Correspondence.

An Arrangement of Twin Propellers for Aeroplanes.

To the Editor of the SCIENTIFIC AMERICAN:

The lesson to be learned from the Wright disaster at Fort Myer, Va., is the fact that having two propellers on a horizontal line is radically wrong, as the forward thrust is shifted entirely to one side, if anything happens to either propeller, and no movement of the steering devices can overcome this side thrust, as the plane of resistance of the supporting surfaces is at nearly right angles to this side thrust. I designed an aeroplane some years ago and placed the propellers above each other to avoid this very contingency. The propellers being in a vertical line allows of a stronger and simpler plan, as one of them can be placed directly on the engine shaft, the other being either above but preferably below the line of the planes. Now if anything should stop one of these propellers, a change in the vertical steering rudder added to the higher speed of the remaining propeller would tend to overcome the loss of one, and would prevent the machine's falling, though it might sail slowly to the earth. Builders of aeroplanes will eventually be forced to adopt this arrangement of propellers, as it may be seen that it has other advantages than those mentioned above.

E. L. BAILEY.

Raleigh, N. C., September 26, 1908.

A Question of Priority of Invention.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article entitled "Nasmyth—the Centenary of a Great Inventor," appearing in your impression of October 10, page 238, and partly quoted from the Engineer of London, allow me to correct two misleading statements as to Nasmyth's priority of invention. The article states that in 1838 Nasmyth brought out a self-adjusting bearing for the shafting of machinery, which consisted in giving a spherical form to the exterior of the bearing; also, he invented an inverted vertical steam engine. In Nasmyth's autobiography, edited by Smiles, the date of the latter invention is given as 1848.

It is far from my wish to detract in the smallest degree from the fame of Nasmyth. He was unquestionably a great inventor, but, as in the case of other great men, some of the prior achievements of his contemporaries were subsequently ascribed to him.

When Nasmyth was established at the Bridgewater Foundry, near Manchester, John George Bodmer, M.I.C.E., was in business at the Britannia Foundry in the same city. The two engineers were much in contact, and Nasmyth frequently consulted Bodmer on difficult matters of construction.

It must be explained that Bodmer was a native of Switzerland (born in 1786) and emigrated to England in the early thirties—partly for the reason that his native country gave no protection to inventors. At that time there was great opposition to foreigners, and the English engineers, as well as the workmen, threw every obstacle in Bodmer's way.

Nevertheless, he made a determined fight for success, and originated many improvements in machinery, among them being a spherical journal box in 1834 of the same construction as Nasmyth's of four years later. These spherical bearings were successfully used on locomotives and cars on English railways. In 1841 he invented the inverted vertical steam engine, anticipating Nasmyth by seven years.

Bodmer's diaries are now in my possession, and they give a highly interesting account of how this indomitable Swiss engineer, who was about fifty years in advance of his time, grappled with difficulties and obstructions which to-day are unknown to the scientific inventor.

During his residence in Switzerland and Germany in 1804, he invented spiral-gear wheels. In 1808 he made a breech-loading rifled cannon, which was thoroughly tested by the officers of artillery in the Grand Duke of Baden's regiment, and pronounced successful; but it was not adopted, for the world was not then ready for breech-loading firearms.

In England, in 1833, he invented the double-piston balanced steam engine, and locomotives on this principle were used on the London and Brighton and South-Eastern railways. Bodmer said that they ran with absolute steadiness at all speeds. They anticipated the balanced locomotive by about fifty years. The original drawings of these locomotives are in my hands; they had cylindrical slide valves, variable expansion valves, superheaters, feed-water heaters, and four-wheeled trucks.

At Manchester Bodmer introduced new forms of cotton machinery and machine tools, some of the latter being subsequently ascribed to Whitworth. Bodmer claimed to have improved the whole system of cotton spinning, one of his inventions being a carding engine, the drums or cylinders of which were self-stripping. He affirmed that if the English cotton-mill owners had adopted all of his improvements, they would have reduced the cost of production by one-half.

English engineers openly opposed him, but secretly copied his improvements, and in 1842 it was found that his inventions were in unlawful use in over sixty mills and machine shops in Lancashire; but Bodmer patented his inventions and proceeded against his infringers, from whom he collected heavy damages. He obtained fifteen patents in England and many more in foreign countries. Three of his English patents were so valuable that they were prolonged, at great trouble and expense, by special act of Parliament.

In 1842 Bodmer invented a rolling mill for rolling railway wheel tires in the circle, and these mills have been manufactured from that day to this, the latest being installed in the Standard Steel Works Company's shops; also a complete plant for the Japanese government.

In 1843 Bodmer brought out his patent air pump for condensing engines. The plunger of this pump was conical, and wiped over the ports in such a way that no valves were required. This valveless air pump is now, with slight improvements, being manufactured by a London syndicate.

Bodmer subsequently moved to London, and associated with the leading engineers of the day, including Brunel and Robert Stephenson; but they regarded him as a radical, and received him coldly. When he suggested that railway cars should be built with a central passageway and a lavatory for the convenience of passengers, he was laughed at. In 1846, at a meeting of the Institution of Civil Engineers, he was amused at the pompous way in which fuel consumption, tractive effort, and counterbalancing of locomotives were discussed by the great English engineers, without proper data. Bodmer affirmed that they were talking wildly, and the only way would be to build a stationary testing plant, so that the locomotive and its movements could be studied while the working parts were running at full speed. This was regarded as such an outlandish scheme, that it was not even discussed.

He tried to get his balanced marine engines built by Penn and Rennie, the leading marine engineers of London, but they feared him as a competitor, and told him that they would not build his engines, not even if they got orders from the British government.

In 1847 failing health necessitated Bodmer's return to Switzerland, where he designed machine tools for his son-in-law, Frederick Reishauer, who was a tool maker at Zürich. These tools were successful, and enabled Reishauer to start the extensive works at Zürich now known as the Actiengesellschaft für Fabrikation Reishauer'scher Werkzeuge, where some of Bodmer's machine-tool inventions are in present use, and where his drawings were lately discovered.

Bodmer died in 1864. He was one of the most brilliant inventors of the nineteenth century, but it is only now that engineers have begun to recognize the great scope and value of his inventions, and the part he played in the development of modern machinery.

HERBERT T. WALKER.

Binghamton, N. Y., October 12, 1908.

Rearmament of Warships.

To the Editor of the SCIENTIFIC AMERICAN:

You have recently published a couple of letters on the rearmament of our more important battleships and cruisers. The projects mentioned would, however, entail considerable reconstruction of ships and turrets, and, as you noted, the money needed to effect this could be spent to greater advantage on new ships.

It seems to me that by using more powerful 8-inch guns the required result might be easily obtained. A 50-caliber 8-inch gun, as used by the Russians, ought to be able to fire a 340- to 350-pound shell. (The new French 50-caliber 12-inch gun uses a shell correspondingly heavier than that employed in their 45-caliber model.)

An 8-inch gun thus equipped would have practically the same size shell and as great a velocity as the 50-caliber British 9.2-inch, which is considered equal to a 45-caliber 10-inch gun.

The increase in length and weight over the present 8-inch model would be very slight and, if the military masts, cranes, and flying bridges were removed from our battleships and cruisers, these guns might also replace some of the 7-inch and 6-inch, thus giving a broadside superior to the "Aki" or "Lord Nelson" for the battleships and to the "Kurama" or "Shannon" for the cruisers. Fifty-caliber guns are more easily worn out than 45-caliber ones, but still the 50-caliber are used.

T. B. THOMPSON.

Greenwich, Conn., September 11, 1908.

On October 11 Mr. Wilbur Wright increased his aeroplane record with a passenger to 1 hour, 9 minutes, and 45 seconds. His passenger in this flight was M. Painleve, a member of the French Institute. The flight was executed with perfect steadiness, and was the most successful that has as yet been made. After teaching three different men how to operate the aeroplane, Mr. Wright, according to report, will return to the United States.

V.—THE JAPANESE NAVY OF TO-DAY.

The fact that our Atlantic fleet of sixteen battleships is just now in a Japanese harbor and the recipient of Japanese hospitality gives particular interest to the present article on the Japanese navy. Comparisons of a friendly character will be inevitable, and it is a matter for considerable satisfaction to know that, in spite of the recent rapid growth of the Japanese navy, it cannot assemble, even to-day, so formidable an array of first-class battleships as that under command of Admiral Sperry.

The Japanese navy ranks fifth in importance among the leading navies of the world. The relative rank of the four other navies is Great Britain, United States, Germany, and France. Each of these has been treated in a separate illustrated article of the present series—the British navy on March 7, 1908, the United States navy December 7, 1907, the German navy August 8, 1908, and the French navy September 19, 1908. The rise of the Japanese navy to its present position as one of the leading navies of the world, has been rapid and highly spectacular. For the beginnings of her *modern* navy, we need go back not more than twenty years, or, say, to the commencement of the last decade of the nineteenth century. At that time her fighting strength consisted of three cruisers of the "Hashidate" class, each carrying a 12½-inch gun and eleven 4.7-inch quick-firers; the little armored cruiser "Chiyoda" of 2,450 tons; and a few smaller cruisers which to-day would be considered in the gunboat class. With this Lilliputian fleet she crushed the naval power of China and gave such evidence of latent genius for naval strategy and tactics that she won the instant respect of naval critics the world over, who predicted for her a brilliant naval future. The wresting from Japan of Port Arthur (one of the richest fruits of her victory) by the joint action of France, Germany, and Russia, stung deeply the pride and stimulated the activity of this valiant race. They immediately set about the construction of that fleet which, less than ten years later, in a series of brilliant victories, crushed the naval power of Russia and all but swept her navy out of existence. Although we have placed Japan in the fifth position in respect of the number, displacement, and fighting power of her ships, it should be remembered that the actual fighting value of a navy depends as much, if not more, upon its men as it does upon its material. Moreover, the fact that the Japan of the future will probably be fighting in her home waters, and within easy reach of her naval bases, will necessarily give her great advantage over any of the navies, more powerful on paper, with which she may have to contend. It is only during the last few years that Japan has undertaken the construction of ships in her own yards. Consequently, the bulk of her navy is of foreign build, and bears the impress of foreign design. The earliest ships of her modern navy were built in France; but the majority of her battleships and armored cruisers have been designed and constructed in English yards, notably those of Armstrong and of Vickers-Maxim. Consequently, her ships, and particularly the battleships, approximate more nearly those of Great Britain than they do to the ships of any other navy. Since the Russian war, however, Japan has progressed by leaps and bounds. She has struck out on original lines, and in her latest battleships and cruisers she has produced ships of large size, high speed, and carrying exceptionally heavy batteries. A particularly notable fact is the tenacity with which she has clung to the secondary battery. She followed the big-gun-ship fashion set by the "Dreadnought," without sacrificing the 6-inch gun; her latest battleships carrying a very formidable armament of 6-inch and 4.7-inch rapid-fire guns. Her new vessels are thoroughly up-to-date, and Japan has adopted the turbine as the exclusive motor power for her future vessels of large size.

SUMMARY.—The Japanese navy includes fifteen battleships of over 10,000 tons displacement, the oldest of which was launched in 1894, and most of which are not over ten years old. Their total displacement is 233,094 tons. Four of these, of the "Dreadnought" type, are at present under construction. The thoroughly modern character of Japan's navy is shown by the fact that it includes but one battleship of such early date as to relegate it to coast defense, and this is the "Iki," one of the Russian battleships captured at the battle of Tsushima. This vessel is of 9,672 tons. Japan is strong in armored cruisers, having thirteen of these ships with a total displacement of 136,212 tons.

Of second-class cruisers Japan possesses four, of 23,306 tons aggregate displacement. These are fast protected vessels with a speed of from 20 to 22 knots. There are also fifteen third-class cruisers of from 2,450 to 4,277 tons displacement—a miscellaneous lot of vessels ranging from the 25-knot "Sutsuya," formerly the Russian "Novik," to the 17-knot "Hashidate," of 4,277 tons, carrying as its main armament a 12½-inch gun. The total displacement of ships in this class is 52,025 tons.

SCIENTIFIC AMERICAN

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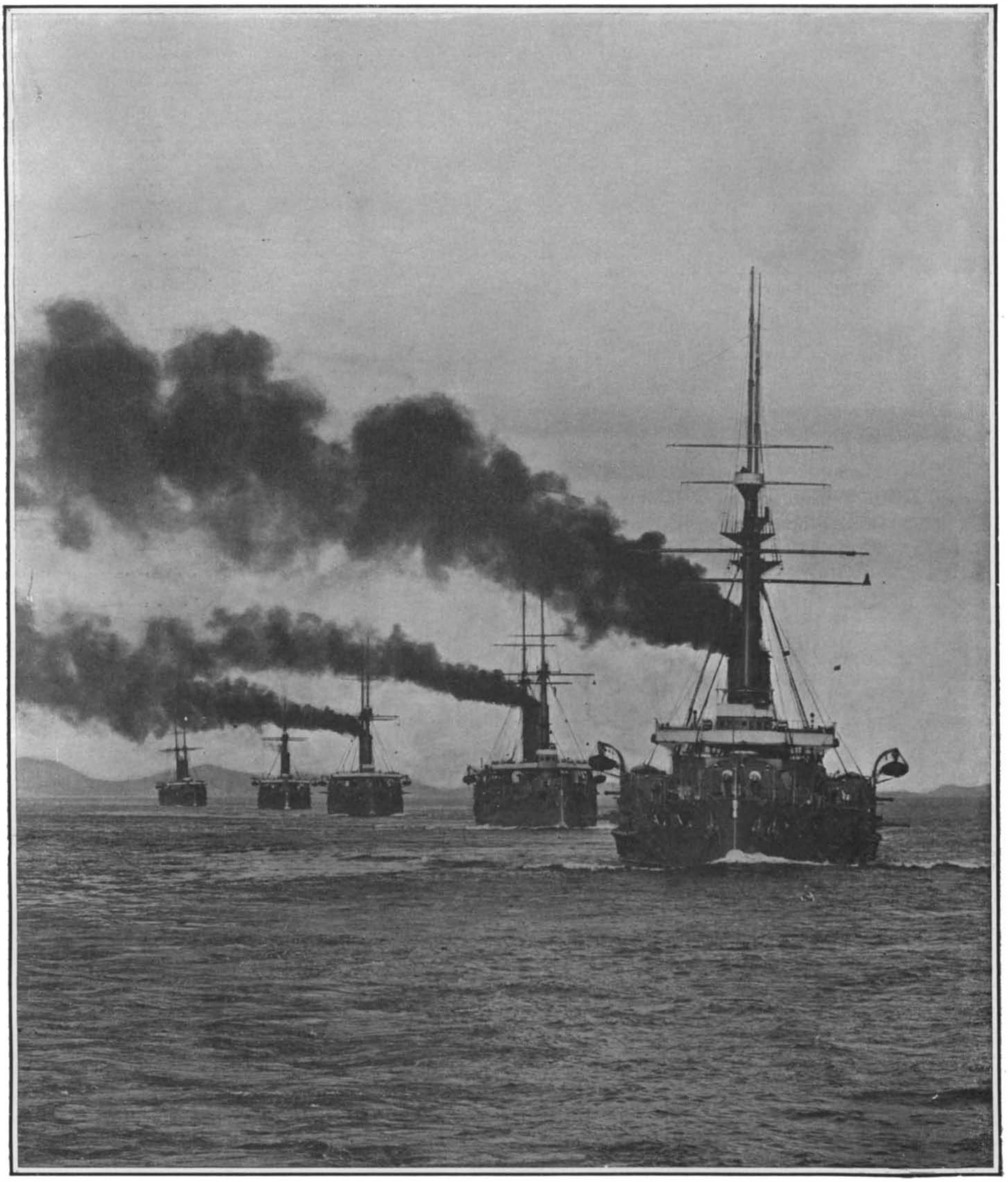
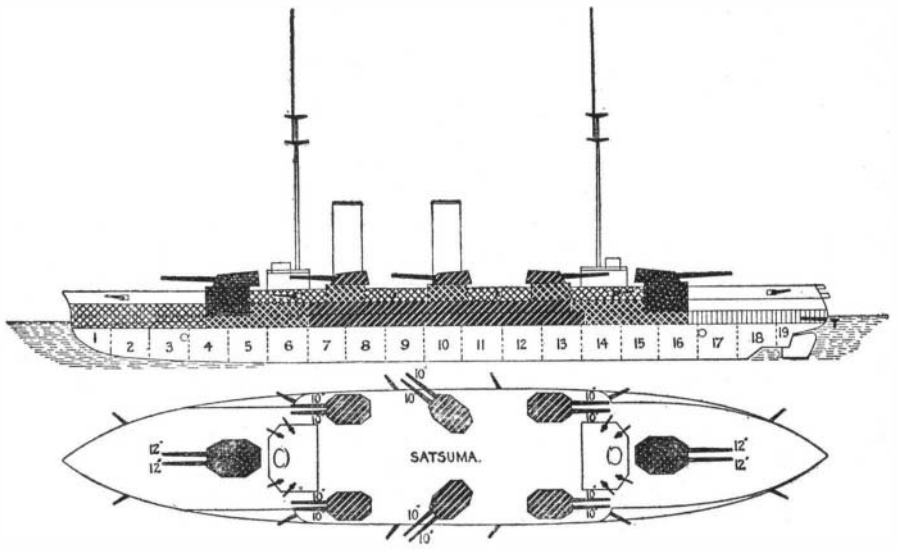


The new 16,400-ton battleship "Katori," with the Crown Prince of Japan on board, entering a Japanese harbor, followed by the armored cruisers "Iwate," "Izumo," "Tokiwa," and "Asama."

V.—THE JAPANESE NAVY OF TO-DAY.—[See page 279.]

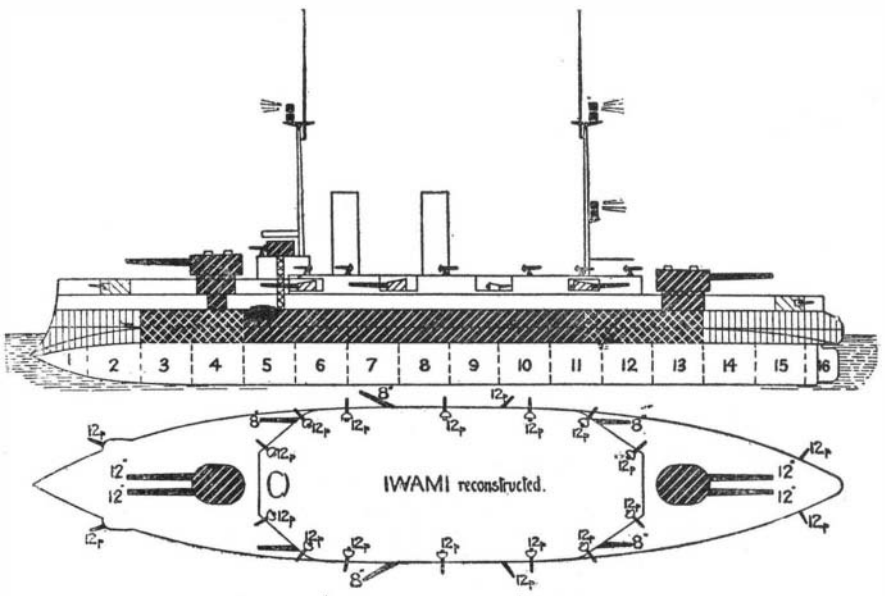
In the above enumeration we have considered only vessels which count for much in modern naval warfare. The Japanese navy includes, as do the other first-class navies, a considerable number of gunboats, old cruisers, and one or two obsolete battleships whose low speed, weak armament, or other defects place them outside of the list of effective ships. The fleet of Japanese destroyers is thoroughly modern, and includes sixty-four vessels built or under construction, ranging in displacement from 320 to 1,100 tons and in speed from 27 to 35 knots. The average displacement of these vessels, excluding a few of the latest designs, is about 350 tons, and the speed about 30 knots. The torpedo fleet also includes ninety-five torpedo boats, which will average in displacement about 125 tons with a speed of 28 knots. Of the ninety-five boats, forty-five are under construction. These are to have a speed of 27 knots and will displace 150 tons.



Displacement, 19,750 tons. **Speed,** 20.5 knots. **Coal,** 2,700 tons. **Armor:** Belt, 9 inches; deck, 3 inches; sides, 8 inches; turrets, 8 inches; central battery, 6 inches. **Guns:** Four 45-caliber 12-inch; twelve 45-caliber 10-inch; twelve 6-inch. **Torpedo tubes,** 5. **Complement,** 850.

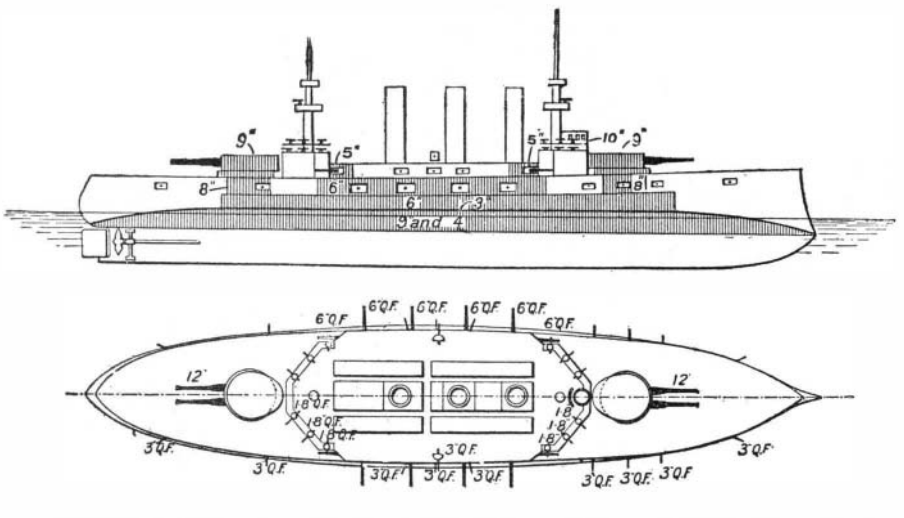
Battleships "Aki" and "Satsuma." "Dreadnought" type.

BATTLESHIPS.—The fleet of Japanese battleships is rather a heterogeneous collection of vessels, much more so than one would have expected from so methodical and judicious a people as this Oriental race have proved themselves to be. That the ships do not arrange themselves readily in classes, is due entirely to the rearrangement of naval forces and strength which took place in the Far East as the result of the Russo-Japanese war, in the course of which Japan not only lost two of her battleships, but also captured so many more than she had lost from Russia, that she actually emerged from the strife with a fleet much more powerful than that with which she entered. All of the captured battleships had suffered more or less severely from the gun, mine, or torpedo. Many of them had been sunk by the Russians themselves in Port Arthur on the eve of the surrender of that fortress. They were subsequently raised by salvage opera-



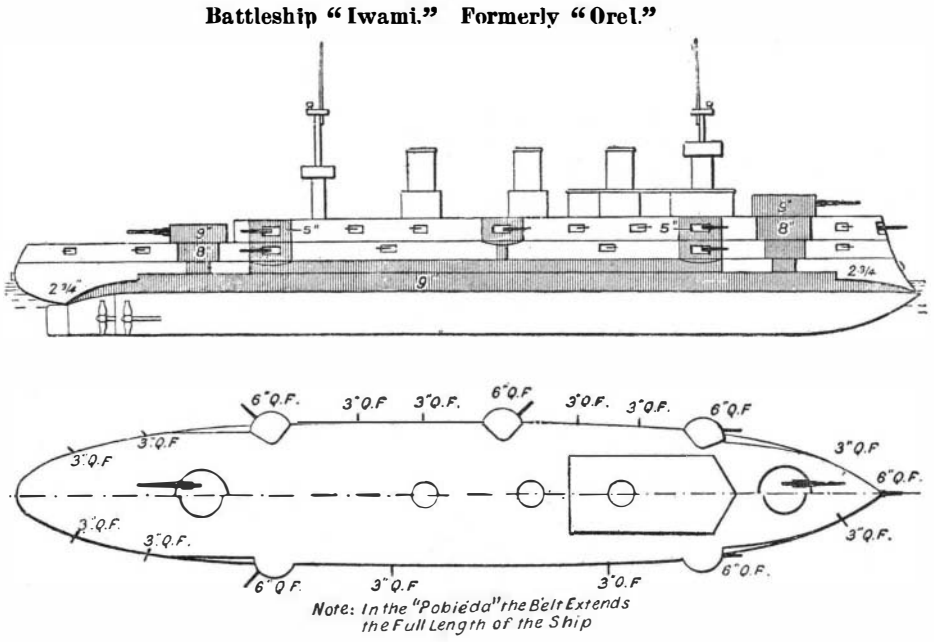
Displacement, 13,500 tons. **Speed,** 18 knots. **Coal,** 1,250 tons. **Armor:** Belt, 7¾ inches; deck, 3 inches; sides, 6 inches; turrets, 10 inches; shields, 6 inches. **Armament:** Four 12-inch 45-caliber Japanese guns; six 8-inch 45-caliber Japanese guns; twenty 3-inch. **Torpedo tubes,** 3. **Complement,** 750.

Battleship "Iwami." Formerly "Orel."



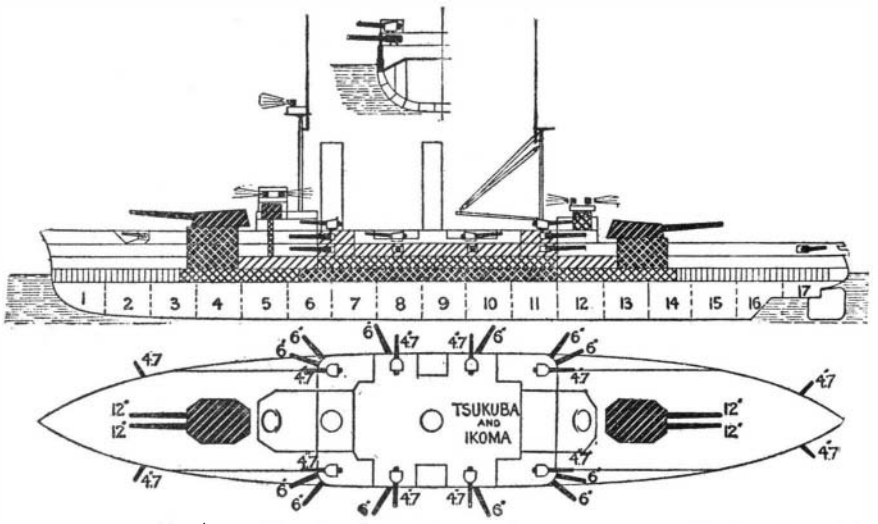
Displacement, 12,700 tons. **Speed,** 18.5 knots. **Coal,** 2,000 tons. **Armor:** Belt, 9 inches; deck, 3 inches; sides, 6 inches; battery and casemates, 5 inches; turrets, 10 inches. **Armament:** Four 12-inch; twelve 6-inch; twenty 3-inch. **Torpedo tubes,** 4. **Complement,** 750

Battleship "Hizen." Formerly "Retvizan."



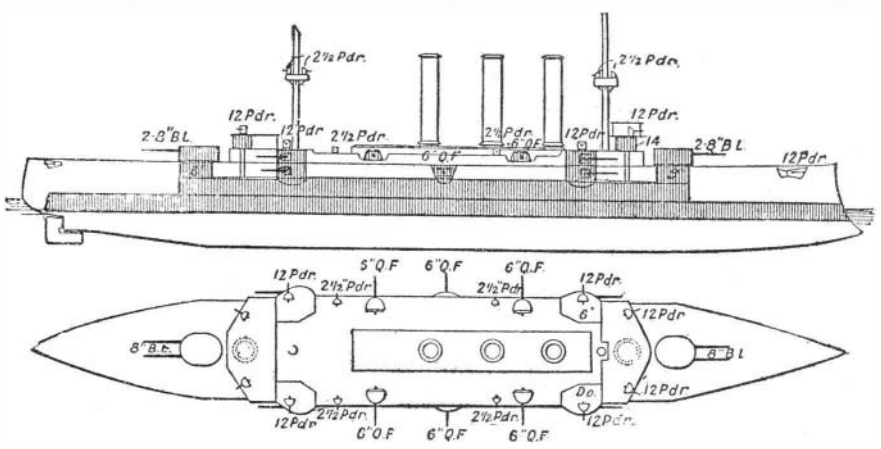
Displacement, 12,674 tons. **Speed,** 19 knots. **Coal,** 2,000 tons. **Armor:** Belt, 9 inches; deck, 2¾ inches; sides and casemates, 5 inches; turrets, 10 inches. **Armament:** Four 12-inch 40-caliber Japanese guns; ten 6-inch; twenty 3-inch. **Torpedo tubes,** 4. **Complement,** 730.

Battleships "Suwo" and "Sagami." Formerly "Pobieda" and "Peresviet."



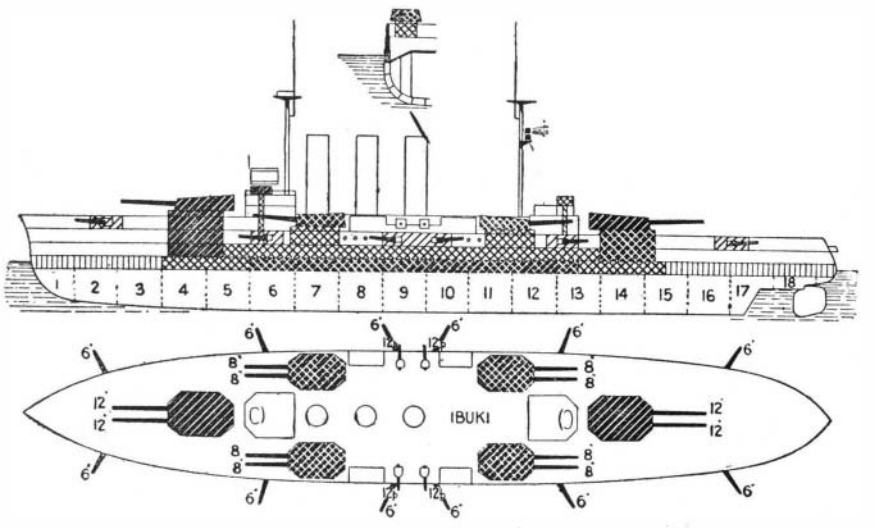
Displacement, 13,750 tons. **Speed,** 20.5 knots. **Coal,** 2,000 tons. **Armor:** Belt, 7 inches; deck, 2 inches; sides, 5 inches; turrets, 7 inches; battery, 5 inches. **Armament:** Four 12-inch 45 caliber; twelve 6-inch 45-caliber; twelve 4.7-inch: four 3-inch. **Torpedo tubes,** 5. **Complement,** 817.

Armored Cruisers "Tsukuba" and "Ikoma."



Displacement, 9,800 tons. **Speed,** 21 knots. **Coal,** 1,500 tons. **Armor:** Belt, 7 inches; deck, 2½ inches; sides, 5 inches; casemates, 6 inches; turrets, 6 inches. **Armament:** Four 8-inch; fourteen 6-inch; twelve 3-inch. **Torpedo tubes,** 4. **Complement,** 483.

Armored Cruiser "Idzumo." Six ships with slight variations.



Displacement, 14,600 tons. **Speed,** 22 knots. **Coal,** 2,000 tons. **Armor:** Belt, 7 inches; sides, 5 inches; deck, 2 inches; turrets, 7 inches. **Armament:** Four 12-inch; eight 8-inch; fourteen 4.7-inch; four 3-inch. **Torpedo tubes,** 5. **Complement,** 850.

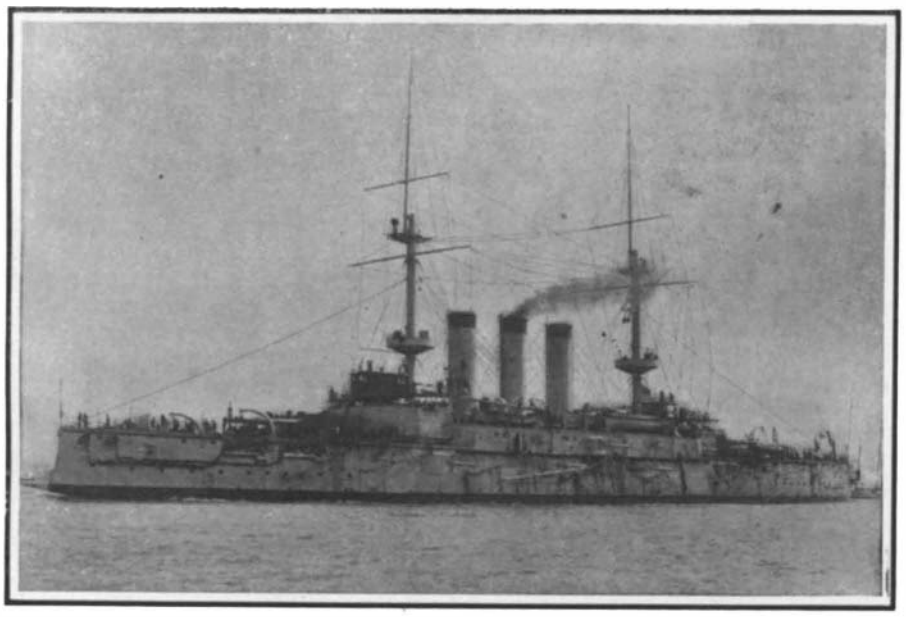
Armored Cruisers "Kurama" and "Ibuki."

(Above diagrams from Jane's Fighting Ships and Brassey's Naval Annual.)

V.—THE JAPANESE NAVY OF TO-DAY.

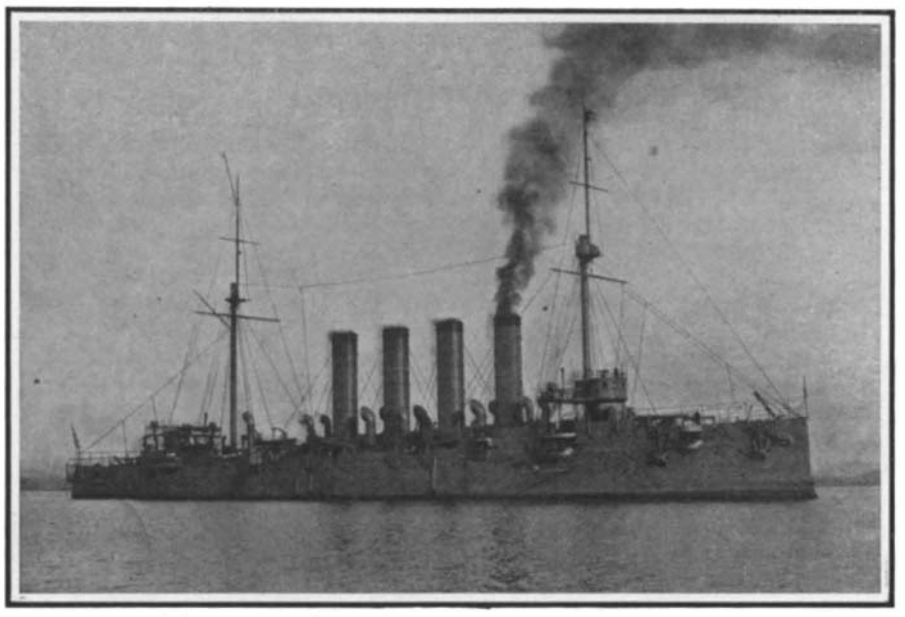
tions in which the Japanese betrayed remarkable patience and ingenuity; and they have been repaired and refitted and in some cases rearmed. The secrecy of the Japanese about their naval affairs renders it difficult to ascertain just what changes they have made. Generally speaking, the useless bridges and upper works have been removed or cut down; in some cases the batteries have been retained, in others replaced by more powerful Japanese guns. It is probable that these vessels are as effective and, in some cases, more so, than when they sailed under the Russian flag.

The most important battleships are four of the "Dreadnought" type, two of which are nearing completion, and the other two about one-third completed. The "Aki" and "Satsuma," built respectively at Kure and Yokosuka, are vessels of 19,750 tons and 19,500 tons displacement respectively. The "Aki" is designed to make 20½ knots with Curtis turbines of 25,000 horse-power. The "Satsuma" will be driven by reciprocating engines of less power and her estimated speed is about 20 knots. Outside of these differences in displacement, engine power and speed, the two vessels are practically identical. The Japanese evidently are not advocates of the high forecastle deck which has been adopted generally for battleships of the "Dreadnought" type. Their ships are flush throughout and have a freeboard of about 20 feet. The armor protection consists of a 9-inch belt thinned down to 6 inches at the bow and 4 inches at the stern. The protective deck is 3 inches in thickness. The armor belt is carried up to the level of the gun deck except from the after turret to the stern where it finishes at the protective deck. The 9-inch belt is carried up amidship to the gun deck, diminishing, however, from 9 to 8 inches, and the whole of the central battery is protected by 6 inches of armor. The battery is unusually powerful, including sixteen armor-piercing guns, four 12-inch and twelve 10-inch. The 12-inch, 45-caliber guns are mounted in two turrets, one forward and one aft, protected by 12 inches of armor. The 10-inch guns of 45 calibers are mounted in six two-gun turrets, three on each beam, protected by 8 inches of armor. For protection against torpedo attack the Japanese retained the 6-inch rapid-fire gun, eight of these being mounted on the gun deck within the central battery, and two on the same deck forward in sponsons and two in sponsons aft. The concentration of fire is two 12's, four 10's, and four 6's ahead and astern, and four 12's, six 10's, and six 6's on the broadside. It will be noted that the Japanese do not favor the mounting of the main battery on the center line as is done in our "North Dakota." The method adopted in the "Aki" and "Satsuma" involves the masking of one-half of the 10-inch battery at all times during an engagement. The two later "Dreadnoughts" laid down at Yokosuka and Kure in 1906 and 1907 are due to be completed in 1910, but little is known with certainty about these ships. They will be somewhat larger than the "Aki" and will displace between



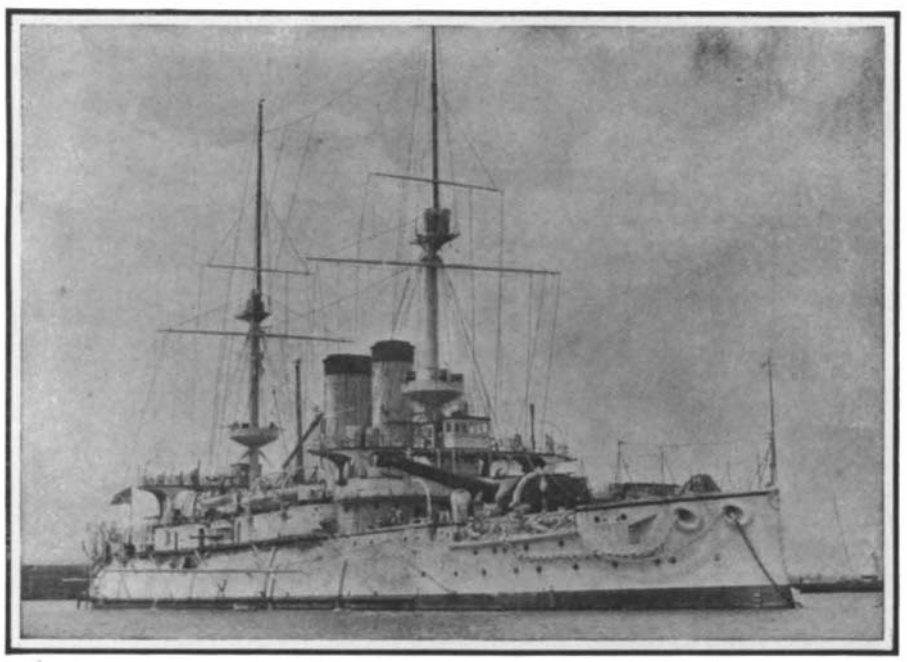
Displacement, 15,000 tons. **Speed,** 18.5 knots. **Coal,** 1,700 tons. **Armor:** Belt, 9-inch; deck, 3-inch; sides and casemates, 6-inch; turrets, 10-inch to 14-inch. **Armament:** Four 12-inch; fourteen 6-inch; twenty 3-inch. **Torpedo Tubes,** 5. **Complement,** 741.

Battleship "Shikishima."



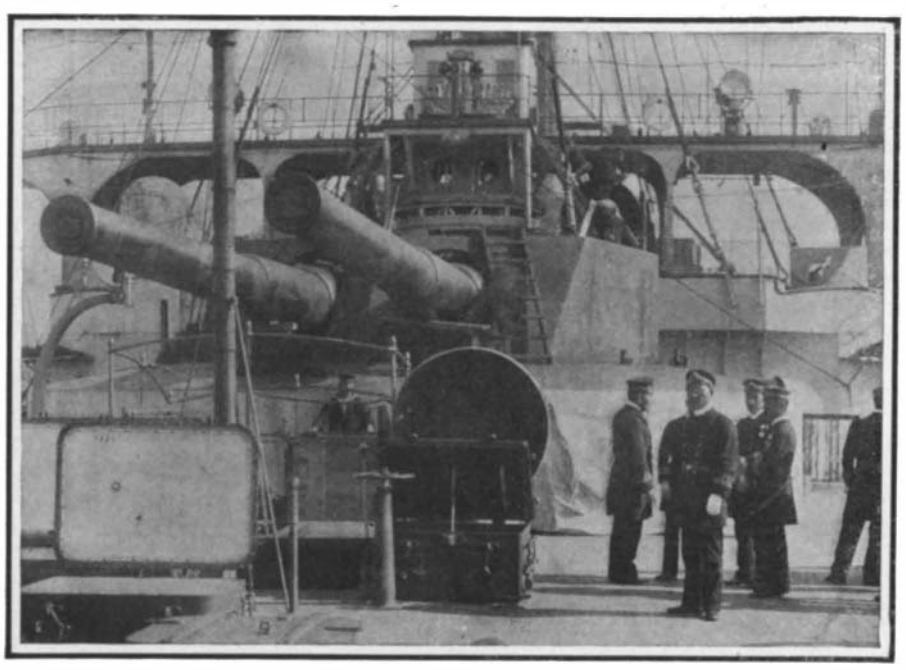
Displacement, 6,500 tons. **Speed,** 24.6 knots. **Coal,** 1,250 tons. **Armor:** Deck, 3-inch. **Armament:** Twelve 6-inch 45 caliber; twelve 3-inch. **Torpedo tubes,** 4. **Complement,** 571.

Protected Cruiser "Soya." Formerly "Variag."



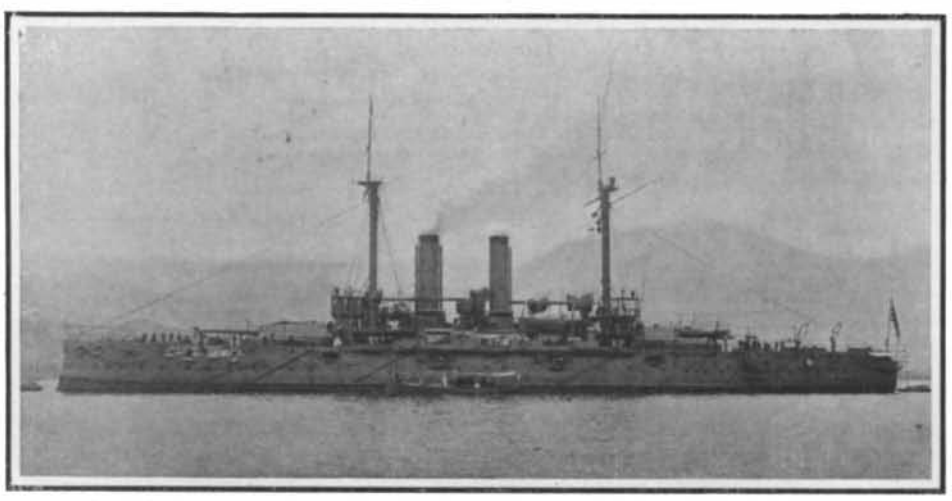
Displacement, 15,200 tons. **Speed,** 18.5 knots. **Coal,** 1,700 tons. **Armor:** Belt, 9-inch; deck, 3-inch; sides, 6-inch; turrets, 10-inch to 14-inch; casemates, 6-inch. **Armament:** Four 12-inch; fourteen 6-inch; twenty 3-inch. **Torpedo tubes,** 4. **Complement,** 770.

Battleship "Mikasa."



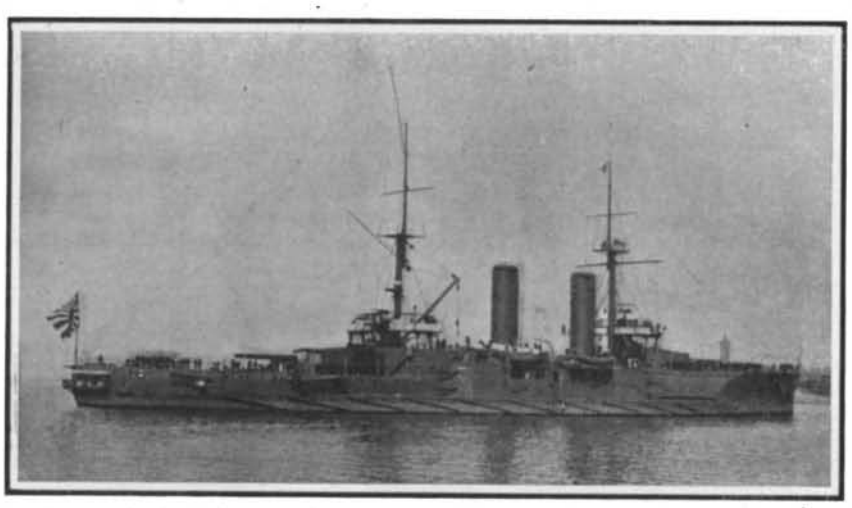
Weight of Shell, 850 pounds. **Velocity,** 2,400 foot-seconds. **Penetration of Krupp Steel** at 5,000 yards is 12 inches.

After Pair 12-inch 40-caliber Guns on the Battleship "Asahi."



Displacement, 12,300 tons. **Speed,** 18 knots. **Coal,** 1,500 tons. **Armor:** Belt, 18-inch; deck, 2½-inch; side, 4-inch; turrets, 1[illegible]-inch to 6-inch; casemates, 6-inch. **Armament:** Four 12-inch 40-caliber; ten 6-inch; sixteen 3-inch. **Torpedo tubes,** 5. **Complement,** 600.

Battleship "Fuji."

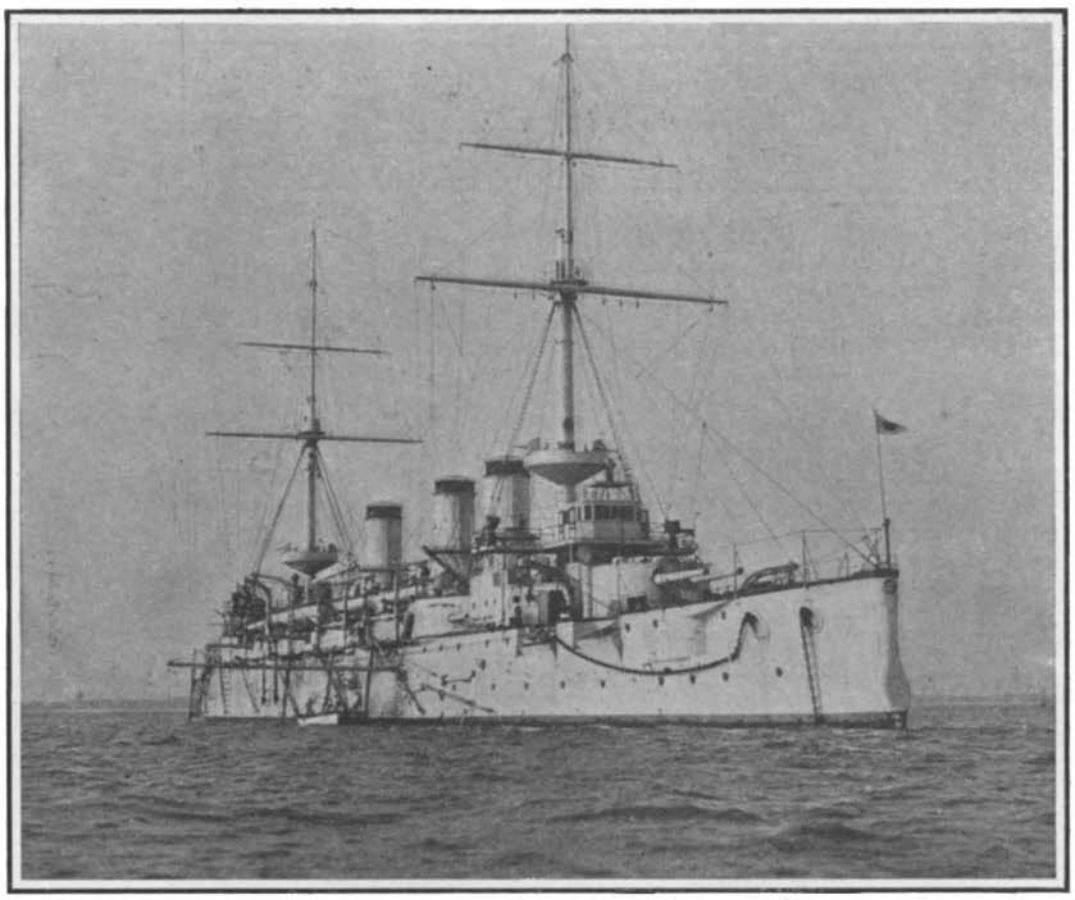


Displacement, 13,750 tons. **Speed,** 20.5 knots. **Coal,** 2,000 tons. **Armor:** Belt, 7-inch; deck, 2-inch; turrets, 7-inch; central battery, 5-inch; sides, 5-inch. **Armament:** Four 12-inch; twelve 6-inch; twelve 4.7-inch; four 3-inch. **Torpedo tubes,** 5. **Complement,** 817.

Armored Cruiser "Tsukuba."

V.—THE JAPANESE NAVY OF TO-DAY.

20,000 and 21,000 tons. They will be driven by turbines at a speed of about 20½ knots and will probably mount a dozen 12-inch 45-caliber guns, and a secondary battery of 6-inch and 4.7-inch guns. In view of the universal adoption by the other powers of the axial position for the 12-inch guns, it is probable that the batteries of these ships will be mounted on that plan, with two turrets forward, two aft, and one on each beam disposed diagonally so as to permit of the whole battery being fired on either broadside. The two most important battleships at present in commission are the "Kashima" and "Katori," built since the war in the Elswick and Vickers yards. They are halfway "Dreadnoughts," since they carry eight large armor-piercing guns, four 12-inch (in the customary positions, fore and aft), and four 10-inch mounted in single turrets, one at each corner of the central battery. The secondary armament consists of twelve 6-inch guns and a dozen 14-pounders. The 6-inch are mounted on the gun deck and the upper deck amidships. These vessels are of 16,400 tons displacement and on trial they made 19.2 and 20.2 knots respectively. The protection consists of a 9-inch belt thinning to 6½ inches at the end; a deck 3 inches on the slopes; 9 inches of protection for the main turrets; 8 inches for the 10-inch gun turrets; and 6 inches of side armor extending from the belt up to the main deck. With a coal supply of 2,000 tons, these vessels have a good radius of action; they are formidable ships, being somewhat more powerful than the "King Edward" class of the British navy. Next in importance are three generally similar battleships which went through the Japanese war, the "Mikasa," "Asahi," and "Shikishima." They are of 15,200 tons displacement and the speed is 18 to 18½ knots. The "Mikasa," famous as Admiral Togo's flagship, carries four 12-inch, fourteen 6-inch, and twenty 12-pounder guns. The same battery is mounted on the "Asahi" and "Shikishima," though the pieces are less powerful in the latter ships, being of 40 calibers as against 45 calibers in the "Mikasa." The armor plan also is similar in thickness and disposition. The belt is 9 inches thick, the deck 3 inches, and the protection to the barbettes and turrets is 14 inches and 10 inches. The "Asahi" and "Shikishima" have Harvey nickel armor. The "Mikasa's" armor was made under the Krupp process. A point of difference in the armor plan is that the secondary battery in the "Shikishima" and "Asahi" is mounted behind casemates of 6-inch armor, while the "Mikasa's" secondary battery is carried mainly behind a central armored redoubt of 5-inch armor. The bunker capacity of these ships varies from 1,400 to 1,700 tons. It will be remembered that the "Mikasa" was sunk during the war, and that she was subsequently raised and repaired. The "Fuji," of 12,300 tons and 18 knots, is the other surviving battleship of the war. She is now twelve years old, having been built on the Thames in 1896. She is similar to the ships of the "Majestic" class. She has a partial belt of 18-inch Harvey armor, with 4 inches of protection to the berth deck. Her ten 6-inch guns are carried in casemates, and her four 12-inch 40-caliber guns in two turrets, one forward and one aft. She is what is known as a soft-ended ship, there being no water-line protection forward and aft. The rest of the battleship fleet consists of vessels captured from Russia. The most important of these is the "Iwami," formerly the "Orel," which was captured at the battle of Tshushima, after being severely hammered by the Japanese, and was reconstructed in 1906 and 1907. As the "Orel," she was a high-freeboard vessel of the French type. The Japanese cut down the smokestacks, removed the bridges, lowered the gun positions and produced a serviceable and rather shapely vessel. The "Iwami" has a 7¾-inch belt, 10 inches of armor on the main turrets, and 6 to 4 inches of armor on the upper belt. She carries four 12-inch 45-caliber Japanese guns in two turrets and six 8-inch 45-caliber Japanese guns on the main deck, behind 6 inches of armor. Next in importance is the "Hizen," formerly the "Retvizan." She was built at Cramp's yard, Philadelphia; was torpedoed in the first attack on Port Arthur; went through the battle of August 10 off Port Arthur; was finally scuttled at the surrender; and was raised by the Japanese in 1905. Her battery consists of four 12's, twelve 6's, and twenty 12-pounders. She is protected by a 9-inch belt, with a secondary belt of 6-inch armor; has 10 inches on the turrets and 5 inches on the secondary battery and the casemates. Her speed on trial was 18 knots and she can stow a maximum amount of 2,000 tons of coal. She still carries her 40-caliber Russian guns; and, unless the Japanese have been able to effect very thorough repairs, her value must be considered to be doubtful. The other two battleships, "Suwo" and "Sagami," are practically twin ships and 12,674 tons displacement. They were formerly known as the "Pobieda" and "Peresviet." Both ships were sunk at Port Arthur and subsequently salved. They are characterized by a lofty spar deck, on which are mounted the forward guns of the main battery. Originally the main battery consisted of four 10-inch guns; but, in rearming these vessels, the Japanese have substituted four 12-inch 40-caliber guns. The secondary battery is mounted in casemates on the main and gun decks. The ships are protected by a 9-inch belt of Harvey armor, which is continuous in the "Suwo," but stops short of the ends in the "Sagami." The bunker capacity is good, being over 2,000 tons, and the designed speed is 19 knots. Among the second-class and coast defense battleships are the "Tango," of 11,000 tons, formerly the Russian battleship "Poltava," carrying four 12's and twelve 6-inch guns, built in 1894; the "Iki," formerly the Russian "Nikolai," carrying two 12's, four 9's, and seventeen 6-inch guns, all of obsolete pattern; and the "Okinoshima" and "Mishimi," captured at Tsushima, vessels of 4,200 tons displacement, armed, the former with three 10-inch, the latter with four 9-inch guns. The protection in each case consists of a 10-inch belt associated with a 3-inch deck.



Displacement, 9,456 tons. **Speed,** 21 knots. **Coal,** 1,300 tons. **Armor:** Belt, 7 inches; deck, 2½ inches; sides, 5 inches; casemates, 6 inches; turrets, 6 inches. **Torpedo tubes,** 5. **Complement,** 490.

Armored Cruiser "Adzuma."

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Armored Cruisers.—The most important armored cruisers in the Japanese navy are two 18,450-ton ships known as "X" and "Y," now being built in Japanese yards, which will be driven by Curtis turbines at 25 knots and will be armed with four 12-inch, eight 10-inch, and eight 6-inch guns. These vessels are to be completed in 1909. The "Kurama" and "Ibuki," of 14,620 tons, which are about completed, carry four 12-inch guns, in two turrets forward and aft; eight 8-inch in four turrets arranged at the four corners of the superstructure; and fourteen 4.7-inch guns, mounted behind casemates on the gun and main deck. These ships have a 7-inch belt, 2-inch deck, 7 inches on the main turrets, 6 inches on the secondary turrets. The "Tsukuba" and "Ikoma," of 13,750 tons and 20½ knots, have about the same armor plan as the "Kurama." They mount four 12-inch in two turrets; twelve 6-inch in a central redoubt of 5-inch armor and in casemates; and twelve 4.7-inch guns mounted behind shields. The "Kasuga" and "Nisshin," purchased from Argentina at the opening of the late war, are of 7,700 tons displacement and 20 knots speed. The armor plan shows a 6-inch belt, 5½ inches on the turrets, and 6 inches on the central battery. The "Kasuga" carries one 10-inch gun in a turret forward, two 8-inch in a turret aft, and fourteen 6-inch in the central battery. The armament of the "Nisshin" is similar, with the exception that the place of the 10-inch gun forward is taken by a pair of 8-inch guns. Next in importance is the fine armored cruiser "Aso," formerly the "Bayan," captured from Russia. She is of 7,800 tons and 21 knots; mounts two 8-inch and eight 6-inch guns and is protected by an 8-inch belt; a 3¼-inch upper belt, and 7 inches on the big-gun turrets. The rest of the armored cruiser fleet is made up of six excellent vessels, the "Idzumo," "Iwati," "Adzuma," "Yakumo," "Asama," and "Tokiwa." The "Adzuma" was built in France, the "Yakumo" in Germany, and the other four at the Elswick Works, England. The six vessels are so nearly alike that it is not necessary to describe them in detail. They are good for 20 to 21 knots and their displacement averages about 9,700 tons. They are armed with four 8-inch 40-caliber guns, carried in two turrets, and fourteen 6-inch guns mounted in casemates on the main and gun decks, with the exception of the "Yakumo" and "Adzuma," which have twelve such guns. The armor plan includes a 7-inch belt, a 2½-inch deck, 6 inches on the casemates and turrets, and 5 inches of side armor on the lower deck. They can stow from 1,300 to 1,400 tons of coal and they proved themselves, in the various actions of the late war, to be very serviceable ships.

Protected Cruisers.—The progress of ideas in naval construction, strategy, and tactics, especially during and since the Japanese war, has relegated the protected cruiser to a comparatively insignificant position. The strength of the Japanese navy lies in its fine fleets of battleships and armored cruisers, and it is not necessary to say much, nor will space allow us, about the protected cruiser class of this navy. The latest of this type to be laid down are two vessels of 4,100 tons and 23 knots, carrying two 6-inch and twelve 4.7-inch guns, which are to be completed this year and next. At present they are known as the "Tone" and "B." These are Japanese-built ships, as are also the "Otowa," of 3,050 tons, carrying two 6-inch and six 4.7-inch guns, and the "Niitaka" and "Shushima," of 3,420 tons and 20 knots, carrying six 6-inch and ten 12-pounders. The "Sutsuya," formerly the "Novik," of 3,000 tons and 25 knots, mounting two 6's and four 4.7's, and the "Soya," formerly the "Variag," built at Cramp's, Philadelphia, are both captured Russian ships. The "Soya" is of 6,500 tons and is designed for 23 knots, though she made over 24. Her battery consists of twelve 6-inch and twelve 3-inch guns. Another Japanese protected cruiser that once flew the Russian flag is the "Tsugaru," formerly the "Pallada," sunk at Port Arthur in 1904, and salved in 1905. She is of 6,630 tons, and 20 knots speed. Her battery consists of eight 6-inch guns and twenty-two 3-inch. Two vessels of interest to Americans are the "Kasagi" and "Chitose," of 4,760 tons and 22½ knots speed. They were built respectively at Philadelphia and San Francisco, and both went through the war. The armament consists of two 8-inch and ten 4.7-inch guns. The "Asashi" and "Suma" are 20-knot vessels of 2,700 tons, designed and built in Japan. They mount two 6-inch, six 4.7-inch and twelve 3-pounders. The "Hashidate" and "Itsukushima," of 4,277 tons and 16½ knots, went through the Chinese war.

Torpedo and Submarine Fleet.—It is scarcely necessary to add anything to the summary of the destroyer and torpedo boat fleet that was given at the opening of this article, further than to say that of the five latest destroyers, four will be of 890 tons displacement and 33 knots speed, and one of 1,100 tons and 35 knots—this last being a smaller edition of the British 38-knot "Swift." The good service rendered by these craft during the war testifies to the quality of the fleet itself and of the personnel which manned them. The Japanese submarine fleet consists of nine vessels, with seven proposed or under construction. The most important of these are five Holland boats of 125 tons; two Japanese boats of 85 tons; and two built by Vickers of 320 tons. The Holland boats have a speed of 9 knots on the surface and 7 submerged; the Vickers boats can steam 8 knots submerged and 13 knots on the surface.