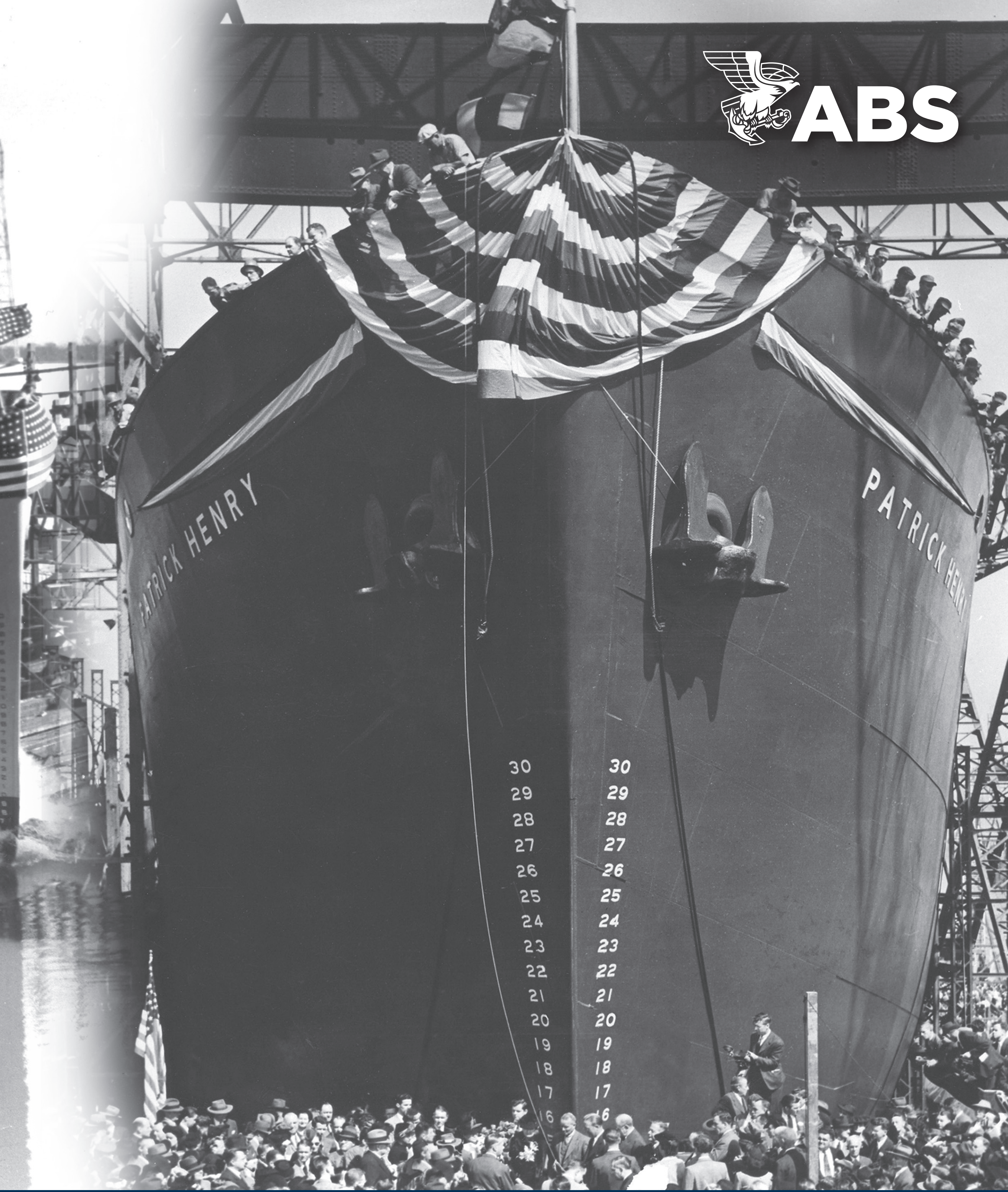

WORKHORSE OF THE FLEET

A History of the Liberty Ships

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We will comply with all applicable legal requirements as well as any additional requirements ABS subscribes to which relate to ABS and our HSQE aspects, objectives and targets.

Workhorse of the Fleet

by

Gus Bourneuf Jr.

A history of the design and experiences of the Liberty Ships
built by American Shipbuilders during WWII.

Workhorse of the Fleet

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To my sons Danny, Pip and Patrick who as young lads
drifted off to sleep in the Chief Mate's and 2nd Mate's bunks
salvaged from the Liberty Ship SS George Gershwin.

Table of Contents

Introduction

Originally called "Ugly Ducklings," the Liberty ships when built, were expected to last one trip and to have no economical life after the war. However, as the record shows, the Liberty ships labored long and hard during the war and dominated the ocean highways of the world for over ten years after the war.

This history is mainly from the point-of-view of the US Maritime Commission with most of the information coming from informal notes kept by several members of the design division of the US Maritime Commission during and just after the war. The existence of the notes was mentioned in Lane's "Ships for Victory." These notes and other documents were transferred to the National Archives in Washington, DC after the war and initially proved very difficult to locate. However, with the assistance of an archives employee who had worked for the Maritime Commission during and just after the war I was able to find most of the available records.

A great deal of assistance and information on the British part of the design came from the Curator of Naval Architecture and Shipbuilding at the National Maritime Museum in Greenwich and the Curator of the Tyne and Wear Museum, Newcastle-on-Tyne. In addition, a lot of information and photographs of Liberty ships in the Atlantic and Russian convoys was found in the archives of the Imperial War Museum in London.

Much valuable information including log books, a complete set of "blue prints," instruction manuals, etc., was salvaged during the scrapping of the SS *George Gershwin*. Copies of some of the manuals pages are included in this history for information. The *George Gershwin* met the scrapper's torch in a back marsh area of southern Mississippi during the very hot summer of 1975. This was a long way from the winter gales of the North Atlantic where, as its logs indicate, it spent a lot of its time.

For all her assistance and advice in preparing the manuscript I wish to thank Natalia Terek.

Finally, I would like to thank John Conlon, for the time he took to review the manuscript and for all his helpful suggestions.

Gus Bourneuf Jr.

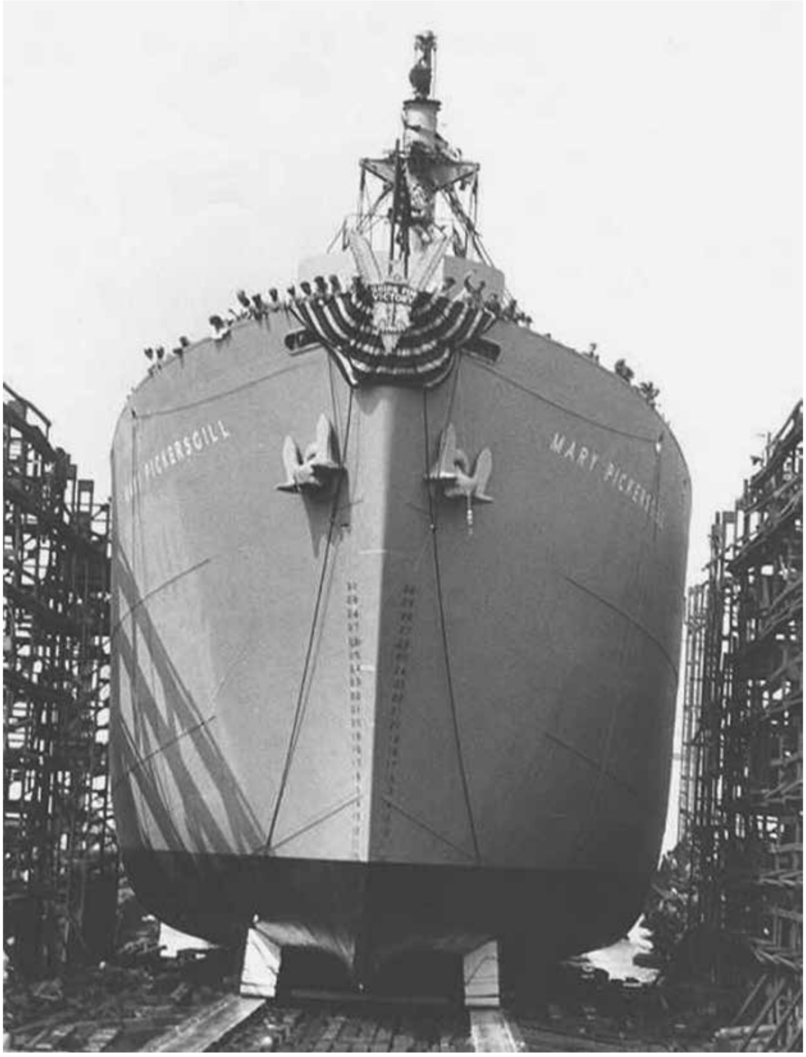
Historical Overview and "Raison d'etre" of the Liberty Ship

A study of history reveals that when the United States entered World Wars I and II the national security of the United States was seriously threatened because the country failed to have a shipbuilding and a shipping industry suitable for its security requirements.

There are many who argue that World War II, and especially the participation of the United States in both world wars, was caused to a large extent by the fact that the United States, together with other powers that finally joined together as the Allies in World War I and as the United Nations in World War II, were inadequately prepared to wage war. Part of the lack of preparation was the lack of ships and the lack of adequate shipyards to build ships quickly. Whether this absence of preparation helped to cause two world wars can probably never be satisfactorily proved, but the possibility of its being true is worthy of serious consideration. Whatever were the causes of the wars, the fact remains that the United States entered both world wars and, especially in World War II, was totally unprepared with respect to ships and shipyards.

The entry of the United States into World War II when it was inadequately prepared forced the United States to run the risk of losing the war. In spite of the fact that world events allowed the United States more time to prepare than many other countries, events in the early days after Pearl Harbor illustrated the serious risk which the United States had incurred. It is known that the results of the Japanese attack on Pearl Harbor were much more favorable than even the Japanese suspected at that time. For almost a year the United States was forced to fight delaying actions with inadequate equipment.

Furthermore, at the time the United States entered the war it had the opportunity to erase part of the effects of the failure. World War II had begun more than two years before the United States formally became engaged, and throughout most of this period the United States was engaged in producing war material for foreign countries and was fast becoming the



arsenal of democracy. Throughout the same period there was some attempt to build up the armaments of the United States in what was known then as the National Defense Program. While the absolute output of munitions in this period was rather small, the experience gained and the industrial facilities prepared, enabled the country to get into large-scale war production much more quickly after Pearl Harbor than would have been true if the period of preparation had not been available.

Not only was the United States granted a time period, while its future allies were carrying on the fight to prepare for engaging in World War II, but likewise those same allies had some of the weapons of war and some ships and shipyards to help with the United Nations' fight. In the early part of the war the ships of its allies were more numerous than those furnished by the United States.

Both before and after entry into World War II, the United States produced large quantities of munitions. On many occasions the full effect of these munitions could not be realized however, because of the inability of the United States and its allies to transport them to the proper places at the time when they would have been most useful.

The unpreparedness of the United States with respect to ships caused serious modifications in the prosecution of World War II. The lack of ships not only modified military strategy but also changed the whole program of production of war goods.

In addition to restricting the strategy of warfare, the lack of shipping contributed to changing the pattern of the war by claiming a large part of the labor and material available for production during the first year after Pearl Harbor. The demand for new ships was great. This was due in part to the inadequate number of ships available at the beginning of the war and in part to the fact that wartime demands far exceeded the number which could or should have been built in peacetime. Because of this great demand, not only were old shipyards using labor and material to build new ships but also the construction of new and the expansion of old shipyards were likewise requiring labor and material.

Thus, neither the shipping capacity nor the shipbuilding capacity of the country was sufficient to meet the needs of war, and both had to be expanded greatly and rapidly. The demand for ships therefore exerted a three-way pressure on the war production program. It demanded men and material to build ships to make up for the inadequate fleet in existence at the beginning of the war; it demanded men and material to build the ships required by the excess demands of war over prewar demands; and it demanded men and material to build up the shipbuilding capacity. All this at a time when the men and material were sorely needed for the production of other implements of war.

These demands were both urgent and large. At a time when the United States had set itself a goal of mobilizing a total fighting force of 10 million men, in comparison with a prewar force of well under 1 million ships and shipyards were demanding more that 1.5 million additional workers and the industries supporting shipbuilding were demanding at least another million. Likewise, the materials used to make a ship are the same kid of materials which are used to make many other munitions. Ships and shipyards were competing with other munitions industries for steel, copper, machine tools, engines and almost every other scarce item.

This lack of preparedness was responsible for the building of the Liberty ships. There will always be competing demands for men and material during wartime, but when the lack of preparation in a single area, such as shipping, demands so many men and so much material that it drastically interferes with the prosecution of the war, the results are extremely serious.

The lack of ships furthermore, was more serious than the lack of some of the smaller implements of war for two other reasons. First, it prevented satisfactory transportation of the men and materials of war which were available, even though the available quantities were small. Secondly, the construction of a ship takes so long that it is much more difficult to supply a missing ship than it is to supply a missing machine-gun bullet. And all this was happening during the first year of the war when time was precious and the country was, as has since become known, in possible danger of invasion.

Finally, the inability to import sufficient quantities of strategic materials such as bauxite and other ores forced further substitutions and modifications in many phases of war production. While it may not be important in a military sense, the shortage of ships also made more difficult the sustaining of the domestic economy.

All the effects of being inadequately prepared for war, especially the failure to have sufficient ships and shipyards in which to build them, can be summarized in the statement that the resulting war was more expensive than it otherwise would have been. Looking back over the 20 years between World Wars I and II, it seems evident that if a moderate but effective program of preparedness had been undertaken the total dollar costs would have been less than the costs incurred by the frantic scramble for production of ships and shipyards that actually took place in 1941 and 1942. Perhaps some ill-advised program of preparedness would not have assured lower costs, but surely a well-planned effective one would have prevented some of the occurrences that led to high cost.

The expense in dollars and in time however, is negligible when compared with the expense in lives. Delays in ending the war cost lives; delays in becoming able to fight an offensive war cost lives; and having soldiers and sailors try to fight wars without sufficient equipment cost lives.

If, as many claim, it is the policy of the United States when fighting a war to be extravagant with material in order to be economical with lives, the policy of lack of preparedness does not coincide with this principle. Even if it had been more expensive in dollars to be prepared for war, according to the wartime ideals of the United States this extra expense would have been worthwhile if it had contributed to saving the lives of American soldiers and sailors.

CHAPTER I

The British Technical Merchant Shipbuilding Mission

At 4:45 a.m. on the morning of 1 September 1939 German Armored Divisions of the XIX Army Corps rolled across the Polish frontier – World War II had begun.

Two days later at 11 a.m. on 3 September 1939, Great Britain, after failing to receive a reply to their ultimatum to Hitler to withdraw his forces from Poland, declared war on Germany.

After Poland fell there was little land fighting anywhere and the last months of 1939 were widely described as the time of the "phony war." But it was different at sea. Not nine hours after Prime Minister Neville Chamberlain's announcement of the declaration of war, at 7:43 p.m. to be exact, a U-boat (*U-30*) torpedoed and sank the British liner *Athenia* off the coast of Scotland. Of the 1,400 passengers aboard, many of whom were fleeing the war in Europe, 112 lost their lives, including 28 Americans.

In the weeks that followed, Hitler's Sea Wolves – as his submarine force was called – struck time and again at the merchant shipping so vital to Britain's economic survival. The losses of material were appalling.

By the end of 1939, the box score on the "Battle of the Atlantic" had mounted frighteningly. Within the short space of four months, U-boats, mines, planes and surface raiders had sent more than 215 merchant ships – a staggering 748,000 tons of shipping – to the bottom. Britain was in desperate shape and was dependent, now more than any time in its history, for its very survival on its merchant ships.

At the outbreak of the war, those British shipbuilders involved in the construction of tramp ships were instructed to continue building to their own designs however, by early 1940 a serious situation was developing. U-boats were taking their toll at a faster rate than the shipyards could produce new vessels. Britain was now facing collapse. Its yards were at maximum production with all building ways full. To speed up construction, it was decided that as far as possible, ships would be produced from one standard design.

Responsibility for British merchant shipbuilding had by now been taken over by the Admiralty and they carried out an examination of the prototypes available in the 9,000/10,500 tons deadweight and 390/425 ft length range contemplated, and the design eventually selected was based on the *Dorington Court* built by J. L. Thompson & Sons, Ltd., at its North Sands Shipyard in Sunderland. The proposed vessel had five holds with the superstructure split by the No. 3 hold between the bridge and machinery casing as was favored at that time. The length between perpendiculars was 416 ft while the molded breadth was 57 ft, some three feet less than the *Dorington Court*. Deadweight was about 10,500 tons. The machinery installation chosen was of the triple-expansion type, based on the North Eastern Marine design fitted in the prototype vessel which had cylinders of 24 in., 39 in. and 68 in. diameter with a 48 in. stroke, taking steam from two Scotch boilers and indicating 2,500 horsepower to give a service speed of 11 knots.

Following the fall of France, it became necessary to change shipbuilding priorities in the United Kingdom with the demand for naval as well as merchant ships to be considered. It was apparent that to build these standard vessels in quantity, help must be sought from overseas yards. Churchill's famous call to America saying, in effect, you give us the tools and we will win the war, was a good illustration of England's desperate need for ships and more ships. It was the World War I situation all over again, only far worse.

The bleak shipping prospect, in the late summer of 1940, led the British Government to canvass the possibilities of building an emergency fleet of cargo ships in the United States and Canada. The matter was under the direction of Sir Amos L. Ayre, Director of Merchant Shipping in the Admiralty. This gentleman was well-known in shipbuilding circles. During the First World War he had been District Director of Shipbuilding (Scotland) for the Admiralty as well as Supervisor of Fleet Coaling, Firth of Forth. After that and up to 1936 he had been Chairman of the Burntisland Shipbuilding Co., Ltd., Burntisland, Fife. Sir Amos joined the Ministry of Shipping in 1939.

A Technical Merchant Shipbuilding Mission was organized in September 1940 for the purpose of inaugurating the building program in North America. It was headed by Robert C. Thompson, the Managing Director of Joseph L. Thompson & Sons, Ltd., Shipbuilders, Sunderland, and also a Director of Sir James Laing & Sons, Ltd., Shipbuilders. The other members of the Mission were: Harry Hunter, a marine engineer connected with Swan Hunter & Wigham Richardson, a shipbuilding and engineering firm in Wallsend-on-Tyne, Northumberland; Williams Bennett, Principal Surveyor of Lloyd's Register of Shipping for the USA and Canada; J. S. Heck, Principal Engineer Surveyor of Lloyd's Register, New York; and R. R. Powell, Assistant Secretary, Admiralty and Secretary of the Mission. The last three were already in America and the first two sailed on the *Scythia* on 21 September 1940. In the following February, John Robson of the Department of Merchant Shipping, Admiralty joined the Mission at its headquarters in New York.

The Mission's purpose was to obtain, at the earliest possible moment, the delivery of 60 tramp-type vessels of 10,000 deadweight tons from the United States and as many more as possible from Canada. They took with them the plans for the standard design based on the *Dorington Court*. At that moment no vessel had been built on that exact design.

The first ship built in England on these lines was the *Empire Liberty* which was built for Joseph L. Thompson & Sons, Ltd., Sunderland, and was launched 23 August 1941. The *Empire Liberty* became the parent ship or prototype of the ships built for British account in the United States and, indirectly, for the American Liberty ships. The first of those built in America was the *Ocean Vanguard*, launched to Todd California on 15 October 1941. The *Ocean Vanguard* was well named, since it was in fact the vanguard of the Ocean class vessels built for the British. There was a slight difference in the dimensions of Empire and Ocean classes, due chiefly to the fact that the latter were largely welded. The smallness of the difference is indicated by the following table:

	Ocean Type	***Empire Type***
Length B.P.	416 ft 0 in.	416 ft 0 in.
Breadth extreme	57 ft .375 in.	57 ft 2 in.
Breadth molded	56 ft 10.75 in.	56 ft 10.5 in.
Draft extreme	26 ft 10.875 in.	26 ft 11.75 in.
Draft molded	26 ft 10 in.	26 ft 9.625 in.

Both types:
Camber 2nd deck – nil; upper deck 14 in.
Sheer 2nd deck – nil; upper deck 8 ft 9 in. forward, 4 ft 6 in. aft
Gross tonnage 7,157
Deadweight tonnage 10,100

Launch of the OCEAN VANGUARD

Other British tramp types have been spoken of as the prototype of the Liberty ship. In particular the *Scottish Monarch*, a vessel of 9,300 deadweight tonnage built by the Caledon Shipbuilding Co. in 1938 and also, the standard motorship tramp-type built by the Burntisland Shipbuilding Co., Ltd. for the carriage of coal, grain and general cargo. This latter type became known as the "economy ship" and had a deadweight tonnage of 10,200 tons and a speed of 12 knots.

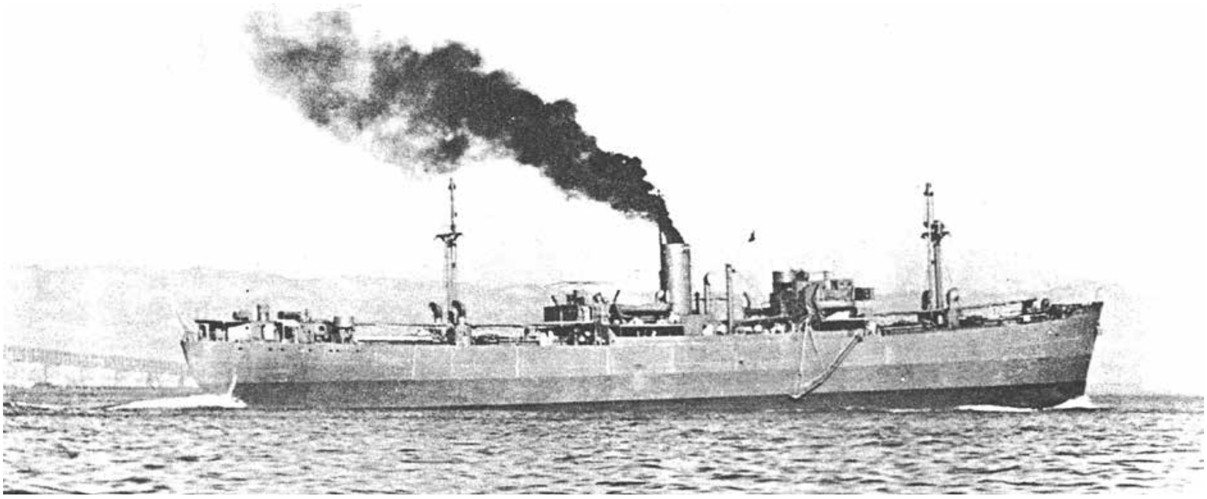
According to the Washington correspondent of the "Daily Telegraph," American Shipbuilders greeted the news of the British program with considerable skepticism. He reported that:

> "In American shipping circles – the British plan is said to involve a new conception in shipbuilding. It involves the construction of a 28-way assembly yard to turn out 'powered scows.' Little more than pointed boxes with riveted steel hulls and a large cargo space. Parts would be built throughout the United States and assembled at the yards. Some parts might even be constructed in inland points."

In England there was also a certain amount of skepticism regarding the value of building this type ship. Shipping interests had not forgotten that after the First World War they had found themselves saddled with slow and inefficient tonnage. They argued that the slowness of the emergency ship made it unsafe in convey and unusable for post-war competition. An editor of the *Liverpool Journal of Commerce* pointed out that, on the other hand, the ships now being built are not like the standard ships of the last war when many different yards built to common design and specification. Today the shipyards are turning out vessels of their own particular planning – what were before the war known as economy ships. They are not so elaborately equipped as they were before the war, but they are not slow, awkward standard ships. They represent the results of shipyard research during the years of depression, and before the war began they were known to be economical and efficient cargo carriers.

This then, was the kind of ship the British Mission sought to build in North America during the bleak months of the winter of 1940-1941. The Mission had its first full meeting in New York on 4 October 1940. After returning to England, Thompson and Hunter gave an account of their activities. In describing their first days they said:

> "After making various contacts in New York and Washington, we met at Todd Shipyards, Inc., and found they were associated with a group of Pacific Coast civil engineering contractors known as Six Services, Inc., headed by a Mr. Henry J. Kaiser, and jointly they owned the Seattle-Tacoma Shipyard. They produced a nicely colored drawing of a modern British tramp steamer, and offered to build ships for us, providing they had reciprocating engines and water-tube boilers Scotch boilers might be possible – and a specification generally to meet the special conditions."



OCEAN VANGUARD on trials

They soon found out that there were not sufficient building ways in existence to support a program of the magnitude they had in mind. New yards would have to be built. They returned to New York on 1 November 1940, after a tour of American and Canadian yards and engine works. By that time the Todd-Bath Iron Works and Kaiser group had submitted tenders. Contracts were finally signed with the Todd-Bath Iron Shipbuilding Corp., South Portland, Maine and the Todd-California Shipbuilding Corp., Richmond, California, on 20 December 1940, for a total of 60 ships. In each case three contracts were signed: 1) for the shipyards; 2) for 30 vessels; and 3) a guarantee contract signed by the respective stockholders. Shortly thereafter orders were placed with Burrards, Canadian Vickers and Davis Shipbuilding Co., for a total of 26 additional ships.

In Canada, the British design was followed very closely and riveting was preferred in the production of these so-called “Fort” class ships. In the United States, it was decided to use welding “to ensure a good supply of labor, to facilitate production, and to get the best value for money.” According to the established practice in many American yards the only riveting done was in connecting the frames to the shell. Other minor modifications included: substitution of cast steel or fabricated mild steel for cast iron stern frames, hawse pipes, fairleads and bitts; reduced amount of woodwork; and a rudder of American design.

The British discovered that “a big problem was involved by the lack of detail in British plans which required a lot of interpretation and amplification.” It became the job of the members of the Mission to cover these points which they did, in part, by having representatives of the shipbuilders inspect British ships of the type in port. It was found that the British were in the habit of making only about 30 percent as many drawings as was customary in American yards. This was explained by the fact that British workers habitually did more bench-work. Other difficulties were caused by differences in pipe and flange standards, timber sizes, hemp and wire rope sizes, use of Standard Whitworth thread, etc.

The Todd group employed Gibbs & Cox, Inc., which had a large organization of about a thousand people, to do shipyard drawing and designing and also to purchase all materials required for both hull and machinery. They produced a new set of plans modified for the substitution of welding for riveting and to otherwise suit American practice.

According to Thompson and Hunter, the welded ship was found to require less steel but more manpower than the riveted one. Man-hours of direct labor in the United Kingdom amounted to 336,000 per ship whereas the first American and Canadian ships required about 600,000 man-hours which was cut down to 510,000 after 20 ships and eventually, in the Todd-California yard, to 375,000 manhours.

As regards machinery it was recognized that the usual type of British tramp ship machinery, namely reciprocating steam engines with coal fired Scotch boilers though preferred, was not available to any extent in the United States. Such machinery was looked upon in the US as archaic, particularly the use of coal as fuel for oceangoing ships. However, at the end of 1940 coal was certainly a fuel readily available to Britain and so it was felt advisable from the manning point-of-view to stay with the familiar type of machinery. The 60 main engines were contracted with the General Machinery Corp., of Hamilton, Ohio, which had built marine engines during the years 1918-1922 but very few in the intervening years. This contract was signed in January 1941, the first engine was delivered 7 July and the last on 1 January 1942. The engine was designed by the North Eastern Marine Co., a division of Richardson, Westgarth & Co., Ltd., Wallsend-on-Tyne. Here again it was found necessary to redraw the plans.

British marine engine builders and other manufacturers in general leave many details of the drawings to shop practice – an arrangement which worked well when the staff grew up on the job, and where the whole unit is usually cast, machined, assembled, erected and installed under one roof. For example the designer did not put down clearances between crankshaft and bearings contrary to American practice. For US conditions however, it was necessary to amplify and redimension the British plans with respect to tolerances, fits and clearances, degree of finish, fillets, etc., and also certain other modifications to meet US standard flanges and fittings. Apart from these items and the use of US threads, wrench sizes, etc., the main engine design followed the British parent design. Also the British practice was to include many items on the one drawing and it was necessary to break these down into single item plans.

It was found that, in the case of the main engine, the 80 British working plans had to be expanded to about 550.

The American Locomotive Co., Schenectady, New York, contracted for 90 three-furnace Scotch boilers, having built some years previously. On the West Coast, the Western Pipe & Steel Co., of Los Angeles and the Puget Sound Machinery Depot, Seattle undertook to make the boilers. The former company had no experience with boilers, having been engaged in making high-pressure equipment for the oil industry, while the latter had built Scotch boilers in 1918-1921 but only occasionally thereafter. The first, and only the first, West Coast vessel had to be equipped with a boiler made in Schenectady, which was unfortunate, because it was a difficult matter to ship such a bulky item 3,000 miles by rail.

British boiler designs were modified for welding just as the hull design was modified for the same purpose. The most important adaption was in the joint of the combustion-chamber wrapper plates to the tube and back plate where a butt weld with main run from outside and sealing run from inside was used. This procedure had the advantage of avoiding the rather specialized workmanship involved in the usual riveted lap joint; the wrapper plate butt was also welded, thereby avoiding the usual awkward three-ply joint.

All boilers were fitted with smoke-tube superheaters, giving the moderate steam temperatures of 520 to 550 degrees F. This temperature range was used as it permitted the use of a superheater able to withstand considerable abuse. It was determined that all ships would be manned with either a Chief Engineer or at least a Second having superheat experience.

While the main engines for ships built in the United States and Canada were all from the same design, those built in Canada used deck and auxiliary machinery of British design. Very naturally British manufacturers wished to supply auxiliary equipment, but Sir Amos Ayres decided that ships built in the United States should be supplied with American-made auxiliaries. This resulted in higher costs but in quicker production. In fact, the only items on these ships that were of British design, besides the main engines, were the main boilers, ash hoists, windlasses and steering gear. The Canadian-built vessels used British design for everything except refrigerators.

The members of the British Mission found that American shipbuilding practices presented some new problems with which they were not familiar. In the United States it was usual to install the main engines, boilers, and shafting before the launching. This worked out well in the case of welded ships but required that the yard be laid out with berth cranes capable of lifting machinery weights and with a large outfitting dock with machine and pipe shops close by.

Thompson and Hunter observed some results of welding which are best described in their own words:

> "Owing to the effect of contraction of the top side welds, there is a pronounced tendency for the vessel as a whole to sag, and in addition contraction stresses can set up local deflections of the aft end; that is, the stern frame is liable to distortion apart from the hull structure – quite an important matter when boring out for the stern tube. The amount of sagging is of the order of one to two inches, and counteracted to a large extent by hogging the keel blocks by an inch amidships. Alternatively, the tendency can be counteracted by leaving the upper shell and decks free in way of forward and aft hatches and leaving welding here to the last. Either way, however, the stern tube is best not finally sighted until the top side welding from midships to right aft is completed."

A second source of deflection was also noticed, particularly in the Richmond yard, where it was found that the hull had a substantial variation of distortion during a 24 hour period – due, presumably to the heating effect of the sun. This variation was probably more pronounced because the ends of the ship were more or less "afloat" as it were, due to the previously mentioned top-side contraction. Measurements disclosed that the stern-tube line was in a mean position between 12 midnight and 2 a.m. and this time period was finally adopted for final sighting through and marking off.

Another aspect of the welded hull calling for special attention was the fitting of chocks under the main engine. In riveted ships the tank top in way of holding down bolts remains very fair and level, permitting the chocks to be conveniently fitted from outboard of the bed-plate. In a welded ship, however, the tank top, due to weld-induced distortion at the top of floors and longitudinals, is not so regular and may present difficulty in the proper fitting of chocks. In general, and in the case of all British ships, the tank top could be levelled off in way of chocks by grinding locally so as to give the desirable parallelism or slight inward taper of the packing space. In some yards, however, where the distortion was more severe, the practice was adopted of welding pads, about one-half inch thick, in way of each holding down bolt and dressing off the top of the pads.

For detailed technical supervision in the US, both for owners' interests and classification, arrangements were made by the Admiralty with Lloyd's Register for surveyors to be employed full time on the British program. The details of Lloyd's involvement were worked out between the Mission and Mr. Bennett, Principal Surveyor in North America. Five Lloyd's surveyors were stationed at each yard, under the direction of Senior Surveyors, Mr. F. C. Cocks at Richmond, California and Mr. J. S. Ormiston at Portland, Maine. The local representatives of the Mission were granted substantial discretionary authority, as it soon became evident that local and quick decisions were essential to rapid progress. The senior surveyors were assigned to the yards well before ship construction started as their duties also included "owners' interests" in respect of the shipyards. Full-time surveyors were also appointed to the main-engine builders and to the boiler makers (East and West Coast respectively) and special arrangements were made for the attendance of surveyors at various other works – these arrangements all took into account the special needs of the situation rather than merely classification requirements.

As vessels approached completion three additional appointments were made to each yard by the Ministry of War Transport. These appointments were: marine superintendent, engineer superintendent and surveyor for statutory requirements. The principal duties of the superintendents were the preparation of ships for sea and matters relating to the ship's crew, but in practice the closest cooperation existed between the superintendents and surveyors.

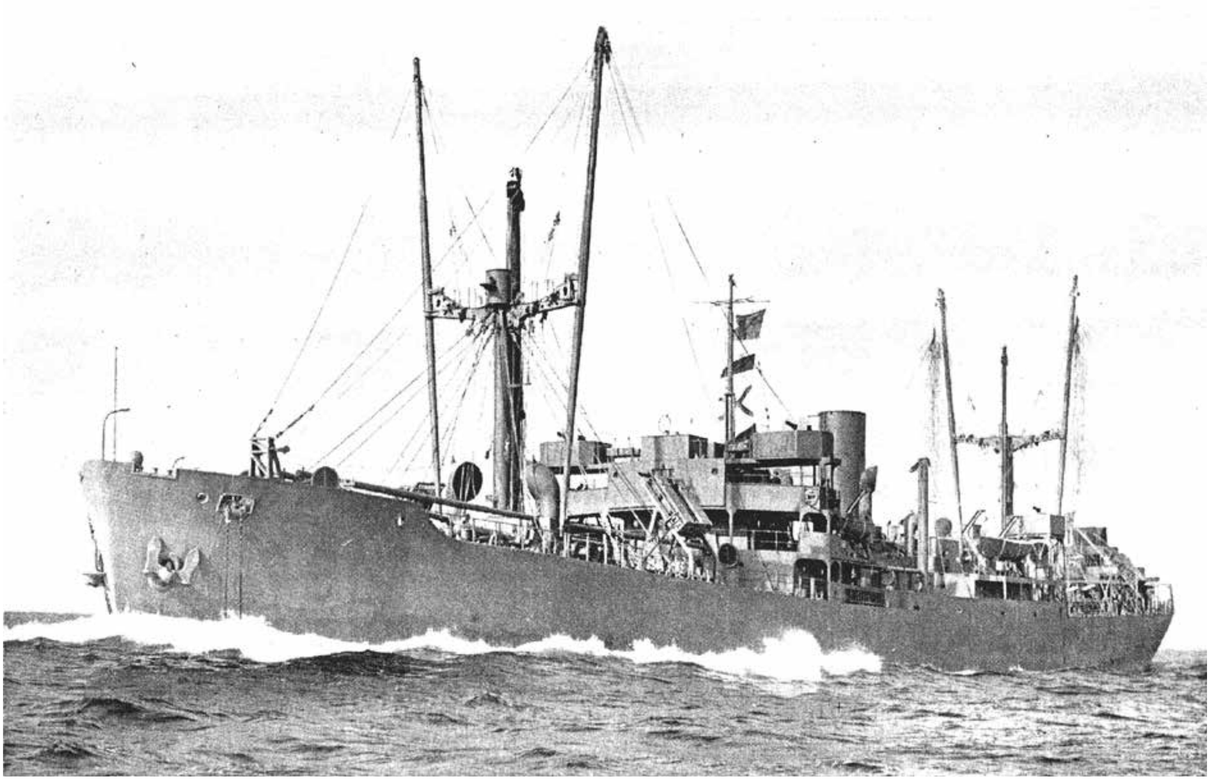
Acceptance of vessels from builders was by the Lloyd's senior surveyor acting as representative of the British Purchasing Commission. Thereafter ships were immediately turned over to the Ministry of War Transport. Acceptance in general took place at each shipyard after satisfactory sea trials, which included six hours running at full power and usual turning, steering and maneuvering trials and tests of all equipment. Captains and Chief Engineers generally arrived at shipyards shortly before launch, other officers shortly before trial, and crews immediately before loading.

Classification for these ships was divided between British Corporation Register of Shipping and Aircraft and Lloyd's Register. The classification surveyors also acted in the owners' interests jointly with local representatives of Wartime Merchant Shipping.

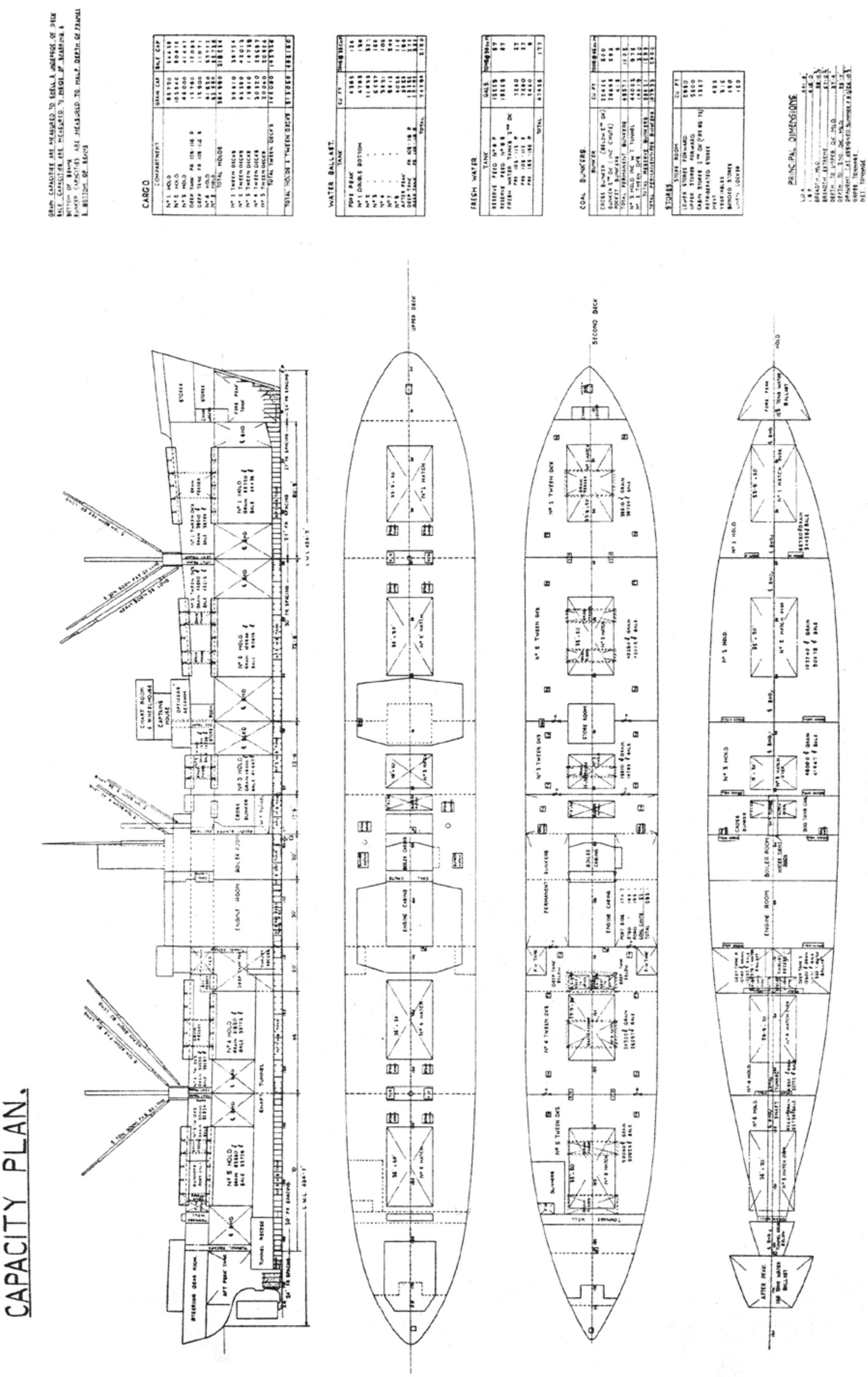
The orders placed for the 60 vessels amounted to a total deadweight capacity of over 633,000 tons. The cost was about $96 million which was paid for in cash. The names of the vessels built for the British account in the United States were prefixed with the word "Ocean."

At the Richmond, California yard the keel for the first vessel, the *Ocean Vanguard*, was laid on 14 April 1941, and the ship was launched on 16 August of the same year. The final delivery was July 1942, five months ahead of schedule. At the Portland, Maine yard the keel for the first vessel, the *Ocean Liberty*, was laid on 24 May 1941 and the last ship was delivered in November 1942, one month ahead of schedule.

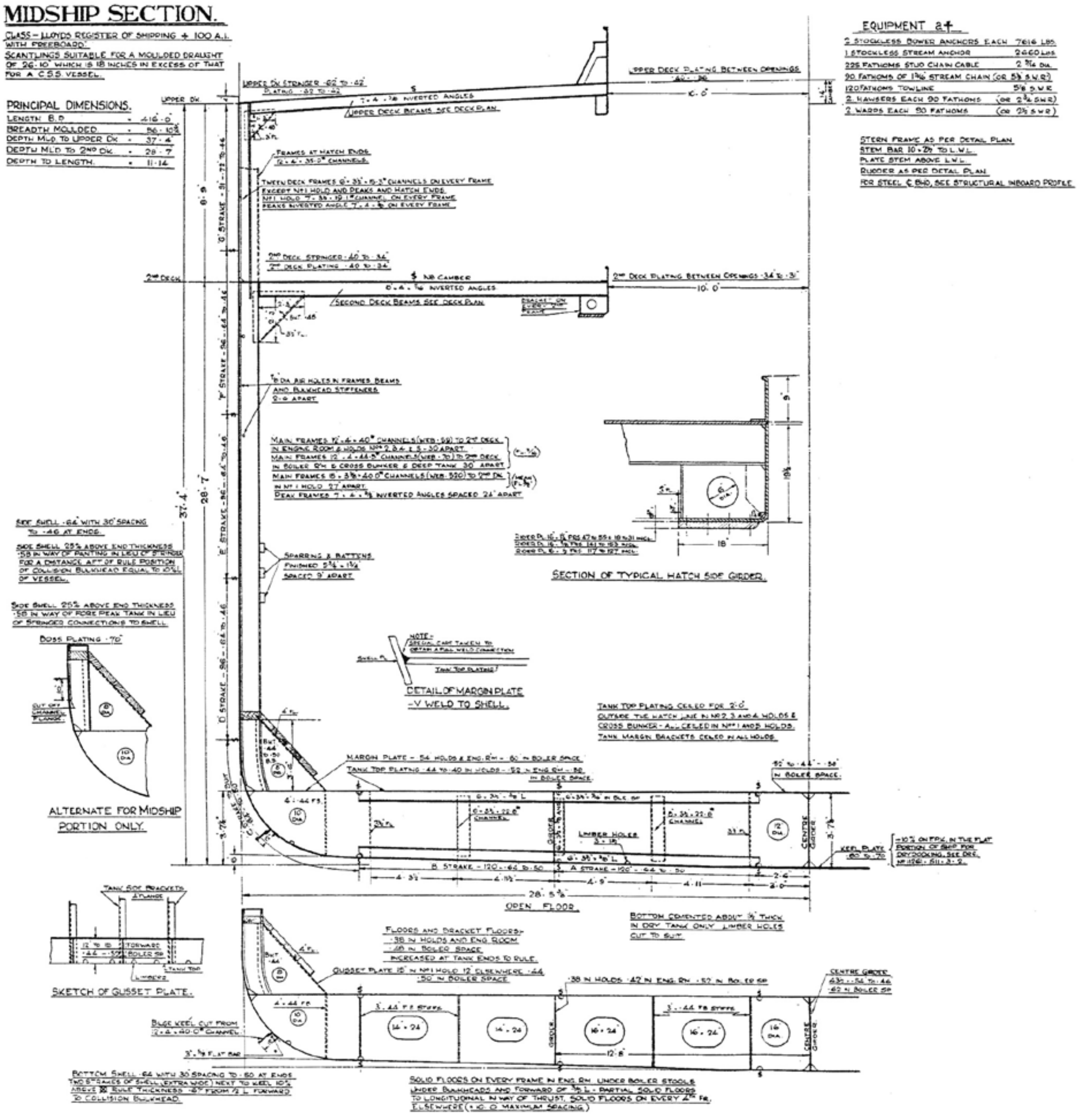
The men who organized and directed the action of the British Mission were experienced shipbuilders and came from firms which had developed a reliable tramp, often referred to as the "economy ship," during the lean shipping years of the Great Depression. The part played by these companies is indicated by the Mission leaders' acknowledgement that progress was greatly helped by the rapid and efficient attention they always received from the British 'parent' firms. It was their knowledge that the British design for the emergency cargo vessel came from such origins that made America ready to adopt it for its own use.



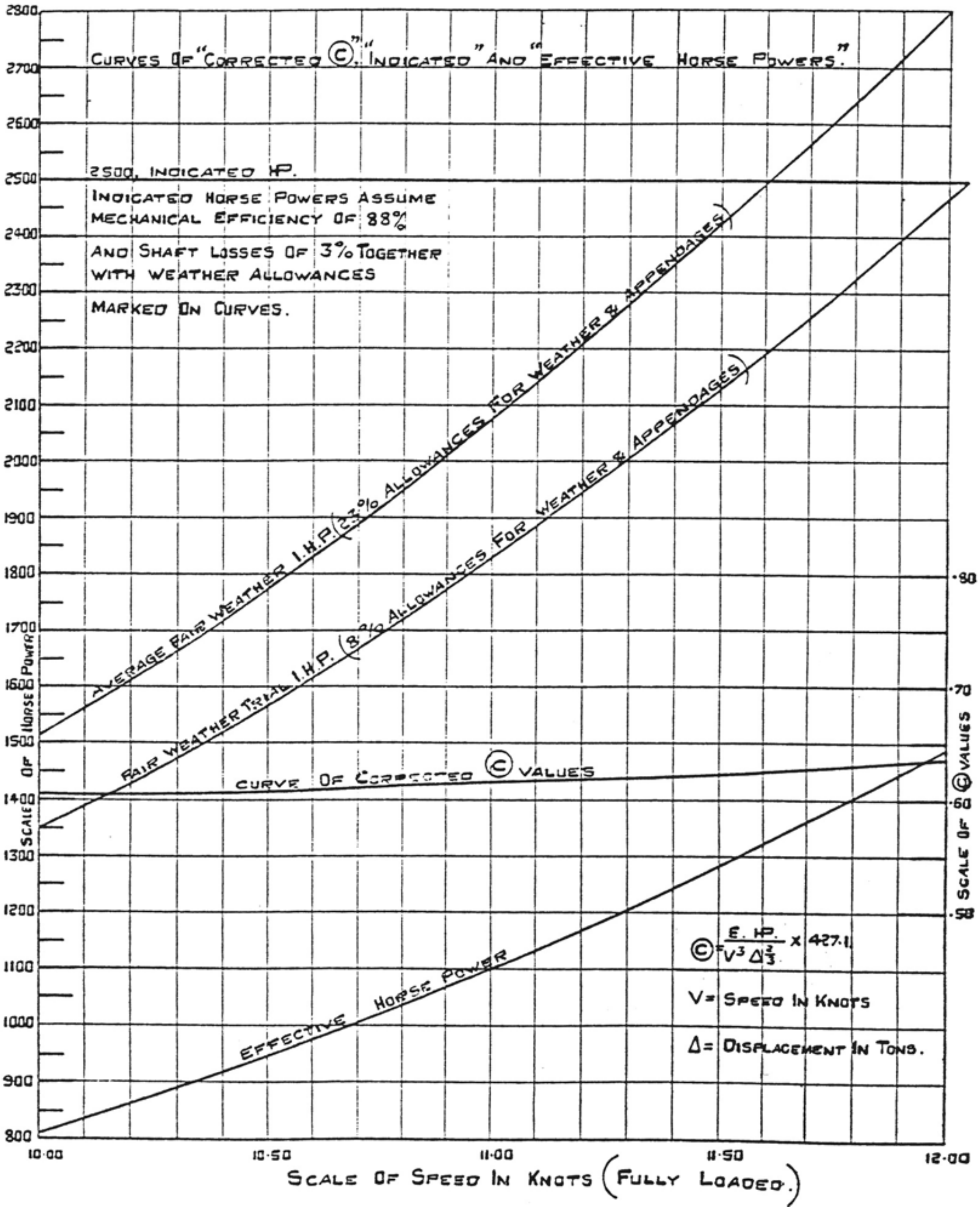
OCEAN LIBERTY off to war



Capacity Plan - Ocean Class

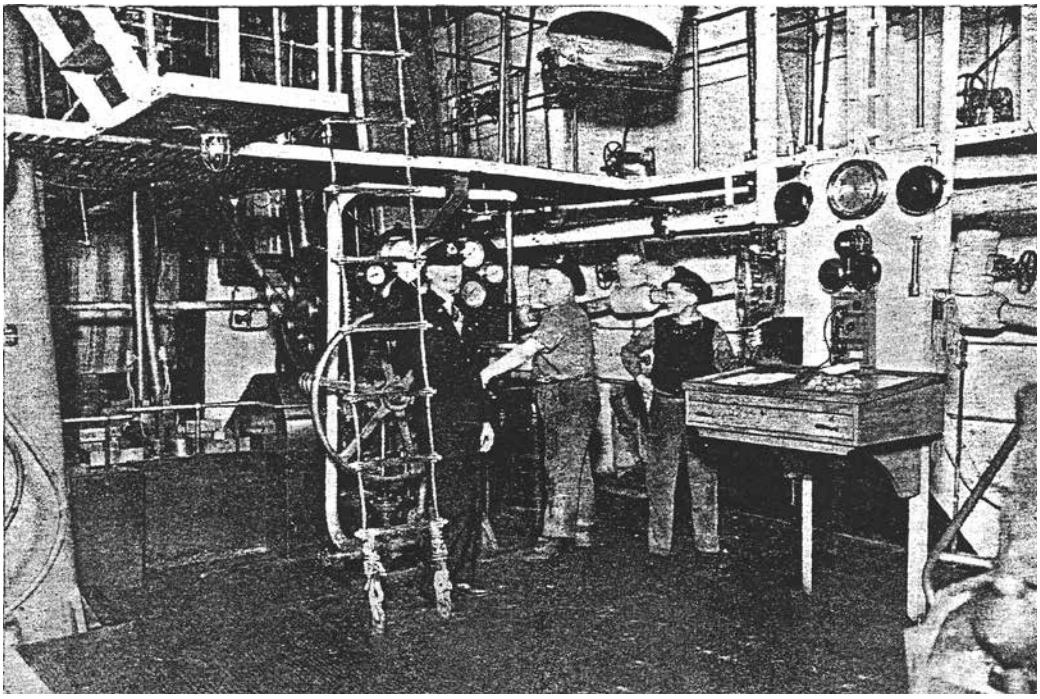


Midship Section - Ocean Class



Tank Test Results - Ocean Class

Reprinted from the *Marine Engineer*, March 1942



Engine room of the "Ocean Vanguard" showing the "chief" in the centre of the illustration.

THE "OCEAN VANGUARD" ARRIVES

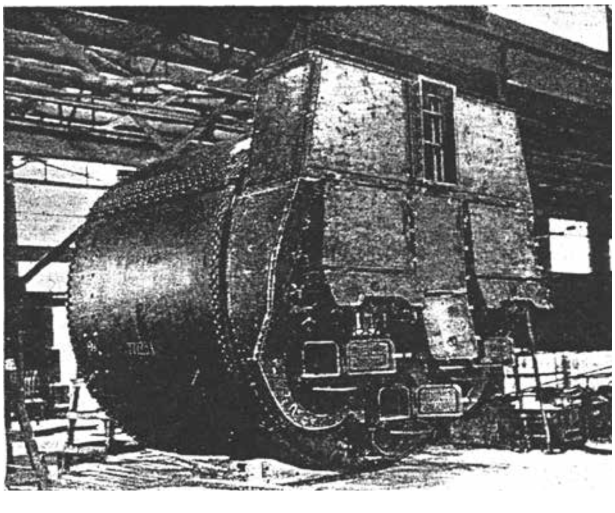
The eagerly awaited arrival of the appropriately named *Ocean Vanguard*, took place in the first week of February, when she was open to inspection at a British port. She arrived without incident well down to her marks with approximately 8,700 tons of mixed cargo. The appearance of the *Ocean Vanguard* at a British port was something more than the arrival of another new merchant ship, welcome though that is at the present time; she represented something more significant and heartening. She is the first of the new American-built ships which we are to receive in the next year or so.

Built in a new yard

The *Ocean Vanguard* has been built for the British Purchasing Commission in one of the two new shipyards of the Todd Corporation and is in actual fact the "ocean vanguard" of 60 similar vessels for Britain. Her keel was laid in the yard of the Todd-Bath Iron Shipbuilding Corporation, South Portland, Maine, U.S.A., on April 14, 1941. She was launched on August 16 and delivered on October 27. Good shipbuilding performance though this is, having regard to the considerable size of the vessel, it does not tell the whole story. A year before the *Ocean Vanguard* was delivered no shipyard existed where she was built; in actual fact, the first sod was broken at Richmond ten months before the *Ocean Vanguard* sailed.

Older readers with long memories may reflect that this is just about what was achieved at the remarkable Hogg Island yard during the last war. We have published enough already to indicate, however, that the present remarkable effort of the American shipbuilding industry bears little comparison with the stout efforts of the last war. These will be well outstripped from the standpoint of actual tonnage delivery, while as all our readers are aware, the class of ship now being built is appreciably different and less easy to build than were the Hog Island vessels. So much for the value of experience development in equipment, and, particularly, the widest possible use of welding in the shipyard.

The *Ocean Vanguard* is virtually of all-welded construction and it is perhaps surprising to many marine engineers to know that she is actually the first all-welded



A three-furnace coal-fired Scotch boiler for a sister ship; the illustration was taken in the works of the American Locomotive Co.

large ocean-going cargo ship in the British mercantile marine; in practice the only important use of riveting is for the attachment of shell plates to frames – the rest of the structure is welded. The principal particulars of this class of "emergency" ship were given several months ago and so it is only necessary to say that she is a shelter decker with a deadweight capacity of 10,100 tons; as a closed shelter deck vessel her gross tonnage is about 7,000. There are five cargo holds and each hatch is served by a pair of derricks and steam winches. Accommodation for the crew of 48 is aft and is comfortable.

The triple-expansion main engine was built by the Hooven-Owens-Rentschler division of the General Machinery Corporation, Hamilton, Ohio, better known to marine men as builders of Hamilton-M.A.N. diesels. The engine develops 2,500 I.H.P. and has cylinders 24½ in., 37 in., and 70 in. by 48 in. stroke. While this is a somewhat smaller engine than many of us would have expected in a vessel of this size, it should be mentioned that the boiler pressure is 225 bb. per sq. in. The three single-ended coal-fired Scotch boilers (the boiler illustrated is for another vessel) were built by the Western Pipe & Steel Co., of Los Angeles. They operate with Howden's system of forced draught, with fans by the Todd Shipyards Corporation. Smoke-tube super-heaters raise the steam temperature to 550°F. There are two steam-driven 25kW. 110-volt generating sets in the engine room and main circulating, feed, bilge, ballast, and general service pumps were supplied by the Worthington Pump & Machinery Corporation, of Harrison, New Jersey; there is a Crompton-type ash hoist it is interesting to note.

In general behaviour the *Ocean Vanguard* showed up well on a stormy maiden crossing and it is understood that her all-purposes daily coal consumption came out at about 25 tons.

CHAPTER II

Origin of the Liberty Ship Design

In the December 1960 issue of the US "Naval Institute Proceedings" Admiral Land, past Chairman of the US Maritime Commission, stated that "the design came from Sunderland and originated in 1879." While the location Sunderland is accurate the date 1879 is a puzzle. It could be argued that the Liberty design could be traced to the Northeast Coast of England, tramps delivering coal to London in the 1850s when compound steam engines were first connected to the screw propeller; or possibly to the year 1880 when the tramp ship *Propontis* was fitted with the first triple-expansion steam engine. This however is going back a bit too far.

To find the real prototype of the US-built Liberty ship we have to look at the British shipbuilding industry during the lean years of the Great Depression between the two world wars.

Immediately after World War I there was an historic boom in shipbuilding. At the time, British yards were building 58 percent of the world's merchant ships. This was followed by a tragic slump and then the Great Depression. At its worst, less than a quarter of Britain's shipbuilding berths were occupied. Most of its shipyards and shipbuilders were standing idle. Approximately 1.97 million tons of shipping was laid up in British ports.

Even though "tramp" owners had money to invest, the market did not justify any new buildings.

In order to try and convince owners to replace obsolete tonnage, British shipbuilders began investigating the problem of producing a hull form for an ordinary tramp ship that could be driven

from 9 to 12 knots with the minimum horsepower and consequent economy in operation. In these investigations the forebody lines, midship section and after body lines and appendages received individual and collective consideration.

Engine builders also contributed their part and produced machinery capable of developing power at a reduced rate of fuel consumption per horsepower.

It was generally felt that even with the poor market the reduction in fuel consumption would be such that the vessels would operate at a profit.

For many years prior to this it was the custom for shipbuilders to take the form of a similar ship that had given favorable results in service, as a basis upon which to design a new vessel. The lines for the proposed vessel were drawn out proportional to the known vessel, and then modified to suit the new dimensions and displacement required for the new vessel.

A wooden model was made, leaving the ends and bilge rather full. The final fairing up was then done by eye, and it depended solely on the intuition and experience of the man with that eye whether a shipbuilding firm turned out a series of efficient or inefficient vessels.

As is well known, a popular form of hull among shipbuilders and shipowners was what was known as a “cod’s head and mackerel tail,” but it was not always recognized that the best proportion of the head to the tail varied with the speed and the size of the ship.

Prior to World War I few if any firms made use of model experiments, however during the Depression shipowners and shipbuilders started to appreciate the great value of tank experiments in designing hull forms of “tramp” vessels.

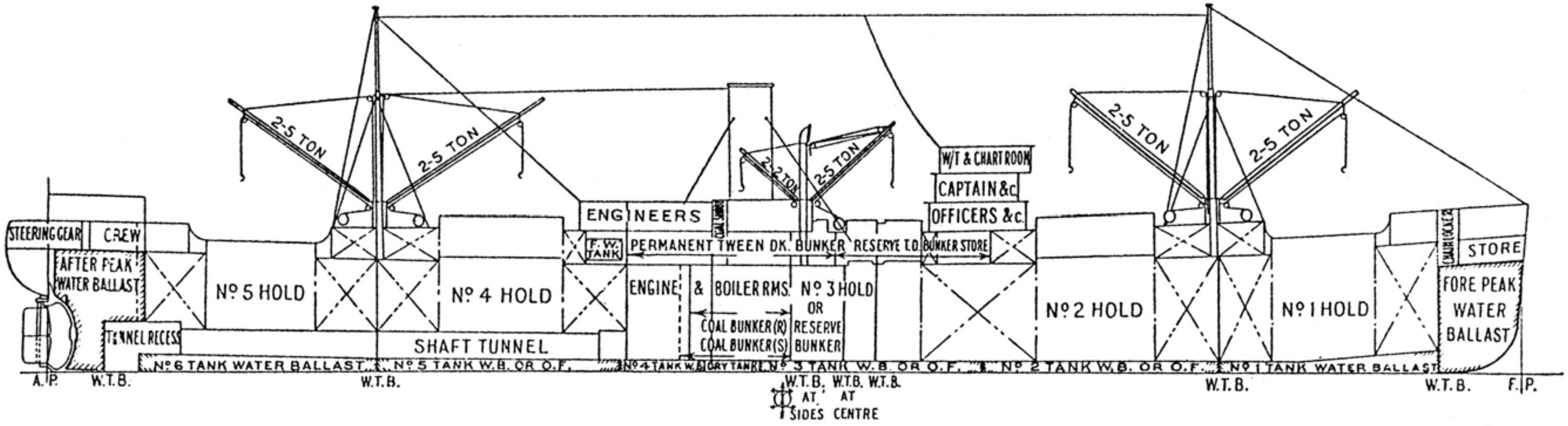
A great deal of work was carried out at the National Physical Laboratory in England and using the results obtained it was possible for a firm maintaining a sufficiently experienced staff to design a form for a “tramp” vessel without recourse to model experiments.

In running these model experiments a great deal of attention was paid to the size and shape of the propellers most suitable for the speed and power to be developed and to see that the after-body lines were designed to give a good flow of water to the propeller. Much work was done in developing a “streamlined” or so-called cruiser stern to assist the even flow of water to the propeller. A lot of attention was also given to rudder design.

For main propulsion machinery most owners preferred triple-expansion engines with coal fired Scotch boilers. This was because of their simplicity, reliability and low capital cost and the fact that coal was cheap and readily available in the UK.

The manufacturers of marine machinery introduced features which reduced fuel consumption considerably such as superheated steam, higher steam pressure, forced draught, improved two-stage feed heaters, poppet valves, more efficient auxiliaries, etc.

On the following page is an inboard profile and particulars of a typical design resulting from the studies and testing carried out. This typical British design is the genesis of the US-built Liberty ship.



Length overall	440 ft. 6 in.
Beam extreme	56 ft. 2½ in.
Load draught	24 ft. 9½ in.
Load displacement	12,635 tons
Block coefficient	0 - 749
Max. designed loaded speed	10½ knots
Gross tonnage	5,484
Net tonnage	3,220

Machinery	Triple Expansion
Cylinders	23½ in., 40 in., 68 in.
Stroke	48 in.
Boilers	2 S.E. Scotch
Diameter	15 ft. 6 in.
Length overall	11 ft. 6 in.
Pressure	220 lb. per sq. in.
Draught	Forced
Superheat	225° F.
Heating surface	5,020 sq. ft.

Aux. Boiler	Scotch
Diameter	13 ft. 6 in.
Length overall	11 ft. 6 in.
Pressure	220 lb. per sq. in.
Draught	Forced
Steam	Saturated

Typical British Tramp Design - 1934

CHAPTER III

Joseph L. Thompson & Sons

The genesis of the Liberty ship was the standard British tramp developed in England during the lean years between the two World Wars. However to find the true forebearer it is necessary to look into the history of the British shipyard known as Joseph L. Thompson & Sons Ltd. which was located on the River Wear, North Sands, Sunderland. This area of England was commonly referred to as the North East Coast. Ships have been built on the River Wear since the 14th century.

The yard owes its origin to an ambitious young man who used his mother's kitchen floor to sketch out ships, and to improve his draughtsmanship. This was Robert Thompson, the son of a Master Mariner who became an apprentice shipwright when about 17 years of age. By the time he reached the age of only 22 he had built several small craft in a berth near one of the wonders of the engineering world at that time, the great cast-iron bridge which was erected across the Wear only a year before Robert Thompson was born.

In 1820 Thompson, and several others, built a ship at North Sands which about that period was a popular place for building ships. There was at one time at least six shipbuilders located at North Sands.

Joseph L. Thompson & Sons Shipyard - 1935

Robert Thompson in 1837 had three sons and in that year they began a family shipbuilding concern. Because of an economic slump which set in, their venture lasted only a few years.

However, in 1846 the company was reformed and the family resumed their business of shipbuilding. This set the roots which established a worldwide reputation as sound, reliable and progressive shipbuilders. Their first ship was the brig *Pearl*.

Precisely 500 years before, in 1346, the Wear had embarked on shipbuilding through a license granted to Thomas Menvill by the Bishop of Durham. There are no records to show that the Wear has been building ships continuously since that time but a river with such an age-old tradition in shipbuilding was bound to breed shipbuilders and the Thompsons, proved outstanding examples.

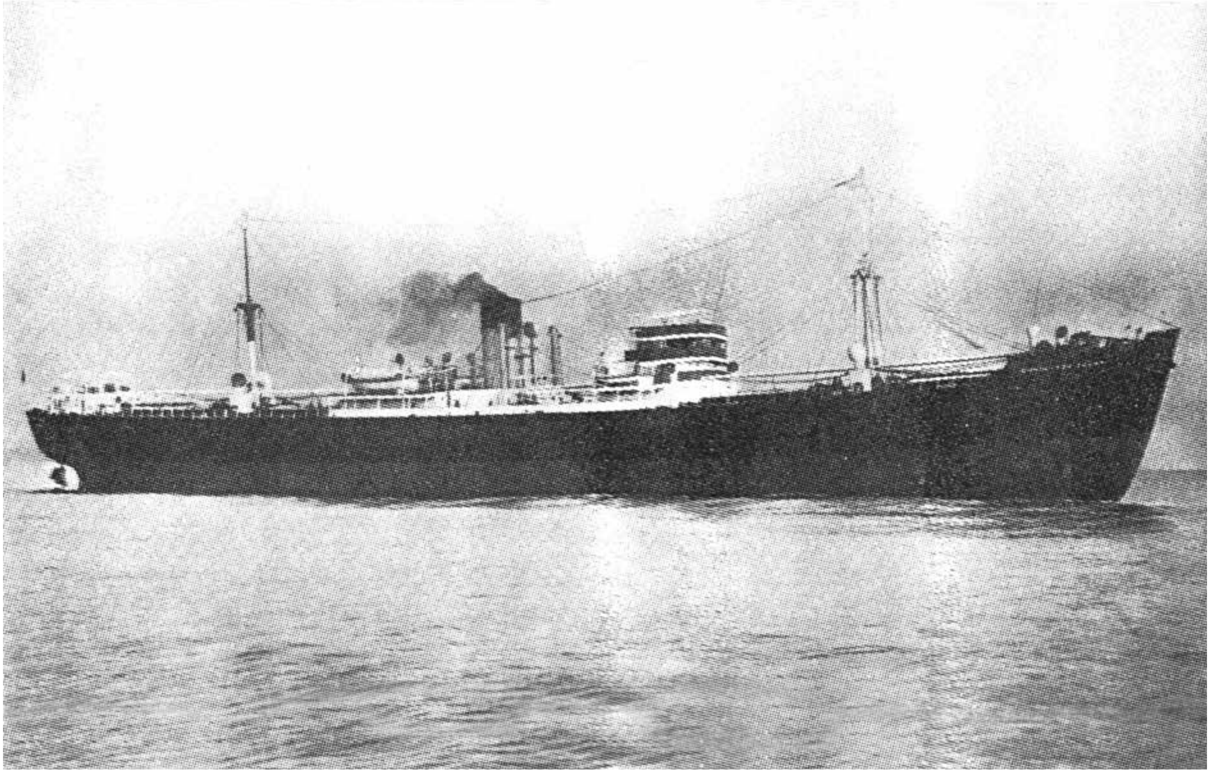
The business followed the usual trend of all businesses, having bright and dull periods but, progressed steadily for the Thompsons since they were not afraid to tackle something new and they seemed to have the gift of moving with the times. They did not rely on traditional and old time methods; the history of the firm shows a steady stream of new ideas and methods.

At the end of 1870 the yard was converted for iron shipbuilding and in that year the last wooden ship was launched being named *Peace* in commemoration of the end of the Franco-German War. The saw pit and the pitch kettle were relegated to the past as essentials for shipbuilding. New methods had taken their place and Hull No. 105, the firm's first iron ship, was launched early in 1871.

In 1884 when the firm had launched its 100th iron ship it turned to the use of steel, the emigrant ship *Algoma* being launched in 1885.

During the 1914-1918 war the yard built 17 merchant ships totaling 91,486 gross tons. In June 1917 King George V visited the yard. During the visit he stopped to chat with a young lad who was around eight-years-old and a rivet heater in the yard. This famous photograph resulted from their meeting and while not directly connected with the Liberty ships I have included it for historical interest. Some people have commented to me that the contrast between the King and the lad as evidenced from the photo, was just one of many conditions that precipitated WWI and

King George V and the Rivet Heater



DORINGTON COURT on trials

WWII and therefore could be connected with the Liberty ships. I leave it to the reader to decide. I think it's a great picture.

In the Depression that followed the boom after the war, the Thompson yard at one point went four years between the years 1930 to 1934 without a launch. During this period and in spite of large lay-offs the design team of the yard was kept intact.

Using information from the tank testing of the standard design, Thompson's staff developed their own hull form to produce an efficient and economical vessel. The first ship built on these lines was the *Embassage*, Hull No. 572 launched in July 1935 for the account of Messrs. Hall Brothers Steamship Company of Newcastle-on-Tyne.

The model of this vessel was tank tested and it was very distinctive and unusual. One marked characteristic was its fullness forward, together with its appreciably sloping bow, while the stern lines were quite fine, and the cruiser stern was more of a "V" section than the "U" section, which had previously been the fashion. The vessel was a shelter decker with a deadweight of 9,100 tons on a draft of about 24 feet. On its maiden voyage with a full load of coal it made a speed of 10 knots and the coal consumption was between 16 and 17 tons per day.

After further tests and refinements the *Dorington Court*, Hull No. 592, was launched. It will be remembered that it was from the *Dorington Court* that the plans for the standard vessel, brought to America by the British Shipbuilding Mission, evolved.

The prime difference between *Dorington Court* and the *Empire Liberty* was in the bilge radius and parallel midbody. The *Dorington Court* had a bilge radius of 4 ft 6 in. and because of this had a parallel body of only 69 ft. Such a "hard" bilge was not considered necessarily helpful to the form of the vessel. It was therefore decided to test a model having a bilge radius of 5 ft 6 in., which gave 149 ft of parallel body; not only was the resistance improved there was a great advantage from the production point-of-view.

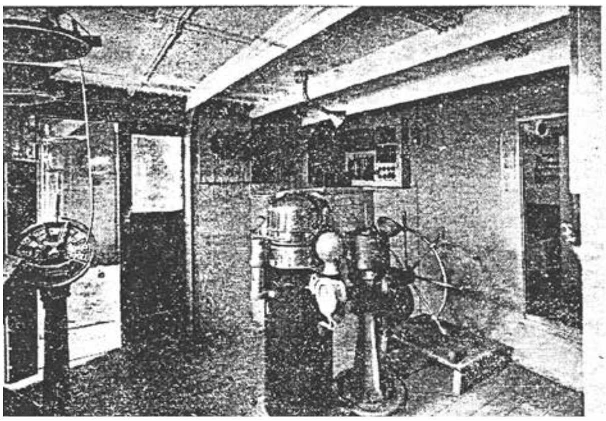
Comparative data on the two vessels is given in the following table:

	Dorington Court	***Empire Liberty***
Length B.P.	416 ft 0 in.	416 ft. 0 in.
Breadth	59 ft 3 in.	56 ft. 10.5 in.
Draught	24 ft 9.5 in.	26 ft. 9.625 in.
Displacement (tons)	12,680	13,994
Block coefficient	0.753	0.768
Prismatic coefficient	0.767	0.782
Mid-area coefficient	0.983	0.983
Rise of floor	6 in.	6 in
Tumble-home at L.W.L.	1 in.	nil
Length of parallel-body	69 ft	149 ft
Radius of bilge	4 ft 6 in.	5 ft. 6 in.
Speed (knots)	11 - 11.5 - 12	11 - 11.5 - 12

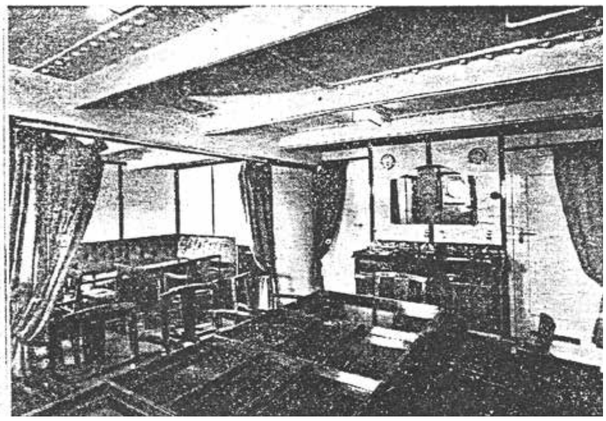
Information on the vessels is difficult to find. The J. L. Thompson Yard closed in the 1960s and all the records, drawings, etc. were taken over by the Tyne & Wear Museum in Newcastle-on-Tyne. Unfortunately most of this information has not been catalogued. Some drawings are available but were not of a size suitable for this publication.

On the following pages are copies of articles from the shipbuilding journals of the war-time years with the descriptions of the *Dorington Court* and the *Empire Liberty*.

Reprinted from the *Marine Engineer*, March 1941



Wheelhouse



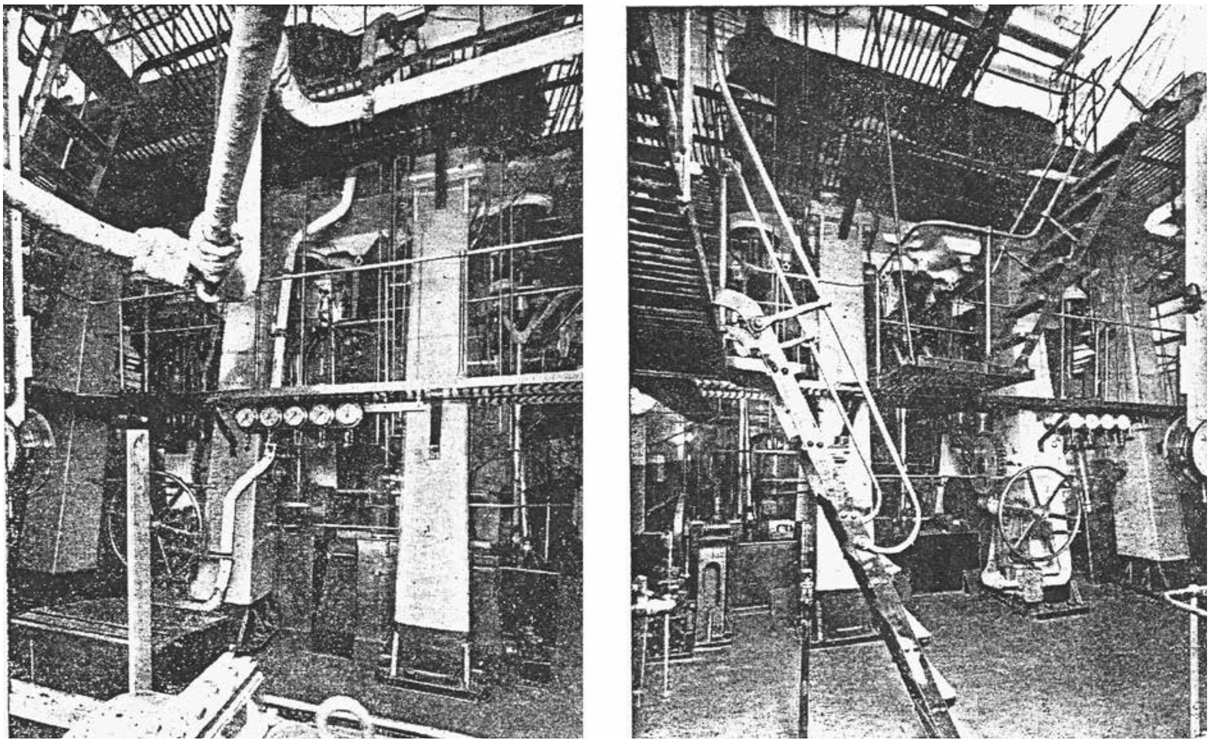
Saloon

A WARTIME STANDARD CARGO STEAMSHIP

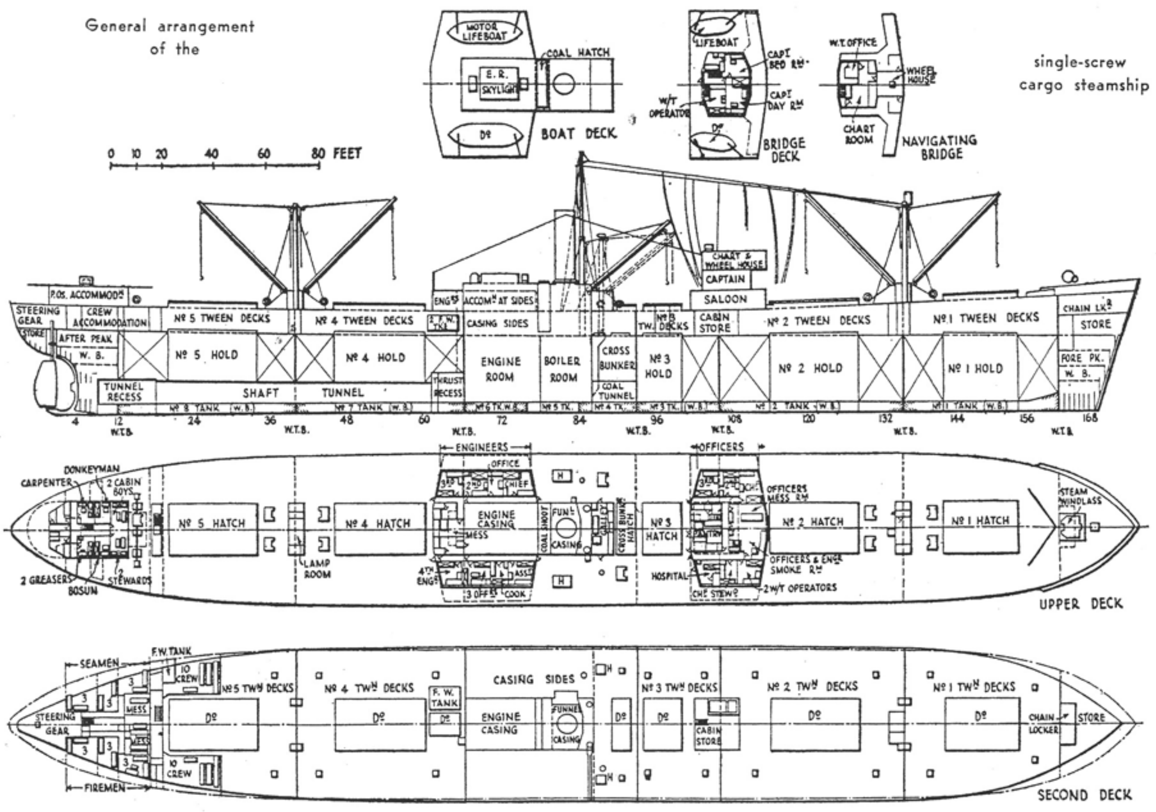
A fair amount of criticism, informed and otherwise, has been directed against our cargo shipbuilding policy. Some of that criticism is fair and we agree with it; but we have noticed that most of these critics have not gone out of their way to give our shipbuilding policy a pat on the back which it deserves. The good feature to which we refer is the sensible way in which those important cargo ship specialists who have developed more or less standard types of their own design have been encouraged to push on as smoothly and rapidly as possible with vessels of a type and size with which they are most familiar. This common-sense policy has not been given the commendation which is its due, for clearly it has facilitated efficient and rapid construction of a number of useful designs.

Last month we briefly described one such type – a motorship. Here we describe another good class cargo vessel of considerable size but in this instance it is a steamship. It may be mentioned that both these ships are rather bigger than the emergency steamships being built in the States for this country, although the vessel described below is of the same power as the American-built ships.

The vessel whose general arrangement plans we reproduce has been built by Joseph L. Thompson & Sons Ltd., Sunderland, and engined by George Clark (1938) Ltd., Sunderland, who are associated with the North Eastern Marine Engineering co. Ltd. Built to



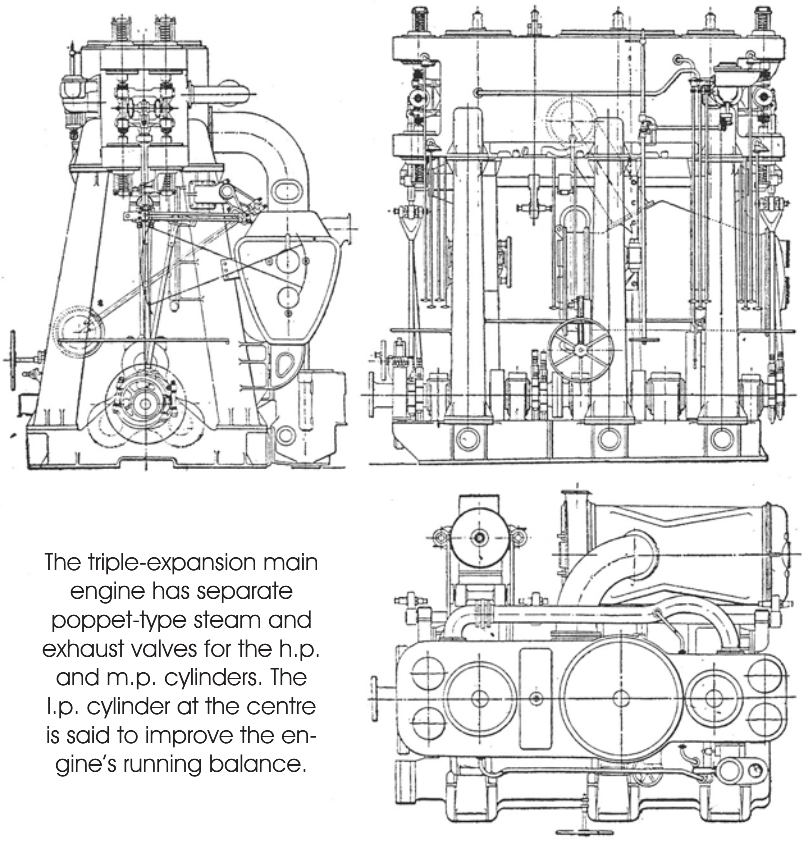
Two engine room views, showing the triple-expansion main engine. Cam-operated poppet valves are fitted to the high- and intermediate-pressure cylinders, and provision is made for the fitting of a reheater after the war.



British Corporation rules and special survey requirements, as well as in accordance with the requirements of the Ministry of War Transport, the vessel is operating as a closed shelter decker; after the war, however, she will be used as an open shelter deck ship, with suitable reduction in draught and net deadweight capacity.

Naturally, the main scantlings of the hull are those for a closed shelter deck vessel and it will be observed that the main watertight bulkheads extend up to the upper deck. At the same time the designers have borne in mind that in happier times the tonnage opening will be in use and so the general design is readily adaptable to the vessel's efficient operation, at reduced draught, as an open shelter decker.

The ship has the fashionable raked stem and a cruiser stern; the absence of a forecastle will be noted, a feature which is said to make for better seakeeping qualities in a head wind. The principal particulars of the vessel are as follows:



The triple-expansion main engine has separate poppet-type steam and exhaust valves for the h.p. and m.p. cylinders. The l.p. cylinder at the centre is said to improve the engine's running balance.

Length	444 ft. 5 in.
Extreme breadth	59 ft. 10½ in.
Deadweight capacity	10,800 tons
Summer draught	27 ft.

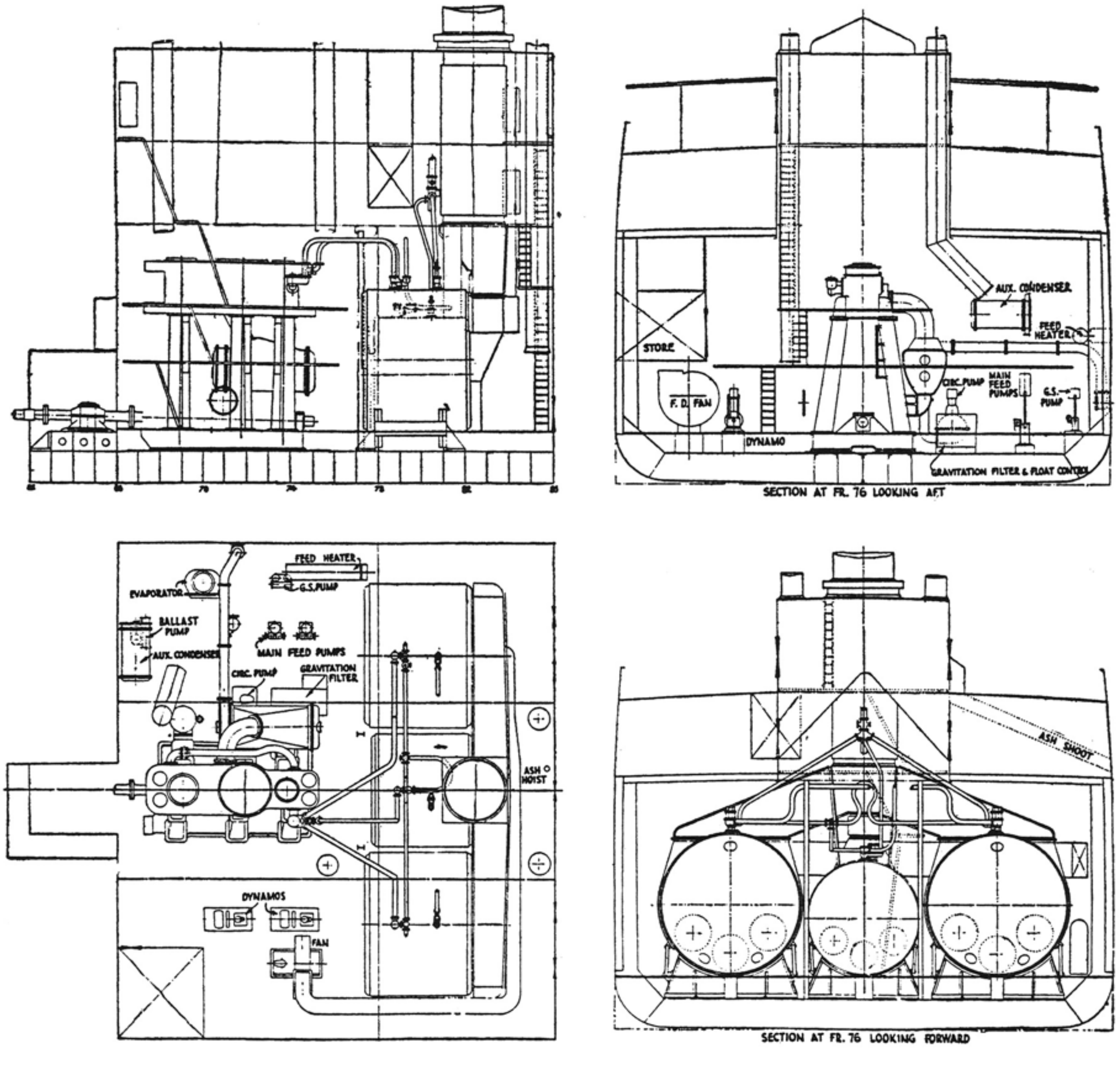
As the general arrangement drawings show there are five cargo holds and a large cross bunker aft of No. 3 hold and immediately forward of the boiler room. It will be observed that a tunnel through the cross bunker allows of No. 3 hold being reached from the boiler room. No. 3 hold is available as a reserve bunker if necessary. Coal for bunker purposes can also be carried in the tween decks alongside the engine casing and No. 3 hatch.

The builders of the vessel furnished us with a number of interior photographs which show the excellence of the accommodation of the vessel. Unfortunately space restrictions make it impossible for us to reproduce more than one of them, the main saloon; the views of the captain's accommodation, etc., show it to be excellent, however. Officers and crew number 65 and it will be noticed from the plans that captain and deck officers are housed in the bridge erection between hatches Nos. 2 and 3, while the engineers officers' accommodation is grouped around the engine casing. The crew's accommodation is in the poop. There are separate messrooms for deck officers, engineers, and crew.

Cargo is handled by means of 5-ton derricks and steam winches, disposed as shown on the drawings. As the plan view of the upper deck shows, the winch just forward of the poop house has extended ends for ship warping and auxiliary steering purposes. The main steering gear is of the Donkin steam-driven type; the windlass in also steam-driven.

Machinery

In the arranging of the main engine and coal-fired Scotch boiler plant a commendable amount of attention has been given to probable post-war requirements. For the immediate present the situation has rightly been regarded as one calling for some sacrifice of economy in the interests of rapid production and conservation of materials. Thus the boilers are not provided with superheaters although they are designed for their incorporation. Similarly, the engine is of the latest North Eastern type, designed for operation with a reheater but the reheater will not, of course, be fitted until the boilers are provided with superheaters. Another wartime measure is



General arrangement of the engine and boiler spaces of the standard cargo steamship.

the suppression of the auxiliary boiler, although it is shown in our machinery space drawings as lying transversely between the two-single-ended three-furnace main boilers.

This unit also will be fitted after the war.

The drawings of the main engine show that it is a standard North Eastern triple-expansion unit with the low-pressure cylinder, with flat balanced slide valve, at the centre. High-pressure and intermediate-pressure cylinders have N.E.M. separate cam-operated steam and exhaust valves, arranged as we have described in the past. The excellent accessibility of these valves and their operating gears is well brought out in the drawings. The engine develops about 2,500 I.H.P. at a moderate revolution speed and two illustrations showing the engine installed in the ship are given on page 253.

No special comment is called for concerning the coal-fired Scotch boilers beyond saying that they are designed for a working pressure of 220 lb. per sq. in. and operate with Howden's system of forced draught. The combustion chamber type of superheater will, of course, have to be employed when in due course the reheater is fitted to the main engine, for a final steam temperature of 750°F. is employed with this device.

The machinery space drawings show the disposition of the various auxiliaries, including two steam-driven dynamos in the starboard wing, together with the steam-engine-driven forced draught fan. A separately-driven centrifugal circulating pump is provided and it will be noted that there are a paid of direct-acting steam-driven main feed pumps near the back of the port boiler. A Crompton's ash hoist is provided and the feed water filter is of the North Eastern gravitational type.

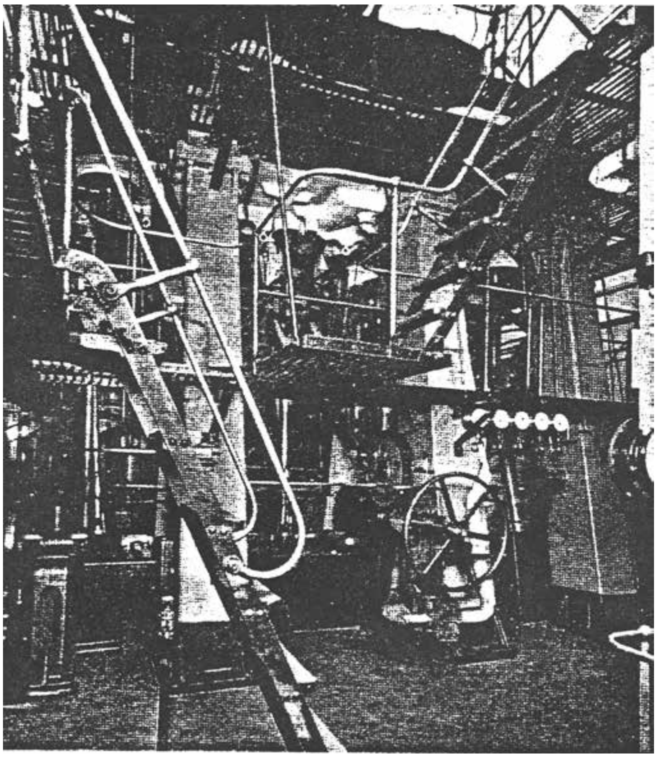
Reprinted from the *Marine Engineer & Shipping Review*, April 1942

British Prototype of the Liberty Ship

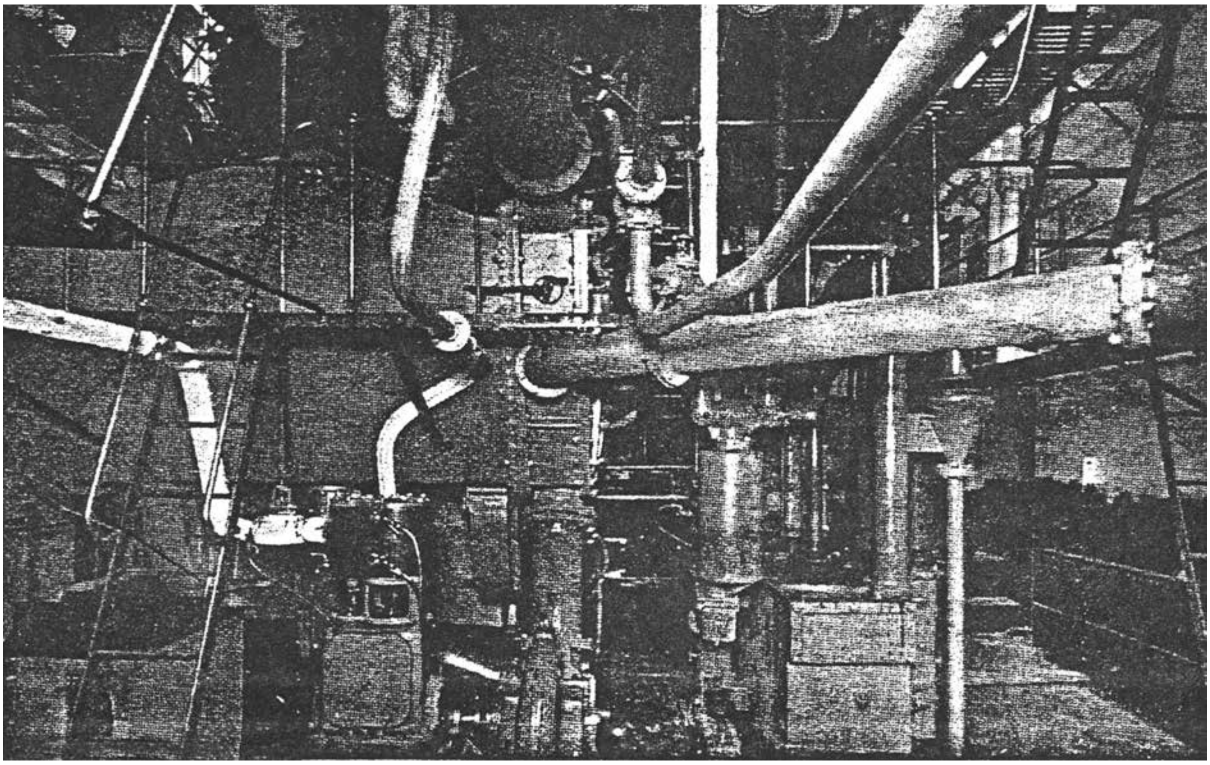
The first of a new type of standard cargo vessel, the *Empire Liberty*, has been completed by Joseph L. Thompson & Sons, Ltd., North Sands Shipbuilding Yard, Sunderland, who are building a series to Government and private account, according to *Shipbuilding and Shipping Record*, of London, from which this article is reprinted. The hull form and general design has been evolved by the builders, and is a parent form of vessels building for this country in America and in Canada.

Certain modifications, particularly with regard to welded construction, were made in the United States and Canada, however, to speed up production in view of the different facilities available. The *Empire Liberty* is substantially a sister ship of the *Ocean Vanguard*, built at Richmond, Cal., as far as the hull is concerned.

The vessels are designed to carry all types of cargo efficiently and economically, and at the same time to provide the maximum comfort



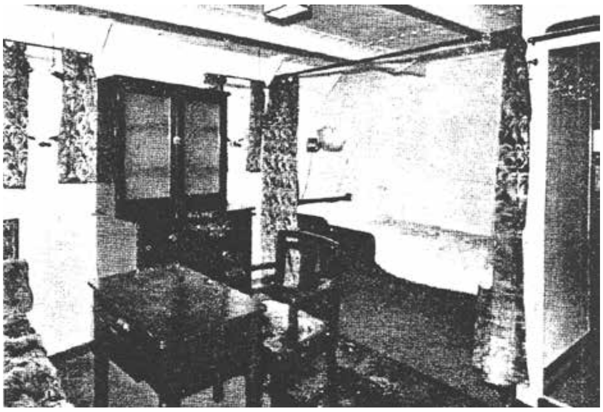
Views in the engine room of the British standard cargo vessel Empire Liberty. Above is shown the main engine from the control platform. Below is shown the main condenser and auxiliaries.

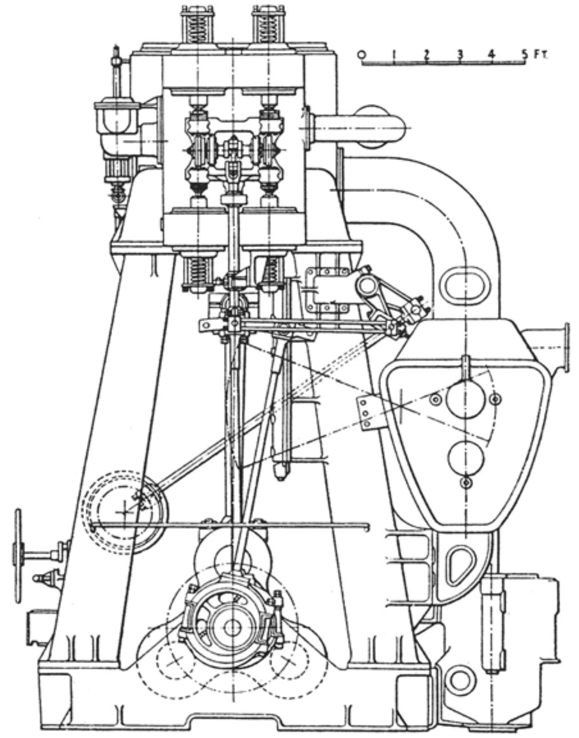


and safety for the crew compatible with speedy production under present conditions. General particulars are:

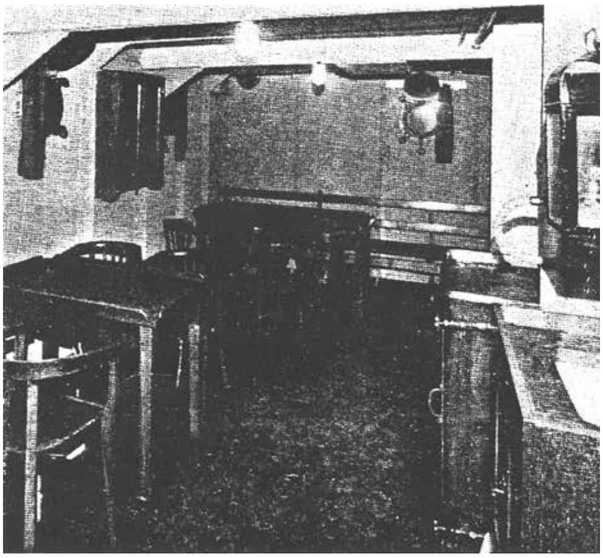
Length overall	441 feet 5 inches
Length between perpendiculars	416 feet
Breadth extreme	57 feet 2 inches
Depth molder to upper deck	37 feet 4 inches
Height of 'tween decks	8 feet 9 inches

Built under special survey of Lloyd's Register and to the latest Ministry of War Transport requirements, the vessels are intended for subsequent use as open shelter deckers with a draft of 25 feet 6 inches. For the present, however, the tonnage opening is closed and the main bulkheads are extended to the upper deck. Together with increased scantlings, this arrangement gives the vessel an extra draft of 18 inches.


The Captain's Stateroom.

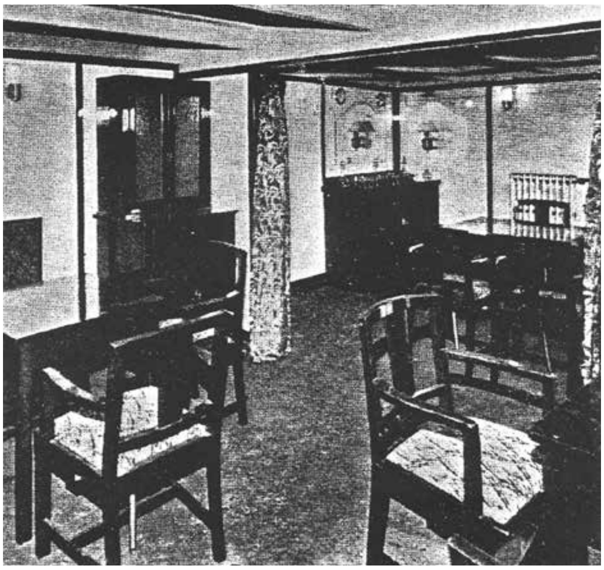


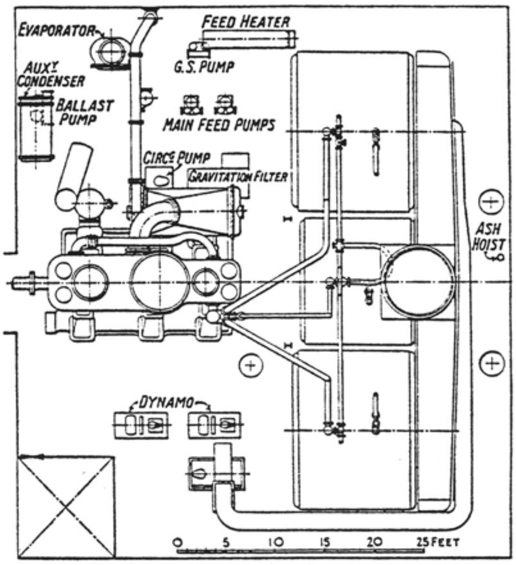
End elevation of main engine.


Seamen's Messroom.

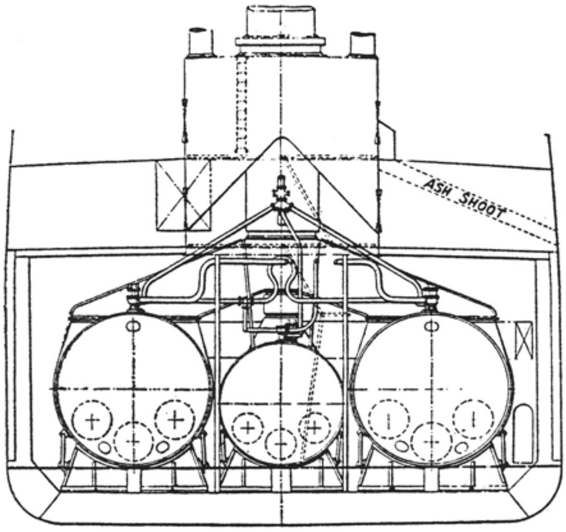
As will be seen from the accompanying plan, the ships have a straight, heavily raked stem and cruiser stern, with sufficient sheer to compensate for the omission of a forecastle.

The design incorporates two complete steel decks and cellular double bottom with solid floors throughout. Machinery is situated amidships, and there are five cargo holds, one deep tank and a cross bunker. The cross bunker has a watertight tunnel running through it on the centerline, giving access to No. 3 hold, which can thus be used as a reserve bunker. Further bunkers are carried in the 'tween decks abreast the engine casings, and a wooden trunk is fitted at No. 3 hatch to enable bunkers to be carried in No. 3 hold without coal in the 'tween decks.


Officers' Lounge.



Plan of engine and boiler rooms showing location of auxiliaries.



Section through boilers showing auxiliary boiler between two main boilers.

The hull is subdivided by seven watertight bulkheads spaced to give the maximum degree of safety possible without impairing cargo capacity and stowage.

As compared with pre-war cargo ships, the crew's accommodation has been much improved. The size of the rooms has been increased and the furnishings improved. The petty officers, seamen and fireman have large separate messrooms. The petty officers' mess is amidships, and those for the seamen and firemen in an enlarged after deck house. The furnishings include hot pressings. Accommodation is provided in the after 'tween decks for 12 firemen, three engine-room hands and nine seamen. In rooms amidships, incorporating the most modern furnishings, the usual number of officers, engineers and petty officers are berthed. Electric light and hot water heating are fitted throughout the crew's accommodation.

The propelling machinery is of the type designed by the North Eastern Marine Engineering Company (1938) Ltd., and follows the lines of that fitted in earlier vessels, such as the Lowther Castle and Dorington Court. Installations are under construction at the North Eastern Marine Works at Wallsend and Sunderland, and also by their associated company, George Clark (1938) Limited, Sunderland.

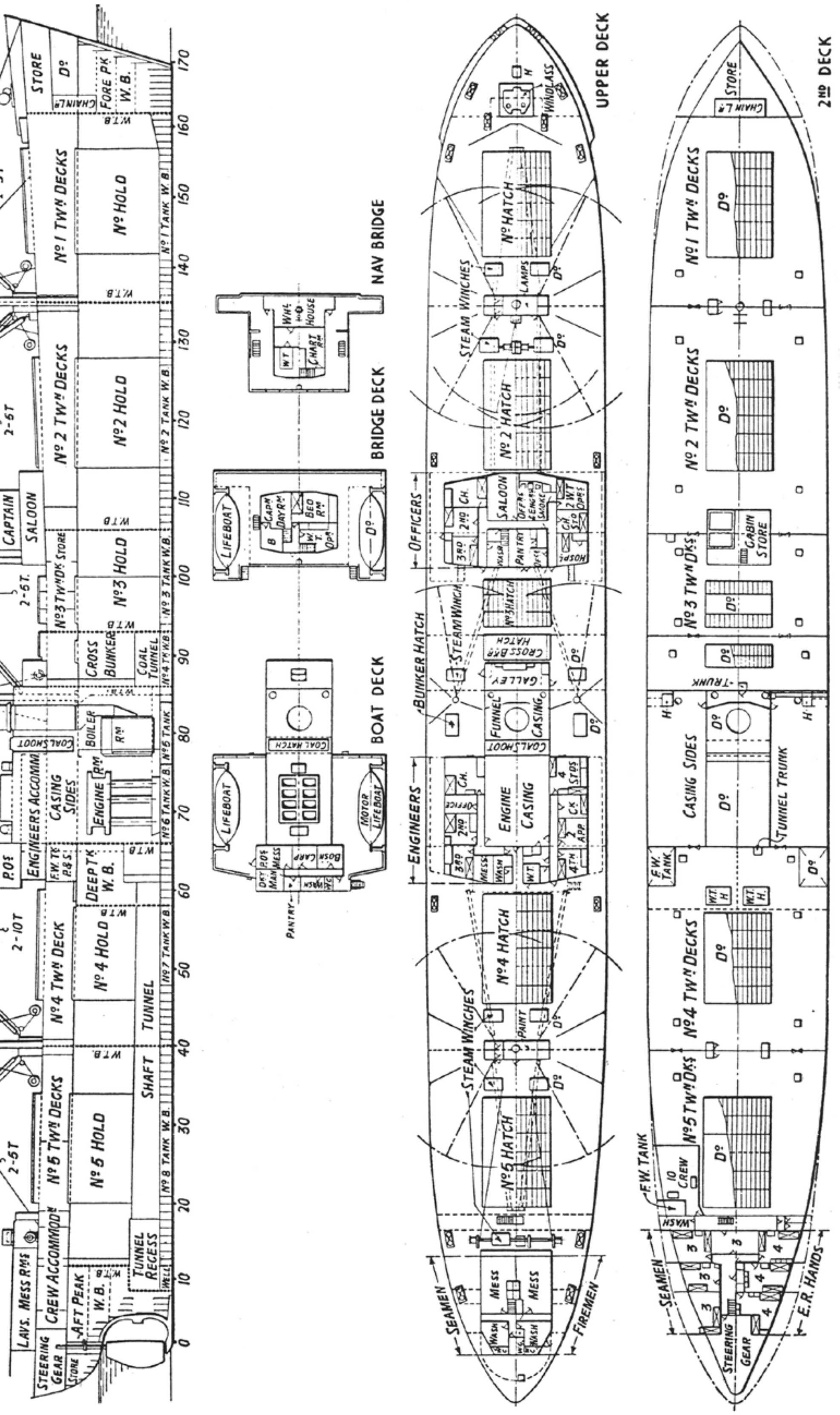
Owing to the urgent need for rapid production, the machinery is at present arranged to work on saturated steam, but provision is made so that it can be easily converted after the conclusion of hostilities, when the machinery will operate with superheated steam having a temperature of about 750 degrees F.

The engines are of the three-cylinder triple-expansion type having cylinders 24 inches, 39 inches, and 68 inches by 48 inches stroke, and space is arranged at the back of the high-pressure cylinder for the accommodation and subsequent fitting of the reheater.

The materials used throughout are such as to satisfy the exacting conditions when working under highly superheated steam, and are based on the company's experience gained over many years. The ships are provided with two large main boilers and one auxiliary boiler, or with three large main boilers, producing saturated steam at 220 pounds per square inch working pressure. They are operated on the Howden forced-draft system.

The holds are served by ten 5-ton steel derricks and 7-inch by 12-inch steam winches, and a heavy derrick is provided at the after side of the foremast together with two 8-inch by 14-inch winches.

Lifesaving appliances to the latest regulations include four lifeboats, all the same size, thus tending to give even distribution, housed in Crescent type mechanical davits.



General arrangement plans of British standard cargo vessel EMPIRE LIBERTY

CHAPTER IV

The Emergency Shipbuilding Program

With the need for shipping becoming critical it was natural that the US Maritime Commission would think of the British program as a model for a possible American program of emergency shipbuilding. However, interest in its own long-range program and unhappy memories of the great over-supply of shipping after the previous war made the Commission shy away from launching upon another mass production program. Admiral Land, Chairman of the US Maritime Commission, in a memo dated 18 November 1940 was quite clear on the matter. “In my judgment,” he said, “we are not interested in the type of ship proposed by the British, which type is for emergency use only. If it is decided to augment our own program we should build ships for 20 years life and have an eye on the future. Therefore, build ships to our standard designs.” An enlarged program would be taken care of by rearranging priorities with the US Navy and expanding yards already in existence. “Any expansion beyond the foregoing limits will result in waste and extravagance, inefficiency and, as far as quick deliveries are concerned, great disappointment.”

President Roosevelt viewed the matter differently. The matter was reviewed in considerable detail during the latter part of November and early part of December. Admiral Land wanted the British and American programs kept distinct and came around to the acceptance of the idea of a plan to build emergency ships on the simple style of the British ones in the proportion of two-thirds to one-third of C-1 and C-2 type which the Commission was already building. At the same time he warned that construction of an increased number of the latter type would interfere with Navy building and machinery requirements. He also emphasized the need of mobilizing American shipbuilding brains and capital.

On or about 2 December a request came from the White House for information on the British emergency vessel. Mr. Bates, Director of the Technical Division of the US Maritime Commission, telephoned F. H. Gibbs, of Gibbs & Cox, who informed him that the matter was in the hands of W. F. Gibbs. The latter got in touch with the British Merchant Shipbuilding Mission and, on the 3rd of December, Messrs. R. Cyril Thompson and R. R. Powell conferred with Mr. Bates and instructed Gibbs & Cox to release drawings and the specifications of the vessel in question.

On 6 December, Admiral Land sent a memorandum to the President, via Mr. Knudsen, Chairman of the National Defense Advisory Commission, minimizing the importance of speed for ships in convoy. He pointed out that the best safeguards lay in air cover, and better protection from combatant ships. A memorandum of this same date, signed by Knudsen, gives comparative advantages of an 11-knot as against a 15-knot vessel. The latter required more steel, would take more time and occupy more shop capacity during construction and have less carrying capacity.

During December the President considered meeting the growing requirements for shipping by a large increase in the American construction program. Admiral Land had indicated his reluctance to build any temporary shipping such as the British were undertaking, but he had also indicated that the 10-knot tramp-type ship was the only one that could be built in great quantity without upsetting Navy priorities. It was known that the British were thinking of increasing their program from 60 to 120 ships and it was assumed that the new American program was intended to build for British use. As Admiral Land expressed the situation, “It became apparent that the requirements for standard types designed by the Maritime Commission could not be built either in the quantity required or in the time required and as the war emergency conditions developed, it was necessary to modify what was considered to be a desirable program into what was a necessary program."

The President appears to have decided upon the emergency shipbuilding program just before Christmas. By 26 December the matter had become a project to build 200 emergency ships. On that date Admiral Land sent the President a memorandum in which he presented his reactions to the proposal. This document makes it clear that he favored expansion along the lines of the British 60 ship program. There should be new yards, located so as to make the best possible use of existing shipbuilding brains and so as to be backed up by steel manufacturing plants. The type of ship was decided in his mind since he enclosed copies of contract plans, contract, and specifications and bills of material borrowed from Gibbs & Cox. His memorandum also indicates that he was undecided as to the kind of boiler (water tube or fire tube), possible use of low pressure turbines, coal or oil fuel or both. He advocated a 100-ship program for a standard design, high speed vessels to be carried along with the 200-ship slow emergency vessel program. Admiral Land foresaw as probable bottlenecks lack of managerial brains, scarcity of skilled shipbuilders, materials, machine tools, forgings, castings, boiler plate, and steel shapes. He also considered it vitally important to contract directly with a control agency for engineering and planning work and for material ordering and control.

A decisive step was taken on 28 December when the President authorized facilities to build 200 ships and conferred with Robert Morganthau, Secretary of the Treasury, to find the necessary funds. The result of the latter action was the allocation of $500,000 in cash from the President's Emergency Fund, and of $36 million from the same fund in contract authorizations for emergency construction.

On the next to the last day of the year President Roosevelt broadcasted an appeal to the American people to dedicate their efforts to national defense and to make the United States the great "arsenal of democracy." On 3 January 1941 he announced the launching of a $350 million merchant

shipbuilding program and the allocation of $36 million from an emergency fund for the creation of new shipbuilding facilities. This new program called for 200 ships of 7,500 tons each and equipped with the simplest possible kind of main propulsion machinery to give a speed of 10 to 11 knots. “In form, the President indicated, these vessels will not be what a ship lover could admire, but they are merely to serve the purpose of providing tonnage in anticipation of a world shortage which, he said, will occur sooner or later. So-called prefabrication will be engaged in to the fullest possible extent.”

Events followed quickly upon this announcement. On 8 January, following a White House conference, Admiral Land stated that the program would get under way in about ten days. The newspaper headlines the next day carried the President’s announcement of a budget of $17.485 billion of which $10.811 billion was for national defense. It was noticed that the merchant shipbuilding program was not included in the budget. The *Journal of Commerce* commented on this as an indication of the suddenness of the President’s decision to embark on the shipbuilding program. It saw further evidence of this having been “in the nature of a surprise move” in the unpreparedness of the Maritime Commission for handling the program. It forecast that the ships would be made available to the British as a part of lend-lease and thought that this explained the apparent lull following the initial activities of the British to finance the building of yards in this country.

Although the President’s decision was a sudden one, the Maritime Commission was not as unprepared as it seemed. The authorization of a two-ocean Navy in the previous July had made it clear that an increased number of auxiliary vessels would be needed. Measures were taken to speed up the long-range program and build more that the 50 vessels planned per year. Another step was the appointment of Admiral Land, 2 July 1940, as Director of the Shipbuilding Section of the National Defense Advisory Commission. Furthermore the Maritime Commission had taken considerable interest in the plans of the British Mission for emergency shipbuilding. It authorized the construction of the Maine and California yards. The plan to build a large number of ships of one design brought to memory the Hog Island experience of the previous war.

Two weeks later, in a special message to Congress, Roosevelt requested, by joint resolution, an appropriation of $313.5 million for the building program. The resolution became law on 6 February 1941.

In reviewing the Maritime Commission files it seems the President started to think about an American emergency building program sometime in mid November 1940. Admiral Land was summoned for a meeting with the President on 16 November and hence his memo of the 18th of November. As can be seen Admiral Land was not really in favor of the program. It is curious to note that in Admiral Land’s autobiography, published in 1955, the building of the Liberty ships is hardly mentioned, nor is the wording Liberty ship to be found in the index.

It might be said that even in early December 1940 the Liberty ship was no more than a gleam in the eye of President Roosevelt. However in the winter of 1940, Britain was straining every moral and material resource to resist the kind of lightning war by which Hitler had overwhelmed France during the previous summer. The Nazis controlled all the coast of Europe from Lapland to the Pyrenees. German aircraft and submarines operating from much better bases than they had had in World War I, seemed likely to strangle Britain by destroying its merchant shipping.

The final decision that there must be additional construction to meet the emergency was made by the President. The British had been urging action of this kind and it is interesting to note that on 8 December 1940 Churchill wrote to Roosevelt: “Looking into the future it would seem that production on a scale comparable to that of the Hog Island scheme of the last war ought to be faced for 1942.”

As a matter of interest the following are pages from Admiral Land’s reading file on his memos to the White House during the period. In addition, there is a copy of the US Maritime Commission press release announcing the Emergency Shipbuilding Program.

Land Reading File Liberty - Design

Nov. 8, 1940

Memorandum for Mr. Knudsen:

The proper procedure for the production of ships in quantities is to settle on the type of ship, which in quantity production for quick delivery, (considering the excessive load on the auxiliary building and turbine building capacity of this country) is a simple type of cargo ships with reciprocating engines, boiler pressure of 200 to 220 lbs., with all steam auxiliaries. The quantity of ships desired and the times at which deliveries are required should be established.

With these factors established it is then possible to set the number of ways required in group locations for maximum production; in other words, a plan similar to the Hog Island production plan of the last War. Such a policy conserves the key-men positions in the labor field, which are the bottle-neck in shipyard production, and avails the industry of all the idle auxiliary-building capacity in the country. Such facilities must be backed up by proper structural fabricating facilities already in existence, such a bridge plants and structural steel plants, as it will probably be impossible to get shipyard machine tools without serious priority changes.

The production of ships of this class, in quantities, is a contracting assembly proposition more than a shipbuilding proposition; the location of yards should be based on the availability of the structural facilities to back them up.

Types of Ships

(a) British - simple - box shape with sharp ends - low speed - Scotch boilers - reciprocating engine.

(b) United States - standard types - C-1, C-2, C-3 - complete plans available in US Maritime Commission.

British types could be more readily constructed in new yards.

United States types could be constructed by expansion of existing facilities in going yards rather than new yards.

In any case, under (b) Navy priorities on combatant ships and proposed contracts on auxiliaries would have to be modified. To obtain speedy results on either (a) or (b) will require modifications in Navy ship priorities.

We have studied the shipbuilding problem as presented by the British Shipping Mission with results about as follows:

(1) 1 East Coast Portland, Maine, or Baltimore (Curtis Bay)
1 West Coast Los Angeles or Portland, Oregon

(2) Simple design as in (a).

(3) 8 to 14 ways at each yard.
British figure 8 each or total of 16.

(4) Cost $1,500,000 each for 100 ships.
Cost $1,600,000 each for 60 ships.
These estimates include plant construction required.

(5) Delivery 60 ships - first ship 1 year.
Complete 60 in 2 years.

(6) It is possible to double or triple these deliveries; i.e., about 50 ships first year to eighteen months and 150 ships the second year.

Enclosure (a) gives a list of possible sites for shipbuilding plants in their order of priority giving consideration, so far as practicable, to the conditions existing at this time with regard to the entire shipbuilding industry. This enclosure is made out on the basis of 100 new ways which is in accordance with your request.

I recommend that when the overall shipbuilding project is discussed by you with the President that I be permitted to accompany you. I feel sure this will meet with the approval of the President.

E. S. Land

Land Reading File   Liberty - Design

Nov. 18, 1940

Memorandum

Subject: Fabricated Ships.

Starting from scratch, the estimated cost for each building way is from $800,000 to $1,200,000. This includes the cost of land and the proportion of shops necessary for a fabricated shipyard.

A rough breakdown of this estimate on a percentage basis is as follows:

Land	4%
Ways	22%
Shops & Equipment	22%
Yard Equipment (cranes, tracks, etc.)	22%
Piers (including wet basin, fitting out basin, etc.)	22%
Miscellaneous	8%

	100%

Hog Island

Time to build	12 months
50 ways	$63,000,000
Number of employees	35,000

The above $63,000,000 may be broken down into plant equipment $39,000,000; land $2,000,000; buildings and building ways $22,000,000.

It is my best judgment that with the exception of fabricating plants for British building, there should be no more new shipyards started.

For any further shipbuilding expansion of our own we should do one of the following:

(a) Rearrange Navy priorities.
(b) Expand present yards for which there are already contracts in existence.

The proposed British shipbuilding referred to in enclosure attached is a separate and distinct proposal involving the simplest kind of ship with the simplest machinery and auxiliary installations. It should be kept separate and distinct from the Navy program and from the Maritime Commission program.

In my judgment we are not interested in the type of ship proposed by the British, which type is for emergency use only. If it is decided to augment our own program we should build ships for 20-years life and have an eye on the future. Therefore, build ships to our standard designs.

Any expansion beyond the foregoing limits will result in waste, extravagance, inefficiency and, as far as quick deliveries are concerned, great disappointments.

E. S. Land

Land Reading File Liberty - Design

On Nov. 29, 1940, Adm. Land sent a Memorandum to General "Pa" Watson, as requested. It "is long and cannot be otherwise. You said that the President wanted it reasonably complete so that he might study the problem; especially if he went on a brief vacation." Whole matter summarized under "Recommendations."

Memo is on subject of "Proposed British Shipbuilding in the United States."

As suggested he conferred with Sec. Morganthau who advised he submit to the Pres. his best judgments in the matter. No recent conference with A. B. Purvis since he is now in England.

"This question of British shipbuilding has been discussed at various times by various British representatives during the past two years."

A British Mission arrived here about two months ago with authority to contract for ships and backed up with about ten million pounds. Shortly after arrival they consulted Land who gave his best advice and told them to make a survey for themselves, which they did.

"Upon the completion of this survey they again consulted me and their proposals in general were about as follows:

"Type A: Simple design, box shape, sharp ends, boilers (Scotch or water tube), reciprocating engines, 9,500-tons deadweight, 2,500 H.P., 10-knot speed. Steam auxiliaries, not electric. (We have estimated the cost at $1,400,000 to $1,600,000 each. Delivery: 11 months for first ship and 100 ships per year thereafter on 27 ways.)

"One other design originally considered but dropped as s result of their survey, etc., may be called Type B:

"Type B: Maritime Commission standard C-1 or C-2 design, steam or Diesel, 9,500-ton deadweight, 15 to 16-knot speed, 4,400 to 6,600 H.P., estimated cost on 100 ship basis, $2,250,000 to $2,500,000 each. Delivery: 15 months for first ship and 50 a year thereafter on 25 ways.

"My investigations indicate that Type A ship will probably not interfere with Navy or Maritime Commission shipbuilding and machinery requirements.

"Type B ship will interfere with Navy building and machinery requirements to the extent of requiring changes in priorities.

"Type A ship is what I would call an emergency production type with a five-year life, which after the emergency would be suitable for tramp operations only.

"On the other hand, Type B ship is what I would call a ship of twenty-year life, useful but expensive for the emergency, but very useful for twenty years after the emergency is over for any route, line or service in the Merchant Marine."

There follows a discussion of possible shipbuilding sites and questions as to size of yards, etc. Land opposed exaggerated concentration such as at Hog Island during last War.

"It was suggested to me that we might build these ships for the British, then lease or charter them to the British. In my judgment, if Type A vessels are built, this would be a mistake. We should sell the ships to the British and be entirely clear of this design of vessel which is suitable for their purposes but would not be suitable for ours. Furthermore, if our emergency becomes equal to or greater than that of the British, we can always commandeer the vessels. The last thing I want to do is to repeat the mistakes of the last war and have a lot of obsolete vessels on our hands unless the emergency is so great as to make this an absolute necessity. If worse comes to worst I should prefer to give the ships to the British rather than charter them. On a gift basis we could collect the net freight rates and control the situation.

"I recommend that we keep the British shipbuilding and the United States shipbuilding entirely separate; that if we build additional merchant marine vessels for the United States, we build Type B, with the necessary readjustment of priorities, shifting over to Type A only if compelled to do so."

As alternatives he suggests for consideration (1) disposal of rest of reserve fleet of about 45 vessels, (2) further transfer and sale of over-age American flag ships, (3) acquisition of foreign flag ships temporarily laid up in the US

<u>Recommendations</u>

"(a) That the British be permitted to build simple ships, Type A, to the extent of their needs and financial capacity. (This is satisfactory to the Navy.)

"(b) That a minimum of two and a maximum of four sites be selected and approved for this construction.

"(c) That the British purchase these ships.

"(d) That we do not build for the British with the idea of leasing or chartering to the British.

"(e) That we continue to permit transfers of flag and sales to the British of obsolete tonnage

(1) from the US Maritime Commission's laid-up Fleet,

(2) from obsolete ships under the American flag to the extent of not seriously interfering with our own commercial and national defense needs.

"(f) That we further explore the Danish flag-French flag situation as something in reserve as the emergency develops.

E. S. Land, Chairman

"P.S. 3:30 P.M. - The above was prepared and signed before my conference with Capt. Callaghan which just took place. We went over the matter and an additional Memo will be submitted covering the points raised in our conference. - - -"

Discussion

In carrying out this 200-ship program authority should also be given to carry on a 100-ship program for standard design, high speed cargo ships in plants now having contracts and in production.

Consideration should be given to following points which have a vital bearing on the time and cost elements of the project as a whole:

"(f) Probable "Bottlenecks"

I. Personnel

(a) Managerial Brains
Engineers and Naval architects
Supervisors, foremen, leading men
i.e., White collar brains

(b) Skilled artisans in shipbuilding trades

II. Material

(a) Machine tools
(b) Forgings
(c) Castings
(d) Boiler plate
(e) Steel (especially shapes)

"(g) Finally, and of vital importance -

For the engineering and planning work on this project and for the material ordering and control - We should contract directly with a control agency through which material will be purchased and apportioned to the contracting yards as the working schedules require."

Dec. 2, 1940

No. 2

Memorandum for The President

Subject: Proposed British Shipbuilding in the United States.

"Capt. Callaghan and I conferred covering Mr. Knudsen's letter to the President of November 19th, together with notes made by Captain Callaghan.

"This British shipbuilding matter has been discussed on several occasions with Mr. Biggers and Mr. Knudsen and we collaborated in the Knudsen letter of November 19th."

"The greatest material bottle-neck in the national defense program today is the machine tool situation and this condition led us to the conclusion that the number of yards for this British program should not exceed four. With the type of ship proposed (Type A), the number of ways is of much less importance than formerly as the time a ship is on the ways can be very materially reduced, particularly as we expect to do a great deal of welding rather than riveting. This means that a maximum of four yards with fourteen ways per yard as the probably maximum number of ways will take care of the situation."

Discussion of possibilities of locating some of these plants in the South. It will be necessary to start from scratch. Also second-hand tool market has been rather thoroughly bought up. These are reasons why yards cannot be prepared in quicker time than stated in Enclosure A of Knudsen letter of Nov. 19th. "In addition, because of difficulty of obtaining shipyard tools, it is essential for quick building that the type of ship be kept to a simple design and that assembly type of yard be used, backed up by bridge or structural fabricating plants already in existence."

Likes idea of building two-thirds of Type A and one-third Type B but doubts if it can be done without interfering with Navy priorities "although in my judgment this interference would not be very serious and I shall make further investigation of the matter, although I anticipate Navy objections."

"It is my present understanding that the Navy priorities board has already assigned tentative priorities to merchant marine ships under construction that will delay their completion. We are investigating this matter and I shall keep you advised of the result."

E. S. Land, Chairman

Longhand -- "If we don't watch our step the Merchant Marine will be 'The Forgotten Man' in the national defense picture!"

Land Reading File Liberty - Design

Dec. 26, 1940

Memorandum for the President

Summary

Project - 200 Merchant Marine Ships

Contracting Agency - US Maritime Commission

Funds - (1) Run a deficiency by Executive Order
(2) Secure appropriations from Congress

Estimated Fund Required - $350,000,000.00

Contract Authorization - $500,000,000.00 (which includes the $350,000,000.00)

Form of Contract: Adapt Navy form, modified as desired from British form;

Obtain authority to negotiate contracts similar to Navy authority;

Enclosures: (Gibbs - British data)

(a) Copy of Contract plans, specifications;
(b) Copy of contract;
(c) Bills of material for one ship;

Estimates of costs per ship in lots of 50 and 100, etc.

Considerations regarding locations of shipyards.

Engine Procurement, Boilers, Auxiliaries, etc. -

Utilize Great Lakes area to the limit of available facilities;

Boilers, Water tube or fire tube (Scotch)

Utilize above, plus Delaware River and N. Y. area as are available;

Fabrication Facilities -

If those already enumerated are not sufficient, utilize Chicago, Cleveland and Pittsburgh areas as necessary;

Boiler plate may be bottle-neck. (Lukens Iron & Steel Co.)

Consider possibility of low pressure turbines although this may complicate gearing and forging capacities;

Coal versus oil-burning - Consider all oil - Alternative consider 50% coal and 50% oil.

Press Release 804 (E - 1) Jan. 8, 1941

"The Maritime Commission announced today that it was taking steps necessary to put into effect the emergency shipbuilding program for 200 ships which was announced by the President, Friday, January 3. Legislation is necessary before actual construction of the ships can be started.

"The ships are being designed with a view to speed in the construction and are not to be compared with the vessels now being built under the Commission's long-range program.

"Tentative designs call for a single type cargo vessel of about 7,500 gross tons, 10 to 11 knots speed, oil burning, with water tube boilers and an overall length of about 425 feet. Simplicity and ease of construction will be paramount in order to meet the requirements of time. While simple and plain, the vessels will be commodious, efficient cargo carriers. They will not have the fine technical equipment, speed or sleek lines of the passenger and combination vessels of the Maritime Commission's long-range program."

There follows some information regarding the new shipyards to build these emergency vessels.

- - - "It is to be borne in mind that the 'emergency' ship program is not to interfere with Navy Department construction and the Maritime Commission's long-range program. It is not contemplated that these vessels will compete with those built for essential trade routes pursuant to the Merchant Marine Act, 1936, as amended.

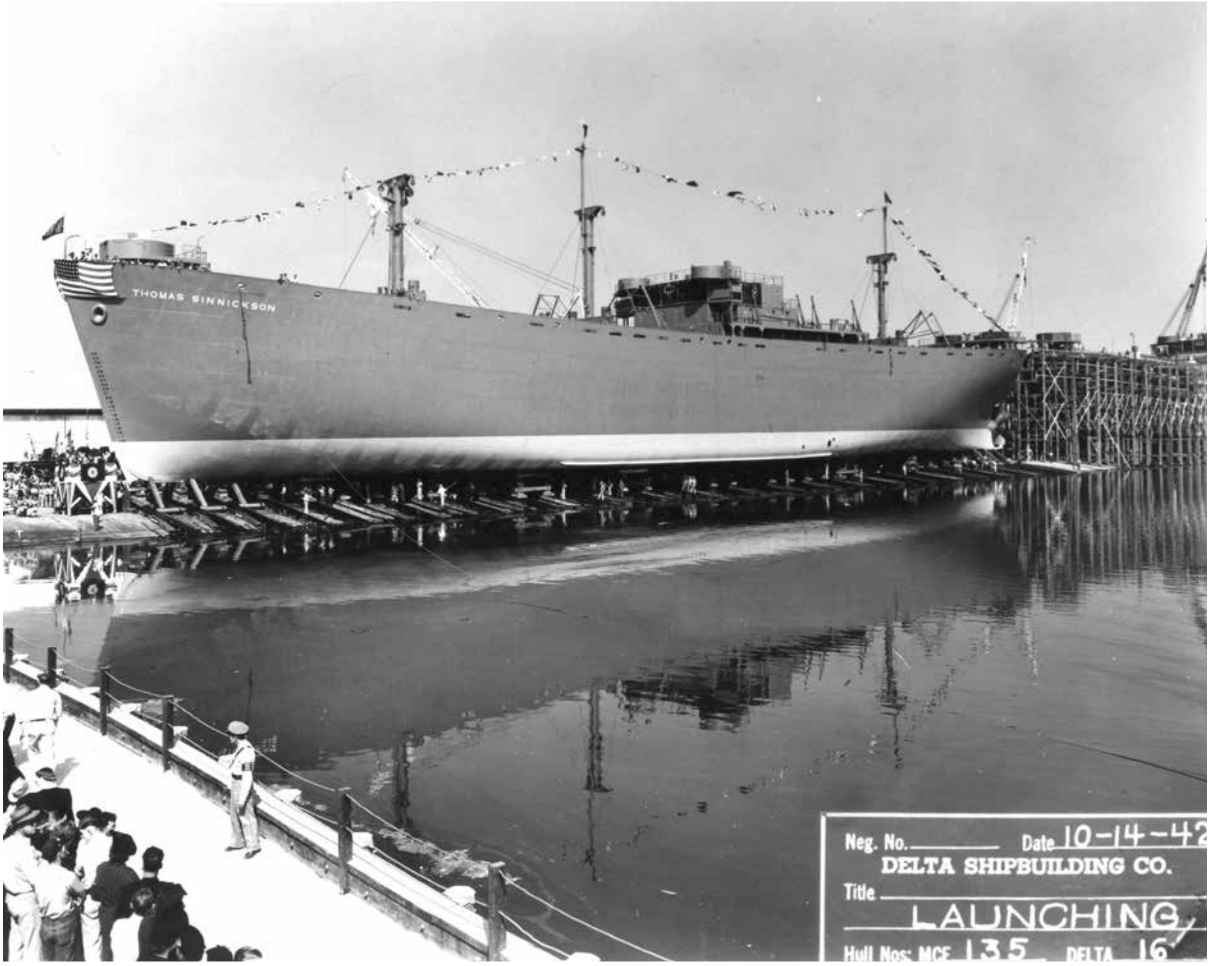
"Contracts will be executed when construction funds are appropriated. The 200 ships will cost approximately $350,000,000."

CHAPTER V

The Design Decision

As noted in Chapter IV some of the plans of the British emergency ship had been in the hands of the Maritime Commission since early in December 1940. Toward the end of that month Admiral Vickery, Vice Chairman of the US Maritime Commission, saw that certain representatives of the shipbuilders, such as James B. Hunter of Bethlehem, had a chance to look over the specifications.

On the evening of 3 January 1941, the day on which Roosevelt announced the launching of the $350 million shipbuilding program, Vickery conferred with Mr. Schmeltzer, Chief of the Construction Division and Mr. Bates, Chief of the Technical Division, on the question of the design of the emergency vessel. Two hundred vessels were to be produced and delivered before the end of 1942. This called for a production schedule similar to that set up for the 60 British ships. It was natural to consider the adoption of the British design. This vessel represented the desired amount of deadweight tonnage, simplicity of construction and operation, and was derived from models of established reliability. Furthermore, it was expected that the vessels would be handed over to the British for operation when constructed. Moreover, there were no equivalent vessels of American design in existence. The cards were stacked in favor of the British model but it was decided to canvas the possibilities for a design of American origin. It was also decided to plan for reciprocating engines, oil fuel and watertube boilers, because of the impossibility of procuring turbines and the difficulty of securing Scotch boilers.



On the next day, 4 January, Mr. Bates held a conference with the Chiefs of the Hull Sections, Messrs. Esmond, MacPherdran, Smith, Rowell and Wanless. He explained that plans for an alternate design would have to be ready by the morning of 8 January since Mr. W. F. Gibbs would arrive on that day and the whole question would then be thrashed out. The Gibbs & Cox organization, he explained, was already revising the British plans for use in American shipyards and work on construction plans was well under way.

As Mr. Bates saw it, the crux of the situation was the difficulty in obtaining working plans quickly. It was felt, he said, that Gibbs & Cox was the only organization capable of handling this particular mass production job. This meant that an alternate plan could not be adopted unless Mr. Gibbs could say that his organization was adequate for the preparation of the two designs. It was decided to go ahead with the preparation of an alternate design for presentation at the forthcoming meeting. The proposed vessel should have the same deadweight as the British emergency ship, should cost under $1.5 million and, as previously decided, should burn oil and use watertube boilers.

At this time Mr. A. Osbourne, Head of the Research Section of the Technical Division, got together information regarding vessels built by mass production during World War I. Drawings for the largest of these, the so-called “Los Angeles” class, were found in storage. Some 238 of these had been constructed, mostly on the West Coast, as against the 110 Hog Islanders. They were somewhat smaller than the British tramp, being 410 ft long, 54 ft in breadth and with a loaded draft of 24 ft and they had a deadweight tonnage of only 7,500 as against 10,000 deadweight tons. Postwar experience with these Los Angeles class vessels indicated certain defects such as a weak skeg, a badly located air pump and an insufficiently rigid engine foundation. These, however, were defects which could be remedied without too much trouble. The advantage these plans offered was that they represented a vessel with a triple-expansion engine, watertube boilers and a designed speed of 10.5 knots. It had already been determined that the emergency vessels would have to have that type of power plant. In addition, the drawings were all third angle projection, the usual American practice, instead of a first angle projection as used by the English and enough different to be confusing to the American shipyard worker. The principal trouble with using these old American drawings was, as Mr. Bates pointed out to Mr. Schmeltzer when the latter brought the matter up, that these drawings would also have to be done all over again, because they applied to a riveted vessel whereas the new ships had to be welded.

In the meantime certain guiding principles were being laid down for a new alternate design. The hull and engine had to be suitable for quick construction. The emphasis was on simplification and standardization. As regards the hull the most important single factor was to eliminate as far as possible all double turns or twists in individual plates. Where these were present there would inevitably be delay, since a special fitting and pressing procedure had to be followed. This used to be done by heating and is still referred to as "furnacing" plates. This could be done by removing all curvature from transverse sections.

Certain dimensions were decided upon, such as the following: LWL 420 ft, LBP 415 ft, beam 58 ft, draft 26 ft 3 in., displacement 13,490 tons, and total deadweight 10,090 tons. With a speed of 11 knots, cruising radius was fixed at 8,000 miles.

The lines plan that was worked out was based on a design of a T2 size tanker prepared by George G. Sharp for the Shipping Board some years before. No vessel had been built according to this design but a model had tested very favorably in the model basin and Mr. Esmond, Chief of the Hull Section, had had a hand in the preparation of the design as a member of the Sharp staff. This hull was essentially a straight-lined form but had curved bilges and some curved framing at the after quarter-point. A summary of conclusions regarding this design was issued on 7 January and reads as follows:

> "This design has been prepared with the idea of obtaining a simplified form capable of mass production in order to meet the desires of the President's emergency program. In preparing the design, three factors were considered: first, simplification of form to permit easy fabrication of materials; second, simplification of form to make for easy erection; and third, a form which would give equivalent deadweight but at the same time better performance than the proposed British standard design. With this as a basis, it was decided to adopt, insofar as possible a straight lined form, to use the Maritime Commission type of cargo vessel, i.e., with all quarters arranged admidships, to use water-tube boilers with oil fuel and to provide two machinery studies, one using the standard 2,500 HP reciprocating engine, and the other, using low pressure simplified turbines."

The preference for midship housing was because of its advantage to crews operating in the North Atlantic where bad weather was to be expected. Furthermore, it made for economy in piping and heating.

As planned, the whole matter was thrashed out at a meeting held on 8 January. William F. Gibbs, representatives of leading shipbuilding firms and representatives of the Commission attended this conference at which Vickery presided. In opening the meeting Admiral Vickery explained the reasons for offering an alternate design. Lines drawings of the two types of ships together with midship sections were exhibited and discussed. It appears that the consensus of opinion favored the Commission's design as simplifying the construction problem, especially if the program was to be extended. Mr. Gibbs pointed out that the adoption of this new design would cause additional delay, but it was argued that an initial delay might be more than counteracted by the speeding up of later deliveries. Messrs. Hunter and Aldrich of Bethlehem agreed to prepare a plating model according to the Commission's design. The representatives of Todd and Newport News indicated their readiness to consider anything that would expedite the whole program.

Thus no final decision was reached at this meeting; rather, it was decided to give the matter further consideration. The thing that seems to have impressed Mr. Bates and Admiral Vickery in particular was, the readiness of the shipbuilders to undertake construction using the British design. There was no data on hand regarding the use of the British ship and its blunt bow and long tapering stern lines indicated it would be slow however, it was realized that the British had had considerable experience with this type vessel and would not propose it for mass production unless it had proven to be economical.

Mr. Schmeltzer discussed machinery changes with Mr. Gibbs and others. It was agreed to retain certain features of the British design for procurement and fabrication reasons. Minor changes were adopted, such as reduction in superheat because of the problem of lubricating the high pressure cylinder which would contaminate the feed and give difficulty in watertube boilers, increased electrical power in the crews' spaces and for several auxiliaries was considered.

Admiral Vickery went over the whole question again in New York on 13 January. The plating model made by Bethlehem indicated that the Commission design would give a minimum of furnaced and rolled plates. Estimates for deadweight and cubic were gone over again and indicated that this design would compare favorably with the British design. No conclusive opinion could be reached with regard to comparative power and speed because there had not been time to obtain model basin tests.

It was not an easy decision to make, but the shipping situation called for action. Finally, Admiral Vickery decided in favor of the British design on the reasoning that the frame bending necessary for this vessel could be managed on a mass production basis with only a slight increase in manhours and that it was somewhat risky under the circumstances to adopt a form whose sea qualities were untried. Then too, of course, it was advantageous to use the plans already being prepared for American shipbuilders by Gibbs & Cox, Inc.

The final decision to build ships on the British design and to follow the British practice of having Gibbs & Cox, Inc., act as purchasing agent, was made on or about 29 January 1941. This date is indicated by a sudden outflow of correspondence relating to the subject. The final decision on the design was made by Admiral Land after giving hurried consideration to alternatives. It must be remembered that this was one of the most urgent periods of the war from the point-of-view of a looming critical shortage of shipping. Decisions had to be hurried.

An Architect's Agreement was drawn up for the signature of Gibbs & Cox on 7 February, the day after the approval of the appropriation of necessary funds, known as Public Law No. 5. This Architect's Agreement was to be in effect for two and half years and called for a compensation of $1,602.56 per vessel. Work began immediately, on preparing plans and contracts were entered into with seven new shipyards shortly thereafter. Gibbs & Cox' contract was executed the following April. By that time it had been decided to build an additional 112 emergency cargo vessels, making a total of 312.

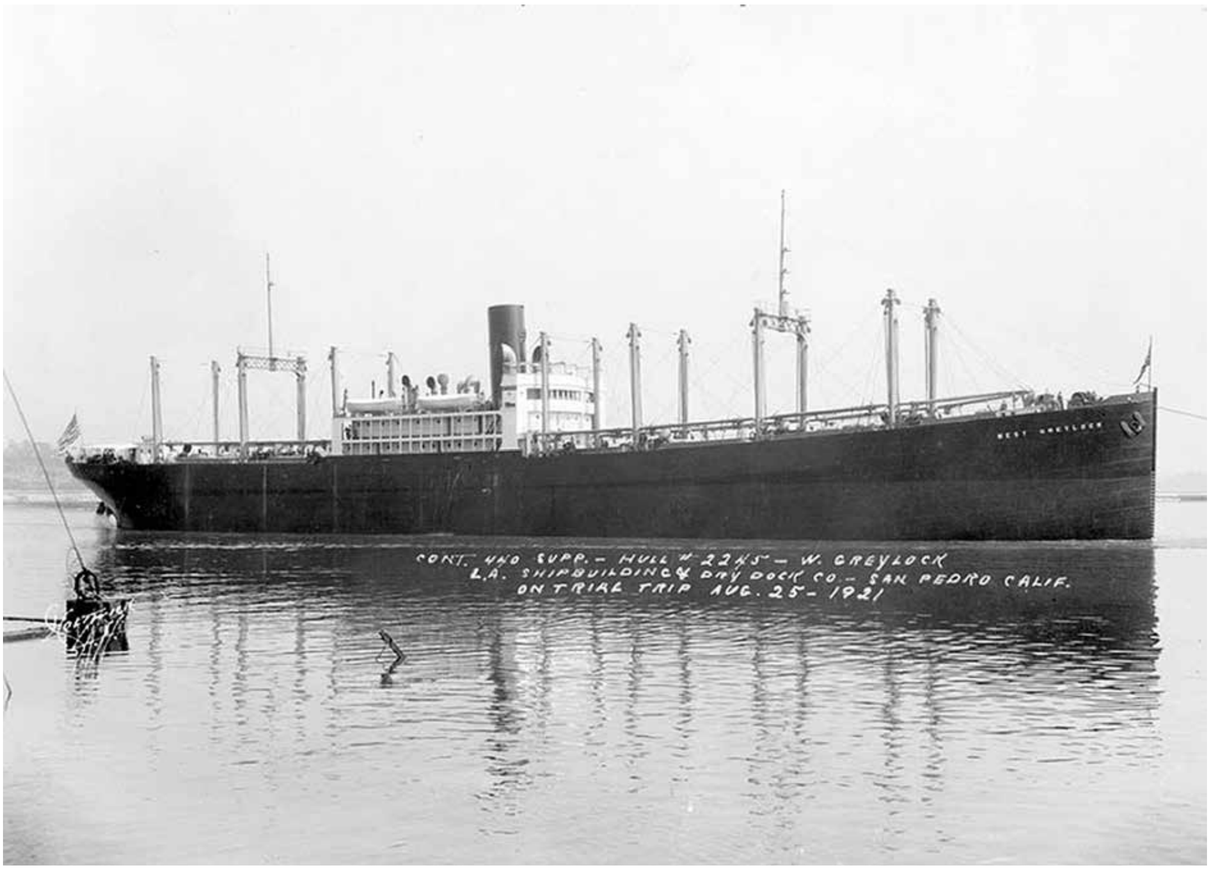
Although the British design was to be used it was necessary to make certain modifications for the production of this large number of vessels. As mentioned before, it had been decided to replace coal with oil and Scotch boilers with watertube boilers. The boiler adopted was designed by Babcock & Wilcox Co., and had the advantage of having only straight tubes and readily interchangeable parts. In the knocked-down condition it could be transported from factory to shipyard much more readily that the bulkier Scotch boiler. It had the disadvantage of using more firebrick which would require repair work under hard use. As regards certain refinements usual for American ships, these were omitted in the interests of speedier construction and with the consent of the Bureau of Marine Inspection and Navigation in view of the emergency. Classification was left to the American Bureau of Shipping in place of Lloyd's.

In going over the Maritime Commission files it was amazing to see the amount of work that was carried out in such a short time period.

Two hundred ships were to be built by 1942. The date of the first contract was 14 March 1941, the first keel was laid 30 April 1941, the first launching was 27 September 1941 and the first delivery was 30 December 1941.

It must be remembered that as of the end of January 1941 basically the only plans available were of the British design and these had to be altered to reflect the American version of the design. There was no computer aided design in those days. A great deal of press was given to the actual building of the vessels however, the planning. drawing engineering and logistics to get the ships built is another story and probably deserves more attention and study.

Following is a picture of the SS *West Greylock* one of the Los Angeles class vessels proposed as a possible alternative for the emergency ship.



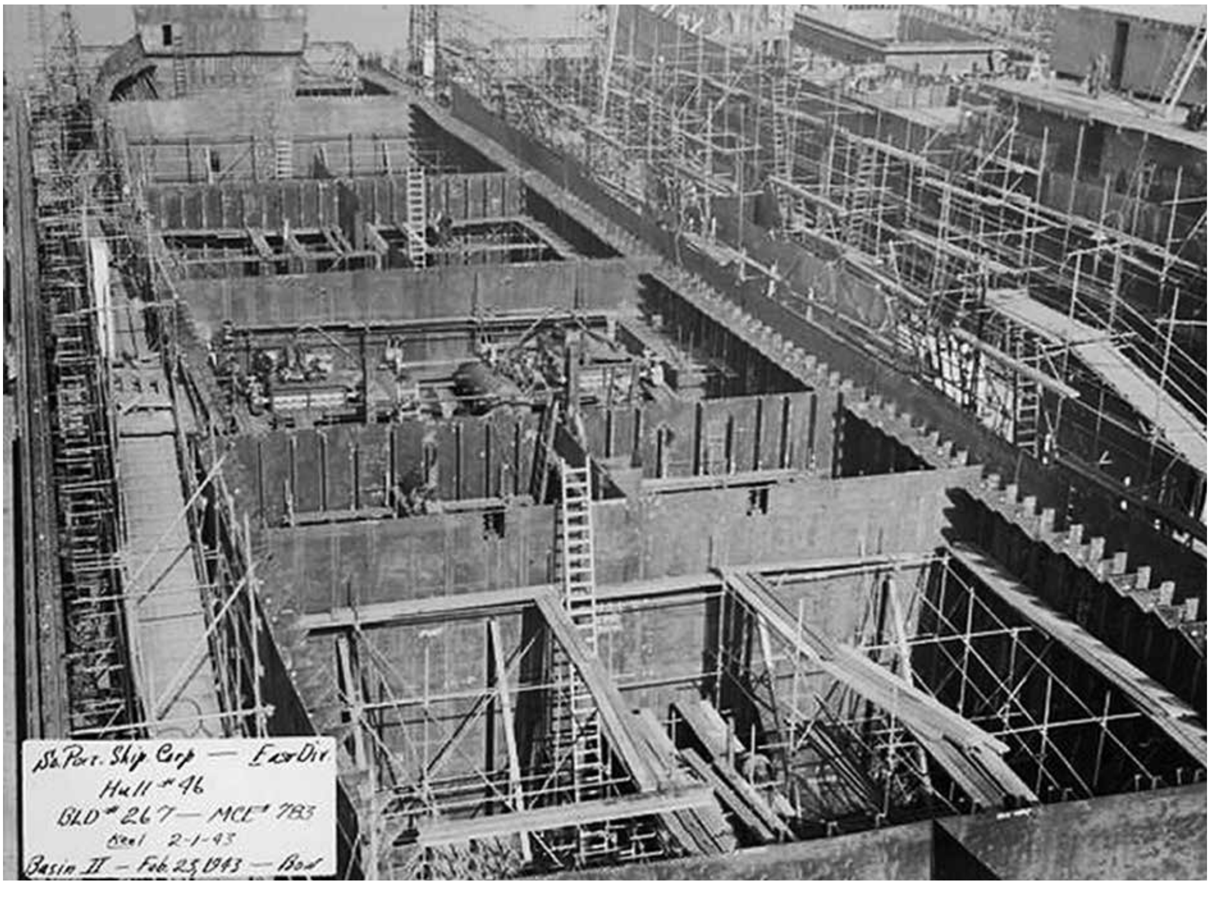
SS WEST GREYLOCK

CHAPTER VI

Modifications from the British Design

The primary fact about the Liberty ship was that it was an emergency vessel. Before the name “Liberty” was attached to ships of this type they were referred to simply as “emergency” ships. They were given the “EC2” designation by the Maritime Commission, which indicated that they were within the length range of the C2 ships, but unlike those long-range program vessels, the Liberties were intended primarily to meet the needs of the war emergency. The American people were not convinced of the existence of an emergency until about May 1940 with the British retreat from Dunkerque. The fall of France made clear what words would not do and that the fall of Britain would leave us exposed to attack. Roosevelt called upon America to make itself “the arsenal of Democracy” but the only way to get American weapons to the British forces was in ship bottoms. The 200-ship program, following close upon the British 60-ship program and the addition of 112 more emergency ships in April 1941, were all logical parts of our determination to supply weapons to the embattled British.

An important reason for the acceptance of the British design for this emergency vessel was the realization that the British had given much thought to the problem of using a design that was tried and that made quick construction possible. The central idea was to produce a ship that was simple to build and easy to operate. They needed many ships in a hurry and gave no thought to their use over a long period of time. Since it was expected that these ships would be manned with crews made up of young inexperienced men or elderly men recalled from retirement, simplicity of operation was essential.



Representatives of the Maritime Commission sought to impress upon Congress the purpose and character of these emergency vessels when the joint resolution appropriating $313.5 million was under consideration. The Report of the House Committee on Appropriations, when it asked for favorable action, shows that this conception of what the ship was meant to be was understood by the members of the Committee. The report explained to the House that “the type of ship proposed is described as what might be termed a ‘five-year’ vessel. It is slow and seaworthy and has the longevity of a modern steel ship, but for the demands of normal commerce in foreign trade it could not compete in speed, equipment and general serviceability with up-to-date cargo vessels. The design is the best that can be devised for an emergency product to be quickly, cheaply, and simply built. They will be constructed for the emergency and whether they have any utility afterward will have to be determined then. The coastal trade may offer some possibilities in that direction.”

Although it had been decided to adopt the British design and to use the working drawings already being prepared by Gibbs & Cox, the Commission determined upon certain changes of its own. The most important of these was the use of oil fuel and the water-tube boiler. As noted before, at the end of January 1941, representatives of the Commission and of Gibbs & Cox held a series of conferences for the purpose of settling details. Mr. Schmeltzer, as Chief of the Construction Division, together with Mr. Esmond, who worked on questions having to do with the hull, and Mr. Grant who worked on those having to do with engineering, represented the Commission and dealt with Mr. William Francis Gibbs and his chief assistants Messrs. C. A. Ward and C. E. Meyer.

The plating model prepared by Bethlehem convinced Mr. Esmond that it would not be necessary to “furnace” more than two plates on each side of the forefoot. This was about what had been expected. It was understood that these vessels would be welded but that the frames might be riveted to the shell if the shipyards so desired. In the case of the Bethlehem-Fairfield yard, it was decided that the seams would be riveted while the frames would be welded to the shell. In order to facilitate construction it was decided that the weather deck should have a straight camber. For the same reason it was decided to have wooden hatch covers and furniture but to omit wood on the decks wherever possible.

The changeover to oil fuel brought in its wake several minor changes. To begin with, the fixed ballast in the double bottom on the British ships was eliminated to make room for fuel tanks and deep tanks were added in the No. 1 hold to provide for salt water ballast forward. Oil necessitated the installation of filling stations and CO_2 smothering arrangements. The galley range was changed from coal to oil. The elimination of coal bunkers and use of one instead of two houses permitted the replacement of kingposts by masts and the lengthening of the No. 3 hatch. It was these changes in the masts and housing which made the American ships easily distinguishable from their British prototype.

There were certain other differences, with respect to the British emergency vessels, which were less noticeable. They included such things as the change from chain rails at the weather deck sides to bulwarks; increased height of bridge bulwark so as to eliminate canvas wind dodgers; addition of non-slip deck covering in way of guns; addition of ladders to lower holds providing access independently of cargo holds; also, addition of such things as ratproofing, after steering station, 12 inch searchlight, more refrigerated store space, running water in officers' staterooms, cooled water tap in midship house and slop chest for crew.

It will be noted that many of these changes tended to make the ship more comfortable for the crew than was the case with the British prototype. It should also be pointed out that many items were omitted which had become standard on American ships. These omissions were decided upon with the idea that this was an emergency ship and that cost should be made as low as possible without sacrificing seaworthiness or serviceability. After careful consideration by members of the Commission and representatives of the Bureau of Marine Inspection and Navigation, it was decided to reduce the number of hospital berths, to substitute round bar davits with operating gear in place of mechanical davits, to use composition deck covering made of incombustible aggregate supplied by manufacturers not on the approved list, reduce the heating range in crews' quarters, eliminate emergency diesel generator, eliminate spare bower anchor and reduce anchor chain from 300 to 240 fathoms.

In many ways the Commission was deviating from its own standards. From a total of about 35 deviations the following are worth mentioning: use of combustible material on bulkheads, ceilings, linings, furniture and hatch covers; omission of mechanical ventilation in holds, engine and boiler rooms, officers' and crews' quarters; reduction in size of crews' lockers and rooms; oil instead of electricity for galley and for accommodation lights; no engine room entrance into shaft tunnel; no fire detection system; no heavy lift booms or double geared winches; hand instead of electric deep-sea sounding machines and no mechanical gear for skylights or ventilator cowls; cement instead of tile in crews' toilet spaces and no heat insulation on shell plating in their quarters; also, omission of certain refinements and navigation aids such as gyro compass, radio direction finder, radio and searchlight in motor lifeboat, stainless steel galley equipment, and shutter type blinker and flag bag and rack with halyards to a triatic stay. These were preliminary modifications and do not reflect on the vessels as finally built. Modifications were a continually evolving matter based upon the needs of war. For example, the ships as delivered had heavy lift booms, RDF, etc.

In spite of these efforts to design a ship of utmost simplicity, there could not help but be many complications and minor decisions to be made before construction could go forward. Since there was a single design for all the 200 ships it had to be faired only once. This was done in the Mold Loft of the Newport News Shipbuilding & Dry Dock Company. This company then made offsets of the frames for distribution to the various shipyards. The lines were made from a parent set sent from England and were identical, except that some slight changes were made to the waterline endings at the stern post and at the bow where a small radius stem casting was used to which the paravane skeg was attached. Since the basic plans called for welding all but the frames it became necessary for Mr. Esmond to visit the Bethlehem plant occasionally to check their drawings revised for riveted seams and welded frames. It had also become necessary to revise the basic erection plan to suit the fabrication methods of Bethlehem-Fairfield. After each working plan was finished it had to be submitted to the American Bureau of Shipping (ABS) for its approval.

One change recommended by ABS was the reduction of the number of plate thicknesses in the proposed design from 75 to 27, thereby helping to simplify procurement during the wartime steel supply crisis. Another change was “on paper” only, but may have been influential at a time when each ton of supplies delivered to the battle line was important. After careful study, ABS discovered that the scantlings specified were more than adequate for the design draft, which in fact could have been deeper. Accordingly the basic Liberty dry cargo carrier was classed at 10,865 deadweight tons, an increase of 430 deadweight tons capacity. Since 2,580 such Liberties were ultimately built, this calculation increased the aggregate deadweight available for the war effort by over one million tons.

Another subject worthy of study is the part played by the American Bureau of Shipping in the design process. There is very little mention of ABS in the Maritime Commission files, however I have never been able to locate some of the most important technical files.

It would seem that ABS must have been involved from the start. For example, Gibbs & Cox completed the midship section of the Liberty ship on 11 February 1941 and it was approved by ABS on 12 February 1941. A very short time in which to review a new design.

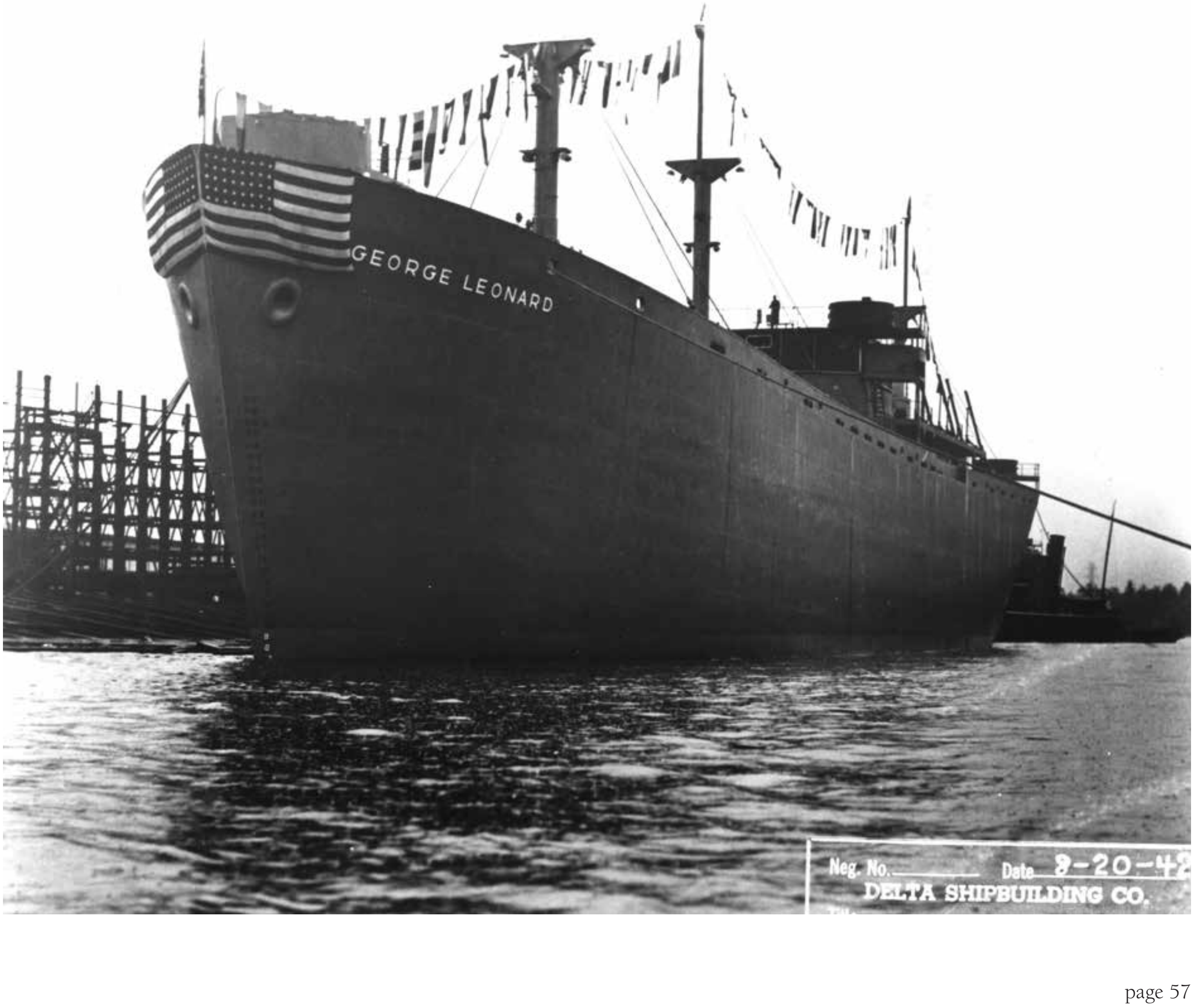
CHAPTER VII

Justifying the Decision

The Liberty ship began its career under the handicap of being described by President Roosevelt, during a fireside chat which reached radio listeners from coast to coast, as an unprepossessing looking vessel. Given the nickname "ugly duckling," before anyone had a chance to really see one of these ships, the name clung to the ship, barnacle fashion, until her reliability and general utility won for her the more complimentary title of "Workhorse of the Fleet."

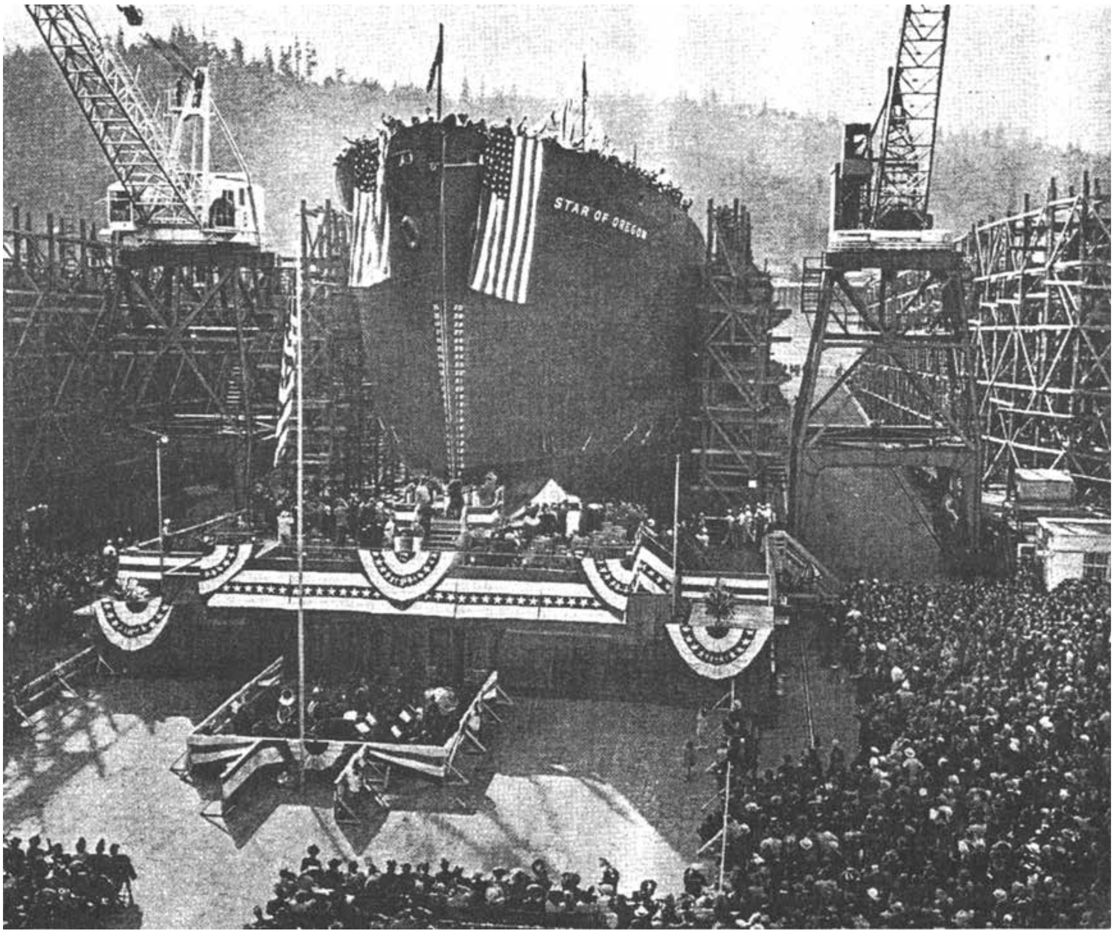
After the emergency fleet construction had begun, but before any hulls were much more than half finished, the wisdom of the choice of vessel was questioned in the newspapers. On 2 July 1941, the *Washington Star* contained an article by Richard L. Stokes, Washington Correspondent of the *St. Louis Post-Dispatch*, which was headlined: "Held Ideal Targets for Stukas; Maritime Commission, Having Acted in Haste, Now has Leisure to Wonder." The opening blast read, as follows:

> "Instead of summoning American inventive genius to out-think what Nazi planes and submarines are doing now, the Maritime Commission reverted to a 1918 British type of simplified cargo boat as model for 312 emergency "Ugly Ducklings," with which to loosen the stranglehold of blockade about the United Kingdom.



> Having acted thus in headlong haste, the Commission is at last finding leisure to speculate as to whether targets more ideal for Stuka bombers and undersea craft could have been hit upon if Air Marshal Goering and Admiral Raeder themselves had been called into consultation.
>
> It is no secret that responsible members of the Commissions marine engineering staff are far from happy over the basic design of what has been boastfully designated as the "Liberty Fleet." Anxious discussions are now in progress. One of the more conservative proposals is that horsepower should be stepped up at least to a point at which an "Ugly Duckling" might have a chance of escape if a submarine happened to miss with its first torpedo."

Stokes then went on to say that some extremists wanted the entire program scrapped before "possibly to little or no purpose" it absorbed the energies of 500,000 skilled workmen, the ways of 25 shipyards and a half-billion dollars of public money. The "sole factor" determining the decision had been to find a design by means of which the largest number of freight ships could be built in the shortest possible time. The design was taken over from the British, it having been worked out at the Clyde yards during the First World War and being immediately available since the British were building 60 such in this country. The triple-expansion reciprocating engine, long since outdated, was resorted to so as not to interfere with the Navy's demand for modern steam turbines and diesel engines. Towards the end of this long article Stokes admitted that "officials high in the commission" agree it would be desirable to increase the speed of these vessels to 16 knots but protest that neither small size nor speed have proved sufficient to protect surface craft from dive-bombers, British corvettes of even 38 knots having been sunk in the Channel with "pitiful ease" by Stukas.



Launching STAR OF OREGON

It is evident that this article caused something of a stir with the Commission for Admiral Vickery requested the Chief of the Design Specifications and Priorities Section of the Construction Division, Mr. Flesher to report on the matter.

In this report it was pointed out that at the beginning of the emergency program the indications were that turbine and gear production would not even meet the needs of the Navy and of the Commission's "C" type program during the years 1941, 1942 and 1943. The expansion of that production would no more than care for the expanding needs of the Navy and the Commissions' tanker program. The reciprocating engine was the only possible solution. Mr. Flesher also reminded the Admiral that the decision on the design had been due to the fact that it represented what the British considered to be the most desirable type of ship for this particular service "and they were closer to the actual need, naturally, than we were; likewise, they had eliminated many details of design which were practical to accept, in order to assure a satisfactory and reliable ship, which is so necessary in a large program. The design, likewise, permitted ready operation by English crews and emergency repairs in England." In the design of the ship as a whole "we kept in mind simplicity at the expense of efficiency, in order to expedite construction by inexperienced personnel."

Another primary consideration had been to have the engine parts interchangeable. This could be accomplished most easily with the simple reciprocating type of engine. The EC2 was the only type of merchant ship to have a standard engine-room and machinery design with complete interchangeability of units. This was not true of the long-range C-type ships except in the case of groups of vessels of a particular type built in a particular yard. Daniel S. Brierley, in charge of maintenance and repair work in the War Shipping Administration, pointed out that, although the proper maintenance of the Liberty ship's engine was arduous work, it permitted the use of a large available pool of seagoing engineering personnel familiar with this type of engine.

The interchangeability and consequent availability of engine parts made for great saving in time needed for repairs. This applied even in foreign waters where it was not possible to secure parts directly from production lines going at full blast. This was achieved by "cannibalizing" vessels damaged beyond repair. "Incredible as it might seem," according to Mr. Brierley, "it was actually possible to remove pistons, complete with rings, from an engine of a West Coast manufacturer, install them in an engine of an East Coast manufacturer in a vessel needing comparable minor repairs, without any alteration or machine work whatsoever. Actual case after case of similar transfers could be described, ranging from such component parts as high-pressure, medium pressure or low-pressure cylinders, complete all the way to connecting rods, and even crankshafts."

It is interesting to note the comments of Mr. Harry Hunter regarding interchangeability of parts with respect to the British 60-ship program. He stated that 30 of the 60 engines originally ordered for the British Ocean class vessels were given to Liberty ships in order that they might be completed without delay.

Hundreds of Liberty ships, Ocean and Fort (Canadian-built) ships were supplied from stock with parts ranging from complete main engines to gear wheels and no single misfit has occurred. With conditions in the United Kingdom consequent upon enemy action both against ships and plants, blackout, and shortage of labor and material, this successful saving had been most gratifying. Hundreds of engine parts manufactured at Wallsend or Sunderland, England, could infallibly be fitted directly into engines built in any of a dozen plants in the United States and Canada.

CHAPTER VIII

Liberty Fleet Day

The Liberty ship was introduced to the American public on what was called Liberty Fleet Day.

President Roosevelt, addressing a special message to the American people on 27 September 1941 as 14 new merchant ships took to the water in dawn-to-sunset launchings from coast to coast, expressed determination to maintain freedom of the seas for the United States by protecting the expanding merchant marine “from torpedo, from shell or from bomb.”

In his message, which he delivered by electrical transcription at each of the 14 launchings and over a nationwide radio network, the President declared that the United States merchant and naval shipbuilding program “is one of our answers to the aggressors who would strike at our liberty.”

His message was broadcast at 12:55 p.m., Eastern daylight time, half an hour before the *Patrick Henry*, the first of the Maritime Commission’s emergency Liberty fleet, slid into the Patapsco River at Baltimore. The launchings ranged from that of the *Surprise* at Chester, Pennsylvania, at 7:00 a.m., Eastern daylight time, to that of the *Ocean Ventura* on the Pacific Coast at 9:30 p.m. Eastern daylight time.

Mrs. Henry A Wallace, wife of the Vice President, led the 14 women who sponsored the launching of the 14 ships. Others who participated were the wives of governors, senators and representatives, relatives of owners of ships, and relatives of persons in whose names the ships were christened.

As the *Patrick Henry* slid down the ways at the Bethlehem-Fairfield yard at Baltimore, Mrs. Wallace christened the vessel whose destiny, as the President said in his address, was to revive the American patriot's slogan: "Give me liberty or give me death!" in a worldwide "pledge to all mankind" that this country was firmly committed to the defense of eternal liberty.

As the vessel gathered speed down the ways, an overhead crane with the beflagged keel plate of Liberty ship No. 12 slung underneath kept pace and laid the plate on the vacated keel blocks.

Speaking at the Baltimore ceremonies, Rear Admiral Emory S. Land, Chairman of the Maritime Commission, described the launching of the *Patrick Henry* as symbolic of the determination of the American people that "human liberty shall not perish from the earth." He complimented the management and workers of American shipbuilding plants on building ships faster than they have ever been built before, so that not only the *Patrick Henry* but the entire construction program is far ahead of schedule. Then, however, he echoed the President in calling for "more speed, and still more speed." Today's Americans, he asserted, "must almost attain the superhuman," as their forefathers did.

President's "Liberty Fleet Day" Address

Franklin Delano Roosevelt
32nd US President

"My fellow Americans:

"This is a memorable day in the history of American shipbuilding – a memorable day in the emergency defense of the nation. Today, from dawn to dark, 14 ships are being launched – on the Atlantic, on the Pacific and on the Gulf, and among them is the first Liberty ship, the *Patrick Henry*.

"While we are proud of what we are doing, this is certainly no time to be content. We must build more cargo ships and still more cargo ships – and we must speed the program until we achieve a launching each day, then two ships a day, fulfilling the building program undertaken by the Maritime Commission.

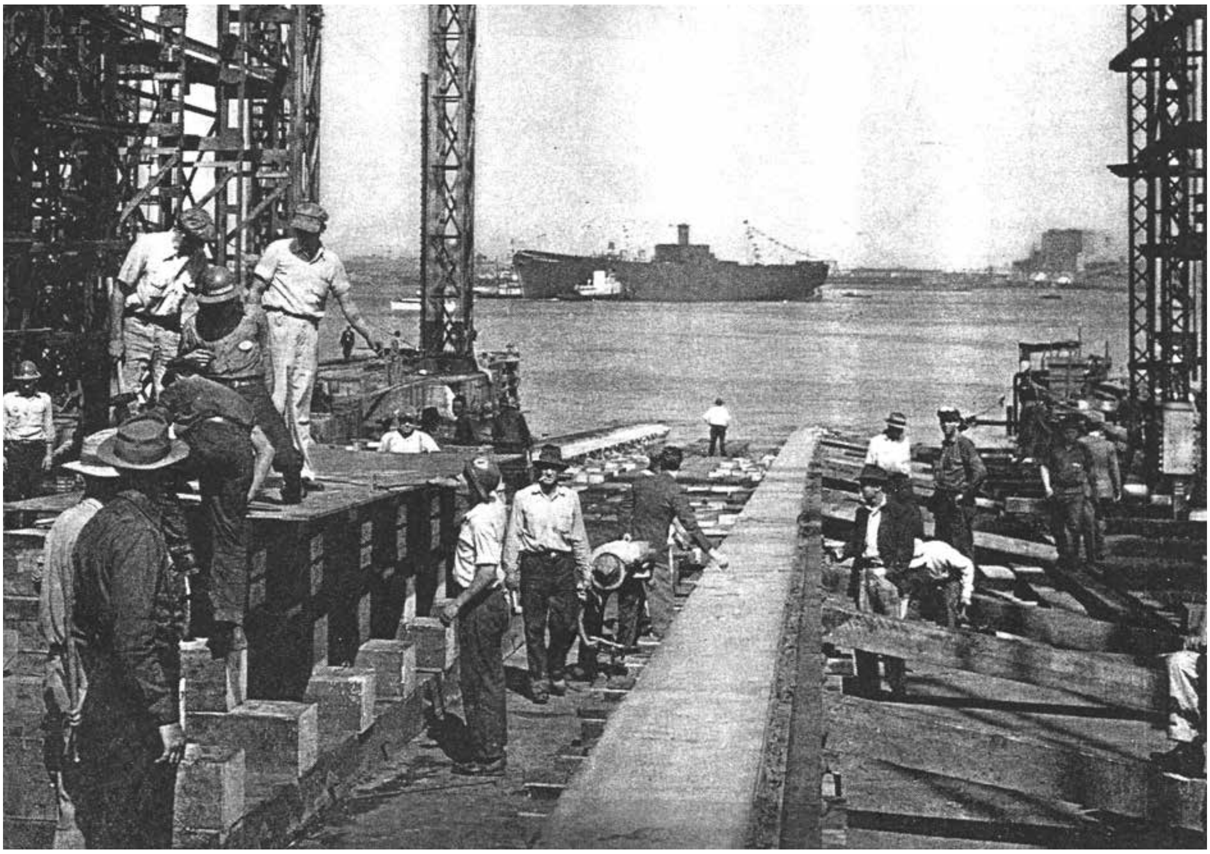
"Our shipbuilding program – not only that of the Maritime Commission, but of the Navy – is one of our answers to the aggressors who would strike at our liberty.

"I am speaking today not only to the shipworkers in the building yards on our coasts, on our Great Lakes and on our rivers – not only to the thousands who are present at today's launching but also to the men and women throughout the country who live far from salt water or shipbuilding.

"I emphasize to all of you the simple historic fact that throughout the period of our American life, going way back into colonial days, commerce on the high seas and freedom of the seas has been a major reason for our prosperity and the building up of our country.

"To give you one simple example: It is a matter of history that at a large part of the capital which in the middle of the past century went into the building of railways and spread like a network into the new undeveloped areas across the Mississippi River, across the plains and up into the Northwest, was money which had been made by American traders whose ships had sailed the seas to the Baltic, to the Mediterranean, to Africa and South America, and to Singapore and China itself.

"Through all the years after the American Revolution your government reiterated and maintained the right of American ships to voyage hither and yon without hindrance from those who sought to keep



Laying keel for the next vessel

them off the seas or drive them off the sea. As a nation we have realized that our export trade and our import trade had a definitely good effect on the life of families not only on our coasts but on the farms and in the cities a hundred or a thousand miles from salt water.

"Since 1936, when the Congress enacted the present Merchant Marine Law, we have been rehabilitating a merchant marine which had fallen to a low level. Today we are continuing that program at accelerated speed.

"The shipworkers of America are doing a great job. They have made a commendable record for efficiency and speed. With every new ship they are striking a telling blow at the menace to our nation and the liberty of the free peoples of the world. They struck 14 such blows today. They have caught the true spirit with which all this nation must be imbued if Hitler and other aggressors of his ilk are to be prevented from crushing us.

"We Americans as a whole cannot listen to those few Americans who preach the gospel of fear – who say in effect that they are still in favor of freedom of the seas but who would have the United States tie up our vessels in our ports. That attitude is neither truthful nor honest.

"We propose that these ships sail the seas as they are intended to. We propose, to the best of our ability, to protect them from torpedo, from shell or from bomb.

"The *Patrick Henry*, as one of the Liberty ships launched today, renews that great patriot's stirring demand: ***'Give me liberty or give me death.'***

"There shall be no death for America, for democracy, for freedom! There must be liberty, worldwide and eternal. That is our prayer – our pledge to all mankind."

PATRICK HENRY being moved to outfitting dock

With the launch of the *Patrick Henry*, the Liberty ship family tree could be drawn as follows:

Standard British Tramp Design
1934

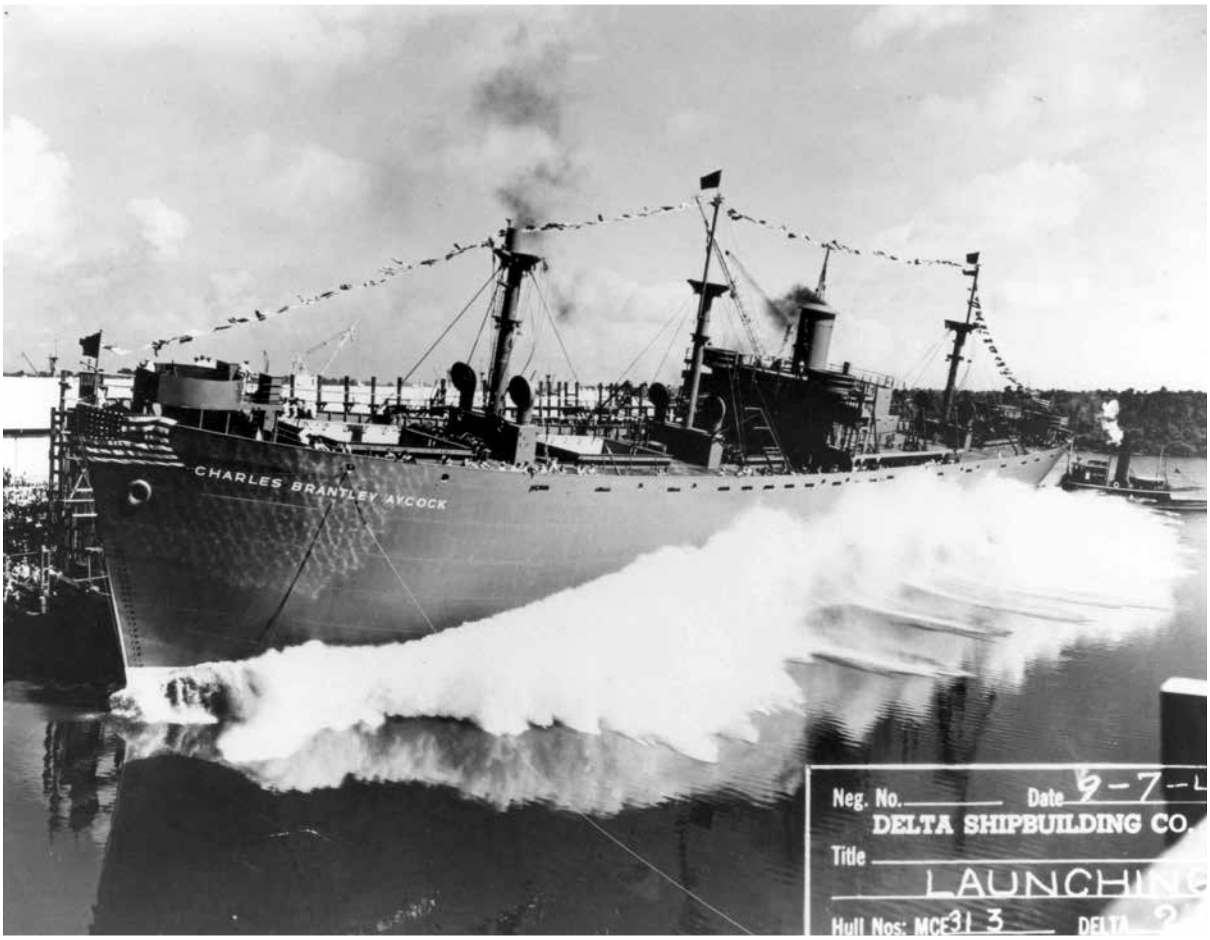
Embassage
1935
|
Dorington Court
1939
|
Empire Liberty
1941
|
Ocean Vanguard
1941
|
Patrick Henry
1941

CHAPTER IX

The Name "Liberty Ship"

Naming the product is half the battle in any advertising campaign. The ship which was to win popular interest under the generic name "Liberty Ship" started off under the severe handicap of being known as the "ugly duckling" because the President in his January announcement of the emergency building program referred to it as a "dreadful looking object," and Time Magazine reported it under the heading "Ugly Ducklings." That name went unchallenged until the middle of April when Admiral Land received several letters protesting on the grounds that the ships were really good looking. Admiral Land circulated the letters through the Commission with the note: "I agree. We can do our bit by calling them 'emergency ships.'" The Executive Director recommended on 2 May 1941 a press release saying that the emergency ship has been designated as the EC2, their design classification, and should be so referred to. Whether they were really to be American ships or were to be turned over to the British was still not clear, but the press release added that those that were to operate under the American flag would be known as the "Liberty Fleet." At Congressional committee hearings in June and July they were still commonly referred to as "ugly ducklings," but Commissioner Dempsey insisted on the name "Liberty Fleet."

The new name, modified finally into Liberty ships, was fixed in the public eye and ear by the widely publicized festivities celebrating the laundering of the first of the type at the Bethlehem-Fairfield yard



on 27 September 1941 on Liberty Fleet Day. The ceremony was eminently successful in catching public attention; and by the time the talk was over and newspaper articles had been written all over the country, “Liberty Fleet” had become “Liberty ships.”

Partly by virtue of this name, ships of the emergency type, as they continued to be called in the Commission’s official statistics, became a kind of national symbol, although none of the standard or C-types of which the Commission was so proud ever won a similar place. There is nothing glamorous about the name C2 or T2. Traditionally the name of a ship is the affair of its owner or operator, not of its builder. Most of the Commission’s standard types were destined to pass to a private company. If they acquired a popular name as a type it was the name with which the operating company advertised its fleet or its line. The naming of the Liberty fleet, popularized as Liberty ships, reflected the change from building for private enterprise to building for the use of the government. It aroused public consciousness that the Commission’s emergency program was public business.

CHAPTER X

The Liberty at War

Without attempting to follow the careers of the hundreds of Liberty ships, it is instructive to take note of one or two. The one which is credited with being the first launched is the *Patrick Henry*, built at Bethlehem-Fairfield. It was given its trials on the Chesapeake on 26 December 1941 and passed with very little difficulty. The *Patrick Henry* served throughout the war and, at its close, became a part of the laid-up fleet. The Oregon yard launched the *Star of Oregon* just a few hours behind the *Patrick Henry*. This ship had a very different history. It ran into difficulty at the very beginning of its career. While undergoing an endurance trial up the Columbia River on 30 December 1941, its main engine HP crosshead slipper and guides and the No. 6 main bearing ran hot and had to be nursed along with water service and excess lubricating oil. On top of this the steering gear failed and the *Star of Oregon* ran aground.

The No. 6 bearing heated again on a re-trial on 4 January 1942, making it necessary to put it in drydock for the purpose of realigning the main engine crankshaft. Five days later it passed successfully a second re-trial. It was delivered for operation by the States Steamship Company on 16 January and put to sea shortly thereafter. It put in at Los Angeles with a cargo winch and two generators out of order. Repairs were effected after plug valves and pistons were flown from the East Coast. The *Star of Oregon* discharged its first cargo in the Persian Gulf area and then headed back to the United States by way of Trinidad carrying a cargo of chrome ore and sisal, picked up in East Africa. It was hit by a torpedo which entered the starboard side and exploded in the No. 4 hold.

One man was believed to be killed by the explosion but the rest of the complement of 54 got safely into the boats. The submarine then surfaced and shelled the vessel setting it on fire and sinking it in about one hour after the torpedo hit. The survivors were picked up by a United States patrol boat and landed at Trinidad the following day.

Apart from the fortunes of war the most important question with regard to the operation of Liberty ships is how well did they stand up to the test of operating in all kinds of weather, in all kinds of seas and under the pressure of wartime needs for quick turnarounds? In our effort to find a general answer, we may find it helpful to look at a couple of individual histories. The great majority, like the *Patrick Henry*, plodded back and forth across the seven seas without meeting extremely trying situations. The third Liberty ship built by the South Portland Shipbuilding Corp., was an exception.

On 11 August 1942, the *Thomas Hooker* was delivered for operation by the American West African Line, Inc., and departed for England on 4 September on its maiden voyage. From Glasgow it made two round-trip voyages to North Africa and on the second one underwent a series of attacks by enemy planes. Tied to a dock at Bone, Algeria, one bomb hit within 50 feet and, in the words of a cadet midshipman aboard, resulted in "pushing the concrete dock into the ship." No leaks resulted and it proceeded to England.

With its fuel and water tanks full and 1,300 tons of sand ballast aboard, the *Thomas Hooker*, set out from Glasgow for the United States on 11 February 1943. Running into a gale it pitched so heavily that the vibration, caused by the propeller coming out of the water, loosened the bolts holding the steering engine, necessitating a return to port. Captain Hathaway, a young man of 26 who had started out as chief mate and taken over command when the skipper became sick, asked War Shipping Administration General Operating Manager, Captain J. F. Devlin, Jr., for an additional 1,500 tons of ballast. Captain Devlin was hard-pressed to find ballast for all the ships loading in the Clyde area at this time and allowed the *Thomas Hooker* only 800 tons additional. He declared it "was seaworthy and ballast distribution good" when it departed on 11 February, so he considered it in even better condition on its final departure, 21 February.

It again ran into heavy seas and on the evening of 5 March rode up on a particularly large wave to come down hard on a small one. There followed "a report like the sound of a gun going off" and the shell plating on both sides of the No. 3 hatch cracked the one on the port side continuing on down to about six to eight feet above the waterline. The next day the crew transferred to HMS *Pimpernel* and left the *Thomas Hooker* to its fate that evening. When last seen it was rolling and pitching heavily with a 12 degree list to port.

In the opinion of Captain Hathaway and of the Chief Mate, William Lyall, the fracture had been caused by insufficient ballast. The latter also gave as his opinion that the steel plates were of inferior quality and that the ship's construction was too rigid so that it did not have sufficient flexibility in heavy seas. It is possible that its bombing experiences may have had some effect on the shell.

Another case of a fracture caused by ballasting involved the *Joel R. Pinsett*, the 43rd Liberty ship built by the Todd-Houston Shipbuilding Corporation.

Delivered 28 February 1943, she made a voyage to the Mediterranean and another to Liverpool. It departed from Liverpool in convoy, 22 February 1944, ballasted with about 4,700 tons of sand, salt water and fuel oil. Contrary to the usual practice, none of the sand ballast was carried in the No. 3 hold. The Master considered that its permanent ballast gave sufficient weight in that location.

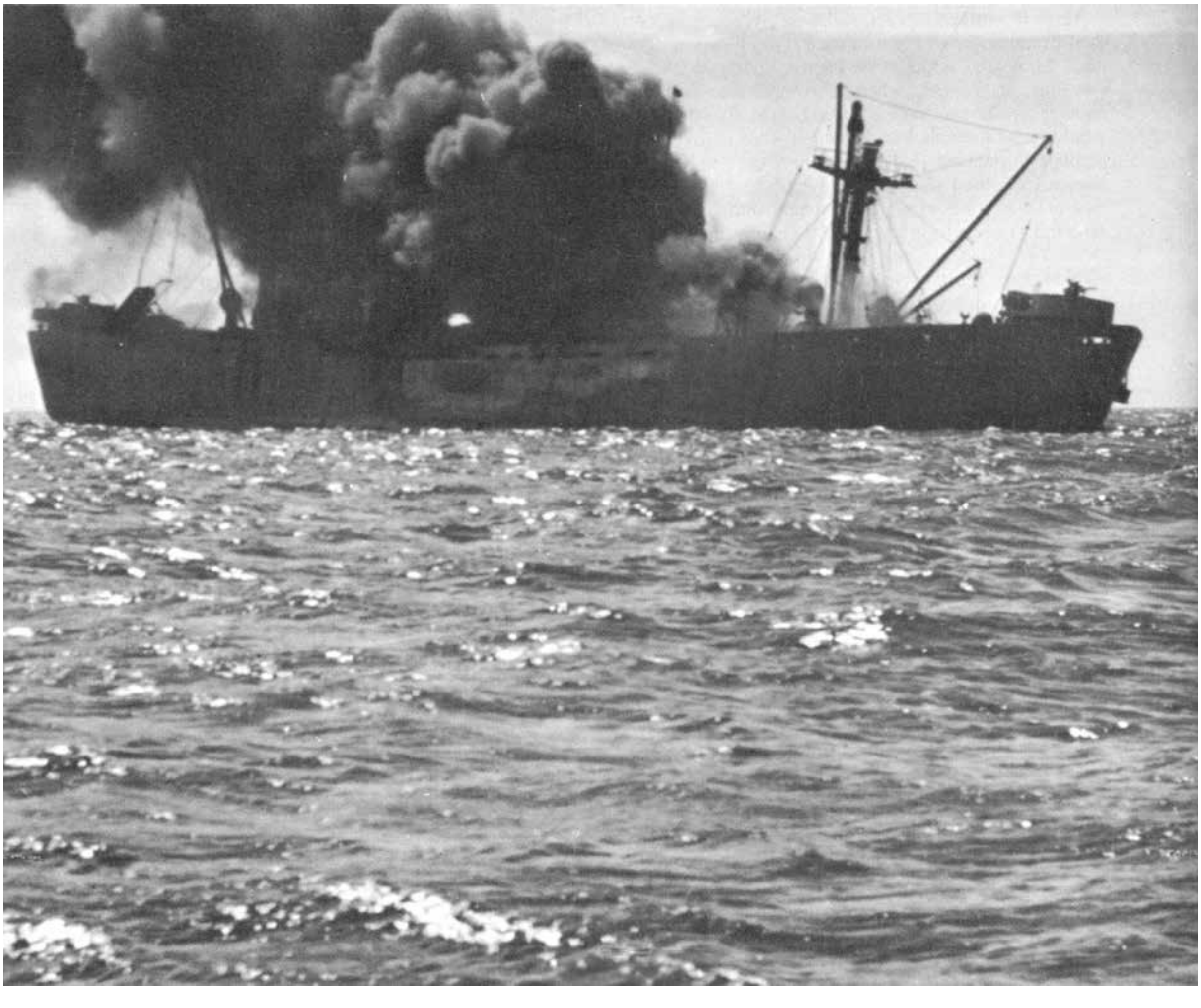
Early in the morning of 4 March 1944, following two days of particularly rough seas, a terrific noise "like an explosion" was heard forward of the bridge, followed by two lesser noises. The engines were stopped and immediately afterward the forward end of the ship separated from the after end and floated away. The break had occurred between the engine room bulkhead and the No. 3 hatch.

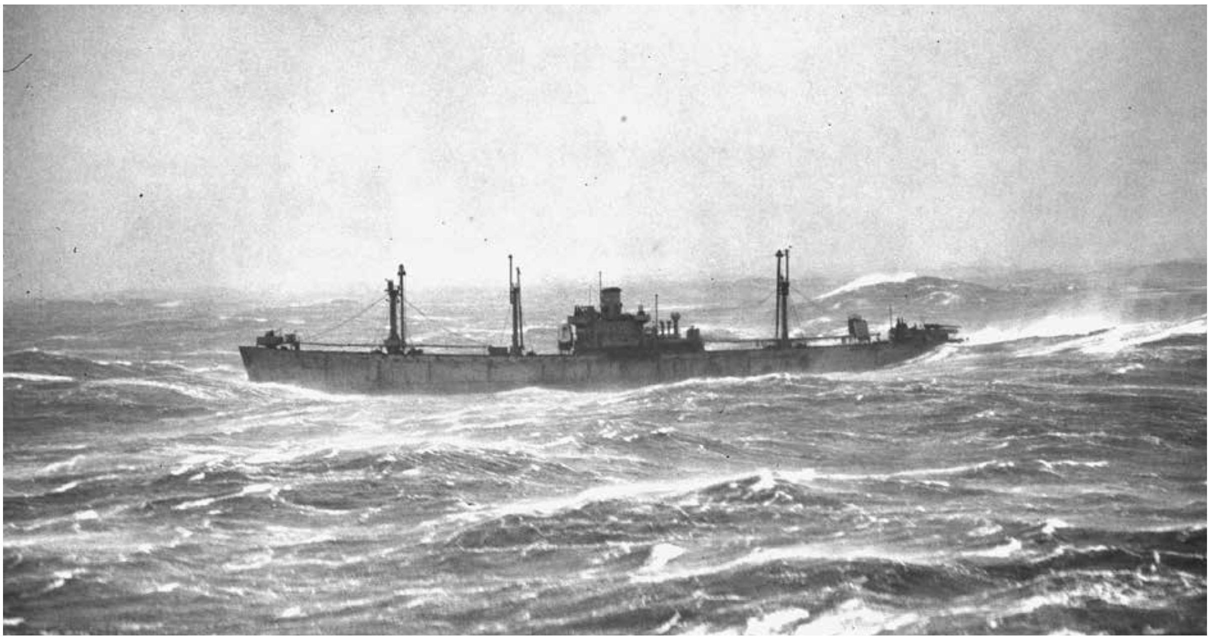
Everybody aboard happened to be in the stern section which stayed afloat. On the following day the crew was rescued by the British ship *Eddystone*, the stern section was towed to Halifax safely intact from stern to bridge, and the engine room was okay with the exception of some broken piping.

Some of the crew thought the vessel had been torpedoed, because of the loud explosion when it cracked, but there was no flash and no sign of the presence of a submarine. The Captain thought "the cause of the breaking was probably fatigue, but may have been a torpedo."

Although only a very small percentage of the Liberty ships suffered serious fractures, small cracks were far from unusual and the Commission was very concerned to discover the best way to remove this hazard. It was recognized that cold temperatures as well as severe seas brought about breaks and this was emphasized by the fact that practically all of them occurred in the cold waters of the North Atlantic or the North Pacific. This was borne out particularly, by the series of fractures suffered by vessels under the Russian flag and operating in the cold waters of the Aleutian area. Out of a total of about 28 such vessels operating at the beginning of 1944 six, all Liberty ships, suffered cracks which caused them to be laid up for repairs. One of these was the *Valeri Chkalov* which broke completely in two.

The Commission, American Bureau of Shipping, the Bureau of Ships and the US Coast Guard both jointly and singly investigated the subject of fractures and sought to determine the best possible safeguards. Measures were taken to ensure careful and properly supervised welding work in the shipyards and a list of required changes was drawn up for all ships in operation. For Liberty ships these changes included modification of hatch corners, installation of inboard and gunwale crack arrestors and bilge keel modifications. Troop and hospital ships were given additional reinforcement.





Spectacular failures attracted more attention than notable successes, among individual ships. A comprehensive view of the Liberty ship program requires that mention of one be followed by mention of the other. The SS *William Moultrie* affords an example of a Liberty ship which underwent repeated bombing attacks and came through with hull intact and no leaks. On one occasion it was near an ammunition ship which blew up. The concussion lifted the *Moultrie* literally out of the water and it struck so hard on coming down that it bounced. Then the bow went under but the vessel righted itself and appeared to have suffered no serious damage. On its return voyage to the United States it experienced heavy weather, but again, the *Moultrie* came through intact.

The *Edgar Allan Poe* is another example of a ship that survived severe treatment. It was torpedoed in way of the engine room. The entire space was damaged as was the whole midship structure and the lower decks were lifted. However, the bulkheads held and no water entered the cargo spaces. The vessel was repaired and continued in service.

By the end of 1943 the Liberty ship was beginning to win the respect of shipping circles. The disparaging name Ugly Duckling was heard less and less. An article by “Skipper” in the *Pacific Marine Review* for September 1943, serves to illustrate this change of opinion. This article was in answer to the question as to why Masters should be known to say that they would rather be chief mate of a “C” ship than Master of a Liberty. “Skipper” replied that “we are firmly convinced that there is nothing wrong with the Liberty ship that a sailor cannot remedy, and that as a ship she is able to go to sea, safely reach her destination and deliver the goods, turn about and return to do the job right over again.”

He then listed the main complaints against the Liberty ship along with his answers to these complaints. They included the following: l) open bridge uncomfortable – the watch officer needs an unobstructed view, especially in war times; 2) they are hot ships – this is preferred in northern latitudes and is aggravated by blackout conditions; 3) they are slow – most of them are doing over their designed speed and, in any case, are usually in convoys which take a safer route than the fast ones; 4) compass difficulties – due largely to the fact the vessel is built in pre-fabricated sections which result in a magnetic upheaval when welded together, and this is complicated further by degaussing, but the Master can rectify errors by moving the compass magnets and flinder bars.

“Skipper” considered the Liberty ship to be very stable, capable of carrying a good deckload and well provided for ballasting according to needs. “These ships,” he said, “handle well and steer fine, have good auxiliaries and equipment, and usually make better than the designed speed. Their power plant is simple and easily handled, their fresh water capacity is ample and well arranged." In conclusion "we are sure that, given another year of operation, the Liberty ship will have just as many loyal boosters as she has fault-finders, if that condition does not exist already."

At this time there was, in the Commission's files, some evidence of the existence of "loyal boosters." For example, Captain Sweeney of the SS *Andrew Hamilton* wrote his port captain that "these Liberty ships are all right. I had this one in North Atlantic gales loaded and in North Atlantic gales in ballast and, can truthfully say I couldn't ask for a ship to behave better. We haven't slowed down or stopped once since we left the yard and no repairs in port." In forwarding this letter to his superior, the port captain remarked that Captain Sweeney had come up "from schooners and square riggers before he went 'monkey-wrench' sailing, so he knows ships and knows how to handle them."

Admiral Land received a letter from the Captain of the SS *Richmond Munford Pearson* and sent it on for publication at the Delta Shipbuilding Company where the vessel was built. After stating that he had been under attack several times and in heavy seas in the Atlantic and Caribbean, the Master went on to say, "You built us a darned good job. The engines worked like a clock. She steered like a yacht. She steers as well going astern as she does going ahead. The vessel has the finest equipment that any seaman could ask. I have been a Master for 40 years both sail and steam and this Liberty is the best handling heavy cargo ship that ever I was on."

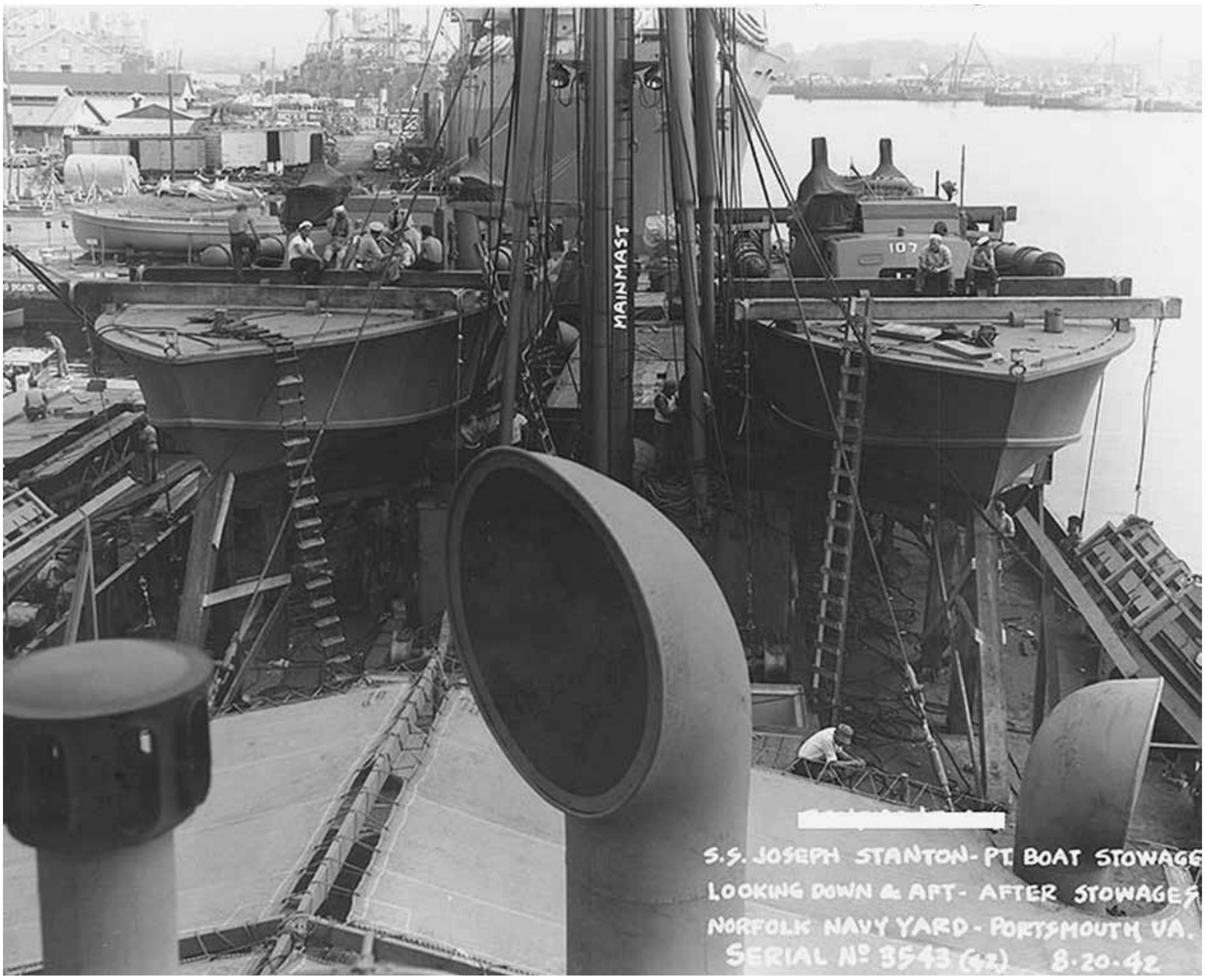
Of all the wartime convoy routes the one that put the Liberty ships to the ultimate test were the "Russian convoys."

These convoys which took war material to the former Union of Soviet Socialist Republics (USSR) via the northern trade route during the Second World War have a special place in the history of the war at sea because of the unequalled hardships they faced. After being assembled in the grim harbor of Hvalfjord in Iceland or a remote Scottish loch, the convoys would sail through the Norwegian and Barents Seas to the Russian port of Murmansk in the Kola Inlet or Archangel on the White Sea. The route the convoys had to follow is notorious for bad weather and conditions which border on the limits of human endurance. In winter the northern latitudes produce conditions of continuous darkness, while from May to August there is perpetual daylight. The fierce storms which frequently battered the convoys caused ice to build up on the ships' superstructures and deck fittings, and this had to be chipped away to prevent the vessels from becoming top-heavy. This was treacherous work, and a man's chances of survival should he fall overboard into that icy water were very slim.

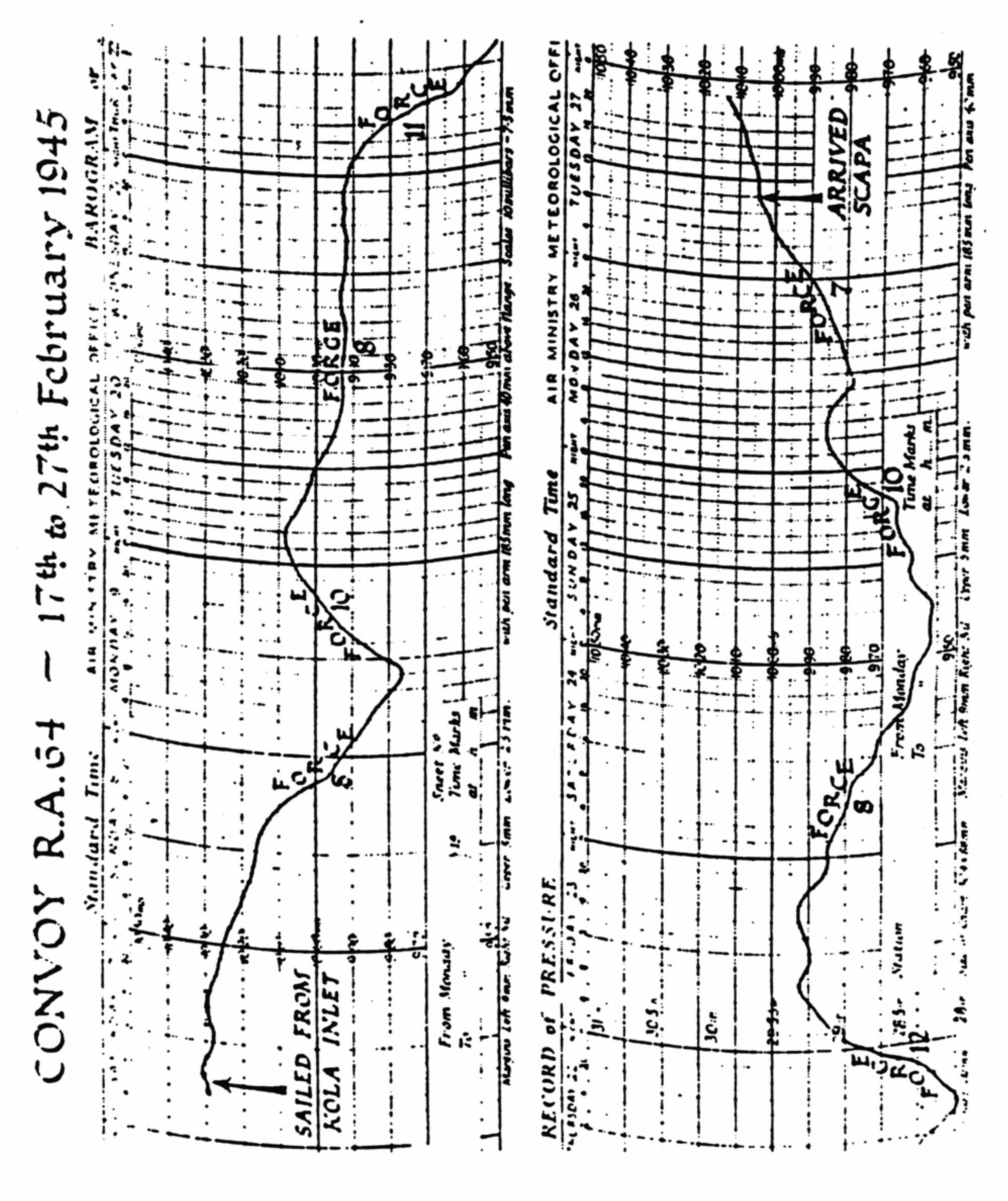
As if the appalling climate were not enough, the convoys also faced continual attack since they were always within range of German airfields in Norway. The Norwegian fjords also sheltered U-boats and capital ships like the *Tirpitz*, which meant that considerable British and American forces were needed to cover the convoys when they could have been put to better use in other theaters of war.

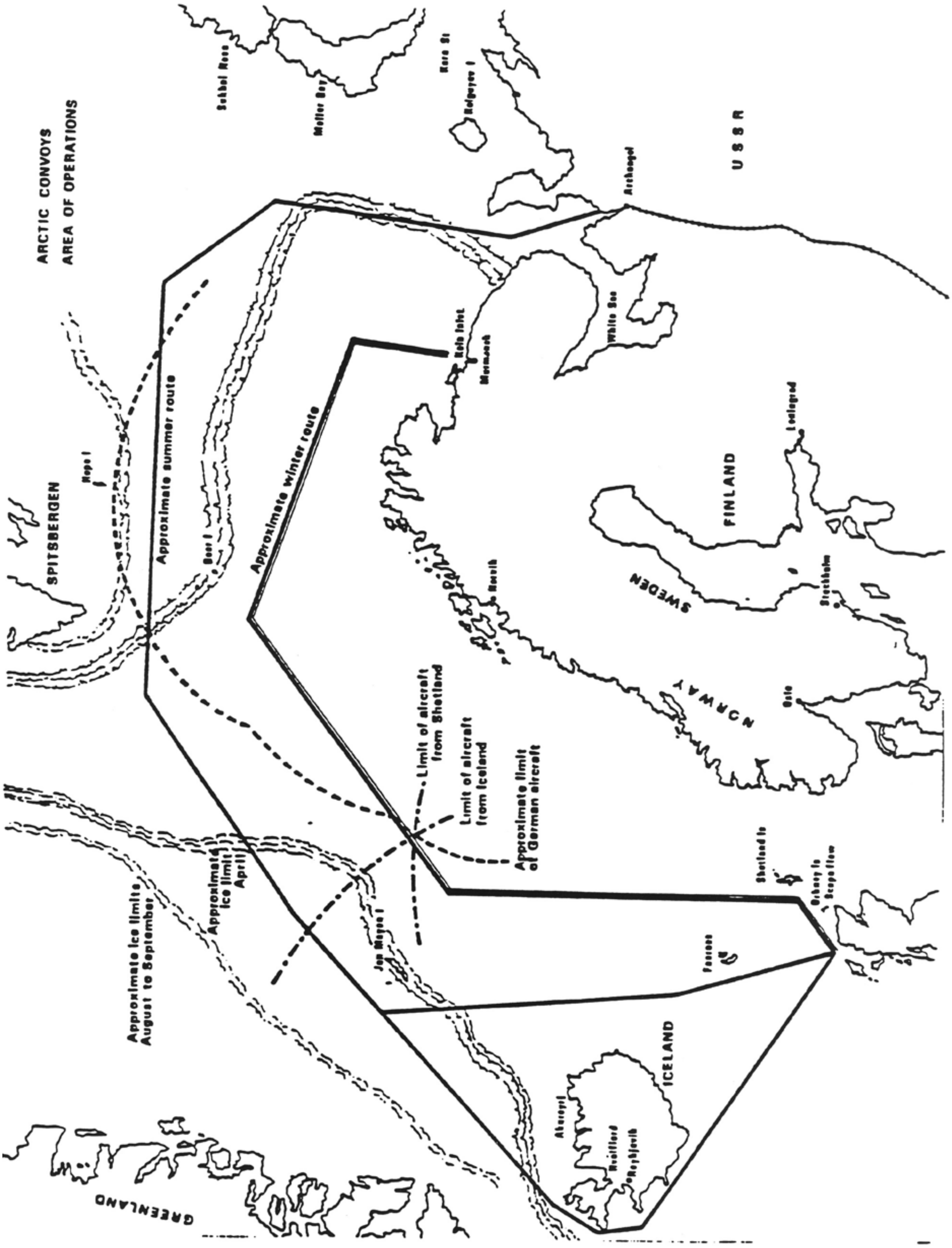
The total quantities of material supplied to the Soviet Union throughout the war were immense, although only 24.2 percent was delivered via the Arctic route; the remainder was sent via the Persian and Pacific routes. There is no doubt that the USSR needed every scrap of assistance available, but in light of these figures it could be argued that the Russian convoys were more important as a political demonstration of Allied solidarity than for the quantities of material they supplied. If this is so, then the price paid was very high.

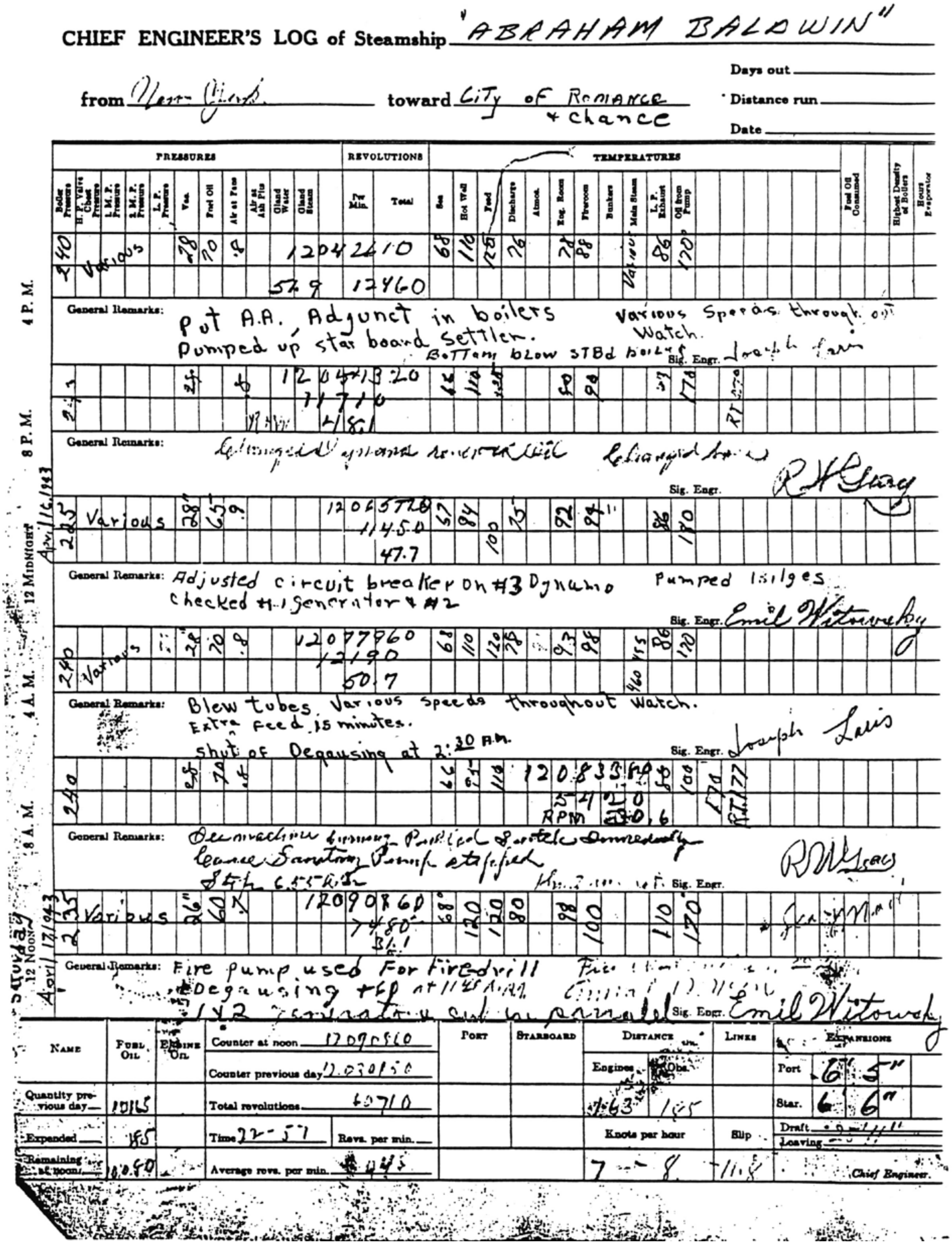
It is sad to note that the heroic deeds of ships and men that braved the hazards of the convoy routes to carry aid to Russia in World War II were soon forgotten in Murmansk. There is not a single testimonial to the allied merchant seamen and their naval comrades who died to keep supplies flowing to the Russian front. The Murmansk Museum reportedly contains many relics of World War II, but I'm told there is no remembrance whatsoever of the wartime convoys or of the 97 ships and countless men lost in making the hazardous Murmansk run.



The images which follow were found in the photo archives of the Imperial War Museum in London and depict the weather encountered by the Russian convoy RA64.


CONVOY R.A.64 — 17th to 27th February 1945
BAROGRAM
AIR MINISTRY METEOROLOGICAL OFFICE
RECORD of PRESSURE
Standard Time
MONDAY 19
TUESDAY 20
SATURDAY 24
SUNDAY 25
MONDAY 26
TUESDAY 27
SAILED FROM KOLA INLET
FORCE 8
FORCE 10
FORCE 8
FORCE 11
FORCE 12
FORCE 8
FORCE 10
FORCE 7
ARRIVED SCAPA
From Monday
Time Marks


ARCTIC CONVOYS
AREA OF OPERATIONS
Sukhoi Nose
Moller Bay
Kara St
Kolguyev I
U S S R
Archangel
White Sea
Kola Inlet
Murmansk
Leningrad
FINLAND
Stockholm
SWEDEN
NORWAY
Oslo
Narvik
SPITSBERGEN
Hope I
Bear I
Approximate summer route
Approximate winter route
Limit of aircraft from Shetland
Limit of aircraft from Iceland
Approximate limit of German aircraft
Approximate ice limit April
Approximate ice limits August to September
Jan Mayen I
Faeroes
Shetland Is
Orkney Is Scapa Flow
ICELAND
Akureyri
Hvalfiord
Reykjavik
GREENLAND



CHIEF ENGINEER'S LOG of Steamship "ABRAHAM BALDWIN"

from New York toward City of Romance + chance

Days out

Distance run

Date

Watch	Boiler Pressure	H.P. Valve Chest Pressure	1 M.P. Pressure	2 M.P. Pressure	L.P. Pressure	Vac.	Fuel Oil	Air at Fans	Air at Ash Pits	Gland Water	Gland Steam	Per Min.	Total	Sea	Hot Well	Feed	Discharge	Atmos.	Eng. Room	Fireroom	Bunkers	Main Steam	L.P. Exhaust	Oil from Pump	Fuel Oil Consumed	Highest Density of Boilers	Hours Evaporator
4 P.M.	240 240	Various				28	70	8				57.9	12042610 12460	68	110	125	76		78	88		Various	86	170			
8 P.M.	[illegible]					28		8				41.8	120491320 11710	66	110	120			90	98			[illegible]	170			
12 Midnight	285 285	Various				28	65	9				47.7	12065720 11450	57	84	100	75		92	94			86	170			
4 A.M.	240	Various				28	70	8				50.7	12077960 12190	68	110	120	78		93	98		455 460	86	170			
8 A.M.	240 240					28	74	8						66	65	110											
12 Noon	235 235	Various				26"	60	X				51.1	12090860 7480	80	120	120	80		98	100			110	170			

4 P.M. — General Remarks: Put A.A. Adjunct in boilers. Pumped up starboard settler. Bottom blow STBd boilers. Various speeds throughout watch. Sig. Engr. Joseph [illegible]

8 P.M. — RT 270 — General Remarks: Changed [illegible] Changed [illegible] Sig. Engr. R. H. Gray

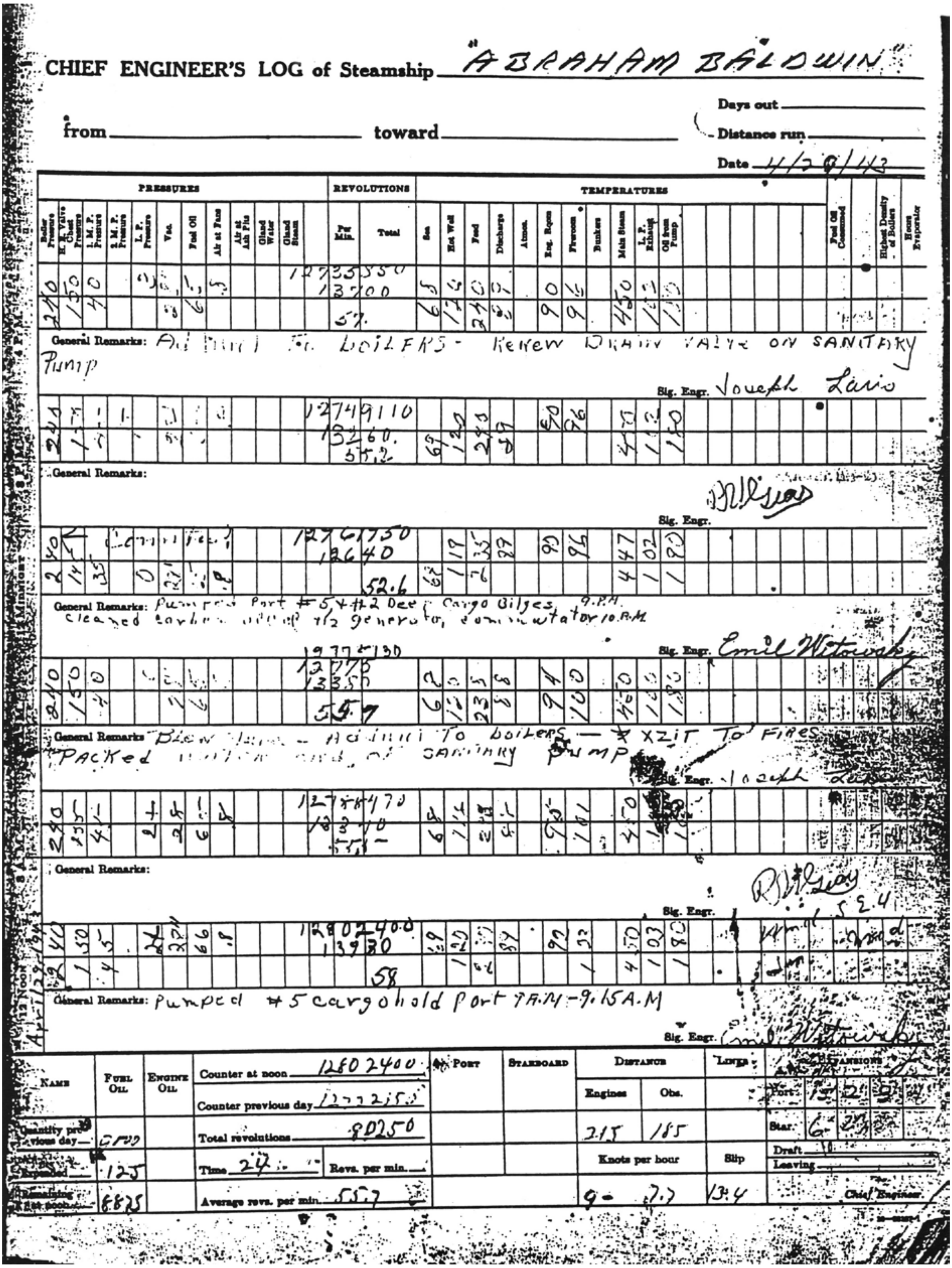
12 Midnight — April 16, 1943 — General Remarks: Adjusted circuit breaker on #3 Dynamo. Pumped bilges. Checked #1 generator & #2 Sig. Engr. Emil Witowsky

4 A.M. — General Remarks: Blew tubes. Various speeds throughout watch. Extra feed 15 minutes. Shut of Degausing at 2:30 A.M. Sig. Engr. Joseph Lewis

8 A.M. — 120833880, 54120, RPM 50.6, 100, 170, RT 177 — General Remarks: [illegible] Sig. Engr. R. H. Gray

12 Noon — Saturday April 17, 1943 — General Remarks: Fire pump used for firedrill. Degausing [illegible] at 11:45 A.M. #1 & 2 generators [illegible] in parallel. [illegible] Sig. Engr. Emil Witowsky

Name	Fuel Oil	Engine Oil			Port	Starboard	Distance Engines	Distance Obs.	Links	Expansions	
			Counter at noon 12090860							Port	6' 5"
			Counter previous day 12030150								
Quantity previous day	1015		Total revolutions 60710				163	165		Star.	6' 6"
Expanded	185		Time 22-57	Revs. per min.			Knots per hour		Slip	Draft [illegible] Leaving [illegible]	
Remaining at noon	1080		Average revs. per min. 44.3				7 - 8		11.8	Chief Engineer.	



CHIEF ENGINEER'S LOG of Steamship "ABRAHAM BALDWIN"

from ______ toward ______

Days out ______
Distance run ______
Date 4/28/43

PRESSURES — REVOLUTIONS — TEMPERATURES

Revolutions: 12733550 / 13700 / 57.

General Remarks: Ad [illegible] To boilers - Renew drain valve on sanitary pump

Sig. Engr. Joseph Lario

Revolutions: 12749110 / 13260. / 55.2

General Remarks:

Sig. Engr. R.V. Gray

Revolutions: 12761750 / 12640 / 52.6

General Remarks: Pumped Port #5 + #2 Deep Cargo Bilges, 9 P.M. cleaned carbon off of #2 generator, commutator 10 P.M.

Sig. Engr. Emil Witowsky

Revolutions: 12775130 / 13350 / 55.7

General Remarks: Blew tubes - Added [illegible] to boilers - Exzit to fires. Packed water end of sanitary pump

Sig. Engr. Joseph Lario

Revolutions: 12788470 / 13340 / 55.[illegible]

General Remarks:

Sig. Engr. R.V. Gray

Revolutions: 12802400 / 13930 / 58

General Remarks: pumped #5 cargohold port 7 A.M. - 9.15 A.M

Sig. Engr. Emil Witowsky

12 Noon April 29, 1943

Name	Fuel Oil	Engine Oil
Quantity previous day	6950	
Expended	125	
Remaining at noon	6825	

Counter at noon 12802400
Counter previous day 12722150
Total revolutions 80250
Time 24 Revs. per min. ______
Average revs. per min. 55.7

Port ______ Starboard ______

Distance	
Engines	Obs.
215	185

Knots per hour 9 - 7.7
Slip 13.4

Expansions
Port 15 2 9
Star. 6 23

Draft ______
Leaving ______

Chief Engineer ______

CHAPTER XI

The Liberty Ship – Basic Design Hull and Machinery

The majority of the Liberty ships were of the standard, or basic, design. The remaining vessels each conformed to one of the several unique designs. These were given a different designation and type number.

The basic design was of a vessel of the full scantling type, with a raked stem, cruiser stern, a single screw and a balanced rudder. There were two complete decks, the upper and the second. The second deck was continuous throughout and seven watertight bulkheads, all extending to the upper deck, which divided the vessel into five cargo holds, fore and aft peak tanks and three deep tanks. The propelling machinery and boilers were located in a single midships compartment.

Hull

The hull was transversely framed and, in most cases, completely welded – taking some 43 miles of welding to build one ship. The stem above the load waterline was of heavy formed plate; the stern frame was of cast steel, in three pieces. The contra-form rudder top post was of forged steel, a gland-packed rudder head carrier took the whole weight of the rudder and the rudder neck bearing was of cast steel with a lignum vitae lining.

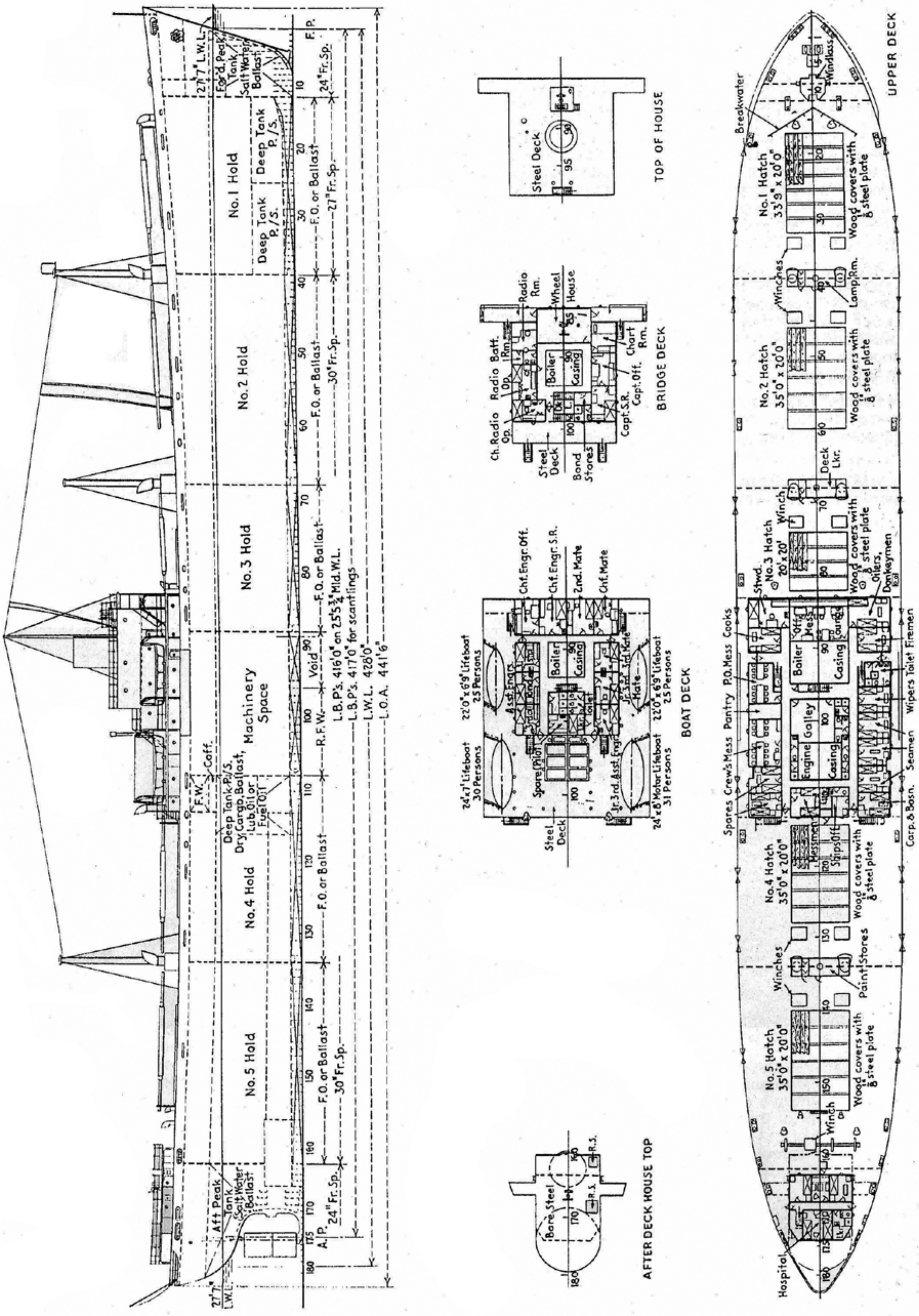
Bilge keels, 10 inches deep, extended from frame 54 (approximately half-way along the No. 2 hold) to frame 105 (after end of machinery space).

All the main bulkheads were watertight. There was one watertight door, this situated at the after end of the engine room and leading to the shaft tunnel. Steel centerline bulkheads were arranged in the holds, clear of the hatches. The centerline bulkhead in the aft deep tank was oiltight and that in the forward deep tank, watertight.

Of the lower holds, No. 1, with a length of 60.75 ft and a depth of 14 ft, had the least capacity, due to the underlying deep tanks. The No. 2 hold – the largest of all – had a length of 72.5 ft and a depth of 24.5 ft and the No. 3 hold, of the same depth, measured 50 ft in length. Nos. 4 and 5 holds – both with the shaft tunnel running through – were of smaller capacity, No. 4 being 45 ft in length by 25 ft in depth and No. 5 being 70 ft long by 26.5 ft in depth. The ’tween deck spaces were similar to the corresponding holds in length, but varied in depth, ranging from 13 ft for No. 1 to 9 ft for No. 5.

The two forward deep tanks, situated under the No. 1 hold, were used either for dry cargo or for salt water ballast. The No. 1 was 28 ft in length by 25 ft in breadth, No. 2 was 30 ft by 49 ft and both had a mean depth of 9 ft. The third one, situated aft of the machinery space, was 20 ft in length by 55 ft breadth and with a mean depth of 24.5 ft, and could be used for dry cargo, cargo oil or fuel oil

The double bottom tanks, six on either side, were fitted as fuel oil tanks but were also able to carry water ballast, except for the portion under the engine, which was designed to carry reserve feed water and, that under the boilers, which was a void tank. The fuel oil settling tanks were located at the sides of the ship, in the way of the boilers.



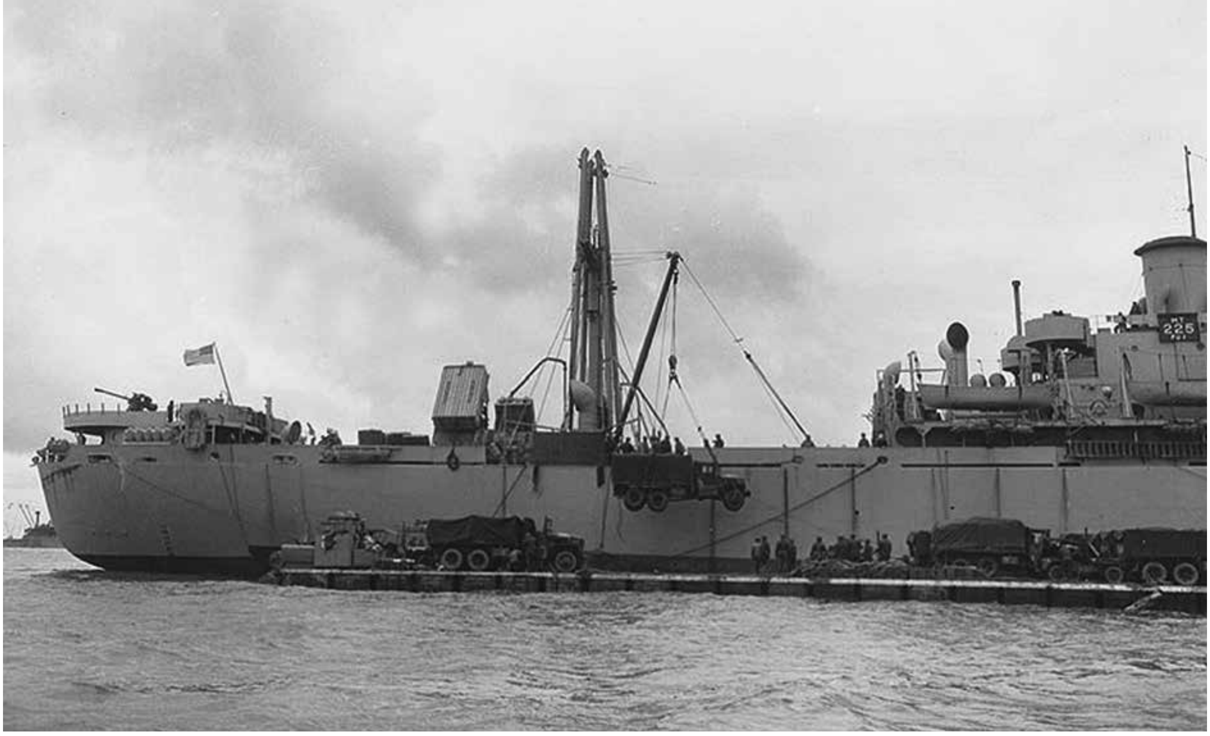
Specifications and basic layout of a Liberty ship

All the upper deck cargo hatches, with 3 ft-high coamings, had a clear width of 19 ft 10 in. In length Nos. 2, 4 and 5 were 34 ft 10 in.; No. 1 was 33 ft 7 in. and No. 3 was 19 ft 10 in. Hatchways were fitted with portable hatch beams and the covers were of wood, except those of the deep tanks on the second deck and in No. 1 hold, which were of steel. The 'tween deck hatch covers were flush-fitting. Wood, mostly Douglas fir, was used as a ceiling on the tank tops and under the main cargo hatches Nos. 2, 3 and 4, extending one foot beyond the hatch line, beyond which a steel-covered brow was fitted all around. Plywood, 1.125 inches thick, was used for joiner bulkheads – those dividing staterooms, passages, messrooms, offices and the like, and wood was also used for the ship's furniture.

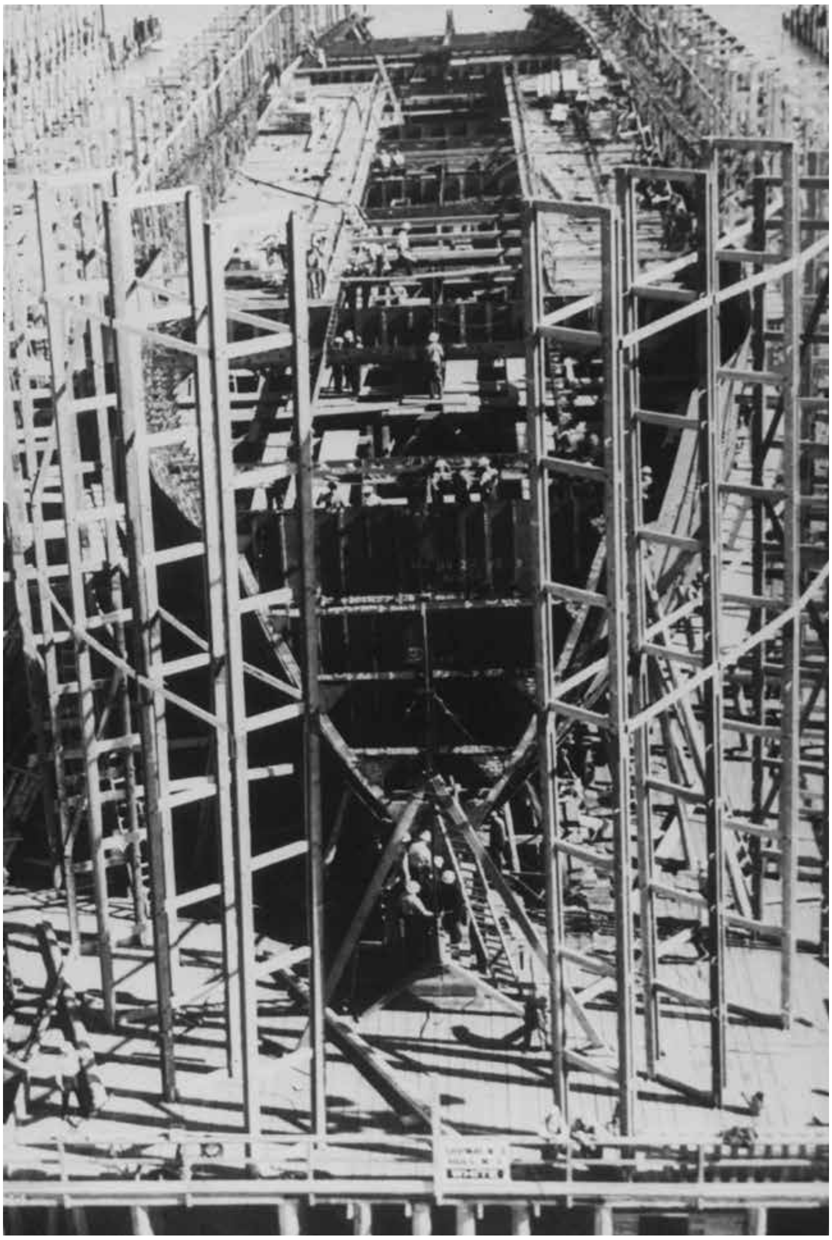
One of the most important attributes of this emergency-type ship was its ability to carry a good deadweight of cargo. The deck space was as important as the under-deck area and except for the midships house and the gun platforms there were no important obstructions for the whole of the Liberty's length. The uniform allowable deck load for the whole of the upper deck was 336 lbs per sq ft. For the second deck the loads ranged from 440 lbs per sq ft to nearly 700 lbs, and these applied from side to side of the vessel, including the hatches. Therefore, it was to the latter positions that the smaller permitted loads applied. For the deep tank tops the load was 1,400 lbs per sq ft and for both the tank tops and the tunnel top recess it was 1,650 lbs per sq ft.

Accommodation was provided in a three-deck-high midship house and in a single deck house aft. The captain's stateroom and office was on the bridge deck, starboard side, with the radio operator on the port side. The quarters for the deck officers and engineers were on the boat deck and for the crew, with a maximum of four persons to a cabin, on the upper deck. The officers' mess and lounge were at the forward end of the deck house on the upper deck, while the petty officers' and crews' messrooms were on the port side of the deck house. The galley was situated amidships, between the boiler and engine casings. The after-deck house accommodated some of the gunners but also included the ship's hospital, medical store-rooms, toilets and showers and watertight-trunk ammunition hoist.

The overall accommodation, though somewhat smaller than that built into the Maritime Commission's "long range program" (C-type) ships, was modern, clean and comfortable, and it boasted the most modern sanitation facilities.



Liberty ship unloading trucks onto a Rhino barge



Built-in berths were provided in the officers' staterooms and pipe berths in the hospital and crews' quarters. The galley was equipped with a two-oven, center-fired, coal-burning range, a 25-gallon steam-jacketed stock kettle and all other necessary appliances. In each mess there was an electric hot plate and an electric toaster.

Beneath the midship house at second (or 'tween) deck level and to port and starboard of the engine and boiler casing were situated the refrigerated vegetable, dairy, meat and fish rooms, clean and soiled linen rooms, dry store-rooms and the engineers' stores.

All the crew spaces were steam heated.

The basic Liberty ships were originally intended to have a crew of 45, but this figure was later increased to include gun crews to a maximum of 36 men, thus making a total of 81 persons. Subsequently the division of this figure was amended: the crew of the ships was increased to 52 and the gun crew reduced to 29.

There were three steel masts, with mast houses, located at frames 39, 68 and 134. The mast at frame 39 was designed for a safe working load of 30 tons, with shrouds and three preventer stays. The mast at frame 68 was designed for a safe working load of 10 tons, with shrouds but without preventer stays, and the mast at frame 134 for a safe working load of 15 tons, with shrouds and a centerline preventer stay.

The cargo handling gear was designed for simplicity of operation to meet the handling difficulties likely to be encountered in foreign ports, and for this reason British practice was followed in its arrangement and detail. As designed, five cargo booms were installed on the mast at frame 39, four of them 5-ton booms, two each to port and starboard, and the other of 30 tons, on the centerline. Two 5-ton booms were installed on the mast at frame 68, and four 5-ton booms and one of 15 tons on the mast at frame 134.

Although many 5-ton booms were fitted, all the fittings for them had a 10-ton safe working load, to permit the installation of 10-ton booms and rigging, if desired. The gear for the 5-ton booms was designed for a boom angle of 25 degrees, and for the 15 and 30-ton booms an angle of 35 degrees. However, all the cargo gear was subject to some variation as requirements changed due to the demand of war, and frequent later additions were a 50-ton boom at the No. 2 hold and a 30-ton boom at the No. 4.

There were ten steam-driven cargo winches, five right-handed and five left-handed, these being nine 7 in. x 12 in. double-geared ones for one 5, 15 and 30-ton booms and one 10.5 in. x 12 in. double-geared winch for the 50-ton boom. In addition to the cargo winches the deck machinery included a windlass, warping winch and steering gear.

The windlass was a two-cylinder steam-driven unit with quick-acting warping head, capable of hoisting two anchors simultaneously from a 30-fathom depth at a chain speed of 30 feet per minute. There were two ‘wildcats” on the main horizontal shaft and two warping heads on the intermediate shaft ends, all driven by spur gearing. Each wildcat was fitted with a hand-operated brake of sufficient capacity to stop and hold the anchor and chain when let go under control of the brake.

The warping winch, installed aft, was of the horizontal reversible steam spur-gear type, capable of handling a load of at least 2,500 lbs at a speed of 75 ft per minute for taking slack lines.

The steering gear was of the two-cylinder type, with a steam engine controlled by telemotor from the wheelhouse and an extension from the steering wheel to the upper bridge. The steering gear was capable of moving the rudder from hard-over to hard-over (70 degrees) in 30 seconds when the vessel was going full ahead. For emergency operations, tackle was arranged for connecting the quadrant to the after winch. A trick wheel was fitted to the engine for emergency local control and was connected by shafting to the wheel at the aft steering station. A mechanical rudder-angle indicator was installed in the steering gear room.

Hawse pipes, of cast steel, were provided for two stockless bower anchors and welded chain pipes led from the windlass bedplate to the chain locker. The anchor chains were of cast or forged steel, made in 15-fathom lengths, the lengths connected by 2.0625 in. patent oval detachable links and the anchors connected by 2.25 in. patent pear-shaped detachable links.

The stream line (for a 2,388 lb stream anchor) and tow lines were of steel wire rope and the hawsers and warps of manila.

The Liberty ship was designed as a full ended, low speed ship with good deadweight capacity and adequate cubic. Its hull lines forward were relatively full with an entrance angle of 45 degrees and relatively fine for the run aft. With a block coefficient of 0.759 and an LCB 1.0 ft. forward of amidships it was considered an efficient hull form. The design was intended for a service speed of 11.5 knots and experience indicated that the ship was well suited for this speed. Its length between perpendiculars was 416 feet, the prismatic coefficient was about 0.76 and the speed length ratio at 11.5 knots was about 0.56. It would have been possible to drive the hull at 13 or 13.25 knots but at speeds above this the power increased so rapidly as to be uneconomical. Standardization trials showed a speed of 12.5 knots at 2,250 shp and 76.0 rpm with a fuel consumption rate of 240 bbls/day. The vessels of this basic design experienced no stability problems. However, the Liberty ship’s length to beam ratio of 7.3 would be considered rather slender by today’s standards.

Liberty Ship Particulars

Length overall	441 ft 6 in.
Length between perpendiculars	416 ft
Length registered	422 ft 8 in.
Length waterline	427 ft
Breadth moulded	56 ft 10.75 in.
Breadth extreme	57 ft
Draft, original	26 ft 10 in.
Draft, as classed	27 ft 8.875 in.
Freeboard	9 ft 8.75 in.

Tonnages

Registered	7,176 gross (4,380 net)
US measurement	7,191 gross (4,309 net)
Panama measurement	7,223 gross (5,093 net)
Suez measurement	7,230 gross (5,399 net)
Deadweight, as planned	10,414
Deadweight, as classed	10,865
Displacement	14,245
Displacement light ship	3,380 (at 7 ft 9 in. draft)
Lightweight	3,401
Defense equipment	130

Capacities

Cargo, cu ft		
No. 1 hold and 'tween decks	84,181 (grain)	75,405 (bale)
No. 2 hold and 'tween decks	145,604 (grain)	134,638 (bale)
No. 3 hold and 'tween decks	96,429 (grain)	83,697 (bale)
No. 4 hold and 'tween decks	94,118 (grain)	82,263 (bale)
No. 5 hold and 'tween decks	93,190 (grain)	82,435 (bale)
Deep tanks (combined)	49,086 (grain)	41,135 (bale)
Totals	562,608	499,573

General stores, cu ft	11,626
Refrigerated stores, cu ft	1,918
Water ballast, tons	2,811
Fixed ballast, tons	281
Fuel oil, tons	1,819
Freshwater, tons	188

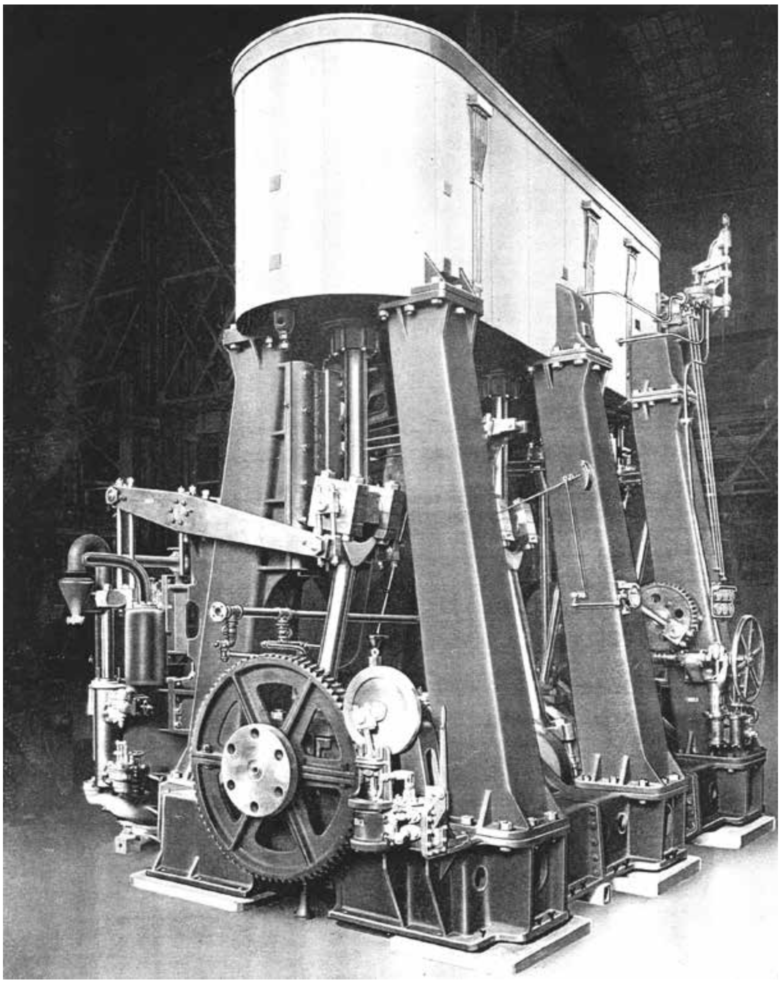
Masts

Height above bottom of keel plate	82 ft 0.25 in.
Telescopic top masts	
Height above bottom of keel plate	102 ft 0.25 in. (not on foremast)

Booms

5 ton (at fore and after masts), length	55 ft
5 ton (at No. 3 hatch), length	47 ft
15, 30 and 50 ton (on centerline) length	51 ft

Machinery – Engines



Operating side of engine

The Liberty ship's main engine was steam reciprocating and based upon a design from the North Eastern Marine Engineering Co. This company commenced business as a marine engine builder in 1865 at South Dock, Sunderland and went out of business in the 1960s. Most of the company's records were taken over by the Tyne & Wear Museum, Newcastle-on-Tyne. The records are not readily accessible for in-depth research. However it is known that the design is representative of engines built by North Eastern Marine around 1910.

It is interesting to note the first completely successful triple-expansion installation was that of the vessel *Aberdeen* built in 1881. Some authorities regard this installation as the first complete demonstration of the efficiency and reliability of the three-crank, triple-expansion steam engine. The diameter of the cylinders was 30 in. x 45 in. x 70 in. with a stroke of 54 in. The engine worked at 55 rpm and was supplied with steam at 125 psi. The vessel had a speed of 11.3 knots using 35 tons of coal per day. Shortly after this steam pressure reached 180-220 psi and this became the norm for the triple-expansion engine.

It can be seen from the above that the choice of the "up and down" reciprocating steam engine as the power plant for the Liberty ship reached back in time, for although it was the predominant propulsion unit for powered ships up to the early part of the 20th century, it was fast becoming obsolete by the start of World War II. However, this type of engine was chosen so that parts could be standardized and manufactured by contractors with no previous experience of marine work.

In America there were no experienced personnel to run this most simple of marine engines. But its workings could be learned quickly and many Liberties sailed with 'black gang' crews of oilers and firemen as young as 16 years of age, many of them with only three months' training and often, with their superiors only a few years older, most of whom had never seen a ship's engine room prior to the war.

The engine was of the vertical, inverted, direct acting, condensing, three-cylinder, triple-expansion type having a high-pressure cylinder diameter of 24.5 inches, a medium-pressure cylinder diameter of 37 inches, a low-pressure cylinder diameter of 70 inches and a stroke of 48 inches. It weighed 135 tons and was designed to operate on a steam pressure of 220 pounds per square inch with a maximum steam temperature of 450 degrees F; with 26 inches of vacuum, it developed 2,500 indicated horsepower at 76 revolutions per minute.

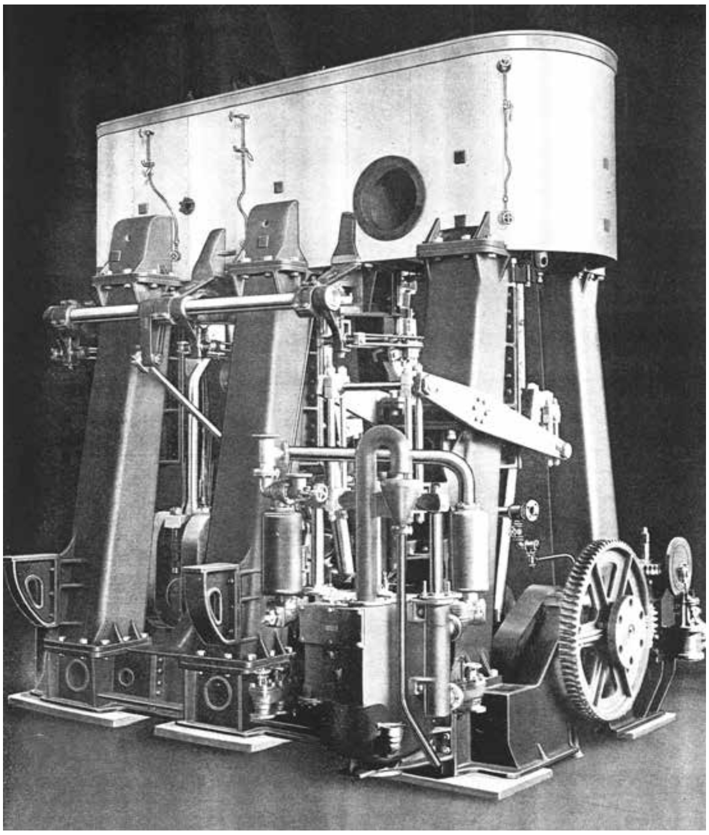
The direction of rotation of the engine was clockwise as seen from the coupling, or after end, looking forward, and the rotational sequence of the cranks was high-pressure, low-pressure and medium-pressure. Customary practice was followed in the actual arrangement of the cylinders, which were disposed high-pressure, medium-pressure and low-pressure from the forward to the after or coupling end.

Designed to bolt directly to the tank top of the double bottom, the engine bedplate, comprising three cast-iron sections fitted together, formed a continuous girder under the entire engine and supported the cylinders through columns. Each of the three sections of the bedplate had two integrally cast cross-girders which were fitted with recesses to receive the main bearings for supporting the crankshaft.

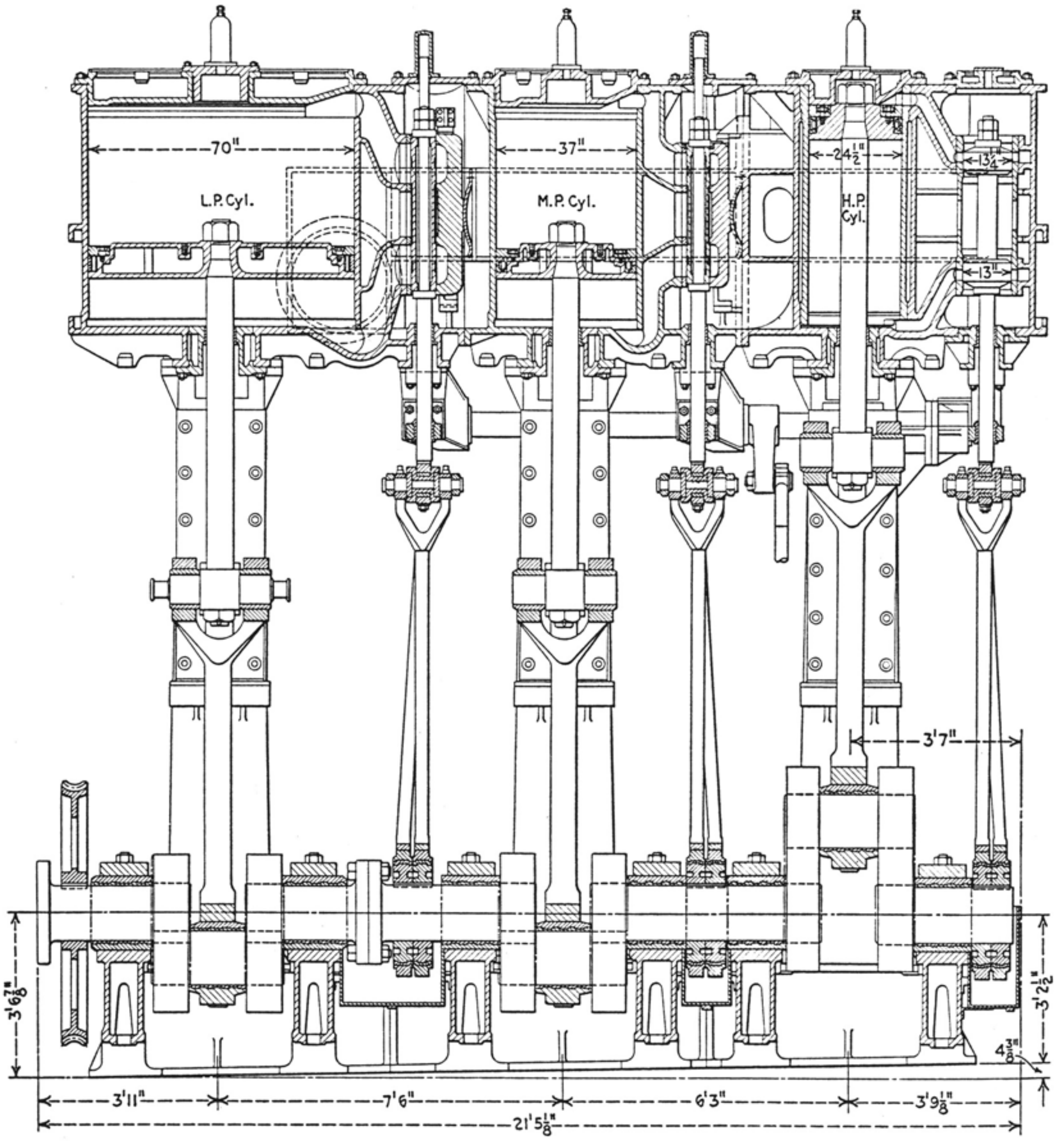
Each cylinder was supported by two columns, one on each side, directly in line with the crank throws and symmetrically disposed in a transverse direction. The columns were of box-type construction and were made of cast iron. Those at the back, or exhaust, side of the engine were fitted with separate crosshead guide plates and backing guides. These crosshead guides were water cooled, as were also the main crankshaft bearings and the eccentrics, the later being provided with sump pans for this purpose; the guides and bearings were connected directly to the water service piping.

Practically all the foregoing parts are shown clearly in the photographs, which were taken from the after or coupling end of the operating and the exhaust sides, respectively, of the finished engine. These pictures together with the plan of transverse and longitudinal sections give a clear idea of the engine except that the condenser is left out for the sake of clarity. Condenser mountings are clearly shown however in the picture on the forward end of the exhaust side of the engine.

The cylinders were cast individually and arranged to be bolted together to form a unit block in a fashion similar to that of the bedplate except that the joints between cylinders were not in line with those of the bedplate but were offset to accommodate the valve chests. Interconnecting steam pipes were eliminated as separate receivers between cylinders by having the steam chests cast integrally with the cylinders. However, a by-pass from the throttle admitted steam to the medium and low-pressure valve chests for warming up and starting. Further simplification of the steam path was obtained by fitting the high-pressure cylinder with a piston valve admitting steam on the inside, while both the medium and low-pressure cylinders were fitted with the box-type slide valves which admitted steam on the outside. All of the cylinders and the medium and low-pressure valve chests were provided with spring-loaded relief valves.


Exhaust side of engine

Metallic packing was used throughout the engine for all piston rods and valve stems. Piston rings of the Lockwood and Carlisle-type were fitted to the high and medium-pressure piston and to the high-pressure piston valve. The low-pressure piston was provided with



Longitudinal section through triple-expansion reciprocating steam engine

Ramsbottom rings and coach springs. The piston rods, crosshead assemblies and connecting rods were completely interchangeable among themselves except for the additional pins on the low-pressure crosshead block for the air and bilge pump beam and link.

The feature of interchangeability was the most outstanding characteristic of the Liberty ship engine and its importance was paramount even to the point of making each engine a nearly perfect duplicate. For example, typical of the methods used in production is that of the full surface plate assembly and alignment procedure for assuring the accuracy and duplication of the alignment of cylinders. Such a surface plate, carried by a solid foundation, was provided with a machined keyway to be used for locating keys in plugs fitted to each cylinder's piston stuffing box bore and valve stem stuffing box bore. Since the surface plate was set to an absolute level in all directions, it also provided an accurate measurement basis for the true axial alignment of all cylinder bores.

Both the solid and the built-up types of crankshafts were used in this engine. All corresponding dimensions were identical in the two types of shafts except for the widths of the crank webs. The duplication was such however, that the shafts were interchangeable between engines. Providing for the interchangeability of crankshafts was more difficult in the case of the built-up type because of the additional problems involved in the assembly of such a shaft before final machining.

In order to attain exact duplication of built-up crankshafts it was necessary to fit and shrink the webs and pins together in a jig similar to that used for the alignment of the cylinder block assembly. Such an arrangement usually comprised a level bedplate with adjustable pedestal bearings which were located to form a master jig exactly like the bedplate of the finished engine. Supplementary pedestals and caps were arranged to support the crank web in their exact positions during the shrinking procedure. Expansion for the shrink fit was generally accomplished by immersion in an oil bath at about 500 degrees F; during cooling the webs were kept in a horizontal position with respect to the crank throw.

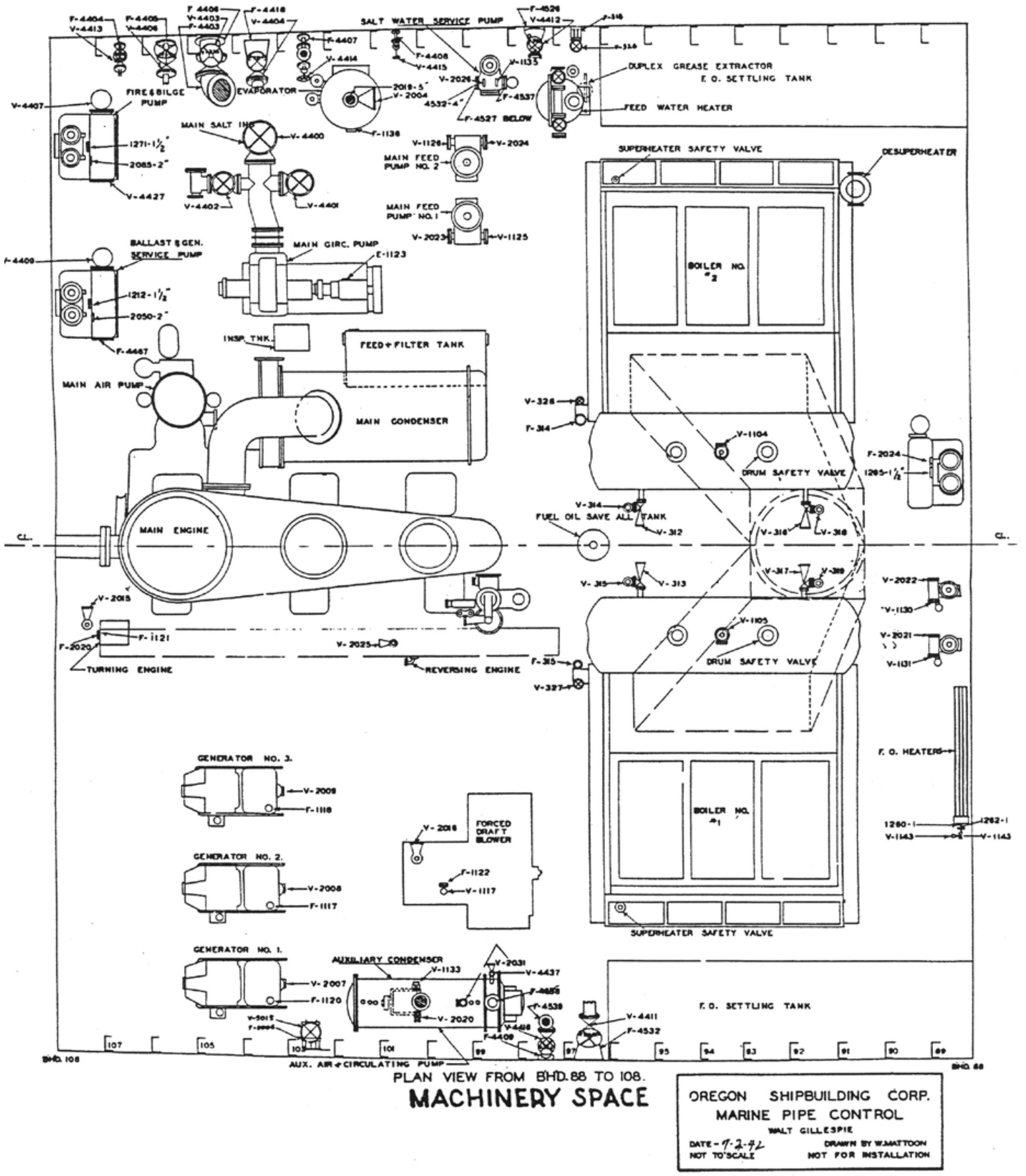
The connecting rods were of the usual marine type and were made of forged steel with cast-steel babbitted boxes on the crank or bottom end and bronze boxes for the crosshead end. Laminated shims were used at both ends for adjustment of proper fit.

All the auxiliaries were reciprocating steam drive. The engine exhausted to a surface condenser bolted to the back of the engine stanchions. Condensate was removed from the main condenser by a combination wet-air pump, which ran off the main engine and functioned as a pump and air ejector to maintain a vacuum. Condensate entered an open hot-well/surge tank, which acted as a feed water storage tank and lube oil separator. The latter operation was carried out in a system of compartments that contained baskets filled with loofah-type sponges, wrapped in terry cloth. There were no economizers and feed pumps supplied the boilers through a feed water heater. One forced-draught fan, running wide open at all times, supplied both boilers.

A complex part of the Liberty engine was the valving and reversing mechanism. It was a combination of eccentrics and valve links for ahead and astern operation – all positioned by a small steam engine, which in turn was controlled by a large wheel on the side of the engine.

Lubrication of the engine was performed manually and by gravity feed; engineers and oilers having to lean over into the massive, moving engine to oil the parts or ‘feel’, with what was known as the ‘hands-on’ technique, the critical points liable to overheat. Cooling water was circulated through the face of each crosshead assembly and it could also be sprayed on to connecting-rod bearings.

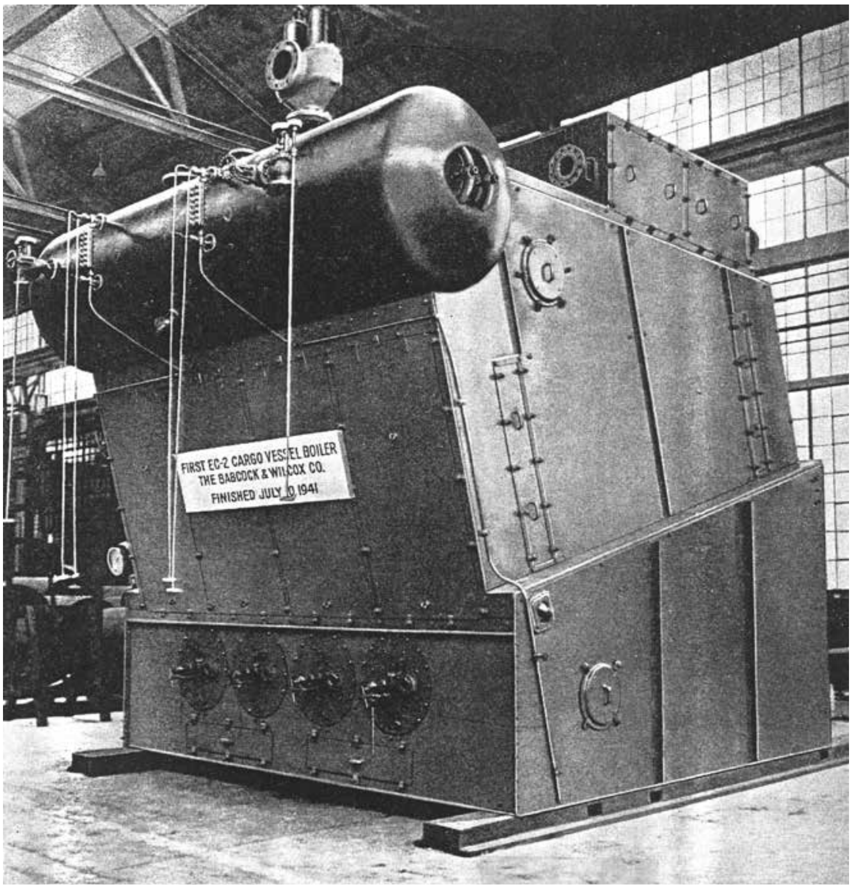
In preparing the main engine for sea, the jacking-gear steam engine, along with small by-pass valves, was used for warm up. Condensate first had to be drained and blown out, then the jacking engine was disengaged and the reversing gear used to ‘rock’ the engine with the throttle valve just open. Once the ship was under way, the wet-air pump would come into play and build up the vacuum.


SALT WATER SERVICE PUMP
FIRE & BILGE PUMP
EVAPORATOR
MAIN SALT INJ.
MAIN FEED PUMP NO. 2
MAIN FEED PUMP NO. 1
DUPLEX GREASE EXTRACTOR
F. O. SETTLING TANK
FEED WATER HEATER
SUPERHEATER SAFETY VALVE
DESUPERHEATER
BALLAST & GEN. SERVICE PUMP
MAIN CIRC. PUMP
INSP. TNK.
FEED & FILTER TANK
MAIN AIR PUMP
MAIN CONDENSER
BOILER NO. 2
DRUM SAFETY VALVE
FUEL OIL SAVE ALL TANK
MAIN ENGINE
CL.
TURNING ENGINE
REVERSING ENGINE
F. O. HEATERS
GENERATOR NO. 3.
GENERATOR NO. 2.
GENERATOR NO. 1.
FORCED DRAFT BLOWER
BOILER NO. 1
AUXILIARY CONDENSER
AUX. AIR & CIRCULATING PUMP
BHD. 108
BHD. 88
PLAN VIEW FROM BHD. 88 TO 108.
MACHINERY SPACE
OREGON SHIPBUILDING CORP.
MARINE PIPE CONTROL
WALT GILLESPIE
DATE - 7-2-42
DRAWN BY W. MATTOON
NOT TO SCALE
NOT FOR INSTALLATION

Machinery – Boilers

The Liberty ship boilers were of the cross drum, sectional sinuous header, straight tube type, fitted with superheaters and based on a Babcock & Wilcox design.

The first sectional header marine boiler of this type was patented by Babcock & Wilcox in 1896. In 1899 this design was further improved. The first boilers constructed from this 1899 design were built for the USS *Alert* and installed in that ship at the Mare Island Navy Yard, California. Hence the design is known as the "Alert" type.



First Liberty Boiler

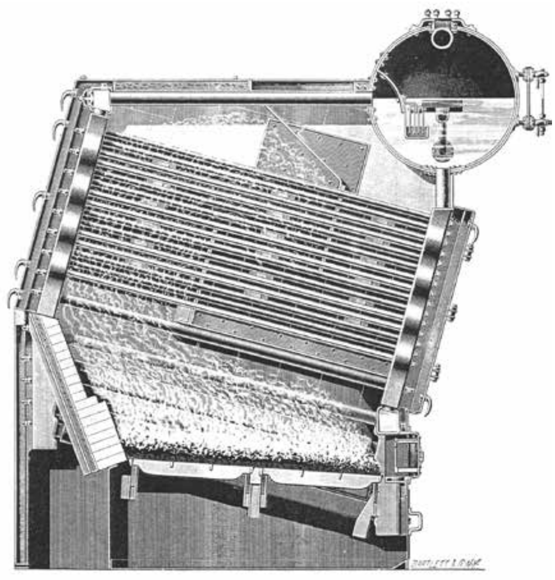
The Liberty ship boilers were essentially the Alert boiler modified for oil firing.

The boilers were of the two-inch, three pass design fitted with an overdeck superheater and oil burners. High superheat was not required so the superheater was located at the top of the first pass, instead of close to the furnace. The boiler was not double cased except for a double front at the oil burners. The furnace was of refractory construction.

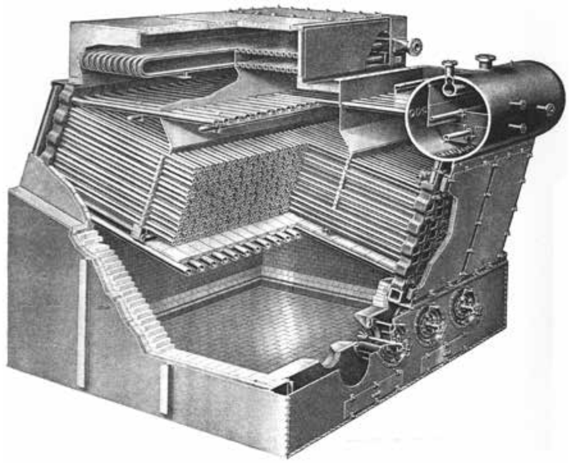
The boiler was of an old design having been used extensively in ships built by the US Government during and after World War I. This provided for a good pool of engineers familiar with the boiler. Being three-pass boilers they suffered from some design problems. For example the refractory roof baffle, on the furnace row tubes below the second and third gas passes, introduced a ledge for soot accumulations and reduced the radiant heat absorption effectiveness of the furnace tubes.

However as a wartime emergency these boilers were admirably adaptable to the Liberty ship design because of their simplicity, reliability, ruggedness and most important of all, ease of fabrication by a large number of boiler manufacturers.

The boilers operated at 220 psi with a superheat temperature of 450 degrees F. The heating surface of both boilers was 10,234 sq ft. At 11 knots fuel rate was 30 tons per day.



Babcock & Wilcox "Alert" Type Marine Boiler, 1899 - Patented



Liberty Boiler

Auxiliaries

- Generators, three, type DC, 400 RPM, 167 amps, 120 volts, 25 KW each.
- Evaporator, one, vertical submerged type, capacity 25 tons per day.
- Distiller, one, capacity 6,000 gallons per day.

- Refrigeration system, one compressor, temperatures:

- Meat and fish rooms	15 degrees F
- Vegetable room	40 degrees F
- Dairy room	30 degrees F

Propeller

- Four blade:

- diameter	18 ft 6 in.
- mean pitch	16 ft
- surface	117 sq ft

CHAPTER XII

Wartime Experience
Hull and Machinery

The Liberty ships were not without their problems during the war years. The one that drew the most press was hull cracking. As this is a vast subject and well beyond the scope of this publication it will be touched on only briefly.

The problems with the Liberty tailshafts and rudders occurred mainly after the war and are well documented therefore these problems will not be discussed. It is interesting to note that the original Liberty design did not call for a sealing ring in the propeller hub. For some reason someone felt that a good fit between shaft, liner and propeller would be enough. Under mass production building a good fit was not achieved and after several shaft failures the design was modified to include the sealing ring.

Hull

The Liberty ships were plagued with structural failures which in some cases were catastrophic in the loss of vessels breaking in two. A board of investigation established by the Secretary of the Navy in 1944 to look into the matter of all-welded merchant vessels reported that of 2,993 ships (mostly Liberties), fractures occurred to 432 ships. A large proportion were minor, but in 95 ships the fractures extended into the hull girder. Twenty vessels suffered complete fractures of the strength deck of which five completely broke in two.

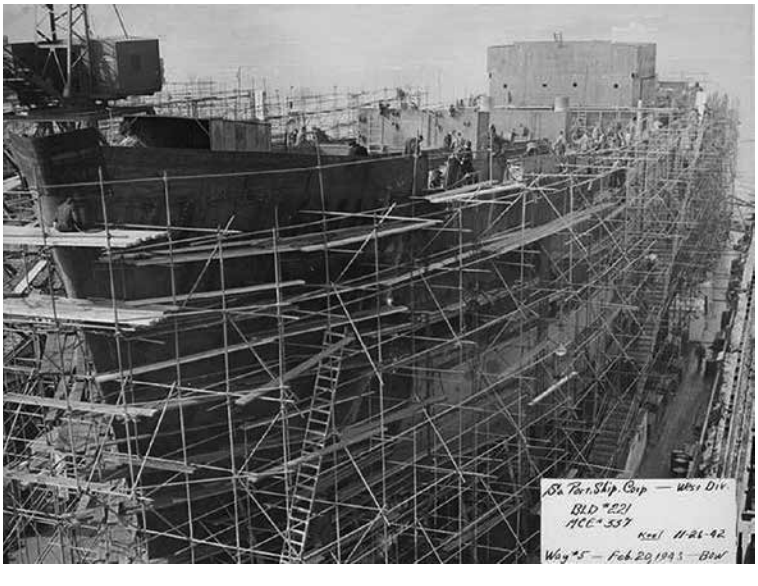
It was concluded that the cause of failure was the result of the combination of the following factors occurring simultaneously:

1. Design: Although acceptable in riveted ship design, stress concentrations due to square corners and other discontinuities were not tolerable in all-welded construction. Square hatch corners were major sources of this problem.

2. Material: Ship steels used were of low manganese content and were notch sensitive, i.e., brittle at the low temperature conditions under which most failures occurred.

3. Construction: Poor quality welding, plus improper welding sequence resulting in “locked-up” stresses.

4. Operation: Vessels heavily loaded, heavy weather, cold climate.



Following much research including material analysis, model testing and strain gauging full scale hulls, improvements were incorporated in new construction, primarily in design and quality control of welding.

ABS and government agencies in 1945 recommended structural modifications to be incorporated on existing Liberties having structural problems and on all new vessels building or to be built. These consisted of riveted connection of sheer strake to stringer strake, riveted bilge strake and radiused corner reinforcement of hatch covers. Additionally, a mandatory installation of crack arrestors was required by government authorities on any existing or new all-welded Liberty ships to be utilized as troop carriers as well as those with records of structural problems.

Engines

The triple-expansion steam engine installed on the Liberty ships demonstrated that from a maintenance, repair and operating point-of-view those responsible for its selection made a sound and rational decision. It is true that proper maintenance of this type of machinery was arduous work. However, aside from the advantages derived from a production point-of-view, it must be recognized that the selection of this type of engine as the main propelling unit in these emergency vessels enabled the utilization of a large available pool of seagoing engineering personnel with considerable past experience and knowledge. It is not meant to imply that difficulties and repairs were negligible because personnel deficiencies were nonexistent, but rather to portray the fact that such problems when considered in the aggregate clearly indicate that the marvelous war records of these vessels is in no small way attributable to the performance of their reciprocating engines.

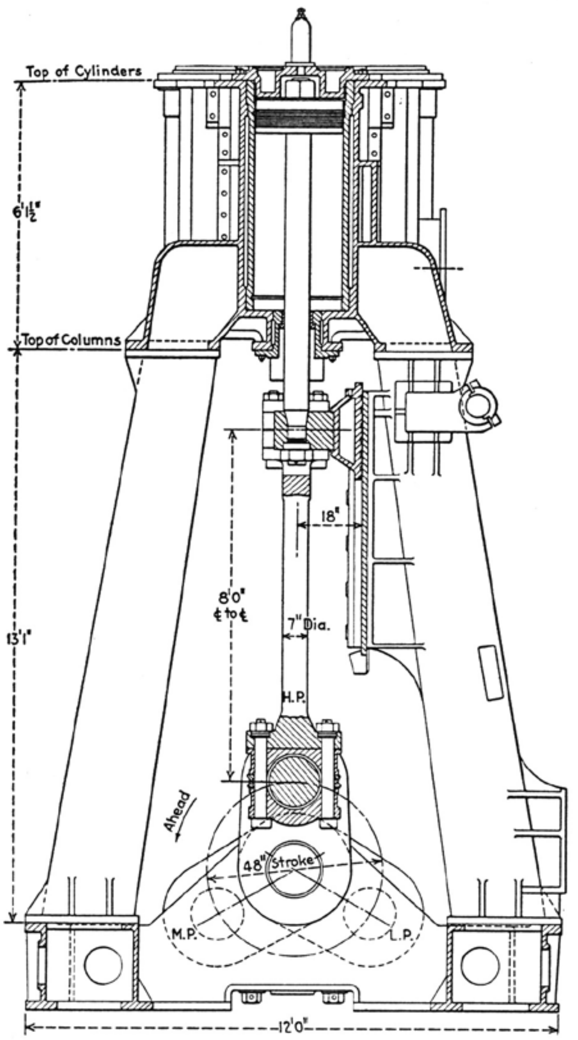
Main bearings, crankpin and crosshead brasses require normal routine adjusting. Where main bearing renewals were required, it is interesting to note that, aside from a few cases of improper lubrication and cleanliness, the difficulties were traced back to misalignment caused by erection and installation at the building yards. Time was the controlling factor and, while many records were shattered in delivering new vessels, secondary consideration was given to the time that might be lost in correcting such conditions while the vessels were in service.

Conditions such as scored rods, broken metallic packing, scored cylinders and wiped thrusts were experienced, the causes, as already indicated, being apportioned between improper operation and improper installation. One item of some concern was that of leaky joints between the high-pressure and intermediate-pressure cylinders which, according to specifications, was made up with a 0.03125-inch gasket. The method of repair utilized with some success was to drill and gun around the locality of the leak.

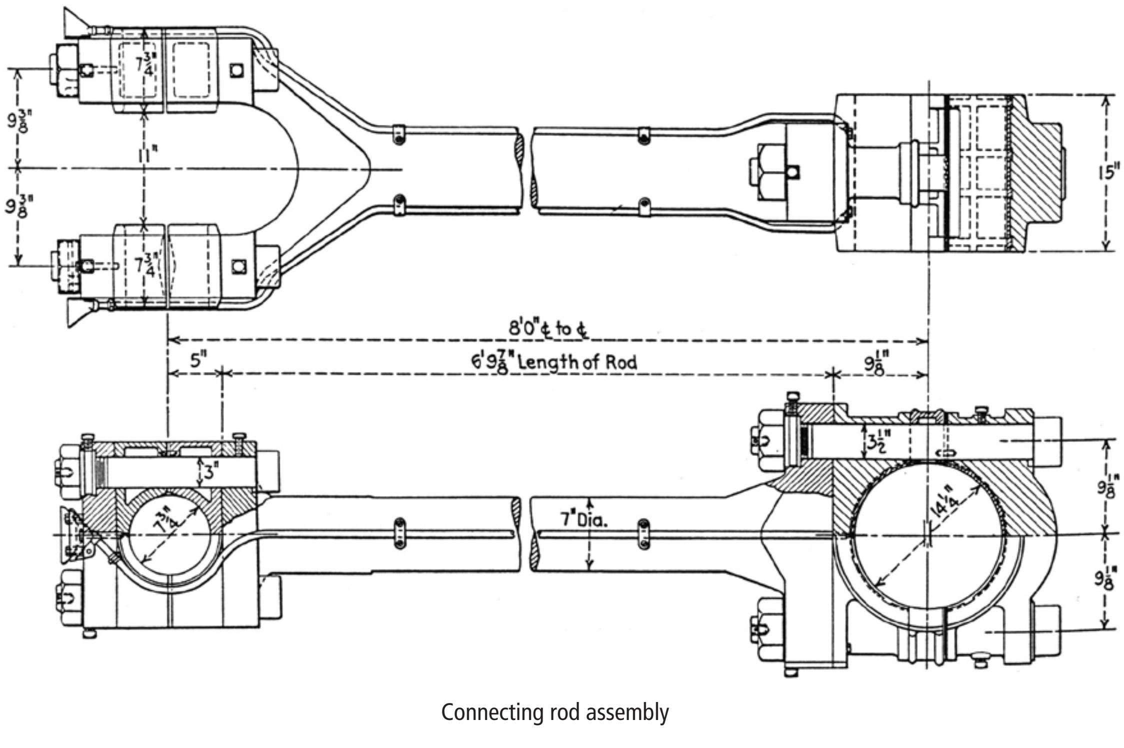
The constant and gradual admission of lubricating oil to feedwater systems was a most aggravating and continued source of trouble and, in many cases, the cause of extensive boiler repairs requiring retubing.

For example, the high-pressure and medium-pressure cylinders on the engines were provided with a pressure lubrication system. This system fed oil through a nozzle connection in the throttle valve for the high-pressure cylinder and through the slide valve for the medium-pressure cylinder. While actual lubrication was mechanically provided, the decision as to quantity was still left to the discretion of the vessel's engineers in making final adjustments. The record indicates that good engineering discretion was not used in many cases.

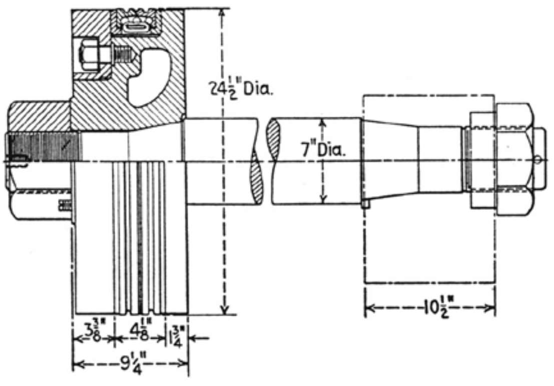
Where evidenced, the consumption of lubricating oil over specific periods of time was abnormal and not consistent with recommended practice. Naturally, such unwarranted admissions of oil into the condensate system required just that much more vigilance in caring for the cleanliness of the grease extractors and the toweling in the hotwells. However, this was not the case and, in the instances referenced, negligence occurred with the result that grease extractors failed to function, toweling in



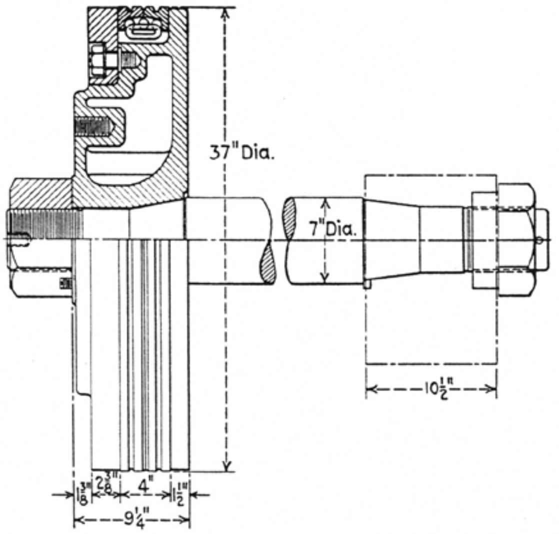
Transverse section through high pressure cylinder



Connecting rod assembly



High-pressure piston assembly



Medium-pressure piston assembly

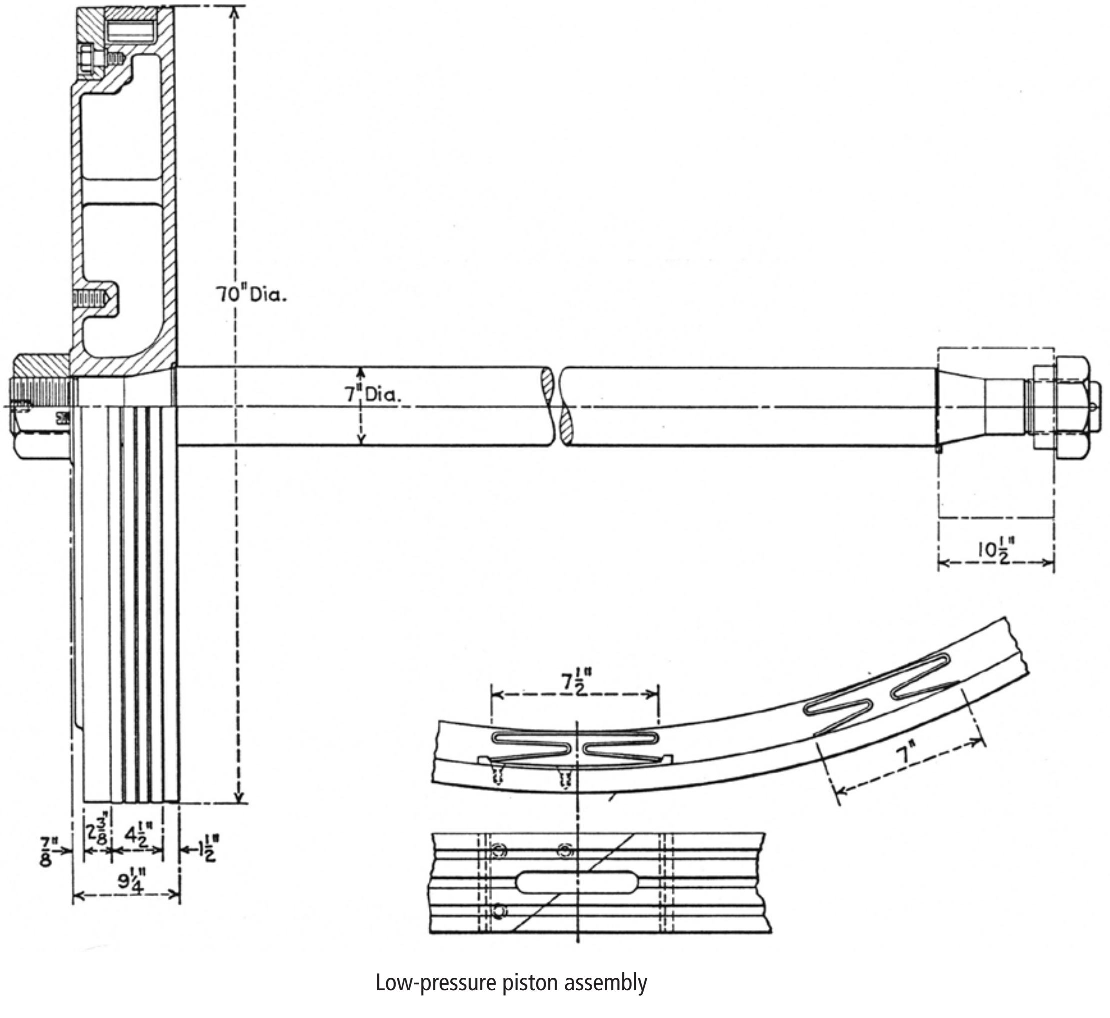
the hotwells became clogged and condensate was returned to the boilers with entrained lubricating-oil impurities. All of the known boiler compounds and feedwater treatment processes could never counteract this very unsatisfactory condition.

While the presence of superheated steam in the high-pressure cylinders requires that outside lubrication be provided nevertheless, from past experience, this is one case where too much lubricating oil does more harm than if the lubrication is on the lean side. The moisture content of the saturated steam was sufficient to provide the necessary lubrication as expansion takes place in the medium-pressure and low-pressure cylinders. However, here again, as pointed out, special lubricating leads were provided for the medium-pressure slide valves, together with tallow cocks, for lubricating the low-pressure slide valves and the medium-pressure and low-pressure stems. Because of improper use, all of these refinements could and were in isolated cases causes for contamination of boiler water.

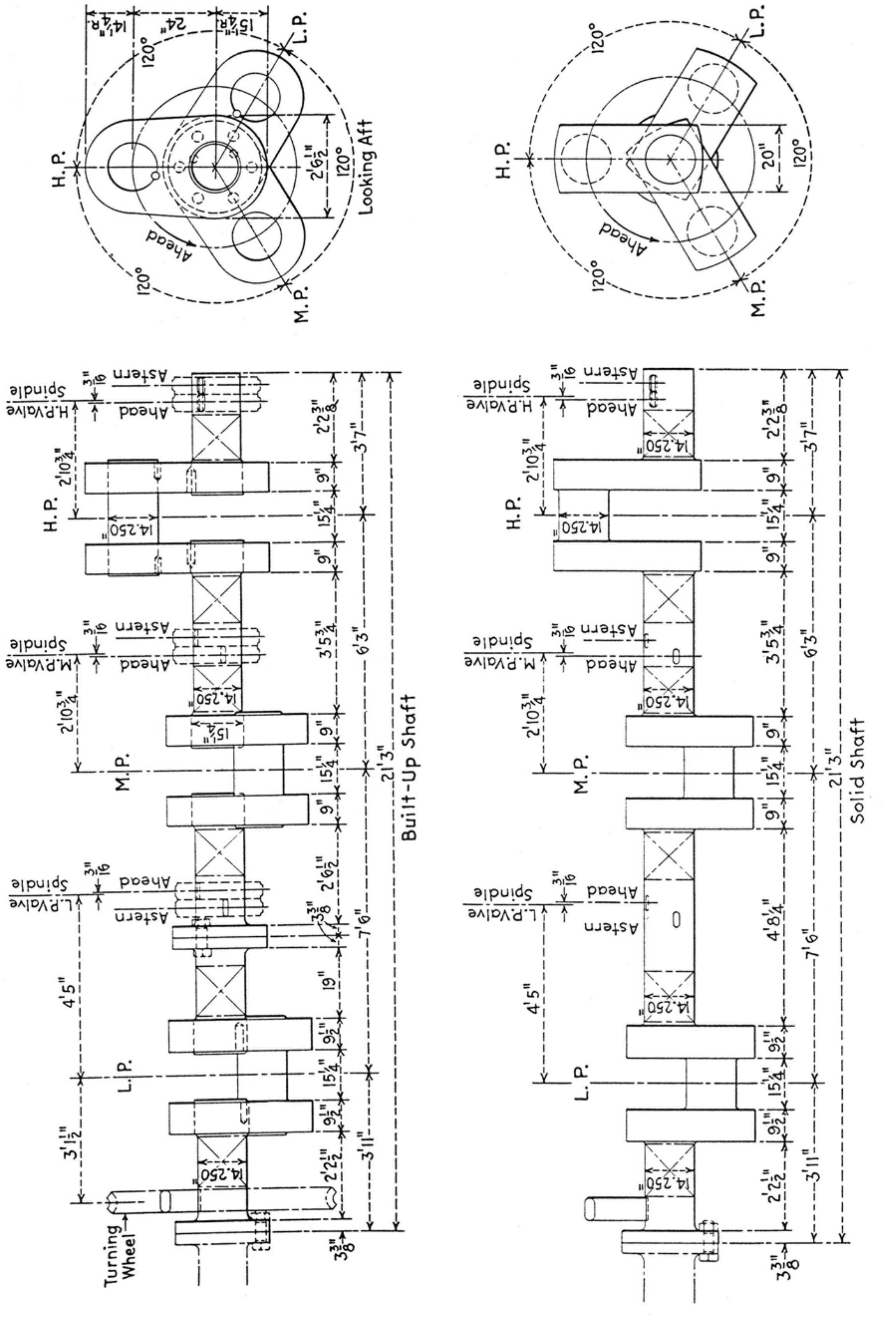
The term misalignment has been used time and again, sometimes promiscuously, to describe or justify conditions for which there is no other apparent reason. Such was the case of the recurring conditions of excessive medium-pressure slide valve side clearances. In accordance with design specifications, the sideway clearance of the medium-pressure slide valve and bridle was within 0.008 to 0.016 inch. However, report after report was received stating that it was necessary to insert spacers as these clearances were ranging up to 0.625-inch. No justification for the presence of this condition ever accompanied these reports and, oddly enough, every case on record involved the medium-pressure slide valve. A close study of the construction of this valve with its more or less floating qualities, and rigidity of support to end guidance around the stem, would tend to mitigate any possibility of introducing misalignment as the cause. Why wasn't this same condition experienced with the low-pressure slide valve? The answer to this is not known. As for the cause of the cases experienced, it is necessary to accept with skepticism the theory of misalignment.

One of the more important features of these engines is the fact that they were single-guided. It is to be noted that the single-guiding provided does not allow for a bearing surface, of the recognized type, in astern operation. Specifically, in the ahead position the crosshead slipper rides on a bearing of white metal while in reversing the outside surface of this same slipper, which is of cast iron, bears on two shoulders of the same metal (cast iron) which have been superimposed by bolting on the same ahead column guide. What, therefore, in view of these changes, were the results? Remarkable as it may appear, there was not one case of difficulty or major repair of these engines because of improper guide-bearing surface involving two like metals – in this case cast iron. Likewise, there were no reports wherein this single-guiding feature did not do all that it was designed to do in astern operation as well as ahead; namely, to provide a guide and bearing surface to absorb the pressure exerted by the crosshead slippers. The advantages of this design proved to be most valuable and from a practical point-of-view readily ascertainable. It isn't necessary to set forth the various steps involved in keying up such an engine. It will suffice to point out that on double-guided engines adjustment of crosshead guides was and is no ordinary, easily accomplished job. With water-cooled columns it required a very good engineer to make such adjustments. For example, practical know-how was the only guide for doing such work on an engine in a more or less cold condition so as to ensure that no seizing would take place between slippers and guide after the engine was placed in operation and the moving parts started to expand because of heat transmission while the water-cooled columns and guides remained relatively intact. True, these single-guided engines had water-cooled columns, but regardless of this fact the expansion causing seizure which leads to repairs and vessel inactivity was not present. The biggest asset lies in the fact that maintenance work and time required were reduced immeasurably.

Another most important feature which resulted in a reduction of maintenance costs normally experienced on this type of engine was the use of the restricted type of high-pressure ring as installed on the high-pressure pistons. The action of these rings in operation proved their worth, and it is estimated for comparative purposes that their use factor was three times that of the ordinary snap type of ring. The important characteristics of this ring were its wearing qualities and ability to adjust repeatedly when excessive wear finally did occur. This wearing quality evidenced by performance in operation is similar in many respects to the operation of a plug piston after the initial ring wear occurs relieving any excessive pressure that might be exerted by the rings on the cylinder walls.



Low-pressure piston assembly



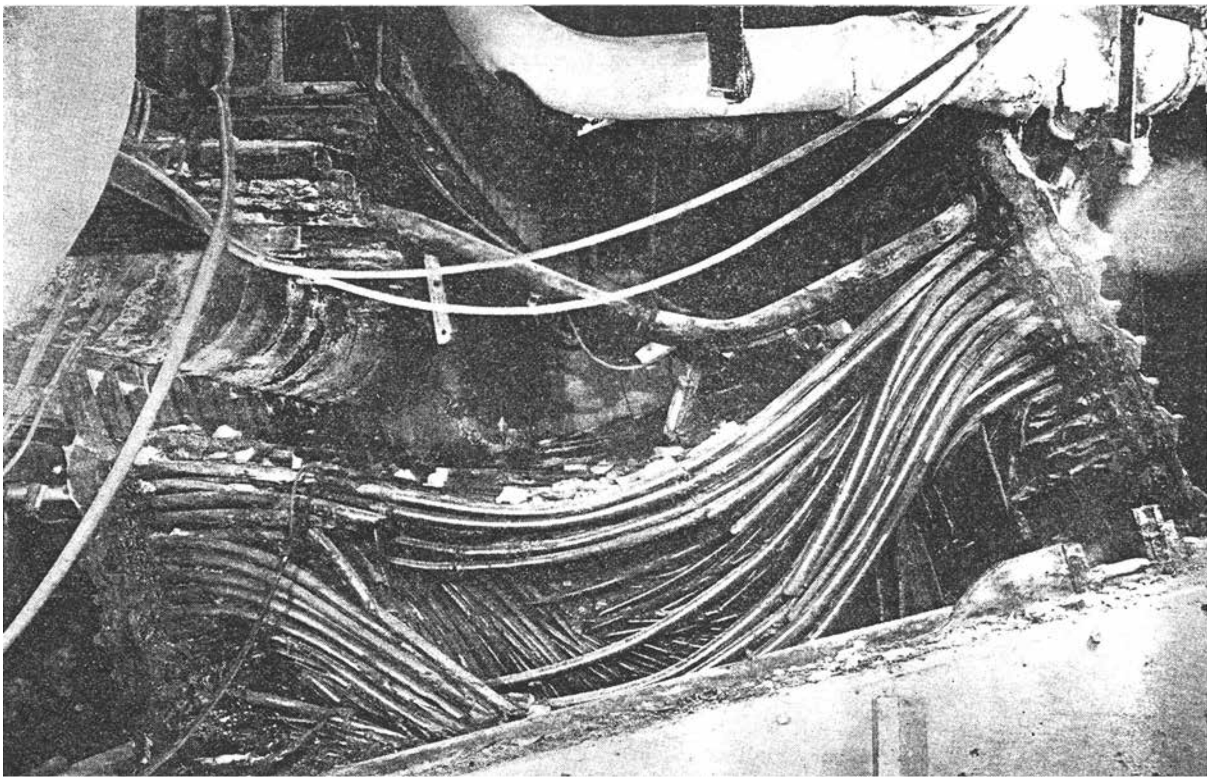
Built-up and solid types of crankshafts

Boilers

Within the limitations of safety requirements, it was necessary during the war period to deviate from the usual marine maintenance policies, in many instances deferring repairs unless they were absolutely necessary. This postponing of repairs was often extended to the port work ordinarily performed by vessel personnel, which in peacetime was more or less standard. Because vessels in ports which might be subjected to enemy attack at a moment's notice were required to have their plants in readiness at all times to permit rapid departures, it was impossible to accomplish even badly needed boiler cleanings, let alone any necessary repairs. The seriousness of these conditions can be appreciated when it is realized that on top of this situation was pyramided the restriction placed on vessels operating personnel by the requirement that no smoke must be visible emanating from vessels' stacks while at sea. The reason is apparent and is justified, as one offender could have been the cause of serious losses to a whole convoy through detection by enemy planes or U-boats. Boiler cleanliness, the prerequisite of efficient maintenance, suffered because there was no opportunity to operate the soot blowers regularly and periodically. Even at night this was not possible unless weather conditions were such as to prevent identification by the lurking enemy.

This problem of ensuring clean boilers was aggravated considerably by conditions over which there appeared to be no control. For example, vessels often were required to take fuel oil in outports of the world. Many times the characteristics of the oil were not known and ranged from light diesel oils all the way to heavy residues. In peacetime, steamship operators make it a point to know as much about the type of oil they are burning as is possible. Because of military requirements, it was necessary on long extended voyages for vessels to obtain freshwater supplies at points unheard of prior to the war. Again it is to be noted that oftentimes the characteristics and types of water placed on board were not known nor were they obtainable. However, the adverse effects which these unknown fuels and freshwater supplies may have had on boilers were secondary as the vessels' services were paramount.

When vessels returned home and there was an opportunity to do the necessary work, it was not always possible because the requirements, from the point-of-view of the number of vessels, often



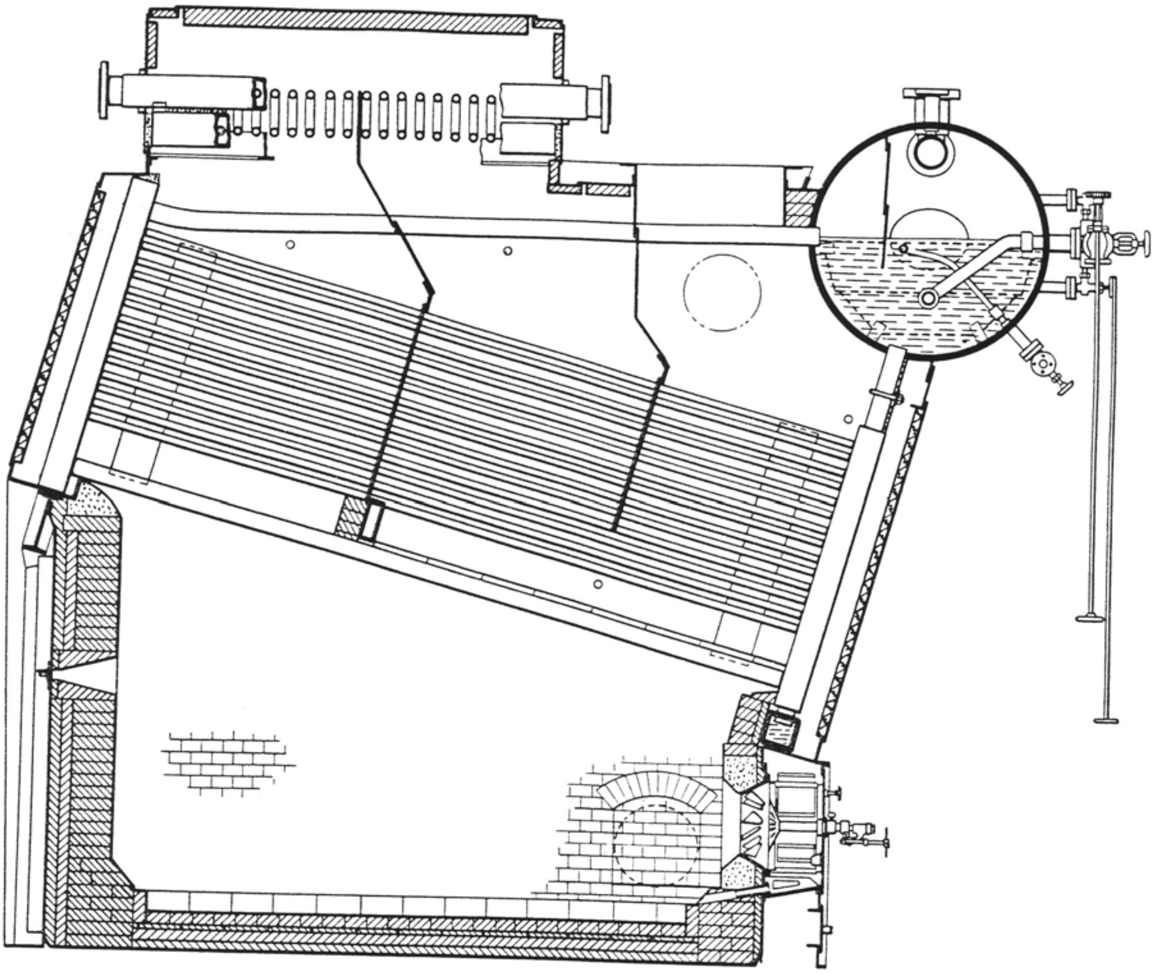
Dry-fired Liberty boiler

exceeded the available facilities. In addition, the fact that vessel turnarounds had to be cut to a minimum eliminated, in many cases, any opportunity to do this work; and finally inexperienced personnel aboard the ships, in many cases entire new crews, taking over with insufficient knowledge as to the condition and past performance of the boilers, precluded any attempts to effect ordinary maintenance and cleanliness work.

With few exceptions, these being limited to defects in design, manufacture or erection and installation, the outstanding trouble during the war period was the inability to maintain marine boilers in accordance with peacetime practice.

Boiler difficulties multiplied not only by the number of recurring failures but also because of troubles which by their nature were classed as isolated and uncommon experiences. There was a prevalence of bottom-row, circulating-tube failures in the boilers. These failures had manifested themselves in ruptured, blistered and tube deformations, the distortion in some cases being so extreme that the tubes were actually pulled out of the headers on one end.

Many theories were propounded as to the causes for these difficulties, ranging all the way from design to the factor of cleanliness. The tubes, 22 in number, were four inches outside diameter and No. 6 BWG. Because of the rapid steaming rate of these boilers when operating at rated capacity, it was thought that the rate of heat transmission through these heavy-gage circulating tubes did not permit rapid enough dissemination of the heat from the furnace to the water. This heat transmission was thought to be retarded further by the cessation of water circulation in these tubes because of the improper use of the bottom blows – in some cases not blowing down at all at regular intervals. As a



Cross section – Liberty boiler

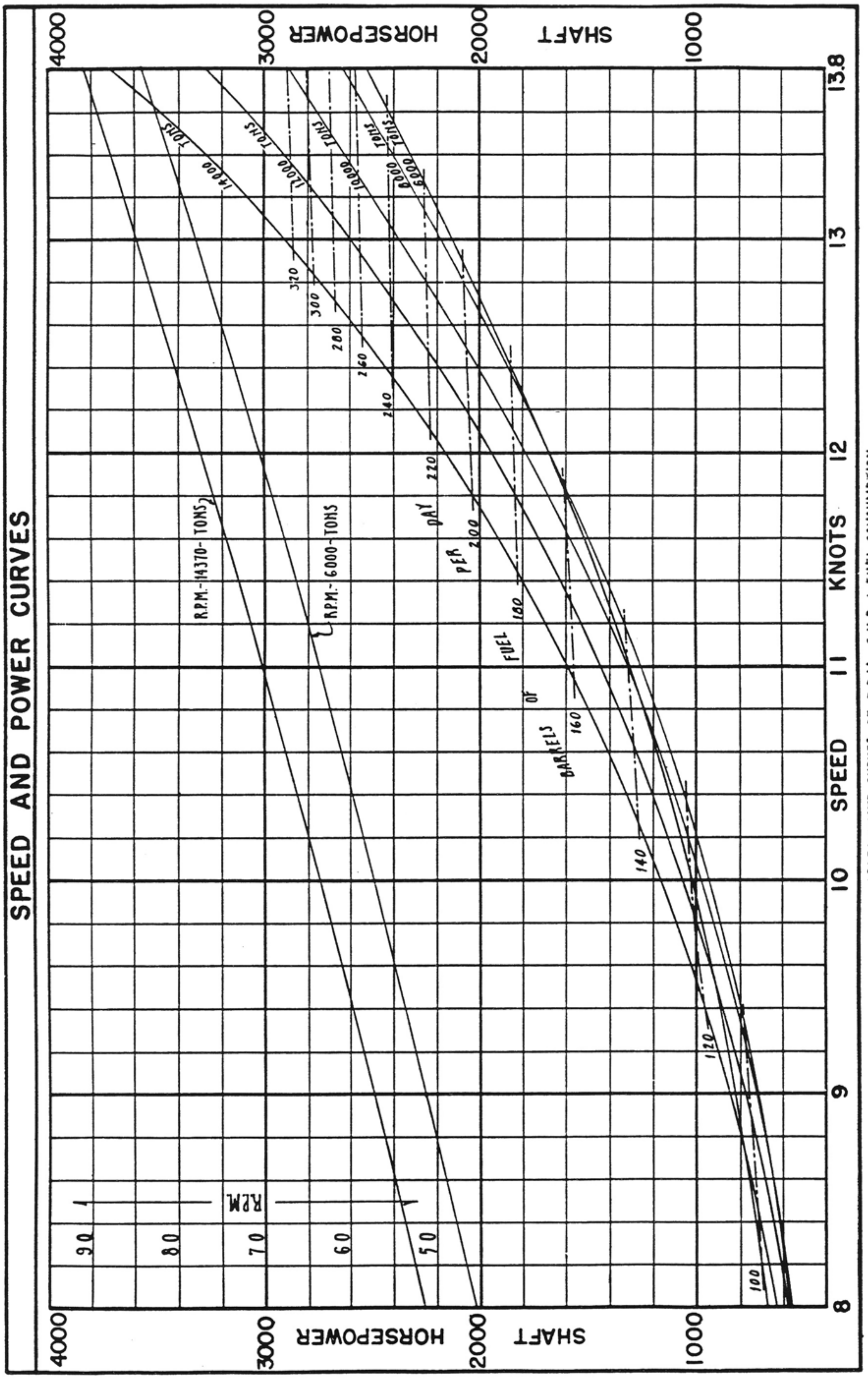
result of this combination, the bottom row of circulating tubes was subjected to overheating, causing them to warp and sag.

Scale has always been a troublemaker and its adverse effects on boiler performance intensified because of the operating and maintenance obstacles presented. These scale coatings caused the tubes to overheat, the underside portions more drastically than the upper portions and again, sagging and warping of the tubes occurred. Constant changing of boiler firing rates, necessary in convoy operations to meet unprecedented situations, was, from the overall point-of-view, an aggravator of tube failures. The repetitive temperature changes in these tubes resulted in a continual expansion and contraction process causing the scale coating to break off in spots. The rate of heat transmission ceased to be uniform in the individual tubes as these particles of scale formation will locate a particular spot in the tube and grow in thickness and size. Such sporadic overheating causes blister formations, which if allowed to continue, eventually ends in a ruptured tube.

It cannot be said that no cases of drastic oil carry-over from the propulsion and auxiliary equipment to the feedwater systems occurred. However, such cases were in the minority, those involving a gradual and continual admission of oil to the boilers having been more serious. Tube failures classified as being the result of these oil conditions, with the tubes appearing warped and bowed but not ruptured, were justified where the presence of oil was determined and in the majority of cases responsibility reverted back to faulty operations and improper maintenance.

Furnace repairs and reconditioning were not too widespread when considered from the point-of-view of the number of vessels requiring renewal of boiler furnace water-wall linings within a year's time. In others, complete rebricking was necessary. Reasons and causes for these difficulties are indeed numerous: fluctuating steam conditions, inexperienced operating personnel, poor workmanship and material are a few of the many. It was reported on one vessel that complete rebricking of the entire furnace in each boiler was necessary at the termination of the vessel's first four successive voyages. After considerable experimentation, it was decided that the type of burner in use was at fault and the vessel's operators found that by fitting a modified venturi ring to the burners it was possible to deflect the flame further back into the furnace. No more difficulties of this nature were reported by this vessel.

Boiler casings overheated in the vicinity of the side tubes as a result of improper sealing of the joints between the roof tiles and side tiles, thus allowing the flame to penetrate behind the side tiling. During peacetimes, furnace explosions are more or less rarities and in the great majority of cases indicate negligence on the part of the operating personnel. Wartime operation did not alter the reasons for these casualties but only increased their number. Fundamentally, such mishaps were attributed to a lack of sufficient purging of unburned oil fumes prior to lighting the burners.



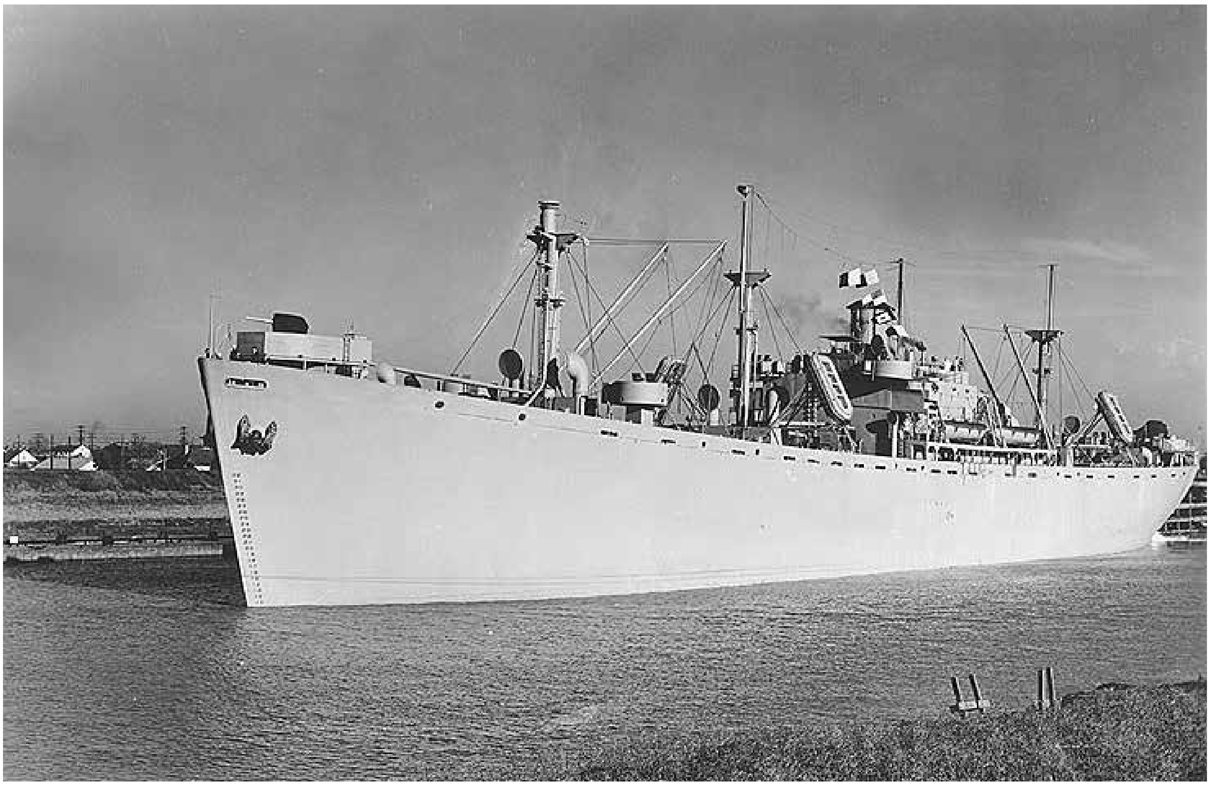
APPROXIMATE CURVES OF R.P.M., S.H.P., & FUEL CONSUMPTION FROM STANDARDIZATION TRIALS OF M.C.E HULL # 50-
S. S. WILLIAM WIRT

CHAPTER XIII

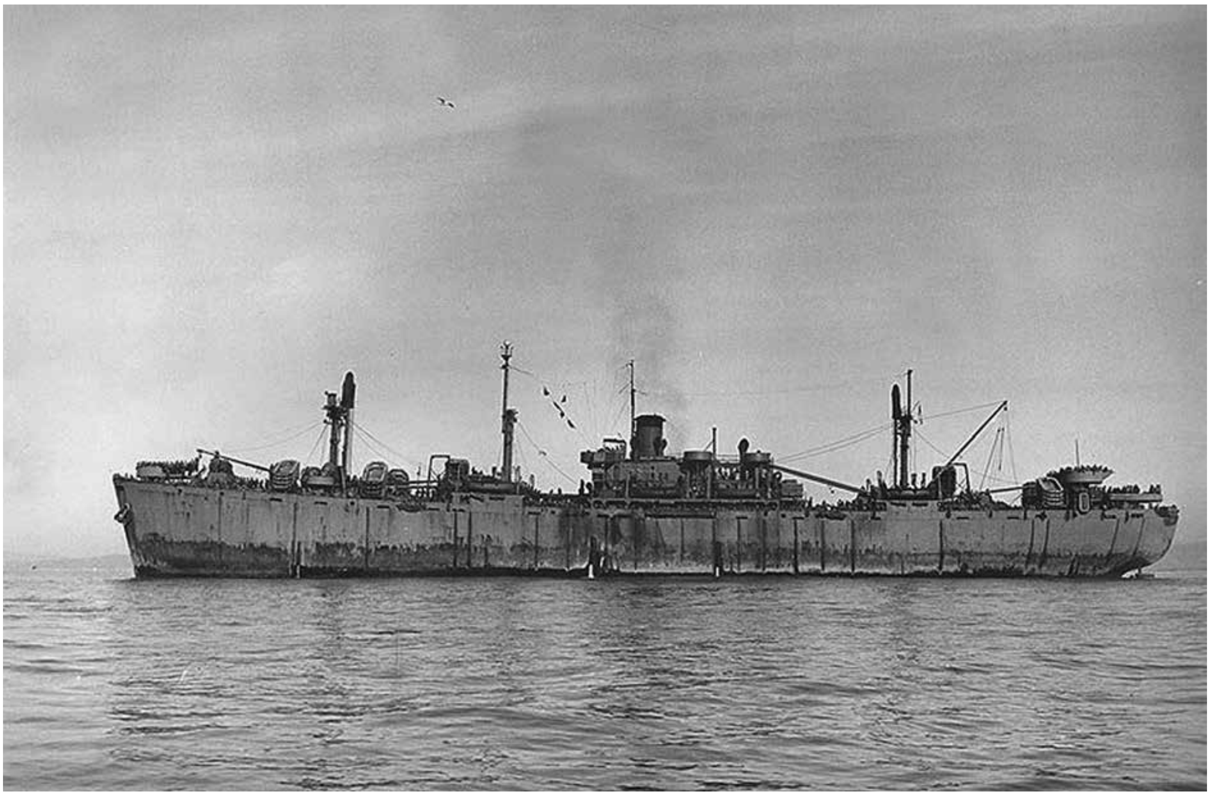
Conversions

One of the most interesting aspects of the Liberty ship was the ease with which it was converted to various uses. Of the grand total of 2,710 vessels of this type constructed, the Maritime Commission converted 130. These conversions included 62 tankers, eight tank carriers, 36 boxed airplane carriers (not to be confused with “flat-tops”) and 24 colliers. These conversions were all carried out by the Commission in its own yards. In addition two Liberty ships were converted into training ships under the direction of the Division of Training of the War Shipping Administration (WSA). Many EC2s were taken by the Navy and by the Army to be converted, according to their own plans and under their own direction. My concern here is with the Liberty ships whose conversion was the work of the Commission and the WSA.

The first conversion planned was never carried out. In the summer of 1941, when the outlook was most uncertain and the chances of America becoming involved in the war seemed ever increasing, it was decided to attempt to protect United States most vulnerable spot, the Panama Canal, by building a third series of locks. This was a mammoth undertaking, particularly when it was expected to be completed within a short time. Gibbs & Cox were directed to develop plans for EC2s capable of carrying 60,000 bbls, or about 10,000 tons, of cement from Houston, Texas to Cristobal, Canal Zone. In order to achieve this the ship had to be limited to a fuel capacity for a one-way trip at a speed of 10 knots average. USMC Hulls 3, 4, 233 and 234 were designated for such conversion but before work began, the Canal plans were modified. This change of plans came in June 1942 and obviated the need for bulk cement carriers.



The SS NORMAN O. PEDRICK was converted to a water distilling ship, renamed USS STAG and redesignated AW1.



SS CARLOS CARRILLO

The first actual conversion was the training ship. The Commission, working with the US Coast Guard, designed the first one the *American Mariner*, which type was designated Z3-EC2-S-C1. The War Shipping Administration, which was to take over training, was not organized until after this ship had been delivered from the Bethlehem-Fairfield Yard. The *American Mariner* was turned over by the yard for conversion when 65.4 percent completed. It was ready for operation by 10 March 1943, at which time it was turned over to the Division of Training, WSA.

This proved to be a more difficult conversion than was at first realized. Starting with the idea that there should be a minimum of changes, more and more changes came to be considered necessary. In the end, the problem came to be how a maximum amount of space could be provided without overloading the vessel topside. The principal installations included evaporators, work shop, new bilge pump, new fire pump, additional sanitary unit, and additional equipment for heating, ventilation, galley, refrigeration and lighting. Also space for a large classroom-auditorium had to be provided forward. To accomplish these things it became necessary to disregard several of the regulations and rules of the Bureau of Marine Inspection and Navigation with respect to the use of hand operated watertight doors, requirements for flooding or damage stability, and for lifeboats. The second training ship was the *American*.

Before America entered the war, plans were made to use some of the EC2 vessels, under lend-lease, for carrying tanks for the British. The design was developed by the Commission with the help of BuShips and with advice from officers of the staff of Rear Admiral L. W. Dorling, Admiralty Supply Representative. America was in the war before the planning had proceeded very far.

In the completed plans as given to Gibbs & Cox, for the purpose of making working drawings, the tank carrier was designated Z-EC2-S-C2. After approval of the drawings by the American Bureau of Shipping they were sent to J. A. Jones Construction Co., Inc., at Panama City, Florida.

The tank carrier differed from the basic EC2 in seven important respects: 1) natural ventilation in the holds was replaced by mechanical ventilation; 2) 14 instead of ten winches and additional loading gear; 3) 3-20 KW generators replaced by 3-50 KW turbo-generator sets as required by ventilating fans and auxiliary equipment; 4) two additional auxiliary condensate pumps to take care of additional winch capacity; 5) two instead of one potable water pump as required by additional personnel; 6) increased refrigeration capacity for the same reason; 7) and additional lighting.

When the work of preparing working drawings was turned over to Gibbs & Cox, late in June 1942, they were informed that these vessels were urgently needed and that the matter of their additional compensation would be discussed at the earliest opportunity. A total of 27 ships were to have been converted. An additional compensation of $2,000 per ship was to have been Gibbs & Cox compensation, an agreement worked out by William Francis Gibbs and Admiral Vickery. The development of the Navy's LST program did away with much of the need of these specially-designed Liberty ship tank carriers and consequently the program was reduced to eight vessels. The reduction of the program made it necessary to reconvert some of these vessels back to cargo ships and also caused a controversy with Gibbs & Cox which claimed compensation totaling $54,000.

In the summer of 1944 an airplane transport was designed which was quite similar to the tank carrier. Twenty-eight of these were built by J. A. Jones and eight by New England Shipbuilding Co. The design of this vessel was, in fact, an alteration of the tank carrier, the effect of the alteration being to bring the vessel closer to the original EC2. The airplane transport (sometimes referred to as "boxed airplane carrier") differed from the Z-EC2-S-C1 in the omission of troop berthing and messing, of fresh water tanks on the upper 'tween deck, of special hold ventilation and of special portable fire extinguishing equipment. The centerline stanchions were portable and standard 10-ton booms replaced the heavier ones needed for tanks. This design was given the designation Z-EC2-S-C5.

The critical shortage of tankers, late in 1942, brought about the conversion of a number of EC2s into bulk oil carriers. When the Commission applied to the Joint Chiefs of Staff for additional steel to permit full utilization of yard capacity, that body recommended that the increased construction should include 100 "national" tankers. There followed some discussion as to whether these vessels should be produced by conversions carried out at repair yards or as new construction.

Although the need for tankers was urgent, the press on repair yards was such that the Joint Chiefs of Staff instructed the Commission to build or convert in the shipbuilding yards.

The Commission authorized Gibbs & Cox to develop plans for the conversion of completed EC2s to bulk oil carriers on 19 December 1942. On the 30th it conferred with representatives of the Delta Shipbuilding Company which it authorized to work on plans for doing the same thing for EC2s not yet completed. It was soon obvious that there would be duplication of effort here, as well as divided responsibility. As a result, Gibbs & Cox' part in the program was terminated, by mutual agreement, on 14 January 1943.

Delta had been selected for this work because it was building all-welded ships, had an experienced engineering force, as a new yard could modify its construction procedure fairly easily and was well placed geographically. These same considerations influenced the selection of California Shipbuilding Company for similar work beginning in May.

The main consideration in the change from a dry to a liquid cargo arrangement was to compartment the holds so that the oil would not circulate in a manner that would endanger the vessel's stability. This called for additional bulkheads, frames and stiffeners. Also pump rooms and piping had to be added. Among the safety devices used were cofferdams and ventilating systems. The vessel was intended to look like a dry cargo ship and, for this reason, dummy booms and masts were to be installed.

In spite of the additional steel required to provide nine cargo tanks on both port and starboard sides, the light ship weight of this tanker was only about 300 tons greater than that of the ordinary EC2.

The inner-bottom fuel and ballast tanks were left undisturbed, but the forward deep tanks were eliminated. The design was the work of the Commission. After approval by the American Bureau of Shipping, it was sent to Delta where working drawings were made and the construction work begun. It was decided, in January 1943, that Delta should build 35 of the 100 authorized by the Joint Chiefs of Staff and by April construction work was under way.

Before the program had progressed very far and because of the urgent need for means to transport gasoline to the war theaters, the Tanker Operations Division of the War Shipping Administration strongly recommended that these vessels be used to carry low flash oils in the tanks forward of the engine room. Accordingly plans were modified to rearrange the venting system and to provide for a cofferdam between the No. 1 cargo tank and the chain locker. A few weeks later WSA requested that low flash oil be carried in all tanks but this would have required so many additional changes that Admiral Vickery decided against it.

The SS JOHN W. BROWN was converted in 1943 for service as a limited capacity troop ship and saw service in the Mediterranean, carrying troops and cargo from North Africa to Italy and southern France.

Part of the requirements of WSA were met, in this case, by converting the deep tanks in the No. 1 hold of all Liberty ships for the carriage of fuel oil. This change was made possible by the development of a synthetic rubber gasket which made it possible to use the hatch covers already in production.

In operation it was found desirable to connect the forward and aft filling and discharge lines to avoid the necessity of shifting the ship. This change was authorized and carried out during the winter of 1943-1944. On the whole it was considered that these vessels were very satisfactory, especially for carrying high flash oils for short hauls. The principal criticism made against them was that they didn’t carry sufficient heavy warping gear or sufficiently lengthy anchor chains for loading and discharging at submarine terminals.

Before the program was completed, the need for tankers declined. As a result only 62 of this type were built, 32 by Delta and 30 by CalShip. Delta launched the first one, *John Stagg*, on 7 July 1943, while the last to be launched was also Delta's and went down the ways on 7 January 1944. Twenty of these tankers were turned over to the Navy and three of them to one of America's Allies.

From the point-of-view of producing a very useful peacetime as well as wartime vessel, the EC2s converted to coal colliers were a happy development. These conversions were decided upon early in 1944 when there was a pressing need for bottoms to haul coal in the domestic trade from Hampton Roads to New England. These colliers were designed by the Commission, designated EC2-S-AW1, and built by Delta.

In appearance these colliers differ radically from ordinary EC2s because the house and machinery were well aft. There were five cargo bolds in line with continuous 36-inch high hatch coamings on deck and with a trunk deck between hatches. Each had two one-piece steel covers which were hinged and equipped with watertight gaskets. Their ground tackle was heavier and their crews' quarters and interior arrangements more spacious than aboard an ordinary Liberty ship. Another difference was that the inner bottom was slightly deeper and the bottom shell, in way of ballast tanks, was covered with a layer of cement about 1.5 inches thick.

This chapter would be incomplete without some mention of the fact that many EC2s were turned over to the Army and Navy and converted by them for their own purposes. For the most part these vessels became transports but some became hospital ships, repair ships and even mule carriers.

The EC2 transports were emergency conversions and were not up to the standard of vessels built for that purpose. Berthing spaces were congested and stores and messing spaces were inadequate. Any soldier who spent any time aboard one in tropical regions can testify to the stifling heat in the holds. They were intended to carry about 1,000 troops but, at times, carried well over that number. Their usefulness in transporting large number of troops with their equipment, particularly on hauls of not more than six days, is unquestioned.

CHAPTER XIV

Statistics

The total number of Liberty ships seems to be a matter of dispute. Based on a review of the American Bureau of Shipping records, the number is 2,710. This is the number of Liberty ships that were built under the cognizance of the US Maritime Commission, delivered as merchant hulls and classed with ABS.

The US Maritime Commission, Office of Director of Construction, Statistical Analysis Section in a report dated 28 February 1946 puts the number at 2,710.

Sawyer and Mitchel in their monumental work on the Liberty ships also put the number at 2,710.

As all three of these very reputable sources agree I have to believe the correct figure to be 2,710.

As there were various variations of the basic design the figures break down as follows:

EC2-S-C1 Basic type cargo	2,580
EC2-S-AW1 Collier	24
Z-EC2-S-C5 Boxed aircraft transport	36
Z-EC2-S-C2 Tank transport	8
Z-ET1-S-C3 Tanker	62
	2,710

These figures do not include those hulls taken over by the US Navy or US Army, etc. before completion and altered for their own specific use.

Although not evident in the statistics the building time and details of one vessel deserve special mention. It was the *Robert E. Perry*, Permanente Metals Corp., Yard No. 2, Hull 440. This vessel established a world shipbuilding record, being launched on 12 November 1942, only four days, 15 hours and 26 minutes from the time of keel laying.

The vessel was commenced on the ways at midnight on Saturday/Sunday, 7/8 November. By 2:00 a.m. the bottom shell was practically finished on the ways and by 8 a.m. the amidships double bottom sections, the entire engine assembly, three transverse bulkheads and two large side shell sections as well as some of the centerline bulkheads were in place. In the first 24 hours, nearly 1,500 tons of steel were in place on the ways and 18,000 feet of welding completed.

The after peak assembly, including the stern frame, weighed 80 tons and the forepeak 70 tons. There were five double bottom units, the largest weighing 110 tons and the upper deck was erected in seven large sections, together with one on which was already erected the midship deckhouse of 84 tons complete with clocks and signal flags.

The total amount of work which was pre-fabricated amounted to 61 percent and, while there were roughly, 250,000 individual items in the hull, the sub-assembly had been carried to such an extent as to only require the lifting of 97 units; one every 69 minutes.

By the time the keel was laid, 152,000 feet of welding had been completed on the platens. Only 57,800 feet remained to be welded on the ways.

There were 23,045 rivets in the ship and nearly 80 percent of these were driven on the platens.

The vessel was launched at 3:27 p.m. on Thursday, 12 November 1942. Three days later it was put to sea on trials.

On the following pages are the ABS statistics on the vessels built.

Number, Tonnage and Horsepower of Liberty Type Ships Constructed by Each Shipyard for the Maritime Commission

BUILDER	EC2-S-C1 – Cargo (c)				EC2-S-AW1 – Collier				ZEC2-S-C5 – Military (a) ZEC2-S-C2 – Military (b)				Z-ET1-S-C3 – Tanker				Totals			
	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.
Alabama D. D. & S. B. Co., Mobile, Ala.	20	143,520	211,580	50,000													20	143,520	211,580	50,000
Bethlehem-Fairfield Shipyard, Baltimore, Md.	384	2,760,529	4,165,620	960,000													384	2,760,529	4,165,620	960,000
California Shipbuilding Corp., Los Angeles, Cal.	306	2,197,315	3,233,545	765,000									30	216,940	319,027	75,000	336	2,414,255	3,552,572	840,000
Delta Shipbuilding Co., New Orleans, La.	132	947,577	1,380,278	330,000	24	159,432	264,455	60,000					32	230,850	336,085	80,000	188	1,337,859	1,980,818	470,000
J. A. Jones Construction Co., Brunswick, Ga.	85	611,618	915,322	212,500													85	611,618	915,322	212,500
J. A. Jones Construction Co., Panama City, Fla.	66	473,616	716,360	165,000					28 8	(a) 200,973 (b) 57,408	270,592 79,140	70,000 20,000					102	731,997	1,066,092	255,000
Kaiser Company, Vancouver, Wash.	10	71,760	107,872	25,000													10	71,760	107,872	25,000
Marinship Corporation, Sausalito, Cal.	15	107,807	157,800	37,500													15	107,807	157,800	37,500
New England S. B. Corp., East Yard, Portland, Me.	124	889,824	1,330,790	310,000					8	(a) 57,408	77,312	20,000					132	947,232	1,408,102	330,000
New England S. B. Corp., West Yard, Portland, Me.	112	803,712	1,200,220	280,000													112	803,712	1,200,220	280,000
North Carolina S. B. Co., Wilmington, N. C.	126	904,265	1,333,140	315,000													126	904,265	1,333,140	315,000
Oregon Shipbuilding Corp., Portland, Ore.	322	2,310,700	3,442,719	805,000													322	2,310,700	3,442,719	805,000
Permanente Metals Corp., No. 1 Yd., Richmond, Cal.	138	990,709	1,450,860	345,000													138	990,709	1,450,860	345,000

Number, Tonnage and Horsepower of Liberty Type Ships Constructed by Each Shipyardfor the Maritime Commission (Concluded)

BUILDER	EC2-S-C1 – Cargo (c)				EC2-S-AW1 – Collier				ZEC2-S-C5 – Military(a) ZEC2-S-C2 – Military (b)				Z-ET1-S-C3 – Tanker				Totals			
	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.	No.	G.T.	D.W.T.	I.H.P.
Permanente Metals Corp. No. 2 Yd., Richmond, Cal.	351	2,522,309	3,689,340	877,500													351	2,522,309	3,689,340	877,500
St. John's River S. B. Co. Jacksonville, Fla.	82	592,939	861,100	205,000													82	592,939	861,100	205,000
Southeastern S. B. Corp. Savannah, Ga.	88	632,968	923,900	220,000													88	632,968	923,900	220,000
Todd Houston S. B. Corp. Houston, Tex.	208	1,504,371	2,181,659	520,000													208	1,504,371	2,181,659	520,000
Walsh-Kaiser Company Providence, R. I.	11	78,936	115,500	27,500													11	78,936	115,500	27,500
TOTALS	2,580	18,544,475	27,417,605	6,450,000	24	159,432	264,455	60,000	44	315,789	427,044	110,000	62	447,790	655,112	155,000	2710	19,467,486	28,764,216	6,775,000
Constructed Each Year:																				
1941	2	14,367	21,480	5,000													2	14,367	21,480	5,000
1942	542	3,891,170	5,723,520	1,355,000													542	3,891,170	5,723,520	1,355,000
1943	1,232	8,848,818	13,124,307	3,080,000					6	(b) 43,056	57,640	15,000	57	411,700	602,497	142,500	1295	9,303,574	13,784,444	3,237,500
1944	720	5,185,185	7,657,613	1,800,000					2	(b) 14,352	21,500	5,000	5	36,090	52,615	12,500	727	5,235,627	7,731,728	1,817,500
1945	84	604,935	890,685	210,000	24	159,432	264,455	60,000	36	(a) 258,381	347,904	90,000					144	1,022,748	1,503,044	360,000
Constructed On:																				
Atlantic Coast	1,012	7,274,791	10,845,592	2,530,000					8	57,408	77,312	20,000					1020	7,332,199	10,922,904	2,550,000
Gulf Coast	426	3,069,084	4,489,877	1,065,000	24	159,432	264,455	60,000	36	258,381	349,732	90,000	32	230,850	336,085	80,000	518	3,717,747	5,440,149	1,295,000
Pacific Coast	1,142	8,200,600	12,082,136	2,855,000									30	216,940	319,027	75,000	1172	8,417,540	12,401,163	2,930,000

(a) Boxed aircraft transport.
(b) Tank transport.
(c) Some converted to special purpose ships; i.e., hospital, seamen training, etc.
Propulsion machinery-triple expansion reciprocating engine of 2,500 I.H.P.

Compiled by American Bureau of Shipping

Number and Average Time to Complete Liberty Ships Constructed by Each Shipyard

Shipyard	No. of Ways	Date First Keel Laid	Number Completed						Avg. No. Days to Complete each Vessel (a)
			1941	1942	1943	1944	1945	Total	
Atlantic Coast									
Bethlehem-Fairfield Shipyard, Baltimore, Md.	16	4-30-41	1	(c) 77	(c) 192	114		384	53.8
J. A. Jones Construction Co. Brunswick, Ga.	6	7- 6-42			21	53	11	85	79.7
New England Shipbuilding Corp., So. Portland, Me. West Yd.	6	9-24-41		12	40	48	12	112	77.2
New England S. B. Corp., (d), So. Portland, Me. East Yard	7	9- 8-42		2	51	52	27	132	70.4
North Carolina Shipbuilding Co., Wilmington, N. C.	9	5-22-41		51	75			126	64.8
St. John's River Shipbuilding Co., Jacksonville, Fla.	6	8-15-42			25	51	6	82	77.6
Southeastern Shipbuilding Co., Savannah, Ga.	6	5-22-42			36	44	8	88	85.6
Walsh-Kaiser Co., Providence, R. I.	6	6-27-42			(e) 6	5		11	208.7
Total	62		1	142	446	367	64	1,020	68.4
Gulf Coast									
Alabama D. D. & S. B. Co., Mobile, Ala.	12	7-28-41		(b) 18	2			20	137.5
Delta Shipbuilding Company, New Orleans, La.	8	10-1-41		28	(b) 35	60	9	(h) 132	82.8
J. A. Jones Construction Co., Panama City, Fla.	6	7- 9-42			21	53	28	102	83.3
Todd Houston Shipbuilding Corp., Houston, Texas	9	7-18-41		32	74	83	19	208	68.4
Total	35			78	132	196	56	462	78.8
Pacific Coast									
California Shipbuilding Corp., Los Angeles, Cal.	14	5-24-41		109	(b) 166	31		(g) 306	60.7
Kaiser Company, Vancouver, Wash.	12	4-15-42		(e) 2	8			10	80.4
Marinship Corporation, San Francisco, Cal.	6	6-27-42		5	(b) 10			15	112.2
Oregon Shipbuilding Corp., Portland, Ore.	11	5-19-41	1	113	197	11		322	44.9
Permanente Metals Corp., Yard No. 1 (d)	7	5-12-42		30	92	16		138	48.3
Permanente Metals Corp., Yard No. 2	12	9-17-41		63	187	101		351	41.1
Total	62		1	322	660	159		1,142	49.6
Grand Total	159		2	542	1,238	722	120	2,624	62.0

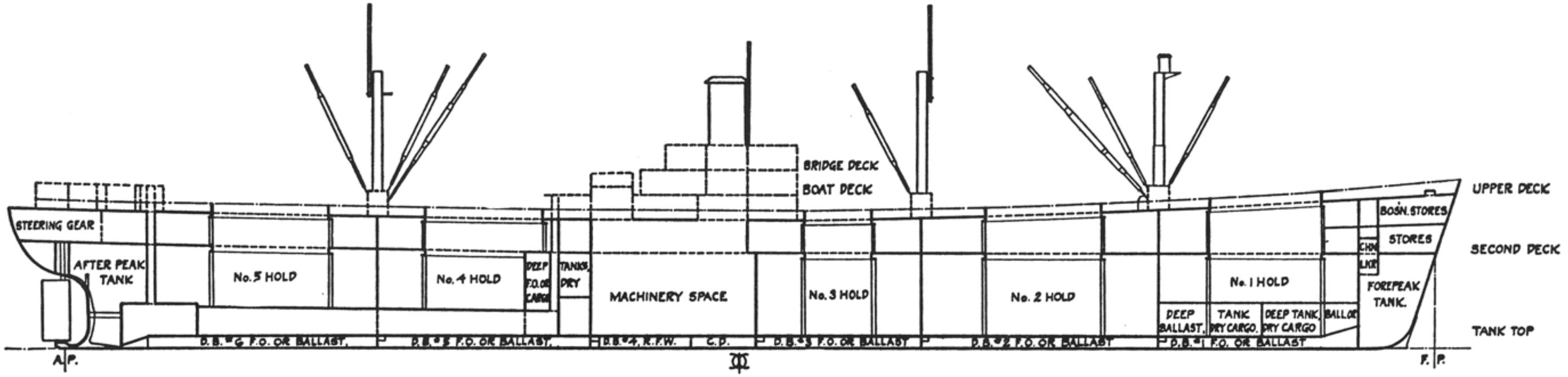
(a) Time to construct includes the day of keel laying.
(b) Part of contract cancelled to permit tanker construction.
(c) Facilities employed part of year on special naval type ships.
(d) Yard previously built 30 similar ships for Great Britain.
(e) Part of contract suspended to permit construction of special Navy type vessels.
(f) Contracts for Liberty ships completed; now constructing other types of ships, or yard closed.
(g) Does not include 30 Liberty type tankers constructed.
(h) Does not include 32 Liberty type tankers constructed, and 24 Liberty Colliers.

Liberty EC-2 Cargo Ships Completed Each Month and Average Number of Days to Build

Month	Number of Yards Producing	Number Built Each Month	Monthly Average Time to Complete	Cumulative Number of Ships Constructed	Cumulative Average Time To Complete
December, 1941	2	2	236.0	2	236.0
January, 1942	2	3	241.3	5	239.8
February	5	12	227.8	17	232.1
March	5	16	217.7	33	225.6
April	5	26	179.2	59	205.6
May	8	43	155.4	102	184.7
June	9	51	122.4	153	164.3
July	10	52	108.4	205	150.4
August	11	57	82.9	262	136.0
September	10	67	70.1	329	122.8
October	11	65	66.0	394	113.6
November	11	68	56.0	462	102.0
December	12	82	55.0	544	97.9
January, 1943	13	79	52.6	623	92.3
February	14	81	62.1	704	88.9
March	14	103	59.5	807	85.2
April	15	110	58.1	917	81.9
May	15	120	57.6	1,037	79.1
June	15	115	56.1	1,152	76.8
July	15	109	53.8	1,261	74.4
August	14	110	46.8	1,371	72.1
September	12	106	42.2	1,477	70.0
October	12	98	42.6	1,575	68.3
November	11	89	43.2	1,664	66.9
December	12	118	42.0	1,782	65.3
January, 1944	12	73	44.0	1,855	64.5
February	13	78	50.7	1,933	63.9
March	13	83	55.2	2,016	63.5
April	13	79	55.1	2,095	63.2
May	12	67	54.5	2,162	63.0
June	10	55	51.4	2,217	62.7
July	10	51	59.5	2,268	62.6
August	9	50	61.6	2,318	62.6
September	9	43	58.1	2,361	62.5
October	9	51	56.9	2,412	62.4
November	8	48	53.1	2,460	62.2
December	8	44	48.8	2,504	62.0
January, 1945	8	32	54.0	2,536	61.9
February	8	30	55.4	2,566	61.8
March	6	21	60.2	2,587	61.8
April	3	8	66.2	2,595	61.8
May	4	6	76.1	2,601	61.8
June	2	7	73.8	2,608	61.8
July	1	2	70.0	2,610	61.9
August	2	6	86.0	2,616	61.9
September	2	4	97.2	2,620	62.0
October	2	4	105.7	2,624	62.0

Note: These figures do not include 62 Liberty ship tankers and 24 Liberty ship colliers.

EC2 (Liberty) Type Cargo Vessel



L.O.A. – 441′-6″. Moulded Dimensions – L.B.P. – 417′-8¾″, Beam – 56′-10¾″, Depth Φ – 37′-4″ to Upper Deck

Built by –
Bethlehem Fairfield Shipyards Inc. – with steam reciprocating propelling power
California Shipbuilding Corp. – with steam reciprocating propelling power
Delta Shipbuilding Co. – with steam reciprocating propelling power
J. A. Jones Construction Co., Brunswick, Ga. – with steam reciprocating propelling power
J. A. Jones Construction Co., Panama City, Fla. – with steam reciprocating propelling power
Kaiser Co., Vancouver, Wash. – with steam reciprocating propelling power
Marinship Corp. – with steam reciprocating propelling power
New England S. B. Corp. – with steam reciprocating propelling power
North Carolina S. B. Co. – with steam reciprocating propelling power
Oregon S. B. Corp. – with steam reciprocating propelling power
Permanente Metals Corp. S. B. Div. Yard No. 1 – with steam reciprocating propelling power
Permanente Metals Corp. S. B. Div. Yard No. 2 – with steam reciprocating propelling power
St. John's River S. B. Co. – with steam reciprocating propelling power
Southeastern S. B. Corp. – with steam reciprocating propelling power
Todd-Houston S. B. Corp. – with steam reciprocating propelling power
Walsh-Kaiser Co. – with steam reciprocating propelling power

Mean Extreme Summer Draft 27′-8½″
Bethlehem-Fairfield Ships 27′-9½″
General Basic Design: Flush deck,
Full scantling

1 No. Off. No. Sig. Ltr.	2 Name of Vessel Former Name Owner Flag Port of Registry	3 Type Water Ballast Size Tank Tons	4 Construction Bulkheads No. of Hatches Largest Hatch No. of Holds Longest Hold	5 Fuel and Capacity Appliances Equipment	6 Dimensions Molded Registered Lgth. Bdth. Dpth. Deck Erections Draft Bale Cub. Freeboard Deadrise	7 Ton-nage Gross Net Dead Wgt. Displ.	8 Builders Ship Hull No. Plac Date Built Engine Date Built Boiler Date Built	9 Type and Particulars of Machinery	10 Hull: Classification; No., Port and Date of Last Periodical Survey Machinery: Classification; Date of Last Survey Mchy. and Boilers; Date Tailshaft Drawn; Etc. Other Classification
491 241,952 KEXH	**ABRAHAM BALDWIN….** United States of America (Dept. of Commerce) Washington, D.C. United States New Orleans, La.	**Sgl Sc** AP 152 DTa 20′ 762 DB 345′9″ 1254 DTf 60′9″ 652 FP 138	**Steel; 2 Dks** Orlop Dk f Metal Arc Welded (Gunwale Strap and Seam Strap Riveted) Trans Frmg 7 WT to Fbd Dk 1 WT to 2nd Dk 5 Ha 35′x20′ 5 Ho 72′6″	**Oil** 1834 tons Rad Tel Rad DF DS C-38(S)	**417′8¾″ 56′10¾″ 37′4″** 422.8′ 57′ 34.8′ Dft 27′8⅞″ 500M Fbd 9′8¾″ Dr 6″	**7232** 5136 10660 14210	**Delta S.B. Co., Inc. 4** New Orleans, La. 7-1942 Combustion Engineering Co., Inc. 7-1942	**3 Cyl TE 24½″ 37″ x70″x48″** IHP 2500 2 WTB; HS 10232; WP 240 Lbs FD;SH SBP;CL 2	✠ A1 Ⓔ SS No. 1 New York 4-47 AS 4-51; Dkd 5-52 ✠ AMS MS 4-51; BS 4-51 n TS 3-51 (Laid up)
5200 243,300 KOBU	**GEORGE GERSHWIN…..** United States of America (Dept. of Commerce) Washington, D.C. United States Los Angeles, Cal.	**Sgl Sc** AP 157 DTa 20′ 760 DB 345′9″ 1234 DTf 60′9″ 652 FP 146	**Steel; 2 Dks** Orlop Dk f Metal Arc Welded (Frames riveted) (Gunwale Strap riveted) Trans Frmg 7 WT to Fbd Dk 1 WT to 2nd Dk 5 Ha 35′x20′ 5 Ho 72′6″	**Oil** 1856 tons Rad Tel Rad DF DS C-38(S)	**417′8¾″ 56′10¾″ 37′4″** 422.8′ 57′ 34.8′ Dft 27′8⅞″ 500M Fbd 9′8¾″ Dr 6″	**7222** 4416 10572 14230	**California S.B. Corp. 174** Los Angeles, Cal. 5-1943 Joshua Hendy Iron Works 5-1943 Babcock & Wilcox Co. 5-1943	**3 Cyl TE 24½″ 37″ 70″x48″** IHP 2500 2 WTB; HS 10232; WP 240 Lbs FD;SH SBP;CL 2	✠ A1 Ⓔ SS No. 1 Baltimore 2-48 AS 3-52; Dkd 3-52 ✠ AMS MS 2-48; BS 9-51 An MS 3-52 TS Drn 4-51 (Laid up)

February 1943

THE
BULLETIN

"CONFIDENTIAL"
(See Page No. 1)

AMERICAN BUREAU
OF
SHIPPING

272

Builder	*Hull No.*	*Type Size*	*Power*	*Owner*	*No. of Vessels*	*Gr. Tons(Est.)***
Delta Shipbuilding Co. New Orleans, La.	1 to 33	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(33)	6,800 ea.
do		Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(28)	6,800 ea.
Equitable Equipment Co. New Orleans, La.	146 to 149	Cargo Vessel 90' x 21' x 10'6"	Diesel 300 H. P.	Quartermaster Corps	(4)	175 ea.
Federal S. B. & D. D. Co. Kearny, N. J.	182 to 186	Cargo Vessel 435' x 63' x 31'6"	Steam 6,000 H. P.	U. S. Maritime Comm.	(5)	7,400 ea.
do	193	Oil Tanker 505' x 72' x 38'	Steam 6,000 H. P.	Sinclair Refining Co.	(1)	10,500
do	233 to 264	Cargo Vessel 435' x 63' x 31'6"	Steam 6,000 H. P.	U. S. Maritime Comm.	(32)	7,400 ea.
Grays Iron Works, Inc. Galveston, Texas	101 to 105	Oil Tanker 212' x 37' x 14'6"	Diesel	U. S. Maritime Comm.	(5)	1,000 ea.
Gulf Shipbuilding Corp. Mobile, Ala.	1-2	Cargo Vessel 445' x 63' x 31'3"	Steam 6,000 H. P.	Waterman S.S. Corp.	(2)	7,400 ea.
do	3 to 12 14 to 17	Cargo Vessel 445' x 63' x 31'3"	Steam 6,000 H.P.	U. S. Maritime Comm.	(14)	7,400 ea.
Houston Shipbuilding Corp. Houston, Texas	1 to 37	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(37)	6,800 ea.
do		Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(32)	6,800 ea.
Ingalls Shipbuilding Corp. Birmingham, Ala.	266-7	Pass. & Cargo 465' x 69'6"x 45'6"	Steam 8,500 H. P.	U. S. Maritime Comm.	(2)	10,000 ea.
do	268 297-9	Pass. & Cargo 465' x 69'6" x 45'6"	Steam 8,500 H. P.	U. S. Maritime Comm.	(4)	10,000 ea.
do	293 to 296	Cargo Vessel 465' x 69'6" x 33'6"	Steam 8,500 H. P.	U. S. Maritime Comm.	(4)	8,900 ea.
do	325 to 330	Cargo Vessel 465' x 69'6" x 33'6"	Steam 8,500 H. P.	U. S. Maritime Comm.	(6)	8,900 ea.
do	331 to 336	Cargo Vessel 465' x 69'6" x 33'6"	Steam 8,500 H. P.	U. S. Maritime Comm.	(6)	8,900 ea.
Birchfield Boiler, Inc. Tacoma, Wash.	7 to 14	Cargo Vessel 90' x 21' x 10'6"	Diesel 300 H. P.	War Department	(8)	175 ea.
Brunswick Marine Const. Co., Brunswick, Ga.	105 to 134	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(30)	6,800 ea.
California Shipbuilding Corp. Los Angeles, Calif.	110 to 164	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(55)	6,800 ea.
do	165 to 224	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(60)	6,800 ea.
Calumet Shipyard & D. D. Co. South Chicago, Ill.	161 to 166	Cargo Vessel 90' x 21' x 10'6"	Diesel 300 H. P.	War Department	(6)	175 ea.
Consolidated Steel Corp. Los Angeles, Calif.	206-7	Pass. & Cargo 389' x 56' x 43'	Steam 8,000 H. P.	U. S. Maritime Comm.	(2)	6,400 ea.

Builder	*Hull No.*	*Type Size*	*Power*	*Owner*	*No. of Vessels*	*Gr. Tons(Est.)***
Consolidated Steel Corp. Wilmington, Calif.	225	Cargo Vessel 395' x 60' x 37'6"	Steam 4,000 H. P.	U. S. Maritime Comm.	(1)	6,400
do	226, 228 to 251	Cargo Vessel 395' x 60' x 37'6"	Steam 4,000 H. P.	U. S. Maritime Comm.	(25)	6,400 ea.
do	276 to279	Cargo Vessel 395' x 60' x 37'6"	Steam 4,000 H. P.	U. S. Maritime Comm.	(4)	6,400 ea.
do	331 to 360	Cargo Vessel 395' x 60' x 37'6"	Steam 4,000 H. P.	U. S. Maritime Comm.	(30)	6,400 ea.
Delta Shipbuilding Co. New Orleans, La.	24-25, 30, 32-33	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(5)	6,800 ea.
do	34 to 61	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(28)	6,800 ea.
do	62 to 76	Cargo Vessel 416' x 56'10¾" x 37'4"	Steam 2,500 H. P.	U. S. Maritime Comm.	(15)	6,800 ea.
Equitable Equipment Co. New Orleans, La.	148 to 149	Cargo Vessel 90' x 21' x 10'6"	Diesel 300 H. P.	War Department	(2)	175 ea.
do	190-1	Cargo Vessel 102' x 21' x 10'6"	Diesel 300 H. P.	War Department	(2)	175 ea.

Epilogue

Handsome of line, seaworthy and tough the Liberty ships were the backbone of the American Merchant Marine delivering 6,000 tons of cargo every hour throughout the war.

In my opinion, Liberty ships were good, reliable vessels that satisfied the needs of the wartime emergency. I do not know, nor do I think anyone can know positively, that given the circumstances, a better ship could have been designed and built with the same speed to meet the requirements of 1941. When the desperate need for the Liberty ships was over and criticisms of the ship were voiced, Vice Admiral Land saltily defended the ship, “we did the best we could with the tools we had. We built the ships; the war was won. And if you don’t like that, you can go to hell.”

Of the more than 250,000 men who served in the American Merchant Marine during World War II at least half served aboard Liberty ships. During the war, 196 Liberty ships were lost and many gallant seamen went to watery graves.

After the war nearly 1,200 Liberty ships were sold to US and foreign interests. As commercial ships they helped to rebuild a war-torn world. There was a great hesitancy in buying the Liberties due to questions of their quality. These fears turned out to be completely false. For their price they turned out to be the finest “tramps” ever produced in maritime history. Once their worth was recognized they were snapped up. Up until the early 1970s they operated under many flags and one could see their familiar profile in the more crowded ports of the world, and the most far-off roads, loading and unloading cargoes ranging from the most usual to the most improbable. Their sturdiness in the face of the roughest kinds of cargo, in all kinds of weather was truly astonishing.

Of all the operators, it was the Greek shipowners who used the Liberties to their fullest potential as tramp ships. It is interesting to note that of the approximately 1,200 Liberty ships sold more than 800 passed through Greek hands.

It has been said that the rebirth of the modern day Greek merchant marine occurred on 7 January 1947, with the granting to Greece of 100 Liberty ships.

The value of the Liberty ships held up amazingly well for two decades after the war. The cost of building ranged between 1.5 to 2.1 million dollars. The US Government sold them for 35 percent of the cost of the ship. The subsequent resale prices reflected the freight market. In 1955, Liberties were sold for $500,000. This rose to $2 million during the Suez crisis in 1956. In mid-1958 the price had dropped to $275,000.

Those Liberties not sold were placed in the National Defense Reserve Fleet and maintained in a State of Emergency readiness. Some were reactivated for use in the Korean War. With one or two exceptions all have now been sold for scrap. Still proving their worth when sold for scrap the ships realized a cash return to the US Treasury.

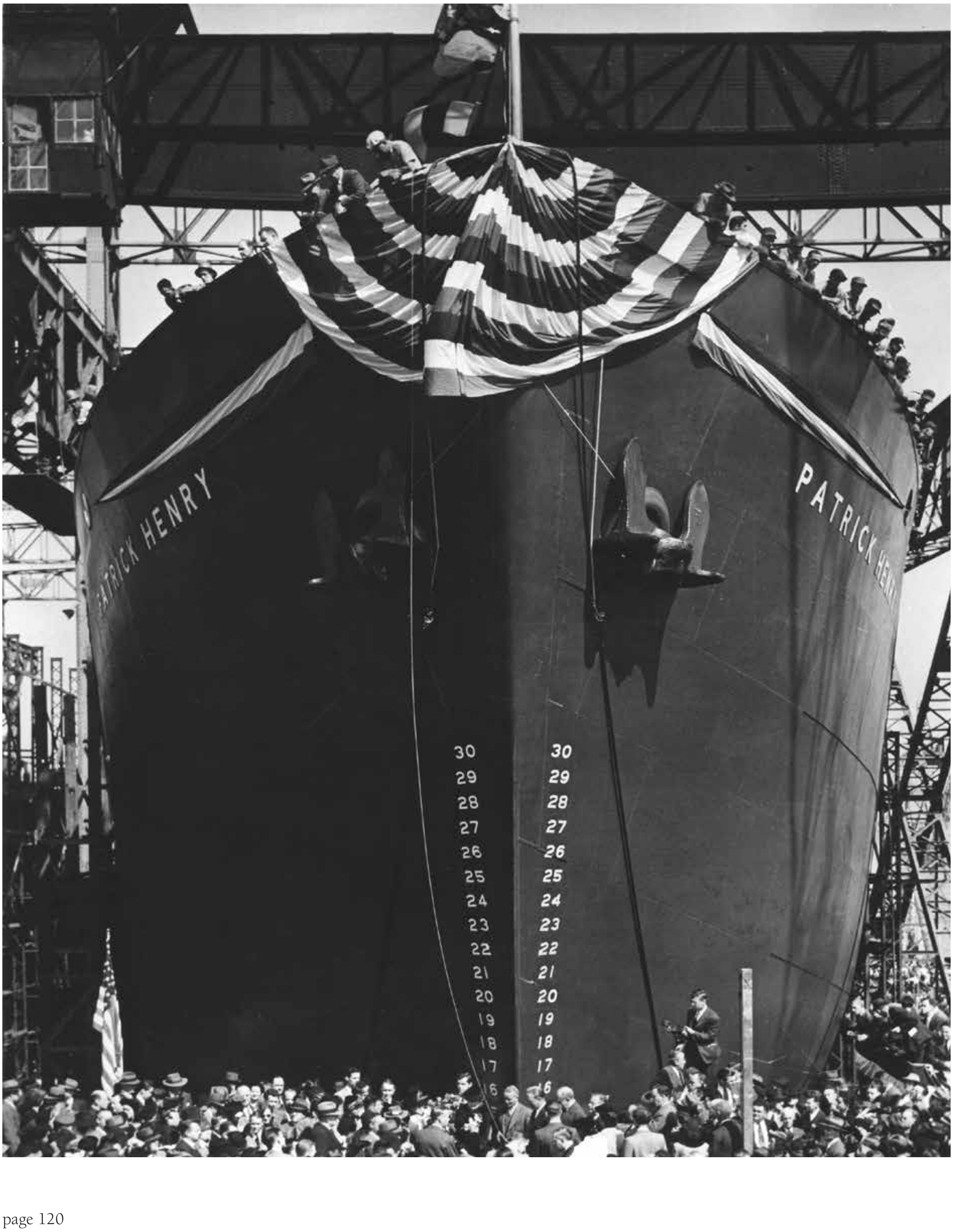
The yards where the Liberties were built have long since disappeared. The ancestral home of the Liberty ships, the J. L. Thompson yard, Sunderland, closed in the 1960s. The area is now a park. Where the air used to be filled with the chatter of the riveter’s gun there is now only silence.

I do not know the fate of *Embassage* or the *Dorington Court*. The *Empire Liberty* was scrapped in Osaka, Japan in 1960. The *Ocean Vanguard* was sunk by a German U-boat in the West Indies on 13 September 1942.

On 14 August 1945, Japan agreed to accept surrender terms and on 30 October 1945 the last Liberty ship, the *Albert M. Boe* was delivered.

In 1958, a rusty veteran of the seas was towed up the Patapsco River in Baltimore. Faded letters on its bow spelled out a name that deserves to be remembered in the annals of the sea: *Patrick Henry*. It was coming back to be scrapped at the same place where it had been launched with cheers and fanfare some 17 years earlier.

The *Patrick Henry* deserved a better fate than the scrapper's torch. It was the first Liberty in the greatest single shipbuilding effort the world had ever seen.



Addendum

Reprinted from ABS *Surveyor*, June 1995

The Story Behind a Name: Liberty Ship *Frank H. Evers*

By Gus Bourneuf Jr.

On the cold night of 8 December 1943, Permanente Metals Corporation of Richmond, California launched from slipway No. 2 Hull No. 2710. Like most of the Liberty ships built for the US Maritime Commission during World War II, it was a sturdy, dependable vessel destined for a long post-war career in commerce. Hull No. 2710 was christened *Frank H. Evers*.

Frank Henry Evers (1867-1943), a veteran of the naval siege of Tientsin during the Boxer rebellion, opened ABS' first exclusive office in San Francisco. A loved and respected figure among the US West Coast shipping fraternity, his friends succeeded in having a Liberty ship named after him a month after his death.

It was common practice for the Maritime Commission to name Liberty ships after prominent Americans, storied patriots or important maritime figures. *So who was Frank H. Evers?*

Frank Henry Evers was for many years a surveyor for the American Bureau of Shipping.

(It is an interesting coincidence that, by war's end, a total of 2,710 Liberties would be constructed and all would be ABS-classed.)

Evers was born 16 March 1867 in Plymouth, England. Immersed in the seafaring culture of that town, he developed a fondness for the sea early in his youth that was to remain with him throughout his life. After attending Plymouth's Royal Grammar School, he took a five-year course in naval architecture, supporting himself by working as a machinist at Armstrong's Shipyards in Newcastle-on-Tyne. After his schooling he went to sea on a number of British tramp steamers and eventually worked his way up to the position of Chief Engineer. During the Spanish-American War he served as Chief Engineer on British tramp steamers plying the China trade and in 1900, served on a ship at the bombardment of Tientsin during China's Boxer Rebellion.

Evers left the sea shortly thereafter to work with Captain H. H. Watson as an engineer/surveyor. Watson was an independent ship surveyor working along the West Coast of the United States. Upon Captain Watson's death in 1901, Evers was appointed as a non-exclusive surveyor based in San Francisco for the American Bureau of Shipping (ABS).

In addition to his position with ABS, Evers was also working as Superintendent Engineer for the Union Oil Company, where he was instrumental to the laying of the first oil pipeline on the Pacific Coast. A pioneer in the development of fuel oil burners for ship's boilers, Evers also played an important role in the development of Pacific Coast oil tankers. In 1916 he designed and oversaw the building of seven tankers for the Pan American Petroleum and Transport Company.

Evers often claimed that he was living on borrowed time, for he had been aboard the SS *Progresso* on 3 December 1903 when it exploded into flames at the dock of San Francisco's Fulton Iron Works.

He was blown into the bay and rescued by a passing tug. For many years thereafter, a large framed photograph of the burning *Progresso* hung in the ABS office in San Francisco. Eventually, the reason for its presence was forgotten and the photo disappeared from the office walls. As this story was being readied for press, however, the framed photo strangely reappeared in the ABS World Headquarters in New York. It seems Mr. Evers is still willing to lend ABS a hand.

The story of the *Progresso* disaster was still a living memory as Evers opened ABS' first exclusive office in San Francisco and took the position of Principal Surveyor. He hired a promising teenager, Cecile McQuaide, to be his secretary. McQuaide was to spend her entire working career with ABS.

There were also three surveyors in the office, including Eugene MacCarthy from Belfast and Matt Flynn from Southern Ireland. Though they worked side by side for many years, Flynn and MacCarthy said nary a word to each other – through all that time they would communicate only through the witness to their sometimes amusing transplanted hostilities, Cecile McQuaide.

In 1939 another surveyor arrived in San Francisco. Over the remaining years of Evers' life the two became close friends and Frank enjoyed telling the young man of his adventures at sea. The new surveyor was Basil McLean, who later rose to become Senior Vice President of ABS.

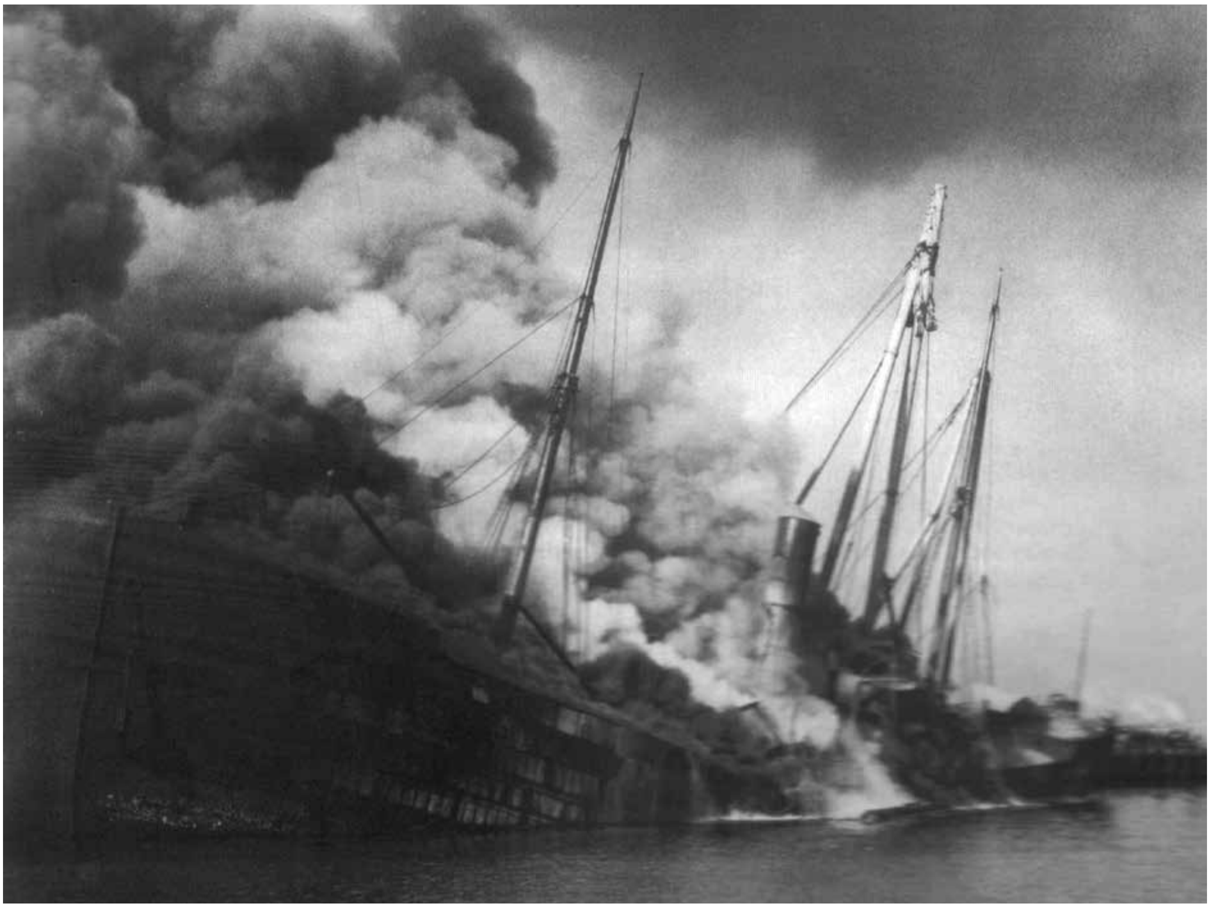
Each of these diverse individuals – and many others throughout the wild, expanding and often cutthroat maritime community of those days – developed and maintained a close, respectful relationship with Evers.

Reflecting his love of the sea, Frank Evers shunned retirement and remained at his post until his death at the age of 76, on 11 October 1943.

Evers' many friends in the West Coast shipping fraternity petitioned the US Maritime Commission, through J. E. Cushing of the War Shipping Administration in San Francisco, to have a Liberty ship named for Mr. Evers. They succeeded.

The keel for *Frank H. Evers* was laid on 19 November 1943 and it was launched nearly three weeks later, surrounded by its namesake's friends and family. The vessel's sponsor was Mrs. W. Bowen Marks, Frank Evers' daughter. The maids of honor were Miss Joan Evers and Miss Nancy Marks, Evers' granddaughters. The speaker at the launching was William B. Warren, ABS Principal Surveyor for San Francisco. Sea trials were completed on 15 December 1943 and the next day, it was delivered to the US Maritime Commission.

Liberty ship, SS FRANK H. EVERS, armed for battle carrying the cargoes of war.



A fiery death captured on film. San Francisco, 3 December 1903 – Minutes after its explosion rocked the Embarcadero, smoke billows from the fire that destroyed the SS PROGRESSO at the Fulton Iron Works on San Francisco Bay. Principal Surveyor Frank Henry Evers was attending the vessel when the blast occurred, but soon found himself flung far into the Bay. He was rescued by a passing tug, and said he was living on borrowed time for the next 40 years.

Another friend saw the ship through its maiden voyage: it was commanded by Captain J. H. Barnhart, the nephew of Cecile McQuaide. At 1300 hours on 1 January 1944, 17 miles west of Cape Mendocino in latitude 40′29″N, longitude 120′46″W, Captain Barnhart cast the ashes of Frank Evers into the sea he loved so well.

For the remainder of World War II, the SS *Frank H. Evers* was operated by American President Lines. It sailed the oceans of the world, delivering the cargoes of war. It paid off on 6 July 1946 in Norfolk, Virginia and, like many of its sister ships, was put in the James River lay-up fleet.

Early on 1 February 1947, SS *Frank H. Evers* was removed from lay-up and delivered to the government of Italy. Under the Italian flag its name was changed to *Enrico C* and, for the next 16 years it was operated by Costa Lines.

One year, midway through its life as an Italian vessel, the ship came due for survey. Who was the surveyor asked to attend this old Liberty ship that came calling to a northern Italian port? Basil McLean, who was then working in Italy. It was a touching moment indeed for him when, looking in the *ABS Record*, he realized that it was the ship once named for his old friend Frank Evers. Recalling that day, Mr. McLean says “It brought back to my mind my affection and admiration for a great and kind man.”

In April 1963 the ship was sold again, renamed *Nicholas A* and, finished its life under the Liberian flag. Finally, in April 1967, *Nicholas A*, ex-*Enrico C*, ex-*Frank H. Evers*, met the scrapper’s torch in Kaohsiung, Taiwan.

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About the Author

Augustin (Gus) Bourneuf Jr.

As the Water Rat so famously said to the Mole in Kenneth Grahame's *Wind in the Willows*, "There is nothing – absolutely nothing – half so much worth doing as simply messing about in boats." Brought up in a small New England fishing town, Gus Bourneuf has been privileged to spend his life in tune with the Water Rat's philosophy. Graduating from the Massachusetts Maritime Academy as a licensed marine engineer, Bourneuf spent his early years at sea on a variety of commercial ships, including his beloved Liberty ships, before family ties brought him ashore.

For the rest of his professional life Bourneuf was a surveyor with the American Bureau of Shipping, one of the world's leading classification societies, eventually rising to the position of Chief Surveyor responsible for the activities of some 700 field surveyors in ports around the world. One of his more remarkable tasks was to be asked to survey 'Old Ironsides', the venerable and historic *Constitution* at its berth in Boston harbor.

Since retiring, Bourneuf has continued to mess about in boats as an enthusiastic volunteer and rigger at the Mystic Seaport Museum in Connecticut and a crafter of fine wooden boats. An avid maritime historian, he has also amassed a comprehensive library of maritime books and artifacts, including some treasured items salvaged from Liberty ships headed to the scrap yards. Bourneuf currently resides in New Jersey.

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