load was 391 tons, equal to 28 tons upon each rope, the same as that of the maximum load of 100 tons. In this way, therefore, the cables have already been tested to the full strain of the maximum load.

The Effects of Temperature.—It is assumed that under the modifying influences of the Falls, the greatest cold will not be below zero of Fahrenheit, and the greatest heat will not exceed +100° by the same scale. The range of temperature provided for in the adjustment of the levels and the construction of the roadway was 100° Fahrenheit.

The length of the cables exposed to atmospheric changes is 1800 ft. It is known by experiments that wrought iron expands .0012 parts of its length between the freezing and boiling points of water, that is, between +32° and +212°, equal to 180° of range.

The expansion of the cables for 100° range of temperature is therefore $100 \times 1800 \times .0012 = 1.20$ ft. in the whole length.

By (2) $\frac{.38}{.98} : \frac{.38}{.98} : \frac{120}{3.09}$

That is, the increase of 1.20 in the length of the cables will produce an increase in the deflection of 3.09 ft., which is the rise and fall of the bridge due to changes of temperature alone.

The Effects of the Wind.—It would seem that every wind that blows rushes into the chasm crossed by this bridge with redoubled force. Winds that are but gentle breezes on land strike the bridge with the force of a brisk gale, and a gale on land becomes a storm on the water. They crowd through the gorge as through a funnel, with increased velocity and power. Even in calm weather puffs of wind from the mysterious depths of the Falls, as from the cave of Aedolus, uncharged with spray, and there may be seen in sunshine the new phenomenon of a rainbow, both over and under the platform, describing a complete circle round about the bridge.

The bridge is undisturbed by ordinary winds, but in the course of construction there were severe storms that affected it to a considerable extent until all the stays and guys were attached and brought to bear upon it. By these and by the cable form of the bridge the lateral force of the wind, tending to produce oscillation, is at once resisted and checked. The undulations from the upward pressure of the wind and from transitory loads are also checked by the stays and guys as far as they reach; and, beyond this, over the remaining space of 400 ft. at the middle, it is counteracted by the vertical struts placed between the cables and the roadway, as before stated.

The prevailing winds are from the south-west. Coming from the open water of Lake Erie they are likewise the strongest, and striking the bridge square upon its beam, act with more power than any other. Allowing for a great storm, such as is but rarely experienced in this locality, and almost a hurricane, and assuming that it strikes fairly on one side, it will press with a force of thirty pounds upon the square foot, and exert a lateral power of 108 tons upon the whole length of the bridge. But the wind passing under the bridge has always an upward tendency. Then, if the angle of incidence be taken at 45°, its greatest effect, we find that while the lateral force on the side is reduced to 68 tons, it is also increased by the horizontal resultant of the pressure on the bottom by 140 tons, and hence the greatest lateral pressure will be 208 tons. To resist this disturbing force we have:

1. The inherent stiffness of the platform fixed at both ends to the solid rock, and fastened at the middle to cables weighing 81 tons.
2. The cradle form of the bridge, the cables and stays being inclined at an angle to resist any lateral motion.
3. The weight of the active suspended system, 253 tons.
4. The direct power of the guys, their united strength on each side being 280 and 260 tons respectively.

The upward pressure at the same angle of incidence will likewise be 208 tons. The platform, with the guys attached to it, weighs 150 tons, or 58 tons less than the lifting power of the wind, but the united strength of all the guys that hold it down is 460 tons, and the central half of the cables also presses upon it, through the studds, with a dead weight of 40 tons.

The Operations.—By request of the directors, the engineer, Mr. Samuel Keefer, proceeded to England for the purpose of procuring the necessary materials for the bridge. Having first fixed upon the line, and laid out upon the ground the positions for the towers and anchorages, and furnished plans and written instructions for the guidance of his assistants, he left Canada in August, 1867. All the ropes, as well as the tension plates for the anchor chains, were manufactured in England to his order, and shipped before the close of the year. The towers were framed and erected, and some progress was made with the anchorages during his absence. He returned to Canada in November. By order of the directors the works had been suspended in October, and were not resumed until the following month of May, 1868. Advantage, however, was taken of the ice bridges, formed in February, to stretch the carrier ropes, afterwards used for the erection of the bridge. During the winter months the engineer was employed in maturing and preparing his plans and calculations for the next season’s operations.

The bridge was so far completed as to be opened for traffic on the first day of January, 1869, the actual working time being about twelve months. It will be