cross-section at the maximum, than under a full load of the truss.

Now the deflection resulting from elasticity in these parts, being less in proportion as the parts are greater, the saving by counter-bracing, must be less in the same degree, as far as it relates to such parts. This at once reduces the above computations for deflection retained, from 81\% and 2\%, to 25 and 19 per C., for the two cases respectively; and, considering the increase of section required for uprights (in iron trusses), on account of great length and small diameter, as heretofore alluded to, it is deemed to have been fully demonstrated, that the effects of counter-diagonals, of half the size of the mains, are, to retain in the truss when unloaded, from one-sixth or less, to one-fourth of the deflection produced by a full movable load.

But it has been seen in the progress of our investigations as to the action of load upon the different parts of the truss, that counter-diagonals are required in one or two panels on either side of the centre, and there, they can not be safely omitted. But, beyond the point where the weight of structure acting on the mains, begins to overbalance the effects of unequal and variable load upon the counters, I do not consider the advantages of counter diagonals to be sufficient to warrant their use.

In the case of rail road trains, gliding smoothly over bridges of ordinary spans, a quarter or a half of an inch more or less of deflection, is of slight importance, while, in bridges for ordinary carriage travel, the only objection to it is, that it slightly increases the degree of vibration produced by successive impulses, as of the trotting of animals, in time with the natural vibrations. Now, counter-bracing tends to shorten the intervals of