First Picture of Japan's New Super-Dreadnaughts,

The following exclusive description of the Japanese battleships, about which there has been so much said in news despatches, has particular interest in connection with the accompanying article on the bombing-tests. It forecasts the type of future dreadnaughts with which bombing-planes would actually have to cope, instead of with the older type that they sank off the Virginia Capes. The picture, moreover, portrays the enormously costly naval construction in which the Powers will henceforward be forced to compete, unless the approaching international conference really results in a limitation of armaments.

By Wilfred S. Ogden

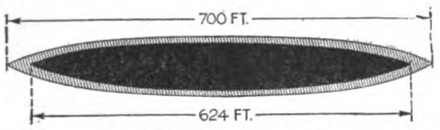
POPULAR SCIENCE MONTHLY publishes herewith the first picture of one of the two largest and most powerful war-ships the world has ever known. They are the new Japanese battleships *Kaga* and *Tosa*. Built in the private dockyards of the Kawasaki Company at Kobe and of the Mitsubishi Company at Nagasaki, these naval monsters—being launched this fall—are units of Japan's 1918-1919 naval program.

When completed, they will cost well around $40,000,000 each. In the United States, with higher labor costs, similar ships would be much more expensive. The normal displacements of the *Kaga* and *Tosa* are stated to be about 41,800 tons, as against 32,600 tons for the United States ship *Maryland*, and 41,200 tons for the British battle cruiser *Hood*. The length is 700 feet and the beam about 104 feet, normal, and 108 feet outside the "blisters." The full load displacement will be close to 48,000 tons.

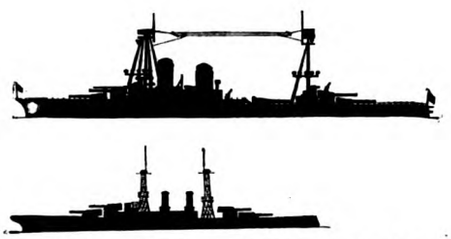
Their main batteries fire a broadside of no less than 24,600 pounds a ship, as against 16,784 pounds for the *Maryland*, and 15,600 pounds for the *Hood*. During the battle of Jutland the Germans were able to make quick work of three modern battle cruisers. The guns that did the work fired only a 900-pound shell. In the United States bombing tests this summer, it took two days for bombs weighing from 600 to 2000 pounds to sink a non-resisting, non-maneuvering war-ship. What could the *Kaga* and *Tosa* do in that time with their great battery power?

Ten 16-inch guns, mounted two in a turret in five turrets mounted on the center of the ship, form the main battery. They are 45 calibers long, of entirely Japanese manufacture, and fire a shell weighing 2460 pounds. Compare this shell with our 16-inch shell weighing 2098 pounds. A platform from which a small, fast airplane can be launched is on the crown of the highest forward turret. The plane is for spotting long-range shellfire. It is estimated that this spotting will give a 25 per cent greater hitting efficiency than was the average in 1914. The fire of these ships can be controlled at six different points.

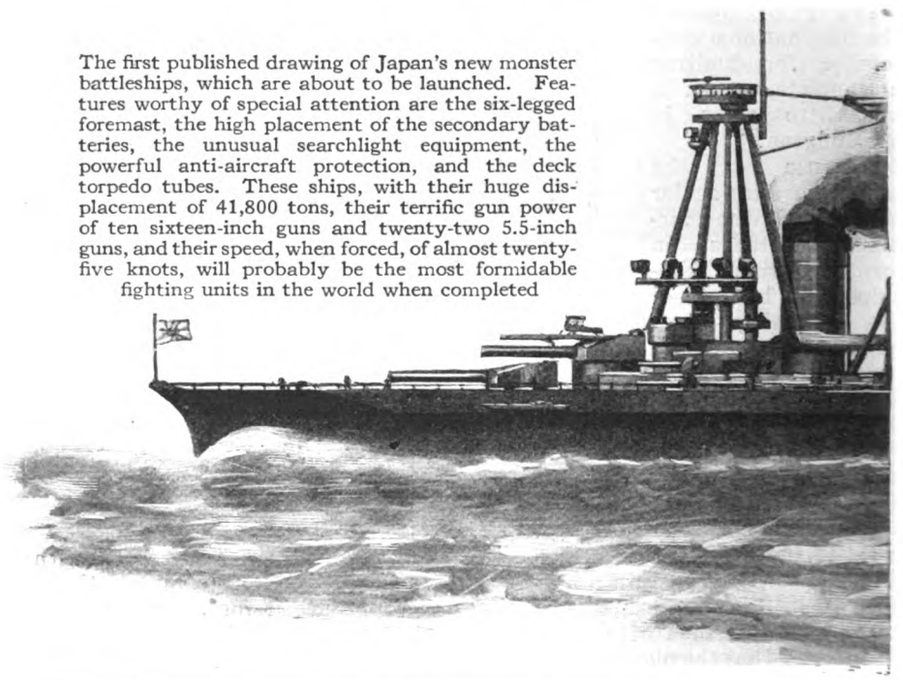
To get a good idea of the battery power of the Japanese ships, consider



The cross-hatched outline illustrates the superiority in size of the *Tosa* over the *Maryland*, indicated by the solid black section.



The length of these drawings indicates the difference in tonnage between ships of the *Tosa* class and the latest United States ships. The normal displacement of the Japanese ships is 41,800 tons compared with the 32,600 tons of the *Maryland*, one of the latest electrically driven United States fighting-ships



The first published drawing of Japan's new monster battleships, which are about to be launched. Features worthy of special attention are the six-legged foremast, the high placement of the secondary batteries, the unusual searchlight equipment, the powerful anti-aircraft protection, and the deck torpedo tubes. These ships, with their huge displacement of 41,800 tons, their terrific gun power of ten sixteen-inch guns and twenty-two 5.5-inch guns, and their speed, when forced, of almost twenty-five knots, will probably be the most formidable fighting units in the world when completed

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Bombs weighing up to six hundred pounds were used against this thinly armored craft. During the morning, however, the attacks were with smaller bombs; and it was found that projectiles weighing up to three hundred pounds failed to inflict serious damage, even when striking flat upon the decks. Five of the smaller bombs that struck the *Frankfurt* were "duds," yet six others did explode, and, though they tore up the superstructure, they failed to pierce the vitals. No less than seventy-eight bombs were dropped, at altitudes under four thousand feet.

In considering the results of this test, it must be remembered that the *Frankfurt*, although a thirty-knot cruiser, never moved an inch during the bombing. Had the bunkers at the sides of the ship been filled with coal, it is unlikely that even a six-hundred-pound bomb, exploding alongside, would have done material damage. This can be said because one bomb actually burst in the water close to the forecastle, and yet did not blow a hole in the side. As proof it was observed that in sinking the ship did not fill up on one side and capsize, but instead went down on practically even keel. The bomb that broke the ship's back landed close alongside the fo'c'sle, where the submerged torpedo tubes weaken the back. The structural weakness caused by the submerged tube has led the British to exclude them in their future ships, and similar structural modifications will undoubtedly be made if the bombing plane ever becomes a menace.

Could Have Floated for Days

To repeat: during the entire test the vitals of the ship were not damaged and the decks were not pierced. In actual combat, of course, the engines would have been running, and as fast as bulkheads were strained, the pumps

Naval Monsters which Surpass America's Mightiest

the performance of the planes in the *Iowa* test—two hits out of more than eighty bombs dropped from an altitude of 4000 feet. These bombs had a velocity of from 300 to 400 feet a second, according to the timing done aboard the destroyers, and so failed to pierce the armored deck of the *Oestfriesland*. The Japanese 16-inch gun fires a 2460-pound shell at a rate of about 2700 feet a second, that will pierce 12 inches of armor at a range of about 12 miles, and at least 10 per cent of the shots fired will be hits. Whereas the planes bombed the *Iowa* for a whole day, achieving only two hits out of eighty bombs fired, Japan's world-beating war-ships could fire 900 shots an hour and ninety of them would hit and pierce a 12-inch belt at a range of 12 miles.

The secondary battery of the *Kaga* and the *Tosa*, consisting of 22 fifty-caliber 5.5-inch guns, is mounted unusually high on the sides of the ships. This distinctive feature will make them available in almost any kind of weather.

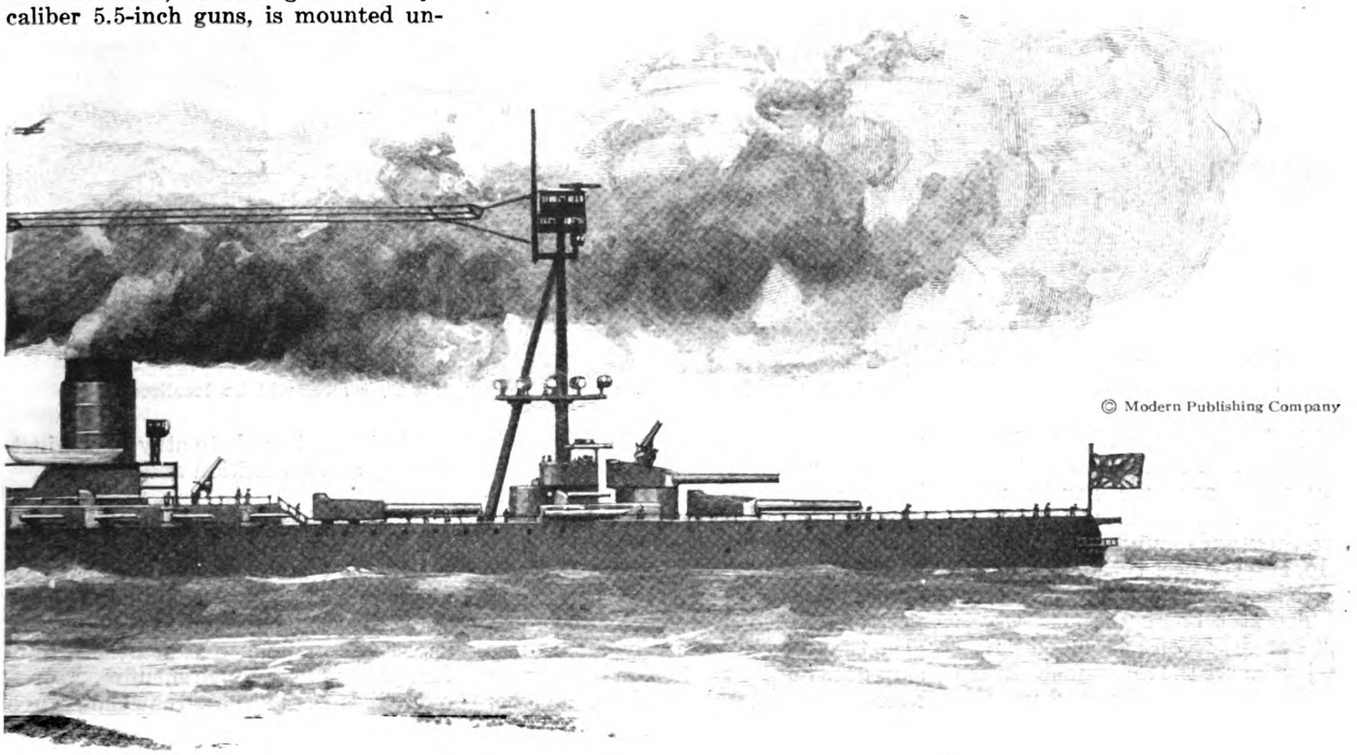
For the defense against aircraft, each ship carries 4 three-inch, fifty-caliber anti-aircraft guns on special high-angle mounts. The torpedo armament consists of four deck and four submerged 21-inch torpedo tubes.

Immense British-built turbines will drive these ships at a normal speed of 23 knots. When these engines are forced, it is said that the ships will be able to make 24.5 knots. Because of the scarcity of oil in Japan, the ships are equipped to burn coal as well as oil.

The Japanese are placing a total of seven inches of deck protection on several levels in these ships. The first deck, three inches thick, would be pierced by a shell, but the second deck, together with the ship's armored bulkheads, would localize the effect of the explosion. The ships have a 12-inch armored belt, and the turrets are protected with 16-inch armor.

Below the water is the "blister" protection. This arrangement is a duplicate of that evolved by the British during the war. It was designed to offset the effects of mines and torpedoes. The protective bulkheads, for defense against submarine explosions, can also be used as fuel-oil tanks. This is one of the features that gives these ships their great cruising radius.

When complete, the ships will have a complement of about sixteen hundred officers and men.



would have prevented the water rising in the affected compartments. In all probability the ship could have been kept afloat for hours, or even days, longer than it was.

When we take up the most spectacular of all the tests, the bombing of the former German dreadnaught *Oestfriesland*, we are apt to forget that it took nearly two days to sink her, under almost perfect conditions. During the first day fifty-two bombs were dropped at low altitudes, of which thirteen were direct hits, although but four exploded. One of the explosive hits was directly in front of the forward twelve-inch-gun turret. The airplane enthusiasts have claimed that even should bombs fail to pierce the decks of a war-ship, the concussion would kill every one in the vicinity. Yet, although one entire side of this forward turret had been removed for ballistic tests, the interior was in no way damaged. Decided damage was done, however, by bombs that exploded alongside the ship and near the areas where armor had previously been removed for experimental purposes. A number of small leaks, which on a fully manned battleship in action could have been repaired quickly, were visible on investigation after the first day's bombing.

The next morning, it was ascertained that the stern had gone down two feet, and that the engine-rooms and a number of compartments were flooded.

No Direct Hits Made

The bombing recommenced, this time with the heaviest obtainable bombs. By noon the airmen were working at a range of slightly less than three thousand feet. At this height, utterly unhampered by the anti-aircraft gunners, who in action would put a fierce barrage in the bombing area over the ship, the planes ought to have

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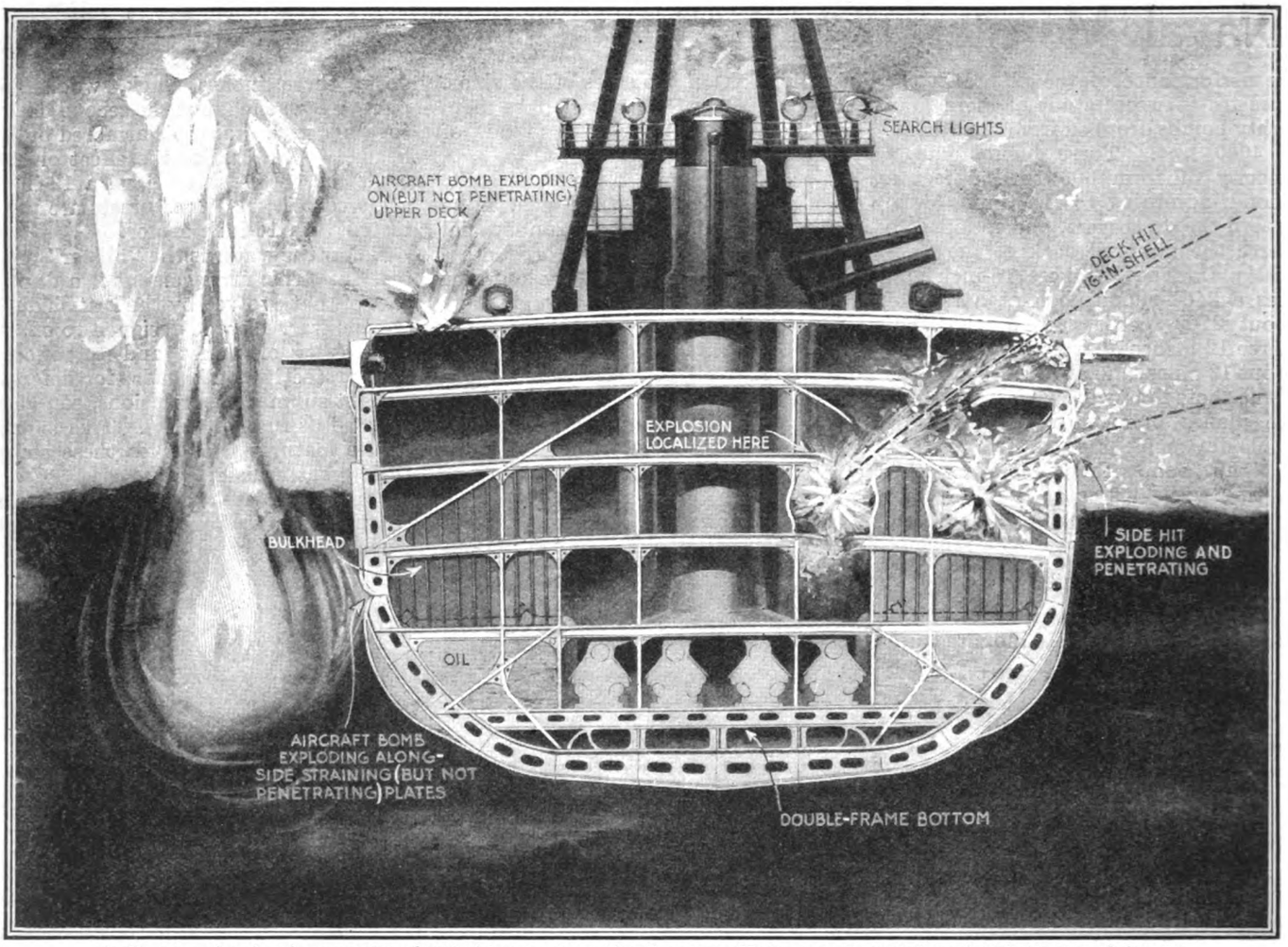

A diagram showing how modern battleships, such as the Japanese *Kaga*, are protected against both aircraft bombs and broadside hits. A bomb exploding alongside may strain the plates, but it will not actually blow a hole in the side. Sixteen-inch shells, with their high trajectory, may penetrate one or more decks, but their force will be localized

been able to make a hit with almost every release. The largest and supposedly most accurate bombs were being used. Nevertheless, not one of the two thousand-pound bombs struck the ship, and the best the airmen could do was to land them in the water alongside. The first bomb dropped was a "dud," but the second exploded in the water, just abaft the mainmast. Little or no damage was observed as the result, but it is assumed that the sides must have been strained somewhat by the concussion.

At this point, too, it may well be remarked that the *Oestfriesland* was known to have been weakened during the latter part of the war. It suffered from a mining experience during the battle of Jutland, and was badly damaged by the crew prior to its surrender to the British. Parts of her armor and machinery had been removed in the United States also, and as a result of the bombing of the day before the vessel was really in a precarious condition.

Sunk after Two Days

Dangerous as this condition was, the ship could have been kept afloat indefinitely if there had been a crew to work the pumps and patch the wounds in her sides. Remember that in the battle of Jutland the British dreadnaught *Marlborough*, with a huge hole torpedoed in its side, was not only kept in line, but was fought until the end of the action, when it proceeded to port under its own steam. Remember, also, that a bomb exploding alongside a ship does not blow a hole in her side, as does a torpedo, but simply springs her plates.

On the second day of the test, knowing that the *Oestfriesland* was leaking badly at the stern, the airmen dropped a bomb only a few yards from the propellers. This was the bomb which General Williams declared was "heard around the world." A veritable mountain of water shot upward and swamped the stern of the vessel. The hull shook with the impact, and when the water receded it was seen that the stern was sinking rapidly.

Thus it was that the *Oestfriesland* resisted for nearly two days the most powerful bombs and most experienced bombers in the American service. The actual results of the test show, not, as generally reported, that the battleship is useless and ready to be scrapped, but that a ship of its type can withstand a fearful pounding, and in actual combat may be able to stay afloat just so long as ammunition and fuel last.

Airplane Still Essential

But the tests did not prove that the airplane should be scrapped, either. Thus the scouting plane is valuable for short reconnaissance expeditions, and for spotting long-range shellfire. Moreover, it is certain now that the future of warfare between airships and battleships rests, not with the bombing plane, but with the torpedo plane. And the trouble here rests at present with the torpedo and not with the plane. The torpedo is always likely to be erratic. When dropped from any considerable height into the water it is necessarily made more so by the impact of its landing. But let somebody invent a method of guiding torpedoes from the plane that launches them, and we shall see the battleship harder pressed to maintain its supremacy than it has yet been. As an indication that the torpedo plane is soon to displace the bombing plane, it can be noted that the British have already removed all the bombers from their great aircraft carriers and have replaced them with "cuckoo" torpedo-dropping planes.