Marrying the traditional gap-frame press to an automated transfer system results in a high-tech, lower-cost transfer-die operation.

Meet the Gap-Frame Press Transfer System

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Stampers considering automated press systems usually focus on progressive-die operations, which use coil feeders, or transfer-die operations, which use transfer feeds. Traditionally, these presses have been straightside. In recent years, however, a third type of automated press system has begun attracting attention because it can compensate for the weaknesses of automated straightside press systems.

While slower than progressive-die operations, transfer operations have been widely used in automated systems because they offer several advantages:

1. There are higher material yields because blanks are used. Since these are either supplied directly from the steel service center or are blanked in another area of the plant, there is less scrap generated than with coil-fed operations.
2. Unlike progressive-die operations, transfer presses do not require that one end of the product be consistently connected to the coil during the forming process. This degree of freedom makes it possible to handle products requiring complex forming operations.
3. Die structure is simpler and less expensive than with progressive-die operations because of the transfer equipment's ability to lift product off the lower die.
4. Product is conveyed in mid-air between stations without touching the dies.

However, since all forming processes are performed in one press, the transfer press must necessarily be large (See Figure 1). This size brings with it a number of disadvantages:

1. A transfer operation means a major investment because of required accessories, such as floor scrap conveyors.
2. Because the press is large, a large pit is required, increasing the initial cost.
3. Large press size dictates high rigging and transportation costs.
4. Typically, an additional press with the same specifications is required as a production backup in case of transfer equipment problems.
5. Larger dies mean higher costs and more storage space.
6. Large press size makes changing the press layout difficult.

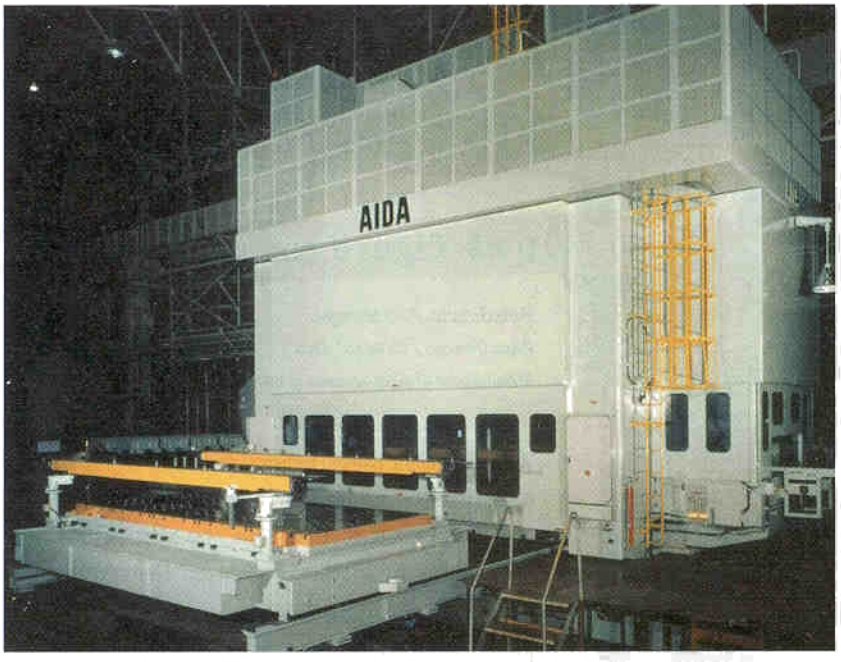

Figure 1.The typical transfer press has a straight-side configuration, requires high ceilings, and a large pit. Because of its size, changing press layout is difficult.

A Flexible Option

Conversely, a gap-frame press transfer system is a flexible option requiring an investment cost one-third that of a transfer press (See Table 1), yet it preserves the advantages offered by transfer operations. Because not all presses within the system have to be used on all jobs and because presses can be added to the system, the gap-frame operation gives stampers the flexibility to handle a range of stampings both in the present and the future. Finally, gap-frame presses as an automated system eliminate the disadvantages inherent with a transfer press.

1. Because gap-frame presses are small, they can be used in a factory with a low ceiling. Also, no large accessory equipment is required.
2. Standard gap-frame presses do not require a pit, making press layout easy to change.
3. Transportation and rigging costs are minimal.
4. Unlike the enclosed straightside transfer press, if problems occur with the transfer equipment in a gap-frame press, production can be performed manually.
5. Dies are the same size as those used in normal gap-frame presses. Therefore, die costs are less than those in the typical transfer press.
6. While a transfer press conveys product between two feed bars, the gap-frame system uses clamping equipment mounted on a single feed bar providing better visibility of dies and product.

Press Features to Look For

In considering gap-frame press transfer systems, it is important to understand not only the advantages of the gap-frame press as part of an automated system, but also the design benefits the press itself can offer. Understanding what design features to look for in a gap-frame press will contribute to maximizing the capacity of an automated system.

Gap press selection for progressive-die operations is somewhat less complicated than press selection for transfer-die production. Progressive-die operations use a single press. The parameters for running a progressive die in a gap press are pretty well defined. The largest machine available has a 250-ton (2224 kN) capacity, 12″ (305 mm) maximum stroke, and the widest bed is approximately 96″ (2.4 m), right to left. Raw material used to produce the stamping should be at least 0.020″ thick (0.5 mm) and no more than eight to 10″ wide (203-254 mm). By staying within these parameters successful progressive-die operations can be achieved on gap presses.

Transfer operations can be performed in a single, two-point suspension gap press, or in a multiple-press cell. In the latter, one- and two-point suspension machines are grouped to provide total capacity of 1000 tons (9 kN) or more and a bed area of 20′ (6 m) or more, depending on number of presses (Lead Photo).

Table 1: Comparison Between One, 800-ton Transfer Press and a Gap-Frame Transfer Press Line Consisting of Four, 200-ton Presses

	Transfer Press	Gap-Frame Line
Press Capacity	800 ton	200 ton
Number of Presses	1	4
Total Press Capacity	800 ton	800 ton
Bolster Area	160 × 65″	54 × 33″ (4 units)
Stroke Length	16″	9″
SPM	20-30	12-15
Pit	Yes	No
Ceiling Height	High	Low
Tooling	Expensive	Same as Gap-Frame Press (Low)
Transportation/Rigging Costs	High	Low
Press Delivery Time	Long	Short
Future Flexibility	Limited	Excellent
Total Investment	$3 million	$1 million

In single-drive application, one long feedbar supports the drive equipment between presses, and provides automation for as many presses as needed.

Other Considerations

Part transfers and press-to-press automation have improved significantly over the last few years. It is now possible to achieve cycle speeds that are much closer to a dedicated transfer press. As with the progressive-die operations mentioned earlier, raw material thickness and width are important considerations when running gap presses.

Angular deflection under load is the reason most often stated when a straight-side press is selected over a gap-frame press. This is a valid consideration, and is the reason that raw-material thickness and width are so important when using gap presses. Always check with the press manufacturer to determine which machines have low angular deflection under full load. This should be stated as thousandths of an inch per inch of throat depth, and should be supported by actual test data.

When a gap press has low angular deflection and the raw material is 0.020″ thick (0.5 mm) or greater, there is little chance of a blanking or perforating punch clipping the die. This is because punch-to-die clearance will be greater than punch movement caused by the angular deflection. Also, if forming and coining operations are to be performed, then limiting raw material or part width will minimize dimensional variations caused by angular deflection.

Hydraulic Overload Protection (HOLP) is also a key feature when looking at purchasing a gap-frame press. An effective HOLP system activates when the tooling becomes dull, thus reducing operational costs and minimizing scrap. Recovery time to reset the overload should take only seconds, so tool setup and downtime are reduced significantly.

Aside from offering quick response time, a HOLP system must be adjustable to accommodate operations where required tonnage is considerably less than press capacity. Since most dies are not run at maximum press capacity, HOLP should offer the capability to reduce the trip point down to 60% of press capacity, providing protection for dies as well as the press.

A wet clutch is another feature that should be considered when purchasing a gap-frame press. A wet clutch

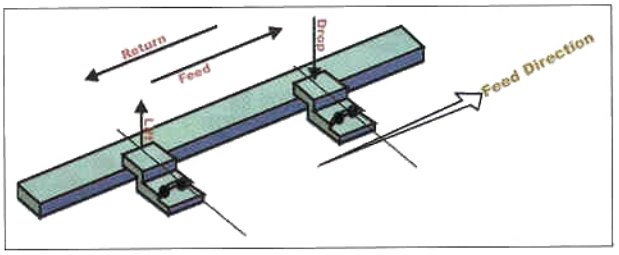

Figure 2. Single-drive transfer drives one long feed bar.

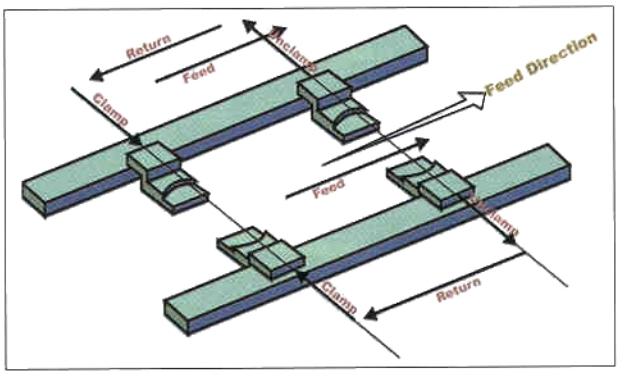

Figure 3. Two-dimensional transfer system slides the workpiece on top of the dies.

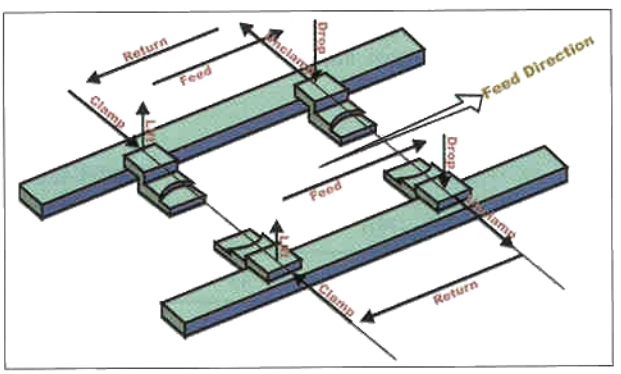

Figure 4. Three-dimensional transfer system transports the workpiece in midair using a feed bar with a lift function.

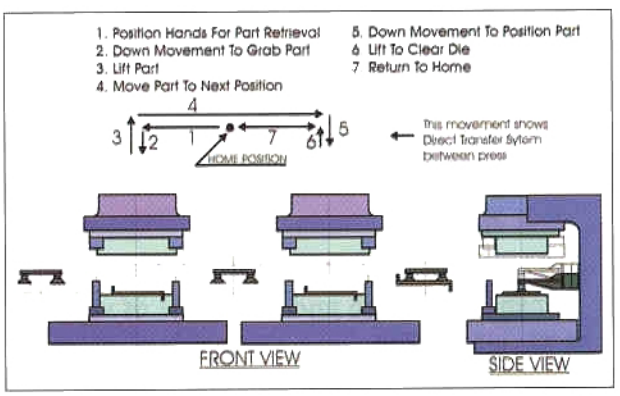

Figure 5. Clamps mounted on a single feed bar attach to the workpiece and convey it using vertical and level two-dimensional movement.

allows high single-stroke rates when using the gap frame in hand-fed operations or with automation. Air volume used with each stroke of a gap-frame press equipped with a wet clutch is reduced by 50% compared to air friction clutches. Manufacturers should also be able to provide a hardened and ground main drive gear and pinion—a benefit that reduces backlash and maintenance while extending gear life.

Gripping Details

Equally as important as the advantages offered by the gap-frame automated press system and the design of the press itself, are the methods the system may use to grip and feed the product. The following discussion applies to stand-alone transfer presses, a single gap-frame press, or multiple presses with a single-drive transfer.

Transfer equipment for single-drive application is a type that drives one long feed bar (See Figure 2) and is divided into a type that transports the product and a type that supports the drive equipment between the presses. With the transport type, direct conveyance between presses is possible, and is suitable for relatively large products. The support version provides for the automation of as many presses as needed. And since each drive unit is only allotted the conveyance weight of two workpieces, higher production is possible.

The conveyance system found on a normal transfer press grasps the product with fingers attached to two feed bars. It then conveys the product to the next process. This system offers two feed-bar types: a two-dimensional system (See Figure 3) that slides the product on top of the dies, and a three-dimensional system (See Figure 4) that transports the workpiece in midair using a feed bar with a lift function. The system shown in Figure 5 conveys the product using vertical and level two-dimensional movement by means of clamps mounted on a single feed bar.

There are also systems that directly convey product between presses and systems where the product is momentarily stopped between presses in order to be flipped, reoriented, and tapped. This is the case with a transfer press where product is grasped from a front-to-back direction in relation to the press. This equipment offers three systems to handle any shape—vacuum cup, magnetic, mechanical grip. Using one or a combination of these systems makes it possible to convey most shapes. ❐