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 Edition (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, DECEMBER 16, 1899.

RELATION OF RAINFALL TO BOILER SCALE.

It is probable that if the average steam user were asked to name the various contributory causes of the formation of boiler scale, he would stop short of the rainfall. Yet we have it on the authority of that excellent little monthly, The Locomotive, published by the Hartford Steam Boiler Inspection and Insurance Company, that there is a direct relation of cause and effect between the two. The unusually light rainfall of the past season in many parts of the country has been a matter of note, and it seems that the reports turned in by the boiler inspectors in regions so affected show that there has been an unusual amount of trouble from scale.

The reason for this, according to our contemporary, is not hard to find, the unusual deposits of scale being due to the increased hardness of the water after a lengthy spell of dry weather. In times of drought the water is drawn necessarily from the lower levels, in reaching which it has become impregnated with lime, magnesia and other soluble substances contained in the overlying strata. In a season of copious rainfall, on the other hand, the ground, being soaked, cannot absorb the surface water, which rapidly drains off into rivers or reservoirs, as the case may be, before it has had time to dissolve out the scale-forming substances in any quantity. In a season of light rainfall, like the present, the ground can absorb practically all the water that falls, and the proportion of surface water is relatively small. Hence, in dry seasons the water used in the boilers will be largely spring or hard water, and in wet seasons it will consist chiefly of surface or soft water, the deposits of boiler scale being larger or smaller in proportion.

The moral of all this is twofold. In the first place, during a dry season boilers should be more frequently opened, examined and cleaned. Just how much oftener this should be done must depend upon local conditions and the severity of the drought; but it is suggested that, judging from observations made in the State of Connecticut, they should be inspected in such a season as the last about twice as frequently. Another fact to be remembered is that when a heavy rainfall comes, bringing a sudden supply of surface and therefore soft water, the scale that is in the boiler will be suddenly loosened up, and unless precautions are taken it will lodge over the fire-sheet and cause trouble. This is particularly liable to happen during the melting of the snow in the spring, when the water will be particularly free from mineral salts.

OPENING OF THE NEW ST. LAWRENCE CANAL LOCKS.

An event which will be of great importance in the development and expansion of the commerce of the Great Lakes is the opening of the new St. Lawrence canal locks. Our readers will remember that when the United States government wished to bring the revenue cutters "Algonquin," "Gresham," and "Onondaga" from the lakes to the Atlantic, to assist in the Cuban operations, it was found necessary to cut the vessels in two and float them through the St. Lawrence locks in sections. Now, although these little craft are only 205 feet in length, they were about 20 feet too long to be admitted, the old lock being unable to accommodate a vessel over 186 feet in length. The operation was not without its risks, as was proved by an illustration published in the SCIENTIFIC AMERICAN of July 2, 1898, showing one of the sections of the "Gresham" capsized in the attempt to make the passage. The new locks are capable of admitting vessels up to 270 feet in length, and the arrival recently of the "Porto Rico," a vessel measuring 250 feet over all, at New York, after making a successful passage from the Great Lakes, indicates that the direct result of the venture will be the shipment of freight direct from the lakes to various points on the Atlantic seaboard.

It has been suggested that these improved facilities, which are entirely under British control, will operate to the naval disadvantage of this country, for the reason that the greater size of the locks will permit a considerable number of the larger gunboats and smaller cruisers of the British navy to enter the Great Lakes, whereas by the treaty of 1814 the shipbuilding yards on the lakes are prevented from the construction of warships. Although the excellent relations existing and likely to continue between the two governments render it unlikely that this strategic advantage will ever be put to the test, it is probable that, as suggested in the President's message, the restriction to warship construction on the lakes will be removed by mutual agreement. The advantage to shipbuilding interests on the lakes from such a change would be considerable, for there are many smaller vessels, such as the twelve 1,000-ton gunboats, proposed by the Naval Board, which under the new conditions could be built on the lakes and then brought to the seaboard through the new locks.

"THE WISH IS FATHER TO THE THOUGHT."

A correspondent in Japan writes us that the following paragraph, taken from The Daily Mail, has been published with apparent delight by a number of English journals in China and Japan, special prominence being given to it in The Japan Mail: "The chairman of the Midland Railway Company was able yesterday to make the highly satisfactory announcement that the American engines which were purchased by that company do not compare at all well with the British-made locomotives. As we have often had to draw attention to the inroads which the United States are making upon our trade, it affords us pleasure to give prominence to this evidence. This is probably the first occasion on which American engines have been fairly tested against British ones upon a high-class road, and the world, we hope, will note the result!" Our correspondent writes that Americans in the East would like to hear the other side of the story, and be assured whether the chairman of the Midland Railway made the unqualified statement that the American engines do not compare at all well with British-made locomotives.

After making careful inquiries both here and in England, we can assure our correspondent that the item referred to is one of those half-truths that are worse than falsehood. Whether the misrepresentation is willful or not, there is no doubt that "the wish is father to the thought." What the chairman of the Midland Company did say was as follows: "With regard to these first ten Baldwin engines, they are at present working on the line, and Mr. Johnson, our locomotive superintendent, says that although they are not by any means up to the finish of locomotives that are made in this country, *they are doing their work satisfactorily*." We have ourselves italicized the last clause, which was omitted by The Daily Mail for the evident purpose of making the chairman seem to condemn, where he actually indorses, the work of the American locomotives.

We are not in the habit of correcting misstatements that occur in the daily press; but the present instance is so purposely misleading, and as our correspondent informs us, the false impression is being so industriously spread abroad in the very countries in which American engines are gaining a secure foothold, as to call for emphatic contradiction. The statement of Mr. Johnson that the new locomotives were doing satisfactory work was made in August. In the intervening three months the whole of the order has been filled by the Baldwin Company and sufficient time has elapsed for a fairly thorough test to be made. The results continue to be strongly in favor of the American locomotive. The engineers who are running the engines report that not only are they hauling the same trains as the English engines upon the same average coal consumption, but they have proved to be capable of drawing much greater trains, and would now be doing so were it not for the fact that the sidings at the English stations are too short to admit longer trains. Hence the American engines cannot be given trains of the maximum weight at which they can show to the best economic advantage, and the fact that they compare favorably with the English engines under conditions that are more favorable to the latter speaks volumes for the American type.

It is urged that the English engine is more durable—a claim that can only be established after a test extending over a lengthy period; but we note that Mr. Ivat, locomotive superintendent of the Great Northern Railway, for which twenty Baldwin locomotives were recently constructed, says: "I have been examining them, and I cannot find any important part that ought not, with fair usage, to last as long, or nearly so, as those of our own engines." In addition to the ten Baldwins, there were ten engines furnished by the Schenectady Works. Regarding these, we are informed that the company has received "very favorable reports," the operation showing the same satisfactory results as have been achieved by the Baldwin locomotives.

The Midland Company is keeping a careful log of the relative performance of the two types, realizing that they have a valuable opportunity to determine the efficiency of the more roughly finished, less expensive, but harder worked American locomotive as compared with the more highly finished, supposedly more durable and certainly more expensive and generally easier worked English engine. There is no doubt that the test will be fairly conducted and the results made known without reserve. If, after taking all the questions which determine economy into consideration, such as first cost, hauling capacity, fuel and oil consumption, repairs, and length of useful life, the American machine proves to be more economical, the English locomotive builders will find that the battle for supremacy is on in earnest, and that in their own exclusive territory.

TUNNELS VERSUS BRIDGES FOR RAPID TRANSIT.

The craze for building bridges, and $15,000,000 bridges at that, which has taken possession of the gentlemen who just now control the expenditures of the city of New York, was forcefully rebuked by the controller at a recent meeting of the Board of Estimate. About a year ago the Board committed itself to the construction of two bridges, between Manhattan Island and Brooklyn, one of which is to cost $15,000,000 and the other $13,000,000. A sum of $50,000 was voted at the time for the preliminary expenses, and at the next meeting of the board a resolution was introduced authorizing a bond issue of $2,000,000 on which to commence active operations. It was suggested by the controller in a very able address that action should be delayed in issuing bonds for construction, until the question of constructing tunnels in lieu of bridges could be thoroughly investigated. He presented reports upon the relative cost of tunnels and bridges, which had been prepared at his request by the Chief Engineer of the Department of Bridges, and the engineers of the Brooklyn Bridge and the new East River Bridge, which made out a strong case for the tunnels on the question of first cost and cost of maintenance.

It was stated that the tunnel beneath the East River constructed to carry the mains of the East River Gas Company is 10 feet 6 inches in diameter, or several inches larger than the City and South London tunnel, which is daily carrying a heavy passenger traffic. This tunnel according to the report could be duplicated to-day for less than $500,000, or two such tunnels, one for east and one for west-bound traffic, could be built for about $900,000.

A report put in by the firm who built the tunnel under the East River used by the New Amsterdam Gas Company stated that a double-track tunnel to carry the same number of passengers as could be carried on the proposed Manhattan Queens Bridge could be built for $1,900,000, whereas the bridge is to cost $13,000,000; and another tunnel, to take the place of the Manhattan-Brooklyn Bridge, would cost only $2,500,000, as against a cost of $15,000,000 for the bridge.

Another feature named by the controller was the great rapidity with which tunnels can be constructed, the East River gas tunnel having progressed at the rate of 100 feet per week. From this it is concluded, that a tunnel between Brooklyn and New York could be completed in two years from the letting of the contract. It was further pointed out that the great height of the bridges above the river called for costly condemnation of private property to provide for the approaches, whereas tunnels can be kept within the line of the city's streets; and, furthermore, that tunnels are not tied down by consideration of topography to particular locations, but may be located with a sole view to meeting the requirements of traffic.

While there is no disputing the broad truth of these arguments, they somewhat overstate the case in favor of the tunnels, and omit to mention compensating features in the bridges. On the question of cost there cannot be two opinions—the tunnel is cheaper. But it is not so much cheaper as Mr. Coler supposes; for, like the bridge, it must have lengthy approaches, which, in the very nature of things, will require condemnation of property to make room for terminals; unless, indeed, it is proposed to dispense with terminals altogether and connect direct with the underground system. Then, again, it is somewhat misleading to draw a parallel between a two-track tunnel accommodating railway cars only and a vast thoroughfare such as will be the new East River Bridge, with two steam railway tracks, two trolley tracks, two wagon roads, two broad sidewalks for foot passengers, and in all probability two separate tracks for bicycles. It would take at least four two-track tunnels to provide the same traffic capacity as this huge bridge with its clear width of 118 feet, and four such tunnels would cost not less than $10,000,000, without any allowance being made for the approaches to accommodate trolley, wagon, and foot-passenger traffic. The object of the new East River Bridge, as stated at the time of its commencement, was to provide a broad thoroughfare across the river over which the surface, elevated, wagon, and foot-passenger travel might pass without interference of terminals or grades.

It seems to us that the situation can best be met by the provision of both bridges and tunnels, the former to connect the elevated and surface roads and the latter to unite the new underground system with the various transportation systems of Brooklyn. One of the