The construction of the Pennsylvania Railroad requiring a large amount of bridge superstructure, has afforded an opportunity for the introduction of various plans, some of which are new, and all have been so fully tested by experience or based upon such well-tried principles, that they can confidently be relied upon. The description of these plans with some of those in use upon other roads, will furnish a very satisfactory exposition of the present state of the science.

It will be observed that no particular mode of construction is advocated in this work, but efforts are made to illustrate and establish the general principles that must govern the engineer in every case. The following are the most important:

1. In a straight bridge uniformly loaded, and without arches or arch-braces, the strain upon the ties and braces at the middle point of the bridge is almost nothing.

2. The strain at each end upon the same timbers is equal to half the whole weight of the bridge and its load.

3. The strain at intermediate points is proportional to the distance from the middle of the span.

4. Where the bridge is subjected to the action of variable loads, the greatest strain on the ties and braces at the middle of the span is equal to the greatest variable load that can be applied in the interval of one panel.

5. The strain upon the chords is greatest in the middle, and at this point is dependent entirely upon the weight, span, and depth of the truss; the inclination of the