Conclusions

Data for the hydrostatic fatigue characteristics of high-strength thick-walled cylinders in the range of 10^3 to 10^5 cycles to failure are presented. Based on this investigation, the following points have been established.

1 Autofrettage significantly improves the fatigue characteristics of thick-walled cylinders at stress levels lower than those associated with the overstrain pressure. The degree of improvement increases as the cyclic stress level decreases.

2 Using the difference in principal bore stress as the cyclic parameter, the fatigue characteristics improve with increasing diameter ratio. This increase with diameter ratio is small in the case of the nonautofrettaged condition. In the case of autofrettaged cylinders, the increase in fatigue life with diameter ratio is substantial. The rate of improvement in the autofrettaged cylinders approaches that for the nonautofrettaged condition beyond a diameter ratio of 2.0.

3 The slope of the difference in principal bore stress versus cycles to failure curve appears to approach zero below 10^3 cycles to failure.

4 Based on the similarity in the correlation coefficient, no single cyclic stress or strain parameter evaluated for the presentation of thick-walled cylinder fatigue data offered significant advantage over the others.

5 Thermal treatment of the overstrained cylinders at 675 F for 6 hours did not affect fatigue characteristics.

6 There is a correlation between the cyclic-stress level and the area and depth of the fatigue crack to the point of ductile rupture; the depth of the crack decreasing with increasing stress level.

7 Internal-diameter surface finishes varying from 16 to 125 micro-inches RMS did not show a consistent pattern in affecting the fatigue life.

8 The fatigue characteristics appear to be proportional to the tensile-strength level for the range of ultimate tensile strength from 160,000 to 190,000 pounds per square inch.

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