C24

A STUDY OF THE FORCES REQUIRED DURING FORGING OF A MAMMOTY (HOE)

L.N. Pussegoda[a] and M.M.A.B. Gallella[b]

[a] *Dept. of Mechanical Engineering, University of Peradeniya*

[b] *Air Lanka Ltd., Katunayake*

The 'raw' material used at the mammoty manufacturing plant of the Ceylon State Hardware Corporation is a steel 'billet' of thickness 16 mm and of composition 0.45 C, 0.60 Mn and 0.20 Si (wt %). The material is currently imported from China, but on occasions is in short supply. 20 mm thick steel plate having composition 0.24C,0.64 Mn and 0.13 Si (boiler plate steel) can be purchased locally as scrap and it can produce sufficient hardness for a mammoty blade by quenching[2]. Forces are compared when using a 20 mm thick billet and a 16 mm thick billet.

The upper bound theorems of plasticity[1] is used to estimate the forces required during forging of the mammoty. The following assumptions have been made in this analysis:

1. The flow stress in shear (τ) during plastic deformation of the material is constant,
2. Deformation of metal adjacent to the die surfaces takes place when the shear stress reaches τ
3. Metal deformation has been separated into 2 independent regions; the mammoty 'eye' and blade. These two regions have constant volume during deformation.
4. The modes of deformation in these two regions have been assumed.

From the estimation of forging force vs. punch position the following comparisons are made:

1. $\frac{\text{Maximum load required to forge 20 mm thick billet}}{\text{Maximum load required to forge 16 mm thick billet}} = 1.72$

2. $\frac{\text{Energy required to forge 20 mm thick billet}}{\text{Energy required to forge 16 mm thick billet}} = 2.93$

References

1. Calladine, C.R. (1969) Engineering plasticity Ch. IV, VII and XI Pergamon Press, London.
2. Pussegoda, L.N., Ravindra Darshana, K.P.W. and Gallella, M.M.A.B. (1986) Heat treatment of carbon steels for mammoties. Trans. Indian Inst. Metals
3. Thayalan, S., Jesuthasan, G. and Pussegoda, L.N. (1984) An improved locally produced mammoty. Trans. Inst. of Engineers, Sri Lanka 63-67