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OUR RECENTLY PURCHASED WARSHIPS.

It may safely be said that Armstrong's is the only shipbuilding yard in Europe where we could have purchased two cruisers whose general features so closely approximate to the distinctive features of warship design as carried out in this country. From time immemorial American ships have been celebrated for their speed, and even more for the great power of their batteries. This was true in the days of the sailing frigate, when our ships were wont to crush their opponents with the weight of their superior gun-fire and their excellent marksmanship, and the same powerful batteries are found on the ships of our new navy. The principle is a good one. It has proved effective in the past, and it will do so in our next naval war. The British "Magnificent" is half as large again as the "Indiana," yet the latter carries by far the heavier battery. The British "Blake" and our own "Brooklyn" are about the same size, yet the American ship is greatly superior in the weight of its guns.

Of late years the celebrated Armstrong firm, in the North of England, has been turning out ships which have carried truly enormous batteries compared with the displacement of the ships, and, at the same time, have shown themselves phenomenally speedy. The most noted instance of this is the renowned "Esmeralda," of the Chilean navy—not the old "Esmeralda," of the late Chilean war, but a new cruiser of 7,000 tons displacement. This vessel carries no less than eighteen rapid fire guns of the 8-inch and 6-inch sizes, besides eight 3-inch rapid firers and ten 6-pounders. From these guns she could pour into an enemy from either broadside during the first few minutes of the fight an amount of shell-fire whose total energy would be far greater than that of the biggest battleship afloat.

Our new acquisitions, the "Amazonas" and "Admiral Bruu," are the very latest product of this yard and they exhibit the characteristic qualities of good speed and abnormally heavy battery, comparing in this respect with our own "Cincinnati." The principal dimensions, etc., of these twin ships are as follows: Length 330 feet, beam 43 feet 9 inches, draught 16 feet 10 inches, displacement 3,600 tons. They have twin screws and engines, the horse power being 7,500 and the speed 20 knots. Their normal coal supply is 700 tons, though they have stowage room for much more, and could therefore proceed at low speed far from our coal supply stations and reach hostile waters with a supply on hand. They are protected from stem to stern by a complete Harvey steel deck which is 3 inches thick where it curves down below the waterline along the sides. This 3 inches would present a sloping surface to the enemy, which would tend to deflect the projectiles. If they were not deflected the oblique 3 inches would be equal to a vertical wall of say 5 inches of Harvey steel. Before the shells could reach this deck, however, they would have to pass through 6 or 7 feet of coal which is stored in the wings of the ship abreast the engine and boiler rooms.

The battery, as we have said, is, for the size of the ship, very powerful. It is not only powerful in numbers, but owing to the fact that its guns are of the latest Armstrong pattern, they have vastly greater power for their size than guns that were built only four or five years ago. Armstrongs are the builders of the wirewound type of gun, which has shown results greatly superior to those obtained by the built-up type. Not only are these guns more powerful for their weight, but they have improved breech mechanism which enables them to be fired with greater rapidity. The following comparison of the Armstrong ship with one of the same size and type built for the British navy from government plans shows clearly the greater fighting power of the former. The figures are taken from the official tables of the British navy and the firm in question. The speed of fire is that actually obtained by crews on board ships in commission. The "Intrepid" is one of a class of thirty ships built under the late Naval Defense Act, and though not so up-to-date as the "Amazonas" may be considered as a good example of the average protected cruiser of the existing navies of the world.

COMPARISON OF TOTAL ENERGY OF FIRE DURING ONE MINUTE FROM EITHER BROADSIDE.

	Number and Size of Guns.	Muzzle Energy.	Shots per Minute from Each Gun.*	Total Energy.
"Amazonas," 1897.....	{ Four 6-inch. Two 4-7-inch. Five 2-24-inch.	{ 4,840 foot tons 2,158 " " 280 " "	{ 6 12 20	{ 116,160 51,792 28,000 195,952
"Intrepid," 1892.....	{ Two 6-inch. Three 4-7-inch. Four 2-24-inch.	{ 3,356 " " 1,494 " " 137 " "	{ 5 10 20	{ 33,560 44,820 10,960 89,340

* This rapidity of fire would not of course be maintained for any length of time in the excitement and slaughter of a modern sea fight. The figures, however, serve for the present comparison.

From this comparison then it is evident that although the two ships are of the same size, the "Amazonas" can deliver from her broadside more than double

the energy of shell fire that the "Intrepid" can, although the latter ship was built only five years in advance of the former—such is the rapidity with which naval science and construction advances.

Foot-ton energy, which we have chosen as the basis of comparison, is the product of weight or mass by velocity; and as the weight of the shells for each caliber of gun is the same, the increase in energy is due to the very high velocities of the "Amazonas" guns as compared with those of the "Intrepid." Thus the 6-inch rapid fire Armstrong gun has a velocity of 2,642 feet per second, against 2,200 feet for the British naval gun; the Armstrong 4-7-inch gun has 2,630 feet per second, the naval gun 2,188 feet, and so on through the smaller calibers.

As further illustrating the development in naval design in a brief five years, we append a further comparison:

	Thickness of Deck.	Horse Power.	Speed.	Coal Capacity.
"Amazonas".....	3 inches.	7,500	20.00	700
"Intrepid".....	2 "	9,000	19.75	400

We find then that by the use of improved materials and methods the naval architect has been able, using the same capital (3,600 tons displacement), to produce a ship having superiority on every point of comparison—a ship with more speed, with 50 per cent better protection, 80 per cent larger coal capacity, and over 100 per cent more powerful armament.

We can imagine no more convincing argument for a systematic and continuous programme of naval shipbuilding than is presented by a study of these figures. The "Intrepid" was one of seventy-two warships which were authorized in a single appropriation and built with a rush. The present policy in England and Europe generally is to build so many ships each year, and thereby insure that each year's ships shall embody all the latest improvements. A similar policy will undoubtedly be adopted in this country, and its effect will be to bring the general average of the navy more thoroughly up to date.

THE EFFICIENCY OF THE WATER TUBE BOILER.

The efficiency of the water tube boiler needs no demonstration at this late day; but the coal consumption trials which have lately been carried out on the new cruiser "Diadem" are worthy of note because of the size of the boiler installation and the high economy realized. The "Diadem" is a smaller edition of the "Powerful," which was of 14,000 tons displacement and 26,000 horse power, the displacement in the present case being 11,000 tons and the horse power 16,000. Like the "Powerful" she is furnished with the Belleville water tube boiler and carries such improvements in the way of economizers for heating the feed water and higher steam pressure as were suggested by the memorable boiler tests on the older ship.

The best results were obtained on a thirty hour test at 12,500 horse power—three-fourths of the full power—when the coal consumption worked out at 1.59 pounds per indicated horse power per hour. It is doubtful if this low rate is ever realized in the navy with the cylindrical boiler, and it is rarely reached with the same type in the merchant marine. The "Powerful" using the same boiler burned 1.83 pounds on a three-fourths horse power trial and the "Terrible" 1.71 pounds. The steam pressure on the "Diadem" was 280 pounds at the boilers and 245 pounds at the engines, and these pressures were maintained with little variation throughout the trial.

IS OUR MARITIME COMMERCE VULNERABLE?

It is a fortunate fact that in the event of hostilities we should be practically invulnerable in a quarter where most nations would be open to disastrous attack. Great and rapidly increasing as is our foreign trade, only a very small percentage of it is carried in American ships. Although American shipping, inland, coastwise and deep sea or foreign, ranks in the aggregate next to that of Great Britain, we are secure from attack for the reason that the bulk of it is confined to the lakes and our great inland canal and river systems. As regards our foreign trade, for the year ending June 30, 1897, the proportion of foreign commerce carried by American ships was a fraction over 11 per cent, and for the month of December, the same year, it had increased to about 7½ per cent. Thus it will be seen that in the fiscal year mentioned, for one ton of our commerce that was exposed to attack there were about nine tons which were safeguarded by the laws of neutrality.

Nor would our coastwise commerce, which is carried entirely in American bottoms, be so seriously affected as might be supposed; for the fastest of the ships which are in this trade would probably be utilized as auxiliary cruisers, and the merchandise, thanks to our superb system of seaboard railways, could be shipped by land.

Turning from the question of defense to that of attack, we note that the Naval Board appointed for the inspection and purchase of auxiliary cruisers has made a start by adding the late Ogden Goelet's fine yacht the "Mayflower" to the fleet. This is a brand new vessel of 2,400 tons and about 17 knots speed. The

vessel is to be transformed into a torpedo boat destroyer at the Brooklyn Navy Yard under the supervision of Naval Constructor Bowles. She will be armed with rapid-fire guns of sufficient power to insure her sinking such torpedo boats as her 17-knots speed will enable her to overhaul. This catching of torpedo boats will not be so difficult a task as might be supposed, for these little craft are only capable of high speed under the most favorable conditions of wind and sea.

The purchase of several other swift merchantmen, yachts and ocean-going tugs is also under contemplation by the Board.

REPORT OF THE COMMISSIONER OF PATENTS FOR 1897.

In the SCIENTIFIC AMERICAN of January 29 we published an advance statement of the business of the United States Patent Office last year, to which but little is to be added from the official report of the Commissioner, which has just appeared. A full abstract of the report appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT. The report is made by Acting Commissioner A. P. Greeley, upon whom the duties of the office devolved for so great a portion of the year, on account of the illness and subsequent death of the former Commissioner, Gen. Butterworth, and shows the largest business ever before transacted in one year in the history of the Patent Office, there having been 47,904 applications for patents and 23,794 patents and reissues. The receipts of the year were \$1,375,641.72, or \$252,748.59 above the expenditures—and the latter amount, carried to the balance already standing in the Treasury of the United States on account of the patent fund, brings the total up to \$4,971,438.06. It is perhaps futile, at this juncture, to more than call attention, as we have done so many times before, to the substantial wrong inflicted upon inventors by the diversion of so great a sum from the fees which they have paid to the government, when the needs of the Patent Office for a larger force of examiners and clerks, and for more commodious and convenient quarters in which to transact the business, are so well known. The appropriations made by Congress for the work of the office have been so meager that, although the fees received for patents are so largely in excess of the expenditures, it has not been possible to increase the force or facilities to meet the steadily enlarging field of work, and the number of applications awaiting action at the close of the year was 11,382, of which 7,858 had not been taken up for examination. Many of these applications had been waiting three or four months for examination, and some of them more than six months, to the serious injury of the applicants and the detriment of the public.

Of the patents granted last year, more were issued to citizens of Connecticut, in proportion to population, than to those of any other State—1 to every 786 inhabitants. Next in order were: Massachusetts, 1 to every 1,180; District of Columbia, 1 to every 1,316; New Jersey, 1 to every 1,377; Rhode Island, 1 to every 1,421; New York, 1 to every 1,585. The fewest patents in proportion to inhabitants were: South Carolina, 1 to every 38,371; North Carolina, 1 to every 17,397; Mississippi, 1 to every 16,120; Alabama, 1 to every 15,598; and Georgia, 1 to every 14,133. Of patents granted to citizens of foreign countries, 706 were for England, 551 for Germany, 286 for Canada, 222 for France, 58 for Austria-Hungary, 48 for Scotland, 45 for Belgium, 44 for Switzerland, 32 for Sweden, 30 for New Zealand, 30 for Victoria, 21 for Russia, 19 for New South Wales, 17 for Ireland, 13 for the Netherlands, 10 each to Denmark and Italy, 9 each to India, Mexico and South African Republic, and 5 each to Norway and South Australia.

The development of industries through patented inventions is treated of at some length in the report, and attention is called to the number of inventions of the highest industrial and commercial value for which the patents have expired. These include the cotton gin, the sewing machine, the self-binding harvester, barbed wire fencing, the roller mill for flour milling, the sulphite paper process, the dynamo and electric motor, important inventions in typewriters, the telephone, and many others, in the earlier forms in which they were brought before the public. It is to be remembered, however, in regard to most patents of high importance that the original inventions afford but the first steps in opening up new and more varied fields of industry, calling for additional improvements and the exercise of further inventive genius.

It is noted that the most remarkable industrial development, due principally to patented inventions, is in the line of electrical work, and within the term of patents now in force or but recently expired. This includes the manufacture of electrical apparatus and supplies, the furnishing of electricity for lighting and power purposes, electric railways and the telephone, an enormous industry, which has grown up entirely within the last twenty years. Although the electric railway is only about ten years old, the total mileage of these roads had increased, up to October last, to 13,765 miles, with an invested capital of about

\$1,000,000,000, and the manufacture of cars and motors to meet this great demand has become a regularly established industry affording employment to many thousands.

The bicycle industry is also referred to as showing a most wonderful development, the product of 1897 having been over 1,000,000 wheels, and the exports of cycles for the year being valued at \$6,902,736. The numerous industries which contribute to this manufacture, and the great number of inventions by the means of which it has been brought to its present state of perfection, are matters of common knowledge.

Among other comparatively new industries, specially noted as peculiarly the product of our patent system, are the manufacture of typewriters and typewriter supplies, the cash register and cash carrier, photographic apparatus and materials, the development of the basic steel business, the manufacture of aluminum, etc., the Commissioner concluding that "to the stimulus afforded by the Patent Office is due the creation of these new industries and the very great development of recent years in the older industries. It is to the stimulus to invention given by our patent system that the great increase in our exports is largely due, and it is on American invention, as fostered and stimulated by the patent system, that we may confidently depend for ability to maintain the high rate of wages paid to American workmen, and yet compete successfully in the markets of the world with nations where the workman receives but a meager return for his labor."

THE NEW NAVAL WAR GAME.

In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT we publish a paper descriptive of a naval war game which is being played by naval officers on the other side of the water. It is intended to represent on a board the actual conditions which would obtain in a modern naval fight, and it is claimed by naval experts that it does this with such success that the game is at once a valuable training to the officers and a test of the comparative values of the various types of warships.

The full details of the game, which represents over ten years' work upon the part of the author, have not yet been published; but the published data shows that it is played upon a board ruled into squares, representing the scene of action, the ships being represented by small models which are moved at their respective speeds (ten, fifteen or twenty knots, as the case may be) at the will of the commanding officers. The game may be played as a duel between two ships or as a fleet action between a large number of ships. The models represent actual ships, and one player is assigned to each ship. The various elements in a warship, such as armor, guns, speed, etc., are assigned certain values by points, and as the game proceeds, the players, it would appear, are awarded so many points by the umpires, according to their tactics.

It is claimed that the victory usually falls to the stronger ship or fleet—a fact that would seem to prove the correctness of the theory upon which the game is based. At the same time, there are certainly exceptions to the rule, as in the case of a game recently played, in which the United States battleships "Indiana," "Oregon" and "Iowa" were pitted against double the number of Spanish ships, viz., the battleship "Pelayo," the three armored cruisers "Teresa," "Cristobal Colon" and "Viscaya," and the destroyers "Terror" and "Furor." Here, in spite of the numerical superiority of the Spanish, the American ships, with their heavy guns and thick armor, would be almost certain to win. As the game worked out, the balance was slightly in favor of the Spaniards, owing chiefly to the distraction afforded by the attempt of the destroyers to torpedo the "Indiana" and "Oregon," which diverted the fire of these ships from the Spanish armorclads. It is considered that, in nine chances out of ten, the game would result in the victory of the powerful few over the individually weaker many.

THE DEVELOPMENT OF EGYPT.

An important step in the development of the Nile Valley has recently been taken in the formal ratifying by the Khedive of the contract for the construction of two large reservoirs on the Nile. The work is planned on a large scale and includes the construction of two great dams across the river, one at the cataract at Assuan and the other at Assiut. At Assuan the waters will be impounded by a granite dam which will be built upon the granite reefs which form the cataract. Its crest will be about 76 feet above the river bed at its deepest point and the total length of the dam will be about 6,000 feet. The difference in the water level in the wet and dry seasons will be about 45 feet. It will be pierced with sluiceways to permit the flood waters to flow through without any considerable backing up in the reservoir.

In the fall of the year, when the waters have carried down their valuable burdens of silt for the enriching of the Nile Valley, the sluice gates will be shut down and the reservoir allowed to fill. The season of low water

lasts from April till August, and during this period the sluice-gates will be opened sufficiently to keep the waters of the lower Nile at the proper level for irrigating the sugar, cotton and rice fields. It is calculated that the amount of water impounded will be sufficient to supply the lower valley until the next season's flood waters come down. If the scheme is successful, the Egyptian husbandman will be able to irrigate his fields throughout the whole year.

The Assiut dam is to be built for the purpose of raising the level of the river during the summer and increasing the supply in the canals of lower Egypt. It will be built on the lines of the celebrated barrage of the Nile, which is situated just to the north of Cairo. This important work is to be completed in five years, and its effect upon the districts affected will be to enormously increase the value of the land and the prosperity of the people.

STREET CAR SERVICE ACROSS THE BROOKLYN BRIDGE.

The new trolley car service across the Brooklyn Bridge has now been running long enough for the public to judge of its value. There can be no doubt as to the relief which it has afforded to the congested travel on the regular bridge cars, particularly in the rush hours. The crowding, indeed, seems to have been transferred to the trolley cars, which are particularly attractive to that part of the public to which rigid economy is an absolute necessity. Residents in Brooklyn can now make the journey from the outlying districts to the City Hall Park, New York, for one fare; and while the journey takes longer to accomplish than it does over the elevated roads and the regular bridge cars, the small difference in cost is sufficient to attract a large amount of suburban travel. The effect of the new service is plainly noticeable on the elevated roads, which, while they retain most of the long-distance travel, are losing a considerable amount of travel to and from points nearer the bridge.

It is estimated that the trolleys provide an additional capacity of 15,000 passengers per hour in each direction, and, as was expected, there has been a large reduction in the receipts of the regular bridge cars. Hitherto the revenues of the bridge have exceeded its expenses; but it is evident that some readjustment will be necessary, either in the shape of retrenchment in the operating expenses or assistance from the city funds. If the last expedient becomes necessary, the public will ask why the consideration paid by the trolley companies for the use of the bridge was not placed at a higher figure.

The cars are run on the inside of the roadways, and at the New York end they cross the footway beneath the terminal station in four parallel loops. A large force of men is stationed at the loops to prevent accidents and assist the people on and off the cars. The arrangement, thanks largely to the intelligence of the passengers, works satisfactorily; and altogether we think the new venture may be voted a success as helping to solve one of the most serious rapid transit problems in this city.

EATING BEFORE GOING TO BED.

A writer in Italia Termale, quoted by The National Druggist, December, is not much in favor of the theory that late suppers are injurious. "He declares, in fact," says the latter paper, "that many persons who remain thin and weakly, in spite of all precautions in regard to diet, etc., owe the fact largely to habitual abstinence at night. He says, very truly, that physiology teaches us that, in sleeping as in waking, there is a perpetual waste going on in the tissues of the body, and it seems but logical that nourishment should be continuous as well. The digestion of the food taken on at dinner time, or in the early evening, is finished, as a usual thing, before or by bedtime, yet the activity of the processes of assimilation, etc., continues for hours afterward; and when one retires with an empty stomach, the result of this activity is sleeplessness and an undue wasting of the system. 'All other creatures,' says the writer, 'outside of man are governed by a natural instinct which leads those having a stomach to eat before lying down for the night.' The infant, guided by the same instinct, 'takes the breast' frequently, in the night as well as day, and if its stomach is allowed to remain empty too long, it shows its discomfort by noisy crying. The digestive organs have no need for repose, provided, always, that the quantity of nourishment taken within the twenty-four hours does not go beyond the normal limit. The fact that the intervals between meals is short works no inconvenience, but, on the contrary, tends to the avoidance of feebleness, which is the natural result of an interval extended to too great a length. Feeble persons, lean and emaciated people, and, above all, those suffering from insomnia, owe it to themselves not to retire without taking some nourishment into the stomach—bread and butter, a glass of rich milk, a few biscuits ('crackers'), or even a bit of juicy cold meat, for instance. We quite agree with the writer in all that he says in regard to the folly of the idea of the harmfulness of a light lunch before retiring."