

cold forged under all conceivable parameters of feed rates, reduction rates, speed of forging, etc. Final results of this development using the GFM machine with its reciprocating four-hammer forging head were negative. A no-turn outside was possible but the finish on the inside was not acceptable for a no-ream process. The GFM four-hammer system when producing as thin a wall tubing as required for our shotgun barrel leaves visible hammer marks in the bore which would require a ream operation to remove. With reaming back in the picture, the economics were no longer attractive. A number of positive factors, however, were developed from this study. High frequency welded tubing during all this testing showed no failures whatsoever indicating continued study and testing of welded tubing for shotgun barrel usage was warranted. Also, a method of roller finishing the outside diameter of the forged shotgun barrels was demonstrated as a simple, superior and lower cost method to replace current, multi-pass grinding, polishing, and supersheathing operations. Our Model 700 CF barrel is now being processed in this manner. 83

A new study was, therefore, recommended and approved to explore other than GFM systems for manufacture of a no-turn, no-ream lower cost shotgun barrel. A development program with Tubular Metal Displacement, Inc. of Joplin, Missouri, a small firm specializing in tubular formed products, was undertaken. A so-called Phase I interim program to develop a no-ream shotgun barrel using high frequency welded tubing was authorized. It was during this development that another manufacturer of high frequency welded tubing was discovered that could produce a tube with a heavy enough wall to make our entire shotgun barrel without an upset operation, a definite advantage from a Capital investment and operating cost standpoint. The supplier of this tubing, The Lone Star Steel Company,