Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, one year, for the U. S., Canada or Mexico..................$3 00
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NEW YORK, SATURDAY, OCTOBER 26, 1895.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending October 26, 1895.

Price 10 cents. For sale by all newsdealers.

PREVENTION OF RUST IN WHEAT.

Mr. E. B. Mayo, of V. Viesca, Coahuila, Mexico, in a recent letter complimenting the SCIENTIFIC AMERICAN, wishes to know whether there is any remedy or preventive for rust in wheat. The prevention of rust and smut of oats and wheat has been made the basis of a series of special investigations and experiments by a number of investigators, while the Division of Vegetable Pathology in the Department of Agriculture has particularly taken up the subject of smuts in oats and wheat. In Farmers' Bulletin No. 5 of that division the experiments of the division, as well as those made at the different State experiment stations, are summarized, the different methods having for object the treatment of the seed grain, since it has been found that infection takes place when the seed is germinating, from spores which adhere to the seed when this is planted.

The soaking of the seed in hot water has had many advocates, but success depends upon exceptional care and the process is somewhat complicated. Potassium sulphide has also been used with more or less success, the seed being soaked for twenty-four hours in a one-half per cent solution of this material; but the preventive which is recommended as superior to this is the treatment with copper sulphate. This consists in immersing the seed in a solution made by dissolving a pound of commercial copper sulphate in 24 gallons of water for twelve hours, and then putting the seed for five or ten minutes into lime water by slaking a pound of good lime in 10 gallons of water.

The bulletin above referred to concludes with the following statement: "These treatments have all been tried and have proved effective. In some parts of the country seed wheat is treated in strong solutions of copper sulphate, and no lime is used. This practice is much inferior, since it injures the seed, while those given here prevent the smut completely and at the same time do not injure the seed if carefully followed. In all forms of seed treatment care should be taken to spread the grain out to dry at once, and by frequent stirring prevent its spoiling. The treated seed should be handled only with clean tools, and should be put in sacks disinfected by boiling fifteen minutes. If these precautions are not taken, the seed may be infected again after treatment, especially in case of stinking smut of wheat. If the seed is to be sown broadcast, it will not have to be so dry as if it is to be drilled."

THE PROPOSED NORTH RIVER BRIDGE—THE GREATEST ENGINEERING UNDERTAKING IN THE WORLD.

The Secretary of War recently appointed a board of officers of the corps of engineers to "investigate and report their conclusions as to the maximum length of span practicable for suspension bridges, and consistent with an amount of traffic probably sufficient to warrant the expense of construction."

The leading features of the design upon which the estimate were made were as follows: A steel suspension bridge having a clear span of 3,200 feet between the towers and carrying six railroad tracks placed side by side. The floor of the bridge to be provided with a stiffening truss, which shall be hinged at the center and be 120 feet in depth. The bridge to be carried on 16 cables, arranged 8 on each side; each cable to consist of 6,000 parallel steel wires wrapped together and having a breaking strength of 28,440 tons; the diameter, inclusive of wrapping, being $21\frac{1}{2}$ inches.

The strength of the bridge to be calculated for a rolling load of $13\frac{77}{100}$ tons per linear foot, and a wind pressure per linear foot of $1\frac{12}{100}$ tons.

With a factor of safety of three, the cables to be strained to 30 tons per square inch. For the stiffening truss a working stress of $7\frac{5}{10}$ tons to the inch to be allowed.

Working upon this data, the board deduced the following table of weights and cost for a 3,200 foot suspension bridge:

STRUCTURAL STEEL.

Suspended weights, in pounds	90,870,000
Towers	52,313,000
Chains and anchor plates	18,324,000
Total	161,507,000
At 4 cents per pound (1).	$6,460,280

WIREWORK.

Main cables and wrapping, in pounds	30,358.000
Backstays and wrapping	22,738,000
Suspenders	3,222,000
Total	56,348,000
At 7 cents per pound (2)	$3,942,260
Cost of superstructure (1 and 2)	$10,402,540
Cost of substructure (foundations, etc.)	11,784,000
Total cost of bridge	$22,186,540

From an engineering standpoint it is not the total length of a bridge that determines its magnitude, but the length of the individual spans. The cost and constructive difficulties of bridge building increase at a rapidly increasing ratio as the span is lengthened. The Tay bridge in Scotland is twice the length of the Forth bridge to the south of it: but the design and erection of its two miles of short girders did not call for the exercise of one-fifth part of the skill and courage required in throwing the huge spans of the Forth bridge across the mile of deep water at the Firth of Forth. In a like increasing ratio will the difficulties multiply in stretching this mammoth structure across the Hudson River.

The seven wonders of the world, that appealed so strongly to the ancients, will be completely overshadowed on every point of comparison by this crowning feat of the nineteenth century.

If mere bulk or mass be taken as the standard of comparison, it will be bigger and heavier than the greatest of the works of the ancients; and in the scientific knowledge involved in its construction, it will embody truths in chemistry, mathematics, and mechanics that would bewilder the Egyptian builders of the Pyramids even more than its vast stretch of steel cables and interlacing girders.

The two masses of masonry that will have to be built on shore to resist the enormous pull of the 16 cables will, in their united weight and bulk, rival the great Pyramid of Gizeh.

The four steel towers that carry the cables will each, in all probability, overtop the lofty Washington Monument; and will be exceeded in height only by one structure, the Eiffel Tower in Paris. Ethically, if we may so speak, they will stand loftier than the last named; inasmuch as the Eiffel Tower is merely a spectacular "freak," whereas the four great towers of this bridge will reach their full stature as part of a great mechanical structure erected for a useful mechanical purpose.

When loaded to its full working capacity, the bridge can carry in midair, at a height of 150 feet above the river, 17 heavily loaded freight trains, which, if strung out in line, would be two miles in length. This would represent a total load of 26,000 tons. Moreover, it could carry this load with a large margin of safety in a tempest of wind that would endanger the stability of many of the adjacent buildings in New York City.

It is fortunate, judged from the æsthetic point of view, that the great structure is to be built on the suspension principle instead of the cantilever, as was at one time proposed. Apart from the much greater weight and cost of a cantilever bridge, there is by comparison everything to be said in favor of the light and graceful appearance of the suspended bridge.

The lofty and tapering steel towers, with the cables rising in a long sweeping curve to meet them 500 feet in midair, will form a picture at once majestic and beautiful.

THE BATTLE SHIP INDIANA.

In placing the Indiana upon the list of available warships in the United States navy, the naval board will make the most important and significant addition to our fighting strength on the seas that it has ever known. In the Indiana we shall possess, for the first time, a first-class modern battle ship that can challenge comparison with any other armorclad afloat.

It is true there are in the English navy ships of 50 per cent greater displacement and 2 knots higher speed; but any superiority in this regard will be fairly well offset by the greater weight and more effective disposition of the armament in the boats of the Indiana class.

The displacement of the Indiana is 10,500 tons; that of the Royal Sovereign 14,900 tons; and yet the American ship can throw a much heavier weight of metal at a single discharge. The cause of this vast disparity in size is to be found in the different nature of the duties that have to be performed by the two types. The Indiana and her class are called coast defense vessels. They are designed for home waters, and their operations will be carried on as far as possible within easy reach of the home coaling stations. Consequently they will not need to carry more than a limited supply of coal, ammunition, and general stores. On the other hand, the world-wide distribution of England's maritime interests and the aggressive system of warfare which she has always aimed to carry on, seeking out and running down the enemy at sea, necessitate the building of battle ships of great coal endurance and capable of carrying a large supply of ammunition and stores for extended cruises at sea. All this necessitates an increase in size, and hence the mammoth proportions of such ships as the Royal George, which, when fully loaded, displaces 16,500 tons. The United States navy has no colonial interests to protect, and her battle ships are designed for the special purpose of guarding the home waters. For their purpose they are ideal ships; and ship for ship, they will be fully the equal of any European leviathan in a naval duel.

The Indiana is 348 feet long, 69 feet beam, and draws 26 feet fully loaded. A belt of steel 18 inches thick and 7 feet 6 inches deep protects her at the water line, 3 feet 6 inches of this being above and 4 feet below water. Above this belt of steel is a steel deck, $2\frac{3}{4}$ inches thick, which, with the side armor, will form a kind of huge inverted box, under which will be placed the "vitals," i. e., the engines, boilers, and stores of powder, shot, and shell. At each end of this armored box, and standing upon the steel deck, is built up a large "barbette," or round tower, of solid steel, 17 inches thick, within which will revolve the two steel turrets, 17 inches thick and 20 feet inside diameter. Each turret contains two steel guns, of a caliber of 13 inches, and 40 feet long, weighing 50 tons each. These four guns can each throw a shot weighing 1,200 pounds a distance of 12 miles, and can pierce 22 inches of steel at a distance of a mile. The Indiana could be off Rockaway Beach and throw shells into New York City.

A little distance behind these two main turrets, and placed one at each corner of the above mentioned armored box, are built up steel towers with armored steel turrets revolving at the top of them, in each of which are placed two 8 inch armor piercing guns. This is what, in battle ship parlance, is known as the secondary battery, and it is just here that the Indiana shows such a preponderance of fighting strength over other warships. In every other battle ship of foreign navies the secondary battery consists of guns of 6 inch caliber or less. These guns are not armor piercing, and the range of their destructive effect against a plated ship is limited. Not so the 8 inch guns of the Indiana. They are capable of piercing at close range all but the very heaviest armor afloat, and in a naval duel they would be the decisive factor of the fight. These eight guns are carried at a height of twenty-six feet above the water line, and could be fought in the heaviest weather without being interfered with by the breaking of heavy seas over the ship.

Between the 8 inch guns, and standing on the steel deck, are four 6 inch guns, which have a broadside and dead fore and aft fire. In addition to the heavy ordnance, the Indiana carries no less than thirty smaller guns, ranging in weight of shot from the 6 pounder down to the bullets of the Gatlings.

She is provided with tubes for the discharge of the deadly torpedo; and last but not least, she has a powerful underwater ram for ripping up the enemy's hull should a favorable opening occur in the confusion of a naval fight. To recapitulate, the Indiana's offensive strength is represented by four 13 inch 50 ton guns; eight 8 inch 18 ton guns; four 6 inch 5 ton guns; thirty smaller rapid fire guns; 18 inch discharges for torpedoes carrying 250 pounds of explosive.

The guns are so advantageously placed that, at a single discharge, she could hurl 6,800 pounds of shot into the enemy, with an average velocity of 2,000 feet per second.

On her trial trip, which took place on the 18th inst., she developed a speed of 15·61 knots over a thirty mile course, which is over half a knot in excess of the contract requirement. She was quick in answering her helm and showed good stability, two most important features in a battle ship. On page 264 we give an illustration of the Indiana.

Franklin L. Pope.

Franklin Leonard Pope was instantly killed by a shock of 3,000 volts in the cellar of his house at Great Barrington, Mass., October 13. He was the manager of the Great Barrington Electric Light Company, the principal buildings of which are at Housatonic, distant five miles. To facilitate the operations of the plant, he had placed in his cellar a large and powerful converter. When the power was turned on he visited the cellar to adjust the bearings. His family upstairs heard a heavy fall, and upon investigation found Mr. Pope dead on the floor beside the converter. Doctors say death was instantaneous.

Mr. Pope was born in Great Barrington in 1840. At an early age he was a telegraph operator. In 1860 or 1861 he came to New York, a green-looking Yankee country lad, to seek his fortune, and strayed into the SCIENTIFIC AMERICAN office, where employment was given him as a draughtsman. Here he gained knowledge of patents. Thereafter he entered the employment of the American Telegraph Company.

He was one of the earliest patent solicitors making electrical inventions a specialty, and for several years he held the office of patent attorney for the Western Union Telegraph Company. He was well known as a writer on electrical subjects. For several years past he was retained as an expert in some of the most important patent suits brought before various courts. In 1886 he was elected president of the American Institute of Electrical Engineers, of which he was a charter member, succeeding in that office the late Dr. Norvin Green. The reconstruction of the Great Barrington electric plant was one of his recent undertakings, and the work embodied many interesting features, which were described in a paper read by him at the June meeting of the Institute at Niagara Falls.

Mr. Pope leaves a widow and three children, two daughters and a son. His brother, Ralph W. Pope, is secretary of the American Institute of Electrical Engineers, and his son Henry W. Pope, is with the American Telephone and Telegraph Company in New York City. The funeral and interment was at Great Barrington.

Eugene Langen.

We regret to learn of the sudden death of Mr. Eugene Langen, one of the noted millionaires of Cologne, and one of the directors of the Otto Gas Engine Works, of Philadelphia, on the 2d inst., of heart failure, at his country seat, Elsdorf, not far from Cologne. Mr. Langen was one of the largest beet sugar manufacturers in the world, acquiring by that business about $20,000,000 in American money. Besides this he had a large business, and was a director of the Gas Motoren Fabrik Deutz, the largest of its kind in Germany. He had many decorations conferred upon him for his ingenuity and enterprise, one being from Emperor William I. He was only once in the United States, and that in 1894, when the firm of Schleicher, Schumm & Company ceased to exist, and the Otto Gas Engine Works were incorporated, which firm is now so well known throughout all the principal cities of the globe. He was about 60 years old, and leaves a family of twelve children, one of whom, Mr. Gustave Langen, is the president of above firm.

Progress of the Jerome Park Reservoir, New York.

The Ingersoll-Sergeant Drill Company have just received a large order for a complete plant of air compressing machinery for running drills, engines, pumps, etc., on the Jerome Park reservoir work, New York.

The contract for the construction of the Jerome Park reservoir was awarded to Mr. J. B. McDonald at $5,473,060. It involves the removal of upward of 3,000,000 cubic yards of rock.

The contractor has, since the letting of the work, made a thorough investigation looking to a determination of the question whether or not machinery for excavation can best be run by steam or from a central compressed air plant. The central plant system has been adopted as the best and cheapest, the saving in expense being largely in labor and fuel.

The plant made by the Ingersoll-Sergeant Drill Company and adopted by the contractor involves the use of compound condensing Corliss air compressors run by high class of boilers transmitting and distributing compressed air at 80 pounds pressure throughout the work.

It is contemplated to use a battery of several air compressors placed side by side, the unit adopted being a duplex compressor with steam cylinders 24 inches and 44 inches in diameter, 48 inch stroke, driving two piston inlet air cylinders, each 24¼ inches in diameter by 48 inch stroke, the capacity in free air of this machine being between 3,000 and 4,000 cubic feet per minute. This is a duplicate of compressor at work at the Anaconda mines, in Montana, where very economical results have been derived.

New Turbines for Niagara.

The Niagara Falls Hydraulic Power and Lifting Company have recently contracted with James Leffel & Company, of Springfield, Ohio, for four of their improved double discharge water wheels, to be of eight thousand horse power capacity, under a maximum head pressure of 218 feet, which is far the highest head under which turbines of large capacity have ever been applied in this country or elsewhere. These wheels will drive eight electrical generators, which will be connected direct to the turbine shafts, without gears or belting. This is the second order for turbines built by James Leffel & Company for Niagara Falls, there being already several of this make of wheel, each of 1,200 horse power, in daily operation in the Cliff Paper Company mills, located at the cliffs, near the tunnel. This water wheel company is also building four of their cascade wheels for one company, to be operated under 730 feet head; part of the power to be electrically transmitted by connecting the wheel shaft directly to the generators. The cascade wheel is, however, essentially and entirely different in construction and operation from the turbine, being in principle an impulse and reaction wheel. This cascade wheel plant will have an aggregate capacity of six hundred horse power.

Preservation of Chloroform.

L. Allain claims to be able to preserve chloroform indefinitely by saturating it with sulphur. Chemically pure chloroform is taken, and the sulphur is prepared from ordinary sublimed sulphur by leaving it in contact with four times its weight of pure caustic ammonia during twenty-four hours. It is then washed with distilled water until neutral to litmus, and placed in a stove regulated to a temperature of 40° C., where it remains for four days, after which it is further dried over sulphuric acid for fifteen days. Purified chloroform exposed to direct sunlight gave a precipitate with argentic nitrate solution after about forty eight hours, but underwent no change under similar conditions if previously saturated with sulphur, except that there was a deposit of insoluble sulphur. Specimens thus treated have been exposed to sunlight for four months without any alteration that could be detected by the usual reagents, and were found to cause perfectly normal anæsthesia in men and the lower animals, without accident. In diffused light the addition of one-thousandth part its weight of sulphur preserved chloroform indefinitely in the presence of a great excess of oxygen. No explanation of the phenomenon is offered, but it is intended to perform similar experiments with selenium and tellurium in place of sulphur.—Journ. de Pharm.

Cycle Notes.

English cycle repairers have recently introduced a new method of patching single tube tires. The patch is put on in the usual manner, and it is then vulcanized in place by means of electricity. The patch is thus rendered inseparable from the rest of the tire.

In France bicycles have been authorized for the distribution of telegrams, and an allowance of $3 a month is made to messengers for the use of their machines.

In Belgium the fire departments of some of the cities have utilized the tricycle as a hose cart, and find the results satisfactory.

By an ordinance, bicycle riders in a Western city are compelled to carry red lamps on their wheels at night, no other color being allowed.

At the National Institute for the Blind, in France, cycling is one of the amusements. A species of home trainer is provided, on which the inmates of the institution ride. The wheels are so arranged that the actual speed is indicated on a dial, so that races are held and some of the inmates have established records. The machines are also arranged so as to give audible signals at various speeds.

The Paris "Palais Sport" is a large arena with a cycle track that rises to a height of sixty-five feet in a spiral course. The ascent and descent are like a double corkscrew, and the tracks are so arranged that in one round trip a distance of one kilometer, or two-thirds of a mile, is covered.

Bicycles have been put to a novel use by Mr. F. A. Sirrine, the entomologist of the Jamaica, L. I., Agricultural Station. Mr. Sirrine rides a bicycle with a square reservoir of concentrated insecticide strapped to his handle bar and a knapsack spraying machine on his shoulders. He visits all parts of the island, giving object lessons to the agriculturists and horticulturists and imparting personal instruction to them in the preparation and use of the remedies which he finds to be efficient.

In the wheel room of the recently constructed palatial club house of the Century Wheelmen, of Philadelphia, 500 wheels can be accommodated.

A wheel should be cleaned and oiled at least once a week. To clean the wheel, remove the lamp, place the wheel upside down, resting on the saddle and the handle bar, which should rest on a cloth or piece of old carpet to prevent its being marred. Remove the dust from the wheel with a dry brush. If the rims and frames are muddy, use a wet cloth; a small brush will be found useful in cleaning the sand or mud from the hub and sprocket wheel. If the enamel of the frame appears streaked after washing off the mud, it should be rubbed with a dry cloth or a piece of chamois skin. Do not use oily rags on the enameled parts. The spokes should be cleaned with a cloth. Every month the chain should be removed and soaked in turpentine, followed by kerosene oil or in kerosene oil alone. The sprocket wheels should be thoroughly cleaned before replacing the chain. There are a number of chain lubricators on the market, including a mica lubricator, which will not soil the hands or clothes. Many wheelmen lubricate their chains with a semi-fluid preparation of plumbago and the solid graphite as well; only a small quantity of lubricant is required. After the bicycle is cleaned it should be thoroughly oiled and the bearings should be examined and tightened, if necessary. When the bicycle is put up for the winter, it should not be allowed to stand on the floor. It should be hung up with the tires partially inflated; this will tend to preserve the tires.

To ascertain the gear of a bicycle, multiply the diameter of the rear wheel by the number of teeth in large sprocket; divide by the number of teeth in small sprocket and the quotient is the gear of the cycle. For example:

28 rear wheel.
18 large sprocket.

———
224
28
———

Small sprocket, 8 } 504

———
63 gear of wheel.

ACCORDING to the Street Railway Journal, the number of street railways in the United States is 976, the total length of track being 13,588 miles, of which 10,363 miles are worked by electricity, 632 miles by cable, and 1,914 miles by horses, the remaining 679 miles being classed miscellaneous. The number of cars in service on these roads is 44,745, or 3·29 per mile.