ticipated, but the British ships led all the rest. Just before 8 o'clock the river around the four British ships the Blake, Australia, Magicienne, and Tartar, suddenly assumed the appearance of golden lakes. Somebody had pressed several buttons and the electricity had done the rest. The hulls of the ships, from water line to the rail, were outlined in globules of fire.

Simultaneously the electrician of the Jean Bart wove around her huge circular tops necklaces of golden beads. The Kaiserin Augusta revealed herself in bright dotted lines, and the Russian flagship arrayed herself in stars. Then came the exhibition of search lights. Electricians on every ship in the fleet stood to their work and sent their harmless charges through the mists. There was a stratum of fog extending a thousand feet or more above the river. Above that the air was clear, but above the cloudless stratum there was more fog. This condition of atmosphere caused many picturesque effects. The little caravels got a big share of attention. Every light on the leading ships was turned on the antique squadron, and they stood out like cameos.

Down the stream and up the stream the silver indices pointed; they gleamed across the historic river and lit up bits of the Palisades and startled folks in cottages along the Jersey shore. The *finale* of the search light exhibition was the concentration of all the glittering shafts on the American ships in one point in the sky. The signal for this display was made from the flagship Philadelphia by the Ardois lights, which flashed red and white in perpendicular strings from the masts. The meeting of the lights suggested a gigantic white-ribboned May pole before it is entwined by the ribbons. At the end of all the Blake showed a fiery figure of Washington, the man who led these colonies in war upon his kingdom. It lacked but an hour of midnight when this magnificent and most interesting display closed.

Although the President and many other officials of high and low rank were anxious to leave soon after the review, to be in Chicago at the inauguration of the Exposition on May 1, there was still a most important feature of New York's Columbian festivities to come off on Friday, the 28th. This was nothing less than a great land parade, such as has probably never before been seen in this or any other country, for it was a parade principally of men from all the different ships. Our own vessels furnished about fifteen hundred men, and about an equal number was landed from the foreign ships. There were bands without number, and some ten regiments of the New York State National Guard furnished the escort, but it was a sight well worth seeing and long to be remembered to view the contingents of English, Russian, French, German, Italian, Brazilian, Argentine and Dutch men-of-war's men swinging along Broadway, together with our own jack tars and marines, all like friends and compatriots, and all the foreigners doubtless forgetting any possible differences of their own in their generous admiration of and regard for the people of the country which Columbus discovered. And thus did New York execute its part of the inaugural work of the world's great Columbian Exposition for which Chicago has been so long preparing.

COST OF THE FAIR.—Auditor Ackerman has made a report showing that the building of the World's Fair has already cost $16,708,826, twice the sum paid for the Paris Exposition, and more must yet be paid out. There is at present a cash balance of $626,396, and $2,361,263 is due on contracts.

A MODEL LOCOMOTIVE.

Some time since it was determined by the locomotive engineers of the Erie Railroad system to join in the construction of a locomotive which should fully represent their ideas as developed in everyday practice in locomotive running. In this system there are between 950 and 1,000 locomotive engineers, who each subscribed for one or more shares of the stock in the engine, at five dollars per share. The result of this undertaking is illustrated by our engraving, which represents a first class passenger engine constructed according to modern ideas. It was built with the idea of exhibiting it at the World's Fair.

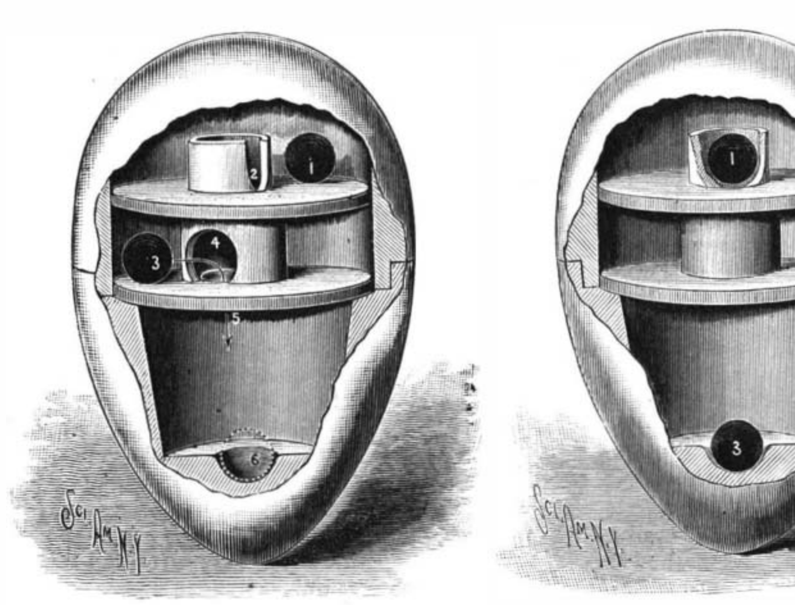


Fig. 1. BENITEZ'S COLUMBIAN EGG PUZZLE. Fig. 2.

Our engraving is made from a photograph taken of the engine while it was being tested; consequently, the valve chest is shown covered with the box used to protect the indicators. This slightly mars the illustration, which in other respects is complete. Several of the great manufacturers of materials used in the construction of locomotives showed great liberality in furnishing some of the parts or the materials from which they are made. The Otis Steel Company presented the steel sheets from which the boiler is made. They are rolled to the thickness of five-eighths of an inch. The Midvale Steel Company gave the drive wheels, axles, journal boxes and side bars. The Snow Car Truck Company presented the pilot truck, and the Westinghouse Brake Company provided complete brake mechanism of the most modern type. The engine does not possess a great many points of novelty, but the variation from the ordinary construction is considered of great importance by these men, who are constantly using engines and know the various good and bad points of existing locomotives.

The total weight of the engine is something over 67 tons. This weight is distributed as follows: On the rear drivers 44,300 pounds; on the front drivers 44,450, and on the truck 45,850 pounds. The drive wheel axles are 8½ inches in diameter, the journals are 12 inches long, and the boxes are heavier than common. To permit of using journal boxes of this length, the wheels are dished, so that the spokes are outwardly convex. The crank pins are 6½ inches in diameter in the larger part and 5 inches in the smaller part, the cylinders are 19 inches in diameter and the stroke is 26 inches. The steam pressure will be 180 pounds. The wheel base is 48 feet and 9 inches, the boiler is of the straight cylindrical type, this form being deemed on many accounts preferable to the wagon top style. The expansion of the inner and outer parts being more uniform, unequal strains are avoided, and the principal cause of leakage is removed.

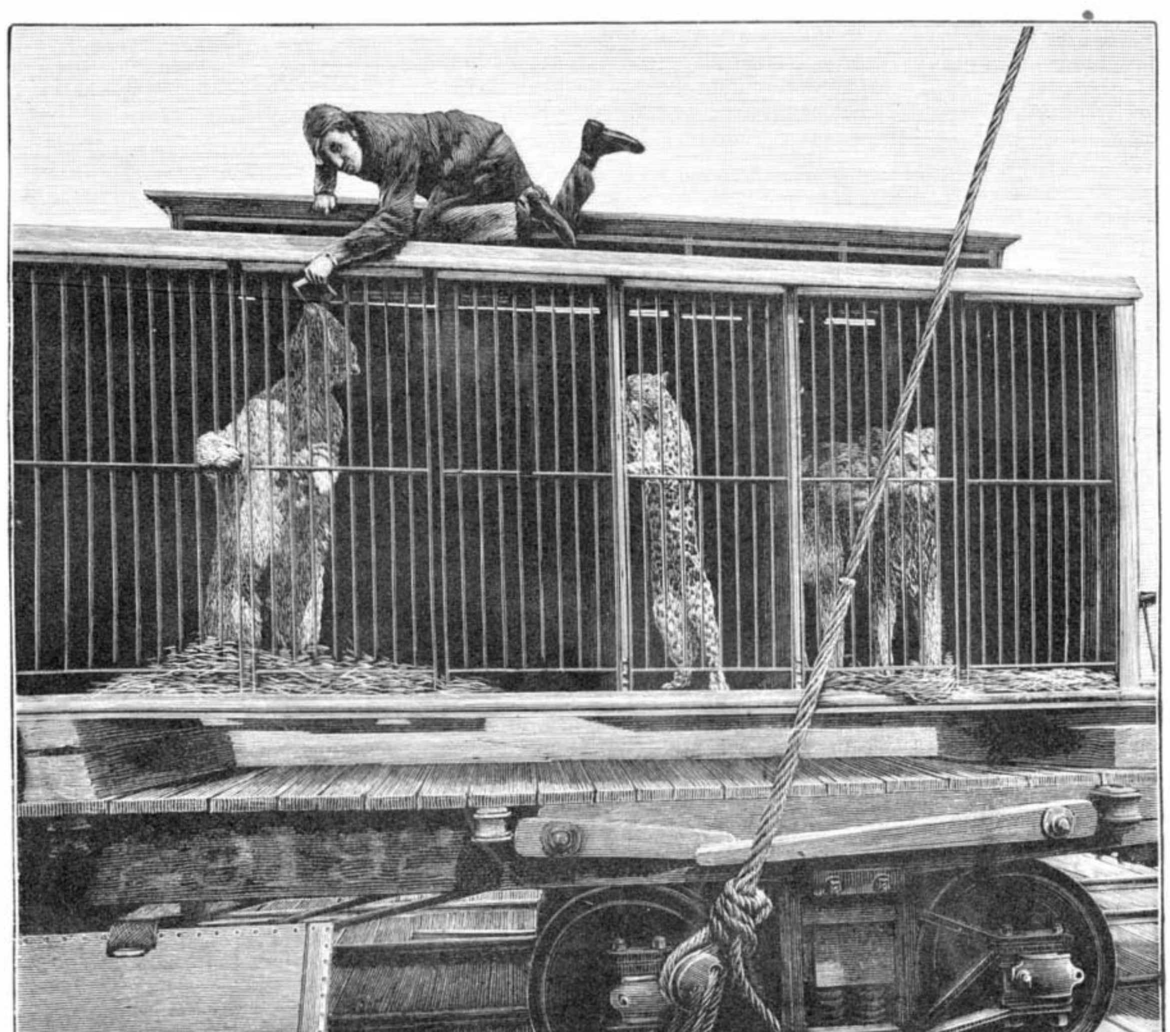
The brakes are applied at the front of the drivers, to avoid the strain caused by applying the pressure in the usual way.

This noble machine does credit to the engineers who conceived the idea of constructing a perfect locomotive, and to the army of practical men who contributed toward its construction. We understand that the engine is to be sold after its exhibition at the World's Fair at Chicago.

This creditable piece of workmanship was produced by the Cooke Locomotive and Machine Company, of Paterson, New Jersey, and we have no doubt it will be duplicated.

A COLUMBIAN EGG PUZZLE.

The illustration represents a puzzle formed of a casing simulating an egg, with which may be accomplished the feat attributed to Columbus, that of causing an egg to stand on end, the shell of the casing being broken away and two views being given of its interior. A double-floored partition divides the larger from the smaller end of the egg, the floors of the partition being united by a hollow central cylindrical portion, in which is an aperture establishing communication with the annular chamber in the smaller end of the egg. Centrally on the upper partition, in the larger end of the egg, is a collar, open at one side, forming a chamber adapted to receive a ball. A ball is placed in the upper chamber and one between the floors of the partition, as shown in Fig. 1, and the egg can then be made to stand upon its small end by turning it around in the hand until ball 1 is moved into compartment 2 in the large end, ball 3 being at the same time guided through aperture 4 into the lower chamber 5, and to the cavity 6. The balls then will be in the line of the axis of the egg, and, its smaller end having a very slight cavity to give it a narrow base on which to stand, there will be no difficulty in making it stand on this end, as shown in Fig. 2. This puzzle has been patented by Mr. Manuel Benitez, and further information relative to it may be obtained of the Columbian Commercial Company, No. 126 Maiden Lane, New York City.



THE WORLD'S COLUMBIAN EXPOSITION—RARE ANIMALS FROM EUROPE EN ROUTE FOR CHICAGO.

IN his annual report for 1892, in respect of the Newton Abbot rural sanitary district, Mr. Harvey, in discussing the diminished tendency to spread of scarlet fever, puts it down, in a measure, to the free use of boracic acid, an ounce or two of which was given to each mother, with instructions for making an ointment by means of lard.

Natural History Notes.

Climbing and Swimming Rabbits.—On the continent of Australia the rabbits, by force of circumstances, are obliged to modify their mode of life. These animals are often observed to climb trees in search of food when they cannot obtain it on the ground. At a recent session of the Zoological Society of London, Mr. Tegetmeier exhibited the fore paws of one of these Australian rabbits, which were seen to be adapted to this new mode of locomotion. It is found, in the first place, that they are more slender than those of the English wild rabbit. Their color is paler and the spots are dark. Besides, their claws are sharper and slenderer.

In the Australian rabbits differences have also been observed in the manner of raising their young. Thus, in certain localities, we find their ordinary seats, but in others the litter is placed upon the ground, without any covering. In summer they sometimes enter the water, with only their heads projecting above the surface. When they are pursued, during their migrations, they swim exceedingly well and cross the wide rivers with ease.

Ants Breeding In and In.—Forel announces that among ants of the genera *Anergates* and *Formicoxenus* there is no other male than a wingless ergatoid form, such as sometimes accompanies the normal male in other genera, and that, therefore, pairing must always take place in the ant hill itself between brothers and sisters; so we have here cases of perpetual consanguineous reproduction. "Among ordinary ants the winged male and female quit the nest in which they were born, take flight, and pair in mid air with their congeners of other nests, permitting numerous crosses. But in the case of the genera which have only an apterous male perpetual consanguineous pairing ensues, for in one and the same nest there are found only brothers and sisters and these brothers and sisters can only pair with one another. The fact appears absolutely clear in the genus *Anergates*, where one finds in each ant hill only a single fecundated female, the mother founder of the colony."

Distribution of Spiders.—Recent catalogues show that entomologists have found 363 species of spiders in the Upper Cayuga Lake Basin, 370 in the District of Columbia, and 340 in New England. Dr. George Marx has complied a list of 292 species which have been found in the polar regions of the globe, and after much study has reached these conclusions:

1. The Arctic spider fauna is composed of the ten families which we may term the common ones, their species constituting the main bulk of the entire spider fauna of the world. They are cosmopolitan, and are found almost wherever animal life is possible.

2. The genera of the Arctic spider fauna are, without exception, those which also occur in other regions of the world, and there has been found, so far, not one genus which is original to that zone of eternal ice and snow. This is a very remarkable fact, since in all other Arthropod orders, and those of higher rank, the polar fauna is distinguished by special and peculiar forms.

3. Even among this species a vast number occur which live in milder climates and under entirely different conditions and influences, and we find some families represented by only such forms, lacking entirely original Arctic species.

4. The differences between the faunas of the eastern and western hemispheres are slight, and, generally speaking those forms which are most frequently represented in one are found in the larger proportion in the other.

Coloring Matter of Pollen.—G. Bertrand and G. Poirault claim to have established the identity of the coloring matter of yellow or orange pollens of diverse origin with carotin, $C_{26}H_{38}$, the substance to which the color of carrots is due. From this generalization they exclude the dry pollens found in the *Urticaceæ*, *Graminaceæ*, etc., which owe their yellow color to the cutinization of their external membrane. The abundance of fatty matters present prevented the crystallization of the carotin of the pollen, but its iodide, $C_{26}H_{38}I_2$, was prepared. The colored crystal-like bodies that appear when pollen rich in oil is mounted in glycerine and examined microscopically are not composed of carotin, but of a fatty body, probably cholesterin, with which the oil is supersaturated.

The Number of Insects in the World.—It is believed, according to Mr. P. L. Simmonds, F.L.S., that there are five times as many insects as there are species of all other living things put together. The oak alone supports 450 species of insects, and 200 kinds make their home in the pine. Forty years ago Humboldt estimated that the number of species preserved in collections was between 150,000 and 170,000, but scientific men now say that there must be more than three-quarters of a million, without taking into account the parasite creatures. Of the 35,000 species in Europe, however, not more than 3,500 are noxious or destructive. There are more than 100,000 kinds of beetles. Such being an enumeration of the different forms, what an array of figures would be required for tabulating a census of individual insects, each a distinct living thing! Some single species include an incredible number of specimens. The locusts on the coast of the Mediterranean, for instance, sometimes cover the ground inches thick for miles, while a few years ago 14,000 bushels of locust eggs were collected in a single season in three Algerian provinces. A single house fly lays from 150 to 200 eggs, which in two weeks become equally fertile flies, and insects generally have astonishing powers of multiplication.

The Fertilization of Orchids.—J. H. A. Hicks, in discussing the fertilization of orchids without pollen, quotes Professor Henslow, who shows how a microscopical examination of the structure of the essential organs at once renders apparent the reason of so small an amount of good seed being set. The pollen, instead of being in well formed distinct grains, is arrested in development and, while the grains are still in contact, a common extine clothes the whole of each mass. Development does not proceed until the pollen mass has been placed upon the stigma. In the pistil, degeneracy is indicated by the prevailing parietal placentation and by the rudimentary character of the ovules, every part of which is degraded. There is no albumen or nucellus tissue to nourish the embryo, and the suspensor does its best to remedy this deficiency by elongating and escaping from the micropyle, then fastening itself like a parasite upon the placentas and extracting nourishment therefrom. As a result, myriads of seeds never succeed in developing even the pro-embryo.

The Autosporadic Seeds of the Yellow Sorrel.—The effective method that the yellow sorrel (*Oxalis stricta*) has of scattering its mature seeds, in which it proves to be a decided "touch-me-not," seems hitherto to have escaped observation. In Gray's Manual, and other like works, the seeds are spoken of as having a "loose and separating" coat, but the part this envelope plays in dehiscence and in the distribution of the species is not mentioned.

In May, 1891, Mr. Ernest Walker made some careful observations and the following memoranda:

As the seeds of *Oxalis stricta* L. attain maturity, the erect loculicidal capsule becomes flaccid. In this condition the least disturbance, as the touch of the hand or shaking by the wind, causes the seeds to be expelled with considerable force, and thrown two or three feet. Sitting for a few minutes by a plant, the tick of the seeds as they were continually projected could be distinctly heard. To place a capsule in the palm of the hand and press it suggested the bursting of pop-corn.

The shooting of the seed was done so quickly that it was some time before Mr. Walker could make out the manner in which it was accomplished.

The active agent is the outer coat of the seed. This consists of a translucent, shining, membraneous envelope stretched tightly over the seed. When it bursts, it suddenly and elastically turns inside out; after which it becomes flaccid.

This coat is thicker in a line along the ventral margin of the pendulous seed, or along the edge which is next the axis of the capsule. The rupture is naturally along the opposite edge. Doubling back against the axis of the upright capsule gives this membraneous coat or spermoderm the power to project the seed.

Placing some of the seeds under a lens and puncturing the coat with a needle, the rupture was found to occur at other parts than the margin, or at any point the coat might be pricked. In this instance the envelope, not having a "back-stop," was often thrown farther than the seed.

When in the capsule the position of the seeds is such as to throw them not only outward but slightly upward. They are cast farther than if projected horizontally. Some seeds were found as far as three feet from the capsule from which they were thrown.

Weeds as Large as Trees.—Of all the routes across the United States to the Pacific coast there is not one that has not done more or less to familiarize the traveling public with what is called sage brush. The further south the route the more abundant is this weed, which has added a phrase to our language by giving its name to the soil upon which it thrives—often when nothing else of vegetation can endure beside it. To speak of a reach of country as "sage brush land" is to present a picture to the mind of a man familiar with the far West. Through that phrase such a man sees a treeless, parched plain or bench of dull, baked-looking earth, dotted with thick-stemmed, dry, flannel-like, dust-covered shrubs of a greenish, whitish-brown appearance. These grow as garden weeds do in the East, a hand high or a yard or so above ground. The land which is distinguished by their presence, in greater or less quantities, is that part of the plains and Rocky Mountain region which receives the least rainfall. A major part of it was once known as the Great American Desert.

The sage brush is known to scientists as *Artemisia tridentata*. Most persons who are familiar with it think of it as an ordinary weed of small size, and even so high an authority as the "Encyclopedia Britannica" refers to it as growing in "treeless valleys and slopes." It will astonish most persons to know that it sometimes grows to such proportions as to provide a section of country with trees of its own wood, producing groves of thick-trunked and comparatively tall trees, instead of mere weeds. Prof. Elwood Mead, the State Engineer of Wyoming, while exploring the northern end of central parts of that State last summer, came upon a district where the sage brush thrived thus gigantically. Many of the sage trees that he saw were eighteen feet high, with trunks at least a foot in diameter. This was in the Big Horn Basin, east of the National Yellowstone Park and northeast of the Wind River Indian Reservation, where the No Wood River joins the Big Horn.

Prof. Mead returned to Cheyenne enthusiastic in his praise of the basin now little known except to the stockmen whose cows range there. It is as big as some of the older States, and will provide plenty of water for irrigation from the tributaries of the Big Horn River. Several very large irrigable tracts have been surveyed already. No railroads yet reach the district, but the Burlington & Missouri Railroad is building to Sheridan in the county of that name, and has employed its agents to "spy out the land" beyond. Prof. Mead had never seen such big sage brush as he discovered there, but since his return he realizes the truth of Solomon's assertion that there is no new thing under the sun, because he has been informed that, at some point in California, the same weed "grows to such proportions that the people cut it for cord wood."

Fixation of Free Nitrogen by Plants.—Schloesing and Laurent, pursuing their investigations on this subject, after describing the methods adopted in their experiments, proceed to detail their latest results. Dealing with seeds planted in prepared soils containing the micro-organisms usually found in good earth, they have not found any plants, outside the *Leguminosæ*, capable of fixing free nitrogen. Their most recent work has been to investigate numerous cases in which the soils employed were rich in nitrogen, but again negative results were met with in experiments upon the higher plants not included in the above mentioned order. Oats, colza, grasses, and potatoes were dealt with, and figures are quoted to show that no measurable proportion of the element in the free state was fixed. It is pointed out that in such investigations it is necessary to ascertain whether any fixation of nitrogen is attributable to the plants or to the soils, and the authors insist upon the importance of the conclusion they have drawn that soils absolutely bare of vegetation, although containing appropriate micro-organisms, do not fix any free nitrogen.

Starch in Plants.—The generally accepted explanation that, in the plant, the transformation of starch into dextrin and sugar is effected under the influence of a diastasic ferment, having been contradicted in recent years by several physiologists, A. Prunet has conducted a series of experiments with potato tubers in the hope of throwing some light upon the subject. The plan adopted was to make comparative determinations of the quantities of dextrin and of sugar on the one hand and of diastase on the other, found in the anterior and posterior halves respectively of tubers in different stages of germination. The former were considered as glucose and determined by Soxhlet's method, and the amount of diastase was indicated by the process of Wortmann. As an outcome of the research, it is shown that in potato tubers there does exist a relation between the distribution of diastase and that of the dextrins and sugars; and consequently between that of diastase and the conversion of starch. The results, therefore, tend to confirm the general opinion that the digestion of nutritive matters is effected, not by the direct action of the protoplasm, but by means of diastasic substances produced as results of its activity.

Pygmies from Africa.

Two Akka girls, who were rescued from Arab capturers by Dr. Stuhlmann and his companions, have been brought to Europe, and will remain in Germany for some months. In the summer they will be taken back to Africa, where they will be placed in some mission house, or otherwise provided for. They are supposed to be between seventeen and twenty years of age. A correspondent of the London *Daily News*, who saw them at Naples, says they are well proportioned, and as tall as a boy of eight years of age. Their behavior is "infantile, wild, and shy, but without timidity." One of them was always cross, bending her head, and glaring from beneath frowning brows, while the other often laughed joyously, was pleased with bead bracelets and other trinkets given to her, and expressed by a queer sniff of her flat nose her appreciation of some chocolate bonbons. After making "a capital dinner on rice and meat," they greatly enjoyed the sunshine in a pretty garden, where they gradually grew more confident, and finally allowed themselves to be photographed arm in arm with the little son of their hostess. "The coquettish one shook with laughter, and seemed to guess that a process was going on flattering to her vanity, while the cross one still looked gloomy and suspicious. They showed neither wonder nor admiration of the people and things around them in the artistically furnished house and tasteful garden. Their eyes, though large and lustrous, have less expression than the eyes of a monkey." These interesting representatives of one of the pygmy races of the world are to be presented to various scientific societies in Berlin.

United States Timber Test Work.

Although all the leading railroad engineers, architects, professors of engineering, and others interested in the timber tests had flooded with hundreds of letters their Representatives and Senators and the Committee on Manufacturing, in whose hands the special appropriation for the work was pigeon-holed, neither the committee nor the House paid any attention to this expression of public interest. The Senate, however, realized that there was value in the work and sincerity in its indorsers, and increased the appropriations for the Forestry Division by $8,000, that is, 20 per cent of the amount asked and considered by those in charge as necessary to continue the work on a proper business basis.

Under the circumstances, the testing will be discontinued until after July, when the new appropriations become available, and then proceed at the slow pace which Congress has set.

Although the result of the efforts of those who took active interest in securing appropriations for the work were not crowned with that success which they deserved, this is the only proper method of influencing legislation, and those interested in the investigation should not fail to move again when the new Congress assembles.

The first compilation of test results is now in the hands of the printer, and will probably be issued within six or eight weeks, as Bulletin 8, Timber Physics, part 2. It will contain the results obtained on longleaf pine, and will especially discuss in detail the results of tests and examinations of bled and unbled timber, results which in themselves justify the expenditure by the government of money on such work.

The Forestry Division will exhibit the methods pursued in this work at the World's Fair, which will be of interest, since nowhere in the world has such comprehensive and systematic investigation of timbers been ever devised. The working plans for a similar undertaking by the Prussian government have only just been perfected.

Another exhibit of interest to railroad engineers and those interested in reducing forest waste will be a collection of the most approved types of metal railroad ties.

ANOTHER EARLY FRENCH PATENT FOR A BARBED WIRE FENCE.

BY A. M. TANNER.

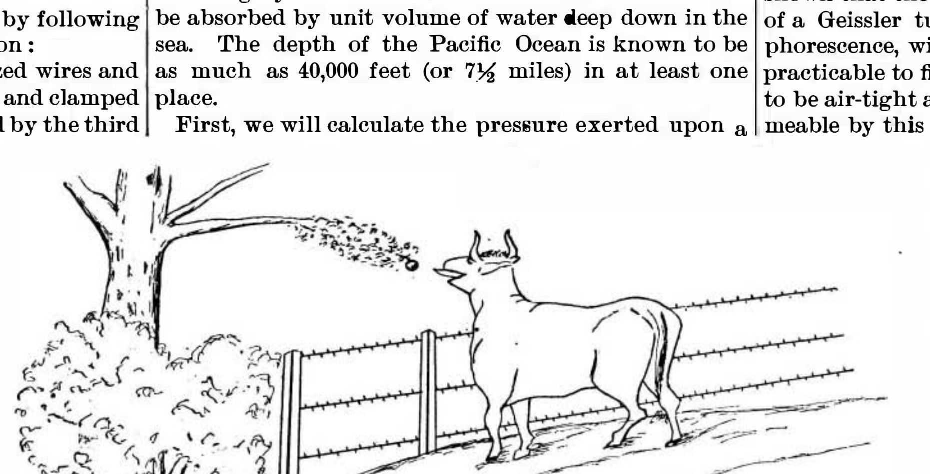
The writer has already called attention in the SCIENTIFIC AMERICAN to French patents of Grassin-Baledans, 1861, and Jannin, 1865, for barbed wire fences, which are both anterior to the earliest date of invention set up by the first American patentee of a barbed wire fence, who, as is well known, provided the wires of a wire fence with a series of spur wheels.

Almost about the same time a Breton brick manufacturer, Gilbert Gavillard, received a French patent, dated August 27, 1867, No. 77,570, for a barbed wire fence, which may be described as follows, by following as nearly as possible the French description:

This fence is composed of three galvanized wires and of spines, also galvanized, placed between and clamped by two strands, while the heads are covered by the third strand. These strands of galvanized wire are twisted together, so as to present iron thorns on all their faces. In order to form a fence, it suffices to plant posts in the ground and attach thereto, by means of iron wire hooks, three of these artificial thorny branches, which are placed at a sufficient distance apart to prevent animals from going over this thorny obstacle.

A drawing annexed to the patent is herewith reproduced.

It will be seen that it presents, in a very striking way, how an ox is prevented from reaching an apple on the other side of the barbed fence. Although the drawing does not show the form of the barbs, it is evident that they are ⊥-shaped, and that the third wire or strand prevents the barbs from dropping out by locking them in place between the two other strands. The Gavillard patent may be considered as resembling the Michael Kelly patent, of February 11, 1868, No. 74,379.



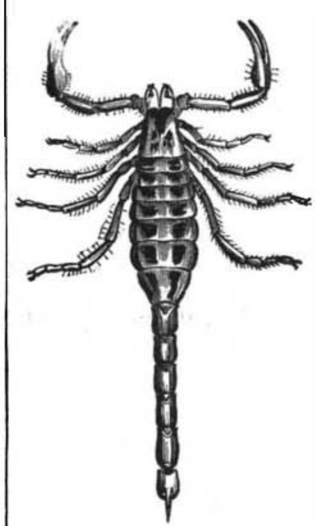
AN EARLY FRENCH PATENT ON BARBED WIRE.

Utilization of Coal Dust.

The London *Times* gives an account of a process by which anthracite coal bricks are now being manufactured by the Coal Brick Syndicate, of London. The bricks are made of grains of anthracite dust, which are forced to cohere by means of a special cementing compound and by great pressure. The coal dust is mixed with the binding material in the proportion of 96 per cent of the former to 4 per cent of the latter. The compound is fed into a mixer, where it meets a jet of steam, a stiff paste being formed, which is delivered successively into a series of moulds under a pressure of 25 cwt. As the mould plate revolves, the charge in each mould is brought between two rams, which exert a pressure of two tons per square inch on each side of the charge, forming a very dense and homogeneous coal brick. The brick, still in the mould, passes on to the delivery ram, by which it is pushed out on to a table, and is removed for the market. These coal bricks are said to make an excellent fuel and to possess a very high efficiency for steam-raising purposes. The *Times* thinks that with such a fuel at the disposal of the public there is room to hope for a reduction in the pollution of the atmosphere of towns, as well as a reduction in the coal bills of steamship companies and of steam users generally.

THE DEADLY SCORPION.

The scorpions have become so numerous in the city of Durango, Mexico, that the municipal authorities have offered a valuable prize, to be given the person capturing the largest number this month. Two thousand of the deadly pests were killed at the hospital there recently in one day. For these scorpions the city pays 60 cents a hundred, and three times a week those collected are counted and killed at the hospital, and 80,000 were thus destroyed last year. Persons who get permits to hunt the pests have the right to enter and search private houses for them.



We give a cut of the little *Buthus carolinianus*, or, as it is now called by systematists, *Centrurus vittatus*. This is the commonest scorpion of the United States, and is found as far north as Tennessee and North Carolina. Of the larger species of the Southwest we have no figure. This, however, will do fairly well for a representative of the family.

The Submarine Atmosphere.

BY A. E. RICHARDSON, B.A., F.C.S., A.M.I.E.E.

It is a well known fact that the amount of gas capable of being held in solution by a given liquid is directly proportional to the pressure exerted, unless chemical combination takes place between the gas and the solvent. But the pressure of any point within a fluid, which is incapable of being compressed, is proportional to the depth of that point below the surface of the fluid. Consequently it is obvious that the water deep down in the ocean must be capable of dissolving greater quantities of air than water at the surface.

To illustrate this point, let us take an extreme case and roughly calculate the volume of air which could be absorbed by unit volume of water deep down in the sea. The depth of the Pacific Ocean is known to be as much as 40,000 feet (or 7½ miles) in at least one place.

First, we will calculate the pressure exerted upon a cubic foot of water at that depth. Assuming that the specific gravity of sea water is roughly 1·026, a cubic foot of sea water will weigh 1,026 oz. (a cubic foot of distilled water is generally taken as weighing 1,000 oz.) Then the pressure exerted per square foot at a depth of 40,000 feet will be

$$40{,}000 \times 1{,}026 \text{ oz.} = 40{,}000 \times \frac{1\cdot026}{16} \text{ lb.}$$

Hence the pressure per square inch will amount to

$$\frac{40{,}000}{144} \times \frac{1026}{16} = 17{,}812\tfrac{1}{2} \text{ lb.}$$

The pressure due to one atmosphere may be roughly taken as 15 lb. per square inch. Thus the pressure at a depth of 40,000 feet is equivalent to that of 1,187 atmospheres. This, with the pressure due to the air above, amounts to 1,188 atmospheres.

It must be borne in mind that this is only an approximate calculation. For instance, the density of sea water is taken at a rather low figure, and no allowance is made for the compressibility of sea water under great pressures.

Accepting, however, 1,188 atmospheres as the approximate pressure at the stated depth, let us calculate the volume of air which a unit volume of the water would be capable of dissolving under this pressure.

I have no data at hand for the absorption coefficients of sea water for oxygen and nitrogen or for air; so I will take the coefficients for pure water. Here again an error will arise, for sea water cannot absorb so much air as ordinary water; for it has been found that in solutions of different substances the solubility of gases is in most cases diminished.

One volume of water at normal temperature and pressure absorbs about 0·0245 volume of air. With the temperature remaining constant the volume of gas absorbed remains the same under all pressures. But this volume of air, under a pressure of 1,188 atmospheres, would occupy a volume of 0·0245 × 1,188 under normal pressure. This quantity amounts to 29·106 volumes. Hence a cubic foot of water at a depth of 40,000 feet is capable of absorbing 29 cubic feet of air measured at normal pressure.

Since a c. c. of air weighs 0·00129 grm., 29 c. c. will weigh 0·037 grm. That is to say, the water in question would be capable of dissolving about 1-27 of its own weight of air. Nor does there seem any reason to suppose that this amount of air is not absorbed, for the atmospheric gases must permeate the whole of the ocean's depth in order that deep sea fishes may obtain the oxygen necessary for the preservation of their existence. At a depth of 1,380 feet water absorbs its own volume of air (measured at atmospheric pressure). Thus in all water below this depth there is dissolved more than its own volume of air. We have then a second but submerged atmosphere.

In this most marvelous submarine atmosphere are vast quantities of air stored away—how vast it is difficult to estimate. Remembering that three-fourths of the face of the earth is covered by water, one is apt to conclude that there is almost as much air hidden away in the ocean's depth as is found above its surface. What effect such great pressures have upon the solvent powers of the water for solid constituents it is doubtful to say. Probably the solvent powers are much modified by the presence of such quantities of dissolved gases. It is possible that such considerations as the foregoing have already appeared in print. As, however, I have never read or heard of such suggestions, I venture to bring the question before your readers.—*Chem. News.*

Aluminum Light.

A remarkable kind of light has been successfully exhibited by Dr. Philip Lenard, of Bonn, and has formed the subject of a paper read before the Royal Prussian Academy of Sciences at Berlin. Hertz has shown that the rays which proceed from the cathode of a Geissler tube, and are capable of exciting phosphorescence, will permeate thin metal. If then it were practicable to find a sheet of metal foil thick enough to be air-tight and opaque, yet thin enough to be permeable by this discharge, it would be possible to allow these rays a passage into the open air by closing an opening in a discharge tube with such a piece of foil. This idea has been realized by Dr. Lenard by means of an ingeniously arranged apparatus and a hammered aluminum plate 0·003 millimeter thick. This plate forms in the apparatus in question a shutter which Dr. Lenard calls the "window," because, while quite impermeable to air and light, it allows the rays from a cathode at a distance of 12 centimeters to penetrate it freely. These rays render the air faintly luminous. A halo of bluish light surrounds the "window," and is moderately bright only on its surface. At the same time a strong odor of ozone is recognizable. Substances capable of phosphorescence, if held near the "window," shine with their peculiar light on the side nearest to it. All the phenomena of phosphorescence cease if a magnet is so applied to the discharge tube as to repel the cathode rays from the inner side of the "window." The atmosphere is a dull medium for the cathode rays to penetrate, coal gas is more permeable, and so is hydrogen, while oxygen and carbonic acid are less permeable than air.

Cost of Columbus' Expedition.

The cost of discovering America by Columbus, says Prof. Ruge, in the "Globus," was 1,140,000 maravedis, or about $7,296 of our money. The money of Queen Isabella, of course, had a higher purchasing power than the dollar of to-day. Of the sum named, Columbus received an annual salary of $320, and the two captains each $192 per year. Each sailor, in addition to his subsistence, received $2.45 per month, or one ducat.