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 unexpected 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.

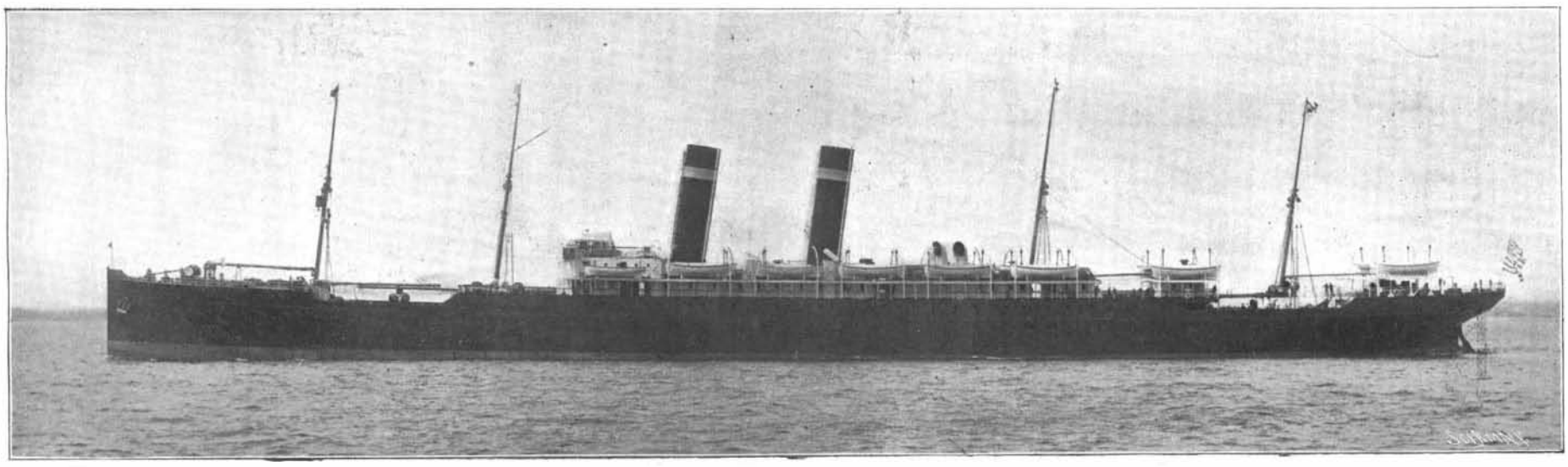
Another curious feature in connection with these ships is that an entirely new company, the Eastern Shipbuilding Company, was formed expressly for the purpose of constructing them, and that this company took the contract before it possessed plant, or equipment, or even the ground on which to build them. 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 630 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.

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 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 construction 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 ⅜-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 speed of the ships is expected to be about 14 knots an hour.



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

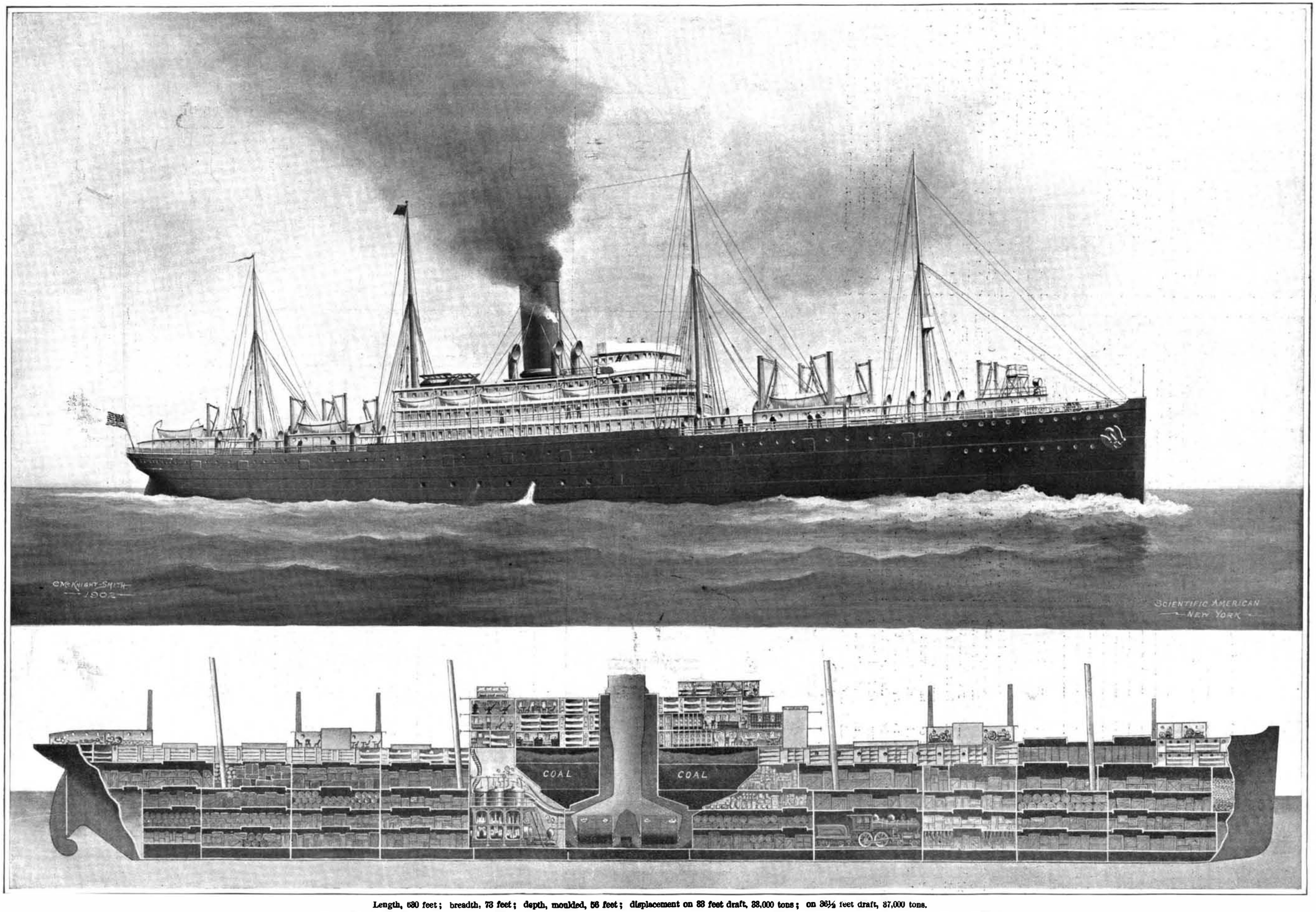
Length, 580 feet; beam, 60 feet; depth, 42 feet; speed, 17 knots; tonnage, 12,760 tons.

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-



Length, 680 feet; breadth, 73 feet; depth, moulded, 56 feet; displacement on 33 feet draft, 33,000 tons; on 36½ feet draft, 37,000 tons.

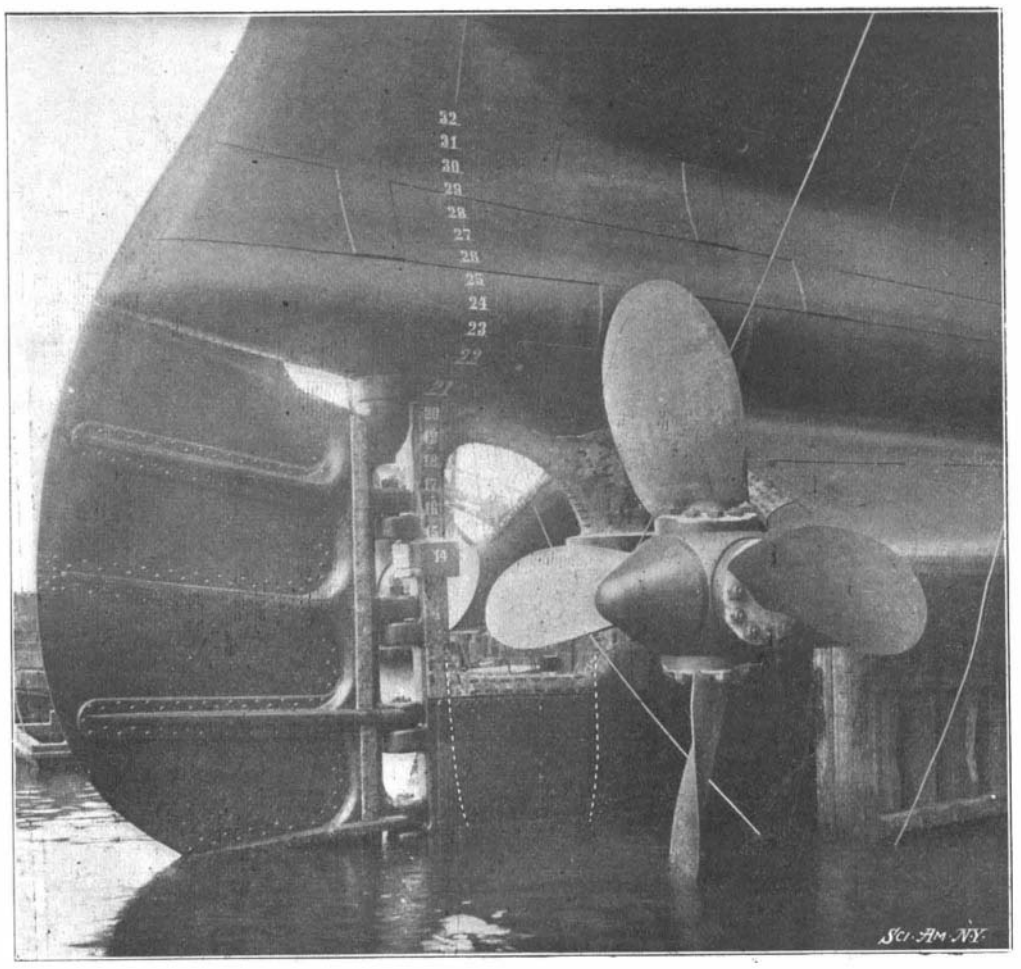
THE 20,000-TON STEAMSHIPS BUILDING AT NEW LONDON FOR THE GREAT NORTHERN STEAMSHIP COMPANY—PACIFIC TRADE.

These vessels are only slightly exceeded in size by the "Celtic" and "Cedric," the largest vessels afloat.

head extending throughout the length of the two engine rooms, thus forming four separate compartments for the engines. The large accommodations of the vessel are accounted for both by her great length and beam, and by the fact that she carries one deck more than is usual in vessels of this class. Above the upper deck, which is, as we have seen, flush with the top of the ship's plating, there is first a spar deck, carrying a midship deck-house which is 49 feet in breadth and 443 feet in length, and a poop-house which is 79 feet in length. The roof of the midship deck-house extends for the full width of the ship and reaches over the poop, which it entirely covers, thus forming a promenade deck, which is 538 feet in length. Upon this there is a deck-house 438 feet in length. Above this deck there is the upper promenade deck, and over this is the boat-deck. It will thus be seen that these four decks above the upper deck provide several wide and sheltered promenades at the sides of the deck-houses, a feature which will be greatly appreciated by those who have traveled on previous steamers when they carried a full passenger list.

The dimensions of the "Kaiser Wilhelm II." are length 706½ feet, breadth 72 feet, molded depth 44 feet 2 inches, and displacement 26,000 tons. Comparing these figures with those given in the table for the other great transatlantic liners, it will be seen that she is 2½ feet longer than the "Oceanic;" but she has 3 feet less beam than the "Cedric" and about 10,000 less displacement than the latter ship. Her estimated speed of 23½ to 24 knots is half a knot greater than that of the next two fastest vessels, the "Deutschland" and the "Kronprinz Wilhelm." The ship will accommodate a large number of passengers, 775 being carried in the first class, 343 in the second class, and 770 in the third class. The ship's complement is the largest of any ship in the world, consisting of 48 engineers and greasers, 229 stokers and trimmers, 170 stewards and waiters, 61 cooks and 46 sailors. Other novelties are a children's saloon, a Vienna café and a grill room, placed on the uppermost deck of all. The first-class dining room will be the biggest afloat, having accommodations for 554 people at one sitting. The greatest interest in this ship naturally centers in the engine and boiler rooms, and on the accompanying page we present a fine view of the engines as they will appear when completely erected on board the ship. It became evident, both when the engines of the "Deutschland" were constructed and during their subsequent operation, that in them the builders of marine engines had reached the limit of desirable size. There are on that ship two engines, one on each shaft, and together they have indicated under favorable conditions as high as 38,000 horse power, or 19,000 horse power on each shaft. When it was determined to make the "Kaiser Wilhelm II." the fastest vessel afloat, it was necessary to provide engines of 40,000 contract horse power, which, judging by the performance of previous engines, meant about 45,000 horse power in actual service. It was realized that this great power would have to be subdivided among more than two engines, in order to keep down the size and weight of individual parts. The plan determined upon was to use four engines in four separate water-tight compartments, two engines being coupled in tandem on each shaft. As arranged, there is in each engine room a complete four-cylinder, quadruple-expansion engine working on three cranks. The accompanying view is taken from the front end of one pair of engines, and shows them in the relative position they occupy in the ship. Steam is admitted to two high-pressure cylinders, 37.4 inches in diameter, which are set immediately above the first intermediate cylinders, which are 49.2 inches in diameter, the common piston-rod of these two cylinders being connected to a common crank shaft. From the first intermediate the steam passes to the second intermediate adjoining it, which is 74.8 inches in diameter, and thence it is led to the low-pressure cylinder, which is 112.2 inches in diameter. The common stroke of the four cylinders is 70.8 inches. As may be imagined, the dimensions of the shafting are very large, the crank shaft of the forward engine being 20.87 inches in diameter, and that of the after engines 25 inches in diameter. Each engine is provided with its own separate condenser, containing 11,732 square feet of cooling surface. The bronze screw propellers are 22 feet 9½ inches in diameter. It should be mentioned that particular attention was paid to the construction of the crank and propeller shafting, the former being made of nickel-steel with a breaking strength of 38½ tons per square inch, the complete crank of one set of engines weighing in all 114 tons. The thrust shaft is also of nickel-steel, while the intermediate shafts are of Siemens-Martin steel and the propeller shaft of crucible steel. The ingot for the propeller shaft, which weighs 80 tons, was cast with the contents of 1,768 steel-smelting crucibles, the work requiring the attention of 490 men for half an hour's time.

The boiler installation is, of course, a very powerful one, and consists in all of nineteen separate boilers. In the first boiler room there are three double-ended boilers, in the second boiler room three double-ended and three single-ended boilers, and the same in the third boiler room, while in the fourth or forward room there are three double-ended and one single-ended boilers. This arrangement has been chosen with a view to facilitating the transportation of the



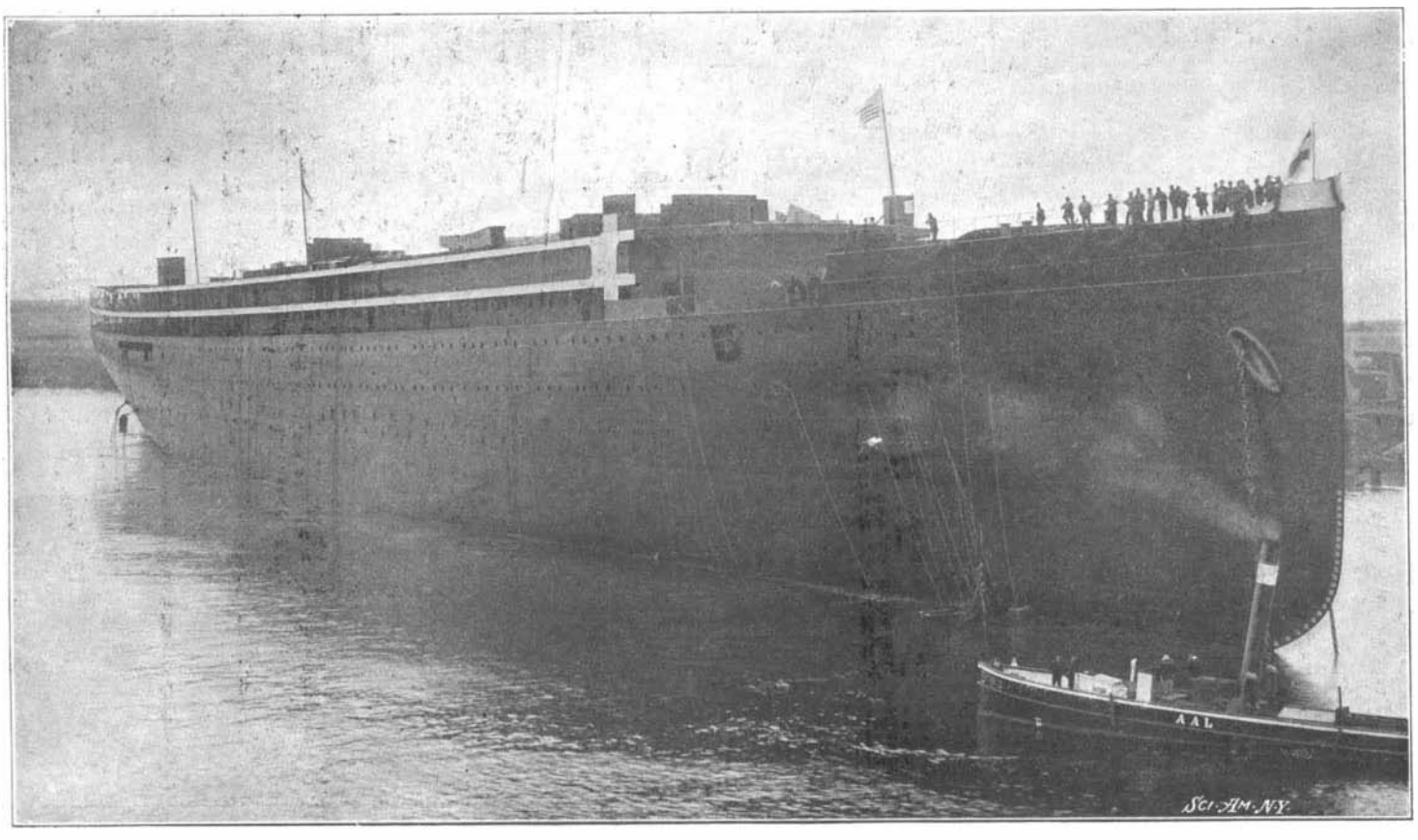
The dotted line indicates size of opening between hull and sternpost in the "Deutschland" (as first built) whose sternpost and rudder were carried away last spring. Note the extension of ship's plating to sternpost across lower half of opening, with a view to strengthening construction and guarding against similar injury to "Kaiser Wilhelm II."

THE PROPELLERS AND STERN CONSTRUCTION OF "KAISER WILHELM II."

PARTICULARS OF RECENT TRANSATLANTIC LINERS.

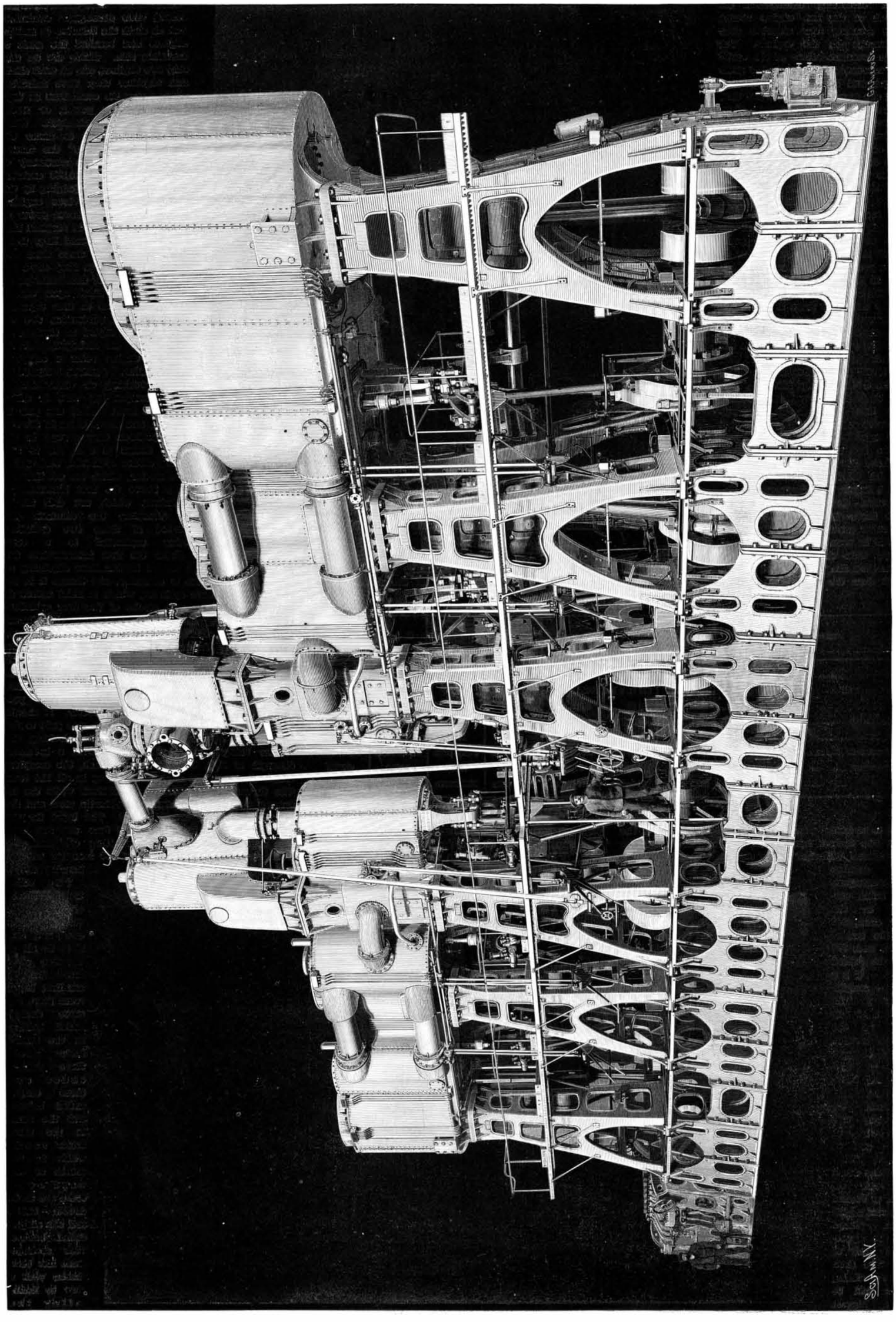
Name of Ship.	Lucania.	Kaiser Wilhelm der Grosse.	Oceanic.	Deutschland	Kronprinz Wilhelm.	Cedric.	Kaiser Wilhelm II.
Date	1893	1898	1899	1900	1901	1902	1902
Length over all	625 ft.	648 ft. 6 in.	704 ft.	684 ft.	663 ft.	700 ft.	706 ft. 6 in.
Breadth	65 ft. 3 in.	66 ft.	68 ft. 4 in.	67 ft.	66 ft.	75 ft.	72 ft.
Molded depth	41 ft. 6 in.	43 ft.	49 ft.	44 ft.	43 ft.	49 ft. 4 in.	44 ft. 2 in.
Draught	29 ft.	28 ft.	32 ft. 6 in.	29 ft.	29 ft.	36 ft. 6 in.	29 ft.
Displacement	19,000 tons	21,880 tons	28,500 tons	23,620 tons	21,300 tons	37,870 tons	26,000 tons
Horse power	30,000	30,000	27,000	38,000	36,000	16,000	*40,000
Speed	22.01 knots	23 knots	20.7 knots	23.5 knots	23.5 knots	16 knots	*23.5 knots

* Both likely to be exceeded in service.



Length, 706½ feet; breadth, 72 feet; depth, 44 feet 2 inches; displacement, 26,000 tons; contract horse power, 40,000; estimated speed, 23½ knots.

"KAISER WILHELM II." WHICH WILL BE THE FASTEST STEAMER AFLOAT.



ENGINES OF THE "KAISER WILHELM II."

coal from the bunkers to the foot-plates—a most important consideration in a ship of this size. The boiler pressure adopted is 225 pounds per square inch. The total grate area is enormous, being 3,121 square feet, as is also the total heating surface of 107,643 square feet.

It is an interesting fact that this new vessel will not make use of forced draft, but will be driven entirely under natural draft, the North German Lloyd Company being strongly opposed to the use of forced draft in any form whatever. This, of course, necessitates a proportionately larger grate surface and heating surface, and a more liberal allowance of space for boiler room installation. Thus the Hamburg-American liner "Deutschland," which has indicated 38,000 horse power under forced draft, has only 2,188 square feet of grate area, and 85,468 square feet of heating surface, as compared with the "Kaiser Wilhelm II.," which for a contract horse power of 38,000 to 40,000 will require 50 per cent more grate surface, and about 25 per cent more heating surface. It is easy to see from the figures we have given that the new ship is likely to exceed her contract horse power and speed by a very wide margin, and we fully expect that after a voyage or two she will be indicating not less than 45,000 and possibly as high as 47,000 horse power, with a corresponding speed of 24 to 24½ knots an hour.

PROVISIONING A LINER FOR A SINGLE TRANSATLANTIC TRIP.

The Book of Genesis does not record the tonnage of the huge vessel which finally stranded on Mount Ararat, after finishing the most wonderful voyage ever described in the annals of mankind. But it is quite safe to assume that the dimensions of the Ark, that old-time floating storehouse, are exceeded in size by the largest of steamships now crossing the Atlantic.

Not the least striking evidence of the size of these modern monsters of the deep is afforded by the vast quantities of food which must be taken aboard for a single six-day trip across the Atlantic. For the 1,500 passengers and the several hundred men constituting the crew, carloads of food and whole tanks of liquids are necessary. To enumerate in cold type the exact quantities of bread, meat, and vegetables consumed in a weekly trip would give but an inadequate idea of the storing capacity of a modern liner. We have, therefore, prepared a picture which graphically shows by comparison with the average man the equivalent of the meat, fruit, and breadstuffs, as well as the liquors used. Each kind of food has been concentrated into a giant unit, compared with which the figure of the average man seems puny.

On the "Kronprinz Wilhelm," of the North German Lloyd Line, which steamship we have taken for the purpose of instituting our comparisons, some 19,800 pounds of fresh meat and 14,300 pounds of salt beef and mutton, in all 34,100 pounds of meat, are eaten during a single trip from New York to Bremen. This enormous quantity of meat has been pictured in the form of a single joint of beef, which, if it actually existed, would be somewhat less than 10 feet high, 10 feet long, and 5 feet wide. If placed in one end of a scale, it would require about 227 average men in the other end to tip the beam.

For a single voyage the "Kronprinz Wilhelm" uses 2,640 pounds of ham, 1,320 pounds of bacon, and 506 pounds of sausage—in all, 4,466 pounds. Since most of this is pork, it may well be pictured in the form of a ham. That single ham is equivalent in weight to 374 average hams. It is 7¼ feet high, 3 feet in diameter and 2 feet thick.

The poultry eaten by the passengers of the steamer during a trip to Bremen or New York weighs 4,840 pounds. This being the turkey season of the year, suppose that we show these 4,840 pounds of poultry in the form of a turkey, dressed and ready for the oven. The bird would be a giant 10 feet long, 8 feet broad, and 5 feet high.

Sauerkraut, beans, peas, rice, and fresh vegetables are consumed to the amount of 25,320 pounds. Packed for market, these preserved and fresh vegetables would be contained in 290 baskets of the usual form, which piled up make a very formidable truncated pyramid.

The quantity of eggs required is no less startling than the quantity of vegetables; for some 25,000 are needed to satisfy the wants of passengers and crew. Eggs are usually packed in cases, 30 dozen to the case. The "Kronprinz Wilhelm," when she leaves New York or Bremen, must therefore take on board 69 of these cases, which have been shown in a great pile, 23 cases high and three cases wide.

The bakers of the ship find it necessary to use 33,000 pounds of flour during the trip. In other words, 169 barrels are stowed away somewhere in the hold of the big ship.

Besides the foods already enumerated, 1,980 pounds of fresh fish and 330 pounds of salted fish are eaten during the six-day voyage. The total amount of 2,310 pounds would be equivalent to a single bluefish 20 feet long, 5 feet in greatest diameter, and 1½ feet broad. Such a fish compares favorably in length, at least, with a good-sized whale.

The potatoes required far outweigh any other single article of food contained in the storerooms; for their entire weight is 61,600 pounds. If it were possible to grow a single tuber of that weight, it would have a height of 14 feet and a diameter of 7 feet.

The butter, too, if packed into a single tub, would assume large dimensions. This single tub would contain 6,600 pounds and would be 6 feet high.

Of dried fruit, 2,640 pounds are eaten, and of fresh fruit 11,000 pounds, in all 37,400 pounds. If this fruit were all concentrated into a single pear, its height would be 7 feet, and the width at the thickest part 5 feet.

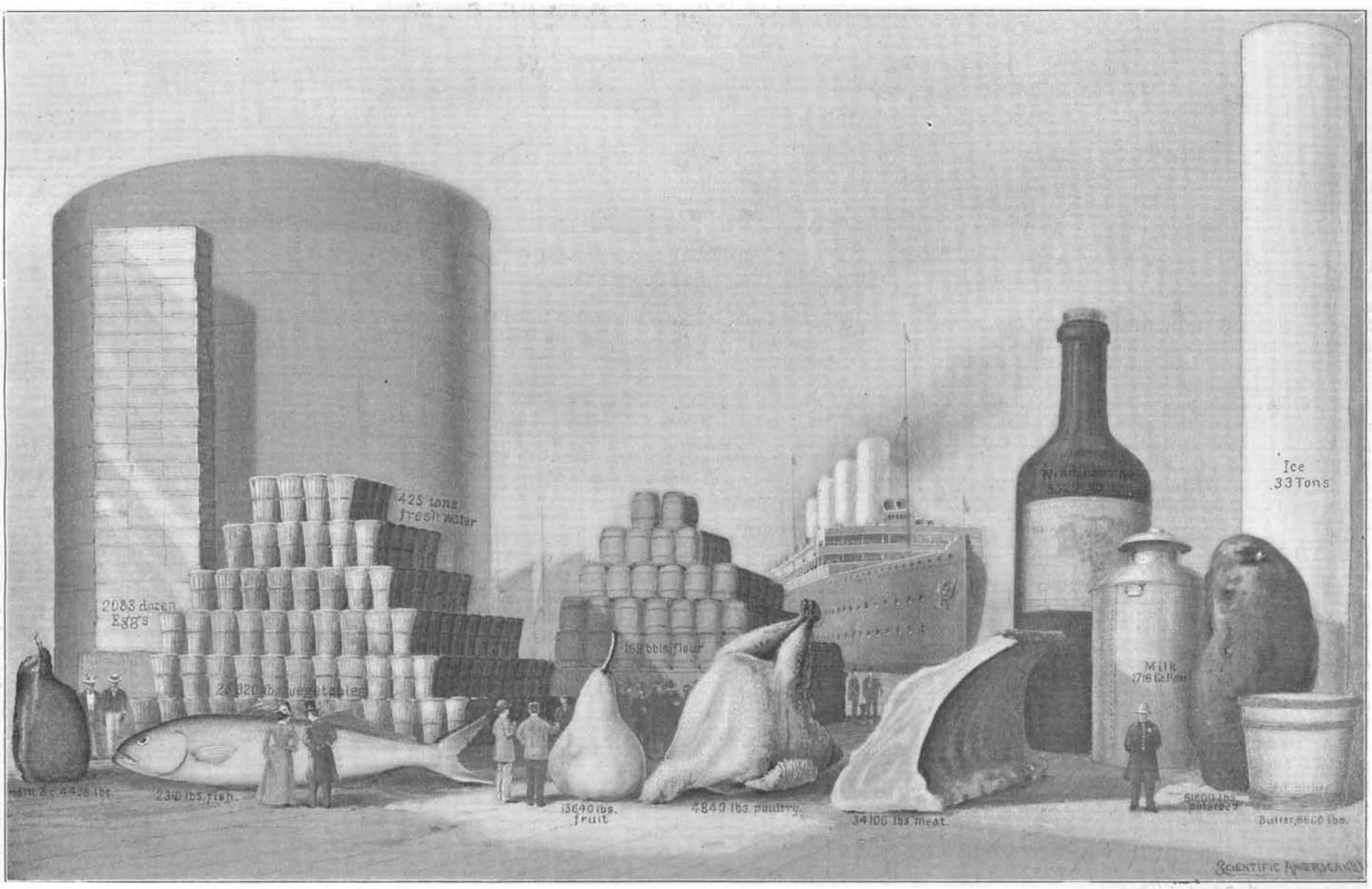
Whole lakes of liquids are drunk up by the thirsty passengers and crew. No less than 425 tons of fresh water are required, which occupy 14,175 cubic feet and would fill a tank 25 feet in diameter and 30 feet high. The 1,716 gallons of milk used for drinking and baking would be contained in a can 6 feet 1 inch in diameter and 11½ feet high. The gallons and gallons of wines, liquors, and beer consumed should dishearten the most optimistic temperance advocate. Under the joyous title of "beverages" the following items are to be found in the purser's account-book:

Champagne	850 bottles.
Claret	980 bottles.
Madeira, sherry, etc.	135 bottles.
Rhine and Moselle wines	1,700 bottles.
Rum and cordials	760 bottles.
Mineral water	5,250 bottles.
Beer in kegs	2,960 gallons.
Beer in bottles	600 bottles.

Suppose these things to drink were contained in one claret bottle. Some idea of the hugeness of this bottle may be gained when it is considered that its height would be over 24 feet and its diameter over 6 feet.

In order to cool the wines and the beer, as well as to preserve the fresh meats, vegetables, eggs and fruit, 33 tons of ice are needed. That seems a small quantity, and, in truth, it is. But the "Kronprinz Wilhelm" has also refrigerating machines, which have cut down the quantity of ice which it is necessary to take on board. The 33 tons of ice actually consumed, however, would make a column 37 feet high.

Compared with these vast quantities of food, the live stock of Noah's Ark must pale into insignificance. It must not be forgotten, however, that in provisioning a liner an allowance is made for accidents, which may prolong a voyage over many days. For that reason not all, but only the major portion of the food taken aboard is consumed.



A GRAPHICAL COMPARISON OF THE PROVISIONS OF A TRANSATLANTIC LINER.