

INSTRUCTIONS for BUILDING and RIGGING

The INTERNATIONAL 110

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- P R E F A C E S -

The International 110 Class racing sloop is a thoroughbred in every respect. Since the time of its conception in 1939 by C. Raymond Hunt, every effort to keep it so has been made by the International 110 Class Yacht Racing Association. In order to maintain uniformity only licensed builders were allowed to build it in the past, and efforts to make changes have been discouraged. The result has been a strictly one-design class. Twelve year old boats still compete successfully with the newest.

It is only after careful consideration by the Board of Governors and the class membership that the decision has been made to permit 'open building'. This does not mean that there has been any relaxation of strictness or departure from the one-design principle which has proven so successful. Of necessity, certain tolerances are permitted to allow for expansion and unavoidable fractional in exactness, but not for the purpose of permitting any intentional deviations. Builders are cautioned not only to forego intentional deviations, but to see that the workmanship is of such quality that in exactness is kept to an irreducible minimum.

In order to be accepted as a 110, to receive a registered number, and to race in the 110 Class, every boat must be measured in and passed on by the International 110 Class Yacht Racing Association. The Association will reject boats which are not built with a high degree of skill, accuracy and workmanship.

The purpose of this booklet is to help the builder to achieve these results with a minimum of effort and expense. Read each section carefully in its entirety before starting any work.

The idea of having an up to date reference manual for rigging and repairing existing 110's has been around for a number of years now and anyone who has served as a Class officer (especially secretary) knows that most questions from new or prospective owners focus on how to update and modify the boat. Anyone who has taken on the project of an extensive overhaul of an old boat knows the tedious amounts of time spent figuring out what to do, purchasing the right hardware and equipment and then installing it so that it works, reliably. One of the goals of the revisions in this book will be to inform existing or prospective owners of 110's as to what to buy and how it goes together and works on the boat, so that rather than spending lots of time running back and forth to your local chandlery, you can sail your 110.

The idea of producing a new book because what we had was so old and antiquated was the general assumption, but after doing a little more work on the plans and skimming the construction manual by H.T. Martin, I felt that to give a comprehensive view, we should try to consolidate the past and present. Why not build on what we have? And, if some of it is antiquated, we'll make a note of it, and if its antiquated into extinction, like bronze Merriman fittings, we'll delete it. However, the goal will be to compile a detailed inventory of available hardware and supplies, as well as, tips and techniques for anything and everything to do with a 110 in the spirit of the

original publication. My views and opinions on what is correct and incorrect rigging-wise will differ, I'm sure, from others in the Class. Having been in and around 110's for over twenty years now, I have begun to weigh new rigging ideas in the boat against their monetary and/or temporal costs, not to mention, their legitimacy within our Class rules, and would like, if possible, to see us stay attuned with the designer's initial concept of a fast but simple and affordable one-design keelboat. So, there are three values I will try to encourage in this publication: simplicity, reliability and value.

If there has been one salvation for wooden boats (or even old glass boats for that matter) since this book was originally written, it has been the introduction of consumer marketed, marine epoxies. Although not a cure-all as many people treat them, these resins do have much more permanence and strength than less expensive polyester ("fiberglass") resins and are worth the additional cost. Being able to use one system for gluing, coating, fiberglassing and fairing, to me, is well worth the additional time spent learning how to correctly use the fillers, additives and solvents, as well as, the resin itself. It will not be the goal of this book to educate the reader on wood/epoxy construction beyond it's uses in building the 110 from the original plans or in repairs or upgrades to existing boats. The use of exotic and expensive materials such as kevlar and carbon fiber will not be encouraged and has generally, been allowed by the Class on areas of boats where owners could not make adequate repairs otherwise. Epoxy, however, has been, and I'm sure, will continue to be, widely used in our Class and reference to it's use will be made frequently throughout this version of this book.

I have never heard of anyone who thought the boat was perfect and wouldn't change it a little here or there and I have often thought that if those changes were implemented all at once, we would be the caretakers of yet another class. I think if anything has kept our class association together for this long, it is the gift by Ray Hunt of an enjoyable design with such originality and performance that make people gravitate to this class and it will be the goal of this book to keep the design alive in his spirit and in the spirit of H. T. Martin, the original author, whose goal was to take the 110 to the backyard builder.

Section I
- MAKING the FRAMES -

Materials Required -

Spruce unless indicated. Sizes shown throughout this booklet are finished dimensions.

Frame No.	Deck Beam (in inches)	Floor Beam (in inches)	Side Frames (2 PCs.) (in inches)
1	13/16 x 6 x 17	Cut with deck beam	13/16 x 6 x 16
2	13/16 x 6 x 27	"	"
3	13/16 x 6 x 32	'	"
4	13/16/ x 8 x 42	"	13/16 x 6 x 15-1/2
5	13/16 x 6 x 48	1-3/4 x 8 x 46 oak	"
6	Cut w/ deck beam fr. 5	1-3/4 x 8 x 49 oak	13/16 x 6 x 15
7	13/16 x 8 x 50	Cut w/ deck beam	"
8	13/16 x 8 x 49	"	13/16 x 6 x 14-1/2
9	13/16 x 8 x 47	1-1/8 x 6 x 48	13/16 x 6 x 14
10	13/16 x 8 x 44	Cut w/ deck beam	13/16 x 6 x 13-1/2
11	13/16 x 8 x 40	"	13/16 x 6 x 13
12	13/16 x 6 x 33	"	13/16 x 6 x 12-1/2
13	13/16 x 6 x 25	"	13/16 x 6 x 12
14	13/16 x 6 x 15		13/16 x 6 x 11

Total Deck Beams and Floor Beams | Total Side Frames

13/16" x 6" x 21 lineal feet

13/16" x 8" x 19 lineal feet

1-1/8" x 6" x 4 lineal feet

1-3/4" x 8" x 8 lineal feet (oak)
 (makes 4 keel beams)

13/16" x 6" x 18 lineal feet

(or 13/16" x 2-1/4" x 35 lineal feet

if straight sides are used)

Gussets: 56- 3/8 plywood scrap from planking

Screws: 450-#8 x 1" Flat Phillips wood screws (brass, bronze or stainless steel) (also, self tapping s.s. in all applications.)

Glue: Resorcinol type such as Casophen- 3 pints (Epoxy resin- approx. 3 quarts plus thickening agents.)

Temporary nailing: 2 lbs. 1-1/2" finish nails (An assortment of drywall screws and a drill or power driver equipped with a Phillips bit will prove to be easier and more affective in all applications.)

Table: Flat 3/4' plywood, 27" x 54" Cover with wax paper or polyethylene

Tape down layouts C and D to your plywood table top. Be careful to check the overall width. (See 49" dimension.)

The deck beams are slightly curved (1-1/2 in. crown in 5 ft. or the arc of a circle with a 25 ft. 4 in. radius). This curve can be made by tracing off the curve from the layout sheets C and D. Likewise, the floor beams have a curve twice that of the deck beams (3 in. crown in 5 ft. or the arc of a circle with a radius of 12 ft. 8 in.).

You will save time here by making up the deck beam and floor beam for frame #8. The deck beam is 2-1/4 in. deep and the floor beam is 2-1/2 in. deep. They will nest together on a piece of 13/16 spruce 8 in. wide and 49 in. long. Cut these out carefully on the bandsaw. It will pay to smooth these up a little with a plane. These will be used as templates.

If it makes sense to be precise here, so that in the future time isn't wasted, you may find it even better to cut these arcs in 1/4 in. plywood with a router. The small amount of additional work will give you precise templates. The band saw can be used for rough cutting and the router and template with a straight ball-bearing bit will make all your frames identical.

Now cut all the pieces for the for the deck and floor beams to the approximate lengths indicated in the table at the beginning of this section. Using the pieces you have already made, mark the curves off and group them according to the table. Mark each piece with its frame number and band saw it out. Lay the pieces down on the full size layouts and mark off the diagonal cuts at each end. Do an accurate job because this defines the curve of the chines. Leave the two extra oak floor beams. These are best trimmed to fit once the hull is assembled.

If there is one area in the plans that I question, it is those 45 degree cut offs. If you lay the cross section drawing of the chine over the full size frame layouts the chines lay in perfectly at stations #7 and #8, But progressively get more out of alignment towards the ends of the boat. The drawing shows the chine will protrude out beyond the true lines of the boat and due to the ever increasing amount of bevel out at the ends, I don't see how they would fit properly. The up side is that you will be leaving on too much wood rather than taking to much off. So, short of re-lofting the lines for yourself, it is probably possible to trim these ends once the frames are set up.

A 3/8" x 5" cut out then has to be made in the top center of each deck beam. This is to nest with a matching crossnotch in the deck furring piece (see drawing 1103 and 1104 if this is not clear). Do not waste time on the deck beams for frames #6, #7, #8, and #9, because these get sawed off later to make the cockpit opening.

The notches for the deck furring can be cut out after the boat is righted. The frames can be marked with the pieces themselves in position. Also, few boats were built with the furring and the deck

Section I
- M A K I N G t h e F R A M E S -

beams notched. I think this is a waste of time. Just let them into the deck beams. (210's, which are much more boat, don't even have deck furring !)

Cut a 5/16" deep by 3/4" wide notch for drainage (limber hole) at the center of every floor beam. The four oak floor beams should now be tapered to 1-1/8" thickness at the ends. Leave about 8" at the center untapered. (See drawing 1104.)

Limber holes can also be cut after the frames are lined up, especially if you put the sides on first. If you want stronger half round ones rather than square notches, use a 1-1/2" hole saw with a regular length bit in it. Take a scrap of plywood and drill a hole in it with the same bit. Clamp the plywood to each frame with the hole in it just above the frame on the centerline. This arrangement will control the hole saw and allow you to cut out more than half a hole on center in the keel frames. Also, don't forget that frame ? has the block for the rudder post and will need two holes one on each side of it.

The side frames can also be curved the same as the deck beams. Use the deck beam again as a template and lay out two to each cut to length piece as indicated in the table. These are cut off square to the length taken from the full size layouts. Make this an accurate job, too. This cut also defines the curve of the chines.

On Haggerty boats, these ends were left long and beveled with the deck and floor beams. This provides a larger surface area to attach the chines and more gluing area on the gussets. If you want to go this route, you will have to add about 5" to the length of each side frame in the table. On Graves boats, the side frames simply butted the deck and floor beams in the same plane as the gussets were simply screwed to one side. This simplified layout but the post spacing on the strong back would need to be refigured, as well as, the location of the frames which locate other things, like the keel bolts at frame # 6.

If you prefer to save a little wood and are tired of using the bandsaw, it is permissible to make a straight side. In this case, the side frames are cut to length from 13/16"x 2 1/4" spruce, the exact length having been marked off from the full size layouts. Do not forget to mark the pieces with the frame number.

Straight side frames were not the norm in production building and for a long time I thought the strength derived from the egg-shell-effect of the compound bending of the planking was worth the additional effort. Now however, after having installed sides myself, alone. and built a small dinghy using the 'sewn seam'

method, I would now try straight sides. Beside the ease of installation, consider ease of repairs later.

Cut the required number of gussets from 3/8 marine plywood. If you wish to use scraps, first rough cut the bottom and deck planking (see dwg. 1107). The trim should give enough for the gussets. The full size layouts for frame 7 give the shape of the gussets for that particular frame. Make them all this size. After assembly, you will find that the angle cuts on the gussets change, but it is easier to trim those that do not fit exactly after the frame has been assembled.

Drawing 1107 does not give you adequate measurements for roughing out the bottom.

Assembly:

Check the layouts again for overall width, and then cover with waxed paper to prevent the glue from sticking to the layout. Temporary nail the two side frame pieces in place over the layouts. (If you are using curved sides, the top and bottom outside corner should be lined up with the layout. The curve of the side frames will extend a little beyond the line on the layout.) Apply waterproof resin glue to the side frames and one side of the gussets. Temporary nail the gussets in place. Drill four holes top and bottom (a special drill which drills and countersinks for a #8 x 7/8" screw will be a big time saver) and apply the screws (see dwg. 1103 for approximate location of screws). Remove all the temporary nails and set aside the two assemblies. Now temporary nail the deck and floor beams in place over the layouts. Apply glue to the ends of the deck and floor beams and also to the opposite sides of the four gussets which were fastened to the side frames. Temporary nail the gussets to the deck and floor beams. Make sure the outside edges line up all around with the outline on the full size layout. Use four more screws at each joint. Make a horizontal pencil line across the frame where the base line intersects. These lines will later be used for lining up. Also, make a vertical line to indicate the vertical centerline line on the deck and floor beam. Remove the temporary nails, trim off the gussets as required, and set aside for drying.

Unless you happen to be able to get 24 ft. long plywood for the bottom and sides, and unless you use the alternative arrangement of three 8 foot pieces for the planking, frame 7 will need to be cut down for the plywood butt splice. Take 3/8" off the bottom of the floor beam and 3/8" off each of the two side frame pieces. Do not disturb the diagonal cut at the end.

Section II
- C H I N E S , S T E M A N D S T E R N -

Materials required-

Chines	4 pcs.	2" x 3"x 24' 6" Douglas or Oregon fir
Stem	1 pc.	1 1/2" x 3 1/2"x 16 1/4" mahogany or oak
Stern	1 pc.	1 1/2 x 3 1/2" x 10 1/2 oak
(Alt. Chine	8 pcs.	1" x 3"x 24' 6" Douglas or Oregon fir)

One of the most difficult jobs is cutting the chines, particularly if they are made from solid 2"x 3" stock, and this is much the best way. If there is a professional mill nearby, it will be better to find out if they will do it inexpensively. Remember that these pieces are over 24 feet long and hard to handle, unless you have your circular saw built into a long table. The sections of these pieces are best shown on sheet "C".

If you still want to try it, first cut a piece 18" or 20" long and the same section (2"x 3") as the long pieces. This will serve as a trial piece to check that the angle cuts are correct and that the fence is set at the correct distance from the saw blade. Follow the notes on sheet "C".

A somewhat easier but much less desirable way to make the chines is in two pieces. (See dwg. 1103.) With this construction there are bound to be voids between the inner piece and the outer capping. The capping, therefore, should be planed down to fit as snug as possible and copious amounts of mastic, such as seam compound, used to fill the voids. Otherwise your chines will quickly rot out. Professionally built boats with this construction have in some cases shown trouble in a very short time.

Cut the mahogany (or oak) for the stem and stern pieces. These should be made to the dimensions shown in the bill of material and will be planed down later to fair in with the hull structure after it is assembled. These are not the pieces which form the extreme end pieces of the boat. They come later and are fastened into the mahogany blocks we are now making. (See dwg. 1103.)

Materials required-

4 pcs.	2"x 6"x 12 ft.	building lumber
1 pc.	2"x 6"x 10 ft.	"
12 pcs.	2"x 4"x 10 ft.	"
8 pcs.	3/8" x 4"	carriage bolts , w/ nuts and flat washers
3 lbs.	12d	common nails
3 lbs.	3/16~	hardware store turnbuckles
100 ft. (4 pcs.)		piano wire approx. .040" diameter

(2x6 and 2x4 are nominal lumber sizes,. Building lumber should be selected for straightness)

Drawing 1107 shows two views of the assembly jig. First study this carefully. You will see that it is made up of two long pieces of 2x6 to which are nailed a series of uprights. These uprights serve to locate and hold each frame in place. The diagonal cross bracing which goes underneath the two lengthwise 2x6 pieces is used to keep the jig in alignment.

It is best to select a space large enough where you can work inside. The floor, of course, should be reasonably level. If such a space is not available the boat can be framed up out of doors. For proper setting of the glue, a temperature of 70° or above is required. So if you plan to work out of doors, wait until it is warm weather before you start the planking operation. Also, if you work out of doors you will need a large tarpaulin to keep the rain off, about 30 ft. by 8 ft. You can use this later as a winter boat cover.

Start with the four 12 ft. 2x 6's which you have selected for straightness. Fasten each pair, end to end, with a splice piece of 2x6, 2 ft. long. The splice piece is, of course nailed on. These two assemblies are the main rail members. Place them parallel to each other and spaced 24" apart across the inside (see dwg. 1107) with the splice pieces towards the inside. Now cut nine pieces of 2x4, 3'10" long. These make the diagonals. Nail them on top of the 2x6 rails roughly at a 45 degree angle, making sure that the rail pieces are kept 24" apart and that the ends of the rails are square across the ends. Cut two pieces of 2x6, 30" long. These go across the ends of the rail pieces and are nailed into them. They should stick about 1 1/2" beyond the rail members.

After all the diagonals and end pieces are nailed on, turn the whole assembly over, so the diagonals are underneath. Pick one or the other end to be the bow end and measure back 3 1/2" from the end of one of the rails and draw a line across on top. Making sure you are square across, make a mark across the top of the other rail member to line up with the first one. This line represents Station 0 and a 2x4, 27" long is then nailed on top of the rails so its vertical forward edge lines up with Station 0. (See dwg. 1107.)

Hook your steel tape on at this point and measure down the rail, marking off the distances indicated on the drawing on the top of both of the rails. Nail on the cross piece at Station 15. It is best now to level up the whole frame. If you are outside, drive a

Section III
- MAKING THE ASSEMBLY JIG -

number of stakes into the ground, one at each corner of the diagonal bracing. Get the frame as nearly level as you can both lengthwise and crosswise.

Cut four more cross pieces from 2 x 4 stock, each 27" long. These will go at Stations 1, 2, 13 and 14, but first nail on the vertical uprights, 6 1/2" long to the edge of the cross pieces. Line up the vertical face of the uprights with the marks at Stations 1, 2, 13 and 14, and nail the cross pieces in place. Study dwg. 1107 to see where these go. The cross piece itself does not go at the mark on the rail.

Cut 20 pieces of 2x4 stock 16 5/8" long and nail them to the sides of the rail members as indicated on the drawing, making sure they are vertical either with a level or a square. This then provides for all the frame locators. Be sure you place them on the correct side of the mark. 1-7 go one way and 8-15 are opposite.

The purpose of the two end structures is to hold the line-up wires. Select for straightness and cut two pieces of 2x4, 5' 4" long, and two pieces 30" long. Nail them together as shown on the drawing. Bolt on the four corner uprights. These are cut 26 3/4" long from 2x4 stock. Also cut four diagonal braces from 2x4 stock. These are 34" long with a 45 degree cut at one end. Bolt one end of the diagonal to the rails; make sure the corner uprights are vertical; then nail the diagonal brace into the upright.

The two cross piece assemblies now should be nailed into place on the corner uprights. This job must be done very carefully to make sure these pieces are horizontal. Use your level. The top surface is located 21 1/4" above the top of the rail. When you are fastening the one on the opposite end, use your level and sight down to the other end to see that both are in line.

The last part of the job is rigging the four line up wires. Cut shallow saw notches in the edge of the cross pieces at Station 0 and Station 15. These notches must be on center halfway between the two rails. Rig the bottom center wire and draw it up tight with a turnbuckle at one end. Carefully locate with a plumb bob the position of the upper centerline wire. This must be exactly above the lower wire. Measure out 2'6" from the upper center line and locate the two base line wires. Cut in four notches in the top of the cross piece edge, and rig the two wires. Check again at both ends to be sure these wires are exactly horizontal across and are tight so there is virtually no sag.

Materials required-

completed	Frames from Section I.
all	Chines, etc. from Section II.
complete	Jig from Section III.
88 pcs.	#12x2" flat head wood screws, brass, bronze or S.S.
4 pcs.	flat head wood screws, galv., bronze or S.S.
4 pcs.	#14x3" flat head wood screws, galv., bronze or S.S.
30	'C' clamps with 5" openings. (You will also need these later for clamping the mast.)
6 pcs.	Pine batten strips 10 ft. x 3/8 x 2"
4 pcs.	2"x 6"x 12 ft. building lumber
1 pc.	2"x 6"x 10 ft. "
12 pcs.	2"x 4"x 10 ft. "
8 pcs.	3/8" x 4" carriage bolts, w/ nuts and flat washers
3 lbs.	12d common nails
3 lbs.	3/16~ hardware store turnbuckles
100 ft. (4 pcs.)	piano wire approx. .040" diameter

(2x6 and 2x4 are nominal lumber sizes,. Building lumber should be selected for straightness)

Setting up the frames-

Place all the frames in the proper sequence and location in the jig. In addition to having them in the proper sequence, be sure that frames #1 through #7 have the side frame pieces forward the frames #8 through #14 have the side frame pieces aft. (See dwg, 1104 if this is not clear.)

Refasten and tighten the upper centerline wire. The frames should be placed upside down with the deck beam at the bottom.

Now bring frame #1 to Station #1 and clamp the deck beam to the positioning stop on the jig.

Before tightening the clamps each frame should be checked very carefully for alignment. First, be sure that the horizontal pencil lines on the frame, line up with the longitudinal wires outside the jig. This can be done by sighting across the wires, being sure that the pencil marks are in line, or a better way, is to clamp a straight edge in line with the horizontal pencil mark. Then raise the frame up until the edge of the straight edge just barely touches the two wires. Using a plumb bob, check to see that the vertical center line of the frame lines up with the longitudinal center wires of the jig. Then tighten the clamps. Again using the plumb bob be sure that the frame is vertical and does not lean forward or aft. Nail one end of a batten to the end cross piece of the jig and temporary nail the batten also to the floor beam of frame #1, so it holds the frame in a vertical position. Don't cut the batten off. It can also brace the next frames to follow. Proceed with all the frames in the same manner.

When this is finished, sight down the center. The horizontal and vertical pencil lines should make a straight line. Correct any frames that may be out of true. Take time to do this job as near perfectly as possible. Also, it will be well worth your while to

Section IV
- ASSEMBLY OF THE HULL -

check the floor beams to be sure they are square crosswise with the centerline of the boat. This can be done easily by fastening a piece of wire to the jig at the bow end - exactly on the centerline. Swing this from one corner of each frame to the other corner. The two corners should, of course, be the same distance.

If they are not, hold them in line with some additional battens tacked on. Keep the space clear of battens where the four chines go. As a double check, use your steel tape and check to see if the station distances check with the dimensions on dwg. 1102. The actual station is the plane of the joint between the plywood gusset and the side frame.

Sight along all the outside curves. They must be smooth with nothing sticking out. Frame #7, of course, will be in 3/8" to allow for the butt splices.

By the way, if it is late at night and you are tired, better let it wait until tomorrow. Don't hurry this part of the job.

Fastening on the chines -

The chines fit against the top and bottom ends of the side frame pieces and also, against the slanting end cuts on the floor and deck beams. Starting with the two bottom chines (these go on top), hold these in place and check to see that the stop back in the chine lines up with the after corner of the side frame Station 1 through 7, and with forward corner for Stations 8 through 14. As you check towards the ends of the boat, you will notice that the bevel cut in the chine, which receives bottom planking, sticks up more than it should. This will be planed down later. Otherwise, the chines should fit nicely and fairly into place. If they don't, check carefully. You may have them upside down, or they may be the chines for the deck. If absolutely necessary, do a little filing on the frame 9 to make the chines fit. This should not be necessary, if your work up until now has been accurate.

Fasten the chines on using #12 x 2" screws to fasten them to the slanting ends of the floor and deck beams. Start at frame 7 and 8. Work both sides of the boat at once to avoid setting up strains that will pull the frames out of line. Progress forward one frame at a time, and then aft from the center. Clamps should, of course, be used to hold the chines in place for drilling and fastening, but don't try to clamp beyond one station past the one you are fastening. Two screws are used to fasten the chine at each frame. One screw is horizontal and the other vertical. They should be countersunk - the vertical ones a little deeper near the bow and stern, because the wood here will have to be planed down some, perhaps 1/8". It is hard to get at the vertical screws for the deck chine, so leave them out until the boat is turned over.

When you got to the bow and stern, the chines will need to be cut on an angle so that they fit one against the other at the centerline of the boat. The ends will also be cut off square with the centerline of the boat at a point 3 1/2" back from the extreme bow and stern which is also Station 0 and Station 15. Note that the width across at this point is 3" (see dwg. 1102 and 1103) so mark the station position and cut back the inside of the chines until they measure 3" across. Leave the chines a little long for the time being.

Study the detail in the upper left corner of dwg. 1103. You will see that there are two screws which go in at an angle. The one on the port side is a little forward and 2

1/2" long. The other is 3" long and slightly aft. This is so they will miss each other at the center. The holes are counter bored with a 5/8" drill; in about 1/4".
Glue and screw all four ends together, making sure that the pieces meet on the centerline of the boat.

Make a saw cut about 1/2" deep and 1-1/2" back from Station 0 and 1-1/2" forward of Station 15. This cut goes in the top of the deck chines and the under side of the bottom chines (remember the boat is upside down). Notch out so it will receive the stem and stern pieces (see dwg. 1103). Trim these stem and stern pieces so that the top to bottom dimension overall at Station 0 is 20-3/8", and at Station 15 is 14-3/8" when these pieces are slid into place. The upper and lower chines may have to be pulled towards each other slightly to achieve this. You will have to remove the centerline wire to get these pieces in place. It will be a good idea to drill a 1/2" hole where the centerline goes through and replace the centerline after clamping and gluing these in place. This line will continue to serve as a check if you may think you have pulled something out of line during the planking operation.

Fairing up -

After the stem and stern pieces are glued and clamped in place, the frame then needs to be faired up. If you hold a batten along the side starting at the bow, you will see that all the forward edges of the side frame pieces and the stem piece stick out. The proper bevel can be cut back with a block plane. Be careful not to cut beyond the back edge because this controls the proper width of the boat. From Station 8 on back towards the stern, it is the back edge that is planed off and the forward edge is the control point.

The groove cut into the bottom chine members should blend in properly with the curve of the floor beams. In the center part of the boat, no fairing up should be required, but as the chine goes out toward both ends, the curve of the bottom decreases and the angle of the chine should be reduced to blend in. This can be checked by holding a small piece of plywood against the end of the floor beam and the groove in the chine, and checking how much has to be planed off. In other words, when the plywood bottom is put on it must fit in nicely and not stick up above the chines. You may also wish to fair up the floor beam curve, but don't take much off or your boat will not measure exactly. The deck planking does not go on until the boat is turned right side up, so don't try to fair up for this until then. You can now trim off the chines so they are flush with the stem and stern pieces. If the glue has thoroughly set, drill the 7/16" diameter holes and drive in the soft pine stopwaters as shown on dwg. 1103. These go in both at the bow and the stern.

Now is the time to fasten in the two other oak floor beams which you made up and which take the keel bolts. Trim the ends so they fair in with the rest of the bottom floor beams, and fasten them to the chines with two screws the same as those at each frame.

Section V
- P L A N K I N G T H E H U L L -

Materials required:

Bottom 12' x 4' x 3/8" marine fir plywood - 2 pcs.*

Sides 12'x4'x3/8" marine fir plywood - 2 ~pcs.*

Rudder post block 7"x5-3/4"x1-1/4" pine - 1 pc

#8 x 5/8 " flat head wood screws, brass (for butts) - 110 pcs.

#8 x 7/8 " flat head wood screws, (for planking to chines and frames - 1032 pcs

#8 x 1 1/4" flat head wood screws (for planking to frame #7)- 16 pcs,

Glue - Resorcinol resin type such as Caseophen - 5 pts,

Five or six cheap brushes for applying glue.

*See dwg. 1107 for economical cuts if more than one boat is built.

Planking the bottom -

Place the forward piece of 3/8" plywood on top of the boat framework and locate the after edge of the plywood 3-1/4" back from the back edge of the floor beam at Station 7. Center the piece. Clamp or hold down the forward end and mark from the underside, the outline of the outside of the chine. Remove the piece and make a new line which is 1-1/4" inside of the outline. With a handsaw, cut around this line. Try the piece in place again and trim as necessary to make it fit neatly, keeping the after edge 3-1/4" back from the back edge of the floor beam at Station 7. Repeat the process for the after portion of the bottom. Try both pieces in place until they both fit neatly in place. Mark pencil lines across the pieces to indicate the centerline of the floor beams at each station. This will help to keep the screws in line and into the floor beam. Also, mark off the area covered by the butt splice. Remove both pieces and fit the butt splice, a piece of plywood 4'x 8" wide. It must go snug up against the chines. Trim it to fit. The forward edge of the butt splice piece lines up with the forward edge of the floor beam. Glue and fasten the butt splice to the floor beam. Use #8x7/8~ screws, spaced on 3" centers.

If you aren't very good at spacing 3" by eye, it is best to mark all the screw locations on the bottom pieces. These go 3' centers all the way around the edges and across each floor. Spot the locations for two rows of screws forward of the bottom joint and two rows aft of the joint. These screws are to fasten the bottom planking to the butt splice.

You will need to work rather fast on the next part, so if at all possible, have a friend who likes to drive screws help you. Apply glue copiously all around to the hull framework where it will receive the forward bottom plank. Work fast. Also, wet the edges of the plywood all the way around with glue. If some runs underneath, so much the better. Put the bottom planking in place making sure it fits all around. Give your friend a pocket full of screws and a Yankee screwdriver. You take the electric drill fitted with a drill suitable for #8 X 7/8" screws with a countersink on it. Drill four holes, two on each side of the boat, into the floor beams at Station 6. and put in screws. Pull the screws down not less than 1 h 6~ below the surface, so there will be space for the putty to cling. Now, you and your friend might prefer to climb up on top of the planking. Your weight will help to hold it down. Run a row of screws down the center

with a couple of screws in each floor beam. Then come back to Station 7 and work forward along the chines. Put in about six screws, then cross over to the other side and do six there, and so on until you get to the bow. Don't waste any time because the glue is setting up. Next put in the screws at the butt splice. These screws are shorter #8 x 5/8" long, so don't drill quite so deep. Last finish up with the rest of the screws into the floor beams. At frame 7, it is necessary to fasten through two thicknesses of plywood so use #8 x 1-1/4" screws. Space them to miss the screws underneath. The procedure for the after part is the same.

Planking the Sides -

The application of the sides is sufficiently similar, so the detail will not be repeated, except to say that it is impractical to try to put both port and starboard side planking pieces on at the same time and, furthermore, this should not be necessary because the bottom planking will stiffen up the hull sufficiently so that there is little likelihood of it being pulled out of line by working one side at a time.

Rudder post block -

Drill a 3/8" diameter hole 2-1/8" back from the 5-3/4" edge of the rudder post block. Also, mark a point exactly on center and 2-1/8" forward of the forward edge of the floor beam at Station 11. Do this on the inside by climbing under the boat, Drill a 3/8" hole up through the bottom plywood at this point. Using a 3/8" bolt as a clamp now glue and clamp the rudder post block in place. Also, from the outside drill holes and drive fourteen #8 x 7/8" screws into the block to fasten it to the bottom plywood.

Fairing in the Chines -

Now you can round off the bottom chine pieces so they make a smooth curve and blend in with the plywood. It will probably also save time if you now give the bottom a prime coat, letting the paint soak down into the cracks while the boat is upside down. Of course, don't do this until the glue is thoroughly dry. You might also wish to putty up the screw heads while it is still easy to get at the bottom. Put in the putty after the primer is dry.

Section V
 - DECK, KEELSON, CARLIN,
 STEM & STERN -

Material required-

Deck 4' x 8' x 3/8" marine fir plywood - 2 pcs.
 (See how to cut deck at cockpit on dwg. 1107)
 Keelson 12' 4" x 6-5/8 x 1" Eastern or Northern spruce - 1 pc
 Deck furring forward 7' x 2 5/8 x 5" x 3/4" Eastern or Northern spruce - 1 pc.
 Deck furring aft 6'-7" x 5" x 3/4" Eastern or Northern spruce - 1 pc.
 Deck carlin 7' 6" x 2 ~ Eastern or Northern spruce - 2 pcs. ~
 Breast hooks 1 ~ x~7x1 ~ pine - 2 pcs. ~ /
 False stem 20~'x3~ x3'~ oak or mahogany - 1 pc~2~
 False stern 14'x2~x3~ oak or mahogany - 1 pc~ ~
 #~x7/~ flat head wood screws, brass - 40 pcs.
 (deck to chine, deck beam, and earling)
 #8x1" flat head wood screws, galv. - 24 pcs.
 (deck furring to deck beams)
 Ox1~It flat head wood screws~ galv. - 44 pcs.
 (breast hooks to chincs, earlings to deck beams,
 , - butt blocks to deck beams)
 s ~12x2~1 flat head wood screws, brass - 25 pcs.
)~ , b (chines to deck beams)
 #12x2~ flat head wood screws, bronze - 20 pcs.
 (keelson to floor beams)
 ~4x~" flat head wood screws, galv. - 2 pcs. \ ~ J
 (keelson to floor beam at Station 9)
 ~16x3 ~ flat head wood screws~ galv. - 7 pcs.(6
 (false stem and stern to boat)
 2 pints Resorein resin glue
 1 pint non-hardening seam compound

Out of the Jig! -

Put some temporary blocking under the chines at Station 4 and Station 11. Remove the clamps and lift the boat out of the jig. You will need at least one person to help lift it out. Turn the boat right side up and use two padded blocks at Stations 4, 7, and 11 to support the boat. Arrange the padding so that most of the weight is taken out at the chines. Lay some temporary floor boards on top of the floor beams so you won't walk on the bottom of the boat.

Put in the #12 x 2" screws which fasten the deck chine to the frame (those that you couldn't reach when the boat was upside down). Fair up the deck beams in the same manner that you faired up the floor beams. Refer to Section IV, paragraph 4 again.

Breast hooks -

Cut the 1-1/2" pine breast hooks so they fit in between the two chines at the bow and stern. The top of the breast hook must be flush with the cutout in the chines which receives the plywood deck. Also, if you study dwg, 1104, you will see that the lower part of these pieces is cut on a 45 degree bevel, so they hook under the sloping part of the chine. A shelf is made in the upper back edge of the breast hook. This shelf is 1-1/2" wide and is 3/4" deep, to receive the deck furring at the bow and stern. Study dwg. 1104. The breast hooks are glued and fastened with three #10 wood screws on each side. These screws go down through the chine and are countersunk into the cutout in the chine.

Keelson -

The keelson extends from frame 2 to frame 10. It is not necessary to glue the keelson to the frames. It is fastened to each floor beam with two #12 x 2" bronze wood screws at each floor beam. Be careful at frame 5 1/2, 6, and 6 1/2 to space these screws so they will not interfere with the keel bolts. Dwg. 1104 shows the keel bolt locations. At frame 9 use two #14 x 2 1/2" galvanized wood screws. (The boats are sometimes hoisted at this point.)

Deck furring -

The deck furring is next to go on. Press it into the notches in the deck beams and also onto the shelf in the breast hook. Mark underneath the furring on both sides of the deck beam where it crosses the furring. Then remove the furring and cut a 3/8" deep groove across for each of the frames. Fasten the furring to each deck beam with two #8 x 1" galvanized wood screws.

Deck planking -

The fore and aft deck pieces are next fitted into place (see dwg, 1107). Follow the same procedure used in planking the bottom (see section V, paragraph 2). The after edge of the forward planking is cut off flush with the after edge of the deck beam at Station 5. Likewise, the after deck is cut off flush with the forward edge of the deck beam at Station 10. After you are sure the decking will fit neatly into place, glue and screw it on with #8 x 7/8" screws spaced 3" on centers.

Cutting out the cockpit -

Dwg, 1102 shows the dimensions for the cockpit cutout. These dimensions are to the outside of the mahogany coaming, so subtract 1/2" for the thickness of the deck carling and mark the top of the deck beam. The coamings slope slightly outwards at the top, 3/4" in 5" or 8-1/2 degrees. Starting at the marks you have made across the tops of the deck beams mark this angle on each of the deck beams at Stations 6, 7, 8 and 9. As an extra precaution, clamp a 2x4 across at frame 8 to the upper gussets. This 2x4 must be fastened under the deck beam at this station. The purpose of the 2x4 is to keep the chines from springing in or out when you cut the deck beams off. Now cut off the deck beams at frames 6, 7, 8 and 9 along the angle mark you have made.

Section V
- DECK, KEELSON, CARLIN,
STEM & STERN -

Save the pieces of deck beam you have cut out, and from them make up the four blocks shown on dwg. 110~ (deck plan) at Stations 5 and 10. These blocks serve two purposes. They help make the deck splice and they also serve to back up the deck carling at those locations. The end of the block which fits up against the chine is cut off square and the other end is cut on the QamC ~ degree angle which you used to cut off the deck beam. Also looking down on top of the block at frame 5, you should cut it so that it should be cut on a fore and aft angle. This angle is roughly across the 13/16~ thickness of the block. Glue and fasten these blocks to the deck beams with 10x1~" galvanized screws, Use two screws in each block.

Now fit and spring the two carlings into place. Fasten them to the end of each deck beam with two #10 x 1-1/2" galvanized screws. The top edge of the carling should be flush with the top of the deck beam. It will need to be planed slightly to fair in.

Deck

Fit the two remaining pieces of deck planking into place. These should fit neatly into the chine along the outside edge. Make sure the butts at both ends fit tightly. Don't finish up the inside edge yet. Glue and screw the deck pieces down with #8 x 7/8" brass screws spaced on about 3" centers. Now you can plane the inside edge off flush with the inside of the carling and take out the 2x4 temporary brace.

False stem and stern -

Make up the false stem and stern pieces (see dwg. 1104). Rough cut these out. Don't try to fair them in too carefully until they are fastened in place. Cover the ends of the boat with a non-hardening seam compound. Use plenty and let it squeeze out when you fasten on the end pieces. It is better not to glue these pieces in because they frequently get banged up and sometimes need to be replaced. It will be a good idea now to give the deck a prime coat and putty up the screw heads.

Materials required -

16l0llx7 ~ mahogany - 2 pcs.
5tO~Ix3 ~ xl~ll mahogany - 1 pc. (if solid thwart is used)
16~011x7 ~ mahogany - 1 pc. (if bridge deck is used)
~loor boards, see comments following
x5ll~5~ rubber for mast bumper
~3xll~ flat head wood screws, bronze - 66 pcs. (for co~ming)
~LO-32x3/4l~ flat head machine screws, brass - g pcs,
(splash board to metal brackets)
7Yl2x2ll flat head wood screws~ bronze - 6 pcs.
(for co~m~ng at center)

Coaming -

The location and dimensions for the cockpit coaming are shown on dwg. 1102. Additional views are also shown on dwg. 1103 frame 5 and frame 10 and also on dwg. 1104. You will probably save time and the possibility of spoiling the mahogany stock if you start with several pieces of box board (heavy cardboard) fastened together to make a strip 10' 9" long and 7" wide. Cut this out until the center portion fits down flush with the bottom of the deck carling, and the front and back part fits down snug along the deck. The front part is curved inward to the center of the boat at a point 22-3/4" forward of the cockpit opening. This will take a little cutting and trying before you get it to fit properly. With the template clamped in place you will notice that it extends somewhat below the carling at the center of the boat, when the front and back ends are held flush. Using the carling as a ruler, mark the back side of the box board template. Also, mark the proper heights above the deck as shown on dwg. 1102. Cut the template out to these lines and transfer the outline to a piece of 1/2" mahogany 10' 9" long and 7" wide. Leave an 1/8" or so excess when you cut out the mahogany.

The coamings should be made to fit neatly and tight all around when they are sprung into place. Otherwise, you will get leaks and water seepage which helps to start rot. As an extra precaution, paint the carling and deck beams at Station 5 and Station 10 with a rot preventative and stick down a band of black cloth electrician's tape all the way around the upper edge of the cockpit opening. This will help seal the crack. Fasten both sides of the coaming with #8 x 1" bronze screws in a staggered row on 6" centers. If you want to do a fancy job, these can be countersunk and plugged with mahogany plugs. The part which extends over the deck, both fore and aft, is fastened from underneath with #8 x 1" screws; 5 screws forward and 3 aft. Don't join the two front edges together yet. First cut out the knife-like piece of coaming which fits along the center of the deck and goes between the two pieces of side coaming. Make this 9"x 2-1/2". Fasten this piece in place from underneath with three #12 x 2" screws and then fasten the two side pieces into it with two #8 x 1" screws on each side.

The end pieces of coaming should now be cut and fitted so they go in place snugly against the side coaming. Fasten them to the deck beams with a staggered row of

Section V

- COAMINGS , FLOORBOARDS & THWART -

screws. Also, put in a screw through from the outside of the side coaming and into the four ends of the end pieces. Fasten in the rubber mast bumper. See frame 5 on dwg. 1103.

Splashboard -

Make up the splashboard as indicated on dwg. 1104. If you already have the fittings for the boat, find the metal brackets which hold the board on (section VIII, paragraph 5) .and fasten it in place with machine screws.

Thwart and bridgedeck -

There have been a number of variations made on the thwart or bridge deck. Two preferred arrangements are shown on dwg. 1102. These designs have the advantage that the jib leads are better because they are higher. Also, the twin winches are more convenient. The drawings go into some little detail, so this will not be repeated here. The bridge deck also serves as a small locker for odds and ends. The simplest arrangement is shown on dwgs. 1103 and 1104. In this case the main sheet leads down to a pulley and cleat on the keelson. Build whichever you prefer and install it in the boat.

Floorboards -

The floorboard arrangements also vary to quite an extent. Those shown on the plans are somewhat elaborate and if you have enough spruce left over, you may wish to use this arrangement. The details are on dwg. 1104. The boards are 1/2' thick and can be made of spruce, pine, or even teak.

Another floor, which is found on many of the boats, is made from 3/8" marine plywood. You may have some of this left over from the planking. The pieces are fastened down to the top of the floor beams with #8 x7/8" brass screws so as to cover the entire cockpit area.

The main thing to remember is to provide two lift out sections on each side of the keelson between frames 6 and 8 so that the boat can be bailed. This is a requirement. Also, the entire cockpit area must be covered so as to prevent any chance of stepping on the bottom planking. Be careful, too, to avoid any places where a person's foot might get caught.

There are various opinions on the necessity of floorboards under the fore and aft decks. The avid racing skippers frequently don't have any here. Maybe they think the boat is a little lighter. If you do put floorboards under both ends, you will find it much easier to pull sail bags, etc., out from underneath. Also, whatever you do have stowed there is not likely to be sitting in a pool of bilge water.

Section VIII, Fittings and Hardware.

The fittings and hardware in general may be purchased from any of the marine supply houses. There are, however, several fittings such as the bow and stern chocks, the chain plates, rudder post and rudder cap, etc., which are special.

As a convenience, Merriman Bros. Inc. (125 Armory Street, Boston, Mass.) will furnish a complete set of fittings for a 110, in the list which follows and on the plans the Merriman fitting numbers are used as a reference and a means of identification. Fittings equivalent to these should be used.

1. Bow chock; (46141). This is screwed into the deck and false stem with #14x2 bronze flat head wood screws - 4 required. See dwg. 1104.
2. Stern chock (46141). This is screwed onto the deck with #14x2 bronze flat head wood screws - 4 required, See dwg. 1104,
3. 6" mooring cleat bow and stern (2 required) (46141). Bolt through deck and deck furring with 5/16x3 bronze flat head bolts - nuts and washers - 4 required.
4. Jib stay deck fitting (46140). Bolt through deck beam at Station 2 with #3-2 bronze flat head bolts, nuts, and washers 2 required - and screw into the deck and furring with a #4x1 bronze flat head wood screw - 1 required.
5. Splashboard brackets - 2 required (46133). See section VII, paragraph 3.
6. Chainplates - 2 required (46131)(46120). Study dwg. 1103. You will need 2 pcs. of 2x2 fir 13" long, Cut as shown on the drawing and glue and fasten to the underside of the chine with #10x1 galvanized wood screws. Fasten the chainplates down to the deck with #10 bolts.

List of required fastenings:

#10 galvanized flat head wood screws - 6 pcs. #4 bronze flat head bolts - 2 pcs.
#4 bronze round head bolts - 2 pcs.
#10 bronze nuts - 10 pcs.
#4 flat washers, bronze - 10 pcs.

7. Jib sheet track and fittings (633)(637)(367c). See dwg. 1104, The jib sheet track is fastened down, starting 6" back from the chainplate fitting, Use #6x1-4-n screws spaced every 2'. The end stops serve also as spinnaker fairleads and these are fastened with #8-d-J screws. Slide the jib block fitting (367c) onto the track before fastening on the

Section V
- FITTINGS & HARDWARE -

end stops. On the plans the forward end stop is shown facing outwards. Many of the boats are sailed with

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the hook end inwards. This reduces chances of the jib sheet catching~ particularly if a cork is suffel under the hook when not in use. As an extra precaution some boats have added screws to make the jib sheeting on the jib track for about 6~ each side of Station 9. The large jib may otherwise tend to pull the track off. Some boats even have bolts~ made from 1/8" brass rod, which extend through the chine at this location.

List of required fastenings:

4x1-1/2" bronze round head wood screws - 100 pcs. #10x1-1/2" bronze flat head wood screws - 50 pcs. 5/8" sail track bronze-610" long - 2 pcs.

9. Rudder port. Fitting the tube (1" o.d. 1/8" wall brass tube 19-3/8" long~ pipe threads one end, up 1" which acts as the rudder port must be done very carefully to be sure first that it is plumb in the boat, and second to be sure it is tight at the bottom and will not leak. First inside under the deck and locate carefully a point which is 2" forward of the deck beam and exactly on the centerline of the boat. The centerline marks on the frame can serve as a guide. Drill a 1/2" hole up through the furring and the deck. Now from above drill a hole 1-1/4" in diameter through the deck and furring~ Also drill down into the rudder block about 1" deep with the 1/2" diameter drill. The outer part of the hole through the plywood bottom is drilled 1-1/8". This is to engage the threads on the end of the brass tube. Push the brass tube down through the deck~ wipe some white lead or heavy paint on the threads and screw the tube down into the block with a pipe wrench, The end of the tube should project about 1/16" below the bottom plywood. Fasten the rudder port deck flange (46129) down to the deck with four 1/2" bronze screws.

9. The main sheet deck block (5091~) is screwed down to the deck with four 1/2x1-1/2" bronze flat head wood screws, and is located 21-1/2" back from the cockpit on the center of the boat.

10. Depending on which thwart arrangement you have selected~ there is some difference in the number and type of fittings required. The minimum is shown on the deck plan of design 1104. Three 4" jam cleats (49g) are required. Two are located on the thwart and one on the 7" beam. With this arrangement fasten a block (509N) to the beam about 6" from the cleat. The mainsheet should lead up just behind the thwart. The winch (595) is located on center of the thwart. Fastenings for the winch are three 1/2" bronze flat head wood screws, Fastenings for the cleats are six 1/2x2-1/4", and for the mainsheet block four 1/2" bronze flat head wood screws.

The other two arrangements shown on dwg. 1102 require two winches and two extra cleats. In the case of the bridge deck, the mainsheet cleat is a special fitting (403S). Neither of these two arrangements have any fittings located on the keelson.

11. Two cleats (522) should also be located on the inside of the coaming at Station 5. See dwg. 1103, frame 5.

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12.. Extra flotation must be provided in every 110. This keeps the boat from sinking, if it should ever become swamped. Closing off the frame to make a bulkhead at Station 1 and Station 14 is not recommended, because it invites rot and also causes peeling of the outside paint. Either use two five gallon sealed galvanized tanks made from light weight galvanized steel sheet (.020" thick) or use two styrofoam blocks (see dwg. 1104). These should be strapped into place. If you use styrofoam, fasten a piece of galvanized wire mesh at Station 1 and 14 to prevent poking holes with the spinnaker pole or paddle.

Section V

- KEEL, KEELSON COVER & MAST STEP -

Materials required -

Keel casting (from approved pattern) - 1 pc. 5/16" galvanized flat head ctsk, or French head bolts - 6 pcs. 1/2" galvanized nuts - 6 pcs. 1/2" washers, galvanized - 6 pcs. 1 pint non-hardening mastic 7/8"x6-5/8"x413" keelson cover - 1 pc, #4 bronze flat head wood screws - 10 pcs. (keelson cover to keelson) Mast step (46134) - 1 pc. 7/16"x1/2" bronze flat head wood screws ~ 4 pcs, (mast step to keelson cover)

The layout for drilling the keel is shown on dwg. 1104. First make up a template out of 3/8" plywood, lay out the holes and carefully drill six 1/2" holes in the template. Clamp the template to the top of the keel and spot the location of the holes through onto the casting. Keep the template. You will need it later.

3. If you do not have special equipment required it is best to have the keel drilled and countersunk at your local machine shop. It must be drilled 17/32", six holes. The holes are 1/2" back 1/2" countersunk with a reverse countersinking tool which is passed through the hole in the keel and then chucked in the drill. The countersinking is done by pulling up on the drill, there isn't room to countersink in the conventional manner.

4. You may wish to smooth up any rough spots on the keel casting before you put it on. The easiest way is with a so-called snagging disc used with a rotary electric machine. Your local machine shop may have one of these and can do the smoothing after they drill the holes. It can also be done with a file.

5. From inside the boat spot the keel bolt locations from the template onto the keelson. Make sure the holes are on the center of each floor beam. Drill six 1/2" holes down through the bottom, Take care to keep the drill perpendicular.

6. It will now be necessary to set the boat up on a pair of saw horses so the bottom is about 32" from the floor. With the help of a couple of friends the keel can be worked into place under the boat. Cover the top of the keel with a heavy coat of non-hardening mastic. Raise the flange of the keel up and work it over until the holes line up. Pass the bolts up through and put on the washers and nuts, Tighten up gradually all around, until the keel is in place. Put a wedge under the keel so its weight is not carried by the floor beams. This should always be done if the keel is to be left hanging for more than a few hours, and always when transporting the boat on a trailer.

7. The template you made in paragraph 2 can now be used to lay out the clearance holes to be counterbored in the underside of the keelson cover. These holes should be drilled large enough and deep enough to clear the ends of the keel bolts and nuts which stick up above the keelson.

~, Round off the keelson cover so it does not have any sharp corners on top. Fasten the keelson cover to the Iceelson with t~o ,Y3x1~l bronze screws at each frame. Dwg. 1104 shows its location,

9. Locate the maststep (46134) 1-3/8" back from the forward edge of the floor beam at Station 5. Fasten it down with four 10 x 1" bronze flat head wood screws. Some latitude is permitted for the maststep location in order to balance the boat. You may wish to move it after you have done some sailing.

Section V
 - M A S T , T I L L E R , R U D D E R & S P I N A K E R
 P O L E -

Section X, 1-Ias, ~L~, Tiller~ Rudder, S~inna}cer Pole. Boom Crutch. 1, Materials required:

- 1~tx1-7/~x23l0~1 Sitka spruce 2 pcs.
- irtlx2-5/~llx23~0ll Sitka spruce 2 pcs.
- 1-5/~1lx1-7/~llx4~6tt pine for filler blocks 1 pc.
(the above for the mast)
- ltx2-7/\$~x914!~ Sitka spruce (for boom) 1 pc.
- 1~Jtx1~tlx6~ Sitka spruce (for spinn~er pole) 1 pc.
- ~x2-IJlx3l4~1 oak or ash (for tiller) 1 pc.
- 7/8l~xl~2llx2~lo~1 mahogany (for rudder) 1 pc.
- 2~lx2-5/gtlx4-3/~ll mahogany 1 pc.
(for boom crutch, use leftovers from coaming)
- ~6x3/4~ bronze round head wood screws (track to mast) 76 pes.
- ~6X3/4~1 bronze round head wood screws (track to boom) 32 pes.
- 1 ~int resorein resin glue
- Masthead fairlead sheave (46136) 1 pc.
- ~lOxl~J~ bronze flat head wood screws for above 2 pes.
- Spinnaker halyard fairlead (645) 1 pc.
- i~lOxl~ bronze flat head wood screws for above 4 pes
- Spinnaker topping lift fairlead (645) 1 pc~
- ~lOxl~ bronze flat head wood screws for above 4 pcs.
- Shroud tangs (502B) 2 pcs.
bronze flat head wood screws 6 pcs,
- 1~x2-3/4~ long bronze rod for rivet 1 pc.
- Jibstay tang (502C) size ,~lO 1 pc.
- ~lOxl ~ bronze flat head wood screws 3 pc
- jib tang tee rivet (502R) 1 pc.
- Adjustable spreader assembly (4~119) 2 pcs.
- ~loxl.'J~ bronz~ flat head wood screws ~ es.
- Track end stop (406s) 1 pc.
- ~lOxl,'L" bronze flat head wood screw 1 ~e.
- Spinnaker pole track (450T) size ~0 1 pc.
- S~inna!er ~ole slide (450S) size ~0l pc,
- Spinn~cer pole sockets (450A) l~ size 2 pcs.
- 3ail slide sto~ (46132) 1 pc
- 5preader shroud tang (502) ~ size 2 pcs.
- #gX~ J; bronze flat head wood screws 4 pcs.
- x31l bronze rod 1 pc.
- 4~ jam cleats (jib and main llalyard~ downhaul (522) 3 ~cs.
- ~l2x2~' bronze flat head wood screws 6 pcs.
- Ihin halyard hook (523P) ~q size 1 pc.

Sliding gooseneck (51SS) 7/8" size 1 pc.
 3/16"xl-1J bronze rod (gooseneck to boom) 2 pcs.
 I-in sheet blocks (509) 0 size 2 pcs.
 Block travelers (50-T) 7/8" size 2 pcs.
 3/16"xl-1 bronze rod (traveler to boom) 4 pcs.
 Track end stop (406S) (end of boom) 1 pc.
 Ckw outhaul assembly (565) 1 pc.
 Sail track on mast 5/8"xl-3-1 1 pc.
 Gooseneck track 5/8"xl-20" 2 pcs.
 Sail track on boom 5/8"xl-910" 1 pc.
 Nut hinge 22-1xl-2 brass for boom crutch 1 pc.

- 24 -

Rudder post (~129) 1 pc.
 Rudder cap and tiller straps (46129) 1 pc.
 Rudder post cap nut (46129) 1 pc.
 Rudder post lockwasher and set screw (L6129) 1 pc.
 3/16"xl bronze rod (rudder to rudder post) 5 pcs.
 3/16"xl-3/4 bronze rod (tiller straps to tiller) 4 pcs.

2, Dwg. 1105 shows the mast and mast details. The upper view is drawn with the cross sections shown in full width and the length shortened to 1/2" = 1 foot scale. You will need a 24 foot long horizontal table to work on so if you have no further use for your assembly rig use one of the 2x6 rail members laid flat for this table. The table as nearly as possible should be made flat by shimming up from the floor. Leave space underneath so you can get the clamps underneath.

Stretch a piano wire down the center and about 9/16" above the top of the table. This will act as a guide for measuring the widths. Slide a piece of Sitka spruce 2-5/8"xl-2310" under the wire. Clamp it to the table top in two or three places. Measure out from the centerline wire and mark off the athwartship dimensions at each station. Leave about 2" or 3" to be trimmed off the ends later. With a spline or batten used as a ruler, clamp this down at the marks and draw the curves.

Remove this piece and cut it down to the lines. Using this piece as a pattern, mark off the second piece and finish it down to the line.

The side pieces are made by lining up one edge with the wire and measuring the fore and aft dimension from the wire. If none of the edges are straight with the wire, true them up with a plane. Draw the curve as before and cut the pieces out.

Section V

- MAST, TILLER, RUDDER & SPINAKER POLE -

Again clamp the piece, which was the first to be made, to the table. Mark off on it the location of the pine filler blocks. A margin line 2 1/2" in from the two edges of this piece will give outline of the filler blocks. The height (above the table) of the filler blocks can be determined by temporarily clamping one of the side pieces in place and marking the height off on the blocks. Drill the drain holes in all the blocks except the top one. It may be easier to cut the bottom block in two and saw a groove down the center for a drain and then glue the two halves together. (Even with an electrician's bit it is hard to keep a straight hole down the center of a 2x6" piece.) Cut the blocks to size, leaving the top and bottom blocks 1/2" or two long for trimming after assembly. Remove the centerline wire and glue each of the blocks in its proper place to the inside of the after (rear) face of the mast. Clamp them down,

Glue the straight edge of the side pieces to the after (rear) face of the mast and also to the filler blocks. Use clamps across the mast at the filler blocks and plenty of clamps to hold the edges of the side pieces down tight. It will help to cut up some 3/4" thick pieces of plywood to span across the edges of the side pieces and also to keep the clamps from denting in these edges and to distribute the forces.

The forward face of the mast is last to be glued and clamped on.

After the glue is dry, trim the mast off to length and cut the top slot in the top for the halyard shoe. Round off the corners with a plane and sand the entire mast smooth. You can now give the mast two or three coats of marine spar varnish.

The list of fittings in part 1 of this section and drawing 1105 will be sufficient guide for assembly of all the fittings to the mast. Put them all on, except the main halyard hook; and the diamond stay tangs. These last two had best be located to suit the length of the wire rigging. Apply another coat of varnish

3. The boom is also made from Sitka spruce and is tapered from the center to both ends on a smooth gradual curve (see dwg. 1105). After it has been planed to shape, sanded, and two or three coats of varnish applied, the fittings should be assembled to it. As an extra precaution you may wish to fasten the outer end of the track down with two 1/2" rivets made from 1/2" brass or bronze rod and passing down through the entire depth of the boom. These rivets should be about 2" and 4" from the end and they will prevent a tendency for ripping the track off in heavy loads.

4. The tiller is shaped from a piece of 1-2" x 3/4" oak or ash. In the side view (see dwg. 1104) it has a slight curve in addition to being tapered. At the stern fitting it is rectangular in cross section and blends slowly into a round at the other end. Varnish the tiller and fasten the rudder fitting to it.

5, rac rudder is made from a piece of 7/~ mahogany and is sawed out as indicated on dwg, 110~, The sides can be planed down or streamlined but the thickness at the center c~not be less than 7/8~, Rivet on the rudder post fitting. The rudder should be painted along with the bottom (see section ~

6. Start with a piece of 1~ square sitl.a spruce to mace the spinnaker pole. It should be rounded and ta~ored to fit into the pole end fittings. The pole should be varnished;

7. Details of the boom crutch are sho~rn on d~rg. 1103, see frame 10. Hinge it to the dec!c so it folds bac7. onto the dcc~ 1~x2~ bloc!c should be ~laced under the deck to receive the hinge screws. Varnish the boom crutch ~rhen you varnish the coamings. (See section XI.)

Section XI. Finishing and Painting

The way you finish and paint your boat not only ms~;es a vast difference in its appearance, but is also most important to prevent deterioration, so plan to spend enough time on this important job.

The plywood surfaces are probably fairly well sanded at the mill so don't do more than sand off the rough spots and the putty at the screw holes. ~ wood sealer or primer should first be used over the entire hull, excepting the mahogany brightwork. Then apply two or three coats of soft chalky undercoat to the deck and sides, sanding with wet sandpaper to remove the grain effect from the plywood. Be careful not to sand through to the wood, Two coats of enamel should finish the job. There are numerous color schcmes used on the 110. The simplest is one color all over including the bottom, if you plan to keep your boat out of water a lot,

For boats which stay in the water, a bronze racing bottom paint should be used, This is built up directly on the sealer coat. To get a smooth bottom perhaps five or six coats of bronze are required with wet sanding between coats. The keel and rudder are painted at the same time. ~ boot top water line stripe sets the boat off, particularly if a bronze bottom paint is used,

Floor boards should of course be painted with an enamel paint and the mahogany coaming and splash board is varnished.

There are different schools of thought about painting the inside of a boat. An unpainted interior will evaporate the moisture quicker from the wood but it also soaks up water quicker from rain or spray~ so take your choice. Most of the boats have the bottom and

Section V

- M A S T , T I L L E R , R U D D E R & S P I N A K E R
P O L E -

sides painted on the inside. Don't wear yourself out trying to get paint inside at the extreme ends of the boat,

You may also wish to consider the use of a rot preservative on the inside surfaces of your boat.

A lot more can be said about painting and finishing but it hardly seems necessary to write it here. Your local paint salesman will, in all likelihood, give you all the advice you need.

STATION NUMBER	Distance Between Stations	Distance From Station 0	Base Line To Sheer Line A-1	Base Line To Chine Line A-2	Total Side Height A	Center Line to Chine Line B-1	Total Width (2 x B-1) B
0 inch- decimal- foot & inch-	0	0 3 1/2" (to bow)	20" 20.0 1' 8"	0 (3/8") (.375)	20-3/8" 20.375 1' 8-3/8"	1-1/2"	3"
1	22-1/4" 1' 10-1/4"	22-1/4" 22.25 1' 10-1/4"	18-1/4" 18.250 1' 6 1/4"	1-13/16" 1.812 1-13/16"	20-1/16" 20.062 1' 8-1/16"	8-3/8" 8.375 8-3/8"	16-3/4" 16.75 1' 4-3/4"
2	19" 1' 7"	41-1/4" 41.25 3' 5-1/4"	17-3/16" 17.187 1' 5-3/16"	2-15/16" 2.937 2' 15/16"	20-1/8" 20.125 1' 8-1/8"	13-3/8" 13.375 1' 1-3/8"	26-3/4" 26.75 2' 2-3/4"
3	19-1/4" 1' 7-1/4"	60-1/2" 60.50 5' 1/2"	16-3/16" 16.187 1' 4-3/16"	36-7/8" 3.875 3' 7/8"	20-1/16" 20.062 1' 8-1/16"	17-5/8" 17.625 1' 5-5/8"	35-1/4" 35.25 2' 11-1/4"
4	19-1/16" 1' 7-1/16"	79-9/16" 79.562 6' 7-9/16"	15-1/4" 15.25 1' 3-1/4"	4-5/8" 4.625 4-5/8"	19-7/8" 19.875 1' 7-7/8"	20-7/8" 20.875 1' 8-7/8"	41-3/4" 41.75 3' 5-3/4"
5	18-3/4" 1' 6-3/4"	98-5/16" 98.312 8' 2-5/16"	14-9/16" 14.562 1' 2-9/16"	5-1/8" 5.125 5-1/8"	19-11/16" 19.687 1' 7-11/16"	23" 23. 1' 11"	46" 46. 3' 10"
6	19-15/16" 1' 7-15/16"	118-1/4" 118.25 9' 10-1/4"	13-15/16" 13.937 1' 1-15/16"	5-1/2" 5.5 5-1/2"	19-7/16" 19.437 1' 7-7/16"	24-1/4" 24.5 2' 1/4"	49" 49. 4'-1"
7	17-3/4" 1' 5-3/4"	136" 136. 11' 4"	13-1/2" 13.5 1' 1-1/2"	5-5/8" 5.625 5-5/8"	19-1/8" 19.125 1' 7-1/8"	25" 25. 2' 1"	50" 50. 4' 2"
8	18" 1' 6"	154" 154. 12' 10"	13-1/8" 13.125 1' 1-1/8"	5-9/16" 5.562 5-9/16"	18-11/16" 18.687 1' 6-11/16"	24-7/8" 24.875 2' 7/8"	49-3/4" 49.75 4' 1-3/4"
9	17-7/8" 1' 5-7/8"	171-7/8" 171.875 14' 3-7/8"	12-7/8" 12.875 1' 7/8"	5-3/8" 5.375 5-3/8"	18-1/4" 18.25 1' 6-1/4"	23-7/8" 23.875 1' 11-7/8"	47-3/4" 47.75 3' 11-3/4"
10	17-7/8" 1' 5-7/8"	189-3/4" 189.75 15' 9-3/4"	12-13/16" 12.812 1' 13/16"	5-1/16" 5.062 5-1/16"	17-7/8" 17.875 1' 5-7/8"	22-1/4" 22.25 1' 10-1/4"	44-1/2" 44.5 3' 8-1/4"
11	18-1/8" 1' 6-1/8"	207-7/8" 207.875 17' 3-7/8"	12-13/16" 12.812 1' 13/16"	4-1/2" 4.5 4-1/2"	17-5/16" 17.312 1' 5-5/16"	19-7/8" 19.875 1' 7-7/8"	39-3/4" 39.75 3' 3-3/4"
12	18" 1'-6"	225-7/8" 225.875 18' 9-7/8"	13" 13. 1'-1"	3-3/4" 3.75 3-3/4"	16-3/4" 16.75 1' 4-3/4"	16-1/2" 16.5 1' 4-1/2"	33" 33. 2' 9"
13	17-7/8" 1' 5-7/8"	243-3/4" 243.75 20' 3-3/4"	13-3/16" 13.187 1' 1-3/16"	2-3/4" 2.75 2-3/4"	15-15/16" 15.937 1' 3-15/16"	12-3/8" 12.375 1' 3/8"	24-3/4" 24.75 2' 3/4"
14	17-7/8" 1' 5-7/8"	261-5/8" 261.625 21' 9-5/8"	13-1/2" 13.5 1' 1-1/2"	1-5/8" 1.625 1-5/8"	15-1/8" 15.125 1' 3-1/8"	7-1/2" 7.5 7-1/2"	15" 15. 1' 3"
15	18-3/4" 1' 6-3/4"	280-3/8" 280.375 23' 4-3/8"	14" 14. 1' 2"	0 (3/8") (.375)	14-3/8" 14.375 1' 2-3/8"	1-1/2" 1.5 1-1/2"	3" 3. 3"

S e c t i o n
- T A B L E O F O F F S E T S -
Books and Articles

"Wood & Epoxy" by Jim Brown

Wooden Boat- Mar./ April- '92, #105 - In-depth article on wood/epoxy technology; it's limitations, pros and cons and future in the industry

"Epoxy Book" by W. Kern Hendricks

Fifty page booklet issued with System Three resin includes user basics and tables for cure times of various mixes. Good quick read and reference book.

The Gougeon Brothers on Boat Construction" by Jan, Meade and Joseph Gougeon

300 page treatise on boatbuilding with epoxy.