Technical and Bibliographic Notes / Notes techniques et bibliographiques

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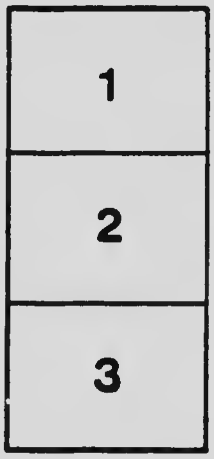

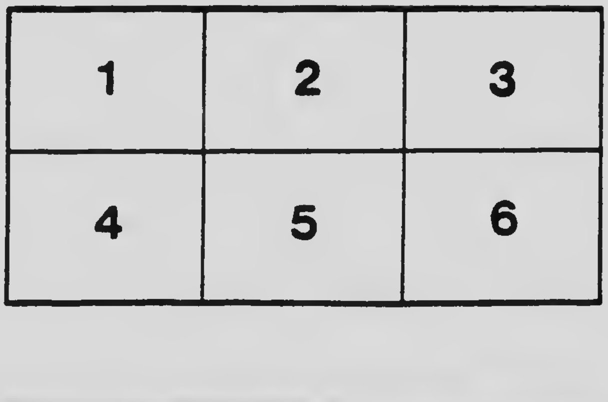

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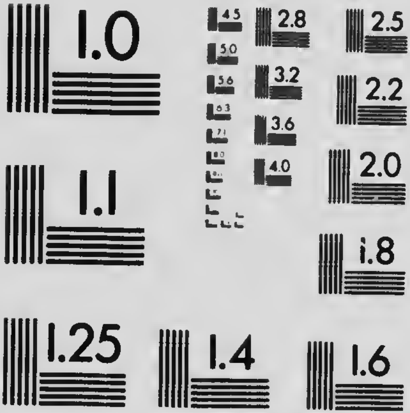

Builders' Architectural Drawing

SELF-TAUGHT

CONTAINING DESCRIPTIONS OF DRAWING INSTRUMENTS AND ACCESSORIES, WITH RULES FOR USING THEM, AND HINTS AS TO THEIR CARE AND MANAGEMENT. RULES FOR LAYING OUT SIMPLE DRAWINGS AND EXECUTING SAME ARE GIVEN, AND THE STUDENT IS TAUGHT STEP BY STEP TO DRAW TO SCALE, FIRST THE PLANS, NEXT THE ELEVATIONS, AND FINALLY THE DETAILS OF BUILDINGS, INCLUDING FOUNDATIONS, WALLS, DOORS, WINDOWS, STAIRS, AND ALL OTHER ITEMS REQUIRED FOR FINISHING IT COMPLETE IN EVERY PARTICULAR.

By FRED T. HODGSON

Author of "Practical Uses of the Steel Square," "Modern Carpentry," Common Sense Stair Building and Handrailing," etc.

ILLUSTRATED

CHICAGO

FREDERICK J. DRAKE & CO., PUBLISHERS

1904

PREFACE

Having been more or less interested in Architecture and the building trades for nearly a half a century, I have in that time become acquainted with a great many workmen, who, while filling a subordinate position, possessed aspirations and ambitions, which, had they had a fair knowledge of drawing and geometry, would have lifted them to the hightest place in the department in which they labored. To give similar good fellows a chance to obtain the necessary knowledge to enable them to apply for the better positions with a certainty of their being able to fill them with credit is the motive which has prompted the compilation of this book, and, knowing the quality and magnitude of their wants, by personal contact with the workmen in the shop and on the building, I think I am qualified, to a large extent, to cull from the vast treasure house of industrial and technical literature, which added to my own experience, to present to the workman in the simplest form possible the material he requires to help him along in the struggle for better conditions. To attempt to write a book on the subject of architectural drawing and claim for it originality, is simply out of the question; for very little that is original can be said, indeed very little is wanted to be said, for the literature now obtainable seems to cover every point and every phase of the subject.

It may be asked then: "Why make another book on the subject?" This seems a just and reasonable query, and one that deserves a well considered answer, and I will, to the best of my ability, endeavor to make such answer. First, then, while admitting that all that need be said on the subject has been said, and better said than I can say it, yet, it is so scattered and broken up, a bit here, and a bit there, that the student for whom this work is prepared would require to own a gold mine to be able to purchase all the works containing just what he requires; secondly, as this work is specially designed for active workmen who have no time to wade through ponderous tomes to find what may be a simple matter after all, they would probably be forced to forego the knowledge if it could not be obtained in a cheap and handy form, therefore, it is thought that by gathering together, and putting within reach of those who want them, a series of instructions containing what is considered the most suitable to satisfy the requirements I have undertaken to fill, and which I hope will prove satisfactory to the young workman. Doubtless there are many things in this little work that, in the opinion of many persons, might be dispensed with; it may be, and likely is, that there are many good things omitted, many things that would have proved extremely useful, but in palliation I can justly say, that everything I have found on the subject, that was plain, simple and within the capacity of most of the persons this book will reach, and that were not too extensive, I have made use of, and to the best of my ability have placed them before my readers in such language as I am sure will meet with their approval.

Collingwood, Ont., Jan., 1904.

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Architectural Drawing Self Taught

INTRODUCTION

Before entering into the subject on which this work is being prepared, the editor and compiler would like to say a few words to the reader, in connection therewith.

It will be noticed that the title of this work is "Architectural and Builders' Drawing Self-Taught"; and this title fairly conveys to the intelligent reader, the scope of the volume, as the work is intended solely for young progressive carpenters and builders who are not going to drag out a tiresome existence by remaining at the bottom of their trades, and who have not had an opportunity of acquiring a knowledge of architectural drawing or the use of drawing instruments. Many of the best draftsmen in the United States, Canada, and Great Britain, came from the ranks of the working men; men who had gained the most of their knowledge of the laws of construction and exactness in the work-shop, at the bench, or on the buildings where they were employed; and I may say that it is within the power of ninety per cent of workmen to become fairly good draftsmen, by their own efforts, and the aid of such books as the one I have now prepared for this purpose; and the young man who has by his own efforts, perseverance and ability, succeeded in being able to place on paper or board with pen and pencil, a plain elevation of a door, window, house, stone wall, or veranda, drawn to scale, and so made as to convey to his fellow workman a correct idea of what is intended, that man has achieved a result which should—and generally does—advance his wages, increase his importance, and make him a more valuable and useful citizen. It is not to be supposed that this little work alone, even though thoroughly digested, will enable the reader to become a finished draftsman, nor is it so intended, but it will aid him materially in acquiring such knowledge as will give him a good start on the highway to success.

Wherever the student can attain access to a school for drawing, there he should at once proceed, for a few hours spent over a drawing board under competent supervision, will do more towards giving him an insight into the methods and practice of good draftsmanship than it is possible to obtain by many days of book study. Where there are no such schools available the student should try and get into an architect's office, or into the office of some mechanical draftsman, and either pay for, or work for, a series of lessons on drawing, but when none of these conditions exist, he should take up a series of studies in practical geometry in connection with drawing; as a knowledge of geometry as presented in either "Modern Carpentry and Joinery", or other works published in this series of work-manuals, by Messrs. Frederick J. Drake & Co.

The construction of geometrical figures is exceedingly good exercise and will not only give the reader good theoretical knowledge, but will help him in his drawing lessons and practice him in exactness.

By application and determination "to fight it out to a finish" the earnest student will be sure to make a good—perhaps a first-class—draftsman, for, to the really earnest man, nothing is impossible within the range of human accomplishments.

I have referred in the foregoing to "exactness." This is the first "necessity" in a drawing that is intended to be used as a guide for actual work.

A drawing may be rough, dirty and inartistically done, but if it be complete and correct it serves its purpose, and is immeasurably superior for practical uses to the inexact artistic one, which may dazzle with its shade and shadows and fineness of execution, but leads to confusion and failure and consequent chagrin and loss.

I have thought it necessary to inject into this little work a few remarks and a few illustrations on Free Hand Drawing, as many persons are gifted with the power of being able to make a fair drawing of objects on sight, and it was thought that, perhaps, a few hints in this direction would be necessary to make the book complete, as these hints may aid those who have these gifts, and stimulate those who have them not, to cultivate the art, as a knowledge of it is one of the most useful aids the drawing student can possess.

It must be remembered this work does not pretend to lead the student beyond the realm of plain practical drawing, such as the everyday workman will find useful and convenient, whenever he wishes to convey to others an idea of what he intends to erect, or to lay out on paper or board a piece of work he is about to execute. I have eschewed perspective, and elaborate drawings of any kind, but, should it be thought wise, I may hereafter, prepare a work for this series, dealing with perspective and a higher grade of work than is herewith presented.

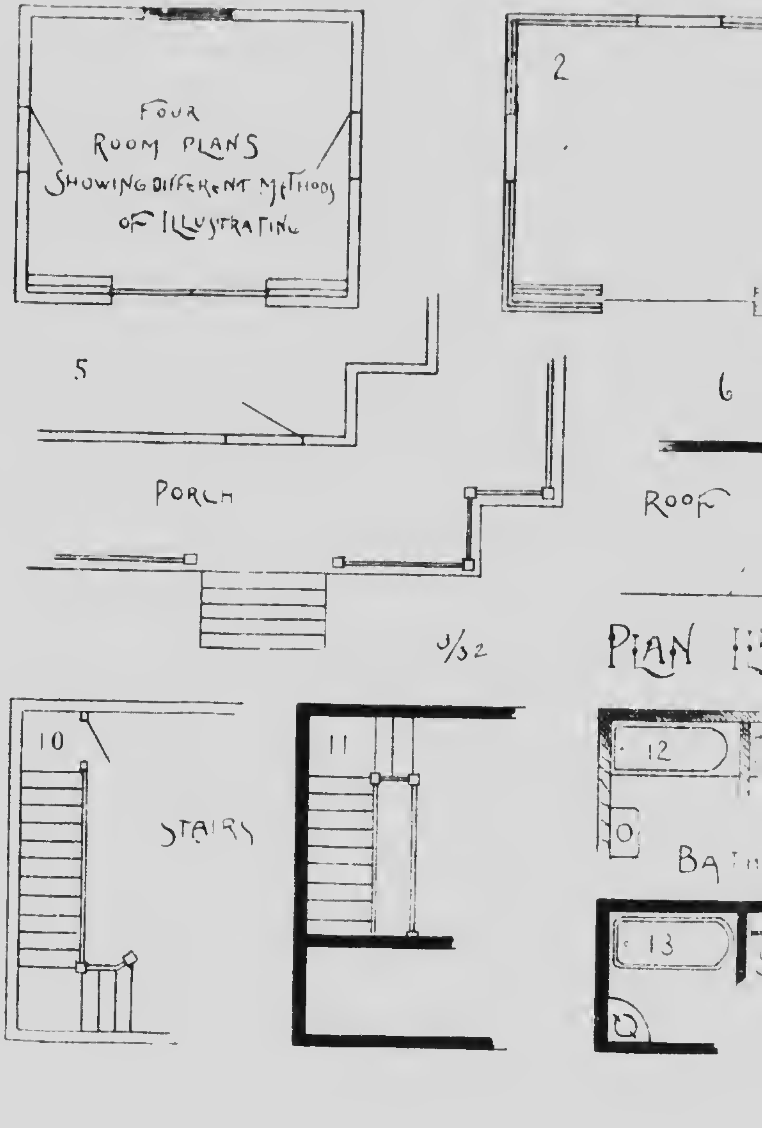
SOMETHING ABOUT DRAWING INSTRUMENTS

In all kinds of geometrical, architectural and mechanical drawing, the accuracy of the work will depend much, in theory, on the excellency of the drawing instruments used.

Practically, these instruments are not quite perfect, and any carelessness or negligence of the draftsman when using them, may render them unfit for accuracy of operation. Indeed, the hand and eye of the operator, viewed simply as instruments, for executing conceptions of form, are vastly superior and more varied than the best of appliances used by the draftsman, and well directed efforts should, and will, bring out this capacity so that, other things being equal, he will make the most expert and elegant draftsman whose eye is most reliable in its estimate of form and size, and whose free hand is most skilled in expressing these elements of figure. Instruments, however, are necessary, and a little talk on the subject will not be out of place, and may prove of practical value to the reader.

PLATE I.

This plate exhibits some eighteen different sketches. No. 1 shows a plain method of laying out a room having sliding doors in it. No. 2 shows the same room presented on another method. No 3 exhibits another simple plan of marking off the same room, while No. 4 shows the walls in plain black. These four examples are intended to convey to the student some idea of the various methods of illustrating. No. 5 shows the layout of a porch, with an angle on one corner. No. 6 shows the plan of the porch roof. Nos. 7 and 8 show plan of semi-octagon bay-windows, and roof plan, while No. 9 shows the roof plan for a pentagon bay-window. Nos. 10 and 11 show two plans of stairs that are suggestive. Nos. 12 and 13 exhibit two styles of laying out a bath room. No. 14 shows several ways of laying out fireplaces, while 15, 16 and 17 show portions of a pantry and kitchen.



FOUR ROOM PLANS SHOWING DIFFERENT METHODS OF ILLUSTRATING
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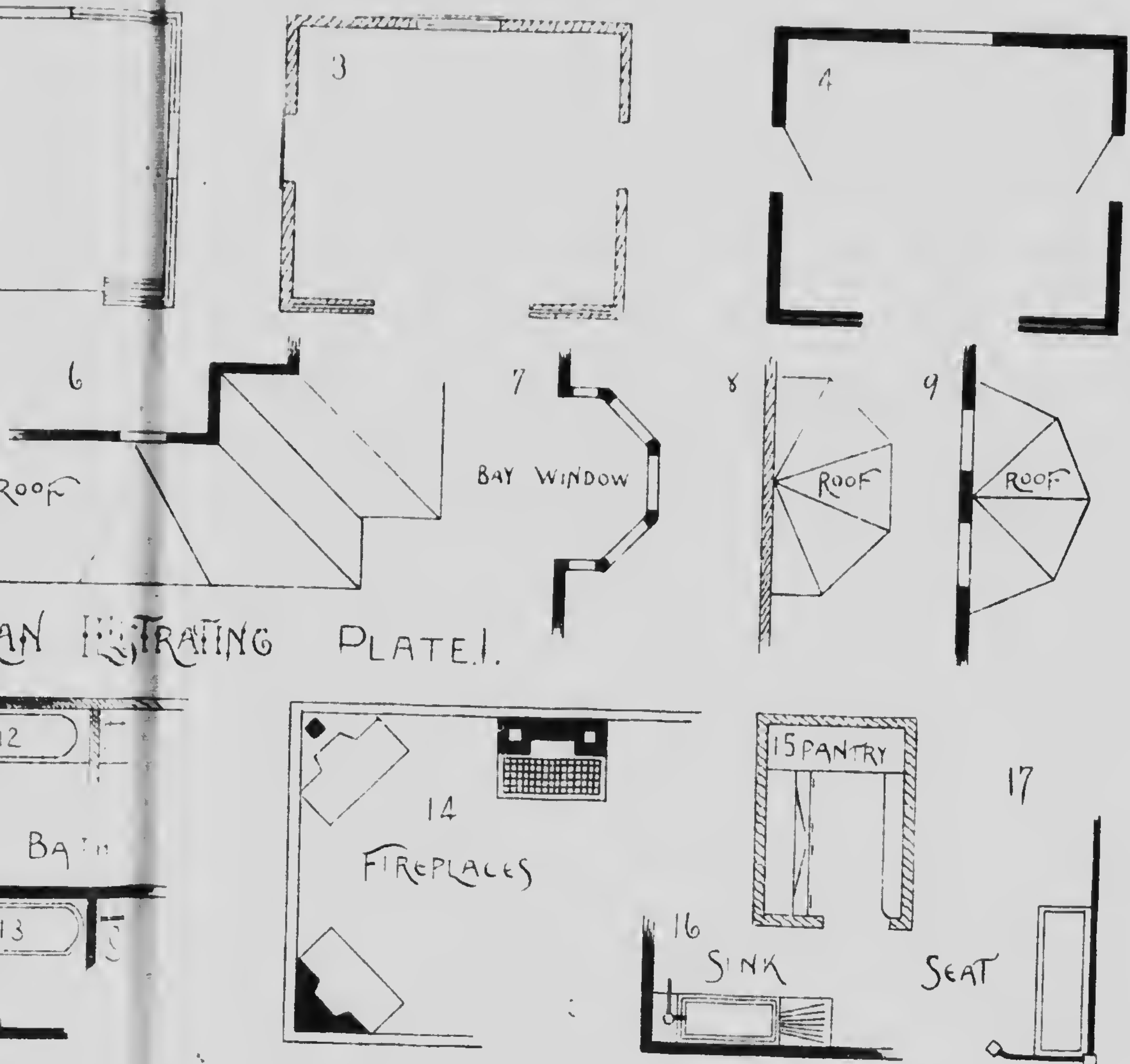
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Almost, in every department of life the best results can only be obtained by the skilful employment of the best means available. Sometimes a genius accomplishes supreme results with the most primitive of means, but it is not for geniuses this work is prepared, but for everyday sort of people, people who do not expect to build houses without materials, or become draftsmen without long and careful preparation; and such being the case it is in order that the reader be advised to purchase the best instruments and accessories his means will admit of.

"A fine workman requires fine tools," and no man can do a fine piece of work not having the proper tools wherewith to do it, so no man can do a good piece of drafting without having the necessary tools; therefore, it will not be out of place to commence with a description of the instruments required, and the manner of using them.

The first thing the young student will require, will be a drawing board. This may be made at home, but should be true on its face and the edges should be exactly at right-angles with each other, or perfectly *square*. The board may be made in size, to suit requirements, but should never be less than 12 by 17 inches. Indeed, it is better to have two or three boards of sizes varying from 12x17 to 36x60 inches.

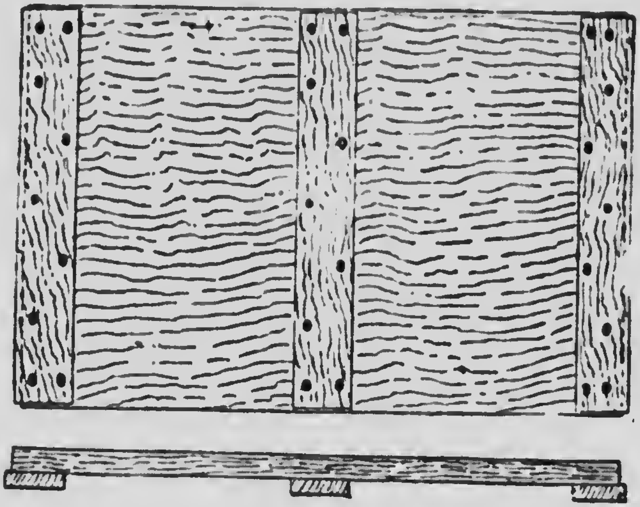


Fig. 1.

They may be clamped on the ends with stuff about 1¼ inches wide and the thickness of the board, or they may be held together with battens either screwed on to he underside as shown at

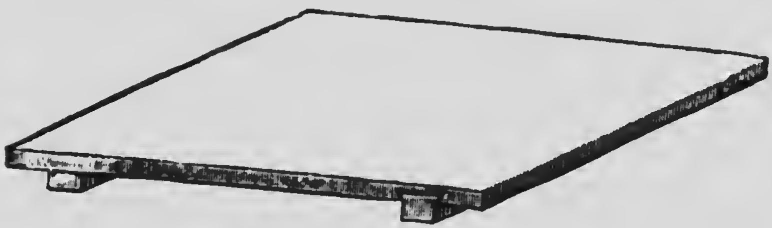


Fig. 2.

Fig. 1, or dovetailed into the board across the grain as shown at Fig. 2. At Fig. 3 a much better board is shown and one I can recommend as possessing nearly all the qualities of a perfect board.

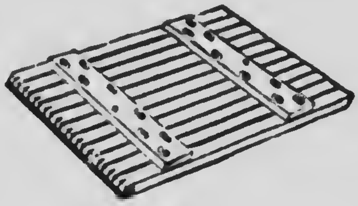


Fig. 3.

A glance at the illustration will explain the good qualities of this style of board. The wood used should be carefully selected pine or basswood with hardwood cross-bars at back. To prevent the warping of the wood, the board is sawed half way through at about every two inches, and for the purpose of allowing to contract and expand, the cross bars are not glued on, but fastened with screws, which run in oblong metal slots. At the ends, pieces of hardwood are inlaid, to give the T-square a smooth working edge. They are also cut at every few inches, to allow for contraction and expansion of the board.

While the cheapest boards are made of white pine or basswood, it doesn't necessarily follow that boards may not be made of other woods; cedar, mahogany and straight grained walnut make very fine boards and answer very well where you do not require to use pins for securing the paper to the board. When, then, hardwood boards are used, it is as well to employ glue or mucilage in fastening paper to the board.

Drawing paper comes in rolls of indefinite lengths, and from 36 to 54 inches wide, and in sheets of various sizes. It is made in different tints, is generally very tough, and is chiefly used for details; it is much cheaper than Whatman's, and for many purposes answers just as well. There is also a paper comes in rolls called "Cartridge paper" of a buff color, very strong and cheap, and admirably suited for details and like work. Tracing cloth, also, comes in rolls, 18, 30, 36, and 42 inches wide; it is convenient and durable, and may be folded up almost any number of times without injury.

Tracing paper is made of different qualities and sizes; it is rendered transparent, and qualified to receive ink lines and tinting without spreading. Like tracing cloth, when placed over a drawing already executed, the drawing is distinctly visible through the paper, and may be copied or traced directly by the ink instruments; thus an accurate copy may be made with great expedition. We cannot give reliable price quotations of these papers, as they vary somewhat, and may be different prices in different localities.

The paper should be fastened to the board with pins or thumb-tacks similar to those exhibited in Fig. 4. These are made with a broad flat head, of brass, white metal or silver, and rounded so as to permit the square to slide easily over them, and the stem should be of steel and riveted or screwed into the head.

Fig. 4

Fig. 5 exhibits several styles of "thumb-tacks," all of which are well enough in their way. There is a number of other styles of tacks of various kinds besides the ones shown.

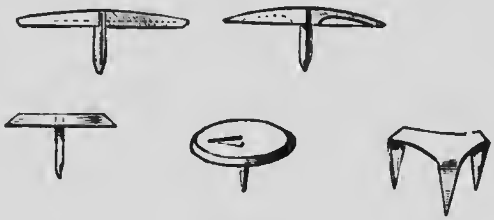


Fig. 5.

When the young student gets down to "real work" and makes use of good paper, he should first damp the edges of the paper, then glue the edges and place fairly on the board, holding it in place with pins or other suitable appliances, which may be removed when the work is dry and ready to operate upon. This method of fastening is sufficient where no shadowing or coloring is to be applied, and if the sheet is not too long a time upon the board. It has the advantage, too, of preserving to the paper its natural quality of surface. With mounted paper, there is no other proper way of fastening. For large, colored, or elaborate drawings, however, a damped sheet is preferable, and where the coloring is a flat tint, damp stretching is indispensable, as the partial wetting by water color causes the surface to buckle; partial wetting of loose paper by water color causes the surface to buckle.

Damp-stretching is performed in the following manner: lay the sheet on the board, with the face side under, and have the thick edges trimmed from the paper; draw a wet sponge freely and rapidly over the upper side, beginning at the center, damping the en[illegible]surface, and allow the sheet to rest for a f[illegible]minutes till it be damped through, and the surface-water disappears. Those parts which appear to revive sooner than others, should be retouched with the sponge. The damping should be done as lightly as possible, as the sponge always deprives the paper of more or less of its sizing. The sheet is now turned over and placed fair with the edges of the board—sufficiently clear of the working edges to permit the free action of the drawing-square. The square, or an ordinary straight-edge, is next applied to the paper, and set a little within one edge, which is then turned up over the square and smeared with glue. The paper is then turned down and pressed on the board, after which it is rubbed down all along the "lap" with some smooth article. The same process is performed on the other edges of the paper. The whole is then left to dry, which, when completed, leaves the surface flat and tense.

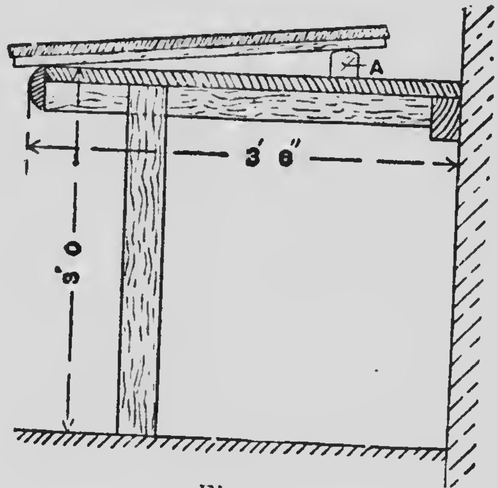


Fig. 6.

It is not likely the ordinary workman will want to color his drawings, therefore he will find it safer, and less trouble, to simply tack his paper on the board with the thumb tacks, and then make his drawings first in pencil, then in ink, but I have thought it well to give some hints regarding the manner of preparing the papers for coloring. Further on, I will have more to say on this subject and on the subject of color.

Having prepared a drawing board, the next thing will be to provide a table or desk to rest the board on. I show a very good scheme for this purpose in sketch Fig. 6, and which can readily be made by any workman who can use tools. This should be fixed in some place where there is an abundance of light and in such a position that the light will fall on the board from the left side as shown in Fig. 7. The height and

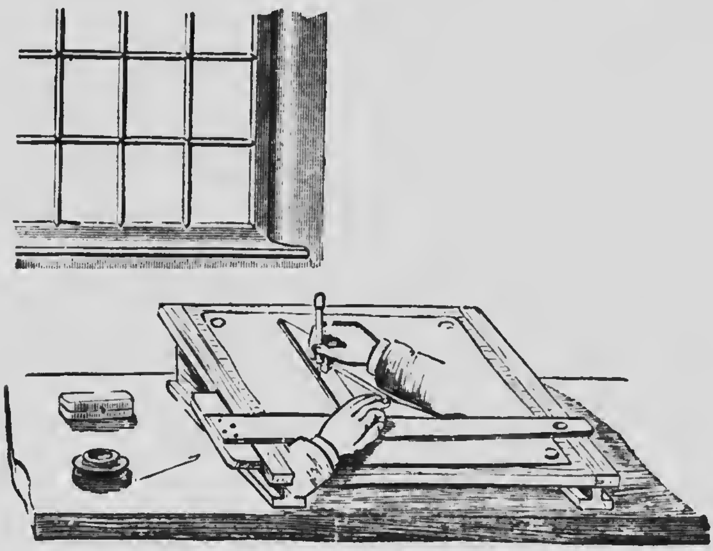


Fig. 7.

projection of the table or desk are marked in Fig. 6, and a movable block of about 3 inches square is shown at A, which can be moved in such a fashion that the angle of the board may be made to suit the operator. This block must of course be as long as the drawing board.

Fig. 7 shows the board in position with the paper tacked on, and the proper position of the hands are shown as they should appear while making the drawing.

The next thing to be considered is the T square. This needs but little description, as every workman is supposed to know what this instrument is; it may, however, be noted that T-squares differ in construction. In the commonest the "blade", or thin portion, is fixed flush with one side of the "butt", or "head", as at A, Fig. 8. In other forms the blade is fastened in the middle of the butt, B, and this is the preferable form for large squares; others, at C, Fig. 8, have the blade above the level of the

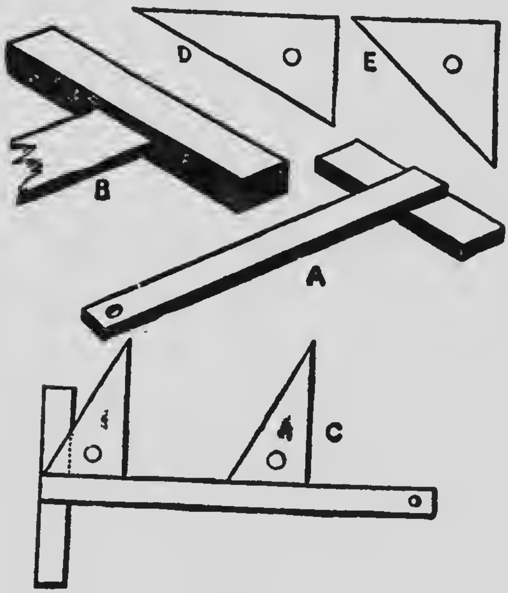


Fig. 8.

head, to permit set-squares to go over it. Very large squares have a couple of little studs, as shown in the figure B, to steady them.

French curves, L, Fig. 9, are made in a great variety of combinations. They are extremely handy for drawing curves not easily struck by the compasses, and also for eccentric curves, which the compasses are not able to describe as in medieval mouldings of some forms. In inking-in a curve by the aid of one of these appliances the edges must be turned about on the pencilled drawing until some part is found which corresponds, when the edge of the curve will guide the drawing-pen. There are a great variety of these curves as may be seen at Fig. 10. These variable or irregular curves are made of thin wood, hard rubber or celluloid, and are sold for a few cents each.

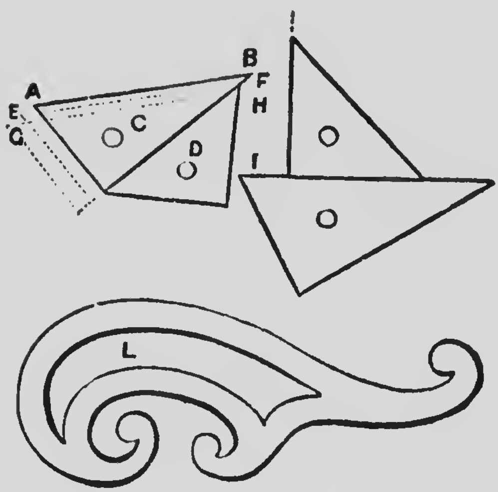


Fig. 9.

The set square or squares, similar to those shown at Fig. 9, C, D, K and B, are great aids

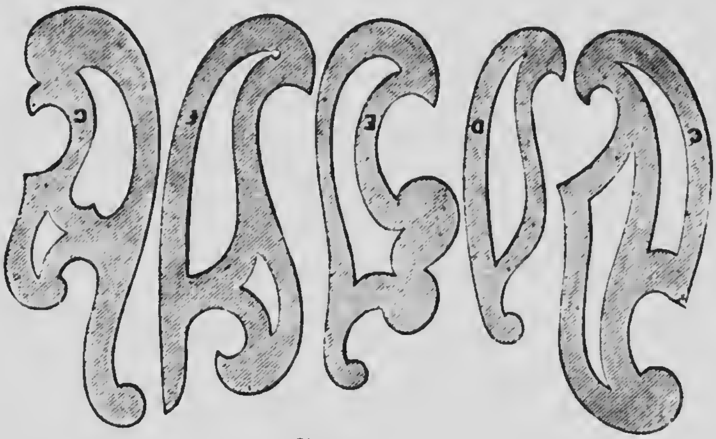


Fig. 10.

to drawing as they may be employed in conjunction with the T-square, for lining off angles, or laying off parallel lines as shown by the dotted lines EG, and FH. These set squares are made

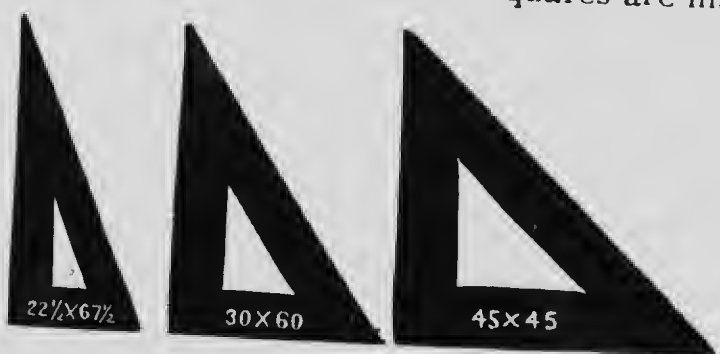


Fig. 11.

to suit different angles, and in many styles, as will be seen in Fig. 11. The manner of using them will suggest itself as the work proceeds.

T-squares of a superior kind may be obtained from any dealer in mathematical instruments for from $1.00 to $6.00 each, but in most cases the workman can make his own squares, as well as his own drawing boards, and save money by the operation. The squares shown at Fig. 12 are of a superior kind, the blades and one edge

Fig. 12.

of the stocks having ebony or other hard wood glued on the edges to prevent them from wearing. The lower square has a movable stock, which is operated by a thumb screw, thus enabling the draftsman to set the blade to any angle desired. The working of this will be easily understood by the reader.

Another accessory, and one the workman can make for himself, is a straight edge—or several of them—which may be made of hard-wood, or it may be made of good clean straight grained soft wood, and have hardwood edges glued on as shown in Fig. 13. Perhaps it would be well to have three or four of these straight edges in different lengths and widths, say one 16 in. long,

Fig. 13.

one 30 in. long, and another 40 in. long. The widths may be 2 in., 2½ in., and 3¼ in. respectively. They should not be more than three-sixteenths of an inch thick, but would be better if they were thinner.

A rule or scale is always necessary, for all architectural or other drawings that are intended to be worked from, must be made to scale. Usually, in this country, scales are made and marked off to some proportion of the English foot, when intended for architectural work. One sixteenth of an inch may represent one foot or one yard, as the case may be, so also may one eighth, one quarter, or one half of an inch represent one foot or one yard, just as the draftsman determines. One eighth of an inch is the most used, though one quarter of an inch is

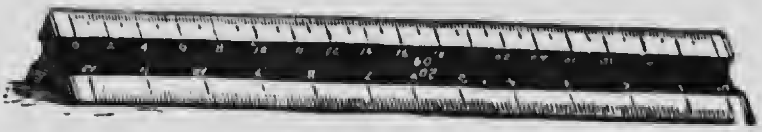


Fig. 14.

the scale generally employed. For workmen's use three quarters of an inch scale is handy, as this makes one sixteenth of an inch represent one inch of the actual work, which is quite convenient in a working drawing.

Scales may be had flat or triangular, and in boxwood, ivory or hard rubber, and one foot

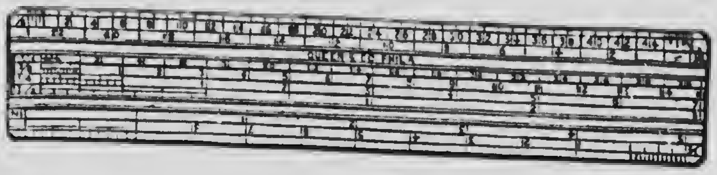


Fig. 15.

long. The flat scales are very handy, but are sometimes confusing, because often two or more scales are laid off on one edge. Perhaps the handiest scale for actual use, is the triangular one, which is similar to Fig. 14. There are six edges on this scale, each edge having a different marking or scale. The flat scale is shown at Fig. 15. This scale is 12 inches long, with 16 scales, as follows: $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{4}$, $2\frac{1}{2}$, and 3 inches to the foot, the first division of each scale subdivided in 12 parts, each.

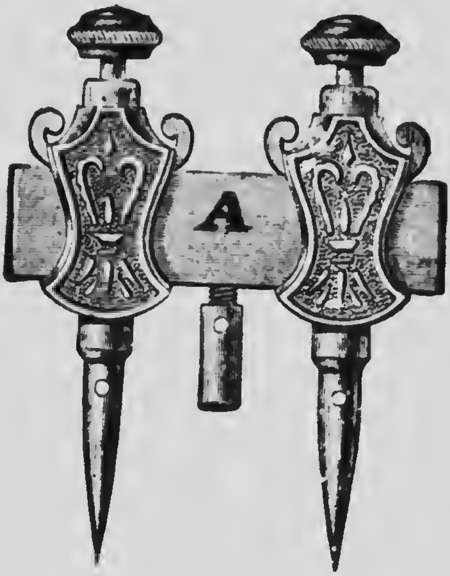


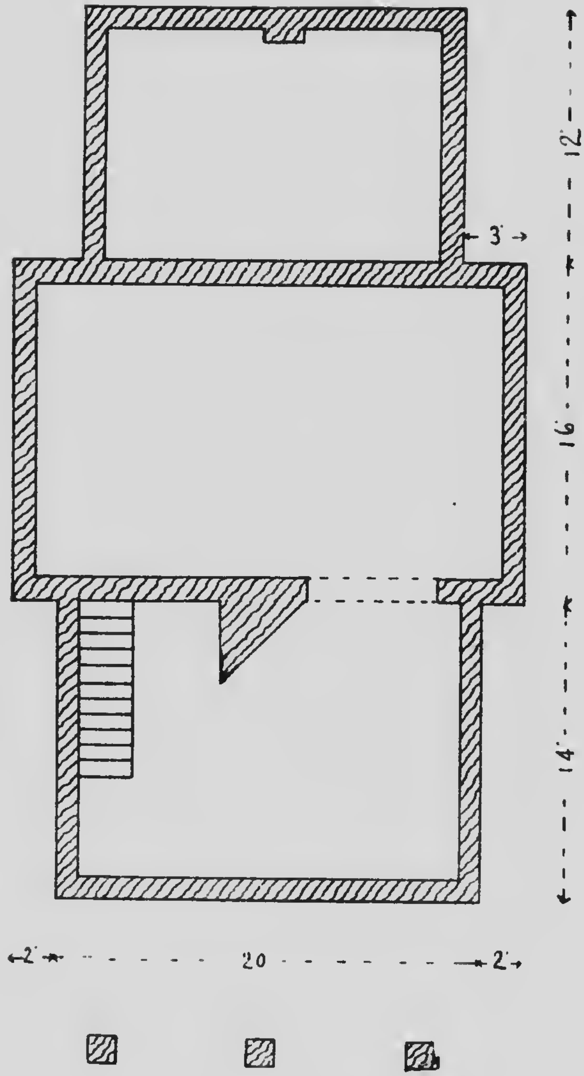
Fig. 16.

Besides these there are many other kinds of scales made use of by Architects, Engineers, and Surveyors, but these shown and described, will suffice for the purpose for which this book is prepared, as it is not intended to embody in this work other than the simplest methods of plain architectural work, and such as can be executed with the simplest kind of instruments.

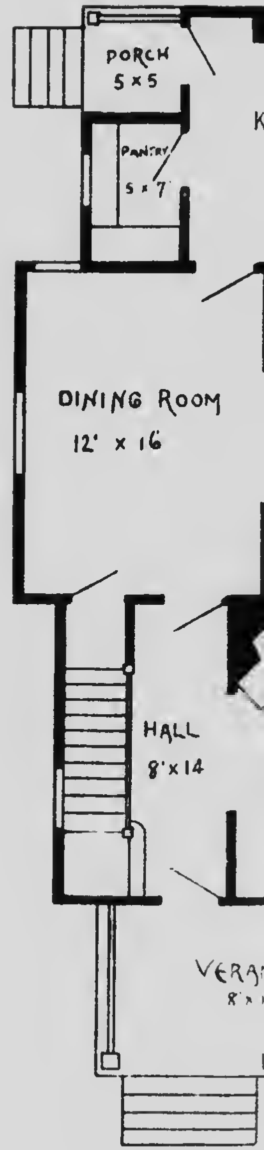
There is a number of other accessories used in drawing besides these mentioned, that are not placed in a regular box or case of instru-

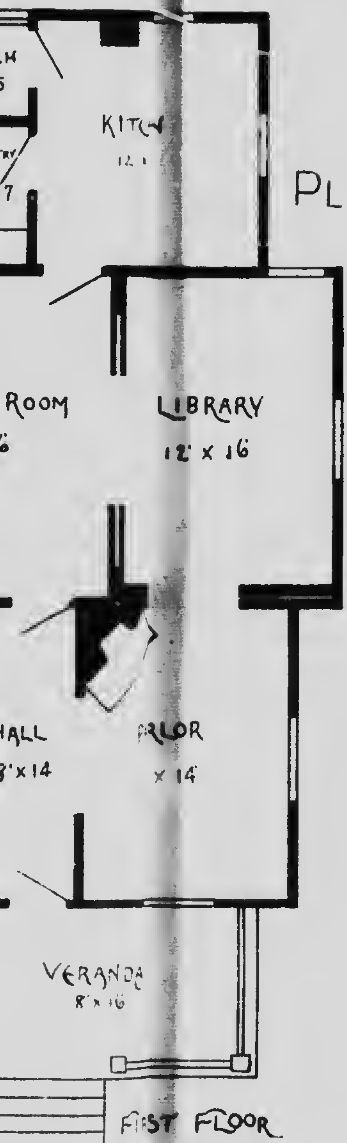
PLATE 2.

Following up the ideas presented ate 1, I give herewith the plans for a s ll cottage and show the cellar plan, first floor plan and chamber plan. This is drawn to a scale of $\frac{3}{32}$ of an inch to the foot, but I would advise the student to double the size, which, as a matter of fact, the original drawings of these examples is the scale to which they are made, namely $\frac{3}{16}$ of an inch to the foot. Every item necessary for a house of this description is shown on these plans.



FOUNDATION

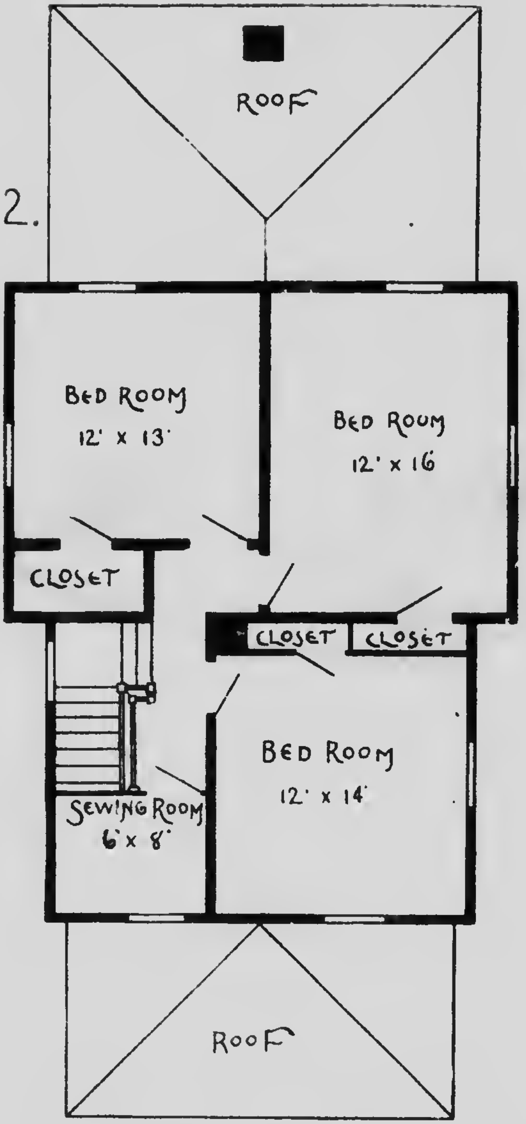




FIRST FLOOR

PLATE. 2.

3/12



SECOND FLOOR

ments, such as splines, ellipsographs, and beam-compasses; the latter being designed for drawing circles of large diameter, and are so made that the points can be moved to the desired distance apart. One steel point may be removed and a pencil or inking pen inserted. Set screws hold the heads in position on the sliding bar A, Fig. 16. This bar may be of wood, or of metal, preferably the former, and it may be of any desired length.

Fig. 17.

Splines are flexible strips of wood or metal, and are used for forming curves—regular or variable—and are held in position by a peculiar attachment which serves to hold the curve in position as shown at S S S, Fig. 17. These attachments are made of lead.

The ellipsograph is a costly instrument and one which the ordinary workman would seldom require; besides, there are a number of ways by which an ellipse may be drawn, and figures approaching an ellipse, so I would not advise the young draftsman to purchase the more expensive one until his means or business warranted it. I give an illustration, however, of

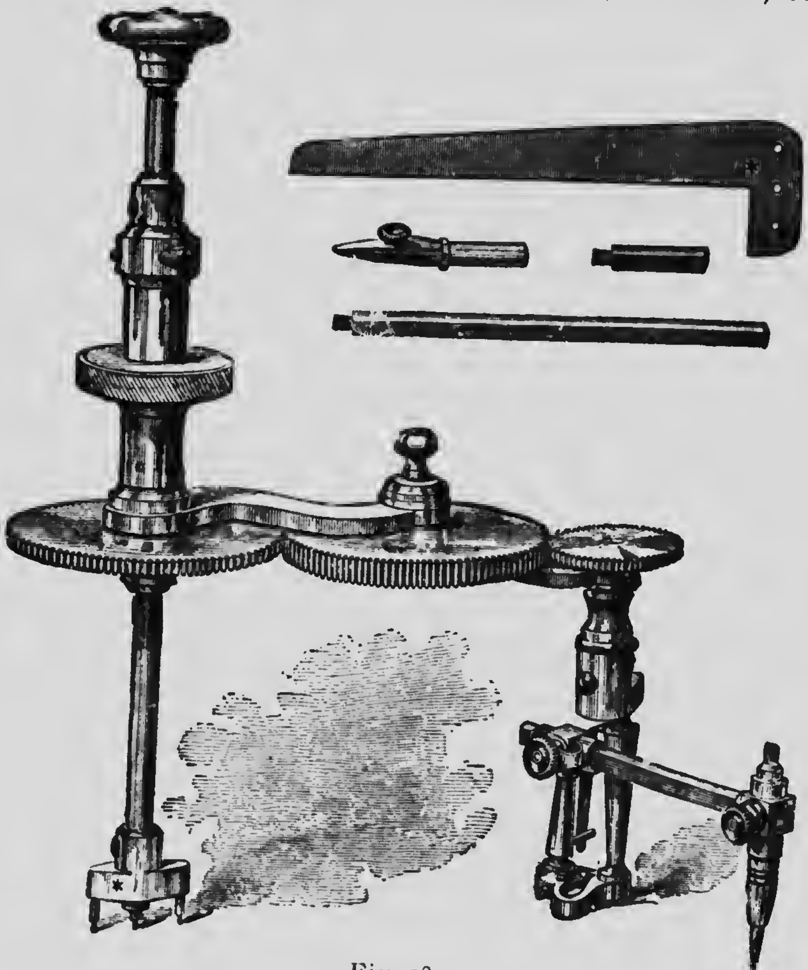


Fig. 18.

Browne's patent ellipsograph in order to acquaint my readers with the style of instrument. This is an excellent device, and can be adjusted to form ellipses or ovals of all kinds within the limits of the instrument. It is shown with some of the attachments at Fig. 18. The price of this device varies from \$9.00 to \$14.00. A very good one may be obtained for about \$12.00.

Apart from the conventional box of instruments, the appliances now described will be about all the young workman will require unless, of course, he intends to study for an architect or mechanical engineer, when, of course, he will have passed beyond the limits of this work which is intended only for such workmen as have no other opportunities of learning the rudiments of draftsmanship.

It will be in order now to say something about the instruments proper the beginner will require, so I will, as briefly as possible, describe the instruments, explain their uses, and offer a few suggestions as to their care and management.

A BOX OF INSTRUMENTS

It is not my province to recommend any particular make of instruments for, so far as I am aware any of, the ordinary makes—that are not intended for school children—will serve the purpose of learning their use, and afterwards, the student, when advanced sufficiently, a more costly and more complete set may be obtained if found necessary. While, of course, purchasing drawing instruments is like purchasing tools, that is, it is always better to buy the very best that can be bought, and I may say that the best may be obtained in single pieces or in boxes containing only three or four pieces. However, perhaps, it is best in our case to get a set similar to the case shown at Fig. 19. This is a Morocco case which contains two dividers, pen and pencil points, drawing pen, and a six inch flat scale. This case can be bought for about $4.00,

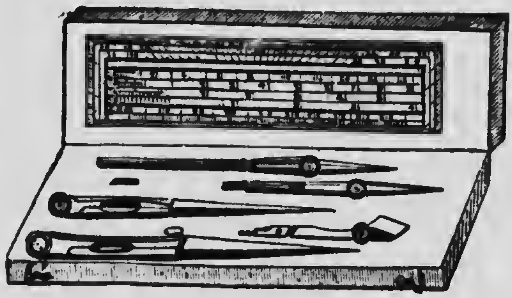


Fig. 19.

for which sum instruments ought to be fairly good; if, however, the student can afford it, and feels that he had better purchase a set of instruments that will meet all his needs, present and future, why then he had better invest in a better quality of goods, and purchase a case containing a greater number of instruments and of a finer grade, such as I show at Fig. 20, which may be obtained for about $20.00 or $25.00. This case contains, besides the box, one 5½ in. dividers, with pen, pencil and needle points, lengthening bar; 3½ in. dividers, with pen, pencil and needle points; 5 in. plain dividers; 5 in. hair spring

Fig. 20.

dividers; spring bow dividers, pen and pencil, needle points, ivory handle; 4½ in. ivory handle hinged drawing pen, needle point; 5½ in. ivory handle hinged drawing pen, needle point; German silver protractor, ebony rule and scale.

These instruments are made of fine German silver with superior steel points.

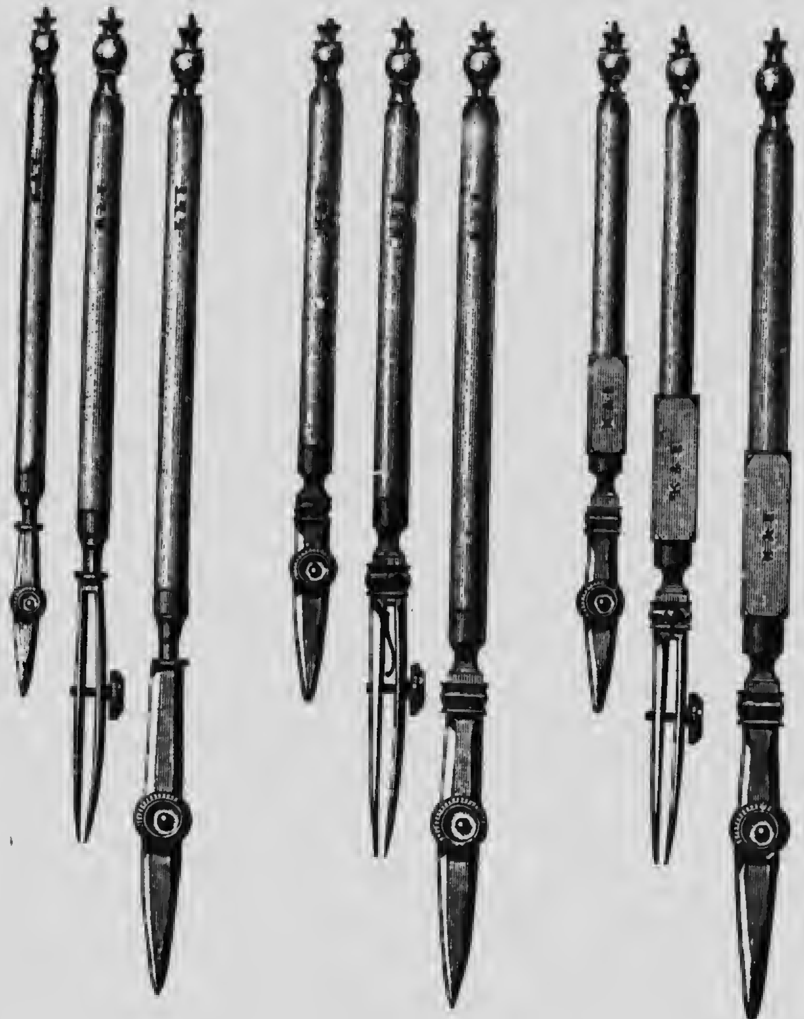


Fig. 21.

Fine Swiss made instruments cost more than German ones, as some of the Swiss cases run up to $150.00 and $175.00. English and American made instruments are high priced, but as a rule are more substantial and in the end give better satisfaction than other makes.

The first things to be considered in a set of instruments are the compasses. These generally include dividers and pen and pencil attachments. It is not necessary to illustrate or describe the form of these instruments, as they may be seen in the case as shown in Fig. 20, and the interchangeable parts will easily find the place they are intended for when required for use; so I will not dwell on the subject of compasses longer.

Perhaps the most important article in the case to the young student is the pen, and I will therefore devote more space to a description of it than I will to any other of the instruments, as a proper knowledge of its use and care will be of great assistance in the work before us.

A DRAWING PEN

This is the most useful and the most used instrument in the case. Fig. 21, which is taken from Keuffel and Esser Co.'s catalogue, shows a variety of pens of the very best make, pens that are suited for any kind of line drawings in ink.

The prices of these, with ivory handles, range from \$1.40 to \$2.50 each, and they are warranted to be the best of their kind.

A few words as to the use and care of this instrument may not be out of place at this juncture, as it is important the instrument should be well understood by the student so that he may the better be able to make the best of it. The man who devotes himself exclusively to any particular vocation, day after day, for several years, acquires an intimate knowledge of its details that is not easily imparted to the novice through the medium of pen and ink, and often when it is attempted, the finer details which contribute so much to success are passed over lightly or are omitted altogether. "In the course of his experience he acquires ways and means of prosecuting his work, if he be intelligent and progressive, which makes its execution easy and places him on the list of "skilled operators."

The art of mechanical drawing contains a few of those mysteries which, if published at all, have not been given a very wide circulation.

Our scientific libraries and dealers in technical works are copiously supplied with books on mechanical drawing, in any of which may be found the illustrations of tools, curves, inks, colors, etc., carefully reproduced from the catalogues of dealers, but the accompanying description does not always give a clear idea of the relative merits of the different tools shown, how they should be selected, handled, and kept in repair, and, while it is not intended in this work to describe the methods of caring for and repairing all the instruments a box contains, it is necessary the pen should have more than a passing notice.

It is a custom with many makers of first-class instruments to hinge one jaw of the ruling pen to the little separating block above the adjusting screw, so that it may be opened after the adjusting screw is removed. In a pen of this kind the joint should be very snug, as the least amount of play will allow the point of one jaw to slip ahead of the other, which would destroy the efficiency of the pen. In the opinion of the writer this joint is altogether unnecessary. It increases the first cost as well as complicates the instrument, and if used often, will get out of order, even with the very best workmanship. If used properly the points need never be separated further than the adjusting screw will permit. Many draftsmen have the hinge joint brazed or soldered so as to fix the movable jaw to the separating block and make it permanent. The points of a pen should never be separated for sharpening, which is the only purpose for which the hinge is made. When the point has become dull from use it will be found with a shape similar to Fig. 22. To restore it to the proper form the jaws should be closed by the adjusting screw, so that the points press gently against each other; then with a fine oilstone worked with a circular motion on the high corners it should be ground to a shape similar to Fig. 23. The point will then be blunt, but will have the proper working when the sides are reduced, which should be carefully done by laying the side of the pen on the stone at an angle with its surface that will allow the metal to be ground in a straight line to a distance of about one quarter of an inch from the point. The jaws should be opened frequently as the work progresses and the points examined to avoid grinding through the point of one jaw into that of the other. The sides are to be reduced till the points of each jaw are equal and just fine enough to slide smoothly over the paper without producing a

Fig. 22.

Fig. 23.

cutting or scratching sensation. When the points are not sharp enough to make a clean fine line the blunt part is easily visible with the naked eye, but when it is sufficiently reduced it is hardly possible to see it. The shape of the curves in the sides, or jaws, of a pen is also an important feature. If the pen is too open near the point on account of the jaws being too much curved, as in Fig. 24, it will leave too much space for ink, causing it to dry quickly or to fall out in using. Fig. 25 shows about the proper amount of curve in the jaws to give sufficient ink space.

Fig. 24.

Wooden handles, though not quite as elegant as bone, are preferable as they are not liable to break when accidentally swept off the drawing-board—an accident that destroys nine-tenths of the bone handles.

Fig. 25.

For spring bow pens and pencil compasses it is advisable to have on the adjusting screw, when the pen or pencil is set to draw its largest circle. With a pen that is not too strong spring an experienced draftsma his centers to draw a s the circle, as this may be easily accomplished by springing the pen gently toward the side to be shaded, as he continues the movement of drawing the circle. The pivot, or needle point, should always be adjustable. When it is made solid with the leg of the instrument it is generally shaped like the point of a sewing needle, and will pierce a large hole through the paper or tracing cloth with the slightest pressure if used several times in the same center; and should a small piece be broken off the point, the pen will be useless unless a similar length be ground off the nibs of the pen.

A very common source of annoyance in nearly all bow pens and pencil compasses is found in the eye or socket provided for the pencil. In many cases it is found too large to hold the ordinary naked lead, and too small for those covered with wood. Frequently draftsmen are obliged to overcome this difficulty by the clumsy makeshift of reducing the wood till it fits the socket.

Sometimes a small bushing is provided with the compass, that will fit in the eye and hold the lead. This is unsatisfactory, as the pencil cannot be readily adjusted as the point wears away. The most effective treatment an instrument of this kind can have is to file away the metal in the parting or "split" of the socket and close in its sides so as to reduce the eye sufficiently to grasp the hexagon lead of a 6H pencil; this makes the pencil-holder very convenient as well as economical, the butts of worn pencils may be stripped of their wood and the leads used in the compasses.

So much for the pen in its various forms; and now a few words concerning some of the other instruments. Among these may be found some possessing various degrees of usefulness, and others having no merit whatever. Some of the devices that have been invented for making broken or dotted lines may be classed among the latter. The proportional compasses or dividers is a very good tool to have in stock, but it should never be used for transferring drawings from one scale to another when accuracy is required; not only is the instrument liable to be in error, but if there should be any mistakes in measurement in the original drawing they will be transferred to the new in a greater degree.

A much more effective and convenient pointer than that usually found in sets of instruments may be made on the one end of a 6H pencil by reducing it to a fine point. The dot or point left by it, indicating the dimension, is always easily found, and, as the other end of the pencil may be made "chisel shaped" or flat for drawing lines, the operation of laying off dimensions and drawing the lines may be carried on without changing tools or losing time. For sharpening pencils, it is very convenient to have a fine file, attached by a string to the under side of the drawing board, or what is still better, as the file very soon gets dull, a piece of wood made about the shape of a small flat file with a piece of emery cloth glued to each side. In using, the pencil should be rubbed on the emery.

The boxwood scale with triangular section, same as shown at Fig. 14, has served its purpose well, but it, too, has its weak points. The requirements of a good scale are that the graduations and figures shall be plain and indelible, that it be perfectly straight and the edges sharp, so that the division lines may be brought close to the paper. The boxwood scale does not possess the first of these features as the lines will be often dimmed or partially obliterated with two or three years' use.

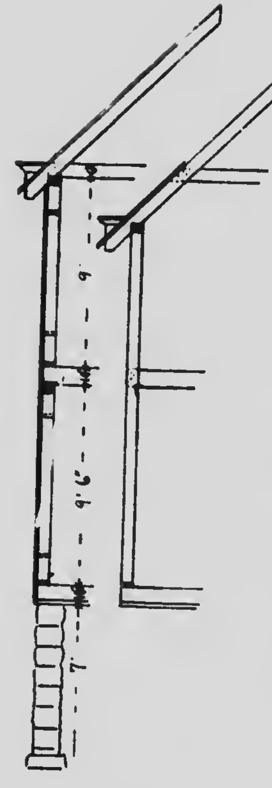
Some draftsmen have a habit of taking off dimensions by placing one leg of the dividers on any particular division and extending the other to the distance required. When this is done with a boxwood scale its usefulness is limited to a very short time. The grain of the wood must be straight, or it will be apt to warp or spring. Some excellent scales are made of hardened steel, by a firm in Providence, R. I., which seem to me to be as near perfection as possible. Draftsmen as a rule, however, object to making use of steel scales, and they have not come into general use; and for this reason, these scales, we are informed, cannot be obtained unless specially ordered at the factory.

Every metallic instrument the draftsman uses should, when possible, be nickel-plated. There is nothing contributes so much to their preservation, no amount of careful polishing and wiping will so effectually prevent rusting and discoloring, and nothing improves their appearance so much or makes them so agreeable to handle. The cost of plating is insignificant compared with the benefit derived; as the average cost of plating would not exceed ten cents for each tool or instrument.

In selecting triangles it is essential to have them of a material that will not change shape with each atmospheric disturbance. For a number of reasons hard rubber is the best that

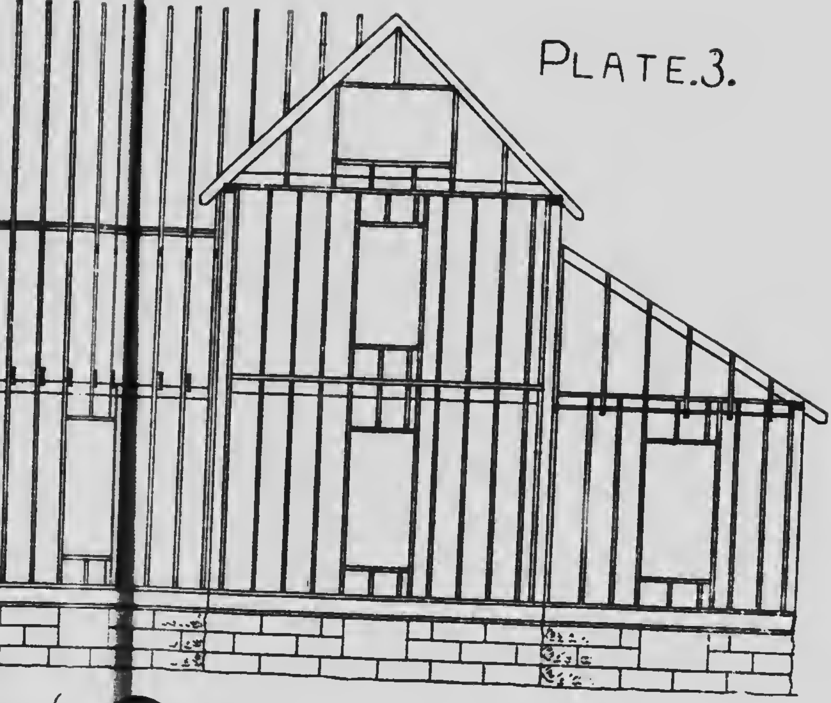
PLATE 3.

On this Plate I show the side frame of the small cottage with all the openings for windows, also two sections of the framework, with the heights marked on for the different stories and sizes of timbers. The stonework and cellar windows are shown.



SKELETON

PLATE.3.



ON FRAME

has been offered to the trade. It is unchangeable, under ordinary conditions, and may be made into angles from $\frac{1}{16}$ to $\frac{3}{32}$ of an inch thick, which is about right for handiness and strength. There are very few woods that are adapted to this purpose, because of their liability to warp and twist, and generally they have to be made too thick for convenient use. The same rule holds good in the selection of a T-square; the blade should be as stiff as possible and the edges not more than $\frac{1}{8}$ of an inch thick; when the edges are thicker it is difficult to draw long parallel lines, particularly with the pen, as the point of contact between the pen and the blade of square is on the upper corner, while the position of the point, when the pen is held vertically, must be the same distance from the lower corner of the edge of the blade on account of the angle formed between the side of the pen and the edge of the blade. On the other hand, it is not advisable to have the edge less than $\frac{1}{16}$ of an inch thick; this would bring the point of contact too close to the point of the pen and would render it liable to smear the ink. An excellent T-square patented some time ago has a thin piece of brass plate with a knife-edge inserted in the working edge of the blade. This does very well when only a pencil is used, but a pen cannot be worked successfully against so thin an edge. A blade made of two different kinds of wood similar to that shown in Fig. 12, such as a mahogany center and ebony edges, while being excellent in their way, are liable to warp and "buckle" and require watching. Squares with swivel butts are very convenient for certain kinds of work, but for general purposes and for such students as this book is intended, the swivel stock had better be eschewed. It is much more convenient to have the blade secured to the stock as shown at A and C, Fig. 8, than to have it dovetailed or mortised into the stock as shown at B, Fig. 8. By this means the upper surface of the stock is on the same level as the drawing-board and does not interfere with the angles or scales when working near it.

Perhaps the most troublesome appendage to a draftsman's outfit is found in the many forms of porcelain ink saucers and "piles." For holding and mixing soft colors the pile of saucers does very well, but it takes a long time to rub ink by this method before a good black ink is produced as the smooth bottom of these dishes does not abrade the stick of ink rapidly. There are several preparations of liquid ink that may be purchased, but they lack that solid black body in fine lines that is so necessary for drawings or tracings that have to be copied by the blue printing process. Prepared liquid ink requires a longer time to dry and is more liable to smear than ink made fresh from the stick. There is an ink saucer made by a firm in New York City that seems to meet all requirements. It is simply a slab of slate about four inches square and three-fourths of an inch thick, having a cup or saucer shaped cavity for holding the ink turned in its center, and covered over with a piece of plate glass. A good black ink may be mixed in this saucer in a few minutes by the grinding action of the slate on the stick when being rubbed. While it is quite necessary to have the ink with some "body" in it, it is not best to make it too thick, as it will not flow well then, and will be apt to dry too quickly and clog up the pen.

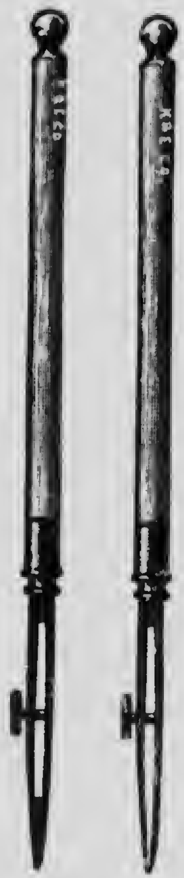


Fig. 26.

When the ink is ready to use, a portion of it may be inserted between the nibs of the pen until there is about as much ink in the pen as shown by the shaded part in Fig. 26, where two pens are shown, one charged and one empty. The ink may be put in the pen by the aid of a

Fig 27.

camel hair or sable brush, such as shown in Fig. 27, which is full size. Clean off all superfluous ink from the outside of the nibs of the pen with a piece of chamois leather or a clean linen cloth, and you are ready for work. The pen may be filled by another method which is often adopted by draftsmen, as follows: Take the pen and open it, say, about a sixteenth of an inch, clean the nibs well with chamois, then close the pen with the screw until the light just shows

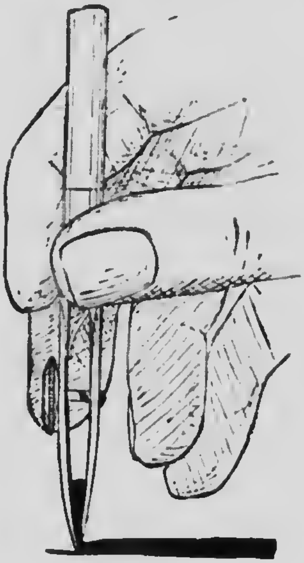


Fig. 28.

between the nibs, then breathe gently between the nibs and dip them carefully into the ink, just touching the surface of the liquid, and the ink will run up between the nibs by attraction of the moisture caused by the breath on the inside of the nibs.

We suppose the paper to be stretched on the drawing board, and either held in place by being pasted or by thumb tacks, such as shown in Figs. 4 and 5. When all is ready, hold the pen as shown in Fig. 28, and carefully ink in all the

Fig. 29.

horizontal lines, both full and dotted, correcting where possible any slight irregularities that may have been made in pencilling. In drawing the graduated lines, Fig. 29, begin with the thinnest, then with the middle finger, as shown in Fig. 28, turn the screw of the pen back, say, about a quarter of a revolution for each of the others, the last opening being about the right thickness for the border line. As the border line takes longer to dry it is very easy to smear, but of course this may be avoided by letting the ink dry while preparing the ink-leg for the compasses. It is well to practice this method of drawing lines a number of times until a certain amount of perfection is attained.

In drawing circles, care must be taken in holding the compasses in order to get an even

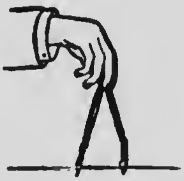


Fig. 30.

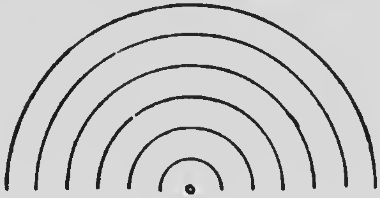


Fig. 31.

thickness of lines, and the pen should always stand vertically over the work, as shown in Fig. 30. When a number of circles drawn from a common center is necessary, as shown in Fig. 31, be sure to draw the outside, or the one having

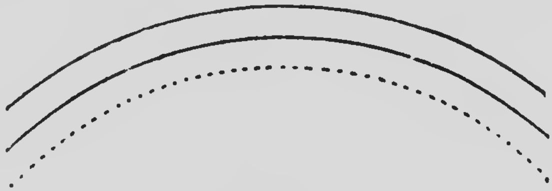


Fig. 32.

the greatest radius, first, when the other circles may follow in regular order. The sharp curves as shown in Fig. 31 are always the most difficult to draw correctly, while the flat curves, or curves with greater radius, are, within certain limits, much easier to describe. The curves shown at Fig. 32 are flat ones, and well within the range of the ordinary compass. The inner curve is "dotted" and to form this without a dotting pen, with any degree of regularity, requires considerable care and practice, but it is much better to make all dotted lines with the ordinary pen, than to make use of a dotting pen, which to a new beginner is generally a source of

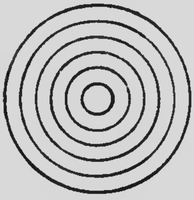


Fig. 33.

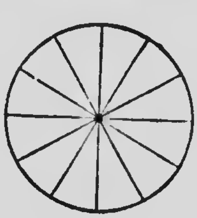


Fig. 34.

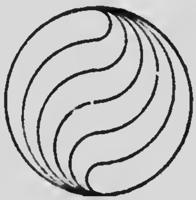


Fig. 35.

trouble and disappointment. The examples of circles shown at Figs. 33, 34 and 35 offer good practice in curve drawing with the compasses. Before drawing them, however, it will be best to draw a pair of center lines for each circle, cutting each other at right angles in the center, and it is a good rule never to draw a circle under any circumstances without having two center lines to mark its proper situation. In the first circle, Fig, 33, mark off points one quarter of an inch apart along one of the diameters from the circumference to the center, and then describe the concentric circles with the compasses, taking care not to bore a large hole through the paper with the point. The compasses, if properly sharpened, should barely penetrate the paper and leave no impression on the board.

To fill up the middle circle, Fig. 34, set the compasses to the radius, and then, putting the point at the intersection of one of the center lines with the circumference, mark across the circumference on each side; do the same at each intersection of the center line with circumference, and it will be found that the circumference is then divided into twelve equal parts. Now join each opposite joint by a line passing through the center and the figure will be complete.

The last figure to be drawn, Fig. 35, is the most difficult, but has the best effect, so it is worth taking some pains over. Draw the two center lines, put in the large circles and divide the horizontal diameter into ¼ in. spaces. Take the small compass, set it to ¼ in. radius, and then put in the smallest semicircle on each side. Then set it to ½ in. radius, and put in the next semicircle; then to ¾ in. radius for the next two semicircles, which should exactly meet at the center. Now to 1 in. radius, and, lastly to 1¼ in. radius, checking the curves before actually drawing them, by seeing how they fit with those already drawn.

Here is an example, Fig. 36, made up altogether with curved lines and which offers good practice. This requires accurate division and correct draftsmanship.

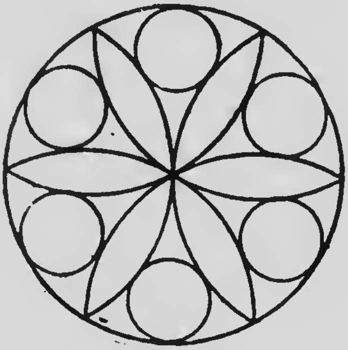


Fig. 36.

A few practical examples of the use of curves are shown in the following figures: Fig. 37 shows a scheme by which an ornament may be constructed where all the

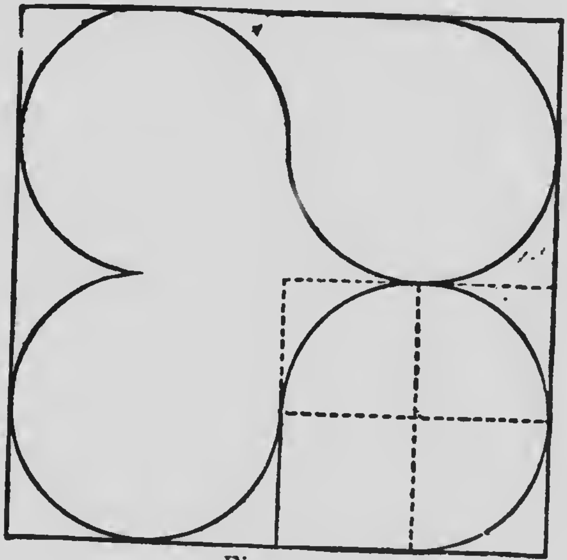


Fig. 37.

curves are drawn with one radius. The manner of getting the centers is shown by the dotted lines. Figs. 38 and 39 exhibit another combination of curves which is easy to draw. To make Fig. 39 is perhaps the easiest of them all, as it is formed of curves drawn with one point of the

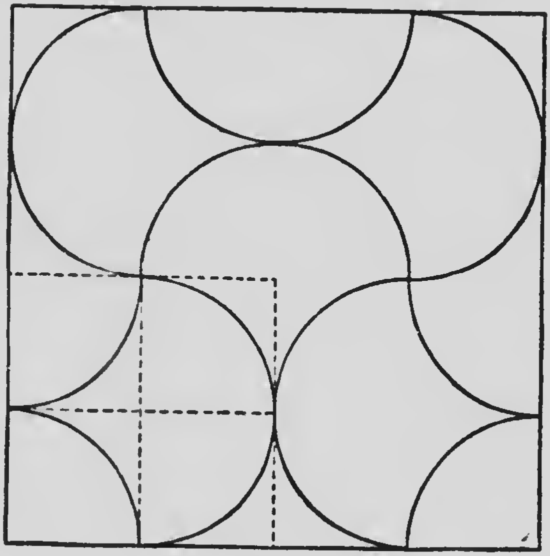


Fig. 38.

compass resting on one corner of each of the smaller squares which are shown by the dotted lines.

The three examples shown in Figs. 40, 41, and 42 are a little more difficult to draw than the previous ones. Fig. 40 may be termed a trefoil ornament, as the central divisions are drawn from the three points of an equilateral triangle, which is shown by the dotted lines. This style

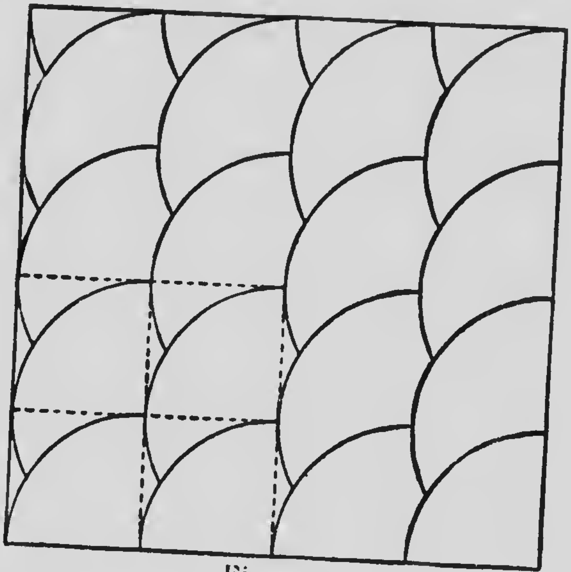


Fig. 39.

of an ornament is in frequent use in church work as the triangle is supposed to be symbolic of the Trinity. The student should copy this often enough so that

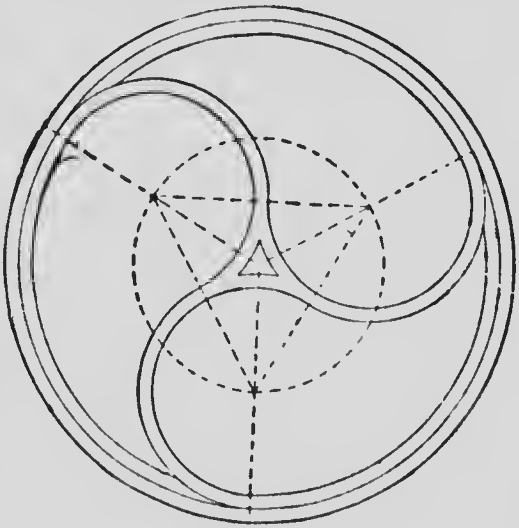


Fig. 40.

he can draw or describe it from memory alone.

Fig. 41 is simple enough when the principle is understood. The circles inside are drawn from

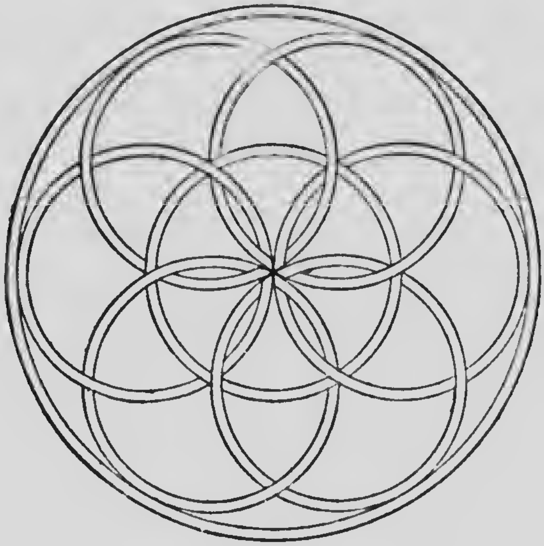


Fig. 41.

six centers, or from the six points of a hexagon. Care must be taken not to cross the lines at the intersections of the circles, when such crossings are not intended. This will give good practice.

Fig. 42 is somewhat complicated, but it is surmised that no trouble will be found in the formation of the ornament; at least, there ought not to be, if the student has been mindful of what has gone before.

There are many situations in which a curved line is required that calls for more or less skill to properly adjust to the purpose, and in order to arm the student with the proper knowledge to find centers for this purpose, the following problem is laid before him: Suppose we have three points that are not in a straight line, as ABC, Fig. 43, through which we want to draw a portion of a circle. Let BHC be a chord of the segment H, and BJA a chord enclosing the segment. Bisect or divide in equal parts the chord BC at H, and square down from this point to D. Do the same with the chord AJB, squaring over from J to D, then the point where JD and HD intersect will be the center of the circle.

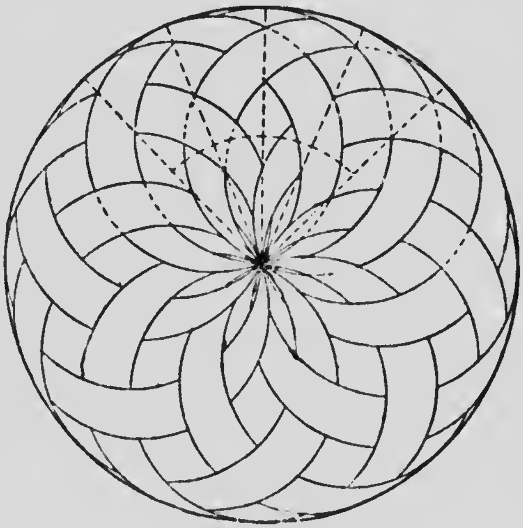


Fig. 42.

This is a very important problem, and will be found useful in many ways.

The same result may be obtained by the use of the compasses alone as may be seen as follows:

Suppose AB, Fig. 44, to be the curve, from the point A and B strike arcs of equal radius inter-

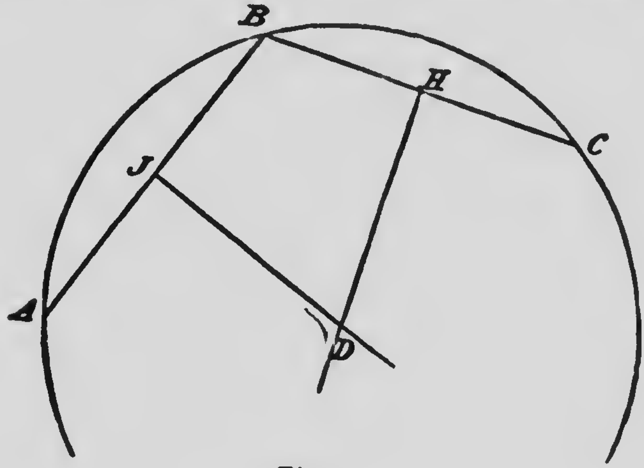


Fig. 43.

secting at *c* and *d*, and draw a line through the intersections cutting the arc at *e*. This line will pass through the center. Then from points *c* and *b*, with a rather shorter radius, strike arcs intersecting at *f* and *g*, draw a line through these intersections, and where the previous line is cut will be the center as shown at *h*.

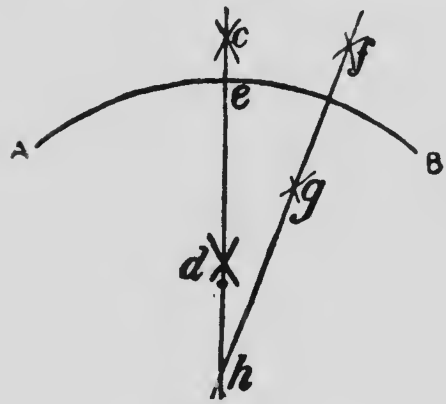


Fig. 44.

A practical application of this example may be used on Fig. 45, where it is desired to round off a corner as shown at BAC. The center of the curve is shown at O, from which the curve is struck.

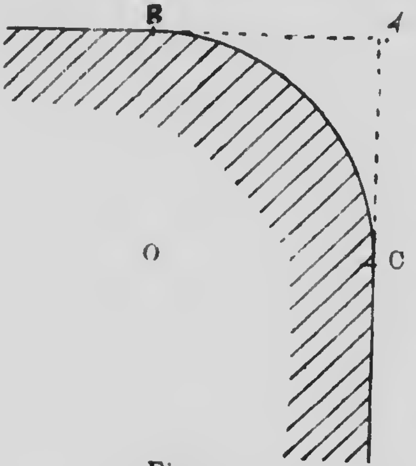


Fig. 45.

Fig. 46 shows the method just described applied to three straight lines forming two right angles and having two adjacent corners rounded.

Fig. 47 shows how to deal with two parallel lines that are to be joined tangentially by a semicircle. In this case bisect the space between the two lines by a perpendicular line that must contain the center of the circle from

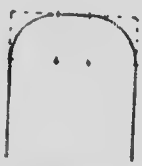


Fig. 46.

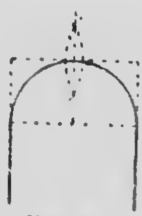


Fig. 47.

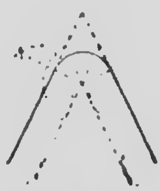


Fig. 48.


Fig. 49.

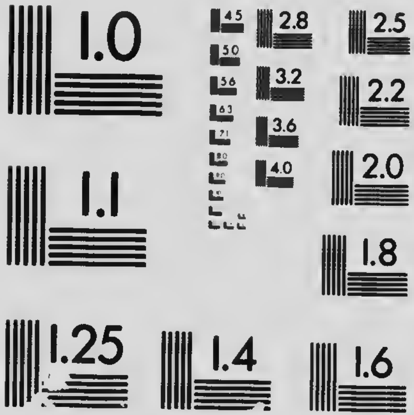
which the required circle is drawn. Determine the extreme position of the curve and mark from it, along the center line, a distance equal to half the distance between the lines, and this mark

PLATE 4.

This plate shows the disposition of the joists in first and second stories, also the position of rafters and ridges on the roof. These sketches show the trimmers for fireplace and stairs. The manner of drawing is very simple and should offer no difficulties to the student.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



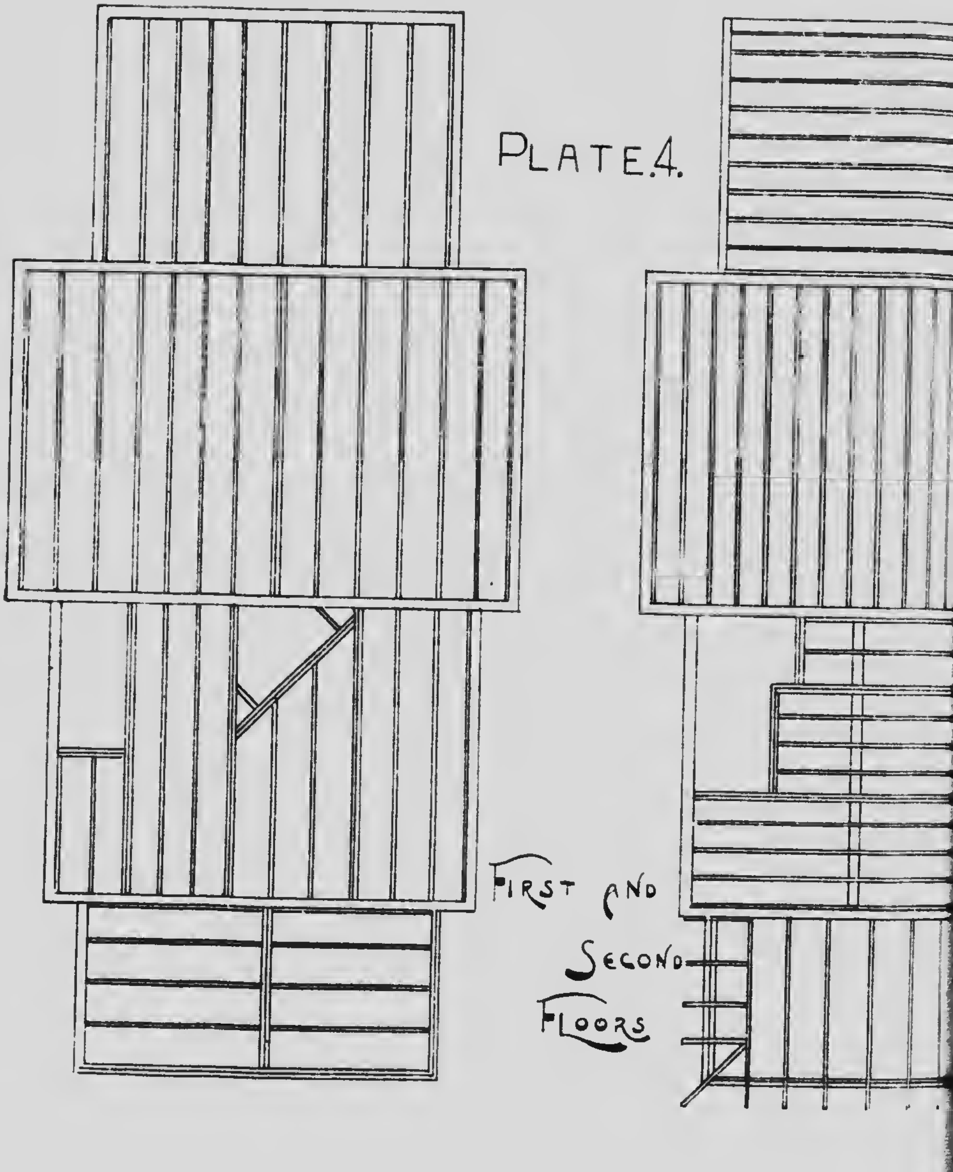
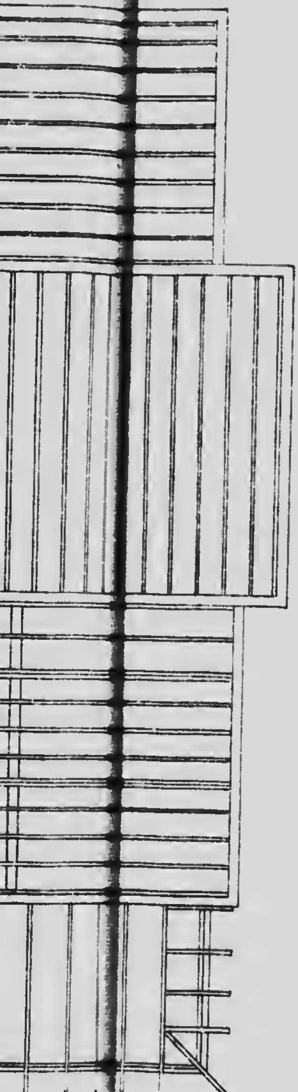
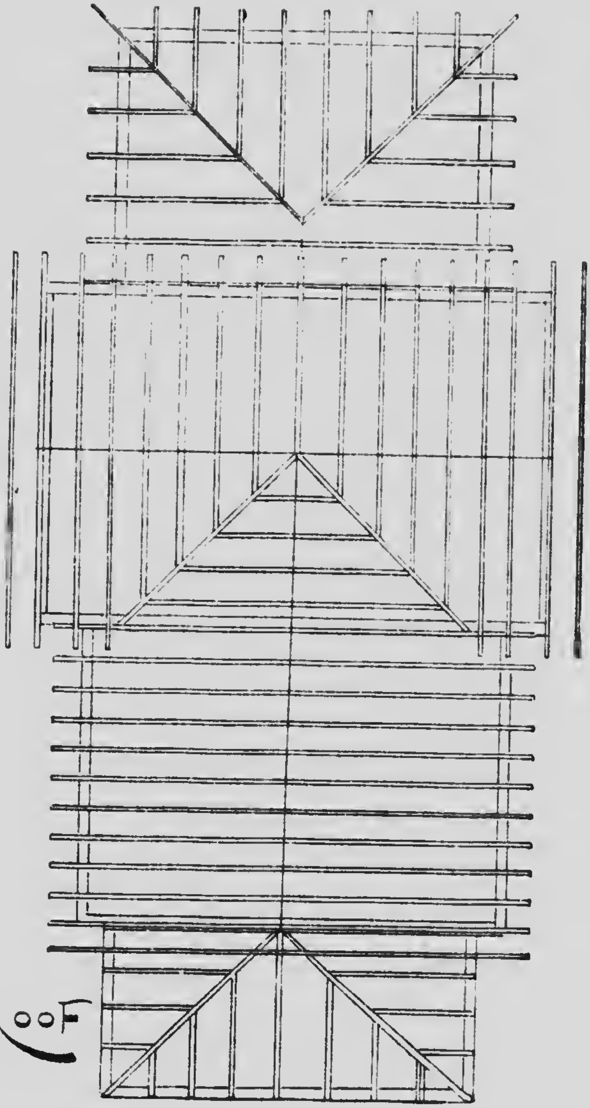


PLATE 4.





ROOF

will be the center of the required circle. The example shown at Fig. 48 is a little more difficult to deal with, as in this figure the lines which it is desired to join by a curve, are not at right angles. Therefore inside these, and at a distance from them equal to the radius of the curve which it is desired to use, draw two parallel lines. To do this, take the radius in the compasses and strike two arcs at some distance apart along the inside of each line. Tangent to these draw the two inner straight lines shown dotted, and their intersection will give the center required. The exact points of junction of the straight lines with the curve can be found by drawing perpendiculars from the center to the straight lines by the method shown on the left hand side of Fig. 48.

The illustration, Fig. 49, on the left side, is exactly similar to Fig. 48 with the exception that it represents a sharper angle than that shown by the angle or corner of the previous example.

At Fig. 50 is shown a method of joining a curve to a straight line by a smaller curve. In this example, after drawing the given straight line and circle, set the compasses to the required radius, and from any point in the circumference of the circle describe a short arc outside it.

From the center of the circle draw a straight line through this last point, and its intersection with the arc will give the radius of an arc concentric with the large circle, which must be drawn towards the given line. Then, with the required radius, again set off arcs from the given line to give a parallel line, as in Figs. 47 and 48. The intersection of this parallel line with the larger arc will give the center to use for the connecting

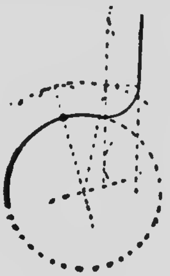


Fig. 50.

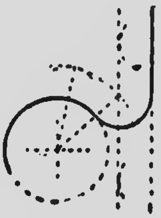


Fig. 51.

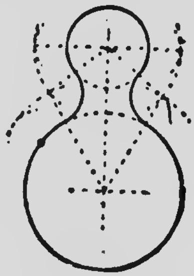


Fig. 52.

curve. In every case it will be observed that the perpendicular line from the center of the junction curve to the line, or the line joining the centers of the two curves, will give the exact termination of the junction curve.

Fig. 51 is practically the same as Fig. 49 with different radii.

Fig. 52 shows two circles of different size joined by two curves of equal radii set off upon the same principle as Figs. 50 and 51.

Fig. 53 shows a straight line cutting a circle and joined by small curves on the inside. After drawing the circle and straight line, take the required radius of connecting curve and draw a short arc on the inside of large curve—say, on the center line—and from the main center draw an arc concentric with the large circle, but inside it. Then, with the required radius, obtain a line parallel to the given line, and the intersections

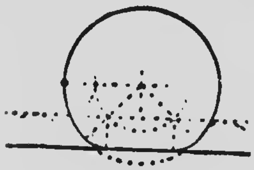


Fig. 53.

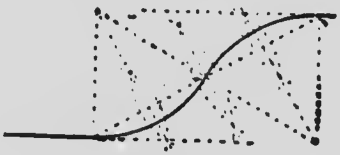


Fig. 54.

of this parallel line with the large arc will give the centers for the connecting curves.

Fig. 54 shows two given parallel straight lines which are to be joined by an ogee or reversed curve. Select a point on one of the lines from which the curves may start, draw a horizontal line and also an inclined line, making an angle of 60 degrees with it. The latter line produced to cut the other given straight line will mark the termination of the curves. Bisect this inclined line, and it will give the junction point between the two curves. Bisect each half of the inclined line and produce the bisection to meet the horizontal lines, to give the centers for the curves. Before drawing the curves, join these centers, to see that a straight line will pass exactly through the junction of the two curves, and then put in the curves with a radius equal to half the length of the inclined line. This is a very useful curve, and is similar to those used for cross-over roads on railways. In architecture the best curves are produced from conic sections or freehand. Circular curves have a harsh appearance. There are nevertheless, many cases where they are necessary or desirable.

The draftsman will often be called upon to describe mouldings of various kinds, and it is proper he should know how to form these so that they may accord with the style for which they are intended whether this be Greek, Roman, or otherwise. The following examples are old, but are of a kind that will always be in vogue and it is but fitting the young student and workman should know how to draw them correctly.

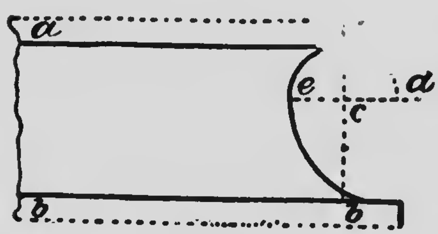


Fig. 55.

The example shown at Fig. 55 is a Scotia or cove and is drawn as follows: Divide *a, b* into three equal parts; with *c* as a center and the radius *c, a*, describe the semi-circle *e, a, d*. Then with *d* as a center and *d, e* as radius, describe the quadrant *e, b*, then *a, c, b*, will form the line of moulding.

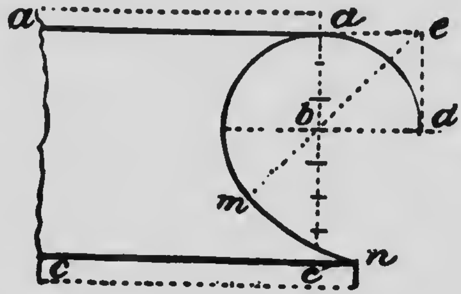


Fig. 56.

Fig. 56 shows another method of getting a deeper moulding. Let *a, a*, be the upper line and *c, c*, the lower; from *a*, drop a perpendicular to *c*; divide *a, c*, into seven equal parts; through the third of these, from *a*, draw a line parallel to *a, a*; from *b*, with *b, a*, draw the semicircle *b, d*, and from *d*, draw to *e*, perpendicular to *b, d*; produce *a, a*, to *e*; from *e*, as a center,

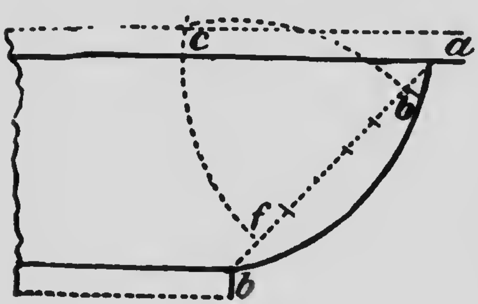


Fig. 57.

r, with *e, m*, as radius, describe part of a circle to *n*.

Fig. 57 shows an "echinus," or "ovolo." This is one of the most useful of mouldings, and was employed largely by the Greeks in many positions. Let *a, b* be the two points; join them by a line *a, b*; divide this into seven equal parts; from *b*, with *b, c*, and from *a*, with he same radius, describe arcs cutting in *c*; from *c*, with *c, a*, describe the arc *a, b*. Another method of describing an ovolo is shown at Fig. 58. Let *a, b*, and *c, d*, be the two horizontal lines of the figure. Divide *b, d*, into four equal parts; make *d, e*, equal three of these; draw *e, f*; then with any radius greater than half of *d, f*, with *d*, and *f* as centers respectively,

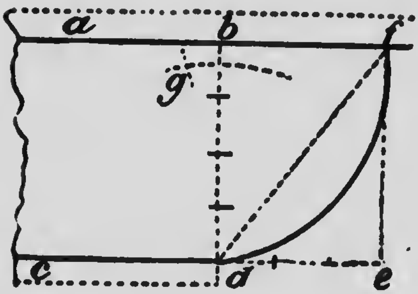


Fig. 58.

describe the arc, cutting at *g*, from which, as a center, describe the arc, *d*, *f*.

At Fig. 59 I show a moulding called a "quirked ovolo." The projection in this case is made equal to five-sevenths of its height, as seen by the divisions, and the radius of the circle *b, c*, is made equal to two of the divisions, but other proportions may be taken. Describe the circle *b, c*, forming the upper part of the contour, and from the point *g*, draw *g, h*, to form a tangent to the lower part of the curve. Draw *g, a,* perpendicularly to *g, h,* and make *g, f,* equal to the radius *d, c,* of the circle *b, c;* join *f,*

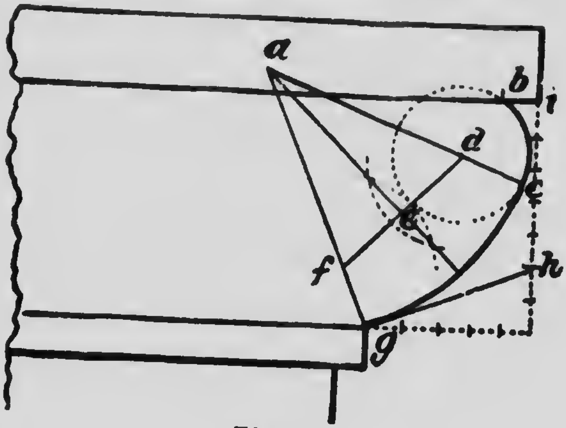


Fig. 59.

d, by a straight line, which bisect by a line perpendicular to it, meeting *g, a,* in *a;* join *a, d,* and

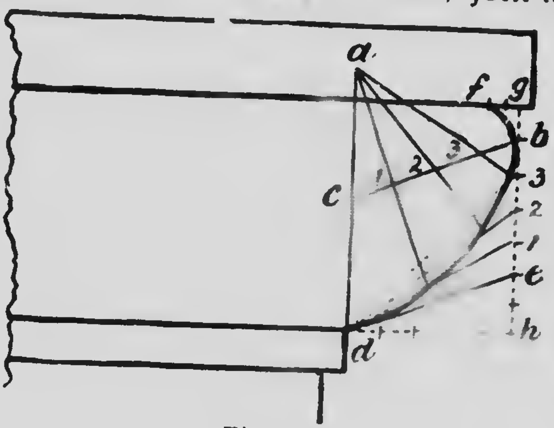


Fig. 60.

produce the line to *c.* Then from *a,* a center, with the radius *a, c,* or *a, g,* describe the ve g.

Fig. 60 is a method where the tang d,

and the projections are given. Through the point of extreme projection b, draw the vertical line g, h, and through b, draw b, c, parallel to g, h, and produce it to a, making c, a, equal to c, d. Divide e, b, and c, b, each into the same number

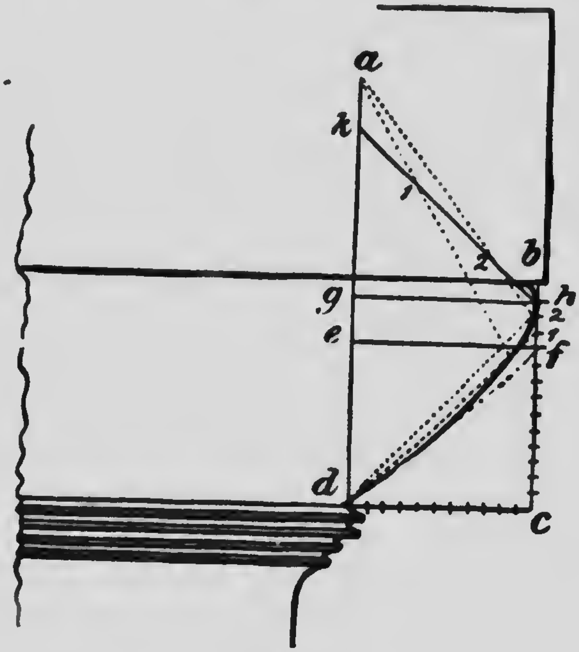


Fig. 61.

of equal parts, and through the points of division in e, b, draw from a, straight lines, and through the points of division in c, b, draw from d, right lines, cutting those drawn from a. The intersections will be the points through which the curve is traced.

In Fig. 61 I exhibit a method of describing the hyperbolic ovolo of the Grecian Doric capital, the tangent *a*, *c*, and projection *b* being given. Draw *d*, *e*, *g*, *k*, *a*, perpendicular to the horizon and draw *g*, *h*, and *e*, *f*, at right angles to *d*, *e*, *g*, *k*, *a*. Make *g*, *a* equal to *g*, *d*, and *e*, *k* equal to *d*, *e*; join *h*, *k*. Divide *h*, *k* and *f*, *h* into the same number of parts, and draw lines from *a*, through the divisions of *k*, *h*, and lines from *d* through the divisions of *f*, *h*, and their intersections are points in the curve.

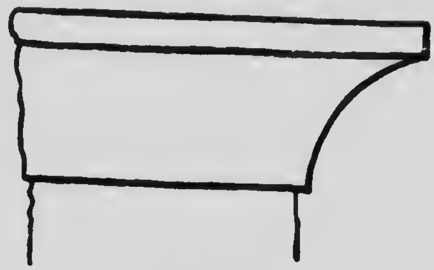


Fig. 62.

In Figs. 62 and 63 I show a cove or "cavetto" mould. To describe it let *ab*, *cd*, Fig. 63, be the lines at top and bottom. From *b*, draw to *d*, perpendicular to *a*, *b*; divide *bd* into three equal parts; from *d*, lay on *dc* to *e* equal to two of these parts; join *be*, from *e* and *b*, with radius greater than half *eb*, draw arcs cutting in *f*; from *f*, with *f*, *b*, draw the arc *be*.

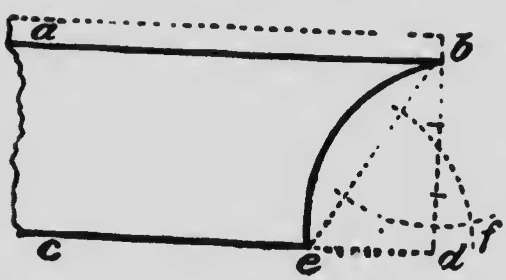


Fig. 63.

Another method of describing this moulding is shown at Fig. 64. *ab* and *cd*, are the two lines, divide the perpendicular into five equal parts, make *de* equal to five of these and proceed as in the last example.

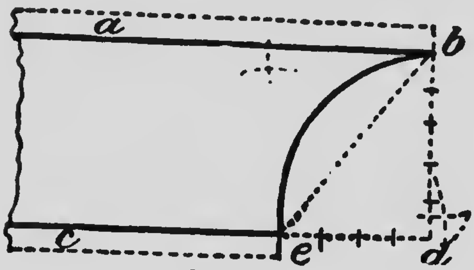


Fig. 64.

The next example is the *cyma recta* moulding. This is considered the most beautiful of mouldings; and this figure is the simplest form, and is easily described; *ab*, and *cd*, Fig. 65, are top and bottom lines of the moulding, *bc* the height and *dc* the projection. Divide the line *d*, 167*nb* into twelve equal parts; take six of these parts as radius, with *b* and 6 as centers, describe the arcs

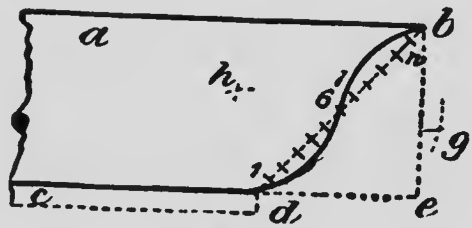


Fig. 65.

g, with 8 as a center, and the same radius, describe the arc 67*b*, then with 1 and 6 as centers describe the arcs at *h*, with *h* as a center, describe the arc *d*, 6.

Fig. 66 shows a *cyma recta* formed by two opposite curves, shown by the use of ordinates. By taking a greater number of points than shown, as centers, the figure will resemble an elliptical curve. The manner of drawing the curves is shown on the diagram and may be easily followed.

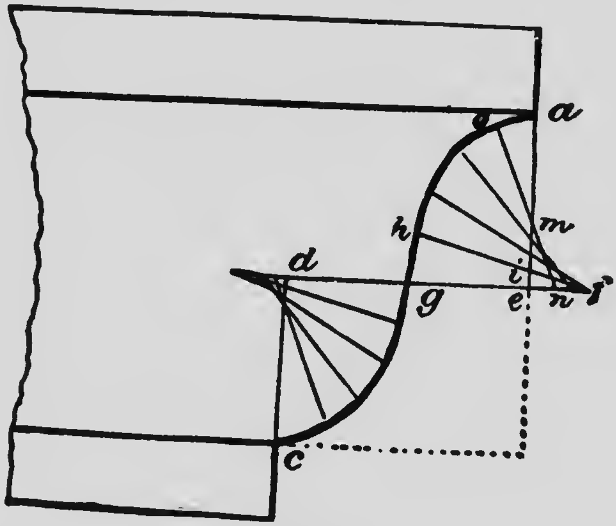


Fig. 66.

Fig. 67 shows a *cyma recta* formed with true elliptical quadrants. These curves may be obtained by following the lines in the diagram, or by any of the methods given for obtaining elliptical curves. This moulding can best be described by the use of a trammel, an instrument I will describe later on; or the curve may be obtained by the use of the ellipsograph, shown in Fig. 18.

These examples will fully suffice to give the learner good practice on circular curves, as by a combination of these, nearly every form of moulding may be made. A few words on elliptical and some of the higher curves may not be amiss, but I do not think it wise to over-

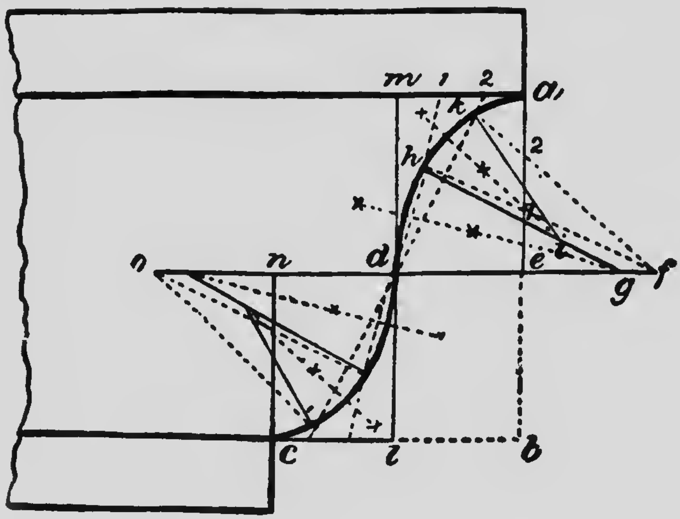


Fig. 67.

burden this work with examples and instructions that the ordinary draftsman or workman may never be called upon to make use of.

One of the simplest methods of forming an ellipse is by the aid of two pins, a string and a lead pencil as shown at Fig. 68. Suppose F B to be the major or longest axis, or diameter, and D C the minor or shorter axis or diameter, and E and K the two foci. These two points are obtained by taking the half of the major axis A B or F A on the compasses, and, standing one point at D, cut the points E and K on the line F B, and at these points insert the pins at E and K as shown. Take a string as shown by the dotted lines and tie to the pins at K, then stand

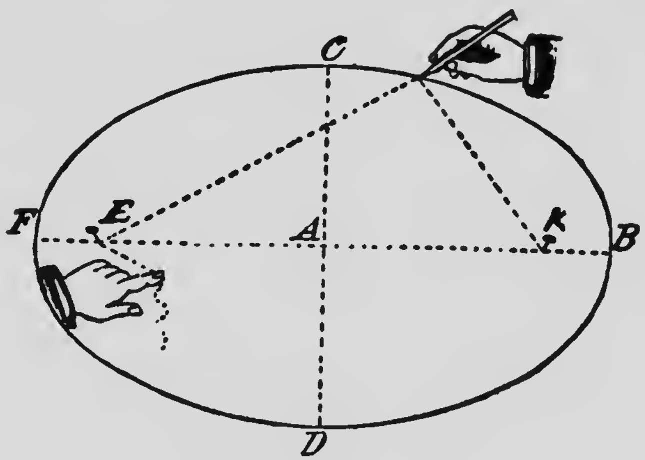


Fig. 68.

the pencil at C and run the string round it and carry the string to the pin E, holding it tight and winding it once or twice round the pin, and then holding the string with the finger. Run the pencil around, keeping the loop of the string on the pencil, and it will guide the latter in the formation of the curve as shown. When one-half of the ellipse is formed, the string may be used for the other half, commencing the curve at F or B, as the case may be. This is commonly called "a gardener's oval," because gardeners make use of it for forming ornamental beds for flowers, or in making curves for walks, etc., etc. This method of forming the curve is based on the well-known property of the ellipse that the sum of any two lines drawn from the foci to their circumference is the same.

The illustration shown at Fig. 69 shows a trammel and the method of using it which is very simple. The instrument consists of two principal parts, the fixed part in the form of a cross as C D, A B, and the movable tracer H G. The fixed piece is made of two triangular bars or pieces of wood of equal thickness, joined together so as to be in the same plane. On one side of the frame when made, is a groove forming a right-angled cross; the groove is shown. In this groove, two studs are fitted to slide easily. These studs are to carry the tracer and guide it on proper lines. The tracer may have a sliding stud on the end to carry a lead-pencil, or it may have a number of small holes passed

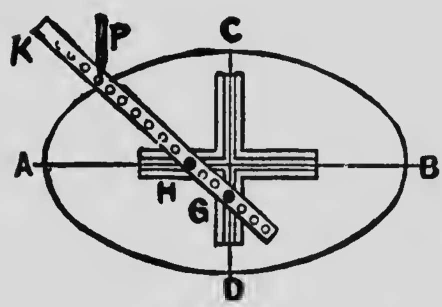


Fig. 69.

through it, as shown in the cut, to carry the pencil. To draw an ellipse with this instrument, we measure off half the distance of the major axis from the pencil to the stud G, and half the minor axis from the pencil point to the stud F, then swing the tracer round, and the pencil will describe the ellipse required. The studs have little projections on their tops, that fit easily into the holes in the tracer, but this may be done away with, and two brad-awls or pins may be thrust through the tracer and into the studs, and then proceed with the work. With this instrument an ellipse may easily be described.

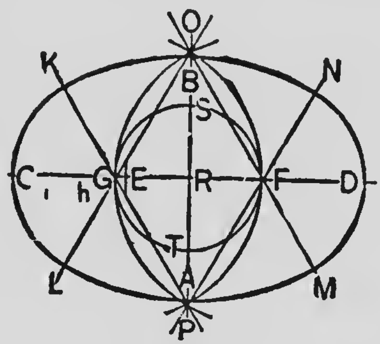


Fig. 70.

A figure that approximates an ellipse may be described by the compasses, and it is well for the draftsman to acquaint himself with the manner in which this is done, and to this end I submit perhaps the most useful method for this purpose. Let us describe the oval shown at Fig. 70. Lay off the length C D, and at right angles to it and bisecting it lay off the width A B. On the larger diameter lay off a space equal

PLATE 5.

This elevation shows the front and side elevation of the cottage in finished order. Two styles of drawing are shown, the one being in plain line and the other shaded. I would not advise the student to attempt shading until such time as he feels assured he can make a presentable piece of work. Of course, I mean, he should not attempt to shade any drawings for exhibition until he has had good practice on preliminary work. This plate is a very good one to copy.

PLATE 5.

FRONT AND SID

TE 5.

SIDE ELEVATIONS

to the shorter diameter or width, as shown by D E. Divide the remainder of the length or larger diameter E C into three equal parts; with two of these parts as a radius, and R as a center strike the circle GSFT. Then, with F as a center and F G as a radius, and G as a center and G F as radius strike the arcs as sh[illegible] intersecting each other and cutting the [illegible] drawn through the shorter diameter at O [illegible] P respectively. From O, through the po[illegible] G and F, draw OL and OM, and likewise fr[illegible] P through the same points draw PK and [illegible]. With O as center and OA as radius, strike [illegible] arc LM, and with P as center and with [illegible]ike radius, or PB which is the same, strike the [illegible] KN. With F and G as centers, and with F D and C G which are the same, for radii, stri[illegible] the arcs NM and K L respectively, thus completing the figure.

The oval is not an ellipse, nor are any of the figures obtained by using the compasses, as no part of an ellipse is a circle, though it may approach closely to it. The oval may sometimes be useful to the draftsman, and it may be well to illustrate one or two methods by which this figure may be described.

Let us describe a diamond or lozenge-shaped figure, such as shown at Fig. 71, and then trace a curve inside of it as shown, touching the four sides of the figure, and a beautiful egg-shaped curve will be formed. For effect we may elongate the lozenge or shorten it at will, placing the shorter diameter at any point.

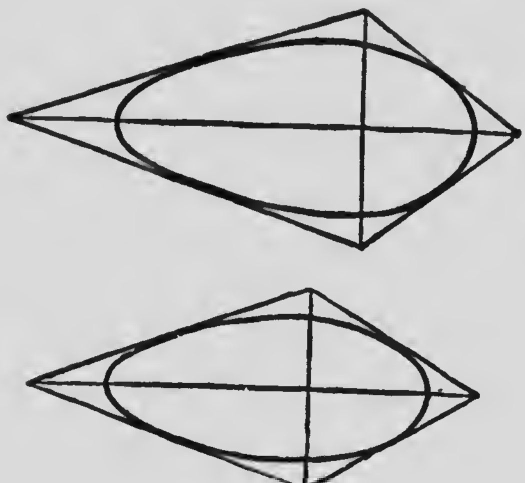


Fig. 71.

An egg-shaped oval may also be inscribed in a figure having two unequal but parallel sides, both of which are bisected by the same line, perpendicular to both as shown in Fig. 72. These few examples are quite sufficient to satisfy the requirements of the ordinary draftsman, as they give the key by which he may construct any oval he may ever be called upon to form.

Scrolls often have to be drawn by draftsmen, and these may be obtained, more or less accurately by various methods. One method employed, is by making use of two lead pencils well sharpened and arranged as shown in Fig. 73. A piece of string is tied tightly around one of the pencils and wound around the conical end as shown, while the point of the second pencil

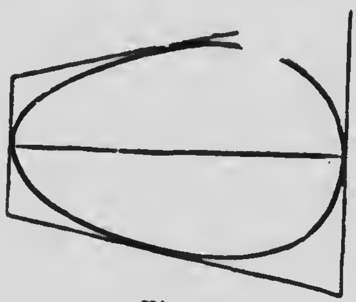


Fig. 72.

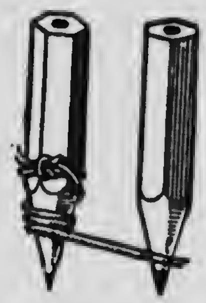


Fig. 73.

either pierces the string or the string is looped to hold the pencil, near the other pencil, which leaves the arrangement ready for work. To draw the scroll the pencils must be kept vertical, the point of the first kept firmly in the hole or center of the figure, and the second pencil must then be carried around the first, with the marking point held in touch with the paper, the distance between the two increasing regularly as the string unwinds.

This is a rough-and-ready means of drawing a scroll, but it has the quality of being fairly correct.

Another similar method is shown in Fig. 74, only in this case the string unwinds from a spool on a fixed center A, D, B. Make loop E in the end of the thread, in which place a pencil as shown. Hold the spool firmly and move the pencil around it, unwinding the thread. A curve will be described, as shown in the lines. It is evident that the proportions of the figure are determined by the size of the spool. Hence a larger or smaller spool is to be used, as circumstances require.

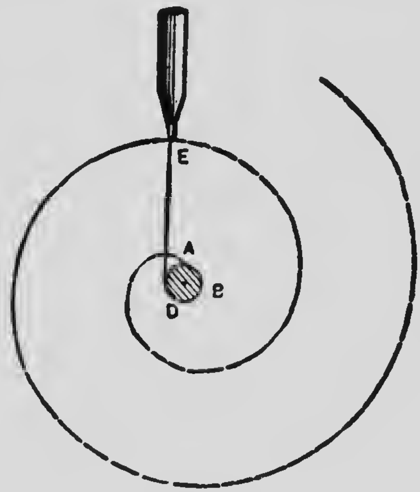


Fig. 74.

A simple method of forming a figure that corresponds to the spiral somewhat is shown in Fig. 75. This is drawn from two centers only, a and e, and if the distance between these centers is not too great, a fairly smooth appearance will be given to the figure. The method of describing is simple. Take a1 as radius and describe a semicircle; then take e1 and describe semicircle 12 on the lower side of the line AB. Then with a2 as radius describe semicircle below the line AB; lastly with a3 as radius describe semicircle above the line and the figure is complete.

These examples, and what may be deduced from them, will be quite enough to satisfy the requirements of the draftsman who does not intend to follow this art further than as an aid

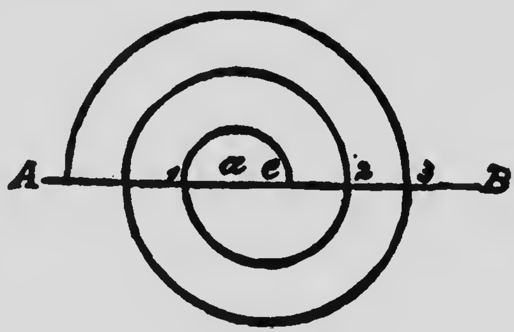


Fig. 75.

to his profession as a builder and workman, so now I will offer a few pages on straight line work.

LINE WORK

In previous pages I gave a few suggestions regarding line work done with the ruling pen, and I now supplement them by submitting the following examples numbered from Fig. 76 to 78 inclusive, which the student is advised to draw and redraw, first by measuring off the distances, and then by attempting to get the exact distances without measurement. If the lines in the examples are placed less than one-sixteenth of an inch apart, they will appear, at a little distance, like an even tint of shading, and the closer they are the more difficult will it be to get the appearance quite uniform, but this

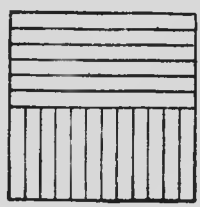


Fig. 76.

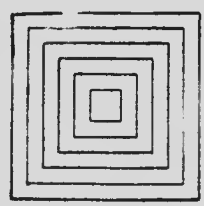


Fig. 77.

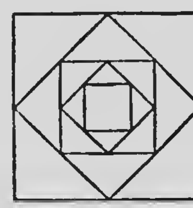


Fig. 78.

kind of work makes excellent practice for the pen.

These examples are selected from a large number of possible combinations, as giving variety of practice while not appearing too difficult. They are, however, more difficult than they appear, so that they must be commenced with the determination to produce very neat and accurate drawings.

After drawing the border line in pencil, ¾ in. from each edge of the paper, find by measurement the center of the paper, so that the second square, Fig. 77, may be placed in the middle, rule a horizontal line for the square to rest upon, draw the middle one in outline first, and then the others, each measuring 3 in. along one side. The spaces between the border line and each of the squares should be equal. In the upper half of the first square, Fig. 76, mark off equal divisions of ¼ in. each, and draw horizontal lines; then, in the lower half, mark off similar distances and draw vertical lines. In the second square, Fig. 76, equal distances must be set off from each of the sides, and parallel lines drawn, so as to make a number of complete squares. These should be drawn with a fine chisel-pointed pencil, and then tested by drawing diagonal lines from opposite corners. If the squares have been correctly set out, all the angles will be upon one or other of the diagonal lines. In the third square, Fig. 78, the inner squares are drawn with their angles tangent to the sides of the one next larger. If very fine pencil lines are drawn across opposite angles of the outer square, and then two other lines bisecting the sides, it will be found easy to join up the inner squares to the points so found.

After the squares are completed in pencil, fill in or line over with the ruling pen and ink.

The set of lines shown at Fig. 79 are of different strength or breadth, all of which may be drawn by a skilful use of the pen. In simple work of this kind the lines need not be penciled only perhaps, to define the limits of the lines.

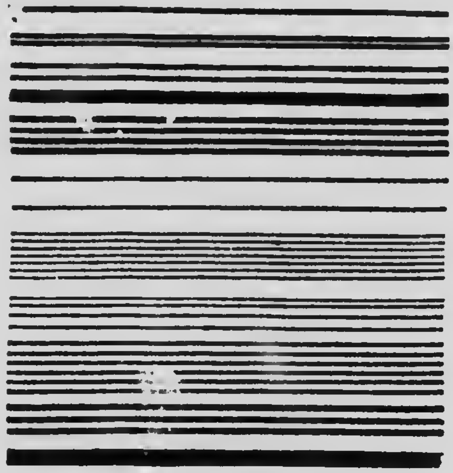


Fig. 79.

Fig. 80 gives practice in drawing dotted lines. Such lines are necessary in all kinds of working drawings. The more important ones should be first drawn with pencil.

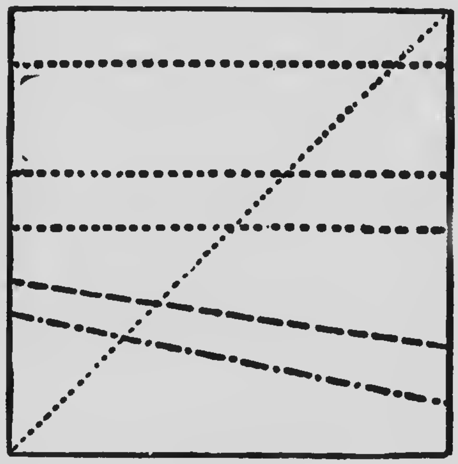


Fig. 80.

These methods of lining should be practiced until the student can make them clear and clean without much effort. The illustration shown at Fig. 81 exhibits a method of cross lines, in making of which the student must be careful and see that one set of lines are perfectly dry before being crossed by the others. It is well to try the pen upon a separate piece of paper before applying it to the drawing.

Where the drawings are complex or very particular, they should always be made first in pencil and inked in afterwards; then, if any corrections are necessary, they may be made before

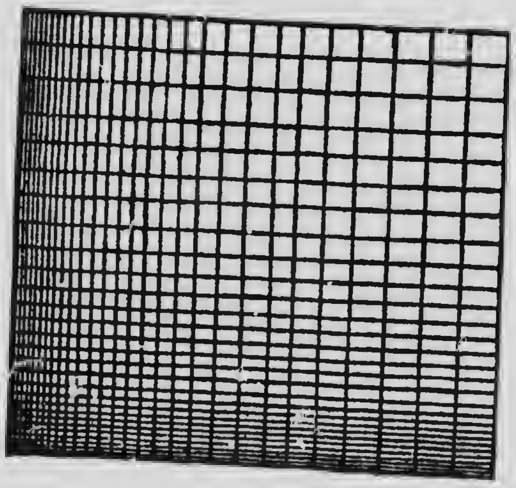


Fig. 81.

the inking is done, and the superficial lines can be taken out by erasing them. To erase strong pencil marks requires hard rubbing, which destroys the surface of the paper. Be careful in making pencil lines and do not get in more than are wanted, as confusion in inking is sure to follow if too many lines are in evidence.

The penciling being done, the drawing may be inked in, but before starting the following instructions must be considered. The drawing pen is filled by dropping the ink between the nibs while held in a nearly vertical position, as before stated. The pen can be used with a straight edge ruler; the taper to the point is sufficient to throw it far enough away from the edge to prevent blotting if care is taken. The breadth of the line is regulated by adjusting the screw. If the pen is not in use, even for a short time, be sure to take out the ink with a blotter and dry the pen thoroughly. The nibs should be kept perfectly bright and clean. The liquid India ink which comes in bottles is nowgenerallyused.

Fig. 82.

This much being thoroughly understood, I will now try and give a few hints as to the proper method of using the drawing pen. Fig. 82 shows the method of holding the pen. The pen is held between the thumb and two forefingers, and carried along the ruler from left to right, with the flat blades always parallel to the direction of the line; otherwise the pen will either be running on the edge of the blade only, or in such a position that the ink cannot flow freely from its points. The result in either case would be a broken or ragged line, a condition to be avoided, or a bad drawing will result.

In marking off dimensions on a drawing, a system of rough lines is generally adopted which is illustrated at Fig. 83, when a dimension is shown guiding the sight from arrow-point to

Fig. 83.

arrow-point. These lines should consist of strokes not more than one-sixteenth of an inch long and should have not less than a quarter of an inch space between them. It will be worth while to measure these distances for a few times at first when drawing them so as to get into the practice of getting them about right, though in a very short time the draftsman will be able to strike the distances near enough with-out measuring. When making finished drawings in practice, it is found best, when inking in, to use straight blue or red ink lines terminating at the ends by black arrow-heads.

When it is desired to show the interior construction of any object, an imaginary cut is made through it, and the representation of the cut surface is called a section. The direction of the cut is marked upon the original drawing by a

Fig. 84.

line of section, formed of strokes and dots placed alternately, with a letter at each end, as A B upon Fig. 84. This line is usually in red ink, but as all the work in the present lessons is black and white, this dotted section line may be made the same as the other lines.

The mode of marking off distances between two points is shown at Fig. 85, where the

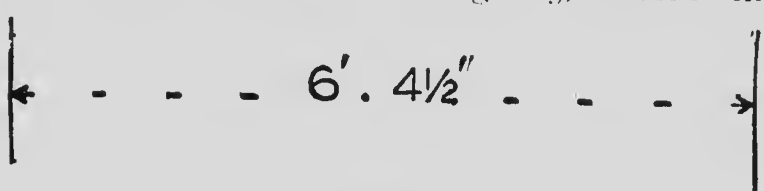


Fig. 85.

arrow-heads mark the limitation; that is, the distance between the lines which are touched by the points of the arrows, is 6 feet four and a half inches. This is marked off regardless of scale, and the method will be found useful when roughing out a house plan, elevation, or other similar work, as the dimensions of rooms, sizes of windows and doors, heights of ceilings, and all other dimensions can be given without drawing to scale. I will have more to say of this later on.

THE LEAD PENCIL

So far I have said but little regarding the lead pencil, which is a very important factor in the

Fig. 86.

Fig. 87.

draftsman's hands. As before stated, all drawings of any importance should first be made in pencil; and a hard pencil should be used for the purpose; in fact, there should be two pencils, one of which should be pointed similar to those shown at Fig. 86, and the other should be sharpened with a chisel-point similar to those shown at Fig. 87. These two illustrations, Figs. 86 and 87, show two methods of sharpening, either of which will answer the purpose quite well.

The pencil should be used solely at first for practicing, and the most expensive drawing pencils are often the most economical to use in drawing. There are many well-known makes that may be depended upon to work smoothly and evenly without grittiness or inequality of texture. The number of H's marked upon the pencil indicates its relative hardness. For general use those marked H or HH will be suitable, while for particularly fine work HHHHHH may be necessary. For roughly sketching details on a large scale, a very soft lead, such as BBB, will be found pleasantest to work with. Pencils of unvarnished cedar are to be preferred, and those of a hexagonal section do not roll off the sloping surface of the drawing-board or desk.

Almost the first lesson for a draftsman is how to properly sharpen a pencil, which is not easy for the beginner to accomplish satisfactorily. A pencil point should be well sharpened so that when the pencil is passing along the edge of the square it should be close against it; and in ordinary drawing or tracing, a clear view should be obtained completely around it on the paper.

A round point wears away very rapidly, and will hardly make even one fine line, whereas if the edge be kept the full thickness of the lead in the direction of the line the pencil will last very much longer and produce better work; the flat faces of the lead point may be slightly rounded.

If properly sharpened, one operation of the knife on the wood will be sufficient to allow of several re-sharpenings of the lead, whilst a badly-sharpened point requires further hacking

Fig. 88.

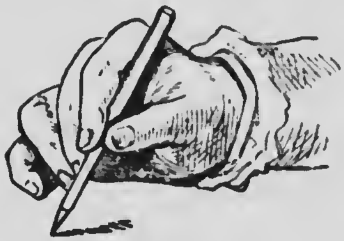


Fig. 89.

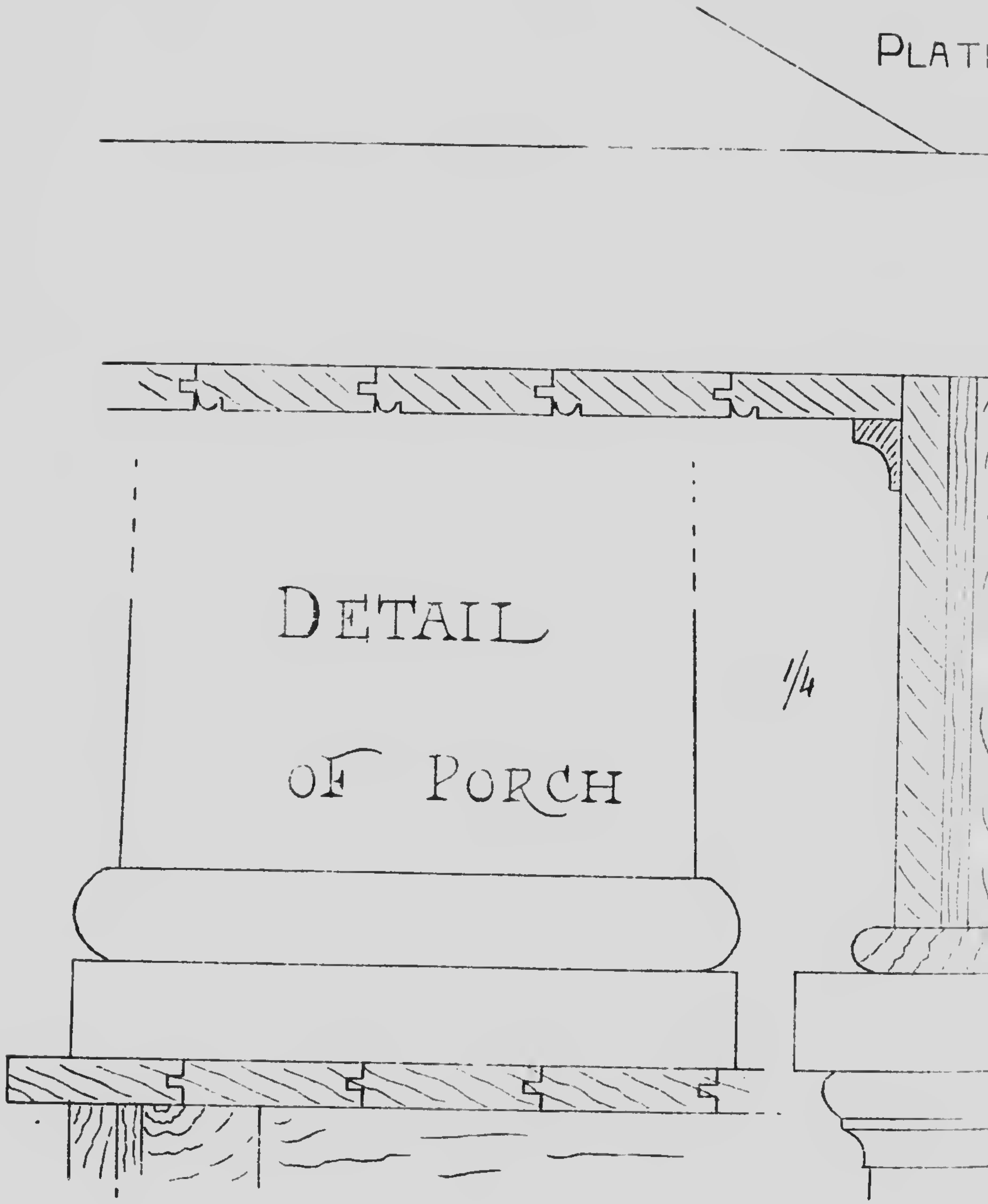
of the wood every time the lead is slightly worn.

Fig. 88 shows the T-square and pencil with the two hands in position for drawing an ordinary horizontal line. The pencil should be upright when looking in the lengthways direction of the line, and sloping about five degrees from the upright in the direction in which it is being drawn, as would be seen at right angles to the line, and in Fig. 89 the method of holding the pencil for freehand or tracing work is shown. This is on a larger scale in order to show the

PLATE 6.

This plate shows the draftsman how to prepare details so that they may be followed by the actual workman. This shows some details of the porch, giving the construction of cornice and other work.

This is shown here to a scale of one quarter of an inch to the foot. It represents, of course, a portion of the cottage.


DETAIL
OF PORCH
1/4

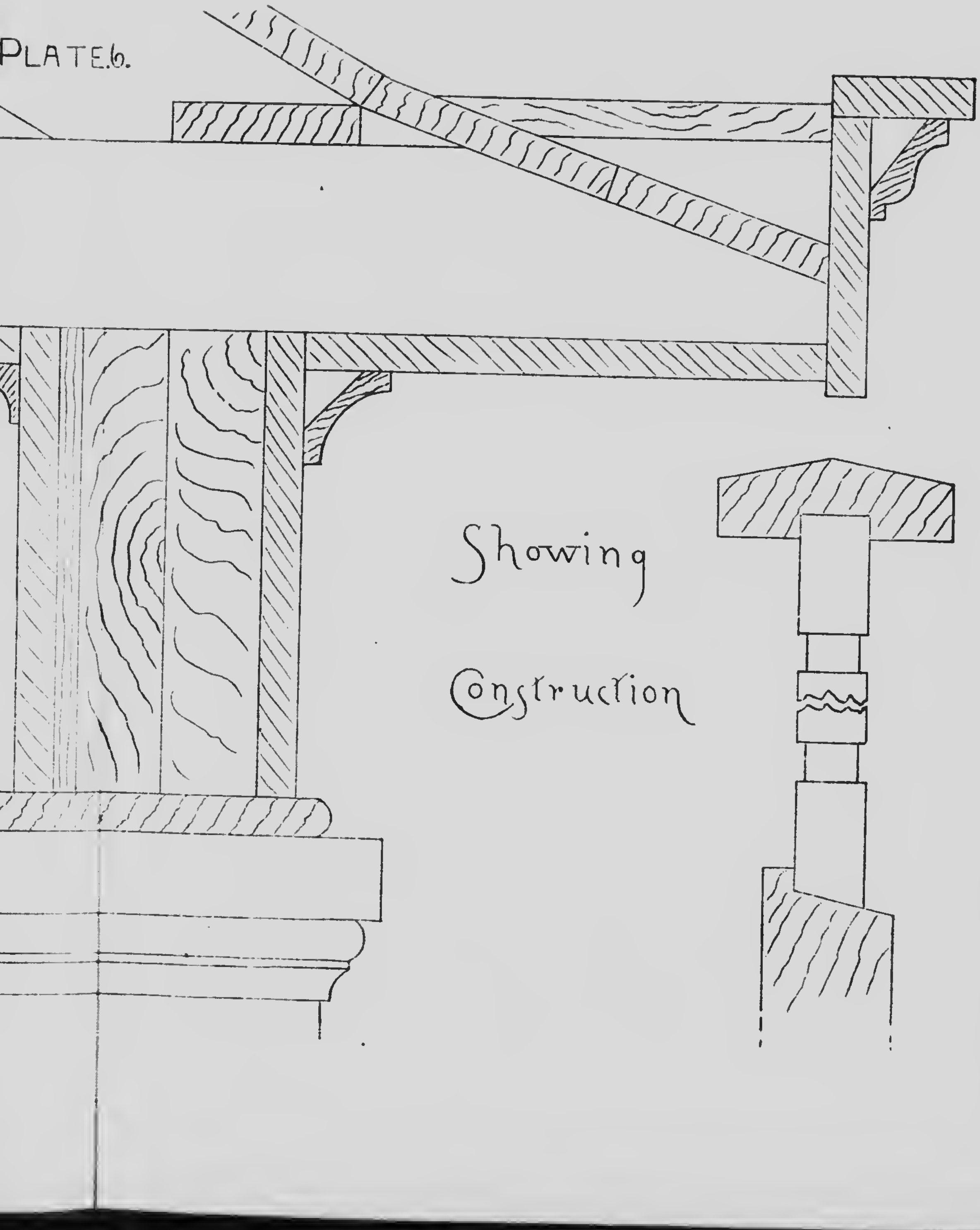


PLATE.6.
Showing
Construction

manner of holding the pencil for this kind of work.

After this from each edge of the paper mark off ¾ in. and draw a border line all round, with plain square corners. The three fingers at the back of the stock of the T-square keep it close to the edge of the board, which is not easy to do at first starting, but with a little patience and perseverance every border line can be drawn with equal facility. It is important to note that all pencil lines upon a drawing should be thin;

Fig. 90.

Fig. 91.

if made thick they cannot be inked over so neatly, and the paper will have a greasy feel to the pen. The india rubber should be used very sparingly and if possible only after a drawing is completely inked in.

A pencil line drawn in error should have a wavy mark across it, as in Fig. 90, and one drawn full, but intended to be inked in dotted, should be marked as in Fig. 91; this is instead of rubbing them out at the time. Another fundamental principle is always to draw a line far enough at the first attempt, but not to draw it beyond the distance it is known to be wanted.

An unnecessary line takes time to draw, wastes the pencil point, and takes time to rub out; all matters of moment when excellence is in view.

Of course, all corrections must be made whilst the drawing is in pencil, for a drawing, while in ink, cannot be corrected, without great injury being done to it, as erasions of ink spoil the surface of the paper and disfigure the whole work.

Fig. 92.

When a drawing is completed, the pencil lines may be erased by using a proper rubber similar to that shown at Fig. 92, which can be purchased for a few cents. Some of these erasers are made so that one end of them is specially devised for rubbing out pencil lines while the other end is intended for erasing ink lines. Never use the ink end when it can possibly be avoided, as it will destroy the fine surface of the paper and disfigure the drawing.

When it can be afforded, it is best to buy a case of assorted pencils. They will come cheaper this way, and a case will last for years and the draftsman will always have at hand pencils to suit all sorts of work. Faber's pencils were considered the best for many years, but they are rapidly being driven out of the market by pencils of American manufacture. Dixon's pencils are excellent and may be relied upon to give good results, but, in my own practice I make use of "Eagle Pencils" and find in them the best of satisfaction. This, however, is perhaps after all merely a matter of taste, a preference for a name or firm.

Pencils—like all other drawing appliances—should be kept in a case and should always be in order for work, so that in a hurried job, there will be no need to hunt all over for a pencil, or a knife to sharpen it. These few hints regarding pencils will, I hope, prove useful to the young draftsman.

PRELIMINARY ROUGH SKETCHES

Often workmen are called upon to make a rough sketch of a piece of work before making a drawing of it in order to get a fair understanding with the employer. A rough sketch taken off-hand with dimensions put on in figures will often give to the person ordering the work a clear idea of what he intends and thus

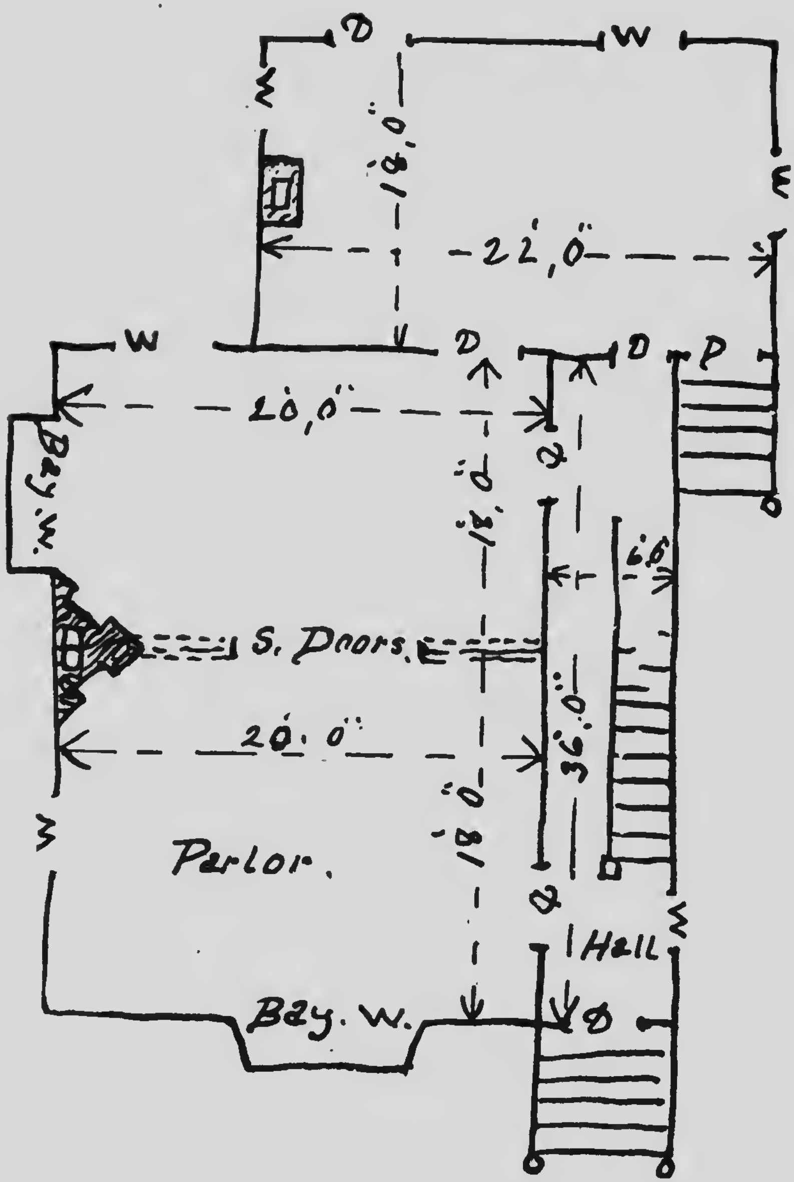

D
W
14' 0"
22' 0"
W
D
D
P
20' 0"
Bay. W.
18' 0"
6' 6"
S. Doors.
20' 0"
36' 0"
Parlor.
18' 0"
Hall
Bay. W.

Fig. 93.

prevent disputes, annoyances and misunderstandings.

Rough sketches may be made of any size and without reference to scale or regard to exactness, providing always, the dimensions are given. In order to illustrate this I show a rough sketch of a house plan at Fig. 93. We suppose, for instance, a man wants a small house; in the house he desires a parlor 18x20 feet, a dining room 18x20 feet and a kitchen 18x22 feet, and a side hall with stairway, 6'6", length of the house, with all the necessary windows, bays, and doors, also chimneys and fire-places. The whole may be drawn, without scale, as shown in the purposely rough illustration. This at once gives a orrect idea of the plan of the house and the general lay out. After satisfying all the conditions required in the plan, a rough sketch of the elevation, showing height of ceilings, pitch of roof, windows and other necessaries; may be reduced to scale and drawn on paper in regular order. Another rough sketch is shown at Fig. 94, on a much smaller basis. I do not advise making these sketches too small, particularly if they are intended to submit to a prospective owner, as then they are apt to be misleading.

Any one acquainted with building matters or the reading of plans, will have no difficulty whatever in thoroughly understanding these rough sketches, or in making a scale drawing from them, if they have the least knowledge of drawing. The windows and doors are shown so far as position is concerned, and are marked respectively, W and D. Where the dimensions of these are decided upon, these dimensions may be marked on the plan, and a rough sketch of the elevation given; if for a door, make it as shown in 95, showing number of panels, and in such style as intended. If the door is elaborate, then, of course greater pains will have to be taken, and this can best be done by making it a scale drawing. If the design wanted is for a window, then a rough sketch may be made similar to the one shown at Fig. 96, which is a simple 6 light window. A more elaborate sash is shown at 97, which may be roughed out to the style shown, or to any other style desired.

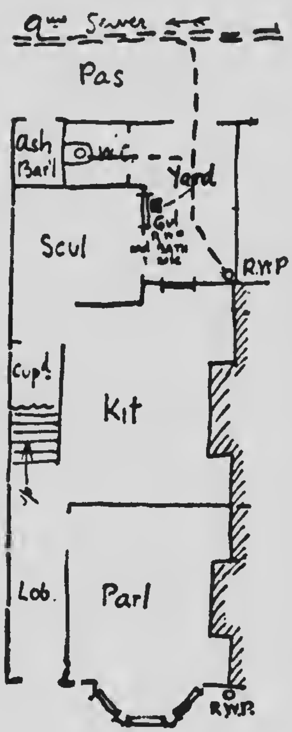


Fig. 94.

These five rough examples are quite sufficient to convey to the student an idea of how he can lay out a rough sketch from which he may construct an exact scale drawing. In the plans shown, I have not given thickness of walls; this

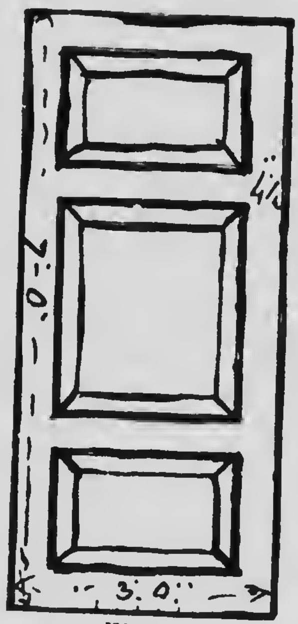


Fig. 95.

Fig. 96.

the draftsman can arrange when he plots out his plan.

I now present a few examples which show the method of marking off measurements and showing the thickness of walls, dimensions of windows, etc. The illustration shown at Fig. 98 is supposed to be the front of a building having a front entrance and windows, and an "over-all" measurement of 39'6". This shows 18'0" for the projection, and 21'6" for the reserved part.

These measurements should be again subdivided, showing the lengths of brickwork, widths of openings, etc.; and the line of measurements inside gives the thickness of the walls, dimensions of rooms, etc. The distance that the part projects should also be noted as shown by 3'0". The inside measurements and the smaller dimensions should exactly agree with the "overall" measurement given.

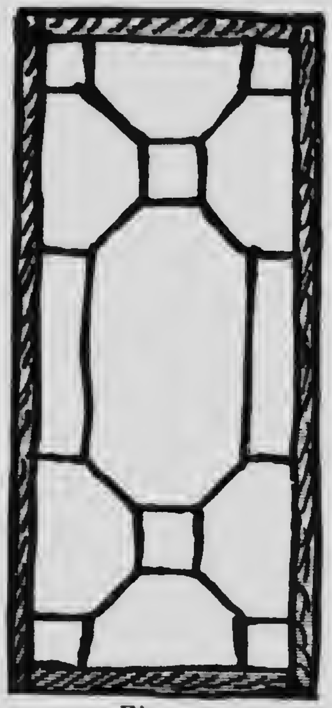


Fig. 97.

In drawing pencil lines they should always be drawn longer than the actual length of the lines to be inked in, so that the exact point of intersection with other lines can be better seen. When the drawing has been inked in, these extra lengths, of course, have to be cleaned off with india rubber, as well as a great many other pencil lines which are necessary in the process of making the drawing, but which form no part of the finished drawing. These "construction lines," as they are called, should be drawn as lightly as possible, so as to be easily removed without greatly damaging the surface of the paper. When drawing circles or arcs of circles with the compasses, a little pencil mark should be made round the center point, so that it can be found without any trouble when it is desired to ink in the drawing. It is useless to draw in

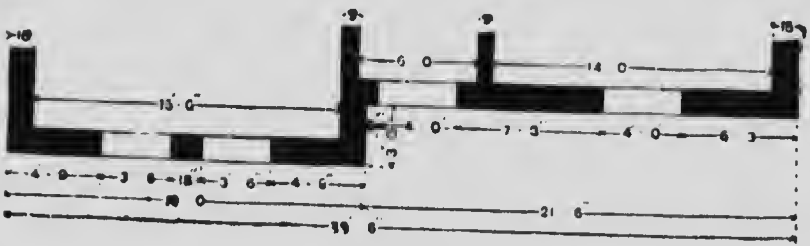


Fig. 98.

pencil every one of a long series of circles or arcs which are alike; it will be more expeditious to mark the centers only after drawing one or two, for in the inking-in of the work when the compasses are once set to the correct radius, the centers will be all that is required to draw them in full.

Every working drawing when it leaves the draftsman should be carefully and completely figured as shown in Fig. 98. A little time spent in figuring builders' drawings, so that the sizes of window and door openings, thickness of walls, etc., are clearly stated, will save time, worry and inconvenience. A measurement of feet only should always have a cipher in the place of the inches as 28'0", and arrow-heads, as before described, should show the extreme limits of the intended dimensions. Perhaps it may not be necessary to explain to the student the use of the foot and inch marks, ' and " which should always be placed over dimensions figures. The single mark denoting feet, and the double mark representing inches, when employed they greatly assist in reading of plans.

Vertical measurements showing the height of rooms or stories are best figured from floor to floor—rarely from floor to ceiling—but allowance must be made for the depth of joists and thickness of floor and ceiling. The height of windows should be always figured from the top of the sill to the underside of the head, and their position from the level of the floor to the top of the sill, this giving exactly the opening in the frame or brickwork. When a drawing is carefully figured it is much easier for the workman to understand, and mistakes and misunderstandings are less liable to occur.

We have now reached a point where the

student may venture to attempt a rough drawing for a small cottage, and to this end the following illustrations are submitted.

We will suppose that a brick cottage 31 feet long and 19'6" wide is to be built, having three rooms and a hall on main floor, a cellar, and attic containing three bedrooms, and attic. The foundation is to be of stone, the superstructure of bricks, and the roof of wood, shingled. Having the paper properly tacked on the drawing board, ready for work, we next decide upon a scale.

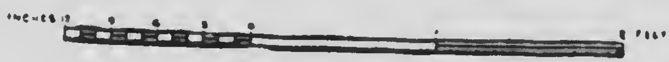


Fig. 99.

I would suggest a scale of four feet to the inch; that is, each quarter of an inch should represent one foot of the building; and as this is an easy scale, and one that can be readily understood by the student, he will have no trouble in dealing with it. A scale is shown at Fig. 99. Of course, the quarter inch must be divided into twelve parts—which will be found on any good rubber or ivory scale—then square off a fine pencil line from your left hand across the paper near the lower edge of the board. From this line, draw another at a convenient point at right angles to the first line. Make these lines with a fine pointed HB pencil, and so light that they may be easily erased. From the junction of the two lines, F, Fig. 100, measure off 7¾ inches, which will equal 31 quarter inches, which again represent 31 feet by scale. From this point, B, square up another line. From E to F, is a

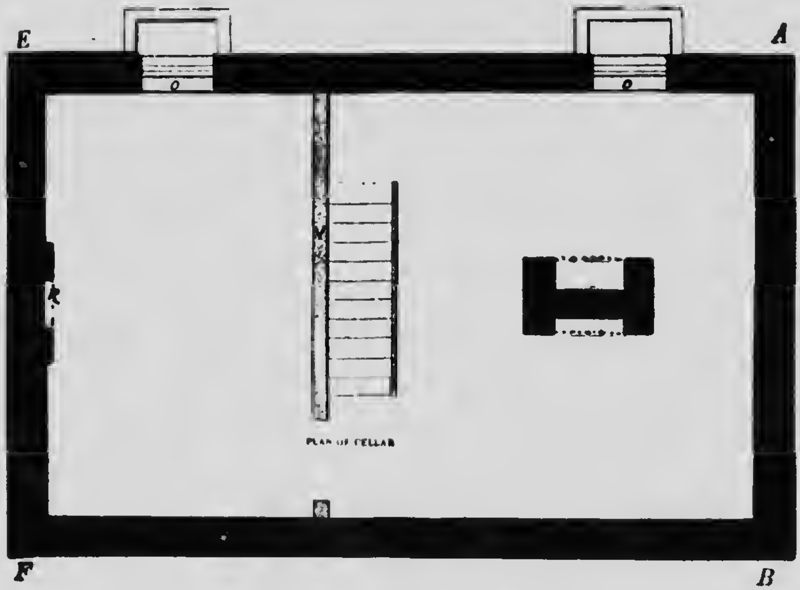


Fig. 100. Cellar Plan.

distance of 4⅞ inches, which contains 19 quarter inches and one ⅛ of an inch. The 19 quarter inches represent 19 feet on scale, and the ⅛ of an inch represents 6 inches, thus, making the total distance between E and F, 19 feet and 6 inches. Square over from E to A, and the lines A B, E F, form the boundary of the cellar plan.

The cellar walls are supposed to be of stone, and are therefore 18 inches thick, so we measure off, working to the inside always, 3/8 of an inch, which according to our scale, represents 1 ft. 6 in., the proper thickness of the wall.

It will be noticed that at R we have projected the wall inside the cellar; this projection is intended to carry the chimney and fireplace. Here we show two projections, but in practice the projection is made in one as shown by the dotted lines. The same is also done with the chimney foundation shown at S. While the shaded parts shown would be ample to carry the chimney and fireplace above, it is generally more economical to make a solid block of stonework, as shown by the dotted lines. In actual practice, the first stones laid should project beyond the faces of the wall six or more inches on each side in order to give the foundation a wider base. These bottom stones are called "footings." They should never be less than 6 inches thick.

The partition V is built of bricks laid on stone footings. This wall is nine inches thick—the length of a brick—and runs up to the floor joists. The partition on the opposite side of the stairway is a studded, lathed and plastered one. The openings, O, O, are for the cellar windows and are three feet (¾ inch) wide. The framework outside the windows are curbs, built around the windows to prevent the earth from filling in against the glass. The student need not mind the shading unless he desires to fill in the walls.

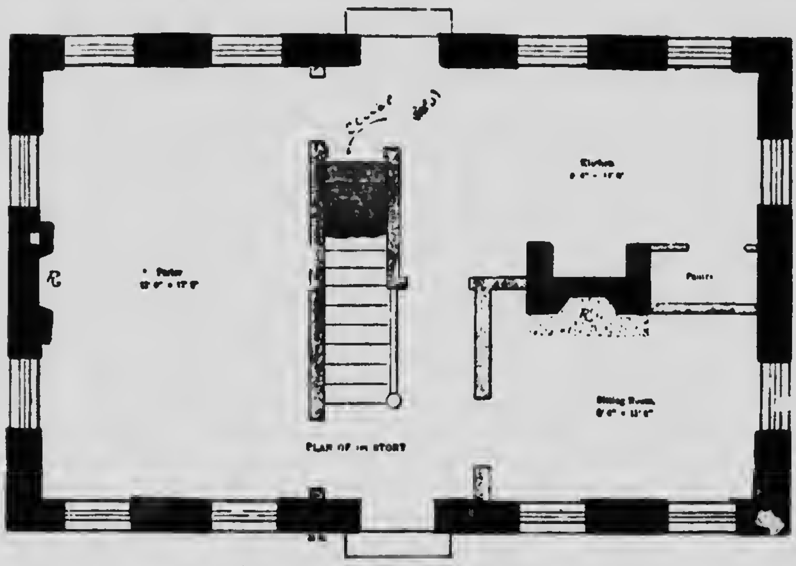


Fig. 101. First Floor Plan.

This sketch is now a complete plan of the cellar, and one that can be worked to.

It will now be in order to draw the first floor plan, as shown in Fig. 101. Proceed the same as before, only in this case the outer walls are made ¼ inch thick, which represents one foot, making the wall one and one-half bricks thick. Measure off the openings as shown, making the

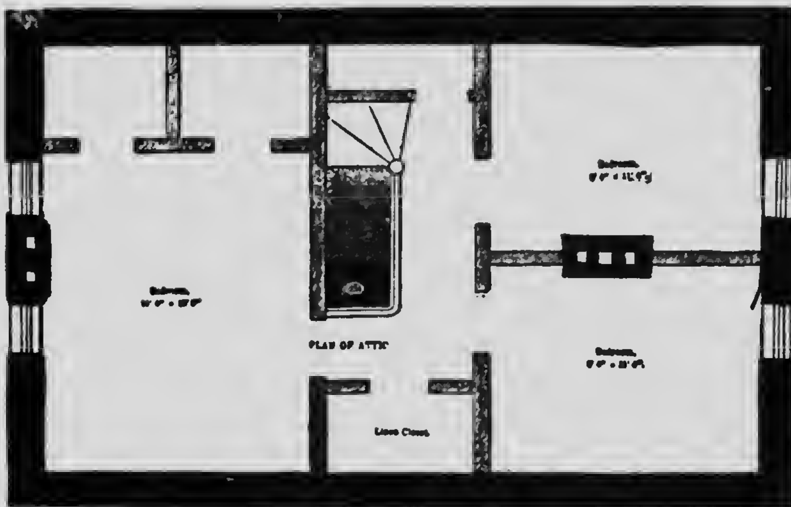


Fig. 102. Attic Plan.

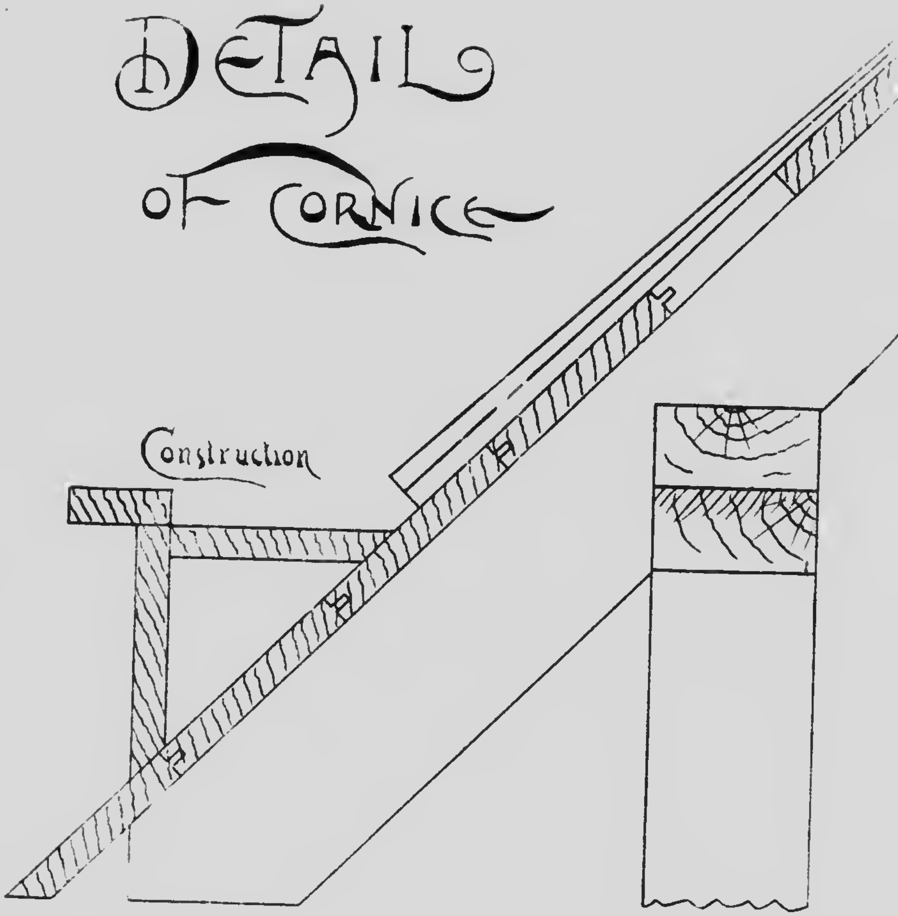
window openings which are represented by three lines running through the openings (¾ inch wide), which is three feet. The two door open-

Fig. 103. Front Elevation.

PLATE 7.

Plate 7 exhibits a portion of cornice and roof of main building. This shows the construction, with roof boards and shingles, also the finished portion of roof and cornice.

DETAIL OF CORNICE



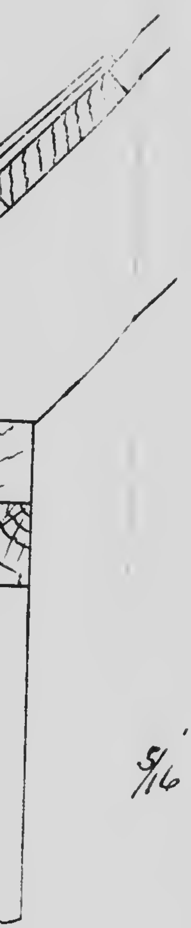
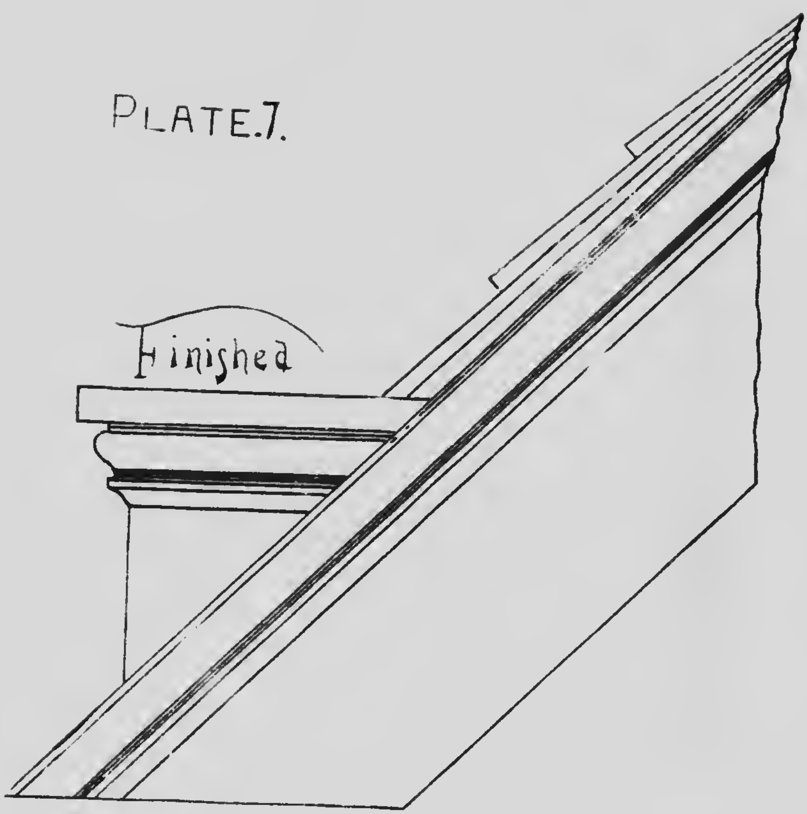


PLATE. 7.



ings are 13-16 inch, or 3 feet 3 in. Measure off the partitions and lay off to sizes as figured. Be careful to have the chimneys and fireplaces, R.

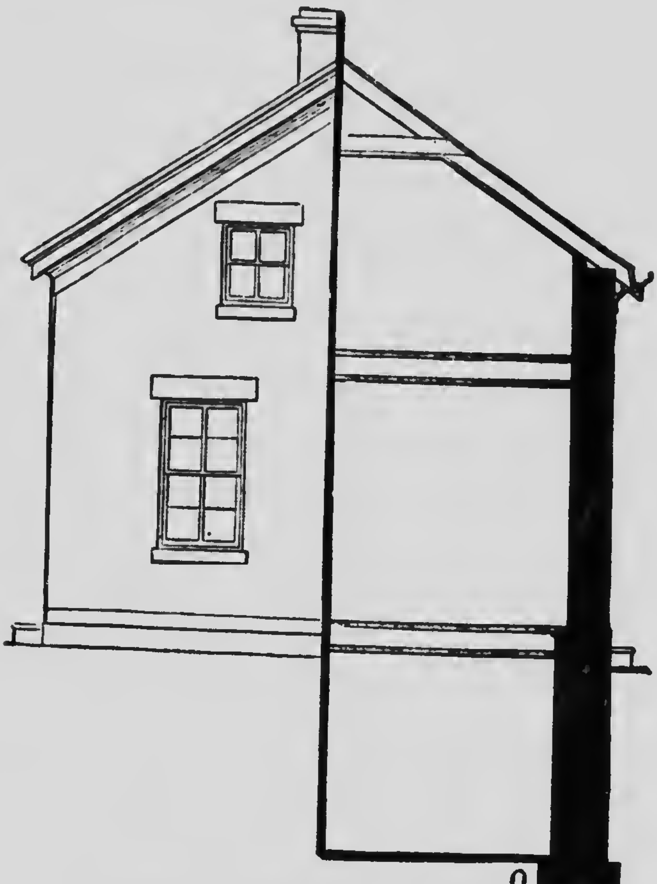


Fig. 104. End Elevation and Section.

R. S., directly over those in the cellar. The stairs in cellar are directly under the stairs as shown in this plan. The projections shown at the doors are steps.

The plan shown at Fig. 102 is for the attic story. A part of the height of this will run up into the roof as will be shown in section Fig. 104. Here the chimneys take another shape and are "drawn in" to suit the flues. The partitions are varied and the stairs land in the hall by three

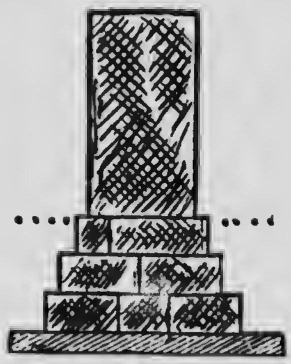


Fig. 105.

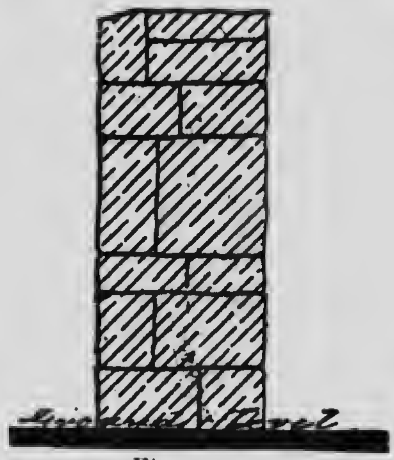


Fig. 106.

winders. The windows are not so wide as those in the stories below, only being 2 ft. 3 in. in the openings. Measure off the rooms as they are figured, making the partitions of 2x4 in. studs, and marking off the newel and rail for stairs as shown.

The elevation shown at Fig. 103 requires but little explanation, as it is simple and easily understood. The windows are 3 feet wide in the opening and 5 ft. 3 in. from lintel to sill; so, keeping these figures in mind, the window and sashes may be laid out readily. The door, from floor to lintel, including fanlight, is 8 feet high, by 3 ft. 3 in. in width. The rest is easy.

A part of the end elevation and a sectional view are shown at Fig. 104. In the section the

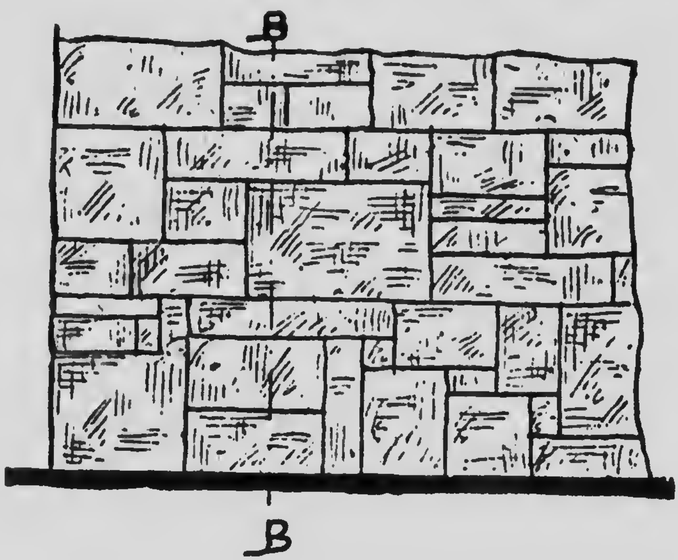


Fig. 107.

foundation footing is shown at O; the projection of door-steps is also shown on the ground line.

All these examples should first be made in pencil, after which, when corrected, they may be "filled in" with ink.

I have mentioned something regarding "footings" for foundations and it may not be out of place at this point to say something more of them. The illustration shown at Fig. 105 shows the footing and a portion of section of wall that would be suitable for the brick partition running through the cellar of the cottage we have just discussed. Here is a flat stone footing with three courses of bricks on top before the regular wall commences. The dotted lines show the top of cellar floor whether it be plank or cement. When the whole foundation and wall are to be of stone, the student may lay it off in accordance with the class of masonry employed. One method of showing square rubble work in a wall, is exhibited at Fig. 106. This shows a section of the wall, through B, at Fig 107. Coursed rubble work is shown at Fig. 108, while random rubble work is shown at Fig. 109.

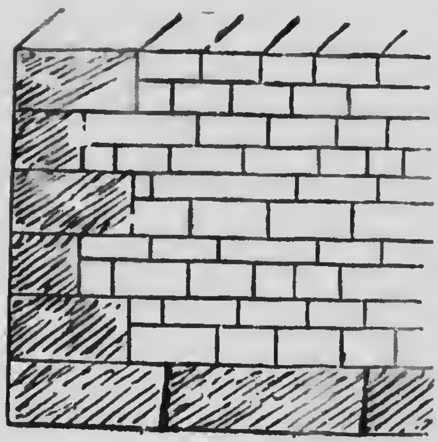


Fig. 108.

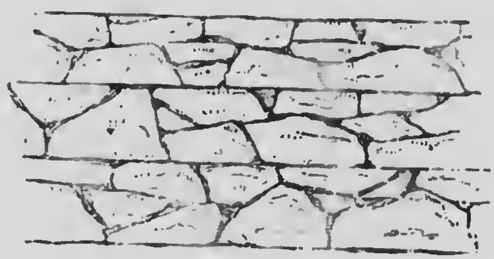


Fig. 109.

In this style of masonry, the wall is brought to a level throughout its length at about every 12 or 14 inches, in height, so as to form courses of that depth. This wall is built of stones rough from the quarry, regardless of size or shape.

Another style of masonry built up of irregular stones that have been broken up from large field stones is shown at Fig. 110. The foundation and corners are built up of squared stones. This kind of work is sometimes called irregular rubble, rustic work, or field stone masonry. It does

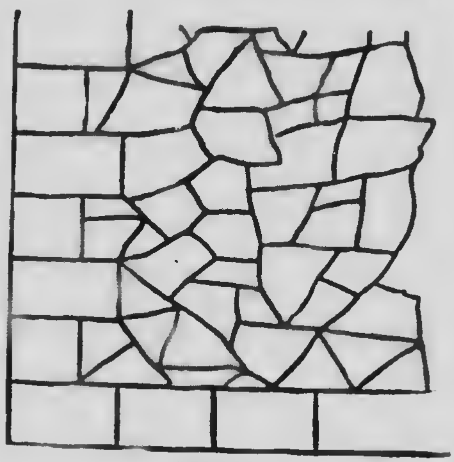


Fig. 110.

very well for garden walls, retaining walls, cellar walls for small buildings, but should not be used where great strength is required.

Block course masonry is where the courses of stone run in straight horizontal lines as shown at Fig. 111. Ashler masonry [illegible] built [illegible] courses of more or less unifor[illegible] from 10 to 14 inches dee[illegible] quoins or corners, and other [illegible] by different names, according to the face put upon the stone—from quarry-pitched, or rock ashler, to wrought ashler. A sample of the work is shown in Fig. 112.

There are many other forms of stonework, but the examples given are quite sufficient for the purposes of this work, and other forms may well be left to the trained architect. Perhaps a

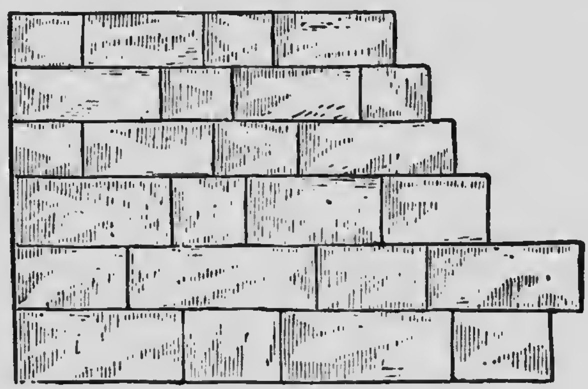


Fig. 111.

few examples of brickwork will not be out of place at this point, as they will give to the student a slight insight into the manner of "bonding," which is quite an important matter in brickbuilding.

At Fig. 113, the end section of a single brick, or 9 inch wall, is shown, having a two brick or 18 inch footing. This will be easily understood as will also the section shown at Fig. 114. The latter shows the section of a brick and a half wall, known generally as a 14 inch wall. The footing for this is formed of three bricks,

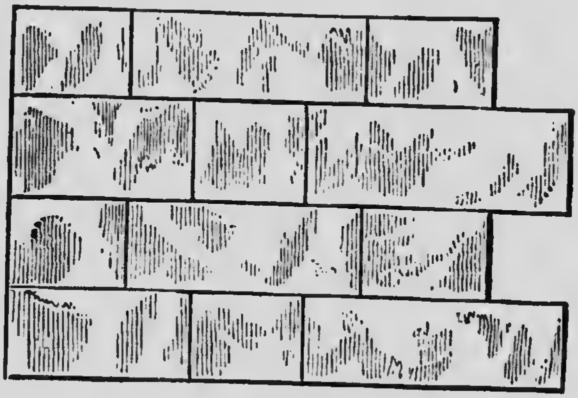


Fig. 112.

making it 28 inches wide. The footing is diminished until it is only two bricks wide on which the actual wall commences. Other thick-

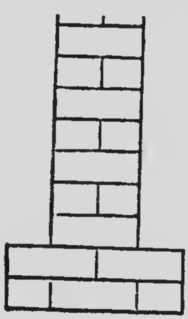


Fig. 113.

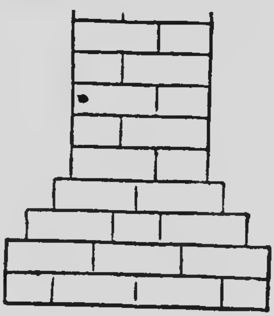


Fig. 114.

nesses of walls are formed on the same principle so other examples of this kind are unnecessary.

At Fig. 115 I show two plans of an 18 inch wall which illustrates the method of "bonding" or breaking joints. I also show a section of the wall shaded.

Before proceeding further, it may be well to explain the meaning of the term "bond," or "bonding." "Bond" is an arrangement of bricks

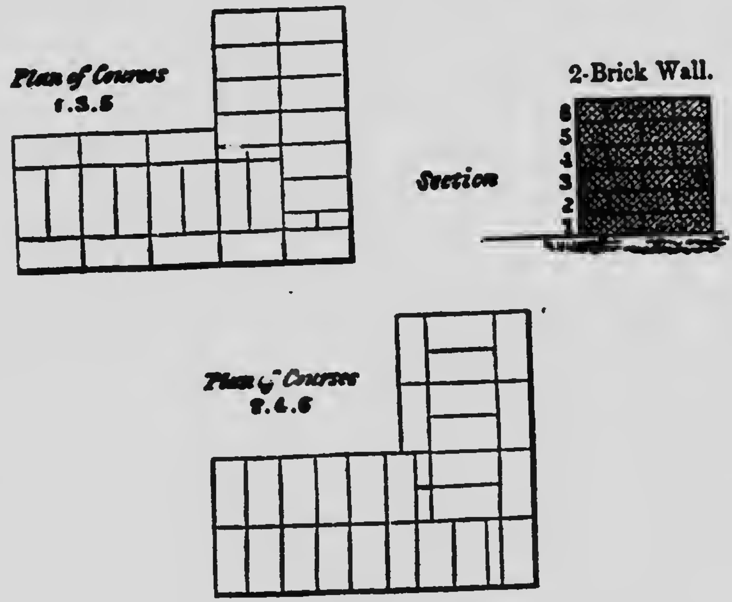


Fig. 115.

or stones placed in juxtaposition so as to prevent the vertical or plumb joint between any two bricks or stones falling into a continuous straight line with that between any other two. This is called "breaking joint," and when it is not properly carried out, that is, when two or more joints do fall into the same line, as at x y, Fig 116, they form what is called a straight joint. Straight joints split up and weaken the part of the wall in which they occur, and should therefore be avoided. A good bond breaks the vertical joints, both in the length and thickness of the wall, giving the bricks or stones a good lap over one another in both directions, so as to afford as much hold as possible between the different parts of the wall.

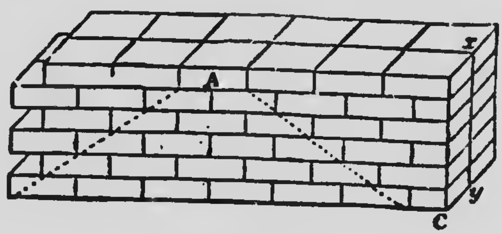


Fig. 116.

A further effect of bond is to distribute the pressure which comes upon each brick over a large number of bricks below it. Thus, in Fig. 116, there is a proper bond among the bricks forming the face of the wall, and the pressure upon the brick A is communicated to every brick within the triangle A, B, C.

A defective bond, either in brickwork or masonry, may look very well upon the face of the work, as in Fig. 116, where the bricks regularly break joint vertically, but in which there is no bond whatever across the thickness of the wall, which, it will be seen, is really composed of two distinct slices of brickwork, each 4½ inches thick, and having no connction with one another, except that afforded by the mortar. To avoid this defect, the bricks or stones forming a wall are not all laid in the same direction as in Fig. 116, but some are laid parallel to the length of the wall and others at right angles to them, so that the length of one of the latter overlaps the width of the two below it, as shown in Fig. 115. In this figure, a wall is shown in section at the top, two bricks in thickness. The second diagram shows a plan of the courses, 2, 4, 6, as numbered in the section, while the lower diagram shows the plan of the courses, as they are laid in the wall, of the courses numbered 1, 3, 5, in the section.

When bricks are laid lengthwise in the wall, as shown in Fig. 117, they are called "stretchers"; when they are laid across the wall, as in Fig. 118, they are called "headers." "Stretchers" are bricks or stones which lie parallel to the length of the wall, those in the exterior of the work showing one side in the face of the wall.

"Headers" are bricks or stones whose lengths lie across the thickness of the walls, the ends, or "heads," of those thin walls like the diagram, or in the outside of thick walls, being visible on the face.

If the student copies these examples and thinks as he draws, grasping the reasons why

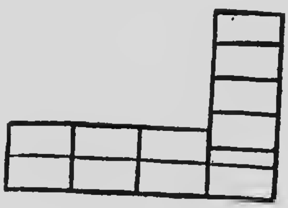


Fig. 117.

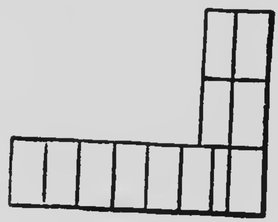


Fig. 118.

the bricks are laid in the manner shown, he will accomplish two purposes, learning to draw and acquiring a constructive knowledge.

There are a variety of "bonds" in brickwork, all of which it will be necessary for the architectural student to be familiar with, and I propose to offer a few examples for practice and to explain them at the same time.

The bond chiefly used in this country for ordinary work is called running "bond." This consists of three, four or five running courses of stretchers, and then a course of headers, as shown in Fig. 119, where there are three courses of stretchers and one course of headers. The small portions of bricks, or "bats," designated by

XXXX, are termed closers, and are required to fill out the courses.

In English 'bond" there is in the face wall a course of headers, then a course of stretchers, and so on all the way. This arrangement is for the front of the wall, and in the thick walls the bricks are made to join in to the best advantage.

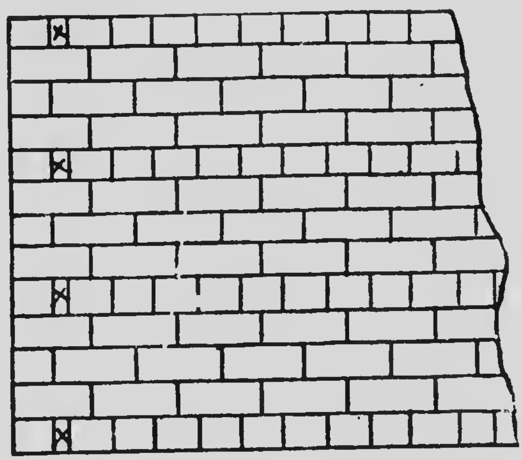


Fig. 119.

Thus, an English bond nine-inch wall will have for each course of stretchers two rows side by side, breaking joint horizontally. The joints in the inside courses should be one-half the width of the brick from the vertical joints of the stretchers above and below. A fourteen inch wall in English bond is shown at Fig. 120, which represents four courses in elevation, and the second course and the top course, from the top, in plan. It is absolutely necessary in this wall to have a row of headers back of the stretchers, as if they were all stretchers in this course, there would be a mortar joint all the way up through

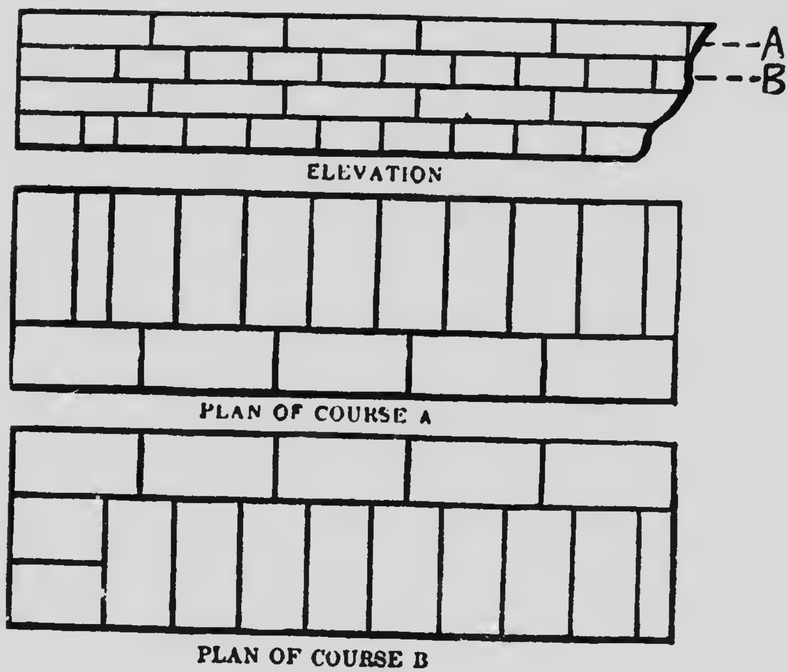


Fig. 120.

the wall along the line A B. There are shown two ways to make the headers in any course; break joints with the stretchers in the same course. In the plan of course A at the left-hand end there will be seen a closer X, which is half of a brick split lengthwise. This piece,

$9 \times 2\frac{1}{4} \times 2\frac{1}{4}$, being put in next to the last stretcher. In the plan of course B it will be seen that the same thing is done by using three-quarter bricks laid flatwise.

The example shown at 121 exhibits several

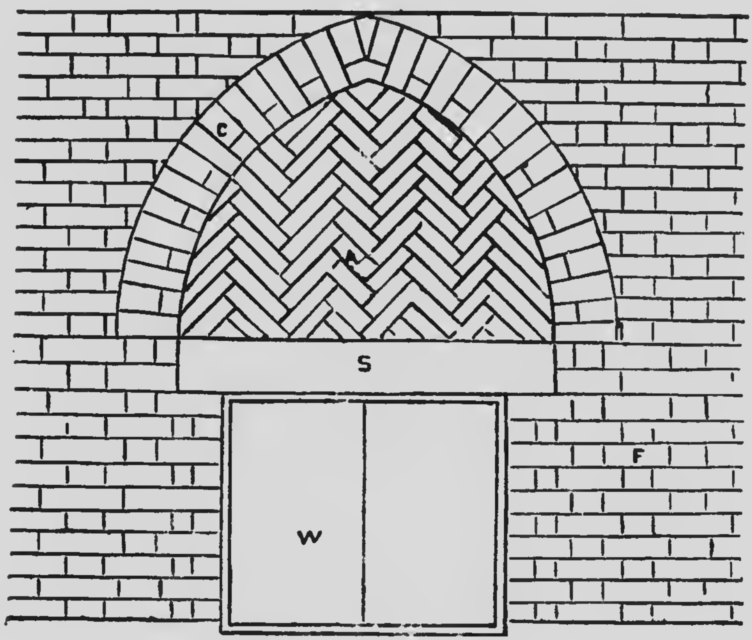


Fig. 121.

styles of laying bricks; C shows the arch A, herring bone filling over a window, S, a stone sill, F the general brickwork and W the window opening. This is a good example to draw, though it is not by any means good architecture.

These examples are sufficient for my purpose, and should the student desire to know more about the bonding of brickwork, he may procure a copy of a manual on brick and stone work I have in preparation, and which will be published by Drake & Co. shortly.

DRAWING ARCHES

It is absolutely necessary the draftsman should know how to draw the forms of arches that are in common use, and in order to instruct

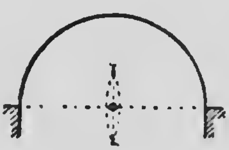


Fig. 122.

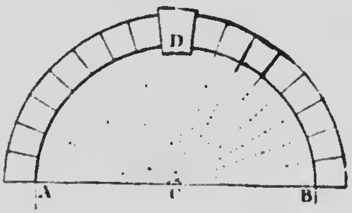


Fig. 123.

him on this point, the following examples are submitted for him to study and work out. The arch shown at Fig. 122 is simply a semicircular one, and the simple line of arch is drawn from a center as shown. When an arch of this form is used for brick or stone work as shown at Fig. 123, a new set of conditions arise, as the joints of the bricks or stone must be shown so that the right bevels or angles may be given them. These joints all radiate to the center of the arch as shown. It may not be out of place at this

PLATE 8.

This plate shows the outside of a plain window frame, a door frame, corner board, and a sectional elevation of sash and frame. This is a very simple plate, and the young draftsman will find no difficulty in re-drawing these details.

PLATE 3

OUT SIDE FRAMES AND

TE 3.

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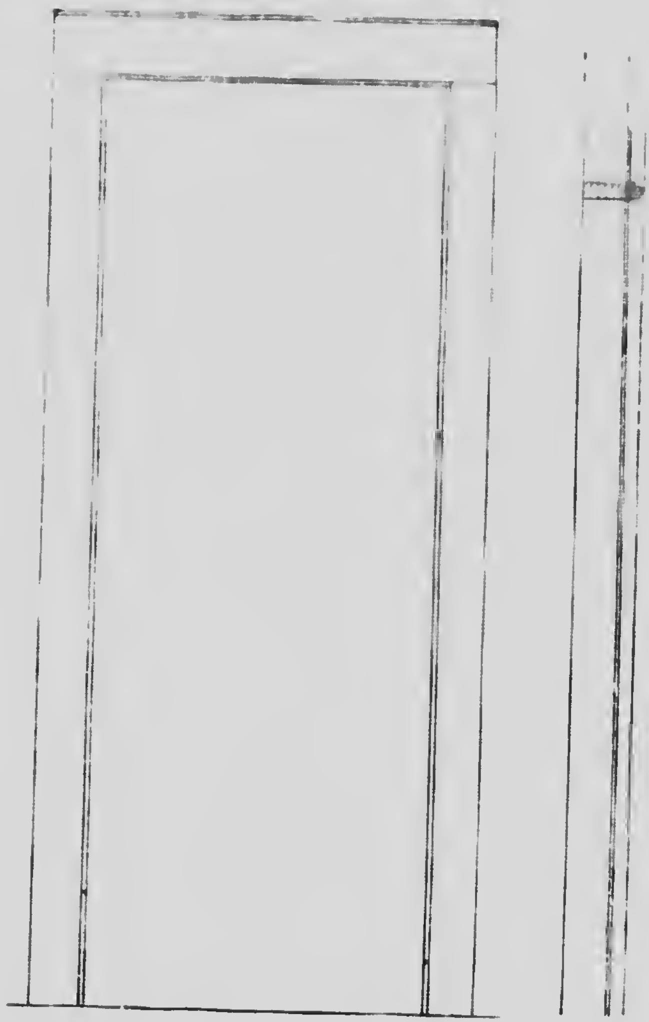

AND CORNER

point to give a description of the arch, with the terms used in connection therewith, and, I may say, the definitions given apply to all other arches as well as to the one in Fig. 123:

(1) The SPAN of an arch is the distance between the points of support, which is generally the width of the opening to be covered, as A B. These points are called the springing points; the mass against which the arch rests is called the ABUTMENT.

(2) The RISE, HEIGHT OR VERSED SINE of an arch is the distance from C to D.

(3) The SPRINGING LINE of an arch is the line A B, being a horizontal line drawn across the tops of the support where the arch commences.

(4) The CROWN of an arch is the highest point, as D.

(5) VOUSSOIRS is the name given to the stones forming the arch.

(6) The KEYSTONE is the center or uppermost voussoir. D. so called because it is the last stone set, and wedges or keys the whole together. Keystones are frequently allowed to project from the faces of the wall and in some buildings are very elaborately carved.

(7) The INTRADOS or SOFFIT of an arch

is the under side of the voussoirs forming the curve.

(8) The EXTRADOS or BACK is the upper side of the voussiors.

(9) The THRUST of an arch is the tendency which all arches have to descend in the middle, and to overturn or *thrust* asunder the points of support. The amount of the thrust of an arch depends on the proportions between the rise and the span; that is to say, the *span* and *weight* to be supported being *definite*, the thrust will be diminished in proportion as the rise of the arch is increased, and the thrust will be increased in proportion as the crown of the arch is lowered.

(10) The JOINTS of an arch are the lines formed by the adjoining faces of the voussoirs; these should generally radiate to some definite point, and each should be perpendicular to a tangent to the curve of each joint. In all curves composed of arcs of circles, a tangent to the curve at any point will be perpendicular to a radius drawn from the center of the circle through that point, consequently the joints in all such arches should radiate to the center of the circle of which the curve forms a part.

(11) The BED of an arch is the top of the abutment; the shape of the bed depends on the

quality of the curve, and is explained in the diagrams.

(12) A RAMPART ARCH is one in which the springing lines are not on the same level

(13) A STRAIGHT ARCH or, as it is more properly called, a *plat-band*, is formed of a row of wedge shaped bricks or stones of equal depth placed in a horizontal line; the upper ends of the pieces being broader than the lower, prevents them from falling down.

(14) ARCHES are named from the shape of the curve of the underside, and are either simple or complex. The simple curves may be defined as those that are described from one center, as Fig. 122, or by a continuous motion, as the ellipse, parabola, hyperbola, cycloid, and epicycloid; and complex arches are those which are described from two or more fixed centers, as many of the Gothic and Moorish arches are.

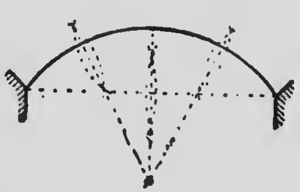

Fig. 124.

Fig. 124 shows the manner of drawing a segmental arch The center of this is below the springing lines. A segmental arch, drawn out for brickwork, is shown at Fig. 125, in which the joint lines are marked off.

A segmental arch drawn from two centers is shown at Fig. 126. The centers are shown so that the student will have no trouble in describ-

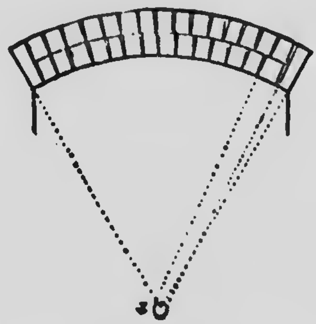

Fig. 125

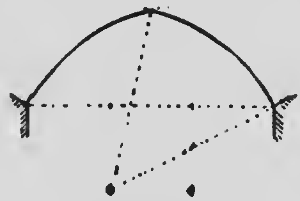

Fig. 126.

ing it. The joints for brick or stone work may be laid out around this arch, by using the centers as fixed points and running radial lines through the curved lines.

The diagram shown at Fig. 127 illustrates a

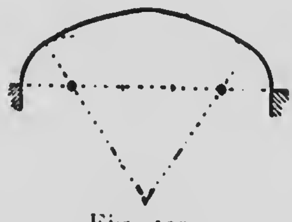

Fig. 127

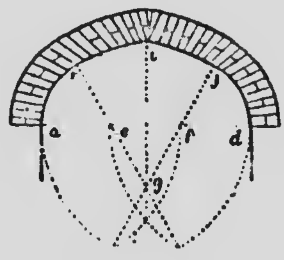

Fig. 128

Tudor arch. It is struck from three centers as shown. It is sometimes called an elliptical Gothic arch, and may be struck as follows:

Divide the span, *ad*, Fig. 128, into three equal parts by the points, *cf*. From *a*, with radius *a, f*, describe an arc, and from *c, f*, and *d*, describe similar arcs, which intersect at *ij*. Now bisect the span, *ad*, and raise *a* perpendicular to *i*. Draw a line through *if* and *jc*, and produce these lines. With compasses from *f* with radius, *fd*, describe arc to *j*, and from *c*, with the same radius, describe a similar arc to *nh*. Then from *i* with radius *ij*, describe arc, *ji*, and from *j* same radius, the curve *hi*, when the interior curve of the arch will be completed, the remainder of the arch being set out in the usual manner.

The elliptical arch can best be described with the trammel shown at Fig. 69, or with a string as described at Fig. 68, but the joints for brick or stone work must be obtained by a method very different from that illustrated for circular arches. To obtain the correct lines for the elliptical arch shown at Fig. 129, we must proceed as follows: Let ZZ be the foci, and B a point on the intrados where a joint is required; from ZZ draw lines to B, bisect the angle at B by a line drawn through the intersecting arcs D produced for the joint to F. Joints at 1 and 2 are found in the same manner. The joints for the opposite side of the arch may be transferred as shown. The semi-axes of the ellipse, H G, G K, are in the same ratio as G E to G A. The

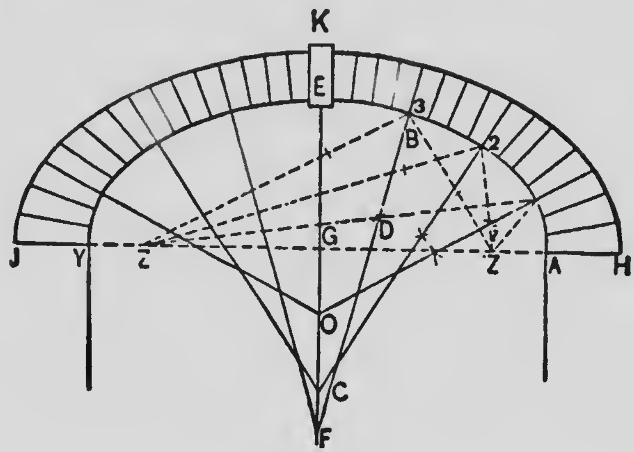

Fig. 129.

voussoirs near the springing line of the arch are thus increased in size for greater strength.

The diagram shown at Fig. 130 shows a lancet

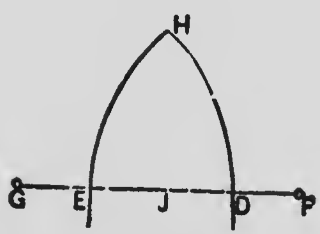

Fig. 130.

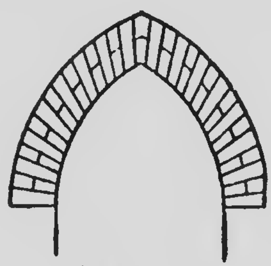

Fig. 131.

arch. This is drawn by placing the centers of the curves outside the figure as at G and F. E O, show the width of the opening, and H J, the height.

A completed lancet arch is shown at Fig. 131, the radial or joint lines being exhibited. These lines are drawn from the centers in all cases.

The diagram shown at Fig. 132 represents an equilateral, Gothic arch. This is drawn with the compasses set to the width of the opening, one leg being placed at the junction of the springing line when the other leg describes the curve of

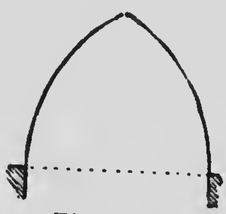

Fig. 132.

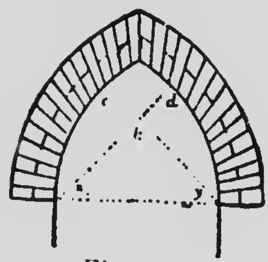

Fig. 133.

one side. The same process forms the other side of the arch.

The completed equilateral arch is shown at Fig. 133, with the method of laying out the curves. The centers being X and Y. As before stated, the joints in all these arches should be struck at right angles to tangents of the curve, which in the case of arcs of circles will cause the joints to radiate to the center from which the curve is struck. There are cases, however, when this rule cannot be followed, as take the last illustration Fig. 133, for instance, when the bonding is not what a good workman would desire, yet it is better than the bonding shown in Fig. 134, though perhaps not so handsome; that, however, is a matter of taste. The employment of the method shown at Fig. 133 gets rid of the small angle closers which show in the crown of Fig. 134. To get the lines properly, as shown in Fig. 133, run up the two dotted lines at an angle of fifty degrees, with the springing line X Y, on each side of the arch. These are produced to cut through the curve lines at C and D.

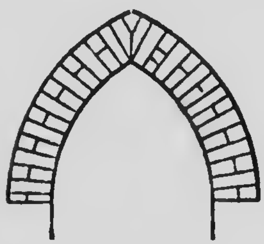

Fig. 134

The joints of the arch from X to C are radiated to Y, those from D to Y to X, and those in the upper portion of the arch to the intersection of the two inner lines at B, whereby the bricks at the crown are eased off. In pointed or two-centered arches, other than equilateral, the same method may be followed, the angles of the dotted lines being greater or less as the circumstances of the case may require.

In setting out gauged arches care must be taken to draw first a middle or "key" brick at the crown of the arch, the object being to provide a brick to resist the increased strain at the point; and secondly, to have the effect of producing an equal number of bricks in the arch excluding the key, so that it may be finished the same on each side.

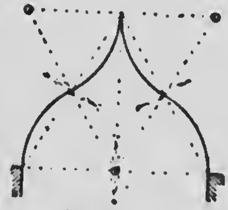

Fig. 135.

The next arch is drawn upon the same principles as the ogee curve shown in Fig. 135, and with the construction lines given requires no further explanation. It is defective as a scientific arch, but occurs often in the Decorated Period, towards the end of the fourteenth century. After that period the arches were made flatter, examples of which are the segmental, or two-centered, and the Tudor, or four-centered, arches.

To describe an equilateral ogee arch, like Fig. 136, proceed as follows: Make YZ the given span; make YX equal YZ, bisect YZ in A;

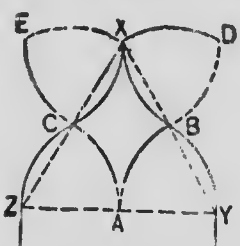

Fig. 136.

on A as center, with A Y as radius, describe the arcs Y B and Z C; on B and X as centers describe the arcs B D and X D, and on C and X as centers describe the arcs C E and X E; on E and D as centers describe the arcs B X and C X.

The flat ogee arch shown at Fig. 137 requires some little different treatment to the previous one. To obtain the proper curves and centers for this style of arch proceed as follows: Let A B be the outside width of the arch, and C D the height, and let A E be the breadth of the rib.

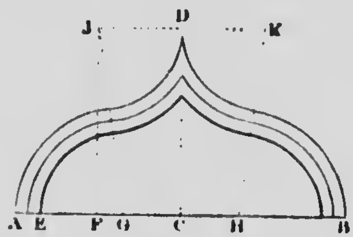

Fig. 137.

Bisect A B in C, and erect the perpendicular C D; bisect A C in F, and draw F J parallel to C D.

Through D draw J K parallel to A B, and make D K equal to D J.

From F set off F G equal to A E, the breadth of the rib, and make C H equal to C G.

Join G J and H K; then G and H will be the centers for drawing the lower portion of the arch, J and K will be the centers for describing the upper portion, and the contrary curves will meet in the lines G J and H K.

This style of arch is seldom used in substantial work other than in Gothic architecture; the carpenter, however, often makes use of it in porch, veranda and arbor work, and sometimes in grille work, so it is well to have a knowledge of it.

Another arch, not in common use, is the

horseshoe or Moorish arch; two examples are shown at Figs. 138 and 139. In the first the curve is struck from a center situated above the springing line. This is said to be the strongest

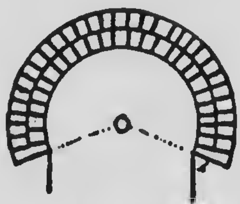

Fig. 138.

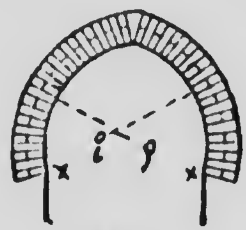

Fig. 139.

of all arches when properly constructed and is often employed for tunneling and other heavy work where great resisting strength is required.

The figure shown at 139 is sometimes called a Gothic horseshoe arch because of its being pointed. It is somewhat similar to the last, but is struck from two centers, I and J. The special peculiarities of these arches is, that they are narrowed in on the springing lines, which gives to them a pleasing appearance.

Often arches are formed by having them two or more bricks deep, or they may be rough and turned in half-brick rings, 4½ inches thick, as shown at *hh* in Fig. 140. In arches of quick curve, with not more than 2 or 3 feet radius, this method is absolutely necessary to prevent

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)

1.0 4.5 2.8 2.5
5.0
5.6 3.2 2.2
6.3
7.1 3.6
8.0 4.0 2.0
9.0
1.1
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1.25 1.4 1.6

very large points at the extrados. In the section of portions of small arches shown in the illustration, of which one *ww* is turned, in nine inch rings consisting of headers. It will be seen that

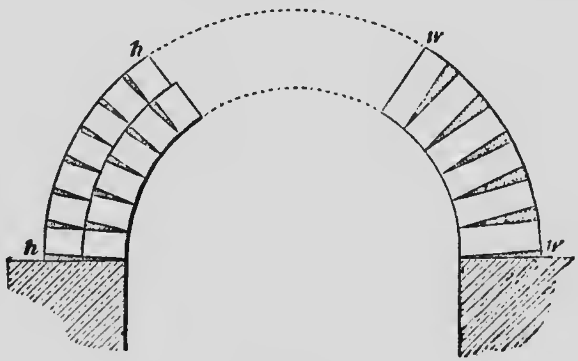


Fig. 140.

the mortar joints in this are much wider at the top than those of the portion *hh*, built in rings half a brick in thickness. The line of joints in both these examples are radial, all being drawn from the center point.

The most common—so-called arch—is what is termed "gauged straight arches," and with these, in brickwork, the draftsman will have the most to deal, and I purpose showing him several examples. Such arches are in very common use, and are generally 12 inches, or four courses of brickwork, in depth.

The *sommering* or splay of the bricks depends upon the angle given to the skewbacks or springings, and varies with the distance of each voussoir from the springing.

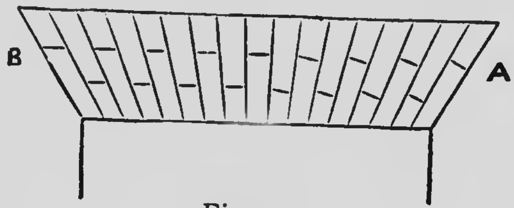


Fig. 141.

The skewbacks are generally inclined at 60° from the horizontal, and are struck by prolonging the sides of an equilateral triangle, as shown on Fig. 142.

The joints give a better appearance when horizontal as at B, Fig. 141; but to save labor they are frequently formed as at A, and carefully concealed by rubbing over, false horizontal joints being marked on the face, though in course of time the true joints are sure to show up and expose the sham.

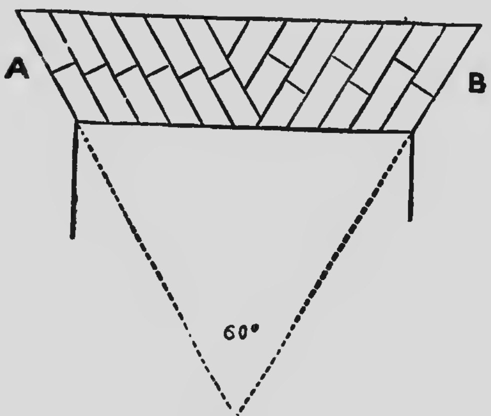


Fig. 142.

The arch shown at Fig. 142 is sometimes called a *French* or *Dutch* arch. It is sometimes used by builders when intended to be plastered or covered over. Such arches are unreliable, and the draftsman should never make them if intended to be built, unless they are to be built up in good Portland cement mortar. The joints may be arranged as shown at A or at B; if, as at A only whole bricks should be used.

Sometimes, in building arches of this kind, it may be necessary to "plug" the brickwork as shown at PPPP, Fig. 143, for the purpose of

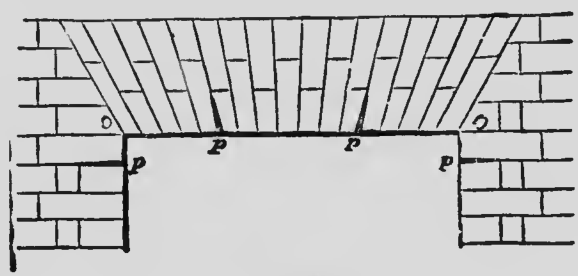


Fig. 143.

attaching finished work to them by screws or other devices, and the draftsman must note this on his drawings in order to save future trouble. The manner of forming the skewbacks is shown in this illustration, at o o; the angle of this line should be about sixty degrees.

In placing in arches of this kind, there must always be timber or concrete lintel behind the face bricks to carry the wall, and over this lintel, there should be a relieving arch built.

This latter arch is generally built up roughly unless it is intended to carry a great weight, then care must be taken in its construction.

Before leaving the subject of arches it may be well to exhibit some examples in stone, and should the student never be called upon to prepare drawings for such work, their con-

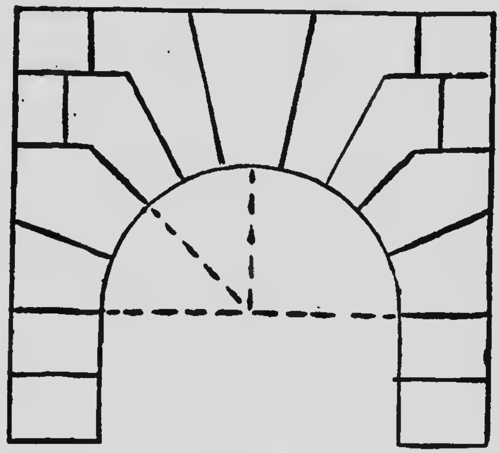


Fig. 144.

struction on paper will make good practice. The example shown at Fig. 144 is a very common one in stonework and shows how the style of work is prepared. It will be seen that the joints are generally radial, while horizontal joints are formed to receive the stone above.

Another style of opening in stonework is shown at Fig. 145, where the head of the

PLATE 9.

Plate 9 shows three examples of inside finish—a door, a window, and sliding door—opening with trim. These like the other examples shown in Fig. 8 are easily understood.

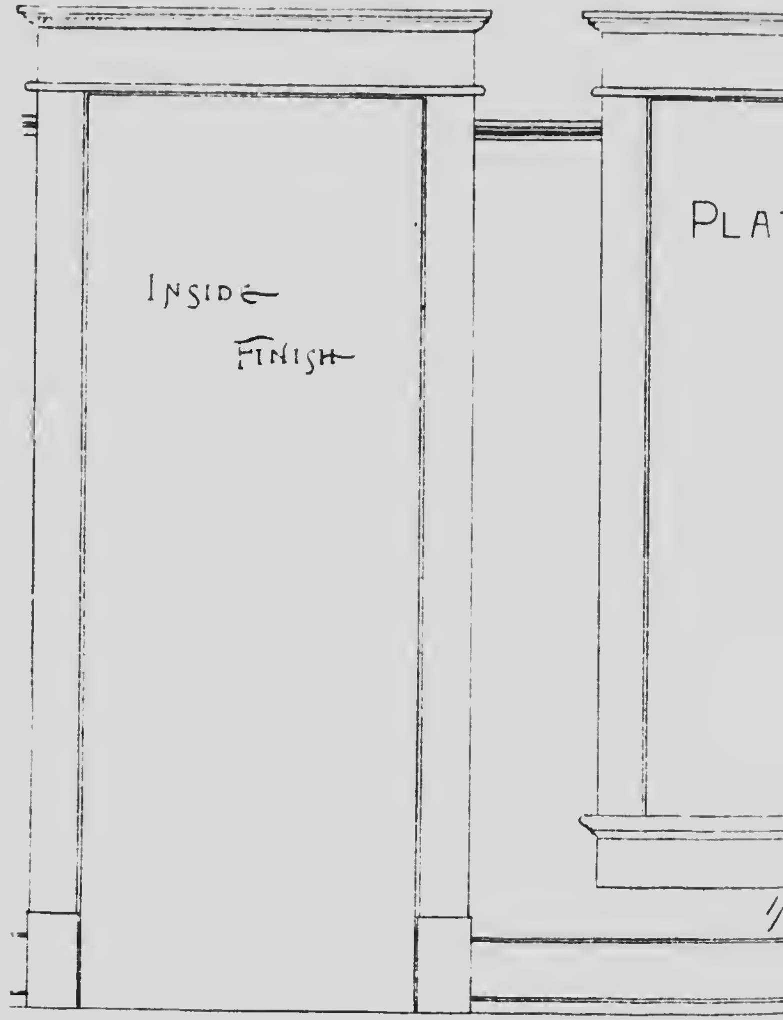
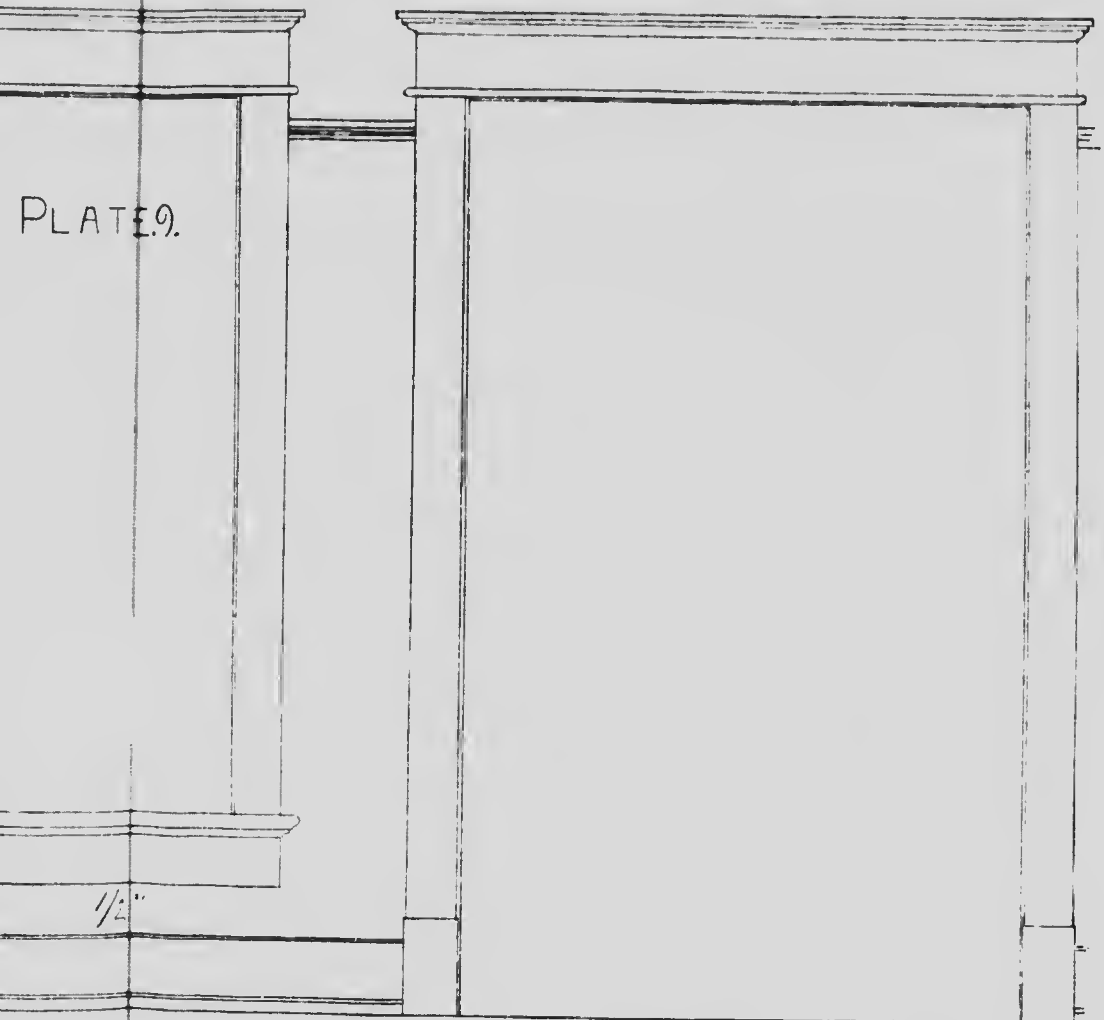

INSIDE
FINISH
PLA

PLATE 9.



window or door is flat. There is a relieving arch thrown over the lintel or cap to carry the

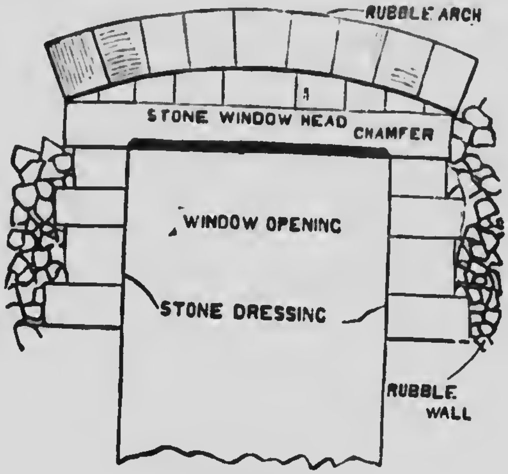


Fig. 145.

weight over to the jambs. The face of the window is all of dressed stone, while the walls are formed of irregular stones.

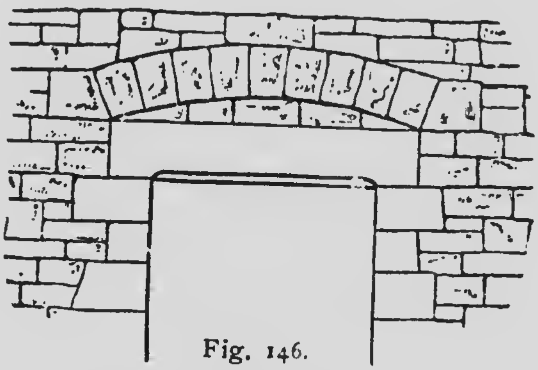


Fig. 146.

Another style of work is shown at Fig. 146, where the walls are formed of square stones laid

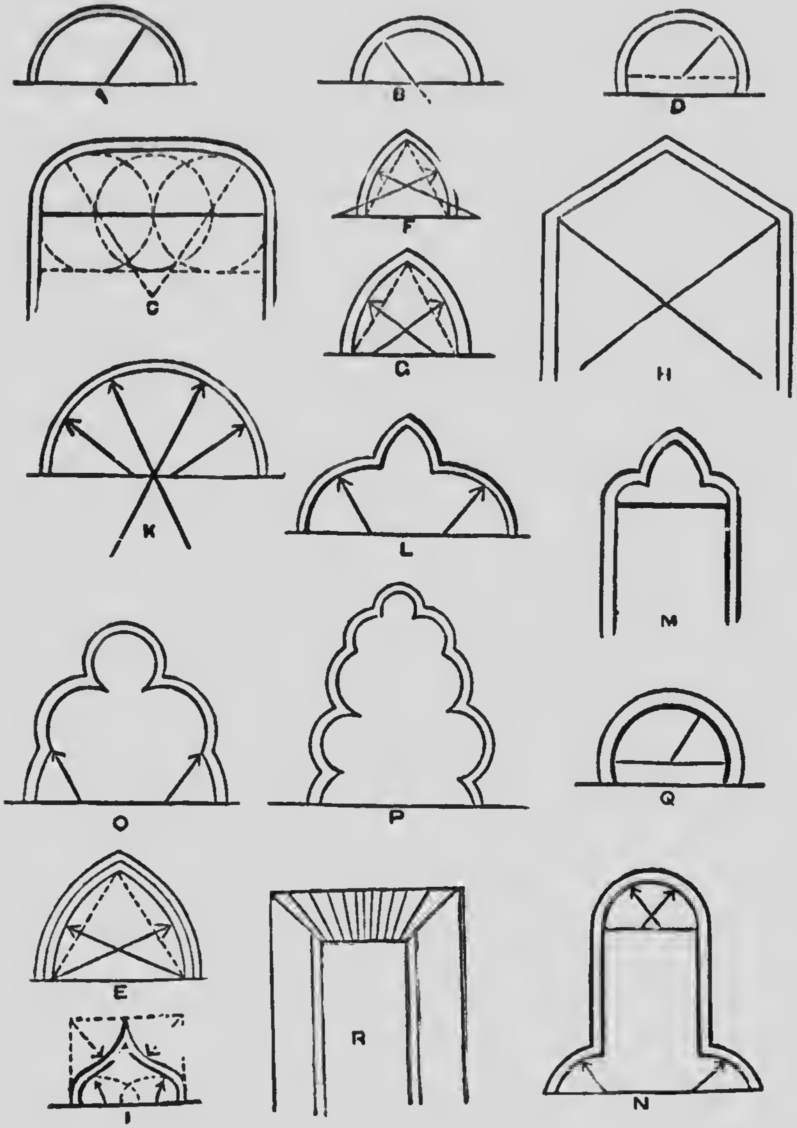


Fig. 147.

up in irregular courses, and the relieving arch ends against a regularly prepared skewback.

At Fig. 147 are grouped some of the principal forms of arch shown in architecture. At A is the semicircular arch, describing half a circle. B is a form of elliptical arch, not unfrequently employed. It is not in reality, elliptical at all, save in appearance, being a segmental arch, or one formed by the segment of a circle, which is struck from below the springings. The elliptical arch C is formed of several circles. The stilted arch D rises from points below its center. The Gothic architects employed various forms of the pointed arch at different epochs. E is what is usually termed an equilateral arch, so called because the two springing points and the crown of the arch form an equilateral or equal-sided triangle. F, the lancet arch, is more pointed than the preceding. It is struck from outside the springings, and has the outline of an isosceles or equal-legged triangle, of which the base is, of course, less than the sides. G, the "drop" arch, in contradistinction to the last example, is less pointed than the equilateral arch. It is struck from within the springings, and has a triangular outline, in which the base is longer than the sides. H, the "segmental Gothic arch", is composed of two segments of a circle, meeting obtusely. I, the "ogee" arch, was introduced at a late period of Gothic architecture, and is struck from four points. K, the "Tudor," arch prevailed during the close of the Gothic, and takes its name from the then ruling family of the English dynasty. It has a much flattened arch, low mouldings, and a profusion of panelings. I now come to arches of the form that are designated "foiled" arches, imitating the foils or leaflets of a leaf, which are generally divided into three varieties, viz., trefoils, cinquefoils, and polyfoils. L, M, N exhibit three forms of the "trefoil" or three-lobed arch, O is an example of the cinquefoil or five-lobed arch, and P, one of the "polyfoil" or many-lobed arch. The latter form is principally confined to Romanesque and Saracenic architecture, and is especially met with in Moorish and Saracenic buildings. The latter people also employed a peculiar arch, special to themselves, and generally styled the "horseshoe" arch, shown at Q. This is only found in Arabic or Moorish buildings. The so-called "flat" arch, R, is in reality not an arch at all, though the voussoirs are so arranged as to radiate from a center, and are laid in parallel courses. This arch is employed in doorways, windows, and fireplaces of buildings, and the intrados are generally supported by a bar of iron or beam of wood. In some very ancient examples the voussoirs are cut to a peculiar form, with the idea of securing great stability and strength, as shown at Fig. 148, which is copied from the fireplace of Coningsbergh Castle.

I think the foregoing illustrations of arches and the accompanying description are quite sufficient for my purpose, as the student can

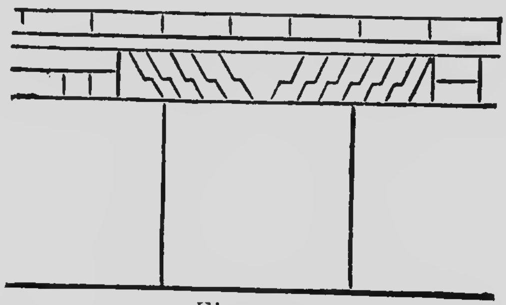


Fig. 148.

gather from them all he will immediately require to know, and after a thorough mastery of these examples he will have no difficulty in obtaining a higher knowledge from the thousand and one other sources that are available, should he so desire.

SOME MISCELLANEOUS PRACTICE

Suppose it is necessary to show a door and casings in a brick wall, with jamb linings, grounds and other finishings, we commence by first laying out the plan as shown at Fig. 149; we decide upon the height and width of door, also

Fig. 149.

style of door, and finish, and work to scale accordingly. In this case I show an elevation, Fig. 151, and plan respectively with a four paneled door with jamb and soffit lining. Fig. 150 shows a portion of the plan enlarged.

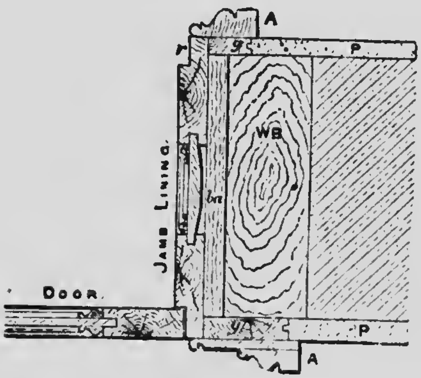


Fig. 150.

In this case it will be seen that the door is hung to the jamb lining itself; the latter is attached to a backing *ba* dovetailed in between the framed grounds, and secured to wood bricks in the wall, the edges of which may be seen in section Fig. 152.

In some cases the grounds are tongued into the jamb linings, but this is very seldom done.

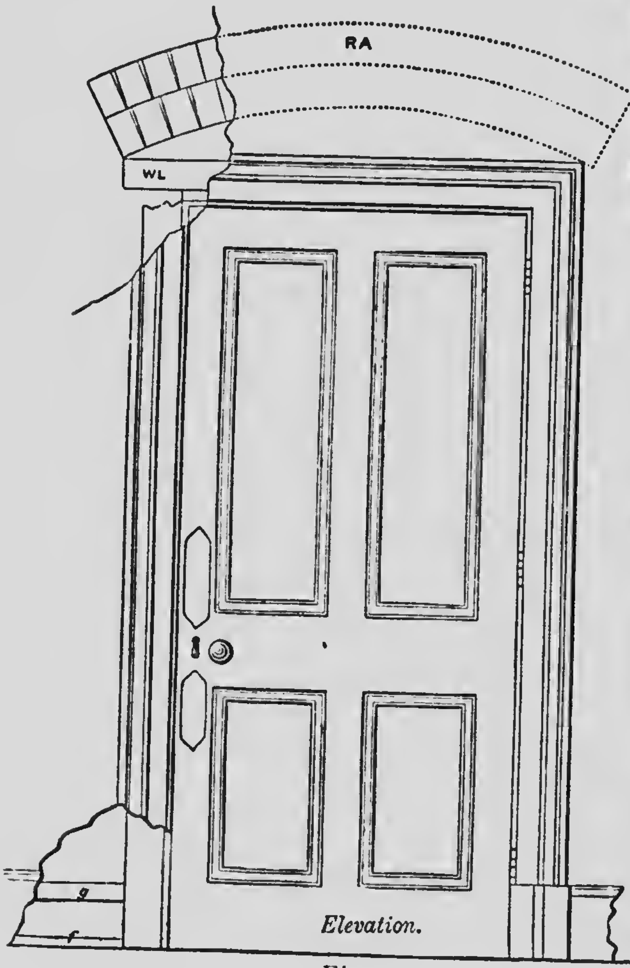


Fig. 151.

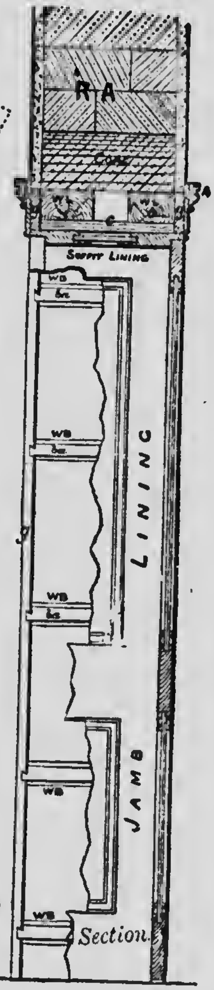


Fig. 152.

The jamb linings go right through the depth of the opening, and on one side of the wall have their edges rebated to receive the door; the

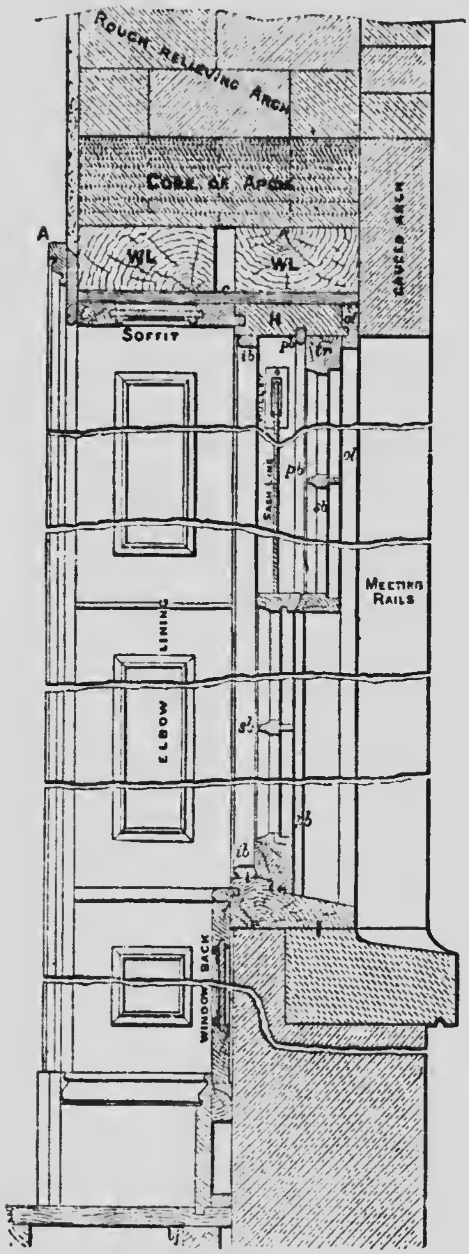


Fig. 153.

edges on the other side of the wall being (in superior work) similarly rebated to correspond.

The soffit lining is secured to cradling or backing *c*, consisting of rough stuff attached to the under side of the lintels over the opening.

Of course the doorway might be spanned by a rough brick arch, or by a concrete beam, without wood lintels, in which case the framing would be secured to plugs let into the arch or beam.

The enlarged

plan in Fig. 150 differs slightly from Fig. 149, inasmuch as a smaller architrave is shown on the inside of the doorway. The paneling of the soffit lining is often shown in dotted lines upon the plan of the doorway.

The whole elevation of one side of the door is shown at Fig. 151, and a section is shown at Fig. 152, with a portion of the jamb lining removed. This latter is a good scheme as it shows the workman exactly what is required of him.

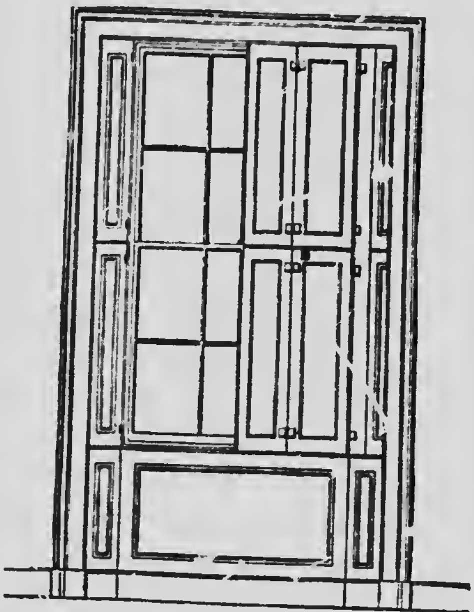


Fig. 154.

The illustration shown at Fig. 153 shows a vertical section of a window and frame for a brick house. s purposely cut short in order to show all the parts. It will be readily understood, as WL stands for wood lintel, b j for bottom joints, *ib* inside blinds, etc. Fig. 154 shows the same window in elevation with shutters or blinds in sight.

The plan is shown at Fig. 155. This shows the shutters box splayed from the wall. The dotted lines show the shutters partly folded.

In redrawing these examples the student should make them at least twice or three times the size shown herewith; this can readily be

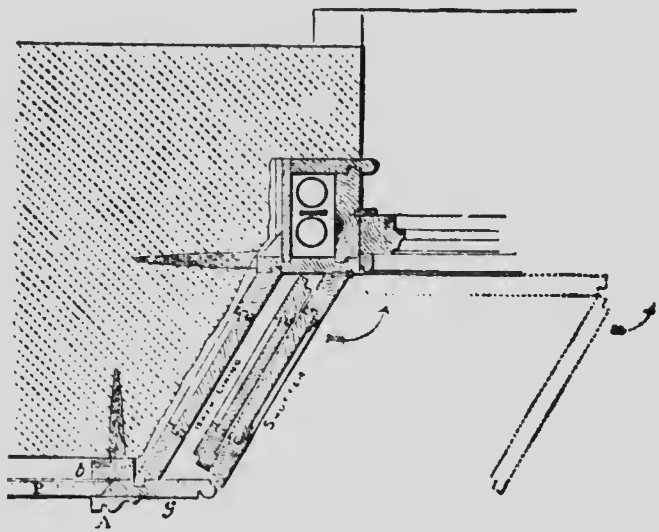


Fig. 155.

done by taking the distances on a compass and transferring to the paper on which the drawing is to be made. If the drawing is to be twice the size of the original, then space off the distance of each feature twice, if to be three times the distance, then space off three times, and so on for other sizes. By following this advice, the student will become familiar with his instruments and with the various kinds of work. Indeed, this work is intended, besides being a teacher of primary drawing, to be a helper in obtaining some knowledge of architectural construction as well; for, it is supposed, it will fall chiefly into the hands of young students, apprentices, and fellows who have not had a fairly good opportunity of acquiring a knowledge of either drawing or construction, but who are desirous of learning what they can of both, during their spare moments.

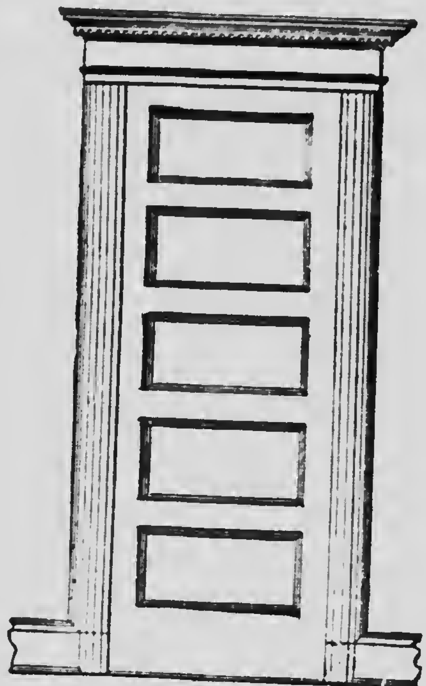


Fig. 156.

The plates, following the general illustrations, will place before the student many things not as yet touched upon, but I have deemed it necessary to show a few miscellaneous items both for practice, and because of their constructive value to the young builder.

The door and casing shown in Fig. 156 is a good example for drawing; its proportions are nearly perfect, and the style is modern. This is an inside door as shown by the base.

The sliding doors shown at Fig. 157 are very nearly built in the same style as the single door

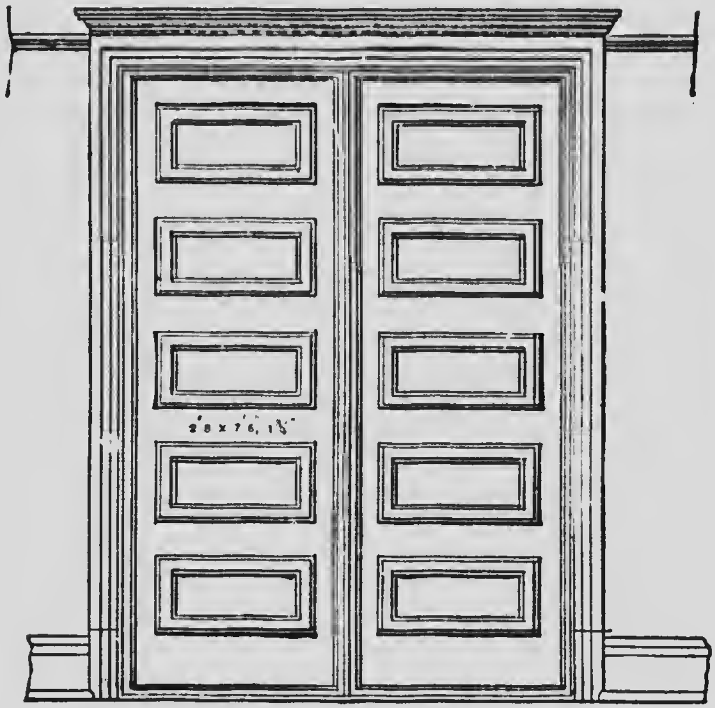


Fig. 157.

shown in Fig. 156. These may be drawn to any special scale, or they may be transferred from the illustration. I show a section of the wall into which the sliding doors run at Fig 158. This drawing shows the method of construction, the end-wood of the studding being seen; also, the linings to protect the pocket.

The illustration, as Fig. 159, shows a method

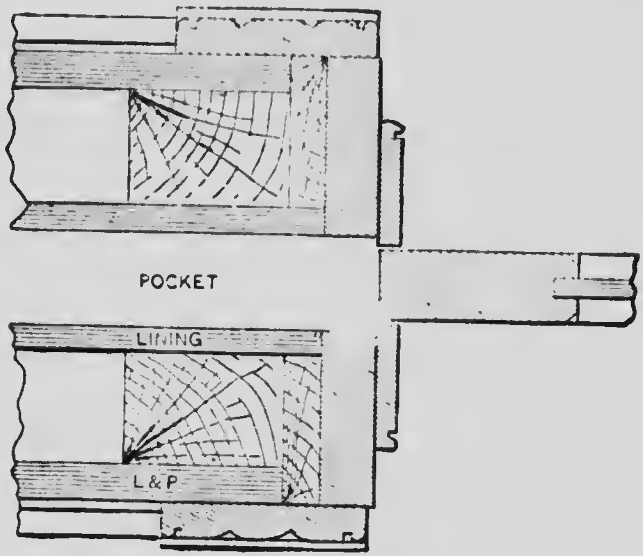


Fig. 158.

of adjusting the joint at the junction of the doors. The section shows clearly how the joint is hidden from view.

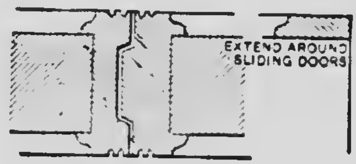


Fig. 159.

A section and elevation of trim for a door is shown in Fig. 160. In this drawing the door, the step, the stud, the plaster and the trim are shown in place, and at the bottom, the plinth block and base are also shown in section. This style of finish is called "block finish," because of the turned block being placed on the corner.

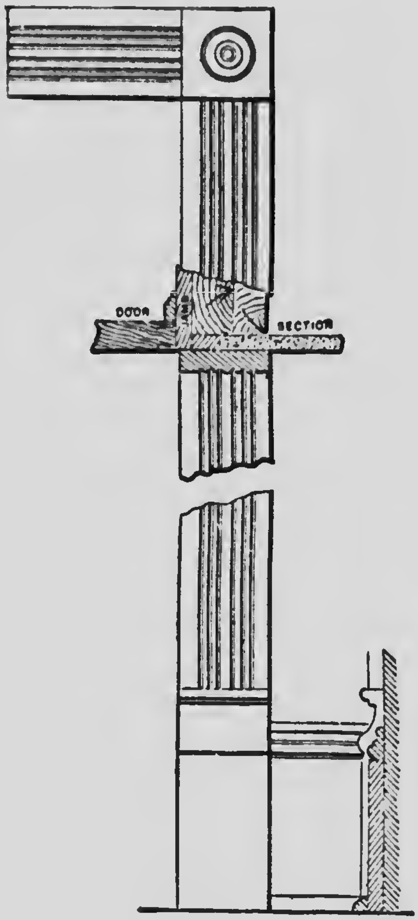


Fig. 160.

Fig. 161 exhibits a corner of a balloon frame, showing the manner of placing the studs, corner boards and other finish.

I show at Fig. 162 a drawing of a cornice for a balloon frame house. The method of construction is made quite apparent and can easily be followed. The walls are boarded or "sheeted" on the outside, and then covered with siding or clapboards.

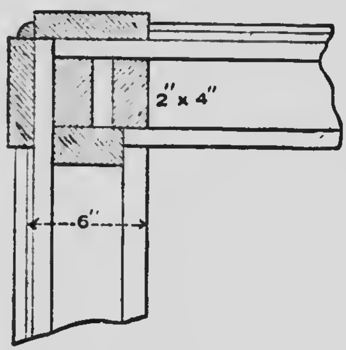


Fig. 161.

The next drawing, Fig. 163, shows a section of a corner for a brick wall. The gutter and com-

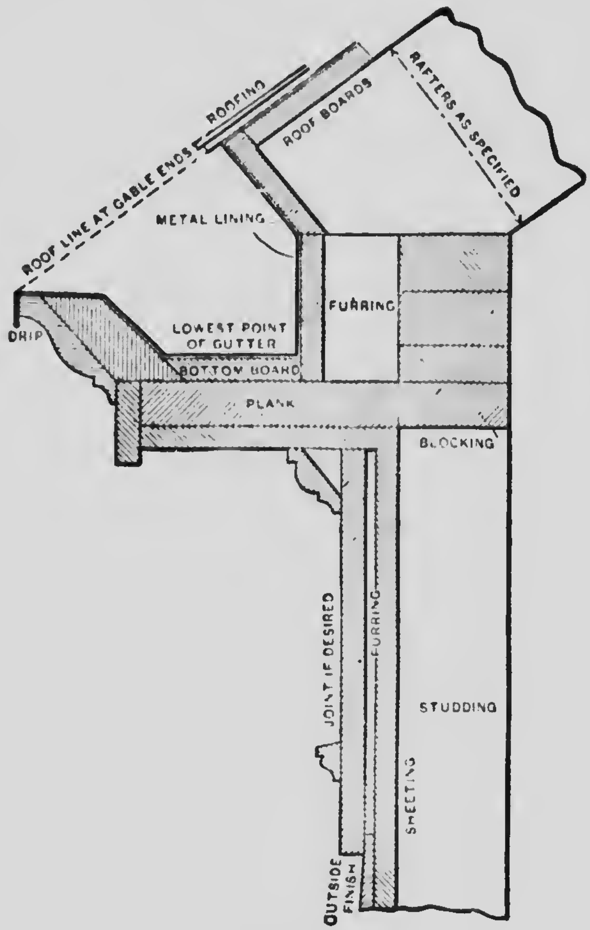


Fig. 162.

plete finish for cornice are shown; also, an iron rod or anchor built into the wall, having a nut on the top whi[illegible] intended to hold the plate

PLATE 10.

This plate shows a number of details half life size. A portion of elevation and section of trim head are given, also section of casing, picture frame mould, plinth-block, base and floor step. The face of plinth-block is also shown.

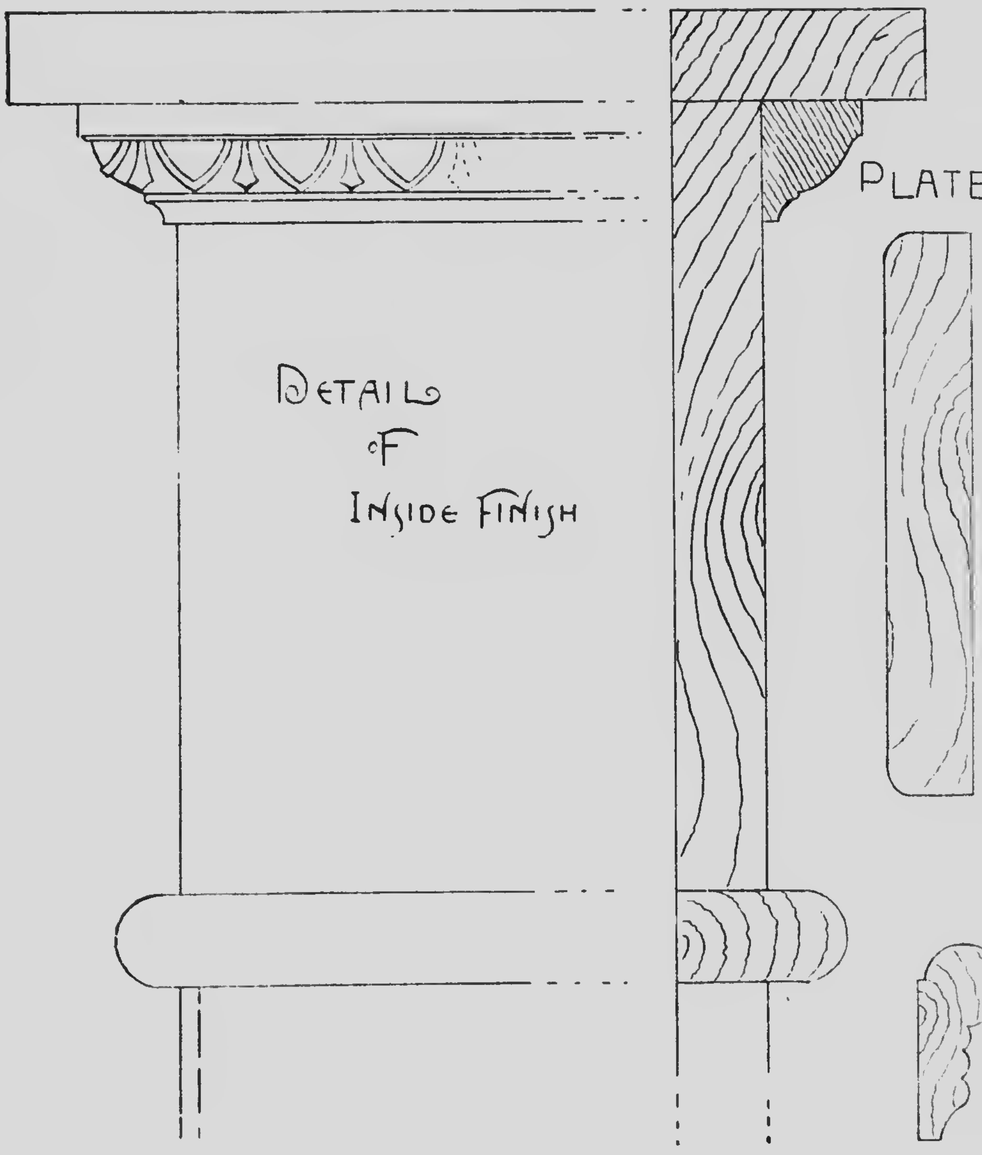
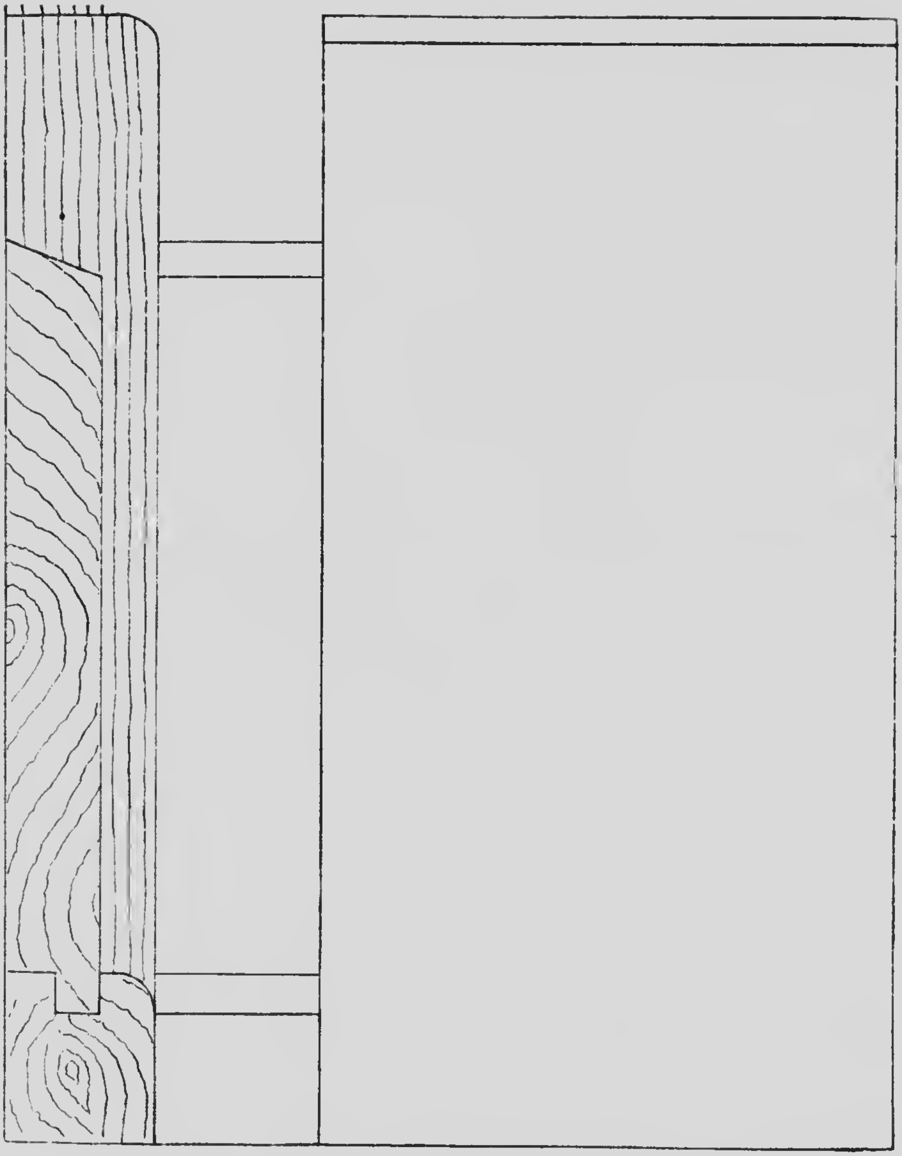


PLATE
DETAILS
OF
INSIDE FINISH

PLATE.10



in its place on the wall. A section of a box window frame is shown at Fig. 164. The weights are seen in the box, the stud forming part of the box. This is designed for a balloon frame house, and it will be seen that the inside trim

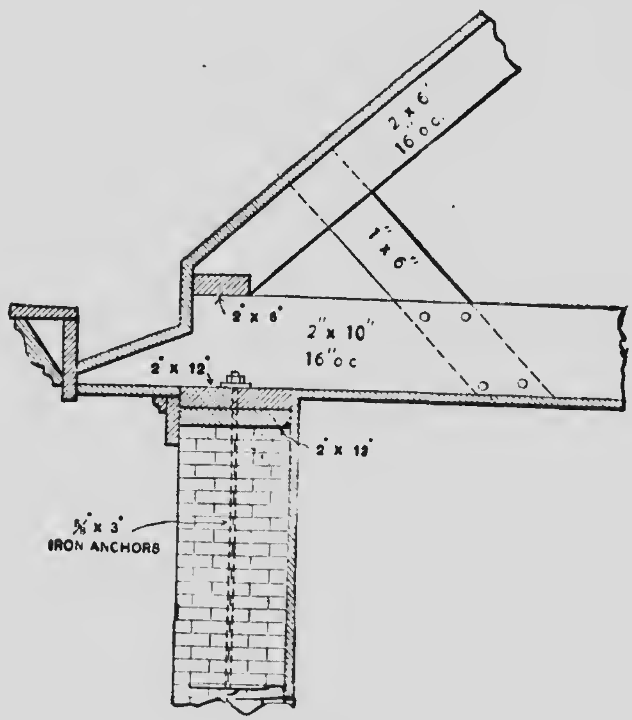


Fig. 163.

forms one side of the box. This is an exceedingly cheap way to make a frame as but very little stuff is required in its construction.

The section of window frame shown in Fig. 165 exhibits the portion cut at the sill. This shows the construction of the frame at the bottom, including inside and outside finish.

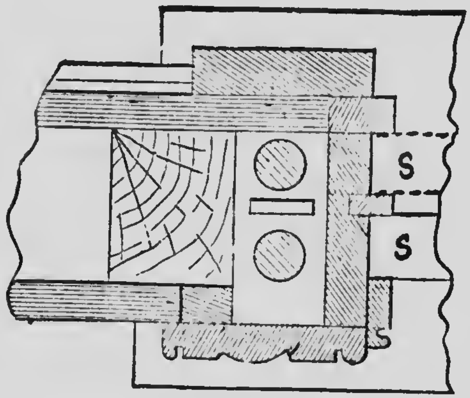


Fig. 164.

It will be in order now to follow the plates I have prepared, in which a large number of constructive details are presented. I would advise that the student copy each item as presented, making each one twice the size as shown on the plates; this will make instructive practice and will soon fit the young draftsman for work of a higher and more elaborate kind.

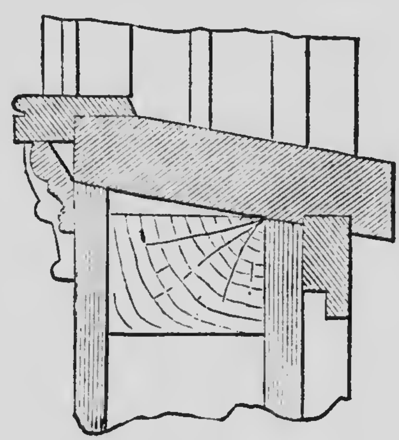


Fig. 165.

The foregoing illustrations have been especially prepared and drawn, with a view of leading the student by easy steps to a fair knowledge of the use of his instruments and the laying out of work on paper.

Each item, too, has a constructive value, as all are drawn from examples of actual work, and will, therefore, convey in some measure a true knowledge of construction, without which the work of the mechanical draftsman has but little value.

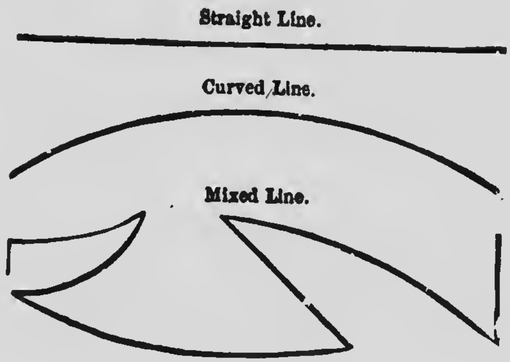


Fig. 166.

SOME ORNAMENTAL EXAMPLES

We have now reached a stage where an attempt at ornamental geometrical drawing is permissible, and though it is not my intention to go deeply into this subject, a few examples along with brief descriptions will probably start some of my readers on a course of drawing extending far beyond the limits of this work.

This kind of drawing—like most other drawing—is composed of straight lines, curved lines and mixed lines, as shown in Fig. 166, but such lines are regular, and are made by the aid of compasses, or other instruments, and this

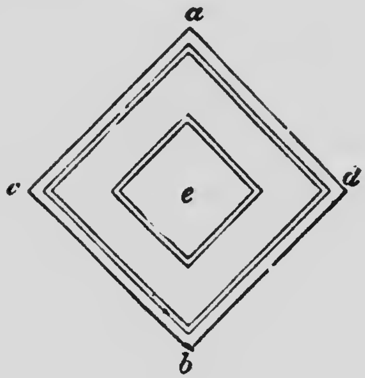


Fig. 167.

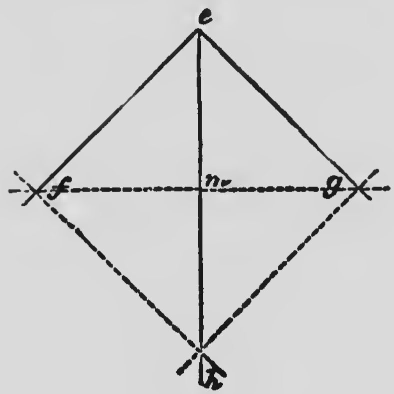


Fig. 168.

fact distinguishes geometrical drawings from drawings wrought freehand. Suppose we desire

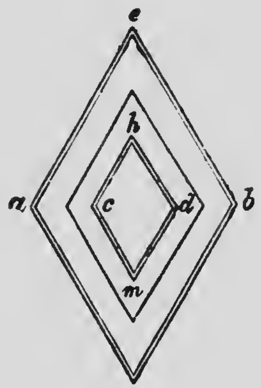


Fig. 169.

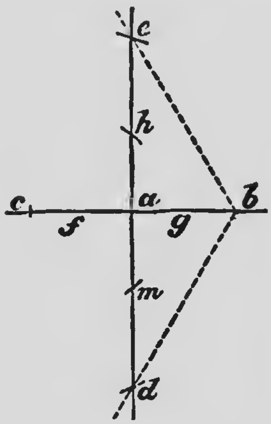


Fig. 170.

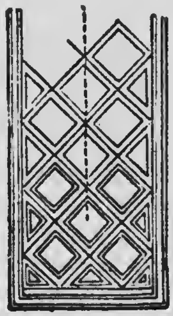


Fig. 171.

to show a square diagonally either for ornamental or practical purposes, we simply proceed as follows: Figs. 167 and 168 show the diagrams; join the lines a b, c d, Fig. 167, crossing at e, as shown in Fig. 168. Take half c d, Fig. 167, as c e, and set it off from m, Fig. 168, to e h, g f; join these, and parallel to them draw the internal squares and we have a figure more or less ornamental. Again, suppose we desire a "lozenge" or diamond shape; this can be accomplished by a similar method as shown at Figs. 169 and 170. Fig. 170 shows the manner in which it is drawn; two lines c b, and e d, intersect at a; a c, a b, a e, a d, are each equal to half of a b, e f, Fig. 169; and a h, a m, a g, a f, Fig. 170, to half of h m, e d, Fig. 169. Let us put one of these examples to some further purpose; this is done in Fig. 171, which shows how this style of drawing may be used for filling in spaces.

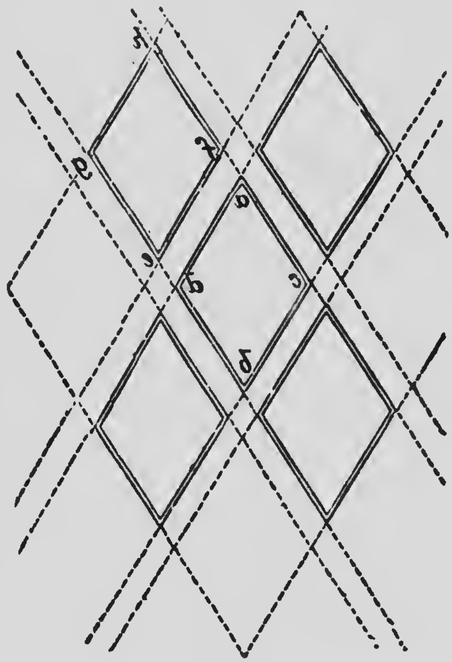


Fig. 172.

The example shown at Fig. 172 exhibits a method of drawing a design for a diamond-shaped pattern. The dotted lines show the construction, the distance between the diamond as e f g h, a b c d, being equal to the distance a f, a d e. The use of this is probably shown at Fig. 173, when a design for tile patterns is shown, the lines a b c d f are drawn to the angle shown and are parallel to

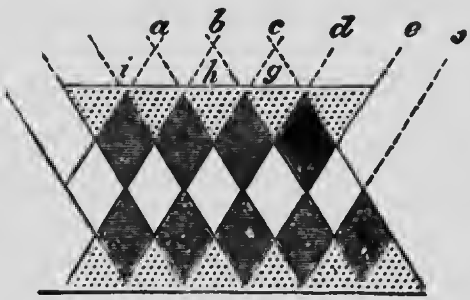


Fig. 173.

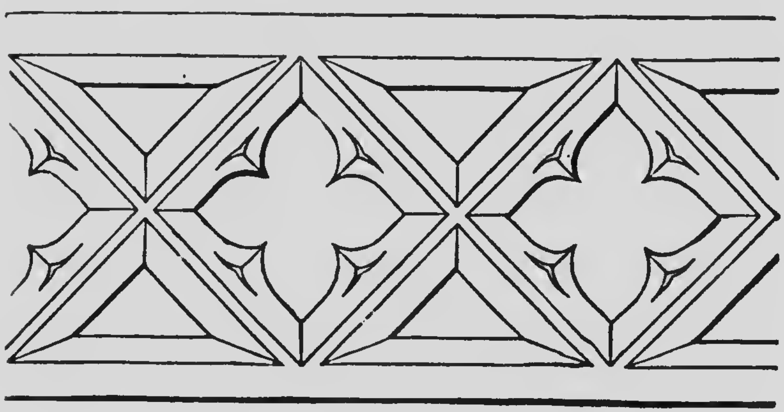


Fig. 174.

each other, the distances being shown at i h g.

Another illustration of a square being set diagonally is shown at Fig. 174, which illustrates an open balustrade in Gothic style. The student should have no difficutly whatever in laying this diagram off, as it is a very simple matter.

Figs. 175 and 176 show another design having

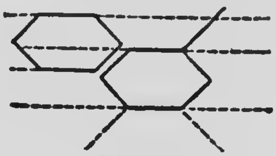


Fig. 175.

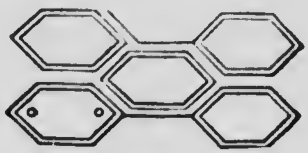


Fig. 176.

six sides, which is often employed in decoration and in Gothic architecture. The manner of laying it out is shown in Fig. 175, and completed figures are shown at Fig. 176.

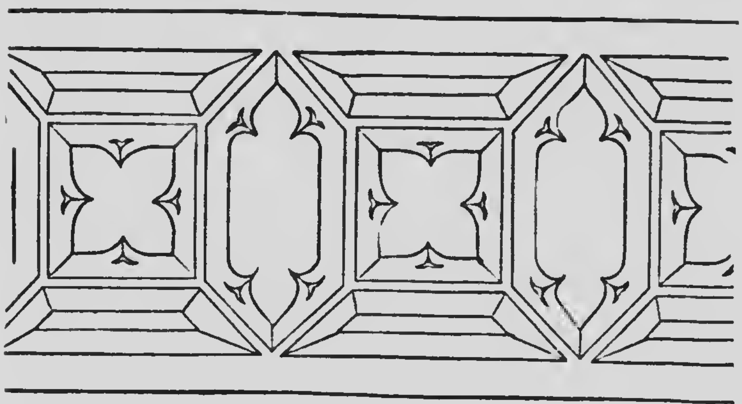


Fig. 177.

The same figure in conjunction with the square is shown in finished work at Fig. 177. This represents a perforated balustrade or parapet; the curved lines are obtained by the compass, centers being easily found.

A still more complicated figure is shown at Fig. 178. This may be formed as follows: If the points 12, 23, 34, 45, 56, 67, 78 are joined, an octagon will be formed, and a square by joining 9 10, 12 11. The octagon forms the basis of the combination, and is the first thing to be drawn,

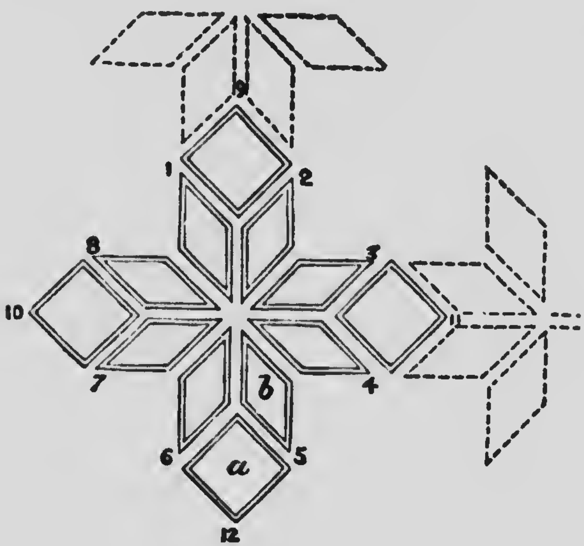


Fig. 178.

which may be done as in Fig. 179, by forming a square, and thereafter an octagon the side of which is equal f e, f g. Draw lines, i i m, distant from each other equal to the distance between the rhomboids in Fig. 178. Parallel to the diagonal lines c b, a d, draw lines equal to i i. From e, one end of the octagon side, draw a line perpendicular to c d, joining the diagonal a d in h. From n, the end of another side of the octagon, draw parallel to c d, a line cutting the diagonal d a in o, parallel to c h, k t; draw lines p t, n s; two of the rhomboids will thus be formed; the remainder are drawn in a similar way. These being obtained, the squares, as in Fig. 178, are easily drawn.

Some good examples in straight line work are shown in the following illustrations. Thus, we

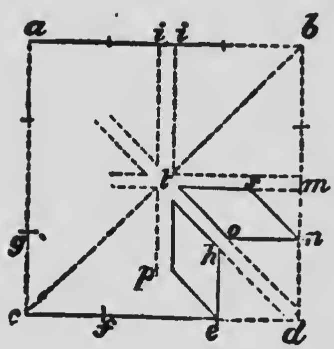


Fig. 179.

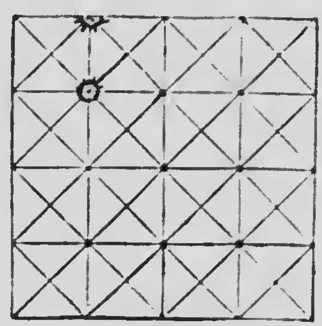


Fig. 180.

see by making diagonal lines, as shown at Fig. 180, the character of the example becomes ornamental, and this may be very much changed again by the introduction of small circles at the junction of the lines, as shown in one instance. This may again be elaborated by adding a line or dot to the circle as shown.

Another example formed of squares and half squares is shown in Fig. 181. This arrangement shows how "squares" may be placed so as to exhibit stars or other pointed ornaments. The shaded portion shows the star figure.

Another example partaking of the same nature is shown at Fig. 182. This may be

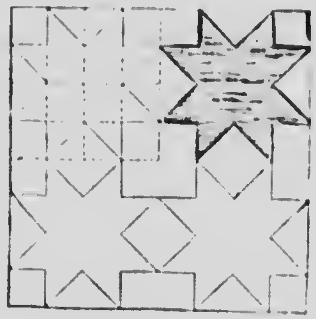


Fig. 181.

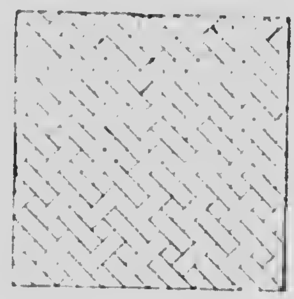


Fig. 182.

termed a basket pattern and is formed of interlacing straps. This pattern is an exceedingly good one for exercise, as it is composed of short lines and requires careful work to prevent overlapping, which would spoil the work. In starting and ending a line, endeavor to have the line clear and distinct and of an even thickness as shown in the example. Lines must not be left short, but must join the cross lines as though they were under them. To draw a panel of interlacing strap work, as shown in example, without a flaw, is fairly good workmanship.

The example shown at Fig. 183 is a little more difficult to plot out than either of the previous ones, and the student will have to use his

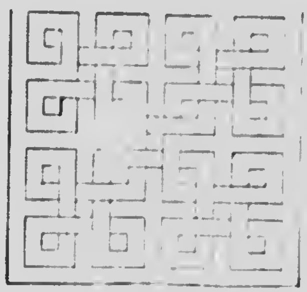


Fig. 183

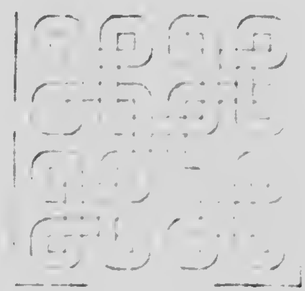


Fig. 184

compasses and set squares and exercise considerable judgment. This example is a strapwork fret, and is a good one to follow for practice.

Fig. 184 is a modification of the same ornament, a quarter circle being used on all external angles instead of having the lines join with a right angle. In other words, the ornament is a combination of curves and straight lines.

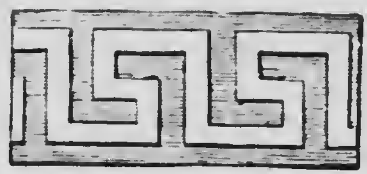


Fig. 185.

Copy these examples four or five times and you will be astonished at your own expertness.

For practice I offer a few simple examples of frets; the first three figures, 185, 186, and 187, are purely Greek examples, the first being the simplest form of running Greek fret. Its construction is very simple and easy, and may be reproduced with a T and set squares alone. Fig. 185 is constructed nearly in the same manner, there being two more angles in the latter than the former. The next fret is a little more difficult to lay off, but I apprehend the student will have no great difficulty in producing Fig. 186.

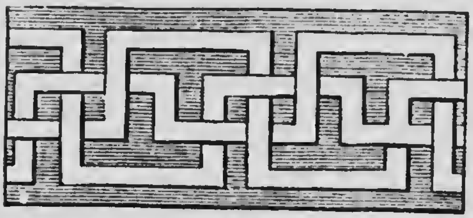


Fig. 186.

Another style of fret, partaking somewhat of the arabesque, is shown at Fig. 187. This can be repeated or continued at will. After drawing one complete figure, its combination will prove quite easy, though some little trouble and care will be experienced in forming the first complete figure as shown.

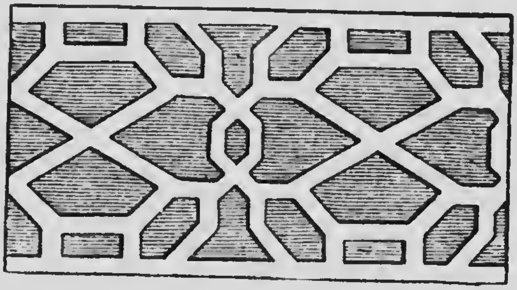


Fig. 187

At Fig. 188 a very different kind of fret is shown. This is composed of different figures, as e e forms a complete square, a number of which are set off at regular intervals, then arrange so that the points a o d will be covered, by the points b o c, and continue the fret to the required length.

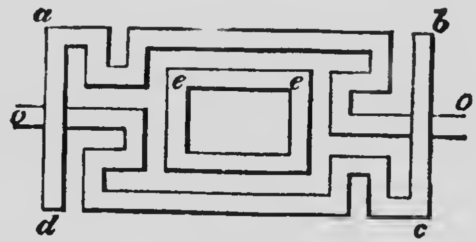


Fig. 188.

In working ornaments having curved lines in them, many examples can be presented, but I do not intend to illustrate more than I think will be necessary to enable the student

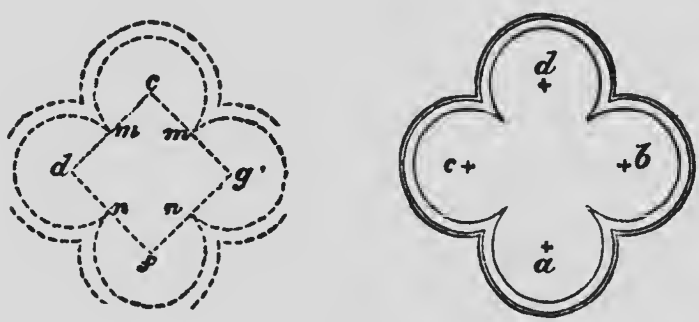


Fig. 189

to fairly understand the principles on which the ornamentation is based. The diagram shown in Fig. 189 will suggest to the draftsman something of the method in which combination of circles may be used for ornamental purposes. Here a diagonal square, c d f g, is first formed, one side of which is equal to the distance between the centers of the circles, as a, b, c, d. The radii of the circles described from the points d c g f is equal to half the side, as d m, f n, etc. Exemplifications of this figure are often found in Gothic perforated parapets and similar work.

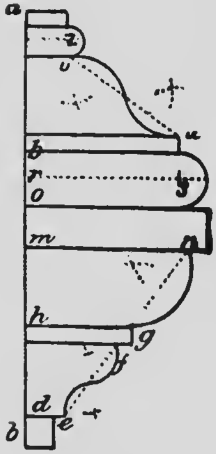


Fig. 190.

Another class of drawing is shown in Fig. 190, where parts of circles and straight lines are used in order to form the ornament. In order to make this, proceed as follows: Draw the base line b first, then make a b at right angles to the first line. The respective depths of the moulding must then be measured off on this line, as d, h, m, o, and r, z, t, show the center line of the torus s, and e f, and u v show the centers of the ogees, and g n, the quarter round. Here in this example we have most of the mouldings in use in architecture—the ogee, or cyma recta, and the reverse ogee, or cyma reverse, the torus, the astragal, the quarter-round, and the fillet.

Fig. 191 shows a design for a baluster that can readily be drawn by the student, as the centers for the various curves are given. The center of the lower curve is at a; centers for the upper curves may be found by drawing a line c b; from a and b describe arcs cutting in d, with radius d

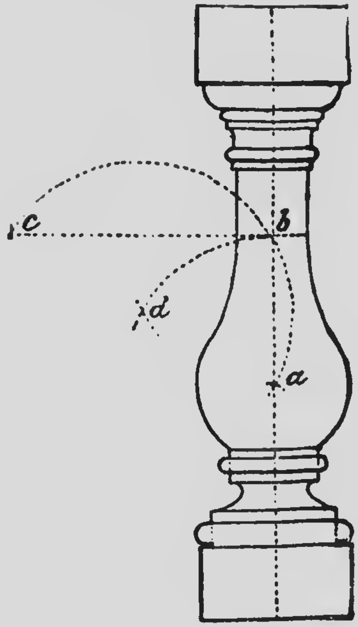


Fig. 191.

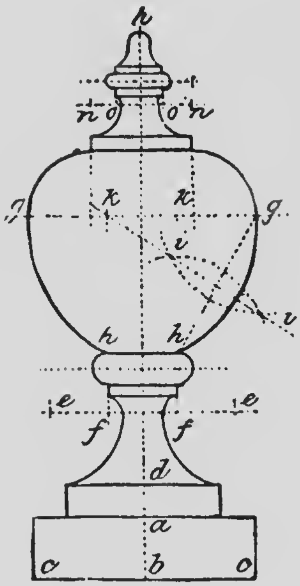


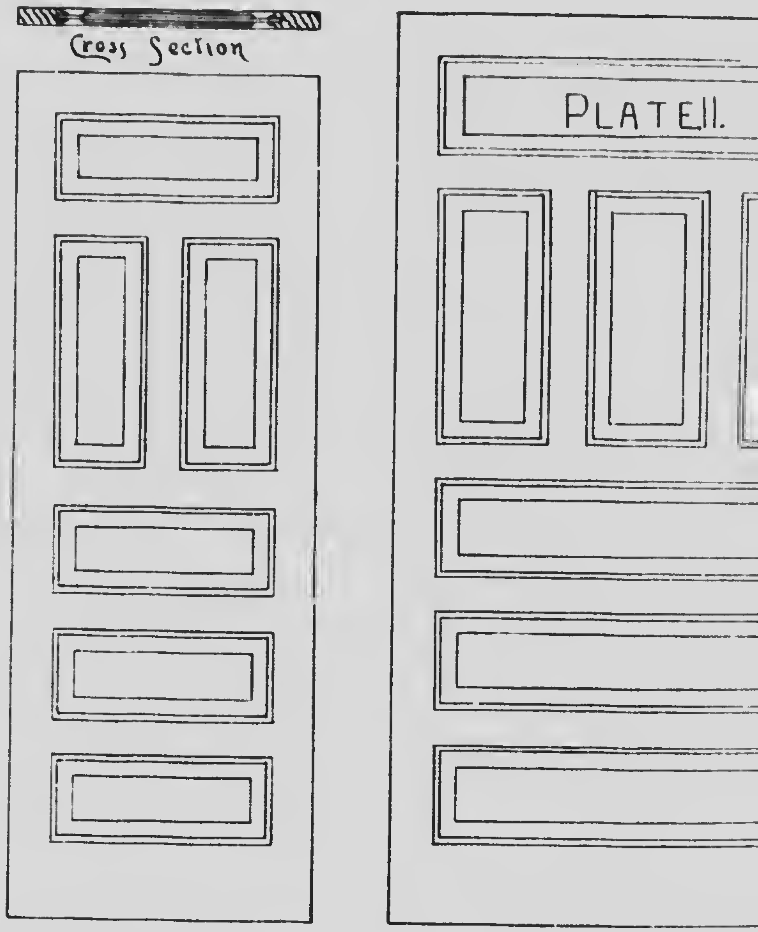
Fig. 192.

a describe an arc cutting the line c d in c; c in the center of the curve which is continued to the dotted line c b; a straight line is then continued to the neck of the baluster. The other curves and lines are readily obtained.

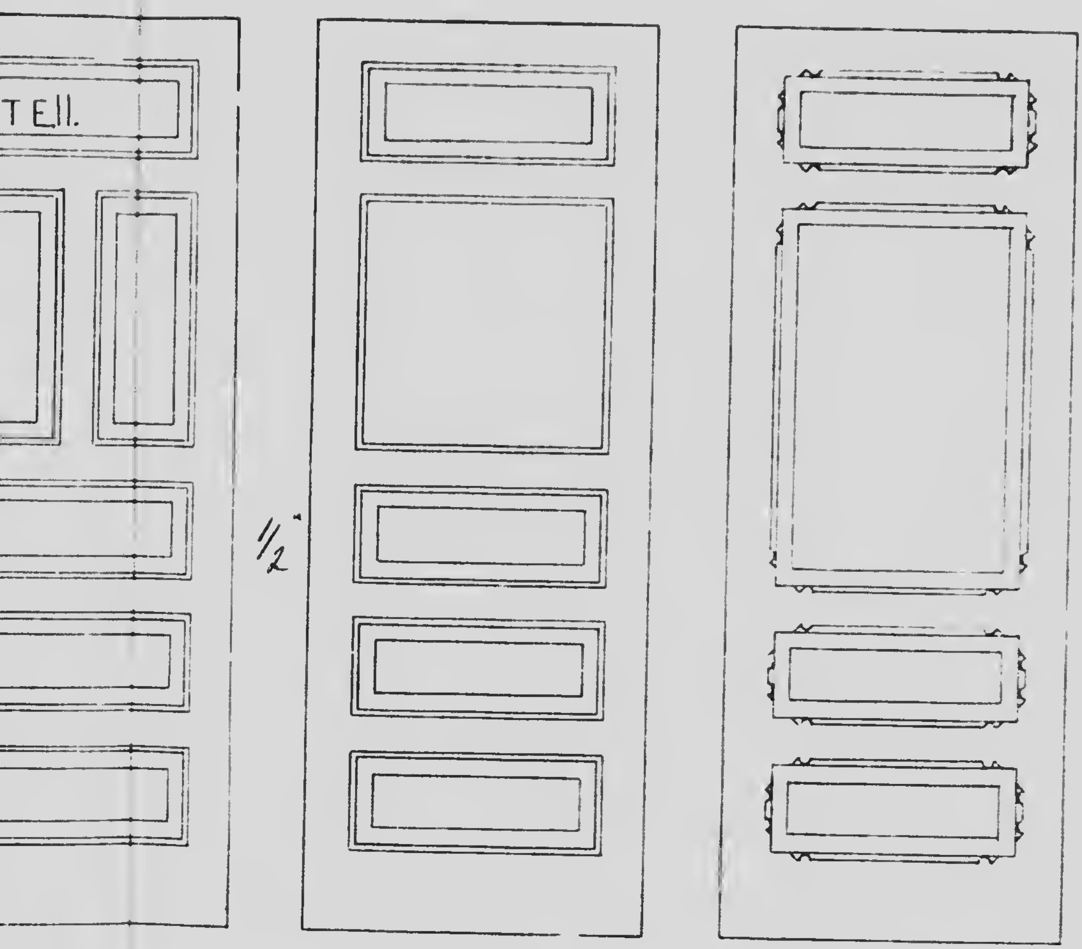
The urn-shaped ornament shown in Fig. 192 is somewhat more complicated than the previous

PLATE 11.

Plate 11 shows four doors of the style to be used in the cottage. These doors are drawn to a scale of one-half inch to the foot. The same character prevails in these four examples, the sliding doors being merely one of the second floor doors. The front doors are chamfered around the panels instead of being moulded, as the others are. The front and rear door may be fitted with glass if so desired, in the second panel from top.



SECOND FLOOR DOOR SLIDING DOOR



DOOR   REAR DOOR   FRONT DOOR

example. It is suited to many purposes, particularly that of terminal. To form it we first draw a center line b h, then the base a b, c c, the fillet d, and the curved lines f f, g g; f f and e e are the centers of the circles; join g h; bisect it by the line i i, cutting g g in k k; from k, with the radius k h, describe arcs g h, and the line n n, the centers of the cap moulding are found.

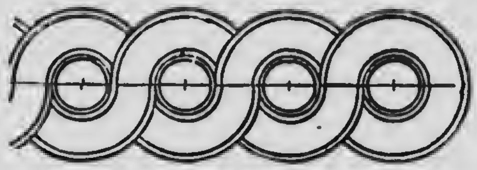


Fig. 193.

The last three examples are of a purely practical kind, and their determination suggests many other forms which will doubtless appeal to the student's imagination.

The ornament shown at Fig. 193 is called a *Guilloche*, or chain, and is formed by concentric circles overlapping each other. This pattern is easily drawn with compasses, but is here given as a freehand study, in order to give the student an exercise in severity and accuracy of form.

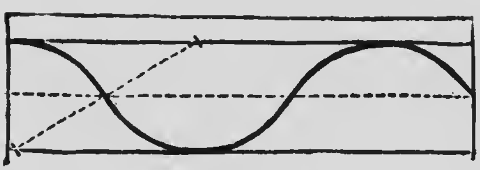


Fig. 194.

Figs. 194 and 195 are studies of the wave-line.

They are, in fact, the cyma recta repeated, the depth being lessened in Fig. 195.

Fig. 196 is a study of the elementary lines of a running scroll, formed of the wave-line, with the addition of spirals. Care must be taken in drawing these spirals, so that they may proceed from the stem in a smooth and continuous manner. They should start as a continuation of the wave-line so gradually, that

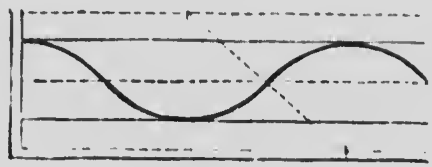


Fig. 195.

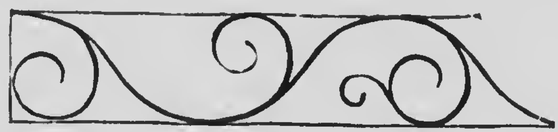


Fig. 196.

if the stem beyond the spiral were removed the scroll would be perfect, and that if the scroll were

Fig. 197.

taken away the wave-line would remain uninjured. This should also be the case in Fig. 197, in which tendrils are added to the scrolls.

Fig. 198 is a further elaboration of the same design, the lines being doubled.

Fig. 199 is another simple running pattern based on the wave-line.

The example shown at Fig. 200 is an ornamental moulding adapted for wood-carving, and gives the pattern and half the repeat.

Fig. 198.

Having drawn the upper and lower horizontal lines, draw A B, C D, E F, and G H; the distance between them being equal. Then it will be seen that C D and G H are the center lines of the heart, and that A B and E F are the center lines of the tongue or leaf between the hearts. Now draw the curve J, and balance it by the curve I.

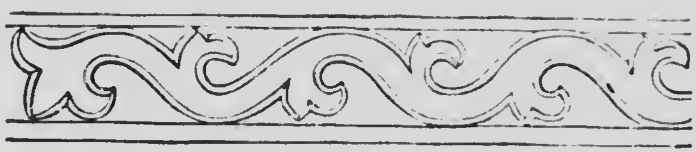


Fig. 199.

It will of course be understood that although the instructions and lettering refer to the complete figure, it is intended that the corresponding lines in the repeat are to be drawn at the same time; in fact, whatever length of the moulding is to be drawn, these divisions or compartments should be first set out, and the single curve

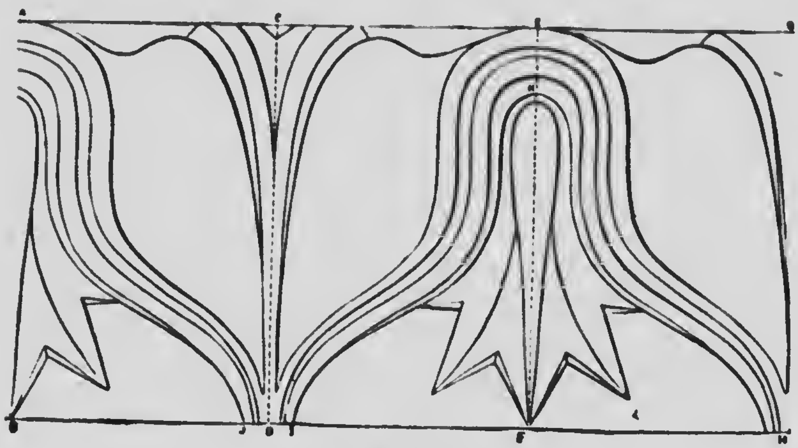


Fig. 200.

drawn in each before proceeding any further. On no account should one portion be completed before the others have been sketched, for as each set of curves is drawn the drawing becomes more complex, and the difficulty of accurate balancing is increased.

When these curves have been completed, the interior ones which depend *upon*, but are not parallel *to* them, are to follow. In drawing these the greatest care is necessary so that the curves may run gracefully downwards, the space between the inner and outer curves becoming gradually narrower.

The center part at C is now to be drawn, following the plan already laid down, viz.: to draw first the left and then the right side of the figure; and after this the leaves between the hec re to be drawn in the same manner.

T e pattern shown at Fig. 201 is for a running, arranged so as to repeat; *a* will therefore join on to *b*, and thus the design may be continued.

It will be seen that in order to equalize the spaces so as to carry out this arrangement, the whole is divided into squares, and the central flower is placed on the intersection of the diagonals.

In commencing this design, the general form is to be sketched of each scroll rising out of the previous one. At this stage no notice should be taken of the husks or foliage *c d*, etc., but the scrolls should be sketched as if consisting of the main stem only, and the husks should then be drawn outside the original form.

Great care must be exercised to insure the smooth, spiral character of the curves. There must be no angular breaks, but the eye must be carried onward towards the center of each

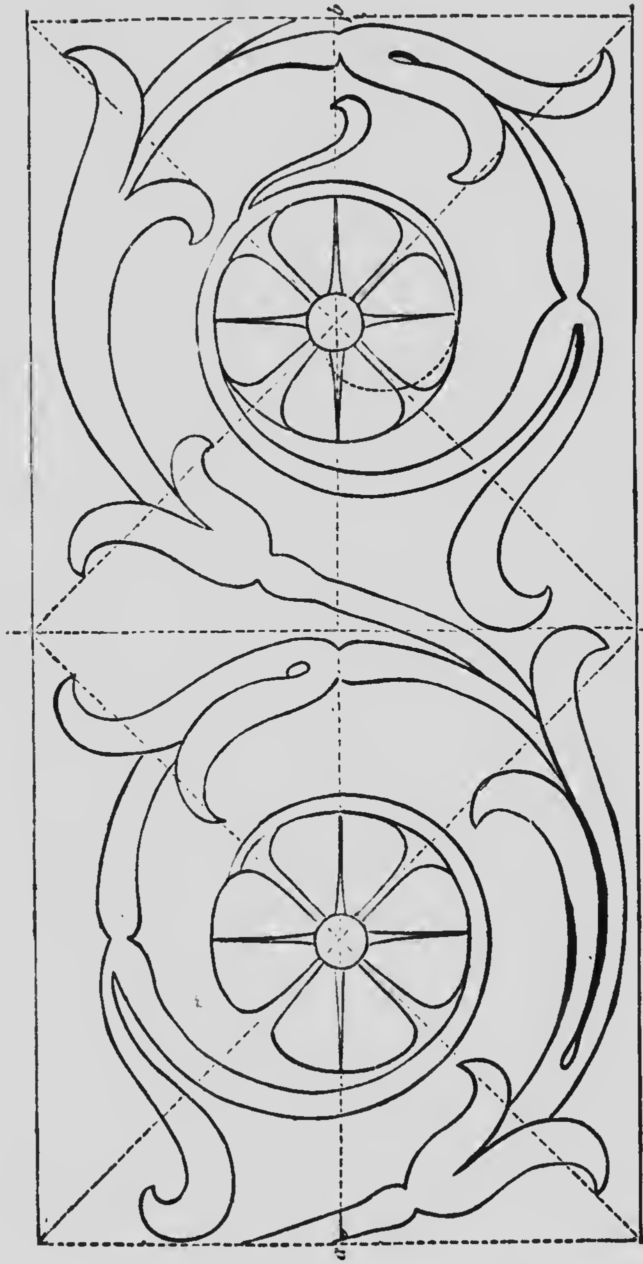


Fig. 201.

scroll, and the husks must appear as additions, but not as excrescences. In order to test the correctness of the forms, turn the sketch upside down, place it vertically, or in any other direction, and if the design has been correctly sketched, the scrolls should be equally perfect in whatever position they may be viewed. This

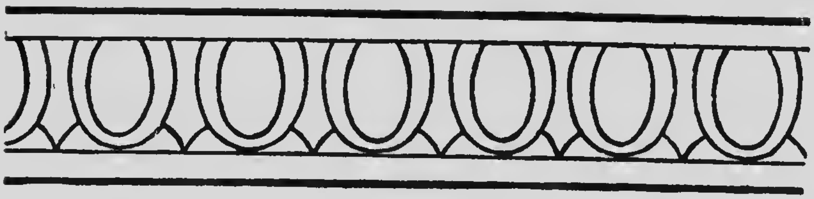


Fig. 202.

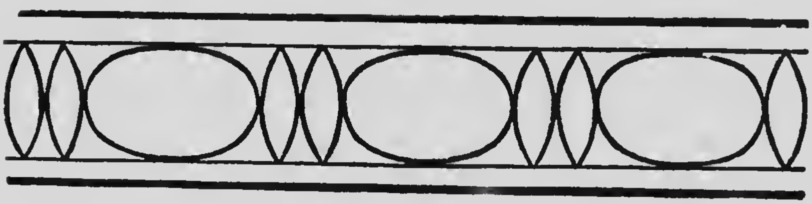


Fig. 203.

should be repeatedly done during the progress of the work, so that any part which may be too full or too flat may be improved before the husks, flowers, foliage, or other details are added.

The ornament shown in Fig. 202 is called the *Echinus*, the egg and tongue, or egg and dart moulding. It is much used by carvers for borders and similar work.

The moulding shown at Fig. 203 is the Greek astragal, chaplet, or knuckle-bone ornament; this, also, is quite a favorite moulding with carpenters and cabinet-makers, because it can

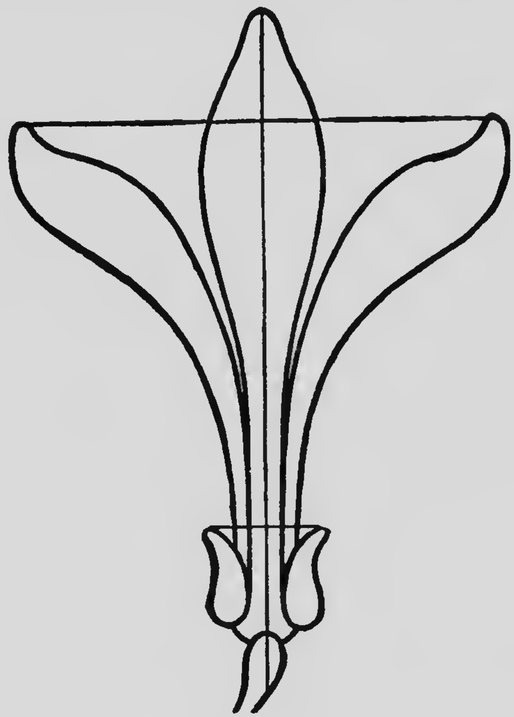


Fig. 204.

be turned in a lathe and then split in two or quartered.

Fig. 204 shows the Greek conventional lily form. It has a faint resemblance to the Egyptian lotus, but has a Grecian delicacy about it that is absent in Egyptian forms.

The ornament shown in Fig. 205 is the Greek

Anthemion. This is a very good example for practice. It can all be drawn by the aid of compasses.

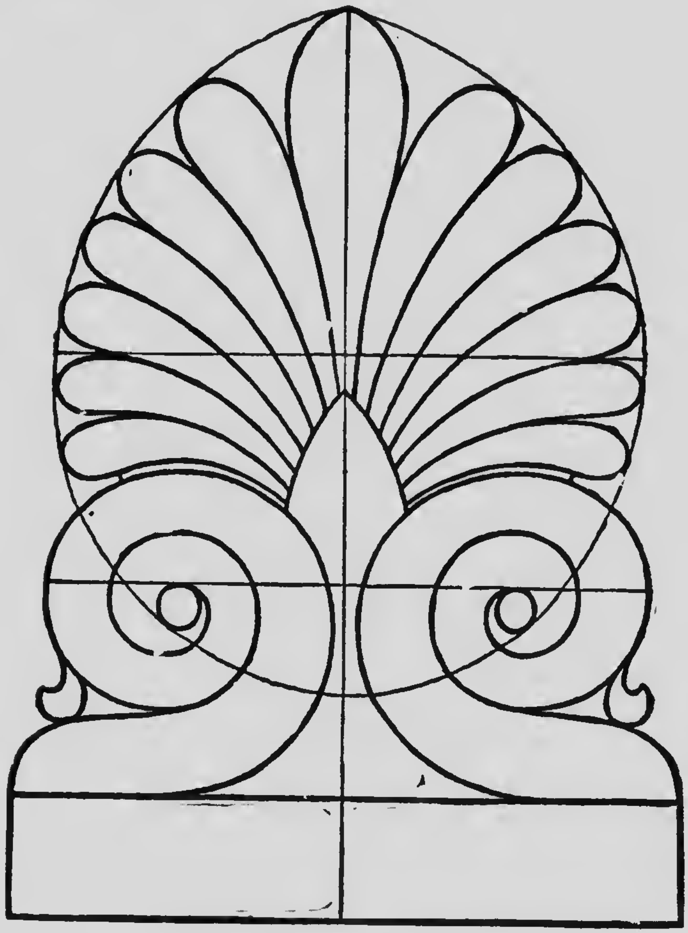


Fig. 205.

The border shown at Fig. 206 is purely Egyptian, and is partly made up of the open lotus flower and the bud. This is a very common ornament for stenciling, incised work and low relief carving.

A circular or rosette ornament is shown at Fig. 207 which is formed of a circle and four

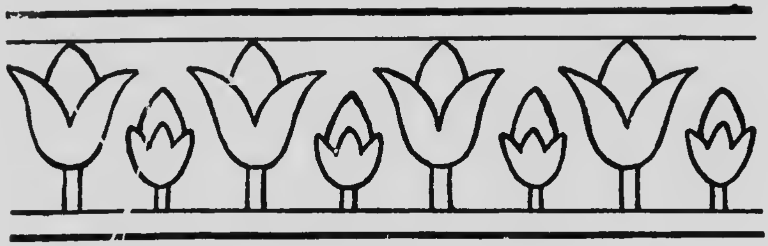


Fig. 206.

lotus flowers. This may be drawn free-hand or by the aid of compasses. A conventional form of the lotus, in a more finished and elaborate state, is shown in Fig. 208. This ornament was much in use with the ancient Egyptians, and was considered as being a sort of sacred emblem with them. Indeed, the lotus was known by Egyptians as "the sacred flower."

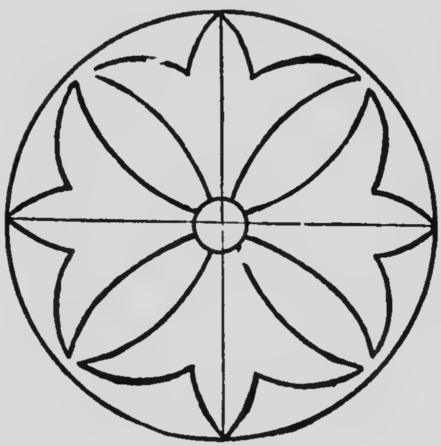


Fig. 207.

The illustration shown at Fig. 209 is a Roman border, and is composed of curved and straight lines.. This border is found on many of the old Roman buildings now extant and appears to

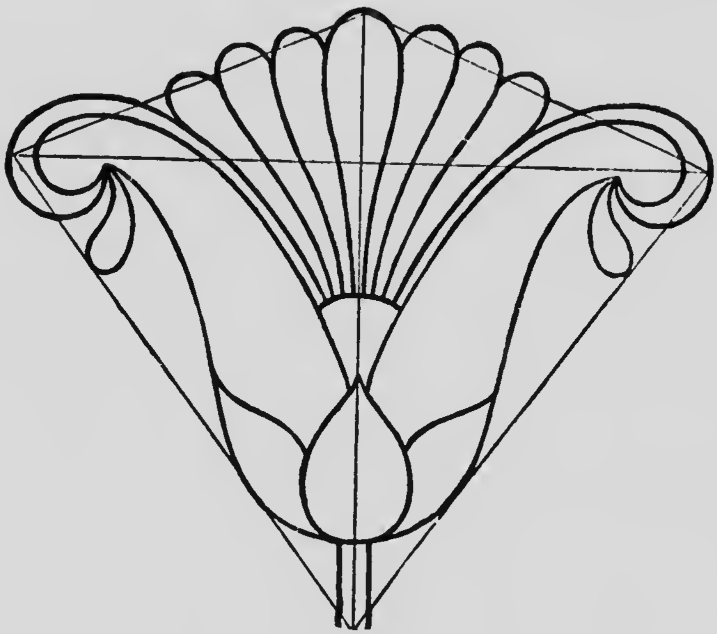


Fig. 208.

have been a favorite ornament with the old designers.

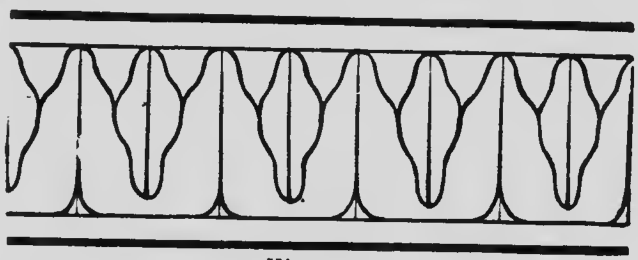


Fig. 209.

The ornament or rosette shown in Fig. 209½ is a Roman one used largely during the period of

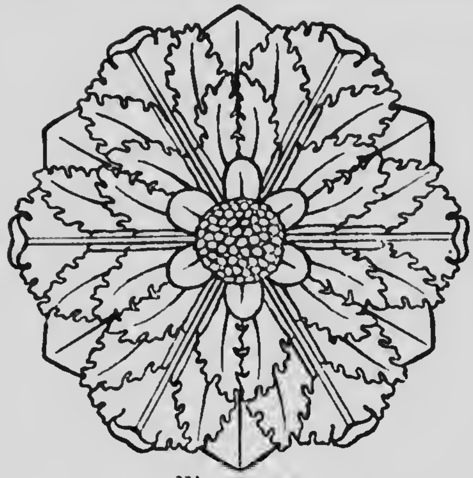


Fig. 209½.

the decay of art, about the second century of our era. It is quite elaborate, but is not by any means effective. The ornament shown in Fig. 210 is also Roman but is the product

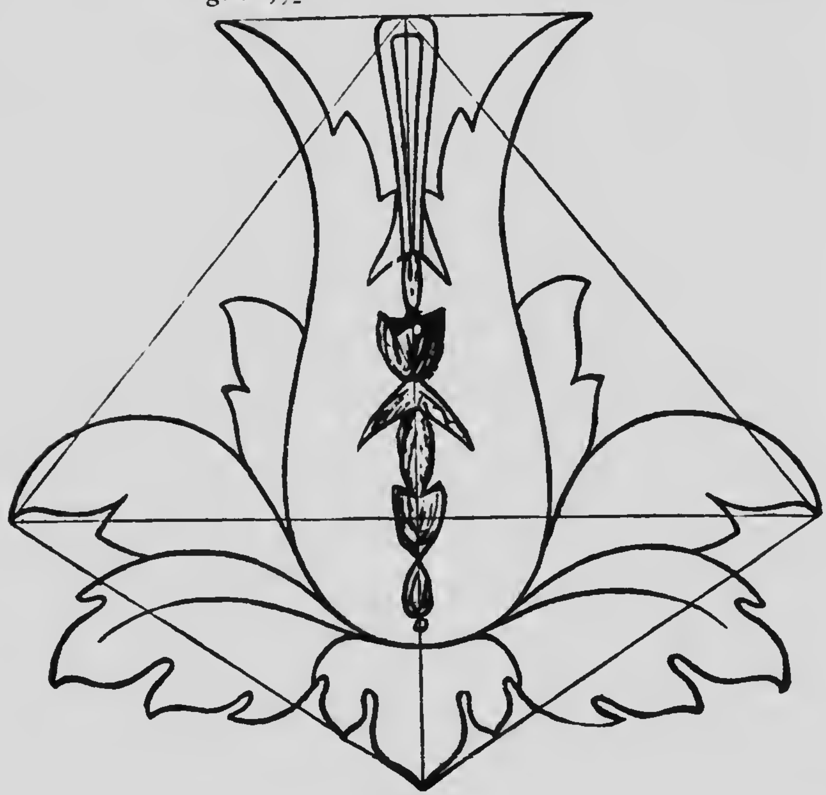


Fig 210.

of a better period and offers some advanced lines for the student's consideration.

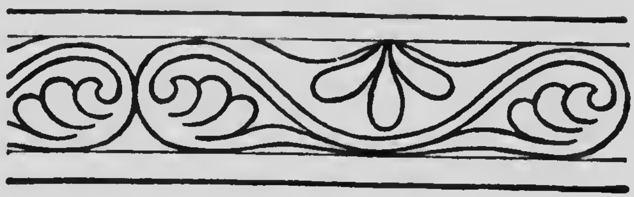


Fig. 211.

The scroll border shown at Fig. 211 is of the Byzantine style of architecture, and is quite

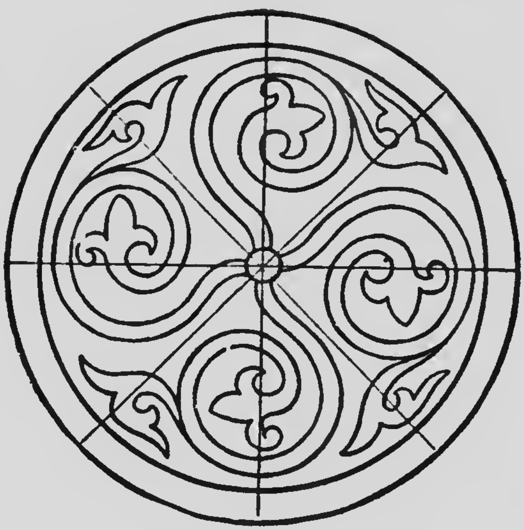


Fig. 212.

effective in its way The rosette shown in Fig. 212 is also of that style and offers good practice to the student.

These latter examples are taken mostly from classic executed work, and while they only touch the fringe of classic ornament, they will, to some extent, give to the student an idea of the ornaments employed in the historical styles, and thus enable him to design his work on these lines with intelligence.

GOTHIC ORNAMENT

Gothic style is so much different to the styles that preceded it, that a separate chapter may well be devoted to it in order that the student

Fig. 213.

may have a fair opportunity of judging for himself the peculiarities of the style.

The first example presented is a Gothic border, Fig. 213, which, it will be seen, has a character of its own, that is far apart from other ornamentation. The main features of this style lie in the fact that its members all have a vertical tendency as may be noticed in its pointed arches, its sharp spires, its pinnacles, its buttresses, its cluster columns, and its wonderful traceried windows and doors. Its chief elements are window tracery, trefoils, quatrefoils, cinquefoils, zigzags, gargoyles, fleur-de-lis and ball flowers. These, along with many other examples of ornamentation, and peculiar lay-out of plan and elevation, may be said to constitute the Gothic style.

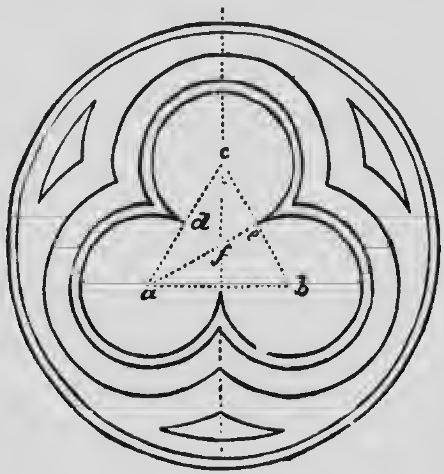


Fig. 214.

The illustration shown at Fig. 214 represents the trefoil ornament, as used in windows and other decoration, and is formed as follows: Draw the equilateral triangle as shown by the dotted lines a b c, then bisect it as at c f and a e, cutting the line c f, which gives the center for the surrounding circles; a b and c are the centers of the trefoil curves.

The next illustration, Fig. 215, is the quatrefoil and is described from the corners, h m, f g, of a

PLATE 12.

This plate shows a portion of the stairs, complete and under construction. The newel post and balusters are plain and chamfered. The bottom step is rounded off at the newel.

DETAIL OF STAIR

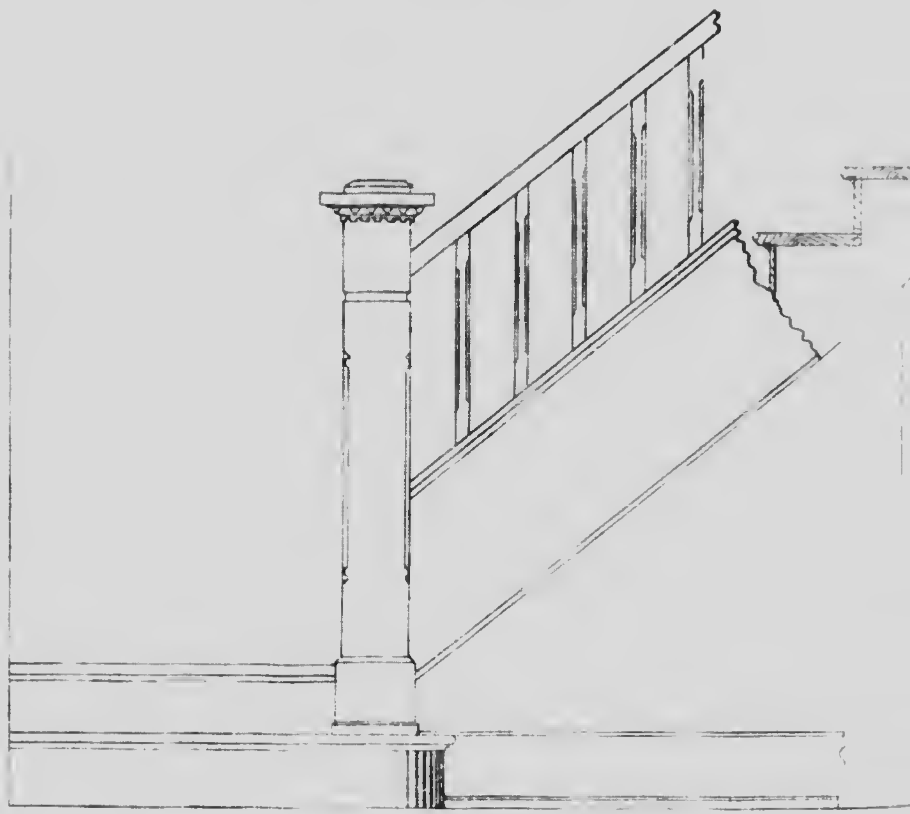
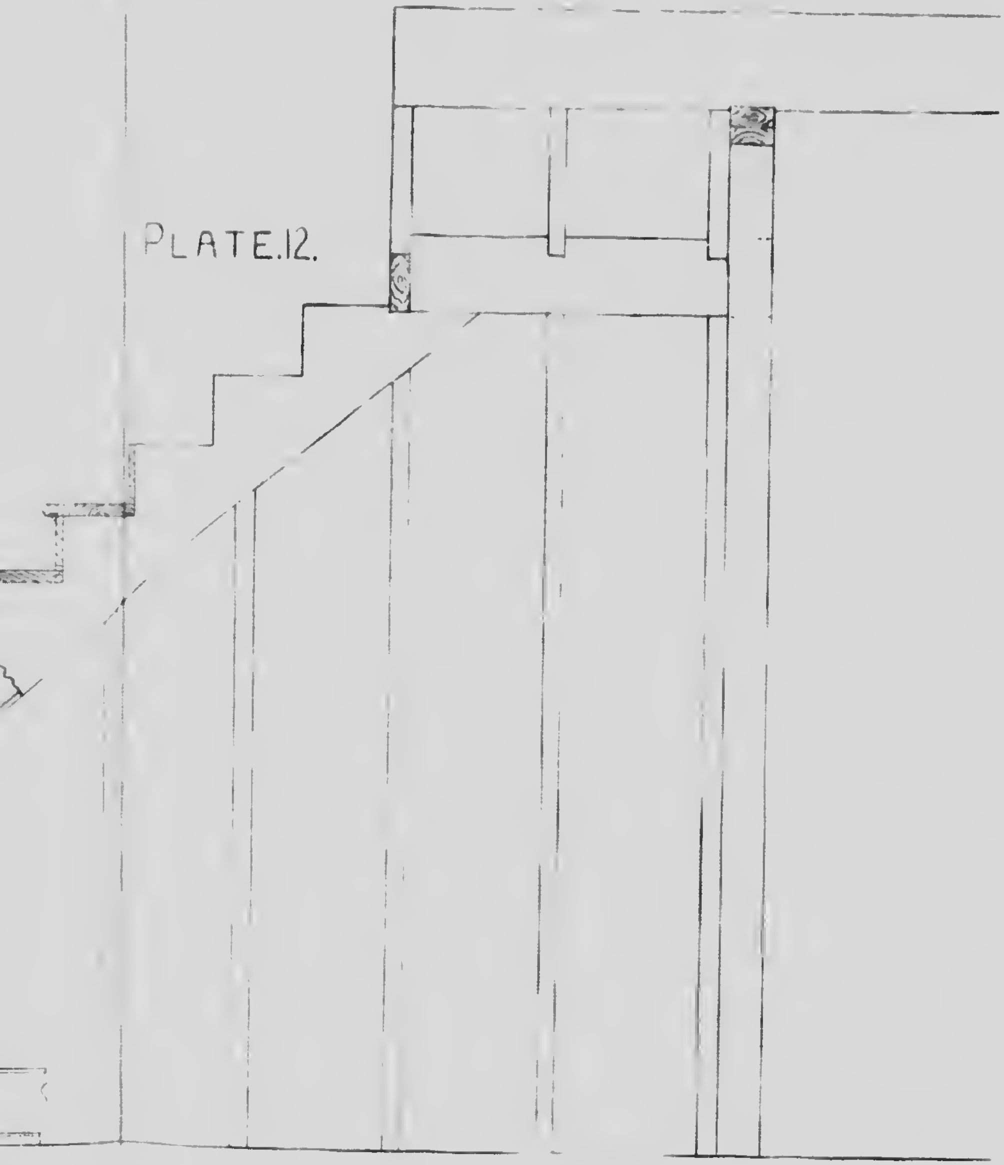


PLATE.12.



square; a is the center of the surrounding circles, found by the intersection of the diagonals, a b, c d, of the square; the curves, s s s s, are drawn from the center a; while those meeting in t t t t are described from the centers, h m, f and g.

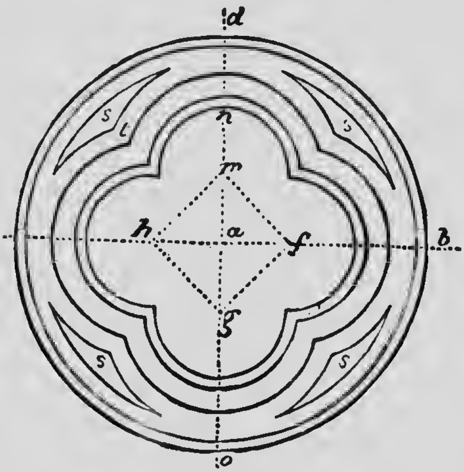


Fig. 215.

The cinquefoil, Fig. 216, is described from the corners of the pentagon, a b, d e f; by dividing e d equally on the point g, and drawing a line from a to it, cutting the perpendicular e c in h, the center n is the point from which the surrounding circles are drawn. The other parts of this ornament are easily drawn.

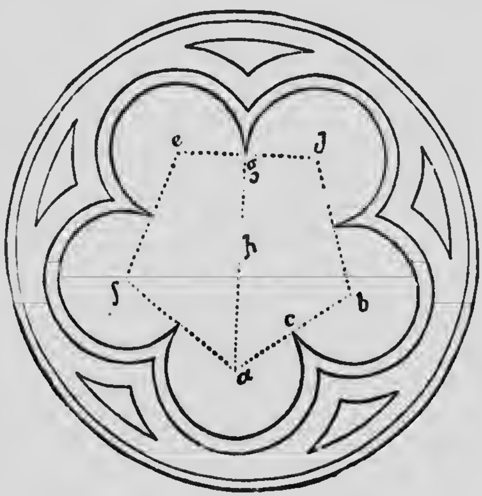


Fig. 216.

Two more examples, and then I have finished in this style, but these are elaborate and will, doubtless, try the skill and patience of the student, but the results will well repay for the labor,

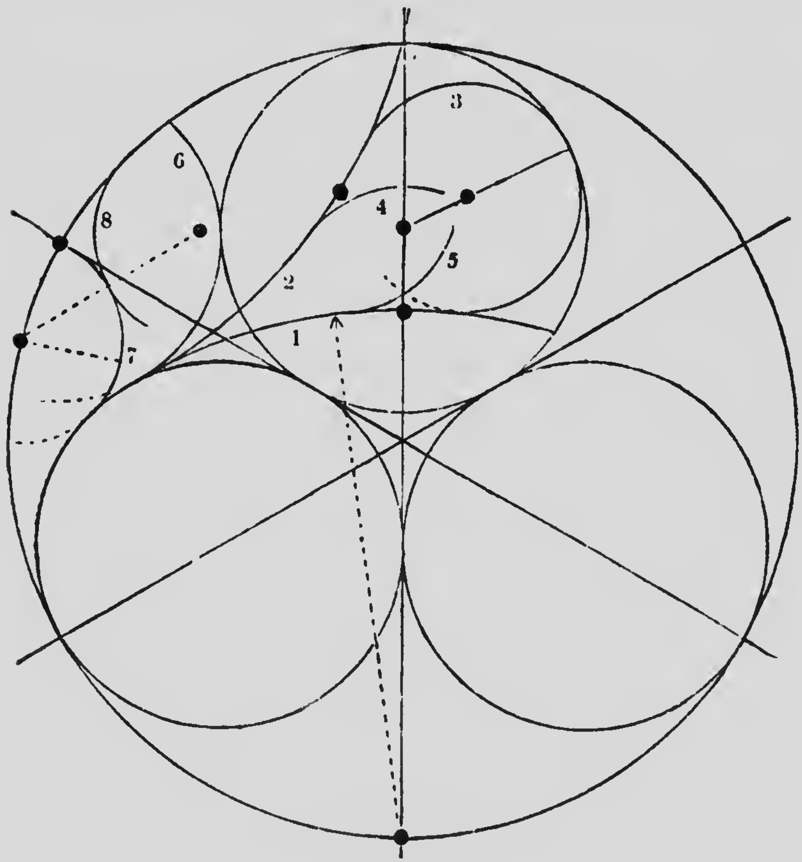


Fig. 217.

and will open up new and unexplored fields for practice, for hundreds of designs may be formed by aid of the knowledge gained in understanding the examples herewith presented.

The diagram shown at Fig. 217 exhibits the skeleton work for the finished tracery shown at Fig. 218. The centers for all the curves of one third of the work are all shown by the heavy black dots. By a little study and patience the

Fig. 218.

student will soon be able to draw the completed work, Fig. 218.

In Fig. 219 we have another skeleton for a still more elaborate piece of work. The centers are all shown by black dots, and portions of the curves are also given. The completed work shown at Fig. 220 has a very rich and ornate appearance. These two examples are quite

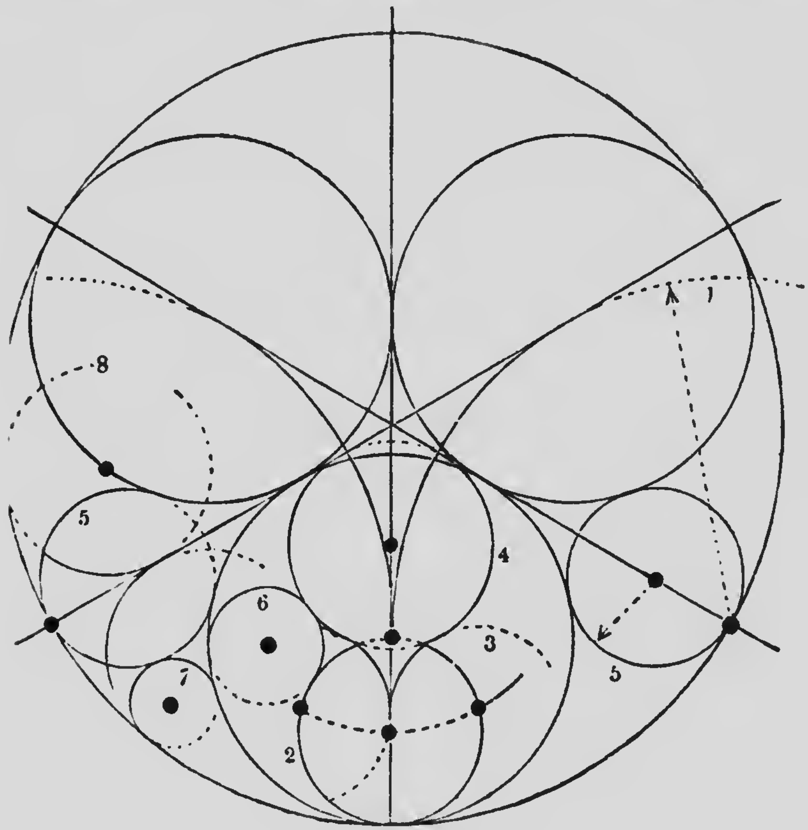


Fig. 219.

sufficient to give the student a good insight into Gothic tracery work, but it must be remembered that in Gothic work the designs of this character are innumerable. Portions of these designs are used in window and door heads, and in a hundred other places, always with effect.

It will be noticed that in these two designs given, that the trefoil, or three circles, forms the

Fig. 220.

foundation of the whole of the work. All the other ornamentation seems to cluster around the three larger circles; this is the peculiarity of these two examples, but it must be borne in mind that the trefoil is not the only basis around which the old Gothic designers built their tracery; but these are sufficient for our purposes.

SOME PRACTICAL EXAMPLES OF ORNAMENTATION

The studious draftsman will soon discover many new worlds to conquer if he pays much attention to his work, and he will find that, for ornamental work, the power of his compasses is almost without limit. I offer a few simple examples herewith,

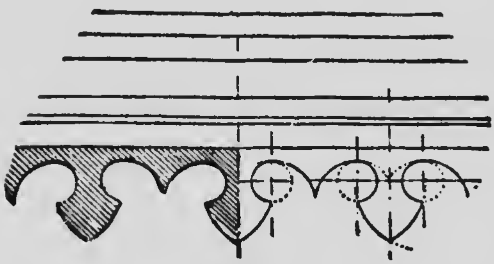


Fig. 221.

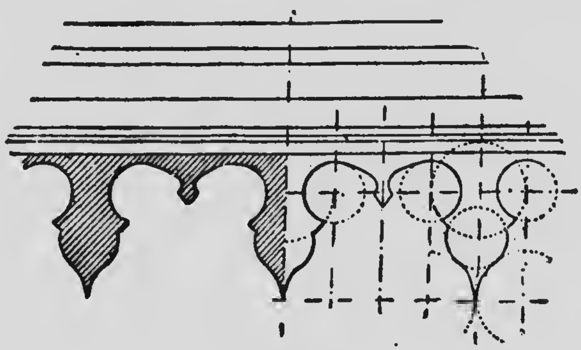


Fig. 222.

and will follow them up with others of a more complicated nature.

The illustrations shown at Figs. 221 and 222 show the finished work, and working diagrams. The method of drawing these curves and ornaments is quite apparent, the centers are all given, and the dotted lines show the direction of the curves. A very little practice on these

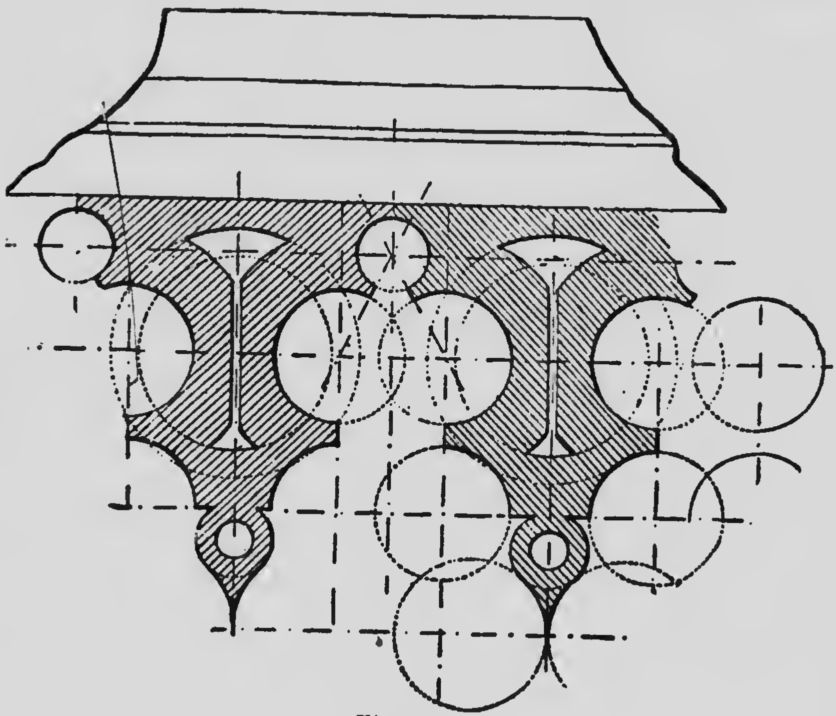


Fig. 223.

examples will enable the draftsman to describe them in quick time, and will give him an insight into the methods employed in designing ornaments of this kind.

Another very simple design, and one that requires but little description on the manner of making it, is self-evident, and is shown at Fig. 223. This is a very effective ornament, and at one time was much in vogue.

The ornament shown at Fig. 224 is drawn right and left, one-half being complete, and the other half exhibiting the various centers from

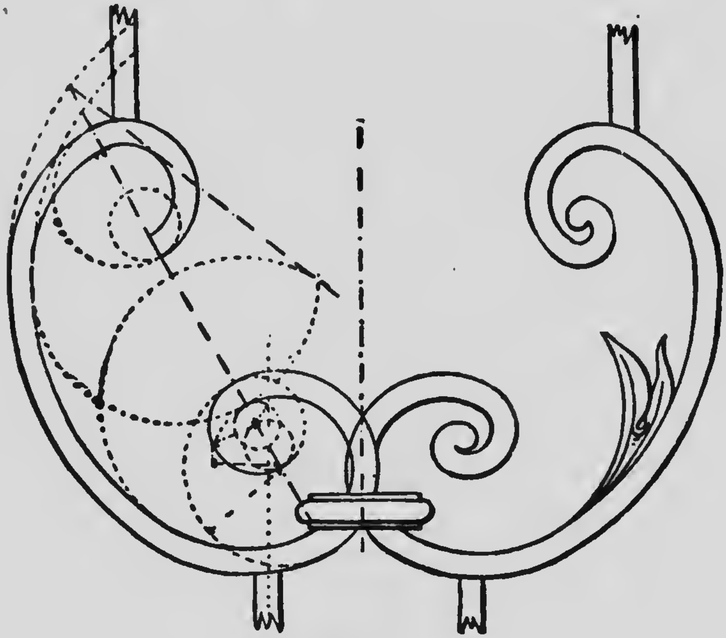


Fig. 224.

which the curves of the pattern are drawn. The method of forming scrolls has been described in a previous chapter, so that it is unnecessary to repeat at this stage. The design is simple, the centers being all given and the dotted lines show the radii of the curves.

The design shown at Fig. 225 is taken from an old example of panel work and has rather a quaint look. The draftsman will have no great difficulty in lining out this design.

The ornament shown at Fig. 226 is intended for a double barge-board, having a belt running along the center, dividing the upper from the lower portion. This design is somewhat complicated, and I therefore give herewith a full description of the method of describing it. To properly divide the diameter a, b, of the circle a b, c, d,

Fig. 225.

into six equal parts, through the third of these, drawing the line c, d, e, f, g, at right angles to a, b. From 3, with distance equal to one of the parts on a, b, set off the line a, c, to the points 6 and 7, and through the points, 2, 4, 6, and 7, draw lines, forming a square. Then from the point 3 as a center, with 35 or 31 as radius, describe the circle hI, i5d. Then with half the distance 5b, nIa, and upon the lines 6

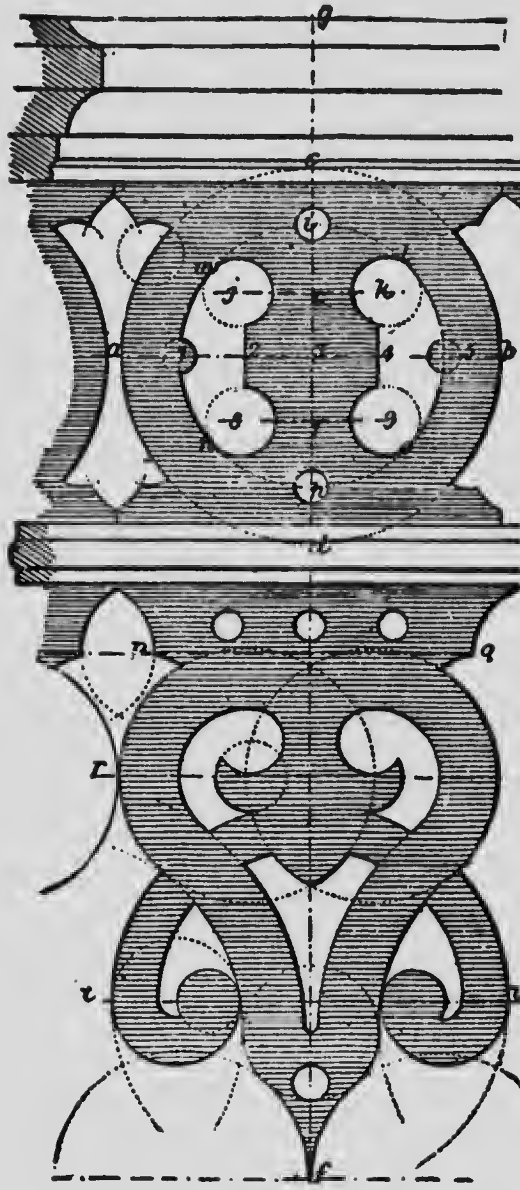


Fig. 226.

and 7, produced to right and left, describe from the centers j, k, 89, the arcs of circles which will join the parts of circle, i5, hi, as 5l, lm, hn, 50, with the sides 2 and 4 of the square. The small circles as j, k, 89, give the standard for the

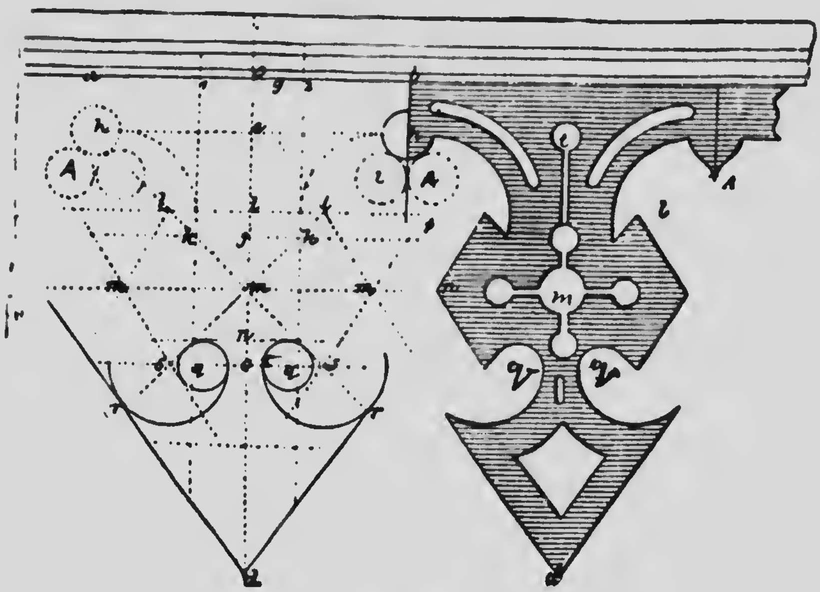


Fig. 227.

various centers and center lines, the moulded part d, being drawn to depth as shown. Set off from the d the distance of the diameter of small circles as k, from the point d, nine and a half times to the point f, which terminates the design. The line p, q is drawn at right angles to g f, through the first part, r, s, through the third and the line t, u, through a point midway between the sixth and seventh points. All the circles and arcs of circles are either equal to parts or multiples of the standard circle as k, or f, any one of the six divisions on the line a, b.

The design shown at Fig. 227 is also a pattern for a verge board, and is a very good example of the kind. The centers for the circles are all shown in the working diagram, the cutting lines all being represented by the dotted lines. I purposely leave this without a further description so that the draftsman may exercise his own skill in working it out, not a very difficult matter when the reference letters are given.

The drawing shown at Fig. 228 is a design for a balcony panel, showing frame and drop mouldings. Suppose a, b, to be the total height; then divide it into seven equal parts and through the fourth of the points draw a line c, d at right angles to a, b. Make the facia at top equal to the distance between the sixth and seventh points. From the line d, set off to e, and f, and make f, g; e, h, each equal to two-thirds of one of the parts on a, b, as 7, 8. Through the point 2, draw a line parallel to c, d, through e, f; g, h, draw lines parallel to a, b. Make b, j, equal to e, f, and through j, draw a line parallel to c, d, joining f, e. Bisect 2, j, in the point k, and through k, draw m, k, l, parallel to c, d. With one-fourth of the distance of g, h, or e, f, set off

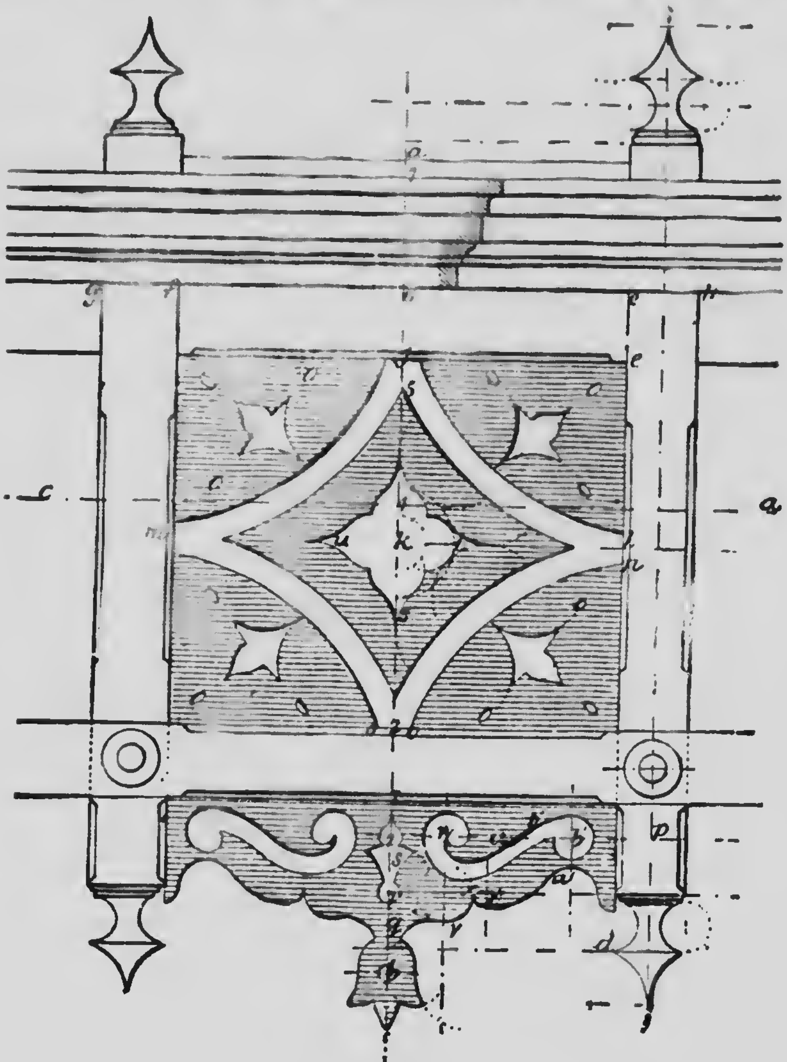


Fig. 228.

from the points j, k, o, and m, on each side of the center lines, as to o, and n, from 2, and 1.

From these points as centers, as o, and n, with radii equal to o, 1, describe arcs cutting as at p, and from p, describe an arc joining o, n. Do the same at all the other points, and describe the double arcs. Divide one of the parts into which a, b, is divided, as the lowest part b, I, into four equal parts, as in the points of r, and s. With two of these as radius, from the point k, in center describe the circle k, t, u, and put in the ornament with the arcs as shown. Through the points I, s, 2, and q, as the line a, b, draw lines with distance q b set off from q to v, and from v draw a line parallel to a b, parallel to m, k, l. With r, s, as radius, from v, as center describe the arc v, x. With half the distance q, v, set off from x, to y, and through y, draw a line parallel to v, w, as y, z; the point z, is the center of the arc y, a. The arc from a, is described with radius x, y, and through the center a line to b, is drawn parallel to w, v. The arc c, is described from the point d. The dotted lines and radii show how the other parts are put in. The ornaments at f, are put in the lines drawn from the center k, to the corner points, as at e.

These examples make splendid practice for the young student, and if repeated two or three times, they will become so impressed on the mind that they may be produced at will without copy, and enable one to form designs, with the aid of rule and compass, to suit almost any situation. All these examples are formed in exact architectural proportions, a matter that is often lost sight of by the draftsman, who is sometimes astonished at his own uncouth creations, which become as offensive to the trained eye as vulgar language does to the cultivated ear. In the formation of ornaments, like everything else in this world, there is an "eternal fitness," a fact which should never be lost sight of.

The design shown at Fig. 229 is a very useful one and will answer very nicely for a drop or an eaves board. Suppose a, b, to be the height of the lower part of the design which is divided into thirteen equal parts. Then, through the second, sixth, seventh, and eleventh of these, draw lines at right angles to a b. From point 1, with half the distance of the space between points 1 and 2, as radius, describe the circle d. From the point 2, draw lines at an angle of 45° to the line c f, cutting the semicircle; these points, as g and h, give the centers of the semicircles. From one center of the circle described between the points 3 and 4 draw lines at right

PLATE 13.

Plate 13 shows a mantel in elevation and section, also a plan of the shelf, with construction lines. This is drawn to a scale of ¾ of an inch to the foot.

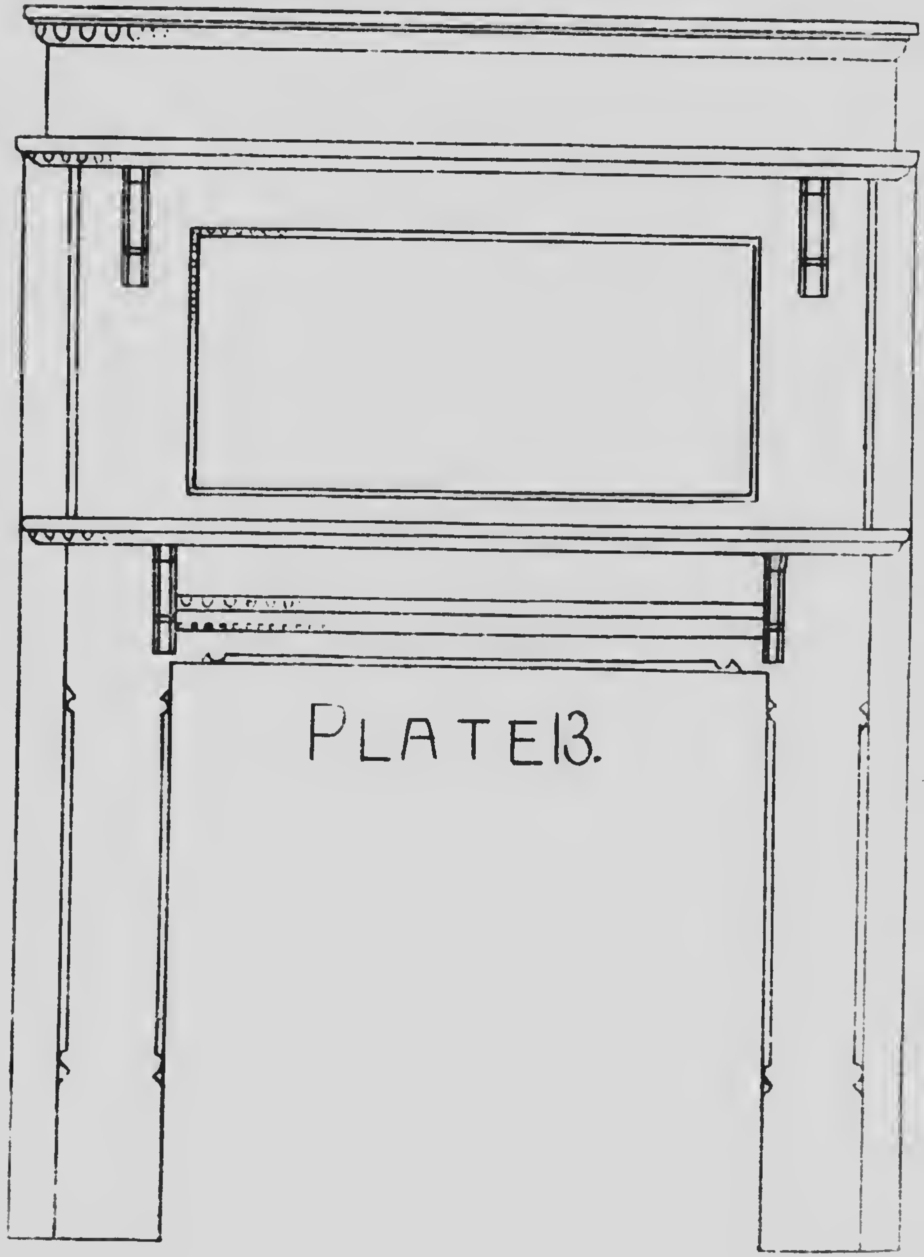
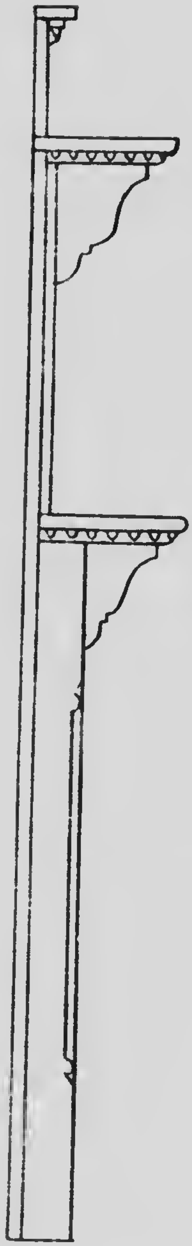
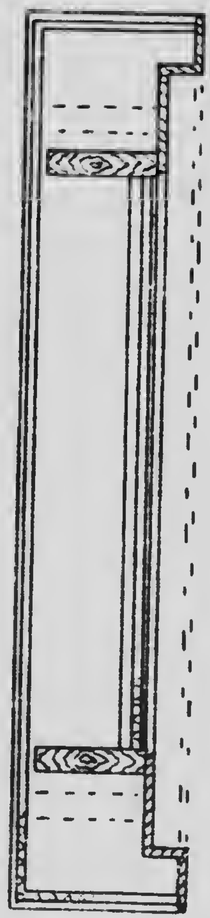


PLATE 13.

Detail of Mantel





3/4"

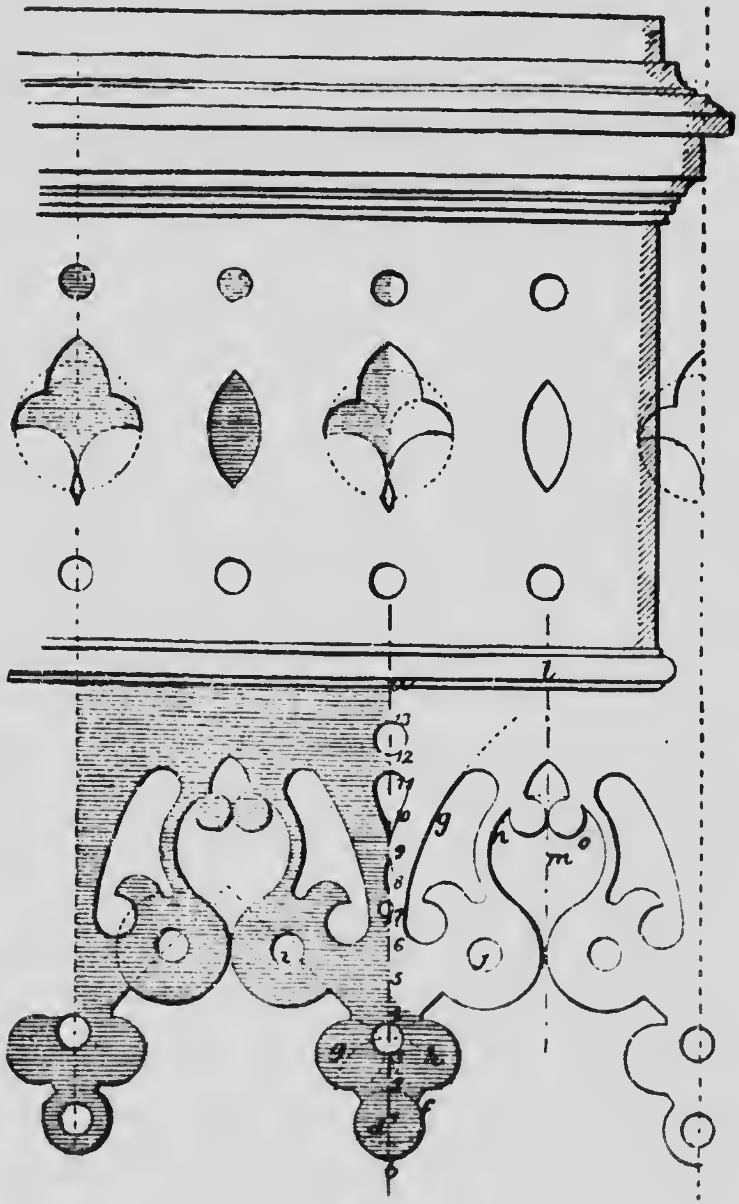


Fig. 229.

angles to the line e, f, to i and j. These are the centers of the parts of circles thus shown. Finishing the circle at the point k draw the line k, l, parallel to a b; on this line the center m, of the arcs n and o, is found. 6 and p are the centers of the arcs q and r. The remaining portions of the design may readily be put in from the lines, curves and centers given.

The example shown at Fig. 230 illustrates an elaborate design suited for a balustrade and many other purposes. Let a b be the height; divide this into two equal parts in the point c, through c, draw a line at right angles to a b, as d c d. Draw the distance a b, into eighteen, or a c, into nine equal parts. With one of these, from the center c, describe the circle e, f, g, h, and from the point where this cuts the line, a b; d, d, describe circles, the radius of which is one-fourth of one of the parts, or a, e. Then with the distance as h, g, from these points as centers, describe arcs cutting in the point i. from i, as a center with e, the same radius still kept on the compasses, describe an arc j. Do the same from the other points, as g, f; f, e; e, h, and thus find the centers from which the arcs corresponding to j, are described. From the points k, l, where the outside of the small circles

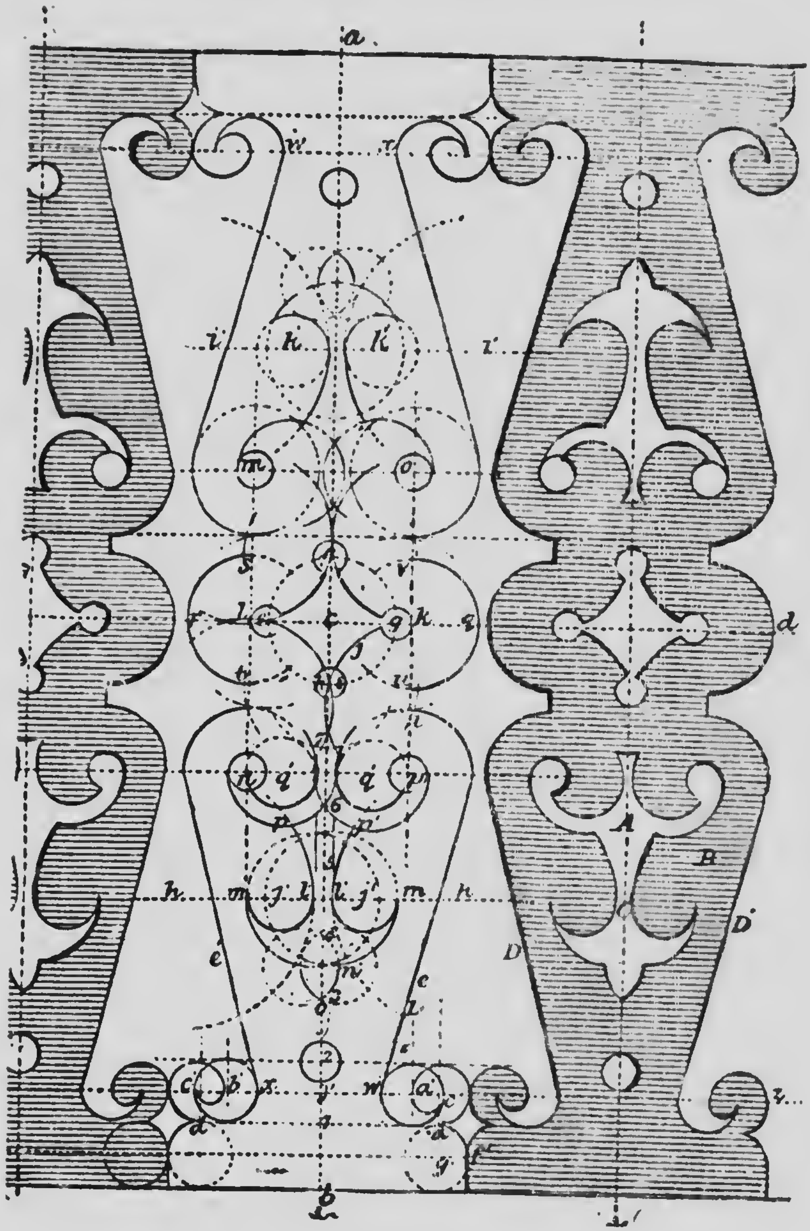


Fig. 230.

e and g, cut the line d, d, as centers with i, j, or c, g, as radius, describe arcs as t, r, s, or u, q, v, stopping at lines n, m; o, p, drawn through the points k, and l, parallel to a, h. Next, from i, set off to the point p, and do the same at the other and corresponding points, thus finding the four centers m, n, o, and p. From these, with e, c, d, or i, j, as radius, describe arcs which are joined by straight lines with the semicircles w, and x, at the upper and lower ends of the design. To find the centers of these semicircles, divide the distance between the points I, and 2, on the line a b, into four equal parts, and at the points draw a line z, z; from the point y set off in the line z z, a distance equal to b g, to the points a and b. From these points a and b with a radius equal to y, I, or y, 2, describe semicircles, as w, c; x, c. Join the points w, and x, by straight lines e, e, with the arcs described from the points p, and n. From a point in the center between b, and c, and a, and c, describe a small arc, and join this with another arc with the points, as d, d; the center of the arcs being at c, c. The lower arc, d, f, is described from the center g, which is on a line drawn through a point the third in the distance b, I, on the line b a. To describe the part marked A, cut out the part B,

B. From the point m, o, and n, and p, describe small circles, the radius being one-fourth part of one of the parts on a b. With a radius equal to half of one of the parts as I 2, on the line a b, describe circles from the point f, f; k, k, having a

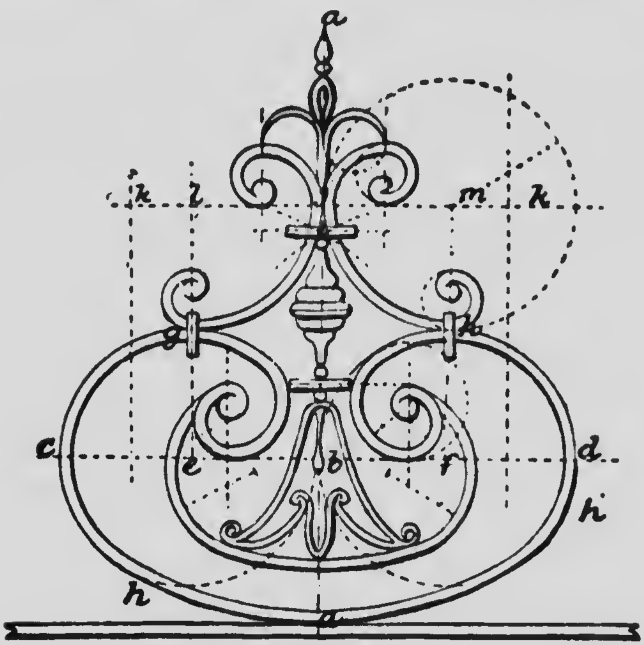
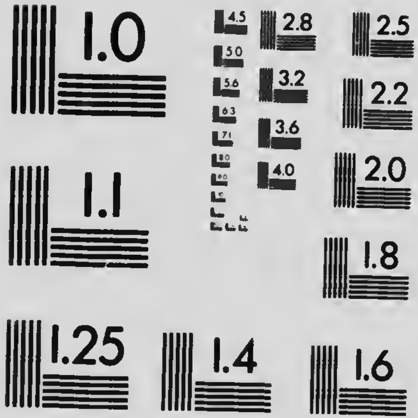


Fig 251.

space between them equal to the space at c, as l, l, and with a radius equal to the diameter of these circles, describe from the points l, l, the arcs m, n; m. n. From n, n, which are equidistant from the center line, a space equal to the radius of the small circles n, p; describe with radius of these small circles the arcs meeting in the point

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



o. With w, v, or s, t, as radius, set off on the line h, h; from the points l, l, to h, h, and from h, h, describe the arcs l, p, l, p, the centers of the arcs p, p, are q. q.

These examples are quite sufficient for our purpose so far as woodwork and decoration are concerned, but it may not be amiss to supplement them with a few on the same line, that will answer for iron, for wood, or for designs in stencilling or other decorative work. To this end, I present an ornament in Fig. 231, that is suitable for a central ornament, and one that may be employed for many purposes. Carvers frequently make use of this as a skeleton figure for carved panel work as it may be elaborated to almost any extent. The manner of drawing it is as follows: Let, a a, be the center line, and a, b, the distance from upper rail to center of lower part of design; through b, draw the line c, d, at right angles to a, b; c, d, in the length of the lower part of the design. Divide c, b, b, d, into two equal parts in the points e, and f, with radius e, c, describe an arc cutting in the point i; from i, with i, a, describe the arc b, a, h. From the point b, set off the distance e, f, to the point j; and through j, draw a line k, k, parallel to c, d. From j, with the distance b, f, set off to the points l, and m, and these will be the centers of arcs forming the upper part of the design. The lines and centers for the spiral terminations of

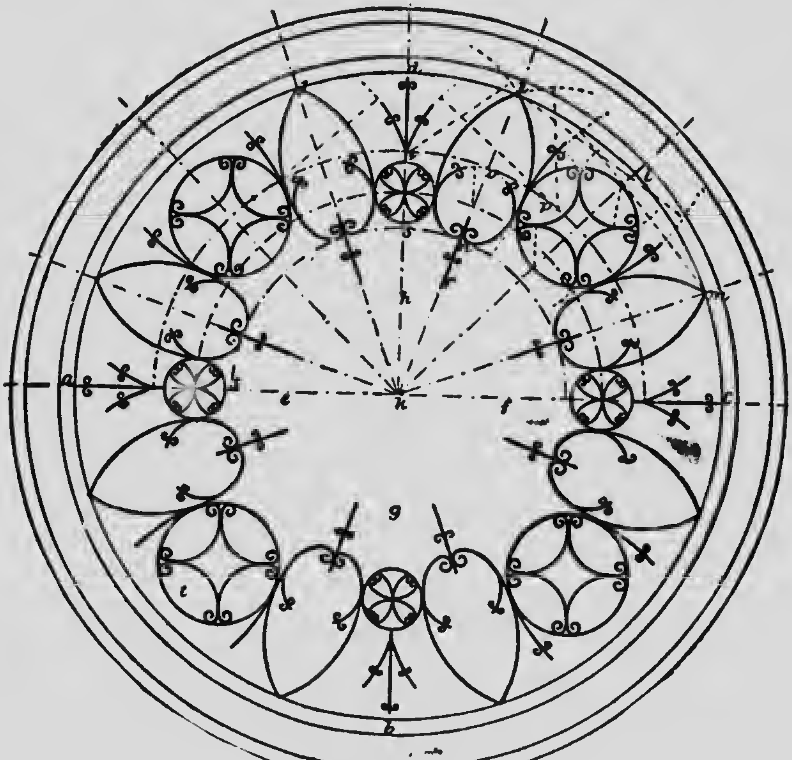


Fig. 232.

the leading curves thus described as shown in the drawing.

The skeleton shown in the illustration, Fig. 232, exhibits an ornament drawn altogether with the compass. The centers are all shown and lettered for reference; r being the general

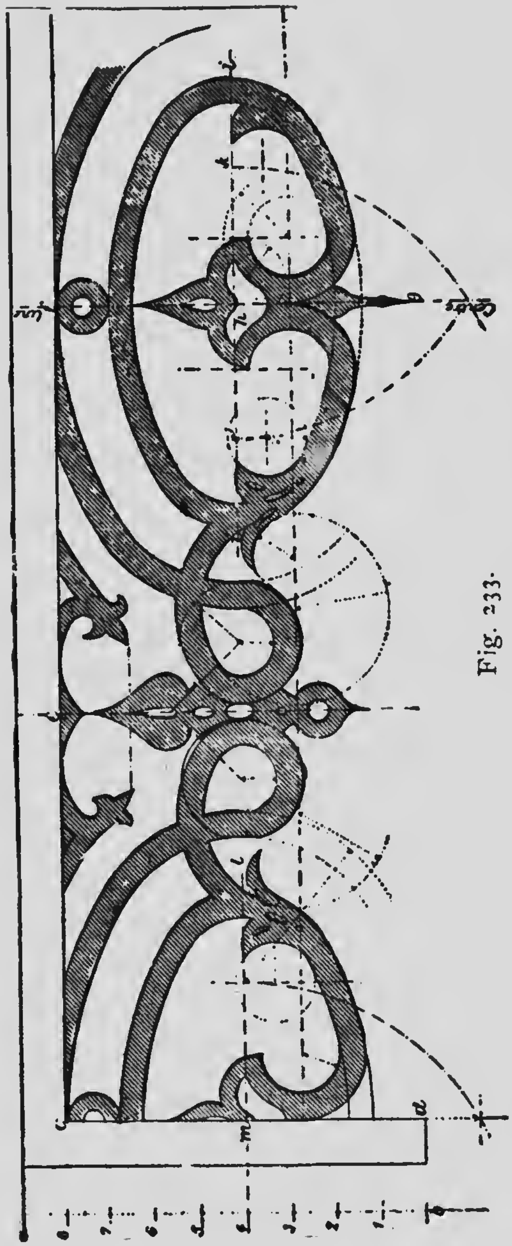


Fig. 233.

center, while a, j, d, i, m and c show the divisions and radiating lines of one-half of the figure. As the centers may all be framed at the intersections of the dotted lines, further explanations are unnecessary.

I close this department by illustrating an ornament in which the ellipse predominates, Fig. 233, which exhibits a running scroll suited to many purposes. On the continent of Europe scrolls of this kind are often used as window screens, being attached to the frame and covered with gauze, or woven wire, to prevent insects getting in the house when the window is open. This shows only half the design. The height of this section, a, b, is divided into nine equal parts, the width of the framework is equal to one of these parts. From c, at right angles to c, d, draw the line c, f, and with the distance a, b, from the point c, set off to the points e and f, and through these points draw lines at right angles to c, f; f, g, is the center line of the design. From the point f, with four of the parts on the line a, b, set off to the point h, and through h, draw at right angles to f, g, the line i, i. From the point h, set off to i, i, five of the parts in a, b, making i, i, equal to ten of these parts; divide i, i, into five equal parts; the first j, and fourth k, are the foci of the elliptical ornament, which draw as shown. Through the point 4 on a, b, draw a line 41, and make the distance m, l, equal to h, i; put in the elliptical part as shown, and finish as in the diagram, in which all the centers and center lines are given. Rules for describing the ellipse were given in previous pages, that should the student experience any difficulty in describing the elliptical curves, he may refer to those pages for assistance.

SOMETHING ON ORDERS OF ARCHITECTURE

It is not my intention to enter deeply into a description of the orders of Architecture or to give the student a history of their rise and growth, or analyze their peculiarities; it is

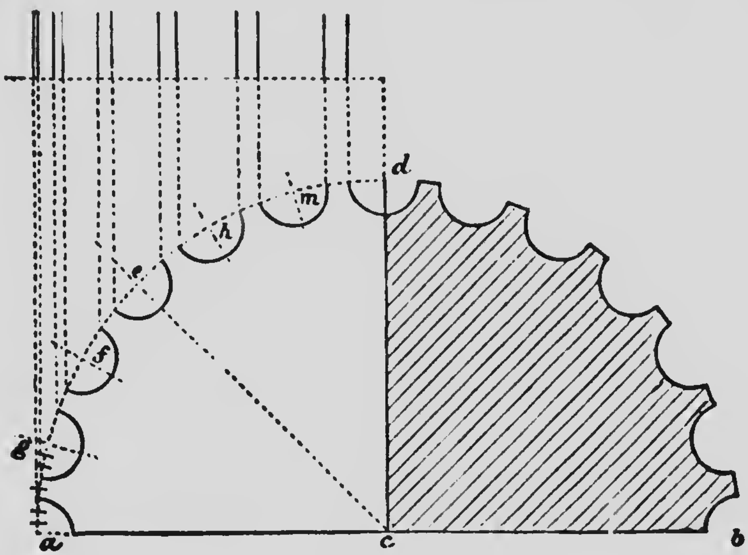


Fig. 254.

enough for our purpose, to be able to draw them, and to give to each order its own proportion and arrangement. Before we can do this, however, it will be necessary for us to be able to lay off a section of a column, showing the position of flutes and fillets in plan and elevation. This is brought out nicely in Fig. 234, where the dotted lines show the width of flutes and fillets as they will appear on the elevation. Suppose a b Fig. 234 to be the diameter of the column, then bisect it in c; and

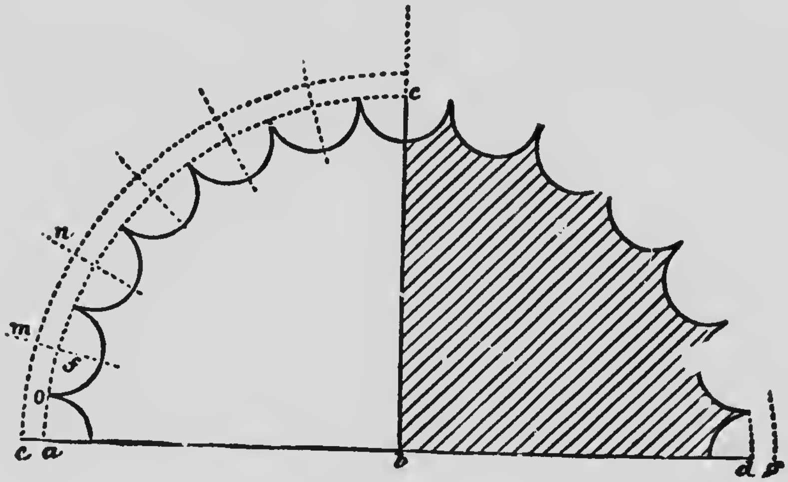


Fig. 235.

draw c d. Make lines corresponding to these, and from the point c, with c b, describe the semicircle a d b, representing half the column. Bisect the quadrant a d, in the point e, and divide the arcs a e, e d, by points g, f, h, m. Mark the position of these by radial lines from c. as in the example. Divide the part a g into eight equal parts; and with three of these as radius, from the points in the quadrant, as g, f, etc., describe semicircles. Six parts will thus be given to each flute, and two to each fillet; and the column will have twenty-four flutes.

To describe the flutes in a Doric column without the fillets, proceed as follows: Lay out the portion of column as in the previous example, by dividing the quadrant b e c, Fig. 235, into six

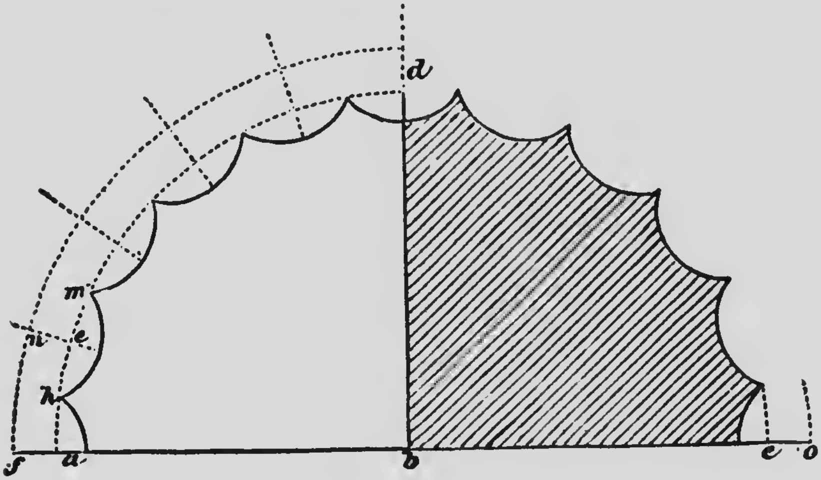


Fig. 236.

equal parts, as e, m, n, etc., giving to the entire column twenty-four flutes as before. Draw radial lines from b. Divide a f into four equal parts, and lay one of these on a b produced to e; from b, with b e, describe a semicircle as e m n, cutting the radial lines. Bisect a f in o, and with f o as radius, from the points—where the dotted semicircle intersects the radial lines—as centers, describe the arcs as in the example. Another method is shown in Fig. 236, which is formed as follows: Make the semicircle a d e and divide the quadrant b a d into five equal parts, so as to give twenty flutes to the column. Produce a b to f; bisect a e in h, and from e lay off e h to m; join h m, and with distance h e lay

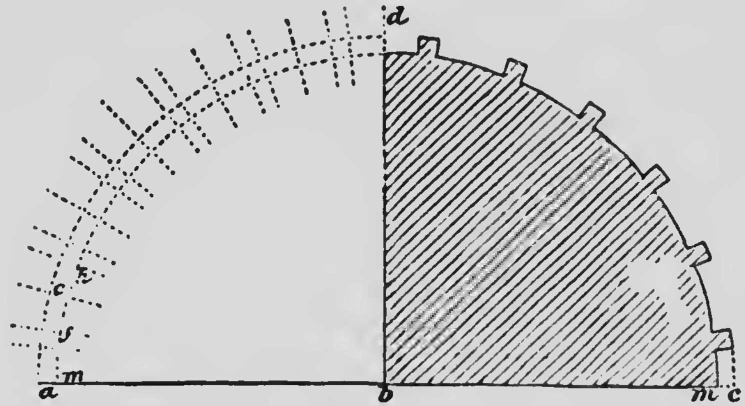


Fig. 237.

off on the radial line b e to n. From b, with b n, describe the dotted semicircle, f n o. The centers f the flutes are placed where the radial lines intersect this semicircle. From n, with n m, describe the lines as shown, and finish the section.

A section of a column having flat flutes and fillet is shown at 237. To describe this draw the semicircle a d c, and divide the quadrant b a d into six equal parts, divide a e into five equal parts. With two of these from the radial line lay off on each side, as f h. With one part lay off from c to m, and from m, with b m, describe a semicircle c d a; complete the diagram as shown. This will give the depth of the flutes,

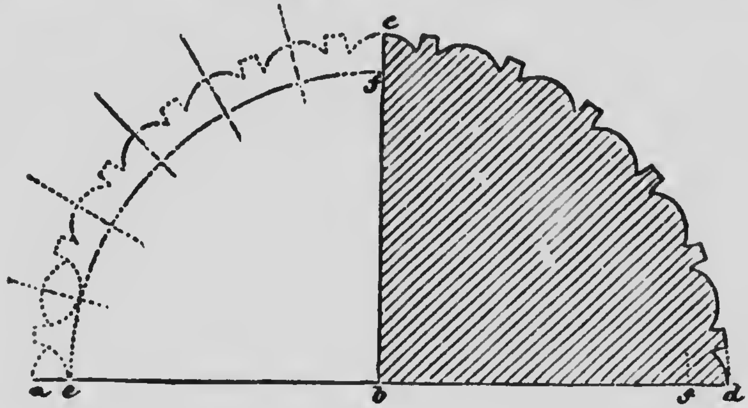


Fig. 238.

one; the width four, and the width of the fillets, one.

In Fig. 238 we give a method of describing the cabled moulding with fillets between. Divide the semicircle a c d in the same proportion as in Fig. 234, giving an equal number as in that example. From b, with b e on the compass, describe the semicircle e f f. From the points where the radial lines intersect this, as centers, with a e, describe the curves as in the example.

I will now endeavor to explain what are known as "The orders of Architecture," showing their various members, their proportion, and the manner of arrangement.

"Order, in architecture," says an authority, "is a system or assemblage of parts subject to certain uniform established proportions, regulated by the office each part has to perform. An order may be said to be the genus, whereof the species are Tuscan, Doric, Ionic, Corinthian and Composite; and consists of two essential parts; a column and an entablature."

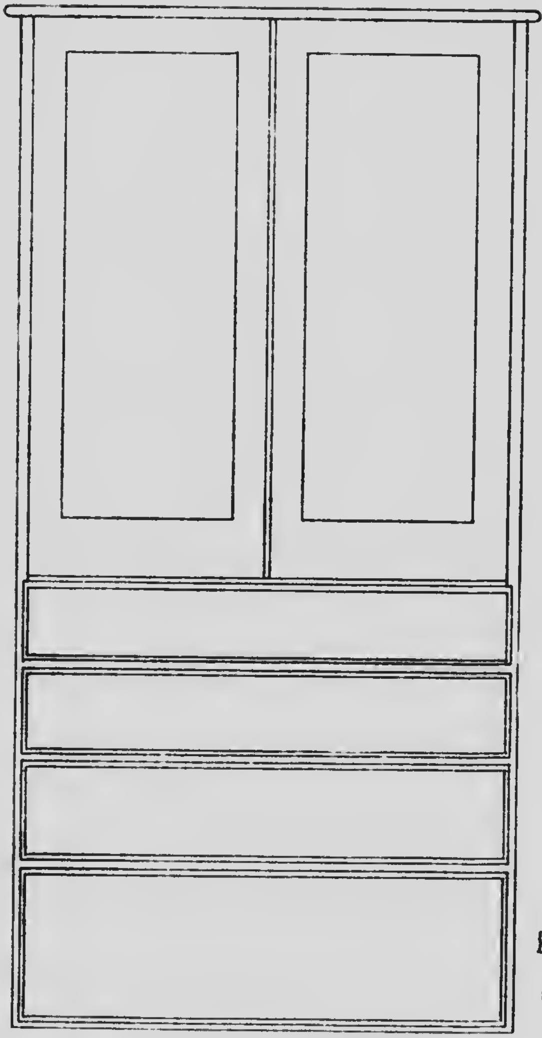
These again are subdivided, the first into three parts, namely: the base, the shaft and the capital; the second also into three parts, namely: the architrave or chief beam, C Fig. 239, which stands immediately on the column; the frieze B, which lies on the architrave, and the cornice, A, which is the crowning or uppermost member of the order. In the subdivisions certain horizontal members are used, which from the curved form of their edges are called mouldings, the construction of which depends on a certain knowledge of geometry. This application may be seen in the illustration; thus a is the ogee, b, the cornice, c the ovolo, d the cavetto, which with fillets compose the cornice, f f the facia.

The capital of the column consists of the upper members or abacus, g, the ovolo moulding

PLATE 14.

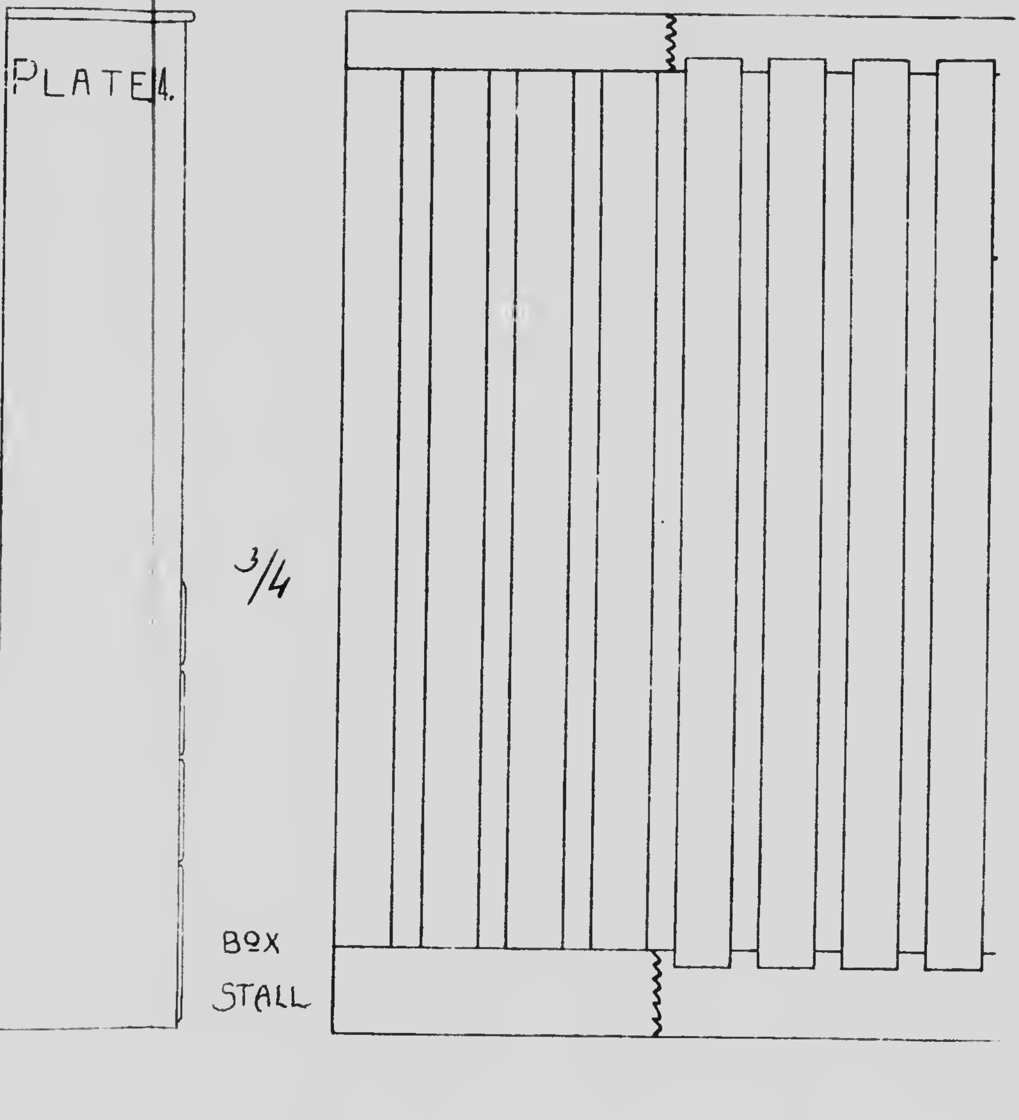
This plate shows an elevation for a cheap book-case suited for the cottage under consideration. The end elevation is also shown with [illegible]ce of drawers laid off. The scheme for a box stall shown in the drawing is somewhat out of the usual course, but may be found very convenient in stable construction.

PLAT



BOOK CASE

PLATE 4.



c, the astragal i i, and the neck h. The base consists of the torus k, and the plinth l. The character of an order is displayed, not only in its columns but in its general forms and details, whereof the column is, as it were, the regulator; the expression being of strength, grace, elegance, lightness, or richness. Though a building be without columns it is nevertheless said to be of an order, if its details be regulated according to the method prescribed for such order.

In all the orders a similar unit of reference is adopted for the construction of their various parts. Thus, the lower diameter of the column is taken as the proportional measure of all the other parts and members, for which it is subdivided into sixty parts, called minutes, or into two modules of thirty minutes each. Being proportional measures, modules and minutes are not fixed ones like feet and inches, but are variable as to the actual dimensions which they express — larger or smaller according to the actual size of the diameter of the column. For instance, if the diameter be just five feet, a minute being one-sixtieth, will be exactly one inch. Therefore, before commencing to draw an elevation of any one of the orders, the diameter of the column must be determined, and

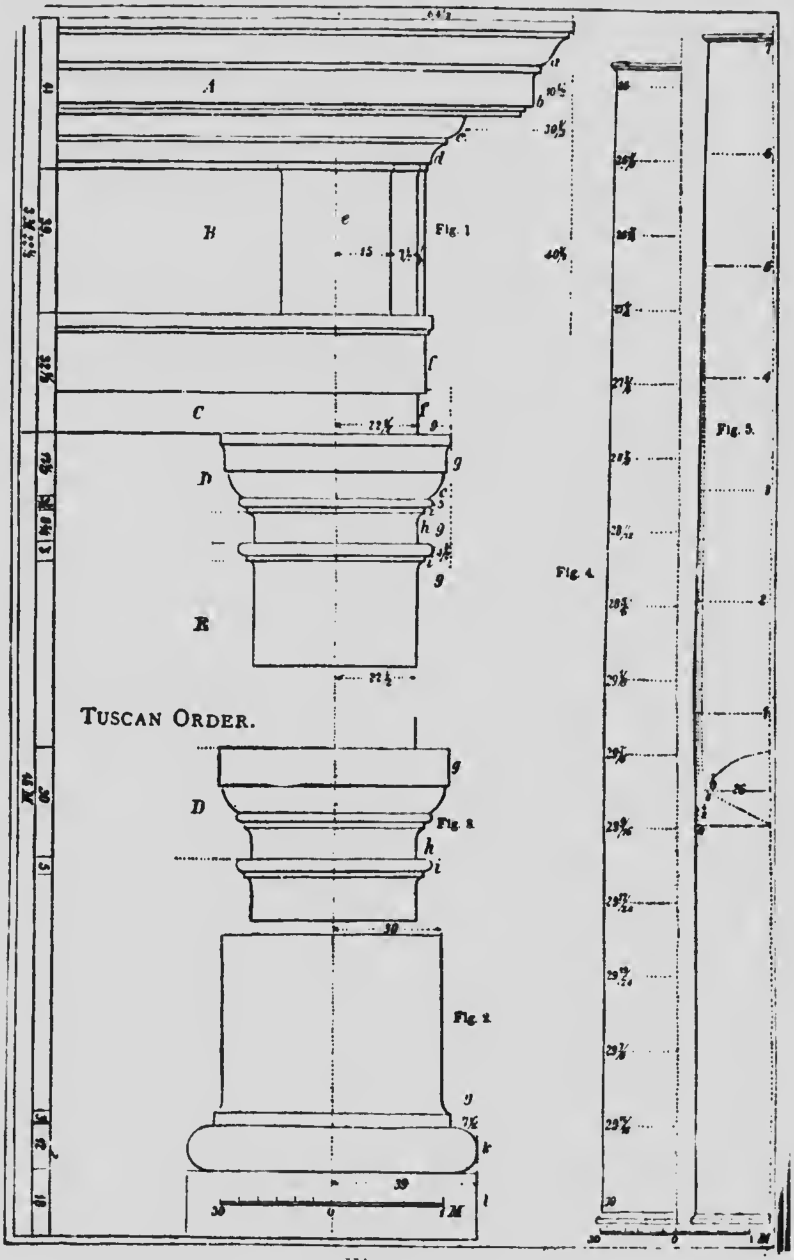


Fig. 239.

from that form a scale of equal parts, by sixty divisions, then lay off the widths and heights of the different members according to the proportions of the required order as marked on the body or on the sides of the illustrations.

Fig. 239 presents an illustration of the Tuscan order, considered by architects as a spurious or plain sort of Doric, and hardly entitled to remark as a distinct order. E in the frieze corresponding to the triglyph, illustrates still further the connection of the two orders; but by many architects this member is not introduced. No. 1 is an elevation of capital and entablature, No. 2 of the base, and No. 3 of a detached capital. Our example is constructed according to the rules given by Vincent Scamozzi.

Examples of two capitals are given, differing merely in the number of mouldings in the abacus.

In fact, this introduction of simple mouldings is about the only variety allowable in the ord[er]. Ornament is not admitted, nor are the pillars ever fluted.

A slightly convex curvature, or entasis, is given in execution to the outline of the shaft of a column, by classic architects, just sufficient to counteract and correct its appearance, or fancied appearance, of curvature in a contrary direction

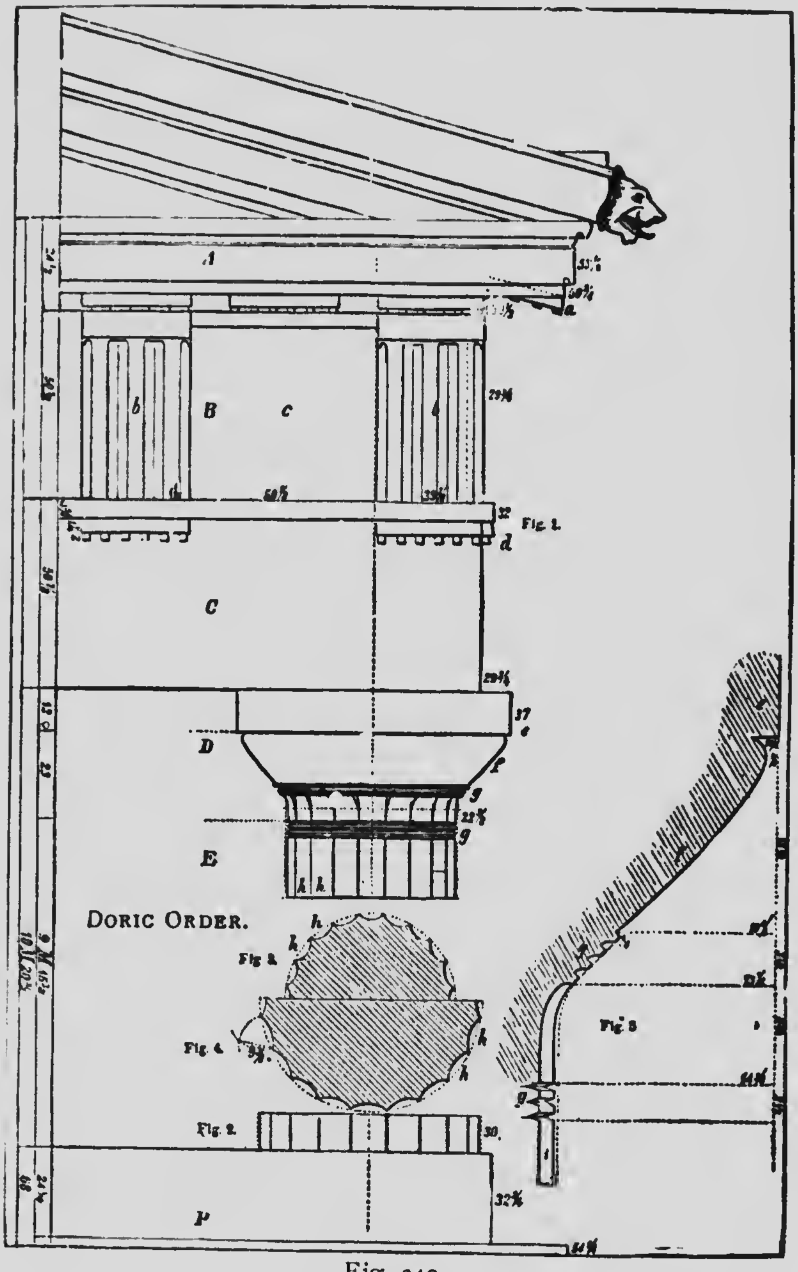


Fig. 240.

(i. e., concavely), which might else take place, and cause the middle of the shaft to appear thinner than it really is.

No. 4 represents the form of a half column from the Pantheon at Rome. In No. 5 another example of entasis, the lower third of the shaft is uniformly cylindrical; the two upper thirds are divided into seven equal parts. On the semicircle shown in the figure, is a chord cut off parallel to the diameter, the length of which is fifty-two parts only one-half being shown. Divide the part a b of the circumference between the diameter and chord into seven equal parts, and draw parallel lines from each division to those of the upper part of the column, which will give the diameter of the shaft at each division; by increasing the number of the divisions, more diameters for different parts of the shaft may be found.

Fig. 240 exhibits an example of the Doric order, from the temple of Minerva in the island of Egina. The dimensions are given in parts of the diameter, as in the preceding example, and the same capital letters denote corresponding parts. No. 1 is an elevation of the capital and the entablature. No. 2 of the base, and a part of the Podium. No. 3 shows the forms of the flutes at the top of the shaft, and No. 4 at the base. No. 5 the outline of the capital on an enlarged scale.

The Doric order may be said to be the original of the Greek orders, of which there are properly but three; the Doric, Ionic, and Corinthian, which differ in the proportion of their parts and in some of their ornaments and mouldings. Of the Doric, the mutules a a, the triglyphs b b, the guttae or drops d d of the entablature, the echinus f and the annulets g g of the capital, may be considered characteristic. With regard to the arrangement of triglyphs, one is placed over every column and one or more intermediately over every inter-column—a span between two columns—at such a distance from each other that the metopes c, or spaces between the triglyphs, are square.

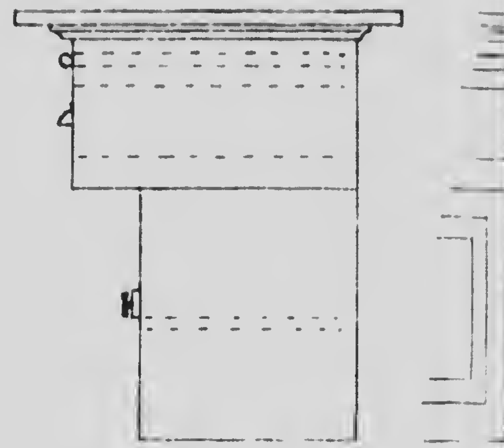
In the best Greek examples of the Doric order there is only a single triglyph over each inter-column. One peculiarity of the Grecian Doric frieze is, that the end triglyphs, instead of being like the others in the same axis or central line as the column beneath, are placed quite up to the edge or outer angle of the frieze. The mutules are thin plates or shallow blocks attached to the under side of soffit of the corona, over each triglyph and each motope, with the former of which they correspond in breadth, and their soffits, or under surfaces, are wrought into three rows of guttae or drops, conical or otherwise shaped, each row consisting of six guttae, or the same number as those beneath each triglyph. Though a few exceptions to the contrary exist, the shaft of the Doric column was generally what is technically called fluted. The number of channels or flutes is either sixteen or twenty, afterwards increased in the other circles to twenty-four, for they are invariably of an even number, capable of being divided by four, so that there shall always be a center flute on each side of the column.

Fig. 241 presents an example of the Ionic order, taken from the temple of Minerva Nolias at Athens. No. 1 is an elevation of capital and entablature, No. 2 the base, No. 3 is a half of the plan of the column at the base and the top; No. 4 an elevation of the side of the capital. In the proportions of its shaft, which are more slender, and the addition of a base, it differs from the Doric; but the capital is the indicial mark of the order by which it is immediately recognized. It is far more complex and irregular than the other orders of capitals; instead of

PLATE 15.

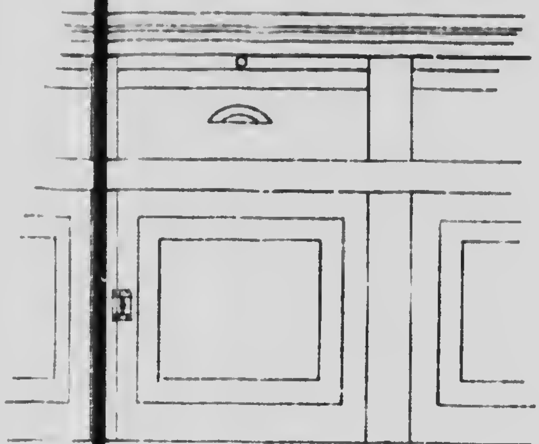
Plate 15 exhibits an odd piece of furniture, termed a "kitchen desk." Twelve students can sit around this desk and work with ease. The elevations show the manner of finish, with drawers on top of case under the desk top, and doors below, that cover shelves, intended for books or other similar materials.

PLATE. 15.



KITCH

FOR TWE



ITCHEN DESK

TWELVE STUDENTS

3/4"

showing four equal sides, it exhibits two fronts, with spirals or volutes parallel to the architrave and narrowed, baluster sides (No. 4), as they are termed, beneath the architrave.

When a colonnade was continued in front and along the flanks of the building, this form of capital occasioned an offensive irregularity; for, while all the other columns on the flanks showed the volutes, the end one showed the baluster side. It was necessary that the end column should, therefore, have two adjoining volute faces, which was effected by placing the volute at the angle diagonally, so as to attain their two voluted surfaces placed immediately back to back. This same diagonal disposition of the volutes is employed for all capitals alike, in Roman and Italian examples of this order.

The capital admits of great diversity of character and decoration—it sometimes is without necking, sometimes with; which may either be plain or decorated, to suit the entire design. The capital may also be modified in its proportions, first as regards its general proportion to the column; secondly, as regards the size of the volutes compared with the width of the face. In the best Greek examples the volutes are much bolder than in the Roman. The spirals

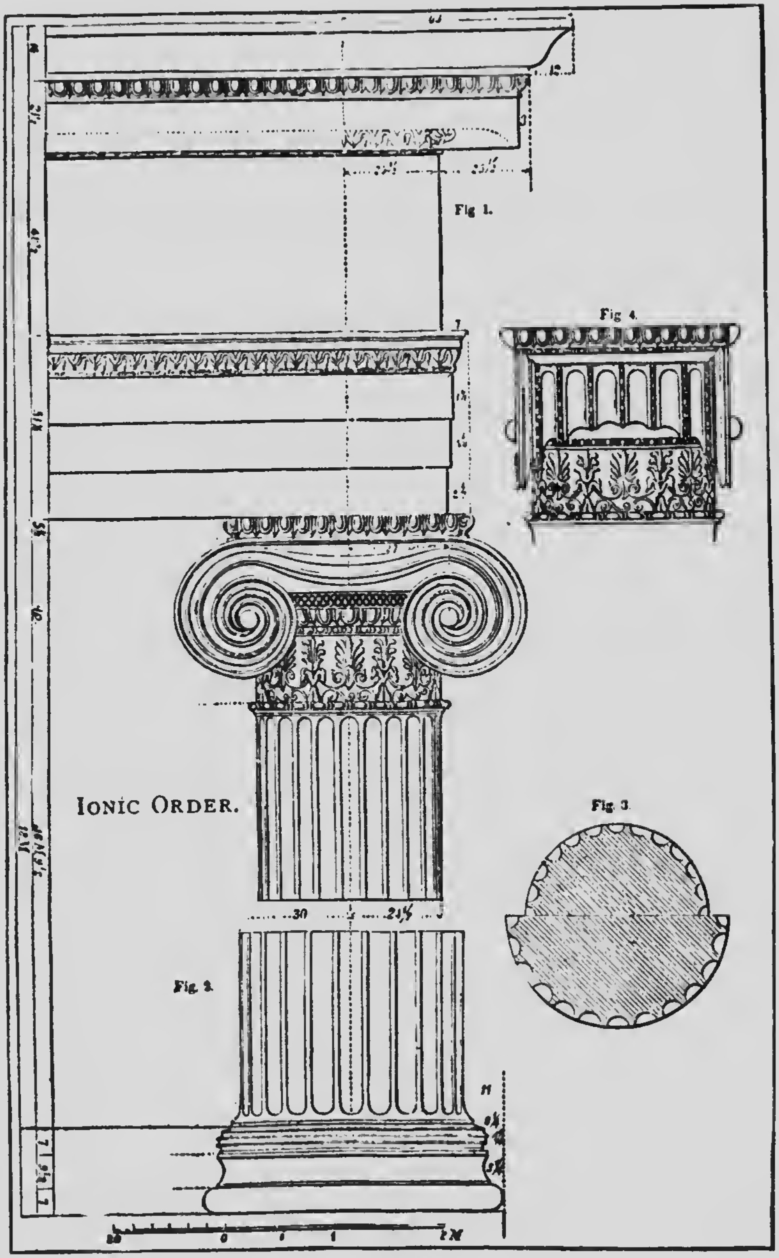


Fig. 241

also of the volutes may be either single or maniold, and the eye or center of the spiral may be made larger or smaller, flat or convex, or curved as a rosette.

Fig. 242 represents an example of the Corinthian order, from the Arch of Hadrian, at Athens. This order is distinguished from the Ionic, more by its deep and foliated capital than by its porportions—the columns of both have bases differing but little from each other, and their shafts are fluted in the same manner.

Although the order itself is the most delicate and lightest of the three, the capital is the largest, being considerably more than a diameter in height, varying in different examples from one to one and a half diameter; upon the average about a diameter and a quarter.

The capital has two rows of leaves. eight in each row, so disposed that of the taller ones, composing the upper row, one comes in the middle, beneath each face of the abacus, and the lower leaves alternate with the upper ones, coming between the stems of the latter; so that in the first or lower tier of leaves there is in the middle of each face a space between two leaves occupied by the stem of the central face, above them. Over these two rows is a third series of

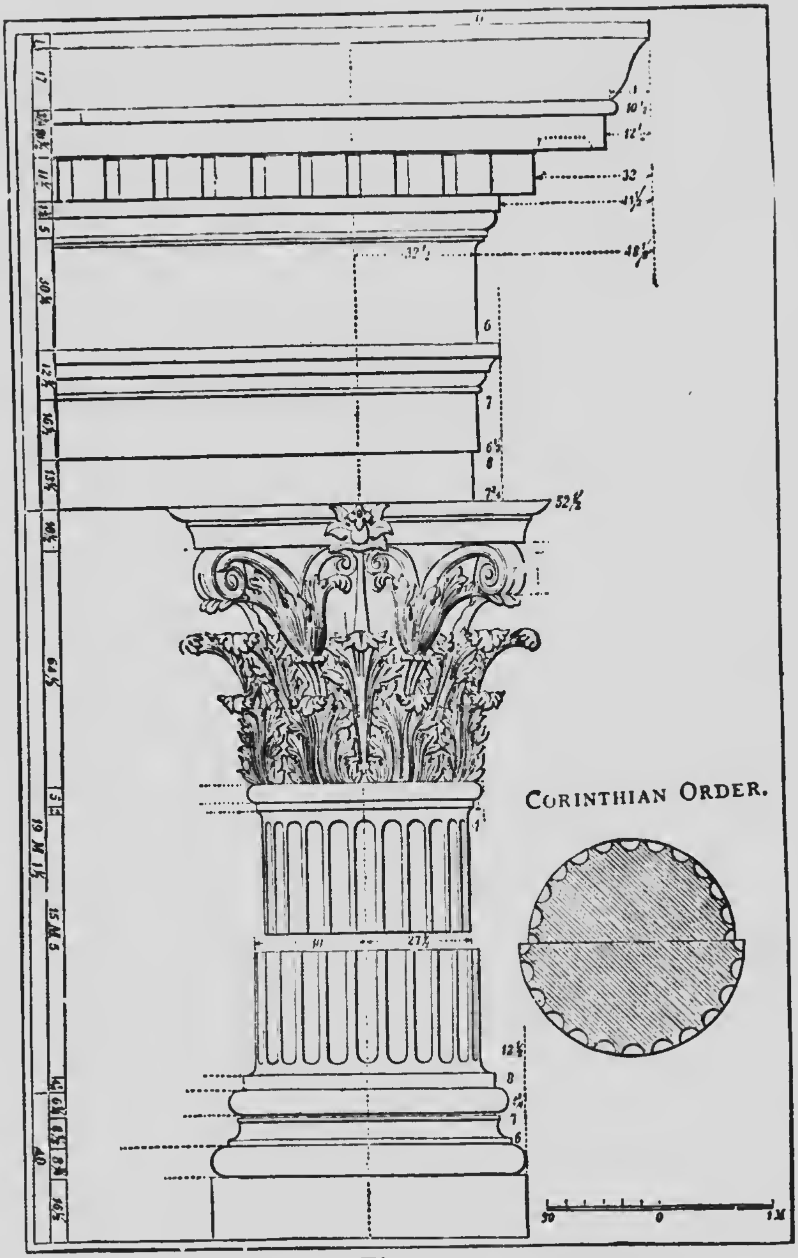


Fig. 242.

eight leaves, turned so as to support the small volutes which, in turn, support the angles of the abacus. Besides these outer volutes, which are invariably turned diagonally, as in the four-faced Ionic capital, there are two smaller ones, termed caulicoli, which meet each other beneath a flower on the face of the abacus. The abacus itself is not, properly speaking, a square, although it may be said to be so in its general form. But instead of being straight, the sides of the abacus are concave in plan, being curved outwards so as to produce a sharp point at each corner, which is usually cut off.

The proper Corinthian base differs from that of the usual Ionic or Attic, in having two smaller scotiae, separated by two astragals; however, both kinds are employed indiscriminately. The shaft is fluted, in general, similarly to that of the Ionic column, but sometimes the flutes are cabled, as it is called; that is, the channels are hollowed out for only about two-thirds of the upper part of the shaft and the remainder cut so that each channel has the appearance of being partly filled up by a round staff or a piece of rope, hence the term cabling.

The cornice is very much higher than in the other orders, which makes more projection also.

From this greatly increased depth of cornice, it consists of a great number of mouldings beneath the corona, for that and the cymatium over it invariably retain their places as crowning members of the whole series of mouldings. In the illustration square blocks or dentels are introduced, but often to the dentels is added a row of modillions immediately beneath and supporting the corona. These modillions are ornamental blocks, curved in their under surface somewhat after the manner of the letter S laid on its edge, and between them and the dentels, also below the latter, are other mouldings, sometimes cut, at others left plain. Sometimes a plain, uncut dentel band is substituted for dentels; sometimes, in simpler cornices, that is omitted altogether and plainer blocks are employed instead of modillions; or else both dentels and modillions are omitted. The dentel is not peculiar to this order, but is considered as more properly belonging to the Ionic.

The composite order is very much akin to the Corinthian, and is sometimes called the Roman Corinthian. It is frequently formed with square *plinths or pedestals* beneath the column. The base is nearly like those of the Doric and Ionic. The shaft is channeled with twenty-four flutings

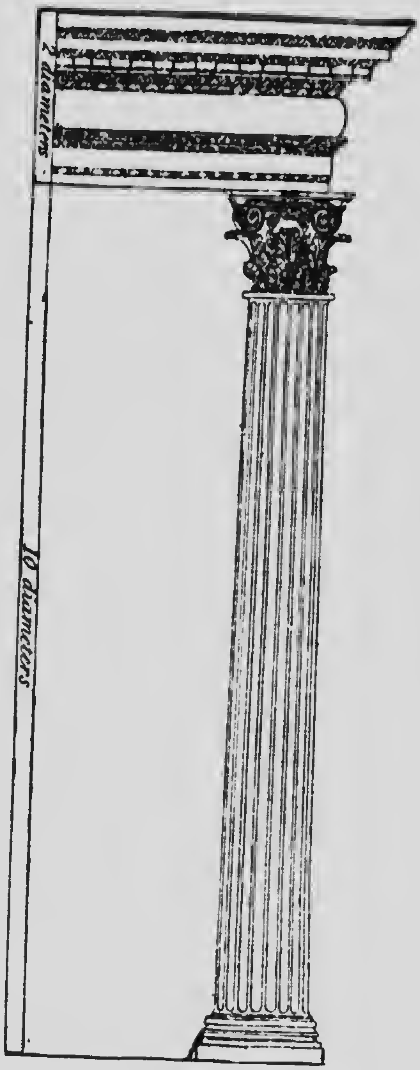


Fig. 243.

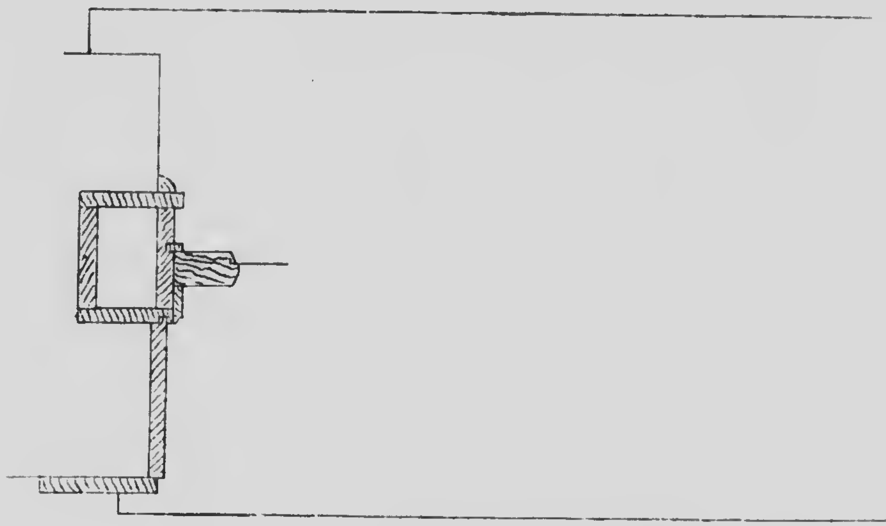
separated by fillets. The capital consists of two rows of acanthus leaves, eight in each row; the upper row being placed over the meeting points of those in the lower row. Four spiral volutes in each face spring from two bunches of acanthus leaves; and two of them are so connected at the corners as to support the abacus of the capital. (See Fig. 243.) Each face of the abacus, besides being moulded into an ovolo form, is a slight difference between the Corinthian and Composite. The Corinthian architrave is divided into three facias, the Composite into two; the facias being in both cases separated from another by small enriched mouldings.

PLATE 16.

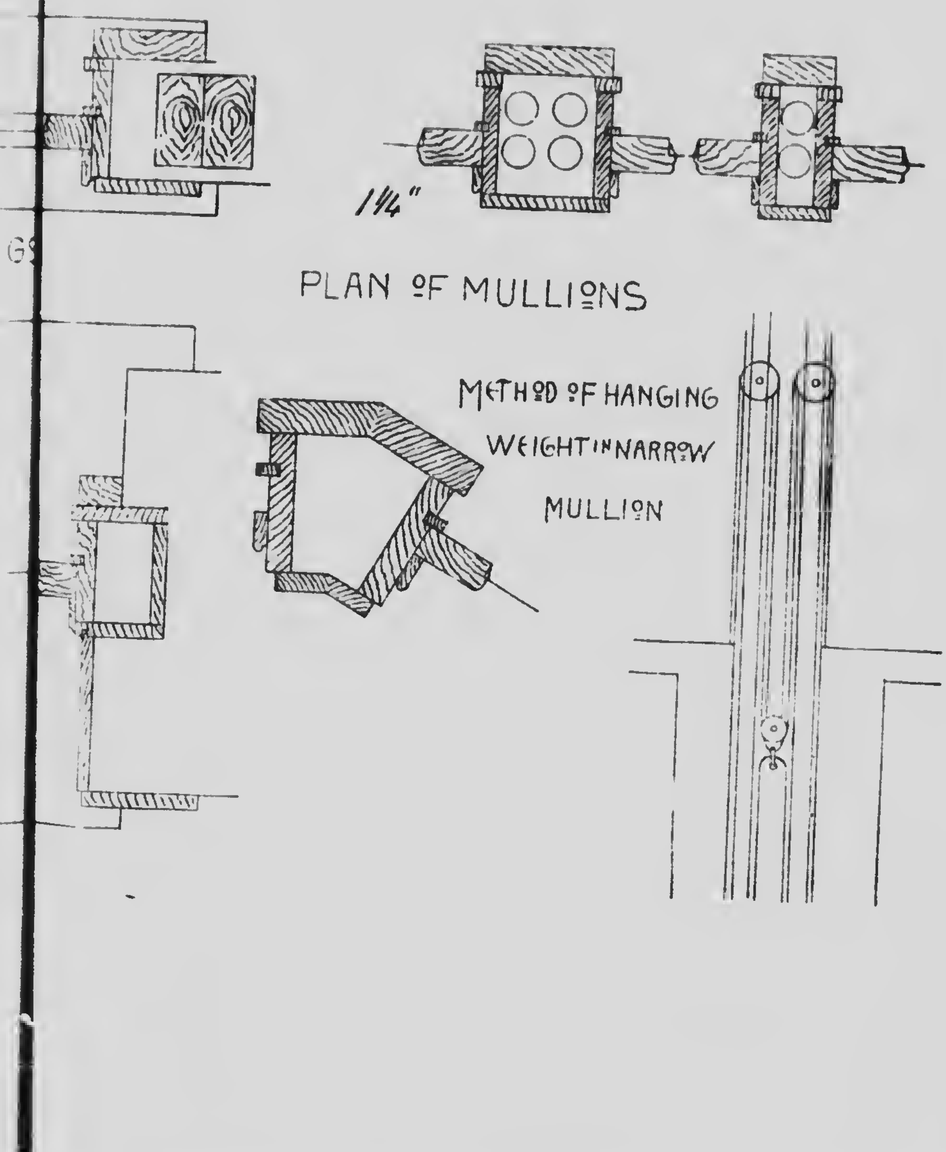
Plate 16 shows sections and plans of windows, for wood and for brick buildings, with weights where the mullion is narrow and will not admit of two weights passing each other. One section shows the manner of constructing the angle of a bay window where boxes and weights are required. This is a very useful plate for the young draftsman.

PLATE.16.

PLAN OF WINDOWS FOR WOOD BUILDIN



AND FOR BRICK


ILDINGS
1¼"
PLAN OF MULLIONS
METHOD OF HANGING
WEIGHT IN NARROW
MULLION

The frieze is enriched nearly all over with sculptures or other ornaments. The cornice, besides a number of small enriched mouldings above and below the corona, has a row of those square blocks which obtain the name of dentils. The Compos' has mutules on the soffit, or underside of the corona, like the Doric; but the Corinthian has peculiar ornaments, called modillions. Between every two modillions, along the under side of the corona, is an enriched panel.

If the student has followed the foregoing closely, he will, by this time, not only be a fair draftsman, but he will have obtained a knowledge of general architecture and construction that will make of him a valuable and efficient mechanic, and one whose services will be sought after and paid for at a good rate.

MISCELLANEOUS

A good draftsman is always supposed to be a good letterer, and as every drawing must have a brief description of some sort, and as it is sometimes a little puzzling to decide on what style of letter to employ, I thought I would give a few examples, so that the draftsman may have something to aid him in deciding. Ornamental letters had better be avoided until such time as the draftsman feels he can make them with ease and celerity, and plain lettering had best be the rule; however, I give a few examples

ABCDEFGHIJKLMNO
PQRSTUVWXYZ &c

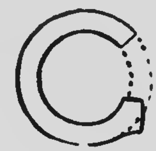


Fig. 244

of both plain and ornamental, so that the student can determine for himself the styles of letter he will employ.

A simple block letter is shown in Fig. 244, with one letter G enlarged at the end. These letters, as will be seen, may be made in single or double line, as may be desired. Figures

1 2 3 4 5 6 7 8 9 0

Fig. 245.

appearing in the heading, Fig. 245, should be the same size as the letters, but as dimensions on the drawing they should not be more than ⅛ in. deep, nor less than $\frac{1}{12}$ in. When dimensions are put upon a drawing, the distance to which they should extend should be carefully shown by dotted lines, with arrow-heads at the extremities keeping the fractions level, and with the small figures two-thirds the size of the large ones. The feet should be marked by a single accent thus , and the inches by a double accent thus ", with a full stop on the line between the figure. If the dimensions consist of an even number of feet, then inches should be represented by 0". The omission has led to serious mistakes in practical work, which should always be guarded against, and, notwithstanding the examples of text-books and the practice of some examiners, this is an important point always observed by practical draftsmen.

After inking in all the figures, pencil out the heading very carefully, making the letters a little thicker than those used in Fig. 244; G, R, S, C, and M will be found the most difficult. The distance apart of the letters should not be quite uniform, but should be such as will look uniform. For example, as I between M and N would require more than the usual space to look right; on the other hand, a T between L and J would require to slightly overlap to give the right effect. The junction points A, M, N, V, and W should not be sharp but the same width as the thickness of the strokes.

Leave ½ in. between the words of the heading.

It is then much easier to read than if cramped closer together or spaced wider apart. Remember that the printing—being thicker—will take longer to dry, and be careful not to use the india rubber too soon. It will be observed that the guide lines for the square and center lines for the circle, as described above, have not been inked in, as they would spoil the

A B C D E F G H I J

K L M N O P Q R S T

U V W X Y Z

Fig. 246.

effect of the drawing, but on machine drawings it is usual to put the center lines in red, using a little crimson lake for the purpose.

Another block letter is shown at Fig. 246, which is easy to make and quite effective. This, and the three following examples, are taken from "The Draftsman," an excellent little journal for the young draftsman, as it is full of useful matter, and will help him along materially. The journal is published monthly, in Cleveland, Ohio, and only costs one dollar a year.

The letters shown at Fig. 247 have some pretentions to ornamentation, but on the whole they are very simple and easy to make.

Fig. 247.

Fig. 248 exhibits a sort of Runic letter that is q[illegible] ornamental and would require considerable p[illegible]e before it could be formed nicely.

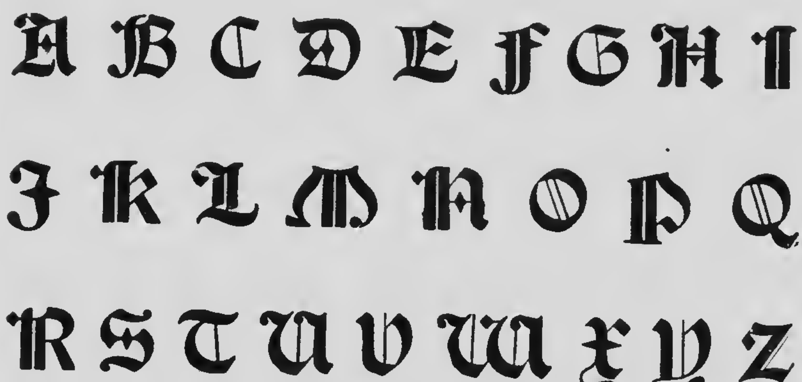


Fig. 248.

The letters shown at Fig. 249 are good old style characters and are always in order for almost any kind of work.

The two styles of open letters shown in Fig. 250 may sometimes be found useful, but as a rule I do not recommend this style of letter; it does not "show up" enough for the trouble; at the same time, it offers excellent practice for the draftsman.

These examples are quite sufficient for my purpose, but the student will do well to try his

A B C D E F G H I

J K L M N O P Q R

S T U V W X Y Z

Fig. 249

hand on other styles, many of which he can find in public prints, headings, and other places.

While I do not advise the young student to attempt the coloring of drawings, yet, if he advances himself sufficiently to be able to make a good drawing, there is no reason why he should not attempt to color some of his work, and to aid him in doing so I submit for his guidance the following hints and suggestions regarding this work. The first thing to do when coloring is intended is to see that the paper has all the superfluous sizing removed by being sponged lightly with clean water. The paper, and everything about it, must be kept perfectly clean. Line off the spaces, with *very fine* pencil marks, that are to be tinted. Never use the eraser on the part to be tinted, either before or after tinting. Try the tinting process on a piece of waste paper until the proper

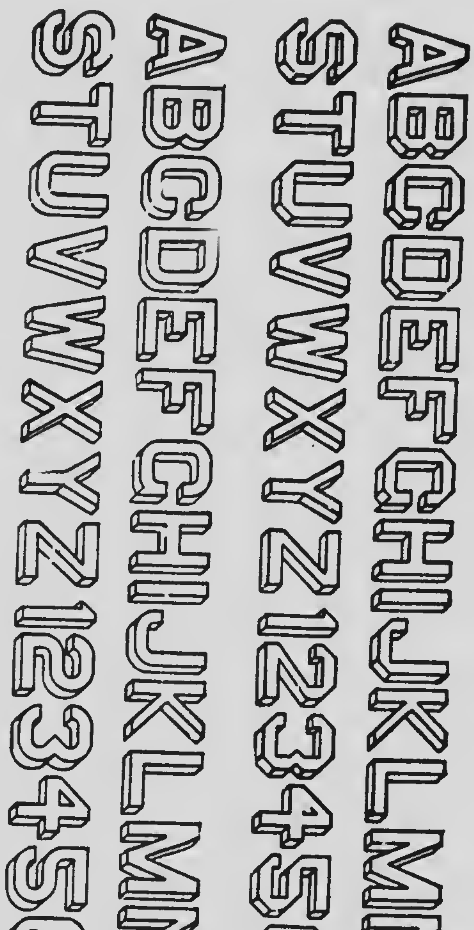
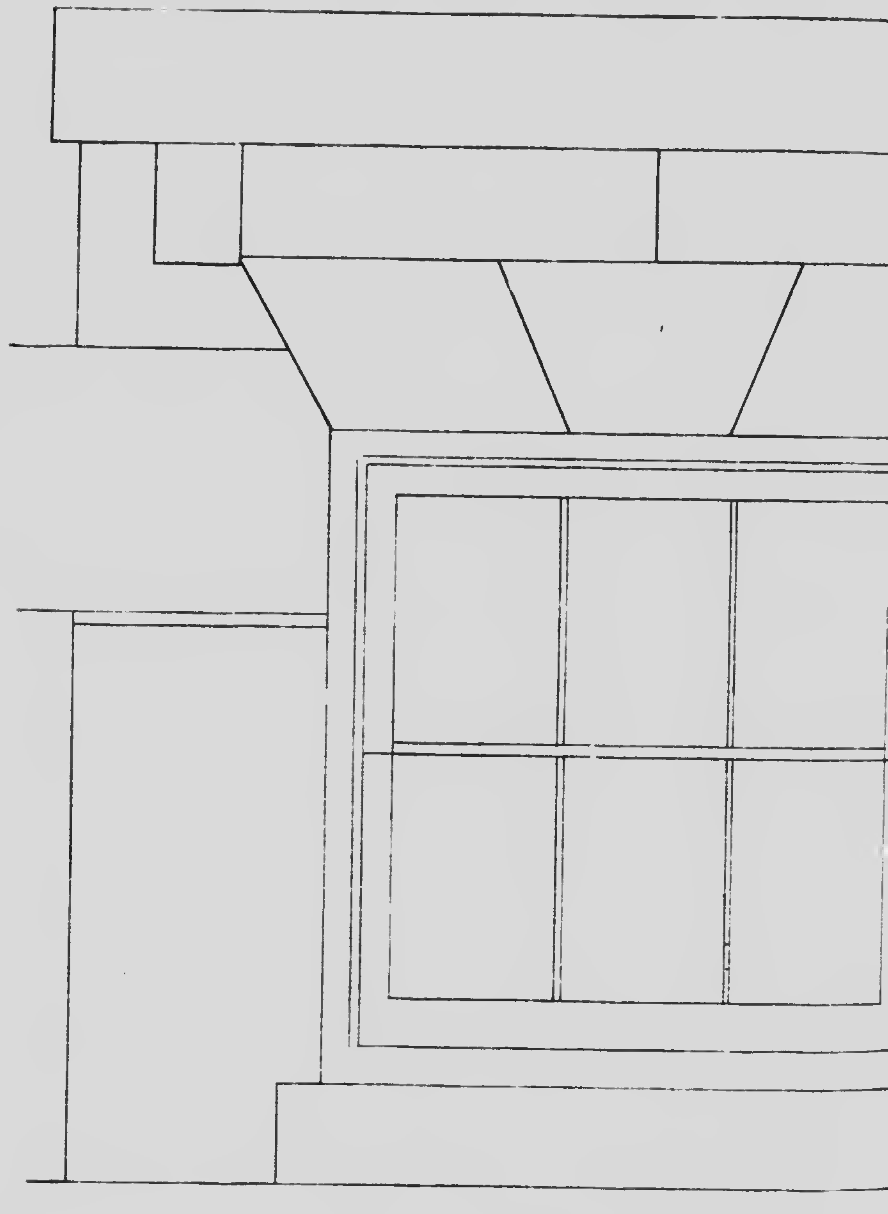


Fig. 250.

PLATE 17.

This plate shows a basement window in a stone wall, the elevation showing the outside of the window, and the section exhibits the manner of constructing the frame and placing the sashes. This is drawn to a scale of ¾ of an inch to the foot.

a
f
r
.
e



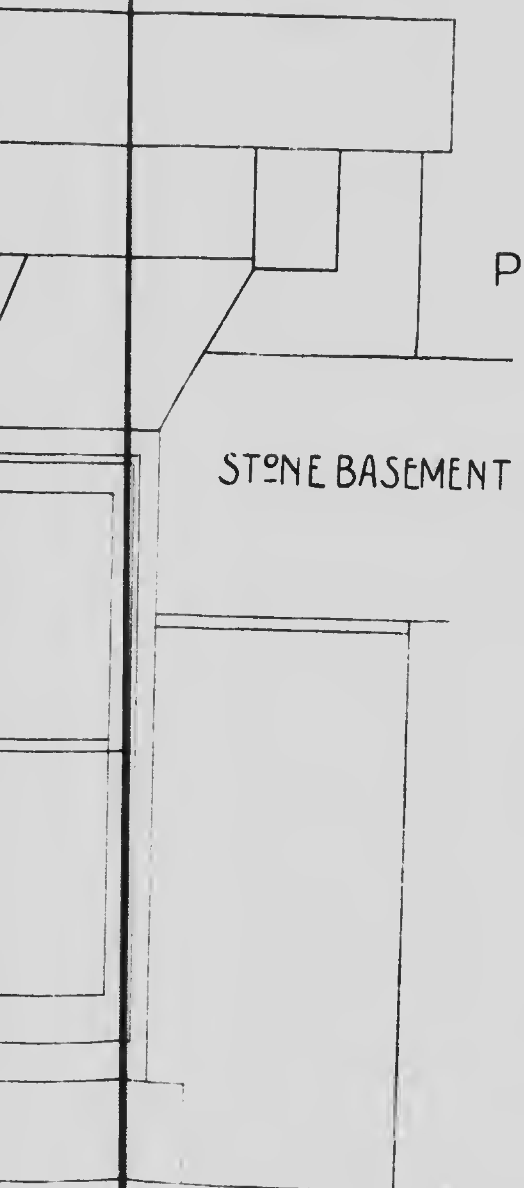
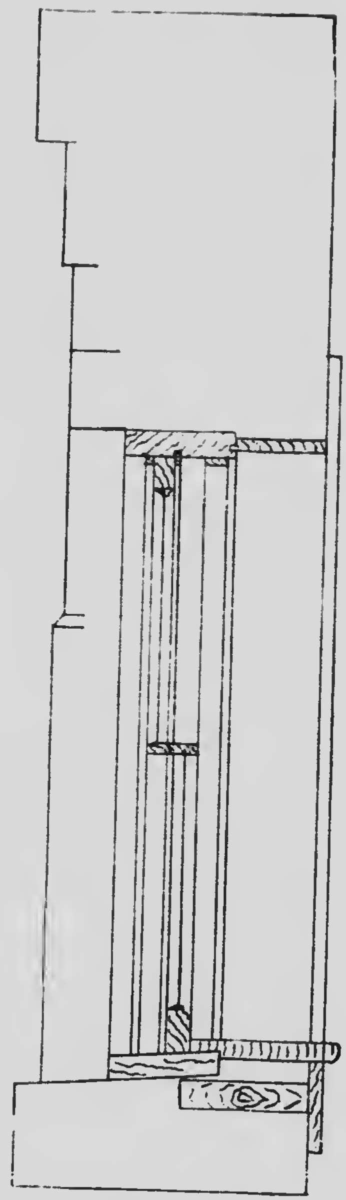


PLATE.17.

ST^O NE BASEMENT WINDOW

3/4"



tint is obtained, before applying to the drawing. Dark tints are formed by applying a number of light ones over each other, but a second tint should not be applied until the first one is perfectly dry. Always finish tinting one portion of drawing before leaving it. Otherwise it will be cloudy. See that the paper is damp before you begin to tint. Ink in all lines after the tinting is completed and the drawing is perfectly dry.

The colors used for representing wood, iron, and other materials, are as follows: For soft pine, a very pale tint of sienna; for hard pine, burnt sienna with a little carmine added; for oak, a mixture of burnt sienna and yellow ochre is used. Mahogany is represented by burnt sienna and a portion of dragon's blood. For walnut, dragon's blood and burnt umber are used. For bricks, burnt sienna and carmine make a good color. Gray stones are represented by a mixture of black and white, with a little Prussian blue and carmine added—pale ink alone is sometimes used for stone work. Brown freestone is represented by burnt sienna, carmine, and ink. Wrought iron is represented by a light tint of Prussian blue, and cast iron by a gray tint composed of black, white, and a little indigo. Brass is tinted with gamboge. Gamboge, slightly mixed with vermilion, makes a good color for copper. Silver is represented by an almost invisible blue.

Many draftsmen have a natural talent for using suitable colors, and putting them on in a suitable manner, but others must go through the drudgery of careful practice according to rule. A perfectly uniform tint such as desired on an engineer's drawing is not required on an architect's drawing, and still less on that for use by a builder; but unless the draftsman learns first to lay on a flat and uniform wash of any tint, he is not likely to be able to put on an appropriate rough tint. For water-color sketching a flat tile with shallow recesses is suitable for mixing the colors, but this is quite unsuited for a draftsman's use. He should invariably use the nests of round saucers fitting one on the other, and of a size to hold as much color as would be required to completely finish the coloring of any one material on one sheet. The saucers should be kept covered while in use, and washed out when done with. The lightest tints should, as a rule, be put on first, and the brush should always be of ample size. Color brushes should be kept scrupulously clean, never put in the mouth, always washed after using, the surplus moisture shaken out, and then put away in the box and not laid on a dusty shelf to dry.

A little practice in the laying of colors one over another will be used for impressing on the memory the general effect of combination, and also a knowledge of the primary colors and their secondaries. Nearly all water-colors are transparent, and a medium tint of any one color, if laid over another after it is dry, will allow the first color to show through. A more intimate combination may be made by mixing the colors together in the same palette and putting them on with the brush in one operation.

Wipe the brush lightly on the edge of the saucer to remove the surplus color, and hold it as described for a lead pencil when about to draw a vertical line; commence at the top left hand of the space to be colored; pass the brush downwards, then along the top, then down by short strokes from the top to the length of the first stroke, and so carry the color downwards for the whole width, finishing at the bottom right-hand corner.

To produce good and uniform coloring, never damp the paper before commencing, refill the brush often, gently wiping it on the edge of the saucer each time. The margin of the color must not dry before the next stroke reaches it, and a part once colored must never be retouched, even though it looks uneven. Retouching is a fruitful source of failure; for color, looking uneven when wet may dry even, but if touched again when partially dried it is certain to show uneven when dry.

There is an advantage in having plenty of color in the brush, but when nearing the bottom boundary the amount must be reduced, so that there is not a pool left at the lower corner. By regulating the amount of color any slight excess may be picked up with the brush by simply raising it slowly, point last, from the corner. The brush should not be wiped in any way, but simply washed in clean water, when done with, or before use with another color. It will soon be found that with a given amount of color in the brush more or less of it may be left behind as the brush is allowed to trail or is used sideways, and it is by unconscious adjustments of this kind that a good colorist produces uniform results.

There are certain tints employed by architects to designate works of various kinds, and I give them herewith so that the student may have them within reach if he has occasion for their use. It must be understood, however, that nearly every drawing office of any note has rules of its own for marking and coloring drawings, so that the rules given herewith may differ materially from many others in vogue.

Banks (Steep)—Shaded with graduated warm sepia, darkest at top of bank; vertical hill-shading in India ink or dark sepia.

Brass—Gamboge with yellow ochre or burnt sienna.

Bricks (Blue)—Elevation, indigo and India ink; section, indigo. (Red)—Elevation, light red (pale); section, India red (dark).

Brickwork (New)—Elevation, Roman ochre; section, crimson lake. (Old)—Elevation, India ink (pale); section, India ink (dark).

Buildings (Brick or Stone)—Crimson lake. (Wood)—Sepia.

Cast Iron—Payne's grey; neutral tint.

Chain—Elevation, Prussian blue (dot and stroke); section, no color.

Concrete—Sepia with black marks; or indigo, or Payne's grey with black marks and small light spots left.

Copper—Gamboge with lake; elevation,

crimson lake and burnt sienna; section, crimson lake and burnt sienna (dark).

Earth—Burnt umber or warm sepia, left jagged at edges; or sepia, light and dark.

Electric-bell Wires—Yellow.

Fields and Vacant Lands—White.

Fir and Deal (rough)—Elevation, burnt sienna or gamboge; section, burnt sienna (edged round and hatched).

Footpaths (Flagged)—Yellow ochre.

Glass—Green; Prussian blue; neutral tint.

Glass Roofs—Cross-hatching of Prussian blue.

Granite—Purple madder; pale India ink.

Greenheart—Elevation, indigo and gamboge; section, indigo and gamboge (dark).

Gun-metal—Elevation, Indian yellow; section, Indian yellow (dark).

Lead—Indigo; indigo with India ink.

Leather—Elevation, burnt umber (very pale), section, burnt umber (dark).

Mahogany—Elevation, light red and burnt sienna; section, light red and burnt sienna (dark.)

Meadows and Cultivated Grass—Prussian green; Hooker's green.

Oak—Elevation, burnt umber (pale); section, burnt umber (dark).

Pine and Spruce (wrought)—Elevation, burnt sienna (pale); section burnt sienna (dark rings).

Pipes (Cold-water)—Prussian blue. (Gas)—Indigo with lake. (Hot-water)—Crimson lake. (Rain-water)—Elevation, Prussian blue (outline); section, Prussian blue (outline). (Soil)—Elevation, burnt sienna; section, burnt sienna (outline).

Plaster—Payne's grey. Plaster and Cement—Elevation, India ink (pale); section, India ink (dark).

Railways—Neutral tint between the rails of each track.

Rope—Elevation, burnt sienna (dot and stroke); section, no color.

Rosewood—Burnt sienna with lake.

Sewers and Drains—Prussian blue.

Skies (in perspectives)—Cobalt blue.

Slate—Elevation, Payne's grey; section, Payne's grey (dark).

Steel—Elevation, violet carmine (very pale); section, violet carmine (dark); or indigo with a little lake.

Stone—Yellow ochre; gamboge with Indian red and burnt umber; sepia; Prussian blue.

Representing stone in section by Prussian blue is to be avoided, though in common use.

PLATE 18.

This plate shows two elevations and sections of windows, one designed for wooden buildings, and the other for brick buildings. The vertical sections of frames and sashes are shown in both cases, and the manner of constructing the sills is given. The segmental headed window shows finish around the frame suited for brick. Both frames show exterior finish, and that designed for wood shows the lines of siding on one side. These examples are drawn to a scale of ⅝ of an inch to the foot.

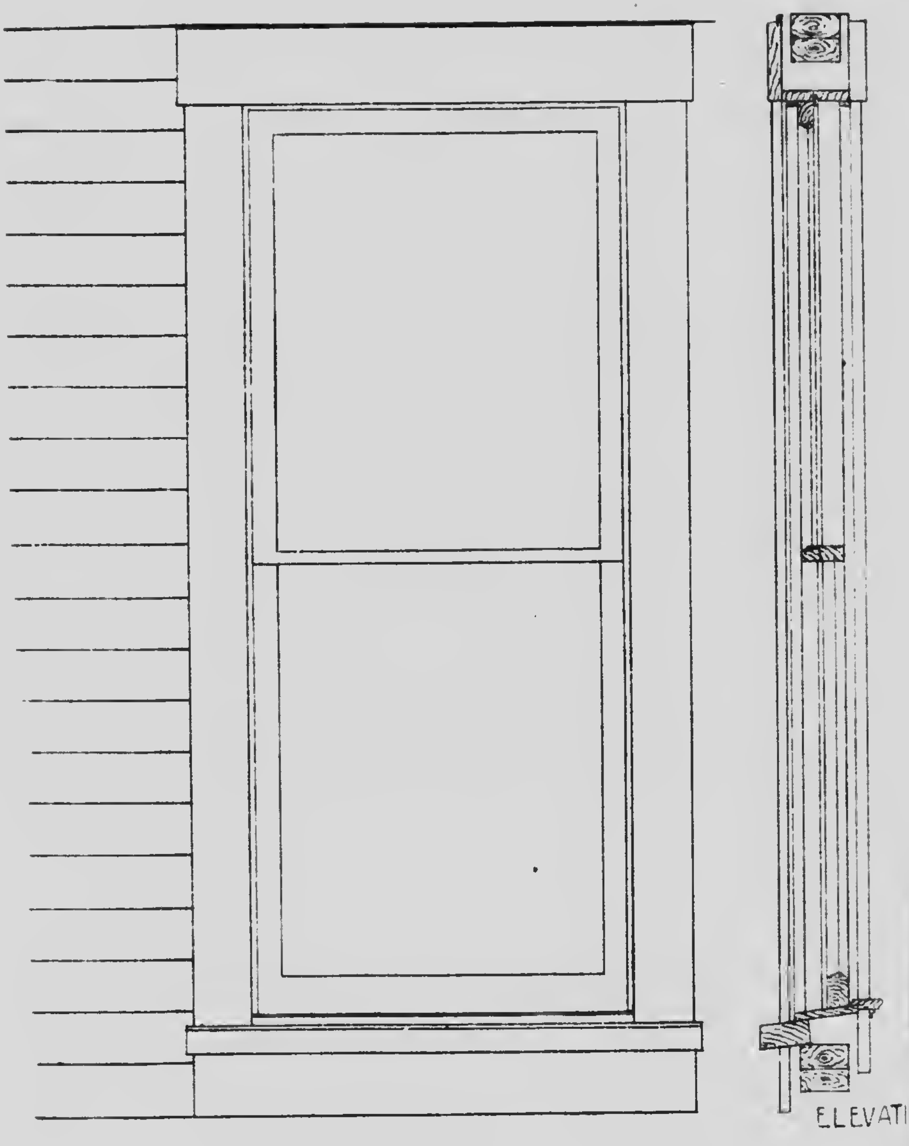
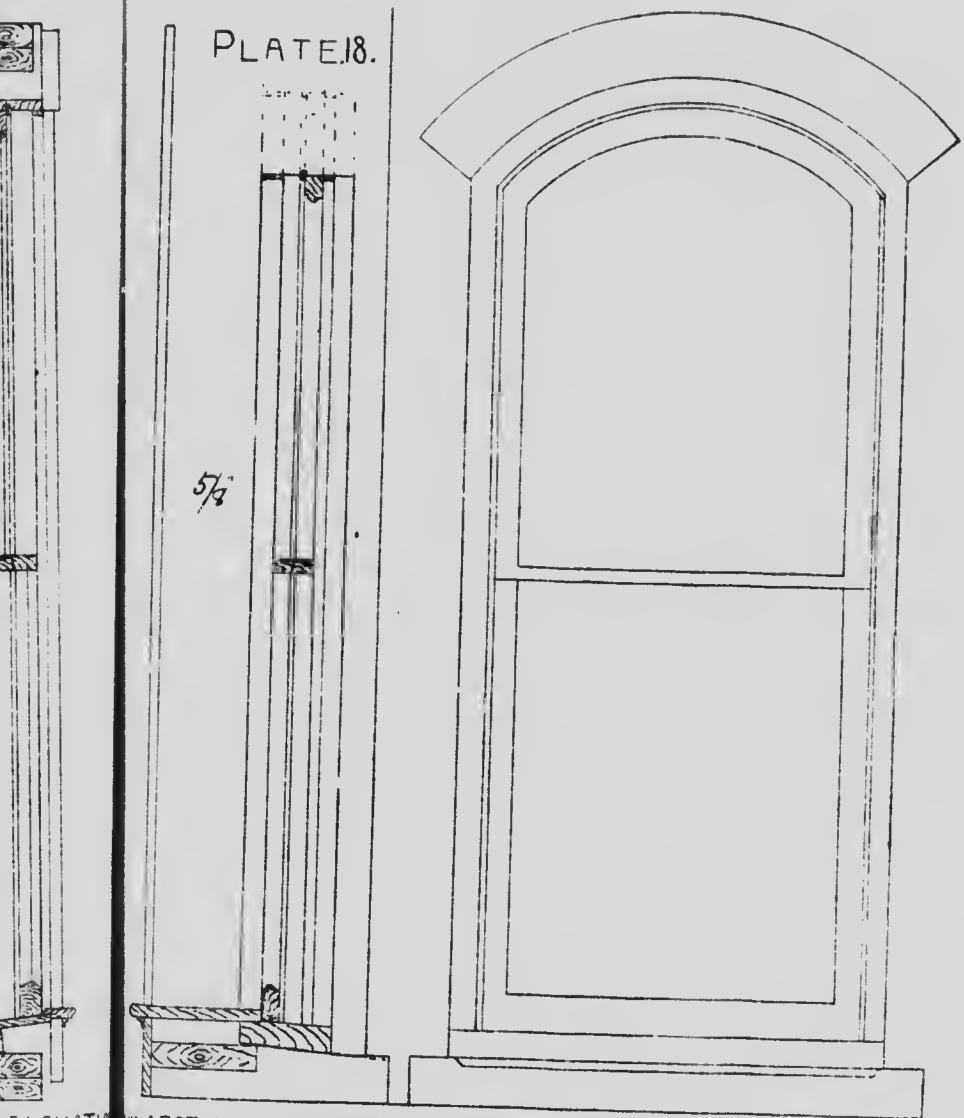

ELEVATI

PLATE 18.



ELEVATION AND SECTION OF WINDOWS FOR WOOD AND STONE BUILDINGS

Prussian blue should be retained entirely for wrought-iron work.

Stone Dressings—Elevation, French blue (very pale); section, French blue (dark).

Streets (Paved)—Neutral tint.

Timber (Existing) — Elevation, India ink (pale); section, India ink (etched).

Tubes (Speaking)—Green.

Water—Elevation, Prussian blue (washed); section, Prussian blue (lines). Water may have graduated blue edges.

Windows Inside—Elevation, French blue (pale); section, Hooker's green, No. 2 (dark).

Windows Outside—Elevation, Payne's grey (dark); section, Hooker's green, No. 2 (dark).

Wrought-iron (Bright)—Elevation, Prussian blue (very pale); section, Prussian blue (dark). (Rough)—Payne's grey.

York and Soft Stone—Elevation, sepia (very pale); section, sepia.

Zinc—Elevation, French blue (very pale); section, French blue (dark).

Often various materials are shown by the manner in which the sections of such materials are hatched or lined off as may be seen by the illustration shown at Fig. 251, where a large number of sections are given. By this method the material is recognized by the method of hatching, and no color is required, the whole being done in black and white.

It may be necessary sometimes for the draftsman to shade portions of his work, and, though this book does not pretend to deal with the

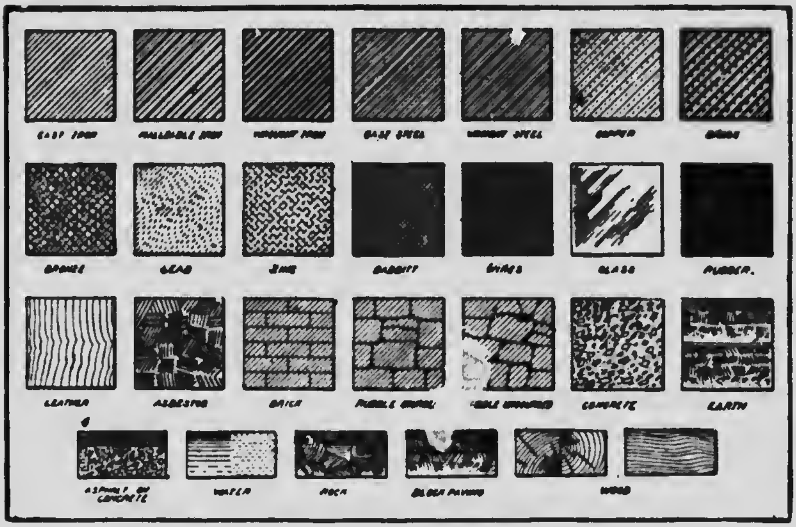


Fig 251.

higher class of drawing, it may not be out of place to say a few words on shading, and offer a few rough illustrations, showing how some objects may be shaded even by an inexperienced hand. The principles of shading are very simple, but do not seem to be generally understood, even by architects. All the exhibition drawings of an Architectural Association were spoilt one year by the roof shading being reversed, presumably in order to comply with some fancied natural requirement. The principles are as follows: (1) The more distant the object the less distinct the light and shade,

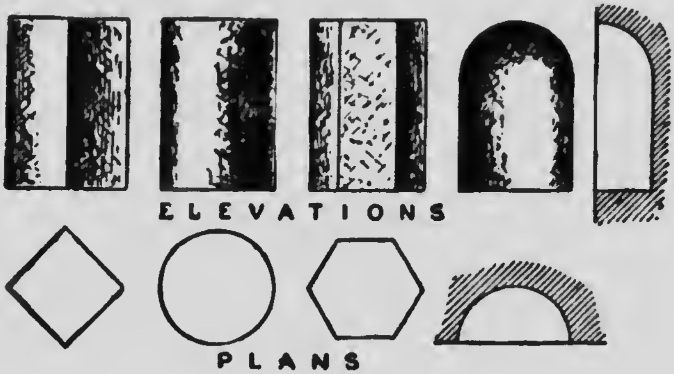


Fig. 252.

and vice versa; (2) for the sake of uniformity the light is usually supposed to come from the left, and on a drawing is generally taken as coming down the long side of a 45° set square, when one edge is placed diagonally on the paper and at right angles to it; (3) on inclined surface in the light the farthest part is the darkest and in the shade the nearest part is the darkest; (4) cylindrical surfaces follow the same rules, but on the right hand or lower sides the effect appears as though some reflected light were shown towards the edge. The accompanying illustrations, Fig. 252, show the application of these rules.

When ink lines to any considerable extent have to be erased, a small piece of damped soft sponge may be rubbed over them till they disappear. As, however, this process is apt to discolor the paper, the sponge must be passed through clean water, and applied again to take up the straggling ink. For small erasures of ink lines, a sharp erasing knife should be used; this is an instrument with a short triangular blade fastened to a wooden or ivory handle. A sharp rounded pen-blade applied lightly and rapidly does well, and the surface may be smoothed down by the thumb nail or a paper-knife handle. In ordinary working drawings a line may readily be taken out by damping it with a hair pencil and quickly applying the india rubber; and, to smooth the surface so roughened, a light application of the knife is expedient. In drawings intended to be highly finished, particular pains should be taken to avoid the necessity for corrections, as everything of this kind detracts from the appearance.

A little Prussian blue, mixed with the ink makes it flow freer and adds to the color. In inking in on ordinary tracing cloth, the student will find the ink will "creep" in such a manner that the lines will be broken. This can be prevented if a drop of ox-gall be mixed with the ink, but where ox-gall is not available, Prussian blue may be substituted, and this will, to some extent, work freer over the cloth.

As this book is not intended for making finished draftsmen, I have avoided in all cases—except in the orders of Architecture—offering any very elaborate or finished examples, as the student can find a number of works in the market that will lead him to a higher plane if he so determines, after he has well mastered what I have served up to him. Neither have I thought it desirable to describe the method of making blue prints, as this method, or methods, has been rendered over and over again in the technical journals, for years past. If, however, the student desires to learn how to make blue prints, I would advise him to purchase a copy of "Blue Print Making" by P. Reissmann, which can be had from the publishers of this book, price 25 cents. This is an excellent little work, and goes into the subject thoroughly.

It must be understood that this work is prepared purposely for the workman who has no time to attend night school, or money to spare to take a course in any one of the excellent correspondence schools; therefore, the illustrations have been left in a plain state, so that the student would not be frightened on the threshold of his work by fancy and elaborate drawings. I state this fact, partly to make it easy for the student, and partly to disarm critics, who can, if they are so disposed, find many defects in the illustrations.

FINIS

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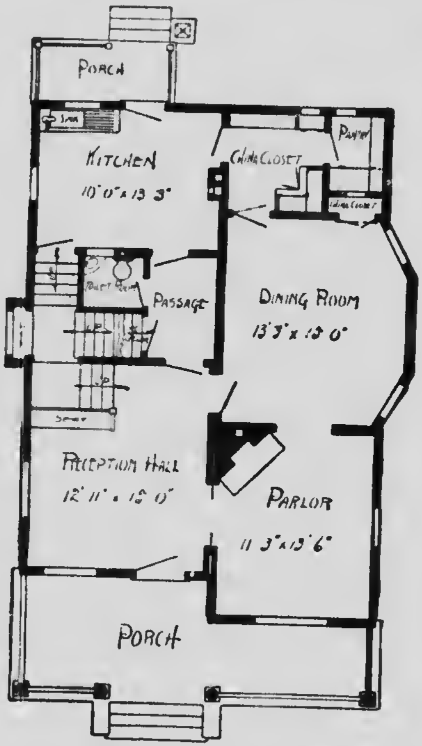
Cost of this house is from $2,200 to $2,500 according to the locality in which it is built.

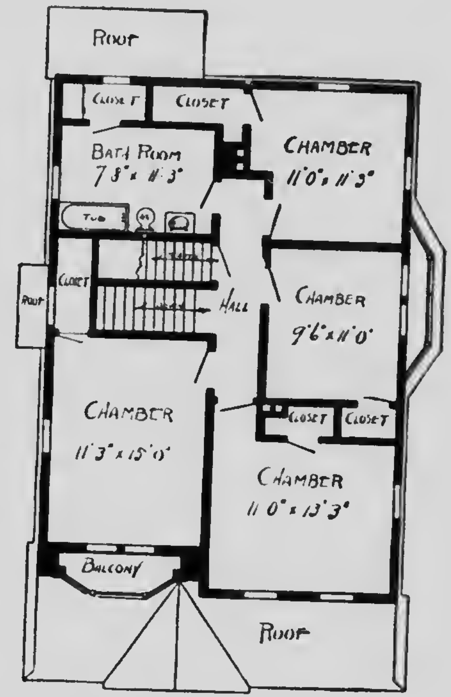
FLOOR PLANS OF DESIGN No. 1122



FIRST FLOOR PLAN

SIZE

Width, 28 feet.
Length, 37 feet,
exclusive of porches.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

No. 1025

PRICE
of Plans and
Specifications
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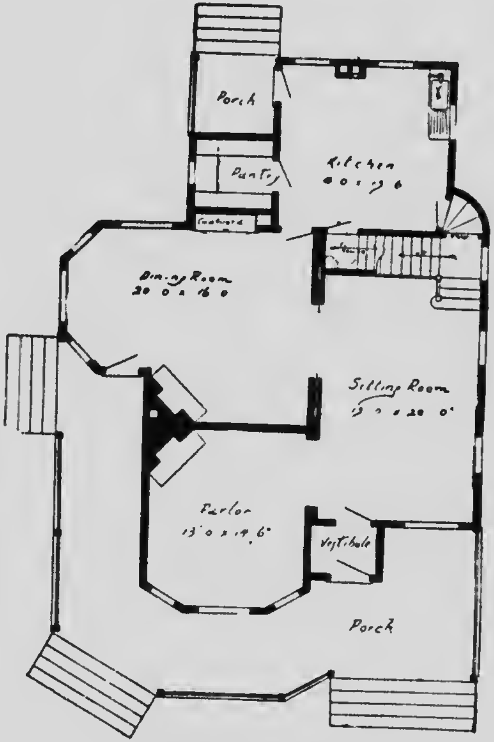
House Design No. 1025

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,950 to $2,200 according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1025



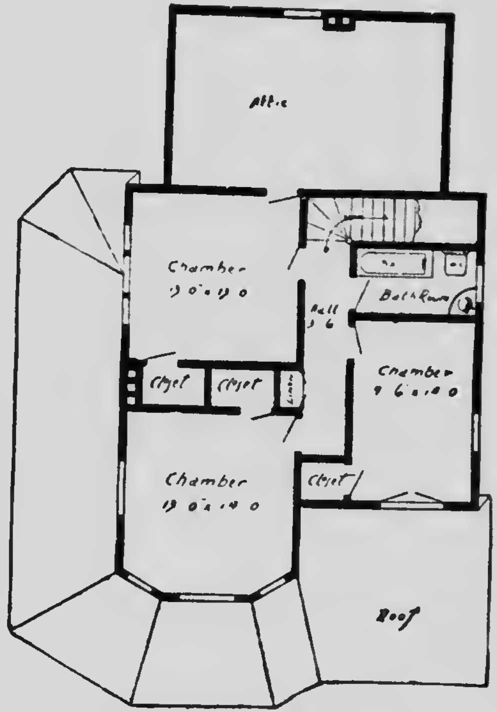
FIRST FLOOR PLAN

SIZE

Width, 35 feet.
Length, 46 feet,
exclusive of porches.

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.



SECOND FLOOR PLAN

No. 1049

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of Plans and
Specifications
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HOUSE DESIGN No. 1049

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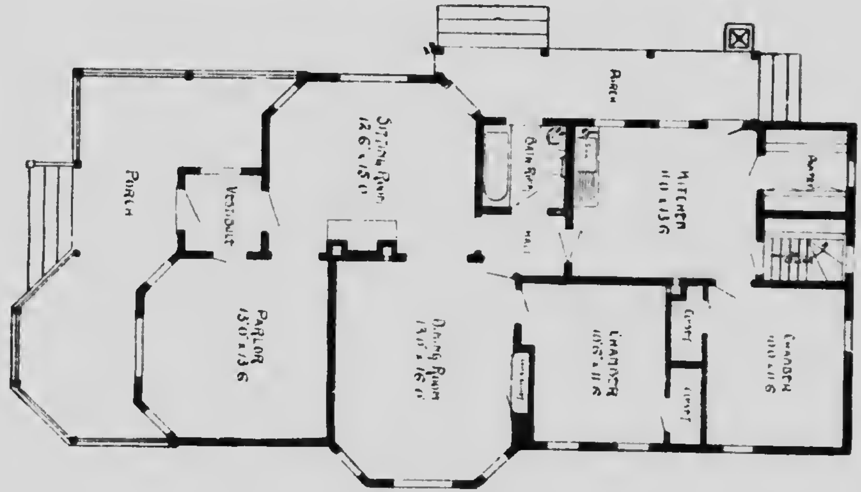
Cost of this house is from $1,500 to $1,650 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1049



FLOOR PLAN

SIZE

Width, 30 feet. Length, 52 feet, exclusive of porches.

Blue prints consist of cellar foundation plan; floor and roof plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

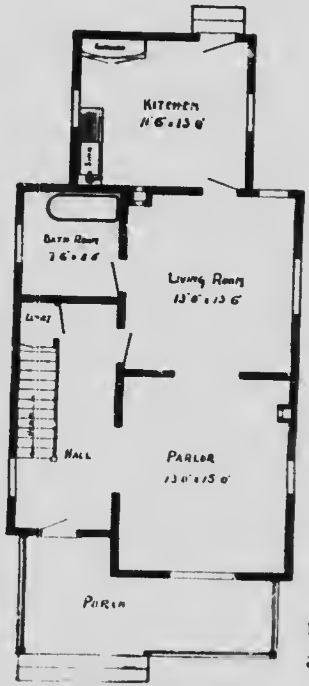
No. 1061

PRICE
of Plans and
Specifications
$5.00

House Design No. 1061

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $800 to $1,000 according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1061



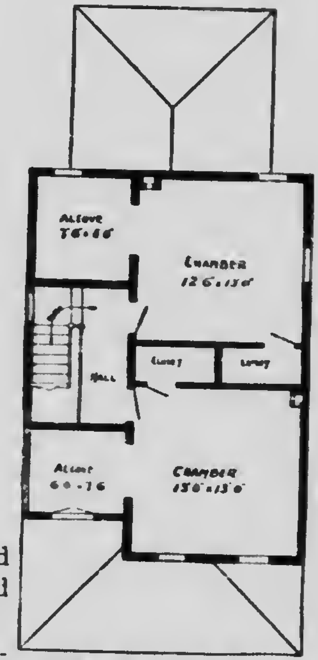
FIRST FLOOR PLAN

SIZE

Width, 22 feet.
Length, 42 feet,
exclusive of porch.

Blue prints consist of foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of type-written matter.



SECOND FLOOR PLAN

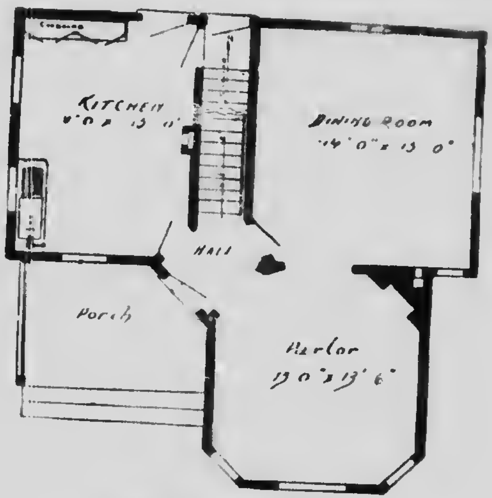
No. 1021

PRICE
of Plans and
Specifications
$5.00

House Design No. 1021

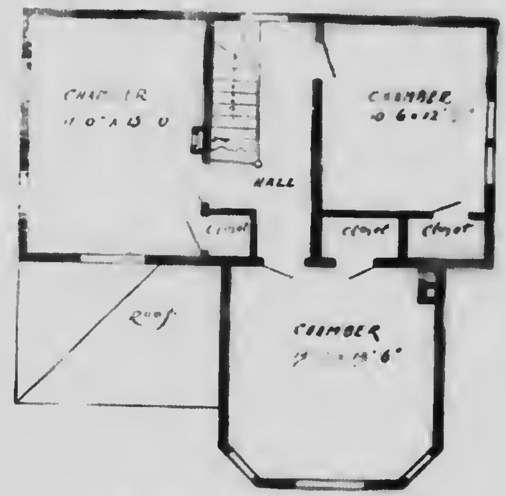
Full and complete working plans and specifications for this house will be furnished for $5.00.
Cost of this house is from $1,000 to $1,225, according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1021



FIRST FLOOR PLAN

SIZE
Length, 30 feet.
Width, 30 feet.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of twenty pages of typewritten matter.

No. 1070

PRICE
of Plans and
Specifications
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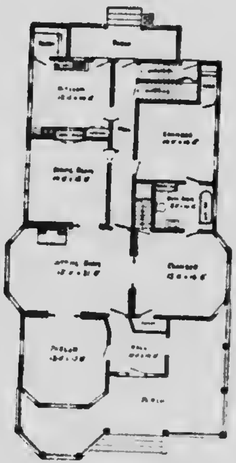
House Design No. 1070

Full and complete working plans and specifications of this house will be furnished for $6.00.
Cost of this house is from $1,850 to $2.000 according to the locality in which it is built.

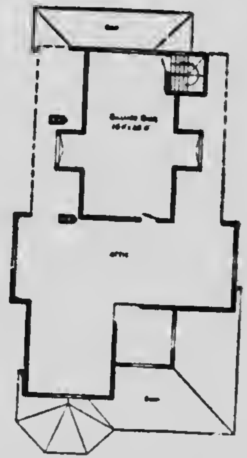
FLOOR PLANS OF DESIGN No. 1070



FIRST FLOOR PLAN

SIZE

Width, 40 feet.
Length, 62 feet 6 inches,
exclusive of porches.



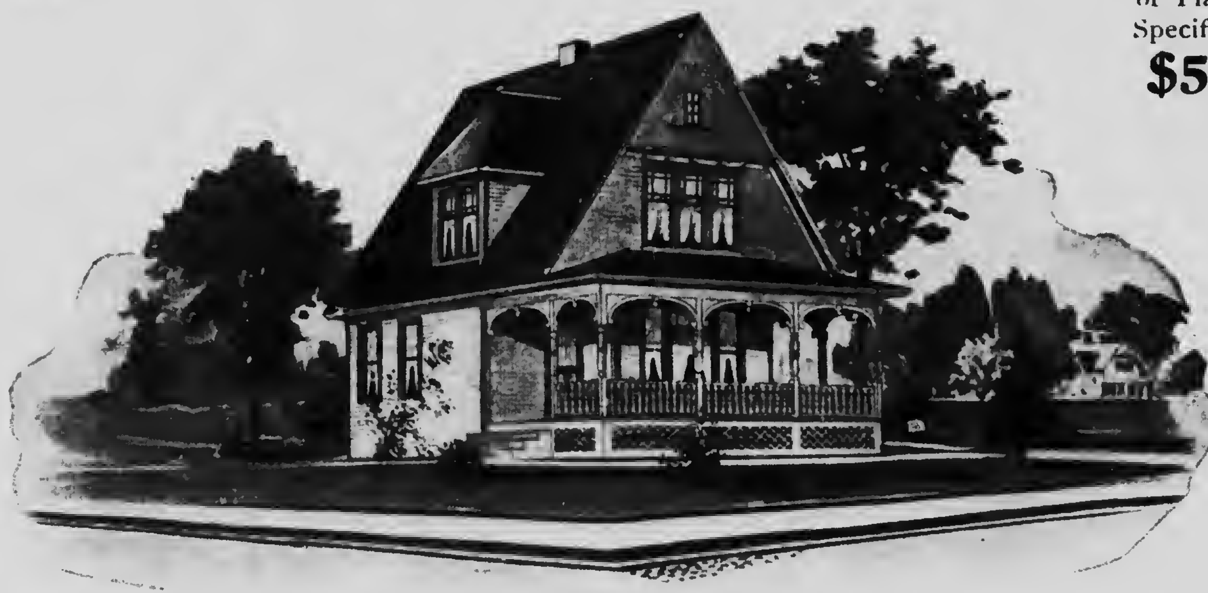
SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

No. 1002

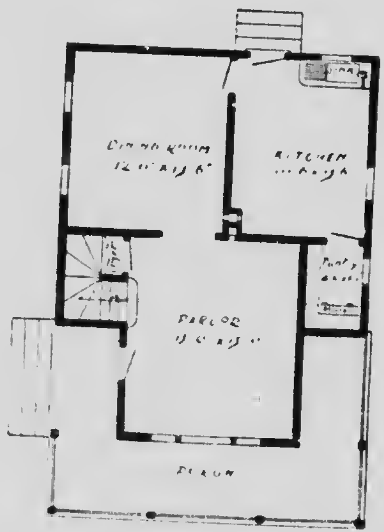
P R I C E
of Plans and
Specifications
$5.00



House Design No. 1002

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $800 to $950 according to the locality in which it is built.

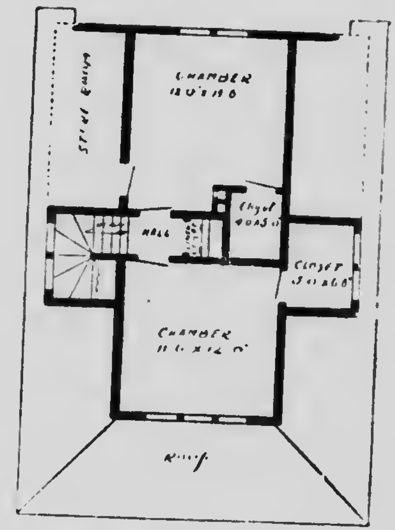
FLOOR PLANS OF DESIGN No. 1002



FIRST FLOOR PLAN

SIZE

Width, 24 feet.
Length, 30 feet,
exclusive of porch.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

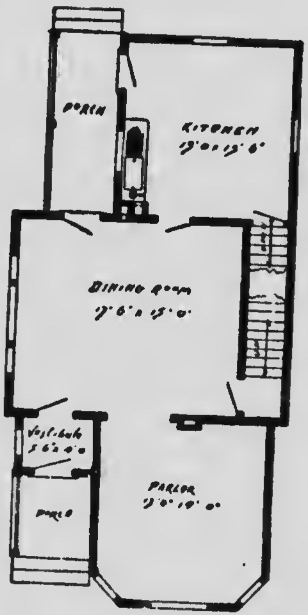
No. 1020

PRICE
of Plans and
Specifications
$5.00

House Design No. 1020

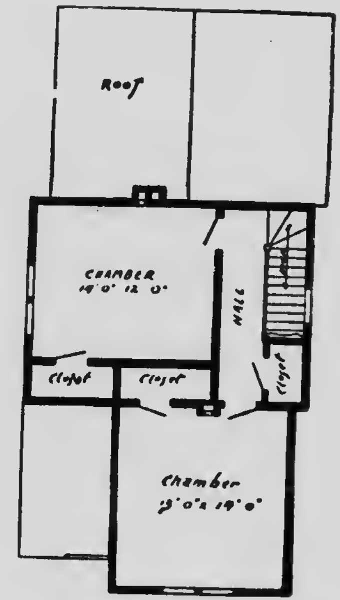
Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $900 to $1,050, according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1020



FIRST FLOOR PLAN

SIZE
Width, 22 feet.
Length, 44 feet.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.

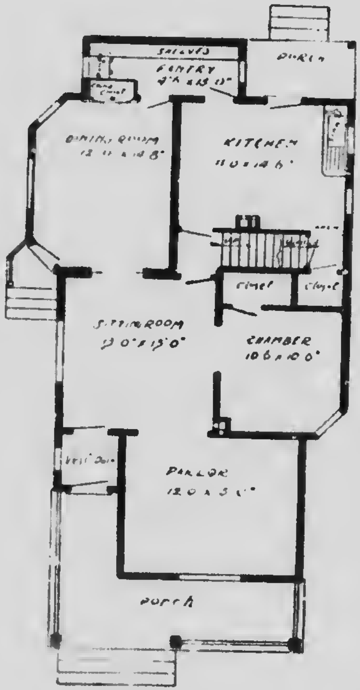
No. 1012

PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN No. 1012

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $1,750 to $1,900 according to the locality in which it is built

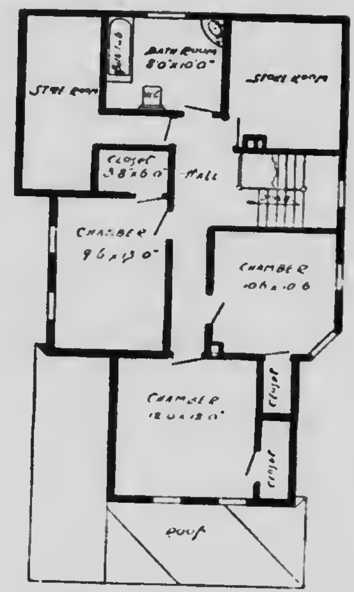
FLOOR PLANS OF DESIGN No. 1012



FIRST FLOOR PLAN

SIZE

Width, 28 feet.
Length, 42 feet,
exclusive of porches.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

No. 1058

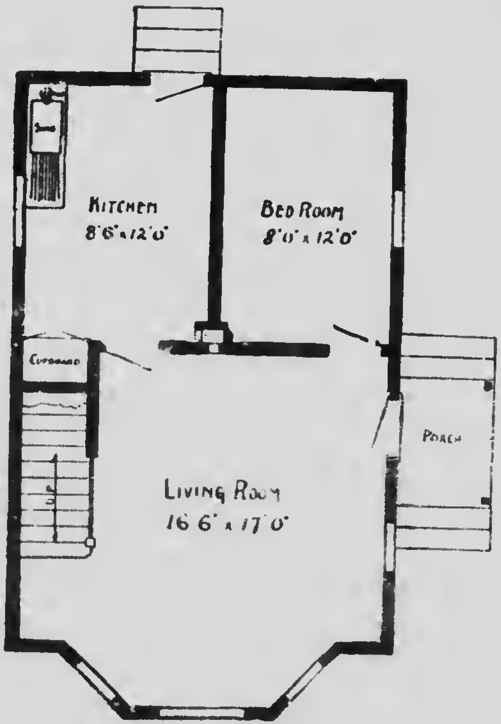
PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN NO. 1058

Full and complete working plans and specifications of this house will be furnished for $5.00. [illegible] of this house is from $600 to $800 according to the locality in which it is built.

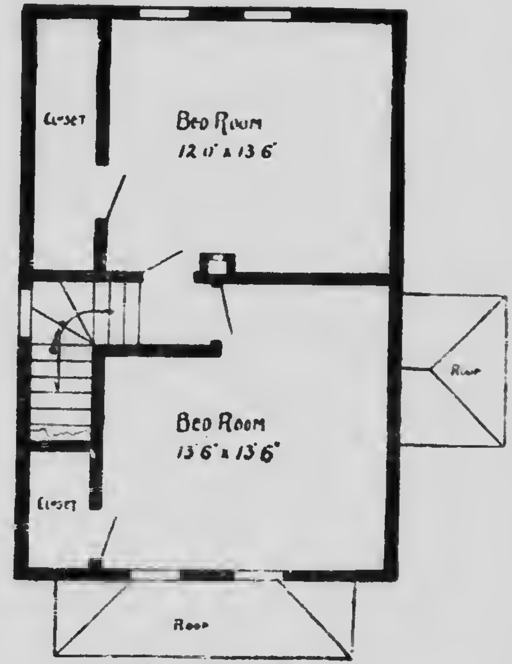
Full and complete working plans and specifications of this house will be furnished for $5.00.
... of this house is from $600 to $800 according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1058



FIRST FLOOR PLAN

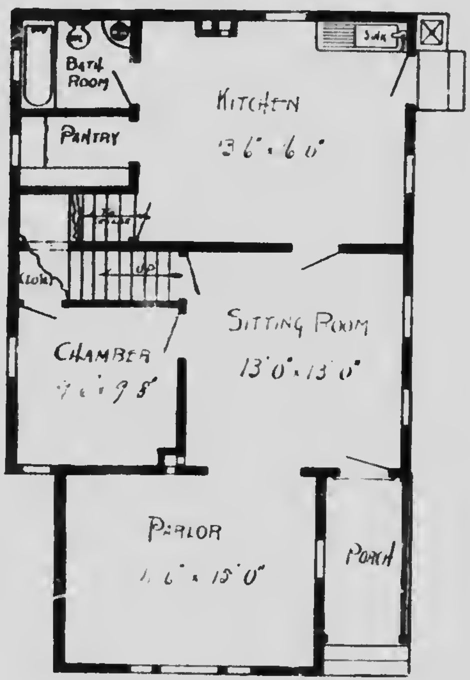
SIZE.
Width, 18 feet
Length, 30 feet,
exclusive of porch



SECOND FLOOR PLAN

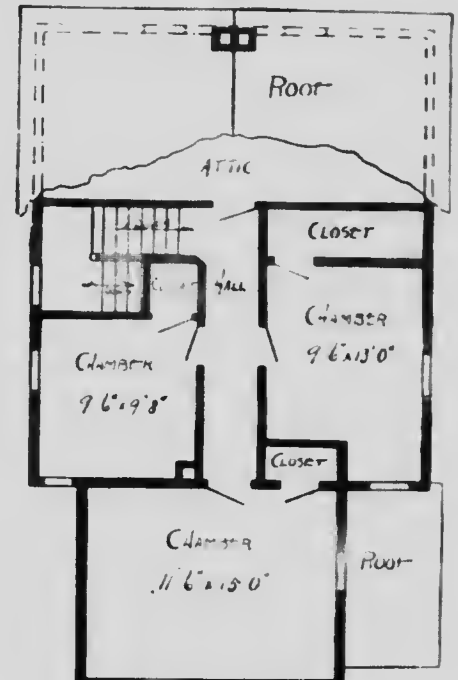
Blue prints consist of foundation plan; first and second floor plans, front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of fifteen pages of typewritten matter.

FLOOR PLANS OF DESIGN No. 1123



FIRST FLOOR PLAN

SIZE
Width, 24 feet.
Length, 39 feet 6 in.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

No. 1123

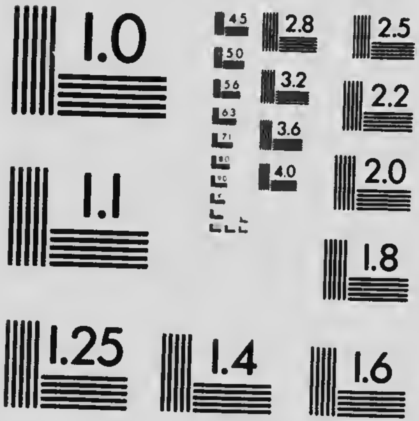
P R I C E
of Plans and
Specifications
$5.00

House Design No. 1123

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,250 to $1,400 according to the locality in which it is built.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



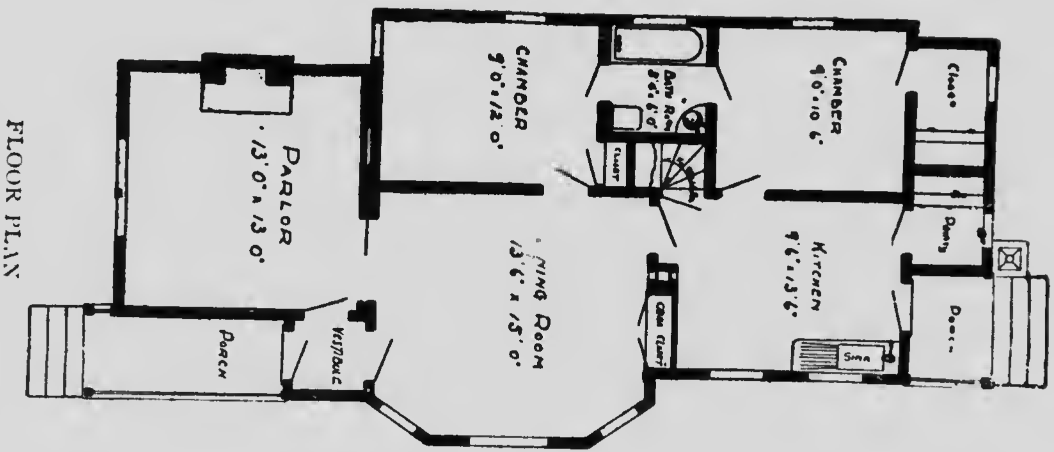
No. 1038

P R I C E
of Plans and
Specifications
$5.00

HOUSE DESIGN NO. 1038

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,100 to $1,350 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1038.



FLOOR PLAN

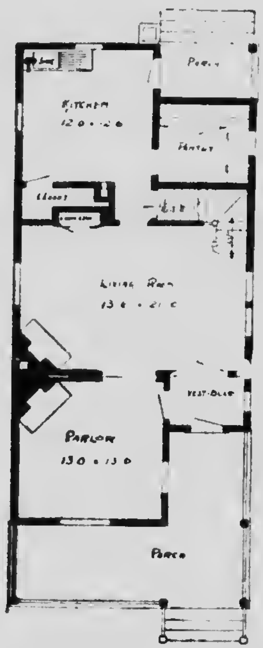
SIZE

Width, 24 feet. Length, 48 feet, exclusive of porches.

Blue prints consist of cellar and foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

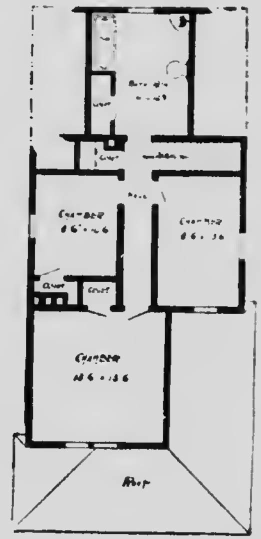
FLOOR PLANS OF DESIGN No. 1059.



FIRST FLOOR PLAN

SIZE

Width, 22 feet.
Length, 45 feet,
exclusive of porches.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.

No. 1059

PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN NO. 1059

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $1,250 to $1,400 according to the locality in which it is built.

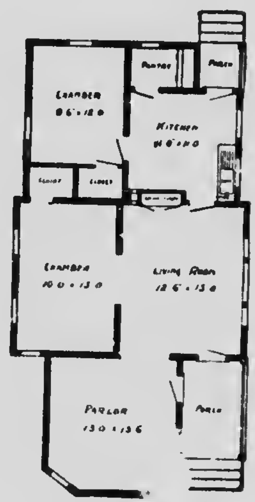
No. 1076

PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN NO. 1076

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $850 to $1,000 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1076



FLOOR PLAN

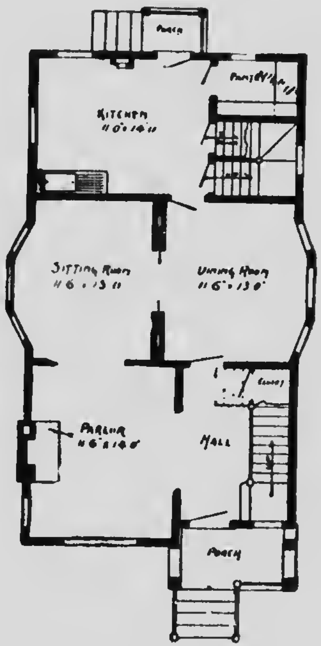
SIZE

Width, 24 feet.
Length, 46 feet.

Blue prints consist of foundation plan; floor plan, front, re[illegible] two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

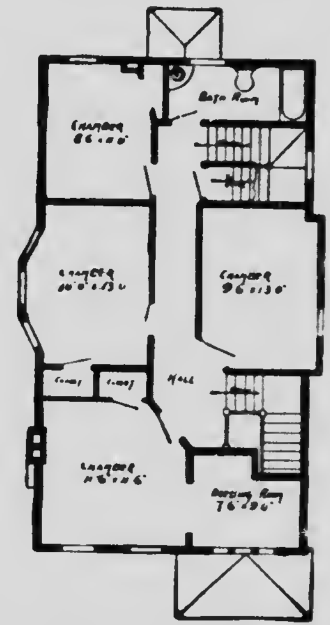
FLOOR PLANS OF DESIGN No. 1052



FIRST FLOOR PLAN

SIZE

Width, 25 feet.
Length, 40 feet,
exclusive of porches.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; roof and attic plan; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.

No. 1052

PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN No. 1052

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $2,000 to $2,200 according to the locality in which it is built.

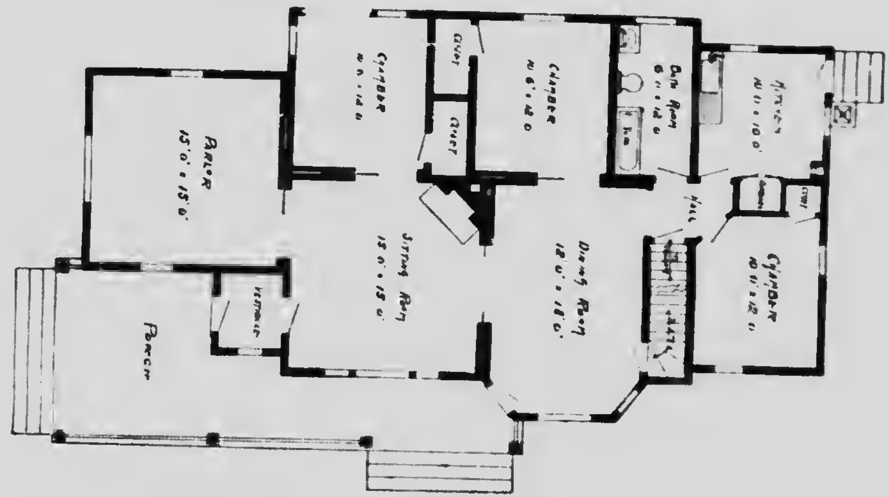
No. 1099

PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN No. 1099

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,650 to $1,800 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1C99



FLOOR PLAN

SIZE

Width, 32 feet. Length, 59 feet.

Blue prints consist of cellar and foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

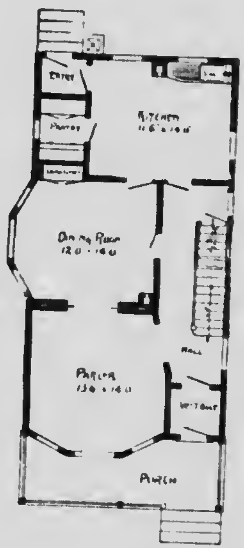
No. 1047

P R I C E
of Plans and
Specifications
$5.00

House Design No 1047

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,400 to $1,550 according to the locality in which it is built.

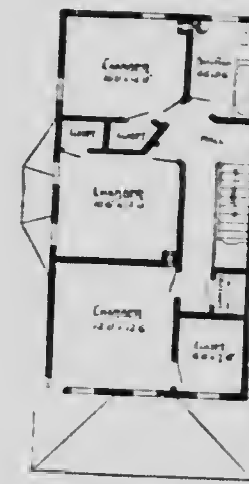
FLOOR PLANS OF DESIGN No. 1047



FIRST FLOOR PLAN

SIZE

Width, 22 feet.
Length, 40 feet,
exclusive of porch.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.

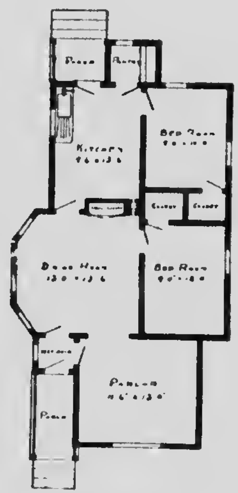
No. 1035

PRICE
of Plans and
Specifications
$5.00

House Design No. 1035

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $900 to $1,050 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1035



FLOOR PLAN

SIZE

Width, 24 feet.

Length, 40 feet.

Blue prints consist of foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

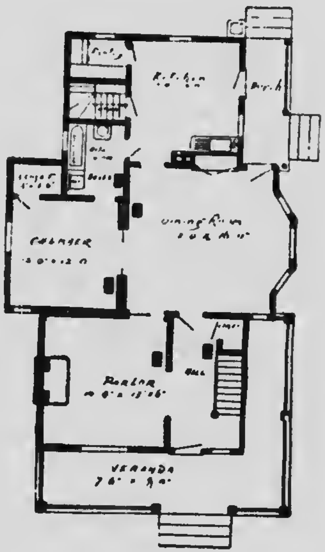
No. 1014

PRICE
of Plans and
Specifications
$5.00

House Design No. 1014

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $1,[illegible]00 to $1,800 according to the locality in which it is built.

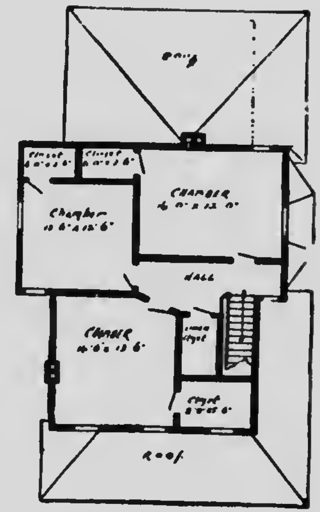
FLOOR PLANS OF DESIGN No. 1014



FIRST FLOOR PLAN

SIZE

Width, 32 feet.
Length, 46 feet,
exclusive of porches.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.

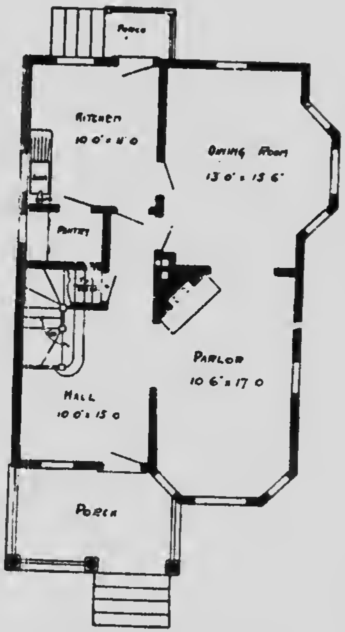
No. 1105

PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN No. 1105

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $1,550 to $1,700 according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1105



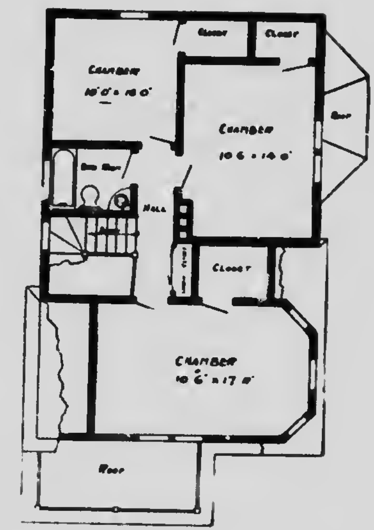
FIRST FLOOR PLAN

SIZE

Width, 25 feet.
Length, 34 feet, 6 inches,
exclusive of porches.

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specification consist of about twenty pages of typewritten matter.



SECOND FLOOR PLAN

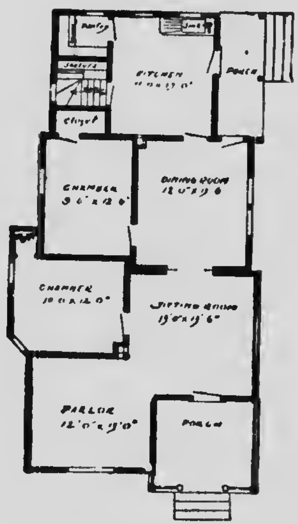
No. 1001

P R I C E
of Plans and
Specifications
$5.00

House Design No. 1001

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,250 to $1,500 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1001



FLOOR PLAN

SIZE

Width, 27 feet. Length, 50 feet, exclusive of porches.

Blue prints consist of cellar and foundation plan; floor plan; roof plan; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

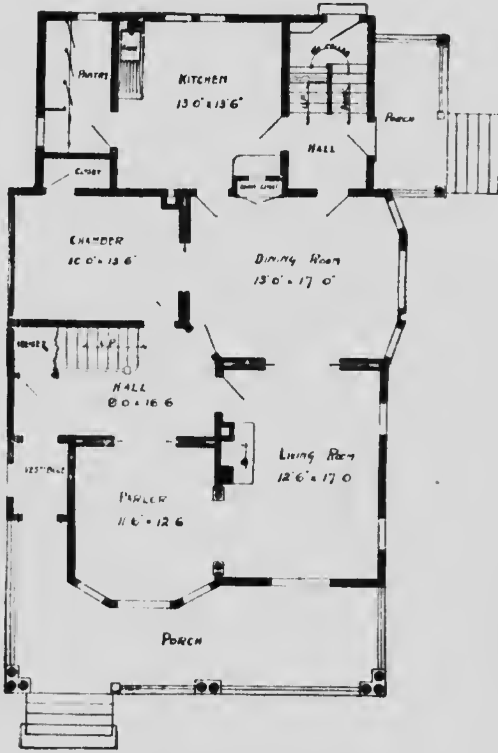
No. 1106

PRICE
of Plans and
Specifications
$8.00

HOUSE DESIGN NO. 1106

Fu" . nd complete working plans and specifications of this house will be furnished for $8.00.
Cost of this house is from $3,659 to $3,900 according to the locality in which it is built.

FLOOR PLANS OF DESIGN No 1106



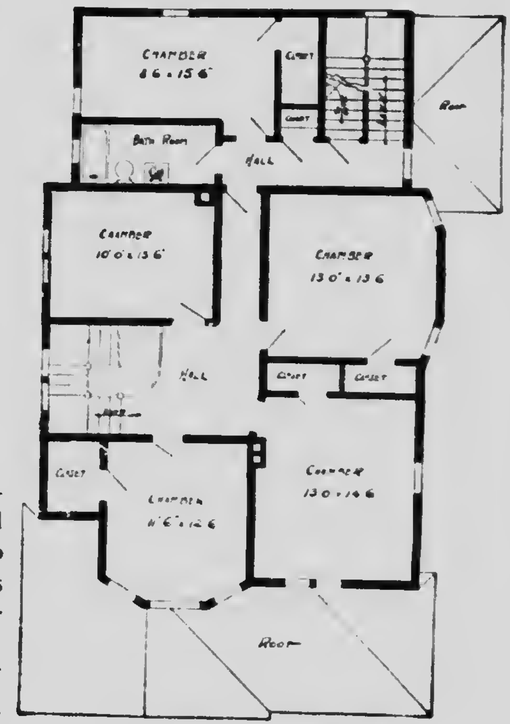
FIRST FLOOR PLAN

SIZE

Width, 32 feet.
Length, 48 feet,
exclusive of porches.

Blue prints consist of foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.



SECOND FLOOR PLAN

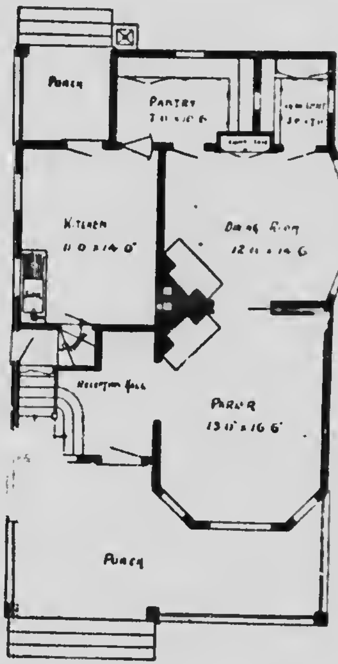
No. 1068

PRICE
of Plans and
Specifications
$5.00

House Design No. 1068

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,600 to $1,750 according to the locality in which it is built.

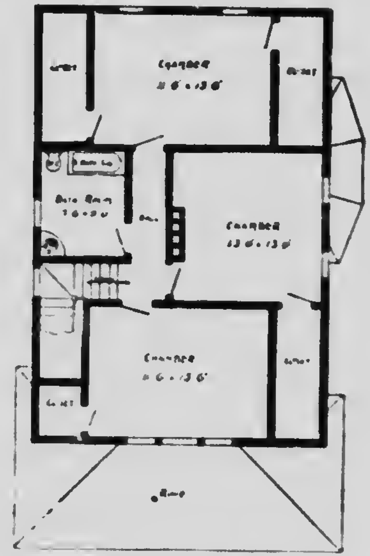
FLOOR PLANS OF DESIGN No. 1068



FIRST FLOOR PLAN

SIZE

Width, 27 feet.
Length, 38 feet,
exclusive of porches.



SECOND FLOOR PLAN

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

No. 1016

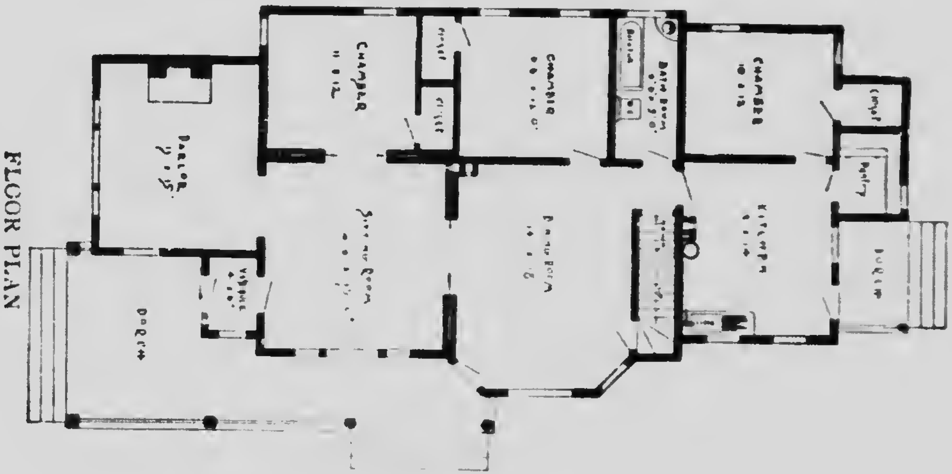
PRICE
of Plans and
Specifications
$5.00

HOUSE DESIGN, No. 1016

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,500 to $1,800 according to the locality in which it is built.

Full and complete working plans and specifications of this house will be furnished for $5.00.
Cost of this house is from $1,500 to $1,800 according to the locality in which it is built.

FLOOR PLAN OF DESIGN No. 1016.



FLOOR PLAN

SIZE

Width, 31 feet. Length, 60 feet, exclusive of porches.

Blue prints consist of cellar and foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about fifteen pages of typewritten matter.

No. 1018

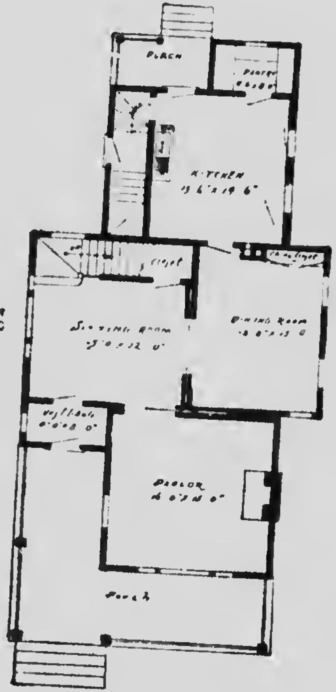
PRICE
of Plans and
Specifications
$5.00

House Design No. 1018

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from $1,700 to $1,900 according to the locality in which it is built.

Cost of this house is from $1,700 to $1,900 according to the locality in which it is built.

FLOOR PLANS OF DESIGN No. 1018



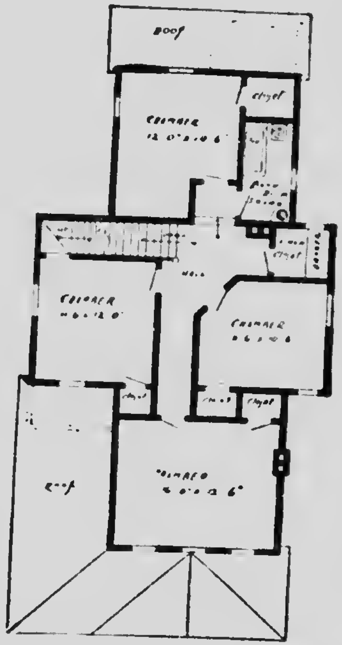
FIRST FLOOR PLAN

SIZE

Width, 30 feet.
Length, 48 feet,
exclusive of porches.

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details.

Specifications consist of about twenty pages of typewritten matter.



SECOND FLOOR PLAN

Remember

We can mail out the same day we receive the order any complete set of working plans and specifications we illustrate in this book.

Remember also

That, if you are going to build, complete working plans and specifications always

Save Money

for both the owner and contractor.

They prevent mistakes and disputes.

They save time and money.

They tell you what you will get and what you are to do.

Estimated Cost

It is impossible for any one to estimate the cost of a building and have the figures hold good in all sections of the country.

We do not claim to be able to do it.

The estimated cost of the houses we illustrate is based on the most favorable conditions in all respects and does not include Plumbing and Heating.

Possibly these houses cannot be built by you at the prices we name because we have used minimum material and labor prices as our basis.

The home builder should consult the Lumber Dealer, the Hardware Dealer, and the Reliable Contractors of his town. Their knowledge of conditions in your particular locality makes them, and them only, capable of making you a correct estimate of the cost.