Cb752 columbium alloy T-section	10.0 W, 2.5 Zr, balance Cb	Hot extruded H-section	E. I. du Pont de Nemours & Co. Inc. [produced under AF 33(657)-11293]	66.0	52.0	--	27.0	--
Ti-6A1-4V wire (0.045-inch diameter)	5.9 Al, 4.0 V, other 0.15, balance Ti	Cold drawn, annealed and pickled	TMCA	140.0	--	--	6.0	--
Beryllium wire (ingot origin 0.020-inch diameter)	0.3 BeO, 0.05 C, 0.07 Fe, 0.12 others, balance Be	Hot drawn, annealed	The Beryllium Corp.	88.0	47.0	--	9.0	--
Beryllium wire (powder origin, 0.020-inch diameter)	2.0 BeO maximum, 0.15 C, 0.18 Fe, 0.36 other, balance Be	Hot drawn, annealed	Brush Beryllium Co.	150.0	137.0	12.4	11.5	--
TZM molybdenum alloy wire (0.1-inch diameter)	0.55 Ti, 0.12 Zr, 0.05 other, balance Mo	Hot drawn, annealed and cleaned	General Electric Co.	125.0	100.0	--	8.0	--

Hydrostatic Fluids

The hydrostatic fluids used in this program for both room-temperature and elevated-temperature trials are described in Table II.

TABLE II. FLUIDS EVALUATED IN HYDROSTATIC-EXTRUSION PROGRAM

Fluid Identification	Description	Kinematic Viscosity, centistokes		Extrusion Temperature, F
		At 100 F	At 500 F	
--	Water	0.76	--	80
--	Castor oil	297	--	80 - 140
--	Ethylene glycol	9.3	--	80
--	Polyethylene glycol	24	--	80
PPE	Mixed isomeric five-ring polyphenyl ether	363	1.2	80 and 500
CBP	Chlorinated biphenyl	44	--	500
TCP	Tricresyl phosphate	35	--	500
TAP	Triaryl phosphate	46	--	500
SE	Silicate ester	6.8	0.88[a]	80 and 400
--	Acidless stearine	Solid	<1	500 - 560

(a) Viscosity at 400 F.

Most of the room-temperature trials were conducted with caster oil as the fluid medium. This fluid was found to have the best combination of efficiency in lubrication and economy in use. Though limited studies showed that water had these qualities too, its corrosive properties might have caused trouble with the experimental tooling. However, a water-based fluid might well prove to be ideal for commercial applications. The ethylene glycol-based fluids performed satisfactory and warrant further investigation as candidate fluids for a commercial operation. The experimental results with this fluid type indicated that compatibility with the billet lubricant was important for efficient lubrication.

A series of fluids listed in Table II was evaluated at 500 F. Because the flash point of silicate ester (SE) was 470 F, trials with this fluid were conducted at 400 F. Of these fluids, polyphenyl ether (PPE) and SE were the most effective with a wide range of materials. Chlorinated biphenyl (CBP) was particularly noxious and did not appear to have commercial potential. Acidless stearine was evaluated late in the program and was used only with beryllium wire. However, the results obtained indicated that this fluid might be as efficient as was PPE and SE with solid rounds. Its main advantage is that it is much cheaper than PPE and SE. Its flash point is about 580 F.

Billet Lubricants

Billet lubricants were most often employed in the form of a wax or lacquer usually containing a solid-film lubricant additive such as MoS_2. More than 50 billet lubricants have been evaluated at Battelle on both this program and in the earlier program[1]. For the sake of completeness, all the lubricants evaluated are described in Table III. All the lubricants from L17 and upwards were evaluated in this program. In addition, L8, L9, and L11, which were developed earlier, were further evaluated.