that much longer distances will be covered in the near future.

A method has now been put in use whereby messages can be printed on receipt at the receiving station (the messages being transmitted by typewriter).

THE LAUNCH OF THE "SATSUMA."

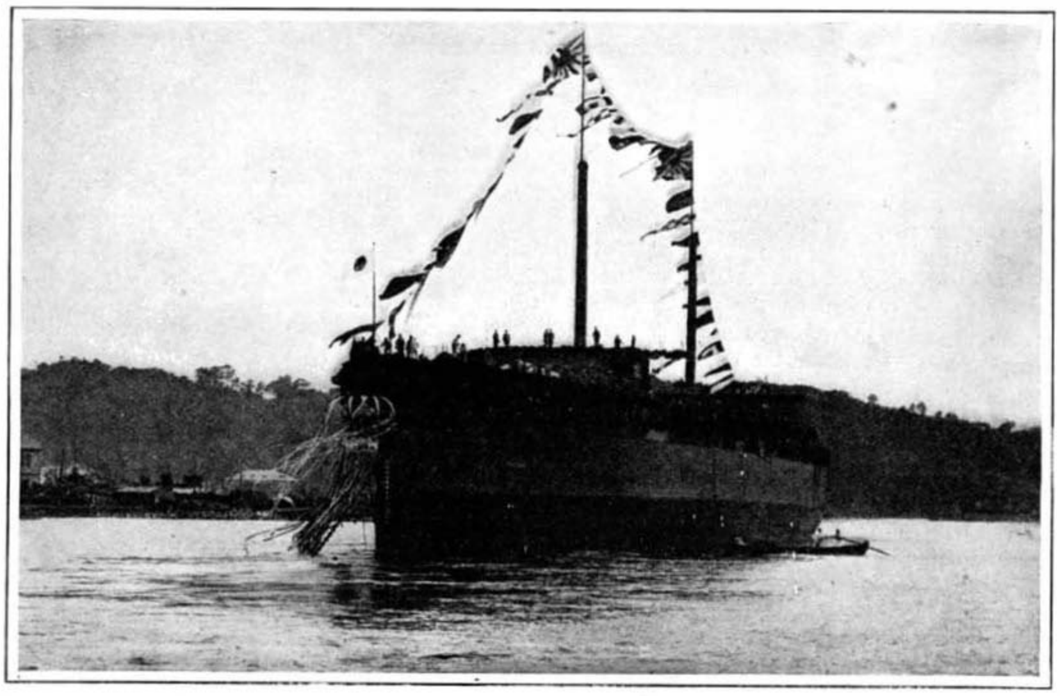
To the Editor of the SCIENTIFIC AMERICAN:

One year and one month after the peace of Portsmouth, which was brought about by the noble efforts of your great President, the launch of the largest battleship afloat took place in the presence of H. M. the Emperor, the Crown Prince, many princes and princesses, and a huge number of all classes of people, at the Yokosuka navy yard, which is but five miles from Uraga, where the monument to Commodore Perry stands.

The battleship "Satsuma," the construction of which began in the midst of the Russo-Japanese war, is 482 feet in length, 83 feet 6 inches in beam, of 19,200 tons displacement and 18,000 horse-power. Her armament is not yet officially declared, and will be kept secret until completion. But the authorities, it is said, at first intended to provide four 12-inch guns, twelve 10-inch guns, twelve 4.7-inch guns, and five torpedo tubes. Thus it will be seen that Japan has not dispensed with intermediate armament, as is the case with the "Dreadnought." Incessant progress in naval matters, however, calls for some new alterations and improvements to be introduced to the armament; and the "Satsuma" will, it is believed, be finally found to be more powerfully equipped than was originally intended. Her armor belt of Krupp steel ranges from 5 to 9 (or 9½) inches, and her intended speed is 19 knots. The ram bow has been dispensed with in her, as in the two armored cruisers, "Tsukuba" and "Ikoma," just built respectively at Kure and Yokosuka. She has a very handsome semi-fiddle bow. Over a year ago, Admiral Sir Cyprian Bridge said it would be interesting to see how long the ram bow would be a feature of warship design. So far as the Japanese are concerned, the day of the ram has passed away, and will not be revived in our future warships, unless some development, as yet undiscovered, is made hereafter in naval warfare. When the "Satsuma" is fully equipped she will also be without the fighting tops so common in modern warships. Compared with our latest battleship, "Kashima," she has a larger displacement by 2,600 tons, and in armament has eight more 10-inch guns. Not only is the "Satsuma" much superior to the "Kashima" in her exterior design, but the difference in her interior design is incomparably greater, owing to the fact that in the construction of the "Satsuma" every available experience obtained from the late war has been turned to account. The new battleship has a larger displacement than the "Dreadnought" by 1,300 tons, though she is inferior in point of speed; and there is a question as to the comparative strength of the two battleships' armaments. The "Satsuma" has four 12-inch and twelve 10-inch guns against the "Dreadnought's" ten 12-inch, so that in fire the latter opposes six 12-inch to the former ship's twelve 10-inch. The allied nations are to be congratulated upon their possession of the two most powerful battleships in the world. In the construction of warships, the most valuable of all experiences are undoubtedly those derived from the tests of actual engagements. A battleship, designed by the experts of a country which has had various experiences of modern naval warfare, cannot fail to have many characteristics peculiar to itself; though the public are yet in the dark as to the details of those characteristics.

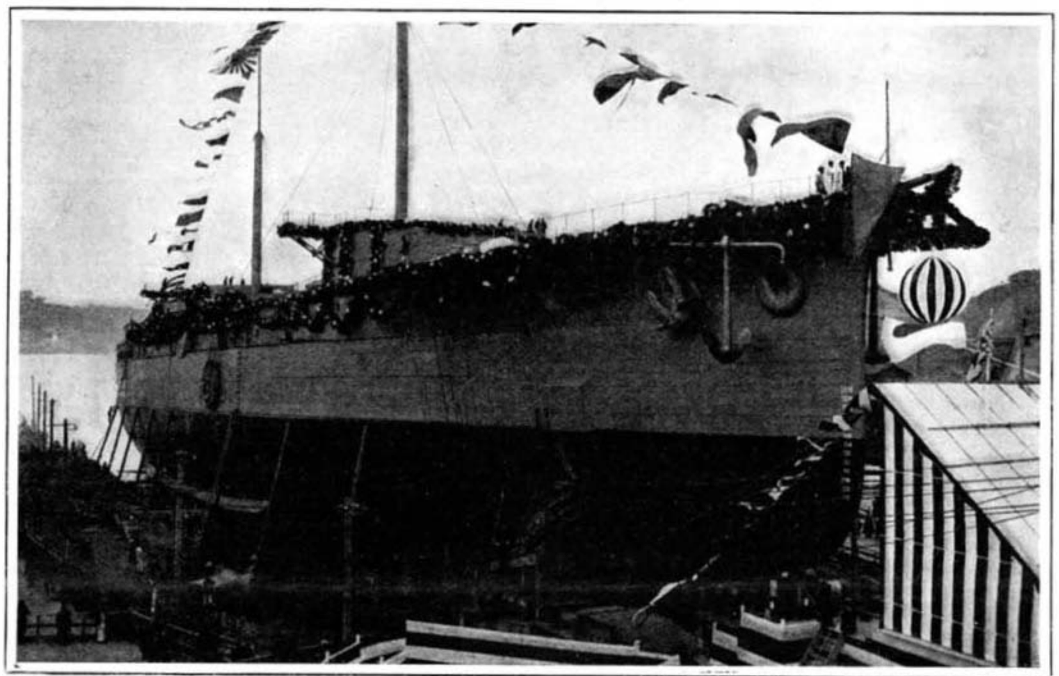
On November 15, when the launch had been arranged to take place, His Majesty entered the imperial stand at about 2 P. M., which faced the stem of the ship. Preparations for the launch were soon commenced. The shores supporting both sides of the hull, the wedges, etc., were removed in accordance with signal orders Nos. 1 to 14. The Minister of the Navy, Vice-Admiral Saito, then proceeded before the throne and read the following document: "On the 15th day of May in the 38th year of Meiji (1905) the construction of the battleship numbered B was commenced, and the hull having now been completed, His Majesty is pleased to name her 'Satsuma.'" The Minister handed the document to Vice-Admiral Kamimura, commander of the Yokosuka naval station, and the latter immediately instructed the superintendent of the arsenal, Vice-Admiral Ito, to launch the ship. As soon as the cord was cut by Vice-Admiral Ito, the hull began sliding. As the "Satsuma" was smoothly going down toward the water, a ball hanging from her bow, as shown in one of the photographs, was automatically broken, scattering pieces of colored paper, cloth, flowers, etc., from among which several pigeons flew away. The thunderous *Banzai* and applause continued for a time. The ship was entirely afloat at 2:25 P. M. It may be added that the "Satsuma" has been built entirely by Japanese experts, and there is no truth whatever in the reports circulated in Europe as to a number of foreign engineers having been employed. SAITO TSUNETARO.

The Imperial Fisheries Institute, Etchujima, Tokio, November 23, 1906.



The "Satsuma" After the Launch.

The striped ball hanging at the bow was opened at the launch, liberating a flock of pigeons.



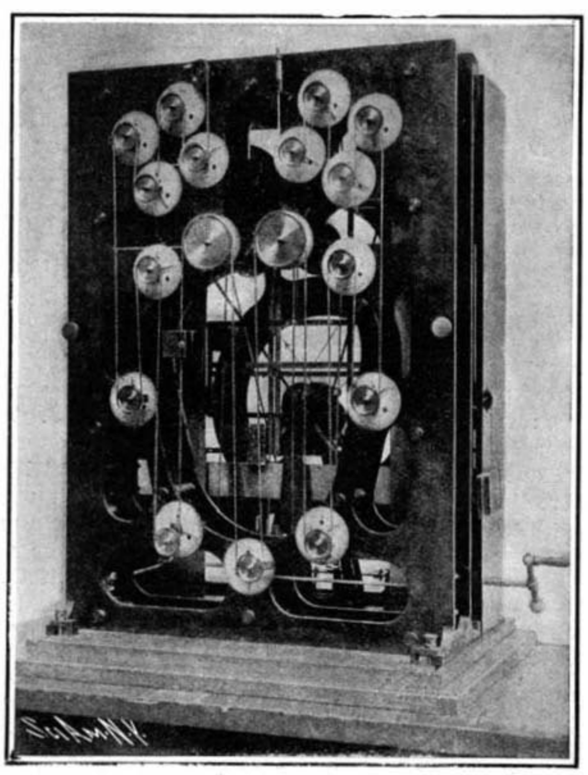
Length, 482 feet. **Beam,** 83¼ feet. **Displacement,** 19,200 tons. **Horse-power,** 18,000. **Speed,** 20 knots. **Armor:** Belt, 9½ inches. **Armament:** Four 45-caliber 12-inch; twelve 45-caliber 10-inch; twelve 50-caliber 4.7-inch. **Torpedo tubes,** 5.

LAUNCH OF THE JAPANESE BATTLESHIP "SATSUMA," THE LARGEST BATTLESHIP AFLOAT.

A MACHINE THAT PREDICTS TIDES.

BY D. A. WILLEY.

One of the most interesting devices utilized in connection with the United States Coast and Geodetic Survey is the mechanism by which the state of the tide at a certain seaport can be closely determined a year or more ahead. While with the machine are used tide tables which have been computed for a period of years, the automatic computation which the tide predictor performs is really wonderful in its accuracy. As the illustrations



Rear View of the Machine, Showing the Arrangement of Mechanical Elements.

Operator Turning Indices to Determine the Height and Time of the Tide at a Future Date.

A MACHINE THAT PREDICTS TIDES.

indicate, the tide predictor somewhat resembles a clock. In fact, it contains one which records every day in the year, the pointer on the dial shown in the upper left hand corner of the illustration making a complete circle of the face of the dial once every twenty-four hours, but this is only one of several parts which might be termed clocks by reason of their mechanical construction and arrangement. There are clocks which serve to indicate when properly "set" the daily stage of tides, and the stage of the moon, so essential in calculating tidal movements. The center "clock," however, is of most importance, for by its manipulation the necessary computations are made with the aid of records obtained from the smaller ones.

The tide predictor contains nineteen mechanical elements or estimators, each consisting of an axle which is moved by a pulley and crank connected by delicately adjusted chains. All of the axles, however, are controlled by what might be called the governing axle located in the bottom of the framework of the predictor and moved by the handle shown in the illustration on the outside of the case at the left. It will be noted that the large dial in the center of the face of the predictor contains two sets of hands and incloses a small disk which has a single hand. The larger hands are called the lunar and solar indexes, for reasons which will be explained. The small index on the little dial serves merely to indicate the period of the day when the computation is made.

When it is desired to ascertain the height of the tide at a certain point on a specified date the operator of the machine first "sets" it so that the mechanism shows the approximate time at which high tide or low tide occurred on a given date in the past at this place. Then with the left hand the operator slowly turns the handle at the lower left-hand corner of the machine and this is what occurs: The hand on the large face in the center known as the lunar index changes its position until it points in the same direction as one of the pair of smaller hands or needles. The operator then notes the position of the solar index, as the other hand of this curious clock is termed. If the lunar index has assumed the same position as the upper needle, the solar index will indicate the time of the first high water at the seaport for which the computation is being made. To determine the height of the tide at the given time, the operator glances at the index at the left lower corner of the large face. Comparing the figures opposite its hand with the figures on the scale by its side gives the height of the tide.

To determine low tide the lunar index is moved by the handle until it is in the same position as the lower needle and the position of its companion, the solar index, is again observed. Thus the time of low tide is secured. In getting the measurement of the tide the index on the lower right-hand side is read and the figures compared with the right of the two measures seen in the lower part of the frame.

Fully to describe the workings of all the mechanism would require more space than can be given, but it should be remembered that when the handle controlling the governing axle is turned, all of the elements are set in motion at a speed proportioned to the work which they are to perform, regulating the various hands and needles so that no errors of importance can be made. As an indication of the accuracy of the machine it may be stated that the maximum deviation of the tide from what has been predicted is never over 0.3 foot, and it records the stage of tide within five minutes of the time when the tide reaches the stage, although, as stated, the prediction may be made a year or more in advance. The machine is a portion of the division of the bureau at Washington of which Mr. O. H. Tittmann is superintendent, and is called the Ferrel tide predictor after the late William Ferrel, by whom it was improved, the original invention being due to Lord Kelvin.

A fuller description of this type of predictor will be found in SCIENTIFIC AMERICAN SUPPLEMENT No. 1464.

Variable Speed Turbine Engine.

A turbine has been patented in England which, by means of two sets of steam admission ports, into either of which steam may be admitted at will, it is claimed will give two different speeds of operation at the same efficiency. For the higher speed the steam is conducted from one set of ports through expanding nozzles to the rotor, where it encounters two sets of moving blades and one set of fixed blades, passing thence to the exhaust. For the lower speed, the steam takes the same path through the blades as before, and is then led from the second set of moving blades into a group of blades consisting of two fixed and two moving sets. This arrangement gives a speed about half that due to the other, the reason being doubtless that, the expansion being carried through a longer stage, the drop in pressure at each set of blades is but half what it was before, with consequent proportional speed factor.—**Iron Age.**

Correspondence.

Large Powder Chambers Reduce Erosion.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your mention, in the SCIENTIFIC AMERICAN Review of the Year, of the high velocity secured at Sandy Hook with the Brown wire gun, which is officially reported as 3,740 feet per second, I beg to draw your attention to the fact that there were some important truths established during these tests, which show the great advantage to our government of high-powered guns, such as the department or Crozier gun and the Brown wire gun, viz.:

If these guns were fired with what the government considers service velocities for the 6-inch guns now in use, the pressures would be so exceedingly low that, with properly banded shells, they would last for an indefinite number of rounds, before being rendered unserviceable on account of erosion; and at least as long as any of the low-velocity guns now recommended by the department, so far as the life of the gun is concerned.

A study of the government record shows: The third round, Brown 6-inch gun, with 59 pounds of powder and 28,475 pounds pressure per square inch, gave 2,879 foot seconds velocity. The fourth round in Crozier gun, which also has an unusually large powder chamber, with 69 pounds of powder and 30,810 pounds pressure, gave 2,938 foot seconds.

These records prove, therefore, that the large powder chambers in the high-powered guns, so far from being undesirable, are a very great advantage; since such guns give higher velocities with lower mean pressures than the 6-inch guns now in use. This is possible because more powder can be burned, and a larger volume of gas secured, without producing excessive pressures. As a matter of fact, nearly 10,000 pounds less pressure per square inch is required than in the 6-inch service gun, to secure the same velocities. Hence, erosion would be correspondingly reduced.

Another important advantage in the high-power gun is that, even if fired with the usual 6-inch service charge, it possesses tremendous reserve energy, to be available in an emergency, when long-range firing may be of inestimable value to cripple the enemy before he could approach near enough to strike.

Gen. Crozier, Chief of Ordnance, implies, in his annual report recently published, the possibility of eliminating erosion, in which event, with these high-powered guns, the government would be in possession of guns of far greater efficiency and range than any other guns within our knowledge, while on the other hand, if our government has low-powered guns only, and erosion should be cured, as it undoubtedly will be, we would be left with a large number of inefficient and obsolete guns.

The government star gaging records show that in the last ten excessive pressure shots from the Brown 6-inch gun there was practically no erosion at all in the last 14 feet of the muzzle end of the gun, because the shells had been properly banded to meet the changed conditions which were required in the gun in order to secure such remarkable results in pressures and velocities.

If all the shells had been banded at the beginning of the test, as the last ten were, both the Crozier gun and the 6-inch Brown wire gun could easily have been fired the 250 rounds originally proposed and been in better condition at the finish than they are to-day.

The greatest erosion occurred during the early part of the test, when the narrow bands were used, as the star gaging shows, and was no fault of the system of construction. It was claimed at the start that the shells were not properly banded for such high pressures and velocities, but the department insisted that the service bands for low-powered guns must be used in this test of the high-powered guns.

The last ten shots (88th to 98th) fired in the Brown 6-inch gun gave an average pressure of over 55,000 pounds per square inch and an average velocity of over 3,600 feet per second with perfect safety to the gun. JOHN H. BROWN.

New York, January 8, 1907.

The Exploration of the Atmosphere at Sea.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 22, 1906, your German correspondent speaks of the research boat "Planet," belonging to the German marine, as if she were the first vessel to make atmospheric soundings with kites and balloons. Permit me to say that kites were used by me to obtain meteorological observations at sea, independently of the natural wind, in 1901, as was related in the SCIENTIFIC AMERICAN, vol. 91, page 479. The same year, after this method had been proved successful on a transatlantic steamer, I proposed (in a paper read before the Glasgow meeting of the British Association) to extend it to the trade-wind region. In order to organize such an expedition, applications for aid were addressed in 1902 to the Prince of Monaco, and in 1903 to the Carnegie Institution, but in neither case was the desired assistance obtained. However, Prof. Hergesell, president of the International Committee for Scientific Aeronautics, of which I am also a member, succeeded in interesting the Prince of Monaco in the scheme, and upon his yacht, the "Princesse Alice," during the summer of 1904, kite flights were made in the region bounded by Spain, the Azores, and the Canaries. Although a height exceeding that of the Peak of Teneriffe was several times attained, the southwest or return trade, which had been observed on this mountain, was not found, leading Prof. Hergesell to conclude that it was due to the disturbing effect of the mountain itself.

This conclusion, which involved so important a matter as the existence of the return trade, led to another expedition being sent out in the summer of 1905 by M. Teisserenc de Bort, director of the Observatory for Dynamic Meteorology at Trappes, near Paris, and by the writer. Mr. Clayton, of the Blue Hill Observatory, in proceeding from Boston to Gibraltar executed with kites the first line of atmospheric soundings across this part of the Atlantic to an average height of 3,000 feet. At Gibraltar Mr. Clayton joined the steam yacht "Otaria," a vessel of 350 tons, purchased and equipped by M. Teisserenc de Bort expressly for exploring the atmosphere, and having on board M. Maurice, of Trappes Observatory. This vessel went as far south as latitude 10 deg. N. and as far west as longitude 30 deg. W., and in seventeen kite flights the barometric pressure, air temperature, relative humidity, and wind velocity were continuously recorded, and the wind direction observed by measuring the azimuth of the kites. To obtain the direction and speed of the wind at greater heights, eleven hydrogen balloons were liberated from several of the islands, from which they were measured trigonometrically, and within the region of the northeast trade all indicated the expected south or southwest return trade above the height of about two miles. The same year Prof. Hergesell made another cruise on the "Princesse Alice," employing for the first time at sea the tandem balloons of rubber, which your correspondent describes as forming part of the equipment of the "Planet," and in this way the first temperatures and humidities were obtained up to an extreme height of about ten miles above the ocean. During the past winter and summer, the "Otaria," equipped with these *ballons-sondes*, captive balloons, and kites, has made two cruises, proceeding across the equator to Ascension Island, at the mutual expense of her owner and the writer. The existence of the southwest current above the northeast trade, and of the northwest current above the southeast trade, was demonstrated, and the hitherto unsuspected fact revealed that in summer at a height of eight miles above the thermal equator a temperature of about 100 deg. F. below zero prevails, which is lower than it is in winter at corresponding heights in temperate regions.

Mention of these researches shows that your correspondent is greatly in error in assuming that the "Planet" has an unknown field to explore, because the conditions in the higher atmosphere over the ocean "are known only through a few observations made in the North Atlantic"; but I entirely agree with him that "these conditions are not as simple as theory has heretofore assumed," and that further observations are desirable. A. LAWRENCE ROTCH,

Director of Blue Hill Meteorological Observatory.

Hyde Park, Mass., December 27, 1906.

The Wireless Telegraph Situation.

To the Editor of the SCIENTIFIC AMERICAN:

I read with great interest your editorial review of the scientific and engineering work for the year 1906. May I be permitted to make a few corrections to the *résumé* of wireless telegraphy work, as the writer of this part of the review seems to be somewhat out of touch with recent developments?

In the first place, the work of the National Electric Signaling Company on transatlantic telegraphy is so very far from having been futile, that uninterrupted communication, with the exception of one day, was maintained between Scotland and Massachusetts from October 1 to December 5, and preparations were being made for placing these stations on a commercial basis when the tower at Machrihanish fell, owing to a defective joint in one of the guys made by an expert engaged from a Glasgow firm. The working up to the date of the accident was, however, so successful that the directors of the National Electric Signaling Company have decided that it is unnecessary to carry on the experimental developments any further, and specifications are now being drawn up for the erection of five stations for doing transatlantic and other cable work, and a commercial permit is being applied for in England.

As regards the question of interference, this ceased to be a vital question two years ago. The Electrical Review of July 6, 13, 20, and 27, 1906, published the results of independent tests of government officials, which showed that it was possible to cut out interference even when the interfering station was only 216 yards away. You will note that the transatlantic stations have been operating without interference, al-