#597-06

Servo press forming applications

Part III: Forming at room temperature, elevated temperatures

Editor's Note: This is Part III of a three-part series on servo presses. Part I, which appeared in the March 2007 issue, provided an introduction to servo presses. Part II, which appeared in the April 2007 issue, focused on servo press drive systems.

This column was prepared by Serhat Kaya, Center for Precision Forming (CPF, formerly ERC for Net Shape Manufacturing), The Ohio State University, Taylan Altan, professor and director.

In this final part of this series on servo press forming applications, we take a look at servomotor-driven mechanical presses for forming at room temperature and at elevated temperatures.

Forming at Room Temperature

Blanking Die Life. According to research studies, in addition to reducing noise during blanking, servo presses also can improve die life in blanking and piercing operations.[1] In a research study, the same tool was used in a conventional press and a servo press and burr heights of the same blanked parts were compared.[2] **Figure 1** shows the blanking velocities and the strokes per minute (SPM) used in these tests. **Figure 2** shows that after blanking 30,000 parts, the die in the mechanical press needed to be ground, while the die in the servo press was still usable and didn't require grinding.

Fineblanking. Figure 3 shows a tooling schematic used in a high-quality blanking process. Because of the press motion flexibility, the slide does not need to go back to top dead center, which reduces cycle times.

In this process, two punches are used, one larger than the other. The larger punch hits the workpiece, extrudes the material slightly into the die cavity, and stops right before the workpiece is completely blanked. The upper cylinder moves the punch holder plate to the right and aligns the smaller punch with the tool. The smaller punch completes the blanking (see **Figure 4**).

Fineblanking is a good example of taking advantage of programmable slide motion available on a servo press. With flexible press motion, a secondary operation such as assembly or painting can be done on the formed part during a single press stroke.

Springback Reduction. Forming of memory-based titanium alloys for eyeglass frames is a process in which springback needs to be reduced or eliminated. In a multistep motion, more force is applied to the part without the slide traveling throughout the complete stroke.[2] Without this specific capability, three strokes would be necessary to control springback at an acceptable level.

Blanking Velocities, SPMs for Servo and Mechanical Presses

	H1F35H (Servo Press)	OBS35-2 (Conventional Press)
Strokes per minute (SPM)	68	69
Blanking velocity (mm/sec.)	32	86

Figure 1

Forming at Elevated Temperatures

In warm-forming applications, one of the most significant advantages of servo press technology is that dwelling can take place through heated tools by stopping the slide during the stroke. This capability eliminates the need for heating and transfer systems outside the press. For example, Part I of this series discussed warm deep drawing of

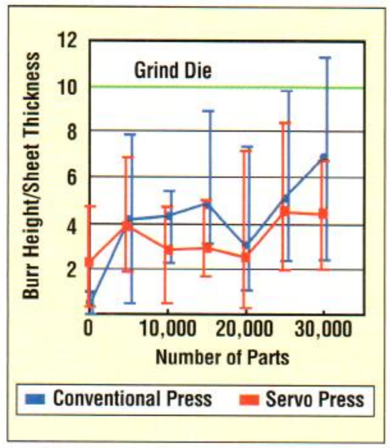

Figure 2

After blanking 30,000 parts, the die in the mechanical press needed to be ground. The die in the servo press was still usable and didn't require grinding.

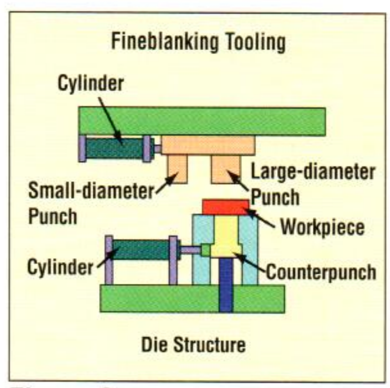

Figure 3

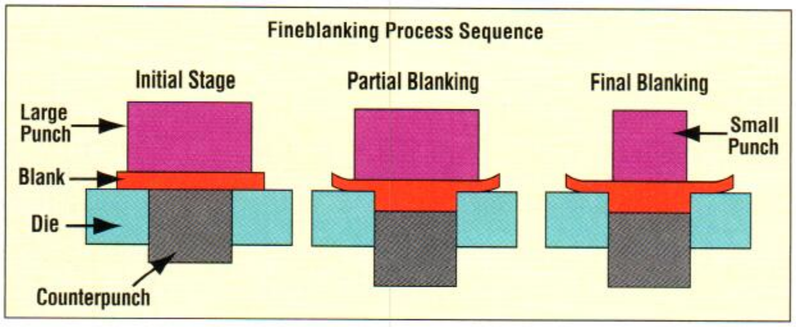

Figure 4

round cups from Al 5754-O, Al 5052-H32, and Mg AZ31-O sheets using a servo press.[3]

Warm-forming a Laptop Case. The deformation in a laptop case is mostly bending with a small amount of drawing. This part, made from an Mg alloy, was formed at 300 degrees C. Forming velocity was varied so that it was slower (1 mm per second) at the initial bending and faster (200 mm per second) once the severe deformation was completed. This mode of operation consisted of controlling slide speed during the stroke to reduce thinning during forming around the corner radii.

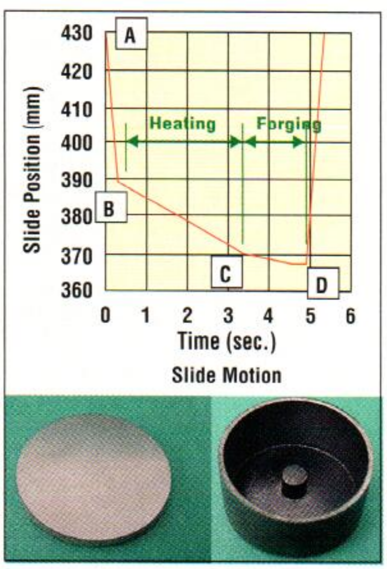

Figure 5

Elevated-temperature forging of Mg disks (30 mm by 3 mm) was successfully achieved by programming slide motion.

Warm-forging Magnesium Components. Elevated-temperature forging of Mg disks (30 mm by 3 mm) was successfully achieved by programming slide motion, as shown in **Figure 5**. In this application, the slide doesn't stop during the heating process. Heating takes place as the slide is moving down.

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Notes

1. *M. Otsu, C. Yamagata, K. Osakada, "Reduction of Blanking Noise by Controlling Press Motion,"* CIRP Annals, *Vol. 52, No.1 (2003), pp. 245-248.*

2. *K. Miyoshi, "Current Trends in Free Motion Presses," in proceedings from the 3rd Japan Society for Technology of Plasticity International Seminar on Precision Forming, presentation slides, sponsored by Stamping Press KBU–Komatsu Industries Corp. Japan, March 2004.*

3. *S. Kaya and T. Altan, "Warm Forming Aluminum and Magnesium, Part I: Forming a Round Cup,"* STAMPING Journal, *Vol. 17, No. 12 (2005), p. 36.*