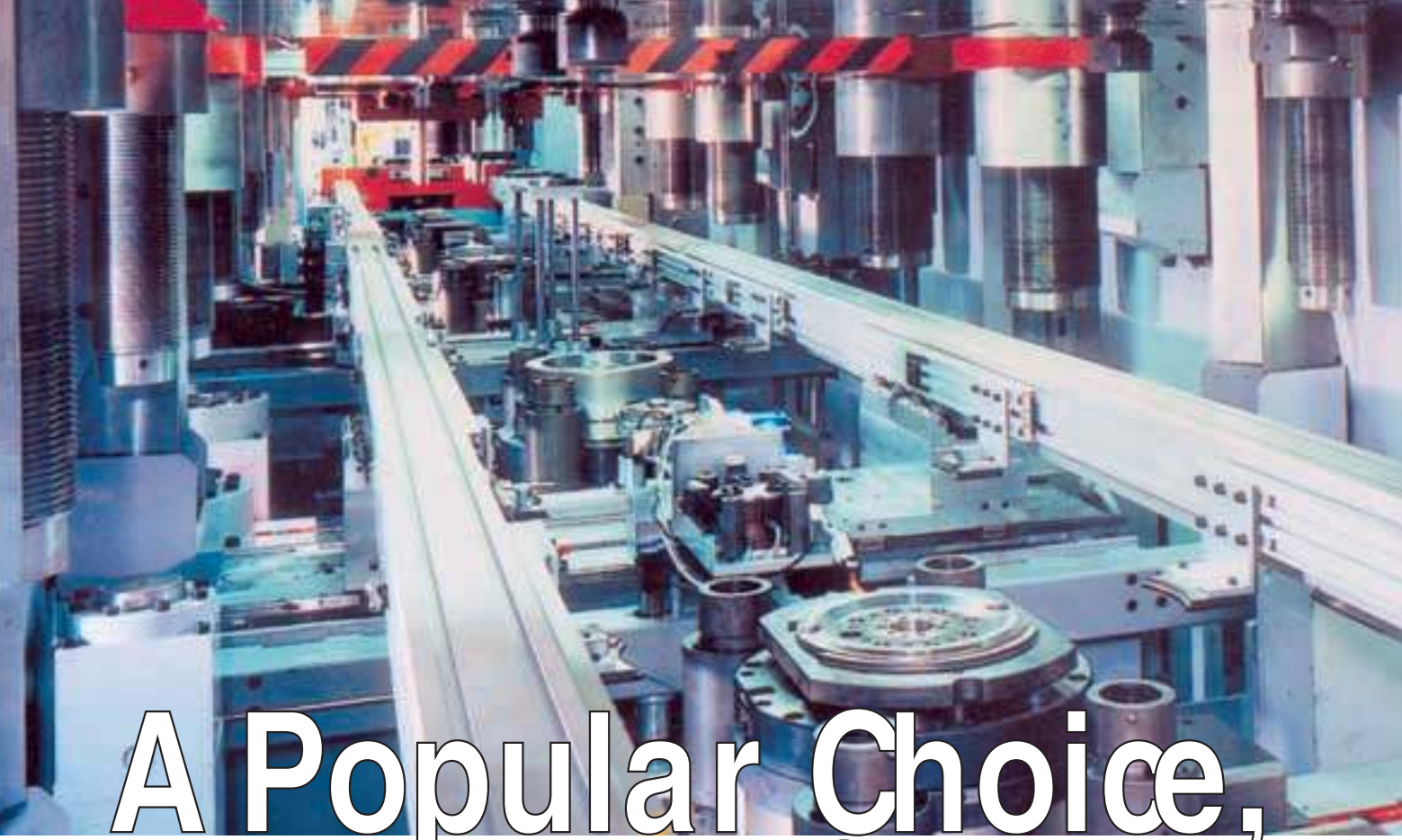

A Popular Choice, Hydraulically Speaking

The old arguments against hydraulic presses don't hold up, thanks to continuous improvement in construction and controls. And changing metalforming markets have contributed to their popularity. We'll look at how technology has improved, we'll find out who's installing hydraulic presses and why, and we'll see the latest technology available from a host of manufacturers.

by Louis A. Kren, Senior Editor

At one time, hydraulic presses often were considered a low-cost option for metalformers who weren't interested in speed and tonnage, and who could readily stock oil-absorbent materials. The old joke was that even a picture of a hydraulic press would leak.

But that was a long time ago. Designs, construction materials and controls have progressed to where hydraulic presses are increasingly specified by metalformers.

Designed and Built Better

The last 15 years have brought a number of improvements in design and construction of hydraulic presses. Leaks have been eliminated to the point that, according to suppliers, hydraulic presses are as leak-resistant as their mechanical counterparts. Advancements in seals and valves, combined with better hoses and couplings, have made leakage a nonfactor. Improved pumps and motors have done much to add reliability to the equation. Better controls give hydraulic presses more flexibility than ever, long considered a major selling point of this technology.

When Hydraulics Can Help

It is highly unlikely that hydraulic presses will ever reach the speeds of their high-speed mechanical counterparts, but, in many applications, speed is not the main factor, and hydraulic presses may provide a perfect fit.

Any deep-drawing application is an ideal candidate for a hydraulic press, since specified force can be exerted throughout an entire, lengthy stroke. Mechanical presses typically deliver full force at the bottom of the stroke, according to hydraulic-press suppliers we contacted, and often are considered for high-count production of flat or shallow parts.

Control throughout the stroke is an important consideration when performing assembly operations on

a hydraulic press, such as when Neff Press, St. Louis, MO, supplied equipment to Harley-Davidson for bushing insertion into a crankcase part (see p. 30).

When dwell time is needed at the bottom of a stroke, hydraulic presses step up to the plate. With proper controls, they can extend pressure to a specific length, then hold that pressure for a preset amount of time, according to officials from R D Sales Inc., Telford, PA, which sells hydraulic and mechanical presses. This characteristic is important when forming difficult materials or forming in heated dies.

This hydraulic transfer-press line from Schuler Hydrap produces an innovative flywheel component for Mannesmann Sachs AG. Included is a Schuler Automation-supplied coil line. The tooling for the application is shown on preceding page.

Hydraulic presses also provide protection against pressure overload, saving the press and dies from damage due to excessive force. When a hydraulic press meets its specified force, relief valves dissipate excess pressure automatically. And tonnage is adjustable, so a 100-ton press, for example, can be set to a force maximum of 50 tons for a particular application. When that force is reached, the press will reverse. This is accomplished through the use of flow sensors or pressure switches. Given this, accurate repeatable pressure can be applied through every stroke.

Flexibility is Key

All the above speaks of the flexibility inherent in hydraulic presses. For example, dies of different heights can be exchanged within a hydraulic press without fine adjustments being made to the ram stroke, since preset pressure is applied to the workpiece wherever it is encountered during the stroke.

Adding to the flexibility characteristic, the "dial-a-tonnage" feature in hydraulic presses makes them ideal for a variety of applications and such presses can accept a range of smaller-lot jobs where parts/min. is not a main factor.

"If you produce a variety of parts and you don't know what jobs you'll have over the next year, hydraulic presses can be a very good option," says Stefan Buchmueller, general manager of hydraulic press sales for Schuler Inc., Detroit, MI. "It is an excellent solution for subsuppliers who take orders from certain companies for a limited time and have to find orders for other parts."

Paulo Teixeira, senior vice president at Capitol Technologies Inc., South Bend, IN, agrees. "If you don't know what you will produce next month or six months from now, you need more flexibility, and a hydraulic press provides that."

Flexibility is even more important with the manufacturing focus on just-in-time (JIT) production, of which the automotive industry has been a big driver. And JIT is not necessarily all about speed.

"The automotive industry has really pushed for JIT production," explains Teixeira. "Automakers want to minimize their inventory and transfer that to Tier-1, -2 and -3 suppliers' inventory. On a high-speed line operating at full speed, you'll produce a lot of parts.

With JIT pressure, there are two things you can do: Produce more parts and increase your inventory, or produce just what you need. The second option idles the machinery and workforce, and that can be filled with lower-count jobs. That is where flexibility of hydraulic presses really comes into play. With improved press controls, you can adjust pace to match production requirements. This is ideal for smaller operations that don't have much working capital to invest."

"With the increase of JIT production has come an increasing number of short-run jobs where hydraulic presses have the speed manufacturers need. Smaller operations with short-run jobs still rely on hand-feeding for the most part, since small-lot jobs make it hard to justify the expense of automatic feeding, according to hydraulic-press makers. For these hand-fed jobs, hy-

A hydraulic five-press system from Capitol Technologies Inc. helped a manufacturer of steel tool cabinets produce two types of drawers, each with different sizes and depths. The system produces a drawer every 20 sec. while using only two operators.

draulic-press speeds often are sufficient.

But hydraulic presses have shown they can handle the big jobs, too. For example, the Big Three automakers have invested heavily in hydraulic presses.

"DaimlerChrysler recently bought hydraulic lead-off presses for tandem press lines, as replacements for mechanical lead-off presses," says Buchmueller. "DaimlerChrysler wanted these presses for their flexibility and control capabilities."

Hydraulic tryout presses also are finding homes at Big Three operations, to simulate the action of high-speed mechanical presses on tooling. Though they don't reach production speeds of the mechanical presses, hydraulic tryout presses provide cost savings while mimicking mechanical-press action. Such tryout presses provide the trial-and-error processes needed by automakers without tying up production lines.

A 1100-ton, four-station hydraulic transfer press line from Macrodyne produces bumpers for an automotive supplier.

Gaining in Popularity

North American manufacturers are recognizing the benefits of improved hydraulic-press technology. In fact, U.S. shipments of hydraulic presses have risen over the past three decades and actually surpassed shipments of mechanical presses in 1991. In 1999, shipments of hydraulic presses totaled 2207 units, according to U.S. Dept. of Commerce data. Shipments in 1998 totaled about 2100.

While manufacturers in North America now are recognizing the flexibility, reliability and relatively low cost of hydraulic presses, their European counterparts have known this for quite a while. Though figures show increased use of hydraulic presses in North America, Europe still is considered the leader in hydraulic press use.

"They are more popular in Europe," says Teixeira, noting that fact has much to do with European markets. "European manufacturers are very much concerned with the ability to adapt to different parts and want that flexibility in their presses."

In many cases, European job orders are smaller and parts/min. is not the driving statistic in European manufacturing planning, according to many hydraulic-press builders.

This is especially true in European automobile manufacturing, points out Teixeira. Since Europeans, and Germans in particular, drive at higher speeds than Americans, automobiles there have completely different specifications and, in some cases, more precise standards.

"This really points to high usage of hydraulic presses, which allow manufacturers to create just the right setup for each part," he says.

Hydraulics in Action

Beyond the numbers and the word of suppliers, much anecdotal evidence exists to support increased use of hydraulic presses in metalforming. Manufacturers have supplied all manner of presses for a variety of applications, as the following examples show.

Beckwood Press Co., Fenton, MO, recently shipped two 1200-ton, four-post presses as well as six 12-ton C-frame presses to a facility in Mexico. The presses perform different tasks for production of cooking-range-top electrical-heating elements including coining and flattening on the uniform flat surface finish of the spiral-shaped elements. Each of these presses feature an Allen Bradley control system with touch-screen interface. Inputs from a linear transducer and pressure transducer allow for input of ram position and pressure values. The press bed includes a pneumatic die shuttle containing two different sizes of coining dies, allowing different-sized elements to be coined on alternate press cycles. PLC control enables two different tonnages to be applied for the different-sized elements.

Capitol Technologies Inc. recently supplied two automated press systems—a semi-automated system to a manufacturer of steel tool cabinets and boxes, and an automated system to an automotive supplier. The semi-automated system had to produce a drawer—in two sizes, each with different depths—every 20 sec. and requiring only two operators, all under space and budget limitations. Capitol developed this system using eight dies in two 110-ton and three 75-ton hydraulic presses, with two-axis transfer. The same transfer and end-of-arm tooling was used for both drawers. The system, combining notching, trimming, piercing, bending and Tog-l-Lock assembly, uses hydraulic clamping with quick-die-change

equipment and die-storage tables. With applicable dies and transfer tooling, the system is flexible enough to be used for manufacturing other parts.

Capitol also was charged with producing a system, for a Tier-II automotive supplier, that could manufacture multiple-layered components in varying geometries. Needs included reduced cycle times, ease of system changeover and flexibility. Also, an efficient means of scrap separation and removal was needed. Capitol delivered an automated press system that accepts three different types of coiled material for blanking, edge-forming, assembly, embossing, draw forming, piercing and in-process gauging. Hydraulic components include a 220-ton draw press station, three 110-ton press stations, one 70-ton press station and one 45-ton press station. Other equipment includes a quick-die-change system at each station, one servo transfer system with 10 pick-and-place stations, two robots, six idle stations, two separation and scrap-conveyor units and two material-feed lines.

A railcar-equipment maker uses a 750-ton hydraulic press from PH Group Inc. to form 0.75-in. steel plate used to construct tank- and hopper-railcar wheel structures.

Making Car Bumpers

Macrodyne Technologies Inc., Woodbridge, Ontario, Canada, recently supplied a 1100-ton four-station hydraulic transfer-press line for the production of automobile bumpers in a hot-forming application. The four-station line includes a loading robot with a destacking feature, an oven for blank preheating, a high-speed servo-driven blank feeder and an unloading robot. The press includes a 107-by-102-in. front-to-back rolling bolster and automatic die-clamping package to ease quick die change. It is designed for high-speed production under heavy eccentric-loading conditions.

This hydraulic multiple-press system with transfer stations was supplied by Capitol Technologies Inc., allowing an automotive supplier to produce multiple-layer parts in a variety of sizes and geometries.

The company also supplied a 565-ton double-acting press for preforming automotive parts prior to hydroforming. This press has eccentric-loading capability, needed to form the asymmetrical parts. The press is equipped with two 132-by-96-in. rolling bolsters traveling left to right through the press sides as well as a quick-die-change clamping package. A 120-in. cushion and CNC package are included for improved deep-draw capabilities. The press-control package incorporates an Allen Bradley PLC 5/05 with a graphic-based touch-screen operator interface mounted on a pendant station.

Neff Press Inc., St. Louis, MO, worked with Harley-Davidson to address quality and productivity concerns by custom-designing a hydraulic press that fully automates an assembly process and increases productivity by inserting all crankcase and bushing components in one cycle.

Neff supplied a four-post press with one 12-ton main clamping ram and five 1-ton work rams. All rams provide force-vs.-distance measurement and control is courtesy of a PLC system and touch-screen interface.

The hydraulic press was designed to clamp a crankcase part from the top and subsequently insert five separate shouldered bushings from the bottom. Neff previously supplied presses to do this type of operation, but without any data feedback. Prior to approaching Neff, Harley Davidson had found that even when a bushing was fully inserted (i.e. the bushing shoulder fully bottomed on the crankcase), the company had no assurance that the press fit was correct. Tolerance stack-up in the bushing sizes and the mating-hole size would sometimes give a "too-loose" or "too-tight"

condition, resulting in costly part failures in the field. A force-vs.-distance measurement system from Neff rectified this problem by allowing the machine operator to key in minimum and maximum force setpoint values and the distance window in which these figures would be evaluated.

Each bushing had its own force and distance feedback plus its own individual setpoints. Allowable values for maximum and minimum force were determined by doing trial runs with the upper and lower limits of bushing-to-case interference fits. If each bushing press fit does not fall within the required tonnage limits, a display identifies which bushings are faulty and the amount of force achieved during the press cycle.

Neff Press' Force-vs.-Distance measurement system allows press operators to key in minimum and maximum force setpoint values and the distance window in which these figures would be evaluated. This control helped Harley-Davidson improve quality when pressing bushings into a crankcase part.

Forming Heavy Plate for Rail Cars

PH Group, Columbus, OH, has designed and shipped a 750-ton hydraulic press to a U.S. producer of rail-car equipment. It will form 0.75-in. plate used to make tank- and hopper-railcar wheel structures. The press can handle forming operations on plate sizes of 7 by 4 ft. and weighing 650 lb., and can perform heavy-plate blanking operations. To combat high forces and breakthrough conditions encountered when blanking this material, company engineers added an integral dampening system to the press.

In focusing on large-press applications, PH Group has been developing high-speed hydraulic circuitry designed, according to company officials, to give customers the speed of mechanical presses along with uniform stroke pressure, dwell-time pressure consistency and force and precision control associated with hydraulic presses.

Schuler divisions have used hydraulic-press technology to help Mannesmann Sachs AG produce automotive components such as a dual-weighted flywheel. The flywheel, when mounted between an engine and transmission, reduces engine vibration and resulting noise. It consists of a heavy primary flywheel, an internal ring gear and a secondary flywheel.

To produce the primary flywheel and other components, Mannesmann Sachs contracted with Schuler to supply a fully automated hydraulic transfer-press line and a coil line. The system, with five hydraulic presses, produces as many as 13 ready-to-assemble parts per min. The compact coil line has storage for four coils and, with its zigzag feeding, provides Mannesmann Sachs with an 8 percent reduction in material usage. The hydraulic-press line includes one 440-ton blanking press, two 275-ton blanking and coining presses and two 1375-ton drawing, blanking and extrusion presses. Universal stations between the presses allow the transport of as many as 15 parts weighing 132 lb. Two of the universal stations can turn parts 180 deg. and two others can spray-lubricate both sides of parts.

A 1500-metric-ton tubular hydroforming press from Verson, installed at Tenneco Automotive, Elkhart, IN, will be used to manufacture exhaust parts.

Tubular Hydroforming

Hydraulic technology plays a large part in the advancement of tubular hydroforming equipment. In tubular hydroforming, internal pressure on a straight or preformed tube expands the tube into a die cavity. The process is said to reduce part weight while increasing part strength and reducing the number of parts per assembly. It has proven itself in the production of automotive exhaust, chassis and frame parts.

The increasing popularity of tubular hydroforming has resulted in a number of recent installations. For example, the Verson division of Allied Products Corp. is installing a 1500-metric-ton tubular hydroforming press at Tenneco Automotive, Elkhart, IN. The press will be used to manufacture hydroformed exhaust parts. **MF**

The Latest in Hydraulic-Press Products

Gib-Guided Gap-Frame Presses

Sutherland Presses, Santa Monica, CA, has introduced its CG series of gib-guided hydraulic gap-frame presses. According to company officials, in contrast to standard C-frame hydraulic presses where deflection may occur if forming commences high in the stroke, the CG press allows full utilization of tonnage at any point in the stroke through the use of full-length mechanical-style gibways to hold the ram in place. The unique design reportedly increases accuracy while protecting the press from side loading. CG series presses are available in sizes from 100 to 200 tons and include touch-screen operator interface, adjustable tonnage, T-slotted bolster and slide, Allen Bradley electronics and Sumitomo cylinders.

write no. 200

High-Speed Tryout Presses

Schuler Inc., Columbus, OH, develops hydraulic die-tryout presses that mimic the actions of mechanical transfer presses and enable manufacturers to test without tying up production lines. Such is the case at the Ford Motor Co. stamping plant in Chicago Heights, IL, where two identical Schuler hydraulic high-speed tryout presses provide slide capacities of 2000 tons each. The presses incorporate moving bolsters for changing complete dies or rolling out lower dies for rework. A die-rotating mechanism on each press can rotate the upper die through 180 deg. for simplified access. For exact simulation of a mechanical press, each Schuler press is equipped with an accumulator drive

system that, combined with Schuler's servo-valve technology, enables the press to reach slide speeds of 500 mm/sec. Control systems allow mimicking of the production press' motion curve and piston accumulators generate the required pressure. The company also supplies hydraulic presses a variety of metal-forming processes and large hydraulic press lines.

write no. 201

Presses Use Hydro-Pneumatic Technology

Schmidt Feintechnik Corp., Cranberry Township, PA, offers a complete line of hydro-pneumatic presses. Developed in the 1970s, hydro-pneumatic technology long was considered only for welding applications, but since has found a niche in precision stamping, fabricating and component-assembly fields. A hydro-pneumatic system consists of two separate cylinders, one a pure air cylinder (booster cylinder) and the other an air cylinder with a built-in oil reservoir (quick-approach cylinder). The system works by sensing resistance, typically occurring when tooling comes in contact with a workpiece. Reported benefits of this system include high force with low-air consumption, rapid approach to a workpiece with relatively low force, low maintenance, low noise and compact design. The company designed four C-frame benchtop presses using this technology covering a force range of 1 to 11 tons, with three of these using PressControl-1001 press-operation monitoring and SPC hardware control. The C-frame units have a rectangular ram guided by adjustable, maintenance-free Teflon-lined gibs. Most of these units have 50-, 100- or 150-mm full-stoke distances with 6, 12 or 22 mm of power stroke distance. Also using hydro-pneumatic technology, the company offers two H-frame presses with force capacities of 11 or 22 tons. The units are designed for perforating, forming/bending and coining operations, and can be used for staking, crimping, swaging and riveting of solid and tubular material.

write no. 203

300-Ton Orbital Press

Schmid Corp. of America, Jackson, MI, has added a 300-ton model to its offerings of hydraulic presses. The press is designed to replace the its 200- and 400-ton lines of orbital cold-forming presses. Orbital cold forming produces a variety of net-shape forging components requiring as much as 300 metric tons of forming force. Components forged with this process are characterized by net- or near-net-shape geometry, improved mechanical properties, economic utilization of simplified shape of blank and impressive dimensional accuracy, claim company officials.

write no. 204

continued on p. 78