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OVER THE DRAWING BOARD

An Introduction to Architectural Draughtsmanship by

ROBERT FORMAN A.R.I.B.A.

Illustrated by the author

SECOND EDITION

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PREFACE TO THE SECOND EDITION

ALTHOUGH one may be highly efficient in handling pen, pencil and brush one cannot tell the student how to draw. Continuous practice plus a certain amount of cribbing from the individual styles of other draughtsmen will result in the development of latent talent. This form of development is particularly evident in schools where students are liable to adopt current fashions in draughtsmanship in proportion to their initial ability. My aim in a book of this sort is to set the student a course of action. I am fully aware that my personal style of drawing and lettering will not be to everyone's taste but the primary object of the illustration is to reinforce various points made in the text.

The friendly reception of the first edition suggests that the book has been found helpful to a fairly wide circle, not only of architectural students, but of technical draughtsmen, commercial artists and others who for work or pleasure have occasion to bend over the drawing board. Accordingly, the main pattern has been preserved, but improvements have been made in the text and some of the illustrations have been replaced.

ROBERT FORMAN

Bristol 1959

INTRODUCTION

THERE is no dearth of good draughtsmen to-day; the standard maintained is perhaps higher than ever before. Yet it is strange to note the paucity of reference books dealing purely with the technicalities of draughtsmanship. By that I mean detailed information of methods and materials to enable the new student to commence drawing easily and fluently. Students of fine art are well catered for by numerous reference books, some of monumental quality, dealing not only with the selection of materials, but also with the various techniques employed by famous artists.

In this volume I have endeavoured to give an explanation of practically every kind of draughtsmanship which an architect will encounter during his career, covering elementary study, professional practice and possibly recreation. In addition, many whose art is employed in other directions will, I hope, find here much of interest and value. While individual draughtsmen have their own mannerisms of presentation, there are certain rules of general application and those I have endeavoured to describe as briefly and clearly as possible.

Draughtsmanship is the language by which the architect expresses his ideas. By means of various media he must produce designs in pencil, ink and water-colour and explain to a client the accommodation and appearance of a projected building. In addition he must support his designs by making drawings and constructional details to enable the builder and his craftsmen to accomplish the actual building. Sufficient information will, I trust, be found in the following pages to put the keen student on the right track from the beginning.

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CHAPTER I

EQUIPMENT AND MATERIALS

THE student will require a suitable drawing board, 'Imperial' size (taking paper 30″ × 22″), square jointed and battened, and possessing an ebony edge at one side which enables the T-square to slide easily. When choosing a board see that the wood is free from knots, straight-grained and absolutely level, with all the sides square and parallel. Battens are usually fixed with domed screws, sunk in slots, to take any subsequent shrinkage or expansion. For small outdoor work such as sketching on the actual job, measuring up, etc., a square piece of hardwood board is sufficient. Always handle the drawing board with the greatest care, for hard knocks, cuts and bruises to the surface will impair its efficiency. A larger type of board known as a 'double elephant' (40″ × 26¾″) will be required later on for bigger drawings. A good T-square accompanies the drawing board. If possible, this should be of mahogany and have a bevelled ebony working edge, which must be kept scrupulously free from dents. It must always be used flat on the surface of the drawing board. See that the blade is screwed on to the stock, facilitating removal of the blade for 'reshooting' should it become damaged in any way.

Two medium-sized celluloid set-squares are recommended, one of 60° and the other of 45°. Celluloid is preferable to wood (some squares are made of ebony or mahogany) for the transparent qualities of this material will be found an asset. An exceedingly useful instrument is the adjustable set-square, which can be set to many angles and supersedes the protractor. The set-squares should also be kept clean and free from cuts.

Other celluloid instruments include the French curve which is useful for drawing what its name implies. There is also a small piece of celluloid known as a horn centre. It is used for preventing large holes in a drawing when several circles are described from the one centre. Various boxwood or ivory scales will be obtained as necessity dictates. They are usually twelve inches long and useful divisions are ⅛″, ¼″, ½″ and 1″. A small six-inch pocket scale with each of these scales on a separate edge is a very useful instrument. This is best in ivory, to withstand wear and tear. Scales are easiest to handle when they are a flat oval shape in section.

Metal drawing instruments are usually bought in complete sets in cases. Large ornate selections are an unnecessary expense, but see that what you do purchase is good. A first-class box of instruments will last a lifetime. The following are practically all essential to the draughtsman:

Compasses. These should be capable of fine adjustment when necessary, and possess

knuckle joints for setting the needle and pencil points as desired. Use a spinning motion when handling. An extension bar is necessary so that one can lengthen the legs for extra large circles.

Spring-bows are small compasses which are useful for pencil and ink circles of fine radius. Dividers are also obtainable in this form and can be used for small repeating measurements.

Dividers, as their name implies, are used for dividing lines or spaces or measuring dimensions on maps or drawings. The type with jointed legs is recommended.

Ruling Pens. There are many types of ruling pens with special advantages for easy cleaning. They are used for ruling lines in ink or colour and generally two pens are ample. They must be kept clean and are filled, not by dipping in the ink or colour, but with the quill which is usually attached to the ink-bottle cork, or for colour, with a small brush. The ink or colour is placed between the blades, not too much at one filling, and the instrument adjusted, by means of the screw, to the desired width of line. Before drawing the final line test the pen on the edge of the 'backing sheet', to ensure that it is running smoothly and producing the right thickness of line. Ruling pens should always be held in an upright position. If the pen becomes clogged, it is advisable to pause and clean it thoroughly with a scrap of soft rag. Some pens are so made that this can be done without losing the original setting of the instrument. Fig. 1 shows a few typical drawing instruments.

Other accessories will include a selection of ordinary writing pens, ranging from a fine mapping nib to broad or rounded nibs for quick lettering on designs. There are various types of one-stroke pens. Cards of these in assorted sizes and various brands are easily obtainable. One or two erasers will be required and should be used as sparingly as possible. A large soft putty rubber is most useful for cleaning down finished work.

Pencils. A good selection is necessary. Buy the best you can afford. Pencils range from 6H (very hard) to 6B (very soft). The student will only be concerned with the intermediate degrees such as HB, B, 2B, or H. The choice of pencils depends both on the student's personality (some people prefer a very soft lead, others a hard one) and the quality or texture of the paper used for drawing purposes. What little interest is taken in this all-important but often neglected instrument! Without it the draughtsman would be powerless, yet what little thought is given to it, especially in the early stages of the student's career; few people can even sharpen one properly. The lead contents consist of a combination of plastic clay and graphite or plumbago. This mixture reaches your hands encased in a cedarwood cylinder. The manufacturer obtains a medium hardness (HB) by a mixture of one-tenth clay and the remainder graphite; by increasing the graphite a softer, and by increasing the clay contents a harder, medium results.

Never throw your pencil down for you will most probably break the lead inside its wood casing, and it will then drop out in short lengths during sharpening. When sharpening start at the opposite end to that on which are the letters denoting the degree of hardness of the pencil. The best manner is to hold it firmly in the left hand, resting the end on the fleshy portion of the thumb, and carefully propel the knife by a pressure

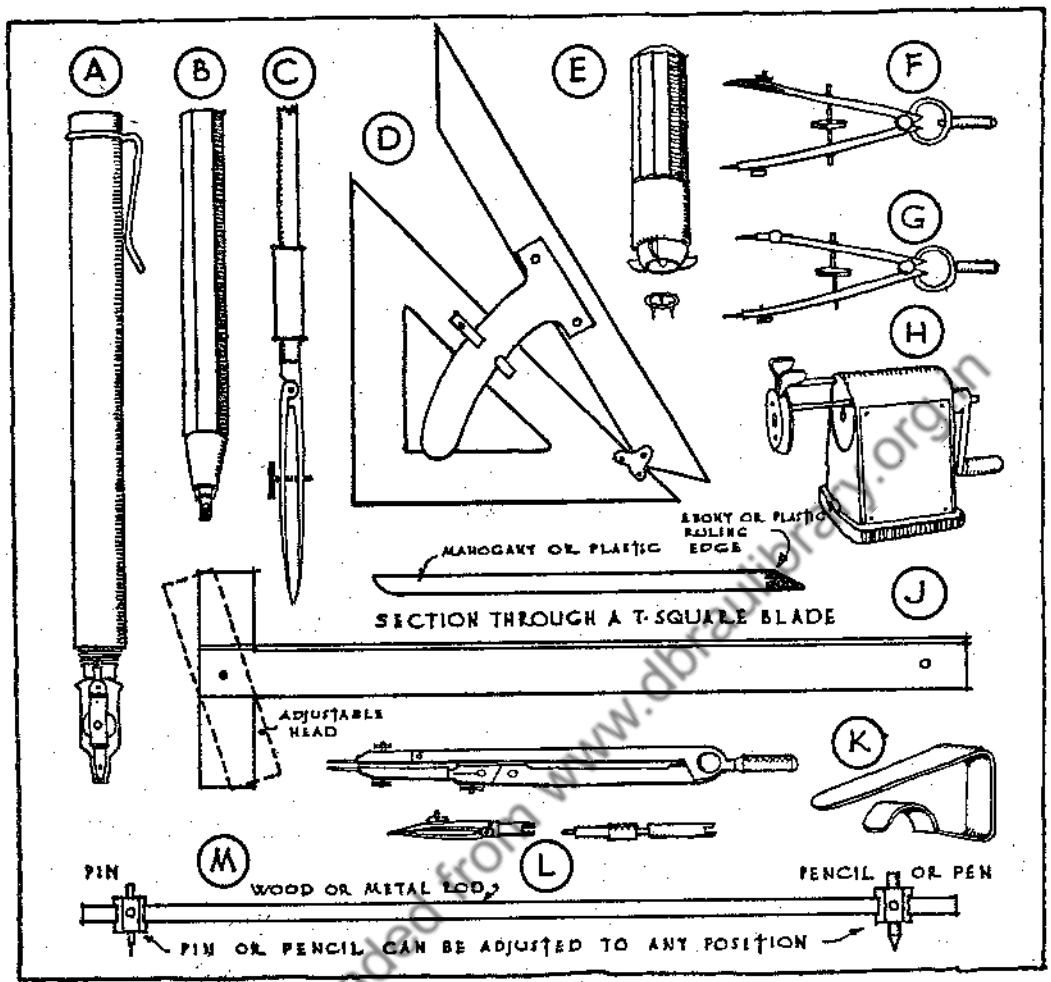


FIG. 1

Typical drawing instruments encountered by the draughtsman. (Note: these are not drawn to any relative scale but are merely to ensure that the student is familiar with the various instruments at first sight.) A *The Graphos Pen which is superseding the drawing pen. Nibs are interchangeable both for drawing and lettering. Ink flows uniformly from a reservoir in the pen. Thickness of ink is covered by varying the feed. Accessories for compass work are also available.* B *Clutch type of pencil.* C *The ruling pen with hinged blade for cleaning.* D *Adjustable set square.* E *Automa tictacker showing type of tack which emerges on pressure.* F *Ink spring bows.* G *Pencil spring bows.* H *Adjustable pencil sharpener to take all thicknesses of pencil.* J *T-Square with adjustable head and section through typical T-Square.* K *Clips for holding down sheets on the board; useful when they are full size.* L *Useful compasses with attachment for pen and pencil; also used as dividers.* M *Beam compass for large circles.*

of the bent first finger of your right hand, the left thumb being supported by the right. Threequarters of an inch is sufficient for the first cut, in one sweeping movement of the blade to the end of the wood. Revolve the pencil and repeat the process until you expose the lead. You will achieve a point to this automatically as you cut away the wood.

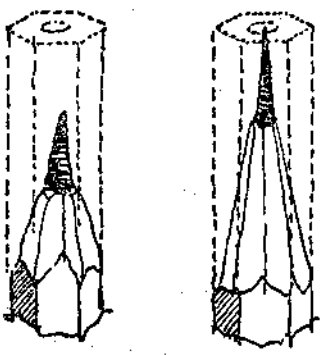


FIG. 2

Most people sharpen a pencil by making wild strokes with a knife away from the body, but this is exceedingly wasteful. Use a good pocket knife or a 'jigger knife'—a razor-blade fixed in a suitable apparatus. Keep the pencil well sharpened all the time. If desired a small sandpaper block can be used for touching up the lead point occasionally. Fig. 2 illustrates the waste incurred by poor sharpening.

Hard pencils are best for setting up constructional lines and the softer brands for sketching, bringing out outlines of detail, etc. Do not use a very soft pencil for geometrical drawing or you will find your work soon becoming smudged and dirty. Never use copying ink pencils for architectural drawing.

Drawing Inks in various colours are useful and should be of the waterproof variety. A bottle of good indian ink is an essential. As regards *water-colours*, do not buy a large expensive box, but a few individual colours of good quality, either in the stick or tube form, and keep them loose in a convenient tin, adding to them as required. Brushes will be necessary and should include a large 'mop' for extensive washes, and small sharp-pointed sables for detail. You can test a sable by dipping it in water, when the hairs should immediately form a fine point. Keep a separate brush for coloured or indian ink, as these soon destroy a good brush.

Sponges, saucers and small containers are also required for painting. A small sponge will be found useful for erasing colours, whereas a rubber would at once destroy the surface of the paper or water-colour board. Erasing shields are very useful when working on architectural drawings. When a shield is not readily available a home-made one can easily be devised by using a piece of Bristol board or thin cardboard cut to the required shape.

Papers and Boards. A good quality white cartridge paper, as heavy as possible and possessing a firm, smooth surface, capable of withstanding a reasonable amount of erasure, is the best surface for original drawings. For original drawings which will neither be handled nor erased to any great extent detail paper can be used, being placed on a temporary white backing sheet.

For the designer's method of developing sketch designs by placing successive layers of tracing paper over earlier sketches or when it is desirable to take prints direct from the original drawing (a process which will be described later), a good translucent material or 'rag-bone' tracing paper is necessary. Avoid paper with a slightly glazed surface for this will prevent the pencil from obtaining the density of line required for good

reproduction. Slightly glazed tracing paper can be used successfully for ink work, but will be found difficult for the eraser. It is possible to obtain specially prepared pencil tracing cloth on which may be produced original pencil drawings for direct reproduction.

Tracing cloth or 'linen' is used for tracing in ink and is strongly recommended for negatives which will receive considerable handling. These materials take longer to prepare than the direct pencil drawing and their use is governed by the amount of handling or reproduction likely to occur. It is often the practice, when economy of time and labour is essential, to make the original drawing on tracing paper and just emphasise such important features as arrow-heads of dimension lines, dimensions and lettering, by executing these in indian ink. This ensures that they will not escape reproduction in the printing stage. Tracing cloth and paper, obtained in rolls 30 and 40 inches wide, are the most popular sizes. There is a wide variety of grades.

Here are those principal surfaces of paper used for water-colour work. They are first 'hot-pressed', which is smooth; second, 'not', that is not hot-pressed, which is slightly textured; and third 'rough', which as the name implies, has a very distinct surface texture. The second and third are often used for architectural renderings. Priced by size and weight to the ream, the following are the sizes and approximate weights:

	in.	*lb.*
Demy	20 × 15½	25
Medium	22 × 17½	34
Royal	24 × 19	40–60
Imperial	30 × 22	70–300
Double Elephant	40 × 26¾	130–250
Antiquarian	53 × 31	240

These large sheets require 'stretching', a process which will be described in detail later.

'Whatman' water-colour board, which is Whatman paper mounted on a stout cardboard backing, is excellent to work on with washes, and is obtainable with the various surfaces described above. There is a wide range of tinted and pastel papers for renderings, not only in water-colour, but for bold treatment and texturing by means of crayon, charcoal, pastel, body-colour, etc.

Such special water-colour papers as R.W.S. paper, David Cox, Michallet, Creswick, Van Gelder, are all excellent but will necessitate a certain amount of preliminary experiment by the student. For very special efforts pure linen paper is splendid, if expensive.

For ink renderings smooth surfaced board, such as Bristol board, is the ideal medium. When setting-out on this material use a soft pencil lightly, because a sharp, hard lead will indent the surface and make subsequent erasure difficult.

Strawboard is useful for mounting cartridge and for packing drawings. Sketch-books, survey notebooks, squared graph-paper and other miscellaneous media will be added

according to the student's requirement. A supply of good quality white blotting paper is very useful when working with water colour and ink.

Fixing Papers. A box of drawing pins, brass or alloy, with a single point are the most reliable but they can prove an obstruction as the T-square slides over the drawing board. Use an extractor for removal of the pins otherwise finger nails are liable to be broken.

There is now available a Swiss invention which consists of a drawing pin injector and withdrawer. Three-pronged pins are used and injected automatically into the board. They can be withdrawn into the barrel of the instrument, and re-used.

Again, there are metal clips which clip the paper to the board without damage to board or paper. Pins can be obviated by using adhesive tape. Sometimes it is an advantage to suspend an opaque drawing temporarily on the wall and for this there is a double-sided adhesive tape. It is used in small patches, concealed behind the drawing.

It is presumed that the student possesses a suitable room in which to work. The table for supporting the drawing board should be rigid, at a suitable height, and the board itself can be tilted to the correct angle for comfortable working conditions. If the table top is flat, shaped blocks of wood will tilt it to the necessary angle. Avoid a direct light in front of the drawing board, for your eyes will soon feel the strain of a reflected glare. Much better to have the light from the left-hand side.

From the outset determine to keep your hands and instruments clean. T-square and set-squares can be cleaned by rubbing them over with a piece of paper or a duster. Instruments should be placed conveniently at the right-hand side of the table. Your T-square should be used only for horizontal lines and the set-square for vertical ones. When setting the T-square with the drawing board or the set-square with the T-square and board, see that they are all set perfectly true to each other. Practice will soon make your various motions almost instinctive. Lift the T-square instead of leaning on it and sliding it heavily up and down the board. When working on a partly completed drawing, portions of which come under your hand, protect the work by means of a piece of tracing paper. Place a spare sheet of cartridge (known technically as a 'backing sheet') on the board to form a smooth surface on which to set your drawing. As you progress over the sheet on which you are working use plenty of spare pieces of tracing to cover up the completed work, for even when a hard pencil is being used it soon becomes smudged by contact with the hands and instruments of the draughtsman. Dust your board after the use of the rubber. Various other convenient and economical ideas of working will suggest themselves.

CHAPTER II

GEOMETRICAL AND FREEHAND DRAWING

BROADLY speaking, for the purpose of the architectural student, drawing can be divided into two classes: *Geometrical Drawing* and *Freehand Drawing*. In the course of his career the architect requires to set out working drawings of buildings and portions of buildings in detail. This type of drawing, to be of value for working purposes, must be drawn to a suitable scale by the aid of proper drawing instruments, and is, therefore, geometrical drawing. For this style of work, from the beginning, a three-dimensional aspect must be cultivated. Plan, section and elevation should all come under consideration, for when drawing to scale, definite sizes and shapes are produced which constitute a guide to the builder and his craftsmen, who will later undertake the actual work.

Freehand drawing is simply drawing without the guide of drawing instruments. At the same time freehand sketches can be dimensioned and used as working drawings, provided sufficient detail is given to communicate the suggested scheme. Therefore, when the student is studying or sketching existing architectural detail, he should add marginal plans, sections and elevations of the work. By looking at an object in three-dimensional form he will train his brain and eye so that when his design is finally put on paper he will draw it geometrically.

The 'Professional' Touch. There are thousands who draw, either for profit or personal pleasure, but who never achieve what may be called the 'professional touch'. This is the goal every student must aim at throughout his career, for its acquisition will gain him immediate recognition. It can best be observed by a close study of the work of past and present-day masters of the graphic arts. What constitutes it? A finish produced by the proper application of the correct medium for the subject in hand, expressing at the same time the personality of the executant, and an obvious sense of ease and mastery of these factors. To achieve it requires assiduous application of the artist's brain and fingers until the requisite amount of vigour and understanding is obtained. Whatever technique the artist employs it must be consistent with itself to produce that precious quality. To a gifted few it may come easily, but to the majority it necessitates the closest study and concentrated endeavour. From the beginning the student must realize that drawing is highly intelligent work. Even in purely geometrical drawing, the 'professional touch' is observed in the discriminating use of pure line and lettering. The thrill of executing a good drawing is a pleasure which the first-class draughtsman learns to appreciate.

Style in Draughtsmanship. There are several styles of draughtsmanship employed

to illustrate constructional work which will ultimately be executed by various tradesmen. Although we are primarily concerned with architectural draughtsmanship there is another important, closely allied type—Engineering drawing. Both styles have a similar object in view.

Architectural drawing and engineering drawing are easily distinguished by their own characteristics. For instance, the latter possesses a distinct rectilinear character. Architectural drawing, though not so scrupulously precise as the former, must also be accurate, but its severity is modified by a certain measure of artistry. Engineer and architect both employ drawing instruments as an aid to accurate draughtsmanship.

The 'artistic touch' finds little or no scope in engineering drawing. Here the designer is illustrating hard precise facts with the maximum of accuracy, and he uses hard precise terms. The drawings of this profession are invariably shown in strong firm lines of a uniform thickness. The beauty of an engineer's drawing is solely the beauty of fitness for purpose.

Architects cultivate (and are encouraged to cultivate) more individual styles of draughtsmanship, which may be expressed in certain mannerisms of lettering or by varying thicknesses of line. An examination of some really good examples of architectural drawing will illustrate my point more clearly. For instance, many architects cross their lines at the corners in a drawing, which not only produces a decorative 'atmosphere' but gives an added crispness of line. This crossing also gives the precise measurement from which the craftsman can scale.

The architectural student should bear in mind that, no matter what he sets up geometrically when designing, he is not only putting his design over to a client, but working on a practical job. Mere slick draughtsmanship and clever colouring, without careful planning, will let you down when the builder subsequently endeavours to produce your schemes in actual materials.

Too much style in drawing is as bad as too little. One's time to-day is limited, and the drawing board can be a good servant but an exceedingly bad master. Over elaboration is purely a waste of time; a drawing should be taken only to the degree of accuracy and finish which will put over the ideas of the designer in an intelligent, scholarly and practical manner. The draughtsman, as he progresses in knowledge and skill in handling his chosen medium, develops naturally various short cuts and stylistic conventions, which will tend to obviate unnecessary labour. All architectural drawing should have the primary object of advancing architectural design.

Figs. 3 and 4 show a comparison between architectural and engineering drawing. I give only a fragment of an old engineering drawing, but on it can be noted the even thickness of line generally employed. Also note how the lines meet sharply and cleanly at the corners. The lettering is of the old square, solid block type—showing little imagination but very easy to read. Compare it with the portion of an architectural drawing. Here the lettering is varied and interesting, based on the pure Roman style, with a pleasant script form in keeping with the capitals. Note the lines crossing at the

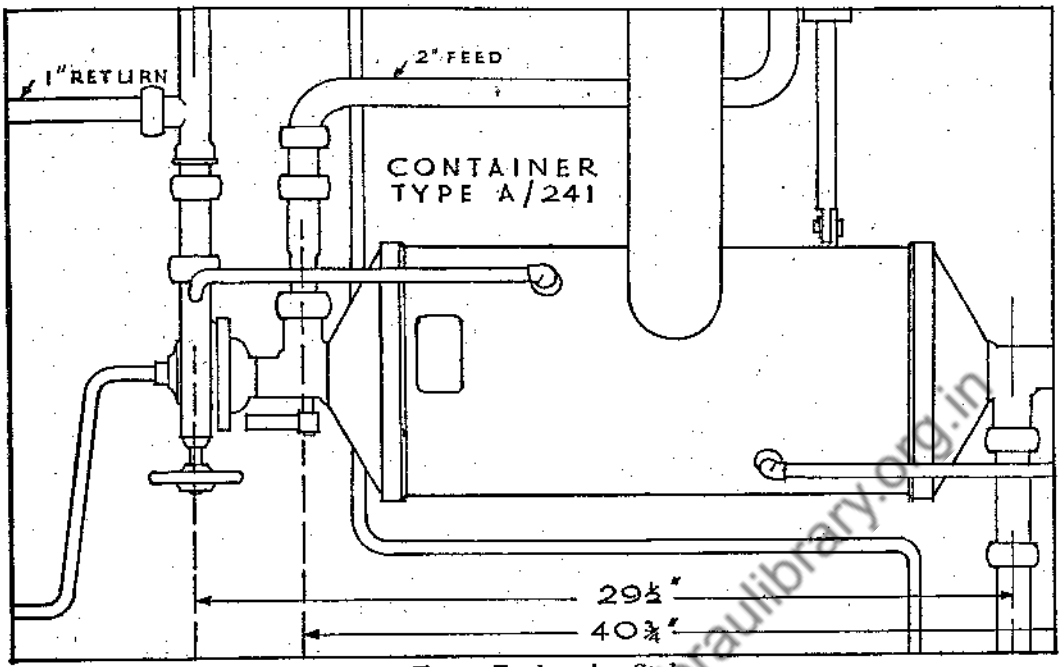


FIG. 3. Engineering Style

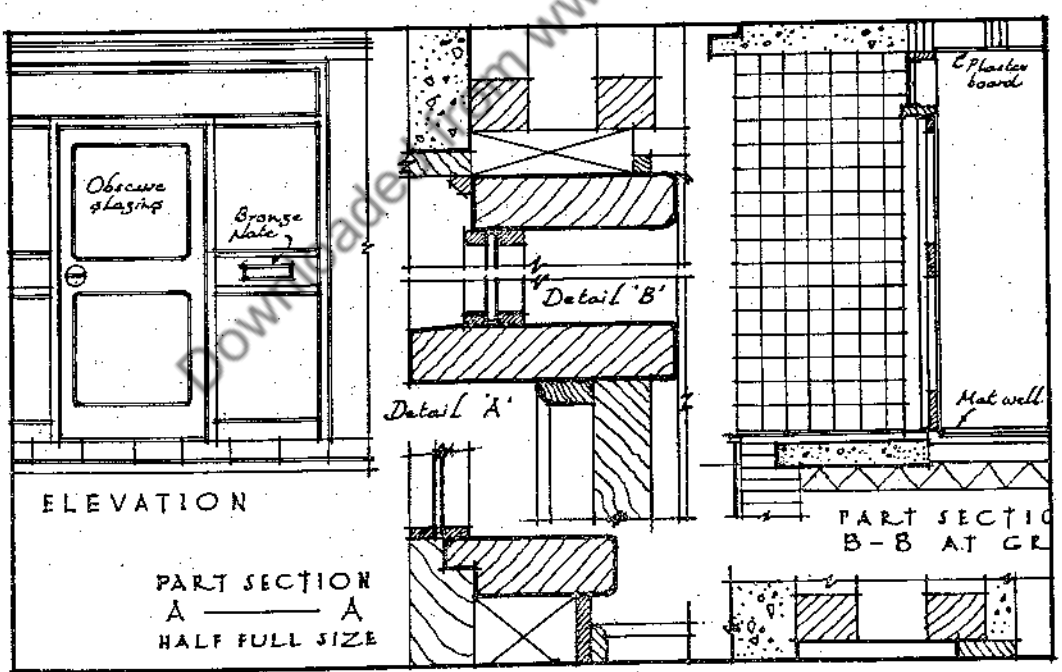


FIG. 4. Architectural Style

corners. There is also a freedom of finish, lacking in the engineering example. The second style is the one for cultivation by architectural draughtsmen.

The Value of Drawings. As well as being a means of expressing clearly a design to the client, drawings have other points of value, equally important in some respects. The drawing constitutes a link between designer and craftsman; it is also a legal document which can prove exceedingly valuable. On the drawing can be set out accurately the design, which is passed on to the client, who approves it and agrees to pay for the work. Without such a drawing it would be possible for the client to turn round on completion of the work and refuse payment on the grounds that he had not received what he had been promised in the beginning. There are other points of this nature which will readily spring to the mind of the student, and he will undoubtedly agree that as it is of such importance the drawing should invariably be truthfully rendered. The drawing is also a symbol of control in the hands of the architect, both as regards craftsman and client.

Drawing to Scale. The architect should be able to draw to scale and be able to read scale drawings. The scale drawing, which shows the object greatly reduced in size, shows complete dimensional detail from which the craftsmen can carry out the actual work. One foot may be represented in the drawing by perhaps 1½ inches, 1 inch, ¼ inch or even less. Fig. 5A shows a portion of a boxwood scale with the dimension to be scaled. The actual three feet six inches in this case is represented by three and a half inches on the scale. Scales must be clearly marked on the drawing, generally at the bottom near the title (a place to which the eye of the reader will be drawn at once) by drawing a portion of the scale; or it can be written 'Scale 1½ inches to 1 foot' as the case may be. Always show a clear scale on your work, otherwise it becomes useless as a working drawing to anyone but yourself. A typical scale is shown in Fig. 5B.

The selection of an appropriate scale is governed by two factors—the size of the object and the size of the paper on which it will be represented. Another point which must be considered is the quantity of detail requiring illustration. Always eliminate unnecessary detail; besides being a waste of time it only complicates a scale drawing. It is better to emphasise fine points of construction or design by greatly enlarged or full-size details. The 1½-inch scale is the most suitable for large-scale detail. Remember that small-scale detail requires very accurate and painstaking drawing and may be found rather a strain on the eyes. 1½ inches, 1 inch, ½ inch, ¼ inch, ⅛ inch, and $\frac{1}{16}$ inch to 1 foot should cover all drawings that the architect is likely to produce. An important point to note is that all the scales given above represent a single fractional ratio between original and drawing. Stick to simple scales of this type. The use of unusual scales is absurd. Most tradesmen possess a two-foot rule marked in inches and eighths and similar straightforward dimensions which will help them to read normal scales; though work which will ultimately pass through a highly skilled craftsman's hands can be drawn to more complicated ratios if occasion demands.

A scale drawing, as an additional check for accuracy, may have one or two main dimensions marked by lines and arrow-heads, but even this is unnecessary if work is

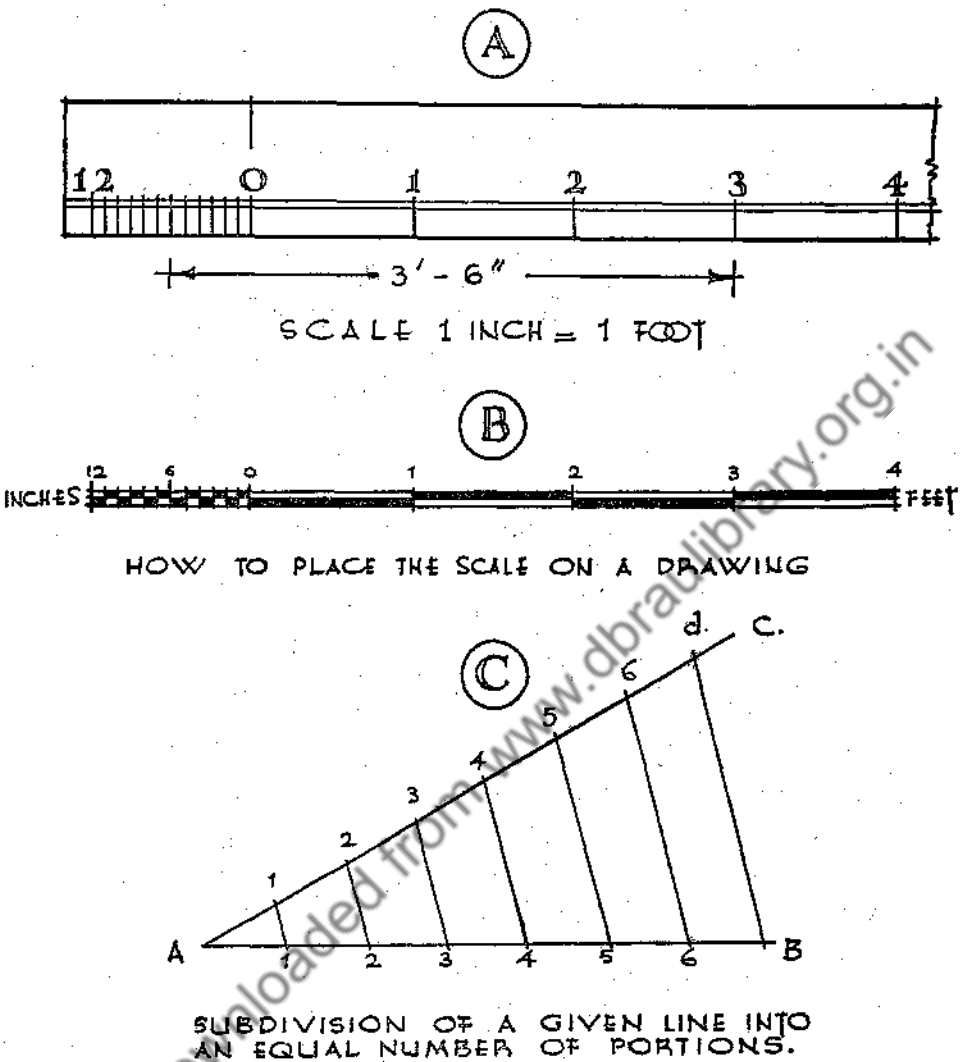


FIG. 5

scrupulously accurate—as indeed all scale work should be. A certain degree of error is liable to creep in through varying thicknesses of lines in the actual drawing, and this must also be guarded against. Put the same weight on the pencil, or use the same adjustment of the ruling pen if you are using ink. It is only when small errors are repeated several times that they may become serious.

As he progresses the draughtsman will find that greater accuracy is required when he is dividing lines or spaces than when he is setting up an object by extending his lines. For real accuracy the former is the true test of ability and consequently of very great importance.

As an exercise on the various principles which have just been explained the student is advised to work out for himself the exceedingly simple problem shown in Fig. 5c. It is the subdivision of a line into an equal number of parts. Draw the line AB and from A set up the line AC, forming an angle. Do not make your angle too acute. Lay off from A the desired number of parts in equal divisions, using for this your scale or dividers. The bow-dividers can be set to a convenient distance which will be retained for repetition of the divisions. The final division mark can be indicated by the letter d from point d to point B. Then draw parallel lines to dB and by this means the line AB will be divided into a number of equal parts.

The student should obtain access to as many working drawings as possible; he may ask an architect for some old prints. Note how the scale is marked and try out the drawing by means of your own boxwood scale, or with the dividers if the scale is clearly drawn on the diagrams. Note how dimensional lines are drawn and how a professional draughtsman does not emphasise the arrow-heads at the ends of close lines too much.

Simple Geometrical Exercises. It is not intended here to give a complete introduction to the art of geometry; but the student must acquire the ability to handle his instruments proficiently by executing various geometrical exercises, particularly those involving the use of compasses and dividers.

The six simple examples given in Fig. 6 will be found of considerable value. (A) the *Cyma Recta* and (B) the *Scotia*, should be practised and memorised, for they will be useful for the time when the student requires to design mouldings and must of necessity set up sections of them. They both involve the construction of two circles to touch internally or externally at a given point (Fig. 6A and B). Describe a circle, mark the centre A. Mark the tangential point C on the circumference, and join up AC. The law of tangency has it that the centre of the second circle, B, must lie somewhere upon the line through A and C. By means of this geometrical construction true curves are obtained.

Fig. 6c is also an important exercise from the point of view of the designer. Only a portion of a circle is given and it is necessary to obtain the centre from which the portion of the circle has been struck, so that the complete circle may be formed. This is carried out as follows: we will presume that AB is the given portion of the circumference. Draw any two lines AC and CB. Bisect these two lines and through the centres obtained draw lines perpendicular to them. The point where the two lines meet is the centre of the circle.

Fig 6D shows how to inscribe any regular polygon in a given circle. First describe the circle. Draw a diameter AB and divide it into the same number of equal parts as you will require sides in your polygon; for the purpose of illustration I have made it seven. With centres A and B, and radius the diameter of the circle, arcs are described which intersect at point C. A line is now drawn through C and 2, and carried on to D. The line AD is one of the sides of a seven-sided figure. (Whatever the number of divisions, point 2 is the one to use.) Once this basic dimension is established it is an

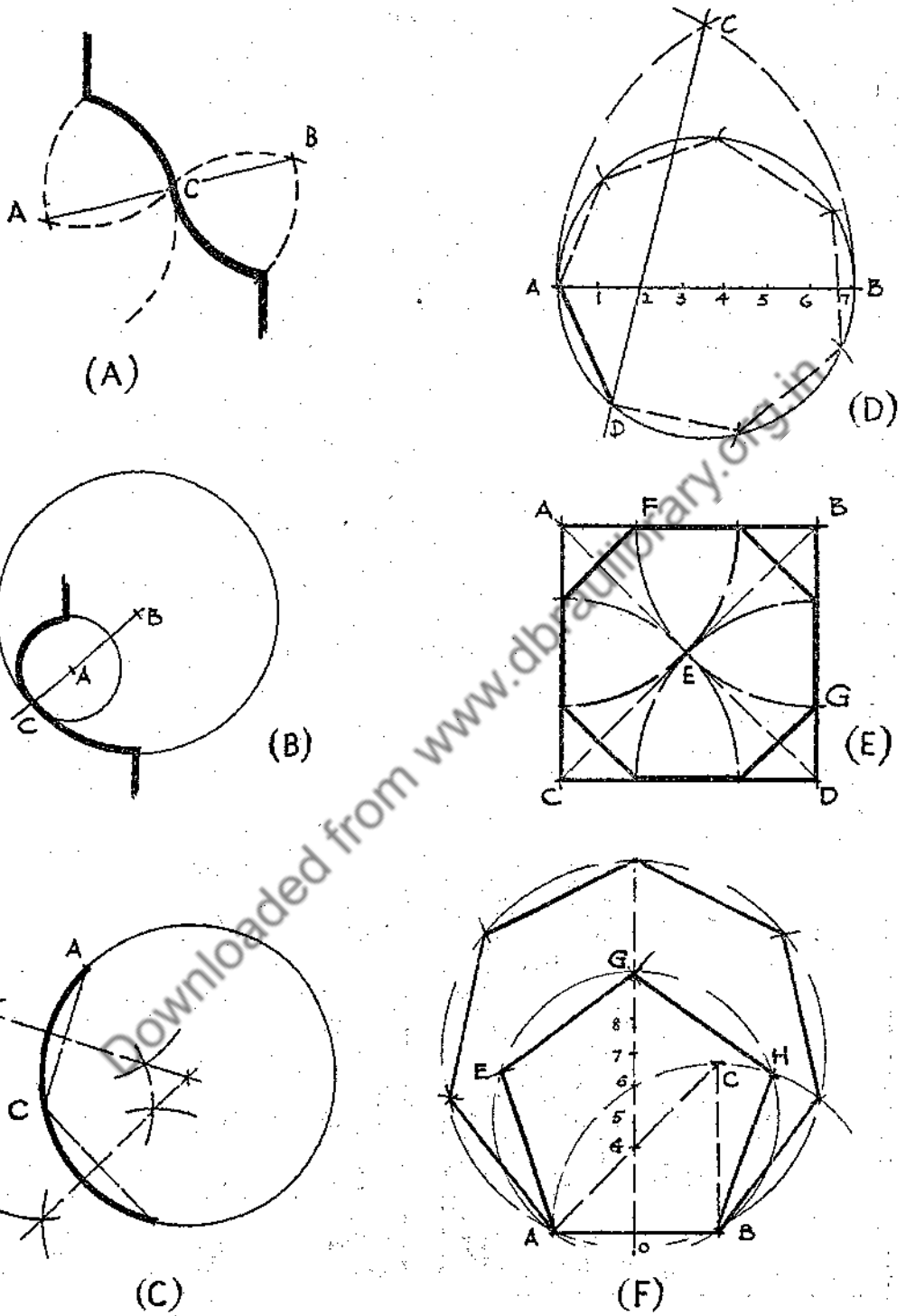


FIG. 6. Six simple geometrical Exercises which explain the use of Compasses

easy matter to complete the figure by striking off, with the compasses, the distance between A and D, round the circumference of the circle; and by joining up these points the figure is produced.

Fig. 6E demonstrates the placing of an octagon in a given square. First draw your square making the four corners A, B, C and D respectively. Draw diagonals from A to D and from C to B. These will cut each other at the point marked E. With centre B and distance BE describe a quadrant, which will cut the square at F and G. Carry out this procedure in each corner and the eight points of the octagon are obtained. Complete the figure by joining up these points.

Fig. 6F is for the purpose of describing any regular polygon. By this means a figure with five, seven, eight or nine sides, only one of which is given, can be described. We will presume that AB is the given straight line. Through point B, a perpendicular BC, equal to AB, is drawn. Join C to A and bisect AB in O and raise another perpendicular at this point. This perpendicular cuts the line AC at a point 4. With centre B and radius BA describe the arc AC, which cuts the perpendicular at a point 6. Bisect the lines 6–4 in 5, and with distances 6–5 strike off 6–7, 7–8, and so forth. We will now assume that a five-sided figure is required. Make 5 the centre and with radius 5A describe a circle. From point A step off AE, EG, GH, and HB, making them equal to AB. Should a seven-sided figure be necessary take centre 7 and 7A as the radius for describing a circle. Proceed to step off the distance AB as before round the circumference of the circle.

Another useful exercise for gaining confidence and proficiency in handling compasses is to practice forming geometrical patterns, two styles of which are illustrated in Fig. 7. In designing a geometrical pattern to fill a given area attention must be paid to the axes, forms and lines suggested by the shape.

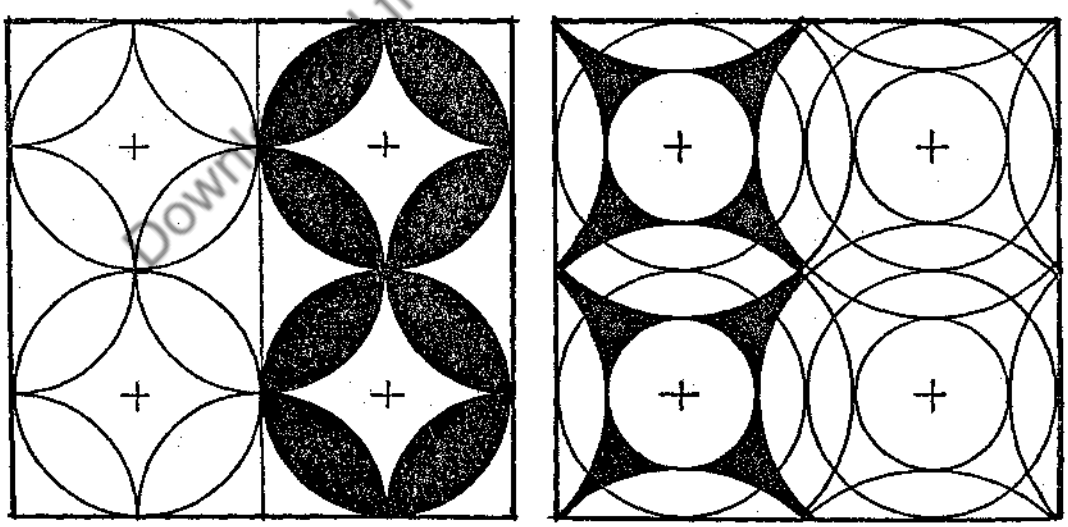


FIG. 7. Geometrical patterns.

CHAPTER III

SKETCHING

THE ability to sketch should be acquired by every architectural draughtsman. He should endeavour to make sketching one of his hobbies—if he is really keen, his principal hobby. He should always carry a sketch-book and use it at every available opportunity. Before the student can describe his schemes in the shape of working drawings by geometrical methods he will find it necessary to capture his ideas and commit them to paper by this means; sketching enables one to evolve designs while allowing one's inspiration full scope. In addition, while attending various jobs, trade exhibitions, museums, galleries and so on, the student will note ideas which will be useful later. For this purpose a rapid, direct form of draughtsmanship should be assiduously cultivated. By constant application there will be developed a personal style. Many lines of elaborate shading are a waste of time and labour.

Again, sketching is necessary for taking particulars of existing buildings and rooms requiring alteration and for making outdoor surveys of sites. Also, there is the type of work, very necessary for study—measured drawing; this involves considerable sketching ability. It is a form of draughtsmanship demanding direct and forceful treatment, together with the addition of useful dimensions and data. Finally, there are times when it is good for the student to forsake his drawing board, especially when he feels he is getting stale, and get out into the country with either a pencil or a box of colours and a sketch-book. Nature study can prove of the greatest value to the designer.

Sketching for Evolution of Design. Before commencing to design you should have the object clearly in view. You must have all the necessary information, such as sizes, ultimate position of the object, and size of the space available. If it is a built-in fitment, you will require exact details and dimensions of the space it will ultimately occupy, its general relation and proportion to the apartment, its main purpose, and the type of material, plus the necessary finish desired. You must have all this clearly in your head or jotted down on a convenient piece of paper before you finally take up your pencil.

Various solutions will no doubt suggest themselves and your object is to select the most suitable. The preliminary analysis can be made on any scrap of paper; the idea is the thing. Seize it and set it down while it is fresh, for refinements can come later on. Do not be satisfied with your first idea, but try alternative suggestions. As you progress you will find your interest crystallising round one particular impression. This is an important step; a definite basis for your design has been established.

The next thing is to pin a piece of tracing paper on to your drawing board. On this you make your first sketch roughly to scale. Over this you place a successive layer and

elaborate or modify your initial impression. The tracing paper method enables you to do this without destroying your first vital sketch. You can superimpose sheets in this manner almost indefinitely. Very often you will find that you will return to your first impression as being the most suitable after all; if you scribble over the original, this first conception is lost beneath a criss-cross of lines. In all your designs, whether it be a complete building or only a fitment for it, bear firmly in mind the function for which your design is intended.

You can often combine freehand with your geometrical drawing. By freehand drawing you can make diagrammatic perspective studies of detail, general mass and line, and any arrangement which cannot be fully described in pure elevation and plan. And by geometric drawing you can start at the beginning by designing to some scale. Finally, the design can be drawn out completely and finished in the most sympathetic medium for the subject in hand. You may prefer the clean straightforward appearance of pen and ink; you may wish to use a more expressive line such as a fairly soft pencil, chalk, crayons or charcoal; or you may decide on body colour in water-colours. With all these media a great range is possible, but do not mix them without due discrimination.

You are not tied to one type of paper either; experiment with all varieties apart from the customary Whatman board and standard cartridge. Try the placing of tracing paper on either a white or perhaps a lightly tinted background. There are all kinds of tinted papers on the market and even the humble brown wrapping paper is capable of interesting effects, achieved by the use of pastel or coloured crayon and charcoal pencils. A sketch showing the evolution of a design for a church doorway is illustrated in Fig. 8. Designing on squared paper is illustrated in Fig. 9.

Rapid Sketching of Useful Data. This type of sketching necessitates a small pocket sketch-book, carried constantly. The student may observe a fine piece of stonework or an interesting detail worthy of inclusion in a scheme: perhaps useful information for future designs. Out comes his sketch-book and with a few strokes he sets down the detail, making an addition to his stock of architectural knowledge. It sounds simple, but this lightning form of sketching requires a great deal of practice. At first one is inclined to sketch loosely, and quite possibly add unnecessary shades and shadows. The student must learn to analyse an object before he sets pencil to paper, observe that there are certain fundamental lines in any design, and seize these and put them down, adding only as much detail as will be necessary to recall the feature when he consults his sketch-book later. Clear indication of, say, texture, can be indicated on a corner of the design, which should be enough for reference purposes. Useful data for the designer consist of all kinds of things. Let us presume you were asked to design a built-in bookcase in some alcove as the completion of a scheme. Perhaps you desired to link up the bookcase with a modern panel heating unit. Then it would be exceedingly useful to be able to consult your sketch-book and turn up a dimensioned diagrammatic sketch of a well-designed type of panel heater which you had recorded while working on some extra special job. I remember designing a bedroom scheme incorporating a built-in wardrobe and how mortified I was to discover how little I knew of the amount

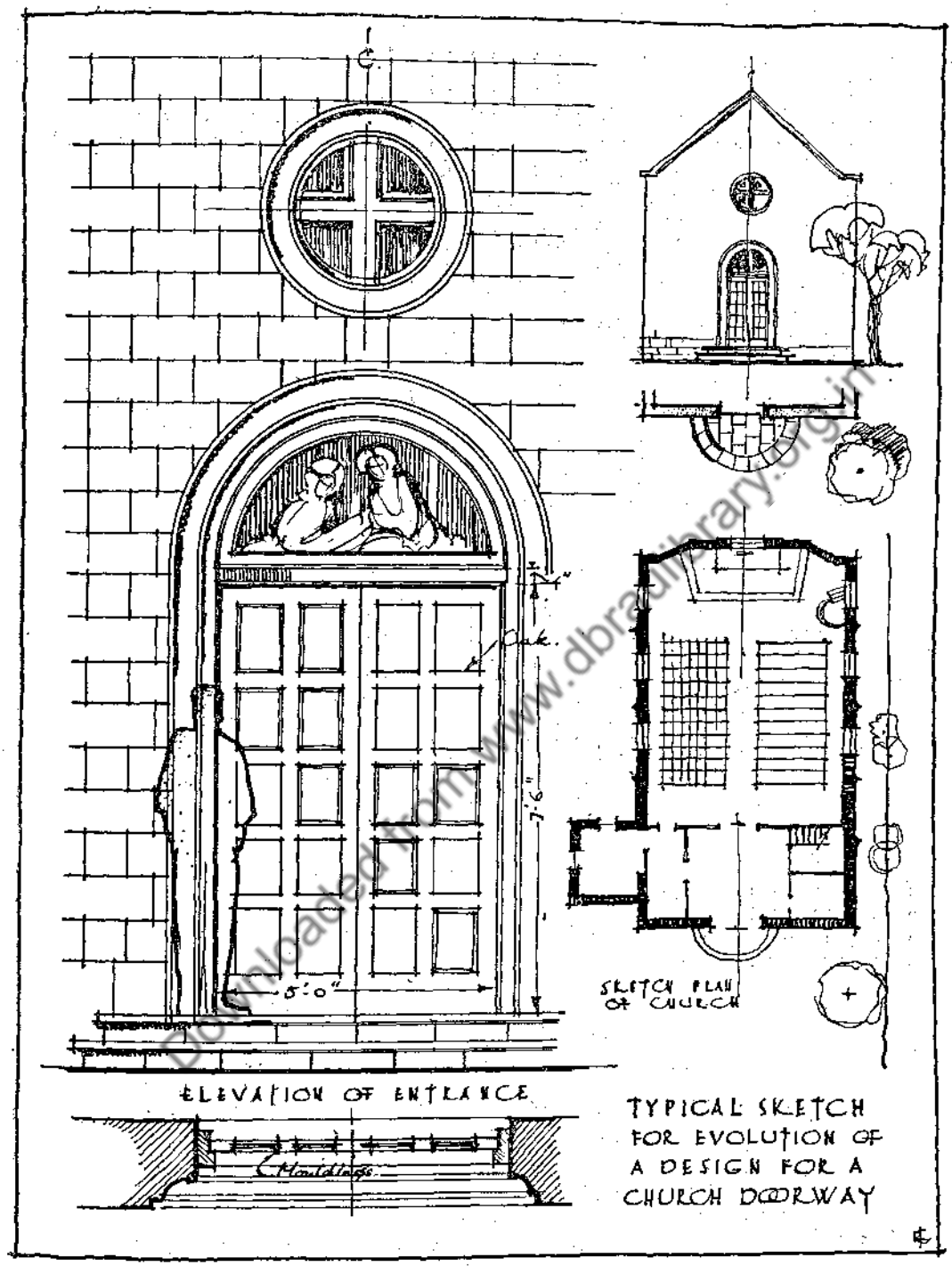


FIG. 8

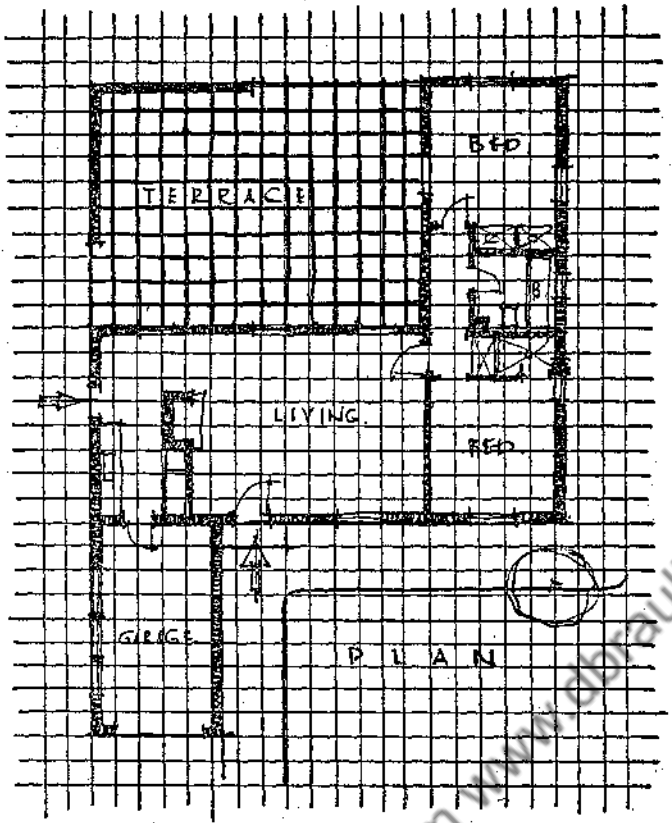
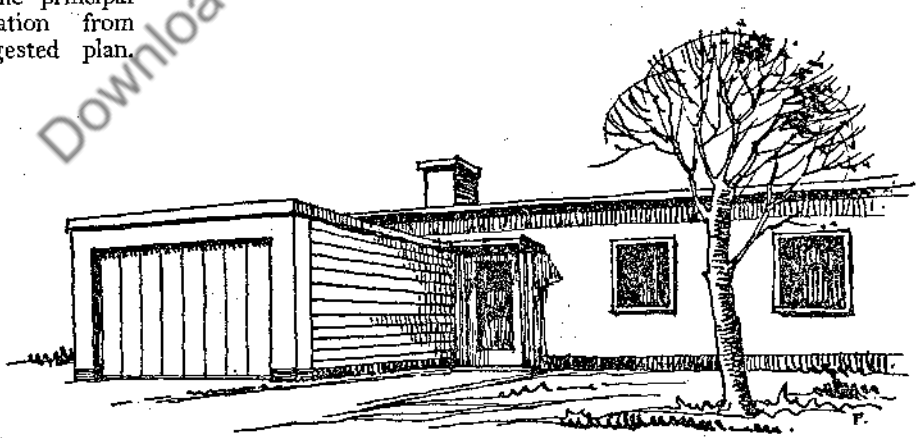


FIG. 9. Two Stages while Designing a typical Small Building

(A) *left*: Sketching the plan on graph-paper.

(B) Impression of the principal elevation from suggested plan.



of space the various objects which occupy a wardrobe require. I did not even know the average length of a jacket. Sketch everything and everywhere, always adding plenty of dimensions, neatly arrayed and clearly marked. Select your specimens with an eye to their value or as data in the evolution of future designs.

Outdoor Sketching from Nature. Outdoor sketching from nature is invaluable. Apart from purely landscape studies which have their own value as a basis for design of decorative panels and so forth, the hedgerows and more intimate corners of the landscape are teeming with interesting flower, foliage and plant forms. The student should make himself thoroughly familiar with tree forms. Study the skeleton and the branches in winter and their clothing and massing of foliage in summer. Also the changing colour of the seasons. Note how each tree has its own characteristics as regards mass of foliage, line and so on. Hills, mountains, rivers, lakes, ponds, the reflection of water, should all be examined with a searching eye for the purpose of discerning form and structure. Many students fail to discern the real beauty in plant form and through their lack of appreciation fail to capture valuable material for design. Trees and flowers at first glance appear to be irregular and untidy, but actually they are most orderly as a critical examination will soon reveal. They all have that beauty of growth known as structure. Note the expression of energy in the lines of a plant, and how these lines vary according to the various types. Sometimes the curve of the stem is slack, other times taut or braced.

FIG. 10

When drawing a plant begin with the main structural lines and from this execute the detail. Commence at the bottom of the stem, as in actual growth, and work up-

wards. When drawing plants as an exercise for design there is no need to carry your work to a particularly high degree of finish, though I personally believe in working until I feel a sense of absolute completeness. A sketch from nature in which the design element is predominant is shown in Fig. 10.

Surveys. Occasionally as he progresses in his studies the young architect will be taught the use of the level and various other surveying instruments. A description of setting out surveys, and so on, is beyond the scope of this volume and books dealing completely with the subject are advised. However, he will find in this work an ability to sketch will prove a great asset. The type of survey which I will deal with here is that of existing buildings; this is apart from measured work but is very similar in procedure.

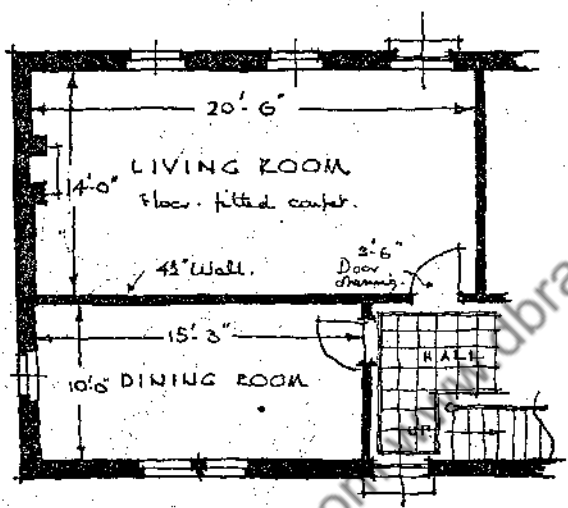


FIG. 11

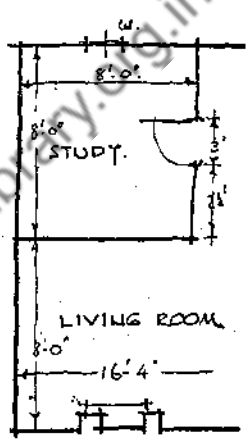


FIG. 12

The author has used an outline method of surveying, about to be described, for several years for a great many jobs, including schemes involving expensive wall treatments, such as hand-printed wallpapers, tapestries and mural work. Try setting out geometrically plan and elevations, details, etc., in the office; later, from the sketch survey, one can work out the design of alterations, quantities, cost, etc. The equipment necessary is fairly simple. A notebook, possessing stout covers which will be termed the survey book, and will be kept solely for this purpose as distinct from your sketch-book for purely freehand work. A good type of notebook is one possessing squared paper. A medium graded pencil (too soft a pencil will allow essential measurements to become blurred and information will be lost, for this book will receive a lot of handling) and a soft eraser. Also the customary measuring instruments including a two-foot rule, a five-foot rod, and where large dimensions must be taken a fifty-foot tape. It is this measuring side of the business that the student will only develop with constant practice along with his draughtsmanship.

Figs. 11 and 12 clearly demonstrate two types of sketching plans from existing

buildings. Incidentally a similar type of sketch is used when designing. In Fig. 11 everything is put down, including thicknesses of walls. Fig. 12 illustrates the outline plan, necessary when the alterations concern the interior only. Even if you are only dealing with the interior, however, it is still advisable whenever possible to use the former method. For instance if one is providing a new service hatch between kitchen and dining-room, as part of a scheme, then the knowledge of the construction and thickness of the wall concerned will be essential. I invariably use the first method. A double line is drawn for outlines of walls and all solid portions of walls are run in with a coloured pencil as the survey proceeds; this is a great aid to clarity of thought later, for to know the very structure of the building gives a great feeling of confidence.

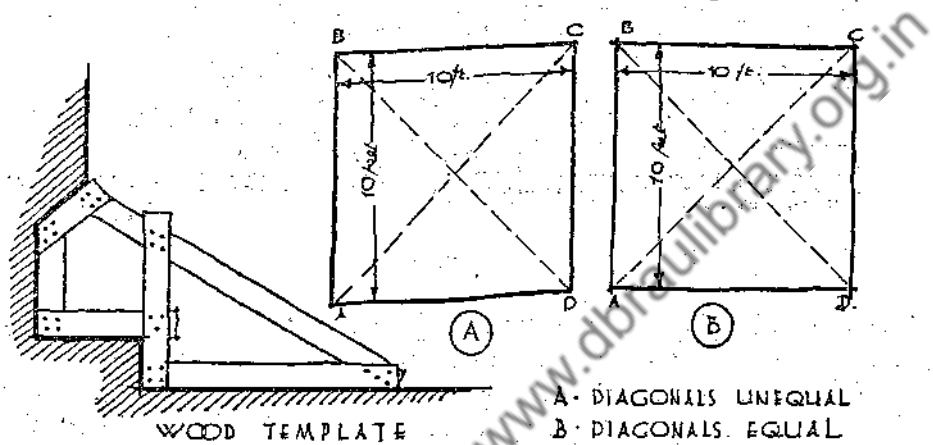


FIG. 13

Taking Measurements. Fig. 13 shows how careful one must be never to assume that a room, even in a new building, is absolutely square or with walls all parallel. Measure the diagonals as shown on the sketch. Make plenty of constructional notes in writing. Make certain of stating whether your measurements are brickwork or plaster sizes. The plaster on the walls may be three-quarters of an inch thick, so naturally the sizes of the room, when only in the brickwork stage, will be one and a half inches larger than when the room has been plastered. These points are particularly important for the placing of subsequent fitments. Another important detail, presuming it is a finished house you are dealing with, will be to note whether the sizes you have indicated on plan are taken right from actual walls or skirting boards. Sketch in positions of doors, fireplaces, cupboards, windows and any projections in the various rooms, and note exact width and depth of projections and recesses.

When measuring openings—the doorway for example—when you state opening to be perhaps 2 feet 9 inches wide, note on drawing whether this refers to the door lining, the stop, or again the edges of architrave moulding. An enlarged detail of mouldings can be jotted down as shown in Fig. 14.

Where corner fitments are likely to be involved, here is a method of finding out

whether the room is square or not. Join up AC and BD, thus obtaining diagonals (Fig. 13). Should your diagonals prove to be equal in length, then your corner is square. Should this not be the case then you have either an obtuse or an acute angle.

For really awkward corners, Fig. 13A shows a method of constructing a template in wood. In some cases cardboard, of the very stiff variety, is sufficient. In the example illustrated strips of wood are screwed securely together and braced by a cross-piece, as displacement would be fatal. Much valuable time, money and material can be saved by the use of templates.

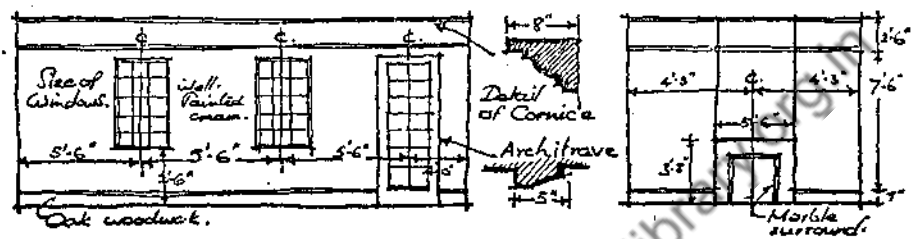


FIG. 14

Fig. 14 shows typical survey sketches of elevational details. On these all heights are given, enabling the various features to be placed. Note especially how the various openings are measured from centre to centre; and how long running measurements enable one to be more accurate. The size of every feature is shown including that of the fireplace opening, together with dimensions of the hearth and the material of which it is constructed. The long dimensions should be taken first and the intermediate ones later. By adding up the latter sizes a double check is given to the survey.

Finally all survey sketches should be at once dated, signed by the surveyor and either filed or kept safe in the survey book for future reference.

Drawing out the Survey. On return to the office you will place your sketches conveniently to hand by the drawing board and by means of your various drawing instruments proceed to set out your rough sketch notes to some suitable scale (Fig. 15). If you set up a ground floor survey first, you will generally find that by placing a piece of tracing paper over this you can quickly run in the floors above. The walls of a building, at least the main walls, are invariably carried right up through the building. The staircase will be found an excellent guide for setting one plan accurately over another.

Measured Drawings. The practice of making measured drawings of existing buildings of merit should be cultivated as an essential part of the student's training. Apart from conveying a sound knowledge of the design of past masters it forms an exceedingly interesting method of studying types of construction. Many young draughtsmen find great difficulty in the early stages of their career in reading diagrammatic drawings. Plans, elevations and sections to the unpractised eye can prove very misleading,

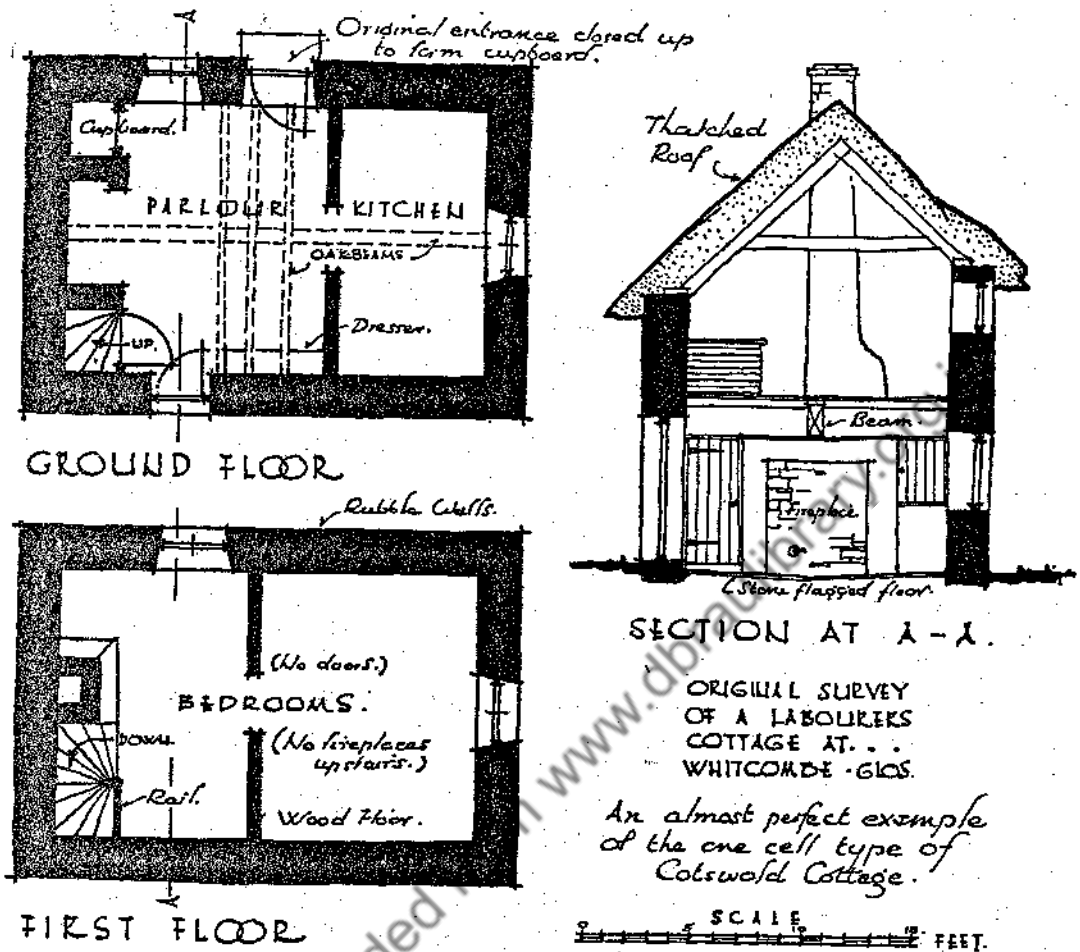


FIG. 15

especially with the symbolism involved in architectural delineation. However, the making of measured drawings encourages confidence and a familiarity with these features.

As a first exercise in measuring up, the student is advised to start on the house in which he lives. Naturally it is more familiar to him than any other building. He will at once be surprised, even though his calling has made him observant of structural work, how little he has grasped of his immediate surroundings. In the Royal Institute of British Architects Intermediate Examination, one of the necessary testimonies of study incorporates the execution of a measured drawing. The candidate is advised to select a building for its architectural character rather than one distinguished for quaintness, elaborate decoration, or archæological interest; and the building chosen should not have been built later than 1851. I mention this specially because it stresses an important

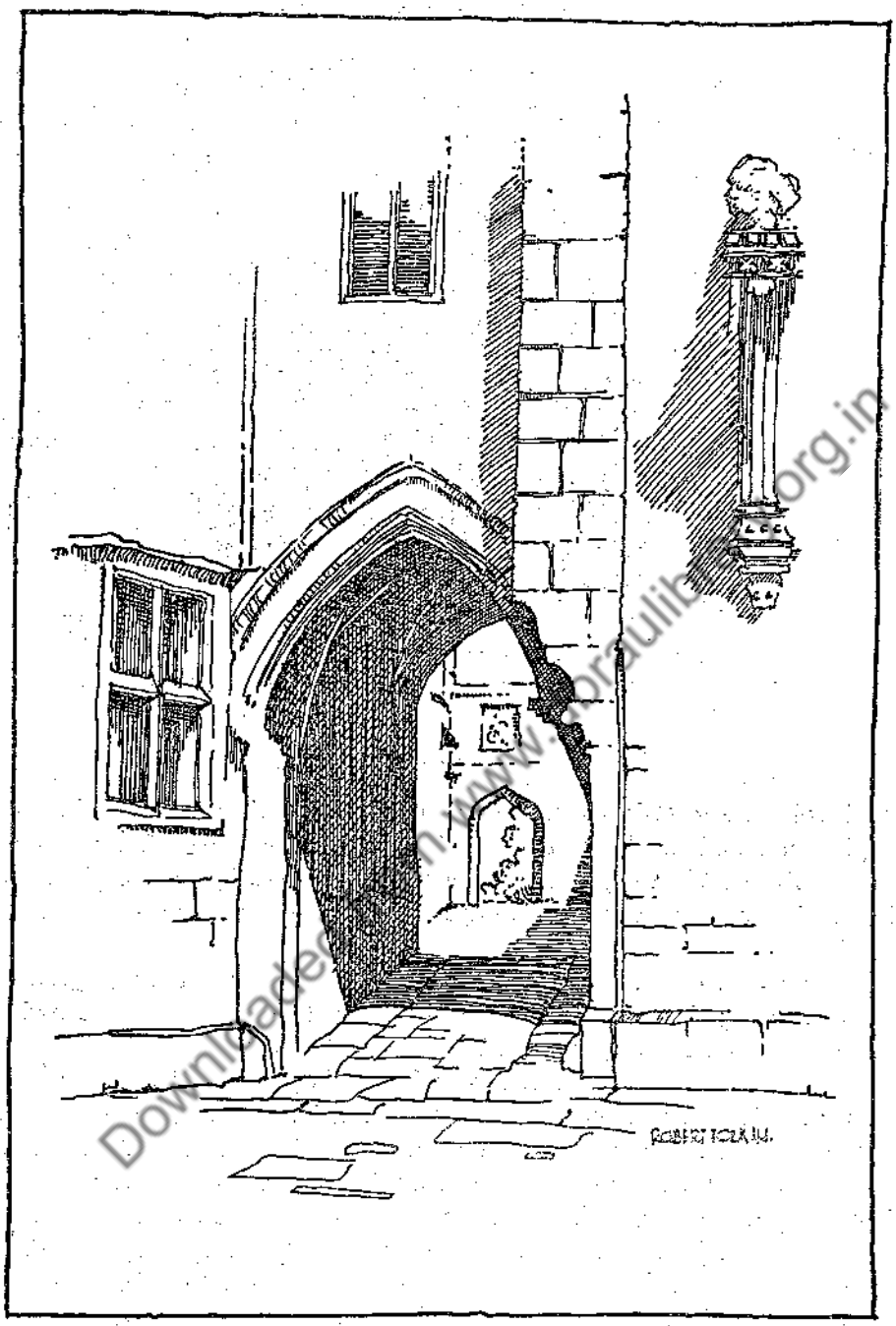
point—that of fitness for purpose in the selection of your measuring subject. By proper study, scale and proportion are impressed on the student as he observes and delineates details of ornament, etc., which he will find of great value later on in his career for incorporation in the evolution of designs.

Just as the most gifted musician must make himself familiar with the work of the classics of his profession, so should the student of architecture or building. Apart from a study of the past masters, measured work can be applied to more modern buildings worthy of a close study. No doubt plans and photographs of new buildings are published periodically in the trade papers; but they are often dismissed with a cursory glance, and many important points of detail, either in construction or design, are overlooked. One cannot gain in any other way the intimate knowledge that is gained by one's own personal survey and setting up on the drawing board. The main thing to bear in mind is that, apart from increasing your knowledge, you are also seeking to further architectural design generally.

Time is an important factor in draughtsmanship, and, therefore, a speedy technique is infinitely preferable to a slow one, especially to-day. At most art schools and institutions, students are advised to execute elaborate measured drawings of historical interiors and exteriors. However, these subjects are mainly given with the purpose of developing good draughtsmanship. As such, they are certainly worthwhile exercises, and on these grounds not to be despised, because in their execution the student must apply his pen or pencil diligently. But when he has completed the task, he is probably no further forward in his knowledge of the design than say, another student who merely made an accurate survey and quickly set up a measured rendering in a fraction of the time spent by the keen draughtsman. With the latter object in view, various conscientious students often proceed no further with the work of measuring up than the first preliminary survey. If these sketches are carefully drawn, preferably on squared paper, they find they have managed to memorise quite enough for study purposes. Wasting no more time, they can go on with another building, and so manage to assimilate a great deal more knowledge than the man who concentrates solely on making a pretty drawing.

Great industry is essential in the study of architecture and building; but one must also exercise intelligence. An intellectual analysis often produces greater rewards in the long run. Measured drawings can be amplified by sketches and these, with careful all-over measurements, provide usually a very fair description of a building (Fig. 16). A folio of half-imperial sheets is better than a notebook for the work. Some of your paper should be of the squared graph variety. This is a great aid for measured sketching, because by giving the squares a definite ratio of proportion—that is perhaps making each square represent a ratio of three inches to the actual object—you can automatically set your drawing to scale as you progress over the sheet. Do not, however, forget dimensions. They are quicker to read and are a check. Finally all your measured work must be scrupulously accurate.

I have included some sketches indicating a typical measured drawing and the kind



The Abbey Gatehouse.
Glastonbury.

FIG. 16

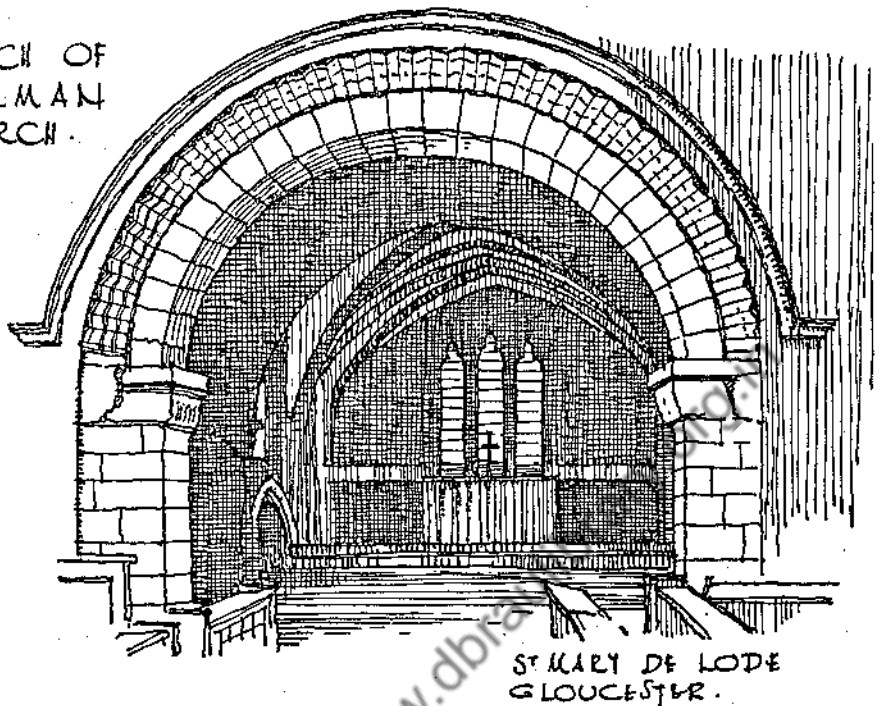
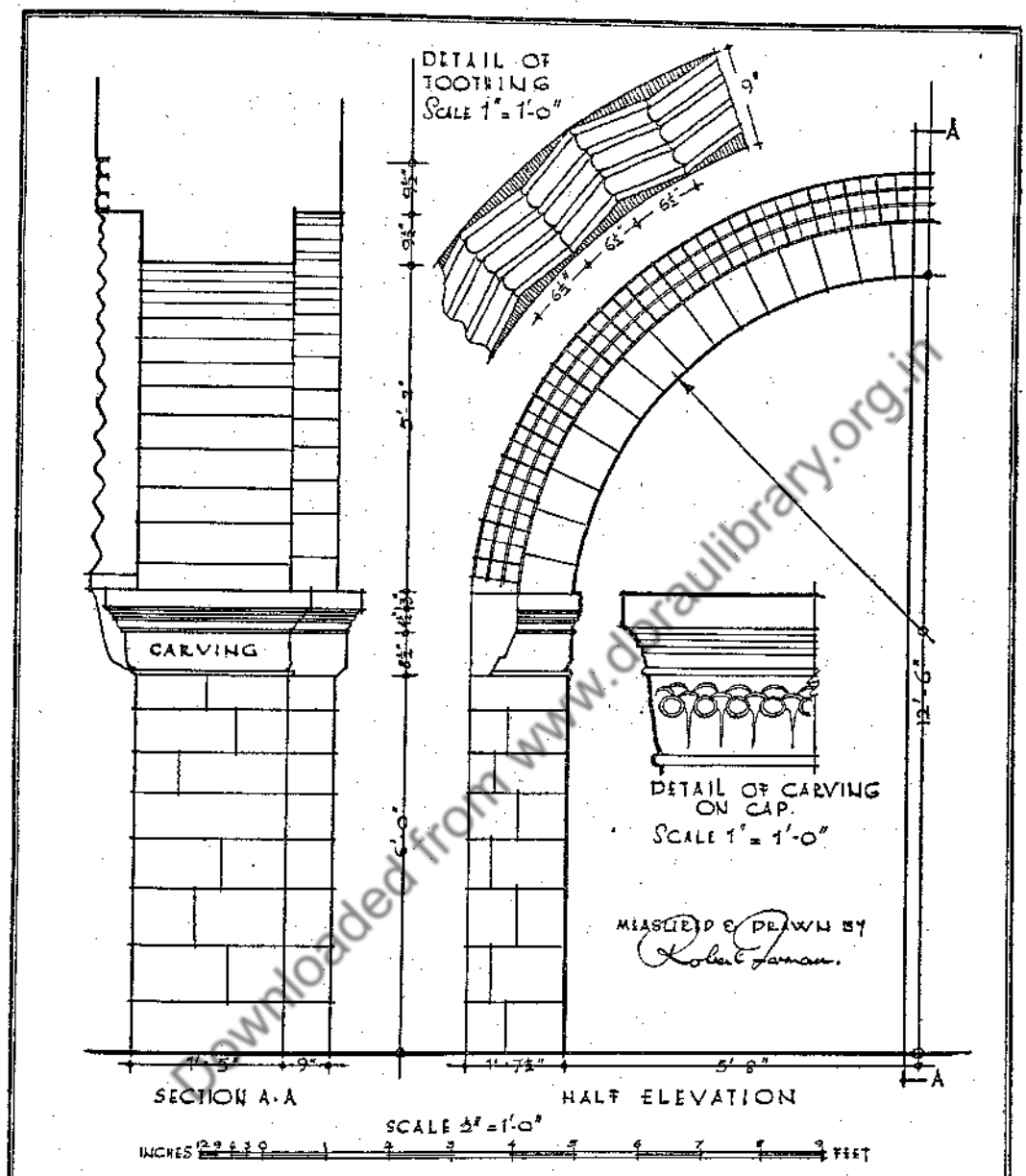


FIG. 17

of work involved. Fig. 17 is a sketch of the measured drawing illustrated in Fig. 18 in its complete state. Obviously the two drawings are closely related. Without the lightning perspective sketch it might be a little difficult to visualise the complete arch, yet the sketch without the measured drawing does not possess much value to the architectural student.

It was necessary to execute a similar type of sketch as shown on both Figs. 19 and 20 before commencing the finished measured drawing. Note how all the drawings are well dimensioned for record purposes. Fig. 18 might well be set up by the student as an experiment. From it he will realise that by making a finished drawing he is only duplicating the information shown on the sketch. It is, however, a useful exercise in draughtsmanship. The latter must on no account be neglected but at the same time do not let it become your master as regards measured drawing. Fig. 19 illustrates measured drawing on squared paper, each square in this case bearing a ratio of six inches to one foot of the actual subject. No doubt the squares may get you a bit out of scale occasionally but you have dimensions as a check and the horizontal and vertical lines are most helpful when sketching. Fig. 20 shows typical measured sketching details of an old Cotswold doorway, the type of information which might easily be gathered in a pocket sketch-book.

Photography as an aid to Sketching. As an aid to study photography cannot supersede sketching, although as a rapid method of securing specimens of architectural detail it



A NORMAN ARCH · ST. MARY DE LODE · GLOS.

FIG. 18

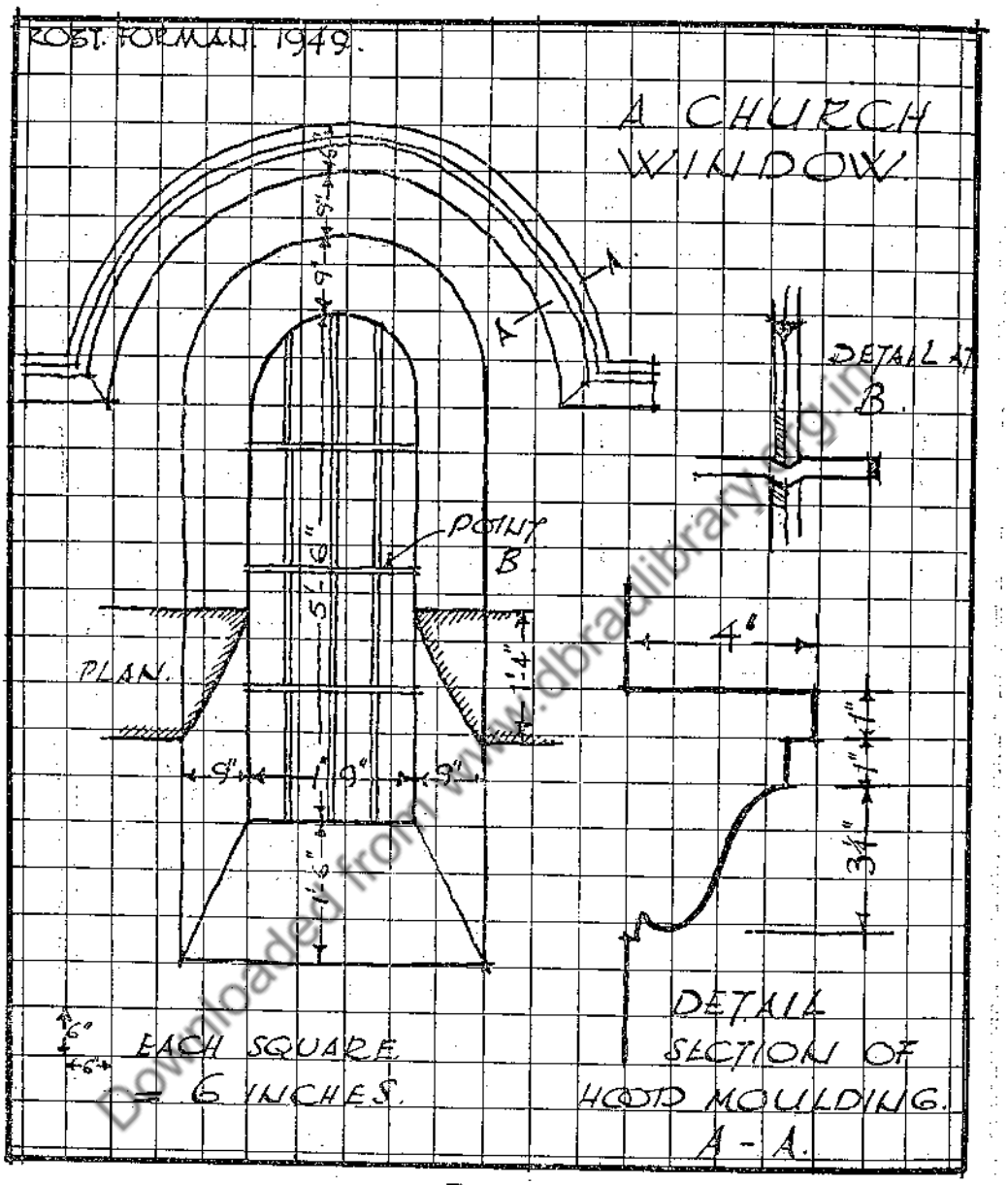


FIG. 19

is of great value. By means of the camera, where there is no time or opportunity for sketching, useful details can be recorded for future reference. Avoid the stereotyped postcard of places or features of interest. They lack vitality and are produced at a scale exceedingly difficult to draw from later.

It is much better to take your own photographs if you desire rapid impressions of things which have a special appeal. Constantly, on your travel in search of architectural

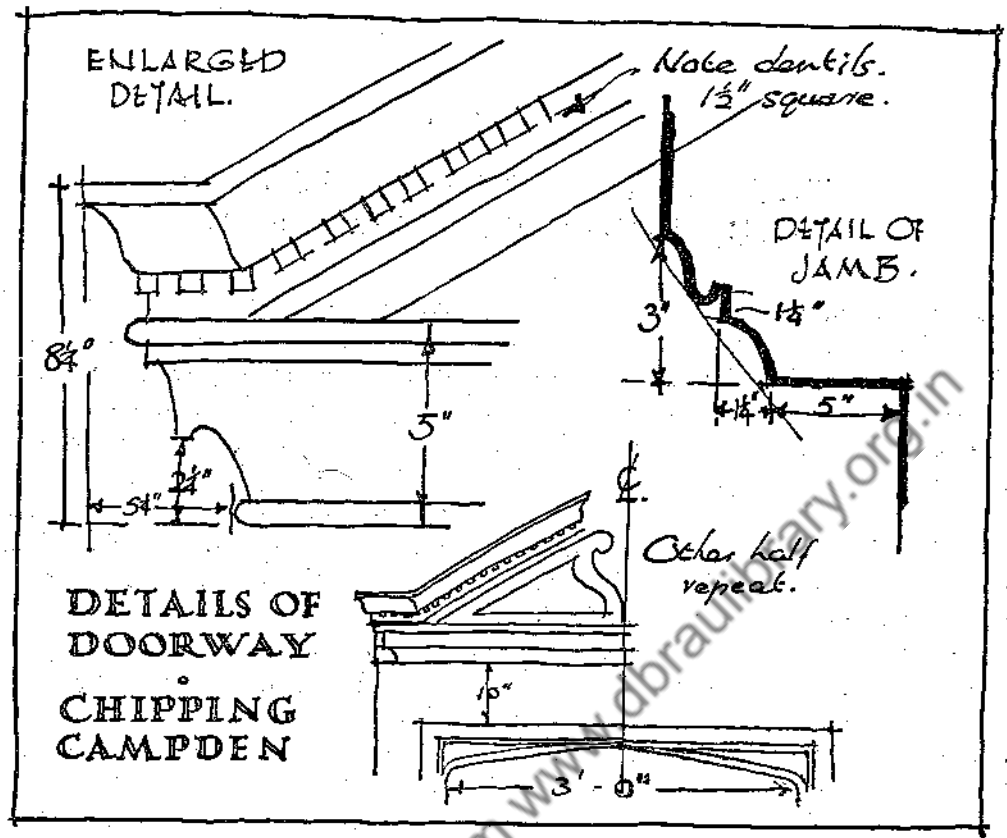


FIG. 20

material you will find examples which probably would require many hours to set down by means of the pencil—this is where your camera is invaluable. Photographs are also helpful in gaining an understanding of light and shade and perspective.

I have taken excellent architectural photographs with a cheap box camera and have secured numerous time exposures of exteriors and interiors and the subsequent enlargements have proved excellent for my purpose. Moreover, the rapid development of colour photography has provided a very useful medium for recording the colour and texture of actual buildings. There are a great many books on the subject for the interested student, but personal experience will teach a great deal more in the long run.

CHAPTER IV

THE ORDERS OF ARCHITECTURE AND ARCHITECTURAL DESIGN

An essential part of the architectural draughtsman's training is a knowledge of the Orders of Architecture. Many students are under the impression that it is an unnecessary study; but it serves a valuable purpose in the training of the eye to a recognition of proportion and scale. A good method of approach is to draw the orders to a different scale from that in which they are set out in the various well-illustrated volumes on the subject, and to calculate the principal parts and their mouldings by the module system. Furthermore the student should prepare designs of a simple character involving the use of an order or orders. This greatly extends the field of study and gives the student many interesting problems to solve, which would not occur if he simply made a direct copy from the book.

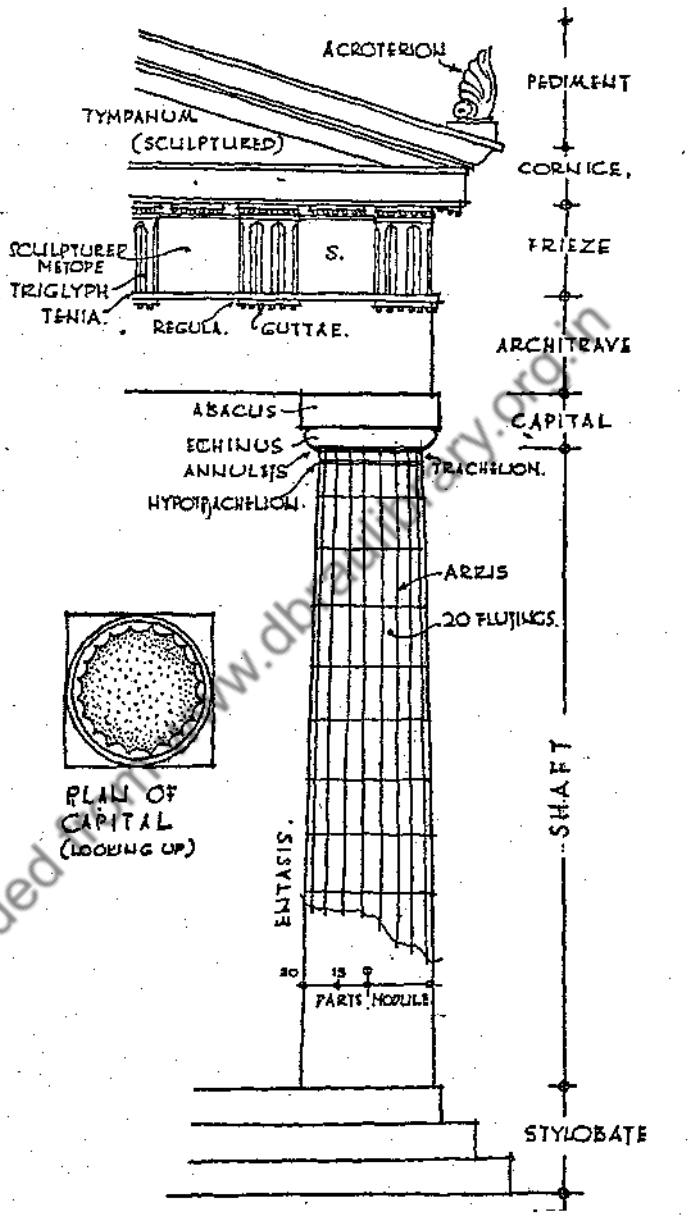
The Module. The module is a measure of proportion by which the various portions of a classic order or building can be regulated, the word being derived from the Latin—*modulus*—which simply means a measure. This proportion constitutes half the diameter of the column at the bottom of the shaft, immediately above the base. Various methods have been evolved but they are all founded on this dimension. The module is further divided into a given number of parts known as minutes. With the Greek and Roman Orders the module is divided into thirty parts. Vignola and various other Renaissance masters used twelve parts for the Tuscan and Doric Orders and eighteen parts for the Ionic, Corinthian and Composite Orders. As a general rule thirty parts is the division used for large-scale detail.

Some brief historical notes are advisable and can be supplemented by further study from specialised books on the subject listed later in this volume.

The Greek Orders. The Greeks established the Doric column; there are seven stone columns of a Doric Temple still surviving at Corinth, reputed to have been erected about 650 B.C. Despite its sturdy appearance the Doric Order possesses great refinement of detail and has been adopted through the centuries on numerous buildings right up to the present day. The finest example of Grecian days and the noblest monument to the Doric Order is to be found in the Parthenon at Athens. It was built by the architects Ictinus and Callicrates, and that great artist Phidias was the chief sculptor. It was dedicated to Athena Parthenos (the virgin Athena). Its beauty is still evident although it is in ruins.

In the Doric Order the column is placed without a base directly on the stylobate which consists usually of three steps, providing a continuous base for the colonnade or row of columns. In this feature it is distinct from the other orders about to be described. An all-important feature is the 'entasis' or the profile of the column. This takes the

shape of a swelling or slightly convex curve given to the shaft, which counteracts an optical illusion, which would give a shaft bounded by absolutely straight lines the appearance of curving inwards at its mid height. All Greek designs were full of similar unexpected subtleties which modern designers would no doubt ignore. Actually in many recent reproductions of the order in our own time one finds that the entasis and other refinements have been sadly overlooked and columns tend to have rather a coarse appearance. The Doric column was fluted, possessing twenty flutings separated by 'arrises'— the sharp edges between the vertical channels. The shaft of the column was terminated by the 'hypotrachelion' consisting of grooves, three in early examples but in later periods cut down to one. The continuation of the shaft immediately above was known as the 'trachelion'. The capital itself comprised annulet rings, echinus and abacus. The first mentioned were from three to five fillets cutting the arrises and the flutings horizontally. The echinus, which resembled the sea-urchin's shell,

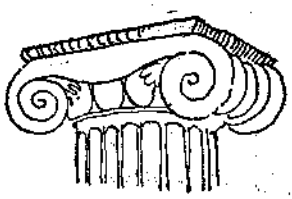


DETAILS OF THE DORIC ORDER
(FROM THE PARTHENON.)

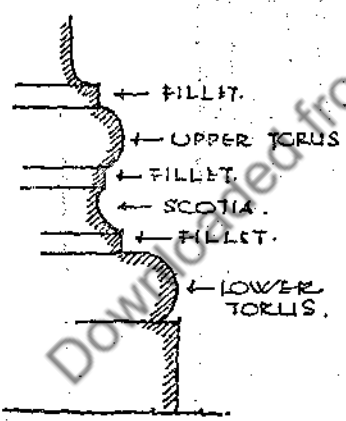
FIG. 21

was the projection supporting the abacus, the latter being a plain, square block immediately beneath the architrave. The entablature was itself divided into three main portions consisting of the architrave, the frieze and the cornice. Between the first two was a dividing moulding known as the tenia, on the underside of which hung small conical drops known as guttæ, on a narrow band called the regula. On the frieze itself appeared channelled blocks known as the triglyphs with sculpture in between them; these triglyphs were spaced one over each column centrally and one over each inter-columniation. The crowning portion was the cornice consisting of cymatium and bird's beak moulding. These various divisions and mouldings are clearly seen in Fig. 21.

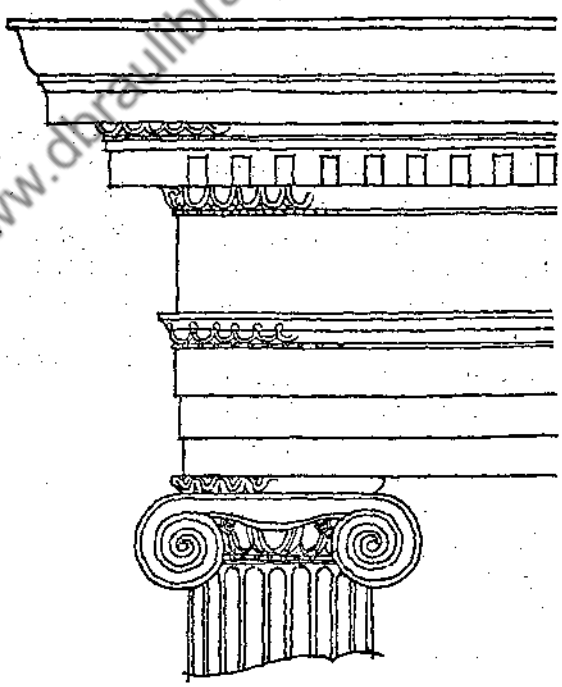
The Ionic Order developed along similar lines to the Doric. It is generally assumed, although there has been much controversy on the subject, that these two orders are a natural development of post and beam construction. Whatever their origin it cannot be denied that their contribution to architecture is incalculable. The Ionic Order is easily recognised by its volute or scroll capital, which it has been suggested is an adaptation



TYPICAL IONIC CAP.



PROFILE OF AN ATTIC BASE · (COLOSSEUM.)
THE MOST USUAL OF ALL COLUMN BASES.



AN IONIC ENTABLATURE FROM TEMPLE OF MINERVA POLIAS · PRIENE

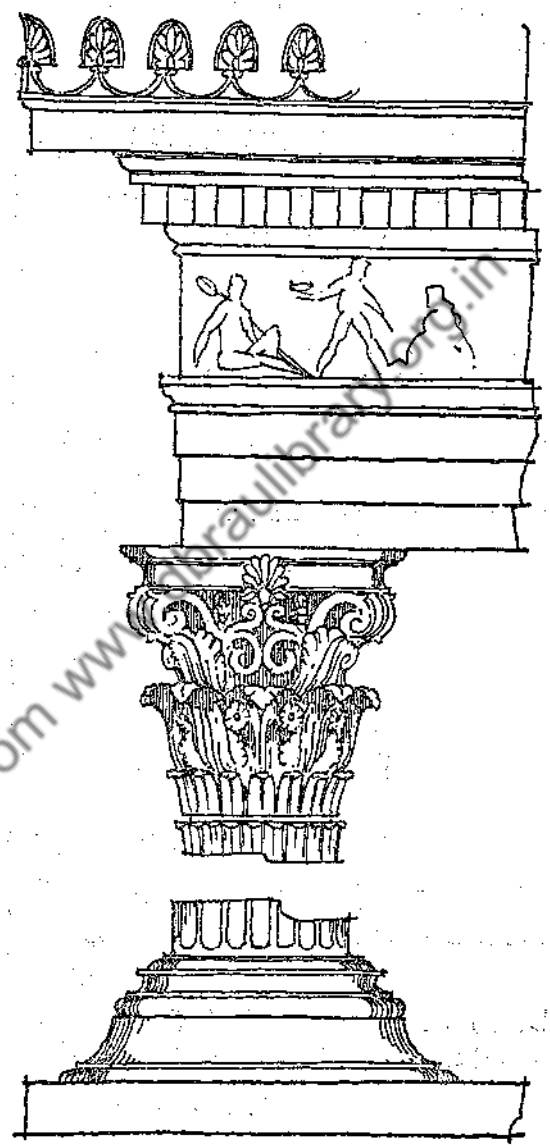
DETAILS OF IONIC ORDER

FIG. 22

of designs of pre-classical civilisations. It is reminiscent of a ram's horns. Columns were again fluted but these channels were separated by fillets unlike the sharp arrises of the Doric. One of the finest examples of Grecian Ionic is the Temple of Victory (Athena or Nike), at Athens. Also the columns possessed a moulded base consisting of an upper and lower torus moulding divided by a scotia moulding and fillets. In some early examples only an upper torus and costia are found but later structures possess the lower torus, the latter example being termed an Attic base.

The graceful spirals on the capital were geometrically produced and there was a pair of these features connected at the sides. Some of the capitals possessed extra ornamentation achieved by egg and dart and bead mouldings. Angle columns, which could be seen on two adjacent faces possessed volutes on the capitals on all four sides. The entablature, similar to the Doric, consisted of architrave, frieze and cornice but in this case the architrave had three different planes rather like overhanging beams. If the frieze was not left plain it was ornamented by a continuous band of sculpture. Squared dentils over which was a corona and cyma recta moulding comprised the cornice (Fig. 22).

The third order of Greek architecture was the Corinthian, but was little used as compared with the two earlier orders. When it was used it graced the more ornate buildings. Its flowery capital is presumed to be a combination of the bell-shaped Egyptian capital and the Assyrian spiral ornament; or it may have developed from the Ionic volutes supported by



DETAILS OF THE CORINTHIAN ORDER
BASED ON CHORAGIC MOUT OF LYSICRATES.

FIG. 23

anthemion sculpture. The abacus block curves out over the volutes at the corners and is moulded. The finest Greek example of this order is found in the small Choragic Monument of Lysicrates, set up at Athens in 335 B.C. Corinthian entablatures closely resembled the Ionic treatment with several additional mouldings (Fig. 23).

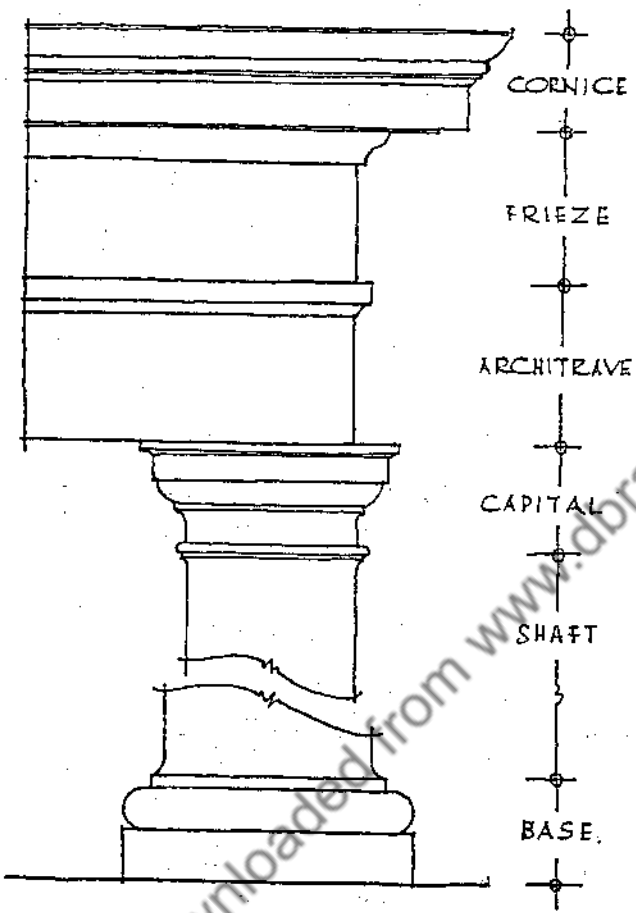


FIG. 24

The Roman Orders. Following the Greek comes the Roman development of the orders. Their main contribution was the introduction of the arch, but they produced two new versions of the old theme in the shape of the Composite and Tuscan Orders. Thus with the Greek orders they used five in all, more in a decorative than a constructive sense. Tuscan, which had been termed a simplified version of Doric, possessed a base, unfluted shafts, moulded capitals and a plain entablature (Fig. 24). The Composite was a hybrid order and practically merely a combination of Ionic and Corinthian, with an exceedingly rich, decorative treatment (Fig. 25).

Although I have treated the Greek orders much more fully than the Roman, the latter civilisation contributed a great deal to architecture in their own individual fashion and the student is advised to follow this up in his historical reading.

Italian Orders and the Renaissance. I will now take a big step forward to the Renaissance when a notable effect was achieved on the orders. The movement commenced in Italy where the chief work was done, although further developments followed in England and France.

The classic style was resuscitated from where the Romans had left off and much greater mastery of detail was displayed. Leaders of the movement in Italy were Vignola and Palladio, designs of which the student will read in his historical studies. In Italian

Renaissance architecture there are few examples of the style used with the birth of the orders—that is, the columns which supported the roof and entablature standing free. The Italian designers generally applied the orders to the walls more an as ornamental feature. In their compositions the walls supported the roofs, and the orders were used in the form of pilasters or as a framework for the fenestration.

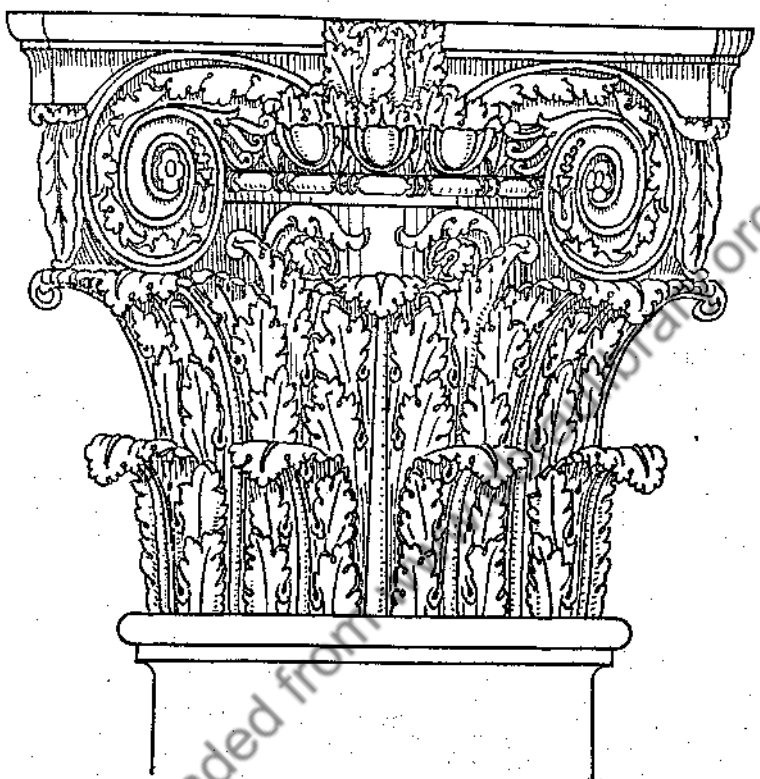


FIG. 25. Typical composite Capital, a combination of Ionic and Corinthian (*J. H. Sexton*).

An important detail was the general use of the pedestal beneath the columns by the Romans and the Italians. Actually it was a replacement for the earlier Greek Stylobate. When you carry a column up directly from the ground level it naturally tends to have a weak appearance.

The Baroque style was introduced about the end of the Italian Renaissance and great liberty was taken in the presentation of the orders. In some cases the result was quite fantastic as the designers sought for originality.

The main features of Italian design were quickly seized by enterprising French and English architects and a further development resulted from various forms of native genius. Traditional features were greatly modified in some cases and equally exaggerated in others. It was all according to the individual whim of the designer. There are

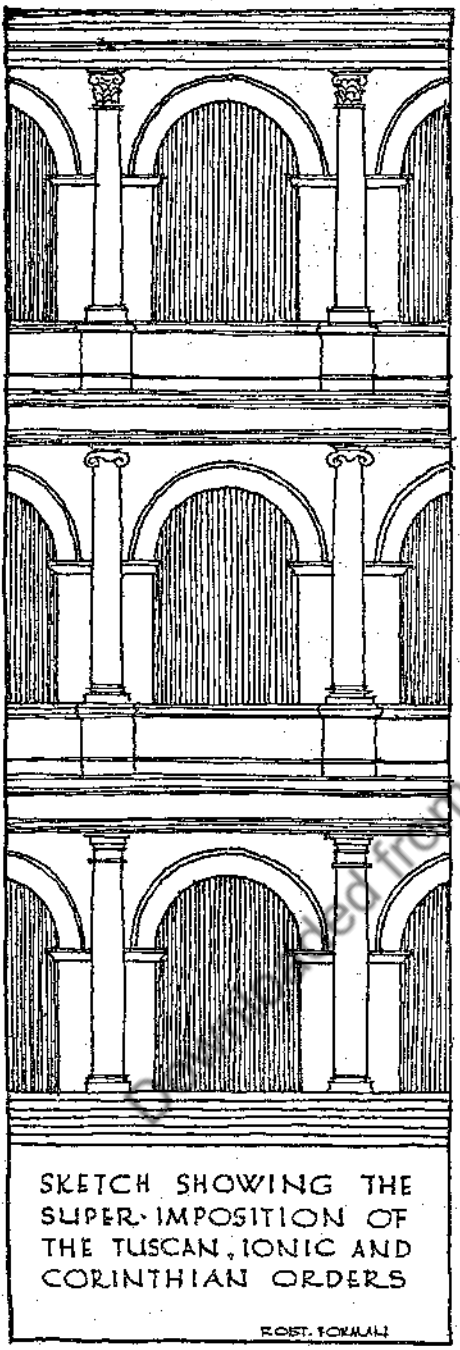


FIG. 26

examples of frieze and architrave formed into a plain fascia, often quite successfully, and other variations too numerous and varied to discuss here.

Superimposition of the Orders. The Greeks' principal buildings consisted of one-story temples but the complexities of Roman civilisation necessitated several stories to their buildings and the superimposition of the orders was a natural result. The placing of one order above another is clearly seen in the construction of the typical Roman amphitheatre. It was very widely imitated during the Renaissance period, when buildings of several stories were practically universal. It is a natural and simple arrangement with the massive order at the bottom story and the more delicate and refined orders on upper stories, following a recognised sequence of design. Tuscan supports Doric, Doric, the Ionic and the Corinthian or Composite, the latter being supported by the Corinthian only (Fig. 26).

With the superimposition the axes of the columns are kept in a vertical line as seen on elevation but in section the upper columns must be set back, due to the reduction of wall thickness in the ascending stories. The column diameter is also reduced. These refinements prevent the top story from becoming top heavy. Even if the same order is used throughout a façade it should suffer a corresponding reduction. Naturally all details are also reduced in scale. If the top cornice were not reduced they would tend to cut off the top part of the façade as seen from the street below. The crowning entablature, however, should be kept fairly bold as it is the completion of the composition. When balustrades are used they should be placed on a suitable plinth.

Inter-columniation. This is the term used for the distance between columns, either in the clear or from centre-to-centre of columns. It

is described in modules and the various inter-columniations are given Greek names. Here are the principal:

Pychostyle	. .	Columns	3	modules	apart
Systyle	. .	,,	4	,,	,,
Eustyle	. .	,,	$4\frac{1}{2}$	,,	,,
Diastyle	. .	,,	6	,,	,,
Aræostyle	. .	,,	7	,,	,,
Coupled Columns	.	,,	1	,,	,,

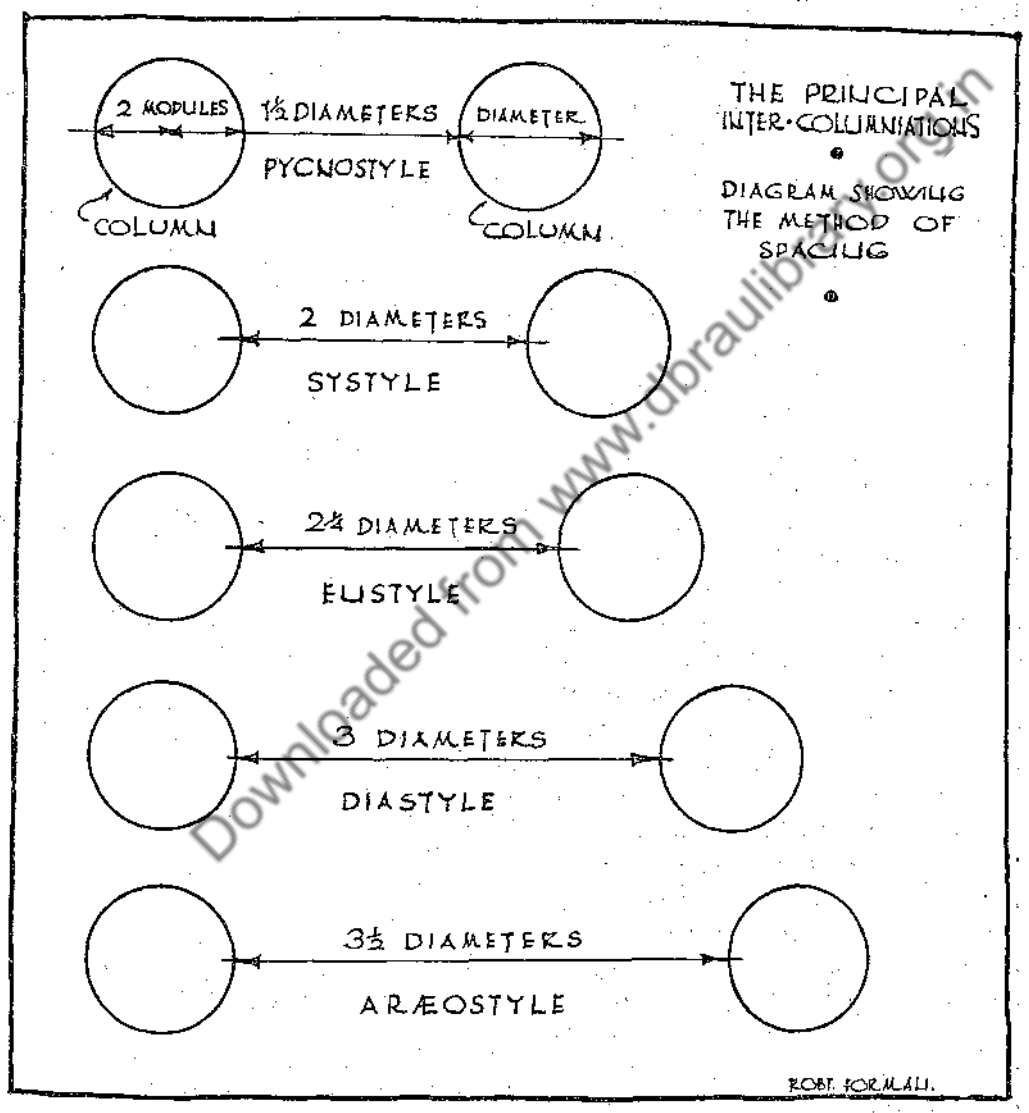
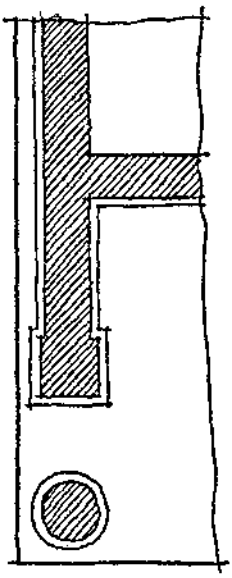


FIG. 27



SKETCH PLAN SHOWING THE GREEK ANTA.

FIG. 28

The Greeks did not use exact inter-columniations but the Renaissance writers set out a system for the application of these spacings. In Greek Doric temples columns were spaced from the positions of triglyphs—blocks with vertical V-shaped channels cut in their faces, found over the axes of columns except at the angles. There they are placed at the extremity of the frieze, consequently angle inter-columniations must be reduced a little. This reduction greatly improves the solidity of the design. End columniations in Italian Doric Order are placed the same as the others (Fig. 27).

The Anta and Pilaster. The Anta is a rectangular projection found in the wing walls of Greek temples. Order columns are placed between Antæ, they are described as being 'in Antis.' With the Doric Order there is usually a moulded base but with the Ionic a similar base to the Column is used with a different anta cap (Fig. 28).

In Roman and Renaissance Orders the projections are termed Pilasters. In this case they have the same projection of capital, shaft and base as the columns with which they are used. Pilasters are used as a respond in conjunction with columns and immediately behind single and coupled columns. In some examples the pilaster diminishes towards the cap, following the lines of the column. Again the pilaster face may be reduced only and the sides remain vertical. The shaft of the pilaster is generally fluted (Fig. 29).

The heyday of the use of the Orders in everyday architecture has passed, although there are still occasions when their use is called for, particularly in the design of civic buildings. As stated earlier their chief use to-day is for the study of good proportion and design generally. If they are used they must be used correctly and not debased as is sometimes done in a fruitless endeavour to bring them 'up to date', either by eliminating essential detail or ignoring the many subtle refinements only touched upon here. However, the student is advised to learn all he can on the subject of the Orders for they will undoubtedly influence his career even though eventually he may develop into the most modern of designers.

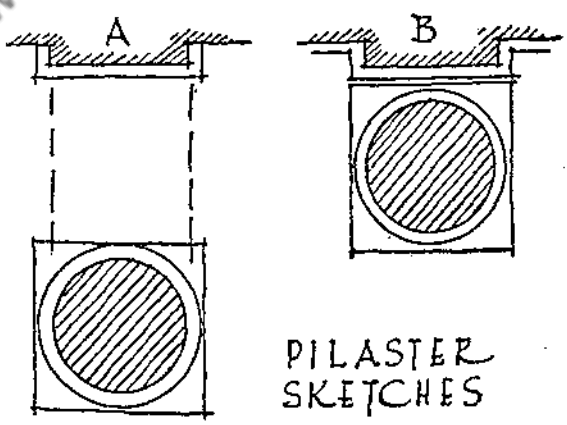


FIG. 29

Architectural Design. Design is a vast subject and it is possible to give but the briefest outline. The student will study design all his life. My purpose is to give some of the basic factors of architectural design which will help to indicate the right path at the beginning. Broadly speaking it can be termed the grouping of geometrical forms, thus a broad vision is essential from the start. Once the ability successfully to group those forms has been cultivated one can concentrate on the details—ornament, colour, texture, and so on. Architectural design is an expression of function, like the design of clothes. For instance, as a workman would appear ludicrous working in a top hat—so would a warehouse ornamented with pinnacles and other kinds of Gothic detail. But before detail may be applied, the composition must be pleasantly shaped. Exterior and interior call for a similar process of thought although actually they are separate operations. They are related to each other being but the same geometric form from different viewpoints. This arrangement of main masses is generally known as the composition of the building, and if you get your geometrical shapes soundly related to each other, a unified design will result. Some designers group masses formally—that is, their shapes and masses have formal relations. Another school of thought believes in informality producing a picturesque effect. The reader may develop along either of these lines but whatever he does providing he considers carefully the existing circumstances, and designs accordingly, he is on the right track.

How little the layman understands this business of architecture! To the man in the street architecture is only the local municipal buildings, his bank, the church or some other civic structure. The warehouse down by the docks is a warehouse and nothing else. But there is no reason why it should not possess a large measure of architectural design. To make such a structure look like a Greek temple would be wrong, but by emphasising its purpose by clear straightforward balanced masses with clear simple lines it could become architecture. Fortunately to-day there is a school of architects who have developed this latter viewpoint. They realise clearly that architecture is essentially a three-dimensional art (the axiom is 'Fitness for Purpose') and arrange their masses to express æsthetically the purpose which underlies the design of the building. Palladio wrote in 1570: 'The beauty of an edifice consists in an exact proportion of the parts within themselves and of each part with the whole: for a fine building ought to appear as an entire and perfect body wherein every member agrees with its fellow and each so well with the whole that it may seem absolutely necessary to the being of the same.' These words ring true, even to-day, and should be borne in mind by the student throughout his career.

Architecture can take many forms and ranges from purely ornamental to more utilitarian shapes. It embraces warehouses, factories, cathedrals, churches, cinemas, town halls, schools, houses, cottages, shops, railway stations—in fact, practically every type of building. It is the primary object of the architect to design these buildings and infuse them with qualities which will appeal to our various emotions. A building can be powerful and vital, it can give a sense of light and grace, and it can give a feeling of strength.

Before the designer can relate the masses of his composition he must cultivate a thorough knowledge of scale, proportion, detail, colour and texture. All these qualities are related and must remain so, otherwise beauty will be lacking. Above all he must become conversant with all types of construction. Unless you know the capabilities of the materials you are handling you cannot use them to their best advantage.

The much-discussed problems of scale and proportion are of paramount importance, for a lack of these qualities can easily condemn a structure. The site and purpose of the building is a governing factor. For instance, an important civic building might well call for certain monumental qualities whereas such a treatment would, it is easily seen, appear ridiculous in a purely domestic setting. The human figure is one of the best factors for deciding scale and often a very large building can prove depressing without the contrast of the human figure. If you enter an immense auditorium devoid of an audience you can feel the vast space enclosing you giving a sense of isolation. Without something with which to compare them the magnificent proportions are lost. It is possible to introduce scale in a large structure by means of subdividing large areas of wall space with string-courses, cornices and other mouldings. Changes in materials or texture can also be used. To take a typical example, often found in Renaissance buildings, you find rough-hewn blocks at the base of a structure and smooth-faced stones on the upper stories. Whatever system is preferred it must be consistent with the site and purpose of the building. Good proportion should not only prevail in the main masses but down to the last detail of moulding. It is the veritable hallmark of good architecture. It naturally affects both interior as well as exterior. A building should imbue the observer with a sense of strength and vitality. As a tree grows up out of the earth on which it stands so should a well-designed building. Note how the shafts and ribs of a great cathedral rise up and are lost in the vaulting high overhead. It is similar to the branches of the trees meeting over a forest glade. This is only one example and there are many more.

A building should convey in its appearance its purpose of existence. That is why wrongly interpreted work from the past is so irritating to the eye and senses. The integral honesty of purpose is lacking. Restraint is also an admirable quality, for too much ornament reminds one of an over-dressed person. Ornament when used should be handled sparingly and placed at vital points of the design. It can best be used to emphasise such features as entrance doorways. Closely allied to restraint is a sense of refinement achieved by using the proper materials in the right situation and manner. Extravagance reveals bad taste. A well-designed building fills the observer with a feeling of repose and grace. The latter quality is particularly applicable to domestic work but both these qualities apply equally well to a large structure. Pure lines and the refining of detail are prime factors for producing these qualities. Symmetry and balance are often virtues of civic work, the most typical example being a chief central administrative block flanked by wings containing offices. A symmetrical arrangement of both mass and detail is essential.

Colour can play a major part but needs very careful handling. This point cannot

be over-emphasised in architecture when one considers the permanency of buildings. Weathering, especially in exterior work, must be considered in relation to colour. While speaking of colour it should be remembered that as regards surface decoration by means of paintwork this material is only for the purpose of beautifying the underlying forms—it definitely is not architecture. At the same time the architect should ensure that his forms will not be ruined by subsequent badly applied surface decoration in the form of paintwork. The general rules of colour must be applied in a three-dimensional form and there are such points as light and shade to be thought of in connection with it, also the effects of texture over a large surface.

A mass of red-brick villas with red-tiled roofs can prove very monotonous but green pantiles with cream-washed walls might in some circumstances prove an exceedingly pleasant combination. On the other hand where the texture provides a large measure of interest such as in Cotswold architecture, stone walls and stone slab roofs blend easily together with no sense of monotony. Your texture in this case produces colour. We could employ a great deal more colour in this country.

Light and shade are of vital importance in design. They are qualities which aid in expressing form and rely on the aspect of a building. Obviously a southerly aspect would receive a great deal of sun and the various projections would produce rich shadow whereas a northerly aspect throwing a lot of shadow would merely appear gloomy. In the south shadows are cool—in the north they are cold. The various features which cast these shadows should develop naturally from the plan and constructional features of the building.

Light and shade are closely allied to the solids and voids, the latter also developing from the fundamental requirements of a building. The door and window openings are the voids and the intervening wall spaces the solids, the disposition of these features being governed by the nature and purpose of the structure. Too much of either quality will weaken a façade unless some feature is introduced to subordinate the dominating factor. In modern buildings where the voids very often exceed the solids the excess of void is obviated by the use of glazing bars and other divisional lines. Georgian architecture is notable for its universally pleasing arrangement of solid and void and can prove a good basis for the study of design in this direction. It is these latter-mentioned qualities such as light and shade, solid and void, and colour which show the hand of the artist in the design of architectural projects.

In architectural design construction is all-important and by means of the afore-mentioned notes its value can be appreciated. It is all very fine to sketch a pleasing elevation or plan but is it constructionally possible? The student must ask himself this question with everything he designs. Without a knowledge of construction he cannot hope to design successfully.

There are all kinds of materials used to-day and new ones are always appearing on the scene. They have all characteristics of their own. Some are hard, others soft, some wear better than others, many are only in the experimental stage or can only be handled in certain situations. Materials may be moulded or bear the stamp of the machinery

used in their production. However, the chief thing to bear in mind is to use them in their proper setting. That outstanding, rather hackneyed example, still found in present-day domestic work—sham half-timbering which has no pretensions of supporting the gable it adorns—is a case in point. It is a primary instance of the misuse of materials and the thing to guard against.

From these brief notes on architectural design the student will realise he has a great deal to learn before he can finally hope to erect a building which will not only have pleasing æsthetic qualities but at the same time prove structurally sound. There are many books on the subject and he is strongly advised to obtain as many as possible and assimilate their contents. Whenever possible he should visit new and existing buildings of merit and endeavour to obtain access to buildings while under course of construction. It is only by much study and hard work that he can one day hope to produce structures which will not only bear the imprint of good design but also the mark of his own personality.

CHAPTER V

LETTERING

FOR the education of the hand and eye of the architectural draughtsman there is no more useful art than that of lettering and every student should endeavour to become thoroughly proficient. I propose to divide the subject into two separate parts. In this first section I will deal with lettering to be executed on plans, drawings or designs, and in the second part with the design of lettering for fascias and permanent inscriptions which an architectural draughtsman may occasionally be called upon to design. Good lettering on a drawing plays a great part in 'putting over' the design. No matter how excellent the draughtsmanship, bad lettering will condemn it immediately.

Before laying pen, pencil or brush to paper the student should consider carefully the principles of lettering and the sources from which they have been derived. Apart from its many purposes in everyday life, lettering has proved one of the finest means of decoration ever conceived. In Roman times they chiselled on their triumphal arches and tombs a magnificent type of lettering (see Fig. 80) which is still used and known at the present time as the Roman capital. It is presumed that in the very early days a master-writer first drew out the letters by means of a brush, being followed by the masons who incised the writing by chiselling. The latter technique should be remembered when studying examples of authentic Roman lettering, for its form and proportions were naturally dictated by the tools and materials used.

FIG. 80. Roman Lettering

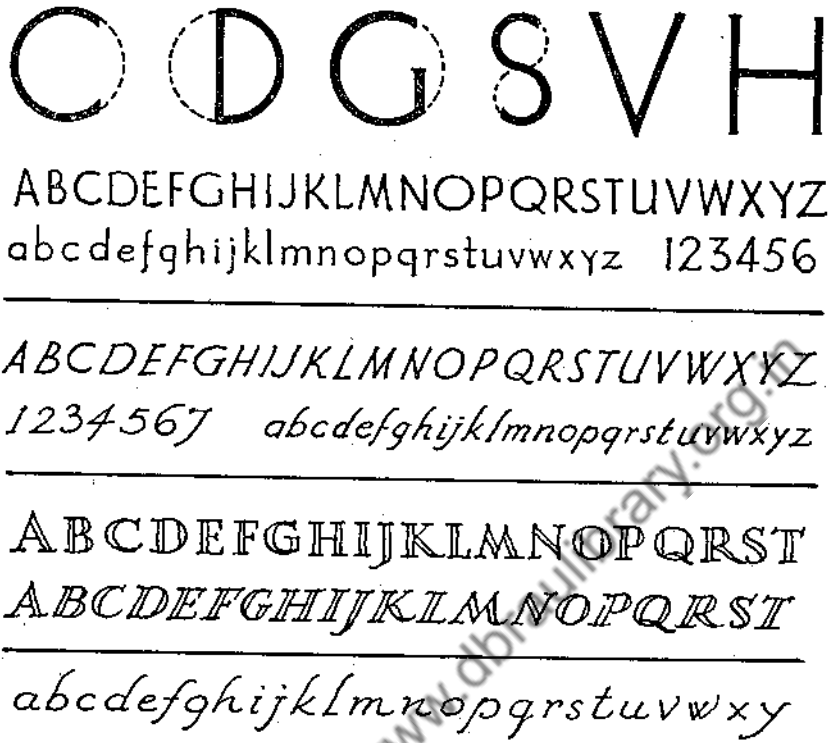


FIG. 31

The essential qualities of good lettering are legibility, beauty of form and fitness for the purpose in hand. The first quality needs little explanation, for naturally all lettering should be easy to read. Beauty of form and good proportion help to hold interest, but let me warn the student against the indiscriminate 'beautification' of lettering by the addition of various growths, flourishes and excrescences.

In the books recommended as a basis for study will be found excellent examples of Roman lettering. These must be closely studied and carefully analysed. Fig. 31 clearly shows the basic straight lines and circles from which Roman and indeed all types of lettering are constructed. Practise good shapes continuously, and try to master the sense of proportion of the letters. Try alphabets of the types which are formed by geometrical construction. Once the proportion is grasped however, immediately discard geometrical means and draw freehand, only using the T-square for setting out suitable spacing lines. It is essential to develop a bold free handling of the pen, pencil or brush. Avoid eccentricities. Personality will soon develop once the principles of good lettering are established in the student's work. Mechanical lettering has its uses in the hands of the competent designer, but once you are proficient at freehand work you will stick to it except for specialised jobs.

Fitness for purpose is very important and means the selection of the right lettering for each job. A slick poster letter used for a dignified memorial inscription would be

an expression of very bad taste. I have seen excellent examples of lettering debased by reason of wrong application. The sense of fitness must be assiduously cultivated and a great deal can be learned by observing existing examples of lettering in the world around you. Lettering should be woven into the very fabric of the design. It is still fairly common to find an exceedingly well-thought-out design marred by the unfortunate addition of illegible and poor lettering. In Fig. 31 are shown several types of one-stroke pen lettering executed by means of a drawing pen and suitable for such work as diagrams, working drawings and schemes. The face types shown require only spacing lines which the student will learn to draw rapidly, as required, with his T-square. The spacing lines are drawn in pencil and rubbed out when the lettering is dry. Although this style of lettering looks exceedingly simple, good and rapid execution is only obtained by close study and constant practice. It can be used very successfully with a combination of the script shown lower in the illustration. Use the small Roman capital style for important notes, headings, etc., and the script for less important remarks. They go well together and the latter type adds to the decorative appearance of the drawing and avoids an impression of monotony. For titles of drawings in details the sloping and upright style in capitals based on the Roman forms, produced by adding a double line for the thick strokes, is most effective, and a feeling of weight is obtained with little effort. All the styles will be found to harmonise well together. Do not, however, mix your styles indiscriminately. Get some working drawings produced by architects and designers of repute, study them carefully and try to evolve a clean, straightforward style.

There is available a complete range of lettering pens with which the student is no doubt familiar. The close relation between good writing and lettering is closely demonstrated by the use of these pens. Some of the nibs have round ball ends which give the same consistent thickness and are useful for executing a rapid block form with slightly rounded ends to the letters. For lettering up drawings, and quick, one-stroke methods for various purposes, when the ordinary nib would be too insignificant, they are admirable. A sample of the work which can be carried out by these special lettering pens can be obtained from almost any stationer or art dealer. As an exercise the student is advised to obtain specimen nibs and copy the Roman forms. Note that in these letters all the vertical lines are thick except M and N. Horizontal lines are all thin, and curves in circular letters are graduated at the top and bottom. Sloping lines, running from left to right downwards are thick, but when running upwards from left to right are always thin.

When executing Roman lettering a graceful effect is achieved by making the scrifs a flat, triangular shape. The curve from stem to horizontal line should be slightly flattened. Whatever you do to introduce an individual note in your lettering see that this note is carried throughout the entire piece of lettering. Bear in mind that you are working on a style of lettering which has been known and used for practically 2,000 years, and avoid exaggeration at all costs. You should not attempt to modify or increase the basic shapes until you have become master of the original alphabet. You must also

note that there are both wide and narrow letters in the alphabet, and that this has an important bearing on spacing and arrangement.

There are also ways and means of correcting lettering by various refinements to overcome optical illusion. To take a most typical example, the letter A, at a distance, usually appears shorter at the apex than the neighbouring letters. To overcome this difficulty the apex is carried slightly over the top spacing line. Similar cases are found with the M, N, and O. Sometimes the axes of the O, C and G are drawn slightly inclined; this is a matter for the student's discretion. It certainly gives an individual note. B, E, K, H and the X have arms to junctions which appear to occur in the middle of the letter. This is not the case—the junction is just over the half-way mark. In the case of the A, P, Y and R the junction occurs immediately underneath the horizontal centre line.

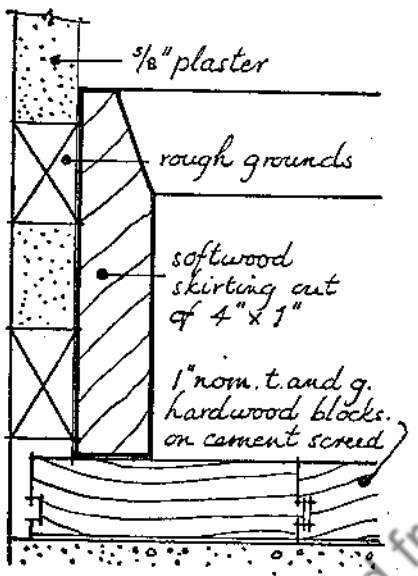


FIG. 32

There is also available to the student a very full range of lettering stencils complete with their own special type of pen. Although I have a personal affection for purely hand-drawn lettering I must admit that lettering stencils have many uses in the drawing office. They are especially useful when several assistants are all working on a set of drawings—either for a large contract or possibly a competition. The use of stencils keeps all the drawings uniform and on occasions, once practice has been obtained, can prove speedy in execution.

Apart from pure lettering, handwritten notes such as shown in Fig. 32 are being increasingly used by present-day draughtsmen. This style of notation is neat, easily deciphered on the site and is speedy in execution—a useful point in the busy office.

In the previous section I dealt purely with lettering on a small scale, but there is another important category of work executed by the architect. There are occasions when a special job comes along, calling for a design of, say, a memorial tablet to be cut in stone or cast in bronze, or it may be wood letters for a fairly permanent fascia. Although the architect may be an excellent exponent of pen and ink letter forms, he should be prepared for these rare and unusual tasks, by having in his mind a good working knowledge of the methods and materials which will subsequently be used in the evolution of his design into permanent form. There is space only for a brief description here, but the keen student is advised to pursue the matter further by studying, whenever possible, engraved and applied lettering in actual practice. Complete books dealing in detail with the subject should prove of great interest to anyone at all concerned with lettering and its design.

Actual designs for this type of lettering should, whenever possible, be drawn out full size, so that the metal craftsman or woodworker, as the case may be, can use the drawing for actual templates. If the lettering is so large that it must be drawn to a smaller ratio of proportion, then see that the scale is scrupulously accurate, for errors in this kind of work can prove very expensive. Whenever possible pay a visit to the ultimate site of the lettering, so that your design will be appropriate to its surroundings.

Applied Lettering. Applied letters are made of wood, metal, or one of the many new plastic materials. For the design of these letters it is obvious that simple geometric or static forms are more suitable than very ornamental styles of lettering. When lettering is designed for use against an architectural background, avoid sloping forms of lettering such as italics. Sloping lines do not harmonise well with the vertical and horizontal lines of architecture. In all cut-out letters make sure that the junctions of letters are all fairly strong. One of the best examples of this point is the form of the letter K. Painted in a good Roman form the two branches touch the main stem lightly.

However, when it is to be cut out of some material and applied bodily to a surface, it must be self-supporting. Therefore, the design must allow for just a skilful thickening at the junction (Fig. 33A). Keep lower-case and small letters fairly stocky, though endeavouring not to lose their beauty of form. Serifs can be kept silent. Large letters (including lettering which may be several feet in height) can be made lighter, yet conveying a sense of sound construction. There is sufficient strength in wood or metal an inch thick or more.

Metal Letters. Metal letters on a large scale are usually cast in bronze from wood patterns; smaller types are stamped out. Both large and small letters can always be cut out of wood and spray-painted to produce an imitation metal finish. Spray painting ensures an even, uniform coat and penetrates all corners of the letters. The designer should also ensure, by showing an enlarged detail section of the letter on his design, that the letters are made with all sharp corners slightly rounded off (Fig. 33B). If this detail is ignored there will be a shrinkage of paint from the sharp edge after painting, which will allow rainwater to penetrate later. Terminals of letters such as C and J, to quote two examples, should be modified as in Fig. 33C, especially for round letters. If this is not done the sharp tips would easily break off.

For cut-out or mechanically made letters adhere to sans serif and uniform strokes whenever possible, as their rigid severity is not only typical of the clean age of to-day but definitely practical.

Raised Letters. Raised letters in wood or stone are formed by cutting away the background. In fact, the same principles are used in line-cutting. Capitals are generally used, as they are more compact and do not involve so much cutting as lower-case lettering. Raised lettering can be cut out in panels, leaving the spaces between the lines of lettering as horizontal bars (Fig. 33D). Usually a block type is used and serifs are cut down to a minimum. In your design, guard against the craftsman having to cut into the background too deeply. Undercutting makes the letters look as if they were

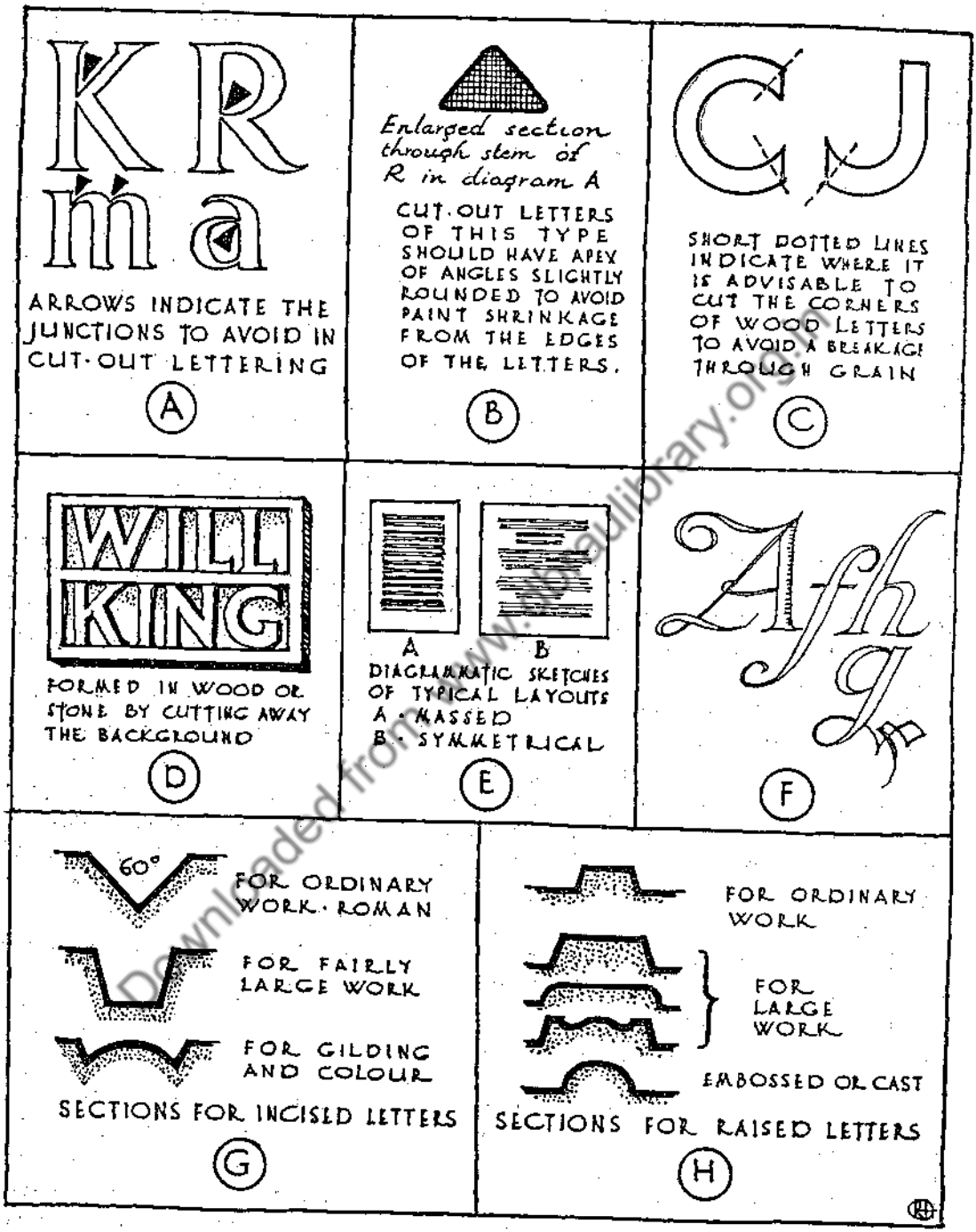


FIG. 33

stuck on, instead of being an integral part of the design. Raised letters are usually more legible than the incised type. The depth of carving can best be governed by the amount of weathering the inscription will receive *in situ*. Raised lettering is often enhanced by the application of gold leaf, and a background picked out in bright colour, perhaps red or blue.

Engraved Letters. Memorial inscriptions, fascias, foundation stones, house names, public inscriptions, etc., are only a few of the uses for carved inscriptions. The lettering as a whole is generally designed to be either massed or symmetrical (Fig. 33E). The first method is a series of closely packed lines and the second possesses lines varying in length. A complete statement is often given an individual line or grouping of lines. Both styles are often combined in one inscription.

Descending as it does from direct carvings on the Trajan Column, the Roman alphabet is the ideal type of letter for incision on stone. It is magnificent and legible. Lower-case and italics have their uses also, and can be combined with Roman effectively. All outdoor lettering capitals should at the very least be $1\frac{1}{4}$ inches high. Minute lettering is quickly filled with dirt. Indoor lettering should rarely be less than 1 inch high, and then only when executed in the finest slate or marble. Do not crowd Roman too closely, and when putting a general margin round, make the bottom margin wider than the other three.

Suitable Carving Stones. A good carving stone, from the craftsman's point of view, should possess a fine close texture, with no flint holes or shells in it. Portland stone is one of the best types for out-of-doors and weathers excellently. Great delicacy of line is obtained on various types of slate. Bath stone is cheap, but difficult to carve, and is not very good for fine lettering. Marbles and alabasters are good but types must be selected with little veining, otherwise the legibility of the inscription will be considerably reduced. A message fairly high above the level of the eye may have letters narrower in proportion to their height. Also horizontal strokes can be given extra thickness, which will make up for visual foreshortening.

Metal and Wood Engraving. Designs are sometimes required for ultimate engraving in metals, though engraving in silver, copper and gold is a highly specialised craft. The work is usually done by means of a burin which cuts a single line in the material, rather similar to a type of wood engraving. The depth is slight, and the chief style adopted is known as 'copper plate'. For extra large letters with a thick stem, two lines are drawn, and the space between patterned with fine lines or dots. A study of sixteenth- and seventeenth-century books in a museum will enable the student to make sketch-book studies of forms most suitable for this kind of work (Fig. 33F).

Engraved letters in bronze are sometimes filled with vitreous enamel and then fired for permanency. Brass will not stand firing so wax is used as a filling medium. Sometimes even acid is used for patterning a background when water is not to be used.

Incised Letters. Incised letters in granite or marble can be filled with lead. Coloured cement is yet another method, and best suited for outdoor work where paint would be

FIG. 34

prone to deteriorate. Practically the same rules apply to incised letters in stone. A V-shaped burin is used for execution, but when a block letter form is required, chisels are called into operation (Figs. 33G and 33H).

Cast Lettering. As the name readily implies, cast inscriptions bear the imprint and character of the mould from which the inscription is evolved. Sometimes the letters are first incised in plaster, which provides the cast to be used as a model for casting in sand. For large letters the various sections can be slightly rounded or even left flat with a slight slope towards the face of the letter. This facilitates withdrawal from the mould. Gesso (a mixture of whiting and size, used as a basis for painting or gilding) can also be used for building up inscriptions to be cast.

With the development of concrete many new possibilities are open to the designer of architectural lettering. Letters in this medium should be bold, clear and simple, as befits the nature of a typical concrete structure.

There has been a great revival of old type faces in present-day publicity. The qualities of many of these letters, oddly enough, fit in extremely well with contemporary style buildings. Fig. 34 shows some typical specimens as follows: (1) A bold italic with slab serifs; (2) Playbill; (3) Clarendon; (4) Rockwell; (5) A bold italic with hair-line serifs; (6) Extended Egyptian; (7) A condensed sans serif.

CHAPTER VI

AN ARCHITECTURAL PROGRAMME

THERE are many references to architectural design in this volume but apart from increasing his knowledge of this all-important subject the draughtsman must also develop a systematic approach to his problems over the drawing board. The youthful designer is carried away in the excitement of architectural composition and often a good scheme has fallen through due to his failure to systematise his efforts. Time, energy and materials are needlessly wasted.

A new building is required. The client states the accommodation required, suggests site, the amount of money which can be allowed and other relevant information. All these particulars are placed in the hands of the designer and his first task is to read all the data over most carefully. As he reads he endeavours to create in his mind an 'atmosphere' of the desired structure. He will probably make references to his files and consult illustrations of buildings of a similar nature to the project. These are known as documents. The very early stages of design are purely a mental process although several tentative sketch jottings may be made of the site, etc. The accessibility and surroundings should be duly noted together with levels and other similar information which will affect the design. Once you have all the information clearly studied you can begin to weigh the various elements one against another as they are so related. To take a typical example and to make this point clear, let us presume you have a number of rooms to group together. These will require a lobby or some kind of an approach corridor. The apartments then are the main elements and the approaches the secondary elements. Practically all the details of the plan can be split up in these two groups which greatly helps to clarify thought. Once you have clearly in mind the outline of the design you can commence with the suggested site plan of the building. This should be to a small scale. Do not grudge the use of plenty of tracing paper and pencils. A similar method of sketching is used to that described in the section 'Sketching for Evolution of Design' (page 23). The main portion of the building or buildings, as the case may be, are sited first and the secondary elements such as corridors are gradually worked round them. Whether the building is one of many, and large or small, use the same method. When laying out a site with several buildings a sound idea is to cut the buildings out of coloured paper to a small scale and it is readily seen how one can move these about to form the desired pattern.

A good plan almost always leads to a good elevation. Many subsequent alterations will, no doubt, be found necessary to obtain final satisfaction, and much depends upon whether your design is more concerned with planning then elevation, and vice versa.

Such problems as picture galleries, cinemas and public halls are known as 'elevational' subjects and as such must receive special consideration.

A prominent elevation must receive many considerations especially as regards its surroundings. The same principles of the planning problem are followed. Major masses are dealt with in conjunction with minor masses, the latter supporting the former, especially at the focal point of the design. Work again to a small scale. In addition light and shade should be sketched in, and that is where a knowledge of shades

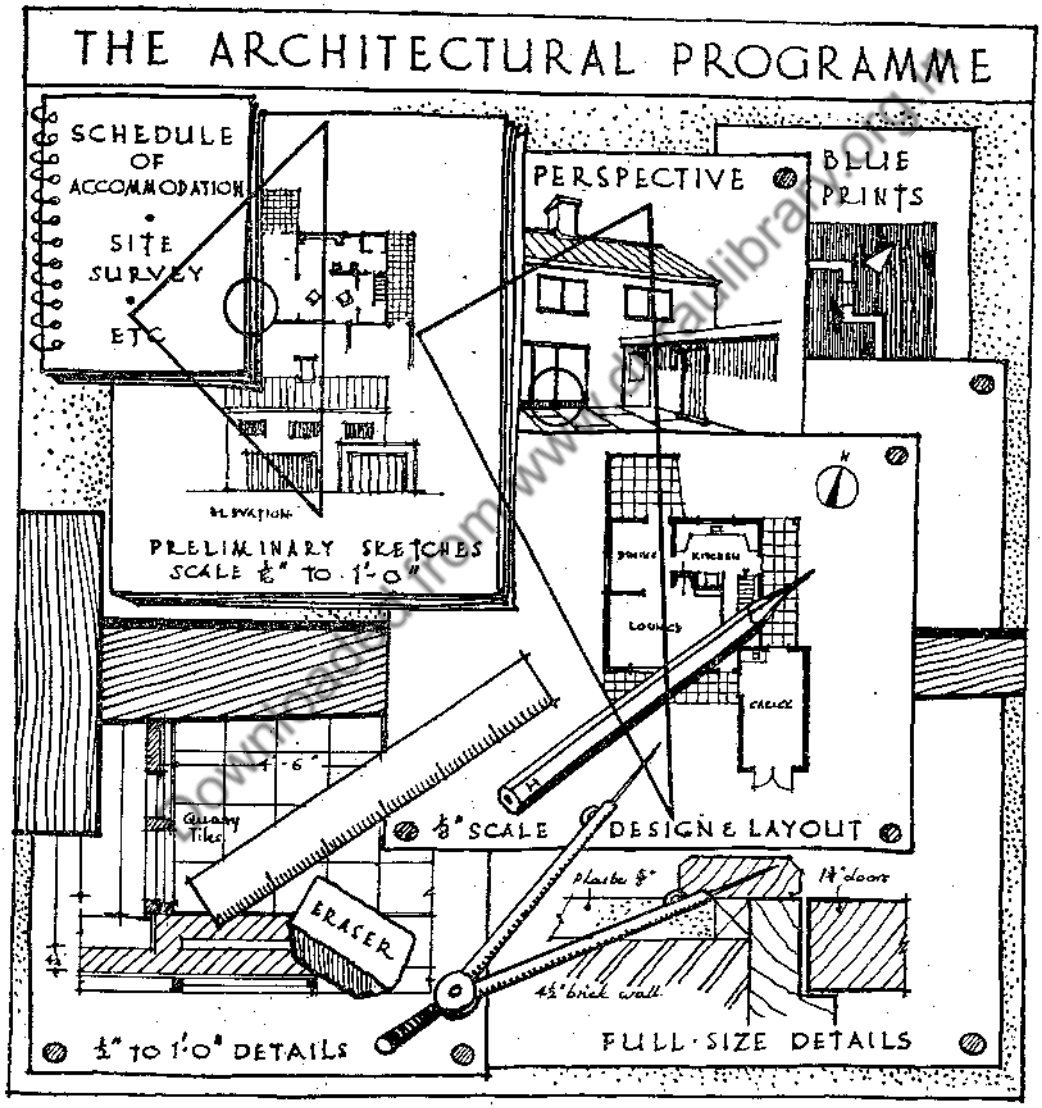


FIG. 35

and shadows is so important. If one can sketch isometrically, this is also an advantage, to give the right impression of the various masses. Little marginal perspective notes can be made. In all your drawings bear in mind the importance of scale. The author usually sketches small figures, approximately 5 feet 9 inches high on the ground line, to assess the height of various features, such as doors and windows. One should always apply a scale frequently to the drawing, checking sizes.

Do not abandon your rough sketches for the finished scale drawings, until you have worked out all your problems to a small scale, for large-scale work is difficult to grasp with the eye. All studies are made on overlaying pieces of tracing paper (Fig. 35). Once the small-scale details are settled you can proceed to the mechanical process of getting down your finished representation to a suitable scale.

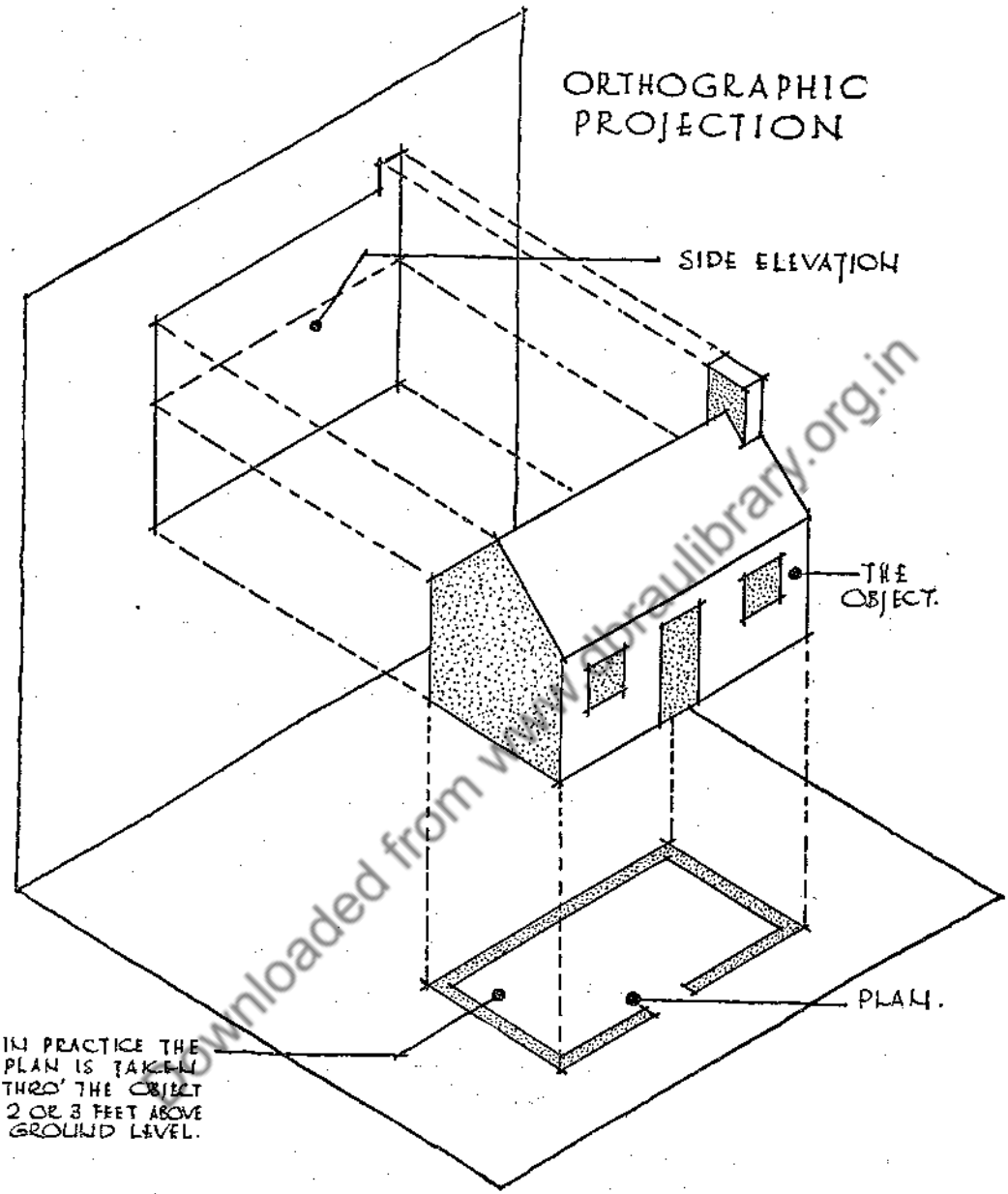
Working Drawings and Full-sized Detail. Before attempting working drawings it is fundamentally necessary for the student to understand the meaning of the terms 'Plan', 'Section' and 'Elevation'. Think of the building in which you are now sitting and imagine a giant knife being propelled horizontally just above your head level and cutting right through the walls and rooms of the building. The same imagination sees the upper part of the building lifted so that you are able to look down on what remains—you are observing the plan of the building. If the same knife was used in a vertical direction thus dividing the building into two parts vertically a section would be revealed when one of the parts was removed.

After this simple explanation it should be apparent that a plan shows length and width whereas a section shows length and height. Generally a plan is shown looking down, but sometimes, for constructional purposes, it is necessary to show a plan looking up, such as a design of a ceiling.

The limitations of plan and section can thus be seen because the eye observes in three dimensions and not two dimensions. In order that a craftsman can interpret your ideas in terms of brick, stone, concrete and timber he must have *actual* dimensions and not merely *observed* dimensions—hence the reason for plans, sections and elevations drawn accurately to scale.

An elevation shows length and height or width and height. This is to say that the operations of the giant knife are not necessary except to cut away surrounding property which might impede a clear paper view of your projected building. To understand a roof plan it is only necessary to imagine yourself looking down on the roof from above.

Orthographic Projection. This is the name of the method used to present three-dimensional objects on a plane surface, the plane surface, in the case of the draughtsman, being his sheet of drawing paper. Fig. 36 illustrates the projection of plan and elevation. For the purpose of clarity imagine the paper folded in an L-shape as shown. To aid explanation the diagram is presented isometrically. It can be seen from this that there are two imaginary planes—one vertical and the other horizontal. By following the dotted lines you can also see how the plan and elevation are projected. On the diagram the plan is drawn at the floor level of the building but in actual practice it is customary, as mentioned earlier, to take a cut through two or three feet above ground level to



TO PRESENT A THREE DIMENSIONAL OBJECT ON A PLANE SURFACE (A SHEET OF PAPER POSSESSING TWO DIMENSIONS) SOME CONVENTIONAL GRAPHICAL METHOD IS NECESSARY. THEREFORE ORTHOGRAPHIC PROJECTION IS USED.

FIG. 36

enable the various openings to be shown. Fig. 37 illustrates the delineation of sections and the theory of slicing an object through. It is practically self-explanatory. The importance of sections cannot be overestimated as they reveal the structure of the body. For further information on three-dimensional drawing see the section 'Isometric and Axonometric Drawing' (page 75).

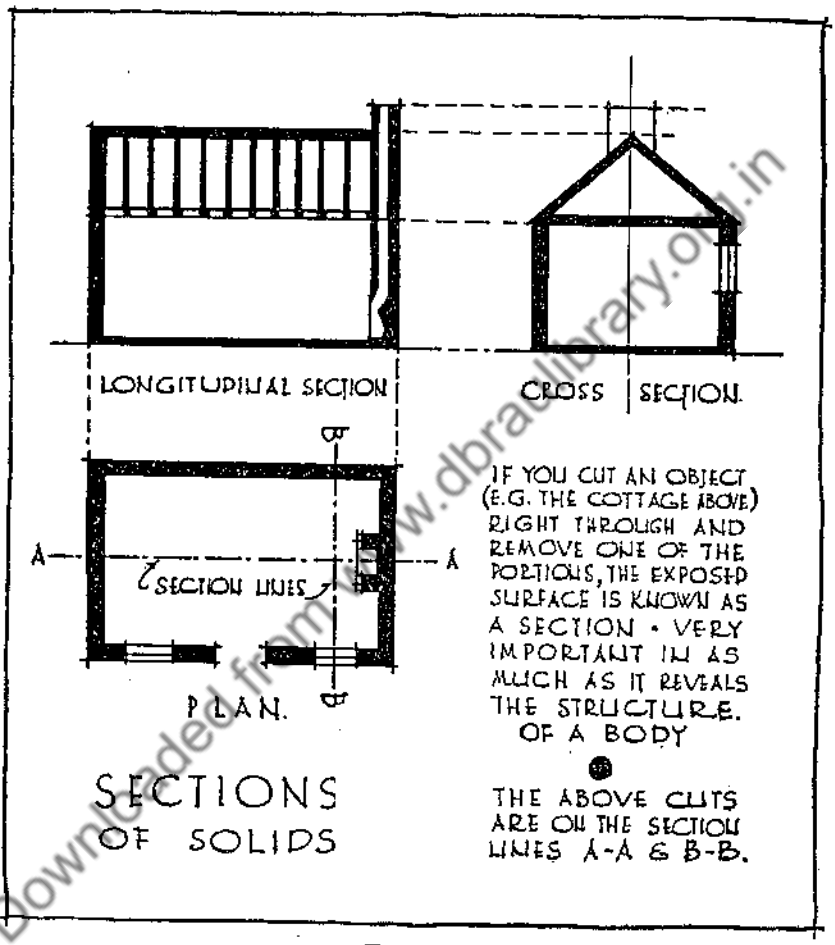


FIG. 37

The best way to study working drawings is to obtain prints of actual work executed by leading architectural firms of repute. A great deal can be learned, which if described in words, would only lead to confusion. However, a good working drawing should possess the following qualities:

1. It should be clear and accurate;
2. It should be well dimensioned with distinct lettering and figures;
3. It should, if colouring is necessary, be coloured clearly and simply;
4. It should be 'full'.

The first quality is obvious—without clarity and accuracy a working drawing will only prove a source of trouble, involving unnecessary expense and considerable waste of extremely valuable time. To achieve clarity you require distinctly figured dimensions backed by clear, concise lettering. Colour is a point which is often neglected. Not only should colouring distinguish the various materials but there is no reason, despite the necessity for contrast, why one should use inharmonious tints. The student who learns to handle colour carelessly may find, later on in his career, that he has destroyed a great deal of valuable colour sense. As regards the term 'full', it means that a drawing should possess all the necessary information required.

A drawing having all these qualities will enable everyone concerned with the work to understand at once what is required. An important point may well be raised here: the simplification of drawings so that all relevant details of a scheme are kept on one sheet. All too often numerous sheets are composed and it is very difficult for the foreman in charge of the work to visualise the complete structure unless he has all his information clearly arranged and grouped conveniently.

Working drawings, broadly speaking, can be divided into two classes:

1. Drawings which form part of the contract and are signed as such;

2. Drawings which are carried out during the progress of the work. These are generally large-scale and may even be full-size details.

The details mentioned in group two are necessary for carrying out the work in accordance with the Bills of Quantities and Specifications. It is considered generally to be bad practice to prepare details after the work has commenced. Details should be in the hands of the Quantity Surveyor for his information before the quantities are commenced. These may be in pencil and an ink tracing and duplication done at a later date although the originals should be preserved as a record of the work measured by the quantity surveyor. In ideal circumstances he will have a complete set of working drawings, photostat copies of the completed tracings, but this is not always possible.

Contract drawings are generally prepared or completed to scale of $\frac{1}{8}$th of an inch to 1 foot. They will show the various floor plans, a roof plan and portions of external walls not shown in the sections. Sections are taken through various portions of the design where a different treatment must be interpreted. They are very often used to show flues, chimneys, etc., on domestic work.

A simple definition of a section has already been given—an imaginary plane dividing a solid, the two surfaces revealed by this cut being known as the sections. You may have cross or transverse sections, longitudinal sections, vertical and horizontal sections. These are shown on plan by various lines as in Fig. 37 and are lettered A–B, C–D, or as some prefer A–A, B–B, etc. Section letters should follow the direction through which the cut is taken. Sections can be shown coloured on some working drawings, but as a rule the large-scale details are devoid of colour. Occasionally a light etching by means of coloured crayon is useful for emphasising a point of detail. As a typical example the contours of a full-size detail can be treated in this manner. Colouring is usually confined to the $\frac{1}{8}$th scale drawing. All dimensions should be clearly figured, the

extent of the dimension line being indicated by neatly drawn arrow-heads. Many modern draughtsmen use minute circles at the intersections of dimension lines as shown in Fig. 38. The figuring should run parallel to the dimension line so that it is easily seen which is a vertical or a horizontal measurement. Remember that the exact setting out of the work depends upon the various dimensions. Naturally the workman is not concerned with the particular style of presentation favoured by the draughtsmen, as long as everything is perfectly clear to him. Also bear in mind that he does not possess the same familiarity with drawings as you do. The thickness and relative height of walls should be in plain, clear figures (Fig. 39). Internal dimensions are usually shown between the various walls. Dimensions between floor and ceiling should not be shown except on top floors, because ceiling height may vary owing to floor thicknesses not being constant throughout a building. Therefore always adopt the method of figuring floor to floor heights with floor thicknesses noted as necessary.

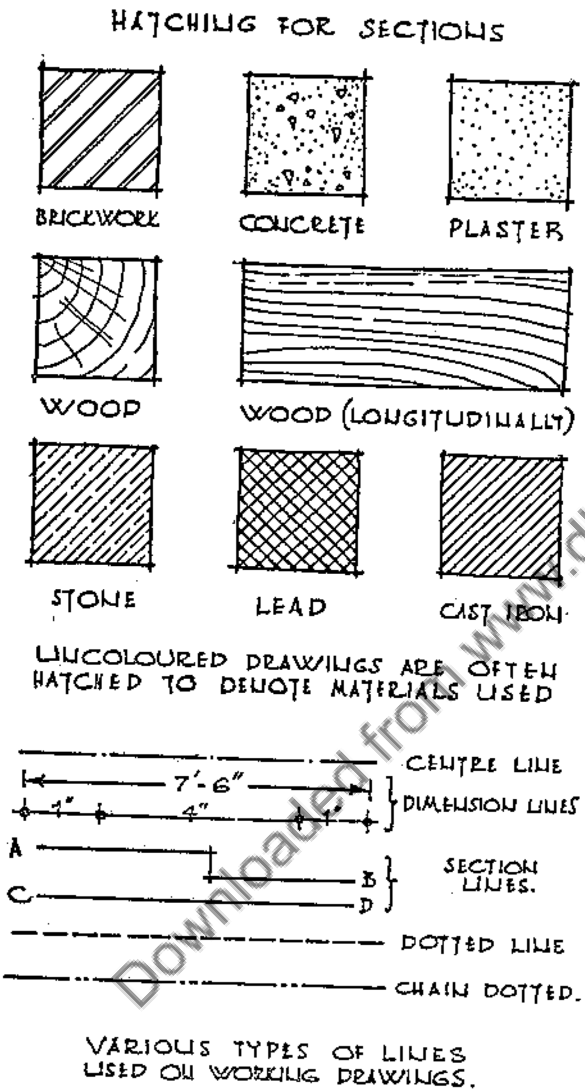


FIG. 38

On a small scale drawing there is no need to figure heights of windows or doors externally; they can appear on the large-scale detail of the exterior treatment which will show the jointing of the material used, etc. If a sketch roof plan is considered to be unnecessary then scantlings of the various roof timbers should be figured on the sections.

Another important point is that of centre lines. When you can use them certainly do so. They may be chain-dotted although many draughtsmen prefer them run through in one continuous line, which is very faintly drawn. The latter method is an aid to speed. Centre lines are generally placed at window and door openings, on columns or

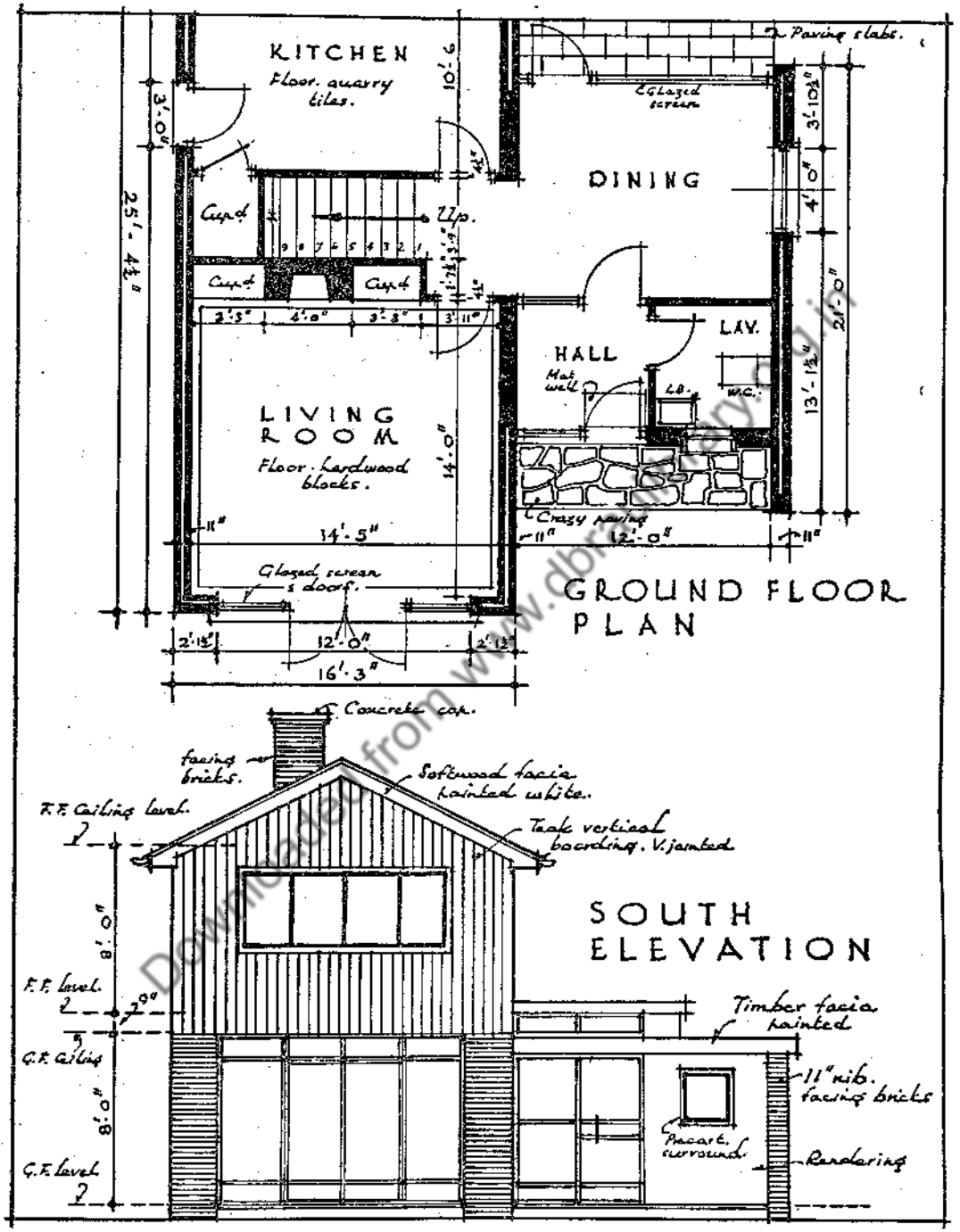


FIG. 39. A typical Working Drawing

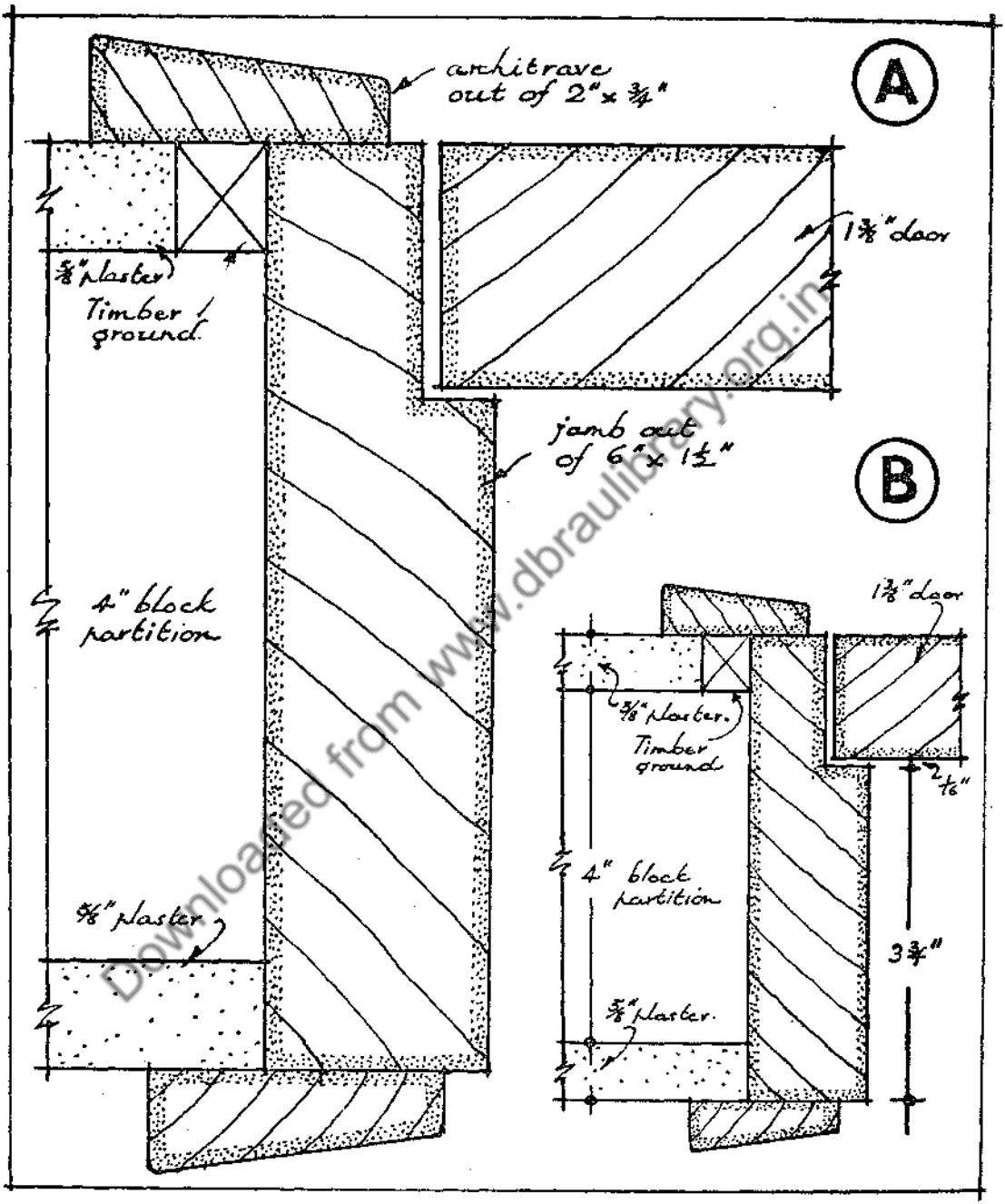
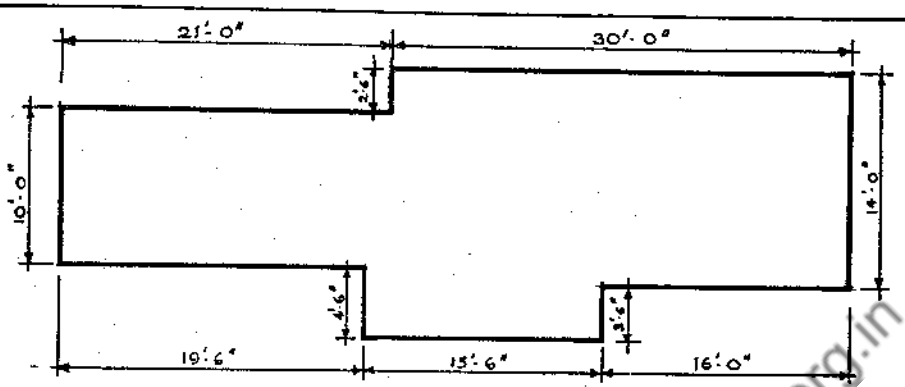
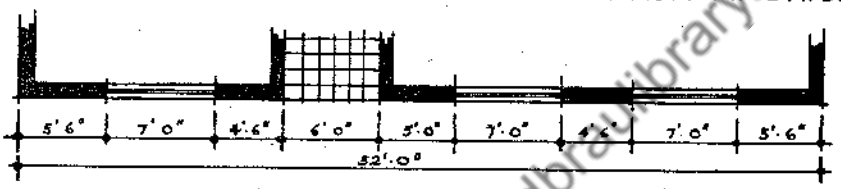


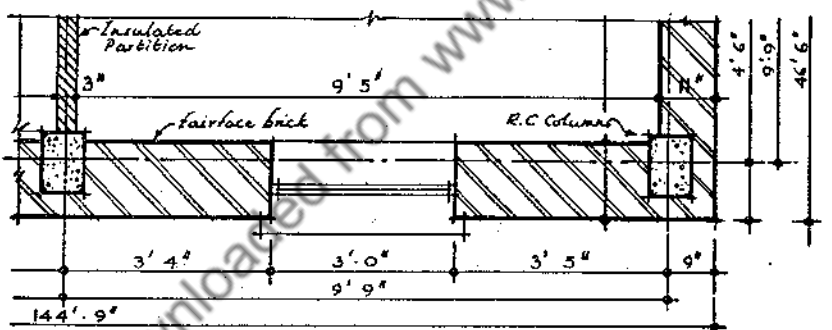
FIG. 40. Reduced Facsimile of a full-sized Drawing



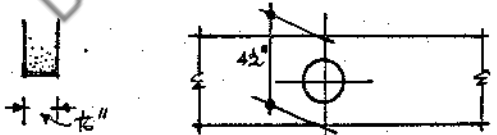
THE METHOD OF DIMENSIONING BY UNBROKEN LINES



THE METHOD OF DIMENSIONING OPENINGS WITH A BASIC LINE WITH AN OVERALL DIMENSION ADDED



THE METHOD OF DIMENSIONING TO THE BUILDING FRAME AND CENTRE LINES



DIMENSIONING SMALL SPACES

PROJECTING OBLIQUE LINES TO MAKE DIMENSION CLEAR

DIMENSIONING RADII

VARIOUS METHODS OF DIMENSIONING DRAWINGS

FIG. 41

where any other symmetrical details occur. They will prove of value both for adjustments and dimensional purposes. If centre lines are found impracticable, a plane surface such as a floor level can be drawn and measurements extended from this line. On rare occasions when no such surfaces or lines are available the adoption of an imaginary line is permitted; providing, materially, that all other measurements bear a relative position to this imaginary line which is generally known as a 'datium' line. A scale should always be drawn, preferably at the foot of all drawings. Dimensions for this are marked off direct from a proper scale—the use of dividers is not recommended. As drawings when printed are liable to shrinkage it always ensures the correct dimensions being taken from the print. It is particularly essential with small-scale detail. Do not, however, neglect to dimension the drawing, even when you provide a drawn scale. Fig. 41 illustrates various methods of dimensioning working and contract drawings. At first glance the diagrams may appear confusing but by studying them carefully the student will soon realise their necessity.

A $\frac{1}{4}$-inch scale drawing of a simple structure will often make the use of a $\frac{1}{2}$-inch scale detail unnecessary. Generally $\frac{1}{8}$-inch or $\frac{1}{4}$-inch scale drawings are supported by $\frac{1}{4}$-inch

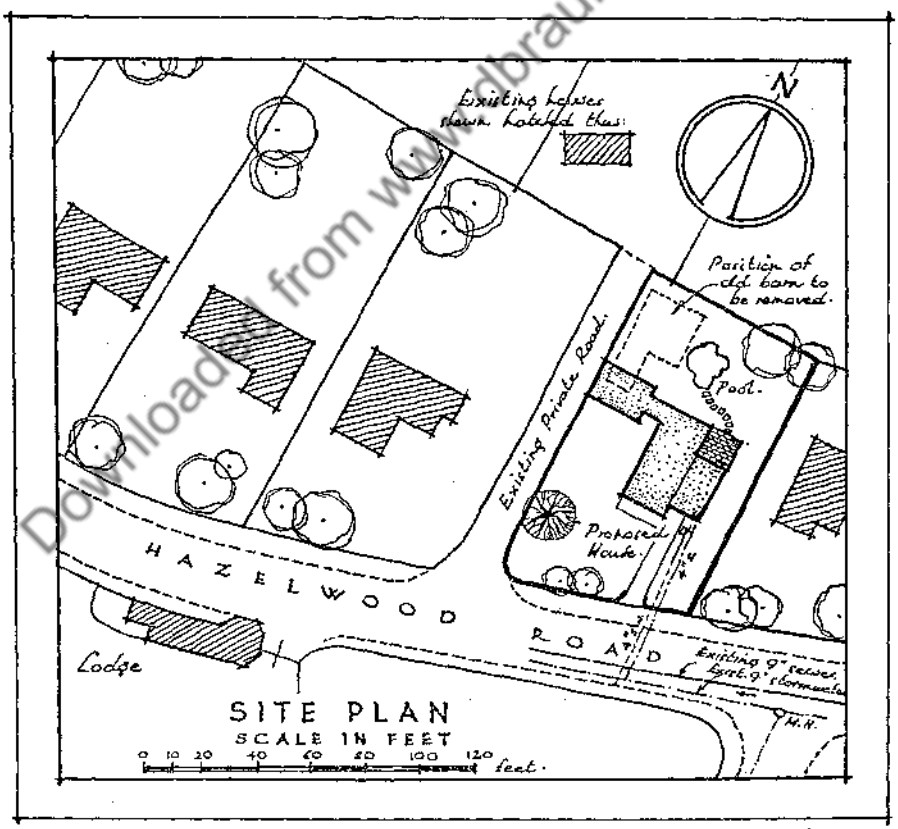


FIG. 42. A typical site plan for the small house used to illustrate a working drawing

scale details, especially with more complicated structures. For any special treatment in the construction they are most useful to the Quantity Surveyor, who can take off his dimensions more easily and accurately. With specially designed detail, drawings can be made to 1-inch or 1½-inch scale. Sometimes it is even necessary to draw details of the work *full size* (Fig. 40). This applies to mouldings, panelling and other special features. On these are shown the correct contours and so forth. Often it is advisable to reduce this large-scale detail and place it on the small-scale drawings. Half-size details are not recommended for they can often prove very misleading. Drawings should, if possible, be finished on linen with ink if the subsequent prints have to be coloured.

On occasions a plan of footings and foundations is found necessary and a block plan must always be provided, usually to a small scale, e.g. $\frac{1}{16}$ inch to 1 foot or when a very large building is concerned $\frac{1}{500}$ inch. This shows the siting of the building or buildings and the surroundings. A typical block plan is shown in Fig. 42. The North Point is a most important essential on the block plan for reading the correct orientation of the building. I think more horrors of draughtsmanship are produced in North Points than any other feature. I have included in Fig. 43 some clear, straightforward examples for adaptation by the student.

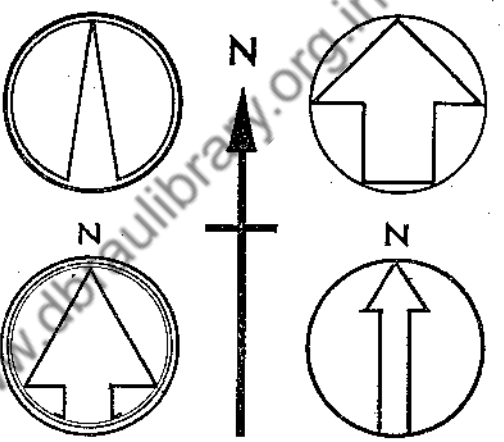


FIG. 43. Some typical North Points

Ground floor, basement plan, or block plan will show details of the drainage system. Various service pipes can either be shown on separate drawings or by means of coloured lines superimposed on the prints. These services are the hot and cold water supplies, electricity, gas, rainwater pipes (if necessary), etc. A line of pipes can be shown in any form the draughtsman may consider advisable in the particular circumstances. In some cases pipe services are shown in coloured inks, but it must be remembered that these will not appear in their proper colours if the tracing upon which they are drawn is duplicated.

A useful method to adopt in such cases is to indicate the services on the tracing in a widely spaced broken line and fill in with colour on each print. Another method is to use a distinctive form of line for each service, for example, extra long dashes with a slight squiggle of the pen might well indicate electricity. Do not become too fanciful, however, for such a method may prove confusing if the services are congested at any point. When pipe runs occur actually in a ceiling the author always adopts the method of showing these on the plan of the floor immediately above, but if they occur below the ceiling, then mark the run accordingly, i.e. 2″ water at ceiling level.

All internal doors, width and possibly height of same, also the width of chimney openings should be shown. Do not draw in every joint and trimmer or confusion will

result from a multiplicity of lines. Only the direction of their bearing need be shown. On the ¼-inch scale drawing on the plan should be shown all the fittings forming part of the contract. The doors and the direction in which they open are also necessary. The last mentioned is known as a 'door-swing' and thus must be carefully considered when designing the particular room concerned. Is it necessary to shield the room from the gaze of an entrant or is it necessary to expose the room at once? Will many people use the room? If so, you must consider easy exit in case of fire and the door must open outwards, but not in such a way as will obstruct a passage or corridor.

The graphic symbols used for doors and windows are illustrated in Fig. 44. With regard to doors single swing B is generally used to show a door only partly opened, when it might otherwise become confused with other lines on the drawing or another door swing adjacent. A door manufacturer's chart will, no doubt, show more types of opening lights, but the forms shown here are the principal examples and these should be memorised.

All these matters properly come under the heading of 'Design' but are mentioned here to illustrate how closely linked are the subjects—Drawing and Design. The draw-

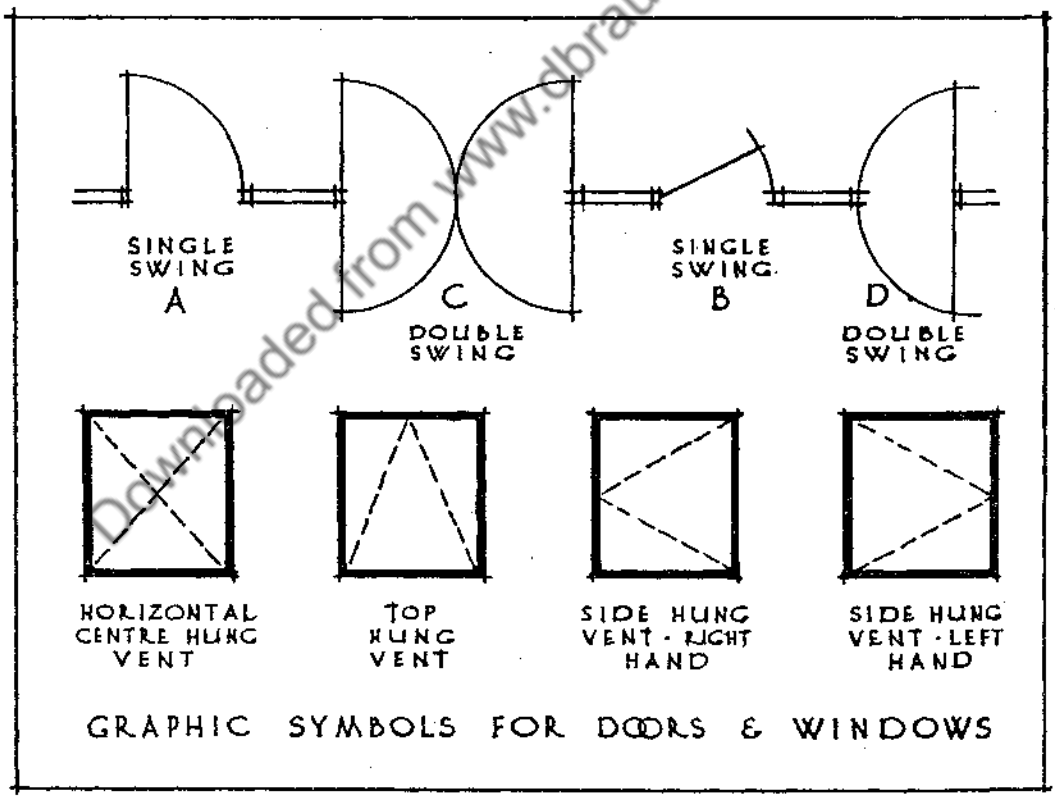


FIG. 44

ing is only a means to an end, the end being the erection and use of the building you have designed. Finally it must be noted that before building work is commenced approval must be obtained from the local authorities concerned, and if the project is a large one the questions of sewage, gas, water and electricity should be considered at a very early stage of the scheme, i.e. before working drawings are commenced. It is, therefore, wise to consult these authorities when the scheme is in 'sketch plan stage'. Whether this is done or not, however, copies of the working drawings must be submitted to the Local Council. In London drawings must be approved by the District Surveyor in addition to the Local Borough Council.

The information on this subject given here is by no means exhaustive but it must be understood that if you are the assistant in charge of the job it is your work to find out this information and to submit the necessary plans. Preliminary copies of the working drawings will also be required for sub-contractor (fireproof floors, metal windows, heating and lighting), because it is essential that all these matters be carefully thought out and discussed before the working drawings are completed.

Colouring the Drawings. Rendering is fully described in another chapter and although the colouring of plans is really a form of rendering, it is not nearly such an elaborate process. For working drawings there is scarcely any need to intermix colours. Direct tints can be used for they are the most easily matched. The primary object in view is to make the various materials easily distinguishable. If this can be accomplished artistically, so much the better. A box of ordinary water-colours and sable brushes will be found sufficient. Colouring on elevations should be light and delicate but darker tints are an advantage of the sections. Coloured inks can be used for various purposes and, providing they are of the waterproof variety, will be found useful.

Here is a list of water-colours which are used on working drawings:

Alizarine Crimson	Lamp Black
Burnt Sienna	Prussian Blue
Gamboge	Sepia
Brown Madder	Raw Sienna
Venetian Red	Raw Umber
Cobalt Blue	Hooker's Green

There are various recognised systems of convenient colourings for well-known materials, which will be observed if the student examines specimens of architectural working drawings. A brickwork elevation, for instance, may be treated with a Venetian Red wash; concrete a green wash; and oak, Raw Umber. Apply the colours as outlined in the section on 'Rendering' (pages 81–6). Once a facility for the laying-in of washes has been cultivated the student should find little difficulty with the work.

Composing the Sheet. The student, from his earliest essays in draughtsmanship, should endeavour to develop his ability to 'compose the sheet'. This sounds complicated but it means simply to arrange your drawings of a subject on the sheet to the best advantage. This ability is necessary for Testimonies of Study required for examination

work and for competition drawings, etc. Even a working drawing, in the hands of the trained draughtsman, can be presented in an attractive as well as a practical manner. Study the frontispiece of an old volume of architectural drawings which can be found in many libraries. Excellent examples of presentation will be found in the volumes in 'A Library List' (pages 113–15). There are many documents which can provide a lead for the student. Apart from the actual drawings, shadow projection, rendering and lettering are all involved and must play their respective parts in the presentation of your composition. A certain amount of perspective may also be involved. A sense of layout must be developed. Layout means composition and composition is the foundation of all good pictures and works of art. It means the planning and arrangement of the various details of the composition to form a pleasing design as a whole. Experiments can be made by the arrangement of masses without worrying unduly over the shape of individual details.

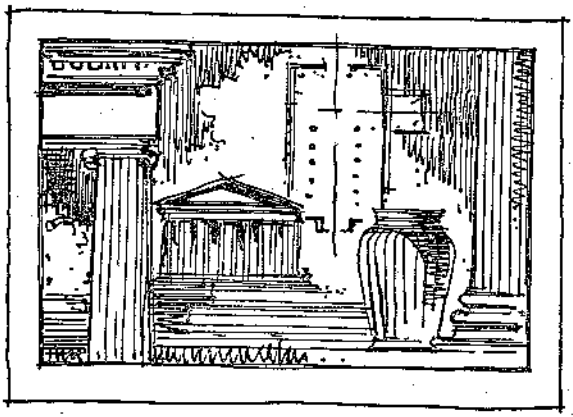
Good layout possesses balance, and if this is not achieved, the sheet will either prove to be top heavy, inclining to one side or another, and altogether devoid of that important virtue—poise. Simple compositions are definitely amongst the most successful, and the appearance of the whole must be borne in mind through the designing operations.

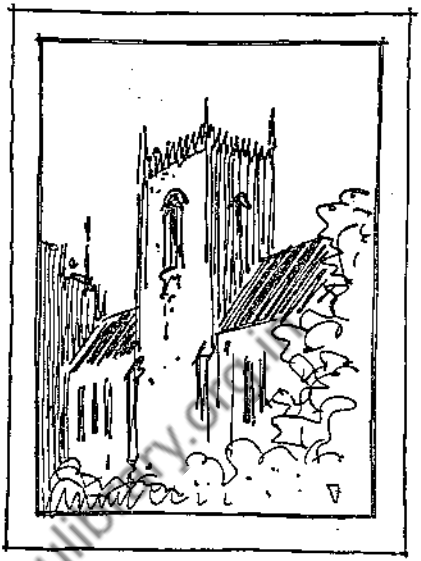
The term balance may be a trifle misleading in giving the impression that the various units should be the same size or weight. This is not the case. A small unit of the design will still balance with a larger unit providing the balance is maintained by what might be termed visional movement. The eye of the observer will first fall upon the large unit and can be led, by means of the design, through to the smaller unit, where it will finally come to rest. This means the smaller detail often receives the most concentrated attention, but this attention helps it to counterbalance with the larger unit of the layout.

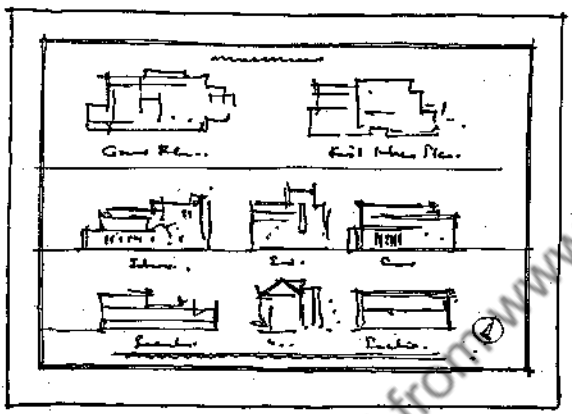
For the purpose of simplifying these notes I will broadly class layouts under two headings. First, the formal type, which means the layout is designed on a centre line running vertically through the area of the sheet—the general atmosphere being one of balance and refinement.

Second, the informal type, which gives a more spontaneous appeal. A strong border to the sheet is recommended for this type. Although the various units appear to be scattered in rather a haphazard manner, a feeling of definite construction permeates the layout. This is best accomplished by extending a certain amount of similarity through every unit of the sheet. Unless this point is borne in mind the layout will lose its unity among the individual units.

A definite sense of continuity should prevail throughout the sheet and the eye must be guided skilfully along without missing a single detail. When designing a layout one must consider the shape of the building and the space it is going to occupy on your paper. If it is long and narrow maintain the vertical feeling by a vertical arrangement. This helps to carry the eye through the design. If the composition has strong, horizontal lines lay out the sheet horizontally. This horizontal or vertical feeling, however, as the case may be, should not be overdone. You must endeavour to give your building a sense of strength and stability to prove it is architecturally sound.







TYPICAL THUMB-NAIL SKETCHES USED FOR COMPOSING THE SHEET

FIG. 45

The first procedure is to sketch out the various details you intend to compose (Fig. 45). This might be a plan, section and elevation of the subject at a fairly small scale with fairly large-scale details of the cornice and various other mouldings, a portion of a column, arch or pedestal. I am thinking chiefly at the moment of the presentation of a sheet of classical detail. This is generally an essential of architectural examinations. Decide definitely what you intend to present and make these first tentative sketches thumbnail size. Once you have made a sketch to your satisfaction you can proceed to set the sheet out roughly to the final scale. Incidentally all the detail need not be to the same scale. For instance, the detail of ornament may be almost full size with a plan or elevation showing them in position at $\frac{1}{8}$-inch scale. A very soft pencil, almost of a charcoal type, can be used successfully at this stage.

From the beginning leave a fairly generous margin to the sheet because you will require this for mounting your 'Whatman' on the drawing board for rendering later. Once your large-scale setting out is satisfactory, take the sheet of 'Whatman' for the final study and pin it on the board. Some draughtsmen prefer to mount it ready for rendering before commencing the final drawing, but this is optional.

Carefully, by the use of dividers and what the Americans call 'ticker-strips' (strips of paper used for marking on dimensions for transferring purposes), transfer your lay-out to the final sheet. Try and avoid having to use a rubber at this stage. All your thinking out should take place in the early sketches and this should be purely a mechanical process, leaving you free to concentrate simply on fine draughtsmanship. Once your sheet is set out and you feel it is complete you can begin to think about the rendering.

CHAPTER VII

PERSPECTIVE

IT is fairly obvious to the architectural student how useful a knowledge of perspective will be found in his career. To many, however, perspective is a subject either to be treated lightly or on the other hand one which appears too complicated to be investigated thoroughly, and that is why so many drawings show absurd mistakes in their setting up.

The great artists of the past, Leonardo da Vinci, Rubens, Raphael and Tintoretto, to mention only a few, took an enormous amount of trouble with their perspectives. They no doubt enjoyed a real sense of power in solving many intricate problems. My aim is only to introduce the reader to the subject, but as the student develops his powers he is strongly advised to study more advanced treatises.

Casting shadows by means of perspective is a study in itself and the reader should endeavour to obtain Hatton's *Perspective for Art Students* and other volumes mentioned in 'A Library List' (pages 102–3). Above all he should practise diligently.

Perspective has been described as 'the science which determines the relative appearance of objects at varying distances'. This, I think, is putting it in the simplest terms possible. It is the general failure of the student to realise how objects alter and diminish the further they are away from the eye that results in faulty perspective. Once he realises, however, that a clever perspective drawing does not depend on some unusual gift of the draughtsman, but purely and simply on logical laws, he will be on the right path. The architectural student will have observed during his studies into the history of architecture many instances, say of ancient wall frescoes, where a lack of perspective is evident, an example being the wall paintings of the Egyptians, who represented various figures, animals and everyday objects, just as they knew they existed. A very typical specimen for the purpose of illustration is their treatment of the human figure (Fig. 46). They knew that the widest part of a man's anatomy was his shoulders; therefore they indicated this feature on their drawings, even though they were actually showing the figure in profile. This particular feature occurs frequently in Egyptian Art and even animals receive a similar treatment. A cow was shown with two horns at their respective angles, despite the fact that the cow might be in such a position as naturally to show only one horn. Despite their lack of perspective, however, it must be remembered that these Egyptian drawings and wall paintings possess an otherwise very high degree of excellence and are valuable as historical records. Occasionally in modern decorative schemes this Egyptian lack of perspective is used deliberately to gain a special effect, often most satisfactorily.

Even though the art of drawing progressed in these early times, we still come across strange perspective effects when we reach medieval days. Most of us have seen old woodcuts in which a figure is shown at one angle and the surroundings or landscape at an entirely different angle. Fig. 47 shows a portion of an old pictorial map which demonstrates this type of draughtsmanship. Note that the buildings have been drawn as if they were all at equal distances from the eye.

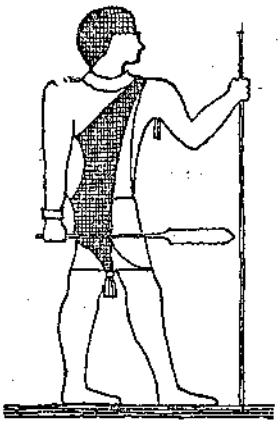


FIG. 46

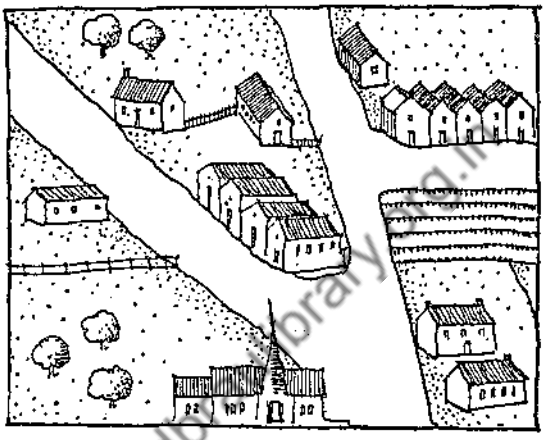


FIG. 47

It greatly assists the young architect to think in three-dimensional form. You realise that a building has more to it than mere 'frontage' and that a plan, sections and elevations must all work out intelligently together. By setting up a perspective of a proposed design he can see his faults before progressing too far and take steps to eradicate them on the working drawings. Compared with fanciful perspective embraced by art students, architectural perspective is a much more mechanical process, although the same laws apply. The following diagrams give merely the essentials of the method commonly used in architectural practice. Before commencing his geometrical setting up of the subject the student should make one or two thumbnail sketches to obtain some idea of the viewpoint he is aiming at in his finished perspective.

Fig. 48 illustrates a perspective made from the plan and elevations of a building. At the top of the illustration are the details of the building required for the purpose of the perspective. These include the Plan (on which is shown the position of the door), the Front Elevation and the End Elevation. Incidentally all these details are necessary to help visualise the complete perspective apart from the purpose of providing heights and positions of features such as openings. The mere 'bones' of a building have been used to keep this explanation as simple as possible. Most perspective diagrams show much more elaborate subjects which with their multiplicity of lines tend to discourage the student.

The first step is to decide the position of the spectator in relation to the actual building. Throughout the diagram this is the Station Point. Actually this will always be a certain

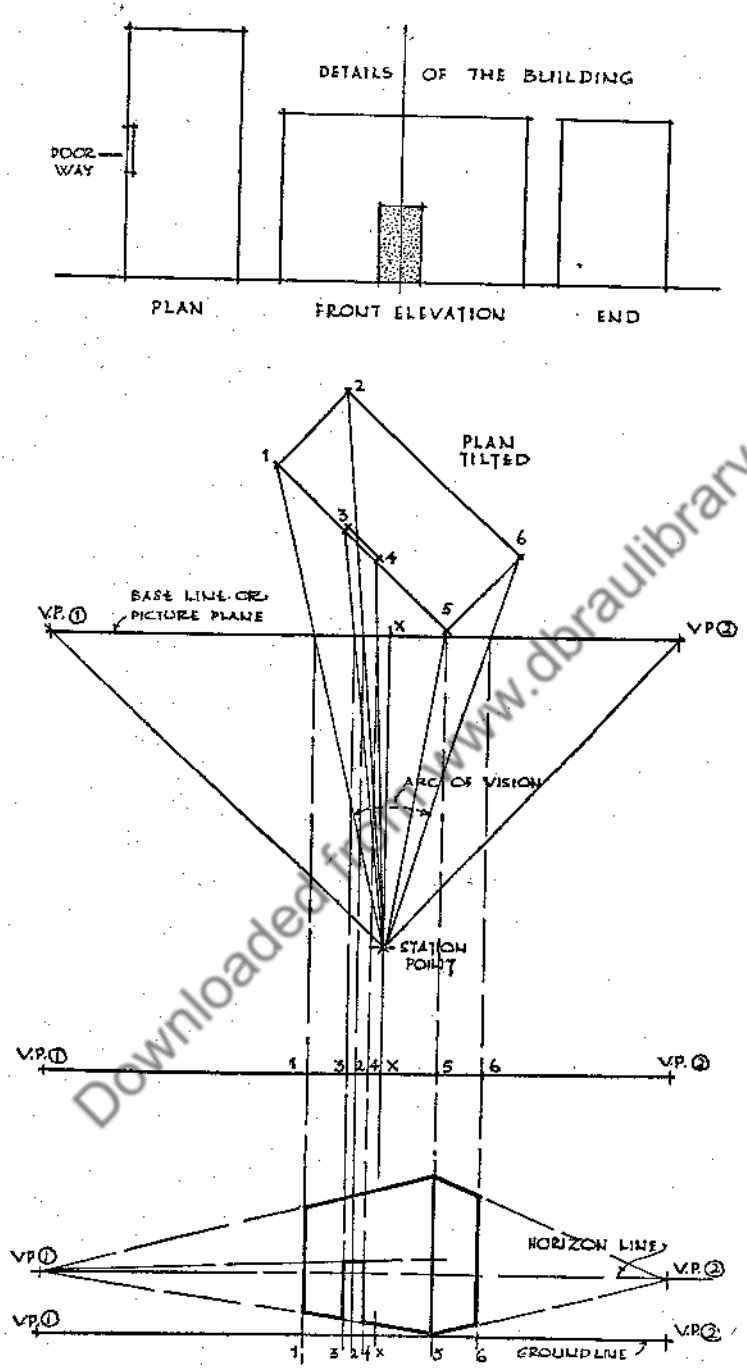


FIG. 48. Perspective: a simple example

distance from the building and a general rule is to make this point about three times the height of the actual building (the distance from ground level to the eaves) away from the building. It is considered bad practice when projecting a square plan to place the spectator in such a position as to observe an equal amount of building at each side of the point from which it will be seen. It produces an awkward effect. Try and imagine you are standing at the Station Point and at what angle your composition would appear to its best advantage. This necessitates the tilting of the plan as shown.

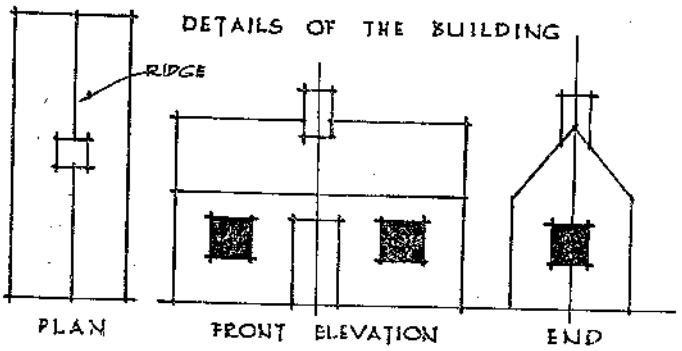
The Base Line touching the nearest corner of the plan is drawn horizontally. A vertical line is drawn from the Station Point cutting the Base Line at X. Lines from the two extremities of the building provide the Arc of Vision—the sector seen by the spectator. Lines are projected from the corners of the building to the Station Point—numbered 1 to 6. Lines are also projected in a similar manner from the doorway on plan and are included in the numbering. All these lines cut the Base Line, the length of the latter being determined by running lines from the Station Point parallel to the walls shown on the plan of the building. Thus Vanishing Points 1 and 2 are provided.

Where the Base Line is cut by the projections to the Station Point, these points are produced down on to the Ground Line. The isolated Base Line is only for the purpose of making the explanations clearer. The sequence of action can be more easily followed by the numbering.

The Horizon Line is then dotted in, parallel to the Ground Line. Do not carry this through too high otherwise an exaggerated perspective will be the result. The Vanishing Points on the Ground Line are projected up on to this. The nearest corner of the building to the spectator provides the means of measuring the various heights of the actual building taken from the elevations. Lines from the various points of height are carried to the Vanishing Points—V.P.1 and V.P.2—including lines from the foot of the nearest corner of the building. The various lengths of wall are cut by the verticals extended up from the Ground Line. Draw this diagram yourself and you will soon see how the perspective view is achieved.

Fig. 49 follows the same procedure as Fig. 48, only this time the building is slightly more elaborated. A pitched roof providing gables together with a chimney stack, and windows, are added. The correct height for the roof is obtained by measuring off the front elevation on the nearest corner to the spectator as before and adding the height of the roof from eaves to ridge. When a two-story building is being shown in this manner the windows and openings on the various floors, to avoid confusion, can be shown in different coloured inks on the plan. In every case a line is projected down to the Station Point to produce the correct perspective dimensions on the Picture Plane and thence to the Ground Line.

The most convenient method of drawing the Base Line is to have it striking the nearest corner of the plan. However, the perspective view of the building can be lengthened or shortened as the case may be. By lowering the Ground Line the perspective view will be lengthened, by raising it the view is shortened. There are many



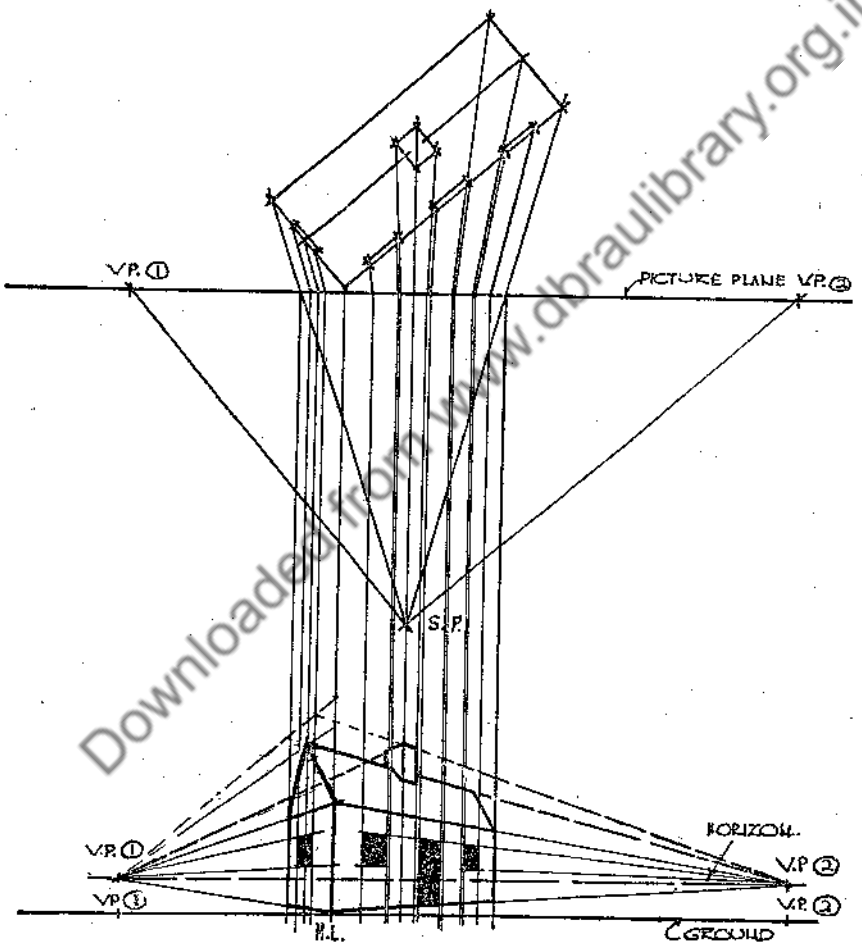


Fig. 49 Perspective: a more elaborate example

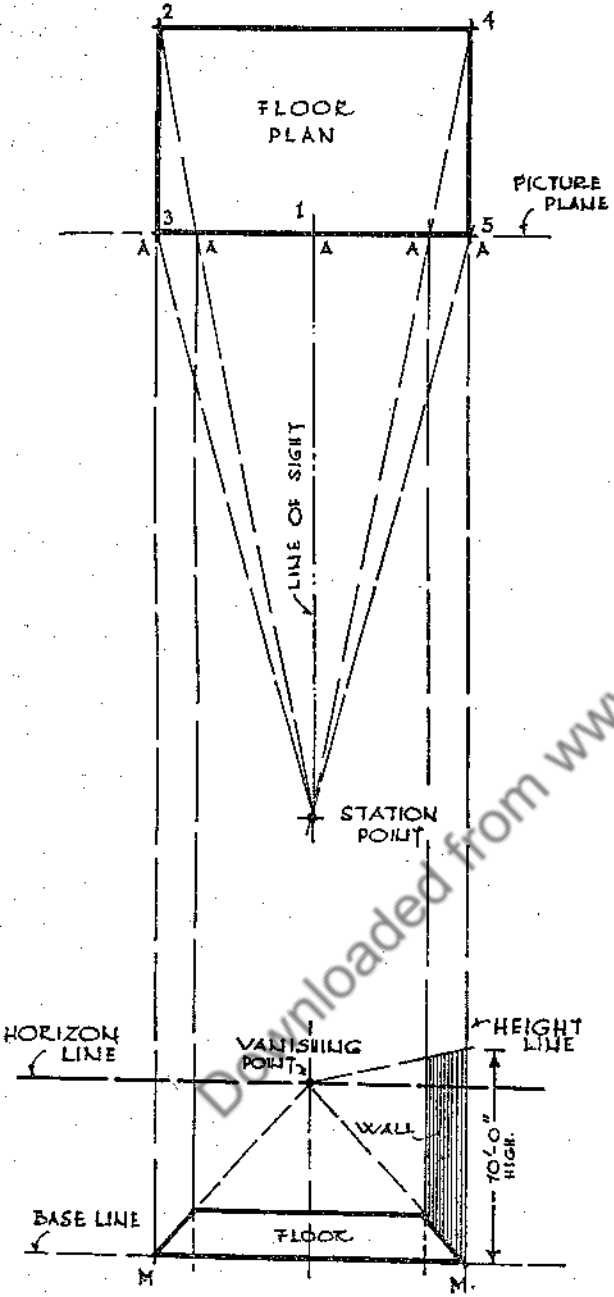


FIG. 50

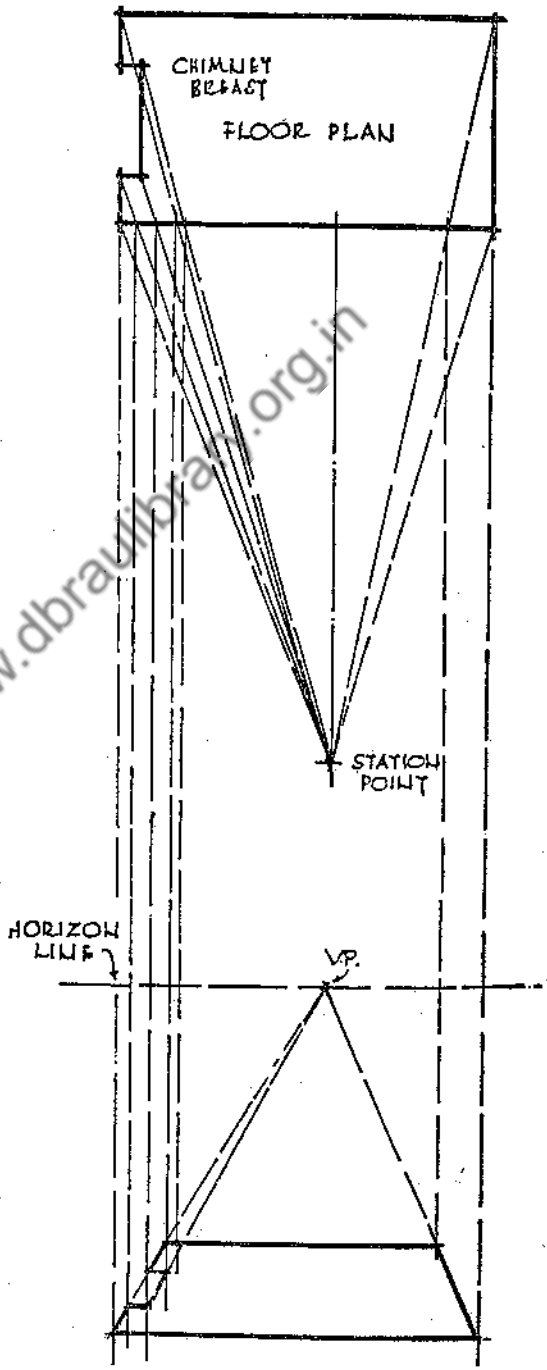


FIG. 51

such principles which will best be realised by trial and error and the student should experiment by means of small diagrammatic sketches.

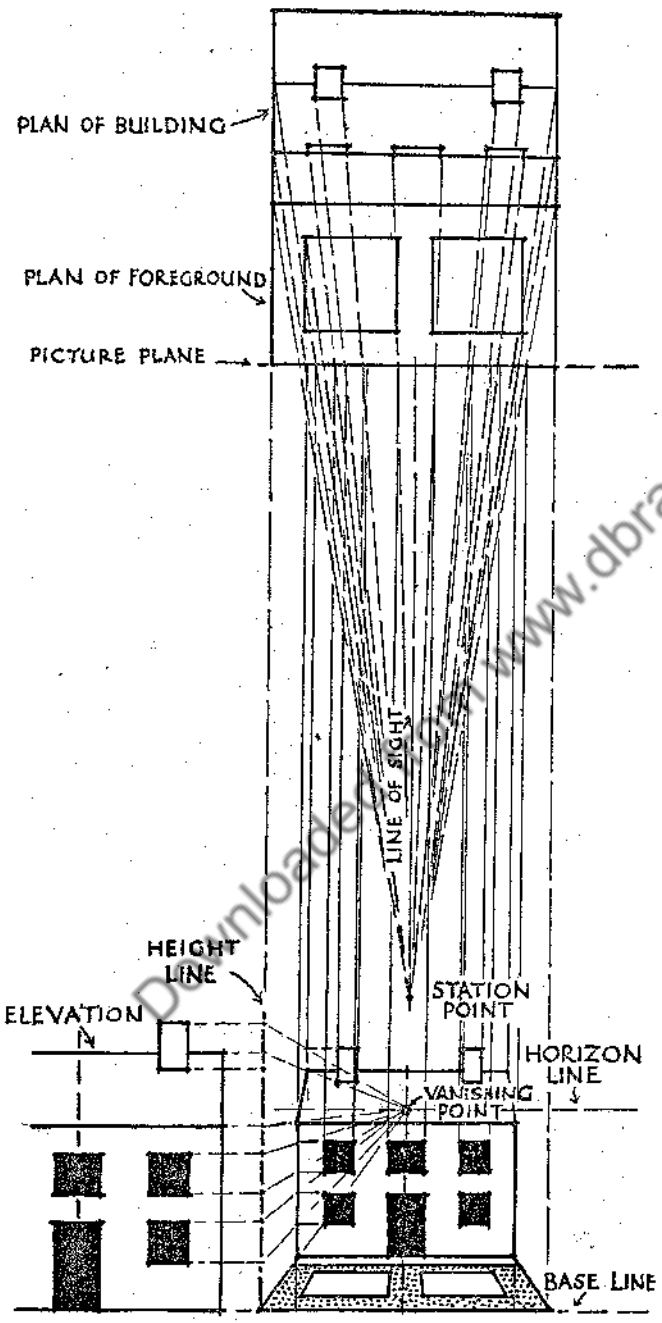


FIG. 52

One Face to Picture Plane. There are many occasions in architectural drawing when it is desirable to produce a perspective of the front elevation of a building including a portion of the foreground. Again, the type of perspective about to be described will apply equally well to an interior view. This kind of perspective was exceedingly popular in early times and because of its success is still used on many occasions. The method is outlined in Figs. 50 and 51.

I will refer the student first to Fig. 50, which demonstrates an interior treatment, although once the elementary principles have been mastered, the designer will easily see how a similar treatment is applicable to a perspective showing a main elevational subject. The plan was first drawn. The Picture Plane was already provided by the nearest side of the plan to the Station Point (the proposed point of view of the spectator). The vertical line of sight was next produced running from the Station Point to the Picture Plane. This is numbered 1 on the diagram. Lines from the four corners of the plan

of the room were projected to the Station Point cutting the Picture Plane at points marked A. The sequence of operations can be followed by the numbers 1 to 5 on the diagram. Now for the actual perspective itself.

First the Base Line was drawn and the various points which were determined and already marked A on the Picture Plane projected down on to it. For the sake of clarity I have followed the above procedure in the diagram, but in actual practice, once the points A have been determined on the Picture Plane they can be transferred to a Base Line on another piece of paper if so desired. Next a reasonable height for the Horizon Line was determined and this drawn in dotted as shown. Where the Line of Sight struck the Horizon Line provided the main Vanishing Point. It can now be clearly seen how by running lines from the nearest corners until they struck the line projected from the rear corners the foreshortening of the plan was evolved.

The wall was raised by erecting a vertical from one of the nearest corners to the Spectator, marked M on the diagram. On this vertical was measured the correct height of the room and by a projectile back to the Vanishing Point the correct foreshortening was achieved. This can be done from both corners and they in turn determine the height of the near wall.

Fig. 51 is merely a repetition of

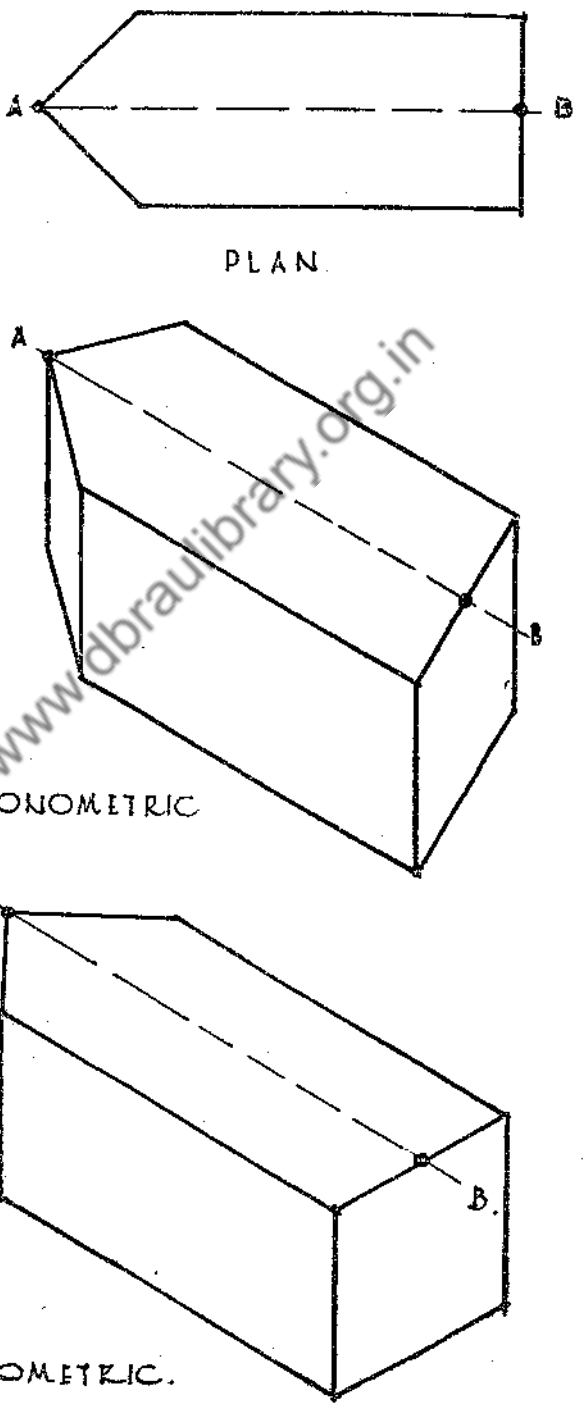


FIG. 53

the former principles with the addition of a chimney breast to the room to make it appear slightly more complicated, while Fig. 52 illustrates the treatment of a more elaborate subject. The student is advised to copy these diagrams for the purpose of memorising the aforementioned points.

Isometric and Axonometric Drawing. These are merely another form of geometrical presentation, and once the main principles are mastered one will soon become proficient with practice. They are exceedingly useful because by their use one can describe a three-dimensioned object in one graphical figure. Plan, section and elevation are all immediately explained more readily to the uninitiated. It encouraged a development of the architectural mind. Axonometrical projection, in mechanical drawing, means the

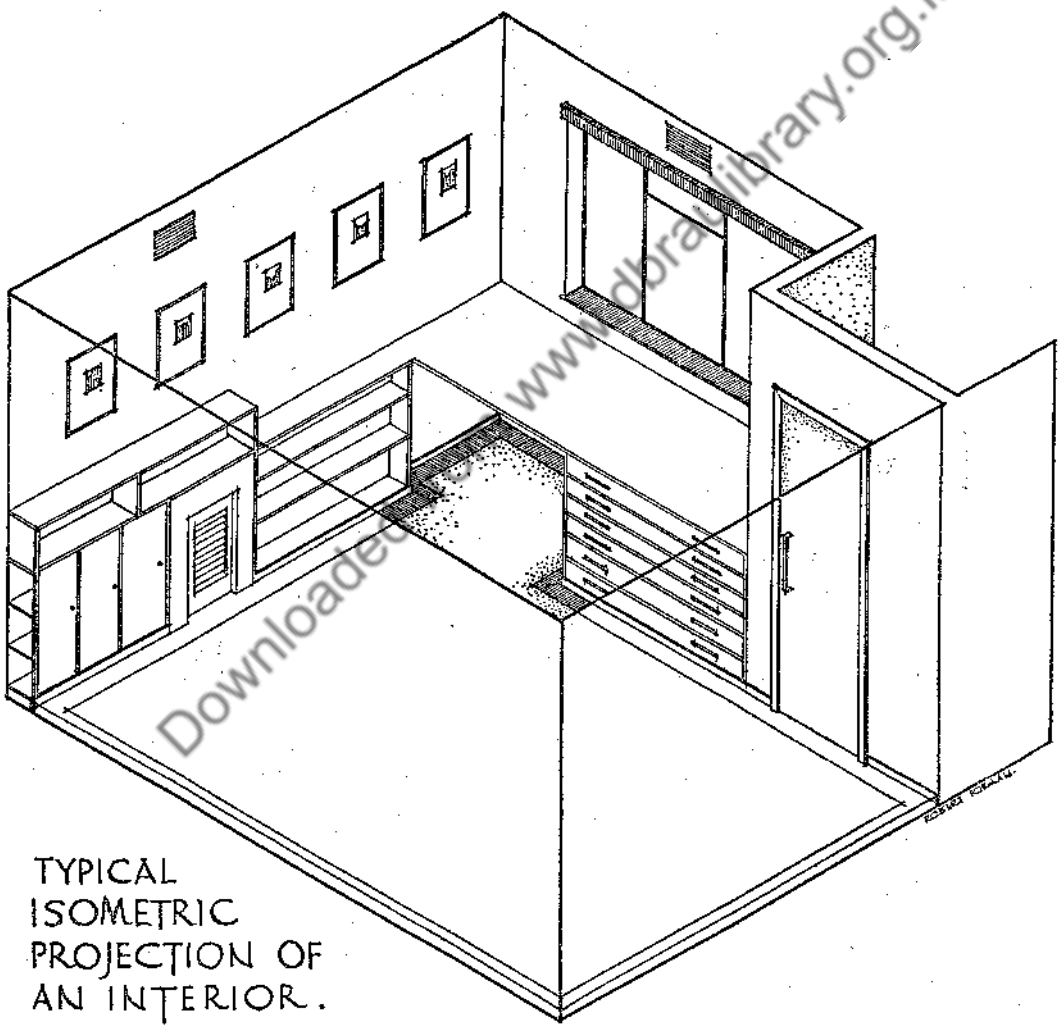


FIG. 54

representation of objects by means of their perpendicular projection on to a single plane (e.g. a flat sheet of paper) so placed that a rectangular solid projected upon it would show three faces, these faces being at different inclinations to the plane of projection. When all three faces are equally inclined to the plane of projection so that all edges and the three principal axes are equally shortened it is an Isometric Projection.

In practice, an architect, wishing to draw an Axonometric drawing from a plan, turns the plan round so that the main axes are at any given angle to the T-square (45° or 60° and 30° are commonly used) and uses a 90° set-square for projecting up

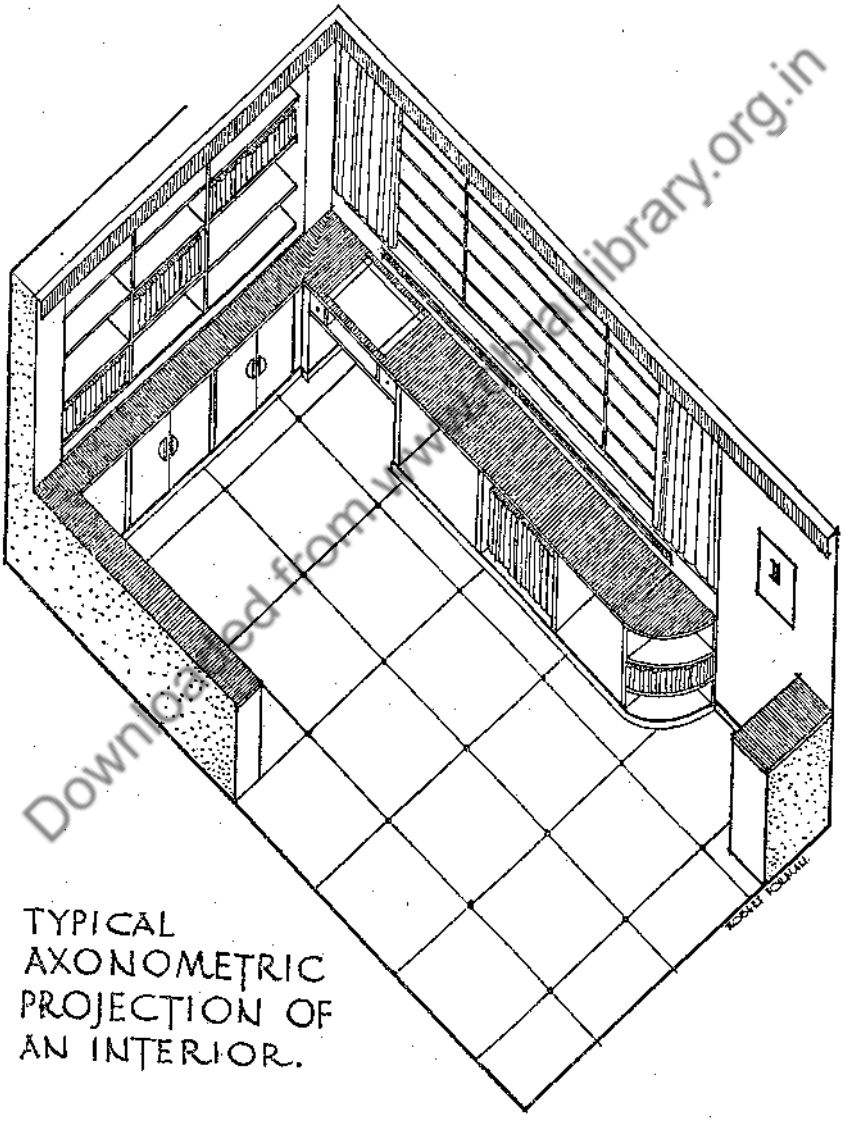


FIG. 55

the verticals, which are drawn to the same scale as the plan. The advantage of this method is that the plan is of correct shape.

For an Isometric drawing, an architect draws one axis vertical and the other two at 30° from the horizontal, all lines parallel to the axis being drawn parallel and to the same scale. Only the measurements of lines drawn parallel to the axis are correct. This is demonstrated in Fig. 53; in the Isometric, A is obtained by drawing AB of the correct length parallel to the axis and the lines forming the point are not equal in length as they are in the Plan and Axonometric.

Through being at an angle to the plane the lines are foreshortened, and although it is permissible to use any scale it should be made clear that the representation is drawn with a (say) ½-inch representation of the object. In the Isometric it is possible to correct this foreshortening by drawing the lines corresponding to the plan in the ratio of 2 : 3 (or by drawing out a suitable reduced scale geometrically). In the case of the Axonometric the lines are at different angles to the plane and it is impracticable in architectural drawing to correct the foreshortening. Fig. 54 illustrates a typical Isometric projection of an interior and Fig. 55 is an Axonometric presentation of a similar subject.

CHAPTER VIII

SHADOW PROJECTION AND RENDERING

MANY draughtsmen are under the impression that architectural shadow projection is only a method of presenting an otherwise uninteresting elevation to the best advantage. This most definitely is not so although undoubtedly it is a great aid in stimulating a design. In fact, it is necessary when designing to obtain the correct juxtaposition of the various masses, etc. Unless you understand how plan, elevation and section are interrelated you cannot cast shadows properly. By means of correct projections the third dimension can be measured from an elevational drawing. An architect's line drawing of an elevation shows only the pattern of the form which is seen by the eye when it is simultaneously opposite to each point on the drawing. Solidity is revealed by the play of light and shade. Therefore, treat your shadows with respect if you desire to avoid revealing the defects of a design. There is, it should be duly noted when studying illumination, a distinction between shade and shadow. Objects or parts of objects may be cut off from the direct rays of light by intervening objects. The surface deprived of light is known to be in shadow. Objects or parts of objects which receive no rays of light at all are in shade.

An artist is interested in illumination of an object from all angles but the architectural draughtsman requires a conventional fixed lighting which enables him to compare various forms. For the purpose of architectural shadow projection the sun is presumed to provide the source of light and the rays to impinge at an angle of 45° to the earth.

Fig. 56, Diagram I, illustrates the direction and angle of the light rays as they are projected on plan and elevation. Geometrical presentation of shadows is considerably simplified by this 45° convention. For instance when cornices or any other horizontal projections cast a shadow, this shadow will be found to be the same depth as the projection (Diagram II). Thus a rendered elevation with shadows gives the relief of the various parts without referring either to plan or section. Diagram III presents the play of light and shadow on a typical Georgian elevation. Notice how even this rough sketch is improved by the introduction of shadows. Note also the projection of the vertical dotted lines from plan to elevation, and the determining of their positions by striking the 45° lines from the various projections on the plan and elevation.

It is not always necessary or convenient to cast shadows by the aid of plan and elevation and there are numerous occasions when only elevation and section are required. This is illustrated in Diagram IV, and is a typical problem encountered by the architectural draughtsman—the delineation of a shadow cast by a dormer on to a roof. The 45° rays are drawn as in the previous diagram and the depth of the shadow on the

roof is determined by striking the horizontal line shown dotted on the sketch. It can now be clearly seen that to project a shadow you must be able to define its position either on plan and elevation or again on section and elevation. Diagram V (*A*) is only a further explanation of the theory of drawing lines representing the rays of light at 45° on plan and elevation. A vertical line is projected where the shorter ray intersects the line AB. Where the vertical line intersects the longer ray gives you the point of the shadow, both in plan and elevation. Diagram V (*B*) explains how a point nearer to the plan surface than the elevation surface projects a shadow on plan or vice versa.

Circular Surfaces. With these surfaces shade is introduced in addition to shadow, for naturally, to take a typical example, a column will throw a shadow on to the wall behind it but at the same time the portion of the column turned away from the light rays, will naturally be in shade. This is explained in Fig. 56, Diagram VI. In this case an abacus is shown upon a cylinder. Any number of points are taken along the bottom edge of the abacus and similar points placed on the lower line of the plan. 45° lines are projected as shown and by means of vertical the points are established. Upon the number of points used depends the ultimate accuracy of your shadow outline. Diagram VII illustrates the method of casting the shadow of an arcade on to the wall behind it. The piers throw a shadow on to the wall and are worked out by 45° lines as shown on the side elevation. At the points where these strike the back wall horizontal lines are carried on to the elevation. 45° lines are carried down from the centre of the arches and the top of the piers and it can be seen how the centres are found for describing the various areas. The plan may be used instead of the section if desirable, a method similar to these in earlier diagrams being used.

Although at first sight elaborate diagrams of shades and shadows are liable to scare the beginner, a knowledge of the principles and a close scrutiny will reveal that they are not so complicated as is at first supposed. The keen draughtsman should make sketch notes of actual shadows observed on buildings on sunny days during his measured drawing excursions. It might even be possible to place actual plaster casts in the direct rays of the sun and make details of the resulting shadows.

Architectural Accessories. When drawing architecture, whatever may be the medium, there have to be considered what are known as architectural accessories. These consist of the general surroundings, which may include neighbouring buildings, trees, foliage and figures. No matter how well the main features of the composition be delineated, a background lacking harmony or containing badly drawn figures will appreciably detract from the work as a whole, and at once provide a loophole for criticism. To produce a good drawing of a tree or foliage of any description it is first necessary to draw the growth carefully in pencil. The outline of the mass can be tolerably free in handling, and the lights and shadows of the leafage should also be indicated broadly and lightly. Keep the treatment subtly suggestive. Apart from this there are no hard and fast rules and a great deal is left to personal technique. Some artists suggest their leafage with scarcely any outline at all, while others employ a strong outline and powerful masses. Personal observation and sketching in the open air from nature are the best

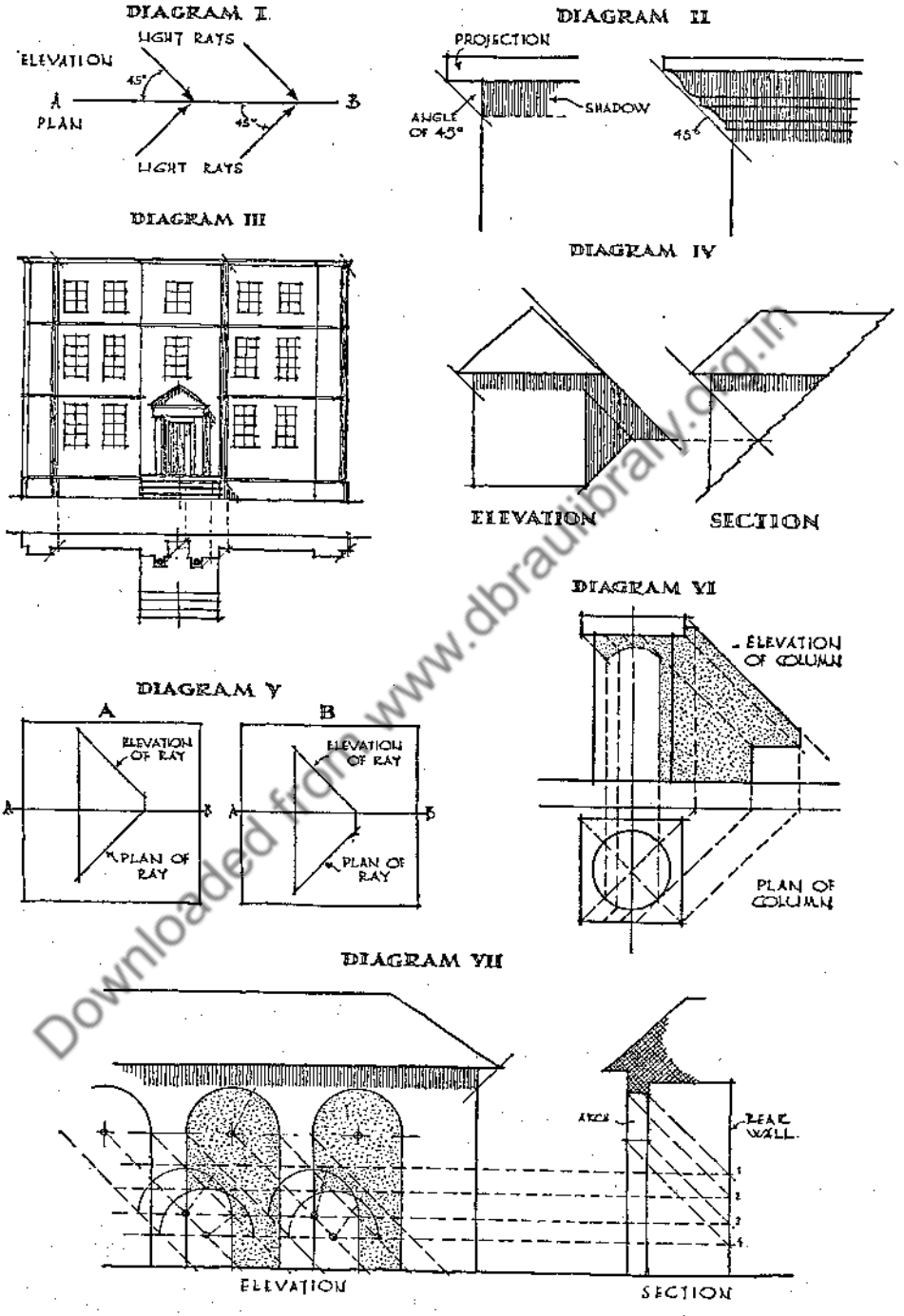


FIG. 56

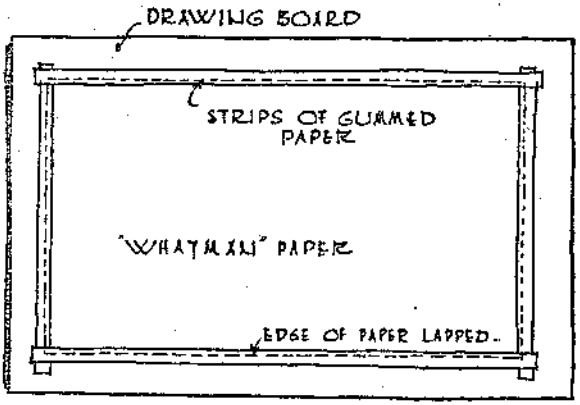
methods of developing a knowledge of the drawing of foliage. A broad treatment of leafage will provide an excellent foil to the light reflecting façade of a building.

Figures. An appropriate grouping of figures greatly enhances an architectural perspective drawing. Figures must be arranged carefully and grouped in a natural manner. They should not be spaced equally. They can be drawn in lightly with pencil first and then built up into suggestive studies. It is a good idea to break up figures in street scenes by the introduction of vehicles. You should avoid any feeling of stiffness in your figures: show them in action and break away from the typical fashion-plate pose beloved of the typical architectural perspective draughtsman. Two of the best artists who might well be studied for their excellent figure drawing on the scale you will be normally working to are Frank Brangwyn and Henry Rushbury. Their figures are always alive and vital.

Rendering. Rendering is the term used for the method of colouring drawings in architectural practice. Before the draughtsman sets brush to paper he must see that his drawing is as perfect as he can make it. Once the colour is applied, even only the first wash, it is exceedingly difficult, in fact almost impossible, to erase any wrongly drawn lines. Always remember you are not endeavouring to produce a pretty drawing but to make your geometrical presentation more intelligible and convincing. Above all, rendering, especially in water-colour, if it is to be accomplished successfully involves a fair amount of time and labour. There will be occasions when the draughtsman feels his work is not going at all well. This sometimes happens after the application of the first initial washes. It is then that all his powers of concentration and patience are called on.

The first essential materials are some suitable sable brushes of varying sizes. A 'mop' brush is necessary for large washes and some of the smaller types for detail work. You can test sable brushes when purchasing by dipping them in water; if they are good sable the hairs should naturally form a point. Use a separate brush for indian ink as this medium in time destroys the bristle. A simple colour box is preferable to an elaborate outfit containing colours which will doubtless never be used. Some simple exercises in mixing and applying washes must be carried out before attempting an actual drawing.

The Process. Before the student commences the actual rendering he will first find it necessary to mount his sheet of 'Whatman' paper on the drawing board for the purpose of 'stretching' it. If this process is ignored, he will find, on the application of the first wash, that the sheet will cockle and crinkle like a piece of corrugated iron, making an impossible surface on which to work. There are several methods of stretching the paper. The author prefers to take the sheet and soak it completely in clean water until it is thoroughly saturated. It is then placed on the drawing board, set squarely by the aid of a T-square, lightly pinned near the margin with drawing pins and mounted to the board with strips of gummed paper, approximately two or three inches in width (Fig. 57). This gummed paper is of a type generally used for wrapping. The pins are removed and the paper then allowed to dry out thoroughly, when it will be found to be absolutely taut and smooth. Some draughtsmen advise wetting the paper with a sponge,



METHOD OF MOUNTING WHATMAN PAPER

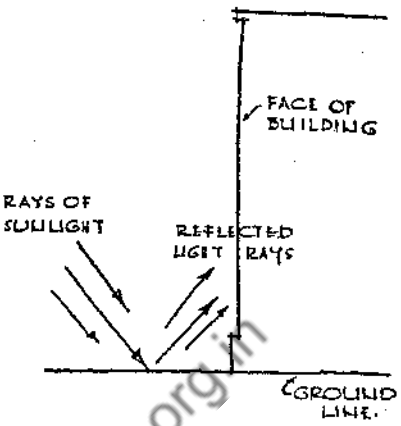
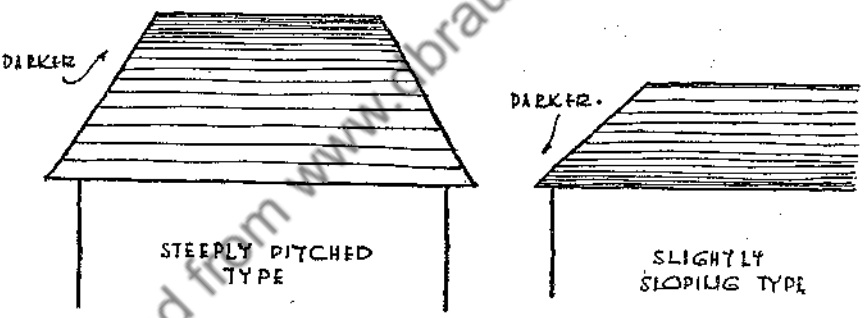


DIAGRAM SHOWING PASSAGE OF REFLECTED LIGHT RAYS.

DIAGRAM OF GRADED BANDS OF COLUMN SHADOW.



GRADUATING ROOF WASHES

RENDERING DIAGRAMS

FIG. 57

but the author finds total immersion perfectly satisfactory. The paper must remain under water until it is soaked right through. The operation should be performed deliberately and not hurried in any way. The mounting should be executed fairly swiftly, but with practice the draughtsman soon acquires speed. Have a towel at hand for surplus water and throughout the operations keep your hands scrupulously clean. The paper must be thoroughly limp before fixing it to the drawing board.

Before rendering, shadows should be lightly and accurately drawn with a very fine pencil point. I have already dealt with the technique of shadow projection and these naturally play a vital part in rendered drawings. All colouring should, whenever

possible, be executed in daylight, even if excellent artificial light is obtainable. It is only by the former that true colour tones and values are achieved.

In rendering there are several types of media used, but with all, the technique is practically the same. The most usual medium is water-colour although occasionally pen and ink, pencil, oil or poster-colour is introduced to emphasise details. There are several general principles which I will enumerate but the student is free to develop his own individual style once the perliminary factors have become firmly grounded.

Handling of Media. An ink wash is an excellent material but requires the practised hand for it acts like a stain on paper, biting easily into the delicate surface. Colour lies more on the surface and is therefore easier to manipulate. The ink is a slower process than pure water-colour on account of the extra care which must be taken. Again, many washes are necessary to obtain the desired depth of tone, as indian-ink washes are always inclined to dry out lighter. One point in its favour is that it does not obscure fine pencil lines. It is this transparent quality that recommends it to the man who can render really well. For the beginnner I would strongly advise the use of a water-colour wash built up from a combination of two suitable colours, e.g. Ivory Black and Raw Sienna or Ivory Black used individually or Sepia in the same manner. By mixing more than two colours there is a risk of overdoing things. Not only is it difficult to match the existing colour if a fresh supply is imperative, but it may be that the pigments will not agree when mixed together and a streaky wash will result.

It is a sound idea to decide on the predominating tone of your proposed scheme and mix up a generous supply of the required colour, which should be thick and strong. One can then thin this down with water in various smaller containers to provide varying tones. By ensuring a plentiful supply at the beginning there is no trouble caused by having to re-mix a fresh container of the original colour later. It is difficult to match wet colour with a similar colour which has dried out on drawing paper.

All rendering must be carried out methodically. It is wrong to work up one portion of a drawing first. Large washes should be applied and so on to the smaller ones and finally the details, the last mentioned consisting of mere blobs of colour applied by means of a fully loaded brush. Incidentally always use a fully loaded brush throughout the application of a wash and apply the material wetly with broad, sweeping strokes. You must learn to float the colour on.

The first wash is important in that it should act as a priming colour but otherwise it is not too important. This first tone will undoubtedly be changed several times. Apply all washes lightly in tone, remembering that it is better to build up a tone with several washes than to endeavour to achieve a final result with one or two generous applications of colour. The washes should be applied neatly up to the pencil or ink boundary lines—but not over. Should you accidentally go over the line the surplus colour can be removed by the application of a blotter placed lightly over the offending portion. If the colour has dried, wet it generously with clean water and follow a similar procedure with the blotter. Apply the latter gingerly, otherwise you will draw too much colour out of the wash, leaving an unsightly light patch. Washes should always be

graded in tone—the reason for which I will explain presently. The student should endeavour to visualise the finished result he is aiming for at the beginning of the rendering. Try and imagine you are proposing to take a photograph. You must 'focus' your drawing so that the important planes will be predominant. With that object in view run in the chief vertical planes first. You must learn to differentiate between light and shade in the drawing—this distinction being of the utmost importance. Pick up the backgrounds and the openings, such as doors and windows, at an early stage in the rendering. This will give you a grip of your subject.

Grading Washes. I have described in the chapter dealing with shadow projection how the conventionalised rays of the sun strike the building at an angle of 45°. These rays also strike the ground and a reflection occurs in the façade of the building. You must, therefore, grade your vertical washes. As a typical example, we will presume there is a light, bright pavement in front of the building. In this case you will have the darker portion of the wash at the top of the façade gradually becoming lighter as it descends. With grass or a dark foreground the situation is reversed and the dark end of the wash is at the foot of the façade.

Roofs present various problems but if it is realised that the steeply pitched type contrasts with the light background of the sky, then it is easily seen that the wash should be lighter towards the eaves level. The slightly sloping roof requires a reverse treatment, for one desires an effect of distance as the roof slopes away much more rapidly. Therefore have the dark tone at the eaves with the wash graduating up towards the ridge (Fig. 57).

Shadow Treatment. The shadow treatment naturally plays an important part in the success of a rendering. By skilful modelling it is possible to convey the message of the design in a most convincing manner. Reflected light is a prime factor in the presentation of an effective elevation. Apart from the direct rays of the sun falling on the building, the surrounding ground and neighbouring features all receive these direct rays and therefore contribute a certain measure of illumination. This reflected light is a great deal more subdued and therefore only observed in certain portions of the structure where direct light does not fall. We can anticipate illumination from the general atmosphere, the sky and the ground itself. These three sources of illumination must be combined effectively. With the counter shadows it is important to note that the reflected light from the surroundings will interfere with the ground reflection; consequently the counter shadow outline assumes a blurred appearance and is merged with the general shadow tone. It is easily seen from these observations why shadows must be graduated.

On small-scale work a freehand pen and a ruling pen can be used for delineating shadows, providing the same colour is applied by means of a brush to these instruments. It is the best method for sculptural or architectural ornament.

The three primary divisions of tone for all rendering are the high lights, half-tones, and the shadows. The first as the name implies should be almost colourless, the second is a variation between the two extremes, and the darkest of all over the shadows.

Using this order of tones one can rule faint lines on an object and it is an easy matter to run in the graduating bands. For the purpose of illustration I have drawn a column (Fig. 57). The modelling of a column is essentially a task for rendering and once these principles of tone have been mastered the exponent can model the entire column with one graduating vertical wash. These divisions of tone apply to all the basic forms.

Sketching from nature and from the cast, especially with a soft medium such as charcoal or a 6B pencil, will greatly assist in developing the student's sense of light and shade. Nature study is essential to grasp the proper form of trees and architectural accessories. Hedges can be treated in a highly conventionalised manner. The darkest tones of trees and hedges occur on the underside portions and the trunk or stem of the growth. One cannot overestimate the value of nature study to the student who desires to become proficient.

After you have applied several washes, prop up the drawing and survey it from a fair distance. This will enable you to view the composition as a whole and one can immediately take steps to correct any unbalanced tones. Should you find a wash too dark, wet it liberally with a sponge until the colour is reduced in weight and re-render the affected part. You must remember the desired effect you are working for. You should sit down and think this out at the very beginning and having once formed a plan of action stick to it throughout the rendering. The main object in view is to cultivate the facility for laying in broad washes. An examination of the books listed in Chapter XI (Pages 102–3) will give a useful impression of the degree of proficiency that is generally expected.

It is the third dimension you are striving to interpret always. When you feel that one more wash might ruin the work stop and let it all thoroughly dry, then carefully remove the drawing from the board. Trim the edges leaving a white margin which can be lined to the correct weight to carry the drawing. A fairly strong line always assists in holding the entire composition together. To render to the edge of a sheet and attach a white border all round is very undesirable. Provision should be made for a generous margin in laying out the drawing at the start.

Indication of Mosaic. This is also a method of rendering, suitable for plans, which consists of the use of pattern formed by the indication of the various floor treatments, sometimes the furniture, or again the ceiling design shown on plan (impression looking upwards). The same plan even on occasions embody features of all these treatments. However, such colouring should not detract from a clear explanation of the circulation of the building, otherwise it is better to leave well alone. The use of these patterns should also give an indication of the type of building and its character. If simplicity and clearness with a definite sense of artistry is achieved, the rendering has been carried out successfully.

Aerographing. Besides normal methods of presentation there are several technical aids which are useful for giving a distinctive finish to rendered drawings, particularly the Aerograph Pen. This is an instrument shaped like an ordinary fountain pen. On the holder is a small container for water-colour and by pressure produced by a small

hand-pumping apparatus, a fine spray of colour is ejected, regulated by the distance the nozzle is held from the drawing. Models are very soundly made and with due care and attention can last a lifetime. With the pen one can add a soft-shaded effect to a wash. It is used only for fine colours and portions of the work not to receive the texture must be protected by using paper templates. The instrument is very finely adjusted and the chief trouble is stoppages due to the use of too thick colour. Should this occur do not probe the nozzle with a needle. Take the pen to pieces (the manufacturers supply instructions) and wash the parts thoroughly. I have found the pen most useful on perspective drawings of interiors where a subdued effect was desirable. Cleanliness is essential to get the best work from the instrument, and never lay it aside without washing it out thoroughly by running clean water through the reservoir.

Other Effects and Textures. Apart from the use of this pen there are various inexpensive means of obtaining graduated tones and textured effects. A broadly blotched line, which has its uses in some cases, such as the shape of shadows, is obtained by dabbing the surface of the paper with a fully charged brush. A treatment with opposite effect is known as a 'dry-brush' stipple and is obtained, as its name implies, by dabbing along the lines or edge of the shape with an exceedingly dry brush. These texturing effects are especially applicable to the representation of modern designs. Use 'stipple' and 'spatter' work moderately, however, otherwise you will give a drawing an 'over-decorated' effect.

Transparent sheets, provided with an adhesive backing, stippled with patterns of lines, dots, etc., are now obtainable. They give the same effect to architectural drawings as printers' 'tints', i.e. the various stippled effects seen on line drawings in the press. Wonderful effects can be obtained by cutting out areas of shadow on a drawing in a selected tint and sticking it to the sheet. Dyline prints can be made showing the stipple providing the stippled paper is stuck to the paper negative.

Coloured chalk or crayon over water-colour produces a lithographic texture, but again moderation is advised. A useful addition to one's colouring equipment is an old toothbrush. This is an ideal instrument for 'spatter' work. The brush is first loaded with colour and held in the right hand firmly over the drawing. Mask carefully the portions which must remain unspattered. Keep the brush between four and six inches from the surface, and for large surfaces keep further off. Experiment will determine the best distances for your own individual technique. Place the thumb of the left hand directly underneath the brush and draw the nail of this finger along the bristles. The paint is released and directed in a cloud of fine particles over the surface of the drawing. It sounds easy, but a great deal of practice is necessary to spatter a fairly even texture. Try it out first on some scraps of paper before attempting an actual drawing. The student, however, will find, by practising these inexpensive methods first, that when he does obtain an aerograph, he will have acquired much useful knowledge which is applicable to aerograph technique. These various methods of obtaining shaded effects could be most usefully applied when colouring architectural models.

CHAPTER IX

TRACING

TRACING plays an important part in architectural draughtsmanship, and I have referred to it before in Chapter III on sketching, where I emphasised the use of tracing paper as an aid to sketching for the evolution of design. Here I propose to point out various ways in which the architectural student can employ the process both as an aid to speed and as an economical means of producing several copies of the same drawing. I will describe how this can be accomplished, but first one or two general notes on the material itself and technical points when tracing. Drawings executed in offices where professional draughtsmen are employed, particularly in the engineering and architectural professions, are invariably carried out on tracing paper or linen, more truthfully known as 'tracing cloth', so that by means of printing by a method similar to that used by photographers, several copies can be taken from the original drawing, known technically as the 'negative'. If cartridge paper were used for the original it would not allow the rays of light from the printing machine to pass through it. This is necessary, as the original drawing must be superimposed on sensitised printing paper. Tracing paper obviously is the best medium to admit the free passage of the light rays. Tracing cloth is used, because in addition to possessing the same qualities of transparency as tracing paper, it is more durable and will withstand much handling, which is naturally necessitated when copies are being repeatedly taken from the same negative. A common practice is to set a drawing up on tracing paper and retrace it on to a sheet of cloth. One has plenty of freedom in drawing on the paper while evolving a design before 'taking off' the required portion cleanly with indian ink on to the linen.

Tracing paper is obtainable either in sheets or in rolls; tracing cloth is always in rolls. Tracing papers are manufactured in several weight grades, from 40/45 gramme to 140/150 gramme. The rolls are usually 25 yards long and 30, 40 and 60 inches wide. From a 30-inch roll up to 40 Imperial and 22 Double Elephant sheets can be obtained without wastage. For the most economical method of obtaining the maximum number of sheets from various rolls the student is advised to consult British Standard 1192:1953 (Drawing Office Practice). Density of paper increases with weight, and the denser the paper the more quickly will you use up the point of your pencil. Ink and pencil are catered for by smooth and matt surfaces. Ink is always used for tracing on cloth, and as it is inclined to possess a glazed surface, the cloth is dusted lightly with french chalk. The surplus is removed with a light flicking with a soft duster, leaving only a very fine film over the surface. Too much chalk will tend to clog the pen and will prove more troublesome than no chalk at all. However, if you do not dust the surface, ink

will not take easily, maybe not at all in places. Even though a drawing has been commenced after this priming with french chalk, and you still have difficulty in applying the ink, you can re-dust the surface of the cloth without injuring the portion already executed. In practice you will soon find your hands tend to remove the chalky film, and that frequent applications of the chalk are essential. Work on the dull surface of the cloth, turning the very shiny surface to the drawing board. There are many grades of tracing paper and cloth, but use only the best; it is cheapest in the long run. An experiment with varying qualities will soon let you know what is best suited to the purpose in hand. Generally tracing paper will be found sufficient for the student's purpose, but if cost warrants it use cloth sometimes, if only for the experience. It is made in 20-yard rolls, white or blue in colour, and there are surfaces for both ink and pencil. Ordinary tracing cloth is not waterproof and the surface can be destroyed by damp, but there is a waterproof type available which also possesses a greater dimensional stability.

You cannot, of course, apply colour to a negative, because naturally printing is done only in one colour. You can, however, have blue-prints for working detail drawings where no colour is required. These show your drawings in white lines on a solid blue ground. When the prints are to be coloured they should be of the 'black and white' type. Apart from obtaining several copies of the same drawing, tracing is used for taking a copy of some decorative drawing, diagram or illustration in a book. The book may be in some reference library, for instance. You must take great care not to mark the original in any way. Sometimes a better material than tracing paper for this work is a piece of thin, clear celluloid or a gelatine sheet. Square this off accurately on your drawing board, and if you intend eventually to enlarge the tracing, square off the complete sheet of celluloid with perhaps half-inch to one-inch squares drawn possibly in red fixed drawing ink. When placed over the original it immediately squares it off, and these squares are used for the enlarging process. A drawing traced by what is called the squared sheet method is much easier to remember. Some draughtsmen use circles drawn on the gelatine as an aid to tracing, but here again there is still much scope for original experiment. The tracing paper can be placed over the celluloid sheet and used in this way. Simply slip the squared sheet under the tracing when desiring to enlarge. Never trace from anything of value direct unless it is unavoidable; otherwise you may injure the original by indenting it with the sharp point of your pencil. You generally use a fairly hard pencil for tracing, as the point of a soft one soon wears on the somewhat grainy surface of almost every tracing paper.

Another aid to clean tracing is to place a piece of plate-glass under the original drawing, if this is convenient. The glass prevents the sharp pencil from cutting through the original into the reasonably soft surface of the average drawing board. Always pin your paper firmly down when tracing, for if the object you are tracing shifts, you may have a very difficult job is resetting your tracing over it correctly.

Erasing on tracing paper or linen must be carried out carefully, especially in the case of ink. It is best accomplished with a really good ink-eraser, the type generally used

by typists. Ink can be scraped off linen with a fine razor blade (care being taken, of course, not to cut the surface) and finished off with the eraser.

Binding Drawings on Tracing Paper. To extend the life of drawings executed on tracing paper, an edge binding machine is a very useful addition to the drawing office equipment. There are paper, cloth or plastic binding tapes available in $\frac{3}{8}''$ or $\frac{1}{2}''$ widths in rolls 36 yards long. The machine is easily attached to the edge of a table and is childishly simple to use. The Perlon thread reinforced paper tape is recommended and there are cloth and plastic tapes available in colours. The coloured tapes are useful for distinguishing different sets of drawings or individual jobs. Always use tape specially made for this type of work.

Printing Drawings. The process of printing drawings is essentially photographic. In early days (and still in some places to-day) it was the custom for the draughtsman, or a lesser assistant, to place his negative drawing in a frame, similar to a photographer's printing frame only larger. Underneath was fitted a piece of sensitized paper. The face of the frame was exposed to sunlight, and when the exposure was considered complete the sensitised paper was removed and washed in developer, thus bringing out the printed copy of the drawing. It was good, but slow.

To-day there are various types of printing machines, electrically driven, which expose the negative placed over the printing paper (and revolving in a drum) to a powerful carbon lamp. After printing the exposed paper is run, by means of fine rollers, through a trough of developer. By this means prints can be made quickly and with the least possible effort. Also, as the printing machine is capable of fine adjustment, prints can be made dark or light in tone. The former type possesses rather a pleasant shaded or finely stippled grey background. For colouring purposes, 'white' prints are best. It is important to note that just as the commercial artist must ensure that his 'quality of line' is suitable for block-making purposes (the means by which his drawing will be reproduced), so must the architectural draughtsman ensure that his line is suitable for the various methods of reproduction which will subsequently be employed on hiswork.

The student should make himself familiar with the various types of prints and methods of printing, also the depth of line which is achieved by different media. If possible he should visit a print-maker's establishment and watch the actual operation, although the majority of large drawing offices usually possess their own printing department, and there is little doubt that the junior draughtsman will soon be initiated into print-making as part of his routine training.

Types of Prints. The following are the types of prints usually made for use on the building site or in the workshops:

1. '*True to Scale.*' There are different trade names for this type of print, but in drawing offices the usual term used is 'true to scale'. In actual fact, they are more true to scale, excellent for colouring and can be mistaken for original drawings and tracings, by reason of their rich black line printed on paper, mounted paper, tracing paper, opaque and tracing cloth. Due to the carbon ink lines being produced as a

natural unsensitised material, deterioration and that great bugbear of poor prints—fading—are obviated. Omissions and additions can be made during the process of printing without showing on the completed print.

2. *Dye Line Prints.* These are produced by what is known as semi-dry development, and appear as brown or black lines on a white background. They are available on paper, mounted paper, opaque cloth, or translucent cloth or paper. There is another form of dye line printing, dry-developed by ammonia gas, which gives similar results with the addition of a blue line. These dye line prints to a large extent superseded the ferro-gallic prints which appeared as indigo-black lines with a white background.

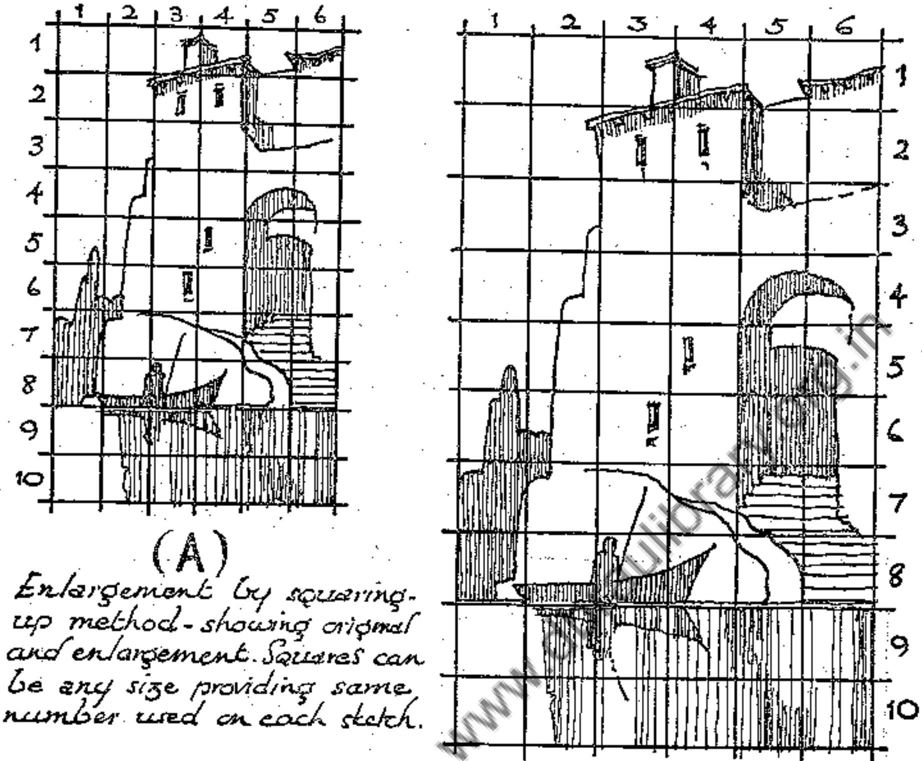
3. *Blue-prints.* These can be either semi-dry developed or water washed. Blue-prints are not coloured as they appear as a white line on a rich blue background. They are useful for illustrating details of construction.

4. *Photographic Prints.* Today the camera is also used for document and plan copying in a wide variety of different ways. Copies can be made on paper, film, translucent paper and cloth. In addition to actual tracings, original prints and drawings on opaque material can be reproduced by its aid. Advantages are the elimination of manual tracing, and avoidance of checking, as photographic methods eliminate the possible introduction of errors. The density and firmness of the lines of a drawing can be increased and reproductions can be made to any suitable size, either larger or smaller.

The storage and classification of drawings may be greatly simplified by making small prints of large drawings and keeping them in card-index files. A much better insurance against loss of essential records by fire, etc., is secured because fresh prints are quickly made from the original negatives. Incidentally, photographic reproductions to-day are less inflammable than ordinary paper. With bromide prints, enlargements and reductions can be easily made, but with Reflex prints, obtainable on paper, translucent paper and cloth, as this is a contact process, reductions cannot be made.

Transferring. Transferring may be for the purpose of preparing a more finished drawing, or for merely study purposes. How much liberty may be taken with the original drawing largely governs the process selected. For instance, you may have been working over a drawing considerably and find that you want to start afresh, retaining the original outline. If your design is symmetrical, you can do this by rubbing off all the surplus black-lead you can. For this use a suitably soft duster. Go round the lines remaining with a very soft pencil—BB is recommended. Lay the drawing thus treated face downwards on the clean sheet of paper. If you do not wish to mutilate the original with drawing pins, you can use paper weights, the flat, square lead kind. Now burnish over the back with a suitable burnisher. You will find that the soft lead transfers the lines of the design. Merely touch up any detail lost during transferring. Avoid

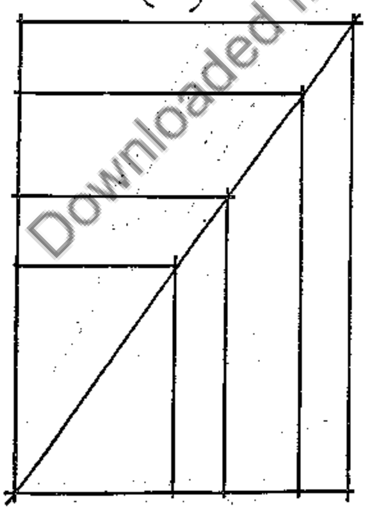
ENLARGING DRAWINGS



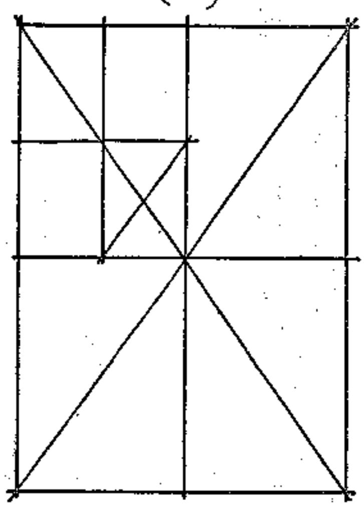
(A)

Enlargement by squaring-up method—showing original and enlargement. Squares can be any size providing same number used on each sketch.

(B)



(C)



ALTERNATIVE METHODS

Fig. 58

carbon papers unless you intend to work on the drawing later with poster or oil colour. Carbon paper gives greasy transferred lines, and colour will not take over them at all well. Some designers rub over the back of an original drawing with a cake of black lead or soft pencil. They then lay this on the sheet on which they wish to transfer the design and pencil round the outlines, etc. This is also an excellent method providing you do not lean heavily on the original or else you will also be transferring various unsightly smudges to the clean sheet.

For transferring a repeating pattern, such as a border, draw any one repeat. Trace this on linen and you will find that by first placing one side and then the reverse side you can go on repeating the design endlessly.

Enlarging Drawings. The architect often has to enlarge designs. There are also several methods available for this purpose. The squaring method is easily the most popular and convenient, although in Fig. 58 are shown several methods of enlarging drawings, keeping the proportion. The illustration clearly explains the theory of squaring up and enlarging. Fig. 58B shows a method by which the proportions remain unchanged when the diagonal is common to both sizes. Fig. 58C is yet another method

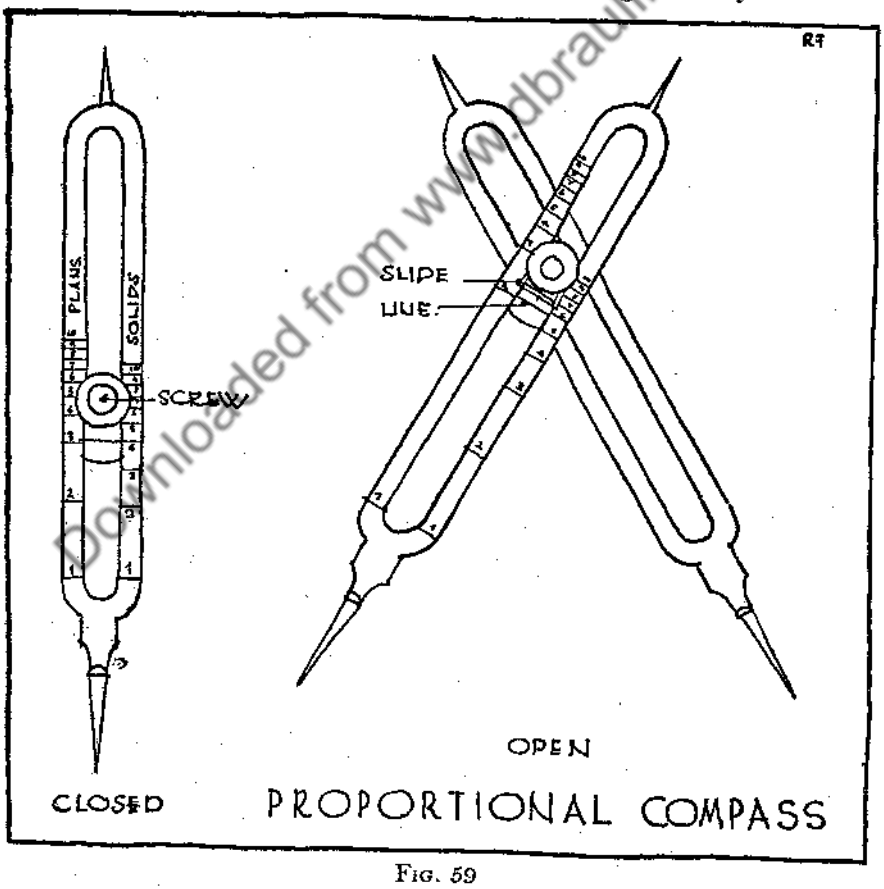


FIG. 59

of division, this time by quarters, eighths, and so forth. When you have detail either concentrated or localised it will be found to be one of the most accurate methods of all.

One must be scrupulously accurate with 'squaring'. The more you grid your drawing with squares, the greater the accuracy likely to be obtained. Too many squares, of course, are apt to become irritating and confusing to the eye. One can use different coloured lines. For instance, the actual sketch might be squared with dark red ink lines and the enlargement with lead pencil lines. The squares can be numbered down the sides and also at the top and bottom as an aid to the eye. Remember that a slight error on a small scale will reach alarming proportions when enlarged several times.

The Pantograph is a mechanical aid for enlarging. It is capable of transferring the main lines of a drawing only. It works best when you are making a slight enlargement. For pictorial work there is also a useful mechanical aid known as the Epidiascope. This is actually a reflecting mirror, and is both speedy and accurate in application. It necessitates, however, a studio to house it. The object which has to be copied is illuminated by two electric lamps. Lenses enlarge the reflected image on to a screen, which can be your sheet of paper; you can govern the size of the reflected image by moving the sheet close up or farther off. It is possible, of course, to lose some detail by enlargement; but this is a small drawback for generally you only require the main outlines when enlarging. Maps and plans are easily enlarged by the squared method. A simple but useful instrument which is used for enlarging and reducing plans is known as the proportional compass. Unfortunately an enlargement can only be made two to ten times the size of the original drawing or a reduction can only be made one-half to one-tenth. If you desire to enlarge a 25-inch ordnance sheet to say a scale of 40 feet to 1 inch they would not be suitable for use. The instrument (Fig. 59) has a scale of lines on one face of the divider towards the left-hand side of the central socket, and a scale of circles on the right-hand side. There are also a scale of plans and solids on the reverse side.

When setting the compasses the two legs must be placed accurately together. By unscrewing the nut it is possible to move the slide until the line on it coincides with the selected division of the scale which is required. By tightening up the screw you can then use the compasses.

CHAPTER X

CARE OF DRAWINGS; ARCHITECTURAL MODELS; SCHEDULES

ANYONE who handles a sequence of drawings must possess a definite system and should adhere to it religiously, otherwise hopeless confusion will result. Every drawing should be duly recorded in such a manner that the print or tracing is easily obtainable for reference. To inaugurate such a system a record book, carefully kept up to date, is essential. For a large drawing office a card-index filing system may be used. Each card in the index should provide space for the drawing number and a record of print numbers of copies of the drawing issued. The date the drawing was produced, future revisions, scale and concise descriptive notes of the drawing must also be included. For the smaller organisation an index book, provided with stout covers, will no doubt prove sufficient. In the front of the book can be printed a key to the index. For example: A = Working Drawings; B = Half-inch Details; C = Full-size Details, and so on. Every drawing issued has the drawing number prefixed by the letter selected for that particular type of drawing. However, there are numerous individual systems and as the student is employed in various offices he will find just how wide and varied they can be. Whatever system is employed it must be rigidly adhered to and the staff should be informed immediately of any changes. To alter a working system can lead to a great deal of confusion unless all drawings can be recalled for a period. A loose-leaf system is best for it allows for future expansion.

By keeping drawing numbers in the bottom right-hand corner of the drawings you facilitate speedy reference when turning them up in a drawer or plan chest. Some typical titles and their location on the drawing are illustrated in Fig. 60. When job titles are rather long and since for clarity's sake the letters used for them should be large, the title panel is usually placed across the full width of the drawing. Whether small or large, titles are almost invariably placed at the bottom of the sheet to enable the job title to be read quickly and easily while the drawing is lying in the open plan desk drawer. A copy number and date of issue of a drawing might well be applied to prints by means of a rubber stamp. Always date a drawing and sign it. The signature acts as a kind of copyright.

Drawings should be as easily accessible as letters and the various methods of keeping them to hand are as follows:

1. In cabinets where they are kept in envelopes. A similar method to correspondence filing, but one which necessitates folding of sheets so that they can be accommodated conveniently.

2. In a set of drawers known as a plan chest, which is a piece of furniture found in most offices connected with the building trade. It is the best and most orderly method of all.

3. In specially made cardboard folders. In these the drawings are kept in sets—one folder for each job in hand. These large folders can be subdivided into sections for very large projects when there are numerous drawings of the same type.

4. Drawings can be kept in long round cardboard containers, each with a closed end which can be labelled. These are placed on shelves in a deep cupboard, an ideal system for storing drawings when finished with and merely retained for record purposes. To handle rolled drawings, however, is an abomination, and if the drawings are in constant circulation an impossible system. It is mainly used when storage space is exceedingly limited. Whenever possible all drawings should be kept flat.

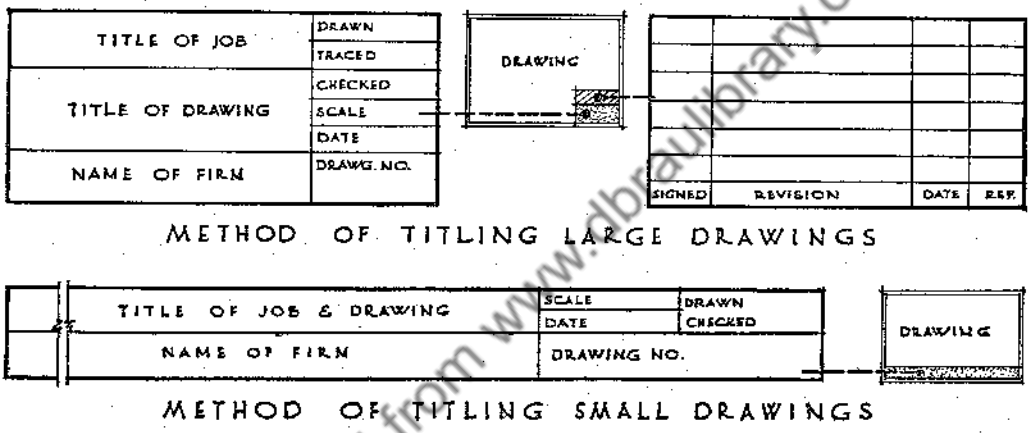


FIG. 60

For the architect who does not possess a plan chest it would be an easy matter for him to design one, to be made either in wood or pressed steel. Drawers should be reasonably shallow to facilitate easy handling of the contents, but at the same time deep enough to carry two or three folders. The contents of folders should be clearly lettered on the covers. Drawers should also be labelled and numbered.

The entire contents of each drawer can be typed out and placed on a sheet at the top of each drawer, or pinned to the wall over the cabinet. The former method is best. All lists of drawings, both in the drawer or on the wall, must be kept scrupulously up to date, someone being detailed in the office to attend to this as a routine task.

Drawings will be circulated to various jobs. Again care in handling cannot be overemphasised. When they receive drawings from the office persons should sign for them in a book specially provided for the purpose. Place for the date, signature of recipient, drawing number, print number and location of drawing should be sufficient. One cannot be too methodical. Linen tracings, original sketches and negatives should never be circulated on the site. A print must be obtained first.

If drawings are executed on paper for a special job, try to mount them. They look so much more impressive. Protect the surfaces of special drawings with a flap of tracing paper, particularly coloured work. In addition to affording protection, the flap serves another useful purpose, for on it the client can superimpose his own ideas without damaging the original work. Use plenty of paper and corrugated card for packing. Be very careful to protect corners.

Architectural Models. The making of models of interiors and exteriors is of great value to the architect and architectural student. By means of a model, properly designed to scale, the architect can submit to a prospective client his ideas in a form most clearly understandable. In the years of reconstruction which lie ahead there will be even greater scope and demand for this type of visual presentation of design. By the aid of a model, such important problems as fitness for future surroundings, mass, line and design generally can be much more easily solved than by a survey of drawings only. Often the lay mind finds great difficulty in visualising the complete structure, even when a perspective is produced. By means of the model it is also possible to make important revisions of detail before the work is eventually carried to the stage when this is impossible. For purely experimental work its value is enormous, and details such as domes, difficult intersections and so forth can be worked out in a practical form, and a sound impression of the ultimate appearance and finish obtained. Sometimes working drawings can actually be made from the model itself. The well-designed model well

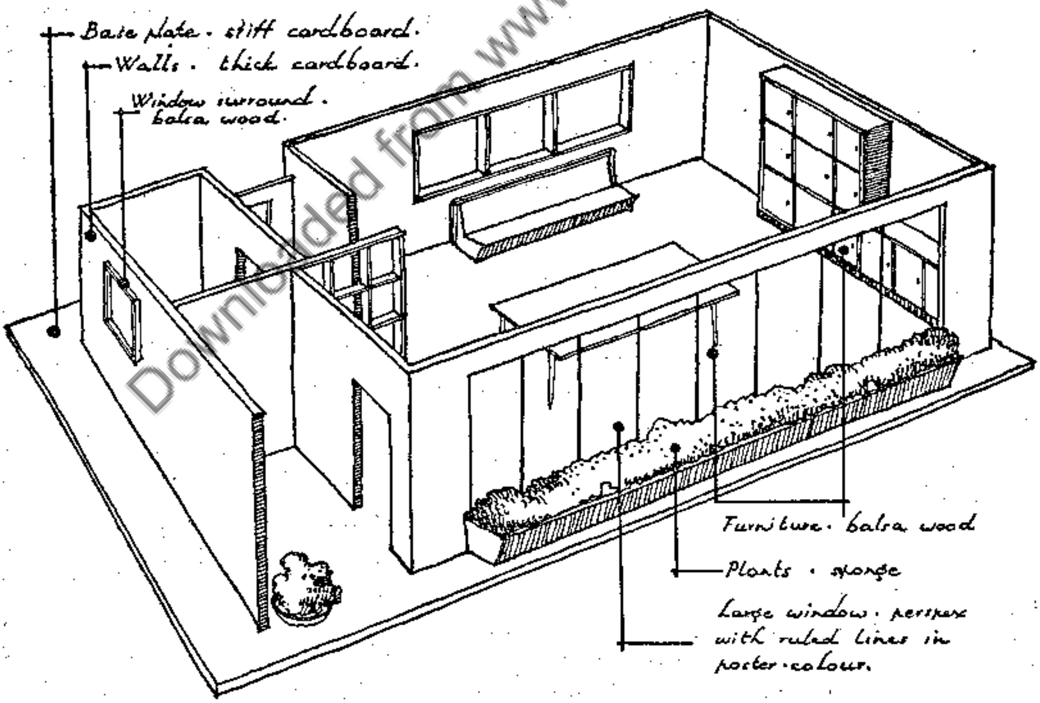


Fig. 61

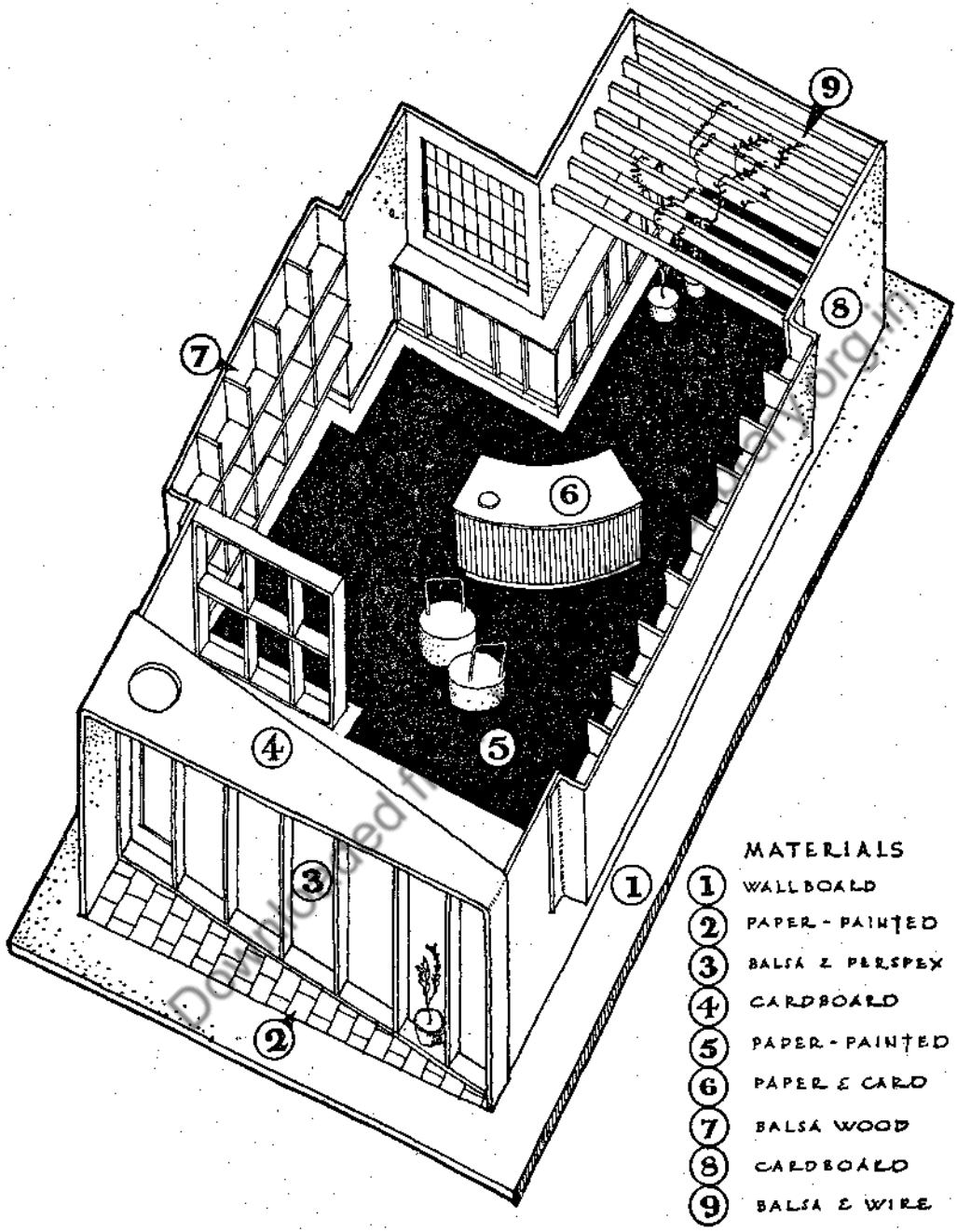
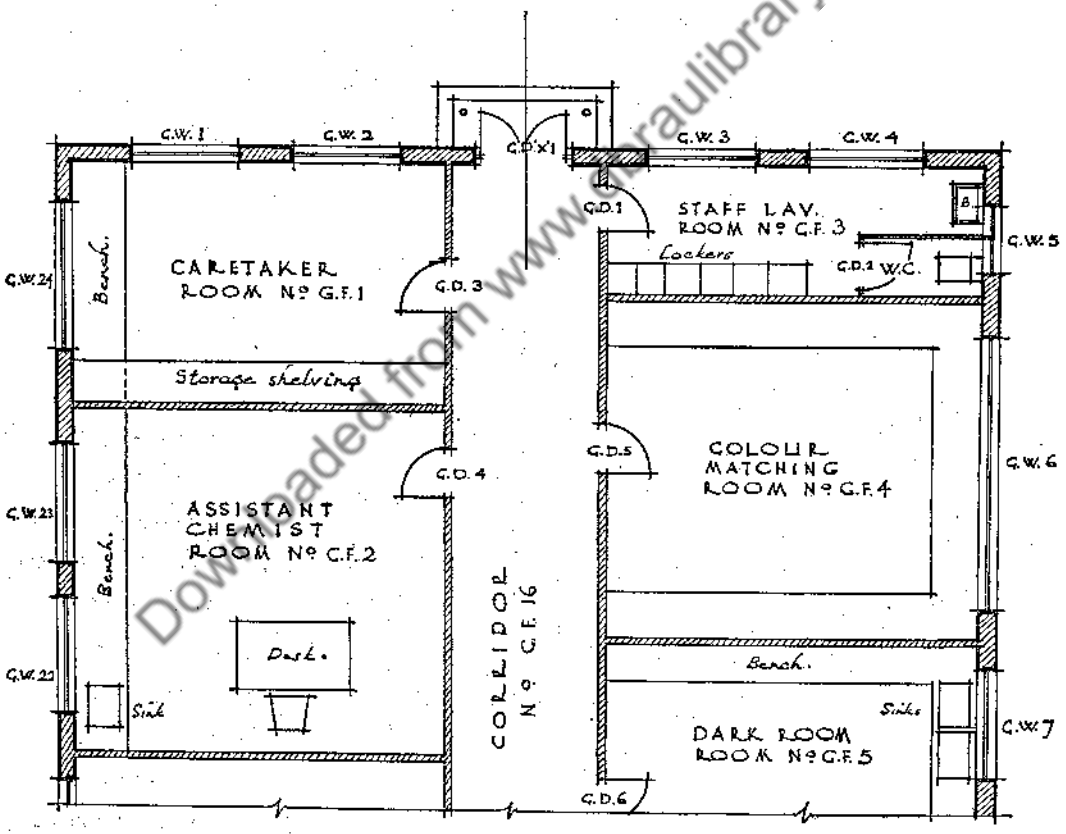

MATERIALS
1 WALLBOARD
2 PAPER - PAINTED
3 BALSA & PERSPEX
4 CARDBOARD
5 PAPER - PAINTED
6 PAPER & CARD
7 BALSA WOOD
8 CARDBOARD
9 BALSA & WIRE

FIG. 62

repays the time spent on it, for in addition to the slight cost of materials, providing economical methods are adopted, irrevocable mistakes are avoided at the very beginning.

The materials required by the model maker naturally vary with the type of design in hand. Elementary models, for the most part of cardboard or blocks of wood, require much less expense or manipulation than a model of perhaps an exterior and interior combined, intended to show complete detail. A great deal in the way of minute detail, however, can be accomplished by the use of many everyday objects found in the studio or the home. The illustrations show some of the simpler forms of model construction. Fig. 61 is a type which can be achieved cheaply. It is a simple little model of a reception and enquiry office and the various materials of which it is constructed are indicated on the illustration. The drawing is practically self-explanatory. Special note should be made of the importance of leaving flaps for joining up sections, etc. In the example shown all the details such as doors, windows, and so forth were first marked out in pencil and coloured with poster colours. The model was cut out with a razor blade on



PART GROUND FLOOR PLAN OF LABORATORY SHOWING NUMBERING OF DOORS & WINDOWS

FIG. 63

a sheet of plate glass for a cutting surface; this gives a sharp, clean cutting line easily. The tabs, after glueing, were held in position with small paper clips until set hard and dry. The baseboard consists of a stout sheet of cardboard.

Fig. 62 shows a very simple model of a flower shop constructed of card and balsa. Note particularly the little refinements which were also cut from slices of wood and glued in position. For a job for which it was designed it proved thoroughly adequate and was also prepared in the minimum of time. Poster-colour was used for colouring the main mass of the model. Most of the materials used are again clearly indicated on the illustration.

Architectural interior models are often combined with the exterior treatment, especially in the case of large and scattered groups such as modern schools, factories, etc. Purely interior effects are usually of single domestic apartments and simple one-story structures. The term 'interiors' is very comprehensive and includes churches, schools, village halls, hospitals and other public buildings, not forgetting domestic interiors, both period and modern. Naturally the fitments and furniture are of the utmost importance to the interior model and the highest quality of craftsmanship is necessary. Strict attention must be paid to scale, for the use of too coarse materials, in an effort to gain effects easily, will destroy this.

Schedules. A task which is often undertaken by the junior draughtsmen in the drawing office is the preparation of schedules. You can have schedules of all kinds of things such as staunchions, manholes, fittings, doors and windows, door furniture, finishes, etc. These schedules are intended to be read in conjunction with the drawings, usually the eighth-scale key plans, and are especially useful on large contracts. They are invaluable to the Quantity Surveyors when they are preparing the Bills of Quantities. From the junior draughtsman angle they are also invaluable as an opportunity for practising ruling lines in ink and the cultivation of a neat and orderly style of lettering.

Fig. 63 illustrates a portion of an eighth-scale key plan for a large paint laboratory on which is noted reference numbers to the various rooms, doors and windows. Fig. 64 shows portions of a door and door furniture schedule and a window schedule which have been prepared from this eighth-scale key plan. The system is quite simple and although there may appear to be quite a lot of repetition on the schedules as regards certain items of information, this form of tabulation does ensure that there can be no argument on the site later on in the contract. The chief point to bear in mind is that all schedules must be accurate and kept thoroughly up to date to prove of practical value at all times.

PAINT LABORATORY FOR MESSRS WALTON LTD. SCHEDULE OF WINDOWS										ROBERT FORMAN A.R.I.B.A. CHARTERED ARCHITECT	
WINDOW No.	ROOM No.	HEIGHT	WIDTH	TYPE	MATERIAL	GLAZING	INTERNAL SILL	EXTERNAL SILL	JAMB	LINTEL	REMARKS
G.W. 1	G.F. 1	4'-6"	6'-0½"	A	Steel	¼" plate	Steel	Concrete	Brick	Concrete	Three coats white paint
G.W. 2	G.F. 1	do	6'-0½"	do	do	do	do	do	do	do	do
G.W. 3	G.F. 3	do	6'-0½"	do	do	do	do	do	do	do	do
G.W. 4	G.F. 3	do	6'-0½"	do	do	do	do	do	do	do	do
G.W. 5	G.F. 3	do	4'-0½"	B	do	do	do	do	do	do	Special mullion to take lav. partition. do
G.W. 6	G.F. 4	do	15'-0½"	C	do	do	do	do	do	do	do

PORTION OF A TYPICAL WINDOW SCHEDULE

PAINT LABORATORY FOR MESSRS WALTON LTD. SCHEDULE OF DOORS & DOOR FURNITURE											ROBERT FORMAN A.R.I.B.A. CHARTERED ARCHITECT		
DOORS								FRAMES			FURNITURE		
DOOR No.	ROOM No.	TYPE	HEIGHT	WIDTH	THICKNESS	MATERIAL	FINISH	TYPE	MATERIAL	FINISH	TYPE	FINISH	REMARKS
G.D. 1	G.F. 3	A	6'-6"	2'-9"	1½"	Wood	Paint	H	Wood	Paint	3	Satin-chrome	
G.D. 2	G.F. 3	B	do	2'-6"	do	do	Paint	J	do	Paint	3	do	
G.D. 3	G.F. 1	C	do.	2'-9"	do	do	Polish	K	do	Polish	4	do	
G.D. 4	G.F. 2	C	do	do	do	do	do	K	do	do	4	do.	
G.D. 5	G.F. 4	C	do.	do.	do	do	do	K	do	do	4	do	

PORTION OF A TYPICAL DOOR SCHEDULE

FIG. 64. Schedules

CHAPTER XI

THE DRAWING OFFICE

TO produce his best work a draughtsman must have clean and comfortable surroundings. There are still far too many robbed of the incentive to give of their best by being placed in some badly lighted, untidy back room, glorified by the title of 'drawing office'. Good lighting, both natural and artificial, is essential. A left-hand light is usually preferred, as a direct front light is liable to prove tiring to the eyes through reflected glare. When a drawing bench is already fixed in position directly under a window an eye-shade will be found most useful to counteract glare. All windows of the drawing office must be kept clean and have a blind or some other form of protection against the direct rays of the sun. A room facing north is the best for natural lighting where drawing is concerned. For artificial lighting the adjustable type of table lamp is ideal. The provision of a daylight lamp is optional.

A large drawing office will usually have central heating, but where a fire is used electricity is best. With a coal fire, apart from the dirt, there is always the temptation to burn scraps of paper on which have been scribbled useful data or tentative designs which very often one would like to refer to again. Good ventilation is essential—one cannot keep a clear brain in a muggy atmosphere. The floor should be covered with a hard-wearing material such as thick linoleum or else a rubber composition which can be easily cleaned. Lino is also a good covering for the tops of tables and benches.

There must be facilities for washing. Not only the hands of the draughtsman, but such instruments as T-squares and set-squares require periodic cleansing. The latter are constantly being propelled over the surface of the drawing. The celluloid types particularly pick up a surprising amount of dirt. Again a generous supply of water is advantageous when colouring. A sink in the draughting room is the ideal arrangement, especially one possessing a good draining board with a few shelves over.

These same points apply if the student decides to have a room of his own where he can concentrate uninterruptedly on his work. This type of room is illustrated in Fig. 65 and is one actually carried out for a client. The drawing is self-explanatory. There was one drawback, water was not immediately to hand, but in this instance could be obtained from an adjacent bathroom. Bench, shelves, cupboards, etc., were constructed of deal and sprayed with cellulose. Everything is conveniently to hand.

A Library List. The architectural student should endeavour to acquire a sound technical library. He should read books which will help him to understand every aspect of his profession. The books suggested in the following list only cover Draughtsmanship, Design and Construction. Many excellent books which cannot be specified here

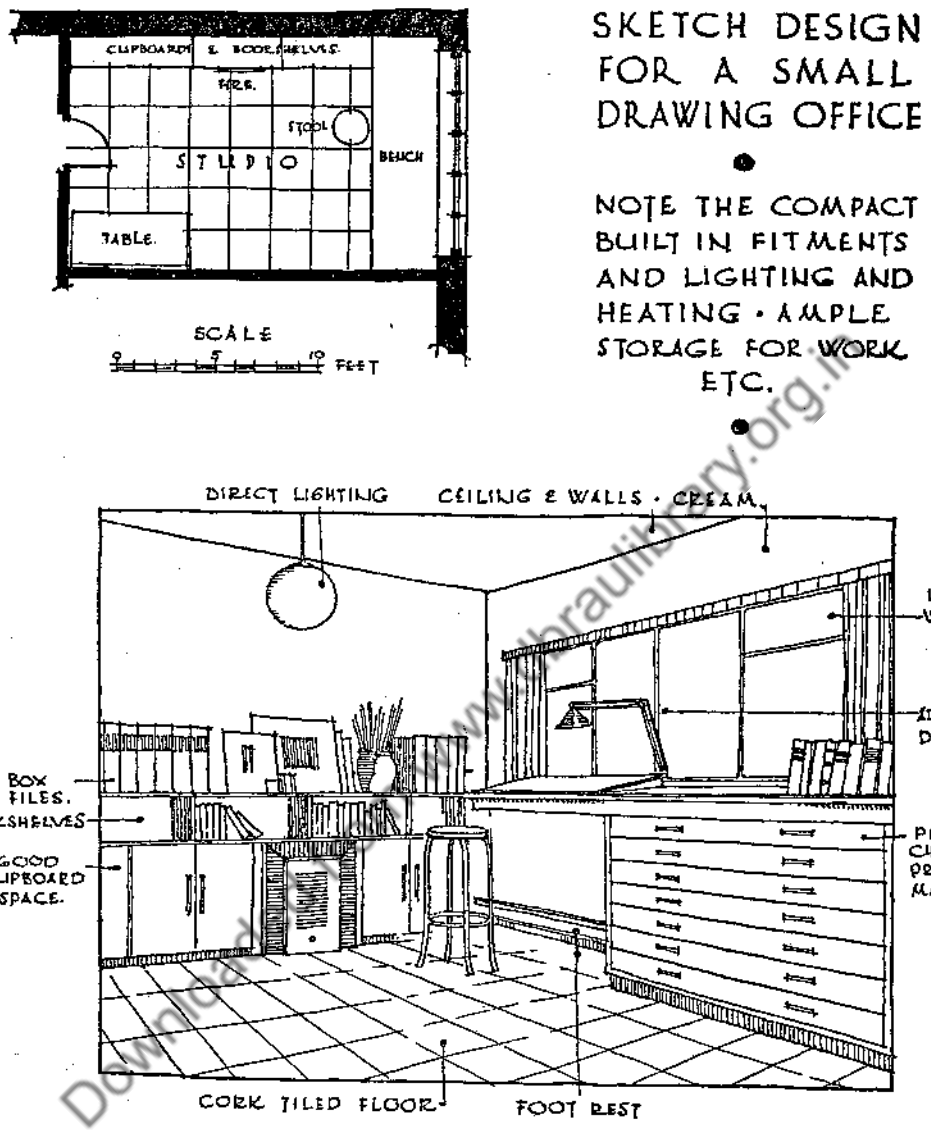


FIG. 65

are sure to be added as needs and experience dictate. Construction is included, because it is not a separate subject distinct from design. The two are supplementary to each other. Some of these volumes may now be out of print but they will be found in good libraries; and local public libraries everywhere will obtain specific books, in case of difficulty, through the National Central Library.

ARCHITECTURAL DRAWING, RENDERING AND LETTERING

Blomfield, Sir R. — *Architectural Drawing and Draughtsmen* (Batsford 1912).

British Standard Specification — *Architectural and Building Drawing Office Practice* (British Standards Institution).

Brown, R. — *Simple Perspective Drawing* (Cresby Lockwood 1956).

Carpenter, H. Barrett — *Suggestions for the Study of Colour* (Batsford 1923).

Curtis, N. C. — *Architectural Composition* (Batsford 1923).

Farey, C. A., and Edwards, A. T. — *Architectural Drawing, Perspective and Rendering* (Batsford 1949).

Hake, G. D. Gordon, and Button, E. H. — *Architectural Drawing* (Batsford 1929).

Hatton — *Perspective for Art Students* (Chapman and Hall 1940).

Hoar, H. Frank — *Pen and Ink Drawing* (Studio Ltd. 1955).

Hobbis, Charles J. — *Pencil Drawing for the Architect* (Tiranti 1954).

Holmes, J. M. — *Architectural Shadow Projection* (Architectural Press 1929).

Sciagraphy (Pitman 1952).

Huggins, F. R. — *Building Surveys* (Batsford 1957).

Johnston, Edward — *Writing, Illuminating and Lettering* (Pitman 1906).

Lee, L. A., and Reekie, R. Fraser — *Descriptive Geometry for Architects and Builders* (Arnold 1943).

Magonigle, H. van Buren — *Architectural Rendering in Wash.*

Middleton, G. A. T. — *Principles of Architectural Perspective* (Batsford 1921).

Nichols, T. B., and Keep, N. — *Geometry of Construction* (Cleaver-Hume 1954).

Reekie, R. Fraser — *Draughtsmanship* (Arnold 1946).

Seaby, A. W. — *The Roman Alphabet and Its Derivatives* (Batsford 1925).

Smith, Percy J. Delf — *Civic and Memorial Lettering* (Black 1946).

Storey, G. A. — *Theory and Practice and Perspective* (Oxford, Clarendon Press 1910).

ARCHITECTURAL DESIGN

Atkinson, R., and Bagenal, H. — *Theory and Elements of Architecture* (Benn 1926).

Burnet, Tait and Lorne — *The Information Book* (Architectural Press 1934).

Burrough, T. H. B. — *An Approach to Planning* (Tiranti 1953).

Esquié, P. — *The Five Orders of Architecture According to to Vignola* (Tiranti 1926).

Forman, R. — *How to Make Architectural Models* (Studio 1946).

Gibbs, James — *Rules for Drawing the several Parts of Architecture* (Hodder and Stoughton 1924).

Lloyd, Nathaniel — *A History of the English House* (Architectural Press 1931).

Penty, A. J. — *The Elements of Domestic Design* (Architectural Press 1930).

Richardson and Eberlain — *The Smaller English House of the late Renaissance* (Batsford 1925).

Robertson, H. — *Modern Architectural Design* (Architectural Press 1932).

Architectural Composition (Architectural Press 1924).

Stratton, A. — *Elements of Form and Design in Classic Architecture* (Batsford 1925).

Stratton, A., and Edwards, A. T. — *The Orders of Architecture: Greek, Roman and Renaissance and their Application* (Batsford 1931).

ARCHITECTURAL CONSTRUCTION

Architects' Working Details (Architectural Press).

Gunn, Edwin — *Modern Building Technique* (Iliffe 1955).

Jaggard, W. R., and Drury, F. E. — *Architectural Building Construction*, 3 vols. (Cambridge University Press 1947).

McKay, W. E. — *Building Construction*, 3 vols. (Longmans 1947).

Mare, E. de (editor) — *New Ways of Building* (Architectural Press 1951).

Mills, Edward D. (editor) — *Architect's Detail Sheets* (Architect and Building News).

Mitchell, C. F. — *Building Construction*, 2 parts (Batsford 1947).

Nield, Denzil — *Building Construction Illustrated* (Spon 1952).

Warland, E. G. *The Fabric of Modern Building* (Pitman 1937).
Building Construction for National Certificate (English Universities Press).
The Technique of Building (Hodder and Stoughton 1949).
White, M. W. *Working Detail*, Volume 1: *Domestic* (Architectural Press, 1938).

OTHER USEFUL PUBLICATIONS

British Standards and *Codes of Practice.*
Specification (published annually by the Architectural Press).
Bulletins and *Reports* of the Building Research Station.
Post-War Building Studies (published by the Ministry of Works).

Documents. Apart from forming a suitable architectural library the student will find it advisable to make a collection of documents. By documents is meant useful data in the form of illustrations obtained from current journals relating to the building industry and allied professions. These can be stored in folders, or better still, box-files, and placed under such headings as domestic work, civic, transport, health, religious, exhibition and display, farm buildings, industrial work, etc. They are invaluable for reference and the stimulation of ideas. Advertisements of special materials can also be usefully retained in this manner.

Catalogues and folders are always being received from firms advertising various products. A card-index system can be used for filing catalogues under the names of the various manufacturers. Records can be kept under separate headings, such as floors, partition blocks, bricks, tiles, etc., of the several manufacturers responsible for the various materials referred to. Samples of actual building materials can also be collected and kept on shelves or in drawers.

Prizes and Studentships. A pamphlet giving full information of Prizes and Studentships, of great interest to the student, can be obtained from the Royal Institute of British Architects, 66 Portland Place, London, W.1. There are prizes to cover every field of activity, including design, measured work, construction, essays, colour work, research and town planning.

The three main prizes for design are the Tite, Victory and Rome. Some important and valuable changes have recently been made in awards and conditions for these scholarships. The prize money for the Tite has now been increased to £100 instead of £35 and the preliminary *en loge* competition eliminated. The prize may now be

awarded for a design in contemporary style. The Victory Scholarship which is an intermediate step between the Tite and the Rome Scholarships carries with it a silver medal in addition to the £150 to be used for the advancement of the student's architectural education. The senior design prize is the Rome Scholarship which entitles the successful student to £400 a year for two or three years, tenable at the British School in Rome. There are many famous names in the list of previous prize-winners, and this in itself should prove an inspiration.

For those who have a flair for construction there are the Archibald Dawnay Scholarships numbering five, which are offered for competition between students of schools of architecture who are in their third year. The intention of these scholarships is to encourage the advanced study of all kinds of construction plus the economic and practical use of building materials. For those who have a bent for measured drawings there are the Neale Bursary and Arthur Cates Prize and the Measured Drawing Prizes.

It is suggested in the preamble in the pamphlet that the measurements should be done during the student's career and the work submitted when he is ready to travel. Remember that the jury prefer quality to quantity. Marks will be given for appropriate choice of subject, and an original approach should be contemplated.

The Neale Bursary carries an award of £125, and while it is intended for the measuring of old buildings, at the same time research is involved. It is an award particularly applicable to research on the evolution of a particular type of building. The last prize-winner submitted a thesis and measured drawings showing the evolution of the stone bridge in this country. To compete you must be over twenty-one and have passed the Final, and produced the necessary certificate.

The Arthur Cates prize, consisting of a certificate and the sum of £115, was founded for the promotion of the study of Architecture, and is offered annually according to such rules as the Council of the Royal Institute of British Architects shall from time to time enact. For 1958 a typical subject was the critical study of the external finish of buildings in Great Britain. The text must be supplemented by annotated sketches and drawings.

For those who prefer written work there is the R.I.B.A. Silver Medal and a sum of £50. This is one of the oldest prizes in the Institute. Your work must be of high literary merit and definitely an Essay, not a Thesis. Two prizes are offered. Then there is the Bannister Fletcher Silver Medal and the sum of 25 guineas for an illustrated essay not exceeding 3,000 words, open to those who have not passed their Final R.I.B.A. examination. A studentship and the sum of £250 is offered for the improvement and cultivation of knowledge of the successful application of colour as a means of architectural expression—the Owen Jones Studentship. There are several other prizes for Research and Town Planning—altogether several thousand pounds to be won. Why should you not be one of the recipients?

As you advance in your architectural studies you will find considerable scope for design in the work involved in architectural competitions.

Competition Work. The promoters of a competition usually seek the advice of the President of the Royal Institute of British Architects or some other competent person

and an assessor is appointed. The work of this person is to draw up the conditions of the competition in collaboration with the promoters and he then judges which design conforms to his conditions in a manner conducive to the carrying out of the promoter's requirements.

It is not my object to discuss the competition system. Already much criticism and controversy has taken place regarding it. These notes are merely included to give the student some idea of the work involved. He will naturally require to have reached a fairly high degree of draughtsmanship and must be fully conversant with most of the methods described in this volume. An open competition is usually advertised in the technical and professional Press and all interested persons can obtain the 'Conditions of the Competition' upon application to the sponsors and the payment of a small fee, which is usually refunded when a design is received or the conditions returned.

The competitor must then carefully study these conditions and the site plan. If he is wise and opportunity permits he will visit the site if this is within reasonable travelling distance. He will then get down to the scheme and commence to design the project. It is wise to keep to the rules and if you are not sure of some point questions may be addressed to the assessor by some stated date.

The drawings required are usually specified in the 'Conditions' and the method of execution should be clear and neat. Remember that the assessor may have to examine hundreds of drawings and he wants to find the best scheme, not to ascertain whether your lettering has 'character' or whether you can use a colour brush. Keep the lettering clear and distinct, and if colouring is asked for or permitted, keep the tints distinct and clean.

In buildings of a certain character (e.g. Municipal Buildings) it may be desirable (or even a condition) that the various suites of offices be indicated by colour. In this particular point keep to the rules and help the assessor in his difficult task. The drawings will not bear your name but a *nom-de-guerre* or a number, as laid down in the rules of the competition. Finally do not complain loudly if the winning design has departed in some small particular from the printed conditions. An unbiased judgment admits that the winner is well ahead of all other competitors with his main theme.

The Student's Background. Draughtsmanship is but the means to an end, which is the design and erection of sound structures—not only the homes of men but places where they worship, seek their business and pleasure and educate themselves. If the young architect leads a narrow existence he will develop cramped, conservative ideas and moreover he will not meet the type of people who may become future clients. The arts of painting, sculpture, music and literature should at least in some degree be studied. Read such books as *A History of Everyday Things* by M. and C. H. B. Quennell; *The Pleasures of Architecture* by Clough Williams-Ellis; *Form in Civilisation* by W. R. Lethaby; *The Architecture of Humanism* by Geoffrey Scott. Study foreign architectural journals, they can prove a great stimulus. Sketching, especially from nature, is a great relaxation and the photography of buildings of merit is a pleasure and a useful technique. It is proper for the architect to have some authority on antique and modern

furniture, carpets, tapestry and *objets d'art* of all kinds. He can only develop this by frequent visits to libraries, museums and art galleries, to study everything from sculpture to china. The books and pamphlets on sale at such places are often valuable adjuncts to a technical library.

The practice of writing clearly and concisely is to be cultivated. Prepare a thesis on some special architectural detail of your own town or county, or make an architectural map showing features of similar interest in your vicinity. Music and the theatre can be fertile in inspiration; a commission to design some scenery for a local society is an experience full of interest.

Architecture is the Mistress Art and an inspiring profession. You are setting out on an important and exciting adventure; an adventure which begins from the first moment you bend over the drawing board.

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