Gujarat Technological University

Mechanical Engineering Department

Shantilal Shah Engineering College,

Sidsar Campus, Bhavnagar

B.E. Semester – II

A.Y.: 2021-22

List of Experiments

Course Title: Workshop / Manufacturing Practices

Subject Code : 3110012

Sr. No.	Title of Experiment
1	Familiarization with workshop.
2	Safety aspect in workshop.
3	Familiarization with measuring instruments and gauges.
4	Introduction and demonstration of Lathe machine
5	Familiarization with Fitting shop and task performance
6	Familiarization with Carpentry shop and task performance.

EXPERIMENT NO: 1

AIM: FAMILIARIZATION WITH WORKSHOP

Objectives: Student should be able to:

1. Name different types of workshops and their application.
2. List various processes carried out at workshop at different shop.
3. Name different types of layout and their importance.
4. State the role of engineer in a workshop.

Introduction:

The word workshop is a combination of two separate words "work" and "shop" regarding work Mr. Webster says, "Work is a physical or intellectual effort directed to some end. Either one, physical effort or intellectual effort taken alone is drudgery, if properly combined it produces enthusiasm.

Shop directs us to place where this work is being properly utilized. So workshop is the place where physical or intellectual efforts get proper utilization.

Every engineer is one way or other is associated with workshop, whether he / she may be Civil, Mechanical & Electrical or of any other branch.

It is very important to get familiar with workshop. i.e. to know:

1. Basic types of workshops.
2. Types of work carried out.
3. Various departments in workshop, their functions & responsibility.
4. Various types of layout.

There are three basic types of workshops:

1. Training workshop
2. Production workshop
3. Repair and Maintenance workshop

1. **Training workshop:**

Ours is a training workshop. The shop where students are trained is called training workshop. Generally training workshop has following departments. :

(A) Carpentry shop:

Here you will know about, various tools used for working on wood, types of wood and how to select proper wood for particular job, Different kinds of joints of wood. How to make a pattern, various kinds of pattern and its use, etc.

(B) Fitting shop:

Here you will learn about various hand tools used to work on metal. Here you will learn about marking, measuring, cutting techniques. This shop will develop your skill to make a part fit with another.

(C) Smithy shop:

This is a place where a work piece is heated and forged to obtain the required shape and size. You can learn about various hand tools, equipment's, processes and technique for the same.

(D) Foundry shop:

Here the pattern is used to prepare mould in sand, the molten metal is poured into the mould and after solidification of the metal we will obtain required casting.

To know in detail, we need to learn, different types of pattern, the processes to mould, the cores for obtaining hollow casting. The various processes to prepare them.

Sand and its varieties and processes for preparing sand mould and various techniques of testing above things, which can lead to make a good casting.

(E) Machine Shop:

Here you will learn about the basic types of machines such as lathe, drilling machine, hacksaw machine etc, you will learn the basic process for metal removal.

(F) Fabrication Shop:

Here you will learn about the different welding processes and related machines. You will learn the use of various hand tools and basic fabrication process for metal joining like, welding, soldering and brazing.

(G) Sheet Metal Shop:

Here you will learn about the Bending, Cutting, Shearing and riveting operations etc, you will learn the use of various hand tools and basic sheet metal operations for metal forming and joining.

(H) Plumbing Shop:

Here you can learn about the various hand tools and pipe fittings used in plumbing work. Also you can learn to cut thread on pipe and bending operation with the use of pipe bending machine.

2. <u>Production Workshop:</u>

Production or manufacturing workshop can be further classified as below:

1. Mass/ Continuous Production Workshop
2. Batch Production Workshop
3. Job Production Workshop

The classification is based on the nature of production or manufacturing. Where limited varieties of products are being manufactured in large volume (in terms of quantity) can be known as mass production shop.

Batch production is a type of manufacturing where production is being carried out in some particular batch for some predefined time period for one variety of products. After that batch is over new product in predefined batch quantity is taken up for production for some predefined time span.

In job production, items are being produced as per the size and design of individual customer.

This environment of production workshop is full of activities. You can see the workman doing his work.

He may be:

- Working himself
- Observing the work
- Guiding the workmen
- Transporting the semi finished material.
- Transporting the finished material to other place for further process.
- Supervising the work

In short everyone is concentrating to the assigned work. All these remain continuous, smooth running if everything goes all right. i.e. enough work, enough supply of material, enough enthusiasm.

3. **<u>Repair and maintenance workshop:</u>**

People can distinguish some workshop as fabrication workshop or repair and maintenance workshop. Where fabrication of structure work or repair or maintenance work is carried out.

From the above discussion an engineer must try to learn in workshop training:

- Various workshop processes used for changing the shape of material, various processes used for joining or assembling of different parts, etc.

- Understand the general routine procedure in the workshop, such as allotment of work, material, and inspection, repairing of faults. First aid and reporting of causality etc.

Majority of engineers are engaged in workshop on shop floor. The following points will help in achieving a successful career:

- Ability to lead, guide and control the groups of persons and take decision without confusion.
- Shop disciplines; such as carrying out orders and instruction, punctuality of yours and your subordinates, etc.
- Sense of cleanliness and alertness about wastage of manpower, time and material.
- Cost-consciousness that is reducing the cost wherever possible.
- Safety consciousness, which factors will lead to safety of personal, equipment or both.

EXERCISE

1. Draw complete layout of the workshop. List different types of layouts and explain in brief about each of them.
2. List the machines and its function we have in our workshop.
3. What is the role of an engineer in Workshop?
4. Classify the following industries on their manufacturing capacity:
   a. Automobile Industry b. Garment Industry c. Furniture Industry

"Accidents Big Or Small, Avoid Them All"

.

EXPERIMENT NO: 2

AIM: SAFETY ASPECTS IN WORKSHOP

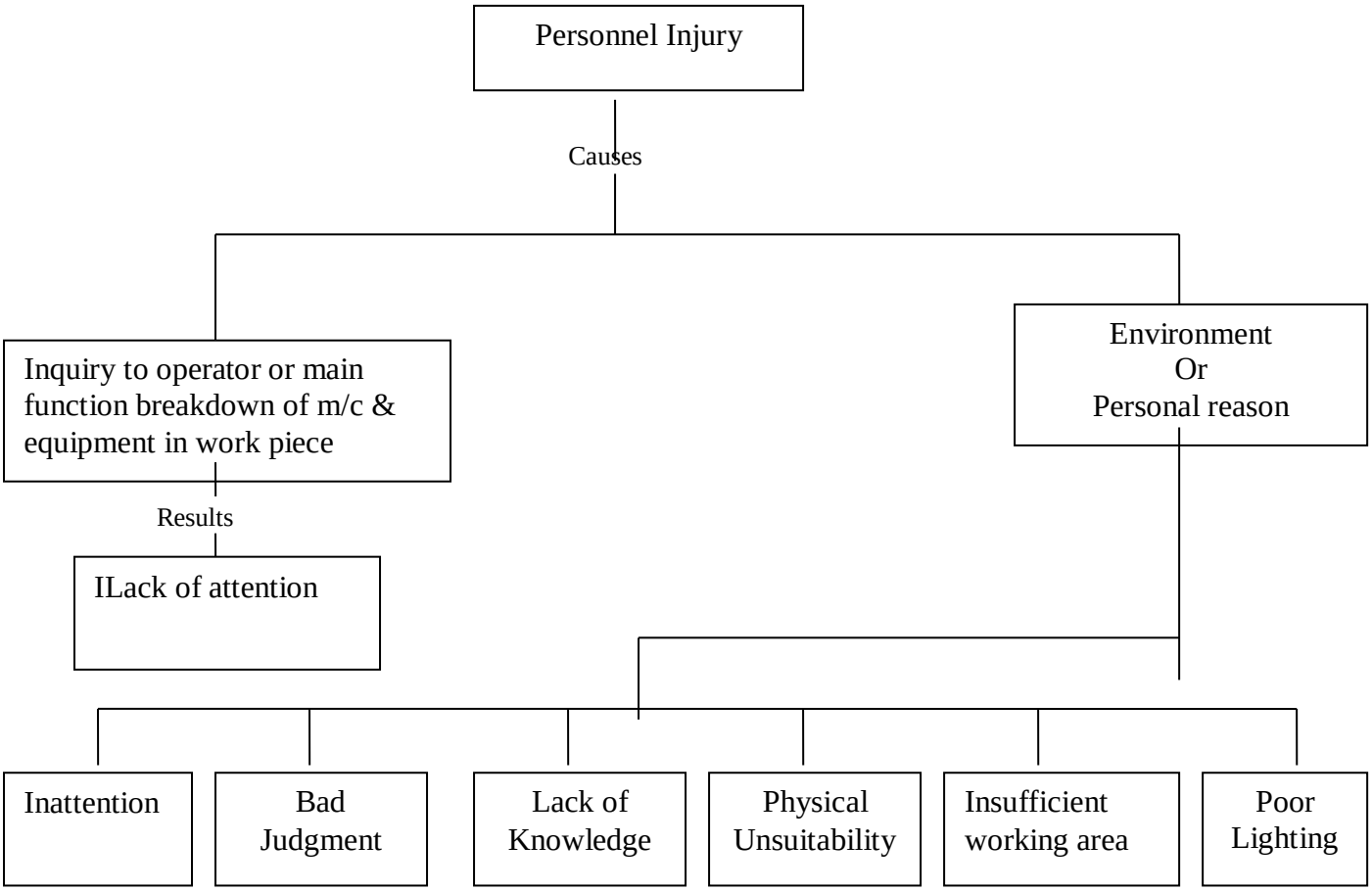
Accidents are mishappening which results in loss of life and property. Accidents occurring in the industries are called industrial accidents. These are generally due to faulty equipment and machinery or negligence on the part of the workers.

Definition:
An event or mishappening that occurs unplanned and unexpected, which may cause or likely to cause an injury is called an accident.

Characteristics of Accidents:

1. Accidents are unfortunate, sudden happenings about which nothing is known in advance.
2. Life and property are affected by accidents.
3. Due to accidents, work is stopped for a certain length of time.

The following chart can explain the accidents occurrence.



COST OF AN ACCIDENT

The complete cost of an accident consists of (a) Direct Cost and (b) Indirect Cost.

DIRECT COST

Compensation and Medical expenses are the direct cost of accidents.

INDIRECT COST

1. Loss of time of injured employee and other employees.
2. Loss of time of Supervisor and foreman.
3. Cost of damage to machine or equipment.
4. Loss in profit due to less productivity.

Directly or indirectly the accidents will put a heavy burden on society. All direct or indirectly the accidents will lead to increase the cost of final product. Thus, in a sense, every citizen has to bear a proportion of the cost of accidents.

Efforts should be made to prevent and eliminate all such accidents.

PRECAUTIONS TO AVOID AN ACCIDENT:

(1) **Safe machine design:**

It is also a responsibility of machine manufacturers to provide a few basic elements in the machine which help in preventing accidents.

(2) **General safety hints for shop floor personnel:**

Over and above the different precautions at different levels, it is the shop floor Workman/Supervisor whose vigilance is required.

The following points must be practiced by workman/supervisor, whose vigilance is required.

1. Do not remove any guard from the machine or any safety device. Any defective guard or device should be reported immediately to the concern supervisor.
2. Learn to stop the machine first and then familiarize yourself with other operations completely.
3. Before working on the machine read the instructions manual carefully and ask your supervisor to explain to you whatever is not understood.
4. Any injury, minor or major, must be reported to the concerned supervisor.
5. Report immediately the faulty tool or machine that is likely to cause an accident. Put a sign board saying “DO NOT OPERATE” on such machine to avoid accident.
6. Never wear loose clothing in the shop. Avoid wearing bracelets, finger rings and other jewelry. Avoid wearing synthetic cloths in shop.
7. Avoid to wear full sleeve cloths and if wear fold the sleeves.
8. Always wear apron while working on machine.

9. Develop the habit of working safely and ask your co-worker/subordinate to follow safety instructions.
10. Do not use damaged or worn out tools, as it may become cause of an accident.
11. Keep aisles, gangways, and work place clean and tidy.
12. Pay due attention to warning signs. Be careful not to smoke or light a match in prohibited areas.
13. Do not look at an electric arc during welding with bare eyes.
14. Do not obstruct exit, fire equipments, safety equipments and switch boxes.
15. Always remember the fire exits and the place where fire extinguishers are located. Also know how to use fire extinguisher with respect to class of fire.
16. All rags (cotton wastes), which are piled, should be put in a container and not sprayed on the floor.
17. Do not play mischief in the workshop during working on job.
18. Wear safety shoes on the shop floor and never use chappals/sandal.
19. Never put on a machine with which you are not familiar or while just passing through the shop as a sport.
20. Use insulated or non-conductor tools while working on electric switches. Replace all unsafe electrical wiring immediately for safety point of view.
21. Always wear safety goggles during grinding.
22. Put off main connections while working on electric lines.
23. While working on a machine, which does not contain safety, guards, do not stand in line with the motion/rotation of the tool.
24. Whenever you see any workman / person working unsafely or in unsafe conditions, warn him immediately and inform concern supervisor or engineer.
25. Be safety conscious and make people safety conscious.
26. Whenever in doubt, ask your foreman/supervisor.

Slogans on safety:

- Proper diagnosis shall be done for each accident to prevent its reoccurrence in future.
- There's no face like your own, wear face protection
- Be mindful of another person's safety; since you yourself can be in the same condition some time.
- Safety by Choice, Not by Chance

EXERCISE

1. "Accidents do not happen, they are caused. Discuss.
2. How does an accident affects to product cost, explain?
3. Fill in the blanks of the following.
   (a) Accidents begin where safety _____
   (b) Make safety a _____
   (c) When_____ your family also suffer.
   (d) Accidents do not happen but they are _____
4. Write any three quotations / slogans on safety.
5. Write short note on fire extinguishers.

EXPERIMENT NO: 3

AIM: FAMILIARIZATION WITH MEASURING INSTRUMENTS

Objective: Students should be able to:

1. Demonstrate proper use of various measuring instruments and gauges.
2. Select proper instrument for particular application.

Introduction:

Measurement provides the fundamental basis for research, development and manufacturing processes. The knowledge of measurement is of immense importance; without the knowledge of this mating of engineering components and their functions could not be properly performed.

Measurement is an act of quantitative comparison between a predefined standard and an unknown component.

Measuring instrument is a device that may be used to obtain a dimensional or surface measurement.

Measuring instrument is used for measurement and inspection to establish the manufacturing accuracy of parts. They help to timely detect inaccurately machined part and to avoid rejection and defects.

Classifications of measuring instrument:

Measuring instrument may be classified as bellow:

(1) Type of measurements:
    (a) Linear (b) Angular (C) Taper (4) Comparative
(2) Direct and Indirect measurement:
(3) Precision and non precision instruments:

1. LINEAR MEASUREMENTS:

NON PRECISION	1. STEEL RULE 2. CALIPERS 3. DIVIDERS 4. TELESCOPIC GAUGE 5. DEPTH GAUGE
PRECISION	1. MICROMETER 2. VERNIER CALLIPER 3. HEIGHT GAUGE 4. SLIPGAUGES

2. ANGULAR MEASUREMENTS:

NON PRECISION	1. PRORACTOR 2. ADJUSTABLE BEVEL 3. ENGINEER'S SQUARE 4. COMBINATION SET
PRECISION	1. BEVEL PRORACTOR 2. DIVIDING HEAD 3. SINE BAR 4. ANGLE GAUGE 5. SPIRIT LEVEL 6. CLINOMETERS 7. AUTO COLLIMETER

In day-to-day life we have to measure mainly linear dimensions and angular dimensions of any components. But some time the surface finish is also important from the functional point of view of the components.

So, we will be using various instruments for the same. Like, comparators roughness tester, etc.

COMPARATIVE MEASUREMENT:

Various gauges like,

1. Plug gauges
2. Ring gauges
3. Snap gauges
4. Limit adjustable caliper gauges
5. Thread gauges
6. Comparators (eg. Surface Comparators)

- **Steel rule**: A steel rule is one of the most useful tool in the shop for taking linear measurement of blanks and articles to an accuracy up to 0.5 mm.
- **Calipers:** A caliper is used to transfer and compare a dimension from one object to another or from a part to a scale or micrometer where the measurement cannot be made directly.
- **Dividers:** A divider is similar in construction to a caliper except that both legs are straight with sharp hardened points at the end. It is used for transferring dimensions, scribing circles and doing general layout work.
- **Telescopic gauge:** The telescopic gauge is used for measuring the inside size of slots or holes.
- **Depth gauge:** Depth gauge is used to measure the depth of blind holes, grooves, slots etc.
- **Micrometers:** Mainly micrometers are of three types

    - External or outside diameter micrometer.

- Internal or Inside diameter micrometer.
- Depth micrometer.

External micrometer is used to measure external dimensions like diameter of shaft, thickness of parts etc. to the accuracy of 0.01 mm.

- **Vernier Caliper:** A vernier caliper is utilized for measuring both inside and outside diameter of shafts, thickness of parts, depth of slots etc. to the accuracy of 0.02 mm.
- **Vernier height gauge:** The vernier height gauge is used to measure the height of part to the accuracy of 0.02 mm, in metric measurement.
- **Slip gauges:** Slip gauges or precision gauge blocks are used for precise measurement of parts and for verifying measuring instrument such as micrometers, vernier calipers etc.
- **Protectors:** One of the simplest ways of measuring the angle between two faces of a component is to use a protector.
- **Adjustable level:** It is used for checking, comparing or transferring angles and laying out work.
- **Engineer's square:** It is used to check a surface at right angle w.r. to another true surface.
- **Combination set:** It combines in one instrument a square head, a center head and a bevel protector. It is very useful in fitting and machine shop.
- **Bevel protector:** The universal bevel protector is an instrument used for measuring angles.
- **Dividing head:** It is used in inspection work for checking angles about a common center.
- **Sine bar:** Measurement of angles using sine bars makes indirect measurement. Sine bars are frequently used in conjunction with slip gauges for setting of angles and of tapers from a horizontal surface.
- **Angle gauges:** Angle gauges are used for measuring and setting out angles for the precision work.
- **Spirit levels:** Spirit levels enable the position of a surface to be determined with respect to horizontal. They are used for static leveling of machinery.
- **Clinometer:** This instrument is really a spirit level mounted on a rotating member whose angle of inclination relative to its base can be measured by a circular scale. They are used for checking angular faces.
- **Auto Collimator:** The auto collimator or auto collimator telescope is an optical instrument used for measurement of small angular differences, changes or deflections.

VERNIER CALIPER:

A Vernier caliper is utilized for measuring both inside and outside diameters of shafts, thickness of parts etc. to accuracy of 0.02 mm. There are two scales in vernier caliper; the Main scale and the vernier scale; with both the scales one can measure small dimensions.

Vernier calipers are available in different size 0-25 mm, 0-150, 0-200, 0-300 mm, etc. maximum dimension that can be measured is according to its size. If the vernier is 0-200 mm, max, dimension that can be measured up to 200mm cylindrical.

Least count calculation

$$\text{L.C.} = \frac{\text{One Division of Main Scale}}{\text{No. of Division on Vernier Scale}}$$

$= 1/50$

$= 0.02$ mm

This is the least count of a vernier caliper

(B) MICROMETER:

Micrometers are of many types:

(1) **External Micrometer –** used to measure outside diameter of shafts, thickness of parts etc. External micrometer is used to measure external dimensions like diameters of shaft, thickness of parts etc, to an accuracy of 0.01 mm.

(2) **Internal Micrometer –** used to measure inside diameter of parts (bore measurements).

(3) **Depth Micrometer** – used to measure depth with respect to flat surface in parts.

Minimum dimension (least count):

On barrel graduation of 1 mm each.

On thimble there are 50 graduations around its periphery, by rotation of one revolution thimble on barrel 0.5 mm advancement of measurement we can achieve.

L.C. = ONE DIVISION ON MAIN SCALE / NO. OF DIV. ON THIMBLE

$= 0.5/50 = 0.01$ mm

EXERCISE

1. List various non-precision measuring instruments and describe it with neat sketch.
2. Why some of the measuring instruments termed as “Indirect” measuring instruments?
3. If a micrometer is having –ve error of 0.25 mm, the reading shows 45 mm, calculate the actual measurement.
4. Name the instruments use to measure the thickness of pipe.
5. Why one should use a Gauge instead of a measuring instrument? List the use of following gauges.
    a. Plug gauge b. Depth gauge c. Ring gauge d. Filler gauge

EXPERIMENT NO: 4

AIM: FAMILIRIZATION WITH LATHE MACHINE

Objective: Student should be able to:

1. Working principle of lathe machine
2. Various operation of lathe machine

Introduction

A centre/engine lathe (Fig. 1) is one of the oldest and perhaps most important machine tools ever developed.

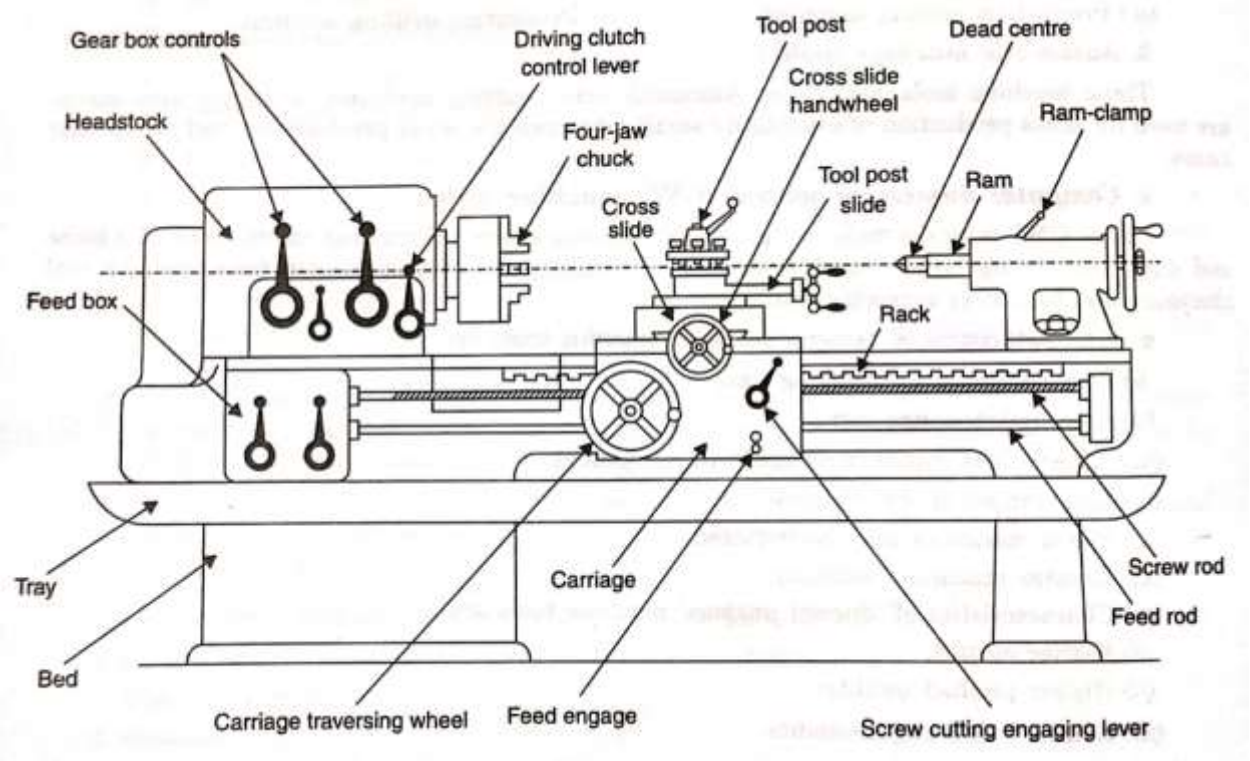


Fig. 1 Lathe Machine

The Job to be machined is rotated (turned) and the cutting tool is moved relative to the job. That is why; the lathes are also called "Turning machines" If tool moves parallel to the axis of rotation of the workpiece, cylindrical surface is produced, while if it moves perpendicular to the axis, it produces a flat surface.

Working Principle

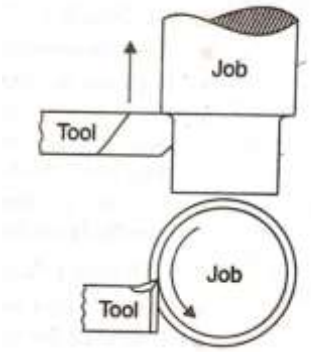


Fig. 2 Working principle of Lathe

In a lathe, the workpiece is held in a chuck or between centres and rotated about its axis at a uniform speed. The cutting tool held in tool post is fed into the workpiece for desired depth and in desired direction (i.e., in linear, transverse or -lateral direction). Since their exists a relative motion between the workpiece and the cutting tool, therefore the material is removed in the form of chips and the desired shape is obtained.

Parts of Lathe

Fig.1 shows a centre lathe. Its major parts are :

1. Bed.
2. Headstock.
3. Tailstock.
4. Carriage.
5. Feed mechanism,

Bed : Refer to Fig. 3.

It is the base or foundation of the lathe. It is a heavy rigid casting made in one piece. In majority of cases the beds are made Of grey cast iron-nodular cast iron, or high strength, wear resistance cast iron. The cast iron offers the following advantages over other materials
(i) It is self lubricant : It can be hardened by induction hardening process.
(ii) It has better compressive strength.
(iil) It has excellent shock absorbing capacity,
(iv) It can easily be cast and machined

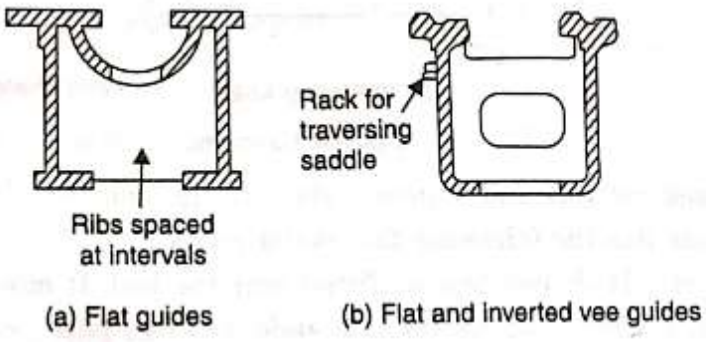


Fig. 3 Bed

It holds or supports all other parts of the lathe, The top of the bed is planed to form guide for the carriage and tailstock

The guide ways are of two types (a) Flat guide ways (Fig.3(a)) or inverted Vee guide ways. Generally, the combination of both the flat and inverted Vee guide ways is used (Fig.3 (b)),

Headstock

It is permanently fastened to the inner ways at the left hand end of the bed. It serves to support the spindle and driving arrangements. All lathes receive the power through the headstock, which may be equipped with a step-cone pulleys or a gear head drive (the modern lathes are provided with all geared type head stock to get large variations of spindle speeds),

In order to allow the long bar or work holding devices to pass through, the headstœk spindle is made hollow. A tapered sleeve fits into the tapered spindle hole.

Tailstock Refer to Fig.4.

It is situated at the right hand end of the bed. It is used for supporting the right end of the work. It is also used for holding and feeding the tools such as drills, reamers, taps etc.

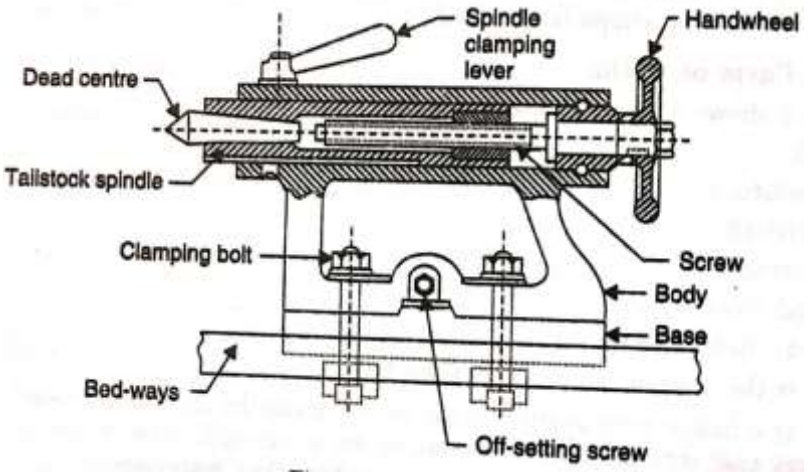


Fig.4 Tailstock

Carriage: Refer fig. 5

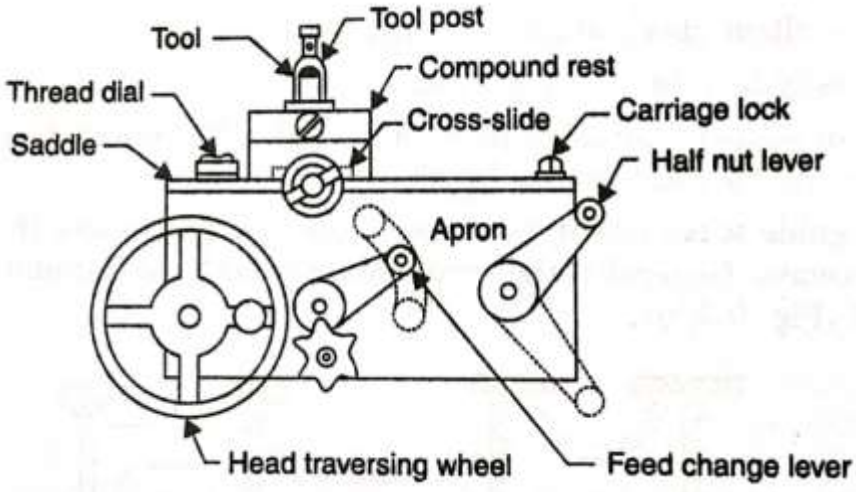


Fig.5 Carriage

The carnage controls and supports the cutting tool. The carriage has the following five major parts . (i) Saddle. It is a H.shaped casting fitted over the bed. It moves along the guideways. (ii) Cross-slide. It carries the compound glide and tool post ; can be moved by power or by hand. (iii) Compound rest. It is marked in degrees ; used during taper turning to set the tool for angular cuts. (iv) Tool post. The tool is clamped on the tool post. (v) Apron. It is attached to the saddle and hangs in front of the bed. It has gears, levers and clutches for moving the carriage with the lead screw for thread cutting.

Feed mechanism

It is employed for imparting various feeds (longitudinal, cross and angular) to the cutting tool. o It consists of feed reverse lever, tumbler reversing mechanism, change gears, feed gear box, quick change gear box, lead screw, feed rod, apron mechanism and half nut mechanism.

Size and Specifications of Lathe

Size of a lathe is specified in any one of the following ways: Refer to Fig. 6

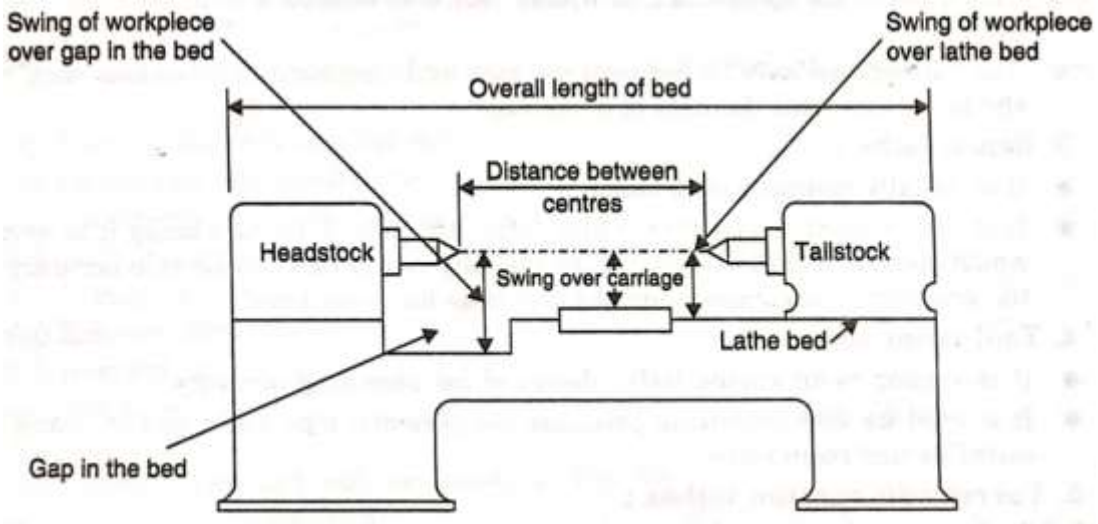


Fig.6 Lathe Specification

The height of the centres measured over the lathe bed. 2. Swing or maximum diameter that can be rotated over the bed ways. 3. Swing or diameter over carriage. This is the largest diameter of work that will revolve over the lathe saddle 4. Maximum job length in mm that may be held between the centres (headstock and tail. stock centres). 5. Bed length in meters which may include the headstock length also. 6. Diameter of the hole through lathe spindle for turning bar material.

In addition to the above, the following specifications are necessary to provide while ordering a lathe : (i) The length, width and depth of bed. (ii) The depth and width of the gap, If it is a gap lathe. (iii) The swing over gap. (iv) The number and range of spindle speeds. (v) The number of feeds. (vi) The lead screw diameter. (vii) The number and range of metric threads that can be cut, (viii) The tailstock spindle travel. (ix) The tailstock spindle set over. (x) The back gear ratio. (xi) The power rating of electric motor.

Lathe Operations

Common lathe operations which can be carried out on a lathe are enumerated and b discussed as follows : 1. Facing, 2. Plain turning, 3. Step turning, 4. Taper turning, 5. Drilling, 6. Reaming, 7. Boring, 8. Undercutting or grooving, 9. Threading, 10. Knurling, 11. Forming

Facing

Facing is the process of removing metal from the end of a work piece to produce a flat surface. This operation is almost essential for all works. In this operation the work piece is

held in the chuck and the facing tool is fed from the center of the work piece towards the outer surface or from the outer surface to the center, with the help of a cross-slide.

Plain turning

It is an operation of removing excess amount of material from the surface the surface of the cylinder work piece. In this operation, shown in fig., the work is held either in the chuck or between centers & the longitudinal feed is given to the tool either by hand or power.

Step turning

It is an operation of producing various steps of different diameters of in the work piece. This operation is carried out in the similar way as plain turning.

Taper turning

Taper turning means, to produce a conical surface by gradual reduction or increase in diameter from a cylindrical work piece. This tapering operation has wide range of use in construction of machines. Almost all machine spindles have taper holes which receive taper shank of various tools and work holding devices.

Drilling

It is an operation of making a hole in a work piece with the help of a drill. In this case the work piece is by rotating the tail stock hand wheel. The drill is fed normally into the rotating work piece by rotating the tail stock hand wheel.

Reaming

It is an operation of finishing the previously drilled hole. In the operation a reamer is held in the tailstock and it is fed into the hole in the similar way as for drilling.

Boring

Boring is the enlarging and truing of a hole by removing material from internal surfaces with a single-point cutter bit. On the lathe, boring is accomplished in either of these two methods:

- Mounting the holder and boring tool bar with cutter bit on the tool post and revolving the work piece.
- Mounting the work piece in a fixed position to the carriage and revolving the boring tool bar and cutter bit in a chuck attached to the headstock spindle.

Undercutting or grooving

The process of cutting a narrow channel or passageway into the outside diameter of a cylindrical work piece.

Threading

The process of cutting a long spiraling groove into a work piece with a single-point tool. Threading processes are essential for the creation of fasteners.

Knurling

A forming process that adds a pattern on the exterior of a work piece, either for cosmetic reasons or better handling.

Forming

The forming is an operation that produces a convex, concave or any irregular profile on the work piece.

EXERCISE

1. What is the working principle of lathe machine? Explain.
2. Explain briefly different parts of lathe machine.
3. Enlist the different lathe operations and explain it briefly.

MCQ

1. On the lathe, a left hand tool cut most efficiently, when the tool travel

    (a) From left to right end of lathe bed
    (b) From right to left end of lathe bed
    (c) At an angle
    (d) Across the bed

2. On the lathe, a right hand tool cut most efficiently, when the tool travel
    (a) From left to right end of lathe bed
    (b) From right to left end of lathe bed
    (c) At an angle
    (d) Across the bed
3. The lathe spindle at the nose end has
    (a) Internal taper
    (b) Internal threads
    (c) External threads
    (d) Pipe threads
4. The slowest speed on a lathe is required for the following operatins:
    (a) Facing
    (b) Taper turning
    (c) Thread cutting
    (d) Undercutting
5. The angle between the lathe centers is
    (a) 15^o
    (b) 30^o
    (c) 45^o
    (d) 60^o

EXPERIMENT NO. 5

AIM: FAMILIARIZATION WITH FITING PRACTICE

Objectives: Students should be able to:

1. Name different hand tools and their applications.
2. Demonstrate proper use of various hand tools.
3. Select proper tool for particular application.

Introduction

Assembly work means bench work and fitting practice. It is the process of removing unwanted material with the help of hand tools, from the given stock for making a component for fitting one in another to form a mating or fitting pair.

The bench work and fitting plays an important role in an engineering workshop. The work carried out at the fitting bench vice is called a bench work. e.g. filling. Chipping, sawing, drilling, tapping etc. that is necessary after machine work for assembling parts together.

A considerable skill is required to execute the fitting job and hence lot of practice and concentrations are most important factors for fitting job.

EQUIPMENTS FOR FITTING SHOP

Fitting shops are provided with equipment for common and individual use. Benches with vices are for individual use, whereas equipment for common use includes drilling machines, tool grinder, filing machines, surface plates, power hacksaw shears, etc.

FITTING TOOLS

Following types of tools are used in fitting shop:

1. Holding tools e.g. Bench vice
2. Striking tools e.g. Hammer
3. Cutting tools e.g. Hacksaw, chisel file etc.
4. Scarping tools e.g. scraper
5. Drilling tools e.g. Drill etc
6. Marking, measuring and testing tools e.g. marking block, scale, vernier, surface plate, height gauge, ”v” block etc.

FITTING PROCESS

A number of hand operations are carried out in a fitting section to finish the work piece to the desired shape, size and accuracy. The operations carried out in a fitting shop are:
Marking, Sawing, Filling, Scraping, Chipping, Drilling, Tapping (internal threading), Dieing (external threading) Reaming etc.

We will discuss here marking, sawing and filling processes, as being common process:

Marking

Proper and accurate marking plays a vital role in producing a product of great accuracy .The accuracy of a component depends upon the accuracy of marking. Sufficient care is there fore needed in performing this operation to maintain by setting out dimension as given in the working drawing or by directly transferring them from a similar part. The surface to be marked is coated with red lead, French chalk or copper sulphate and allowed to dry. After this the work piece is laid on the surface plate if it is flat or held in a v-block or against angle plate. Marking of vertical lines is done by means of scribing block or height gauge.

Sawing

Sawing is the process of cutting different metal pieces to the desired shape and size. In sawing the job is held in a bench vice, the handle of a hand hacksaw hold action in sawing takes place in the forward stroke and no pressure must be applied on the return or idle stroke. During cutting make sure that the cutting direction is straight and hold the hacksaw frame firmly in your hand otherwise the blade may break. Do not use new blade on hard material directly and coolant must be used for cutting throughout the operation except for sawing cast iron.

Power saw is used for cutting thick materials at rapid rates. It consists of cast iron body witch is fitted with adjustable vice to hold the stock. While cutting on power saws proper cutting speed and coolant plays an important role.

Two types of hacksaw frames are available, one is "**solid"** (rigid) and other one is **"Adjustable"**

IMPORTANT

"During cutting the travel of the blade must be in straight line. The blade must be held tightly in the frame. A slight twisting will damage the blade and blade may break."

Filling process

In this operation normally the job is held in a vice, the file handle is held in the right/left hand and other side of the file is held in the left/right hand. The right/left hand applies force while the left/right hand used to apply pressure. The worker stands with his left/right foot forward and right/left foot behind.

Normally the left/right foot is below the vice. The cutting action takes place in the forward direction only. In the return stroke no force should be applied on the file as no cutting actions take place in the backward stroke and application are the methods of filling. No one will learn to file without some advice from a skilled filer and plenty of practice.

PRECAUTIONS TO BE TAKEN DURING FILING

1. Apply pressure on the file in the forward direction only.
2. Before keeping the file in the kit. Clean it properly.
3. Don't use those files on soft metals, which have been used on iron and steel. It results in clogging

4. In order to prevent clogging apply turpentine oil or paraffin, while filling on aluminum piece.
5. File the chilled surface of a casting first by an old file and then with a new file.
6. Use a bastard file for rough cuts and second cuts and a smooth file for the finishing.
7. When using a new file for the first time applies light pressure in the beginning.
8. For lathe work use a mill file.
9. For general work use a second cut file.
10. For filing square corners always use a safe edge file.
11. Don't use a file previously used on lathe for filing work.
12. Don't use a new file for cleaning welds.
13. For filing a metal like gunmetal, brass, bronze, nickel, silver etc. use a new file.
14. Provide solid supports to the thin sheets before filing.

Drilling process

To produce the hole in a job this process is used. The tool used to produce hole is termed as "DRILL" Various type & size of the drills are available and to be used as per the requirement.

Pillar drill press is a common type of drill machine used in fitting shop.

Various types of drilling machines available are

1.Upright drilling machine
2.Radial drilling machine
3.Gang drilling machine
4.Portable drilling machine

Tapping operation

To cut threads on a job (internal) standard size tapes are used and hence it is termed as tapping operation. To cut internal threads 1 set, consist of 3 taps. Die is used to cut external threads. Tap is held in appropriate tap wrench and die is held in die wrench.
Two types of tap are available:

(1) Machined taps
(2) Hand taps.

Two types of dies are available:

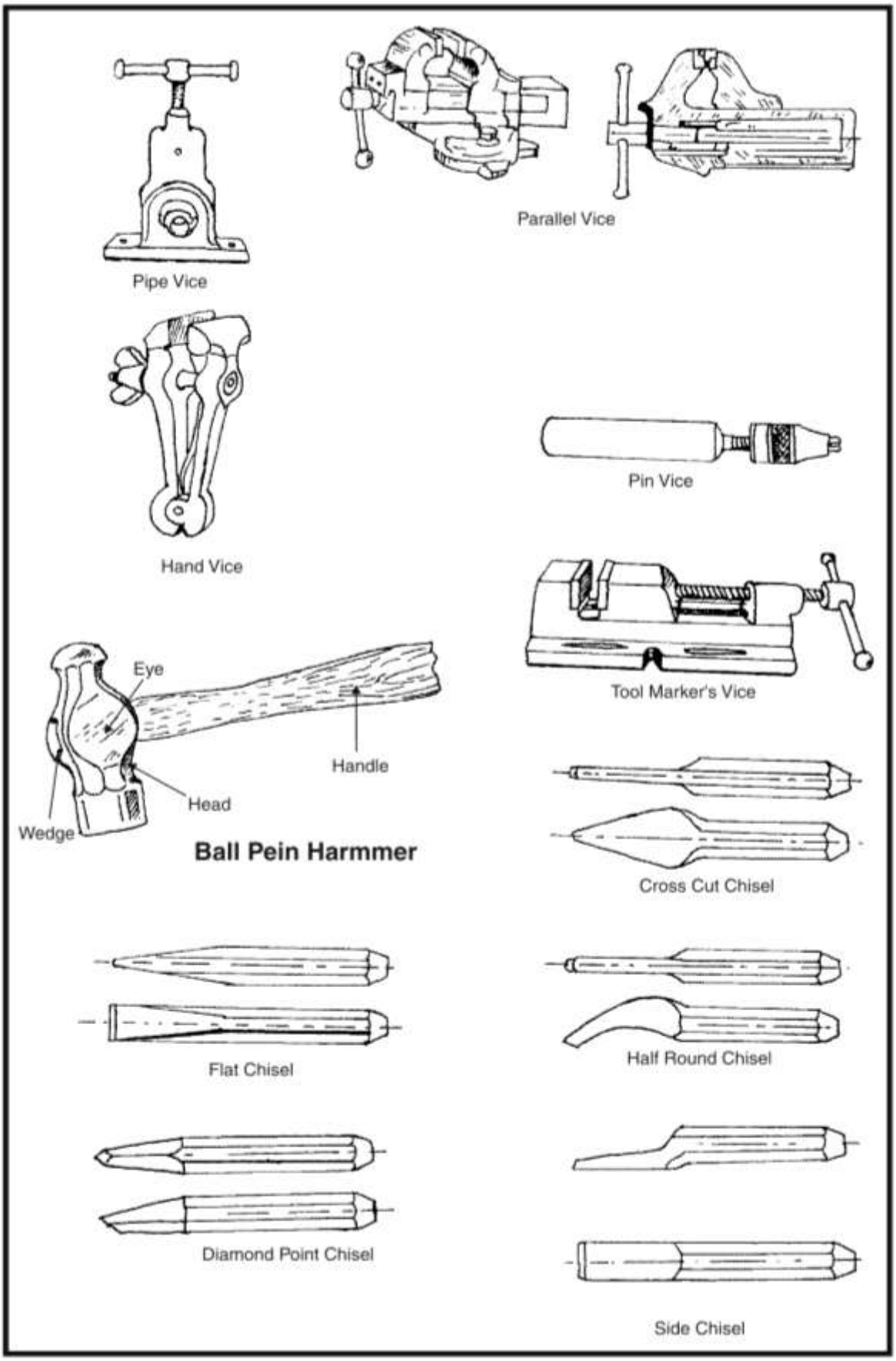
(1) Solid die.
(2) Adjustable die

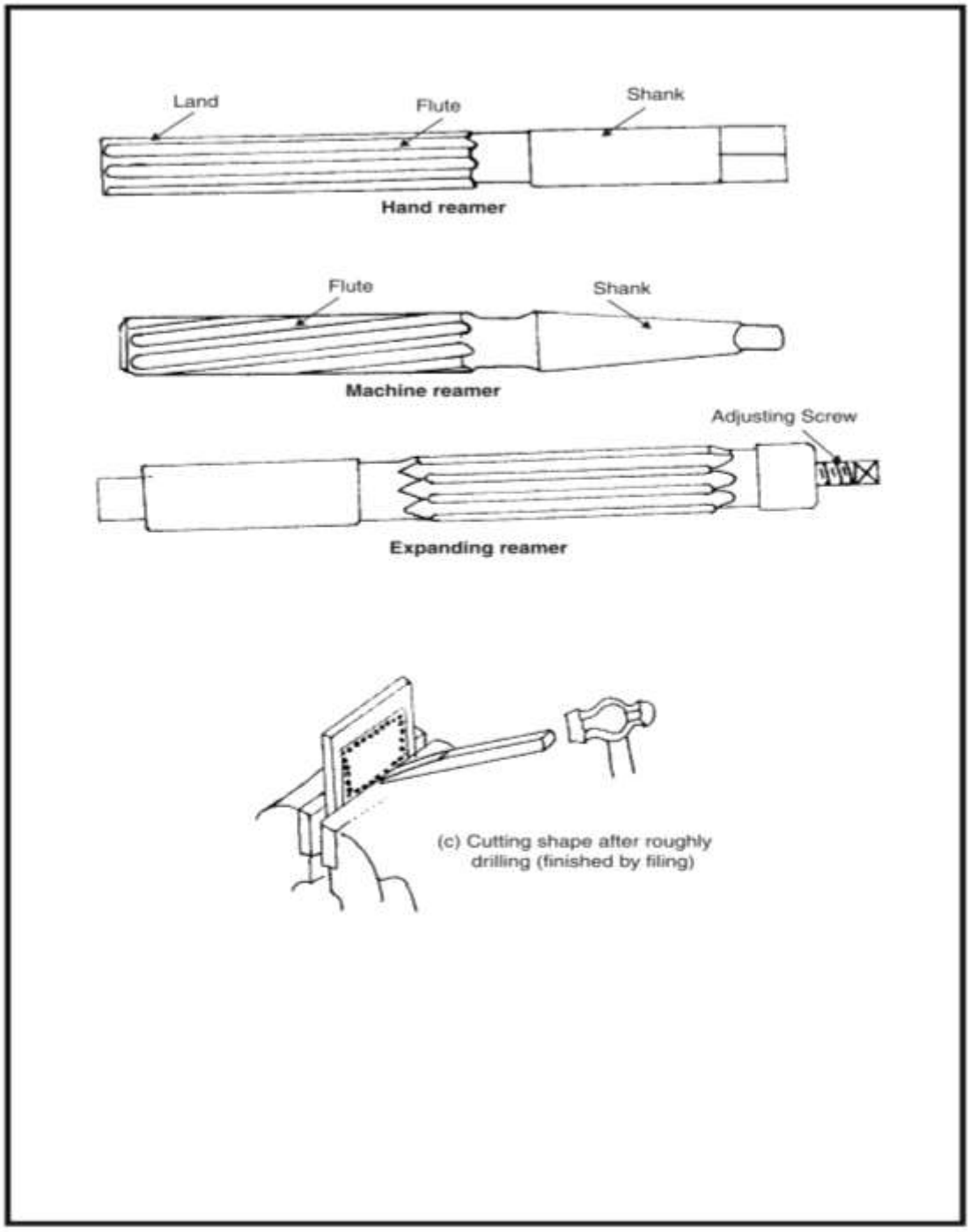
Reaming Operation

This operation is used to improve the surface finish of the drilled holes. Types of reamers:

(1) Straight edge.
(2) Slant edge.
(3) Expandable reamers.

"Safety is as simple as ABC…Always Be Careful"





“Don’t be a fool. Use the proper tool “

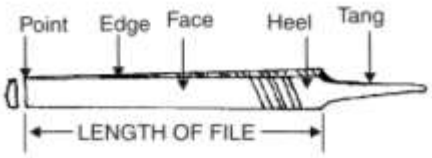
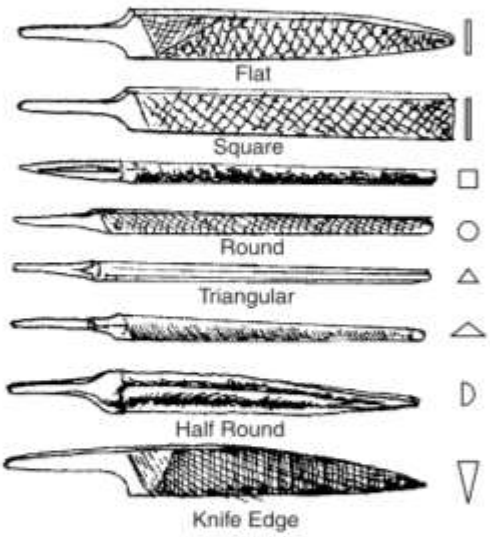
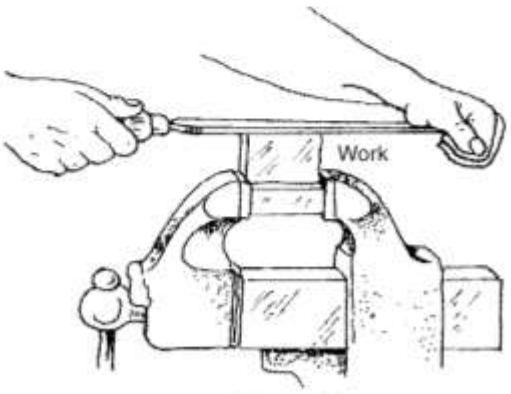


Fig. DIFFIRIENT PARTS OF FILE



Shapes of File



Filing a job

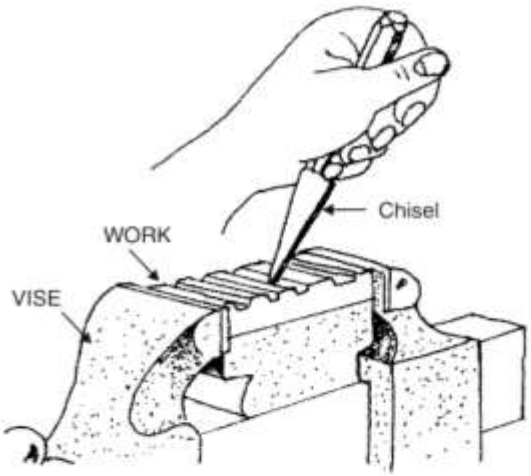
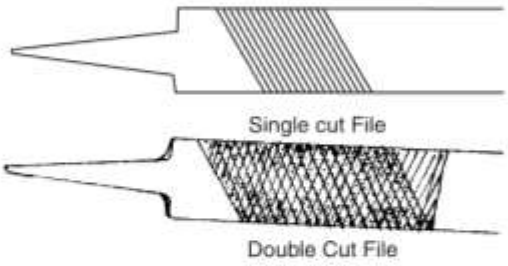
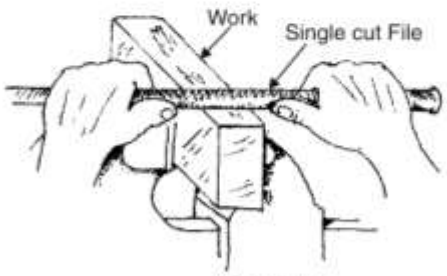


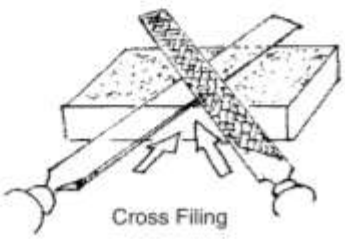
Fig. Chipping by a cross-cut chisel



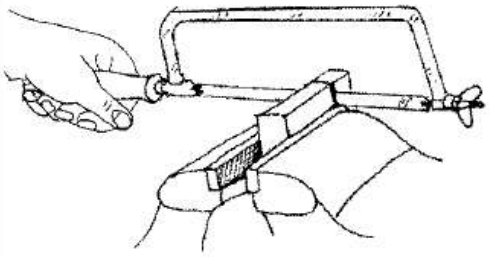
Single cut & Double Cut File



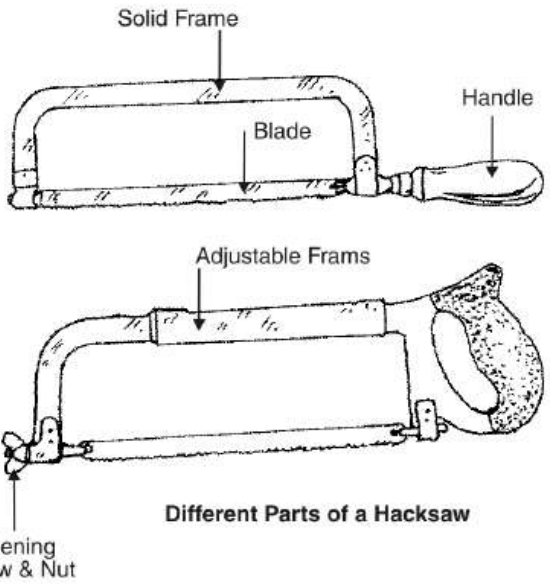
Draw Filing



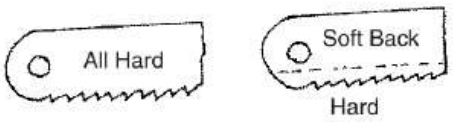
Cross Filing



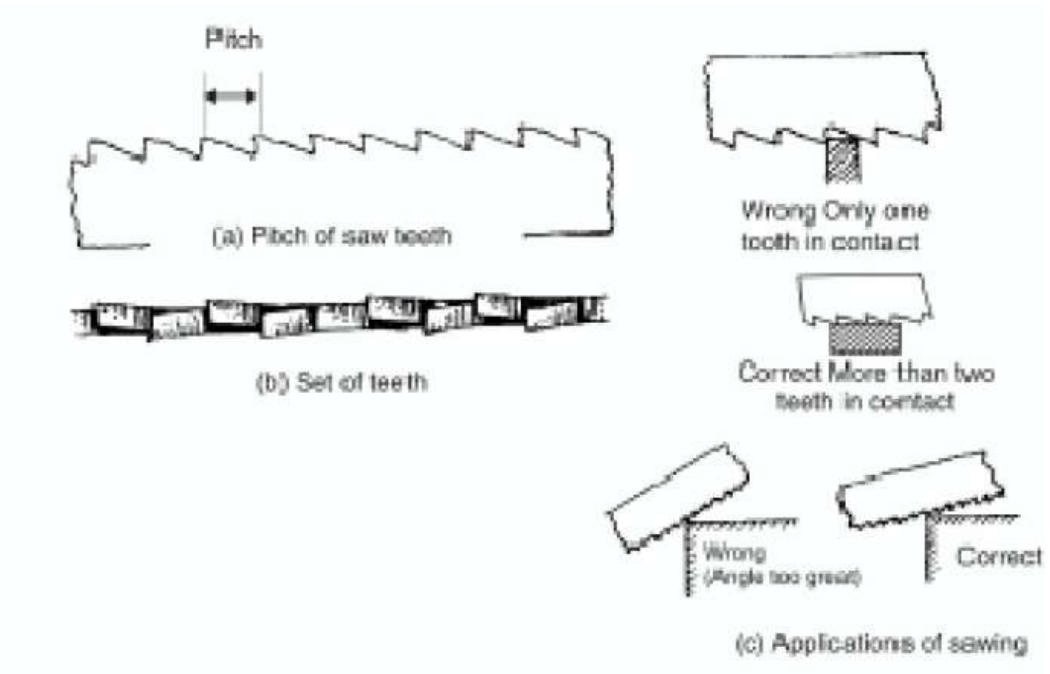
Sawing



Different Parts of a Hacksaw



All Hard & Flexible Type of Blade



EXERCISE

1. Enlist steps you have followed to do the job and tools you have used.
2. Explain the use of following tools used in fitting shop with neat and clean sketch:
   (a) Center punch (c) chisels (b) v-block (d) hack saw blade
3. List the parameters to be considers for selection of a hacksaw blade?
4. To cut external thread we use:
   a. Tap b. Die c. Drill d. Reamer
5. File is specified by its:
   a. Length b. Width c. Thickness d. Weight
6. Tri-square is used to check:
   a. Right angel of the two-face b. straightness c. Both a & b
7. For the marking the lines on job we use:
   A. Pencil b. scriber c. Ink pen d. Chalk
8. What is the use of surface plate?
9. Hacksaw blade is specified by its:
   a. Length b. width c. pitch d. a b & c
10. Reamer is used for:
    A. Make hole b. Cut thread c. Finish hole d. none

EXPERIMENT NO. 6

AIM: FAMILIARIZATION WITH CARPENTRY PRACTICE

Objective: Students should be able to:

1. Name different types of wood and their applications.
2. Sketch different types of joints used and their applications.
3. Select proper hand tools/machines used for specific application.

Introduction

Carpentry is a process that deals with timber, which is used, in building work, furniture work, wooden toys, geometrical instruments, patterns etc. This process involves different types of woods, like Hardwood and soft wood.

1. Soft timber or soft wood e.g. pinewood, deodar etc.
2. Hard timber or hard wood e.g. teak, oak, mango, babul etc.

Timber is available in different forms:

(1) Log : Trunk of a tree
(2) Balks : Rough and square log
(3) Posts : Square and round sectioned pieces ranging from 175 to 300 mm size.
(4) Deals : Parallel side 225 mm wide & approx 100 mm thick.
(5) Planks : Parallel side pieces 275 mm to 450 mm wide & approx. 75 mm to 100 mm thick & 2.5 to 6.5 meter. Long.
(6) Batten : Rectangular pieces up to 175 mm wide & 35 to 50 mm thick.
(7) Board : Swan pieces less than 35 mm thick & over 150 mm wide.

Seasoning

It is necessary to remove moisture and sap from the fresh timber before using it, to avoid shrinkage, cracking and warping during its usage. This process is termed as seasoning. Seasoning can be through a natural process or an artificial process.

Carpentry Process

To give shape, size and finish to wooden articles, large no of operations are performed, they are:

1. Marking, measuring and laying out
2. Sawing/cutting
3. Planning
4. Chiseling
5. Mortising & Tenoning
6. Boring
7. Glooming
8. Molding

9. Rebating
10. Recessing

Common Defects In Timber:

The common defects can be broadly classified as follows:

1. Natural defects
2. Processing defects
3. Weather/environmental defects

Carpentry Machines

For accurate working and large-scale production, power driven machines are used in carpentry shop.

1. Wood working lathe

The woodworking lathe is one of the most important machines used in carpentry shop. This is employed primarily for turning jobs in making cylindrical parts. However, by suitably manipulating the tools. Tapers, radius and other irregular shapes can also be easily turned.

2. Circular saw

This is the second most important machine of carpentry shop. It can be used for ripping, cross cutting metering beveling, grooving, etc.

3. Band saw

The band saw is designed to cut wood by means of an endless metal saw band that travels over the rims of two or more rotating wheels.

4. Wood planer

The wood planner is designed for planning large and heavy stock at a comparative faster rate. The boards to be planed are fed by means of feed rolls along a table against a revolving cutter head.

5. Mortiser

A mortiser is used to cut square slot in the direction of depth for the purpose of making a mortise and tenon joint in a wooden piece.

6. Sanding machines

Sanding is the operation of finishing wooden items after they have been machined. Abrasive paper belt is used for the same

Preservation of Timber

To increase the life of converted timbers, generally chemical or coats of oil paint is applied.

"In case of injury remember "RICE"- rest, ice, compress and elevate."

Plywood or laminated wood

Thin layers, called veneers are glued together under pressure such that the grains of one layer at right angle to the next are known as plywood.

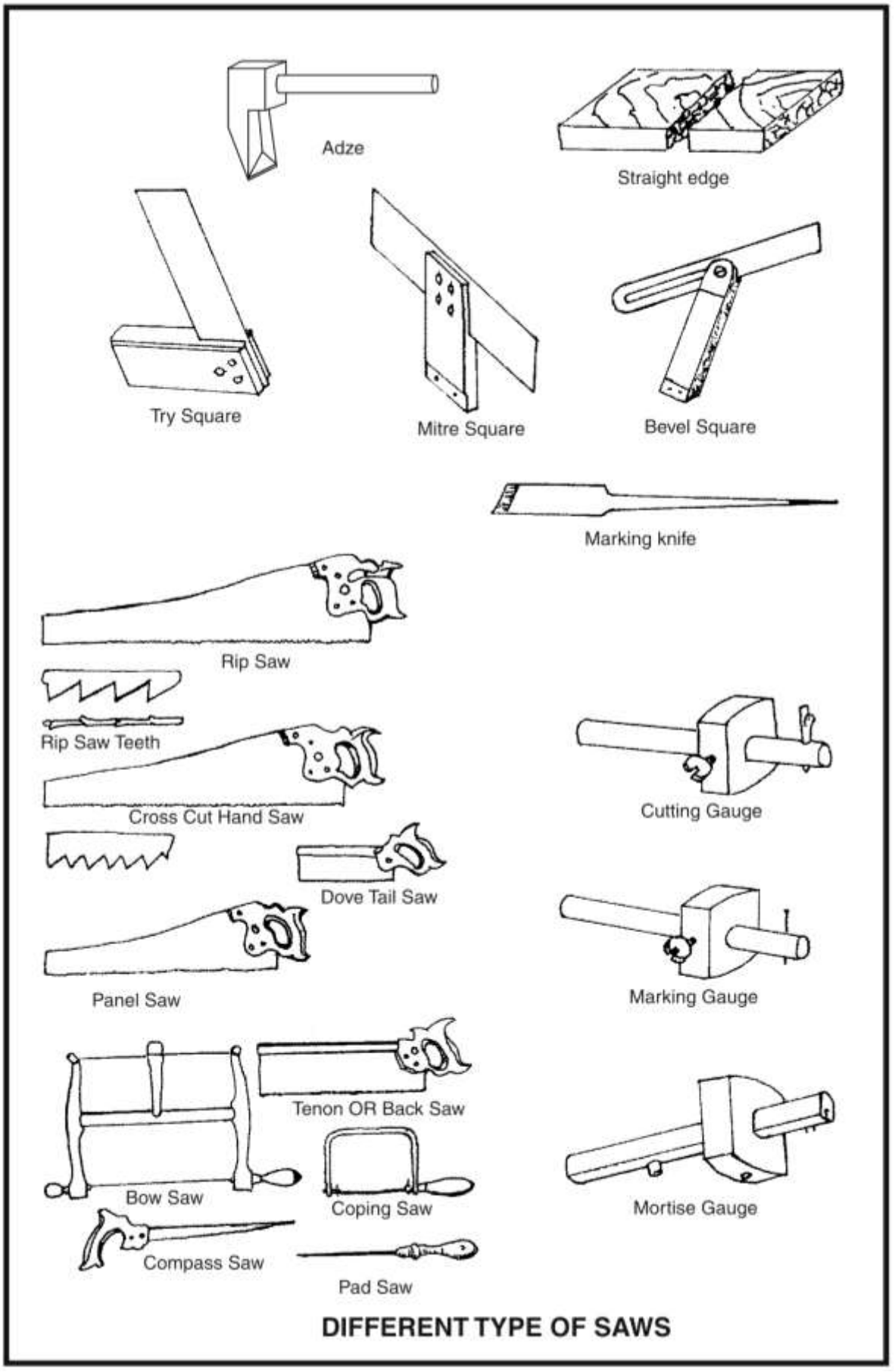
Carpentry tools: Tools used in carpentry shop are grouped as under:

1. Marking, measuring & inspection tools. E.g. rule, straight edge, try square, bevel square, gauges, etc.
2. Cutting tools. e.g. saws, chisels, etc.
3. Planning tools. e.g. jack plane, smoothing plane, etc.
4. Boring tools, e.g. gimlet, hand drill, etc
5. Striking tools, e.g. hammer mallet, etc.
6. Holding tools, e.g. bench vice, sash cramp, etc.

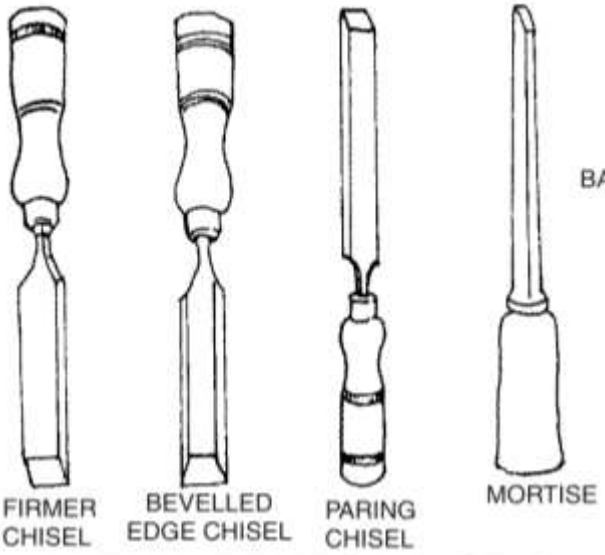
In frame work typical joints, used, are the various halving joints, mortise and tennon joints, bridle joints, etc.

Safety In Carpentry Shop:

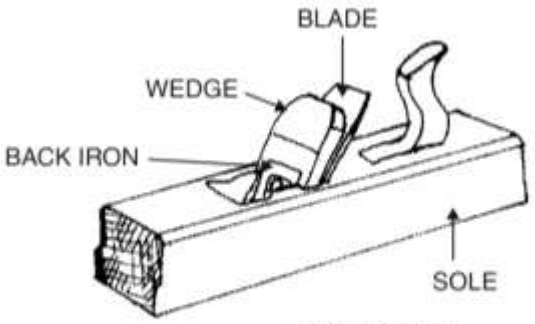
1. Never wear loose cloths
2. While working with cutting tools like chisels make sure that cutting is performed in the direction, away from the body.
3. Always use a well-sharpened tool. A blunt not only tales more time but there are chances of slipping, that may result in an accident.
4. Never keep boards or other pieces carrying nails on the floor.
5. While working on a machine use safety guards provided on them.,
6. While working on a band saw adjust the guide properly.
7. Always keep the tools at proper position when not in use, they should not be scattered on the bench or work floor.
8. Keep the floor area free from the hand obstructions.
9. Operate the machine only with the permission of the shop in charge or when you are familiar with it.
10. Before starting machine, be sure that the guards are in proper position
11. While working on a circular saw always stand away from the line of the
12. Blade rotation and keep your hands at a safe distance from the saw.
13. Never feed the stock faster than its capacity.
14. Feed the stock directly against the moving band and do not press from side.
15. Before taking cut, allow the saw to attain full speed.
16. Always keep the shop floor clean and free from scrap
17. Hold the job firmly with clamping device while working on the machines.



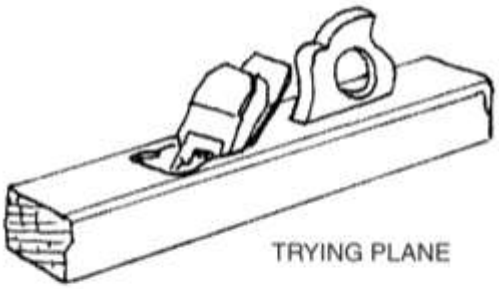
DIFFERENT TYPE OF SAWS



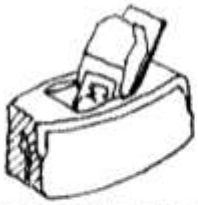
DIFFERENT TYPE OF CHISELS



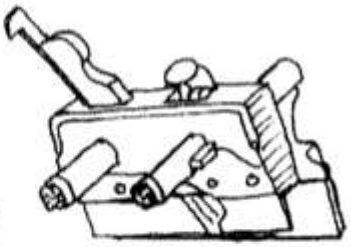
JACK PLANE



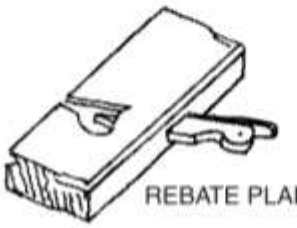
TRYING PLANE



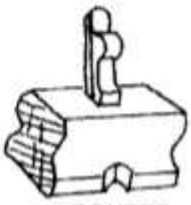
SMOOTING PLANE



PLOUGH PLANE

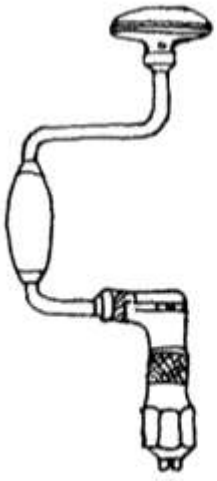


REBATE PLANE

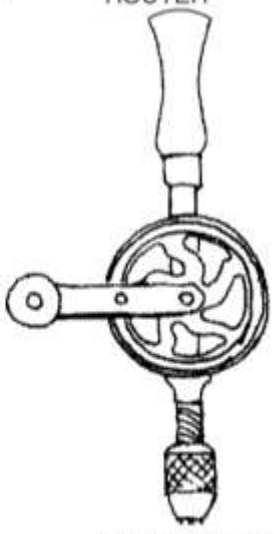


ROUTER

METAL JACK PLANE

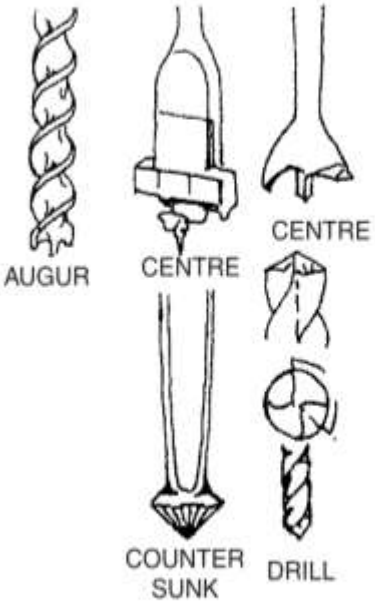


RATCHET BRACE



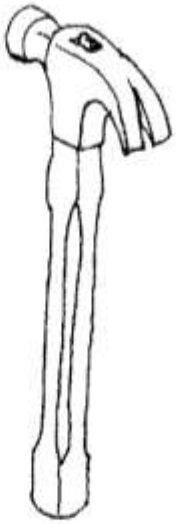
WHEEL BRACE

SPOKE SHAVE

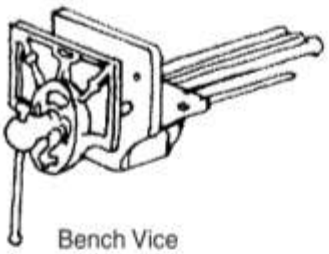


DIFFERENT TYPES OF BITS

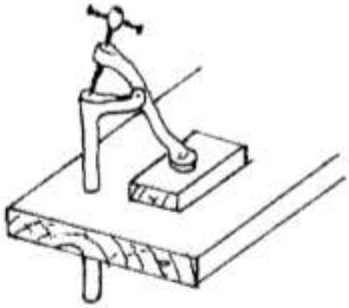
Warrington Hammer



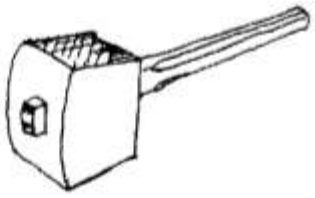
Claw Hammer



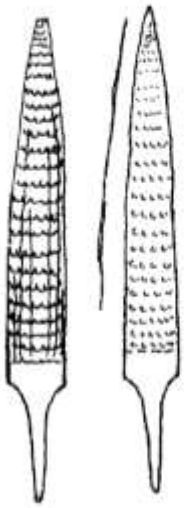
Bench Vice



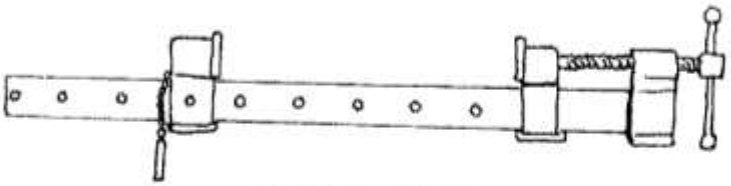
Bench Hold Clamp



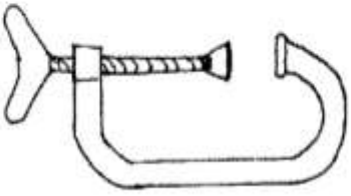
Mallet



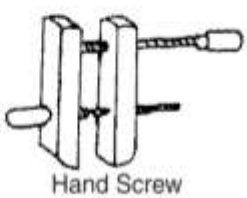
Rasp



Sash OR Bar Clamp

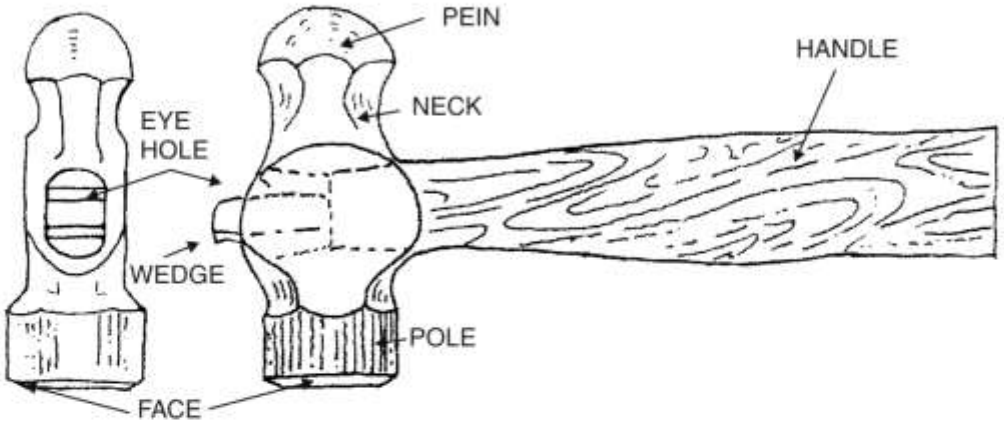


C.Clamp

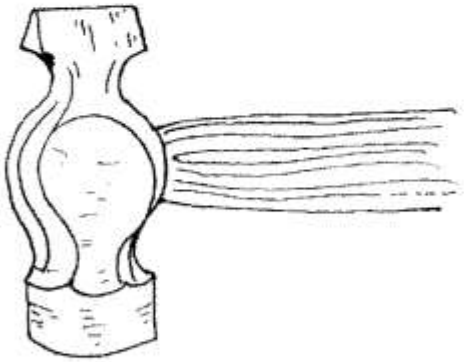


Hand Screw

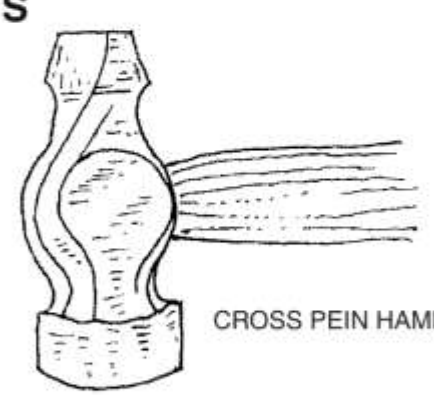
KINDS OF HAMMER



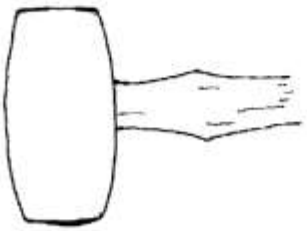
BALL PEIN HAMMER WITH PARTS



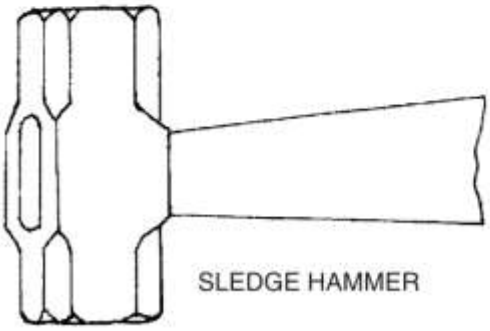
STRAIGHT PEIN HAMMER



CROSS PEIN HAMMER



MALLET



SLEDGE HAMMER

EXERCISE

1. List the common defects found in timber and explain in brief.

2. Explain the functions of following wood working tools

   a. Jack Plane b. Mallet c. Firmer Chisel d. Try Square

3. Give name of the tools used for the following operation

   a. Pulling out a nail b. To produce small hole manually in wood c. Marking parallel lines
   d. To produce square hole manually in wood

4. Sketch and describe following joints made in carpentry shop.

   a. Tee lap joint b. Dovetail joint c. Double mortise & tenon joint d. Bridle joint

5. What is “Seasoning” of timber?

6. Name some wood working processes.