Discussion

Stresses in a Notched Strip Under Tension[1]

R. E. PETERSON.[2] For design purposes considerable use has been made of the Neuber values of stress-concentration factor. For this reason it may be of interest to superpose a curve of such values on the author's Fig. 3; this is shown in Fig. 1 of this discussion. For $\lambda = 0$ the Neuber value is 3, the same as for a hole in an infinitely wide plate. Approaching $\lambda = 1$, the Neuber values are for a deep hyperbolic notch. An arbitrary function connects these end conditions, so that in the general region of $\lambda = 0.1$ to 0.4 the Neuber values are particularly questionable. It is not the intention of this discussion to attempt to draw any conclusions by comparison with experimental points; it is merely intended to show the differences between the author's results and those which we have been using.

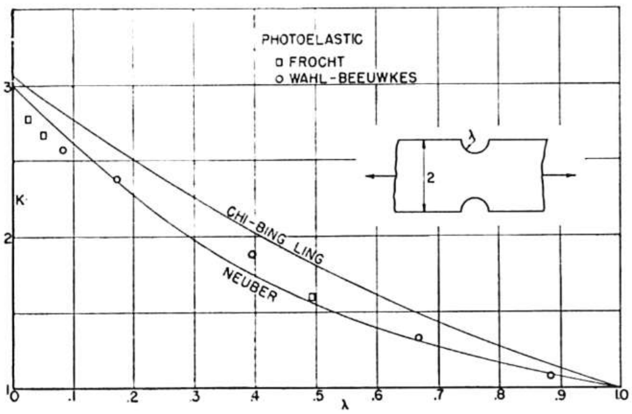

FIG. 1 STRESS-CONCENTRATION FACTOR FOR A NOTCHED STRIP IN TENSION

AUTHOR'S CLOSURE

The author acknowledges with appreciation the discussion of Mr. Peterson.

In Fig. 1 of his discussion, the Neuber curve appears to be considerably lower than the author's theoretical curve. Also, save at both ends, this curve for its greater portion lies below the experimental points obtained by Frocht, Wahl, and Beeukes. It is not the intention of the author to reaffirm here the theoretical curve he obtained, but merely to indicate that Neuber's curve indeed underestimates the stress-concentration factor of the notched strip.

In experimental measurement, it is often found exceedingly difficult to obtain a very precise determination of maximum stress in a plate and usually a lower value is obtained, particularly when the stress in the plate drops rapidly from the point of maximum stress. For instance, a stress-concentration factor as low as 2.5 has been found photoelastically by Capper[3] in the case $\lambda = 0$, as compared with the theoretical value 3.065. This leads us to think that Neuber's curve probably underestimates the factor concerned.

To establish the statement positively, let us consider an infinite number of such notched strips matched sidewise and cemented together. We then have an infinite plate perforated by a series of equal and equally spaced circular holes. Such a plate has been investigated theoretically by Howland.[4] He gave a maximum stress $3.24T$ in the case $\lambda = {}^1/_2$ when the plate is under a tension T, acting transversely to the line of holes. Together with the end values, the stress-concentration factor of the plate is as follows:

λ	0	$^1/_2$	1
Stress-concentration factor	3	1.62	1

It is curious to note that such end values are the same as Neuber's, and besides, the value 1.62 is equal very nearly to Neuber's 1.56 and slightly higher. Thus Neuber's curve would indeed give closely, though perhaps slightly nonconservatively, the stress-concentration factor of such a plate. Now consider strips to be cut off one by one from both sides of the plate along the cementing lines until finally only a single strip is left. Each cut increases the maximum stress at the rim of the notch in the last strip by some amount; the nearer the cut, the larger will be the effect. This leads us to infer that Neuber's curve definitely underestimates the factor.

[1] By Chih-Bing Ling, published in the December, 1947, issue of the JOURNAL OF APPLIED MECHANICS, Trans. ASME, vol. 69, p. A-275.

[2] Mechanics Department, Westinghouse Research Laboratories, East Pittsburgh, Pa.

[3] "Photoelasticity," by E. G. Coker and L. N. G. Filon, Cambridge University Press, London, England, 1931, p. 560.

[4] "Stresses in a Plate Containing an Infinite Row of Holes," by R. C. J. Howland, Proceedings of the Royal Society of London, England, vol. 148, 1935, pp. 471–491.

Note on the Tightness of Expanded Tube Joints[1]

R. G. LLOYD[2] AND G. J. SCHOESSOW.[3] A new paper on expanded tube joints is always welcome, and the present one offers new analytical methods for consideration. In this paper particular reference is made to the paper on holding power and tightness by Messrs. Goodier and Schoessow.[4] The present paper claims a considerably simplified method of obtaining like results.

The author's results are apparently obtained solely from elastic theory with no use made of plasticity considerations. The paper is based upon his Equation [1], which is obtained from the elastic equation of equilibrium for an element in a cylindrical body by neglecting differentials of higher order and simplifying. This equation is then integrated for the specified boundary conditions. Together with the elastic equation for radial stress in a plate, these equations are combined to give a function which, when plotted, has some agreement with results from the Goodier-

[1] By G. Sachs, published in the December, 1947, issue of the JOURNAL OF APPLIED MECHANICS, Trans. ASME, vol. 69, p. A-285.

[2] Engineer, The Babcock & Wilcox Company, Barberton, Ohio. Jun. ASME.

[3] Engineer, The Babcock & Wilcox Company, Barberton, Ohio. Mem. ASME.

[4] "The Holding Power and Hydraulic Tightness of Expanded Tube Joints," by J. N. Goodier and G. J. Schoessow, Trans. ASME, vol. 65, 1943, pp. 489–496.