system, and \( n d : x : : w : \frac{w x}{n d} \) = weight on second system.

The sum of these must equal the whole weight. Hence

\[
v = \frac{w x}{n d} + \frac{w x}{d}.
\]

Whence \( x = \frac{n d}{n + 1} \) and \( \frac{w x}{d} = \frac{n}{n + 1} w \)

\( = \) weight on second system.

In other words, the strain upon each system will be exactly proportioned to its powers of resistance, and the whole together may be estimated as one truss.

In the construction of a bridge with a system of arch-braces, the simplest and best plan is to depend upon the latter to sustain the entire weight of the structure, using only a very light truss with counter-braces or diagonal ties to establish the necessary connection of the parts, prevent flexure and vibration, and resist the action of variable loads.

Instead of using arch braces, trusses are sometimes strengthened by the addition of arches. Great benefit results from their use, but nearly the same effects may be obtained by arch-braces.

An arch, when of the proper figure of the curve of equilibrium, is capable of sustaining any constant load without change of form; but, as the load upon a bridge is variable, it is obviously impossible to make an arch of equilibrium for a wooden viaduct.

The flexibility of an arch renders it but poorly adapted to sustain a variable load; when used for this purpose, therefore, it must always be connected with a truss capable of giving it the necessary stiffness. Such combinations are extensively used.

*Means of increasing the strength of bridge trusses.*

When a truss, in consequence of having been too lightly proportioned, gives way by vertical flexure, an arch, or arch-braces with a straining-beam connecting the upper ends, may be bolted to the truss. Such additions have been often made, and are found to answer well. Many of the bridges on the