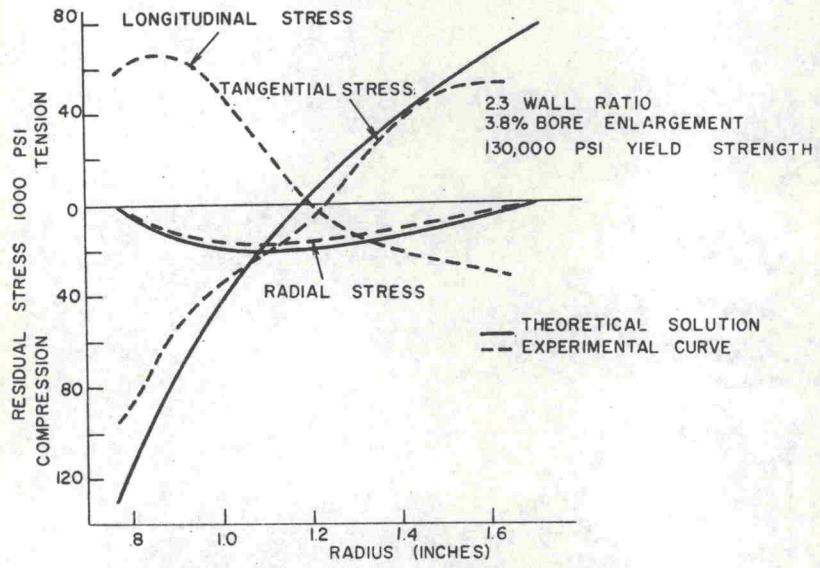

Fig. 10—Residual stresses in mechanical-push-swaged specimen

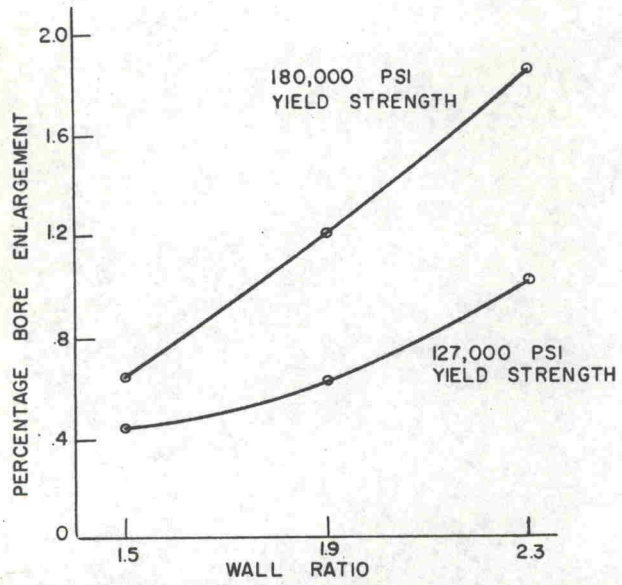

Fig. 11—Percent bore enlargement to yield exterior surface. Empirical data

of the mandrel through the specimen. However, an examination of the bore surfaces revealed no damage.

An immediate evaluation of the effectiveness of the residual stresses induced by both pull and hydraulic-push methods was provided by subjecting test cylinders to hydrostatic pressure until yielding resulted. A comparison is made in Fig. 9 of the internal pressure versus exterior surface strain for a typical hydraulic push-swaged specimen, a nonswaged specimen, and a specimen of conventional autofrettage. It is seen that the hydraulic-push swage method produces an autofrettaged condition which was as effective in increasing yield pressure as the conventional hydrostatic method. The results shown in Fig. 9 are also typical for the pull-swaging method.

Residual Stresses

The induced three-dimensional residual stresses were evaluated and compared at five transverse sections. The Sach's boring-out method was used. Figure 3 shows a specimen mounted in a special jig designed to facilitate this evaluation. Two SR-4 strain gages were oppositely placed on diameters at mid-length, $\pm 1/2$ in., and ± 1 in. from mid-length. Uniform results from these locations indicated that the center inch of length was free from end effects, which verified the previous dynamic records.

Experimental curves of the stress distribution through the cylinder wall at the mid-length section are shown in Fig. 10 for tangential, radial and longitudinal stresses. A summary of the data indicated that the experimental distribution which most nearly coincided with the theoretical distribution is that associated with yield just to the outer surface. Yielding less than or greater than this changed the residual-stress distribution significantly. The theoretical curves compared with the experimental in Fig. 10 are based on the autofrettage of a monobloc open-end tube using conventional internal hydraulic pressure. Good agreement is shown.

Figure 11 summarizes the experimental data for the 120,000 and 180,000 psi yield-strength materials, and expresses percent bore enlargement as a function of wall ratio to just yield the outer surface.

Acknowledgments

The authors wish to express their appreciation to R. A. Petell and his personnel in the Laboratory Unit of the Metal Working Section for their assistance in the execution of this work.

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