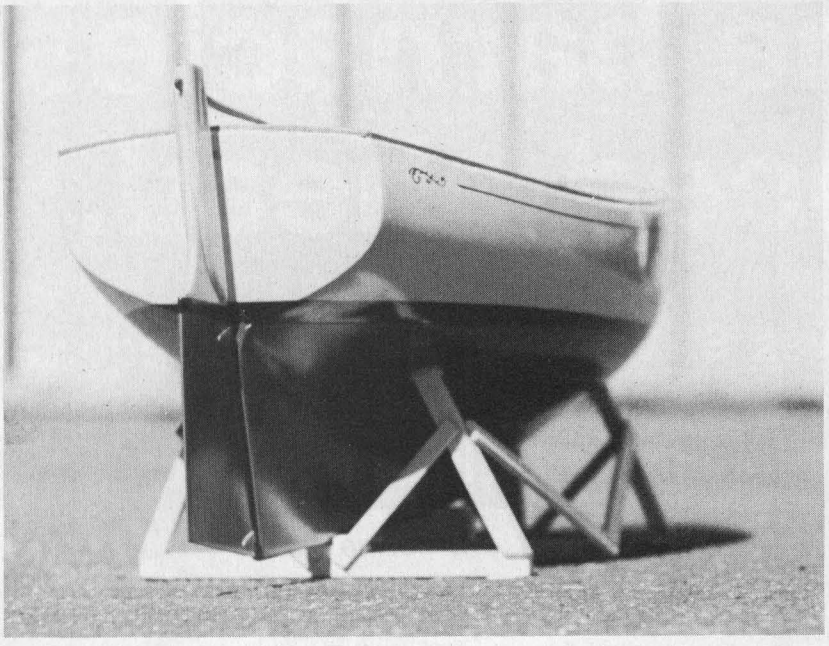


HOW TO BUILD FLICKA

PART SIX SANDING AND MASKING

COMPLETE PLANS/ILLUSTRATIONS
BY BRUCE BINGHAM

LEACHING AND CURING AGENTS

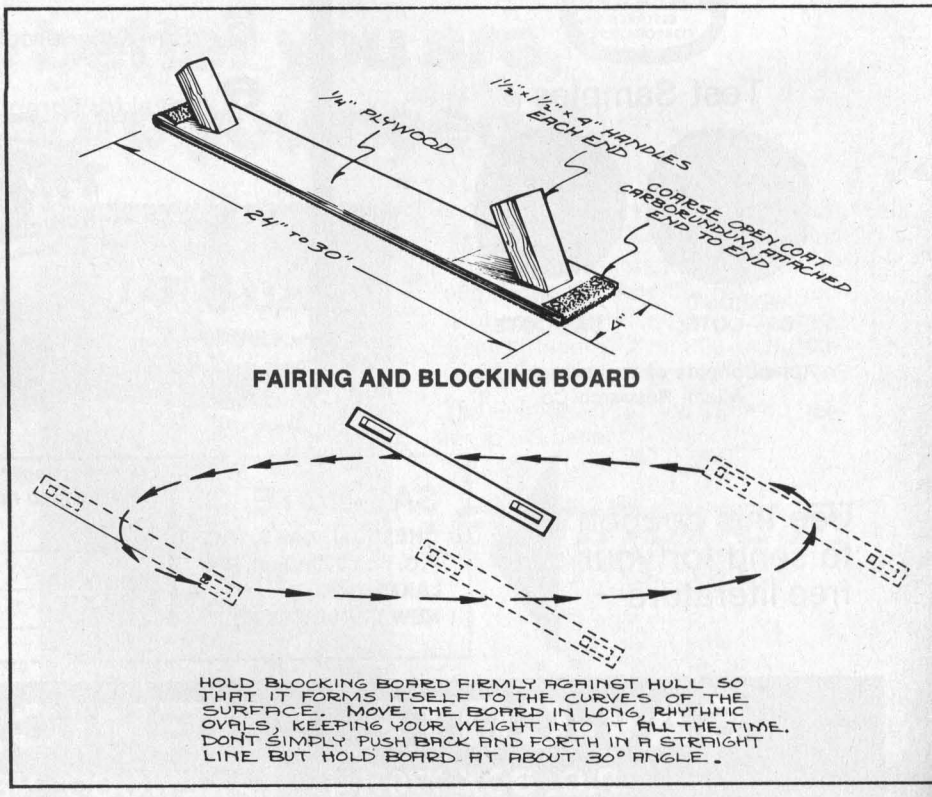
☐ During a recent trip to Marina del Rey on the California coast, I saw a professionally built ferrocement boat that had weathered a storm during a short seven-day sail. The hull paint was blistered and peeling severely. Upon closer inspection I realized that the loss of paint had no connection with the storm at all, but was caused by the leaching of alkalis and lime from within the concrete shell. This leaching had loosened the bond of the epoxy hull sealant, thus dislodging large areas of the finish. Unfortunately, I have seen many such ferrocement hulls—and usually the ultimate cause of damage has been a matter of over-simplification by the early proponents of concrete hull construction. "Coat the hull with epoxy" was the common instruction called out by promoters as the "cure all" to finishing maladies. But it's a little more complicated than that.

Once an untreated ferrocement hull dries, you will be able to wipe off a fine white surface powder with a stroke of your hand. A few weeks later, the powder will have reappeared in the same place. You will be able to wipe the surface many many times, but the powder will still reappear. It is this powder building up under an epoxy sealer which causes the ultimate failure of the finish.

This problem may be easily solved by swabbing the hull with Crete-Seal, allowing it to dry, then washing away the residue with fresh water. This cycle should be repeated as many times as necessary until no residue appears upon drying. Crete-Seal, available from Tri-Col Products, Bakersfield, Cal., has the remarkable property of leaching intrapped lime and alkalis to the surface of the concrete while sealing the concrete for increased resistance to water and oil absorption. These properties aid greatly in hull-finish adhesion as well as tank lining. Once held as a "super secret process" by many self-seeking professionals, it is now available through a simple phone call or a letter. So before you begin the finishing processes on your hull, make sure it's ready—and that there is no leaching still occurring. Once this is done you're ready to begin sanding and fairing.

GRINDING AND BLOCKING

Heavy grit carborundum paper is available on a sanding belt and I highly recommend its use over a disc sander for grinding down high spots



FAIRING AND BLOCKING BOARD

on the hull. A disc sander will usually leave deep circular scores when improperly handled and will offer you little "feel" for unfairness. The belt sander, on the other hand, is fast and powerful and betrays irregularities quite readily with less risk of causing gouges. The longer the sander the better.

When belt-sanding, concentrate only on the most obvious bumps. Don't try to smooth the hull completely, as this may expose mesh lying near the hull surface. Keep the sander in motion at all times and run it in all directions, not just back and forth. Change belts as soon as they begin to clog. "Open coat" belts last much longer than "closed coat" and cut more effectively. Don't forget to wear goggles and a painter's mask as concrete dust can cause serious eye and lung damage. Carborundum blocks (available at your cement supplier) may be used in the same way as the belt sander but should be restricted to sculpturing and knocking down the smallest imperfections. Hand blocking is very slow work and should be used with long pushing strokes, not with quick back and forth motions. If the pores of the block tend to fill with the cement powder, it can be wire-brush cleaned.

BLASTING AND ETCHING

Regardless of the glazing or sealing material you intend to use on your hull, it is imperative that the concrete surface be porous or gritty to provide a "tooth" for the finish. Without this condition, the sealants and fillers do not become a permanent part of the hull and may dislodge during the service of the vessel. If you sponge-floated on plastering day, you are way ahead of the game. But still, grinding and blocking will cause some areas to become smooth while filling the concrete pores with cement dust. By far the best abrading preparation is light sandblasting—this leaves a consistently rough surface without using chemicals that could affect the curing of the glaze and sealant. Be sure to vacuum the hull after blasting to remove dust and aggregate. If you do not prefer this additional expense, the alternative to sandblasting is washing the hull with an acid bath. There are several acids which may be used but require different solutions and working times:

1) Muriatic (hydrochloric) or acetic acid (powder): dilute 1:10 by weight of acid powder to water. Apply liberally with brooms and let set for two hours. If any areas of the hull tend to dry during this period, re-wet with acid.
2) Muriatic or acetic acid (concentrate liquid): dilute 1:3 by volume of acid concentrate to water. Apply in the same manner as above.

During etching, the hull will foam and may even smoke, but don't be concerned. This is a normal indication that the acid is doing its job. Be sure that you protect your eyes with goggles during this operation and protect your hands with rubber gloves. If foaming persists after the prescribed etching time, the acid must be neutralized to arrest its action. This may be done by washing the hull with a five-percent solution of baking soda or a one-percent solution of ammonia. To check neutralization, press strips of litmus paper against the hull in various areas. If the paper turns pink, continue the soda or ammonia wash until succeeding test papers remain unchanged in color. After neutralization, rinse the hull thoroughly with high-pressure water. You cannot over-rinse. No acid or salt (a product of neutralization) should remain as it may affect the curing or bond of the sealant. Allow the hull to dry for several days after the final rinse before applying finish coatings.

INITIAL GLAZING

Most books will tell you to simply cover the hull with an epoxy sealer, but there's a lot more to it than that (if you want a professional appearance). Your hull surface will still bear shallow divots, even after your initial grinding and blocking. These divots should be corrected—*now*—before proceeding with any finish coatings.

The best glazing compound to apply to untreated concrete are those with an epoxy base, not polyester. Polyester putties such as used on auto bodies do not have the absorbent characteristic of epoxies and have only a fraction of the strength. Remember that the initial glazing must become an actual part of the hull, not simply a cosmetic coat. The epoxy used should be specifically formulated for bonding to concrete. A couple of good ones are: Concresive 1001-LPI (Adhesive Engineering, San Carlos, Cal.) and "Pro-Line 3007" (Pro-Line Paint Co., San Diego, Cal.). Once the epoxy has been mixed as directed by the manufac-

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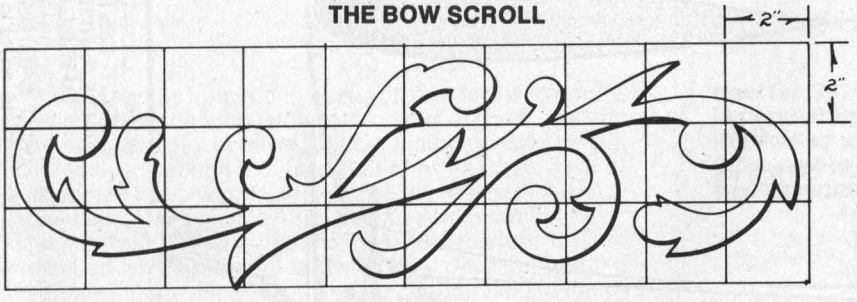
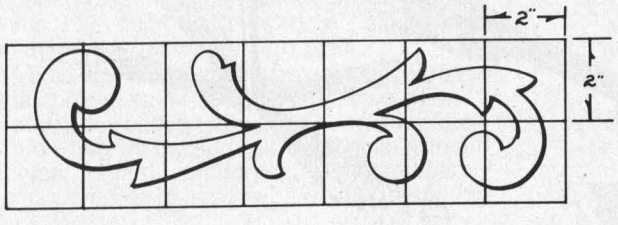
THE BOW SCROLL



FLICKA'S SCROLLS MAY BE 1- LAID OUT AND CUT FROM SELF-ADHESIVE METALLIC MYLAR; 2- CUT FROM SHEET BRASS, PLYWOOD OR TEMPERED MASONITE; 3- SCULPTURED IN CLAY, THENCE CAST IN PLASTER THEN MOLDED WITH CASTING POLYESTER RESIN. NUMBERS 2,3 ARE ATTACHED TO HULL WITH EPOXY.



QUARTER SCROLL

FLICKA

Continued

turer, it may be thickened to the consistency of cake batter by adding talc, Cabosil or micro-balloon powder.

The glazing compound is now applied to the hull with a long, stiff rubber squeegee or 2½-ft. strip of ¼-in. plywood. Before using, wet the squeegee or plywood with soapy water to retard the sticking of the glazing compound. Apply a sufficient quantity of glazing to the divot area. Spread the compound by bending the squeegee to the fair shape of the hull and draw it slowly over the divot. If the divot does not fill on the first pass, draw the squeegee once again, but no more. Over-working the compound will only cause the soapy solution to impregnate the epoxy.

Don't expect to produce a perfect surface on the first go-round. Allow the glazing to cure until it is hard enough to rasp or sand smooth. Knock off any peaks which lie above the fair line of the hull and reglaze all divot areas again. (Caution: never apply new epoxy to old without first abrading the original surface.) The complete glazing and sanding cycle should be repeated over and over until all hollows in the hull surface are eliminated. The hull fairness may be easily checked at night by shining a flashlight at a low angle along the surface. Remaining hollows will be betrayed by dark shadows. Mark the hollows with a felt-tip pen so they may be found the next day. Your final fairing work will best be done just before sunset since this will visibly exaggerate irregular shapes. You might also find the bumps and hollows by slowly passing the palm of your hand over the surface.

EXTERIOR SEALING

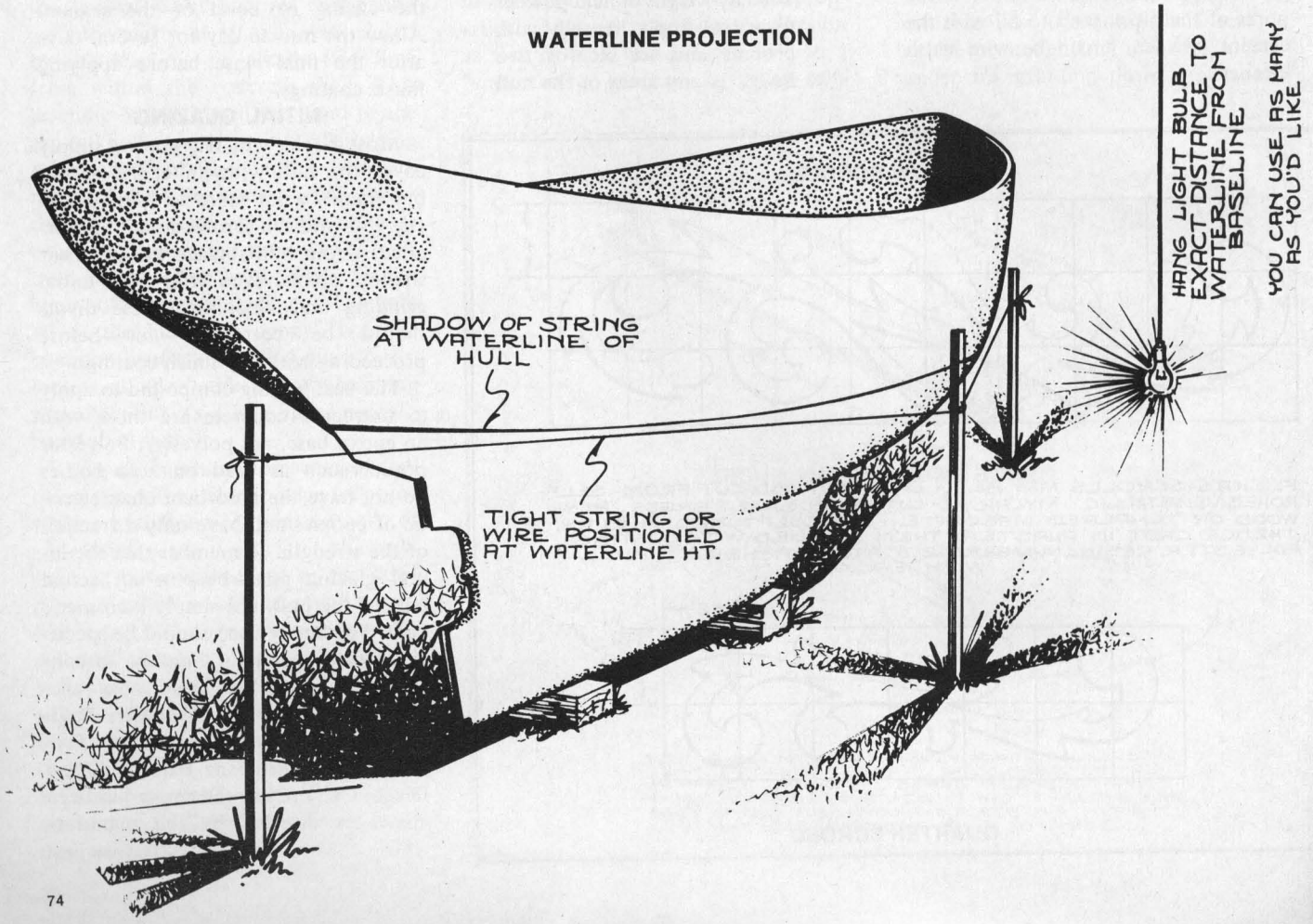
After the initial glazing of the hull has been completed and sanded, it may be coated with a two-part epoxy specifically formulated for sealing concrete. This sealant will have a penetrating quality that will cause it to become deeply absorbed into the hull surface. Its purpose is to make an absolutely watertight seal, to protect the hull from corrosion, abrasion and chemical attack and to provide a base for subsequent finishing coats. Epoxy sealants are available in clear or amber liquids and are of low viscosity. They generally have a pot life of about five hours at 75° F. and cured to tacky roughly two hours after application. The application of a sealant may be repeated as many times as desired and each successive coat will fill in more of the surface irregularities. To enhance the glazing and filling qualities of the sealant, Cabosil or talc may be added to the epoxy (which works especially well with the squeegee applicator). For spraying, however, be careful that you don't build the viscosity to the point of clogging the equipment.

Sanding between coats should be done first with carborundum paper attached to a 4" by 30" plywood strip with handles at each end. This will knock down remaining high spots. The low areas and divots must be done by hand.

SANDING UNDERCOAT

So far your efforts have been aimed specifically at correcting unfairness by concentration on the obvious bumps and hollows. Now that they have been brought in line with a smooth-shaped hull, and no severe irregular shadows appear when viewing with a flashlight,

Continued on page 101



FLICKA

Continued from page 74

you may begin your fine-finish work.

Many white sanding undercoatings have been specifically manufactured by virtually all the marine paint companies for use on plastics and other synthetic materials (i.e., polyester, epoxies, vinyls, etc.). Any of these products may be used successfully over your epoxy sealer. Do not use an undercoating formulated for wood or concrete as its inhibiting qualities will be totally ineffective on the epoxy. The purpose of the undercoating is to fill any pores which exist in the hull surface and to provide the proper chemical bond for the finish paint. Because each paint manufacturer has devised his own sets of formulas for various finishes in order to ensure that his products are compatible, stick with one brand of paint throughout the remaining finish coats.

Most boat owners think in terms of painting with a brush alone and it's fine if you have time on your hands. But I have found it far quicker to have one man to lay the paint on with a roller while a second man immediately follows with the brush. You can then concentrate solely on smoothing the finish without wasting precious time dipping and spreading. This prevents unsightly overlaps from occurring, especially on hot days. Your first brush strokes should be short diagonals

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GIN-PROOF LLOYD'S

Lloyd's first began registering the world's shipping in 1764, and early in this century the classification society began listing yachts. This month the 1973 Lloyd's Register of American Yachts is out with easier-to-read type and a new cover that it reputed to be both water and booze-proof—should you happen to be perusing its 1550 pages of boat listings, sailing clubs, signal letters, yacht club and private burgees with a drink in your hand during a storm at sea. The cost is $35. Add $2 for imprinting of your name or that of your yacht on the cover. New listings have a one-time-only cost of $10 and are updated every year. Write Lloyd's Register of American Yachts, 17 Battery Place, New York, N.Y. 10004.

FLICKA

Continued from page 101

followed by long, slow horizontal passes. This combination will ensure an even spread while preventing most runs. Do not "flood" the surface with too much undercoat at one time because this will affect the drying and shrinking rate while causing runs. Allow at least a full day of set before sanding.

FINISH GLAZING

Previously, your sanding has been done with a coarse carborundum, but now you should shift to aluminum-oxide open-coat paper. After each undercoat use a progressively finer grit starting with No. 100 and working up to No. 200 or 300 just prior to final painting. You may work with a heavy-duty rotary or reciprocating electric vibrating sander, but don't bother buying a magnetic vibrator as they are totally useless for boat builders. Don't ever touch the hull with a disk or belt from this point on—they will completely undo your efforts in a minute.

Once again, check your finish with a flashlight. This time, indicate any low spots with colored chalk, not a felt-tip pen as it will bleed through paint.

"Plastic" marine glazing compound is available from your chosen manufacturer and is formulated to be compatible with your undercoating. Glazing may be applied directly out of the can using a wide putty knife (a 6-in. blade works well) or rubber squeegee. If you use a squeegee, the glaze must be thinned slightly to a creamy paste (done by mixing in a small quantity of white undercoating, not solvents). Fill the hollows and divots as best you can on one pass but avoid overbuilding. You should now begin concentrating on the smaller, less obvious imperfections. After allowing the glaze to dry thoroughly, sand down any peaks. Now give the entire hull another coat of prime.

The prime-glaze-sand cycle should be repeated as many times as necessary to produce a shadow-free surface. Of course, all of these preparatory stages are physically exhausting and seemingly unrewarding and your efforts will pay off long after the last brush stroke, but unfortunately this is the nature of all painting. A good finish cannot be rushed. It usually takes several weeks to develop a flawless gloss and your patience here is your most valuable asset. Remember again that smoothness of the hull is the result of a chain reaction: fair mold, fair armature, fair plastering, fair grinding, fair glazing. Every boat, regardless of her material, must pass through this sequence successfully to achieve a professional appearance, so don't blame ferrocement for the shortcomings of a bumpy hull.

After finishing the cycle, you're ready to mark for masking. The upper and lower edges of the boot-top may be measured on the lines drawing. The actual transfer of the boot-top may be accomplished in several ways. The "water level" (a long flexible plastic tubing filled with water) may be attached to the scaffolding or other upright, then filled with water until it

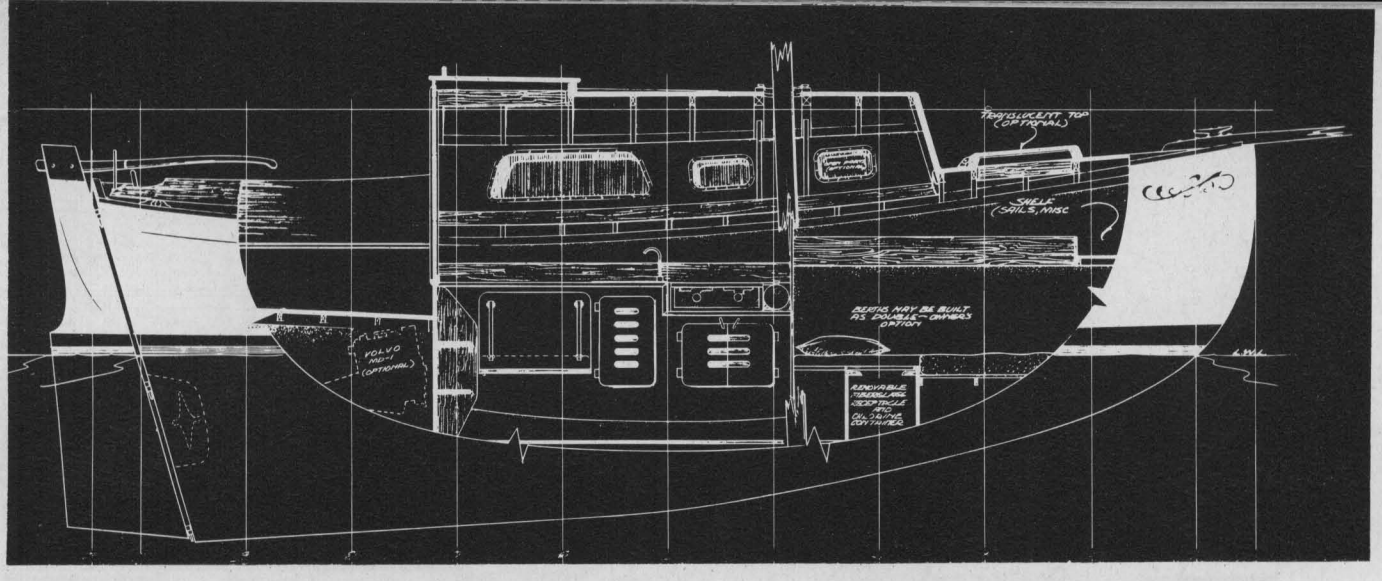
reaches the exact boot-top level. The free end may now be carried to any location along the hull. Place marks at the water level on the vessel at approximately 18-in. intervals. Once done, you're ready for masking.

Another successful transfer method is that of stretching a tight wire from one end of the vessel to the other, including temporary level supports at each end so the wire stretches about a foot away from the hull. Now suspend several 150-watt light bulbs from the scaffold cross spans at equal distances. Both the light wire and the bulb centers should coincide exactly with the lower boot-top line. The shadow of wire as it falls on the hull will be your masking line. Caution: on large vessels the tight wire will sag significantly between its supports so intermediate supports will be required for accuracy.

A long carpenter's spirit level may also be used for transferring the lower boot-top line. With this method, the boot-top position is marked on each scaffold upright. Thus the level is employed to project the mark onto the hull. Because the hull may be a considerable distance from the scaffold, a straight edge extension should be attached to the level. A variation of this method is to attach the carpenter's level perpendicular to a long 1″ by 2″. The length of the 1 by 2 to the level should be equal to the boot-top relative to the base line. Now hold the rig so that the end of the 1 by 2 is against the bottom of the scaffold cross spans (they usually represent the base line) while the end of the level touches the hull. Mark the hull at 18-in. intervals.

When marking for the boot-top, remember that the upper edge of the boot-top should never be a straight line but rather a long, gentle curve. The boot-top, when seen in profile, is always about 30 to 40 percent wider at its ends than amidships, the narrowest portion located at approximately 65 percent of the water line aft. The boot-top width at its narrowest point should be about 7 to 8 percent of the freeboard. The tapering of the boot-top is done to create several effects. Because of the twist of the planes of the hull at the waterline, an optical illusion occurs which causes the boot-top to visually diminish, bow and stern. By altering the boot-top width, this illusion is canceled. Tapering the boot-top also tends to accentuate the curve of the sheer. Boats which have a straight boot-top often look "down by the bow," lacking in spirit while appearing very amateurish.

If your architect has not indicated the boot curvature on the lines drawing, you may do so using a ¼″ by ¼″ pine batten, holding its position with weights. Carefully scale the line position from the base at each station, then transfer the dimensions to the hull using a spirit or water level. You are now ready for masking. A word of caution before masking: most professional wood and fiberglass boat builders score the hull with a saw or router along the boot-top lines and cove stripe. This is done to aid masking, to prevent paint bleed and to preserve the line for the life of the vessel. Scoring should *not* be done on ferrocement hulls, as it can become an area for the concentration of bending stress, resulting in severe cracks and possible hull failure. An alternative to scoring is to permanently and accurately attach an epoxy-soaked string to the hull along the boot-top edges. This will adequately serve the same purpose. Once marked, continue with the masking. □



HOW TO BUILD FLICKA · PART SIX
FINISHING THE INTERIOR

COMPLETE PLANS/ILLUSTRATIONS BY BRUCE BINGHAM

By this, the sixth and last installment of *Flicka* you have probably barely completed the hull of this perky little vessel, but most of the procedures required for finishing *Flicka* are quite common to that of wooden construction. And *Flicka*'s rigging is really no different than that of most other boats of her type. I shall rely upon graphic descriptions of her interior structures, cabin construction, deck, spars, rigging, etc., to help you complete your boat. The drawings herein will tell you much more at a glance than I could say in five or six pages. I would also strongly suggest that you dust off your library card and make several trips to your local branch. There you will find scores of books on boat building, rigging and simple cabinetry. I most heartily recommend:

Boat Building .....Chapelle
Mast Making, Sail Making and Rigging .....Steele
Small Boat Construction ..Steward
Boat Building in Your Backyard .....Rabl
Amateur Boat Building ....Verney
Complete Amateur Boat Building .....Verney

INSTALLING THE CLAMP

It is in this area that ferrocement departs most drastically from other forms of construction. The sheer clamp is two layers of ¾-in. mahogany or fir. While the lumber can be sprung outboard, it is necessary to spile the vertical curvature of the sheer prior to installation. Once the clamp is shaped and fitted, etch the clamp area of the hull with muriatic acid. Trowel a section of the clamp area liberally with epoxy grout (epoxy mixed with Cabocil or sand) and immediately spring the first sheer clamp layer firmly against the hull. Use plenty of "C" clamps. Continue to install all other sheer clamp sections in the same manner.

The second layer of the sheer clamp is laminated to the first in much the same way. This time, however, you

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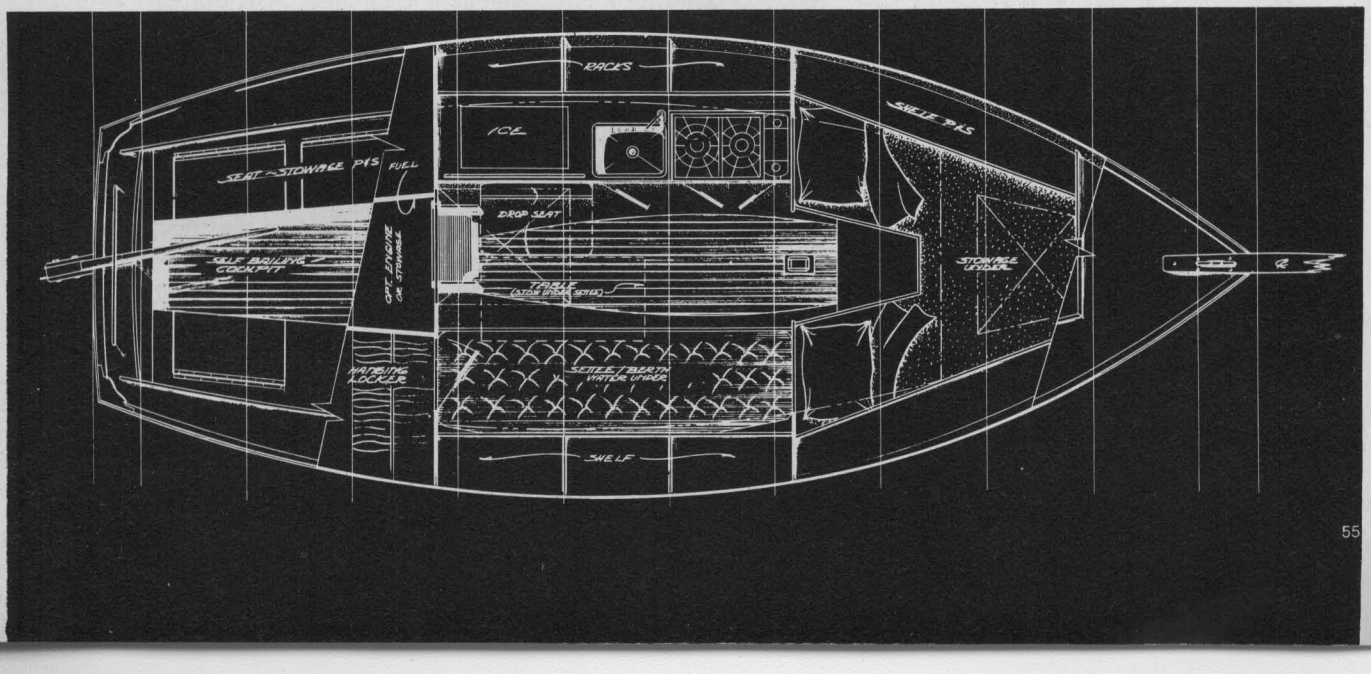
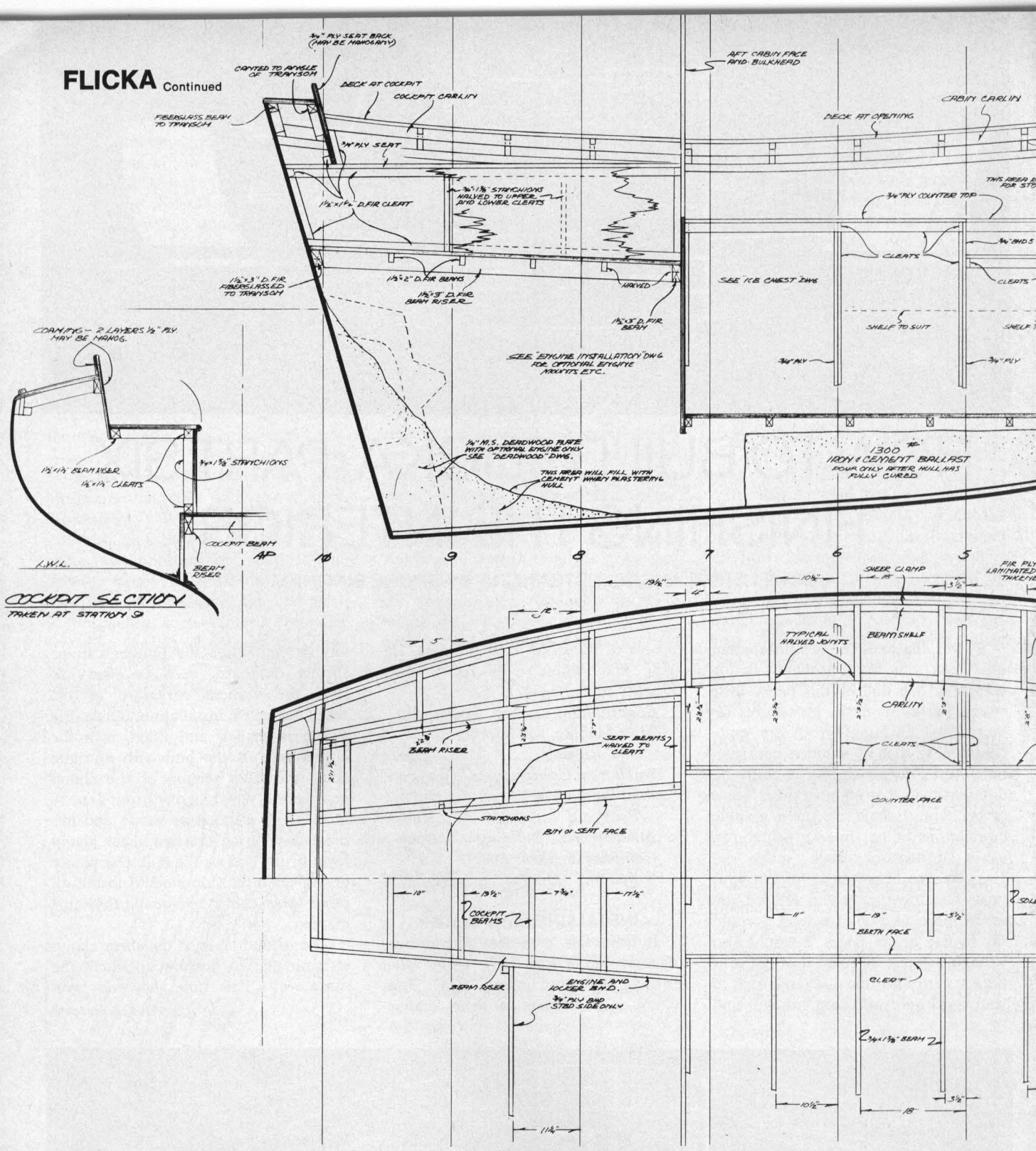




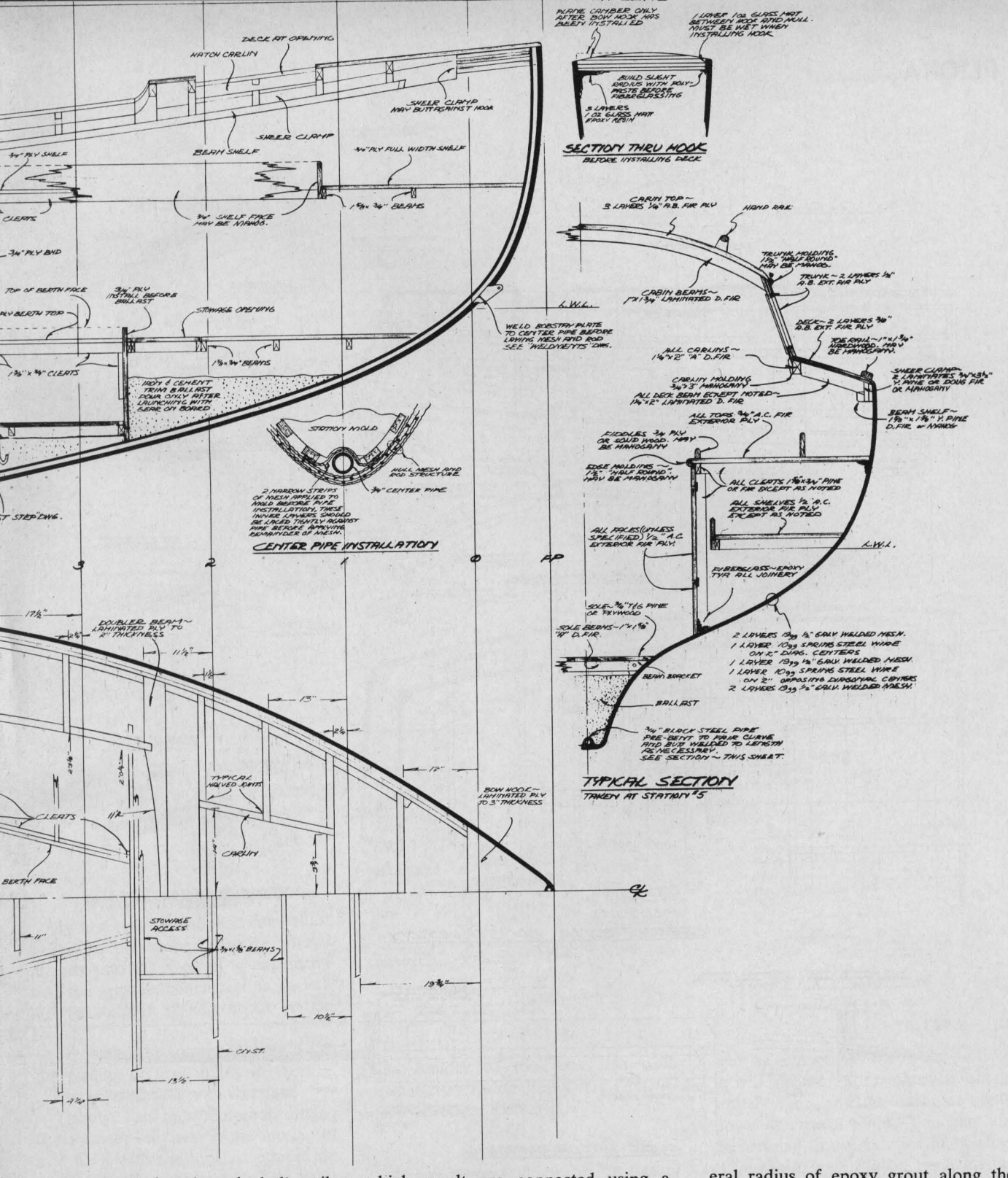
may elect to use resorcinol glue or phenolic resin. Once this has set up, drill and insert ⅜-in. flat-head bolts on 12-in. centers, taking care to countersink the heads into the hull. When drawn up tight, the bolt heads should be glazed with epoxy grout.

The beam shelf is fashioned of 1⅝-in. by 1⅝-in. mahogany or fir and is sprung, glued and screwed to the lower outer portion of the sheer clamp.

THE TICK STICK
(Taking Patterns from the Hull)

While this is a very simple procedure, it's one that few amateur boat builders are familiar with and it can save countless hours of time in fitting bulkheads, berth tops, and the like.

To start, draw a line within the hull at the exact location of the bulkhead or other surface. Temporarily position a wide plank on the same plane as the surface to be installed, and brace it against movement. Now cut a stick to a three or four-foot length, pointing one end. Holding the stick flat against the temporary plank, position the point so that it just touches the hull. Carefully scribe a line on the plank along the edge of the stick. Then make a small pencil tick on the plank and the stick wherever convenient. Reposition the stick at another point on the hull and, once again, draw a line and ticks on the plank and stick. Repeat this proc-



ess every few inches along the hull until the entire shape has been covered, being sure to pick up critical points such as the corners of the sheer clamp.

Laying the marked plank on top of the wood to be cut, you can now reproduce the exact shape of the hull simply by repositioning the tick stick in its original positions and making a small dot on the lumber at the pointed end of the stick. The series of dots which result are connected using a plastic or wooden spline.

ATTACHING BULKHEADS

Once the bulkhead has been carefully cut and fitted, the edges against the hull must be liberally beveled from both sides. This is done to expose all ply layers to the epoxy bonding. Etch the hull along the area of the attachment with muriatic acid. Place the bulkhead in position and trowel a liberal radius of epoxy grout along the corner of the bulkhead at the hull. I have found that a quart pickle jar makes an excellent trowel for producing a clean and consistent radius. I suggest that the bottle be dipped in warm, soapy water prior to its use to prevent the epoxy from sticking to it.

The berth tops, galley cabinetry, etc., may be installed in exactly the same manner as the bulkheads.

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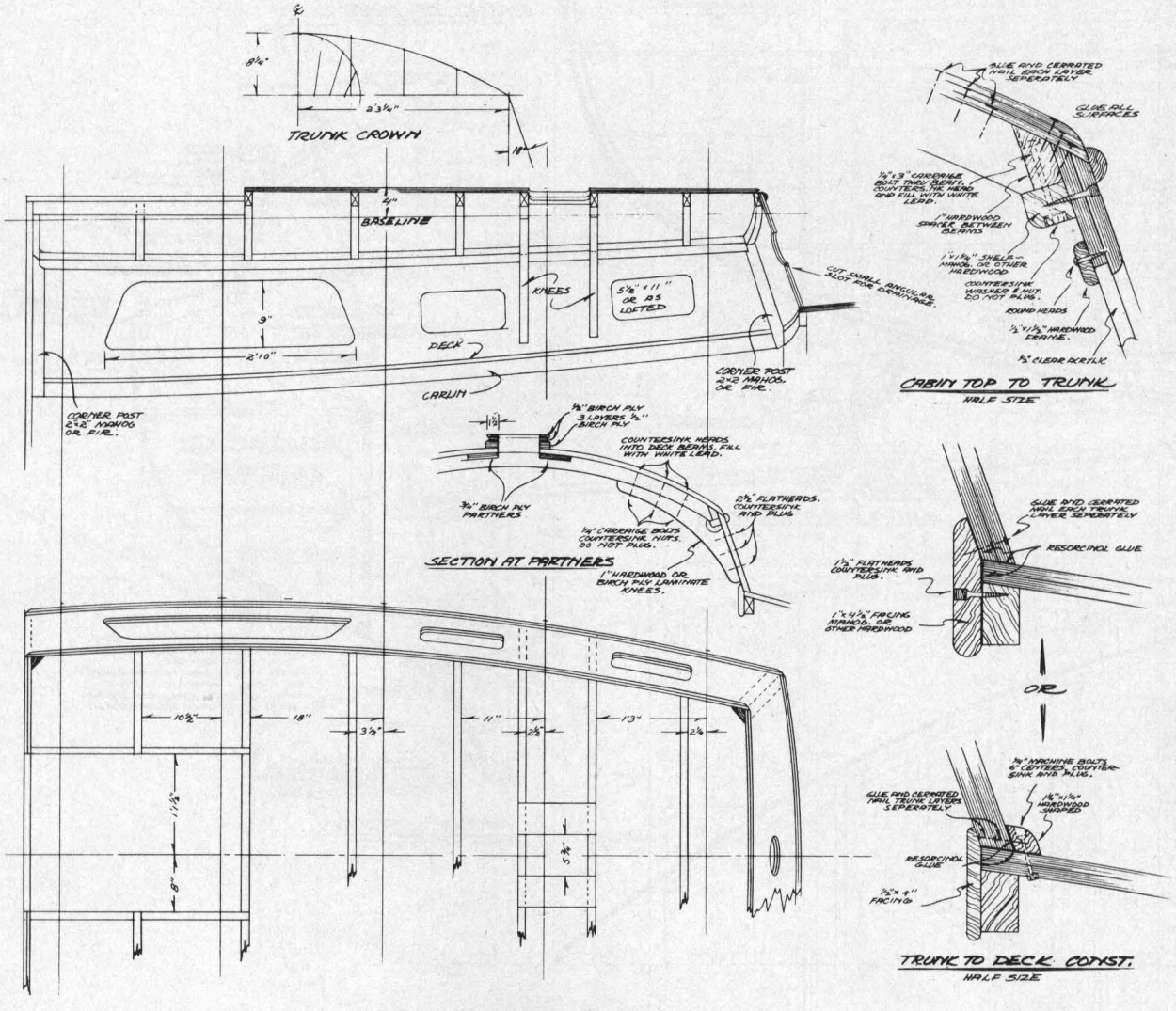

CABIN TRUNK CONSTRUCTION

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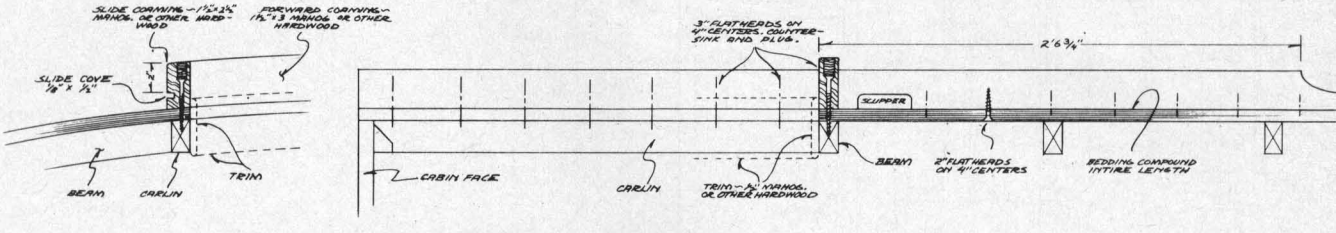
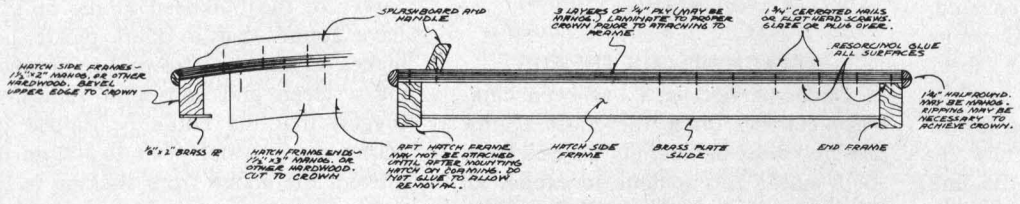


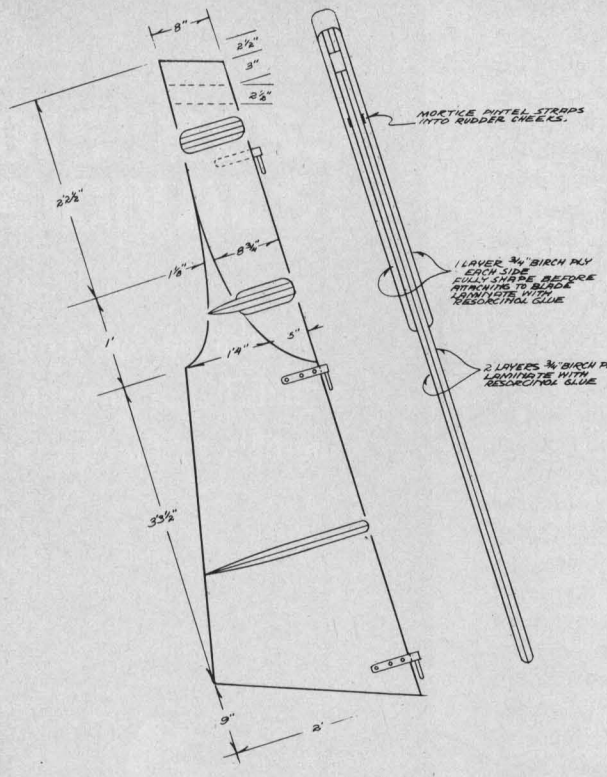
SLIDE HATCH CORNING

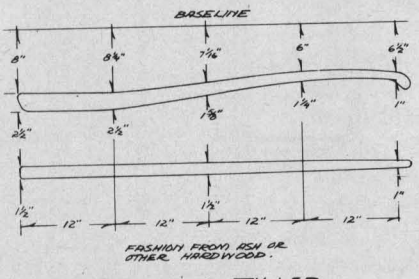
3" = 1'



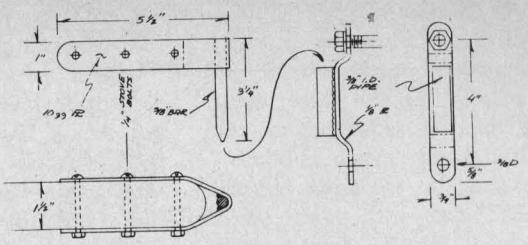
SLIDE HATCH

TAKE ALL MEASUREMENTS FROM FINISHED CORNING



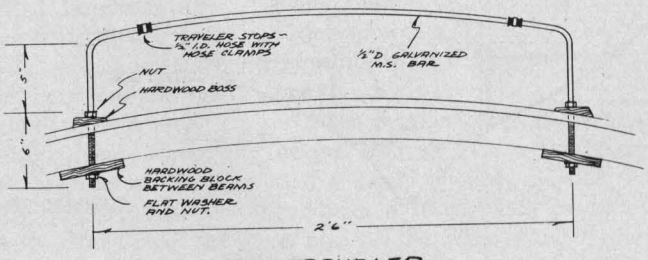


RUDDER AND TILLER
1½" = 1'

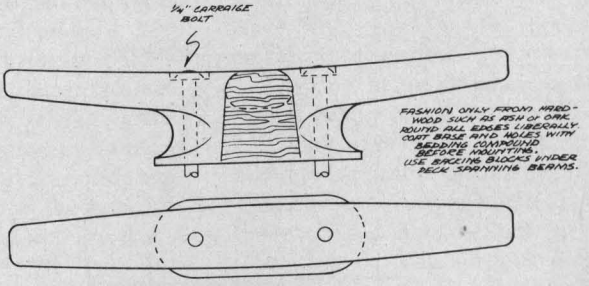


PINTLES
HALF SIZE

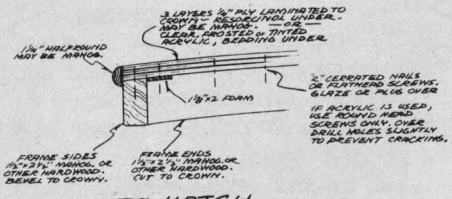
GUDGEONS
HALF SIZE
GALV. M.S., S.S. or BRZ.



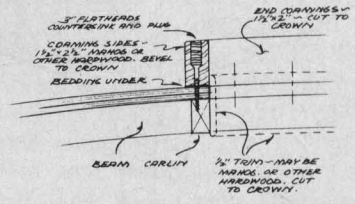
MAIN TRAVELER
3" = 1'



8 INCH HARDWOOD CLEATS
FULL SIZE TEMPLATE
SCALE FOR OTHER SIZES



LIFT HATCH
3"=1'
TAKE ALL MEASUREMENTS FROM FINISHED COAMING



LIFT HATCH COAMING
3"—1'
ALL CORNERS TO BE "HALVED"

Continued from page 57

POURING BALLAST

My first recommendation for ballast is always that molten lead be poured directly into the keel. It is imperative that the greatest concentration of ballast be located at and about station No. 425

My second recommendation is for the placing of lead ingots in the keel cavity, poured over with concrete.

Thirdly, and most common among ferrocement builders, is the mixing of iron balls with the mortar, poured directly into the keel area. In the latter case you should attempt to reach a density of at least 330 pounds per cubic foot.

I suggest that you install only 1400 pounds of ballast prior to commissioning your vessel. This will allow for the installation of approximately 400 additional pounds after launching and outfitting. This figure may be quite flexible (as much as 300 pounds) because hull weights differ considerably from one builder to the next and each owner may locate heavy items in different areas of the vessel.

LUMBER

It has become almost impossible in this day and age to locate A-grade air-dried timber. However, its use cannot be undersold. If it is not available in your area, or is prohibited by cost, you will have to settle for the kiln-dried stuff. Occasionally you may find some beautiful dried lumber at demolition sites and, although it may be unsightly on the surface, you may find very excellent lumber within. Above all, avoid using green lumber. You may be tempted by the lower cost, but it will shrink, split and swell uncontrollably, causing the eventual breakdown of critical joints. You may also be inclined to use exterior fir plywood throughout your *Flicka*, but I caution you to restrict this use to light cabinetry only since it is not as structurally important as the bulkheads and deck covering. The voids found in exterior plywood can become rot pockets in a very short time as well as being severe weak points along their lengths.

FASTENINGS

Most construction within *Flicka*

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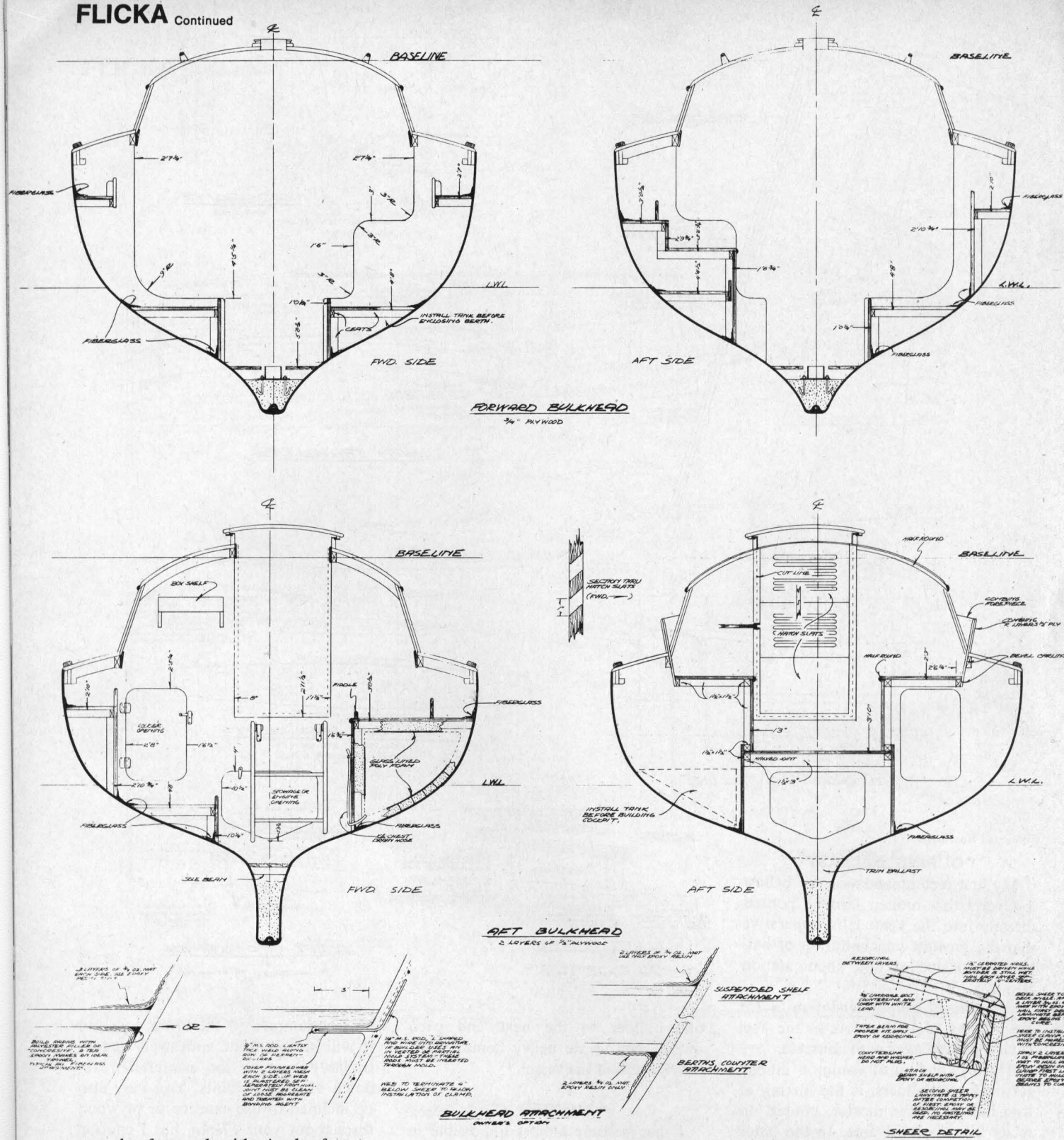

may be fastened with Anchorfast or comparable nails and resorcinol glue. Screwing units together is not necessary. For cabinetwork, use galvanized finishing nails, set and glazed. Ultimately, the glue will bear more of the load in the end, anyway.

CONCLUSION

The outcome of your *Flicka* will depend entirely upon the standard of quality that you set for yourself. The books that I have recommended will be of immeasurable help, of course, but far more important than this will be our own visualizing of the outcome of each stage of construction. The best exercise at this point is to make many trips to your local marina to see how the professional builders have handled each construction situation. Looking at a well-finished hatch or counter will be far more beneficial than my trying to explain its detailed fabrication, and this is true of every other aspect of boat construction.

If, during the course of your finishing, you find it difficult to read or understand the drawings contained herein, you may find it prudent to send for the complete set of large-scale construction drawings for *Flicka*, available through the RUDDER Plans Department. Remember at all times that nothing destroys a potentially fine boat more effectively than a lack of patience, so take your time. □