# What's new with Multiblanking lines?

## Advancements in leveling, slitting, feeding, shearing, and stacking

**By Ken Shoop**

Multiblanking lines are used to produce small, accurately shaped blanks directly from large coils. Sometimes they can eliminate the need for a separate slitting line, which helps to decrease floor space requirements and reduce capital spending on machinery and labor.

Modern lines can process many different types of material over a range of thicknesses while still allowing quick changeovers and minimal maintenance.

New technology is available in several key areas that limits the capacity of a typical multiblanking line. These key areas are (see **Figure 1**):

- Leveling.
- Slitting.
- Feeding.
- Shearing.
- Stacking.

### Leveling

Perhaps the most critical operation in a multiblanking line is leveling. Generally speaking, flat-rolled strip needs to be leveled because the rolling mills it was produced on aren't perfect. Ideally, the mill would apply equal pressure across the width of the strip. In reality, though, the mill rolls deflect, causing edge wave, or they have excess crown, causing center buckle. Even though modern mills have improved, most material still needs to be leveled.

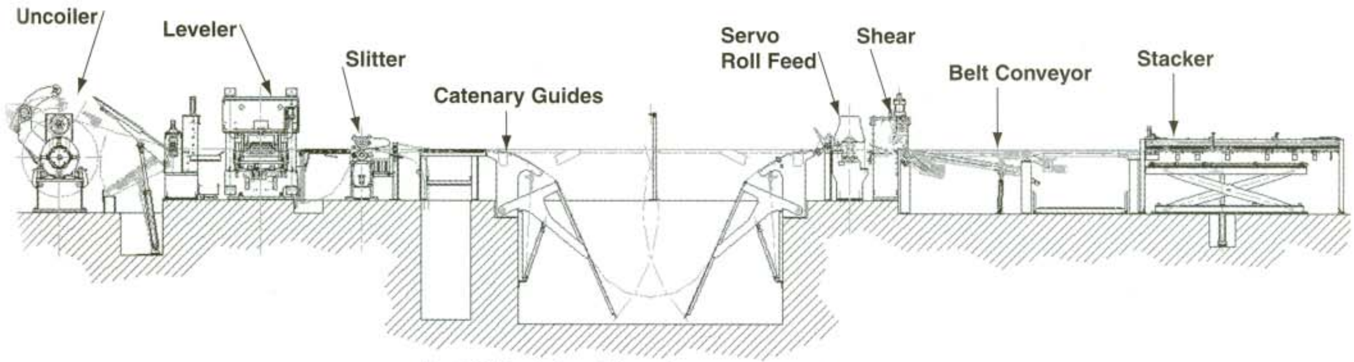
Shape problems occur when a rolling mill stretches one section of the strip more than another, but no machine can shrink metal, so a roller leveler stretches the short areas to match those elongated by the mill. This is accomplished by nesting the rolls (bringing them closer together), which increases the strip's travel distance through part of the leveler (see **Figure 2**).

Remember that only part of the strip needs to be stretched, so forcing part of the strip to take a longer path by using roll nesting stretches just that part of the strip. Multiple flights of backup rolls allow for increased nesting just in the desired area. To help ensure strip flatness, nesting occurs on the entry end and feathers to zero at the exit end.

Operating a leveler requires training and skill, but computers are making the task much easier. A computer quickly sets the machine to a good starting point and allows very fine adjustment of the backup rolls. Once the leveler is delivering good results on a coil, the settings can be saved and called up later. This saves a lot of setup time when coils are partially run and then sent back to stock.

Roller levelers come in a variety of styles and configurations to suit the material being run. They can be mechanically or hydraulically actuated, can have four-, five- or six-high roll configurations, and can have fixed or removable roll modules.

Mechanical and hydraulic roller levelers both use multiple flights of backup rolls to adjust roll nesting. The difference between the two is that mechanical levelers use wedges to move the backup rolls, whereas hydraulic levelers use cylinders (see **Figure 3**).

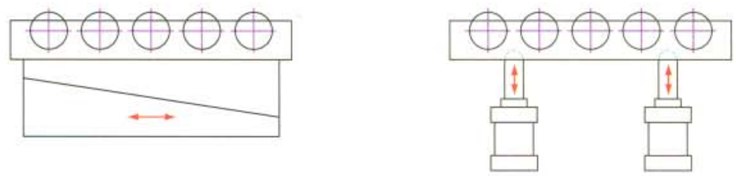



**Multiblanking Line Arrangement**

**Figure 1**

**Figure 2**

*Nesting the rolls, or bringing them closer together, increases the strip's travel distance through part of the leveler. The left illustration shows the leveler rolls open (no nesting), which gives strip a short path through the machine. The right illustration shows the leveler rolls closed (some nesting), which gives strip a longer path through the machine.*



**Mechanical Leveler Backup Adjustment**

**Hydraulic Leveler Backup Adjustment**

**Figure 3**

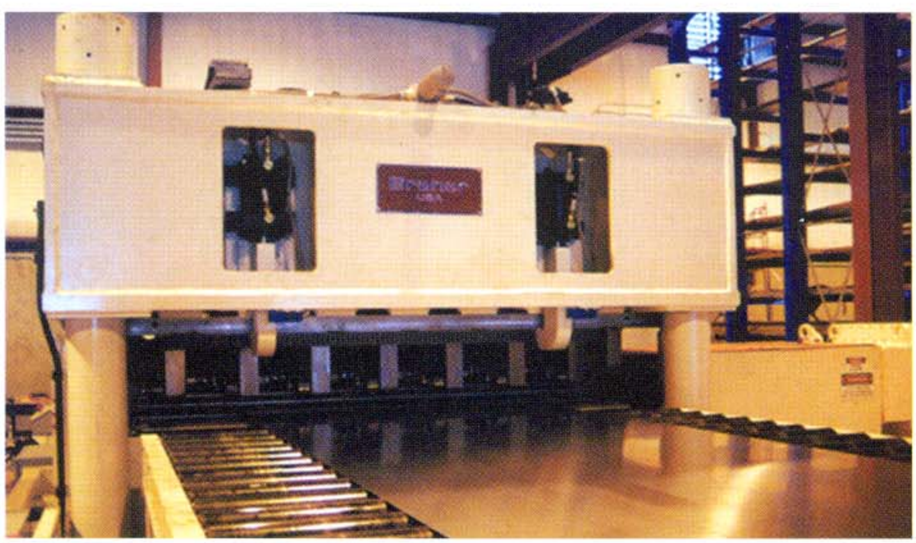


**Figure 4**

*Hydraulic levelers, such as this one, have two cylinders under each backup flight. These cylinders are independent of each other, allowing the entry and exit end of each backup also to move independently.*

On mechanical roller levelers, a jack is connected to a pair of wedges at each backup flight. The entry and exit ends of each backup move up and down equally, and feathering is accomplished by tipping the top frame with four large jacks.

Hydraulic roller levelers have two cylinders under each backup flight. These cylinders are independent of each other, allowing the entry and exit end of each backup also to move independently. This design allows the backup rolls to do the feathering, and the top frame is rigidly fixed. It also allows aggressive roll nesting, resulting in maximum shape correction. In addition, the cylinders are not mechanically tied to the backup rolls, so hydraulic levelers are well-suited for quick-change cassette designs (see **Figure 4**).

Four-high levelers have backup rolls that act directly on the work rolls. These machines do the best job of leveling, but they might mark surface-critical material.

Five-high levelers have one row of full-face intermediate rolls on the top side of the strip. The adjustable backup rolls are underneath and act directly on the work rolls, so these machines do a good job of leveling and prevent marking on the top side of the strip.

Six-high levelers have two rows of full-face intermediate rolls located above and below the strip. The adjustable backup rolls act on the intermediate rolls, so it's difficult to correct poor shape, but they do prevent marking on the top and bottom side of the strip.

**Figure 5**

*Powered cassette levelers allow offline cleaning and maintenance. Cassette changeovers take about two minutes and can be accomplished without tools.*

**Figure 6**

*Programmable-head slitters have a knife-positioning system that automatically sets the tooling after the operator enters data in a computer. They are suitable for running small batch sizes with frequent restocking of coils.*

Work roll diameter and center distance greatly limit the thickness capacity of roller levelers. Generally, the maximum thickness that can be leveled is three to four times the minimum thickness.

Lines that handle a variety of products or a wide thickness range likely will require two separate levelers. Another option for increasing leveler capacity is a cassette leveler with removable roll modules. Each cassette can handle a different roll diameter or backup arrangement, allowing increased capacity on a single machine.

In addition, cassette levelers allow offline cleaning and maintenance. The line can continue to run while one cassette is being serviced, reducing downtime. Cassette changeovers take about two minutes and can be accomplished without tools (see **Figure 5**).

## Slitting

After the material has been leveled, the next key function is slitting. The slitter can be located before or after the looping pit, but placing it before the pit allows the slitter to run at a constant speed. This reduces knife wear, eliminates material scuffing, and allows the material to be fanned out without inducing camber. Placement before the pit also allows quicker, easier restocking of partially run coils.

Slitter designs typically fall into three categories:

**1. Fixed-head slitters** usually have packed arbor tooling that must be removed and replaced each time the setup is changed. Since the machine is fixed in place, the line can't be run while the tooling is changed.

**2. Injector-head slitters** have a second slitter head that can be tooled offline, reducing downtime.

**3. Programmable-head slitters** have a knife-positioning system that auto-

**Hydraulic Cassette Levelers**

*1/2" x 96" Hot Rolled*

*1/4" x 60" Stainless*

*1/4" x 72" Hot Rolled*

*.135" x 72" Cold Rolled*

**Cassette Opener**

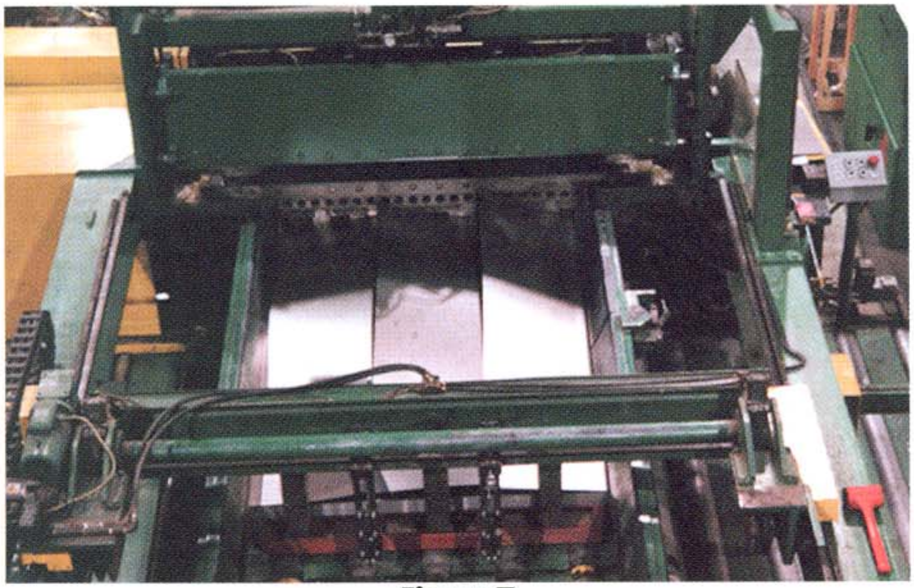


**Figure 7**

*Combination stackers have a blower to provide a cushion of air for supporting single or multiple blanks. They also have a series of skate wheels on each side for supporting single sheets. The blower helps protect surface-critical material and has low maintenance requirements. The skate wheels allow paper and polyvinyl chloride interleaving on single-sheet runs.*

matically sets the tooling after the operator enters data in a computer. No other input or adjustments are required. They are suitable for running small batch sizes with frequent restocking of coils (see **Figure 6**).

## Feeding

After slitting comes feeding, which affects the accuracy and productivity of the line. Feeders can be designed to run in either free-loop or tight-line mode, depending on the thickness of material being run.

In free-loop mode, the leveler runs at a constant speed, the feeder starts and stops, and a shallow pit provides a buffer zone for material to accumulate. Free-loop mode offers high productivity and eliminates roll marks caused by stopping the leveler.

In tight-line mode, both the leveler and feeder start and stop, and the looping pit is not used. This reduces the size and inertia of the feeder drive and provides a logical solution for heavy-gauge material.

Roll-type feeders with electronic servo drives work equally well in free-loop and tight-line modes. Because they are nonreversing, they provide smooth acceleration and high speeds. Full-width contact on the material eliminates side-to-side slippage. Length is measured by counting pulses, so feeding is controlled electronically rather than mechanically. A computer tracks piece count and batch weight and can stop the line automatically when the desired level is achieved.

## Shearing

The next key function is shearing, which also affects line productivity. Points to consider when choosing a shear are cycle time and maintenance.

Shears are available with a hydraulic or mechanical design. Hydraulic shears use cylinders to force the knife through the strip and are simple, relatively maintenance-free machines. Mechanical shears have an AC or DC motor that drives a large flywheel. The shear ram is connected to the flywheel through a clutch-brake arrangement that, when fired, engages for one (very fast) revolution.

On short-length blanks, AC shears can make up to 60 cuts per minute, and DC shears can make up to 100 cuts per minute.

Two knife configurations commonly used are bow tie and straight blade. Bow tie shears have quick cycle times, but they can dimple heavy-gauge material. Straight blade shears have longer cycle times, but they do not dimple the strip.

The knives in any shear must be set to the proper clearance to ensure a good-quality cut. Powered knife clearance adjustment can help save time.

When inspection is required, a belt conveyor system located after the shear can be helpful. Belts allow good visibility for online inspection, quick access for offline inspection, and single-blank rejection at high speeds. When required, they also allow a double stacker arrangement.

## Stacking

The last key function is stacking. Airfloat stackers are commonly used in multiblanking lines. Another option is a combination design.

Combination stackers have a blower to provide a cushion of air for supporting single or multiple blanks. They also have a series of skate wheels on each side for supporting single sheets. The blower helps protect surface-critical material and has low maintenance requirements. The skate wheels allow paper and polyvinyl chloride interleaving on single-sheet runs (see **Figure 7**).

With modern technology, multiblanking lines have become more productive and versatile enough to process many different types of material over a range of thicknesses.

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