If a unit vertical load, $P = 1$, be applied to any point, A, of the rib, the moment produced by P will be $M = -P x' = -x'$ and, therefore, the horizontal displacement of the left end where H is applied, due to P is:

$$\Delta x = \int_L^R M y \, d w = -\int_L^R x' y \, d w$$

This term is the same as the numerator in Equation (22). According to Maxwell's theorem, the horizontal displacement of the point, L', produced by a unit vertical load at A is equal to the vertical displacement of Point A produced by a unit horizontal load at L'.

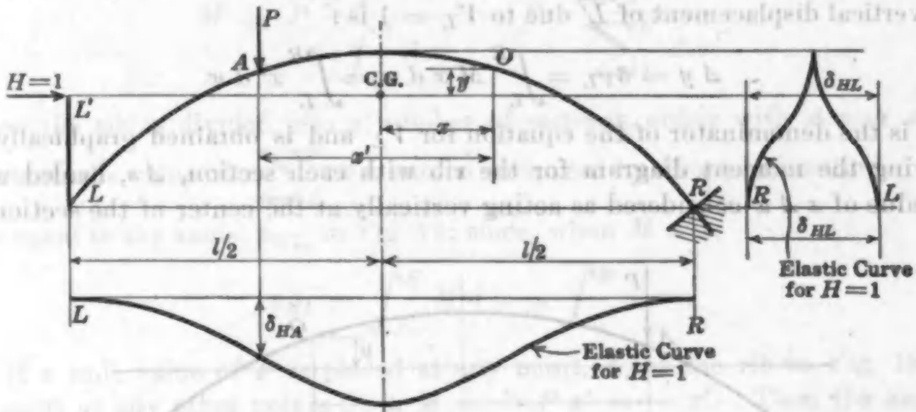

FIG. 10.

Therefore, applying a unit horizontal force, H, at L' as before, the vertical displacement, δ_{HA}, of the point, A, is equal to the horizontal displacement of L' due to $P = 1$, or,

$$\delta_{HA} = -\int_A^R x' y \, d w$$

As $M = y$, the value of δ_{HA} can easily be found graphically by constructing the bending-moment curve for the rib with each section, Δs, loaded with its value of $y \Delta w$ acting vertically at the center of the section. The ordinate of this bending-moment curve is δ_{HA}. Then, referring to Fig. 10:

$$H = P \frac{\delta_{HA}}{\delta_{HL}} \quad \text{(24)}$$

The temperature thrust is:

$$H_t = \frac{t \alpha l}{\delta_{HL}} \quad \text{(25)}$$

The rib-shortening thrust is:

$$H_{RS} = \frac{-H l}{E A'_m \delta_{HL}} = -H u' \quad \text{(26)}$$

in which,

$$u' = \frac{l}{E A'_m \delta_{HL}}.$$