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THE NEW YORK STATE CANALS BLUNDER.

The matter of the New York State canals improvement furnishes the latest evidence of the incredible looseness which too frequently marks the construction of our public works. The slipshod manner in which the first estimates were made, the readiness with which the committee, with the most meager, and, on the face of it, unreliable, data to go upon, passed the estimates, and the amateurish defense now set up by the State engineer in his attempt to explain why that estimate of $9,000,000 must now be raised to $16,000,000, constitute a chapter in the history of public works which would be discreditable if it related merely to the building of a country bridge or the laying of a length of village sidewalk.

The plan of improvement for which a sum of $9,000,000 was voted in 1895 included the deepening of the canals throughout their entire length of 454 miles and the lengthening of the locks throughout the system. These were straightforward engineering works of a kind which has often been executed before; it entailed no untried problems; the nature of the ground was ascertainable, and the general data was of a kind which should have enabled a closely approximate estimate of cost to be made. In his published statement explaining the enormous increase of $7,000,000 in the estimated cost, the engineer gives as one reason the fact that deepening the canal has caused the old walls in many places to slip into the canal. The public will ask how these walls could be expected to do anything less when the dredge, in deepening the canal, dug away their foundations. It is further explained that it was found to be impossible to use the material dug out of the canal for raising the embankments, as at first contemplated, and that suitable material had to be excavated elsewhere, thus entailing a double amount of excavation.

To an engineer this explanation is even less satisfactory than the last; for, surely, if there was any one thing more than another that was ascertainable from the records, it was the nature of the material met with in the first construction and subsequent maintenance of the canal.

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WHY ARE AMERICAN FASTER THAN ENGLISH LOCOMOTIVES?

The persistent discrediting by The Engineer, of London, of the records attributed to American locomotives has at last given way in the face of testimony so reliable as to establish the accuracy of these records beyond a possibility of doubt. The offending parties in the present instance were the officials of the Atlantic City Railroad, who had dared to assert that they were running a regular scheduled train at a speed of sixty miles an hour, and keeping well within the schedule at that.

In the midst of a voluminous correspondence, most of which proved on à priori ground that such performance was simply impossible, there appeared a letter from Mr. Clement E. Stretton, an English authority on locomotive matters, stating that a year or two previously he had himself taken the very greatest precautions in timing a train on this particular road, and that speeds equal to and exceeding those under discussion had been accomplished. Thereupon The Engineer announced, editorially, that the time had come, at least as far as that journal was concerned, to admit that American locomotives were undoubtedly faster than English locomotives, and correspondence was invited to discuss the causes of the difference. For some weeks past a vast number of letters has been published, some of which persisted in casting doubt on the correctness of the records, while others attributed the difference to construction of track and rolling stock, and a small minority, consisting mainly of those who had visited America and seen our locomotives at work, traced the superior power and speed of our locomotives to the proper causes.

Undoubtedly the fundamental difference between the two national types lies in the boiler capacity, the American boiler having from fifty to seventy per cent more heating surface and steam-raising capacity than the English boiler. Next in importance is the larger area of the steam ports in our engines, enabling them to receive and discharge the steam freely when running at high speed; and lastly, there is the smaller diameter of the American driving wheels, giving a larger tractive effort and a higher piston speed with its consequent increase of the indicated horse power. If the loads hauled, the grades, the weather and all other modifying circumstances are the same, the speed of two trains will vary as the indicated horse power, and the indicated horse power will vary as the piston pressure and the piston velocity. Good results at the piston can be maintained by providing free passages between a boiler which can furnish ample supplies of steam and the back of the piston, and an instant release of the steam from the front of piston. High piston speed can be secured by keeping down the size of the driving wheels.

Now all of these conditions are provided in the typical American locomotive. The boiler power is liberal, extravagantly so, judged by European methods; the steam passages are large, and the piston speed is high. On the other hand, the boiler power of the English engine is relatively limited; the steam passages are cramped and the driving wheels are large, giving a low piston speed. Hence it follows, as naturally as the day follows the night, that the American locomotive can haul bigger loads or haul its loads faster than those of the English type. Whether it can do the work more economically is another question. The advantage on this score would probably lie with the English engine, which is known to be a proverbially light coal burner.

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THE ARCH IN STEEL BRIDGE CONSTRUCTION.

The suspension and the cantilever systems of bridge construction have heretofore been preferred in building the largest bridges, or rather the bridges of longest single span. For lengths below five or six hundred feet the simple end-supported truss and the arch have been chosen to span the rivers or ravines, but when the proposed structure has exceeded that length, engineers have preferred to adopt the suspension or cantilever structure. The popularity of the latter forms is due to the fact that erection can be carried out without the use of falsework or scaffolding, which is not only costly, but in many cases is prohibited by the natural features of the site.

Of the four forms of bridge—the truss, the arch, the suspension and the cantilever—the arch, if artistically designed, is perhaps the most beautiful; moreover, where it is possible to erect it by the cantilever or overhang system, it is, for the longer spans, the most economical. This is due to the fact that it is self-contained and does not, like the other forms, require shore arms or anchorages to counterbalance the weight or resist the pull of the central river span. At the time when the plans for the great 1,710-foot cantilevers of the Forth Bridge were published, Mr. Max Am Ende presented an alternative plan for a bridge with steel arches carrying a suspended floor, and showed that it could be erected for less cost than the cantilever design of Mr. Baker or any design for a suspension bridge. A similar comparison was made by the same engineer when the plans of the proposed North River Bridge were published, and a similar economy was shown in favor of the arch design. It was proposed to build out the trussed arches by overhang, tying them back by steel cables to temporary anchorages on shore. Whether or not the calculations of strength, stability and cost were sound, it is certain that, once erected, an arch of this magnitude would have an imposing appearance and a beauty which could not be surpassed by either of the other systems of construction.

What will be by far the largest steel arch, or arch of any kind, ever constructed is now being built across the Niagara Gorge on the site of the upper suspension bridge. At this point the cliffs are 1,268 feet apart, and 840 feet of this opening is to be spanned by a handsome trussed steel arch. What a great advance this is upon previous construction may be judged from comparison with the new railroad arch a couple of miles down the river, which was recently completed for the Grand Trunk Railroad. This has a span of 550 feet and is only surpassed by the Louis I bridge at Oporto, Portugal, which measures 566 feet in the clear. The deck of the structure will be 50 feet wide and will provide room for two trolley tracks, two driveways and raised walks for foot passengers.

The site will be advantageous for construction as the cliffs on either side will afford good anchorage for the two halves of the arch during the time they are being built out to a connection at the center of the gorge.

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ELECTRIC TRACTION ON THE NEW YORK ELEVATED ROADS.

The Rapid Transit Commission has charge of the interests of the people of New York, and in furtherance of its efforts to secure improved transit facilities it has extended a standing invitation to the Manhattan Railway Company to submit a plan for the extension and improvement of the elevated roads in this city. The invitation of the citizens' commission has been steadily ignored by the company. Only at such times as there seemed to be any likelihood of a tunnel road being built has the company had anything to say, and then it has been voluble in its expressed intention to extend and improve its system. We heard many promises of this kind when the first rapid transit tunnel scheme was under review by the Appellate Justices; and now that the Metropolitan Street Railway Company—the most powerful rival of the elevated roads—has been talking of building the tunnel, the Manhattan interests have "authorized" a "statement" of the great change they are preparing to make on their system.

The public will judge for itself of the probability of these costly improvements being made except under the spur of absolute necessity. According to the authorized statement of Mr. Gould, the system is to be electrically equipped, the present steam locomotives being replaced, either by electric locomotives, or by a system similar to that on the Chicago elevated roads, in which motors are applied to each car of the trains. If the change should be made, it will constitute by far the largest electrical equipment in existence. In every twenty-four hours as many as 3,500 trains are