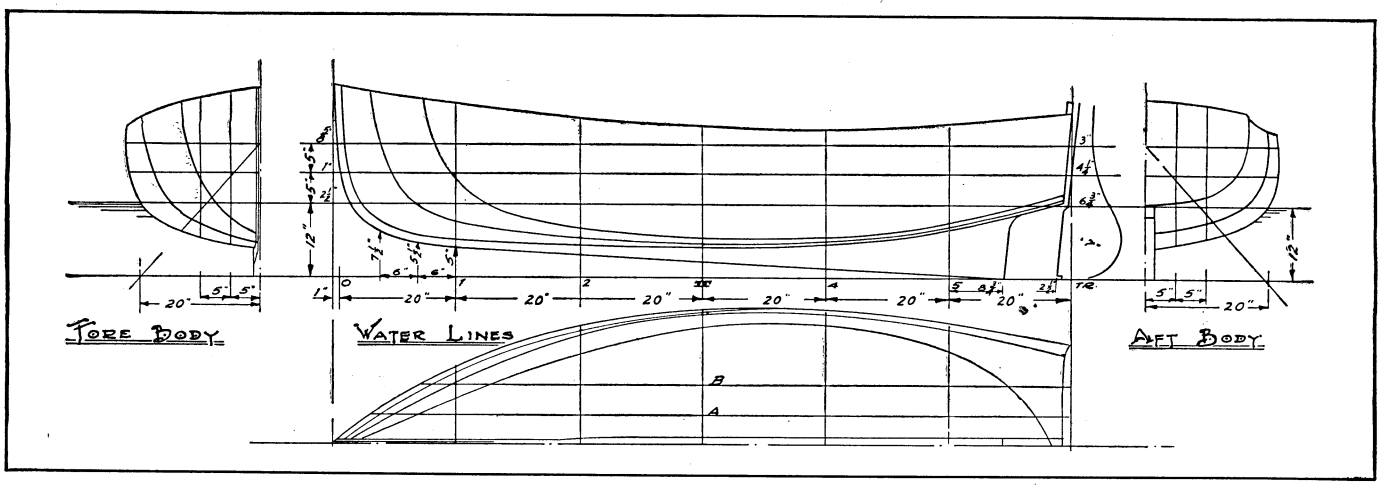


Always included in a boat plan is the lines drawing. The shape of the boat is shown by waterlines and buttock lines.

HOW TO UNDERSTAND A BOAT PLAN

By WESTON FARMER

A MAN BUILDS his own boat for two reasons: to save money and to have fun doing it.

With such inducements, it is little wonder that boating each season sees new recruits. These newcomers to the sport usually smoke along under a full head of steam until they actually decide to build. Then they need a few words of advice on where to start.

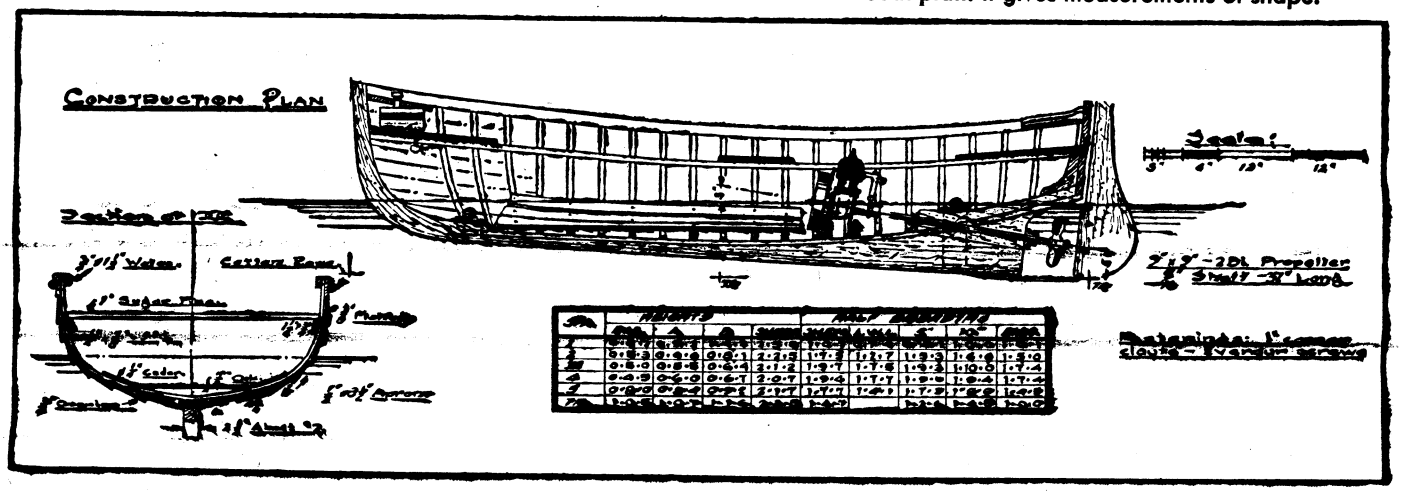
When you show them the rudiments on how to interpret a boat plan, a great light seems to dawn, and they make out very well.

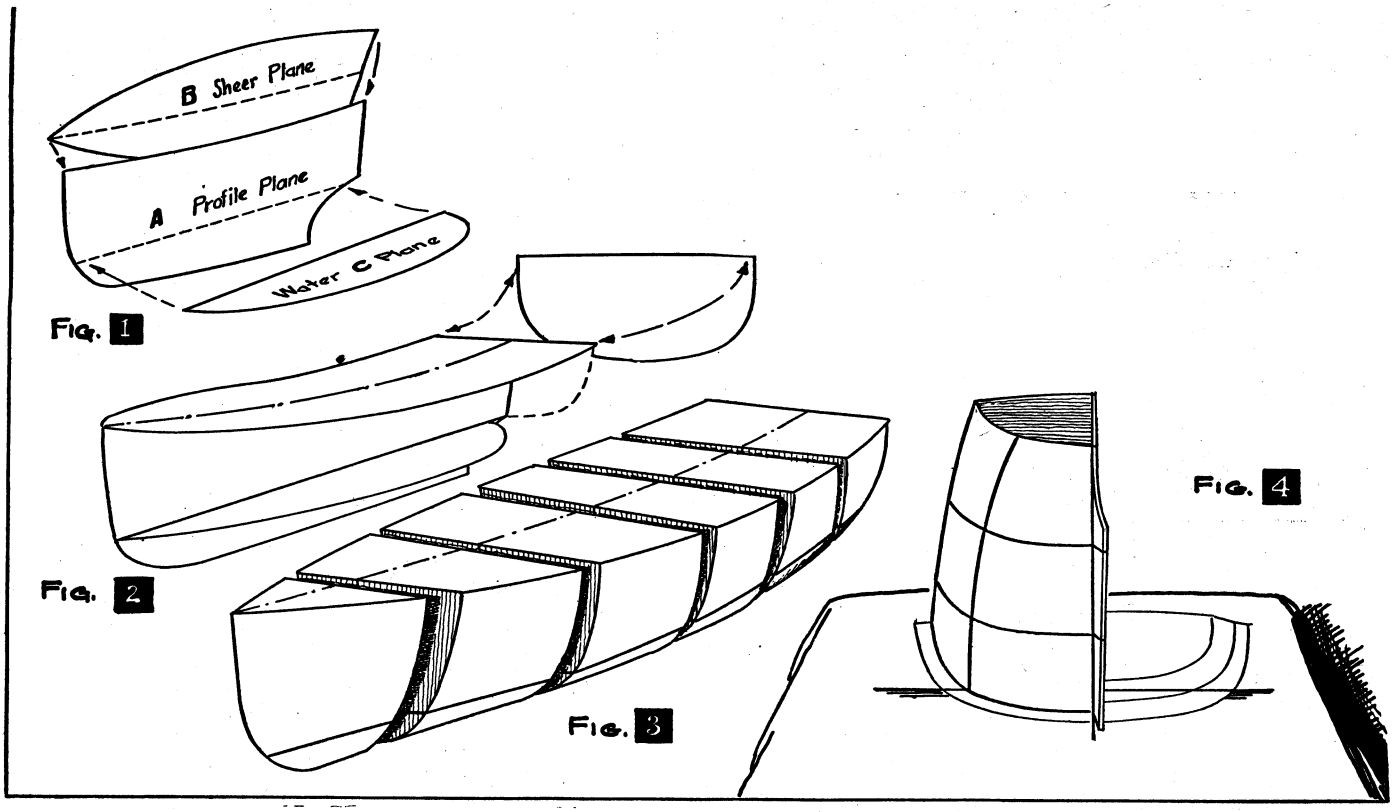
The first question they usually ask is, "How do you *read* boat plans?" The next question is, "Why are they drawn that way?" Here are the highlights:

A boat obviously is a three-dimensional structure. But the paper on which it is drawn is *two-dimensional*. The boat has form—length, breadth, depth. Paper is flat. It is the naval architect's job to depict on two-dimensional paper the shape which his boat must have to become, at the hands of the builder, the formed thing the architect designs.

To show the builder what he has in mind, the designer supplies a *lines drawing* which shows the boundary planes of the hull. He also supplies an *offset table*. The offsets

The inboard construction plan is a longitudinal section of frame elements. The scantling plan shows transverse positioning of hull structural members. An offset table is included in a boat plan: it gives measurements of shape.





The outline of a boat's hull is depicted by the planes it intersects. These figures (see text) show the progression in drawing.

are measurements for the lines from center *out* and from baseline *up* to points on the outboard face of the planking—measurements set off from center and base.

Custom has found it of most convenience to tabulate these measurements in three simple digits, reading in *feet, inches* and *eighths*. Thus the figure 1-3-5 in an offset table reads one foot, three and five-eighths: 1'-3⅝". In addition to the lines drawing and the offset table which enables a builder to lay down or loft the boat full size, various other drawings are supplied.

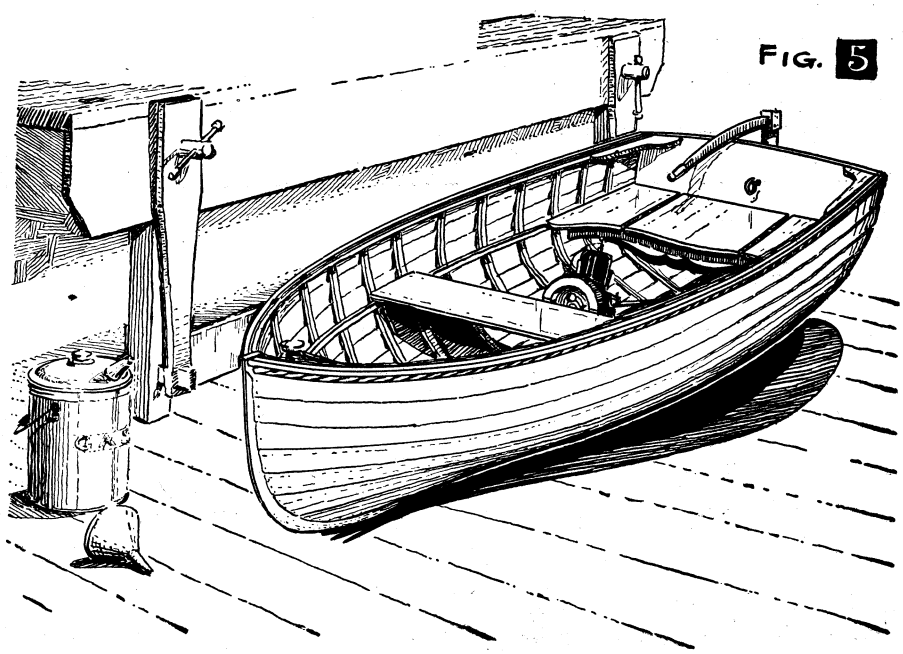
Always a *construction profile* must be shown. This is the inboard profile of structural elements shown as though the boat were split in two along the center of the keel and stem. A further key to the inboard profile is always given. This is the *scantling section*. It shows in cross dimension the sizes and outward locations of the elements shown on the inboard profile. This trio of drawings is all a knowing boatbuilder wants or needs to construct the average small boat.

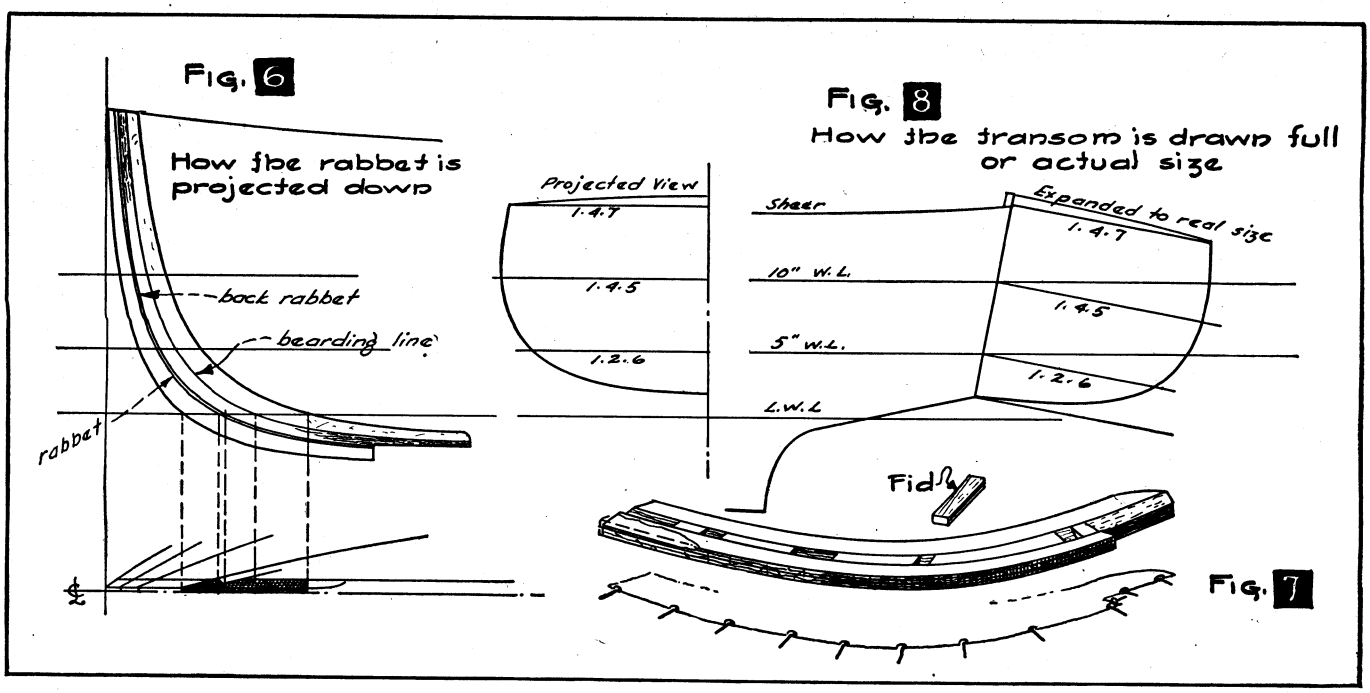
An *outboard profile* drawing is given in nearly all but the simplest boats to show the external aspect afloat. In larger boats such as a cruiser or a runabout where there are several levels of construction when viewed from top down in plan, the *plan of framing* is shown. This plan shows framing, floors, deck framing, cabin sole (flooring) framing, and disposition of parts in the joiner-work scheme.

In such larger boats, usually more cross sections are shown to give the builder information as to where these pieces of joiner work go and how they are put together, hence these views are termed *joiner sections*.

As far as the builder goes, probably the most important plan is the lines drawing, for without exception the *boat must be laid out full size* on the shop floor or on a piece of building paper before the rigid mold or backbone on which the boat is

In the final boat you have merely fitted pieces of wood together to provide the hull shape shown on the lines drawing and body plan.





The stem of most boats is rabbeted for the hood ends of planking. Fig. 6 shows how the waterlines are projected up on full sized lofted drawing to give back rabbet and bearding lines. Fid is shown.

framed can be built.

To learn by example how to "read" a set of boat drawings and why they are drawn as you see them, take a good long look at the set of lines heading the opening page of this article. This set of lines is for a little 10-foot power dinghy. She is an inboard power boat. Her construction profile, scantling section and table of offsets are shown on this page. From the information given, you have all that the average boat yard asks for in building information—you could build a nice little boy's launch from these plans.

Because she is a boat of normal form, very small and hence understandable, and, being round-bottomed, which seems to bother most beginners, her drawings will serve ideally as a guide in explaining the starting points to you. (Her name is *Irreducible.*)

If you can "dig" the principles involved in this design, you can understand 'em all. Take a good look at her.

Now look at Fig. 1. This shows the profile plane "A" with which the designer starts. The profile plane is the boundary line showing stem profile, transom rake, keel outline and the character of the sheer line.

To give this silhouette three-dimensional form, imagine the sheer or deck plan cut out of cardboard, the outline of which gives boundary to the width of the boat as at "B," Fig. 1. To further give outer hull limits, also imagine the shape for the waterline, and we have water plane boundary as at "C," Fig. 1.

So on the equivalent flat paper drawing of *Irreducible,* we would now have—in two dimensions—the profile only. And below it in plan, we have the sheer outline and the load waterline.

Now our boat begins to take on form. To fill it in, imagine as in Fig. 2, that the boundary planes of sheer plan, profile and water plane all jump into proper three-dimensional relationship. If we can also imagine a pleasing transom shape and glue it astern by imagination, our vessel takes still more definite form.

The naval architect gives his boat its final bulk by shaping up the sections. If we now cut the bulk into sections as in Fig. 3, we get an idea of the change of hull shape from point to point along the profile.

If this stack of sections were now placed at a common center and a common waterline on flat paper as in Fig. 4, and the outline of each section were drawn on the paper, we would have a two-dimensional record of the sections necessary to re-create the boat we wanted.

This would give us the fore body sections and the aft body sections. It is usual to show only the sections for *half* a boat, as both sides are always symmetrical.

If we turned the boat in plan and pressed it through the paper, leaving a record of the horizontal boundaries, we'd have a deck line and a waterline. But *one* waterline isn't enough to give a builder the information he needs for laying out sections. He needs more check points.

So the designer gives us more waterlines. In *Irreducible,* two waterlines are drawn in at 5″ and 10″ above the load waterline. You get the plan shape of these from the sectional views drawn beneath the profile. A baseline, 12″ below the load waterline is also drawn in to give a point of departure for heights of the intersections. But this still isn't enough.

You need check points between waterline and the keel rabbet. So the designer uses what are termed *buttock lines.* These are slices through the hull in vertical plane, outboard of center.

In this design the buttock lines are 5″ apart. This gives you points on the sectional plan by which you can locate the sweep of the mold sections from keel rabbet to waterline.

To tie all of these check points together, and to prove fairness, a designer frequently slices the hull, as though with a band saw on a solid model, by a diagonal line. Sometimes these diagonal lines are projected in plan view. To skilled eyes, they tell

much of performance, particularly with sailing vessels.

In *Irreducible* the diagonals are not projected down, serving merely in the offset table as additional locating points for the sectional shapes.

To sum up: Each of the lines in the lines drawing represents the boundary of a *plane* passing through the hull shape. By measuring off these points with reference to a center line and a baseline, you can reproduce full size on the floor of your shop the boat the designer intended. Why must you do this?

You do it to mechanically save a lot of time, to avoid errors. There is *no other way* to build a boat if it is built from plans. The reason is simple: As shown in Fig. 5, the boat has planking; she has frames; she has a transom. All these are shown in the construction profile and scantling section. All of these pieces must go together and fit.

The stem is rabbeted for the hood ends of the planking. (See Fig. 6) The transom must be expanded to real size and beveled for the stream the planks will take. (See Fig. 8) The planking has thickness and so do the frames. These must be *subtracted* from the outside hull shape the architect draws. (See Fig. 10)

All of this must be done *full size.* You can't scale a small blueprint 1/12th or 1/16th the size of the boat and get the necessary bevels, nor fair cross sections.

No one but the novice would build a boat without laying down the lines full size, checking for obvious errors in scaling, and *fairing* the whole thing.

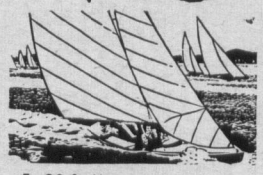
Further, a stem must be got out. Usually you do this by transferring the lofted line to lumber by inserting nailheads around the line and hammering the character of the curve into the lumber. This is shown in Fig. 7.

Templates for cutting knees and the keel and shaft log are needed. And if they are to go together, you must take them from an integral master loft drawing. If there were no other reasons but these for laying down the boat full size, it would be enough for a good mechanic. But always there are some who think this a nuisance.

Once laid down full size, the shape of the hull has integrity and matches the lines drawing, and the main pieces of the hull frame such as stem, knees, and expanded transom, are in



Choose One of These "Easy-to-Build" Designs!


1. 20-ft. Marconi-rigged sloop


2. 13½-ft. Outboard runabout

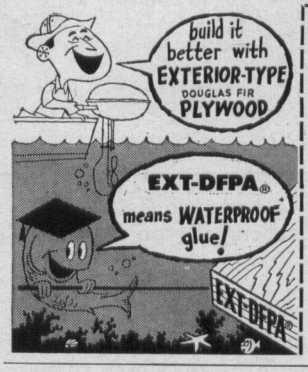

3. 7'9" Pram dinghy


4. 15-ft. Knockabout


5. 9-ft. Flat-bottom skiff


6. 11½-ft. Utility skiff

Exterior-type FIR PLYWOOD boats are light, fast, dry and rugged. Easy-to-build, too. EXT-DFPA® on panel identifies quality-tested plywood with 100 per cent waterproof glue.



DOUGLAS FIR PLYWOOD ASSOCIATION
Tacoma 2, Washington

Please send me plans for the boat listed below. (Circle the one of your choice. Enclose 10c each to cover mailing.)

1. 20-ft. Marconi-rigged sloop
2. 13½-ft. Outboard runabout
3. 7'9" Pram dinghy
4. 15-ft. Knockabout
5. 9-ft. Flat-bottom skiff
6. 11½-ft. Utility skiff

☐ Also send me catalog showing 240 available plans for plywood boats—from skiffs to cruisers. Tells where to send for plans, how much each costs.

Name.....

Address.....

City.....Zone....State.....



NO.		BRONZE	CHROME
20	Pair	$3.60	$4.60
21	5-inch	1.05	1.25
22	3½-inch	1.05	1.25
23	2-inch Streamline		
	Cleat	.65	.75
24	2-inch Fender		
	Cleat	.65	.75
25	Alum. only, pair	$2.00	

NO.		BRONZE	CHROME
26	3/8x3"x5" eye	.85	1.10
27	Pair	2.75	3.50
28	Pair, 3¼"	1.90	2.35
29	Bow Handle	1.35	1.60
30	Pair	1.90	2.35
31	7-inch Streamline		
	Bow Handle	2.20	2.75
	Aluminum	$1.65	

Dealers write for further information

PLEWS BUILT BOATS

Dept. SA 1736-38 Division Ave. S.
GRAND RAPIDS 7, MICHIGAN

Build a Boat at ⅓ the Cost . . .

by using our Full Size Cut-to-Shape Boat Patterns, Fully Detailed Blueprints and Complete Specifications



Our new 1954 illustrated "Build a Boat" catalog gives descriptions and details of 50 Naval Architect designed Cruisers, Runabouts, Sloops, Skiffs, Outboard Boats, Sailing, Racing, Houseboats, etc., from 7½ ft. to 38 ft.—send for it NOW. 25¢ postpaid.

AMATEUR BOAT BUILDERS!

Be sure to get the illustrated ABC instruction book, "How to Build Boats", covering in detail everything from laying the keel to the final paint job. Mailed postpaid $1.75.

USE THIS COUPON

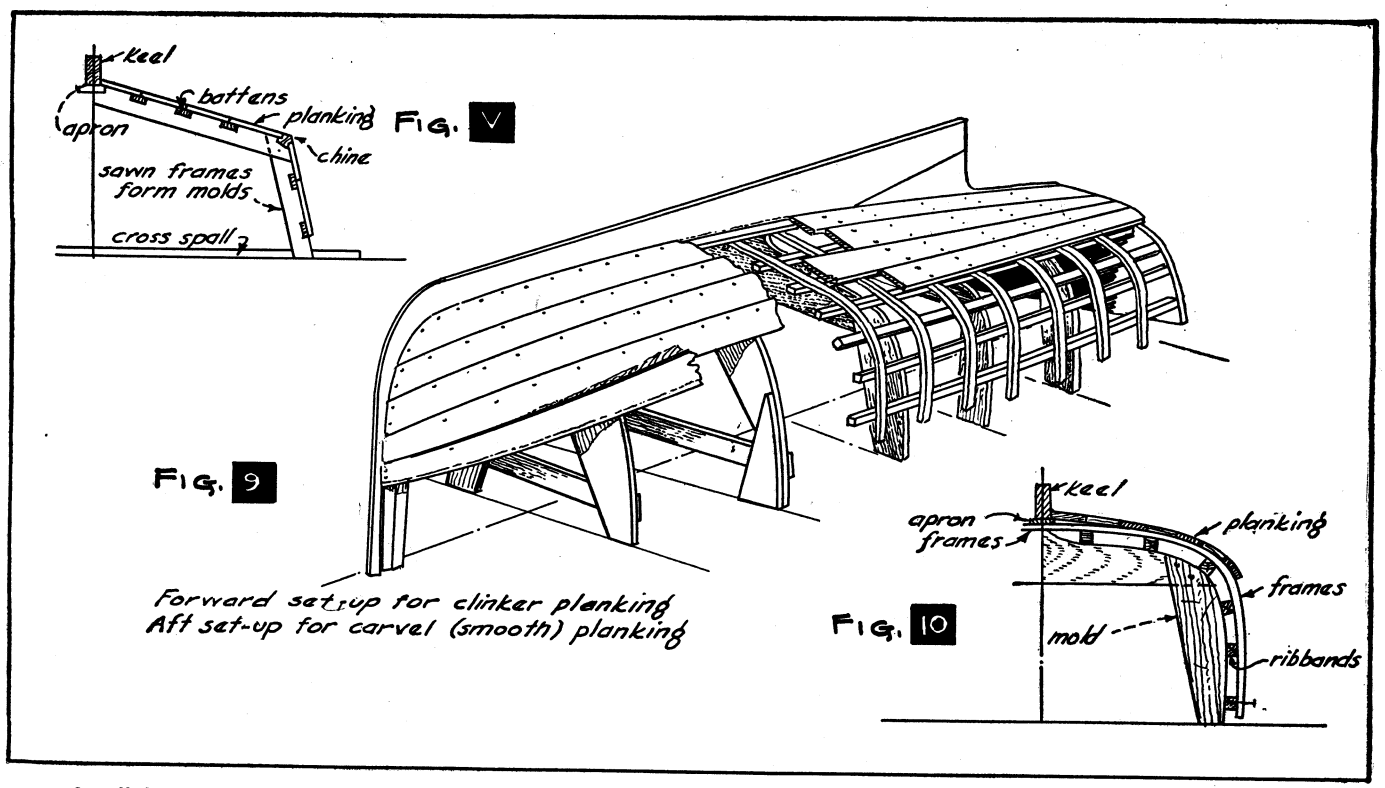
Cleveland Boat Blueprint Co.
Dept. SA34, Cleveland 4, Ohio

☐ Enclosed is $2.00 for "How to Build a Boat" book, and "Build a Boat" catalog.

☐ Enclosed is 25¢ (coin) for "Build a Boat" catalog.

NAME_____

ADDRESS_____



Small boats are best built upside down as it is easier to finish off the planking. Framing setups for both clinker and carvel type shown.

size to transfer to lumber.

At this point, for the novice, the only seeming constructional mysteries have to do with getting out the stem and expanding the transom. Fig. 6 shows how you project the waterlines on the profile down to the half siding of the keel to stream into the stem. By drawing in the planking thickness behind the plan waterlines, you can find the lay of the rabbet, the back rabbet, and the bearding line.

As in Fig. 7, a small piece of wood called a "fid" can be used to gain in small pockets along the rabbet and bearding line. After these gains are cut in with a chisel, the pockets are connected by cutting away the intervening wood.

As shown in Fig. 8, if the transom is on a raked angle, it must be expanded. This merely means it must be drawn to real size. If you were to project the transom as shown in the aft body plan in strict elevation as shown to the left in Fig. 8, then build the transom to this outline, you'd find it too small, because you would not have allowed for the slant, or rake. The drawing is self-explanatory.

Boats have dozens of types of construction. Hull shape may be round or V. But the basic idea behind the plan, when you start to build, is to get the correct shape for the hull. Then, as shown in Fig. 9, provide a secure set of forms on which to frame and plank the boat.

For some reason, the V-bottomed seam and batten type of boat, shown in Fig "V," is readily understood by beginners. The frames of the boat itself, and the battens, are left in and become an integral part. Such construction takes nice lofting, and the frames must be beveled and faired to a hair.

The professional boatbuilder, using methods evolved by his craft over thousands of years, makes an easier thing of building by preferring to build round-bottomed boats. The form, as at Fig. 9, can be built of junk lumber, the ribbands over which the frames are bent by that most useful device, steaming, can all be thrown together so they fair themselves, and the resulting boat, being made of smaller and more pliable pieces, is easier to build.

Small boats like the one shown usually are built *bottom up* as they

Some designers put all design coefficients on their plans. Here explained are what is meant by block or prismatic coefficient.

