CHAPTER ONE

1.0 INTRODUCTION

1.1 The origin of Technical Drawing

The origin of Technical Drawing is as old as man. In an instrumental, subordinate role, it developed along with the other arts in antiquity and the Middle Ages. Yester years, people drew pictures to show their own and other peoples' ideas. The sketches then were crude and were on clay tablets. Ancient Egyptian stone mansions made plans for the pyramids and many other structures on papyrus, slabs of limestone and in some occasions on wood. However, when the actual construction begins, they drew several lines on the ground in other to locate important position of large stone blocks for temples and other big structures. 1-li story made us to understand that the Romans were probably the first to make the best mechanical drawings of the classical period. They provided highly detailed sketches and pictures for their buildings roadways, temples, and aqueducts.

Drawing was recognized as a means of recording, for example, the features of the great, as in the portrait drawings by Albrecht Durer, Hans Holbein, or the french court artists of the 16th century, some of which correspond to no known paintings. Rembrandt, a prolific draughtsman, seldom used his drawings for preparing paintings or etchings but treated them as an independent from.. (Encyclopaedia Britannica, 2002)

In the early 17th century, Jacqucs Callot of france recorded with the pen his clever inventions and great picture stories, primarily in bold abbreviations. Most Dutch painters of the 17th century, such as the Van de Velde family, Brouwer, Van Ostade, Pieter Saenredam, and Paulus Potter, were also industrious draftsmen who recorded their special thematic concerns in drawing that were largely completed land scape, drawing was initiated by the brothers Agostino and Anniable Carracci and further developed by Domenichino and Salvator Rosa in Italy in the 17th Century.

In African generally and Nigeria specifically, drawing signifies various cultural beliefs and traditions religions, and thinking perceptions of people's ideals. Cultural according to Tylor can be define as the complex whole of man's acquisitions of knowledge, morals, beliefs, arts, customs, technologies, etc., Which are shared and transmitted from generation to generation. This is why in the African traditional setting; all these and their beliefs are always reflected in their sketches and graphics, since drawing is often a stage preliminary to work in a more substantial medium, such as printing , sculpture, or architecture (Encyclopedia Britannica; 2002) The Yorubas and the Kanuris used to make sketches of what to carve on gourds and calabashes, coal and stone and sometimes experiment by first drawing with forefinger or stick on the ground or clay. The fulanis do their own drafting of weaving styles on leather shoes, hand fans, etc directly. The Bennins and the Awka people in

Anambra state of Nigeria are not left out in their bronze casting and blacksmithing of knife. Fabrication designs respectively using direct approach on the object to cast or on the mould pattern and on the metal directly.

Freehand sketches are not uncommon in most of the designs done in African, they are done without the use of any instrument. Their designs, were rough and unredefined but at least showed to some extent element of graphic designed. More recently different Adire (TRADITIONAL) after pouring pap Wax etc. On the clothing before dyeing) patterns are drawn with forefingers or sticks on the clothing before dying. In the African setting , differently weaving styles and embroidery patterns on flowing gowns, and other traditional dresses used to be drawn with hand on hard papers and then transferred to the dress using needle and thread. Different patterns used to be made on pots to make them look attractive and to manifest the cultural beliefs of different ethnic groups using stones or sticks when it is still wet before firing them in the kiln. Incisions are made on hands, chests, legs, cheeks, etc to reflect cultural beliefs and family background of new born babies using sharp objects such as sharpened stones and knives.

In the fast developing Society, an engineer plays a vital role. He is rightly called "The Creator" a man who puts his imagination into actual practice. He thinks of problems in his mind and conveys them to others through the language of systematic lines. It is this language of ^stematic lines which is called technical drawing. Therefore, an engineer must have knowledge of this language to project his ideas correctly on the paper and then execute the job efficiency and effectively with the help of this drawing.

Since the modern research work in engineering depends mainly upon engineering drawing. It is therefore, necessary for an engineer to acquire a good working knowledge about the subject in order to express and record the shape, size and other information necessary for the construction of various objects such as building, roads, bridges, structures, machines etc.

1.2 IMPORTANCE

1. Drawing is a Universal language which everybody understands. Drawing can be an effective means of communication among people. Therefore, drawing and illustration are very important in our everyday life because they afford us common understanding. On the other hand, writing takes place in different languages and only those who understands the language can interpret the meaning.

In Engineering drawing, an object is drawn with a combination of straight and curved lines to produce the imaginary image of the object ready for manufacture or reproduction. To do this, technical drawing experts and students use a lot of instruments, some of which are described in chapter 2.

2. Engineering drawings are used as records of what has been designed and made.
3. It provides information with clarity, accuracy for production engineer, craftsman etc. in details to produce components /machines/ equipments.
4 Being a graphic language, it function as a medium of visualisation

1.3 ARE AS OF APPLICATION

The subject of Engineering drawing has the following areas of application in engineering and technology.

a. Civil Engineering-
To express Civil Engineering works and projects for actual execution i.e. representation of Civil Engineering objects such as roads, building, bridges, dams, etc. on a paper.

b. Electrical and Electronic Engineering -
Representation of electrical objects such as motors, generators, transformers, poles, towers, wiring diagrams etc. on a paper.

c. Mechanical Engineering:-
Representation of Mechanical Engineering objects such as machines, machines parts, etc on a paper.

Other areas of application involves Chemical Engineering building technology , land surveying , quantity surveying and Science technology.

CHAPTER 2

2.0 DRAWING TOOLS/EQUIPMENT AND DRAWING BOARD PRACTICE

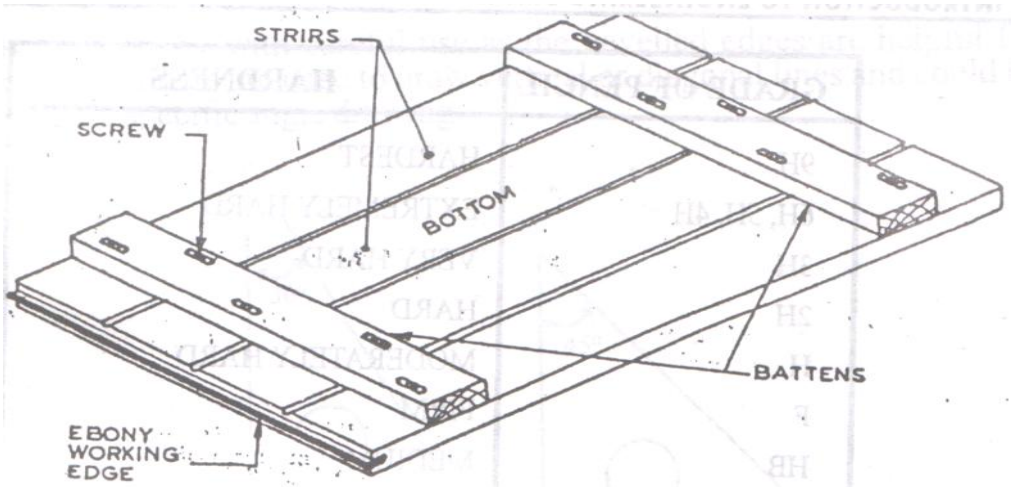
2.1 IDENTIFICATION OF VARIOUS DRAWING EQUIPMENTS AND MATERIALS

A good and accurate drawing can only be made through constant practice with the aid of drawing instruments and materials listed below:-

Drawing board
Tee square
Drawing pencils
Set of drawing instruments
Set squares 60° - 30° and 45°
Drawing paper clips or tape
Protractor
Scale rule
French curves
Drawing paper
Eraser
Compasses and Divider

2.2 USES **OF DRAWING INSTRUMENTS AND MATERIALS**

Drawing Board :-
The drawing board is made of wood, such as yellow pine, soft enough to permit the easy insertion and ready withdrawal of the drawing pins and yet hard enough to stand the wear and tear of daily use.



2.1 Drawing Board

Drawing boards can also be made of fine, even-grained plywood 12-18 millimeters in thickness, with battens screw to the underside.

TEE SQUARE:
Is as important as the board, and should be well-chosen and well-cared for. The best are of mahogany having an ebony edge to both blade and stock. The tee-square is placed on the drawing board with the stock at the left hand edge of the board.

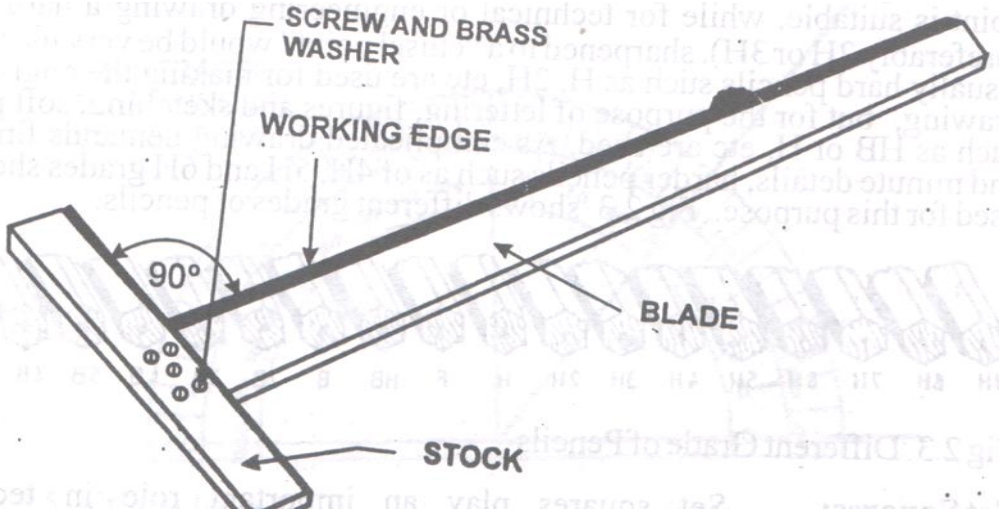


Fig. 2.2. Tee Square

GRADE OF PENCIL	HARDNES S
9H	HARDEST
6H, 5H, 4H	EXTREMELY HARD
3H	VERY HARD
2H	HARD
H	MODERATELY HARD
F	FIRM
HB	MEDIUM
B	MODERATELY SOFT &
2B	BLACK
3B	SOFT AND BLACK
4B, 5B AND	VERY SOFT AND BLACK
6B	VERY SOFT AND VERY
7B	BLACK
	SOFTEST

Table 2.1

Drawing Pencils:
Drawing pencils are of different grades. For Technical drawing, a 2H pencil is ideal for general drawing while H or HB grade pencil sharpened to a conical point is suitable, while for technical or engineering drawing a hard pencil (preferably 2H or 3H). sharpened to a "chisel point" would be very useful Usually hard pencils such as H, 2H, etc are used for making the engineering drawing, but for the purpose of lettering, figures and sketching, son pencils such asHB or H, etc are used. As complicated drawing demands fine lines and minute details, harder pencils such as of 4H, 5H and 6H grades should be used for this purpose. Fig 2.3 shows different grades of pencils.

2H 6H 7B 4H 5H 4H 3H 2H H F HB B 2H 3H 4B 5B 6B 7B

Fig 2.3 Different Grade of Pencils

Set Squares:- Set squares play an important role in technical, engineering or geometrical drawing. Wooden or tinned iron set squares are of no use, especially when inking- in. A cyclic set squares are of great value, and

highly satisfactory with careful use as the bevelled edges are helpful for inkin-in. Set square are used to draw vertical or diagonal lines and could be paired up for specific angle drawing.

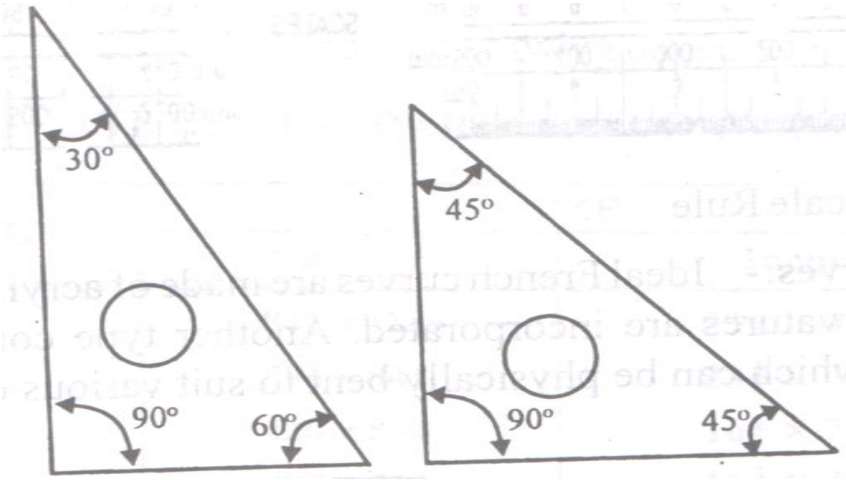


Fig. 2.4 Set Squares

Drawing paper and adhesive tape.

Drawing papers are best held on the boards with the aid of clips or adhesive tape.

Protractor:- An ideal is made of acyclic material with divisions ranging from half a degree through 90° to 180°.

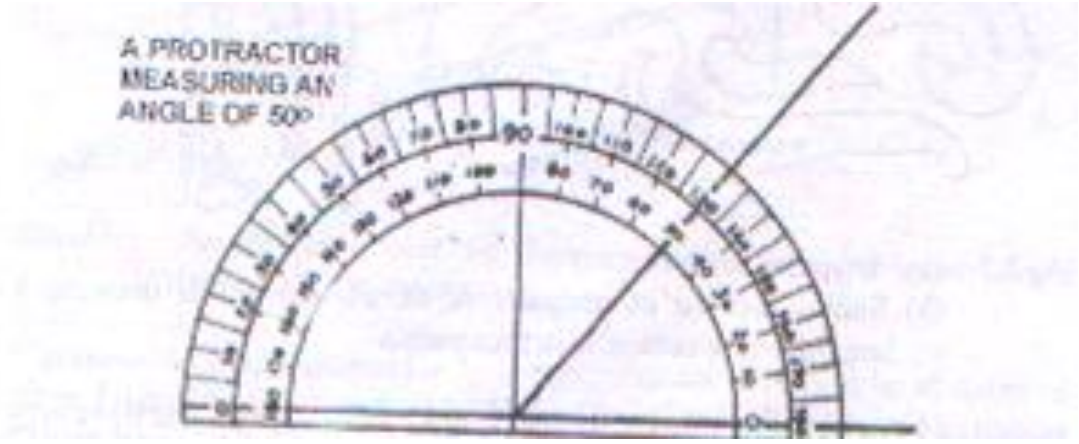


Fig. 2.5 Protractor

Scale Rules:- The use of scale rule is vital as most linear sizes are not possible on paper.

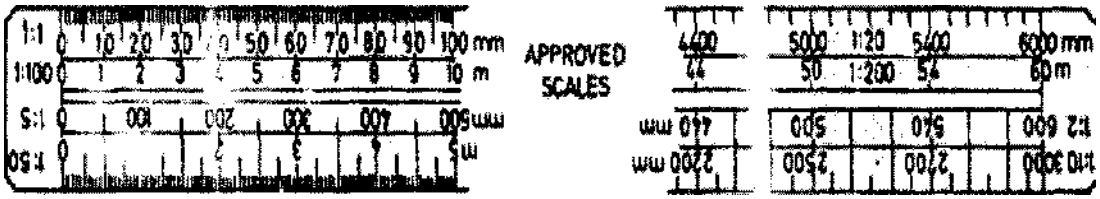


Fig. 2.6 Scale Rule

French Curves:- Ideal French curves are made of acrylic material in which possible curvatures are incorporated. Another type consists of a flexible plastic bar which can be physically bent to suit various curves (known as a flexicure).

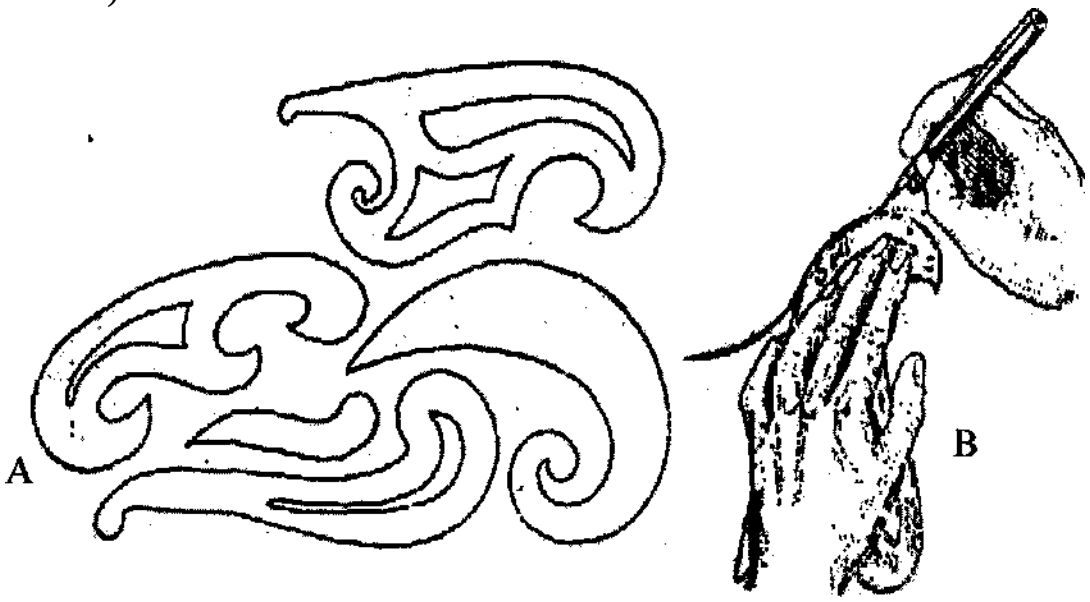


Fig 2.7 (a) Irregular or French curves
(b) Shows the use of irregular or french curves for drawing a smooth curve between various points

Drawing Paper:- Creamy-white paper is ideal for drawings. The sizes vary in relation to the size of the drawing board, usually from quarters to full imperial. Suitable metric sizes of paper are: A2, **A3, A4.**

Other drawing papers:-

Apart from the normal Creamy- white drawing papers, there are:

(a). Tracing paper.

(b). Transparent cloth backed drawing paper.

Table 2.2 **LIST OF STANDARDS OF DRAWING SHEET**

GRADE	SIZE	
	Millimetres	Inches
AO	841 x 1189	$33\frac{1}{8}$ x $46\frac{3}{4}$
Al	594 x 841	$23\frac{3}{8}$ x $33\frac{1}{8}$
A2	420 x 594	$16\frac{3}{8}$x $23\frac{1}{8}$
A3	297 x 420	$11\frac{3}{4}$x$16\frac{1}{2}$
A4	210x297	$8\frac{1}{4}$x $11\frac{3}{11}$
A5	148 x 210	$5\frac{3}{4}$ x $8\frac{1}{4}$

Eraser: There are various makes of erasers and they are generally called "rubbers". A soft white rubber closely resembling cheese in colour and structure is idea].

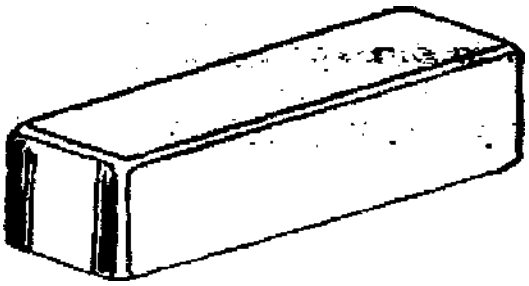


Fig. 2.8 Erazer

Divider: The divider is used for dividing straight or curved line is into number of equal parts

Compass: Compass is used for drawing circles and are of circles of required sizes. It consists of two metal legs hinged together at its upper end by means of a joint known as knee joint.

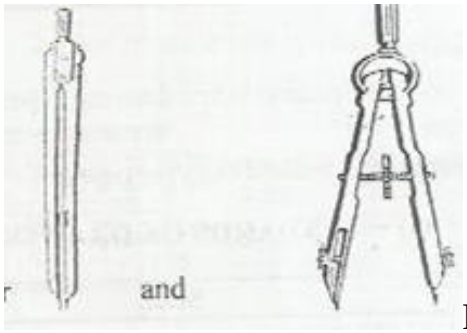


Fig.2.9(i) Divider Fig.2.9(ii) Compass

2.2 **ALIGNMENT AND FIXING OF DRAWING PAPER ON THE DRAWING BOARD WITH TEE SQUARE**

Paper is a medium through which drawing are made in graphics, if paper is not well aligned, there will be transfer of error from the paper to the paper to the graphics thereby making it unpleasant to the eyes. To align paper on the board, tee square is required. Make sure the stock of the T -square is firmly held against the batten of the drawing board withleft-hand and the paper inserted in-between the Tee square and the board such that the edge of the paper coincides with the edge of the blade of the Tee-square.{see figure 2.9(a)}. The cello tape or drafting tape is placed across each Gorner of the sheet as shown in figure 2.9 (b) while firmly and tightly holding the Tee-square against the paper and board. Care must be taken to remove the cello tape after drawing otherwise the corners of the drawing sheet may be torn off. If the stik-tacks are to be used, you will follow the same procedure except that the adhesive is first mounted on the board by smartly flipping the paper up and then close gently as shown in figure 2.9. (C). The head of the pin must be pressed closely down such that the blade of the Tee-sqaure can not knock on its sides during the back and forth movements of the Tee-square can not knock on its sides during the back and front movements of the Tee-square.Drawing pins are no longer popular because of the havoc of perforation the surface of the surface of the drawing board and has been replaced with clips.

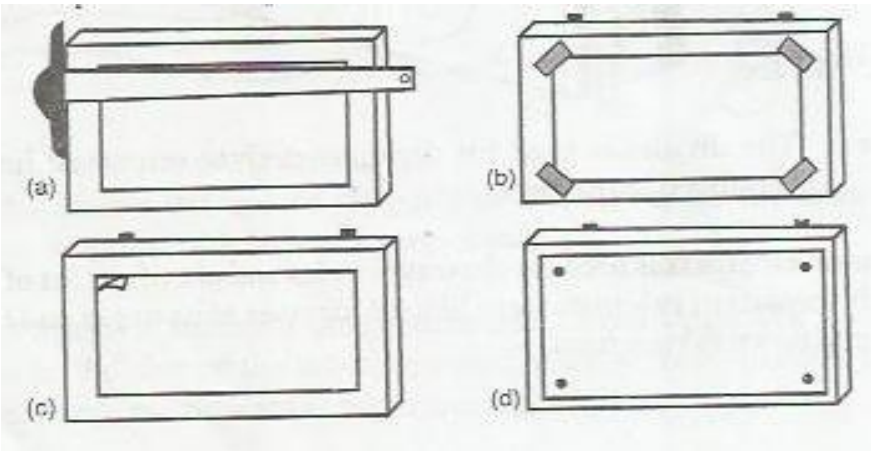


Fig.2.10(a-d) Alignment and Fixing of Drawing paper on the Drawing Board with Tee Square.

2.3 MAINTENANCE OF DRAWING INSTRUMENTS AND MATERIALS

DRAWING BOARD

(i) As far as possible, do not use pins on the drawing board,
(ii) Do not use the drawing board for any purpose other than for drawing.
(iii) When you are not using it, you should cover the face with paper or place the drawing board face down.

TEE SQUARE

i. You should never use the tee square as a walking stick.
ii. Never use any pen knife or blade along the edge of the Tee-square for any reason(s).
iii. The underside of the blade of the Tee square should be kept clean so that the drawing paper does not get dirty.

SETSQUARES

i. Do not use any sharp object such as a knife or razor blade on their straight edges.

COMPASSES

i. Never use compasses as paper holders

OTHER INSTRUMENTS

All other instruments should be kept in their packets after use. A cupboard should be made available for complete storage of the drawing boards and all other instruments.

CHAPTER 3

3.0 Line Work

3.1 PRELIMINARY GEOMETRICAL TERMS

i. A POINT has no area, it indicates a position, it can be indicated by a dot.

ii. A LINE has length but no area. It may be curved or straight.

3.2 TYPES AND USES OF LINES

(i) **Thick continuous lines:** are used for visible outlines and edges. The thickness of this kind of line is about 0.7mm. However, you do not have to measure the thickness of lines each time you draw.

(ii) **Thin continuous lines**: are used as dimension lines, projection lines, construction lines and outlines of adjacent parts and revolve sections. They are also used as hatching lines.

(iii) **Thick long chain lines:** are used for cutting planes and viewing planes.

CONVENTIONS FOR VARIOUS LINES (ACCORDING TO B.I.S.S.P. 46-1988)

LINE	DESCRIPTION	GENERAL APPLICATIONS
A	CONTINUOUS THICK	A1 VISIBLE OUTLINE A2 VISIBLE EDGES
B	CONTINUOUS THIN STRAIGHT OR CURVED	B1 IMAGINARY LINES OF INTERSECTION B2 DIMENSION LINES B3 PROJECTION LINES B4 LEADER LINES B5 HATCHING B6 OUTLINES OF REVOLVED SECTIONS IN PLACE B7 SHORT CENTRE LINE
C	CONTINUOUS THIN FREEHAND	C1 LIMITS OF PARTIAL OR INTERRUPTED VIEWS AND SECTIONS, IF THE LIMIT IS NOT A CHAIN THIN
D	CONTINUOUS THIN (STRAIGHT WITH ZIGZAGS	D1 LINE
E	DASHED THICK	E1 HIDDEN OUTLINES E2 HIDDEN EDGES
F	DASHED THIN	F1 HIDDEN OUTLINES F2 HIDDEN EDGES
G	CHAIN THIN	G1 CENTRE LINES G2 LINES OF SYMMETRY G3 TRAJECTORIES
H	CHAIN THIN, THICK AT ENDS AND CHANGES OF DIRECTION	H1 CUTTING PLANES
J	CHAIN THICK	J1 INDICATION OF LINES OR SURFACES TO WHICH A SPECIAL REQUIREMENT APPLIES
K	CHAIN THIN DOUBLE-DASHED	K1 OUTLINES OR ADJACENT PARTS K2 ALTERNATIVE AND EXTREME POSITIONS OF MOVABLE PARTS K3 CENTROIDAL LINES K4 INITIAL OUTLINES PRIOR TO FORMING K5 PARTS SITUATED IN FRONT OF THE CUTTING PLANE

e). Thin long chain lines: are used as centre lines, path lines for indicating movement, or extreme positions of moveable parts, and for pitch circles.
e). Thick continuous wavy or irregular lines: are used for short break lines and boundary lines.
f). Thin ruled lines with short zig-zags:- are used for long break lines.
g). Thin continues wavy or irregular lines: are used for limits of partial views or for sections when the lines are not axis.
H). Arrow head: are used at the ends of dimension lines. They are also used to indicate viewing planes, and to indicate labelled parts.
(i). Thin short dashes: are used for hidden outlines and edges.3.3

TYPES OF PENCILS

The following are the two types of pencils according to a way of mending, for good and accurate work:

1. Chisel edge pencil
2. Conical or round point pencil

The Chisel Pencil as a chisel edge, flat on each side which remains fine for a long period. It is generally used for drawing straight lines. 2H, 3H etc Pencil are generally mended to chisel shape.
Conical Pencil such as HB etc are sharpened to a conical or round point as

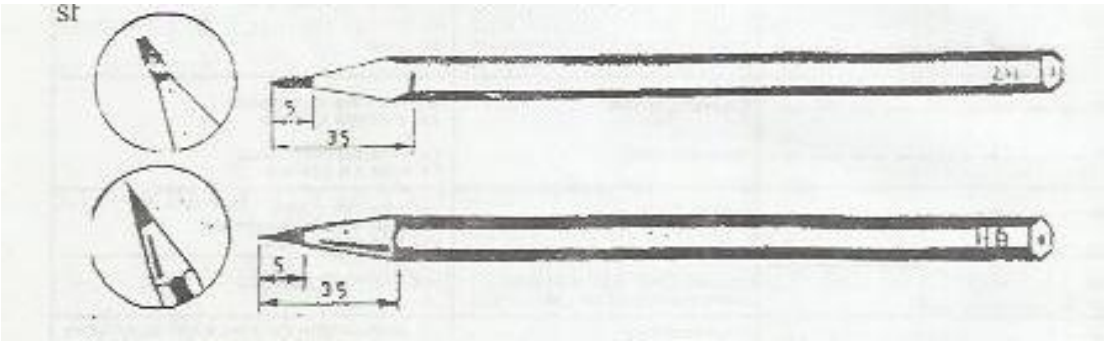
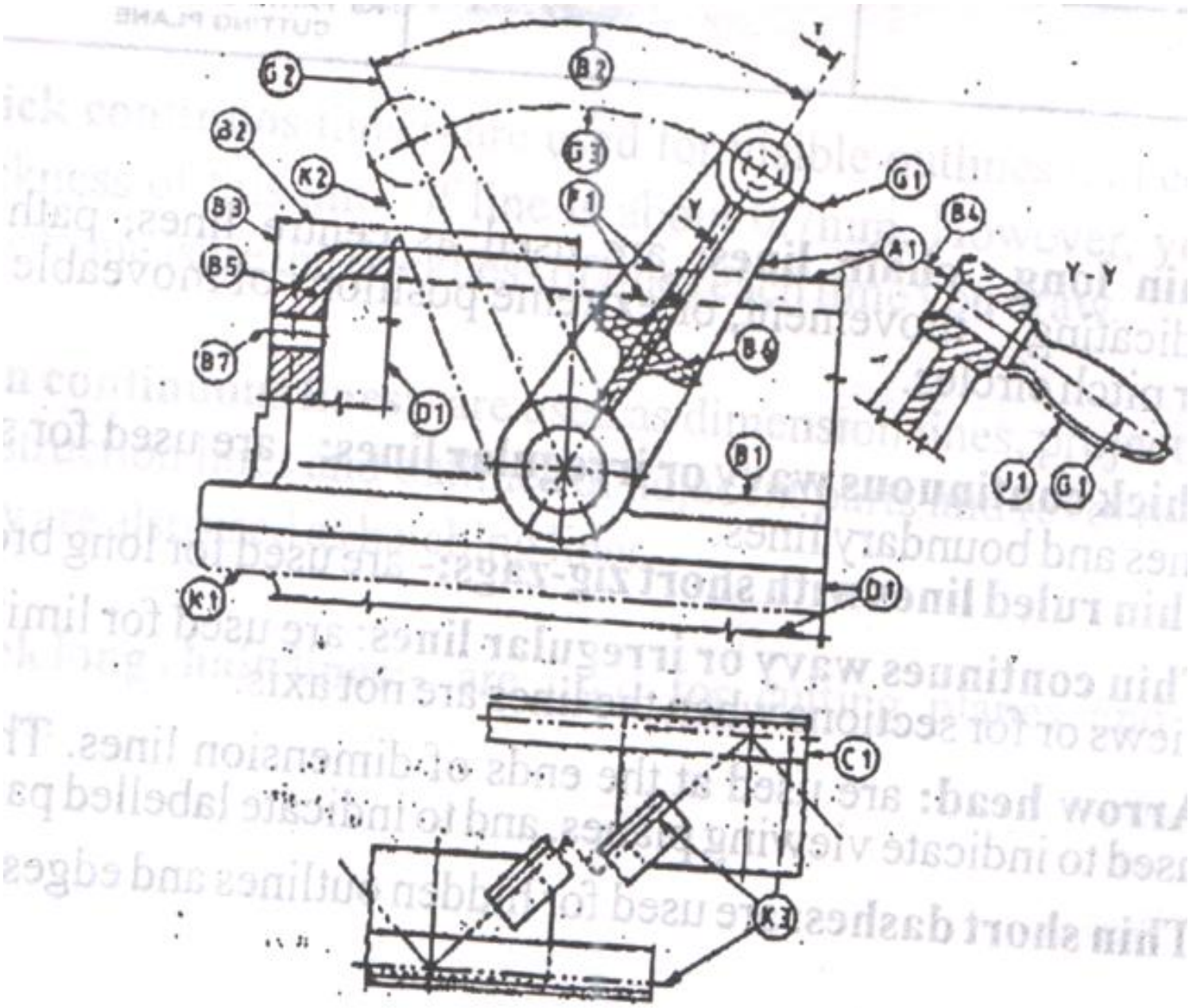


Fig. 3.1 T Chisel edge and conical or round point pencils

3.4 APPLICATION OF LINES



SELF EXAMINATON QUESTIONS

1. Define Technical Drawing. Why drawing is called the Universal language of engineer?
2. List the areas of application of technical drawing in engineering and technology.
3. Name different types of drawing instruments.
4. While drawing horizontal lines, in what direction should the pencil be inclined?
5. The art of representation of an object by systemic lines on a paper is called.....
6. The working edge of the drawing board should be on ……... side of the draughtman.
7. Define a point and a line.
8. Identify the various types of lines used in technical drawing and show their application according to B.I.S Sp:46-19§S.