

SECTION 2, CHAPTER 1

WORKSHOP DRAWING

List of Contents

	Para.		Para.
Introduction	1	Dimensioning	14
Reproduction of Drawings	3	Gauge Numbers, Drill Numbers or Letters	15
Scales	5	Screw Threads	16
Types of Lines	6	Flat or Square on Round Bar	17
Pictorial Projection	7	Machining Symbols	18
Orthographic Projections	8	Abbreviations	19
Types of View	9	Title Block	20
Types of Workshop Drawings	13		

List of Illustrations

	Fig.		Fig.
Types of Lines	1	Part Section View	8
Conventional Breaks	2	Staggered Section View	9
Pictorial View	3	Broken View	10
Orthographic Projection—First Angle	4	Auxiliary View	11
Orthographic Projection—Third Angle	5	Methods of Indicating Screw Threads ..	12
Section View	6	Method of Indicating Flat or Square on Round Bar	13
Half Section View	7		

Introduction

1. **Purpose.** The object of a workshop drawing is to convey the ideas and wishes of the designer to the tradesman in such a manner that the work can be completed with accuracy and as rapidly as possible.

2. **Requirements.** To make the reading of a drawing easy, it should satisfy the following requirements.

- Show all necessary measurements without unnecessary dimensions or repetitions.
- Not entail any kind of calculation.
- Clearly indicate the limits of accuracy or the class of fit.
- State the raw materials from which the parts are to be made.

(e) Provide a key to machining and other symbols.

(f) Give any other information, not provided for in clauses (a) to (e), to ensure satisfactory completion of the job.

Reproduction of Drawings

3. The original drawings and tracings are not used in the workshop because they would most likely be damaged, and therefore the production of prints for general use is more satisfactory.

4. When drawings are reproduced as prints, part of the process requires the print to be washed in water and then dried. This causes shrinkage of the paper, making the print not exactly to scale. For this reason

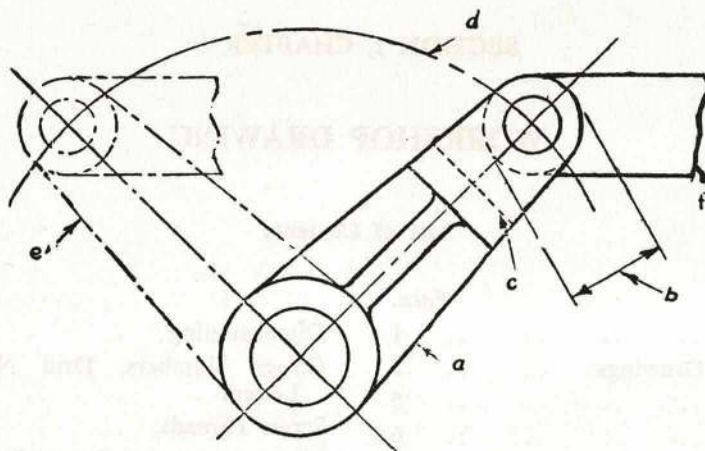


Fig. 1. TYPES OF LINES

do not take measurements direct off the print, but work to the dimensions stated.

Scales

5. It is not always possible to make the dimensions of a workshop drawing the same length as the real dimensions of the object drawn. When it happens that the dimensions of the object have to be reduced on the drawing paper, then resort has to be made to the use of a scale. Assuming that a dimension of 2 in. on the object is represented on the paper by a line 1 in. in length, then the line is drawn to half size. The scale is shown at the foot of the drawing. Other examples are as follows :—

3 in. on the drawing = 1 foot of the object = Scale $\frac{1}{4}$.

2 in. on the drawing = 1 inch of the object = Scale $\frac{2}{1}$.

Types of Lines

6. The thickness and method of marking lines has been standardized, and for general engineering drawing is as follows :—

(a) **Continuous Thick Line.** Used for visible outline.

(b) **Continuous Thin Line.** Used for sectioning, dimensions, projection or extension lines.

(c) **Thin Short Dashes.** Used for hidden detail, or portions to be removed.

(d) **Thin Long Chain.** Used for centre lines, or path lines indicating movement.

(e) **Thin Short Chain.** Used for developed or false views, or adjacent parts.

(f) **Continuous Wavy Thick Line.** Used for irregular boundary lines ; not true length.

(g) **Short Break Lines.** Used to shorten the view of long uniform parts.

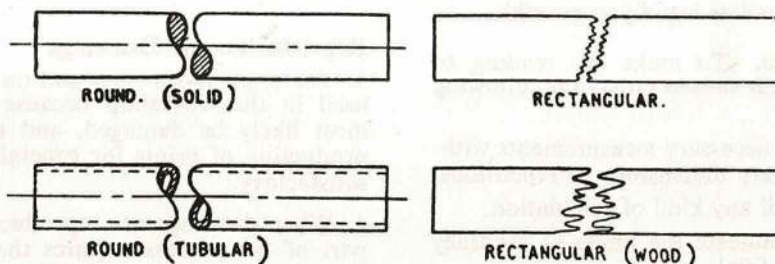


Fig. 2. CONVENTIONAL BREAKS

Pictorial Projection

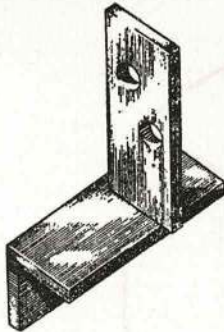


Fig. 3. PICTORIAL VIEW
because of the difficulty in arranging dimension lines.

7. One method of illustrating a detail or an assembly of parts is known as isometric projection, and provides an easily understood pictorial view. This method is used frequently when making sketches, but is seldom used in workshop drawing because of the difficulty in arranging dimension lines.

Orthographic Projections

8. The usual, or conventional method of presenting a workshop drawing requiring a number of views is by orthographic projection. This style of projection shows

the object as it actually is, both in size and shape when viewed from the horizontal and vertical planes, drawn to the most convenient scale. There are two standard methods in use as follows :—

(a) **First Angle Projection.** Imagine the object suspended in a box of which the front and left-hand sides and the lid have been removed. Project the views of the object, as seen when looking square at each face, on to the inside faces of each of the remaining walls and the base of the box. Hinging back the two walls of the box, in the manner shown in the illustration, until they are lying flat in the same plane as the base of the box displays three views of the object ; the front elevation, the side elevation and the plan.

(b) **Third Angle Projection.** Imagine the object suspended in a transparent box, and view the object through the sides and lid. The views projected on to the lid

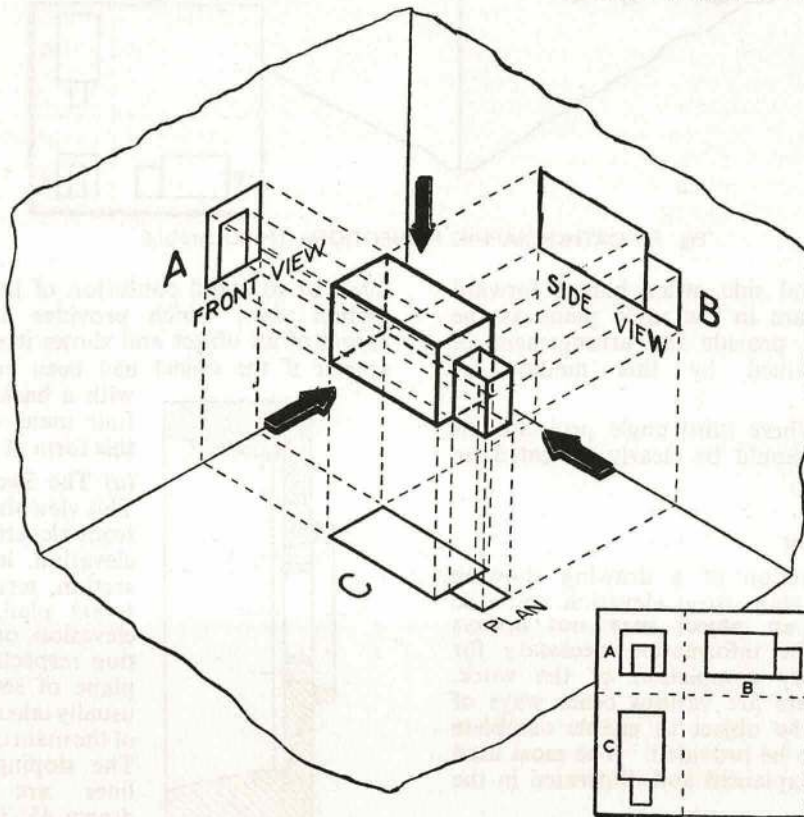


Fig. 4. ORTHOGRAPHIC PROJECTION—FIRST ANGLE

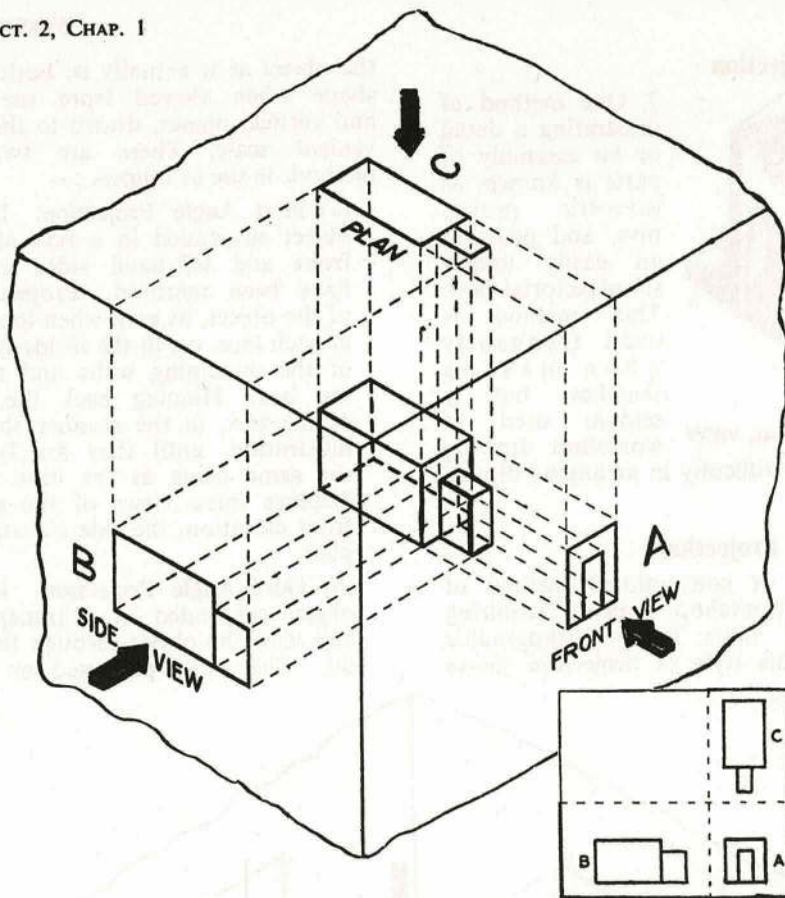


Fig. 5. ORTHOGRAPHIC PROJECTION—THIRD ANGLE

and left-hand side, when hinged forward until they are in the same plane as the front view, provide the arrangement of views obtained by this method of projection.

Note.—Where third angle projection is used, this should be clearly indicated on the drawing.

Types of View

9. The production of a drawing showing views of the plan, front elevation and side elevation of an object may not always provide all the information necessary for the satisfactory completion of the work. Therefore, there are various other ways of representing the object to enable complete information to be provided. The most used methods are explained and illustrated in the following text.

10. **Sectional Views.** Hidden details may be shown on a drawing by using thin broken

lines, or to avoid confusion of lines, by the section view, which provides an internal aspect of an object and shows it as it would appear if the object had been cut through

with a hacksaw. The four main variants of this form of view are—

(a) The Section View.

This view shows a plan, front elevation, or side elevation, in complete section, termed a sectional plan, sectional elevation, or cross section respectively. The plane of sectioning is usually taken along one of the main centre lines. The sloping sectional lines are normally drawn 45° to the edge of the drawing sheet, and at right angles to

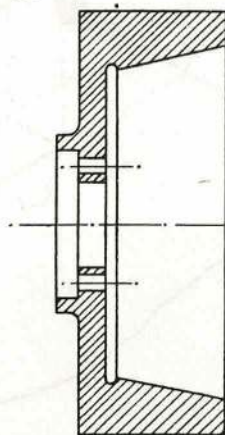


Fig. 6. SECTION VIEW

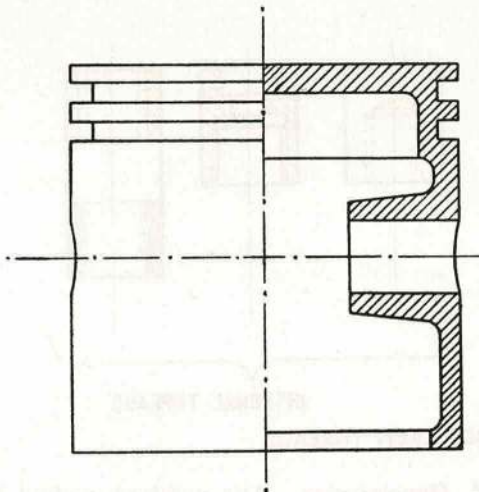


Fig. 7. HALF SECTION VIEW

each other to distinguish between adjacent parts in section.

(b) **Half Section View.** Used when it is

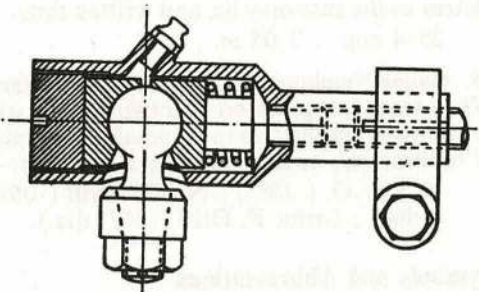


Fig. 8. PART SECTION VIEW

convenient and time saving to draw one half of the object in plan or elevation, and the other half in section.

(c) **Part Section View.** This view is used

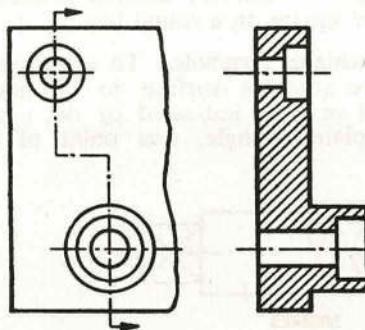


Fig. 9. STAGGERED SECTION VIEW

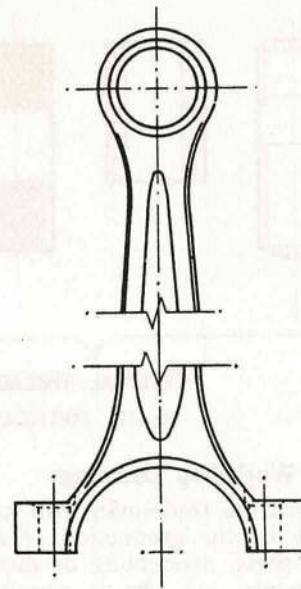


Fig. 10. BROKEN VIEW

when it is only necessary to show a portion of the whole view in section.

(d) **Staggered Section View.** Provides for a view through an object on two or more section planes, thus providing necessary information without additional drawings.

11. **Part or Broken View.** Where a component is symmetrical about an axis or is of extreme length, a part or broken view may be employed.

12. **Auxiliary View.** If the part is complicated an auxiliary view may be given. The view is drawn directly in line with the arrow which represents the direction in which the object is viewed.

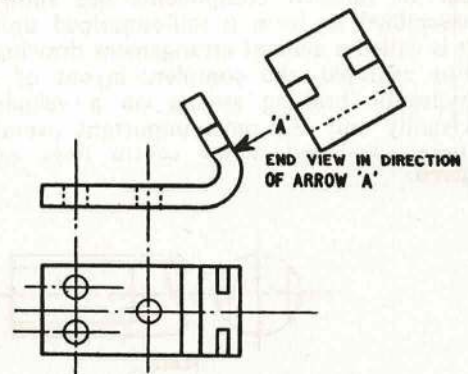


Fig. 11. AUXILIARY VIEW

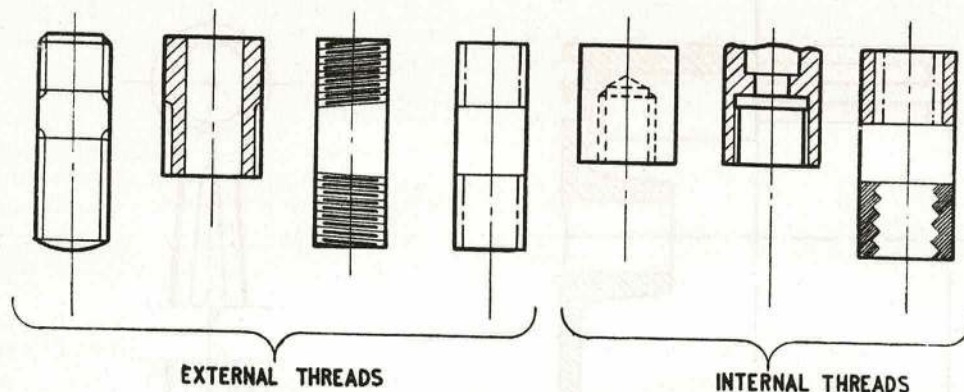


Fig. 12. METHODS OF INDICATING SCREW THREADS

Types of Workshop Drawings

13. To assist the tradesman with his work, which may be the production of an item, mating of parts, assembling or dismantling of components, etc., he is supplied with various types of drawings, the nature of the work to be performed deciding the type of drawing required.

(a) **Detail Drawing.** The detail drawing provides all the necessary dimensions and working instructions to enable the tradesman to produce the item to which the drawing refers. For example, the piston in a hydraulic brake master cylinder.

(b) **Assembly Drawing.** When the drawing shows the component assembled, it is called an assembly drawing. For example, the assembly of the various parts of a hydraulic brake master cylinder. A useful variant of this type is called the exploded view.

(c) **General Arrangement.** Where a number of finished components are shown assembled to form a self-contained unit, it is called a general arrangement drawing. For example, the complete layout of a hydraulic braking system on a vehicle. Usually only the most important overall dimensions and major centre lines are given.

14. **Dimensioning.** The standard method of dimensioning is in inches, or feet and inches, expressed thus:—

$7\frac{1}{8}"$; $7\cdot625"$; $6'-2"$.

When the metric system is used, the dimensions will be expressed in millimetres or metres as the case may be, and written thus:—

$25\cdot4$ mm. ; $3\cdot05$ m.

15. **Gauge Numbers, Drill Numbers or Letters.** When these are given on a drawing, they will be followed by the size in decimals of an inch or millimetres, as the case may be. Thus:—

10 S.W.G. ($\cdot128"$) ; No. 55 Drill ($\cdot052"$ dia.) ; Letter F. Drill ($\cdot257"$ dia.).

Symbols and Abbreviations

16. **Screw Threads.** All threads are assumed to be right-hand. If left-hand, they are indicated with the letters L.H. The size and type of thread is stated. The diagrams show methods of indicating screw threads.

17. **Flat or Square on Round Bar.** The drawing illustrates the method of indicating a flat or square on a round bar.

18. **Machining Symbols.** To save long descriptive notes, a surface to be machine-finished may be indicated by the use of a small plain triangle, one point of which

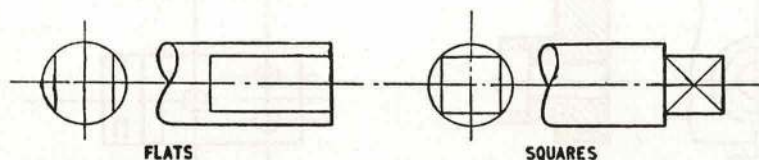


Fig. 13. METHOD OF INDICATING FLAT OR SQUARE ON ROUND BAR

should touch the surface defined. If a particular kind of machining is required, a letter symbol is inserted within the triangle. A few symbols of the more common machine finishes are shown below.

B = Bore F = File R = Ream.
D = Drill G = Grind S = Scrape.

If all surfaces of an article are to be machined, or finished in the same manner, it is indicated by one general symbol usually shown in the Title Block, e.g.

▽ all over = Machine all over.

▽ all over = Turn all over.

19. **Abbreviations.** The following are a few of the standard abbreviations used on work-

shop drawings. If further information is required, then B.S. 308/53 should be consulted.

Title Block

20. The title block is usually placed at the bottom right-hand corner of the drawing sheet, and provides the following information.

Drawing or part number	Material
Source of authorization	Number required
Description or title of drawing	Heat treatment
Scale	Draughtsman's signature

Note.—A space is usually provided for recording alterations to the drawing which may become necessary at a later date.

Term	Abbreviation	Term	Abbreviation
Annealed	ann.	Diameter	dia.
Approved	appd.	Material	Mtl.
British Standard	B.S.	Mild Steel	M.S.
Case Hardened	C.H.	Not to Scale	N.T.S.
Centre Line	C.L. or C	Nickel Steel	Ni. S.
Chamfered	chamf.	Pitch Circle	P.C.
Countersunk	csk.	Revolutions per Minute	r.p.m.
Cylinder	cyl.	Sheet Steel	Sh. S.
Cast Iron	C.I.	Threads per inch	t.p.i.



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