SPEED TRIALS OF THE BATTLESHIP "VERMONT."

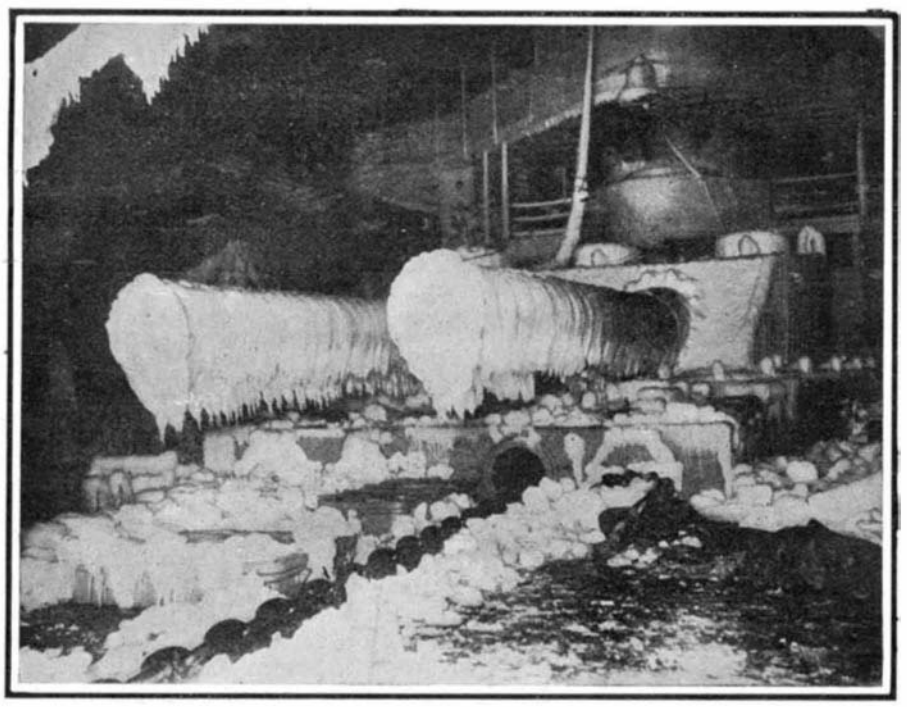
There was a time, and not many years ago, when the speed trials of a first-class United States battleship figured in large type in the headlines of the daily press, and awakened an interest which was felt to the remotest corners of the United States. That, however, was in the early days of the reconstruction of our navy, when the putting of a new warship to the test was an event of rare occurrence. Now these speed trials come at such frequently recurring intervals, that they have lost their novelty, and to some extent, their interest.

This acceptance of the success of our warship trials as a foregone conclusion, and the lack of the one-time interest in the trials, afford the best evidence both of the rapidity with which our navy has been built up, and of the excellent work which is being done in our shipbuilding yards. During the past year cruisers and battleships which are the peers of any afloat have passed successfully through their trials in rapid succession, and with a wonderful uniformity of success. The latest of these is the battleship "Vermont," one of the ships of the improved "Connecticut" class, which embodies some improvements in armor distribution and in less important details over the type vessel. Including the "Louisiana" and "Connecticut," the United States navy has, at present, six powerful battleships of the "Connecticut" type under construction or completed, namely, the "Connecticut," "Louisiana," "Kansas," "Minnesota," "New Hampshire," and "Vermont," all of 16,000 tons displacement and 18 knots speed. These vessels will form a homogeneous squadron, identical in speed, power, radius of action, and maneuvering qualities, which it would be difficult to match in any of the world's navies—always excepting the battleships of the new type carrying only the 12-inch gun as their main armament.

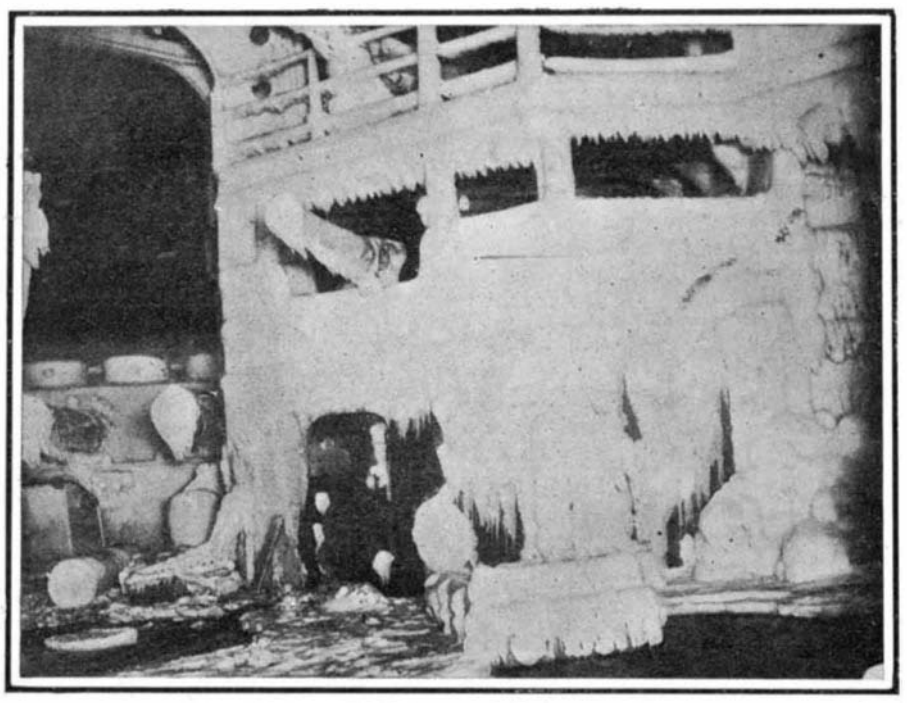
The "Vermont," which is being constructed by the Fore River Shipbuilding Company, of Quincy, Mass., is 450 feet long between perpendiculars, 76 feet 10 inches broad, and draws at mean draft 24 feet 6 inches. Her designed speed, which was exceeded on the trials, is 18 knots an hour with 16,500 horse-power; her coal supply is large, the total bunker capacity being 2,200 tons. The armor protection consists of a continuous water-line belt of an even thickness through its vertical section, which has a maximum thickness of 9 inches amidships and tapers gradually toward the bow and the stern. Associated with this belt, and sloping at the sides to meet its lower edge, is a protective deck which is 1½ inches thick on the flat amidships, 3 inches on the slopes, and 3 inches in thickness forward and aft of the main barbettes. Above the main belt is a wall of side armor, 7 inches in thickness, which extends between the main 12-inch barbettes, and reaches vertically from the top of the main belt to the level of the upper deck. The main belt and the 7-inch side armor are associated with transverse bulkheads extending from the side of the ship to a connection with the barbettes. There is a conning tower with 9 inches of armor forward, and a secondary conning tower aft protected with 5 inches of armor.

The armament is numerous and very powerful. It consists of four 45-caliber, 12-inch guns carried in two turrets, forward and aft, the barbettes being protected with 10 inches, and the turrets with 12 inches of armor. On each beam there are mounted two turrets, each containing two 8-inch 45-caliber guns, the barbettes being protected with armor from 4 to 6 inches in thickness, and the turrets with armor 6½ inches in thickness. The central casemate battery, with its protection of 7 inches of armor, is pierced by twelve casemates, in each of which is mounted a 7-inch, 50-caliber rifle. On the main, upper, and superstructure decks are mounted twenty 14-pounder, 3-inch guns, for repelling torpedo attacks. The armament also includes twelve 3-pounders, four 1-pounders, four machine guns, and two 3-inch field guns. There are also four submerged torpedo tubes for firing the new and very powerful and fast 21-inch torpedo. The "Vermont" has been fitted as a flagship, and she has accommodations for 916 officers and men.

The standardization trials of the "Vermont" took place on December 5; her four-hour full-speed trial on December 7; and this was followed by her twenty-four-hour trial, which ended December 8. On the four-hour run the highest speed recorded was 18.58 knots for 119.013 revolutions per minute, and the average for the four hours was 18.33 knots for 117.12 revolutions per minute. This performance is particularly creditable because of the fact that it was made under adverse conditions of strong wind and bitterly cold weather. Particularly fine was the twenty-four-hour endurance run. The contract called for 13,200 horse-power to be developed by the engines on this run, without any limitations as to speed. The conditions met with were those of "extreme cold, thick snowstorm, and a heavy gale of wind." Nevertheless, the horse-power developed by the main engines during

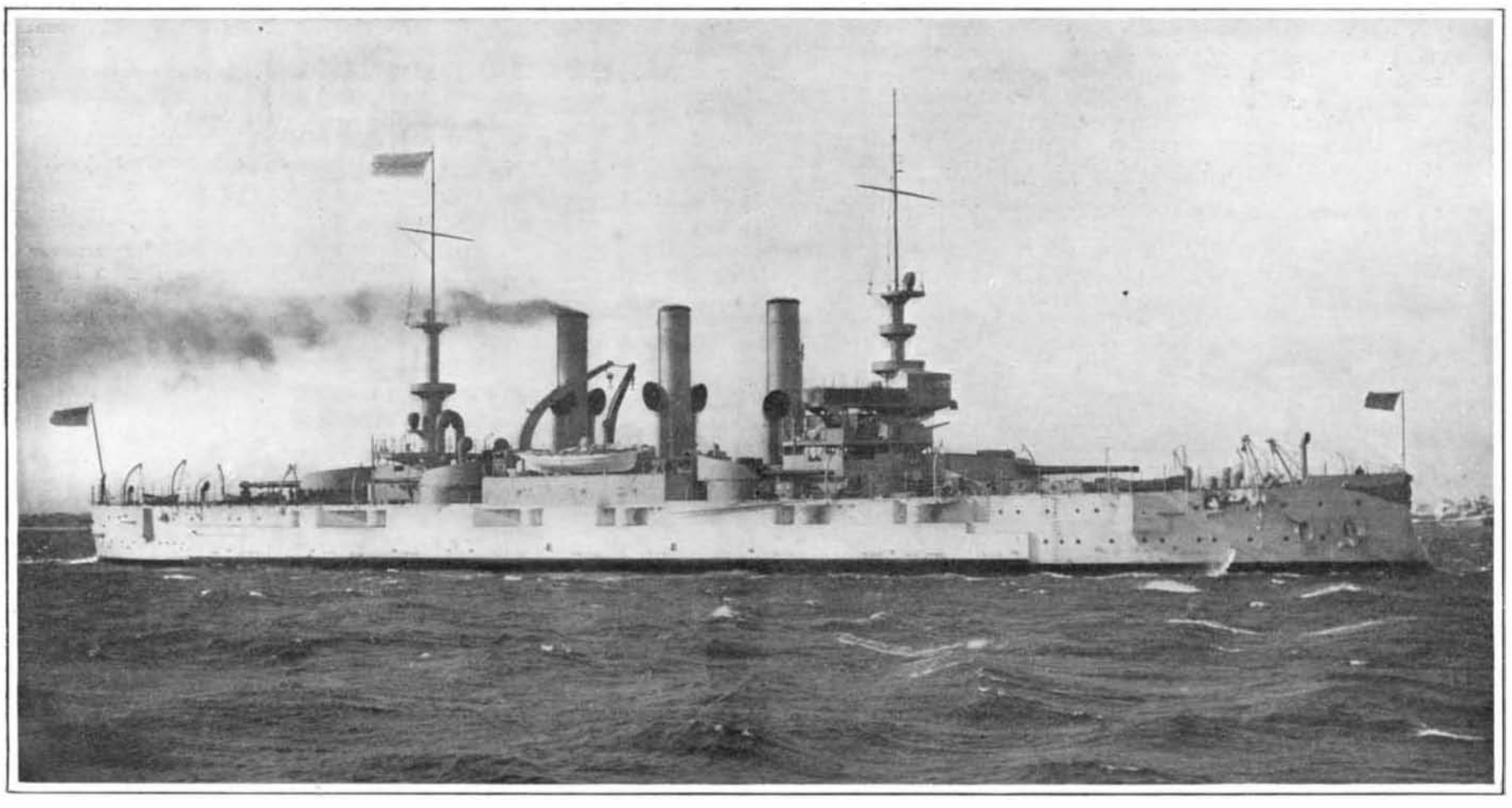


Forward 12-Inch Guns and Turret of Battleship "Vermont" at Close of Trial in Snowstorm.



Ice on Forward Bridges and Superstructure.

By courtesy of the Boston Herald.



THE 16,000-TON BATTLESHIP "VERMONT," WHICH RECENTLY AVERAGED 17.43 KNOTS ON A 24-HOUR RUN IN A BLINDING SNOWSTORM AND STRONG GALE.

the run was approximately 14,500, or 1,300 in excess of the contract, and the average speed was 17.43 knots. The heavy spray thrown up over the bows during this run froze upon the forecastle deck and the bridge, with the result that, when the ship returned to the harbor, she presented the extraordinary appearance shown in the accompanying engravings, for which we are indebted to the courtesy of the Boston Sunday Herald.

REVIEW OF THE YEAR 1906.

(*Continued from page 5.*)

power consists of two 85-horse-power motors driving four propellers, two on each side of the ship. Another new dirigible is the latest French airship "La Patrie," 33¼ feet in diameter by 196 feet long, and driven by a 70-horse-power motor, which is credited with a speed of 30 miles an hour. This airship was built by the Lebaudy brothers for the use of the French government on the same general lines as the "Lebaudy" airship. The most successful trip occurred on November 26, when the airship sailed for two hours and twelve minutes, and covered a distance of 57¾ miles. A trifle larger than the "Lebaudy" airship is the new machine of M. Henry Deutsch, known as the "Ville de Paris." It is 196.85 feet long, 35.43 feet in diameter, and is driven by a 70-horse-power Panhard motor. Although the dirigible airship has received the most attention, the European inventors have done some meritorious work with aeroplanes, and mention should be made of those of Bleriot and of Santos Dumont. The latter, which is built on the lines of the Wright brothers' machine, recently managed to rise above the ground for a brief flight of a few hundred feet. The balloonists have been exceedingly active during the year, and world-wide interest was aroused by the great international race for the Bennett cup, when sixteen balloons, representing seven different nations, started from Paris and met with varying fortune. Seven of the machines crossed the English Channel and landed in England, the greatest distance, 402 miles, being covered by the American contestant Lieut. Lahm, who landed near Whitby, in Yorkshire. This distance was exceeded later in the year by an independent trip, not in a contest, made by Mr. Leslie Bucknall, an English aeronaut, who, starting from London, landed at Vevay, on Lake Leman, after covering 472 miles, the trip being remarkable alike for the distance covered and the high speed. With a view to stimulating the development of the aeroplane, the London Daily Mail recently offered a prize of $50,000 to any one who will travel by aeroplane from London to Manchester in one day. This was followed by an offer of the London Daily Graphic of $5,000 to the inventor who should fly with one or more passengers between two given points not less than one mile apart. Other prizes offered in England bring the total up to about $70,000. In the United States the Aero Club of America has offered a $1,500 prize for a balloon race at the Jamestown Exposition.

AUTOMOBILES AND MOTOR BOATS.

That the automobile industry has settled down to certain fixed types, and that improvement is to be looked for, from now on, more particularly in details, is proved by the fact that in any review of the year's work it becomes increasingly difficult to find any novelties of a radical and far-reaching character. This was evident at the seventh annual show of the Automobile Club of America, in which it was evident that the makers had approximated so closely one type and standard of excellence that a visitor failed to observe those broad points of difference between the machines which formerly lent a stirring interest to the technical review of these annual shows. The gasoline motor still reigns supreme. While the makers of steam and electrical machines are turning out a product of the highest excellence, these types give no signs of ever again becoming serious competitors of the automobiles driven by internal-combustion engines. The electric motor promises to find its most successful field of work in the propulsion of heavy motor trucks and delivery wagons, of which some splendid specimens were shown at the late exhibition.

The public interest in competitions both of speed and endurance remains unabated. At the Ormonde-Daytona meet, held early in the year, new world's records were made in almost every event. The most sensational feat was that of the Stanley steam racer, which covered the mile on the smooth sands of the beach in 28 1-5 seconds at a speed of 127.65 miles an hour. The 200-horse-power Darracq racer won the 2-mile race, covering the distance in 58 4-5 seconds at a speed of 122.46 miles an hour, which is the fastest speed ever made by a gasoline automobile. The 100-horse-power Napier racer secured the 100-mile record of 1 hour, 15 minutes, 40 2-5 seconds, at a rate of speed of 79.28 miles an hour. Later in the year occurred the Automobile Club of America's 2-gallon fuel efficiency contest, which was won by a four-cylinder, air-cooled Franklin runabout, which covered a distance of 87 miles at a fuel expense of 0.613 cent per ton-mile. The 24-horse-power air-cooled Frayer-Miller car covered 47.9 miles at the phenomenally low cost for fuel of 0.517 cent per ton mile. Toward the close of the year the annual Vanderbilt cup contest was run off with its usual brilliant success, although, as usual, the honors went to the foreign machines. The race was won by a 100-horse-power Darracq, driven by Wagner, who covered the 297.1 miles of the course at an average speed of 61.43 miles an hour, the second place being taken by a 120-horse-power Fiat driven by Lancia, whose average speed was 60.84 miles an hour. The failure of the American cars was attributed almost entirely to the failure of the non-skid tires with which all the contestants had to be equipped, because of the rather greasy condition of the track. The best of the American machines, notably the Locomobile and the Thomas, seemed to have plenty of speed; but they were so severely handicapped with tire troubles as to have no chance at taking a leading place. That they possessed the speed is evidenced by the fact that the fastest round of the course made by any contestant was credited to the 110-horse-power Locomobile, which covered the distance in 26 minutes and 21 seconds. That these races exert a beneficial effect upon the interests of automobiling in more ways than one is shown by the fact that as the result of the last Vanderbilt cup contest a 60-mile special automobile highway, on which the future contests will be held, is being built on Long Island for the exclusive use of automobiles. Other highways of the same kind are proposed, and it may prove that this venture marks the first of a system of such roads, which may ultimately cover the country.

It begins to look as though the application of the internal combustion motor to boat and ship propulsion will, in the future, find its most successful field not in flimsy high-speed racing craft, but in staunch, serviceable, sea-going launches and cruisers, and ultimately in the propulsion of various types of merchant craft. The record for racing craft still remains at the speed of 30¾ miles an hour at which it was placed by the French motor boat "Antoinette" in the year 1905. An interesting development of the racing craft is that of the hydroplane type, several of which have been illustrated from time to time in the columns of the Scientific American. In this type an effort is made to lift the boat clear, or partially clear, of the water and drive it along on a series of slightly inclined planes. A vessel of this type was recently tried on western waters, and two others in France, the latest type being that of Levavasseur, which consists of a front boat holding the motor, to which is attached a light wooden frame for carrying a long tail at the rear end of which is the propeller. The gasoline motor has been applied successfully to a torpedo boat by the Messrs. Yarrow in London, who produced a little vessel weighing only 8 tons which has shown a maximum speed of 26 knots an hour and has a radius of action, when carrying one ton of oil, of about 300 miles. This vessel has been purchased by the British Admiralty, and is likely to become the pioneer of a new and very useful type of torpedo craft. The producer-gas engine, also, is making progress in its application to the propulsion of vessels. The Thornycroft Company have recently constructed a vessel which is driven by a producer-gas engine of 500 horse-power, while the Otto Gas Engine Company have already fitted their producer-gas engines to a dozen or more vessels, the power ranging from 35 to 90 horse-power. The latest success of this company was realized with a flat-bottomed barge of 240 tons, which is driven by a four-cylinder, 100-horse-power engine. The vessel has proved to be highly economical in operation, as will be seen by the fact that during a single year 5,200 tons of freight were carried, representing nearly 2,000,000 ton-miles at a cost of about one-fourth of a cent per ton.

MERCHANT MARINE.

The most significant event of the year in the merchant marine has been the steady advance in the performance and popularity of the steam turbine, as a drive for ships of all types, sizes and speeds. It is true that in proportion to the number of ships afloat or even of those building, the number of turbine-driven vessels is, as yet, very small; but the uniformly excellent results obtained with the latest and most improved forms of marine turbines point with increasing emphasis to this as the ultimate type of engine for all vessels, unless we except the tramp steamers of large capacity and low speed. The year has witnessed the launch of the two Cunarders, the weight of each vessel as she went down the ways being over 16,000 tons. These ships, 786 feet long, 88 feet broad, 60 feet deep, and of 45,000 tons displacement, are considerably the largest afloat. Their contract speed is 25¼ knots on trial; their contract horse-power 68,000. The "Lusitania" will make her maiden voyage to this port in the summer and the "Mauretania" in the late autumn of 1907. Outside of these vessels and a sister ship to the "Kaiser Wilhelm II." being built for the North German Lloyd Company, all of the new transatlantic liners, now under construction, belong to the large, moderate-speed, freight-and-passenger type, represented by the "Kaiserin Auguste Victoria," of the Hamburg-American Line, which made her maiden voyage to this port during the year, and the new "Adriatic," of the White Star Line. A vessel which excited considerable comment on her appearance at this port, was the great auxiliary clipper "R. C. Rickmers," which has the distinction of being the largest sailing ship afloat, her length being 441 feet, and her displacement 11,360 tons. She is equipped with an auxiliary steam engine of 750 in icated horse-power. Under steam she can make from 6 to 8 knots an hour, and under sail she has made 16 knots. Shipping interests in the United States are in a bad way, at least as far as the deep-sea carrying trade is concerned. Shipbuilding on the Great Lakes is, as usual, in a wonderfully prosperous condition; and for the coastwise trade, several excellent vessels, some of them turbine-driven, have been built or are under contract. The only salvation of our deep-sea shipping will be the passage of the Shipping Bill, of which, thanks to the assistance of the President, there seems to be at last some real grounds for hope.

Meeting of the American Association for the Advancement of Science.

The Fifty-seventh Meeting of the American Association for the Advancement of Science was opened at Columbia University with a very large attendance at 10 A. M. on Thursday, December 27, by the retiring president, Dr. C. M. Woodward, who introduced to the Association the new president, Dr. W. H. Welch. An address of welcome was made by Dr. Nicholas Murray Butler, president of Columbia University, which Dr. Welch followed with a reply. At the adjournment of the general session, the various sections met at their respective meeting places. Interesting papers were read in the departments of Mathematics and Astronomy, Physics, Chemistry, Mechanical Science and Engineering, Geology and Geography, Zoology, Botany, Anthropology, Social and Economic Science, and Physiology and Experimental Medicine.

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The Current Supplement.

The current Supplement, No. 1618, opens with a handsomely illustrated article on "The Treasures of Cumæ." Dr. Wilhelm Haacke writes a popularly worded article on Mendel's law of heredity, which law taken in conjunction with the work of De Vries may be said to have partially upset the Darwinian view of heredity. Another biological article of rare interest is that by Prof. E. Korschelt, on Regeneration and Transplantation in Animals. Mr. John D. Shoemaker contributes an entertaining account of electricity in the treatment of disease. President Roosevelt's message on the Panama Canal is concluded. Among the minor articles may be mentioned those entitled Heating of Feed Water to Approximately Steam Temperature, Colors for Book Edges, the De la Vaulx Airship, and a Wick Carbureter. Those interested in home experimental science will find Mr. A. Frederick Collins's article on an easily made high-frequency apparatus well worth reading. Mr. Collins removes the general impression that currents of high frequency and high potential can be obtained only with apparatus of special construction and shows how either D'Arsonval or Oudin currents can be produced by a high-frequency apparatus which can be easily made at home and which consists of a plunge battery of six cells, an induction coil giving a two-inch spark, a pair of one-pint Leyden jars and an inductance coil. By far the most important paper which was read at the recent meeting of the American Society of Mechanical Engineers was that of Mr. Fred W. Taylor on the Art of Cutting Metals. An abstract of this paper is published. Mr. Taylor's work is probably the only treatise to be found in print on modern work with tool steel.

Since 1891, the electrolytic copper refining industry has undergone enormous expansion, chiefly in America, and the number of electrolytic refineries in existence in 1905 was stated to be thirty-two, distributed as follows: United States, nine; Germany, nine; United Kingdom, six; France, four; Russia, two; Austria-Hungary, two. To this total of thirty-two must be added four refineries, which are reported to be working in Japan.

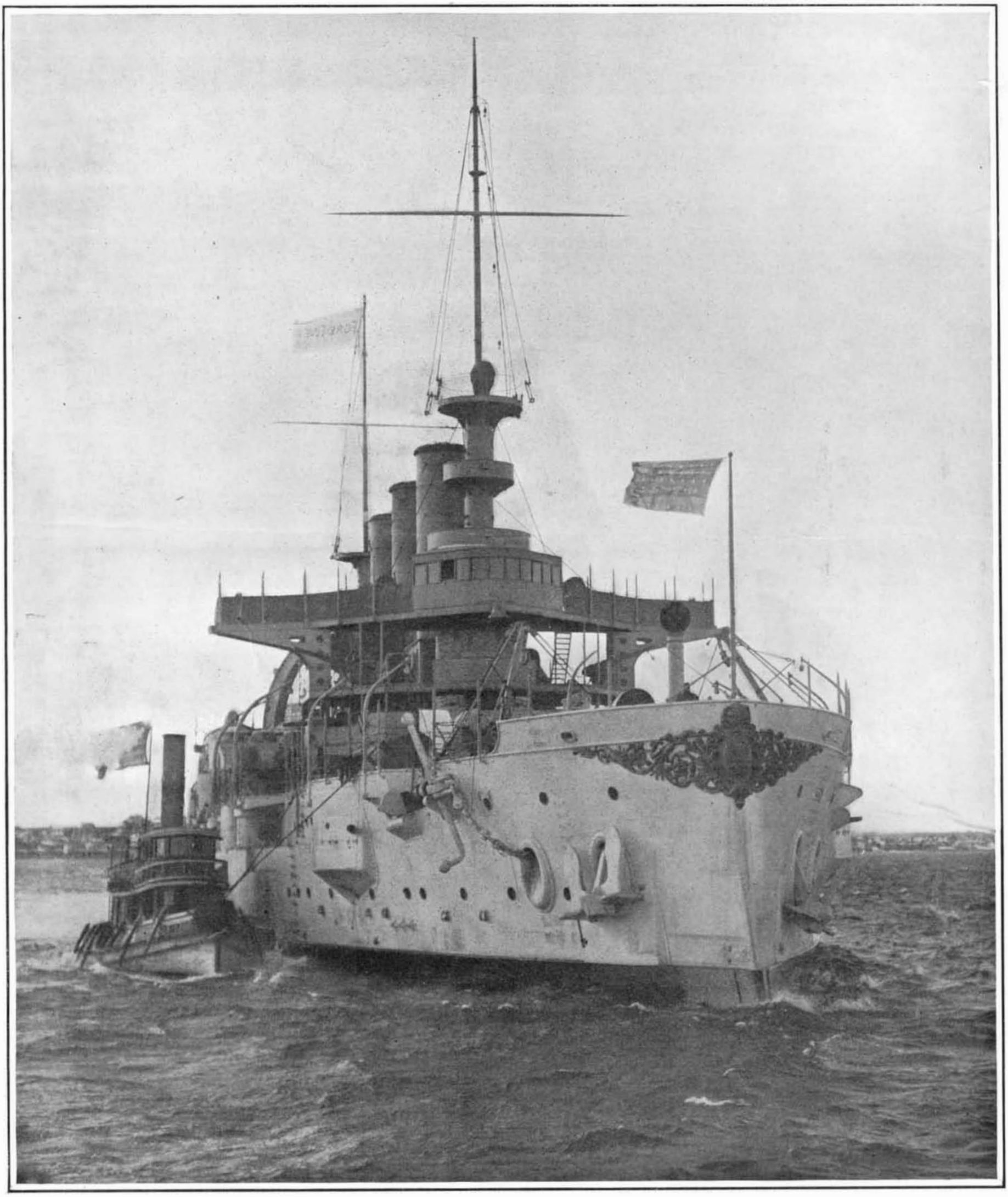
SCIENTIFIC AMERICAN

(Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1907, by Munn & Co.)

Vol. XCVI.—No. 1.
ESTABLISHED 1845.

NEW YORK, JANUARY 5, 1907.

10 CENTS A COPY
$3.00 A YEAR



Displacement, 16,000 tons. **Speed,** 18.33 knots. **Coal supply,** 2,200 tons. **Armor:** Belt, 9 inches; turrets and barbettes, 10 to 12 inches; deck, 1½ to 3 inches. **Armament:** Four 12-inch; eight 8-inch; twelve 7-inch; twenty 3-inch; twelve 3-pounders; 8 small guns. **Torpedo tubes,** four 21-inch. **Complement,** 916.

BATTLESHIP "VERMONT" LEAVING HARBOR FOR HER STEAM TRIALS.—[See page 7.]