

FIGURE 2. COLD HYDROSTATIC EXTRUSIONS OF AISI 4340 STEEL TUBING

Upper ---- 3.77 extrusion ratio (Trial 354).

Lower ---- 2.58 extrusion ratio (Trial 352).

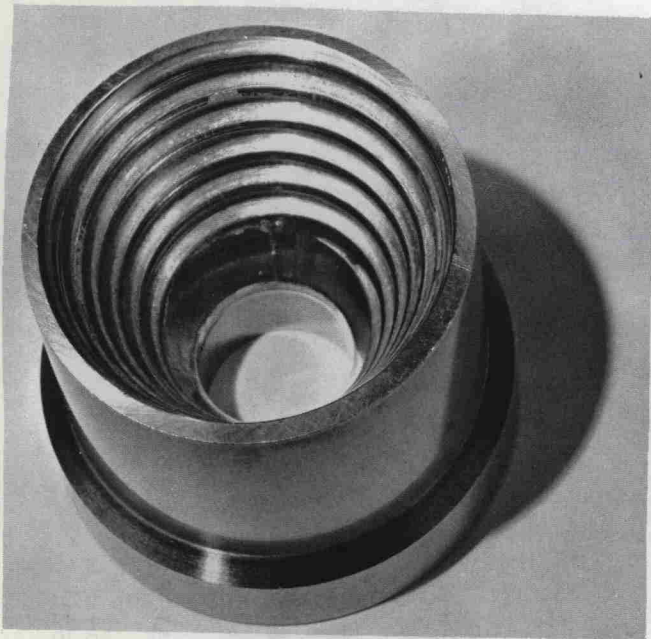


FIGURE 3. DIE DESIGN WITH HELICAL GROOVE IN CONICAL-ENTRY SURFACE

The experimental results obtained with the grooved die during extrusion of AISI 4340 and 7075-0 Al are summarized below:

Die angle 45 degrees Stem speed --- - 20 ipm
 Fluid Castor oil Lubricant ---- - L17
 Extrusion ratio --- - 5:1

Trail	Material	Extrusion Pressure, 1000 psi				Length of Extrusion, inches
		Breakthrough		Runout		
		Stem	Fluid	Stem	Fluid	
284	4340	244.0	220.5	--	--	3
348	7075	147.0	135.5	--	--	12-1/2

In both cases, the billet was found to have upset into the groove, only partially with the steel but completely in the case of the aluminum alloy. This indicates that the pressurized fluid itself does not provide adequate support to the billet to prevent upsetting. Part of the upsetting would, of course, be due to elastic compression of the fluid under pressure. It may also be due to some nonuniformity of pressure within the fluid itself as the fluid becomes more viscous and approaches solidification. The groove did not assist but hindered the extrusion operation. It is possible, however, that other groove configurations, perhaps more shallow in depth, might prove to be beneficial. This may be investigated later in the program.