



FIGURE 4. STEM-SEAL ARRANGEMENT USED FOR WARM HYDROSTATIC EXTRUSION

With the single PTFE O-ring, fluid leaks were frequent. The other two O-ring arrangements successfully contained fluids at pressures up to about 220,000 psi. In none of the arrangements, however, were the rings reusable, because of distortion or breakage.

In the several trials conducted successfully with a single PTFE O-ring, it is noted that the stem pressure/fluid pressure differences were least of the three combinations. Thus, an increase in stem-seal/container friction is obtained with a dual O-ring system. Because of this, future trials will be made with the aim of eliminating the need for two O-rings.

WARM HYDROSTATIC EXTRUSION OF AISI 4340 STEEL ROUNDS

In hydrostatic extrusion of AISI 4340 rounds at 500 F, the variables investigated included fluids, lubricants, and extrusion ratio. In addition, some trials were made at 400 F because one of the fluids had a relatively low flash point (470 F). In the trials, the fluid, billet, and tooling were at the same temperature. Tables 1 and 2 contain information pertaining to lubricants and fluids used. The experimental extrusion data for these trials made with 4340 steel are given in Table 6.

TABLE 6. EXPERIMENTAL DATA FOR 500 F

Die Angle: 45 deg
Stem Speed: 20 ipm

Item	Trial	Extrusion Ratio	Hydrostatic Fluid	Type of Stem Seal ^(a)	Billet Lubricant	Extrusion Pressure, Breakthrough	
						Stem	Fluid
1	394	4	PPE	1t	L31	198	196
	418	5	PPE	2t	L31	243	213
	420	5	PPE	2t	L31	230	200
2	393	4	PPE	1t	L33	195	195
3	397	4	PPE	1t	L34	187	199
4	409	4	PPE	2t	L35	194	190
5	399	4	PPE	1t	L38	199	204
	401	4	PPE	1t	L38	193	200
6	407	4	PPE	1t 1r	L40	195	189
7	406	4	PPE	1t 1r	L43	202	198
8	408	4	PPE	1t 1r	L44	199	192
9	410	4	TCP	2t	L31	200	187
10	411	4	TAP	2t	L31	202	192
11	412	4	CBP	2t	L31	196	186
12	413	4	SE ^(b)	2t	L31	189	182
	423	4	SE	2t	L33	198	173
	414	5	SE	2t	L31	--	--
	422	5	SE	2t	L31	223	196

(a) 1t = one Teflon O ring on stem; 2t = two Teflon O rings on stem; 1t 1r = one Teflon and one Buna N rubber O-ring on stem.

(b) Because SE fluid flashed at about 470 F, trials with this fluid were made with fluid, tooling, and billet at 400 F.