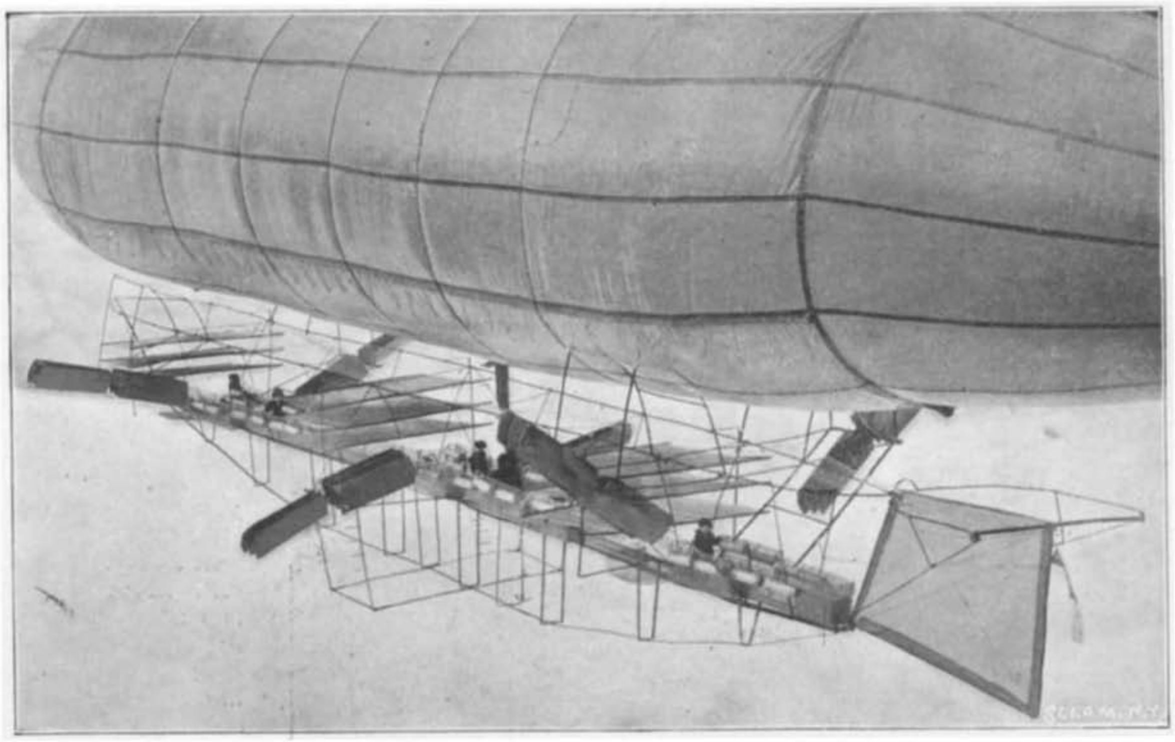
## NEW AIRSHIP UNDER CONSTRUCTION FOR THE BRITISH WAR OFFICE.

BY OUR ENGLISH CORRESPONDENT.

The designer of the airship which is herewith illustrated, Dr. Barton, of London, England, after devoting the past two decades to the practical study of aerial navigation, has closed a contract with the British War Department for the construction of an experimental airship, on the lines of the model herewith illustrated, which is built on a scale of one-twelfth. Special interest attaches to it from the fact that it combines the good qualities of both the airship and the aeroplane.

The cigar-shaped balloon measures 180 feet over all, with a maximum diameter of 41 feet. The greatest diameter occurs at a point 72 feet from the bows. It is divided into three compartments. The diaphragms, or dividing walls, are built loosely, and are fitted with a special contrivance to permit the passage of the gas from one compartment to another, at will, the necessary action for this purpose being controlled from the car, as follows: In the central compartment is a balloonette of 12,000 cubic feet capacity, into which air, at a pressure of approximately one atmosphere, is pumped, to compensate for any leakage that may possibly occur in the balloon, and which is let out when the hydrogen expands, so that none of the gas is lost, while the whole structure is kept rigid. The balloon has a capacity of 144,000 cubic feet of hydrogen which, together with the 12,000 cubic feet air capacity of the balloonette, represents an aggregate capacity of 156,000 cubic feet, while its lifting capacity will be roughly 10,000 pounds.



Length, 180 feet; diameter, 41 feet; horse power, 135; speed, 20 miles an hour.

AN AEROPLANE AIRSHIP UNDER CONSTRUCTION FOR THE BRITISH WAR OFFICE.

The balloon is built of varnished Japanese silk, and over this is fitted a "chemise" covering, in the edge of which are sewn fine strips of bamboo, bound together so as to form one long suspending rod, to which are attached the cords that run down to the aeroplane frame. This bamboo is continued up over the nose to almost the largest diameter of the balloon, and through the side pieces as well as over the ends. These pieces are all connected by bamboo bound together in a similar manner and fastened in gussets in the chemise.

The aeroplane frame is 120 feet from end to end. It is built of tubular steel throughout. To this frame are fitted the three sets of horizontal aeroplanes, three to each set, which constitute the salient feature of the Barton airship. One set of aeroplanes is fitted near either end of the frame, and one in the center. The slats are placed one above the other on the interior transverse bars of the frames, but are movable up and down in an arc, the center of which is posterior to the anterior transverse bars. When resting in a horizontal position they are aeroplanes, but when raised or lowered form aerocurves. Each aeroplane measures 12 feet in length by 18 feet in width, thus giving a superficial area of 216 square feet per plane, and a total area of 648 square feet for each set of planes, while the aggregate superficial area of the three triple sets is 1,944 square feet. The aeroplanes are constructed of varnished Japanese silk, stretched out upon frames, and sufficiently supported by transverse bracings.

The inventor, in the combination of the aeroplanes with the balloon, has availed himself of the results of Mr. Hargreave's experiments with kites. The latter discovered that an aeroplane forced against the air at a speed of 20 miles per hour will give a lifting power of 2 pounds to the square foot. Dr. Barton in his airship has reduced Hargreave's lifting power per foot at the same speed to one fourth, so that even allowing ½ pound lifting power per square foot, with 1,944 square feet, which is the total superficial area of three triple sets of aeroplanes in his machine, a lifting power of 972 pounds results, which is equivalent to letting out approximately 14,900 cubic feet of gas or throwing out 972 pounds of ballast.

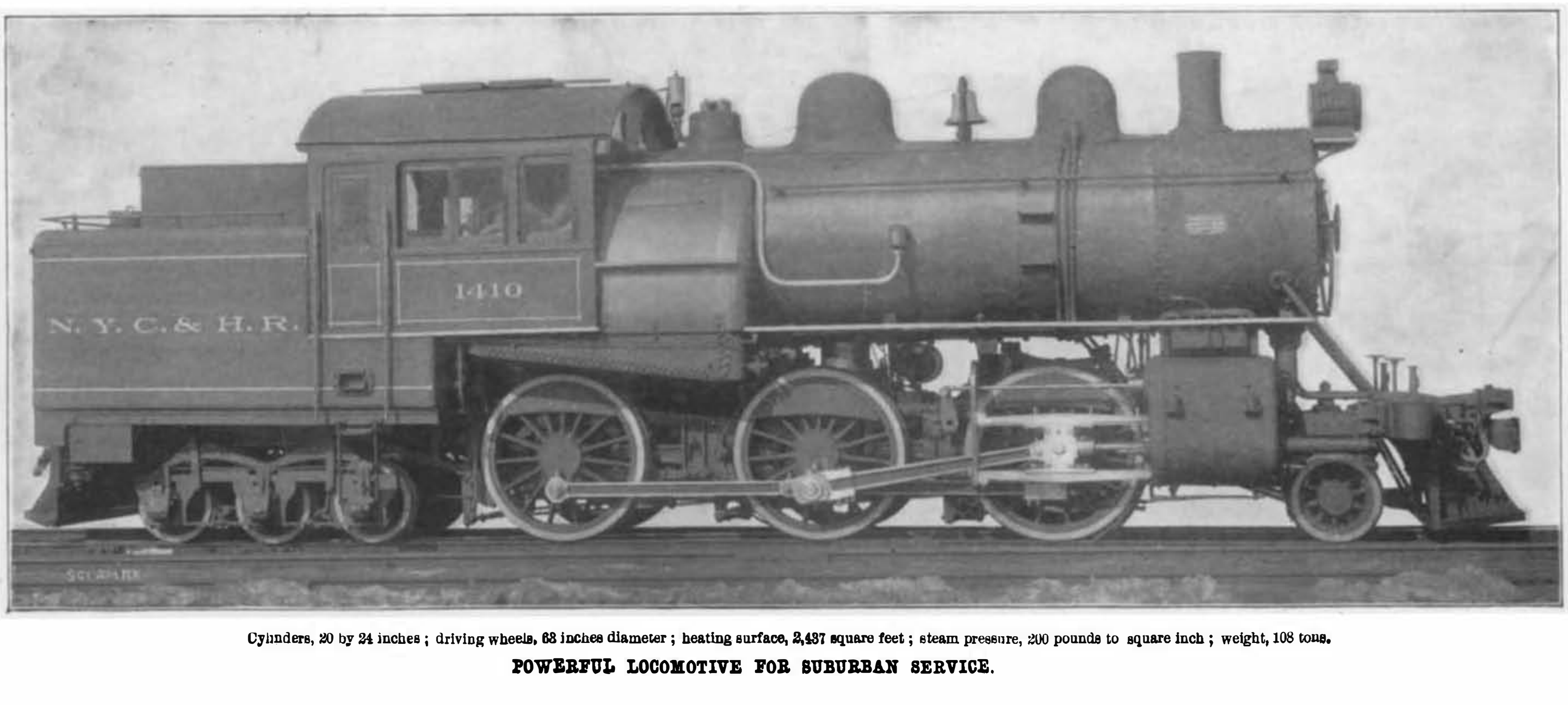
The airship is forced through the air by six sets of propellers, three on each side, placed at the bows, amidships and at the stern respectively. The set amidships, however, is placed in a lower plane than the bow and stern sets. They are of the two-blade triple Mangin type, each propeller measuring 17 feet from tip to tip by 2½ feet maximum width. Each pair of propeller sets is driven by a 45 horse power four-cylinder petrol engine and the thrust obtained will be 900 pounds, estimating a force of 20 pounds per horse power. As there are three sets of engines, one for each pair of propellers, the aggregate horse power is 135, which produces a total thrust of 2,700 pounds. Dr. Barton, however, anticipates obtaining a force of 25 pounds per horse power so that the aggregate thrust will be increased to 3,375 pounds.

The inventor has relinquished the sliding weight or trail rope counterbalance, but has devised an ingenious system of automatic water balance. At each end of the car is a tank capable of stowing 50 gallons of water. These tanks are connected by two pipes, running underneath the car. Amidships each pipe passes through a double pump, pumping in opposite directions, driven by a single cylinder 3½ horse power motor. Close to the aeronaut in charge of the steering apparatus is a pendulum, which is connected to cocks fitted to the above pipes, and controls the direction of the flow of water to and from the tanks. These cocks are opened or closed automatically according to the swing of the pendulum. When the ship is perfectly horizontal, the pendulum hangs at right angles to the deck, and both cocks are open, the water circulating freely and evenly between the two tanks. Immediately the ship dips at either end, the pendulum indicates the degree of deviation from the horizontal, and the water is shut off from flowing from the raised into the depressed tank, while the water pumped from the lat more freely into the form thereby equalizing the weight and causing the ship to resume its equilibrium. Supposing, for instance, the engineer at the forward motor walks to the stern. As he traverses the deck the center of gravity is shifted, and the ship will commence to dip down at the stern. The pendulum comes into action, the water supply from the forward tank is cut off, and the water is pumped from the stern tank more quickly into the forward tank, the operation being continued until a volume of water equivalent to the weight of the engineer has been discharged from the stern into the bow tank, thus compensating the removal of the engineer's weight upon the bows. The car is built on the latticed bridge principle and is 104 feet in length. Three hundred and sixteen gallons of petrol are carried for the supply of the propelling motors. It is stored in cylindrical tanks, each of six gallons capacity, slung upon either side of the car.

The War Office airship is to travel at a speed of 20 miles per hour, and to have accommodation for seven men. It is to be equipped with every appliance necessary for reconnoitering and signaling. For maintaining communication with the earth a wireless telegraphic apparatus is to be installed. It is to remain steaming in the air for 48 hours. A French government firm has already endeavored to purchase the Barton airship, but a contract has been entered into between the British War Office and the inventor for its exclusive use by the British Military Department, and the essential and vital details of the vessel are maintained secret, the negotiations for patenting the invention having been interrupted by the authorities. The government trials are to be carried out in the course of the next two or three months.

## POWERFUL LOCOMOTIVE FOR SUBURBAN SERVICE.

For suburban work, where there is frequent stopping and starting, the steam locomotive is at a great disadvantage as compared with the electric motor, because of the much more rapid acceleration which is




Cylinders, 20 by 24 inches; driving wheels, 63 inches diameter; heating surface, 2,437 square feet; steam pressure, 200 pounds to square inch; weight, 108 tons.

POWERFUL LOCOMOTIVE FOR SUBURBAN SERVICE.

possible with the latter. The average speed of the suburban train is very largely a question of rapidity of starting and stopping. In regard to quick stops, of course, the steam and electric service are on the same basis, although the introduction of the magnetic brake, which is being applied so successfully in the street car service, would place an electrically-operated system at a great advantage, even in respect of rapidity of stopping. It is in the relatively slow acceleration that a steam suburban service is handicapped as compared with one operated electrically.

With a view to handling its suburban trains with greater despatch, the New York Central Railroad Company has brought out a suburban locomotive of great size and power, of which we herewith present an illustration. The first of this class was built by the American Locomotive Company several months ago, and the service which it gave was so satisfactory that a later order was given for fifteen additional locomotives of the same type. As will be seen from the illustration, the locomotive is carried on no less than fourteen wheels, consisting of a pony truck, six coupled drivers and a six-wheeled truck beneath the tender, the latter being carried on the same frame with the boiler and engines. The barrel of the boiler, which is of the straight, wide firebox type, is 70 inches in diameter. The firebox is 93 inches in length, 97⅞ inches in width, and 67 inches in depth at the front end and 53½ inches at the back. There are 365 2-inch tubes which have a total length over tube sheets of 12 feet. There are 2,275 square feet of heating surface in the tubes, and 162 square feet in the firebox, making a total heating surface of 2,437 square feet, while there are 62 square feet of grate surface. The steam pressure is 200 pounds to the square inch.

The cylinders are 20 inches in diameter by 24 inches stroke, and the driving wheels are 63 inches in diameter. The slide valves are of the piston type, with inside admission and 5½ inches travel when in full gear. The engine frames are narrowed down to plate form where they extend under and support the tank.

The weight of this fine engine in working order is 216,000 pounds, of which 128,000 pounds is on the driving wheels. The tender has a capacity of 3,700 gallons of water and 5 tons of coal. These are considerably the heaviest and most powerful engines ever made for suburban service for this or any other country.

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**The fifty-first meeting of the American Association for the Advancement of Science will this year be held at Pittsburg, Pa., from June 8 to July 3. Mr. Stewart Culin, of the University of Pennsylvania, will preside over the section of Anthropology.**

## THE GROWTH OF THE TRANSATLANTIC STEAMSHIP.

On July 4, in the year 1840, a little wooden sidewheel steamer cast loose from her dock at Liverpool and fourteen days and eight hours later steamed into Boston Harbor, amid the acclamations of the assembled citizens and every manifestation of civic pride and rejoicing. The little craft was the "Britannia," the first of the since-famous Cunard line, and the first steamer to sail under regular government contract for the conveyance of the transatlantic mails. In the accompanying very interesting diagram, showing the growth in size of the transatlantic mail steamship, we have commenced with the "Britannia" for the reason that although she was not, by any means, the first steamship to cross the Atlantic, she was the first to do so on a regular schedule. The Cunard Company continued for many decades to be the most prominent of the transatlantic steamship companies, and the successive vessels put afloat by this company are representative of the development of the steamship. The first seven of the vessels shown in our diagrams, therefore, are chosen from the records of the Cunard Company.

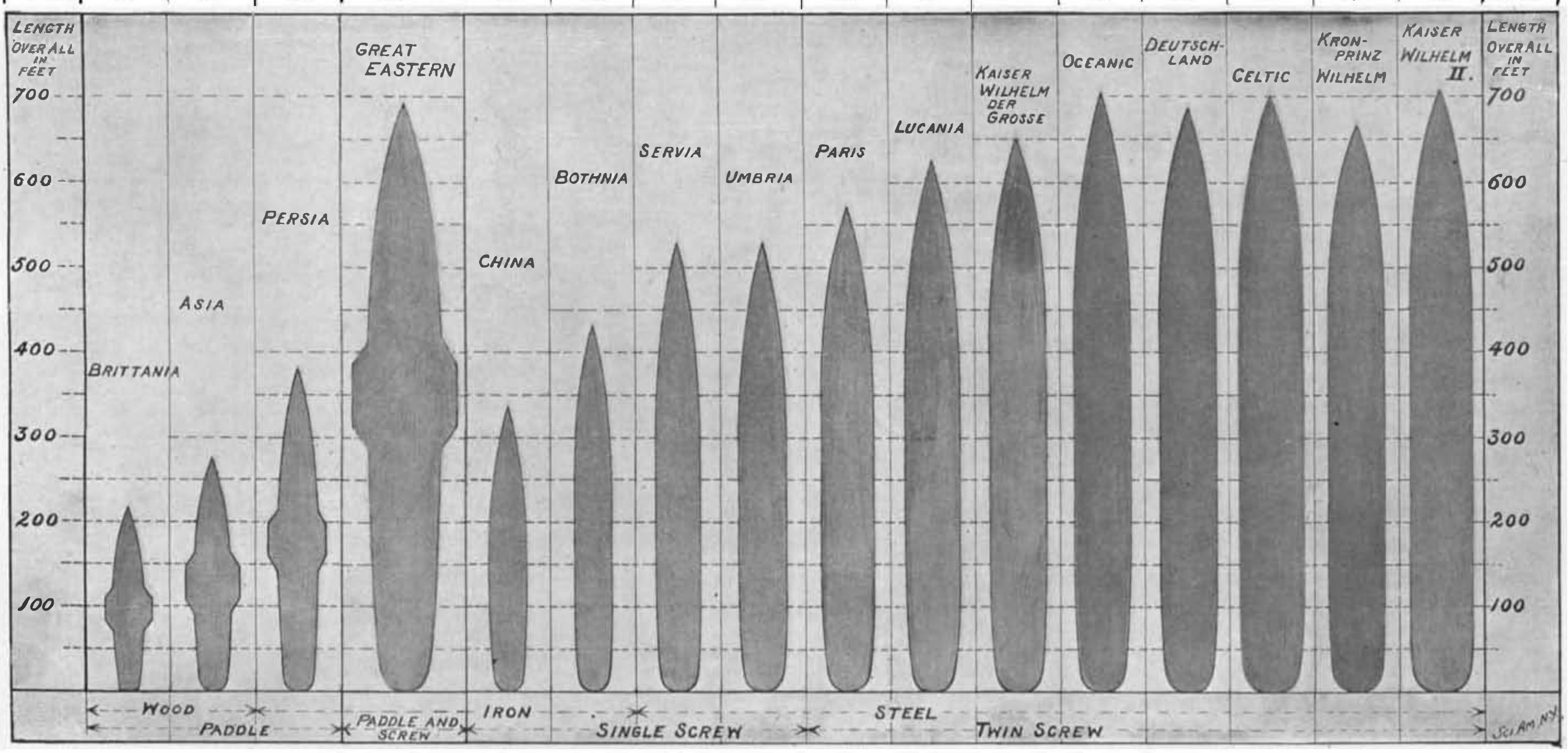
The "Umbria" was the last, largest and fastest of the single-screw vessels, and it was not until the "New York" and the "Paris" of the Inman and International Company were built, that the twin-screw steamer made its appearance on the transatlantic route. After this time the credit of producing the notable steamships of the world is jointly due to the Cunard Company, the White Star, and the two great German companies, the Hamburg-American and North German Lloyd.

The "Britannia," as we have said, was a wooden sidewheel steamer. Her length over all was 215 feet; her beam 34 feet 4 inches; her molded depth 24 feet 4 inches, and her displacement 1731 tons. Her engines of 740-horse power gave her an average sea speed of 8.5 knots an hour. She was one of four sister ships which were built under a seven years' contract with the government, by which the company was to provide four steamers and despatch one of them from Liverpool for Halifax and Boston on the 4th and 19th of every month from March to October, and on the 4th of each of the four winter months. For this they were to receive a subsidy of $400,000 per year. During the ten years from 1840 to 1850 the company added six additional wooden paddle-steamers to their fleet on the Atlantic and had a practical monopoly of the trade; but the formation of the United States Collins line introduced an element of fierce competition, to meet which two larger and faster boats, the "Asia" and the "Africa," were built. They were 275 feet long over all, 40 feet beam, 27 feet 2 inches molded depth and displaced 3,340 tons. With 2,400 horse power they maintained an average speed of 12.5 knots an hour across the Atlantic. Seven years previous to this the great Brunel had built the first iron steamship, "Britannia," and the success of this vessel induced the company to build their next mail ship, "Persia," of the same material. Launched in 1855, the "Persia" was a great advance in size and power on all previous vessels. She was 385 feet on deck, 45 feet 3 inches in beam, 31 feet 6 inches in molded depth, and her displacement was just under 5,000 tons. With 4,000 horse power she maintained an average speed for the whole passage of 13.8 knots an hour. The "Persia" and her sister ship, the "Scotia," were the last of the big sidewheelers.

We have introduced into our diagram a phenomenal vessel which, strictly speaking, should not have any place in the history of the development of the transatlantic mail steamer, for the reason that she was never run on any regular schedule under a government contract. We refer to the "Great Eastern," and she is shown in our diagram to emphasize the fact that she was fifty years ahead of her time and, in fact, anticipated in point of size such vessels as the modern "Oceanic" and "Celtic." The "Great Eastern" was a splendidly-built ship, and cost no less than $3,650,000. She was 692 feet long on deck; 118 feet broad over the paddle-boxes; her beam was 83 feet; her depth 58 feet, and her displacement about 28,000 tons on the draft on which she was ordinarily run, although on a draft of 30 feet she would have displaced 32,160 tons. She was driven both by paddle wheels and by screw propellers. Her paddle wheels were enormous affairs, 56 feet in diameter; they were driven by a pair of two-cylinder, oscillating engines of 14 feet stroke. The screw propeller was driven by horizontal engines, and the combined indicated horse power of all engines was 8,000. Her maiden trip was made from Southampton to New York, in 1860. The highest speed during the trip was 14½ knots an hour, and the longest day's run 333 miles. Although she was a failure commercially, she proved invaluable by successfully laying the first Atlantic cable in the year 1866. She laid two more Atlantic cables in 1873 and 1874, and finally, in 1888, she was sold and broken up at Liverpool.

For several years the Inman line, now the American line, had been using the screw in place of the paddle-wheel, with very satisfactory results, and consequently the next vessel built by the Cunard Company, the "China," was of the screw-propeller type. She was considerably smaller than the "Persia," as the dimensions show, and her speed was about the same. It was about this time that the compound engine with its higher steam pressure and superior economy began to make its appearance. Simultaneously came in that era of long and narrow ships which was destined to

| Date..... | 1840 | 1850 | 1855 | 1858 | 1862 | 1874 | 1881 | 1884 | 1889 | 1893 | 1897 | 1899 | 1900 | 1901 | 1901 | 1903 | Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length on Deck... | 215′ | 275 | 385′ | 692′ | 337′ | 435′ | 530′ | 525′ | 560′ | 620′ | 649′ | 705′ | 686′ | 700′ | 663′ | 707′ | Length on Deck. |
| Beam ... | 34′ 4″ | 40′ | 45′ 3″ | 83′ | 40′ 5½″ | 42′ 3″ | 52′ 3″ | 57′ 3″ | 63′ | 65′ 3′ | 66′ | 68′ | 67′ | 75′ | 66′ | 72′ | Beam. |
| Moulded Depth . | 24′ 4″ | 27′ 2″ | 31′ 6″ | 58′ | 29′ | 36′ | 40′ 9″ | 40′ | 42′ | 41′ 6″ | 43′ | 49′ | 44′ | 49′ | 43′ | 43′ | Moulded Depth. |
| Displacement in Tons | 1,731 | 3,340 | 4,950 | 28,000 | 3,808 | 6,834 | 11.088 | 12,190 | 15,000 | 19,425 | 21,000 | 32,500 | 23,500 | 37,700 | 21,300 | 27.000 | Displacement in Tons. |
| Indicated H. P... | 740 | 2,400 | 4,000 | 8,000 | 2,250 | 3,250 | 9,900 | 14,500 | 20,000 | 30,000 | 31,000 | 28,000 | 37,500 | 14,000 | 37,000 | 38,000* | Indicated H. P. |
| Speed in Knots. | 8.5 | 12.5 | 13.8 | 14.5 | 13.9 | 13.8 | 16.7 | 19.6 | 20.7 | 22.1 | 23.0 | 20.7 | 23.5 | 16.0 | 23.27 | 23.0* | Speed in Knots. |




* This is the contract horse power and speed; likely, as in the "Kronprinz Wilhelm," to be greatly exceeded when the ship is in service.

**GROWTH OF THE TRANSATLANTIC STEAMSHIP FROM 1840 TO 1903.**