RAILWAY BRIDGE AT NIAGARA.

This great work, which is to unite the United States with Canada by a railway, is rapidly advancing under the supervision of Mr. John A. Roebling, an engineer favorably known in connection with the suspension aqueduct on the Pennsylvania Canal, at Pittsburg, and a suspension bridge over the Monongahela, near the same place. As it is to be on some accounts one of the most remarkable mechanical achievements in the world, we shall be pardoned for devoting considerable space to a careful description of its plan and prospects. It is well known that Stephenson, the Magnus Apollo in engineering, whose fame rests upon his Tubular Bridge over Menai Straits, has decided against the suspension principle as applied to railway bridges, mainly on the ground that it is incapable of rendering them sufficiently stiff. The successful construction of this work, therefore, at Niagara, will make an era in bridge building. It will be doing what has not merely never been done before, but what has been pronounced by the highest authority impracticable.

The present suspension-bridge, having been constructed in 1847 to aid in the erection of the railway bridge, will be removed after performing that service. It was begun by a boy on the Canada shore, who elevated a kite, and by that means established a thread communication with the other side. Over this tow-path wire was drawn, and the wire cables were soon formed.

The railway bridge will consist of two parts, each suspended from two cables; a covered one for common travel, and above that, on its roof, an open track for the railroad. It was first intended to build a bridge with a single floor, but the difficulty of rendering it wide enough for purposes of horses, foot, and steam locomotion at the same time, without making it too heavy and too expensive, caused the plan to be abandoned. The double floor of this bridge simplifies the problem of rendering a stiff support to the weight of a rail road train, by placing under it, in addition to other props, the trusses that will form the sides of the lower portion of the bridge. The hollow tube, also, which that part will form, is expected to aid materially in strengthening the work, operating like the tube in Stephenson's bridges.

The bridge will be 800 feet long, hung by wire ropes, five feet apart, to four huge wire cables, stretching from shore to shore, with a considerable deflection, over the tops of towers 60 feet high. The towers are now far advanced towards completion, having been begun some four or five months since. They are 15 feet feet square at the base and 8 square at the top, built of a dark colored limestone, very hard and compact. But the first operation, which was commenced last winter, was to sink shafts 25 feet deep, in the rock below the towers; four on each side of the tower. In the bottom of each of these, enlarged for the purpose, a cast-iron plate, six feet square, was placed, to which an immense chain was fastened. The shaft was then filled in with masonry, the chain being imbedded in a mixture of cement, lime and sand. These chains reach the surface, outside the base of the towers, and are to connect with the cables. They will be 66 feet long, each consisting of eight links, that average over 8 feet in length. The links are made alternately of seven and eight plates of wrought iron, each plate formed into one piece without a weld. Each link of eight plates has sandwiched in, to use an expressive phrase, the plates of the sevenfold link, and the whole fifteen are rivetted together firmly by an iron bolt, three-and-a-half inches in diameter. The anchor plate at the bottom of the shaft cannot be lifted until the whole rock is raised bodily, with all its incumbent masonry. Nor can the plates and chains give way from any force which can be withstood by the cables, and they are calculated to withstand a pressure four times greater than the whole weight of the superstructure, combined with any load that will be placed upon it. The towers, it will be observed, act as fulcrums, between the chains on the one side, and the cables on the other, and the weight of a loaded bridge will not act upon them sideways, but vertically.

The cables are to be 9¼ inches in diameter, each formed of 3,390 strands of wire. Long lines of wire are first formed, by fitting the ends of separate pieces to one another and wrapping them round with smaller wire. These are then dipped in boiling oil, and dried, and the process is repeated a number of times, until a coating is formed that will protect the metal from the moisture. The wire is then wound round large cylinders. These operations are now going on upon the Canada shore. When the cable comes to be formed, the wire will be drawn over to the American side, one strand at a time, passed through the link of a chain, then drawn back to the other side, passed through a chain there, and so on, back and forth, until the whole cable is made up; this will then be tightly wound round with a small wire. The cables will connect with the chains, after passing through iron saddles on the top of the towers, these being iron blocks with a grove fitted to the cable. Each saddle rests upon a wrought iron roller, three inches in diameter, that rolls on a smooth iron plate. This is to accommodate any slight motion that may arise from unequal tension between the chains and cables, when the balance is from any cause disturbed.

Stephenson's great objection to the suspension principle, as was stated above, was the want of stiffness. It is conceded by the engineer of this bridge, in his report on the subject, that wire cables alone will not be sufficient. But he relies for stiffness, first, on the timber placed under the railway. Two girders, as they are called, or longitudinal timbers, four feet deep, are to be placed in the upper floor, for the immediate support of the track. In addition to these, are the trusses or sides of the lower bridge, which will consist of upright posts five feet apart, supporting the upper floor, and connected with one another by a light bridging and by iron rods. Any pressure upon either floor is thus shared with the other. These rods are to be one inch in diameter, and 27½ feet long, and will connect the posts by fives, crossing at right angles, between the top and bottom of the first and fifth. The vertical action or each post is by these means transferred to each of those with which it is connected. The rods will have a nut at each end, which will be screwed up tight to the post, so that these rods will make the trussing extremely rigid. Besides these two sources of stiffness, stays will be made use of, that is, iron rods reaching out from the towers to the bridge at different angles.—These three resources, it is believed, will supply to the bridge all needed stiffness.

The action of the wind will not be very great, the trussing of the lower bridge being quite open, and allowing it pretty free passage. The width of the lower part will be nineteen feet clear of the upper, twenty-four feet, the latter being elevated twenty feet above the other floor, and 230 feet above the water. As to the capacity of the bridge—supposing it covered from end to end with a loaded train, the weight of such a train is estimated at 430 tons, which, added to the weight of the bridges, 782 tons, and 15 per cent. on the weight of the train, as the result of a speed of five miles an hour, viz: sixty-one tons, make 1,273 tons. The tension of the cables resulting from this and their average deflection, is equal to 2,240 tons. Their capacity is 10,000, or more than four times that tension. The tension referred to, it will be observed, is an extraordinary one, as it can scarcely be supposed that a loaded train equal in length to that of the bridge, will ever be allowed upon it. Assuming, as the engineer does, 2000 tons as a tension to which the cables may more frequently be subjected, he has provided a resistance equal to five times that. The covered floor, were it crowded to its utmost capacity, might hold 310 tons. But as this might be closed in case of a very heavy train approaching, before it was allowed to come upon the bridge, it is not necessary to make a calculation for an extreme load upon both parts at once.

The suspension bridge at Lewiston, is 1,040 feet in length, the largest in the world. This will be 240 feet shorter, but a far more surprising work. It is to be done next June. Its cost was estimated at $250,000, but it is likely, we are told, to exceed that sum. Supposing it is twice as much, what a saving, even then, in comparison with the immense expenditure to which Stephenson has subjected the English at Menai Straits and Montreal. The tubular bridge at Montreal is not yet done or paid for, to be sure, but its cost is estimated at $7,000,000.

Report of the Water Committee.

To the Select and Common Councils of the City of Pittsburgh.

Your Committee respectfully submit for your consideration the accompanying reports of the Superintendent and Assessor, which will exhibit in detail the expenditures, and amount of Water Taxes assessed.

And it will be seen that the expenditures have been kept within the limit of the appropriation, and after having deducted the expenses of the work from the assessments that the sum of $24,933,71 will be left for the benefit of the City Treasurer.

It is with pleasure we refer to the consummation of an order from Councils, extending further safety from fire to the Lower Engine house, which is the main branch and starting point of the entire works. This department is now in a safer condition than it has been heretofore, and the greatest degree of care should be perpetuated.

The City property is generally well guarded against fire, there having been an increase to the number of fire plugs their total number now amounting to two hundred, nothing has occurred to interrupt the general and abundant supply, of water to the people, and there has been no limit to the comfort enjoyed.

The reservoir's machinery and general extensions of both establishments are all in a good condition and are efficient in full in carrying out the great object of their origin.

Your Committee with satisfaction regard the present prosperous state of the Water Works mainly as the result of the competency of the several officers in charge of the same. And have awarded them a full testimonial to that effect.

JOHN S KENNEDY, JOHN ALLEN,
JAMES B YOUNG, JOHN BISSELL,
JAMES T KINCAID, JAMES DUNCAN,
H N SPEER.

Report of Superintendent of Water Works.

The period having again arrived for an annual exhibit, the following is presented--embracing the revenue, appropriations, expenditures, extensions and condition of the Water Works, for the past year:

Amount of Water Rents assessed in 1853		$41,477 75
Appropriation by Councils	$16,500 00	
Cash in hand of Superintendent from last year	98 49	
Cash received for old paper &c from the Board of Guardians of the Poor & others	533 15	
		$17,131 64

Expenditures as per Clerk's books for current expenses of Lower Works, to wit:

Coal	$4,505 57	
Labour	4,531 62	
Oil	372 69	
Hardware	43 50	
Brass work and castings	145 58	
Hauling	63 12	
Smith work and castings	418 94	
Tallow and candles	19 19	
Yarn and rope	75 24	
Iron and nails	71 67	
Gas fixtures	158 53	
Stationary	16 00	
Shovels, hoes, files, turpentine, paint, wheelbarrows, glazing, shilac, lime, copper, brooms, damper, hay, &c.	226 12	
		$10,647 77

Expenditures for current expenses of Upper Works, viz:

Coal	$945 75	
Labor	1179 58	
Oil	190 98	
Smith work and Castings	65 88	
Yarn and Rope	28 00	
Hardware	13 05	
Paint, Turpentine, Hose, Iron, Glazing, Lime, Hauling, Brooms, and Buckets	127 24	
		$2550 48

Expenditures for permanent extension of the entire Works, viz:

Labor	$1637 62	
Brass work and Castings	102 60	
Hauling	85 50	
Smith work and Castings	321 96	
Lead	220 40	
Leather	5 16	
Hemp	3 50	
Lumber	33 96	
Pipes	910 78	
Iron and Nails	21 31	
		$3345 79

Payments have been made as follows:

By warrants drawn on the Treasury, by order of the Water Committee	$16,286 13	
Cash in honds of Superintendent from last year	98 49	
Cash received for old pipes	159 42	
		$16,544 03

Unexpended in all, $587 60.

Leaving a difference between the revenue and expenditures of the past year, $24,933 71.

The following extensions have been made:

Eight inch in Robert street	270 feet.
Four inch in Duncan street	715 "
	985 "
To this add former amount	124,713 "
Total	125,698 "

Which gives over twenty three and three quarter miles.