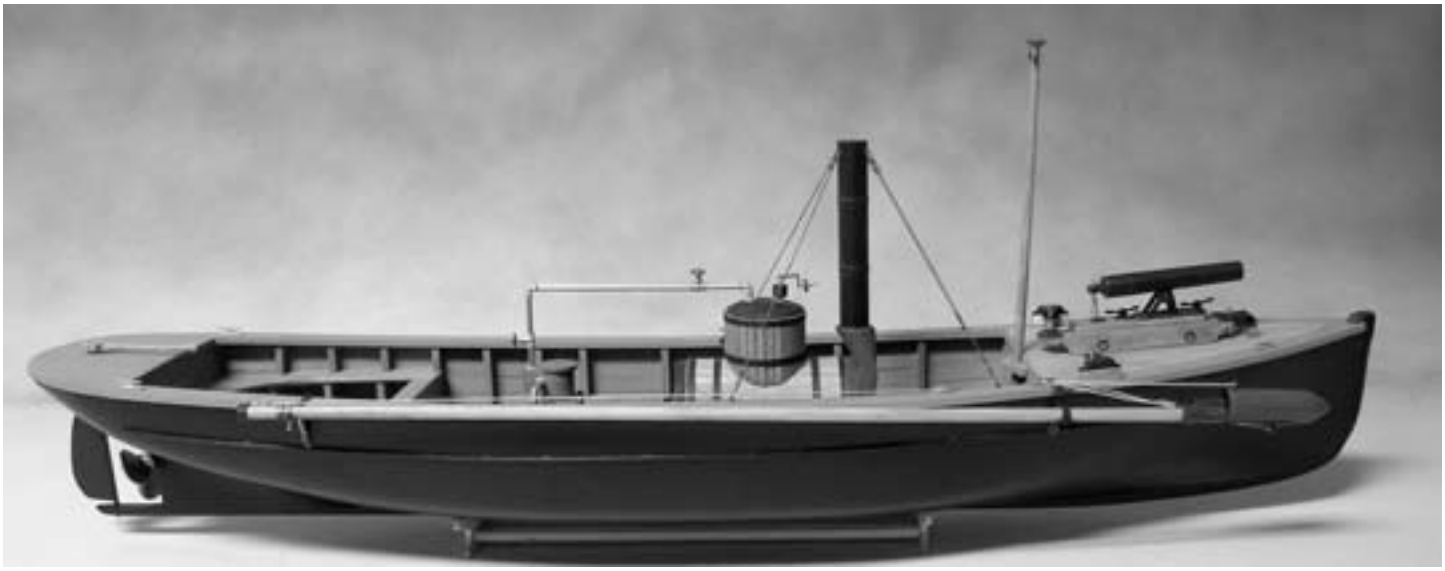
Building the *U.S.N. Picket Boat No. 1*

1864



Technical Characteristics:
Scale 1:24, ½" = 1 foot
Overall length 22 1/2"
Width 5"

Kit design, plans, instruction manual, and prototype model by Bob Crane, 2010

Civil war stories of heroism, gallantry and daring abound. While Sherman, Grant and Lee are well-known, comparatively few have heard of Lieutenant William B. Cushing, arguably the greatest naval hero of the Civil War. From Naval Academy wash-out to flamboyant warrior, Cushing accomplished one of the most daring and successful exploits of the war, a dramatic attack on the Southern ironclad *CSS Albemarle*, which had kept Union ships from advancing into Eastern North Carolina. On a cold, rainy night in late October, 1864, Cushing and a group of volunteers used a tiny steam launch and spar torpedo in a surprise attack. While the virtual suicide mission succeeded and the warship was destroyed, Cushing was the only one to successfully escape from the rebel-held river. An artist's depiction of the event is below.

Cushing's Daring and Successful Exploit

Cushing was born in Delafield, Wisconsin on November 4th, 1842. He enrolled in the U. S. Naval Academy in 1857. William was a practical joker and hell raiser who accumulated so many demerits that he left the Academy in March 1861, probably leaving voluntarily before being thrown out. But when war broke out, William Cushing was back in the Navy. William served with distinction aboard several vessels, and his courage and daring earned him promotions and accolades. But if there is one event for which he is most remembered, it is for his successful mission to destroy the Confederate ironclad ram *C.S.S Albemarle*.

In the spring of 1864, Plymouth, North Carolina was an important Union Army supply depot for Federal forces operating in eastern North Carolina. Plymouth is situated on the south side of the Roanoke River, about eight miles from where the river empties into Albemarle Sound. In April, Confederate army forces under the command of Brigadier General Robert Hoke captured the town. Assisting in the operation was the

brand new 152 foot ironclad ram *C.S.S. Albemarle*, which sank one Union vessel. On May 5th, *C.S.S Albemarle* steamed in to Albemarle Sound and engaged the Union squadron there, heavily damaging another ship.
If the Federal forces were going to recapture Plymouth, they would have to do something about the *Albemarle*. Lieutenant William B. Cushing had a plan for doing just that. He proposed a plan using two small steam powered boats against the ironclad. Each was to be armed with a 12 pounder howitzer and a torpedo mounted on a 14 foot spar and detonated using a complicated lanyard system. One boat would place its torpedo on the *Albemarle*, while the other provided cover fire and acted as a backup if the first boat failed in its mission. The plan was approved. Cushing obtained some suitable boats, and set off on his mission.


Lt. William B. Cushing, circa 1864

One boat sank on the way to North Carolina, but Cushing pressed on. "Impossibilities are for the timid, we determined to overcome all obstacles" he wrote. The small steamer, named *Picket Boat Number 1* entered the Roanoke River on the night of October 27th and headed towards Plymouth. Cushing had a crew of 14 with him, all of whom volunteered for the hazardous mission. The steamer's engine was muffled as Cushing tried to sneak into the town's harbor. If they could make it in undetected, Cushing planned on capturing the ironclad instead of destroying it. However, as they were approaching the *Albemarle*, which was tied up at the wharf, guards on board the ironclad spotted *Picket Boat Number 1*.

Cushing sprang into action as the guards on the ship and more on shore opened fire. Cushing steamed towards *Albemarle*, but then noticed a barrier of logs circling around the ironclad. Cushing steamed ahead to get a good view of the barrier, then turned, circled around, and headed back at top speed hoping to blast over the logs so he could get close enough to place and detonate the explosive. The Confederate fire was intense, and Cushing responded with the boat's howitzer and later wrote that "a dose of canister at short range served to moderate their zeal and disturb their aim". The steamer smashed into, and up and over the log barrier and the torpedo was placed. Cushing detonated it, just as the *Albemarle's* cannon fire. "The explosion took place at the same instant that 100 pounds of grape[shot], at 10 feet range, crashed among us" Cushing remembered.

There was no way *Picket Boat Number 1* could escape. The Confederates ordered the raiders to surrender. Cushing told the men not to surrender and to save themselves, and they jumped into the water.

Of the 15 on board, two men drowned, and 11 were captured. Only William Cushing and one other man escaped, though they were separated. Cushing hid out in the swamps, and captured a small boat that some Confederate pickets had used to reach their post. Cushing paddled the boat as hard and as fast as he could, down the Roanoke to Albemarle Sound, where he finally found the Union fleet. "I have the honor to report that the rebel ironclad *Albemarle* is at the bottom of the Roanoke River" Cushing wrote in his after action report.

This adventure made Lt. William Cushing a hero in the media of the time. His picture and story were on the cover of the November 19, 1864 issue of *Harper's Weekly*. He also was promoted to Lieutenant Commander in the Navy. And with the *C.S.S. Albemarle* out of the way, Plymouth fell back into Union hands on October 31st.

Research

The story of the successful sinking of the Albemarle is well known to historians. It is said that it is still a sore point to folks living along the Roanoke River near Plymouth, North Carolina, where the incident took place. There a scale reconstruction of the Albemarle and a reconstruction of Picket's boat participate in an annual event recreating the battle. As to the details and design of Cushing's boat, the historical records vary greatly. The reported length varies from 30 feet to 47 feet. The length of the spar and its method of deployment also vary. The number of crew members ranges from 15 to 22. Old navy photographs said to be of the actual boat used by Cushing would indicate a length closer to 45 or 47 feet.

In 2005 the History Channel produced a DVD about the event entitled "The Most Daring Mission of the Civil War". Extensive research was performed by the director and staff into the characteristics of Cushing's boat and the sequence of events leading to the successful mission. I was fortunate to be put in touch with the director of the film who was most

cooperative and helpful in sharing the results of their research. The DVD is available at the History Channel website. The resulting model is a result of the best conclusions and determination of the researchers involved, and is believed to be the most accurate model ever created of Cushing's picket boat #1.

Before You Begin

The *Picket Boat* is an historic and interesting boat and makes a splendid model. At 1/2" = 1' 0" scale, it is easy to build and obtain precise detail. Plank-on-bulkhead hull construction with laser-cut parts offers a simple building method. It assures an accurate hull form built from interlocking self aligning parts. Britannia fittings, and brass photoetch parts, eliminate creating parts from scratch.

Before starting the model, carefully examine the kit and study the plans and this instruction manual. First, determine if all the listed parts are present. Handling them will produce a better understanding of the kit's requirements. Try to visualize how every piece will look on the completed model. Also, determine the building sequence - what must be done first - ahead of time and what can be done simultaneously if you wish. The instructions will help, but a thorough knowledge of the plans at the outset is essential.

The Plans

Five plan sheets are provided. The plans are done in an isometric format illustrating the construction sequence and identifying the parts and their placement. Sheet 5 show the layout of the parts on the laser cut boards and identifies the parts by number. It also shows the photo-etched brass sheet and identifies these parts. These drawings are to no particular scale, being illustrative of the construction sequence and sized to fit on the sheet. There are no parts to be made by referring to a full size plan. Some items are drawn to full scale and are so noted on the plan sheets. A card stock pattern sheet is included with helpful patterns to aid in various steps of the construction.

Making Allowances along the Way

Try to be exact when following the plans and instructions, but use common sense. Adjustments may be necessary to compensate for small differences in how your model is shaping up. Perhaps a bit of shaving here, a little shim there, a little filler there, etc., will alleviate any annoyances. Use logic and do not fret over exactness. An old saying in the boat building craft is that "if it looks right, it is right."

Kit Lumber

Strips and laser cut sheets of basswood are supplied in the kit. Sorting the wood in the kit by dimension will save time. After selecting and cutting what you need, return the remaining stock to the proper dimension pile. Don't worry about using a piece for one item intended for another. Model Shipways supplies enough extra wood to complete the model before running out.

Britannia Metal Fittings

There are only a few Britannia fittings in this kit, the howitzer barrel, engine pumps, propeller, and pipe fittings. These items will require final finishing before mounting on the model. First, remove any mold joint flash with a #11 hobby blade, then file or sand with fine sandpaper. Second, wash fittings in dishwashing liquid and warm water to remove traces of mold release agent and the body oils your fingers deposit. Allow the parts to dry thoroughly before applying primer and painting.

Working with Brass

The brass in your kit is a photoetched sheet. Refer to sheet 5 to identify the parts by number and name. Many of these parts are designed to be formed into shape by bending. In most cases the bend lines are etched into the part making correct bending easy. The bend lines are etched halfway through the sheet and are easily identified. In most cases it is desirable to bend the parts so that the bend lines are to the outside of the bend. This is not always possible so use common sense and judgment. Before removing each part from the sheet, determine if it has holes designed for the passage of nails, rods, or tubes. Check that the holes are of appropriate size for the free passage of the intended nail, rod, or tube. It may be necessary to drill out the hole to ensure assembly. Appropriate drill bits are supplied. This is important as many of these parts are very small and it would be very difficult to drill them out once separated from the sheet.

Glues

White or woodworker's glue in yellow or tan will suffice for most of the model. Five-minute epoxy provides extra strength for some cases. Super glues, such as Jet, Flash, or Zap, produce quick adhesion. For most applications, the medium viscosity, gap-filling variety is best. For some applications the gel type works best. The thin type is recommended for filling a narrow crack and wicking into laminate joints.

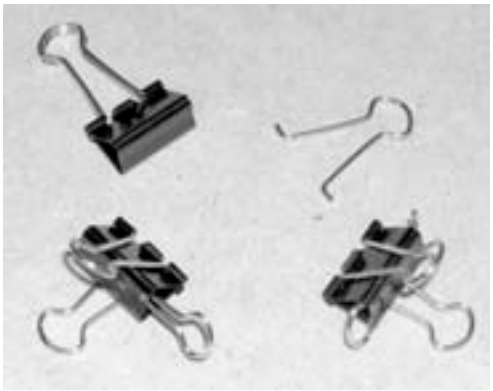
A word about gluing laser cut parts. Laser cutting burns through the wood and leaves a charred surface. This charred surface does not make good glue joints. It is recommended to lightly sand or scrape away the loose char before gluing. It is not necessary to remove all the char, just what comes off with light sanding or scraping. In most cases simply scraping with a no. 11 blade is sufficient.

Working with Aluminum Tubing

All tubing in the kit is of Aluminum. There are two reasons for this. The tube is the right color for the model and it is very easy to cut. To cut Aluminum tubing to length, simply lay the tube on a hard surface, lay a hobby knife on it and roll the tube applying pressure with the knife. Use a sanding block to square the cut and remove any burrs.

Clamps

Clamps are an essential part of the model building experience. In the full size boat building arena it is often said, "a boat builder cannot have too many clamps." This is true of model building also. There are so many situations in the course of building a model that require a particular type of clamp. The photo below shows a typical collection of clamps that are useful in model building.



Fortunately, most of these clamps are cheap and readily available. Note the spring type clothespin that has been reversed and pads added to the tips. The pads are covered with sandpaper to improve the grip. Of special usefulness are the office binder clips shown at the lower right. These are modified office supply items and their usefulness will become apparent later. They come in various sizes. The ones shown are ¾" binder clips. To make the modifications refer to the picture at left. Remove the wire clips from a binder and insert into another as shown. Thus of three clips two useable modified clamps are obtained. These clamps are very useful, particularly during the planking process. The binder can grip a bulkhead while pressure is applied to a plank by the wire clip.

Building the Hull

Study the construction sequence on plan sheet 3. Refer to detail 3-1. Locate parts 19 through 24. The keel is made up of the center keel, part 19, and two parts each 20, 21, and 22. Begin by gluing a part 20 to one side of the center keel. Apply carpenters glue by using a spot of glue every inch or so. Do not flood the parts with glue lest the moisture in the glue cause warping. Weight the assembly on a flat surface to ensure straightness and let dry. Turn over and repeat for the other side. Add parts 21 and 22 to both sides at the bow. This method of laminating will result in a straight keel and eliminates the need to carve a rabbet. Now is the best time to carve the bow entry at the stem. Use the pattern supplied to mark out this feature and carve as shown. Refer to the stem cross section on plan sheet 2 if needed. Cut six pieces of 1/16" x 5/16" strip and apply to the keel assembly as shown. These pieces bridge the slot for the prop shaft. When dry carve away the bridges across the keel slot and check for free passage of a 3/32" dia. tube. This completes the keel assembly.

Locate the 3/16" thick bulkheads 1 thru 4, 12, and 16 thru 18. Use a ruler and a No.2 pencil to draw lines on bulkheads 4, 16, and 12 as shown to simulate plank seams. Refer to detail 3-2. Carve the fairing bevels on bulkheads 1 thru 4 and 16 thru 18 as shown. The bevel lines have been determined in CAD and laser engraved on the bulkheads. Note that the faired bevels face forward on bulkheads 1 thru 4 and face aft on bulkheads 16 thru 18. Glue in bulkheads 4 and 18 first. Ensure that these bulkheads are square to the keel as they will later receive mating parts. Glue in bulkhead 16 again making sure it is square to the keel. A handy small square for these tight places is to cut off the corner of a poster board or card stock. Glue in bulkheads 1, 2, 3, and 17. Refer to detail 3-3. Carve parts 19B to the engraved lines as shown and glue in place. Add a short piece of 1/8" square filler as shown taking care that the passage for the rudder shaft is not blocked. Add a short piece of 1/8" square seat support to bulkhead 16. The top of this piece aligns with the top of the slot in bulkhead 16 and is parallel to the top of bulkhead 16. Carve parts 19A as shown to the engraved lines and glue to bow, port and starboard. These parts provide a landing for the planking at the bow.

Refer to detail 3-5. Draw plank seam lines on the cockpit floors, parts 25, and the single joint line on the seats, parts 26, as shown. The remaining bulkheads in the model are somewhat fragile at the keel junction due to the design of this boat and the grain of the basswood material. The design depends on the strength gained when the decks, floors and seats are joined to the bulkheads. Handle them with care during assembly. If you should happen to break one, just glue it back together, it will be plenty strong when subsequent parts are added. Find some way to hold the assembly vertical on your workbench. As can be seen in photo 1, a simple clamp will do. Fit bulkheads 13, 14, and 15, to the keel and the cockpit floors and seats to the bulkheads. When satisfied with the fit glue the bulkheads to the keel and temporarily use the floors and seats to hold them in alignment while the glue dries. Do not glue in the floors and seats yet. Place a weight on the floors to hold everything in alignment while the glue dries.

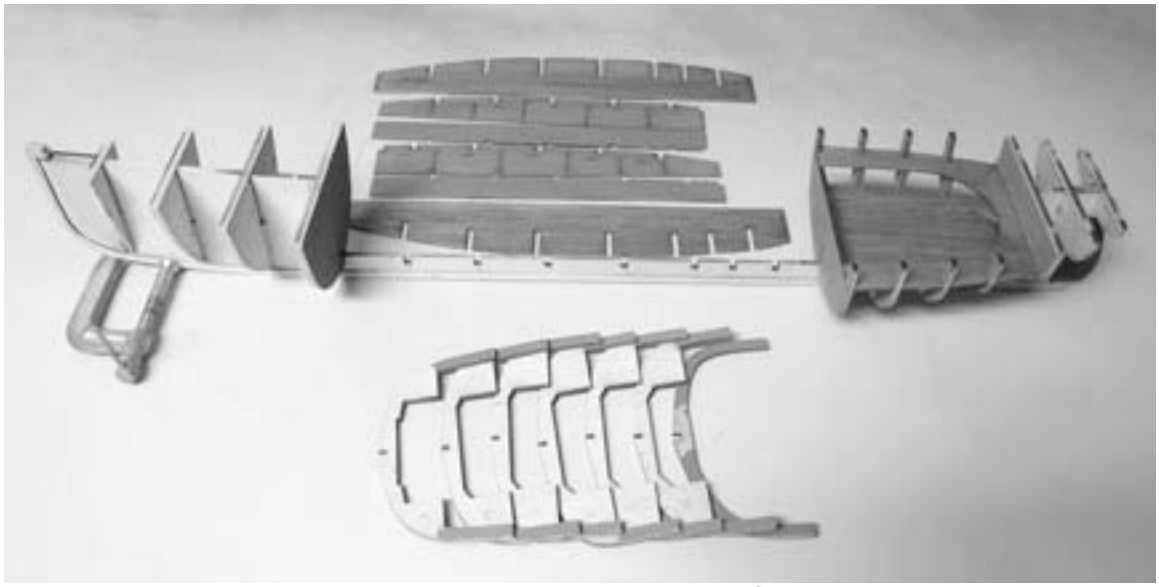


Photo 1: assembly at this stage and pre-finished parts

As afore mentioned it is advantageous to pre-finish some parts as the building proceeds. Photo 1 is an example of this. Note that all bulkheads have been pre-finished on surfaces that will be exposed. Also the decks, coal bunker sides and tops, cockpit floor, and seats have been pre-finished. No information as to how the picket boat might have been painted was turned up in the research.

As a workboat intended for battle it is not likely that anything more than a rudimentary finishing treatment was used. Perhaps the deck and floor were simply oiled. The interior may not have been painted at all. In consultation with researchers at the History Channel it was decided to paint the interior medium gray and the exterior black. As Cushing was planning a night raid it is thought to be unlikely that the hull was painted a bright color.

The cockpit floors and seats and bulkhead 12 may now be glued in. Bulkheads 5 thru 11 have very little purchase at the keel. The kit has been designed such that the decks (27) and coal bunker tops (29) will provide alignment of the bulkheads. It is advisable to not to try to glue all of these bulkheads in place at one time as the glue may begin to set up before alignment is achieved. Use carpenters glue and glue 3 or 4 bulkheads in place. Fit the decks and bunker tops temporarily in place, weight down and let dry. Check for proper alignment of all parts. Repeat for the remaining bulkheads. Refer to detail 3-7. The decks and coal bunker parts may now be permanently glued in place. Glue the sheer strake, a 1/16" x 1/8" strip to the tops of the bulkheads as shown in photo 2. Begin at the bow and glue on the strake to about bulkhead 12. Then soak the strips aft end before attempting to bend around the aft end of the hull to bulkhead 18. Rubber bands are useful here to hold the strake to the bend. Let this dry, then glue to the bulkheads and trim the strake flush with bulkhead 18. The 5/16" wide piece shown in detail 3-7 can be glued to the top of bulkhead 12 now or later. Refer to detail 3-6. Note the 1/8" dia. AL tube rudder bearing. Install this now. The tube should be flush with the center keel and protrude a small bit on the underside. Use a 3/32" dia. tube thru the bearing and down to the notch in the keel to assure alignment while the glue dries. The structure has now gained considerable strength and stiffness and is ready for planking.

Photo 2: the completed hull structure ready for planking

Planking the Hull: Plank**in**g a full size ships hull begins with a process called "lining off". The goal is to establish lines along the hull that will determine the run of the planking, the width of the planks and the consideration of the width and length of the lumber available to plank the hull. Study the planking development drawing on plan sheet 3. A strake is the continuous run of plank along the hull from stem to the stern. There are 13 strakes in our model hull and they are numbered so on the drawing. Each strake is made up of a number of individual planks butt jointed on the bulkheads. Normal practice is to begin by dividing the hull into sections called belts. The number of belts depends on the size of the hull. In our case three belts would be considered and are shown as belts A, B, and C. Battens would be fastened along the length of the hull establishing the belt lines and adjusted until pleasing lines are achieved and the spacing between belts seemed reasonable as to the number of strakes comprising a belt. The bulkheads (or frames) would then each be divided into an equal number of strakes between the belts and so marked. Joining these marks along the length of the hull would establish each strake line. It all may sound complicated but in practice is easily accomplished once an understanding of the process is achieved. There are many variations of this process and usually the method and preferences of the master planker governed.

Fortunately for our model we do not have to go through this process. Most of the work has been done for you in CAD. You will have noticed the laser engraved tick lines on some of the bulkheads. These are the marks that define the run of the strakes. Not all of the bulkheads have been so engraved. It is advisable as you proceed with the planking to pin a batten, say a 1/16" x 1/8" strip to the bulkheads at the marks and then mark all bulkheads across their outboard surfaces (edges) clearly defining the run of the strake. A cordless rotary tool such as a Dremel Minimite model 754 is extremely useful for this work. Use a small bit to drill through the batten into the bulkhead and use common straight pins to fasten the batten to the bulkheads so that the strake line can be drawn. A batten can be seen in photo 6. You can mark all strakes at this time or mark them as you go. Refer to the profile view on plan sheet 3. The ends of the planks that meet the stem at the bow are called "hood ends". Templates have been provided on the pattern sheet to locate the position and width of these hood ends. Cut out the templates, fit to the stem and mark the locations on part 19A.

We have already installed strake 1. Strake 1 was designed such that it is a constant width from stem to stern. This will not be true of the other strakes. Each plank must be fitted and shaped to both lay tightly to the curvature of the hull and

meet the marks that define the run of the strakes. Fitting planks requires both bending and twisting of the plank. The process of shaping planks to meet the marks is call spiling.

Study detail 8 on plan sheet 3 to familiarize yourself with the technique. Photo 3 shows a compass being used to spile a plank. There are 3 sizes (widths) of planking stock in the kit, 1/4", 3/8", and 1/2". Which size you use for each plank will be determined by the location of the plank on the hull and what shape it must take to meet the marks. Always choose a width that will allow you to fit the plank to one edge and have enough remaining width to spile and shape the planks other edge to meet the marks. As in full size boat practice, the plank lengths do not run the full length of the hull. In most cases 3 or more planks will make up a strake from bow to stern, the planks butt jointed on the bulkheads.

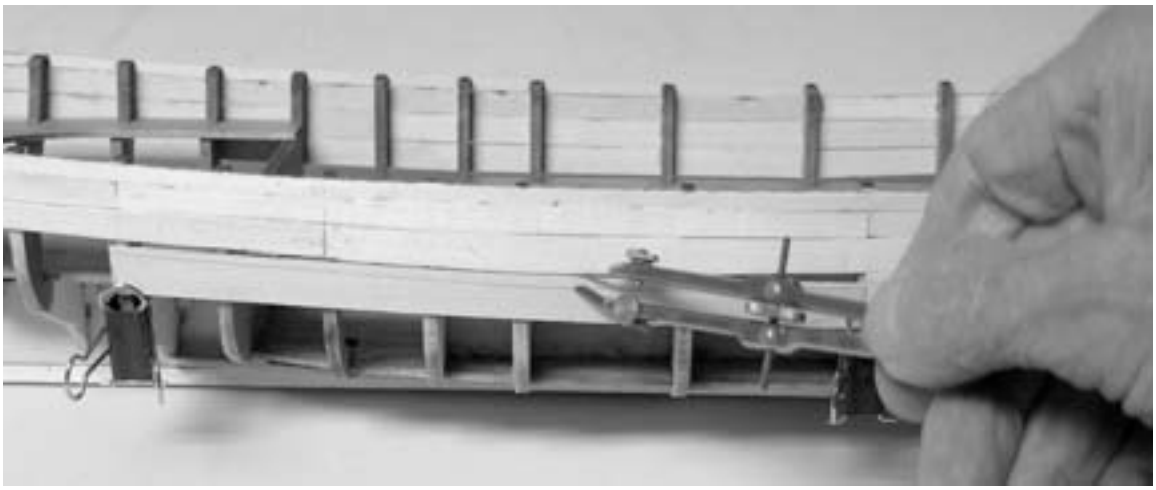


Photo 3: spiling a plank

Begin with strake 2. Fit a piece of plank stock to the stem (bow) and wrap around the hull to about bulkhead 6 or 7. Snip off the strip leaving it a little long, i.e. past bulkhead 6 or 7. Use the narrowest plank stock that will fit to strake 1 and still meet the marks that define strake 2. Does it meet the marks or does it need shaping? Shape if necessary to fit. Try the fit on the other side of the hull. It is usually the case that a plank for a particular position fitted to one side of the hull may be used as a pattern for the same plank at the same position on the other side of the hull. It is good practice to always soak a plank in water and clamp or pin into position and let dry before gluing in place. In fact it will be nearly impossible to glue down planks with severe bend and/or twist without doing so. To complete strake 2, spile and fit a plank to the midships, say to bulkhead 12 or 13. The remaining plank, to the stern has a lot of bend in it. It is not likely that you will be able to use the compass method to fit this plank to strake 1. Bend a piece of stock in place and observe what needs to be cut away to improve the fit. Continue carving and trial fitting until you have a good fit when the stock is bent into place. Soak and clamp and let dry. Then mark the bulkhead locations on the plank as in detail 3-8, transfer the widths at each bulkhead, spring a batten to the width marks and draw the line connecting the marks. Carefully cut to the line and fit to the hull. If you have come this far you now have a good understanding of the planking process.

Tackle strake 13 next. This plank, next to the keel is called the garboard plank. It is standard practice to plank a hull from the sheer down and from the garboard up. Shape a plank to the curvature at the stem noting from the template marks you made where the garboard should end at the stem. Run this plank to midships, about bulkhead 7. Soak, clamp in place, and let dry. Mark bulkhead locations and transfer the distances from the keel to the strake lines. Clamp on a batten to the marks and draw the other edge of the plank. Continue with a plank from bulkhead 7 to bulkhead 13. The reason for this is that the natural lay of the planks from 13 to the stern require a good deal of twist and upsweep. Study photo 4. The upsweep defined by the batten as it lies naturally along the hull requires a plank of much greater width to complete the garboard strake. In full size practice filling this area is accomplished by the use of filler planks called "stealers". The stealer planks are shown on the profile drawing on plan sheet 3. In the model world we need not comply with this standard practice for we can use wider wood that would not be available for a full size hull.

Clamp a batten as shown in photo 4 allowing the batten to take its natural lay to the bulkheads. This is a good time to note that some beveling of bulkheads 14 and 15 is necessary. Use a batten across the bulkheads to note the bevel required and finish this step now. With the beveling done, again clamp a batten as in photo 4 and mark the line of the garboard strake on the bulkheads. Use card stock to make a pattern of the shape to be filled. Cut and re-cut the pattern until you have it nicely fitted to the space. This piece is wider than the planking stock supplied but there is plenty of scrap wood from the laser cut boards to make this part. Cut out the part, soak and clamp in place to dry. If you wish the stealer planks to show, simply use a pencil to mark and scribe the stealer shape.

Complete strake 12 from bow to bulkhead 12 as shown in photo 4. Again use a batten to determine the line of the upper edge of strake 12 at the stern. This strake will run up to the juncture of the keel and bulkhead 16.

Study the fit shown in photo 5. Make a card stock pattern as shown in photo 5 and complete strake 12. Note in photo 5 that strake 11 has made the turn from the keel to the bulkhead and meets the stern at the landing on part 19B. Continue adding planks and completing strakes alternating from the upper strakes to the lower strakes as seen in photo 6.

Study photo 7 for the shape of the planks at the stern

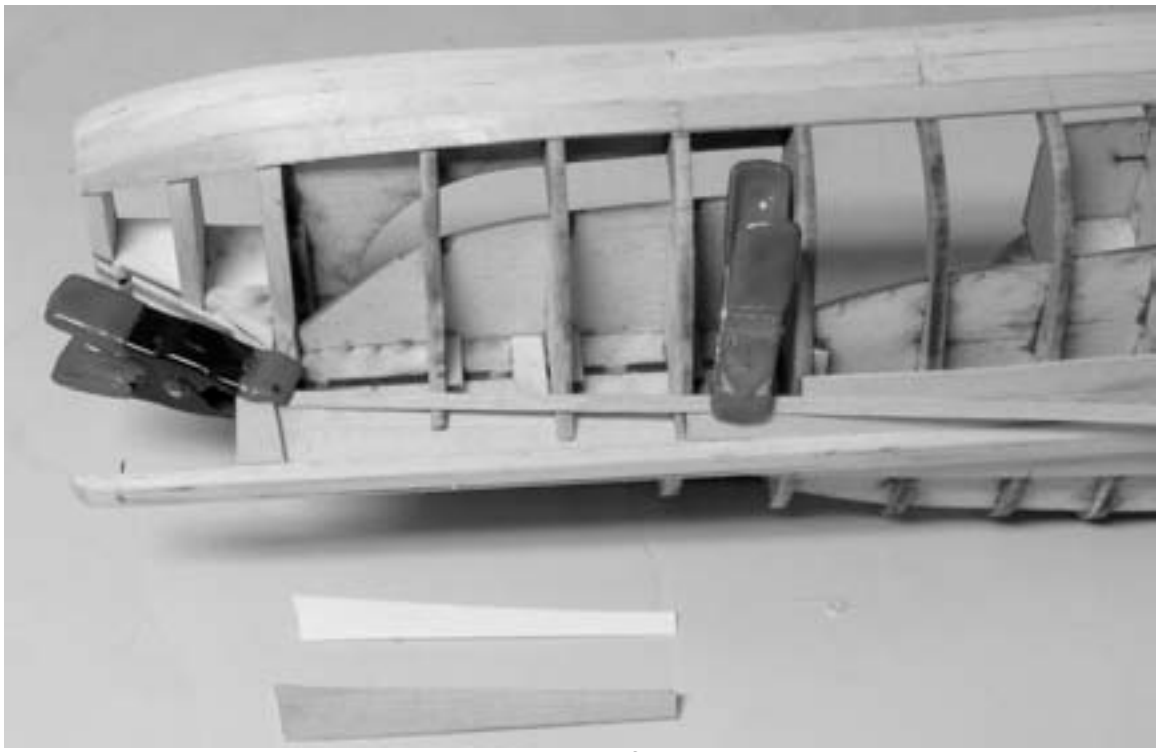


Photo 4: Finding the strake line of the garboard at the stern

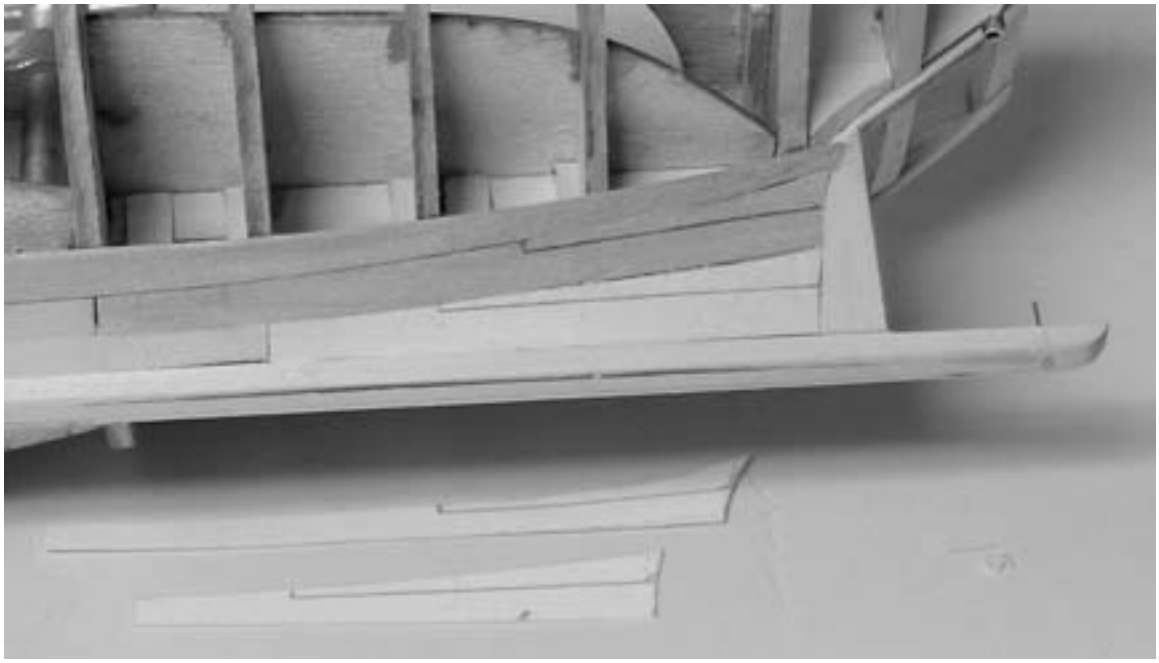


Photo 5: Strakes 11, 12, and garboard completed. Note patterns and stealer planks

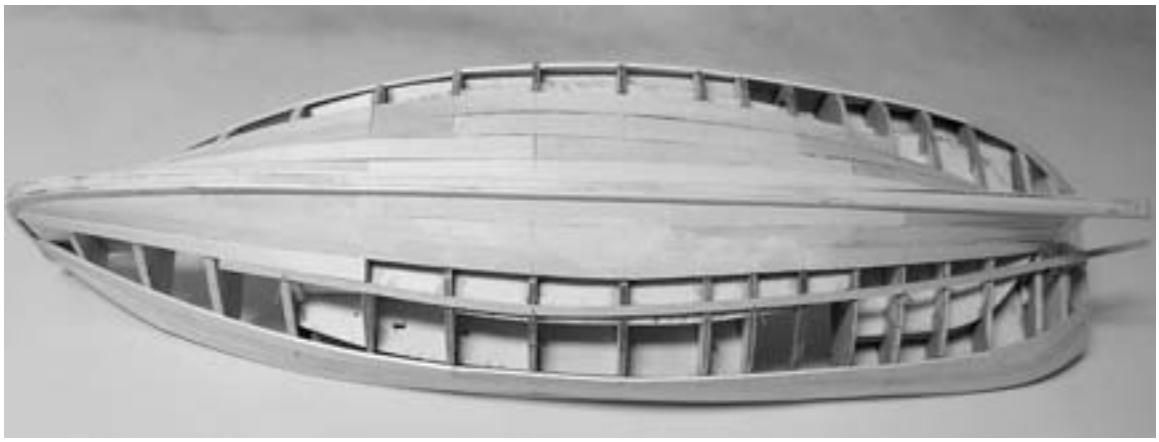


Photo 6: Use of batten to define strake line

Photo 7: The shape of planks at the stern

The final plank to close up the hull is called the shutter plank or sometimes the whiskey plank. With the planking completed we can now finish the fantail stern.

Fantail sterns are somewhat difficult to frame and plank as the plans become very narrow as they taper to meet the stern. We have alleviated this difficulty by using carved blocks to complete the run of the shape at the fantail stern.

Refer to detail 3-9. Fit and glue down part 31, the aft deck. Glue in place parts 33, 34, and 35. Carve, sand, and fair as shown.
Note in the section view that part 33 is not taken to a sharp point but is left largely intact.

Photo 8: The completed fantail stern. Sanding and filling has begun

We may now begin the sanding and filling process. Proceed through various grits of sandpaper from coarse grit to fine grit and continue applying filler and sanding until you are satisfied with the hull. Elmer's brand filler was used on the prototype.
Refer to detail 3-10. The fore deck, part 30, can now be fitted and glued. Fit and glue on the covering boards, parts 32. Begin the 1/32" x 1/8" rub rail by wetting the center portion of a strip and bending around the stern as shown, Clamp in place and let dry then glue in place. Complete this rail to the bow. Refer to the hull cross sections on plan sheet 2 for the location of the 1/16" x 1/16" rub rail. This rail runs along the joint between strake 3 and 4. Add the 1/32" x 3/32" trim strips as shown in detail 3-11. Note that it terminates at about frame 14. Add the mast keepers, parts 38.

The hull may now be painted. It is not known what color(s) that Cushing's boat was painted. As afore mentioned I chose black hull and gray interior. Add the two sizes of cleats as shown in detail 3-11. Now is the best time to install the brass simulated hinges on the coal bunkers. CA gel was used to apply these on the prototype. Now is a good time to build and install the rudder. Refer to the rudder construction depicted on plan sheet 4. Note that the rudder shaft must be made in two pieces in order to be fitted to the hull. If desired, the two pieces may be CA glued together as a final step after installation. Note in many of the photos the pin installed from the bottom of the keel through the rudder shaft slot in the keel. This will serve to keep the rudder in place. Your hull should now look like photos 9 and 10.

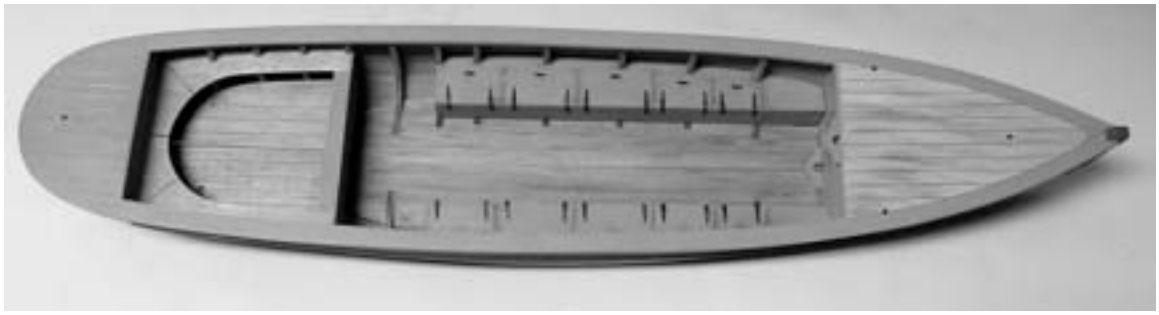


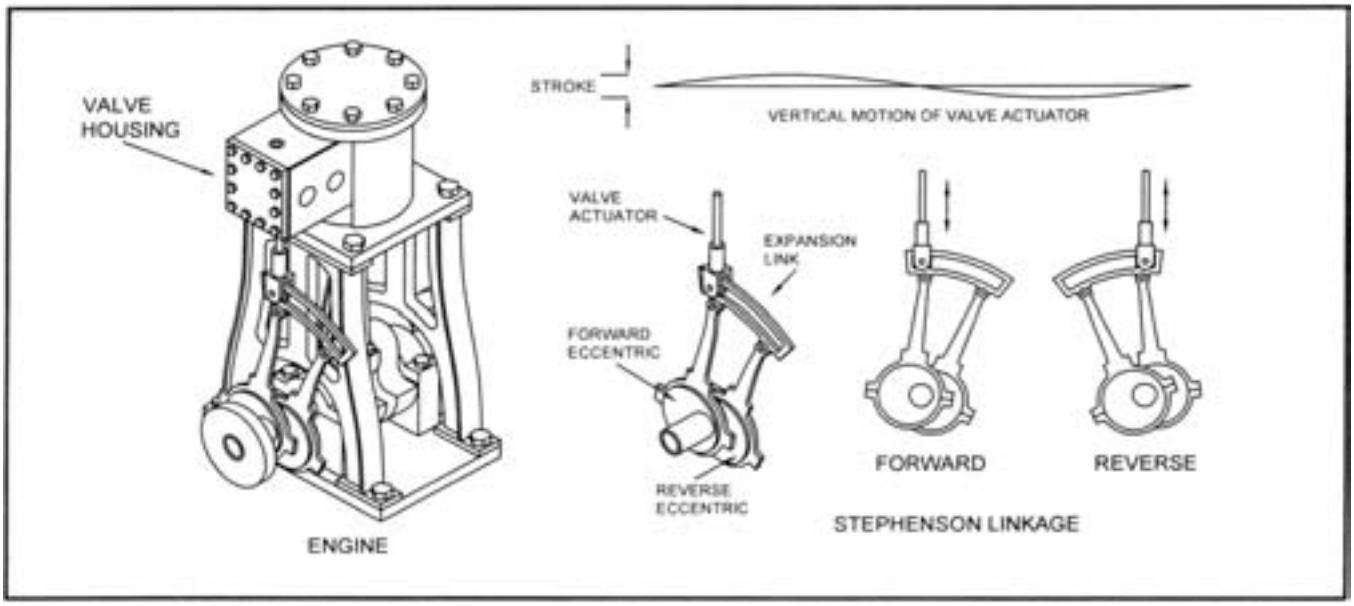
Photo 9: Hull topside painted

Photo 10: Hull bottom painted

Building the Steam Power Plant

Historical references lead us to believe that the steam power machinery for the boat was probably built by the Clute Bro's Co. of Schenectady, New York. The Clute brothers were one of the country's earliest manufacturers of steam power machinery. They built steam locomotion for marine use as well as railroad engines. It is documented in the historical records of Schenectady that in October 1861 the Clute Brothers Foundry and Machine Shop received a Federal commission to build the steam engine that would power the USS Monitor's turret mechanism. It is recorded that Lt. Cushing took delivery of his torpedo boats in New York.

The steam engine modeled for our kit is taken from drawings and pictures of typical Clute engines of the era. It is a single cylinder condensing type of approximately 7" stroke and a piston diameter of 8". These steam engines were high torque slow revolving devices which swung a large propeller (wheel) with a high pitch. Our torpedo boat probably had a propeller of a diameter between 36" and 42" which reached about 150 revolutions per minute. The engine was of a reversing type with the reverse accomplished by a Stephenson linkage. A Stephenson linkage is a clever device of links and eccentric cams which could selectively switch the steam input valving mechanism to forward or reverse. Stephenson linkages or a variation thereof were also used on railroad engines.



Building the Boiler

Locate four parts S2 and three parts S1. Assemble and glue as shown in detail 1-1. Sand the laser cut surfaces to remove char and fair the parts smoothly. The metal shells of these boilers were hot in operation and were covered with wooden slats to protect the crew. Begin planking the structure with 1/32" x 3/16" strips aligning the first one with part S2. Snip off a bunch of strips slightly over length and work from the first strip adding planks on each side. The final strip could leave a gap that will be placed on the bottom of the boiler and thus not seen. Glue on a few strips and then trim the ends with a hobby knife as you go.

Glue parts S3 and S4 together to form the steam dome framework as shown in detail 1-2. Select what part of your structure to be the top of the boiler and glue the dome framework to the center taking care that the steam dome is square to the boiler shell. Plank the steam dome with 1/32" x 1/8" strips just as you did the boiler shell. Now is the best time to apply wood stain and a finish to the wood parts of the boiler. Stain the wood and when dry rub lightly with steel wool. Apply a clear finish such as Krylon clear. Testors Dullcote may be used to remove any sheen. Locate part S5, the dome top and carve and sand to the section shape shown in detail 1-3. Finish this part flat black and apply. The wooden slats were held to the boiler by iron straps. Cut out the card stock strapping material supplied on the pattern sheet. Paint the straps black and apply as shown. Complete the boiler mounts from parts 1 and 1/16" x 3/16" strips. Use the full size views to determine the length of the 3/16" parts. Glue the mounts to the boiler in the position shown ensuring that the dome is square and plumb.

Forward Boiler End: Refer to detail 1-4. Locate parts S7, S8, and S9. Glue part S8 to part S7 aligning with the laser engraved marks. Glue two parts S9 to parts S7 and S8 as shown. Apply parts S10, S11, and S12 next. Cut pieces of 1/8" square stock and glue in place as shown. Square off the top of the assembly and glue on part S13. Glue on part B10. Carve and sand the corners to fair into part B10 as shown. This step is optional but gives the boiler a more realistic appearance. Fill and smooth this assembly so that joints and wood grain do not show. The goal is the appearance of sheet metal. Cover the gap at the bottom end of part S11 with card stock as shown. Note that very little of the gap needs to be covered as the underside of the smoke hood will not be seen. Paint the assembly flat black.

Refer to detail 1-5. Smooth the fire door parts filling the grain. Glue parts S15and S16 to part S14 using the full size view to locate. Form brass parts B2, B4, and B9 as shown. Cut a length of 1/32" dia. rod. Parts B2 may be soldered to the rod or simply glued in place. Apply the brass parts as shown. Paint this assembly flat black and apply to the forward end. This completes the forward end assembly.

Aft Boiler End: Refer to detail 1-6. Locate part S17, boiler end. Fill and finish this part flat black. Make up the boiler water sight glass as shown. Cut a length of 3/32" dia. to about 7/16". Glue two Els as shown to the ends. File off the flange of the Els adjacent to the tube for a more realistic appearance. The purpose of the boiler water sight glass was to indicate the level of the water in the boiler. Assemble two parts B13 with pins to make up the valve cocks. It is convenient to solder the pins to the brass.

TIP: It is convenient to solder or glue the pins to parts B13 before cutting them loose from the brass photo etch sheet. Cut off the pins to an appropriate length. Drill and install the two valve cocks. Paint the Els black and the tube white. Drill 1/16" holes and install the sight glass in the approximate location shown. This completes the aft end assembly.

Before gluing the ends to the boiler shell it is best to prepare and finish the smoke stack. The smoke stack is made from a 1/2" dia. dowel, 3" length. Fill and finish the dowel flat black. Glue the stack in place. Glue the forward end in place with carpenters glue, align the forward end assembly such that the stack is vertical and plumb. Glue the aft end in place. Refer to detail 1-7 and make up the safety valve and plumbing as shown and install to the dome. The pressure gage is made up from part S25 and the gage dial face from the card stock sheet. This completes the boiler assembly.

Building the Engine

The steam engine construction sequence depicted on plan sheet 1 may appear complicated but is actually rather straight forward. The parts are small and some patience is required to successfully build this engine. In fact, if carefully assembled, the engine will actually turn over. That is, by rotating the flywheel the crankshaft will rotate and you will be able to see the Stephenson linkage operate. Before beginning study detail 1-8 and the sequence of construction steps shown in other details

NOTE: It is not known what color the Clute Company painted their engines. The boat was purchased for the U. S. Navy by Lt. Cushing not built for the navy so the engine was most likely the original manufacturers color. The choice is yours. It is recommended you decide early on what color or colors you are going to finish the engine in and pre-finish the pieces before assembly.

Refer to detail 1-9. Locate parts E15A, E15, and E16. Prepare the 1/16" dia. AL tubes and assemble as shown. Note that the only difference between part E15A and E15 is the size of the hole in the portion that forms the valve housing. This hole will later receive a portion of the 3/32" dia. piping.

NOTE: When cutting tubing and rods ensure that the ends are square and burr free so that any tubes and rods intended to slide into each other will do so without difficulty.

These 1/16 tubes have two functions. One to help align the assembly and two to later receive the piston rod and valve actuator rod for smooth operation. This assembly will now serve as an alignment jig for assembling the piston rod. Prepare the 1/32" dia. brass piston rod and parts E12 and B6. Insert the rod in the Al tube as shown, assemble part E12 and B6, and apply a small dab of CA glue being careful not to glue the assembly to the underlying part. Remove the piston rod assembly and apply a liberal amount of CA to the joints. Locate part E11, the connecting rod, Assemble the piston rod to the connecting rod as shown with 1/32" dia. rod. **TIP:** Insert a longer piece of rod; apply a bit of CA glue to the rod and brass ensuring that the connecting rod remains free. We want the rod to stick to the brass part B6 but not the connecting rod. Then snip of the excess rod and file smooth. If desired, apply the 0.04 hex nuts for added realism. Finish paint the assembly silver.

NOTE: Three sizes of extruded hex styrene rod are included, .04, .06, and .08. These are intended for the creation of simulated bolt heads. Cut off small bits of rod with a hobby knife and apply. Refer to detail 1-10. Locate two parts E9. Soak these parts in thin CA to strengthen them. Fill and finish these parts silver.

Prepare the two 1/8” dia. Al tubes to length shown. Assemble the parts E9, the 1/8” dia. tubes and the connecting rod as shown. Pass the 3/32”dia. alignment tube through the 1/8” tubes and the 1/16” dia. AL tube through the connecting rod as shown.

Assure that all parts are properly aligned and carefully apply CA glue to the assembly. We want the connecting rod to remain free. If necessary file the 1/16 tube flush with the face of parts E9. Locate parts E10 and soak in thin CA. Fill and finish these parts silver. Apply the .06 hex bolt heads if desired before painting. Check the fit of a 1/8 tube through these pieces and adjust as necessary. The tubes should rotate freely. Refer to detail 1-11. Locate part E6 and glue the crank assembly in place using the laser engraved lines for alignment. Remove the 3/32 tube. If properly done the crank should rotate. If not, no problem, it just means you will have a static engine. Refer to detail 1-12. Locate parts E1, E2, E3, and E4. Glue up two frame assemblies as shown, remembering to cut away the area between the laser engraved lines on parts E3. Locate part E5 and finish with .08 hex bolts. Apply the frames and part E5 as shown. Note the .08 hex bolts at the feet of the frames.

Study detail 1-8 and 1-13. Locate four parts E8, two parts E7 and two parts B5. Note that the only difference between parts E7 and E8 is that E7 is of a smaller diameter and thicker than E8. Before assembly check the fit of parts E7 within part B5 and adjust as necessary for a smooth fit. In operation part B5 rotates about part E7. Also check that a brass pin will pass through the upper end of part B5. Gather a piece of 1/8” dia tubing and a piece of 1/32” dia. rod to use for alignment of the parts during assembly as shown. Glue one part E7 to one part E8. Repeat with the other parts E7 and E8. Place a part B5 on part E7 and glue another part E8 to E7 thus capturing brass part B5. Check for free rotation of part B5. Repeat for the second assembly. Study the side view of the eccentrics in detail 1-3 and the engine full size views. Note that the forward eccentric arm bends slightly toward the reverse eccentric and vice versa for the reverse eccentric. This is so the connections to the expansion link are in the same plane as the face of the expansion link. These bends are very slight and may be made before assembly or after attachment to the expansion link.

Locate part B8, expansion link. The brass pins used to attach the eccentric links to the expansion link will have a neater appearance if chucked in a rotary tool and held against sandpaper to reduce their size a bit. Also some of the head height can be filed off. Pass a pin through an eccentric link and the expansion link, snip off the pin and holding the head end of the pin on a hard surface tap the other end of the pin to form a rivet. A word about riveting: if the pin is cut off too long it will likely just bend over instead of forming a rivet head. If too short it will not form enough of a rivet to hold. In either case, just remove the pin, and try again. When both eccentrics have been attached align the pair of parts E8 and E7 such that you can pass a 1/8” dia. tube through both of them. When satisfied with the alignment the eccentrics may be glued together taking care not to glue to the temporary alignment tube. This is the configuration that will be applied to the engine assembly. Construct the valve actuator as shown from 1/32” dia. rod, a short piece of 1/16” dia. tube, and part B7. Square up the assembly and secure with CA glue. Rivet the assembly to the expansion link as shown. This completes the Stephenson linkage and it is ready to assemble to the engine.

Refer to detail 1-14. The cylinder and valve housing assembly can be finished in one of two ways. That is to fill and finish the wood parts in a conventional manner. This requires a lot of filling and sanding. A more convenient way is to cover the surfaces with card stock as shown. Apply card stock pieces cut from the supplied card stock sheet as shown. Trim as needed. Apply parts E17, E19, B15, B16, and two parts E14 as shown. Center the upper part B14 over the 3/32” dia. hole in the housing. Drill thru the part B14 on the side of the housing a short depth to prepare for later installation of the plumbing. Finish this assembly as desired.

We are now ready for final assembly of the engine. Slide the Stephenson linkage onto the engine shaft into position to align the valve actuator rod with the valve housing. Carefully fit the cylinder/valve housing assembly in place inserting the valve actuator and the piston rod into their respective tubing. Check the alignment of the Stephenson linkage with the valve housing, center the cylinder assembly on part E6, and glue the cylinder/valve housing in place. It is not necessary to glue the Stephenson linkage to the shaft unless you are trying for a working engine. Refer to detail 1-15 and assemble and finish the flywheel and the drive flange and glue in place.

Refer to detail 1-16: Locate the two pump castings. Assemble the parts as shown noting that the EL on the seawater pump points aft while the EL on the feed pump points forward. These pumps were driven by a cam arrangement connected to the engine shaft. It is not practical to model this mechanism as it is much too small. Instead we will point the drive rod at the shaft to give the appearance of a driven mechanism. The pumps simply mount thru the holes in part E6. Complete the piping as shown. Note that the steam exhaust should not protrude beyond the seawater pump due to space constraints. This finishes the engine.

Photo 11 Engine front

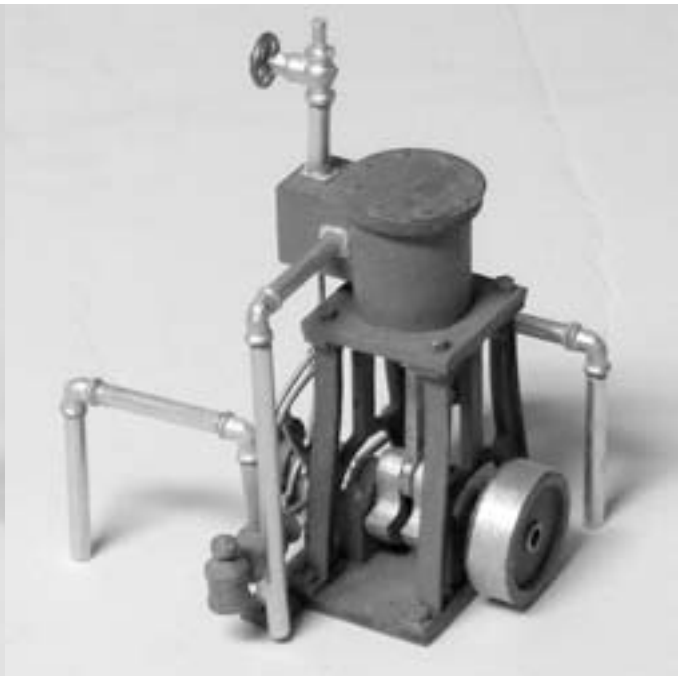


Photo 12 Engine rear

Refer to detail 4-7 for the construction of the Condenser. Cut a length of 1/2" dowel to 1". Glue on parts S23 and the card stock band. Note the alignment of the holes in parts S23. Add parts 22. Complete the plumbing as shown. Note that the vertical piping simply goes to the deck giving the appearance of thru deck piping.

Refer to detail 4-8 for the construction of the hot well. The hot well received the condensed water and was designed to separate any oil in the water before sending the water back to the boiler.

The entire steam plant layout is depicted on sheet 4. The relative position of these elements is up to the builder. The hot well should be between the condenser and boiler. Refer to the photos as to the placement on the prototype model. It is advisable to install the steam plant and remaining piping as a final step in the model construction.

Building the 12 pounder Dahlgren Howitzer

The boat mounted Dahlgren howitzer is an interesting piece of naval ordinance history. To account for and absorb the recoil of the gun, it was mounted on a slide that topped the carriage base and held to the base by large wing screws that threaded into another plate under the carriage bed. The screws were tightened such that upon firing the slide could move relative to the carriage bed thus absorbing the recoil through friction between the slide and base. The carriage was held to the deck by a pin through plates attached to the deck. There were three such attach points arranged in an equilateral triangle. The rear of the carriage could be swung to the port or starboard attachment point, the front released and the carriage swung around athwart ships. The rear of the carriage could then be swung to the front attach point, the front released and the howitzer swung so that it had turned 180 degrees. It could then be reloaded and the process reversed to return to firing position. Imagine the work involved swinging such a heavy gun through these maneuvers.

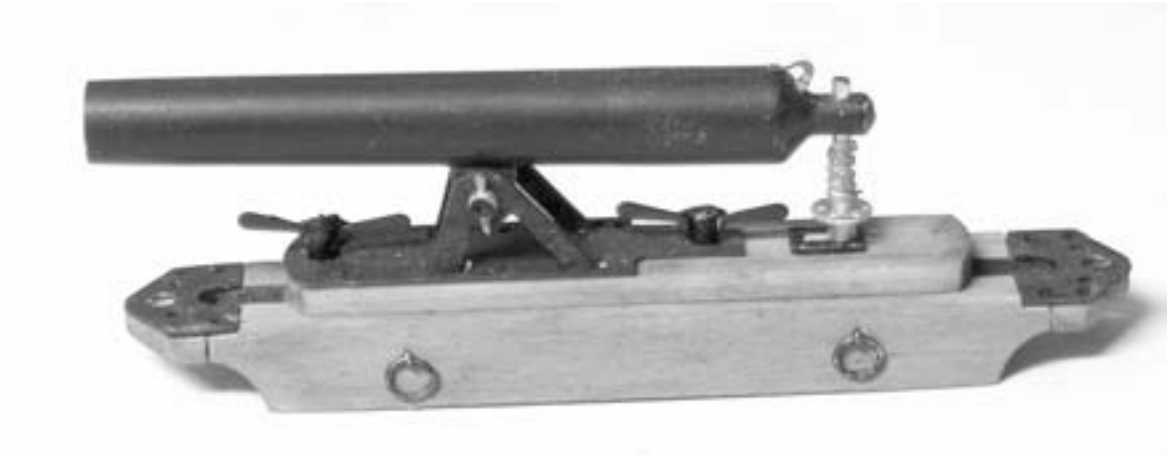


Photo 13: 12 pdr Dahlgren Howitzer

Refer to the construction sequence on sheet 4. Part H1 and parts H2 form the carriage base. Part H1 needs to be carved to achieve the angle taken by parts H2 as shown. Cut to the laser engraved line. Lay a part B19 on the ends of part H1 and mark the line for the recess. Cut the recesses so that part B19 lies flush with part H1. Glue part B18 to H3. Makeup two of the wing bolts from parts B20 and 3/32" dia. tubing. Use a razor saw to cut the slots and assemble with epoxy glue. Assemble the remaining parts as shown in details 4-3 and 4-4. Drill a 1/32" dia, hole slightly off center for part B33. Part B33 simulates the firing mechanism. Make up three of the attach points from parts B23 and H5. Make the bends in part B23 with the bend lines to the outside of the bends. Make three pins from 3/32 dia. tubing and brass pins. These parts may now be glued to the deck in their appropriate positions. Pin the howitzer in place on the deck.

Building the Spar Torpedo

Historical references differ as to the exact configuration and deployment method of the spar torpedo. It's basic function is well understood but certain details such as method of deployment, method of attach and release, and rigging of the spar are missing. Some references show a line from the spar reeved through the block at the top of the mast, others do not. The rigging and hardware for the model were comprised of the best information that could be gathered.

Refer to the drawings on sheet 4. Carve the end of the remaining 1/2" dowel to a point as shown. This is best done with a sharp chisel but may be accomplished with a hobby knife. Cut to a length of 1 5/8". Cut a 3/16" dowel to a length of 14". Bend part 31 to shape as shown keeping the etched bend lines to the outside of the bend. Fit and adjust the bends to fit the 3/16" dowel. Cover the aft portion with card stock as shown. Cut two pieces of 3/32" square stock to a length of 1/4" and one piece to a length of 3/8". Shape and apply as shown. Mark the location of part B32 relative to the opening in part B31 and drill and glue in part B32. A pin through these two parts serves to connect them and allow a release of the torpedo. You may want to glue or pin the Torpedo in place. Add the eyebolts as shown.

The construction of the spar hanger hardware is shown on sheet 4. Bend parts B24 and B25 to shape and rivet as shown. A tip on riveting. If you cut the brass pin too long it will likely bend instead of forming a nice rivet. Cut the pins off very close to the parts. Set the head on a hard surface and tap the protruding pin portion with a small hammer, or hammer and punch.

The forward spar hanger is designed to allow the spar to slide forward as well as rotate downward as well as side to side. Bend parts B27 and B28 to shape and rivet. Bend part B30 to shape and rivet to part B28. Check for proper fit of the 3/16" dia. spar. Rivet this assembly to part B26 as shown. Bend part B29 to shape and CA glue to part B26. The aft hanger is applied to the starboard side at bulkhead 13. Drill holes and attach with pins. The forward hanger attaches at bulkhead 4. Be careful when drilling the holes not to let the drill poke thru the hull. Shorten the pins if necessary. Insert the spar and wrap the aft end with a card stock strip as shown. This simulates an iron ring that serves as a stop when the spar is pulled forward to deploy. The aft end of the spar is held in place with a lashing to the hanger.

Rigging the spar is a matter of choice to the builder. In practice the spar was pulled forward by a line attached to the aft end. A line to the forward end was used to position the torpedo before releasing it. Just how this was accomplished is not known. Another line would release the torpedo and another line would be for pulling the firing pin. On the prototype model these lines were run to cleats and the remainder coiled and displayed on the boiler deck.

Installing the Steam Plant

Using the photos as guide, decide where you want the steam engine. Measure and cut a length of 3/32" dia. tubing for the prop shaft such that it will engage the engine shaft. Glue the propeller to the shaft with CA glue. Glue in the engine. It might be a good idea to not glue the prop shaft to the engine lest the engine be damaged by folks trying to turn the propeller. Install the boiler and complete the piping. Glue in the condenser and hot well. The rudder and tiller may now be permanently installed.

Final Details

Use black rigging line to attach the four stays that secure the boiler smoke stack. These secure to eyebolts as shown in the photos. The mast construction detail is on sheet 2. The cradle to display the model is on sheet 5.

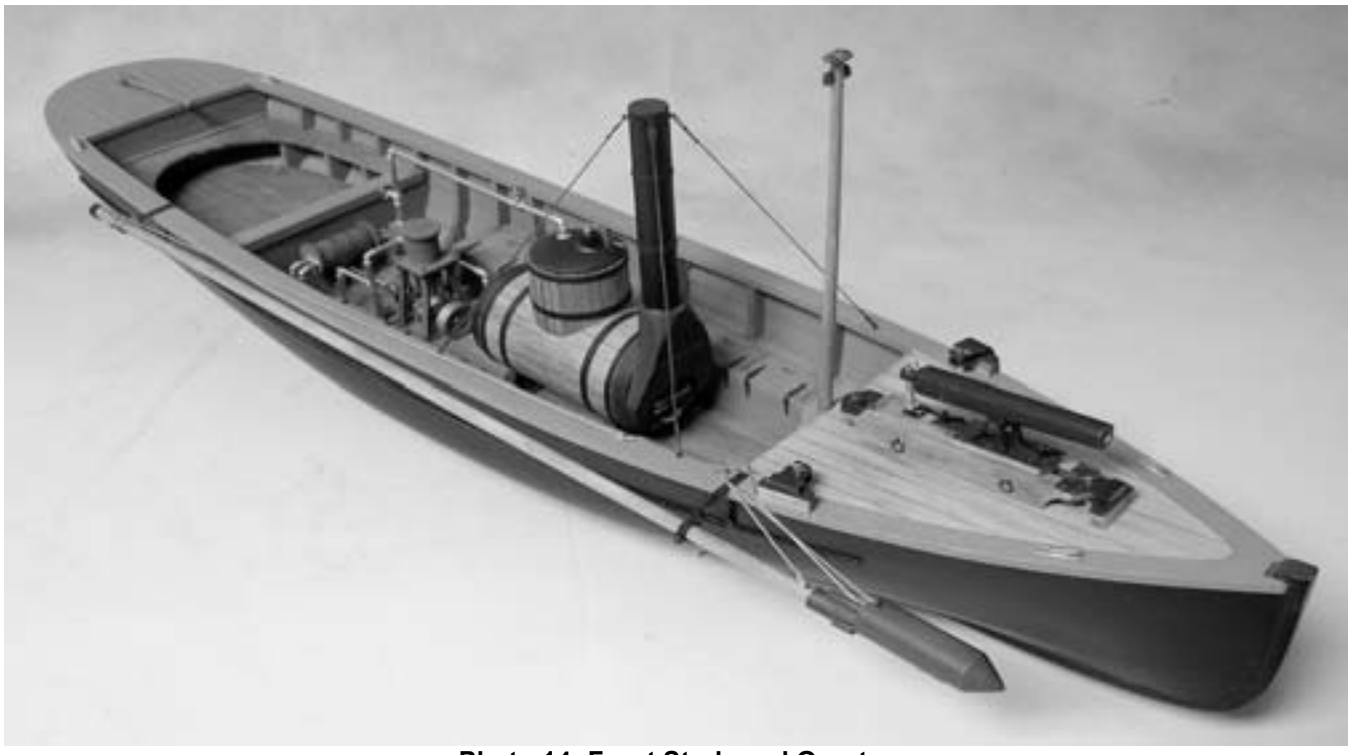
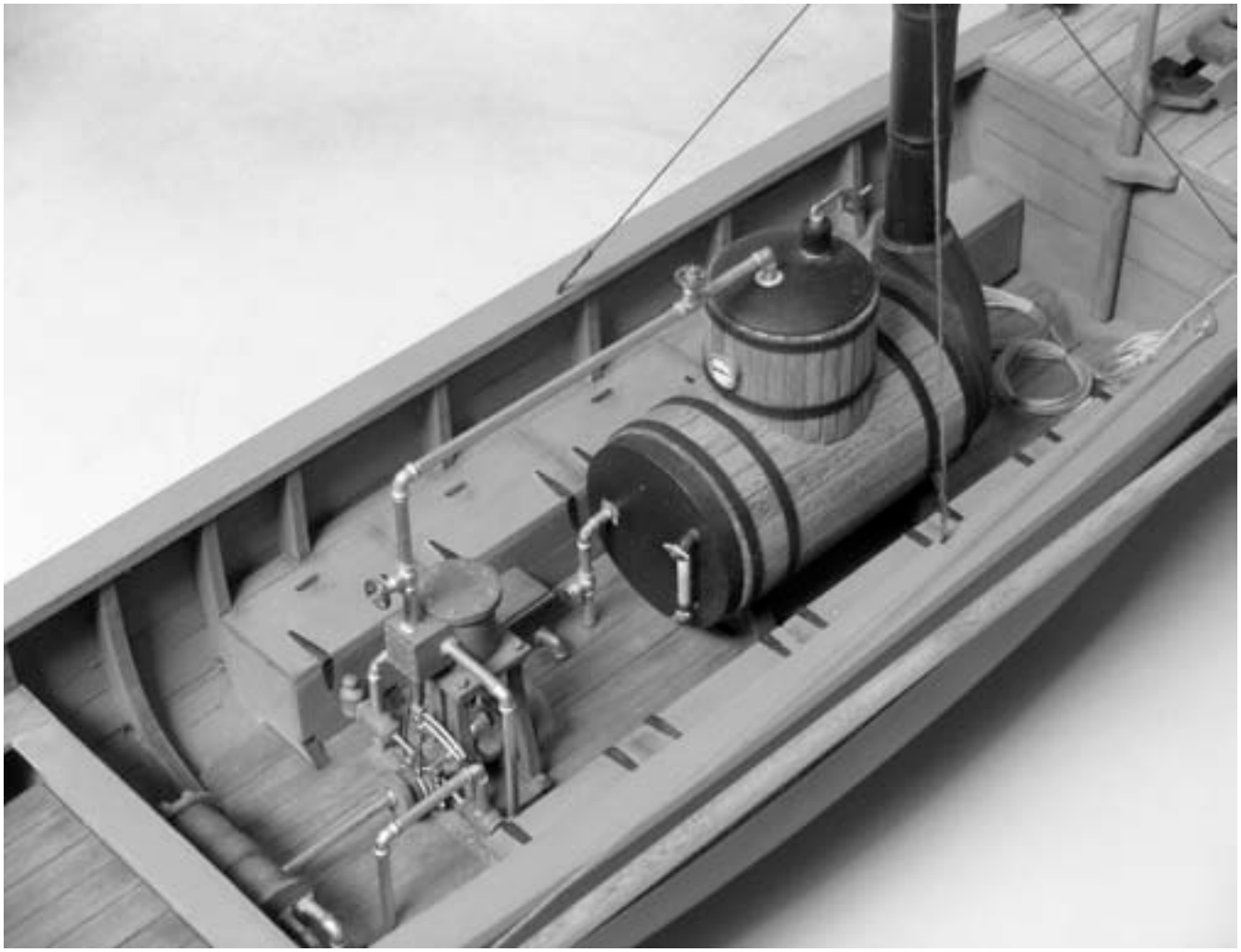


Photo 14: Front Starboard Quarter



3/15/2013

GUNBOAT PHILADELPHIA
PARTS LIST MS2263

PART #	ITEM	QUANTITY	DESCRIPTION/NOTES
BRITANNIA CASTINGS 3 packs			
WP8401	Pump assembly	2	
WP8402	Propeller 40mm	1	
WP8403	Dahlgren howitzer barrel	1	
WP40172-	Pipe Fittings set:		
	1. Elbows	16	
	2. valves	3	
	3. Hand wheels	2	
BRASS, WOOD AND MISCELLANEOUS FITTINGS AND MATERIAL			
WP0046	Cleats large	4	Britannia metal
WP0806	Cleats small	4	Britannia metal
WP0303	5/32” Single Blocks	2	
WP0428	Eyebolts	12	Brass
WP0993	Nails	30	
WP0953	Split Rings	4	
WP0873	.04 Hex Rod	2”	white plastic
WP0874	.06 Hex Rod	2”	white plastic
WP0875	.08 Hex Rod	2”	white plastic
WPDRL22641	Drill bit #41	1	
WPDRL22670	Drill bit #70	1	
WPDRL22675	Drill bit #75	1	
WP160K-12	Rod - 1/32" dia. X 12”	1	
WP100K-12	1/16” x 12” aluminum tubing	1	
WP101K-12	3/32” x 12” aluminum tubing	4	
WP102K-12	1/8” x 12” aluminum tubing	1	
WP1727	Photo etched	1	Brass
RIGGING LINE			
WP1211	0.028” Dia. Black	2 yds	
WP1243	0.028" dia. tan	7 yards	

WOOD DOWELS

Note: All dowels are Beech unless otherwise noted. Dowels are supplied in lengths as noted. Cut to length as required.

WP5103-12	3/16" x 24"	2
WP5108-06	1/2” x 8”	1

WOOD STRIPS

Note: All wood is Basswood or Limewood (European Basswood) unless otherwise noted. Wood strips, sheets, and blocks are supplied in lengths as noted. Cut to length as required.

STRIPS

WP3603-24	1/32" x 3/32”x 24”	3
WP3604-24	1/32" x 1/8” x 24”	6
WP3606-24	1/32" x 3/16”x 24”	4
WP3618-24	1/16" x 1/16” x 24”	4
WP3622-24	1/16" x 3/16”x 24”	1
WP3623-24	1/16" x 1/4” x 24”	4
WP3676-24	1/16" x 5/16” x 24”	1
WP3656-24	1/16" x 3/8” x 24”	6
WP3624-24	1/16" x 1/2” x 24”	12
WP3620-24	1/16" x 1/8” x 24”	2
WP3625-24	3/32” x 3/32”	1
WP3631-24	1/8" x 1/8” x 24”	1

LASER CUT AND MACHINE CUT PARTS WOOD PARTS

Note: All Laser-Cut wood is Basswood or Limewood (European Basswood) unless otherwise noted.

WP4608-24	1/16” Thick Set	1	
	PB1		24 parts
WP4607-24	1/16” Thick Set	1	
	PB2		24 parts
WP4613-24	1/8” Thick Set	1	
	PB3		14 part
WP4629-24	1/8” Thick Set	1	
	PB4		21 part
WP4619-24	3/16" Thick Set	1	
	PB5		27 part
WP4656-20	1/64" Thick Set Plywood	1	
	PB6		8 parts

WP4655-20	1/32" Thick Set Plywood	1
	PB7	11 parts
WP4633-20	1/16" Thick Set Plywood	1
	PB8	11 parts

PLANS AND INSTRUCTIONS

WP2261MB	Instruction Manual	1
WPPL2261-A	Plan, 5 Sheets	1
WPPL2261	Parts List	1
WP2261HT	Pattern sheet	1
WP2261	Photoetch identifier sheet	1