Punch Presses

Training Objective

After watching the program and reviewing this printed material, the viewer will gain a basic knowledge of hole punching techniques and the operation of holemaking machinery.

- The basic type of punch press is detailed.
- The CNC turret punch operation is explained.
- Types of punches are examined.
- Punch press accessories and material handling systems are depicted.

The Punch Press

Although the punching of holes is often accomplished with die sets that also perform bending and forming, a punch press is designed specifically for the making of various shaped holes and cutouts on sheet metal and plate material. The punch press is fitted with punches and dies of the size and shape of the hole required. For irregular and non-standard holes, the modern punch press is capable of nibbling. This refers to a series of successive “hits” following a predetermined pattern that creates the cutout.

The punching action is accomplished by a vertical moving ram that forces the punch through the material and into a die through which the resulting slug is ejected. Additionally, a device to hold the material in place as the punch is withdrawn, call a stripper, is often an integral part of the punch tool.

The press ram may be activated manually, mechanically, or hydraulically. The manual press, usually a tabletop model, is capable of generating about four tons of force. Mechanical punch presses use a system of flywheels, gears, and eccentrics to stroke the ram. Hydraulic presses use oil pressure to perform the punching action. These last two types can generate from 8 to 60 tons of force with some larger models creating over 150 tons. Mechanical presses can operate faster than hydraulic models but the latter can exert more punching pressure more uniformly on the thicker workpiece.

Press Capacity is determined by not only available tonnage, but also by effective throat depth. This determines how large a workpiece the press can accommodate. Throat depth is measured from the center of the punching tool to the rear of the press. Other capacities are the movement of the carriage on which the work is mounted and the weight of the workpiece. A press may have a single tool mounting station or multiple stations mounted in a revolving turret. Very heavy punching in plate structurals is done in the “ironworker.” These perform cutting and parting in addition to punching.

Turret punches can hold from 12 to 70 punch assemblies and can be rotated depending on the press type, manually or automatically with a CNC system. Tool changing can also be done in semi- and full automatic modes. By rapidly revolving and presenting a specific punch to the work, the punching speed is then determined by how fast the workpiece can be moved and positioned under the turret. CNC punching stations can achieve 500 strokes per minute.

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Punch tools are selected by the size and shape of the hole produced. Their tips may be flat or have various contours that can reduce the punching force needed and helps minimize workpiece distortion. An almost infinite variety of punch shapes are available. The CNC punch press can also perform certain forming operations including single and multiple knockouts, embossing, and louver making. Forming operations are, in relation to the punching motion, inverted. This means that the raising of the embossing, dimple, or louver is done from the bottom up, allowing the underside of the work to continue to move freely across the work table. This movement follows the typical “X-Y” coordinate pattern.

The modern CNC punch press’ versatility is enhanced by several innovations. The “Wilson wheel” is an arrangement of shearing or forming wheels positioned on both sides of the workpiece. The device is able to shear in a straight or curved line and also form continuous or intermittent embossing. This type of operation is more efficient than nibbling, causing less wear and tear on both tooling and the machine while leaving cleaner edges. The “multi-tool” is like a turret within a turret. They can contain from three to 30 smaller punches within a single tool body. Self contained and indexed automatically, they add greatly to the main turret capacity.

CNC punch press accessories include a plasma cutting torch for accurate high speed cutting of any conductive material from a few thousandths to over one inch thick. The inclusion of plasma cutting greatly reduces special punch tooling needs. A laser attachment expands versatility further by being able to cut non-metallic material as well as the ferrous metals. Non-ferrous metals such as aluminum, copper, and brass are difficult to cut with the laser due to their reflectivity.

Automatic loading and unloading systems enable the press to run with virtually no operator intervention. A carrier is mounted on an overhead rail and is located so material is picked up on one side, placed on the machine’s work table, and removed to another pile when punching is complete. Sheet material is lifted by suction cups and sensors on the work table insure the pieces proper location. In cases where a very large workpiece extends beyond the normal punching range of the turret, such systems can reacquire the workpiece and reposition it laterally to another fixed location.

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Review Questions

1. A method of making non-standard holes and cutouts is called:
a. blocking
b. nesting
c. nibbling
d. scalloping

2. The device which enables the punch to withdraw evenly from the work is called:
a. a knockout
b. a swage
c. an index tool
d. a stripper

3. A manual punch press can generate punching force amounting to about:
a. 2 tons
b. 4 tons
c. 8 tons
d. 10 tons

4. The throat depth of a punching machine is measured from the rear of the press to the:
a. front of the press
b. center of the turret
c. center of the punch tool
d. center of the table

5. CNC punching can be as high as:
a. 500 spm
b. 1000 spm
c. 1500 spm
d. 2000 spm

6. Punch press forming is done from the bottom up:
a. because less force is needed
b. to improve accuracy
c. to avoid interference with the turret
d. to allow free movement of the workpiece

7. A “multi-tool” is:
a. a multi-use punch press
b. a punch with a variable shape
c. several smaller punches in a single tool holder
d. another term for a turret

8. It is difficult to cut non-ferrous metals with a CNC laser because they:
a. are non-magnetic
b. dissipate heat too quickly
c. are reflective
d. are too soft

Answer Key

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