Sheet Metal Coil Processing

Training Objective

After watching the program and reviewing this printed material, the viewer will be aware of the essentials of sheet metal coil processing and the equipment involved.

- Coil stock production and handling is shown
- Slitting line systems are explained
- Blanking and shearing processes are explored
- Basic components of a coil processing line are depicted

Coiled Sheet Metal Processing

Sheet metal stock is produced in varying widths and material thicknesses. This stock is typically coiled for efficient handling, transport and further processing. Coiled sheet metal is processed in several ways:

- It can be slit into a number of individual coils of reduced width
- It may be sheared into rectangular or irregularly shaped blanks for further processing
- It may be fed directly into a stamping press or other machinery for parts production

Coil Slitting

Slitting is a shearing process in which the width of an original, or master, coil is reduced into multiple narrower coils. A wide range of materials and thicknesses can be slit, ranging from thin foils to thick plate. Normally, the outside edges of the master coil are trimmed. This creates an accurate register cut, providing a reference point from which the other cuts can be made.

Slitting is performed on slitting lines which consist of four basic devices:

- The uncoiler, or pay-off reel, which tightly grips the master coil on its inside diameter using an expandable mandrel. The coil is fed into the slitter by either rotating or jogging the mandrel.
- The slitter, which consists of two parallel arbors mounted with rotary cutting knives. These knives partially penetrate the coil stock causing a crack or fracture on both sides of the stock, separating the material.
- A tensioning device, which is placed between the slitter and the subsequent recoiler. A tensioning device is needed because the master coil is crowned or larger in diameter in the center of its width than at the edges. Without a tensioning device the slit material from the center of the master coil would take up more quickly while the outboard strips would hang loosely.
- The recoiler, which takes up the slit coils on a driven, expandable mandrel. The recoiler mandrel is fitted with separator discs which prevent interleaving of the narrower coil widths.

Other slitting line equipment can include:

- Scrap disposal machinery
- Edge conditioning equipment
- Packaging devices

There are two basic types of slitting lines:

- The pull-through slitting line
- The loop slitting line

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On pull-through slitting lines the recoiler provides the power to pull the coil material off the uncoiler reel, through the slitter, and recoil the processed strips.

In loop slitting lines, a pit is incorporated into the line. The processed coil strips are looped into the pit which assists in absorbing the strip length differential within the slit coils. The slitter typically provides the power to both uncoil and slit the material, while the recoiler provides the power to rewind the material.

Coil Blanking

Medium to large size sheet metal parts are produced from stacked blanks fed into a stamping press. These blanks are generated from coiled stock using either cut-to-length shearing lines or blanking presses.

Critical to subsequent processing is the need to flatten the naturally occurring curvature, or set of the master coil stock. To achieve this, the coiled material is fed through a straightener or leveler. As the sheet metal material moves through the straightener or leveler, it gets flexed between opposing, adjustable rollers. This flexing results in flattening of the material. Straighteners only remove coil set, but levelers, in addition to removing coil set, also improve flatness by correcting some common defects found in coiled sheet metal stock, including:

- Wavy edges, where the outer strip edges are longer than the center
- Center buckling, or oil-canning, where the center of the strip is longer than the edges

After straightening and leveling the blanks are sheared to size. This is most commonly accomplished using either the stationary-shear, or loop-type cut-to-length line or the flying-shear cut-to-length line. The primary difference between the two cut-to-length lines is that the coil is momentarily stopped during shearing on the stationary-shear line, while the shear travels and cuts the continuously moving coil material on the flying-shear line.

While regularly shaped blanks are produced by direct shearing operation, more complex and irregular shapes are produced with blanking presses. Such presses may be either high speed eccentric or hydraulic types presses having a maximum of 80 strokes per minute. Holes and slots may also be produced during the basic blanking operation.

Coil Processing Lines

Coil processing significantly improves the efficiency of sheet metal stamping operations as well as other processing lines, such as roll-forming and duct work manufacturing. Because the coil is fed continuously through the system, production is uninterrupted. In addition, coil processing lines can eliminate the need for separate blanking presses and reduce storage and handling requirements.

The basic components of a coil processing line include:

- Pay-off reels, upon which the coil is loaded with a variety of coil handling equipment. For coils of thicker material and where surface finish is not critical, coil cradles may be used.
- straightening or leveling equipment to insure the coil stock is flat.
- Automatic coil stock feed mechanisms, such as slide, roll, or gripper feed systems to move the coil stock.

Coil stock feed systems can be press driven or independently driven. The most popular and versatile feed system employs independently powered feel rolls driven by digitally controlled servomotors.

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All coil production will generate an amount of scrap. In some cases scrap processing can be a function of the stamping die itself. Most often scrap is processed by separate mechanisms which may be press actuated or independently powered.

For high production coil operations, a continuous and uninterrupted flow of coil stock is needed. For this purpose coil-to-coil welding stations are placed so that the leading edge of the new coil can be welded to the trailing edge of the previous coil, eliminating the need to thread a new coil into the line. To facilitate the welding, a coil or strip accumulator is used to hold enough coil to keep the line running while the weld is taking place.

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Review Questions

1. The basic advantages of using coiled stock include:
   a. ease of handling, transport and processing
   b. storage shelf life
   c. cost savings
   d. variety of thicknesses and materials available

2. Master coils are often:
   a. lubricated for ease of processing
   b. stacked for continuous production
   c. slit into narrower widths
   d. unrolled before feeding

3. Master coils are held onto the pay-off reel by:
   a. strap and toggle clamps
   b. temporary welds
   c. bolts and fasteners
   d. an expandable mandrel

4. The arbors of a slitter are fitted with:
   a. high-speed bearings
   b. scissor-action shear blades
   c. adjustable spacers
   d. rotary cutting knives

5. The loop slitting line incorporates a:
   a. pit
   b. rewind counter
   c. vertical mounting of the master coil
   d. cradle mounting of the master coil

6. Shearing lines used for blank production require:
   a. larger size master coils
   b. straightening and leveling of stock before shearing
   c. only motorized pay-off reels
   d. foil thickness stock

7. Coil stock feed mechanisms can employ
   a. slides
   b. grippers
   c. rolls
   d. all of the above

8. The device used to enable the constant feed of stock during a coil-to-coil weld cycle is called:
   a. a dwell roll
   b. an intermediate take-up roll
   c. a drooping pit
   d. an accumulator

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Answer Key

1. a
2. c
3. d
4. d
5. a
6. b
7. d
8. d