making for the four pieces, 2M for tension, and 2M for compression.

The tie or chord ln, suffers tension equal to the horizontal constituent of the thrust of ql, manifestly equal to the weight sustained by ql, or equal to \( \frac{1}{2} w \). Therefore, the length being equal to 4, the material required in its construction, equals 2M. The remaining member pq (= 2) sustains compression equal to the combined horizontal constituents of the tension of mq, and the compression of ql, each of said constituents equal to \( \frac{1}{2} w \), making compression of pq, equal to w, and length being 2, material = 2M.

We have therefore, for this plan of truss, 4M, for thrust material, and 4M for tension material, which is \( \frac{1}{4} \) less than in case of Figs. 3 and 4. Consequently, this plan is decidedly more economical than either of the others, unless the compression material acts with better advantage in the latter than the former; that is, unless the thrust members in 3 and 4, have a greater power of resistance to the square inch of cross-section, than those in Fig. 5.

XIII. As to this, both theory and experiment prove, as will be shown in a subsequent part of this work, that the long thrust members in bridge trusses, are liable to be broken by deflection, rather than by a crushing of the material; that in pieces with similar cross-sections, with the same ratio of length to diameter, the power of resistance to the square inch is the same. That, since the cross-section is as the square of the diameter, and the diameters (in similar pieces), as the lengths, the absolute powers of resistance (being as the cross sections), are as the squares of the lengths.