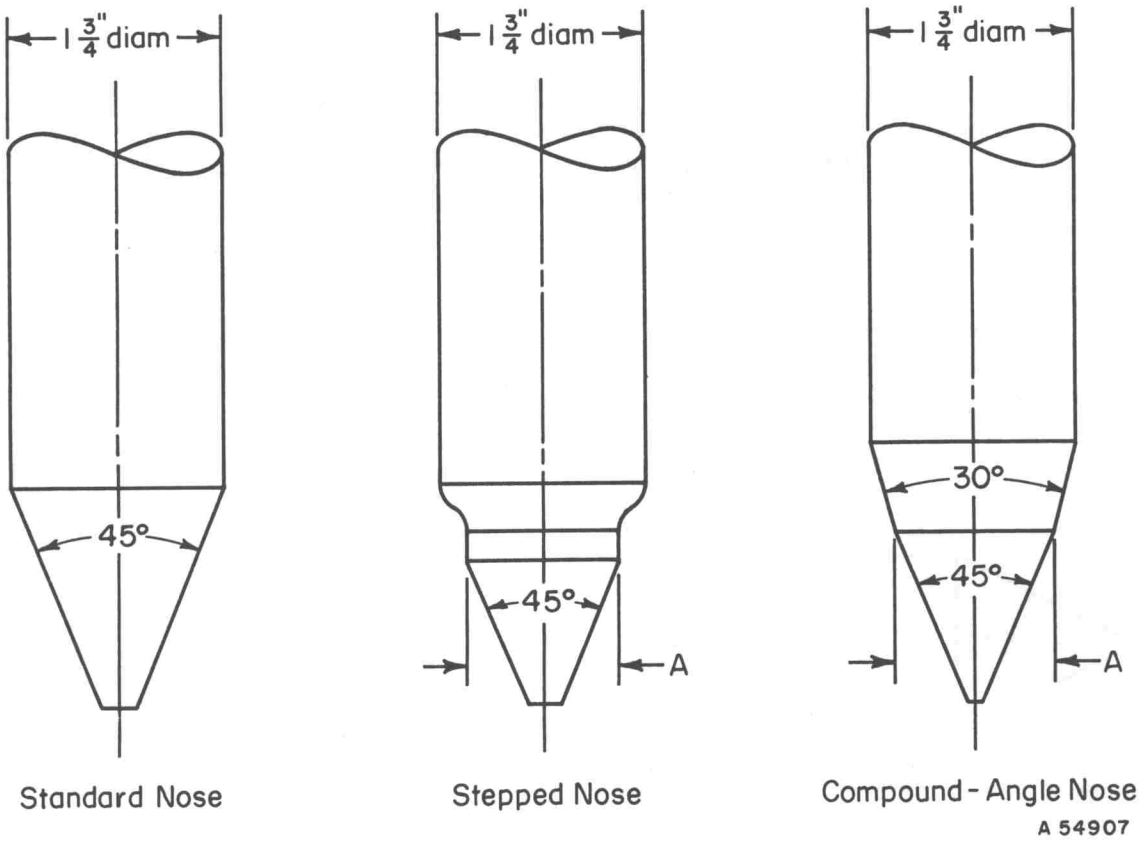

FIGURE 5. BILLET NOSE DESIGNS EVALUATED IN HYDROSTATIC EXTRUSION

(2) Elimination of a high P_b prevents the initiation of stick-slip during runout. Apparently, this is partly because "slip" from a high P_b peak occurs at such high speeds that some lubrication breakdown may occur during this time.

The compound-angle nose design will be incorporated in billets to be used in future extrusion trials where stick-slip is known to be a problem, e.g., in the extrusion of T-sections and at higher ratios with 7075 aluminum.

It is of interest to note that the compound-angle nose was evaluated in the last program[1] on 1100-0 aluminum at a ratio of 10 : 1. No pressure reduction was obtained, however, because the lubrication system used here was entirely adequate, the extrusion conditions being less severe.

Tandem Extrusion

Tandem hydrostatic extrusion (Trials 453 and 454) was carried out to determine the feasibility of stopping an extrusion, placing another billet on the back end of the first and commencing to extrude them in sequence. This technique would be desirable for a high-production operation.

The two methods of seating the second billet evaluated are shown in Figure 6. Design A is a counterbore fit and Design B is a taper connection. The extrusions were conducted at an extrusion ratio of 20:1 and stem speed of 20 ipm. Lubricant 53 and castor oil comprised the lubrication system, but the joint faces were not lubricated.

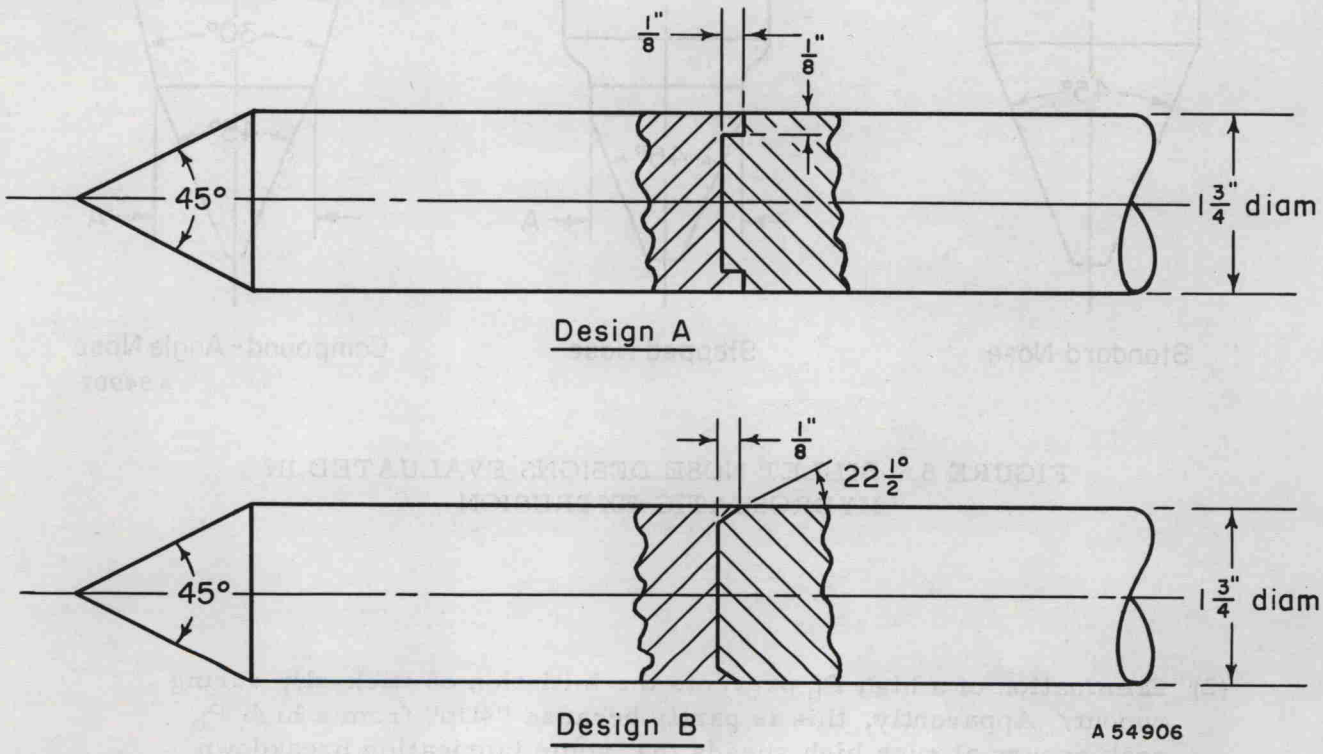

FIGURE 6. TANDEM BILLET JOINT DESIGNS EVALUATED IN HYDROSTATIC EXTRUSION

With Design A, the tandem joint extruded through the die satisfactorily without any discontinuity in the extrusion pressure curve. The shoulder in the female portion of Design A apparently gripped tightly around the mating surface and prevented the billets from separating. In contrast, with Design B, the second billet failed to extrude because of seizure in the die due to a lack of lubrication on the joint.

It is worthwhile to point out that the breakthrough pressure on restarting after stopping was, in both cases, about 43,000 psi or 32 percent higher than the pressure required for initial breakthrough. Also, it is significant that severe stick-slip occurred during runout, whereas no stick-slip occurred during runout of the first billet. In future trials, efforts will be directed toward minimizing these problems in restarting.