

# Introduction to Tooling

## 1

**The** word tooling refers to the hardware necessary to produce a particular product. The most common classification of tooling is as follows:

1. Sheet metal press working tools.
2. Molds and tools for plastic molding and die casting.
3. Jigs and fixtures for guiding the tool and holding the work piece.
4. Forging tools for hot and cold forging.
5. Gauges and measuring instruments.
6. Cutting tools such as drills, reamers, milling cutters broaches, taps, etc.

### **1. Sheet metal press working tools.**

Sheet metal press working tools are custom built to produce a component mainly out of sheet metal. Press tool is of stampings including cutting operations like shearing, blanking, piercing etc. and forming operations like bending, drawing etc.

Sheet metal items such as automobile parts (roofs, fenders, caps, etc.) components of aircrafts parts of business machines, household appliances, sheet metal parts of electronic equipments, Precision parts required for horlogical industry etc, are manufactured by press tools.

### **2. Molds and tools for plastic molding and die casting.**

The primary function of a mould or the die casting die is to shape the finished product. In other words, it is imparting the desired shape to the plasticized polymer or molten metal and cooling it to get the part. It is basically made up of two sets of components.

- i) The cavity & core
- ii) The base in which the cavity & core are mounted.

Different mould construction methods are used in the industry. The mould is loaded on to a machine where the plastic material or molten material can be plasticized or melted, injected and ejected.

### **3. Jigs and fixtures for guiding the tool and holding the work piece.**

To produce products and components in large quantities with a high degree of accuracy and Interchangeability, at a competitive cost, specially designed tooling is to be used. Jigs and fixtures are manufacturing equipments, which make hand or machine work easier. By using such tooling, we can reduce the fatigue of the operator (operations such as marking) and shall give accuracy and increases the production.

Further the use of specially designed tooling will lead to an improvement of accuracy, quality of the product and to the satisfaction of the consumer and community.

A jig is a device in which a work piece/component is held and located for a specific operation in such a way, that it will guide one or more cutting tools.

A fixture is a work holding device used to locate accurately and to hold securely one or more work pieces so that the required machining operations can be performed

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## Introduction to Press tools

Press working is used as general term to cover all press working operations on sheet metal. The stamping of parts from sheet metal is shaped or cut through deformation by shearing, punching, drawing, stretching, bending, coining etc. Production rates are high and secondary machining is not required to produce finished parts with in tolerance.

A pressed part may be produce by one or a combination of three fundamental press operations. They include:

1. **Cutting** (blanking, piercing, lancing etc) to a predetermined configuration by exceeding the shear strength of the material.
2. **Forming** (drawing or bending) whereby the desired part shape is achieved by overcoming the tensile resistance of the material.
3. **Coining** (compression, squeezing, or forging) which accomplishes surface displacement by overcoming the compressive strength of the material.

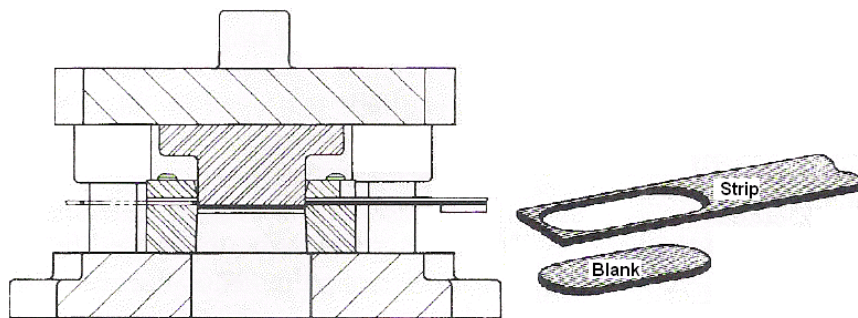
Whether applied to blanking or forming the under laying principle of stamping process may be desired as the use of force and pressure to cut a piece of sheet metal in to the desired shape. Part shape is produced by the punch and die, which are positioned in the stamping press. In most production operations the sheet metal is placed on the die and the descending punch is forced into the work piece by the press.

Inherent characteristics of the stamping process make it versatile and foster wide usage. Costs tend to be low, since complex parts can be made in few operations at high production rates.

### Various operations that are performed in Press tools are;

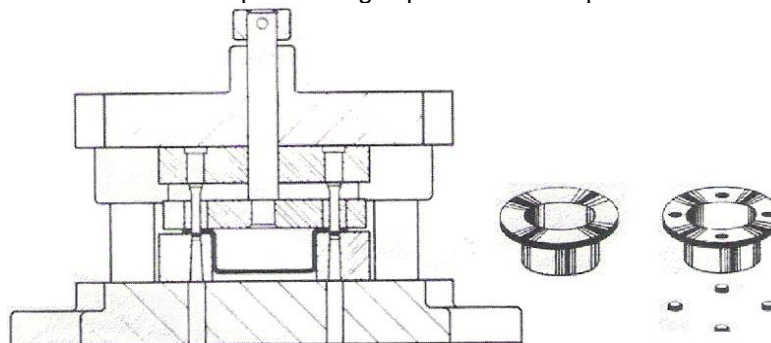
#### Blanking

When a component is produced with one single punch and die with entire periphery is cut is called Blanking. Stampings having an irregular contour must be blanked from the strip. Piercing, embossing, and various other operations may be performed on the strip prior to the blanking station.



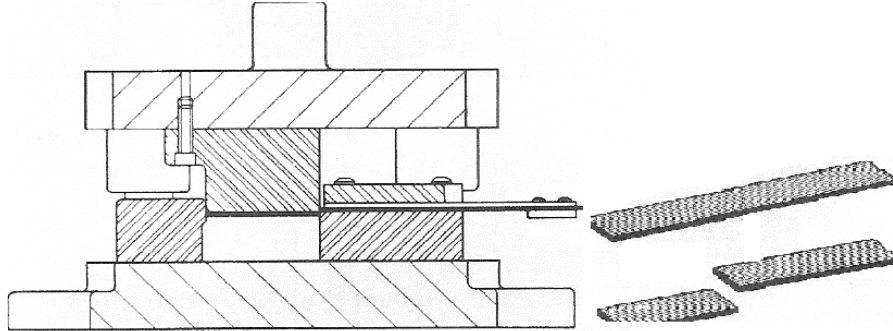
#### Piercing:

Piercing involves cutting of clean holes with resulting scrape slug. The operation is often called piercing, although piercing is properly used to identify the operation for the producing by tearing action, which is not typical of cutting operation. In general the term piercing is used to describe die cut holes regardless of size and shape. Piercing is performed in a press with the die.



## Cut-off

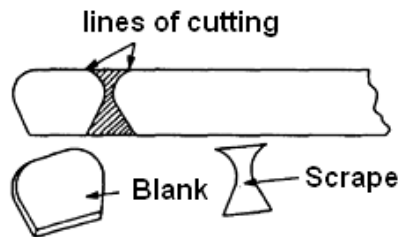
Cut off operations are those in which strip of suitable width is cut to lengthen single. Preliminary operations before cutting off include piercing, notching, and embossing. Although they are relatively simple, cut-off tools can produce many parts.



## Parting off

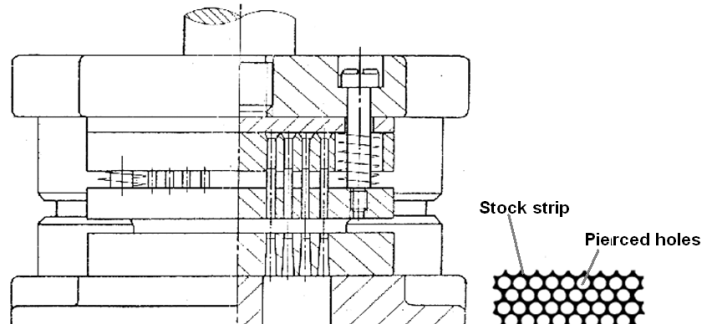
Parting off is an operation involve two cut off operations to produce blank from the strip. During parting some scrape is produced. Therefore parting is the next best method for cutting blanks. It is used when blanks will not rest perfectly.

It is similar to cut off operation except the cut is in double line. This is done for components with two straight surfaces and two profile surfaces.



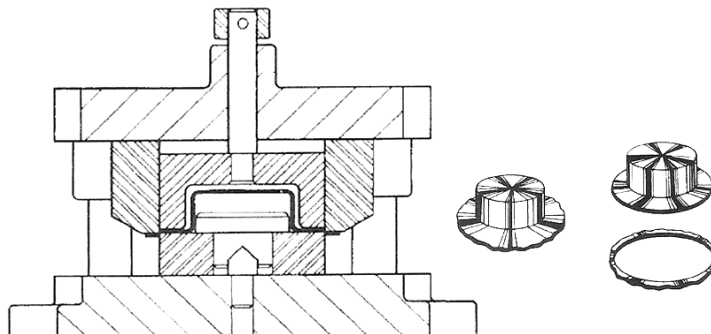
## Perforating:

Perforating is also called as piercing operation. It is used to pierce many holes in a component at one shot with specific pattern.



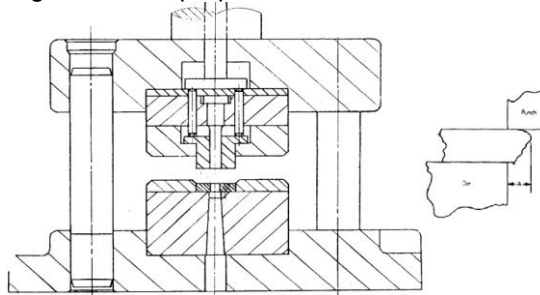
## Trimming

When cups and shells are drawn from flat sheet metal the edge is left wavy and irregular, due to uneven flow of metal. This irregular edge is trimmed in a trimming die. Shown is flanged shell, as well as the trimmed ring removed from around the edge. While a small amount of Material is removed from the side of a component or strip is also called as trimming.



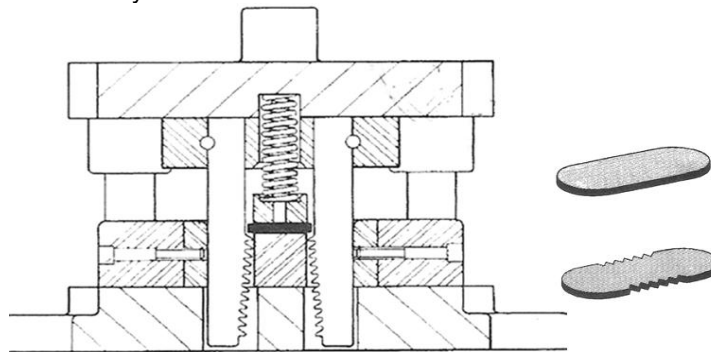
## Shaving

Shaving removes a small amount of material around the edges of a previously blanked stampings or piercing. A straight, smooth edge is provided and therefore shaving is frequently performed on instrument parts, watch and clock parts and the like. Shaving is accomplished in shaving tools especially designed for the purpose.



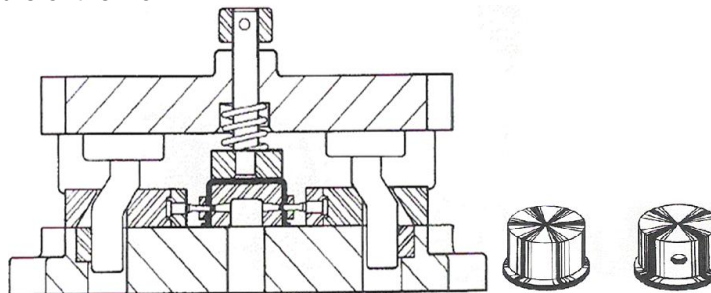
## Broaching

Figure shows serrations applied in the edges of a stamping. These would be broached in a broaching tool. Broaching operations are similar to shaving operations. A series of teeth removes metal instead of just one tooth's in shaving. Broaching must be used when more material is to be removed than could effectively done in with one tooth.



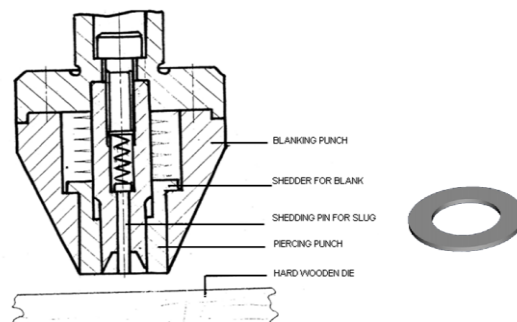
## Side piercing (cam operations)

Piercing a number of holes simultaneously around a shells done in a side cam tool; side cams convert the up and down motion of the press ram into horizontal or angular motion when it is required in the nature of the work.



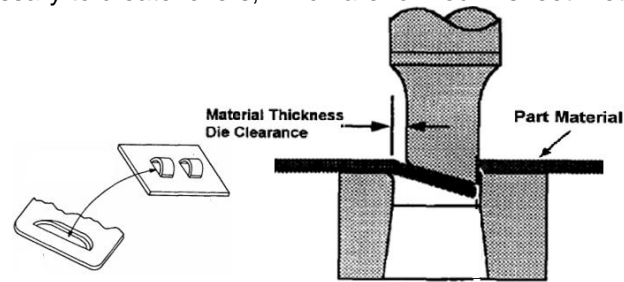
## Dinking

To cut paper, leather, cloth, rubber and other soft materials a dinking tool is used. The cutting edges penetrate the material and cuts. The die will be usually a plane material like wood or hard rubber.



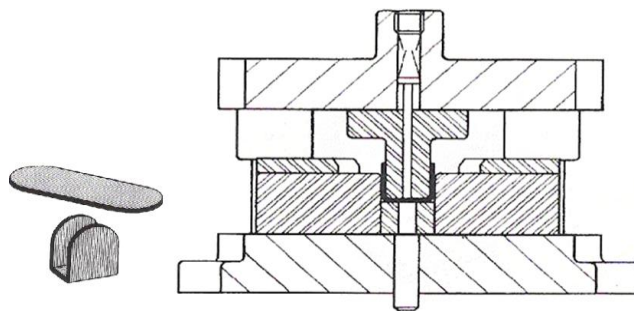
## Lancing

Lancing is cutting along a line in a product without feeling the scrape from the product. Lancing cuts are necessary to create lovers, which are formed in sheet metal for venting function.



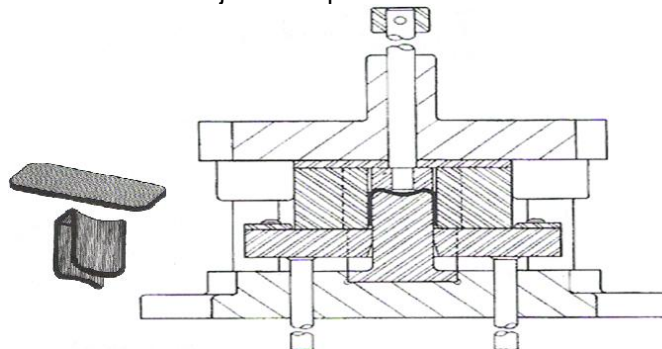
## Bending

Bending tools apply simple bends to stampings. A simple bend is done in which the line of bend is straight. One or more bends may be involved, and bending tools are a large important class of pres tools.



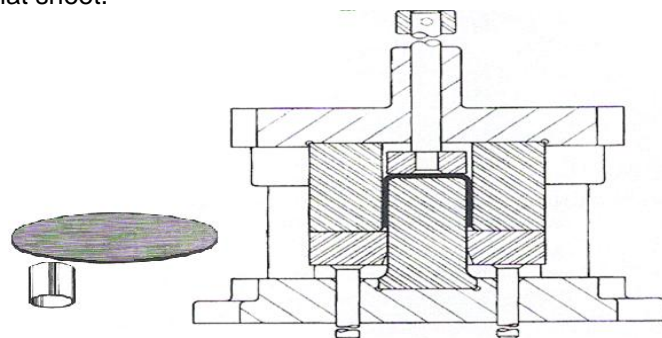
## Forming

Forming tools apply more complex forms to work pieces. The line of bend is curved instead of straight and the metal is subjected to plastic flow or deformation.



## Drawing

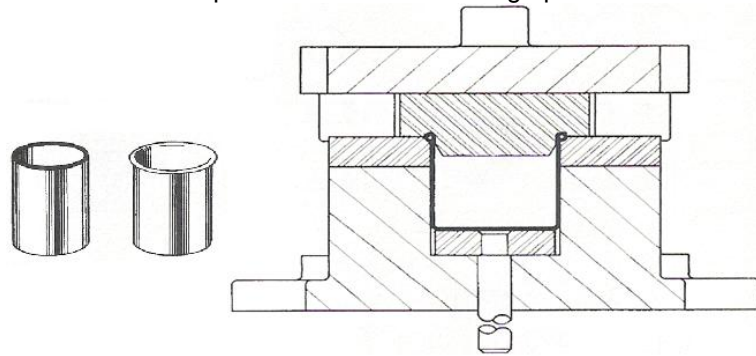
Drawing tools transform flat sheets of metal into cups, shells or other drawn shapes by subjecting the material to severe plastic deformation. Shown in fig is a rather deep shell that has been drawn from a flat sheet.



## Curling

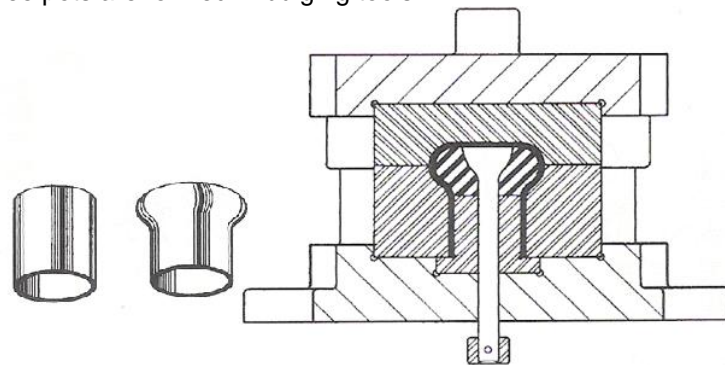
Curling tools curl the edges of a drawn shell to provide strength and rigidity. The curl may be applied over aware ring for increased strength. You may have seen the tops of the sheet metal

piece curled in this manner. Flat parts may be curled also. A good example would be a hinge in which both members are curled to provide a hole for the hinge pin.



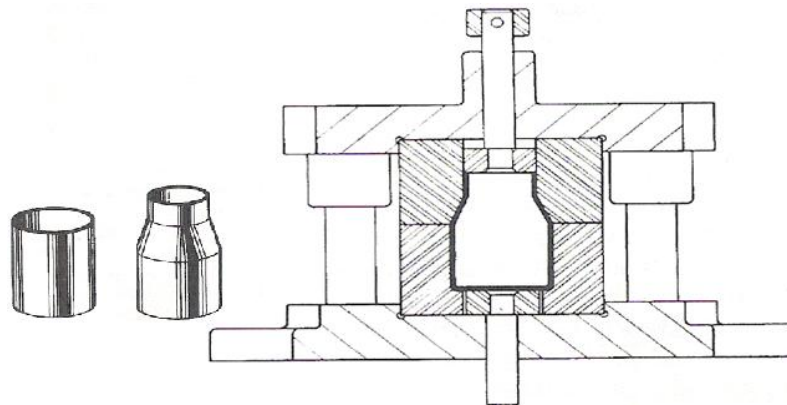
### **Bulging**

Bulging tools expand the bottom of the previously drawn shells. The bulged bottoms of some types of coffee pots are formed in bulging tools



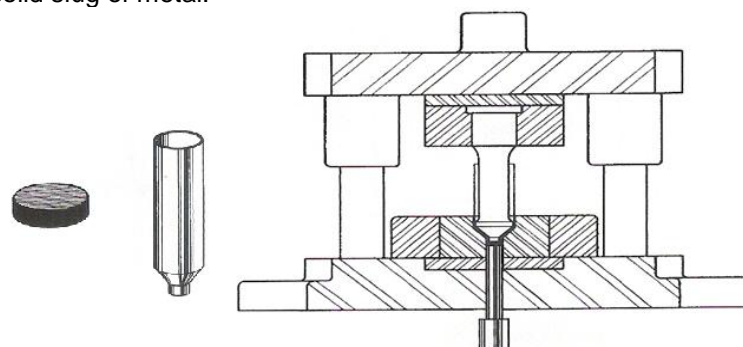
### **Swaging**

In swaging operations, drawn shells or tubes are reduced in diameter for a portion of their lengths.



### **Extruding**

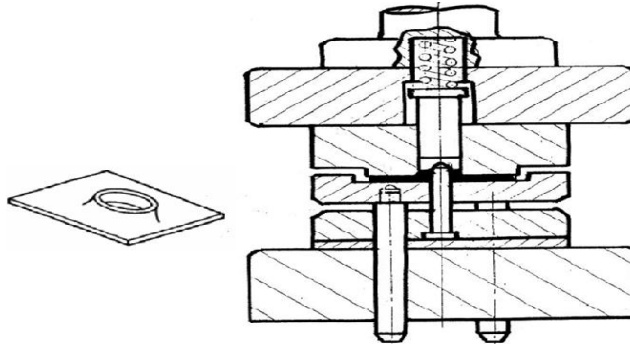
Extruding tools cause metal to be extruded or squeezed out, much as toothpaste is extruded from its tube when pressure is applied. Figure shows a collapsible tool formed and extruded from a solid slug of metal.





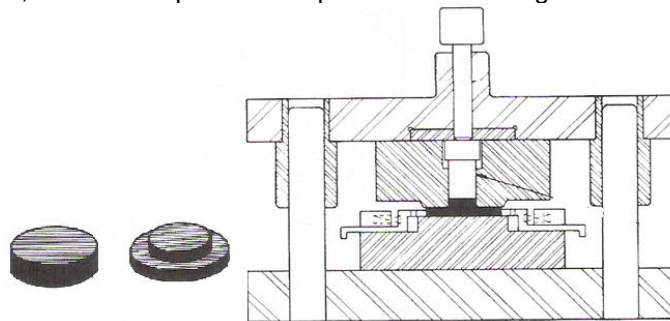
## Flaring, lugging or collar drawing

Flanging or collar drawing is a operation in which a collar is formed so that more number of threads can be provided. The collar wall can also be used as rivet when two sheets are to be fastened together.



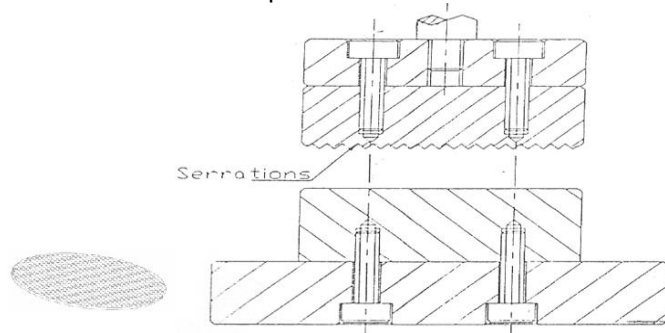
## Cold forming

In cold forming operations, metal is subjected to high-pressure and caused to and flow into a pre determined form. In coining, the metal is caused to flow into the shape of the die cavity. Coins such as nickels, dimes and quarters are produced in coining tools.



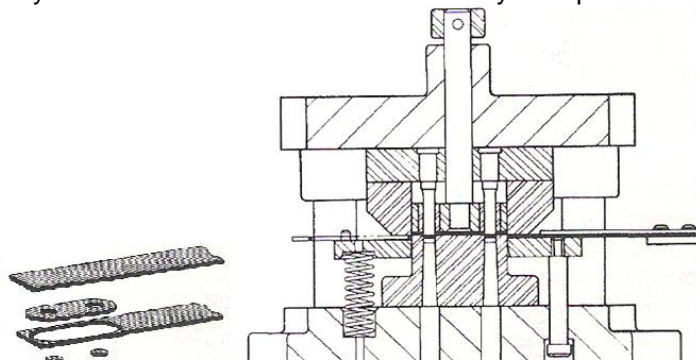
## Planishing

Planishing tool is used to straighten, blanked components. Very fine serration points penetrate all around the surface of the component



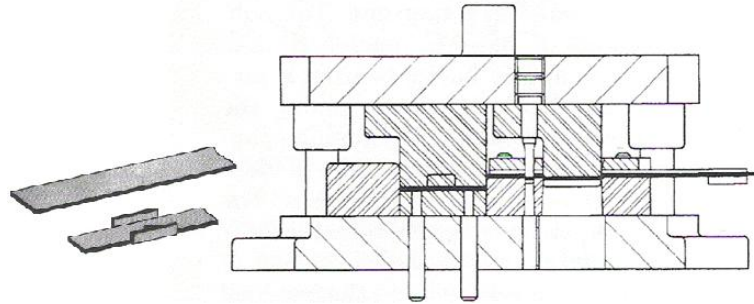
## Compound

Compound tools pierce and blank simultaneously at the same station. They are more expensive to build and they are used where considerable accuracy is required in the part.



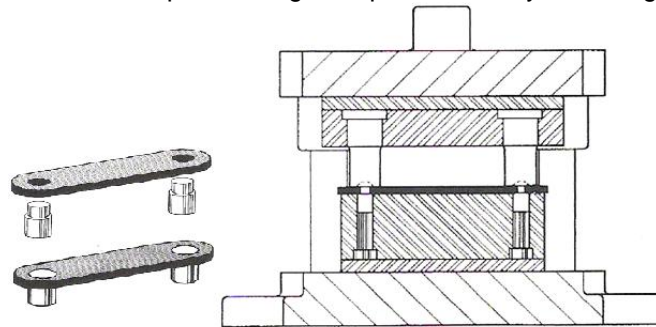
## The Progressive operations

Progressive operations are those in which progressive tools perform work at a number of stations simultaneously. A complete part is cut off, blanked at the final station, with each stroke of the press.



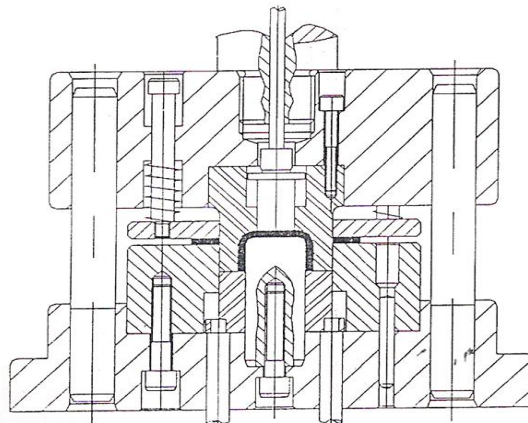
## Assembly tools

Represented is an assembly tool operation where two studs are riveted at the end of a link. Assembly tools assemble the parts with great speed and they are being used more and more.



## Combination tool

In combination tool two or more operations such as forming, drawing, extruding, embossing may be combined on the component with various cutting operations like blanking, piercing, broaching and cut off.



## Sub press operations

Sub press tools are used for producing tiny clock, and instrument components, represented by the watch needles.

Sub presses are special types of tools used only for such precision work. As you study the sections to follow, you will be introduced, step-by-step; to the fundamental die components and you will learn the methods by which die designers assemble these components in designing tools. When you have completed you will know the elements of die design quite thoroughly. Knowledge such as this is well paid for industry. You will have acquired the foundation of a career that can benefit you for the rest of your life.



