

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., No. 361 Broadway, NEW YORK

Marine Transportation.

THE AMERICAN MERCHANT MARINE.

In almost every review of the American merchant marine that has been written during the four decades which have passed since the great civil war, all comparisons of our standing and progress have referred back to the year 1861, in which the total tonnage of the United States had reached the figure, particularly remarkable for such an early day, of 5,539,813 tons. The war almost swept our merchant marine out of existence, such of it as was not hastily transferred to the protection of a foreign flag being captured or sunk by Confederate cruisers; and it has taken just forty-one years for our shipping to reach the standard of comparison of 1861. In 1902, for the first time we have passed the earlier mark, the total tonnage, foreign, coasting and fisheries, sail and steam, amounting to 5,797,902 tons. From 1898 to 1902 the world has witnessed a period of extraordinary shipbuilding activity, in which our own shipbuilding yards have shared, the average annual output for this period being some 400,000 gross tons. The revival in our shipping industry is to be attributed primarily to the encouragement given by the government when it set about the great work of constructing our new navy. In anticipation of a steady run of work on government ships, new plants equipped with the most modern appliances were laid down, and with the experience in steel shipbuilding thus acquired, our yards were soon in a position to receive orders for merchant ships also.

Although the present article is devoted particularly to the merchant marine, the totals given above include every kind of shipping, whether coast line, inland river, lake or foreign, and before proceeding further it will be of interest to give the geographical distribution and the nature of this tonnage as printed in the Report for 1902, of the Commissioner of Navigation. The distribution is as follows: Atlantic and Gulf coasts, 2,978,876; Porto Rico, 6,180; Pacific coast, 741,825; Hawaiian Islands, 32,386; Northern Lakes, 1,816,511; and on the western rivers, 222,124 tons. Of the total shipping, 2,621,000 tons consists of sailing vessels and 3,177,000 tons of steamships; while the balance, to the extent of 679,000 tons, is made up of canal boats and barges.

To-day the shipbuilding industry is in a flourishing condition. During the past year 1,491 vessels of a gross tonnage of 468,831 were built in this country. A list of all vessels of a thousand tons and upward, built during the year, shows that there were launched for the merchant marine sixteen vessels ranging from 2,036 to 12,760 tons, making a total tonnage of 95,105 tons. Five steel ferry, river and bay steamers were built, of a total tonnage of 5,479 tons, and seven square-rigged vessels, aggregating 12,336 tons, together with twenty-one wooden schooners, aggregating 36,122 tons, and four rigged barges of 7,359 tons. It is interesting to compare these totals with those of the Great Lakes. The total seaboard tonnage in vessels of a thousand tons and over included fifty-three vessels of 156,431 tons, while the total tonnage built on the Great Lakes was made up of forty-one vessels of a gross tonnage of 158,631 tons, thus showing that in point of total tonnage, shipping on the Great Lakes exceeded in new construction last year that built for the deep sea service. Among the vessels included in these totals are the "Kroonland," of 12,760 tons—the largest ocean steamer ever built in this country. The sister ship, the "Finland," was launched during the year and is now in service. The "Korea," of 11,276 tons and 19 knots speed, launched last year and now in service, has been followed this year by her sister ship the "Siberia." These two are the largest and fastest merchant steamers of any nationality running on the Pacific Ocean. Another notable fact is that the two largest cargo steamers ever built in America, the "Shawmut" and the "Tremont," both of 9,606 tons, are plying regularly on their routes between Puget Sound, Japan, China and Manila; while another notable fact is that the "Alaskan," of 8,716 tons, built at San Francisco and now trading between Hawaii and the Atlantic coast, is the largest merchant steamer ever launched on the Pacific Ocean. Another noteworthy vessel is the seven-masted schooner "Thomas W. Lawson," of 5,218 gross tons, which is the largest schooner and the second largest sailing vessel in the world.

At the commencement of the fiscal year, there were under construction or contracted for, in our yards twenty-five steel steamships of 1,000 tons and upward. For the transatlantic trade there were seven large vessels, which included two 600-foot ships for the Atlantic Transport Line, of 13,400 tons; the "Finland," of 12,760 tons, for the International Navigation Company; the "Missouri" and "Maine," of 9,800 tons, for the Atlantic Transport Line; and for the same line, two vessels of

8,900 tons, making a total of 76,960 tons for this trade. For the Trans-Pacific trade, there were two great vessels of 20,000 tons building at New London, Conn., to sail under the flag of the Great Northern Steamship Company. For the Trans-Pacific trade by way of Hawaii there was building the "Siberia" of 11,276 tons, to sail under the flag of the Pacific Mail Company; while for the Hawaiian coasting trade, two vessels of 8,600 tons were under construction. For the coasting trade there was a 9,000-ton vessel for the Standard Oil Company, a 6,250-ton vessel for the New York and Texas Steamship Company, and a 5,252-ton ship for the Ocean Steamship Company, in addition to nine vessels of from 1,000 to 4,577 tons, making at total under construction for the coasting trade of 48,679 tons.

In considering the important question of the manning of our ships, it is gratifying to learn that there is a marked increase in the percentage of American over seamen of foreign nationality. The returns compiled from the reports of shipping commissioners showing the nationality of seamen shipped on American vessels for the past nine years, prove that there has been an increase in the percentage of Americans from 31 per cent in 1894 to 35 per cent in 1901, and to 46 per cent in 1902. Out of a total of over 71,000 shipped in 1894, 22,000 were Americans, 22,000 Scandinavian, 10,000 British, 6,000 Germans, 865 Italians and 628 were French; while various other nationalities together represented a total of 9,000. In 1902, out of a total of over 108,000 shipped, 50,000 were Americans, 16,000 Scandinavians, 14,000 British, 5,600 Germans, 2,300 Italians, 576 French, and there were about 20,000 of mixed nationality. It must be understood that while there is a total of about 108,000 shipments, they really represent only about 24,000 seamen. Further proof of the greater interest of Americans in their merchant marine and their tendency to seek employment therein is afforded by a table given by the Commissioner of Navigation, showing the nativity of men employed on 654 sea-going American vessels. Out of a total of 13,879 men, 5,455 are Americans by birth or naturalization, 2,347 are British, and the balance is made up of various nationalities. As the table does not include the masters of these vessels, all of whom must be citizens, it may be said that of the whole complement of these vessels, amounting to 14,536, forty-two per cent were Americans.

SOME NOTABLE PASSENGER STEAMERS RECENTLY CONSTRUCTED FOR OUR FOREIGN TRADE.

We have selected for illustration a few of the more notable of the passenger steamers recently constructed in American yards for our foreign steamship companies, and in this connection we give a list of the principal deep-sea shipping companies, in this country, showing the number of vessels owned by each, their gross tonnage, and the main routes on which they are employed. Of the vessels herewith illustrated, the largest, and because of the unexpectedly high speed developed the most notable, is the "Korea," one of

TABLE SHOWING NUMBER AND TOTAL TONNAGE OF AMERICAN-BUILT SHIPS IN THE VARIOUS ROUTES.

Name.	No. Vessels.	Gross Tons.	Main Routes.
International Navigation Co.....	10	81,939	New York—Southampton. Antwerp.
Pacific Mail.....	17	70,970	San Francisco—Panama. Honolulu. Hongkong.
New York and Cuba Mail.....	16	59,465	New York—Havana. Mexico.
American Hawaiian.....	9	58,000	New York—San Francisco. Honolulu.
Southern Pacific.....	18	55,993	New York—New Orleans. Galveston. Havana.
Clyde Lines.....	18	41,528	New York—Santo Domingo. Philadelphia. Jacksonville.
Merchants & Miners. New York & Texas Massachusetts S.S. Co.	16 10 5	34,460 31,937 3,135	Baltimore—Boston. New York—Galveston. Puget Sound—China. Japan.
Oceanic (Spreckels).....	7	30,296	San Francisco—Honolulu. Australia.
Old Dominion.....	30	27,890	Baltimore—Boston.
Pacific Coast S.S. Co.....	13	21,848	San Francisco—Mexico. Brit. Colum.
Atlantic & Caribbean.....	5	9,398	New York—Porto Rico. Venezuela.
North American Mail.....	3	9,150	Puget Sound—Japan. China. Hongkong.
American Mail.....	4	8,400	Boston. Philadelphia. Jamaica.
Panama Railway.....	3	8,193	New York—Colon.
Ocean Steamship Co. U. S. & Porto Rico S.S. Co.....	5 6	15,914 15,318	New York—Savannah. New York—Porto Rico.
Metropolitan Steamship Co.....	6	14,505	Coasting.
Cromwell Steamship Co.....	4	14,155	New York—New Orleans.
Boston & Phila. S.S. Co.....	7	11,544	Boston—Philadelphia.

two sister ships built by the Newport News Shipbuilding Company for the Pacific Mail Steamship Company, in service between San Francisco, Japan and China. She has shown an average sea speed on the Pacific of 17.78 knots an hour. She is 572 feet 4 inches in length, 41 feet 10 inches in molded depth, and on a draft of 27 feet she has a displacement of 18,400 tons. She has a coal bunker capacity of 2,600 tons and is

driven by twin engines of vertical, inverted, quadruple-extension type, with cylinders, 35, 50, 70 and 100 inches in diameter, and 66 inches stroke. Upon the trial trip they indicated 17,902 horse power and drove the ship during the trial at a speed of 18 to 19 knots an hour. The boiler plant consists of six double-ended and two single-ended Scotch boilers arranged in two compartments. The boiler pressure is 200 pounds. The vessel contains accommodations for 210 first-class passengers, while the steerage has accommodations for 54 white passengers and 1,144 Chinese. Limitations of space prevent any detailed descriptions of the accommodations and reference is made to the accompanying illustrations, which explain themselves. As will be seen from the deck views, there is ample promenade space afforded on the boat deck. This vessel will shortly be joined on the route by a sister ship, the "Siberia." The fleet of the Pacific Mail Steamship Company contains seventeen American-built vessels with a total of 70,970 tons.

Although the most speedy of passenger vessels recently constructed, the "Korea" is not so large as the "Kroonland," the "Korea" being of 11,276 tons, and the "Kroonland" is 12,760 tons. The "Kroonland" and her sister ship the "Finland" were built at Cramps' yard, Philadelphia, Pa., for the International Navigation Company. She is a steel vessel of an over-all length of 580 feet, a molded breadth of 60 feet and a molded depth of 42 feet, while her displacement is 23,100 tons. She is driven at a speed of 17 knots by two sets of triple-expansion engines with cylinders 32½, 54 and 89½ inches, by 42 inches stroke. Their indicated horse power is 10,200. The boiler plant consists of nine single ended Scotch boilers working under a pressure of 170 pounds. Their heating surface is 22,400 square feet, and their grate area 643 square feet. The passengers are carried on the promenade, the upper and saloon decks amidships. There are berths for 364 first-class passengers, 190 second-class passengers and about 1,000 third-class passengers. These fine vessels are sister ships to the "Vaderland" and the "Zeeland," which were built on the Clyde for the same company in 1900. The fleet of the International Navigation Company consists of twenty-four ships of 180,639 total tonnage. Of these, ten ships, of 81,929 tons, fly the American flag.

One of the largest and most efficient steamship companies operating on the Pacific is the Oceanic Steamship Company, who for a great many years worked their service to Honolulu, New Zealand and Australia by two ships, the "Alameda" and "Mariposa," built at the Cramps' yard. With the rapid expansion of our southwestern Pacific trade the company completely overhauled these two vessels and gave an order to the Cramps for three much larger and faster sister ships, one of which, the "Sierra," is herewith illustrated. This very handsome craft is a twin-screw ship of 6,253 tons. She is 400 feet long, 50 feet 2 inches broad and has a molded depth to the spar deck of 37 feet 2 inches. Her engines are of the triple-expansion vertical type, with cylinders 28, 46 and 75 inches diameter by 48 inches stroke, with a total indicated horse power of 8,000 and capable of driving the ship at a speed of 17 knots an hour. The distance from San Francisco via Honolulu, Samoan Islands, and New Zealand is 7,200 knots, and the trip is made at an average speed of 15 knots for the whole distance. These vessels were constructed under Lloyd's rules and in accordance with the requirements of the United States Navy laws as regards auxiliary cruisers. They are of the very first class in every respect, having a double bottom, electric light, and cold storage. To render them thoroughly comfortable during the hot weather in crossing the line, there are no staterooms below the main deck, all of these being on the upper and promenade decks, and they are provided with specially large square port-holes and a perfect system of ventilation. There is a particularly large deck space for promenading. A steamer sails from San Francisco to the Samoan Islands, New Zealand and Australia once in three weeks; to Honolulu every ten days; and to the island of Tahiti once a month. The fleet consists of seven steamers of a combined tonnage of 30,296.

The increase in our trade with the West Indies consequent upon the Spanish war necessitated the construction of several new vessels to meet the increased demand of both freight and passengers. As representative of these new vessels we present illustrations of that very fine ship "Morro Castle," a vessel of 6,004 tons gross and of 8,280 tons displacement. The "Morro Castle" is 416 feet long, 50 feet broad and 36½ feet in molded depth. She was built by the Cramps in 1900. She is built with a double bottom and seven steel bulkheads to the main deck. The main engines are of the vertical, four-cylinder, triple-expansion type, designed to indicate 8,000 horse power at 100 revolutions under a working steam pressure of 170 pounds. The cylinders are 32, 52, 60 and 60 inches diameter by 42 inches stroke. Accommodations are provided for 104 first-class, 60 intermediate and 44 second-class passengers, and the ship carries a crew of 117 persons. The average

sea speed of this vessel is 17 knots per hour. In closing this article, attention is drawn to the fact that the two largest and most important vessels building in American yards for an American company are the great unnamed vessels now upon the stocks at New London, Conn. As these remarkable vessels call for more lengthy treatment they are described in a separate article of this issue.

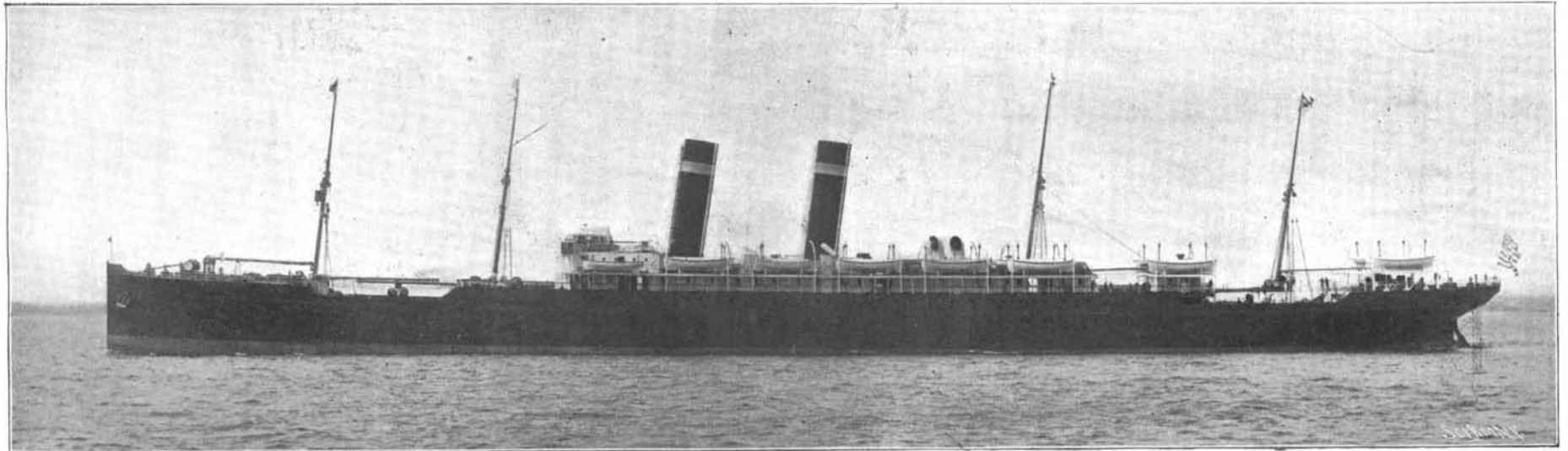
THE TWO GREAT FREIGHTERS FOR THE PACIFIC TRADE.

It is a curious fact that the two most notable ships under construction in American yards for the American merchant service are probably the two least known to the American public. This is to be explained by the fact that both the owners and the builders of these ships have gone about their great task in a very quiet way, and made no effort to draw attention to its importance, and the somewhat unprecedented character of the enterprise which has called these vessels into existence.

The last of the transcontinental lines to be built to a deep-sea terminus on the Pacific coast was the Great Northern Railroad. This road, which owes its existence to the energy of Mr. James J. Hill, is reputed to be the best constructed and equipped transcontinental line across the United States; for being the latest to be constructed, it naturally embodies the most modern ideas and improvements in railroad construction. The road has a terminus at Seattle, perhaps the finest harbor on the Pacific coast, and it was natural, in view of the easy grades, heavy steel and solid roadbed of the new line, and its consequent facilities for handling a voluminous and heavy traffic, that its owner should look to a furtherance of its interests by building a line of steamers to share in the undoubtedly large future trade with the Orient. An unex-

We present an inboard profile of the vessel, with the various decks and compartments filled with freight or occupied by passengers and crew, as they will be when the vessel is traveling with a full cargo and passenger list; and from this drawing one gets a very graphic idea of the enormous proportions of the vessel. From the outer bottom to the navigating bridge there are no less than eleven distinct decks or platforms. First we have the outer bottom of the ship; 6 feet above that is the inner bottom, which forms the floor of the ship; then follow, all within the plated structure, the orlop, lower, between, main, and upper decks. All these decks are of steel plating, and the whole inclosed structure is 56 feet in height. Above the upper deck, and in their order, are the promenade deck, the upper promenade deck, and the boat deck, the boat deck being 25½ feet above the promenade deck, or 81½ feet above the keel; while another 8 feet above this, or say 90 feet above the keel, is the navigating bridge. Now, since the vessel at her full draft will draw 33 feet, it follows that the navigating bridge will be 57 feet above the waterline; and since she draws only 17 feet in the light condition, the same bridge, when the vessel is running light, will be 73 feet above the water, and the passengers on the upper promenade deck will be 65 feet above the waterline. This means that at a medium draft of say 22 feet, the passengers can promenade at a height of 60 feet above the sea level. Now, it has been ascertained by observations that the very heaviest waves seldom exceed 30 feet in height; and hence passengers on these ships, even in the stormiest weather, will be able to look down upon the Pacific rollers from a point of observation 30 feet above their crests. The decks above the upper deck, which do not extend the full length of the vessel, but only for a certain distance amidships, are devoted entirely to the

struction considerably stiffer and stronger than any vessels built for the American merchant marine. The outer plating of the ship's bottom is of 1¼-inch steel, and the shell plating is strengthened by an additional strake of 1-inch plating at the main and upper decks, while continuous, 1-inch stringer plates are worked from stem to stern along these two decks as a stiffening to the regular deck plating, which on the main deck is 16-20 of an inch in thickness, and on the upper deck is 18-20 of an inch. The ship is strengthened against hogging and sagging strains by a continuous central, longitudinal bulkhead reaching from keel to upper deck. Longitudinal bulkheads have been used between adjacent engine rooms in other ships, but this is the first vessel that we know of that has a complete web of steel from upper deck to keel, and from stem to stern. This bulkhead is of ½-inch plating at the top and bottom, and a ¾-inch plating throughout the intermediate decks. The vessel also receives great longitudinal strength from a new system of stanchions and girders. Instead of using a large number of ordinary pipe or tube stanchions spaced at frequent intervals, there are three lines of heavy box section stanchions, measuring 13x24 inches in section. These stanchions are spaced 20 feet apart, longitudinally, and the deck loads of the deck above them are carried by means of continuous lines of 13x24-inch box girders. This is not only an economical distribution of material, but it adds enormously to the longitudinal stiffness of the vessel. The longitudinal bulkheads necessitate double hatches, and there are in the ship no less than fourteen cargo hatches. As we have stated, the vessel is designed to meet the special requirements of the Oriental trade, and one pair of hatches is made of sufficient length to enable a locomotive to be lowered complete into the hold. Under a horse power of 11,000 the sea



Copyright 1902, International Navigation Co., N. Y.

THE AMERICAN-BUILT STEAMSHIPS "KROONLAND" AND "FINLAND" OF THE INTERNATIONAL STEAMSHIP COMPANY.

Length, 580 feet; beam, 80 feet; depth, 42 feet; speed, 17 knots; tonnage, 12,760 tons.

pected feature of the new shipping venture was the enormous size of the ships that were proposed and quickly contracted for. For instead of these vessels being, as one would expect in what might be termed an infant enterprise, of moderate proportions, Mr Hill ordered two vessels which will be about equal in total carrying capacity to the largest vessels ever constructed.

Another curious feature in connection with these ships is that an entirely new company, the Eastern Shipbuilding Company, was formed expressly for the purpose of constructing them, and that this company took the contract before it possessed plant, or equipment, or even the ground on which to build them. After a thorough survey of the Atlantic coast line, a site was chosen opposite New London, Conn. The vessels were designed by Mr. William A. Fairburn, naval architect, under the supervision of Mr. C. R. Hanscom.

Apart from their great size, "the New London ships," as they are popularly called, embody several features of construction and internal arrangement which render them of special interest. Their dimensions are, length 580 feet, breadth 73 feet, and molded depth 56 feet. On a draft of 33 feet the displacement will be 33,000 tons, and on a maximum draft of 36½ feet the displacement will be 37,000 tons, or within 870 tons of the displacement of the "Cedric" on the same draft, the "Cedric" being the largest vessel afloat. In length and breadth the New London ships are less than the "Celtic" and "Cedric," which are 700 feet in length by 75 feet in breadth; but the plated or molded depth will be greater by 6 feet 8 inches, the plating being carried up everywhere to the upper deck, which is flush throughout the whole length of the ship. The greater depth and more bulky model of the new ships account for their nearly equaling the longer and broader White Star boats in displacement.

first and second class passenger accommodation. The passengers are not only separated from the noise and general inconvenience incident to the operation of the vessel; but being amidships, they are removed from the vibration of the propellers, and are subject to but little of the pitching motion of the vessel. Accommodations are provided for 150 first-class passengers, 100 second-class passengers, 100 third-class passengers and 1,000 steerage. There are also quarters for the accommodation of 1,200 troops. The total cargo capacity is 20,000 tons.

Referring to the inboard profile, the vessel is proportioned as follows: First we have the 6-foot double bottom, which contains the trimming and ballast tanks for trimming the vessel and giving her ample stability in the light condition. The engine and boiler space and the coal bunkers are amidships, extending between the double bottom and the main deck. With the exception of the space occupied by engines, boilers and coal, the space below the main deck is given up entirely to cargo, one series of compartments on the boat being devoted to cold storage and the storage of silk from the Orient. The main deck forward of the engines and boilers is occupied by the crew, cargo and cattle, and the space aft of the engine is devoted to second-cabin passengers and to the steerage passengers. Forward on the upper deck is a deck-house filled with refrigerating machinery, and aft on this deck are the second cabin smoking room and ladies' room, while astern is the laundry and steering gear. Amidships on the main deck are the first-class dining saloon, lavatories, first cabin staterooms, galley, and the officers' rooms. On the promenade deck amidships are the library, a series of first-class passenger staterooms, and a children's room. On the upper promenade deck are the first cabin staterooms, smoking room and barber shop, while on the boat deck are the chart house and accommodations for the captain and officers.

It is claimed that the new vessels are in their con-

speed of the ships is expected to be about 14 knots an hour.

THE LATEST OF THE FAST TRANSATLANTIC LINERS.

The "Kaiser Wilhelm II.," which will shortly sail for this port, was built at the Vulcan yards, Stettin, by the same firm that has built the "Kaiser Wilhelm der Grosse," the "Deutschland" and the "Kronprinz." It is for this reason, and because of the uniformly good results obtained with these vessels, that the new ship is expected to develop the horse power and to show the high speed contracted for. Indeed, if she lives up to the record of her predecessors, she will greatly exceed her contract requirements in these respects. Her advent, moreover, should serve to settle all doubts as to whether high-speed transatlantic liners of this type are paying investments. On a round trip made in the "Deutschland" of the Hamburg-American Line by a representative of this journal, a sum of \$200,000 was taken in for passenger fares alone. As the total expenses including every fixed charge of the round trip were \$100,000, or slightly under, there was a profit of about \$100,000 for the single trip to Europe and back.

The building of high-speed liners is first and last a business proposition, and although it has been claimed that the companies that run these vessels are willing to suffer a financial loss on the ships themselves, for the sake of the great prestige and the advertisement which they secure, it may be taken for granted that if the ships already constructed had not been a paying proposition *per se*, the "Kaiser Wilhelm II." would never have been built.

The new vessel is constructed with the usual double bottom. The molded depth is 44 feet 2 inches, and it includes four separate decks, the plating extending to the upper deck. This portion of the hull is divided by sixteen transverse bulkheads, all of which extend to the upper deck, while there is a longitudinal bulk-