

THE RECONSTRUCTED CRUISER "CHICAGO."

The good work of reconstructing the older ships of the United States navy is making fair progress. Not only are we constantly adding new ships to our navy, but we are gradually reconstructing the earlier vessels of the new navy. The "Chicago," one of the first of our steel warships, launched in 1885, was recently placed in commission, after an overhauling and reconstruction that has practically made a new ship of her. Fortunately, the lines of the vessel are excellent for speed and the material and construction of her hull are both first-class and fully warrant the large sum of money that has been expended in improving her speed and fighting power.

There is something very pleasing in the thought that this vessel, the first large steel warship and the first flagship of our modern navy, has been given a new lease of life, and that it has been found possible to make such changes in her motive power and armament that she is able to rank fairly well with cruisers of her displacement that were not built until fully ten years after the "Chicago" had been designed.

It is gratifying to know that a similar overhauling, not quite so complete, perhaps, but still very thorough, is being carried out and is nearly completed on the "Atlanta" (a cruiser built at the same time as the "Chicago"), and that as soon as the exigencies of the service will permit, the "Boston," sister ship to the "Atlanta," will be also rearmed and improved.

The "Chicago" under her new lease of life carries very little of the original material that was put into her at the time of her first construction. Indeed, it may be said that the mere shell of the vessel is all that remains of the work done in Roach's shipbuilding yard. In the first place her engines and boilers are entirely new, and are of an improved and thoroughly modern type. Her protective deck, which formerly extended merely above the vitals of the ship (the engine and boiler rooms), has now been carried forward and aft to the stem and stern, so as to make a continuous armored protection throughout the ship. And not only the main engines, but all the various auxiliaries with their steam piping and general fittings, are entirely new. In the armament only the heavy 8-inch guns have been retained. The whole of the battery of slow-fire guns on the gun deck has been replaced by a battery of fourteen 5-inch rapid-fire guns of the latest navy type, and the secondary battery of 6-pounders and 1-pounders has been disposed to suit the improved arrangements of the superstructure and the fighting tops.

The great change in the outward appearance of the vessel is due to the alteration in her rig. When she returned from her last cruise she carried her familiar bark rig, with heavy yards on the fore and main masts and a complete bowsprit and jibboom. The yards and jibboom have disappeared, and with them the main-mast, so that the ship now carries two masts (fore and main mast) of the usual military type, with a fighting top on the fore-mast in which are carried two 1-pounder guns, and just below the fighting top a searchlight platform, which is sponsoned out in front of the mast. There is a small signal yard on each mast and a gaff on the main-mast. These changes in her rig, together with the lengthening of the smokestacks, which now extend some eighty feet above the grate bars, have completely changed the appearance of the "Chicago," and have given her a much more ship-shape and businesslike appearance judged by the modern standards of warship design.

The most important changes in the ship are, of course, those which have been made in the motive power, as may be judged from the fact that the horse power has been raised from 5,000 to 9,000, and the speed from about fifteen up to eighteen or possibly to eighteen and a half knots an hour. The machinery of the original ship was of a curious and cumbersome type. It consisted of two heavy compound engines, the cylinders of which were connected to overhead, athwartship, walking beams, which served to drive the crankshafts on the opposite side of the vessel. Thus the starboard cylinders drove the port screw shaft, and vice versa. The boilers were even more out of date, if that were possible, than the engines. They were of the externally fired return tube cylindrical type, the furnaces being bricked up around the outer shell. The boilers have been replaced by six Babcock & Wilcox water-tube boilers and four Scotch boilers. With a view to testing the merits of nickel steel for boiler construction, one of the Scotch boilers was built of this material, and if the results in respect of corrosion and general durability are satisfactory, it is probable that nickel steel will be largely adopted for boiler construction. The greater tensile strength of the alloy, as compared with common commercial steel, will enable a considerable reduction to be made in the total weight of boilers for a given horse power. The Babcock & Wilcox boilers average about 64,200 pounds in weight, with all attachments, but no water. The weight of water is 11,930 pounds; the total heating surface for the six boilers is 14,700 square feet, and the total grate area is 360 square feet, while the pressure for both types of boilers is 180 pounds. The average weight of the Scotch boilers,

empty, is 81,400 pounds; the weight of water is 40,430 pounds, the total heating surface is 8,562.6 square feet, and the total grate area is 273.52 square feet. It is interesting to note that the weight of water used in the Scotch boilers is over three times as great as that used in the boilers of the water-tube type. The total heating surface of all boilers is 23,352.3 square feet, and the total grate surface is 633.52 square feet.

The ship is driven by twin-screw horizontal triple-expansion engines, the engines being slightly inclined. The high pressure cylinder is 33½ inches in diameter, the intermediate 50½ inches, and the low pressure 76 inches in diameter, the common stroke being 40 inches. All the valves are of the piston type, there being one single piston valve for the high pressure and two each for the intermediate and low pressure cylinders. The total indicated horse power is 9,000. The engines are in two separate water-tight compartments, the cylinders being on one side of the center line of the ship, and the screw shafts on the opposite side. Thus the starboard engine, or the engine driving the starboard propeller, has its cylinders lying on the port side of the ship, while the port engine has its cylinders lying on the starboard side.

The ship is provided with a well-found machine shop, in which motive power is furnished by a Greenfield vertical engine. The tools consist of two lathes, two drill presses, one shaper, one emery grindstone, and various machine shop etcetera, besides a well-found bench for vise work.

The system of ventilation has been well worked out. The engine room is ventilated by both exhaust and forced blowing and the ship ventilation is arranged on the same system. The ship is provided with an Allen dense air ice machine, connected to a freezing box and a cold storage room. The coil also passes through the scuttle-butts to provide cool drinking water for the crew.

Of almost equal importance to the radical changes which have been made in the motive power is the extensive rearmament of the ship which has taken place. The old 8-inch guns which are carried in sponsons on the main deck are retained. They are thoroughly serviceable weapons of the same type as those which did good duty at the battle of Manila Bay on the "Baltimore." The gun deck broadside battery of five slow-fire 6-inch guns and four slow-fire 5-inch has given place to a battery of fourteen 5-inch rapid-fire guns. To keep pace with the increased demand for ammunition by the rapid-fire weapons, new electric ammunition hoists have been built into the ship. They are of the endless chain pattern and are capable of putting the ammunition on deck considerably in excess of the ability of the guns.

An interesting installation on this ship is the system of hydraulically operated watertight bulkhead doors invented by Mr. W. B. Cowles of the construction department of the United States navy. This device, known as the "long arm" system, secures doors which will open and close again tightly under a head of water, and they will close tightly through a doorway full of coal. All the doors can be actuated by a single operator, who from his station on deck can move any single member of the system. The advantage of this concentration of control in case of flooding through attack by the ram or torpedo is obvious. An illustrated description of the system as carried out on the "Chicago" will be found in the SCIENTIFIC AMERICAN for June 25, 1898.

The extensive structural changes in the "Chicago" were carried out under Naval Constructor Bowles, and the machinery was installed under the superintendence of A. F. Dixon, chief engineer of the ship.

OUR LATEST BATTLESHIP, THE "KEARSARGE."

About the time this article appears our latest battleship, the "Kearsarge," is expected to arrive at the Brooklyn navy yard, where she will enter drydock preparatory to undergoing her speed trials off the Massachusetts coast.

The "Kearsarge" and her sister, the "Kentucky," will, in some respects, be the most interesting vessels of the new navy; for apart from the fact that they will represent the latest efforts of the Bureau of Construction and Repair and our leading shipbuilders, the vessels possess peculiar interest on account of some decidedly novel features in their design and construction. We refer to the manner in which the main and intermediate batteries are carried, the method of mounting them being known as the double-decked turret system. The system can best be understood by comparing it with the plan adopted in the case of the "Iowa," the latest of the large battleships completed for our navy. In the "Iowa" the main battery of 12-inch guns is carried on the center line of the ship, two of the guns in a turret forward, and two in another turret aft. The intermediate battery of 8-inch guns is carried in four turrets at the four angles of the central armored citadel, amidships. As there are two of these guns in each turret, the intermediate battery is seen to be of a very formidable character.

This arrangement of the main battery in fore and aft turrets, with the turrets of the intermediate battery

flanking it, the two 8-inch forward turrets being aft of the forward 12-inch turret, and the two after 8-inch turrets being forward of the after 12-inch turret, also characterizes the three ships of the "Oregon" class. It provides an unusually powerful "end-on" fire, the concentration ahead or astern being, in the case of the "Iowa," two 12-inch and four 8-inch, and in the case of the "Oregon" two 12-inch and four 8-inch guns. In the gun trials of the "Oregon" type, however, it was found that in firing ahead, the blast of the 8-inch guns affected the officers in the sighting-hoods of the 12-inch turrets, if the former were fired closer than within 10° of the longitudinal axis of the ship. This difficulty has been overcome in the case of the "Kearsarge" and "Kentucky" in a novel and somewhat daring manner. Four of the 8-inch guns were thrown out altogether and the remaining four were mounted in two turrets, which were superimposed upon the roofs of the 12-inch turrets, in the manner shown in our engraving. By this distribution, not only were the defects of interference overcome, but a more efficient all-round fire was obtained. Though only half the number of 8-inch guns and turrets is employed, the all-round fire from this caliber is better than is possible in the earlier battleships; for on the broadside it is the same, and dead-ahead fire is now possible without interference with the 12-inch gun positions. The 8-inch turrets have been changed from the original designs so as to enable them to be trained independently of the 12-inch turrets—a most important modification.

As regards the rest of the armament, the principal change is the substitution of a secondary battery of fourteen 5-inch rapid-fire guns in place of the four 6-inch guns of the "Oregon" or the six 4-inch guns of the "Iowa." So large a battery calls for a large supply of ammunition and a wide area of armor protection, but the throwing out of four 8-inch guns and two turrets placed a large amount of weight at the naval architect's disposal, which he was able to use advantageously in a powerful secondary battery. The great rapidity of fire in the 5-inch battery greatly outweighs the heavier weight of the 8-inch guns which it in part displaces. In sixty minutes' fighting one broadside of seven 5-inch guns could fire fifty-six shells weighing in the aggregate nearly 3,000 pounds at a velocity of 2,300 feet per second, the total energy of which would be equal to 103,704 foot-tons, sufficient to lift the ship itself 9 feet bodily into the air. The accompanying table shows the broadside discharge:

BROADSIDE DISCHARGE OF THE "KEARSARGE."

Number of Guns.	Diameter in Inches.	Weight in Pounds.	Velocity in Feet-Seconds.	Energy in Foot-Tons.	Total Energy.	Penetration in Inches at Muzzle.	Point of Attack in Enemy.
4	13	1,100	2,100	33,627	134,508	34.6	Belt and main turrets.
	8	250	2,150	8,011	32,044	21.6	Conning tower and casement armor.
7	5	50	2,300	1,834	12,838	13.0	Thin armor, superstructure, and unarmored ends.

These two fine ships were constructed at the extensive shipyard of the Newport News Shipbuilding Company. They are identical in all respects, having been built from the same set of drawings and specifications. The "Kearsarge" is named after the famous wooden steam frigate (shown in the smaller view on the front page) which met and sank the "Alabama" off Cherbourg toward the close of the Civil War.

The principal dimensions of the new ship are as follows: Length, 368 feet; beam, 72 feet 2½ inches; mean draught, 23 feet 6 inches; displacement, 11,525 tons. The protection at the waterline will consist of a belt of Harveyized steel, which tapers amidships from 16½ inches at its upper edge to 9½ inches at its bottom edge. It is 7½ feet deep, 3 feet being above and 4½ feet below the waterline. This belt maintains its full thickness, as given, throughout the wake of the engine and boiler space and tapers gradually to 4 inches at the bow. Astern, it reaches to a point aft of the after barrette. Above this belt is a flat deck 2¾ inches in thickness, which extends over the engine and boiler spaces. It is continued forward to the bow and aft to the stern in a curved or turtle-back form. Above the armored deck the sides are protected by 5½ inches of Harveyized steel to the level of the main deck, and this armor is also continued to the level of the superstructure throughout the whole length of the central citadel. There are heavy armored bulkheads extending athwartships from side to side, which inclose the bases of the barbettes. The secondary battery within the citadel is also protected by 5½-inch transverse bulkheads. The 6-pounder battery of twenty guns is disposed eight on the berth deck and twelve on the superstructure deck, while the six 1-pounder guns are placed in the military tops. The vessels each carry four torpedo tubes.

Taken altogether, the "Kearsarge" and her mate will form a very powerful addition to the United States navy. Of course their speed seems slow when it is remembered that some foreign navies are building ships of nineteen and twenty knots speed, but this defect is, perhaps, somewhat compensated for by the powerful armor and armament which characterize these two vessels.