# Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

**TERMS FOR THE SCIENTIFIC AMERICAN.**

**(Established 1845.)**

One copy, one year, for the U. S., Canada or Mexico.....**$3.00**
One copy, six months, for the U. S., Canada or Mexico..... **1.50**
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. **4.00**
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

**The Scientific American Supplement**

**(Established 1876)**

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year for the U. S., Canada or Mexico. $6.00 a year, or £1 4s. 8d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country.

**Combined Rates.**—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries, *eight dollars and fifty cents a year*, or £1 14s. 11d., postage prepaid.

**Building Edition of Scientific American.**

**(Established 1885.)**

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders, and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign countries, $3.00 a year, or £0 12s. 4d. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign countries, $6.50 a year, or £1 6s. 9d. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN, and SUPPLEMENT, $9.00 a year. To foreign countries, $11.00 a year, or £2 5s. 2d., postage prepaid.

**Export Edition of the Scientific American**

**(Established 1878)**

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, or £0 12s. 4d., postpaid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JUNE 4, 1898.


**Contents.**

(Illustrated articles are marked with an asterisk.)



**TABLE OF CONTENTS OF**

## Scientific American Supplement

**No. 1170.**

**For the Week Ending June 4, 1898.**

Price 10 cents. For sale by all newsdealers.



## THE ARMORED CRUISER IN THE NAVIES OF THE WORLD.

The modern warship is the most cosmopolitan product of this essentially cosmopolitan age. Except for a few minor characteristics, which may temporarily distinguish the ships of one nation from those of the rest of the world, there are no broad international differences in naval construction such as we find in the other great branches of industry.

The reason is not far to seek. It is to be found in the fact that each great naval power realizes that it must not only have many ships, but the ships must be the very best possible. The question of naval efficiency is a question of national life and death, and no sentimental objections are now allowed for a moment to prevent a nation from imitating its neighbors and rival in the construction of the latest types of ships, guns and armor. Occasionally, in former years, a nation held on to some inferior and obsolete practice rather than follow the lead of its more progressive rivals, as when some years ago England continued to build muzzle-loading guns when other nations were adopting the breech-loader, and France at a later day refused for some years to follow England's example in the building of rapid-fire weapons; but such conservatism has always cost the nations dearly and has resulted in the conveyance of much costly material to the scrap heap.

Hence it has come to pass that the publication of each year's naval programmes of construction is an event looked for with profound interest by naval constructors, inasmuch as these programmes show conclusively what is the majority opinion as regards the best types of ships to build.

We have taken occasion to read carefully through the lists of the world's navies and note what is the general character of the ships which have lately been built or are under construction or are authorized to be built, and we are impressed with the fact that the coming warship will be of a type between the battleship and the swift armored cruiser, a vessel with heavy battery, medium armor protection, high speed and exceptionally large coal supply.

Two tendencies are noticeable, each of which we as a nation should take special note of. The first is the disposition to build armored cruisers instead of the protected type, the other is the very high speed which is being given to battleships, a speed which in many cases gives to the battleship all the advantages claimed for the armored cruiser.

The following is a statement of the armored cruisers built or building in each navy. We have included no ship of less than 18 knots speed, and it will be noticed that it is only the older ships that are as slow as this; the later cruisers being of 20 knots speed or over. In the British navy there are seven armored cruisers of the Australia type, of 5,600 tons and over 18 knots speed, with a belt of 10-inch armor, and an armament of two 9·2-inch and ten 6-inch rapid-fire guns. The normal coal capacity is 900 tons. There are also under construction four armored cruisers of 12,000 tons, 21 knots, 800 tons coal supply; they will have a 6-inch belt and 6-inch protection for the guns, and an armament of two 9·2-inch and twelve 6-inch rapid-fire guns.

The Argentine Republic possesses two armored cruisers, the "Garibaldi" and the "San Martino," which are sister ships to the "Christobal Colon," of the Spanish navy. They are vessels of 6,840 tons and 20 knots speed, with a 6-inch belt and citadel and an armament of two 10-inch, ten 6-inch, and six 4·7-inch rapid-firers.

Austria-Hungary possesses the "Kaiserin Maria Theresia": 5,270 tons, 19 knots, 4-inch belt, and armament of two 9·4, and eight 5·9 rapid-firers. She is also constructing an armored cruiser of 6,100 tons, 10½-inch belt, and 20 knots speed, to carry the same armament as the vessel just mentioned.

Chile possesses in the "Esmeralda" a remarkable vessel of 7,020 tons, which to a 6-inch belt and extremely powerful battery of two 8-inch rapid-firers, sixteen 6-inch and eight 3-inch rapid-firers adds the high speed of 23 knots an hour. Such a ship, preying upon an enemy's commerce, would prove to be the "Alabama" of her day. Another powerful armored cruiser is being built for this enterprising republic by the Armstrongs, the firm that built the "Esmeralda." This is the "O'Higgins," of which we have lately heard so much. She is of 8,500 tons displacement and 22 knots speed and will carry 1,500 tons of coal. Her belt is 7 inches thick and she carries an armament of four 8-inch rapid-firers, ten 6-inch, four 4·7-inch and ten 3-inch rapid-firers. The 8-inch rapid-firer can fire from three to four shots per minute, so these guns could discharge as many shells per minute as a dozen 8-inch slow-fire guns.

France is already well provided with armored cruisers, and her new ships are to be nearly all of the armored type. The "Charner," "Bruix" and "Treville," of about 4,800 tons and 18·3 knots speed, carry a 3½-inch belt and an armament of two 7·6-inch and six 5·5-inch rapid-fire guns. The "Pothuau," 5,360 tons, 19·2 knots, is armed with two 7·6-inch and ten 5·5-inch guns and has a 3⅛-inch belt. The "Dupuy de Lome," 6,406 tons, 20 knots speed, is completely sheathed from stem to stern and up to the top deck with 4 inches of steel. Her armament is similar to that of the "Bruix." It is in new construction, however, that the French are showing the high value they put upon the armored cruiser type. No less than nine of these vessels, the smallest of which is of 7,700 tons displacement and none of less than 21 knots speed, are either building or proposed. The "Dupleix" and "Kléber," each of 7,700 tons and 21 knots and will carry a 6-inch belt. They will have a battery of ten 6·4-inch rapid-fire guns of great power. The six great ships of the Dupetit Thouars class will be of 9,517 tons and 21 knots speed. They will be armed with two 7·6-inch, eight 6·4-inch and four 3·9-inch rapid-fire guns. They can carry a normal supply of 1,020 tons of coal, in addition to a supply of liquid fuel. Not content with this, the French have laid down a large armored vessel of 11,270 tons, the "Jeanne d'Arc," which is to steam at 23 knots and carry a normal coal supply of 1,400 tons. The armament will consist of two 7·6, eight 5·5 and twelve 3·9 rapid-fire guns, and she will have a 6-inch belt.

Germany is building the "Fürst Bismarck," of 10,650 tons and 19 knots. She is to have a 7¾-inch belt and carry four 9·4, twelve 5·9 and ten 3·4 guns, all, including the 9·4-inch, to be rapid-firers.

Italy possesses two armored cruisers of 6,500 tons and 20 knots speed, which carry a 6-inch belt and an armament of twelve 6-inch and six 4·7-inch rapid-firers; one armored cruiser of 4,583 tons and 19 knots: and she is building two sister ships to the "Christobal Colon" (Spanish), which was constructed in Italy.

Japan is also in the fashion in the construction of two 9,750-ton armored cruisers of 21½ knots speed and a third of 9,436 tons and 21½ knots. The armament of each will consist of four 8-inch rapid-firers, fourteen 6-inch and twelve 3-inch rapid-firers.

It was Russia who a few years ago started the construction of huge armored cruisers by building the "Rurik," of 10,923 tons and 18 knots speed. She has a 10-inch belt and an armament of four 8-inch, sixteen 6-inch and six 4·7-inch guns, all slow-firers, with a maximum coal supply of 2,000 tons. She followed this with the "Rossia," 12,130 tons, 10-inch belt, 20 knots speed and a similar armament, except that it consists of rapid-firers. She also possesses the "Pamyat Azova," 6,000 tons, 9-inch belt and 18·8 knots speed. Two others are authorized, one of 7,800 tons and 20 knots and the other of 12,336 tons and 21 knots speed, and it is reported that the fast 6,000-ton cruiser to be built by the Cramps is to be of the armored type.

Spain, our present antagonist, is relatively by far the strongest in this type of ship of all the nations. She has either built or just about completed nine large and fast armored ships, including the "Carlos V." of 9,235 tons, 2-inch belt, 20 knots speed and armament of two 11-inch, eight 5·5-inch, four 3·9-inch rapid-fire guns; two of the "Christobal Colon" type, of 6,840 tons, 20 knots speed, 6-inch belt and citadel, and armament of two 10-inch, ten 6-inch and six 4·7-inch rapid-firers; and six of the "Vizcaya" type, of 7,000 tons, 20 knots speed, 12-inch belt and armament of two 11-inch and ten 5·5-inch rapid-fire guns.

In general it may be said that the fleets of armored cruisers in the navies of the world, especially those recently laid down or authorized, are characterized by high speed, exceptionally heavy armament, in which the rapid-firer predominates, and great coal carrying capacity. It is evident that this is to be the prevailing type of ship in the cruiser class. The decision to build these vessels, and to build them in large numbers, is evidently unanimous as far as the foreign naval powers, great and small, are concerned. As we have already pointed out, our present building program makes no provision whatever for this type, and unless the defect is remedied at an early date, we are liable to be confronted by a fleet of swift hostile warships, against which we would be powerless to act.

At the same time, prudence suggests that we await the actual conflict between our ships and those of Spain before the supplementary naval bill is passed. The experience gained in such a battle will be of untold value in determining the relative value of the various types of vessels, and the country will be in a far better position to judge of its need a few weeks hence than it is just at present. The armored cruiser, it almost goes without saying, is our most pressing need, and we are glad to note that a bill is now before Congress calling for the construction of several of this type. The same bill, however, calls for a further authorization of torpedo boats and destroyers. The exact value of these small craft has yet to be determined, and this can only be done in the test of a naval fight.

## OBSTACLES TO SOUTH AMERICAN TRADE.

We are in receipt of a letter from a correspondent in Tocopilla, Chile, Mr. Juan E. Franz, who complains of the fact that although it is possible to send by postal order any small sums from the Chilean post offices to most of the countries in Europe, "facilities which are very favorable to business," if it is desired to remit small sums to the United States it is necessary either to buy drafts on England or pay excessive premiums for

exchange and then a surcharge of fifty cents for each draft on New York. "What is the value," our correspondent asks, "of the Pan-American Congress and other bodies for opening trade with the South American republics when one of the most useful mediums to this end (postal facilities) is neglected?" Mr. Franz makes the suggestion that the provision of parcel post and postal order accommodation would remove a serious obstacle to trade, and he is not by any means the only citizen of the South American republics who has complained of the disadvantage under which the United States labors in this respect. In these days of keen competition we cannot afford to suffer any handicap such as imposed by the conditions referred to, and the subject may well be referred to the thoughtful consideration of our own post office authorities.

## NATURAL PRODUCTS AND RESOURCES OF THE PHILIPPINE ISLANDS.

BY M. W. HARRINGTON.

The great commercial products of the Philippine Archipelago are sugar, hemp, tobacco, copra and coffee, and their importance, as articles of export, are in the order given.

The production of sugar has increased rapidly. In 1871, it was less than 100,000 tons; in 1881, 230,000 tons; in 1893, 261,686 tons; and it was then increasing at the rate of 15,000 tons per year. About one-third of the total production is from the province of Pampanga, in the central area of Luzon, and nearly north of Manila. The provinces about Manila Bay and the one north of Pampanga are also large producers. This sugar is exported from Manila and goes chiefly to Spain and Great Britain.

A better quality of sugar, but in smaller quantities, is obtained from the violet-colored cane in the central islands of Panay and Negros. The very best comes from the province of Capiz, on the north coast of Panay. This sugar is exported from Ilo-ilo, and is sent chiefly to the United States.

The processes of manufacture are yet crude and antiquated. There are a few large plantations, and these are generally monastic. These plantations are usually leased to Chinese half-breeds, from whom better results are obtained than from Europeans. The small cultivators perform their own work with hired labor, but suffer under the difficulty of not being able to manufacture economically. There is a tendency toward their absorption into larger estates, under the charge of corporations.

The Manila hemp is so called because of the resemblance of the fiber to that of hemp, at least in color. It is derived from the leaf stem of a banana plant (Musa textilis). The plant has an inedible fruit, and grows in poor soil. The best plants grow in southeastern Luzon and the adjacent islands of Samar, Leyte and Bohol. The plant is rudely cultivated, cut down when three years old, and the fibers separated from the surrounding tissue by rude domestic machines. It takes two natives to prepare 25 pounds a day.

The coarser outside fibers are exported in the crude state, chiefly to Great Britain, the United States and the Australian colonies, where they are used for making a highly prized cordage. The finer fibers are used at home for domestic manufactures of fabrics used for dress and ornament. They are light, transparent and very durable. The fabrics are varied by using some cotton, silk, or other fiber with the Manila hemp.

The native name for the fiber is abacá, taken from the plant. The abacá has been introduced into other parts of the world, but the conditions of its native home of the Philippines are more favorable and the labor is there so cheap that no successful competition has been established.

Export of abacá began in 1831, and the amount exported is steadily increasing. In 1893 it amounted to 97,787 tons, valued at ten million dollars.

Next in order of value, but first in popular estimation, is the so-called Manila tobacco. It is a highly prized tobacco, classed by some as the equal of Havana tobacco, and by a few as its superior. Certain it is that some Manila leaf is imported into Cuba, though it is not known how it is used. The Cuban tobacco is classified with regard to its excellence, the Manila with regard rather to its fine appearance. Manila tobacco is stronger than it looks, and it has a fine herby flavor, to which those who use it become very much attached.

The tobacco was made a monopoly of the government in 1781. That is, anyone could raise it, but the government only could buy it, and could set the price and pay for it when it pleased. It often pleased to be two or three years behind in its payments. In 1882 this restriction was removed, and small growers now can produce it more profitably.

It is grown over Luzon and the neighboring islands, but the very best comes from the two large provinces of Cagayan and Isabela, in the extreme northeastern part of the island. Here the land suitable for it is now all occupied. The cultivation of the plant requires little labor. The man of the household usually performs the tillage, and the women and children the rest of the work.

Rather less than half of the crop is sent out in the leaf and this goes largely to Spain and other European countries. The remainder is made up into cigars and cigarettes, two-thirds of which are consumed at home and the remainder exported, chiefly to the neighboring countries of continental Asia and to Japan. In 1893 about 11,000 tons of leaf were exported and nearly 140,000,000 of cigars. The price of this tobacco in the Oriental countries is low. Boxes of 500 excellent cheroots (a cigar open at both ends) can be got for $18.

The copra is a preparation of the cocoanut made in great quantities in tropical islands all over the world. It seems to be a relatively new product for the Philippines; 11,500 tons were exported in 1893. The cocoa palm is very common and highly prized in the Philippines. All parts of it are used.

Coffee was introduced in the Philippines, probably in the latter part of the eighteenth century, from Brazil. The first large plantation was established in 1826, and the production began to extend actively fifteen or twenty years ago. Latterly the export has decreased very greatly. It used to average 2,500 tons a year, but has recently sunk to only 300. This is probably due to the revolution, for the coffee is of good quality, some of it excellent.

Unlike Manila hemp and tobacco, the coffee requires some capital on the part of those who undertake it. It takes the trees four or five years to begin to bear. Those who are able to make the necessary advances have prospered greatly, and, especially about Manila, have become rich.

The exported coffees formerly went exclusively to France, but are now scattered well over Europe, usually through Singapore. They are of two sorts, the Manila and the Zamboanga. The first is grown about Manila, chiefly to the south and east of Manila Bay. It has a small berry and is more highly prized than the other. The Zamboanga coffee is produced in the south, principally on Mindanao and the Sulu Islands. The berry of this variety is larger, but less care is used in its preparation. It goes directly to Singapore.

Rice is the chief product of the Philippine Islands, but it is not exported. It is the staple food of the natives, and sometimes the supply is short. Both the mountain and lowland rice are produced, and more than ninety varieties are known. It is easy to cultivate them, and in favorable years the yield is very generous.

Maize is grown in considerable quantities. So are the sweet potato, yams, ground nuts, gourds, potatoes, peas. A little wheat is raised at high elevations. Among the fruits are the mango, plantain, banana, mangosteen, jack fruit, medlars, lanzon and durian, the last especially in the Sulu Islands. The islands are generally mountainous, and at proper elevations the fruits of southern Europe and of Florida flourish, as the orange, citron and sapotilla.

The cotton of this archipelago is excellent and its production makes some progress. The cacao can be successfully grown and of good quality, but little attention is paid to it. The tea plant has been tried in botanic gardens and is found to thrive. The islands are rich in odorous flowers, and the manufacture of essences and perfumes is increasing. Cinnamon, the pepper tree and many other of the valuable plants of the Malay Peninsula and the East Indies either grow here naturally or can be easily introduced.

The islands are very rich in forests and they contain many valuable woods, mostly unknown even by name in the rest of the world. There are said to be thirty-two tinctorial woods, giving the entire series of colors and shades. Among the valuable ones is the ebony, with very black and fine-grained wood, of high value for fine furniture. The magkano of the forests of Mindanao is said to be absolutely indestructible by rot. The forests generally remain intact in the interior except for Luzon, where they have been extensively thinned out or cleared off.

The chief domestic animal is that useful and tractable Oriental beast, the buffalo, not our bison, but the buffalo proper. He is especially useful in the simple and rude tillage still used by the natives. The horse is small, active, hardy, but rustic. He is derived by a mixture of Oriental and Occidental stocks. The ox, goat and hog do well, but the sheep are inferior. The most of these animals have in places escaped from domestication, and large numbers of wild ones may be found, usually in herds.

The native manufacturers of the Philippines are not few, and their textile fabrics are especially fine and worthy of a larger market than they have so far found. The natives make many other things, among them a coarse pottery of great utility.

Valuable minerals are generally diffused through the islands, but few are yet mined profitably. Gold exists generally over the entire area, in placers and veins, but usually in quantities which do not pay with the rude methods employed for its collection. It is mined in the Camarines Norte province in southeastern Luzon and in the Misamis and Surigao placers of northern and northeastern Mindanao, but with small results. With the refined modern methods of collecting gold it could be profitably obtained in many places, and probably the prospecting has been incompletely done.

There are two known coal fields, one in southern Luzon, the other on the western slopes of Cebu and the eastern of Negros. The first probably extends over into Samar, and has furnished good steaming coal. One bed is known to be 10 to 20 feet thick. In the other there are at least five beds of varying thickness and quality.

Iron ore of excellent quality is known in southern Luzon, especially in the Camachin Mountains, where there are now a few small foundries. Copper ore has long been known in the province of Lepanto. It was early worked by the natives, and in 1862 a company was formed to conduct copper mining in this region. It is also found on Masbati Island, on Panay, and in several other places. Traces of lead and mercury are known, and also of rock oil. Sulphur is obtained on Leyte for use in the powder factory at Manila. It comes from a solfatara at Mount Manacagan.

## FOOTGEAR FOR THE SOLDIER.

The greatest English soldier and commander of modern times said that the most essential thing for a soldier is a good pair of boots, and the second most essential thing is a second pair of boots. Every one who has had any experience with marching troops will be likely to agree with this immortal. Now that 125,000 of our National Guardsmen, from all walks and stations of life, have been mustered into the regular service, it behooves the commissary department of the army and its various agencies to use supreme vigilance, precaution and wisdom in providing suitable footwear for this vast number of practically raw recruits.

It probably does not overshoot the mark to say that eighty per cent of the men who have enlisted are improperly shod on entering service. And if the commissary department is not in possession of properly accredited and well advised purchasing agents, these soldiers are likely to be seriously handicapped and many of them made useless as implements of war when they come to be landed in Cuba or the Philippines, where they will be subjected to tests of unaccustomed climate and soil. The quartermasters of companies should therefore bear in mind in attending to the shoeing of their troops that they are not dealing with the normal foot in the vast majority of cases. This is the first obstacle to contend with. The second is the vanity of man concerning his feet, even though he be a soldier.

The absolute requisites in a shoe for marching are that it be comfortable and enduring; that is, that it be made on the right kind of a last from the proper material, and that it be properly and firmly put together. The essential elements of the first are that it have a straight inside line; that the sole lie flat or nearly flat upon the ground; that the arch be firmly and solidly supported; that the shoe fit snugly around the heel and the instep; and finally, in order that the pressure may be equally distributed, that there be sufficient room for the unhampered play of each pedal articulation when the weight of the body is successively thrown upon it. Unless the shoe fulfills these indications, it should be discarded. The sole should project beyond the upper so as to give firm support to the foot when it is fully expanded under the combined influence of the weight of the body and the resultant muscular relaxation of fatigue; and it should be composed of solid double sole, not paper or leather packing sandwiched between two thin pieces of leather, which, unfortunately, is often found. The uppers should be of stout, yet pliable, thoroughly seasoned hide, double stitched and by proper dressing made impervious to moisture. If these details are insisted upon, more will be done toward contributing to the capacity of the soldier than by the most elaborate system of acclimatization. It is more necessary to make Mulvaney immune to fatigue than it is to make him immune to fevers; by accomplishing the former you encompass the latter.

A properly clad, well fed American soldier is well prepared to give battle to the Cuban germ and the Spanish parasite, but he expects his government and its officers to provide him with the most approved implements of war and accouterment. It is the poorest sort of economy to grudge a few cents on a pair of shoes, especially in the light of what has just been said. Yet this is what the quartermaster's department has set out to do, if we may give credence to the reports in the daily press. In response to an invitation for estimates for 25,000 pairs of shoes, Chicago manufacturers offered to furnish army footgear at prices varying from 90 cents to $2 per pair. It is not at all improbable that the latter figure embraces the cost of manufacture plus a fair profit for shoes that will meet all the requirements mentioned above, while it is just as certain that any figure very much below it does not do so. This is not the time to be cent wise and dollar foolish. A few cents extra expended on a pair of boots may mean a live, fighting soldier in time of pressure and of need, while a 90-cent pair will be very sure to be found bound in tatters on a lamed or dying sacrifice.—Medical News.