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Beam Blank Deformation Characteristics during Open Pass Web Rolling

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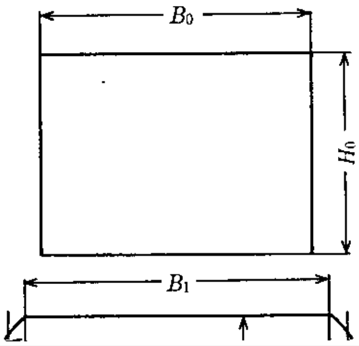
Synopsis :
As an approach to clarifying complicated beam blank deformat ion characteristics during the open pass breakdown rolling into H-shapes, the deformation of dog bone beam blanks is studied using plasticine models starting with the web portion deformation behavior which is assumed to correspond to that of a flat plate under rolling force. Based on experimental result s, mathematical expressions that can calculate the exact amount of metal flow and dimensions have been established to a level applicable to actual steel rolling. A new method of partial web rolling is also introduced.

The body can be viewed from the next page.

Beam Blank Deformation Characteristics during

Takashi KUSABA ** Toru SASAKI **



analysis in consideration of the influence of rolling conditions upon it:

$$2a/H_0 = 0.15\frac{\sqrt{\frac{2R}{H_0}}(H_0 - H_1)}{H_0 + B_0/5} \cdots\cdots\cdots\cdot (3)$$

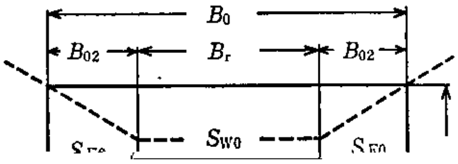
From eqs. (1), (2) and (3), eq. (4) can be derived as the mean spread ratio (B_{1m}/B_0):

$$B_{1m}/B_0 = (H_0/H_1)^{0.39S^{1.77}}$$

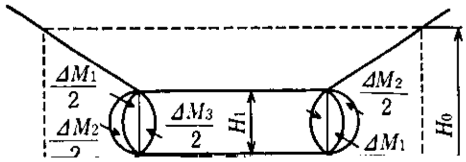
$$0.1H_0(H_0 - H_1)\sqrt{\frac{2R}{H}}$$

calculated values correspond well with the measured values at the same time. Therefore, eq. (5)

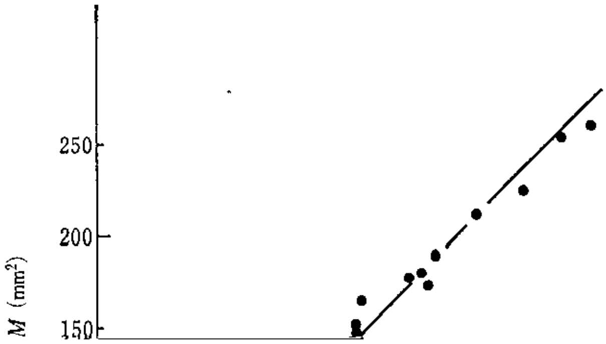
rolled; while a noticeable width contraction occurs at both ends of a light reduction. This shows that a constraint force works at the central flat portion,

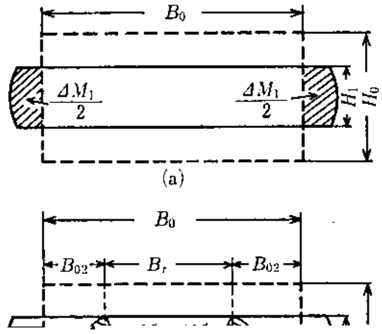


B0
B02
Br
B02
SW0



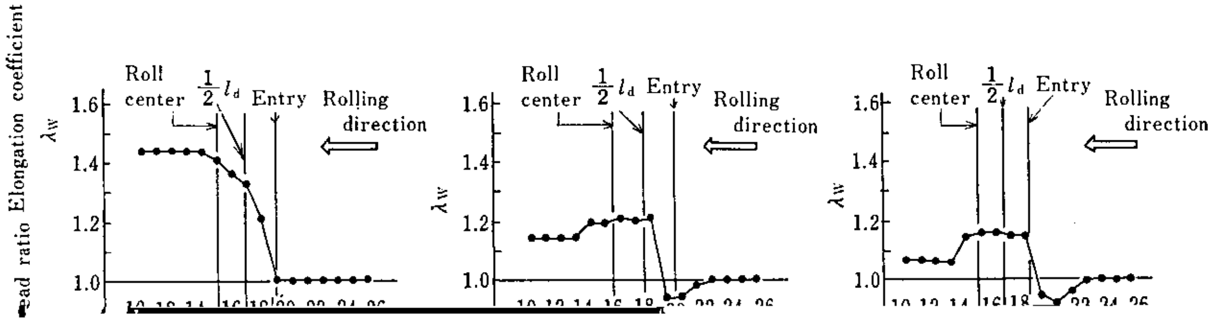
ΔM1/2
ΔM2/2
ΔM3/2
H1
ΔM2/2
ΔM1
H0


250
200
150
M (mm²)


B₀
ΔM₁/2
ΔM₁/2
H₁
H₀
(a)
B₀
B₀₂
Bᵣ
B₀₂

4 Metal Flow Equation when Web of Dog Bone

the position which will be the peak of the spread ratio



Elongation coefficient
λw
Roll center
1/2 l_d
Entry
Rolling direction
1.6
1.4
1.2
1.0

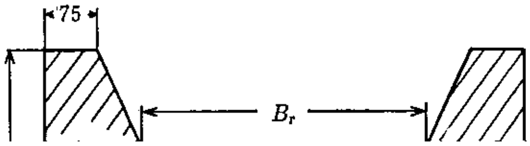
above manner. The amount of metal flow at each deformation stage is expressed as part of the total metal flow. ΔM_A stands for the amount of metal flow

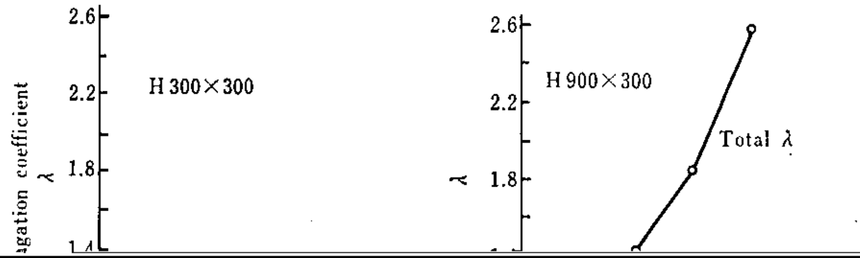
mation, and the rest is the amount of metal flow caused

area will be derived, therby facilitating the calculation of external dimensions from both these and the shape of deformation.

rolling only the web of the dog bone is as follows:

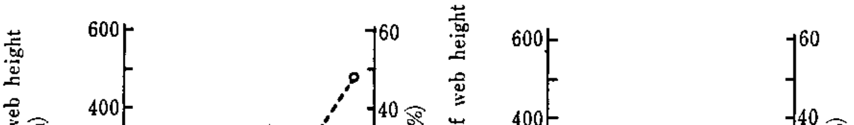
the flange section. In rolling for H300 × 300 whose S_{F0}/S_0 is especially large, above all, no elongation is caused by rolling in the rolling direction because of the large amount of metal flow toward the flange but



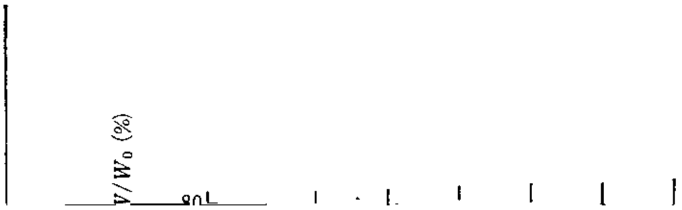


H 300×300
H 900×300
agation coefficient
λ
Total λ
2.6
2.2
1.8

n ratio
width
F_0
1.0
0.9



web height
f web height
600
400
60
40



of the web can be decreased in a state where elongation is little, and thus, effective flange forming rolling can be carried out while maintaining the sectional area

[redacted]

mine optimum rolling conditions involving pass shape, material shape, rolling reduction, etc; by making the most of the model expression for the deformation behavior based on the metal flow equation, without using actual steel.

5 Conclusion

The authors took note of web rolling as having the greatest influence upon the deformation of the dog bone material for H-shape in the open pass rolling, and performed experiments with plasticine models. At first, the case where the web is regarded as a flat plate, and then the case where only the web of the dog bone is rolled, were analyzed and the following results

[redacted]

can be quantified.

(3) In rolling only the web of the dog bone, a marked spread deformation is caused before and after contact with the roll, and it becomes more noticeable, the larger the flange cross section. The amount of metal flow in this case is described as follows:

$$\Delta M = \Delta M_1 + \Delta M_2$$

(4) The amount thus obtained can be used as the basis for, calculating the dimensions of material after rolling.

(5) The prepared calculation expressions have high accuracy, and they can be suitably applied to the estimation of deformation in actual steel rolling.

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