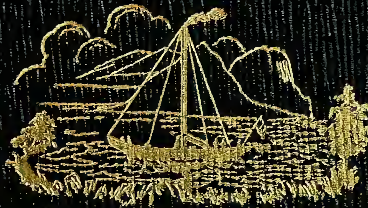

130 YEARS
of
STEAM NAVIGATION

Robert Dollar


Robert Dollar

ONE HUNDRED THIRTY YEARS OF

Steam Navigation

A HISTORY
OF THE MERCHANT SHIP
BY

Robert Dollar

PRIVATELY PRINTED FOR THE AUTHOR BY
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CHAPTERS

ILLUSTRATIONS

FOREWORD

SOME BOOKS are written in a few months, but this is not one of them. The present account of the growth of steam navigation has had, like the ships themselves, a slow development. To use marine terms, the keel of this book was laid about twenty years ago, when some friends suggested that I write a volume of this kind. The idea appealed to me; the subject of ships was uppermost in my thoughts. Since that day this book has been under construction, but its superstructure was not completed until 1931, the year of my eighty-seventh birthday.

My life has never been one that would permit of sitting down and writing a book, and such books as I have written have been done at odd times. Long ago I found that the work could be done best during a voyage to or from the Orient or round the world, and therefore most of the writing I have done has been accomplished on the high seas. My secretary always accompanies me, and part of his duty on shipboard is to transcribe material intended for publication.

The present book is no exception. Parts of it have been prepared on every ocean; between business calls in foreign ports, during passages from country to country, pages were added to the manuscript. In my reading of marine articles and books and in my contact with shipping affairs, I was always on the lookout for facts about steam navigation. Clippings, penciled notes and dictated fragments were slowly collected in a special folder, and piece-meal the written pages piled up. And with a book, as with any other undertaking, constant work brings results. At last the manuscript was rounded out, the last chapter written. The ship-book I had started to build nearly twenty years ago was ready for launching.

It has been a pleasant task, organizing the material about a subject that has occupied my waking hours for so many years. Ships and shipping—an industry that is both romantic and practical, and therefore of absorbing interest to the layman as well as to the shipping man. The merchant vessel, trading across our oceans and bringing into closer relationship the peoples of the world, has done more for the advance of civilization than any other commercial factor. The story of the rise of present-day passenger and cargo steamships from their crude beginnings of 130 years ago is a story of splendid accomplishment. During that period the genius and energy of countless men have gone into the task of creating more efficient ships.

That is the story I wanted to tell, and have told in the following pages. I have tried to avoid making a dry history of shipping development, and for this reason I have included many personal observations and comments along with the necessary statistical facts.

There is inspiration in the daring and skill displayed by the long list of designers, builders and engineers of steamships. Their successes—and even their infrequent failures—have pointed the way for the creators of our modern merchant fleets. If the telling of the step-by-step progress made since the days of the earliest steamship pioneers will also add to the public's appreciation of the vital part played in the world's affairs by commercial ships, my pleasure in the preparation of this book will be doubled.

ROBERT DOLLAR.

San Francisco,
November 6, 1931.

Chapter I

One Hundred Thirty Years Ago

In this account of the development of the steamship it is not my intention to go into the controversial subject of who was the first to use steam propulsion, nor to take up the cudgel for any of the men around whom the battle rages so hotly. Relatives of the early developers, historians and others whose wish it is to give credit to the right individual have presented their arguments in the past and are still doing so; my idea in this book is to set down as accurately as I can the facts gathered here and there during many years of interest in ships and shipping. Nevertheless, the reader may detect a slight prejudice in favor of William Symington. The reason for this personal partisanship will be explained later.

We know that as early as 1615 a Frenchman named Solomon de Caus equipped a boat with a crude steam engine. We also know that about 1707 Dennis Papin operated an experimental boat propelled by steam. About the same time Thomas Savery invented a "fire-engine" and proposed to fit a boat with it. In 1736 Jonathan Hulls took out a patent for a steam paddle vessel, and in 1783 Jouffroy d'Abbans ran trials with a steam-powered boat. Numerous others of that general period also proposed steam-power for boats, but all of these enterprising men failed to develop their ideas. The steam engine had not been developed quite far enough. Their engines and their propulsion equipment were not practical.

It was not until about ten years after James Watt perfected his steam engine in 1775 that a really successful steam-propelled boat was launched. Therefore, the present account will begin with the steamboats built during the closing years of the eighteenth century, for it was these early craft that established steam-power afloat and gave other designers and builders something definite to improve on.

From the records we find several men active in the development of steamboats from the year 1785 onward. All of them were indebted to Watt, for without his genius in invention the birth of steam-driven boats would have been much longer delayed. The most prominent and successful of these men, and the dates of their accomplishments, were:

John Fitch, who built his first model in 1785, his first boat in 1787, and several others before 1790, in America.

James Rumsey, who built a steamboat operated on the jet system in 1787, in America.

William Symington, who built his first boat in 1788, his second in 1789, and his third in 1801, in Scotland.

Robert Fulton, who built his first boat in 1803, in France, and his second in 1807, in America.

John Stevens, who built a twin-screw steamboat in 1804 and a paddle-wheel boat in 1807, in America.

Henry Bell, who built the first European commercial steamship in 1812, in Scotland.

Others on both sides of the Atlantic were working on steam-propelled vessels during the period covered by the above developments, but the men named were the ones most persistent and therefore the most successful.

These pioneers of steam navigation deserve great credit; they went ahead with their ideas at a time when the world was convinced that sails were the final improvement that could be made in ship propulsion. They were called crazy, dreamers, and worse, but they persisted in the face of strong opposition. They were the forerunners of a long list of enterprising men who, taking leaves from the books of these early experimenters, have continually improved the hulls and engines of seagoing vessels down through the years. Over a century and a quarter this work has been going on, and as a result our present-day ships are almost incredibly efficient, safe and comfortable.

Before attempting to outline the wonderful progress made in the size and power of ships for the last 130 years, I will draw on old records and clippings for details about the leading pioneers in steam navigation.

John Fitch—This pioneer American inventor of steamboats attained considerable success with his various experimental craft, but it was his poor luck to be ahead of the times. His first model steamboat had large side-wheels which did not work successfully. His next move was to put a steam engine in a 45-foot boat equipped with six paddles on each side. The trials at Philadelphia in 1787 were successful, and in the following three years he built two new boats. The last one, completed in 1790, had three large paddles at the stern, and she attained a speed of eight miles an hour.

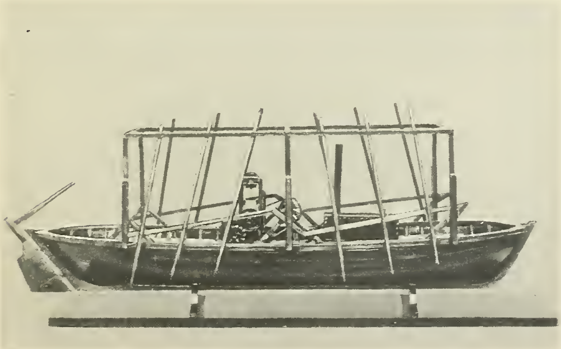
He next designed a freight and passenger boat to run on the Ohio River and its tributaries, but a storm prevented the craft's completion in time and his patent was defaulted. Fitch had no money, and his associates deserted him. The time was not ripe to interest anybody in steamboats, and after several failures to raise funds he went to Europe. There he could not get a hearing, so returned home as a common sailor. In 1796 he tried a small boat fitted with a screw-propeller, and still the people refused to listen to him. Thoroughly discouraged, John Fitch died without the honors that were later given him. His faith in his invention never wavered; in his "Journal" he wrote: "The day will come when some more powerful man will get fame and riches from my invention, but nobody will believe that poor John Fitch can do anything worthy of attention."

James Rumsey—In 1787 this American inventor launched his first steamboat on the Potomac River. The trial trip developed a speed of four miles an hour by the method known as the "jet system." His engine forced out a stream of water at the stern of the boat, driving it ahead. Following this, he went to England,

Courtesy C. O. Buckingham

JOHN FITCH WORKING ON HIS MODEL OF THE FIRST STEAMBOAT

From a Fresco Painting in the Capitol, Washington, D. C.



Courtesy of the Museum

MODEL OF JOHN FITCH'S STEAMBOAT, 1787

Now in the U. S. National Museum, Washington, D. C.

France and Holland and secured patents on his invention. This propulsion method was not as efficient as side or stern paddle-wheels, but Rumsey must be included among the pioneers of steam navigation. Like John Fitch, he did not live to benefit by his scheme. He made a successful demonstration of his boat on the Thames in 1792, but died before he could carry his experiments further. A model of his boat is in the United States National Museum at Washington.

WILLIAM SYMINGTON—This Scotch engineer-inventor's life was a particularly interesting one, for he is credited with the first efficient steamboat to operate in European waters, and also with the honor of being "the father of the modern steamship." In dealing with his successes and failures I can do no better than to quote from a biography written by J. and W. H. Rankine and published in 1862 by Archibald Johnston in Falkirk, Scotland. This account of Symington's life has long been out of print, but through the courtesy of the publisher's son, Fred Johnston, publisher of the *Falkirk Herald*, a part of this interesting book is reprinted here. It gives a picture of Symington's time and the difficulties facing a man so advanced as to try to prove that steamboats were better than sailing ships. This is perhaps the most complete account available of the life of any of the early steamboat inventors, which is one of my reasons for drawing so heavily from its pages. Besides, I was born in Falkirk, and the scene of Symington's struggles is familiar to me. Later I shall explain more fully my seeming disposition to favor him over the other inventors of his day.

The book I quote from is "The Biography of William Symington, Inventor of Steam Navigation." The authors were two engineers thoroughly familiar with the inventor's life history.

"William Symington, the real inventor of efficient steam navigation, was a native of Leadhills, Lanarkshire, Scotland. Intended for the Church, he received an excellent education, but his predilection for mechanics defeated that intention. Before completing his twentieth year he conceived the idea that the steam engine could be rendered available for the propulsion of land carriages, an idea he afterward embodied in a working model which he exhibited to the professors of the University of Edinburgh and other scientific gentlemen, who were much pleased both with Symington and his invention.

"Among those who examined the model was Mr. Miller, of Dalswinton, who had spent much time and no little money in experimenting on ordnance and naval architecture. Among his other schemes he attempted to propel double-keeled vessels by turning paddle-wheels with a capstan. He told Symington that he, too, was an inventor, and described his boats, and his disappointment that the power he employed was not sufficiently effective. Symington then said, 'Why do you not use the steam engine?' and proceeded to show how it could be connected with the wheels of the boat. Convinced by this explanation, Mr. Miller

Model of James Rumsey Steamboat, 1787

U. S. National Museum, Washington, D. C.

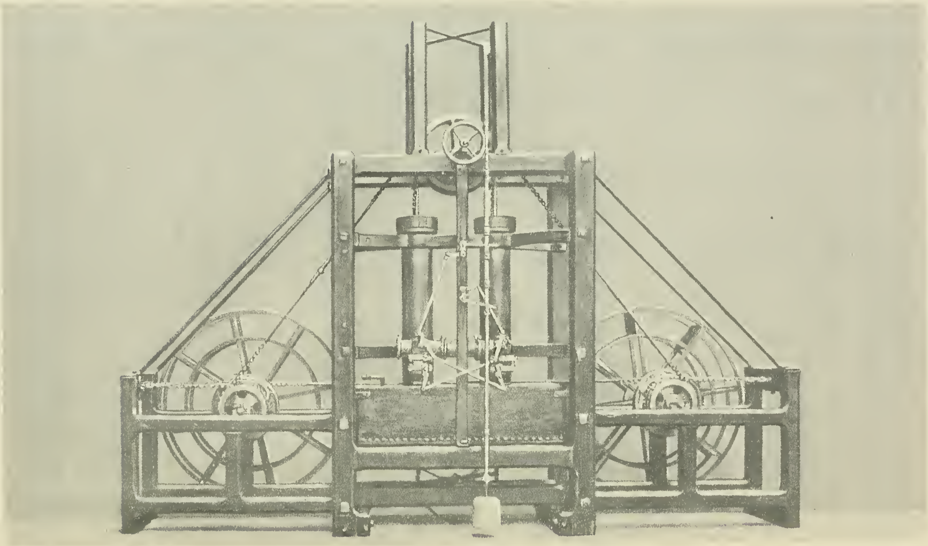
expressed a wish that Mr. Symington should construct a steam engine similar to that which he had invented and fit it into a double-keeled boat with which Mr. Miller was experimenting.

"It was not until the autumn of 1788 that Symington could get everything in readiness, being engaged in constructing and erecting machinery for the Wanlock Lead Mining Company. When the steamboat was tried it proved most successful, which induced Mr. Miller to give orders that one of his larger experimental boats, and an engine of greater magnitude and power, should be gotten ready. This was done, and in 1789, amidst the cheers of assembled multitudes, the boat was propelled on the Forth and Clyde Canal at the speed of nearly six miles an hour. But here, when success had so signally crowned his efforts, Symington had the misfortune to lose the co-operation of Mr. Miller, who, most unaccountably, at once and for ever abandoned experiments in steam navigation.

"From that time until the year 1800 this invaluable nautical auxiliary was allowed to lie dormant, the state of its inventor's pecuniary resources being such as to prevent his attempting to carry it further unaided. One day, however, he met Lord Dundas, who told him that, having seen his former steamboat experiment, he had come down from London principally to see him and to learn whether steamboats could not be substituted for the horses used in dragging vessels on the Forth and Clyde Canal, of which his lordship was a large proprietor and governor.

"Fortunately for his country and the world, although most unfortunately for himself and his family, Mr. Symington gave up all thoughts of his mine work and returned home, elated to be able to re-embark in his favorite project under such promising auspices. An arrangement was speedily affected, and in 1801 the first boat, named *Charlotte Dundas* (in honor of his lordship's daughter, afterward Lady Milton), was built for the express purpose of being propelled by a steam engine.

"After making a trip to Glasgow, she was set to work, and towed on various occasions vessels in the canal, besides running down into the river Forth and dragging thence at one time up the river Carron into the canal at Grangemouth, four or five sloops, detained by a contrary wind. Although thus far successful, the proprietors of the canal, with the exception of Lord Dundas, fearing its banks might be injured by the undulations caused by the paddle-wheels, ordered it to be discontinued. His lordship, however, who was not so easily prejudiced or discouraged, advised Mr. Symington to get a model of his boat constructed and take it to London. Mr. Symington took the model to Arlington Street and presented it to Lord Dundas, who was so much pleased with it that he introduced Mr. Symington to the Duke of Bridgewater, who not only expressed his admiration of the plan, but immediately gave orders that eight boats of similar construction should be gotten ready as speedily as possible for his canal, which bears his name.



Symington's First Marine Engine, 1788

This engine, the oldest marine engine extant, is now in the Science Museum, South Kensington. This bears no resemblance to Symington's later engine of 1801

"Soon after this interview Symington returned to Scotland and completed his second and largest steamboat, likewise named *Charlotte Dundas,* for Lord Dundas. This boat was tried in March, 1802, when she towed two laden sloops, the *Active* and the *Euphemia,* of seventy tons burden each, from Lock No. 20 to Port Dundas, Glasgow—19½ miles in six hours, notwithstanding that during the whole time so strong an adverse gale prevailed that no other vessel in the canal could that day move to windward.

"But even this further proof of the efficiency of the invention did not remove the objections of the managers of the canal company, and they peremptorily ordered all further trials to be discontinued. The boat was therefore laid up in a creek of the canal and Mr. Symington had to suspend his attempts to introduce steam navigation in that quarter—especially as on the very day he made his successful towing experiment he was informed by Lord Dundas of the decision of the canal managers, and also of the sudden death of the Duke of Bridgewater.

"The experiments made under the patronage of Lord Dundas were far more perfect than those he made for Mr. Miller, as a direct-acting engine and crank for procuring a rotary motion were substituted for the engine and ratchet wheels used in the first boats; indeed, it may be said that here commenced the present system of steam navigation.

"For several years from this time Mr. Symington resumed his usual engineering avocations, and would soon have become independent but for the difficulties in which his steamboat experiments had involved him, having cost him not only several thousand pounds of his own money but also considerable sums belonging to his family. In 1824 he endeavored to bring his claims under the notice of the Government, and through the kind interest of Sir George Clerk and Sir Ronald Ferguson he received £100 from the privy purse of his Majesty King George the Fourth, and the further sum of £50 a year or two afterward. No additional allowance was ever granted, although the expense incurred in collecting evidence and going to London exceeded all he ever received for his trouble.

"For the last two or three years of his life he was, with Mrs. Symington, totally dependent for support on the members of his family. He went to London for the last time in 1829, laboring under a painful and dangerous disease, but by medical care and other attentions he received he so far recovered as to be able to resume his mechanical pursuits, and soon afterward to endeavor to procure a Parliament investigation of his claims. The latter object, however, he could not attain, a circumstance which preyed so much on his mind that his malady made rapid progress, and he died on the twenty-second of March, 1831, wounded in spirits and broken down by misfortune. His mortal remains rest in the churchyard at St. Botolph, Aldgate, London, so that he owes not even a grave to the land of his nativity.

"Of the many subjects upon which there has been almost endless discussion, possibly there has not been one on which there has been so much diversity of opinion. Many have claimed the merit of having invented efficient steam navigation, and for equally as many has the merit been demanded, but to William Symington, the subject of this biography, the real merit is alone due. From 1788 to 1800 steamboat experiments had been asleep, at least to the world, although not in Symington's mind. In 1801 he made his great improvements in machinery for use in his historic boats on the Forth and Clyde Canal. All honor to the name of Symington, who gave this great invention of steam navigation to the world—and who died unrewarded."

The *Charlotte Dundas* was built at Grangemouth in 1801 by Alexander Hart. She was 56 feet long, 18 feet beam, and 8 feet deep. Her engine was of 10 horsepower and was placed horizontally on deck with the boiler beside it. The paddle-wheel was in a cavity at the stern, ahead of the double rudders; the cylinder was 22 inches in diameter and had a 4-foot stroke, with a connecting-rod from the piston-rod to the crank on the paddle-wheel shaft. The engine had a jet condenser and an air-pump worked by a bell-crank. The machinery was built at the Carron Iron Works under Symington's direction. His first marine engine was fortunately preserved and is now in South Kensington Museum—the oldest example of marine engine extant.

Robert Fulton—Fulton's first steamboat was built in France and was tried on the Seine in 1803, but his proposal was not received with any warmth. Two years later he ordered a steam engine from Boulton and Watt of Birmingham to be shipped to America. His second boat, the *Clermont,* was built in 1807 and fitted with Watt's engine. She was 150 feet long, 13 feet beam, and 2 feet draft. The machinery and paddles were exposed; the thrashing of the paddles on the trial trip drenched the passengers with water, and the clatter of the power plant and the cloud of wood smoke from the furnace added to the excitement of the run. The *Clermont* went 150 miles up the Hudson River to Albany, breasting both current and wind, in thirty-two hours, giving an average speed of about five miles an hour. In 1809, with paddle-boxes and guard rails added, the hull widened and strengthened, cabins made more comfortable, the vessel was renamed *North River* and entered the regular service between New York and Albany.

Seventeen steamboats were added to the Fulton fleet thereafter, at least one a year, and sometimes as many as three a year, until 1816. The monopoly Fulton and his associates had on the Hudson River was a financial success; Fulton was the only steamboat builder of his time who was able to carry on his work beyond two or three experimental vessels. Most of the others died poor, without the honor they deserved for pioneering in a field that required both money and perseverance.

John Stevens—This pioneer steamboat developer first turned his attention to the screw propeller, and

Robert Fulton's Pioneer Steamer, *Clermont*, which made its first voyage from New York to Albany in August, 1807

not only did he apply this principal successfully, but his first boat was equipped with twin-screws. In design, the propellers he used were practically the same as the short four-threaded helix type screws of later steamship days. Like so many inventors, he found few to believe in his ideas. His first boat, with twin-screws, was built in 1804, and he ran it on the Hudson River.

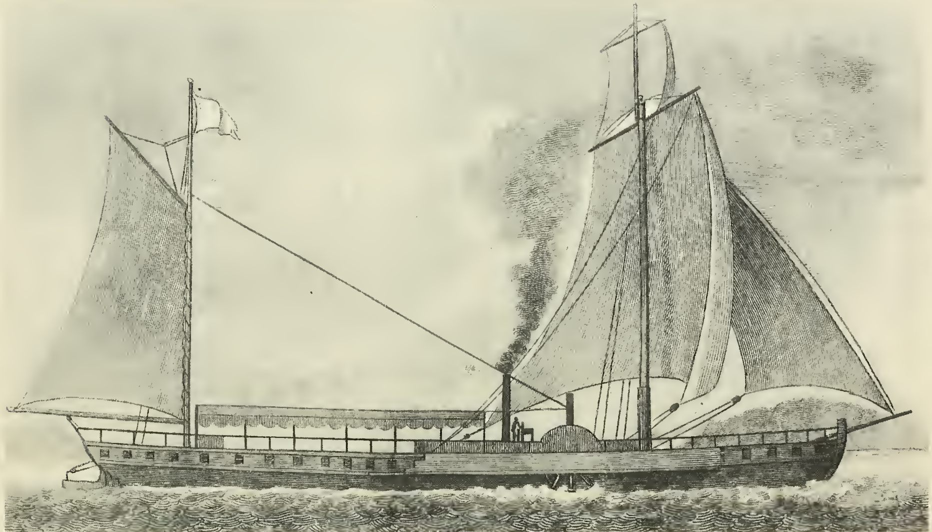
It is interesting to note that Colonel Stevens advocated several points in steamships that have since been adopted, although it was nearly half a century later that any of them were applied. For the screw-propelled steamer he stated that five essentials were necessary: the short four-bladed propeller; the multitubular boiler; high-pressure steam; direct connection of the engine to the propeller shaft; and the use of twin screws. He hit upon the very foundation of successful steamship design in these ideas, yet during his lifetime his suggestions were disregarded. The eventual adoption of these five points proved how right he was.

In his experiments, Stevens discovered that a boat with one screw had a tendency to veer off a straight course, the bow moving in a direction opposite to the direction the screw turned. Modern single-screw ships show this tendency, as every engineer knows. Stevens overcame this by putting his two screws side by side, each revolving in reverse directions. His plan for driving two screws by a single cylinder was very simple, and in this he was followed by other builders when screw propellers were adopted long afterward.

One reason given for Stevens' failure with screw propulsion was that at the end of the seventeenth century there were neither tools nor skilled mechanics in America to construct the quick-moving engine he designed. Therefore he put that project aside for the time and devoted his attention to boats with paddle-wheels driven by the slow-moving engines of the period. In 1807 he and his son Robert built the *Phoenix,* a paddle-wheeler, which made the voyage from New York to Philadelphia—said to be the first boat to make a sea voyage under steam. The piston rod of the *Phoenix* was guided by slides; the cylinder rested on the condenser; the paddle-wheels were guarded, unlike Fulton's first paddles. This vessel ran on the Delaware for a number of years.

After his father's death, Robert Stevens demonstrated the propeller engine and boiler in a boat before a committee of the American Institute of New York, proving the power of screw propulsion with a speed of about nine miles an hour. Even after this proof, marine engineers considered the screw impractical and continued to improve on paddle-wheels and the engines designed to drive them. The original boiler and engine of Stevens' experimental boat are now in the Stevens Institute at Hoboken.

Henry Bell—The inventor of the *Comet,* the first British passenger steamboat, was a stonemason and then a carpenter, and in the latter capacity he worked in a Bolness shipyard. At this time he became interested in the work of Symington and Patrick Miller, but had no money to carry out his experiments in steam naviga-



Peabody Museum of Salem

FULTON'S STEAMBOAT THE *Paragon*, 1811

tion. He made some of the woodwork for Symington's first vessels, and saw the ill-fortune of this pioneer. Bell was convinced that success was possible; in 1798 he was experimenting, and in 1800 tried to interest the Admiralty in his plan for a boat. He was told by the president of the Royal Society, "It is a very pretty plan, but there is one point overlooked; a steam engine requires a firm basis on which to work."

It was not until 1812 that he launched the *Comet,* built at Glasgow. This craft was 42 feet long, 11 feet beam, and had a draft of 5½ feet. She had a 3 horse-power engine, but she attained a speed of five to six miles an hour. He advertised that his boat would run regularly on the Clyde, between Glasgow and Greenock, leaving the former city on Tuesdays, Thursdays and Saturdays, and returning "on the other lawful days of the week"—which would indicate that such travel was not permitted on Sundays.

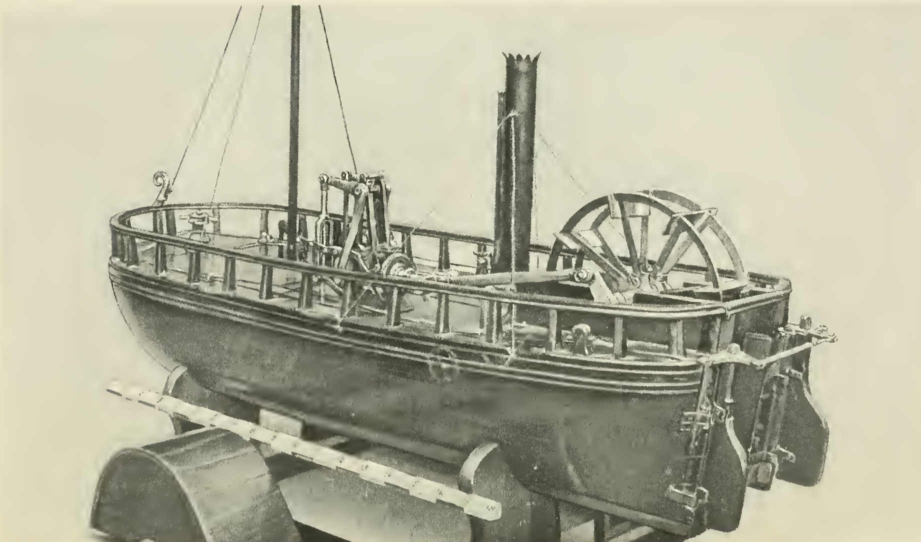
The *Comet* was a mild commercial success, carrying passengers and freight on the twenty-five-mile trip. Later the *Elizabeth* was built to succeed the *Comet,* but the latter was lengthened to 60 feet and continued in the service. Bell did not make much money from his invention but he was one of the few pioneer steamboat builders who lived to see his ideas developed into a real success.

The *Comet's* boiler was placed at one side, with the funnel bent so as to appear to rise from the center; this funnel was used as a mast. The engine had an upright cylinder 12½ inches in diameter with a 16-inch stroke.

Two rods were used to drive a pair of side levers. From these a connecting-rod worked the crank shaft, which carried a heavy fly-wheel. The condenser was placed between the side levers, which drove the vertical air pump. The vessel was in service for eight years on the Clyde, and in 1820 ran ashore, but the passengers got off safely.

Referring again to William Symington, you will recall that I said I was probably a little prejudiced in his favor. This may be attributed to two reasons: (a) He was a Scotsman, and (b) his *Charlotte Dundas* was the only one of the early steamboats that I saw. The fact is, as a boy, more than seventy-five years ago, I used to play about the deck of this historic boat. She was abandoned in the mud in a wide place in the Forth and Clyde Canal called Top Hill Entry, on the south side of the canal between Locks Nine and Ten. She had outlived her usefulness and lay there neglected. Her deck was a few inches above the water and provided an ideal place for the boys to strip off and go in swimming.

Two parts of her hull were impressed on my young mind; she had an unusual opening in her stern about 4 feet wide and 12 feet long, and she had two rudders. After the lapse of about twenty-five years I was much pleased to find, on examining the model of the *Charlotte Dundas* in the South Kensington Museum, London, that the memory I had carried all those years was perfectly correct. And to refresh my memory further, I recently visited the spot where she lay and



Model of the *Charlotte Dundas*, 1801

Now in the Science Museum, South Kensington

found that she had been broken up about twenty-five years ago. An old sunken barge occupied her former berth, with a crop of flags and water plants in her hold almost covering her up.

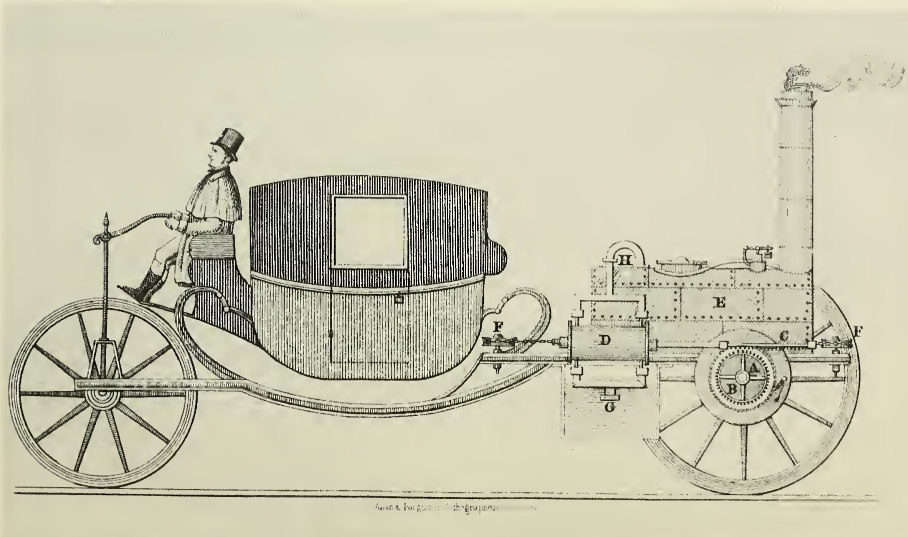
This visit brought back many pleasant boyhood memories. My recollections of the canal and locks were that they were much larger than they actually are; perhaps my ideas have expanded as I grew older. I was fortunate enough to get one of the oak-knees from the *Charlotte's* hull, which I brought back to San Francisco. It is now in a glass frame at the entrance of the India House, Hanover Square, New York, where thousands have the pleasure of looking at a piece of oak that has withstood the elements and decay for more than 130 years.

Strange to say, although the outside shows the effects of the severe Scotch weather, the inside of the wood is as sound as it was the day it was put into the vessel. It had been fastened with the old-fashioned wooden treenail. This valuable souvenir was unearthed through the energy and perseverance of Provost I. G. Russel of Falkirk in the attic of a house occupied by a very old man in the village of Lauriston, where it had lain undisturbed for over 50 years. What a sad commentary on the indifference of the world at times, to allow articles of such historical value to lie forgotten. But how much more this indifference is apparent in the case of the inventor of the first practical steamboat! He was left in such destitute circumstances in his last years that he was dependent on the charity of relatives and friends.

Truly the race is not always to the swift, nor the battle to the strong. Neither he nor any man of his day could foresee the tremendous development that steam navigation was destined to make from such a small start.

Before closing this chapter I want to give credit to another great pioneer of steam navigation, David Napier of Scotland. He was an engineer, a shipowner, and a shipbuilder; he worked on the machinery for the *Comet,* and thereafter built engines for a number of steamers to ply between Scotch and Irish Ports. He removed to London and with his son established a yard where numerous steamships were launched. Napier is credited with being the first engineer to adopt the vertical engine, and to build ships with double bottoms—not for the purpose of carrying water ballast, but for the purpose of taking through the used steam for condensation. Furthermore, he introduced the system of surface condensation of steam, as opposed to the usual practice of condensation by jet. His engines and equipment went into many vessels that were to leave a mark on the history of steam navigation; the names of Watt, Boulton and Napier should be bracketed together whenever pioneer steamship engineers are mentioned.

Watt, through his long and costly experimentation, developed the first complete steam engine, a double-acting engine used in a coal mine. His early products



LATERAL SECTION OF STEAM CARRIAGE MODEL, BUILT IN 1786

came from the shops of the famous Carron Company. Later he went to England and formed a partnership with the great engineer Boulton, and this company advanced the science of the steam engine to a point where other engineers could gradually build on the basic idea and create larger and more powerful machinery. Watt introduced the term "horsepower" for measuring the output of engines, and his name is immortalized in the English language by the use of the words "watt" and "kilowatt" to denote units of electric power. Watt and Napier are the two great Scotch names in the long list of steam engine pioneers.

Chapter II

The Land of the Lochs

It may not be amiss to give a short description of this part of the world that was the birthplace of practical steam navigation, for it is full of historic importance. Starting a few years after the Christian era, the Romans saw the strategical importance of this part of Scotland on account of the narrowness of the island between the Forth and the Clyde. Here they built the famous Roman wall, extending from near Borrowstounness on the Forth to Kirkpatrick on the Clyde, a length of about thirty-four miles. The chief features of it were a ditch varying in depth according to the nature of the ground, a wall or parapet on top of the earth thrown out of the ditch, and a causeway road on the south or Roman side. It was further protected by forts about every two miles. These were substantially built of stone and permanent, for the Romans retained possession of this part of Scotland nearly 300 years.

Many changes have taken place in the topography of the country since that period. Then Camelon, on the great wall and having a large fortification, was a seaport; at least the river Carron was navigable for small craft, as proved by the finding of a small boat and an anchor during excavation work. Today there is no navigable water closer than four miles. It was near this historic spot that the *Charlotte Dundas* spent her last days neglected in the mud of the canal.

Many things were shaping for the future of shipbuilding and engineering in this section with the commercial activities of the eighteenth century. Here the Carron Iron Works was established, which was to play a prominent part in the development of steamboats. At first this company had a hard time financially, but was put on a firm basis by the great ability and energy of Joseph Stainton, where it has remained to the present day. James Watt was consulted in regard to early machinery for the Carron Works, and here several of Watt's first engines were built. During the wars with Napoleon, Carron manufactured cannon which were known as Carronades, which made this district celebrated all over the world.

In 1768 active construction was commenced on the Forth and Clyde Canal, the birthplace of practical steam navigation. It paralleled the Roman wall from river to river, never more than two miles distant from the wall, starting at Grangemouth on the Forth and ending at Port Dundas on the Clyde. It was formally opened to traffic in the summer of 1790, although part of it had been used previously to that. Not satisfied with the usual slow means of travel over this waterway, in 1809 boats called "Swifts" were put in service between Falkirk and Glasgow. The distance was twenty-five miles, and two fast horses were used to haul the

UNPARALLELED CHEAPNESS:

IN TRAVELLING SAFE, COMFORTABLE & EXPEDITIOUS,

BY THE

BIG PASSENGER BOATS,

FROM PORT-DUNDAS, GLASGOW.

WINTER HOURS.

To and from EDINBURGH, in 7 [illegible]

From Port-Dundas Glasgow [illegible] at [illegible] morning	From Port [illegible] Edinburgh, at 8 o'clock morning.
From Do. at 11 [illegible]	From [illegible] at 11 — forenoon.
From Do. at 2 [illegible]	From D[illegible] at 2 — afternoon.

[illegible] 5/. [illegible] 3/.

To and from STIRLING, in 4 hours,

From Port-Dundas Glasgow, [illegible] o'clock morning	From [illegible] King [illegible] Stirling [illegible] at 6½ o'clock morning.
From Do. [illegible] 11 [illegible] forenoon	From Do. at 11½ — forenoon.
From Do. [illegible] 4½ [illegible] afternoon	From Do. at 2½ — afternoon.

FARES.

Cabin of Boat and Inside of Coach — 4/	Steerage of Boat and Inside of Coach — 3/
Cabin of Boat and Outside of Coach — 3/	Steerage of Boat and Outside of Coach — 2/

No gratuity payable to Coach Drivers.

To and from ALLOA, in 5 hours.

From Port-Dundas, Glasgow, at 4½ o'clock afternoon	From Thomson's Inn, Alloa, at 9 o'clock forenoon.

FARES.

Cabin of Boat and Inside of Coach, — 4/6	Steerage of Boat and Inside of Coach, — 3/6
Cabin of Boat and Outside of Coach, — 4/	Steerage of Boat and Outside of Coach, — 3/

No gratuity payable to Coach Drivers.

To and from FALKIRK, in 3 hours.

From Port-Dundas, Glasgow, at 8 o'clock morning.	From [illegible] at 7 o'clock [illegible]
From Do. at 11 — forenoon	From Do. at 12 — [illegible]
From Do. at 2 — afternoon	From Do. at 3 — [illegible]
From Do. at 4½ — [illegible]	From D[illegible] 6 — [illegible]

Cabin 3/.—Steerage 2/.

To and from PERTH, in 8 hours.

Via CREIFF, DUNBLANE, BRIDGE OF ALLAN, &c.

From Port-Dundas, Glasgow [illegible]	[illegible] Perth [illegible] 6½ o'clock morning

FARES TO PERTH.

Cabin of Boat and Inside of Coach, — 10/6	Steerage of Boat and Inside of Coach — 9/6
Cabin of Boat and Outside of Coach, — 7/6	Steerage of Boat and Outside of Coach — 6/6

Fares to Creiff, [illegible] &c. in proportion.

No gratuity payable to Coach Drivers.

To KIRKALDY, via DUMFERMLINE & KINCARDINE, at 8 o'clock A.M.

FARES TO KIRKALDY.

Cabin of Boat and Inside of Coach, — 12/	Steerage of Boat and Inside of Coach — 11/
Cabin of Boat and Outside of Coach, — 8/	Steerage of Boat and Outside of Coach — 6/

Fares to Dumfermline, &c. in proportion.

(Seats and Parcels Booked for this conveyance at Ly[illegible] 78, Trongate, Glasgow.)

Seats and Parcels Booked for the above places (Kirkaldy and Dunfermline excepted,) at the [illegible] Office, 91, Trongate, Glasgow, and Ticket Office, Port-Dundas.

N. B. The Boats and Coaches take Passengers to and from [illegible] Kirkintilloch, [illegible] and other intermediate places [illegible]

☞ An Omnibus starts from the [illegible] Glasgow [illegible] Port Dundas with Passengers [illegible] Boats [illegible] before [illegible] Boat [illegible] Boat to take Passengers [illegible] Fare, [illegible] Baggage, Trunks, or Par[illegible]

[illegible]

boats, the trip being broken by several relays. The time for the passage was 3½ hours, and considering that there were four locks to pass through, this was fast time. The drivers of the horses wore red coats and cocked hats, and otherwise were very stylish. A photograph of the quaint advertisement of this service will be of interest to modern travelers.

If such conditions as these were not brought prominently to our attention we might forget how our forefathers got along. Before the days of the canal my great-great-grandmother rode on horseback from Falkirk to Glasgow along the old Roman road; it was still in good condition at that time, and was the only highway across Scotland. At Glasgow, she could cross the Clyde on stepping-stones, where now the largest steamer floats. The canal reduced the time between these points greatly, and made travel less burdensome. Today we would say that the horsedrawn boats were slow and uncomfortable; in their day they were a great advance over previous methods.

This interesting waterway connecting two historic rivers is 39 miles long, 63 feet wide at the top and 30 feet wide at the bottom; the locks are each 68 feet 6 inches long, 19 feet 10 inches wide, and 9 feet 6 inches deep on the sills.

I secured copies of some of the minutes of the Forth and Clyde Navigation Company meetings in the period of Symington's activities with steam-powered boats in the canal. These show the difficulties the inventor and his supporter, Lord Dundas, struggled against. The first minutes bear the date of June 5, 1800, and from them we learn that the directors of the company had no confidence in steamboats; after putting considerable money into the project, they abandoned it and lost all of their investment. They did not know that steam navigation had come to stay; that the crude beginning made by Symington on their canal was to become a mighty industry. The leaven had begun to work, but it remained for more progressive and enterprising men to carry steam-power to success.

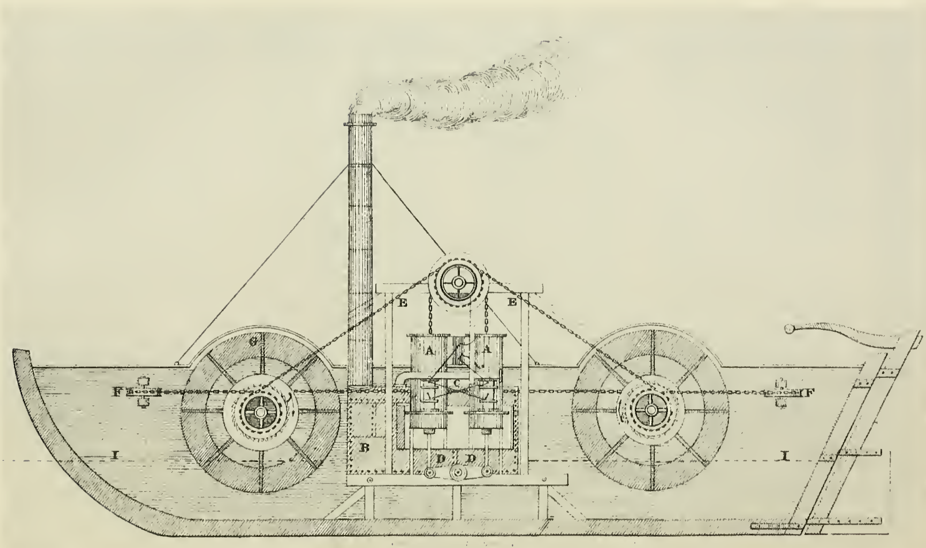
Following are copies of the directors' minutes, showing how in a little over two years these men changed their opinion about the value of steamboats for commercial use.

Minutes of June 5, 1800, showing enthusiasm for a steamboat:

"RESOLVED AND ORDERED: That a boat be immediately built after Captain Schank's model and an engine erected after Mr. Symington's plan under the Governor's inspection, and that his Lordship (Lord Dundas) be empowered to draw on the committee for money sufficient to defray the expenses thereof."

Minutes of January 18, 1802, after the first *Charlotte Dundas* had been some time in service, showing how enthusiasm was cooling and doubt was beginning to spread in the directors' meetings:

"The committee observing from the books of the company that the steamboat constructed by Mr. Symington has already cost £858.12.1, and that several of the gentlemen of the committee have good reason to



LATERAL SECTION OF THE ORIGINAL STEAMBOAT, BUILT IN 1788

think that she will by no means answer the purpose of towing vessels, it is the opinion of this meeting that Mr. Symington should be desired by the Governor to give in a statement of all apparatus belonging to the boat and an account of his whole expenses, so that a final settlement may be made with Mr. Symington and steps taken to turn the boat and apparatus to the best use."

Minutes of August 25, 1802, showing that the directors were worrying about costs and failing to give Mr. Symington the support promised:

"READ: A letter from the Carron Company requesting payment of an account for furnishings for the steamboat, ordered by Mr. Symington and attested by him, amounting to £136.13.7.

"RESOLVED: That the Carron Company be informed that the Committee of Management cannot pay any more money on account of the steamboat, whether attested by Mr. Symington or not, without the express orders of the Governor, who has the direction of this business.

"The Superintendent also laid before the meeting a number of accounts which had been delivered to him by Mr. Symington for furnishings and work done on the steamboat, amounting to £168.17.1, which Mr. Symington requested might be remitted to him, as he wished to have that concern settled and the people wanted their money.

"RESOLVED: That the Superintendent do inform

Mr. Symington that no money can be paid on account of the steamboat without the Governor's orders.

"Ordered: That the Superintendent do transmit to Mr. Symington a copy of that part of Mr. Baird's report mentioning the careless manner in which the steamboat has been allowed to lie in the canal, and inform Mr. Symington that it is the desire of this Committee that the said boat and all her machinery, with every article belonging to her, be properly taken care of until he may receive directions from the Governor of the Company how she is to be disposed of.

"Resolved: That in consequence of what is stated by the Surveyor in the last part of his report for the month of July, relative to a report he has heard of a new steamboat being now up on the stocks at Grangemouth and building for the Canal Company, the Superintendent is directed to write the Secretary of the Company in London to know whether any orders have been issued by the General Manager or the Governor and Council for building a second steamboat.

"Resolved: That as the present steamboat is not likely to answer the purpose for which she was built, this Committee is of the opinion she cannot be better disposed of than by taking out her machinery and putting a bottom into her to be used on the canal as a ballast boat, which is very much needed at Grangemouth, and that on account of the action of the paddle-wheel washing in the banks of the canal, the steamboat be prevented from navigating in the canal."

The new steamboat referred to above was the second *Charlotte Dundas,* which was tried in the canal in 1803, with complete success as a towing vessel, as previously described. But the short-sighted members of the canal company still clung to their belief that steam was out of place on their waterway, and their arguments prevailed. By their stupidity and want of enterprise the navigation of the canal by steamer was prohibited. We are not told why the vessel was not taken to the Clyde or the Forth, where no one could stop her from running. We can only conjecture that she was specially built for service in the canal. Lord Dundas, the owner, and Symington, the engineer, gave up in despair; the boat lay in a slip at Bainsford for many years, and was then removed to the Old Top Entry, between Locks Nine and Ten, where she remained neglected until she was broken up about forty-five years ago. Her timbers were used to make furniture and souvenirs; I recently saw several of these tables and chairs, some made of oak and some of beech. And as previously mentioned, I brought back to America one of her oak knees.

My deep interest in William Symington led me to visit the churchyard at St. Botolph, Aldgate, where he was buried in a corner without a stone to mark his grave. However, inside the church I found the following memorial tablet had been put up for him:

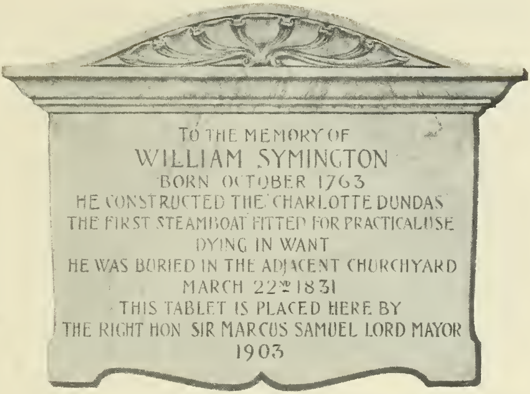
> To the memory of William Symington, born October 1763. He constructed the *Charlotte Dundas,* the first steamboat fitted for practical

use. Dying in want, he was buried in the adjacent churchyard March 22, 1831. This tablet is placed here by the Rt. Hon. Sir Marcus Samuel, Lord Mayor, 1903.

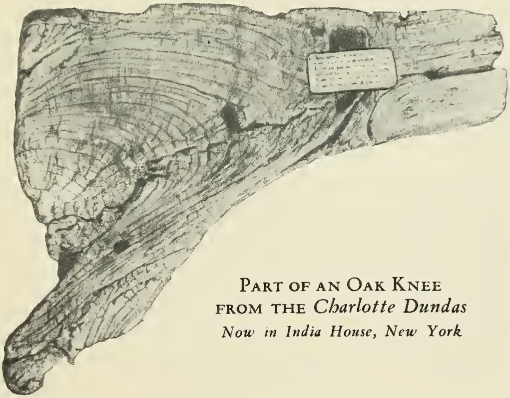
In addition to this I was shown a framed photograph of him and a printed extract from some local paper, dated May 1, 1837, six years after his death. According to this clipping there were at this time not less than 600 steamships registered in the United Kingdom, apart from those in service in other countries. The writer of the notice suggested that if each steamer were to contribute one pound and each steam carriage one shilling, Symington's widow would be suitably remunerated. On March 22, 1931, the centenary of his death was appropriately observed in London.

The tonnage carried in the Forth and Clyde Canal in the days of the first steamships was about 200,000 tons per annum. Nowadays the merchandise carried totals many millions of tons, over three-quarters of it being handled by steam vessels. These craft are all screw-propeller driven, and are counted by the hundreds. Incidentally, screw-propellers are more damaging to the banks of a waterway than paddle-wheels, yet the banks of the Forth and Clyde Canal are today about the same as they were 130 years ago, when a 10-horse-power toy steamer 56 feet long was forbidden to operate because of the harm the wash from its paddles might do to the banks.

In those days in Grangemouth the harbor master was not burdened with elaborate rules for regulating



Tablet in St. Botolph's Church, Aldgate



Part of an Oak Knee
from the *Charlotte Dundas*
Now in India House, New York

the traffic. The only one I can trace from the records of the canal company was worded as follows:

"In consequence of the number of foreign sailors and lawless characters who frequent the port and refuse to obey orders, the Governor and Council unanimously resolved to provide the harbor master with an axe."

Evidently the directors functioning at the end of the eighteenth century considered an axe the most efficient weapon for preserving order in the port. Leastwise, I found no record of fatalities following the adoption of this instrument, so probably the foreign sailors and lawless characters behaved better after seeing how the harbor master was armed.

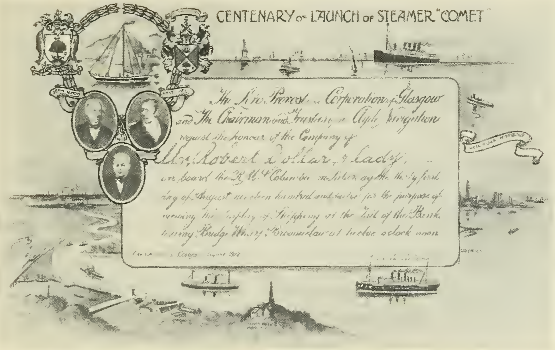
Further study of the records showed that in 1795 a total of 64,000 tons of cargo was handled through the canal; by 1867 this had increased to 2,856,992 tons. After that date the railroads caused the traffic to decline. The second railroad in Great Britain, the Edinburgh and Glasgow Railway, was built about 1846. It runs parallel to the Roman wall and the canal.

The first locks of the canal were constructed under the superintendence of Thomas Wilson, familiarly known as "Old Top;" he was my mother's uncle, her name was Mary Wilson Melville. He is credited with the honor of having built the first lighter made of iron, the sailing vessel *Vulcan*. She was launched in May, 1818. All the plates, rivets and angle irons of the *Vulcan* were formed on the anvil of Mr. Wilson's blacksmith. The plates were riveted to the hull perpendicularly.

While this boat was under construction, Mr. Wilson was the subject of a great deal of ridicule; he was solemnly warned that it was contrary to nature to expect an iron ship to float. But a coal miner's wife settled the point in his favor by telling his detractors that there was no fear but that Tom Wilson's boat would float, for when she was washing her iron porridge pot in the canal it slipped through her fingers and floated across the canal.

So much for the actual birthplace of successful steam navigation. The child was born in the Forth and Clyde Canal, but the river Clyde nurtured and brought it to maturity. The infant has grown to be a giant, and this section of Scotland may well feel proud of the fact that it has for over a century and a quarter retained supremacy in shipbuilding against the competition of the world. This cradle of steam navigation had James Watt, a native of Greenock, and Henry Bell, a native of Helensburgh, which is directly across the Clyde from Greenock; the famous engineer David Napier, and the famous shipbuilder William Denny, of Glasgow, were of the same period. John Wood, who built Bell's *Comet*, and John Robertson, who built the *Comet's* engines, added luster to the record of the region. To the credit of the long list of men who followed them, the position of the Clyde as the greatest shipbuilding center of the world has been sustained.

I had the honor and pleasure of being present at the Centenary of the launching of the steamer *Comet*, held on the Clyde in August, 1912. This brought



Invitation to Centenary of Launch of Steamer *Comet*

Henry Bell's *Comet* on the Clyde, 1812

home forcibly to me the great importance of the Clyde —the wonderful advancement that had been made in 100 years. In the nineteen years since then many new accomplishments have been added to that record, and the end is not yet.

It does not take a prophet to see that after 130 years of steam navigation we are on the eve of still greater improvements in freight and passenger ships. Advancements in power plants, hulls and other details bid fair to revolutionize our present shipping industry, as efficient as our vessels now are.

Chapter III

The First Fifty Years

MAN'S FIRST BOATS were fashioned of logs, and his first means of propulsion was arm-power. The main desire was to keep afloat; time was not very valuable, and the early boatmen had no desire to go far from shore. Of course, there is no record of when wind-power was adopted to save human labor; the savage early men simply noted the tendency of their boats to move with the wind, and that natural phenomenon led them to give the wind something to press against. A mast and a spread skin, and a paddle to guide the crude craft; thus was born the forerunner of the gallant square-rigged ship which for so many years was supreme in the commerce of the world.

Steam engines, coming into use during the last years of the eighteenth century and the early part of the nineteenth century, gradually gained ascendency over canvas, although the builders and operators of sailing vessels put up a stubborn fight. During the early years of steam navigation it was the joy of the masters of windjammers to outsail the clumsy, slow steamers—which they did without much trouble. The tubby little steamers, with their thrashing paddle-wheels and clanking machinery, were bested on every voyage so long as the wind was right. But they proved their ability to reach their ports regardless of weather conditions, and they made shrewd use of sails whenever possible.

In fact, the early commercial steamships were actually sailing ships equipped with auxiliary steam power. They carried a press of canvas, almost, if not quite, as great as the straight sailing vessels. Only with the improvement of the engines, giving greater efficiency with less fuel, did the area of canvas decline. Then the new ships reversed the order and became steamships fitted with auxiliary sails. It was not until 1840 that a steamship crossed the Atlantic under steam-power alone, without unfurling the sails, yet for over forty years thereafter steamers were equipped with masts and canvas for use in case of engine breakdown or in order to conserve fuel.

The *Great Britain*, an iron steamship built in 1843, had six masts and a full complement of canvas. The famous *Great Eastern* of 1858, the largest ship built up to that time and not equalled in size for many years afterward, had both paddle-wheels and a screw-propeller—and six masts equipped with a great spread of canvas. Clear down into the '80s of last century ocean-going steamships had at least foremast sails, but soon after that masts and sails were left off new steamers; cargo masts took the place of the tall sticks, and steamships became wholly mechanical. Probably the steam schooners in the lumber-carrying trade of the Pacific

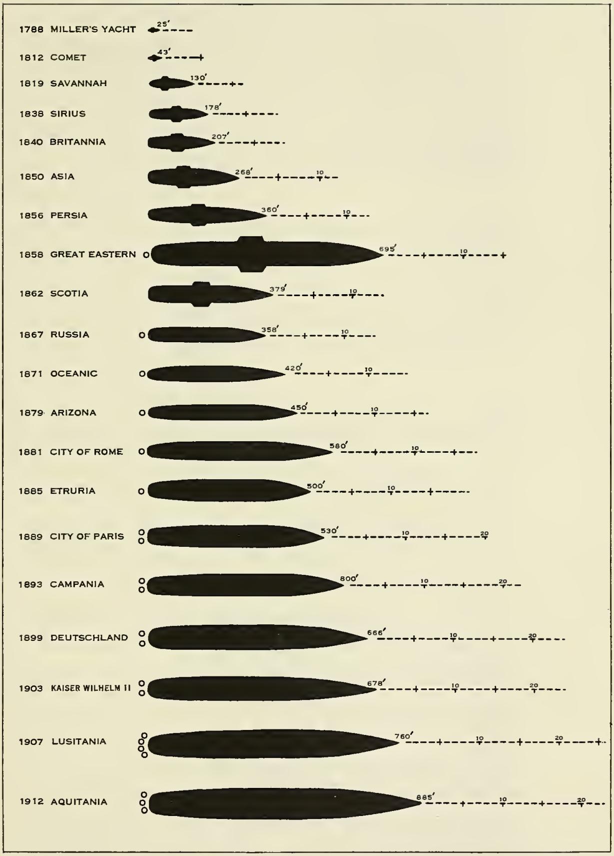


DIAGRAM SHOWING THE INCREASE IN SIZE AND SPEED FROM *Comet* TO *Aquitania*

Circles indicate propellers. Dotted lines indicate speeds in knots

Coast, and the auxiliary sailing vessels of the northern cannery fleets, were the last to give up canvas. Picturesque and beautiful as the square-rigged ship was, she could not hold a place in the economic scheme of things, and gave way to the less romantic steamship which was capable of holding to a schedule and earning profits for her owner.

Vessels built of wood, designed along the lines of the sailing ship, established steam on the oceans of the world. Before the adoption of the screw-propeller, the wooden paddle-wheelers blazed the trail that has since been followed by so many generations of steamship designers and builders.

Great Britain and the United States were for a time practically the only steamship building nations. The inventors of both countries were working along the same lines; they were sure that boats could be successfully driven by steam-power, and the development of Watt's steam engine gave them something on which to work. Within a few years of one another, these inventors put their first steamboats into the water, and although as we have seen, they found indifference and antagonism on the part of the public, the steamboat was proved to be more than a wild dream of a few crazy men.

These first boats were crude and immature; they were slow, noisy and often dangerous. But they established the principal, and as more efficient power plants were developed rivalry was started among shipbuilders and engineers. Improvements and simplification that would give a new boat more power and greater speed than previous boats had were studied; some queer and impractical experiments were made along with those that were constructive; gradually the engineers evolved power plants that were reliable and efficient. The steamship then began its long voyage down through the years, taking on new ideas and improvements as it went.

A listing of all the steam-propelled ships launched during the first half-century of steamboat history would be a tremendous task, for once these ships passed the first experimental stage new vessels equipped with paddle-wheels and side-lever engines came from the builders in constantly increasing numbers. But if we take a representative list of the principal ships we will see what the designers, builders and engineers of the period did to improve the wooden paddle-wheel steamship.

Following the *Clermont* in 1807, Fulton and his associates built no less than seventeen steamboats, aside from several ferries, before 1817. In that year there were at least twenty side-wheelers running between New York and Albany, Connecticut and New Jersey. Other steam vessels were operating on the Delaware River, in Chesapeake Bay, and in the open sea between Maryland, Virginia and New England ports. The Mississippi River already had two shallow-draft paddle-wheel craft.

In 1827 the ferryboats *Union* and *William Cutting* were added to the Fulton fleet; the *De Witt Clinton*

S. S. *Great Eastern*, 1858

was launched in Albany in 1828; in 1835 the *Lexington* earned the title of the fastest steamboat so far built; she ran between Providence and New York. Three years later a speedy rival appeared, the *John W. Richmond,* and these two fast boats had many exciting races. By 1849 the waterways of New York State and the Atlantic coast ports within reasonable distance of Manhattan harbor were alive with chugging steamboats.

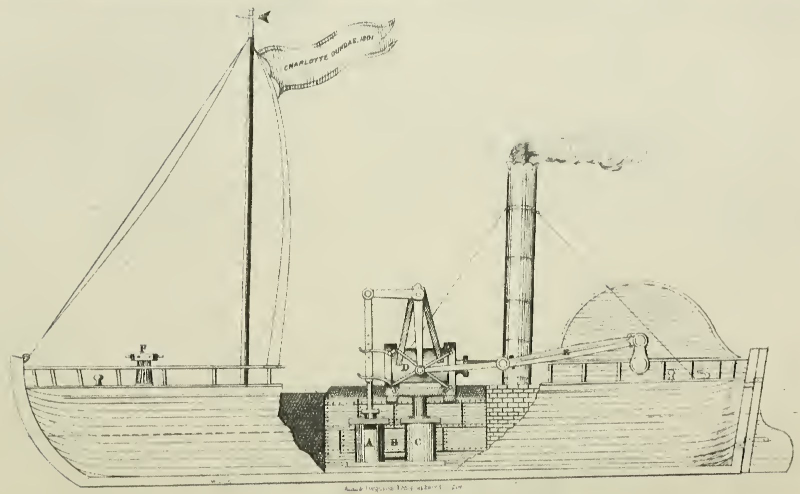
Progress on the Great Lakes was keeping step with the developments on the Atlantic Coast. The picturesque name of an Indian Chief, *Walk in the Water,* was given to the first steamer to ply on the Lakes. This pioneer was launched in 1818. By the middle of the century there were twenty-nine side-wheelers and ten screw-propelled steamers operating out of Buffalo harbor. The paddle-wheel boats ranged from 500 to 1,500 tons each; the screw-boats were all under 500 tons.

Historic interest attaches to the *Vandalia,* which was launched in 1841, for she was the first screw-propelled vessel in the Great Lakes service, and was fitted with the first American-built engine designed for such propulsion. John Ericsson made the drawings and the engine was built at Albany and transferred by ox-team and water to Oswego, where the hull was on the ways. This was the third vessel to be equipped with the Ericsson propeller, the first two being British boats. The engine had two cylinders 14 inches in diameter; the stroke was 22 inches. The *Vandalia* was 91 feet long, about 29 feet beam, and 138 tons. Her success led to the immediate building of other screw-propelled boats somewhat larger and more powerful.

Meanwhile, the steamship was making rapid progress in Great Britain. Naturally the development was for many years confined to craft intended for cross-channel and coastal traffic, for long voyages called for more fuel than the little ships of the day could carry. Coaling stations were not numerous, the first steamers consumed a good deal of coal for their size, and the steam engines so far created were not proof against breakdown.

Following Bell's *Comet* of 1812, a number of steamboats were launched by British builders. The *Clyde* was built in 1813, and the *Elizabeth* in the same year; the latter is credited with being the first British steamer to make a sea voyage. She had an engine of only 8 horsepower, but she managed to reach Liverpool from Glasgow in spite of a severe storm and a breakdown of her paddle-wheels. The *Caledonia* and *Humber* were put in service in 1814, as were the *Princess Charlotte* and the *Prince of Orange,* fitted with Boulton & Watt engines, and the *Marjory.* Another interesting vessel was the *Industry,* built that year; she was called the "Coffee Mill" owing to the grinding sound of her cogwheels.

By 1815 the commercial possibilities of the steamship seemed to be pretty well accepted, and the building of this type of craft increased. Every year new steamboats entered service, each a little bigger than its



LATERAL SECTION OF THE *Charlotte Dundas*, BUILT IN 1801

predecessor. By 1820 the competition between steamship companies was keen. Boats propelled by what was called "the new invention" had taken hold of the public, and coastal voyages were a pleasant adventure. Most of the craft, all of which were under 500 tons, carried passengers only; a few operated on river service with freight or towing other vessels. The coasting trade in 1822 was augmented by foreign voyages, mostly to France and Holland, and the two latter countries began to establish steamship services. Later other countries followed suit, although for a good many years the sailing ship transported most of the freight and carried most of the passengers.

About this time occurred an apparently insignificant incident that resulted in one of the most important discoveries in the history of the marine engine. Fletcher's "Steam Ships" recounts that James Watt the younger happened to be on the steamer *Dumbarton Castle* when the engineer told him that the vessel had grounded the previous evening, and that the rising tide, turning the paddles the wrong way, had caused the engines to reverse. Watt explained to the engineer the importance of this, and at last took off his coat and showed what could be done with the engines. Before that date the reversing of machinery on steamers was either unknown or not generally practiced. Watt's discovery enabled the steamer to enter her dock with precision and promptness, the custom previously having been to stop the engine some distance from the dock and allow the vessel to drift alongside.

Another important change is recorded by this writer. David Napier altered the shape of the forepart of the steamers' hulls, which added to the superiority of their speed over sailing vessels. Before that time steamers had been built with bluff bows, following the style set by the sailers. Napier observed that a ship's progress was greatly obstructed by bows of this shape, especially in dirty weather.

He was crossing from Glasgow to Belfast in one of the sailing packets which then made the voyage in anything up to a week. He perched himself on the bows, heedless of waves and spray, and watched. Occasionally he asked the captain if the sea was rough. The captain said it could not be called very rough. The weather grew worse, and at last a tremendous wave swept over the vessel from stem to stern. Napier went back to the captain and asked, "Do you call it rough now?" The captain replied that he could not remember a worse night in his experience. To his astonishment Napier was delighted with this answer, and went down to his cabin remarking, "I think I can manage if that is all."

Subsequently he made a series of tank experiments with models, and these resulted in the adoption of the fine wedge-shaped bows which distinguished the steamships he afterwards built. This was the origin of the first great departure from sailing ship models in steamship construction.

Disastrous competition developed in the early '20s among the several companies then operating passenger

S. S. *Rising Star*

boats. A serious rate war broke out, which benefitted no one but the passengers. Prices for passage were cut so low that saloon passengers were carried from Belfast to Glasgow, for example, for two shillings each; second cabin passengers were taken for six pence, and deck passengers went free. Between Liverpool and Dublin for a time passengers were carried free. A story is told of a passenger going into one of the companies' office to ask the cabin fare to Liverpool. He was told that he would be taken for nothing. He sniffed and replied, "That is not good enough, you will have to feed me as well." Another story related that when one of the competing companies advertised it would carry passengers for nothing and give them a loaf of bread, another company capped the offer by promising to give bread and a bottle of stout besides.

These early steamers were usually overcrowded, as there were no safety regulations in force yet, and complaints were often made that the boats traveled at reckless speed. Rules were made that the speed should not exceed five miles an hour, but this was hard to enforce for the reason that the captains of the steamers could not resist racing with rival boats. This condition continued for a number of years, while the number of steamboats in coastal and channel trade increased. They were small, their tonnage ranging between 250 and 500 tons. A commission appointed in 1839 reported that there were 766 steam vessels registered in Great Britain—river steamers, coasters and offshore ships. This was an increase of 89 vessels over the previous year, so we can see that the shipyards were turning out steamboats rapidly.

After steamships had proved their ability to make sea passages between European ports, shipping men began to dream of sending steam vessels across the Atlantic. The first ship we have any record of was the *Conde de Patmella,* but information about her and her voyage is vague. We are told that she crossed from Lisbon to Brazil, and that she was the first ship equipped with an engine to make the east-to-west passage. Beyond that we know practically nothing.

The facts about the *Savannah,* however, which in 1819 made the first westbound crossing, are available. She was an American vessel, a sailing ship equipped with auxiliary steam-power, and her voyage was made mostly by sail, with only eighty hours of steaming. For this reason opinions vary as to her right to precedence in the Atlantic run. She was not built originally as a steamer, but was a full-rigged sailer into which an engine was fitted. She was 130 feet in length, with 26 feet beam; tonnage 350 burden. Her paddle-wheels were hinged at the axle and so constructed that they could be folded and removed from the paddle shaft and stowed on deck. The steam pressure employed was only two pounds, the estimated pressure being ten pounds. The voyage required twenty-nine days eleven hours from Savannah to Liverpool, without passengers or freight, the owners being willing to spend the money to prove that the trip was possible.

Underwood & Underwood

S. S. *Savannah*

Records of the voyage are preserved in the United States National Museum, and they show that steam was raised six times and that the engines were run not more than eighty hours. Inability to carry enough fuel is the reason given for using steam power so little. The cost of the ship and her machinery was about $50,000. The experiment was successful, but when the *Savannah* returned to America the engine was taken out and she became again a sailing ship.

The wonder and disbelief of the public, including shipping men, is seen in the fact that when the *Savannah* arrived off the coast of Ireland she was reported afire. A cutter was sent out to her relief. This rescue vessel, a fast craft with all sail set, was unable to overtake the smoking ship with bare poles. After a while the cutter fired several shots, which caused the *Savannah* to stop her engine. The cutter's crew was greatly surprised when they learned their mistake, and went aboard the Yankee ship to examine the machinery.

Late in the year 1821 the little steamer *Rising Star* left Gravesend, England, for Chile, arriving at Valparaiso in April, 1822, and according to a letter written by a passenger, "arrived in excellent condition, having proved herself a very superior sea-boat, frequently going twelve knots an hour." Enthusiasm on the part of this passenger may have influenced his statement of speed. The records of this ship and her voyage fail to give details about her engine or propulsive power beyond the fact that she was built "upon the principle of navigating either by sails or by steam, the propelling apparatus being placed in the hold and caused to operate through apertures in the bottom of the vessel." A picture published in 1821 shows a full-rigged ship with two tall slim funnels side by side and no paddles or paddle-boxes showing. The surmise is that she was fitted with some development of the jet system that James Rumsey pioneered on the Potomac River in 1787.

Although these auxiliary steam vessels were successful in the long drive across the Atlantic, it was eight years before the next steamship made the attempt. This was the Dutch craft *Curacao,* built on the Clyde and equipped with engines and sails, which crossed from Rotterdam to the West Indies in 1827 by steam-power alone, save for the stopping of the engines for repairs. In 1828 the *Curacao* made a second round voyage, and in 1829 a third. For this reason the claim is made that she is entitled to the honor of being the first steamship to cross the Atlantic. She was 134 feet long and was of 438 tons register. She had two side-lever engines of 50 horsepower each.

Another claimant for first Atlantic honors was the *Royal William,* a Canadian steamship built in Quebec in 1831. The fact that little is generally known about the *Curacao* accounts for this; it is said that the *Royal William* depended wholly on her engines, and that she was the first to cross under steam power only. She was 176 feet long, 27 feet beam, and measured 830 tons. Her side-lever engines were of 200 nominal horsepower, and came from the Boulton & Watt plant. This


Courtesy Peabody Museum of Salem

S. S. *Curacao*, 1827

ship made regular voyages until 1833, when she was sold to the Spanish government for use as a warship.

It is said that Samuel Cunard, founder of the famous line bearing his name, was interested personally and financially in the *Royal William,* and that her success convinced him that steam was the coming power in the trans-Atlantic trade. Nine years later, in 1840, he organized his steamship service.

Beginning in 1838 there was a great activity in building and equipping steamships for service between the old world and the new. The kinks in the early steam engines were being ironed out, and marine engineers were making improvements at the same time they were making their engines larger. The wooden paddle-wheelers *Great Western* and *British Queen* were launched in this year, and the *Sirius* was taken off coastwise service and rushed into the Atlantic trade.

The *British Queen* was ordered by the Transatlantic Company in 1836, but financial troubles of the builders of her engines caused the launching to be delayed. Some shipping men of Bristol, seeing an opportunity to get ahead of the Transatlantic Company, organized the Great Western Steamship Company and contracted for the *Great Western.* The latter ship was completed first, but the owners of the *British Queen* determined to beat their rivals and so secured the little *Sirius,* which was known to be too small for regular ocean work but which was expected to save the day by beating the *Great Western* to New York. The *Sirius* therefore was the first steamship to cross from England to New York, a 16½-day passage, during which she averaged 8½ knots an hour with 24 tons of coal consumed per day.

The *Sirius* was 178 feet long, 25 feet beam, and 703 tons register. Her engines were of the side-lever type used on all ships of her day, 250 horsepower, with cylinders 60 inches in diameter and a 6-foot stroke. She was fitted with a surface condenser not unlike those used today. She carried no cargo, but had ninety-four passengers. The voyage was not easy, however; the ship fought head winds and the crew demanded that they turn back. Her commander used "stern discipline and the persuasive arguments of loaded firearms" to convince the crew that the ship was going to New York.

The *Great Western* sailed on her maiden voyage three days after the *Sirius* started. A small fire which did little damage held the larger ship in port and permitted the *Sirius* to gain first place; this was no more than justice, seeing that the *Great Western* was trying to take advantage of the misfortune that prevented the *British Queen* from being completed on schedule. The *Great Western* made her run in fifteen days, but when she settled down to regular service she reduced her time to twelve days seven hours. She was 236 feet long by 35 feet beam. Her side lever engines were of 240 horsepower, with 73-inch cylinders and 7-foot stroke. Her paddle wheels were 28 feet in diameter.

The owners of the *British Queen* had a further revenge on the rival company's *Great Western*, for when the former vessel entered service in 1839 she beat the

Great Western easily, and thereafter she found much pleasure in repeating the performance every voyage. She was the largest and fastest steamship afloat, and remained the largest for about four years. She made the passage from Portsmouth to New York in thirteen days eleven hours; the *Great Western* had, according to a letter of her rival's captain, ten hours' shorter distance to run. The *British Queen* had a length of 275 feet, a beam of 40, and engines of 500 horsepower. Her paddle-wheels measured over 30 feet in diameter. Two other ocean steamships were launched in this year, the second *Royal William* and the *Liverpool.*

A year later the *President* was launched, a wooden side-wheeler that was almost a duplicate of the *British Queen* in design. She was ten feet shorter and one foot wider; she had forty more horsepower, and her paddle-wheels were slightly larger. In 1841 this vessel was lost at sea with 136 passengers.

Up to now the mails had been carried by sailing vessels. With the proved ability of steamships to cross safely and with fairly close schedules, the British Government invited bids for carrying the mails to America by steam. This was the cue for Samuel Cunard; since about 1830 he had tried to interest capital in a steamship mail service. He was a merchant of Halifax, Nova Scotia, and being in London in connection with his plan, he met Robert Napier, then the greatest steamship builder in Great Britain. Through him Cunard met other influential shipping men and the Cunard Line was formed. It received the government mail contract and forthwith proceeded to build the four vessels called for under the subsidy.

Contracts were placed with four different builders on the Clyde in order that the four ships would be ready at the same time. They were launched in 1840—the *Britannia*, the *Arcadia*, the *Caledonia* and the *Columbia.* They were wooden side-wheelers averaging 207 feet long by 34 feet beam, 1,150 tons. Their engines were furnished by Napier and were side-lever of 740 horsepower each. The cargo capacity of these vessels was about 275 tons, for they were built expressly for passenger and mail service. They averaged 8½ knots on 38 tons of coal a day. The *Britannia* was the first steamship to cross the Atlantic without unfurling her sails. Her time was 14⅓ days.

Disappointed in the loss of the mail contract, the Great Western Company decided to build a ship far in advance of anything afloat. Not only was she to be bigger and more modern in appointments, but she was to be built of iron. This was a great departure, for iron had never been tried in vessels of her size. The *Gary Owen,* an iron ship, had been built in 1834, but she was only 125 feet long. The *Great Britain,* now planned, was to be 289 feet long, 51 feet beam, 3,500 tons, with coal bunkers for 1,000 tons of fuel.

Experience in constructing iron ships of this size was lacking, and it was generally believed that a hull of this size could not be successfully built of metal. Anyway, no shipbuilder could be found who would undertake the contract, and the Great Western Com-

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THE ARRIVAL OF THE *Sirius* AT NEW YORK, APRIL 22, 1838

pany had to establish its own plant to build the ship and its engines. The design called for a paddle-wheel craft, but before the hull was completed the *Archimedes,* a small screw-propeller boat, visited the harbor and her performance was so startling that the owners of the *Great Britain* ordered changes in the ship that would permit her to have screw-propellers. She became, therefore, the first large iron ship and the first large screw-propelled ship in a period when builders and engineers were turning out wooden paddle-wheelers. And she remained the only large iron ship for something like seven years.

Cunard's service in 1843 had become so popular that two more side-wheelers were ordered, the *Hibernia* and the *Cambria,* sister ships 210 feet long and over 35 feet beam. They were of 1,422 gross tons, and were fitted with 1,040 indicated horsepower engines that gave a speed of more than 9 knots. These vessels, with the first four, maintained the service until 1847, the year the mail contract expired, by which time the traffic had grown so big the government demanded that the company double the number of its ships before the contract would be renewed. In addition, the Admiralty specified that the new ships should have not less than 400 nominal horsepower.

Therefore orders were placed for four new vessels, the *Niagara,* the *Canada,* the *America* and the *Europa.* They were not the biggest ships in service, but they had increased power and their speed was stepped up to an average of more than 10 knots. They were 251 feet long, 35 feet beam, and 1,825 tons gross. The engines had an indicated horsepower of 2,000.

American shipping men had done little toward getting their steamships into foreign trade, for in the '40s the New England-built clippers were attaining great fame for speed and their owners were satisfied to watch these graceful ships beat the early steamboats across the Atlantic, which they did frequently. For this reason all the Atlantic liners were British between the years 1838 and 1847. In 1845, however, an Act was passed by the United States Congress providing for contracts with owners of American vessels for carrying United States mails. Evidently the lawmakers realized the growing importance of steam for regular services, for they stated that steamships were preferred.

Commenting on this Act of 1845, an American writer said: "This Act is all-significant as the beginning of American steamship service in the foreign trade. Not until national protection was offered in the form of generous subsidies could our enterprising merchants and sailors see their way clear to enter into the rivalry with the state-aided steam fleets of Europe. The mail subsidy legislation of 1845 was a wise step and indispensable, but it was too long delayed. Congress should have acted five years before, when the first Cunarder, floated and maintained by a liberal subsidy by Parliament came across the ocean, beating the time of our celebrated packet ships."

Therefore the first American mail steamship line was formed, the Ocean Navigation Company. It started a fortnightly service between New York and Bremen, calling at Southampton, with two new wooden paddle-wheel steamers, the *Washington* and the *Hermann*. They were 236 feet long, 39 feet beam, and of about 2,000 gross tons. Both were bark-rigged and had full spreads of canvas. The *Washington's* engines had more than twice the horsepower of the *Britannia,* the Cunard ship built seven years earlier, but her performance was disappointing. She raced the British ship across, and the latter beat her by two days. This company ran its ship only about a year and then dropped out.

The next American shipping organization for mail transport was the New York & Havre Steam Navigation Company, started in 1848. The wooden paddle-wheeler *Franklin* was built in 1850, a ship 263 feet long and of about 2,200 tons, with 1,250 indicated horsepower engines. A year later the *Humboldt,* somewhat larger, was added. These two vessels were unlucky; in 1853 the *Humboldt* was wrecked near Halifax, and in 1854 the *Franklin* met a similar fate on Long Island.

By 1850 the Cunard Line found that its steamship fleet was not big enough to take care of the demand for Atlantic passage, although in that year there were seven other lines operating across the ocean. Two sister ships, the *Asia* and the *Africa* were built, larger than previous Cunarders and with more power and speed. Wisely, designers and builders were going slow, increasing the size of their hulls and the power of their engines by safe steps. Successful new ships were for the most part designed along the lines of successful older ships; each advance brought the steam vessel nearer perfection, but there were many refinements the builders and engineers did not yet know. The *Asia* and *Africa* were 266 feet in length, with a beam of 40 feet and a gross tonnage of 2,226. Their engines were of 2,400 indicated horsepower, which gave the ships a speed of over 12 knots.

The Cunard Line was the leader among the steamship fleets, and in 1850 the Collins Line was formed with the avowed purpose of putting ships into service that would surpass the Cunard fleet. A Government subsidy was obtained, calling for ships of the finest type ever built, with greater speed and more luxurious passenger accommodations. The founder of the line, K. Edward Collins of New York, owned a fleet of sailing ships named after prominent theatrical stars, which earned the fleet the name of the "Dramatic Line." America was ready and eager to have a big and successful mail line, and Collins was supported by capitalists and merchants. The service was between New York and Liverpool with a sailing every two weeks in summer and every month in winter. The first five ships built not only complied with the contract, but they exceeded the Government's demands in every way. They were a long step in advance of any steamship built up to that time—1850. They so far exceeded the requirements in strength and equipment that Congress two years later greatly increased the amount of the subsidy.

These five wooden ships were the *Atlantic,* the *Pacific,* the *Arctic,* the *Baltic,* and the *Antarctic.* The *Atlantic* and *Arctic* were sister ships, and may be used to indicate the size and power of the fleet. They were 282 feet long, 45 feet beam, breadth across the paddle-boxes 75 feet. The paddle-wheels were 36 feet in diameter. Their 1,000 horsepower engines were of the familiar side-lever type, the cylinders being 96 inches in diameter with a 9-foot stroke. Their tonnage was 2,860. These ships were fitted with steam heat, the first ships to have it, and in every way they were luxuriously appointed.

When the first of the fleet reached Liverpool it was discovered that she was too wide to enter the dock, so a special dock was built. In design, these American ships departed from the hull lines of all the British vessels; they had straight cutwaters, no bowsprits, and their sterns were rounded. But in the matter of sails they did not differ from other steamers of the period. They not only carried plenty of canvas, but they relied on it a good deal. Their sea speed was more than 13 knots an hour, an achievement for the times.

All was not easy sailing for the Collins Line, however. In the building and fitting out of these ships money was spent extravagantly, and before the vessels were completed the funds were exhausted. The Government came to the line's assistance, and in addition increased the amount of the mail subsidy. With this aid the line took first position in the Atlantic trade with the largest and fastest steamers. Its income was large, but the company was wastefully managed, so that costs always exceeded the income. The loss of two of the vessels within two years was a heavy blow; the line built only one more ship.

This was the *Adriatic*, launched at New York, a larger and faster wooden side-wheeler than any former Collins ship. She not only went past the 300-foot length, but she measured 355 feet long, with a beam of 50 feet. Her tonnage was 4,144 tons gross. But owing to extravagance in operation, and the withdrawal of Government subsidies, the Collins Line was forced to quit.

This brings us up to the middle of the nineteenth century, covering a period of about fifty years in the history of the steamship. At this time the wooden ship still was supreme; paddle-wheels still were the most used method of propulsion. But big changes were on the way. The sizes of new ships were to show a decided increase. Iron was to take on new importance in shipbuilding. And the reliable paddle-wheels were due to become old-fashioned. The screw-propeller had proved its efficiency, and it, and improved engines to drive it, were ready to start the first great evolution in the design and performance of the steamship. This did not come all at once, by any means, but the iron screw ship was well on its way in the '50s.

Chapter IV

1850 to 1914

Pioneers in any line of development usually have to carry out their ideas in the face of much ridicule. There is always somebody ready to say "It can't be done," and because such a person lacks the nerve or the enterprise to try, he bolsters up his own timidity by belittling the attempts of those who are honestly trying to improve existing materials, machinery or methods.

This trait has been shown a good many times during the years since the first steamships, when people who knew little about the subject either laughed at the pioneers or showed indifference to their projects. Other men, whose connection with shipping should have made them wiser, have also stood in the way of improvements. The attitude of the latter may be expressed by the standpatter's slogan, "What was good enough for father is good enough for me." Yet when bolder men prove that their theories were sound, the timid men are quick enough to follow the leaders.

The history of the steamship is filled with examples of this attitude. First, the steamboat was an impossible dream. Then, when it was established successfully, improvements such as screw-propellers were a long time getting adopted. Many years after steamboats were in operation a learned doctor told the Royal Institute in Liverpool that a steamship voyage from Europe to America was as wild a dream as a trip to the moon, although several auxiliary steam vessels had already made the passage. And in less than four years several steam vessels were in regular service across the Atlantic. Coming down to modern times, the establishment of a regular round-the-world service was considered by many to be foolhardy.

Engineers who were trying to develop higher steam-pressures and more efficient engines had to fight the conservatives, and the advocates of iron ships met the same sort of attitude, even after vessels built of this material proved seaworthy and safe.

When iron was first proposed, scoffers were in the habit of saying, "Nobody can make a piece of iron float." They made the error of thinking of the specific gravity of the material rather than the displacement of the floating hull. It was a genuine surprise to such people to learn that an iron ship actually weighed from thirty to forty per cent less than a wooden ship of the same size. If the carrying of ocean freight had been as great an industry then as it is now they would have been quicker to accept the iron ship, for the reduced weight allowed more cargo tonnage to be carried without increasing the displacement. The primary idea in those days was to increase the strength of the hull.

After about 1810 the British shipbuilders began to face a shortage of oak, and they found it advisable to substitute iron for wood in the ships' knees, breast hooks, pillars, etc. But a vessel built entirely of metal was beyond the comprehension of the majority. The size of sailing ships and steamships was constantly being increased, yet it was not until about 1845 that the swing from wood to iron began in real earnest.

Wood held its own against iron in much the same way that sail resisted the encroachment of steam. The transition was gradual in spite of the fact that the length of wooden vessels was limited to about 275 feet. Wooden hulls longer than this, especially when they were fitted with heavy machinery, had a tendency to sag or hog. With iron hulls, there seemed to be no limit to the length a ship could be built. The *Great Eastern's* iron hull, which will be discussed later, was 692 feet long and 80 feet beam, with a displacement tonnage of 27,000—or nearly three times the length of the largest wooden ships. She was the wonder of the world at the time of her construction, and if efficient power had been developed for her she might have been a great success instead of a failure.

Going back to the beginning of iron shipbuilding, we find that as early as 1787 an iron barge was constructed by one J. Wilkinson, an iron founder. Probably he was laughed at; anyway, further experiments along this line languished until 1818, when Thomas Wilson built the iron sailing ship *Vulcan* near Glasgow, as referred to in Chapter II. She carried coal in the Forth and Clyde Canal, and the records show that she was still in service in 1875, a period of sixty-seven years. Even this example did not interest shipbuilders for several years.

The first iron steamship was the *Aaron Manby,* built near Birmingham in 1821. She was 106 feet long, 17 feet beam, and had a 30 horsepower engine. She crossed to France and entered service on the Seine. A second vessel for the same service was also built soon afterward, the parts being shipped to France ready for assembling. In Ireland about this time some small iron sailing craft and steam vessels were built for inland use, but several years passed before Great Britain turned out another seagoing iron steamship.

John Laird of Birkenhead, watching the success of the pioneer iron ships, in 1828 built his first vessel of that material, and other builders on the Clyde, the Thames and the east coast of Scotland followed his example within the next three years. Most of these iron ships, however, were sailing craft. Yards on the Mersey established a reputation for small iron ships, and here were built the first iron vessels for American owners.

The *Garry Owen,* 125 feet long and 21 feet beam, equipped with two steam engines developing 90 horsepower, was built in 1834, and her actions in service was a strong argument for iron shipbuilding. On her first voyage she ran into a storm which drove her and several wooden ships ashore. The latter vessels were either lost or seriously damaged, while the iron ship got herself afloat and proceeded on her way under her own steam power. This adventure proved to the sceptics that iron hulls were, after all, not to be laughed at. They were safe and seaworthy, and could weather storms which the best built wooden ships could not. After this demonstration iron shipbuilding took on new activity.

Beginning about 1850 and continuing until about 1880, iron as a shipbuilding material was in the ascendency. The principal steamships built for offshore service during this period were of iron; here and there a wooden steamer was launched, but iron was well on its way; steel as a material began to gain advocates toward the close of this period, and after 1880 the adoption of steel came on with a rush. Wood yielded to iron slowly; steel displaced iron in a surprisingly short time.

Among the famous steamers of the iron age—an age that saw speed records broken, engine designs radically changed, and methods of propulsion greatly improved —the following may be considered representative of their times. Grouping them according to dates, they show the gains made in size and power to the time of the steel ship.

The *Sarah Sands* was built in 1846 at Liverpool. She was 186 feet long, 33 feet beam, and of 1,400 gross tonnage. Her engines were of 300 indicated horsepower —two oscillating cylinders 50 inches in diameter and a stroke of 3 feet, with a direct coupling between the crank shaft and the propeller shaft.

In 1850 the Inman Line entered the trans-Atlantic service with the first of a fleet of iron ships with screw-propellers. The enterprise of this company opened the eyes of the world to the desirability of iron hulls and propellers; from this date on a constantly growing list of this type of ship came from the builders. The first Inman ship was the *City of Glasgow,* 227 feet long and 33 feet beam. Her side-lever engine had two beams that worked athwartship. The cylinders were placed on one side; a large geared wheel on the other side engaged with the propeller shaft pinion. The engines were of 350 horsepower, and drove a two-bladed screw 13 feet in diameter and 18 feet pitch. The vessel was bark-rigged and had a clipper bow, and was divided into six water-tight compartments. Her passenger accommodations were for fifty-two first class passengers, eighty-five second class, and four hundred steerage, with a crew of seventy.

In 1851 the second Inman screw-ship was launched, the *City of Manchester,* 2,125 tons, with 350 horsepower "overhead" geared engines. In her other particulars she was similar to the *City of Glasgow.* The same year the third liner was completed, the *City of Pittsburgh,* built in Philadelphia—the first American-built screw-propelled steamship to enter the Atlantic service. She was followed in 1853 by the *City of Philadelphia,* built on the Clyde, and then by the *City of Baltimore.* Each of these ships was somewhat bigger than her predecessor; the particulars of the *City of Baltimore* were: Length, 326 feet; beam, 39 feet; gross tonnage, 2,472. The sixth Inman liner was the *City of Washington,* 358 feet long, 40 feet beam, and of 2,870 gross tons.

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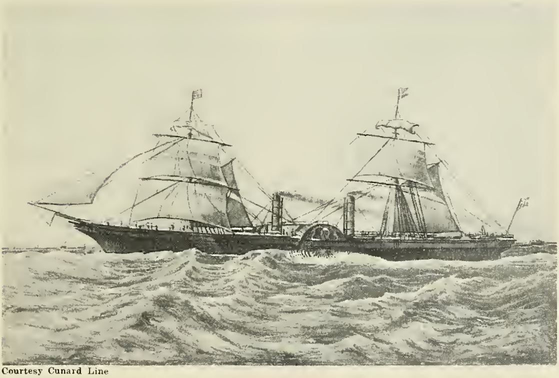
S. S. *Arabia*



Courtesy Cunard Line

S. S. *Persia*, 1856

People were calling these ships "Inman's Iron Screws," but it was not done derisively now. These six ships were setting an example for other builders, and were giving rival steamship operators reason to worry about the future.

The year 1852 saw the last wooden steamer to be launched for the Cunard Line. She was the *Arabia,* 285 feet long and 41 feet beam, with a gross tonnage of 2,402 and a power plant developing 3,250 horsepower, which gave her a sea speed of 13 knots.

Profits to be made in the Atlantic trade were inviting, and in 1853 the Allen Line tossed its hat into the ring. Starting with the *Canadian,* the company added the *Indian,* the *North American,* and the *Anglo-Saxon,* and their service to Canada grew and prospered. The Donaldson Line likewise established a Canadian service in addition to its other activities; this company may be the first to specialize on what we call today "cabin class," one class of passengers only.

In 1855 and the following year the New York & Havre Navigation Company put into service its third and fourth steamers, the *Arago* and the *Fulton.* Both were larger than the company's *Humboldt,* launched in 1851, and the familiar side-lever engines were replaced by oscillating cylinder engines, with cylinders 65 inches in diameter with a 10-foot stroke.

The first iron steamship for the Cunard fleet was the *Persia,* built in 1856. She did not, however, have screw-propellers like the Inman ships and other contemporary vessels. She was called "the longest vessel afloat in any ocean," for she was over 360 feet in length. Two years later the *Great Eastern* took this honor away from her—but the *Persia* continued to perform in service, whereas the *Great Eastern* was defeated by her too great size.

More than a brief paragraph should be given to the *Great Eastern,* the most interesting and the most unlucky ship of her day. Her building in 1858 was watched by the whole maritime world, as well as by the public at large, for she was a monster in size and her hull and machinery called for a number of innovations. I well remember the excitement among shipbuilders at the time, for I was twelve years old and working in the office of David Robertson & Company, shipping office, Grangemouth, Scotland.

Several financial failures of ships built in the '50s were due to lack of space to carry enough fuel for long voyages, and the *Great Eastern* was designed to correct this disadvantage. Her length of 692 feet, her beam of 80 feet, and her displacement of 27,000 tons, so far exceeded anything ever considered before that time that she was looked on as one of the wonders of the universe. She was double-hulled, with transverse iron bulkheads, and was equipped with paddle-wheels, screw-propeller, and sails on six masts. Her great size was a disadvantage; it held up her launching for nearly three months and added over half a million dollars to the cost of the ship. And in the water she disappointed everybody, and after a few voyages in the Atlantic trade (for which she was not originally intended) she became a cable-laying ship and did good work.

Misfortune seemed to follow the *Great Eastern* at every turn. She was launched broadside-on, which was a mistake. A few feet down the ways she stuck—for the builders had tried to use iron ways for an iron ship, and the hull refused to slide. The extra cost to get her into the water bankrupted the company. Public subscriptions were taken up, but another company had to take over the vessel. On her trial trip in 1859 an explosion killed six men. Her maiden trip to New York was made with only thirty-six passengers; her best speed was 14½ knots an hour on the outward voyage. Her next outward voyage took her into a storm which crippled her steering gear and she was almost lost. Six years after her trial trip she joined the Atlantic cable-laying fleet and remained in this work off and on until 1886, when she was sold to a shoreside merchant as a showroom. In 1890 she was sold to be scrapped.

In spite of the misfortunes, in spite of the fact that the *Great Eastern* was designed and built many years too soon, her effect on the later development of the steamship must be recognized. In an address in London in 1903 by Sir William H. White, the following opinion was expressed: "Having recently gone again most carefully through I. K. Brunel's (co-designer with Scott Russel) notes and reports, my admiration for the remarkable grasp and foresight therein displayed has been greatly increased. In regard to the provision of ample structural strength with a minimum of weight; the increase of safety by water-tight subdivision and cellular double bottom; the design of propelling equipment and boilers with a view to economy of coal and great endurance for long distance steaming; the selection of forms and dimensions likely to minimize resistance and favor good behavior at sea; and to other features of the design which need not be specified, Brunel displayed a knowledge of principles such as no other ship designer of the times seems to have possessed, and in most of these features his intentions were realized. To him large dimensions caused no fear. 'The use of iron,' he remarks, 'removes all difficulty in the construction,' and experience of several years have proved that size in ships is an element of speed, strength and safety, and of greater relative economy, instead of a disadvantage, and that it is limited only by the extent of demand for freight, and by the circumstances of the ports to be frequented."

So while the designers and owners of this huge ship failed to benefit, and huge sums were lost, her construction pointed the way for future large vessels. The mistake of the *Great Eastern* was that she was too big for her time; it was not until 1899, or forty years later, that a larger ship—the second *Oceanic*—was built. The *Great Eastern's* troubles were a lesson to shipbuilders; they should progress, but by degrees, not in one jump from a ship around 300 feet long to one nearly 700 feet long.

The increasing popularity of the Inman Line caused the seventh iron screw steamer to be built in 1860, the

City of New York, a vessel 336 feet long by 40 feet beam, and a gross tonnage of 2,360. She was fitted with horizontal trunk engines, the first of this type of equipment employed in the fleet. The *City of Bristol* came off the ways soon after.

By now the competition between Cunard and Inman was brisk, with each company striving for the advantage. The Collins Line had dropped out, but a little later a new line was established that was to inject new activity into the Atlantic trade. This was the Guion Line of New York, and the ships it ordered were more luxurious than those of its competitors. Striving for supremacy in the "Atlantic ferry," the rival companies planned bigger and swifter ships. Engineering was keeping pace with the other developments in ship design, and the day of the "Atlantic greyhound" was at hand.

Cunard launched in 1862 his last iron paddle-wheel steamer, the *Scotia.* She was 379 feet long, of 3,670 tons, and had engines of 4,900 indicated horsepower which gave a speed of 14 knots. This liner took the place of the *Persia* as the longest vessel—except, of course, the *Great Eastern*—built to date. She was the last big Atlantic liner of any company to be equipped with paddles. Six years after her launching she was sold to be converted into a sailing ship; the superiority of the Inman screw-ships in the matter of fuel economy and speed had much to do with the *Scotia's* short life in the express passenger service.

The next Cunarder, launched in 1862, was the *China*, the line's first screw-propelled ship. The second of this type, the *Java*, was built in 1865. By now the paddle-wheel was definitely out of the running for ocean liners.

A year later the first *City of Paris* made her appearance in the Inman fleet, called "the finest commercial vessel afloat." But she was not long in service before the Cunard Line brought out the single-screw *Russia*, which shared the honors for luxuriousness. These two were pitted against each other, and on several crossings they ran almost bow to bow.

The Guion ships were being completed. The first was the *Manhattan*, 343 feet long and 42 feet beam, 2,866 tons register. She bunkered 1,000 tons of coal and could carry 1,500 tons of cargo besides over 850 passengers. She had low-pressure inverted direct-action engines, surface-condensing, with 60-inch cylinders and 42-inch stroke. Sister ships, the *Chicago* and the *Merrimac*, followed, and then came the *Nebraska, Minnesota, Colorado, Idaho* and *Nevada*. They were fine sea-going craft, with much attention given to luxury, but it was not until some years later that the liners of the Guion Company attained the speed of the rival ships.

Inman now came forward with a record-breaker, the *City of Brussels*. She was of 3,081 tons, and had an average speed of from 14 to 15 knots at first; later she was re-engined, which increased this speed. In her first year she established a record for Atlantic crossings from

S. S. *Rio de Janeiro*, 1878

New York to Queenstown which she held until 1875. This vessel had a steam steering gear developed by McFarlane Gray, the first to be installed in a vessel in this trade.

In 1870 still another rival appeared in the "Atlantic ferry." Up to this time Ismay, Imrie & Company, soon to be known as the White Star Line, had stuck to sailing vessels. Now it entered the lists with a fine new steamship, the *Oceanic,* establishing a new record for size which the *Scotia* had held since 1862. This new "greyhound" went beyond the four-hundred mark, being 420 feet long and 41 feet beam, with a registered tonnage of 3,707. She had, also, improved machinery, compound 4-cylinder engines arranged in tandem driving a single screw. The high-pressure cylinders were 41 inches in diameter, the low-pressure cylinders were 78 inches, with a stroke of 5 feet. In rapid order she was followed by the sister ships *Belgic, Gælic, Adriatic* and *Celtic.* The White Star Line became an important factor in Atlantic traffic.

In 1870 the Guion Line launched two more advanced type ships, the *Wyoming* and the *Wisconsin,* 366 feet long, 34 feet beam, and of 3,238 tons register. Since they were completed ahead of the White Star Liner *Oceanic,* they are credited with having the first compound engines. A vertical high-pressure cylinder 60 inches in diameter, and a double-trunk horizontal low-pressure cylinder 120 inches in diameter worked on the same crank with a stroke of 42 inches. Further improvements were made in the *Montana* and *Dakota,* brought out in 1872. They had steel plating, water-tube boilers and compound engines. The *Montana's* boilers were fitted with 15-inch cross tubes and were designed to carry 100 pounds pressure; an explosion which occurred at 70 pounds pressure proved that this principle was not well enough developed yet, and regular tubular boilers of 80 pounds pressure were installed.

About this time The American Line started a service in the Atlantic trade with four 3000-ton steamships built by Cramp at Philadelphia and several British built ships. The Red Star Line took over this fleet in 1884, and about ten years later resold the ships to a new American Line, which also bought the Inman fleet when that company ceased operation, and had Cramp build the *St. Louis* and *St. Paul.* These two were 554 feet long and of 11,600 gross tons. They were built many years after the period we are now discussing, and so their dimensions do not indicate a sudden jump in size over the ships of the '70s.

In 1874 and 1875 the White Star Line built the *Britannic* and the *Germanic,* ships of 5,005 registered tons, 455 feet long and 45 feet beam. They had engines similar to those of the *Oceanic,* but the new ships made a speed of upwards of 16 knots, and cut the Atlantic crossing time to less than seven days. Engineers were still experimenting with screw-propellers, and since the ships of the day still carried plenty of canvas, attempts were made in the *Britannic* to perfect a lifting propeller. The idea did not work out, and this was the last White Star liner to be tried with this system. Experiments were also made to use gas lighting, but leaks developed and the ship was fitted with oil lamps.

The Inman Line in 1875 built the *City of Berlin* with the avowed intention of having the finest ocean liner afloat. She was 513 feet long and 45 feet beam, of 5,491 gross tons. Her compound engines were of the inverted direct-acting type of more than 5,200 indicated horsepower. She had twelve boilers heated by thirty-six furnaces, arranged to permit any number of the boilers to be cut out. Four years after entering service the *City of Berlin* was equipped with electric lights, the first installed in a ship for Atlantic service.

The next ship for the Guion Line was the *Arizona,* 450 feet long, 45 feet beam, 5,147 tons register. She was an iron ship, one of the last of this material to be constructed by the big passenger companies. In 1879, when the *Rotomahana* of 1,777 gross tons was built by the Union Steamship Company of New Zealand, the age of steel ships might be said to begin.

Steel vessels had been constructed at earlier periods, of course, but they were small ships intended for coasting or river service. The first steel steamer was the *Ma Robert,* for use in Africa, a little river boat 73 feet long. The *Rainbow,* a small steel-plated steamship, was built in 1858. She was a side-wheel river boat with a schooner rig; her high-pressure engine was said to be so noisy that it could be heard across the Mersey.

Such vessels were experiments; twenty years were to pass before shipbuilders took up steel in earnest. One difficulty was that steel was too brittle. David

Kirkaldy discovered the process of oil hardening steel, and from this came the Siemens-Martin process. In 1875 the British Admiralty built two cruisers of steel. Four or five years later the builders of merchant ships were taking this material seriously, and the steel age of ships was launched.

To the Allen Line goes the credit of building the first ocean steamship of steel. This was the *Buenos Ayrean*, launched in 1881. This year also saw the first steel Cunarder, the *Servia,* 515 feet long, and of 7,392 gross tons. She was given engines of 10,000 indicated horsepower, which drove her at 17 knots. This ship was the first of the Cunard fleet to have electric lights.

Another big iron ship was completed in '81, the Inman liner *City of Rome,* 560 feet long by 52 feet beam, 8,144 gross tons. She took first place in the matter of size, exceeding the length of the Guion ship *Arizona* by 100 feet. She had three high-pressure cylinders and three low-pressure cylinders arranged in tandem, and her boilers carried 90 pounds steam pressure. Her performance, however, did not equal expectations, and certain of her mechanical features were altered. The Guion ships *Alaska* and *Oregon,* of 1882 and 1883, were also of iron. First the *Alaska* broke the speed record across the Atlantic; then the *Oregon* set up a record even faster. The last named was 500 feet long, 54 feet beam, 7,375 registered tons. Her steam pressure was 110 pounds, a gain in this direction, and her compound engines had one high-pressure and two low-pressure cylinders, 70 inches and 104 inches, respectively.

The *Aurania,* the next Cunard steel liner, was launched in 1883; she was not quite so big as the *Servia* but she had just as much speed. She was followed by *Umbria* and the *Etruria,* for many years thereafter the fastest liners in service. These fine ships had 14,500 indicated horsepower engines that gave a speed of 20 knots. They were single-screw vessels, driven by the largest compound engines afloat. The next step for big ships was the adoption of turbines and the employment of multiple screws.

The Inman liner *City of New York,* built in 1888, was a twin-screw steamer with clipper bows and sails, but less canvas than the older ships carried, being schooner-rigged. Her two engines were of the three-crank type, and her boilers carried what was for that time a high steam pressure—150 pounds. The *City of Paris,* of similar size and equipment was built the following year; these two were the last vessels to be ordered by the Inman Line, which dissolved in 1893 to become the rejuvenated American Line. The *City of Paris* was the second ship of that name; the first, built twenty years before, was of 2,651 tons; the new ship was 10,499 tons, showing how much progress was made in two decades.

For three years the *City of Paris* was monarch of the Atlantic; was the first to cross the ocean in less than six days, and she set new standards for the construction of liners thereafter. Fore-and-aft as well as transverse bulkheads were used; three funnels were installed. Later vessels went to four funnels, but today the swing is back to two or one, short and of huge diameter.

An English writer tells of an accident aboard the *City of Paris* which greatly endangered the ship and her passengers. I will quote from his account simply to show how the courage of an officer saved a fine ship and many lives. Heroic action has never been confined to any period or walk of life, yet I like to think that the men who go to sea have just a little more loyalty to their ships than landsmen have to their jobs ashore.

"The *City of Paris* was engaged in a record run and was twenty-four hours from Queenstown Harbor, when there was a frightful crash below. Steam belched out of the engine room, the ship trembled from stem to stern, and seven terrified men tumbled up on deck through the hissing steam. In the intense excitement and confusion no one appeared to know what had happened. In the engine room could be heard a crashing and thrashing as if some titantic power was smashing everything to pieces. That was exactly what was taking place. The starboard engine had broken; a huge rod like a giant flail was being whirled round and round with untold force, battering everything within its reach. Steel bulkheads were shattered; pieces of machinery were dropping; the bottom was in imminent danger of being perforated; a thousand lives were hanging by a thread.

"Suddenly a man darted down into the steaming hell. Almost at once the racket ceased. John Gill, the second assistant engineer, had risked his life to bring the whirling machinery to a standstill. He had saved the ship and the souls aboard her with that calm assurance that is ever to be found in the officers and men of our mercantile marine."

Twin-screws had been adopted by a few earlier ships, but after the *City of Paris* had proved their advantage decisively new ships employed them, and it was only a matter of time when triple and quadruple screws would follow. The competition on the Atlantic was so intense that naval architects and marine engineers were kept on their toes to improve the performance of their new ships. Speed was the great necessity; and a ship that could capture the blue ribbon was the dream of every owner.

The next aspirants for this honor were the White Star liners *Teutonic* and *Majestic,* sister ships completed in 1889. These 10,000-ton vessels were the finest vessels built to date, and they both lowered the record for the Atlantic passage. In 1892-3 The Cunard Line launched the twin-screw sister ships *Campania* and *Lucania,* almost 600 feet long by 65 feet beam, with a gross tonnage of 12,950, engines of 30,000 indicated horsepower, and a speed of 22 knots on a coal consumption of 485 tons a day. They were the largest merchant ships in service, exceeding the length of the *City of Paris* by about 70 feet. They were also the speediest in the world—a position they held for four years, when Germany tossed her hat into the ring and began to launch record-breakers in size and speed.

The first challenger from Germany was the *Kaiser Wilhelm der Grosse,* launched by the North German Lloyd in 1897. She was 627 feet long, 14,349 gross tons, with triple-expansion engines developing 27,000 horsepower. Her first voyage showed less than 22 knots, the speed of the *Campania,* but later she made an average of close to 23 knots an hour, and so took the blue ribbon from England. Not satisfied with that, Germany further clinched the record when the Hamburg-American Line built the *Deutschland* in 1900, a ship 662 feet long, 16,502 gross tons, with a power plant of 30,000 horsepower. She raced across the Atlantic to New York at a speed of from 22 to 23 knots.

Other mammoth German liners followed in rapid order, all designed to be the biggest and most spectacular vessels in use. But in the meantime the White Star Line brought out a ship that exceeded in size anything afloat. This was the second *Oceanic,* built in 1899, a twin-screw steel vessel 704 feet long, 16,900 gross tons, with engines of 29,000 indicated horsepower and a sea speed of 21½ knots. She was the first ship built that exceeded the length of the ill-fated *Great Eastern,* and she was the last word in luxury and comfort.

Perhaps the Cunard Line, watching the efforts of the Germans to establish speed records, decided that super-fast liners were not worth what they cost to build or operate. At least, the next Cunarders, the *Ivernia* and the *Saxonia,* built in 1900, were of 13,800 gross tons and had a speed of 16½ knots. They were not built for records, but to earn profits; the Germans were finding out that it was very expensive to have the fastest ships. In spite of their popularity, the profits of the big ships were slim. The Cunard ships carried 1,960 passengers, 250 crew, 11,000 tons of cargo, and had a coal consumption of 150 tons a day. These ships each cost half the cost of the *Deutschland,* operated with less than half the German ship's crew, used only about one-fourth the fuel, carried eighteen times more cargo, and twice as many passengers. Holding the speed championship hardly made up for the loss in money, but the Germans were very proud of their ships.

Almost every year a new contestant appeared. The White Star Line answered the German challenge with the *Celtic,* built in 1901, and the *Cedric,* the following year. Of 20,904 gross tons, they were the largest in size at the time they were launched, surpassing the huge *Deutschland* by more than 4,000 tons. They held their own until the German builders could build a bigger ship.

Their next one was not bigger; she was the North German Lloyd *Kronprinz Wilhelm,* of 15,000 tons; but in 1903 came the *Kaiser Wilhelm II,* longer than any previous German vessel. She was 678 feet long, with four funnels, and built for speed, but against the *Deutschland* the older vessel held her leading place. The company added the *Kronprinzessin Cecile,* and maintained a weekly service between Bremen and New York.

Keeping pace, the Hamburg-American Line built such big ships as *Cleveland, Cincinnati, Koenig Wil-*

helm II, Amerika, Kaiserin Auguste Victoria, Patricia, President Grant and *President Lincoln.*

The giant liner *Adriatic,* launched by the White Star Line in 1906, exceeded the *Oceanic* in size, being 709 feet long, 75 feet beam, and displacing over 40,000 tons. This gigantic vessel had such modern improvements as an electric passenger elevator, swimming pool, etc.

A little smaller in size, but with all the luxury any passenger could reasonably want, were the sister ships *Campania* and *Carmania,* built by the Cunard Line. They were alike in dimensions—675 feet long, 72 feet beam—but they differed in their power plants. The *Carmania* was given turbines, the first Cunard ship to have them, and triple propellers. The *Campania* had quadruple-expansion engines. This was done in order to study the relative values of the two propulsion methods in vessels of equal size and in the same service.

Turbines were fitted into the new Allen Line ships *Victorian* and *Virginian,* two 10,000-ton vessels. The results shown by these craft, and by the *Carmania,* were successful. With some improvements, the marine turbine took the leading position at sea, and in big fast passenger liners this type of prime mover soon became the only one employed.

A great shipbuilding era was ushered in. In the period beginning around 1903 and extending to 1914 appeared such outstanding turbine-driven vessels as the *Republic, Baltic, George Washington, Laurentic, Megantic, Olympic, Titanic, Imperator, Vaterland, Lusi-*

tania, Maurentania, Ultonia, Carpathia and *Acquitania* —the finest ships in the world, big, powerful and fast, and, with few exceptions, more luxurious than the ships that had gone before them.

In 1914, the year that the *Vaterland* was launched—breaking all former records for size, being 907 feet long and of 54,647 tons—war was declared, and immediately all thought of record-breakers was dropped. Shipbuilding was immediately directed to supplying ships for government use, particularly in Great Britain and America. We were not involved right away, but our shipping increased by leaps and bounds. The world needed ships and needed them badly. When we joined the Allies our need became tremendous, and we began to build cargo ships in increasing numbers on all coasts.

England launched only three merchant ships of over 12,000 tons in the years 1915-17. The war cost Britain 2,197 merchant vessels lost; France, Italy, Japan and the United States lost 597 vessels. Therefore, when peace came in November, 1918, not only did the world have to make up the ships lost but it had to make up the tonnage that would normally have been built during the four-year war period. The whole shipping world was disrupted; the United States had on hand about 2,310 vessels, 1,689 of them steel, 592 wood, and the balance composite and concrete ships. This was the nucleus of a merchant fleet that would re-establish our flag upon the seas.

Since only twenty-six of these ships were designed to carry passengers, this emergency fleet was organized by the Shipping Board and sent out in forty-one definite trade routes. Thus American ships were all at once back in the world trade, getting a great start on the crippled maritime nations of Europe. A month before the Armistice, in fact, we had 184 ships employed in essential trade with Europe, 95 ships with Africa, 187 with Australia, 132 with Asia and India, 478 with South America, and 295 with the West Indies and the Caribbean countries.

Chapter V

Since the War

WHEN PEACE RULED the world again the steamship lines began their rebuilding program. The Cunard Line ordered thirteen new turbine vessels, the largest being the *Franconia,* of 16,600 tons; the White Star Line launched the *Doric,* 16,650 tons; the P. & O. built what almost amounted to a new fleet, sixteen steamships totaling 105,000 tons; the Canadian Pacific, the Anchor Line, the Pacific Steam Navigation Company, the Orient Line, and many other British lines built larger steamships than before. Germany was out of the picture for the time being; France and Italy were poor; the United States had over two thousand new cargo ships and a few passenger liners, and was having a hard time employing all of them, so no building was possible on this side.

The reparations agreement brought four of the biggest ships to us and to England. The *Vaterland* became the *Leviathan,* of the United States Line; the *Imperator* became the *Berengaria* of the Cunard Line; the *Bismarck* and the *Columbus* became the *Majestic* and the *Homeric* of the White Star Line. The Canadian Pacific also received three German vessels which were renamed the *Empress of Scotland, Empress of Australia,* and *Empress of India.*

Post-war costs were high, so for a time no big liners were built. The three mammoths, *Majestic, Leviathan* and *Berengaria,* stood to retain their position for size and speed for a long time. The British *Mauretania* held the blue ribbon for the fastest Atlantic crossing, and although she was an old ship she seemed able to keep the record against all comers. But Germany was not to be dismissed; taking her ships away from her did not kill her memory of the time when she controlled so much of the world's seaborne commerce. As hard-pressed as she was by the reparation payments, she began to organize and build new cargo and passenger ships.

In 1928 the White Star Company announced the intention of building a new liner not less than 1,000 feet long. The Cunard Line came forward with another monster, planned to be more than 1,000 feet in length, and to have the most powerful propelling equipment ever given a merchant vessel. This super-liner was started, and the idea was to equip her with turbine or turbine-electric drive. Already known as the *Oceanic,* the project became widely discussed. Any ship that runs more than 73,000 gross tons, as this one will, calls for widespread interest.

In the meantime, Germany started to build two record-breaking steamships, the *Bremen* and the *Europa,* each of close to 50,000 tons and with a speed of around 27 knots. They were 933 feet long and 100 feet beam, with four screws. They were avowedly built to take the *Mauretania's* blue ribbon from her, and the world watched eagerly. The *Europa* caught fire at her dock at Hamburg before she was completed, so her entry into the trans-Atlantic service was delayed. But the *Bremen* sailed, and on her maiden voyage to New York lowered the record for crossing by nearly nine hours.

The power plant of the *Bremen* was advanced in design, and for a while kept secret. She has a high-pressure, an intermediate-pressure and a low-pressure turbine on each of the four shafts, running at 1,800 revolutions a minute but geared down to 180 revolutions at the shaft by single-reduction gearing. She has two engine rooms, each containing two turbine units, and there is an auxiliary engine room for the electric equipment and four diesel generators. She is not the biggest ship, but she is the fastest—along with her sister, the *Europa,* who divides that honor with her.

Immediately after the record run, orders went out to stop construction work on the giant *Oceanic.* Here were two new ships that had to be beaten in speed, and the improvements the Germans had made in the design of the hulls, in the power and propulsion equipment, and even in the stream-lining of the upper works of the ships, should be studied before going ahead with the *Oceanic.*

Perhaps the Cunard interests wondered if it was worth the tremendous cost of building and operating a ship designed primarily as a speedy passenger vessel.

The competition before the war, when Germany took the speed record away from the British was a costly one to the Teutons. They had pride in owning the fastest ships, but the dividends were slim. They sacrificed much to gain speed, while the British ships carried more passengers and cargo and earned profits.

On the boards or in the shipyards at this time are other super-liners as well. The giant French liner now building will be about 1,000 feet long, with turbine-electric drive of 150,000 horsepower and a promised 30 knot speed. Italy is likewise entering the lists with a big record-breaker, and the United States Line has now under construction two big liners which they plan to enter in the Atlantic service.

So we see that the Atlantic passenger service is still a highly competitive game, with the builders of England, America, Germany, France and Italy striving to produce vessels that will excel in size and speed. America has been able to enter the contest through Government aid, which at the present time is giving us a real shipbuilding boom. The Merchant Marine Act of 1928, known as the Jones-White Act, through its mail contract and construction loan provisions, has made this country once more a shipbuilding nation.

Already a number of large American-owned ships, built with Government loans up to 75 per cent of their cost, have been launched. This activity, however, is confined to mail vessels; the crying need now, if we are to have a balanced merchant marine and are to meet foreign competition, is to provide some Government aid in the important work of building cargo ships. It is a vital question, for our best freighters are not new and must be replaced by faster ships if we are to hold the ground we have regained since the war. New cargo ships are coming off the ways in most foreign countries, and they are faster by several knots than our fastest freighters. Aside from tankers, practically every new ship being built in this country is a combination type which complies with the requirements of the Post Office Department. Our total tonnage is growing; in 1929 we launched 126,063 tons of ships; in 1930 we launched 246,687 tons, a gain of 120,600 tons. But nothing has been done to aid the owners of freight ships —and our freighters are getting older all the time while our competitors are launching faster vessels. With the differential in cost of construction here and abroad, no private shipowner can afford to build without help of some kind.

In our coastwise and intercoastal trade we have some of the finest vessels afloat; the turbine-electric ships *California*, *Virginia* and *Pennsylvania* are models of efficiency; they set the pace for this new type of propulsion for merchant ships.

I can hardly be expected to pass by the two new Dollar liners, *President Hoover* and *President Coolidge*, without showing a certain pride. For we are very proud of these fine ships, so modern in design and so advanced in their power plants. To date they are the largest merchant ships ever built in an American shipyard; they are a credit to the Newport News Shipbuilding and

Dry Dock Company, the builders, and naturally we feel that they will add luster to the Dollar Line's record.

The vessels are 654 feet long, 81 feet beam, 23,000 tons gross, with about 60,000 cubic feet of refrigerated cargo space and over 655,000 cubic feet of general cargo space. So you see, while we have gone in for size and luxury, we have not overlooked the cargo-carrying side of our business. I could no more build a big ship for passengers only than I could build one with antiquated equipment.

Turbine-electric propulsion such as these ships have is still rather new in marine construction; the *California* and her two sisters of the Panama-Pacific Line were the first merchant craft to employ this type of drive. Then the Navy took it up for equipping the two airplane carriers, *Lexington* and *Saratoga;* it is a development of American engineers, but its success at sea has caused it to be adopted since by British owners for powering several large and fast passenger vessels.

The *President Hoover* and the *President Coolidge* are among the most completely electrified ships in existence; every department of the vessels have made the fullest use of electricity to give power and comfort. When it is considered that each of these ships develop 26,500 shaft horsepower for driving the twin screws, the magnitude of the liners is appreciated. Here is a brief description of the main propelling equipment of either of these craft:

Each propeller is driven by a motor rated at 13,250 shaft horsepower at 133 revolutions per minute of the propeller. The propulsion motors receive their power from two turbine-generator sets, each rated 13,250 horsepower, 2,660 revolutions per minute, 4,800 volts. The turbines are of the downward-exhaust type and are mounted directly over their respective condensers. Steam is generated at a working pressure of 300 lbs. per square inch and 200 degrees F. superheat by twelve water-tube boilers arranged in two firerooms. In fact, the electric-drive power plants of these two ships are the most powerful so far applied to a merchant vessel. The ships have a service speed of 21 knots.

Cooking and baking, lighting and ventilating, cargo handling, a hundred and one things about the ships, are done by electricity. Some improvement over the old days of coal fuel, oil lamps, and no artificial ventilation! Now we have talking pictures, radio programs, elevators, navigation equipment, clocks, and numerous other things that depend on electricity for power. Motors that drive individual auxiliary equipment are scattered all over the ships. Each vessel, for instance, has a total of 187 motor-driven auxiliaries. These are truly well named when they are called "all-electric" ships.

These new liners, which are the twentieth and the twenty-first of our fleet of *President* liners, will enter service this year in the New York-California-Orient run. The other *President* ships are turbine-driven, with a deadweight carrying capacity of over 12,000 tons. Therefore, the service of the Dollar Lines across the Pacific from San Francisco and Seattle, round-the-world, and the newly inaugurated eastbound service through the Panama Canal—all of which run on railroad-like schedule—provide the best of passenger accommodations and also give a freight service that could not be duplicated by cargo ships with their slower schedules. Commodities that do not call for particular dispatch are carried in our freighters, naturally. The fact is, the day of the tramp cargo ship is about over, save for bulk cargoes. Liners that arrive and depart from world ports on fixed hours of fixed days are giving the shippers a cooperation that the older types of vessels could not promise.

Within recent years the diesel engine has come rapidly to the front for marine use, particularly in medium sized cargo ships. There are several very large and luxurious passenger ships with diesel motors, and more that are of moderate size. The difficulty in the past has been to build diesel engines of sufficient power to fill the needs of really big and really fast ships, but the time is undoubtedly coming when more passenger liners will be motorships. For the cargo vessel, however, diesels are popular and efficient, with a somewhat greater first cost, but with advantages, such as fuel saving, that make them the choice of many companies.

This growth of diesel ships has been confined to European nations, however, with the exception of a few Shipping Board steamers converted to diesel drive some years ago, and some American-built tankers. This country can turn out diesel engines that compare with any other country's product, but the differential in shipbuilding cost and the fact that American shipowners are reluctant to take up the newer propulsion method so long as steam engines are doing their work efficiently, has so far kept the diesel in the background. The early troubles of motorships, and the prohibitive cost which went with the development of the early engines, have been ironed out. Troubles are practically done away with now, and the initial cost of diesel power plants is close to the cost of steam plants of equal size. Every marine man knows of the present-day struggle between the designers and builders of steam engines and diesel engines; each group has been put on its mettle, and the outcome is going to be of great value to the shipping industry.

It may be of interest to relate briefly an experience I had in London some eighteen years ago at which time I had the pleasure of meeting Mr. Rudolph Diesel, after whom the engine was named.

My meeting with him was brought about through a luncheon tendered me by the president of Lloyd's Register. This was given in their building to which about sixty shipping men were invited. I was seated on the right of the president and on his left sat Mr. Diesel. During the luncheon the president said to me, "Mr. Dollar, with all the ships you are building will you build a diesel ship?" I replied that I would not, and he then asked me why. This was a difficult and puzzling question to answer for the reason that I did not want to hurt Mr. Diesel's feelings. Therefore I continued eating. The chairman of the meeting then said to me, "There are sixty men at this table Mr. Dollar, and each one of them has paused awaiting your reply to my question." This made it necessary for me to say something, but as the question was a perplexing one to answer I simply remarked that I would not build a diesel ship because I was born in Scotland, and being a Scot I was a little wary of any experimentation. It so happened that about two-thirds of the gentlemen present were from Scotland and at this remark they gave me a rousing cheer. Mr. Diesel stood up and was about to express himself when the chairman said that he could not permit him to reply to an answer such as I had given.

Four months after this incident I was deeply grieved to learn of Mr. Diesel's death. While traveling across the English Channel aboard the steamer *Antwerp-Harwich* on the night of September 30, 1913, he fell overboard and was drowned. The poor man, worried and discouraged, never lived to see the success of the engine that bears his name.

In the diesel ship of today the tendency is to adopt a standardized type of about 10,000 tons and a service speed of about 14 knots. In the last five years the motorship tonnage built has gained tremendously. During 1925 there were 690,000 gross tons of motorships launched; in 1930 the gross tonnage launched reached a figure greater than the figure for steam-driven ships built; the diesel ships totaled 1,577,685 tons, and the steamships totaled 1,252,352 tons, according to the records I have, which shows the growing popularity of the oil engine.

Pulverized coal is gaining too. Of recent development, there are now about twenty-five ships equipped to burn this fuel. Great Britain particularly is becoming interested in the system, being a coal producing country and having to import oil fuel from the United States or other distant countries. In this system the coal is stored aboard and run through the pulverizing equipment as needed, and fed to the furnaces by mechanical stoking.

But oil is of course the prime fuel of the shipping world; no really large ship of any nation burns anything else now. The contest between the different fuels and their methods of burning is interesting to watch, and when definite proof is established of greater economy and efficiency in any of the various systems, shipowners will not be slow to adopt the best. World competition is too keen for any shipowner to remain satisfied with anything but the best. If he doesn't keep step, others will take his trade away from him.

I'll never forget my first experience with oil fuel. It was in 1902 that I pioneered by equipping the cargo steamer *Arab* to burn oil, much to my sorrow. I went on her on a voyage from San Francisco to China. We had not proceeded very far before we discovered we did not know how to use the oil properly. We kept on changing and improving the defective equipment, and in the meanwhile we were approaching the Aleutian Islands, and it was in the dead of winter. Then our pumps positively refused to furnish oil to the burners, the oil being very heavy, far more so than any used at a later date.

Naturally our fires went out, but we had some coal so we managed to get steam on one boiler. Think of our situation—no steam, and drifting on to the Aleutians. In sheer desperation the Chief Engineer and I decided to take a chance. We drilled a hole in the bulkhead and allowed the oil to run under the boilers so it would get warmed up; then we used it.

What a terrible risk we took! If the oil had ignited, we could not have saved the ship. So while we were attempting this risky business I made my home in the boiler room, and I did not sleep much, either. When we got into the Sea of Japan I found we had coal enough to take us to Shanghai, so we cleaned up all the furnaces to burn coal. When this was finished I said, feelingly, "No more oil for me."

But here I am with every ship burning oil, because we have since learned how to use it and the oil men know how to prepare it.

The company bearing my name was started a good many years ago, in a small way and with lumber as its backbone. I established my lumber business on the Pacific Coast back in 1888, and because the supply was greater than the transportation facilities, I decided to run my own ships. We used sailing vessels and built up a great outlet for our timber products. Then we bought our first steamship, the little *Newsboy,* a lumber schooner with a capacity for 240,000 feet of lumber,

STEAMBOAT SCHOONER *Newsboy*

and as the needs grew we added more ships. There were dark days; the period of 1907 was disastrous to many, but we were prepared beforehand and our business was not affected to any great extent. Other dark days followed; when things were pretty black for world affairs, in 1920-21, we bought more ships. You see, my faith in the future of the Pacific has never wavered, and one of my rules has been to strengthen and consolidate during slack periods so that when times are better I am prepared to take advantage of them.

But our big growth has taken place since the war. Seven round-the-world liners were bought in 1923. The fleets of the Dollar Oriental service and the American Mail service running out of Seattle, were purchased not long after. And now, with the Government getting behind the upbuilding of a real American merchant marine, we are constructing new ships. Other companies are keeping pace, and the shipyards of the East Coast are humming with activity. Owing to the cost differential between the two coasts, the Pacific shipyards have not been able to secure any of this new work, but legislation is under way to provide for this differential. I should like to see the yards of every big port of America busy with new tonnage. It really looks like we are going to put the American flag on the seas in a way that we can all be proud of.

And when we are competing profitably with foreign ships, remember my dream that is so rapidly coming true: The Pacific Ocean will become the world's greatest shipping center, and the Pacific Coast of North America, with its wonderful ports, will be the busiest and most prosperous region in the world.

Chapter VI

Deep-Sea Cargoes

In the preceding pages I have dwelt almost entirely on the passenger steamship, which represents the romantic side of the shipping business. The biggest and the fastest vessels are naturally the passenger carriers, and through discussing them we get the best picture of what has taken place in marine engineering and naval architecture since the first experimental steamboats were put afloat. The advancements in shipbuilding and the increased efficiency of ships in five generations is one of the outstanding achievements of history; too little credit has been given the men who have devoted their engineering and scientific skill to the perfection of the ocean liner. It is my wish to do honor to their accomplishments in this book.

There is another side of shipping that the layman gives little thought to because it lacks the color and dash of the passenger carrying trade, and that is the transportation of freight. It represents innumerable ships, far in excess of the passenger liners, but these hard working vessels go about their business so industriously and with so little public notice that their importance is often overlooked. Marine men need not be told how valuable this branch of the industry is. They know that the steady going unromantic cargo ship is the backbone of the shipping business.

In the early days of steam navigation builders and owners of steamships did not consider it possible to compete with sailing vessels for the carrying of cargo. Sailing masters of British and American ships were master navigators; their "tall ships" carried much canvas and made fast passages. And the economy of operating windjammers was such that the expensive steamships could not figure to meet the reasonable freight rates of that period.

The first steamships were built for service in rivers and canals, and for short ocean runs, and they did not at first attempt to carry much cargo. The passenger traffic was what they wanted, and ships were built to please the traveling public. Long voyages were out of the question for such craft, owing to the fuel requirements; they used a great deal of coal for their horsepower and speed, and their size did not permit of carrying bunkers for extended trips. For this reason the cargo steamers were slow in getting a foothold in this trade. It was only after the compound engine displaced the one-cylinder jet-condensing engine that cargo steamers began to take the place of sails in the off-shore trades—at first in the short runs, for the sailing ship was able to hold out longest against the newcomer in the trades calling for long voyages.

The first cargo boats were built along the lines of the sailing vessels. In fact, for a long time it was thought that no speed could be got out of a hull designed any other way. But experience taught the designers many things, and they gradually flattened down their models until cargo ships assumed the form of a rectangular box fined up at the ends to suit the speed required; the stability of the vessels increased and the draft decreased, so that we have 9,000-ton deadweight steamers drawing only 24 feet, a condition the earlier builders did not think possible.

With this came a decrease in the number of decks; tiers of beams and rows of stancheons disappeared, and clear holds of great capacity came into use. As an illustration of the great change that has taken place in cargo capacity and cargo handling, one of my granduncles wrote in a letter from Singapore in the year 1798:

"I am pleased to report that I have secured a full cargo of 800 tons for this big ship, and we hope to finish loading in three weeks."

Now we want 15,000 tons, and handling less than 1,500 tons a day would show woeful lack of efficiency. Times certainly have changed! Today the cargo steamer is of immeasurable importance in the world's commerce.

As already stated, they were slow to get started. They did not figure much in ocean commerce until after about 1860, when cargo steamships of from 1,000 to 1,500 tons deadweight capacity began to make their appearance. They were single-deckers with little or no steam equipment for the loading or discharging of cargo, but they were a great improvement over previous ships, and from that time on they gradually increased in size and efficiency. In 1880 the freighter had increased to a maximum length of about 250 feet, with a beam of about 33 feet, and a deadweight capacity up to about 2,500 tons. They were built of iron, and they had a speed of from 7 to 8 knots.

Taking an average of the larger cargo steamships over a thirty-year period, at ten-year intervals, the progress in size and speed was about as follows:

Year	*Length*	*Beam*	*Gross*	*Net*	*Speed*
1890	254′	34′ 4″	1,498	880	8
1900	339′ 5″	44′ 8″	3,592	2,314	9
1910	397′ 7″	50′ 10″	4,792	3,033	10
1920	431′ 8″	56′ 2″	6,318	3,761	10.5

What the limit of size of cargo ships is we are not sure. We know that there is a limit beyond which the cost of operation will be out of proportion to the earnings of cargo carriers. Different trades and the conditions affecting each trade—such as the length of the voyage and the commodities to be carried—are controlling factors which determine the most efficient size of freighters. Generally speaking, the most desirable size at the present day is from 8,000 to 10,000 tons deadweight. Certain trades with short runs call for smaller ships; others, with long runs, find the ship of 10,000 deadweight carrying capacity or over to be desirable, but this is the exception and not the rule.

Of recent years there has been a general disposition to increase the speed of cargo ships. Competition has made it necessary to step up the speed to at least 10 or 12 knots, and some vessels in highly specialized trades find it economical to turn up 15 knots. Many such ships, however, are motor vessels, which the European countries have gone in for rather strongly.

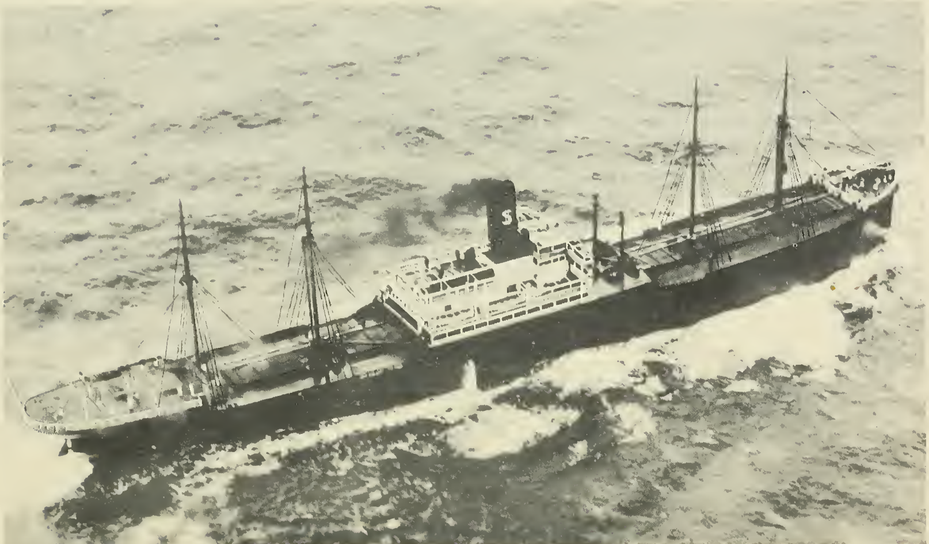
As is well known, the power required to propel a steamer an additional two or three knots is very great. A comfortable sea speed of 11 knots, for instance, is built into a ship. She can exceed that under necessity, but the fuel consumption will be far out of proportion for the extra knots. Recently the steam engineers, facing a growing competition by the diesel engine in cargo ships, have brought out new efficiency in the steam plant, efficiency never dreamed of by older engineers. They have increased steam pressures beyond the wildest fancy of men a few years ago—300 pounds per square inch and even higher being used today; they have developed super-heating equipment; they have improved fuel-burning apparatus; they have harnessed exhaust steam and devised an efficient combination of reciprocating engine and turbine; they have refined and improved steam engines until the modern cargo ship is able to make considerably greater speed without additional cost of operation.

A great many other improvements have been worked out, all helping the cargo ship to do its work with the most dispatch. Winches and gear for handling cargo are models of efficiency now; today we load and discharge a cargo in half the time it took not so long ago. Shore facilities have kept step, and we can handle with this equipment at least double the amount of freight in a given length of time. And such improvements have not been confined to important ports only. I noticed in some Indian ports that railroad tracks were laid along the edge of the roof of a two-story warehouse, and that locomotive cranes handled the cargo. In Bombay there are plenty of hydraulic cranes, and in numerous other harbors I have watched modern equipment working at the ship's side. The Orient is fast getting educated to modern methods.

From my notes I find that I wrote a memorandum of the above ten years ago, while on board the *Robert Dollar,* which is now the *Chief Capilano,* under Canadian registry. At that time the three largest freighters in the world were the *Winifredian,* the *Tyndareus* and the *Robert Dollar.* A comparison of their sizes follows:

	Built	*Length*	*Beam*	*D.W.Tons*	*Fuel*	*Speed*
Robert Dollar	1920	523.5	65.5	15,450	Oil	13 knots
Winifredian	1899	552	59	12,980	Coal	14 knots
Tyndareus	1916	507	63	14,200	Coal	14 knots

Since 1920 many large cargo ships have been built in Europe, but the increase in size shows no comparison to the jumps made in passenger ships. Because of economic reasons already discussed, America has built no freighters since the war. The old *Winifredian* has recently been sold for scrap, having outgrown her usefulness after about thirty years of service. The above dimensions, however, are not so far from the limit that cargo carriers have been built. As already stated, it requires a rather special trade to support the larger



The S. S. *Robert Dollar* in Mid-Atlantic giving position to the "ZR-3", first zeppelin to cross to America. Picture was taken by one of the crew of the giant airship

freighters today. These vessels have grown in size slowly, as demands seem to warrant.

The cargo steamer came into use long after passenger steamers were well established; as late as 1887 the total carrying capacity of all steamships engaged on the Pacific Coast and to the Orient was not much more than 12,000 tons. By 1920 there were about 120 large steamers permanently engaged in this trade, and their combined carrying capacity was over 1,000,000 tons. At the present writing there are many more cargo vessels in the same field, and the total capacity has been greatly multiplied. Such gains are wonderful and give us an idea of the value of foreign trade to the Pacific Coast. Truly, it takes no prophet to see that in a few decades the Pacific states will be at the front instead of the back of the United States, and San Francisco will be the front door. In through this door will flow the rich commerce of the Orient and the southern ports which have not been fully developed; and out through it will flow a greater volume of American raw materials and manufactured products to supply the wants of the awakened foreign markets. The potentialities of foreign trade in the Pacific are so great that they are hard to believe. But they will come true; I have studied the subject too hard and too long to be mistaken.

While in Manila some years ago I was intensely interested in seeing in Smith Bell & Company's office some of their freight reports and statistics for the year 1866. In their monthly list of sailings I noticed only about two vessels of 1,000 tons among about 35 ships.

All were sailing ships. Many as small as 300 tons register were shown to clear from Manila for New York and Great Britain. Looking back from our modern standpoint, it seems impossible for ships so small to make such long voyages and make them pay, remembering that they went by Cape Horn or the Cape of Good Hope. It is only by taking a retrospective view such as this that we can fully realize how far we have progressed in the transport of ocean freight.

In those old days there were no cables. The captain of a tramp ship had to be depended on to make the best bargain he could. Often the owner of the ship at home did not know the next destination of his ship until he got the mail, delivered long after the vessel had sailed. Now we have cable, radio and telegraphic communications everywhere, so that in a very short time information can be sent to and from the most remote parts of the world.

There was generally a supercargo aboard each of the old-time ships whose duty it was to sell the cargo at destination and buy a return cargo. The shipowners of that day were generally merchants, and as a rule they became very rich, although many came to grief through losses not covered by insurance. Nowadays it is possible to cover fully all risks.

The increase in the size of ships depends to a large extent on the cargo offerings. One hundred years ago the ordinary cargoes were from 400 to 600 tons. If ships had jumped in size suddenly, it would have been impossible for the merchants to reorganize their methods of doing business so as to provide, say, 15,000 tons instead of a few hundred tons. It was well and proper for ships to keep pace with the growth of freight; as the size of ships increased, the shippers increased their facilities for gathering cargo. In this way the merchant was able eventually to get together a modern cargo as easily as in former days he collected a cargo of 500 or 600 tons.

Improvements and expansions that are going on in this world are part of a progressive evolution wherein practically everything advances at about the same rate of speed. Now and then we see examples of trying to go too fast, when one development outstrips the conditions on which it has to depend. A ship built too big for the freight it can get will starve to death. In the shipping business all of the factors must keep step. The world had to be brought gradually up to the use of big vessels. Before the building of steel ships no man could ever have thought that we could build passenger ships 1,000 feet long or cargo ships that would carry from 10,000 to 15,000 tons of freight. Now it would be foolhardy to say that larger ships will not be built, although it would appear that we had about reached the limit in freighters owing to the difficulty in getting enough cargo for larger ships.

For long voyages the ideal cargo carrier is of at least 10,000 deadweight tons, with a speed of 12 or 13 knots. The reliable old stand-by, triple-expansion engines driving a single screw, are hard to beat for such service. This vessel should have ten or twelve winches and three derricks for each hold, so that cargo can be loaded or discharged on both sides of the ship. The dividing line between single-screw and twin-screw propulsion seems to be that a ship with a greater deadweight than 10,000 tons should have twin-screws and a corresponding increase in speed. Therefore, finer lines are required now than formerly. For voyages up to 5,000 miles a steamship of from 7,000 to 9,000 tons is desirable, but the modern tendency is for bigger ships, greater power and more equipment for the rapid handling of cargo.

Pre-war cargo ships probably averaged between 4,000 and 5,000 tons deadweight, with a speed of about 9 knots. It is estimated that out of 45,000,000 tons of ocean vessels in the world before the war, fully two-thirds consisted of tramp steamers carrying low-grade freight and bulk goods. Our war-time shipbuilding provided more than half a million tons of fabricated steel freighters of the following dimensions and power: Length, 335 feet; beam, 46 feet; deadweight tonnage, 5,350; single-screw; water-tube boilers; geared turbine engines of 1,500 indicated horsepower; speed 10½ knots an hour; fuel oil storage in double bottoms, 660 tons, providing a cruising radius of 7,000 miles; with deep tank carrying oil, radius 13,000 miles; crew 60.

The bulk of the ships built for the emergency fleet were of 7,500 deadweight tons, and with these and the vessels mentioned above the foreign trade of the United States was re-established on the oceans of the world.

The Shipping Board and the Emergency Fleet Corporation turned this great army of war-built ships into trade channels, establishing freight routes with practically every foreign country. But it was not the intention of the Government to remain in the shipping business; the cargo ships were operated by the Government, but they were eventually to be sold to private owners. Wisely, the provision was made that the established trades must be carried on for a period of years after the ships were bought; within a short time after the war ended the country had a network of cargo trades that were the nucleus of a new-born American merchant marine.

Our company bought fleets of ships on the Pacific after we had operated them for the Shipping Board. Other lines did the same. Today but a few freight lines remain under the Shipping Board, and eventually these will be absorbed by private capital.

Since the war America's world commerce has changed greatly. We now export manufactured products and import raw materials, which is the reverse of our position before the war. And as to the increase in foreign trade, here are some enlightening figures: Compared with our position before the war, our increase is 50 per cent with Europe, 200 per cent with South America, 325 per cent with Africa, and 380 per cent with the Orient. All of which goes to show what America can do in shipping when we work together. I might call particular attention to the gains made in our

Oriental trade if I did not feel that the reader might think I referred to that subject too often.

But you'll read more about the Pacific Coast and its future in later pages, for I have set a chapter aside to discuss the potentialities of this territory as well as to discuss the growth of Pacific shipping from the days of the '49ers down to the present.

Chapter VII

On the Pacific Ocean

In view of the general belief that in years to come the world's commerce will be centered in the Pacific instead of the Atlantic, a chapter devoted to the growth of this important trade is necessary if we are to get a clear picture of world shipping. The Pacific Coast of North America is still a new country, compared with other seaboards; European countries and the East Coast of the United States had established many merchant steamships long before the West Coast was fully explored. But the richness of its natural resources, its wonderful harbors, and its ideal geographical location in reference to the Orient were factors that could not be kept in the background. After its slow start, owing to a limited population in the early days, the shipping of California, Oregon, Washington and British Columbia came to the front with astonishing speed. That growth is still going on, with each year seeing greater sea traffic and more and better ships.

Long before the Panama Canal was opened I predicted that the time would come when the commerce of the Pacific would exceed that of the Atlantic. This prediction has not yet come true, but it is on its way toward fulfillment. The progress made in Pacific shipping up to now has been greater than our best expectations—and there are some who may recall that when I uttered this prediction it was not received with much enthusiasm. Commerce then was on such a small scale that a prophesy of this kind was hard to believe. Yet not so many years later the Pacific Coast commerce had increased by such leaps and bounds that even the most conservative old-timer is forced to agree that this territory's shipping future is the brightest of any in the world. Just as the Mediterranean was the center of the world's trade centuries ago, and just as this center shifted to the Atlantic, so will the movement continue westward and find its greatest development in the Pacific.

Steam navigation did not actually begin on the Pacific Coast until a few years before the California gold discovery. Ships driven by engines had appeared before that time along South and North America, but they were hardly to be considered more than temporary experiments. Not until the days of the Pacific Mail Line and the Pacific Steam Navigation Company did steamships appear in regular trade routes; from then on steam navigation was destined to make history in the Pacific Ocean.

Going back 106 years, or to 1825, we find the little steamboat *Telica* pushing her bow into the little known ports of the Pacific Coast. This venturesome craft was owned and operated by a Spaniard, and was the first steam-driven ship to sail on the waters of the Pacific. Yankee whalemen and Yankee traders, in their

New England-built windjammers, were venturing into these waters, sailing as far north as British Columbia, and, incidentally, having trouble with the Spanish coast guard vessels which were stationed along the Mexican Coast to prevent smuggling.

The fact is, much of the trading done in those days was in reality smuggling. The customs duties were so high and the restrictions so great that the shipmasters, in order to earn a profit on the voyage, often landed and took on cargoes without going to the trouble of notifying the official guardians of Spanish America. And since the ships of the visitors could outsail anything the Spaniards had, they usually managed to carry on their trade with just enough excitement to make their work interesting.

The *Telica*, pioneer paddle-wheeler on the West Coast, seems to have encountered considerable trouble. Not from the authorities, but from the inability to make her voyages pay. Perhaps she met the same sort of indifference or scepticism that people of the day showed toward steamboats in other parts of the world. The prospects for profitable freight must have been slim, there could not have been many passengers, and probably the crude machinery did not work any too well. In addition, the fuel problem must have been troublesome, and the sailing ships could make better speed.

The end of this venturous ship was sad. Her discouraged owner decided to put an end to his troubles, and since his little ship was the cause of them, end her life at the same time. He anchored in the Gulf of Guayaquil, Ecuador, and blew up the ship and himself with some kegs of gunpower. This marked the end of steam navigation on the Pacific Coast for over ten years. The martyred *Telica* was not followed by another steam-powered vessel until 1836.

In 1831, however, the British ship *Sophia Jane,* a 256-ton paddle-wheeler, sailed round the Cape of Good Hope to the Australian Coast, and thus is credited with being the second steamship to sail in Pacific waters.

The second Pacific Coast steamship was the *Beaver,* which came from the Thames to Victoria in 163 days in the service of the Hudson's Bay Company. She was 109 tons, but a staunch little ship. She made the voyage under sail with her machinery in the hold; her engine was installed after her arrival. The *Beaver* continued in service on the Coast for over fifty years.

Four years later (1840) the Pacific Steam Navigation Company sent two paddle-wheel vessels into the Pacific, the *Chili* and the *Peru,* for service along the west coast of South America. They were ships of 700 gross tons, 198 feet long by 50 feet beam, and were powered by 150 horsepower engines; they were the first steamers to sail round the Horn. In service, their difficulties arose more from the fuel problem than anything else; coal was so scarce that at one time they were forced to lay up for three months. About this time the steamboats on the Hudson River were burning wood,

Leonard Frank Photos

S. S. *Beaver* AT VICTORIA, B. C.

but for some reason the *Chili* and *Peru* did not switch to that fuel.

In the '40s the Law and Aspinwall interests began to see that profits were to be made in shipping between New York and California. The Law Company secured a mail contract between New York and Aspinwall, (now *Colon)*, on the Isthmus of Panama, and the Aspinwall Company were given a contract to carry the mails up the Pacific Coast. The joining of these two interests in 1847 formed the Pacific Mail Steamship Company, and from that date steam-driven ships increased rapidly in the Pacific trade.

Passengers, mails and light cargoes were transhipped across the Isthmus; and with the discovery of gold in California, the trade increased so rapidly that more ships had to be provided. The first Pacific Mail steamship was the *California*, a paddle-wheel vessel of about 1,000 tons, 225 feet in length and fitted with American-built beam engines. She sailed through Magellan Straits and up the west coast in 1848. During the voyage the news of the gold discovery reached New York, and by the time the *California* called at Panama there were thousands of gold-seekers waiting to get passage to San Francisco. On the twenty-eight-day voyage from Panama to the Golden Gate she was overloaded with passengers; the lure of gold thereafter kept the Pacific Mail ships more than filled.

The *Oregon* was the second ship to reach the Coast. She was slightly smaller than the *California*, and arrived early in 1849. The *Panama*, which was the first of the three to start west, broke down on the voyage and returned to New York. The equipment of these pioneer vessels was practically alike. For a long time they were the most important steamships in the Pacific Coast trade. Operating difficulties were much greater than those of the Atlantic ships; the West Coast ships were five thousand miles from their home port by the sea-and-isthmus route, and thirteen thousand miles from New York by way of Cape Horn. Facilities for dry-docking and repairing the fleet were not in existence. The company did some of its reconditioning at Panama, and later built a great repair plant at Benicia, in San Francisco Bay.

Rivalry sprang up between the Pacific Mail Company and the Law interests on the Atlantic. The former started a competing line between New York and Chagres, and the latter retaliated by placing four steamers on the Pacific run. In 1851, however, peace was established when the Pacific Mail bought the four Law steamers and sold their ships on the Atlantic to the Law Company.

Traffic to the "Golden West" boomed after the discovery of gold, and the Pacific Mail Company became an important unit in American transportation. It is said that their ships carried 175,000 passengers to California during the gold rush period, and handled two-hundred million dollars worth of the precious metal. Commenting on the success of this line, J. Russel Smith says in "The Ocean Carrier":

"The Administration, which was so liberal in helping the Collins Line to beat the British, contracted with the Pacific Mail Steamship Company, formed in 1847, for a service from Panama to Astoria, and from New York, Charleston, and New Orleans to Havana, from which port the company already had a connection between the coasts... The speed from Panama to San Francisco was more than ten miles an hour. Thus the United States had line traffic of first-class character connecting its remote coasts before it had an American line to Europe. At Panama it connected with the Pacific Steam Navigation Company, giving service to Peru and Chili, so that before the middle of the century the Pacific had at least 5,000 miles continuous steam line traffic."

In 1852 the Pacific Steam Navigation Company added four 1,000-ton steamships to its fleet trading between Valparaiso and Panama, where connections were made with Pacific Mail ships. The Aspinwall Company was interested in building the Panama Railroad, and after a long period of difficult construction, the line between Colon and Panama was completed in 1855, and traffic across the Isthmus greatly increased.

Improvements in steam engines were being made. The compound engine was developed in 1855, and to the Pacific Steam Navigation Company went the honor of being the first steamship owners to adopt this type of engine for deep-sea ships. With the increase in power came a decrease in fuel consumption, which to vessels running in the early Pacific trades was of great importance.

Once the steamship was established in this part of the world, the fleets grew rapidly. From 1851 to 1861 the companies operating between New York and California built twenty-nine new steamships, with a total tonnage of 38,000 tons, an average of about 1,400 tons. The sizes of ships were being increased gradually; in this the designers and builders were showing good judgment. Steam engines were comparatively novel; it was not definitely known how big a steamship could be safely built; iron was only just coming in as a shipbuilding material, and up to that time the longest wooden ships were not more than 275 feet overall. The wisdom of proceeding slowly was demonstrated by the colossal failure of the *Great Eastern,* to which I have already referred. Because paddle-wheels and screw propellers were both successful, the designers incorporated both types of propulsion, and in addition fitted the huge vessel with sails. The *Great Eastern* was born too soon; the day of big ships had not yet come, and the optimistic builders learned this to their sorrow.

The Pacific Mail fleet grew rapidly. Ships were built on the East Coast and sent round the Horn in constantly increasing numbers. In the fifteen years following 1860, the company built or bought sixty steamships. The transcontinental railroad was building, and the company was preparing to establish a trans-Pacific service when the rails should reach the coast. In 1867 the *Colorado,* a 3,728 ton side-wheeler, opened the

Oriental service by sailing for Japan and China; such well remembered ships as the *Great Republic,* the *China,* the *Japan,* the *America,* the *Orizaba,* the *Alaska* and the *Dakota* followed, and when the railroad was completed in 1869 the Pacific Mail had nine steamers in regular Oriental service, with sailings every month.

These ships were all wooden side-wheelers, big for their day and comfortable, but they were not the best type for ocean voyages. In a heavy sea one or the other paddle was often thrashing out of water. Elsewhere in the world the shipbuilders were using iron for their new vessels; many were adopting the screw-propeller and higher steam pressures. But the Pacific Mail continued to build wooden side-wheelers long after the British sent their iron ships into the Pacific. This condition could not continue, for the iron screw-propelled ships were taking much of the business.

In fact, Congress appointed an investigating committee in 1870 to find out why American steamships were not holding their own. Among other findings, the committee reported that American shipyards, with the exception of one at Wilmington, Delaware, were unable to build iron ships. Iron was later developed in the Great Lakes district, and in 1874 the Pacific Mail built its first two iron ships, the *City of Tokio* and the *City of Peking,* which became the largest American vessels of their day. They were 423 feet long, 48 feet beam, and of 5,800 tons. By 1876 the company owned and operated thirty-three steamships and maintained services to forty-seven ports around the Pacific Ocean.

Mail contracts were secured to Australia, and the American-built steamers *Vasco de Gama, Colima, Granada, City of New York, City of Sydney* and *City of San Francisco* served in this trade, together with the *Zealandia* and *Australia,* built in Great Britain.

The three *City* vessels above were fine ships, built by the famous old-time plant of John Roach at Chester, Pennsylvania. They were of 3,000 tons, 350 feet long, 40 feet beam, 1,900 indicated horsepower. Their engines were compound, with steam supplied by six boilers. As an example of the steaming ability of these ships, the *City of New York* on her maiden voyage to the Pacific made the passage from New York to San Francisco in 54 days 14 hours without taking on coal en route, an average of about 10 miles an hour. The *Zealandia* and the *Australia* were of 2,737 gross tons, with engines of over 2,100 indicated horsepower for the latter and over 1,700 for the former. Both established a trial trip speed of over 13 knots.

But the Pacific Mail Company was unlucky, or lacked foresight. When their mail contract expired in 1885 it withdrew some of its services and went into a temporary decline. The Union Steamship Company of New Zealand and the Oceanic Steamship Company of San Francisco established a joint service with the 2,598-gross ton steamer *Mararoa,* the first triple-expansion vessel in the Pacific trade, the *Monowai,* 3,433 gross tons, built in Scotland, and the *Zealandia,* chartered from the Pacific Mail. These, with the Oceanic ships *Mariposa* and *Alameda,* sister ships of 3,158 gross tons and fitted with triple-expansion engines of 3,000 indicated horsepower, operated in this service for many years.

In 1900 the United States Government passed the law forbidding foreign vessels to trade between American ports, and the British lines therefore could not remain in the service between Honolulu and California. The Union Line put its mail ship into the Vancouver run, and the Oceanic Company ordered three new mail liners, the *Sierra,* the *Sonoma* and the *Ventura* for the Australian run. These 6,000-ton ships were built in 1900, and became famous for their years of service down to the present day. In 1907 the mail subsidy was withdrawn, and for two years no mail steamers ran to Australia.

The Union Line ran the 8,000-ton ships *Makura* and *Tahiti* from Sydney to San Francisco, and the Oceanic ships *Sierra, Sonoma* and *Ventura* underwent conversion to oil-burning equipment and were otherwise reconditioned. These ships then entered the San Francisco-Sydney run, which has been maintained ever since. At this writing the construction is progressing on three new turbine ships to replace the three old vessels. They will be named *Monterey, Mariposa* and *Lurline,* and will be 632 feet long, 79 feet beam, and will have a speed of 21 knots. The Oceanic Company was taken over by the Matson Navigation Company, and although owned by Matson the new ships will be Oceanic vessels.

It has not been my purpose in this book to list every ship and every steamship company in any trade, for the reason that such a complete discussion would require more pages than seems advisable. Furthermore, my plan is to show the growth of trade, the increase in the size and power of steamships, and this can be done by the mention of outstanding vessels of each period. If we consider the leading companies and their best known ships we can get a broad picture of the development, which is the object of this book.

We have the coastwise services, the intercoastal services, the across-Pacific services, the trade with Europe and Africa. The opening of the Suez Canal in 1869 was a wonderful development in shipping and commerce; completion of the Panama Canal in 1914 gave tremendous impetus to shipping both on the Pacific and the Atlantic, and from that date to this we have a record of growth and progress which points to the fulfillment of my prediction, which I have repeated many times, that the Pacific will eventually become the busiest center of world commerce. We were set back many years by the Great War, but America is now on its way to rebuilding its merchant marine on a bigger and better scale than ever.

Long after regular services were running to the Orient and to Australasia, there was no trans-Pacific line operating north of San Francisco. In 1887 Adamson Bell & Company, in connection with the Canadian Pacific Railway, started an Oriental service from Vancouver and Victoria with the *Parthia*, *Abyssinia* and

Batavia, former Cunard steamers. These 3,800-ton ships ran until 1891, when the C. P. R. brought out the *Empress of Japan,* the *Empress of China* and the *Empress of India,* express liners of nearly 6,000 gross tons with a speed of 17½ knots. Early days of this service were not very profitable; the three small steamers could carry no more than 2,500 deadweight tons of cargo each, yet they never carried full cargoes. Westbound they went practically in ballast, and eastbound they depended on high-grade freight such as silk and tea, for in order to make operating costs and income meet the ships had to charge almost prohibitive rates. With the increase in passenger traffic and the exporting and importing of more goods, the line with its new ships did well later. Today the Canadian Pacific Line is among the leading companies of the world.

Next to enter the Oriental trade was Dodwell & Company, running coastwise to Tacoma in connection with the Northern Pacific Railroad. The old vessels *Olympia, Victoria* and *Columbia* were employed. They had a freight capacity of from 1,800 to 2,000 tons each, and in 1892 the first ships had fifteen sailings. In that and the following year they carried approximately 37,000 measurement tons of cargo eastward, and only 7,550 tons westward. The next year they carried 40,000 tons of silk, tea, etc., eastward, and 20,350 tons of flour, lumber, etc., westward. On the following year the total had reached 52,000 tons eastward and 26,800 tons westward, with fourteen sailings. The gains caused increased sailings; in 1895-6 there were eighteen sailings, with a total of 56,670 tons eastward and 28,000 tons westward; in 1896-7 the sailings numbered twenty-three, and the freight amounted to 75,000 tons carried eastward and 52,300 tons carried westward.

I give these figures to show the general tendency of the Pacific trade to increase year by year. We are not dealing with tonnage statistics, for if we did we would have dull reading, as interesting as the growth in trade is to the owners of ships. The above figures simply give an idea of the steady increase in the movement of freight eastward and westward—especially westward.

In 1897 the Oregon Navigation Company started an Oriental service in connection with Dodwell & Company, which continued only three years. The trouble was the lack of full cargoes. They got more freight eastbound than westbound, and they had to sell flour and other commodities in the Orient to make westbound freight for their steamers. They were, therefore, the pioneer exporters from Puget Sound.

Such conditions changed, of course, as time passed. The reverse of that condition took place, when the great bulk of ocean freight went from America, and shipowners were buying commodities in the Orient in order to fill their holds. Sailing partly loaded in either direction was common, but that was not due to a decrease in the amount of freight available. The cargo tonnage increased a hundred fold up to the time of the war, but owing to the increased number of very large steamers on the Pacific there was still not enough cargo offerings to more than furnish part cargoes.

Grace Dollar, 1892

M. S. *Dollar*, 1900

For a short time the Harriman interests ran a line from Portland to the Orient, but soon stepped out. The Santa Fe in 1898 also started a line across the Pacific from San Diego to various Oriental ports, using chartered steamships. This line met with poor success at first, but before it was discontinued in 1902 it was doing a very good business, with the ships running practically full. An arrangement was made with the Pacific Mail whereby the San Diego route was abandoned and the Santa Fe was to get a share of the Pacific Mail business which formerly went entirely to the Southern Pacific. After the dissolution of the Pacific Mail Line the Japanese T. K. K. Line began running a direct connection with the Santa Fe at San Francisco.

Then the China Commercial Company started a line of chartered steamers from the Orient to San Francisco, but after two years the ships were diverted to Mexican ports. With the completion of the railroad lines to Puget Sound more steamship lines became necessary, and in 1902 Dodwell & Company made arrangements with the Holt Blue Funnel Line and the China Mutual Steamship Company whereby the ships of these companies replaced the old Dodwell vessels. They ran with full cargoes both ways, and Dodwell acted as agent.

The next step was the arrival of the mammoth ships of the Great Northern, the *Dakota* and *Minnesota,* the latter of 20,600 gross tons. They worked in conjunction with four N. Y. K. ships, and, for a time, five vessels of the Boston Towboat Company. The *Dakota* was lost off Yokohama and only six American steamships remained in the Pacific trade. It was a period of low vitality for American shipping. The Pacific Mail had built in 1900 two new vessels, the *Korea* and the *Siberia,* and had bought the *Manchuria* and *Mongolia* which had been built in the East in the expectancy of receiving an American subsidy. The bill did not pass; the ships were sold to the Pacific Mail.

But America had lost its enthusiasm for American ships, and the Mail Company was not able to pay dividends. This discouraging condition continued until the seaman's bill became a law, which, if it were enforced, would make it impossible to operate American ships profitably in the foreign trade in competition with the ships of other nations. So the Pacific Mail Steamship Company, the pioneer in the Pacific and the oldest American steamship line, gave up the struggle and sold its ships.

Unfortunately for that company, it never doubted that the seaman's act would be enforced. The writer was so sure it would be that the terminus of the Dollar steamers was moved from San Francisco to Vancouver. But President Wilson realized that if he enforced the law to the letter every American vessel engaged in foreign trade would be driven off the seas, and that it would prohibit the clearance of foreign ships to such an extent that it would paralyze the foreign trade of the country. So he wisely refused to enforce the law, and to this day it has never been enforced, nor will it

Robert Dollar SAILING FOR NOME FROM SEATTLE. GREAT GOLD EXCITEMENT, 1900

ever be. It was too bad that the Pacific Mail could not foresee what was going to happen.

Coastwise and intercoastal steamship companies were not affected by this prohibitive law. Numerous companies at different times operated fleets in the coastwise trade; the California Steam Navigation Company, the California, Oregon & Mexico Steamship Company, the Anchor Line and the Pacific Coast Steamship Company being among them. The latter was formed in 1874 and in 1877 had a fleet including the side-wheel steamers *Mohongo, Senator, Orizaba* and *Ancon,* and the screw-propelled steamers *San Luis, Los Angeles, Santa Cruz, Monterey, Donald, Gypsy, Salmas, Idaho, Constantine* and *San Vincent.* A new 1,700-ton ship, the *Queen of the Pacific,* was built in 1882. This company's name was changed to the Pacific Steamship Company, "The Admiral Line," and went in for bigger ships and a wider field. In addition to its present big fleet of *Admiral* ships, this company operates the *H. F. Alexander,* the *Ruth Alexander* and the *Emma Alexander,* famous on the Pacific Coast. The "H. F." is called the "Greyhound of the Pacific" on account of her size and speed. She was built by Cramp at Philadelphia for the Great Northern in 1914, together with a sister ship. These were named *Great Northern* and *Northern Pacific,* and in 1915 they showed their 22-knot speed by running regularly from Astoria to San Francisco on the same time schedule the coast-line trains made. This was spectacular and exciting, but the cost of maintaining the service after the Panama-Pacific Exposition closed was found to be too expensive, and the big ships entered the transport service during the war.

After the war the Pacific Steamship Company bought the *Northern Pacific*, but while still on the Atlantic Coast she burned and was lost. The Company then bought the *Great Northern* for $1,000,000 and gave her the name *H. F. Alexander*. Her service was the Seattle-San Francisco run, a thousand-mile voyage which she covered in 39 hours. In 1926 she was first transferred to the Atlantic Coast for seasonal coastwise service, but is now in service on this coast. She has three turbines, and is considered the fastest vessel on the Pacific. Her record from San Francisco to Honolulu is the best ever made—3 days, 17 hours, 54 minutes.

The big companies were operating Shipping Board fleets for the Government for some years after peace was declared. Gradually these fleets were sold to the established lines and the ships remained in the trades already established. Thus the Dollar interests acquired three fleets of combination passenger and freight liners running out of Pacific Coast ports—the vessels in the San Francisco-Oriental run, in the Seattle-Oriental run, and the ships which we entered in the round-the-world service in 1924. At the present time all Pacific Coast ships are privately owned, although there are several Atlantic Coast lines still being operated for the Government.

The tremendous progress made on the Pacific Coast is a story of great interest. The Panama Canal was opened in 1914, with a first-year revenue of $4,-286,000. In 1930 the revenue had increased to $28,-000,000. In that year the total number of vessels transiting the Canal was 5,885, a decline of 8.5 per cent from the figures for 1929, owing to the world-wide adverse business conditions. Yet even the smaller amount of traffic shows the importance of the Panama Canal in world commerce.

Recently the United States Government engineers started a survey of Nicaragua, to determine the feasibility of a ship canal across the country along the route that was so popular in the days before the Panama Canal was opened. Then great quantities of ocean freight was carried from ship to ship across the land by railroad. Such a canal would greatly shorten the distance between San Francisco and New York, for the new water route would be about 1,000 miles north of Panama. Should this work be undertaken the Pacific will benefit immeasurably.

When we think that only a few years ago, comparatively, such world ports as Los Angeles, Seattle, Portland and Vancouver were obscure harbors, we realize how rapidly the gains have been. In 1915, for instance, Los Angeles as a seaport was almost unknown. Now it ranks close to the top among the ports of the United States. Foreign shipments in 1915 totaled about 87,000 tons, valued at about $748,000; in 1930 the tonnage was 6,585,000, with a value of $138,000,000—a growth unequaled by any other port in the world in the same number of years. Approximately 8,500 vessels enter Los Angeles harbor each year, with petroleum making up about 72 per cent of the total cargo.

San Francisco has always been a seaport of importance since the days of gold, but its growth has been marvelous. San Francisco Bay now has at least 118 shipping services with more than 7,500 arrivals a year. Most of the ship lines of the West Coast are owned and operated out of San Francisco. Portland has regular services from sixty steamship lines. Tacoma is served by sixty-seven lines. Seattle shows a total of over 5,500 ship arrivals a year. Vancouver and Victoria, B. C., have had a surprising growth from small ports to ports that figure big in the world trade.

Forty-five years ago the states of Oregon and Washington did not have a railroad. Foreign commerce out of Puget Sound had not commenced. Only about half a man's lifetime ago, and today these states are vitally important links in our foreign commerce.

Look across the Pacific to Japan and China and India and the Philippines. There lie the richest trade countries of the future. We have developed commerce with them until the figures are staggering, yet we have hardly scratched the surface of the possibilities for foreign trade. Within my lifetime Commodore Perry compelled Japan to open two of its ports to world commerce. He had to do it with the threat of cannon. From that awakening, Japan has grown to be a world power, with unlimited trade possibilities and

Leonard Frank Photos

Vancouver Waterfront, 1886

ranks among the leaders in import and export and modern ships.

To show the progress Japan has made, let me tell about my visit to Hakodate when they were celebrating the fiftieth anniversary of the opening of this port by Commodore Perry. A great procession formed in the street where a huge painting was hung overhead showing the Mikado shaking hands with Perry. As a matter of history, the ruler positively refused to see or talk to Perry. However, the procession marched to the park which is on an elevation above the city. Here I saw a canvas reproduction of a yacht that Queen Victoria had presented to the Mikado. On it was an inscription in Japanese which I had translated. It read:

> "This vessel was our entire steam fleet thirty-five years ago. To show what progress we have made since then, please turn around and look at the harbor."

Below, in the harbor, lay the entire battleship fleet that was destined a few months after to destroy the battleship fleet of Russia. I have never seen an illustration of progress so convincing and conclusive as this was. It was a tale without words.

China is probably the greatest country of all for future world business. She has had many troubles, war, banditry, changes of government, hunger. But modernism is on its way, and the day will come when the old Celestial nation will establish herself in world trade on such a scale that I should dislike to predict its volume for fear my friends would say I was dreaming.

The Province of Szechuen, which I visited recently, has over seventy millions of people, and no outlet to the world except down the dangerous Yangtze River; a few small steamers serve as connecting links with the outside world. The people of this province produce everything they require, and live without the need of the rest of the world. But when this region is opened to foreign trade we will see some surprising changes. I am quite safe in saying that 75 per cent of China is not reached by foreign trade. What can we expect when this giant awakens?

China's greatest drawback is her lack of communication. Only about 6,000 miles of railroad exist in that vast country, and until but a short time ago no wagon or automobile roads were in evidence. The people in one province did not know their neighbors in the next; the wheelbarrow was practically their only land conveyance. This fact always distressed me, and I talked roads to Government officials in different places. In 1921 there was about 600 miles of road in settled areas and 100 miles of road in outside territory. Lately I had the great pleasure to receive a letter from the Government saying that at the beginning of 1930 there were approximately 84,000 li, or 25,000 miles of good roads completed.

The last time I was in the great city of Shanghai, one of the wonder ports of the world, with a population of over three million, it was impossible to drive an automobile more than twenty miles outside the city. They depended a great deal on junks and small boats on

S. S. *President Hoover*

the rivers; steam navigation was practically unknown except for the steamers of three or four large companies on inland waters. Nevertheless, here is going to be one of the greatest ports of the world, where the greatest development of the future will take place. For in this region are more than one-quarter of the entire population of the globe; these people have the greatest undeveloped resources waiting for development—more coal, by estimate, than all the other countries, and I believe as much iron ore.

Consider the primitive treadwheel boats used by the Chinese on their inland waters and you get a picture of their backwardness. These craft are ordinary stern-wheelers with a treadmill some distance forward, with the power transmitted by a chain on the sprocket-wheel principle. Generally twelve or fourteen men furnish the foot-power, tramping away for half-days at a time, holding to a bar that runs athwartship. There they go, singing songs and laughing and appearing to be quite happy. I have made several attempts to get photographs of these human power plants in operation, but since the men are all under cover I never did succeed in getting a good picture. These boats are double-deckers and carry passengers. They are about 100 feet long and 20 to 22 feet beam. They make about 7 or 8 miles an hour, and go long distances up the rivers, mostly starting from Canton and running up the West River.

In spite of their lack of progress so far, the real awakening of the Chinese people will astound the world.

Japan has emerged from its shell of isolation; China will do the same some day soon.

The development of the countries around the Pacific, as well as the countries elsewhere in the world, has depended largely on the steamship. But for the ocean vessel pushing her bow into foreign ports, the seacoast countries would still be isolated the way so much of China is. Communication by sea, as I stated earlier in these pages, has been one of the most active factors in the advance of civilization; the steam engine, when it went to sea, became the world's benefactor.

To use a common expression, the world has grown smaller. The intercourse between nations is much greater now than was the intercourse within any nation one hundred years ago. It is quite safe to say that the countries of the world today are better acquainted with each other than the inhabitants of the north of Scotland were with those in the south of England a century ago. Steam has done this; without steam our travels would be limited and our luxuries would be fewer and costlier. Symington and Fulton and Watt and the others started something, indeed, when they began tinkering with steam engines in boats!

It is almost incredible the enormous number of people that are continually traveling from one country to another nowadays. A look at the passenger lists of the innumerable passenger steamers arriving and departing from world ports will convince you that everybody must be traveling. We can not get far enough away from home, into what we call the outskirts of the world, to get out of reach of our own countrymen. Give steam the credit for it.

Then, when we consider the changes that have taken place in the movement of commodities from one part of the world to another, we realize how we have progressed. Cargo trades that would have been impossible and undreamed of a century ago are now not only possible but quite profitable to the ship and the merchant. Steamships have sought out the business and built profitable trades where such business was unheard of before. It is a common saying, when wishing to state that a trade is impossible, to remark that it would be like carrying coals to Newcastle. It may be true about coals, but not always so about other commodities. I was standing on a wharf the other day watching a large steamer discharge a huge quantity of paper. At the other end of the ship they were loading cargo. I looked and saw that it was also paper. Nowadays the ships get it coming and going, and those of us who are watching the movement of merchandise see many anomalies.

You have discovered by this time that I have several hobbies. If you have read these pages carefully you will have discovered them. I shall admit the two that are foremost in my thoughts—steamships and foreign trade. A few months ago I visited the Far East. While there I called on 735 people in a period of three months. There are few elevators, and I failed to keep count of the number of stairs I climbed—all in an effort to develop and increase foreign trade. And I am eighty-seven years of age.

They go hand in hand, a good ship and a well filled hold. The age of steam has certainly been the age of civilization, and in the promotion of trade it has benefitted mankind as nothing else has done in the same length of time. I feel quite certain the greatest single influence in the rise and fall of nations can be directly attributed to ships and shipping, for the world has progressed only in accord with the development of transportation and communication facilities.

ADDENDA

After the foregoing material was ready for the press it occurred to me that perhaps it would not be amiss to devote a short added chapter to my own experience as a steamship operator. I have touched on the subject here and there in the preceding pages, but it did not seem proper to include such a personal history in a world-wide discussion of ships. However, I feel that it has a place in this book because it provides an excellent example of the growth in size and power of steam vessels within a forty-year period.

When I was located in California but a short time I bought an interest in the Usal Redwood Company in Mendocino County, which was so located that the only way to get the product of the mill to market was by sea. Often it was rough and dangerous for vessels, and shipowners were very independent as to whether they would operate steadily or not. They were more worried about the safety of their ships than they were about our deliveries.

Once when we had a big shipment to get out, the owner of the steam schooner *Newsboy* left me in the lurch, which made it necessary to take extreme measures to carry our lumber out and get provisions to the mill. I went to a broker and told him to buy for me a fifty-five per cent ownership in this schooner. He asked what price I was prepared to pay and I replied, "Buy as reasonably as you can."

When I returned home from his office I received a message informing me that he had bought the required number of shares. As soon as the *Newsboy* returned to port I had Captain Fosen take the ship's papers to the Customs House. Then and there I became the owner of my first steamship, a little lumber-carrier of 185 net tons. Later, out of the export lumber trade, I made my start as a steamship man.

The *Newsboy* was acquired in 1892. In two years of operation we earned the full value of the ship. This gave me encouragement, and later I went ahead and let the contract to build a somewhat larger steam schooner, the *Grace Dollar.*

Some time after this vessel entered service, gold was discovered in the Klondike. This brought a great demand for steam vessels to carry passengers, and the ship was used for this purpose and did very well from the first; a deck was constructed for passengers and she ran with a full list of gold-seekers all that season. But like all booms, the Klondike rush did not last; at the end of the second year there was a more or less return to normalcy and the earnings of the vessel from that source came to a rather abrupt end. I therefore stripped off her upper deck and placed her back into the service she was intended for, the carrying of lumber.

Two years later I let the contract to build a steamer in Hoquiam, Washington. This was to be the largest vessel of her class, and my competitors thought I was making a great mistake to order a ship that would carry 800,000 feet of lumber. But I was following out my principle of building every new ship larger than her predecessor, and I went ahead with it.

Shortly after this vessel, which we named the *Robert Dollar* (the first ship of this name; the second *Robert Dollar* was of steel), was under construction, another bit of what is called luck occurred—gold was discovered at Nome, and a great demand arose for ships to go there the following season. Nome is closed to navigation from November until May. The contract had been let for this vessel in September; in January two men came to me and chartered her for the season's run. I agreed to deliver her to them in Seattle in April, and they paid me in cash an amount nearly equal to half the cost of the ship.

I became skeptical at this and therefore obtained a guaranty company's bond covering the transaction. It was lucky I did. The boom did not materialize as they had expected and the bonding company adjusted with me in full. When the craft was delivered back to me I had her passenger deck stripped off and she was a cargo schooner again.

My next step as a shipowner was to order from the Moran Shipbuilding Company in Seattle a new ship to be named the *Stanley Dollar*. All my previous ships were of wood; this one was to be of steel. I intended her for the lumber trade and wanted her to be of the larger steam schooner type. This vessel is still running, although I sold her many years ago.

Then came the Spanish-American War, and all large-sized vessels going into foreign service commanded good rates. Coastwise ships also profited.

My business was still lumbering, regardless of the fact that I was an owner of ships. They were used primarily for carrying the lumber we manufactured. In addition to those mentioned, I had other vessels, among them were fore-and-aft rigged schooners, and some that I chartered to carry lumber to China.

About this time, the opportunity presented itself to buy the *Arab,* a 6,000-ton steamer, afterward known as the *M. S. Dollar.* The war in the Philippines was at its height, and we chartered this ship to take a cargo for the American Government.

We were using oil fuel to some extent in our coastwise steam schooners, and I decided to try it in the *Arab.* The result of this experience is related earlier in this book.

Carrying stores for the Government gave me the thought to try to see if I could not develop trade in the Far East by selling lumber and providing cargoes for the *Arab* and the ships which were to follow. Therefore I investigated and decided to enter into that, making Shanghai our headquarters. We gradually increased our steamships and decreased our sailing vessels. Step-by-step we built up the sales of lumber, and in order to get cargoes both ways we found it necessary to buy part-cargoes of merchandise, although whenever we could prevail on the regular merchants to take the business off our hands we were glad to let them have it. To a certain extent this explains how it was possible steadily to increase our business. And so it went, until in 1920 we bought the *Robert Dollar,* now the *Chief Capilano,* which at that time was the largest freighter in the world.

An incident occurred a few years prior to the building of this large cargo ship which I will speak of briefly here, as it shows the feelings of the Chinese toward me in my relations with them since that time I first went out to their country to try to develop trade.

During the World War, when ships were needed faster than they could be built at home, the United States Government contracted with the Chinese Government to purchase fourteen million dollars' worth of ships. It was first expected the contract would run to thirty millions of dollars. These ships, of course, were to be built in Chinese shipyards. Hon. Wellington Koo, then Chinese Ambassador, called on Edward N. Hurley, at that time president of the United States Shipping Board, when the contract was about to be closed. I had assisted in the negotiations.

"You can turn the money over to Captain Dollar as our depositary," Ambassador Koo instructed President Hurley. "When we complete the contracts, he will then turn the money over to the Chinese Government."

"Very well," said President Hurley. "Fourteen millions of dollars, but in the meantime—how about Captain Dollar's bond?"

"He doesn't need any bond or agreement so far as the Government of China is concerned," Mr. Koo answered. "I have a cable from the President of China instructing me to take neither bond nor contract." So the first payment of one and one-quarter million dollars was handed over to my representative and a copy of the cable was attached to the contract. So I handled the amount of money called for in the contract, some fourteen million dollars, without a bond being required by either government. This I considered a very high honor indeed.

In 1923 my son Stanley commenced negotiations with the Shipping Board for the purchase of seven *President* steamers, called 502's. Later he closed the deal, and on the fifth of January, 1924, the *President Harrison* inaugurated our round-the-world service. No such service had ever before been tried and it was condemned to failure by all shipowners. There is no denying the fact we at first had a trying time of it, with a loss of a great deal of money, but by persistence and hard work we finally succeeded, and our ships are still running satisfactorily in that service.

I preceded our first ship in this service, the *President Harrison,* in an effort to get patronage for this new line, but I was confronted with remarks everywhere I called such as this, "You Americans are all 'fly-by-nights', here today but Heaven knows where tomorrow!" So at the end of my trip round the world it looked as if I had not succeeded. Lord Inchcape, during this trip, informed me that I was an interloper and had no right to interfere with his company—the great P. & O. Line. However, by playing fair and meeting competition in a clean way, we became the best of friends. We had a struggle to make a success of this service, but finally overcame the obstacles which continually presented themselves, and saw it established with a regular service.

The next year the Shipping Board advertised for sale publicly five steamers known as 535's, the largest of the *President* ships. These were then operated by the Pacific Mail Company. We submitted our bid, but the company operating them made a determined effort to prevent our getting these fine passenger steamers. Finally they took the Shipping Board and ourselves into court. The judge, however, ruled that since our bid was the highest we were entitled to receive these five steamers, and ordered the Shipping Board to deliver them to us, which was done. We then started our trans-Pacific passenger service.

We were operating five similar steamers out of Seattle for the Shipping Board. They advertised these for sale, and our bid being highest we obtained them also. This gave us ownership of seventeen *President* liners in all. The five steamers we ran out of Seattle later made a continuous "horseshoe" run between San Francisco, Manila and Oriental ports and Seattle.

The Jones-White law was passed in 1928 and Stanley went to work to endeavor to obtain a mail subsidy to help us out. He first obtained a mail contract for the round-the-world service, then for the San Francisco run and later for the Seattle service. This meant a great deal, as it has aided us in our efforts to maintain and give a regular service in these runs.

As previously stated, every ship we built was larger than her predecessor. From the first 185-ton steam schooner of forty years ago we have gone on until we now have the 23,000-ton *President Hoover* and the *President Coolidge,* the newest units of our fleet, as well as the largest merchant vessels ever constructed in the United States. This is just one example of the increase in size that steamships have made.

Ships, engines, world trade, they have all come a long way since the first experimental steamboats were launched 130 years ago!