

## Discussion

E. K. HENRIKSEN,<sup>5</sup> In the present paper, together with previous papers,<sup>6</sup> the author has shown that the shear line may take on three different shapes, differing from each other with respect to curvature.

One may say, with appropriate definitions, that the curvature of the shear line is positive, zero, or negative, depending upon whether the cut surface itself has positive, zero, or negative curvature (Fig. 13 of this discussion).

Another case of a curved shear line has been described by Merchant,<sup>7</sup> who observed that in orthogonal straight-line cutting the conventional rectilinear shear line is an approximation only, and that the real shear line in many cases showed a curvature (Fig. 14) although so small that the approximation is perfectly permissible. It is obvious that the curvature which Merchant refers to is of an origin and a nature different from the curvature in the author's cases.

However, it would be interesting if the plasticity theory developed by the author could be brought to explain the curva-

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<sup>6</sup> (a) "The Theory of Plasticity Applied to a Problem of Machining," by E. H. Lee and B. W. Shaffer, *Journal of Applied Mechanics*, Trans. ASME, vol. 73, 1951, pp. 405-413.

(b) "The Mechanics of the Simple Shearing Process During Orthogonal Machining," by B. W. Shaffer, Trans. ASME, vol. 77, 1955, pp. 331-336.

(c) "Analysis of Chip Formation in the Turning Operation," by B. W. Shaffer, Proceedings of the Second U. S. National Congress of Applied Mechanics, June 12-14, 1954.

<sup>7</sup> "Chip Formation, Friction and Finish," by Hans Ernst and M. E. Merchant, The Cincinnati Milling Machine Company, 1940.

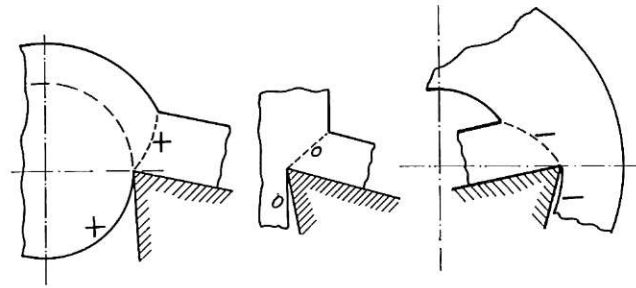


FIG. 13

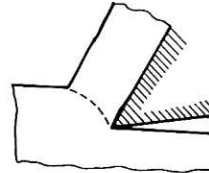


FIG. 14

ture in straight-line cutting observed by Merchant. Is there any possibility of doing this?

### AUTHOR'S CLOSURE

While it is true that a slightly curved shear line has been observed experimentally in orthogonal machining, the current theory which predicts a flat shear line does not offer an explanation for this phenomenon. It may be, as Professor Henriksen suggests, that an extension of the theory could be brought to explain the observed deviation.