CLASSIFICATION OF ROLLING BASED ON THE PRODUCT

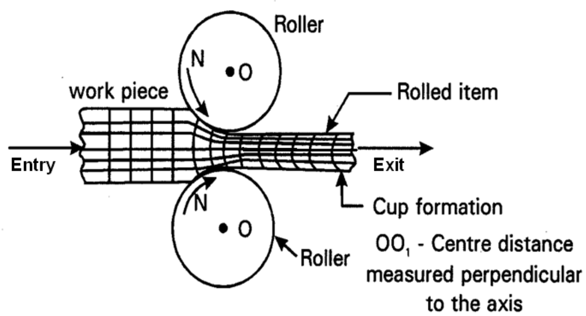
•Blooming Mill- Here only blooms are produced from the Ingot. Blooms will have a dimension of approx.150x150mm.•Billet Mill- Here Billets are produced from Blooms. Billet will have a dimension of approx. 100x100mm.Rod/Bar Mill - Here bars or rods are produced from billets. Bar will have a dimension of 40x40mm.

•Slab Mill- Here slab is produced from the bloom. $t>b$ and $b=100$mm•Plate Mill- Here plate is produced from the slab. $t>4$mm.•Sheet Mill – Here sheet is produced from plate. $t<4$mm.Structural Mill- Here structural shapes like I, U,L or channel sections are produced.

Metal flow pattern in Rolling

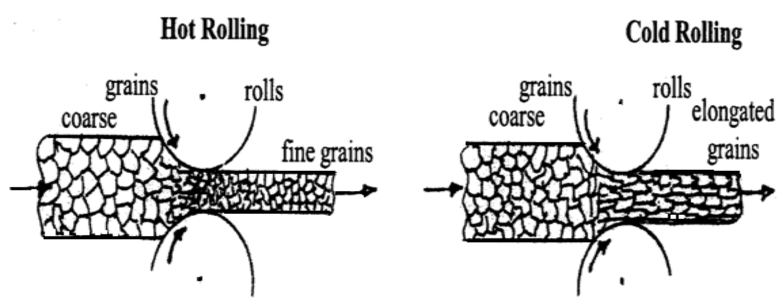
When the metal is rolled it is seen that the outer surface of the metal is deformed to a greater extent. This is due to the fact that the metal will be in direct contact with the roll surface. The frictional forces will be dragging it in the direction of rolling. The center portion of the metal is not at all deformed as it is free from any contact with the roll surface. To study the effect of rolling on the deformation process grid markings are made in the vertical and horizontal directions.
The deformation pattern is observed after rolling.

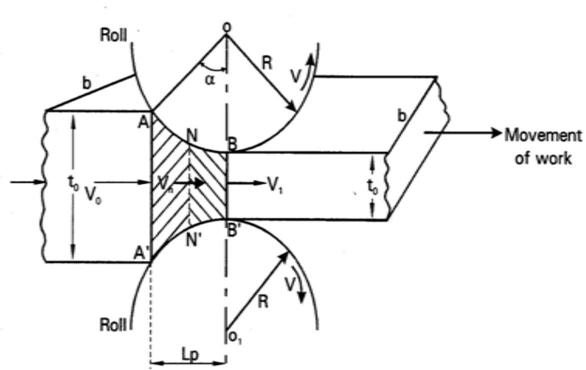
It is observed that distance between the horizontal grids decreases and they come closer. The distance between the vertical grids increases and are bent forward in the direction of rolling.



Metal Flow Pattern in Rolling

The velocity of the work piece as it leaves the rolls is greater than the circumferential velocity of the rolls due to stretching of the layers.
Thickness of the work piece is reduced and the length is increased as it passes out of the roll gap.





Geometric Relationship in Rolling

Let a slab of constant width 'b' enter the gap between the rolls and leave it with the same width 'b'

R - is the radius of the rolls

V - is the surface velocity of the rolls

AA^1 - is the entry plane of the slab

BB^1 - is the exit plane of the slab

t_0 - is the thickness of the slab at the entrance

t_1 - is the thickness of the slab at the exit

V_0 - is the velocity of the slab at the entrance

V_1 - is the velocity of the slab at the exit

NN' - is the neutral plane

The velocity of the work piece increases steadily from entrance to the exit.
At one point along the contact surface of the roll and work, the surface velocity of the roll will be equal to the velocity of the work.

This point is referred to as "Neutral point" or "No Slip Point".

V_n - is the velocity of the slab at the neutral plane

α - angle of contact or angle of bite

$\widehat{AB}$ - arc of contact

L_p - Projected length of arc of contact

$(t_0 - t_1)$ - is the draft

b - is the constant width of the slab at the entrance and at the exit.

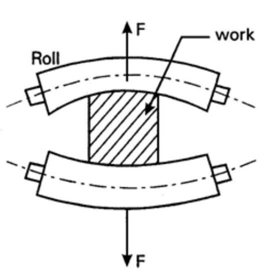
00_1 - is the plane corresponding to the line joining the centers of the rolls.

AA^1B^1B - is the deformation zone

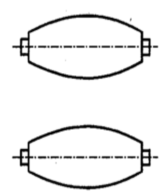
AA^1N^1N - is the Lagging zone $V_0 < V_n$

Roll Camber

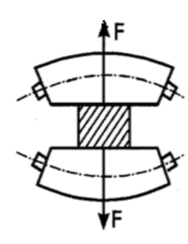
For a given reduction in thickness of the work piece the roll separating force (influencing roll bending) increases linearly with roll radius.
Forces will be set up along the length of the roll and try to deflect and separate the rolls.



Flat rolls undergoing deformation



Rolls with convex surface ie. camber before rolling



Camber rolls after deflection experiencing roll separating force

The convex contour provided on the rolls is called “Roll Camber”.
Without Roll Camber the thickness of the work piece is more at the centre than at the ends.
But with Roll Camber, uniform thickness is maintained across the width of the work.

Source : http://elearningatria.files.wordpress.com/2013/10/vtu-e-notes-mpiii-18.pdf

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