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

In view of the somewhat strained relations which exist between certain sections of the press of the United States and Spain, and the rather thin ice upon which the diplomatic representatives of the two countries are just now venturing, a comparison of the strength of the two navies will have more than a passing interest.

In looking over the lists of the ships, and noting the date of building, one is struck with the fact that both navies, though small, are of modern construction and thoroughly up to date. The period of reconstruction dates from the early eighties, and previous to that time neither nation possessed a navy which, judged by modern standards, was of great practical value. Spain could boast of two or three obsolete types of iron ships, armed with muzzle-loading guns, and a few small cruisers of slow speed carrying breechloaders of the slow-firing type; while the navy of the United States, though numerically stronger, consisted mainly of ships built some twenty years before and during the war between the North and South.

It is difficult to make a comparison of the two navies class by class for the reason that the most important warships of Spain are of a type midway between the battleship and the cruiser, which is not represented in our navy. Of these Spain possesses six ships, known as the Infanta Maria Teresa class, of 7,000 tons displacement and 20 knots speed, with a complete 12 inch belt at the water line and carrying two 11 inch guns as the main armament. In respect to their high speed and unprotected upper works they approximate to the cruiser, while the great thickness of the belt and the barbette armor and the size of the main armament would rank them as second-class battleships.

Comparing the two navies seriatim by classes, we find that the United States has a great preponderance in first-class battleships. Of these she possesses four, with an average displacement of 10,568 tons; average speed, 16·42 knots; thickness of belt armor, 18 inches of Harveyized steel, and a main armament of 13 inch guns. Against this Spain could oppose her one battleship, the Pelayo, 9,900 tons, 16 knots speed, 17¾ inch belt, and armament of 11 inch and 12½ inch guns. The Pelayo is a French built ship, with a high freeboard, and its main battery disposed in four barbettes, two fore and aft and two on the broadside. She is a formidable ship, but would scarcely be a match for either of our battleships, except in a heavy sea, when her greater command would be a considerable advantage.

Spain has no second-class battleships to offset the Maine, 6,682 tons, 12 inch belt, 17·4 knots speed, and four 10 inch guns; and the Texas, of 6,315 tons, 12 inch belt, 17 knots speed, and armament of two 12 inch guns, unless we reckon the Infanta Maria Teresa as belonging to this class, in which case Spain possesses a superiority of four ships. This would go far to offset our advantage in battleships of the first class. The high speed—20 knots—of these ships would give them a great tactical advantage over the Maine and the Texas, and would enable them to choose the fighting position in relation to our Massachusetts or Iowa which would expose them to the least damage.

In the armored cruiser class Spain could oppose one ship of 6,840 tons, 6 inch belt, 20 knots speed and armament of 10 inch and 6 inch guns, and one ship, the Carlos V, of 9,235 tons, 20 knots speed, 2 inch belt and armament of 11 inch and 5½ inch guns, against our Brooklyn, of 9,250 tons, 3 to 7½ inch belt, 21·9 knots speed and armament of 8 inch and 5 inch guns, and New York, of 8,200 tons, 4 inch belt, 21 knots speed and armament of 8 inch and 4 inch guns.

The United States possesses six coast defense monitors of from 4,000 to 6,000 tons, 10 to 13 knots speed, and armament of 10 inch and 12 inch rifle guns. Spain has none of this class of ship, unless two obsolete iron vessels, the Numantia and Victoria, of 7,300 tons and 8 and 10 knots speed, armed with muzzle-loading guns, be included.

In the protected cruiser classes the United States leads with the two commerce destroyers, Minneapolis and Columbia, of 7,357 tons, 23 knots speed and great coal endurance. Spain has no warships answering to these, and neither her merchant marine nor navy could furnish a sea-going vessel that could overtake them upon the high seas. The Olympia, though not so large or fast, is more formidably armed, carrying 8 inch and 5 inch guns; at the same time she is credited with the high speed of 21·69 knots. Spain has no ship answering to the Olympia.

To the 4,500 ton cruisers of the Baltimore and Newark types, of which we have six, Spain could only oppose the Alfonso XIII, of 5,000 tons, and the Lepanto, of 4,826 tons, both of 20 knots speed and armed with 6·2 and 7·8 inch guns and a battery of 4·7 rapid fire guns. The superior size and delivery of shell fire from the rapid fire guns of these two ships would make them formidable antagonists of any two of the six boats above named.

The United States also possess five cruisers of from 3,000 to 3,700 tons, and three of 2,000 tons, most of which have a speed of 19 knots and are armed with rapid-fire guns. To these Spain could oppose five cruisers of from 3,000 to 3,300 tons with a speed of from 14 to 17½ knots. The latter cruisers were built between 1879 and 1887 and are not so fully up to date as our ships, which were built in the nineties and carry rapid-fire guns.

The United States has seventeen gunboats and smaller cruisers of between 1,000 and 1,750 tons displacement and from 12 to 17½ knots speed, as against four of the same class in the Spanish navy which range in displacement from 1,030 to 1,130 tons and are of 14 and 16 knots speed. Spain has also eighteen gunboats of about 550 tons displacement and from 11 to 20 knots speed, according to their date of construction.

Spain possesses two torpedo boat destroyers, fourteen first-class and three second-class torpedo boats, whereas we have three destroyers built and building, and eighteen torpedo boats under construction or completed, with one submarine boat.

From this brief review of the two navies it is evident that Spain is an antagonist who, in the present stage of naval affairs in the two countries, is by no means to be despised. Although she is second to the United States both in the number and power of her ships, her fleet would be effective for the class of warfare which she would probably elect to wage. It is not to be supposed for an instant that she would run the risk of a pitched battle where she would meet such mighty ships as the Massachusetts or the Iowa. Her policy would be to avoid the line of battle and content herself with depredations upon our seacoast cities and our commerce. The great speed of her 7,000 ton armored cruisers would enable them to elude our battleships, and the range and great weight of the 11 inch guns which they carry would prove terribly destructive in long range bombardment.

If a war should prove to be protracted, the delay would be in favor of the United States, as we should soon put in the water the five first-class battleships and the torpedo boats now under construction; and this would give us a powerful preponderance. As matters now stand, however, Spain would undoubtedly be able to maintain for some time a fierce and destructive naval war.

THE DISASTER ON THE NEW YORK CENTRAL RAILROAD.

The fatal wreck of the Buffalo Express on the New York Central Railroad will go on record as one of the worst disasters in railroad history. In the practically complete demolition of the train, and in the long list of fatalities, it possesses all the features which used to characterize the all too frequent accidents on the flimsy pioneer railroads of an earlier day; and the profound sensation which such a calamity always produces on both the lay and professional mind is, no doubt, greatly intensified by the fact that in this case it has happened upon one of the most solidly constructed and best equipped railroads in the world. In common with the Pennsylvania Railroad the New York Central has been generally accepted as the representative railroad of America, and the fame of its four-track line with its hundred-pound rail, heavy ties, broken stone ballast and solid roadbed has reached every corner of civilization.

The scene of the accident lies in the Highlands of the Hudson, and therefore in the midst of some of the most noted natural scenery of that famous river. At this point the lines are carried on an embankment on the outside of which is a dry retaining wall, that is to say, a wall in which the stones are laid upon one another without any cement to bind them together. Judging from the evidence, it would seem that when the Buffalo Express reached this embankment a portion of it collapsed, and the wall, together with that half of the roadbed covered by the southbound track, slid off sideways into the river. The engine and seven cars, including three sleepers, plunged into the river, with the result that a score of passengers lost their lives, chiefly by drowning, and a large number of others were injured.

Travelers who have passed through the Hudson Valley at this point will remember that the river is closely hemmed in by the mountains and foot hills, which often descend precipitously to the river or slope to the water's edge and beneath it at various angles of inclination. In some places, the roadbed through the Highlands consists largely of "cut" or "fill," that is to say, it is either cut from the hillside or consists of an embankment hugging the shore line at the base of the sloping rock, or thrown across the mouths of the small gulches and valleys which run down between the hills to the river. The construction of this line took place so many years ago that accurate records are not available; but that the engineers met with serious difficulty in the Highlands is probable, judging from the experience of the builders of the New York, West Shore and Buffalo Road along the opposite bank of the river. Here the dip of the rock beneath the river was frequently so steep that the rock embankment and even the cribwork could not obtain a foothold, and slid off bodily into the river. It became necessary to span

such places with costly steel bridges, two of the most notable of which are located respectively below Cozzens' Hotel and just below Fort Montgomery. The former is 210 feet long and the latter 290 feet, and they are only two instances out of many where this expedient had to be used. Illustrations of this work and a description of the difficulties of railroad building in the Highlands were given in the SCIENTIFIC AMERICAN of January 26, 1884.

We refer the reader to these facts because they suggest a probable explanation of the recent disaster on the opposite side of the river. An examination of the site shows that the natural surface of the rock dips abruptly toward the river. The original single track roadbed was constructed about half a century ago. Subsequently a second track was added on the river side and a retaining wall, laid dry, was built up, which acted both as a sea wall to protect the embankment from the wash of the river and as a retaining wall to hold the material of the roadbed in place. That it had to do the work of a retaining wall is evident from the fact that the filling was carried up to the top of the wall, which would therefore be subject to the lateral thrust of the embankment.

The fact that the embankment has carried the traffic safely for forty years has led the company to suggest that some violent external cause, such as a derailed engine or dynamite in the hands of malicious parties, caused the wreck. But while the long continued stability of the roadbed makes its sudden collapse more puzzling, it cannot be taken as proof that the wall carried a sufficient margin of stability through all these years. If the friction between the roadbed filling and the sloping surface of the underlying rock was sufficient, but only just sufficient, to hold the embankment in place, it only needed the saturation of the material by exceptionally high tides—such as were occurring at this time—and the concussion of a heavy express train to start the slide.

The New York Central holds a well merited reputation for the excellence of its roadbed and equipment. If the careful examination which is being made shows that the wreck was due to the cause above suggested, it is probable that a regard for its own interests and those of the public will lead the company to reconstruct its embankments in all places where the shelving rock may imperil the safety of the roadbed.

AN INTERESTING SOCIOLOGICAL EXPERIMENT.

An interesting sociological experiment has been inaugurated in New York City. The housing of men in moderate and reduced circumstances has always been an interesting and important problem. Many attempts have been made in that direction, but in nearly every instance the buildings have been so arranged that they did not attract a desirable class of people, or the architecture, decoration—lack of decoration—or general effect was to give the house an institution-like appearance, with no semblance of refinement, comfort or home. Mr. D. O. Mills was interested in this problem, and at last resolved to venture a large fortune in the erection of a superb hotel for men with small incomes. In the beginning it must be said that there is no charity connected with "Mills House No. 1" on Bleecker Street, New York. The man pays for what he gets, but unlike the frequenter of the ordinary lodging house he gets all he pays for. He has a clean, comfortable room, furnished with a well appointed bed, the floor carpeted and the windows curtained and shaded, for twenty cents a night. Well equipped lavatories, shower baths and luxurious reading and smoking rooms are at the disposal of the guests of the house without extra charge. A good restaurant furnishes meals at the lowest possible price.

Lodging houses in the lower part of New York will not suffer by the opening of the Mills House, because the class of men who frequent them will not be entertained there, but it is expected there will be enough men in moderate circumstances who desire a comfortable home at a minimum price to fill the 1,560 rooms which the house contains. So satisfied is Mr. Mills of this that he is now erecting on the east side a similar building at Rivington and Clinton Streets. Mr. Mills, who is a very successful man of affairs, may be trusted to make no failure in an investment of this kind. Unfortunately, philanthropy is usually divorced from business principles, and the mischief that this does is incalculable, and the result is often that the masses are pauperized, whereas they might be benefited and made self-respecting by enabling them to help themselves. The use of wealth for bettering the conditions of life under such circumstances as will secure to capital its due return is a beneficent experiment which has hitherto been imperfectly tried in New York or elsewhere.

The Mills House No. 1 has a frontage of 200 feet on Bleecker Street. It is ten stories in height and is built of white brick and Indiana limestone. The architect is Mr. Ernest Flagg, who has been entirely successful in designing this hotel. The house is built in two parts, each in the form of a hollow square with two courtyards reaching to the top and ending in skylights. These courts are lighted and heated and comfortable chairs are provided, and each court is ornamented with palms and plants. The windows of the sleeping rooms on the court give light and air, and are provided with grilles and lace curtains, no window glass being used. The rooms on the outside of the building have windows and curtains. The various floors are reached by means of elevators. The rooms are, of course, very small, just large enough to contain a bed and a chair. They are all separated, however, and are lighted over the partition, there being no lights in the rooms. Though the rooms are not luxurious, they are very comfortable. No better bedding can be found in any hotel in New York. Lockers in the basement allow for the storage of the effects of the guests.

The entire front on Bleecker Street is occupied by a series of tastefully decorated parlors which would not disgrace a first-class hotel. A large collection of well-selected books is already in place. Great washrooms are provided with hot and cold running water. The most modern form of baths with hot and cold water are free to all guests. A laundry is provided in the house, and the men may, if they desire, wash their own clothes, facilities being provided for this purpose. The dining room is in the basement and is intended to furnish cheap meals of a good quality.

The Mills House No. 1 was opened on Wednesday, October 27, in the presence of a large number of invited guests. The exercises included a prayer and address by Bishop Potter, of the Diocese of New York, and addresses by Ex-Mayor Abram S. Hewitt and Dr. Chauncey M. Depew. They all spoke warmly in favor of such a use of capital, which does not pauperize old or young men, but which tends to make them self-respecting. The erection of a building of this kind is indeed the truest kind of philanthropy.

AN URGENT PATENT OFFICE REFORM.

We recommend to the careful perusal of our readers the admirable letter upon the question of Patent Office reform which will be found elsewhere in this issue. The high authority from which it proceeds and the unanswerable arguments with which it abounds should serve to bring home to the inventors and manufacturers of the country the urgent necessity for combined action, with a view to securing the necessary reforms at the forthcoming meeting of Congress.

The wearisome delays of which such correspondents as Mr. Heath have from time to time complained are not more harassing to the inventor than they are to the various Patent Office officials, whose hands have been tied and whose best efforts have been crippled by the parsimonious policy of Congress in the matter of appropriations. This parsimony would be more intelligible if the Patent Office were a losing investment for the government; but in view of the fact that this department is netting the government a clear $300,000 a year and that there is a neat surplus of $5,000,000 to the credit of the Patent Office in the Treasury, the reluctance of Congress to grant the modest requests of Commissioners for an increased appropriation is a crying injustice both to the inventors and the overworked staff of the office.

The request for more generous appropriations is so reasonable that the failure of Congress to grant it can only, we think, be due to indifference or want of information as to the workings of the Patent Office. The surest remedy will be for the great body of inventors throughout the country to make the matter a personal one—as it surely is—and bring their individual and united influence to bear upon the senators and representatives with whom they are personally acquainted.

In pleading their case and that of the Patent Office—the two are identical—we do not know of any better brief to put into their hands than the clear and forceful letter to which reference is herewith made.

A RECORD PATENT ISSUE.

The simultaneous issue of one hundred and twenty-five patents to a single individual has caused The Patent Office Official Gazette of October 27, 1897, to assume proportions which make it by far the largest of its kind ever issued. Up to this date the largest issue of The Gazette contained 194 pages. The present issue contains 288 pages. In making it up the Norris Peters Company, according to the Washington Star, used 250 reams of paper and made 252,000 impressions, the usual number of impressions for The Gazette being 140,000. To meet the emergency the government printing office had to telegraph for extra type, and sixty extra men were put upon the work.

The increased bulk of the issue is due to the insertion of the batch of 125 patents above mentioned to Milo G. Kellogg, of Chicago, Illinois, who has assigned the whole set to the Kellogg Switchboard and Supply Company, of Chicago.

The application for the first of Mr. Kellogg's patents was filed April 27, 1887, and the others followed at intervals up to March 9, 1895, which is the date of the last of the 125 applications. A remarkable feature is that every one of them relates to the same subject, namely, improved ways of constructing and operating switchboards for telephone exchanges. The final government fee on these cases amounted to $2,500. This constitutes the largest check ever paid into the Patent Office at one time for government fees, and it is almost needless to add that the 125 patents is the largest number ever issued at one time to one inventor.

Apart from the interest which attaches to the Kellogg patents, on account of the features above mentioned, they should serve to remind inventors of a fact which they too often overlook, but which sometimes seriously affects the value of their patents. We refer to the disinclination of the average inventor to file applications for modifications. Too often they are content to lay stress upon a particular form of the device, and merely make mention of its various modifications, whereas the modifications should form the basis of separate applications. It is only in this way that the inventor can secure the most complete protection. Mr. Kellogg has carried out this principle to its fullest extent, and while there will probably be few subjects that will call for anything like the same number of applications, this notable issue is an object lesson which may be commended to the thoughtful consideration of inventors at large.

THE AGE OF WATER POWER.

It is stated that during a recent interview in Canada Lord Kelvin asserted his belief that the time would come when the greater part, if not all, of the waters of Niagara would be utilized for industrial purposes; and that on being asked if he would not regret the loss of the grandeur and beauty of the falls which would result, he stated that in view of the vast industrial benefit to be gained, he would not regret it. Whether the distinguished scientist was correctly reported or not, there are good grounds for believing that the future will see the new, or rather newly developed, source of energy utilized for industrial power purposes to a degree that will make it only less universal than coal and the steam engine. Time was when water was the leading source of energy for the power necessary to drive the machinery of mills and factories; but the cumbersome and otherwise unsatisfactory nature of the old under or overshot wheel, and the necessity for locating the factories where the power was generated, was a severe drawback to its usefulness. The introduction of steam, with its advantage of being generated wherever the factory might be situated, led to the disuse of water power in almost all cases where coal was available.

The advent of the dynamo and the motor opened a new and wider sphere of usefulness for water power. It gave to it something of the mobility of steam power, and unwound the chains which had tied it down to the banks of the rivers and streams. The water wheel gave place to the turbine, and electrical transmission has carried the silent energy to distant cities and the scattered centers of industry. And who shall place a limit to the distance that may be covered? The recent developments of electrical science point to the possibility of transmitting the stored energy of our rivers and waterfalls to vast distances with but a trifling loss; and with the improvements which analogy teaches us to expect in this comparatively new branch of engineering, we may look for its successful competition with steam in districts far removed from the source at which the power is generated. When this time shall come, it is quite conceivable that Niagara will be depleted of its waters, if the authorities are so utilitarian as to allow it.

The statistics of the present state of the art show that it is advancing with rapid strides. America leads the world with a total installation of over 70,000 horse power. Switzerland comes next with 32,000 horse power. France has 18,000 horse power, and the great power plant at Rheinfelden, Germany, will give Germany the fourth place with about 17,000 horse power. Italy has nearly as much, and Norway and Sweden are each credited with 15,000 horse power. In Great Britain there is a total installation of about 4,000 horse power. These figures suggest that the development of its water power may have a powerful influence in rearranging the centers of industry throughout the world. With the exception of the United States, the best natural water power is located in countries that are deficient in coal beds, and, on the other hand, the leading manufacturing countries, as a rule, are deficient in water power. Switzerland, Italy, Norway and Sweden have in the new system a powerful ally that will assist to bring them well to the front as industrial nations. To the United States, which already possesses enormous deposits of coal, the full development of her natural water power will mean the more speedy coming of that commercial supremacy which is already well within its grasp.

L'ELECTRICIEN, Paris, quotes from the Optician, London, an account of an invention by a man named Wilcox, in which a minute incandescent electric lamp is fastened to a pen near its point in order to illuminate the writing. "A little reflector," it says, "placed behind it, prevents the light from dazzling the eyes and directs it toward the paper. This arrangement . . . may be applied also to a pencil or to any instrument of the same sort."