



# Chapter 4

## (Metal Forming Process)



# Press Working

Press working may be defined as, a manufacturing process by which various components are made from sheet metal. This process is also termed as cold stamping. The machine used for press working is called a press.

The main features of a press are:

- A frame which support a ram or a slide and a bed, a source of mechanism for operating the ram in line with and normal to the bed.
- The ram is equipped with suitable punch/punches and a die block is attached to the bed.
- A stamping is produced by the downward stroke of the ram when the punch moves towards and into the die block.
- The punch and die block assembly is generally termed as a “die set” or simple as the “die”

## **Press working operations:**

The sheet metal operations done a press may be grouped into two categories.

### **1: Cutting operations**

In cutting operations the work piece is stressed by its ultimate strength. The stresses caused in the metal the applied forces will be shear stresses. The cutting operations include:

- |                 |              |              |
|-----------------|--------------|--------------|
| (a) Blanking    | (b) Punching | (c) Notching |
| (d) Perforating | (e) Trimming | (f) Shaving  |
| (g) Slitting    | (h) Lancing  |              |

### **2: Forming operations**

In forming operations , the stresses are below the ultimate strength of the metal , in this operation , there is no cutting of the metal but only the contour of the work piece is changed to get the desired product.

The forming operations include:

- |             |             |               |
|-------------|-------------|---------------|
| (a) Bending | (b) Drawing | (c) Squeezing |
|-------------|-------------|---------------|

# Sheet Metalworking Defined

Cutting and forming operations performed on relatively **thin** sheets of metal

- Thickness of sheet metal = 0.4 mm (1/64in) to 6mm (1/4 in)
- Thickness of plate stock > 6 mm
- Operations usually performed as **cold working**

# Sheet and Plate Metal Products

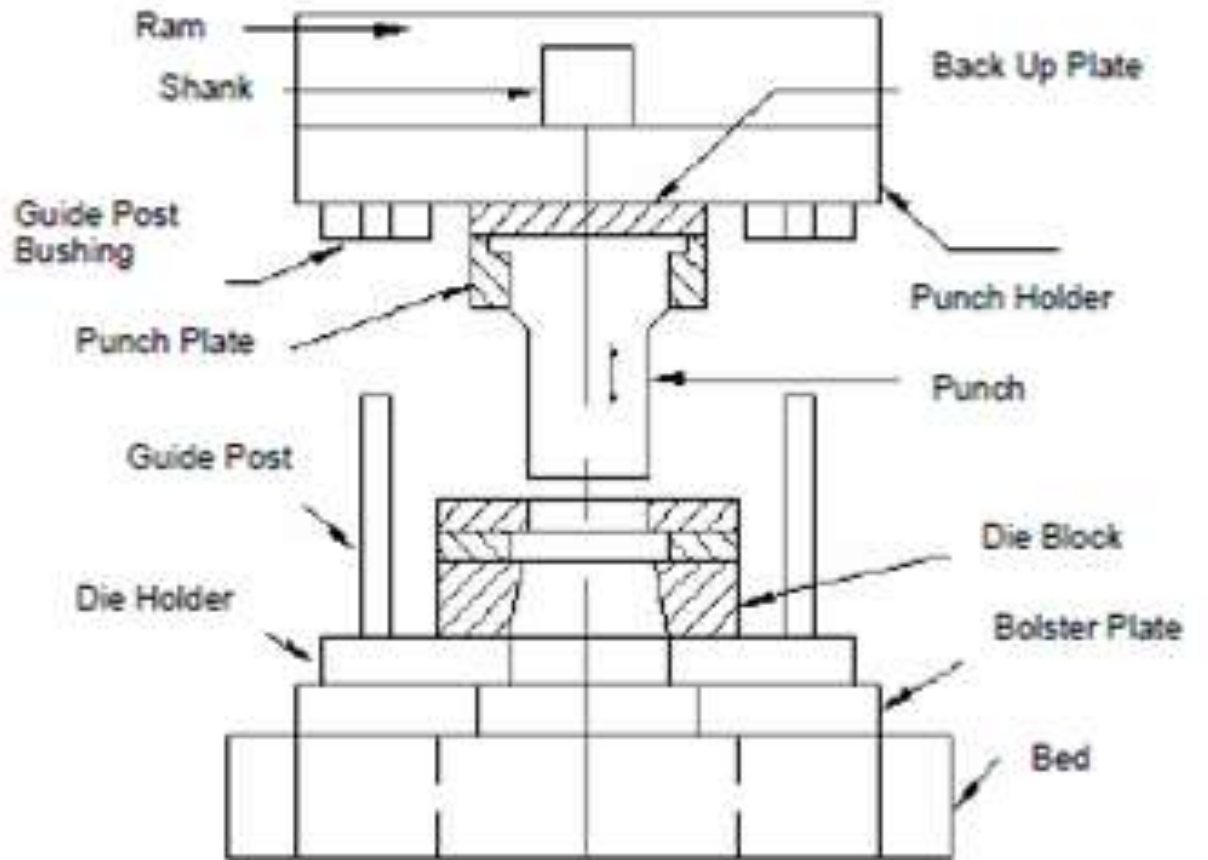
- Sheet and plate metal parts for consumer and industrial products such as
  - Automobiles and trucks
  - Airplanes
  - Railway cars and locomotives
  - Farm and construction equipment
  - Small and large appliances
  - Office furniture
  - Computers and office equipment

# Advantages of Sheet Metal Parts

- High strength
- Good dimensional **accuracy**
- Good **surface** finish
- Relatively low **cost**
- Economical mass production for large **quantities**

# Basic terms used in Press working

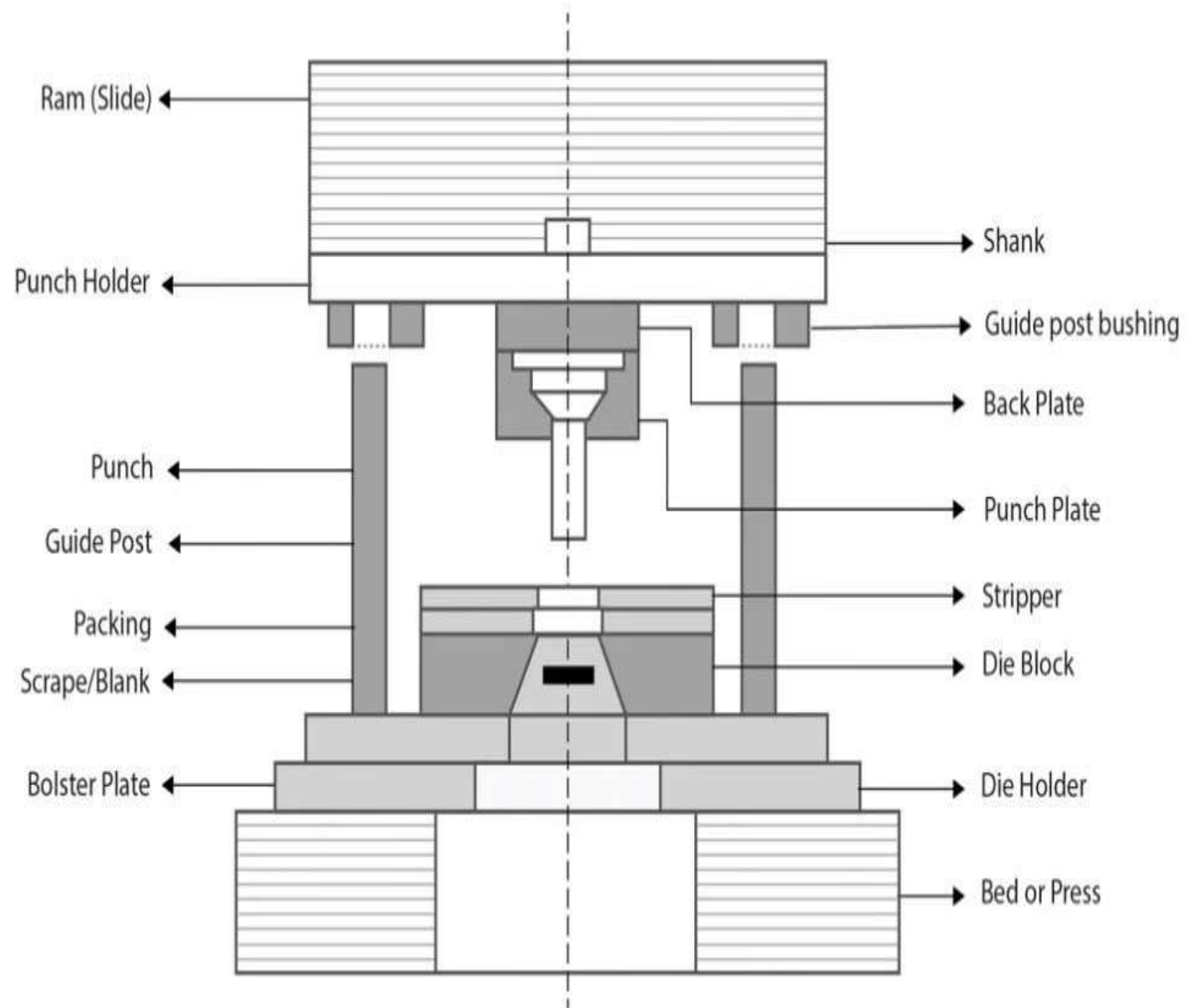
- Press working or sheet metal working
- Spring back
- Press machine
- Press tool
- Punch-and-die
- Stroke
- Bolster plate
- Back Plate or Pressure Plate





# Press tool components

- **Working Components**
- **Structural Components**
- **Guiding Components**
- **Locating and locking components**
- **Feeding Components**
- **Fastening Components**



# Type of Presses

```
graph TD; A[Type of Presses] --> B[Based on source of Power]; A --> C[Based on type of frame]; A --> D[Based on drive mechanism]; B --> E[Manual Drive]; B --> F[Power drive]; C --> G[Open Frame Press]; C --> H[Closed Frame Press]; D --> I[Crank Press]; D --> J[Cam Presses]; D --> K[Rack and Pinion Press];
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Based on  
source of  
Power

Manual Drive

Power drive

Based on type  
of frame

Open Frame  
Press

Closed Frame  
Press

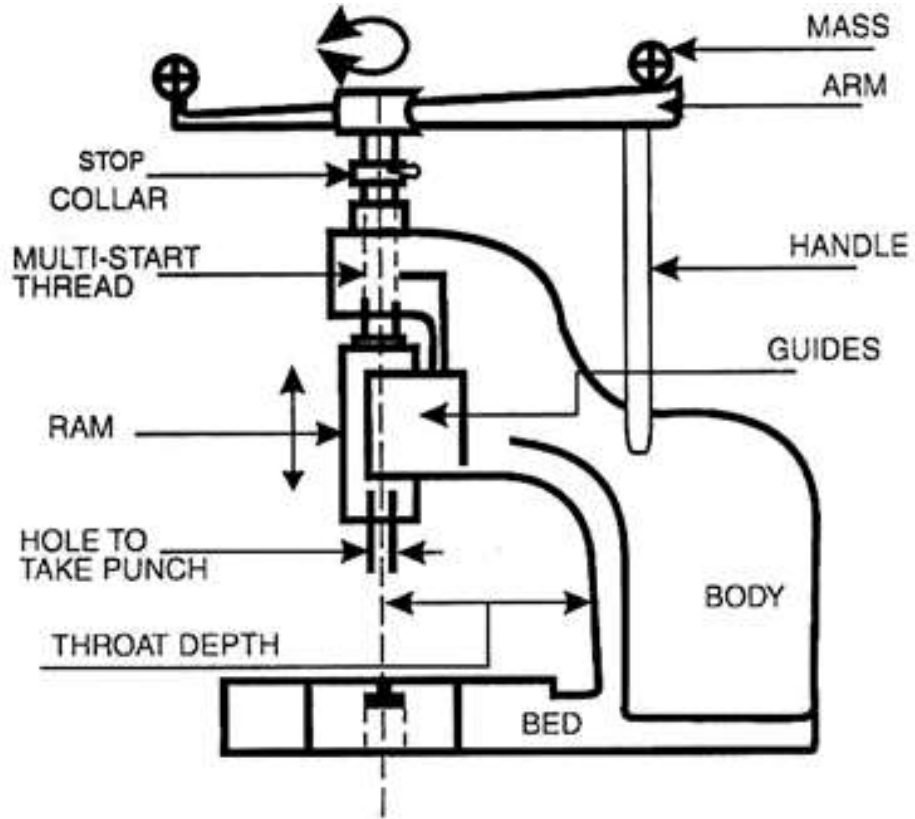
Based on  
drive  
mechanism

Crank Press

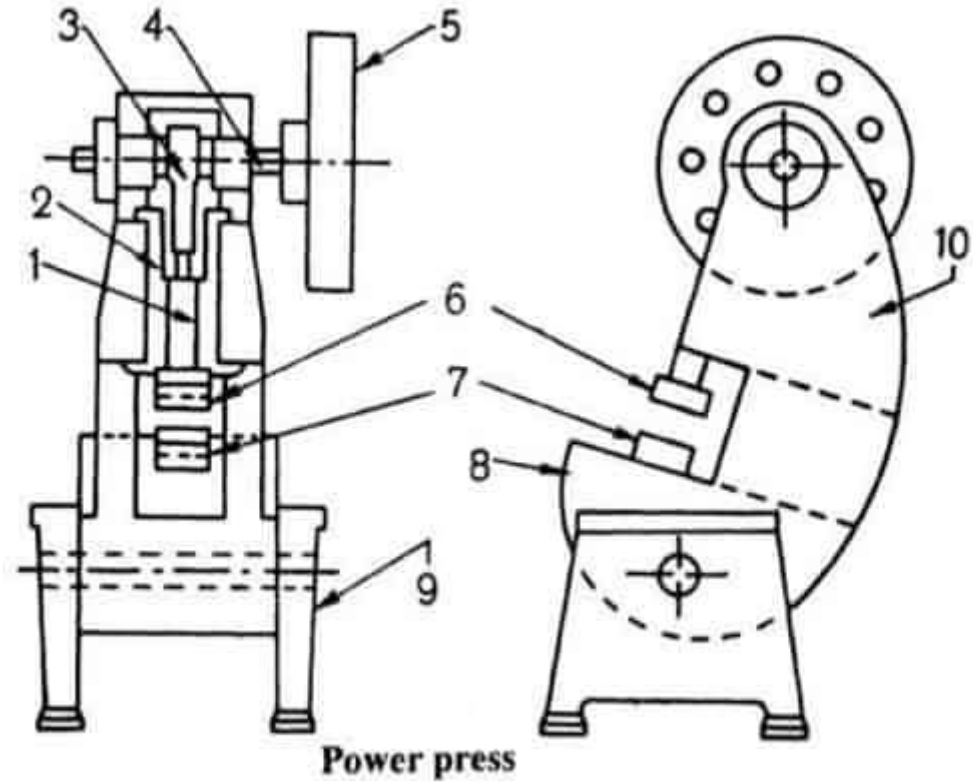
Cam Presses

Rack and Pinion  
Press

# Press based on source of Power



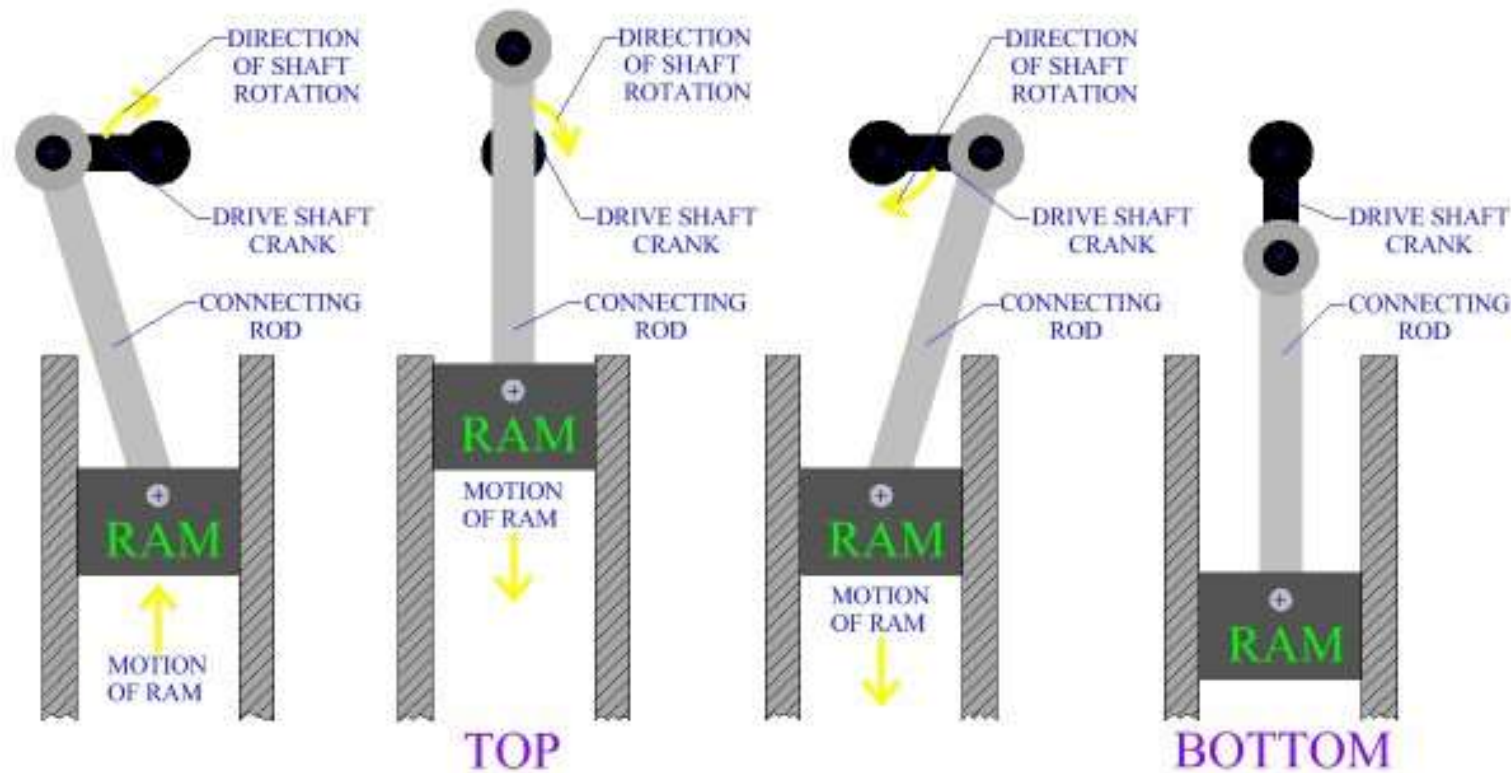
**Fig. 6.2.** A manually operated (Fly) Press.



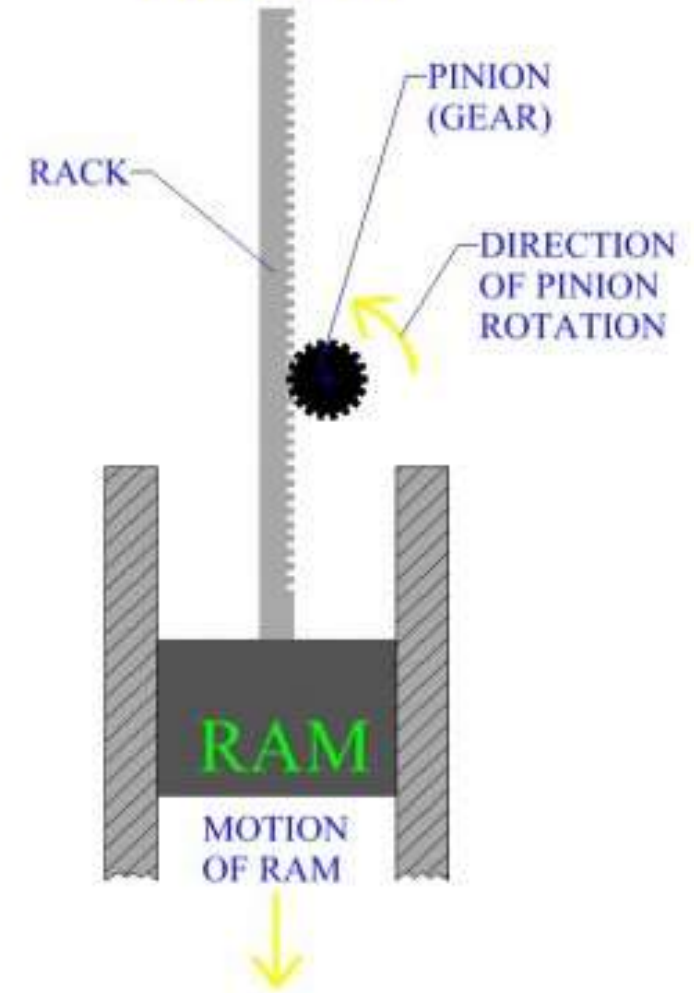
1. Ram 2. Ram guide, 3. Pitman, 4. Crankshaft, 5. Flywheel, 6. Punch, 7. Die, 8. Bolster plate, 9. Base, 10. Frame.

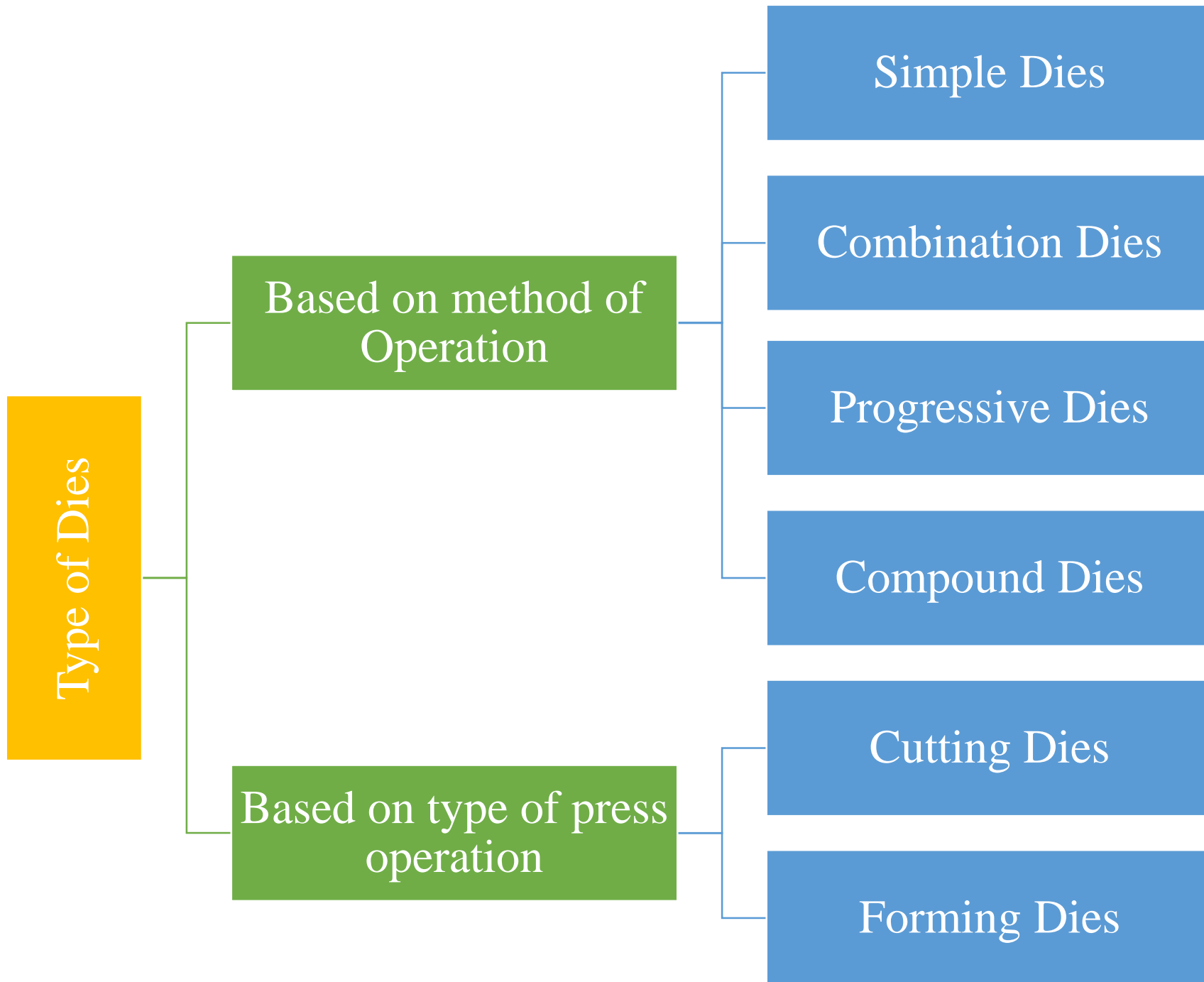
# Press based on driving mechanism

## CRANK PRESS



## RACK AND PINION PRESS

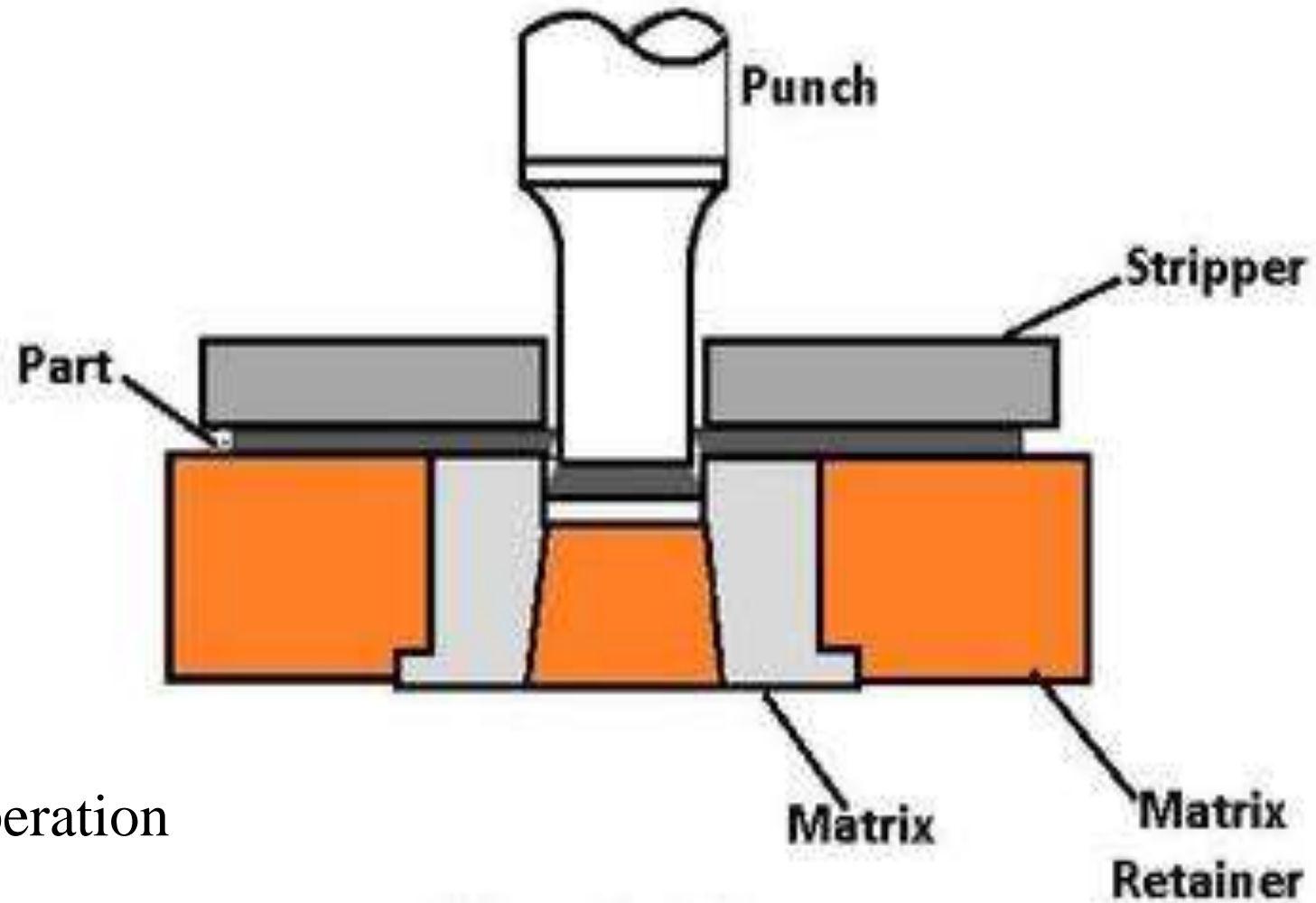




## Type of Dies

Based on method of  
Operation

Simple Dies



Perform single operation  
for each stroke.

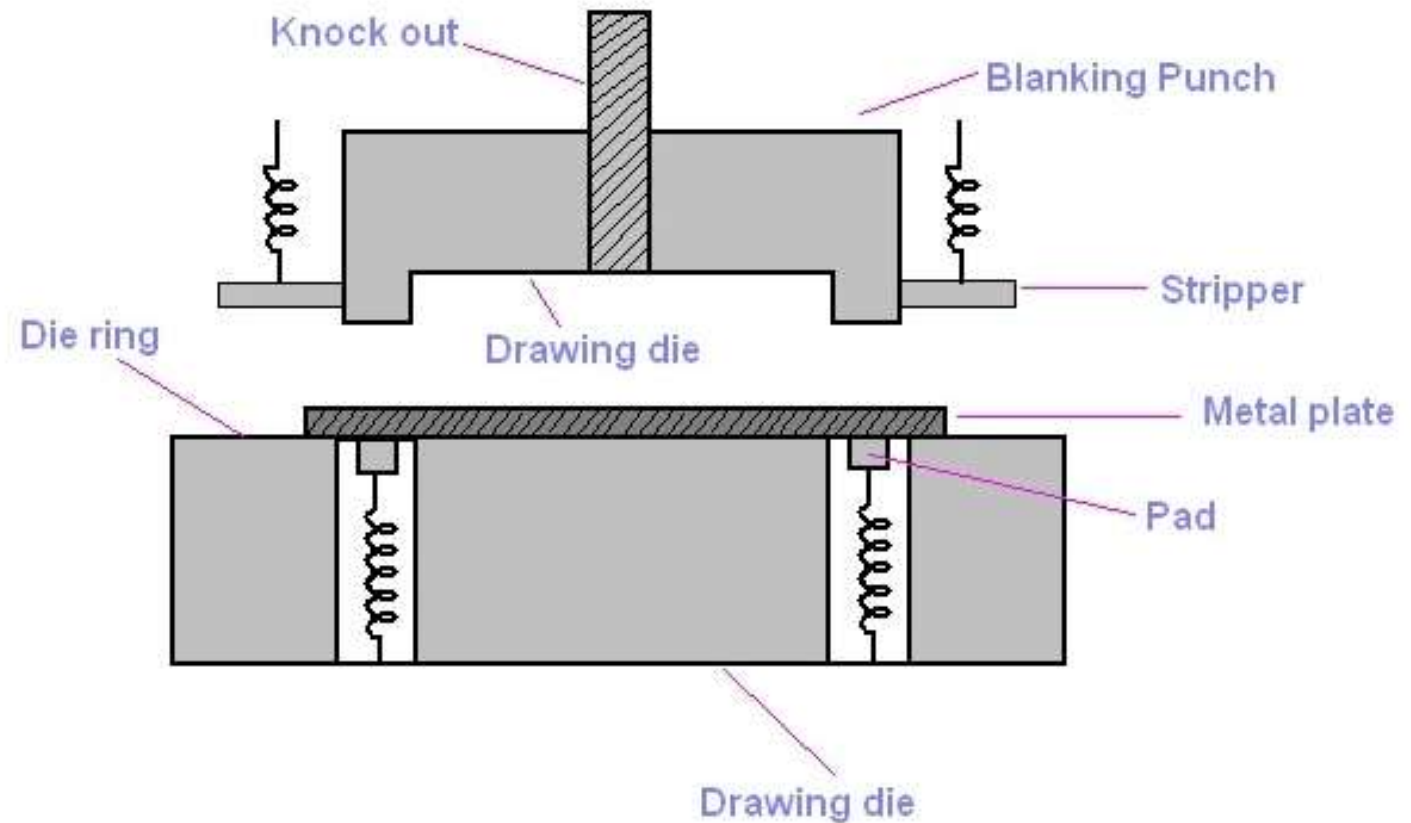
## Type of Dies

Based on method of Operation

A cutting operation is combined with a bending or drawing operation

### Combination Dies

#### Combination Die

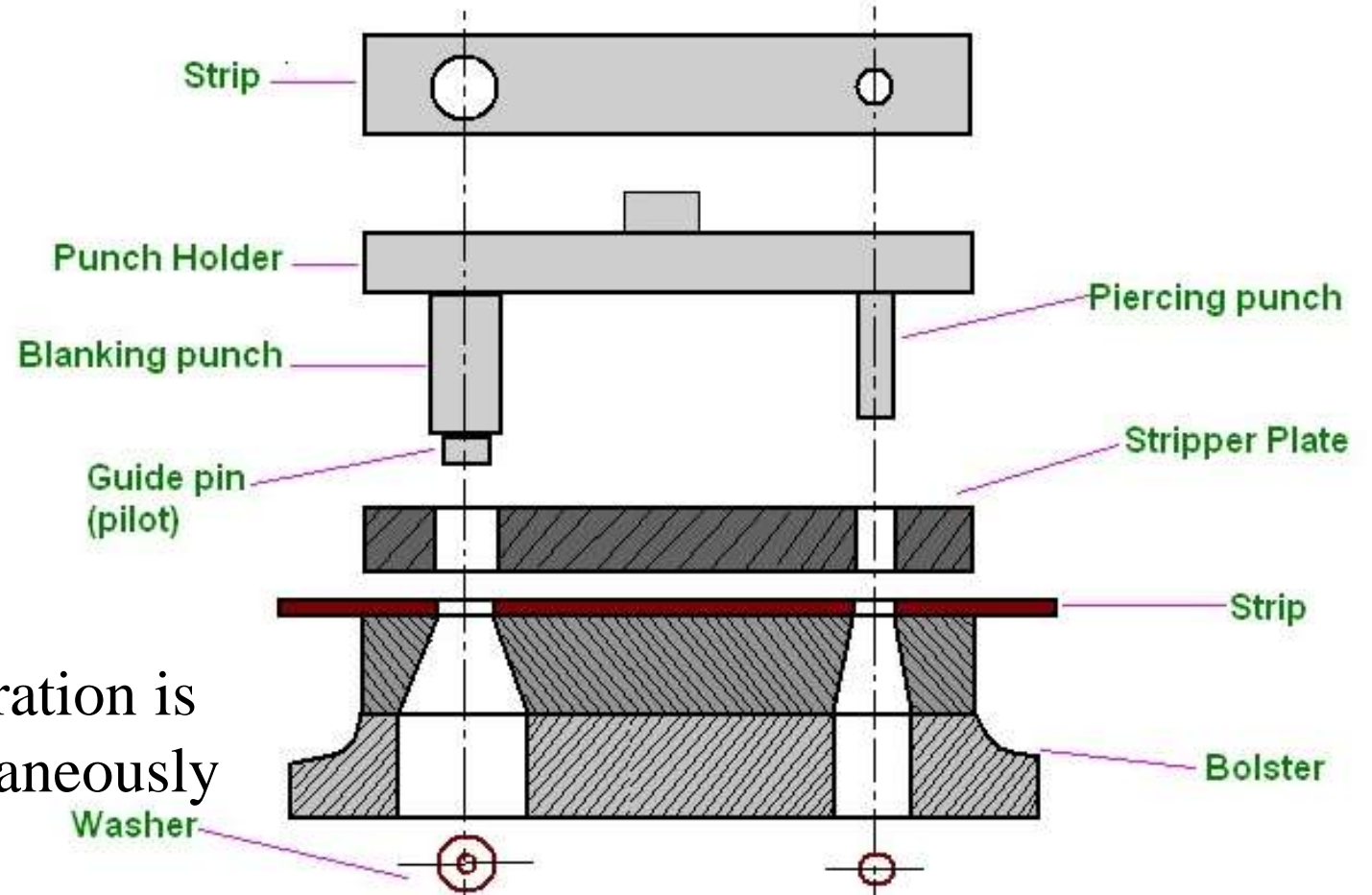


## Type of Dies

Based on method of  
Operation

Progressive Dies

### Progressive Die

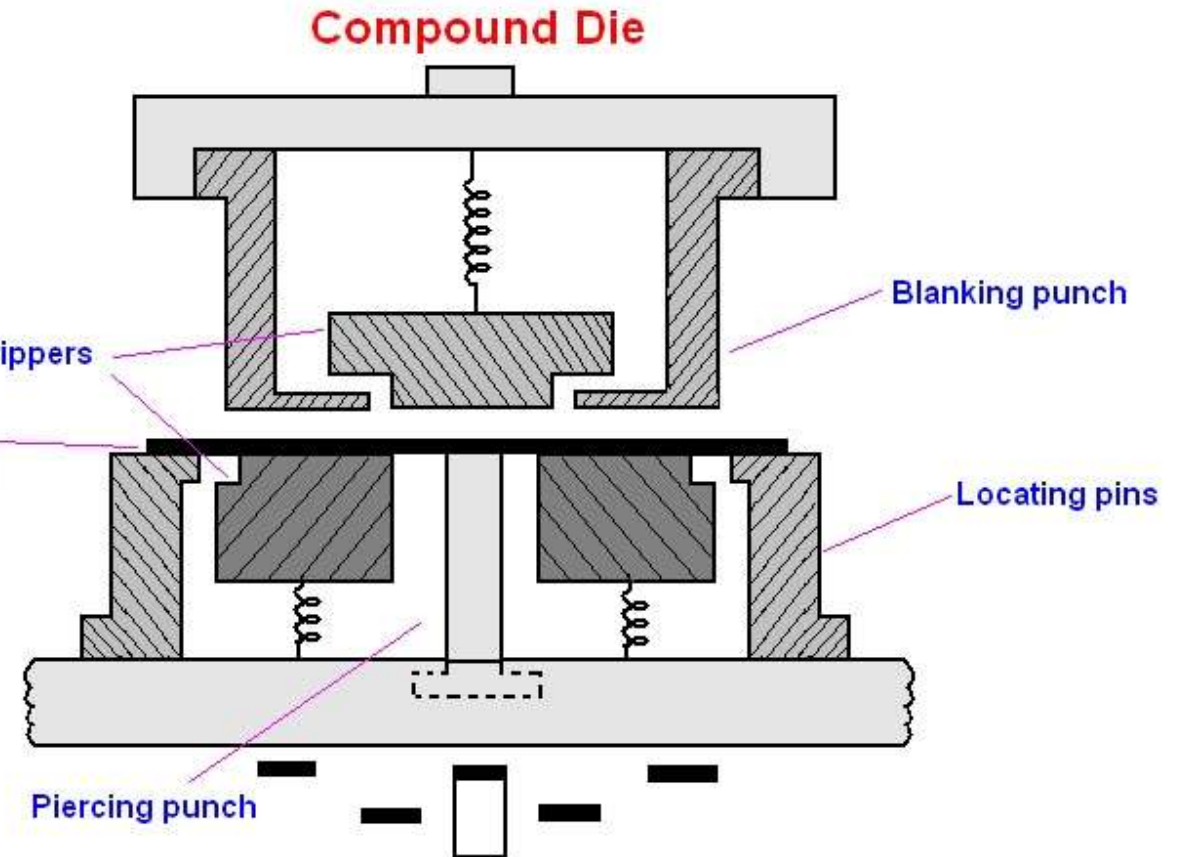




## Type of Dies

Based on method of  
Operation

Compound Dies



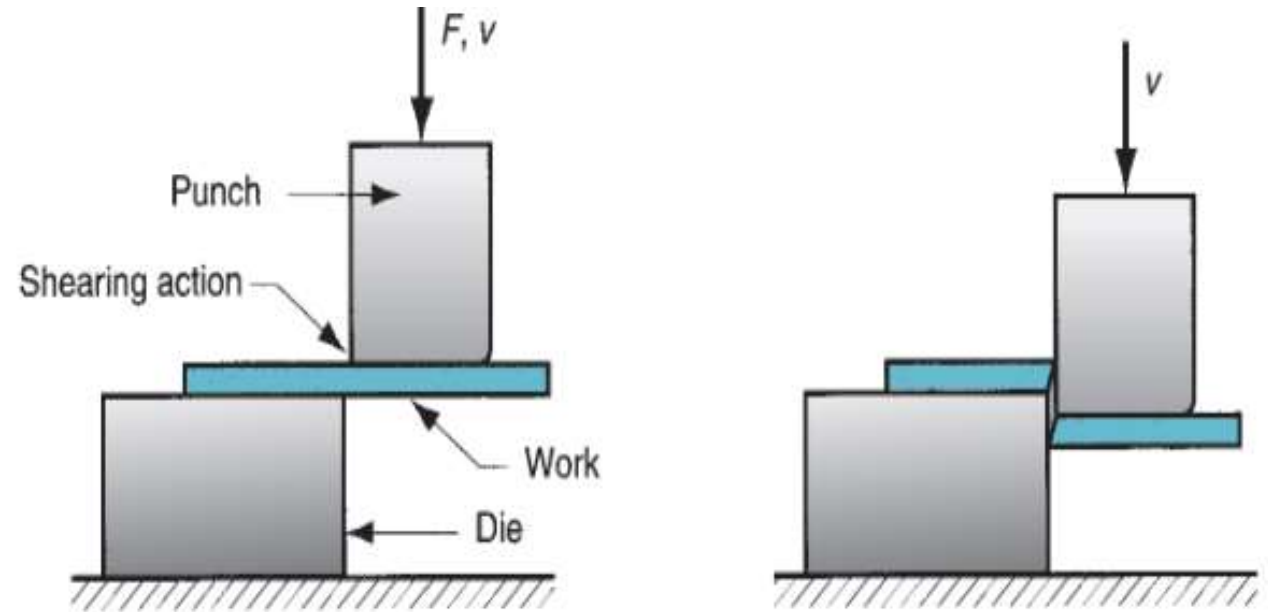
Two or more operation is performed simultaneously but it is slower than progressive dies

## Type of Dies

Based on type of press operation

Cutting Dies

Dies are used for cutting metal pieces

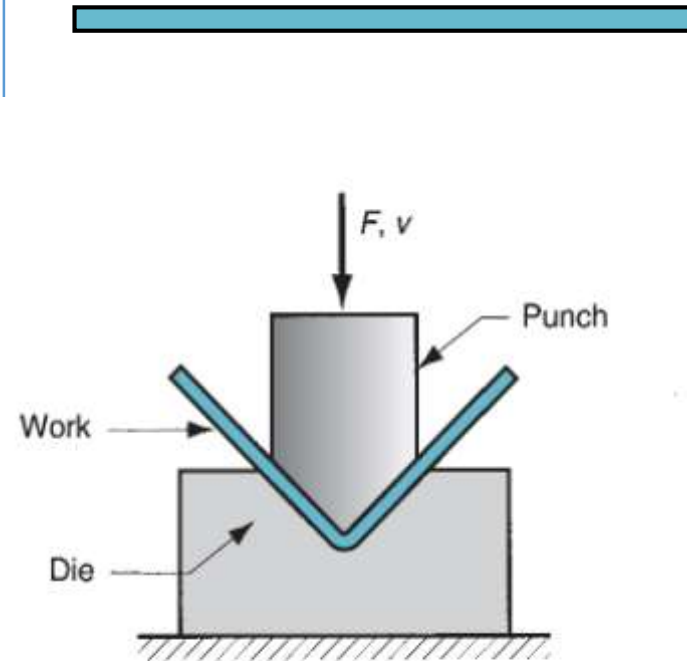


**shearing**

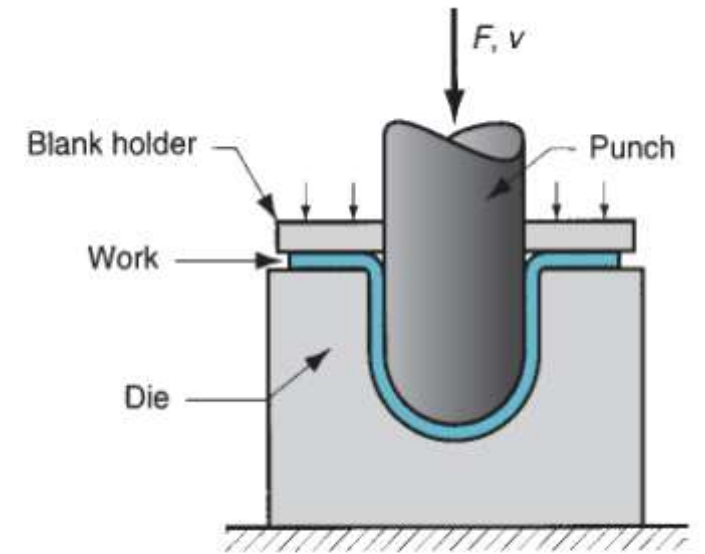
# Type of Dies

Based on type of press operation

Forming Dies



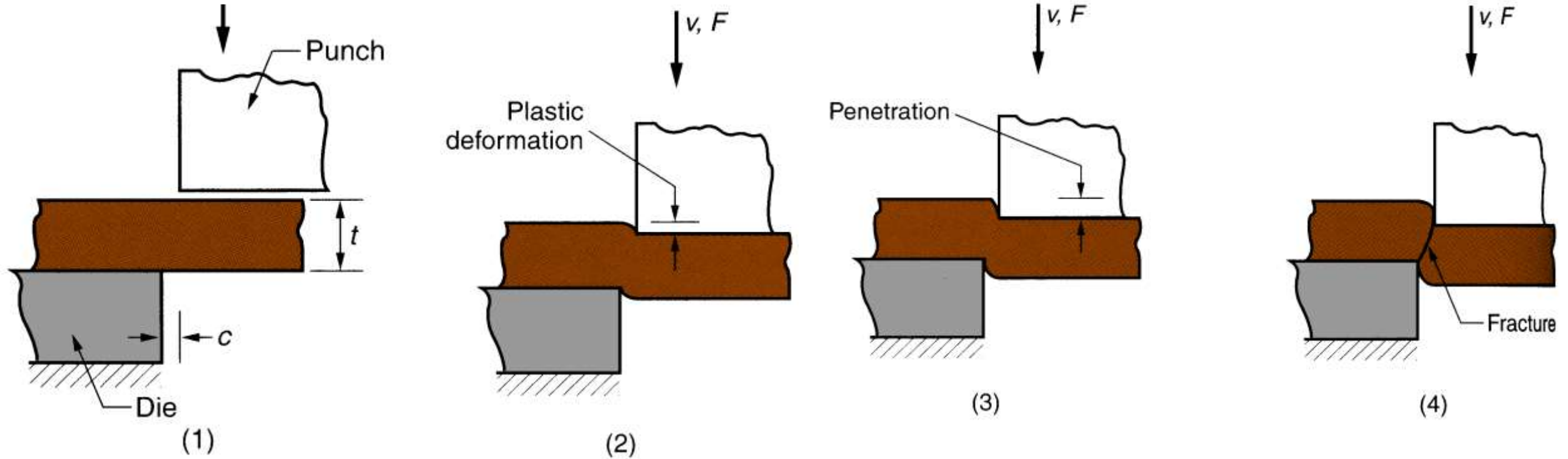
**Bending**



**Deep drawing**

Dies are used to change the shape of the blank without removing the material from the blank

# Press Operation- Shearing



Shearing of sheet metal between two cutting edges:

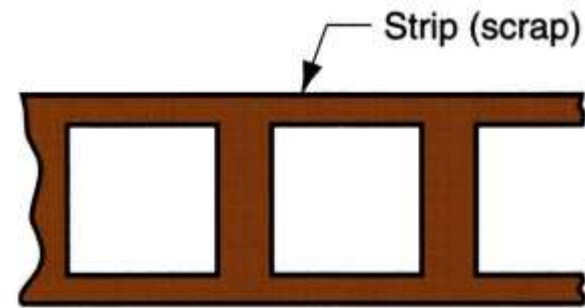
- (1) just before the punch contacts work;
- (2) punch begins to push into work, causing plastic deformation;
- (3) punch compresses and penetrates into work causing a smooth cut surface;
- (4) fracture is initiated at the opposing cutting edges which separates the sheet.

# Press Operation- Shearing

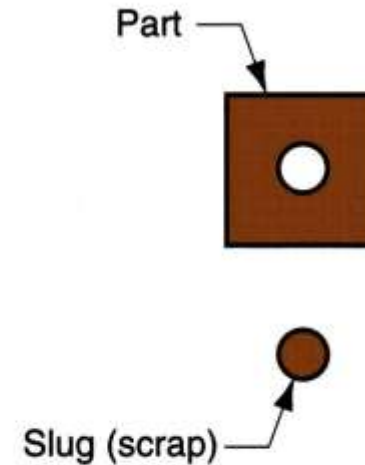
## Blanking and Punching

**Blanking** - sheet metal cutting to separate piece (called a *blank*) from surrounding stock

**Punching** - similar to blanking except cut piece is scrap, called a *slug*



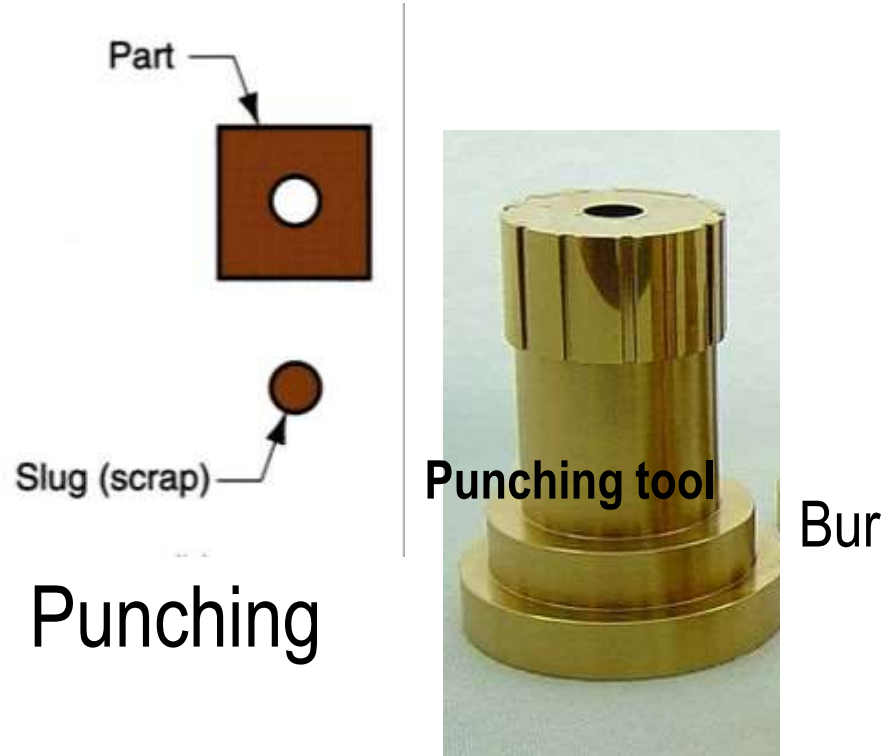
(a)



(b)

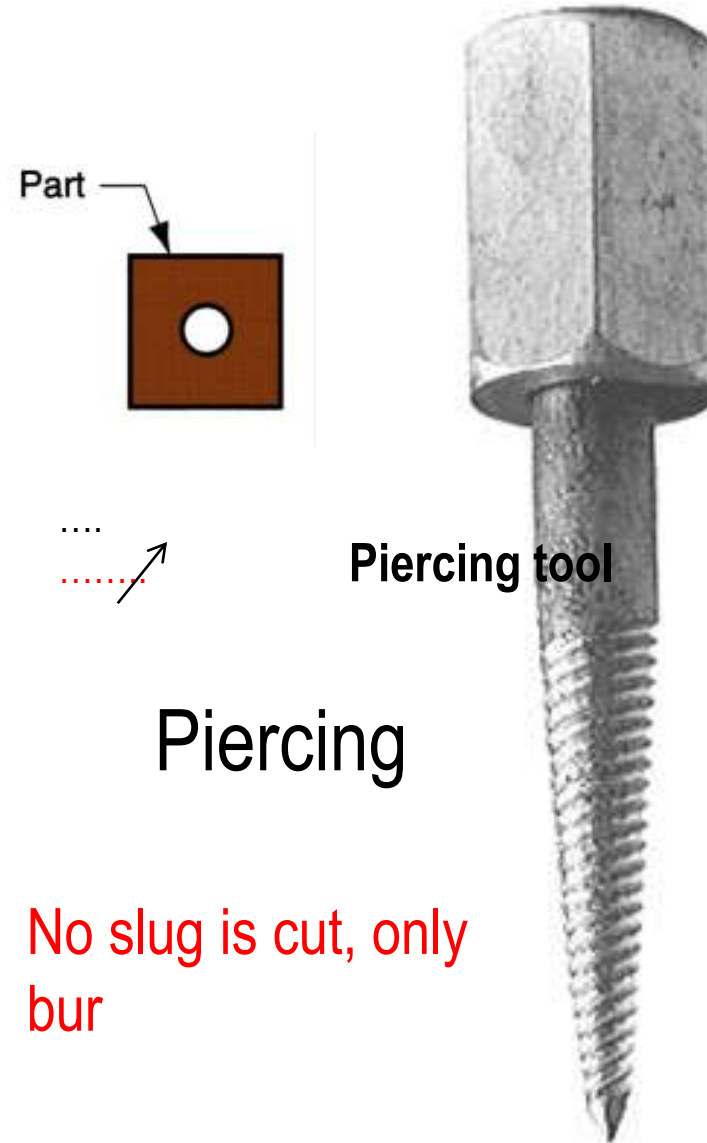
(a) Blanking and (b) punching.

# Punching and Piercing



Punching

Slug is cut and bur  
is minimum



Piercing

No slug is cut, only  
bur