were in the lighter portion of the section and secondly that none of it could lie with the wreck of the rest of the train, and *debris* of the bridge, these carriages were undoubtedly thrown out from the line of the bridge, and in the exact direction of the *resultant of two forces*. I will endeavour to show this, and account for the accident by the laws of motion, and give a practical illustration of causes and effects.

At the time of the accident, the bridge had undoubtedly a vibratory motion—a gentlemen in a previous train felt or saw this before the hurricane was at its highest, for he describes the lurching as alarming; now this vibratory motion must have been uniform before any disturbance took place, there was no checking or conflicting force to interfere with the uniform oscillating motion, until the train came along at a snail-like pace, and as it approached towards the centre of the high portion of the structure, the oscillation was coming to the point of rest, which it would have passed, but for the dead weight of the train; had the train arrived in the centre and point of rest no accident would have occurred, but it had reached only the haunch of the structure, and did check the uniformity of the vibration; that check caused an entire change in the motion, it became deflected, in common parlance tortuitous, with an irregular succession of curves, and the whole structure fell like a pack of cards without their uniformity. The bridge could not resist this sudden and unequal strain; there were two forces directly antagonistic, the train running at right angles to the vibrations, their *resultant* within the lighter carriages, or lying away or out of the debris, and line of the bridge. Had the train collided, as some suppose, the wreckage of trains and bridge would be a heterogeneous, a confused mass of debris on one side the bridge, and scarcely beyond the outside line of it, for there would have been no *resultant* or any cause to throw it far away.

I have alluded to the law of forces, and shown the consequences; if, therefrom, I have defined the main features of the wreck it may be presumed I am not in error. I will now give a practical illustration, and the results of two opposing forces, which most of your readers will understand. I will take a child's swing, and so propel it that the oscillation shall be uniform; as the swing reaches the lowest point of the oscillating curve, if I apply a force (finger or stick) against the seat of the swing exactly central, there is no swerving either to the right or to the left; there is but one motion, the endeavour to go onward; there has been nothing to cause a deviation from the right line of the swing; but if I place the opposing force on one side the centre of the swing, it immediately flies round; if a weight was insecurely suspended on either side to the ropes of the swing, they would be propelled, one forward with *considerable force*, the other with limited, to the rear; these actions are the results of antagonistic and opposing forces; they are identical with those caused by the whirlwind and train at the Tay bridge, and every feature every principle which obtains in the swing obtained at the bridge.

This communication has extended far beyond what I contemplated, though the subject is by no means exhausted.

Yours, etc.,

J. Kilner,

Major General Royal, late Bombay, Engineers.

Fredericton, N. B., 4th February, 1880.

We have felt much pleasure in giving insertion to Major-General Kilner's remarks on the cause of the falling of the Tay Bridge, and believe that the theory he advances is really the correct one, although there may have been other causes by which the calculated resistance of the bridge to high winds was weakened. One reason why we give much faith to our correspondent's theory is, that it is just the result of such *antagonistic and opposing forces* that would have caused the destruction of such a length of the bridge, both in rear and in advance of where the train fell through.

But one very important statement has recently been made, viz., that both the workmanship and ironwork were inferior. If such were really the case all calculations as to strength and resisting forces are utterly useless and deceitful.

We have not space to enumerate many such cases that have come to our knowledge, but we will give the following: In the construction of the Suspension Bridge over the Montmorency Falls, the contract for the ironwork was given, it was said, to a party who was totally incompetent to forge the quality of iron required for such a purpose. The plate-chains which were attached to the anchors were seven in number, seven feet long with knuckle joints resting upon iron templates. Three or four of these bars or plates broke on the east side a few days before the bridge was opened to the public. This the engineers and directors kept from the knowledge of the public, and they were replaced with new ones; but immediately after three gave way on the west side. The Engineer concluded that, as a lesser number were broken and that fewer sustained it before, he could also replace them without the knowledge of the public; but, in the meantime, the bridge was opened to travel and the old one closed, and on the very day it was opened the bridge went over the falls carrying with it three human beings.

Upon an investigation as to the cause of this disaster, which was presided over by Lieut.-Colonel Fenwick, Royal Engineers, no question was raised as to the correctness of the calculations as to what weight the bridge would support over and above any probable test it might be put to, as it was too evident that it was the bad workmanship and the materials employed (the iron being of the most inferior quality) which caused the catastrophe.

During the construction of the Victoria Bridge several rumours were afloat as to inferior workmanship in the tubes. It was also stated that the longitudinal timbers, on which the rails rest, were laid continuous instead of being disconnected, as the tubes are, at every second tube—no allowance having been made for contraction or expansion. It was even said that a similar blunder was made in covering the roof. If bad workmanship was made and such blunders did occur under such engineers as Stephenson and Ross, the most eminent engineers are likely to lose their reputation, and the public meet with another fearful catastrophe, from the want of proper superintendence over the most minute details and the use of inferior materials by the contractors.—Ed. Scientific Canadian.

Disinfectant for the Breath, etc.—A very weak solution of permanganate of potash is an excellent disinfectant for light purposes, such as rinsing spittoons, neutralising the taint of diseased roots of teeth, cleansing the feet, and keeping the breadth from the odor of tobacco smoke. Permanganate is not poisonous.