public works of Pennsylvania have been strengthened in this way, and rendered sufficiently strong for the heaviest locomotives and trains.

When a beam is laid over several supports, its strength for a given interval is much greater than when simply supported at the ends. The same principle is applicable to bridges, and when several spans occur in succession, it is of great advantage to continue the upper and lower chords, if the bridge is straight, across the piers. By this arrangement, the strength of chords of each central span in a series would be double that of the same spans disconnected, and the extreme spans would be stronger in the proportion of 3 to 2.

Notwithstanding this, we often see bridges in which the upper chords are not connected over the piers, and the absurd remark has been made, by practical builders, that the bridge must yield somewhere, and better there than elsewhere. Just in proportion as this point is capable of opposing a resistance, must the strength of the bridge be increased; and it is obvious that if a bridge should be cut in two in the centre of the span, and one-half removed, the other half could not fall as long as the connection over the pier remained perfect.

Even in bridges of a single span, it would not be impossible to communicate the strength of a continuous bridge, by connecting the upper chords with chains passing over the back of the abutments, and anchored into the ground on the principle of a suspension bridge; but such an arrangement is not to be recommended in ordinary cases.

When the chords of a straight bridge are of equal size, the lower are necessarily much weaker than the upper within the elastic limits; the latter resist a force of compression which naturally closes the joints, and brings every part of the cross-section into full bearing. But the case is very different at the lower chord; here, from the nature of the strain, which is one of extension, the joints are opened, and, from the manner in which the connection is formed, only one-half the area of the cross-section opposes any resistance.

Fortunately, we have a simple means of correcting the evil; but, simple as it is, it does not appear to be generally resorted