PRACTICAL

SHEET METAL WORK

AND

DEMONSTRATED PATTERNS

A COMPREHENSIVE TREATISE IN SEVERAL VOLUMES ON

SHOP AND OUTSIDE PRACTICE AND PATTERN DRAFTING

VOLUME V

CORNICE PATTERNS

COMPILED FROM THE

METAL WORKER

PLUMBER AND STEAM FITTER

EDITED BY

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PREFACE

THROUGHOUT its existence the METAL WORKER, PLUMBER AND STEAM FITTER has had the services of experts in the lines the paper represents. This has been notably so in the Sheet Metal and Pattern Drafting departments. The experience of these experts has been and is utilized to answer queries of readers who, having a problem they cannot solve, resort to the columns of that journal. In addition, many readers have contributed ideas, methods of procedure and little time saving kinks of decided interest to the trade. Naturally then, a large collection of every-day problems has resulted. With the assurance, by numerous inquiries, that in book form these solutions would be invaluable, they are compiled in a series known as PRACTICAL SHEET METAL WORK AND DEMONSTRATED PATTERNS.

It has been proved that the average person prefers a direct demonstration of his problem, and "THE NEW METAL WORKER PATTERN BOOK," which has long been considered the standard authority on pattern drafting, not only elucidates the principles, but presents such a large collection of problems that it would seem all problems were covered. In reality this is true, for though the exact problem may not appear, there surely is one, the principles of which could be adapted to the problem at hand, with a little adjusting.

Rather than add other problems to that book and make it so voluminous as to be unwieldly, all valuable problems in the category of cornice work, which have appeared in METAL WORKER are compiled in this work This division of the series, BOOK FIVE, therefore, should be of immeasurable value to the cornice cutter when used in conjunction with the pattern book mentioned.

No attempt has been made to group these problems in classes, in respect to the method of developing the patterns, as in the pattern book referred to. Due care, however, has been exercised to select only such problems as actually occur in practice, and, as far as possible, not covered by the pattern book.

Inasmuch as in a compilation, the work of many authors is selected, some under a pseudonym, no authorship can be given. Sincere appreciation is expressed by the publishers for the contributions for this book (FIVE). Two authors, however, are known, namely, George W. Kittredge and William Neubecker, to whom especial thanks are due.

J. Henry Teschmacher, Jr.

CONTENTS

Practical Sheet Metal Work and Demonstrated Patterns

KINDS OF PROJECTIONS

As the principles of pattern cutting are based on geometry and projection and as there are several kinds of projections, and as these are mentioned but not explained, the explanations are here given.

No explanation is given in "The New Metal Worker Pattern Book" of perspective, cavalier or isometric projections, as they are not used in pattern cutting, though a knowledge of them often will be of help. It has been said that the difference between orthographic and perspective projections is that the former shows an object as it *is*, while the latter presents it as it *looks*. In the orthographic pro-

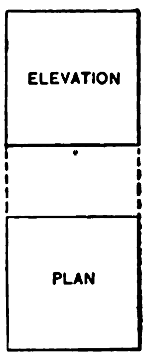


Fig. 1. Orthographic Projection of a Cube

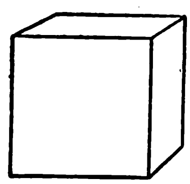


Fig. 2. Perspective View of a Cube

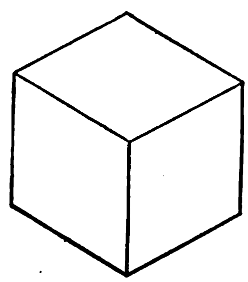


Fig. 3. Isometric Projection of a Cube

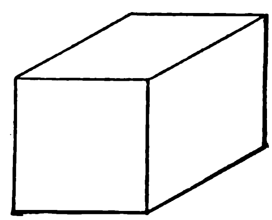


Fig. 4. Cavalier Projection of a Cube

jection the eye is placed at an infinite distance from the object, and the points on the object are projected on a horizontal and also on a vertical plane, the horizontal projection being commonly called the plan, and the vertical the elevation. Fig. 1 is an orthographic drawing of a cube.

In perspective the eye is brought within visible distance of the object, and the object is reproduced as it appears to the eye from that viewpoint. The best example of perspective is a photograph. Fig. 2 shows the cube put into perspective.

The word isometric means equal measures. In an isometric projection three directions, or axes, are first drawn from a common center or origin, as it is called. One of these is drawn vertically, and the other two are separated from it 120 degrees, one to the right and the other to the left. All vertical lines are drawn vertically, horizontal lines parallel to the picture plane are drawn parallel to one of the other axes, while lines perpendicular to the picture plane are drawn parallel to the remaining axis. All lines that are in reality vertical, horizontal and parallel to the picture plane, or perpendicular to it, are measured or scaled their full length. There is no foreshortening, as in perspective. Positions of other lines can be found by locating points on the lines by means of triangles. Circles are generally projected as ellipses. Isometric drawings have an advantage over orthographic in that they present a picture resembling a perspective view from which measurements may be directly made from the principal lines, thus being very useful as working drawings. Fig. 3 shows the isometric projection of a cube. On this it will be noticed that each of the lines is of the same length.

Cavalier projections are not extensively used. They answer much the same purpose as the isometric. Fig. 4 illustrates the cube in cavalier projection. From this it will be seen that lines parallel to the picture plane are represented in their true length. Lines perpendicular to the picture plane are represented in their true length, and are all shown at the same angle in the same drawing, although a different angle may be used in every drawing. The theory of this is that these lines vanish at a point infinitely distant from the object, and the direction of this point may be located at the will of the draftsman, provided he keeps it back of the picture plane.

In a cavalier projection circles parallel to the picture plane are projected as circles.

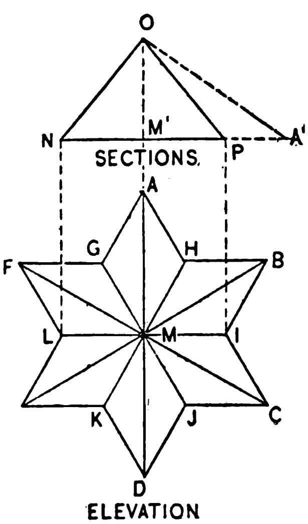


Fig. 5. Elevation and Sections

PATTERN FOR A SIX POINTED STAR

In Fig. 5 is shown the elevation and sections of the star, in which A B C D E F G is the elevation and N O P the true section on the line L I in the elevation. A true section will also be necessary on the line M A in elevation. Take the distance M A and place it as shown from M^1 to A^1, and draw a line from A^1 to O, which is the true length on M

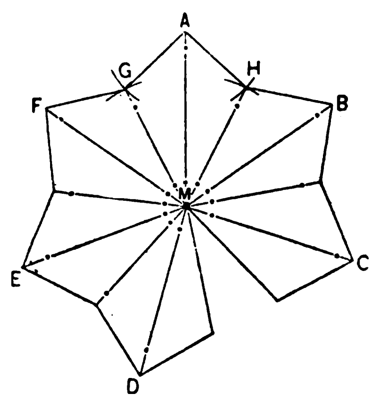


Fig. 6. The Pattern Shape

A in elevation. For the pattern proceed as follows: Draw any line on Fig. 6, as A M, equal to A^1 O in Fig. 5. Now with radii equal to A G or A H and with A in Fig. 6 as a center describe the arcs G and H. Then with O P in Fig. 5 as radius and M in Fig. 6 as center intersect the arcs G and H at G and H. Draw lines from M to G to A to H to M, which will be the pattern for one point of the star. If the pattern is desired in one piece join six of these points, as shown by D E F A B C, and bend on the lines shown to fit the outline in elevation.

PATTERN FOR BRACKET FACE

To obtain the pattern for the face of the bracket shown in Fig. 7, in which A B C D shows the front of the bracket and E F G the side, the portion for which the pattern is required being indicated by H I J K L in front and M N O P in side view. In Fig. 8 H I J K L is an enlarged reproduction of similar letters in Fig. 7 and is called the plan in Fig. 8, and M N O P is the side-elevation, being an enlarged reproduction of similar letters in Fig. 7. The problem is a tapering

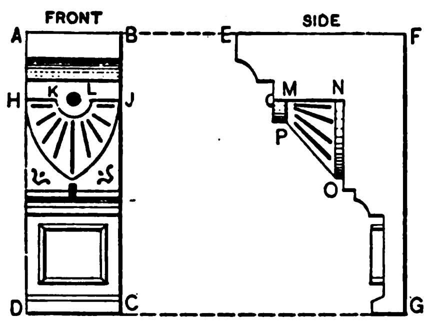


Fig. 7. Front and Side View of Bracket

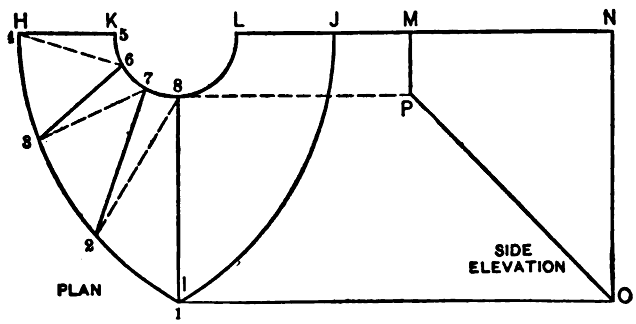


Fig. 8. Obtaining Measurements for Triangles

article the base being indicated by the half plan H I J in Fig. 8 and top by the semicircle K L, the side view or hight being indicated by M N O P.

The problem will be solved by triangulation and the first step will be to obtain a diagram of triangles, as shown in Fig. 9, for which proceed as follows: Divide one-half of the plan H I in Fig. 8, as shown by the small figures 1 to 4. In similar manner divide one-half of the semicircle K L into the same number of spaces, as shown from 5 to 8. Now connect solid lines from 1 to 8, 2 to 7, 3 to 6 and 4 to 5, and dotted lines from 2 to 8, 3 to 7 and 4 to 6. Then will these solid and dotted lines represent the bases of the triangles, while M N in side elevation will represent the altitude or hight.

In Fig. 9 draw any horizontal line, as C D, equal in length to M N in Fig. 8. At right angles to C D in Fig. 9 and through D draw the line D 1 and D 8 indefinitely, as shown. Now take the various lengths of the solid lines 8 1, 7 2, 6 3 and 5 4 in plan in Fig. 8 and place them on the line D 1 in Fig. 9, measuring in each instance from D, thus obtaining the points 1, 2, 3 and 4. From these points draw lines to the apex C. Then will these solid lines represent the actual distances on similar lines in plan in Fig. 8 when measured on the finished article. Proceed in similar manner for the triangles on dotted lines; take the various distances of the lines 2 8, 3 7 and 4 6 and place them on the line D 8 in Fig. 9, measuring in every instance from the point D; then draw lines from 6, 7 and 8 to the apex C. Then will these dotted lines represent actual lengths on dotted lines of similar numbers in plan in Fig. 8.

For the pattern shape proceed as is shown in Fig. 10. Draw any vertical line, as 1 8, equal in length to P O in Fig. 8 or C 1 in Fig. 9. With 1 2 in plan, Fig. 8, as radius and 1 in Fig. 10 as center describe the arc 2. Then with C 8 in Fig. 9 as radius and 8 in Fig. 10 as center describe an arc intersecting the arc as shown.

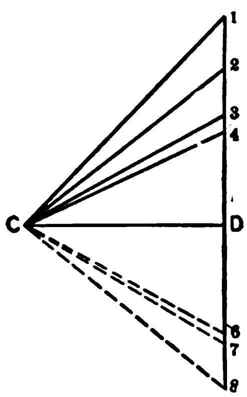


Fig. 9. Triangles for Pattern

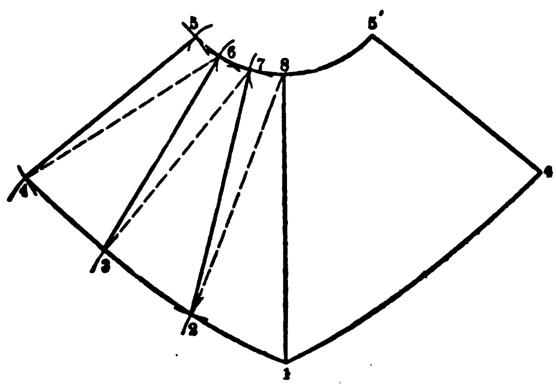


Fig. 10. The Pattern Shape

With 8 7 in plan as radius and 8 in Fig. 10 as center describe the arc 7, and with C 2, Fig. 9, as radius and 2 in Fig. 10 as center describe an arc intersecting arc 7. Proceed in this manner, using alternately as radii the divisions on the plan H I in Fig. 8, the length of the dotted lines in Fig. 9, the divisions in the semicircle in plan K L in Fig. 8 and the length of the solid lines in Fig. 9, until the line 4 5 in pattern has been obtained. Trace a line through intersections thus obtained and then will 1 4 5 8 be the pattern. Trace the other half opposite the line 1 8, as shown by 4′ 5′. Then will 1 4 5 8 5′ 4′ 1 be the desired pattern.

Referring to the front and side views in Fig. 7, it will be noticed that incised work is cut into the pattern. This is accomplished by drawing the opening on the pattern, in Fig. 10, and cutting out the incisions, then stripping to the required depth and soldering the portion cut out to the back of the sink strip.

OBLIQUE INTERSECTION OF HORIZONTAL MOLDING WITH ROOF

In the accompanying diagram, Fig. 11, A B C D represents the elevation of molding, the profile of which is shown at S, and A E the pitch of the roof against

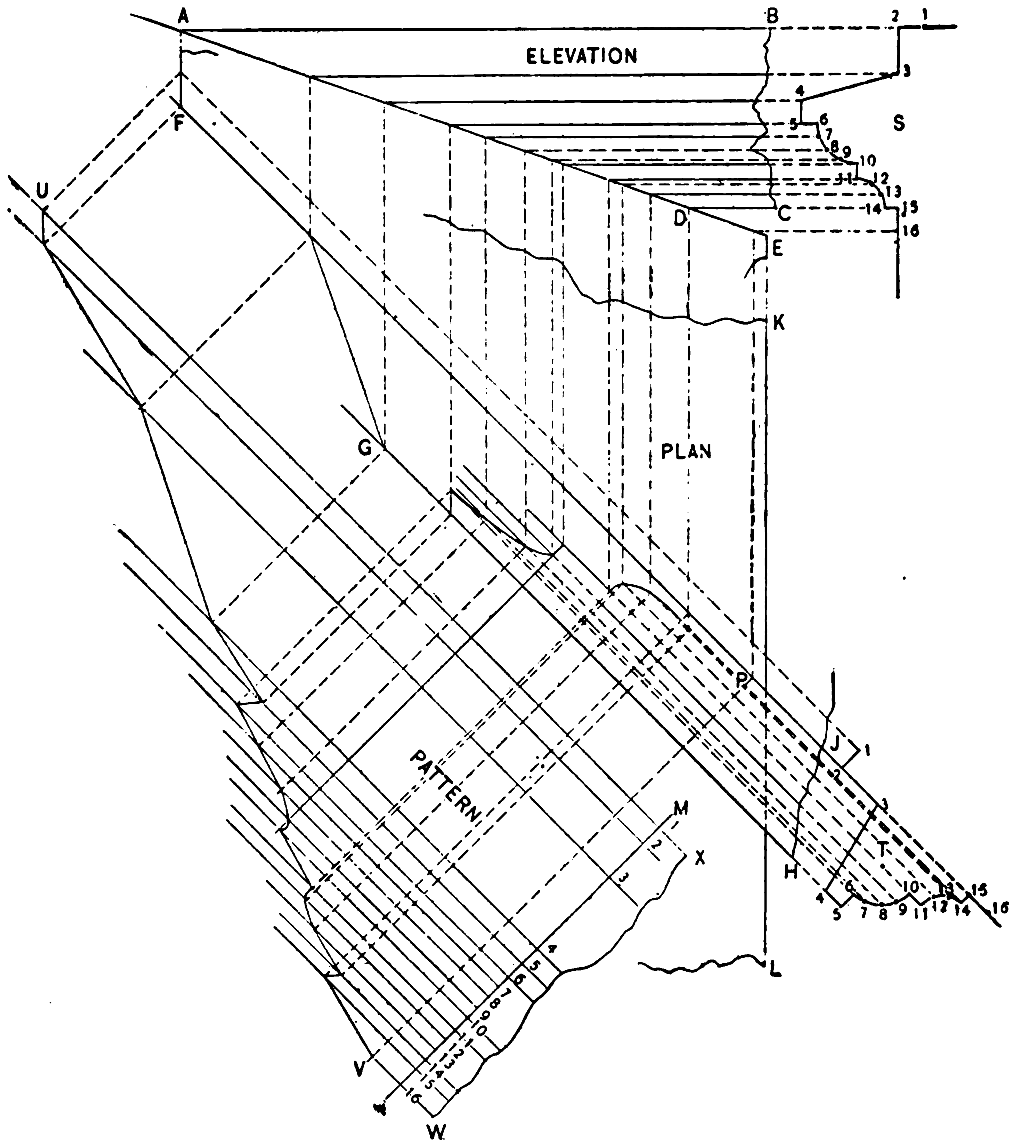


Fig. 11. Elevation, Plan and Pattern

which the molding is required to miter; while F G H J, the plan of the molding, shows that it is placed at an angle of 45 degrees with K L, representing the eaves of the roof or any horizontal line drawn upon the roof surface.

Before the pattern can be developed a plan of the intersection of the mold with the roof surface must be obtained. Therefore, first draw a duplicate of the profile S in the plan, as shown at T, placing its vertical lines at the required angle with K L and its face toward the front of the plan corresponding with the elevation, and divide the curved portions of both profiles into the same number of equal parts respectively, as shown by the small figures. From the several points and angles in profile T carry lines at the required angle with K L indefinitely, as shown, and from the points in profile S carry lines horizontally, intersecting the roof line, as shown between A and D. Finally, from the several points of intersection just obtained drop lines vertically into the plan, cutting lines of corresponding number. Lines connecting the adjacent points of intersection, as shown from F to P, will give the required plan of the intersection or miter.

To obtain the pattern a stretchout of the profile may now be set off on any line, as M N, drawn at right angles to the lines of the molding in plan, as shown by the small figures on M N. From the points so obtained on M N draw the usual measuring lines parallel to F J indefinitely, and from the several points in the plan of the miter F G P project lines at right angles to F J, cutting measuring lines of corresponding number, as shown between U and V. A line traced through the several points of intersection will give the required miter. The complete pattern is shown by U V W X, which may be extended beyond W X to suit convenience.

PATTERN FOR A HEAD TO FILL THE END OF A CORNICE CUT OFF OBLIQUELY

In the accompanying illustration, Fig. 12, is shown a problem presented for solution together with the method of laying out the required end piece. In the sketch the profile of the cornice is drawn in the manner shown at B, which position would be correct were the view an elevation instead of a plan. As the profile shown is that usually employed in a crown mold, it is clear that it should occupy the position shown at A, since the points 1 and 2, being its points of extreme projection, should be on the line F G, which is the line of extreme projection from the wall in plan. Attention is called to this because a correct drawing is the first essential to a correct result. Failure or inability to develop the pattern results in many instances from the fact that a drawing has not been first made in which the required conditions are correctly shown.

There is also some doubt implied in the sketch as to whether the angle in the wall at which the cornice ends is an interior or an exterior angle. It would seem rather to show an interior angle, but since if it were an interior angle the end of the cornice would come against the wall on the other side of the angle, and would therefore scarcely require a full end or "head," therefore, it is assumed, and a drawing made showing a cornice at the end of a wall terminating with an exterior angle. In either case the method employed is the same. Care must be taken, however, to see that the profile is correctly placed — that is, with the points 0 and 14 at the wall line, and the points 1 and 2 at the line of extreme projection. Therefore, if C F G were the wall line instead of C D E, as shown, and D E were the line of extreme projection, instead of F G, the profile should be turned over so that the points 0 and 1 would change position with each other.

Considering, then, that C D E is a plan of the wall, and that F G is the line of extreme projection of the cornice, first extend the line C D, as shown, by D F,

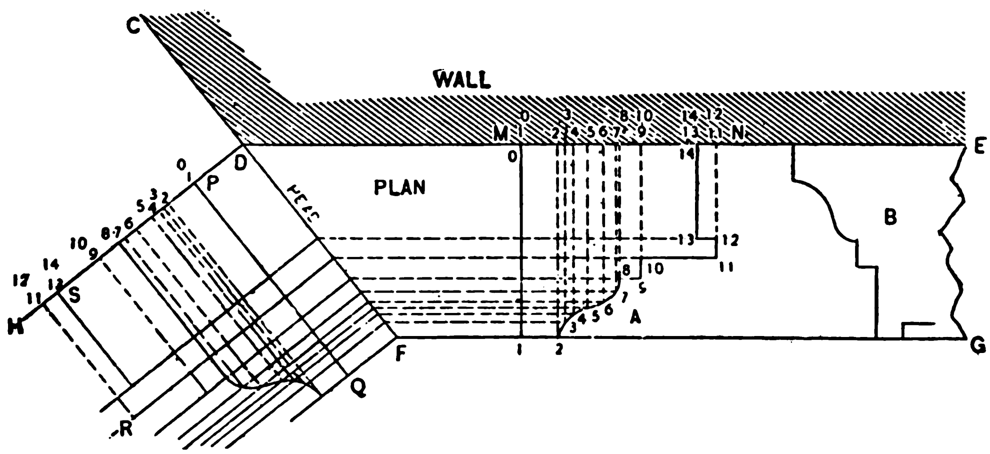


Fig. 12. Plan, Profile and Required Head.

this line showing the position in plan of the end or "head" required to fill the opening produced by the oblique termination of the cornice. Divide the curved portions of the profile into any convenient number of spaces and number all points and angles of the profile, as shown by the small figures on profile A. From each of the points project lines parallel to D E, cutting the line D F, as shown, and from the several points of intersection on D F carry lines at right angles to the same indefinitely, as shown at the left. From the several points in profile A also carry lines at right angles to D E, cutting the same as shown by the small figures between M and N; corresponding with those of the profile. Now transfer the points in M N to the line D H, seeing that each point maintains the same relative distance from all of the other points, as on M N; and from each of the points on D H project lines at right angles to the same cutting lines of corresponding number previously drawn from D F. A line traced through the points of intersection, as shown by O P R S, will be the shape of the required end piece.

The miter of the cornice moldings to fit against the end piece is an ordinary butt miter, of which D E is the miter line, and the same set of points may be used with convenience in cutting both pieces.

LAYING OUT PATTERNS DIRECT ON THE METAL

When it is desired to carry the miter patterns direct on to the metal from the drawings, the short rule employed in shops is as follows: Let E, Fig. 13, the given profile, be divided into equal spaces, as shown by the small figures from 1 to 8.

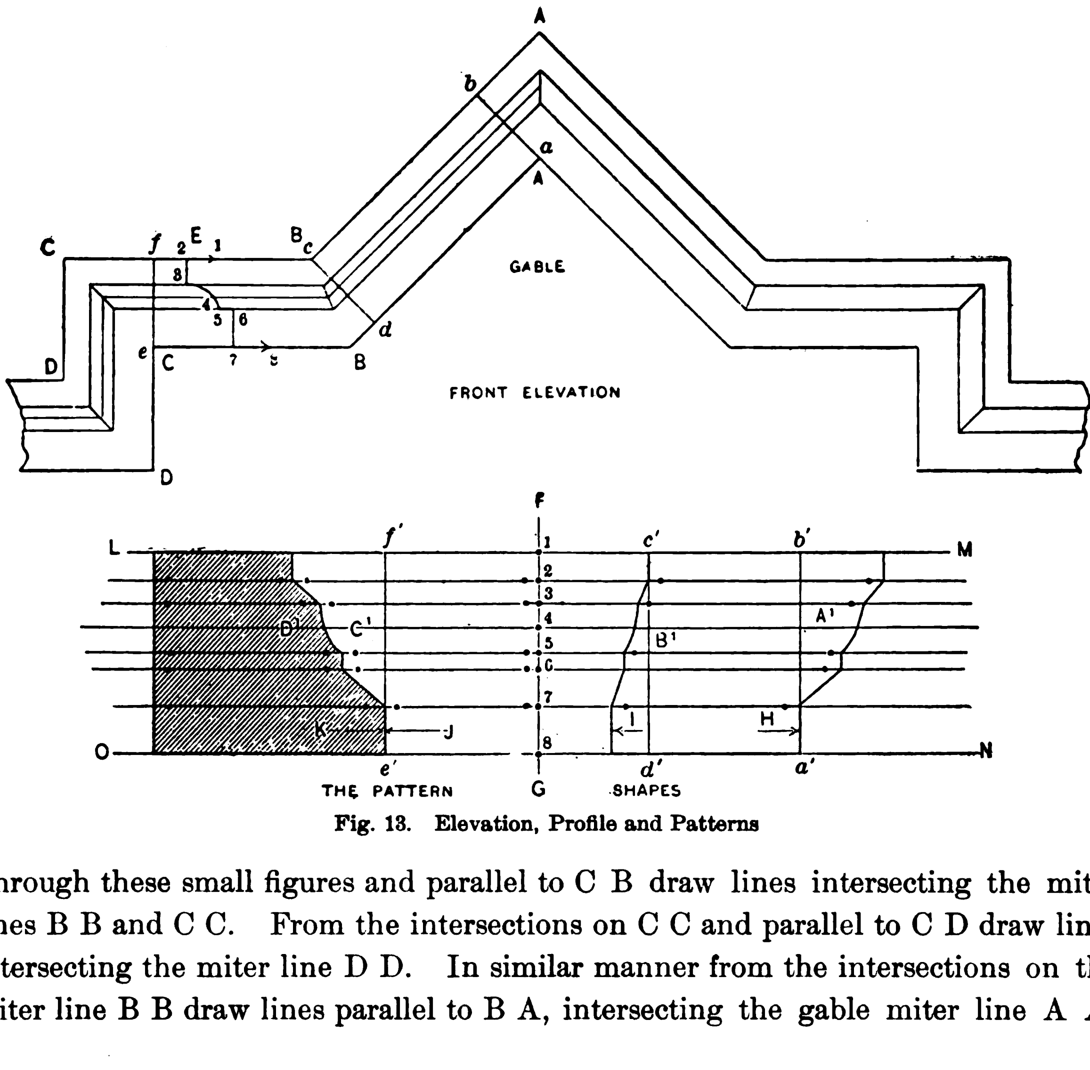


Fig. 13. Elevation, Profile and Patterns

Through these small figures and parallel to C B draw lines intersecting the miter lines B B and C C. From the intersections on C C and parallel to C D draw lines intersecting the miter line D D. In similar manner from the intersections on the miter line B B draw lines parallel to B A, intersecting the gable miter line A A.

Now, at right angles to A B and from point *a* draw the line *a b*, and from the point *c* draw the line *c d*. In the same manner at right angles to B C and from point *e* draw the line *e f*.

Let L M N O represent a sheet of metal of the required width, upon which erect the vertical line F G, upon which place the stretchout of the mold E, as shown by the small figures 1 to 8 on F G. Through these figures draw lines parallel to L M or N O on the sheet of metal. At right angles to N O draw the line *a′ b′*. Now, measuring with the dividers in every instance, from the line *a b* in elevation take the lengths of the various lines intersecting the miter line A A and place them in the pattern, measuring in each instance from the line *a′ b′* on lines having similar numbers; trace a line through points thus obtained, resulting in the miter cut A^1, which will be the miter pattern on the line A A in elevation. In similar manner at right angles to N O erect the vertical line *c′ d′*. Now take the various lengths from the line *c d* to the miter line B B in elevation and place them on lines having similar numbers in the pattern, measuring from the lines *c′ d′*. Trace a line through points thus obtained, resulting in the pattern B^1, which will be the miter pattern on the miter line B B in elevation. Finally at right angles to N O erect the line *e′ f′*, from which place the various distances on the various numbered lines obtained by measuring from the line *e f* in elevation to the miter line C C on similar numbered lines. Trace a line through points thus obtained in the pattern; then will C^1 be the miter pattern on the miter line C C in elevation, while the reverse cut, or the shaded part D^1 in pattern, is the miter pattern on the miter line D D in elevation. This completes the entire set of patterns for A, B, C and D. In practice these miter patterns are cut out of metal seperately about 8 inches long. Thus the pattern A^1 and B^1 would be on one piece of metal, while C^1 and D^1 would be separate.

When laying out the length of the gable molding A B measure from H to I in the patterns, first marking on the metal the miter cut A^1, then moving the pattern to the desired length from H to I, equal to A B in elevation, and marking the pattern B^1. When getting out the horizontal molding B C in elevation measure from J to I in the patterns, first marking the miter pattern C^1 on the sheet, then reverse the pattern B^1, making the distance from J to I equal to B C in elevation, then marking the pattern B^1. For the vertical molding C D measure from J to K the length of C D; in other words, first mark the miter pattern C^1 on the metal, then reverse D^1, making the distance from J to K equal to C D. For the lower horizontal molding use the pattern D^1, measuring from the point K.

PATTERNS FOR REDUCED MITER

This article treats on the method of how to get the patterns for a return miter for a bay window, or the best way to make a finish at the point B in plan in accompanying illustration, Fig. 14. The distance from B to C on the finished wall is 8½

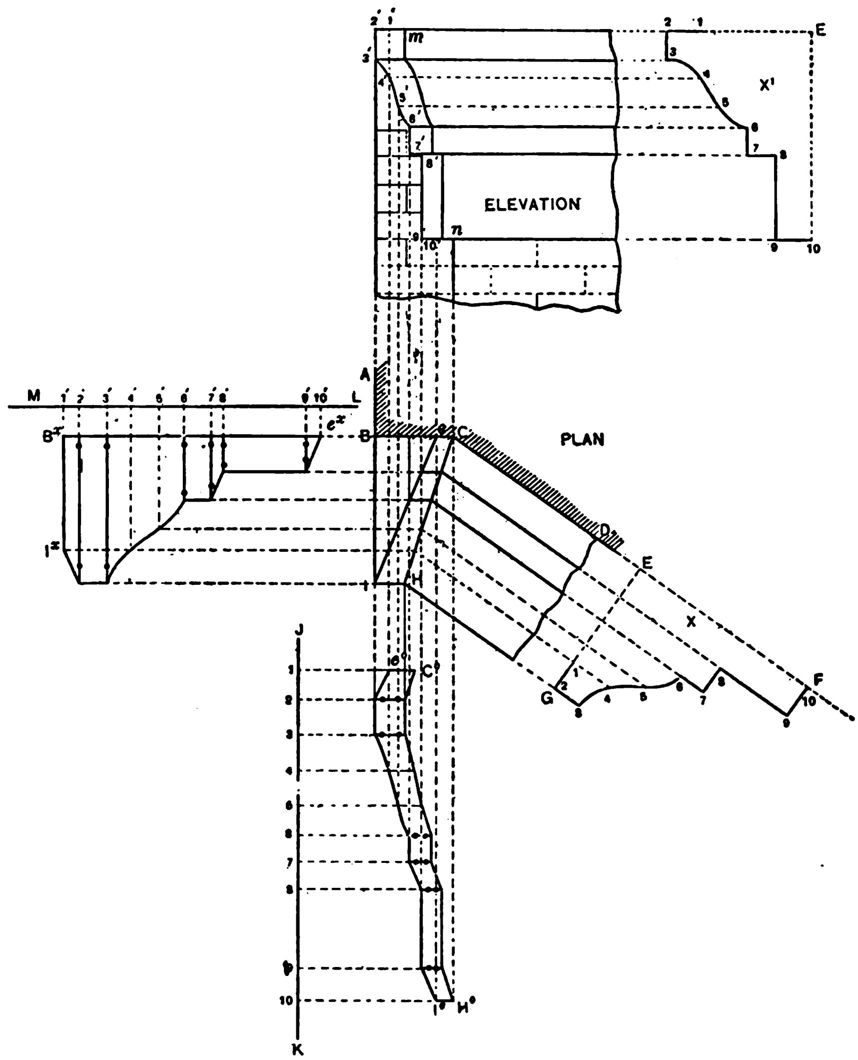


Fig. 14. Elevation, Plan, Profile and Pattern

inches, while the projection of the molding from G to E is 18 inches, and would naturally bring the return miter 9½ inches outside of the wall line A B.

In a case of this kind a reduced miter is used, which is obtained as follows: Let A B C D represent the part plan of the bay window. In its proper position draw the profile of the mold, no matter what its shape may be, as shown by E F G, which divide into equal spaces, shown by 1 to 10. Bisect the angle B C D in plan. Where the bisecting line meets the line drawn from 2 in the profile X parallel to C D, call the point H. From H draw a line parallel to C B, meeting the wall line A B, extended at I. If desired, the projection of the reduced return miter could be made equal to B C, but this would not make a neat appearance. Therefore, make the distance C *e* in plan equal to 2 inches, and draw a line from *e* to I. Then will *e* B I be the plan view of the reduced return miter.

From the numbers in X draw lines parallel to C D, cutting the miter line C H, as shown, from which points parallel to B C draw lines intersecting I *e*, as shown. Take a tracing of the profile X and place it in the position shown by X^1. From the various numbers in X^1 draw horizontal lines, which intersect by lines drawn from similar intersections on *e* I in plan, at right angles to B C, resulting in the intersections 1′ to 10′ in elevation. Through these trace a line as shown. Then will 1′ 10′ in elevation represent the true profile of the reduced return on B *e* in plan and *m n* in elevation the miter line on C H in plan. To obtain this miter line *m n* project from the various intersections on C H in plan vertical lines cutting similar horizontal lines in elevation, the lines being omitted in the illustration to avoid a confusion of lines.

For the pattern for *e* C H I in plan draw any line, as J K, at right angles to I H, upon which place the stretchout of X, as shown by similar numbers. Through these small figures draw lines at right angles to J K, which intersect by lines drawn from similar numbered intersections on the miter lines *e* I and H C at right angles to I H, thus obtaining the intersections e° to I° and H° to C° respectively. Trace a line through points thus obtained, then will e° C° H° I° be the pattern for that part shown by similar letters in plan. The reverse of the cut C° H° will also answer for C H on the piece H C D in plan. For the pattern for the reduced return draw any line as L M, parallel to B C, and proceed in a similar way, obtaining I^x B^x e^x, the pattern for the portion shown by I B *e* in plan.

PATTERN FOR GABLE AND HORIZONTAL MOLDINGS HAVING DIFFERENT PROFILES

To obtain the patterns for two moldings of different profiles forming a miter, as a gable molding meeting a horizontal molding as shown in Fig. 15, in which A B C D represents the part elevation of the gable, E being the given profile of the gable mold and F the desired profile of the horizontal mold.

The first step is to divide either profile (in this case E) into equal spaces, as shown by the small figures 1 to 12 in E. Take a tracing of E with the various

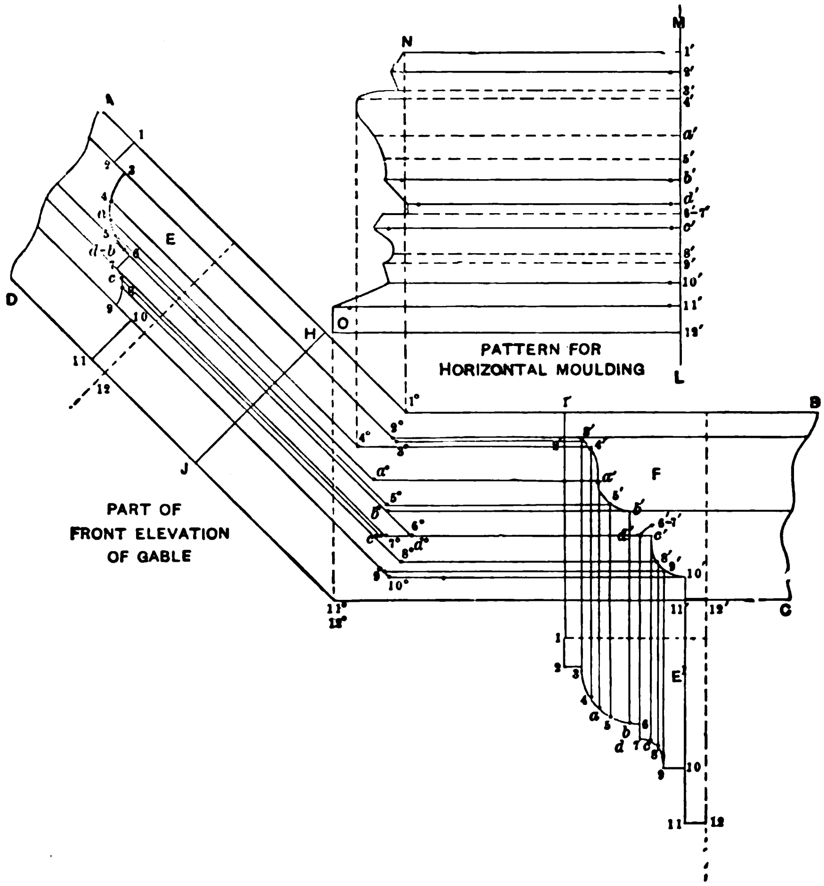


Fig. 15. Obtaining Points of Intersections and Pattern for Horizontal Molding

points of intersections and place the tracing with its bottom line on the vertical dotted line extended through 12′ in F, the position of the tracing being marked E^1.

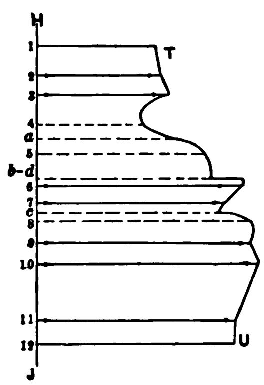


Fig. 16. Pattern for Gable Molding

From the points 1 to 12 erect vertical lines cutting the profile F from 1′ to 12′. Establish at pleasure the point *a*′, and from this point and also from *b*′, *d*′ and *c*′ drop lines intersecting E^1 at *a*, *b*, *d* and *c*. Now, from the various points of intersections in the profile F, parallel to the lines of the horizontal molding, draw lines as shown, which intersect with lines drawn parallel to the gable molding, from similar intersections in the profile E, and resulting in the points of intersections shown from 1° to 12°.

For the pattern for the horizontal mold take the stretchout of F and place it on the vertical line L M, as shown. Draw the usual measuring lines, which intersect by lines drawn from similar intersections 1° to 12° at right angles to 1° B. Then will N 1′ 12′ O be the desired pattern.

For the pattern for the gable mold take the stretchout of E or E¹ and place it on the vertical line H J in Fig. 16, and draw the usual measuring lines.

At right angles to the gable mold in Fig. 15 draw any line, as H J. Measuring from this line, take the various distances to points 1° to 12° and place them on similar lines in Fig. 16, also measuring from the line H J. A line traced through points thus obtained, as T U 12 1, will be the desired pattern.

PATTERN FOR DISSIMILAR MOLDING

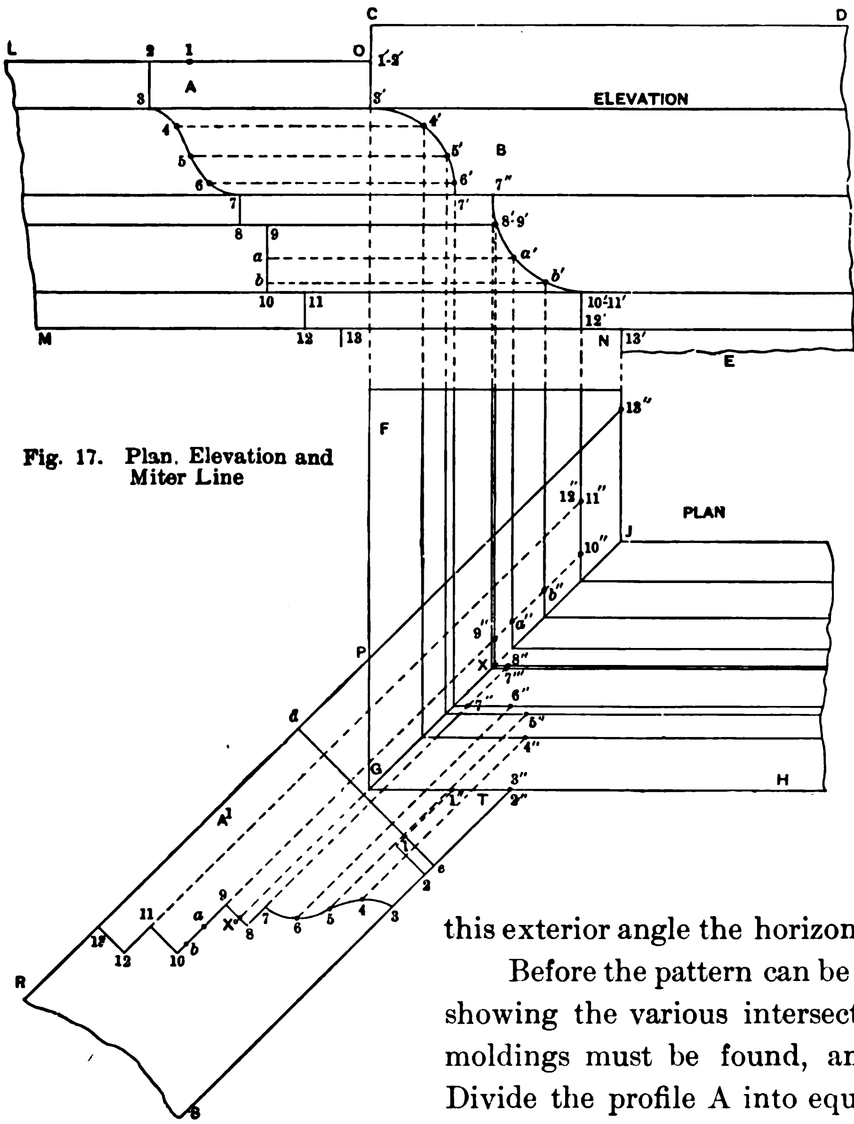


Fig. 17. Plan. Elevation and Miter Line

This problem treats on how to obtain the pattern for a horizontal molding intersecting a dissimilar molding at an exterior right angle, the horizontal molding being placed at an angle of 45 degrees in plan. In Fig. 17 let A represent the profile of the horizontal molding L O N M in elevation, shown in plan at an angle of 45 degrees by R P T S. B represents the profile of the molded corner shown in plan at right angle, F G H. Against this exterior angle the horizontal molding is to miter.

Before the pattern can be obtained the miter line showing the various intersections between the two moldings must be found, and is done as follows: Divide the profile A into equal spaces, as shown by the small figures 1 to 13. From those intersections, parallel to M N, draw lines intersecting the profile B from $1'$ to $13'$. At pleasure locate two points between $9'$ and $10'$, as indicated by a' and b', and from these points draw lines parallel to M N, intersecting 9 10 in A at a and b.

From the various intersections in B drop vertical lines, intersecting the miter line G J in plan, as shown, from which parallel to G H draw lines indefinitely. Take a tracing of A with the various divisions on it and place this in its proper position in plan, as shown by A^1. Through the various intersections in A^1, parallel to S T, draw lines intersecting similar lines in F G H as shown by the points of intersections $1''$ to $13''$. As the plane 8 9 in A^1 cuts the angle in plan shown by $8''$ $3''$, the corner X must be projected to the plane 8 9 in A^1, as shown by X°. A line traced through points $1''$ to $13''$ would be the miter line (but is here omitted).

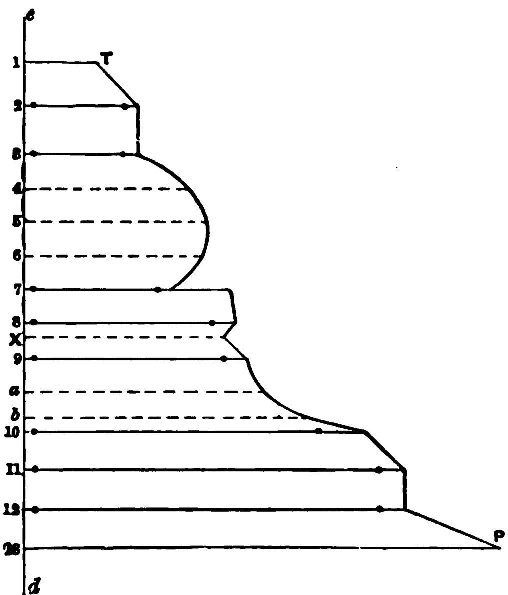


Fig. 18. The Pattern Shape

For the pattern for the horizontal mold A, or A^1, take the stretchout of A^1 and place it on the vertical line e d in Fig. 18, as shown, through which draw horizontal lines indefinitely. From any point as d, at right angles to R P in Fig. 17, draw the line d e. Measuring in each instance from the line d e, take the various distances to points $1''$ to $13''$ and place them on similar lines in Fig. 18, also measuring in each instance from the line d e resulting in the points of intersections shown. A line traced through these intersections, shown from T to P, will be the desired pattern.

PATTERNS FOR A SQUARE SHAFT MITERING ON A CONE

When a square shaft, the longitudinal axis of which, coincides with the axis of a right cone and miters with that cone, to find the patterns for the shaft and for the cone, proceed in this manner:

In Fig. 19 let A B C represent the elevation of the cone, corresponding to L M N O of the plan, and D E G F the elevation of the shaft, corresponding to P R T S of the plan. Space the plan L M N O into a number of equal parts, as shown by the small figures. Before being able to obtain the patterns the miter line shown in elevation by F G, forming the intersection between the shaft and cone, must first be established. To do so proceed as follows: From the spaces obtained on M L O in the plan view draw lines to the center point, U, as shown, intersecting one of the sides, P R, of the shaft. Now parallel to the axis A L of the cone draw lines from the intersection in the half plan, M L O, intersecting the base of the cone B C. From these points draw lines to the apex A, as shown. Now from the intersections on the side of the shaft P R in plan draw lines upward parallel to the axis of the cone, each intersecting the radial lines of corresponding numbers that have just been drawn. To obtain the point of intersection on the

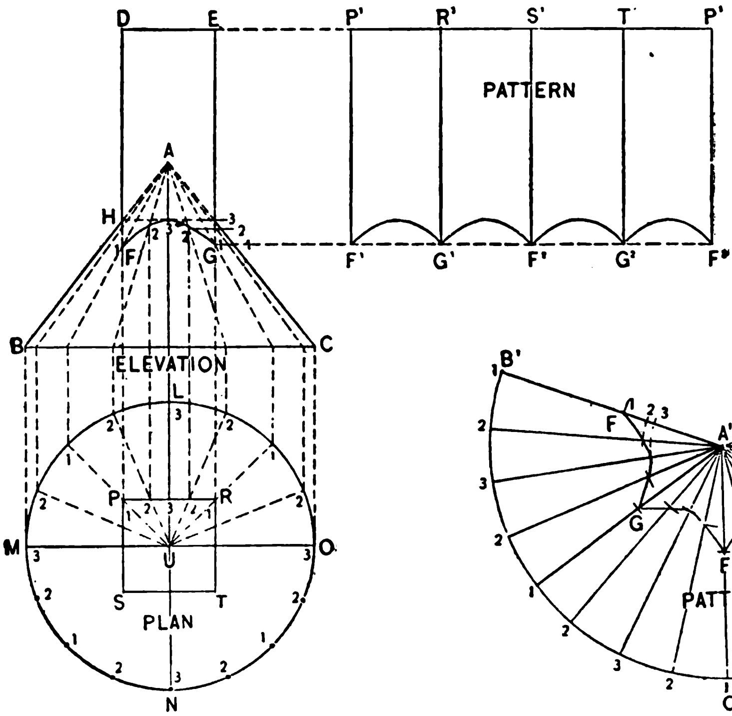


Fig. 19. Plan, Elevation and Pattern for Shaft

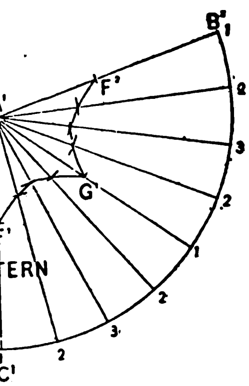


Fig. 20. Pattern for the Cone

center line 3 in elevation, proceed as follows: From where the line of the shaft D F intersects the side of the cone A B, as indicated at H, draw a line at right angles to D H, intersecting the center line 3, as shown at 3. Trace a line through these intersections, as shown. Then will F 2 3 2 G represent the miter line in elevation between the intersection of the shaft and the cone, and will at the same time give the pattern for one side of the shaft.

To obtain the pattern of the shaft in one piece, draw at right angles to the line E G of the shaft the stretchout line P^1 P^1, upon which place the stretchout of the square shaft shown in plan by P S T R, and as indicated on the stretchout line by P^1 R^1 S^1 T^1 P^1. At right angles to P^1 P^1 draw the usual measuring lines, as shown, which intersect with line drawn at right angles to E G from G. Now trace the miter line F 2 3 2 G shown in elevation upon each side of the shaft, as shown in pattern by F^1 G^1 F^2 G^2 F^3. Then will P^1 F^1 F^3 P^1 be the required pattern for the square shaft mitering upon the cone.

At right angles to the axis of the cone draw lines from the intersections 3, 2 and G in the miter line, cutting the line A C of the cone, as indicated by 3 2 1. For the pattern of the cone proceed as follows: Set the compasses to the space A C, or the slant hight of the cone, and from any convenient point as center, as A^1 in Fig. 20, strike an arc indefinitely. Connect one end of the arc to the center point, as shown by the line B^1 A^1. From the point of the arc B^1 step off the divisions shown in the plan L M N O in Fig. 19, as indicated by the small figures shown in the pattern in Fig. 20, making them of corresponding numbers to those in the plan in Fig. 19, and draw radial lines to the center A^1 of the pattern in Fig. 20 in like manner, with the radii A 3, A 2 and A 1 of the elevation in Fig. 19, and with the A^1 of the pattern as center in Fig. 20, describe arcs indicated by 3, 2 and 1, intersecting radial lines of corresponding numbers as shown. Trace a line through these intersections, as shown by F, G, F^1, G^1 and F^2. Then will B^1 C^1 B^2 F^2 G^1 F^1 G F represent the desired pattern of the cone.

PATTERN FOR TAPERING PANEL

To cut the pattern for a tapering panel, a sketch of which is shown in Fig. 21, let A B C D be the plan of the panel and E F G a section on the line B D, the elevation being shown by H I J. The central lines in elevation, plan and section are indicated by the dotted line K M L. As each quarter plan is uniform it will will only be necessary to obtain the pattern for one quarter. The pattern will be developed by triangulation; therefore divide the quarter plan D C into equal spaces, as shown by the small figures 1 to 9, and draw lines as shown to the center of the plan M. These lines will represent the bases of the triangles, the altitudes of which are equal to K I in elevation or F L in section. Now measure each and every line, in plan from M 1 to M 9 and place the lengths as

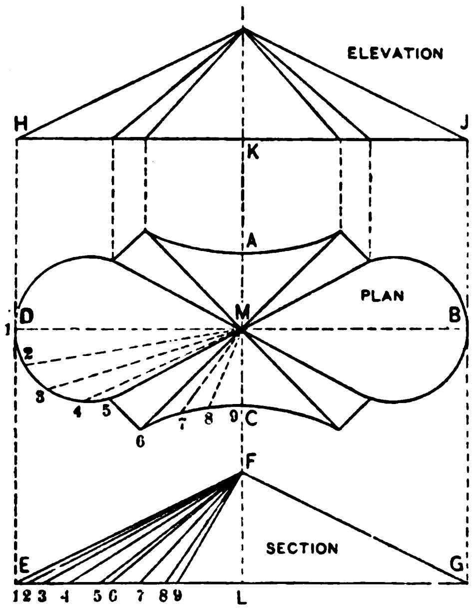


Fig. 21. Plan, Elevation and Triangles

shown in section from L 1 to L 9 measuring in each and every instance from the point L. From the small figures 1 to 9 draw lines to the apex F. Then will these lines F 1 to F 9, represent the true distances on the finished article on lines of similar numbers in plan.

For the pattern proceed as follows: With any point, as A in Fig. 22, as center and with radii equal to F 1 to F 9 in section in Fig. 21 describe arcs as shown in Fig, 22 by 1, 2, 3, 4, 5, 6, 7, 8 and 9. From any point on the arc 9 draw the line 9 A. Now set the dividers equal to the divisions in 9 6 in plan, Fig. 21, and setting one leg of the compasses in the point 9 of Fig. 22 step from one arc to the other of corresponding numbers until the point 6′ on the arc 6 has been obtained. Now take the distance 6 5 in plan, Fig. 21, and step from 6' of Fig. 22 to the arc 5, as shown by 5′. Now set the dividers equal to the divisions in 5 1 in plan, Fig. 21, and starting from the point 5′ on the arc 5 of Fig. 22 step from one arc to another having corresponding numbers until the point 1′ on the arc 1 is obtained. Draw a line from 1′ to A and trace a line through intersections on the various arcs, as shown from 1′ to 5′ to 6′ to 9. Then will A 9 1′ be one quarter of the pattern. If the pattern is desired in one piece trace the quarter pattern opposite the lines A 1′ and A 9, as shown. Then will 9′ 1′ 9 1″ 9″ be the full pattern.

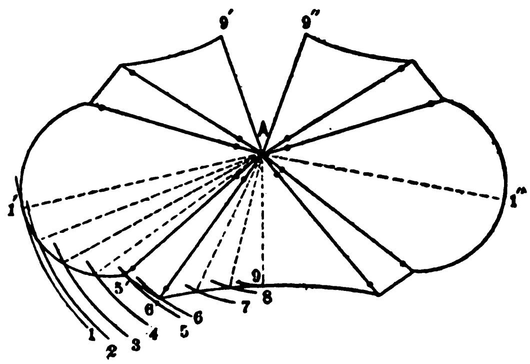


Fig 22. The Complete Pattern

A SHORT RULE FOR OBTAINING THE PATTERN OF A SUN PANEL OF ANY SHAPE

Let C D E F in Fig. 23 represent the front elevation of a square molded panel, into which the sun panel shown by Y J K L A M N O Z is to be placed. G Z H I in section represents the section through A B in front elevation, and Y Z H H^1 in section represents the section through A A^1 in elevation, and also gives the flare of the flute through A A^1 in front elevation. B Y^1 A^1 Z^1 in front elevation gives the outline of the half circle against which the bottom of the flutes miter. The rule to be observed in using this short method is that the lines of the sun panel shown by Y Y^1, J J^1, K K^1, L L^1, etc., all meet in one center point, as shown at B. After the lines of the flute have been drawn to the center point B draw the curves, as shown from Y to J, J to K, K to L, etc.

With B as center and B A as radius, strike an arc from A, cutting the line $L L^1$ at P. Now bisect the arc A P by the dotted line shown by X B. Draw a straight line from A to P, upon which place the section which the flute is to have at that point, as shown by $A T^1 P$. The hight of the section in the center, as shown by $O T^1$, corresponds to the projection of the flute Y Z in section. Divide the section V into an equal number of spaces, as shown by the small figures.

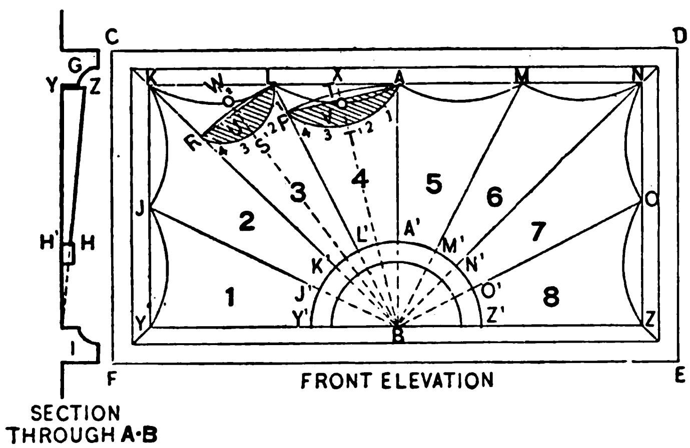


Fig. 23. Front Elevation and Section

The same method is followed for obtaining the section for flute **3**. With B as center and B L as radius strike the arc L S R, cutting the line $K K^1$ at R. Bisect L R by the dotted line W B, as shown. Draw a line from L to R, upon which make $O^2 S^1$ equal to Y Z in section. Then draw the section $L S^1 R$, as shown by U, and divide into spaces as shown by the small figures. As the flute **4** is the same as **5**, **1** and **8**, and the flute **3** the same as **2**, **6** and **7**, it is only necessary to obtain the sections of these two flutes **3** and **4**, as shown.

To obtain the pattern proceed as follows: Draw any perpendicular line, as $A^2 B^2$ in Fig. 24, making it in length equal to A B in Fig. 23. Now with B^2 as center in the pattern and $B^2 A^2$ as radius strike the arc $A^2 T^2 P^2$, making it in length equal to the stretchout of the section V in Fig. 23, as shown by the small figures A^2, 1, 2, T^2, 3 4 and P^2 in Fig. 24. Draw a line from B^2 to P^2, extending it indefinitely, as shown. With B L in Fig. 23 as radius and with B^2 in Fig. 24 as center strike the arc $L^2 S^2 R^2$, as shown, cutting the line $B^2 P^2$ at L^2. Upon the arc $L^2 S^2 R^2$ place the stretchout of the section U, shown in Fig. 23, as shown by the small figures L^2, 1, 2, S^2, 3, 4, R^2 in Fig. 24. Draw a line from the center point B^2 to R^2, extending it indefinitely. Take the distance from R to K in Fig. 23 and place it on the line $B^2 R^2$ extended in Fig. 24, as shown from R^2 to K^2.

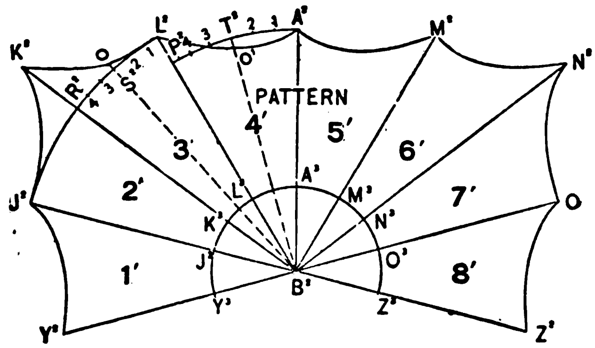


Fig. 24. The Pattern Shape

Bisect the two arcs A^2 T^2 P^2 and L^2 S^2 R^2 in pattern by dotted lines shown by S^2 B^2 and T^2 B^2 corresponding to the dotted lines X B and W B in Fig. 23. Now take the distance from the center point B in front elevation to where the outline L A of the flute **4** intersects the dotted line X B at O and place it in the pattern in Fig. 24, as shown from B^2 to O^1 on the dotted line T^2 B^2 in the flute **4**′. Trace a line, as shown by L^2 O^1 A^2. Now take the distance from the center point B in front elevation in Fig. 23 to where the outline K L of the flute **3** intersects the dotted line W B, as shown at O^2, and place it in the pattern in Fig. 24, as shown from B^2 to O on the dotted line S^2 B^2 in the flute **3**′. Trace a line, as shown by K^2 O L^2.

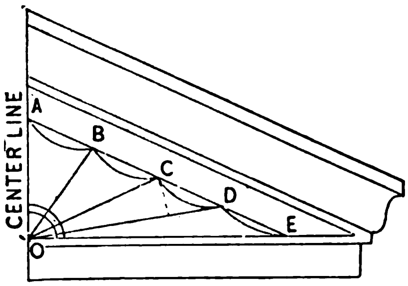


Fig. 25. Sun Panel in Pediment to Which the Principles Can be Applied

Now with B^2 of the pattern as center and B Y^1 in Fig. 23 as radius strike the arc Y^3 A^3 Z^3, as shown in Fig. 24. Then will K^2 K^3 L^3 L^2 be the pattern for flute **3** in the elevation in Fig. 23, and L^2 L^3 A^3 A^2 in Fig. 24 be the pattern for the flute **4** in the elevation in Fig. 23. If the pattern is desired in one piece, as shown in Fig. 24, the portion of pattern **4**′ **3**′ can be turned over on the line K^2 K^3, resulting in a duplicate, shown by **2**′ **1**′, having then the half of pattern. It can be turned over on the center line A^2 A^3 and traced, thus giving the other half, indicated by **5**′, **6**′, **7**′ and **8**′, the figures in the pattern representing similar figures in the elevation in Fig. 23.

If the outline of the panel were the same as shown by A B C D E O in Fig. 25 the same method would be used. No matter what shape or outline the panel has the above rule holds good. Although not geometrically correct, it is accurate enough for all practical purposes. By referring to the front elevation in Fig. 23 it will be seen that the sections of the sun panel V and U are convex. The same method is employed if the sections are concave, it being only necessary to reverse the sun panel when soldering in position.

PATTERN FOR SUNBURST

To obtain the pattern for an article, which is called a triangular sunburst, and which is reproduced in Fig. 26, A B C being the plan view of the sunburst and D E F the elevation on the line B C in plan. It is required that the distance N I in plan be greater than I H, and that J K L represent the section on I H, showing the pitch of the flutes. The problem gives an interesting study in raking profiles and pattern drafting.

In Fig. 27 is shown an enlarged half plan, showing the sections and profiles and points of intersections on the pitched lines. Let A B C represent the one-half plan of sunburst and D E F the half plan of the cylinder, against which the flutes are to miter. Draw the true profile on A B in plan at pleasure, which will at once be the pattern for the closed end, as shown by H I J K.

Number each bend as shown from 1 to 8. From A in plan draw the miter line A G, intersecting the half circle D E F at E, G representing the center point from which the semicircle is struck. At right angles to A B and from the intersections 1 to 8 in the true profile draw lines, as shown, intersecting the miter line A E from 1 to 8. Draw a line from H to 3 in the true profile on A B and extend the line 2 2, intersecting the base line K J at *a* and H 3 at *b*, and call the point 2 *c*. Then will *a b c* represent the vertical hights of the flutes on the line A B in plan, which will be used in constructing a section on B G in plan, as follows:

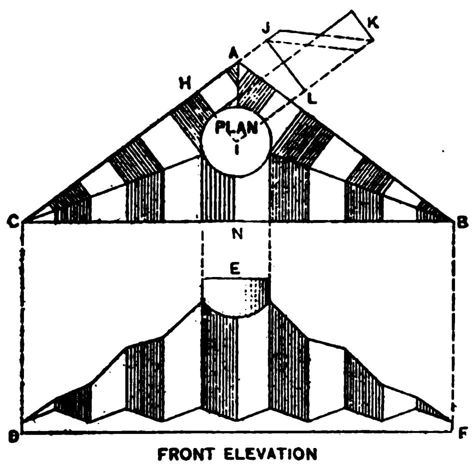


Fig. 26. The Sunburst

Draw any line, as L M, parallel to B G. At right angles to B G and from B and G draw the lines L R and M P indefinitely. Take the hights *a*, *b*, *c* in the true profile and place them, starting from M, as shown by a', b', c', thus obtaining the points M, O, P, in section. Now establish at pleasure the point R on the line L R and draw a line from R to P, and from O draw a line parallel to R P, as shown by O N. At right angles to R P draw any line, as *ef*, which will represent the depth of the flutes at right angles to the rake. Then will N O P R be the true section on B G in plan, and N R R^2 X the section of the cylinder on G F in plan. It will now be necessary to obtain a true section on the line *e f* in section, as follows: Take the distance *ef* and place it on the line A K, extended, as shown, from e' to f'. Parallel to K J and from e' and f' draw the lines e' *l* and f' *m*. At right angles to K J and from points 2, 4, 6 and 8 in the true profile drop lines, intersecting the line e' *l* at 2′, 4′, 6′ and 8′, and at right angles to K J and from points 1, 3, 5 and 7 drop lines, intersecting the line f' *m* at 1′, 3′, 5′ and 7′. Now connect the points, as shown by the lines 1′ to 2′ to 3′ to 4′ to 5′ to 6′ to 7′ to 8′, which will represent the true profile on the line *e f* in section.

As the line R P in section represents the points shown in the profile having even numbers, as 2′, 4′, 6′, 8′, and the line N O in section represents the points shown in profile having uneven numebrs, as 1′, 3′, 5′ and 7′, then, at right angles to G B in plan and from points 2, 4, 6 and 8 on the miter line in plan, erect lines, intersecting the line R P in section, as shown by points 2, 4, 6 and 8. In similar manner, at right angles to G B and from points 1, 3, 5 and 7 on the miter line in plan erect lines, intersecting the line N O in section at points 1, 3, 5 and 7. Now, at pleasure, between the arc E F in plan, establish the point 9, and parallel to F B drop a line, intersecting the true profiles at *i* and *d* and the line *f′ m* at *b″*. Take the distance from *b″* to *d* and place it at right angles to N O in section, as shown by K *d″*. From *d″*, parallel to N O, draw a short line, as shown by *d′ d″*, which inter-

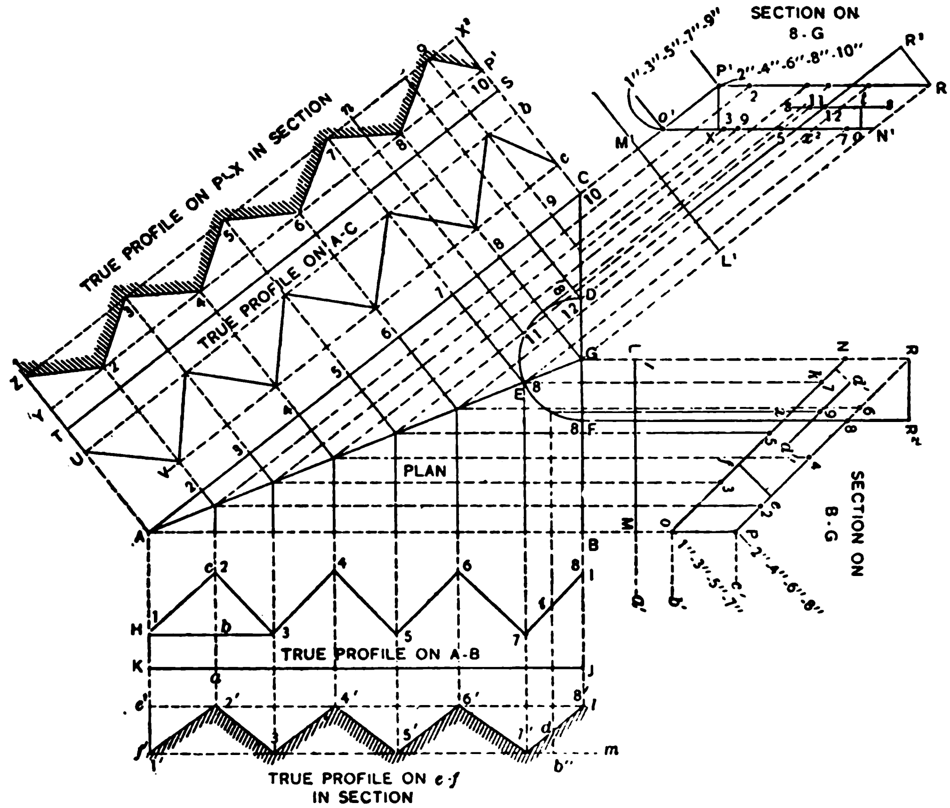


Fig. 27. Enlarged Half Plan, Sections and Profiles

sect by a line drawn from the point 9 in plan at right angles to G B, thus obtaining the point 9 on the line *d′ d″* in section. As P O in section represents the vertical cut through the flutes, then will P represent the even numbers in profile, as shown by 2″, 4″, 6″ and 8″, and O the uneven numbers, as 1″, 3″, 5″ and 7″. Having obtained the points of intersections on the section, the pattern is developed as shown in Fig. 28, in which R P O N, with the various points of intersection on same, is a reproduction of R P O N in section in Fig. 27 with the various intersections.

At right angles to R P in Fig. 28 draw the line J K, upon which place the stretchout of the true profile on *e f* in section in Fig. 27, as shown by the small figures 1, 2, 3, 4, 5, 6, 7, 9, 8 on the line J K in Fig. 28. At right angles to J K and through these small figures draw lines indefinitely, as shown, which intersect with lines drawn at right angles to R P from intersections having similar numbers, as shown in R P O N. A line traced through points of intersections thus obtained, as shown by A B F E, will be the pattern for A B F E in plan in Fig. 27, formed after the profile *f′ l*, while the true profile on A B will be the pattern for the vertical face of the flutes shown by P O in the section.

As the distance 8 G at right angles to A C in plan is less than G B, it will be necessary to construct a true section on 8 G in plan from which to obtain the true profiles necessary to form a miter with the opposite flutes on the line A E in plan. Therefore, parallel to 8 G draw the line M^1 L^1, and at right angles to 8 G and from points 8 and G erect the lines G R^1 and 8 P^1 indefinitely, as shown, intersecting the line M^1 L^1 at M^1 and L^1. Now take the hights from L to N to R in the section on B G and place them, as shown, from L^1 to N^1 R^1 in the section on 8 G. In similar manner take the hights from M to O to P in the section on B G and place them in the section on 8 G, as shown, from M^1 to O^1 to P^1. Now draw a line from R^1 to P^1 and from N^1 to O^1. Then will N^1 O^1 P^1 R^1 be the true section on 8 G in plan and N^1 R^1 R^3 X^1 the section of the cylinder on 8′ G in plan.

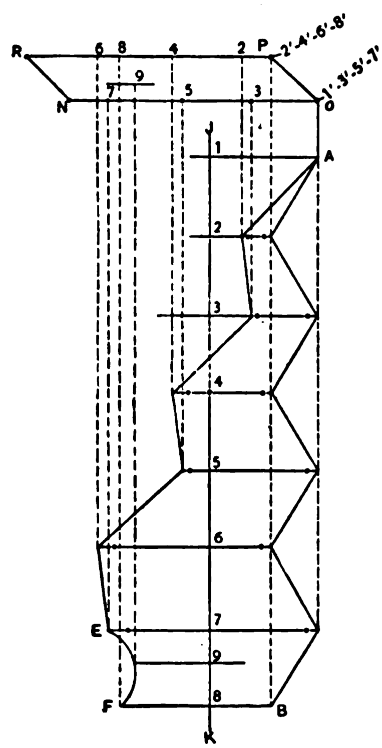


Fig. 28. Pattern for A E F B of the Plan, Fig. 26

From the point P^1, at right angles to P^1 R^1, draw the line P^1 X, which gives the depths of the flutes at right angles to the rake. At right angles to A C in plan and from the various intersections from 1 to 7 on the miter line draw lines, intersecting the line A C from 1 to 7. Set the dividers equal to one of these spaces and step off on A C, 7 to 8, 8 to 9, and let 9 to 10 be as it may. Then, at right angles to A C and from the intersections 1 to 10 on A C draw dotted lines indefinitely, as shown.

At pleasure draw any line, as S T, parallel to C A. Now take the hights from M^1 to O^1 to P^1 in the section and place them at right angles to S T, as shown by S *b c*. From *b* and *c*, parallel to S T, draw the lines *b* U and *c* V, letting *b* U, which represents the bottom line of the flutes, intersect the lines drawn from uneven numbers, as 1, 3, 5, 7 and 9, and the line *c* V intersect lines drawn from even numbers, as shown by 2, 4, 6, 8 and 10. Trace a line through points thus obtained; then will T U V *c b* S be the true profile on the line A C in plan, shown in section by O^1 P^1, and will at once be the pattern for the vertical bottom or head to close the ends of the flutes on the line A C in plan.

For the true profile on P^1 X in section draw any line parallel to C A in plan, as X^2 Z. Take the distance from X to P^1 in the section and place it, as shown, from X^2 to P^1, at right angles to Z X^2. From P^1 draw a line parallel to X^2 Z, as shown by P^1 Y. As X^2 Z represents the bottom of the flutes, then must this line intersect uneven numbered lines, as 1, 3, 5, 7 and 9, and the line P^1 Y intersect even numbered lines, as 2, 4, 6, 8 and 10. Draw lines connecting these numbers, as shown by the shaded lines 1 to 10; then will Z P^1 be the true profile on P^1 X in section. As the line P^1 R^1 in section represents the points shown in the profile Z P^1 having even numbers, as 2, 4, 6, 8 and 10, and the line N^1 O^1 in section represents points shown in profile Z P^1 having uneven numbers, as 1, 3, 5, 7 and 9, then, at right angles to 8 G in plan and from points 2, 4, 6 and 8 on the miter line erect lines, intersecting the line R^1 P^1 in section, as shown by points 2, 4, 6 and 8. In similar manner, at right angles to 8 G in plan and from points 1, 3, 5, 7 and 9 on the miter line in plan erect lines, intersecting the line N^1 O^1 in section at points 1, 3, 5, 7 and 9. Now, at pleasure, on the arc E D establish any point, as 11, and call the point D 12. From the points 11 and 12 and parallel to 8 G draw lines, intersecting the true profile Z P^1 at 11 and 12 and the base line X^2 Z at *n* and *o*. Take the distance *n* 11 and *o* 12, which in this case are equal, and place them at right angles to N^1 O^1 in section, as shown by *o t*. Through *t*, parallel to N^1 O^1, draw a short line, as shown by S S, which intersect by lines drawn from points 11 and 12 in plan at right angles to 8 G, thus obtaining the points 11 and 12 on the line S S in the section. As P^1 O^1 in the section represents the vertical cut through the flutes, then will P^1 represent the even numbers in the profile, as shown by 2″ to 10″, and O^1 the uneven numbers, as 1″ to 9″.

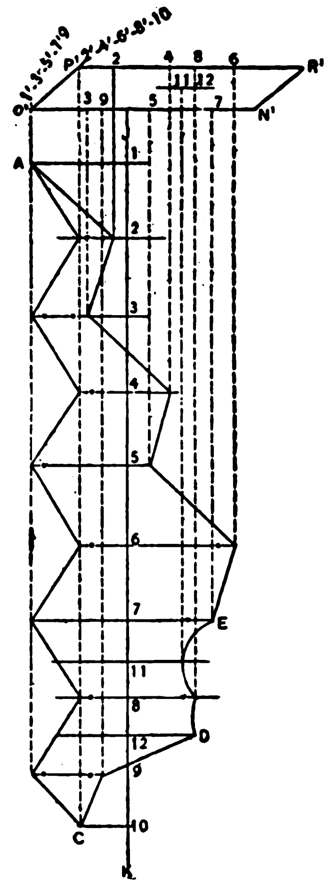


Fig. 29. Pattern for A C D E of the Plan Fig. 26

Having all the points of intersections on the section, the pattern is obtained as shown in Fig. 29, in which R^1 P^1 O^1 N^1, with the various points of intersection on same, is a reproduction of R^1 P^1 O^1 N^1 in section in Fig. 27 having similar intersections. At right angles to R^1 P^1 in Fig. 29 draw the line J K, upon which place the stretchout of the true profile on P^1 X in section in Fig. 27, as shown by the small figures 1, 2, 3, 4, 5, 6, 7, 11, 8, 12, 9, 10 on the line J K in Fig. 29. At right angles to J K and through these small figures draw lines indefinitely, as shown, which intersect with lines drawn at right angles to R^1 P^1 from intersections having similar numbers in R^1 P^1 O^1 N^1. A line traced through points of intersections thus obtained, as shown by A C D E, will be the pattern for A C D E in plan in Fig. 27, formed after the profile Z P^1. It should be understood that the two patterns in Figs. 28 and 29 represent the half panel or sunburst, therefore there must be two of each pattern cut, one formed right and the other left. The pattern for the cylinder is not necessary, as that is made the same as a tube and slipped inside the circular opening of the sunburst.

PATTERNS FOR SUN PANELS

The triangular sections of pediments usually have some sort of ornamentation, and this article treats of the exact method of developing the patterns for a sun panel ornamentation; which can be either of a semi-circular section as at A Fig. 30, or triangular as at B.

As each flute in both sides of the pediment are different in length, a separate pattern must be obtained for each one, it will be explained how to obtain the pattern for the semi-circular flute **1** and the triangular flute **2**, the same principles being applied when developing the other flutes. In Fig. 31 let **A B C** represent a half elevation of the background of the pediment, in which the elevation of four flutes have been drawn, two semi-circular and two triangular, all radiating to the center **B**. Using **B** as a center, draw the quarter circle **D**. Draw a graceful sweep to the end of flute **1**, as shown by 1″, 3″, 5″; also draw the outline to the end of flute **2**, as shown by 6, 7, 8.

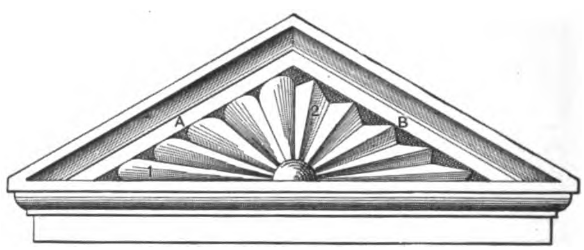


Fig. 30. Finished Ornamentations

Flute **1** will be developed first, the principles of which can be applied to any size semi-circular flute. Extend the sides of flute **1** indefinitely, as shown, and with any radius as **B** 5, using **B** as center, draw the arc *a* 1 intersecting the opposite side of the flute at 1. Draw a line from 1 to 5, which bisect, obtaining the point 3′. Now using 3′ as center and 3′, 5 as radius, describe the semi-circle 5, 3, 1, which represents the profile of the flute on the line 1 5. Divide this semi-circle in equal spaces—in this case four—as shown from 1 to 5, and from these divisions at right angles to 1 5 draw lines intersecting the line 1 5 at $2'$, $3'$ and $4'$. From these points draw radial lines to the apex **B**, cutting the curve at the end of the flute at $1''$, $2''$, $3''$, $4''$ and $5''$, also cutting part of the quarter-circle **D** as shown. Now at right angles to the center line 3 **B** from the intersections $1''$ to $4''$ draw lines intersecting the side of the flute 5 B at 1^x to 4^x.

For the pattern proceed as follows: With **B** as center and **B** 5 as radius,

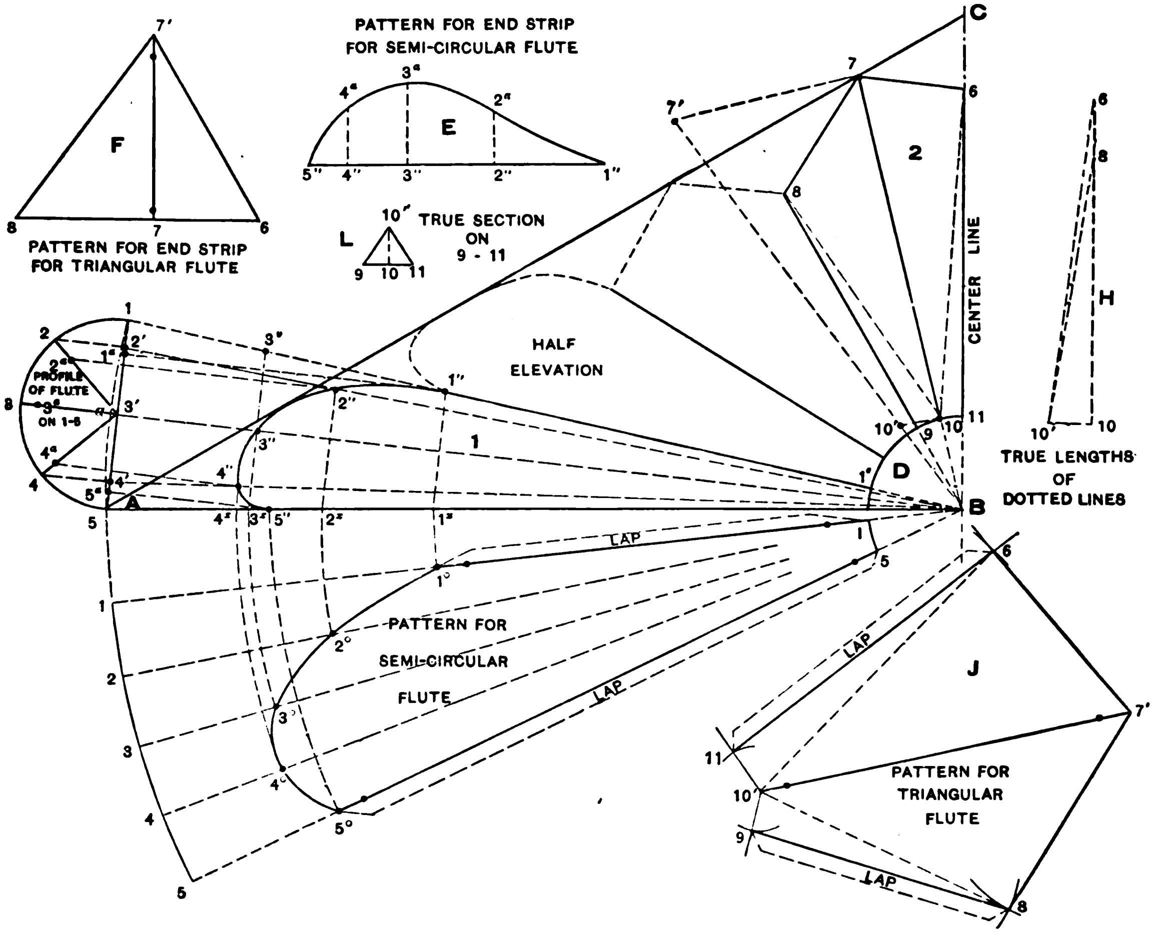


Fig. 31. Method of Obtaining Patterns for Semi-circular and Triangular Flutes

describe the arc 5 5, upon which place the girth of the profile on 1 5, as shown by the small figures 1 to 5 on the curve 5 5. From these small figures 1 to 5 draw radial lines to the center **B** and intersect them by arcs struck from **B** as center with radii equal to the various intersections 1^x, 2^x, 3^x, 4^x and $5''$ on the side of the flute 5 **B**, thus obtaining the intersections 1° to 5° in the pattern. In similar manner using **B** as center and **B**1° as radius, draw the arc 1 5 in the pattern. Then 1, 1°,

2°, 3°, 4°, 5°, 5, with laps allowed, will be the pattern for flute **1**. This flute can be used right and left.

Another pattern will be required for the end strip shown from 1″ to 5″, which closes the end of flute **1**, and is obtained as follows: From the various intersections 1 to 5 in the profile of flute, draw radial lines to the center 3′ as shown, and intersect these lines by lines dropped from similar numbered intersections 1″ to 5″ in flute **1**, parallel to the center line 3 **B**. Thus a line drawn from 1″ in elevation, intersects the radial line drawn from 1 in the profile at 1^a. A line drawn from 2″ in elevation intersects similar numbered radial lines in profile 2^a, while lines drawn from 4″ to 5″ in elevation intersect similar radial lines in profile at 4^a and 5^a, respectively.

To obtain the point 3^a in profile, a line is drawn from point 3″ in elevation, at right angles to 3 **B**, until it meets the side of the flute at 3^v or 3^x. Now take this distance, 3″ 3^v or 3″ 3^x and place it from 3′ to 3^a on the line 3′ 3 in the profile.

These points, 1^a to 5^a in the profile, will be used in obtaining the various hights for the end strip. Now take the girth of the various spaces along the curve 1″ to 5″ in elevation, measuring each one separately, as they are all unequal, and place them on any horizontal line in **E**, as shown by similar numbers 1″ to 5″. From these small figures erect perpendicular lines indefinitely as shown. Now measuring from the line 1 5 in the profile of flute, take the various hights to points 2^a, 3^a and 4^a and place them in the pattern **E** on similar numbered lines, measuring in each instance from the line 1″ 5″, resulting in the intersections 2^a, 3^a, 4^a. A line traced through points thus obtained as shown, will be the pattern for the end strip for the semi-circular flute **1**. In this manner must the balance of the end strips be obtained for the various flutes.

Let 6 7 8 9 10 11 be the outline of the triangular flute shown by **2**. The first step in developing this flute is to know the hight that the flute will have at 7. Assume that the hight at 7 should be as high as from 7 to 7′; then at right angles to 7 **B** draw the perpendicular 7 7 of the desired hight, and draw a line from 7′ to **B**, intersecting the line drawn from 10 at right angles to 7 10 at 10′. This hight 10 10′ then represents the hight of the flute on point 10. 7′, 10′, then shows the true length of the line 7 10; 8 9 and 6 11 also show their true lengths.

The true lengths must now be obtained on the dotted lines 8 10 and 10 6 as follows: Take the lengths of 8 10 and 6 10 and place them on any vertical line, as shown by similar numbers in diagram **H**. As the hight at 10 in elevation is equal to 10 10′, take this distance and place it as shown from 10 to 10′ in **H** at right angles to 6 10, and draw a line from 10′ to 8 and 10′ to 6, which show respectively the true lengths of the dotted lines 10 8 and 10 6 in elevation. Now take the girth of the end 6 7 8 in flute **2**, and place it as shown by 6 7 8 in **F**. From point 7 erect the perpendicular 7 7′, equal to 7 7′ in elevation, and draw a line in **F** from 6 to 7′ to 8, which represents the pattern for the end strip for flute **2** and gives the true lengths for the end when developing the triangular flute **2**. In similar manner take the girth of 9 10 11 in flute **2**, and place it as shown by similar numbers in **L**; from 10 erect the perpendicular line 10 10′, equal to 10 10′ in flute **2**, and draw a line in **L** from 9 to 10′ to 11, which represents the developed section on 9 10 11 in elevation.

The pattern for flute **2** can now be developed as shown in diagram **J**. Draw any line 7′ 10′ equal in length to 7′ 10′ in elevation. Now with the radius equal to 6 7′ in **F**, and 7′ in **J** as center, draw an arc, which intersect by an arc struck from 10′ as center and 10′ 7 in **H** as radius. Now with 10′ 11 in **L** as radius and 10′ in **J** as center, draw the arc 11, which intersect by an arc struck from 6 as center and 6 11 in flute **2** as radius.

In similar manner complete the opposite side of the pattern **J**. 7′ 8 and 10′ 9 are obtained from 7′ 8 in **F** and 10′ 9 in **L** respectively, while the true lengths 10′ 8 and 9 8 in the pattern **J**, are obtained from 10′ 8 in **H** and 9 8 in flute **2** respectively. Connect intersections thus obtained in **J** by straight lines, to which allow laps as shown, which will then be the pattern for the triangular flute **2**.

It will be noticed that the lines 8 10′ 11 in pattern **J** are straight lines, but they intersect against a curved surface shown by 9 10 11 in the quarter-circle **D** in elevation, which, however, will hardly be noticeable in practical work.

Using the principles employed for developing the flute **2**, all other flutes having different lengths must be laid out the same way.

PATTERN FOR HORIZONTAL MOLDING INTERSECTING A TAPERING POST

This article exemplifies the method of obtaining the pattern for a horizontal molding intersecting a tapering post, as shown in Fig. 32. A and B represent the base and rail of a balustrade intersecting the tapering post C, *b* being the profile of the rail.

In Fig. 33 and 34 is shown the method of obtaining the pattern for the rail B in Fig. 32, which is also applicable to the base A. First, in Fig. 33 draw the center line A B and construct the part elevation of the post shown by C D E F.

In its proper position draw the section of the rail H. Divide this into any convenient number of spaces, being careful to place a few divisions in the vertical lines 1 11 and 8 10, as shown by 12, 13 and 9. Through these intersections draw horizontal lines through the elevation, as shown, which will represent the planes in elevation.

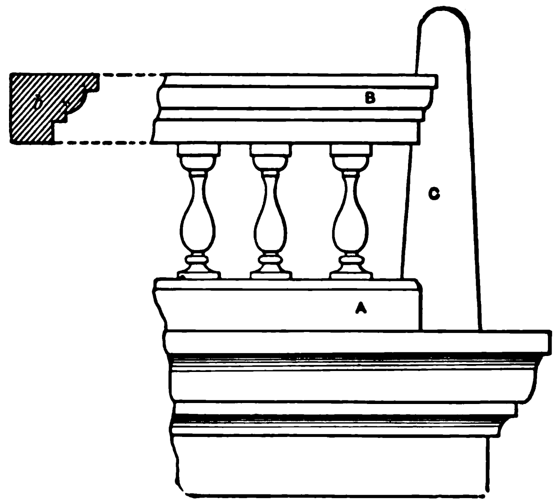


Fig. 32. Balustrade with Tapering Post

On the center line A B establish the point J, through which draw the line K L. From the various intersections of the horizontal planes with the line D E in elevation drop vertical lines intersecting the line K L in plan, as shown.

Using J as center, with the various radii describe circles, which will represent the various horizontal planes when viewed in plan. Take a tracing of section H in elevation and place it in its proper position in plan, as shown by H^1.

Through the various intersections in plan draw horizontal lines intersecting similar circles or planes, as shown from 1′ to 13′. If desired to show the miter line in elevation vertical lines can be erected from 1′ to 13′ in plan to similar lines in elevation, as shown from 1° to 13°, although this is not necessary in developing the pattern.

For the pattern shape for the horizontal molding take the girth of the section H or H^1 and place it on the line L M in Fig. 34, at right angles to which, from the various points, draw lines as shown. Erect at pleasure any vertical line, as L M in Fig. 33, from which take the various distances to points 1′ to 13′, and place them on similar lines in Fig. 34, measuring in each instance from the line L M and obtaining the intersections shown from 1″ to 1‴.

As the horizontal planes 1 2, 3 4, 7 8 and 10 11 in section H in Fig. 33 are represented by similar arcs of circles in plan, these arcs can be transferred to the pattern, as follows: With radius equal to J 1′ in plan, and 1″ and 2′, in Fig. 34 as centers, describe arcs intersecting each other at *a;* then using *a* as center describe the arc 1″ 2′. Using 3′ and 4′ as centers, and with radius equal to J 4′ in plan Fig. 33, describe arcs intersecting at *b* in Fig. 34; with *b* as center, using the same radius, describe the arc 3′ 4′.

Using radius J 7′ in plan in Fig. 33 and with 7′ and 8′ in Fig. 34 as centers, describe the arcs *c;* with the same radius, and *c* as center, draw the arc 7′ 8′.

Using 10′ and 11′ as centers, and J 10′ in plan in Fig. 33 as radius, describe

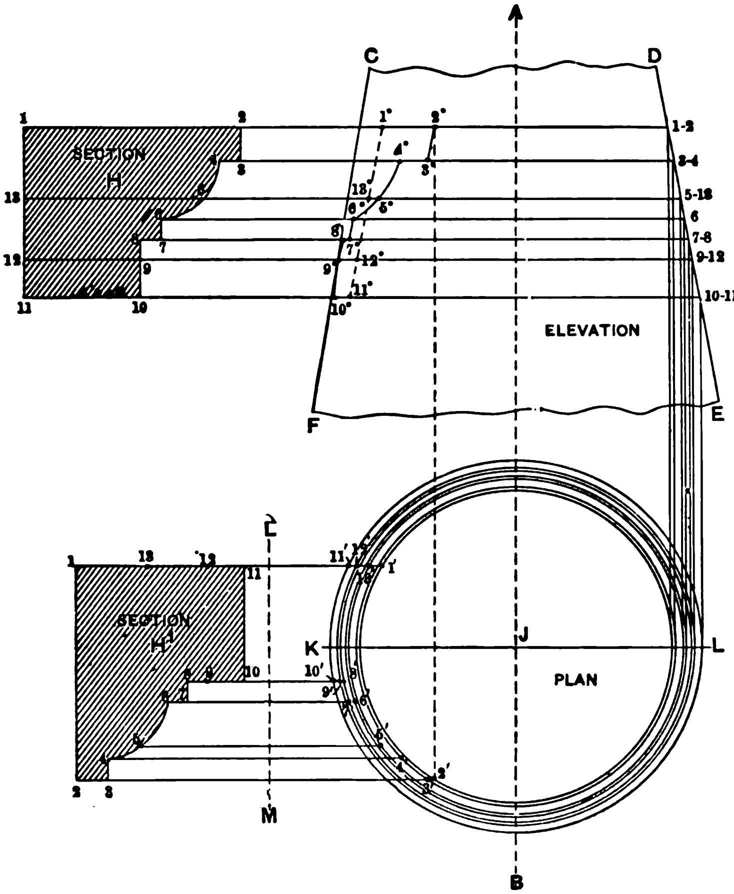


Fig. 33. Preparation for Developing Pattern

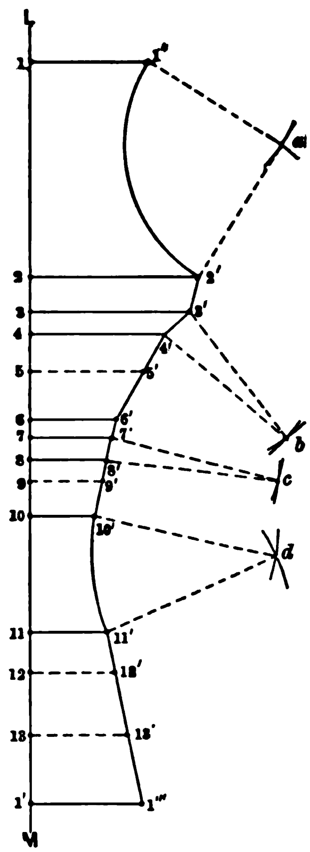


Fig. 34. Pattern Developed

the arc 10′ 11′ in Fig. 34. Connect the various points as shown, which completes the pattern.

CORNICE RETURN CONFORMING TO ROOF PITCH

A vexing problem that frequently arises in the sheet metal cornice trade relates to making the crown return to the cornice conform to the pitch of the roof. In the majority of cases the roof pitches back from the cornice and the eminently practical method would be to make the return and crown mold of cornice level throughout. Then, after the cornice is set and wall is built up, the framer should lay the roof boards so that the roof will pitch back from the crown mold, or front of the building; and also at the return of cornice, he should build a saddle, creating a valley from the miter of the cornice to the inside line of the wall. It is then an easy matter to lay the roofing, all as indicated in Fig. 35.

It is a fact, though, that the framer often neglects to provide this saddle, and the roofer, finding that the crown return sticks up at the wall above the roof sheathing and caring little for the appearance of the cornice, squeezes the return out of shape until its flange lies on the roof boards throughout; for his only interest in the matter is to make the connection of his roofing with the cornice. Although it would be possible to guard against this by strict superintendence, occasions arise when, by reason of the design of the building and its structural formation in regard to the steel lookouts and the like, it is necessary to have the return pitch with the roof.

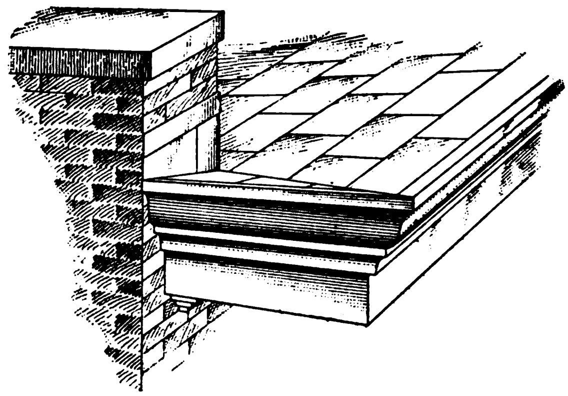


Fig. 35. Roof Pitch and Return of Cornice

In Fig. 36 is shown a method of pitching this return by allowing for a difference in hight of the return at the miter and at the wall line, in the facia members 5 4 J K. The problem is now similar to a raking pediment molding necessitating the ascertaining of the raked profile of the return. This is accomplished by dividing the profile of the crown molding as shown and placing its horizontal distance on any line as A B. This line, with the spaces numbered to correspond with those of the profile, is drawn parallel with the raking lines of the return, as A^1 B^1, and the lines dropped to the raking lines of the same numbers drawn from the profile of the crown O results in the modified profile P.

For the pattern, the stretchout of this profile P is placed on a line M N, which is at a right angle to the lines of the return; the usual parallel lines are drawn through the stretchout points on the line M N and are intersected by lines parallel to M N from the wall line K T and the profile O, which gives the pattern for the part of the return above the fascia member K J 4 5.

Add the fascia member to the pattern by scribing arcs from points 5′ and 5″ equal K J and 5 4 of the fascia. These arcs are intersected by lines drawn parallel to M N from points J and 4. A line joining these points of intersection on the arcs, as R S and from R to 5′ and S to 5″ is the pattern of the fascia member.

The pattern for the drip and planceer of the crown molding 4 to O is not raked and will be an ordinary square miter; hence, for the pattern of that part of the return, draw any line as X Y at right angles to line R S with the spaces 4 to 1 of the molding. Through these points on line X Y and parallel to R S draw lines. At right angles to line A B draw any line as H G and at a distance equal to G 5 on line A B draw a line at right angles to R S indicated by H′ G′. From this line and on lines 3, 2 and 1, place the distance corresponding to G 1, etc., on A B.

A line traced through these points realizes the pattern for the drip of the return.

In most cases the planceer of the return is eliminated for the sake of appearance, obviating a conspicuous overhang for the return. In consequence the planceer of the crown molding from point 1 to 0 is a straight cut and on the return a lap is necessary as shown by the line R G′ in the pattern of the return. The pattern of the crown molding is simply a square return, with the exception of the above mentioned planceer part, and would be obtained by placing the stretchout of profile O on any lines (as H G continued) and dropping lines from points in profile O to similar numbered lines on H G extended. It should be understood that the rest of the cornice, the bed mold, frieze and foot mold, do not enter in this discussion.

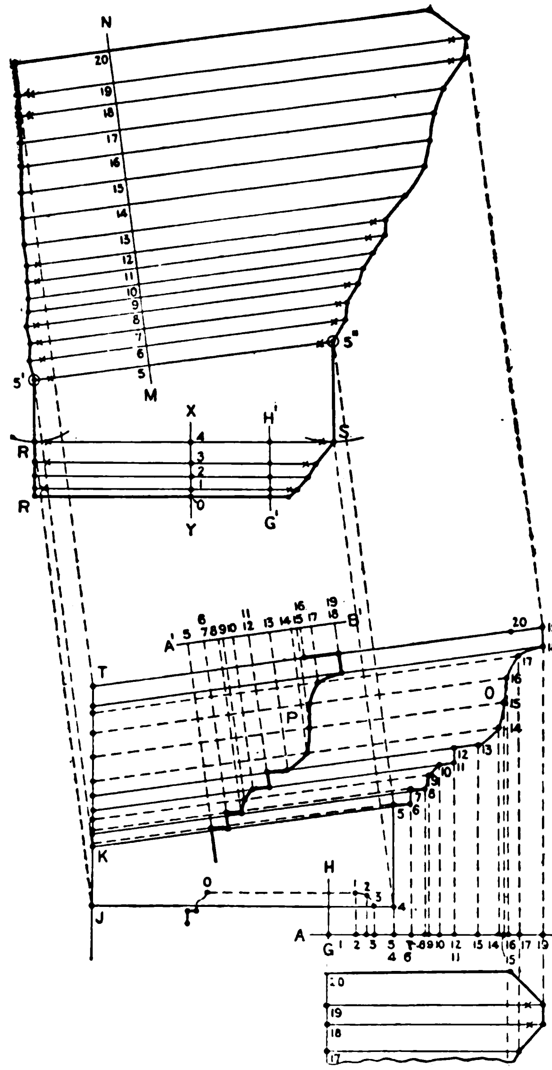


Fig. 36. Pattern for Return of Crown Molding

Should objections be raised to this manner of compensating in one member only and it is still essential to have the return conform to the pitch of the roof, each member of the return may bear the difference proportionally (in the hight of the crown return at the wall and outer edge as 19 of the profile O) by drawing the lines of all the members to a common center. This method was pursued in Fig. 37; and though it must be said that this scheme balances. as it were, the evil, it

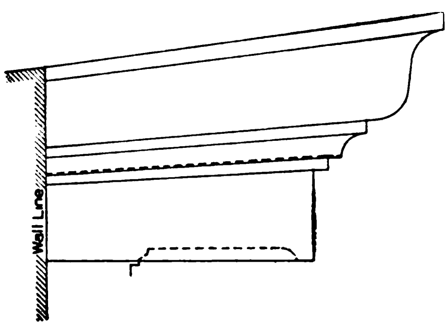


Fig. 37. One Way of Conforming to Roof Pitch

involves an intricate pattern, which apparently must be developed by the triangulation process. The question then comes to mind, would it pay when, as is often the case, the cornice is so high that the mode of compensating would be imperceptible to one on the ground?

PATTERNS FOR AN OCTAGONAL CORNUCOPIA

An exemplification of the methods of obtaining the patterns for an octagonal cornucopia, as shown in elevation and plan in Fig. 38. In working out the pattern in Fig. 39, the plan view will be omitted and the problem solved by a short method, the elevation, a sectional view, and a series of planes taken through the side elevation of the cornucopia only being used.

The first step is to draw a correct side view of the cornucopia, as indicated by 1 11 34 44 and then add the profile of the ornamental finish at the top from 1 to 4° and 44 to 4°. Directly above the side elevation draw the half plan of the ornamental finish, as shown by E^1 F^1 G^1 H^1 J^1, which equal one-half of a true octagon. In a similar manner below the line 11 34 in the side elevation draw the plan of the true opening shown by E. Take a tracing of the half section E and place it on the center line A° B° in the half plan, as shown by the smallest semi-octagon. The from the corners of the largest semioctagon draw lines to the center C.

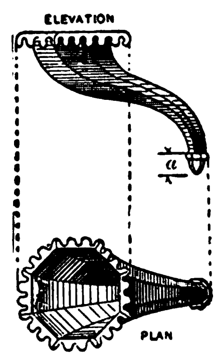


Fig. 38. The Octagonal Cornucopia

The next step is to draw a sectional view through the center of the cornucopia when viewed from the front, and this is done as follows: Extend the upper and lower lines of the cornucopia, as shown by 44 *a* and 34 *k*, at right angles to which draw the vertical line A B. As the top and bottom of the cornucopia are true octagons the widths through the front view will be similar to the widths in the side elevation. Therefore, measuring from the point C in the half plan, take the distance from C to *k* and C to *a*, and place them, measuring from the center line A B, from B to *k* and *k*°, and from A to *a* and *a*°, respectively, and then draw graceful curves from *a* to *k* and *a*° to *k*°. In practice it is necessary to draw only one-half sectional view. Next establish a series of planes through the side elevation by dividing the outline 1 to 11 into any desired number of spaces, and in a similar manner divide the outline from 34 to 44 into the same number of spaces. Connect opposite points as from 2 to 43, 3 to 42, 4 to 41, etc., down to 10 to 35.

On these planes true sections must be found, as shown in the half plan, which are obtained as follows: Bisect each plane in the side elevation as by the points *a, b, c, d, e, f, g, h, i, j* and *k*, from which horizontal lines are drawn through the sectional view cutting the curve *a k*, as shown by similar letters. For example, to obtain the true section on the line 5 40 in the side elevation take the distances from *e*, which is the bisecting point of 5 40, to 5 and 40, and place it on the line A° B° in the half plan, as shown from C to 5′ and C to 40′. From 5′ and 40′ at right angles to A° B°, erect lines cutting the miter lines at 5 and 40 respectively. Measuring from the center line A B in the sectional view, take the distance to joint *e*, which represents the half depth through *e* in the side elevation, and place it as shown from C to *e*, on the center line, erected from C in the half plan, and through *e* parallel to A° B° draw a line intersecting the miter line at 18 and 27. Draw lines from 18 to 5 and 27 to 40. Then will 5′ 5 18 27 40 40′ be the true half section on the plane 5 40 in side elevation. In this manner are all of the semisections obtained on the various planes in the side elevation, as shown by similar numbers in the half plan.

All of the true sections having been obtained, the miter lines 12 22 and 23 33 in the side elevation must be found as follows: Measuring from the center line erected from C in the half plan take the distance from *a* to 22 and *a* to 23 and place it in the side elevation, measuring from the point *a* and obtain points 22 and 23. In a similar manner measuring from *b* in the half plan take the distances to points 21 and 24 and place them in the side elevation from *b* to 21 and *b* 24. In this manner all of the points from 21 to 12 and 24 to 33 are obtained, after which a line is traced through points thus found as shown from 12 to 22 and 23 to 33, which represents the miter line or line of joint. Connect opposite points by means of dotted lines as shown from 2 to 22 to 24 to 42, etc. The semisections in the half plan show the true lengths of similar numbered solid lines in the side elevation, but the true lengths of the dotted lines in the side elevation must first be found. For example, there will be shown how to obtain the true length of the dotted line 27 39 in the side elevations, and when this is understood the balance of the dotted lines can be easily obtained. Take the length of 27 39 in F in the side elevation, and place it in diagram K on the line A^{v} B^{v} from 27′ to 39′. At right angles to A^{v} B^{v} from points 27′ and 39′ erect lines, making 27′ 27 and 39′ 39 equal respectively to the vertical distances obtained in the half plan, measuring from the line A° B° to points 27 and 39. A line drawn from 27 to 39 in diagram K will be the true length of the line 27 39 in the side elevation. In this manner all of the true lengths on dotted lines in F in elevation are obtained, as shown in diagram K. The true lengths of the dotted lines in G and H, are obtained in a similar manner, as shown in diagram N, the various sections being erected from the line A^{p} B^{p}.

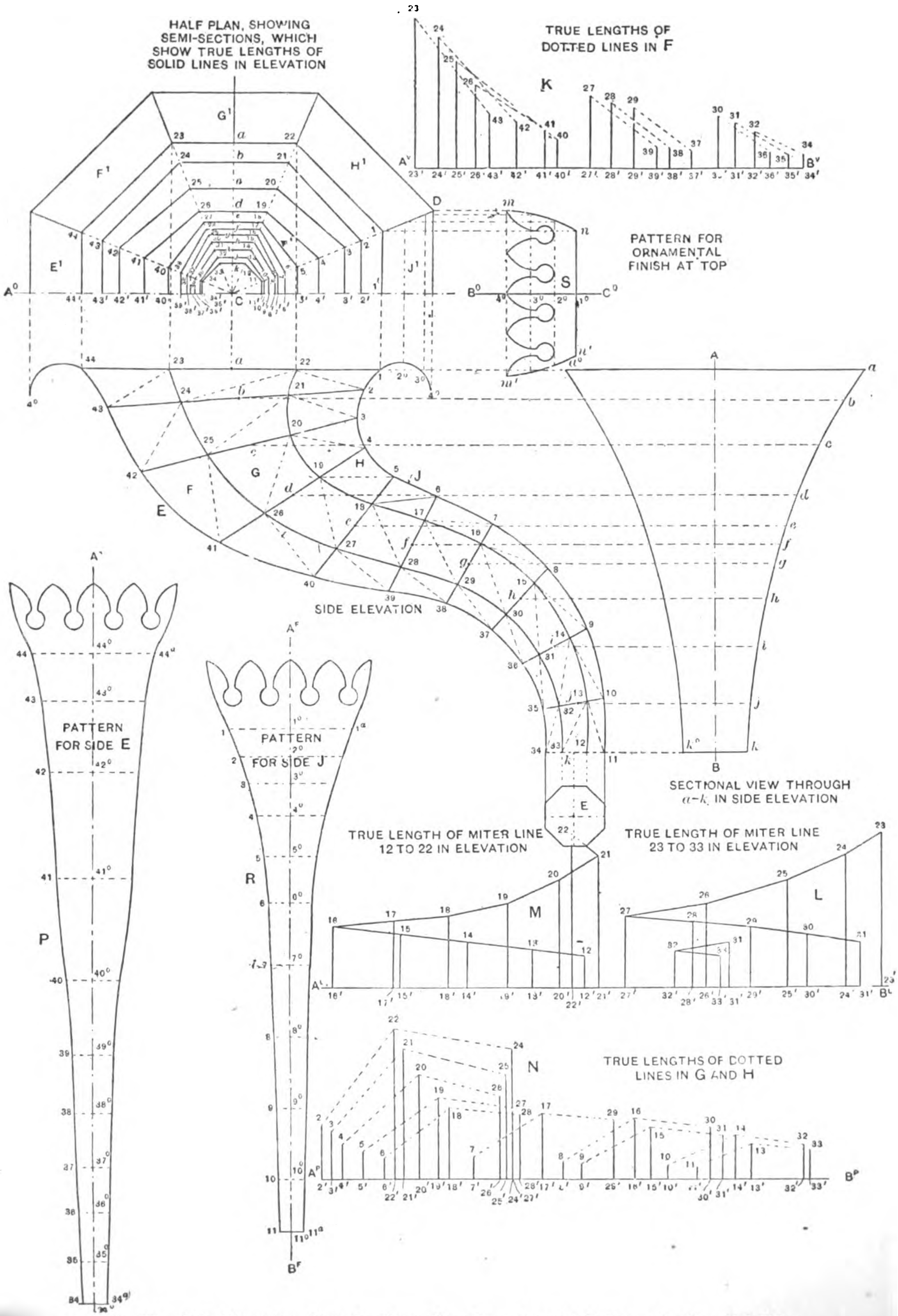


Fig. 39. Side Elevation, True Sections, True Lengths and Patterns for Parallel Sides

When the pattern for the lower piece of the cornucopia E in the side elevation is developed, as shown by P, the miter cut from 34 to 44 will give the true edge line for the lower part of the piece F in the side elevation. In a similar manner, when the upper part J in the side elevation is developed as shown by R, the miter cut from 1 to 11 will give the true edge line for the upper part of the piece H in the side elevation. It now becomes necessary to find the true lengths on the miter lines 12 22 and 23 33 in the side elevation as follows: Take the distances from 12 to 13, 13 to 14, 14 to 15 to 16 to 17 to 18 to 19 to 20 to 21 to 22 and place on the line A^1 B^1 in diagram M, as shown by similar numbers 12′ to 13′, to 14′ to 15′, etc., placing one over another so as to save space. At right angles to A^1 B^1 from the various small figures vertical lines are erected, equal to the various vertical hights of similar numbered points in the semisections in the half plan. For example, the hights, 12′ 12, 13′ 13, 14′ 14 in diagram M, are equal to the vertical distances, measured from the line A° B° in the half plan to points 12, 13 and 14. Lines drawn from points 12 to 13 to 14 in M give the true length of part of the miter line 12, 13 and 14 in the side elevation. The true length of the miter line from 23 to 33 in the side elevation, is obtained in a similar manner as shown in diagram L by similar numbers.

The necessary true lengths having been obtained, the patterns are now in order. The first pattern to be developed is that of the ornamental finish at the top. Divide the profile of the finish from 1 to 4° in the side elevation into equal spaces, and erect perpendicular lines until they cut the miter line 1 D. Extend the center line A° B° as B° C°, upon which place the girth of 1 4° in the side elevation, from 1° to 4° on the line B° C°. At right angles to 1° 4° through the small figures draw perpendicular lines and intersect them by lines drawn parallel to B° C° from similar intersections on the miter line 1 D. A line traced through points thus obtained will be the miter cut for an octagon bevel. Reverse this cut *m n* opposite the center line B° C° and obtain *m′ n′*. Then *m m′ n′ n* will be the pattern for the upper finish, which will be added to all patterns. At pleasure between the points *m* and *m′* draw any ornamental design such as the one shown.

For the pattern for the top J in the side elevation, take the girth from 1 to 11 and place it as shown by similar numbers 1° to 11° on any vertical line A^f B^f, at right angles to which through the small figures draw lines indefinitely. Measuring from the center line A° B° in the half plan, take the various distances to points 1 to 11 on the miter line C D and place them on similar numbered line in the pattern for the side J, measuring in each instance from and on either side of the line A^f B^f. Trace a line through points thus obtained. Then will 1 11 11^a 1^a be the pattern for the upper side J in the side elevation or J^1 in the half plan. Take a tracing of the ornamental finish S and place it to the pattern R as shown. In a similar manner obtain the pattern for the lower side E in the side elevation. Take the girth of all the spaces between 34 and 44, and place them on any vertical line A^x B^x as shown by similar numbers from 34° to 44°, through which points at right angles to A^x B^x, draw lines indefinitely. Measuring from the line A° B° in the half plan, take the various distances to similar numbers 34 to 44 on the miter line, and place them on either side of A^x B^x on similar numbered lines as shown. A line traced

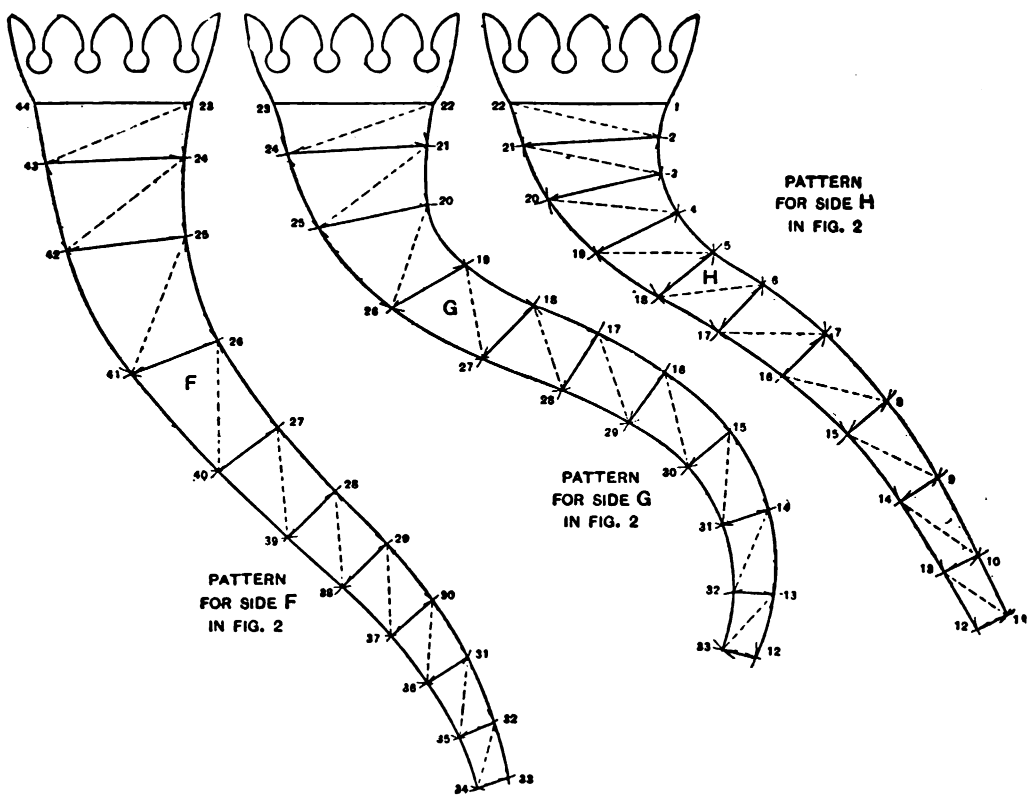


Fig. 40. Pattern Shapes for Three Sides of an Octagonal Cornucopia

through points thus obtained as shown by 34, 44, 44^a, 34^a will be the desired pattern, to which the ornamental finish is added.

As before mentioned, the miter cuts on both patterns P and R are used in developing, by triangulation, the patterns for the sides F and H, respectively, in the side elevation. The patterns for the three sides shown by F, G and H in the side elevation, or F^1, G^1 and H^1 in the half plan, are shown in Fig. 40. The method of developing the pattern F will be explained, then the same method can be applied to the patterns G and H. In developing the pattern for side F in side elevation in Fig. 39 it should be remembered that the true lengths of the solid lines in elevation are given in the half plan; the true lengths of the dotted lines in F are shown in the diagram K; the true length of the miter line 23 33 in the side elevation is shown in diagram L, and the true edge line along 34 44 in the side elevation is found along the miter cut 34 44 in the pattern P. Proceed with the pattern for side F as follows: Take the distance of 23 44 in the half plan and place it as shown by 23 44 in F in Fig. 40. With a radius equal to the distance 44 43 in the miter cut in the pattern P and 44 in the pattern F in Fig. 40 as center, describe the arc 43, which intersect by another arc struck from 23 as center and 23 43 in diagram K in Fig. 39 as radius. Then with 23 24 in diagram L as radius and 23 in F in Fig 40 as center, describe the arc 24, which intersect by an arc struck from 43 as center and 43 24 in the half plan in Fig 39 as radius. Proceed in this manner, using alternately first the proper division on the miter cut in pattern P, then the proper numbered slant line in diagram K, the proper numbered slant line in diagram L, then the proper numbered line in the half plan, until the line 33 34 in F in Fig. 40 has been obtained. A line traced through points thus obtained, with the ornamental finish added, will be the pattern for the side F in Fig. 39.

In obtaining the pattern G in Fig 40, the divisions from 23 to 33 are obtained from the miter cut 23 to 33 in pattern F. The length of the solid lines in pattern G are obtained from the half plan in Fig 39, and the lengths of the dotted lines for pattern G in Fig. 40 are obtained from diagram N in Fig. 39; the outer edge line from 12 to 22 in the pattern G in Fig. 40 is obtained from diagram M in Fig. 39. When developing the pattern H in Fig. 40, the edge line from 12 to 22 is obtained from 12 to 22 in pattern G, while the true lengths of the solid and dotted lines in pattern H are obtained from diagram N in Fig. 39 for the dotted lines and from the half plan for the solid lines. The edge line from 1 to 11 in the pattern H in Fig. 40 is obtained from the miter cut from 1 to 11 in R in Fig 39. Edges must be allowed on all patterns for soldering purpose.

The small octagonal acorn shown at the bottom of the cornucopia at *a* in Fig. 38 is developed the same as an ordinary octagon miter.

PATTERN FOR MULLION INTERSECTING GABLE MOLD

An interesting problem in projection and development is given in the accompanying illustration, that of a mullion intersecting a gable mold. In Fig. 41 let A B C represent the angle of the gable mold, D being the profile at right angles to the rake. In its proper position place the profile of the mullion mold E, the lower part of the mold from 2 to 8 being similar to similar numbers in the profile of the gable mold D. The wash or water table from 2 to 8° in E can be drawn at any

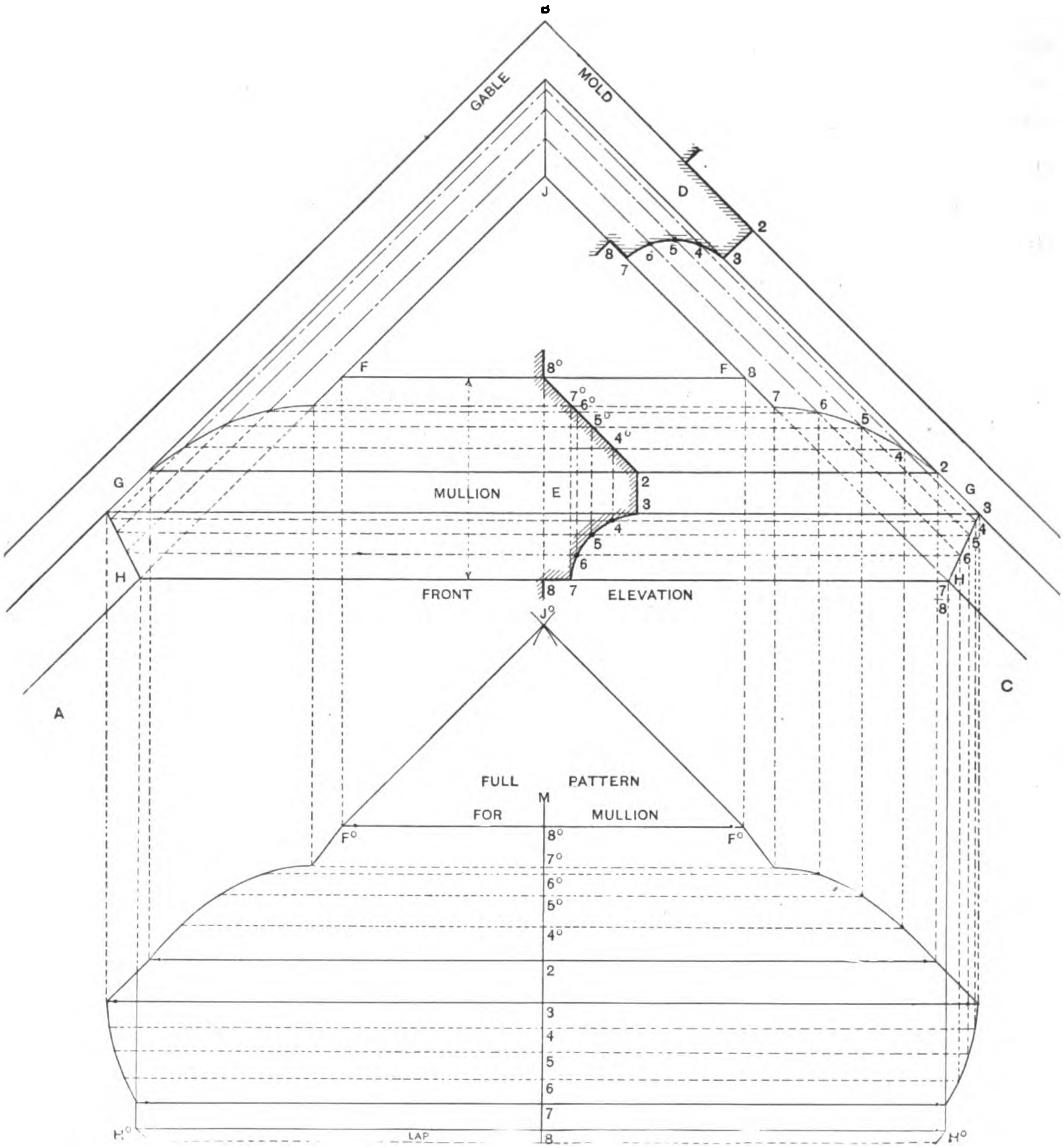


Fig. 41. Elevation, Profile, Miter Lines and Patterns

angle, being careful, however, that the point 8° is vertically above the point 8 as shown.

Divide the profiles D and E into similar number of parts as shown from 2 to 8. Through the points in the profile D, draw lines parallel to the gable mold indefinitely as shown. Through the points in the profile E erect vertical lines from 4 to 8 until they intersect the wash from 4° to 8°. Then from the various intersections in the profile E draw horizontal lines until they intersect the lines drawn from the profile D in the gable mold, thus obtaining the points of intersections from 8 to 2 to 3 to 8, the miter line being shown traced by F G H. While both miter lines are here shown, it is only necessary to draw one-half in practice.

Having obtained the miter line, the pattern for the mullion is obtained as follows: Extend the center line of the gable as M L, upon which place the girth of the profile E from 8° to 2 to 8, being careful to measure each space separately, as they are all unequal as shown by similar numbers on M L. Through these points at right angles to M L draw lines, which intersect by lines drawn from similar numbers on the miter line F G H at right angles to H H. Trace a line through points thus obtained, then will H° F° F° H° be the full pattern for the mullion.

If it is desired to add the triangular face to the pattern shown by F J F in elevation, then use as radius the distance F J, and with F° and F° in the pattern as centers, describe arcs intersecting each other at J°. Draw lines from F° to J° to F°, which completes the pattern.

INTERSECTION OF HORIZONTAL WITH INCLINED DISSIMILAR MOLDING

This is the solution of the above problem which in Fig. 42 is represented the elevation of the moldings and indicating the inclined or gable molding by A B C D E F and the horizontal molding by G H J K. The profile of the gable molding is shown at X, and of the horizontal molding at Z. The pattern required is for the miter at G J or H K. In Fig. 43, part of the elevation in Fig. 42 is shown and enlarged. In this figure A B F E represents the inclined molding, the profile of which is shown at X. G H K J represents the horizontal molding and Z is the profile. To obtain the pattern G H J K where joints A B F E at G J, it is only necessary to acquire the miter line G J, when the pattern can be described in the usual manner.

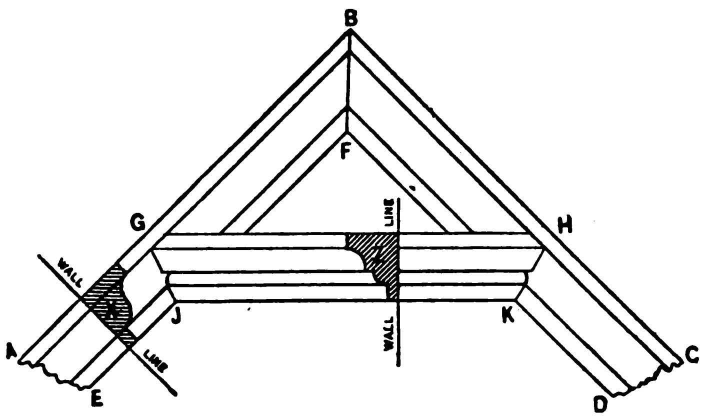


Fig. 42. Elevation of Inclined and Horizontal Moldings

In Fig. 43, 2 to 5 of the profile X miters with 2 to 5 of profile Z, and these two shapes are alike. From 5 to 9 of profile X miters with 5 to 9 of profile Z, and these two shapes are different. To obtain the miter line G J, proceed as follows: On the

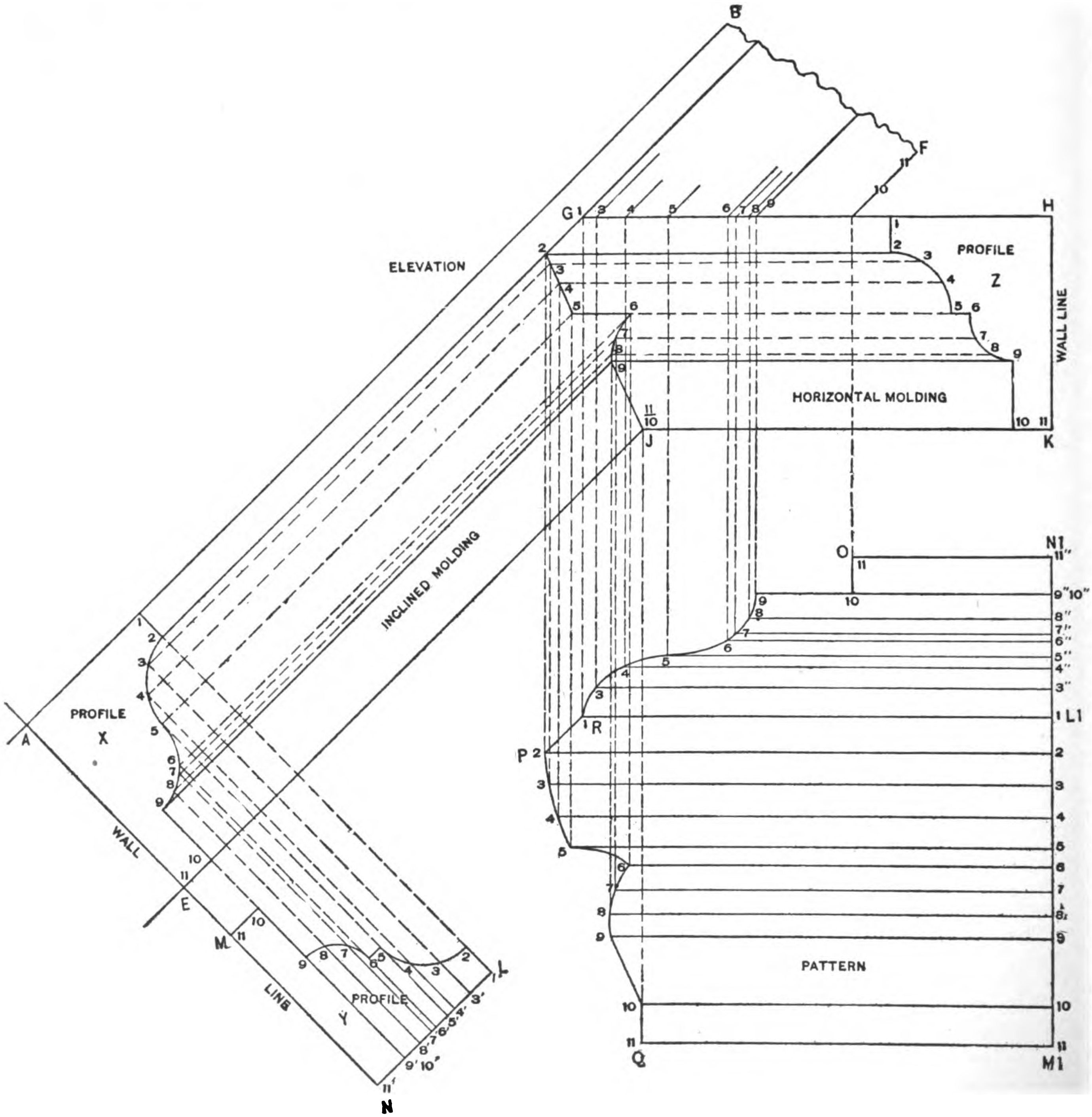


Fig. 43. The Intersection and Pattern

wall line A E extended, as M N, draw a duplicate of profile Z as shown. Divide the profiles Y and Z into the same number of parts, as indicated by small figures in each. From the divisions in profile Y carry lines parallel with the wall line A N, cutting the face of the profile X, and also carry the lines through profile Y, cutting L N, as shown by the small figures 1′ to 11′. With the T-square parallel with the lines of the inclined molding, as A B, carry lines from the points in profile X, extending them in the direction of B F. Also draw lines from the points in profile Z, cutting lines of similar numbers drawn from profile X. A line traced through these points of intersection, as shown by G J, will be the miter line.

For the pattern of the horizontal molding proceed as follows: At right angles to the horizontal molding, as on H K extended lay off a stretchout of N L M of profile Y, as shown by the points in N 1 M 1, in which N 1 to L 1 are the points in N L of the profile. Thus the distance L 1 3″ of stretchout is equal to L 3′ of profile. L 1 of 4″ of stretchout is equal to L 4′ of profile, etc. With the T-square at right angles to the stretchout line N 1 M 1 draw the measuring lines, in this case extending them to the left indefinitely. With the T-square parallel with the stretchout line M 1 N 1, drop lines from the points in G H of horizontal molding to lines of similar numbers drawn at right angles to N 1 L 1. A line traced through these points of intersections, as shown from O. to R of pattern, will give the shape of pattern for the top of molding.

In a similar manner drop lines from the points in G J to lines of corresponding number drawn at right angles to L 1 M 1, when a line drawn through the points of intersection, as shown by R P Q, will form the remaining part of pattern.

PATTERN FOR A BROKEN SHAFT

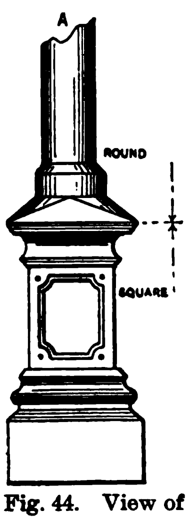


Fig. 44. View of Shaft

The following will describe how to cut the pattern for a monument of sheet metal representing a broken shaft, a sketch of which is presented in Fig. 44, A being the shaft resting upon a square base. In Fig. 45 let A B C D be the elevation of the broken shaft and E the plan. Divide the half plan into equal parts, as shown on the small figures 1 to 7. Through these divisions and parallel to the shaft A D drop lines until they intersect the center line in plan and erect perpendiculars intersecting the break A B, as shown by the small figures on A B.

For the pattern proceed as follows: In the line with D C draw any line, as F H, upon which place the stretchout of the plan E, as shown by the small figures 1 to 1. At right angles to F H and from the small figures erect perpendiculars, which intersect with lines of corresponding number drawn from A B of the elevation. Trace a line through the points thus obtained, as K J and F H J K will be the pattern for the broken shaft.

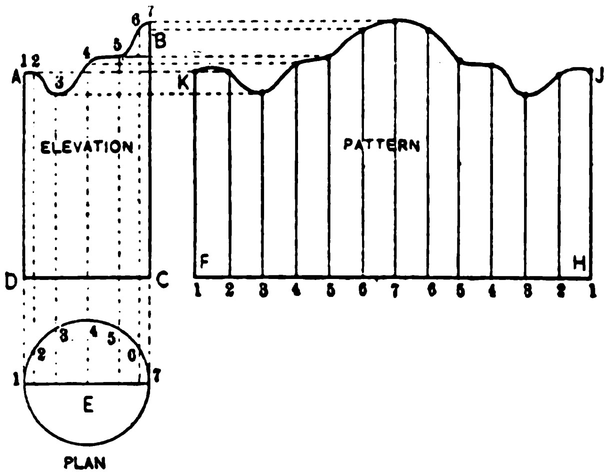


Fig. 45. Plan, Elevation and Pattern

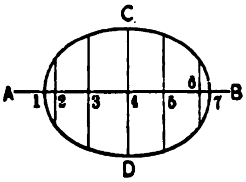


Fig. 46. Pattern of Head

For the pattern for the cover to close the broken part of shaft draw any line, as A B in Fig. 46, upon which place the stretchout of the break A B in Fig. 45. When taking the stretchout of the curve in A B in Fig. 45, and of the space from 3 to 4, it will be seen that the latter does not run in a straight line but is more or less curved; therefore make two divisions of this space and transfer them to 3 to 4 on A B of Fig. 46, as shown, the subdivision not being indicated on the stretchout line. Through these small figures and at right angles to A B draw vertical lines, as shown. Now, measuring in each instance from the line 1 to 7 in the plan E of Fig. 45, take the various distances to the small figures 2, 3, 4, 5 and 6 on the semicircle and place these distances on lines of similar numbers in Fig. 46, measuring in each instance above and below the line A B. Trace a line through the points thus obtained and C D will be the desired pattern.

PATTERN FOR HALF ROUND BRACKET STAND

To draw a pattern for the half round stand which is to be made in six pieces and to be set at an angle, as indicated by A B C in Fig. 47, proceed as follows: As the article is to be made in six pieces, placed in a half circle, draw any horizontal line, as D O^1, as the center line of the plan. Drop lines from the extreme points of the profile, as X and B, intersecting the horizontal line at D and O^1. Now with O^1 as center and O^1 D as radius draw a quarter circle (shown dotted) intersecting a line dropped from O^1 at P^1. Divide the quarter circle, P^1 D into three equal parts, as shown by Ha nd G. Draw the lines D H, H G and G P^1 forming the sides of the bracket in plan. At right angles to A B in profile and from the point C drop a line, intersecting D O^1 at E. Then will E be the point to which all miter lines in plan will be drawn. Thus from the point E draw lines to H and

G. As the side of the stand shown in plan by G P^1 butts against a plain surface oblique in elevation, the miter line shown by F X E in plan must first be found from which to obtain the pattern.

To do this proceed as follows: It should be understood that the profile shown by A B C is a profile on the miter line D E in plan and is not a profile at right

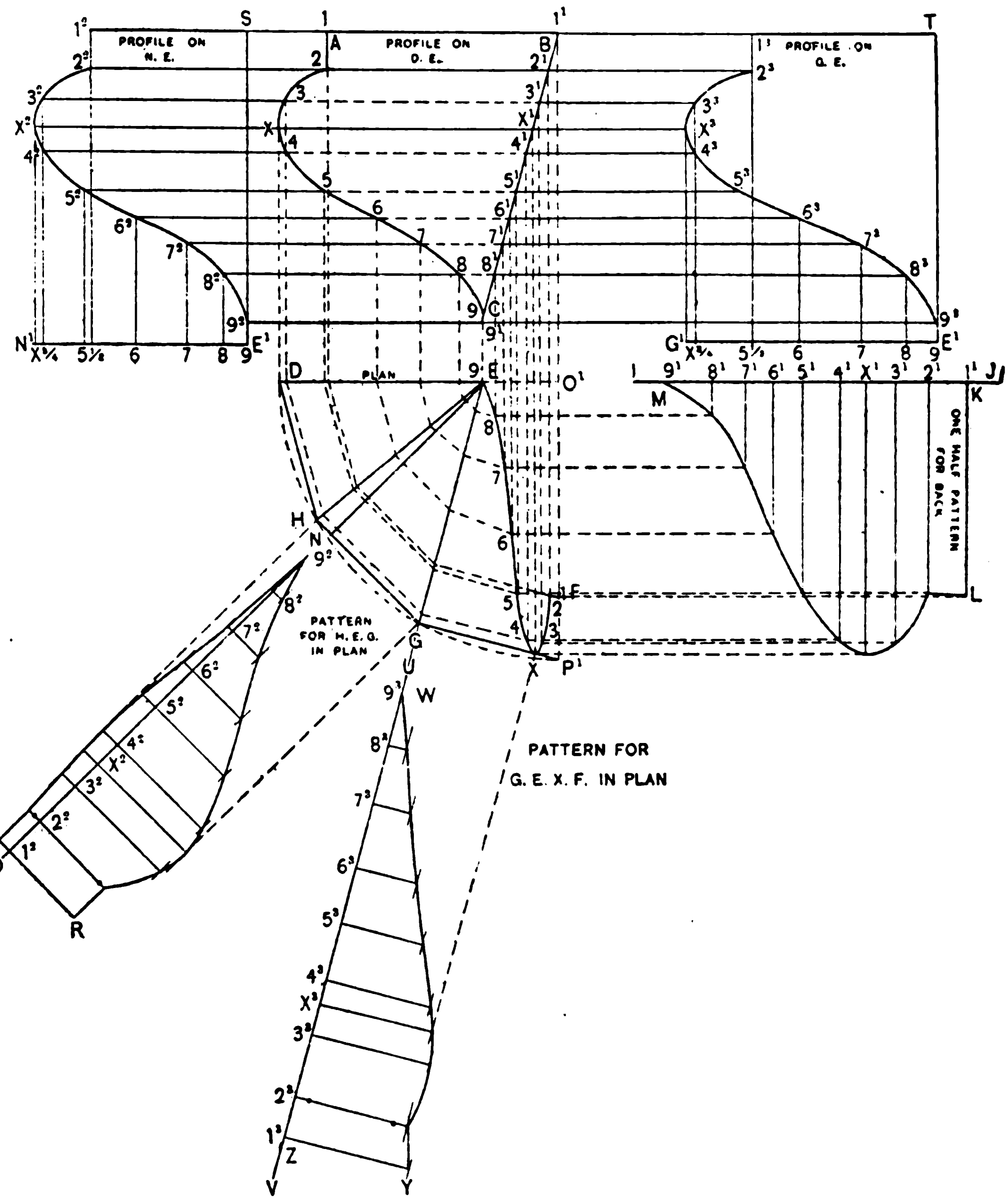


Fig. 47. Plan, Profiles and Pattern

angles to the line of the molding. If, however, a profile was given at right angles to the line of molding, the same principles would be employed. Divide the profile shown from A to C into any number of spaces, as shown by the small figures 1 to

9. At right angles to A B and from these points draw lines, with which intersect the line D E, as shown. From the intersections on the line D E draw lines parallel to D H intersecting the miter line H E, as shown. In the same manner, from the intersections on H E draw lines parallel to H G intersecting the miter line G E.

Now parallel to A B in profile and from the intersections in A C draw lines, as shown, intersecting the slant line B C, as shown by 1^1, 2^1, 3^1, etc. At right angles to A B and from the intersections on B C drop lines intersecting those of similar numbers drawn from the intersections on the miter line G E parallel to G P^1. A line traced through the points thus obtained, as F 1 2 3 X 5 6 7 8 9, will represent the miter line in plan, showing the intersection between the side G P^1 and the slant line B C in elevation. It will now be necessary to obtain true profiles at right angles to the lines of the moldings, to be used for obtaining the stretchouts in the development of the several patterns. At right angles to G P^1 and from the point E draw a line, which in this case happens to coincide with the miter line G E. In the same manner, at right angles to H G and from the point E draw the line N E. Now through the small figures in the profile A C draw lines right and left indefinitely parallel to A B. Take a duplicate of the line N E in plan, with the various intersections numbered to correspond to the various intersections on the profile A C, and place it, as shown by N^1 E^1, parallel to the lines previously drawn. At right angles to N^1 E^1, and from intersections on it draw lines intersecting those of similar numbers drawn from the profile A C. Trace a line through the points thus obtained, as shown. Then will 1^2 X^2 9^2 represent the profile on the line N E in plan. In the same manner take a tracing of G E in plan with the various intersections on it as before described and place it as shown by G^1 E^1. At right angles to G^1 E^1 and through the figures draw lines intersecting those of similar numbers drawn from the profile A C. Trace a line through the intersections thus obtained and 1^3 X^3 9^3 will be the profile on the line G E. For the pattern for that part of the stand shown in plan H E G proceed as follows: At right angles to G H in plan draw the line N O, upon which place the stretchout of the profile on N E, transferring each and every space separately, as shown by the small figures on the line N O. At right angles to N O and through the small figures draw lines which intersect with lines not shown of similar numbers drawn from the miter lines H E and G E. Lines traced through these points, as shown by P N and R N, will represent the pattern of the part H E G. For the pattern for the part shown in plan G E X F proceed in the manner as before described. At right angles to G X draw the stretchout line U V, upon which place the stretchout of the profile on G E. At right angles to U V and through the small figures draw lines, which intersect with lines not shown of similar numbers drawn at right angles to G X from the intersections on the miter line E X F. Trace a line through the points thus obtained and W Z Y will be the pattern for G E X F. It will be noticed that one side of W Z of the pattern is straight, because the miter line G E in plan is at right angles to X G.

For the profile and pattern for D E H in plan proceed in the manner described in connection with the piece H G E. For the pattern for the back, shown in profile by B C, proceed as follows: Draw any horizontal line, I J, at right angles to O^1 P^1, upon which place a tracing of B C and the various intersections on it, as shown by M K. At right angles to I J and through the small figures draw lines, which intersect with lines of similar numbers drawn from the miter line E X F at right angles to O^1 P^1. A line traced through the points of intersection thus obtained, as shown by M L K, will be one-half the pattern for the back. The other half can be traced opposite the line M K.

MITERS OF MOLDINGS OF DIFFERENT PROJECTION

When a molding of given profile is to miter, at any angle, to a similar molding that has a different projection the method of procedure is as follows: Assuming that M is the given profile as indicated by Fig. 48, and that the wall line has

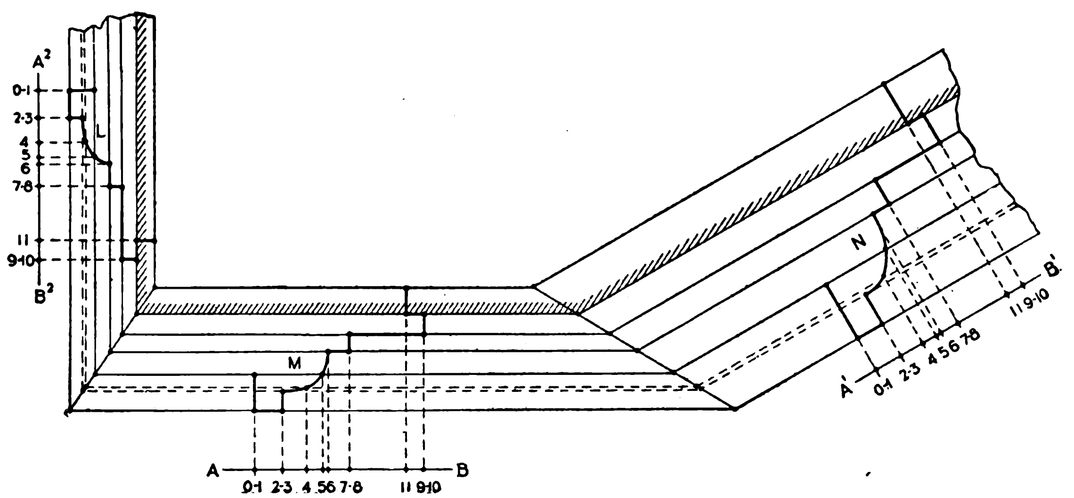


Fig. 48. Plan, True and Modified Profiles

the angles as shown by the cross hatched line; also that the given projections of the two arms of the molding are as shown by the outer line. By drawing a line through the points of intersection of the outer lines and the wall lines the miter line is obtained. To these miter lines, lines are drawn from the profile M and from the points of intersection on the miter lines and parallel to the wall lines continued for the two arms of the molding.

The hights 0 1 2 3, etc., of profile M are placed on a line as A B, inasmuch as only the projections vary and not the hights. Place duplicate of line A B at the two arms as A^1 B^1 and A^2 B^2. Projecting these hights to the correct lines in both arms and tracing a line through the points of intersection gives the modified profiles of the arms, as L N.

For the patterns, the stretchouts of L M N would be stepped off on a line drawn at right angles to the wall lines for their respective moldings. The usual lines are drawn through the points on these lines which are intersected by lines drawn parallel to the stretchout lines from the points on the miter lines.

THE PATTERN CUT OF THE WASH OF A PEDIMENT

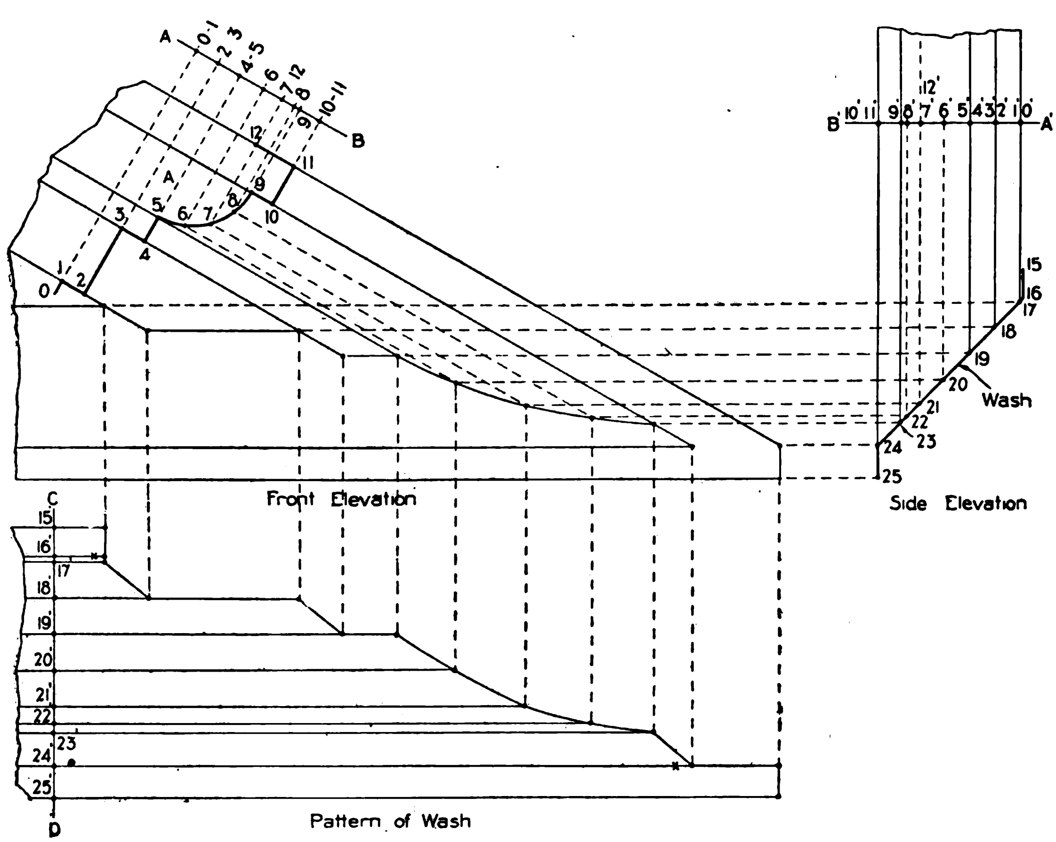


Fig. 49. Elevations and Method of Obtaining Pattern

Though there are many demonstrations of the problems of pediments on a wash, all, apparently, neglect to give the miter cut of the wash. It would immeasureably facilitate the assembling of the pediment and be truer to profile, for it is an easy matter to dress the wash up to the pediment if the pediment was out of shape; whereas, by soldering to the line or cut on the wash it must come to shape accurately. It does not, therefore, seem out of place to exemplify the procedure for acquiring aforesaid cut, even though the principles are explained in many of the problems.

Fig. 49 indicates a pediment of the profile A mitering on a wash the pitch of which is pronounced to better illustrate the problem. The miter line in the front elevation having been obtained by usual process; draw a line B C at right angles to the horizontal lines of the wash, upon which place the distances 15 16 17 18, etc., of the wash in the side elevation. Draw the usual parallel lines through these points which intersect by lines drawn from the front elevation of similar numbers. A line drawn through these points of intersection will give the miter cut of the wash. It is customary to place laps on the wash cut leaving the cut on the pediment sharp.

PATTERN FOR DROP ON FACE OF SPHERE

The following is an exemplification of the method of obtaining the pattern for the drop A in the accompanying illustration, Fig. 50, and the return strip mitering against the sphere. A B C represents the half sphere, a half plan of which is shown by D E F, H I J shows the projection of the drop around the sphere in plan. Bisect the arcs J I and I H by the points K and L and draw lines from these points to the center X, as shown; then will L^2 K^2 represent one-quarter of the sphere in plan, against which the drop is to miter. From the points L and K in plan and at right angles to H J draw the lines upward intersecting the line A B in elevation at M and N; then within the points M and N construct the drop, as shown by M N O P R. From the points H and J, representing the projection of the drop in plan, and at right angles to H J draw lines intersecting the line A C extended in elevation at U and U^1. Now draw the side view of drop, U T S and U^1 T^1 S^1, the miter line showing the intersection between drop and sphere being omitted in elevation. Having obtained the face of the drop in elevation, the next step is to obtain the line of intersection, or miter line in plan, between the return strip and sphere, for which proceed as follows: Divide one-half the drop shown from O to P into equal spaces, as shown by the small figures 1 to 7; from these points and at right angles to A C drop lines intersecting the arc K 1 in plan at 1, 2, 3, 4, 5, 6, 7, as shown. Now parallel to A C in elevation and from the small figures on the half drop O P draw lines intersecting the curve of the sphere, as shown by the small dots. From these dots on the curve of the sphere and at right angles to A C drop lines intersecting the center line F D in plan at points 1 to 7. Now with X in plan as center and with radii equal to X 1, X 2, X, 3, etc., describe arcs intersecting vertical lines of similar numbers drawn from the divisions in O P. A line traced through the intersections thus obtained, as shown by X^1 W Y Z K, will be miter line between the half drop and sphere. To complete the drop in plan duplicate the line X^1 W K on the opposite side of the center line X^1 1.

For the pattern for the face of the drop proceed as follows: In line with A C draw the line A^1 B^1, upon which place the stretchout of the arc K I in plan, meas-

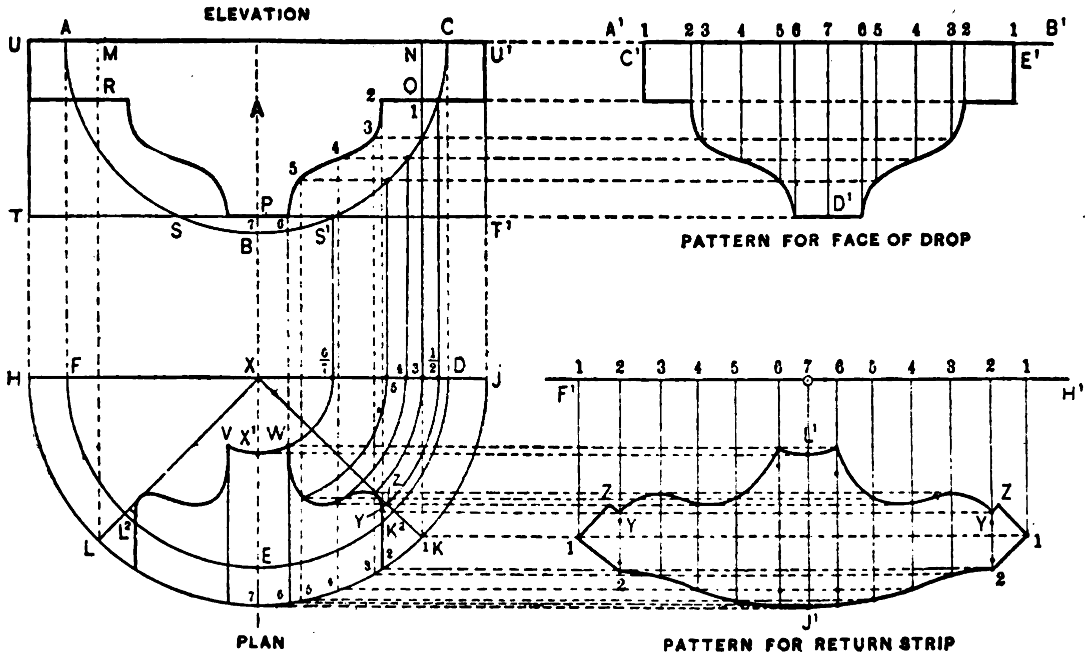


Fig. 50. Method of Obtaining Miter Lines and Pattern

uring each space separate, as shown, from 7 to 1 each way from the center line. Now at right angles to A^1 B^1 and from the small figures draw lines, which intersect with those of similar numbers drawn from the points on O P at right angles to U^1 T^1. A line traced through the points of intersections thus obtained, as shown by C^1 D^1 E^1, will be the pattern for the face of the drop, of which four will be required to inclose the sphere.

For the pattern for the return strip for one of the drops draw any horizontal line, as F^1 H^1, upon which place the stretchout of the half drop 1 to 7 in elevation, measuring on either side of the point 7 on the line F^1 H^1. Now at right angles from

F^1 H^1 and from the small figures draw lines, which intersect with those of similar numbers drawn from the intersections on the line K I and the miter line X^1 W K at right angles to X I. Lines traced through the points of intersection, as shown by 1 Y L^1 1 and 1 2 J^1 2 1, will complete the pattern.

PATTERN FOR A MITER AT DIFFERENT ANGLES

The following deals with the method of developing the pattern of the adjacent miters to the triangle H N G in the plan of Fig. 51. A B C D is the elevation of the article, E F G H J the plan of the base, and K L M N the plan of the top, the miter line in elevation, corresponding with the line N G in plan, being omitted, as

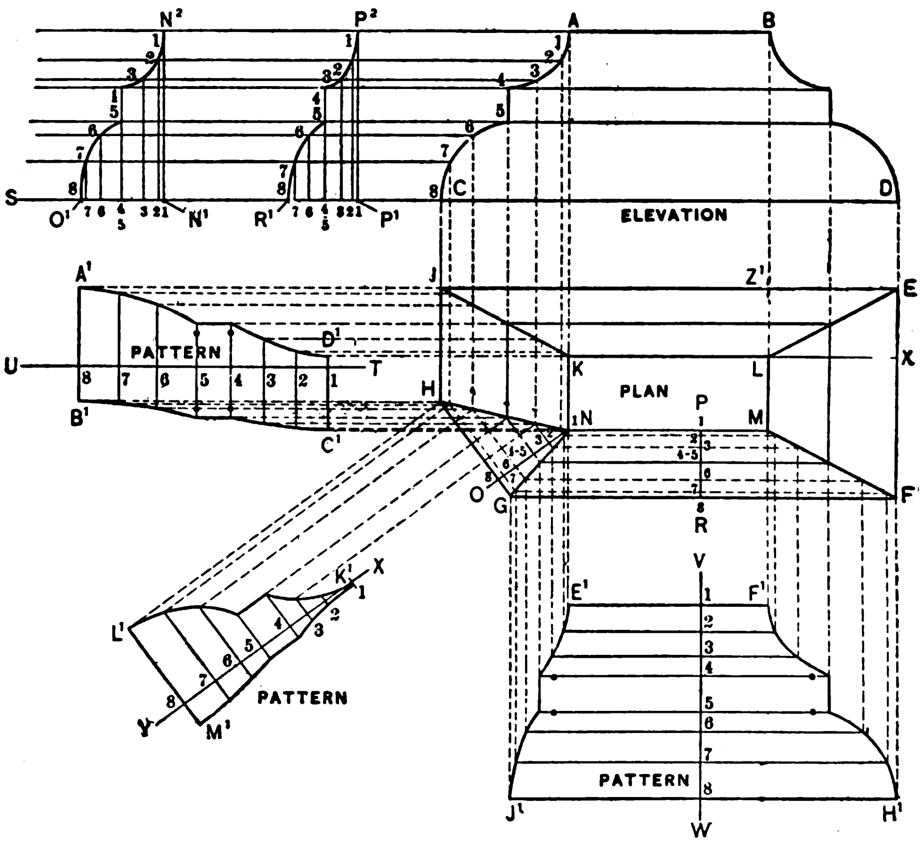


Fig. 51. Plan, Elevation, Profiles and Patterns

unnecessary on the development of the patterns. As every side has a different projection in plan, it will be necessary to obtain profiles for the various sides from which to obtain the stretchout for the developement of the patterns. Divide the profile A C in elevation, which represents the section on the line Z K in plan, into a number of equal spaces, as shown by the small figures 1 to 8. From these small figures and at right angles to C D draw lines passing through the miter line J K in plan and intersecting the miter line H N. From the points of intersections on the miter line H N and parallel to H G draw lines intersecting the miter line G N; then from these intersections and parallel to G F draw lines intersecting the miter line M F, as shown. Now at right angles to F G and G H draw the lines P R and N O respectively, intersecting the lines drawn from the profile A C. On the line D C in elevation, extended as D S, place a duplicate on the lines P R and N O, including the several points in each, as shown by P^1 R^1 and N^1 O^1 respectively. At right angles to C S and from the various intersections on the lines P^1 R^1 and N^1 O^1 draw lines intersecting those of similar numbers drawn from the profile A C parallel to C D. Trace a line through points of intersections thus obtained, as shown by P^2 R^1 and O^1 N^2 respectively. Then will R^1 P^2 be the section on the line R P in plan and O^1 N^2 be the section on the line O N in plan.

For the pattern for J K N H in plan proceed as follows: At right angle to J H draw the line T U, upon which place the stretchout of the profile A C, as shown by the small figures. At right angles to T U, and through the small figures draw lines, which intersect with those of corresponding numbers drawn at right angles to J H from intersections on the miter lines J K and N H of the plan. Lines traced through intersections thus obtained, as shown by A^1 D^1 and B^1 C^1, will be the pattern for that part shown by J K N H in plan. For the pattern for the triangular part shown by H N G in plan draw at right angles to H G the line X Y, upon which place the stretchout of the profile O^1 N^2, as shown by the small figures. At right angles to X Y and through the small figures draw lines, which intersect with those of similar numbers drawn from the intersections on the miter lines H N and N G of the plan at right angles to H G. Lines traced through the points thus obtained, as shown by K^1 L^1 and K^1 M^1, will be the required pattern.

For the pattern for that part shown by N M F G draw V W at right angles to G F, upon which place the stretchout of the profile R^1 P^2, as shown by the small figures. At right angles to V W and through the small figures draw lines, which intersect with those of similar numbers drawn from the miter lines G N and M F at right angles to G F. Lines traced through points thus obtained, as shown by E^1 J^1 and F^1 H^1, will be the required pattern.

For the pattern for that part shown by M L E F proceed in similar manner, obtaining the stretchout of the profile B D, which is the same as A C, and for the pattern for the part L K J E obtain the stretchout for R^1 P^2 because the projection L Z^1 is equal to P R.

PEDIMENT CHART

The accompanying diagrams and descriptions show a method of laying out pediments of any size, without going to the trouble of drawing full size details. They also show a method of laying out pediments of different lengths, having the same rake and profile, using but one pattern, as indicated in Fig. 53, and the pediment chart shown in Fig. 54. Referring to the diagrams, let Fig. 52 represent a front elevation of a cornice drawn to a scale of ½ inch to the foot, the hight of the cornice being 4 feet, and including the pediment 6 feet 8 inches. There is also shown in Fig. 52 the measurements of the brick piers and window openings, besides the brackets spaced to set over the brick piers, the correct lengths of the pediment and crown moldings returns being given. In this connection it may not be out of place to show how the divisions between the brackets and the lengths of the pediment and crown moldings are determined.

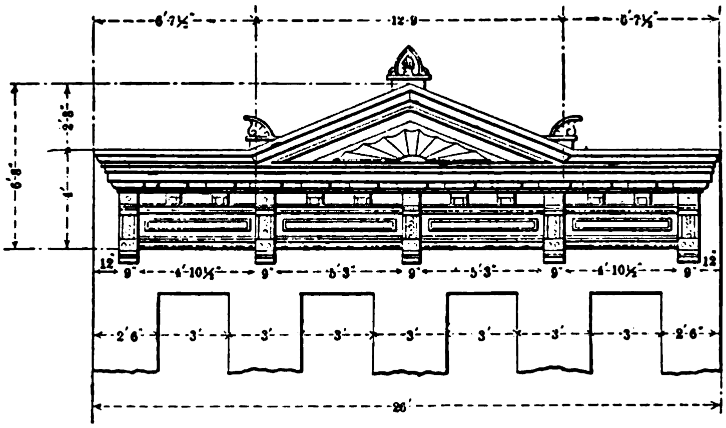


Fig. 52. Front Elevation of Cornice

As shown in Fig. 52, the width of the window openings is 3 feet, the end piers 2 feet 6 inches and the middle piers 3 feet, thus making the total width of the building 26 feet. The width of each of the brackets is 9 inches, and the projection of the cap and crown moldings over the sides of the end brackets on each side is 12 inches.

As shown on the elevation, Fig. 52, the three center brackets are to set over the center of the brick piers, and the two end brackets are to set 12 inches from the line of the wall on each side.

To figure these divisions proceed as follows: Referring to Fig. 52, add the width of the end pier, 2 feet 6 inches, the width of the window opening, 3 feet, and one-half of the second brick pier, which is 1 foot 6 inches, the total of which amounts to 7 feet. Now add the distance that the end brackets sets from the wall line, which is 12 inches, the width of the bracket, 9 inches, and one-half width of the second bracket, which is 4½ inches, and amounts to 2 feet 1½ inches; deduct the 2 feet 1½ inches from the 7 feet before obtained, and there remains 4 feet 10½ inches, which is the distance between the brackets for the two ends of the cornice, as shown. For the two center spaces, add the one-half of the second pier, which is 1 foot 6 inches, the width of the window opening, which is 3 feet, and one-half of the center pier, which is 1 foot 6 inches, the total of which amounts to 6 feet. Now add one-half of the second bracket, which is 4½ inches, the one-half of the center brackets, which is 4½ inches, and amounts to 9 inches; deduct the 9 inches from the 6 feet before obtained, there and remains 5 feet 3 inches, which is the length for the two divisions in the center of the cornice, as shown.

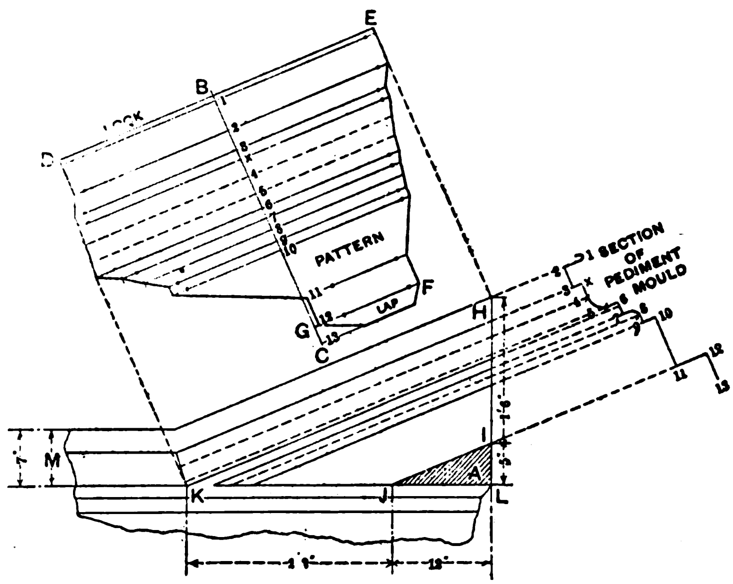


Fig. 53. Enlarged View of Part of Pediment

If these divisions are figured correctly, the total should amount to 26 feet. Now, to obtain the lengths of the pediment and crown moldings, proceed as follows: Referring to Fig. 53 note the intersection K. This intersection K should come plumb over the outside line of the two brackets, as shown by the dotted lines in Fig. 52. Now, by adding the widths of the three center brackets, which amount to 2 feet 3 inches, and the two center divisions, which amount to 10 feet 6 inches, there will be 12 feet 9 inches, which gives the length of the pediment from intersection to intersection, shown by the dotted lines in Fig. 52. For the length of the two end crown moldings add the end space, 4 feet 10½ inches, the width of the bracket, 9 inches, and the space of 12 inches, the total of which amounts to 6 feet 7½ inches, as shown.

Now, if these lengths have been correctly figured the amount should be 26 feet. The panels are usually given 3 inches margin from the side of the brackets; then is each panel 6 inches shorter than the spaces shown between the brackets; the modillions are easily spaced after the brackets are in position. To illustrate the use of the pediment chart shown in Fig. 54, suppose that Fig. 52 is an architect's drawing, from which is to be drawn a full size detail, omitting the full size detail of the pediment and using instead the pediment chart, which is drawn to one-third full size, the chart being drawn full size in practice.

First obtain the bevel of the pediment shown in Fig. 52, as shown by A in Fig. 53, and make the base or horizontal line J L in Fig. 53 12 inches; draw the bevel or slant line J I indefinitely until it intersects the perpendicular line I L, drawn at right angles to J L, as shown. The diagram in Fig. 53 is drawn to a scale of ½ inch to the foot, and shows the hight of the perpendicular line I L to be 5 inches, or in other words, that the one-half pediment shown in Fig. 52 has a rise of 5 inches to every 12 inches of base.

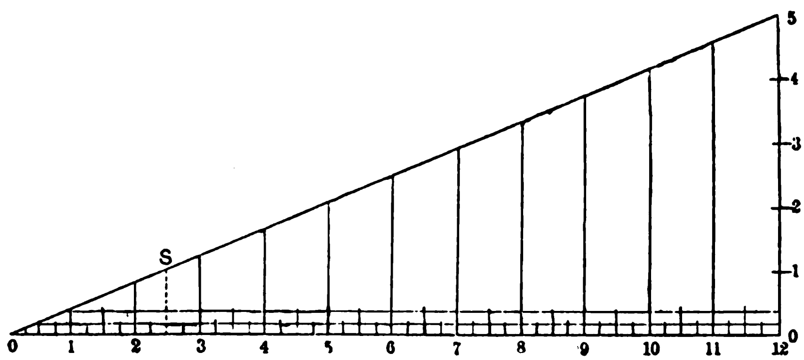


Fig. 54. Pediment Chart

Fig. 54 represents the pediment chart and is an enlarged view of the triangle A in Fig. 53, and shows how the base line J L in Fig. 53 should be divided into quarters, halves and inches. In practice it is not necessary to draw an extra chart as shown in Fig. 54, but make the divisions of inches direct upon the chart, as indicated by A in Fig. 53. The bevel I J L in Fig. 53 being correct, the pattern for the pediment is obtained direct from this bevel in the usual manner, as shown in Fig. 53, and needs no further explanation. In this case the hight of the miter cut H I in Fig. 53 will be 1 foot 6 inches, and the length of the miter cut on the horizontal line K J will be 2 feet 2 inches. Having obtained these measurements in practice, it is now in order to figure out the backgrounds and pediment moldings of any length pediment having the same rake and profile without making any further details, but simply using the chart shown in Fig. 54 and the pattern shown in Fig. 53. The chart, as before explained, should be at A in Fig. 53. Thus, to obtain the sizes of the background and moldings for the pediment shown in Fig. 52, with but 12 inches of detail, proceed as follows: The length of the pediment in Fig. 52 from intersection to intersection is 12 feet 9 inches; the miter cut on the horizontal line from intersection K to J in Fig. 53 is 2 feet 2 inches; twice 2 feet 2 inches is 4 feet 4 inches. Deducting 4 feet 4 inches from 12 feet 9 inches leaves 8 feet 5 inches. One-half of 8 feet 5 inches equal 4 feet 2½ inches, as shown in Fig. 55, and gives the length of one-half of the base of background. The rise of one-half of the pediment is 5 inches to the foot, as shown on the chart in Fig. 54. If 1 foot rises 5 inches, 4 feet will rise 20 inches, and 2½ inches will rise as much as is shown in Fig. 54 where the dotted line intersects the hypotenuse at S, which is

1 1-24 inches (in practice the 1-24 inch can be omitted, which has been done in this case), thus making the total rise 1 foot 9 inches for 4 feet 2½ inches of the base, as shown in Fig. 55. Then will Fig. 55 represent one-half of the background of a pediment having the length and bevel shown in Fig. 52. For the length and miter cuts of the pediment moldings use the pattern shown in Fig. 53, and measuring on the line G F make G F in length equal to the slant line or hypotenuse of the background shown in Fig. 55, making similar miter cuts at each end of the molding, as shown on pattern in Fig. 53.

The hight of the background in Fig. 55 is 1 foot 9 inches, and the hight of the miter cut H I in Fig. 53 is 1 foot 6 inches, the total of which amounts to 3 feet 3 inches; deduct the 7 inches, being the amount of the molding M in Fig. 53, giving 2 feet 8 inches as required for the entire hight of the pediment as shown in Fig. 52. By saving for future use the pattern and chart, any length pediment can be quickly laid out; and if a different design of cornice is used, the same pediment can be employed. By using the same rake, the bevel on the ornaments shown in Fig. 52

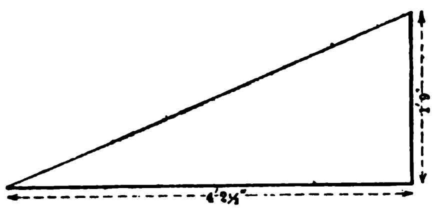


Fig. 55. One-Half of Metal Background

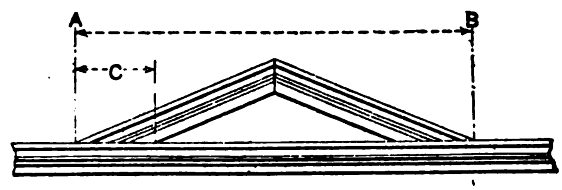


Fig. 56. Pediment on a Horizontal Molding

need not be changed. For example, if the length of the pediment was 16 feet 4 inches, instead of 12 feet 9 inches, as shown in Fig. 52, deduct twice the length of K J in Fig. 53, which is 4 feet 4 inches, from 16 feet 4 inches, which leaves 12 feet or the base length of the background. One half of 12 feet equals 6 feet; 1 foot rising 5 inches, 6 feet would rise 30 inches, or 2 feet 6 inches, or the center hight of the background. The length of the moldings would be obtained from the hypotenuse or slant line of the background, using the pattern and miter cuts shown in Fig. 53, measuring on the line G F for the length of the moldings. After once having the chart and patterns the measurements are quickly obtained.

It may be required to know what the hight of a pediment of this length would be above the top of the crown molding of a cornice. The procedure being: The center of the background rises 2 feet 6 inches, as before explained, and the miter cut H I in Fig. 53 is 1 foot 6 inches, making the total hight 4 feet; deduct the 7 inches, being the hight of the molding M in Fig. 53, which leaves the hight of the pediment 3 feet 5 inches from the top of the crown molding to the apex. In Fig.

52 a pediment is shown which intersects with the horizontal crown molding, while in Fig. 56 is shown a pediment entirely above a horizontal molding. The chart shown in Fig. 54 is applicable for both forms of pediment, it only being necessary to know the length of A B in Fig. 56, and from this length to deduct twice the width of the miter cut C on the horizontal molding, following the rules as before explained, or as explained further on.

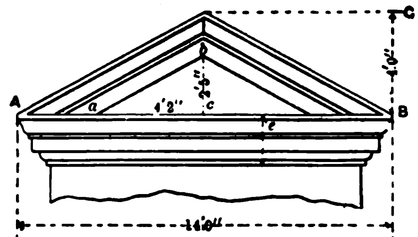


Fig. 57. Elevation of Pediment

To illustrate the time and labor saved by using the pediment chart, as shown in Fig. 54, it is cited that a cornice similar to Fig. 52, having a pediment 22 feet 4 inches in length, and having a rise of 4½ inches to the foot, was made in accordance with this method. To draw to full size one-half of this length pediment, so as to get the correct dimensions of the background, it would have required 11 feet 2 inches of space or drawing paper; whereas as shown in Fig. 54 a triangle only was required 12 inches in length, having the correct bevel, from which the pattern, base and rise of the pediment background was obtained as before explained, and from the hypotenuse or slant line of the background the length of the pediment molding was obtained.

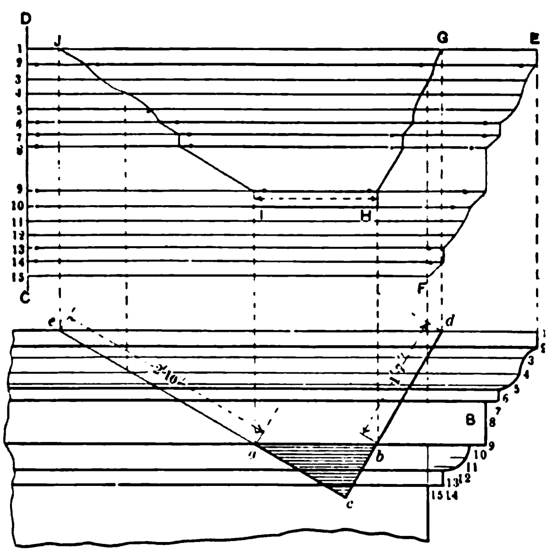


Fig. 58. Obtaining the Patterns

Fig. 57 represents the elevation of a raking pediment or gable on a horizontal cornice. It is now desired to find the size of the flat triangle *a b c* without drawing the full size pediment. The method usually employed is to strike a chalk line, A *c*, equal to 7 feet, and another from *c* to *b*, at right angles to A *c*, equal to 4 feet, and draw a line from the apex *b* to A. Then deduct the width of the mold and draw *a b*.

The short method is shown in Fig. 58. After the detail of the horizontal mold *e* in Fig. 57 has been drawn, as shown by B in Fig. 58, simply take a tracing of the triangle *a b c* in Fig. 57, no matter to what scale it has been drawn, and place it on its proper line, as shown by *a b c* in Fig. 58, and extend the lines *c b* and *c a* until they intersect the top line of the mold at *d* and *e*, respectively. *a b* has been placed on the line 9 because the pediment mold in Fig. 58 is similar to the part of the horizontal mold *e*. Then assuming that the distances *e a* and *b d* were 2 feet 10 inches and 1 foot 7 inches, respectively, on the full size, then simply deduct these amounts from 7 feet and 4 feet in Fig. 57, leaving the base of the triangle 4 feet 2 inches and the altitude 2 feet 5 inches, which is laid out directly on a 30-inch sheet, thereby obtaining the two triangles from one rectangular sheet. Hăving the miter lines in position in Fig. 57, obtain three miter cuts on one drawing by dividing the profile B and drawing lines as shown. Place the stretchout of B on C D, and obtain the miter patterns in the usual manner. Then E F is the pattern for the returns at A and B in Fig. 57, G H in Fig. 58 the cut for the miter *b* in Fig. 57, and J I in Fig. 58 the cut for the miter A *a* in Fig. 57. Then, knowing the length from *a* to *b*, which is obtained by measuring that line on the metal, lay out the pediment mold of similar length, measuring from I to H in Fig. 58.

INSIDE MITER OF A RAKING MOLDING

Although the principles for a problem of this nature are elucidated in Raking Moldings II and IV, the demonstration of the method of procedure, for acquiring the miter line in elevation and the raked profile, is here presented as an additional aid in the study of the principles. Assume that the angle in plan is as shown by Fig. 58a, and that the gable slant is as shown; also that the normal profile is as shown by R. If the normal profile was given for the gable, the procedure would be identical; that is, the normal profile would be placed in the gable and the process reversed, as it were. The normal profile was placed in the horizontal molding inasmuch as in the majority of cases, the horizontal molding has the given profile.

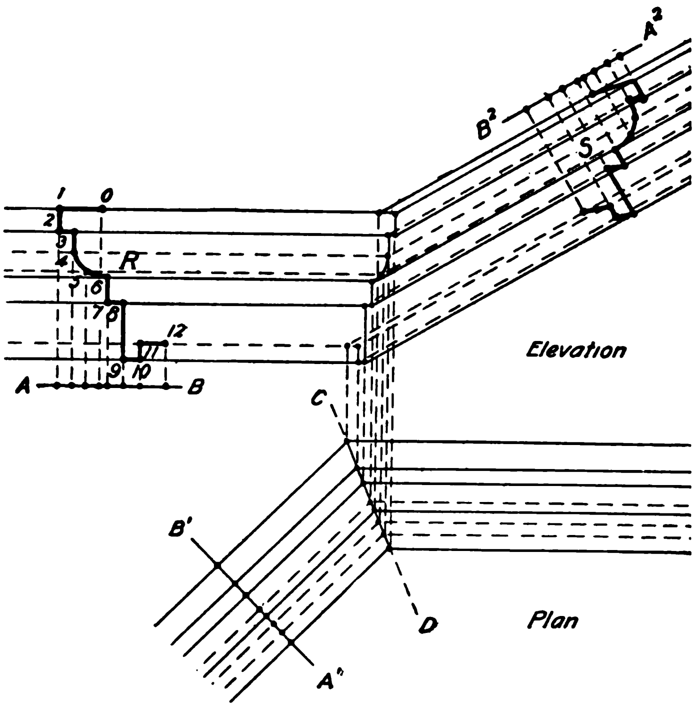


Fig. 58a. A Method of Procedure

Divide and number profile R as shown, and draw lines through the points toward the miter. In the raking of the profile for the gable the projections or widths of the profile do not change, the hights only; hence drop lines from the points in the profile R to any line as A B. Place this line in the plan as indicated by A′ B′, being careful to have the front of the profile, which is A, to the front of the plan. Draw lines to the miter line in plan from this line and where they intersect it, project lines upward until they intersect like numbered lines from profile R in the elevation. A line traced through these points of intersection will give the miter line in elevation.

From these points in the miter line draw lines parallel with the slant of the gable. Place the line A B parallel with the gable as shown by A^2 B^2 and drop lines to intersect lines of similar numbers in the gable; a line traced through these points of intersection will be the raked profile of the gable as indicated by S. The patterns would be developed precisely as for Problem IV on page 65.

RAKING MOLDINGS—I

The twelve problems, immediately following, appeared serially in the *Metal Worker*, and although they are, in a measure, covered by "The New Metal Worker Pattern Book," they are incorporated in this work, owing to their being exceptionally clear demonstrations and another author's method of procedure.

In these twelve articles will be described the method of developing the various raking moldings arising in practical work. Twelve developments are to be given to cover any problem which may be encountered in the shop. The text covering these twelve problems will be as brief as possible, but the drawings will be arranged so that the various parts will be easily understood by referring to similar reference letters or figures. The principles will be explained so that they are applicable to any form, whether the molding runs straight or circular or whether the plan has a square or other return.

Fig. 59, of Problem I, shows the development of raking molding, with right angle horizontal returns at top and bottom, when the normal or given profile is in the rake. Having established the proper angle of the rake, as shown by 7 7° T in the half elevation, place the normal profile (A) in its proper position as shown, and divide the profile into an equal number of spaces as shown from 1 to 10. Through the points in (A) draw lines indefinitely parallel to the raking molding. Upon the line X Y, which is drawn parallel to the rake, place the various projections of the profile (A) as shown. Having established the point 7° in elevation, place the various projections on X Y in a horizontal position as shown by X^1 Y^1, being careful that the point 7 on $X^1 Y^1$ comes directly on a vertical line below the point 7° in elevation as shown.

In similar manner, having established the point 7 in the upper return in elevation, place the projections on X Y, as shown by $X^2 Y^2$, being careful to have the point 7 on $X^2 Y^2$ come directly in a vertical line above 7 in elevation as shown. Now from the various points in $X^1 Y^1$ and $X^2 Y^2$ draw perpendicular lines which intersect with similar numbered lines drawn through the profile (A). Trace lines through points thus obtained. Then will (B) be the modified profile for the lower return, and (C) the modified profile of the upper return.

In its proper position below the elevation is shown a half inverted plan $N^1 O^1 M^1 K^1$ which, however, is not necessary in the development of the patterns, but is only shown to make clear the principles which must be followed when the returns are other than right angles. Thus it will be seen that (A) in plan is a reproduction of (A) in elevation. From the intersections in (A) in plan horizontal lines are drawn, cutting the miter lines O^1 V and M^1 U. Lines are then erected, cutting similar lines drawn parallel to the rake in elevation, and resulting in similar modified profiles (B) and (C).

For the three patterns proceed as follows: For the lower return pattern take the girth of the profile (B) and place it on the horizontal line $N^2 P^2$ as shown. Draw the usual measuring lines which intersect by lines drawn from similar intersections on the miter line O^1 V. Trace a line through points thus obtained when $N^2 O^2 R^2 P^2$ will be the lower return pattern. This same pattern could be obtained without the use of the plan by placing the girth of B on the vertical line N P, drawing the usual measuring lines and intersecting them by lines drawn vertically from similar numbers in the profile (B) and making the distance O N equal to $O^1 N^1$ in plan. Then O N P R would also be the pattern for the lower return.

The pattern for the upper return is also obtained by the short method, that is, by placing the girth of (C) upon the vertical line K L, drawing the usual measuring lines and intersecting them by lines drawn from similar numbers in the profile (C), and making K M equal to $K^1 M^1$ in plan. K M L is then the pattern for the upper return.

For the pattern for the rake molding take the girth of (A) and place it on the line D E, which is drawn at right angles to the raking molding. Through D E draw the usual measuring lines which intersect by perpendicular lines drawn from similar numbers in the modified profiles B and C and resulting, when a line is traced through points thus obtained, in the pattern shape F G H J. No matter what profile or angle the rake may have, these principles are applicable to any case.

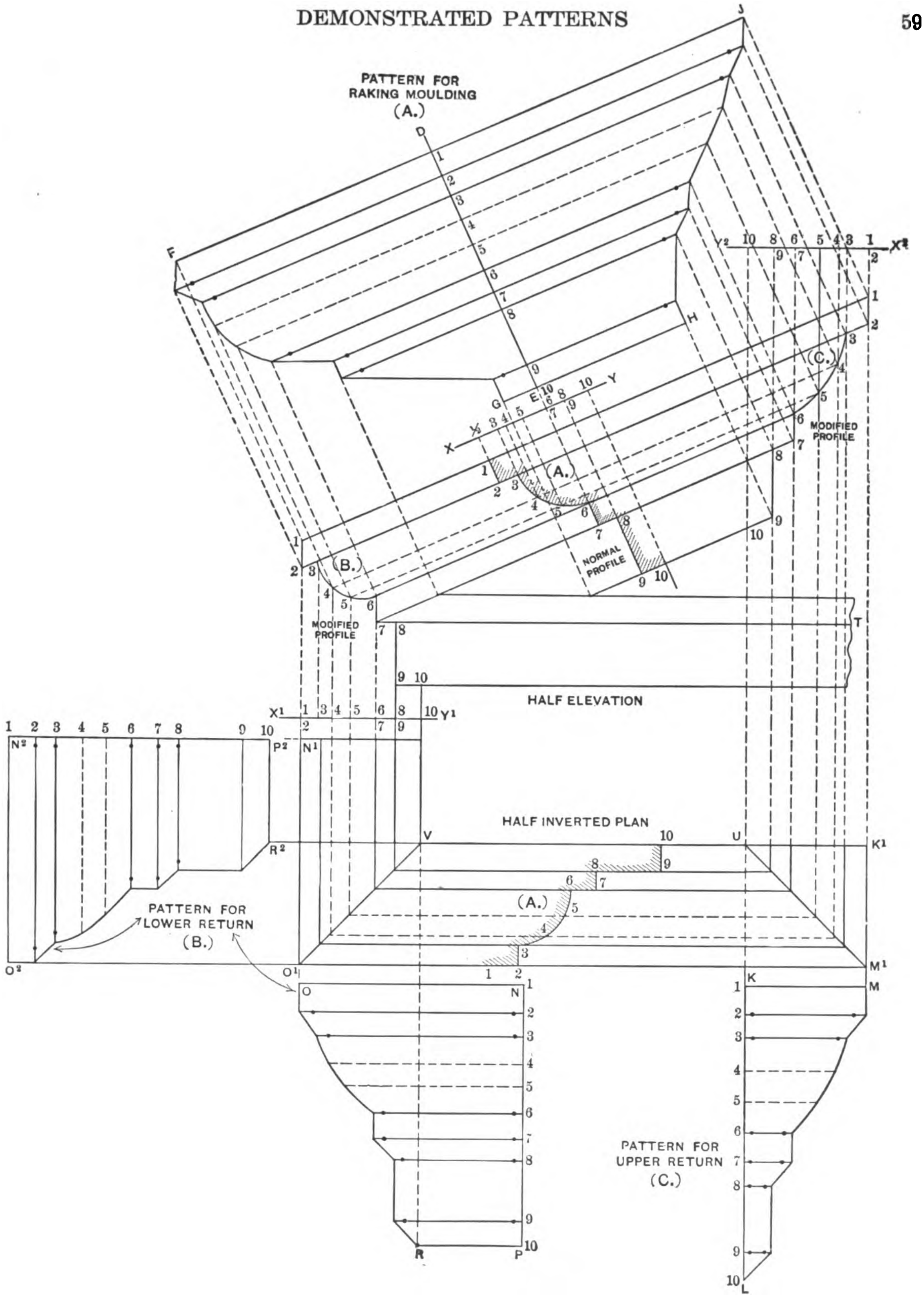


Fig. 59. Drawings for Problem I on Raking Moldings

RAKING MOLDINGS—II

Problem II shows the development of a raking molding, with the normal profile placed in the rake, with a lower horizontal return at other than a right angle. In this case a plan must be used when developing the horizontal return. In this case the upper return would be a right angle, and as this pattern was developed in in Problem I, it is omitted here.

In Fig. 60 first establish the angle S 7′ T, and from 7′ drop a vertical line, intersecting any horizontal line drawn below the elevation, as shown by 7°. Draw the angle as desired, as shown by *b*7°*a*. Bisect this angle as follows: With 7° as center, draw any desired arc as *ab*. Using the same radius, with *a* and *b* as centers, intersect arcs at *c*. Now draw the miter line *c*7°K^1. Place the normal profile A in elevation as shown, which space in equal parts. Through this division parallel to 7′S draw lines indefinitely, as shown.

Take a duplicate of A and place it in its proper position in plan, being careful that point 7 in the profile in plan comes upon the line drawn from 7°. Through A in plan draw lines parallel to 7° 7 until they intersect the miter line *c*K^1, as shown from which lines are erected intersecting similar lines drawn through A in elevation and resulting in the miter line shown from 1′ to 10′. From the intersections 1′ to 10′ draw horizontal lines, which intersect by vertical lines dropped from the projections on X^1Y^1, which were obtained from XY in the normal profile A. A line traced through the intersections 1 to 10 in B is the modified profile for the horizontal return. Complete the part inverted plan by making K^1J^1 the desired length.

For the pattern for the lower cut of the raking molding, take the girth of the normal profile A and place it on the line CD drawn at right angles to the rake, through which parallel lines are drawn, as shown, and intersected by lines drawn from similar numbers in the miter line 1′ 10″ at right angles 7 S. A line traced through points thus obtained, as shown by EF, will be the desired cut.

For the pattern for the horizontal return, take the girth of the modified profile B and place it on the line HJ drawn at right angles to J^1K^1 in plan. Through the divisions on JH lines are drawn parallel to J^1K^1 and intersected by lines drawn at right angles to J^1K^1 from similar intersections on the miter line *c*K^1. Trace a line through points thus obtained; then JKLH is the pattern desired.

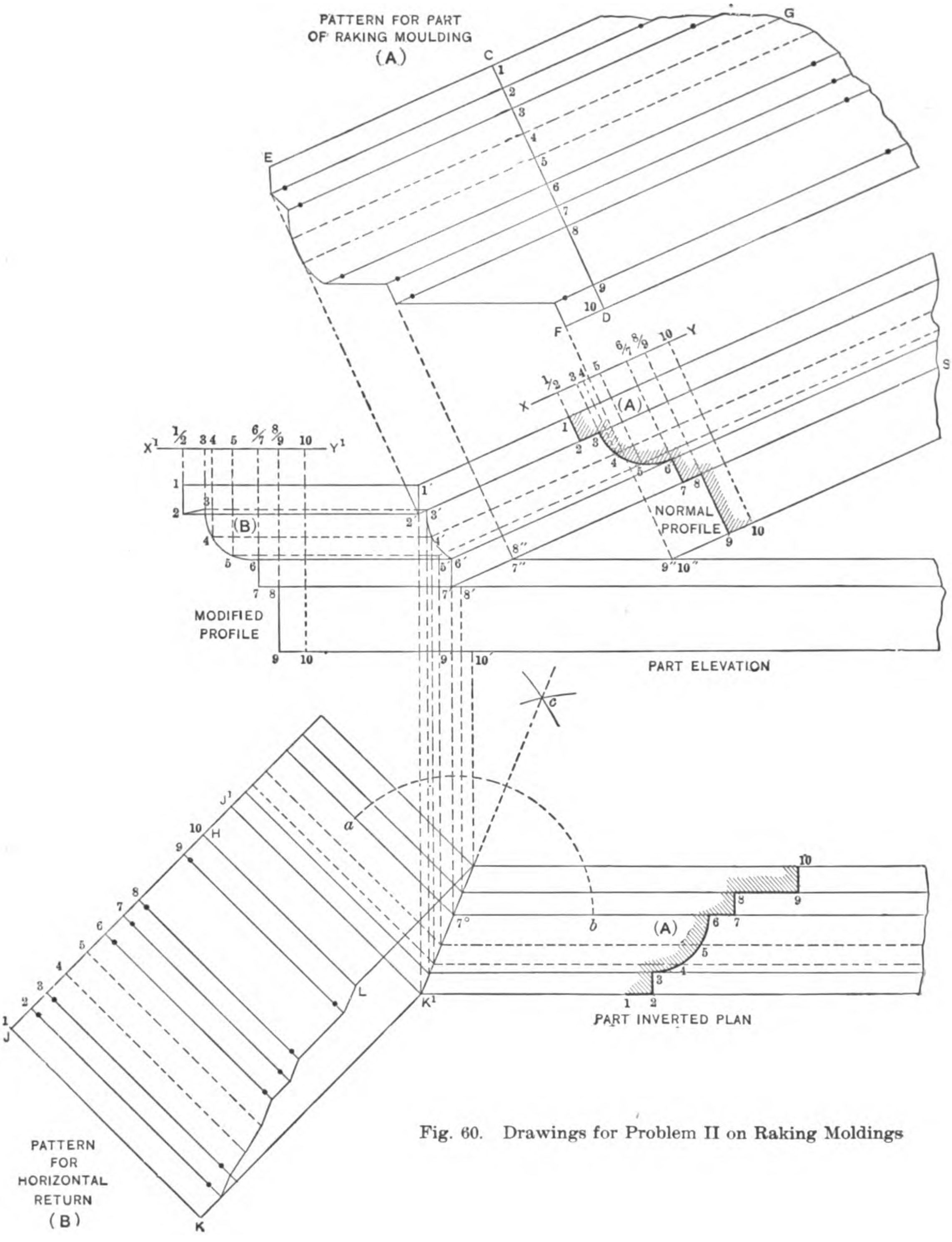


Fig. 60. Drawings for Problem II on Raking Moldings

RAKING MOLDINGS—III

Problem III shows how the various patterns are obtained, when the normal or given profile is placed in the lower return A, and it becomes necessary to find the modified profile for the raking molding B and upper return C as shown by Fig. 61. Should, however, the normal profile be given in the upper return C, the modified profiles for the inclined and lower moldings would be found in precisely the same manner as that which will follow.

Having drawn the normal profile A, complete the half elevation, drawing the horizontal and inclined lines indefinitely, as shown. Divide the profile A into equal spaces, as shown, from which erect vertical lines on *a b*, as shown by similar numbers. Take a tracing of *a b* and place it parallel to the raking molding, as shown by *a′ b′*. At right angles to *a′ b′* and from the various numbers draw lines, which intersect by lines parallel to the raking molding from similar numbered intersections in the normal profile A. Trace a line through points thus obtained; then will B be the modified profile for the raking molding.

Establish at will the point 1 of the upper part of the raking molding and place a duplicate of the projections on *a b*, as shown by *a″ b″*, being careful that the point 1 on *a″ b″* comes directly over 1. Now drop vertical lines from *a″ b″*, intersecting similar numbered lines in elevation and resulting in the modified profile C.

The patterns for the raking and upper and lower returns are obtained as shown. As the returns run at right angles, the girth of A is placed upon the vertical line D E and the girth of C upon the vertical line A B. Measuring lines are drawn and intersected by lines drawn from similar figures in the profiles A and C, respectively. Then A B C is the pattern for the upper return and D E F G the pattern for the lower return.

The girth of B is now placed on the line H J, drawn at right angles to the inclined molding, measuring lines drawn, and intersected by lines drawn from similar intersections in A and C. L M N O is then the pattern for the raking molding. In obtaining the length of the upper and lower returns measurements are taken from the plan in Problem I, or they can be made any length required.

RAKING MOLDINGS—IV

In this problem is shown how the patterns are obtained when the normal profile is in the lower return, the latter forming an angle other than a right angle, while the upper return is a right angle. First draw the plan in Fig. 62 showing

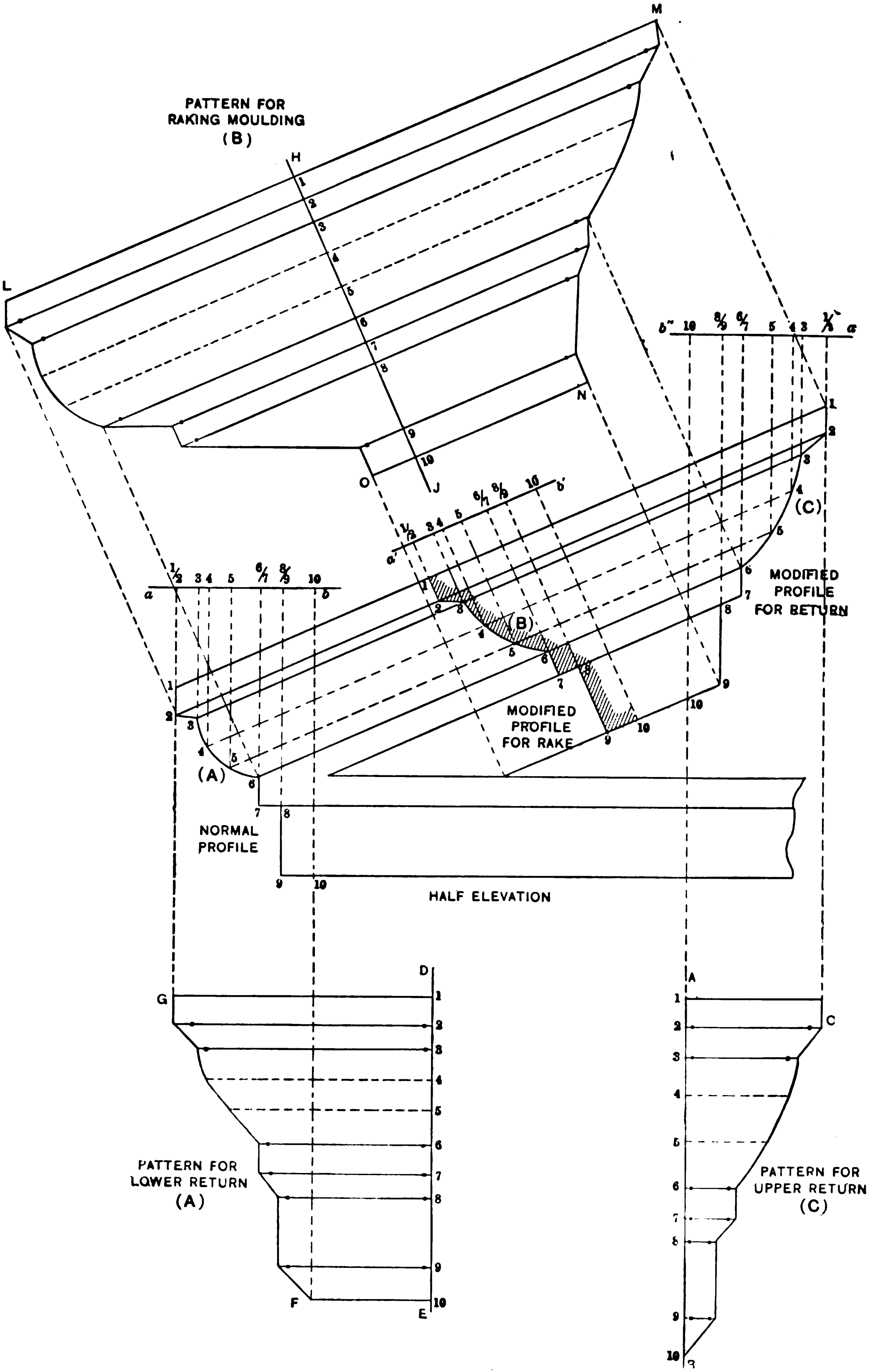


Fig. 61. Drawings for Problem III on Raking Moldings

the proper angle of the lower and upper returns, and place in its proper position, in plan, a profile of the normal or given profile as shown by A. Obtain the miter line by bisecting the angle as shown by *a*, *b*, c and draw the miter line *c* D^1.

Divide the profile A in plan into a number of equal spaces, as shown from 1 to 10, through which draw lines parallel to the lower return A^1 D^1 until they intersect the miter line *c* D^1, as shown. From 6° erect the vertical line intersecting any horizontal line in elevation at 6^T. From the joint 6^T draw the angle of the rake as shown. Now place a duplicate of the profile A in plan as shown by A in elevation, being careful that the point 6 in the profile comes on the horizontal line drawn from 6^T.

From the various intersections in A of the elevation, draw horizontal lines which intersect by vertical ones erected from similar intersections on the miter line *c* D^1, resulting in the miter line in elevation shown from H to J. From the various intersections in H J draw lines parallel to the rake indifinitely. Now draw any horizontal line, *d e*, upon which obtain the projections of the various points in the profile A, as shown, and place them parallel to the rake, as shown by *d' e'*, at right angles to which draw lines intersecting similar numbered lines and resulting in the modified profile for the rake B. In similar manner take a tracing of *d e* and place it on a horizontal line, as shown by *d'' e''*, being careful that 1-2 comes directly over the desired position in elevation of 1-2 of the upper return. Drop vertical lines from the various points on *d'' e''* until they intersect similar numbered lines drawn parallel to the rake. Trace a line through points thus obtained resulting in the profile C.

For the pattern for the upper return take the stretchout of the profile C and place it on the vertical line G F, from which draw the usual measuring lines, which intersect by vertical lines dropped from similar points in (C). Make the distance E G in the pattern equal to the return E^1 G^1 in the plan. Then E G F is the pattern for the return (C). For the pattern for the lower return take the stretchout of either profile (A) and place it on the line A A^1 drawn at right angles to A^1 D^1.

Draw the usual measuring lines which intersect by lines drawn from similar numbers on the miter line *c* D^1, and resulting in the pattern shown by A B C D.

The pattern for the raking molding is obtained by placing the girth of B on any line drawn at right angles to H 1, drawing the usual measuring lines, and intersecting same by lines drawn at right angles to H 1 from the intersections on the miter line H 9-10 and the profile C, thus resulting in the pattern L M N O.

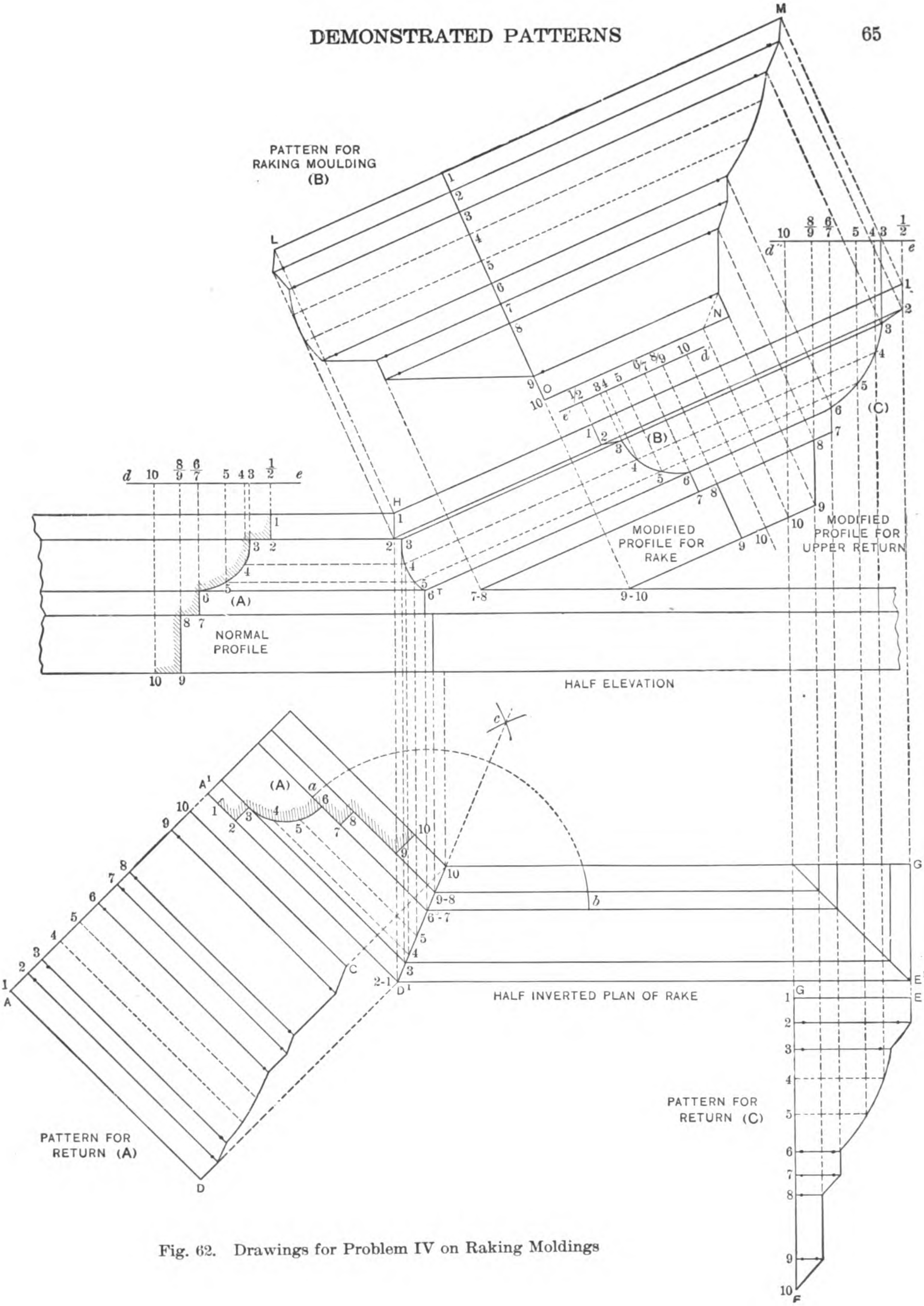


Fig. 62. Drawings for Problem IV on Raking Moldings

RAKING MOLDINGS—V

Problem V shows how the pattern for the lower right angle return is obtained when it miters with a curved molding with the normal profile in the horizontal return, as shown by D F in Fig. 63. Place the normal profile in its proper position

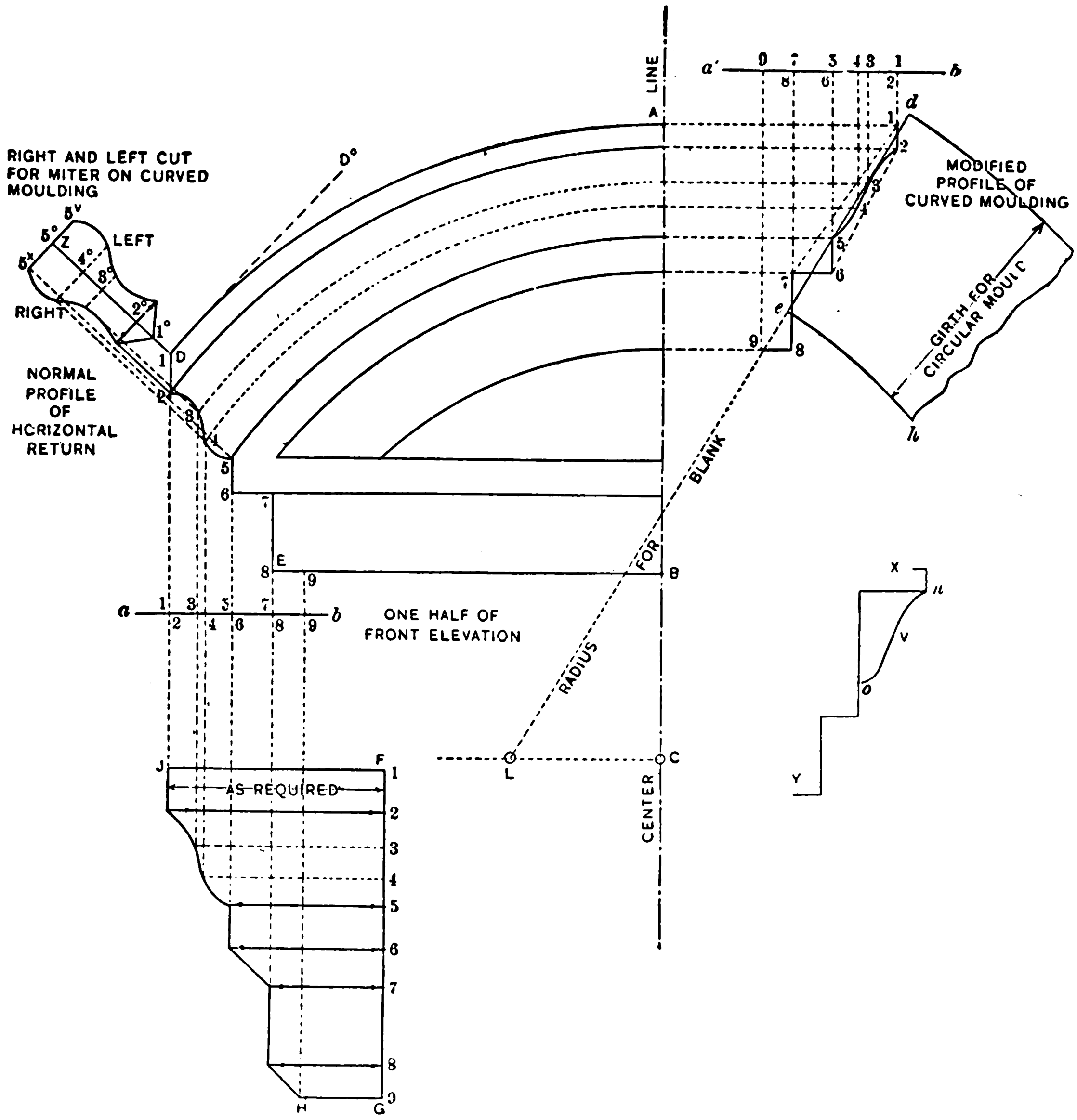


Fig. 63. Drawings for Problem V on Raking Moldings

from the center line in elevation, and with the required radii and C on the center line as center draw the arcs shown and complete the one-half front elevation.

Divide the ogee between 2 and 5 in D E into equal spaces, as shown, and with C as center draw the dotted arcs shown. Below the normal profile draw any horizontal line, as *a b*, upon which drop the projections of the various points in the profile and place these projections in a horizontal position shown by a' b'. At right angles to a' b' from the various projections, drop vertical lines, which intersect by lines drawn at right angles to A B from previously intersected arcs drawn from the center C. Trace a line through points thus obtained, resulting in the modified profile for the curved molding, shown by *d e*. Between these two profiles, namely, the normal and modified, a miter joint can be effected. For the pattern for the lower return take the stretchout of D E and place it on any vertical lines, as F G. Draw the usual measuring lines, which intersect by vertical lines dropped from the divisions in the profile D E, as in a square miter. Then F G H J represents the pattern for the lower return. The distance from F to J is made as long as required.

Assuming that the curved molding is to be made by machine, and the blank is to be developed, which will be accomplished as follows: Draw a line through the extreme points of the modified profile, as shown by 2 6 and 1 7. Bisect the distance 1 2 and 6 7 and draw the averaged line *d e*, extending it until it meets the line drawn from the center point C, at right angles to A C, at L. Then L is the center with which to strike the pattern. Obtain the girth of the profile from 5 to 1 and place it on the line *d e* above 5, and also the girth from 5 to 7 and place it below 5, as shown. Using L as center with radii equal to L *e* and L *d*, draw the arcs *d i* and *e h*, making the blank as long as required, or twice the girth of the arc D A in elevation.

The miter cuts are not placed upon the blanks for circular moldings, but are trimmed after they are hammered up. So that this cut may have the proper projection, a small template is used to mark the miter on the curved mold, the pattern for which is obtained by placing the girth of that portion shown from 1 to 5 in the modified profile, at right angle to a line drawn tangent at D in elevation as D D°, as shown by D 5°. Through the small figures 1° to 5° at right angles to D 5° draw measuring lines, which intersect by lines drawn at right angles to D D° from the intersections 1 to 5 in the normal profile thus obtaining the cut 1° 5^x. Trace this cut, 1° 5^x, opposite the line 1° 5°, and obtain 1° 5^v. Then 5^x 1° 5^v is the right and left miter cut formed to correspond to the modified profile and is used in trimming the miters in the curved molding.

When the curved molding must be made by hand the various faces are stripped as shown in the diagram X Y and the ogee V developed the same as explained in connection with *d e* in the modified profile, and soldered in position at *n* and *o* in the diagram X Y.

RAKING MOLDINGS—VI

When a curved molding is to miter with a horizontal molding at other than a

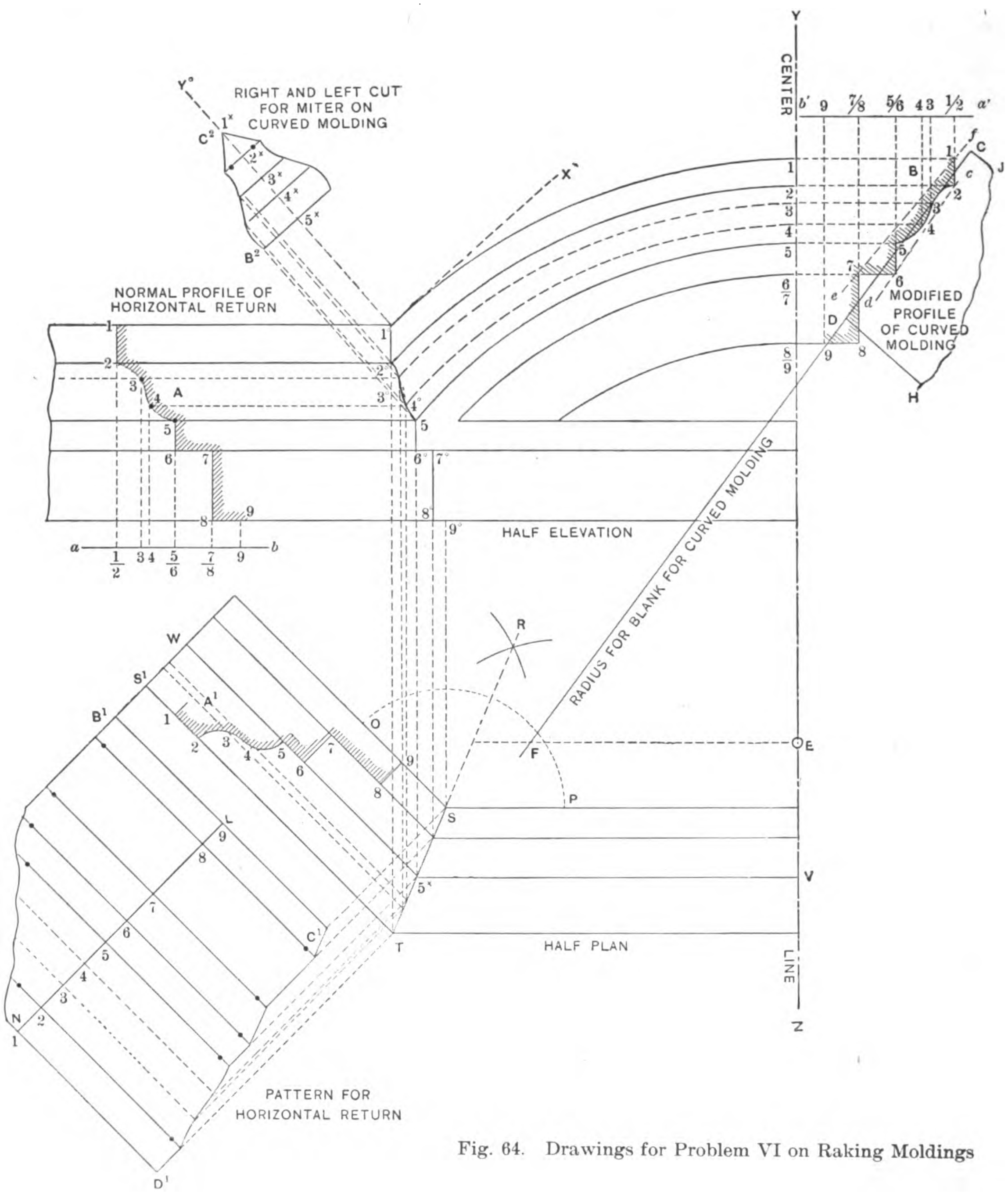


Fig. 64. Drawings for Problem VI on Raking Moldings

right angle in plan, the normal profile being placed in the horizontal molding, then the method to be employed is shown in Problem VI.

In Fig. 64 first draw the center line Y Z, and establish the width of the front elevation of the curved molding as shown by 5°. Drop the vertical line 5° 5^x, and establish the desired angle between the curved and horizontal mold as shown by V 5^x W in the half plan. From 5° in elevation, draw the horizontal line 5° 5, upon which place the normal profile of the horizontal return as shown by A.

Divide the profile A into equal spaces, and draw horizontal lines as shown. Now take a tracing of the normal profile A, and place it in its proper position in plan as shown by A^1. Divide into similar divisions as in A. Through the divisions in A^1, draw lines parallel to 5^x W, and complete the half plan shown.

Bisect the angle O P by the miter line R S T. From the intersections on the miter line S T, erect vertical lines intersecting horizontal lines drawn from A in elevation, resulting in the miter line 1° to 9°. Establish the center point E on the center line Y Z, and describe arcs from the various divisions in the miter line in elevation 1° to 5°, intersecting the center line as shown, and complete the rest of the half elevation.

Obtain the projections of the normal profile A on the horizontal line *a b*, and place a duplicate of it in the position shown by a^1 b^1. Drop vertical lines from the various divisions on a^1 b^1, which intersect by lines drawn at right angles to Y Z from similar intersections obtained from the miter line 1° 5°. Trace a line through points thus obtained, and B will be the profile of the curved molding. Obtain the blank for the curved molding by drawing 2 6 and 1 7 in B. Then bisect 1 2 and 6 7 and average a line until it intersects the horizontal line from E at F. Then F is the center with which to strike the blank, partly shown by C D H J, C D being the girth of the molding 1 to 7 in B.

The pattern for the horizontal molding is obtained by placing the girth of A^1 in plan on L N drawn at right angles to S^1 T, drawing the usual measuring lines at right angles to L N, and intersecting them by lines drawn parallel to L N from similar numbered intersections on the miter line S T. Then B^1 C^1 D^1 is the pattern required.

For the pattern for the miter with which to trim the ends of the curved molding to miter with the horizontal returns, proceed as follows: Draw the tangent line 1° X in elevation. At right angles to it draw 1° Y°, upon which place the girth of the modified profile from 1 to 5. Draw the usual measuring lines, which intersect by lines drawn parallel to 1° Y° from similar intersections in the miter line 1° to 5°, resulting in the cut, shown by B^2, C^2. Trace the cut opposite the line 1° Y°, which completes the right and left miter cut for the curved molding.

RAKING MOLDINGS—VII

When a circular molding is to have a right angle return and the normal or given profile is placed to the curved molding, then the method to be employed is shown in the drawing herewith, Fig. 65. In this the one-half front elevation is shown.

In its propor position place the normal profile of the curved molding A. Divide this into equal spaces, and from the points determined draw lines at right angles to the center line in elevation, intersecting it as shown. With B as center draw the various arcs shown. Intersect the arcs by vertical lines drawn from the projections on a' b' placed in its proper position, and which had previously been obtained from the normal profile A on a b. Trace a line through points thus obtained, and then will D be the modified profile for the horizontal return.

The girth of D is now taken and placed on the vertical line 1″ 10″, the usual measuring lines drawn and intersected by vertical lines dropped from similar numbered intersections in D, resulting in the miter cut or pattern for the horizontal return, shown by C D°. The depth from C to 1″ can be made the length desired. Thus it will be seen that the principle in this case is similar to that given in Problem V, with the exception that the normal or given profile is placed in the curved molding in Problem VII.

The blank for the curved molding made by machine is obtained by averaging a line through the profile A, between the two lines drawn from 1 to 8 and from 2 to 7, extending the averaged line until it meets the horizontal line drawn from the center point B at C°. The girth of the profile A from 1 to 8 is then obtained, and using C° as center the blank is struck as partly shown.

To obtain the miter cut with which to trim the ends of the curved molding, take the girth from 1 to 8 in A and place it at right angles to the tangent line 1′ X, as shown by 1′ Y. Draw the usual measuring lines parallel to 1′ X, and intersect them by lines drawn parallel to 1′ Y from similar numbered intersections in the profile D, resulting in the miter cut shown. Trace opposite the line 1′ Y and complete the pattern for a right and left cut.

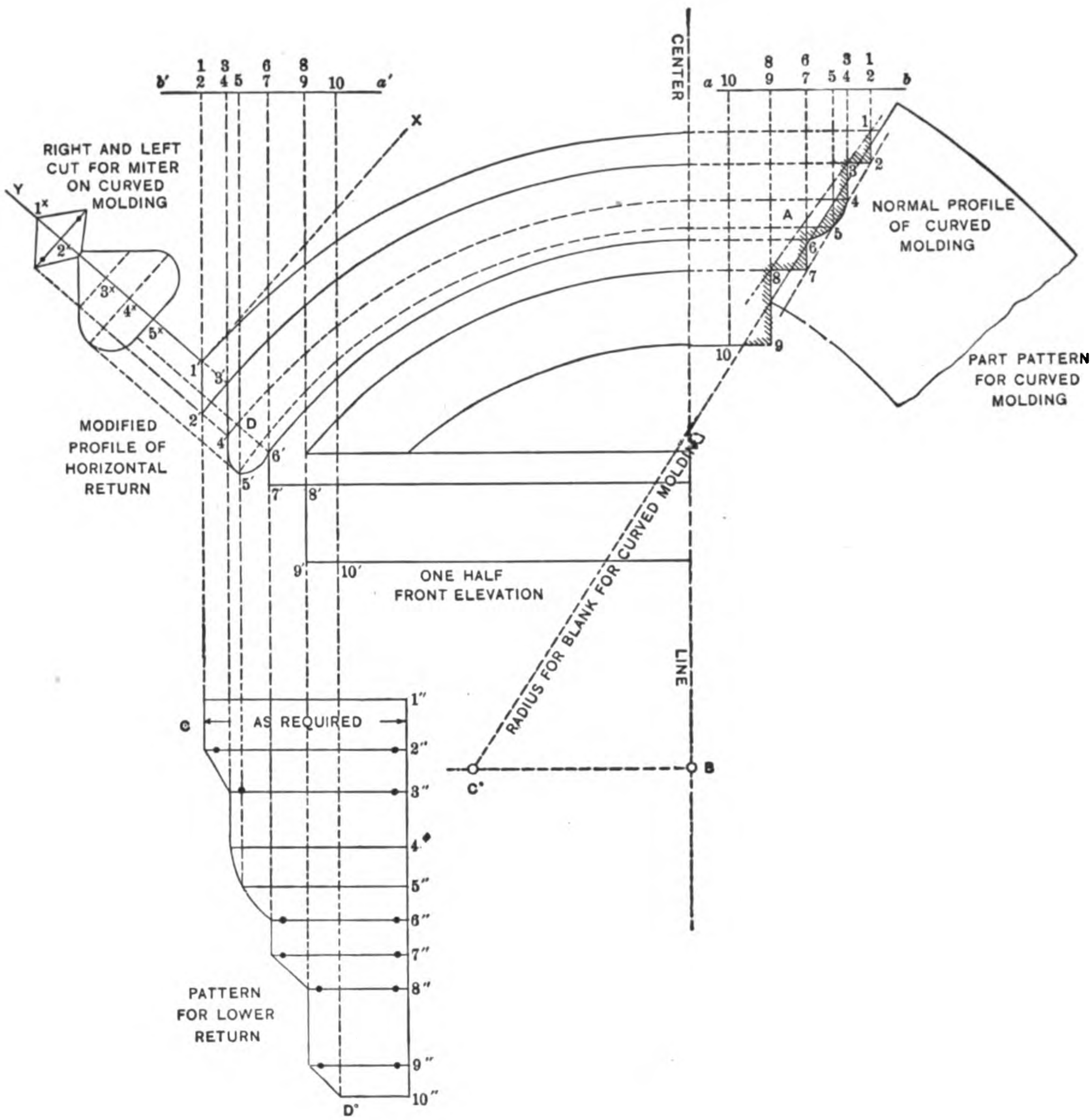


Fig 65. Drawing for Problem VII on Raking Moldings

RAKING MOLDINGS—VIII

In this problem it is shown how the patterns are obtained when the given profile is placed in the curved molding, which miters with a horizontal return at other than a right angle in plan. First, draw the half plan and elevation in their proper positions and place the normal or given profile A with its various divisions at right angles to the center line, as shown in Fig. 66. In its proper position in plan, place a tracing of the profile A with its various divisions as shown by A^1. Complete the plan J H G F E D and draw the miter line E H. With B as center, and radii equal to the divisions on the center line, obtained from the profile A, draw the various arcs, which intersect by vertical lines, erected from the points on the miter line H E in plan, and resulting in the miter line 1° to 10° in elevation. From the various points, 1° to 10°, draw horizontal lines as shown. Obtain the projections from A onto *a b*, and place on the horizontal line a^1 b^1, from which drop vertical lines intersecting those obtained from 1° to 10°, and resulting in the modified profile for the horizontal return indicated by B from 1^1 to 10^1. Obtain the girth of B and place it on a line drawn at right angles to F E in plan, as M L. Draw the usual measuring lines, which intersect by lines drawn parallel to M L from the various intersections on the miter line H E. Then R S T represents the pattern for the horizontal return.

The miter cut for trimming the curved molding is shown at Y, which is obtained by taking the girth of A from 1 to 6 and placing it on the line W 1° drawn at right angles to 1° X and the pattern obtained in the usual manner. The center for obtaining the pattern for the curved molding is shown at C, the averaged line being drawn between 3 8 and 2 7.

In this problem the principle is similar to that shown in Problem VI, except that in Problem VIII the given profile is placed in the circular molding.

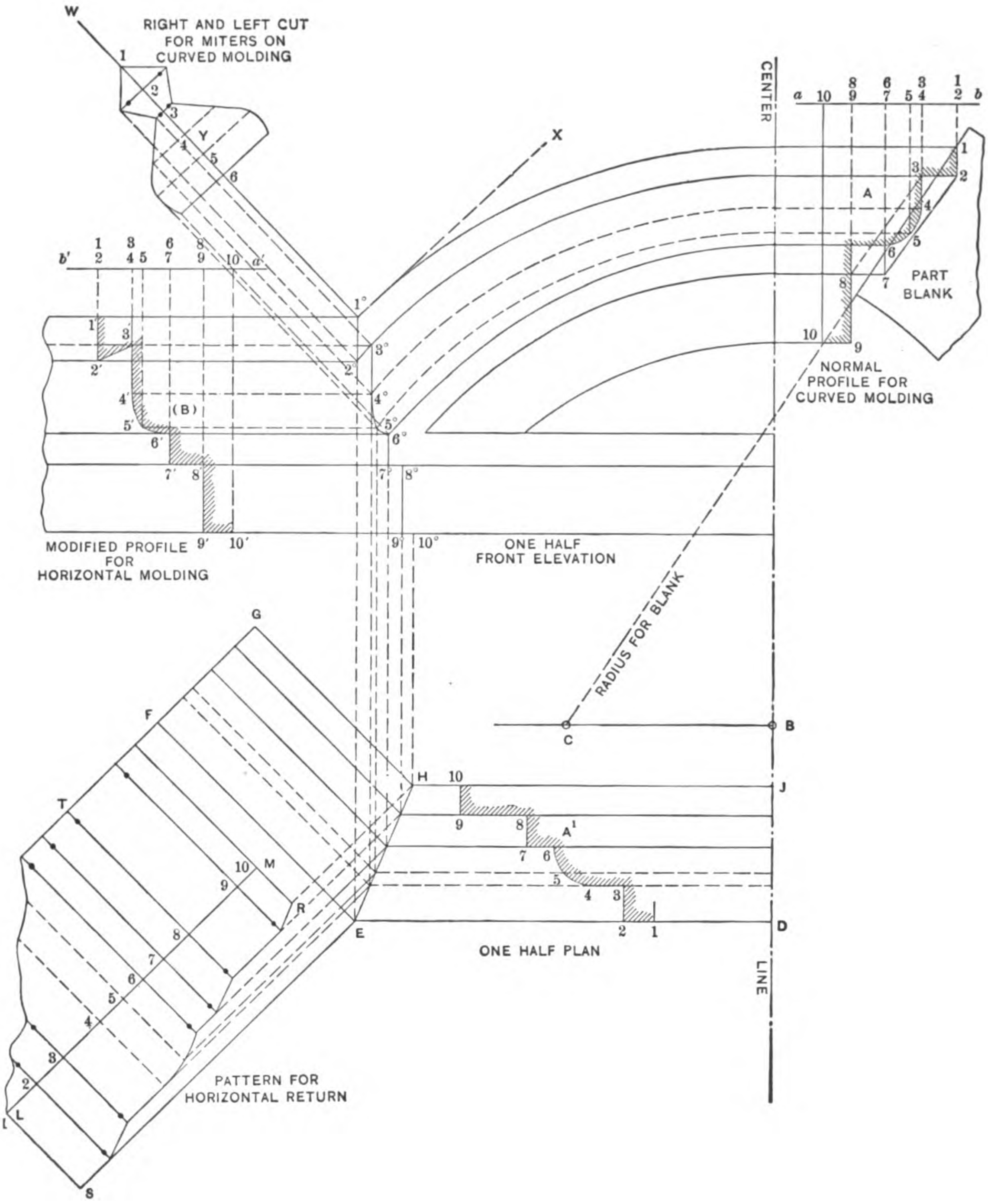


Fig. 66. Drawing for Problem VIII on Raking Moldings

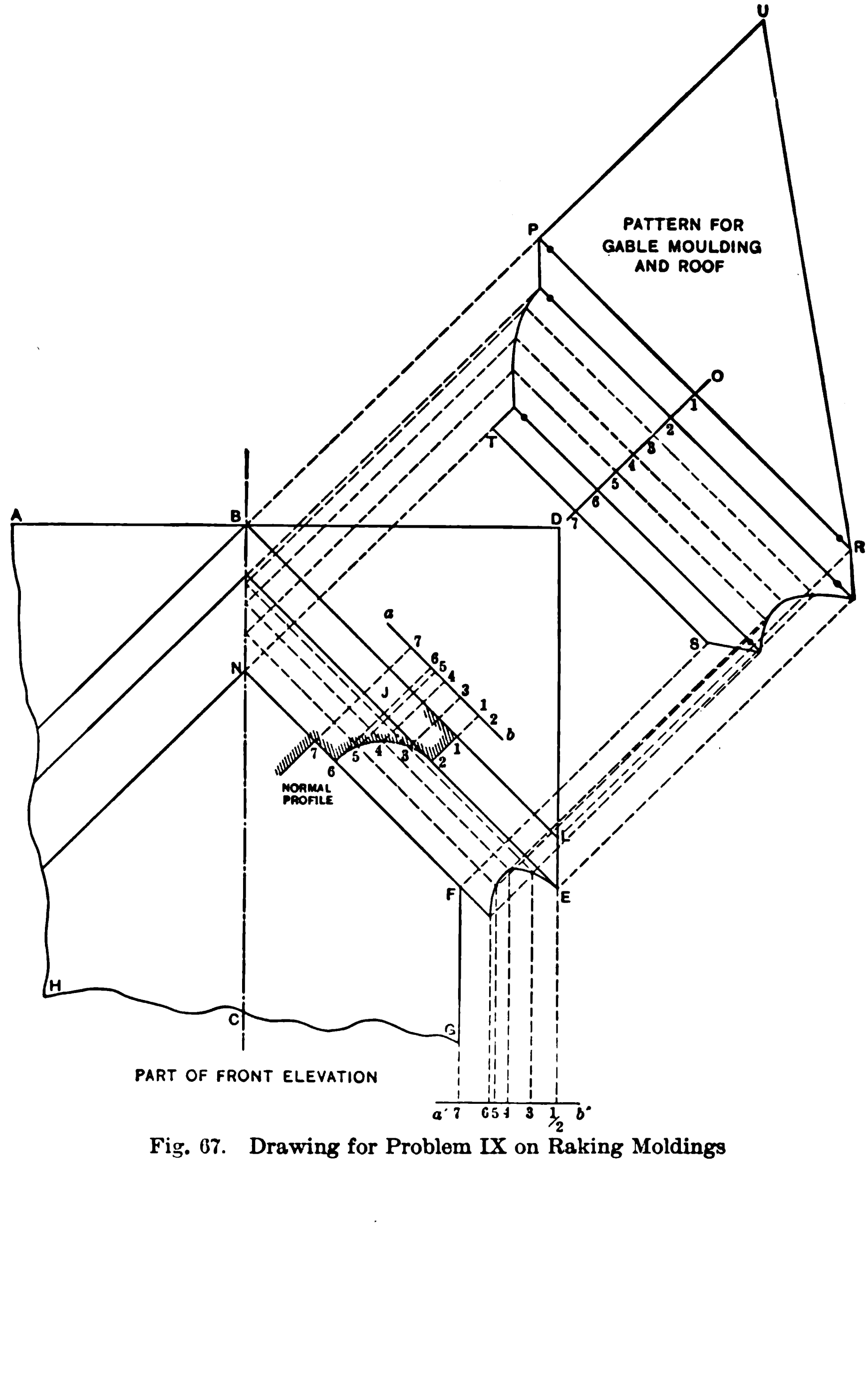


Fig. 67. Drawing for Problem IX on Raking Moldings

RAKING MOLDINGS—IX

When four gables are to be joined together at right angles in plan, each side being similar in width, then the method to be employed is shown in Problem IX. A part front elevation is shown by A D E G H, Fig. 67. The one-half elevation only is required. After the rake N F has been established place the normal or given profile J in its proper position, as shown, and divide it into equal spaces, as from 1 to 7. Parallel to the rake N F draw any line, as *a b*, upon which obtain the projections of the various points in the profile J. Take a tracing of *a b* and place it in a horizontal position, as shown by *a′ b′*, being careful to have the point 7 come in line with F G. From the various projections on *a′ b′* erect vertical lines, which intersect by lines drawn parallel to the rake from the various intersections in the profile J, resulting in the miter line L E F.

Having established the miter line L E F and knowing the line of joint, N B, the pattern is developed as follows: At right angles to B L draw any line, as D O, upon which place the stretchout of the profile J, as shown. At right angles to D O through the various points on same, draw lines which intersect by lines drawn at right angles to B L from similar points in the miter line L E F and line of joint N B, resulting in the pattern for the gable molding, P T S R. If the roof shown by B D L in elevation is to be joined to the molding in one piece, then, at right angles to R P in the pattern, draw the line P U, equal in length to B D in elevation, and draw a line from U to R in the pattern. U P T S R U is then the full pattern, of which eight are required. The above principle is applicable to any shaped mold.

RAKING MOLDINGS—X

When four gables are to be joined together with alternate wide and narrow sides, as shown by Fig. 68 in the reduced plan by A and B, then the principle to be employed is shown in Problem X. In this case the normal or given profile will be placed in the wide side and the modification made in the narrow side. Should, however, the given profile be placed in the narrow side, the modified profile in the wide side would then be obtained in precisely the same manner as that which will follow:

First, draw the center line I F of the wide side, and draw the one-half elevation of the shaft with its proper rake as shown by C D E F. Place the normal profile G in its proper position, which divided into equal spaces, as shown, from 1 to 7. Through these draw lines parallel to C D indefinitely. Obtain the projections of the profile G upon the line *a b*, drawn parallel to I H, and transfer these projections upon the horizontal line *a' b'*, as shown, being careful that the point 7 will be in line with D E. From the various projections on *a' b'* erect the vertical lines intersecting those previously drawn parallel to I H, giving the miter line H, 2, 6, D.

Take a tracing of H, 2, 6, D and place it, as shown, from 1' to 7', on horizontal lines drawn from H D, as shown. From 7' place the half horizontal distance of the narrow side of shaft 7' *f* and draw the vertical center line through *f*, as shown by L K. From I, in the wide side, draw the horizontal line I K, intersecting the center line L K at K. Draw a line from K to 1', and parallel to this line, from the various intersections 1' to 7', draw lines intersecting the center line K L, as shown. Take a tracing of the projections on *a b* and place them parallel to 1' K as shown by *a" b"*. From the points on *a" b"*, at right angles to 1' K, draw lines intersecting lines previously drawn, as shown by the intersections 1 to 7 on R S; through these points at right angles to narrow side. Complete the ridge lines I J H in the elevation of the wide side and K P 1' in the elevation in the elevation of the narrow side as shown.

For the pattern for the wide side proceed as follows: At right angles to I H draw any line as R S, upon which place the girth of the normal profile G, as shown from 1 on 7 on R S. Through these points at right angles to R S draw the usual measuring lines, which intersect by lines drawn from similar numbers on the miter line I C and H 2 D, at right angles to I H, and resulting in the pattern V U T P^1. If the roof is to be added to the pattern, then take the distance from P to K in the narrow side and place it at right angles to T P^1 in the pattern, as shown by P^1 K^1, and draw a line from K^1 to T. Then K^1 V U T is the full pattern, of which four will be required.

For the pattern for the narrow side, take the girth of the modified profile O and place it on the line X Y, drawn at right angles to 1' K, as shown from 1° to 7° on X Y. Draw the usual measuring lines, which intersect by lines drawn at right angles to 1' K from similar intersections on the miter line K N and 1' 7' and resulting in the pattern Y Z and J^1. Then will 1^1 Y Z and J^1 I^1 be the full pattern for the narrow side, of which four will be required. Where the roofs are of such size that they can not be joined direct to the molding, then laps must be allowed to the patterns for the moldings, so that the roofs can be locked to them.

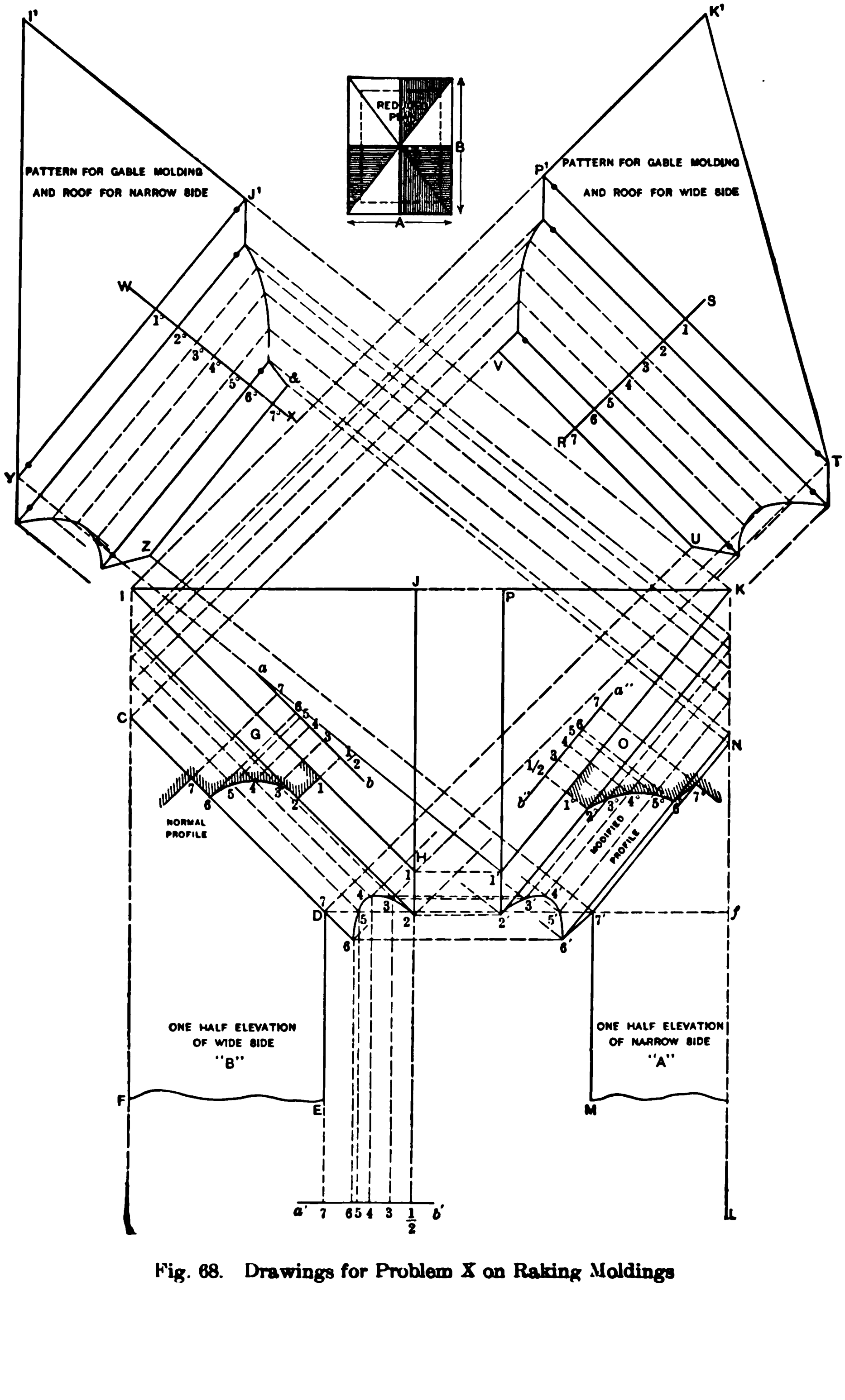


Fig. 68. Drawings for Problem X on Raking Moldings

RAKING MOLDING—XI

In Problem XI is shown how the patterns are developed when eight gables are to be joined together at the angles of an octagon or 135 degrees. The principles here shown are applicable to any angle, providing, however, that the angles are equal and that each side has the same width.

In Fig. 69 first draw the center line A B, and with C on that line as center and with radius equal to the half width of the shaft as C D, draw the quadrant D E. Now complete the one-quarter plan of the shaft as shown by D G F 7′ E, as shown by the dotted line. Place the normal profile H on the line of the shaft as shown, and divide same into equal spaces shown from 1 to 7. Draw the valley or miter lines C 7′, C G, also the ridge line C F, extending same to meet the projection of the molding H. Through the various divisions in H draw the lines parallel to E 7′, intersecting the miter line from 1′ to 7′ as shown. From 7′, in plan, erect the vertical line 7′ 7°, and draw the desired rake 7° J. Then J K L 7° will represent the one-half elevation of one side of shaft, all that is necessary in the development of the pattern.

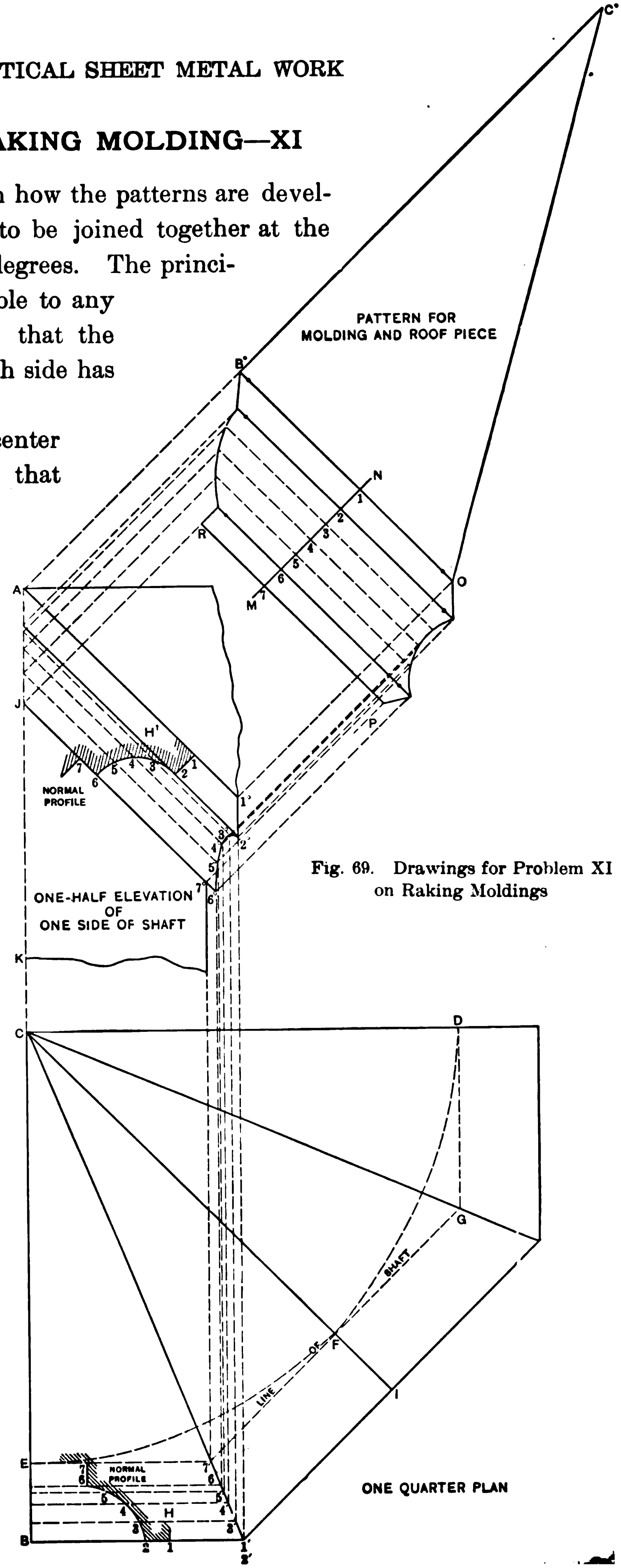


Fig. 69. Drawings for Problem XI on Raking Moldings

Take a tracing of the normal profile H with the various intersections on same, and place it as shown by H^1. Through the points in H^1 parallel to J 7° draw lines, which intersect by vertical lines drawn from similar numbered points on the miter line in plan, parallel to the center line B A, and resulting in the miter line in elevation shown from 1° to 7°.

Having obtained this miter line, the pattern is obtained as follows: At right angles to A 1° draw the line M N, upon which place the girth of the profile H or H^1 as shown from 1 to 7 on M N. Draw the usual measuring lines, which intersect by lines drawn at right angles to A 1° from similar points on the miter lines A J and 1° to 7°. Trace a line through points thus obtained, then will O P R B° be the pattern for the molding. If the roof piece is to be attached to same, then take the length of the ridge line B C in plan, and lay it off at right angles to B° O in the pattern as shown from B° to C°, and draw the valley line C° O. Then C° R P C° is the full pattern, of which 16 will be required.

RAKING MOLDINGS—XII

When gables are to be joined together having alternate wide and narrow sides, and the angles are not right angles, then the principles shown in problem XII are applicable to any angle or width of alternate sides. Let A B C D E, in Fig. 70, represent the one-quarter plan of shaft having alternate wide and narrow sides. Place the normal profile F in its proper position and complete the plan view of the molding, as shown by G H I J K. Draw the miter or joint lines of the molding, as shown by D H and J C, and the valley lines of the roof H A and J A, and the ridge lines A K, A I and A G.

Divide the normal profile F into equal spaces and draw lines parallel to E D until they intersect the miter line D H, as shown. From D erect the vertical line D 7°, and draw the desired pitch 7° M. Then M N O 7° represents the one-half elevation of wide side of shaft.

Place the normal profile F in the position shown by F^1, and divide F^1 into the same number of spaces as F. It should be understood that, while the normal profile is placed in the wide side, it could just as well be placed in the narrow side, and then proceed as follows: From the various intersections in F^1 parallel to L 1° draw lines, which intersect by vertical lines erected from intersections on the miter line D H in plan, and resulting in the miter line shown from 1° to 7° in elevation for wide side.

For the one-half elevation of the narrow side draw any vertical line, as P R, and from R set off the horizontal distance R S equal to one-half of the narrow side, C D, in plan. From S draw the vertical line shown, which intersect by a horizontal line drawn from 7° in wide side at 7ᵛ in the narrow side. Take a tracing of the miter line 1° 7° and place it as shown by 1ᵛ 7ᵛ, being careful that 7° is placed directly on 7ᵛ, and that 1ᵛ 2ᵛ is in a vertical position, as shown by the dotted lines drawn from 1° to 7°.

From L in the elevation of the wide side draw a horizontal line, intersecting R P in narrow side at P. Draw a line from P to 1ᵛ, and parallel to this line, from the various intersections in 1ᵛ 7ᵛ, draw lines in-

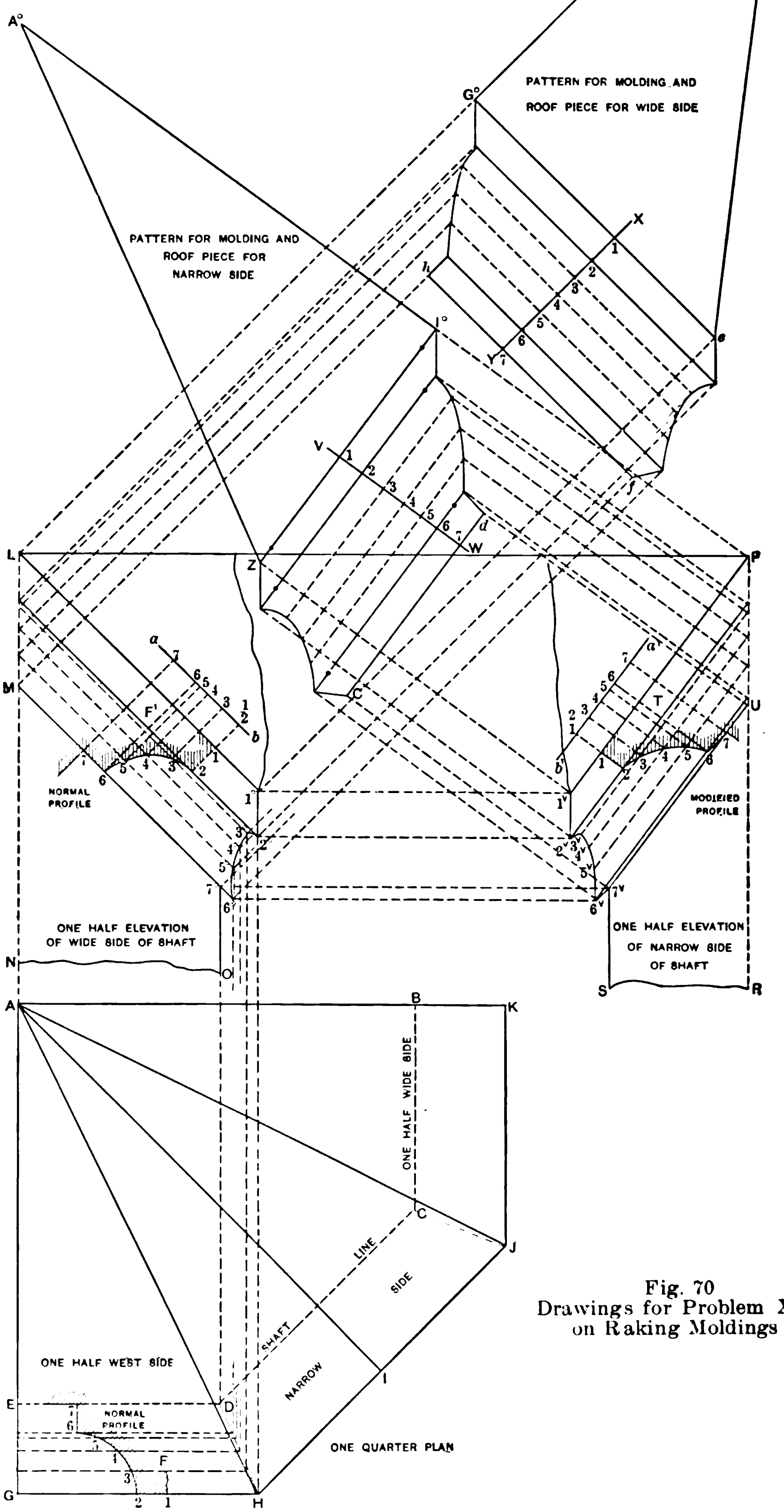


Fig. 70
Drawings for Problem XII on Raking Moldings

tersecting the center line P R, as shown. Now obtain the projections of the normal profile F^1 on the line *a b*, drawn parallel to L 1°, as shown from 1 to 7 on *a b*. Take a tracing of *a b* and place it parallel to P 1^v, as shown by a^1 b^1, from which points at right angle to b^1 a^1 draw lines intersecting lines previously drawn from the miter line 1^v 7^v. Trace a line through points thus obtained, then will T be the modified profile for the molding on the narrow side.

For the pattern for the narrow side take the stretchout of the modified profile T and place it on the line V W, drawn at right angles to 1^v P; draw the usual measuring lines, which intersect by lines drawn at right angles to P 1^v, from intersections on the miter lines 1^v 7^v and P U, and resulting in the pattern for the molding shown by Z I° *d c*.

If the roof is to be attached to this mold, then take the distance of the ridge line A I in the narrow side in plan and place it at right angles to Z I°, as shown from I° to A°, and draw a line from A° to Z. Then A° *c d* is the full pattern, of which eight will be required.

For the pattern for the wide side take the girth of the normal profile F^1 and place it at right angles to L 1°, as shown by X Y. Draw the usual measuring lines at right angles to X Y, which intersect by lines drawn at right angles to L 1°, from intersections on L M and 1° 7°. Then *e f h* G° is the desired pattern. At right angles to *e* G° draw the line G° A^x equal in length to the ridge line G A in the wide side in plan. Draw a line from A^x to *e* in the pattern. Then will A^x *h f* be the complete pattern for the roof and molding for the wide side, of which eight will be required.

RAKING INSIDE MITER BETWEEN INCLINED ARMS

The method of obtaining the patterns for raking moldings, such as the ones shown at A and B of the plan and elevation, in Fig. 71, is as follows: From this it appears that portions of the front wall of a building, as seen at B B of the plan, are placed obliquely to the main front A A, both portions of either half of the front terminating at the eaves of a roof of uniform pitch throughout, as shown by A A and B B of the elevation. The difficult part of the problem is to cut the miter between the two arms A and B of the cornice as well as the miter at its upper end, that at the lower end being a simple butt miter.

In Fig. 72 is shown an enlarged plan and elevation giving all the details of the molding, in which the profile and the several miter lines have been brought close together for convenience in performing the work. The elevation of both arms of the molding is shown by A B C D, the portion E B C F of the elevation of which I K L J is the plan only appearing in true elevation; while A E F D is an oblique elevation of the upper arm, as shown by G I J H of the plan. The normal profile of the cornice is shown at M of the elevation, from the points of which lines are drawn parallel to the pitch of the roof A B, and terminated at the top and ends by the sides of the piers against which the cornice abuts. At N of the plan the normal profile is also shown correctly placed with reference to the lines of that view. Through the point of extreme projection of the profile in plan draw the line J L; also draw H J parallel to G I at a distance from it equal to K L, the projection of the molding. From the intersection J of these two lines draw J I; then will J I be the correct miter line in plan between the two arms of the molding; or, in other words, the position of a vertical plane against the opposite sides of which the two arms of the molding must meet at different angles, forming the miter at E F of the elevation.

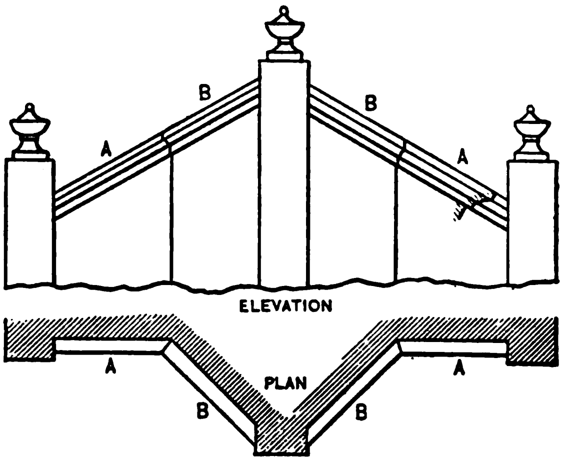


Fig. 71. Raking Inside Miter Between Inclined Arm

As the miter cannot be cut from the plan for the reason that the arms are inclined, the first requisite is to obtain a correct elevation of the miter at E F. To accomplish this first divide the curved portions of the two profiles M and N into the same number of equal spaces, as shown by the small figures, and from all the points of the profile N carry lines parallel to I K, cutting the miter line I J. From the several points in the profile M carry lines parallel to E B to the right, cutting B C, the side of the pier against which the cornice is required to miter at its lower end; also carry them toward E F indefinitely and intersect them with lines drawn vertically from points of corresponding number previously obtained on I J. A line traced through the points of intersection between E and F will give the required miter line in elevation, as shown.

To lay out the pattern for this arm first set off the stretchout of M upon any line, as O P, drawn at right angles to E B, as shown by the small figures 1 to 10. Through the several points on O P draw the measuring lines, as shown, parallel to E B, which intersect at the right by lines drawn parallel to O P from the points of corresponding number on B C. A line traced through the points of intersection, as shown from B^1 to C^1, will give the required miter at B C. Now from the points of intersection previously obtained between E and F carry lines parallel to O P, cutting measuring lines of corresponding number at their left, when a line traced through the points of intersection, as shown from E^1 to F^1, will give the required miter cut at E F of the elevation.

Since that portion of the wall between the lines E S and A T of the elevation

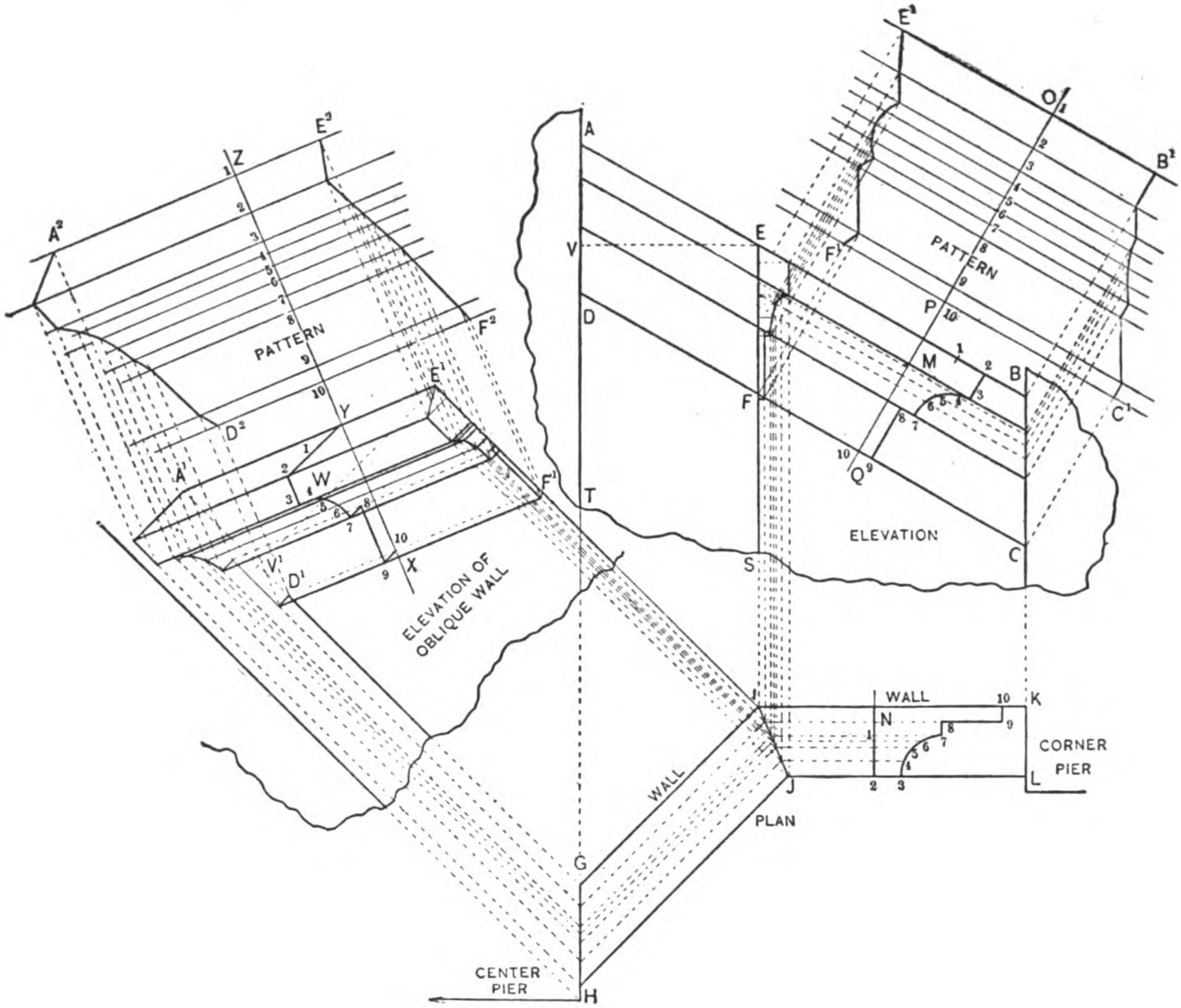


Fig. 72. Method of Obtaining the Patterns for Both Arms of the Miter.

stands obliquely to the other portion, as shown by G I of the plan, it is evident, as intimated above, that the angle D A E does not give the correct pitch or rake of this arm of the molding, for the reason that while A V gives the correct hight of the point A above the point E, the correct horizontal distance between those points is not V E, but is equal to G I. It will be necessary, therefore, to construct a triangle the equivalent of A E V, but correct in all its dimensions. The best method of procedure then is to project an oblique elevation of the wall and cornice H G I J of the plan, as shown at the left in Fig. 72. Therefore from points G and I first erect the two lines I E^1 and G A^1 at right angles to G I, representing the perpendicular lines of the wall. Upon I E^1 assume any point, as E^1, the equivalent of the point E of the normal elevation, and from E^1 draw the horizontal line E^1 V^1, giving the true length of E V. Make V^1 A^1 equal to V A, and draw A^1 E^1; then will A^1 E^1 be the correct pitch of the arm shown by G H J I of the plan.

Since the miter line at E F of the elevation has been established, and since the arm at its left lies at a different angle to the perpendicular E S than the arm at the right, it is evident that the profile of the left arm of the miter must be so changed or raked that lines from all of its points shall meet lines from corresponding points of the normal profile M upon E F. To accomplish this it will first be necessary to place the miter line E F in its correct position in the oblique elevation. From an inspection of the plan it is evident that when the miter at I J is viewed at right angles to G I it will appear turned as much to the left as it appears turned to the right in the normal elevation, or when viewed at right angles to I K. Therefore the miter line as it appears at E F may be traced and transferred in a reversed position to the oblique elevation; or it may be obtained in the following manner: Carry short lines from each of the points by which it was originally obtained horizontally to the vertical line E F, and transfer the points thus found to E^1 F^1 of the oblique elevation, and draw horizontal lines from each to the left, which intersect by lines drawn perpendicular to G I from points of corresponding number on I J, all as shown. Now from each of the points in the miter line E^1 F^1, just obtained, draw lines parallel to the line of rake E^1 A^1 and continue them indefinitely beyond A^1 V^1. To obtain the profile of the raked molding draw any line, as X Y, at right angles across those just drawn, and upon each line set off from X Y the projection of the corresponding points in the normal profile M, as measured from P Q on lines parallel to E B; then will the profile W thus obtained be the correct profile of the left arm of the miter. To obtain the miter at the left or upper end of this arm, first carry lines from each of the points on I J of the plan parallel to I G till they intersect the side of the center pier at G H, and from the points thus obtained erect lines at right angles to G I, intersecting those of corresponding number previously drawn from E^1 F^1. A line traced through the points of intersection, as shown from A^1 to D^1, will give the required miter line.

To lay out the pattern of this arm of the molding, first set off the stretchout of the profile W on any line, as Y Z, drawn at right angles to A^1 E^1, and through the points of the same draw the usual measuring lines parallel to A^1 E^1. It may be here noted that the spaces upon the curved portion of the profile W must be measured from point to point as they exist, as by the process of raking they are necessarily unequal. From each of the points in the two miter lines A^1 D^1 and E^1 F^1 carry lines parallel to Y Z till they intersect with measuring lines of corresponding number. Lines traced through the points of intersection, as shown at A^2 D^2 and E^2 F^2, will complete this pattern.

It will be understood that the correct lengths of A^1 E^1 and E B of Fig. 72 and their respective patterns are not given in the diagram, and that in practice the miter cuts at the two ends of either of the patterns given must be separated to the required dimensions or perhaps made into separate patterns.

If it is immaterial just what appearance the miter has, then the molding profile need not be raked, inasmuch as the two arms A and B of Fig. 72 lie in one plane; that is, the roof being of uniform pitch. In this case the miter E F will be perpendicular to the line of the roof A E B, of Fig. 72; requiring no change of profile for either arm. Then too, the miter cut will be the same for both arms. The miter at B C will be laid out like Problem 1 and at A B as Problem 70 of "The New Metal Worker Pattern Book."

PATTERN FOR RETURN IN GABLE MOLDING

Time and again problems are sent to the *Metal Worker* of surprising singularity, as evinced by the sketch, Fig. 73, submitted by a reader of that paper. Undoubtedly there was need for a solution of this decidedly interesting problem, and the following was prepared and here reprinted. Therefore to cut the patterns for the moldings from R to S shown in Fig. 73, where R S S^1 R^1 is a reduced reproduction of the sketch, X showing the section on the lines A B. While all patterns are asked for, from R to S, the patterns are only shown for those pieces adjacent to the miters C, E and F of Fig. 74. The miter A is obtained the same as any ordinary gable miter, the miter B is a square outside miter, and the miter C is an inside face miter. The pattern for the miter T of Fig. 73 is obtained the same as in a raking molding with a square horizontal return. The method of obtaining the patterns for the cuts F and E of Fig. 74 are shown in Fig. 75, where D E F G H I J K L M is a reproduction of the front elevation of similar parts in Fig. 73, the cut against the leader head being omitted in Fig. 75, and P R S T U V W Q is the side elevation of the same. As A in the front elevation is the given profile for the raking molding throughout, also for the horizontal molding F E in front view and the return and vertical molding P R S in side view, it follows that a change of profile must be obtained for the horizontal return S T N V in side view to permit of perfect miters at F and E of Fig. 74.

To obtain the change of profile shown at B in front view, Fig. 75, proceed as follows: Divide the curved portion of the profile A into equal spaces, as shown by the small figures 1 to 8. Construct a duplicate of the true profile at A^1, which also divide into similar spaces as profile A. Now, parallel to H G and from the small figures in the profile A^1, draw lines, which intersect with those of similar numbers drawn from the small figures in the profile A at right angles to F E. A line traced through the points of intersection thus obtained, as shown by the small figures 1^1 to 8^1, will be the profile for the horizontal molding shown in side view by T S V N.

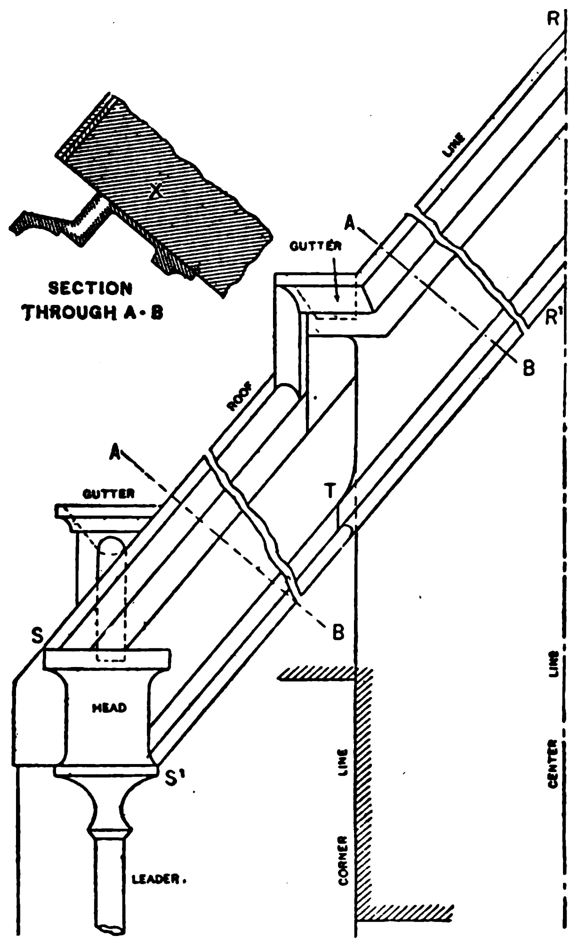


Fig. 73. Outline of Problem

Before obtaining the patterns for the vertical and horizontal moldings shown by R S T N V W it will be necessary to obtain the miter lines O and N in side view, for which proceed as follows: From the intersections in the profile B in front draw lines indefinitely at right angles to F G, as shown. Now take a tracing of the profile A and place it as shown in its proper position in side view by A^2. From the intersections on same and parallel to the lines of the molding draw lines, which intersect with the horizontal lines of similar numbers previously drawn from the profile B. A line traced through the intersections thus obtained, as shown from 1 to 8 in miter line N, will be the desired miter line between the raking and horizontal moldings. As the angle V W Q in side view is a right angle, then from the profile A carry lines parallel to P R until they intersect the miter line R W; then from the intersections on R W and parallel to R S drop lines intersecting the horizontal lines of similar numbers drawn from the profile B. A line traced through intersections thus obtained, as shown at O, will be the miter line between the horizontal and vertical moldings of different profiles.

Having thus obtained the miter lines for the patterns proceed as follows: As the space does not allow obtaining the patterns direct from the views, each pattern is developed, as shown in Figs. 76, 77 and 78, by measurements instead of by projection, as usual. For the pattern for the vertical molding shown by R S V W in side view, Fig. 75, draw any horizontal line, as S^1 W^1 in Fig. 76, upon which place the stretchout of the profile A of Fig. 75, as shown by the small figures 1 to 8. At right angles to S^1 W^1 draw lines through the small figures indefinitely. Now, measuring in every instance from the line S W in side view, Fig. 75, take the

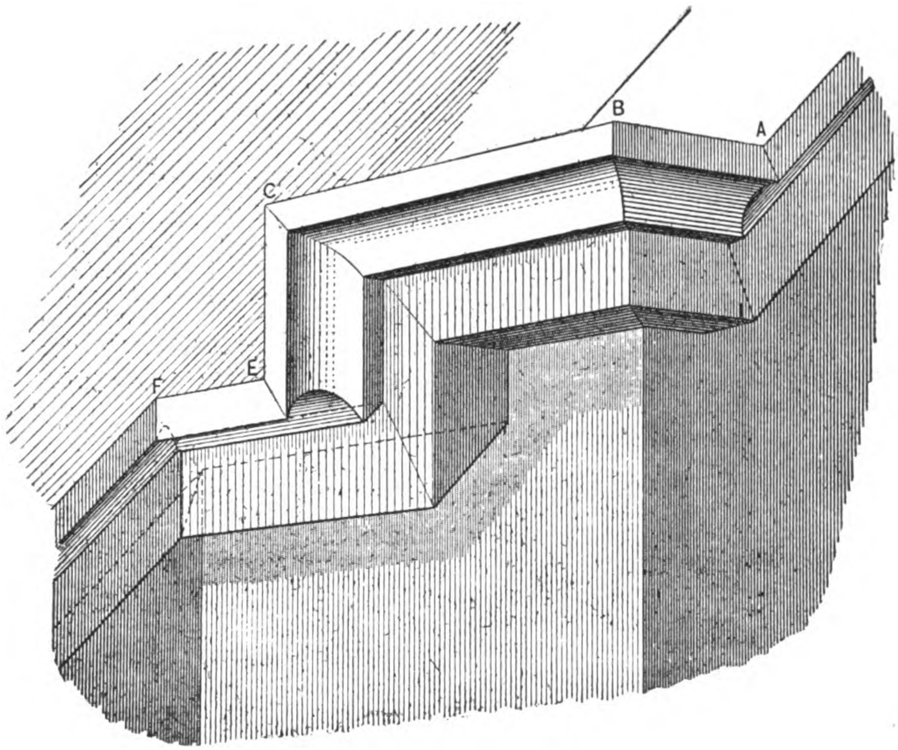
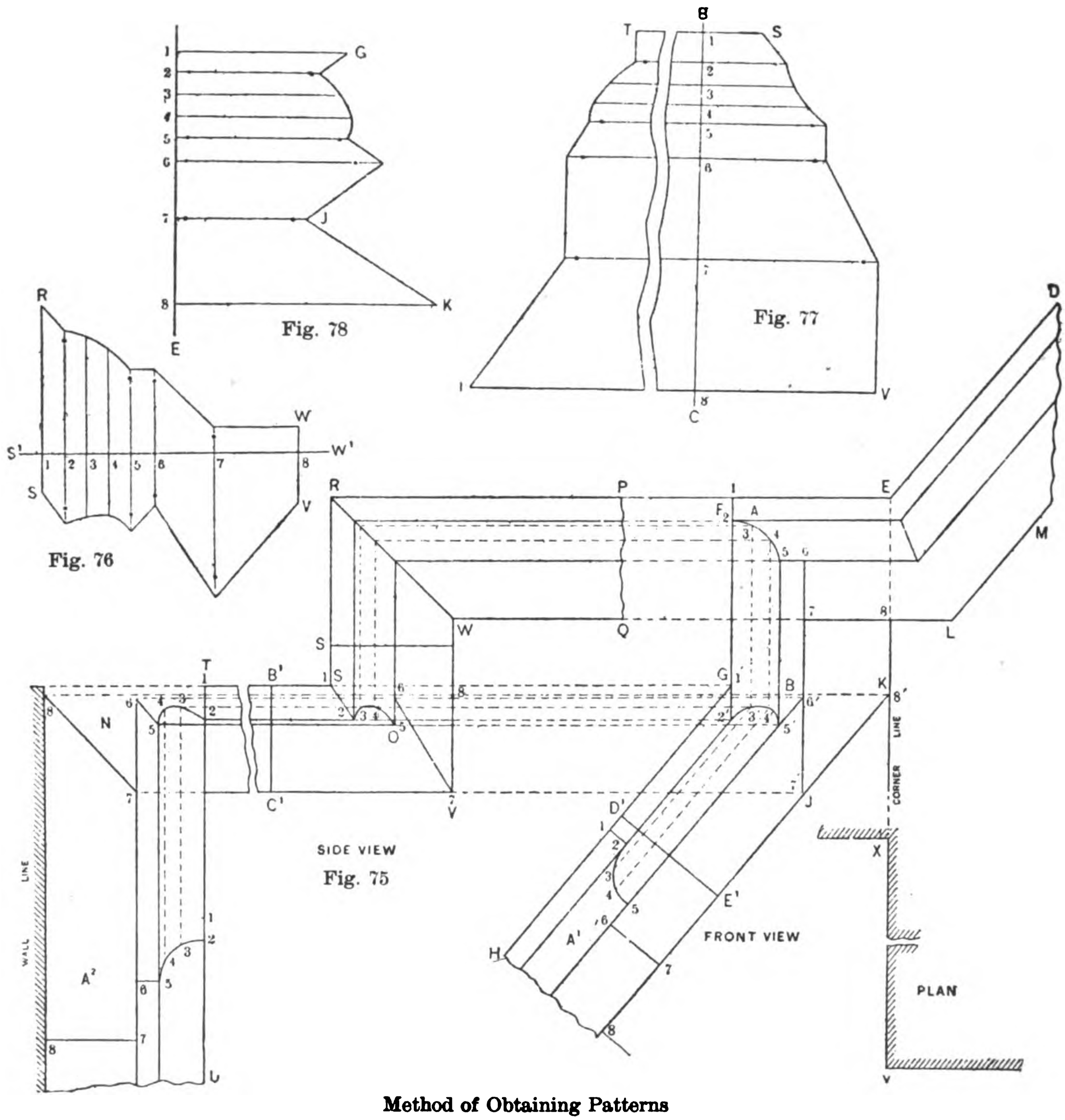


Fig. 74. Perspective View of Problem

distances on each of the lines to points in the miter line O from 1 to 8 and transfer them to lines of similar numbers in Fig. 76, measuring from S^1 W^1. In the same manner measure in every instance from S W in Fig. 75 to the miter line R W and carry these distances to lines of similar numbers in Fig. 76, measuring from S^1 W^1. Then a line traced through points thus obtained, as shown by R W and S V, will be the pattern for the vertical molding shown by R S V W of Fig. 75.

For the pattern for the horizontal molding shown by T S V N proceed in the same manner. Draw any vertical line, as B C in Fig. 77, upon which place the stretchout of the profile B in front view, Fig. 75, as shown by the small figures 1 to 8. At right angles to B C and through the small figures draw lines indefinitely, as shown. Now, measuring in every instance from the line B^1 C^1 in Fig. 75 right and left to points of intersection in the miter lines O and N, carry these distances to lines



Method of Obtaining Patterns

of similar numbers in Fig. 77, measuring right and left from the line B C. A line traced through points thus obtained, as shown by T S V N, will be the pattern for the horizontal molding shown in side view, Fig. 75, by T S V N. In similar manner obtain the pattern for the raking molding in front view, Fig. 75. Draw any vertical line as D E in Fig. 78, upon which place the stretchout of the profile A or A¹ of Fig. 75, as shown by spaces 1 to 8. At right angles to D E draw lines indefinitely, as shown. Now, measuring in every instance from the line D¹ E¹ in Fig. 75 to points of intersection in the profile B, carry these distances on lines of similar number in Fig. 78, measuring from the line D E. Trace a line through intersections, as shown, when D G K E will be the pattern for the raking molding shown by D¹ G K E¹ of Fig. 75.

PATTERN FOR A RAKING BRACKET

This exemplification is similar to Problem 88 of "The New Metal Worker Pattern Book," but as it has one or two different features, and as it is a design of bracket of frequent occurrence, it is here presented.

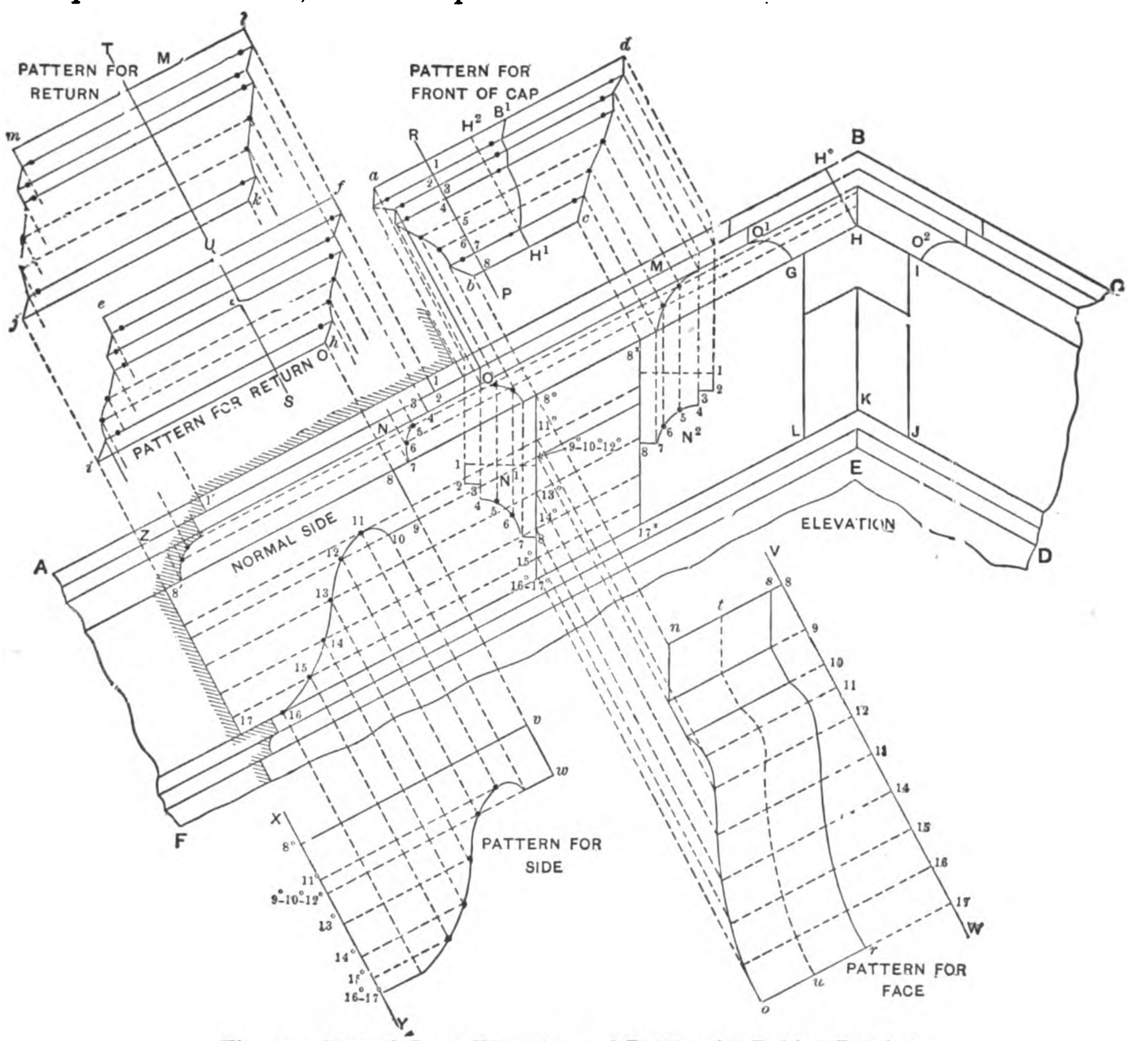


Fig. 79. Part of Front Elevation and Pattern for Raking Bracket

This is a method of obtaining the pattern for a raking bracket and molding, as shown in the accompanying illustration, Fig. 79, in which A B C D E F shows the part elevation of the cornice, 1′ 8′ 17 9 1 the normal side of cap and bracket, 8° 8^x 17^x 17° the face of the raking bracket and G H I J K L the face of the center bracket.

The first step is to obtain the modified profiles of the returns of the cap shown by O and M, for which proceed as follows: Divide the normal profile N into equal spaces, as shown from 1 to 8, through which extend lines indefinitely parallel to the lines of the cornice, as shown.

Take a tracing of N with the various points of intersections and place it in the position shown by N^1 and N^2, and from the various intersections erect vertical lines intersecting similar lines drawn from N. Trace a line through points thus obtained, resulting in O and M. Take a tracing of the profile O and place it upon the center bracket, as shown by O^1 and O^2, which completes the elevation of that view.

For the pattern for the face of the cap, draw the line P R at right angles to A B, upon which place the stretchout of the profile N, as shown from 1 to 8 on P R. Draw the usual measuring lines, which intersect by lines drawn from similar points of intersections in O and M, at right angles to A B, and resulting in the miter cuts *a b* and *d c*. Then *a b c d* is the pattern for the front of cap.

For the pattern for the front of the cap of the center bracket, take the distance from G to H and place it, as shown, from *b* to H^1. Erect the perpendicular H^1 H^2, and also the perpendicular H H° in the center bracket. Then measuring from this line, take the various distances to the miter line B H and transfer them to similar lines in the pattern for front, measuring from the line H^1 H^2. Trace a line through points thus obtained, then will H^1 B^1 *a b* be the pattern for the face of the center bracket.

For the pattern for the return caps O and M, take the stretchouts of O and M and place them on the line S U and U T drawn at right angles to A B. Draw the usual measuring lines, which intersect by lines drawn from similar points of intersections in the normal return Z N. Trace a line through points thus obtained, then *e f h i* is the return cap for O and *j k l m*, the return cap for M.

The pattern for the face of the bracket is obtained by dividing the normal side 8 17 into convenient spaces, as shown, from which lines are drawn parallel to A B until they intersect the side of the bracket in elevation, 8° 17° and 8^x 17^x. A stretchout of the normal side 8 17 is now placed upon the line V W, drawn at right angles to A B, as shown, from which the usual measuring lines are drawn and intersected by lines drawn parallel to V W from similar points on 8° 17°, resulting in the miter cut *n o*.

Now take the distance of 8° 8^{x} and set it off on similar lines in the pattern for face and obtain the cut *s r*. Then *n o r s* is the full pattern for the face of the bracket. Take the distance G H in the center bracket, and set it off, as shown in the pattern, by the dotted line *t u*. Then *n o u t* is the pattern for the half face G H K L of the center bracket.

The last pattern is that for the side of the bracket, and is obtained by taking the various intersections on 8° 17° and placing them on the line $8'$ 17 extended as X Y. Perpendiculars are drawn to X Y from the various points and intersected by lines drawn from similar points of intersections in the normal side at right angles to A B. Then 8° *v w* 17° is the pattern for the side.

PATTERN FOR A RAKING BALUSTER

To develop the pattern for an octagonal baluster in a raking balustrade, a general view of which is shown in Fig. 80, in which A shows a vertical baluster in a raking balustrade, B showing the cap and C the base. The problem gives an interesting study in drawing and projections, which, when accomplished, is more than half the battle in the developments of the patterns. The method for obtaining the patterns for the cap B will only be shown; as the same principles can be applied when laying out the patterns for base C.

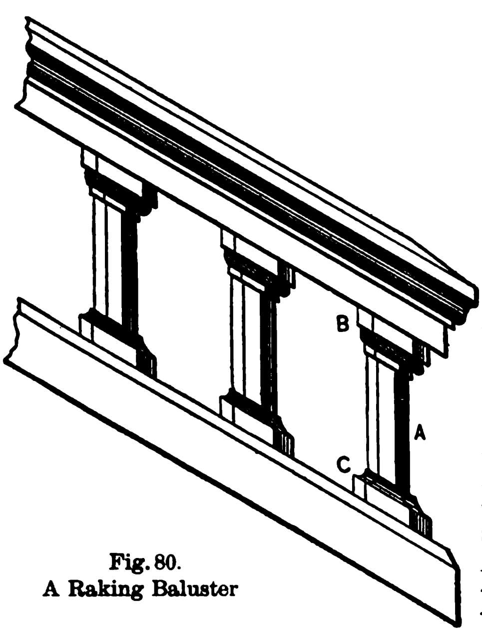


Fig. 80.
A Raking Baluster

In Fig. 81 let D E F G H I J K represent the plan view of the shaft of the baluster, and L M N O P Q R S the elevation of same placed in line above the plan, as shown. Let C in elevation represent the desired profile at right angles to O P, which will be called the given profile. Now divide this profile C into equal spaces, as shown by the small figures 1 to 8, and parallel to O P or L S draw lines indefinitely through these small figures, as shown. Take a tracing of the profile C and place it at right angles to D K in plan, as shown by C^1. Draw the outer plan of the cap, as shown by T U V W X Y Z &. Then draw the miter lines in plan, & V, T D, U E, V F, W G, X H, etc., as shown. Divide

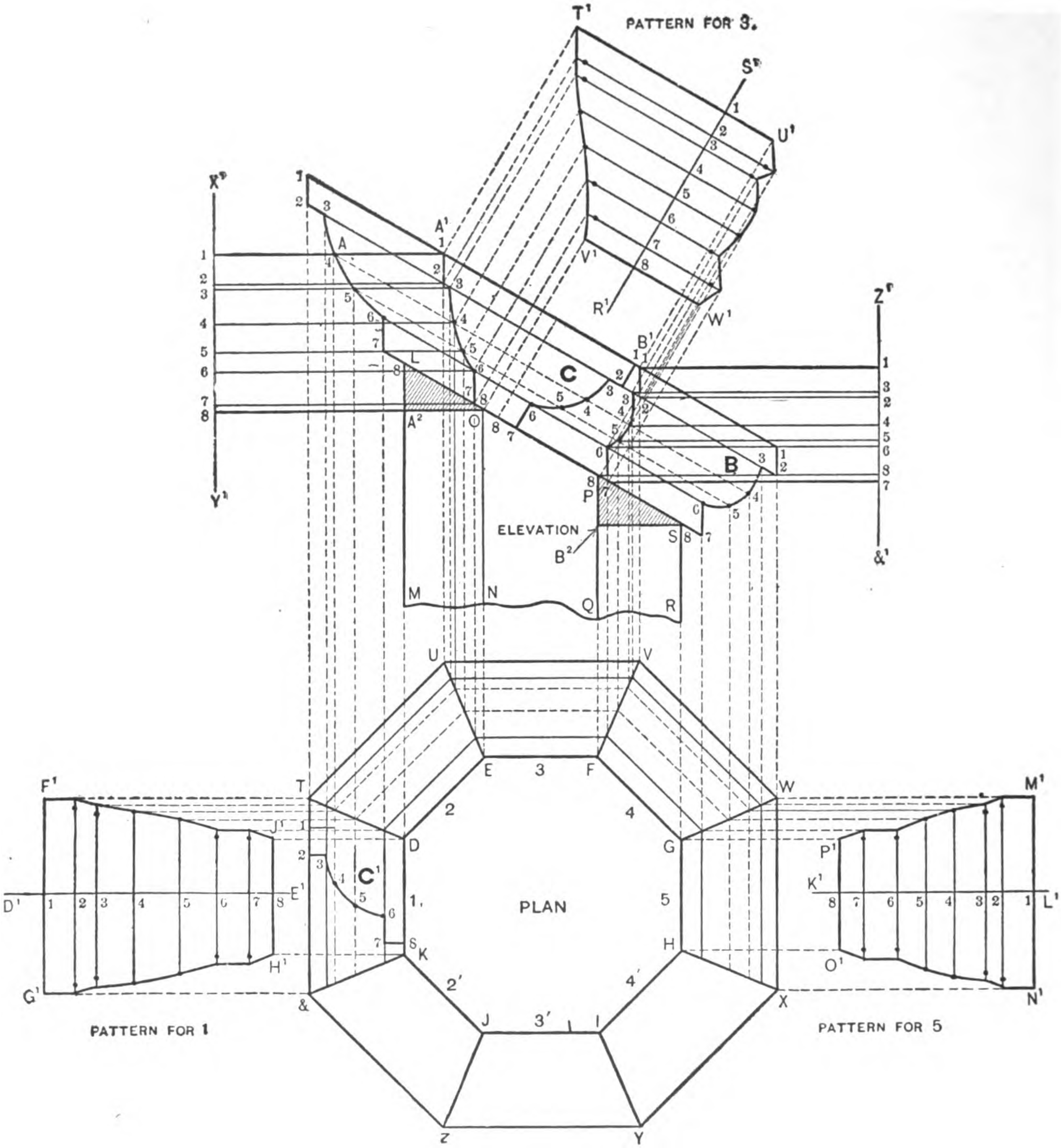


Fig. 81. Plan, Elevation, Miter Lines and Patterns

the profile C^1 in plan into the same number of equal spaces as the given profile C in elevation was divided, as shown from 1 to 8 in the profile C^1 in plan.

Through these small figures and parallel to K D draw lines intersecting the miter lines K & and T D. From the intersection on T D and parallel to D E draw lines intersecting the miter line E U. In similar manner from intersections on the miter lines E U, F V, G W, etc., and parallel to E F, F G, G H, etc., respectively, draw lines, as shown. Now parallel to K D and from intersections on the miter line T D carry lines upward, intersecting lines having similar numbers drawn through the profile C in elevation parallel to L S.

Trace a line through points thus obtained, as shown by 1 to 8 in profile A. Then will the profile A represent the true section or profile taken through that part of the cap shown by 1 in plan. In similar manner, parallel to H G and from the intersections on the miter line G W draw lines upward, intersecting lines of similar numbers drawn through the profile C in elevation parallel to L S. Trace a line thus obtained, as shown from 1 to 8 in profile B. Then will the profile B represent the true section or profile, taken through that part of the cap shown by 5 in plan. Now at right angles to U V in plan, and from intersections on the miter line U E, draw lines upward, intersecting lines of similar numbers in elevation, as shown. Trace a line through points from 1 to 8, then will A^1 O be the miter line in elevation, on U E in plan. In similar manner at right angles to U V and from intersections on V F carry lines upward, intersecting lines of similar numbers in elevation, as shown. Trace a line from 1 to 8, then will B^1 P be the miter line in elevation on F V in plan.

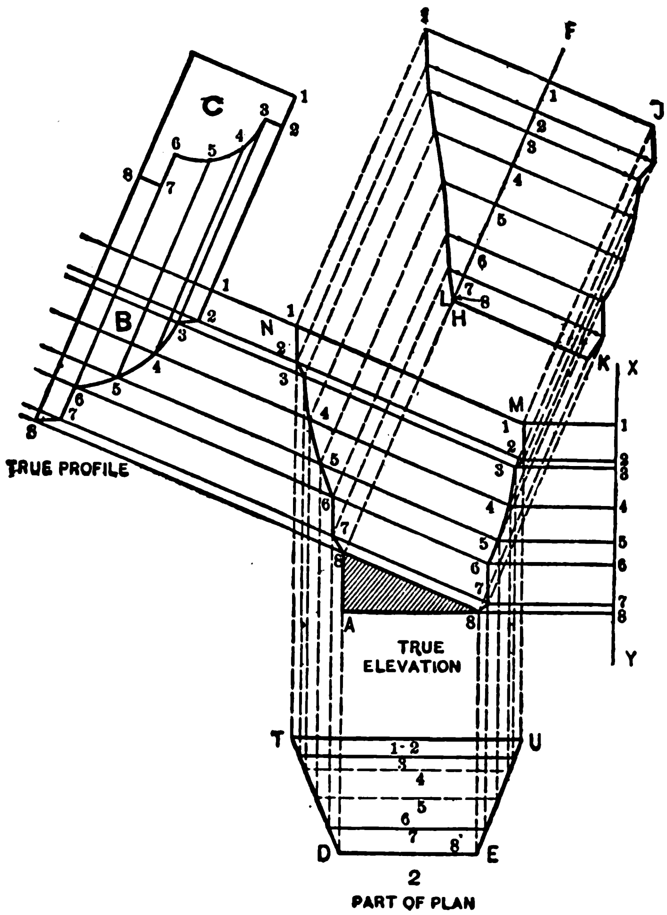


Fig. 82. Plan, True Elevation and Pattern for No. 2

The plan and elevation of the baluster is now completed and from which the patterns for parts 1, 3 and 5 shown in plan can be obtained. For the pattern for part 1 proceed as follows: At right angles to T & in plan draw the line D^1 E^1, upon which place the stretchout of profile A in elevation, being careful to carry each space separately onto the line D^1 E^1, as shown by the small figures 1 to 8. At right angles to D^1 E^1 and through the small figures draw lines, which intersect with lines having similar numbers drawn from the intersections on the miter lines T D and K & at right angles to T &. Trace a line through points thus obtained, then will F^1 G^1 H^1 J^1 be the pattern for part 1 in plan, formed after the profile A in elevation.

Now at right angles to W X in plan draw the line K^1 L^1, upon which place the stretchout of the profile B in elevation, being careful to carry each space separately onto the line K^1 L^1, as shown by the small figures. At right angles to K^1 L^1 and through the small figures draw lines, which intersect with lines having similar numbers drawn from the intersections on the miter lines G W and X H at right angles to W X. Trace a line through points thus obtained, then will M^1 N^1 O^1 P^1 be the pattern for part 5 in plan, and is to be bent after the profile B in elevation.

For the pattern for part 3 and 3′ in plan proceed as follows: At right angles to A^1 B^1 in elevation draw the line R^1 S^1, upon which place the stretchout of the given profile C, as shown by the small figures 1 to 8 on the line S^1 R^1. At right angles to R^1 S^1 and through the small figures draw lines, which intersect with lines having similar numbers drawn at right angles to A^1 B^1 from the intersections on the miter lines A^1 O and B^1 P. A line traced through points thus obtained, as shown by T^1 V^1 W^1 U^1, will be the pattern for the parts 3 and 3′ in plan, formed after the profile C in elevation, one right and one left.

For the patterns for parts 2 and 4 true elevations must be constructed, but before doing so the vertical hight of the intersections on the miter lines A^1 O and B^1 P must be obtained as follows: Draw any vertical lines in the positions shown as X^1 Y^1 and Z^1 $\&^1$. At right angles to these two vertical lines X^1 Y^1 and Z^1 $\&^1$, and from the intersections 1 to 8 on both miter lines A^1 O and B^1 P, draw lines intersecting the lines X^1 Y^1 and Z^1 $\&^1$, respectively, as shown by small figures 1 to 8 on both. Now take a tracing of T U E D or part 2 (all eight parts being alike), and place it as shown by T U E D or part 2 in Fig. 82, being careful to have the various intersecting lines and numbers as shown. Draw any horizontal line, as A 8, in length equal to D E in plan, as shown. At right angles to A 8 draw the line A 8′, equal in hight to A^2 8 in elevation in Fig. 81. Then draw a line from 8 to 8′ in Fig. 82. Take the various hights on the line X^1 Y^1 in Fig. 81 and place as shown by X Y in Fig. 82, being careful that the point 8 is placed so that it will meet the line A 8 extended, as shown. At right angles to X Y and from the points 1 to 8 on same draw lines which intersect with lines drawn from intersections having similar numbers on U E in plan at right angles to D E. Through the points of intersections thus obtained trace a line, as shown by the small figures, or from 8 to M. Now parallel to 8 8′ and from intersections on the miter line M 8 draw lines indefinitely, as shown, which intersect with lines drawn from intersections on T D in plan having similar numbers at right angles to D E. Trace a line through

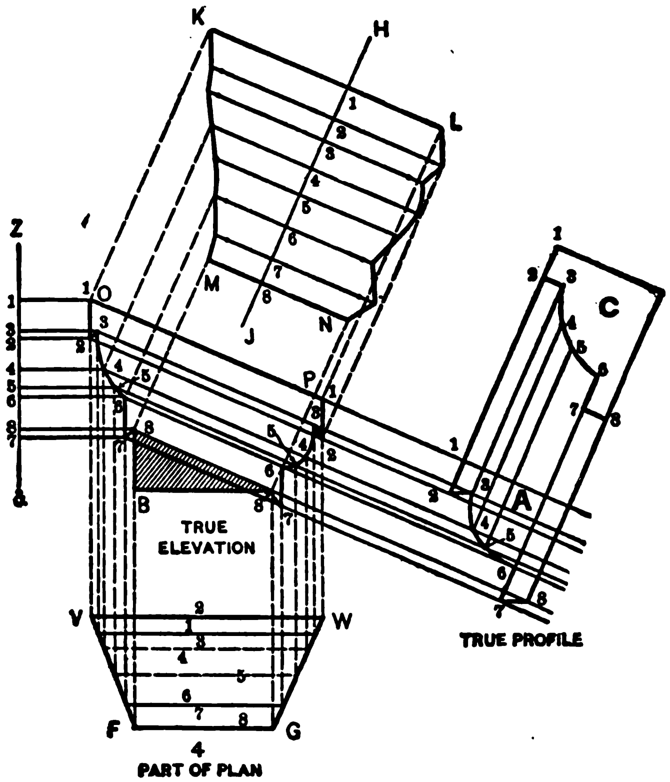


Fig. 83. Plan, True Elevation and Pattern for No. 4

intersections thus obtained, as shown by the small figures, and from N to 8′. Then will N M 8 8′ be the true elevation for part 2 and 2′ of the baluster in plan in Fig. 81.

Before obtaining the pattern for part 2 a true profile must be obtained at right angles to N M in Fig. 82, for which proceed as follows: Take a tracing of the given profile C in elevation in Fig. 81 and place it, as shown, at right angles to M N extended in elevation in Fig. 82, as shown by C. At right angles to M N and from the various points 1 to 8 in the profile C draw lines, as shown, intersecting lines of similar numbers drawn from the intersections in the miter line M 8.

Trace a line through points thus obtained, as shown, then will B be the true profile. For the pattern proceed as follows: At right angles to M N draw the line H F, upon which place the stretchout of profile B, being careful to carry each space separately onto the line H F, as the divisions are unequal, as shown by the small figures 1 to 8 on H F. Now at right angles to H F and through the small figures draw lines which intersect with lines drawn from intersections in N 8′ and M 8 having similar numbers at right angles to N M. Trace a line through points thus obtained, then will L I J K be the pattern for part 2 and 2′ formed after the profile B, one right and one left.

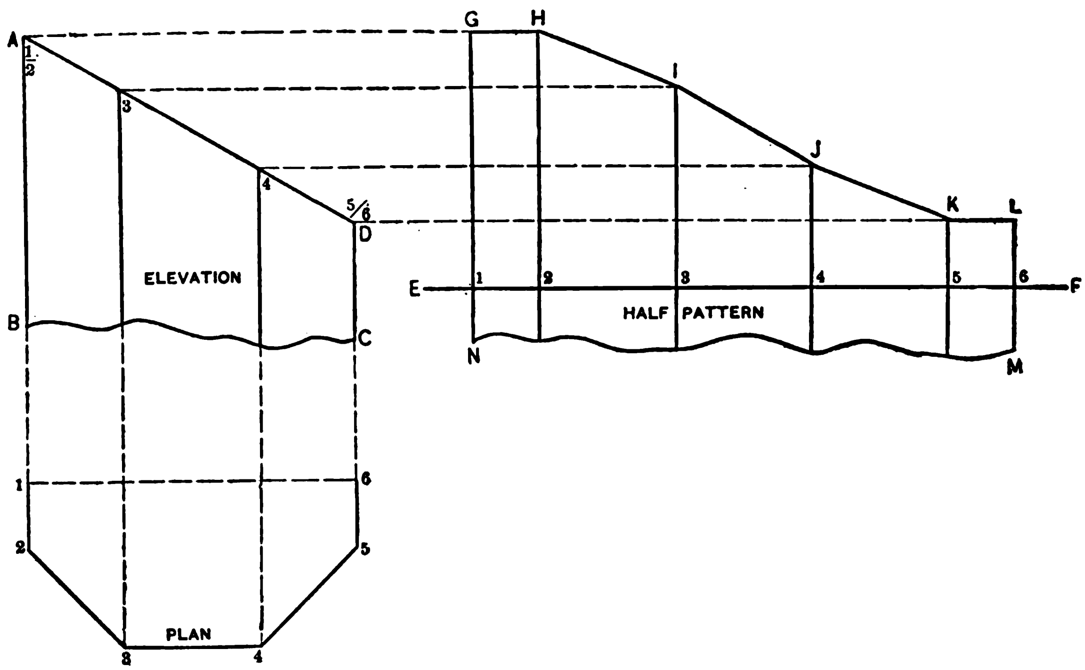


Fig. 84. Plan, Elevation and One-Half Pattern for Shaft at Top.

For the pattern for part 4 and 4′ in plan in Fig. 81 proceed as shown in Fig. 83, in which F G W V is a reproduction of F G W V in plan in Fig. 81. Draw any horizontal line, as B 8, in Fig. 83, equal in length to F G in plan, as shown. At right angles to 8 B draw B 8′ equal to B^2 8 in elevation in Fig. 81, and draw a line from 8 to 8′ in Fig. 83. Take the various hights on the line Z^1 $\&^1$ in Fig. 81 and place as shown by Z & in Fig. 83, being careful that the point 8 is placed so that it will meet the line drawn at right angles to B 8′ from the point 8′, as shown. Referring to Fig. 82, it will be noticed that the vertical hights on X Y are placed to the right of the triangle A 8 8′, because the hights are taken from the miter line A^1 O in elevation in Fig. 81, which is to the right of the triangle L A^2 O; while in

Fig. 83 the vertical hights on Z & are placed to the left of the triangle 8 B 8' because the hights are taken from the miter line B^1 P in elevation in Fig. 81, which is to the left of the triangle P B^2 S. Bearing this in mind, now at right angles to Z & in Fig. 83, and from points 1 to 8 on same, draw lines which intersect with lines drawn from intersections having similar numbers on V F at right angles to F G. Through points of intersections thus obtained trace a line, as shown by the small figures, or from 8' to O. Parallel to 8 8' and from intersections on the miter line O 8' draw lines indefinitely, as shown, which intersect with lines drawn from intersections on G W in plan having similar numbers at right angles to F G. Trace a line through intersections thus obtained, as shown by the small figures, and from P to 8. Then will O P 8 8' be the true elevation for part 4 and 4' of the baluster shown in plan in Fig. 81. For the true profile, at right angles to O P in Fig. 83 take a tracing of the given profile C in elevation in Fig. 81 and place it as shown at right angles to O P extended in Fig. 83 by C. At right angles to O P and from the various points 1 to 8 in the profile C draw lines, as shown, intersecting lines of similar numbers drawn from the intersections in the miter line O 8'. Trace a line through points thus obtained, as shown, then will A be the true profile.

At right angles to O P draw the line J H, upon which place the stretchout of the profile A, as shown by the small figures on the line H J. Now at right angles to H J and through the small figures draw lines which intersect with lines drawn from intersections having similar numbers in O 8' and P 8 at right angles to O P. Trace a line through points thus obtained, then will K L N M be the pattern for part 4 and 4' formed after the profile A, one right, the other left.

This completes the entire patterns for the cap of the baluster. For the cut of the baluster shaft at the top proceed as shown in Fig. 84, in which 1 2 3 4 5 6 represents the half plan of the baluster shaft reproduced from the plan in Fig. 81, and A B C D in Fig. 84 shows the elevation of the shaft similar to L M R S in Fig. 81. For the pattern draw the line E F in Fig. 84 at right angles to C D, and upon it place the stretchout of the half plan, as shown by similar figures 1 to 6. At right angles to E F and through the small figures draw lines, which intersect with lines drawn from intersections having similar numbers on A D at right angles to C D. Trace a line through points thus obtained, then will G H I J K L M N be the half pattern for the shaft of the baluster. The reverse cut of this pattern will answer for the pattern for the shaft, butting against the base of the baluster as at C in Fig. 80.

PATTERNS FOR COMPLICATED RAKING MOLDINGS

In the accompanying illustration, Fig. 85, is shown the plan and elevation of a gable molding with horizontal returns at either end, at an acute and obtuse angle, respectively. Owing to the different angles in plan, it will require four different profiles and patterns to miter the various molds. If the miter line of the gable were allowed to run at right angles to F G in plan, as shown by J *x*, it would only be necessary to obtain one profile for the gable mold; but as it is desired that the miter line of the gable shall be a continuation of the ridge line I J, as J K, makes it necessary to obtain two profiles.

Let E F G H represent the plan of the wall of the building and I J the line of the ridge parallel to G H. Bisect the angles G and F as indicated by *u v w* and and *r s t*, respectively. Draw the miter lines *t* F and *w* G, extending them indefinitely. In its proper position above the plan draw the gable F° J° G°, making the rise N J°, as desired. In this case it is desired that the normal or given profile be placed on the horizontal return F E in plan, as shown by the profile A.

The first step is to divide this profile into an equal number of spaces, as shown from 1 to 11, through which points, parallel to E F, lines are drawn until they intersect the miter line F M from 1 to 11. From these intersections lines are drawn parallel to F G, crossing the miter line J K as shown, and intersecting the miter line G L, also from 1 to 77, from which intersections lines are carried parallel to G H, if desired.

Now take a tracing of the given profile A in plan and place it in the position shown by A^1 in elevation, being careful that points 10-11 are in line with G° F°, extended as shown. From the various intersections in A^1 horizontal lines are drawn and intersect vertical lines erected from similar numbered intersections on the miter line F M in plan, resulting in the miter line M° to F° in elevation, when a line is traced through points thus obtained.

From the intersections 1 to 11 in M° F° lines are drawn parallel to F° J° and intersected by vertical lines drawn from similar numbered intersections on the miter line J K in plan, partly shown by 2, 3 and 11. A line traced through points thus obtained, as shown from K° to J°, will be the miter line at the gable juncture. From the intersections 1 to 11 in the miter line J° K° lines are drawn parallel to J° G° and intersected by lines erected from the intersections on G L in plan, resulting in the miter line L° G° in elevation. This completes the miter lines in elevation, from which patterns are obtained, but to obtain the girths of these patterns modified profiles must be obtained, as follows:

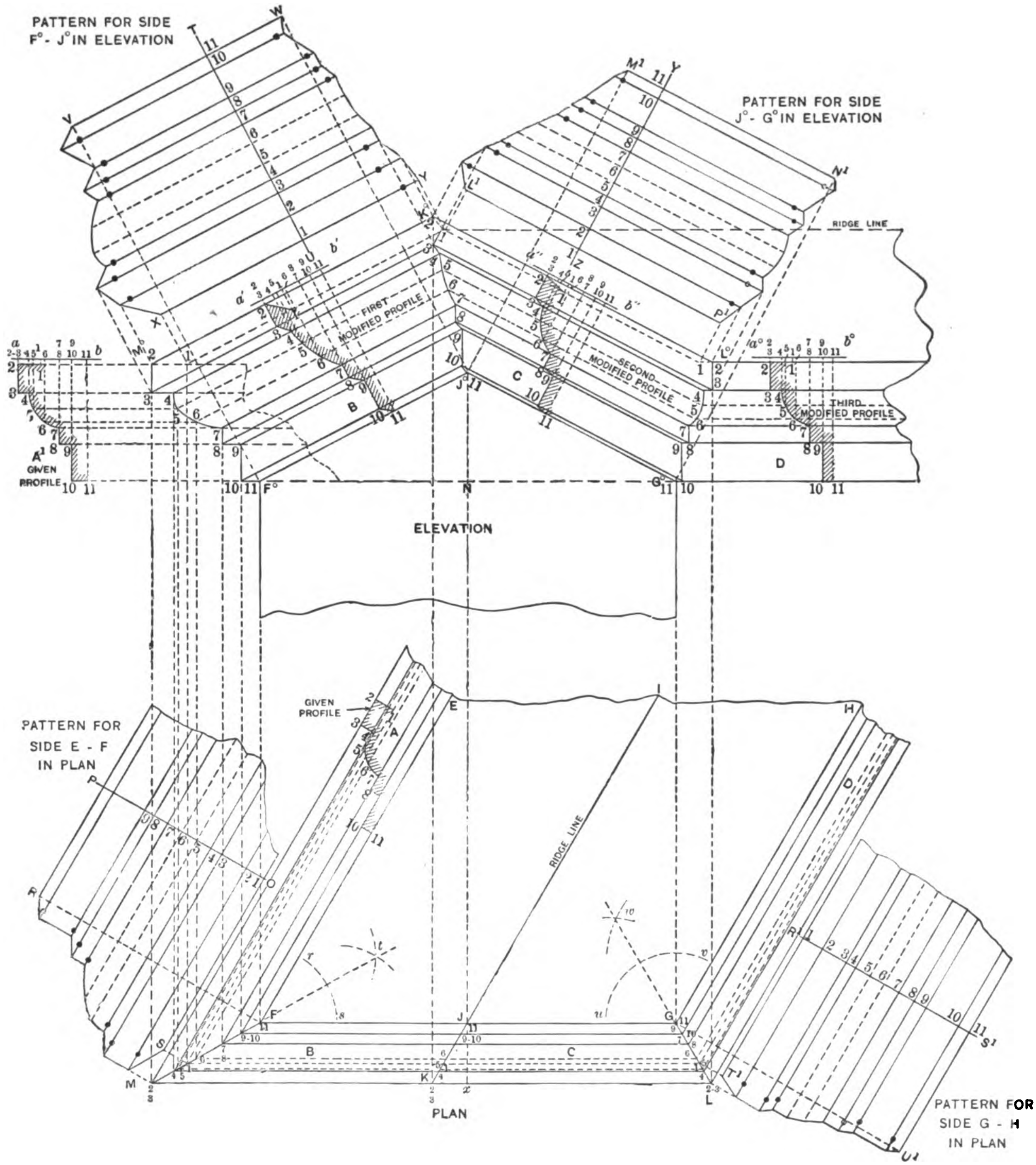


Fig. 85 Drawings for Developing Patterns of Complicated Raking Moldings

Obtain the projections of the various points in the given profile A^1, on the horizontal line $a\ b$, and place it in the positions shown by $a'\ b'$, $a''\ b''$ and $a^\circ\ b^\circ$, the line in each case being drawn parallel to the line of the molding, as shown. Perpendiculars are now drawn intersecting similar numbered lines in the molding. Trace lines through points thus obtained; then B is the modified profile for the left gable mold, C the modified profile for the right gable mold and D the modified profile for the right horizontal return.

Having obtained the miter lines and profiles, the patterns are developed as follows: On the line O P, drawn at right angles to F E in plan, place the girth of the profile A, or A^1, as shown from 1 to 11 on O P. Through these points draw lines parallel to F E and intersect same by lines drawn at right angles to F E from similar numbered intersections on the miter line F M. Trace a line through points thus obtained; then will P O S R be the pattern for the side F E in plan. In similar manner on the line $R^1\ S^1$, drawn perpendicular to G H in plan, place the girth of the third modified profile D, as shown, from 1 to 11 on $R^1\ S^1$, through which draw lines parallel to G H, intersecting same by lines drawn from similar intersections on the miter line G L in plan, at right angles to G H, and resulting in the pattern $R^1\ T^1\ U^1\ S^1$ for the side G H in plan.

The horizontal return patterns were obtained from the plan, while the gable patterns will be obtained from the elevation. At right angles to $F^\circ\ J^\circ$ draw the line T U, upon which place the girth of the modified profile B. Through the points draw the usual measuring lines, which intersect by lines drawn at right angles to $F^\circ\ J^\circ$, from similar intersections on the miter lines $M^\circ\ F^\circ$ and $K^\circ\ J^\circ$ in elevation. A line traced through points thus obtained, as shown by V W Y X, will be the pattern for the left gable mold. The pattern for the right gable mold is obtained similarly, as indicated.

MITERING A DORMER AGAINST A DOME

For an accurate solution of this problem—that is, the miter of a molding against a spherical surface—the following demonstration and diagrams are appended: Let A B C, in Fig. 86, be one-quarter of the plan of a round dome, and D E a profile of the same. Let F H represent the profile of the return molding placed in its proper position, as shown, and H J part of the line of the dormer window. Draw a soffit plan of the molding, as shown by K L M N. Now divide curved portion of the profile F H into an equal number of spaces, as shown, and drop perpendicular lines from the spaces in F H until they intersect the miter line M O in plan. Then from the intersections on the miter line M O, and parallel to M N, draw lines until they intersect the plan of the round dome C A, as shown from K to N. At right angles to B A in plan, and from intersections on the curve K N, draw lines until they intersect the base of the dome P D. Place one point of the dividers at P, the center from which the dome is struck, and bringing the pencil points successively to the several points of intersection just obtained on the base line P D, draw arcs from each intersecting horizontal line of corresponding number drawn on the profile F H, as shown by the intersections 1^1, 2^1, 3^1, etc. The line R S T, traced through points of intersection thus obtained, will represent the miter line in elevation from which the pattern is obtained. For the pattern proceed as follows: At right angles to R F in elevation draw the stretchout line V W, upon which place the stretchout of the profile of the molding F H, as shown by the small figures 1, 2, 3, 4, etc. At right angles to W V, and through the small figures, draw the measuring lines, which intersect with lines of similar numbers drawn from the intersections in the miter line in elevation R S T and the profile F H at right angles to R F. Trace a line as shown from X to Y in pattern, which will be the square miter cut for the dormer return. It will be noticed that the pat-

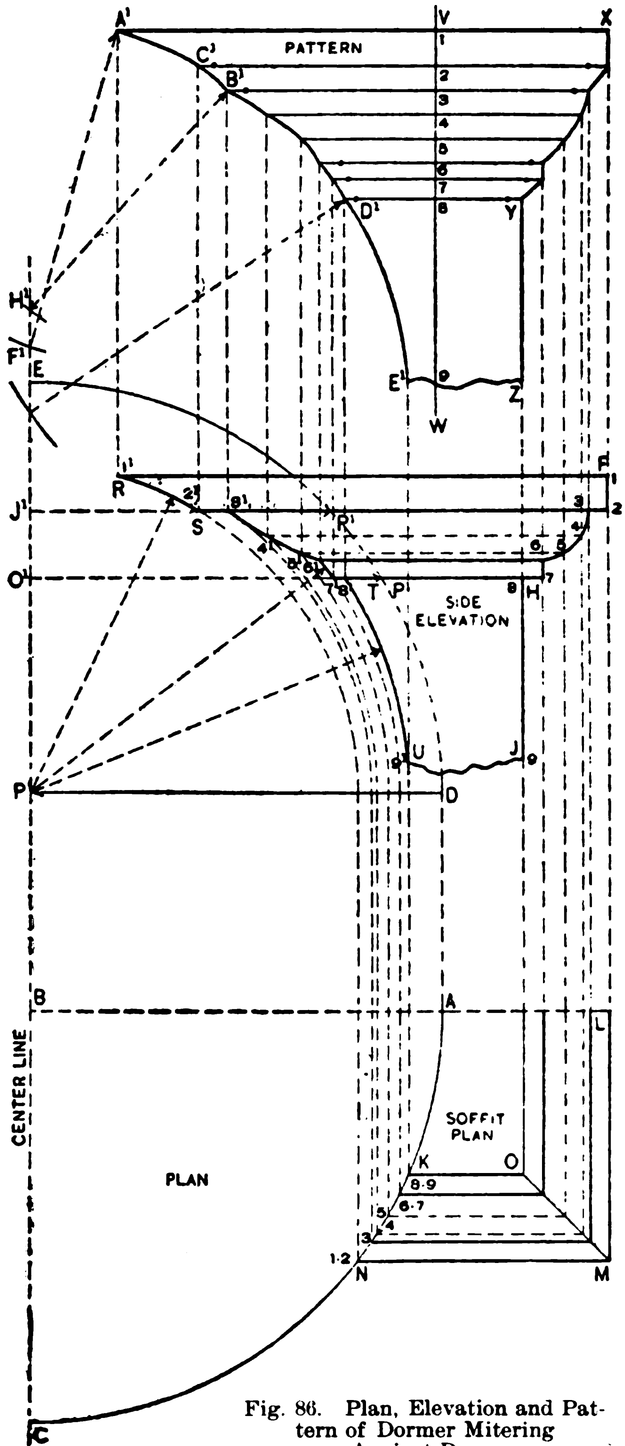


Fig. 86. Plan, Elevation and Pattern of Dormer Mitering Against Dome

tern for the miter cut at the other end of the molding will require arcs, which are struck from centers corresponding to the arcs shown in the miter line in elevation. To strike these arcs, proceed as follows: Extend the center line, above the elevation, as shown; now, with P R or P S in elevation as radius, and with A^1 in pattern as center, strike an arc intersecting the center line at F^1. Then with F^1 as center, and using the same radius, draw an arc shown from A^1 to C^1. As that part of the profile shown from 2 to 3 in the profile F H meets the dome on a horizontal plane, the arc shown from C^1 to B^1 in pattern will be struck with a radius equal to J^1 P^1 in elevation. Then with C^1 or B^1 in pattern as center, and a radius equal to J^1 P^1, draw an arc intersecting the center line at H^1. Then with H^1 as center, and with the same radius, strike arc shown from C^1 to B^1.

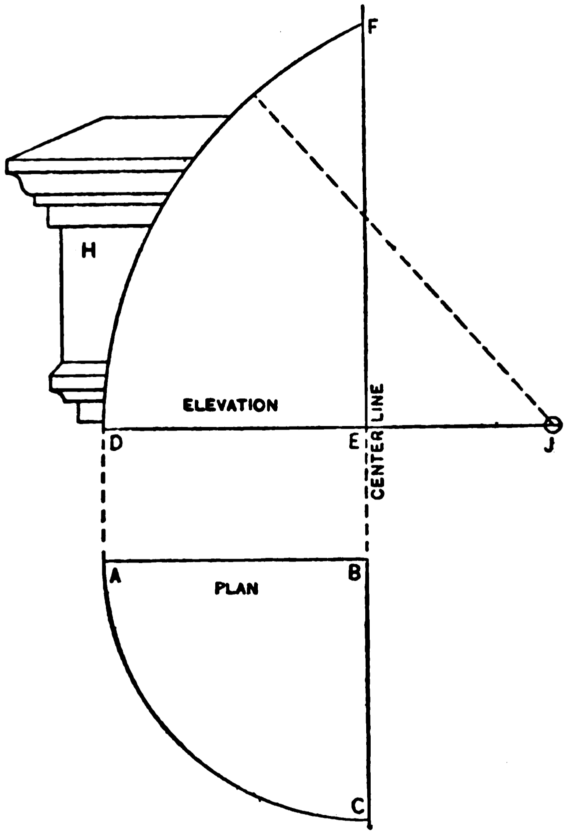


Fig. 87. Dormer Mitering Against Irregular Curved Dome

Now trace a line from B^1 to line 6 in pattern. The arc shown between lines 6 7 in pattern will be struck with a radius equal to P 6^1 or P 7^1 in elevation, while the arc shown between lines 7 8 in pattern will be struck with a radius equal to O^1 P^1 in elevation. Then will A^1 C^1 B^1 D^1 Y X be the pattern for the return of the dormer molding against the dome. The arc shown from D^1 to E^1 in pattern is struck, as previously explained, with the radius shown in elevation by P T or P U.

In Fig. 87 is shown a dome of similar construction, and the principles employed in obtaining the pattern in Fig. 86 can also be applied to Fig. 87. A B C represents the plan, D E F the elevation, and H the side of the dormer. The method shown in Fig. 86 should be applied in the same manner for Fig. 87, with the exception that the center point with which the dome is struck in Fig. 86 lies in the center line, while in Fig. 87 the center point lies outside of the center line, as shown at J. After the intersections are obtained on the base line of dome D E, Fig. 87, J would be struck to intersect with horizontal lines, as explained in connection with Fig. 86.

PATTERN FOR MOLDINGS MITERING AGAINST CONCAVE CONICAL TOWER

This problem deals with the method of how to cut the pattern for the moldings on the sides of a dormer window mitering against a concave conical tower, shown in the accompanying illustration, Fig. 88, in which E F G H represents a partial elevation of the tower, and I J K the side of the dormer window which is to miter against the tower. In this connection it may be proper to remark that it is not necessary when obtaining the pattern to draw a full elevation of the tower; all that is required being the center line of the tower and as much of the curve of the tower as will be necessary to receive the side of the dormer. Draw any vertical line, as A B, which represents the center line; let E F and H G represent the half diameters of the tower at these points respectively, then draw the desired curve or sweep F G. In its proper position draw the profile or side of dormer indicated by J K. Divide the curved portion of the profile into equal spaces, as shown by the small figures 1 to 8, introducing two extra points, X and Y, as shown. Now at right angles to the center line A B and through the various points draw lines intersecting the curve of the tower F G between I and K.

From any convenient point, as C on the center line, and at right angles to A B, draw the line C D. At right angles to C D and from the various intersections on the curve I K draw lines intersecting C D at points 1, Y, X, 2, 3, etc., corresponding to lines of similar numbers in the profile J K. Now with C as center, and with radii equal to the distances to the various points shown by the small figures on the line C D, draw arcs as shown. At right angles to the center line C D in plan, set off half the width of the dormer window, as at Z. Now take a tracing of the side of the dormer J K in elevation and place it as shown by J^1 K^1 in plan, placing the line 1 2 parallel to the center line in plan, as shown. Space the profile into the same number of parts as shown in elevation, then parallel to C D and from the various points in the profile J^1 K^1 draw lines intersecting arcs of similar numbers, as shown by points 1 to 8 in plan. A line traced through points of intersections thus obtained will show the line of intersection between the side of the dormer and the roof of the tower. Now at right angles to C D and from the various points of intersection in the miter line in plan 1 to 8 draw lines upward intersecting lines of similar numbers in elevation drawn from the profile J K parallel to I J. A line traced through points of intersection thus obtained, as shown from 1^1 to 8^1, will be the miter line in elevation, showing the

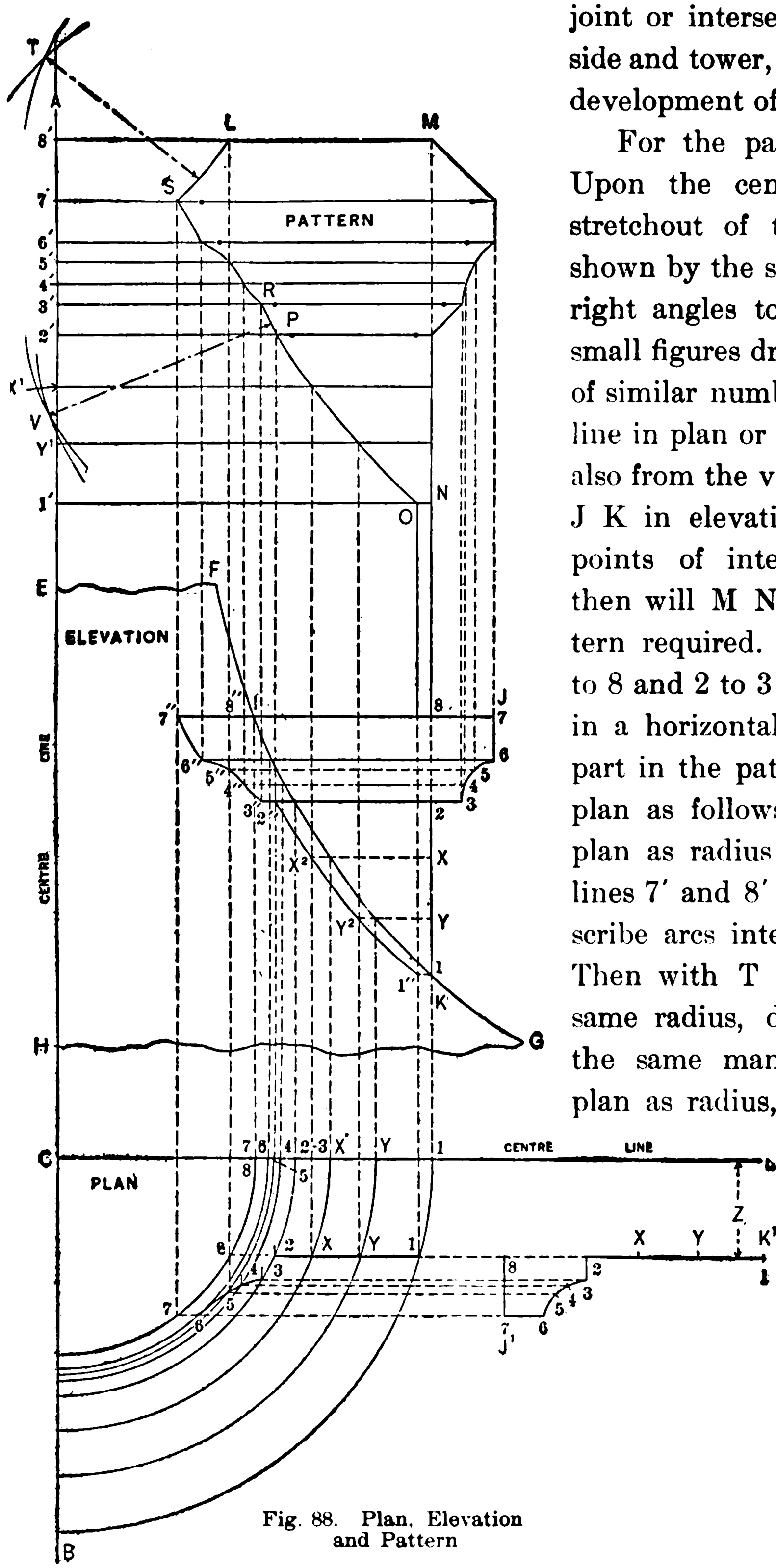


Fig. 88. Plan. Elevation and Pattern

joint or intersection between the dormer side and tower, but is not necessary in the development of the pattern.

For the pattern proceed as follows: Upon the center line A B place the stretchout of the molding 8 J K, as shown by the small figures on A B. At right angles to A B and through the small figures draw lines intersecting those of similar numbers drawn from the miter line in plan or elevation parallel to A B, also from the various points to the profile J K in elevation. Trace lines through points of intersections thus obtained; then will M N O P R S L be the pattern required. As the distances from 7 to 8 and 2 to 3 in profile in elevation lie in a horizontal plane, the shape of that part in the pattern is obtained from the plan as follows: With C 7 or C 8 in plan as radius and points S and L on lines 7′ and 8′ in pattern as centers, describe arcs intersecting each other at T. Then with T as center, and using the same radius, describe the arc L S. In the same manner with C 2 or C 3 in plan as radius, and points R and P on lines 2′ and 3′ in pattern as centers, describe arcs intersecting each other at V; then with V as center, using the same radius, describe the arc RP.

HORIZONTAL MOLDING AND CURVED WASH

To lay out the patterns for the intersection of a horizontal molding, A, with the curved wash D of the accompanying illustration, Fig. 89, in which J K L shows half the elevation of the curved molding, struck from the center C, and M N O P the elevation of the horizontal molding; let R^1 S^2 S be the true section of the curved molding taken on the line K L in elevation and T^1 be the true

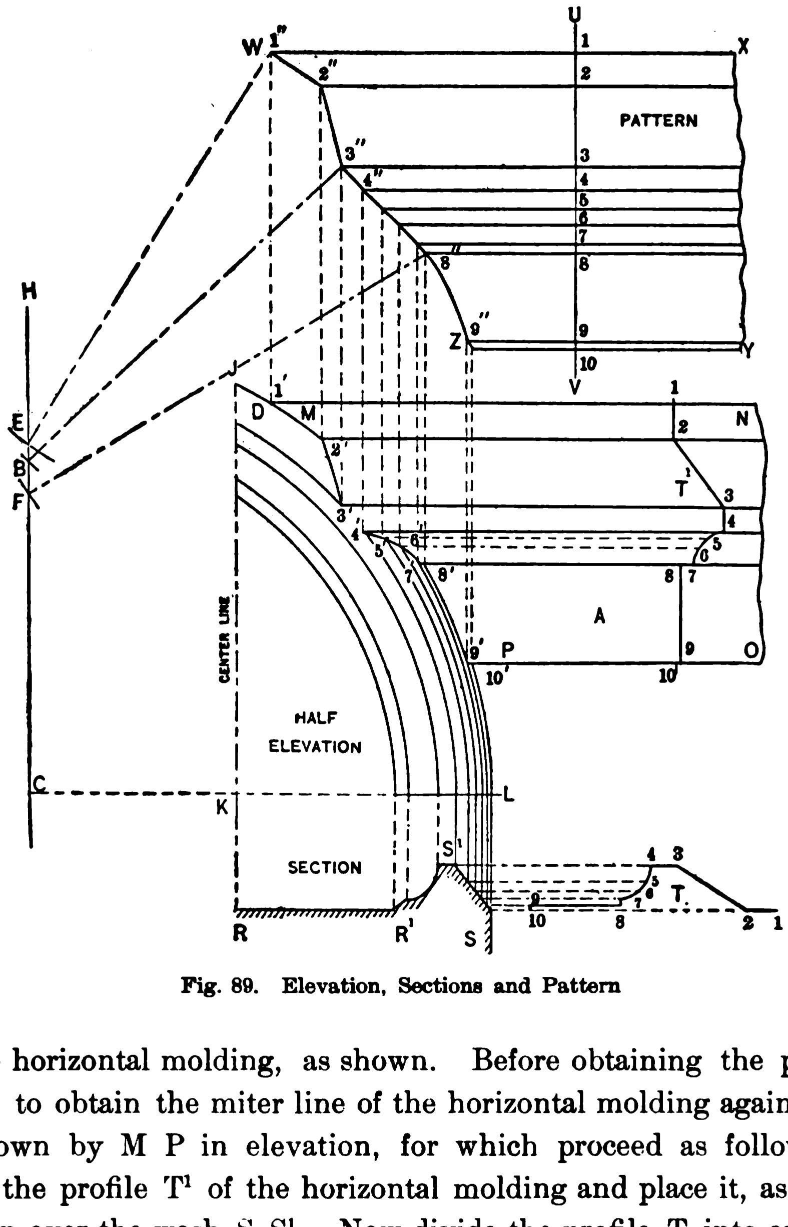


Fig. 89. Elevation, Sections and Pattern

profile of the horizontal molding, as shown. Before obtaining the pattern it will be necessary to obtain the miter line of the horizontal molding against the curved wash, as shown by M P in elevation, for which proceed as follows: Take a duplicate of the profile T^1 of the horizontal molding and place it, as shown by T, in the section over the wash S S^1. Now divide the profile T into any number of equal spaces, as shown by the small figures 1 to 10; then from these divisions and parallel to 1 to 10 draw lines intersecting the wash S S^1, as shown. At right angles to K L in elevation and from the intersections on the wash S S^1 draw lines intersecting the base line K L. Then using C as the center, and with radii equal to the distances from C to the several intersections, draw arcs, which intersect with lines of similar numbers drawn parallel to M N from the divisions in the profile T^1 which is spaced similar to the profile T. A line traced through intersections thus obtained, as shown by 1′ to 10′, will be the miter line.

For the pattern proceed as follows: At right angles to M N draw the line U V, upon which place the stretchout of the profile T^1, as shown by the small figures. At right angles to U V and through the small figures draw lines, which intersect with lines drawn at right angles to M N from intersections of similar numbers in the miter line M P. Trace a line from 2″ to 3″, from 4″ to 8″ and 9″ to the line 10 in pattern. The balance of the spaces are arcs of circles, and are obtained as follows: With C 1″ as radius and 1″ in pattern as center describe an arc intersecting at E the line C H, which is erected from C at right angles to C L. Then with E as center and using the same radius draw the arc 1″ 2″ in pattern, which is the same as 1′ 2′ in elevation. Now with C 3′ in elevation as radius and 3″ in pattern as center describe an arc intersecting the line C H at B. Then with B as center and using the same radius describe the arc 3″ 4″. Finally with C 8′ in elevation as radius and 8″ in pattern as center describe an arc intersecting the line C H at F. Then with F as center and with similar radius describe the arc 8″ 9″ in pattern. Then will W X Y Z be the pattern for the miter cut against the required curved wash.

OCTAGON BASE OVER CIRCULAR WINDOWS

To obtain the patterns for an octagon base to fit over two circular windows, similar to the diagram Fig. 90 in which A and B represent the circular windows over which the octagon base D C E is to fit, F H I J K being plan view. At right angles to E D, and from the point of the base C erect a line, intersecting the line J F in plan of K; then from the corners H and I draw the miter lines H K and K I. As the given profile of the octagon base D C E in elevation is a true section on the line J F in plan, it will be necessary to obtain true sections at right angles to the lines J I and I H in plan before the patterns can be obtained. To do this, proceed as follows:

Divide the half profile of the base C D into equal spaces, as shown by the small figures 1 to 9; then at right angles to E D, and from the small intersections, draw lines intersecting the line J F in plan, as shown. Now from the intersections on J K, and parallel to J I, draw lines intersecting the miter line I K; then parallel to H I, and from the intersections on I K, draw lines inter-

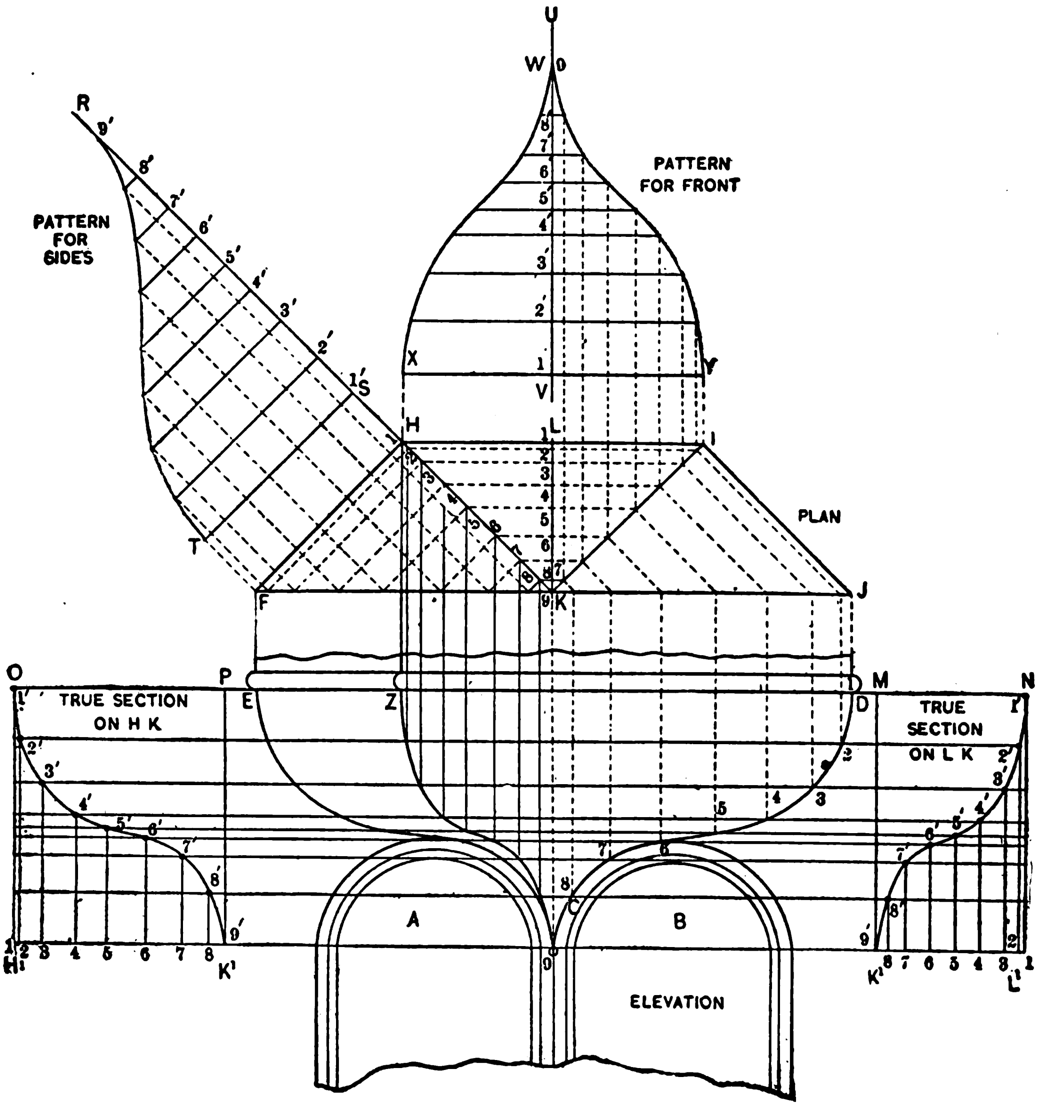


Fig. 90. Detail of Window Base and Method of Developing Patterns

secting the miter line H K. From these intersections and parallel to H F, draw lines intersecting F K. Through the intersections 1 to 9 in the profile C D in elevation draw line indefinitely, parallel to E D right and left. Now, at right angles to H I in plan, and from the point K, erect the line K L, as shown. Take the distance K L, with the various intersections on same, and place it on the horizontal line 9, drawn from 9 in elevation, as shown by K^1 L^1. At right angles to K^1 L^1 and from the small figures, draw lines, intersecting horizontal lines of similar numbers, as shown, from $1'$ to $9'$. From K^1, and at right angles to K^1 L^1 erect the line K^1 M. Trace a line from 1^1 to 9^1; then will M N K^1 be the true section on the line L K in plan.

For the section at right angles to F H or I J in plan proceed as follows: In this case it happens that the miter line H K in plan is at right angles to H F; therefore take the distance H K, with the various intersections on same, and place it on the horizontal line drawn from the point 9 in elevation, as shown by H^1 K^1. At right angles to K^1 H^1 and through the small figures, erect lines intersecting lines of similar numbers drawn from the points in profile D C. Trace a line through points thus obtained as shown from $1'$ to $9'$. From K^1, at right angles to K^1 H^1 erect the line K^1 P. Then will O P K^1 be the true section on H K in plan.

For the pattern for the front H I K proceed as follows: At right angles to H I erect any line, as U V, upon which place the stretchout of the section M N K^1, being careful to transfer each and every space separately, as shown by the small figures $1'$ to $9'$ on the line U V. At right angles to U V, and through the small figures, draw lines, which intersect with the line drawn from the intersections of similar numbers on the miter line I K at right angles to H I. Trace a line thus obtained, as shown by W Y. Trace the miter cut opposite the line U V, as shown by W X. Then will W X Y be the pattern for front. Proceed in similar manner for patterns for side. In line with H K in plan, or at right angles to H F, draw the line R S, upon which place the stretchout of the section O P K^1, transferring each and every space separate, as shown by the small figures, 1 to $9'$ on the line R S. At right angles to R S and from the small figures, draw lines, which intersect with lines drawn from the intersections on F K, having similar numbers at right angles to F H. As the miter line H K is at right angles to H F I the pattern cut for that mitre will result in a straight line, as shown by R S. Trace a line from R to T, and R S T will be the pattern for the two sides, one formed right, the other left. If for any reason it is desired to show the miter line in elevation on the line H K in plan, it can be done as follows: At right angles to F J, and from intersections on H K, drop solid lines, as shown, intersecting lines of similar numbers in elevation. Trace a line through points thus obtained, as shown by Z 9.

PATTERN FOR BOTTOM ON BAY WINDOW

This is an exemplification of the method of cutting the pattern of the bottom of a bay window when the miter lines A B, C D, E F, and G H must be made as drawn in elevation, so as to conform with the architecture of the bay. A section through I J is shown at K L M, the miter lines in the plan being curved.

The plan and elevation, Fig. 91, are an illustration of the bay window in

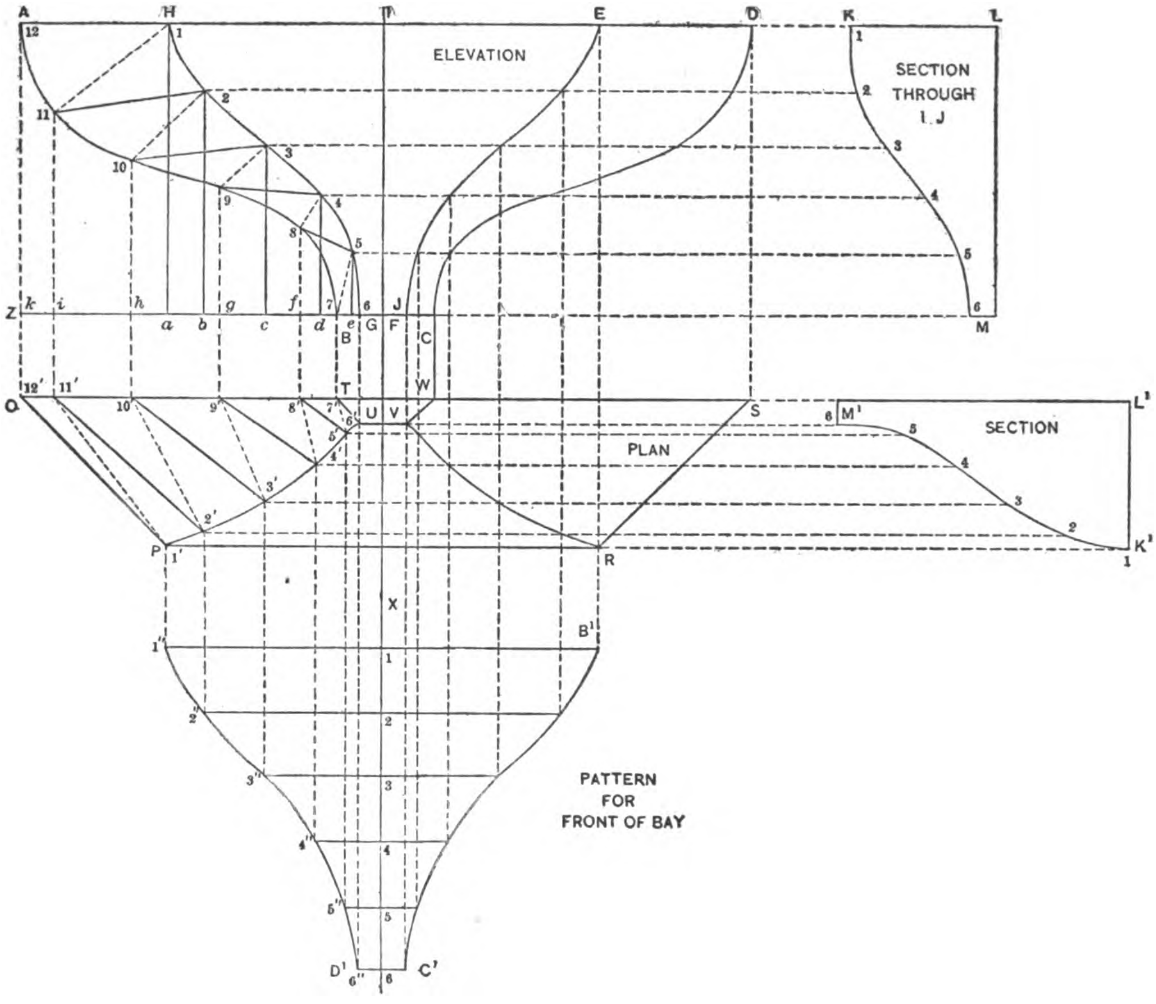


Fig. 91. Detail of Bottom of Bay, True Sections and Pattern

which A B C D represent the true profile of the outline of the bay against the wall O S in plan, while E F G H represents the given miter lines in elevation. K L M is the true given section on I J in elevation, and O P R S the plan view on the line A D in elevation, while T U V W is the plan view on B C in elevation. With the elevation, section and plan in their relative positions, the first step is to obtain the miter lines in plan, for which proceed as follows: Divide the section K L M into equal spaces, as shown by the small figures 1 to 6. At right angles from L M and from these intersections draw lines intersecting the given miter lines E F and G H in elevation, as shown by the points 1 to 6 on the miter line G H. Now take a duplicate of the section K L M, and placing the lines L^1 M^1 of the section to correspond with O S of the plan, divide the profile K^1 M^1 into the same number of divisions as are contained in K M of the elevation. Now parallel to K^1 M^1 and through the small figures draw lines into the plan, which intersect with lines of similar numbers drawn from the intersec-

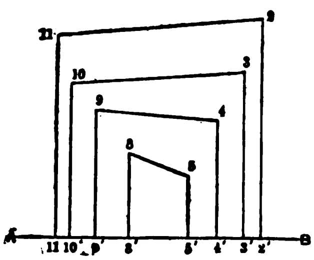


Fig. 92

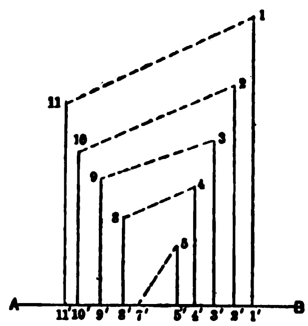


Fig. 93

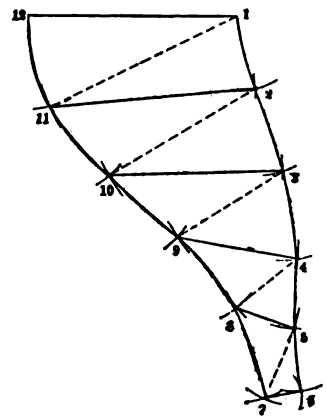


Fig. 94

Diagram of Triangles and Pattern of Sides

tions on the miter lines H G and F E in elevation at right angles to O S in plan. Lines traced through the point just obtained will give P U and V R as the miter lines in plan.

Having obtained the miter lines in plan, the pattern for the front of the bay can be developed as follows: Upon the center line I J, extended as X Y, place a stretchout of the section K M, as shown by the small figures 1 to 6. At right angles to X Y and through the small figures draw lines, which intersect with those drawn from intersections having corresponding numbers on the miter lines in plan T U and V R at right angles to P R. Trace a line through the points thus obtained and A^1 B^1 C^1 D^1 will be the pattern for the front of the bay, shown in plan by P U V R and in elevation by E F G H.

As it will be impossible to obtain the patterns for the sides of the bay by means of parallel lines the triangulation method will be employed. As all sides are the same only one will be developed. As the miter line H G in elevation is divided into five equal spaces, divide the profile A B into five equal spaces. The miter line H G being numbered 1 to 6 continue the numbers on the profile B A from 7 to 12, as shown. Now connect solid lines from 2 to 11, 3 to 10, 4 to 9 and 5 to 8, and dotted lines from 1 to 11, 2 to 10, 3 to 9, 4 to 8 and 5 to 7. Project the intersections 7 to 12 onto plan on the line O S, as shown by the dotted lines and from 7′ to 12′. Number the intersections on the miter line P U in plan to correspond with those on the miter line G H in the elevation, as shown by 1′ to 6′ in plan. Now draw solid lines in plan from 2′ to 11′, 3′ to 10′, 4′ to 9′, 5′ to 8′ and dotted lines from 1′ to 11′, 2′ to 10′, 3′ to 9′, 4′ to 8′ and 5′ to 7′. Extend the line C D in elevation, as shown by C Z. Now from the various intersections 1 to 12 in elevation draw vertical lines intersecting the line C Z at *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*. Then will the solid and dotted lines in plan represent the bases on the vertical lines just drawn in elevation the altitudes for the sections, which are constructed as follows: In Fig. 92 draw any horizontal line, as A B, upon which place the various lengths of the solid lines shown in plan, Fig. 91, as indicated by similar numbers in Fig. 92. At right angles to A B and through the small figures draw lines equal to hights of similar numbers in elevation, Fig. 91, all as is shown in Fig. 92. For example, take the distance 2′ 11′ in plan, Fig. 91, and place it on the line A B, as shown by 2′ 11′ of Fig. 92. At right angles to A B and from points 2′ and 11′ draw lines, making 11′ 11 and 2′ 2 equal respectively to *i* 11 and *b* 2 in elevation, Fig. 91. Draw a line from 2 to 11 in Fig. 92. Then will 2 11 be the actual distance on the finished article on the line 2′ 11′ in plan, Fig. 91. Proceed in precisely the same manner for the sections on dotted lines shown in Fig. 93. For example, take the distance 3′ 9′ in plan in Fig. 91 and place it in Fig. 93 on the line A B, as shown from 3′ to 9′. At right angles to A B from points 3′ and 9′ draw lines making 3′ 3 and 9′ 9 equal to *c* 3 and *g* 9 in elevation, Fig. 91. Then draw a line from 3 to 9 in Fig. 93, which will represent the true distance on the finished article on the lines 3′ 9′ in plan for 3 9 in elevation, Fig. 91.

For the pattern proceed as follows: Draw any horizontal line, as 1 12 in Fig. 94, equal to 1′ 12′ in plan, Fig. 91. Now with 12 11 in elevation as radius and 12 in Fig. 94 as center, describe the arc 11. Now with 1 as center and 1 11 of Fig. 93 as radius describe an arc in Fig. 94 intersecting the arc 11. Then with 1″ 2″ in the pattern, Fig. 91, as radius and 1 of Fig. 94 as center, describe the arc 2. Then with 11 as center and 11 2 of Fig. 92 as radius describe an arc in Fig. 94 intersecting the arc 2. Proceed in this manner, using alternately as radii first the divisions in the profile A B in elevation, Fig. 91, then the lengths of the dotted lines in Fig. 93, the intersected divisions in the pattern, Fig. 91, then the length of the solid lines in Fig. 92, the last division, 6 7 in pattern, Fig.

94, being obtained from 7′ 6′ or T U in plan Fig. 91. Trace a line through points thus obtained in Fig. 94. Then will 1 6 7 12 be the pattern for the sides of the bay, the miter cut 1 6 mitering with the cut A^1 D^1 in pattern, Fig. 91, while the cut 7 12 in Fig. 94 butts against the wall, indicated in elevation, Fig. 91, by A B.

DETAILS OF A LAWN VASE

One of the many useful articles that can be made of sheet metal is a vase for the ornamentation of a lawn. In Fig. 95 is shown the design of an attractive vase drawn to scale, the patterns for which may be developed by the method of Problem 116, in "The New Metal Worker Pattern Book."

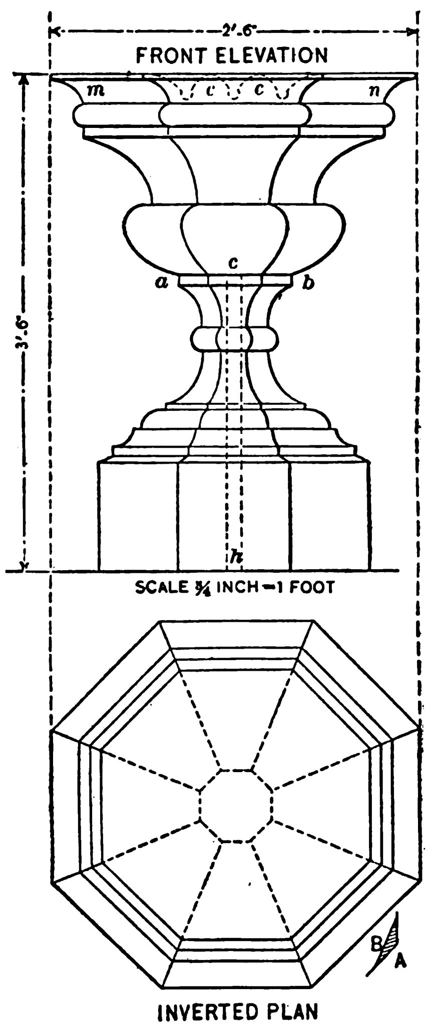


Fig. 95. Detail for Lawn Vase

Inasmuch as the method of obtaining the pattern is explained in another book, it should not be irrevelant to here elucidate the manner of constructing this vase, to wit: In work of this nature it is advisable, for the allowing of greater ease in the assembling, to have horizontal joints or seams, especially at *a b*. Then the general scheme of assembling would be to solder together two sides, of each section, giving four units because there are eight sides in all for each section. Two of these units are likewise soldered together, giving two units for each section; then these two units are soldered together at the two miters of adjoining sides, completing each section. A heavy bottom should be soldered in at joint *a b* to hold the ground in case it is desired to have growing plants in the vase. After soldering in the bottom, all sections are mounted and soldered to each other completing the work, with the exception of the tube *c h* to discharge surplus water, which is soldered to the bottom *a b* and stayed by pieces of sheet metal fastened to the sides at *h*.

When soldering together the sides, it is a good plan to reinforce the soldering of the miters by soldering vertical strips, the entire hight of miter; these strips are about two inches wide and is better indicated in the little diagram B A. To insure stability the bottom of the vase, as high as the fascia or flat member at the bottom, can be filled with concrete, this to be done before mounting the section, leaving a hole for the tube.

For additional ornamentation at the curved members at *m* and *n*, scallops may be cut as shown at *c c*. A good method for the cutting out of these scallops, is to mark them on the material by the usual manner of doing this and then cut the small circle, or round hole, with a hollow punch of suitable size; laying the material on a block of wood, or better still, a smooth lump of lead. After which the balance of the scallop is cut with the snips. Finally smoothing out the burr on the metal, caused by the cutting operations, by laying the material on the smooth surface of an iron block and striking with a mallet that has been rasped smooth. Although this makes a very pretty finish for the top of the vase, it presents sharp points and edges that are likely to cut the hand or clothes of any person having occasion to be near it, or tending to the plants growing in the vase. It is, therefore, recommended that the edge of the top of the vase be made plain with a wide edge to both stiffen it and for protection.