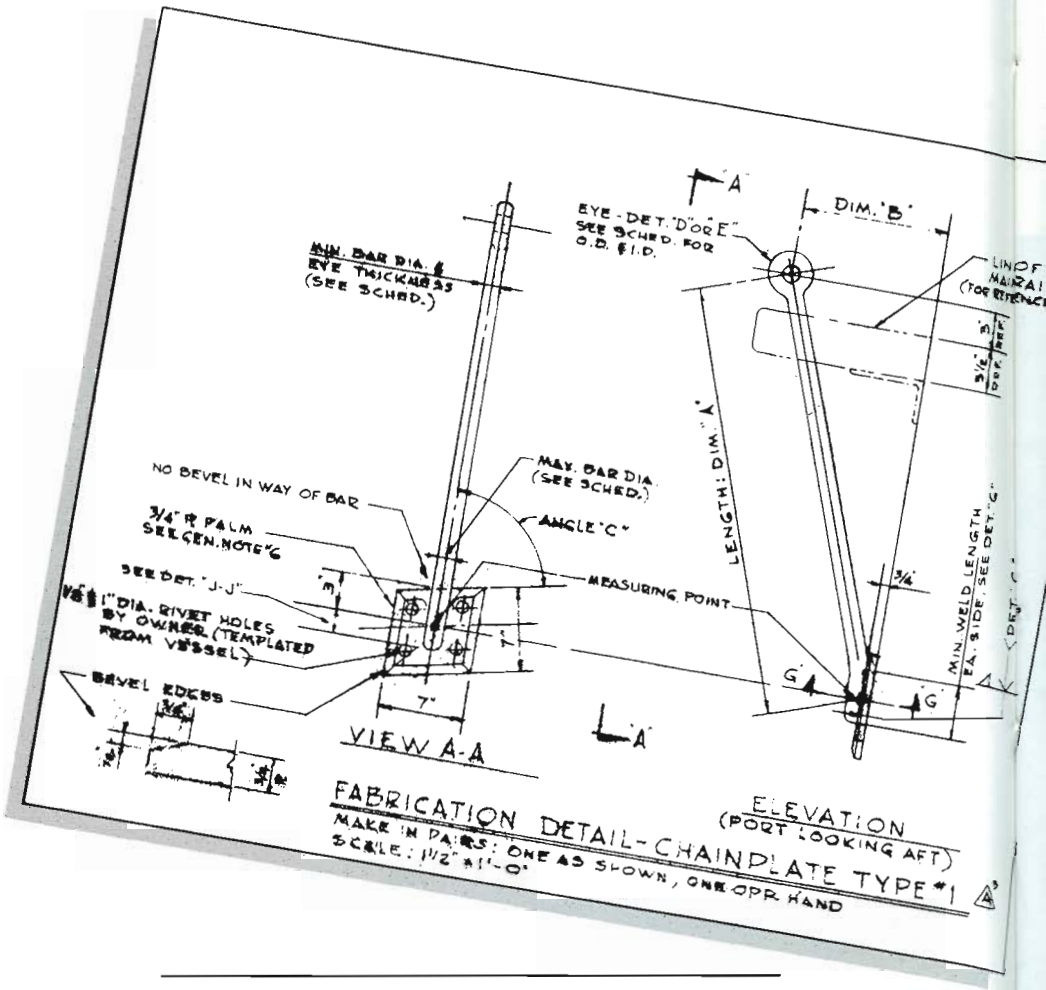
ELISSA: A WROUGHT IRO

Part II: Restoration Begins

In 1980 not much more than the hull and deck beams of the "Elissa" sat at a Galveston dock ready for the task of bringing her, as close as possible, to her original 1877 condition. This was to be done without benefit of the original plans which were destroyed in a bombing raid at the Aberdeen shipyards during World War II. A great deal of research and planning had to be accomplished by the restoration staff of historians and engineers before actual reconstruction could begin. Design and engineering decisions needed to be done not only on paper, but on board the ship as well, so that each element would be compatible with the time-altered structure of the ship.

It became evident early in the restoration process that the large shipyards and manufacturing companies were not sympathetic to the significance of the project, nor were they familiar with the quality and skill that the job demanded. Contractors bid on the work using the same criteria that they would employ while working on an oil supply boat. A problem of communication evolved as to what was expected for the restoration versus what the union establishments were able and willing to provide at a reasonable rate. It was evident that using the traditional outside manufcturing sources would become, for the most part, financially as well as technically impossible.

It was apparent that the restoration required skilled individual craftsmen who would work on the project and train a support crew of workers in their respective fields. In October, 1980, representatives of the "Elissa" Project approached Joe

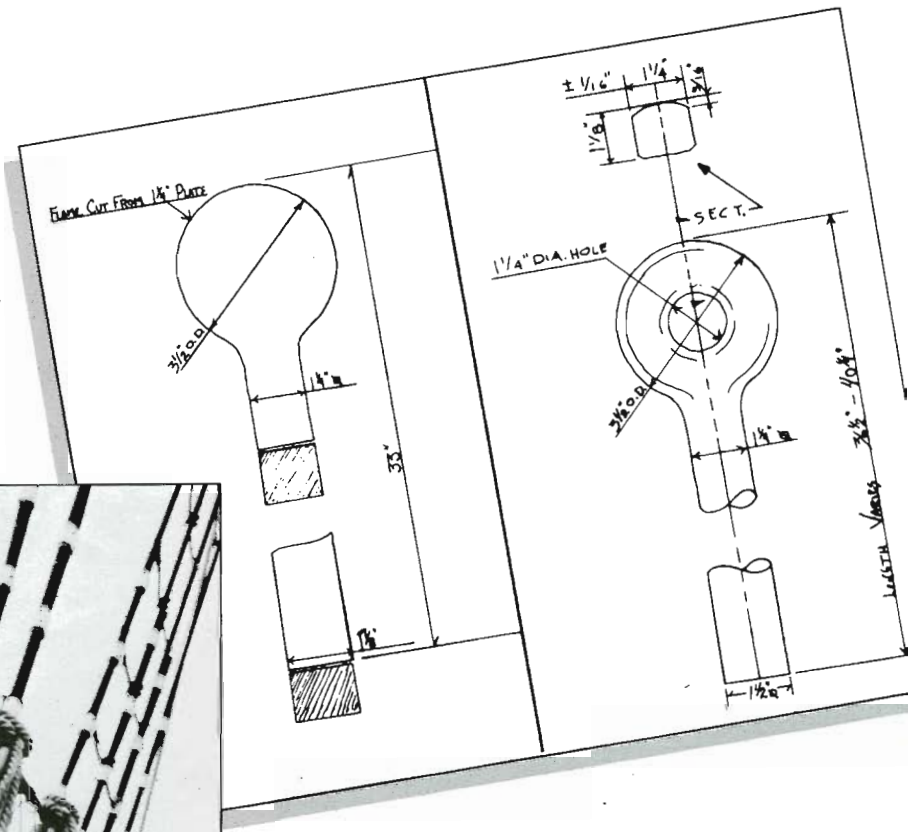


Partial List of Specifications for Ironwork

- Welding must be of good quality, sound & thoroughly fused. Contractor to submit welding procedure &/or qualification tests . . . required by "Lloyds" representative for his approval. Partial or 100% mag. partical inspection of welds to be made . . . defective welds to be corrected by contractor, as directed by "Lloyds" surveyor.
- Contractor to fabricate one chainplate for approval by owner. This shall become the standard for acceptance of all chainplates.
- All welds shall be ground smooth before inspection.
- Blast and shop coat approved work with inorganic zinc silicate, "interzinc" QHA028/QHA027 . . .
- Steel to be A.S.T.M. Grade A-36 furnished by contractor. Furnish mill sheets to owner . . . ultrasonic tested for lamination by contractor for owners' approval.
- Chainplate bar & eye to be cut and forged from one piece of stock to dimensions shown.
- All dimensions to be held to ± ⅛" . . . except where noted.

ON BARQUE

by: Joe Pehoski
Doug McLean
George Holliday



Chainplates installed.

Pehoski at his shop in central Texas as part of a feasibility study to see if blacksmithing could be incorporated into the restoration project. In response to that meeting it was decided to award Joe the contract to fabricate 72 chainplates. In addition to this contract Joe also agreed to help set up a basic blacksmith shop at the restoration site and teach Doug McLean the fundamental skills in smithing necessary to forge in-house fittings at the site. This was the beginning of a strong friendship and working relationship that has been productive to this day.

The three following things had to be kept in mind for the restoration of "Elissa": cost, authenticity and technique.

Cost: The restoration had to be done within a budget. Considerations dealing with authenticity had to give way at times to the practicality of getting the job done. For example, mild steel was used throughout the restoration because of its availability and its ease of use when dealing with contemporary

techniques such as machining and welding.

Authenticity: The restored "Elissa" was to be as close to the original ship as possible. Although electric welding was used, a great deal of research was done to guarantee that the flow of lines of any reproduced fitting was in keeping with the lines of the original forged fittings. To find out the techniques used in making the original fittings we took original fittings or parts of fittings from what survived on "Elissa" or what could be found in collections. These fittings were then cleaned and treated with muriatic acid to bring out the grain of the wrought iron. Using this technique, we were able to discern whether a fitting had been punched, welded or split. With this knowledge we could then design a fitting for the "Elissa" with the proper lines at junctions and bends. Often, we would build up welds far beyond their structural requirements so that the proportions would be correct after grinding.

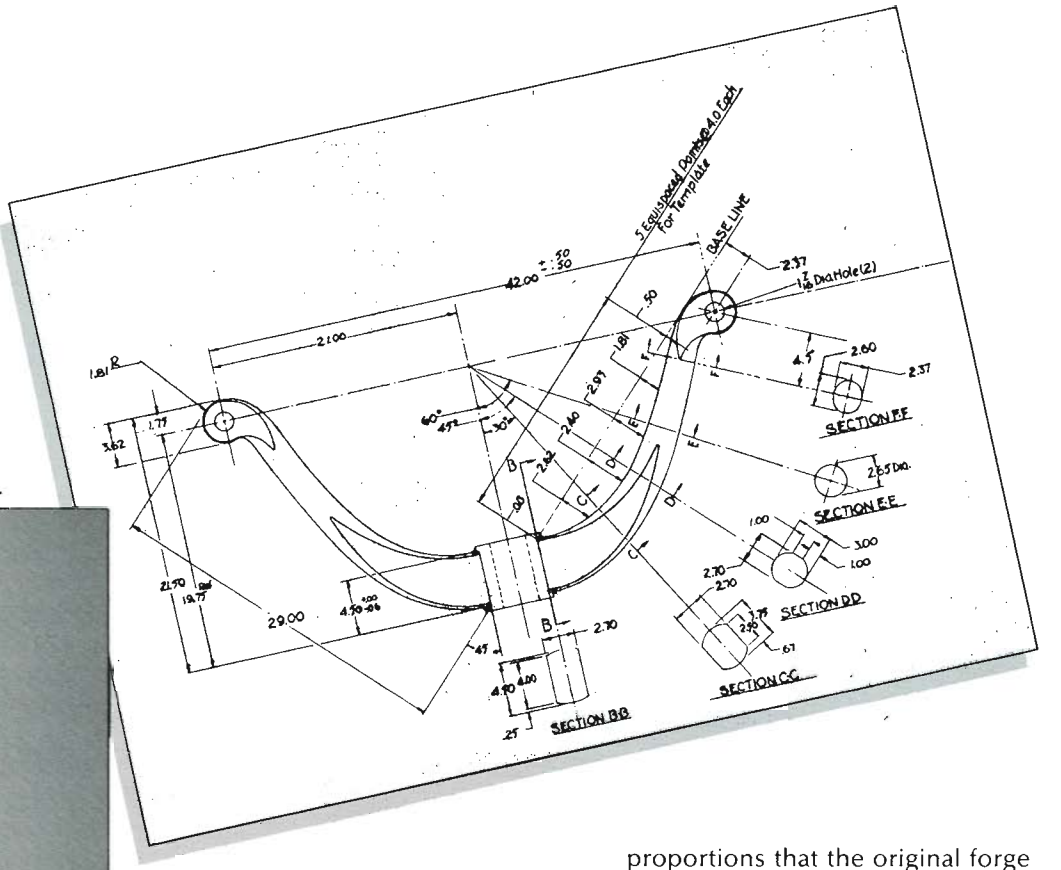
Technique: Originally, maritime blacksmithing on this scale was done in shops that were especially equipped to handle the work. McDonough Ironworks in Galveston still had an original, though dismantled, 20 ton steam hammer and the tools that were used in maritime blacksmithing. Through the kind assistance of McDonough Ironworks' shop foreman and former maritime blacksmith, David Henry (note: David Henry passed away in Sept. 1984, shortly after "Elissa" was restored), we were shown how specialized this type of blacksmithing was before the company became modernized and eventually retired its blacksmith operations. Our greatest single challenge was in evolving procedures which successfully combined traditional and modern techniques that would produce quality restoration fittings within a defined budget and that would hold up under the rigours of a working ship.

The first project to develop these techniques and test their feasibility was in the production of the chainplates. Chainplates are used as anchoring devices for the lower mast shrouds and are fastened to the bulwarks by 1" × 6" rivets. The shrouds are 1" cable rigging used to keep the mast from shifting from side to side, sort of like guy wires. Each chainplate must be made to a specific length and properly aligned angle to endure the tremendous force subjected to it.

The specifications for the chainplates called for the bar and eye to be forged from one piece and the bar to be arc welded to a

Working blanks for truss bows on parral bucket assemblies.

Lower yard truss bow installed.



palm plate. Rather than starting with material 3½" × 1¼" and forging it to the needed proportions, it was decided to pattern-cut blanks from 1¼" plate. The blanks were then forged to the finished dimensions under a 50 lb. Little Giant powerhammer. The finished bar tapered from 1¼" round below the eye to 1½" round at the base. In order to get a 1½" dimension from the 1¼" plate the blanks were flame cut 1⅞" wide at the base to give an extra ⅛" material. This worked out well and the finished forgings came within $\frac{1}{16}$" tolerances in all dimensions.

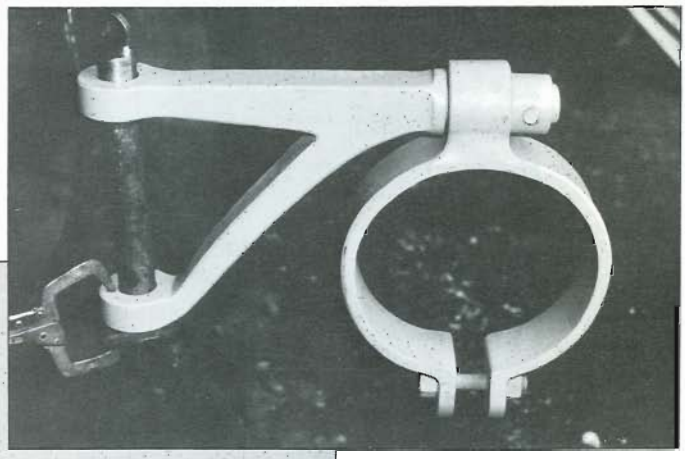
After the bars were forged, they were sent out to have the 1¼" eyes drilled. The bars were then returned to the forge for chamfering on the eyes. The palm plates, ¾" × 7" × 7", were then chamfered and sent out to be bent out of flat by ⅛". This warpage was pulled out when the bar was welded to the palm, making the finished palm lay flat and true. Welding was built up and ground down to create the same proportions that the original forge welded chainplates had.

The final adjustments for the angles of the bars leaning out from the palms were done using a large (250,000 BTU) propane heating tip, a jig and come-a-long. The propane heating tips were often used as a heating source during the "Elissa" project. Not only is it far more economical than acetylene, but it gives a more gentle heat and reduces the chance of burning the surface of the iron.

The procedures worked well. The chainplates fell within the ⅛"-$\frac{1}{16}$" and strength tolerances that the specifications required, were within budget, were delivered on time, and were identical to the original chainplates in other than material and technique. Consequently, much of the continuing work on "Elissa" followed a similar pattern of fabrication techniques. When a fitting was too large or too complex to forge from one piece, it was flame cut and then forged either by hand or under the 50 lb. Little Giant. Components were then arc welded together.

The lower yard truss bow

Lower topsail yard crane; 24" H × 18" W × 14" dia.



Lower topsail yard crane installed.

assemblies were the largest fittings we produced using this fabrication technique. The truss bows (pictures #5 & #6, page 6, A.R., Fall '85) are 350 lb. fittings that both hold and allow movement of the lower yard on the fore and main masts. The strength of the truss bow is critical as it must support the weight of the 63 ft. long, 2,000 lb. lower yard, the weight of the sails and 8-10 men as they work the sails. Originally a truss bow used on a ship the size of "Elissa" would have been forged from one piece of iron, 5½" × 2¾" × approx. 4' long. A 3" hole was hot punched through the width and the arms were drawn out. After considering our facilities and the precise tolerance requirements, we decided a different approach was needed.

The basic forms for the arms of the truss bow were flame cut from 2¾" plate. These pieces were further refined by chamfering the edges with a cutting torch. This rough shape was then forged to its final dimensions. The arms were arc welded to a 5½" length of 5" round steel with a 3.062" hole bored through its length. The welds were 100% penetration, built up and ground to give the same configurations as the original punched holes. It should be noted that the welds had to be of X-ray quality and represented 80 lb. of welding rods.

At this point it may be asked, had a large power hammer been available would it have been possible to forge more fittings from one piece? In some cases the answer would be yes. However, it must be noted that many of the original fittings were forge welded together from smaller forgings. Also, when large power hammers were used originally they were outfitted with special dies; these costs would have been prohibitive for the forging of so few fittings, as in our case.

A point of pride for us was how much we were able to do using so little compared to the modern industry we were competing with. Our bids were consistently below our competitors', the quality of our work was higher and we were reliable. From a questionable position at the beginning of the restoration, the concept of using blacksmithing and small shop craftsmen became the cornerstone of "Elissa's" rebirth.

(The next issue will discuss the basic forge set-up at the ship site and its contributions.)