INTERNATIONAL CENTER FOR MARINE RESOURCE DEVELOPMENT

University of Rhode Island, Kingston, RI

PLYWOOD WORKBOATS FOR SMALL SCALE FISHERIES

by Timothy C. Visel, and William H. Highsmith

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The authors would be grateful if readers of this construction guide would send comments or questions to the University of Rhode Island, International Center for Marine Resource Development, 126 Woodward Hall, Kingston, RI 02881. Responses will help us to evaluate and prepare future construction guides.

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We wish to extend our sincere thanks to Earle Brockway of Brockway Boat Works in Old Saybrook, Connecticut. His cooperation in sharing with us not only the details of the boatbuilding process, but also of his own personal family boatbuilding history, was greatly appreciated.

Preface

There exists a need for small inshore fishing vessels in many developed and developing countries today. These inshore craft should be versatile, cheap to build, and require little maintenance. In less developed countries, several small boat construction development projects have been initiated in many inshore fisheries. These assistance programs, using modern materials and sophisticated new techniques combined with the available local construction skills, have been met with mixed success. All steel, and many fiberglass (except C-Flex) construction techniques require the use of supporting technologies that involve complicated equipment and machinery. The skilled labor needed to operate this machinery, however, is unfortunately lacking in many developing countries. Modern boat-building materials are expensive and the finished product often requires costly periodic maintenance that many developing countries cannot afford, or once purchased, cannot maintain. Attention is now being focused upon what is becoming a basic boatbuilding material; plywood. "Plywood" or laminated processed fiber, because of its worldwide accessibility and its conformity to traditional boatbuilding designs, has recently been used successfully in development projects. With the increased interest in worldwide small scale fisheries development, the availability of detailed information and design criteria concerning inshore plywood skiffs and scows would benefit many developing and developed countries. In many inshore fisheries, small scale fishermen are not only vital producers of protein, but also provide employment. Occasionally, natural disasters such as floods or storms will reduce the viability of inshore fleets; or, in some instances destroy large numbers of inshore craft. The loss of these craft can be critically damaging to local economies and fishing communities. Plywood construction techniques have the potential to rapidly replace inshore craft in these situations, lessening the impact of future losses.

In Southern New England, many types of small inshore fishing vessels are employed in several small scale fisheries. In Connecticut, a great number of skiffs and scows are constructed out of plywood. These plywood boats are often constructed at Brockway Boat Works, located in Old Saybrook, CT. Brockway Boat Works currently builds seven different skiffs and five different scows. Here, specially designed scows are built for several Chesapeake Bay oyster companies. Brockway skiffs are used mostly for lobstering, trawling, and gillnetting. The scows are more suited to inland fishing of areas such as rivers and bays. In Rhode Island, Brockways are used for bullraking. In the Connecticut River, the scows are used for shad gillnetting. They are used for seed oystering in many, many rivers and creeks. Brockway boats are noted for their strength, versatility, and low initial investment. Most inshore fishing operations involve the setting and hauling of many types of fishing gear. Brockway skiffs and scows are well suited for these inshore fisheries. The vessels are easy to maintain, relatively light, and quite able to hold large amounts of gear such as lobster pots and traps. They are simply made, and with little care will last 15 years. The Brockway boats are extremely popular among Connecticut, Massachusetts, and New York inshore fishermen.

Today, low horsepower outboard motors are the primary power source for these skiffs and scows. Due to their flat-bottomed design, fuel consumption is excellent, which contributes to their low operating cost. Also, because of their slight draft, the ability to maneuver around coastal reefs and rocks is facilitated. Brockways can be rolled large distances, and are easily launched from shores and beaches. Repairs can also be made when the boat is above the highwater level.

Considering all factors, there does not seem to be an easier, more versatile plywood work boat to maintain. It is hoped that by making these plywood skiffs available, labor intensive, small scale fisheries will be aided by the provision of a simple, low cost vessel for both developed and developing countries.

Introduction

Within the last decade, most of the world's coastal nations have extended economic and fishery conservation zones. These extensions have allowed many developing nations to increase their domestic fisheries. In the wake of the tremendous increases of energy costs and severe shortages of protein sources, many developing countries have established programs to increase fuel efficient small scale, or artisanal fisheries.

Presently, small scale fisheries provide critical employment opportunities, produce substantial amounts of food (about 50% of the world's fish production), and generate valuable foreign exchange. It is unfortunate that in order to meet these development goals, natural resources were often grossly exploited in many of the world's less developed coastal nations. One of the exploited resources was the large timber resource of the third world nations. Even today, the harvest of timber for pulp, and hardwoods for lumber products continues at an unprecedented rate. It is not surprising, then, that many fishing communities have witnessed a decline in the supply of boatbuilding materials. Lumber of a suitable size to produce dugouts is becoming more and more scarce.

Lumber and wood resources are vitally linked and crucial to small scale fishermen throughout the world. Because plywood is a by-product of large lumbering companies, and because it is universally used in ocean-going containers and air freight, it is nearly always available. Plywood is also easily adaptable to many traditional boatbuilding designs. Many factors, one of which is the simplicity of construction, make the use of plywood an economic alternative for small scale fisheries.

This guide was written for fishery extension agents, Peace Corps volunteers, and fishermen. It was designed especially for the novice with limited boat-building experience. We hope it will be of some help to them, and to many others.

Boatbuilding With Plywood

Plywood is a term recognized worldwide that signifies a panel manufactured by gluing several slices or "veneers" of wood to form a sheet or block. In cutting the veneers, long, thin slices are cut from a log. These veneers are processed and graded according to grain and absence of defects. In gluing these veneers, the grain direction is alternately reversed at right angles. In completing the sheet, the thickness and grain direction of each veneer is matched so as to create a panel of balanced veneers. This matching is necessary to equalize the elasticity and shrinkage, while providing the greatest strength possible. Usually, the making of plywood utilizes a core of lower quality wood on which the veneers are laminated. Sometimes the core slices are made of wood leftover from the veneer slicing process. Often the core consists of uneven width strips. Short blocks of core material are sandwiched between high quality veneer slices. The type of core and veneer grade are usually specified on the plywood sheet. Poorly-made panels of unmatched veneers bonded to a low quality core may fail when placed under stress or warp in the boatbuilding process. A plywood sheet made of many thin veneers is of a higher quality than one that has fewer, thicker veneers. Lastly, plywood that is made with inferior adhesives or glue will delaminate when submersed in water. A water-resistant or waterproof glue is necessary for most boatbuilding activities.

In choosing plywood sheets for boatbuilding, the plywood should be soaked in water for a few days if grade, or adhesive quality, is unkown. If the panel swells or delaminates, discard it as a boatbuilding material. Most plywood sheets are made with a good veneer having little or no defects such as voids (holes) and knots, and a lower quality side containing these defects. Typically, this type of plywood is designated as "A.C." plywood; the "A" side being relatively free of defects in the veneer and the "C" side of lower quality. Plywood can

further be designated as "exterior grade" or "interior grade". Exterior grade plywood is recognized as being resistant to weather, microorganisms, and temperature fluctuations. Interior grade plywood is recognized as being glued with a non-water resistant adhesive, which provides little resistance to continuec exposure to weather. Use of interior grade plywood in building boats will be discussed later in the text. It is generally thought to be a poor boatbuilding material. "Marine grade" plywood is specially bonded with waterproof glue , and imperfections have been cut out, patched and sealed with a veneer slice. Most marine grades of plywood are too expensive for small boatbuilding use. It is possible to use marine plywood that has been rejected due to splitting of the veneer surface or warping after gluing and curing. These sheets can be repaired with polyester resin, and used at a much lower cost than higher grades of marine plywood.

Plywood is especially adaptable to small boatbuilding applications. It can be bent around molds, cut to any shape, and is relatively light. Because of its non-splitting characteristics, it is possible to nail close to the edge of the plywood sheet (unlike lumber). Due to the size of the plywood sheets, boats can be made with fewer seams. Also, because veneers are balanced for strength, shrinkage among sheets is minimal. Therefore, small boats can be built both quickly, and cheaply.

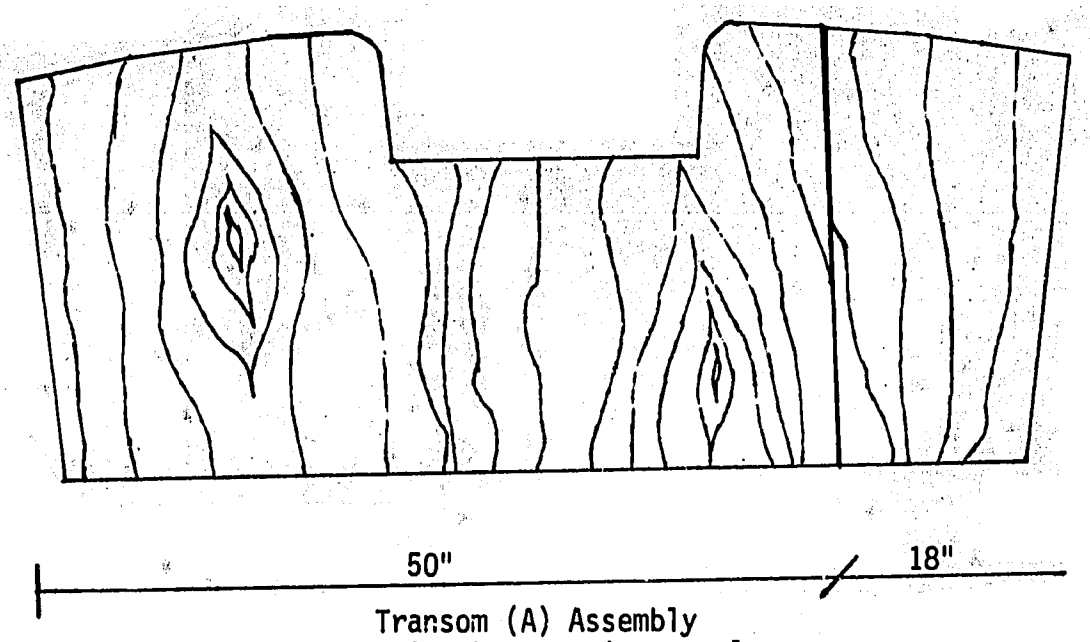
Construction Procedures

The sides of the 15'8" Brockway Skiff introduced here are built from a single 4' by 16' by ½" sheet of exterior grade A.C. plywood. Three sheets of 4' by 8' by 3/4" exterior grade A.C. plywood will form the bottom, side butt blocks, and transom pieces. If 4' by 16' sheets are not available or not economically feasible, two 4' by 8' sheets joined together will work nicely. This method of construction allows the top edge of the plywood (the straight edge) to determine the sheer and basic shape of the vessel. All of the dimensions and materials needed to build this boat are listed in the back of this pamphlet.

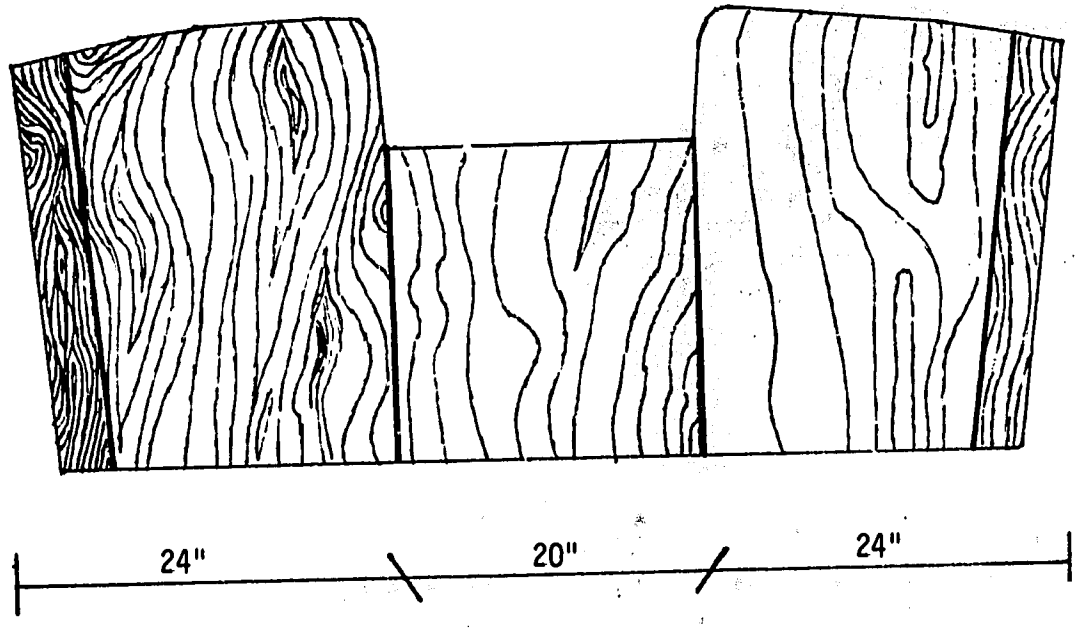
The transom is the first piece to be cut from the 3/4" thick sheets of plywood. Two full sized transom pieces are assembled from the three sheets that will be utilized for the bottom panels (refer to the cutting plans for the bottom plywood sheets). In this way, waste of plywood is kept to a minimum. If desired an additional sheet of 3/4" plywood can be purchased to cut entire transom sections.

To build the transom seven plywood pieces are cut from the plywood sheets (refer to the transom assembly diagrams). The 3 piece interior transom (Transom B) is to be glued and nailed to the 2 piece exterior transom (Transom A). If the builder does not wish to laminate separate sections two full-sized transom pieces will be glued and nailed together to provide the full 1½" thickness needed. If a laminated transom is constructed it is important that all surfaces have a glue bond and that each plywood seam is butted so that no two edges meet. This is necessary to provide strength. Any waterproof glue can be used in addition to nailing the transom pieces together. Nails should be 1¼" galvanized common nails spaced 3 to 4 inches apart. In addition two transom strengthening pieces (C) (upper left hand corner of cutting plans) are nailed at each end to give the transom a 2¼" thickness. Finally, the bevel of the side of the transom can now be cut. The transom will be beveled in 3/8" on both sides (see figure 1).

Transom Assembly



Transom (A) Assembly
This is the exterior panel



Transom (B) Assembly
This is the interior panel

Note: Transom strengthening pieces are nailed and glued at each end.

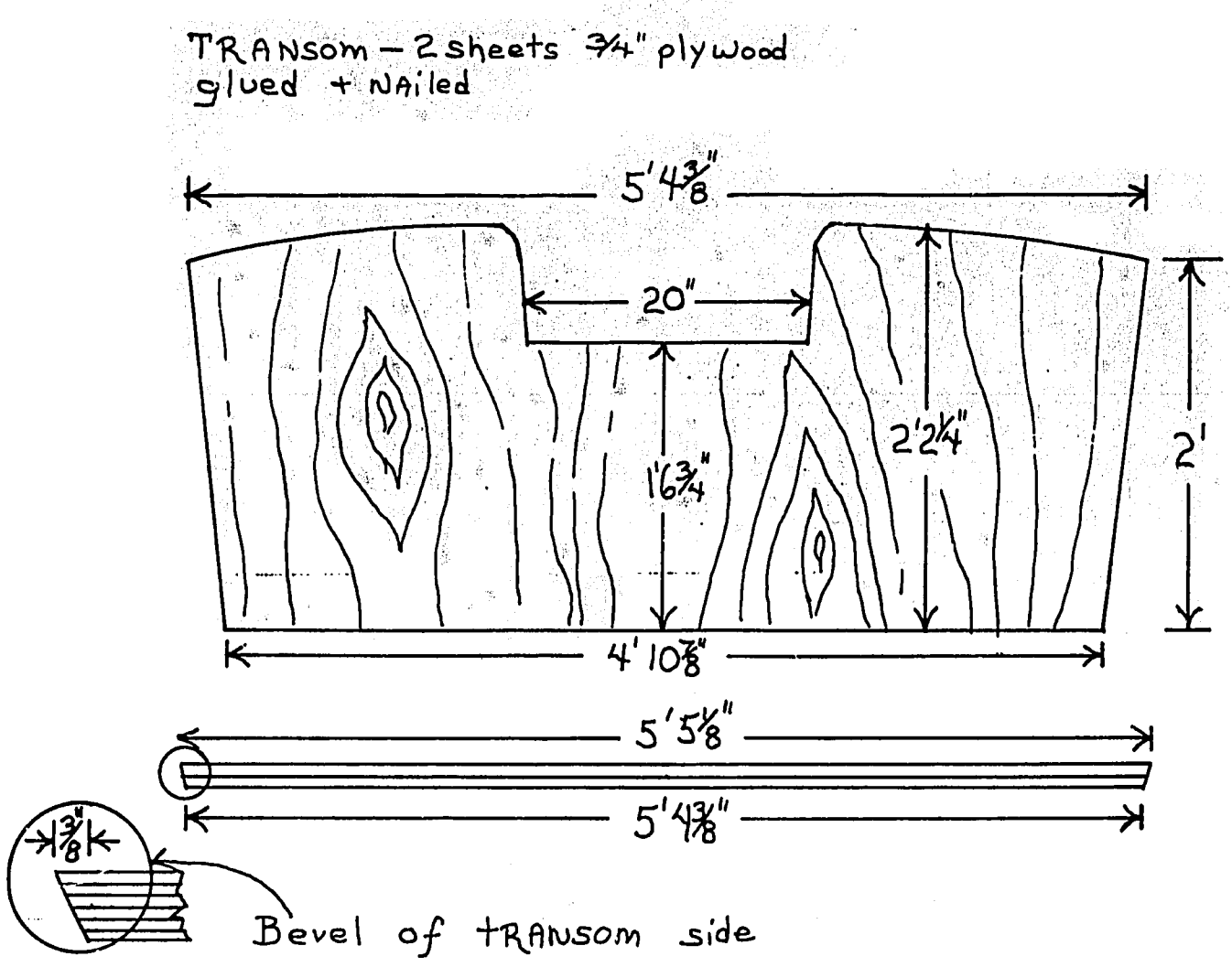


Figure 1 TRANSOM ASSEMBLY

Two sections of plywood are nailed with 100, 1¼" galvanized nails. For good holding ability, the nail heads should be at least one centimeter in diameter and slightly recessed.

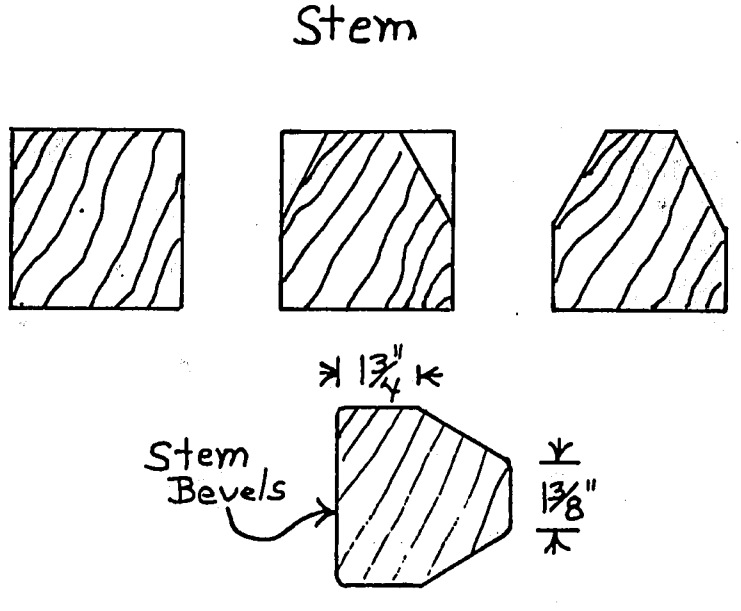


Figure 2 STEM ASSEMBLY

The stem is then cut from a 6' long piece of lumber measuring 4" by 4". Eventually, almost 1½' of the stem will be driven into the ground in order to set up the skiff. The first step is to bevel the forward edges to accomodate the plywood sides. (see figure 2). This bevel can be cut with a table saw, hand held electric saw, or hand saw. It can also be roughed out with a hatchet and finished with a drawknife. When both forward edges are cut away, the finished stem will be 4" by 1 3/4" by 1 3/8". (see figure 2).

After the stem is cut out and the transom pieces assembled, a temporary mold can be made from 1" by 4" lumber or from any available scrap. The mold is utilized in order to help keep the shpae of the boat and maintain its dimensions when the sides are nailed to the stem and transom. Once the mold has been made according to the plans' dimensions, remeasure it and make any necessary adjustments. Notch the bottom corners of the mold for the 3/4" by 3½" chine. Note the bevels for the chine. (see figure 3).

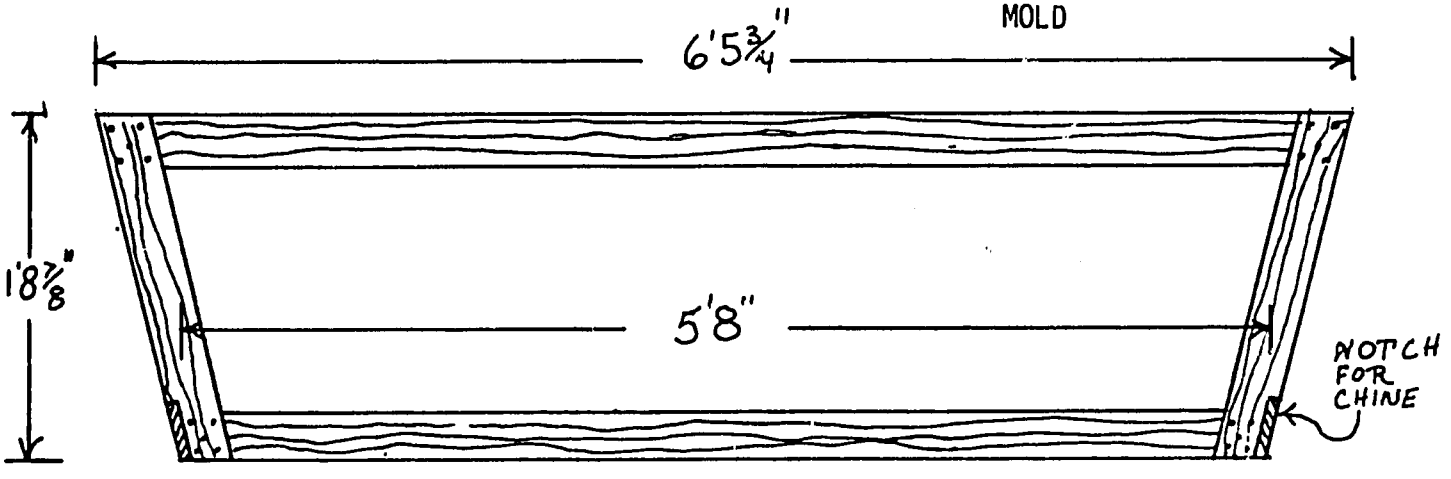
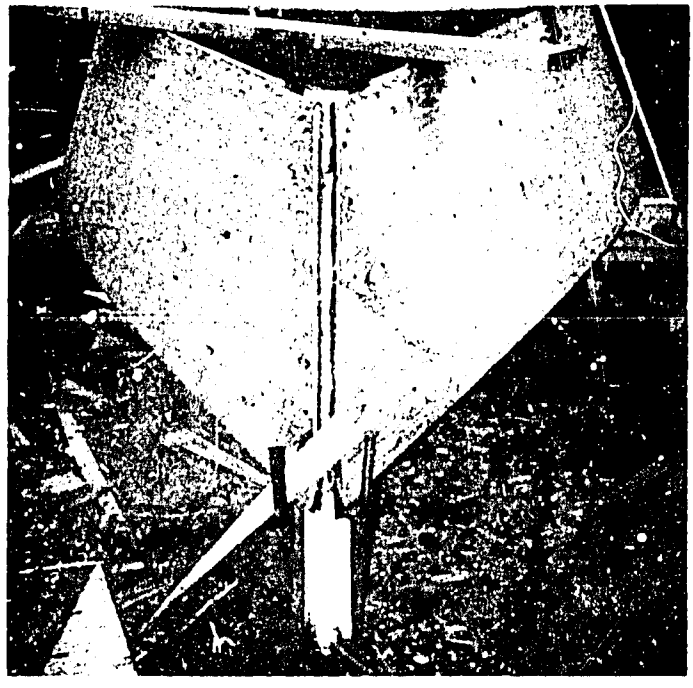
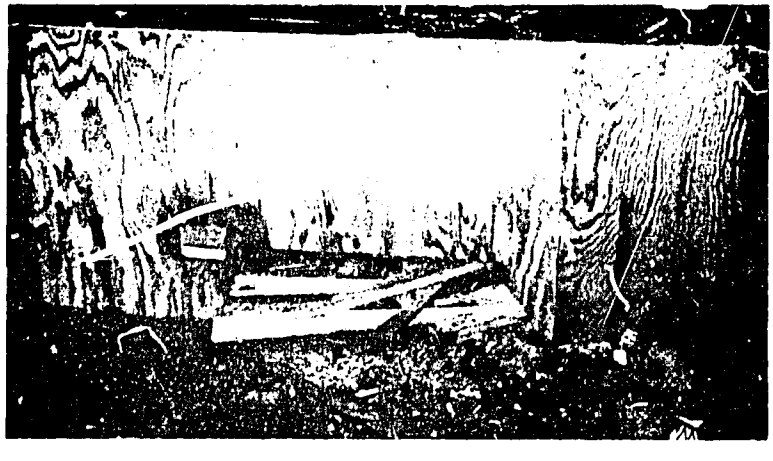


Figure 3 MOLD ASSEMBLY

For ease of construction, the skiff will be built upside down. The stem, transom, and mold need to be rigidly set up. The stem and mold are dug into the ground, and stakes are driven next to the transom to hold it in a fixed position. Both the transom and stem are beveled as in Figures 1 & 2, to facilitate nailing of the sides. Drive the stem into the ground and fasten transom to stakes or



Photograph 1 BOW OF A SMALL SKIFF
Note: iron stakes holding the stem stationary.



Photograph 2 TRANSOM OF A SMALL SKIFF
Note: iron stakes holding the transom stationary.

have stakes hold the transom firmly in place. (see photographs 1 & 2). The transom and stem are angled. (see figure 4). Put mold aside for future use.

Next, the two sides are ready to be assembled and cut out. The two 4' by 8' sheets of ½" A.C. exterior plywood will be butted together. The two plywood butt blocks, which will overlap each edge by 6", are bedded with a layer of waterproof glue, and then nailed. Each butt block is cut from a sheet of plywood

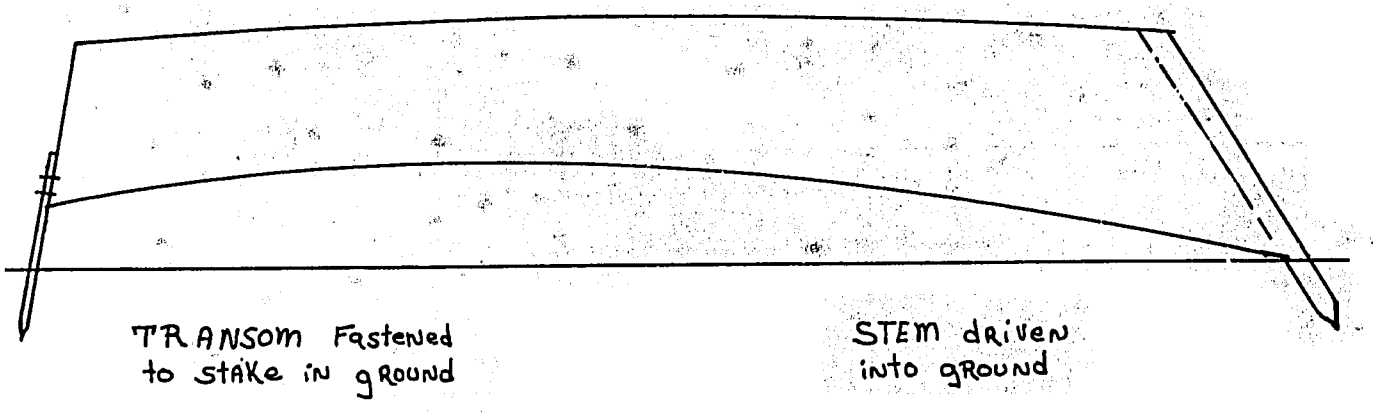


Figure 4 TRANSOM & STEM POSITIONS

that will eventually be used for a bottom panel. Be sure to cut the butt blocks from the edge of the plywood sheet in order to allow sufficient room for the bottom panel to be cut, (refer to the cutting plans for the bottom plywood sheets). When nailing the butt blocks, overlap the two sheets, and evenly space the 1¼" galvanized common nails 3 to 4 inches apart. Use at least 40 nails per butt block, (see figure 5, and photograph 3). Nail heads should be left flush with the outside surface of the plywood. For good holding ability, tne nail heads should be at least one centimeter in diameter.

A 4" space is left between the side and butt block so that the chine will lay against the sides. Once the two sheets have been joined together by the two butt blocks, an outline of the sides can be marked with a piece of chalk or pencil. Placing a thin strip of wood over the marks on the plywood will make the drawing of neater lines much easier, (refer to the cutting plans for the two plywood side panels). When the measurements have been marked properly, cut out the two sides using a table saw, hand held electric saw, or a thin-bladed hand

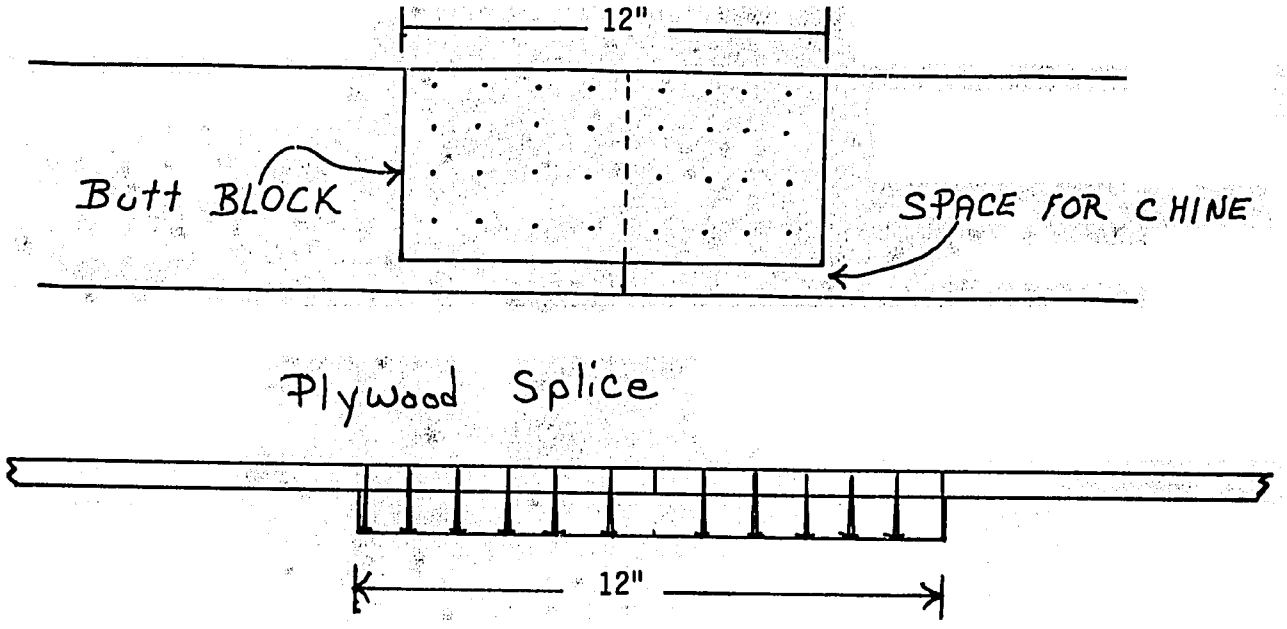
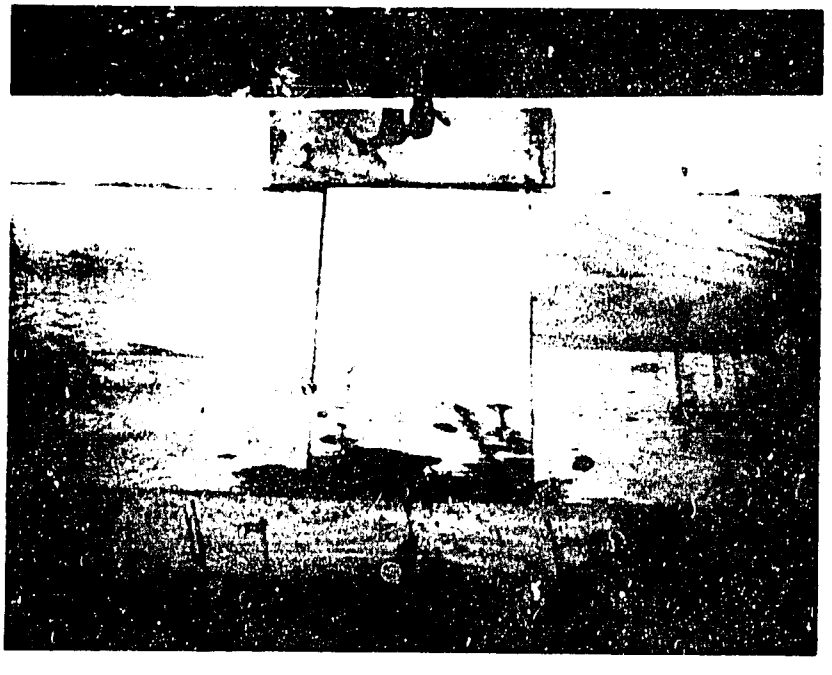


Figure 5 BUTT BLOCK ASSEMBLY FOR PLYWOOD SPLICE



Photograph 3 BUTT BLOCK ASSEMBLY
Note: the chine below the plywood butt block.

saw. In cutting two sides at once, very little plywood is wasted. A template can be made from thin plywood if several boats are to be made at once. Side measurements can be easily made by tracing the outline of the template on plywood sheets. This technique would greatly speed the boatbuilding process.

When the sides are cut, mark the position of the mold on them by measuring 5'5" from the transom end on each sheet. This mark will ensure the proper placement of the mold when the sides are attached. To attach the sides, start at the bow (stem) and fasten the plywood with 2" common galvanized nails every 3 inches, about 12 nails per side. Be sure to bed the meeting surfaces of the plywood sides and stem with plain roofing tar or glue. Making sure that it is secure (place mold at marks previously made on plywood sides), bend the plywood around the mold. A spanish windlass would assist in bending the sides to meet the transom. (see figure 6).

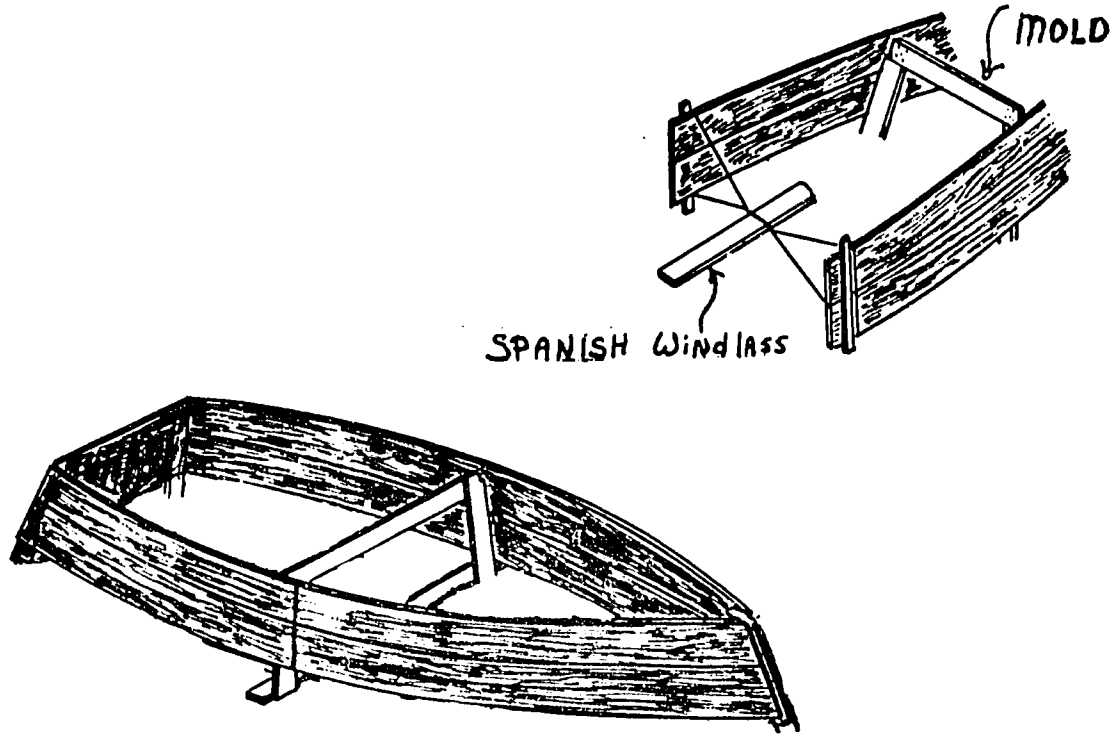


Figure 6 ATTACHING SIDES TO STEM AND TRANSOM
Note placement of mold.

Once both sheets are fastened to the stem (see figure 7), nail the sides to the transom with 2" common galvanized nails every 2 to 3 inches, about 10 nails on each side. At this point, the mold should be holding the sides apart in their proper shapes. If the mold is loose or not placed properly, the boat sides will be uneven. It is best to check and remeasure the mold at this point before continuing.

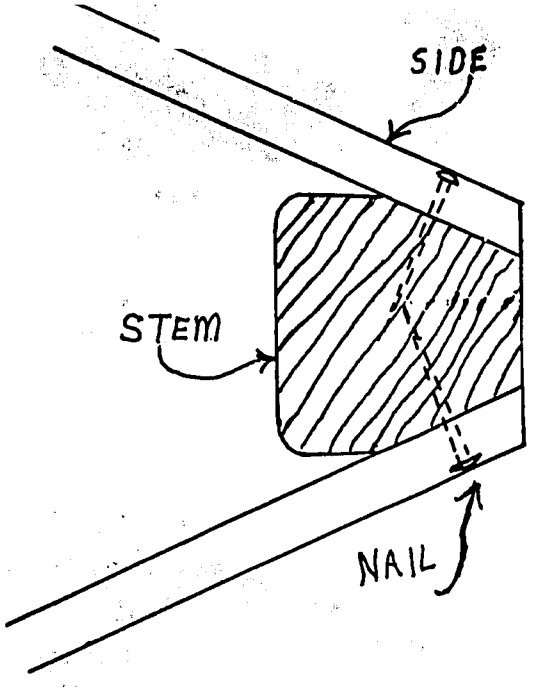


Figure 7 SIDE-STEM ASSEMBLY

The two chines are then made from two pieces of sawn lumber, each measuring 1" by 4" by 14' long. The lumber should have a high enough moisture content and be relatively free of knots or other defects, so that it will bend easily. Dry, warped, or split lumber might break when drawn against the mold. Most often the actual stock size will be 3/4" by 3½" by 14' long if milled or

planed. A thicker and wider lumber could be used, but not so thick that it would inhibit the curvature on the sides, or disrupt the plywood butt blocks or mold. The chines can also be cut from any large piece of stock such as a piece 1" by 10" by 14' long. A center cut will produce enough material for two chines. If 14' lumber is not available, two shorter pieces can be lapped with a butt block and joined with glue and nails, (similar to the joining of plywood sides). Chine butt blocks should overlap at least two feet on each side of the join. Once the chines are cut, they can be glued and nailed to the sides. Make sure to nail the chine flush with the inside edge of the plywood. This edge will be beveled in order to accomodate the bottom plywood sections, (see figure 8).

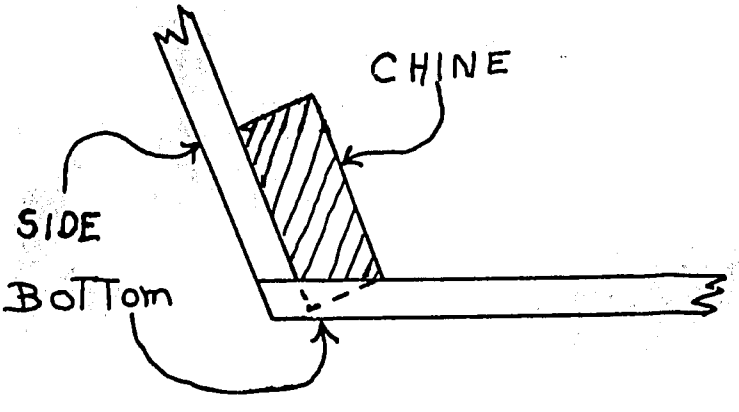
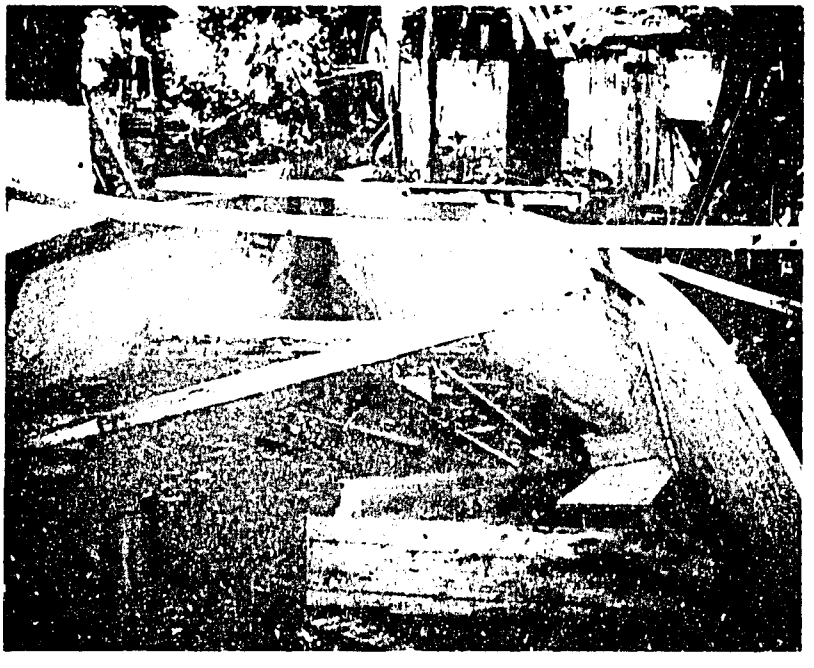


Figure 8 SIDE-CHINE-BOTTOM ASSEMBLY

The chine will also be cut to fit into the stem and transom. The cut-away section on the mold will allow the chine to be drawn against it for a proper fit. To attach the chines, apply glue to the chine, stem, and the upper inside edge of the plywood side. Then, starting at the stem, fasten the chine to the side with 1¼" galvanized nails. Nail from the chine into plywood every 3

inches in two rows along the upper and lower edges. It is best to scribe two lines on the chines with a pencil or chalk for easier nail placement. The chine will have less of a tendency to split if nails are placed alternately above and below these lines. Do not place the nails so close to the chine edges that the chine will split. About 120 nails will be needed to attach each chine to the plywood side. Nails should not go through the plywood side. If nails go through the plywood in the nailing process, use shorter nails. After the chines are attached and the glue has cured (dried), trim the chines, plywood sides, stem, and transom as needed, so that the plywood bottom sheets will sit flat on all of these surfaces. A quick method of trimming the chine with a draw knife, plane, or hatchet is to place a piece of square stock (lumber) across the sides. The chine should be trimmed until the stock sits flush with the sides. When surfaces are flush opposite each other from stem to transom, the bottom can then be nailed and glued to produce a watertight seal. (see photograph 4).



Photograph 4 TRIMMING CHINES

Note - Two pieces of lumber are used to help trim the chines. Below, two temporary braces are used to help maintain the skiff's shape before the bottom is fastened.

The three bottom panels are now ready to be cut. The three 3/4" sheets of exterior grade A.C. plywood (C side up) are placed over the skiff to produce the shapes represented in the cutting plans for the bottom panels. In this case, these sheets do not need to be marked, as the outline of the boat itself will act as a template. Once the sheets are properly positioned over the chines (they should be even with the transom and not angled), mark them with a pencil or piece of chalk. It is a good idea to leave at least an ½" extra overhanging the sides and transom. Now, remove the marked sheets and cut the bottom pieces from them. Replace the three panels on the boat chines and assembl the sections as though they were to be nailed to the bottom. At every join where two plywood sheets come together, mark with a pencil or piece of chalk the exact position of the seam on the plywood sides. These marks will serve in guiding the placement of floor timbers. Floor timbers will be placed at every seam and will act as butt blocks on these surfaces. Remove the bottom panel sections and fit three floor timbers tight to both chines where the bottom seams meet. The floor timbers can be made of any lumber between 2" by 4" to 4" by 4", and of the appropriate lengths. When fitting these floor timbers, it is important to bevel the ends so that they will be tight to the wood chines in all places. This task is difficult because each floor timber is beveled at both ends. (see figure 9). Once the three floor timbers are cut out, bed the ends with roofing tar or glue, and nail them in the exact positions marked on the plywood sides. Nails should be 3" common galvanized nails. Nail from the plywood side into the floor timbers. The timbers should all be level with the chine and plywood sides at each position. Two nails driven into each end of the floor timber are sufficient. If too many nails are used the floor timber will split. If large lumber is used for the floor timbers, such as 4" by 4" stock, four nails for each end are sufficient. Refer to the boat plans for an example of spacing the floor timbers.

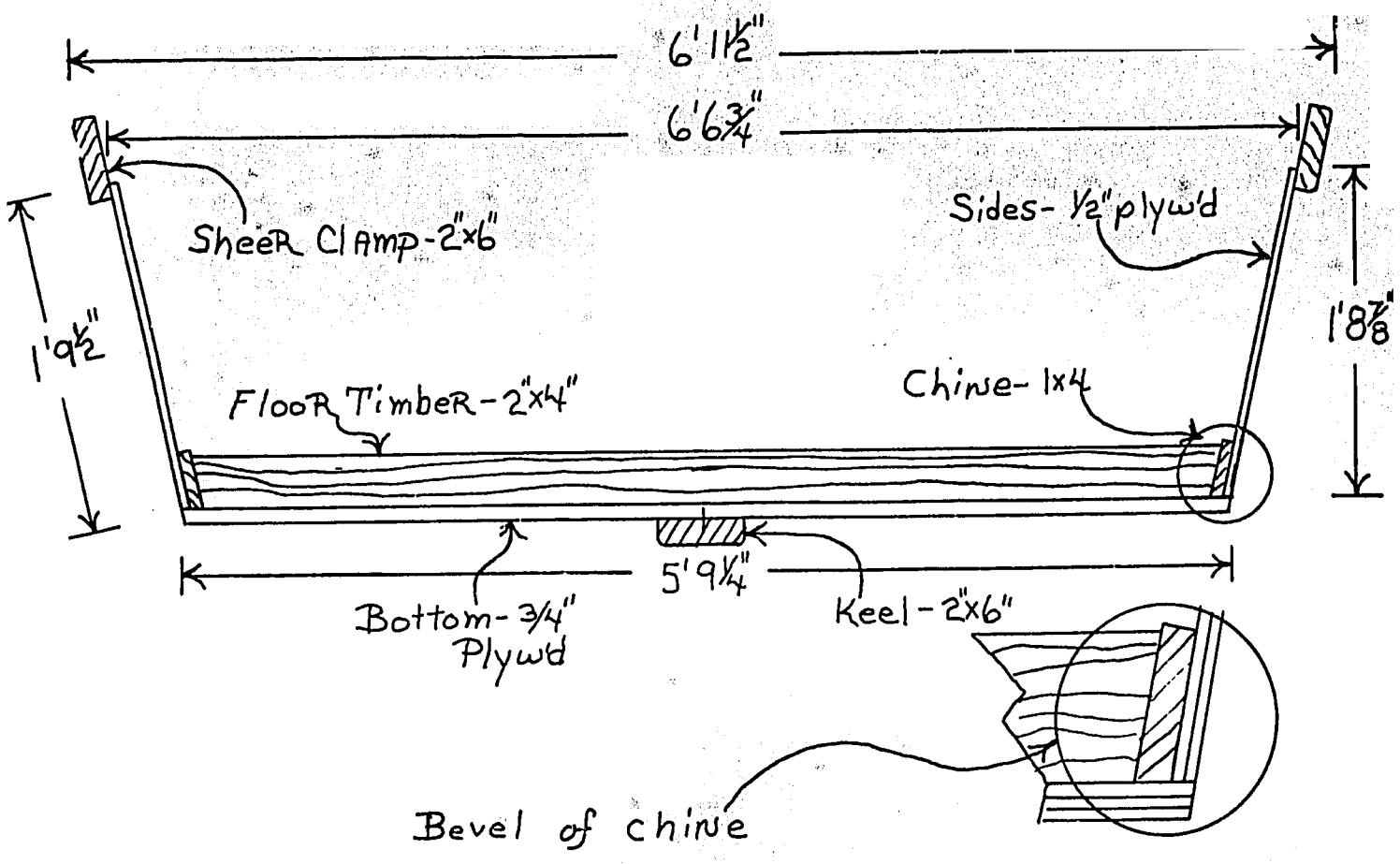


Figure 9 CHINE-FLOOR TIMBER ASSEMBLY
Note: the sheer clamp (rail) and keel are also shown.

Once the timbers are in place, and the stem, chines, and transom made flush, the bottom panels can be glued and nailed. In this step, a substantial amount of waterproof glue is prepared and materials made ready. Next, generous amounts of glue are applied to the stem, floor timbers, chines, plywood side edges, and transom. Make certain that there is a glue bond on all of these surfaces. Voids and uneven glue distribution may cause leaks. Once glue has been applied, place the three pre-cut bottom sections over the boat in the proper position marked by the floor timbers. Apply glue to the plywood edges to be joined over the floor timbers and have each timber evenly lap the two sheets to be joined. Push all these sections together to make a tight fit. Glue

should be pushed out on all of the bottom plywood seams. This gluing should ensure a thorough watertight seal after nailing. Quickly nail all three bottom panels to the chines, stem, transom, and floor timbers. Nails should be 2½" galvanized common nails spaced every 2 inches, and recessed 1/8". A total of approximately 300 nails will be needed to nail all glued surfaces. Be sure to avoid placing nails too close to the edge, especially on the floor timbers. It is important to complete the nailing process before the glue begins to dry. Two people are usually needed for this step; one to nail, and the other to hold the bottom panels in place. It may be necessary to place weights on the plywood to bend it over the chines in some places. Large rocks or stones will usually help if this need should arise. It is very important that nails should be angled so that they are driven into the chine and not through the sides. (see figure 10).

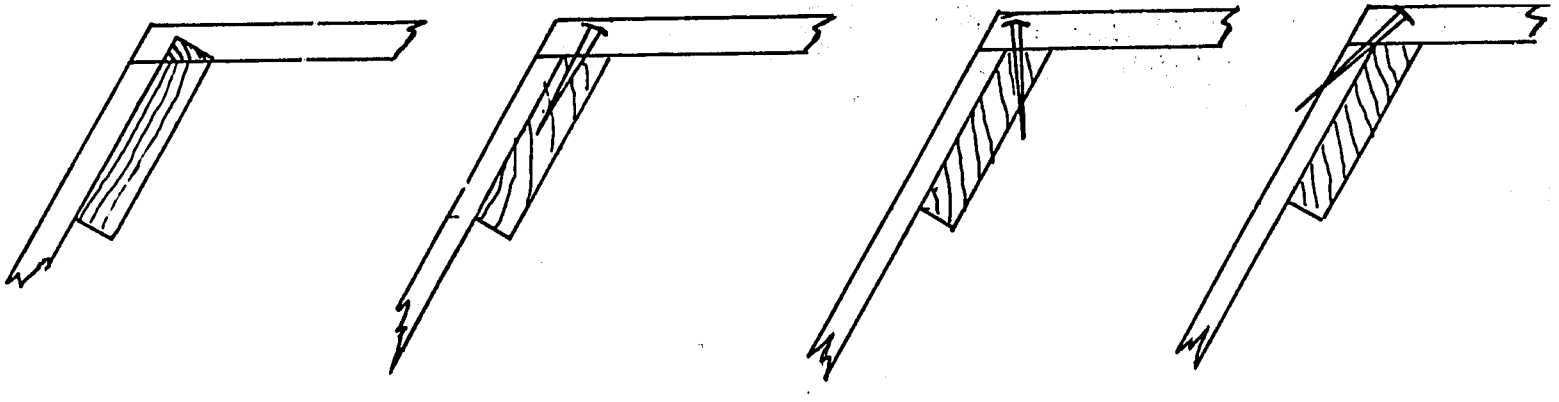
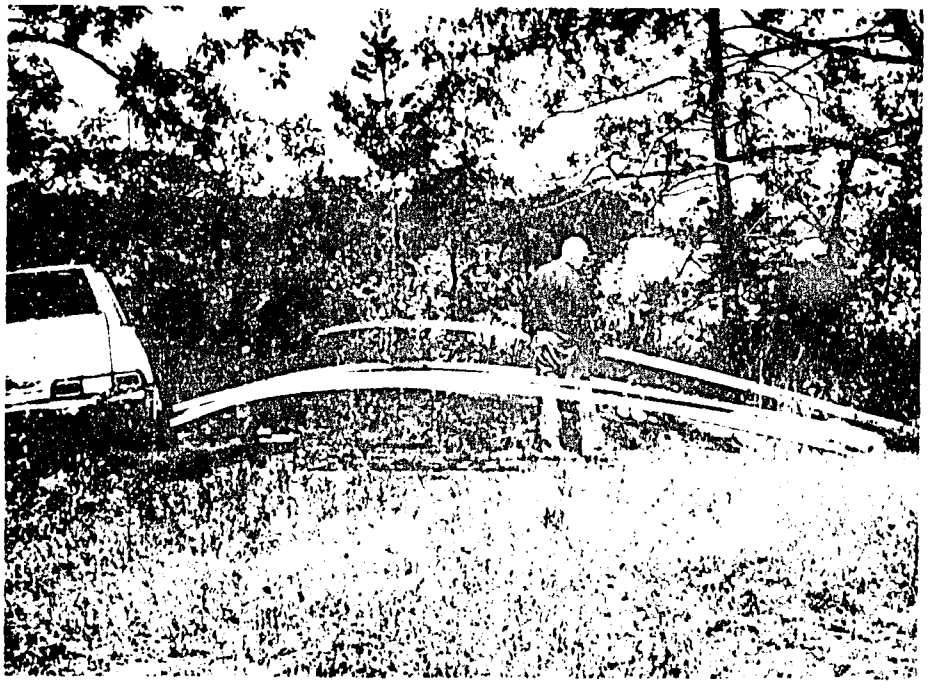


Figure 10 PROPER NAILING OF THE BOTTOM

If a nail does go through the side, pull it out immediately. Reset in the same hole a new nail, covered with glue and driven at a slightly different angle. The excess glue should seal the previous nail hole. The second person

should watch for misdriven nails. After the bottom is nailed, allow the glue to dry before distrubuting the skiff.

After the bottom has dried, a 2" by 6" by 14' long keel is bolted on the bottom in the center of the boat with ¼" galvanized bolts 3" long every ten inches. The keel should have a bend in it to approximate the shape needed. The bending can be done over a period of days by applying weights, such as stones, at one end. (see photograph 5 and figure 11).



Photograph 5 EARL BROCKWAY REMOVES A RAIL AFTER BENDING

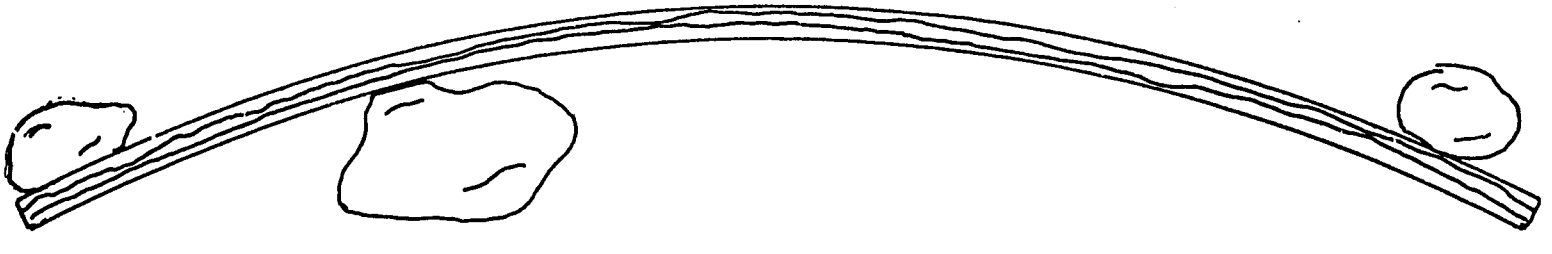


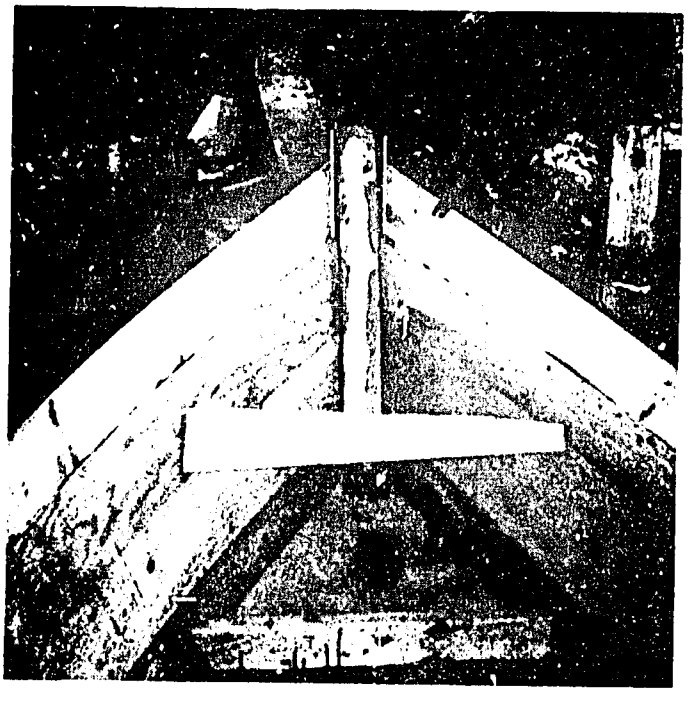
Figure 11 BENDING LUMBER WITH STONES

If bolts are unavailable, large 3" galvanized nails will suffice, but be sure that each nail end is bent over. If nails are used, they should be driven from underneath the vessel so that the bentover nail end is on the keel. Before the keel is attached, a layer of roofing tar is spread on the keel and plywood bottom. Do not glue the keel to the bottom plywood. This mistake would cause additional work if the keel should ever need to be replaced. Once the keel has been properly bent and the roofing tar has been applied, place the keel on the boat bottom and drive two 3" galvanized nails into the stern, the three floor timbers, and transom. Heavy weights, such as large rocks, placed on the keel will make it lay flat on the bottom. Drill holes into the keel and bottom plywood, then bolt the partially-nailed keel to the boat. (see photograph 6).

Photograph 6 LARGE SKIFF WITH KEEL IN PLACE
Note: use appropriate washers with bolts

Once the keel is in place, the boat is ready to be finished. Before turning the boat over, fasten three temporary braces to the plywood sides in

order to keep the boat in the correct shape. The bracing is quickly accomplished by placing three 2" by 4" pieces of lumber from side to side above each floor timber. There is no need to bevel these pieces as these braces are only temporary. The braces should fit tightly, but not so tightly that they distort the sides. Do not bang the braces into place. Nail the braces to the plywood sides about 6 inches below the top edge with one nail at each brace. Leave the nail heads exposed so that the nails can be easily removed. Once the braces are in place, carefully turn the skiff over. Sudden or sharp falls will crack the glue lines and ruin the waterproof seals. (see photograph 7).



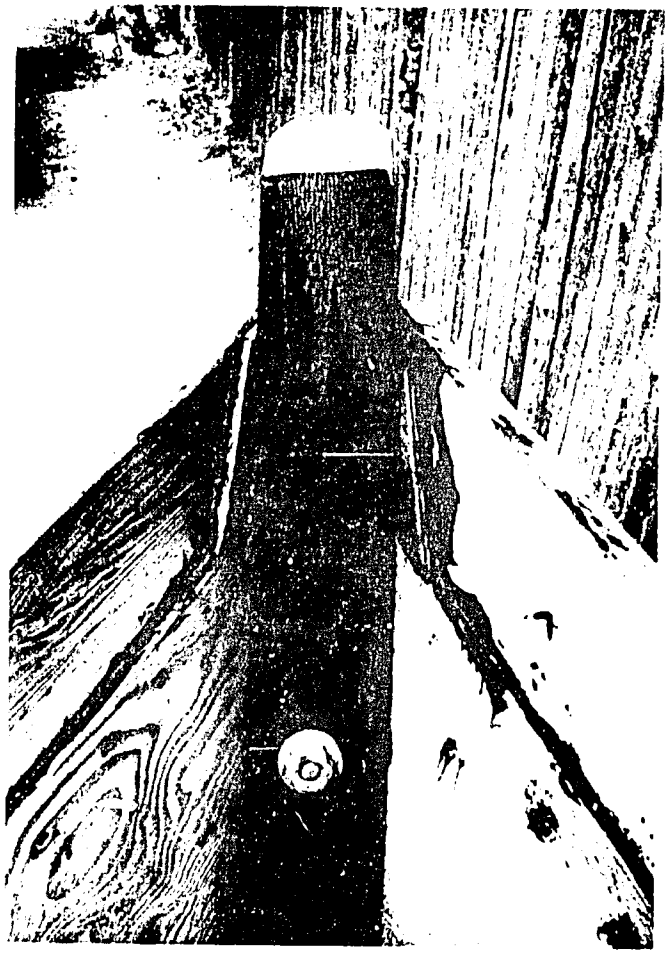
Photograph 7 TEMPORARY BRACE IN BOW

Note: Filler blocks between the stem and rails are present in this photograph.

Next, the rails are fastened to the plywood sides. The rails give the skiff strength. The first step in this process is to draw a line 1¼" down from

the top of the sides on the outside of the boat. A piece of 2" by 6" by 16' long stock will be placed along this line, overlapping the plywood sides. The rail should have a bend in it to approximate the curvature of the sides. Bend the rails in the same manner as the keel. Once each rail is bent to the appropriate shape, bed the plywood edge with roofing tar and nail the rail to the side from the plywood edge with 1½" galvanized spaced every two inches. Approximately 100 nails will be needed for each rail. Four ½" thick plywood filler blocks will need to be cut and placed at the stem and transom. These blocks will fill the area above the plywood sides. The blocks will measure ½" by 2" by 4¼" for the stem, and ½" by 1½" by 4¼" for the transom. The four blocks can be cut from ½" plywood scrap that is leftover from cutting the sides. Each block should be bedded with tar and nailed in place with the rail. At the stem and transom, drive in three large nails from the rail. These nails should be heavy 3½" galvanized nails. The nails will provide strength at the transom and stem. Twelve nails are required for this step. (see photographs 8 & 9).

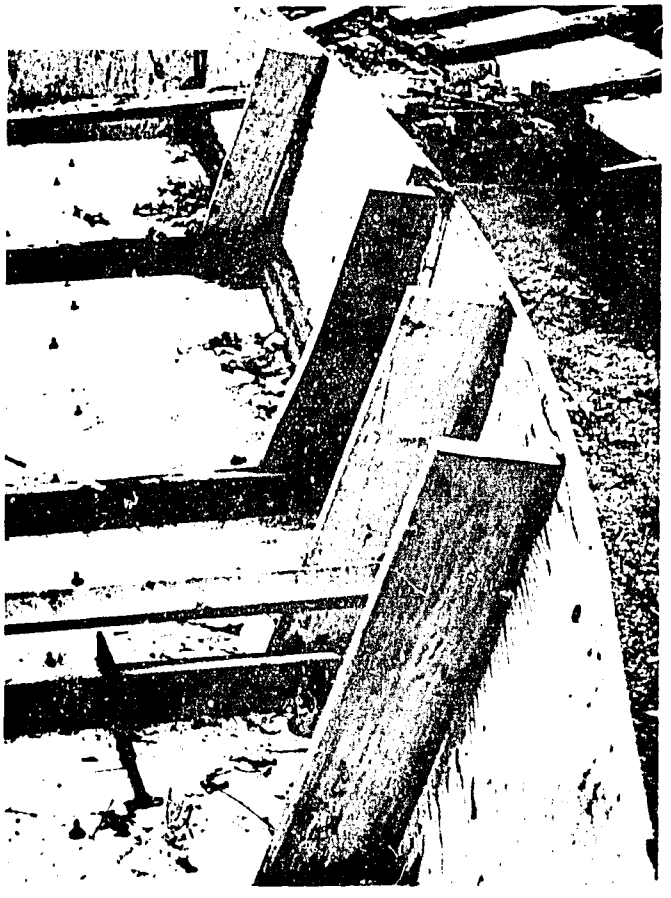
When the rails are finished, the temporary braces can be removed. Frequently, extra strength is needed to keep the sides rigid. If desired, frames can be cut out and bolted to the three floor timbers. Six 2" by 6" frames can be cut and beveled; two for each floor timber. Each frame has to be notched to fit against the chines and plywood sides. This notching is accomplished by cutting off a 2" by 4" piece from the bottom of each frame. Filler blocks such as the ones used with the rails will also be needed. These blocks can be cut from the leftover ½" plywwod. Bolt the frame bottom directly to the floor timber with the appropriate length ¼" galvanized bolts. Two bolts per frame will suffice. The length of the bolt depends upon the width of the floor timbers. Once the frame has been bolted and is against the plywood side,



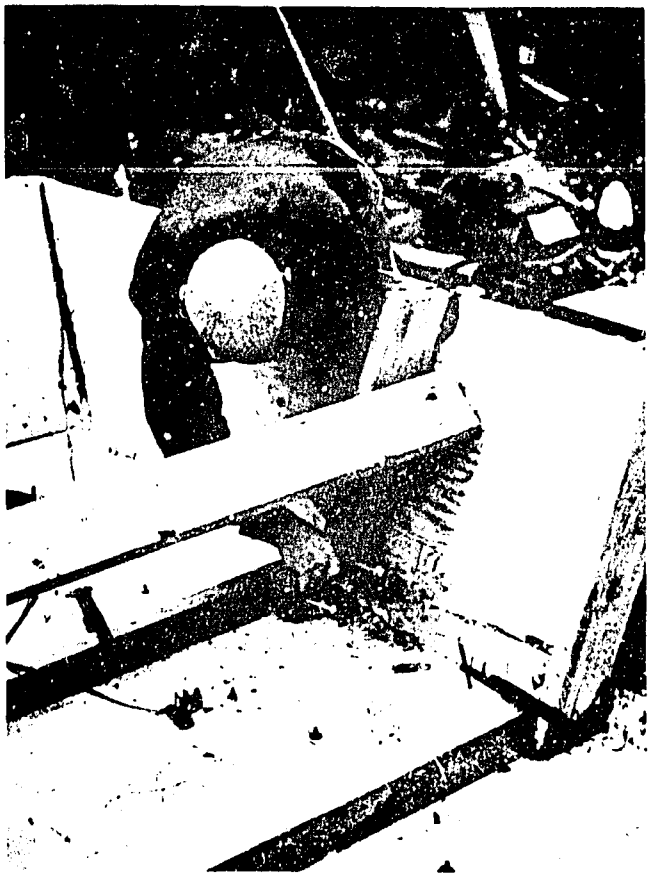
Photograph 8 FILLER BLOCKS AT STEM

Photograph 9 FILLER BLOCK BETWEEN RAIL AND TRANSOM

place a filler block between the rail and frame. The frame is now ready to be nailed to the plywood side. Nail the frame from the plywood side (note; it may be necessary to brace the frame) using 3" galvanized common nails. (see photograph 10). About 12 nails per frame is sufficient. Finish the remaining five frames.



Photograph 10 FRAMES IN A LARGE SKIFF



Photograph 11 EARL BROCKWAY INSTALLS A FRAME
Note: Temporary brace.

In many fisheries, boats are required to have seats. If seats are desired, risers can be added by gluing and nailing blocks of wood to the plywood sides. Thwarts (seats) are then nailed into the two opposite risers. (see figure 12).

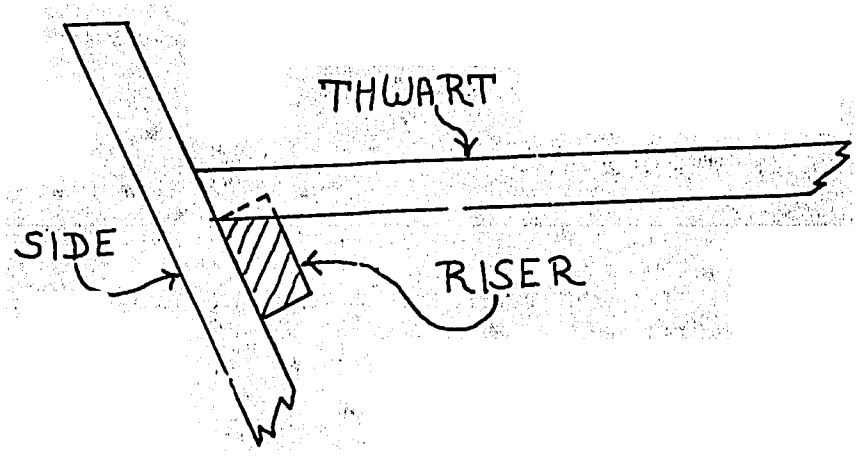
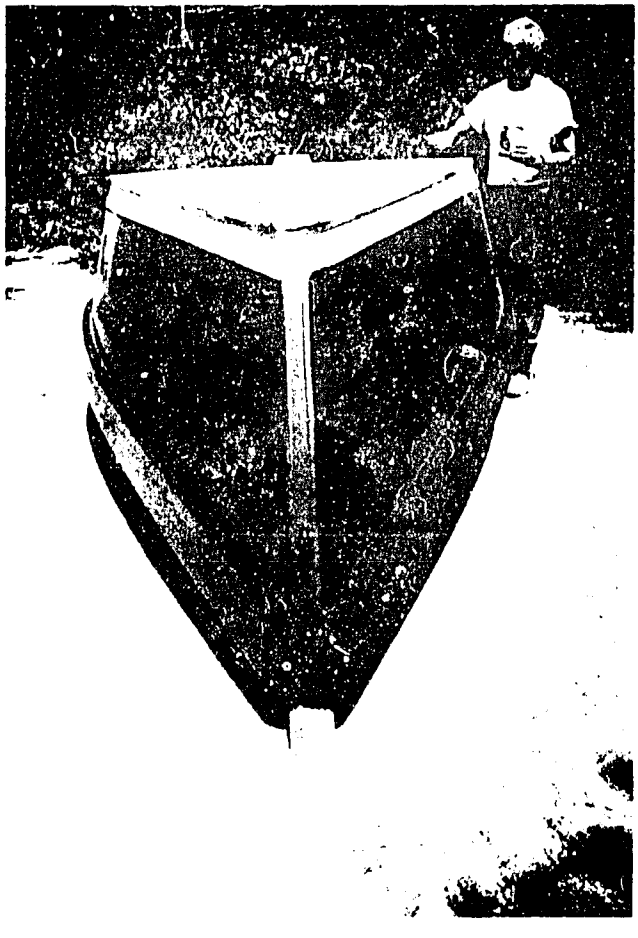


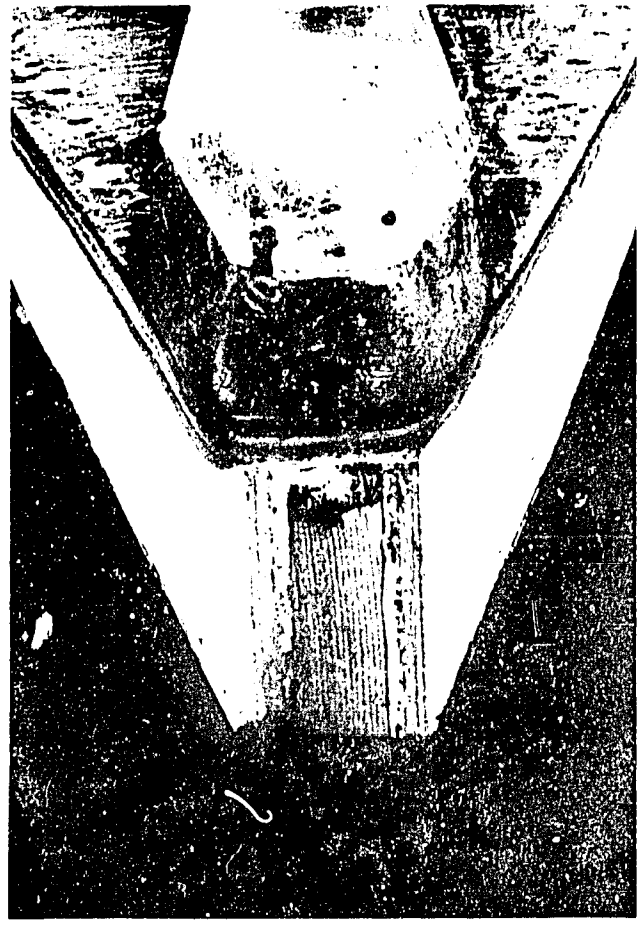
Figure 12 THWART-RISER ASSEMBLY

After frames and thwarts are added, it is now time to repair any of the plywood surfaces that are defective. Defects are often found on the "C" side of the plywood sheet. Most often these defects are small voids where core material is absent, or dry knots that will easily fall out, or that are loose on the surface veneer. The "A" side should have a clear veneer, or knots should have been cut out and repaired with a veneer patch. Polyester marine resin (glue) (a product associated with fiberglass boatbuilding) can repair most plywood defects. The resin is usually mixed with a catalyst or "hardener" before immediate use. It is best to mix small portions of the resin and, using an old paint brush, paint the resin over defects to fill and seal them. (see photographs 12 & 13). In a situation where resin is unattainable, epoxy or waterproof glue will work. On seriously defective sheets such as "C" and "D" grades, the use of resin can make these sheets usable. High quality interior sheets of plywood should only be used as a last resort when no other plywood is at hand. At least two coats of resin would be needed to get satisfactory

results from these plywood panels. The authors do not recommend the use of nonwaterproof glue (interior) plywood panels for boatbuilding. After plywood defects have been repaired, fill all nail holes with a small amount of resin or waterproof filler. (see photograph 14). Then, sand the filled holes and knots until they are flush with the surrounding plywood. Trim excess plywood to about ¼" from the sides and transom. Smooth the stem and bow plywood sides also. The plywood edges should be sanded smooth and curve slightly. Sharp plywood edges will chip and flake, and will not hold paint.

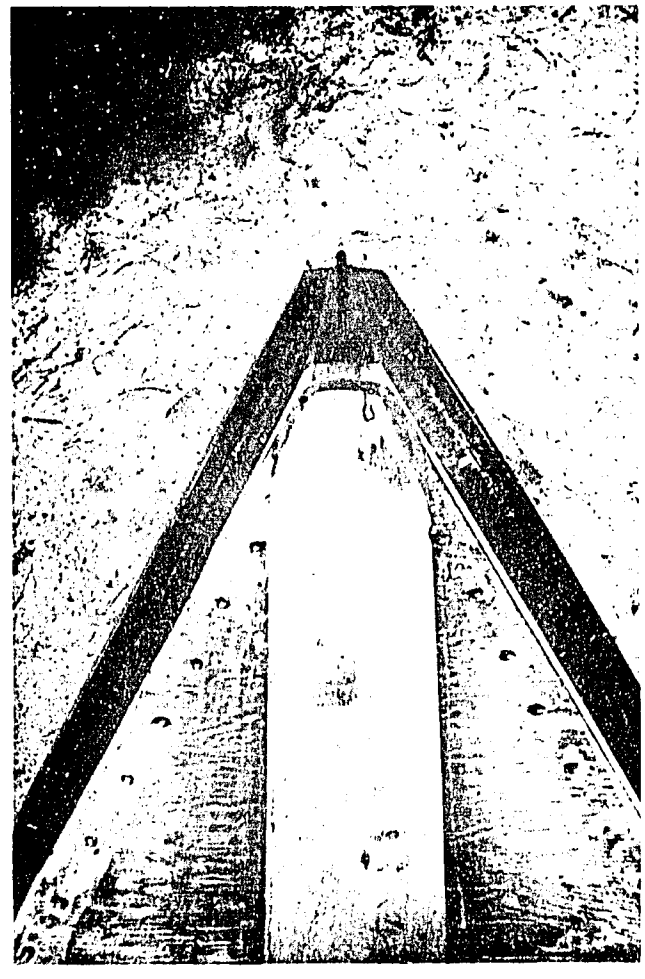


Photograph 12 APPLYING RESIN TO PLYWOOD DEFECTS



Photograph 13 KEEL, STEM, & SIDES
Note: All plywood edges have been sealed with resin.

Repair any visible voids or defects in these edges with glue and slivers of plywood. It is very important to seal all plywood edges with paint. This sealing will prevent plywood failure and ply delamination. Scrape and remove any excess tar and glue. All wood surfaces should be sanded (surface scratched for paint adhesion) and be completed free of dirt in preparation for painting.

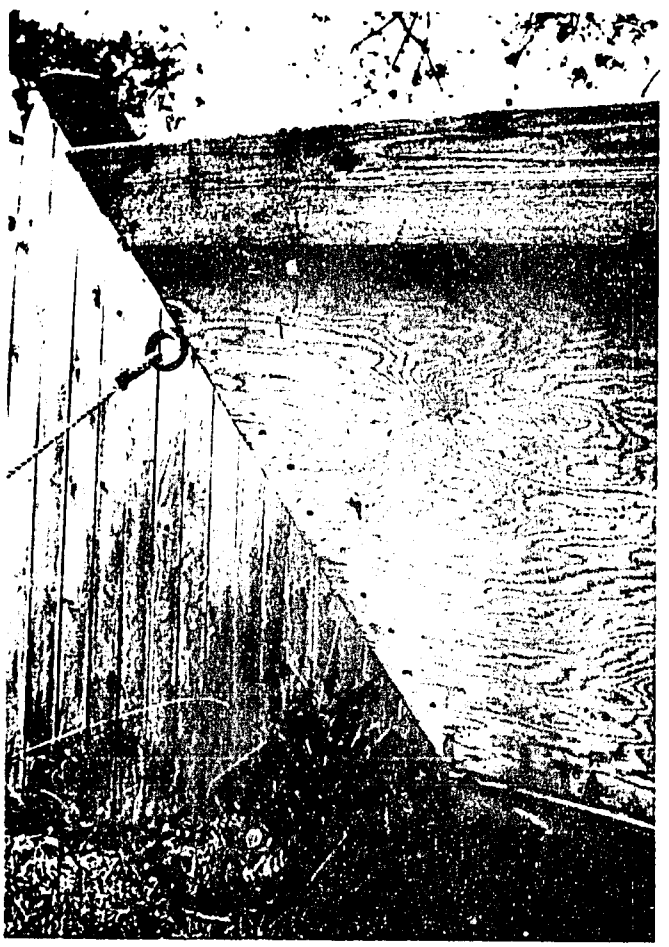


Photograph 14 KEEL AND BOW SECTION
Note: nail holes are filled with polyester resin.

In many climates, damage to wood from marine worms can be substantial To protect the skiff from shipworms, use a copper-based stain or copper-based wood preservative. Paint the hull with this wood preservative stain. The

stain should go immediately into the plywood and floor timbers. It should not lay on the surface of the wood as this treatment is not a paint. Two applications will provide additional protection. This protection will lengthen the usable life span of any wooden vessel.

The last step is to cut off the excess stem. Using a hand saw, cut a level line. Leave about 4 inches of stem above the rails (see photograph 15). Lastly, sand the stem so that the edges are rounded.



Photograph 15 STEM
Note: Keel, rail and bottom plywood are visible.

Once the skiff is completely sanded it is ready to be painted. Any marine enamel or lead-based paint can now be applied. The first application should be thin. The second and third coats should not be thin. For best results, sand the skiff after each application of paint. The sanding will allow each coat of paint to adhere to the previous application. Finally, the bottom and waterline (about 5 inches on the plywood sides) should be painted with a copper paint. This paint will protect the plywood immersed in water. In areas where shipworm damage is slight (such as in freshwater), copper paint need not be applied. In a warmer climate, worm damage can be severe. In this case it is advisable to check the skiff occasionally for shipworms. Skiffs that are hauled out of the water daily and turned over will suffer much less damage because the worms' larvae die when the plywood veneer surface dries. If the builder is unsure about the presence of shipworms or other marine borers, ask local fishermen about them. An untreated piece of wood placed in the water for at least 40 days will show whether or not worms are present. Every 3 days, slice a piece of wood off and examine it for worms. In some regions, worms and marine bores are only present in the summer. To be certain, examine pilings, docks, and trees that have been in the water for several seasons. Every skiff should be hauled out of the water to dry completely and be repainted at least once a year.

The color of the paint used is of little importance. In temperate climates dark colors are preferred, as these will allow the skiff to absorb heat in the winter and melt any ice that may have formed. Just the opposite is most likely true in tropical climates. Once the paint has dried, the boat is ready for fishing.

This pamphlet includes two additional plans from Simplified Boatbuilding. The 15'6" skiff could be used for summer offshore fishing. There are several advantages to

cutting a well for an outboard motor in the stern of the boat. The well creates a flat section aft of the propeller which helps to keep the stern from squatting, and protects the engine while working in close quarters. Both the well in the stern, and the narrower transom, protect the skiff from being caught in a following sea. (see figure 13 for construction details). In order to provide strength, 2" stock should be used for the sides of the well.

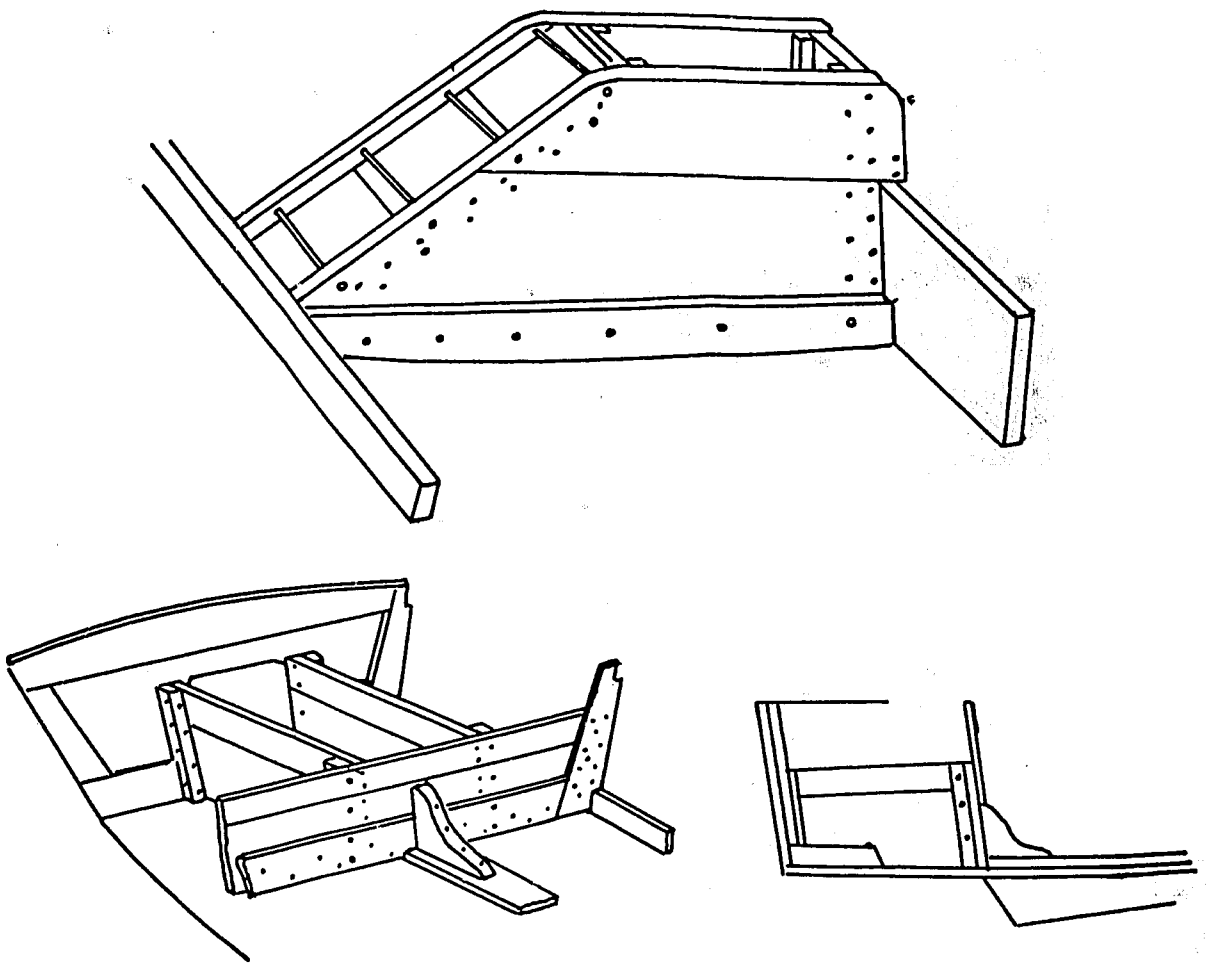


Figure 13 OUTBOARD WELL
From Simplified Boatbuilding

The 19' 6" offshore trolling skiff is a displacement type of boat. This skiff maintains moderate speeds, rides with an easy motion in choppy water, and boasts a good carrying capacity. The raised sheer forward and the

short foredeck provide safety in head seas. The outboard motor well in this skiff is placed forward (see figure 13 for construction details) Another useful operational feature of this skiff is the detachable steering shelter, which is placed just forward of amidships and supported by two thwarts. Though this shelter provides only sitting headroom, do not raise the roofline. If a trolling mast is required, the plans show how to place one just aft of the center of buoyancy so as not to upset steering. A large net platform could be built aft for seine fishing, or a small drum installed for dragging. This skiff would be suitable for many different types of fisheries. A 12 to 15 horsepower outboard engine will economically drive this hull at about 7 knots.

MATERIALS LIST

Number	Description	Purpose
4	sheets of ½" "A.C." Exterior grade plywood	sides, butt blocks, filler blocks
3	sheets of 3/4" A.C. Exterior grade plywood	transom, bottom
1	4" x 4" x 6' native lumber	stem
2	1" x 4" x 14' native lumber	chines
2	2" x 6" x 16' native lumber	sheet clamp rails
1	2" x 6" x 14' native lumber	keel
1	2" x 4" x 15' native lumber	floor timbers
Optional:	native lumber for frames	one sheet of 3/4" A.C. plywood
	native lumber for thwarts (seats)	
500	1¼" galvanized nails	transom, butt blocks, chines
200	1¼" galvanized nails	sheet clamp rails
300	2½" galvanized nails	bottom panels
60	3" galvanized nails	sides to stem, transom, floor timber
12	3½" galvanized nails	sheer clamp rails to stem, transom
2	gallons oil-based paint	hull
1	quart polyester marine resin	repair defects in ven
2	quarts high quality waterproof glue	glue seams
1	quart roofing tar	non-glue seals
1	gallon copper-based wood preservative stain	hull
1	quart copper-based paint	boat bottom

TOOLS LIST

Number	Description	Purpose
1	14 to 20 ounce hammer	Nailing procedures
1	hand saw	Cutting boat pieces
1	hand drill	Drill holes for keel placement
1	wood rasp	Smooth chines and finish stem
1	drawknife	Shape stem and chines
1	hatchet	Shape stem

Optional:
- one electric or mechanical table saw
- one electric sander
- one hand electric saw
- box plane
- power drill (electric)

GLOSSARY

C-Flex - a type of fiberglass plank consisting of solid rods in a woven fiberglass material

Mold - a rigid frame utilized to keep the shape of hulls in the construction process

Butt Block - a piece of wood that is used to join two lengths of wood by overlapping both

Skiff - a flat bottomed boat having a pointed bow and a square stern

Scow - a flat bottomed boat with both the bow and stern being square

Sheer - the upward curve of a vessels hull as viewed from the side

Stem - a curved beam at the forward put of a vessel to which the sides and bottom are attached

Bevel - to cut on an angle

Transom - the end or stern of a vessel

Bow - the forward section of a vessel

Chine - a piece of lumber at the intersection of the sides and bottom of a flat bottomed vessel

Keel - a structural beam or member of a vessel that runs from bow to the stern on the center line of the hull.

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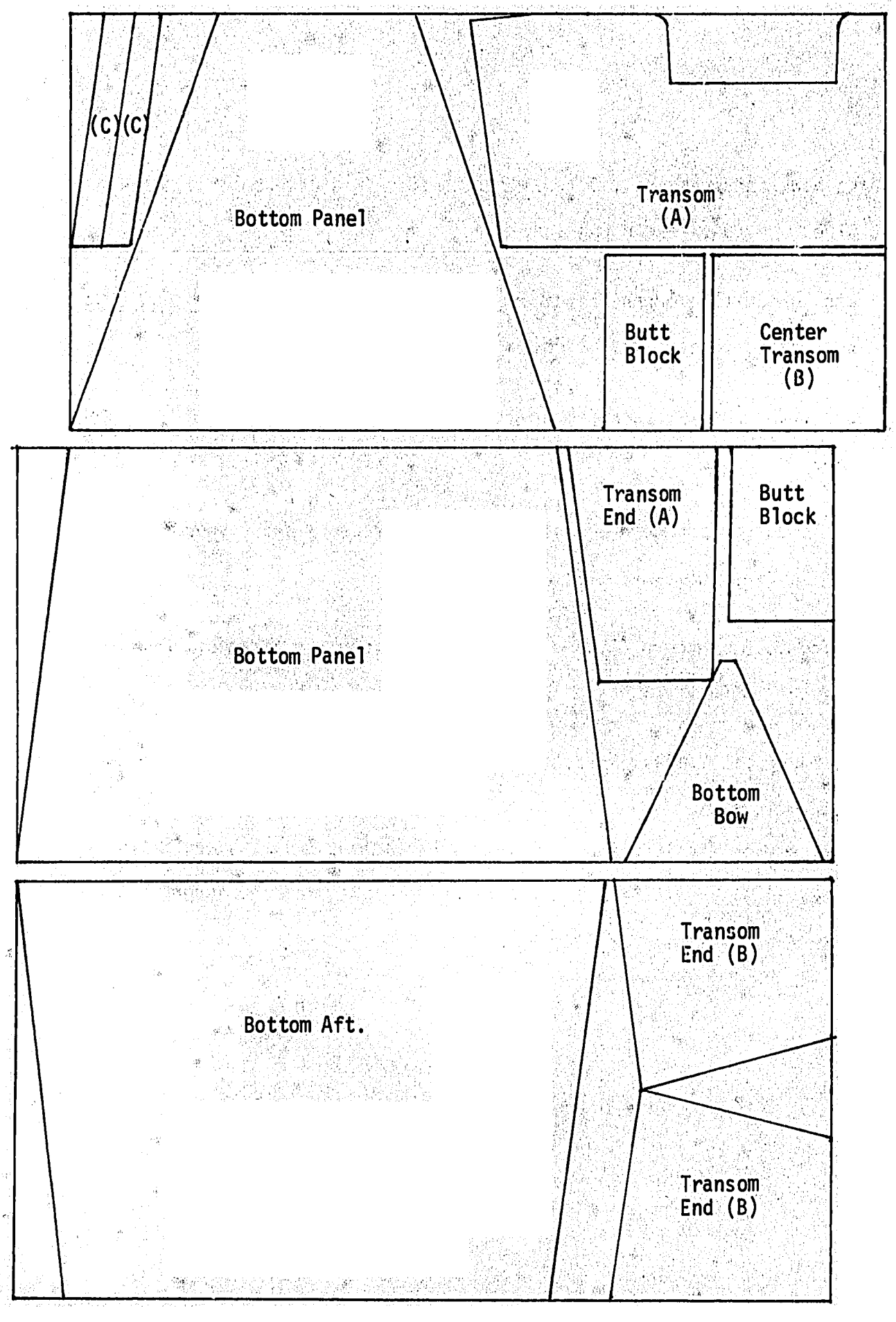
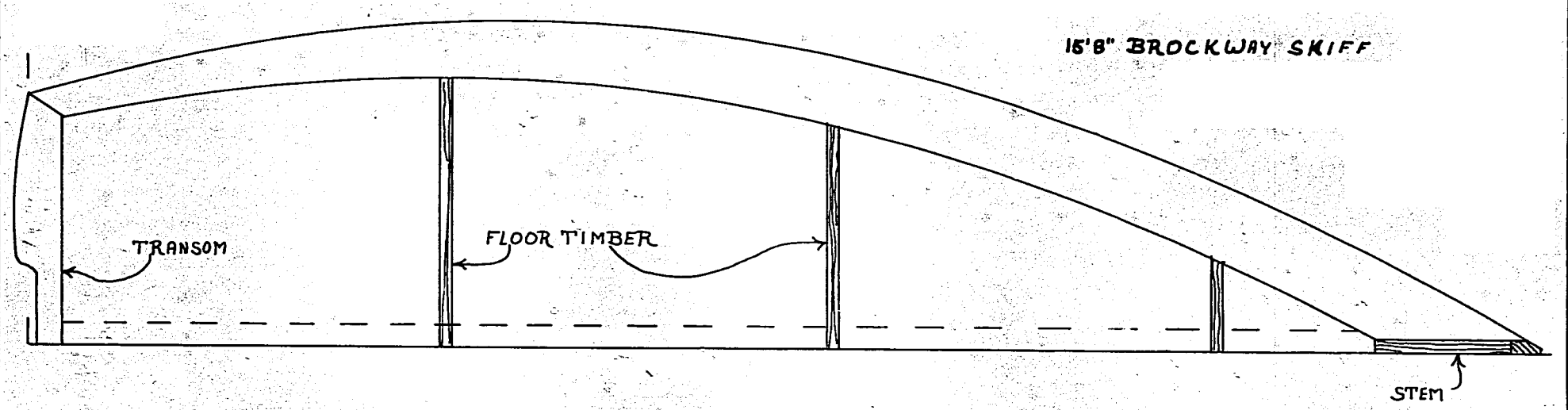
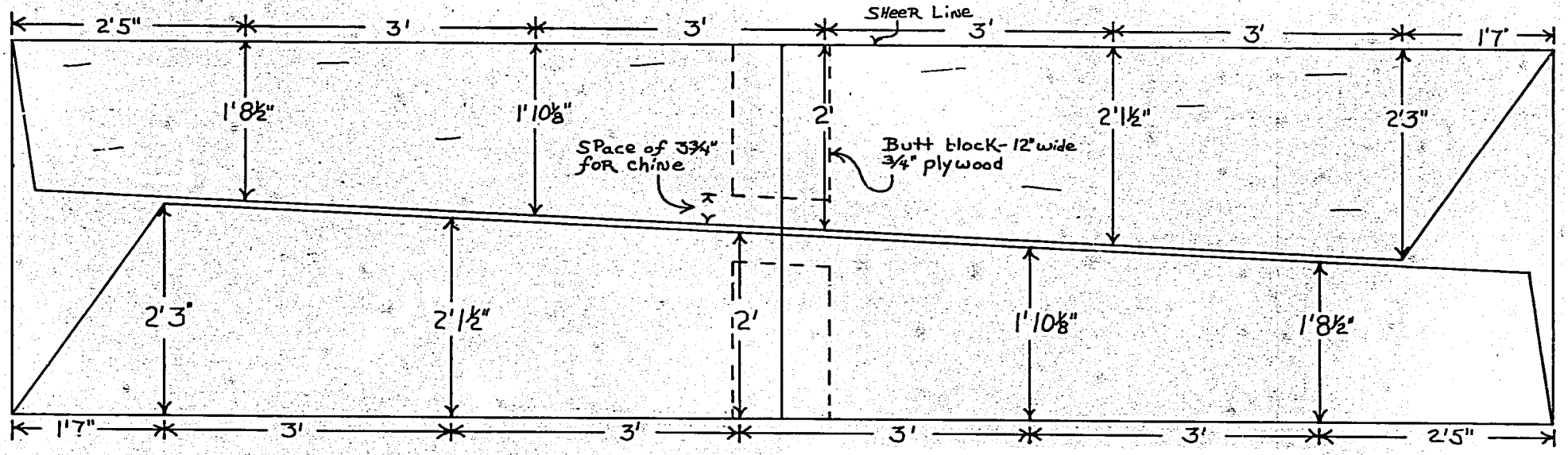
Cutting Plans For Bottom Panels & Transom Sections



15'8" BROCKWAY SKIFF

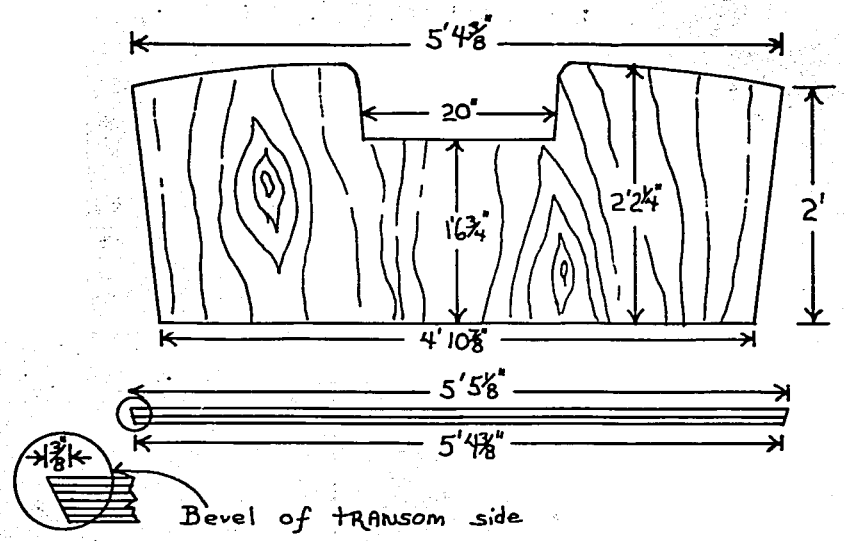


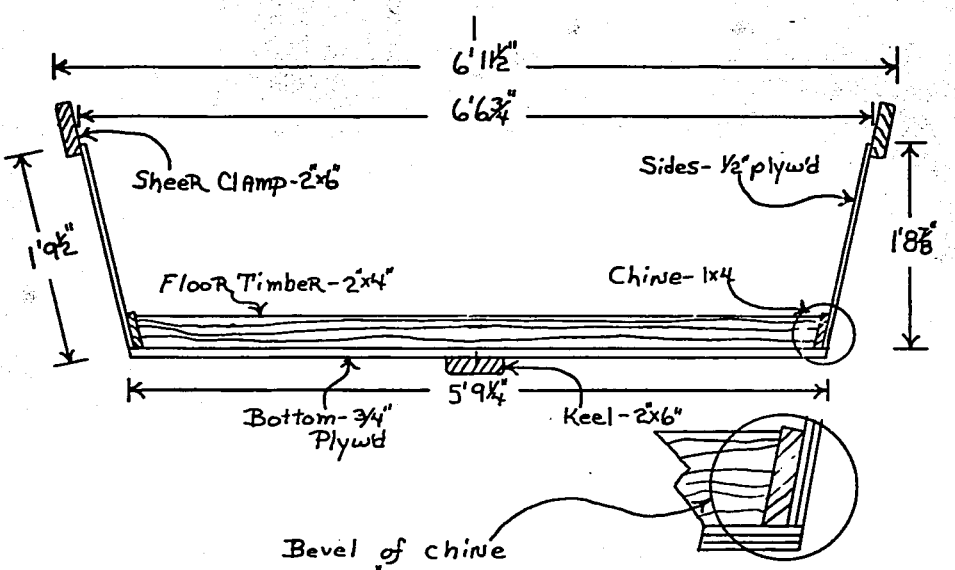
Plywood layout for skiff sides - 4'x16'

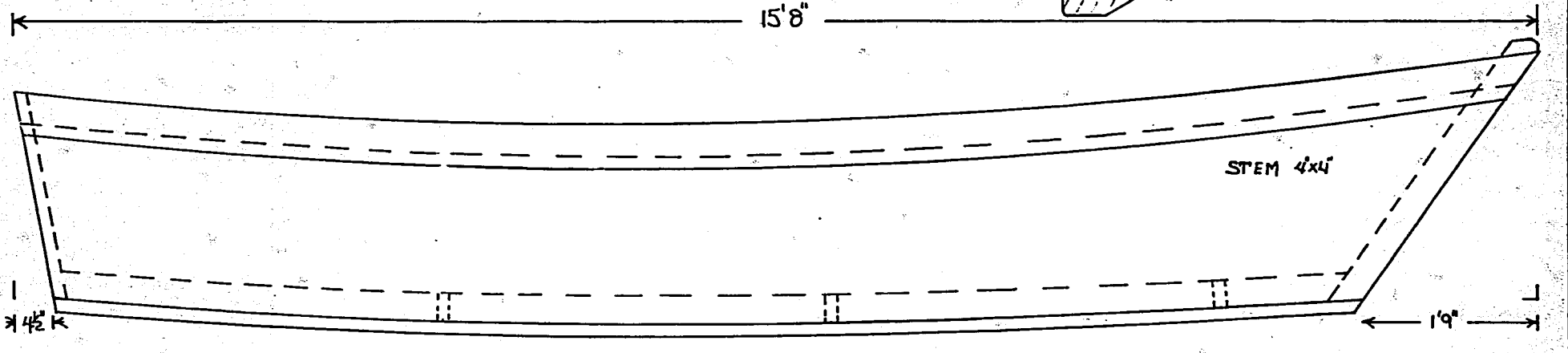


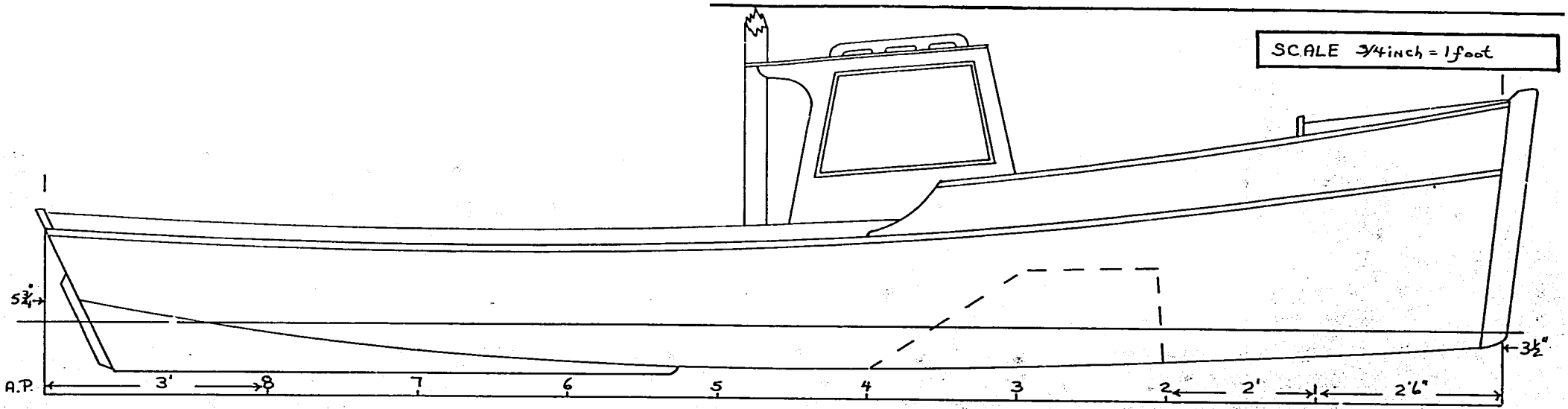
15'8" BROCKWAY SKIFF

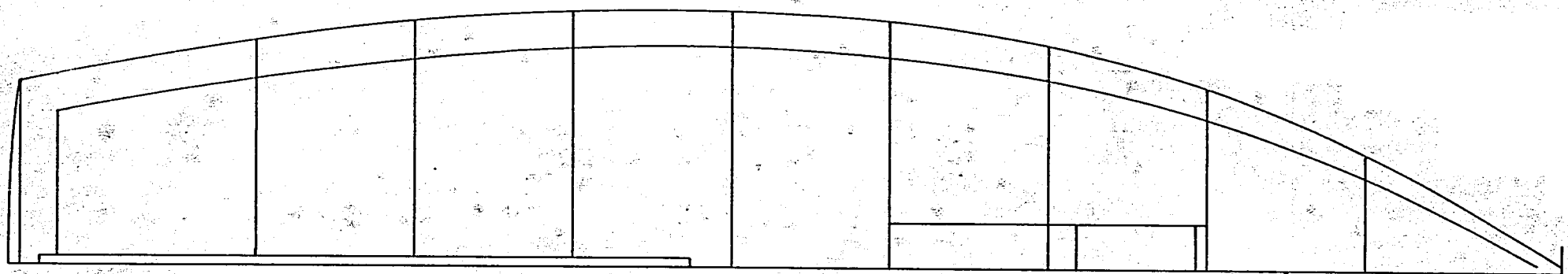
TRANSOM – 2 sheets ¾" plywood glued + nailed



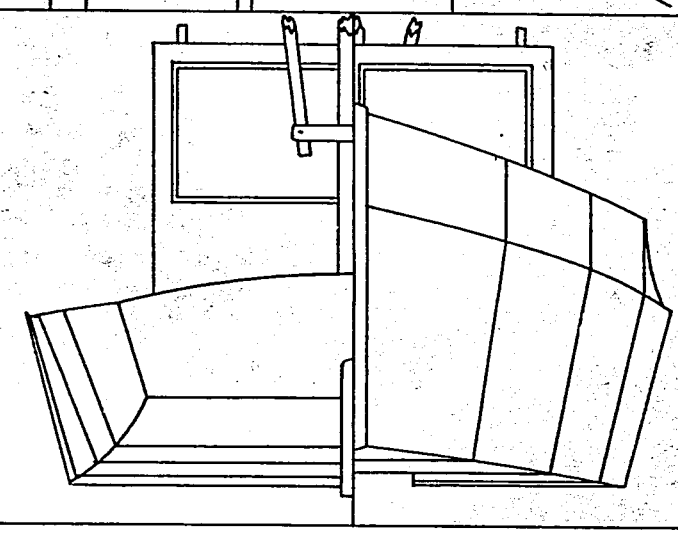




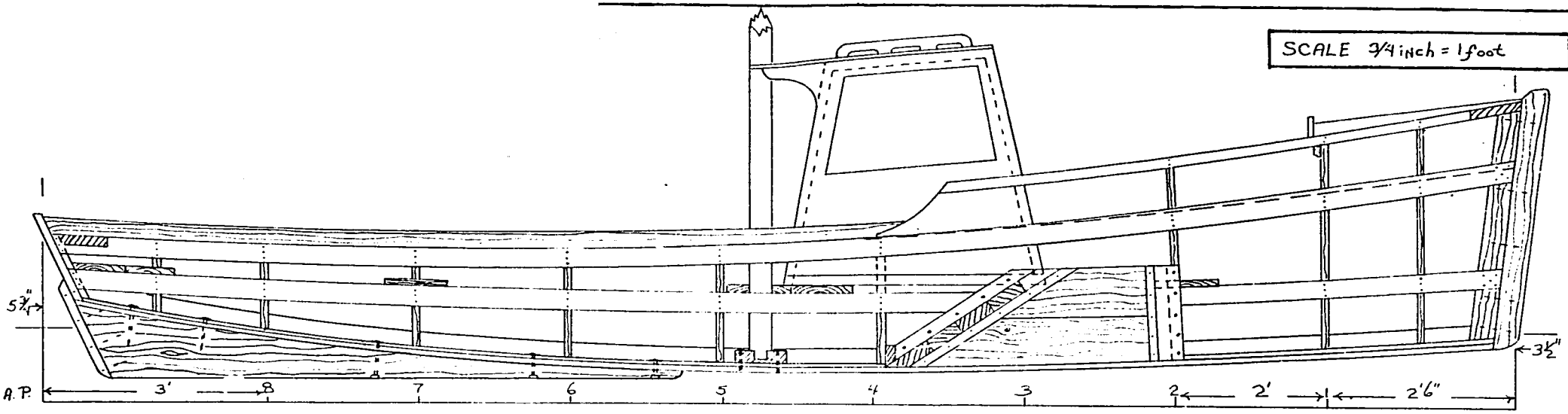


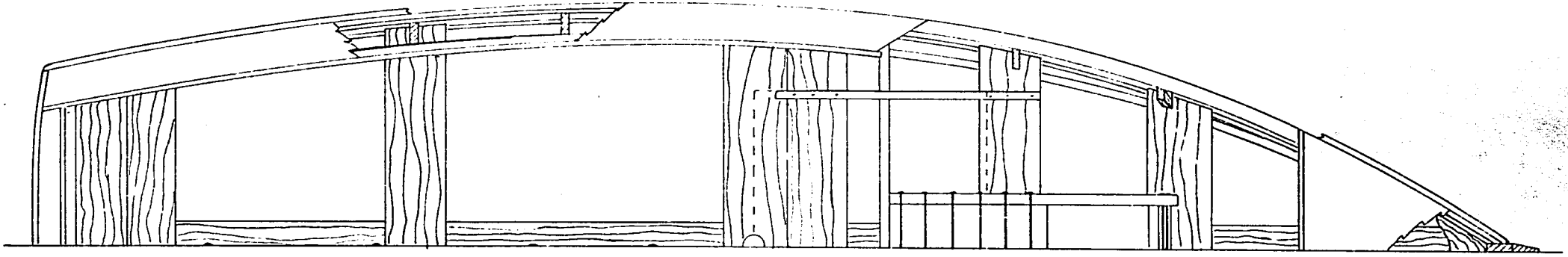


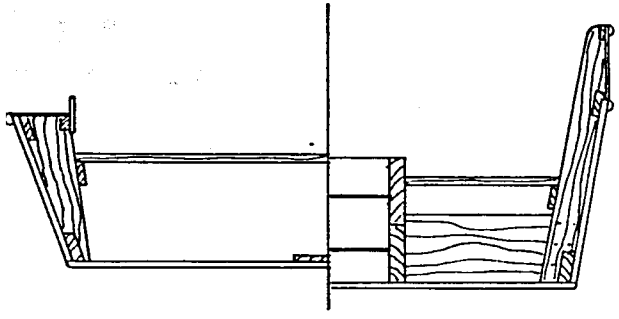
TROLLING SKIFF 19ft. 6in. x 6ft. 9in. x 8½ in.										
OFFSETS IN FEET, INCHES + EIGHTS TO OUTSIDE OF PLANKING										
STA.	A.P.	8	7	6	5	4	3	2	1	F.P.
Heights										
R.D.							3-1-4	3-4-4	3-6-4	4-2-0
SHEER	2-2-6	2-1-6	2-1-2	2-1-2	2-1-6	2-2-6	2-4-6	2-7-4	2-10-4	3-3-0
CHINE	1-3-4	0-9-6	0-7-6	0-6-0	0-5-0	0-5-4	0-5 6	0-6-6	0-8-0	0-9-4
Half-Breadths										
R.D.							2-9-4	2-4-2	1-6-2	
SHEER	2-4-2	2-10-6	3-2-0	3-3-4	3-3-4	3-2-2	2-9-4	2-4-2	1-6-2	
CHINE	1-11-4	2-4-4	2-7-6	2-9-6	2-10-0	2-8-4	2-5-4	1-11-4	1-2-4	



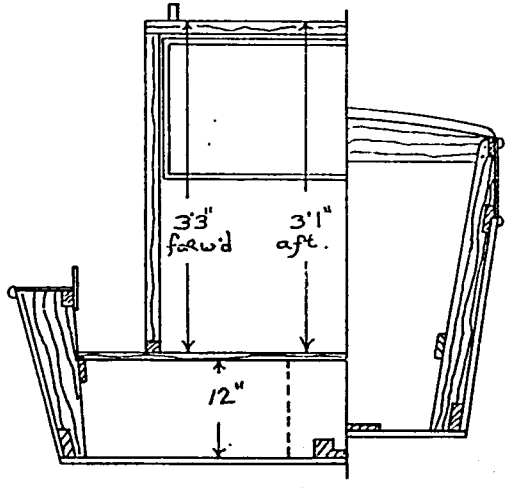
SCALE 3/4 inch = 1 foot







TROLLING SKIFF 19ft. 6in. x 6ft. 9in. x 8½ in.		
MATERIAL SPECIFACTIONS		
Side Plank ¾ in. ply.	Side + Foredeck ⅜" ply.	Coaming ½", Ht. to suit
Bottom Plank ¾ in. ply.	over 1½" x 1½" supports	Steering Shelter ¼" ply.
Side Frames ⅞" x 6" stock	Skeg + Post 1½" stock	over 1½" x 1½" frames
Spaced as shown	Trasom ¾" – ⅞" ply	Motor well 2" Stock
Sheer Clamp ⅝" x 3"	over ⅞" frame	side posts 1½" x 1½"
Seat Riser ⅝" x 3"	Quarter Knee + Br. Hook 1½"	¼" bolts
Chine 1¼" x 3½"	Raised Deck sides ⅜" ply.	Fastenings 1½" – 2½"
Keel Bottom ⅞" x 8"	R.D. Clamp ½" x 2"	F.H. screws or boat nail
Stem Liner 3" x 4"	Covering Board ½" x 2"	Motor well dimensions
Stem Face 3" x 4"	Mast Step 2" x 8" x 10"	to suit 12 to 20 h.p.
Thwarts ⅞" x 10"	Mast 4" x 4" (3½" x 3½") x 12'	engine



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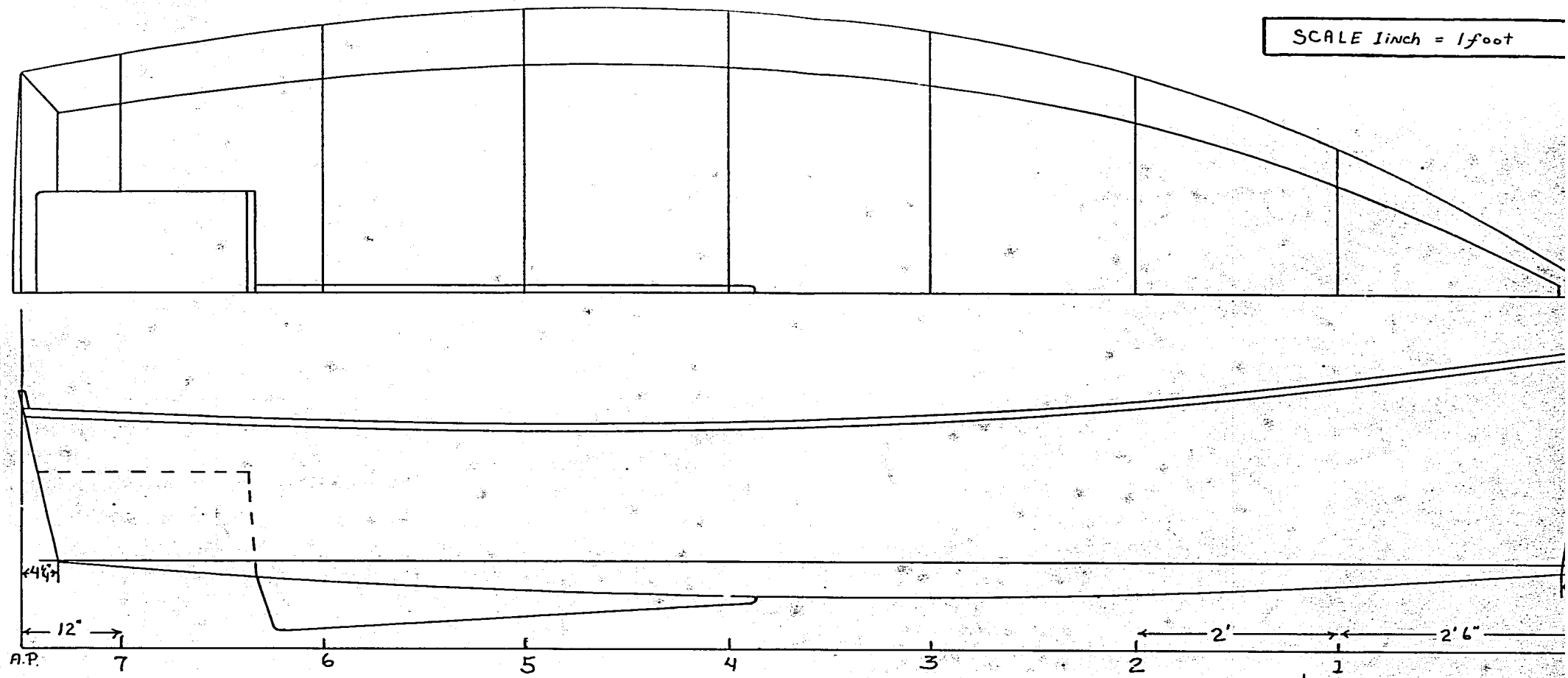
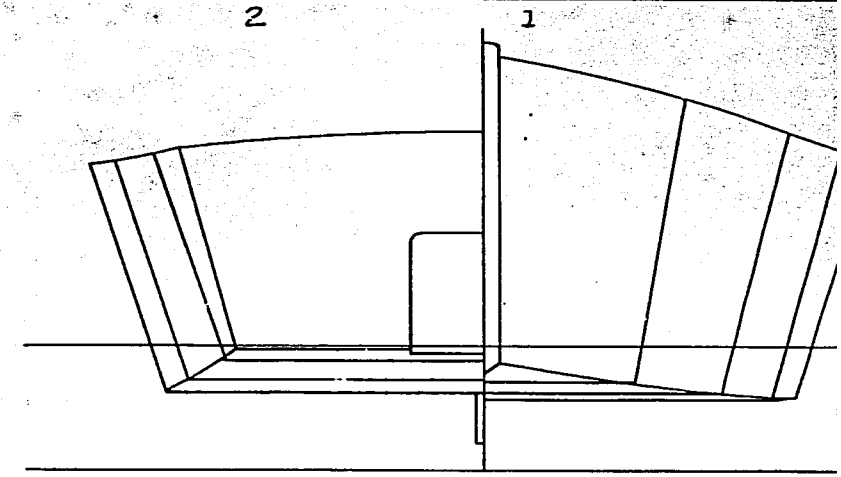
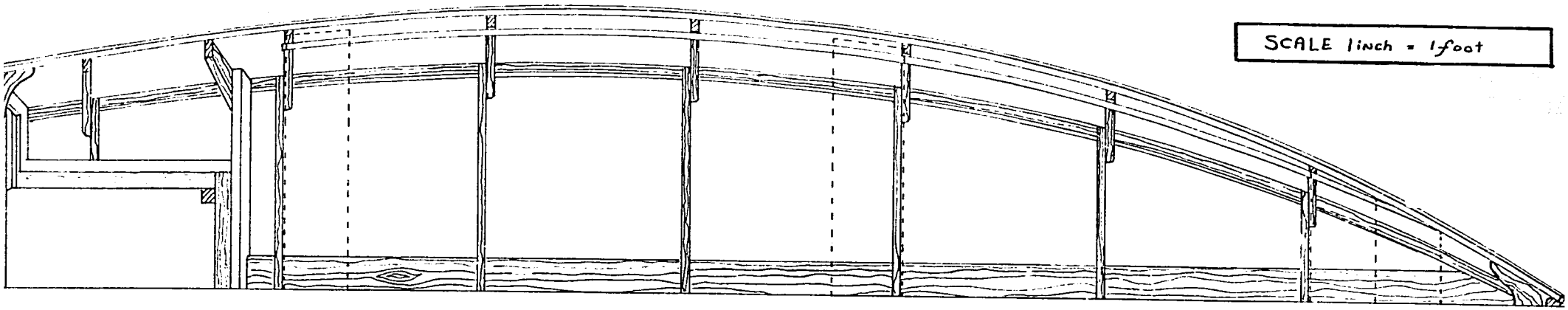
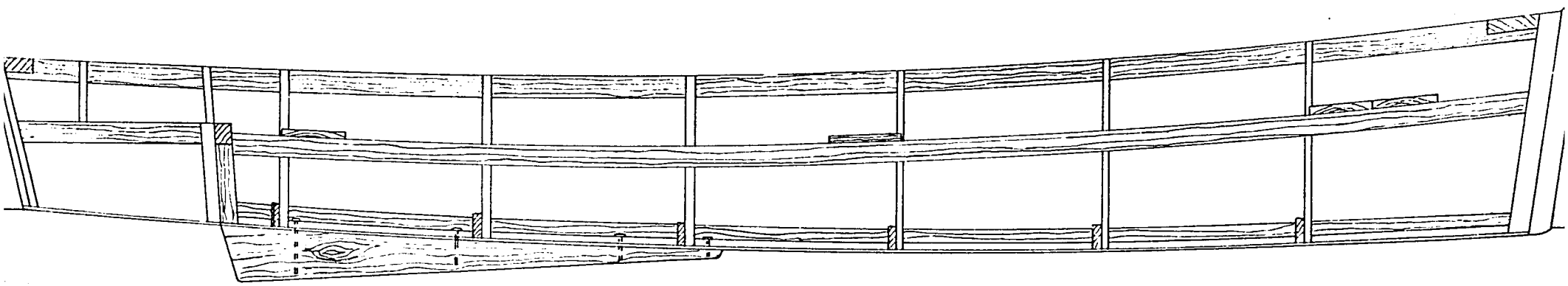


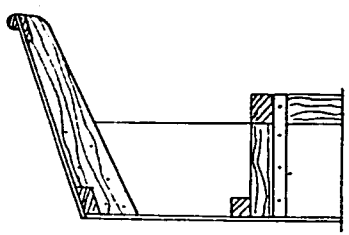
OUTBOARD SKIFF 15ft 6in. × 5ft 9in. × 8½ in.									
OFFSETS IN FEET, INCHES + EIGHTS TO OUTSIDE OF PLANKING									
STA.	A.P.	7	6	5	4	3	2	1	F.P.
Heights									
SHEER	2-4-4	2-4-0	2-3-4	2-3-0	2-3-6	2-4-2	2-6-2	2-8-6	3-0-6
CHINE	0-10-2	0-9-6	0-8-0	0-6-6	0-6-4	0-6-2	0-6-6	0-7-6	0-9-4
HALF-BREADTHS									
SHEER	2-2-4	2-4-6	2-8-2	2-10-2	2-10-0	2-7-2	2-2-6	1-5-6	—
CHINE	1-9-6	1-10-6	2-1-6	2-3-4	2-3-2	1-10-2	1-8-6	1-1-0	—



SCALE 1 inch = 1 foot







OUTBOARD SKIFF 15 ft. 6 in. x 5 ft. 9 in. x 8 1/2 in.		
MATERIAL SPECIFACTIONS		
Side Plank 7/8 in. Plywood	Stem Liner 2 1/2" x 2 1/2"	Breasthook 1 1/2" stock
Bottom PLANK 3/8" Plywood	Stem Face 2 1/2" x 2 1/2"	Quarter Knees 1 1/2" stock
Side Frame 7/8" x 4" taper to 2"	Transom 3/4" Plywood	Motor Well 2" Stock
Bottom Frame 7/8" x 3"	Transom Frame 7/8" x 4"	with 1 1/2" x 1 1/2" parts
Fasten with 1/4" Bolts	Sheer Clamp 1/2" x 2 1/2"	Skeg 1 1/2" x 6 1/2" taper to 1 1/2"
Keel Bottom 3/4" x 8"	Seat Riser 1/2" x 2 1/2"	Fastenings 1 1/2" - 2" Boat Nails
Chines 1 1/4" x 3 1/2"	Thwarts 7/4" x 8"	Dimensions for 10-15 hp engine