

THE NAVIES OF THE UNITED STATES AND SPAIN—  
A COMPARISON.

While we are hopeful that the existing difficulties with Spain may even yet prove to be capable of adjustment by peaceful methods, it is likely that if hostilities come at all they will come quickly. It is equally certain that the issues of war would be determined upon the sea, and a brief comparison of the fighting strength of the two navies will be just now of special interest.

Could we defeat Spain upon the high seas? It is safe to say that there is not a citizen of this country that doubts for a moment that we could. To the lay mind the task of annihilating the Spanish navy appears not only certain, but easy; to the professional mind, as represented by the men who design and fight our ships, the task appears equally certain, but by no means so easy of accomplishment.

It is better to over rather than underestimate an opponent, and it is best of all to rate him at his true value; hence we may as well admit at the outset that Spain would go into the war, as far as her ships are concerned, with a homogeneous, compact and very formidable fleet—one which, if properly handled and bravely fought, would be a by no means unworthy opponent for the powerful ships of the United States navy. Each fleet would be strong where the other is weak, and taking the two fleets as they stand—swift,

would be the controlling factor, and it is the supreme confidence of the American public in the pluck and discipline of the crews and the skill and daring of our naval officers which renders it so confident of final victory.

If war should come, it would be the object of Spain to obtain a decisive naval victory at the very outset.

pleted torpedo-boat destroyers, would be dispatched to give battle to our combined fleets in the neighborhood of Cuba.

We will suppose that only the armored ships would be placed in the first line of battle, and for the purpose of comparison, we will suppose that all the modern armored ships of Spain would be sent over in the effort to win a decisive battle.

The Spanish line could boast of only one first-class battleship, the "Pelayo." She is a 9,900-ton ship, of 16 knots speed, carrying two 12½ and two 11-inch guns in 11-inch steel barbettes, placed high above the water line. She has a 17-7-inch steel belt along the whole water line, and her secondary battery contains nine 5½-inch rapid-fire guns. She is a good ship, but possesses the fatal defect of having no armor protection between the barbettes and the belt. On this account, high explosive shells bursting beneath the barbettes might easily put them out of action. To the "Pelayo" we could oppose the "Iowa," of 11,410 tons, carrying

four 12-inch guns, eight 8-inch guns, and a secondary battery of four 6-inch guns. She is protected by a 14-inch belt, and the main battery is protected from the turret roof down to the belt with 15 inches of steel. She is thus larger and more heavily armed and armored than the "Pelayo," and, saving the chances of a modern sea fight, should easily silence or sink the Spaniard.

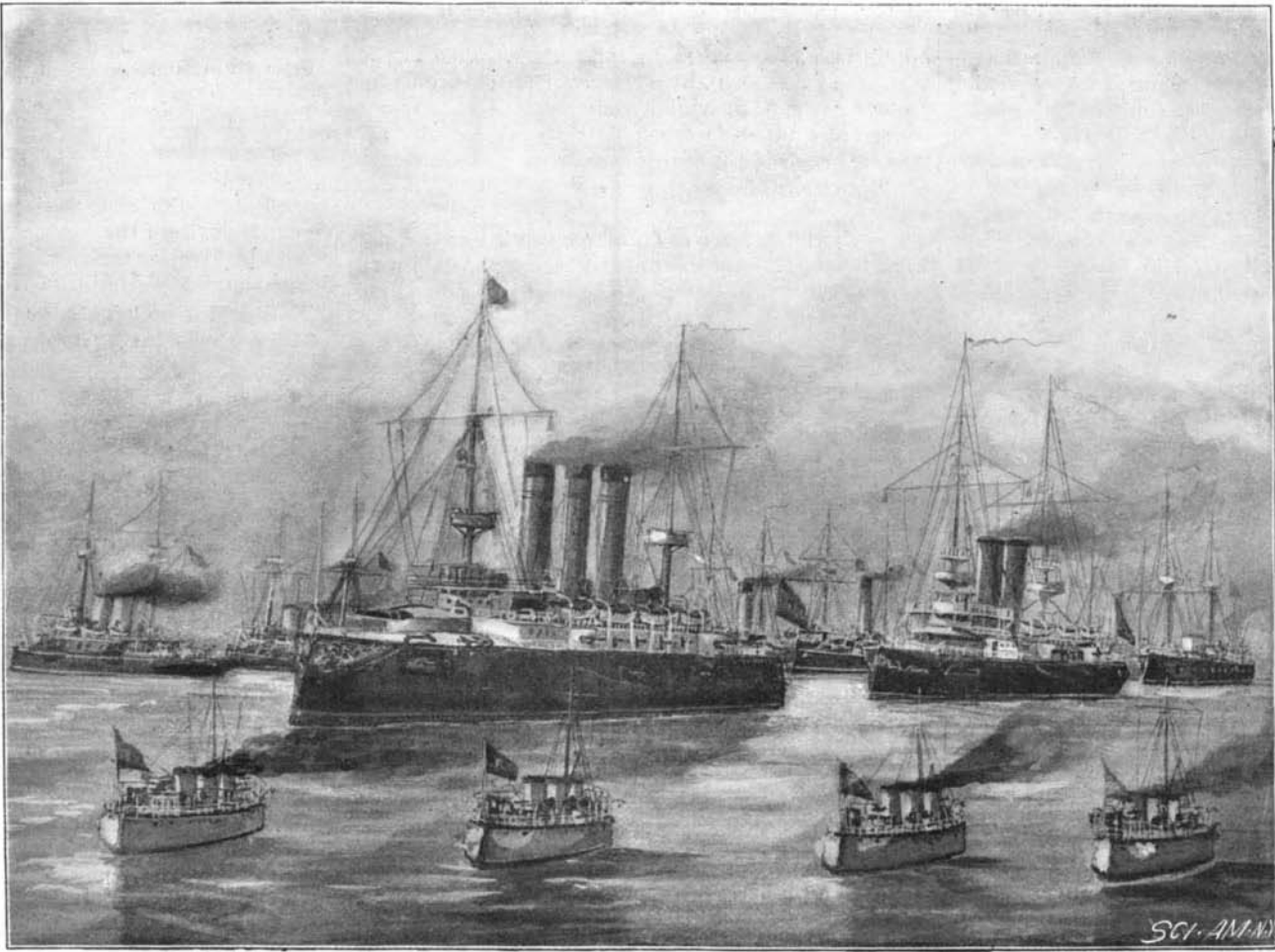
"Maria Teresa." "Alfonso XII."

"Carlos V."

"Isla de Luzon." "Ensenada."

"Cisneros."

"Numancia."



"Audaz."

"Osado."

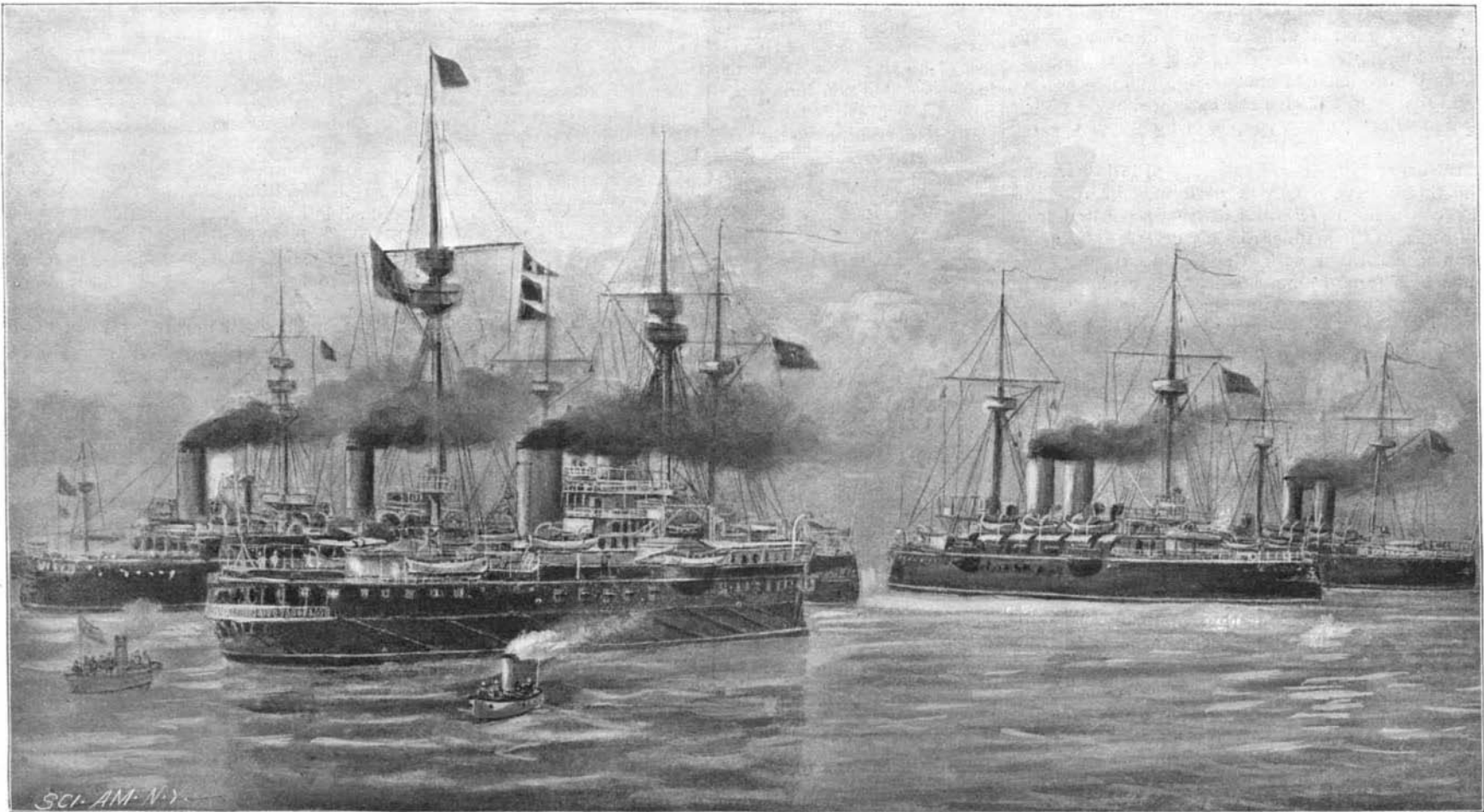
"Terror."

"Furor."

THE FIGHTING LINE OF THE SPANISH NAVY.

Cuba being the objective point of both combatants, the war would probably be carried on in Cuban waters. The almost insuperable difficulties of coal supply would prevent any delay in risky attempts upon our now well defended sea ports. The same difficulty would render it to Spain's advantage to wage an aggressive warfare and deal as early as possible an effective blow in a

Cristobal Colon."



"Vitoria."

"Pelayo."

"Oquendo."

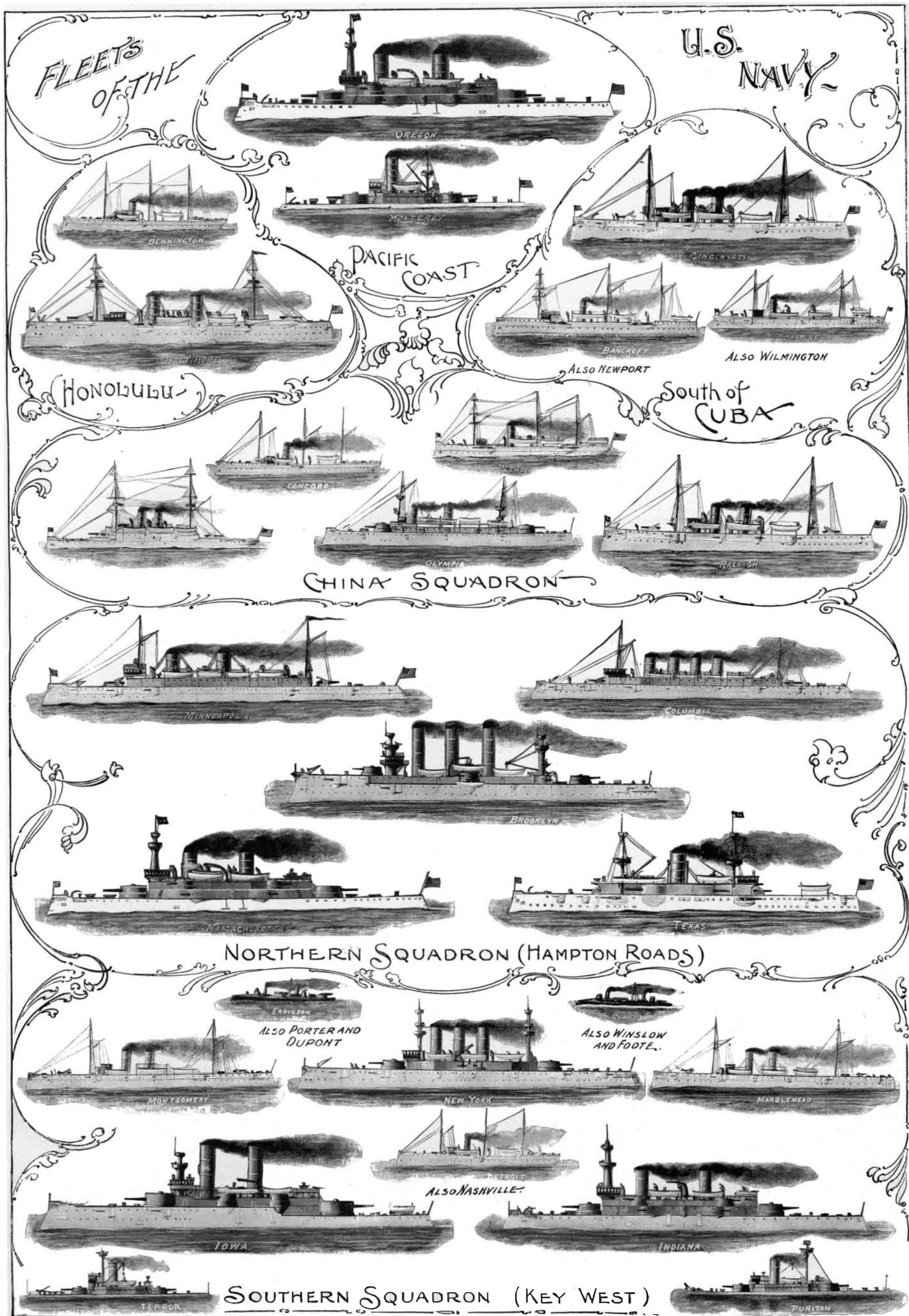
"Vizcaya."

THE FIGHTING LINE OF THE SPANISH NAVY.

heavily armored cruisers and deadly destroyers against mighty battleships and more lightly armored cruisers—the issue, judged independently of "the men behind the guns," would be by no means so certain as is popularly supposed. The man behind the gun, however,

general engagement. The approach of the powerful battleship "Oregon," from the Pacific, would prompt such a policy. It is more than likely that a numerous squadron, comprising all the powerful armored fighting ships of the Spanish navy and their recently com-

With the exception of its one first-class battleship, the Spanish line of battle would consist of a magnificent fleet of eight swift, heavily armed and heavily armored cruisers, similar in size, speed and power, and admirably adapted to act together in a concerted fleet



action. There is no nation in the world that possesses such a fleet, not even England, and the fact that the ships are all built to carry the large normal coal supply of 1,200 tons would seem to indicate that they were built for just such an emergency as now confronts them.

The most important and largest of these ships is the "Carlos V." of 9,235 tons and 20 knots speed. Her curved deck plating is  $6\frac{1}{2}$  inches thick, and her secondary battery is protected by a continuous belt of 2 inches of steel. She carries two 11-inch guns disposed in two barbettes of 10-inch steel, and a secondary battery of eight  $5\frac{1}{2}$ -inch and four 3.9-inch rapid-fire guns. Against her we could oppose the "Brooklyn," which closely resembles her in many points. She is of 9,250 tons displacement, 21.9 knots speed and is protected by a steel deck 6 inches thick on the slopes, to which is added a belt of 3-inch steel extending in the wake of the engine rooms and boilers. She carries an exceptionally heavy battery of eight 8-inch guns, protected by  $5\frac{1}{2}$  and 8 inches of steel, and a secondary battery of twelve 5-inch rapid-fire guns. Unless a lucky shell from the great 11-inch guns of the "Carlos V." should find its way into her engine or boiler room, she should prove more than a match for the Spaniard.

Following the "Carlos V." in importance is the "Cristobal Colon," built in Italy, whose sister ship, the "Varese," the Spaniards were very anxious to purchase from Italy. This is a most interesting ship, and it is a question whether, in spite of her smaller size—6,840 tons—she is not more formidable than the "Carlos V." The remarkable feature in this ship is the extensive armor protection, which is so complete as to entitle her to be called a battleship rather than a cruiser. A 6-inch steel belt encircles the whole waterline. Above this is a redoubt of continuous 6-inch steel which completely protects a battery of ten 6-inch rapid-fire guns, and above this is another battery of six 4.7-inch rapid-firing guns. The main battery consists of two 10-inch armor-piercing guns in 6-inch barbettes. The speed is the same as that of the other cruisers—20 knots. Against this boat we could oppose the "New York," a smaller edition of the "Brooklyn." She is of 8,200 tons displacement, 21 knots speed, and is protected by a 4-inch belt and a curved deck 6 inches on the slopes. The armament consists of six 8-inch guns and twelve 4-inch rapid-fire guns, the gun positions being protected with casements and turrets of from 7 to 10 inches of steel. The superior protection and heavier secondary battery of the "Cristobal Colon" should render her a fair match for the "New York."

Following these two ships in importance is a group of six sister ships, two of which are already very familiar to the people of New York. They are the "Almirante Oquendo," the "Cardinal Cisneros," the "Cataluna," the "Princesa de Asturias," the "Infanta Maria Teresa" and the "Vizcaya." The "Maria Teresa" represented Spain at the Grant Memorial services last year and lay for some time off Riverside Drive in the Hudson River, and the "Vizcaya" visited this port immediately after the Maine disaster.

Each of these six ships is of 7,000 tons displacement and 20 knots speed. They are provided with a belt of 12-inch steel, at the top of which is a 3 inch protective deck. At each end of this belt an armored tube rises to connect with a barbette of  $10\frac{1}{2}$ -inch steel, and in each barbette is an 11-inch armor-piercing gun. Between these guns is a battery of  $5\frac{1}{2}$ -inch quick-firing guns.

Against these speedy ships we could oppose two powerful first-class battleships, the "Indiana" and "Massachusetts," the armored cruiser "Texas" and four powerful monitors, the "Puritan," "Terror," "Amphitrite" and "Miantonomoh." In point of guns and armor the advantage would be vastly in favor of the battleships and monitors, though this would be offset by the speed, handiness and ability to use the ram of the Spanish cruisers. In an artillery duel there could be little doubt of the issue. In heavy guns the seven American ships have eight 13-inch, ten 12-inch, twelve 10-inch and sixteen 8-inch, a total of 46 armor-piercing guns against a total of twelve 11-inch guns on the six Spanish ships. This superiority however would be greatly offset by the murderous discharge of the secondary rapid-fire batteries of the Spaniards, which would comprise sixty  $5\frac{1}{2}$ -inch guns, against which we could only make reply with fourteen 6-inch and eight 4-inch guns. The result of such a duel would be that the unarmored ends and the central secondary batteries of the "Indiana," "Massachusetts" and "Texas" would be blown away, while the armor belts of the Spanish ships would be pierced and the ships either sunk or disabled.

Thus far, however, we have taken no note of two other novel and hitherto untried elements, which would at least figure prominently in such a battle, if they did not prove to be its deciding factor. We refer to the armored ram "Katahdin," of the American fleet, and the deadly torpedo boat destroyers of the enemy. The "Katahdin" is a vessel of 2,150 tons and 16 knots speed, whose sole duty is to ram. For this purpose she presents but little of her bulk above the water, and that which is visible is curved and armored with a view to deflecting the shells of the enemy. She is quick in turning, and it would be an extremely

difficult task for a warship to elude or sink her before the fatal blow was struck.

The six destroyers, "Audaz," "Osado," "Terror," "Furor," "Pluton" and "Proserpina," are the fastest and most formidable of their class. They have a speed of 30 knots and carry two discharge tubes for the deadly Whitehead torpedo. As they are unarmored, they can be easily sunk by gun fire, and for this reason they will rarely make an unsupported attack in the open. In line of battle, however, they will be certain to play a very important part. Sheltering themselves behind the advancing ships (which they can easily do, on account of their small size), they will rush out at the opportune moment and fire their torpedoes at the enemy. So greatly is the torpedo dreaded that the hostile fire is certain to be drawn away from the battleships and concentrated on the destroyers in the effort to sink them. This diversion will be of great value to the fleet possessing a torpedo flotilla, and may easily turn the tide of battle at a critical moment. The moral effect which these boats will produce in a naval battle is shown in the naval war game which we illustrated in the last issue of the SCIENTIFIC AMERICAN SUPPLEMENT. We have nothing of the size and speed of these 400-ton destroyers which we could send against them, unless it were the "Porter" and "Dupont," of 28 knots. Our torpedo boats would be too small to accompany a fleet on the high seas.

The possession of a numerous torpedo flotilla by Spain goes far to restore the balance which, on account of our battleships and monitors, would be strongly in our favor in a pitched battle, and it is the knowledge of this fact which renders the sailing of the flotilla for the West Indies a matter of the gravest concern to this country. The flotilla consists of six torpedo boat destroyers and six torpedo boats convoyed by a couple of small cruisers. The boats have been stripped of their guns and torpedoes and they are being nursed across the water by the larger boats, which are ready to give them all necessary assistance. The flotilla in its present condition is as helpless as a brood of ducklings, and it is no doubt the knowledge of this fact that has led Spain to hurry them across the water in time of peace.

It will be noticed that in the foregoing comparison we have taken no note of protected cruisers and gunboats, for the reason that these have theoretically no proper place in a battle between armorclads. Of protected cruisers Spain has two of 5,000 tons, three of 3,090 tons and three of 1,000 tons, besides some older wood and iron ships of less value. Against these we could at present oppose on the Atlantic two protected cruisers of 7,500 tons, one of 4,000 tons, one of 3,600 tons, one of 3,200 tons, three of 1,750 tons and sixteen of from 1,000 to 1,500 tons.

In torpedo gunboats and craft of under 1,000 tons displacement Spain is stronger. She has fourteen torpedo gunboats of from 500 to 850 tons displacement and 19 to  $22\frac{1}{2}$  knots speed, and over ninety small gunboats, many of which, however, are obsolete. We have three gunboats of less than 1,000 tons displacement, among which is included the "Vesuvius," with its pneumatic guns for the discharge of dynamite shells.

Should the war be prolonged, our navy would rapidly increase in strength. The "Oregon" would reach eastern waters, and in a few months we should have the powerful battleships "Kentucky" and "Kearsarge" in commission, to be followed later by that celebrated trio, the "Alabama," "Wisconsin" and "Illinois." Our torpedo fleet would grow apace, and it would not be long before we should have an overwhelming superiority upon the seas. We are indebted to La Ilustracion for our illustration of the Spanish fleet.

#### Government Alaska Literature.

We have received from the United States Geological Survey three excellent works regarding the gold fields of Alaska and the Yukon district. The first is intended for general distribution. It is entitled "A Map of Alaska, Showing Gold-Bearing Rocks, with Descriptive Text Containing Sketches of the Geography and Geology of the Gold Deposits and Routes to the Gold Field." The map is large (57 miles to the inch) and clearly colored, showing all the gold districts, and the various routes to all parts of Alaska are clearly indicated. This important pamphlet is written by S. F. Emmons, aided by W. H. Dall and F. C. Schrader. It will prove of great use to prospectors and miners who might visit Alaska. There are 40,000 copies printed. The other two books are not of as great interest to the prospector but are important to those who are interested in geology and to the mining expert. The "Geology of the Yukon District, Alaska," by Josiah Edward Spurr, with an introductory chapter on the history and condition of the district to 1897, by Harold Beach Goodrich, an abstract from the eighteenth annual report of the Survey. It is a quarto of 392 pages and is illustrated by 51 plates in addition to maps. The third book is "The Reconnaissance of the Gold Fields of Southern Alaska, with Some Notes on General Geology," by George F. Becker, which is also an abstract from the eighteenth annual report of the Survey. It is illustrated by maps and excellent half tone engravings. The books have been published most opportunely.

#### THE TOTAL SOLAR ECLIPSE, JANUARY 22, 1898.

There could hardly be a greater difference than between the eclipses of 1896 and 1898. The shadow track in the former case ran through a vast extent of country which offered, however, but few suitable sites. These were clustered together at two or three main points, and in almost every case the intending observers were disappointed of the spectacle which they had come to see. In 1898 the eclipse track lay chiefly in one single country which offered a large number of easily accessible sites, nearly all of which were occupied, and all were favored with the most perfect weather. Up to the present time it certainly is the record eclipse, either as regards the number of observers, the character of their equipment, or the uncheckered favor which they experienced from the weather.

"A victory all along the line" is what we have to record. The full significance of that victory, and what results may accrue from it, it will take us many months to learn.

As a sensation, the eclipse did not fulfill the popular descriptions. Whether, as has been asserted, the corona was unusually large and bright, or, from the special atmospheric conditions prevailing in India at the time, the darkness was much less than is usual in any eclipse of two minutes' duration, the general effects in color, light and the appearance of the landscape were very much those which were brought about more slowly some four and a half hours later, some thirty-five or forty minutes after the sun had set. At any rate, the light at mid-totality was certainly greater, considerably greater, than we ordinarily get at night at the full of the moon.

The fall of temperature was, however, considerable, amounting to some twelve degrees; and it was noticed by some of those who had taken part in the Norway expedition of 1896 that, whereas on that occasion the darkness of the eclipse was felt to be a sensible relief from the unceasing sunlight, so now the coolness of the eclipse was a relief from the too powerful heat of the sun.

Consistently with the small amount of darkness of the eclipse, the approach of the shadow at the beginning of totality was less marked than usual, and in some places, though watched for, escaped notice. The only record that has yet reached me of its approach having been distinctly observed is from Dr. Robertson, of Nagpur. The shadow bands were also looked for at some stations without success, though they were caught at both Jeurand Nagpur. At the latter place Miss Henderson, M.D., describes them as having been faint dusky ripples some two inches in breadth, and separated from each other by about the same interval, and in appearance and speed of motion resembling the ripples seen on the ceiling of a cabin in an ocean steamer as they are deflected through the porthole from the water outside.

Of the stars visible during the eclipse, one caught every attention, and was, indeed, seen after totality had passed. This was the planet Venus, some six degrees southwest of the sun at the time. Mars, though very small and further from the sun, was also glimpsed and some two or three other stars were noted.

The shape of the corona recalled at once that of 1896, and with it the two earlier years, 1868 and 1886, which it had resembled. To the southwest a long ray nearly in the solar equator was easily traceable for two, if not three, solar diameters from the dark limb of the moon. On the east side a pair of broader and less extended streamers formed a single connected structure in which the characteristic coronal curves were repeatedly seen.

Bearing in mind that these four years all fell at the time of small but not of minimum sunspot activity, it appears clear that we have here brought out a third coronal type as distinct and definite, perhaps even more so than those which have been already recognized as appropriate to the times of actual maximum and minimum; and it may be hoped that we have now material enough to enable us to trace the course of change which the corona undergoes in its passage from one extreme form to the other.

It may be opportune here to correct a widespread misapprehension, that minimum coronæ are small and faint except for the two great equatorial rays. The reverse would seem to be the case, except in the immediate neighborhood of the sun's pole. The corona, for instance, of 1878, so far from being small and faint, was unusually large and bright; and the present one, though we have not yet reached the actual minimum, possesses the same characteristics.

The feathery structure round the solar poles, which was so plainly seen in the eclipse of 1878, and which has been recognized more or less clearly at so many eclipses since—especially at or near the time of minimum—was very apparent on the present occasion.

The photographs of the corona have been unusually numerous, and have been taken on every variety of scale, from a diameter of a single millimeter with a hand camera, up to one a hundred times as great. The latter were obtained at three stations: by the Astronomer Royal at Sahdol, with an aperture of nine inches and an enlarging lens; by Dr. Copeland, at Gogra, near