— \( u = cp \). Substitute the value of \( u \) and reduce: the expression \( \frac{w}{l} u + \frac{w}{2} \) becomes \( \frac{w}{l} x \) which is the equation of a straight line passing through the origin \( C \).

It follows therefore that the vertical strains are exactly proportional to the distance from the centre, a consequence of the greatest importance in its application to the practice of Bridge Construction.

To find the curve which represents the horizontal strain.

The horizontal strain at any point of a beam supported at the ends and loaded uniformly, was found to be \( \frac{u w}{2d} \times \frac{(l-u)}{l} \) in which \( u \) represents the distance of the point from the end, \( w \) = the whole weight, \( l \) = the length, and \( d \) = the depth of

Note.—It may be thought that the principle which I have endeavored to establish is too simple to require the explanation that has been given; but simple as it is, the consequences are important, and I do not know that it has been noticed by writers upon Bridge Construction or the resistance of Solids; certainly it is that the effects which naturally result from it have been overlooked in proportioning structures. In fact it was not until some months after my attention had been directed to the theory of Bridge Construction, that I was led to observe the difference in the vertical forces at different points of a straight truss. The fact that such difference exists was first pointed out to me by H. R. Campbell, of Phila., a gentleman who in the course of a long and extensive practice as a Civil Engineer, has enjoyed rare opportunities for becoming acquainted with Bridge Construction and for observing the effects of time and accidents.

In a conversation with him upon the principles of the art, he asked me to explain why the chords of a Bridge which had settled considerably were more bent at the abutments than at the middle. I had not then particularly noticed the fact, but he assured me that although the depression was greatest in the middle when a straight Bridge settled below its level, yet the curvature was not uniform, and the quickest bend, or in other words the least radius of curvature, was always nearest the abutment. In a subsequent examination of a large number of bridges, I invariably found that the joints of the braces near the abutments were compressed and tight, whilst near the centre of the spans no symptoms of crushing were perceptible, and in some cases where the joints of the central braces were not well fitted, a knife blade could be introduced, clearly indicating a great increase of pressure towards the abutments, and as a consequence, the necessity of increasing the number or size of the vertical supports towards the extremities.—Author.