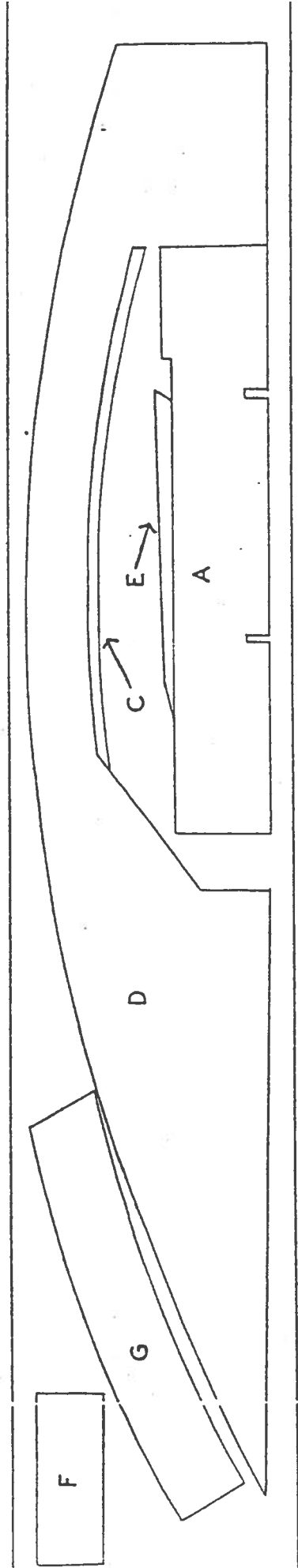
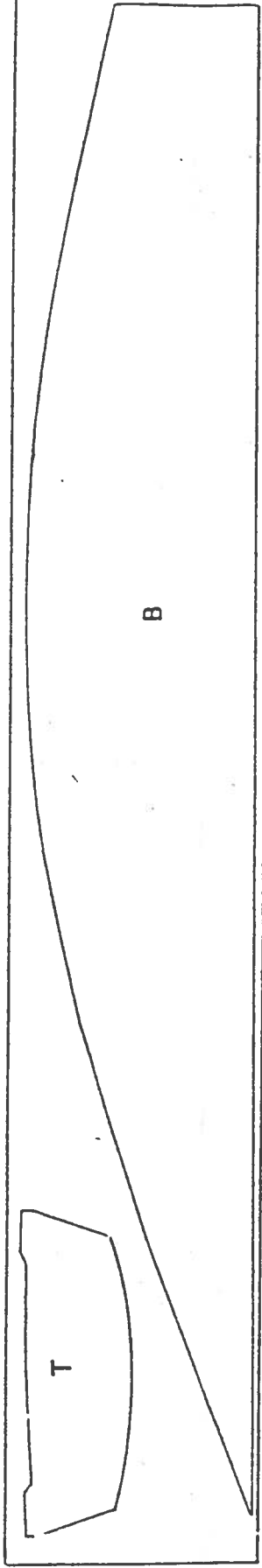
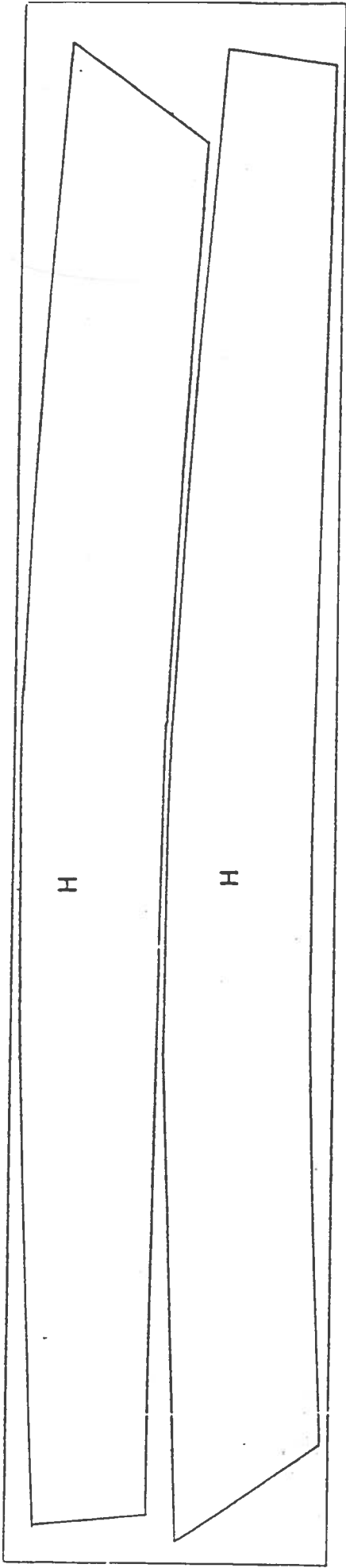
If you sail your boat, you may want to make some adjustments to make it sail better. Raking or tipping the top of the mast back will make the boat turn into the wind. This is done by adjusting the jib stay and back stay. Moving the bottom of the mast back by drilling another hole will have the same effect. You will find it sails best with the tiller in the notch, Fig. 7, in the block on the deck to hold it centered.

I hope you have fun building and sailing your LIGHTNING.

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