DEVELOPMENT OF THE TRANSATLANTIC STEAMSHIP.

On July 4th of the present year it will be exactly sixty-nine years since a diminutive, wooden, side-wheel steamer, the "Britannia," smaller than many of the steam yachts of to-day, started from Liverpool for America. Fourteen days and eight hours later she steamed into Boston harbor. This little craft, 215 feet in length and capable of a sea speed of 8.5 knots, was the first steamer to sail under regular government contract for the conveyance of the transatlantic mails. In the accompanying diagram showing the growth in size and speed of the transatlantic steamship, we have commenced with the "Britannia," not because she was by any means the first steamship to cross the Atlantic (she had many predecessors) but because she was the first to do so on a regular schedule. During the following two decades, the development of the steamship was steady. The "Asia," 1850, was 275 feet in length, and had a speed of 12.5 knots; and the "Persia," an iron vessel built in 1855, was 385 feet in length with a speed of 13.8 knots.

Toward the close of the second decade of this development, that great engineer Brunel, whose ideas were always far in advance of the period in which he worked, designed a huge ship, 692 feet in length, 83 feet in beam, 58 feet in depth, and of 28,000 tons normal displacement, whose combined paddle-wheel and screw engines drove her at a maximum speed of 14.5 knots, and a sustained sea speed of about 12 knots.

Although commercially she was a failure, there being neither sufficient passenger nor freight traffic to keep her regularly employed at a profit, the later trend of shipbuilding has shown that Brunel was right, both theoretically and in his constructive methods. Now that the world's trade has developed sufficiently to warrant its construction, the big ship is found to be the most profitable. The greater the size of the ship, the less the cost of carrying a ton of freight a given distance. Moreover, in his construction, Brunel antedated our modern shipbuilders by using the cellular system of construction and steel decks. He was the first to introduce the longitudinal girder method, which, during the past few years, has been reintroduced by many naval architects with a view to securing a stronger construction and one better adapted to meet the stresses to which a ship is subjected in a seaway. About this time the advantages of the screw propeller as a means of propulsion were receiving increasing recognition, and the "China," built in 1862, is a good type vessel of that date. She was 337 feet in length, and maintained a sea speed of about 14 knots. From this time on, all transatlantic steamships were driven by single-screw propellers. There was a rapid increase in size and horse-power, until the maximum for single-screw ships was reached in 1884, when the twin ships "Umbria" and "Etruria" were launched. These vessels, 525 feet in length and 19.6 knots in speed, were provided with engines of 14,500 horse-power, which was developed on a single shaft.

The difficulty in securing reliable propeller-shaft forgings of sufficient size to carry the large horse-power of modern transatlantic liners, coupled with the many advantages secured by the use of twin screws, led to the construction of two vessels, the "City of Paris" and the "City of New York," which were provided with two triple-expansion engines, each driving a separate propeller. These vessels were not only the first of their type, but were unprecedented in size and in the richness of their appointments. They were 560 feet long, 63 feet broad, of 15,000 tons displacement, and their engines of 20,000 horse-power drove them across the Atlantic at a sustained sea speed of about 20.7 knots. They went into service in 1889.

The first vessel to cross the Atlantic at a speed of over 22 knots was the twin-screw ship "Lucania," 620 feet in length and of 19,425 tons displacement, whose engines of 30,000 horse-power enabled her to make a crossing from New York to Queenstown at a speed of 22.1 knots. She was placed in service in 1893.

The part played by the German companies in improving the transatlantic steamship record has been a brilliant one. The first ship to surpass the mark set by the "Lucania" was the "Kaiser Wilhelm der Grosse," 1897, of the North German Lloyd Line. This handsome vessel was the first to carry the four funnels which are now characteristic of fast ocean liners. She was 649 feet long, of 21,000 tons displacement, and her engines of 31,000 horse-power sufficed to carry her from Sandy Hook to Plymouth, under favorable conditions, at an average sea speed of 23 knots.

The first ocean steamship to exceed the "Great Eastern" in length was the "Oceanic" of the White Star Company, which made her appearance in 1899. She is 705 feet in length, 32,500 tons maximum displacement, and she has made the transatlantic voyage at a speed of 20.7 knots.

The first ship to take the record from the "Kaiser Wilhelm der Grosse" was the "Deutschland" of the Hamburg-American Line, which came out in the year 1900. She was remarkable for the great power of her engines, which, in the second year after her appearance, when indicating an average of 37,500 horse-power, earned for this ship the distinction of being the first to cross the Atlantic at an average speed of 23.5 knots.

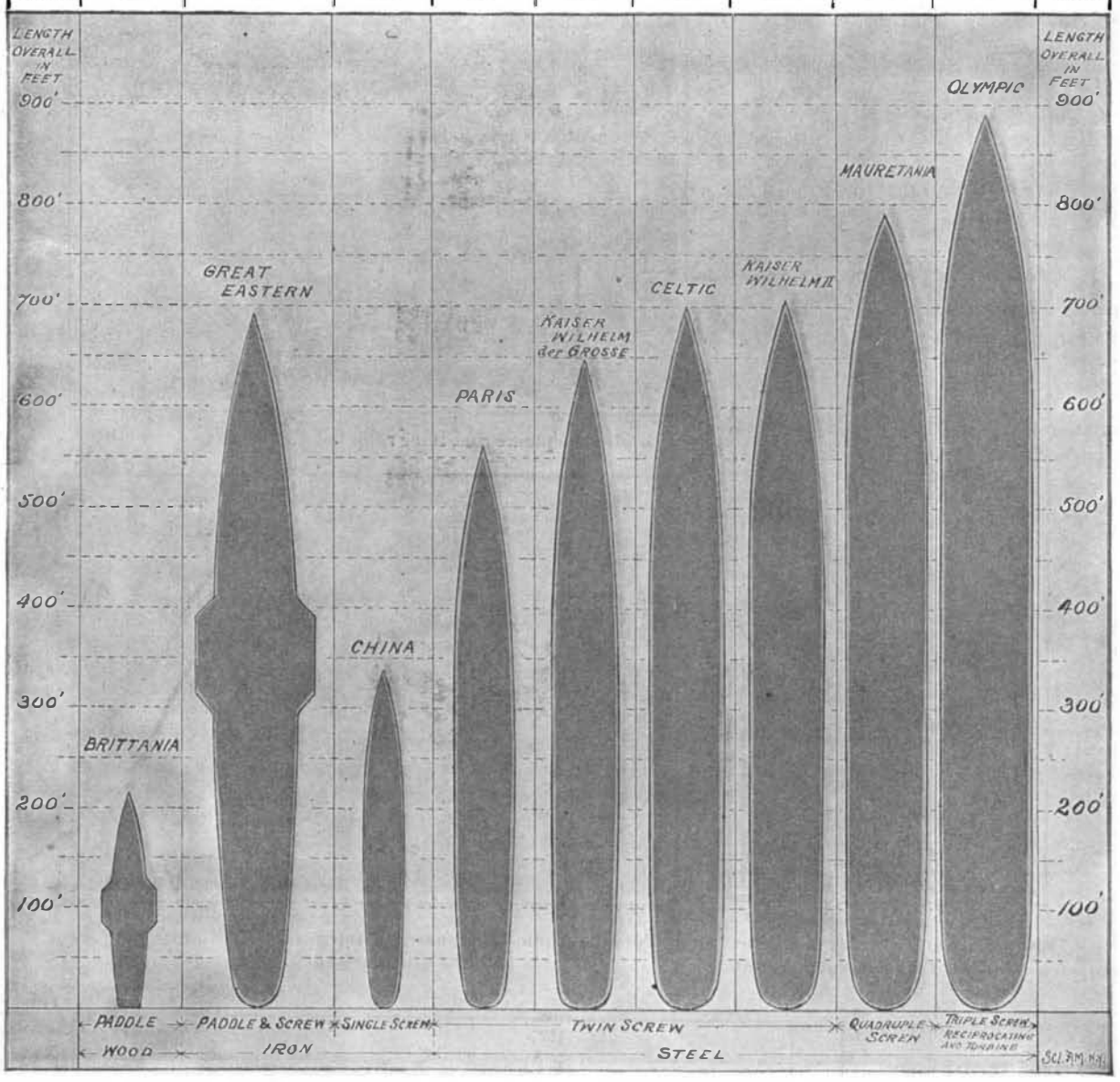
During these years, transatlantic passengers began to show in a very marked way their partiality for a new type of ship of moderate speed and of large cargo and passenger carrying capacity. A good type ship of this era is the "Celtic" (1901) of the White Star Line, a 16-knot vessel of 37,700 tons maximum displacement. In 1903 the North German Lloyd put in service a magnificent ship, the "Kaiser Wilhelm II," 706 feet in length, 72 feet in beam, which, in the early years of her service, crossed the Atlantic at a speed of slightly over 23½ knots.

During the period in which the twin-screw reciprocating engine was giving such fine service in the transatlantic flyers, the Hon. Charles Parsons in England had been steadily developing a new type of marine motor in the form of the steam turbine. As compared with the reciprocating engine, it had shown marked superiority, except in the matter of coal consumption at low speeds. It was lighter, more economical in coal consumption, and required less engineering staff, and its advantages were particularly manifest when the ship was driven at its highest sustained sea speed. When the Cunard Company determined to build two transatlantic ships of a size and speed far exceeding anything afloat, they decided to install the turbine engine and drive the ships at 24½ knots sustained sea speed with 68,000 horse-power developed on four shafts. The outcome of this was the appearance in 1907 of the "Lusitania" and "Mauretania." These vessels are 785 and 790 feet long, 88 feet beam, and at maximum draft displace 45,000 tons. Both ships have made passages at an average speed of over 25 knots, and at the present writing, the record is held by the "Mauretania," which has crossed to the eastward in four days, eighteen hours, and eleven minutes, at an average speed of 25.7 knots. It is expected that during the present summer, under favorable conditions of wind and weather, this ship will make the trip at an average speed of 26 knots.

When the great Cunard turbine boats made their appearance it was predicted that they marked the limit of dimensions, and that they would never be surpassed in size or speed. In speed they probably never will be surpassed, at least until some lighter and more economical form of motive power, such as the producer-gas engine, has been developed for high-speed transatlantic work. In size, however, they are destined to be greatly surpassed, as our front-page diagram shows, by the "Olympic," which is now under construction at Belfast for the White Star Company. Although this vessel will probably not be in service for two or three years, we are enabled by the courtesy of the company to present the accompanying outward profile, or side view, and cross section, which have been furnished from Harland & Wolff, the builders. These truly enormous vessels (the sister ship will be named "Titanic") will be 890 feet in length, 92 feet in beam, and 64 feet in molded depth. The extreme height of the ship from keel to roof of pilot house will be 105 feet. In general appearance the "Olympic" will not be unlike the "Mauretania." She will have four elliptical funnels, each 28 feet in diameter. Her freeboard will be somewhat greater, being about 52 feet at the bow, 45 feet to the level of the main deck, 62 feet to the boat deck amidships, and 42 feet at the stern. A striking novelty will be the provision of a single pole mast forward of the bridge. At 35 feet draft the roof of the pilot house will be 70 feet above the water.

No attempt will be made to emulate the speed of the famous Cunarders, the 45,000 horse-power engines

Date.....	1840	1858	1862	1889	1897	1901	1903	1907	1911	Date.
Length on Deck.	215 ft.	692 ft.	337 ft.	560 ft.	649 ft.	700 ft.	706 ft.	790 ft.	890 ft.	Length on Deck.
Beam ...	34 ft. 4 in.	83 ft.	40 ft. 5½ in.	63 ft.	66 ft.	75 ft.	72 ft.	88 ft.	92 ft.	Beam.
Molded Depth...	24 ft. 4 in.	58 ft.	29 ft.	42 ft.	43 ft.	49 ft.	43 ft.	60 ft.	64 ft.	Molded Depth.
Displacement in Tons...	1,731	28,000	3,808	15,000	21,000	37,700	27,000	45,000	60,000	Displacement in Tons.
Indicated H. P.	740	8,000	2,250	20,000	31,000	14,000	40,000	70,000	*45,000	Indicated H. P.
Speed in Knots...	8.5	14.5	13.9	20.7	23.0	16.0	23.5	25.70	*21	Speed in Knots.



* This is the contract horse-power and speed.

GROWTH OF THE TRANSATLANTIC STEAMSHIP FROM 1840 TO 1911.

SCIENTIFIC AMERICAN

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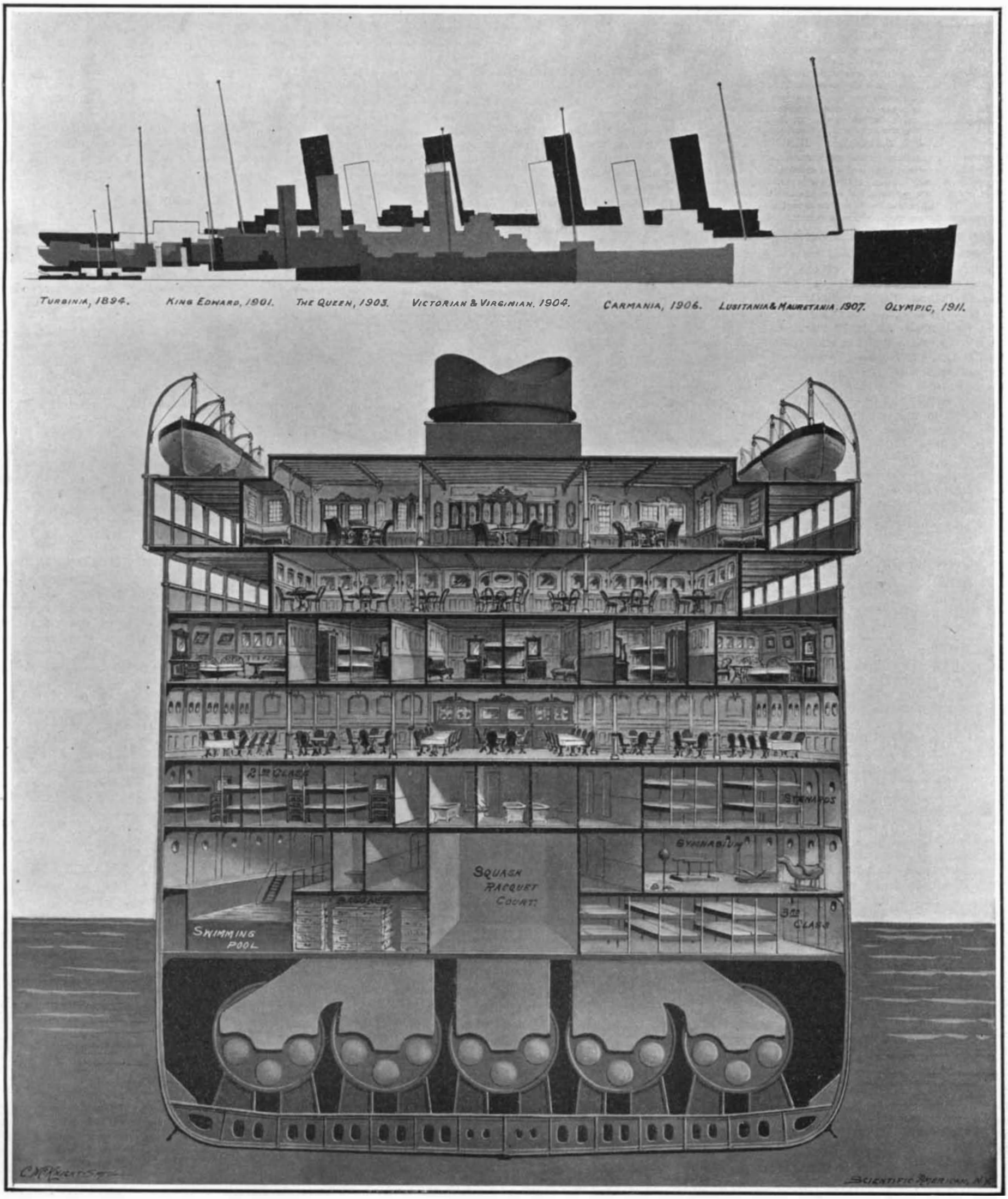

Length over all, 890 feet. **Beam,** 92 feet. **Plated depth,** 64 feet. **Displacement** at 37½ feet draft, 60,000 tons. **Horse-power,** 45,000. **Speed,** 21 knots.

Midship section of White Star liner "Olympic."

DEVELOPMENT OF THE TURBINE STEAMSHIP.—[See page 458.]

being sufficient, calling for 21 knots sea speed. To secure this, the ship will be provided with combined reciprocating and turbine engines, consisting of two reciprocating engines driving the wing propellers, which will exhaust into a low-pressure turbine driving the center propeller. In point of displacement the "Olympic" will greatly exceed the "Mauretania." Her speed being so much less, it is not necessary to give the hull such fine lines, and therefore her model will "fill the block," as the naval architects say, more fully. On her maximum draft of 37½ feet she will displace about 60,000 tons, as against a displacement of 45,000 tons on the same draft for the "Mauretania."

The Indianapolis Balloon Races.

Nine balloons were cast loose on June 5th at Indianapolis, and sailed off due south, six of them competing in the National Distance Race for the trophy of the Aero Club of America, and three for the cup offered by the Indianapolis Aero Club to the pilot and his aid who remained aloft longest.

The entries in the Indiana endurance race were the following: Dr. H. W. Thompson and W. E. Mast in the balloon "Ohio"; Dr. G. Link and J. R. Irwin in the balloon "Indianapolis"; and C. A. Coey and John Bennett in the balloon "Chicago." The endurance race was won by the "Indianapolis," which remained in the air 22 hours. The "Chicago" was second, and the "Ohio" third. The "Chicago" landed at Scottsville, Ky., and the "Ohio" within 40 miles of the starting point and within two hours after having started. The record for endurance is held by Alfred le Blanc of France, who remained in the air 44 hours in the International Race from St. Louis, October 21st, 1907, for the James Gordon Bennett Cup. Hence this year's showing is by no means remarkable.

The National Race was won by John Berry and John McCullough, of St. Louis, in the "University City," the distance covered being 380 miles. Next came the "New York," 357 miles; the "St. Louis," 321 miles; the "Indiana," 264 miles; and the "Hoosier," 234 miles. The course taken by all the balloons was almost directly south. There was a narrow belt of calm air 30 miles wide. The contestants who became entrapped in this belt lost the race. Indeed, Baldwin and Walsh in the "Hoosier" said that for a long time they stood practically still in the air, and that they could see the shadow of their balloon motionless on the field far below them. The individual experiences of the balloons are as follows:

The "New York."—The "New York," manned by A. Holland Forbes and Clifford B. Harmon, made its long flight as a result of going to a high altitude—about 3 miles—and taking advantage of a north wind that was blowing there. The balloon sailed in an almost direct southerly course from Indianapolis until it nearly reached Linton, Ala., where it was caught by a wind from the east and sailed west to Guin, Ala., and thence in a northwesterly course to Corinth, Miss. (357 miles), where a landing was made, since the balloon was again traveling northward and shortening its distance from Indianapolis. Only about half the ballast was used. The balloon was in the air 25 hours and 10 minutes. Mr. Forbes suffered considerably from the heat during his sky voyage. His face was blistered. The heat which marked the first hundred miles from Indianapolis gave way to extreme cold as higher altitudes were reached. Eventually, both balloonists were obliged to wrap themselves in heavy blankets. Eighty miles north of Birmingham, Ala., the balloon was fired upon by a farmer, a wanton act that certainly should be punished.

The record made by the "University City" falls far below the distance record held by Oscar Erbsloeh of Germany, which was made in the James Gordon Bennett Cup race of October 21st, 1907, the distance covered being 852 miles.

The "University City."—The "University City," with John Berry and P. J. McCullough on board, landed six miles southeast of Fort Payne, Ala. About 380 miles were covered without particular incident. Chattanooga was passed at an altitude of about 10,000 feet, at which height the temperature was 39 degrees. In the neighborhood of Fort Payne the current was lost. In an effort to regain the upper current several sacks of sand were thrown overboard. Three hours were thus lost in a vain attempt to reach a favorable layer of air. Realizing that further effort would be fruitless, a landing was effected southeast of Fort Payne. This balloon was an old one, and it attracted very little attention at the start. The "New York," on the other hand, is a new balloon built by Capt. Baldwin.

The "St. Louis."—The "St. Louis," manned by A. R. Lambert and N. E. Honeywell, landed at Blanche, Tenn., after covering 321 miles. No detailed account of its experiences is at present available.

The "Hoosier."—The "Hoosier," manned by Capt. Baldwin and Charles Walsh, landed at Green Brier, Tenn. The balloonists were caught in the 30-mile strip of comparatively calm air to which reference has already been made, and tried hard to find a favorable current. They frequently dropped low in the hope of catching a breeze. Finally their anchor caught in a tree, and as they were unable to free themselves in the 15 minutes allowed, they landed.

The "Indianapolis."—The balloon "Indianapolis," manned by Dr. G. Link and J. R. Brown, won the endurance race, landing at Westmoreland, Tenn. Dr. Link maintains that he could have remained longer in the air, but, knowing that the "Ohio" had come down soon after the start, and seeing the "Chicago" descend near the Kentucky-Tennessee line, he felt no incentive to remain any longer in the air, particularly since it would have been impossible for the "Indianapolis" to have made a record against the starters in the National Race. As in the case of the other contestants, much suffering was caused by the intense heat.

The "Chicago."—The "Chicago," manned by C. A. Coey and John Bennett, landed at Scottsville, Ky. The "Chicago" was by far the largest balloon that took part in the contest. When inflated the balloon measures 67 feet in diameter, so that its circumference is more than 200 feet. It requires 120,000 cubic feet of gas to inflate the bag fully. The balloon has a flight of more than 500 miles to its credit under favorable circumstances.

The "Cleveland."—The balloon "Cleveland," piloted by A. H. Morgan and J. H. Wade, Jr., came down at the beginning of the race because of a leak. It was overhauled by Leo Stevens, who discovered that the balloon cloth had been ripped. Mr. Morgan and Mr. Wade knew that the balloon leaked and attributed the leakage to faulty stitching.

The "Indiana."—C. G. Fisher and G. L. Bumbaugh, who manned the balloon "Indiana," disqualified themselves because they touched earth twice before they made their final landing at Dickson, Tenn. Their water was unfit to drink and in a temperature of 110 degrees they preferred to quench their thirst to winning the race. Hence they descended. Had not the "Indiana" disqualified herself by touching earth she would have broken the American endurance record, which, as before stated, is 44 hours. Mr. Fisher also reports an experience similar to that of Mr. Forbes. A number of farmers began firing upon the balloon in Brown County, Ind., and the balloon had to run a regular gauntlet of guns down to Tennessee.

The "Ohio."—The "Ohio," manned by Dr. H. W. Thompson and W. E. Mast, landed 35 miles from Nashville because of lack of ballast. The trip seems to have been uneventful.

Taken as a whole, both balloon races were not particularly exciting and produced no new records. Four of the nine contestants landed inside of the first eighteen hours. Perhaps this indifferent showing may be largely attributed to the quality of gas at Indianapolis. Indeed, some of the pilots have not hesitated to declare that their early landings were due entirely to poor gas.

The Current Supplement.

The current SUPPLEMENT, No. 1746, opens with an article by Day Allen Willey on a new type of Great-Lakes ore steamer. Dr. A. Wagner writes on the greatest altitudes attained by unmanned sounding balloons. Prof. Edgar L. Larkin shows the impossibility of signaling to Mars. E. S. Frash contributes an excellent discussion on testing gas engines and motors. In an article entitled "A New System of Wireless Telegraphy," Count Arco describes the new Telefunken system, which is a compromise between the spark and the arc systems. Glass building bricks is the subject of an article which will probably interest engineers and architects. S. Leonard Bastin contributes an excellent copiously illustrated popular essay on giant leaves. Prof. F. R. Moulton writes on possible changes in the form and dimensions of the sun. Interesting researches concerning the action of bodies on a photographic plate in the dark have been carried on by Dr. William J. Russell, F.R.S., with metals, woods, juices of plants, etc., most of them showing the curious property of acting on a sensitized plate in the absence of light. These experiments are described by the English Correspondent of the SCIENTIFIC AMERICAN. The new science of metallography, which may be briefly described as microscopy applied to the study of metals, is discussed by Walter Rosenhain. The usual engineering notes, electrical notes, and trade notes and formulæ will be found in their accustomed places.

Saponification under pressure can be effected very rapidly and there are other theoretical arguments in its favor, but the process is hardly practicable in commercial soapmaking. As much soap can be made in a large open vessel as in a smaller closed autoclave, in the same time and at a much smaller cost. As satisfactory results are currently obtained by open-air saponification with alkaline carbonates, there appears to be no advantage in the introduction of saponification under pressure, especially as the high temperature employed in that process (300 to 320 deg. F.) may injuriously affect the color of the soap.

The Ocean Motor-Boat Race to Bermuda.

With twice the number of entries that have appeared in previous years, the third annual motor-boat race to Bermuda started on June 5th from Gravesend Bay. The voyage was about 670 nautical, or 771 statute miles in length. Four motor boats started, namely, the "Heather" (58.44 feet, 44.32 horse-power), the "Insep" (58.6 feet, 41.23 horse-power), the "Ilys" (50.21 feet, 30.58 horse-power) and "Nereides II" (55.8 feet, 32.92 horse-power). The "Heather" allowed the "Insep" 32m. 59s., the "Ilys" 4h. 15m. 53s., and the "Nereides II" 7h. 23m. 24s. The boats are all trunk cabin cruisers. The "Nereides'" gasoline capacity is but 425 gallons, for which reason two extra tanks were carried along to make up the necessary 700 gallons.

The race was won by the "Heather," the largest and most powerful of the four. The "Ilys" and "Nereides" met with mishaps, which prevented them from making a better showing. The "Nereides" had been launched only a week before the start, and was in such poor condition that she should not have been allowed to start. Her extra tank of gasoline, placed high above the water, did not improve her stability. Even with this extra supply of fuel, she could not finish the race under power. Her captain, Walter Bieling, tried to repair the faulty carbureter of the "Nereides" while the motor was running, fearing that he would lose time if he stopped it. The result was that he succumbed to the gasoline fumes, and was revived only after some difficulty. Near the finish the boat was almost driven on the reefs off St. David's Head by the gale blowing from the sea. In spite of all these accidents and the unfitness of the boat, the "Nereides" would probably have beaten the "Heather" if she had not been compelled to set sail in order to cross the line. She was beaten by 3 hours only if her time allowance is considered.

The "Ilys" made the voyage in exactly four days. At the start of the voyage the connecting rod of her forward cylinder was broken, due to carelessness. Repairs were made, and the boat finished the race running on three cylinders, thereby reducing her speed from 9 to 6 knots. Her actual loss of time was about 6 hours.

The time of the winning boat, "Heather," was 80 hours, 56 minutes, 18 seconds, which corresponds to an average speed of 8.2 knots or 9.75 statute miles. She was the only craft to make the trip without considerable delays, while all of them encountered heavy seas the entire distance. Her time, however, was beaten by 15 hours 17 minutes and 5 hours 54 minutes by the two competitors, "Ailsa Craig" and "Idaho," in the 1907 race, and 14 hours 24 minutes by the "Ailsa Craig" last year. The "Nereides II" was 91 hours 10 minutes making the trip, and the "Ilys" and "Insep" 96:6 and 97:25 respectively. The "Heather" has a 4-cylinder 6 x 8 Standard motor and a 3-bladed, 32-inch diameter, 42-inch pitch wheel; "Insep," a sister craft, a 6-cylinder 6¼ x 8 Jager motor and 3-bladed 38x38 propeller; "Nereides II" a 4-cylinder 6½ x 8 Sterling engine and 3-bladed 35 x 40 propeller, and "Ilys" a 5½ x 6¼ 4-cylinder Hall motor and a 24 x 26 3-bladed wheel. All the engines are of the 4-cycle type. That of the "Ilys" was fitted with a Warner magnetic tachometer indicating the number of revolutions per minute, while this boat also had a Nicholson ship log to measure her speed.

The doubling of the entries this year shows a decided increase in interest in this, the only long-distance ocean race for cruisers; and, although the time was not bettered, decided improvement was shown in the reliability and comfort of these practical sea-going craft.

Presentation of the Aero Club Medals to the Wright Brothers.

The two $1,000 gold medals voted to Orville and Wilbur Wright by the Aero Club of America the first of the year, were presented to them by President Taft in the White House on June 10th. The President expressed his appreciation of their achievements, and gave them due honor for having solved the problem of flight. He made a humorous allusion to his size, saying that although he was apparently not a man of the flying type, he nevertheless had a keen interest in the subject. Miss Katharine Wright was present, and was also honored by the President for the aid and encouragement she had given her brothers in their years of experiment. The medals voted by Congress have just been completed. They are said to be the handsomest medals ever given by Congress. President Taft expects to present these medals during the celebration at Dayton in honor of the Wrights this week. The Aero Club medals were reproduced in our issue of March 27th, 1909. The brothers are busily engaged in getting ready their government aeroplane for the tests at Fort Myer, near Washington, which must be completed before June 28th. A. M. Herring also expects to test his government aeroplane at the same time. This new machine is similar to the Curtiss aeroplane shown on page 460, but it is said to be even smaller and lighter.