

STUDY OF DIFFERENT HAND TOOLSOBJECT

To study and observe the different carpenter's and fitter's hand tools and measuring tools used in engineering practice for executing the operation of chipping, filing, marking, sawing, drilling, tapping, dyeing etc.

JOB

Sketch with specification and use of different hand tools as given below

a) *Marking tools and equipments :*

- i) Scale, ii) Tri-square, iii) Divider, iv) Chalk pencil , v) Dot punch, vi) Claw Hammer
vii) Marking Gauge etc.

b) *Cutting tools and equipments :*

- i) Hack saw (12" long), ii) Flat File (second cut, 10" long), iii) Triangular file (8" long), iv) Twist Drill V) Tap set vi) Tap Wrench vii) Dye viii) Dye Handle ix) Hand saw, x) Flat chisel (1" & $\frac{1}{2}$ "), xi) Mortise Chisel (1/4"), xii) Rasp file xiii) Hand planner xiv) Tennon saw , vii) Mallet etc.

c) *Finishing tools and equipments :*

- i) Flat File smooth ii) Rasp file iii) Emery Paper

d) *Work and tool holding device :*

- i) Fitter's Bench Vice ii) Carpenter's bench vice



Figure 16.3 Steel rule

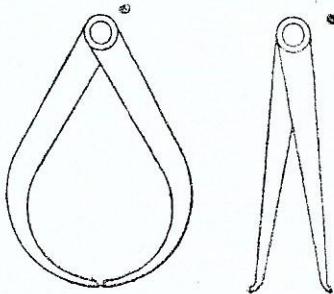


Figure 16.4
Outside caliper

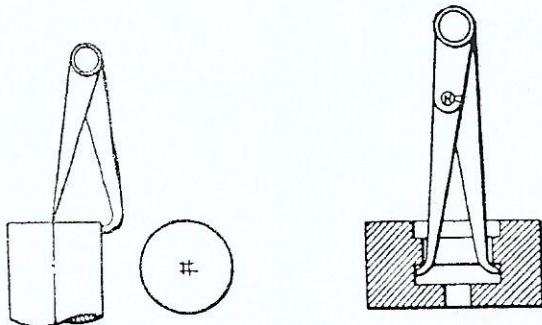


Figure 16.5
Inside caliper

Hermaphrodite caliper

Figure 16.8 Transfer caliper

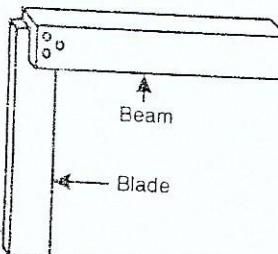


Figure 14.30 Try square

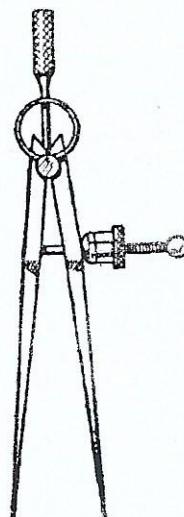


Figure 16.9 Divider

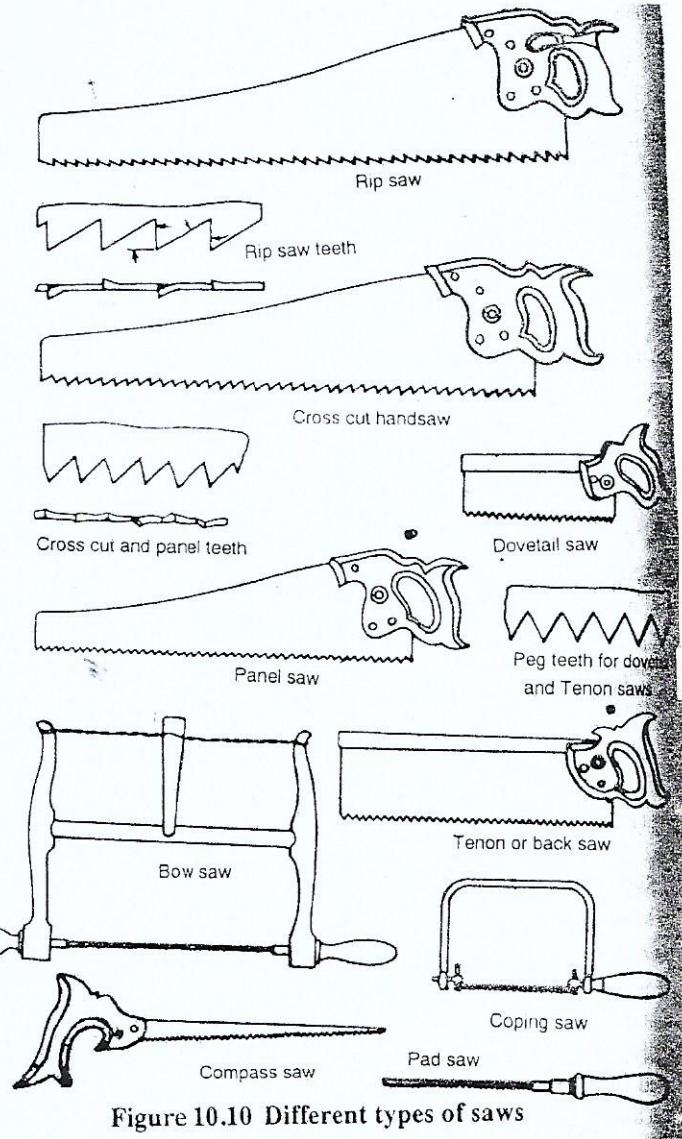


Figure 10.10 Different types of saws

Figure 10.30 Mallet

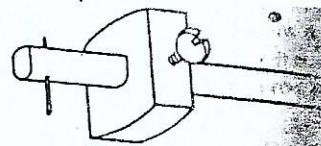


Figure 10.7 Marking gauge

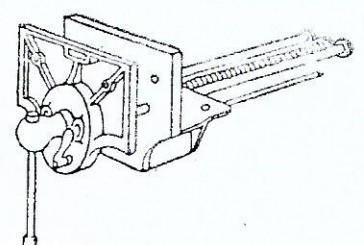
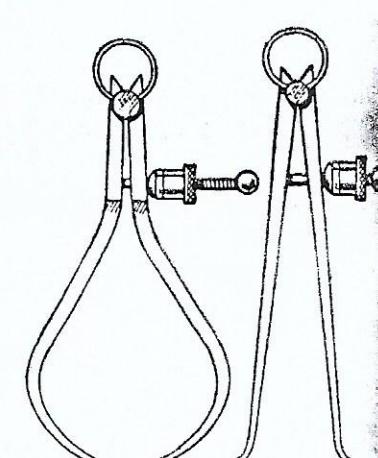
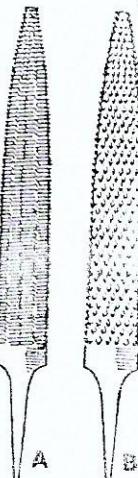


Figure 10.31 Bench vice



Outside caliper

Figure 16.6 Spring caliper



Inside caliper

Figure 10.36 Rasp and file

Spring caliper

Figure 10.36 Rasp and file

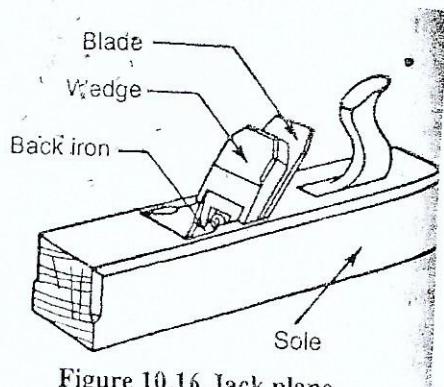


Figure 10.16 Jack plane

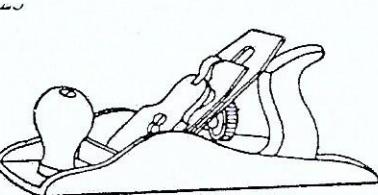


Figure 10.23 Metal jack plane

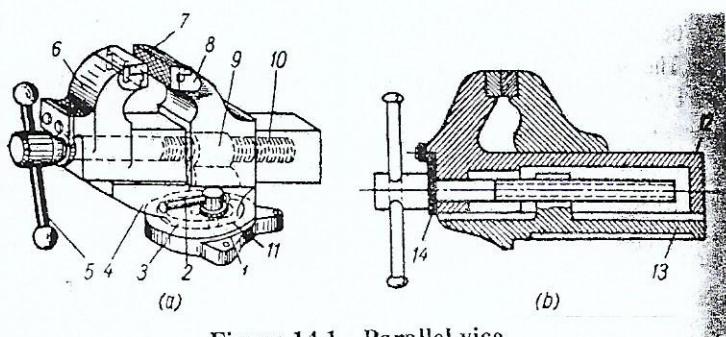


Figure 14.1 Parallel vice

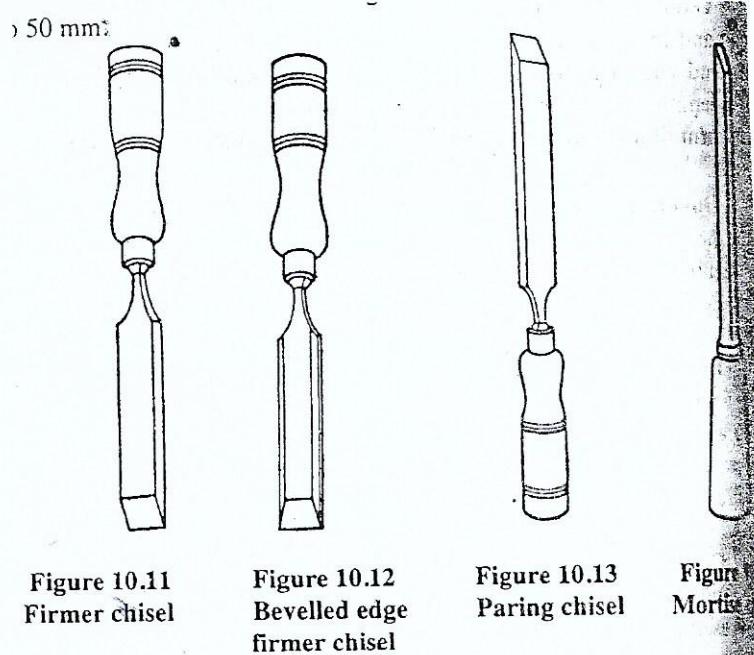


Figure 10.11
Firmer chisel

Figure 10.12
Bevelled edge
firmer chisel

Figure 10.13
Paring chisel

Figure
Mortise

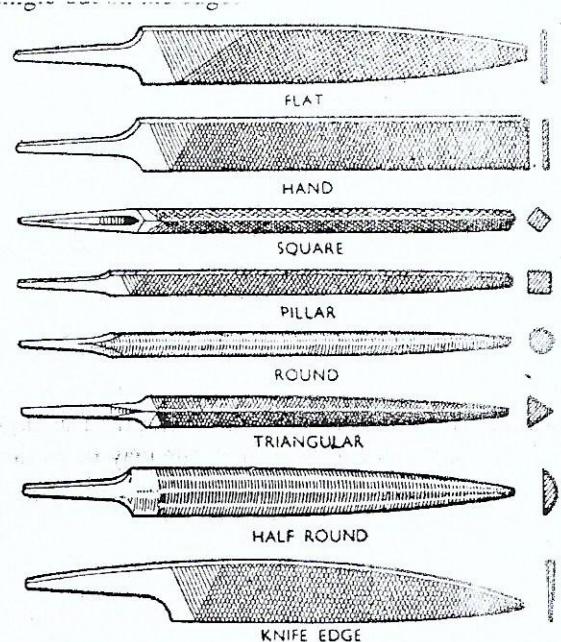


Figure 14.16 Shapes of file

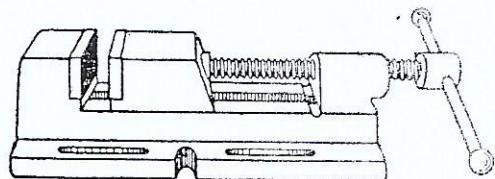


Figure 14.5 Toolmaker's vice

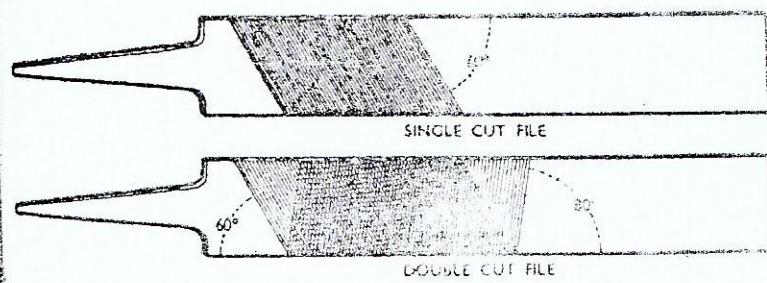


Figure 14.15 Single-cut and double-cut of a file

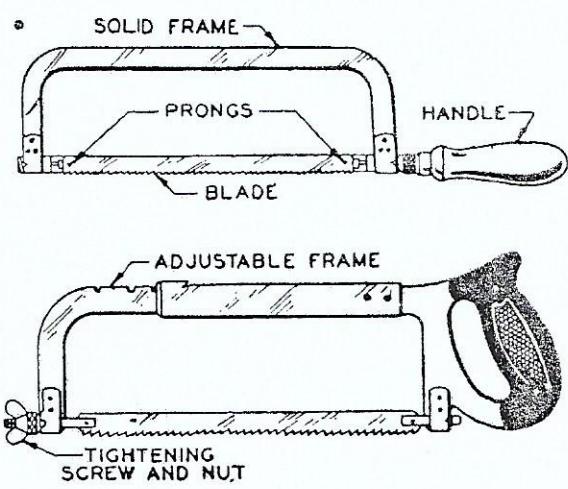


Figure 14.21 Different parts of a hand saw

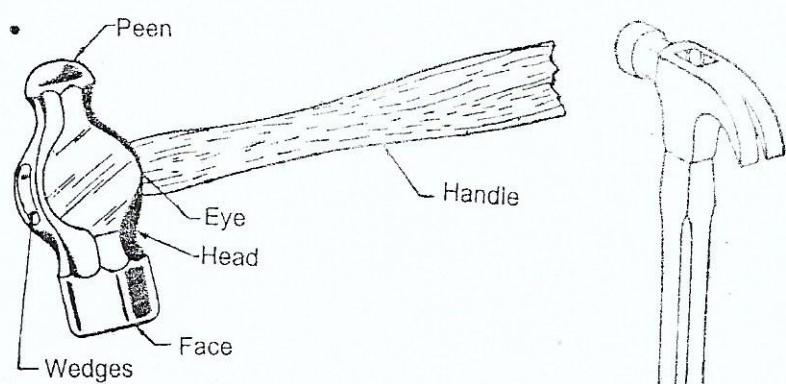


Figure 14.6 Hand hammer

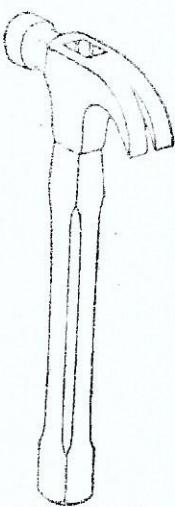


Figure 10.29 Claw Hammer

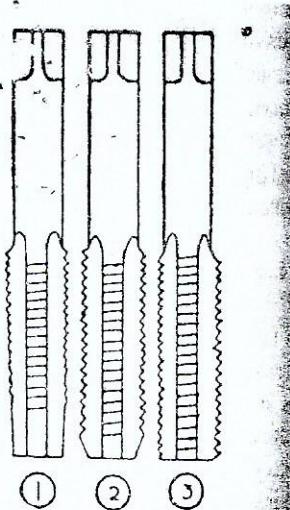


Figure 14.39 Types of hand taps

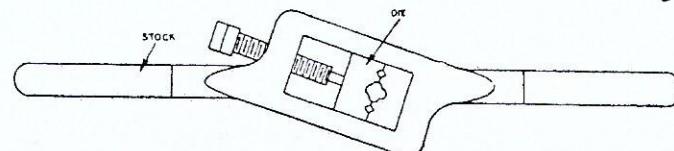


Figure 14.42 Die stock and dieing

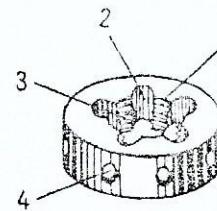


Figure 14.40 Solid die

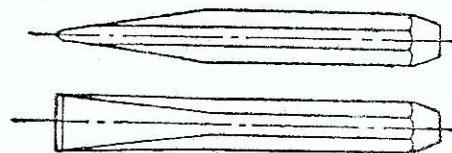


Figure 14.8 Flat chisel

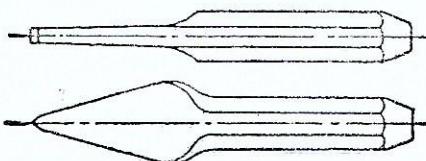


Figure 14.9 Cross-cut chisel

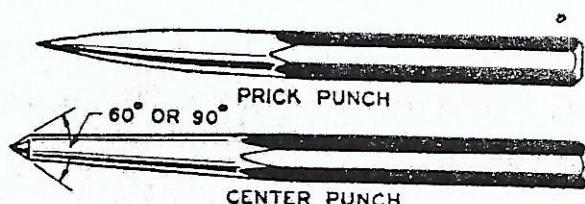


Figure 14.28 Punch

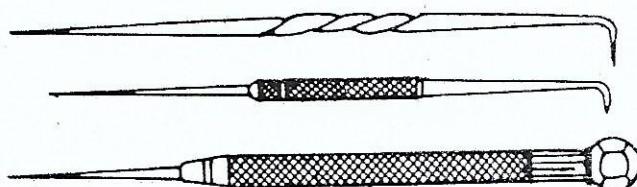


Figure 14.27 Scriber

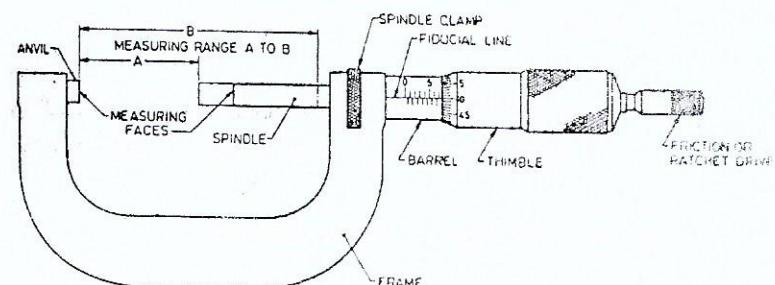


Figure 16.12 Different parts of an external micrometer (metric)

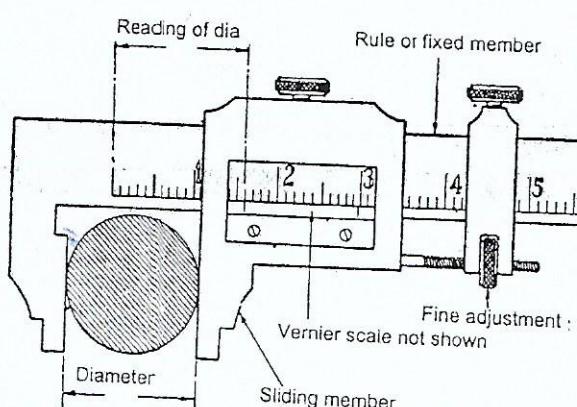


Figure 16.18 Vernier caliper

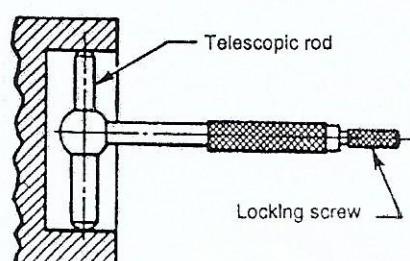


Figure 16.10 Telescopic gauge

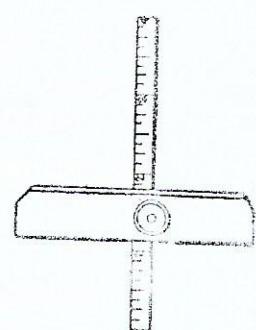


Figure 16.11 Depth gauge

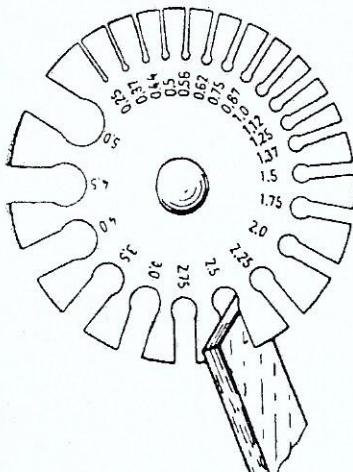


Figure 16.52 A plate gauge

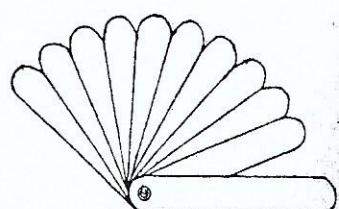


Figure 16.51 Feeler gauge

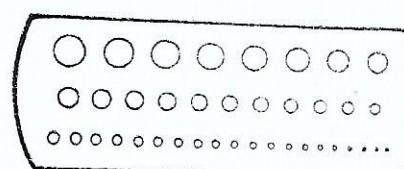


Figure 16.53 A wire gauge

HAND TOOLS USED IN FITTING WORKS

MEASURING TOOLS AND EQUIPMENTS:

STEEL RULE- Steel Rule is a standard direct measuring instrument in the shop, graduated to the same size according to the standardization in English and or Metric units, used to measure the actual dimensions to the accuracy of 0.5 mm or 1/64 of an inch. It is made of steel thin sheets. It is available in the lengths of 150 and 300 mm (6 inch, 12 inch and 24 inch) in general.

OUT SIDE CALIPER- It is an inwards bent two legged measuring instrument used to measure outside dimensions.

IN SIDE CALIPER- It is an outwards bent two legged measuring instrument made of steel, hardened and tempered. It is used to measure inside dimensions like hole, slot etc.

TRY SQUARE- A Try Square is a marking and checking instrument of right angles. It is made of two parts, a beam and a blade fixing right angles to one another. It is used to check-up the accuracy of right angles 90° on external and internal surfaces and to find the even flatness to right angles.

MARKING TOOLS AND EQUIPMENTS:

ODD LEG CALIPER- This caliper is extremely used for scribing lines parallel to the edge of the work and for finding the centers of the cylindrical work. It has one pointed leg like a divider and one bent leg. It is also called Harmophrodite Caliper.

PUNCH- Punch is made of tool steel, hardened and tempered used to make a small pointed impression on metal surfaces particularly for marking purposes and to locate the centre of a drilling point etc. Two types of punches are used: 1. Prick punch or Dot punch 2. Centre punch.

SCRIBER- A scriber is a piece of hardened steel pointed tool like needle and it is required to scratch or scribe lines on metals.

DIVIDER- A divider is a two legged steel instrument with hardened points, used for scribing circles, arcs, dividing the straight or curved lines into parts, finding center of a round stock and to transfer the measurement from rule to job.

SURFACE PLATE- Surface Plate is made of gray cast iron and used as a base for marking purpose and also used for testing the flatness of work itself.

V- BLOCK- It is a rectangular or a square block made of cast iron having V- shaped grooves on both opposite side. It is used as a fixture to hold the rounds while measuring, marking and drilling.

HAMMERING OR BLOWING TOOLS:

HAMMER- Hammer is commonly used for striking purposes to give heavy blows for production of a certain degree of movement. Different sizes/shapes/types of hammers are used for different suitable purposes. They are Ball peen hammer, Cross peen hammer, Straight peen hammer and Soft hammer. It is made of forged steel/medium or high carbon steel. A hammer consists of four parts namely Peen, Head, Eye, and Face.

WORK AND TOOL HOLDING DEVICES:

VICE- Vice is the most common device made of mild steel, used for holding the work/job/tool for different types of operations like bench work, fitting etc. Various types of Vices are used for various purposes. They are Bench Vice, Leg Vice, Pipe Vice, Hand Vice, and Toolmaker's Vice etc. The size of a Vice is known by the width of its Jaws.

VICE CLAMPS- The vice clamps are used to save the finished part from damaging.

CUTTING TOOLS AND EQUIPMENTS:

CHISEL- Chisel is commonly used for chipping/cutting metals, cutting oil grooves, cutting key-ways etc. It has a cutting edge at one end. The cutting edge of the chisel is hardened and tempered properly. It is made of carbon steel. It is generally specified by the length and width of the cutting edge. Various types of Chisels are used for various purposes they are namely Flat Chisel, Cross cut Chisel, Half round Chisel, Diamond point Chisel etc.

FILE File is a most common hand cutting tool of teeth surfaces made of cast steel, used to remove small quantity of metals on flat surfaces to get a smooth surface and also for fitting purposes. There are many types of file used for different purposes. They are Flat file, Square file, Round file, Half round file, Triangular file, Knife file etc. The main parts of a file are Tang, Heel, Face, Edge and Point. A file is specified by length, shape, roughness and cut of teeth. (Say 12" flat bastard double cut). Files are divided according to the coarseness (roughness) namely, Rough, Bastard, Second cut, Smooth, Dead smooth, Super smooth etc.

HACK SAW Hack saw is used to cut metal parts such as rods, flats and making a thin metal part in two pieces etc. A hand hacksaw consists of a Blade, Frame, Handle, Prongs, Tightening screw and Wing nut. Hacksaw frame is of two types. They are Solid frame and Adjustable frame. Hacksaw blades are made of high carbon steel or high speed steel. The length of the blade is the distance between the centers of the holes at each end. Hack saw blades are available of 14 teeth, 18 teeth and 24 teeth to an inch for different types of work.

SCRAPER- Scraper is a hand cutting tool used for scraping on flat, concave, angular soft surfaces like Bearing, Bush etc. to reduce very small quantity of metal to reduce friction and or to get a smooth surface. It is made of high quality forged steel having very hard cutting edges. Depending on the nature of work to be done, Scraper is of three types. They are Flat scraper, Triangular scraper, Half round Scraper.

REAMER- Reamer is a side cutting tool made from cast steel/high speed steel, used to remove a little metal from a drilled hole for enlarging the size or to bring it to the correct size or to get a smooth finished inside surface after drilling hole.

DRILL A Twist Drill is an end cutting tool used for making round holes on metal/wood. It is made from High Speed Steel or High Carbon Steel.

TAP- The Taps are used to make internal screw threads in parts like Nut etc. It is made of hardened and tempered tool steel/carbon steel/high speed steel. The taps are usually available in sets of three. The first tap has long taper end and less number of threads. The second tap has less taper end and more number of threads than first tap. The third tap or final tap has parallel diameter and full number of threads (cutting edge).

DIE- Dies are used for cutting external threads on round metal rod or bolt etc. It is made of hardened steel. There are two types of dies in common use namely Solid die and Adjustable die/Split die. The size of a die is specified by the outside diameter of the thread to be cut and pitch of the thread.

PRECISION TOOLS AND EQUIPMENTS:

MICROMETER Micrometer is a precision measuring instrument used to measure small and fine various dimensions by using various types of Micrometer in English and Metric units. Outside micrometer is used for measuring the outside dimensions of round or flat jobs to an accuracy of 0.001" or 0.01mm. Inside micrometer is used for taking minute measurements of inner dimensions in the holes, slots etc. with a great accuracy of 0.001" and 0.01mm which cannot be measured with a rule or calipers. Depth micrometer is used for measuring depth of holes, slots to an accuracy of 0.001" and 0.01mm. Micrometer is available in the range of 0"-1", 1"-2".

VERNIER CALIPER Vernier Caliper is a multipurpose precision measuring instrument used in a machine shop for measuring outside, inside, depth dimensions up to 200 mm very quickly with a great accuracy which cannot be measured with a rule or calipers. Vernier calipers are normally available in 6", 12" and 18" length.

HAND TOOLS USED IN CARPENTRY

MEASURING AND MARKING TOOLS AND EQUIPMENTS:

STEEL TAPE: - It is made of steel. Millimeter (mm) and Centimeter (cm) marking on one edge and inches ("') marking on another edge. It is used for taking direct accurate dimensions on the job. It is available in the market in length of 1 meter and 2 meter.

MARKING GAUGE: - Marking Gauge is used for marking lines parallel to a face or an edge. Its parts are a) Stock b) Stem c) Thumb screw.

PENCIL: - Used for drawing lines in the setting out the shapes of parts of the job.

TRY SQUARE: A Try Square is a marking and checking instrument of right angles. It is made of two parts, a beam and a blade fixing right angles to one another. It is used to check-up the accuracy of right angles 90° on external and internal surfaces and to find the even flatness to right angles.

HAMMERING TOOLS:

MALLETS: - It is used for driving chisel handle as well as assisting in assembling jobs. It is also called as wooden hammer.

CLAW HAMMER: - It is used for where heavy hammering is necessary to drive large nails. Useful size of this Hammer is normally 0.45 to 0.57kg. It is also has claws for extracting nails.

WORK AND TOOL HOLDING DEVICE:

CARPENTER'S BENCH VICE: - It is used to hold the job (wood) while performing various operations like planning, sawing, chiseling, screwing etc.

CUTTING TOOLS AND EQUIPMENTS:

CUTTING SAWS: - There are three types of Saws;

1) **Hand Saw** (Taper Blade Saw): - It is used by the carpenters for sawing wooded blocks or planks. It is available in 18" to 24" in length.

2) **Tenon Saw** (Parallel Blade Saw): - It is used for fine and accurate cutting in wood joinery. It is 8" to 12" in length with 12 to 14 teeth per inch with closed handle.

CHISELS: - Mostly Firmer chisel and Mortise chisel are used in carpentry. Its size depends on the width of blade, range in (1/4", 1/2", 3/4", 1" & 2") / (6, 12, 18, 25) mm, up to 50mm. Both chisel consist of two main parts Blade and Wooden handle. Firmer chisel is used for finish laps, mortise socket, etc. And Mortise chisel is used for making square and rectangular holes in wood called mortise.

METAL/WOOD JACK PLANE: - It is made of wood or metal. But now days, a metal jack plane is used in carpentry. This is the quick adjustable plain. It is 14" in length. It is used for smoothing as well as removing rough surfaces quickly to bring in required size of wooden piece. The width of the blades is normally 2" to 3".

RASP FILE: It is used for filing on Woods, Bone and Horn etc. There are many types of rasp file used for different purposes. They are Flat and Half round in general. The main parts of the file are Tang, Heel, Face, Edge and Point.

OTHER TOOLS AND EQUIPMENTS:

SCREW DRIVER: - It has an alloy blade or bar (flat, round) and Wooden or molded handle. Common screw drivers are used by the carpenters as well as fitters for loosing or tightening the screws. The length and diameter of the rod of the screw driver and its working end depend on the size of the screw heads. Wooden or molded handle must be fitted on the top end.

JOB NO-2

CARPENTER'S JOB

OBJECT:

To study and to use carpenter's hand tools and equipments for executing the operation to make a wooden Cross-Joint.

LIST OF TOOLS AND EQUIPMENTS:

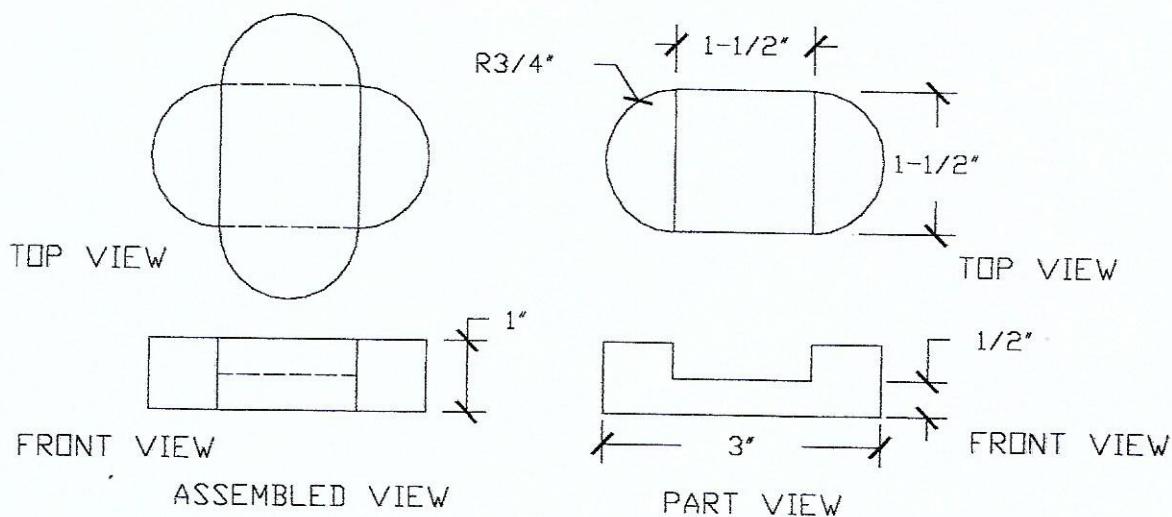
- a) **Marking tools and equipments:** i) Scale ii) Try Square iii) Divider iv) Wood Pencil v) Marking gauge.
- b) **Cutting tools and equipments:** i) Panel Saw ii) Firmer Chisel [Bevelled edge] (1") iii) Rasp file (flat 12") iv) Hand planer v) Tennon Saw vi) Mallet.
- c) **Finishing tools and equipments :** i) Rasp File (flat 12") ii) Sand paper
- d) **Job holding device:** i) Carpenter's bench vice (4").
- e) **Material required:** i) Wooden Block (3 $\frac{1}{8}$ " X 1 $\frac{5}{8}$ " X 1 $\frac{1}{8}$ ") – 2 nos.

SEQUENCE OF OPERATIONS:

- 1) Studied the working diagram of the job properly. Observed its dimensions.
- 2) Prepared a list of tools and equipments required for the job. Received the same from the store.
- 3) Checked the condition of the tools and equipments. Sharpened the blunt edges of the tools on grinding wheel.
- 4) Checked the condition of the carpenter's vice. Lubricated the vice operating screw by lubricating oil.
- 5) Received the wooden blocks from store and checked its overall dimensions.
- 6) Plained all the surfaces by a hand planner. Made necessary marking on both the halves.
- 7) Formed the end curves and central grooves formed in both the halves by means of hand/panel saw, tennon saw, rasp file and chisel. Smoothed the pieces finally by rasp file and sand paper.
- 8) Fitted the two pieces together properly and tightly. Finally polished all the surfaces by sand paper.

SAFETY PRECAUTIONS:

- a) No loose garments and footwear should be used during working.
- b) Safety goggles should be used as an eye protecting equipment.
- c) All the tools should be properly sharpened.



FITTER'S JOB

OBJECT:

To study and to use Fitter's hand tools and equipments for executing the operation of Marking, Filling, Sawing, Drilling and Tapping to make a 'V' grooved fitting.

LIST OF TOOLS AND EQUIPMENTS:

- a) **Marking tools and Equipments:** i) Scale ii) Try Square iii) Divider iv) Chalk Pencil v) Dot Punch vi) Hammer.
- b) **Cutting tools and Equipments:** i) Hack Saw (12") ii) Flat File (Bastard 12") iii) Flat File (Smooth 10") iv) Triangular File (8") v) Twist Drill 23/64" vi) Tap set 7/16" BSW.
- c) **Finishing tools and Equipments:** i) Flat File (Smooth 10") ii) Emery paper.
- d) **Job holding device:** i) Fitter's Bench Vice (4"), vii) Tap Wrench.
- e) **Material required:** i) Mild Steel (M.S) plate (3"x 1" x 3/32") – 2 nos.

SEQUENCE OF OPERATIONS:

- 1) Studied the working diagram of the job properly and observed its dimensions.
- 2) Prepared a list of tools and equipments required for the job and received the same from the store. Checked the condition of the tools and equipments and sharpened the blunt edges of the tools on grinding wheel. Checked the condition of the bench vice. Checked and lubricated the lead screw by lubricating oil.
- 3) Received two numbers M.S plate from store and checked their overall dimensions.
- 4) Held the M.S plate in the vice between the two vice jaw and filed two faces and the four edges by means of files. Checked the surfaces and corner angles by means of a Tri-Square. The corner angles should be 90° and no light should be seen between the surfaces or edges and blades of the Tri-Square, in contact with the plate surface.
- 5) Applied a coat of chalk paste on the surface of the plate, dried and made necessary markings as per drawing on them. Made the markings permanent by dot punch along the markings.
- 6) Held the M.S plates in the fitter's bench vice and removed the marked portions by means of hack-saw and then file the cut portions by means of files.
- 7) Marked the holes to be drilled by centre punch. The holes of the tap size drill diameter to be made as per calculation below;

Calculation of tap size drill diameter:-

Minor Diameter = Tap size drill diameter = Major Diameter – $2 \times$ depth of thread.

For, B.S.W (British Standard Whitworth) screw threads,

The depth of thread = $0.64 \times$ pitch. = $0.64 \times 1/\text{TPI}$ [Teeth Per Inch] = $0.64 \times 1/14$ [BSW thread, TPI=14]= 0.046.

Hence, the tap size drill diameter = $7/16" - 2 \times 0.046 = 0.438 - 0.092 = 0.346" = 23/64"$.

- 8) Drilled the holes 23/64" by a drill bit of 23/64" held in the drill machine by means of a drill chuck.
- 9) Cut the internal screw threads in the drilled holes by means of 7/16" B.S.W tap, three in number in a set by operating the taper tap first, next the plug and finally by bottoming tap by means of a tap wrench.
- 10) Finally finished the job after filling, polishing by smooth file and emery paper and checking all dimensions.

SAFETY PRECAUTIONS:

- a) No loose garments and footwear should be used during working.
- b) All the tools should be properly sharpened to avoid accident and in accurate performance.
- c) To maintain proper accuracy during cutting along marking by saw, the marking should be properly visible.

