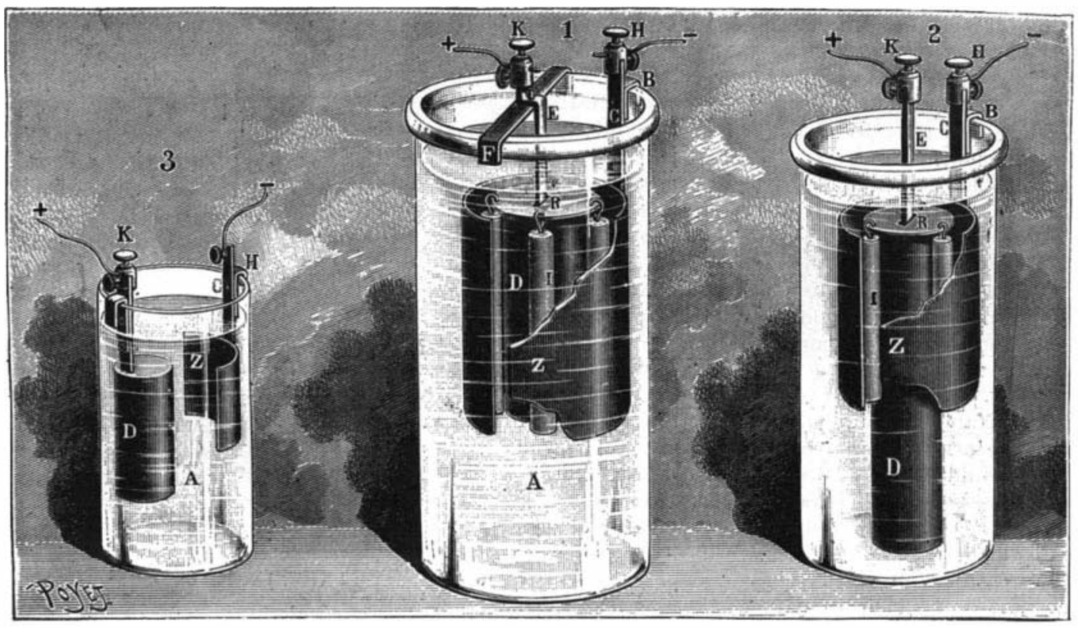
OXIDE OF COPPER BATTERIES.

The De Lalande oxide of copper battery, which is well known to electricians, is now widely used, and more than five hundred thousand elements have already been employed. This battery, in fact, does not wear away in open circuit and uses the products only in proportion to the energy furnished. It has, moreover, the advantage of giving a constant intensity.

The last styles of this battery contained a zinc electrode forming the negative pole, a disk of agglomerate of oxide of copper forming the positive one, and a 30 or 40 per cent solution of potassa. The generating reaction of the current is as follows: When the circuit of the battery is closed the water is decomposed. The oxygen proceeds to the zinc, which combines with the potash to form a very soluble zincate of the latter, while the hydrogen reduces the oxide of copper to the metallic state.

M. De Lalande, without changing the constituent elements of his batteries, has just introduced a certain number of improvements into their practical arrangements and a few simplifications that reduce the net cost. The oxide of copper is now placed in cylindrical boxes of perforated sheet iron and surrounded with a porous material of very feeble resistance. In this way deposits of copper upon the zinc are avoided. A few new arrangements have likewise been introduced into the form of the zinc. One of the principal peculiarities is the method of dissolving the potash. This product, placed in tin boxes, is, when the battery is in use, suspended from the top of vessels filled with water. The water enters these boxes, which are provided with a perforated bottom, and very quickly dissolves the caustic product. The result is the formation of a thick solution which falls to the bottom of the vessel. The liquid is then mixed and the pile is ready to operate.



NEW ARRANGEMENTS OF THE DE LALANDE OXIDE OF COPPER BATTERY.

The new arrangements adopted are shown in the accompanying engraving, which is reproduced from La Nature. In No. 3 is represented a small sized element of which the total height is 8 inches and the diameter 4. This style is capable of furnishing 75 amperes-hour. Its e. m. f. is 0·8 volt and the normal intensity is one ampere, but it is capable of giving from 2 to 3 amperes upon very feeble resistances. The zinc, Z, is suspended by a hook, H, from the edge of a vessel opposite the oxide of copper cylinder, D.

The style shown in No. 1 is the largest size. Its height is 14 inches and its diameter 7. It is capable of furnishing 600 amperes-hour at an intensity of from 5 to 6 amperes, and even a discharge of from 15 to 20 amperes. The zinc cylinder, Z, is suspended from the edge of the vessel, A, by a hook, B, and is provided with a strip, C, carrying a terminal, H. In the center there is an oxide of copper cylinder held at a distance from the zinc one by four porcelain insulators, I. The zinc cylinder is connected with a strip, E, which rests through an elbow upon a cross piece, F, and carries a terminal, K.

The medium sized battery represented in No. 2 has sensibly the same arrangements. The oxide of copper cylinder, D, rests here upon the bottom of the vessel. This element, which is 13 inches in height and 6 in diameter, has a capacity of 300 amperes-hour and is capable of furnishing from 3 to 4 amperes in a normal operation.

Such are the new arrangements of the De Lalande battery, in which the drawback to the use of potassa is greatly diminished by the recent improvements. It remains the sole type of a primary battery of large discharge that does not wear away in open circuit. All the parts are so calculated as to wear away at the same time.

This battery is much employed for actuating induction coils and for the ignition of gas and gasoline motors. One battery will actuate for a year an induction coil operating ten hours a day. It likewise renders great services in all cases where there is needed a source of feeble electric energy for constant or intermittent use.

AN ANCIENT CACTUS HEDGE.

BY C. F. HOLDER.

When, in 1771, the Spanish explorer Potola made his overland march from San Diego to Monterey, he determined to found a mission in the San Gabriel Valley. Despite the threatened hostility of the natives of the Indian village Sibanga, the mission of San Gabriel the Archangel was established in August of that year by Padres Cambon and Somero with a guard of twenty-one men.

This mission rapidly increased in wealth; but, the mission building being injured by an earthquake, it was deserted and replaced by another on a different location in about 1775. The mission became a power in the land and one of the most interesting in the remarkable ecclesiastical chain which tells the story of Spanish courage in this country.

It is interesting to note how the early Spaniards utilized the material of the country. One of the most striking instances is the old tuna hedge or fence which in early days entirely surrounded the San Gabriel Mission property, portions of which are intact to-day, and form a striking feature of the landscape in the vicinity. The hedge was planted by Father José Maria Zalvidea in 1806. The grounds of the mission embraced hundreds of acres, and owing to the hostility of the Indians, it was necessary to fence them in. Timber was very scarce, the only available material being the fine oak forest in which the mission was built, which gradually disappeared, probably as fire wood. Other timber was to be found only in the mountains, seven, eight or ten miles distant. Zalvidea had noticed the tuna, or Cactus opuntia, growing in great masses all over the country, saw that it was impenetrable and that its fruit was eaten by the natives; so he ordered the latter to collect and plant the cactus along the boundaries of the mission property. The opiny plant grew rapidly, and in a few years was an impenetrable chevaux de frise, a perfect fence and barrier which the domestic animals could not pass nor an invading foe easily cut down. To-day the remnant of the great hedge constitutes one of the historical points of interest in the San Gabriel Valley and is visited by hundreds yearly.

The accompanying illustration shows several hundred yards of the old fence. Its height ranges from 6 to 10 feet, and it was probably higher when cared for by the natives of the mission. The original fence was undoubtedly several miles in extent, but has been broken by the passage of roads and streets, the disconnected portions being widely scattered but still vigorous, telling a most interesting story of the energy of the early settlers of the region. This cactus is one of the most economical hedges on a cattle range.


ANCIENT HEDGE IN CALIFORNIA.

In this connection it is interesting to note the plants which are utilized in this way. The spiked leaves of the century plant are often employed. The plants are placed 4 or 5 feet apart, the leaves soon meeting and forming a hedge which is almost impossible to penetrate without serious injury. The name of this agave is a misnomer, especially in California, where it blossoms in from ten to twelve years, then dying down, the leaves falling away on all sides, deprived of life and vigor to supply the rapidly growing flower stalk.

In strange contrast to these warlike fences in California are the hedges of flowers found in the cities and towns. Thus one of the commonest hedge plants is the calla lily, which grows with the pertinacity of a weed and forms a beautiful hedge when in bloom. Geraniums and heliotropes are alone employed for this purpose. A fence or hedge of the latter on the island of Santa Catalina is nearly 5 feet in height, with woody matter sufficient to make it of value beyond a mere ornament.

Rose hedges of the rarest climbing roses are common everywhere in Southern California, those of the Cherokee and Gold of Ophir roses being especially beautiful when in bloom, the latter forming solid masses of color; while the Cherokee, with its broad-petaled white blossoms, presents a striking contrast against the glossy dark green of the leaves. The old tuna hedge will, in all probability, soon disappear. The gradual increase of population, the building of towns, will necessitate its removal, and thus one of the interesting landmarks of the country will have passed away.

The Identification of Our Soldiers.

A new plan has been adopted for identifying the men in the regular and volunteer United States armies who may go into action. They will wear around their necks little tags of aluminum, by which they may be identified if found on the field of battle. In the last war it was often impossible to properly identify the dead soldiers, and thousands were buried in graves marked "unidentified." The War Department has prepared this system of identification, and each tag will bear the numeral assigned each man on the muster rolls, with the letter of his company, battery or troop and his regiment.

IT takes 72,000 tons of paper to make the post-cards used in England each year.

The National Academy of Sciences.

BY MARCUS BENJAMIN, PH.D.

Notwithstanding the rumors of war and the hurrying of soldiers through our capital city, there was gathered two weeks ago a group of men who, in a quiet room of the beautiful Congressional Library building, in Washington, found time to discuss the various problems of their favorite sciences.

In this connection it is interesting to recall that just thirty-five years ago—on March 4, 1863—the National Academy was created. At that time Alexander Dallas Bache was superintendent of the Coast Survey and Joseph Henry secretary of the Smithsonian Institution. To these men and their associates was referred the very many propositions requiring a scientific solution that were submitted to the government. Finding that such work consumed so much of their time, a bill was introduced into Congress organizing the academy, whose function should be to act as adviser to the government on scientific matters.

The most important work of this character that it has been called upon to take up in recent years has been that of the forest reservations, and it will be remembered that, nearly two years ago, at the solicitation of the Secretary of the Interior, a National Forestry Commission was appointed by the academy to visit different parts of the United States and recommend that reservations of proper forest lands be made.

The stated session of the National Academy is fixed for the third Tuesday in April, and this year, as in years gone by, the academy met in Washington on April 19. Owing to the repairs that were being made in the National Museum, the lecture room in that building could not be procured, and so a meeting place was found in the library.

The scientific sessions, which are open to the public, are usually held after luncheon, and it is at such sessions that the scientific papers are read. A programme of twenty papers was presented at this meeting. Of these, three were by Alexander Agassiz, the director of the Museum of Comparative Zoology, in Cambridge. Dr. Agassiz has spent considerable time during the last year studying the coral reefs of the Pacific, and the results of his studies were given in a paper on "The Coral Reefs of Fiji," by himself, and two others, one in association with Mr. W. McM. Woodworth, on "The Fiji Bololo," and the other with Mr. A. G. Mayer, on "The Acalephs of Fiji."

Dr. John S. Billings, the director of the New York Public Library, found time from his arduous duties in connection with the supervision of the great libraries now under his charge to present a paper on "The Variation in Virulence of the Colon Bacillus," which is in continuation of the scientific studies that he pursued so long and ably while connected with the Army Medical Museum, in Washington, for so many years.

Dr. Theodore Gill, who presided over the meeting of the American Association for the Advancement of Science last summer, presented to the academy a biographical memoir of his lifelong friend Edward D. Cope, who had died since the last meeting of the academy.

Prof. Alpheus Hyatt, of the Massachusetts Institute of Technology, read a technical paper on "New Classification of Nautiloidea," which had to do with mollusks of the nautilus family.

Prof. Albert A. Michelson, of the University of Chicago, was present and described "A New Spectroscope." His researches on light are continued, notwithstanding the fact that his time is largely occupied with the duties of the chair of physics in the great university with which he is connected.

Prof. Ira Remsen, who is not only secretary of the academy, but also fills the chair of chemistry in Johns Hopkins University, presented four papers descriptive of work done under his direction in the Johns Hopkins laboratory. The first of these was "On Double Halides containing Organic Bases;" another was in association with Mr. E. E. Reid, "On the Hydrolysis of Acid Amides;" still another, in association with Mr. W. A. Jones, was on "The Question of the Existence of Active Oxygen;" while finally, with Mr. J. W. Lawson, he presented the result of studies "On the Product Formed by the Action of Benzenesulphonchloride on Urea."

The Johns Hopkins University was also represented by Prof. W. K. Brooks, who is connected with the natural history department of the university. His paper bore the title of "McCrady's Gymnophthalmata of Charleston Harbor," and was descriptive of certain kinds of jelly fishes.

Dr. Carl Barus, who fills the chair of physics in Brown University, presented two papers on his specialty before the academy. They bore the titles of "Ballistic Galvanometry with a Countertwisted Torsion System" and "A Curious Inversion in the Wave Mechanism of the Electromagnetic Theory of Light."

Among the representatives of the faculty of Yale University was Dr. Charles S. Hastings, who brought forward a paper entitled "A Consideration of the Conditions Governing Apparatus for Astronomical Photography." His associate in New Haven, Prof. Arthur W. Wright, described "A Method for Obtaining a Photographic Record of Absorption Spectra."

Among the astronomical papers was one on "Theories of Latitude Variation," by Mr. H. Y. Benedict, who was presented by Prof. Asa Hall, the distinguished discoverer of the moons of Mars.

Of similar character was that "On the Variation of Latitude and the Aberration Constant," by Charles L. Doolittle, who, not being a member of the academy, was introduced by Dr. Seth C. Chandler.

Another paper of an astronomical character was one by Mr. E. W. Brown on the "Progress in the New Theory of the Moon's Motion." Mr. Brown was introduced by Prof. Simon Newcomb, formerly of the United States Naval Observatory.

An exceedingly interesting paper on "The Use of Graphic Methods in Questions of Disputed Authorship, with an Application to the Shakespeare-Bacon Controversy," was read by Prof. Thomas C. Mendenhall, of the Worcester Polytechnic Institute. This was essentially a report of progress in which Prof. Mendenhall discussed his studies of the writings of Shakespeare by means of curves which showed the number of letters contained in words, and the corresponding proportion of words of a given number of letters in the writings of each of the persons mentioned.

Of less popular interest, although perhaps of more personal interest, was the election of new members to the academy. The election of foreign associates was first considered, and that honor was conferred upon the following:

Prof. Poincare, whose name is well known among mathematicians the world over; Prof. David Gill, the astronomer in charge of the observatory at Cape Town, Africa; Lord Rayleigh, the eminent English physicist; Lord Lister, the physiologist; Prof. Edward von Suess, the Vienna geologist; Prof. H. de Lacaze-Dutheirs, the Parisian zoologist; Prof. Strasburger, the great German botanist; Prof. H. Klein, of the University of Göttingen, Germany; Prof. Henri Moissan, the great chemist of Paris; and Prof. Karl von Zittel, the distinguished paleontologist of Munich, Germany. The election of the foreign associates was followed by the election of a treasurer for the academy, Dr. Billings having resigned on account of his removal from Washington. Mr. Charles D. Walcott, director of the United States Geological Survey, was elected in his place for a term of six years. All of the present members of the council were re-elected for the coming year. They are: J. S. Billings, H. P. Bowditch, G. J. Brush, A. Hague, O. C. Marsh and S. Newcomb. The officers of the academy are members of the council ex-officio.

It is very much to be regretted that the academy were unable to decide upon any of the numerous candidates that were presented before them for election. The membership in recent years has met with serious losses owing to the death of many of the early members, so that to-day Dr. Walcott Gibbs, president of the academy, the venerable James Hall, Prof. J. P. Lesley, director of the State Geological Survey of Pennsylvania, and Fairman Rogers, are the only surviving original members. That such eminent scientists as David A. Wells and Edward Atkinson among economists, David Starr Jordan and Henry F. Osborn among naturalists, Daniel G. Brinton and Franz Boas among ethnologists, and William Harkness and James E. Keeler among astronomers, are not admitted to the academy is a most unfortunate fact.

The death of Prof. William A. Rogers, of Colby University, was announced to the members, and the autumnal meeting of the academy was recommended by the council to be held in New Haven, Conn.

The Audibility of Thunder.

While lightning may be seen and its illumination of clouds and mist may be recognized when it is even 200 miles distant, thunder is rarely audible more than ten miles. The thunder from very distant storms, therefore, seldom reaches the ear, says Industries and Iron. The reason of the great uncertainty in the audibility of thunder is not difficult to understand. It depends not merely on the initial intensity of the crash, but quite as much on the surroundings of the observer, even as in the quiet country one will observe feeble sounds that escape the ear in a noisy city. Perhaps the most curious and important condition of audibility is that the thunder wave of sound shall not be refracted or reflected by the layers of warm and cold air between the observer and the lightning or by the layers of wind, swift above and slow below, so as to entirely pass over or around the observer. Sound, in its wavelike progress obliquely through layers of air of different densities, is subject to refraction, and this refraction may occur at any time and place. Thus, observers at the topmast of a ship frequently hear fog whistles that are inaudible at sea level; those on hilltops hear thunder that cannot be heard in the valley; those in front of an obstacle hear sounds inaudible to those behind it. The rolling of thunder, like that of a distant cannonade, may be largely due to special reflections and refractions of sound. Again, the greater velocity of the air at considerable altitude above the ground distorts the sound wave and shortens the limit of audibility to the leeward, while increasing it to the windward.

Miscellaneous Notes and Receipts.

Production of Lac-varnish.—The alcoholic solutions of shellac and other resins are known to be decomposed into various constituents by the addition of water, a part separating as precipitate. In order to accelerate the separation of the precipitate, an acid may be added to the alcoholic resin solution mixed with water. According to a German patent, this precipitate is filtered off from the solution and dissolved in benzine, benzole, etc.; this solution represents the varnish. The lac-varnish prepared in this manner possesses the advantage of giving a rather dull surface after drying, and is therefore especially adapted for the production of washable wall paper.—Chemische Revue.

In the production of extremely thin leaflets of metal, the gold beaters generally subject the gold to hammering between two sheets of parchment. But with this treatment there is a limit as regards the thickness of the leaflets, since the mechanical production requires a certain resistibility of the object. In order to produce very fine leaves, the galvanoplastic process is now employed. A very thin plate of smoothly polished copper is immersed in a suitably prepared bath, from which, on closing the current, gold is precipitated on the copper. To remove the copper the double leaf of metal is immersed in a solution of chloride of iron, which loosens the copper completely, but leaves the gold leaf, which has a thickness of one ten-thousandth of a millimeter, untouched.—Die Mappe.

Graphite as a Lubricant.—The use of graphite as a lubricant is now recommended even by the organ of the Prussian steam boiler inspection society. An important condition, however, is that the graphite must not only be free from all hard foreign bodies, such as quartz, but also be in the shape of flakes, which cling to the rough surface of the metal and fill up all irregularities left in the manufacturing. Such graphite, if used alone, is, according to recent experiments, three times as effective as the best mineral sperm oil, and in the case of simultaneous employment of a like quantity of lubricating oil, six times as efficacious. According to the Hannov. Gewerbeblatt, Prof. Kingsburg is said to have found that while heavy mineral oils showed a coefficient of friction of 0·14, the same volumes of oil with graphite had one of only 0·07. In the necessary flocculent form, which is the product of a doubtless expensive chemical treatment, graphite is at present only placed upon the market from two places, viz., from Ceylon and from Ticonderoga, in the State of New York.

Something New Regarding the Potato.—One would imagine that science could not furnish us with anything new in our daily foods, but it is a remarkable fact that our food potato has not been sufficiently examined from a scientific standpoint, while greater attention has been paid to the varieties of potatoes employed for industrial uses.

The French chemist Balland has striven to fill this void in an essay presented to the Paris Academy of Sciences, divulging many interesting characteristics of the potato used for food. Aside from the skin, which only represents a small fraction of the total weight, the potato consists of three layers, well distinguishable with the naked eye if a thin slice is held against the light. Still more distinctly these three layers become visible if photographed with the Roentgen rays. The strata are of different thicknesses, which decrease toward the interior. The outermost layer contains comparatively the most starch, but less nitrogenous substances; with the innermost layer the proportion is just the reverse. The middle layer has a mean composition between the two others. The skin layer is the driest, while the inside marrow contains considerably more water. On an average a potato contains three-quarters of its weight of water, two-tenths of starch and one-fiftieth of nitrogenous matters. Balland has discovered the important fact that the food value of the potato is so much greater, the more nitrogenous substances it contains, and so much smaller, the richer it is in starch. In the best table potatoes the proportion between nitrogenous matters and starch attains three times as high a value as with the food potatoes of the lowest quality. Hence the value of a potato can be ascertained by a chemical analysis; but it so happens that the food value of different varieties of potatoes can be judged according to their behavior when boiled. We all know that some potatoes swell up in hot water, cracking in certain places and even breaking apart, while others retain their original shape, even when well done. It was supposed, formerly, that the cracking or breaking apart of potatoes was indicative of an especially large percentage of starch, the starch swelling up and breaking the skin According to the latest investigations this is erroneous, the percentage of albumen being responsible. If a potato is comparatively rich in this substance, it will keep its shape on boiling; a cracking and falling apart indicates a deficiency of albumen. The potatoes containing most albumen being the most nutritious, everybody can determine the worth of a potato by boiling it. The best varieties are those which do not fall apart, but remain whole, on cooking.—Staats Zeitung.