### Ordnance Notes.

The following are from the recent report of the Chief of Ordnance, General Flagler:

The German smokeless powder has the advantage of giving as good velocity as the French with a somewhat less charge. The German powder has the further marked advantage that it is readily made up into cartridges, while a great deal of time is required for putting up the French powder. The type 10 inch B. L. rifle has been fired to date 158 rounds and the type 12 inch B. L. rifle 64 rounds.

The department will have completed by the end of the calendar year 1892, fifteen 8 inch guns, eight 10 inch guns, and three 12 inch guns, which will be available for issue to the service as soon as the necessary carriages for mounting them are provided.

The extreme accuracy of fire is better illustrated by the statement that with the 8 inch gun in a target of five shots at a range of one mile, four out of the five shots struck within an area 20 by 21 inches, and in a target of eight shots at a range of 3,000 yards (about 1¼ miles) six shots struck within an area 1½ by 4 feet.

The test of the type 12 inch B. L. mortar, cast iron, hooped, has been completed by the board for testing rifled cannon, etc., and adjudged to be satisfactory for issue to the service.

### The Stone Cutters' Strike.

A writer in *Stone* who is in a position to know, says that the granite cutters lost in wages and assessments during the recent long strike enough to buy and operate the leading quarries in New England. He estimates the loss to the strikers at $2,800,000, and his estimate is probably nearly correct. This shows pretty clearly where the strike hits hardest. The quarries are still there. The owners may have lost a portion of this year's profits, but they have lived comfortably and the strikers have not.

The above is from the *Brickmaker*, and if the figures are true it might be a good idea for the cutters, the next time they contemplate a strike, to put their heads and money together and buy out the works. They can then regulate their own wages and hours, and arrange everything else exactly to suit themselves, besides enjoying the satisfaction of having no boss to watch and direct their work.

### How to Color Lantern Slides.

Procure an assortment of Judson's liquid dyes of suitable tints, a small quantity of spirits of wine, not methylated, and some camel hair pencils, small paper stumps, and a piece of glass to do duty as a desk. I may here say it is of no use trying to mix the dyes like other color in order to make certain tints, for one color seems to destroy the other instead of forming a tint midway between the two. The dyes must therefore be used alone, diluted more or less with spirits of wine, and one tint allowed to dry before another is applied. The principal difficulty is in avoiding the thickening of color at the edges of the stroke, but with a little practice this is easily overcome. Begin with the most delicate tints first; in a landscape, the sky and water, finishing with the more pronounced colors. A drop or two of a suitably colored dye being put into a small saucer, add sufficient spirit to dilute it to the proper tint, having at hand a little plain spirit into which the brush can be dipped as occasion may require. Owing to the volatile nature of the medium, promptitude must be used to avoid waste, or the different tints may be kept diluted in small bottles.

Suppose we desire to tint a moonlight scene with good clouds, and bright reflections on the water, a cottage with the windows illuminated, or lanterns hanging to the rigging of ships. First take a small stump, dip it into a solution of wax in benzole, or suitable greasy matter, going over all parts carefully that have to remain colorless. The windows and lanterns having been tinted yellow or red, let these be waxed also. The slide then may be bodily immersed in weak greenish blue dye; blot off the edges and dry. This will be probably all that is required to complete the picture. With a daylight view, tint the sky pale blue, softening off the color toward the horizon with plain spirit. Then carefully go over the landscape with suitable tints, always putting on the lightest and most delicate first, and drying before the application of the darker greens, etc. It is best to use but little color, slightly tinted pictures having the best effect on the screen. Simple as this process is, excellent results may be obtained with little practice. Some colors are apt to dry duller than others. When this is the case a little gelatine solution poured over will restore the brilliance, care being taken to avoid dust in drying.—*E. Dunmore, Br. Jour.*

### PRINCE EDWARD ISLAND TUNNEL TEST.

It sometimes happens that an engineer by a simple, bold expedient revolutionizes certain engineering processes, and not only greatly reduces the cost of construction, but renders possible either a new class of work or develops a new phase of work in well known lines, either of which could not have been successfully carried out by the old methods.

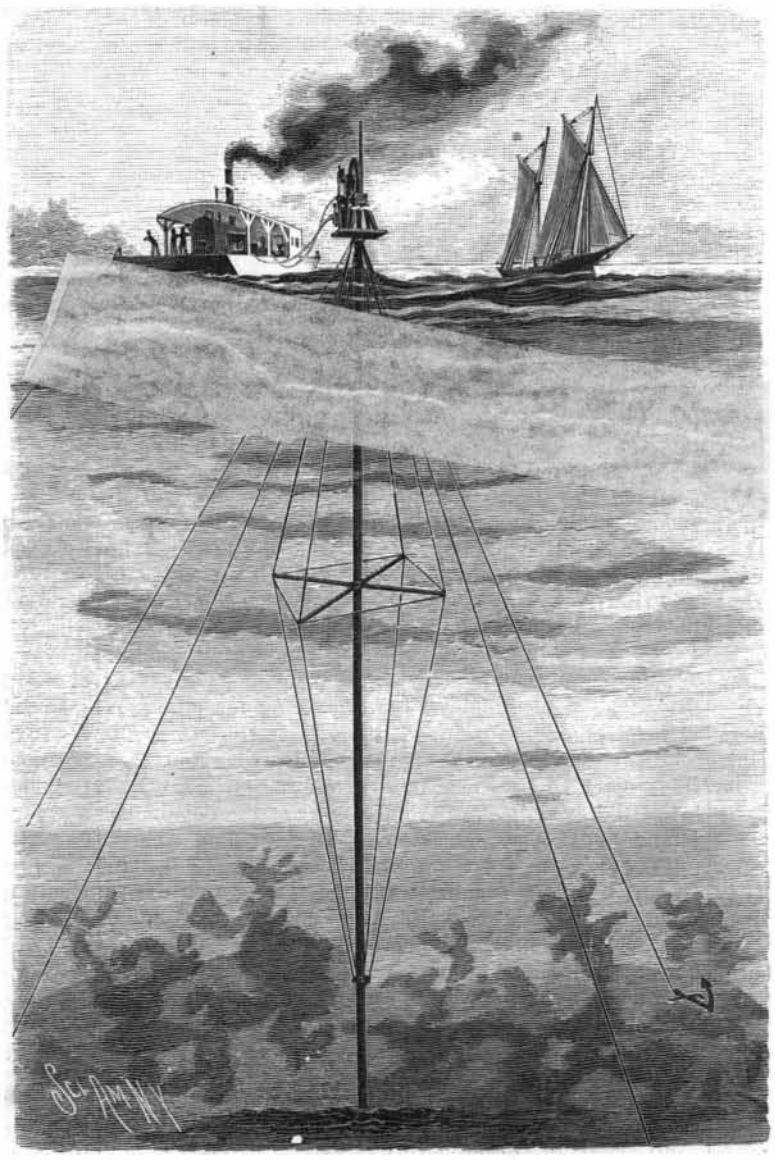
Examples of inventions of this class will occur to the


ROUTE OF PRINCE EDWARD ISLAND TUNNEL.

reader, and we now have to add to the list the record of an engineering feat which, in the boldness of its conception, the simplicity of the devices by which it was executed, the success attained, as well as the bearing of the work on associated interests, will compare favorably with any engineering work of like magnitude.

The work contemplated was the construction of a tunnel between Prince Edward Island and New Brunswick, as shown on the annexed map, the distance being eight miles. The problem presented was that of testing the nature of the earth between the proposed termini of the tunnel; but the Straits of Northumberland being perpetually stormy and the depth of the water being more than one hundred feet, the problem was not so simple as it might appear.

Our engraving illustrates the way in which the feat was accomplished. The method and apparatus are the invention of Mr. Alfred Palmer, C.E., of the Mills Building, in this city. A four-inch wrought iron pipe made up of 20 foot lengths rests upon the bottom of the sea, and upon the upper end of this pipe, which reaches above the surface of the water, is arranged a platform on which is mounted an engine running at a high rate of speed. The pipe is trussed to make it rigid and it is supported in an upright position by means of four wire ropes set out at right angles to heavy anchors. The engine drives a diamond drill at the rate of 1,000 revolutions per minute. A scow anchored near the pipe carries a 10 horse power boiler and other necessary machinery, the boiler being connected with the drill engine on the upper end of the pipe by means of flexible tubing. Another flexible tube supplies water to the drill for lubricating purposes. By means of this arrangement the drill is always held in a vertical position, and is not subject to any vertical or lateral movement, although the scow carrying the boiler and pump may be tossing about in a heavy sea. The current in the channel offers a resistance to the pipe of 36 pounds to the square foot, but it is so thoroughly braced and stayed that it easily resists this pressure.



TESTING THE GEOLOGICAL FORMATION OF THE PROPOSED ROUTE OF THE PRINCE EDWARD ISLAND TUNNEL.

The tests made indicate that the formation is highly favorable to tunnel construction. The contract for the tunnel is being carried out under the direction of the Dominion government, represented by Hon. George E. Foster, Minister of Finance, Mr. Collingwood Schrieber, Chief Engineer, and Sir Douglas Fox, Consulting Engineer, of London. Mr. Alfred Palmer is reporting engineer for Sir Douglas Fox.

### An Historian's Brain.

The late Mr. George Grote, the historian of Greece, expressed in writing, eight years before his death, a desire that after his decease his cranium should be opened and his brain weighed and examined. The task was undertaken by the late Prof. John Marshall, and the results of his observations are set forth in a full report printed in the current number of the *Journal of Anatomy and Physiology*. The entire encephalon, says *Nature*, was somewhat above the average in size, if compared with the adult male brain at all ages. If allowance be made for the effects of senile wasting, it must be regarded as a rather large brain, but not as an actually or especially large one. There can be no doubt, however, that it was, at death, further diminished in size and weight through the effects of disease, as shown by its marked deviation from the ordinary ratio as compared with the body weight. As tested by the standard of macrocephaly adopted by Welcker, its utmost allowable weight was below that standard; and as contrasted with the encephala of certain other eminent men, it would find its place about one-third up from the lower end of the list. The general form of the cranium was rather or nearly brachycephalic, but it was decidedly higher than usual. The cerebrum itself was, in accordance with the shape of the cranium, short, broad, and deep. The cerebral convolutions were very massive, being not only broad and deep, but well folded, and marked with secondary sulci. This condition was observable all over the cerebrum, but chiefly remarkable in the frontal and parietal regions. Studied in reference to Dr. Ferrier's researches into the localization of function in the brain, the relative size of certain convolutions or groups of convolutions suggested some reflections as to individual peculiarities, but these reflections did not seem to Prof. Marshall to be quite trustworthy. From the size and richness of the convolutions, the sufficiency of gray matter, both on the surface and in the interior of the hemispheres, and from the remarkable number of the white fibers, especially of the transverse commissural ones, the brain of Mr. Grote is pronounced to have been of very perfect and high organization.

### Mirage.

A beautiful and instructive lecture experiment, illustrative of the conditions of the heated atmosphere which give rise to the mirage, says *Nature*, is described by MM. J. Mace de Lepinay and A. Perot, in their "Etude du Mirage," which appears in the *Annales de Chimie et de Physique*. Water is poured into a long rectangular trough, with glass sides, and covered with a layer of alcohol about two centimeters thick, containing a trace of fluorescence. After a few hours, during which the alcohol diffuses slowly through the water, a flat beam of light is sent through the mixture at a very slight inclination to the horizon. Under these conditions a kind of garland of light is seen to traverse the liquid, due to a series of curvilinear deflections or "mirages" in the less highly refractive water below and total reflections at the upper surface of the alcohol.

### Natural History Notes.

*Migratory Crabs.*—In the West Indies there exist crabs that are both marine and terrestrial. These crustaceans, according to the *Revue des Sciences Naturelles Appliquées*, always reproduce their species in the sea, but, in the adult state, frequent the shore, and, like the fish of the deluge of Deucalion, spoken of by Horace, make their way to the summit of high mountains. Once a year a curious instinct leads them to emigrate by thousands toward the sea, whither they go to deposit their eggs. They travel as far as to the roadstead of Port Royal (Jamaica). Advantage is taken of this passage of the crabs to capture them. Many of them contain magnificent corals. Their flesh, besides, is highly esteemed in the Antilles. Their young pass their larval state in the sea, wherein they swim about freely, and afterward pass through a fresh water and terrestrial stage.

*The Torpidity of Fish under Ice.*—The *Zoologische Garten* gives an account of some recent observations that have been made upon the resistance of fish confined under ice. It was already known that the carp (*Cyprinus carpio*) loses the power of motion when the temperature of the water descends below 4° C. In the recent experiments, from twenty to thirty specimens of the following species were taken in the month of January: The common minnow (*Phoxinus lævis*), the gudgeon (*Gobis fluviatilis*), the bleak (*Leucaspius delineatus*), and the loach (*Cobitis barbatula*). These fish were put in the open air into wide-mouthed vessels, whose bottoms were covered with a layer of earth. After a continuous period of cold, these vessels became covered with ice reaching a thickness of several centimeters. The fish were soon observed to turn over, some upon the back and others upon the side, and remain motionless. It was remarked that the chromatophores, especially in the minnow and loach, had become more intense than at the epoch of spawning. All the animals appeared to be dead, but after a hole had been made in the ice they soon began to move their gills, at first slowly, and then more rapidly. It was not till after several hours, when the water was warmed, that they regained their ordinary vivacity.

*Hairs and Feathers.*—A remarkable speculation that necessitates further independent research appears in a recent number of the *Morphologisches Jahrbuch*. As is well known, it is the common belief that the hairs of mammals, the feathers of birds, and the scales of reptiles are all epidermal structures of a fundamentally identical character; but after an elaborate study of the growth and development of these several protective coverings, Dr. F. Maurer, of Heidelberg, now arrives at the conclusion that hairs are, in every respect, distinct from feathers and reptilian scales. He considers that they are homologous with the sensory points in the skin of the amphibia, or, at least, that they are outgrowths from these points as bases. Referring to the fact that the characters of the integument are of importance in classifying the great groups of vertebrata, Dr. Maurer thus concludes that his researches confirm the supposition that the mammalia are derived directly from the amphibia, and have not had any reptilian ancestors.

*The Ascent of Sap in Plants.*—A problem familiar to all students of botany is that relating to the ascent of water in plants. Text books explain the phenomenon in more or less plausible ways, and doubtless it may be news to many to be told that they know nothing about it.

The latest and perhaps the most thorough investigation in this direction is that by Professor Strasburger, of the University of Bonn. In the recently issued record of his latest physiological work the present aspect of the question is clearly put. It is shown that experiments in the "ringing" of plants had no other result than to again prove that the water current is conducted through the wood. The living alburnum in this alone is functional, but it is not admitted that living cells have any share in the process. Then, again, though facts seemed conclusively to indicate that the current passes through the cavities of the tracheæ, the theory that the protoplasm assists the passage of the water, by its contraction or by its influence on osmosis, had to be rejected as untenable. The evidence all appears to favor the conclusion that the ascent of water in plants is a purely physical process. That it is not a vital one was proved by the ability to cause an upward flow in plants previously killed by various methods. The conditions necessary for the ascent of liquid are stated to be that the cell walls should be in a state of imbibition, while the tracheæ are within certain limits filled with water and isolated from the air. The learned professor definitely disposes of some time-worn explanations when he states that atmospheric pressure simply helps to keep the water suspended, that the only importance of transpiration in this connection is that it makes room for the ascending fluid, and that root pressure is not immediately concerned in the process at all. Capillarity has long been known to be insufficient to account for the phenomena, and the net result of the research is that we are left in the position of knowing nothing whatever concerning the cause of the ascent of sap in plants, save that the process is a purely physical one.

*Influence of the Electric Light upon Plants.*—Knowing that the cultural experiments made with the electric light have had as a special object the general development of plants, Mr. Gaston Bonnier has, in some investigations undertaken by him, endeavored to ascertain what modifications of anatomical structure it would be possible to obtain by submitting plants to a light of sensibly constant intensity. Two lots of similar plants were submitted, one of them to a constant electric illumination and the other to the same illumination from six o'clock in the morning to six o'clock in the evening, and then to darkness from six o'clock in the evening to six o'clock in the morning. Finally, a third lot was submitted in the open air to the ordinary normal conditions to serve as a term of comparison.

From the experiments, which were made in the pavilion of electricity of the Central Halles at Paris, it results: 1. That, through a continuous electric illumination, it is possible to produce a great modification in the leaves and the young trunks of trees. 2. That it is possible to realize a medium such that the plant shall respire, assimilate, and transpire, night and day, in an invariable manner, the plant then seeming as if incommoded by such continuity and its tissues having a simpler structure. 3. That discontinuous electric illumination (with twelve hours of darkness out of the twenty-four) produces in the various organs a structure that more closely approaches the normal one than that brought about by an uninterrupted electric light.

*The Feeding Habits of Serpents.*—Since the month of August of 1885, the Garden of Plants, of Paris, has been in possession of a South American boa (*Boa murinus*), which has been the object of some interesting observations on the part of Mr. Vaillant, especially as regards its alimentation.

This serpent is at least twenty feet in length. From the time of its reception by the garden up to the end of the year 1891 it has taken food thirty-four times, that is to say, on an average of five times a year, the interval between its meals varying from 28 to 204 days. The animal regulates its own meals, manifesting its hunger by a characteristic uneasiness. Its food has almost always consisted of goats of small size, although on three occasions it has taken rabbits, and on one occasion a goose. The largest animal that it has swallowed is a kid weighing 26 pounds, representing about a sixth of its own weight. It is well known, however, that serpents are capable of swallowing animals almost as large as themselves, and at the menagerie of the museum, a few years ago, a horned viper was caught in the act of swallowing a French viper, its companion in captivity, which was a little larger than itself. The horned viper did not appear in any way to suffer from its meal. As for the digestive function, that is relatively rapid, for the residua of it are generally evacuated at a single time, after each meal, and at the end of but a few days.

*The Double Cocoanut Palm.*—After many failures, the horticulturists of Kew have succeeded in growing a young "double cocoanut palm" (*Lodoicea seychellarum*). The plant is a native of the Seychelles, and very rarely seen in cultivation. The germination of the double cocoanut occupies nearly two years, and its attainment to maturity is very slow. Its peculiar mode of germination is a source of great difficulty in cultivation. The radicle grows down from the large, heavy seed in the form of a stout tap root, carrying with it the stem bud or plumule inclosed in the sheath of the cotyledon. By the ultimate splitting of the latter the plumule is set free and able to ascend. If this long and slowly-growing process be injured, success cannot be expected. The trunk of the adult tree may reach 100 feet in height, though scarcely a foot in diameter. The male and female flowers are borne on separate individuals. The immense fruits average forty pounds in weight; they contain, within a thick fibrous husk, one, two, or sometimes three large nuts, with hard and thick black shells, each divided about half way down into two lobes. Before the discovery of the Seychelles Islands, in 1743, considerable mystery attached to these nuts, which were often found floating in the Indian Ocean (hence the name "Coco de Mer"), and highly prized by the natives of the Archipelago. Rumphius, in his "Herbarium Amboinense" (1750), speaks of the nut as "hujus miri miraculi naturæ, quod princeps est omnium marinarum rerum, quae rarae habentur." It is not, he says, a terrestrial fruit which has happened to fall into the sea and thus become petrified, as Garcias ab Orta would persuade us, but a fruit actually growing in the sea, the tree being hidden from the human eye. He mentions some curious fables in connection with it, and says there are many more not worth the telling.

In olden times important medicinal virtues were attributed to the fruits of this magnificent palm, water drank out of vessels made from them being supposed to preserve people from all complaints, and extravagant prices were consequently paid for them. At the present day they are converted into various domestic utensils, while the wood serves for many useful purposes, and the leaves are made into hats and beautiful baskets, cigar cases, etc., besides being used for thatching.

The reprehensible practice of destroying the trees for the sake of their nuts will, it is to be feared, lead to the extinction of the coco de mer, which will become in reality as rare as it was supposed to be by the voyagers who picked up the first known specimens of the nuts floating on the sea.

*The Distance to which Bees Fly.*—*Insect Life* says: However difficult it is to determine the rate of speed of bees, and hence however erroneous any calculations based upon such determinations may be, it is not at all difficult to tell practically how far bees actually go after honey. *Apis Mellifica* has been introduced into regions where the species did not exist before, and careful observations have been made regarding the range of its flight, and also the yellow varieties have been taken to countries or localities where only brown or black bees were found, and the dark varieties have been experimented with in regions where only yellow bees were natives. In this manner it has been readily and accurately determined that they generally work within a distance of 2 miles from their hives, although they will in rare instances go as far as 4 or 5 miles, and a resident of an island off the coast of Texas reported, several years ago, having followed his bees in a boat, and found them working on the mainland, a distance of 7 miles from their hives. But no practical bee keeper would expect favorable results from pasturage located over 3 miles from his apiary, and marked advantage can only be awaited when the honey sources are located within 2 miles in a direct line from the apiary.

### A New Industry for Mexico.

It is stated that C. P. Huntington, of the Southern Pacific and Mexican International Railways, has purchased the Cerro Mercado, of Durango, Mexico, and that he intends to erect a large steel and iron plant near Durango City. This Cerro Mercado is an immense mass of iron ore, one mile long, one-third of a mile wide, and rising from 400 to 650 feet above the level of the plain on which it is situated. Its existence has been known for many years. It was discovered by the Spanish early in the sixteenth century, and in 1558 an expedition was sent out to examine it, owing more to the rumors that it contained large bodies of gold and silver ores than from any belief that an iron property, however rich, could be profitable at that time. No discoveries of the precious metals being made, it was abandoned for the time being, and it was not until after the independence of Mexico was declared that an English company acquired the property and the right to establish iron works on it, when actual development work and the production of pig iron was commenced on a comparatively large scale.

Previous to this a small quantity of malleable iron was produced by the agriculturists of the vicinity, metallurgists for the time being, in small Catalan forges.

Weidner, who examined the property for the Mexican government in 1858, estimated the mass to contain 250,000,000 net tons of 50 per cent ore, and Mr. John Berkinbine, the eminent authority on iron, while disagreeing with Weidner's extravagant estimate, pronounced the deposit to be "the most extensive known single deposit of iron ore on the American continent, or, possibly, in the world." He is inclined to the belief that the Cerro Mercado consists of one or more lenses of specular iron ore standing nearly vertical, the walls of which cannot be observed, owing to the detrital *talus* at the bottom. An average of all the samples, from about 10,000,000 square feet of surface, analyzed by McCreath, gave metallic iron 55·8, manganese 0·079, sulphur 0·085, phosphorus 1·328. Selected specimens showed but 0·003 phosphorus, and Mr. Berkinbine thinks it not improbable that large quantities of Bessemer ore could be mined.

In late years the property has been in the hands of American capitalists, who, it is to be regretted, have not made any profits on their investments, but this is to be ascribed rather to the want of fuel and the small and local demand than the failure of the deposit itself to meet the requirements of a successful venture. At the present day the conditions are changed, as the Mexican International Railroad is at Durango. Instead of being obliged to rely upon the insufficient supply of charcoal brought in by the burro load, coke of fair quality can be hauled to Durango by rail, and the production instead of being limited to the requirements of the immediate vicinity can be extended to supply the entire republic.—*Eng. and Min. Jour.*

### The Yard Measure and the Meter.

The true equivalent of the yard measure in terms of the meter is found by Professors Comstock and Tittman, of the United States Coast Survey, and by Dr. Peters, of Germany, director of the International Committee of Weights and Measures, to be 39·3700 inches. The correction is 0·0008 of an inch, the value found by Kater and Arago in 1818, and in vogue since that year, being 39·3708 inches. The corrected measure, 39·3700 inches, will, it is expected, duly become the recognized standard.