

COMPARATIVE STRENGTH OF THE WORLD'S NAVIES.

The question of the relative strength of the navies of the world, with a particular reference to the standing of the United States, cannot fail to be just now of very vital interest. In the brief three months of the Spanish war, the supreme importance of sea power was brought home to the American people in a series of events the significance of which they have not failed

inadequate. At present we are fourth on the list, having recently passed the Italian and German fleets in total displacement. If the new programme proposed by the Naval Board is accepted by Congress, the total displacement of our navy will be about what that of Russia is now. Russia, however, is actively engaged on new construction, and we must continue to add liberally to our navy if we are to take the third position—a ranking which would be more appropriate to our wealth

apolis" and "Columbia," but her speed and endurance will be gained at the expense of armor and armament.

We cannot expect to get "a quart of efficiency out of a pint of displacement."

The science of naval designing consists in securing such an apportioning of the total displacement of a ship to the different elements of efficiency as shall best meet the requirements of the nation in whose service

TABLE I.—NAVIES OF THE WORLD COMPARED BY DISPLACEMENT.

DESCRIPTION OF TYPE.	GREAT BRITAIN.				FRANCE.				RUSSIA.				UNITED STATES.				GERMANY.				ITALY.			
	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.
Battleships, 10 years or less.	34	14,008	476,272	18.0	14	11,457	160,398	17.5	17	11,200	190,400	17.7	13	11,010	143,130	16.7	9	10,672	96,048	17.3	8	12,236	98,688	19.3
Battleships, 10 to 20 years.	11	9,474	104,214	16.1	9	10,143	91,289	15.6	5	10,120	50,600	16.0	...	...	...	...	...	...	...	...	7	12,018	84,126	16.7
Battleships, Old or refitted.	9	8,872	79,848	14.1	12	7,482	89,794	13.6	1	...	9,891	14.5	...	...	...	...	10	7,211	72,110	14.1	...	...	...	...
Totals	54	...	660,334	...	35	...	341,471	...	23	...	250,891	...	13	...	143,130	...	19	...	168,158	...	15	...	182,814	...
Coast Defense Vessels.	25	6,284	157,100	11.9	14	3,637	50,920	14	14	2,915	40,810	13.0	11	3,551	40,261	12.2	19	2,081	39,539	12.6	...	...	...	...
Armored Cruisers, 9,000 tons and up.	8	13,500	108,000	22.0	7	9,767	68,369	21.3	4	11,846	47,384	20.0	1	...	9,215	21.9	1	10,650	10,650	19.0	...	...	...	...
Armored Cruisers, 7,000 to 9,000 tons.	2	8,400	16,800	17.4	3	7,700	23,100	21.0	1	...	8,524	16.7	1	...	8,200	21.0	...	...	...	...	...	...	...	...
Armored Cruisers, Below 7,000 tons.	7	5,600	39,200	18.0	10	5,578	55,780	17.0	6	5,754	34,524	15.6	...	...	...	...	...	...	...	...	5	6,347	31,735	19.8
Totals	17	...	164,000	...	20	...	147,249	...	11	...	90,432	...	2	...	17,415	...	1	...	10,650	...	5	...	31,735	...
Protected Cruisers, 10,000 tons and up.	10	11,640	116,400	20.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Protected Cruisers, 7,000 to 10,000 tons.	11	7,780	85,550	20.2	4	8,014	32,056	21.0	...	...	...	...	2	7,375	14,750	22.9	...	...	...	...	...	...	...
Protected Cruisers, 4,000 to 7,000 tons.	30	5,000	150,000	19.0	13	4,833	62,829	18.9	4	6,222	24,888	19.4	6	4,539	27,234	19.6	9	5,315	47,835	20.1	...	...	...	...
Cruisers, 2,000 to 4,000 tons.	46	2,924	134,510	19.5	20	2,978	59,560	18.7	2	3,439	6,878	18.6	11	2,974	32,710	18.4	3	2,225	6,675	21.25	17	2,754	46,818	18.0
Totals	97	...	486,460	...	37	...	154,445	...	6	...	31,766	...	19	...	74,694	...	12	...	54,510	...	17	...	46,818	18.0
Small Cruisers and Gunboats.	97	924	89,628	15.2	33	988	37,544	17.1	32	1,250	40,000	16.6	22	1,237	27,210	16.0	22	1,205	26,510	16.0	28	886	24,808	17.9
Grand Totals	290	...	1,557,522	...	144	...	731,629	...	86	...	453,899	...	67	...	303,070	...	73	...	299,637	...	65	...	286,175	...

to perceive. A brief sea fight lasting less than half a day, at Manila, and a four hours' running fight at Santiago, brought the close of a war which, had the struggle been decided on land, would have lasted for many months with a prodigal expenditure of blood and treasure.

The world-wide policy to which we are committed by the acquisition of the Philippines and West Indian Islands renders the possession of an adequate navy an immediate and pressing necessity. In the present article we have endeavored to determine exactly where we stand at the close of the year 1898, and while there is cause for congratulation on our improved position compared with our practical extinction as a naval power a decade and a half ago, we must bear in mind that our improved standing brings with it added responsibilities, for which our present naval strength is quite

and the extent and responsibilities of our foreign possessions.

BASIS OF COMPARISON.—The difficulty of making a satisfactory comparison of naval strength is proved by the many different systems of comparison adopted. Some of these are obviously misleading, as when the mere number of ships is taken, or the aggregate number of guns, or the speed, or the thickness of armor. The value of a navy is not to be determined by any one of these features alone. A ship of a limited size can only embody a certain amount of the elements of fighting efficiency. She may carry an unusually heavy battery and thick armor, but it will be done at the expense of the speed or the coal endurance, as in the case of the "Indiana" or "Massachusetts." Again, a vessel may be extraordinarily fast, and capable of steaming around the world without recoaling, like our "Minne-

she is to be employed. The fact that there is a considerable difference in the service required of their ships by the various nations, differences due to geographical position and general foreign policy, renders it difficult to institute any hard and fast comparison between the various navies of the world, and the best that can be done is to compare them as to their actual fighting value on a basis of displacement and age.

Such a comparison is more satisfactory than any other that can be adopted, for the principles of warship design are so well understood, and the leading naval architects are so thoroughly in touch with each other's work and the contemporaneous improvements in material, that we think it is likely that a thousand tons of displacement in a battleship of a certain date is worth about as much as a thousand tons in another battleship of the same date, even though the ships

TABLE II.—NAVIES OF THE WORLD COMPARED AS TO EFFICIENCY.

DESCRIPTION OF TYPE.	GREAT BRITAIN.			FRANCE.			RUSSIA.			UNITED STATES.			GERMANY.			ITALY.		
	Displacement.	Factor of efficiency.	Estimated efficiency by displacement.	Displacement.	Factor of efficiency.	Estimated efficiency by displacement.	Displacement.	Factor of efficiency.	Estimated efficiency by displacement.	Displacement.	Factor of efficiency.	Estimated efficiency by displacement.	Displacement.	Factor of efficiency.	Estimated efficiency by displacement.	Displacement.	Factor of efficiency.	Estimated efficiency by displacement.
Battleships, 10 years or less.	476,272	1.00	476,273	160,398	1.00	160,398	190,400	1.00	190,400	143,130	1.00	143,130	96,048	1.00	96,048	98,688	1.00	98,688
Battleships, 10 to 20 years.	104,214	0.80	83,371	92,289	0.75	68,467	60,600	0.85	43,010	...	...	...	...	...	...	84,126	0.80	67,301
Battleships, Old or refitted.	79,848	0.50	39,924	89,794	0.45	40,403	9,891	0.65	6,429	...	...	...	72,110	0.60	43,266	...	...	...
Totals	660,334	...	599,567	341,471	...	259,337	250,891	...	239,839	143,130	...	143,130	168,158	...	139,314	182,814	...	165,988
Coast Defense Vessels.	157,100	0.40	62,840	50,920	0.70	44,912	40,810	0.70	28,567	40,261	0.65	26,170	39,539	0.60	23,788	...	...	...
Armored Cruisers, 9,000 tons and up.	108,000	0.85	91,800	68,369	0.85	58,114	47,384	0.85	40,276	9,215	0.85	7,833	10,650	0.85	9,052	...	...	...
Armored Cruisers, 7,000 to 9,000 tons.	16,800	0.80	13,440	23,100	0.85	19,635	8,524	0.80	6,819	8,200	0.85	6,970	...	...	...	...	...	...
Armored Cruisers, Below 7,000 tons.	39,200	0.75	29,400	55,780	0.70	39,049	34,524	0.75	25,893	...	...	...	...	...	...	31,735	0.90	28,561
Totals	164,000	...	134,640	147,249	...	115,794	90,432	...	72,978	17,415	...	14,803	10,650	...	9,052	31,735	...	28,561
Protected Cruisers, 10,000 tons and up.	116,400	0.85	98,940	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Protected Cruisers, 7,000 to 10,000 tons.	85,550	0.80	68,440	32,056	0.80	25,645	...	...	...	14,750	0.80	11,800	...	...	...	...	...	...
Protected Cruisers, 4,000 to 7,000 tons.	150,000	0.75	112,500	62,829	0.75	47,122	24,888	0.75	18,666	27,234	0.75	20,425	47,835	0.75	35,876	...	...	...
Cruisers, 2,000 to 4,000 tons.	134,510	0.70	94,157	59,560	0.70	41,692	6,878	0.70	4,815	32,710	0.70	22,897	6,675	0.75	5,006	46,818	0.70	32,773
Totals	486,460	...	374,037	154,445	...	114,457	31,766	...	24,168	74,694	...	55,122	54,510	...	40,692	46,818	...	32,773
Small Cruisers and Gunboats.	89,628	0.40	35,851	37,544	0.45	16,895	40,000	0.45	18,000	27,210	0.45	12,245	26,510	0.45	11,930	24,808	0.45	11,164
Grand Totals	1,557,522	...	1,206,935	731,629	...	551,395	453,899	...	383,552	303,070	...	251,470	299,637	...	224,766	286,175	...	238,485

differ greatly in design. This statement of course does not apply to vessels in which glaring defects of design and workmanship are known to exist; but, as a general rule, it may be safely followed.

There are some builders of warships who are notorious for turning out vessels of a sensational character, in which what might be called the showy and spectacular features, such as great speed and exaggerated batteries, are emphasized at the cost of other less attractive features, such as coal capacity and ammunition supply. The most notorious example of this is to be found in the celebrated Armstrong firm, whose vessels are the fastest and most powerfully armed in the world. It is safe to say that the speed and battery power of these ships are secured at the cost of other elements of efficiency, and that a thousand tons in an Armstrong vessel does not represent so much more fighting efficiency than a thousand tons in other contemporaneous vessels turned out from any of the best shipbuilding yards of the world.

It must be admitted at the outset that, in spite of the

indicated by the respective bulk of the vessels shown. Each navy is represented by a typical first-class battleship. The vessels are as follows: England, the "Royal Sovereign;" France, the "Jauréguiberry;" Russia, the "Sissoi Veliky;" United States, the "Iowa;" Germany, the "Brandenburg;" Italy, the "Sardegna." The drawings, as will be seen, have been made with great care and attention to detail, with the object of showing at a glance not only the relative size of the navies, but the types of vessels to which is intrusted the duty of forming the first line of defense.

In the first of the two tables the ships are arranged in five classes, according as they are battleships, coast defense vessels, armored cruisers, protected cruisers, and small cruisers and gunboats. We have taken no account of the torpedo fleets, for the reason that they are such an uncertain quantity that no exact value can be put upon them in a comparison such as this; moreover, it is extremely unlikely that the torpedo fleets will take any part in pitched battles upon the high seas. The

nearly all of modern construction, can best be rated according to their size, for it will be noted that the size is accompanied with high speed, and, as a matter of fact, the largest cruisers are in every case of late construction.

The tables include all those ships which, as far as we have been able to learn, will be actually under construction by January 1, 1899. No account is taken of the ships authorized under ten year programmes of construction, but not yet laid down.

It will be noticed that the total number of vessels is not equal to that shown in the official lists, notably in the case of Great Britain and the United States. This is due to the fact that we have imposed a limit, either of age or speed, in making up the tables. Thus, under the head "Battleships, old or refitted," none are included that are over twenty-five years old, while from the coast defense class are excluded all vessels of less than 10 knots speed. No vessels included in the armored and protected cruiser classes have a speed of less than 15 knots, and none in the small cruiser and gunboat class have a speed of less than 12 knots. The result is that our tables show the available fighting strength with a closeness which we think has never been attempted in any similar tabulation.

But, while the displacement basis gives us a fair estimate of the strength of navy as compared with navy, class by class, it does not afford a true comparison of the relative strength of the classes in any individual navy. So many thousand tons in battleships (so to speak) is worth more than the same number of tons in cruisers and considerably more than the same amount in gunboats. So also there is a variation in the displacement value due to the age of the boats and to other features which do not appear in our first table.

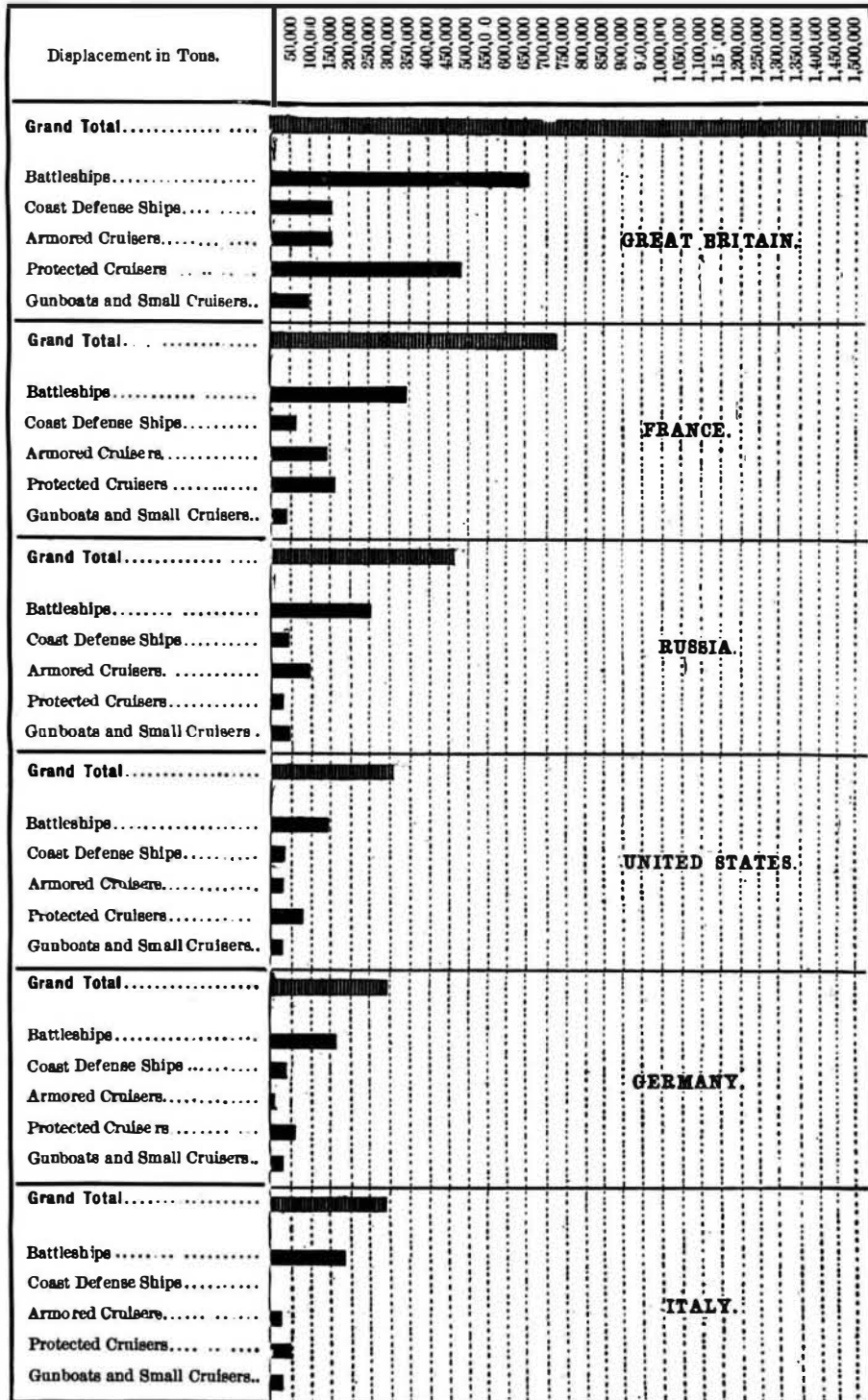
In order to rectify this disparity and reduce the displacement of the various classes "to common terms," as it were, we have multiplied the totals by a scale of factors of efficiency, the battleships standing at par value and the other types having decreasing values, descending to as low as 0.40 for the British coast defense vessels and gunboats. It will be noticed that the armored cruisers are valued in the British and Italian navies above the ten year old battleships, it being considered that their high speed, coal endurance, and modern armor more than outweigh the heavy batteries of the battleships. The Russian coast defense vessels, being of modern construction, with high power guns and good speed, are rated at 0.70 as against 0.40 for the older British ships, many of which carry muzzle-loading guns.

The percentage basis affects the United States favorably; that is to say, it brings out the fact that our battleships are all modern, as against the German and Italian battleships, nearly one-half of which were built from ten to twenty years ago. While the factor of efficiency adopted is purely arbitrary, it undoubtedly gives results which are more truly representative than those contained in the first table.

It will be noticed that Great Britain easily more than maintains the position which she has set for herself, of being equal in power to the next two strongest navies, those of France and Russia; and the fact that we have moved up into the fourth place with (as the efficiency table shows) a substantial lead over Germany and Italy, will be a pleasant surprise, and highly gratifying to all those who are interested (and who is not?) in the growth of our naval power.

THE equipment of the army, in the late war, is reported upon by Quartermaster-General M. I. Ludington. In three and a half months an army of 275,000 men was uniformed, armed, and equipped with supplies and an army of 16,000 men was sent to Cuba. In the war period the animals purchased cost \$3,871,690; wagons and harness cost \$358,449, and 83,078 tons of coal were purchased. The movement of troops by rail aggregated 17,863 officers and 435,569 men. The department chartered on the Atlantic coast, to June 30, 43 vessels with a total of 104,201 tons, and these had a carrying capacity of 1,287 officers, 22,335 men, 6,746 animals, and the arms, ammunition, and camp subsistence and medical supplies; four water-boats, of a total capacity of 820,000 gallons, tugs, and barges were added to this fleet. On the Pacific coast 14 ships were chartered, aggregating 41,152 tons, capable of carrying 629 officers and 13,059 men and their stores. These vessels cost \$186,632 for fitting up; and there was paid for the service of these ships \$1,007,952 on the Atlantic side and \$319,764 on the Pacific side. After June 30, other vessels were chartered or purchased, increasing the total tonnage to 111,099 tons, and the carrying capacity to 25,000 men on the Atlantic, and to 61,287 tons and 20,000 men on the Pacific. Fourteen ships, aggregating 61,298 tons, were purchased for \$5,431,000; including other vessels and lighters bought, the aggregate expenditure on this account was \$6,476,300.

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fact that three modern naval engagements have been fought, the battles of the Yalu, Manila, and Santiago, we are yet very much in the dark as to the relative values of speed, guns, armor, ammunition, and coal. If any one knew, to a certainty, that a protected cruiser like the "Esmeralda," that is crammed with guns, could rush in and sink, in the first few minutes of a fight, an armored cruiser like the "Dupuy de Lome," which is clothed from stem to stern and from upper deck to water line with armor, our estimate based on displacement would count for very little—but no one does know that guns are absolutely supreme. At Santiago not a belt or a barbette was penetrated, and the stoutest shield that was pierced was not over two inches in thickness.

Until a contest between nations of equal strength and skill has taken place, and a thousand-and-one vexed questions have been determined, the only satisfactory basis of comparison will be that of displacement, qualified by the age of the particular ships under consideration.

We show the relative strength of the navies of the world by three graphic comparisons and two tabular analyses. In the front page cuts the size of the navies is

fate of the "Furor" and "Pluton" at Santiago will certainly not encourage the use of these craft in the open sea and in broad daylight. If the torpedo fleets were to be considered, it would strengthen Great Britain's position, because of the number, size, and seaworthiness of her destroyers.

The data regarding the vessels in each class includes the number of ships, average displacement, total displacement, and speed.

Two different systems of classification have been adopted for the battleships and the cruisers, the former being graded according to their age (the latest ships being, of course, the best) and the cruisers according to their size. There is a much greater disparity in the age and, therefore, in the efficiency of the battleships than in the cruisers. The former have been built at various times during a period of thirty years, whereas the great fleets of cruisers, particularly in the larger classes, are much more modern, nearly all of them having been built during the past ten or fifteen years. Hence in the battleships their age is a very safe indication of their efficiency, especially when, as in our tables, their speed and average displacement is stated. The cruisers, on the other hand, being