Steam Schooner *WAPAMA*
Army Corps of Engineers Dock
San Francisco Maritime National Historical Park
Sausalito
Marin County
California

HAER No. CA-67

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Western Regional Office
National Park Service
U.S. Department of the Interior
San Francisco, California 94102

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HISTORIC AMERICAN ENGINEERING RECORD

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Steam Tug *WAPAMA*
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NOTE: Photographs were taken by Jet Lowe, HAER Photographer, April 1988

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HISTORIC AMERICAN ENGINEERING RECORD

Steam Schooner *WAPAMA*

HAER No. CA-67

Location:	Army Corps of Engineers Dock, San Francisco Maritime National Historical Park Sausalito, Marin County, California
Rig/Type of Craft:	Single end steam schooner, wooden hulled
Trade:	Pacific Coast lumber trade and coastwise service
Official Number:	213092
Principal Dimensions:	Length: 204.8' Gross tonnage: 951 Beam: 40.2' Net tonnage: 584 Depth: 14.3'
Propulsion:	Steam triple expansion engine, 825 horsepower
Date of Construction:	1915
Designer:	James H. Price
Builder:	St. Helens Ship Building Company St. Helens, Oregon
Original Owner:	Charles R. McCormick Steamship Company
Previous Names:	WAPAMA (1915-1938) TONGASS (1938-1955)
Present Owner:	National Park Service U.S. Department of the Interior
Present use:	Historic ship exhibit
Significance:	The last surviving example afloat of some 225 steam schooners specially designed for use in the 19th and 20th century Pacific Coast lumber trade and coastwise service. These vessels formed the backbone of maritime trade and commerce on the west coast-- ferrying lumber, general cargo, and passengers to and from urban centers and smaller coastal settlements.

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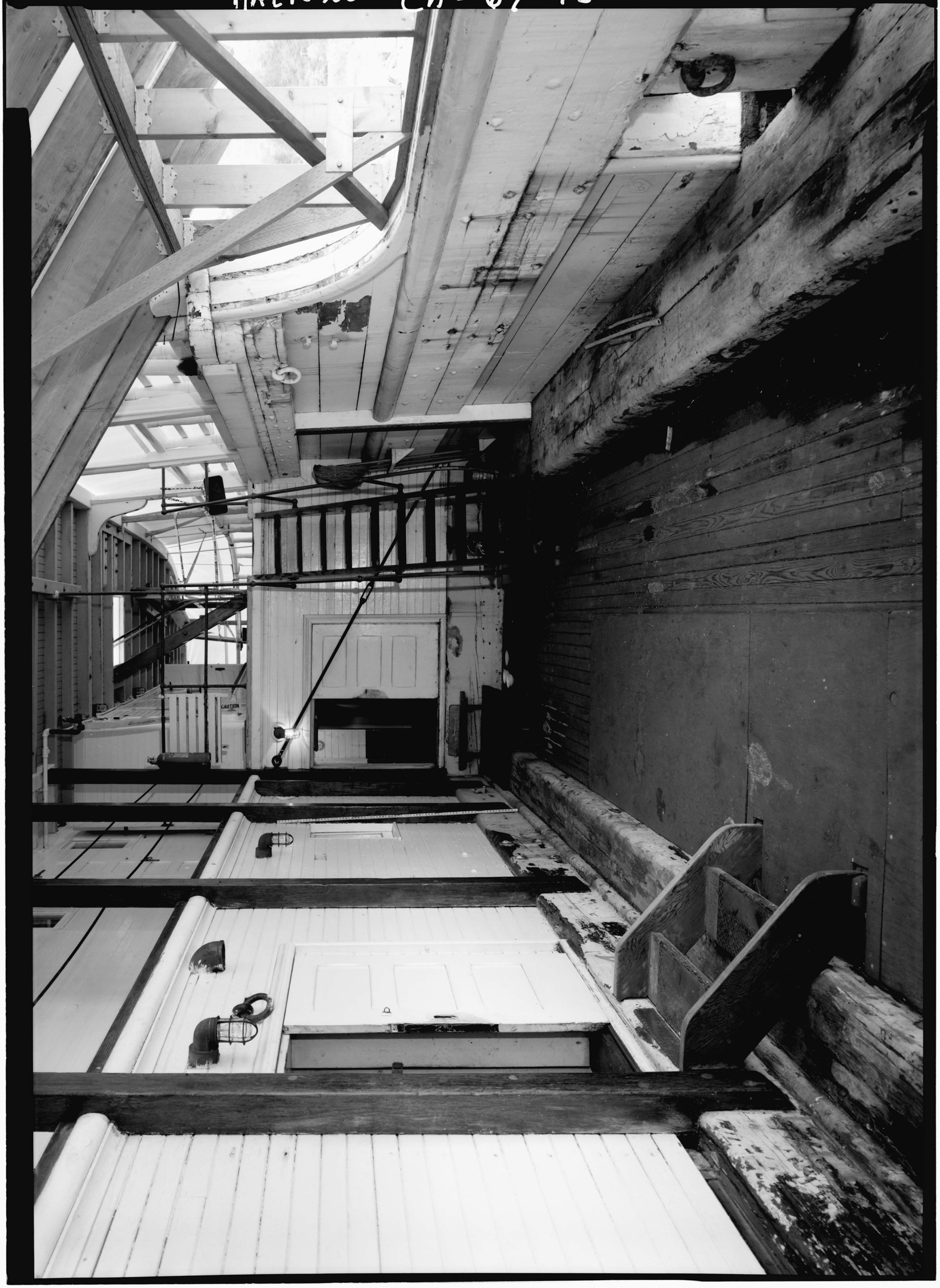

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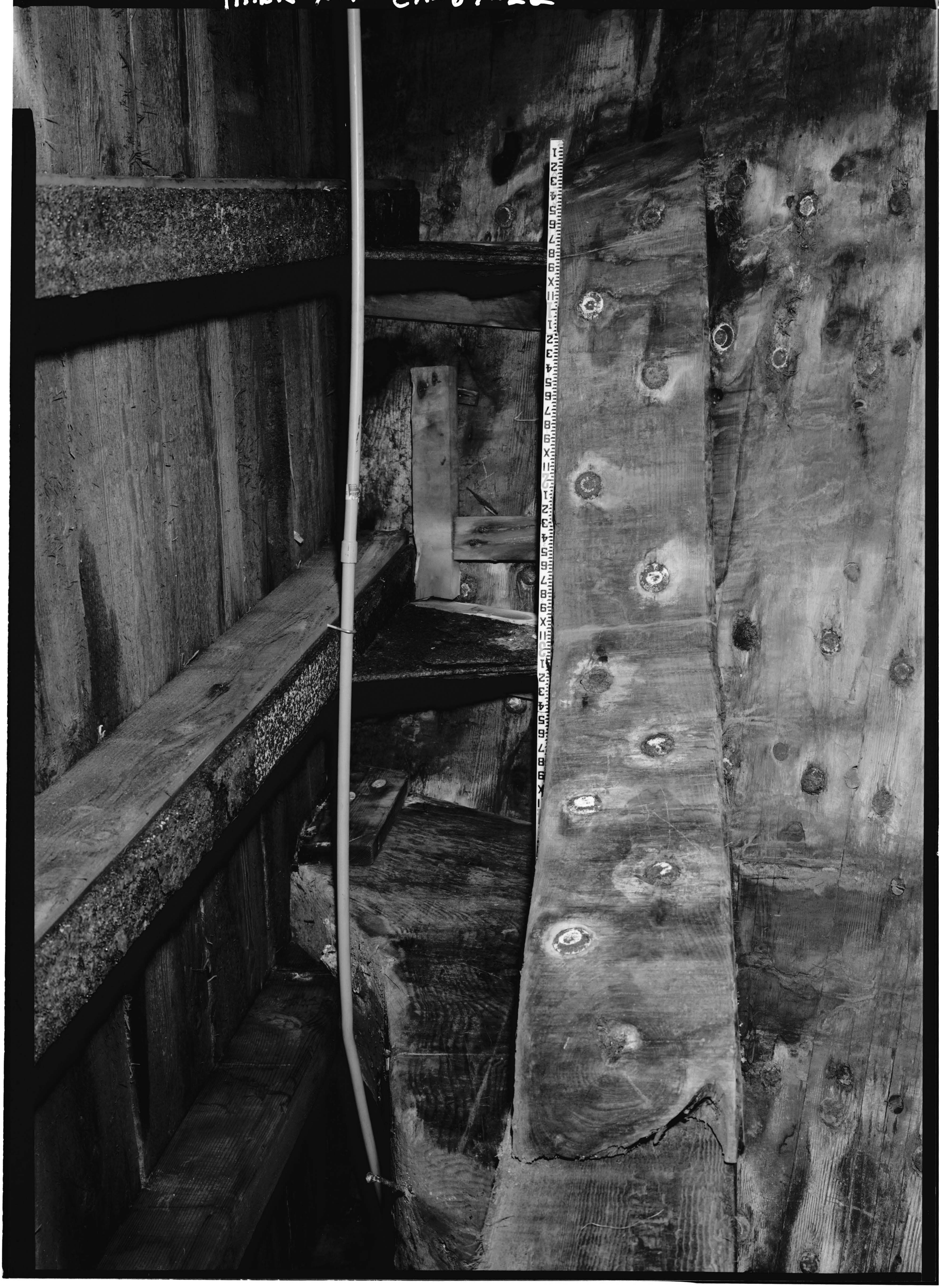

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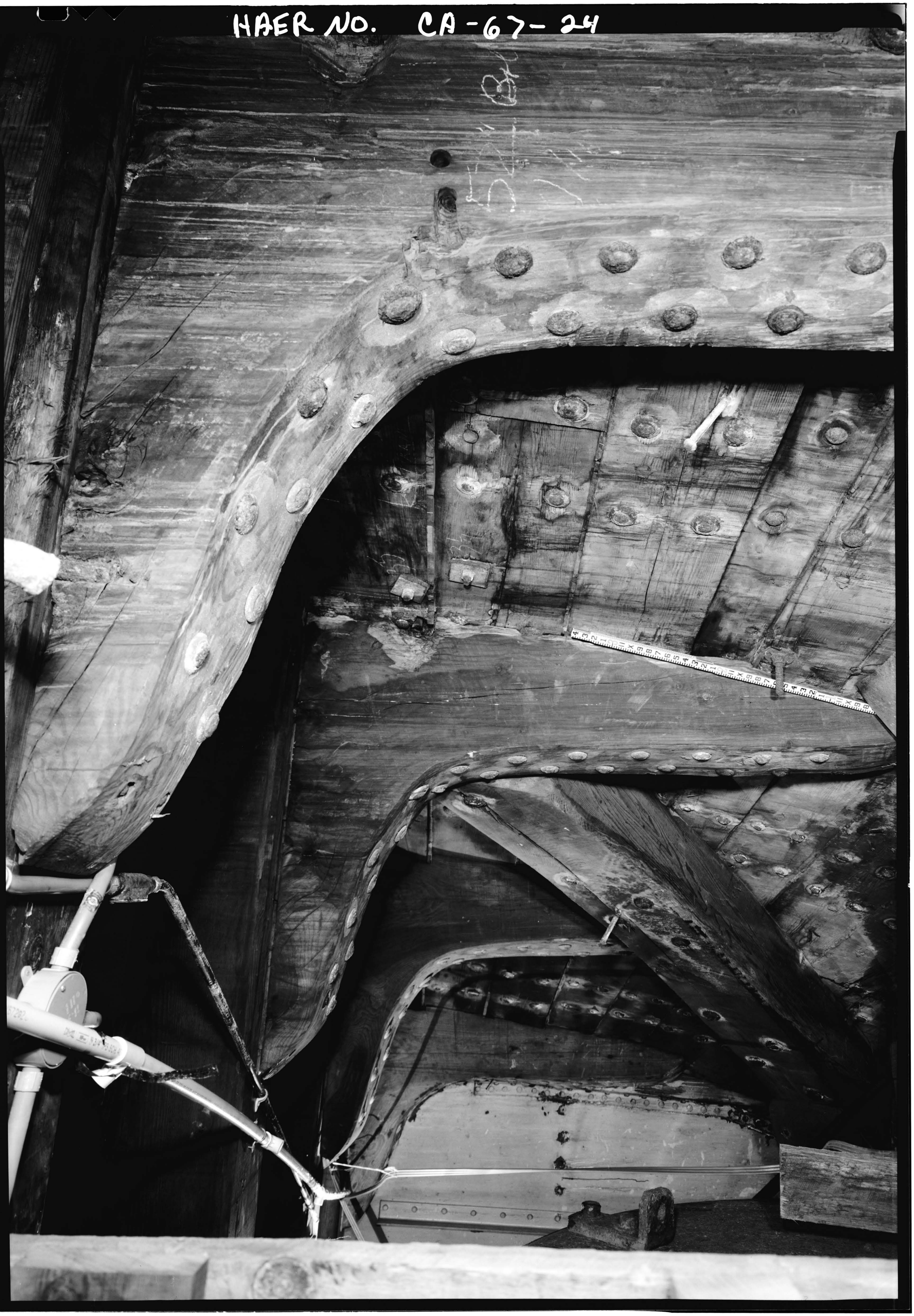

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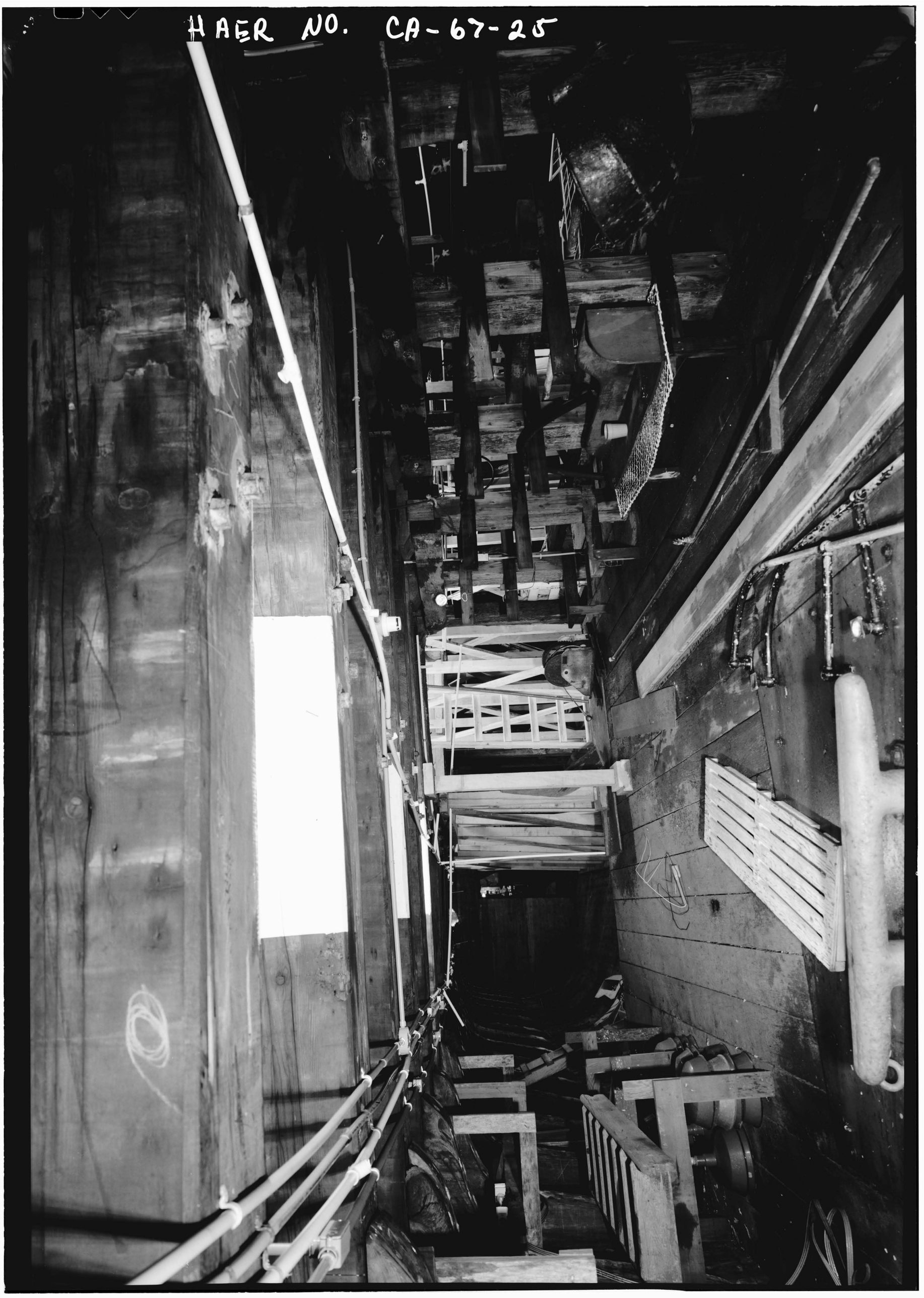

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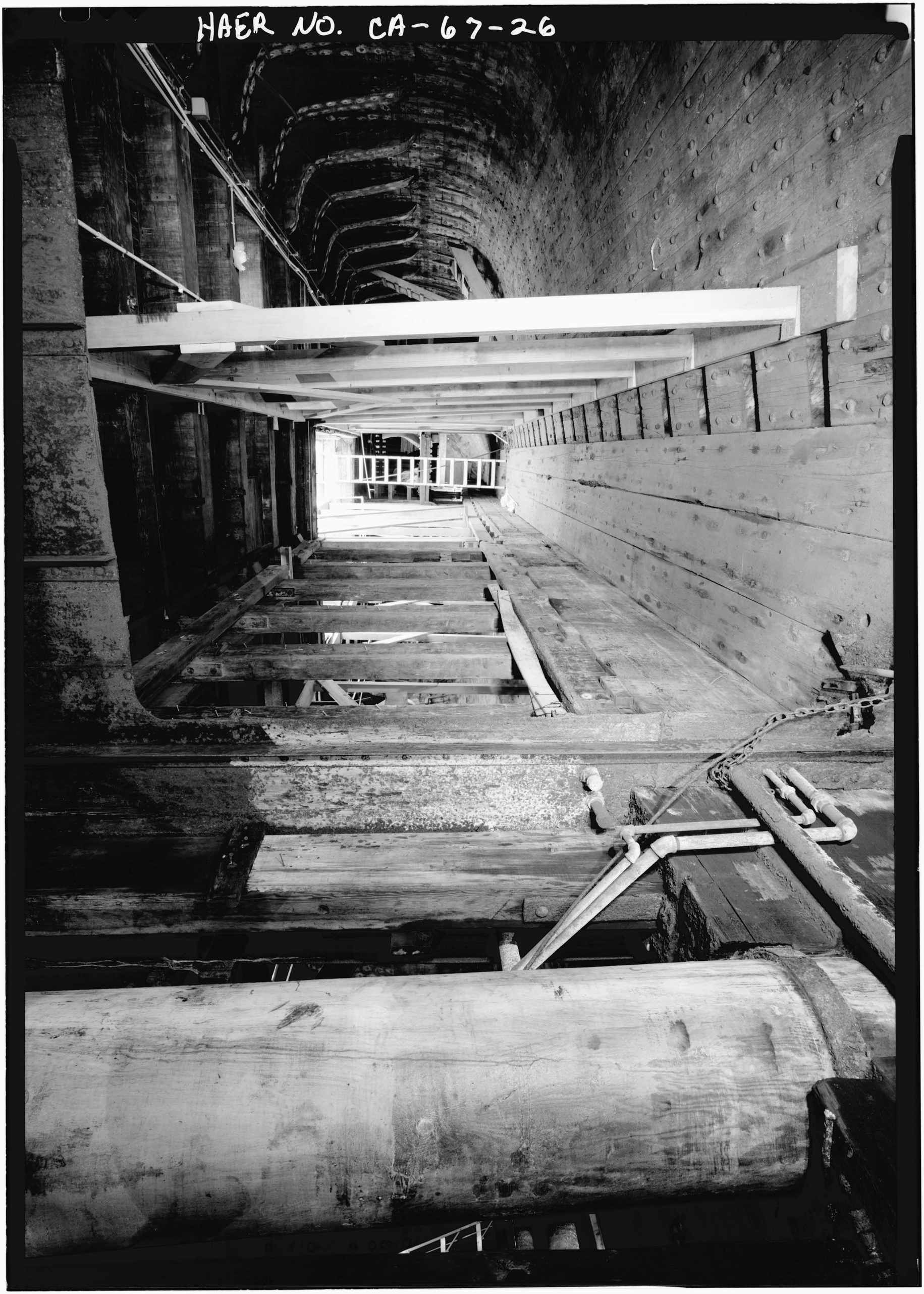

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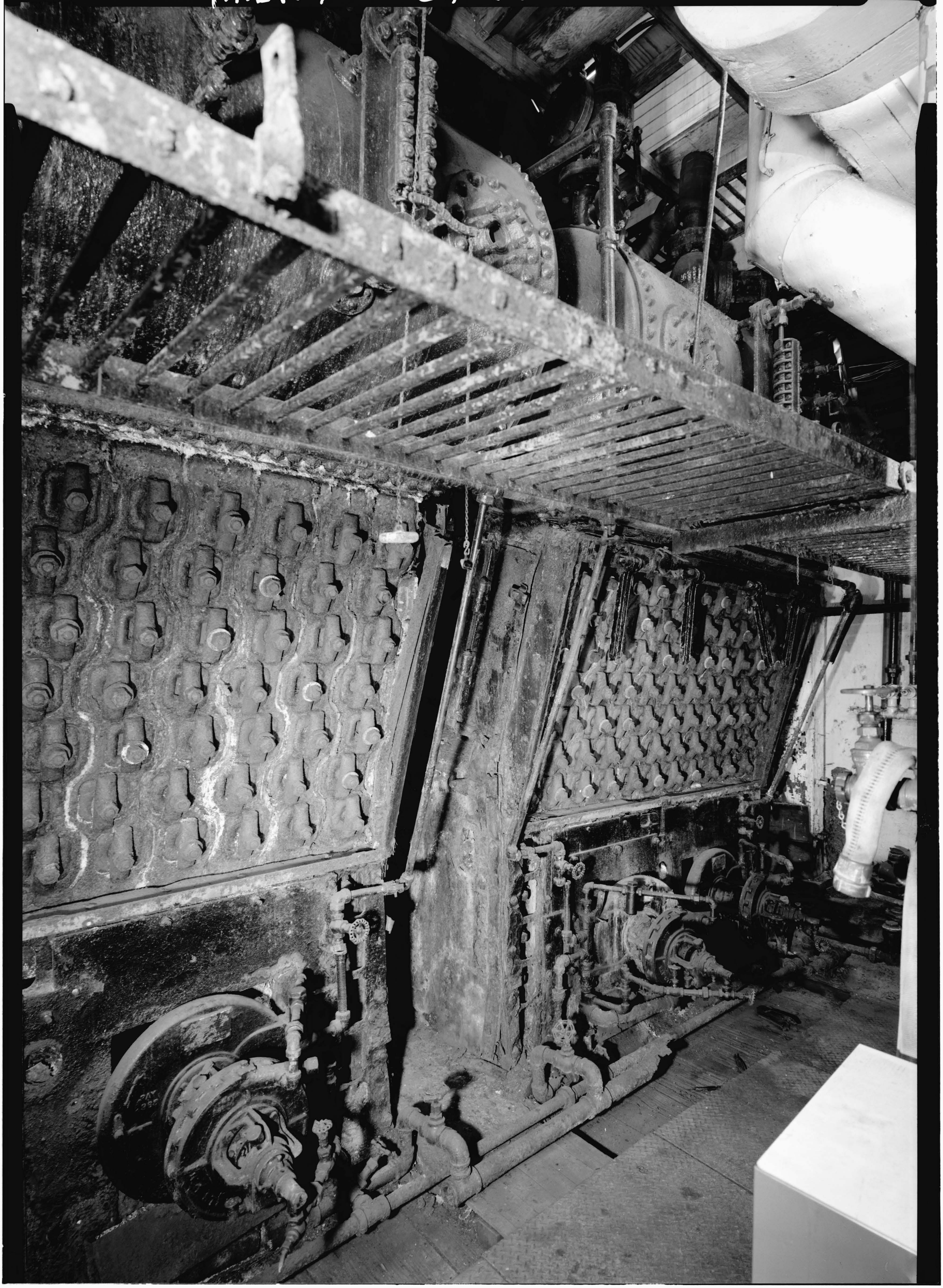

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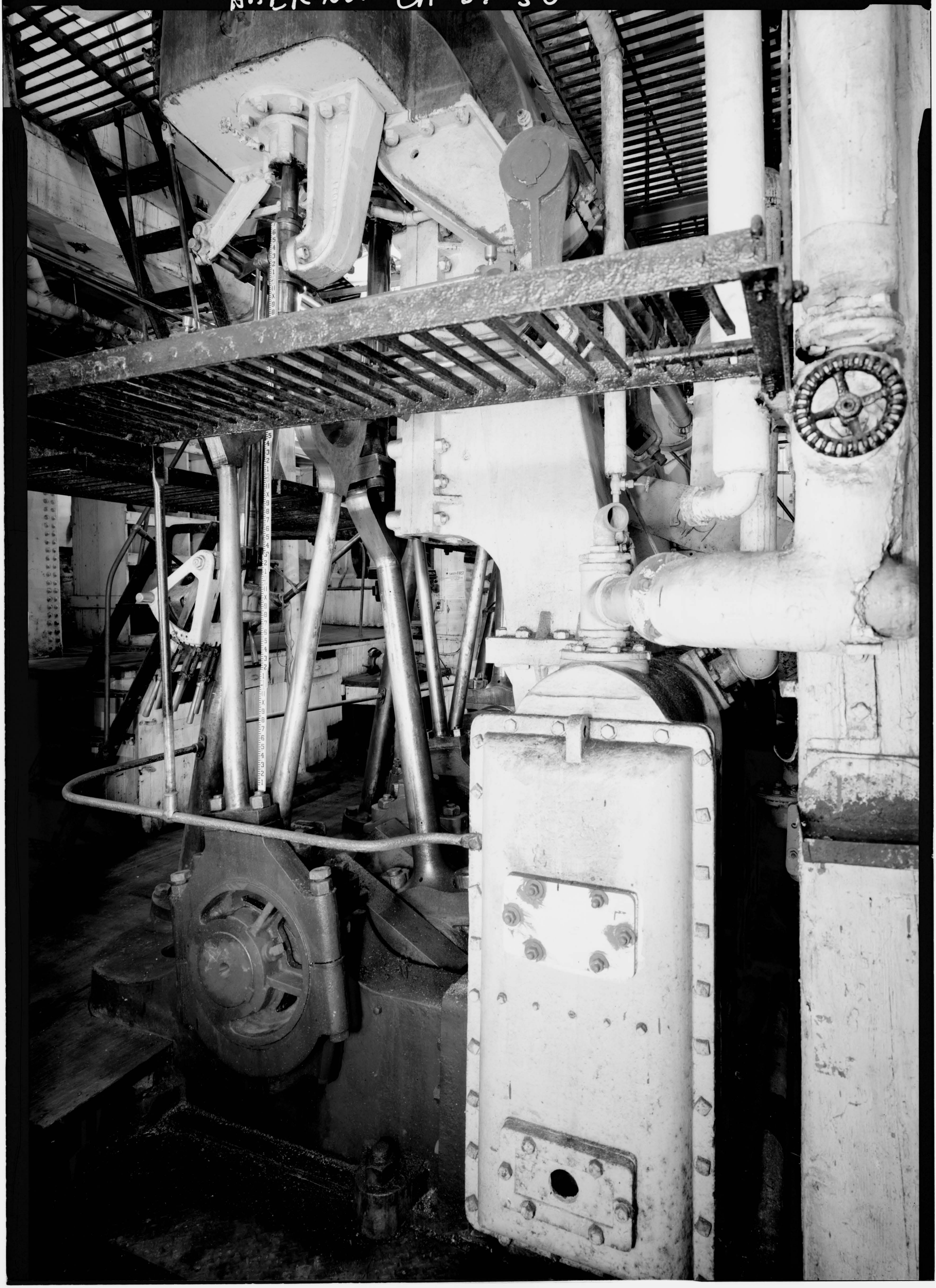

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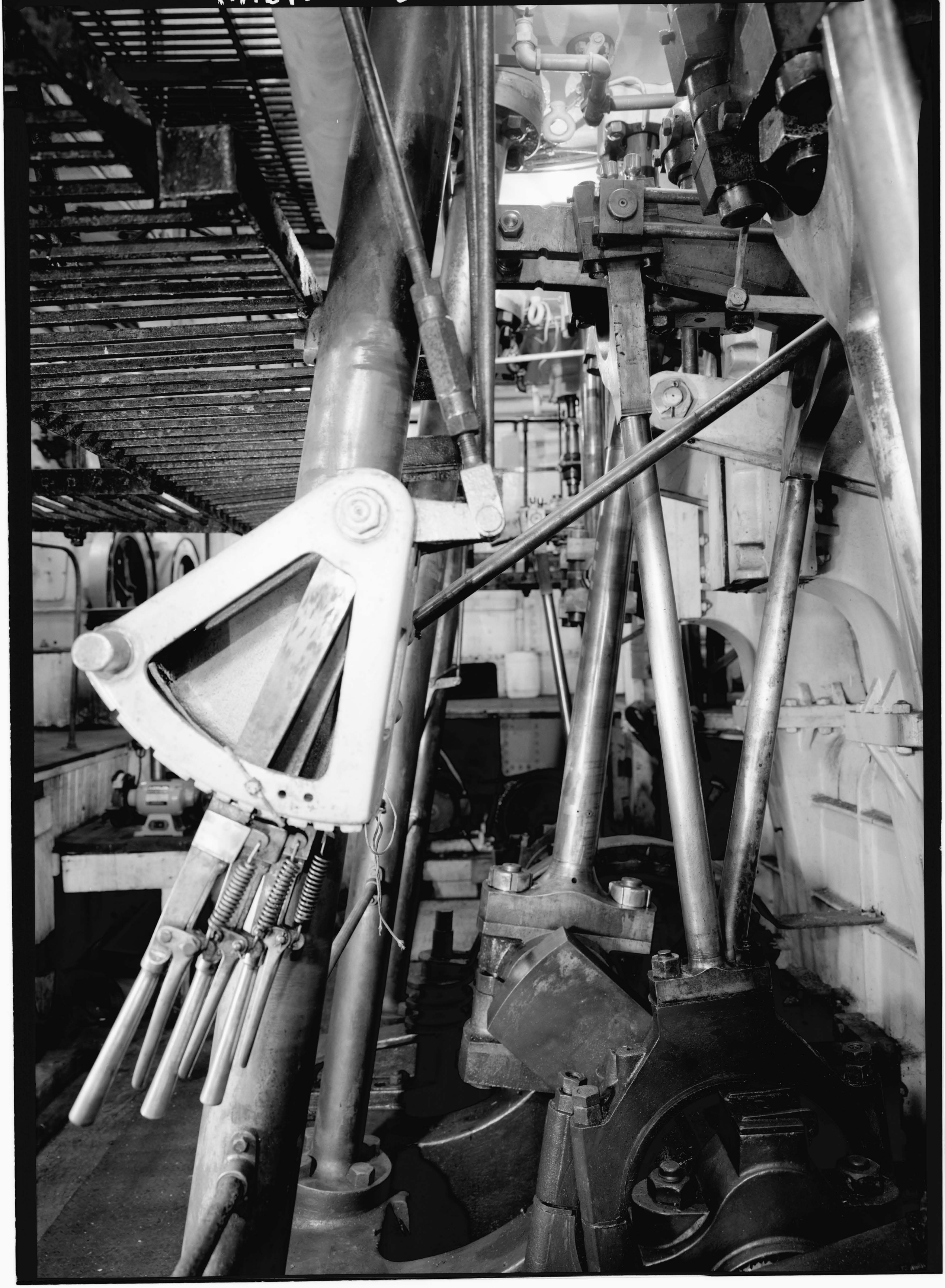

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ADDENDUM TO:
STEAM SCHOONER WAPAMA
San Francisco Maritime National Historical Park
Sausalito
Marin County
California

HAER No. CA-67

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C St. NW
Washington, DC 20240

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HISTORIC AMERICAN ENGINEERING RECORD

ADDENDUM TO
STEAM SCHOONER WAPAMA

HAER No. CA-67

This report is an addendum to a 1 page report previously transmitted to the Library of Congress.

Rig/Type of Craft: Steam Schooner

Trade: Passenger and freight carriage

Principal Dimensions: Length: 216'-11" Gross Tonnage: 945
Beam: 42'-4" Net Tonnage: 524
Depth: 19'

Location: Richmond, California

Date of Construction: 1915

Designer: St. Helens Shipbuilding Company

Builder: St. Helens Shipbuilding Company
Sauvies Island, St. Helens, Oregon

Present Owner: United States Department of the Interior
National Park Service

Present Use: None (Vessel in dry storage)

Significance: Shipyards along the coastline of California, Oregon, and Washington built more than two hundred steam schooners. They were descendants of the sailing lumber schooners once common in the area and were conceived and built to serve in the interregional trade that flourished along North America's Pacific Coast. The men who built them took advantage

of plentiful timber and built the ships out of wood, long after builders in most of the Western world had shifted to iron and steel construction. These wooden ships were a mainstay of the coastwise carrying trade for decades. WAPAMA is the sole survivor of the once numerous class.

Researcher: Marc R. Porter, 2001

Project Information: This project is part of the Historic American Engineering Record (HAER) Eric DeLony, Chief, a long-range program to document historically significant engineering and industrial works in the United States. The HAER program is administered by the Historic American Buildings Survey/Historic American Engineering Record Division (HABS/HAER) of the National Park Service, U.S. Department of the Interior, E. Blaine Cliver, Chief.

The project was prepared under the direction of HAER Maritime Program Manager Todd Croteau. The historical report was produced by Marc Porter, and edited by Richard O'Connor and Justine Christianson, HAER Historians.

Significance

Shipyards along the coastline of California, Oregon, and Washington built more than two-hundred steam schooners.[1] They were descendents of the sailing lumber schooners once common in the area and were conceived and built to serve in the interregional trade that flourished along North America's Pacific Coast. The men who built them took advantage of plentiful timber and built the ships out of wood, long after builders in most of the Western world had shifted to iron and steel construction. These wooden ships were a mainstay of the coastwise carrying trade for decades. WAPAMA is the sole survivor of the once numerous class.

Principal Dimensions

Length: 216' -11'
Beam: 42'-4"
Depth: 19'-0"

Gross tonnage: 945
Net tonnage: 524

Designer

No separate designer is listed in the records pertaining to WAPAMA. She was probably designed by the yard that carried out the construction.

Builder and Location

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[1] Estimates regarding the exact number of steam schooners vary slightly. The most common estimate places the number at 225 vessels, while the high figure of 235 vessels is in *Historic Structure Report: Steam Schooner Wapama*, 3.

The St. Helens Shipbuilding Company built WAPAMA on Sauvies Island, St. Helens, Oregon.[2] James H. Price, formerly superintendent of the Hans Bendixsen Yard in Fairhaven, was the master builder at the St. Helens yard. He led the 85-100 men working for the company during WAPAMA's construction.[3]

James Price was an émigré from England who arrived in the San Francisco area in 1902. His first job in California was with John Dickie in Alameda. From there he went to work as a superintendent for the Hans Bendixsen Yard from 1905-1906. The Hans Bendixsen Yard retained its original name during this period but was no longer under the ownership of its founder; Bendixsen sold the yard in 1900 and died two years later. In 1907 Price established his own yard in Brandon, Oregon. Price's yard turned out four vessels, DAISY, GLEANER, KLIYHAM, and J.J. LOGGIE, over the next two years. In 1909, he returned to the Bendixsen operation, and in 1912 moved to St. Helens to run St. Helen's Shipbuilding Company. During his tenure, the yard built a number of ships, including CITY OF PORTLAND, one of the few five masted lumber schooners built. J.H. Price left St. Helens in 1916 and moved to Houghton, Washington where he built ships commissioned by the U.S. government to support the war effort. After World War I, he moved to Victoria, British Columbia to head the Cameron Genoa Yard. J.H. Price returned to the United States after he retired; he died in Oakland, California in 1929.[4]

St. Helens Shipbuilding Company was a subsidiary of the Charles McCormick Lumber Company. Charles McCormick purchased a large tract of land, including 160 acres of waterfront property, in St. Helens, Oregon in 1908. Four years later, he incorporated the

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[2] Theron Bean, Letter to Mr. Harry J. Dring. 27 November 1961.

[3] Glenn E. Burch, "S.S. Wapama: A History" (California Department of Parks and Recreation, San Francisco, n.d. Photocopy), 6-7.

[4] James P. Delgado, *National Register of Historic Places Inventory Nomination Form: WAPAMA* (Washington, D.C.: National Park Service, 1982), Section 8, page 7.

St. Helen's Shipbuilding Company and headquartered it on land acquired in the 1908 purchase.[5]

The newly formed yard launched its first vessel, the MULTNOMAH, on October 12, 1912. The St. Helens yard maintained a prodigious output and was considered one of the West Coast's most prominent yards for the next fifteen years. The largest and final steam schooner was the EVERETT, a giant that measured in at 1751 tons, the largest steam schooner ever built.[6]

WAPAMA was little more than a finished hull when launched; it lacked an engine and still required finish work on the interior. The hull was towed to Main Street Iron Works in San Francisco for engine installation. WAPAMA got underway for the trip south under tow by the McCormick owned KLAMATH. At some point during the tow, the hawser connecting the two vessels parted and WAPAMA drifted free. The Merchants and Shipowners operated tug GOLIAH caught the steam schooner and took it in tow. GOLIAH eventually passed WAPAMA off to the McCormick owned steam schooner MULTNOMAH; that vessel delivered WAPAMA safely to the Main Street Iron Works in San Francisco.[7]

During February and March 1915, Main Street Iron Works installed a main engine and associated machinery in WAPAMA. Comfortable accommodations for passengers and crew were also built during this yard period. After the engine installation, WAPAMA was admeasured, given an official number, and licensed for coastwise trade. On April 29, 1915, She entered service under the ownership of her builder's parent company, the McCormick Lumber Company.[8]

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[5] Burch, 3.

[6] G.F. Matthews, "Steam Schooners and Builders" (San Francisco Maritime Museum, Harry Dring Collection 648/157, San Francisco, n.d. Photocopy), 7; Delgado, 8/6.

[7] Burch, 7.

[8] Burch, 7-8.

St. Helens has always been listed as the place where WAPAMA was built and, as the hull was built there, this is a reasonable classification. More than one knowledgeable observer has commented, however, that WAPAMA was really built in two places: "Like nearly all of the steam schooners, she was at least in part a San Francisco product, for if her wooden hull was built in the forests of the Northwest, her machinery was manufactured and installed in San Francisco."[9]

Date of Construction

WAPAMA's construction took eight months and culminated on January 20, 1915 when the daughter of a state senator smashed the obligatory bottle of champagne across the bow and the hull slid into the Columbia River amidst a cloud of liberated white doves.[10]

WAPAMA was completed after the heyday of steam schooner construction had passed; even taking this into consideration WAPAMA was built during a very slow year. Only one other steam schooner was completed in 1915: the MUKILTEO, built in Raymond, Washington and sold to the Charles Nelson Company of San Francisco.[11]

Original Price

It cost approximately $150,000 to build WAPAMA.[12]

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[9] M.H. Spies, *Veteran Steamers: A Story of the Preservation of Steamships* (Copenhagen, Denmark: Trykkeriet, 1965), 114.

[10] Richard Read, "S.S. Wapama," *The Oregonian*, 17 March 1983.

[11] Matthews, 13.

[12] Tri-Coastal Marine Inc. *Historic Structures Report: Steam Schooner Wapama* (San Francisco: Tri-Coastal Marine, 1986), 6.

Original Construction

WAPAMA is typical wooden ship construction of the plank on frame variety, with certain local adaptations. These adaptations and the overall design of the vessel arise out of her intended occupation. WAPAMA was built by and for the lumber industry. Like all steam schooners, she was meant to carry lumber from the mills of Northern California and the Pacific Northwest to cities like San Francisco, Los Angeles, and San Diego. Owners often engaged the steam schooners in alternate pursuits like passenger carriage or general cargo hauling but these were sidelights to the main business or, later, ad hoc efforts to bring in revenue once the steam schooners had passed their prime. WAPAMA was built as a cheap and easily constructed platform for delivering wood, and this is reflected in everything about her from the shape of the hull to the constituent materials used by St. Helens Shipbuilding.

According to a 1986 survey:

> WAPAMA is built almost entirely of Douglas Fir. The stern post and rudder post are ironbark. Ironbark is also used for battens and guards in high chafe locations. Inboard joinery work in the social hall and other compartments is of oak. With these exceptions, the ship is structurally a product of the lumber industry she was built to serve.
>
> Bottom planking is fastened by both trunnels and spikes. Most of the structure is fastened with clinched bolts. Douglas fir is much softer than oak or other hardwoods that were used in framing East Coast vessels. To compensate for the reduced holding power of fastenings in fir the number of fastenings is about 25% greater than for a hardwood framed vessel.

Another construction feature that reflects her regional origin is the lack of diagonal iron strapping placed between the frames and planking in order to improve longitudinal strength (and prevent hogging). This was standard practice in large wooden vessel construction by the time WAPAMA was built, but was seldom used in steam schooners. As compensation, the size of her timbers was increased and the spacing of frames decreased. This construction method resulted as much from the greater expense of importing iron or steel to remote building sites in the Pacific Northwest as from the cheapness and abundance of timber in the area. Steam schooners had to be strongly built for their hard trade but were also cheaply built through maximum use of indigenous material.[13]

WAPAMA was built unlike wooden vessels of her size produced elsewhere. The lack of iron or steel strapping reflects a regional adaptation in shipbuilding: metal was expensive and wood was not. Beyond being a symbol of regional shipbuilding, the failure to use strapping may have had far reaching ramifications, though not necessarily negative ones. According to one naval architect:

> When steel strapping was used on timber hulls, it was laid between hull planking and frames. This rendered the strapping virtually inaccessible for maintenance and repair. Over the years, corrosion would eventually destroy the strapping and its ability to add stiffness to the hull. Although rot and marine life affect timber, it is essentially an inert material and tends to outlast steel in a marine environment. In this sense it would be no coincidence that WAPAMA survived

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[13] Tri-Coastal Marine, 13.

> other vessels of its class which were reinforced with steel strapping rather than sister frames.[14]

Other construction details separated WAPAMA from the hypothetical norm of wooden shipbuilding as outlined by the American Bureau of Shipping (ABS) and other classification societies. More treenails were used than was acceptable to the ABS. The floor timbers were built in the "naval timber" fashion that was frowned upon by the ABS.

WAPAMA's differences from the norm are well understood; what remains a mystery is how prevalent those differences were throughout the West Coast Shipbuilding industry. A naval architect familiar with the vessel and region held that:

> The WAPAMA may have been a perfect example of West Coast shipbuilding, or it may have been unique to the St. Helens yard in which it was built. The publications of that period, circa 1915-1920, which document wooden shipbuilding practices and the ABS "Rules for Construction of Wood Vessels" were all products of an East Coast establishment.[15]

Beyond the generalities of what materials make up WAPAMA and how they are joined, the 1986 survey addresses the design or shape of the vessel:

> WAPAMA is a wooden steamship of typical steam schooner proportions. The hull is single decked and characterized by a plumb stem, full bows, straight keel, moderate deadrise and an easy turn of the bilge. The run is moderately full and the counter meets the round stern at a knuckle line at main deck level.

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[14] Zachary M. Reynolds, "Evaluation of Construction Techniques and Variations From Standard Shipbuilding Practices: Steam Schooner Wapama." (San Francisco National Maritime Museum, San Francisco, 1981, photocopy), 9.

[15] Reynolds, 9-10.

> WAPAMA is very beamy for her depth. This feature was due to the draft restrictions of the small lumber ports she was built to service.[16]

WAPAMA was built with a raised forecastle. Inside the forecastle were berths for crewmembers to port and accommodations for a maximum of twenty-two steerage passengers to starboard. There were also heads installed aft of the living areas. Atop the forecastle were mounted cargo winches, mooring bitts, an anchor windlass, and a capstan. Below the level of the main deck, WAPAMA mounted a steel collision bulkhead.

Immediately aft of the forecastle is the main deck. This is the space where WAPAMA's main cargo, lumber, was stacked for transport. The main deck is pierced with a single cargo hatch that allows access to the hold below. The cargo hatch is located amidships. The main deck's role as an area for cargo is reflected in its construction. The bulwarks and waterways are heavily built; while the deck itself is supported by the addition of full-length longitudinal stringers that run on either side of the cargo hatch.

WAPAMA's heavy loads of wood were too large to be handled by hand. Lumber was loaded and offloaded using cargo-handling booms aided by steam winches. The booms were mounted on masts placed fore and aft of the main deck.

Aft of the open cargo area on the main deck was WAPAMA's superstructure. This deckhouse was built to a height of three stories and runs along almost the entire after third of the vessel. The levels of the deckhouse, working from lowest to highest, were known as the main deck, cabin deck, and boat deck. The deckhouse contained a number of cabins for passengers and could accommodate about forty-four paying customers. A galley was installed to feed passengers and crew, and a dining saloon capable of seating at least thirty-three diners in a sitting was located in the deckhouse. This space also housed a large social

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[16] Tri-Coastal Marine, 8.

hall for the use of those traveling aboard. In addition to passengers, the mates, engineers, steward, cook, and master, were quartered in the deckhouse.[17]

WAPAMA's pilothouse was built as a two level cabin perched on the forward end of the boat deck. The lower compartment housed the helm. Officers on watch used the upper level as a chartroom and lookout station. The upper level had exposed bridge wings on either side; these were built on hinges and could be stowed out of the way during cargo handling operations.

The stack exited the superstructure aft of the pilothouse and separated it from the main cabin on the boat deck. Located in the same area were ventilators for circulating air through the engine room. On either side of the boat deck cabin, located aft of the stack, were lifeboat davits that held a total of four boats. The lifeboats were divided evenly between port and starboard stations.

Aft of the deckhouse was a grating at the main deck level that covered the top of the rudder and quadrant. There was little else of note in the stern section other than a steam driven capstan.

Below the level of the main deck and out of sight were the all-important engineering spaces. It was the equipment housed in these sections that allowed the steam schooner to buck headwinds, navigate treacherous currents, maneuver in narrow channels, and load thousands of tons of cargo.

As originally built, the steam schooner had four tanks for fuel oil, two forward of the boilers and the other two on either side of the boilers. The boilers themselves were oil fired, water tube boilers built by Babcock and Wilcox. They were installed close together near the vessel's centerline and were supported on a grating system. The steam generated by the boilers was 225 psi working pressure and powered a Main Street Iron Works

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[17] Tri-Coastal Marine, 8-9.

intermediate sized triple expansion engine that produced between 800-825 horsepower and turned a single shaft connected to the engine with a thrust bearing and intermediate shaft coupling. The engine itself had cylinders of 13", 23", and 40". The stroke was 30.[18]

The steam produced by the boilers was piped throughout the ship to power steam winches, windlasses, and capstans. The steam was also used to power two dynamos that generated electricity for use aboard the vessel. Surrounding the engine were the pumps that circulated water throughout the ship. The engine room also contained a refrigeration condenser.[19]

WAPAMA was built with a donkey boiler housed in a compartment forward of the main engine. This auxiliary boiler produced steam to power the winch engines and electrical dynamo when the ship was in port and the main boiler was shut down to conserve fuel.[20]

To the rear of the engine room was an after-peak compartment. The after-peak contained two water tanks molded to the shape of the hull. The stuffing box was accessible through the after-peak, as was the rudder trunk.

As originally built and outfitted, WAPAMA was capable of carrying 1,100,000 board feet of lumber and sixty-six passengers at a cruising speed of 10 knots.[21] To keep up this pace WAPAMA's engines consumed about 110 barrels of oil per day.[22]

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[18] Tri-Coastal Marine, 12; Spies, 113; Burch, 7.

[19] Tri-Coastal Marine, 12.

[20] Tri-Coastal Marine, 12.

[21] Burch, 7.

[22] Burch, 8.

Alterations and Additions

Shortly after her purchase by the Alaska Transportation Company WAPAMA was renamed TONGASS and underwent several alterations designed for the owners by the W.C. Nickum and Sons naval architecture firm. The Lake Union Dry Dock and Construction Company carried out the work, which ended in May 1938. The alterations included the addition of a "half tween deck" in the forward section of the hold. Two new freezers were installed on the new deck. The alterations were followed by a new admeasurement that changed WAPAMA's (TONGASS) specifications from 951 to 999 gross tons and 584 to 524 net tons.[23]

From 1959 to 1963 the vessel underwent restoration under the direction of the San Francisco Maritime State Historic Park. Restoration work included the replacement of WAPAMA's spars and work on the decks and passenger accommodations. All restoration work took place at the Oakland Dock and Warehouse Company. During this period the steam schooner's name was officially changed back to WAPAMA. WAPAMA opened to the public as a museum ship after the restoration was completed.[24]

WAPAMA was drydocked for further repairs in 1964-65, 1967, and 1970. The first two yard periods took place at Bethlehem Steel Shipyard in San Francisco, the latter at Merritt Shipyard in Oakland. In 1979, WAPAMA was placed on a barge to ensure the steam schooner did not sink or suffer a broken back. The steam schooner remains on the barge as of 2001.[25]

Original and Subsequent Owners and Masters

WAPAMA's first owner was Charles McCormick and Company, one

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[23] Burch, 30.

[24] Karl Kortum, "Notes on the Steam Schooner Wapama" (San Francisco Maritime Museum, n.d. Photocopy), 2.

[25] Kortum, 2.

of the great entrepreneurial success stories of the Pacific Northwest. Charles R. McCormick came to Oregon in 1901 after working for over a decade in Michigan's lumber industry. McCormick's first few years in the Northwest were spent as a lumber salesman or broker. His success as a broker led, in a partnership with other investors, to the purchase of a tract of forestland for use as a logging site. The first effort as a logging company actually resulted in a loss for McCormick; but apparently not a large enough loss to discourage him. In 1908 McCormick purchased land along the Columbia River at St. Helens, Oregon. There he refurbished an old lumber mill that existed on the site and went into business as a lumber company. The family of businesses started by McCormick upon the foundation laid at St. Helens prospered. The rural and remote St. Helens logging camp eventually became a town with thousands of residents. McCormick owned corporations became important in the lumber, paper products, and forestry supplies industries at the national level.[26]

Soon after becoming a producer and exporter of lumber, McCormick realized that chartering ships to carry his product was cutting into the profit margin. To remedy this situation, he hired a consultant to help him enter the shipping business. McCormick chose Captain Edward Jahnsen to advise him on shipping matters. Captain Jahnsen advised the fledgling lumber magnate to purchase a vessel under construction at Hans Bendixsen's shipyard in northern California. This ship, a steam schooner, set sail under Captain Jahnsen's command as the CASCADE in December 1904.[27]

McCormick found shipping to be a profitable endeavor. By 1924, McCormick Steamship Company was operating seventy-one ships between twenty-three ports on the Pacific Coast.[28] Several years later it acquired the East Coast based Munson Steamship Company

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[26] Burch, 2.

[27] Burch, 2.

[28] Burch, 17.

and began operating along shipping routes to South America.[29]

Less than a decade after entering the shipping business, McCormick was ready to enter the shipbuilding business. In 1909 the Charles R. McCormick Lumber Company leased the Bendixsen Shipbuilding Yard from the Bank of Eureka. The Bendixsen yard, under Superintendent J.H. Price, built two steam schooners for McCormick. The KLAMATHOF and WILLAMETTE measured in at 1083 and 903 tons respectively; they were both towed to San Francisco for completion after the hulls were launched at Fairhaven.[30]

In 1912, the focus of McCormick shipbuilding moved to the newly established St. Helens yard under J.H. Price. Three years later, WAPAMA was launched and ownership transferred shortly thereafter from St. Helens Shipbuilding to Charles R. McCormick and Company.

WAPAMA spent the next eighteen years under McCormick control, though ownership of record changed for legal or corporate reasons as McCormick's holdings changed or evolved. In 1915 the steam schooner was sold to the Wapama Steamship Company for a total of $10. There is evidence that other investors may have owned a small stake in the ship during its ownership by the Wapama Steamship Company; operational control remained with McCormick, and any shareholders were bought out during the next change of ownership. The title was transferred to McCormick Steamship Company in November 1922. The Charles R. McCormick Lumber Company became WAPAMA's owner in September 1925. It was under this ownership that WAPAMA served out her time in the McCormick fleet.[31]

The Los Angeles-San Francisco Navigation Company purchased WAPAMA on May 20, 1930. A Mr. Gillespie operated Los Angeles-San

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[29] H.M. Delanty, "The Pacific Coast Steam Schooners." (San Francisco Maritime Museum, Harry Dring Records 648/157, San Francisco, n.d. Photocopy), unpaginated.

[30] Matthews, 6.

[31] Burch, 10-23.

Francisco, and while he actually ran the business, for unknown reasons, the ownership of individual vessels was regularly transferred among family members. During this period, Claudine C. Gillespie, Albert E. Gillespie, and Charles Gillespie all owned WAPAMA.[32]

The Gillespie operated company sold WAPAMA to Erik Krag, president of the Viking Steamship Company, on April 20, 1937. Viking Steamship paid $12,500 for the vessel. It appears that Viking, a Nevada registered corporation, was a subsidiary of Inter-Ocean Steamship Corporation, a company run by Erik Krag and Harry Brown.[33]

The Alaska Transportation Company purchased WAPAMA from Erik Krag on December 23, 1937. The purchase price for the steam schooner was $27,000. On February 4, 1938, the steam schooner's name changed to TONGASS.[34]

WAPAMA (TONGASS) was purchased in 1948 by Jack Mendelsohn and Son. The new owner's plan was to scrap the steam schooner rather than operate it.[35]

The state of California bought WAPAMA (TONGASS) from Jack Mendelsohn and Son on January 10, 1958. The purchase price was $16,000. After acquisition by California, the vessel was renamed WAPAMA and towed to San Francisco.[36] In 1977 the vessel was acquired by the National Park Service as part of the Golden Gate National Recreation Area.[37]

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[32] Burch, 24.

[33] Burch, 27-28.

[34] Burch, 29-30.

[35] Kortum, 1.

[36] Kortum, 2.

[37] Kortum, 2.

Masters came and went aboard WAPAMA with regularity; many served for a time then left, only to reappear in command at a later date. They are listed in Appendix A in order of their first appearance on the steamer as master; reappearances thereafter are not reflected. A few of the men had already served aboard the vessel in other capacities.

On WAPAMA, as with any other ship, the master's billet was of extreme importance; it was upon the shoulders of these men that responsibility for the vessel's success or failure fell. The age of steam, however, differed from the age of sail in that a new member of the crew became quite important aboard the ship. The chief engineer was responsible for everything that occurred within the engineering spaces and thus shared the responsibility of getting the vessel from port to port. The chief engineer never quite became the captain's equal, but he was nonetheless an essential part of a successful steamship operation. Unfortunately, most of WAPAMA's chief engineers remain anonymous. There is, however, one notable exception. Axel Fagerlund served as WAPAMA's chief engineer from 1917 to 1927 and his tenure aboard the steam schooner was unequaled in WAPAMA's career.[38]

Source of Original Name

The steam schooner was named after Wapama Falls in California's Hetch Hetchy Valley. It was customary for vessels in the McCormick fleet to be named after waterfalls.[39]

WAPAMA was renamed TONGASS on February 4, 1938. The new name honored Tongass National Forest in Southeastern Alaska.[40]

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[38] Burch, 15.

[39] Burch, 6-7.

[40] Burch, 30.

History of Vessel Type

Thousands of men and women shipped out for California in the second half of the nineteenth century. Some went to find gold. Some went to find an easier life. Some went because a lot of other people were doing the same thing. Whatever their motivations, once they arrived, these pioneers required certain things to make life possible. Outside of food and fresh water, one of the most pressing needs common to all the latter day argonauts was wood. They needed it to build houses. It was used to support mine shafts. There was no other building material for boats and ships in pre-industrial California. The West Coast may have had gold, but gold was not much use when it came to cooking or heating homes; burning wood was the only available source of heat in an area bereft of coal deposits.

In the early days of San Francisco's settlement some wood was cut locally and some was imported. This arrangement was far from ideal as the lumber reserves around the Bay area were far from inexhaustible. Importing lumber could meet some needs but it was quite expensive. In a curious case of economics bending geography the nearest lumber ports to San Francisco were those in New England or Hawaii. The long haul around Cape Horn from the East Coast and voyages to distant Hawaii were the established trade routes and California's sources of lumber. These long ocean voyages combined with the inflated prices of a gold rush economy to make lumber a very expensive commodity.

The solution to California's lumber shortage was close at hand and brought to light through a serendipitous turn of events. A ship bound from Asia to San Francisco with a valuable cargo of silk, tea, and other luxury goods wrecked on the rugged California coast in 1852. At least part of the crew survived the accident and made their way to San Francisco in the ship's boats. The site of the wreck was approximately 150 miles north of the Golden Gate and it was not long before a band of would-be salvers mounted an expedition to recover the ship's valuable cargo. It is unclear whether the salvage party brought back much from the ship's hold. They did bring back something far more valuable. The men returning to San Francisco brought information,

information that would spark the formation of an industry worth more than the contents of a thousand treasure ships. The men brought word that a vast forest of giant redwood trees covered much of the land north of San Francisco Bay.[41]

It is quite likely that a fair number of individuals knew of the redwood forests before 1852. A small number of ships had been sailing along, and wrecking along, the coast for decades. Overland explorers had made forays into the coastal wilderness. Contact with Native Americans, who had to be cognizant of the forests, was well established. It was the 1852 salvage expedition, however, that established the forest's presence in the popular consciousness of the region.

Soon after word of the great forests reached San Francisco, groups began to head north to stake out territory and begin harvesting trees. Reaching the timber areas was difficult, as they were in remote and rugged regions accessible by few natural harbors and unreachable by road. Once there, the entrepreneurial lumbermen faced all the difficulties inherent to living in rustic areas far from civilization, not to mention the challenges of accomplishing heavy and dangerous labor while there. The most daunting problem was not reaching timber country or cutting down trees, but the problem of getting the product to market. Once felled and trimmed, the trees needed to be moved to San Francisco or other towns; if the lumber could not be moved, it could not be sold.

The lumber could be removed from timber country by two avenues, land or sea. Moving anything by land, let alone a bulky and heavy product, was virtually impossible. There were no rail systems on the West Coast and roads were few, primitive, and often impassable. Moreover, building rails or roads would take years and incur immense expense. The topography of Northern California was simply beyond the abilities of mid-nineteenth century engineering and construction, at least if the end result

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[41] Jack McNairn and Jerry MacMullen, *Ships of the Redwood Coast* (Stanford, CA: Stanford University Press, 1945), 25.

was to be profitable.

This left shipment by water as the only way to move the timber industry's product. Topography was once again less than ideal. It is a coastline with few natural harbors. Most of the coast is rocky and exposed to the open ocean. There were very few places where a standard merchant ship of the day could anchor or dock in protected waters to load lumber.

Moving timber from forest to town was accomplished by building a new class of vessels: the West Coast lumber schooner. Schooner rigged, they used fore-aft mounted sails, which allowed them to work their way up the coast against contrary winds; fore-aft rigging also gave them the ability to work their way into confined harbors. The first lumber schooners were generally two masted vessels. Almost all were bald-headed; that is, they did not carry the topmasts and associated sails used by schooners elsewhere.

The two-masted lumber schooners were relatively small, each capable of transporting 70,000-100,000 board feet of lumber.[42] Their small size was not accidental or a function of the builder's capabilities. The lumber schooners were small so they could maneuver into tiny inlets on the exposed coast. These inlets, often called "dogholes," were little more than indentations in the rocky cliffs that line the coast. The "doghole schooners" would work their way into the coves and anchor or moor under the steep cliffs. They were loaded by chutes of various designs that brought the lumber from cliff top to the waiting vessel.

Loading cargo was a dangerous position for vessel and crew. Any change in the wind or sea state could throw the schooners against the unforgiving cliffs or trap them in rock rimmed enclosures little bigger than the schooner itself. Similarly, the schooner's routes meant sailing close to the coast, giving them

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[42] Jackson C. McNairn, "Steam Schooner Sagas," *United States Naval Institute Proceedings* 68, no. 473 (1942): 943.

little sea room in which to run from foul weather. Exacerbating the situation was the direction of the prevailing winds that blew from northwest to southeast, putting the schooners in the unenviable position of always being on a lee shore.

Despite the dangers and difficulties of working on the Northern California coast, the lumber schooners were successful and the timber industry grew. The industry continually moved northwards through the redwood forests and eventually into the vast coniferous forests of the Pacific Northwest. As the industry grew and distances from forest to California's markets lengthened, the schooners grew in size. Three-masted schooners became as common as the two masted variety, and four masted members of the class were regular visitors in certain lumber ports. The larger lumber schooners were used to serve the larger ports of Northern California, Oregon, and Washington; they were not normally used in the tiny dogholes, as they simply did not fit. Two excellent examples of larger lumber schooners are preserved in Seattle and San Francisco. The C.A. THAYER is owned by the National Park Service and berthed at the San Francisco National Maritime Park. The WAWONA is owned by the Northwest Seaport Museum in Seattle, Washington. Both schooners are still afloat and open to public visitation.

The advantage of the larger schooners was economic. They could carry more lumber and were better suited to longer coastwise voyages. This improved economic efficiency did little to alleviate the basic problems with using sailing vessels of any type in this trade. They were subject to being trapped or wrecked on the rocks if the wind changed direction. They could not penetrate into the interior by way of rivers, as their ability to go upriver was marginal. A large sailing vessel used in ocean service typically has a deep keel. Thus, harbors with shallow entrances were inaccessible. Finally, their reliance on wind made scheduling impossible, the ships arrived when they could and nothing but a change in the wind would change their pace.

The limitations of the sailing lumber schooner were overcome in the 1880s with the introduction of the steam schooner. As

suggested by the name, steam schooners remedied the deficiencies of the lumber schooners by the application of steam power:

> The passing of the two masted schooner came about when some ingenious mariner hitched a steam engine to one of the schooners and thus made the ship respond to the will of pilot rather than to the elements. No longer were the coastal ships forced to lie dormant awaiting a wind to take them on their way. No longer were the small rivers and shallow harbors inaccessible to schooners. Soon, ships were loading from alongside wharfs at mills on inland waterways rather than from precarious outside ports by wire chute method.[43]

Exact origins are difficult to pinpoint in the case of steam schooners. The quote above lauds, "some ingenious mariner." That mariner, however, remains anonymous. A number of vessels have been held up as the first steam schooner. SURPRISE was built by C.G. White in San Francisco and launched in 1884. SURPRISE was outfitted with three masts and a full set of sails in addition to a steam engine and propeller. Interestingly, SURPRISE had a rounded or semi-cylindrical stern section typical of steam vessels and very different from a sailing schooner's stern profile. The presence of two modes of propulsion and a hull that resembled a steamer at the stern and a sailing vessel at the bow indicates SURPRISE was clearly a transitional vessel, simultaneously exhibiting vestiges of forerunners and descendants. This was not simply a case of an auxiliary engine being thrown on a sailing vessel or a few sails mounted on a steamship to catch a favorable wind.[44]

BEDA, CELIA, LAGUNA, NEWPORT, ALEX DUNCAN, and LACME are often named, along with SURPRISE, as the first of the type. POINT ARENA, PRENTICE, and NEWSBOY are credited with being the first

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[43] McNairn, 943.

[44] *Restoration of the Steam Schooner Wapama: Report #2 to the California Division of Beaches and Parks, on the History and Restoration of the Wapama* (San Francisco: San Francisco Maritime Museum, 1960), 3.

steam schooners launched with engines installed. This might be a meaningless distinction since many steam schooners, like WAPAMA, were built in timber country and towed to San Francisco for engine installation; this was not a case of retrofitting or converting an older design, rather it was a two-stage building process played out over a large geographic area.[45]

From uncertain origins in the late 1870s and early 1880s the steam schooner came to prominence in the late 1880s. Steam schooners had become a distinctive class of vessel engaged in the lumber trade by 1886. In 1887, eleven steam schooners were built in San Francisco and one other was built elsewhere along the Pacific Coast. Total production grew to seventeen vessels in 1888, with thirteen built in San Francisco. The rate of new construction was somewhat abated during the 1890s but received a boost from the Klondike Gold Rush of 1898 and another boost after the 1906 earthquake and fires severely damaged San Francisco. The building boom resulting from the movement of people to Alaska and the reconstruction of San Francisco produced almost one hundred steam schooners in a single decade. World War I spurred a final spike in steam schooner building as every available resource was used to increase the nation's waterborne carrying capacity. The building frenzy during World War I proved to be the last gasp of steam schooner construction. In 1923 the Matthews Yard launched the last steam schooners ever built, QUINAULT and DAISY GRAY. Over the next twenty years the fleet dwindled as ships lost to retirement and casualty were replaced with larger, steel-hulled ships. By the 1940s only a handful of the wooden steamers remained, and by 1948 only the WAPAMA (TONGASS) was still working.[46]

The lifespan of the class was longer than the lifespan of individual vessels. Therefore, as might be expected, the design

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[45] McNairn, 944.

[46] *Restoration of the Steam Schooner Wapama: Report #1 to the California Division of Beaches and Parks, on the History and Restoration of the Wapama,* (San Francisco: San Francisco Maritime Museum, 1960), 8; *Restoration of the Steam Schooner Wapama: Report #2,* 10,13.

of new steam schooners evolved as the class matured. The general trend of steam schooner development is marked by an increase in size. The earliest precursors of the group averaged around 175 tons. Steam schooners built in 1886 averaged 260 tons. Two years later there were many over 300 tons and some over 500 tons.[47]

Steam schooners reached the apex of their size and development in the first two decades of the twentieth century. By 1900 the basic design had become fairly standardized. According to a steam schooner builder:

> The Pacific Coast steam schooner developed into a vessel with a high forecastle and poop to protect the ends of the lumber on deck.
> The form of the vessel has to be:
> (1) Fine below the light waterline to keep the propeller under water going north along the coast in the light condition.
> (2) Full above the light waterline to make the vessel a good carrier.
> (3) The displacement must be properly distributed fore and aft so the minimum of power is required to drive the vessel while at the same time permitting proper stowage at the ends of the hold.[48]

These later vessels were larger in size than their predecessors. During the final years of construction, a period that saw the last sixty steam schooners launched, the majority of new vessels were over 1000 tons.[49]

Most steam schooners were built with their superstructure and machinery installed in the after portion of the vessel. This arrangement yielded the typical steam schooner profile or

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[47] *Restoration of the Steam Schooner Wapama: Report #2*, 7.

[48] *Restoration of the Steam Schooner Wapama: Report #2*, 11.

[49] *Restoration of the Steam Schooner Wapama: Report #2*, 12-13.

silhouette where the long foredeck is loaded with stacked lumber reaching almost as high as the pilothouse. A few steam schooners, mainly larger vessels, were laid out with the superstructure and machinery positioned amidships. This double ender arrangement allowed the ships to carry and work additional sets of cargo handling gear and shorter loading times in port.[50]

Coal was the fuel of choice for the early steam schooners, but by 1893 steam schooner operators had begun to experiment with oil as an alternate fuel for the boilers. That year the Kerckhoff-Cuzner Company converted its coal burning steam schooner PASADENA to an oil burner. PASADENA was outfitted with a 190 horsepower, gravity-fed engine manufactured by the Hinkley, Spiers, and Hayes Company. The conversion, while arguably visionary, was not a technical success and PASADENA was re-engineered to burn coal. PASADENA underwent a third conversion, back to oil burner, when a pressure feed was developed to carry the oil. For a vessel that was an augury of things to come, PASADENA was not well received in certain circles. Port authorities in San Francisco were so wary of the fire threat they perceived in the oil burning system that in the early days of PASADENA's operation the vessel suffered the ignominious fate of having to extinguish its boilers at the harbor mouth and accept a tow into port.[51]

Despite PASADENA's cool reception, oil was the fuel of the future. It was available in California whereas coal had to be imported from distant mining regions. Less than two decades after the first experiment with PASADENA the oil-burning contingent of the fleet had grown to the point where less than twelve coal burners remained in service by 1911.[52]

While the size, design, and powerplants of steam schooners varied, their use did not until the very end. The steam schooner's raison d'etre was the lumber industry: they were built

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[50] *Restoration of the Steam Schooner Wapama: Report #2*, 13.

[51] McNairn and MacMullen, 18.

[52] McNairn and MacMullen, 18.

to carry the trees felled in the vast coastal forests to markets further south. In the early days, the vast majority of cargoes were bound for San Francisco; as time passed, building booms in Southern California drew an increasing share of the cargoes.

The wooden ships that plied the coast were well suited to their trade. Their engines gave them access to the dog-holes with a greater chance of survival than that enjoyed by the sailing schooners. Steam propulsion and shallow draft also allowed them to navigate well past harbor bars and penetrate rivers; this led to the development of inland cities and the opening of new timber reserves. Steam also powered the winches that proved very effective at rapidly loading and unloading lumber. The increasing size of these lumber carriers made them more efficient and able to deliver larger loads than any sailing schooner. Moreover, these loads, stacked high on deck and often exceeding 1 million board feet, could be delivered on a strict timetable.[53]

While lumber was the paramount cargo on steam schooners, it was not the only cargo. Many of the earliest steam schooners were built for the produce trade between northern and southern California, though they were quickly transferred to the lumber trade.[54] A more lasting trade was passenger carriage. Many steam schooners were built with passenger accommodations in the superstructure. Since they served a number of out-of-the-way ports, the steam schooners often provided the only passenger service along certain routes. Even where there was competition with dedicated passenger steamers the low cost of a passage on a steam schooner attracted passengers.[55] The passenger trade would have never spawned the development of so many vessels; passengers were only an auxiliary cargo. They were, however, a cargo that shaped the way the steam schooners were built. The large superstructures found on most of the class were a result of making room for human cargo.

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[53] *Restoration of the Steam Schooner Wapama: Report #1*, 9.

[54] *Restoration of the Steam Schooner Wapama: Report #2*, 6.

[55] *Restoration of the Steam Schooner Wapama: Report #2*, 10-11.

The carriage of lumber was a one way trade. Trees felled in timber country were carried south to California's growing cities but no bulk cargo made the return trip. From an economic standpoint this was undesirable as it meant ships were only working at half capacity and spent a great deal of time traveling without cargo. There is evidence that steam schooner operators sought to remedy this inefficiency by carrying whatever cargoes they could secure, in addition to passengers, on the trips north.[56]

After World War I, coastwise shipping became more and more the province of steel ships that were larger and could carry more than their wooden cousins. This gradually pushed existing steam schooners out of the lumber trade and into more varied trades on peripheral routes. It also meant there was no incentive to build new steam schooners. The problem was exacerbated by the Great Depression and again worsened after World War II when an increasing share of the cargoes once consigned to coastal ships were shifted to expanding rail networks.[57]

The number of steam schooners dwindled rapidly and by the late 1940s even the last holdouts had been driven out by old age and more able competitors.

History

WAPAMA left San Francisco on her maiden voyage, discounting the trip south under tow, on May 1, 1915. That year there were 144 steam schooners, controlled by fifty-five separate owners, working on the West Coast. WAPAMA arrived in Astoria, Oregon on May 3, to load her first cargo. In the coming months the new steam schooner began a pattern which would last, with temporary deviations, for the entire period of McCormick

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[56] Burch, 16.

[57] *Restoration of the Steam Schooner Wapama: Report #2*, 15.

ownership. WAPAMA would leave San Francisco with passengers and whatever cargo was available and arrive in the Northwest, usually Astoria, Everett or Tacoma, to load lumber. The heavily laden ship would then turn south and sail for San Francisco or San Pedro to offload its cargo and any passengers returning from the Northwest. A one way ticket from Oregon to San Francisco cost $10 in the early days of WAPAMA's operation.[58]

On some voyages WAPAMA would augment money earned from cargo carriage with money earned towing other vessels. In 1915 the steam schooner towed the lumber schooner ALPENA from near Astoria to San Francisco and the whaler BOWHEAD from the vicinity of San Francisco to San Pedro. Both tows were initiated at sea and appear to be opportunistic rather than preplanned.[59]

There were ample dangers involved in working the Pacific Coast of North America and many steam schooners were lost at sea or wrecked on the rugged coastline. WAPAMA managed to avoid any serious incidents but, as can be expected, was involved in a number of minor mishaps over the course of her working career. Appendix B contains details of various mishaps involving WAPAMA.

In the early days of WAPAMA's career the crew numbered thirty-one men, including the captain, divided into deck, engineering, and steward departments. The total number of crewmembers stood at twenty-six in 1927, the loss coming mainly from the combination of fireman and oiler responsibilities into one billet. Other than the captain the highest paid crewmember was the Chief Engineer who earned $150 per month. The first mate and first assistant engineer each earned $100 per month. The lowest paid members of the crew, waiters in the steward department, earned $35 per month. Able-bodied seamen earned $50 a month, as did cooks, oilers, and winch drivers. Firemen made $55 a month. The steward was paid $70 for his work. The second mate and second assistant engineer earned $85 each for their labor. The crew

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[58] Burch, 8-9; *Restoration of the Steam Schooner Wapama: Report #2*, 13.

[59] Burch, 10.

list also recorded the presence of two wireless operators, both young Americans, but does not specify their wages.[60]

Paperwork documenting the crew's pay rates in 1927 also recorded its ethnic make-up. Almost the entire deck department hailed from Northern Europe; the two exceptions were a winch driver from South America and an able-bodied seaman from England. The engineering department was made up of men from Southern Europe and North America with the Americans holding the more senior positions. The steward department contained three Americans, two men from Great Britain, and a New Zealander.[61]

WAPAMA changed owners and routes in May 1930. At that time the steam schooner was purchased, along with the McCormick steam schooner CELILO, by the Los Angeles-San Francisco Navigation Company and put into service carrying passengers and assorted cargo between the two cities. During this period it cost $12 per person for a one way ticket and another $12 if passengers wanted to bring their automobile with them. A surviving ship's menu from the period indicates the passengers, and presumably crew, ate adequate if not fancy meals while steaming along the coast.[62]

Despite efforts to continue passenger service by increasing cargo loads, WAPAMA's parent company was in financial trouble by the mid-1930s. Increased labor costs and a drop in business led Los Angeles-San Francisco Navigation Company to sell WAPAMA in April 1937.[63]

The new owners, Viking Steamship Company, made an attempt to turn a profit using WAPAMA as a passenger vessel but the effort was abandoned after the first two trips resulted in a loss; the ship

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[60] Burch, 11-12, 22.

[61] Burch, 11-12.

[62] Burch, 24-28; Los Angeles-San Francisco Navigation Company. *Supper Menu for S.S. Wapama* (and S.S. Celilo). 17 December 1932.

[63] Burch, 24-28.

was laid up after the second trip. By the end of the year WAPAMA had a new owner and was soon to steam under the name TONGASS for the Alaska Transportation Company. WAPAMA's new owners sent the ship north to Seattle in February 1938 with a load of rock salt ordered by the owners of C.A. THAYER. After arrival in Seattle the steam schooner was sent to a shipyard to be refitted for cargo service to Alaska.[64]

WAPAMA (TONGASS) began making runs to Alaska sometime after April 1938 and continued making the runs until May 1947. During this period the ship carried passengers, mail, and general cargo to Alaskan port towns and returned with a cargo mainly composed of frozen fish. The crews on the Alaska run usually numbered around thirty men and included a pilot and purser.[65]

The only voyage during this period for which records survive is the vessel's last. WAPAMA (TONGASS) left Seattle on May 5, 1947, on voyage number seventy-two for Alaska. Ketchikan was visited on May 13, and the ship reached Petersburg the next day. On May 15, the anchor was dropped in Juneau. Haines and Skagway were both visited the following day; stops were made at Hoonah and Pelican on May 18. On May 19, WAPAMA (TONGASS) visited Tenakee. Second stops were made at Petersburg and Ketchikan on the May 21 and 22. Five days after departing Ketchikan WAPAMA (TONGASS) ended the voyage and her career in Seattle.[66]

On June 6, 1947, the steam schooner underwent a Coast Guard inspection in a Seattle drydock. The inspector noted that although the vessel's hull was in "fair" condition, the ship was to be taken out of service.[67]

A salvage company bought WAPAMA (TONGASS) in 1948 and the vessel

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[64] Burch, 29-30; Delgado, 8/4.

[65] Delgado, 8/4; Burch, 33.

[66] Burch, 34-35.

[67] Burch, 35.

was laid up in Lake Union in preparation for scrapping. Various brass fittings were removed from the vessel for their scrap value. The rest of the vessel went without maintenance and grew quite deteriorated. It did, however, continue to float and eventually survived to become the last steam schooner.[68]

Legislation authorized the California Division of Beaches and Parks to purchase the vessel in 1958. The state moved the steam schooner to San Francisco for preservation as a historic vessel. Several years of restoration work culminated on October 2, 1963 when the ship was opened for public tours, almost fifty years after it was built and long after its anticipated twenty year lifespan had ended. In 1977 WAPAMA was acquired by the National Park Service for inclusion in the Golden Gate National Recreation Area.[69]

After almost two decades of service as a museum ship in San Francisco, the WAPAMA's condition had worsened to the point where she had to be removed from the water to await significant repairs to restore a measure of structural integrity. WAPAMA was placed atop a barge in 1979. The vessel has been on a barge for more than twenty years and, though steps have been taken to arrest the ship's deterioration, there are no plans to undertake restoration work in the immediate future.[70]

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[68] Burch, 37.

[69] Tri-Coastal Marine, 6.

[70] Tri-Coastal Marine, 6.

Appendix A

WAPAMA's Masters: 1915-1949[71]

Master	Date of Entry
Edward Jahnsen	4/29/15
Charles Green	5/12/15
John Foldat	5/15/15
O.C. Orland	5/??/19
Olaus Bellesen	2/18/20
Martin Muhrer	5/01/26
Niles C. Ronberg	2/09/27
John J. Silvia	2/24/27
Oscar Salo	12/??/28
Carl J. Johanson	1/23/29
Peter Lund	8/??/29
George Wedelsted	12/??/31
A.F.M. Abbors	5/03/35
I. Halverson	4/20/37
Olaf Hansen	2/??/38
Eldred Hansen	4/06/38
Chris L. Ross	8/26/40
Lawrence A. Parks	8/27/40
Maitland M. Merkley	12/16/40
John B. Edwards	7/15/41
Victor Seidel Luber	12/05/42
Harry A. Clark	5/19/43
Arne Monsen	7/20/43
Lowell E. Smith	8/02/45
John B. Edwards	8/24/45
A Clark Hare	2/21/46
Eugene Butts	5/14/46
Richard S. MacRae	5/05/47
H.E. Sievers	1/05/49

[71] Burch.

Appendix B

Accidents and Mishaps During WAPAMA's Career[72]

DATE	LOCATION	INCIDENT	RESULT
11/27/1915	Frasier River, B.C.	Grounding on silt	No damage; refloated
12/6/1915	San Francisco (foot of Jones Street)	Grounding on mud	No damage; refloated
5/17/1917	Ranieer	Collision with steamer DORIS	No damage
6/16/1917	Near San Diego	Grounding on mud	No damage; towed off by Navy tug
12/1932	San Francisco	Masts snapped off while loading	Masts repaired or replaced
unknown	Long Beach	Collision with breakwater	Extensive damage; repaired
5/10/1947	Seattle	Strucker steamer REEF KNOT	Increased leaking to hull
1950s	Seattle	Fire, Engine room	Damage to structures in engine room.

[72] Burch; Delgado.

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