THE NEW JAPANESE BATTLESHIPS.

The Japanese navy has now under construction two battleships, which are probably the most powerful of any built or building (if we except the one battleship recently ordered by Great Britain) for any navy. They embody the lessons of the present war, though not to the extent that would be evident, were the plans for the ships being drawn at the present time. The striking feature is that, in addition to the usual main battery of four 12-inch guns, they also carry four 10-inch guns. The 10-inch gun was the main armament on several of the destroyed Russian battleships, and is the main armament on one or two modern British battleships to-day. Therefore, it may be said that the main battery of each of the new Japanese vessels is equal to that of two battleships of some existing types.

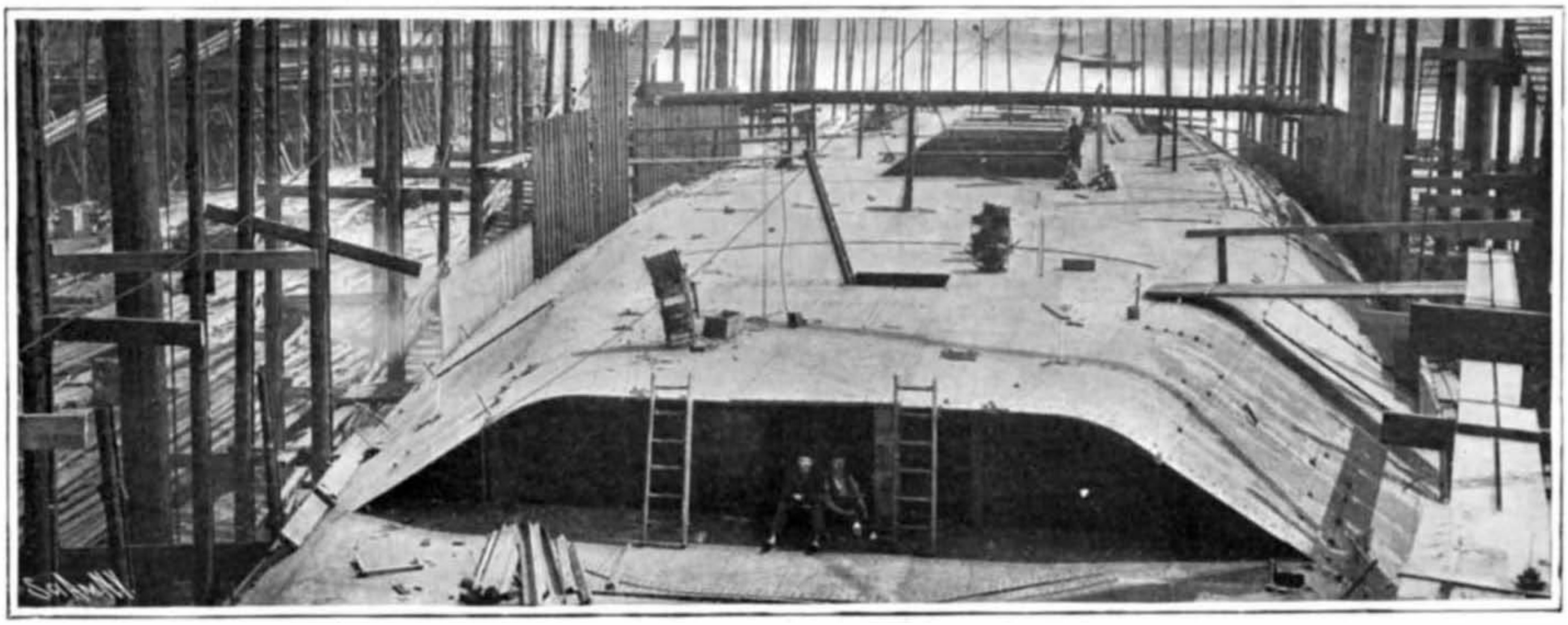
Of the two ships, the "Katori" is being built at the yards of Messrs. Vickers, Sons & Maxim at Barrow, and the "Kashima" is being built by the Armstrong firm at the Elswick yard. The "Katori" measures 455 feet 9 inches over all, 78 feet in beam, and on a draft of 27 feet she displaces 16,000 tons. The "Kashima" measures 425 feet on the waterline and 455 feet over all. Her breadth is 78 feet 2 inches, and on a draft of 26 feet 7½ inches she displaces 16,400 tons. The armament of each ship consists of four 12-inch guns mounted in pairs in barbettes; four 10-inch guns mounted singly in barbettes, one at each corner of the central battery, on the plan first adopted in our own "Oregon" class; twelve 6-inch guns carried in a central citadel; twelve 12-pounders; six Maxims; three 3-pounders; and five under-water torpedo tubes. The 12-inch Armstrong gun on the "Kashima" weighs 59 tons, has a length of 46.7 calibers, and fires an 850-pound projectile. The 10-inch guns weighs 34 tons, has a length of 46.7 calibers and fires a 500-pound projectile. The 6-inch guns will be about 47 calibers in length. Messrs. Armstrong inform us that the charge will probably be a modified cordite, and that the power of the 12-inch guns will be such that no armor that any ship carries can hope to withstand them up to a distance of three thousand yards. The 10-inch gun will have a penetrating power which will be equal at 3,000 yards to any of the 12-inch guns at present afloat in any navy. The breech-screw of these guns is arranged for a parallel motion, which does away with the necessity of having a steep cone at the seat of the obturating pad, and saves weight and length at the breech of the gun. The 12-inch Vickers guns of the "Katori" are of 45 calibers, and weigh 57 tons each. The 10-inch guns are also 45 calibers long, and weigh each 34½ tons.

The disposition of the armor in the two ships presents no features of novelty, and it is practically the same in both ships. The following description of the "Kashima" will answer therefore for both vessels: Amidships, it is carried from below the waterline up to the upper deck, above which further protection is given by a screen of 4-inch armor, which extends 7 feet 6 inches above the upper deck and covers the 6-inch gun positions amidships and also the spaces between the 10-inch gun positions. The waterline armor belt which is 9 inches in thickness amidships, and tapers 4 inches at the ends, reaches 5 feet below and 2 feet 6 inches above the waterline at normal draft. Above this is a belt of armor 9 inches thick amidships, which reaches from the after 12-inch barbette forward to the stem. Above this belt is the 6-inch citadel armor, which reaches to the upper deck and extends forward and aft to inclose the two 12-inch barbettes. Ten of the 6-inch guns are mounted within this citadel on the gun deck, and they are separated from each other by armored screens. On the main deck above, mounted midway between the 10-inch guns, are two more 6-inch pieces, one on each broadside. The armor on the barbettes of the 12-inch guns is 9 inches in thickness where it is exposed, and 5 inches in thickness where it is protected by the citadel armor. The 10-inch gun barbette armor is 6 inches in thickness, which we think is scant protection for such important pieces. The conning tower carries 9 inches and the observer tower at the after bridge, 5 inches of armor. A novelty will be the provision of two other shelters for the officers, which will be placed on the boat deck amidships, and protected with 3 inches of armor. The protective deck, the construction of which is shown very clearly in each of our views, is 2 inches in thickness on the flat and 3 inches on the slopes. Toward the ends of the ship where the thickness of the side armor is reduced, this deck is increased in thickness from 2 to 2½ inches.

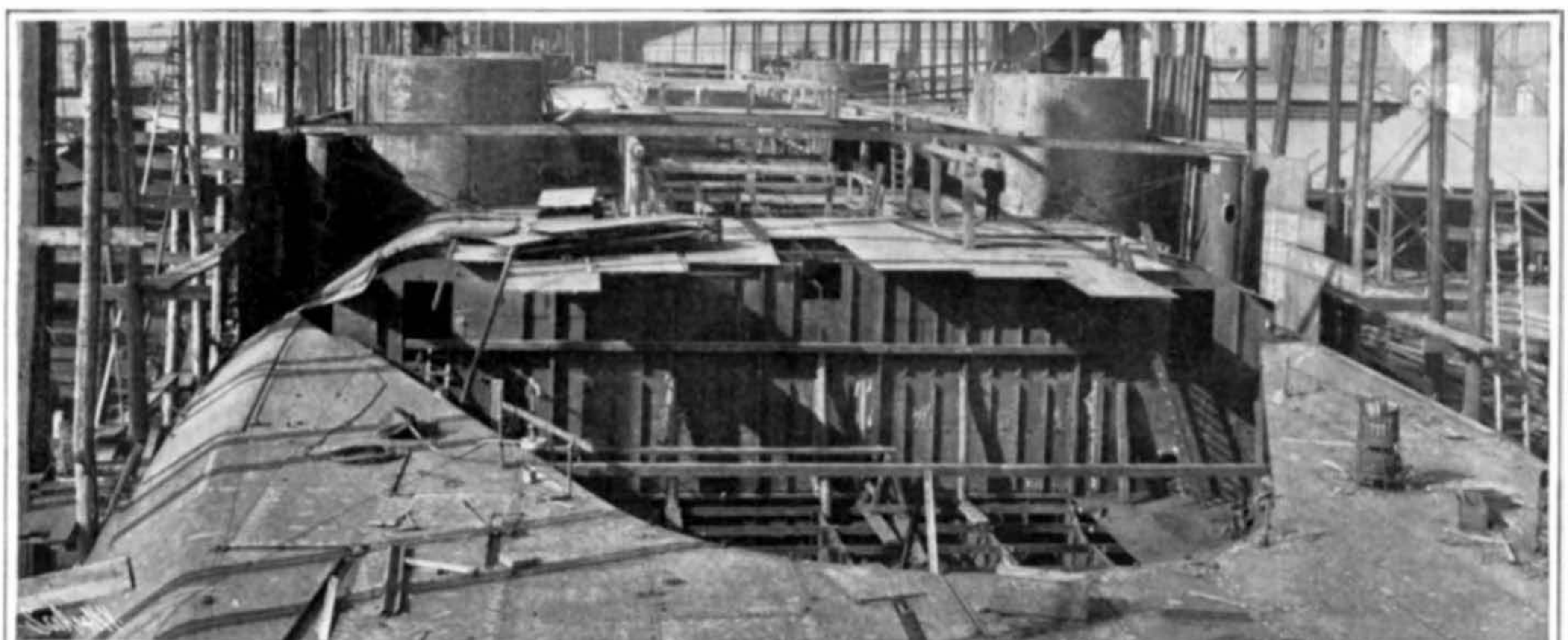
Each of the big gun turrets, six in all, is provided with an independent magazine; the 6-inch and smaller guns obtain their supplies from an ammunition passage which extends around the machinery space below the waterline. Of the five under-water torpedo tubes, two are located forward and two aft on the broadside, and one tube is built into the stern and fires in line with the axis of the ship. The coal bunkers have been designed with the double object in view of giving all possible protection to the vitals, and of minimizing labor in trimming and in transporting the coal to the furnaces. The longitudinal coal bunkers at the side of the boiler rooms and below the protective deck can be kept closed during action, thereby affording additional protection against the torpedo.

Another important feature in the bunker arrangements is that the bulk of the coal can be brought to the stoke holes without opening any of the doors in the main water-tight bulkheads; moreover, reserved coal bunkers are arranged at the slopes of the protective deck up to the height of the main deck throughout the length of the machinery space. The total coal bunker capacity is about 2,000 tons. It is estimated that with about 16,000 indicated horse-power the speed of the two ships will be 18½ knots an hour.

Our illustrations of the "Kashima," taken during her construction, speak for themselves, and serve as an excellent object lesson in the internal arrangements of a



View Looking Aft on the Protective Deck, Showing the Way in Which it Slopes at the Sides to Meet the Lower Edge of the Waterline Armor.



Looking Forward on the Protective Deck, Showing the Opening for the After 12-inch Gun Barbette, and the Four Barbettes for the 10-inch Guns.

CONSTRUCTION OF THE NEW JAPANESE BATTLESHIP "KASHIMA."

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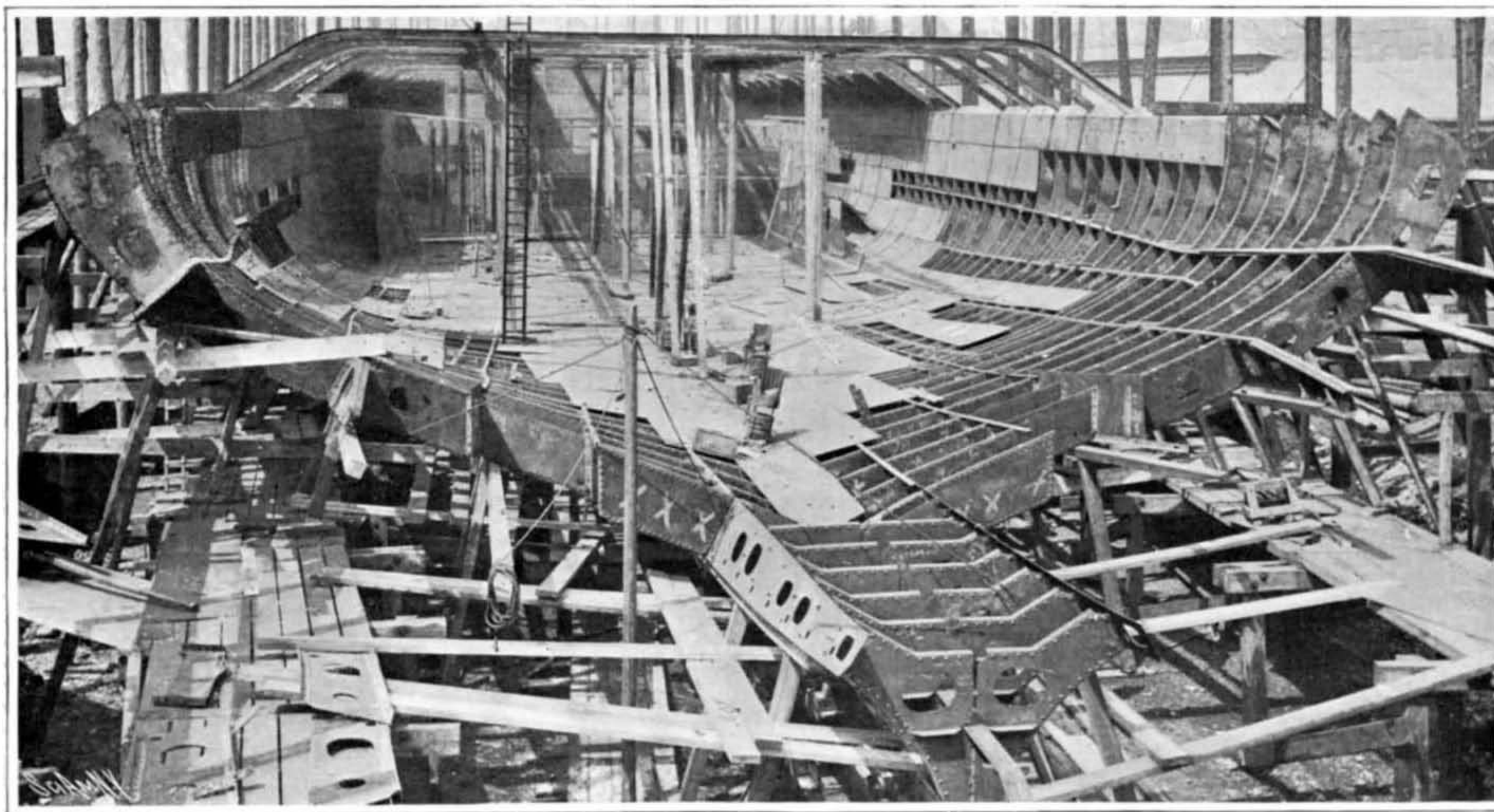
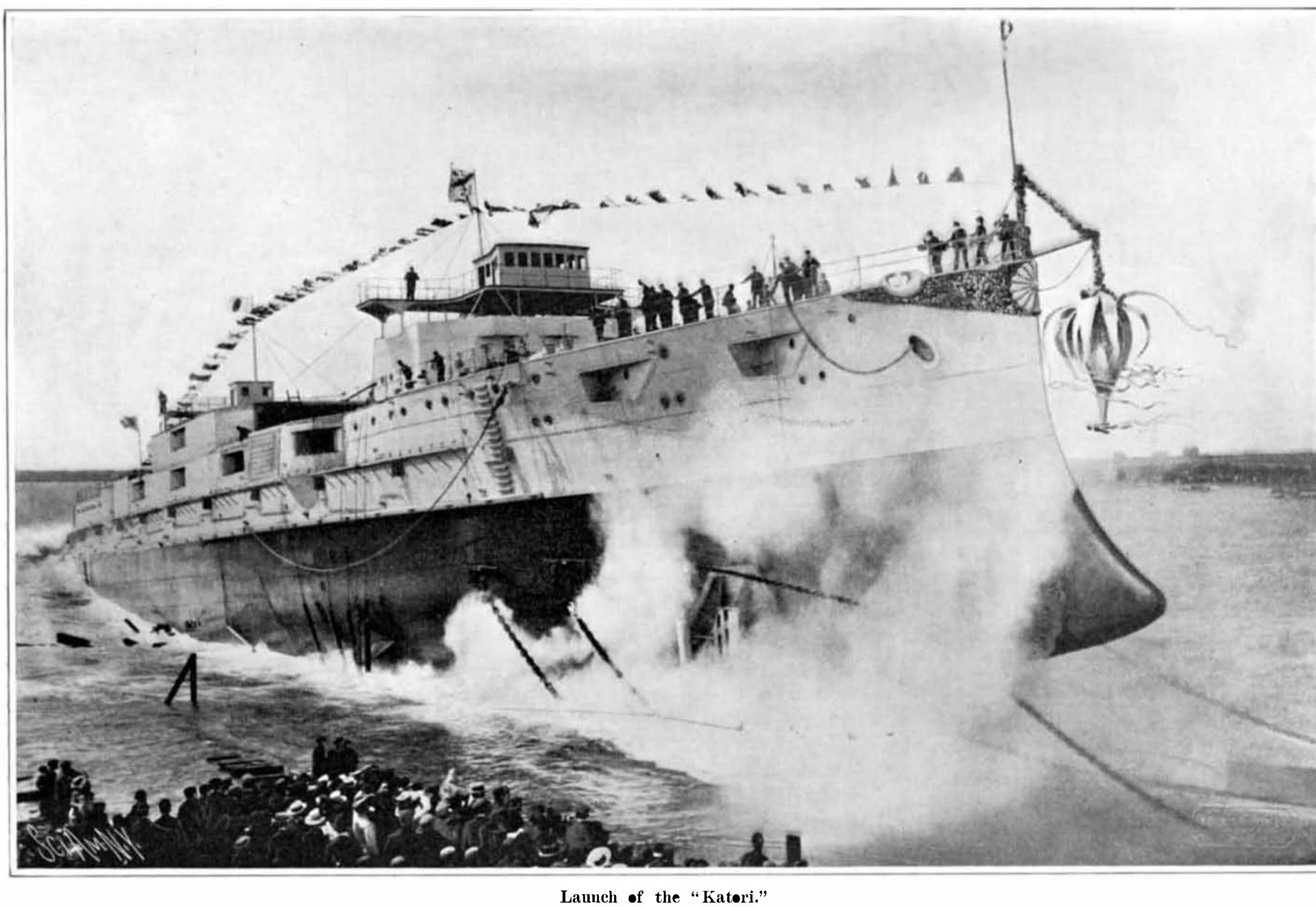


This View of the "Kashima" Shows the Deep Framing and Inside Plating of the Double Bottom; Also the Deck Beams That Carry the Protective Deck, and One of the Watertight Bulkheads.



Launch of the "Katori."

Length, 455 feet 9 inches. **Beam,** 78 feet. **Draft,** 27 feet. **Displacement,** 16,000 tons. **Armor:** Belt, 9 inches. Side, 6 inches. Barbettes, 9 inches and 6 inches. **Armament:** Four 12-inch; four 10-inch; twelve 6-inch: 21 small guns. **Torpedo Tubes,** 5 submerged.

THE NEW JAPANESE SISTER BATTLESHIPS "KASHIMA" AND "KATORI"—[See page 105.]

modern battleship. The ship was launched last spring, and is rapidly approaching completion. The spirited photograph of the "Katori" shows this vessel as she was taking the water at her recent launch. The big chains which reach forward from the bow are cables, which are dropped at the moment of launching, and serve by their friction as they are dragged over the ground to check the ship's speed. The ship was named by Princess Arisugawa of Japan, who pulled a cord attached to the small balloon at the bow of the ship and released several pigeons, a characteristic Japanese ceremony.

By-Product Coke.

About 30,000,000 tons of coal are carbonized in beehive ovens every year, 20,000,000 tons being carbonized into coke for blast furnace use and the balance for sundry other manufacturing purposes. In this connection we would like to impress upon your mind the fact that there goes off as waste products from this 30,000,000 tons from 80 cents to $1 per ton. Consequently you can see the advantage of saving these waste products because it is not American-like to see so much waste go into the air. Our friends, the financiers, are usually after the mighty dollar, and they don't like to have it get into the air where they can't get it.

By-product ovens have been in use throughout Germany and other parts of the Continent, and largely in England during the past 25 years. There are no beehive ovens in operation in Germany at the present time. The introduction into this country was comparatively slow at the first, but the field has greatly increased during the past three or four years. There have been built, or are in course of construction at the present time in the United States and Canada, about 3,950 by-product ovens, about 2,605 of these being of the Otto-Hoffman and United-Otto systems, carbonizing approximately 15,000 tons of coal per day, and about 1,345 Semet-Solvay, carbonizing approximately 8,000 tons of coal per day, amounting in a year to a total carbonization of approximately 8,400,000 tons. It will be seen that, although the number of by-product coke ovens apparently does not approach the number of beehive ovens installed, on account of the difference in the size of the charge and the shorter coking time, the coke made in by-product coke ovens will be much nearer the total coke tonnage of beehive ovens than would at first be supposed.—Mines and Minerals for July.

How the Ox Bow Tunnel was Cooled.

The boring of the Ox Bow tunnel in Idaho is one of the great engineering feats of the age. The Payette River at this point makes a loop, and by putting a tunnel through 1,200 feet, the river bed is left dry for two and a quarter miles. It is the intention to mine the river bed for gold. Experts have estimated its value at from $6,000,000 to $42,000,000 dollars. Ordinarily, the putting through of this tunnel would be a simple matter, but at 300 feet from the upper end and 250 feet from the lower, hot water was struck. The heat at first was from 95 deg. to 105 deg., increasing as the work progressed to 132 deg. at the hottest point. Different fans and blowers were experimented with to cool the air in the tunnel, but without success until William Flick, the superintendent of the work, thought of spraying the walls of the tunnel with water pumped from the river. Very simple pumping apparatus and common garden sprays were used with complete success. The tunnel is 28 feet wide and 9 feet high, and the flow of hot water amounted to 75 miner's inches. The cold water so cooled the hot water that it was caught in sumps and pumped out with common pumps.

THE FUTURE UNIVERSITY OF CALIFORNIA.

BY ENOS BROWN.

Five years ago the most noted of European and American architects engaged in a competition to provide the University of California with plans and suggestions for buildings and their arrangement in reference to the site. The competition was held in Antwerp, and the response to the invitation was general. Of the number exhibited, about ten were commended for future consideration, and from these the one designed by M. Benard, of Paris, was selected as the most meritorious. The successful architect subsequently visited the university, and, in conference with the regents, his design, with some necessary modifications, was adopted and definitely settled upon as the one to which all new erections for university purposes should be subordinated.

The architect of the university, John Galen Howard, has recently completed a plaster cast of the site, with the location and detail of the buildings now being erected and of those it is contemplated building as the necessary funds are provided.

The site of the University of California is incomparable. By a gentle ascent it rises from the shores of the bay, from which it is distant about two miles. The entrance is 100 feet above sea level, but, within the grounds, the slope is more abrupt, climbing the low coast range until at the crest, upon which the observatory will stand, a height of 597 feet is attained.

CAST OF BUILDINGS OF THE UNIVERSITY OF CALIFORNIA.

The profile is undulating and the view wide. The small buildings immediately below the observatory are dormitories, and to the right of the picture are the amphitheater and, in order, the department for chemistry, physics, mathematics, clock tower, languages, library, California hall, zoology, agricultural, botany, history, library extension, physiology, and hall for alumni. The large building to the right is the athletic field and accompanying gymnasiums. To the left of the central roadway, from the top, is the dining hall, geology, mining, electrical, mechanical, and civil engineering buildings, museum, fine arts, pathology, physiology, anatomy departments, with mansion for the university president. Even on the minute scale at which the cast has been made, the architectural type and general appearance of the buildings have been faithfully shown. The structure in the central basin is the great auditorium for gatherings of faculty and students. The dome of this structure will dominate the entire group.

Considerable progress has already been made in the erection of new buildings based upon the general plan. The concrete amphitheater is completed and the president's mansion, California hall, and mining building are in a state of advancement, while funds have been provided for the new library. The older structures, that now serve a necessary purpose, will be dispensed with as soon as possible. In time the plan will be complete; and no institution of learning in the world will be so magnificently housed. It is not as yet estimated what the cost will be, but many millions will be required. The munificence of individuals with the generosity of the State are confidently looked upon to supply the necessary funds.

A Novel Smelting Process.

A novel smelting process patented by the Köln-Müsener Mining Company in Kreuzthal is receiving much attention in German engineering circles. This process is intended to be used mainly in the operation of blast furnaces, its object being to open with extraordinary rapidity any closed blasting molds or obstructed tapping holes. It further serves to dismount rapidly any kind of iron construction. It may be mentioned that about fifty mining works have already secured licenses under the patents.

The risk and heavy loss involved in blast-furnace operation whenever the tapping hole does not open normally, and the hard and oftentimes useless work of many hours in chiseling through the hardened mass with steel rods, are known to every metallurgist. There is the risk of the rising liquid pig iron reaching the water-cooled cinder molds and the tuyeres, which may result in fatal explosions and bursting. All these difficulties and risks are entirely done away with by the Köln-Müsener process, which is carried out in a few minutes, and frequently in less than one minute.

The process consists in heating the mass to be melted in one of its points by any means, to the combustion temperature of its combustible components, after which oxygen is thrown against it under high pressure. The local combustion heat in the concentrated oxygen current is so enormously high that the neighboring parts will at once become liquefied.

To preheat the material an oxyhydrogen flame is used to advantage in most cases, while electrical arcs, for instance, can also be used for this purpose. In the latter case it will be possible to pierce cold armor plates of 200 millimeters (8 inches) diameter in about 10 seconds. The current from two accumulator cells that furnish 120 amperes at 2.3 volts will be quite sufficient. The fact that this process renders it possible to remove the iron before the copper from assembled iron and copper plates without any prejudice to the copper, will be found interesting and important for many purposes. This will prove of importance also for blast-furnace operation, it being possible to melt into the extensions of copper or bronze blasting molds or cinder molds without any risk to the copper.

The process will further prove rather valuable whenever dismounting work is to be performed at short notice, the operation being reduced to a few minutes' work, while the cost as compared to the efficiency is quite negligible. It is true that the construction of special types of apparatus is required to enable the process to be carried out safely.

The Academy of Sciences of California has just fitted out and dispatched an expedition to the Galapagos Islands. The expedition has sailed in the schooner yacht "Academy" for Enseñada, Mexico, and after taking out clearance papers there, will visit the following Mexican islands: San Benito, Natividad, Cerros, San Benedicto, and Socorro. After leaving Socorro, the expedition will proceed to Cocos Island, and thence to the Galapagos Archipelago. The chief work of the expedition will be at the Galapagos, where a year will be spent in studying the natural history and collecting specimens for the museum of the Academy of Sciences.