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NEW YORK, SATURDAY, MAY 25, 1901.

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.

PIPE GALLERIES FOR THE RAPID TRANSIT SUBWAY.

The construction of the rapid transit subway afforded an opportunity for making proper provision for the mass of electric cables and gas and water pipes, which lie beneath the streets of the city, and are the cause of endless annoyance in the way of excavations for repairs and relaying. The opportunity to build along one or both sides of the subway special galleries to contain these pipes appealed at once to the engineers in charge of the scheme. As we have shown elsewhere, plans were drawn up which made adequate provision for present and future needs, and \$35,000 was spent in their construction. It is to be regretted that the pipe galleries have been abandoned, chiefly, it would seem, as the result of pressure of a semi-political nature brought to bear upon the Railroad Commission. The municipal engineers chiefly affected by the erection of pipe galleries have, for various reasons, so bitterly opposed their construction that, rather than entangle the whole tunnel contract with legal complications, the Commission has abandoned the galleries, at least for the present. We are of the opinion that the question of the construction of these galleries is second only in importance to the construction of the subway itself, and that it is absurd even to suggest that there are any insuperable difficulties in making adequate provision of this kind for the water pipes, gas pipes, electric cables and other lines which at present lie buried beneath our main thoroughfares. The present interruptions to traffic, the interminable and absolutely stupid way in which our choicest streets are dug up, relaid and dug up again, is a perpetual and obtrusive nuisance, which would not be tolerated in any provincial town, and cannot be too soon removed from the streets of the second greatest city in the world.

REMARKABLE RESULTS AT SANDY HOOK.

One does not need to be an artillery expert to appreciate the great significance of the results obtained during the last two or three weeks at Sandy Hook in a series of government tests of the new high explosive Maximite. It is safe to say that just now there is no problem of greater interest in naval and military circles than that of carrying charges of high explosives in shells through armor-plate, and bursting them within a fort or battleship. We have heard a great deal of late about the English explosive Lyddite, which is, like Maximite, a picric acid compound, but is altogether wanting in the remarkable insensitiveness to shock shown by the latter explosive. When the battleship "Majestic" fired Lyddite shells against the "Belle Isle" last summer, the shells passed through the skin plating of the vessel and burst within it; but whenever they struck the armor, which was of an old and easily penetrable type, they exploded harmlessly on the outside. Elsewhere in this issue it is told how at Sandy Hook shells of all sizes, from 6-pounders up to 12-inch, carried their loads of the new explosive through armor-plates of from 3 inches to 12 inches in thickness, and either exploded the charge in the plate or just beyond it. No such results as these have hitherto been obtained at any proving ground, either here or in Europe. When it is remembered that the new compound is far more powerful than wet guncotton; that it has an explosive value equal to that of nitro-gelatine and picric acid; that not only can it be fired from powder guns at the highest velocity with safety, but that it will withstand the far greater shock of penetrating any armor-plate that the projectiles themselves can get through, we can well understand that the ordnance officers are much gratified with the results. These Sandy Hook tests show that in the matter of high explosives the United States government has a long lead over any other.

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THE GROWTH OF LONDON AND NEW YORK.

The census returns for the city of London, which have recently come to hand, afford a basis for comparison between the two great cities of the Old and New World. In each there has been a rapid increase during the past decade; but there is something prophetic of the future in the fact that not only has the rate of increase of New York city been very much greater than that of London, but that the actual increase has been two hundred and fifty per cent greater. In 1891 the population of London was 4,433,220 and in 1901 it has increased to 4,803,342, an increase in ten years of 370,122. In the year 1890 the population of what is now Greater New York was 2,492,591 and by the year 1900 it had increased to 3,437,202, an increase during the decade of 944,611. Fifteen years ago London was growing at the rate of 50,000 a year, whereas the increase of the past decade only averages slightly over 37,000 per year. As against this, a comparison of the census of the last two decades in this country shows that Greater New York increased from 1,901,000 in 1880 to 2,492,591, an increase of 591,246 or thirty-one per cent; while the increase of 944,611 from 1890 to 1900 was at the rate of thirty-seven and eight-tenths per cent. Assuming a rate of only forty per cent during the next ten years, the population in 1911 should be equal to that of London at the present time. It is likely, however, that the rate of increase will be nearer fifty than forty per cent, and should the rate at which London is growing continue to decrease, it is quite possible that by the time the next census is taken the population of the two cities will be about the same.

Outside of New York, the census shows that there are two cities (Chicago and Philadelphia) whose combined population is 2,992,272, while the increase during the decade has been 845,458, and the rate of increase 39.3 per cent, or slightly higher than the rate for New York. The greater increase has been that of Chicago, which has grown at the rate of 54.4 per cent, the rate of increase in Philadelphia being only 23.5 per cent. There are in this country three cities of between 500,000 and 1,000,000 inhabitants, five of from 300,000 to 400,000, and eight of from 200,000 to 300,000 inhabitants. The rate of increase in these three classes ranges from 28.5 to 23.2 per cent.

In looking at these figures, there is food for reflection in the fact that, as a rule, the larger the city, at least as far as the United States is concerned, the greater seems to be the rate of increase. At the same time it is reassuring, in the presence of this centralization, to bear in mind that improved means of transportation are rendering it possible for the teeming millions of the great cities of the world to be scattered over an increasingly wide area of outlying suburbs.

FORESTRY IN INDIA AND CANADA.

Canada might well learn a lesson regarding forest preservation from India. The government of the latter country found that as a result of the destruction of forests by ax and fire, vast tracts of land had been desolated, and there was danger that the whole country would become barren if the work of destruction were allowed to continue, for a country without forests is likely to be afflicted with alternate floods and droughts.

The work of protecting the forests was begun in India in 1844 and gradually extended, but it has been placed upon a thoroughly scientific basis only during the last twenty years. The service is divided into 210 departments under the direction of expert foresters, most of whom have been trained in Germany and France. They are assisted by a number of subordinate officials, many of whom are natives of India. A training school for these officials has been established near Dehra, and it is intended to have similar training schools at all the local centers, as it is desired to have none but expert foresters in the service. Promotions are made according to merit, and it is expected that in a few years about twenty per cent of the superior positions will be in charge of natives selected from subordinate positions. The foresters have to guard against fires, see that there is no waste in cutting, and that the smaller trees are not destroyed; also to provide for the maintenance of seed-bearing trees and the reforestation of sections denuded of trees. In each province there are state forestry reserves, and altogether these reserves cover an area of more than 80,000 square miles, which will eventually be largely extended. Forest revenue is raised by the sale of timber or other products, and by the issue of permits to graze cattle, cut timber, make charcoal, and gather firewood, bamboos, canes, and other minor forest produce. These permits are issued at specified fees. In the Central Provinces, where the reserved forest area is computed at 19,115 square miles, 1,950,000 cattle were grazing last year, and of these only 5,500 were allowed in the reserves without payment of fees. A large revenue is derived from the forests by the government of India and it is expected that it will steadily increase. In Canada it is pointed out that the time has arrived for the various governments to establish systems of scientific forestry. The officials of the

MAY 25, 1901.

Dominion experimental farms began some time ago to encourage tree-planting by farmers, especially in the treeless regions of the Northwest, but it is said it is to the provincial governments, which control the crown lands in all the provinces with large forest areas, that the people must look for forest legislation. Many districts altogether unsuited for agricultural purposes have been denuded of trees, and if the provincial governments had profited by the experience of other countries, these districts would have been maintained as forest reservations and would now yield a large annual income. It is not, however, too late to begin the reforestation of many of these districts, although it will take a long time to restore them to their former condition; but it is in the districts where the forests still remain standing that scientific forestry can accomplish the best results. There are still vast areas of forest lands which may be made a permanent source of wealth to the people and yield a large annual revenue to the provincial governments as well as affording employment to many thousands of men. Much of the land now covered by forests is well suited to agricultural purposes, and it would be a mistaken policy to keep the whole of it as a forest reserve; but in opening the country for settlement, experts should examine each district and determine what lands should be maintained as forests and what should be offered to settlers. One of the conditions of land grants to farmers should be that a certain number of acres should be kept permanently covered with trees. Germany is most advanced in the science of forestry, and the government derives an immense annual revenue from the forests.

NEW PROCESS FOR PLASTER OF PARIS.

The subject of the formation of plaster of Paris, which, as is well known, is produced by the baking of gypsum, has received considerable attention in Europe of late, and especially in France, where the researches of Prof. Le Chatelier, of the College de France, have been followed by some improved methods for producing the plaster. Prof. Le Chatelier found that the dehydration of gypsum presents two distinct phases, the first at a temperature in the neighborhood of 130° C., and the second near 165°. Below 160° C. the gypsum loses only 15.6 per cent of water to form the normal plaster (the gypsum having 21 per cent for the formula $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) which then contains but 5.4 per cent of water of combination and corresponds to the formula $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$. It is important, therefore, that in the baking of gypsum the temperature should be thus regulated in order to secure the normal plaster; however, in the usual practice this is far from being the case. The process usually employed for building plaster in France, and especially in the region of Paris, which is very rich in gypsum, is to carry out the baking in a special form of oven. The oven is itself constructed of gypsum blocks in the form of vaulted chambers, which are then loaded with gypsum; between the blocks are left air-spaces, and a fire is lighted under the vaults, which have been partially filled with combustible. The baking is thus quite irregular, and the lower parts nearest the fire are calcined and lose completely their water of combination, and the others are blackened by the smoke and lose more or less water according to the distance. In this way the resulting mixture contains but a small proportion of normal plaster, and, besides, is never white. To obtain the best plaster, such as is used for modeling, another process is used. The gypsum is carefully picked and freed from impurities. Several months after its extraction from the quarries, the stone, which is then sufficiently dry, is broken in small pieces as regular as possible and heated in a furnace resembling a baker's oven, in the same way in which bread is cooked. Under these conditions the plaster is white and is normally dehydrated, but its price is very high, this being \$12 to \$16 per ton, while that of the ordinary plaster is \$3 to \$4. A number of furnaces have been recently devised for producing a plaster which shall be normally dehydrated and white, and at the same time cheap. The Périn furnace is one of the best of these, and has the advantage of needing but little hand-work and of pushing the dehydration to the desired point by the introduction of hot gases; besides, as it makes 8 furnaces in 24 hours, the production is rapid, and one of its main advantages is a great economy of combustible. It consists of a heating furnace and a baking chamber; the furnace, heated by coke or other smokeless combustible, communicates by a conduit with the chamber, which is formed of a metallic cylinder revolving about its axis upon mechanically operated rollers, and contains the pulverized gypsum, which rolls upon itself by the continuous movement of the drum, so that its particles are successively exposed to the hot gases which traverse it. Above the drum is the charging-bin, in which the gypsum is heated previous to its introduction, being surrounded by a series of tubes which are heated by the discharge gases. When one charge is baked, it is let fall into

a lower chamber by a trap, and a new supply fed in from the charging hopper. The latter is kept supplied from the grinding mills by a bucket conveyor. A company is being formed to work this process, with a capital of \$300,000, and it has obtained possession of an extensive gypsum bed situated in Algeria, on the banks of the Oued-Harbel.

WILD ANIMALS IN WINTER.

BY CHARLES FREDERICK HOLDER.

The devices of animal life to bridge over the winter season, and their ways and habits during this time, present an interesting, indeed fascinating, page of nature. Why certain forms should defy the elements and roam abroad, seeking a precarious livelihood, while others, much stronger and apparently better equipped by Nature to survive the struggle, enter the strange and remarkable winter sleep with all their functions in abeyance, and sleep away the winter, is one of the problems that is of more or less interest. The fox well illustrates the former with its winter habit of prowling over the snow.

At the approach of winter, animals are affected in various ways. In the North all the reptiles—snakes, lizards, frogs and toads, a vast concourse—disappear in a most miraculous manner. The snakes enter holes and crevices, projecting themselves as far into the earth as possible, and, coiled tightly, assume a condition, a state of coma, in which they remain until the heat of the sun comes to waken them the following spring, when they appear voracious, and eager for prey to rehabilitate them physically after months of fasting. The frogs plunge down into the mud of the ponds where they have made music during the long summer; and the same is true of turtles. Lizards affect the same places as snakes, and when taken out at this time are apparently lifeless. In some marvelous manner the functions of life are arrested. There appears to be a minimum consumption of tissue; Nature apparently making an exact calculation, the functions of life being so almost completely arrested that they are enabled to lie in this quiescent state without food or water, or until the food supply comes again and the conditions are favorable to outdoor life.

This is the case with the reptiles of the Eastern and Middle States, or wherever there is a cold winter, ice and snow; but on the Pacific slope, in Southern California, in the same latitude as the above, a different condition holds. Here—and the San Gabriel Valley may be taken as an example—the lizards are subjected to a winter and summer every twenty-four hours. There is no snow, the days are bright and beautiful, resembling a cool Eastern summer, and insect life does not disappear. All winter I have found lizards basking in the sun on these bright days, but as the winter day wears on and four o'clock approaches, there is a very material change—a strange chill that affects reptilian life at once. It is their winter, and just as the Eastern lizard creeps down into the earth for shelter and enters its winter sleep, so this California lizard crawls out of sight beneath rocks, into crevices or under the bark of trees, and enters what is the equivalent of a state of coma. It seems to shrivel, becomes seemingly intensely cold, often stretches out its entire length, and lies, to all intents and purposes, dead and lifeless, in this way passing the night until nine or ten o'clock in the morning, when the rays of the sun slowly bring it back to life.

This curious night coma is, so far as appearances go, identical with the winter sleep of eastern lizards. The functions are in abeyance for the time and life is at its lowest ebb. In observing these sleepers I have found them by turning over the piles of stones early in the morning, and have often found a row of them, limp, cold and apparently dead, lying in the sun, to watch the gradual return to life. It came very gradually; those lizards placed on their backs first showing signs of life by a quivering of the limbs, which were then drawn up; then the long tail would move, and finally the little sleeper would clumsily roll over into an upright position; and as the direct rays of the sun struck and warmed it into life its eyes would grow brighter, and suddenly, as though touched by some magic wand, its head would be lifted high, the blue breastplate gleamed in the light, and with an air of astonishment and alarm this sleeper awakened would dash over the ground and escape, once more a living creature, a type of activity, a menace to insect life. Every night in the Californian winter this occurs, and the condition can easily be superinduced by subjecting the animals to artificial cold. The bears in Southern California are found abroad at all times, while in the northern part of the State and in the East they enter into a complete state of hibernation, going into their winter sleep well conditioned and fat, evidently living on the latter until spring, when they emerge lean and ugly.

The change in color of animals at the approach of the winter season is one of the remarkable features of life. The ermine as an example and several others assume a white coat, the change being a protective

feature. The ptarmigan has a similar habit, a change which renders it inconspicuous to its various enemies.

At the approach of winter the birds perhaps present the most remarkable spectacle. With some few exceptions they move away from the conditions which threatened them; and in what is popularly called the departure and return of the birds we contemplate a wonderful migration, in which the highest instinct of self-preservation appears to have been developed. The birds of the coast have a definite line of migration; the shore line at this time constitutes a bird highway, over which tens of thousands are passing—in the autumn to the South, where there is a food supply; in the spring to the North, to the fields they know so well, and the nesting places where the young are to be raised. Much of this migration is carried on at night high in air, and during storms myriads of birds are often confused and killed by dashing blindly into the lighthouses that mark the highway. At Heligoland Light the ground in the morning is frequently strewn with birds, from ducks and geese to the smallest songsters. In the interior the birds follow valleys and the mountain ranges.

On the Pacific coast the Coast Range and Sierra Nevada Mountains constitute a well defined line of travel. In Southern California the flight of cranes and geese along this pathway is a remarkable sight. The birds, especially the cranes, cover long distances by soaring, gradually reaching within rifle shot from the ground; then they stop and begin a spiral movement, turning in graceful curves, flashing like silver dollars in the sunlight as they turn and disappear, rising ever higher until they are a mile or more above the valley, or above the summit of the Sierra Madre; then, as though at the command of the leader, they turn, and in long lines soar away with remarkable velocity, literally sliding down hill, covering six or seven miles or more before the maneuver is repeated.

The winter finds the trees, groves and gardens deserted except by the few forms which defy the cold. The birds are in the South—Florida, Cuba and even South America; the reptiles are housed underground; insect life has been destroyed or is hibernating, and will spring into life in the spring. The only animals abroad are the mammals; the deer, elk, caribou, fox, cougar, wild rat, lynx and other forms, which wander over the barren wastes and in the deep snows of the woodlands, finding a precarious living until the spring comes, the wanderers return and all life takes on a new meaning.

NEW TRANS-PACIFIC CABLE.

It has at last been decided to construct the Trans-Pacific telegraph cable connecting Australia direct with England via Canada. The contract has been placed with the Telegraph Construction and Maintenance Company, is to be completed by 1902, and will cost \$8,975,000 to construct, exclusive of preliminary surveys and other incidental expenses which will amount to about another \$900,000. The cable will run from England to Vancouver, thence to Queensland, and New Zealand, via Fanning Island, Fiji, and Norfolk Island. It is impossible to estimate the importance and commercial value of this route, since it will enable the most distant colonies to communicate with England, independently of the lines that pass through or near Europe, while messages will be conveyed at a cheaper tariff, and commercial activity will be considerably stimulated.

The growth of telegraphic business between Australasia and England has developed remarkably during the last twenty-seven years. In 1873 the International line was opened, and during the first year 8,952 messages were transmitted to and from the colonies. In 1884 this total had grown to 48,896 messages, which is equivalent to an annual increase of 40 per cent.

The present scheme has been under consideration for several years, but it was not until 1886 that the enterprise first assumed any tangible shape. In that year the Agents-General for the colonies, in a deputation to Sir Charles Tupper, who was High Commissioner for Canada at that time, declared that after careful investigation they had concluded that such a cable could be laid for a total annual subsidy of \$500,000, extended over twenty-five years. For several years the scheme was then permitted to remain in abeyance, but six years ago an expert estimate was prepared as to what amount of business might be anticipated from such a cable. It was then calculated that the gross earnings at an average tariff of 50 cents per word would amount to \$550,000 for the first year; for the second year, \$632,500; and for the third year, \$715,000; while a surplus of \$772,500 would be yielded during those first three years' working.

Regarding the construction of the cable, it has been apprehended in some quarters that great difficulty would be encountered in laying the cable at certain points of the route, notably at Fanning Island, the approach to which is rather steep. In the opinion of cable engineers, however, this is considered of small moment, since there are several stations of other cable companies which are approached by equally

steep gradients, and yet the cables have never suffered any disturbance of any kind. The cable will be laid in deeper water than has previously been the case, since, whereas the greatest depth for such work has been 2,500 fathoms, in this instance it will be for the most part 3,200 fathoms. It is not anticipated, however, that any trouble will be encountered in this direction, since various types of cables have been designed for varying depths. They will be most carefully made, and in the deepest water the cable will be of small diameter. It is expected that the transmission of a message between London and Australia will occupy twenty minutes.

No decision has yet been made regarding the tariff. The Eastern Telegraph Company at present charges 87 cents per word, which in course of a few years, will be reduced to 62 cents per word. Fourteen years ago the tariff was \$2.70 per word, so that some estimate may be gathered of the development of telegraphic communication between England and Australia to permit of such a large reduction.

SCIENCE NOTES.

Berlin was treated to zero weather during January. The River Spree was frozen over so suddenly that the ice caught thirteen of the city's swans, and the Fire Department was called out to release them.

Cocaine sniffing is on the increase in the South among the negroes. The drug is sniffed up the nose and the results produced are somewhat the same as those obtained by smoking an opium pipe.

A dispatch from Cardiff states that an electrician named Smith has invented two X-ray tubes which he claims do not produce any bad results upon the subject, one of them actually tending to heal burns and wounds, says the New York Sun. It is said that one of them makes bones and not flesh visible on a photographic plate, while the other makes neither visible, the plate only showing foreign substances.

To promote uniformity in results and to secure accuracy and to give legal value to the evidence of X-rays it is necessary to standardize methods of doing the work. To this common benefit all X-ray experts are asked to contribute for the general good of the cause. The Roentgen Society has issued a circular giving a list of standards which it is desired to establish. A copy of this circular can be obtained from S. H. Monnell, M.D., 47 West 27th Street, New York city.

"Synthol" is a chemically pure substitute for absolute alcohol. It may be used for every purpose for which alcohol is used except for internal consumption. Being chemically pure it does not have as much odor as absolute alcohol from grain or wood. It is perfectly free from color, is non-irritant to eyes or skin and has ten to fifteen per cent more solvent power than ordinary alcohol. As a killing, fixing or hardening agent it is in every respect equal to the best absolute alcohol and can be used as a substitute for it in the preparation of stains, reagents, etc. As a preservative it is superior to any alcohol, as alcohol becomes tinged with color on exposure to light, while synthol retains its absolute colorlessness under all conditions.

The Germans have invented a new description of glassware, specimens of which have been on exhibition in England. This cloisonné glass, as it is called, is similar to stained glass, but is claimed to be superior. The design is prepared in double brass wires, and the interstices are filled with small pieces of colored glass. This design is then mounted upon a large sheet of plain glass, to which it is firmly attached by means of a translucent cement. Another similar sheet of glass is then placed upon the top of the design in the same way, so that the colored glass is inserted between two sheets of glass. By this means the cloisonné glass is smooth on either side. It cannot be bent or loosened, and in view of the thinness of the brass wires more light is admitted than is the case with stained glass, owing to the thickness of the leaden framework in the latter.

Sir Harry Johnson, Special Commissioner to Uganda, reports the established existence in the Semliki forests of a peculiar ruminant thought to be long extinct, says the New York Sun. Fossilized remains of this animal have been found plentifully in Greece, and it has been called hitherto helladotherium. A complete skin and two skulls are now on their way to England for the British Museum. The natives call this animal the okapi. It is a giraffe-like creature, and is closely akin to the ox in size. The neck is a little longer, proportionately, than that of a horse; the ears like those of the ass, with silky black fringes; the head taper-like, and the nostrils like those of the giraffe. The forehead is a vivid red, and the neck, shoulders, stomach and back a deep reddish brown. Parts of the animal are almost crimson and others blackish in hue. The hind quarters and legs are boldly striped in purplish black and white. The animal is hornless, although there are traces of three horn-cores.