will be in some other direction such as *nn*, and the maximum stress will occur at *b*. Choose any convenient rectangular axes *Gx*, *Gy* through the centre of gravity (if the section is a standard one of which the moments of inertia are tabulated in the hand books, *Gx* and *Gy* should be the axes of the given moments of inertia) and indicate the angle *KGx* by λ. Then the inclination, α, of the neutral axis to the axis *Gx* is given by the equation

$$\tan \alpha = \frac{I_x - J \tan \lambda}{J - I_y \tan \lambda} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 2$$

Where I_x is the moment of inertia of the cross-section about *Gx*, I_y the moment of inertia about *Gy* and *J*, the product of inertia about *Gx*, *Gy*. The only assumption made in deducing this is that the distribution of stress follows a linear law. Expressing this symbolically, and forming three equations expressing that the total normal internal force across the section is equal to *N*, and that the sums of the moments of the internal forces about *Gx* and *Gy* are equal to the moments of *N* about *Gx* and *Gy* respectively, equation (2) may be deduced. (See page 23.) In a similar way the equations

$$f = N\left[\frac{1}{A} + \frac{y - x \tan \alpha}{J - I_y \tan \alpha}\, x_k\right] \quad \ldots\ldots\ldots\ldots\ldots \quad 3$$

$$f = N\left[\frac{1}{A} + \frac{y - x \tan \alpha}{I_x - J \tan \alpha}\, y_k\right] \quad \ldots\ldots\ldots\ldots\ldots \quad 4$$

giving the stress, *f*, at any point (x, y) of the cross-section, may be found. In these equations *A* is the area of the cross-section and x_k and y_k are the co-ordinates of the load point *K*. In order to find the maximum stress, all that is necessary is to substitute for *x* and *y* in (3) or (4) the co-ordinates of the point *b* furthest away from the neutral axis. This may usually be determined readily by inspection. If *f* be made zero, either (3) or (4) will give the equations of the neutral axis and thus its position may be found.

The above equations become much simpler if *Gx* and *Gy* happen to be the principal axes of inertia of the cross-section, for in this case *J* is equal to zero. The moments of inertia given in the hand books for standard angle sections, etc., are not taken about the principal axes. For this and other reasons, it is better to take the axes for such sections parallel to the legs of the angle and to calculate *J*, which is

$$\iint xy\, dx\, dy$$

taken over the section. This is usually easy to evaluate, as will be seen from the example considered later.

A few points in the application of this theory to long members subjected to tension or compression must now be considered. In