T-profile to make a good seal. In addition, the die entry angle for each leg of the T-shape was 45 degrees included. The die designations given in Figure 33 are for reference in later discussion.

Experimental Procedure

The experimental approach used in the hydrostatic extrusion of round billets through the T-dies was the same as that for the round-to-round trials except that for the compound angle dies, the billet had to be machined to conform to the dual-angle die profile. However, in the re-extrusion of T-sections, special techniques were required for sealing against fluid leaks.

Initially, attempts were made to machine the billet nose to conform closely with the die profile so that fluid leakage would not occur at the start of extrusion. This proved to be extremely difficult because of the complex shape of the die. In addition, the technique for mating the billet nose with the die contours was time consuming and therefore expensive. To simplify the technique, the nose was machined roughly to the die contour and a low-melting-point metal was cast into the orifice of the die with the billet standing in position. Lead, solder (50-50), and Wood's alloy were evaluated. Some limited success was achieved with the Wood's alloy and this material was adopted. This sealing procedure, however, presented an additional problem in that the hot metal tended to destroy the effectiveness of the billet lubricant in the nose area, generally resulting in high breakthrough pressures. However, it is believed that this problem is not insuperable. It is possible that other sealing materials, such as low-melting-point plastics, which exhibit good lubrication qualities in themselves, might be available. Also, it still might be possible to find a billet lubricant which would be unaffected by a molten metal contact. Alternatively, it might be possible to prepare a closely mating point fairly cheaply by such techniques as electrochemical machining.

Cold Hydrostatic Extrusion and Re-extrusion of 7075-0 Al Shapes

The data obtained in the study of critical process variables for the hydrostatic extrusion and re-extrusion of 7075-0 T-sections are given in Table XXX. Stem speed, billet surface finish, and die design were investigated.

Extrusion Pressure Requirements

Most of the trials were conducted at a ratio of 7.3:1 which represented a reduction of the 1-3/4-inch-diameter billet to a T-section having leg thickness of 1/4 inch and whose overall profile was circumscribed by a 1-inch-diameter circle. The pressures required to produce a T-section from a round billet at a ratio of 7.3:1 were about 105,000 psi, whereas about 92,000 psi is required to produce a round-to-round extrusion at the same ratio. This represents only about a 15 percent increase in pressures required to produce a T-section over those for rounds. However, stick-slip occurred at this ratio at stem speeds up to 20 ipm.

TABLE XXX. EXPERIMENTAL DATA FOR 80 F HYDROSTATIC EXTRUSION AND RE-EXTRUSION OF 7075-O ALUMINUM T-SECTIONS[a]

xtrusion Ratio	Die[b] Design	Stem Speed, ipm	Billet Surface Finish, microinches	Billet Lubricant (Listed in Table III)	Extrusion Pressure, 1000 psi: Breakthrough Stem	Breakthrough Fluid	Runout Stem	Runout Fluid	Type of Curve (Fig. 26)	Length of Extrusion, inches	Comments
				Hydrostatic Extrusion of 1-3/4-Inch-Diameter Billet to T-Section							
7.3	CA1	6	Grit[c]	L17	133	130	120	101	D2	17.0	
7.3	CA1	6	30-200	L17	133	121	119	100	D2	12.0	
7.3	CA1	20	Grit	L17	123	116	119	105	D1	15.0	
7.3	CA1	80	40-130	L17	130	124	112	108	B1	22.0	
7.3	SA1	6	300	L17	151	135	114	101	D1	20.0	
7.3	SA1	20	400	L17	154	142	116	103	D1	14.0	
7.3	SA1	80	Grit	L17	135	126	118	104	B1	11.0	
7.3	CA2	20	60-120	L53	120	105	108	99	D1	25.0	
14.5	SA2	6	60-120	L17	276	232	--	--	--	--	Pb not achieved
				Re-extrusion of 1/4-Inch-Thick T-Sections							
2.0	SA2	--	60-120	L53	--	--	--	--	--	--	Fluid leaked; Pb not ach
2.0	RD1	20	60-120	L17	30	34.5	--	--	--	1.5	Fluid leaked; Wood's all
2.0	RD1	6	60-120	L17	42	40.5	--	--	D1	14.0	Wood's alloy aided seali
4.0	RD2	20	60-120	L53	75	73.5	55	52.5	D2	24.0	Wood's alloy aided seali

astor oil.
res 31, 33 for die design details.
s grit blasted, then vapor blasted.
8, 509, and 510 were conducted under the same conditions except that sealing was attempted with lead, solder, and Wood's alloy, respectively; fluid leal
on each occasion.