ABSTRACT

In this thesis, an attempt is made to study the mechanics of plastic deformation in thread rolling, on the basis of plane strain indentation of a rigid — perfectly plastic material by a pair of rigid wedges situated at a finite distance apart.

When a pair of such wedges indent a flat surface, they act independently for small depths of penetration; for larger depths of penetration, the plastic fields initiated by the two wedges overlap. Considering the case of larger depths of penetration, two solutions, one based on the slip-line method and the other on the principle of minimum energy, are obtained. The slip-line solution assumes perfectly sharp apexes of the wedges, negligible friction, and a circular crest of the indented material between the wedges. The solution based on the minimum energy principle considers truncated wedges and prescribed frictional shear factor; a flat crest of the indented material between the wedges is assumed. The method establishes not only the load required for indentation, but also possible velocity fields under different conditions.

The above approach is extended to calculate theoretically, the load when a threaded roller indents a flat surface normally. The closeness of this normal load to the normal load which prevails when the roller rolls on the flat surface is examined experimentally. Further, a method of calculating the radial load on a thread rolling die when fed tangentially past a revolving cylindrical workpiece is developed.

Several experiments are conducted to verify the reliability of the above theoretical investigations when applied to actual situations. Within the limits of the experiments, a fair degree of agreement is obtained between the theoretical and experimental results.