

NAVIES OF THE WORLD.

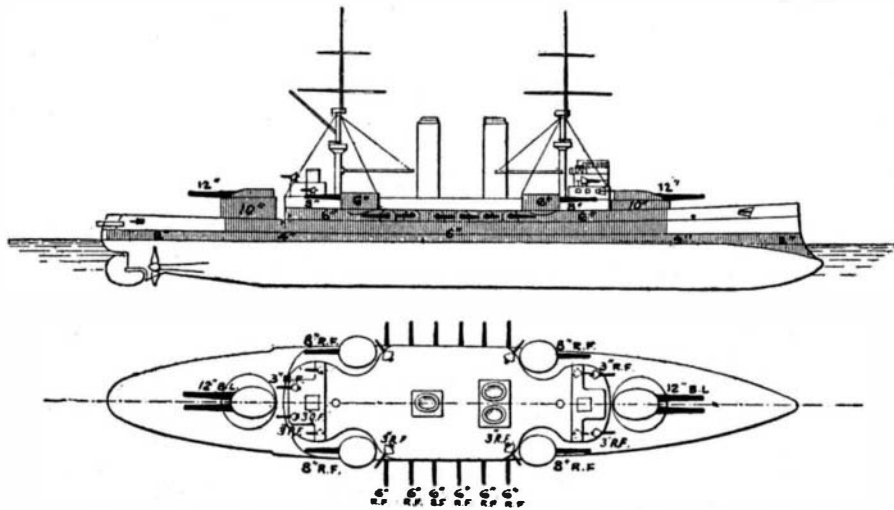
VI. ITALY.

BATTLESHIPS.—The mention of the Italian navy suggests at once the huge battleships and cruiser-battleships which were for many years the characteristic feature of this, as distinguished from the other great navies of the world. As far back as the year 1876, the Italians had launched a battleship, the "Duilio," of the then unprecedented displacement of over 11,000 tons, which carried 21½ inches of armor on her sides and mounted four huge muzzle-loading guns of 17¾ inches caliber and 100 tons weight as her main armament. Two years later, she was followed by a sister ship, the "Dandolo." These two vessels produced a veritable sensation, for there was nothing afloat, even in the British navy, to compare with them, the nearest approach being the "Devastation" of 9,330 tons and the "Dreadnought" of 10,820 tons, which, however, carried only four muzzle-loading 36-ton guns, and armor 12 and 14 inches in thickness. The 17¾-inch 100-ton muzzle-loader has a muzzle energy of 33,220 foot-tons and is capable of penetrating 18 inches of steel at a thousand yards and 16 inches at twenty-five hundred yards. As the armor-piercing and the common shell weigh a ton, and carry a bursting charge respectively of 30 and 80 pounds of powder, it can be seen that the old "Duilio" is a powerful coast defense vessel, despite her age. Of the two ships the "Duilio" remains practically unchanged, but the "Dandolo" has recently had her muzzle-loaders replaced by modern 10-inch breech-loading rifles, and a

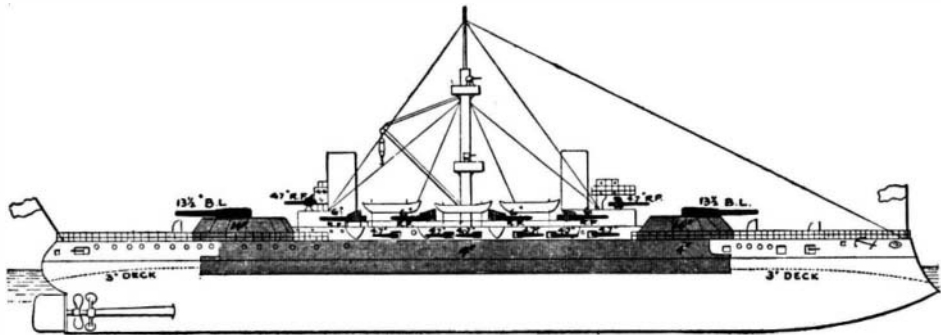
world. In the first place, massive side armor, or indeed any side armor whatever, was abandoned, and reliance was placed in a thick, curved deck placed several feet below the waterline, and associated with a minute cellular subdivision of the space above the deck at the level of the waterline. Massive inclined armor was placed around the smokestacks where they entered the protected deck. The vessels were given a lofty freeboard throughout, and the armament of four 100-ton breech-loading guns was placed within a diagonal redoubt of 19-inch armor, resting upon the flush main deck. A heavily armored ammunition hoist led from the protective deck to the redoubt, and the big

and guns until she ran into close range she would be a most dangerous antagonist. In a recent test of the naval wargame, the "Italia" was matched against the British "Magnificent." The boats approached head on, the "Italia" reserving her fire until she was within point-blank range, when she let fly with all four 105-ton guns at the same instant at the forward transverse bulkhead of the enemy. The victory was awarded to the "Italia," as it was considered that the bulkhead of the "Magnificent" would have been smashed in and the engines and boilers wrecked by the 200,000 foot tons of energy embodied in the four 2,000-pound projectiles.

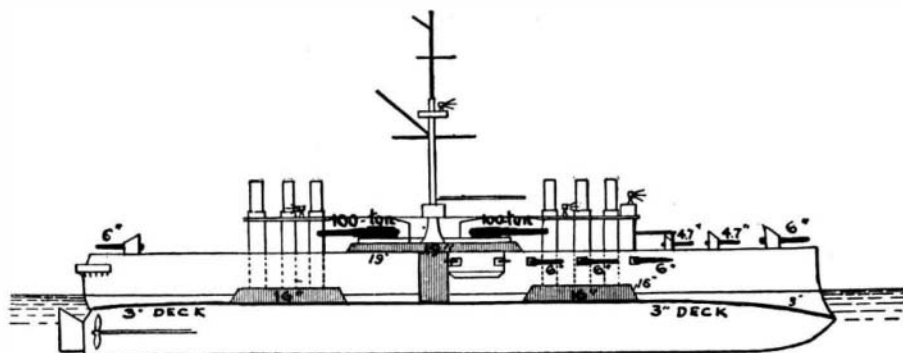
The "Italia" type was not repeated, and the next lot of battleships, the "Andrea Doria," "Francesco Morosini," and "Ruggiero di Lauria," launched in 1884-85, are a reversion to the "Duilio" type. They are provided with a belt extending amidships in the wake of engines and boilers, above which is a diagonal redoubt reaching to the main deck. Within the redoubt are four 17-inch 105-ton breech-loading rifles, disposed in pairs diagonally or *en echelon*, as in the "Italia." The armor, which is of the English compound type, is 17.7 inches in thickness on the belt and redoubt, and 14 inches on the bulkheads. The deck is 3 inches in thickness. The trial speed of the ships was from 16 to 17 knots; but the sea speed would not probably be over 14. The armament is, of course, of tremendous power, no vessels in the world being able to deliver such a combined attack at a single discharge as these vessels



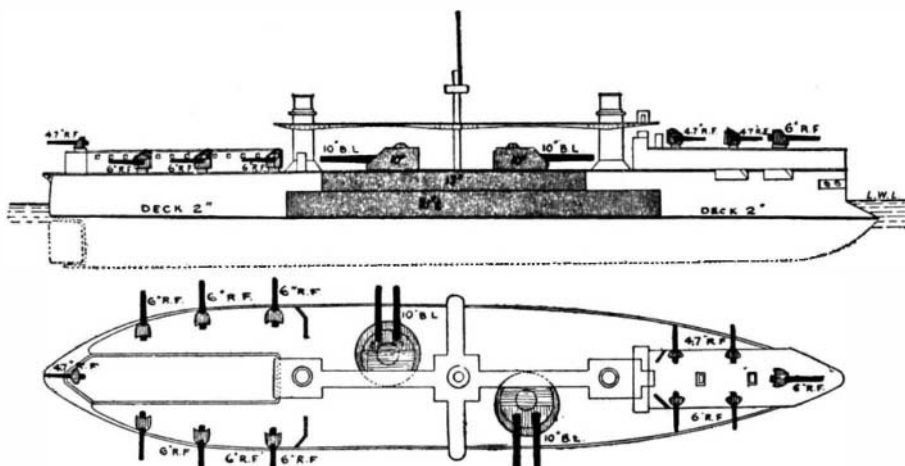
First-class Battleship "Benedetto Brin." Also "Reina Margherita." Displacement, 12,765 tons. Speed, 21 knots. Normal Coal Supply, 1,000 tons. Armor: Belt, 6 inches; gun positions, 6 and 10 inches; deck, 3 inches. Armament, four 12-inch, four 6-inch, twelve 6-inch, ten 3-inch, six 1.8-inch. Torpedo Tubes, 4 (submerged). Complement, 600. Date, 1899.



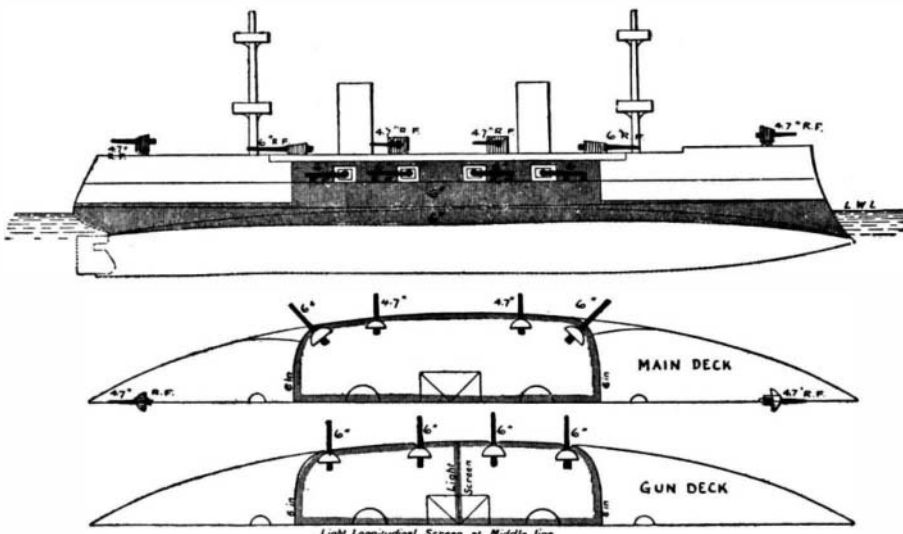
First-class Battleship "Re Umberto." Class of Three Ships. Displacement, 13,360 tons. Speed, "Re Umberto," 19 knots; "Sicilia," 20.2 knots; "Sardegna," 21.2 knots.



First-class Battleships "Italia" and "Lepanto." Displacement, 14,400 tons. Speed, 18.4 knots.



Second-class Battleships "Duilio" and "Dandolo." Displacement, 11,200 tons. Speed, 15.6 knots. NOTE.—"Dandolo" has been reconstructed and re-armed as per data given. Similar changes were proposed for the "Duilio," but probably will not be made. She now carries four 17-inch 100-ton muzzle-loading guns as her main armament.



Armored Cruisers "Vettor Pisani" and "Carlo Alberto." Displacement, 6,500 tons. Speed, 20 knots.

NAVIES OF THE WORLD—VI. ITALY.

powerful battery of eight 6-inch and four 4.7-inch rapid-fire guns has been mounted on the main and superstructure decks. The 6-inch guns on the main deck have necessitated the sacrificing of the dead astern fire of the 10-inch guns; but as the "Dandolo" is designed to fight anything afloat, the loss is only nominal. She can still concentrate four 10-inch, one 6-inch, and two 4.7-inch guns dead ahead.

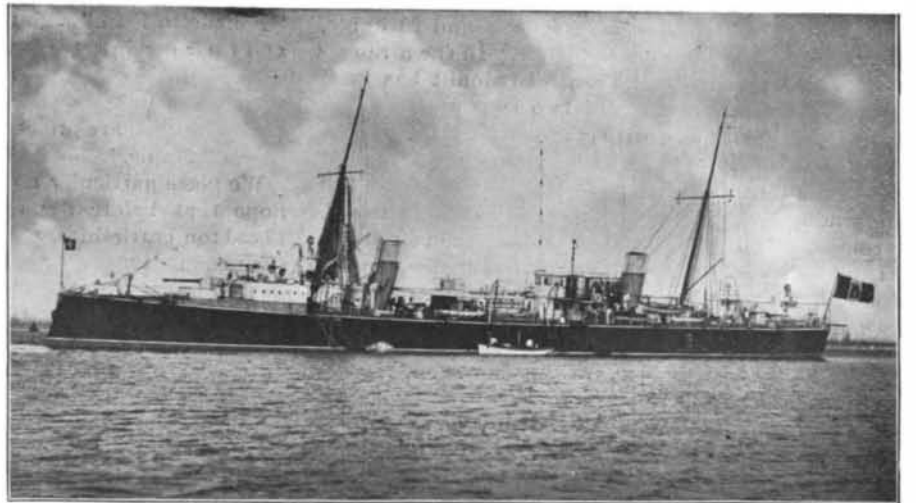
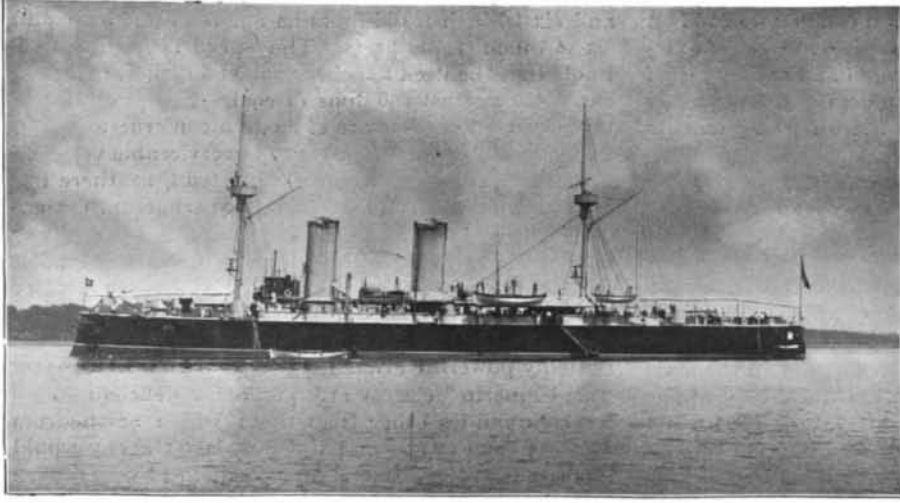
Not content with the unusual dimensions of the "Duilio" and her mate, the Italians proceeded to even greater extremes in the "Italia" and "Lepanto," launched in 1880 and 1883, both of which were of about 14,400 tons displacement. These vessels are of special interest, both on account of the many radical features embodied in their design, and because they anticipated by a dozen years or more the size and speed which are only now becoming usual in the navies of the

guns were placed in barbette at a height of over 30 feet above the waterline. The weight saved in armor was put in motive power, the "Lepanto" developing 15,800 horse power with a resulting speed of 18.38 knots per hour. The object aimed at in these vessels was to produce a warship which by virtue of her speed could accept or refuse battle as she pleased, that could choose her own fighting distance, and that could steam swiftly to close quarters and deliver a crushing attack with her monster guns before the enemy could do fatal injury to her unprotected hull. For those days of big guns and slow fire it was an ingenious theory; but the rapid-fire guns of a modern ship would speedily wreck the supporting structure of the barbette and big guns, and bring the latter crashing down into and possibly through the hull of the vessel. Nevertheless it is certain that if the "Italia" could maintain the integrity of the barbette

and the "Italia" and "Lepanto." The guns of the "Andrea Doria" fire a 17-inch 2,000-pound projectile, with a muzzle energy of 55,030 foot-tons and a penetration through iron of 35 inches. The combined energy of her fire in any direction would thus be 220,120 foot-tons for a single round from these guns alone.

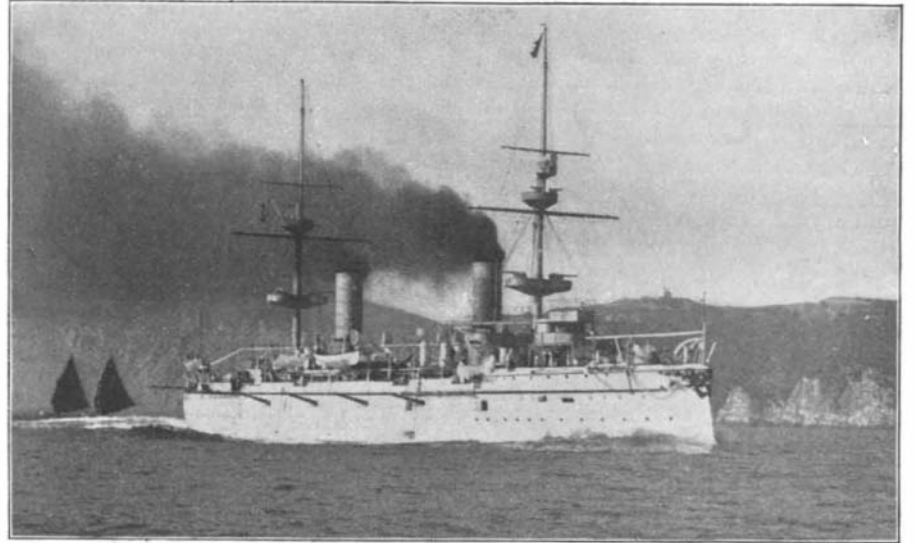
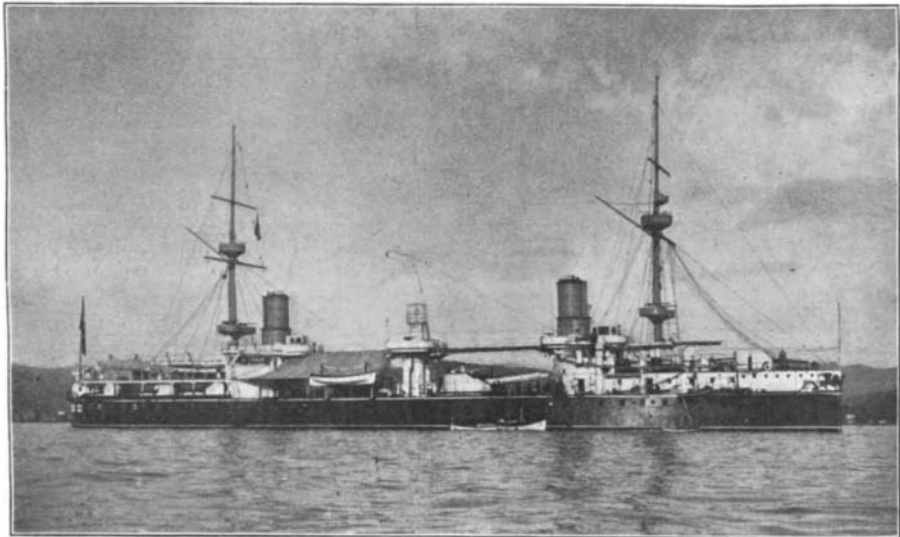
The great defect of these ships is their low freeboard (freeboard being sacrificed to armor) and the concentration of the whole main battery in one redoubt, where a single heavy shell might disable every gun. Also, judged by modern ideas, the absence of a numerous secondary rapid-fire battery is a fatal weakness.

Following the "Andrea Doria" class came the three battleships "Re Umberto" (1888), "Sardegna" (1890), and "Sicilia" (1891), in which a return was made to the extreme dimensions of the "Italia." The displacement and speed of these three ships are about the



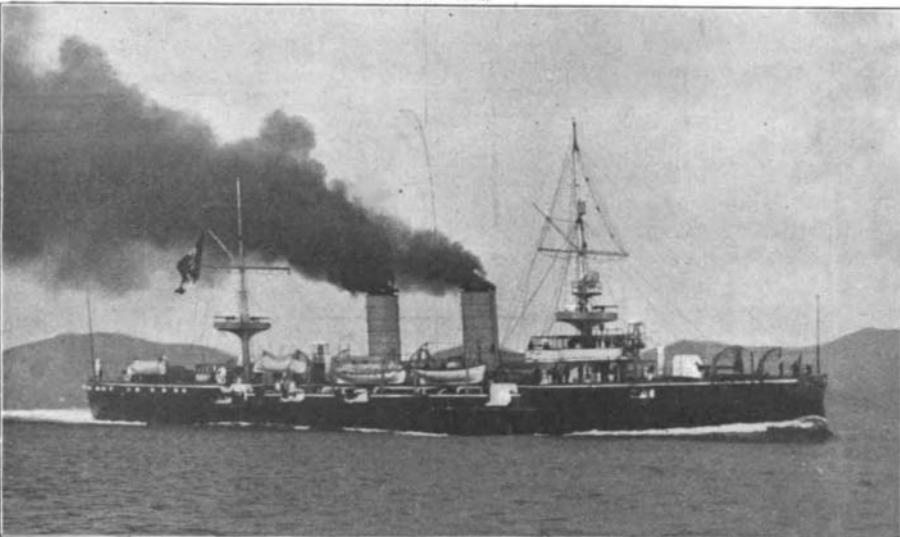
3.—Third-class Protected Cruiser "Etruria." Class of Three Ships. Displacement, 2,230 tons. Speed, 19.8 knots. Normal Coal Supply, 400 tons. Armor: Deck, 2 inches; gun positions, 4 1/2 inches. Armament, four 5.9-inch rapid-firers, six 4.7-inch rapid-firers, one 2.9-inch rapid-firer, eight 2.2-inch, ten 1.4-inch rapid-firers, two machine guns. Torpedo Tubes, 2. Complement, 257. Date, 1891.

4.—Torpedo Gunboat "Partenope." Class of Eight Vessels. Displacement, 840 tons. Speed, 19 knots. Normal Coal Supply, 100 tons. Armor: 1-inch deck; light gun shields. Armament, one 4.7-inch rapid fire gun, six 2.2-inch and three 1.4-inch rapid-fire guns. Torpedo Tubes, 5. Complement, 111. Date, 1890.



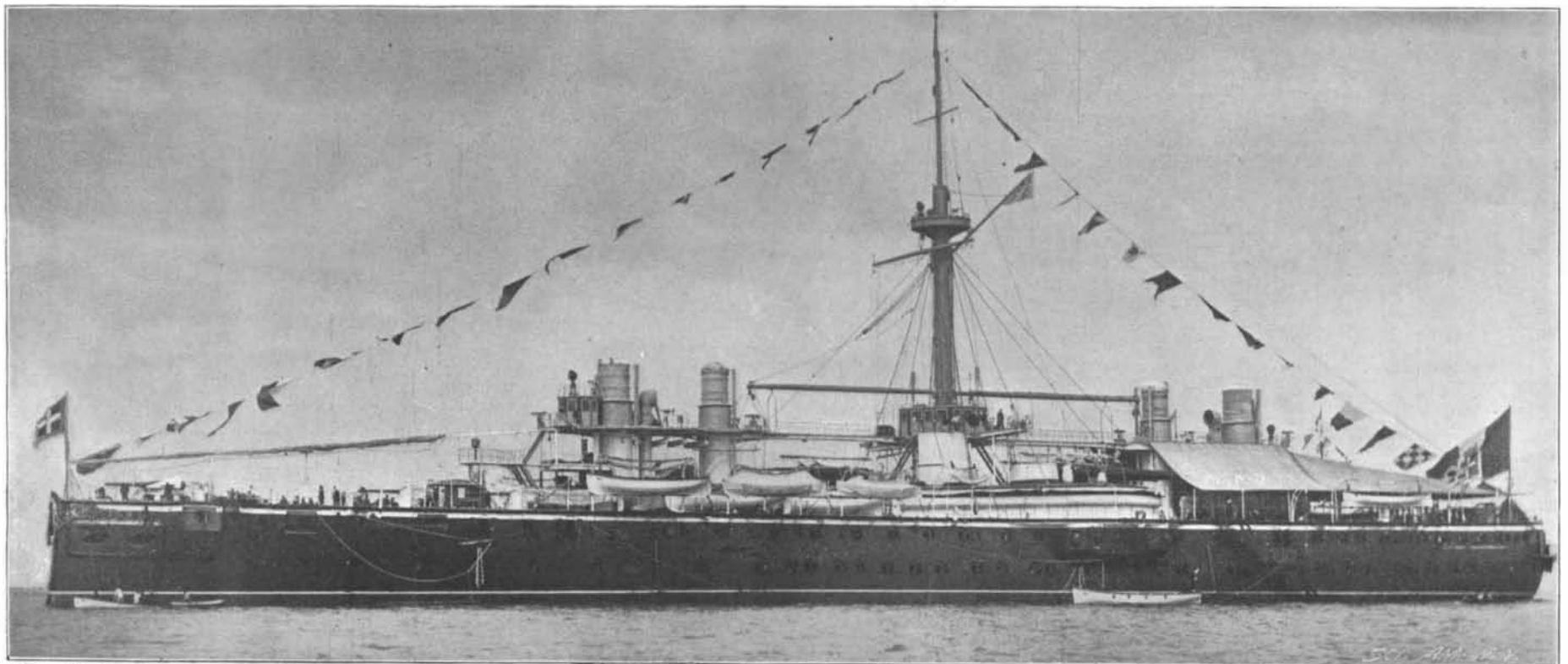
5.—Second-class Battleship "Dandolo." Also "Dulio." Displacement, 11,303 tons. Speed, 15.6 knots. Normal Coal Supply, 1,000 tons. Armor: Belt, 21 1/2 inches; gun positions, 18 inches; deck, 2 inches. Armament, four 10-inch B. L. rifles, seven 6-inch rapid-fire guns, five 4.7-inch rapid-fire guns, two 2.9-inch, ten 2.2-inch, fourteen 1.4-inch rapid-fire guns, two machine guns. Torpedo Tubes, 4. Complement, 487. Date, 1878; 'Dandolo' refitted and rearmed, 1898. 'Dulio' still carries old armament.

6.—Armored Cruiser "Vettor Pisani." Also "Carlo Alberto." Displacement, 6,500 tons. Speed, 20 knots. Normal Coal Supply, 600 tons. Armor: Complete belt, 6 inches; central battery to main deck, 6 inches; gun positions, 6 inches; deck, 1 1/2 inches on flats. Armament, twelve 6-inch rapid-fire guns, six 4.7-inch rapid-fire guns, two 2.9-inch, ten 2.2-inch, ten 1.4-inch rapid-firers, two machine guns. Torpedo Tubes, 4. Complement, 460. Date, 1895.



7.—Armored Cruiser "Marco Polo." Displacement, 4,533 tons. Speed, 19 knots. Normal Coal Supply, 630 tons. Armor: Belt and bulkheads, 4 inches; gun positions, 4 inches; deck on flats, 1 inch. Armament, six 6-inch rapid-firers, ten 4.7-inch rapid-firers, two 2.9-inch rapid-fire, nine 6-pounders, four 1-pounders, two machine guns. Torpedo Tubes, 5. Complement, 315. Date, 1890.

8.—Armored Cruiser "Giuseppe Garibaldi." Also "Varesa." Displacement, 7,400 tons. Speed, 20 knots. Normal Coal Supply, 650 tons. Armor: Complete belt, bulkheads, and redoubt extending to main deck, all 6 inches; gun positions, 6 inches; deck, 1 1/4 inches on flats. Armament, one 10-inch, two 8-inch rapid-firers, fourteen 6-inch rapid-firers, ten 2.9-inch, six 1.8-inch rapid-firers, and two machine guns. Torpedo Tubes, 4 (submerged). Complement, 540. Date, 1897.



9.—First-class Battleship "Lepanto." Also "Italia." Displacement, 14,440 tons. Speed, 18.4 knots. Normal Coal Supply, 1,650 tons. Armor: At base of funnels, 16 inches; barbettes, 19 inches; deck, 8 inches. Armament, four 17-inch, 100-ton B. L. rifles, eight 6-inch, four 4.7-inch rapid-fire guns, twelve 2.2-inch, thirty-four 1.4-inch, and two machine guns. Torp do Tubes, 4. Complement, 743. Dat, 1883.

NAVIES OF THE WORLD—VI. ITALY.

same, the "Sardegna," of 13,860 tons and 20 knots, being slightly the largest and fastest. In the arrangement of their armament the central redoubt has been abandoned and the system of two separate fore and aft main gun positions, with a central rapid-fire battery amidships, adopted. This arrangement was first used in the "Admiral" class of the British navy, and is now adopted universally in the navies of the world. As compared with the "Andrea Doria," the belt armor has been reduced from 17.7 inches to 4 inches, and it covers about two-thirds of the length amidships, extending to the main deck. The barbettes project above this deck to a height of about 13 feet, the axis of the main 13½-inch guns being about 26 feet above the waterline. This gives a good command, but the seagoing qualities of these fine ships would have been greatly improved if the amidships superstructure deck had been carried out to the bow as in our own "Alabama" and "Maine" classes. The 13½-inch gun weighs 68 tons, and fires a 1,250-pound projectile with a muzzle energy of 35,230 foot-tons and a muzzle penetration of 33 inches of iron. The amidships rapid-fire battery of these ships is unusually powerful, consisting of twelve 4.7-inch guns on the main deck, eight 6-inch guns on the superstructure deck, and four 4.7-inch guns on the bridges, two forward and two aft. None of this battery, however, has more than shield protection, and its formidable character is modified by the meager character of the side armor. Strictly speaking, these ships belong to the armored cruiser class, for they could never lie in line of battle against well protected battleships with much hope of success.

The faults of the "Re Umberto" are corrected in the "St. Bon" and "Emmanuele Filibert," launched in 1897, in which, on the small displacement of 9,800 tons, the Italians have secured the following admirable qualities; a complete Harveyized belt tapering from 9¾ inches amidships to 4 inches at the ends; a belt above this of 6-inch armor extending to the main deck and covering the sides between the barbettes; two 9¾-inch turrets protecting a main battery of four 10-inch guns, and a continuous wall of 6-inch steel surrounding a central battery of eight 6-inch rapid-fire guns on the main deck; eight 4.7-inch guns protected by shields, carried on the superstructure, and twenty-four smaller rapid-fire guns. The speed is 18 knots and the normal coal supply 1,000 tons. Although she is 50 per cent smaller, the "St. Bon" would prove more than a match for the "Re Umberto."

The latest Italian ideas of battleship construction are shown in the "Benedetto Brin" class, which at present includes two ships of 12,765 tons displacement and the unprecedented battleship speed of 21 knots. The "Benedetto Brin" is being built at Castellamare and the sister ship, "Regina Margherita," at Venice. The particulars are as follows: An armor belt 6 inches thick amidships tapering to 2 inches at the ends and reaching from the bow nearly to the stern. Above this a 6-inch belt extending between the barbettes and connected by transverse bulkheads which inclose the bases of the barbettes. This upper belt reaches to the spar deck and thus provides a complete central redoubt of 6-inch armor. The barbettes are protected by 10-inch armor and each contains a pair of 12-inch breech-loading rifles. The after barrette is carried on the main deck, and on the same deck, within the central citadel, is a rapid-fire battery of twelve 6-inch guns mounted in broadside. On the spar deck above, at each corner of the casemate, is a turret protected by 6-inch armor, carrying an 8-inch rapid-fire gun, and forward on the same deck is mounted the forward pair of 12-inch rifles. Ten 3-inch and six 1.8-inch guns are carried on the superstructure and bridges. It is evident that the high speed and powerful armament of these ships must have been gained at the expense of the defensive powers. This is best shown by a comparison of this vessel with the "Maine" of our own navy, which is of about the same displacement.

	"Maine."	"Benedetto Brin."
Length.....	368 feet.	413 feet.
Displacement.....	12,500 tons.	12,765 tons.
Speed.....	18 knots.	21 knots.
Coal supply.....	1,010 tons, normal.	1,000 tons, normal.
Belt armor.....	12-inch maximum.	6-inch maximum.
Citadel armor.....	7 inch.	6 inch.
Barbette armor.....	12-inch maximum.	10-inch maximum.
Main battery.....	Four 12-inch.	Four 12-inch.
Intermediate battery.....	None.	Four 8-inch rapid-fire.
Secondary battery.....	Sixteen 6-inch, twenty 6-prs., six 1-prs.	Twelve 6-inch, ten 12-prs., six 3-prs.

The adjoining table shows that while the armament of the Italian ship is far more powerful than that of the "Maine"—the difference being due to the rapid-fire 8-inch guns—the "Maine" is much better protected, the belt being 100 per cent thicker and the barbette protection 12 inches as against 10 inches. We greatly regret that the "Alabama" and "Maine" classes do not carry any 8-inch guns. This weapon has been particularly identified with United States warships; it proved to be the most effective of all the guns in use at Santiago and Manila; and ever since Armstrong showed the practicability of applying the rapid-fire mechanism to it, its destructive powers have been enormously increased. The four 8-inch guns of the

"Benedetto Brin," with their high command of 28 feet and their good protection, would give the Italian vessel a marked theoretical advantage in an artillery duel with the "Maine." The 12-pounders and 3-pounders of the "Brin" are preferable to the 6 and 1-pounders of the "Maine."

We place particular stress upon these points in the hope that before the contracts are let for our new 13,500-ton battleships, authorized by the last Congress, such changes may be made as will admit of the reintroduction of the 8-inch gun and the substitution of the 12 and 3-pounders for the 6 and 1-pounders. The use of Krupp in place of Harvey armor (supposing Congress desists from its obstructionist policy in the matter) would greatly reduce the total weight of the armor and compensate for the added weight of the 8-inch guns, mounts, and ammunition.

COAST DEFENSE VESSELS.—The Italian navy is but poorly provided with coast defense vessels pure and simple. Like Great Britain, she favors an aggressive policy, placing her floating armaments in large ships of good speed and sea-keeping qualities. Moreover, her principal strategic points are well protected by fixed fortifications. The coast defense type is represented by five small armored vessels that were built over a quarter of a century ago. They are the "Affondatore" (4,062 tons), built at Millwall, London; and the "Ancona" (4,460 tons), the "Castelfidorio," "Maria Pia," and "San Martino" (4,260 tons), built in France. The first named has a 5-inch belt and carries two 28-ton Armstrong guns and six 4.7-inch rapid-firers; the other four have 4½-inch belts and are armed with six 6-inch and six 4.7-inch rapid-fire guns. The speed of all five vessels is 12 knots, and the complement from 300 to 400 men.

ARMORED CRUISERS.—At the opening of the present year there were five armored cruisers built or building for the Italian navy. The most important of these vessels are the twin ships "Vettor Pisani" and "Carlo Alberto," of 6,500 tons, and the "Varese" and "Giuseppe Garibaldi," of 7,400 tons displacement. These very fine ships are modifications of the "Christobal Colon," which was originally laid down at Sestri Ponente for the Italian navy, but was sold to Spain before her completion. They are all distinguished by their unusual protection, which consists of a complete 6-inch belt, a central citadel of 6-inch armor extending over two-thirds of the length, and from the belt to the main deck, and an armored deck. The speed is 20 knots in case of all four ships, and the maximum coal supply is 1,200 tons. The "Vettor Pisani" and her mate carry eighteen guns of the large rapid-fire type distributed as follows: Eight 6-inch on the gun deck in broadside and four 6-inch on the main deck within the citadel, the latter having a dead ahead and dead astern fire; four 4.7-inch on the main deck, between the 6-inch guns; one 4.7-inch on the same deck in the bow and one 4.7-inch in the stern. There are also twenty-two 12 and 3-pounders. The "Varese" and "Garibaldi" have the same armor, speed, etc., but the armament consists of one 10-inch gun forward in a barbette, two 8-inch rapid-fire guns aft in a barbette, ten 6-inch rapid-fire guns in the gun deck battery, and four 6-inch rapid-fire guns at the angles of the main deck battery.

These two ships have a greater energy of gun-fire per minute than any ship built or building in the world to-day; the total being greater even than that of the German "Fürst Bismarck" of 10,432 tons, or the British "Cressy" of 12,000 tons.

The "Marco Polo" is a smaller vessel, of 4,583 tons and 19 knots, whose particulars are given beneath the accompanying cut of the ship. The battery is entirely of the rapid-fire type and is characteristically powerful. The six 6-inch guns are carried, one forward on the forecandle deck, one aft on the poop, and four on the main deck at the break of the forecandle and quarter decks. The ten 4.7-inch guns are all on the main deck, two beneath the forecandle deck, two beneath the poop, and six amidships between the 6-inch guns. In appearance and distribution of armament the armored "Marco Polo" resembles our own protected "New Orleans."

PROTECTED CRUISERS.—The strength of the Italian navy lies in its armored vessels, and in this respect it resembles the Russian navy. What protected ships Italy has built have been small, none of them exceeding 3,600 tons displacement. Of vessels of this class, between 2,000 and 4,000 tons in displacement, there are seventeen, with an average speed of 18 knots, an average displacement of 2,754 tons, and a total displacement of 46,818 tons. There are also twenty-eight small cruisers and gunboats of an average displacement of 886 tons and an average speed of 17.9 knots. None of these vessels call for special remark, unless it be the "Piemonte," of 2,500 tons, built in 1888 at Armstrong's, which was the first warship to be armed with rapid-fire guns. In this respect, and in respect of her at that time unprecedented speed of 21 knots, she is an epoch-marking ship.

We illustrate a typical vessel of each class above mentioned. The "Etruria" is one of three ships built in Italy, between 1890 and 1893. They are 220 tons smaller than the "Piemonte," and carry four 5.9-inch

and six 4.7-inch rapid-firers as against six 6-inch and six 4.7-inch rapid-firers. The speed is from 2 to 3 knots less, the deck 2 inches against 3 inches, and they carry 400 against 560 tons of coal. The majority of the protected cruisers are of modern construction, and, as a class, they should prove to be serviceable vessels.

In conclusion, it must be admitted that there has been so much variety, so much experimental designing, in the Italian fleet that only the actual test of war can settle the actual fighting value of its first line of battle. Judged by current ideas, the battleships of the "Duilio," "Andrea Doria" and "Italia" classes are hampered by a slow and cumbersome though admittedly powerful armament, while the "Italia" and "Re Umberto" classes are perilously deficient in defensive qualities other than those which accrue from ability to run away—and the Santiago tragedy would indicate that the latter is an expedient of very doubtful value, to say the least. It is in her armored cruisers, of which it is difficult to say too much in praise, that Italian naval architects have scored their greatest success, and it is not unlikely that the original cruiser-battleship "Christobal Colon" will prove to be the prototype of the standard fighting ship of the future.

Novel Switch for Electric Cars.

Mr. Hiram Stevens Maxim has lately patented a new means of operating the switches of electric cars. It is well known that, in order to get quick acceleration, it is necessary that practically the whole weight of the train should rest on the drivers. It is therefore necessary to provide each car with a motor, and when several cars are coupled together in a train, as they will have to be on the Underground in London, it will be necessary to have a man to each car, or to have some device by which the driver of the front car can control the switches of the entire train, and various devices have been thought out and patented for this purpose.

These all require some connection between the various cars other than the coupling, but by Mr. Maxim's method the drawbar of each car is attached to the switch in such a manner that the switch is operated by the tendency of each particular car to pull back as relates to the drawbar. The drawbar of each car is an inextensible rod running the whole length of the car, with a coupling at each end. This rod is held in a central position by two spiral springs, and is connected to the switching device of the car in such a manner that, no matter in which direction the bar is moved as relates to the car, it switches in the current which moves the car in the same direction. Therefore, each car follows the drawbar automatically, and the motor of each car does just sufficient work to propel that particular car. This device is of great simplicity and is easily understood, as it requires no coupling or connection between the various cars of the train except the coupling itself.

THE BIRD GIANTS.

BY CHARLES FREDERICK HOLDER.

Among the big things which the State of California produces are ostriches. It has been found that the mild climate of Southern California is remarkably well adapted for the purpose, and that ostriches breed and thrive as well here as in their native African haunts. The experiment was first tried by an Englishman, Mr. Edwin Cawston, who, in 1885, bought fifty-two birds in South Africa. It was a hazardous experiment, as the big birds are extremely difficult and dangerous to handle; but forty-two were landed on American soil. From these pioneers the fine ostrich farm at Pasadena, Cal., has grown, which at present contains two hundred birds. Here one can study the history of these birds from the egg to the adult; and as the industry is now protected by an import duty of 20 per cent, the ostrich farm is on a sure financial basis and has become one of the paying American industries.

The Pasadena ostrich farm is beautifully situated among a grove of live oaks on the Arroyo Seco, between the cities of Pasadena and Los Angeles. The inclosure of several acres is divided into corrals in which the various classes of birds are seen. As we enter, the birds approach in droves with a queer mincing gait, ludicrous in the extreme. The ostrich impresses one as being the type of stupidity, posing as a very wise personage; its large body, small head and brain, constructed on economical principles, its enormous eyes, all carrying out the idea.

The birds are fearless and approach visitors, taking food from their hands. The correct thing to do seems to be to feed oranges, which are devoured whole, the diversion being mutual, as the orange presents a remarkable appearance as it passes down the long neck of the bird. The keeper, who tells us that he was once nearly killed by a bird, is a fund of information, and from him we learn all the secrets of running an ostrich farm. First, one must have the birds, which cost from one thousand dollars upward apiece in Africa; but, as they breed when they are three years old, there is a quick return.

There is a definite arrangement in the corrals. The best-feathered are selected and paired, space being left between the males, which fight and often kill one another.