

Workshop Technology

Hand Tools

WORKSHOP TECHNOLOGY

Introduction

A hand tool is any tool that is powered by hand rather than a motor.

Hand tools may be divided into two classes:

Non-cutting Tools

Vises, hammers, screwdrivers, wrenches and pliers

Cutting Tools

Hacksaw, files, scrappers, hand taps and reamers



Holding, Striking and Assembling Tools

Bench Vise

- A bench vise is used to hold small work securely for sawing, chipping, filing, polishing, drilling, reaming and tapping operations.
- Vises are mounted close to the edge of the bench; they permit long work to be held in vertical position.
- Vises may be made of cast iron or cast steel.
- To grip finished work or soft materials, use jaw caps made of brass, aluminum, or copper to protect the work surface from being marred or damaged.



Figure: Bench Vise

Holding, Striking and Assembling Tools

Clamps

C-clamps are more portable and versatile than vises, but do not hold the complete work stationary.



Figure: Different types of clamps

Holding, Striking and Assembling Tools

Hammers



Holding, Striking and Assembling Tools

Ball-peen hammer

- Ball-peen hammers are made in variety of sizes, with head masses ranging from 2 ounces to 3 pounds ($1\text{ kg} = 2.20462\text{ lbs}$).
- The small sizes are for layout work and larger sizes for general work.
- Used by shop servicemen for riveting and concave indentations.

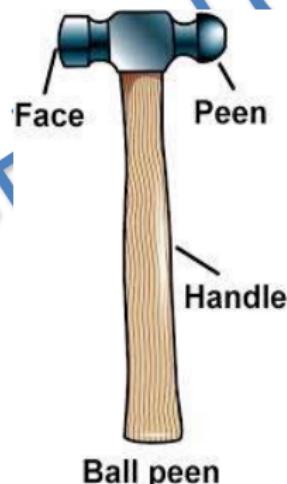


Figure: Ball-peen hammer

Holding, Striking and Assembling Tools

Cross peen hammer



Straight peen hammer



Used for making grooves, cross indentations

Used for making grooves and straight indentations

Holding, Striking and Assembling Tools

Soft faced hammer or Mallet

- Soft faced hammers are made of plastic, rawhide, copper, or lead.
- They are used in assembling or dismantling parts so that finished surface of work will not be damaged.



Holding, Striking and Assembling Tools

Claw hammer



Used for removing pins

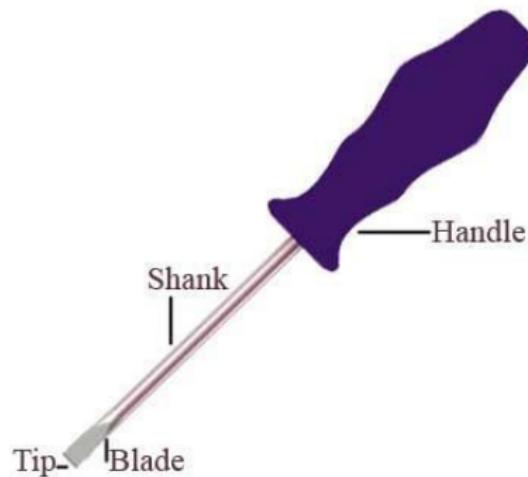
Sledge hammer



Used for heavy works

Holding, Striking and Assembling Tools

Screwdrivers



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Holding, Striking and Assembling Tools

Types of screwdriver



Holding, Striking and Assembling Tools

Offset screwdriver

- An offset screwdriver is bent at the ends and used similar to a wrench
- It is used to install or remove fasteners that do not have enough space above to use a conventional screwdriver.



Figure: Offset screwdriver

Holding, Striking and Assembling Tools

Wrenches

- Many types of wrenches are used in machine shop work, each suitable for a specific purpose.
- The name of the wrench is derived from its use, shape, or construction.



Figure: Wrenches

Holding, Striking and Assembling Tools

Open-end wrench

- The opening of these wrenches are usually offset at a 15° angle to permit turning bolt head in limited spaces.
- It may be single-ended or double-ended.



Holding, Striking and Assembling Tools

Box-end wrench

- The box-end wrenches have a precisely cut notches around the inside face, which fit closely over the points on the outside of nut or bolt head.
- These type of wrench cannot slip when correct size is used.



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Holding, Striking and Assembling Tools

Combination wrench



Consists of a box wrench on one end and an open-end wrench on the other.

Socket wrenches



Similar to box wrenches in that they are usually made with 12 points and surround the nut.

Holding, Striking and Assembling Tools

Adjustable wrench



- May be adjusted within a certain range to fit several size of nut or bolt head.
- This particular wrench is useful for odd size nuts or when another wrench of proper size is not available.

Allen set screw wrenches



Are hexagonal and fit into the recesses of socket head setscrews.

Holding, Striking and Assembling Tools

Punches

Punches are used to mark the center of a point. It is usually used to mark the center of a hole when drilling holes. A center punch forms a large enough dimple to guide the tip of the drill.

- Center Punch
- Prick Punch
- Automatic Center Punch

Note

Larger angle of punch is used for hard metal punching and smaller angle punch is used for soft metal punching.



Figure: Center punch

Holding, Striking and Assembling Tools

Prick Punch



Automatic Center Punch



Holding, Striking and Assembling Tools

Scriber

A **scriber** is a hand tool used in metal work to mark lines on workpieces, prior to machining.

- Double end scribe
- Plain scribe
- Pocket scribe

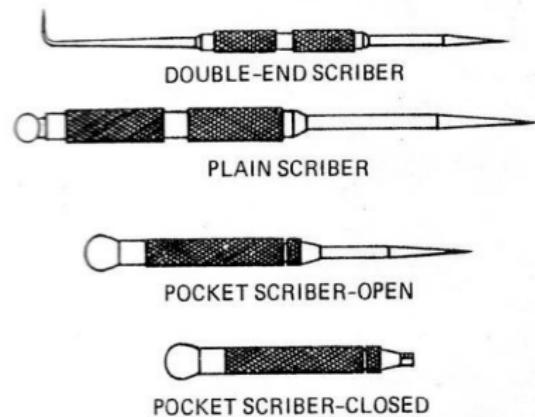


Figure: Types of scribes

Holding, Striking and Assembling Tools

Pliers

Pliers are used for **gripping** and **holding** small parts for certain machining operations.



Pliers

2GY

Combination or slip-joint pliers

Adjustable, used to grip both large and small work pieces.



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Pliers

2GY

Side-cutting pliers

Used mainly for
cutting, gripping, and bending of
small diameter rods or wires.



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Pliers

2GY

Needle-nose pliers

Used for holding small parts, for positioning them in hard-to-get-at places, and for bending or forming wire.

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Pliers

2GY

Diagonal cutters

Used solely for cutting wire and small pieces of soft metal



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Pliers

2GY

Vise-grip pliers

Provide extremely **high gripping power** because of the adjustable lever action



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Cutting Tools

Files

A file is a hand cutting tools made of high-carbon steel, having a series of teeth cut on its body by parallel chisel cut.

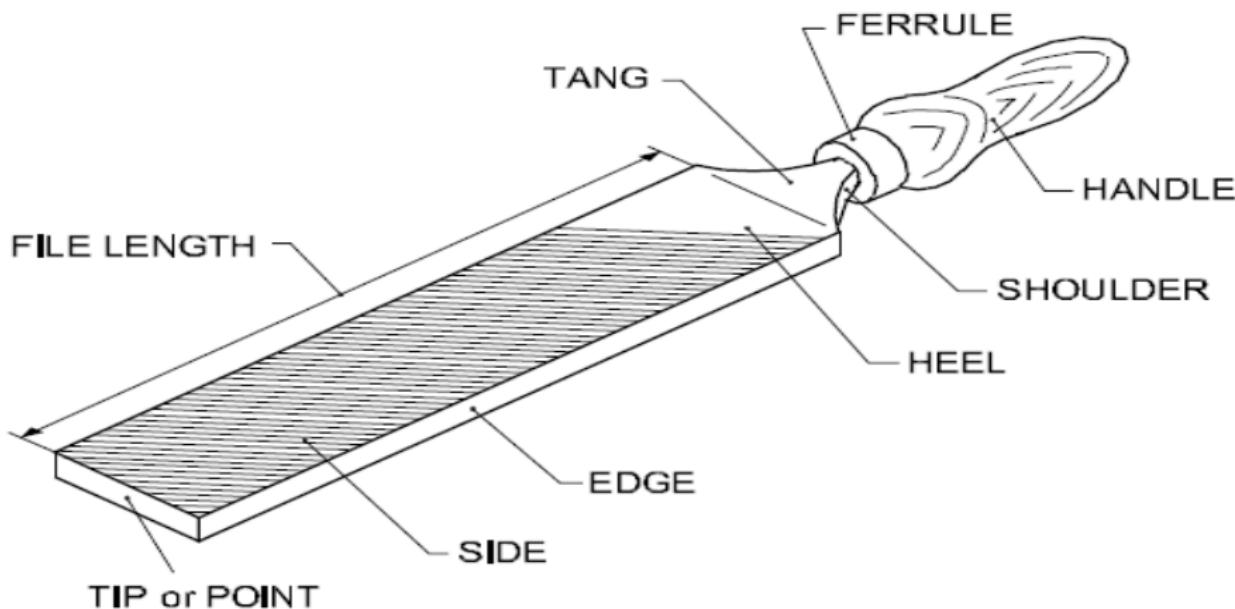
Files are used to remove surplus metal and to produce finished surfaces

Files are manufactured in a variety of types and shape, each for specific purpose.



Cutting Tools

Parts of file

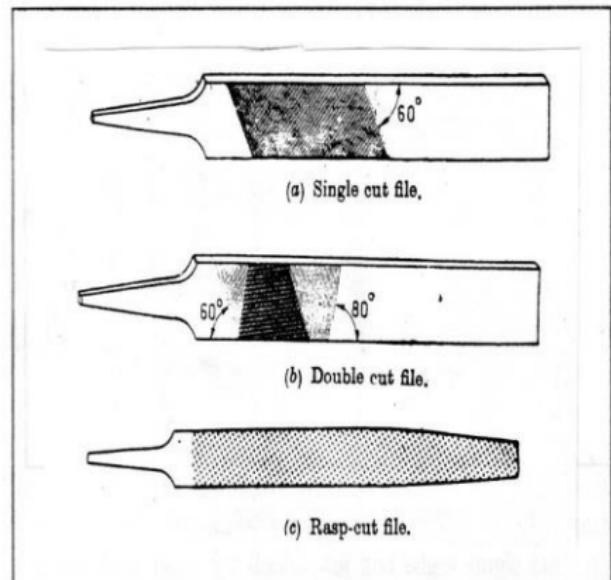


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Cutting Tools

Classification of files According to cut of files

- Single cut 60° for hard metal
- Double cut $60^\circ \times 80^\circ$ for soft metal
- Rasp cut for wood, shoes etc.

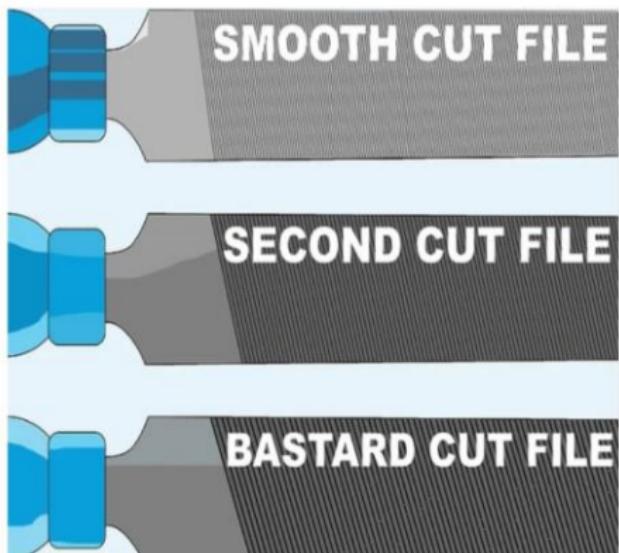


Cutting Tools

Degree of coarseness

VERY SMOOTH
↓
SMOOTH
↓
SECOND CUT
↓
BASTARD
↓
ROUGH

Determine the degree of coarseness needed



Cutting Tools

Hand File:

The common file used for roughing and finishing. It is a rectangular in section and parallel in width. It has double cut teeth on two faces and single cut on one edge and one save edge.



Figure: Hand file

Cutting Tools

- **Triangular File:** It is triangular in section, with tapered towards the tip with double cut on both faces. It is used for filing corners or angles less than 90°



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Cutting Tools

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- **Square File:** It is square in section, with tapered towards tip, and usually double cut on all four faces. It is used for rectangular slots or grooves.



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Cutting Tools

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- **Round File:** It is of round section. It is used for enlarging holes, producing internal round corners.



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- **Round File:** It is of round section. It is used for enlarging holes, producing internal round corners.
- **Flat File:** It is of rectangular in section, tapered slightly in width and thickness towards to the tip. It has double cut on two faces and single cut on two sides.



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- **Flat File:** It is of rectangular in section, tapered slightly in width and thickness towards to the tip. It has double cut on two faces and single cut on two sides.
- **Half round File:** The section is chord of circle. It is used for forming radii, grooves, etc. and the flat side is used for finishing flat surfaces.



Cutting Tools

Needle File:

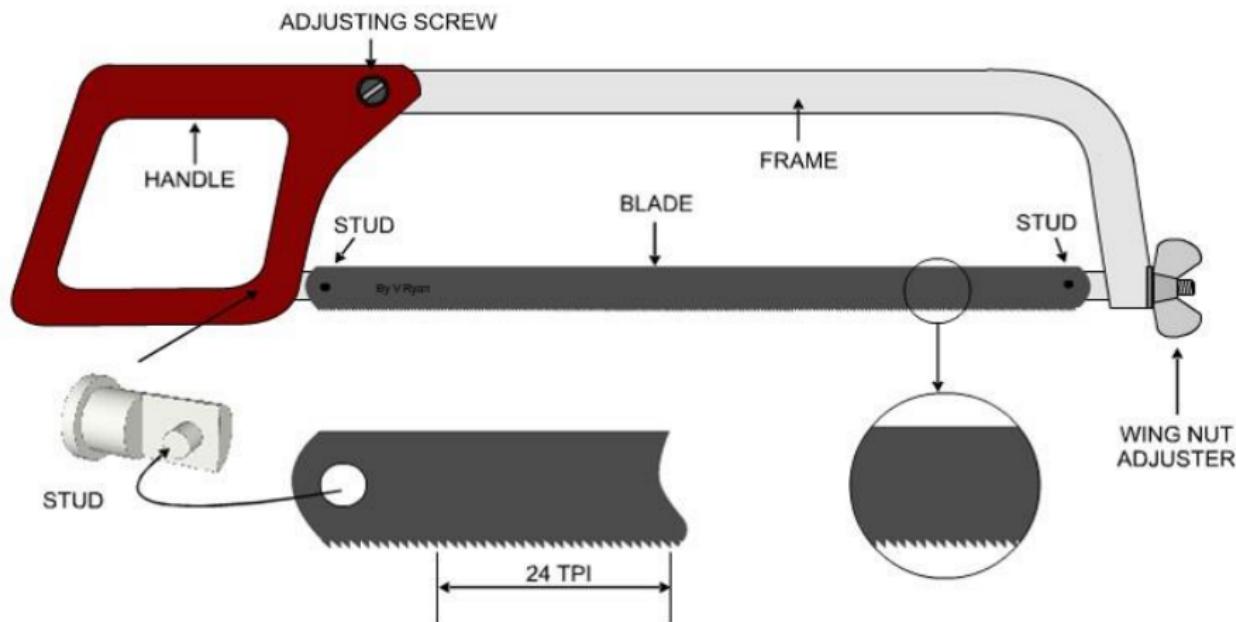
Needle files are a set of small files with their shapes made in a way similar to the large ones. They are generally used for small and delicate works such as the repair of small instruments.



Figure: Needle file

Cutting Tools

Hacksaw



Cutting Tools

Hacksaw Choice of blades

DGY

Teeth per inch	uses
14	Machine steel, structural steel
18	Aluminum, cast iron ,tool steel , high speed steel (HSS)
24	Tin, Copper, Brass, and sheet metal above 18 gauge
32	Tubes, sheet metal below 18 gauge

Note: thinner metal required more teeth per inch

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Cutting Tools

Hacksaw

Tooth Form

Tooth forms refer to the shape and pattern of the saw teeth.

- **Standard(regular) tooth form:** The standard blade or regular tooth form has large radii in the gullet area of the saw teeth and zero rake angle.

Well suited for general cutting of many types of steel and will give an accurate cut and good surface finish.

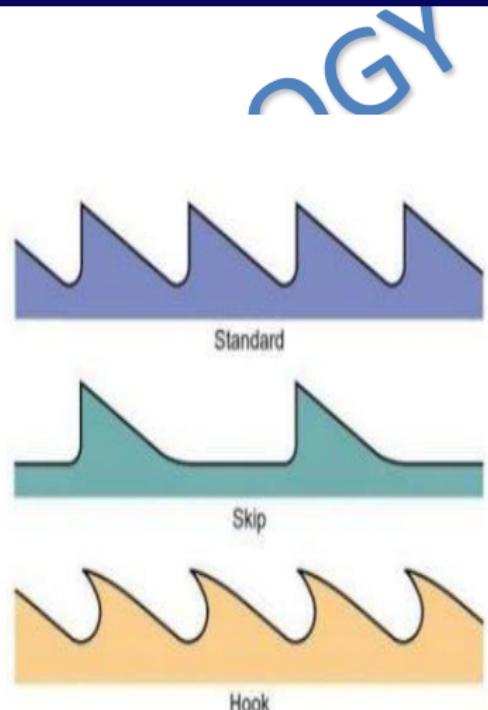


Figure: Tooth form

Cutting Tools

Hacksaw

Tooth Form

- **Skip tooth form:** Every other tooth on the skip tooth blade has been omitted.

This opens up the area between the adjoining saw teeth, allowing some additional room for chip clearance.

Mainly used to cut softer materials such as aluminum and brass where higher blades speeds are often used that also create a higher volume of chips.

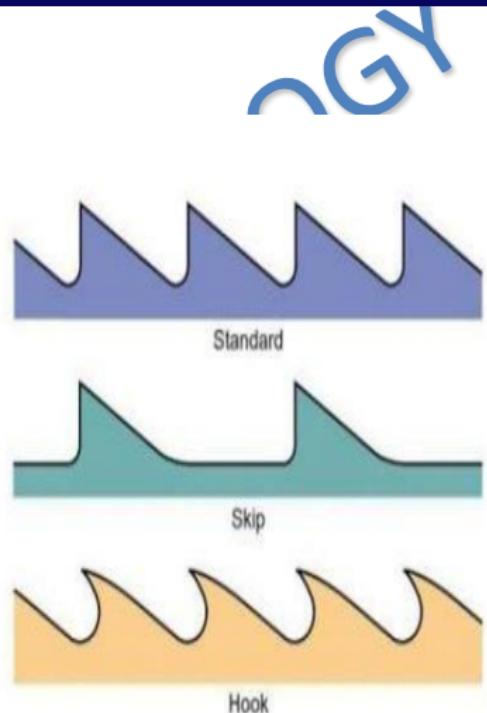


Figure: Tooth form

Cutting Tools

Hacksaw

Tooth Form

- Hook tooth form:** Positive rake angle (shaped like a hook) and large gullet area.
Has a built-in chip-breaker design ideal for cutting softer materials that commonly cause chips to stick in the saw blade teeth, such as aluminum and copper.

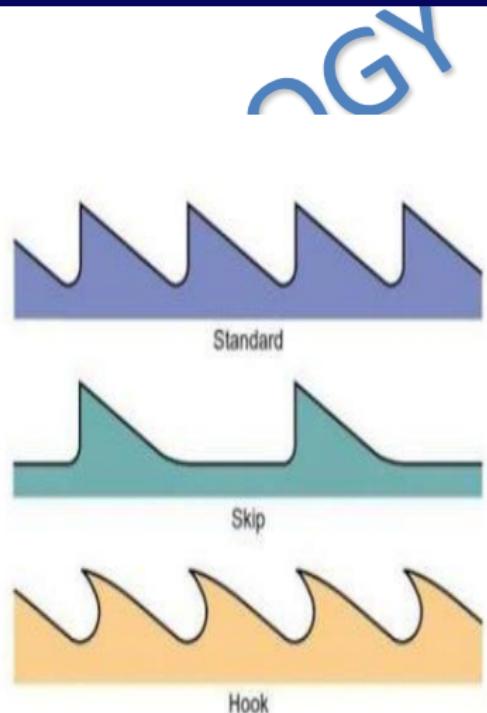


Figure: Tooth form

Cutting Tools

Hacksaw Tooth Set

- Staggered arrangement of the saw teeth.
- To provide clearance for the saw blade body as it travels through a workpiece.
- To make kerf wider than the blade so that blade move through the cut freely without binding or excessive frictional resistance, thus reducing the heat generated.

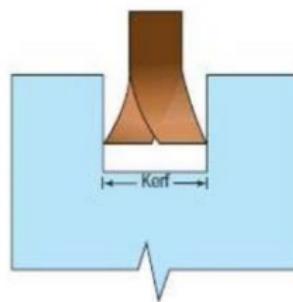
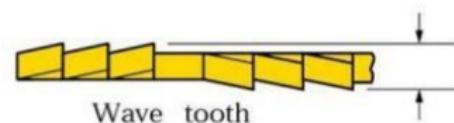
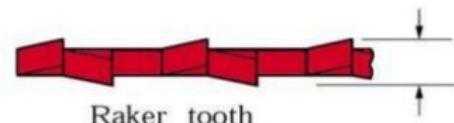


Figure: Tooth set

Cutting Tools

Tooth Set

- **Straight set:** Teeth are offset alternatively to right or left. Suitable for non-ferrous metals and non-metals.
- **Raker set:** One straight tooth is followed by two teeth set in opposite direction.
Used for most steel and cast iron cutting.
- **Wavy (circular) set:** Several teeth are offset in one direction and then several other teeth are offset in opposite direction.
Employed with small teeth. Used for sawing thin sheets and sections.



Cutting Tools

Taps and Dies

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Cutting Tools

Taps

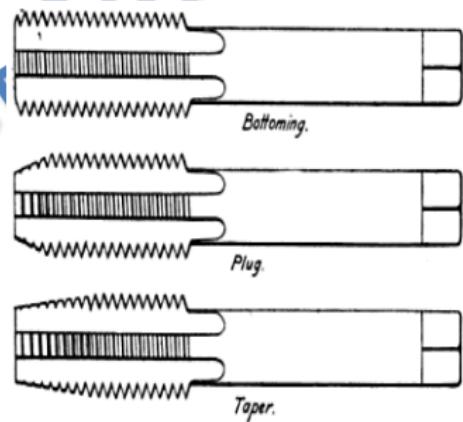
- Taps are cutting tools used for making **internal threads**
- Taps are made of **carbon steel or high speed steel (HSS)** and are carefully hardened and tempered for long life.
- Taps are quite brittle and are easily damaged if not handled properly.



Cutting Tools

Set of hand taps

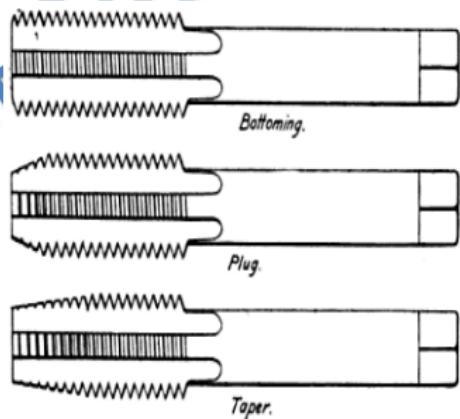
- **Taper tap:** Tapered from end approximately six threads.
Used to start a thread easily.



Cutting Tools

Set of hand taps

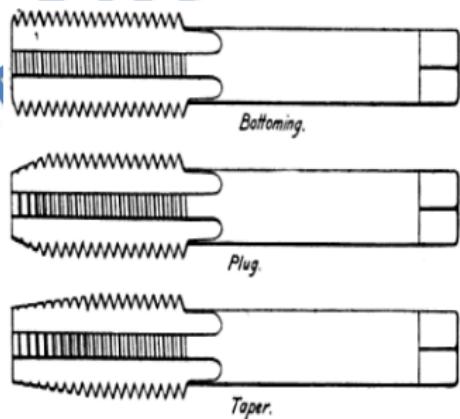
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- **Plug or Intermediate tap:** Tapered for approximately three threads.
Used to thread a hole going through a work piece.



Cutting Tools

Set of hand taps

- **Taper tap:** Tapered from end approximately six threads.
Used to start a thread easily.
- **Plug or Intermediate tap:** Tapered for approximately three threads.
Used to thread a hole going through a work piece.
- **Bottoming tap:** Not tapered but chamfered at the end for one thread.
Used for threading to the bottom of a blind hole.



Cutting Tools

Tools used for holding taps



Figure: Chuck pattern tap wrench

Figure: Adjustable tap wrench

Cutting Tools

Dies

Threading dies are used to cut **external threads** on round work.

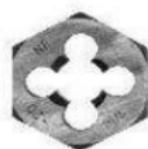


Cutting Tools

Types of dies

Solid die

Used for chasing or re-cutting damaged thread



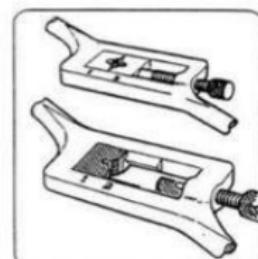
Adjustable split die

Has an adjustment screw that permits an adjustment over or under the standard depth of the thread.



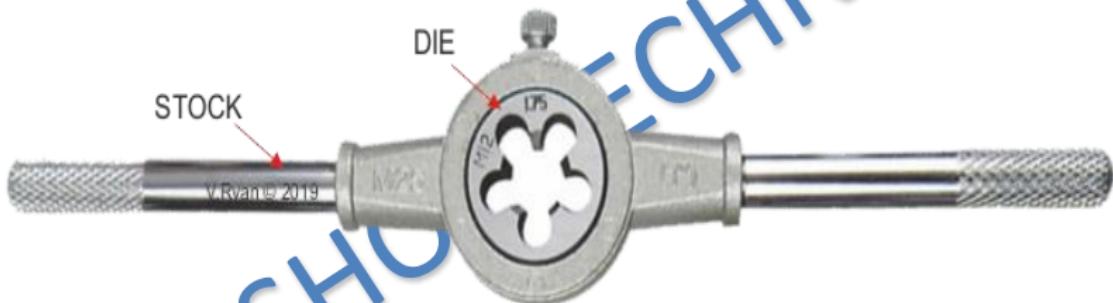
Half die

Half dies have the advantage of taking smaller cuts to reach correct size, so the amount of material taken off can be controlled



Cutting Tools

Die Stock



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Cutting Tools

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Snips or Shear

Used for cutting sheet metal.

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