June 11, 1963 F. W. KLOPSTOCK ETAL 3,092,850

BOAT CONSTRUCTION

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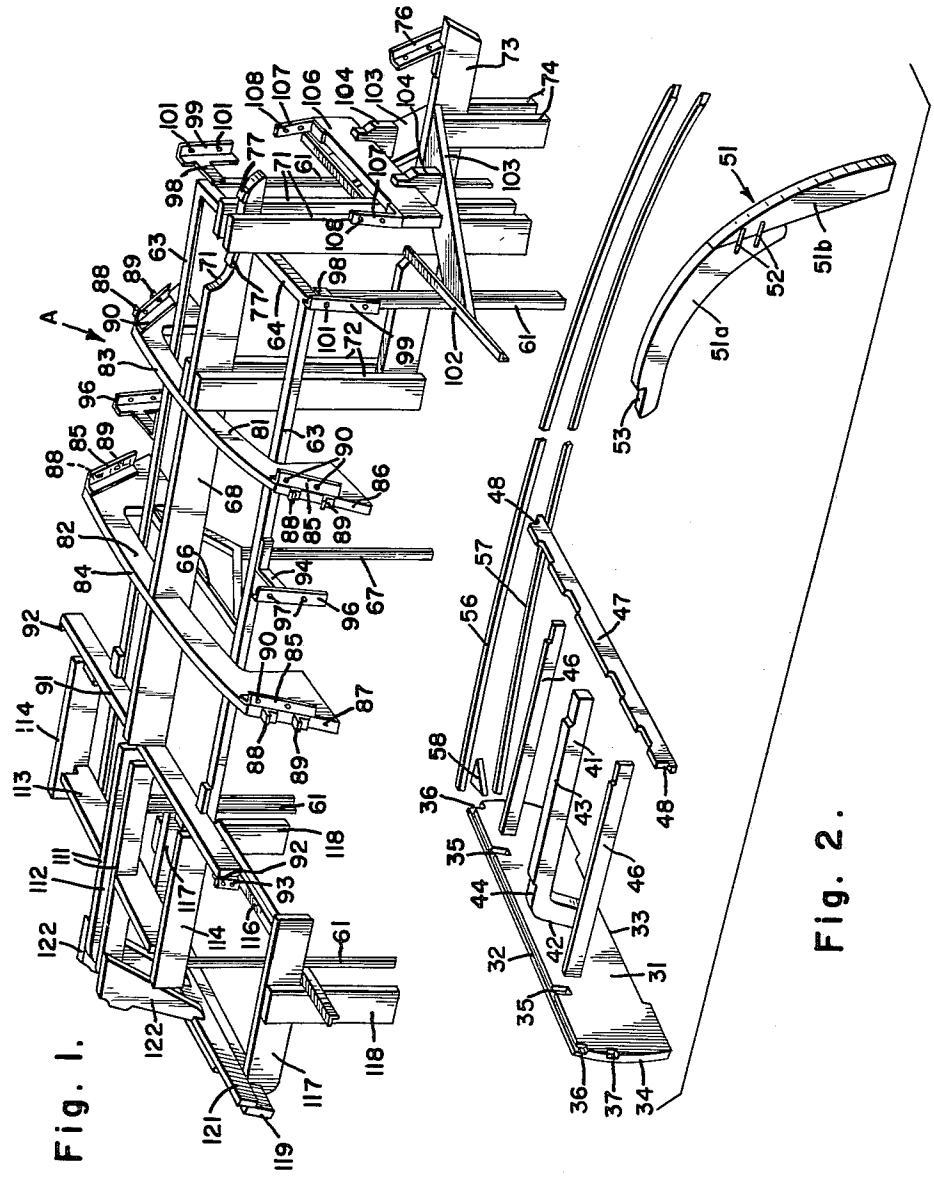


Fig. 1.

Fig. 2.

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June 11, 1963 F. W. KLOPSTOCK ETAL 3,092,850

BOAT CONSTRUCTION

Filed Aug. 10, 1959 6 Sheets-Sheet 2

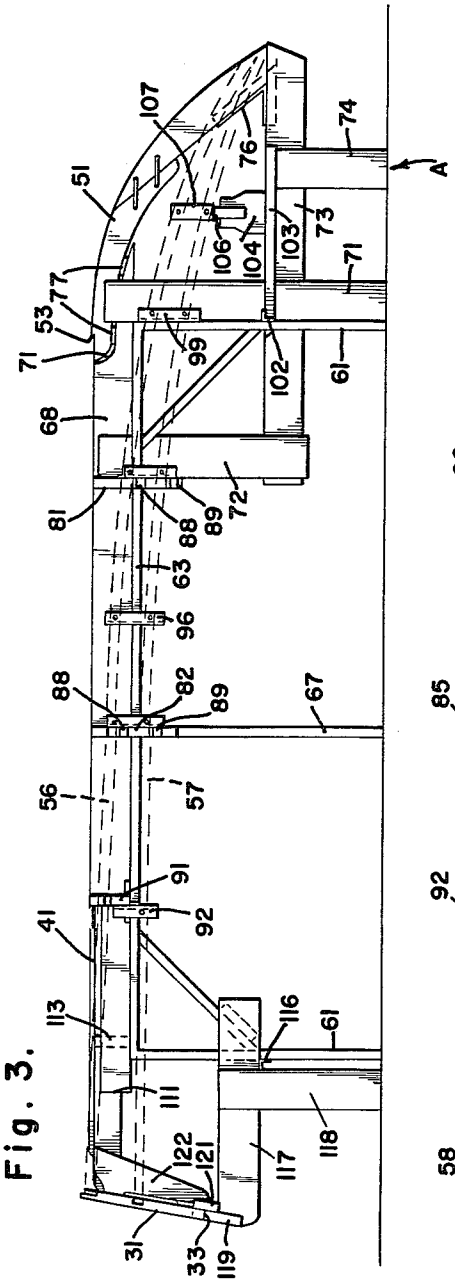


Fig. 3.

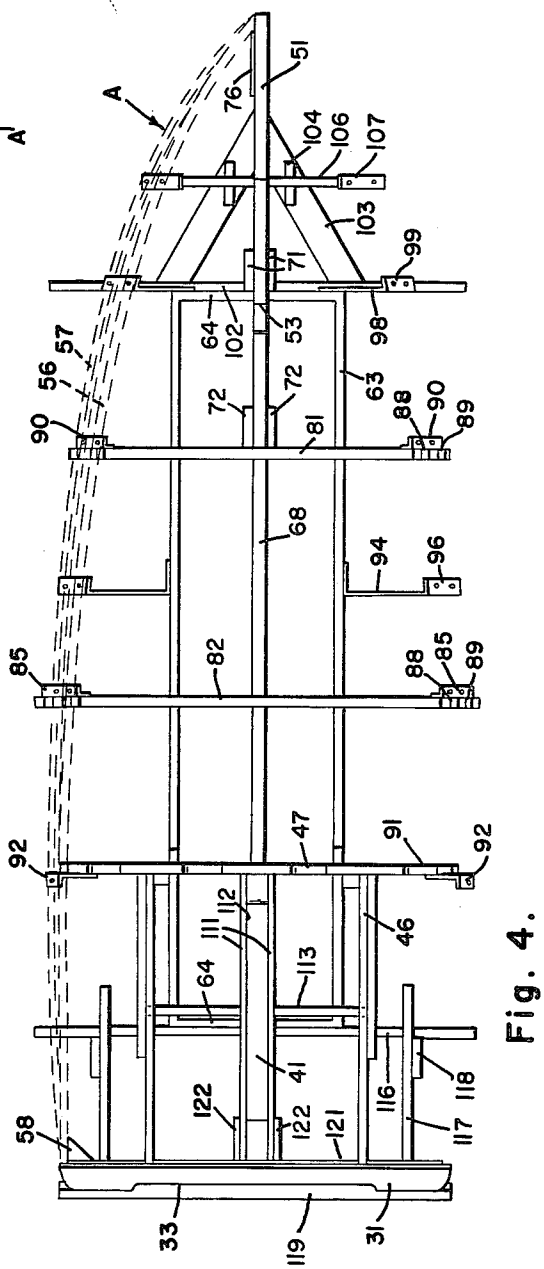


Fig. 4.

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June 11, 1963 F. W. KLOPSTOCK ETAL 3,092,850

BOAT CONSTRUCTION

Filed Aug. 10, 1959 6 Sheets-Sheet 3

Fig. 6.

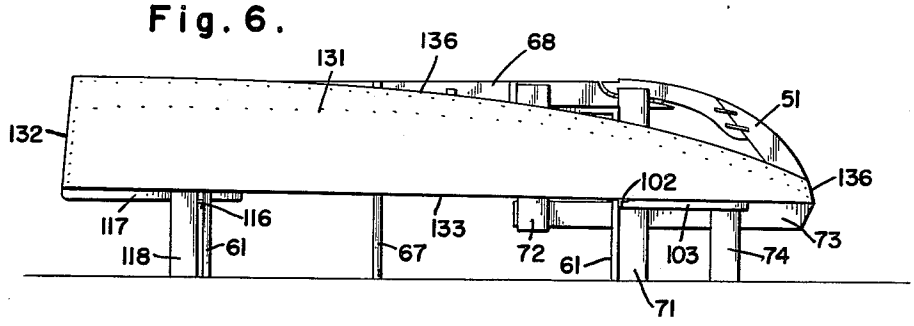


Fig. 5.

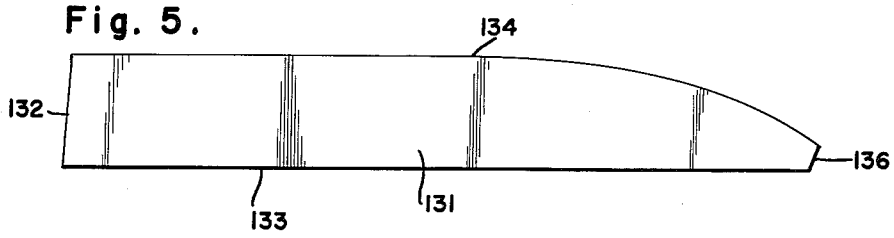
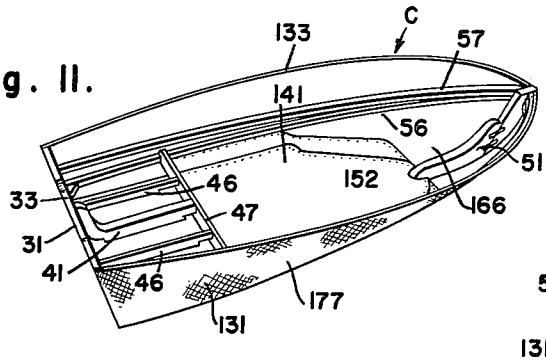


Fig. 11.



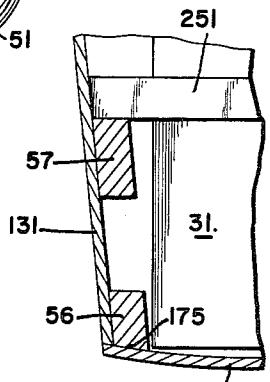
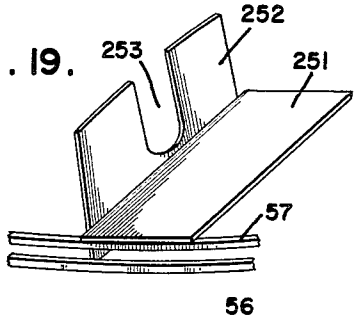


Fig. 20

Fig. 19.



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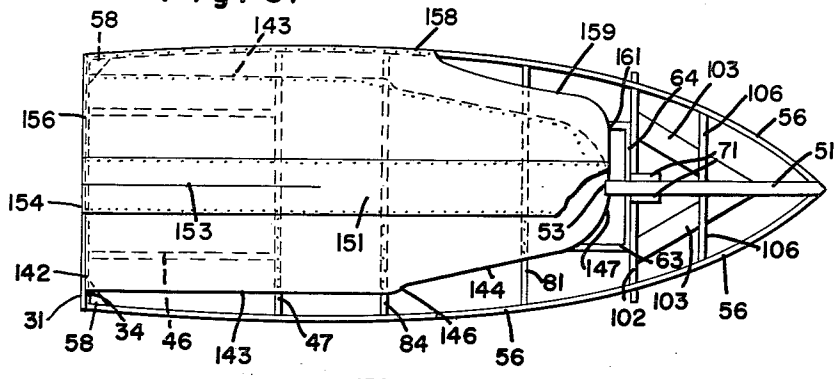
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June 11, 1963 F. W. KLOPSTOCK ETAL 3,092,850

BOAT CONSTRUCTION

Filed Aug. 10, 1959 6 Sheets-Sheet 4

Fig. 8.



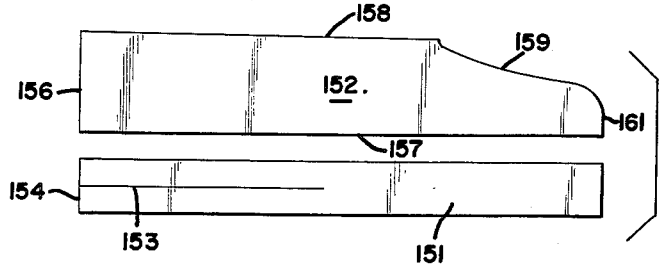


Fig. 7.

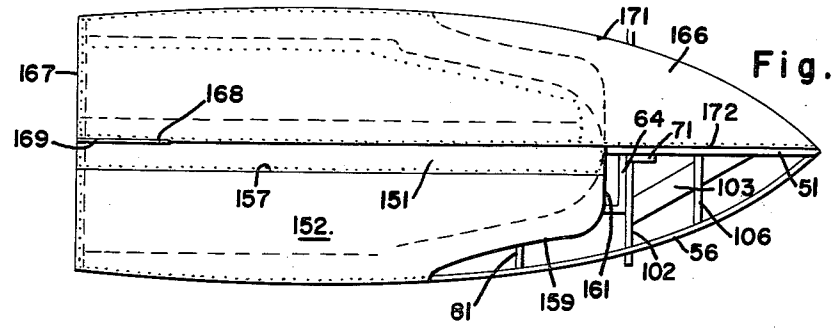


Fig. 10.

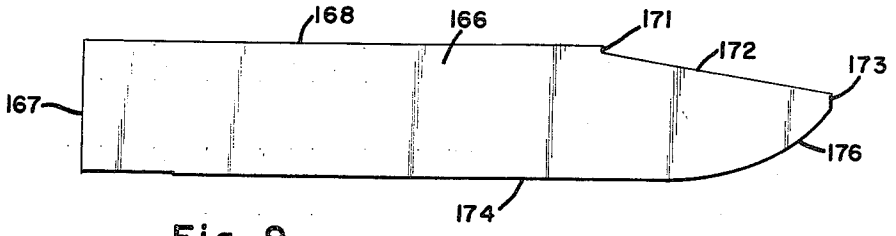


Fig. 9.

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June 11, 1963 F. W. KLOPSTOCK ETAL 3,092,850

BOAT CONSTRUCTION

Filed Aug. 10, 1959 6 Sheets-Sheet 5

Fig. 12.

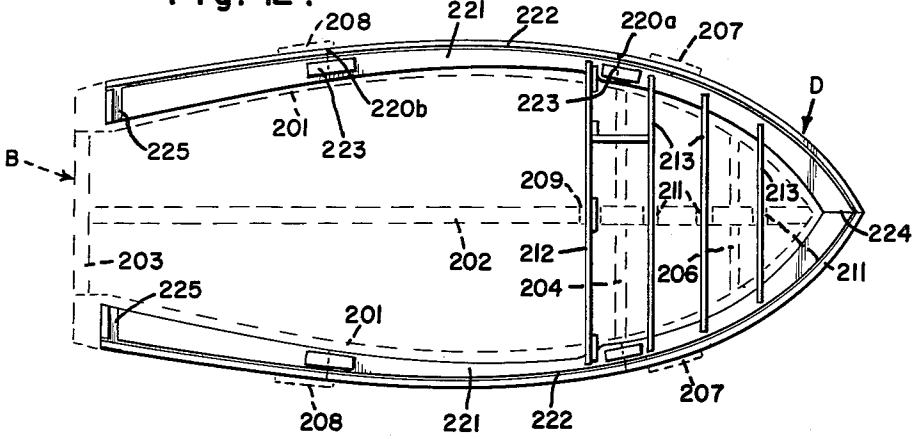


Fig. 13.

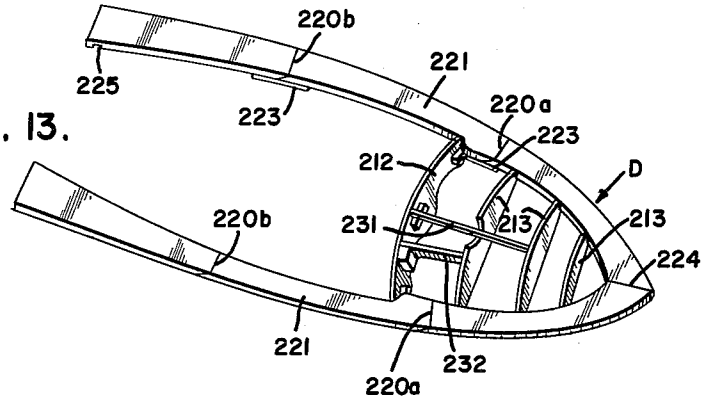


Fig. 17.

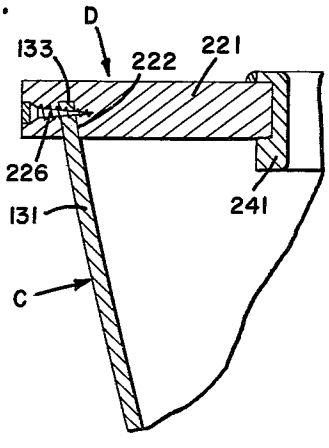
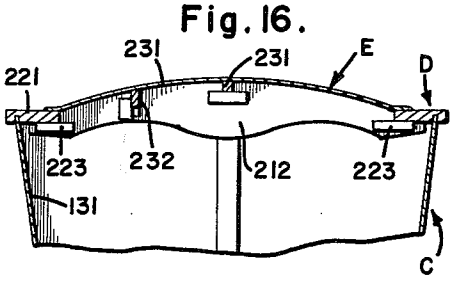


Fig. 16.



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BOAT CONSTRUCTION

Filed Aug. 10, 1959 6 Sheets-Sheet 6

Fig. 15.

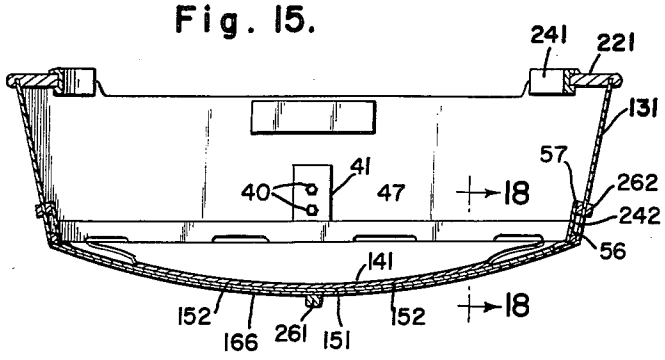
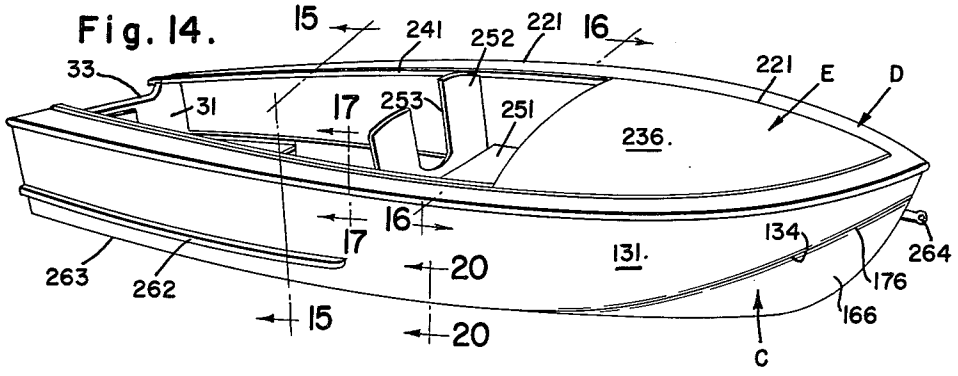


Fig. 14.



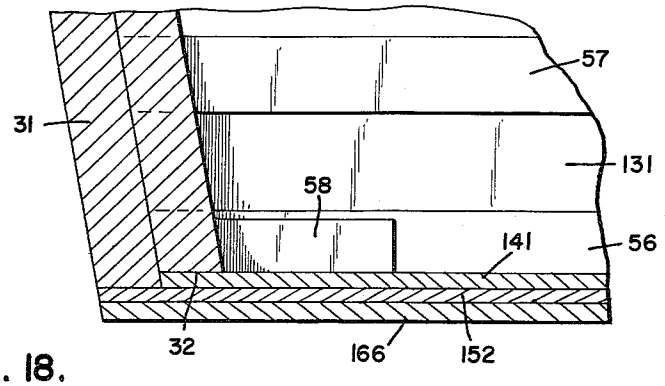


Fig. 18.

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United States Patent Office 3,092,850 Patented June 11, 1963

3,092,850

BOAT CONSTRUCTION

Frederick W. Klopstock, Atherton, and Joseph Samson, Menlo Park, Calif., assignors to George B. Garrett, Redwood City, Calif.

Filed Aug. 10, 1959, Ser. No. 832,577
9 Claims. (Cl. 9—6)

This invention relates to a new and improved boat construction and the apparatus and method for the assembly thereof.

The present invention relates to boat constructions of the type used with an outboard motor and is characterized by a relatively short hull having complex curves but a relatively flat bottom, and lightweight construction. Essentially, the boat consists of a hull, a decking on the front part of the hull, and a gunwale surrounding the edges of the hull and forming a foundation to which the decking is attached.

One of the features of the present invention is the provision of a boat construction and means and apparatus for the assembly thereof which permit the rapid production of an irregularly curved boat, and wherein the labor required is reduced very materially as compared with conventional manufacturing. Further, the simplification of assembly permits use of relatively unskilled labor.

A further feature of the invention is the fact that the hull is formed of a plurality of sheets of plywood which are preferably pre-cut to shape and which are laminated together whereby the hull thus formed functions as a structural member with the result that fewer frame members must be used to reinforce the hull as compared with conventional boat construction.

Thus, the hull of the present invention is made up of very few parts, thereby eliminating many of the ribs and reinforcements conventionally employed in boat construction.

A further feature of the invention is the provision of a relatively flat planing surface on the bottom of the hull extending well forward of the stern. The method of assembly of the hull makes this contour possible and improves the stability of the boat.

Another feature of the invention is the fact that prefabricated parts may be assembled together, with a minimum of machining operations required during assembly.

A particular feature of importance in connection with the present invention is the employment of jigs, preferably two in number, one being used for the assembly of the hull and the other preferably being used for the assembly of the gunwale. The jigs are constructed so that the various curved contours of the hull or gunwale are automatically produced. produced. To hold the parts in position, the hull jig is preferably formed with slots into which the transom, at least one transverse rib, knee and bow may be fitted, and which further has notches to locate in position the chine and false chine.

A further feature of the invention is the assembly of the hull in one jig and the assembly of the gunwale in a separate jig, the gunwale being grooved or routed in its under surface so that the gunwale may be fitted over the top edge of the hull and secured thereto and thereafter the deck fastened to the gunwale. This method of construction differs from conventional boat manufacture wherein the gunwale is fabricated on the hull and is made up of several pieces which must be fitted together. Simplification of the gunwale materially reduces the amount of labor required. Additionally, the gunwale construction of the present invention is stronger and more resistant to breakage when the boat touches piling, docks, and the like.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

FIG. 1 is a perspective view of the hull jig.

FIG. 2 is an exploded perspective view of portion of frame which are inserted in the hull jig.

FIG. 3 is a side elevational view of the hull jig with parts illustrated in FIG. 2 installed therein, the chine and false chine being shown in dotted lines.

FIG. 4 is a top plan view of the structure of FIG. 3.

FIG. 5 is a plan view of the side prior to installation on the boat.

FIG. 6 is a side elevational view showing the side applied to the hull in position on the jig.

FIG. 7 is a plan view showing the central and one side portion of the intermediate bottom hull layers.

FIG. 8 is a top plan view of the hull on the hull jig showing the first layer and portions of the intermediate layer applied.

FIG. 9 is a plan view of one side of the outer hull bottom layer prior to installation.

FIG. 10 is a plan view of the hull and jig showing one side of the outer hull layer applied.

FIG. 11 is a perspective view of the hull after it has been removed from the hull jig.

FIG. 12 is a plan view of the gunwale (in inverted position) showing the gunwale jig in dotted lines.

FIG. 13 is a perspective view of the gunwale in upright position.

FIG. 14 is a perspective view of the completed boat.

FIG. 15 is a sectional view taken substantially along the line 15—15 of FIG. 14.

FIG. 16 is a fragmentary sectional view taken substantially along the line 16—16 of FIG. 14.

FIG. 17 is a fragmentary vertical sectional view taken substantially along line 17—17 of FIGS. 14.

FIG. 18 is a fragmentary vertical sectional view taken substantially along the line 18—18 of FIG. 15.

FIG. 19 is a perspective view of the seat and a portion of the chine on which it rests.

FIG. 20 is a fragmentary enlarged sectional view taken substantially along the line 20—20 of FIG. 14.

The present invention preferably employs two jigs, a hull jig A and a gunwale jig B. The hull C is assembled in inverted position on the hull jig A and gunwale D is separately assembled in inverted position on the gunwale jig B, and after the two parts C and D are completed they are assembled together and a deck E applied over the front end of the gunwale.

The hull C is made up of a plurality of frame members which are initially installed in the hull jig A and a plurality of layers of pre-cut plywood which are applied over the frame members on the jig. Preliminary to a description of the hull jig A, the hull frame members will be described. The plywood members which are subsequently applied are described later in the specification.

Hull Frame Members

Transom 31 is a thick piece of laminated plywood which comprises the rear of the boat and is strong enough to support the weight and thrust of the outboard motor which is customarily fastened thereto. The bottom edge of transom 31 is preferably horizontal and flat and is formed with a step 32 along the forward side thereof. The upper edge 33 may be curved and irregularly shaped for purpose of ornamentation. The side edges 34 are slightly arcuate. Notches 35 are formed on either side of the centerline of the boat on the forward face of transom 31 extending inwardly from the bottom edge for the

reception of the ends of laterals 46. A pair of notches 36, 37 are formed on the front face of the transom on either side thereof extending inward from the side edges 34 for the reception of the ends of the chine 56 and false chine 57 which lie along either side of the boat.

Knee 41 is a piece of laminated playwood which is thick and rigid, having a vertical back 42 which is fastened to the transom by bolts 40 and an elongated horizontal extension 43 which is located longitudinally centrally of the boat extending forwardly approximately one-quarter of the length thereof and to which layers of plywood are applied. The corner 44 at which the bottom and back surface of the knee meet is slightly rounded at both interior and exterior surfaces to strengthen the knee structure.

On either side of the knee 41 are laterals 46 which extend forwardly from notches 35 in transom 31 and are of substantially the same length as the knee 41. Extending transversely across the boat immediately forwardly of the ends of the knee 41 and laterals 46 is a cross-brace 47. The bottom surface of cross-brace 47 is level with the bottom surface of knee extension 43. Notches 48 are formed on the ends of cross-brace 47 to receive chine 56.

At the forward end of the boat is the bow or stem 51 which is a laminated member preferably formed in two pieces joined together by staples 52. The composite shape of the bow 51 is arcuate, conforming to the shape of the stem of the boat. A notch 53 is formed in the bottom surface of the rearward end of stem 51.

On either side of the boat are a chine 56 and a false chine 57. The rearward ends of the chine and false chine are received in notches 36, 37 in transom 31 and the forward ends are beveled and fastened to stem 51. The chine and false chine are flexible, strong members which control the shape of the hull sides.

Corner braces 58 may be applied at the corner where chine 56 and transom 31 meet.

Hull Jig

The hull jig A consists of a frame preferably having legs 61 at each of four corners and a center post 67 interconnected by horizontally disposed longitudinal and transverse end frame members 63 and 64. Intermediate transverse frame member 66 interconnects members 63 at their midpoints and is reinforced by center post 67. Supported by members 64, 66 is a longitudinal frame member 68 which extends from the front about three-quarters of the length of the boat along the center thereof and is supported by legs 69 at the front and is cut out at its front top edge as indicated by reference numeral 71 to receive stem 51. Vertical members 72 depend from member 68 and are connected to forwardly extending stem support 73, which is supported by short front legs 74. Support 73 carries an angle bracket 76 which supports one end of stem 51. The other end of stem 51 rests on removable pads 77 in cut-out 71. The pads 77 are removed whenever an excess of glue accumulates. Rearwardly of verticals 72 are transverse frame members 81 and 82, the top edges 83 and 84 of which are curved to correspond to the curvature of the inside surface of the bottom of the boat. The ends 86 and 87 have the curvature of the sides of the boat and carry upper and lower angles 88 and 89 which support chine 56 and false chine 57.

At the rear end of longitudinal frame member 68 is a transverse member 91, having angle brackets 92 at the outer end thereof which conform to the curvature of the hull at that point. Holes 93 are formed in brackets 92. Extending outwardly from longitudinal members 63 intermediate members 81 and 82 are brackets 94 carrying sloping members 96 at the outer ends which conform to the curvature of the hull at this point and which are formed with holes 97.

At the forward end of the frame projecting outwardly are brackets 98 carrying slanted angle bars 99 at the outer ends formed with holes 101. Extending transversely across legs 61 and fastened to legs 61 is an angle 102 which is at the level of the lower edge of the hull when it is finally assembled on jig A. The outer ends of angle 102 are connected with stem support 73 by horizontal forwardly inwardly disposed braces 103 which support guides 104 which in turn support transverse member 106. Member 106 carries a bracket 107 on its upper surface formed with apertures 108. Attached to members 81, 82 are brackets 85 formed with holes 90. The function of brackets 85, 92, 96, 99 and 107 is to support the chine and false chine 56 and 57 in cooperation with supports 88 and 89. Temporary screws are inserted from the inside through holes 90, 93, 97, 101 and 108, and are screwed into the chine 56 and false chine 57 to hold them in their proper shape and position until the plywood hull coverings are in place, whereupon the temporary screws are removed.

Extending rearwardly of transverse member 91 and spaced apart a slight distance to either side of the centerline of the jig are longitudinal knee support members 111, having a space 112 between them. Intermediate their length, members 111 are supported by transversely extending brace 113 which rests upon the rearward end of longitudinal frame members 63. The knee 41 fits into the space 112. The cross-brace 47 rests upon member 91 between the rearward end of member 68 and the forward end of members 111. On either side of members 111 are longitudinal locating members 114. The ends of brace 113 and locating members 114 provide locating sockets for laterals 46.

Extending transversely across rearward legs 61 is a horizontal support 116 at the elevation of the bottom edge of the hull when in an inverted position of manufacture. The ends of member 116 support rearwardly disposed horizontal longitudinal member 117 which is held in position by vertical leg 118. The rearward ends of members 117 are connected by transom bottom edge support 119 which in turn carries a forwardly disposed transom guide 121, and is interconnected with members 112 by diagonal bracing 122. The edge 33 of transom 31 rests upon member 119 which is curved complementary to edge 33, and is held in longitudinal alignment by member 121. The transom 31 also rests against brace 122 and is thus held in proper position, as best shown in FIG. 3.

Assembly of Hull Frame

At the commencement of manufacture of the hull A, the bow or stem 51 is fitted into cut-out 71 and stem receiving angle 76, and clamped in position by means of clamps. The transom 31 is slid into position resting on members 119 and against braces 121 and 122. Cross-ribs 47, knee 41 and laterals 46 are slipped into the appropriate slots in the frame. Thereupon, the chine 56 and false chine 57 for each side ar installed on supports 88, 89, fastened into notches 36, 37 in transom 31 and screwed temporarily onto brackets 92, 96, 99, 107 and then stem 51, working from rear forwardly to the bow. By reason of the curvature of the various members, the chine 56 and false chine 57 assume the proper curvature for the shape of the completed hull. Other than reinforcements which may be inserted at corners, if desired, the foregoing described elements comprise all of the hull frame elements, other than the covering of the hull itself, and this materially reduces the number of parts conventionally employed in boat hull frame construction.

Hull Layers and Assembly

The hull covering itself consists of three layers of plywood at the bottom of the boat, and a single layer at the sides and outer edges of the boat. Preferably, eight pieces of pre-cut plywood make up the hull covering.

On either side of the boat is a side member 131, the right and left side members being symmetrical and each having a rear edge 132 which fits along edge 34 flush

with the rear edge of transom 31, a substantially straight edge 133 which ultimately becomes the top edge of the hull but in the inverted position of manufacture is the bottom edge in FIGS. 1 to 6, inclusive, and a curved edge 134 which conforms to the curvature of the chine 56 when the side is applied to the hull jig A. The front end 136 of the side is truncated, as indicated by reference numeral 136 where it meets the upper end of the stem 51. The sides 131 are laid over the frame on the jig as shown in FIG. 6. Screws fasten to the edge 132 to the edge of transom 31. Additional rows of screws are driven through side 131 and into chine and false chine 56 and 57 so that the side 131 assumes the curvature of the chine and false chine, which are in turn determined by the supports 85, 92, 88, 89, 96, 99, 107 to which the chine and false chine are fastened as has heretofore been explained. Transverse members 102 and 116 limit the downward movement of the side 131 and hold it in place on the jig.

The lowermost or inner layer of the plywood hull covering is an irregularly shaped sheet of plywood 141 shown in FIG. 8. The rearward edge 142 of said sheet 141 rests in the step 32 in the edge of transom 31.

The rearward side edges 143 extend forwardly along either side of the boat, and at about the location of transverse member 84 taper inwardly, as indicated by reference numeral 144, there being a curved jog 146 at the intersection of portions 143 and 144. The curved forward portion or nose 147 of sheet 141 fits under the notch 53 in stem 51. Sheet 141 is fastened at its rearward edge 142 to transom 31, and is also fastened to cross-brace 91 and to stem 51. The portion of sheet 141 rearwardly of jogs 146 comprises the planing surface of the hull and is relatively flat, thereby contributing to the stability of the boat. The flat contour is determined by knee 41, laterals 46, brace 47, transom step 32 and the contour of chine 56.

The intermediate plywood layer of the hull consists of three pieces, including a central piece 151 and symmetrical side pieces 152. Center piece 151 is generally rectangular in shape and, in order to enable to conform to the flat contour of the planing surface of the hull yet permit an angular separation at the keel, is preferably formed with longitudinally centrally extending slot 153 which extends from the rearward end approximately one-half the length of sheet 151. Sheet 151 is applied first, its rearward edge 154 over the step 32 of transom 31 and edge 142 of sheet 141. Sheet 151 is fastened to cross-brace 91 by means of screws and also to underlying sheet 141. Its forward end fits under notch 53. On either side of central portion 151 are side portions 152. The rearward ends 156 thereof are aligned with the rear edge of the transom 31 and the longitudinal edge 157 abuts longitudinal edge of member 151.

The outer longitudinal edge 158 extends somewhat beyond the edge 143 of layer 141. Forwardly of edge 158 the sheet 152 curves inwardly forwardly in a compound curve 159 and terminates in a truncated forward end 161 which merges into the forward edge of layer 151, as best shown in FIG. 8.

The outermost hull layers 166 are likewise symmetrical about the center line of the boat. The rearward edges 167 thereof fit flush against transom 31 and are secured thereto by means of screws. The central longitudinal edge 168 extends along the centerline of the boat, but because of the slight angularity of the bottom of the boat at the planing surface a slight gap 169 exists between the two edges 168 of the two halves, and this gap 169 is filled with a filler to preserve a smooth surface on the bottom of the boat. Near the forward end of the sheet 166, the central edge jogs inwardly about one inch, as indicated by reference numeral 171, and forwardly thereof is slanted outwardly, as indicated by reference numeral 172, to a blunt point 173. The outer edge is straight, as indicated by reference numeral 174, for most of the length of sheet 166, but its forward end is formed in a curved portion 176 which joins with blunt point 173. Fastening of edge 172 to stem 51 provides the desired curvature of the prow of the boat. The shape of sheet 166 is such that edges 174, 176 merge with the chine 56 and abut the edge 134 of side members 131. In order to meet in a smooth rounded edge, it is desirable that the chine 56 be beveled off with a plane, as indicated by reference numeral 175, before the sheets are applied.

Layers of adhesive, such as wood glue, are applied evenly over the surface 43 of knee extension 41 and the top surfaces of laterals 46 and cross-brace 47. Furthermore, layers of glue are applied between the hull bottom layers, such as between layer 141 and the intermediate layer composed of members 151 and 152, and also between layers 151, 152 and the outer layers 166. Screws are also employed to fasten the layers one to the other and to the various hull frame members.

Fasteners, such as screws, are driven into the inner edge of the outer hull facing to further secure the three layers of the hull which exist at the center together.

The hull is then removed from the hull jig and a layer of glass cloth 177 is applied, consisting of two sheets which cover the entire hull and a resin is rolled on to the glass cloth and hardens with a hard waterproof covering which prevents the entry of water into the screw holes into the seams in the plywood. The hull C now has the form shown in FIG. 11.

Gunwale Jig B

Simultaneously, the gunwale is being assembled on the gunwale jig B. The gunwale jig consists of a frame supported above the ground having horizontal longitudinal frame supports 201 larger than but of the same contour as the gunwale, a central longitudinal member 202 and a rear and two intermediate transverse members 203, 204, 206. The outer edges of supports 201 are curved corresponding to the curvature of the hull and gunwale and, to facilitate assembly of the gunwale, edge stops 207, 208 extend vertically up from the side edges of supports 201.

Member 202 has slots 209, 211 for the reception of the transverse dashboard 212 and a plurality of transverse deck supporting ribs 213 which are suitably notched and secured to the gunwale D by means of fastening means such as screws.

Gunwale

The gunwale D consists of two halves 221 which are complementary to each other for the left and right half of the boat. For economy in use of materials, each half 221 is preferably made up of three sections, joined at parting lines 220*a* and 220*b* and braced by braces 223. Since the gunwale is fabricated in inverted position, the underside of the gunwale is uppermost and is provided with grooves 222 which are routed at an angle in the surface of the gunwale, the angle being equal to the angle of the upper edge of the hull side 131. The routing 222 is preferably formed in the prefabricated gunwale sections prior to assembly on the gunwale jig, but it is found desirable to finish the groove by running a routing tool throughout the entire length thereof after the gunwale sections are secured in place on the jib. The edge of the jig may function on a guide for the routing tool. Transverse grooves 225 at the rear ends of sections 221 are formed to receive the top edges of transom 31.

Preliminary to the assembly of the gunwale sections, the dashboard 212 and transverse deck supporting ribs 213 are fitted into the slots 209, 211 in the gunwale jig. Thereafter, the gunwale sections 221 are installed on the supports. The two sections 221 meet along a central joint 224 at the front which is finished to present a smooth workmanlike point.

Assembly of Hull and Gunwale and Finish of Boat

Thereafter, the gunwale D is removed from the jig B

and subsequently inverted. The gunwale D is slipped over the hull B, the upper edges 133 of the hull sides 131 fitting into the grooves 222 in the gunwale and fastening means 226, such as screws driven inwardly, may be employed to hold the two parts together. Since the angle of the groove 222 is the same as the angle of the upper edge 133 of the side 131 of the hull, assembly of the parts is facilitated.

Thereafter, longitudinal deck supports 231, 232 are applied over ribs 212, 213, the decking 236 which may consist of a sheet of plywood is secured to the inner edge of the forward end of the gunwale and to the dashboad 212 and deck support ribs 213.

Following the application of decking 236, the carlun 241 or edge trim on the interior of the gunwale 221 is applied. Further, a chine plate 242 is applied attached to both the chine 56 and the false chine 57 and extending forwardly from the transom 31 to the front of the boat.

The seat 251 and seat back 252 are assembled together, the seat back preferably being formed with a cut-out portion 253 to permit passage from the seat to the rear of the boat. The seat 251 rests upon and is fastened to the false chine 57. It will be understood that additional seats and different seat arrangements may be employed, if desired.

Additional trim of various types may be attached to the hull, as desired. Thus, as shown in the accompanying drawings, an outside keel 261 is fastened to the bottom of the boat overlying the filler 169. A bumper 262 may be attached to the sides 131 in appropriate location. Various types of nautical hardware, such as the bow eye 264, may be fastened in suitable locations.

What is claimed is:

1. A method of manufacturing a boat comprising providing a first jig having the general outline of the interior of the completed boat in inverted position and having slots for the reception of bow, transom, knee, at least one transverse rib, and at least one chine on each side extending longitudinally from said transom to said bow; placing said bow, transom, knee, transverse rib and chines in said slots on said jig; securing said knee to said transom, said knee to said rib, and said chine to said transom, rib and bow; providing pre-cut sides; fastening said sides to said chines and extending below said chines; said sides having outwardly sloping upper edge portions; providing pre-cut bottom layers, applying a plurality of said pre-cut bottom layers over said knee and extending from said transom to said bow and from the longitudinal centerline of said boat out to said chines; providing a second jig having the general outline of the gunwale of the boat, fitting together pieces of wood having the shape of one-half of said gunwale split on the longitudinal centerline of the boat, and having grooves disposed at an angle in one surface corresponding to the angle of the edges of the sides of the hull; fitting the two halves of said gunwale together on said second jig; inverting the gunwale and slipping the edges of the sides of the hull into the grooves in the gunwale; and securing said hull and gunwale together.

2. A method according to claim 1, which further comprises initially securing said chine to said first jig extending substantially transverse to said transom and slightly downwardly, and then curving inwardly and downwardly approximately amidship and separating said chine from said first jig after the bottom layers have been secured in position.

3. A method according to claim 1, which further comprises beveling said chine to receive the edges of said sides and at least one bottom layer meeting along a line parallel to said chine.

4. A method according to claim 1, in which said bottom layers are laminated in a plurality of layers at the bottom, and which comprises the steps of adhering the first layer to the transom and knee, the second layer to the first and the outermost layer to the second and to the chine.

5. A method according to claim 2, which further comprises providing for each side a false chine, initially securing said false chine to said first jig generally parallel to said chine and spaced downwardly from said chine in the inverted position of assembly of said first jig, fastening said false chine to said transom and bow, fastening said sides to said false chine, and separating said false chine from said first jig after the bottom layers have been secured in position.

6. A method according to claim 1, which further comprises providing laterals parallel to and on either side of said knee, providing slots in said first jig for said laterals, locating said laterals in said last mentioned slots and securing said laterals to said transom and said transverse rib.

7. A boat construction comprising a hull having a transom and sides having exposed outwardly flared upper side edges extending forwardly to meet at the front of said hull, a gunwale having relatively wide horizontal member on either side extending from the front to said transom, said gunwale having a substantially flat bottom formed with an inclined groove into which said upper side edges fit and means securing said sides and gunwale together.

8. A boat construction according to claim 7, in which the rear ends of said gunwale are formed with transverse grooves and the upper edge of said transom fits into said transverse grooves.

9. A boat construction according to claim 7, in which said gunwale is provided with arched transverse deck support ribs and which further comprises decking arched over said ribs and secured at its outer edges to said gunwale.

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