

NAVIES OF THE WORLD.
V.—GERMANY.

HISTORICAL.—In looking over the official list of the Germany navy, one is struck with the fact that it contains the name of only one ship, the "König Wilhelm," launched prior to the Franco-German war and the unification of Germany. The German navy has grown to its present proportions under the rule of the Emperor's, and, particularly, under the fostering care of William II. At the outbreak of the war of 1870, there were but five ironclads to oppose the formidable fleets of France. The best of these was a fine broadside battleship, the "König Wilhelm," of 9,567 tons, which had just been completed in an English yard, and was armed with a powerful battery of eighteen 10-inch, four 8½-inch, and six 5.9-inch breech-loading guns. Besides the "König Wilhelm" there were two broadside ships of 5,000 and 6,000 tons, and two small coast defense monitors. In addition to these there were some twenty-five gunboats and dispatch boats, and this little fleet of some thirty vessels was all owned by the one state of Prussia.

During the decade immediately following the war, Germany added to her navy four serviceable battleships of the belted and central citadel type so generally favored at that time, the "Kaiser," "Deutschland," "Preussen" and "Friedrich der Grosse"; and they were followed by the four central citadel and partially belted ships of the "Sachsen" class. These were all ships of from 7,000 to 8,000 tons displacement, 14 knots speed, and fairly powerful batteries of Krupp guns of the older patterns. Between 1876 and 1880 there were also built eleven small belted coast defense vessels of 1,109

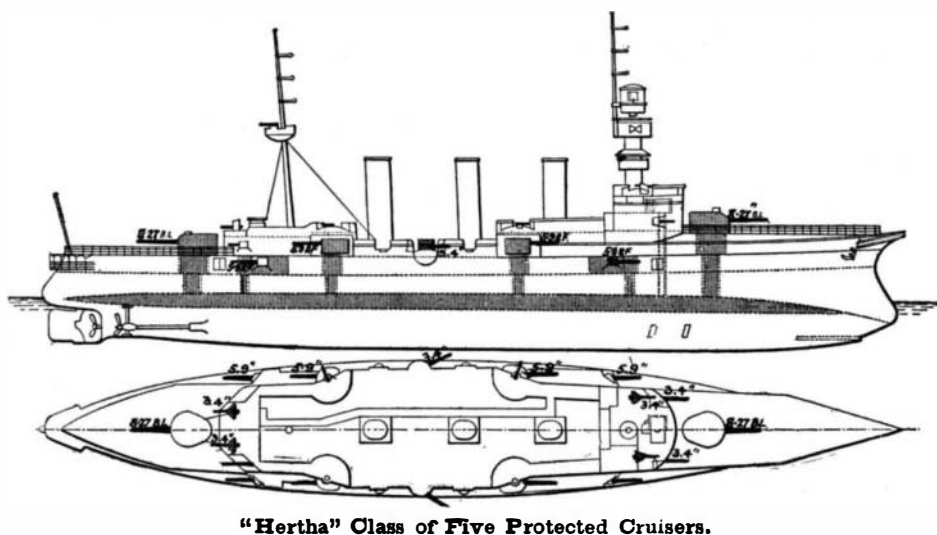
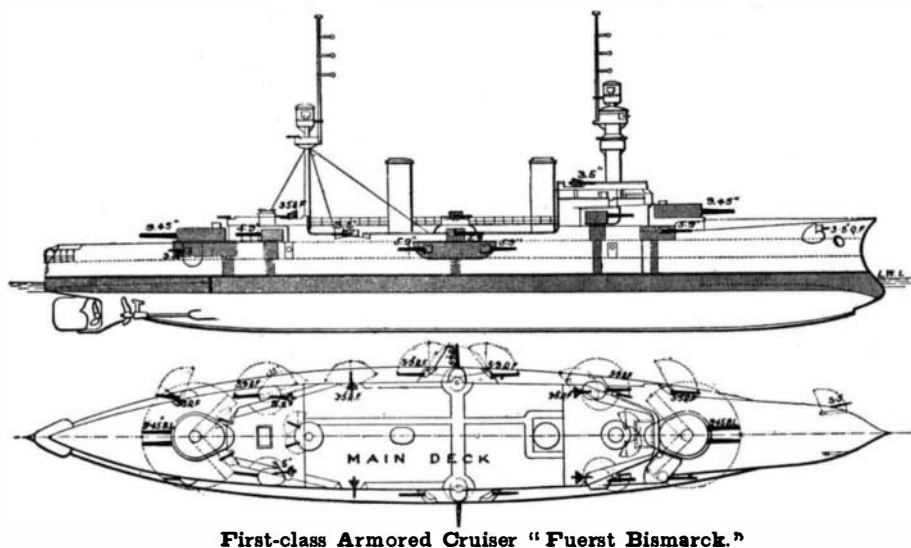
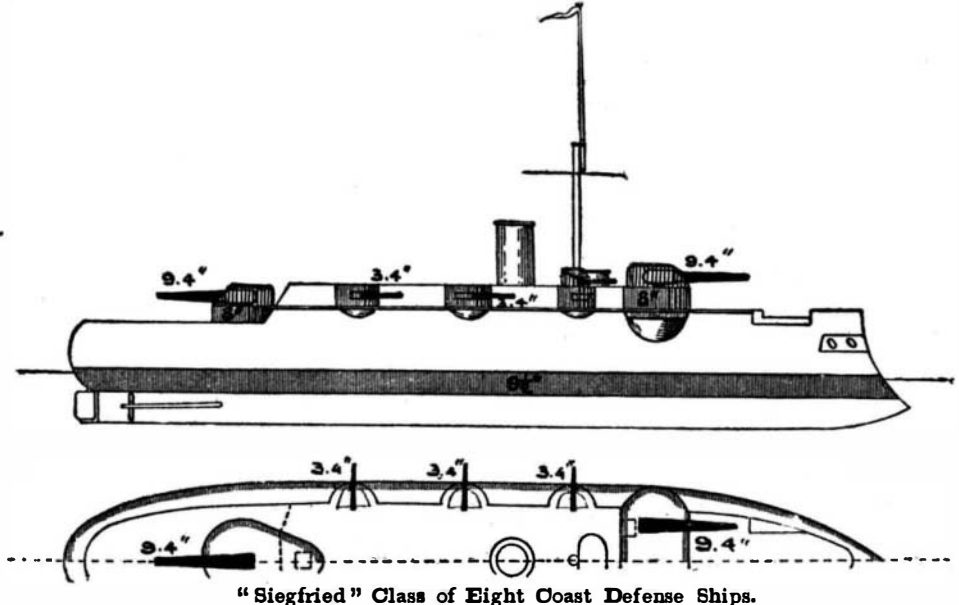
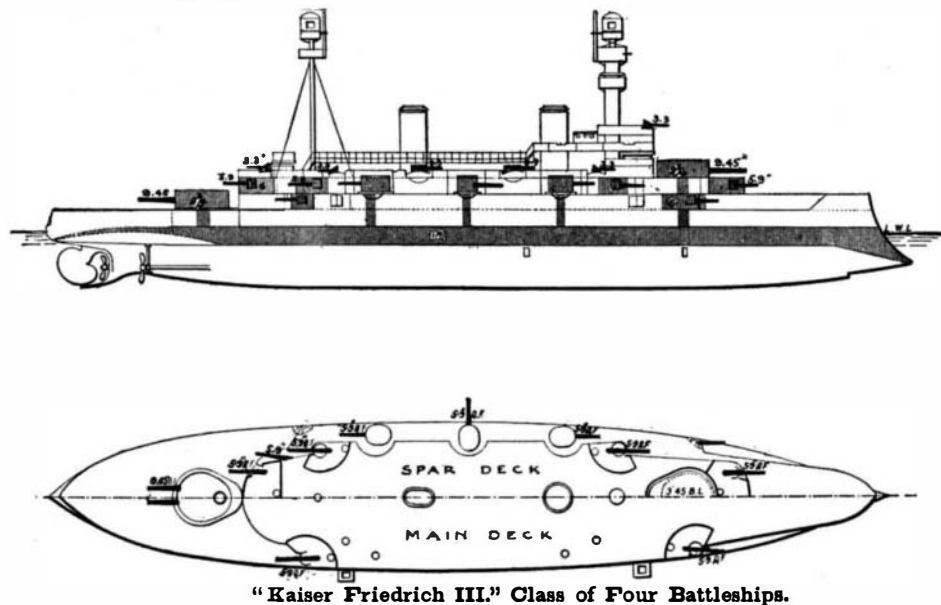
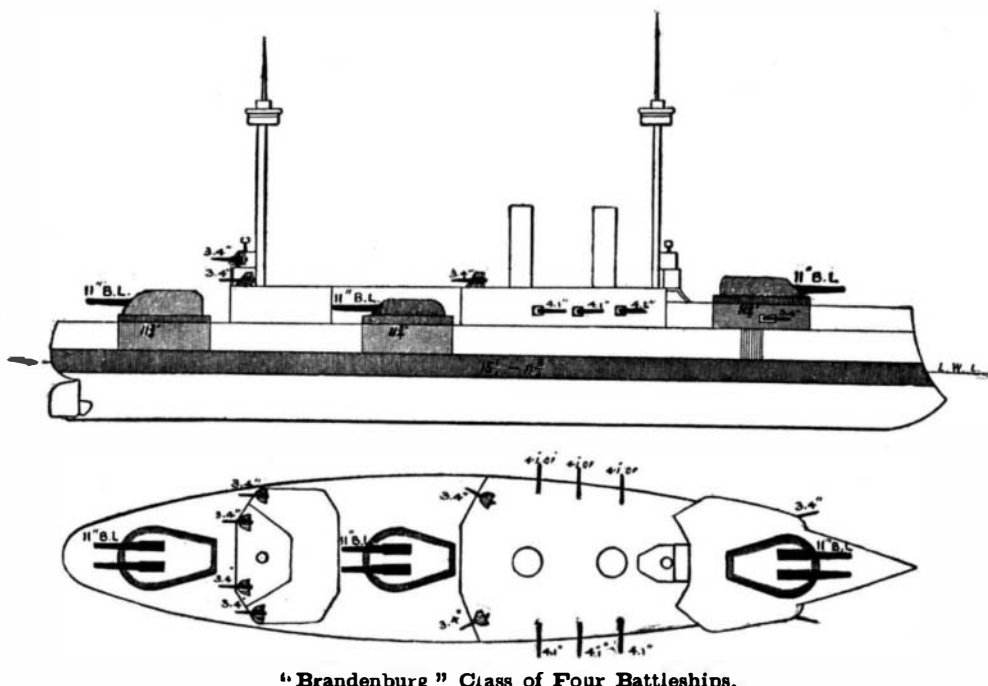
tons and 10 knots speed, each armed with a 12-inch gun, and some score of small unarmored cruisers and gunboats were added to the navy.

When the present Emperor came to the throne, the German navy, in comparison to the magnitude and growing importance of the merchant marine, was altogether inadequate, and the young Kaiser, who is an ardent yachtsman and, like his brother Henry, a thorough sailor at heart, set himself with characteristic energy to the work of reconstruction. For the ten years of his reign he has exerted all the powerful prestige and influence of his position to bring the German people to realize the necessity for creating a navy commensurate in numbers and power with the growing commercial interests of the Fatherland. His

plete new navy, the construction and cost of which was to have been spread over a period of seven years; although as finally passed the period is limited to six years. The bill provides, in addition to new torpedo boats and gunboats, for the raising of the strength of the navy to 17 battleships, 8 coast defense vessels, 9 large cruisers and 26 small cruisers. This will involve the construction of 7 new battleships, 2 large and 5 small cruisers, and new gunboats and torpedo boats, which will be built to take the place of obsolete vessels of this class that will be removed from time to time from the active list. The total cost will be about \$103,000,000 and the ships will all be in commission by the close of 1904.

PRESENT STRENGTH OF THE NAVY.—On the first of January, 1899, the German navy, reckoning on the basis assumed in our comparative estimate of the navies of the world (SCIENTIFIC AMERICAN, December 31, 1898) included the following ships as built or building: 19 battleships, 1 armored cruiser, 12 protected cruisers of between 2,000 and 7,000 tons displacement, and 22 small cruisers and gunboats—a total of 73 vessels with an aggregate of 299,637 tons displacement. This places Germany between the United States with 303,070 tons and Italy with 286,175 tons total displacement. If the United States should keep up the rate of increase which has marked the last two years, during the years covered by the German Septennate bill, this country will have greatly increased its lead over Germany by the close of 1904; but unless Italy should increase her present rate of progress, she will fall yet further behind the northern navy in numbers and strength.

BATTLESHIPS.—The most formid-



First-class Armored Cruiser "Fuerst Bismarck."

"Hertha" Class of Five Protected Cruisers.

NAVIES OF THE WORLD—V. GERMANY.

tons and 10 knots speed, each armed with a 12-inch gun, and some score of small unarmored cruisers and gunboats were added to the navy.

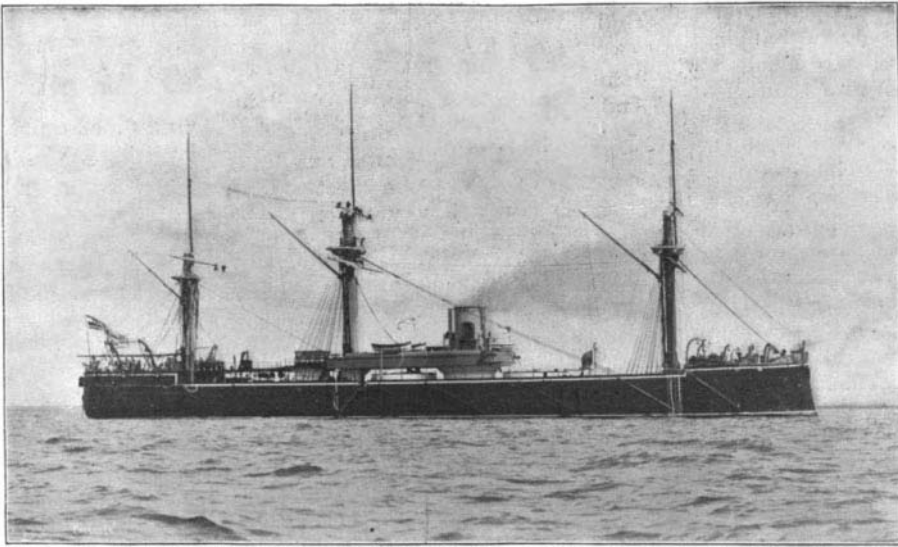
The decade 1880-90 was marked by an almost total stagnation in the construction of armored ships, only one small battleship, the "Oldenburg" of 5,200 tons and 13.5 knots speed, being added to the navy, if we exclude one or two of the above mentioned coast defense vessels which were completed in 1880-81. The new construction during this period was confined to gunboats and small cruisers. Two of the former were built, and fourteen of the latter, the cruisers being, with two exceptions, vessels of 2,000 tons displacement and less, and several of them possessing a speed of 14 knots and less. The most important of these ships were the protected cruisers "Irene" and "Prinzess

efforts have been crowned, first with partial, and latterly with complete, success. In the first half dozen years of his reign he has seen that splendid quartette of first-class battleships known as the "Brandenburg" class added to the navy, together with the eight effective coast defense vessels of the "Siegfried" type, while in the last five years the cruiser classes have been augmented by such vessels as the "Kaiserin Augusta," the "Gefion" and the effective vessels of the "Hertha" type.

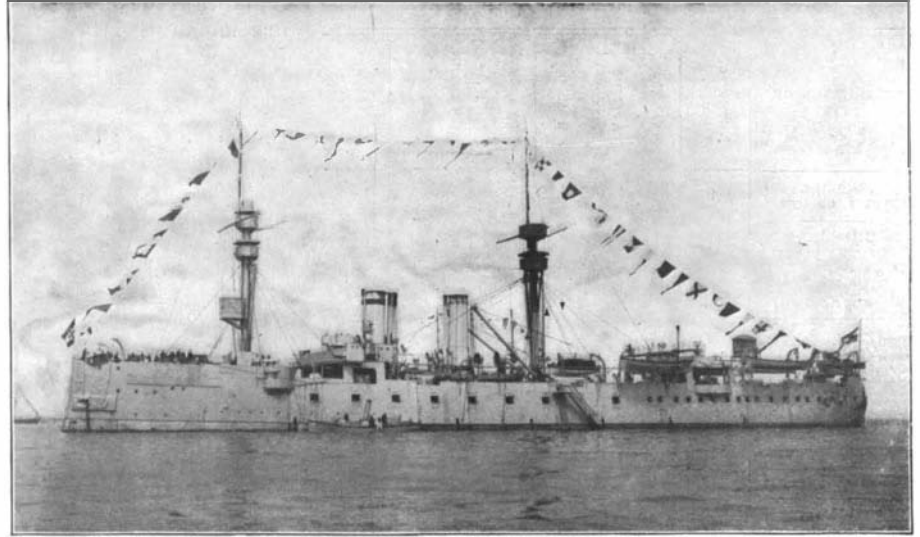
The crowning success of the Emperor's policy, however, was witnessed in the passage last year of the famous Naval Septennate Programme.

The Naval Septennate bill (so named because it is patterned after the system adopted for the army) provides for the creation of what is practically a com-

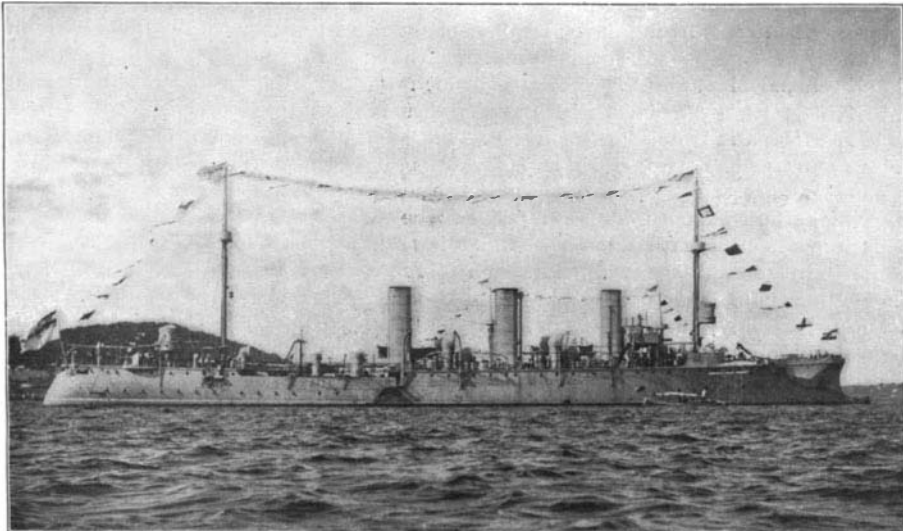
able ships in commission in the German navy are the four powerful battleships of the "Brandenburg" class. The striking feature of these ships is the power of the main battery, which includes six, in place of the customary four heavy guns. The only other warships that are thus distinguished are the Russian battleships of the "Sinope" class, which carry six 12-inch B. L. rifles within a central bar-bette. The "Brandenburg's" guns are not so heavy, being of 11 inches caliber, but they are better distributed, and she is able to concentrate all six guns on the broadside, which the "Sinope" cannot do, although she can train four guns ahead, against the "Brandenburg's" two. The guns of the "Brandenburg" are better protected, as the breech of the guns is covered with a shield, while the Russian gunners must work in an



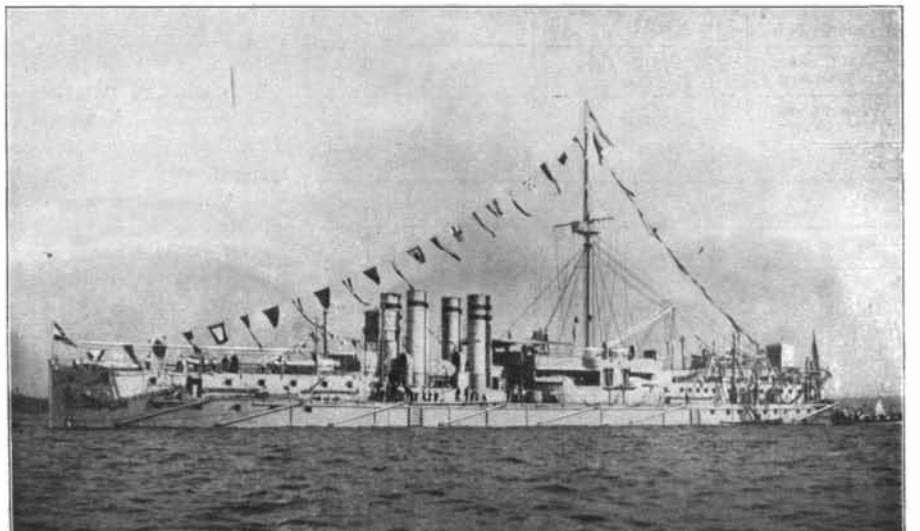
3.—Third-class Battleship "Preussen." Also "Friedrich der Grosse." Displacement, 6,770 tons. Speed, 14 knots. Normal Coal Supply, 550 tons. Armor: Belt 9 inches; gun positions, 8 inches. Armament, four 10.2 B. L. rifles, two 6.6-inch B. L. rifles, ten 3.4 inch rapid-fire guns, six machine guns. Torpedo Tubes, 4. Complement, 537. Date, 1873.



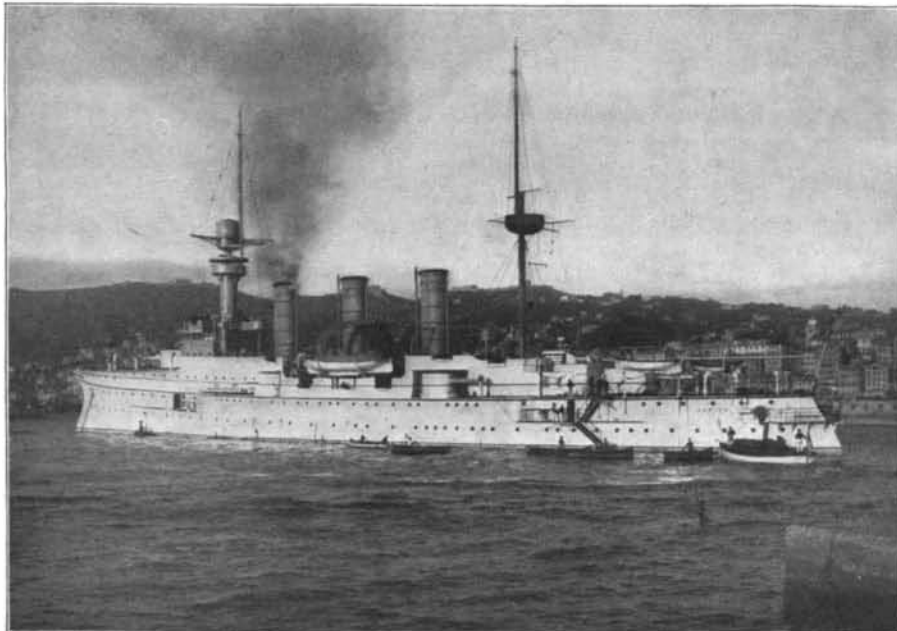
4.—Reconstructed and Rearmed Battleship "Koenig Wilhelm." Displacement, 9,757 tons. Speed, 14.7 knots. Normal Coal Supply, 700 tons. Armor: Belt, 12 inches; gun positions, 6 inches; deck, 2.6 inches. Armament, twenty 5.9-inch rapid-fire guns, eighteen 3.4-inch rapid-fire guns, eight machine guns. Torpedo Tubes, 5. Complement, 759. Date, originally built 1868; reconstructed and rearmed 1896.



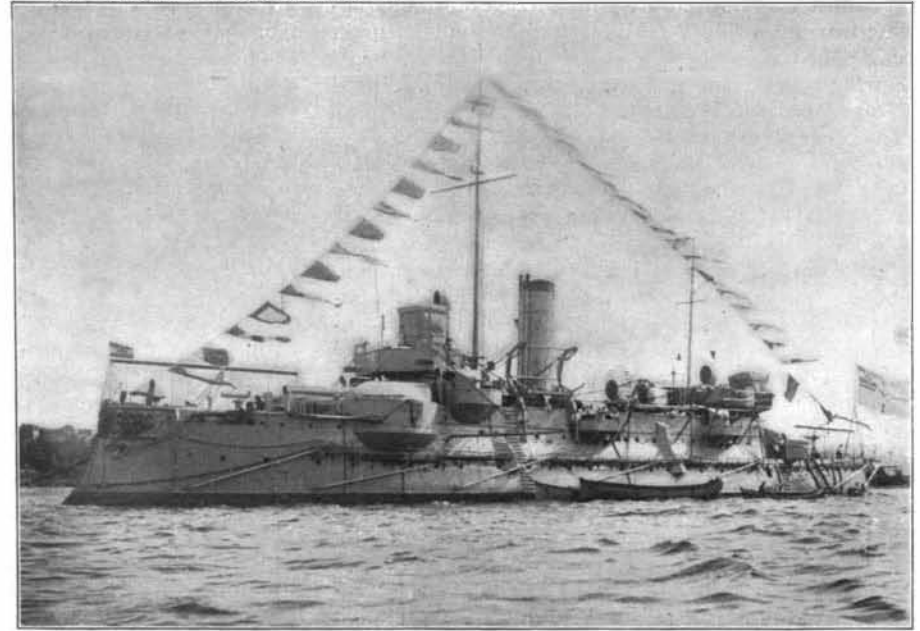
5.—Protected Cruiser "Gefion." Displacement, 4,207 tons. Speed, 20 knots. Normal Coal Supply, 350 tons. Armor: 3-inch deck; gun positions, 3.5 inches. Armament, eight 5.9-inch rapid-firers, ten 4.1-inch rapid-firers, six 1.9-inch rapid-firers, two machine guns. Torpedo Tubes, 2. Complement, 312. Date, 1893.



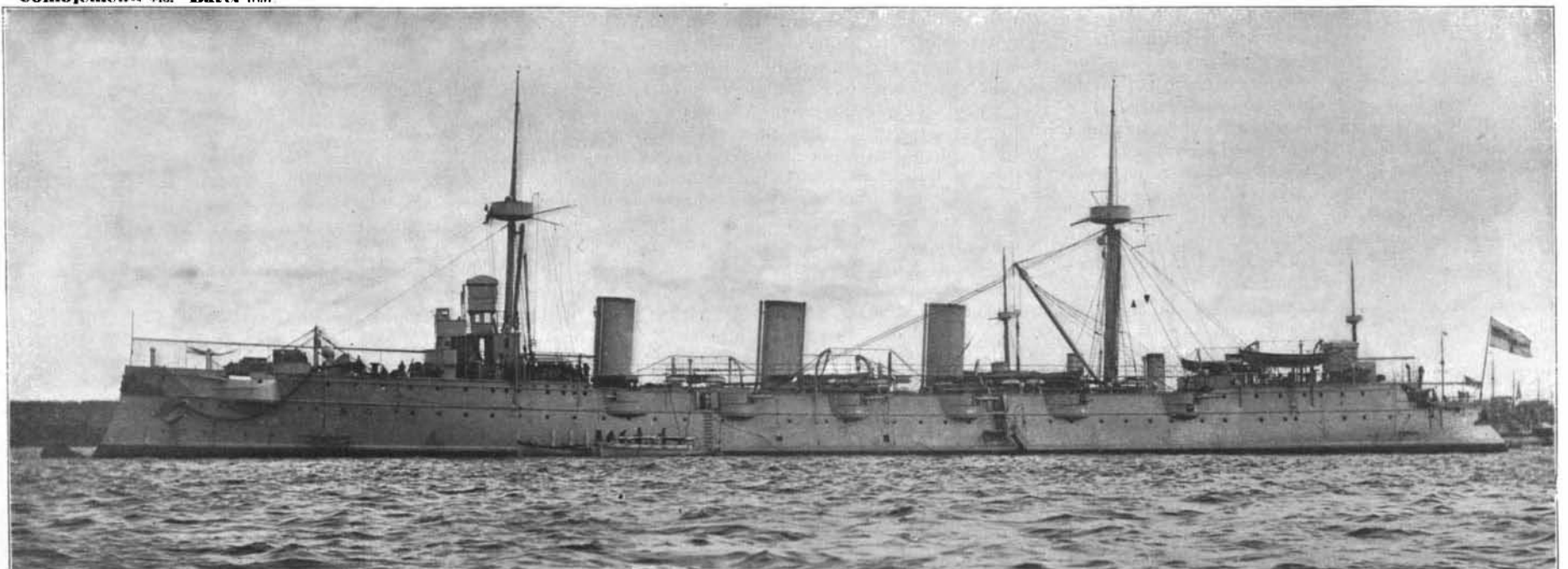
6.—Second-class Battleship "Bayern." "Sachsen" Class of Four Ships. Displacement, 7,441 tons. Speed, 14 knots. Normal Coal Supply, 700 tons. Armor: Belt, 16 inches; gun positions, 10 inches; deck, 8 inches. Armament, six 10.2-inch B. L. guns, eight 3.4-inch rapid-fire guns, eight machine guns. Torpedo Tubes, 5 (2 submerged). Complement, 376. Date, built 1878; reconstructed 1896.



7.—Protected Cruiser "Hertha." Class of Five Ships. Displacement, 5,850 tons. Speed, 20 knots. Normal Coal Supply, 500 tons. Armor: Gun positions, 4 inches; deck, 4 inches. Armament, two 8.2-inch rapid-firers, eight 5.9-inch rapid-firers, ten 3.4-inch rapid-firers, ten 1.4-inch rapid-firers, four machine guns. Torpedo Tubes, 3 (submerged). Complement, 440. Date, 1897.



8.—Coast Defense Vessel "Heimdall." "Siegfried" Class of Eight Ships. Displacement, 3,500 tons. Speed, 16 knots. Normal Coal Supply, 225 tons. Armor: Belt, 9.4 inches; gun positions, 7.4 inches; deck, 3 inches. Armament, three 9.4-inch B. L. rifles, eight 3.4-inch rapid-fire guns, six machine guns. Torpedo Tubes, 4. Complement, 225. Date, 1892.



9.—Protected Cruiser "Kaiserin Augusta." Displacement, 6,331 tons. Speed, 23.5 knots. Normal Coal Supply, 850 tons. Armor: Shields, 3.5 inches; deck, 3.5 inches. Armament, twelve 5.9-inch rapid-firers, eight 3.4-inch rapid-firers, eight machine guns. Torpedo Tubes, 5. Complement, 427. Date, 1892.

NAVIES OF THE WORLD—V. GERMANY.

GERMAN NAVY, JANUARY 1, 1890.

DESCRIPTION OF TYPE.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.
Battleships, 10 years or less.	9	10,672	96,048	17.3
Battleships, 10 to 20 years.	1	5,200	5,200	13.5
Battleships, Old or Refitted.	9	7,434	66,910	14.0
Totals.....	19	106,650	168,158	17.3
Coast Defense Vessels.	19	2,081	39,539	12.6
Armored Cruisers, 9,000 tons and up.	1	10,650	10,650	19.0
Armored Cruisers, 7,000 to 9,000 tons.	.....	.....	.....	.....
Armored Cruisers, Below 7,000 tons.	.....	.....	.....	.....
Totals.....	1	10,650	10,650	19.0
Protected Cruisers, 10,000 tons and up.	.....	.....	.....	.....
Protected Cruisers, 7,000 to 10,000 tons.	.....	.....	.....	.....
Protected Cruisers, 4,000 to 7,000 tons.	9	5,315	47,835	20.1
Cruisers, 2,000 to 4,000 tons.	3	2,225	6,675	21.25
Totals.....	12	34,715	54,510	20.1
Small Cruisers and Gunboats.	22	1,205	26,510	16.0
Grand totals.....	73	143,620	269,657	17.3

open barbette, and would be at the mercy of well-timed shrapnel. One pair of guns is mounted on the main deck aft, another pair on the same deck amidships, while the forward pair is carried on the fore-castle deck, at a height, probably, of about 22 feet above the sea. The belt is continuous and tapers from 15 $\frac{1}{4}$ inches amidships to 11 $\frac{1}{4}$ inches at the ends; the gun positions carry 11 $\frac{1}{4}$ inches of armor, while the speed and coal capacity of 16 knots and 750 tons are only moderate. The power of the main battery is secured at the expense of the secondary rapid-fire battery, which is comparatively light. It consists of six 4.1-inch rapid-fire guns, mounted in broadside within the superstructure, and eight 3.4-inch rapid-fire guns carried on the superstructure and bridges and in the bow on the main deck. The vessels of this class are the "Brandenburg," "Kurfürst Friedrich Wilhelm," "Weissenburg," and "Wörth."

The other five battleships of the first class are the powerful vessels of the "Kaiser Friedrich III." class now under construction. Three of these, the "Kaiser Friedrich III.," "Kaiser Wilhelm II." and "Ersatz König Wilhelm," are launched and well advanced toward completion, while two others have been commenced. These ships are in many respects a class entirely by themselves, possessing features which distinguish them sharply from the latest battleships of other navies. They represent the latest ideas of the German designers as to what are the requirements of a modern first-class battleship, and as such they are to be compared with our "Maine," the British "Magnificent," the French "Charlemagne," the Italian "Re Umberto" or the Japanese "Fugl." The displacement, 11,130 tons, is moderate, being about the same as that of the "Charlemagne," 1400 tons less than that of the "Maine," 1,000 tons less than that of the "Fugl," while the "Re Umberto" and "Majestic" exceed it by 2,700 and 3,700 tons respectively. Bearing in mind the moderate size of the "Kaiser Friedrich III.," it is evident that her armament is extremely powerful. The German dislike of bulky ordnance is seen in the fact that the ship does not carry a larger caliber than 9.45, four of this size placed in 9 $\frac{3}{4}$ -inch turrets constituting the main battery. These guns, however, are of the rapid-fire type and fire a 474-pound projectile with a muzzle energy of 17,340 foot-tons and a penetration of 23 $\frac{1}{2}$ inches of steel. The secondary battery includes thirty rapid-fire guns; namely, eighteen 5.9-inch rapid-firers, each in separate turrets and casemates, and twelve 3.3-inch rapid-firers mounted behind shields, while this is supplemented by a score of one-pounders and machine guns.

The important problem of distribution has been well worked out, the larger guns being carried at four different stages above the water. The lowest are the two 9.4-inch in the after turret on the main deck and the four 5.9-inch in casemates, two forward and two aft on the main deck. On the spar deck above are six 5.9-inch in turrets on the broadside and eight 5.9-inch in casemates, four forward and four aft. Forward in a turret on the superstructure deck and 30 feet above the water is the remaining pair of 9.4-inch rifles, and ten 3.4-inch rapid-firers are carried at the same height in broadside and astern on this deck, while another pair of 3.4-inch guns is mounted on the upper bridge at a height of 46 feet above the water line. The concentration of fire is two 9.4-inch, eight 5.9-inch and six 3.4-inch ahead; four 9.4-inch, nine 5.9-inch, and six 3.4-inch on either beam; and two 9.4-inch, eight 5.9-inch and four 3.4-inch astern.

A glance at the plan and longitudinal section, for which, in common with the other diagrams, we are indebted to Brassey's Naval Annual, shows how difficult it would be for a successful shot to wreck more than one or two gun positions at a time. The belt armor varies from 11 $\frac{1}{4}$ to 6 inches; the main turrets are 9 $\frac{3}{4}$ inches and the smaller turrets and casemates 6 inches thick. The vessels are driven by triple screws, steam being supplied by a combination of cylindrical and Thornycroft boilers. The speed is to be 18 knots. Altogether we must confess to a strong liking for these vessels. Their tremendous rapid-fire batteries, the unusual end-on fire, the wide separation of their guns, their admirable protection, and the great height at which the guns are carried should render them exceedingly efficient ships, if well handled.

The weak feature is the unprotected bases of the casemates and turrets. In this respect the "Brandenburg" would be at a great disadvantage in a stand-up fight with our own "Maine" or the British "Magnificent." But one cannot have everything, particularly in a battleship.

In the class of "battleships from ten to twenty years old" (see table) Germany possesses one ship, the "Oldenburg," launched in 1884, of 5,200 tons, 13.5 knots, 13-inch belt, and carrying eight 9.4-inch guns within a central redoubt of 8-inch armor.

The class of "battleships old and refitted" includes nine ships of between 6,770 and 9,757 tons, most of which have been reconstructed and rearmament and transformed into useful fighting ships. Our readers who follow closely the progress of naval affairs will remember that this is the policy which Lord Charles Beresford so strongly recommends in connection with the many old broadside battleships built some thirty years ago and armed with muzzle-loading guns, which still remain on the active list of the British navy, and we think that Germany has shown good judgment in carrying out the change on her early ships. The most notable instance of this change is the thirty-one year old "Koenig Wilhelm," of which we present an illustration. Originally she was three masted and fully rigged, while her armament consisted of heavy slow-firers of an obsolete pattern. Her mizzenmast has been removed altogether, the fore and mainmasts have been cut down, the yards removed and fighting tops fitted. The old guns have been replaced by a numerous battery of twenty 5.9-inch and twelve 3.4-inch rapid-fire guns, while five torpedo dischargers have been fitted. She carries a 12-inch iron belt and 6 inches of armor on the gun positions, while the 3.3-inch guns are protected by shields. In her reconstructed state she is listed as an armored cruiser; but, on account of her low speed, we have thought best to place her and the other reconstructed or rearmament vessels in the battleship class.

The "Kaiser" and "Deutschland," built in 1874, of 7,531 and 7,319 tons and 14.5 knots speed, are sister ships with complete 10-inch belts. They each carry eight 10.2-inch breech-loading rifles, while the secondary battery of the "Kaiser" consists of one 5.9-inch, six 4.1-inch, and nine 3.4-inch rapid-fire guns, and that of the "Deutschland" contains seven 5.9-inch and nine 3.4-inch rapid-fire guns, both vessels having the usual complement of machine guns.

The "Preussen" and "Friedrich der Grosse," sister ships of 6,770 tons and 14 knots speed, were built in 1873-74. They have been relieved of their top and top-gallant masts and yards and their batteries have been modernized by the addition of ten 3.4-inch rapid-fire guns and several machine and light guns. They are protected by a complete belt of 9-inch armor, and the main battery of four 10.2-inch Krupp guns is carried in two 8-inch turrets within a central redoubt.

The four second-class battleships of the "Sachsen" class, the "Sachsen," "Baden," "Bayern," and "Württemberg," were built between 1877 and 1890. They are of 7,441 tons displacement and 14 knots speed. They are protected by a short belt of 15 $\frac{1}{4}$ -inch armor, which only covers a little more than a third of the length amidships, although there is a continuous 3-inch protective deck. The belt, however, extends to the level of the main deck and, in conjunction with transverse bulkheads, forms a big rectangular redoubt. At the after end of this structure a smaller rectangular redoubt rises to the level of the superstructure deck, and at each corner of the redoubt is mounted a 10.2-inch Krupp gun. Two other guns of the same caliber are carried at the forward end of the redoubt, within a pear-shaped barbette. Eight 3.4-inch guns are carried upon a boat deck above the after redoubt. The ships of this class were reconstructed and refitted in 1890.

COAST DEFENSE VESSELS.—Germany has nineteen of this class all told, eleven of the early "Wespe" class, 1876 to 1881; and eight of the "Siegfried" class, 1890 to 1895. The "Wespe" class have already been described. Although they are of only 1,109 tons displacement, they mount a 12-inch gun forward in an 8-inch barbette, two 3.4-inch rapid-firers aft, and have a continuous belt of 8-inch armor. They also carry two torpedo discharge tubes.

In the "Siegfried" and her class the German navy possesses some excellent coast defense vessels, of a de-

sign which we could wish to see substituted for our own monitors. They have a serviceable speed of 16 knots, a freeboard of 18 feet, three 9.4-inch guns, of which the forward pair have a command of 24 feet; they have a secondary battery of eight 3.4-inch rapid-fire guns and they carry four torpedo tubes. While the moderate draft of 17 feet 9 inches would enable them to enter any harbors, they could at any time join in a fleet action on the high seas. All this is secured on a displacement of 3,500 tons. If three 10-inch guns in two barbette turrets were substituted for the three 9.4-inch, the displacement being raised to 4,000 tons, these ships would be ideal coast defenders, and infinitely superior to the obsolete monitors which we are now engaged in constructing.

ARMORED CRUISERS.—Germany had only one armored cruiser, the "Fuerst Bismarck," constructing at the opening of the year, though a sister ship, the "Prinz Adalbert," has since, we believe, been commenced. As will be seen from the diagram on page 250, the armament will be made up of the same caliber of guns as that of the new battleships, and she will be almost as well protected, the deck being the same, and the vertical and turret armor only from 2 to 4 inches less in thickness. The particulars are as follows: Displacement, 10,650 tons; speed, 19 knots; normal coal supply, 1,000 tons; armament, four 9.4-inch rapid-fire, twelve 5.9-inch rapid-fire, ten 3.4-inch rapid-fire, ten 1.4-inch and eight machine guns, six torpedo tubes (five submerged). The complement will be 565 men. The ship is remarkable for the abnormally high freeboard forward and the lofty command of the guns, and she should prove to be a most effective fighter, although her speed, in view of the fact that the latest English and French armored cruisers are to steam 23 knots, is very low.

PROTECTED CRUISERS.—The largest and fastest of the protected cruisers is the "Kaiserin Augusta," familiar to many Americans because of her presence at the Columbian Naval Review at New York. She is the longest vessel in the navy and her horse power exceeds that of any other vessel. Her trial speed was 22.5 knots, and in this respect she is likely to remain for a time the crack ship of any fleet to which she may belong. The main armament of twelve 5.9-inch rapid-fire guns is carried in sponsons on the main deck, and the eight 3.4-inch rapid-firers are carried partly on the spar deck and partly on the main deck. The protective deck has a maximum thickness of 3 inches. The practice of placing all of the main battery on one deck exposes it to disablement by a raking fire, and, as we shall show, the fault has been remedied in the later cruisers of the "Hertha" class.

We also illustrate the "Gefion," launched in 1893, a slightly smaller vessel than the sister ships "Irene" and "Prinzess Wilhelm," which were launched six years earlier. The particulars of the "Gefion" are given under the cut of the vessel. The "Irene" carries four 5.9-inch and eight 4.1-inch rapid-fire guns and fourteen smaller guns. Her speed is 19.8 knots. This vessel is specially interesting as having figured prominently in the press dispatches from Manila during the recent Spanish war.

There are also completed or building the five effective vessels of the "Hertha" class. It will be noticed from the diagrams that, within the limits of their class, they have the same characteristics as the new armored cruisers; lofty freeboard, high command for the guns, wide distribution of the gun positions, and a complete rapid-fire armament carried in turrets and casemates. These ships compare favorably with any ships of their class in the world, and in the ratio of total gun-fire per minute to displacement they are only surpassed by some of the Armstrong boats built for South American republics. There are also constructing or built three other cruisers of 15 knots speed and over: Cruiser "G," 2,650 tons, 19.5 knots speed, and the sister ships "Greif" and "Hela," 2,000 tons and 23 and 20 knots speed respectively.

CRUISERS AND SMALL GUNBOATS.—The vessels of this class, twenty-two in all, call for no special notice. There are six of about 1,700 tons and 16.5 knots; four of about 1,350 tons and 16 knots; two are of 1,120 tons and 13.5 knots; one boat, the "Wacht," is of 1,250 tons and 19.6 knots; while the smallest gunboats are of about 900 tons, with speeds ranging from 12 to 21 knots according to the date of their launch. The vessels in this class are chiefly armed with the 4.1-inch and 3.4-inch rapid-fire guns.

Of the personnel of the German navy nothing is known beyond the fact that it is possessed of the physique and distinguished by the strict discipline which marks the fighting forces of Germany whether ashore or afloat. The German navy has seen next to no fighting in the half century of its existence; but, judging from the fighting record of the army, there is every reason to expect that the German sailors will, in conflict, do justice to the excellent fighting ships of which the modern navy is composed.

The projected removal of the famous Ponte Vecchio of Florence has raised such a storm that its safety is doubtless insured for many years to come.

SCIENTIFIC AMERICAN

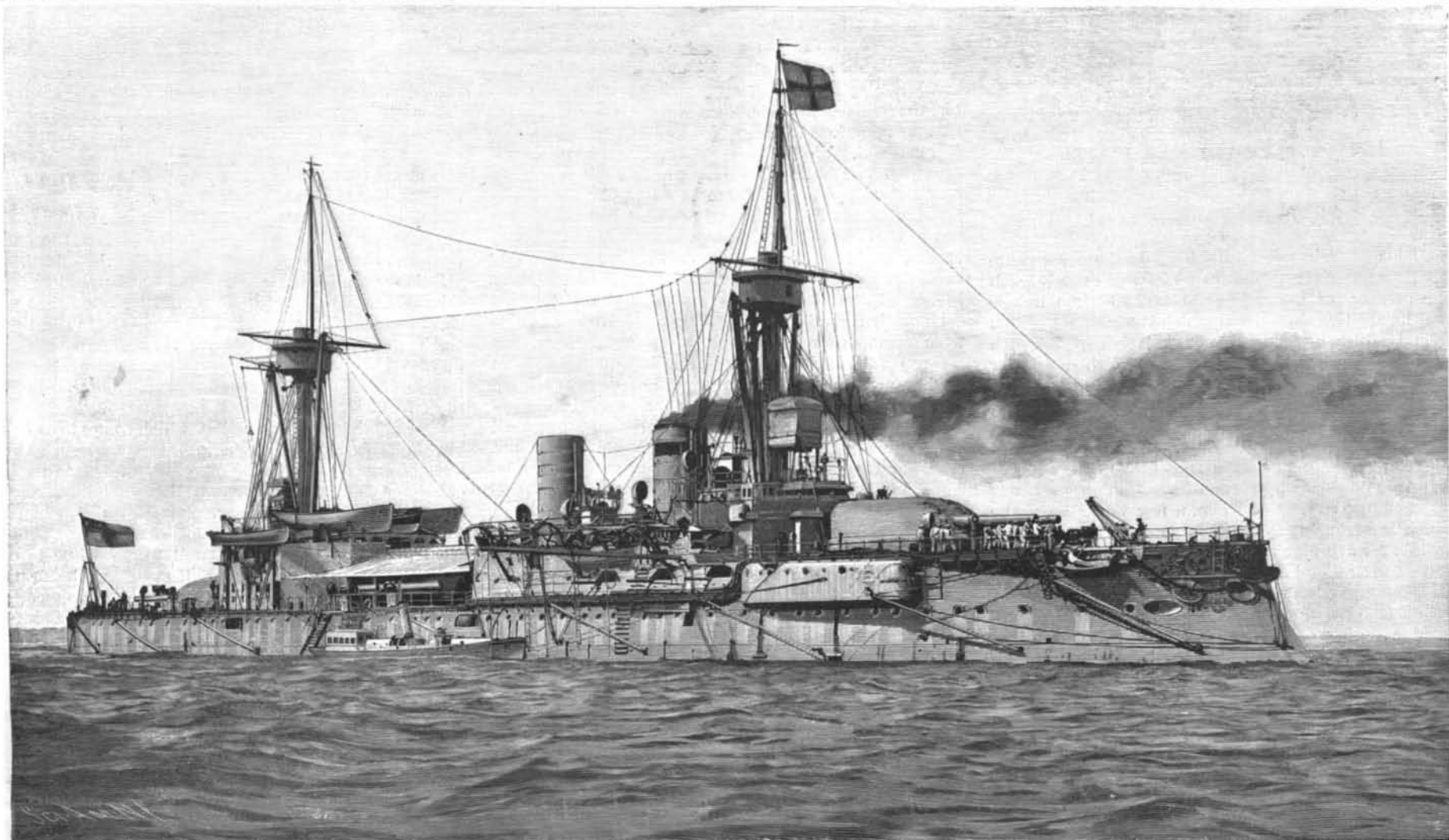
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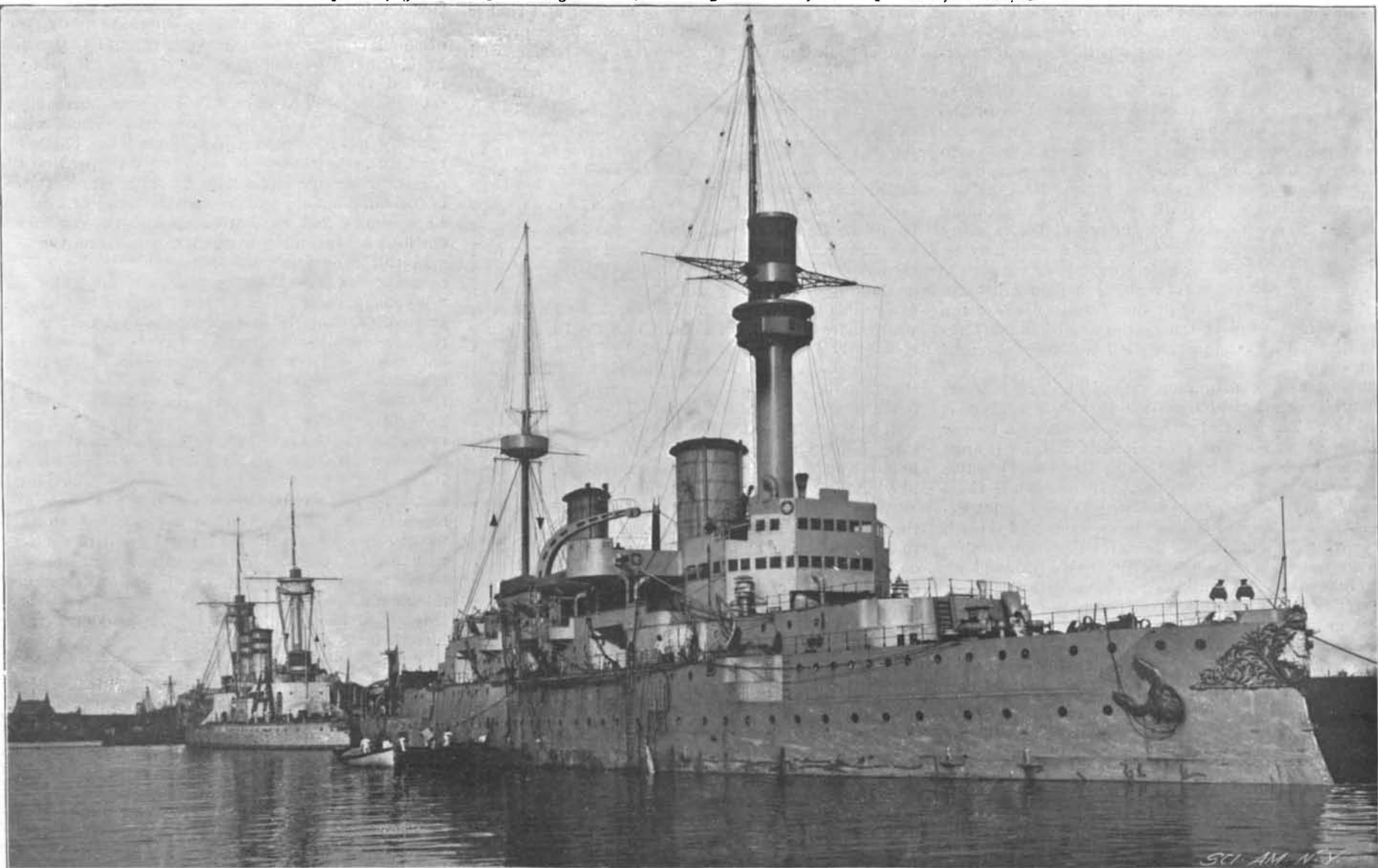
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From Photograph by Symonds & Company, Portsmouth, England.

1.—First-class Battleship "Brandenburg." Class of Four Ships.

Displacement, 10,100 tons. Speed, 16.5 knots. Normal Coal Supply, 750 tons. Armor: Belt, 15 1/4 inches; gun positions, 11 3/4 inches; deck, 2 1/2 inches. Armament, six 11-inch B. L. rifles, six 4.1-inch rapid-firers, eight 3.4-inch rapid-firers, eight machine guns. Torpedo Tubes, 7. Complement, 532. Date, 1891.



2.—First-class Battleship "Kaiser Friedrich III." Class of Four Ships.

Displacement, 11,130 tons. Speed, 18 knots. Normal Coal Supply, 650 tons. Armor: Belt, 11 3/4 inches; gun positions, 9 3/4 to 6 inches; deck, 3 inches. Armament, four 9.4-inch rapid-firers, eighteen 5.9-inch rapid-firers, twelve 3.3-inch rapid-firers, twelve 1.4-inch rapid-firers, eight machine guns. Torpedo Tubes, 6 (5 submerged). Complement, 655. Date, 1896.

NAVIES OF THE WORLD—V. GERMANY.—[See page 250.]