

ABSTRACT

Development of the Manufacturing Capabilities of the Hydrostatic Extrusion Process

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The purpose of the present program is to develop the manufacturing capabilities of the hydrostatic extrusion process. Specific applications to be studied are fabrication of wire, tubing, and shapes from relatively difficult-to-work materials such as refractory-metal alloys, high-strength steels and aluminum alloys, titanium alloys, beryllium, and other selected materials.

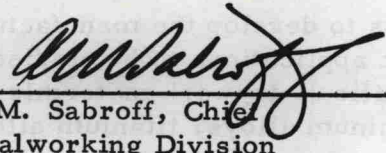
Investigation of critical process variables for cold hydrostatic extrusion of 7075-0 aluminum alloy was continued during this interim report period. Also, work was continued on the cold extrusion of steel and aluminum tubing and T-sections. In addition, warm hydrostatic extrusion of AISI 4340 steel, Ti-6Al-4V titanium alloy and beryllium was conducted. Important results obtained include:

- (1) Production of good-quality thin-walled tubing by re-extruding previously hydrostatically extruded tubing.
 - (a) With AISI 4340 steel, the cumulative reduction was 91 percent
 - (b) With 7075-0 aluminum the cumulative reduction was 98 percent.
- (2) In the extrusion of 7075 aluminum T-sections, a 10 percent reduction in breakthrough pressures has been achieved by using compound-angle dies. At a stem speed of 80 ipm, stick-slip on runout was eliminated.
- (3) A number of fluids and lubricants operated satisfactorily in warm hydrostatic extrusion of AISI 4340. Significant reductions in extrusion pressures were achieved over those required at room temperature.
- (4) Most notable in the warm extrusion of Ti-6Al-4V alloy rounds was the elimination of a billet coating that is required for satisfactory extrusion of this alloy at room temperature. Equally important is the elimination of a breakthrough-pressure peak and stick-slip during runout. Moreover, the extrusion pressures, compared with those at room temperature, were reduced on the order of 15 percent.
- (5) Beryllium extruded at 500 F displayed less cracking and required 50 percent less fluid pressure than that encountered at room temperature.

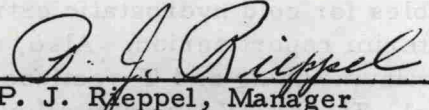
- (6) Preliminary trials in the hydrostatic extrusion and drawing of beryllium wire have provided much information on the experimental procedure, especially in the handling of fine wire. The equipment for applying the drawing stress has been designed and tested.
- (7) Tensile test data obtained on hydrostatic extrusions of AISI 4340 steel and 7075 aluminum rounds indicate significant increases in strength over that in the billet material with good retention of ductility.

PUBLICATION REVIEW

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