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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1034.

For the Week Ending October 26, 1895.

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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 21½ 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, 2¾ inches thick, which, with the side armor, will form a