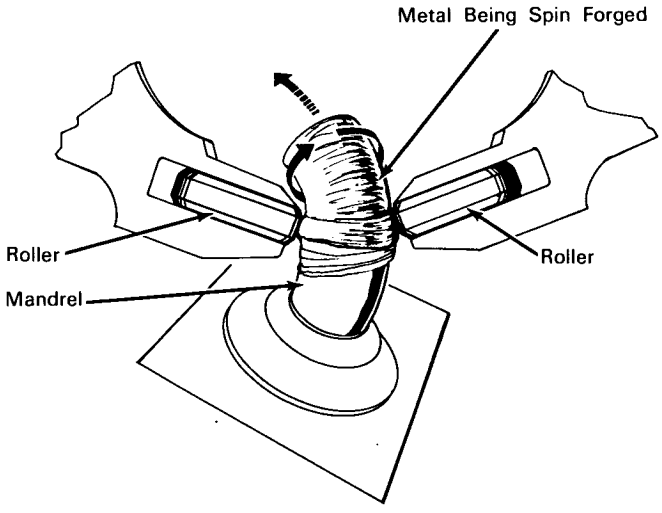
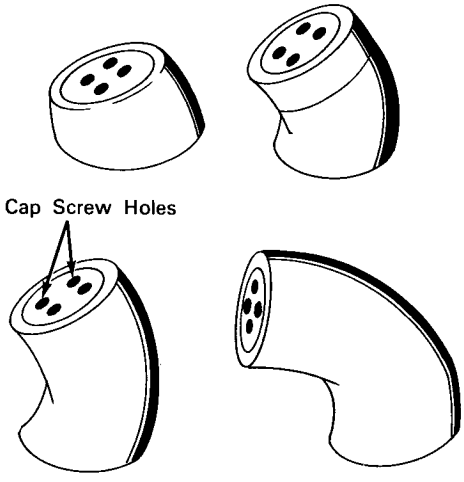
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Stainless-Steel Elbows Formed by Spin Forging





STAGES OF SPIN-FORGING A 90° ELBOW

The problem: Fabricating large seamless austenitic stainless-steel elbows. The elbows were required to meet the following specifications: 17-inch diameter on a 17- to 25-inch centerline bend radius, wrinkle-free 90° bend, 0.040-inch uniform wall thickness, 100,000 psi minimum yield strength, 8% minimum elongation with 1-inch straight sections at the ends.

The solution: Spin forging (rotary shear forming) was selected as the most promising method for fabricating the elbows. A spin-forging tool for mounting on a hydrospin machine was specially designed and built for this purpose.

How it's done: A blank from which the elbow is to be forged is mounted on a mandrel corresponding in shape to the finished elbow. The blank is fastened to the outer end of the mandrel with cap screws. Two rollers are forced against the metal at one end of the blank, and the mandrel is rotated about an axis bisecting and perpendicular to an imaginary line separating the rollers. As the blank is thinned between the rollers and cold-flowed to extend along the mandrel, the mandrel is moved axially between the rollers and simultaneously tilted to keep its spin axis (at the rollers) perpendicular to the line separating the rollers. When the metal extends to the desired distance around the bend on the mandrel, the machine is stopped and the finished elbow is removed. The wall thickness of the elbow is determined by the spacing between the rollers and mandrel.

Notes:

1. Preliminary tests with this machine tool indicate that satisfactory seamless elbows can be made to the required specifications from SS-321(18Cr, 11Ni) and A-286 (15Cr, 25Ni) stainless steels.

(continued overleaf)

2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama, 35812
Reference: B63-10590

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

Source: Chance-Vought Corporation
under contract to Marshall Space Flight Center
(M-FS-122)