DISCUSSION

H. F. Bueckner[1]—It might be well to review briefly the stress-analysis situation regarding the notched round bar in tension, since this geometry appears to be important from the standpoint of fracture testing. Several treatments of this problem can be found in the literature and are compared in Table 8, which gives the coefficient, $F(d/D)$, of Eq 57 in the paper, as derived from various references. The values used by Lubahn[2] and by Wundt[3] represent my first and second estimates, respectively. The first estimate was based on extrapolation of Peterson's published stress-concentration factors[4] to a vanishingly small radius of curvature. These values agree well with those reported by Irwin[5] who used the same procedure. The results obtained by this extrapolation method are, of course, only at best as accurate as the stress-concentration factors from which they are derived. The second estimate was made using Neuber's formula for deep notches in combination with a computation for a notch in an elastic half plane.[6]

TABLE 8—COEFFICIENTS FOR COMPUTATION OF THE STRESS-INTENSITY FACTOR, K_I FOR A NOTCHED ROUND BAR. $[K_I = F(d/D)\sigma_N (\pi D)^{1/2}]$

Notch Depth, d/D	$F(d/D)$ as given by:				
	Lubahn[a]	Irwin[b]	Wundt[c]	Paris[d]	Present Solution[e]
0.5	0.230	0.224	0.239	0.227	0.240
0.6	0.234	0.232	0.252	0.238	0.255
0.707	0.229	0.233	0.258	0.240	0.259
0.8	0.217	0.224	0.250	0.233	0.251
0.9	0.195	0.199	0.210	0.205	0.210

[a] See footnote 2.
[b] See footnote 5.
[c] See footnote 3.
[d] From Table 5 of the paper.
[e] To be published.

Recently I completed a more rigorous analysis[7] of the problem using a certain singular integral equation, the kernel of which is found by means of Fourier transforms. The coefficients derived from this solution are shown in the last column

[1] General Electric Co., Large Steam Turbine-Generator Dept., Schenectady, N. Y.

[2] J. D. Lubahn, "Experimental Determination of Energy Release Rate," *Proceedings*, Am. Soc. Testing Mats., Vol. 59, 1959, p. 885.

[3] B. M. Wundt, "A Unified Interpretation of Room Temperature Strength of Notch Specimens as Influenced by Size," *ASME Paper No. 59*, MET 9, 1959.

[4] R. E. Peterson, "*Stress Concentration Design Factors*," John Wiley & Sons, Inc., New York, N. Y., 1953.

[5] G. R. Irwin, "Supplement to: Notes for May, 1961 meeting of ASTM Committee for Fracture Testing of High-Strength Metallic Materials."

[6] H. F. Bueckner, "Some Stress Singularities and Their Computation by Means of Integral Equations," *Boundary Problems in Differential Equations*, edited by R. E. Langer, University of Wisconsin Press, Madison, Wisc., 1960, pp. 215–230.

[7] To be published.

of Table 8 and are considered to provide values of K_I having an accuracy within 1 per cent. It is interesting to note that the coefficients obtained by the present analysis agree well with those used by Wundt, but are higher than those given by Irwin or by Paris. Considering, for example, a notched round bar with $d/D = 0.707$, a geometry commonly used in fracture testing, the ASTM Special Committee[8] gives the following expression for the stress-intensity factor:

$$K_I = 0.414\, \sigma_N\, (D)^{1/2}$$

The coefficient in this equation corresponds to the value 0.233 in Eq 57 of the paper. The present analysis yields a value of 0.259, about 10 per cent higher than that given by the above expression.

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[8] "Screening Tests for High-Strength Alloys Using Sharply Notched Cylindrical Specimens," Fourth Report of a Special ASTM Committee, *Materials Research & Standards*, Vol. 2, March, 1962, pp. 196–203.