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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.

AN UNPARALLELED VICTORY.

When Japan boldly threw down the gauntlet to Russia, the world wondered at her daring; Russia was the "Colossus of the North"; Japan, the youngest of the nations to be born into our modern civilization, had not yet reached the dignity even of comparison with the mighty Muscovite empire. By sea and by land Russia overtopped Japan on every point of comparison. Hers was the third most powerful navy of the world, with half a million tons of fighting ships to command, and the unlimited resources of the empire to back it. Japan's little navy, on the other hand, had but just graduated into recognition. Although the foretaste which she had given of her quality in the Chinese war led us to expect that Japan would make a creditable effort, the best that we expected from her was that she would ultimately go down to defeat, everything lost but the honor of having fought a brave but hopeless campaign.

So the world thought and spoke, as the curtain was being rung up for the opening scene of the naval war. To-day, after eighteen months of the fiercest and most bloody fighting of modern times, the curtain has been run down upon the final act. In that brief interval, we have seen the third greatest navy of the world literally and absolutely swept out of existence, and this by a modest little navy that finds itself at the close of the war as strong in material and stronger in efficiency than at its beginning.

If Japan had won out with the loss of half her fleets, and the battered remnants had limped home in a condition of absolute exhaustion, it would have been a feat equaled but not surpassed in naval history.

But that she should have absolutely annihilated, in pitched battles upon the high seas, two successive fleets of the enemy, and have sunk, driven ashore, or otherwise put out of action fourteen battleships, twelve other armored vessels, and a dozen protected cruisers, without any diminution of her own fighting strength, is a feat for which naval history can find no parallel. That her navy is intact cannot be disputed; for her captures and new construction during the war about offset her losses.

Wherein are we to look for an explanation? Certainly not to any disparity in the materials of war, for the ships, engines, guns, and armor of the Russian navy were the best that the leading shipyards and gun factories of Europe and America could turn out. Nor was the distance of the seat of war from Russia's home ports so serious a handicap as might be supposed; for at no time did Japan make any serious effort to prevent the sending of re-enforcements and supplies. In the case of the Baltic fleet, she evidently encouraged its advance, feeling assured that every ship that entered the immediate zone of war was one ship lost to Russia.

Nor can the result be set down to cowardice. The Russian is no coward. He gives place to none in his ability to fight a losing battle to the bitter end. This was abundantly proved in the battle of the Sea of Japan; for the stories of the eye witnesses on both sides agree that the Russians fought with the grim energy of despair.

The explanation of the result is to be found first and last in the Japanese people themselves—in certain excellent traits of their character, many of which are due to a system of ethics that is older than our western civilization. Among these may be mentioned: Intense patriotism; self denial; scrupulous honor in all matters affecting the welfare of the State; a keen sense of duty; strict discipline; unquestioning obedience to authority; absolute unity of purpose; a firm belief in the destiny of their race; patience and endurance; an absence of self consciousness and posing, that may well put our "white" civilization to the blush; a close attention to detail; and lastly, a combination of great prudence and forethought with a marked ability to adapt themselves quickly to the circumstances of the hour.

It was a foregone conclusion that a people such as this, being naturally born to a seafaring life, would render a splendid account of themselves in the stress of a naval war. The ships were maintained in a high state of efficiency, and they were perfectly familiar to officers and men; the fleets were accustomed to maneuver in fighting formations; the marksmanship, judging from this last fight, was excellent; and lastly, the whole series of operations was controlled by an admiral who must be admitted to possess the highest qualities of his profession in the highest degree.

ELECTRICITY AS A STIMULANT TO PLANT GROWTH.

The flora of the north polar region is remarkable for rapid growth, fertility, and brilliancy of coloring, phenomena which seem incompatible with the climate. For the Arctic summer, though nightless, is very short, the sun is low, and its rays are often intercepted by fog and clouds, so that it cannot furnish an amount of light and heat favorable to very rapid growth.

The investigations of Prof. Lemstrom, of Helsingfors, and others, tend to show that electricity exerts a great influence on the growth of plants, and this view is confirmed by the luxuriant vegetation of the zone of action of that violent electrical manifestation, the aurora borealis. Furthermore, a close connection has been found, in Finland, between fruitfulness and frequency of auroras. Finally, Lemstrom was led to attribute to the sharp points of plants, such as the beard of grains, the function of "lightning rods," which collect atmospheric electricity and facilitate the exchange of the charges of the air and the ground.

Thereupon he proceeded to submit the suspected effect of electricity upon vegetable growth to the test of experiment, beginning in 1885 with a number of flower pots containing similar soil and seed. Some of the pots were subjected to the action of an influence or inductive statical electric machine, one pole of which was connected with the soil in the pot, and the other with a wire netting stretched over it. The other pots were left to nature. The electric machine was driven several hours daily. Within a week the electrified plants showed a more vigorous growth than the others, and in eight weeks the disparity in weight, of grain and straw alike, amounted to forty per cent. This favorable result suggested a field experiment with barley, in which an increase of 37 per cent was obtained by electrification. In the following year the experiments were extended to various plants. The results were contradictory in some respects, and showed that the advantage derivable from electroculture depends also upon other factors, such as temperature, moisture of air and soil, and the natural fertility and the manuring of the latter. The supply of water proved to be of especial importance. Extensive experiments with potatoes, carrots, and celery showed increases in crop of from 30 to 70 per cent. Potted strawberry plants, in the greenhouse, produced ripe fruit, under electrical influence, in half the usual time. Small differences, possibly due to extraneous causes, appeared when the direction of the current was reversed. Other field experiments gave increases of 45, 55, occasionally 85 per cent for grain, and 95 per cent for raspberries, while cabbage, tobacco, flax, turnips, and peas grew better without electrification than with it.

Then Lemstrom, in order to test the effect of climate on electro-culture, transferred his experiments from Finland to Burgundy, where he found his earlier observations confirmed, particularly in regard to the great influence of irrigation. He concluded that the more vigorous growth induced by electricity must be sustained by a rapid ingestion of food, that is to say —a rich soil being presupposed—by an abundant supply of water. With copious watering peas, which in the earlier experiments had reacted unfavorably to electrification, now showed a difference of 75 per cent in favor of the electrified plants, carrots gave an increase of 125 per cent, and sugar beets augmented their percentage of sugar by 15 per cent. The experiments in Burgundy also confirmed the importance of the character of the soil. The richer the soil, the greater is the advantage of electrical culture, which is quite useless in very poor ground. Hence, the Sahara cannot be converted into a garden by electro-culture.

In 1888 Lemstrom's experiments ceased for a time, but other investigators attacked the problem from a different side, endeavoring to affect by electrification, not the growing plant, but the seed. The Russian botanist, Spechniew, submitted grain to electrical action, and thought that it sprouted earlier and more vigorously than grain not so treated. Pautens, who in 1894 repeated Spechniew's experiments on a larger scale, came to the conclusion that electricity had no effect on dry seeds, but that it promised excellent results when applied in connection with moisture—which in itself promotes germination. The same conclusion was reached by Kermey, who in 1897 electrified grain strewn on moist sand in a glass cylinder through which it could be observed. The metal top and bottom of the cylinder were connected to the poles of a galvanic battery.

But while electrical treatment of dry grain is comparatively simple and cheap, electrification during germination is even more difficult and costly than the application of electroculture to the growing plant. Grandeau and Leclerq, therefore, returned to the latter method, but, instead of using an artificial source, they studied the effect of atmospheric electricity by covering part of a field with wire netting. The uncovered plants showed an increase of 50 or 60 per cent in growth and fruitfulness over the plants which were shielded by the netting from natural electrical action.

In 1898 Lemstrom resumed his experiments with the aid of an improved electrical machine and distributing apparatus. Again he observed remarkable increases of crop—with tobacco 40, potatoes 50, peas 56, sugar beets 40, carrots 37, grain 25 to 30 per cent. Spechniew and Bertholon obtained similar results.

As it is not practicable to cover fields with electrified nets, and as the influence of atmospheric electricity had been proved, Lagrange and Paulins have recently sought to increase the supply of the latter by setting among the plants galvanized iron rods to serve as conductors, and have thus obtained great increase in crops. This, as well as other methods of electroculture, is probably too expensive to be applied to ordinary field crops.

But in the cultivation of fruits and vegetables, particularly under glass, the economic conditions are very different. For, as electroculture promises not only greater, but also earlier crops, which command high prices, its introduction would secure to local gardeners large sums which now go to the South and would, at the same time, benefit consumers by reducing prices somewhat, though leaving them still remunerative. Floriculture offers another promising field for the application of electrical methods.

All this, however, belongs to the future. Much study and experiment and probably many failures must precede the general introduction of electroculture, though the results already obtained are certainly promising.

In what way is the growth of plants affected by electricity? Plants transform the energy of the sun's rays into chemical energy. Though the heat produced by the electric current may have some direct effect, especially in germination, the electrical energy supplied cannot, in general, replace or even greatly reinforce the energy of sunshine. It is rather to be regarded as a stimulus to metabolism and all the vital processes. One of these is the capillary elevation of water, which is promoted by a positive electric current flowing upward. This is one possible explanation of the promotion of growth by electricity, and though in some cases the best effect is obtained by directing the positive current downward, or in the opposite direction to the assumed principal flow of sap, these exceptions may mean that more food is supplied by the leaves than is commonly supposed. Another possibility is an increase in activity in both leaves and roots. The electrical influence on the flow of sap, however, appears to be proved by the fact that electroculture is beneficial only in connection with an abundant supply of water. According to Kermey, there is also an electrolysis of water within the plant, and further experiment may prove the existence of other electrical actions.

SOMETHING NEW ABOUT THE VOCAL MECHANISM.

To a recent issue of the British Medical Journal (No. 2308) Major R. F. E. Austin, of Imtarfa, Malta, contributed a very interesting paper on commonly overlooked factors in vocal mechanism, in which he asserts that the universal idea that all of us naturally possess either a good, bad, or indifferent voice is wrong, and contends that Nature is directly responsible for one, and one only, of these conditions and that the others must be attributed to man's unconscious departure from Nature's laws. It will be news to many that by far the greater number of us do not possess full control of the adductor muscles of the cords, and are therefore unable to place and keep the cords in the most appropriate position quickly. The author states that it is surprising what a number of professional voice users, as well as amateurs, fail in this respect. According to his thinking, the majority of voices are lost, not from overwork, but as a result of improper emission.

Major Austin contends that, in order to obtain quickly the thorough control of any muscles or set of muscles, they should be developed by brisk movements, which fully contract them. In the case of the adductor muscles of the cords, this can only be done by using the voice in a most inartistic although physiological manner. That is to say, words should be sung or spoken quickly in acute penetrating tones ("pat-a-wat-quack" being given as an excellent phrase for the purpose). The voice should be extended up and down, note by note, in this manner until the limits of the compass are reached. Classification into soprano, baritone, etc., should not be attempted before this has been done.

When the singer is able to obtain acute metallic ringing notes in the whole of the compass with ease, the author says he should attempt to sustain the various vowels. In the first instance this can best be accomplished by prefixing "pat-a-wat" to them, thus: "pat-a-wat-way," "pat-a-wat-wee," "pat-a-wat-wy," "pat-a-wat-woh," etc. Afterward they must be practised by themselves, and when perfected, words, phrases, etc., should be tried in the whole of the compass. It should be noted that the vowel "Ah" must not be used until the voice is thoroughly under control. When this is so, Austin admits, there is no better vowel for practice, for it helps to give the open throat so very necessary for good voice production, but if used too early in the training, it tends to force the vocal cords apart.

In the above method no attention is paid to breathing, the whole of the mind being concentrated at first on getting a loud, sustained, metallic ringing tone. When the habit of contracting quickly and fully has, so to speak, been impressed upon the adductor muscles of the cords, gradations of tone can be carried out with safety and delightful ease, and it will be found that whatever amount of breathing is required for phrasing, etc., can now be taken in and scientifically dealt with without having to worry about breath control.

THE RAILWAY AROUND LAKE BAIKAL.

Lake Baikal has hitherto made a very troublesome break in the continuity of the great Siberian railway. This large sheet of water, one of the biggest lakes in the world, has had to be traversed by various means, according to the season of the year—by steam ferry, ice-breaker, and, when the ice was strong enough, by carriage; and finally, since the outbreak of war, by a railway laid on the ice. This line round the lake has been under contemplation from the outset, but the natural conditions of the country through which it had to pass offered a multitude of obstacles to the engineers, and several distinct plans have been under consideration. This should be taken as only applying to the section as far as Kultuk, beyond which place the direction of the line was decided upon as early as 1899, while the former section could not be taken in hand till 1901. The railway was not expected to be ready before the beginning of next year, but the work has progressed so fast since the beginning of the war that it is now practically complete. Although water supply and the full complement of sidings allow of fourteen trains per day in each direction, it was proposed to run only seven trains a day in each direction and to use the ferry, the arrangements for which have been improved, as a kind of auxiliary and reserve.

The line eventually chosen is the one proceeding from the station called Baikal to Kultuk, and from thence to what is now the town of Myssowek along the shore of Lake Baikal. Proposals were made in favor of an alternative line passing over the elevated country between Irkutsk and Kultuk, which at places rises more than 2,000 feet above the level of Lake Baikal, which is again some 2,000 feet above the sea. Among the reasons why this plan was discarded were the heavy gradients, in some places over 17 per cent; and the unfavorable quality of the rock. The total length of the shore line which was eventually chosen is 161 miles, while the calculated expenditure is $27,049,803, part of the aggregate expenditure including some works connected with the extension of the harbor at Tanchoi, which materially increase the capacity of the ferry traffic. The railway is thus the most expensive line ever built within the Russian empire, and the one which has presented the most serious engineering difficulties, its building necessitating a large number of special constructions, such as tunnels, bridges, viaducts, etc. The coast of Lake Baikal, from the mouth of the River Angara to Kultuk, a distance of about 530 miles, is very mountainous, the rocks in many places leaving but a narrow strip of foreshore, while in others they descend sheer into the lake, rising to a height of 1,000 feet above the level of the water. These mountains are, besides, in many places intersected by awkward crevices and clefts. On this section of the line there are no fewer than 32 tunnels, in addition to which there are 210 bridges, viaducts, special supports, etc. The railway, like a huge snake, crawls along the side or makes its way through the mountain in a variety of twists and bends, at one place having to cross an inlet of the lake. It has often been necessary to take special precautions against the falling upon the line of pieces of loose rock, as the mountains in this region have been much affected by volcanic eruptions. Water is apt to make its way into the tunnels from the same cause. The looseness of the rock in many places has also necessitated the bricking up of the tunnels to a far greater extent than was originally calculated. The amount of rock and earth work is enormous, the former even reaching the figure of 10,000 cubic saschen (70,000 cubic feet) per verst.

The other section of the new line, from Kultuk to Myssowek, runs over an entirely different kind of country and has in every respect been much easier to build, nor has there been any wavering as to its direction. Beyond Kultuk the mountains on the whole recede further from the shore, leaving ample flat land for the railway, which, on the whole of this section, only passes one tunnel. On the other hand, several large streams have to be crossed, necessitating the building of bridges up to 500 feet in length. The country is almost uninhabited, and the soil is always frozen; the mean temperature of the year is half a degree Centigrade of frost. The bridges are all built of stone and iron, as are the viaducts. The railway has the ordinary Russian gage and only one line of rails, but the tunnels are constructed wide enough for a double track. The traffic, under ordinary circumstances, is calculated to comprise seven trains daily in each direction, a number which, however, as already mentioned, can be doubled. The maximum gradient is 8 per cent (in the tunnels considerably less), and the smallest radius of curve is about 1,080 feet.

The whole of the railway round Lake Baikal has been built by contractors, and has not been split up in such small portions as was the trans-Baikal Railway, nor partly built by the government itself, as was also the case with portions of that line, and there is every reason to believe that it has been satisfactorily constructed.—London Times.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1536, is opened with an excellent article by Emile Guarini on the new Jungfrau locomotive. The first installment of a good review by Sir William H. White on submarines is presented. How modern geodetic rules are corrected for expansion of metals is explained in a thorough article. The methods followed in the manufacture of ferro metals in general, and the result of four years' study of ferro-titanium in particular, are presented by Auguste J. Rossi. Dr. O. Schott writes on a new ultra-violet mercury lamp which is primarily intended for the production of therapeutic ultra-violet rays. The demands made upon locomotives in point of speed and tractive power have steadily increased. Still, their size and weight are limited. The efforts of locomotive builders have, therefore, long been directed toward increasing the efficiency of the steam and thus obtaining a greater power from a given boiler capacity. How German builders have used the superheater for this purpose is clearly explained in a well-illustrated article. The result of an investigation of the oscillations of railway vehicles is published. Mr. Cowper-Coles has recently made a series of experiments on the electrolytic piercing of metals. These experiments are described. One of the men who ran the 130-mile-an-hour Berlin-Zossen train was an American engineer, Mr. Charles A. Mudge. His critical tabulation of the results obtained in that famous run are of interest. Charles E. Benham describes a curious induction experiment. In the SUPPLEMENT of February 27, 1904, we presented a copiously illustrated paper on clock escapements. In the current SUPPLEMENT will be found a counterpart to this paper on watch escapements. The usual science notes, electrical notes, and engineering notes are also published.

A NEW STAR.

Harvard announces the apparent discovery of a new star, R. S. Ophiuchi. Miss Cannon, from an examination of the light curves, called attention to the remarkable increase in the light of this star which took place in 1898. The star has been photographed every year since 1888, except 1889. The star appears to have had about the tenth magnitude before 1891, gradually increasing in brightness from the year 1893 to 1897.

In 1898 it was somewhat fainter, until May 31, and one month later, on June 30, it was more than three magnitudes brighter. Then it gradually grew fainter, until October 8, when it was again at about the tenth magnitude. During 1899 it remained faint, but in 1900 became brighter, diminishing again to the tenth magnitude in September of that year.

Since then the variations have been slight. An examination of several good chart plates shows only one star in this position. Both spectrum and light curves indicate this object should be regarded as a new star rather than a variable star, and its proper designation would be Nova Ophiuchi No. 3. The new stars of 1604 and 1848 appeared in this same constellation.

METEOROLOGICAL SUMMARY, NEW YORK, N. Y., MAY, 1905.

Atmospheric pressure: Highest, 30.38; lowest, 29.65; mean, 29.99. Temperature: Highest, 80, date, 7th; lowest, 41, date, 2d; mean, 60.5; normal, 59.8; excess over mean of 35 years, + 0.7. Warmest mean temperature, 65, 1880. Coldest mean, 54, 1882. Absolute maximum and minimum for this month for 35 years, 95 and 34. Average daily temperature deficiency since January 1, — 0.8. Wind: Prevailing direction, South; total movement, 8,632 miles; average hourly velocity, 11.6 miles; maximum velocity, 48 miles per hour. Precipitation, 1.12. Average for 35 years, 3.11. Deficiency, — 1.99; since January 1, — 4.10. Greatest precipitation, 7.01, 1901; least, 0.33, 1903. Thunderstorms, 13th, 15th, 18th, 28th. Clear days, 9; partly cloudy, 14; cloudy, 8.

SCIENCE NOTES.

What is believed by antiquarians to be the oldest paper book in existence is the "Red Book of Lynn," an ancient register belonging to the Corporation of King's Lynn (England). This volume is known as the "Red Book" from its original binding having been of that color. The first entry is a transcript of the will of Peter de Thorndon, burgess of Lynn, dated 1309; the latest entry is on folio 100, and is dated 15 Richard II. Some fifty years ago it was repaired and rebound, and the leaves, which age had reduced to a loose, fibrous substance, were carefully resized as an aid to preservation.

Pursuing his studies on the presence of methyl aldehyde in smoke, in the course of which he has established the fact that it is found in all usual combustions, M. Trillat has communicated to the Académie des Sciences these conclusions: Formic aldehyde exists in the soot of our chimneys and in the air of cities. It is found in noticeable quantities in the combustion of sugar, juniper berries, sweet roots, benzoin; in particular, when the combustion occurs in contact with hot metallic surfaces, whose catalytic effect intervenes to increase the yield. The constant presence of formic aldehyde in the gaseous or solid part of fumes explains their disinfecting action, in which the good effects of formic aldehyde were utilized long before they were known or studied.

M. Leduc has presented to the Académie des Sciences the course and results of his experiments, and draws the following conclusions: (1) Muscular contraction raises the osmotic pressure in the muscle; (2) this elevation of the pressure may exceed 2.521 atmospheres, 2.604 kilogrammes per square meter of surface; (3) the elevation of the intramuscular pressure is the greater as the excitations are stronger and more prolonged; (4) the elevation of the osmotic pressure in a contracting muscle is, for the same excitations, the greater as the resistance met by the contraction is the greater; and (5) these considerable changes of the osmotic pressure in a contracting muscle necessarily exercise a preponderating, if not a unique influence, in causing fatigue.

Many astronomers have sought to photograph the solar corona when not totally eclipsed, but have not secured a satisfactory result. M. Hansky, in a communication to the Académie des Sciences, describes his success in operating at the summit of Mont Blanc, where in the rarity and purity of the atmosphere the red rays in the spectrum are feeble as compared with the yellow rays and the green. By combining colored lenses, suitably selected, employing plates very sensitive to the red, and profiting from these facts, (1) that the rays appertaining to the red part of the solar spectrum traverse an atmosphere without sensible absorption or dispersion, (2) that the continuous spectrum of the corona is very intense in its least refrangible part, and (3) that photographs render very sensitive the slight difference in luminous intensity of objects photographed, and that processes permit even of increasing these contrasts, he succeeded in photographing the corona of the sun in the red part of its spectrum. The photographs which he presented exhibited the solar corona with an intensity and perfection not hitherto attained, except during solar eclipses.

The results of the geological surveys that were carried out by Mr. H. H. Hayden, of the Geological Survey of India, who was attached to the recent British expedition to Lhasa, have been published. From his investigations the country is strikingly poor in minerals of economic value, the only one found *in situ* being gold, which is obtainable in very small quantities from the coarse gravel beds of the Tsangpo. The largest yield obtained by panning was only at the rate of 28 grains of gold per ton of gravel. Concentrates were found to contain, in addition to much magnetite and zircon, a small quantity of rutile and hercynite, and probably uraninite. During his sojourn at Lhasa the geologist purchased varied samples of the gem stones employed by the local jewelers, among them being turquoise, ruby, tourmaline, emerald, and sapphire. The jewelers stated that all these stones were brought from a considerable distance, some coming from Ladak and Mongolia, and others from India. Mr. Hayden could obtain no trustworthy information as to the existence of any native sources of gems, and concludes that turquoise is practically the only native gem stone. He also succeeded in disproving the general belief that coal is to be found at Lhasa.

The production of all kinds of rails in the United States in 1904 amounted to 2,284,711 gross tons, against 2,992,477 tons in 1903, a decrease of 707,766 tons, or 23.6 per cent. The production of Bessemer steel rails in 1904 amounted to 2,137,957 gross tons, against 2,946,756 tons in 1903, a decrease of 808,799 tons, or over 27.4 per cent.