



MINI-CUP

Stevenson Projects

Mini-Cup

The Mini-Cup 12' sailboat featured in POPULAR SCIENCE is a fast-handling, wet-and-wild little sportboat that's a good bet for beginning builders, as well as first-time sailors (or for anyone looking for a lot of performance for little outlay).

The Mini-Cup tacks on a dime and in a gust she'll show her heels to a lot of bigger boats with fast reputations. Simple box-section plywood construction makes for easy building; the deck and hull bottoms are identical and can be cut at the same time by stacking the plywood. The hull sides are four straight-cut 9" wide strips of plywood. And even with floatation foam in all four watertight compartments, the weight is kept down to the same as the popular Laser Class boats.

Sealed floatation compartments means the boat can be capsized and righted and sailed off without bailing - while an arc bottom and hard chines provide great stability for beginners. A cockpit controlled kick-up rudder and daggerboard makes beach launching easy. Deck-mounted grab handles double as tie-down hooks for simple car-top transporting. Add to these features the fact that it's just about the cheapest boat to build on the market and we think you've got a definite winner with the Mini-Cup.

GENERAL BUILDING STEPS

Materials:

Marine Grade Plywood can be used for construction, but we have found over the years that in many applications, ACX grade plywood can do just as well, costs about one third less, and doesn't have to be special-ordered. The only difference between the two grades, as we understand it from the American Plywood Association, is that the knots in the inner laminations of Marine Grade are filled - otherwise the wood and glue are the same. If using ACX grade, however, it's best to pick out the panels yourself, checking the back (or unfinished side) to choose ones without gaps or lots of knots.

If painted properly in the first place, plywood boats can last for many seasons with only a minimum of upkeep, even when stored out in the water. You can add a layer of fiberglass for extra protection, but we've found that unless the glass is carefully applied with multiple layers of resin, it isn't as much protection as is generally thought. On a dry-sailed boat such as the Mini-Cup, with adequate applications of flexible seam seal and glue on the inside and polyester putty and oil base enamel on the outside, we've found that glass just isn't needed and isn't worth the added weight and cost.

We used water-mixed waterproof marine glue found in most lumberyards. It seems to hold as well as the two-part resorcinol glue, is much cheaper, and there tends to be less waste.

Clear fir was used for the framing and control surfaces, although other medium hardwoods such as spruce or mahogany can be substituted if needed. Most pine is too soft to hold a screw well, which can be important when working with flexed panels.

Actual lumber sizes will vary slightly, but generally when we call for a certain "stock" size such as 1" x 6", 2" X 4", etc, the actual sizes will be slightly smaller. A typical 2" x 4" is actually about 1-5/8" X 3-1/2", and a 1" x 2" is often 3/4" X 1-1/2" and so on.

Generally, the basic building steps are split into four basic steps: Lofting, Cutting, Assembling, and Finishing.

In Lofting the more intricate panel layouts, you may find it easier to follow the sequence shown, marking each line as it's numbered to simplify the geometry a little. When marking a lot of dimensions on parallel "station lines" (as in Fig #3), it's often a good idea to write the dimension next to the mark to keep the sequence straight. And it's always a good practice to run a quick re-check of the dimensions and your marking of them just before each cut. It's awfully hard to make it grow back together if it's cut too short.

LOFTING:

To loft the curves, we simply draw the parallel station lines one foot apart, mark the dimensions on each line offset from the centerline, then drive nails down into each offset mark. Then a batten (you can use a string) is pushed up against the inside of the curve marked by the nails. Starting at one end, push the batten up against at least three or four of the nails at a time, draw along the outside of the curve marked by the batten. Then push the batten against the adjacent nails farther along, and continue drawing the line, overlapping your marks as you go. After marking a complete curve, place your eye down near the panel at one end of the curve to check to make sure the curve marked doesn't weave in and out. If a nail needs to be moved more than about 3/16", re-check the dimensions and markings.

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CUTTING

One way we've found to cut plywood is to place it down flat on scrap boards, spaced about a foot apart on a firm surface. The depth of the blade of a hand-held circular saw should be set to 1/8" to 1/4" below the depth of the plywood to be cut. A circular saw with a sharp combination blade can produce smooth, even curves, giving you a steady, straightening tendency to push against. Make sure there aren't any nails in the scrap lumber used as a back up, or they can ruin your blade in no time. It's much easier to follow a line with a sharp blade, and easier yet if you wear protective eye coverings so you can watch the blade closely. It's good practice to wear eye protection whenever running power tools.

ASSEMBLING

To fasten plywood panels to the frame lumber, we used 1", #8 plated flathead wood screws (Phillips head, if possible). To attach 1" stock to other frame parts, we used 1-1/2", #8 plated flathead wood screws.

Before driving each screw, a pilot hole is drilled. Since there are a lot of screws, it's worthwhile to get a 1", #8 combination screw hole/countersink bit for your drill (and a 1-1/2", #8 bit as well). Another tool that we think is essential to a boat builder is a push screwdriver. With it and a countersink drill bit, you can cut your building time in half - and save your wrist muscles. Yankee screwdrivers are expensive, but they'll change the way you think about assembling projects and you'll find yourself tackling bigger jobs with confidence.

On all seams we marked the screw holes first with a yardstick, 3" apart, then drilled and drove screws in one at a time, aligning edges of the parts as we went. Screws should be inset from the panel edges so they sink into the centers of the stringers.

We used water mix, waterproof glue. Make sure it says on the label that it can stand immersion (it'll usually have a picture of a boat, indicating marine use on the label). Mix only a part at a time by adding just a little water and stirring until it balls up into a paste. Then you can add a little more water to thin it to a slightly runny paste, so it's wet enough to soak in, but not thin enough to run off.

Depending on the dryness of your lumber and the grain of each particular piece, some stringers will have to be "kerfed" in order to make the bends without cracking. To Kerf, simply figure out which side of the stringer faces the inside of the curve (as shown later), then make cuts into this side, every 3" to a depth of 1/4" to 3/8".

HULL CONSTRUCTION STEPS

Fig #6 shows the four basic steps of hull building. Basically the two bottom panels are joined ("A"), then the side stringers are attached to the bottom and the first parts of the box section frame are attached to the bottom ("B"). in "C" the framing is completed with the center frame for the bow and the mast step/daggerboard box added. Then in "D" the sides and transom are attached to the bottom and the four watertight compartments inside the hull are sealed, painted and filled with EPS packing foam particles before the deck panels are finally attached (the two halves of the bow are joined into a single compartment).

HULL BUILDING

To get construction under way, look over the stringer description in Fig #5, set the blade angle of the saw and rip guide at 7° cutting a string 3/4" wide on it's widest side and about 5/8" on it's narrow side, as shown, and rip seven 14' stringers from a straight-grained, 14' clear fir 1" x 6". (Before ripping, cut the 1" X 6" down to about 12' 6")

Start lofting the hull sides and mast box sides shown in Fig #2. You can follow the alphabetical markings on the lines to make the sequence of marking easier. The side edge of an uncut plywood panel makes a good straight edge for marking the lines.

Next, the hull bottom and deck panels can be cut. Cut one panel exactly in half to make the 4' X 4' piece.

Lay down one 4' X 8' panel, finished side up and then but one of the 4' X 4' pieces up against the end of the 4' X 8' sheet, with the grain directions aligned, as shown in Fig. #3. Mark a centerline down both panels, 24" in from both sides. Measure carefully and place marks along both side edges, 12" apart, then

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connect these marks with lines across the panels at right angles to the centerline (to mark the "station lines" numbered in Fig #3).

If you cut carefully, it's possible to mark the side curve of the deck/bottom pieces along one side only, then after cutting, the cut-off pieces can be flipped over to the opposite side edge and used as a template to mark the opposite side.

To mark the curve, measure out each station line the dimension shown in the sketch. Then loft the curve, using the method discussed in the general building section. To cut both the deck and hull bottom at one time, stack the two panels to be cut with the edges aligned. Then either clamp or nail the panels together. The panels can be nailed near the "Panel Break" edges and corners at the bow and stern.

The curve around the back of the cockpit can be drawn freehand on one side of the centerline. Then half the cockpit can be cut out, flipped over, and used as a template to mark the opposite side. Or, you can use the following method to loft.

Draw a light line across the back of the cockpit at right angles to the centerline. Loft the curves at the cockpit sides, then at the tighter curve at the rear of the cockpit you can draw an arc around a 14" diameter pan or trash can lid so that the curve meets the line across the back of the cockpit and the curved cockpit side lines. (You can make a "beam compass" to draw the arc by drilling two 1/8" holes through a board or batten, 7" apart, then inserting a nail through one hole to hold it in the center and a pencil into the other hole to draw the arc of the circle to connect the cockpit side lines to the line across the rear). Cut the cockpit curve with a saber saw.

To loft the two bulkheads and transom shown in Fig #4, first draw a centerline down a 4' X 8' panel of 1/4" plywood. Then mark the lines drawn across the panel marked "a" through "h", with the straight edge of an uncut panel.

Next, mark the dimensions to both sides of the centerline of the bulkheads and transom, connecting the marks with a straight line to mark the ends of the pieces. Drive nails into all four corners of the three parts, then push a batten up against the nails so its center hits the mark at the center, giving a uniform, symmetrical curve for the top and bottom edges.

To loft the bow center frame, mark the squared reference lines (lettered "j", "k", and "l") then mark the dimensions shown on these lines, drive nails at the corners, and use a flexed batten to mark the curves at top and bottom. Loft the pair of cockpit sides, shown lower left, and cut out the parts lofted on the panel.

In Fig #5, upper left, is shown the hull bottom panel joint overlap. Use battens and nails driven into the dimensions shown to mark the part carefully on a 4' length of clear 2" x 4" stock. We found the curves could be cut with a circular hand saw, but whatever you use (circular, band saw, or saber saw) make sure the bottom (outside curve) is smooth and regular. Use a Surform to smooth it off, if needed.

The daggerboard is lofted on a 1" x 12" stock, while the rudder is drawn on 1" x 12" stock, using 2" squares to locate the positions of the curves. These can be lofted and cut out later if desired.

If your panel cuts were a little ragged, don't forget that almost all edges will be backed up with a stringer, which will tend to even out your curves. By the time the corner seams of the hull have been rounded down in the finishing steps, not much of the original cut line will remain anyway, so don't despair if your cuts have a few minor flaws.

When cutting the framing parts (such as the panel joint overlap) the cuts should be carefully finished to assure a watertight joint.

ASSEMBLY

Begin assembly by attaching the unfinished side of both bottom panels to the bottom joint overlap (shown in "A" of Fig #6). Place the joiner on a flat surface, bottom side facing up, then spread glue on the unfinished side of the plywood to be attached (to about 1" in from the edge to be joined), then attach the panel to the joiner so the panel edge lies along the center of the joiner edge (or 1/4" in from the side of the joiner). Attach with screws spaced about 3/8" in from the edge of the panel and 2" apart. Attach the front bottom panel, then the rear bottom panel to the joiner to butt the panels together.

The stringers along the side edges of the hull bottom are attached to the upper, unfinished sides of the panels so that the beveled or angled side of the string leans out at the top. This means the narrow side of the string will be attached to the hull bottom with the angled side facing outboard.

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Place the hull bottom down on a flat surface with the finished (bottom) side facing up. Place a stringer down next to the bottom on one side with the narrow side facing up and the angled or beveled side facing away from the hull bottom. Place screw hole marks along both side edges of the bottom panels about 3/8" in from the edge and 3" apart.

Spread glue onto the narrow side of the stringer facing up, for about 30" from the end near the rear of the bottom. Spread glue onto the unfinished side of the bottom to be attached down onto the stringer for about the same distance.

Place the hull bottom down onto the narrow side of the stringer so the angled stringer edge is flush with the side edge of the bottom panel for about 12" from the stern. Drill and drive in two or three screws starting at the aft end of the hull bottom. Pull in on the free end of the stringer until the outer edge of the stringer is flush with the edge of the panel at the next screw hole mark, then drill and drive this screw. Repeat this step to sink the next screw, and so on, driving one screw and progressing to the next.

If you're working alone, you can slide the panel sideways so the free end of the stringer is pushed up against a solid object and is bent so it's flush at the next screw mark. Then you can place your weight down onto the panel to hold it in place while you drill and drive the screw. The same method is used to attach all stringers to curved edges, always starting at the end of the curve with the tightest bend (so you have the best leverage at that end).

Trim the stringers as they're attached to the bow along the centerline of the hull bottom so they clear each other at the bow (this is a temporary trim).

Next stringers can be attached to the unfinished sides of the two bulkheads and the two cockpit sides, flush at the top and bottom. Attach the bulkhead stringers so the right-angled edges are flush with the top or bottom of the part (to follow the curve of the deck and hull bottom). Trim off the stringers at the notches in the top and bottom edges after the stringers are attached. Trim the 1" x 1" notch at each corner of the both bulkheads to clear the stringers of the hull bottom and deck. When attaching stringers, trim them to the length needed, then place the stringer in its position in the hull and turn the stringer until the beveled or right angled edges are aligned to follow the angle between the two parts to be joined by the stringer. By placing the stringer where it will be used, it's simple to see which two sides of the stringer should be attached to the adjacent parts. Attach end stringers to the backs of the cockpit sides with the right-angled edge flush with the ends.

Now draw two vertical lines on the finished side of both bulkheads 16" out to both sides of the centerline and parallel to it to mark the positions of the inboard (finished) sides of both cockpit sides.

Refer to the cutting dimensions of the cockpit sides to determine which way faces up, then attach the aft ends of both side pieces to the front side of the aft bulkhead with the finished sides lying along the vertical lines on the bulkhead. Drill and drive screws through the back of the aft bulkhead and into the aft end stringers of the cockpit sides to attach the parts flush at the top and bottom.

Draw a centerline down the top, or unfinished side of the hull bottom, then place the three part assembly down on top of the hull bottom so the bottom notches in the cockpit sides fit down over the joint overlap and the bulkhead is centered over the hull centerline. To make sure the assembly is right side up, check to see that the notches at the top of the cockpit sides are forward of the notches at the bottom.

Measure and place the front ends of the cockpit with the finished sides also 16" out from the hull centerline. With the assembly in this position, draw around its outline, and mark screw holes every 3" within the outlines of the stringer bottoms on the hull bottom. Then drill through 1/8" pilot holes at the marks, glue the joining surfaces, replace the assembly in position with the hull bottom resting on its side edge and drill and drive screws in through the pilot holes and into the bottoms of the stringers to attach the assembly as seen in "B" of Fig #6.

Whenever attaching a part to a panel "blind" like this (where the positioning can't be seen from the side the screws are driven into), use this method of first drawing around the part in place onto the part to be joined to; then drilling pilot holes within the outline marked; and finally drilling and driving the screws in through the pilot holes.

Next, attach the front bulkhead to the front edge of the cockpit sides and hull bottom with its stringers on the forward side. Cut and attach end stringers to both bulkheads.

MAST/DAGGERBOARD BOX

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In Fig #7 is shown the installation of the mast/daggerboard box and bow frame. Rip a 10' length of 1" x 3" to 2-3/8" wide, then cut squarely and carefully to the lengths shown. Attach part "A" to the finished side of one box side piece, flush at one end, with screws every 3" and glue. Then attach "C" flush at the bottom of the side, as shown; and drill and drive two 1 1/2" screws in through "A" and into the end grain of "C", making sure to pre-drill to prevent splitting.

Attach the "B" to the side piece, flush at the rear end, then drive two screws up through "C" into the end grain of "B". Attach "D" flush at the top of the side piece and drive two screws down through "D" into the top of "B". Attach "E" 2-3/8" behind "A" and parallel to it, and drive two screws down through "D" into "E" and two more through "C" into "E".

Make sure the edges of the box parts to be joined to the unattached side are flush to make a good watertight joint. Paint glue into any cracks around the joints inside the box, then glue the edges of the box framing and the box side and attach the finished surface of the box side down onto the box framing.

Mark the rectangular cutouts for the daggerboard as shown in Fig. #7 (1" x 11-3/8") with its aft end 1" forward of the aft end of the box, and with its centerline along the centerline of the box. Next remove the screws (after the glue has dried) along the sides of the holes and cut out with a saber saw, starting from a 1/2" hole drilled in the cutout.

After cutting, nip off the ends of any screws extending into the hole when replaced. Attach short lengths of scrap stringer to both sides of the box next to the mast hole at top, as shown.

ATTACHING BOX

Place the finished box down centered on the centerline on the top of the hull bottom piece with the aft end of the box butted up against the front of the forward bulkhead (with the center of the top of the box aligned with the center of the bulkhead at top).

Draw around the box onto the hull bottom and bulkhead stringers to mark the position. Then mark screw holes spaced about 2" apart to be driven up through the bottom and into the bottom of the box so the daggerboard hole will be securely sealed by screws ringing the hole (in front and back of the hole, as well). Round off the bottom of the box, if needed to sit down snugly on top of the hull bottom.

Glue the joining parts, then drill and drive screws in through the bottom and into the box bottom to make a good watertight seal. With the top of the box centered on the bulkhead, drill and drive two 1-1/2" screws forward through the bulkhead, 3/8" down from the top and into the aft end of the bulkhead.

BOW FRAME

Attach the stringers along the curved top and bottom edges of the bow frame so the wide side of the stringers are joined to the frame side, with the angled sides of the stringers flush with the top or bottom edge of the frame.

Attach a stringer along the bottom edge on the other side of the frame piece with 1-1/2" screws. Attach a short stringer along the aft edge with its wide side joined to the part and its right angled side flush with the aft end of the frame. Round off the bottom edge to fit. Spread glue onto the joining parts (down the front of the box and forward along the bottom piece centerline for only 12").

Attach the aft end of the frame to the forward end of the mast box with the centerlines aligned, driving 1-1/2" screws through the aft stringer of the frame and into the box. With the center of the frame aligned with the hull bottom centerline, drive screws up through the hull bottom 1/2" out to both sides of the centerline on the bottom to sink into both bottom stringers to 12" forward of the mast box.

TAPERIN THE BOW

Forward of this point, a dart is cut out of the hull bottom at the bow to forma V-bow entry, tapering back into an arc-hull bottom. Turn the hull upside down and cut the hull bottom along the centerline from the bow point to 24" back as shown in Fig. #8. Now, push either side of the split bow down so it lies along the curved bottom edge of the bow center frame. Note that the side stringer of the hull bottom will have to be trimmed away at the tip to clear the bottom stringers of the center frame of the bow, trimming to a snug fit. When the side of the hull bottom can be pushed down to rest on the bottom stringer of the bow frame, glue, drill, and drive screws through the bottom and into the bow frame stringer 2" apart.

With one side of the bow bottom attached, re-trim this side exactly along the new centerline of the bow frame bottom so the second side can be bent and attached ("B" in Fig #8). Bend the second side down,

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mark and trim the side stringer clear, and mark the bent piece to clear the edge of the first bow side already attached; after trimming, attach to the bottom of the bow frame with screws 2" apart and plenty of glue.

Rip tapered bow gussets at a 45° angle and about 2" wide, then mark so that they can be trimmed to clear the top and bottom bow frame stringers and be attached to both sides of the bow frame with their tapered edges flush with the bow frame front. Re-trim the ends of the top and bottom stringers flush with the tapered edges of the bow gussets. Round off the forward tip of the hull bottom panel flush with the front of the bow frame tip and shave off the angled edges of the bow gussets to lie flush with the side of the hull bottom stringers at the bow.

ATTACHING HULL SIDES

There are two 8' x 9" side pieces and two shorter 9" wide side pieces. Each 8' piece is joined to one of the shorter side pieces with a 7-1/2" length of 1" x 6" stock mounted to the inboard, unfinished surfaces of the side pieces as shown upper left in Fig. #9. Mark the joiner placement on both sides of the butted panels, then glue the joining surfaces, place the joiner down, glue side up, and sides, unfinished side down, then drill and drive screws to make a firm, watertight joint.

While the sides are drying, take some time to shape down the exposed edges of the bottom and bulkhead stringers to present a surface that's easy to join to with a watertight fit.

The hull sides flare out at the bow, but lean in at the top, giving a "tumblehome" at the stern. The changing side angle is shown by the bulkheads, so use the Surform to shave off the stringer gradually a little more as you move back to the angle shown by the end of the forward bulkhead. At the bow, you can increase the stringer angle a little by shaving off a little of the bottom panel edge with the stringer. Continue altering the bevel angle a little more until you reach the angle shown at the aft bulkhead. The transom can be held in place temporarily to check the bevel angle needed at the stern. Shave off the bulkhead end stringers and bow gussets to provide a faired surface for joining the side pieces to.

To attach the side panels, mark screw holes 3" apart and 1/2" up from the bottom edge of the side. Lay the side up against one side of the hull bottom, adjust fore and aft to have a little overhang at both the bow and transom, then start drilling and driving screws in through the side and into the side stringer near the center of the boat, keeping the bottom edge of the side flush with the bottom side of the hull, except at the bow. Work out toward the stern and bow from your starting point until you reach the transom and get to about 20" aft of the bow. Use plenty of glue on the bottom side and bulkhead stringers.

Now push the side against the bow and mark the cut-off line along the front of the bow frame. Cut along this line, then place the hull down on a flat surface, blocking up the bottom so the side edges are an equal distance from the floor. Use a square to align the bow frame at the nose vertically, at right angles to the floor, then drive in screws into the bottom side stringer. Repeat to attach the opposite side piece, then trim off the side pieces where they extend down below the bottom near the point of the bow. Drive screws in through the side pieces to the bulkhead end stringers.

ATTACHING THE TRANSOM

Rip a 2' length of 1" x 3" with the saw blade set so the wide side of the tapered gusset is about 1-1/2" wide and the beveled side angles up at 60°. Kerf this on its right angled edge every 3". Bend in place across the hull bottom at the stern, mark its length, cut off, and attach in place on top of the hull bottom with its pointed edge flush with the transom edge across the back end of the hull bottom. Mark the stern line up the side pieces from the end of the transom line at the bottom of the sides, leaning up toward the bow at 60° and cut off (Note: double check the transom angle on the hull sides by laying the aft deck panel down in place, with its forward edge over the center of the notches in the tops of the cockpit side pieces. Then mark where the aft end of the deck lies on the top of the hull sides - to make sure the tops of the transom line on the hull sides will not be aft of the end of the deck). Attach stringers on the inside of the side pieces to fit with their narrow side against the inside of the side and beveled side flush at the rear of the side pieces.

To attach the transom, shape off the side stringers and bottom gusset flush, then attach the transom to the bottom gusset at the center, flush at the hull bottom. After driving the first two screws near the center, pull up on the sides and push forward on the transom as you drill and drive the screws out to both sides from the center, aligning the transom bottom flush with the hull bottom as you go. Align the hull sides flush with the side edges of the transom and attach. Cut and kerf a top gusset for the transom like the

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bottom gusset, with its narrow side attached to the transom front and its beveled edge facing up to follow the deck line, flush at the top.

Attach the side top stringers inside the hull sides, joining the narrow sides of the stringers to the inboard surface of the hull sides with their angled sides facing up, following the curve of the deck. Start attaching the stringers at the transom, bending them down and in to fit flush at the top of the sides as you progress forward. Attach a 9" length of 1" x 2" or 1" x 3" scrap to the front side of the transom so its centerline lies along the vertical centerline of the transom and its top edge is up against the bottom of the top transom stringer.

We're now at the stage show in "D" of Fig #6, and ready to seal the hull, insert the foam, attach the deck, and finish.

SEALING

To seal in compartments inside the hull we mixed up catalyzed polyester auto body putty and spread it onto the corner joints in the hull at the bow, across the transom bottom and up the sides, and at the side panel joints (and anywhere there seemed to be any gaps or cracks), forcing the putty well into any openings in the joints. The corner notches at the bulkheads were puttied to keep the compartments watertight. Then we ran a bead of seam sealer along all corners and joints in the hull compartments and the cockpit. (After attaching deck, the cockpit top joint to the deck can be sealed too.)

After laying a bead of sealer out of the tube, run your thumb along it to spread it well into the seams. Seal around the bottoms of the mast box and bow frame well. Next, paint the compartments in the hull with waterseal or oil base enamel to seal (use up your old oil base paint sitting around for this, if you want). If you want drain holes for the compartments, drill through the cockpit sides and bulkheads near the cockpit floor and then plug with rubber stoppers in use.

ATTACHING THE DECK

Smooth off the top edges of the frame and side top stringers, rounding the top of the mast box with a Surform to provide a faired curve for the deck to be attached to. Then fill the hull compartments with 15 cubic feet of EPS packing foam particles. We found our EPS (Expanded PolyStyrene) packing foam at packing and crating companies in 15 cubic foot bags for \$13-\$15 (foam is shaped into small "stars" or "peanuts"). Place the hull on a flat surface; prop the bottom up evenly with blocks. The attaching of the deck should be done in one operation, so schedule this when you're fresh and ready for a lot of action.

Spread glue onto all top edges of the hull frame, place the deck down on top of the hull, check that the bow is squared vertically with the floor level (when viewed from the front) with a framing square. If there is a little twist to the bow, push the bow top over in the direction needed and lock in the squared position by driving first the rear alignment screws, then the front alignment screws down through the deck and into the hull frame top (shown as vertical arrows in Fig #10). Position the rear edge of the front deck panel over the centers of the notches in the tops of the cockpit sides.

Then start aligning the top of the hull sides and the edge of the deck and attaching with screws, starting at the middle of the boat and working alternately toward the end. Use a wide screw driver to pry the side tops out to position if needed. Whenever attaching a panel down to make a compound curve surface, the panel edge will seem to want to pop up at a different spot, no matter where you push down on it. Look over the length of the pane edge that's sticking up, push it down in the center of this length and fasten, making two shorting lengths sticking up. Push down and fasten the centers of these two length of side edge, and so on until the panel is attached down all along the edge that didn't seem able to lie down flat in the first place.

Generally, you can follow the arrows around the deck to drive your screws in. Drive screws down into the tops of the mast box (missing the mast and boar holes) and the bulkhead top (using screws in the ends of the bulkhead to locate the top if needed).

Cut the 1-1/2" X 1-3/8" X 8-1/2" deck panel joint overlaps. Insert through notches in the cockpit sides and attach to the bottom of the deck, sticking out so the rear panel can also be attached down onto it.

Attach the rear deck panel, starting at the joint overlaps, and fastening down onto the compound curve of the frame tops, as described.

After attaching to the transom top, trim off the excess deck panel aft of the transom (and trim off excess deck panel extending forward of the bow). Measure and locate the daggerboard hole on the deck

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and hull bottom, drill as starter hole within the marks, and cut out the holes with a saber saw, using the hole already cut through the box framing as a guide for the blade. Measure and mark the placement of the mast hole through the deck (check the placement of the framing beneath the deck by driving a couple of small nails down into the hole placement to locate the sides of the opening. Then cut out the 2-3/8" mast hole. If the hole comes out a little off, cut a plywood doughnut to fit down on the deck covering the area around the base of the mast.

RUDDER AND DAGGERBOARD

To shape the rudder and daggerboard to a tapered point (below the rudder box and below the point where the daggerboard sticks out below the hull) draw a line along the center of the edges to be shaped, then shave off the board to a tapered edge with the Surform.

To make a handle for lifting out the daggerboard, we cut off an 11" length of 1-5/8" dowel, angling the end cuts, then screwing to the top end of the board by countersinking the screws down into the dowel. You can use a scrap of 1" x 2" just as well if you don't have scrap dowel handy.

To make the rudder box from scrap 1/4" plywood, first loft the dark lines shown in "A" of Fig #11 (a horizontal line with three angled lines below it). Then loft the lines shown in "B" on these. Cut out the box side and flip it over to mark and cut the second side. Rip a 2' length of 1" scrap stock to 7/8" wide, then cut to the length shown. Attach these, as show upper right, to the unfinished surface of one side, then attach the opposite side to the edges of these strips. Rip and trim 11" x 3/4" x 1-3/8" cap strip and attach as shown, to the front edge of the rudder box.

Drill the 1/4" pivot hole in the position shown through both box sides, and drill the rudder pivot hole as show in "B" of Fig #5. Next, use a vise or wrench to open up one 3" x 1/4" screw eye, slip the eye of a second one over the first one, and re-close the eye, linking the two screw eyes together. Drill a 1/4" hole, 2" deep, into the end grain of the tiller, 1" up from the bottom edge and parallel to it. Drill another 1/4" hole into the top end grain of the rudder near the corner of the notch in the top, roughly parallel to the grain direction. Screw one screw eye into the tiller hole, the other into the rudder end hole and then insert the tiller and rudder up through the center of the rudder box and insert a bolt through the pivot holes in the box and the rudder.

Rotate the screw eyes to clear the box sides to the rudder position can be controlled up or down by pulling or pushing on the tiller.

Drill a 1/4" hole through both box sides near the front as shown in Fig #11, lower right, then insert and bolt tight a 1/4" bolt. Pull the tiller to raise the rudder to "full up" and mark the placement of a locking notch on the bottom edge of the tiller. Then push the rudder down to "full down" mark the locking notch placement, then cut both notches, as shown (about 1/2" deep). The tiller can be wrapped with tape where it sits in the box to remove any unwanted side play.

Mount barrel bolt locks to the top and bottom of the transom as shown, aligned with the centerline, using 1" screws to mount all barrel bolt parts. The top of the upper barrel bolt holder is 1/4" down from the transom top (with the barrel bolt sticking up above the transom) and the top of the lower barrel bolt holder is 8-3/4" below the top of the upper bolt holder.

Raise the upper bolt to the "up" position and drive a screw part way in just under the lower end of this bolt to lock it permanently "up".

Mount the smaller bolt receiver parts to the center of the 1-3/8" cap strip on the rudder box near the top. Mount the lower bolt receiver with its top edge 8-7/8" below the bottom of the upper receiver. Now the top receiver can be slipped down over the top barrel bold and the lower bold can be locked down into the lower receiver to lock the rudder on. Trim away the cap strip where it hits both barrel bolt lock handles when the rudder is hard over to permit a fuller swing and allow the lower bolt to be unlocked easily (use a 3/4" spade wood drill bit to remove the wood easily).

FINISHING

The first step in finishing is to round off all corner edges with a Surform shaper to provide nice smooth curves with evenly radiused corners (the rounder the better) - except for the transom side and top edges (rounding the bottom edge only to prevent it from being too fragile). Next, all gaps, cracks, and screw heads should be filled with catalyzed polyester auto body putty. There are a few tricks to using this that can save a lot of time and make it an easy job to smooth the hull.

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Mix up small batches (about 1/2 at most) on a smooth board or palette. Squeeze out about a 25 cent piece size blob of catalyst and mix quickly with turning strokes using a 2" or 3" putty knife. (Use a separate stick to dish the putty from the can, preventing the catalyst from entering the can). As soon as the putty is mixed to a uniform gray-red (or gray-blue, depending on the brand), smooth it into the largest gaps to be filled first. Too much catalyst (making a dark colored putty) will make the putty harden too fast; too little (making a light gray mix) will prevent it from hardening, so stick with a "hotter" mix to begin with and work fast. On a hot day you'll need less catalyst, and never work in full sunlight or it will always harden too fast.

Work the putty rapidly into the depressions to be filled, smoothing out air bubbles and leaving a lump where there was a hole (smoothing it flat will result in a dent when the putty "goes off" and shrinks).

A soon as the putty begins to lump like cottage cheese on the palette, stop applying it and clean up the palette and putty knife. In a few minutes it will get like Swiss cheese (a good time to peel any spills off the floor). Then it will gradually harden to the point where you can scratch it with your fingernail and leave a white mark. At this point you can use the Surform (gently at first) to shave away great amounts of putty easily and quickly (like grating cheese). This will last about ten minutes, so work fast and you can smooth the whole batch in a few minutes. After the whole boat has been filled and smoothed, you can mix up slightly "cooler" batches and give the filled spots a careful second treatment to fill any exposed air bubble holes, smoothing them off flush with the surface.

Next, sand with about 80 grit paper, then sand with 150 grit paper, and being painting, sanding with finer paper between coats.

A good initial paint job of oil base gloss enamel will prevent maintenance problems later on. The first coat is only a seal to permit finish sanding. The second coat will show where any final finish puttying is needed. Make sure coats are well dried before applying the next. Just before painting, give the hull a light sanding and rub down with thinner to clean it well and prevent "fish eyes" from forming and to remove dust. Don't paint in direct sunlight (to prevent bubbles), nor outside late in the afternoon (any dew will turn the paint flat). Thick coats tend to dry on the surface, then run into sags underneath. Even applications of thinned paint prevents drips. You can thin with paint thinner (but then you lose covering ability) or you can thin the paint by warming it in the house to retain coverage and get a good flow. If the brush tugs or loses bristles as you paint, the paint probably needs thinning. Use parallel, long strokes as you finish a surface.

We've found that if you apply the paint with a short hair roller, then smooth it out immediately with a brush, you can get a flat, glossy surface in a hurry, with a minimum of drips.

To texture the deck and cockpit floor to prevent slipping when action starts, mask off the areas to be textured, shown in Fig #12. Paint this area with a thick coat, sprinkle on sifted sand or "Agrashell" (crushed walnut shells, available at boat yards) until the entire area is heaping. When dry, pour off or vacuum up all loose grit which will then leave a uniform texture adhered to the surface. Repaint the area (after removing the tape) with two coats applied with a long hair, fuzzy roller.

A good paint job will take four to six coats, but can effectively prevent checking and cracking for years, even when the boat is stored outside.

Attach hefty lifting handles to the hull ends (two at rear) about 2" in from the ends so long screws will grab into the framing stringers.

RIGGING

Sometimes the hardest step of rigging your boat can be finding the right tubes, and we've come across a couple of tricks that may save you headaches and time. First of all, never use the phone to hunt down a tube supplier. When you call up to find a certain material, you rarely get a chance to talk to the person best qualified to answer your questions. What you usually get is a fast answer rather than an accurate one - one that will get you off the phone in a hurry.

Many times we've found that a distributor may actually have just what you're looking for, but it may take a bit of game-playing to get access to it. First, it's a good rule to show that you're sufficiently concerned about tracking down the material to show up in person. Next don't scare the man off by loading him down with a bunch of confusing specifications until you get a chance to look over what he has in stock.

Just have a general idea of what you're looking for, and ask to help look around for it. If you simply call and rattle off a bunch of numbers, they'll usually pass you on to the next supplier in the Yellow

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Pages. Large distributors of tubing and raw materials won't want to bother with such a small retail order and will quote an astronomical price - if they deign to give one at all.

Salvage scrap and surplus yards sell aluminum tubing and material by the punt, and you shouldn't spend much over thirty dollars for a rig. Another good source is irrigation suppliers, who can usually sell three twenty foot lengths for under thirty dollars. However, irrigation pipe is a little thinner and softer than most tubing stock, and should be reinforced with clear fir 1" X 3" boards trimmed to fit snugly inside the pipe. Shorter pieces can be spliced together in the same way, with 2" x 2" stock trimmed to fit.

What's the best tubing to look for? Anything form 2" to 2-3/8" diameter aluminum tube (2-1/4" is best) with a wall thickness of around 1/16" or .056". If you have a choice of tempers, 6061-T6 seems to have the right sort of hardness, springiness, and resistance to corrosion. As we said, however, wood reinforcers can beef up softer pipes enough for use. Some builders report good luck with auto exhaust pipe welded up from 10' lengths.

To start rigging the boat, cut the tubes to the lengths shown and rip the 1" x 3" clear fir or spruce reinforcing strips to fit snugly in the tubes (if needed). If the tube seems to lack springiness, or is a little on the thin side, we generally run reinforcing up the mast about three quarters of the way to the top, and down from the top of the upper boom (or gaff) down to about the center of the tube. After inserting the strips, drill all hardware mounting holes so that the strips will be held with their wide sides lying across the direction of the boat (athwartship).

After the rig is assembled, the sail will be cut, and the rig is attached to the gaff and boom pockets. Then the mast can be slipped down into the mast box, and the gaff can be raised by pulling down on the line running from the gaff, through the pulley block at the top of the mast and back down to be tied to the cleat near the base of the mast.

To connect the front ends of the gaff and boom, drill a 5/16" hole through both tubes about 1" back from the end (and through the reinforcers, the long way if used). Then slip each end of a 5/16" x 3" U-bolt (check materials list for exact specifications of the galvanized iron hardware used throughout the construction of the rig), through the tube holes, run on a nut, slip on the two-hole washer strip, and run on double lock-nuts and tighten securely.

The gooseneck is made up of two galvanized iron eyebolts. With pliers or a vise, twist the loop of one eyebolt so the loop of the second eyebolt can be slipped onto it. Then hammer or twist the opened eyebolt back closed again. Drill a 3/16" hole, as shown, through the mast (and through any reinforcer the long way) and through the boom, as shown, parallel to the hole drilled through the same tube at the front. Insert the ends of the joined eyebolts through the holes in the tubes and secure with double lock-nuts, and trim off the leftover bolts.

The halyard pulley block is held to the top of the mast with a 3/16" eyebolt mounted through a hole drilled about 1" down from the top and at right angles to the hole drilled through the mast for the gooseneck below. Open the bolt eye, slip on a block and re-close. The halyard line is tied neatly to the gaff in the position shown, then the knot is wrapped tightly with 2" grey duct tape to lock it in position.

After raising the gaff with the halyard, the free end of the line is tied to a galvanized cleat mounted vertically, as shown, near the base of the mast by drilling starter holes and then attaching the cleat with large sheet metal screws driven into the mast.

To tie a line to a cleat, pull the line tight, wrap it once around the base of the cleat, then lead the line up over the center of the cleat, looping it over one ear of the cleat - then back over the center and loop it over the other ear. After looping the ears of the cleat a few times, make a final loop, twist it so that the free end of the line is now under the line from the previous, slip it over the ear and pull the free end tight.

When you pull the gaff up, you'll have a lot of loose line lying around the deck and to prevent this from falling overboard, loop the free line into a coil and tie to the top ear of the cleat by reaching through the coil to grab the line leading from the cleat to the coil, pulling it back through the loop in a twisted loop, and slipping this loop over the top ear of the cleat.

Twist open two 3" x 5/16" eyebolts and slip a single pulley onto one and a double pulley on the other and close both. Drill a vertical 5/16" hole through the boom about 1" forward of the aft end and bolt the double pulley to the bottom of the boom. Drill and attach a single pulley forward on the boom in the position shown.

To hold the mainsheet (the line controlling the sail position) to the hull, cut a 4' length of the mainsheet line. Tie a single pulley to the very center, then tie a snap hook to both ends. To rig for sailing,

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snap each of the hooks over one of the lift handles at the rear of the boat, then insert one end of the mainsheet through one side of the double pulley on the boom and tie a simple knot so it can't be pulled back through. Run the free end of the mainsheet through the pulley attached to the hull, then back up through the other side of the double pulley, forward through the front boom pulley and from there back down to the cockpit. It's a good idea to tie the mast to the forward lift handle, as well (you can use the end of the halyard) to attach it to the boat.

MAKING THE SAIL

To make the sail, spread out the 12' X 20' sheet of 6 mil polyethylene (known as "visqueen" at many lumber yards where it is sold) on a flat clean surface. Pull the gaff up to the top of the rig and place the entire rig down over the polyethylene, as shown, with the tips of the gaff and boom lying on one side edge of the plastic.

To mark the sail shape, use a 12" wide box as a guide to slide along the outsides of the tubes while marking the 12" outside the tube with a felt tip pen. Cut along the lines marked, then trim the plastic off the boom ends at right angles to the tubes, as shown.

With small scissors, cut holes along the top and bottom (but not the rear) edges of the sail. These holes should be about 3/4" in diameter, with about 1/2" margin in from the edge of the plastic. Space the holes about 4" apart.

Next, fold the edges with holes back over onto the sail, making a 12" wide pocket along the boom and gaff edges. Smooth the plastic flat along the fold, pulling the pocket material tight from both ends; then use the pen to mark the exact positions of all the holes through onto the lower layer of plastic while the edge is held in position.

Cut out these holes and fold the plastic over into a pocket again and smooth out flat. Now run an unbroken strip of 2" wide grey duct tape (use the fabric-backed kind, not the all-plastic type) along the row of holes. Overlapping the seam of the pocket edge. When reaching the end of the pocket at the edge of the sail, cut a 1" diameter semicircle in the sail edge and then run the tape over this, as shown. Work on a carpet, if possible, to prevent picking up dirt on the adhesive side of the tape.

Carefully turn the sail over and apply a second strip of tape to the other side of the sail, following the path of the first strip of tape, so that the adhesive of both strips of tape can grab onto each other through the holes in the sail. This is the real strength of the seam, so make certain the holes are aligned before taping. Now rub down both sides of the seam thoroughly with your fingernail, burnishing the two layers of tape adhesive together to make a good bond. Place a block of wood behind the sail and tap the taped seam with a hammer all along the edge to get an extra-strong seam. Then repeat this to tape the other seam of the sail.

To attach the sail to the rig, remove the gaff and boom from the mast and insert each into its pocket in the sail. Pull the rear ends of the boom and gaff apart so that the sail is pulled tight, then wrap tape around the tips of the sail at the ends of the tubes to attach. Cut rounded holes so that the halyard, pulley blocks and gooseneck can stick out through the pockets, then reassemble the rig.

Coloring the sail is an option you may want to save for later if you're anxious to get sailing right away (there's a lot of curing involved). Because of the triangular sail shape, you can actually get two complete sails from a 12' x 24' sheet of polyethylene, which gets your per sail cost down next to nothing, so you can easily end up with a working sail to get started right away (one that will take the rough handling it's liable to get until you get your transporting drill down to a smooth routine), with enough left over for a colored sail you can take your time on at your leisure. Once the material has been exposed to moisture and dirt, it won't hold the paint.

To color the sail we removed the mast and propped the ends of the booms about 3' off the ground, typing the boom ends to a solid object to pull the sail taught, suspended horizontally (working inside a garage is best, to keep dust and leaves off the paint). Then the border of the color panels were taped with marking tape to the dimensions shown. Next, every other color panel was masked off, using newspapers and masking tape. Then a light was placed under the sail so the evenness of the paint thickness could be easily seen. Try to work with good ventilation and wear a face mask for protection whenever spraying paint.

With the light visible through the panel to be sprayed, a well shaken can of Rustoleum paint was held vertically and allowed to spray out horizontally to fall like a light rain ton the panel, "dusting" it

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evenly with color over the whole panel. As the dots of paint multiply on the plastic, even out the thickness sprayed on until the dots are fairly close together, but not joined into a flowing coat of paint. Spray the exposed panels, then let dry until they are not tacky at all. Then carefully remove the newspapers and cover the painted panels with newspapers before painting the remaining panels of the sail.

The main problem with handling a newly painted sail is that the paint will want to stick to itself more than to the plastic at first. So never let the painted panel fold over to touch themselves in the first week or so. The sooner you can expose the colored sail to dust and dew, the better (it will coat the paint, preventing it from sticking to itself). As time goes on, the paint will stick better and better to the plastic, but for the first few months, roll the sail carefully, prevent sharp objects from rubbing on it, and generally avoid abrasions. It's best to allow a couple of weeks curing time before using the colored sail.

The plastic sail itself has proved to be extremely durable in heavy wind conditions and has given years of service. Like a dacron sail, however, it should be stored out of direct sunlight when not in use.

Before heading out for a sail, make sure you have a paddle aboard in case the wind quits early, plus a sponge to dry things off, and a Coast Guard approved life-jacket for each crew member. Keep one hand free to hold onto the boat, don't sit on the mainsheet, and keep an eye out for what's coming up.

Because the construction of a Mini-Cup is dependent on factors of materials used and craftsmanship that are beyond the control of the designer and the magazine publisher, neither the designer nor the contributors can accept responsibility for the performance of the boat as actually constructed.

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MINI-CUP MATERIALS

LUMBER:

- 5 - 4' X 8' panels of 1/4" ACX (or better) exterior grade plywood
- 1 - 14' clear fir 1" x 6" stock
- 1 - 8' clear fir 1" x 6" stock
- 1 - 8' clear fir 1" x 12" stock
- 1 - 12' clear fir 1" x 3" stock
- 1 - 5' clear fir 2" x 4" stock

HARDWARE (all galvanized)

- 2 - sets Barrel-bolt locks
- 2 - 1/4" x 2" Bolts
- 2 - 1/4" x 3" Screw-eyes
- 1 - 5/16" x 3" x 1-3/4" U-Bolt
- 1 - Clothesline Cleat
- 1 - Double Pulley (for 1/4" line)
- 3 - Single Pulleys
- 5 - 5/16" X 3-1/2" Eyebolts
- 3 - Large Grab - Handles
- 2 - Plated or brass snap hooks
- 800 - 1" plated, flathead, #8 wood screws
- 100 - 1-1/2" plated, flathead #8 wood screws

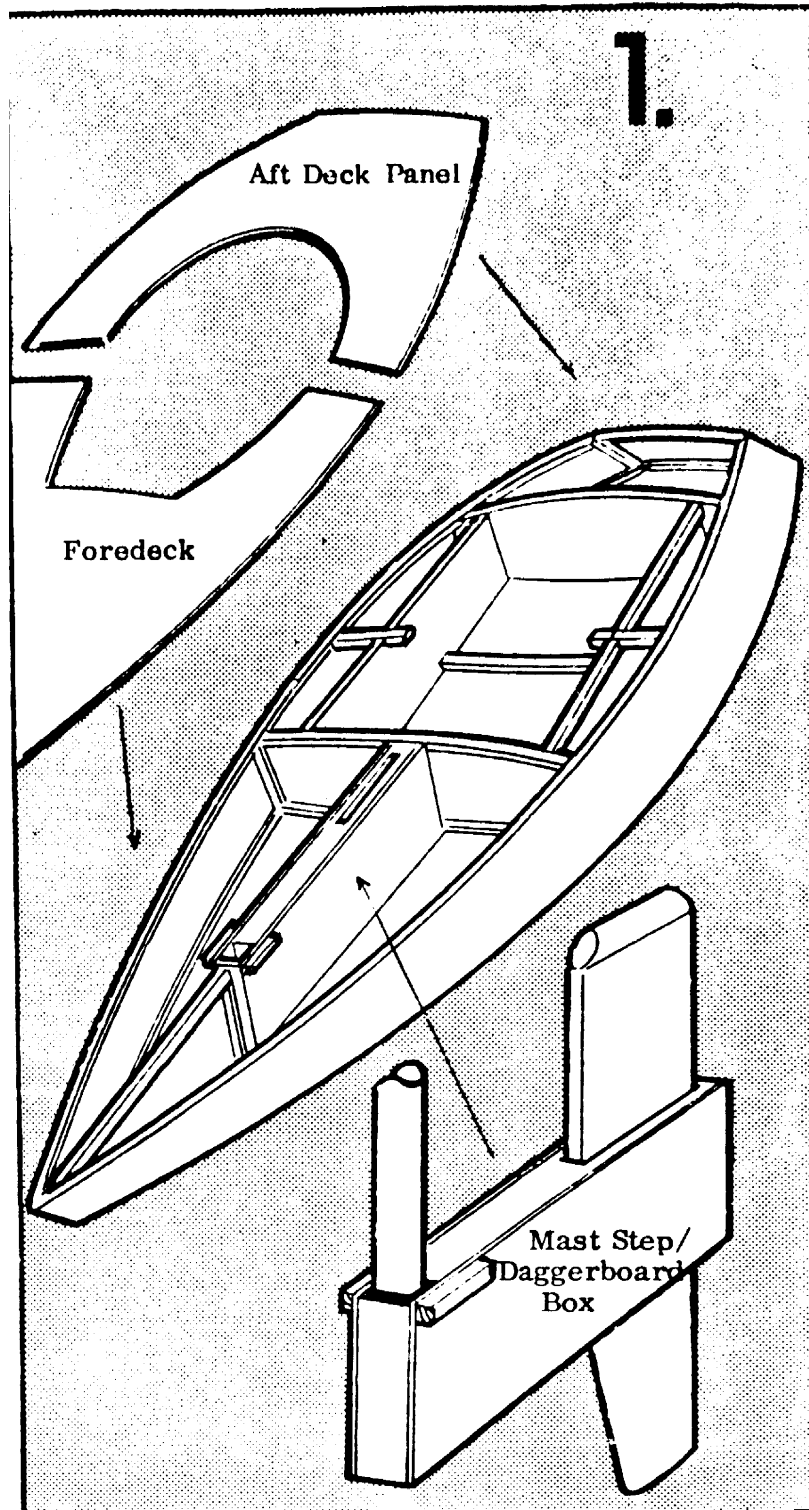
MISC

- 1 - quart polyester auto body filler putty
- 2 - quarts waterproof glue
- 1 - gallon oil-base gloss enamel
- 1 - tube DAP or silicon seam sealer
- 15 cu.ft. Expanded Polystyrene packing foam particles
- 50' - 1/4" or 3/8" braided nylon or dacron line
- 5lbs "Agrashell" medium grit

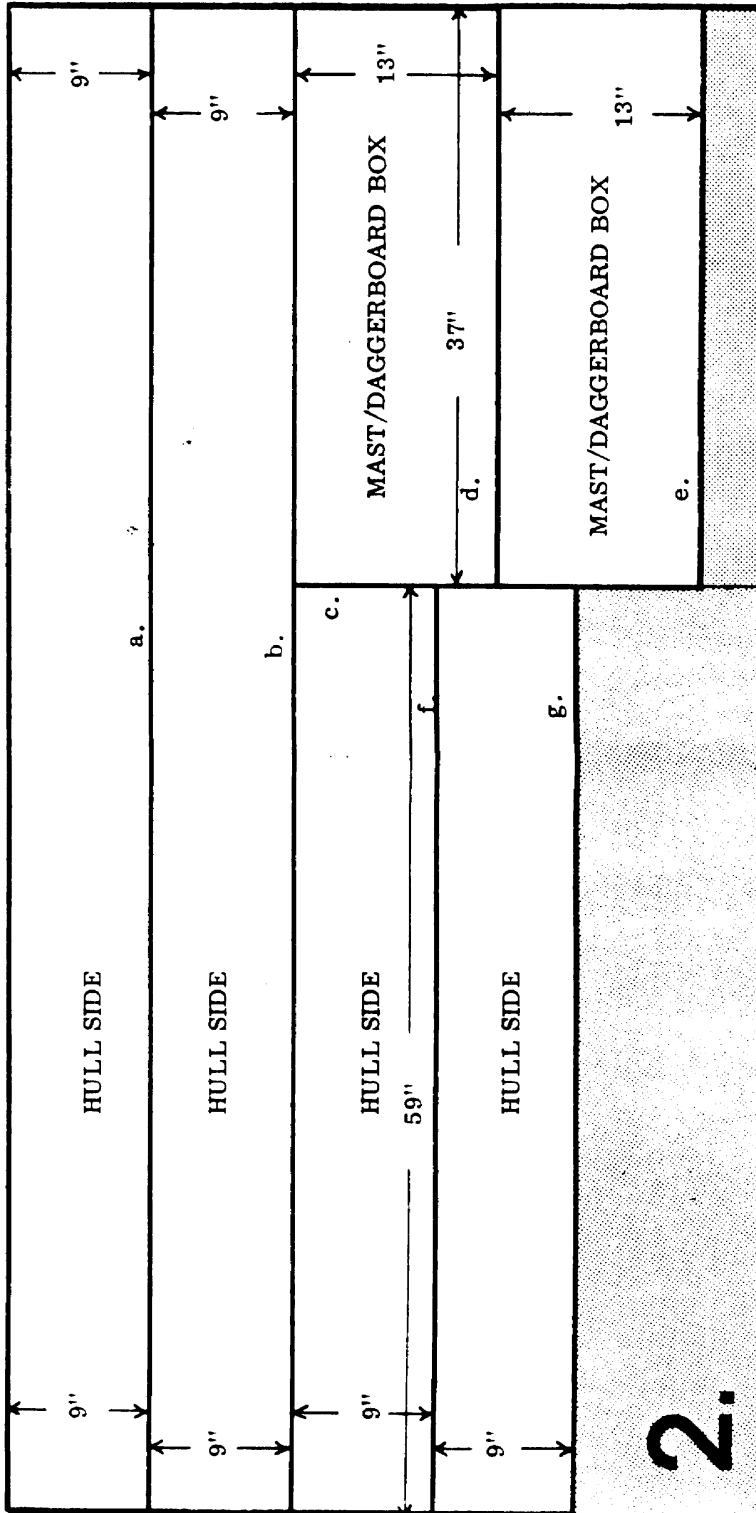
RIGGING

- 1 - 16' Tube (2" to 2-3/8" dia., 1/16" or .065 wall thickness - aluminum tubing or irrigation pipe)
- 2 - 12' Tube (2" to 2-3/8" dia., 1/16" or .065 wall thickness - aluminum tubing or irrigation pipe)
- 1 - 12' x 20' sheet of 6 mil polyethylene ("visqueen")
- 1 - 60' roll of 2" gray duct tape (fabric backed)
- Tubing reinforcing (if needed): 1 - 16' clear fir 1" x 3", 1 - 10' clear fir 1" x 3"
- Sail Coloring (if desired) - Rustoleum Spray Paint

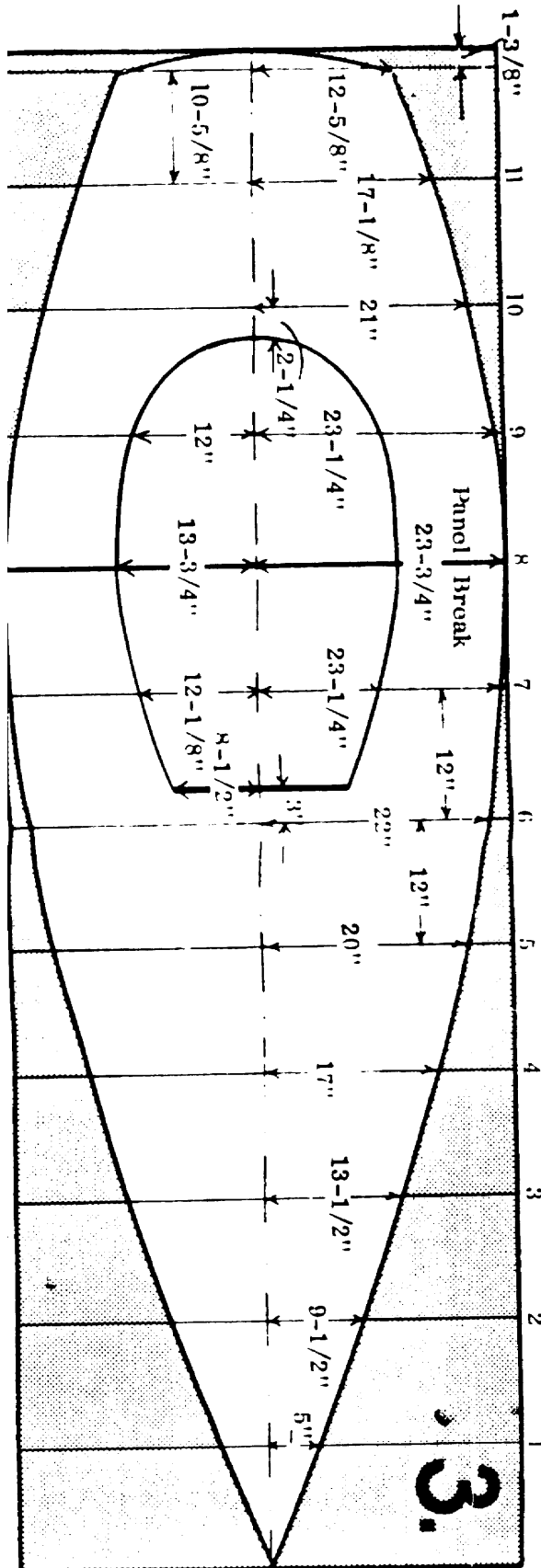
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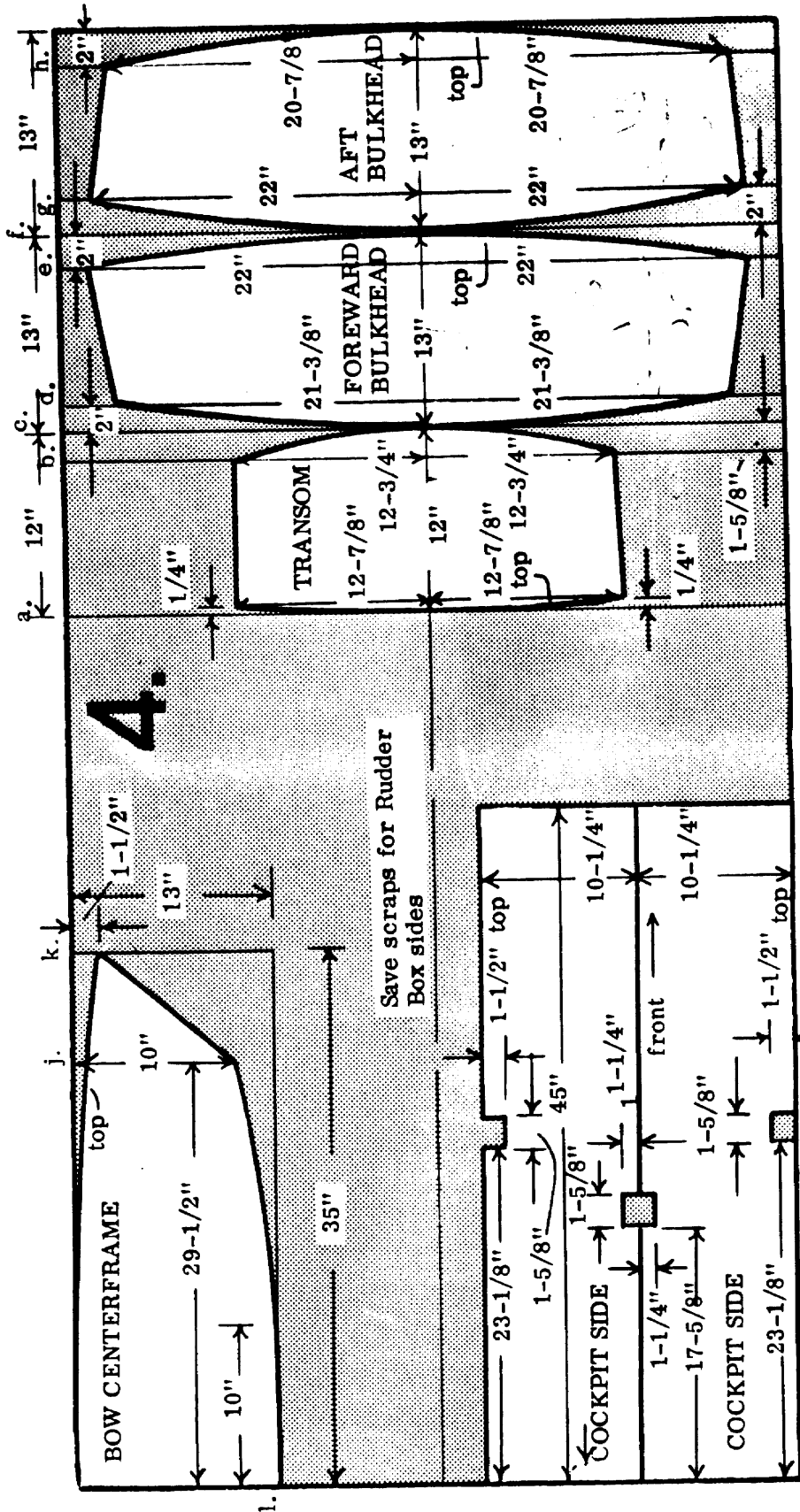
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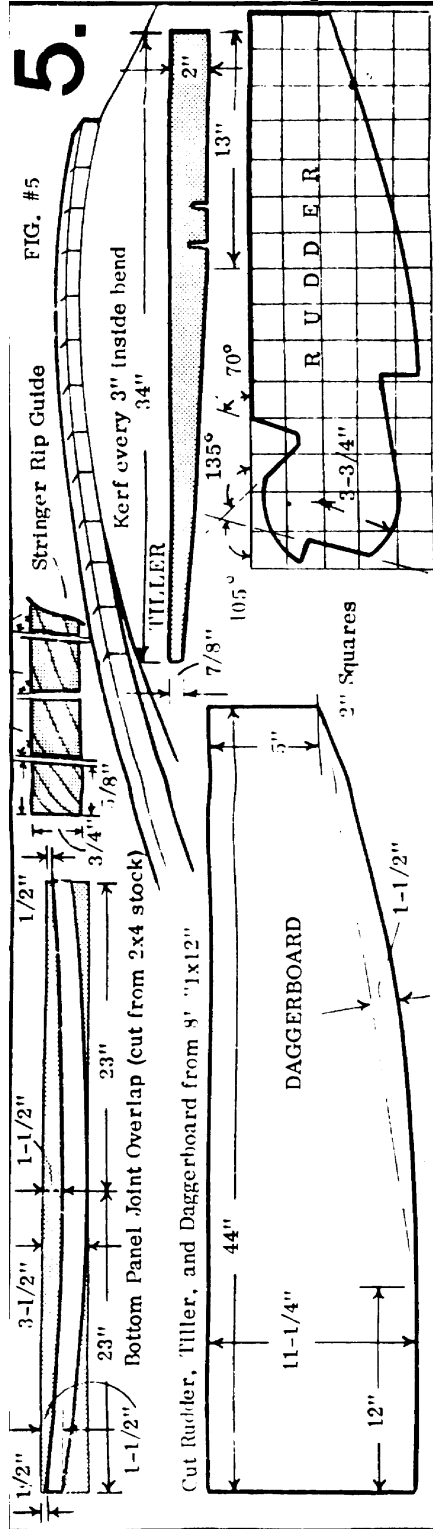
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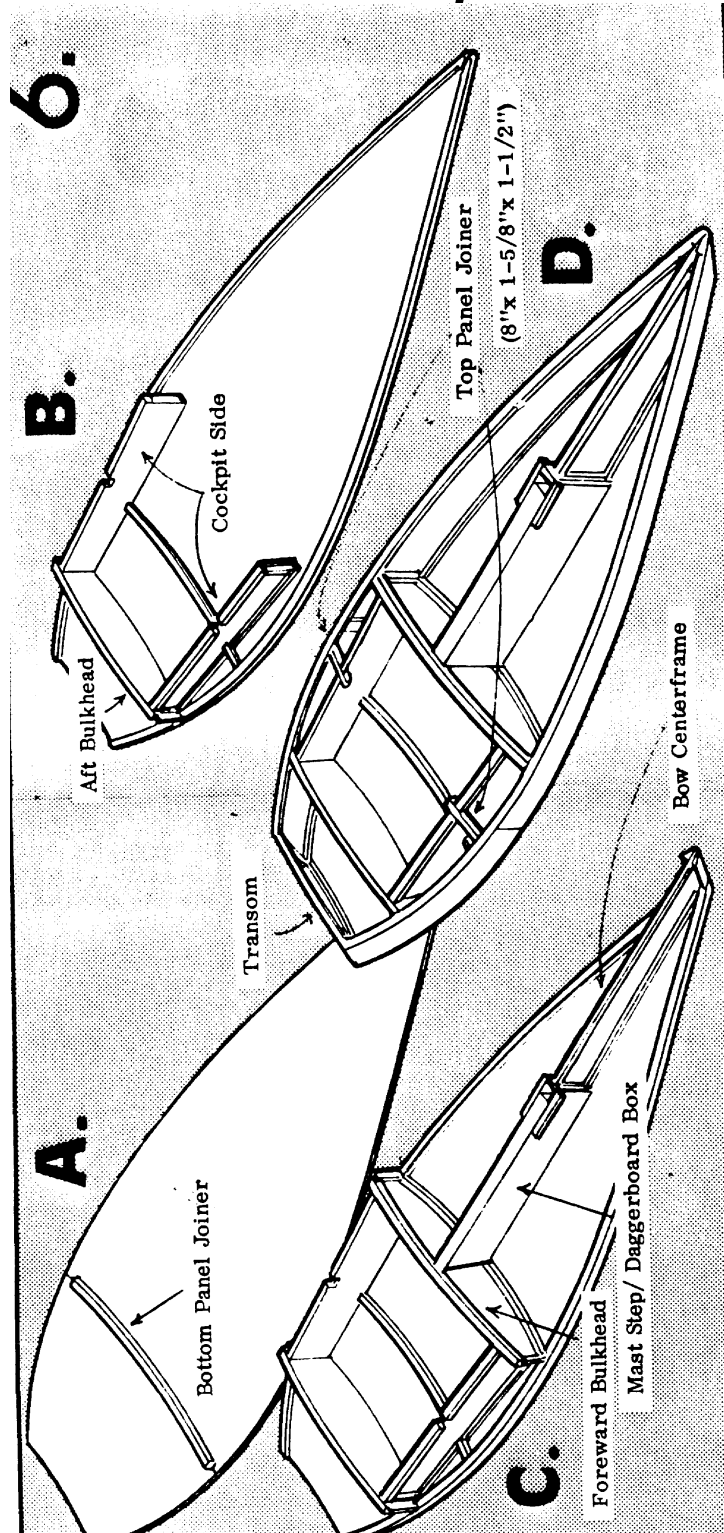
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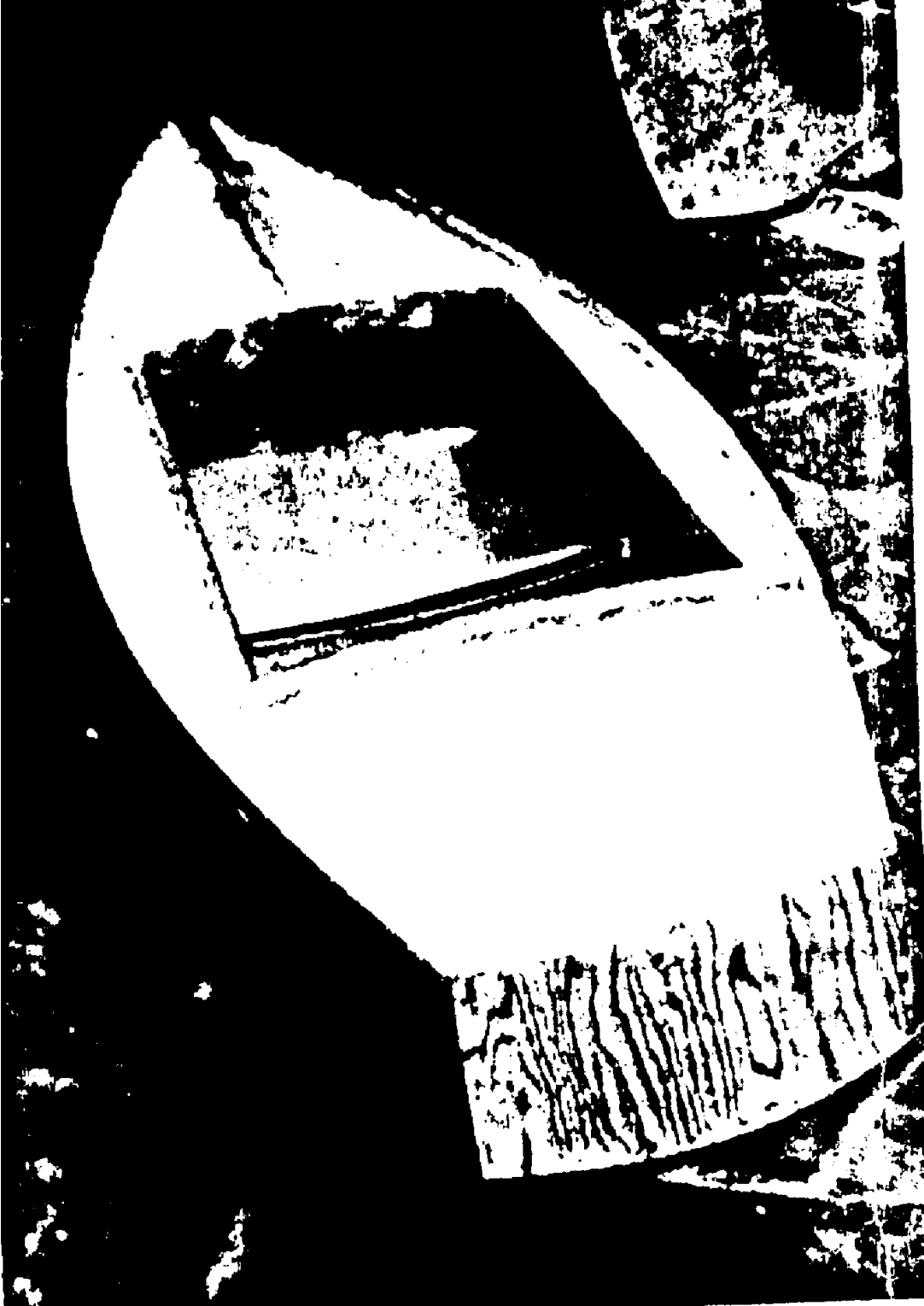


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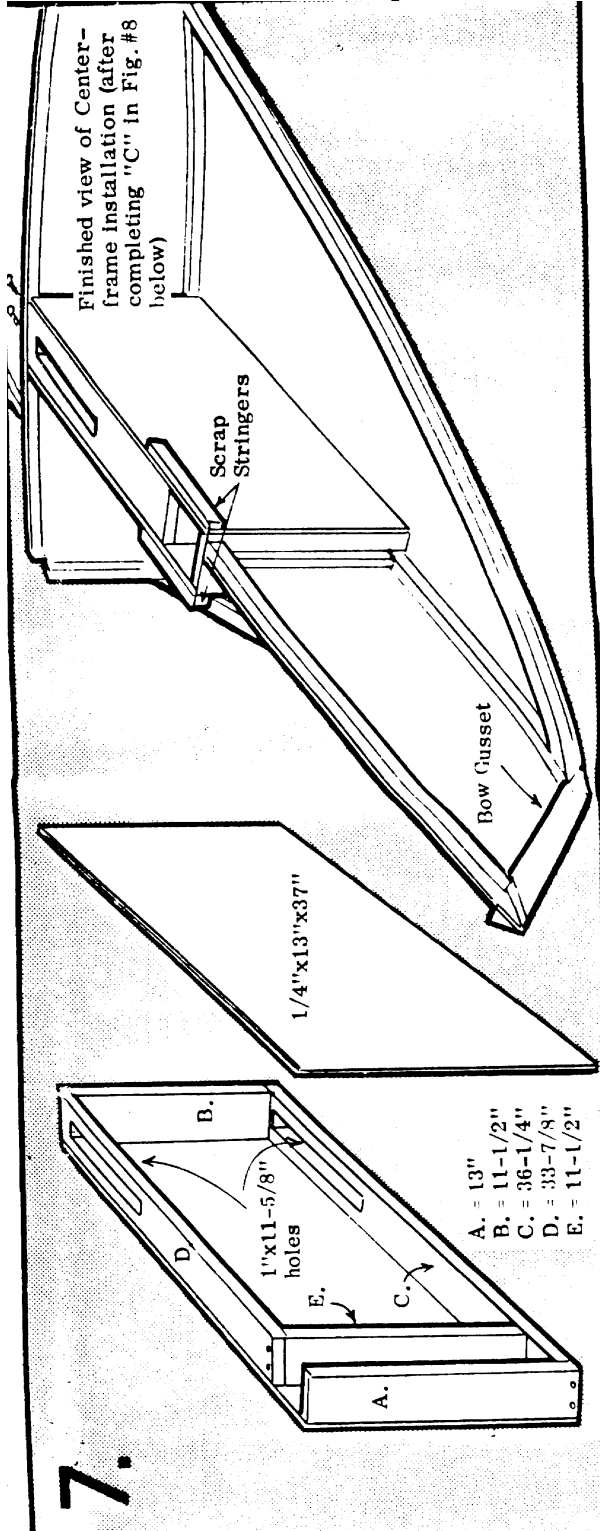
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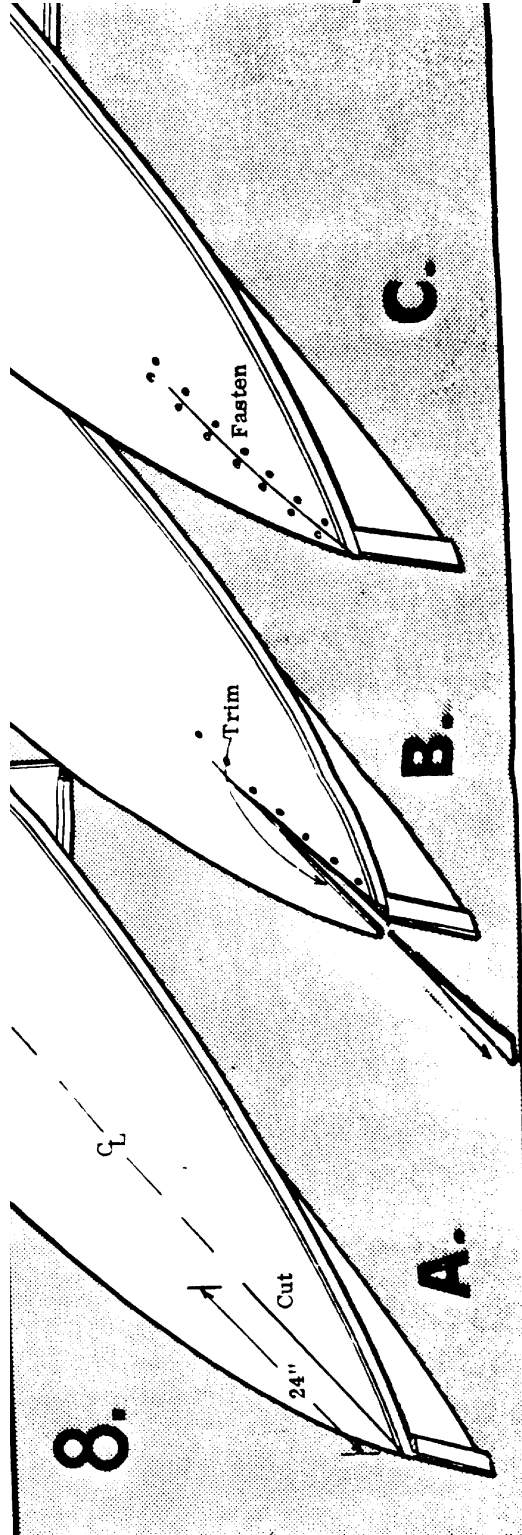
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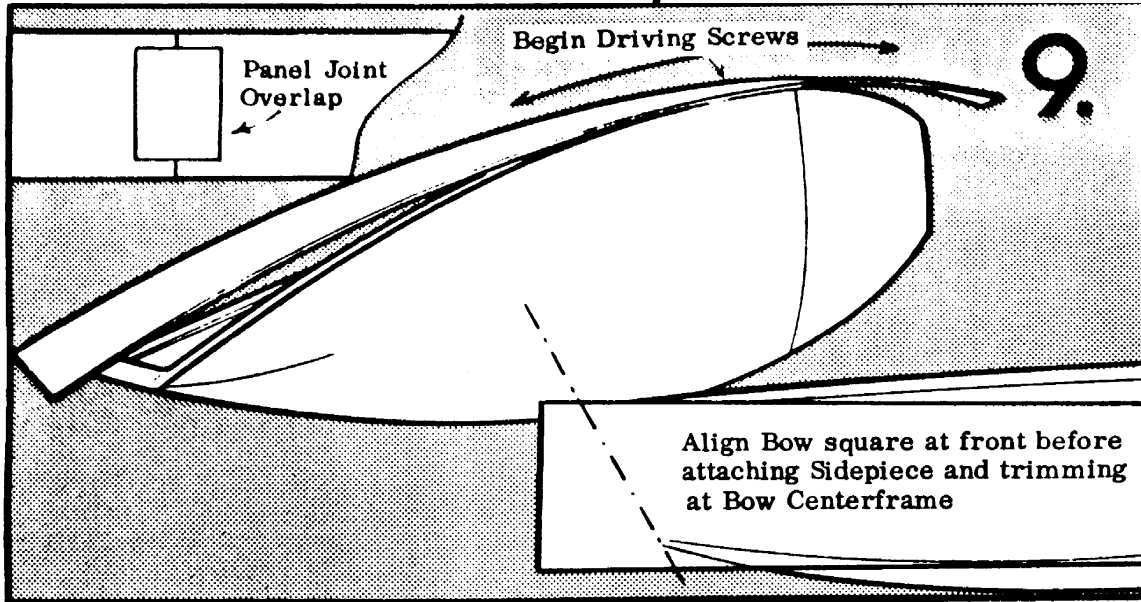


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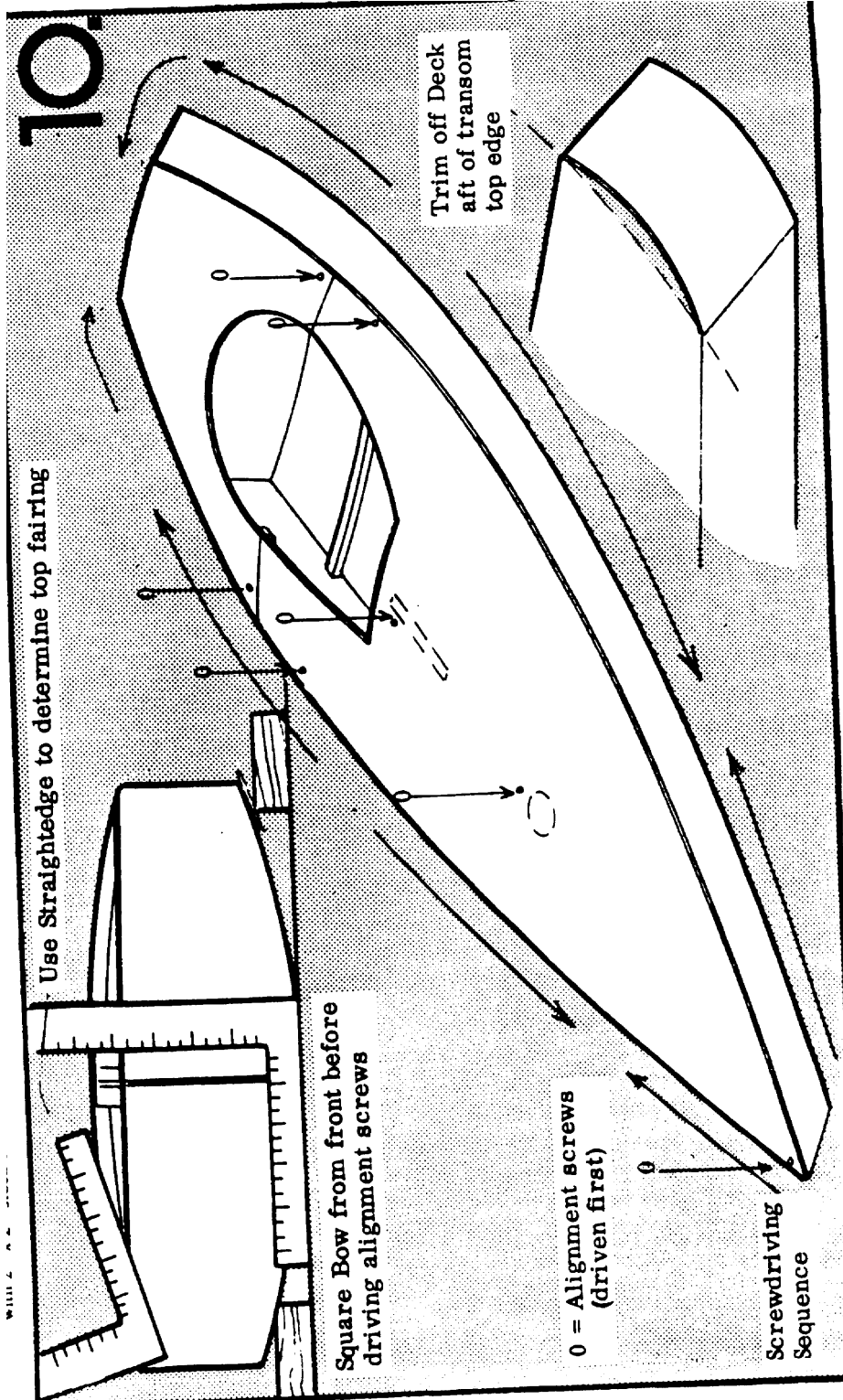


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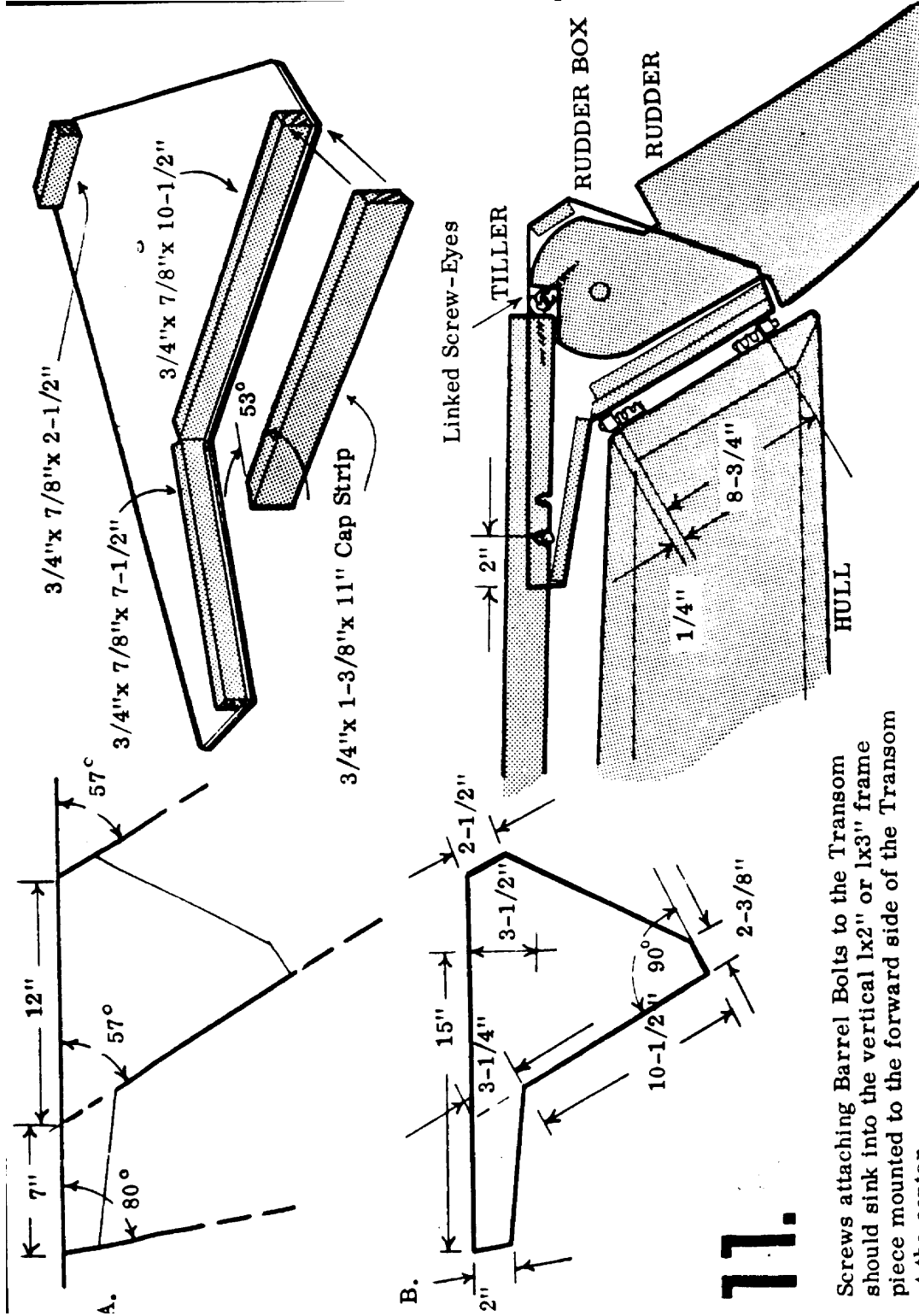
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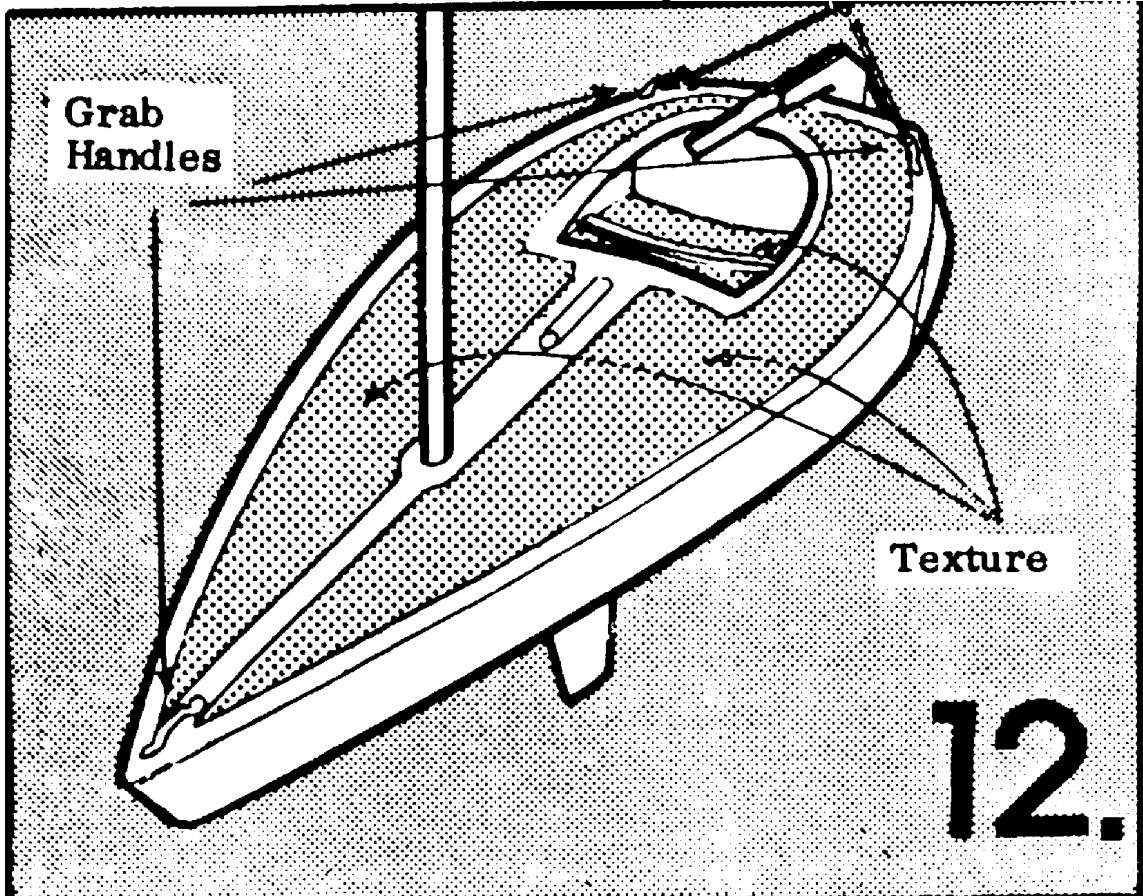


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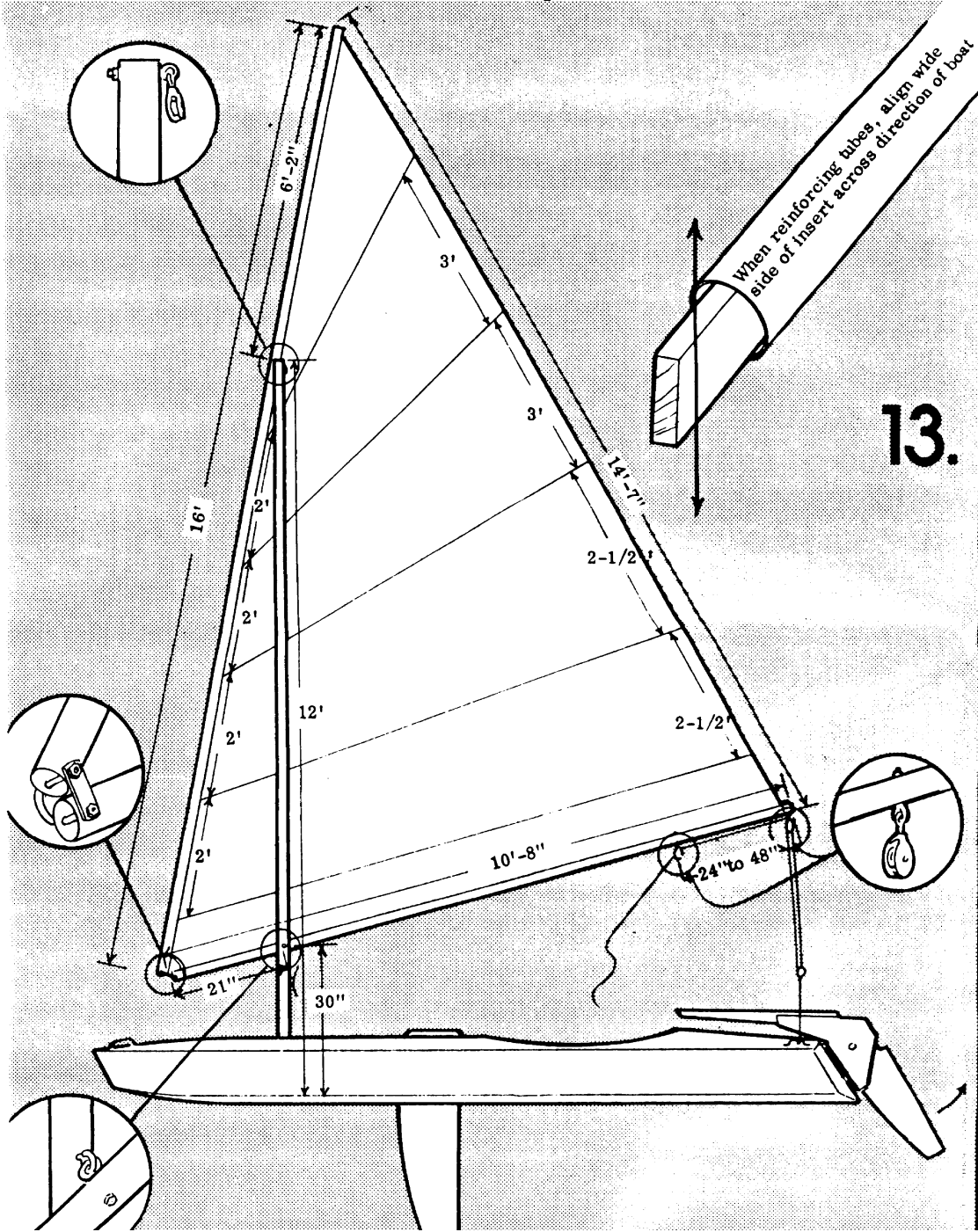
Screws attaching Barrel Bolts to the Transom should sink into the vertical 1x2" or 1x3" frame piece mounted to the forward side of the Transom at the center

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