THE RUSSIAN BATTLESHIP "RETVIZAN."

The first-class Russian battleship "Retvizan" possesses special interest because of the fact that she is the first important foreign battleship to be constructed in an American shipyard. The first foreign orders for warships of the modern type were those given by the Japanese government to the Union Iron Works of San Francisco and the Cramp Shipbuilding Company of Philadelphia, for two high-speed cruisers. Both of these vessels have been built and delivered, and each of them considerably exceeded the contract speed. Following closely upon the trials of these vessels an order was placed by the Russian government at the Cramps' yard for the construction of a battleship and cruiser. The latter had her trials last year and achieved a speed of more than 23 knots an hour, thus taking rank as one of the very fastest vessels of her kind in the world. The battleship which forms the subject of our front page illustration has recently undergone her builders' trial, on which she attained an average speed on a 12 hours' trial of 18.8 knots per hour.

The "Retvizan," as she is called, is a first-class battleship of 12,700 tons displacement. In size and speed she may be compared with our own vessels of the "Maine" class, as is done in the table below:

		Maine.	Retvizan.
Length		388 feet.	374 feet.
Breadth		72 feet 2½ inches.	72 feet 2 inches.
Draft		22 feet 6 inches.	25 feet.
Displacement		12,300 tons.	12,700 tons.
Battery	4 12-inch.		4 12-inch.
	16 6-inch.		12 6-inch.
	6 3-inch.		20 3-inch.
	8 6-pounders.		20 3-pounders.
	10 small caliber.		6 1-pounders.

The "Retvizan" is protected by a belt of armor 9 inches in thickness which extends from 4 feet below the waterline to 3 feet above, reaching to the level of the protective deck. The latter is 2 inches in thickness on the flat and 4 inches on the slopes. It commences to slope at the level of the top of the 9-inch belt, and descends to a junction with the bottom of the belt below the waterline. The space between the slope and belt is occupied by coal bunkers. A projectile, before penetrating the engine or boiler rooms, would consequently have to penetrate 9 inches of Krupp steel, from 6 to 10 feet of coal and 4 inches of sloping Krupp armor. The coal would equal in resistance about 3 inches of vertical steel, and the 4-inch slope would be equivalent to 6 inches of steel, thus giving a total resistance equal to a vertical belt of 18 inches of steel, which is the thickness carried by our vessels of the "Oregon" class. In reality this triple protection would be equal to more than 18 inches of solid steel, for the reason that two successive face-hardened surfaces would have to be broken through, a test which would, unquestionably, break up any projectile that exists. The protective deck is carried the full length of the vessel, and curves down to meet the stem and stern. At the stem it is merged into the framing of the ram-bow, and being 3 inches in thickness and of turtle-back form, it gives enormous stiffness to the ram, and would assist in transmitting the shock of ramming to the whole structure of the vessel. Above the 9-inch belt amidships, and between the protective and the gun decks, is worked another belt of armor, 6 inches in thickness. This will prevent rapid-fire shells from penetrating and bursting beneath the guns on the gun-deck above.

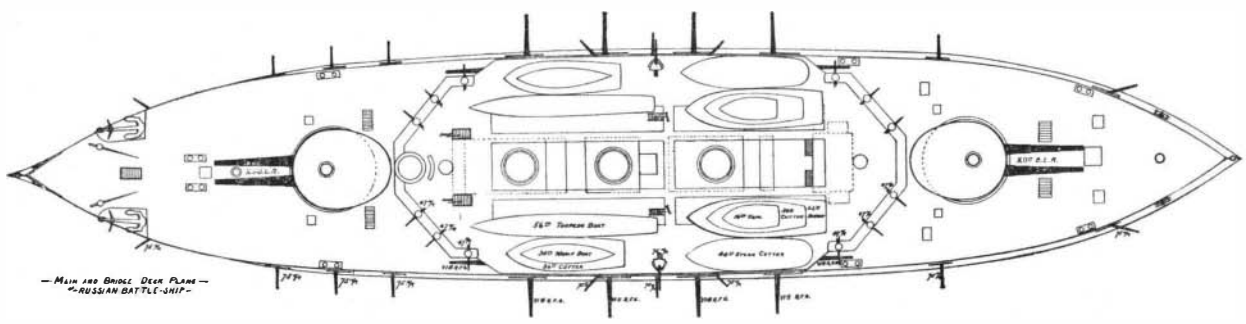
The bulk of the rapid-fire armament is carried on the gun-deck. Amidship, above the 6-inch belt of armor above referred to, is a battery of eight 6-inch rapid-fire guns in casemates, each gun having a considerable train forward and aft. The casemates are protected by 5 inches of steel and the armor is carried athwartships at each end of the battery as a safeguard against raking fire. The 9-inch and 6-inch belts of armor are also carried athwartships to connect with the armor of the barbettes, thus forming a completely inclosed armored citadel amidships. At the four corners of the superstructure deck, above the central citadel, are four 6-inch rapid-fire guns, of which the forward pair can be trained dead ahead and the other two dead astern. These guns are protected in front with 5 inches of steel, and they are inclosed in the rear with a wall of 2-inch steel, thus forming a completely inclosed casemate.

Forward of the central battery on the gun-deck are four 3-inch rapid-fire guns, each with a protection of 2 or 3 inches of casemate armor, while aft of the battery are six rapid-fire guns of the same caliber. The upper or main deck is flush throughout the ship, and is broken only by the amidship superstructure. Forward and aft of the superstructure are two elliptical balanced turrets, carrying 10 inches of Krupp steel. In each turret are placed two 12-inch, 40-caliber, breech-loading, rifles of the standard type manufactured by the Russian government. Both the turrets and the guns are operated electrically. An interior view of these turrets impresses one with the fact that the manipulating gear of both the guns and turrets is of a compact and serviceable design. There is an absence of complication and an abundance of working space for the gun-crew. The guns are mounted very close to the roof of the turret, according to the regular Russian practice, and the roof itself, which is of 3-inch Krupp steel, is slightly curved to clear the muzzles of the guns when the latter are elevated or depressed.

This battery, as it stands, is a numerous and powerful one, but the Russians, even more than ourselves, believe in a multiplication of guns, and outside of the twelve 6-inch and 3-inch rapid-firers, above mentioned, there are twenty-six smaller guns which are mounted on the boat-deck, the bridge and the fighting tops. Forward and aft on the boat-deck, there are distributed twelve 3-inch rapid-firers, while on the forward and after bridges, immediately above these, are eight others of the same caliber. These guns have a range of fire from dead-ahead to abeam. There are also six one-pounders in the two fighting tops. With such a numerous rapid-fire battery, a specially large supply of ammunition has to be carried, 2,400 rounds being supplied for the 6-inch guns alone. Three hundred and eight rounds are carried for the 12-inch guns, which is considerably above the number of rounds ordinarily carried in modern battleships for the main battery. Special provision is made for the supply of ammunition, electric hoists being installed throughout the ship.

The vessel is driven by triple-expansion engines, and steam is supplied by Niclausse water-tube boilers of a combined capacity of 16,000 horse power. The normal supply of coal is 1,016 tons, but it is possible to stow 2,000 tons aboard if so desired. As compared with our battleship "Maine," it will be seen that the main battery is not so powerful, our vessel, which is about the same displacement, carrying sixteen as against twelve 6-inch rapid fire guns. This, however, is somewhat offset by the larger number of 3-inch rapid-firers installed on the "Retvizan." The Russian government is so secretive in all matters affecting its naval department, that very little is known to the public about the present state of its ordnance. The guns, both 12-inch and 6-inch, appear to possess features in common with both the Canet and the Krupp types, although modifications have been introduced in accordance with Russian ideas. The 6-inch rapid-fire guns are of 45 calibers, or 5 calibers less than our new 6-inch guns. It is believed that the Russians, like the Germans, favor a heavier projectile and lower initial velocities than we do, having in view the consequent gain in remaining velocities, and greater penetrative ability at long range. Compared with our 6-inch naval gun, recently illustrated in the SCIENTIFIC AMERICAN, the Russian piece is considerably more complicated. The recoil and return to battery are controlled by a combination of glycerine cylinders and recoil springs. These springs, of which there are four, are located in the open on each side of the recoil cylinders, and certainly detract from the appearance of the piece, besides rendering it more liable to disablement by flying fragments of shell. The breech mechanism, moreover, is considerably more complicated than the modified Welin breech mechanism which was recently adopted by our navy.

The "Retvizan," taken altogether, is unquestionably an exceedingly fine representative of the up-to-date, first-class battleship. She has high speed, large fuel capacity (for it should be mentioned that her double bottom is to be utilized for carrying a certain amount of liquid fuel); the battery is numerous and thoroughly modern; while the ship itself has a high freeboard, and is remarkably free from those towering superstructures which disfigure many modern battleships, especially in the French navy. On going through the vessel we were impressed with the fact that inflammable material was practically non-existent. The decks are of steel and the partitions are of the same material, as are the shelves, boxes and general furniture. The Messrs. Cramp are to be congratulated on having turned out such a thoroughly handsome and effective vessel.



DECK PLAN OF RUSSIAN BATTLESHIP.

Emery-Coated Tools.

The use of emery tools has been limited because the material does not lend itself readily to shaping; we are practically confined to grinding surfaces of simple forms, says The Engineer. The galvanic process invented by Joseph Rieder, of Leipzig, however, allows us to make use of any kind of emery powder, and to arrange it in various shapes, so that we are presented with a new style of emery tool. Rieder is known as the inventor of the electro-engraving process, whose characteristic feature is a machine which returns the plaster negative to its position with mathematical accuracy, so that the galvanic etching, which has to be interrupted several times a minute to secure uniform electrolytic action, practically remains continuous. In order to fix the emery sand on the tools referred to above, he first coats the emery with a varnish obtained by dissolving wax or paraffin in benzin. Graphite will adhere to the grains when they have been treated thus, and in this way the emery surface is made electrically conductive. The tool, e. g., a disk, is placed in the sulphate of copper bath, and the prepared sand dropped on it. Each grain will become embedded in a coating of copper, and the grains will thus be fixed just as gems have been mounted for some time by means of a galvanoplastic process. The sand can also be treated with a glycerine paste, which is then applied to the surface to be covered with emery. As soon as a thin film of copper has settled on the steel, the glycerine is washed off with hot water, and the copper film is afterward thickened in the bath. In this way emery tools are obtained, which are said to wear very well. Their disadvantage is that they do not cut deeply, because the interstices are filled up. But such disks can be revolved at a much higher rate than we could venture to adopt in the case of an ordinary emery wheel of the same dimensions. Another advantage is that we can construct tools of this kind in almost any shape—hollow drums, cutters of various profiles, reamers, convex or concave lenses, knives, engraving tools, and even files. When the electrolytic file-sharpening process came up about ten years ago, the invention was ascribed to and claimed by several inventors. In that case the file is the anode. Here we have a cathodic process which may also have occurred to several scientists, though we are not aware that anybody but Rieder has put emery-coated tools on the market.

Agriculture Along the Yukon.

The outlook for gardening and some agriculture in the cold interior region of Alaska, along the Yukon, is made quite encouraging by official reports recently received at the United States Department of Agriculture at Washington. Prof. C. C. Georgeson, who is in charge of the Alaska experiment stations, has spent the summer in the interior and along the Yukon Valley, visiting the experiment station established by the Department of Agriculture last year at Rampart, just outside the Arctic Circle, and other points where experiments were arranged for. Good gardens were found all along the route, especially at Eagle City and Holy Cross Mission. Although the season was unusually late this year, new potatoes, cabbage, cauliflower, beets, and other vegetables were ready for the table before the middle of August, and lettuce, radishes, and turnips grown in the open had been in use for some weeks. Flower gardens containing a large variety of annuals grown from seed furnished last year were in full bloom. At the station at Rampart, rye, seeded the previous fall, wintered perfectly and was ripe in July. Spring-seeded barley had ripened about the middle of August, and there was quite a prospect for oats and wheat to mature.

Extensive areas of excellent land were found on the Lower Yukon upon which there was an abundant and often luxuriant growth of grasses over six feet in height. The abundant moisture and long days during the summer months account for the surprising luxuriance of vegetation in that far-north region.

One of Prof. Georgeson's assistants will make a trip overland from the Yukon Valley to Prince William Sound, taking the trail from Eagle City. This will afford opportunity for a reconnoissance of that region, which is reported to contain large tracts of land well suited to agriculture. A report of this trip and of the season's operations of the Alaska stations as a whole will be submitted to Congress in the early winter.

SCIENTIFIC AMERICAN

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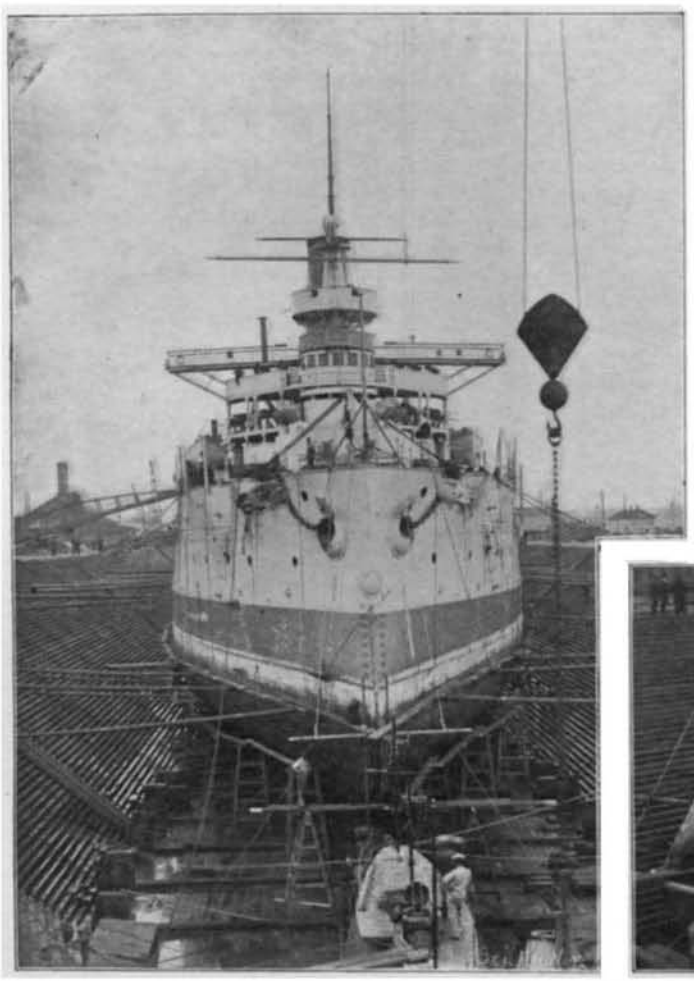
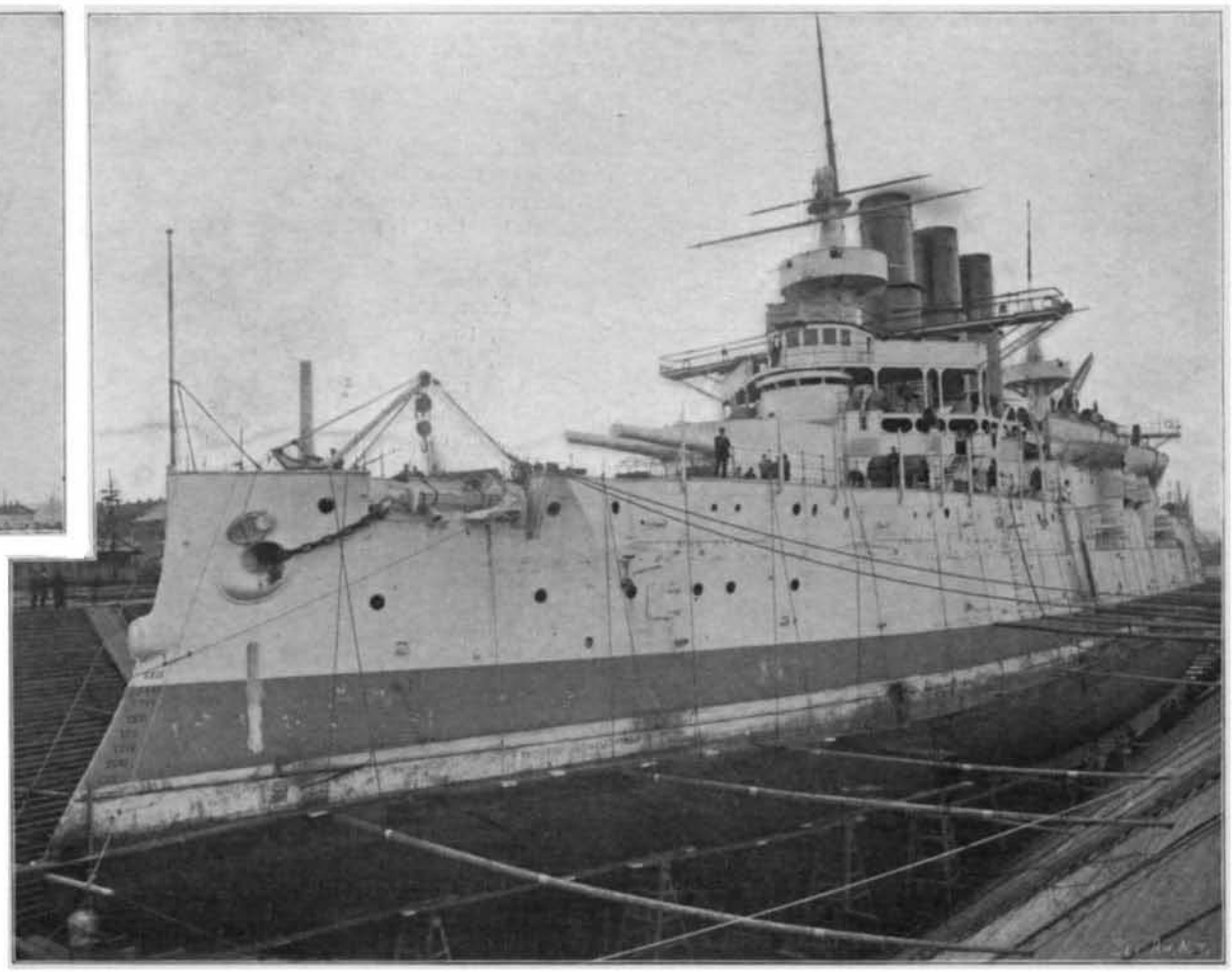
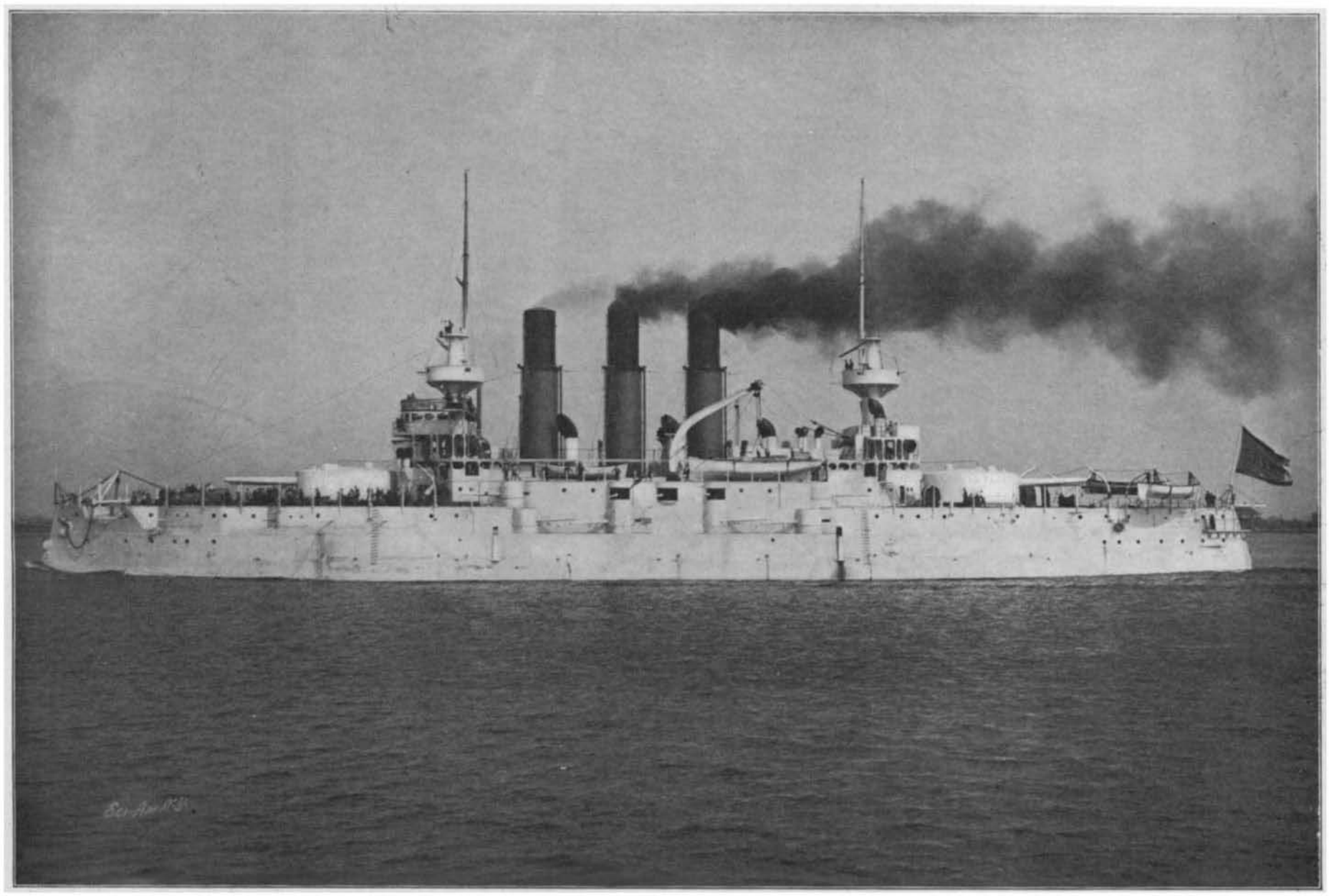


Bow View.



In Drydock at the Brooklyn Navy Yard.



Displacement, 12,700 tons. **Speed,** 18·8 knots. **Maximum Coal Supply,** 2,000 tons. **Armor:** Belt, 9 inches; turrets, 10 inches; deck, 2 to 4 inches. **Armament:** Four 12-inch 40-caliber; twelve 6-inch 45-caliber; twenty 3-inch; twenty 3-pounders; six 1-pounders. **Torpedo Tubes,** four (two submerged). **Complement,** 600.

THE "RETVIZAN"—AMERICAN-BUILT BATTLESHIP FOR THE RUSSIAN NAVY.—[See page 263.]