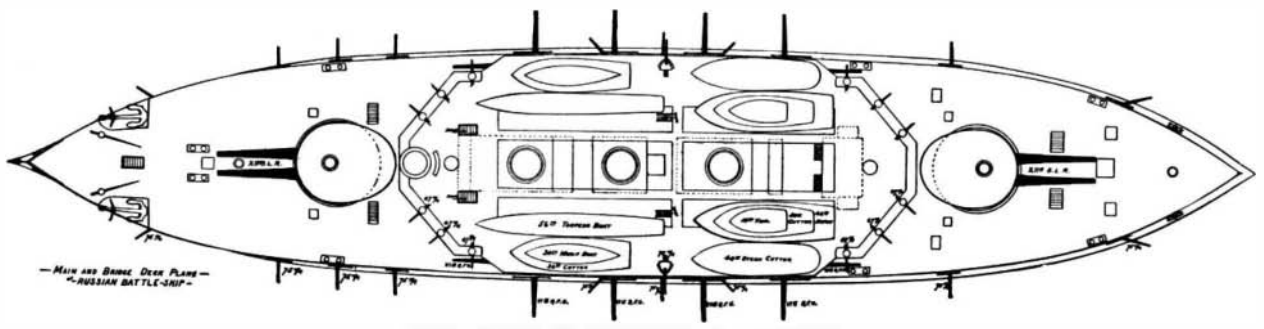
AMERICAN-BUILT WARSHIPS FOR THE RUSSIAN NAVY.

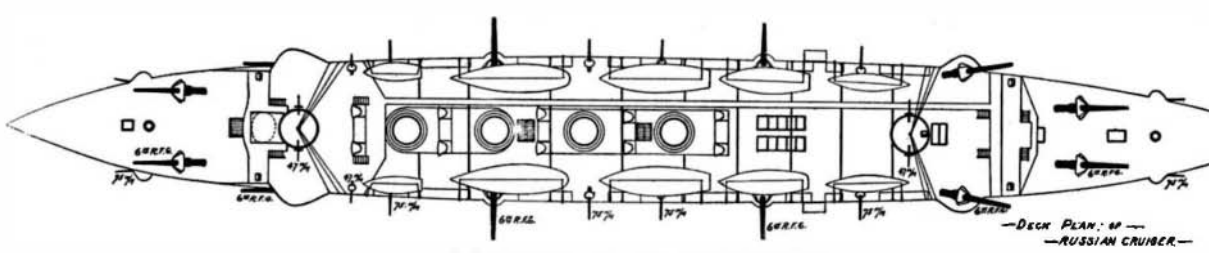
Fifteen years ago, when the United States undertook the task of creating a new navy, it found itself equipped with but few of the tools and less of the experience necessary for the costly and intricate art of warship construction. It was starting in a race in which its competitors had a start of nearly a quarter of a century. Few indeed, at the date of its birth, would have ventured to assert that within a decade and a half it would stand fourth among the great navies of the world, surpassing the fleets of Germany, Italy, and Spain in size and equaling that of Great Britain in efficiency.

Next to the test of actual war, no stronger indorsement of the excellence of a nation's warships can be desired than the fact that its shipbuilding yards are patronized by foreign governments, especially if the orders include the highest type of ships in the shape of first-class cruisers and battleships. It is well understood that the task of building a modern battleship involves such a vast and costly plant, and the exercise of such a high order of technical skill, that it can only be accomplished by a comparatively few shipbuilding yards whose plant and working staff are of the most elaborate and perfect description.

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 Cramps' Shipbuilding Company, of Philadelphia, for two high speed cruisers. These vessels, which were described in an illustrated article in the SCIENTIFIC AMERICAN for July 3, 1897, have been built and tried, both of them with highly satisfactory results. Following closely upon the successful trial of these ships has come an order to the Cramps' yard for the construction of two first-class ships—a battleship and a cruiser—for the Russian government. By the courtesy of the contractors we are enabled to give the accompanying illustrations of the vessels as they will appear when completed, together with the following details of their construction and equipment.



DECK PLAN OF RUSSIAN BATTLESHIP.



DECK PLAN OF RUSSIAN CRUISER.

THE 12,700-TON BATTLESHIP.

Taking the battleship first, as being the more important, we find that she is an exceedingly handsome vessel, with all the characteristic points of the most modern type. Half battleship, half cruiser, it is difficult to say whether she truly belongs to the one class or the other. She has the size, armor, and armament of the battleship, with the speed, coal capacity, and wide radius of action of a cruiser. Her principal dimensions are as follows:

GENERAL DIMENSIONS.

Length between perpendiculars	376 feet.
Breadth	72 feet 2½ inches.
Displacement (approximate)	12,700 tons.
Draught, not to exceed	26 feet.
Speed at full displacement for 12 hours	18 knots.

The Russians, like the French, have hitherto rather favored a continuous belt of side armor at the waterline; but in the new vessel they are adopting the partial belt which characterizes the British ships and our own. The belt will extend for two-thirds of the vessel's length and will be 9 inches in thickness up to the level of the protective deck. Associated with this will be a protective deck 2 inches thick on the flat and 4 inches on the slopes. These slopes will start at the level of the top of the 9-inch belt and descend to a junction with the bottom of the belt below the waterline. The space between slope and belt will be occupied by the coal bunkers, so that to reach the engine or boiler rooms a projectile would 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 steel and the 4-inch slope would equal 6 inches of vertical steel, thus giving a total resistance equal to a single vertical belt of 18 inches of steel, which is the thickness carried by our vessels of the "Oregon" class.

The protective deck, of course, extends the full length of the vessel, curving down to meet the stem and stern. At the stem it is merged into the framing of the ram bow, and serves both to stiffen the ram and transmit the shock of impact 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 6-inch armor, which will prevent rapid-fire shells from penetrating and bursting beneath the guns on the gun deck above.

The gun deck carries the bulk of the rapid-fire armament. Amidships, above the 6-inch belt referred to, is a battery of eight 6-inch rapid-fire guns, mounted in broadside, with a considerable train forward and aft. The casemates through which these guns are fired are protected by 5 inches of steel, and protection is afforded against a raking fire by complete athwartship walls of armor. It should be mentioned that the 9-inch belts are also continued athwart the ship to form bulkheads for the protection of the engine and boiler rooms. Forward of the central battery on the same deck are eight 3-inch rapid-firers, and aft of the battery are four other guns of the same caliber.

The upper or main deck is flush throughout the ship, except where it is occupied by the amidship superstructure. Forward and aft of the superstructure are two elliptical turrets each of which will contain a pair of high-powered 12-inch rifles. Within the superstructure, one at each angle, and commanding a wide range of fire from dead ahead to well abaft the beam, will be four 6-inch guns protected by Krupp armor. Between these on the broadside will be half a dozen of the effective little 3-inch rapid-firers.

One would think that this was armament enough to suit even a Russian battleship (for the Russians, like ourselves, are firm believers in the advantages of a crushing gun-fire); but there are yet thirty-four guns to be accounted for, and these will be found on the boat deck, the bridge, and the fighting tops. Two 3-inch guns are mounted amidships on the boat deck, one on each broadside; six 1⅞-inch rapid-firers are mounted forward and another half dozen 1⅞-inch aft on this deck, while yet another dozen are mounted on bridges above these. Elsewhere are two 2½-inch rapid-firers, while from the tops half a dozen 1½-inch rapid-firers will add their storm of shells to the awful hail that will be poured forth from the bridges and boat decks below. The armament is completed by no less than six torpedo tubes.

How the problem of supplying projectiles simultaneously to some seventy rapid-firing guns has been worked out we are unable to state; but we are assured by the contractors that full provision has been made for every gun.

The ship will be driven by triple expansion engines and steam will be supplied by Niclausse water-tube boilers of a combined capacity of 16,000 horse power, and this vessel will be the first battleship built in this country having a complete installation of water-tube boilers and machinery particularly adapted to the water-tube boiler. It should be mentioned that the turrets will be operated by electricity; in fact, many of the auxiliary machines usually operated by steam will on this vessel be driven by electric motors.

In the features of drainage, ventilation, the comfort of the officers and crew, this ship will be more than abreast of current practice in naval equipment. The requirements of the trials for speed, the amount of ammunition, and the various guns to be carried and adequately protected, together with the large amount of stores and outfit to be provided for, make the fulfillment of these conditions possible only to a company like that of the Messrs. Cramp, whose long and successful experience in designing and building vessels of war gives ample assurance that these difficult requirements will be fully met.

THE 6,500-TON CRUISER.

The new cruiser will have the same characteristic features of speed, heavy armament, and radius of action that are conspicuous in the battleship. Her principal features are as follows:

GENERAL DIMENSIONS.

Length between perpendiculars	400 feet.
Beam	52 feet.
Draught, about	19 feet 6 inches.
Displacement, about	6,500 tons.
Speed for 12 hours	23 knots.

Battery: Twelve 6-inch rapid-fire guns; twelve 3-inch rapid-fire guns; six 1⅞-inch rapid-fire guns; four torpedo tubes.

The protective deck will be 1½ inches on the flat and 3 inches thick on the slopes.

The main battery of 6-inch guns is carried as follows: Four amidships on the main deck in broadside; two forward and two aft on the main deck mounted in sponsons so as to command a dead ahead and dead astern fire; two bow chasers on the forecastle deck and two stern chasers on the quarter deck. There is thus a concentration of the fire of four 6-inch guns forward, four aft, and six on either broadside. There are also two 3-inch rapid-fire guns forward and four amidships on the main deck and two 3-inch rapid-firers aft on the berth deck. Six 1⅞-inch rapid-firers are carried on the bridge and in the two tops. There are four torpedo tubes.

As in the battleship, the cruiser's boilers will consist entirely of the Niclausse water-tube type. Attention is directed to the unprecedented conditions of trial for this ship, the high speed of 23 knots an hour having to be maintained for twelve consecutive hours. The same long period of full power test is exacted in the case of the battleship, and it is certain that, if the Messrs. Cramp can successfully fulfill these severe requirements, the result will revolutionize the conditions of future speed trials.

Judged from the standpoint of appearance, it must be admitted that these vessels will be remarkably handsome specimens of the naval shipbuilder's art.

An Accident on the London Underground Electric Road.

A few days ago Londoners were alarmed by an accident which occurred on the new electric underground road. There had been a great crowd at the Waterloo Station to welcome home the Guards from their campaign in the Soudan. Afterward there was a rush of people to the City, and naturally the new electric line came in for a considerable part of the traffic. It was crowded to its utmost capacity, and the electric power proved inadequate to carry the overloaded trains up the heavy grade from beneath the river to the City terminus, and the result was the cars stopped. The electric lights became dim, but there was no uneasiness among the entombed passengers. In a few minutes, however, the air became heavy, and while there were no choking odors such as are familiar to passengers on the other underground London lines, still there was a peculiar sensation of suffocation which resulted in almost a panic. Opening doors and windows did no good, for the tunnel itself was very little larger than the cars themselves. The passengers left the cars and made their way with considerable difficulty through the narrow space on each side between the trains and the walls of the tunnel until they finally reached the City terminus, about a quarter of a mile distant.

The theory of the deep underground electrical railways is that no ventilation is necessary beyond that automatically provided by the motion of the trains themselves. Experiments seem to justify this theory, and no serious difficulty had been experienced until the present time, and it would really seem that in a very short line like the City and Waterloo Railway no artificial ventilation would be necessary, but there is no question that the danger really exists even in this short line, and undoubtedly some means will be provided for supplying air to victims of such mischance as that above described.

EFFECTS OF THE ARC ON EYES.—The report of Tracinski, in the Zeitschrift für Beleuchtungswesen (April 30), gives the result of investigations in connection with the operation of the Zerener arc welding process, which is now coming into use quite largely. The operator wears a pair of spectacles of dark, smoked glass, besides which he looks through a pane of deep red glass, which is connected with the apparatus. The action of the light is sufficiently reduced by this means, says The Progressive Age. He tried using the red glass alone, but it affected the eyes for some time after. The workmen who are using this apparatus continuously at first experienced pain in the eyes at night, but later on this disappeared; the sight, however, was not affected. He concludes that no permanent ill effects are produced if proper precautions are taken, and if the operator becomes gradually accustomed to the work. It is a mistake to have a new operator work a whole day with the arc, as he should begin with a few hours a day until his eyes have been accustomed to it. Only those who have healthy normal eyes should attempt this work.

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