

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. 20 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 Monthly (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, New York.

NEW YORK, SATURDAY, APRIL 26, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RECONSTRUCTION OF WEST POINT ACADEMY.

The decision of the Military Committee of the House to favor the appropriation for new buildings and plants at West Point is a welcome evidence of the fact that Congress is at last awakening to the great value of that too-much-neglected institution. The elaborate plans for what is practically the rebuilding of the Academy have for some time been ready for active construction, and the three million dollars which, if everything proceeds favorably, will be available for the work, will clothe the beautiful and historical promontory on which West Point is located with a collection of buildings, which will not only form an admirable architectural group in themselves, but will adequately represent the national importance of the great military school.

Every well-wisher of his country will hail with positive delight this tardy appreciation of the claims of West Point. From the days of George Washington, who gave the initial impetus that led to the foundation of the Academy, throughout the first century of its existence, not merely has it failed to receive the encouragement from Congress which its importance and the splendid character of its work deserved, but it has been the subject of an indifference and neglect which posterity will find it extremely difficult to understand. Twice in the early period of its existence it was without graduates; in 1819 it was deprived of supplies of any kind whatever and was under the command, if you please, of a lieutenant; and in 1812 it was without either students or instructors, and remained in that condition some time thereafter. It was only the exigencies of the war of 1812 that saved it from extinction at the hands of the Secretary of War, who sought to strangle the already-enfeebled institution. Congress showed its hostility a few years later in an endeavor to extinguish the Academy altogether, and again it was the exigencies of war, in this case the war with Mexico, in which the graduates of West Point so greatly distinguished themselves, that prevented the closing of the institution. It is scarcely necessary to add that the great struggle of the civil war gave such indisputable proof of the value of West Point training as to insure the perpetuity of the Academy. Nevertheless, it is a fact that after the war Congress was so well leavened with men whose brilliant military records had been obtained in spite of the fact that they had no West Point advantages, that the hope of obtaining much-needed appropriations was destined to disappointment. However, now that Congress has decided to recognize the claims of the Academy, it is preparing to do so with no niggardly hand; and it is our conviction that generous as is the contemplated appropriation, it will ever be considered as among one of the most judicious and thoroughly merited distributions of the national funds ever made.

If the value to the nation of West Point needed any further demonstration, it is surely sufficient to point to the splendid service rendered by the officers of the Regular Army during and subsequent to the Spanish war. Had the entirely novel and extremely complicated problems that presented themselves with our acquisition of foreign possessions been left for their solution to the tender mercies of the political "carpet-bagger," the results in damage to our national prestige and in misery to our various new possessions would have been untold and irremediable. Fortunately, at the close of the war (in which the service of West Pointers was of that high character which the nation has always learned to expect and has invariably received), our Army officers displayed marked executive ability in the various, most complicated, and untried duties which presented themselves. The demonstration of West Point influence during the war, and in the solution of the problems which that war bequeathed to the nation, is an endorsement of our great military institution which, we venture to think, will insure for all time its generous treatment by Congress.

THE FLEETS OF THE WORLD.

The latest records of Lloyd's Register show that the fleet owned by the United States Steel Corporation has grown to such proportions that it now ranks as the fifth among the great steamship companies of the world. Considerably the largest of these is the Hamburg-American Company, which owns 134 vessels of an aggregate gross tonnage of 668,000 tons. The next largest is the North German Lloyd Company, whose 120 vessels aggregate 556,000 tons; the third company is the British Elder Dempster Company, which owns 153 vessels, aggregating 431,000 tons. Then follow the British India Steam Navigation Company with 122 vessels and 384,000 tons, and the United States Steel Corporation, with 113 vessels aggregating 343,517 tons. From the same source we gather that in point of total number of vessels owned and of their gross tonnage, the fleets of the United States stand second among those of the world. Great Britain and her Colonies, out of a total for the whole world (including countries possessing over one million tons of shipping) of 29,091 ships, aggregating 30,600,510 gross tons, possesses 10,869 with a total tonnage of 14,708,206 tons, one-seventh of which is composed of sailing ships. The United States owns 3,286 vessels with a gross tonnage of 3,077,344 tons, of which two-fifths are sailing vessels; and then follow Germany with 2,905,782, of which one-sixth are sailing vessels; Norway with 1,627,220 tons, one-half of which are sailing vessels; France with 1,406,833 tons, a quarter of which are sailing vessels, and Italy with 1,117,538, of which two-fifths are sailing vessels. While the lead shown by Great Britain is so great, strenuous efforts are being made by competing countries to reduce, by means of judicious subsidies, this great preponderance. Germany and France subsidize many of their lines heavily, and the policy has proved to be, particularly in the case of Germany, a wise one. The Ship Subsidy Bill now before Congress would very materially assist in the development of our merchant marine, discourage the purchase of foreign-built vessels and stimulate the shipbuilding industry on our own sea-coast. Contemplating the figures we have given above, there is much food for thought in the fact that about the year 1840, Great Britain possessed under 800 vessels whose aggregate registered tonnage was less than 150,000 tons, and that during this period the aggregate tonnage of the steamships owned by the United States was about 155,000 tons, or 5,000 tons more than that owned by Great Britain. That was in the days of wooden shipbuilding, and before the advent of steel, and more particularly before Bessemer steel, had given that wonderful impetus to British shipbuilding, the influence of which still enables her to maintain such a commanding lead.

THE COST OF AMMUNITION AT MANILA AND SANTIAGO.

An echo of the thrilling days of the Spanish war has recently been heard in a most interesting return made by Rear-Admiral O'Neil, Chief of the Bureau of Ordnance, U. S. N., in which he gives the total cost of ammunition in the decisive battles of Manila and Santiago. At Manila Bay the ships under Admiral Dewey fired at the Spanish ships and batteries at Cavite, \$50,045 worth of ammunition, a remarkably low figure if we consider the momentous effect which that conflict had upon the operations of the war at large, and the fact that it was mainly instrumental in bringing the valuable Philippine Islands within United States control. At the battle of Santiago, the main batteries of the United States vessels fired 1,300 shots, and the secondary batteries 8,174 shots; the cost of the ammunition being about \$80,000. The total cost of powder and projectiles of the naval operations in the Spanish war was only \$175,000. As we showed in a recent article in the SCIENTIFIC AMERICAN, the gunnery practice of the North Atlantic Squadron costs considerably more in a year than the whole cost of ammunition expended in either of the important battles of the campaign, and herein is clear evidence of the great importance attached to good gunnery in the United States Navy.

REPORT OF THE PRUSSIAN COMMISSION ON AMERICAN RAILROADS.

Some two years ago the Prussian government sent to this country a committee of experts to investigate the methods of construction, equipment and management followed by the railroads of the United States. The investigation was carried out chiefly on the Pennsylvania system, which was taken as being thoroughly characteristic of the best methods in vogue. The chief of the Prussian Ministry of Railroads has stated that much has been learned from this scientific study of railroad conditions which are so fundamentally different from those upon which the Prussian system has been slowly built up. With regard to locomotive construction, the commission were favorably impressed with the American plan of building to standard sizes and using interchangeable parts—a method which is being gradually adopted on German roads. On the question of freight and passenger cars, the minister stated that, while the

commission was favorably impressed with the large freight cars of from 40 to 60 tons capacity which are common in the United States, the existing traffic conditions were so different in Germany that such changes as were contemplated would have to be considerably modified to suit both the nature of the merchandise carried and the method of its distribution. The commission believed that while these huge cars were highly economical in the United States, where freight was moved in unbroken bulk over great distances, in Germany, where the total amount of freight and the bulk of each shipment is smaller, and the distances proportionately shorter, cars of 40 to 60 tons capacity would be out of proportion to the demands of traffic. This would be understood when it was borne in mind that, where a large number of small shipments have to be left at numberless local freight stations, it would be poor policy to drop a 40 or 60-ton car at a way station to unload a consignment of 8 or 10 tons of freight. At the same time, the standard 10-ton German freight car is to be advantageously replaced by double-truck cars of a maximum capacity of 30 tons. Enlargement beyond that limit would necessitate changes in track, platforms, and in the yard arrangements of mines, furnaces and other manufacturing plants that would be costly and generally inadvisable. It is probable that American practice in passenger cars will have less effect upon Prussian methods of the future than freight car practice is likely to have. The present model for long-distance service in Prussia is a vestibule car about 60 feet in length, which is divided into separate compartments and has a corridor extending along one side of the carriage. Although three standard Pullman American cars were brought to Germany for trial, and ran with great smoothness and absence of noise, they are not liked by the German public, who prefer their own system of smaller compartments with accommodations for six or eight passengers, in each of which a certain privacy, not obtainable in a Pullman car, can be secured. It is probable, therefore, that the Prussian state railways will continue to build their own type of standard passenger car and sleeper. The most popular type of the latter in Germany is divided into compartments, each containing an upper and lower berth and a separate wash bowl and water supply.

In the opinion of the German commission the American system of railroads is admirably adapted to the needs of a country like the United States, where vast distances are to be traveled, where there is the keenest competition between parallel and independent lines, and where the restrictions of caste do not exist. On the other hand, it is evidently considered that, in the main, the Prussian system, which has grown up through long years of development under state control, is pretty well suited to the needs of the German people. It has been slowly developed into an organization which pays over and above its operating expenses the entire interest on the Prussian debt, and also turns over an annual surplus of several millions to the public treasury. At the same time it must be remembered that the rates for freight and the first-class passenger fares are very high; the freight rates alone constituting a heavy handicap on agriculture and on many of the inland industries.

WIRELESS TELEGRAPHY AND THE PROMOTER.

There is one form of activity of our modern commercial life which, unfortunately, is as omnipresent as it is harmful and humiliating. We refer to that peculiar practice or calling, familiarly known as "promoting." Not that promoting is essentially an evil; for honestly conducted, and with a true regard for veracity, it is one of the most essential elements in the complex machinery of everyday commercial life. Without the promoter, indeed, many of the most valuable inventions would probably never have got beyond the theoretical stage, nor would our industrial development have reached its present marvelous proportions.

Unfortunately, the introduction of important inventions, and the securing of the necessary capital to exploit them, opens a lucrative field for the professional and none too scrupulous exploiter. So vast have been the fortunes realized from the great inventions of the past, such as the telegraph, the telephone, and the electric light, that the general public is strongly attracted, and properly so, to any invention which promises to have a wide field of application and to return generous profits to investors. It is unquestionable that there is a vast multitude of people, with a limited amount of money to invest, who, being naturally anxious to secure the very largest possible returns upon it, are powerfully attracted by any opportunity of acquiring interest in a new device that promises to be, to use the favorite term of promoting literature, "revolutionary" in the particular field that it covers; and it is upon the eager credulity of these people that the bogus promoter raises rich harvests of profit—for himself. We believe it may safely be said that the victims of this kind of fraud are rarely to be found among the people whose wealth entitles them to rank among the

capitalists; for the capitalist has his thoroughly trained experts at command, men who are retained at generous salaries for the express purpose of investigating schemes in which he is a prospective investor. Somebody once said that there is nothing so shy as a million of money, and nobody knows this better than the gentlemen who begin to scatter alluring prospectus literature broadcast, immediately upon the appearance of any well-authenticated invention that promises to catch the eye of the too-little informed and over-eager small investor.

The class of people who desire to get rich by "short-cut" methods has always been a large one, and it draws its recruits chiefly from the people of limited means who draw a weekly or monthly salary, and find it difficult to make the bank account cover the rather broad stretch of their social and other obligations. It is among this restless and over-eager class that the average promoter finds his most lucrative sphere of operations.

It is not so very many months ago that the SCIENTIFIC AMERICAN warned its readers against being led away by the exaggerated representations which were being made of the commercial possibilities of liquid air; and it seems now that on account of the brilliant accomplishments of Marconi, we are to have a revival of bogus promotion in its most objectionable and harmful forms. We do not for a moment question that wireless telegraphy has come to stay, and that it will play a most important part in the great world of telegraphic communication; but we are perfectly satisfied that it will by no means sweep out of existence the already established and most highly organized systems of communication by cable. Within the next few years we shall of course see powerful companies established for the legitimate exploitation of the new system, and no doubt there will be considerable profits accruing to those who have the good fortune to be associated with the properly organized corporations.

Unfortunately for the small investor, the prospectus fiend is already opening a vigorous campaign, and there are several concerns organized for the express purpose of relieving a more or less ignorant public of their money, by inducing them to invest, at anywhere from 75 cents to \$10 a share, in so-called wireless telegraph companies. The Editor has now before him a choice assortment of advertising literature, culled, most of it, from the daily press and current magazines, and much of it from pamphlets of the most alluring and up-to-date kind, which goes to prove that pure-minded philanthropy is not yet dead on the earth. There are corporations that are willing to take the public into their confidence, and for a nominal subscription of 75 cents a share are willing to let it reap the "golden harvest." Lest the reader should fail to grasp the magnitude of his opportunities, he is informed that within two or three days prices will be raised from 75 cents to a dollar; that the stock, in fact, will soon be selling in the open market at two, three, four or even twenty times its par value.

Now, there is no question but that ninety per cent of this literature is a tissue of lies, from its scare-head title page to its final announcement of the "make payable" address. And unless the public has learned well the lesson of the frauds which were perpetrated in connection with liquid air, the extraction of gold from sea water, and other famous prospectus swindles of the past few years, we much fear that there will be many an honest but foolish investor to whom the future mention of wireless telegraphy will come to have anything but pleasing suggestions.

RECENT MEETING OF THE NATIONAL ACADEMY OF SCIENCES IN WASHINGTON.

BY MARCUS BENJAMIN, PH.D.

The spring meeting of the National Academy of Sciences was held in the United States National Museum in Washington on April 15 to 18, with Dr. Alexander Agassiz presiding.

Prof. Henry F. Osborn, who holds the Da Costa chair of zoology in Columbia University, New York, was the first of the members to address the Academy, presenting a brief communication entitled Homoplasmy and Latent Homology. At the last meeting of the Academy the subject of Potential or Latent Homology was discussed, especially as bearing on the independent origin of certain bones of the skull and other parts of the skeleton, as well as upon the cusps of the teeth, particularly the grinding teeth. It was shown that structures which are ordinarily considered analogous by comparative anatomists have not been derived from each other, but arise independently in different groups of animals, and this presents an interesting question as to how far these structures are latent or potent in the ancestral forms which have given rise to these different groups.

A second paper by the same author, entitled Evidence that North America and Eurasia Constituted a Single Zoological Realm During the Mesozoic and Cenozoic, and that Correlations can be established as a

Basis for Uniformity of Geological Nomenclature, was then presented.

Prof. Edward W. Morley, of Adelbert College, Cleveland, Ohio, then read a paper on Determination of the Weight of the Vapor of Mercury at Temperatures Below 100 Degrees.

The next paper to be read was one on The Atomic Weight of Cesium, by Theodore W. Richards, who fills the chair of chemistry in Harvard University. He began with a general discussion of the subject of atomic weights, and then passed to a description of his work on cesium. The material on which the research was conducted came to him from Prof. Wells of Yale, and he established the fact that cesium was an element, that the material on which he worked was pure, and gave as his result 132.878. This figure he checked by similar determinations obtained by using the nitrate, from which salt he secured results that averaged 132.877.

James M. Crafts, formerly President of the Massachusetts Institute of Technology, Boston, presented a summary of his recent progress in the admirable researches made by him on Catalysis. He referred in opening to the old theory of solution and similar chemical processes, and then passed to the more recent beliefs of the new chemistry. Formerly it was claimed that life could only be produced from life, but results are now obtained by the action of enzymes on chemical compounds that were believed formerly to be due to vital force. He then described the special results obtained by him during the past year. These were highly technical, and not susceptible of condensation for popular presentation.

The Significance of Changing Atomic Volume was the title of a second paper by Theodore W. Richards, and was a brief presentation of the recent theory on the construction of matter advanced by this brilliant young chemist; his contention being that atoms in chemistry are compressible. This subject he has already presented before the American Academy of Arts and Sciences in two papers, entitled, The Possible Significance of Changing Atomic Volume, and The Probable Source of the Heat of Chemical Combination, and a New Atomic Hypothesis.

On Thursday afternoon Alexander Agassiz presented his two papers, both of which embodied results of his recent expedition to the South Pacific Ocean. The first paper was On the Coral Reefs of the Maldives, in which he described the formation of these islands as consisting of numerous atolls, contending that the theory of subsidence, advanced by Darwin, was not satisfactory as an explanation of their origin.

His second paper, On the Theory of the Formation of Coral Reefs, was a more elaborate presentation of the subject, and in it he argued that the rims of the atolls had first been elevated, and on these rims the sand had found a resting place, leaving lagoons in the center. He referred to his finding large nodules of manganese, which he believed to be of volcanic origin, and his contention was that the atolls, the rims of which were of limestone or of coral formation, had been raised up by volcanic action as they rested on a volcanic foundation. In closing he referred briefly to the vegetation on these islands, most of which he thought had been brought by the agency of man.

William Sellers, the well-known engineer, then presented a paper on The Compulsory Introduction of the French Metrical System into the United States. He made an exhaustive review of the metrical system and its various features. He also reviewed the bill now pending in Congress making its adoption compulsory by the manufacturers and the merchants of the United States. Mr. Sellers declared that he did not favor the proposed law, for the reason that he believed it would work a severe hardship and injury to the manufacturing concerns of the country, and would seriously affect trade. He declared that he could not see any advantage to be gained from the use of the system in lieu of those now in vogue in the United States, and that, to his mind, the only difference was one in the standard of measurement, from the inch to the centimeter, and from the yard to the meter.

The next paper was on Psychophysical Fatigue, by J. McKeen Cattell, of Columbia University, in which he described the measurements of fatigue of the senses, of the muscular system, and finally of the mind itself. He illustrated his paper by means of small diagrams, in which he showed, for instance, how the eye became tired on examining a piece of cardboard in which part of the surface is practically darkened.

Prof. Edward L. Nichols, of Cornell University, then presented a paper On Some Optical Properties of Asphalt. When a thin layer of asphalt varnish is spread upon glass and allowed to dry, and some luminous source, such as the filament of an incandescent lamp, is observed through the film, it is found that a considerable amount of red light is transmitted, the unusual purity of which is readily ascertained by means of a spectroscope. The suddenness with which the rays beyond the red are cut off indicates the existence of a well-defined absorption band with a very steep gradient on the side toward the greater wave-lengths;

and one would expect to find a considerable degree of perviousness in the infra-red and anomalous dispersion in the region where the change from transparency to opacity occurs. The purpose of his paper was to describe his studies in this direction, concerning which nothing appears to have been previously published. The paper in full will appear in the Physical Review for April, 1902.

The public session on Thursday began with the presentation by Charles S. Minot of a paper descriptive of The Physiological Station on Monte Rosa, by Henry P. Bowditch. It consisted largely of lantern slides taken at high altitudes, showing the construction of this new enterprise established in the Italian Alps under the direction of Italian scientists, but which, it was hoped, would pass under the care of an international committee of scientific men. The paper was a special plea for its recognition by the National Academy of Sciences. The lantern slides of the Alpine peaks were especially interesting, and received the well-merited applause of the Academy.

Charles S. Peirce followed with three papers, entitled, The Classification of the Sciences, The Postulates of Geometry, and the Color System, which, however, were read only by title.

The meeting was then practically turned over to the astronomers, and brief abstracts were presented by Asaph Hall of a paper on The Disintegration of Comets, followed by one of Ira Ibsen Sterner, entitled A New Computation of the Co-efficients of Precession and Nutation. Prof. Edward C. Pickering, of Harvard Observatory, presented briefly The Distribution of the Stars and The Variability in Light of Eros, both of which were highly technical, and were illustrated by means of mathematical formulas, which cannot here be produced. Several papers biographical in character were then read.

In the evening Prof. Charles F. Chandler, of Columbia University, delivered a lecture on The Electro-Chemical Industries at Niagara, in honor of the Academy. In that brilliant way, so familiar to those who have been so fortunate as to study under him, Dr. Chandler held an audience almost spell-bound for nearly two hours, during which he described the marvels of chemistry and the splendid results obtained at Niagara Falls by the application of electricity to chemical compounds. The tearing apart of the molecule of common salt, resulting in the formation of caustic soda and bleaching powder, which has come about from the inventions of his pupil, Hamilton Y. Castner, whom he described as a natural-born genius, were strikingly set forth, as well as the original invention of Castner, by means of which the aluminium industry was created.

SCIENCE NOTES.

William Flinders Petrie, the distinguished Egyptologist, in an address to the supporters of the Egypt Exploration Fund, said that they had completed the most important historical work that had yet come into their hands, settling, in a manner which had hitherto seemed beyond hope, the very foundations of Egyptian history, says the Sun. No such complete materialization of history had been obtained by one stroke in any other country or age. He detailed the discoveries of the gold scepter of Nena, the founder of the Egyptian monarchy, gold vases and jewels of the same period, twenty engraved tablets and dozens of fragments of tablets, and 100 inscriptions on vases, giving more information of dynasties ruling 6,600 years ago than is known regarding half the Saxon Kings of England. The discoveries were all made in the neighborhood of Abydos, in ground abandoned as exhausted. The next work would be done on the site of the Temple of Osiris at Abydos, which was probably the burial place of the head of Osiris, which drew around it the burials of historic times and probably those of the earliest dynasties also.

Two-thirds of all the letters which pass through the post offices of the world are written by and sent to people who speak English, says Bradstreet's. There are substantially 500,000,000 persons speaking colloquially one or other of the ten or twelve chief modern languages, and of these about 25 per cent, or 125,000,000 persons, speak English. About 90,000,000 speak Russian, 75,000,000 German, 55,000,000 French, 45,000,000 Spanish, 35,000,000 Italian and 12,000,000 Portuguese, and the balance Hungarian, Dutch, Polish, Flemish, Bohemian, Gaelic, Roumanian, Swedish, Finnish, Danish and Norwegian. Thus, while only one-quarter of those who employ the facilities of the postal departments of civilized governments speak as their native tongue English, two-thirds of those who correspond do so in the English language. There are, for instance, more than 20,000 post offices in India, the business of which in letters and papers aggregates more than 300,000,000 a year, and the business of these offices is done chiefly in English, though of India's total population, which is nearly 300,000,000 fewer than 300,000 persons either speak or understand English.