SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 6, 1902.

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.

THE PENNSYLVANIA RAILROAD TUNNEL.

The attitude of the Board of Aldermen of this city in holding up the franchise for the construction of the Pennsylvania Railroad tunnel beneath Manhattan is one of the most shamefaced exhibitions of political tyranny that ever disgraced the city of New York. Here is a great corporation which offers to remove the insular disadvantages under which this city labors, owing to its being cut off by the Hudson River from direct railroad communication with the West, by building, entirely at its own expense and at a cost of something like $50,000,000, a vast engineering work on which, for many years to come, it cannot hope to realize a penny of interest. The tunnel will be built at such a depth below the street grade that there will be practically no interference with traffic, and but very little surface indication that such a vast excavation is being made. From the point of view of transportation the gain to New York city will be simply enormous; and as to the question of rental, there have not been wanting many prominent citizens, and especially those who understand transportation problems, who have declared that the charging of any rental whatever to a company that is voluntarily providing such a beneficial scheme to the city, is altogether unwarranted. The ultimatum which has been presented by the lawyers of the Pennsylvania Railroad Company, stating that if further opposition develops they will drop the scheme altogether, is perfectly natural. While we should greatly regret to see the threat carried through, its execution would be a logical outcome of the exasperating and disgraceful tactics employed by the Board of Aldermen.

TEST OF THE MAXIMUM CAPACITY OF THE NIAGARA FALLS TUNNEL.

In order to ascertain beyond any question of doubt the tailrace capacity of its tunnel, a most interesting test was recently made by the Niagara Falls Power Company. This tunnel is 7,436½ feet long, 21 feet high and 18 feet 10 inches wide. When ground was broken for it, the idea prevailed that it would not have to be lined, but later it was found that a portion of the rock through which it was constructed was so soft that it might possibly be worn by the rushing water. For this reason and in order to make it perfectly substantial, the tunnel was lined from end to end with four courses of brick. In the rough, the tunnel was to have had a capacity of 120,000 horse power; but the lining lessened its capacity, so that it has always been rated at 100,000 horse power.

While not doubting the correctness of the calculations of the eminent engineers who had to do with the tunnel construction, the opportunity presented itself on November 19 for testing the tunnel by sending through it an amount of water equal to the quantity that would be used by the perfected installations in the development of 100,000 horse power. By making a test the Power Company would know by actual practice what up to that time had been theory. While the first six units in the new station will probably be in operation within the next three months, the complete installation will not be in service until the latter part of next year, so by its test of the date referred to the Power Company now knows under just what conditions its tunnel will operate when the flow of all the turbines is passing through it.

The quantity of water sent through the tunnel on the occasion of the test was twice as great as many notable rivers carry. Still, it was only a very small fraction of the water that comes down the upper Niagara from Lake Erie. Observations showed that its diversion was not noticeable on the brink of the cataract, the beauty of which was unimpaired. The test began at 10 A. M. and lasted until 5 P. M., giving ample opportunity to observe the effect on the river, the currents and falls, also the conditions existing in the wheelpits and tunnel.

The discharge at the portal of the tunnel was a most interesting spectacle. The stream from the tunnel extended clear across the river to the Canadian shore, and it was noted that a portion of the surface current passed upstream and a portion of it downstream. Between the top of the arch and the rushing water at the portal considerable space was shown, the entire semicircular arch remaining above water. The test was announced as a success in every particular.

Those who observed the test were of the conviction that one result from the discharge from the tunnel, when 100,000 horse power is being developed, will be that the flow of water will serve to hold back the ice that comes over the falls from Lake Erie, and aid in forming ice bridges of far greater magnitude than have been witnessed at Niagara at any time in the past. If this proves true, no doubt many interesting ice conditions will be seen in the Niagara gorge.

THE GUN IN NAVAL WARFARE.

We have heard so much of late years about the wonderful efficiency of the modern breech-loading rifle, that one feels something of a shock of surprise to learn from the lips of a Lieutenant-Commander of the United States Navy that in future wars it will be only pure good luck that one ship will sink another by the power of her gun-fire. The late annual gathering of the Society of Naval Architects and Marine Engineers was marked by one or two rather startling papers, among which one on "The Tactics of the Gun," by Lieutenant Commander A. P. Niblack must be reckoned. The writer defined a battleship as being, when reduced to its simplest terms, a floating gun-platform. Considered as a unit of defense it contained, on a given displacement, the maximum of concentrated destructive power, first for giving battle on the high seas, and secondly, for attack on an enemy's coastline. The author of the paper believes that if ships are to be sunk it will be done by the ram or torpedo, whose special province it is to penetrate the underwater body of a ship, destroying its watertight subdivisions, and by letting the water into the "vitals"—engine or boiler rooms, or magazines—either putting it out of action, or sinking it altogether. On the other hand, the province of the gun is to deal with the above-water portion of the ship, putting out of action the guns, gun mounts, ammunition hoists, etc., and destroying the officers and gun crews. It is argued that as long as the motive power and steering gear of a warship and such personnel as is not engaged at the battery are intact, it is almost impossible for the guns alone to destroy the vessel. When Mr. Niblack says, "It is only by luck or by indirection that a modern battleship can sink another by gun-fire alone," it is evident that he has in mind the results shown by the examination of the Spanish vessels which have been raised since the battle of Manila Bay, and also the results of gun-fire as shown on the ships sunk at Santiago. "We need not," he says, "in the future expect to set ships on fire by gun-fire as at Santiago and Manila, and, indeed, we have a long way to go before we can expect to achieve victories over our next adversary." Of course, it is well understood that the great destruction of the Spanish fleets was due to fire started by bursting shells, and in what he says above, the writer has in mind the fact that modern warships carry practically no combustible material in the way of inflammable decks, bulkheads and fittings. Hence, we cannot expect, should we engage in another naval war, to see the enemy's vessels burning up before our very eyes after the first fifteen minutes of an engagement. The present situation as regards the tactics of gun-fire is stated succinctly as follows: Bow-fire has become a great factor in modifying tactics. The ram is more than ever a dangerous weapon. Armor has almost nullified the great danger from raking fire at close quarters. The torpedo has made it dangerous to fight at closer range than 1,000 yards. Smokeless powder and high speed make the windward position of little importance compared with getting the sunlight on the enemy and in his eyes. Elaborate subdivisions in ships tend to prolong the time and increase the difficulties of the destruction of a ship by any weapon.

Gun-fire, then, being concerned mainly with the destruction of batteries and personnel, the author of the paper goes on to show that the public does not realize the horrible destructiveness of modern gun-fire. What our fleet accomplished at Santiago was done with only four hits out of every one hundred shots fired; yet since that day, "both ordnance and gunnery have been almost revolutionized, and methods good enough for 1898 are an invitation to-day to disastrous and bitter defeat." To illustrate how gunnery has improved in the past three or four years, and how terrific must be the hail of projectiles in a future engagement, Lieutenant Commander Niblack instances the progress made since the war in the British Navy in the matter of target practice, and he quotes official records of the annual prize-firing contest for last year. A target 20 feet long and 16 feet high was anchored at a distance of about one mile from the course followed by the contesting ships, each of which steamed by the target at a speed of 12 knots and fired for two minutes with each 6-inch gun, firing one gun at a time. According to the official reports, the average of forty-eight ships was nearly two hits per gun per minute. The best fifteen ships made from two to four hits per gun per minute. This means that eighty-two 6-inch guns fired eight hundred and sixty-seven projectiles in two minutes and made 518 hits, or nearly sixty per cent. The battleship "Ocean" averaged nearly five hits a minute, while one of her gun captains fired nine shots and made nine hits in one minute. This, Lieutenant Commander Niblack states, is easily the world's record, as it means less than seven seconds between aimed shots. One gun in particular fired seventeen shots in two minutes and made fifteen hits.

"Just now," says the author of the paper, "the navy needs unusual and heavy expenditures for ordnance." This somewhat pessimistic view of the condition of our navy may seem puzzling in view of the abstract of the report of the Bureau of Ordnance given in our last issue, in which it was shown that our new guns are fully the equal of any that have been built abroad. Mr. Niblack, however, is referring to the number of ships of our navy that are carrying the older types of weapons, shells and powder, which, although excellent in their day, have become outclassed by modern material. He says that owing to the pressure of the past five years, some of our ships have been in continuous service for that period, and everyone of these needs a thorough overhauling as to battery and ammunition, and particularly as to ammunition, as they have on board a heterogeneous lot of brown powder, smokeless powder and projectiles collected from various sources, most of it for the war with Spain. These are matters that can easily be remedied if Congress will only grant sufficient appropriations to renew these older batteries and replenish the magazines with modern shells and powder. A good beginning has been made in this work, and it should be carried through with regard to every ship on the active list of the navy.

THE DEATH OF FRIEDRICH KRUPP.

The death of Friedrich Alfred Krupp, head of the iron and steel industry of Prussia, removes the most conspicuous citizen of the German Empire and one of the greatest manufacturers of the world. The reputation of his works for fine artillery earned for him the name of the "Cannon King" in Germany.

Friedrich Krupp was born on February 17, 1854, the son of Alfred Krupp, who inherited the works at Essen from his father. The first of the steel-makin' Krupps began work at Essen with two laborers in 1817. When the late Friedrich Krupp became the head of the firm he found at Essen a well-established business which he developed into a world-wide enterprise. The Krupps will always be remembered as great steel makers and as armorers of the world's fighting forces. That was the work of the "Cannon King."

The Krupp works are vast in extent. The real estate belonging to the firm amounts to 900 acres, of which 150 are covered by buildings. The daily output of the works amounts to about 1,877 tons. The late Herr Krupp had the general management of these gigantic works; but the various branches were placed in the hands of a board of twelve directors, who were responsible to him for all the departments, numbering about one hundred.

Friedrich Krupp was the richest man in Germany. Yet he had been accustomed all his life to toil with both hands and brains.

"From my fourteenth year," he once said, "I had to care like a father for my family during the day added to hard work at the factory. At night I had to study how to overcome the difficulties in the way. During this period I lived on potatoes, bread and coffee and scant portions of meat, and toiled until late in the night. For twenty-five years I struggled thus, until conditions grew a little easier. My last remembrance of that period is the growing danger of total ruin and my endurance, suffering and hard labor to avert the calamity; and I say all this for the encouragement of young men who have nothing, are nothing and want to get something and be somebody."

The Krupps have always been known for the interest they have taken in the welfare of their employes. But the "Cannon King" so far excelled his predecessors in this respect that he was more than once accused of harboring socialistic principles. It was Friedrich Krupp's father who started the system of modern dwellings for workingmen as an experiment. The late Herr Krupp himself appears to have developed them from conviction and in accordance with his ideals. He owned 5,469 dwellings, each being constructed differently to avoid architectural monotony. All the houses have front yards with beds of ornamental gardening. Besides convalescent hospitals and orphanages, Fried-

rich Krupp maintained a pension fund for his employes, amounting to $4,125,000.

Notwithstanding his vast benevolent interests, he is said to have been an autocrat in the management of his affairs. He was almost unknown by sight to his workmen, and rarely visited the works or even his offices. Unlike his father, he took no interest in the technical side of his business, and yet in fifteen years he more than doubled the fortune which he inherited.

AN AMERICAN PARALLEL TO THE TULIP CRAZE IN HOLLAND.

BY IRVING U. TOWNSEND.

Probably few persons not thoroughly conversant with the history of the silk industry in America, are aware that the tulip mania which raged in Holland nearly three hundred years ago, had its counterpart here two hundred years later.

Five hundred dollars was often paid for a bulb of the Admiral Liefkens or of the Gouda variety, $1,000 to $1,200 for a Viceroy, and $2,000 for a Semper Augustus during the mania. In 1634 the craze became so great that all usual industries were abandoned. A choice bulb sold for $1,900 in cash, two horses, a carriage and a set of harness, representing in all $3,000. Persons frequently invested $50,000 in a few dozen bulbs with which to begin business, mortgaging their houses or giving personal property in exchange. These extraordinary values checked the cultivation of tulips, as the bulbs could be bought and at once sold at a profit to speculators. Finally the real tulip lovers became disgusted and in February, 1637, suddenly placed large quantities of the most valuable varieties upon the market. This produced an immediate and disastrous decline in the price of bulbs. Without a day's warning, thousands found themselves ruined. It was several years before Holland overcame the effects of this strange mania.

Now comes the analogy. James I., who almost insanely hated tobacco, was determined that silk worms should be reared in Virginia, mainly because he thought he could thus destroy the tobacco culture, which he ordered to be abandoned. Some silk was produced and sent to England. The coronation robe of Charles II. was made from such silk. During the next hundred years there occasionally appeared a waistcoat or handkerchief of a Colonial delegate, made from homespun and woven silk, and sometimes grand ladies were arrayed in gowns of native-grown silk. For a time silk culture met with great success in Georgia. In 1759, 10,000 pounds of raw silk were thence exported to England. Connecticut was, however, the center of the industry. The Legislature offered a bounty for planting trees. As late as 1825 the culture of silk was very general there and also flourished in Massachusetts. In Pennsylvania it was undertaken and continued with success until the Revolution.

Silk worms were fed on the white mulberry (*Morus alba*) until 1830, when there appeared the Chinese mulberry or *Morus multicaulis*. Dr. Felix Pascalis made known the remarkably rapid growth and the supposed excellent qualities of the tree, thus opening this Pandora's box whence so many evils escaped. It was predicted that by its culture two crops of silk could be raised annually. It had large, thin, tender leaves; it could be propagated easily by cuttings and cultivated as a shrub; and it was claimed that its leaves formed the most nutritious food for silk worms. Soon all the agricultural literature and the newspapers of the country became surfeited with descriptions of this wonderful tree.

At this very time Congress was considering the subject of silk culture. In 1825 the country had imported silk goods valued at $10,000,000, and had exported breadstuffs worth only $5,000,000. This was considered an alarming state of affairs. Secretary Rush of the Treasury was directed to prepare a manual on the growth and manufacture of silk. This was issued in 1828 and known as the "Rush Letter." Many documents relating to sericulture were published by Congress. A Congressional committee recommended that all public lands be leased gratuitously to those who would undertake the cultivation of the mulberry. A bill barely failed of passage that authorized an expert to instruct the farmers everywhere how to cultivate the *Morus multicaulis*. The Massachusetts Legislature ordered the preparation of a manual on silk culture which was very potent in fomenting the craze. The legislature of nearly every State provided for the payment of liberal bounties for planting mulberry trees and raising cocoons.

Thus it was that a speculative furor, a veritable madness, seized upon all classes of people, and particularly—of all men—upon the shrewd, calculating Yankee. It raged like an epidemic. Not only agriculturists, but doctors of divinity, law and medicine, scholars, tradesmen and mechanics, men and women, old and young, were infected with an insane passion to raise mulberry trees. Every one thought the glorious day was dawning when each farm would be a nursery for the young trees, and every house have its cocooneries and its silk worms yielding two or more crops of cocoons yearly. The farmers' wives and daughters, when not feeding the worms, were to reel the silk which would become as cheap as cotton, every woman having at least a dozen silk dresses. A writer of the day said, "You can scarcely go into a house but you find the inmates engaged in feeding worms."

The large profits anticipated in producing silk were insignificant compared with the fortunes that all expected to make by raising the new mulberry tree. This was planted in close hills or in hedges, it adorned highways, and rarely was a garden or any cultivated spot to be seen without it. In 1834 trees of a season's growth were sold for $3 to $5 a hundred, but they soon sold at $25, $50, $100, $200, and $500 a hundred, and sometimes $7 apiece. There is recorded an instance of two trees of one season's growth, raised by one Elder Sharp in North Windham, Conn., which were sold at auction. The first brought $106, and the second $100. Further sales were then withheld because the bidding was not considered to be sufficiently spirited.

As cuttings with buds or eyes were sufficient for planting, slender switches two feet long sold for $25 a dozen and were declared to be worth $60. In fact, the value of the trees became greater than that of the silk which they could by any possibility produce. They became worth too much to be used for silk culture. When the craze reached its height, but little silk was produced for every one was busy raising the new mulberry tree. The speculation in planting, buying and selling trees withdrew attention from the more legitimate business of raising silk worms. Men expected to make fortunes in a few months buying land and planting mulberry slips, and the silk companies almost without exception sank their capital in this way, many fully equipped mills being closed.

One farmer planted $1,000 worth of trees in ¾ of an acre and sold them the next year for $6,000. Elsewhere the trees upon two acres brought $4,000, those upon fifteen acres brought $32,500, and those upon ten acres brought $38,000. The sales in a single week in Pennsylvania exceeded $300,000, and often the same tree was sold several times at advancing prices. A newspaper of the period said:

"Friday, the 'Alabama' took to Baltimore 22,000 mulberry switches, the value of which at the lowest calculation, based on actual sales throughout the country, cannot be less than $45,000. The number of eyes on these switches is ascertained by carefully counting them, to be 2,254,000, which would be considered cheap at 2 to 2½ cents a piece. The whole was raised on fifteen acres of land that would be considered well sold at $10 an acre in ordinary situations."

In 1839, just before the people came to their senses, a nurseryman sent an agent to France to purchase several millions of young trees. He carried $80,000 in cash as a first payment. When the trees arrived, the inevitable crash had come, and the nurseryman failed for so large an amount that he could never reckon up his indebtedness. His trees were offered in vain at a dollar a hundred for pea brush.

After the crash some large holders sought to unload without loss. They chartered an unseaworthy vessel, loaded her with trees and sent the cargo heavily insured via New Orleans to Indiana. To their great chagrin the vessel reached New Orleans safely and the trees were transferred to river boats at great expense and hurried on to their destination. When finally they arrived no one would take them as a gift.

When the fever was over and the people realized that their capital stock was suddenly worthless, a deep reaction set in. They pulled up all the mulberry trees in a rage and burned them as brushwood. The numerous companies which had invested their capital in them succumbed almost without exception. In 1841 only one survived and that perished four years later. In 1844 a violent storm following a general blight destroyed most of the remaining *Morus multicaulis* trees and even the more hardy white mulberry variety. This was the finishing blow and thus silk culture in America practically ceased to exist. No industry ever, in this country, received such a crushing stroke.

From that day to the present, sericulture has at times been spasmodically undertaken on a small scale in many States, but the total output has been almost infinitesimally small. The Secretary of Agriculture is now endeavoring to revive American sericulture by governmental aid.

RESTORATION OF THE PARTHENON.

Despite foreign criticism Greece is determined to restore the ancient Parthenon. At first the work was to be carried out with old fragments of marble taken from the surrounding earth, but the authorities finally decided that nothing but new, freshly quarried stone should be used. The result will probably be grotesque, for the ancient stone is weather-stained.

The original appearance of the old structure can probably never be restored. It has been quite definitely settled that although the edifice was built of the purest white marble, it was colored here and there. It is likely that the sculpture was also relieved by color and that the moldings were painted or gilded. The Greek government intends completely to restore the building merely so far as its original shape is concerned.

SCIENCE NOTES.

An oxyacetylene blow-pipe is described by M. Fouché in the Bulletin of the French Physical Society. The flame is formed by the combustion of a mixture of one part of acetylene to ¼ of oxygen, and in order that the explosion may not travel back into the blow-pipe, a jet velocity is required, due to the pressure of a water column four meters in height. The flame melts most metals readily; it will solder iron and steel. Even silica and lime are melted by it. With a reduction of the proportion of oxygen, the flame becomes luminous, and on falling on lime the free carbon goes to form carbide of lime.

J. O'Brien contributes a suggestive note to the Gardener's Chronicle, on the differing odor of *Odontoglossum hebraicum* as observed at different periods. When first flowered by the writer the blooms had a marked cinnamon odor, quite distinct from the hawthorn fragrance of other members of the group. On passing into other hands, the plant, when it first flowered, gave off the hawthorn odor but on the next occasion of its blooming the smell was that of cinnamon. The writer does not state if these differences of odor have been traced to diverse periods of the blooming. It has been noticed by those who grow the common jasmin that the flowers, when first expanded, possess in a marked degree the delicious fresh odor which is characteristic of them. But as flowering progresses, the perfume becomes less delicate, and the blooms are then very attractive to blue-bottle flies. This would appear to have some connection with the recorded formation of indol in the jasmin bloom as the process of flowering approaches completion.

Mr. J. Halm, of the Royal Observatory of Edinburgh, has proposed a new and more complete theory of the sun, briefly as follows: Previous theories of the periodic changes have taken no account of the absorbing envelope surrounding the photosphere. If the loss of energy by radiation exceed the production of heat due to shrinkage, the temperature must fall. The level of the layer of maximum radiation, i. e., of the photosphere, must shift toward the center, and consequently the photosphere becomes protected by a greater thickness of absorbing and reflecting matter. After a time the increasing reflection may overheat the photosphere, but the overheated material may be retained at the level of the photosphere by convection currents until the upward tendency becomes so strong as to produce an eruption by which thermal equilibrium is temporarily restored, after which the cycle is repeated. The mathematical expression of the theory gives an equation from which a curve of sun spots may be computed which agrees very closely with the results of observation, while a "great period" of solar phenomena is accounted for by changes in the intensity of the convection currents, the equation showing that when the spot development is powerful the rise from minimum to maximum will be accelerated. A remarkable conclusion from the theory is that times of maximum spottedness correspond to times of minimum radiation, which would seem to be supported by the more important recent researches.

At the recent International Aeronautical Congress at Berlin Prof. Dr. Assmann, Director of the Aeronautical Observatory of the Prussian Meteorological Institute, described his registration balloon of caoutchouc or Para rubber, which was one of the novelties of the meeting. The ordinary *ballon-sonde*, made of silk or paper and open at the bottom, has the great disadvantage that, when it approaches equilibrium in the upper strata of the atmosphere, its velocity of ascent decreases and the effect of insolation on the thermograph becomes greater, without it being possible to determine afterward the place where the solar disturbance began during the ascent or where it disappeared during the descent; in fact, it is only in certain cases that we can distinguish between the insolation influence and the curious thermal anomalies that have been described by Teisserenc de Bort and Hergesell. The use of a closed balloon made of elastic material has this advantage, that in proportion as the inclosed gas expands, the ascensional force is increased so that the balloon rises faster with augmenting height until it bursts and then falls to the ground with diminishing velocity, because checked by a parachute. The time of equilibrium is therefore reduced to an instant, and although the higher the altitude the more intense is the solar radiation and its effect on the thermograph, yet the speed of ascent and descent is also increased and, consequently, the ventilation, which counteracts the radiation, is likewise stronger. The least possible weight of balloon envelope and of registering apparatus is required, for the lighter the whole apparatus, the less gas is needed, and the smaller the quantity of gas the more it can expand before the envelope bursts at a proportionally greater height.