Scientific American.

ESTABLISHED 1845.

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

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, OCTOBER 1, 1898.

PATRIOTIC CRITICISM.

Considerable discussion has been evoked by a letter recently published in The Sun in which the writer made some very just and timely criticisms upon the guns of our navy. Reference was made in this letter to the fact that in energy and rapidity of fire our larger weapons are greatly inferior to guns of the same caliber now being turned out by some of the leading manufacturers of Europe. In proof of this, certain facts, which are well understood by our ordnance experts, were quoted, and the statement was made that, while it is generally known and conceded that our gunners are the best in the world, it is not generally known that the guns they handle are far from being up to the present standard of excellence. The facts, as given, were perfectly correct. They may be found stated at greater length in the special editions which we have recently issued on naval and coast defence, where the pressing necessity for naval guns of greater rapidity and power is shown by a series of comparative tables.

The publication of this letter, however, drew forth an indignant protest from an ex-officer of the navy, who, after making a series of misstatements, which prove how greatly he and, we fear, many others stand in need of such information as the offending letter furnished, ended with the following statement:

"It is a crying shame that any one who calls himself an American . . . should make invidious comparison with other lands, or try to belittle his own nation."

In a brief but excellent editorial, The Sun makes the comment that, while the navy's guns are the best of their type ever made, and the early European guns were not serviceable, this is not true of them to-day, and the high quality of our weapons is no proof that they cannot and, therefore, should not be improved.

As it has been our intention to take up this extremely important question at an early date, we were gratified to see that a conservative journal like The Sun had lent its columns to the publication of such a strong criticism of what is undoubtedly the weakest point in our navy to-day, and we congratulate our contemporary on the fearless regard for the truth which prompts it to indorse the necessarily unpopular criticisms of its correspondent.

The late achievements of the navy, the deadly execution wrought by its guns upon the Spanish fleets, render the task of criticism an extremely unthankful one. To the lay mind the statement that the very guns that sunk Montojo's and Cervera's fleets are so far behind the latest productions of some European gun shops as to be distinctly in the second class sounds very captious and untimely. Yet the publication of such a fact with a view, not to the belittlement of the navy, but to its betterment, is more truly the expression of patriotism than to keep silent for fear of wounding the national pride.

It is true that the early and experimental European guns showed signs of failure; it is also true that when we undertook the manufacture of heavy ordnance we profited by their experience—as they did themselves. It is equally true that our guns designed in the late eighties have shown excellent qualities, being in some respects superior to guns of a similar date manufactured abroad. But it is equally true that, while the heavy guns on our ships are chiefly of the 1888 model, foreign powers have gone steadily ahead and are producing weapons which, weight for weight, are from thirty to forty per cent more powerful than our own and possess points of superiority in other points of comparison.

There is no sentiment in statistics. The facts have been demonstrated at the proving grounds and are recorded in the ballistic tables of the various ordnance manufacturers of Europe whose weapons are in the market for purchase by any fifth-rate power that cares to buy them. If Congress had furnished our Board of Ordnance with the necessary funds for experimental work, and if the board itself had been a little more progressive in spirit, the above mentioned criticism would have been uncalled for. As it is, our guns, which were the best of their kind at the beginning of the present decade, can scarcely be expected to hold their own with the improved weapons of to-day, in which are embodied all the results of ten long years of experimental work by the highest ordnance experts of the old world.

An enlightened and thoughtful patriotism will lead us to look the facts squarely in the face and govern ourselves accordingly. The actual facts regarding the heavy guns which are carried on our crack battleships are such as ought to afford the Ordnance Bureau of the Navy Department the gravest concern. Within a year there will be a battleship afloat carrying 12-inch guns, which, if it should encounter one of our crack battleships, would overmatch her 12-inch guns to the following extent: To an energy of 25,985 foot-tons she would oppose 45,000 foot-tons; to a velocity of 2,100 feet per second she would oppose a velocity of 2,759 feet per second; and while the enemy's guns could penetrate 46 inches of iron at the muzzle, our 12-inch guns could only get through 31 inches. Moreover, the enemy's shells would be delivered in greater numbers and with a much flatter trajectory, thereby increasing the chances of a hit.

It may be answered that the superior marksmanship of our gunners would more than outweigh the superior ballistic properties of the opposing weapons. Perhaps it would; but why subject our men to such a handicap? If our gunners have been trained until they are the best marksmen in the world, the least the nation can do is to furnish them with the best weapon that a modern gunshop can turn out. It is the first duty of patriotism to insist that in all our future warships this shall be done.

THE WORLD'S SUPPLY OF WHEAT.

The address of the President of the British Association for the Advancement of Science, at the great annual gathering of that society, has come to be regarded as one of the most notable occasions in the scientific world, a milestone of progress as it were, by which we may measure off our advance into the unexplored regions of science. It has so frequently been made the medium for the announcement of the more recent and valuable, we had almost said sensational, discoveries of science, that the attention of the scientific world is fixed upon the president of this renowned association with considerable expectancy when he delivers the annual address.

In the recent gathering, held at the ancient city of Bristol, the inaugural address delivered by Sir William Crookes was of an unusually startling and in some respects sensational character. Choosing as his main theme the question of the world's food supply, he produced a formidable array of statistics regarding the present and probable future ratio between the supply and demand of the world's staple article of food—all tending to show that, before many decades are past, the demand for wheat will be far in excess of the earth's capacity to produce it.

Although Sir William disclaims any intention of being pessimistic, we cannot but feel that his statistics, from whatever source they have been gathered, will bear revision, particularly as regards the wheat-growing area and capacity of the United States; and when one's confidence in the statistics for one country is shaken, a doubt is naturally thrown upon the accuracy and value of the statistics of the other wheat-producing countries of the world.

But while the distinguished lecturer may have been unfortunate in his choice of statistical authorities, there is no questioning the value of the remedy in the way of chemical treatment of the soil by which it is proposed to double the world's wheat supply and stave off the supposed danger for a practically indefinite period.

In 1871, according to the statistics gathered by the lecturer, the bread eaters of the world numbered 371,000,000. Ten years later they had risen to 416,000,000, and at the present time they number 516,500,000. The increase is in a geometrical ratio, for the yearly increase grows progressively larger. To supply 516,500,000 bread eaters will require a total of 2,324,000,000 bushels for seed and food; but the best authorities estimate the total supplies for 1897-98 to be only 1,921,000,000 bushels, which means a deficit of 403,000,000 bushels, which has not been urgently apparent, owing to a surplus of 300,000,000 bushels carried over from the last harvest. Respecting the present harvest year, we start with a deficit of 103,000,000 bushels, and have 6,500,000 more mouths to feed. It is claimed that the reason scarcity and high prices have not prevailed in recent years is found in the fact that since 1889 we have had seven world crops of wheat and rye abundantly in excess of the average, and these generous crops increased accumulations to such an extent as to obscure the fact that the harvests of 1895 and 1896 were each much below current requirements. Hence it is concluded that bread eaters must be fed from the current harvests, and that even a harvest equal to the fruitful yield of 1894 would not prove sufficient for current needs.

This being the present condition of things, the future prospects are determined by the lecturer in a survey of the various wheat-growing countries of the world. The United States is the chief of the wheat-exporting countries. For thirty years it has been the principal source of the foreign supply, exporting no less than 145,000,000 bushels annually, and the bread-eating world to day depends largely upon the United States for the means of subsistence. Sir William states that practically there remains no uncultivated prairie land in the United States suitable for wheat growing, and within a generation the ever increasing population of the United States will consume all of its own wheat and be obliged to import from other countries. The withdrawal of 145,000,000 bushels will cause a serious gap in the food supply of wheat-importing countries, with the probability of a dearth for the rest of the world after the British Isles have been supplied.

The statement that there remains no uncultivated prairie land in the United States suitable for wheat growing is so at variance with the facts that it raises a natural doubt as to the truth of many of the statements which follow regarding the other wheat-producing countries of the world. As a matter of fact, there are vast areas of land in the Western States that would now be raising excellent wheat crops if the cost of hauling or of railroad transportation did not render such farming unprofitable. There are other and yet vaster areas in Eastern Oregon, Washington, and other Western States, which will yield abundant harvests of wheat as soon as artificial irrigation is introduced, and in many States further to the east there are extensive areas, formerly devoted to wheat, that would at once be given up to this cereal if the price and demand warranted the change.

The lecturer finds even less comfort in an examination of Russia, the next source of supply to the United States in point of importance. The annual export of wheat from Russia is 95,000,000 bushels, but this supply is regarded as being provisional and precarious. The yield in European Russia is not over 8·6 bushels per acre, and in Siberia the climatic conditions are not favorable to wheat raising, except over a limited area. The ripening of wheat requires a temperature of at least 65° Fah., for fifty-five to sixty five days. As all Siberia lies north of the summer isotherm of 65°, it is ill adapted to wheat culture unless some compensating climatic condition exists. The Russian Minister of Ways and Communications declared in 1896 that Siberia never had produced and never would produce wheat and rye enough to feed the Siberian population.

Canada yields 18,261,950 bushels from 1,290,000 acres of fine wheat-growing land. Performance in this region however has not come up to promise, the wheat-bearing area of all Canada having increased less than 500,000 acres since 1884.

In Australia climatic conditions limit the wheat area to a small portion of the littoral belt. Queensland is stated to have 50,000,000 acres suitable to wheat, but it has never had more than 150,000 acres under cultivation. In South Australia the harvest averaged last year only 3¾ bushels per acre, and in other districts the yield is very unsatisfactory. New Zealand has a climate admirably suited to wheat raising, Denmark and the United Kingdom alone yielding as much per acre. The Zealander, however, finds fruit and dairy farming so profitable that he is not likely to devote his lands to wheat.

Exports of wheat from Austria-Hungary have practically ceased. France imports 14 per cent of her own production and Germany imports 35,000,000 bushels annually. The prospective supply of wheat from Argentina and Uruguay has been greatly overrated. The present wheat area in Argentina is about 6,000,000 acres and there is no prospect of that country ever being able to devote more than 30,000,000 acres to wheat. Of South Africa the lecturer says that wheat culture fails where the banana ripens. In India, though an enormous acreage is devoted to wheat, it has been declining for years. In 1895 over 20,000,000 acres yielded 185,000,000 bushels. One-eighth only of the yield, on an average, is available for export.

Summing up, Sir William Crookes estimates that there is to-day a deficit in the wheat area of 31,000 square miles. When provision shall have been made for feeding the 230,000,000 units likely to be added to the bread-eating population by 1931—by the complete occupancy of the arable areas of the temperate zone now partially occupied—where, asks the lecturer, can be grown the additional 330,000,000 bushels of wheat required ten years later by a hungry world?

The solution of the problem is to be found in artificial fertilization of the soil. Wheat pre-eminently demands nitrogen, fixed in the form of ammonia or nitric acid. All other necessary constituents exist in the soil, but nitrogen is mainly of atmospheric origin and is rendered "fixed" by a slow and precarious process, which requires a combination of rare meteorological and geographical conditions to render it of commercial value. After examining all the present sources of nitrogen, such as ammonia, formed by the distillation of coal, guano, cropping the soil with clover and plowing in the plant, the drainage of our cities, and the saltpeter of Chile, the lecturer concludes that

some other and vaster source of supply must be found, if the world is to be provided with the 12,000,000 tons of sodium nitrate which must be distributed annually to secure the necessary increase in the crops. Sir William proposes the fixation of atmospheric nitrogen as the best solution of the problem.

As far back as 1892 he exhibited at one of the soirées of the Royal Society an experiment on "The Flame of Burning Nitrogen," which showed that nitrogen is a combustible gas,and the reason why, when once ignited, the flame does not spread through the atmosphere and deluge the world in a sea of nitric acid is that its igniting point is higher than the temperature of its flame. By passing a strong induction current between terminals, the air takes fire and continues to burn with a powerful flame, producing nitrous and nitric acids. The lecturer, basing his estimate on an experiment of Lord Rayleigh, estimates that one ton of sodium nitrate could be produced by this process at a cost of $130. Electricity from coal and steam engines would be too costly; but, by utilizing water power, the product might be turned out at a cost of not more than $25 per ton. In reply to the question how to produce by the combustion of the atmosphere the enormous annual total of 12,000,000 tons of nitrate of soda, the lecturer states that Niagara alone is capable of supplying the required electrical energy without much lessening its mighty flow.

THE HEAVENS IN OCTOBER.

BY GARRETT P. SERVISS.

Those who begin their acquaintance with the constellations in the month of October are quite likely to become enthusiastic star gazers. It is in this month that the splendid group called "The Royal Family," including Andromeda, Cassiopeia, Perseus, and Cepheus, becomes conspicuous. Nearly overhead at about 10 P. M., on October 1, will be seen the great square of Pegasus, about 15° on a side. The star at the northeastern corner of this square belongs in reality to the constellation Andromeda. It is nearly of the second magnitude, and, with two other stars of equal brightness, forms a line extending toward the northeast from Andromeda's head to her feet. North of the middle star in this line are two fainter stars, constituting the girdle of the imaginary chained figure. Not far from the uppermost of these fainter stars the naked eye, on a clear night, detects a hazy speck. It is the Great Nebula of Andromeda, and its central condensation can be glimpsed with an opera glass.

North of Andromeda the eye is caught by a zigzag rowof stars resembling the letter "W;" these mark the constellation Cassiopeia. The western part of the "W" forms, it will be observed, a more perfect triangle than the other part. Beginning at this end, the stars are named, in their order, Beta, Alpha, Gamma, Delta and Epsilon. Less than half way from Alpha to Gamma is a fainter, yet fairly conspicuous, star named Eta. This is a very beautiful double, and a splendid object for those who have telescopes of three inches or more in aperture. The components are of magnitudes 4 and 7·5 and their distance apart is about 5″. The larger star is yellow and the smaller purple, a peculiar combination.

A test for a more powerful glass, say not less than 4 inches aperture, is furnished by the star Iota. This will be found next beyond Epsilon in extension of a line drawn from Delta through Epsilon. It is a triple, the largest star being of the fourth magnitude. Its nearest companion, distant only 1·5″, is of the seventh magnitude. At a distance of 9″ is another companion of the eighth magnitude.

Following Cassiopeia and Andromeda from the east appears Perseus, the hero armed with diamond sword and flying sandals who, in the old classic story, rescues Andromeda from the sea monster. Perseus is a striking constellation marked by a bow-shaped row of stars, the middle one of which is the brightest of the group. With an opera glass or a telescope the background of the sky on which Perseus appears flying is a wonder of starry beauty. The principal star of Perseus, in particular, has an amazing double loop of small stars apparently attached to it as if they were gems strung upon a swinging whip lash. Interposed between Perseus and Cassiopeia appears the glowing starry mass of the Sword Handle, plainly visible to the naked eye, and a glorious object for a modern binocular glass.

Between Perseus and the last star in Andromeda is the marvelous Algol. Although this star's changes have been noticed for centuries, it is only within recent years that their cause has been known. It seems certain that the remarkable loss of light which Algol experiences every two days, twenty hours, and forty-nine minutes is due to an eclipse caused by the passage across the star of a huge black companion revolving close around it. The fading of Algol and its subsequent recovery are very interesting to watch. The process occupies several hours. There will be a minimum at about ten minutes before 10 P. M. on the 22d of October.

The possessor of a telescope should not leave the constellation Andromeda without looking at the celebrated double Gamma, the last in the row of three bright stars first described.

West of Cassiopeia, and between the zenith and the Pole Star, will be found Cepheus, who was the father of Andromeda and the husband of Cassiopeia. His constellation is not very conspicuous. Four of its brightest stars form a diamond-shaped figure. Lyra, the Northern Cross, and Aquila will be seen descending the western sky, while Hercules is setting, Aquarius is on the meridian, the bright star Fomalhaut shines alone in the south, and Taurus and Auriga are rising in the northeast.

THE PLANETS.

Mercury is a morning star in October, being found in the constellation Virgo at the beginning and in Libra at the end of the month. On the 19th it passes superior conjunction to become an evening star. There is a very close conjunction of Mercury and Jupiter in the forenoon of the 16th, when the planets, unfortunately, will be hidden by daylight.

Venus is still the glory of the evening twilight, becoming brighter and brighter until the 27th, when it attains its greatest brilliancy. It is continually drawing nearer the earth, and in the telescope its crescent figure becomes noticeably narrower and more elongated from week to week. In the course of the month Venus moves from the constellation Libra into Scorpio, and on the 18th it will be near the red star Antares.

Mars is becoming more conspicuous, as it rises earlier and approaches the earth. At the beginning of the month it rises about 11 P. M. It passes from Gemini into Cancer and grows rapidly brighter. Its polar snow-cap should be looked for with the telescope.

Jupiter, which is too near the sun to be observed, passes three or four degrees north of the star Spica in Virgo, and comes into conjunction with the sun on the 13th, after which it emerges in the morning sky.

Saturn remains on the borders of Scorpio and Ophiuchus, and its brilliancy, too, is diminished by the twilight. It is in conjunction with Venus on the morning of the 22d.

Uranus, just west of Beta, in Scorpio, is in conjunction with Venus on the 10th.

Neptune still rides on the "golden horns" of Taurus.

THE MOON.

Like September, October this year opens with a waning moon. The new moon of the month occurs on the 15th, the first quarter on the 22d, full moon on the 29th, and last quarter on the 7th. The moon is nearest to the earth on October 19th and farthest from it on October 7th.

The lunar conjunctions with the planets occur as follows: Neptune, 5th; Mars, 8th; Mercury, 15th; Jupiter, 15th; Uranus, 18th; Venus, 18th; Saturn, 18th.

Out of the ninety annual meteoric showers enumerated by Mr. Denning, nine are noted as of more than usual brilliancy, and one of these falls on the night of October 18th, the radiant being in the eastern part of Orion.

NEW TROOPSHIPS FOR THE ARMY.

It is announced that the War Department will retain some of the vessels bought at the beginning of the war and fit them up for hospital troopships. The former Atlantic transport liner "Mobile" will be the first ship to be fitted up, and the Cramps, of Philadelphia, have been given the work. Plans and specifications were prepared by well-known naval architects, and they have been inspected and passed upon by the army authorities and experts whose services they secured.

According to the plans, the ship will be overhauled from stem to stern. The quarters of the officers will be on the spar deck, which will have stateroom accommodations for eighty-four. Each stateroom will accommodate two officers, and there will be one bathtub for every twenty officers. On the aft promenade deck there will be a hospital with a capacity for seventy-six cots. It will have a complete dispensary and operating room and bathroom. On this deck, forward, there will be a promenade where the men will take exercise. It will be covered with dark blue awning as on the hospital ships, so that invalid soldiers will be protected from sun and rain. The quarters for the men will be between decks. The framework of the bunks will be of tubular cast iron, and each bunk will be so fixed that it may be folded back against the side of the ship when not in use, so that when they are folded up, the men will have practically the entire space between decks, from one end of the ship to the other, to move about in. There will be two or three berths, one above the other, depending upon the part of the boat. Each berth will be provided with a mattress and blankets. Amidships, on the main deck, will be the galleys. Forward of them will be what will be known as the armory and mess hall for the men. From the ceiling of the room gymnasium apparatus will be hung, so that the men will have indoor exercise and be able to practice at sea the army "setting-up" exercises. The mess tables will be so arranged that, when the room is to be used as a gymnasium, the tables will be folded back against the wall. Aft of the galleys on the main deck will be the lavatories and bathrooms for the men. Each bathroom will be supplied with hot and cold water and a shower bath. The entire ship will be lighted with electricity and the space between decks supplied with cooled air from a large ventilating plant. A distilling apparatus will be provided having a capacity of 3,000 gallons a day, as well as a refrigerating plant large enough to keep an ample supply of fresh beef and vegetables.

The next ship to be refitted will be the "Mohawk." Other ships to be refitted are the "Mississippi," "Michigan," "Massachusetts," "Manitoba," "Minnewaska," "Roumanian," "Obdam," and "Panama." The War Department desires to make these vessels the finest troopships afloat, and it is particularly desired to make the men as comfortable as possible. The discomfort and downright hardships which our soldiers suffered in going to Cuba and Porto Rico and returning from these islands in a sick and enfeebled condition certainly warrants the expenditure of a large sum of money in the equipping of proper troopships. We should at all times have vessels, ready at a moment's notice, which could transport an army of 10,000 or more troops.

END OF AN ELECTRICAL WAR.

It is announced that two of the largest electrical manufacturing concerns in the country are about to unite. We refer to the Westinghouse Company and the Walker Company. It is probable that the plants of the latter company at Cleveland and New Haven will continue their operation as in the past. This company has been extremely successful of late in securing contracts for work, and at the present time there is about $1,300,000 worth of work going through its shops. Among the recent orders taken by them was one for a 5,000 horse power dynamo, for the West End Railroad in Boston, the equipment of the Brooklyn Elevated Railroad system, besides several orders from abroad; one for 600 street car motors to be distributed over the Continent of Europe by French syndicates.

The work of the Westinghouse Company is well known. The growth of the Walker Company marks a peculiar development in the manufacture of machinery in this country. At one time the shops in Cleveland were devoted to the manufacture of heavy machinery required by the operation of the street cable system. For a time the cable appeared to be the governing factor in traction systems for city use, but suddenly it was found electricity was destined to displace the cable, and the huge business built up by the company began to fade away. At this juncture the Walker Company leased the shops on advantageous terms and began manufacturing electrical machinery, and they were soon able to rival the older concerns. Naturally a young company pushing its way into the electrical field was sure to meet obstacles in the way of patents. The result is that the Walker Company has been in almost constant litigation with other electrical concerns. Of course, the new combination will end the costly and unfruitful litigation, which will result alone in the saving of a large sum each year. It will be remembered that, some time ago, the General Electric Company and the Westinghouse Company made an arrangement for operating on a pool basis as to the business done and as to the enjoyment of the patent rights, each licensing the other.

A 35·2-KNOT TORPEDO BOAT.

A cable dispatch says that the extraordinary record 40·8 miles an hour was made at the second trials of the torpedo boat destroyer "Hai Lung," just built at Elbing, Germany, by the Schichau works for the Chinese government. The runs were made in the open sea between the lighthouses at Pillau and Brüsterort, which are 19 knots apart. The wind was fresh (five by the scale) and there was considerable sea on. The "Hai Lung," according to the Kölnische Zeitung, traversed the course several times, the average time for the runs being 32 minutes 28 seconds, which gives a speed of 35·2 knots, or 68 kilometers, or 40·8 statute miles. This exceeds by far any speed heretofore made on the water, surpassing even the best performance of the "Turbinia."

A STATUE OF CHAMPLAIN.

The British and American Commissioners assisted, with the Governor-General, Lady Aberdeen, the Lieutenant-Governor of Quebec, officers of the U. S. S. "Marblehead," and officers of the British fleet and Canadian garrisons, at an interesting celebration at Quebec, on September 21. This was the unveiling of a beautiful monument to the memory of Samuel de Champlain, discoverer of Lake Champlain and founder, in 1608, of the city of Quebec. The monument is fifty feet high and cost $30,000. It is by the architect La Cardonnel, of Paris, and the heroic sized bronze of the navigator which surmounts it is by M. Chevre. The monument is on Dufferin Terrace overlooking the St. Lawrence River, and is a prominent object for miles around.