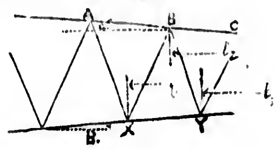
[This method applies of course to other structures equally with cantilevers. In the case of independent trusses the deformation would be plotted commencing from the middle of the bridge, where under a symmetrical load the booms are horizontal.]

If the analytical method be used, let ABYX (Fig. 7) be one panel of a cantilever whose booms AB and X Y make respectively angles α° and β° with the horizontal. Let l_1, l_2, l_3 be the distances respectively of X, B and Y from the vertical through the extremity of the cantilever.

Fig. 7.



Then if the length AB of the top boom, be expanded by an amount $K_1 \times AB$ the vertical deflection at the end of the cantilever due to this change, all the other members of the cantilever remaining unaltered in length, is:—

$$(2) \qquad \delta_1 = \frac{K_1 \cdot AB \cdot l_1}{BX \cdot \sin ABX}$$

Similarly for the length XY of bottom boom contracted by an amount $K_2 \cdot XY$:

$$(3) \qquad \delta_2 = \frac{K_2 . XY . l_2}{BX . \sin BXY}:$$

For the diagonal tie BY:

$$(4) \quad \delta_3 = K_3 \left\{ \frac{BY \cos \beta}{\sin BXY} - l_3 \; (\cot YBC - \cot BXY) \right\}$$

For the diagonal strut BX

$$(5) \quad \delta_4 = K_4 \left\{ \frac{BX \cos \alpha}{\sin ABX} - l_2 \; (\cot BXY - \cot ABX) \right\}$$

These expressions are here given in their most general form. In any particular case they will be much simplified. For instance, when the booms are parallel (4) and (5) consist of their first term only. If in addition the strut BX is vertical, sin ABX in δ_1 and δ_4 is unity. K varies according to the stress per sq. inch, but usually k_1 will be nearly equal to $k_3 \propto k_1$, $k_2 \propto k_3$ will not vary much from one panel to another. In tension members of course, th gross section must be estimated in order to determine the elongation, where in calculating stresses deductions would have to be made for rivet-holes. Some useful deductions may be made from the propositions given above.

Consider two similar cantilevers whose linear dimension in all directions are as $m_1 : m_2$, and whose external loads are in the same ratio. The stress per sq. inch. on corresponding members of the two cantilevers being the same we see at once that the deflections will be in the ratio of $m_1 : m_2$. The angular deformation will be the same in both cases. Let us now compare the secondary stresses to which these angular deformations give rise if the two cantilevers compared, be rigid at the joints, and not hinged. The form of the booms under strain will be a curve of continuous curvature passing approximately through the positions of the joints given by the diagram of deformation in which the joints were treated as hinged. It will not be accurately so, because at each joint the web members and the boom act on each other with equal and opposite couples, and also the curvature of any web member, by shortening the distance between its ends, tends to elevate the lower boom and depress the upper, but the effect of these forces will not modify the form of the boom to any great extent compared to the whole deformation.

It follows then from the similarity of the figures that in the two cantilevers compared, the radii of curvature of the booms at corresponding points are as $m_1 : m_2$. Let ρ be the radius of curvature, r the distance from the neutral axis of the boom to its most strained edge, t the stress