

PART VIII

PATTERNS FOR ROOF FLANGES, COLLARS, VENTILATOR BASES AND HOODS

ROOF FLANGE AND CYLINDER INTERSECTING SINGLE PITCHED ROOF

Solution 64

A VIEW of a cylinder or pipe and roof flange intersecting a single pitched roof is shown in Fig. 274<sup>a</sup>, where the roof flange is indicated by A and the pipe or cylinder by B. The method of developing patterns of this nature, regardless of the pitch of the roof, is shown in detail in Fig. 275.

Let A B represent the pitch of the roof and D C 5' 1' the elevation of the cylinder. Above the line D C, draw the profile of the cylinder in its proper position, as indicated by E, and through its center draw the horizontal line a b. Divide the profile E into an equal number of spaces, as shown by the small figures 1 to 5 to 1; from these points drop perpendicular lines until they cut the roof line A B, as shown by similar numbers 1' to 5'. Having obtained these points of intersection, the pattern for the cylinder may be laid out as follows: Extend the line C D in side elevation as D F; upon this place the girth of the profile E, as shown by similar numbers 1 to 5 to 1 on D F. At right angles to F D and through the small figures thereon, draw lines and intersect these lines by lines drawn parallel to F D from similarly numbered intersections on the roof line A B. Trace a line through

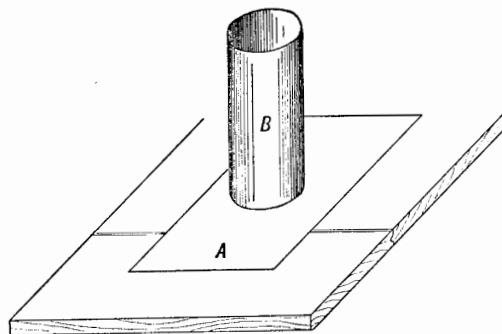


Fig. 274a.—View of Roof Flange and Cylinder on Single Pitch Roof

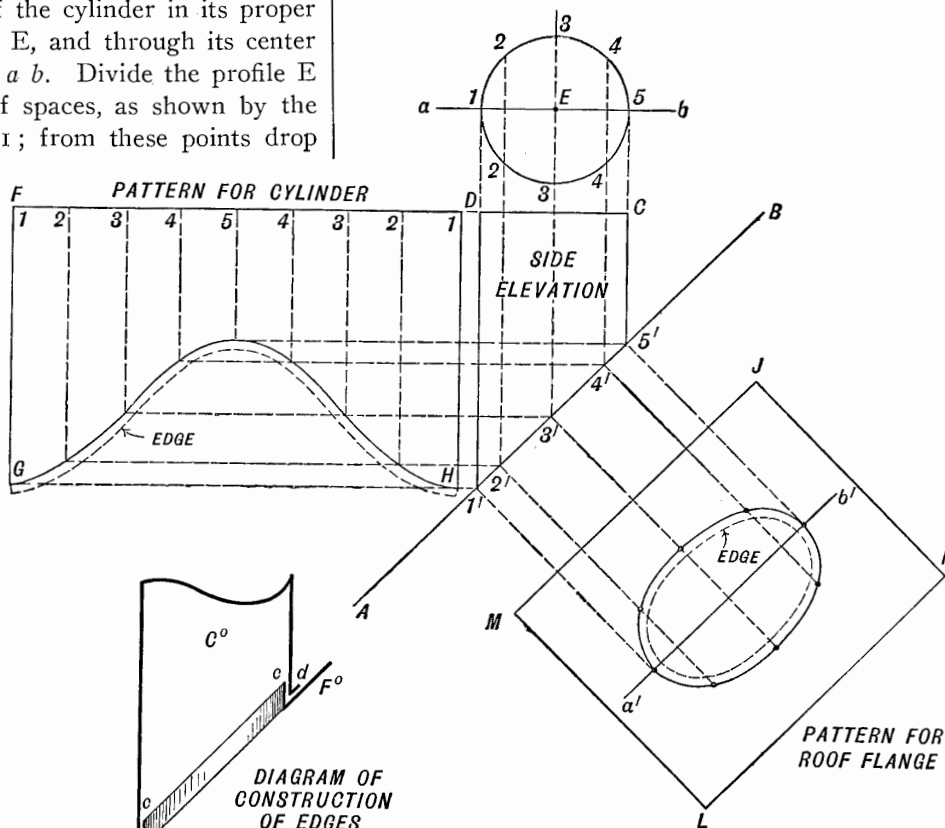


Fig. 275.—Patterns for Roof Flange and Cylinder on Single Pitch Roof

points thus obtained; D F G H outlines the pattern for the pipe or cylinder. It will be noted that the seam in the cylinder has been placed along D r' in the side elevation; this arrangement prevents the water from flowing against the seam.

The pattern for the roof flange is laid out as follows: At right angles to A B from the various intersections 1' to 5' draw lines indefinitely, as shown. Then, parallel to A B, draw any line, as a' b', crossing the lines drawn from points 1' to 5'. Then, measuring in every instance from the line a b in the profile E, take the various distances to points 2 to 4, and place them on either side of the line a' b' on similarly numbered lines, as indicated by the heavy dots. Trace a line through points so obtained, as shown by the elliptical figure. Around this elliptical figure place sufficient material for the flange, as shown by the rectangle J K L M, which completes the pattern. When these collars and flanges, as they are commonly called, are assembled, they can be joined by soldering, edges being allowed as indicated in the diagram of construction. Here R° F° indicates the roof flange with an upturned edge at c c, while C° shows the collar, with an outward flange at d d. The method of adding these edges to the two patterns is shown by the dotted lines on each. These edges are thoroughly sweated with solder. This method of construction may be applied to the seven examples of work to follow.

### ROOF FLANGE AND CYLINDER INTERSECTING A DOUBLE PITCHED ROOF

#### Solution 65

Fig. 276 illustrates a cylinder or pipe passing through the ridge of a double pitched roof. A, be-

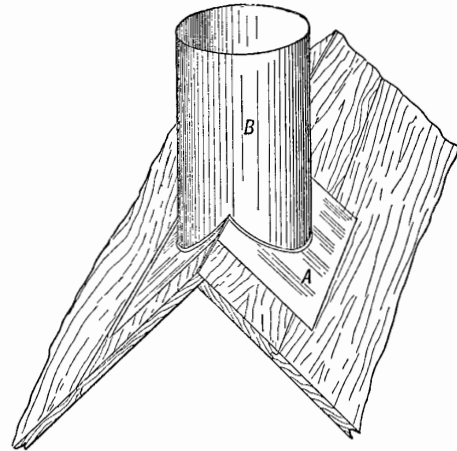


Fig. 276.—View of Roof Flange and Cylinder on Double Pitch Roof

ing the flange and B, the pipe. The method employed in laying out the pattern is shown in Fig. 277. Here the pitch of the roof is shown in the end elevation by A 3' B, in the center of which the elevation of the cylinder is drawn as indicated by

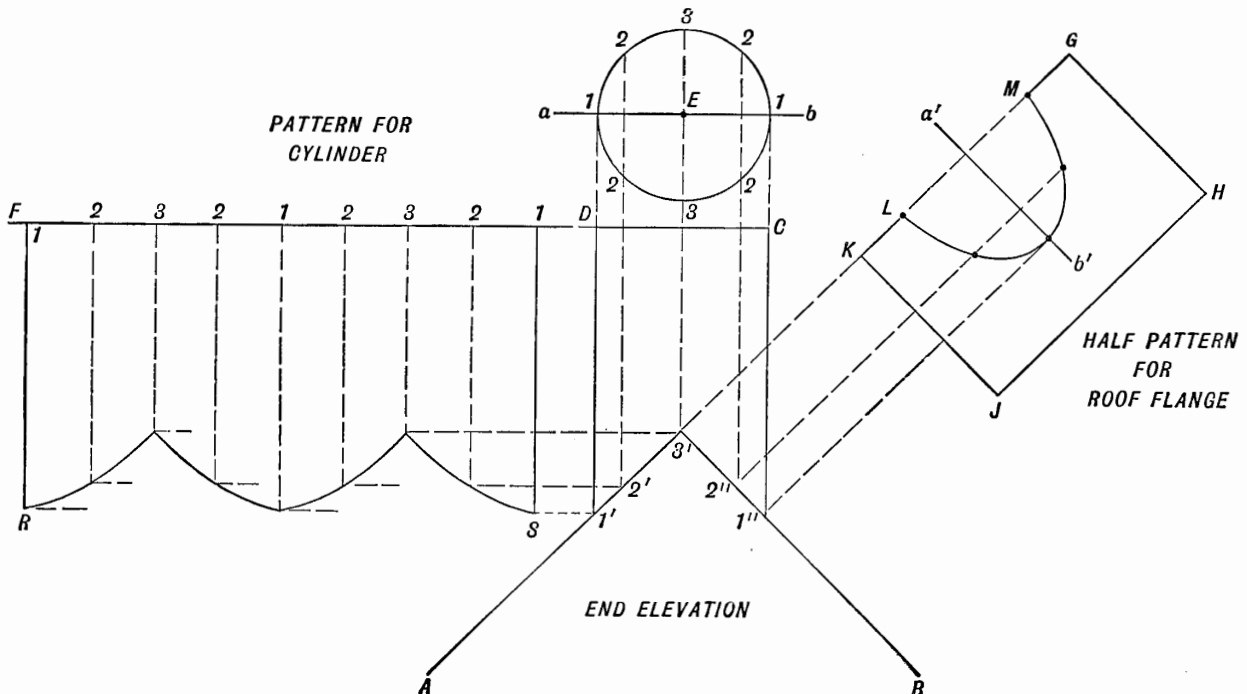


Fig. 277.—Patterns for Roof Flange and Cylinder on Double Pitch Roof

C-D-1'-1". Above the line D C and in its proper position draw the profile E, with diameter equal to D C and through the center of the circle E draw the line a b. Divide the circle E into any number of equal divisions as indicated by the small figures 1 to 3 to 1 to 3 to 1; through these points and parallel to the lines of the cylinder drop lines cutting the roof line A 3' B, as shown by similar numbers. Having found these points of intersection, the pattern for the cylinder may be laid out as follows: Extend the line C D or a line drawn at right angles to D 1', as shown by D F and upon this place the girth of the circle E, as shown by similar numbers on D F. Through these small figures and at right angles to D F draw the usual measuring lines; intersect these by lines drawn parallel to D F from similarly numbered intersections on the roof line. A line traced through points so obtained, as shown by 1 R S 1, will be the desired pattern. As the cylinder sets in a central position over the ridge of the roof and as the pitch of both sides of the roof is similar, a pattern for one side of the roof flange can be used for the other. Therefore, at right angles to the roof line 3'-B and from the various intersections, 1", 2" and 3', draw lines indefinitely, as shown; at right angles to these lines draw the line a'-b', cutting the lines previously drawn, as shown. Then measuring in each instance from the line a b in the profile E, take the distances to the several points 2 and 3 and place them on either side of the line a' b' on similarly numbered lines, as shown by the heavy dots. Trace a line through these points of intersection; L b' M is the semi-elliptical cut, around which the desired flange is added, as indicated by G H J K. This half pattern may also be used for the opposite side, or the roof flange may be made in one piece by placing the half pattern shown opposite the line G K. Edges are to be allowed, as explained in the preceding problem.

**ROOF FLANGE AND CYLINDER INTERSECTING THE RIDGE AND HIPS OF A HIPPED ROOF**

**Solution 66**

In Fig. 278, A represents the roof flange and B the pipe or cylinder intersecting the ridge and hips of a hipped roof. The development of these patterns is somewhat more difficult than that of the two preceding problems but a short and accurate method is set forth in Fig. 279. The patterns may

be laid out *without* the usual procedure of first finding the miter lines in elevation by an operation in projections. This method saves time, but precaution is to be taken to number the points in plan accurately, according to the procedure set forth hereinafter. First draw the pitch of roof, as indicated by A 1' B, and in the center of the ridge, draw the elevation of the cylinder, as shown by 5' K J 5". Draw the horizontal line A B and below it, draw a part plan, as shown by C D E F. From the corners D and E and at angles of 45 degrees draw lines intersecting each other at H, from which point draw the ridge line H 1. Using H as center, with a radius equal to one half the diameter of J K, draw the plan of the cylinder, as shown, cutting the ridge line at 1 and the hip lines at 3 and 3°. A J K B then represents a section on the line b c in plan. To avoid the operations in projections before mentioned, draw a line from the center H in plan and at an angle of 45 degrees, as indicated by H X. H-X-3° in plan will be similar to H-3-3° in the front part of plan, because the pitch of the roof on all three sides is alike. Divide the arc between 1 and 3 in plan into equal parts, in this case two, also the arcs between X and 3°, also 3° and 3, both into the same number of spaces, as shown from 3 to 3° to 3 in both arcs. Starting at the ridge, number the points 1, 2 and 3 up to X, then continue on the next arc to 4 and 5, then back from 5 to 4, to the hip line or 3° and number the front arc, 3°, 4, 5, 4, 3 to correspond to the side between 3° and 3. By following the numbers in this order, no mis-

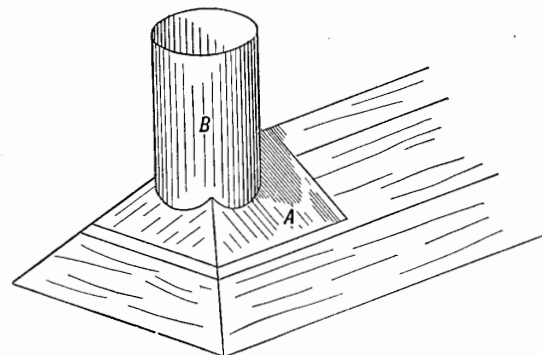


Fig. 278,—View of Roof Flange and Cylinder over Ridge and Hips of Roof

take will occur in laying out the pattern. From these divisions between 1 and the hip line at 3°, carry up perpendicular lines as shown, cutting the roof line 1' B in the section, as indicated by 1', 2', 3', 4' and 5'.

The pattern for the cylinder cutting the three sides of the roof, may now be laid out. Extend

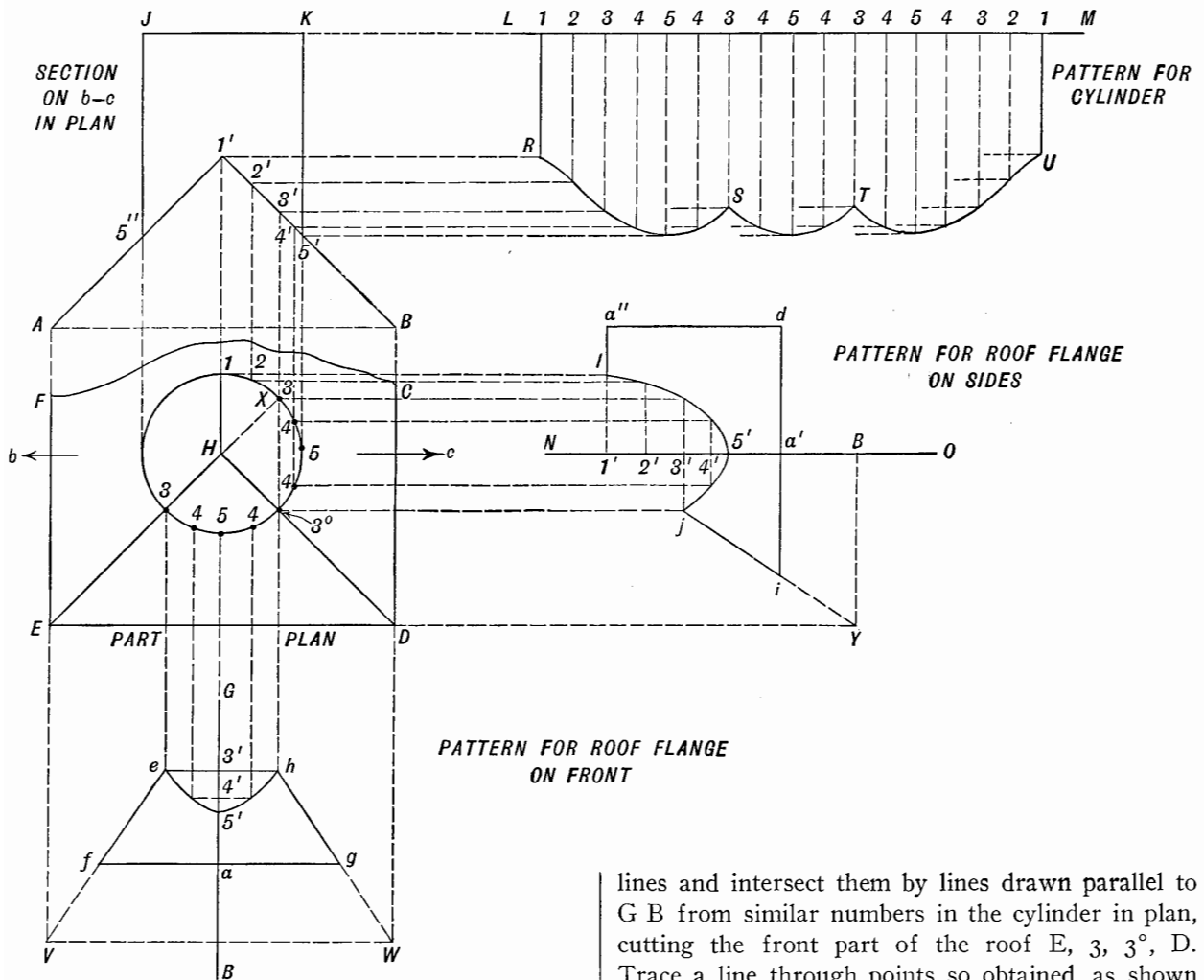


Fig. 279.—Patterns for Roof Flange and Cylinder over Ridge and Hips of Roof

J K in the section, as indicated by L M, and upon this place the girth of the full circle in plan, as shown by corresponding numbers on L M, or 16 divisions in all. From these divisions and at right angles to L M draw the usual measuring lines and intersect these by lines drawn parallel to L M from similarly numbered intersections on the roof line 1' B. Trace the miter cut as shown; the part from R to S and from T to U represents the cut on the sides of the hip roof, and the part from S to T represents the cut on the front of the hip roof. 1 R S T U 1 represents the full pattern. As the roof flange for the front part in plan takes up only the points 5, 4 and 3, on the roof line 1'-B, take the girth of the roof pitch where these numbers intersect, as from B to 5' to 4' to 3' in the section, and place these divisions on any vertical lines below the plan, as shown by similar numbers on G B. Through these small figures and at right angles to G B draw

lines and intersect them by lines drawn parallel to G B from similar numbers in the cylinder in plan, cutting the front part of the roof E, 3, 3°, D. Trace a line through points so obtained, as shown by V e 5' h W. Establish the width of the flange 5' a and through a draw a line parallel to V W cutting the sides e V and h W at f and g, respectively. e f g h 5' is then the pattern for the roof flange on front. As the roof flange for the sides takes up all that part of the circle between 3° and X, and also between X and 1, take the girth of all the spaces contained on the roof line 1' B in the section and place them on the line N O drawn at right angles to D C in plan, as shown by similar numbers 1' to 5'. Through these small figures and at right angles to N O, draw lines and intersect them by lines drawn parallel to N O from similarly numbered intersections in plan, all as shown by the dotted lines. Trace a line through points so obtained, as shown by l 5' j Y. Make the distance 5' a' equal to 5' a in the front roof flange pattern, and through a' in the pattern for side roof flange, draw a line parallel to Y B, cutting the line j Y at i. Make the distance l a'' equal to 5' a' and from a'' draw a line parallel to N O until



**ROOF FLANGE AND OCTAGONAL SHAFT INTERSECTING A DOUBLE PITCHED ROOF**

**Solution 68**

Fig. 282 presents a perspective of a roof flange, A, and an octagonal shaft, B, intersecting a double pitched roof, affording an idea of the manner in

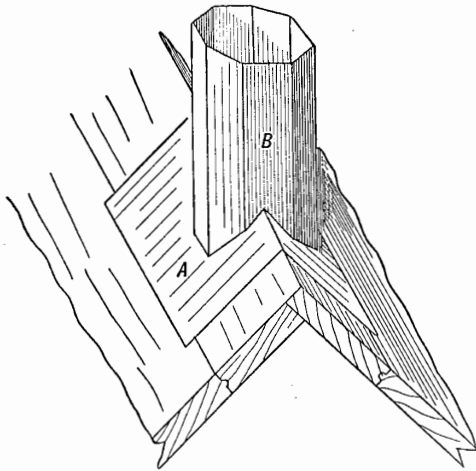


Fig. 282.—View of Roof Flange and Octagonal Shaft on Double Pitch Roof.

which large octagonal ventilation bases intersect the ridges of double pitched roofs. The method of developing the patterns is shown in Fig. 283, in which the double pitch is first drawn, as shown by A a' B; in the center of this the elevation of the octagonal

shaft is drawn, as shown by 1' D C 1'. Above the line D C place the profile of the octagonal shaft E, as shown, and number the corners in the manner indicated. Through the center E of the octagon draw the horizontal line a b, and from the various numbered corners drop lines intersecting the double pitched roof line A a' B, as shown by similar numbers. From the ridge a' in elevation erect a vertical line cutting the side of the octagon 2-2 at a. This point a will be used when developing the pattern.

For the half pattern of the shaft, take the girth from 1 to 1° or the half octagon, as shown by the diagonal dotted line drawn from corner to corner, and place it on the line C D extended as D F, as shown by similar numbers; from these numbers and at right angles to D F, draw lines and intersect them by lines drawn parallel to D F from similarly numbered intersections on the roof line a' A. A line traced through points so obtained, as indicated by J H G, will be the desired cut, and 1 J G 1 will be the desired half pattern.

The pattern for the roof flange for one side is laid out by drawing lines of indefinite length from points 1', 2' and a' on the roof line and at right angles to a' B, as shown. Parallel to a' B draw any line, as a'' b'', crossing the lines just drawn from a' 2' and 1' on the roof line a' B. Measuring in each instance from the line a b in the profile E take the various distances to points 1 and 2, and place them on either side of the line a'' b''

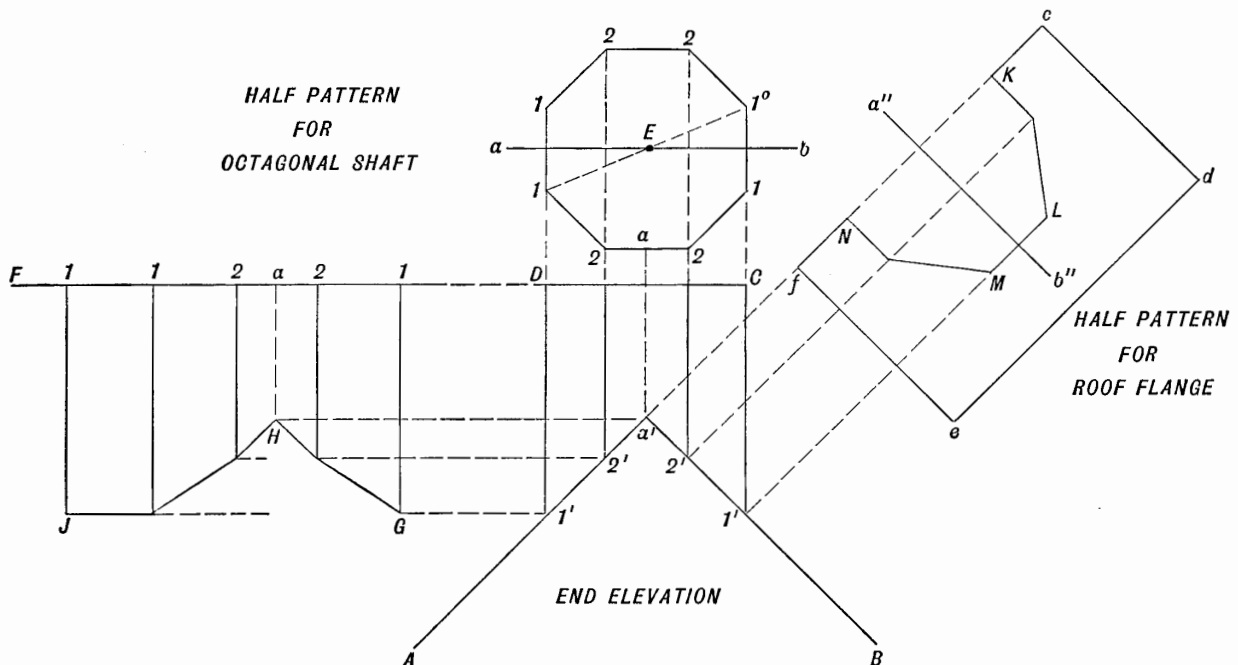


Fig. 283.—Patterns for Octagonal Shaft and Roof Flange on a Double Pitch Roof



The pattern for the shaft may now be laid out, as follows: Take the girth of all the spaces contained in the profile G and place them, as shown by similar numbers, on the line K L drawn at right angles to J 3'. From these small figures and letters on K L and at right angles thereto draw lines and intersect them by lines drawn parallel to K L from similarly numbered points, 1' to 3', on the roof line 1' B. Trace a line through these points, as shown by P O N M; 1 P O N M 1 gives the pattern desired, the angular cuts at O and N being the cuts over the hips at a and a in plan.

To obtain the pattern for the roof flange on sides, take the various divisions, 1' to B on the roof line in the section, and place them on the line W X, drawn at right angles to C D in plan, all as shown by similar numbers. At right angles to W X and through the small figures and letters, 1' to B, draw lines as shown; intersect these lines by lines drawn parallel to W X from similarly numbered intersections in the octagonal figure in plan. Trace the miter cut, e, 3', d, B<sup>2</sup>, as shown. Establish as desired the distance e a and 3' x and draw a line through x parallel to B B<sup>2</sup> cutting the miter cut at c and meeting the horizontal line drawn from a at b. a b c d 3' e a then represents the pattern for the side roof flange.

As the front part of the plan E D is intersected by the part octagon a 3 3 a, take the various divisions B 3' a' in the sectional view and place them on the girth line R B, which is drawn at right angles to E D, as shown by similar letters and figures on R B. Through these points a', 3' and B draw lines at right angles to R B, and intersect these lines by lines drawn parallel to R B from similarly numbered intersection in the plan. Trace the outline through points so obtained; A<sup>v</sup> B<sup>v</sup> S 3' V gives the miter cut.

Make the distance 3' X<sup>1</sup> equal to 3' X in the pattern for side flange and draw a line through X' parallel to A<sup>v</sup> B<sup>v</sup>, cutting the miter cuts at U and T, as shown. V U T S 3' represents the pattern for the roof flange on front.

### SQUARE TAPERING SHAFT AND ROOF FLANGE INTERSECTING THE RIDGE AND HIPPS OF A ROOF

#### Solution 70

Occasionally large ventilators are built with square tapering bases mitering down on the ridge and hips of a hipped roof, as shown in the perspec-

tive in Fig. 286, in which A and B show respectively, the roof flange and tapering shaft. These shafts or bases are sometimes round, sometimes octagonal, in either case tapering. The octagonal base will be taken up in the next succeeding problem,

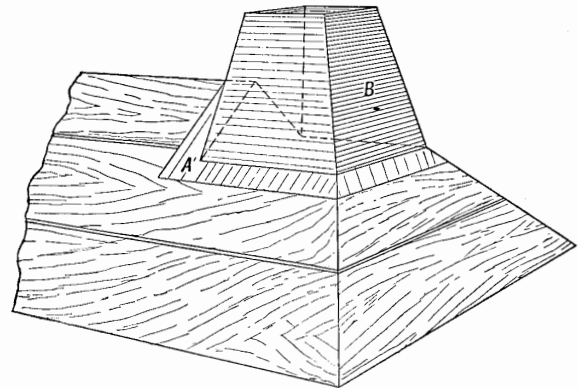


Fig. 286.—View of Square Tapering Shaft with Roof Flange over Ridge and Hips of Roof

while the round base will later be explained in the consideration of radial line developments. To lay out the square tapering shaft refer to Fig. 287, which illustrates the operations in detail. First draw the end elevation of the roof, which indicates the pitch, B A C. Below B C draw the plan view, indicated by D E F G, and draw the hip lines, F U and E U, also the ridge line, U a''. Construct the elevation of the base, as shown by 1, 2, 2', 1', from which the plan view of the top is projected, as indicated by H J K L in plan, also the plan view on the bottom line 2-2' in elevation, as shown by P O N M in plan. As the rear side of the shaft, P O J H in plan, sets over the ridge of the roof and as this side is also tapering, the intersecting line between the shaft and roof line is found as follows: From the apex A in elevation and parallel to B C, draw a line cutting the side of the shaft 1'-2' at a; from this point a perpendicular line is projected to the plan, cutting the miter line of the shaft at a'. From this point, a' a line is drawn parallel to P O cutting the ridge line at a'', the desired point. Draw the miter lines P to a'' and a'' to O, as shown.

Having completed the plan and elevation, the patterns are now in order. Assuming that the shaft is to be made in four parts and the corners double seamed, the patterns may be developed as follows: Take the distance of the taper 1'-2' in the end elevation and place it on any vertical line, as R S, shown by similar numbers; through these and at right angles to R S draw lines of indefinite length as shown. Take one-half of the distance 1-1' and 2-2' in the end elevation and place it on either side



**OCTAGONAL TAPERING BASE; INCLUDING ROOF FLANGE, INTERSECTING THE HIP AND RIDGE OF A HIPPED ROOF**

**Solution 71**

An octagonal ventilator base and roof flange intersecting the ridge and hips of a hipped roof is shown

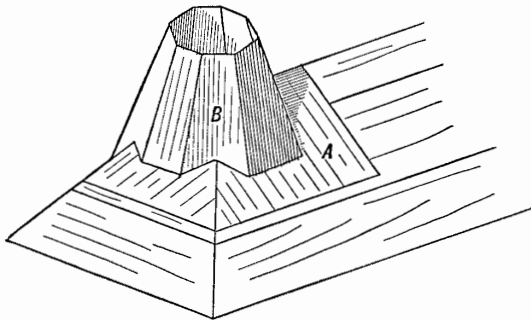


Fig. 288.—View of Octagonal Tapering Shaft with Roof Flange over Ridge and Hips of Roof

in perspective in Fig. 288, where A is the flange and B the base or shaft. This problem presents an interesting study in projections and intersections and should be carefully followed as outlined in Fig. 289. In this connection we will take up also the method of laying out, all on *one* pattern, the various patterns for the shaft.

As in the preceding solutions, first draw the pitch of the roof, as indicated by B A C in the end elevation. Establish at any point the width of the octagonal base as K L, the vertical height as L° H° and the width of top as J H. In line with and below B C draw the plan of the roof, as indicated by D E F G, and draw the hip lines, E A² and F A²; also the ridge line, A² A°. Using A² as a center, construct a horizontal section on the line L K in elevation, as shown by the octagonal figure, a b c d e f g h, in plan. In like manner, using A² as center, construct the octagonal section i j k l m n o p, representing the horizontal section on H J in elevation. Connect the corners of the octagon in plan as a to j, b to k, c to l, etc., as shown. It is now necessary to find the miter or intersecting lines between the tapering octagonal shaft and hipped roof. Referring to the plan, it will be noted that the sides of the shaft marked I intersect on horizontal lines; those marked II intersect the hips; those marked III intersect the double pitched roof, while the one marked IV intersects the ridge.

To find the intersection on the hip, take the distance of the hip line A² E in plan, and place it, as

shown from A° to E° in elevation, and draw a line from E° to A, which shows the true length of the hip line. Where the flare of the octagonal base J K intersects this hip line at M, draw a line parallel to B C from this point M until it intersects the pitch of the roof A C at u''; from this point project a vertical line in the plan intersecting the hip line at u', the desired point. Draw a line in plan from d to u' to e and reproduce on the opposite side, as shown. The same point, u', in plan, could be obtained by projecting a vertical line from the intersection M on the hip line in elevation until it meets the base line B C at u, then taking the distance from E° to u and setting it off in plan on the hip line from E to u'. From o and n in plan erect vertical lines in the elevation, cutting the top line of the shaft at o' and n'. In like manner, from the corners f and e in plan erect perpendicular lines cutting the bottom line of the shaft at f' and e'. Connect lines from o' to f' and n' to e'; from u'' draw a line to e', another from e' to f' and another from f' to u'. This completes the end elevation of the shaft intersecting a hipped roof.

To find the line of intersection in plan, where the sides of the shaft marked III meet the roof line, simply project a vertical line from the intersecting point between the miter line o' f' and the roof line A B in elevation, indicated by r, into the plan, cutting the miter line a j at s, and draw a line from s to h which can be traced to the opposite side, if desired.

The intersection between the side of the shaft IV in plan and the ridge line is found by drawing a horizontal line from the ridge A in elevation until it cuts the pitch of the shaft H L at A°. From this point a perpendicular line is projected in the plan cutting the miter line h i at t. From t a line is drawn parallel to i j to cut the miter line a j at t' and from this point a line is drawn parallel to j k to cut the ridge line at t'' the desired point. Draw a line from s to t'' and reproduce on the opposite side, if desired. This completes the plan view and the patterns are now in order.

By referring to the plan it will be seen that four separate patterns will be required for the shaft, which we will proceed to lay out on one pattern, as is done in the practical work of the shop.

From the various intersections r and u' in the end elevation draw horizontal lines cutting the pitch of the octagonal shaft at r' and M°, respectively. Take the various divisions in the end elevation from H to A° to r' to M° to L and place them on the vertical line in diagram S, as shown by similar

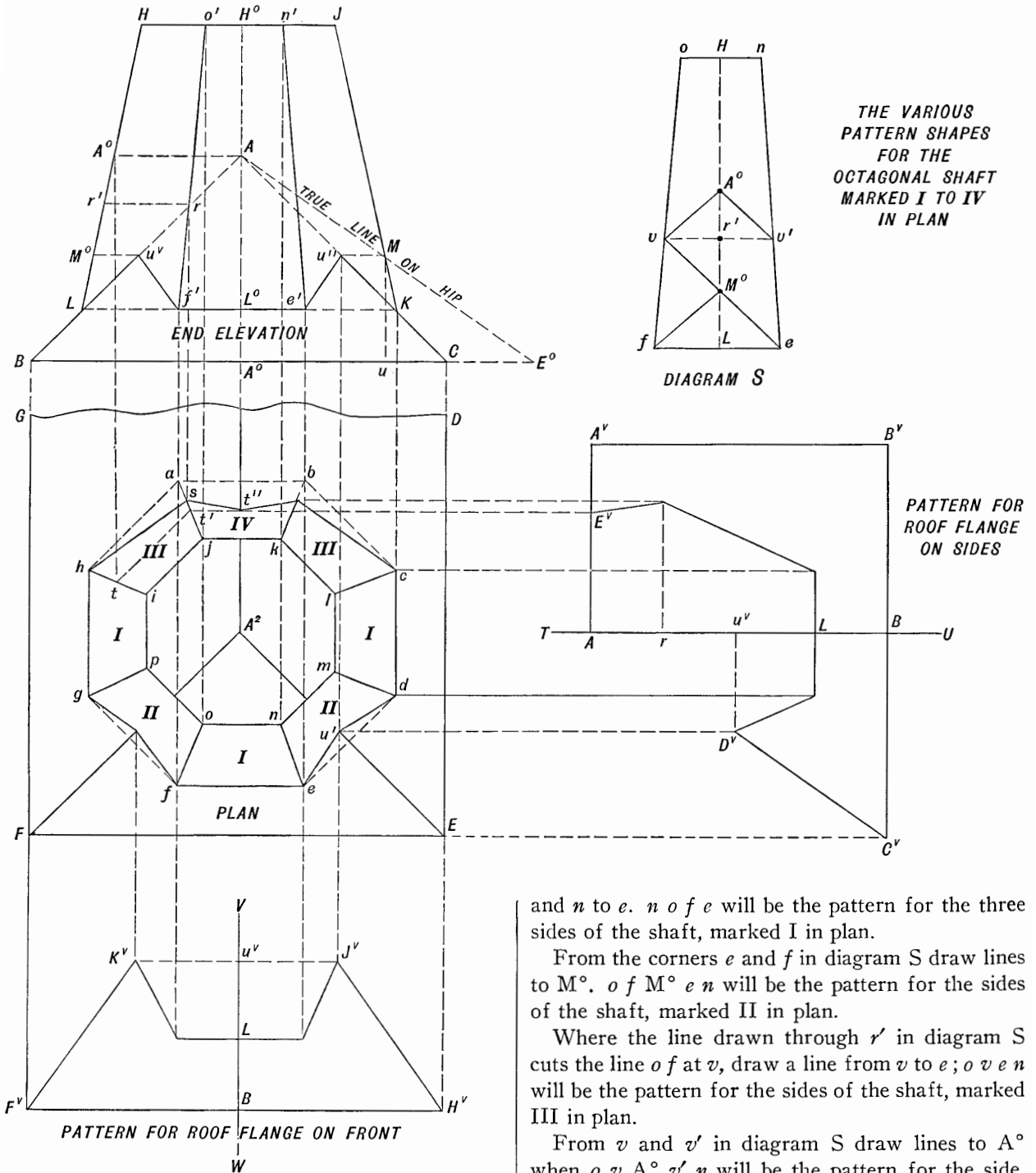


Fig. 289.—Patterns for Tapering Octagonal Shaft and Roof Flange, over Ridge and Hips of Roof

letters. Through these letters H,  $r'$  and L and at right angles to H L draw horizontal lines to any length as shown. Measuring from the center line  $H^\circ L^\circ$  in the end elevation take the distances to points  $e'$  and  $n'$  and place them in diagram S on either side of the line H L, as shown by  $e$  and  $f$ , also by  $n$  and  $o$ , respectively. Draw lines from  $o$  to  $f$

and  $n$  to  $e$ .  $o n e f$  will be the pattern for the three sides of the shaft, marked I in plan.

From the corners  $e$  and  $f$  in diagram S draw lines to  $M^\circ$ .  $o f M^\circ e n$  will be the pattern for the sides of the shaft, marked II in plan.

Where the line drawn through  $r'$  in diagram S cuts the line  $o f$  at  $v$ , draw a line from  $v$  to  $e$ ;  $o v e n$  will be the pattern for the sides of the shaft, marked III in plan.

From  $v$  and  $v'$  in diagram S draw lines to  $A^\circ$  when  $o v A^\circ v' n$  will be the pattern for the side, marked IV in plan.

Thus it will be seen that the four patterns have been laid out as one. In cutting out these patterns from sheet metal, the proper method of procedure is as follows: Assuming that the necessary laps have been allowed for double seaming and soldering, first cut three, alike to  $o n e f$  in diagram S. Then cut away  $e M^\circ f$ , allowing laps, and cut two alike to  $o n e M^\circ f$ . Then cut away  $M^\circ v$ , allow-

ing laps, and cut two alike to *o n e v*. Again cut away *v A° v'*, allowing laps, which leaves that for the side intersecting the ridge.

The roof flange is now laid out, for the front part of which take the girth of *B L u<sup>v</sup>* in end elevation and place it on the vertical line *V W* drawn at right angles to *F E* in plan, as shown by similar letters; through these letters horizontal lines are drawn and intersected by lines drawn parallel to *V W* from similar points in plan, all as shown by the dotted lines. Connect the intersections thus obtained in the pattern, by lines; when *K<sup>v</sup> F<sup>v</sup> H<sup>v</sup> J<sup>v</sup> L K<sup>v</sup>* will be the pattern sought.

The pattern for the roof flange on sides is obtained by taking the girth of *A r u<sup>v</sup> L B* in the end elevation and placing these distances on the line *T U* drawn at right angles to *E D* in plan, as shown by similar letters on *T U*. Through these letters at right angles to *T U* draw lines and intersect them by lines drawn parallel to *T U* from similar intersections in plan, all as shown by the dotted lines. Connect lines through points of intersection thus obtained, as shown by *E<sup>v</sup> L D<sup>v</sup> C<sup>v</sup>*. Establish as de-

sired the width of the flange *E<sup>v</sup> A<sup>v</sup>* and draw the line *A<sup>v</sup> B<sup>v</sup>* parallel to *T U* intersecting the line drawn through *B* at *B<sup>v</sup>*. *A<sup>v</sup> B<sup>v</sup> C<sup>v</sup> D<sup>v</sup> L E<sup>v</sup> A<sup>v</sup>* is then the desired pattern. Allow laps for soldering purposes, as specified in preceding solutions.

**CONICAL ROOF FLANGE ON ROOF HAVING ONE INCLINATION.**

**Solution 72.**

Fig. 290 presents a view of a conical roof flange, indicated by *A*, while *a b c d* shows a roof plate or

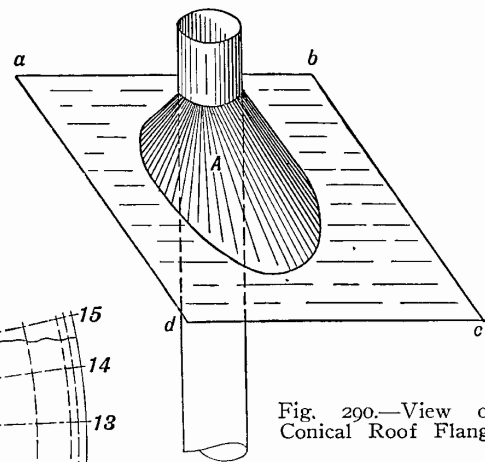


Fig. 290.—View of Conical Roof Flange

flashing. The method of finding the opening in the roof plate will be taken up in a later succeeding problem. The development of the conical flange *A* is illustrated in Fig. 291 where a quick, accurate method is shown.

First draw a half plan and elevation as shown, and draw the roof line *P T*, which in this case is at 45 degrees. Divide the half circle of the plan into any number of equal spaces, twelve in this case, as shown in the figures, *1', 2', 3', etc.* Project the points of division vertically until they cut the horizontal line *13' 1'* and thence carry them toward the apex of the cone at *A*. *Q R* shows the opening of the top of the flange or the outside diameter of the smokestack. The lines just drawn toward the apex are called the elements of the cone, and the points of intersection of the elements with the roof line *P T* give the points to be used in the development of the pattern. Project those points, as shown, horizontally toward the right to cut the outer edge line of the cone *R 1'*.

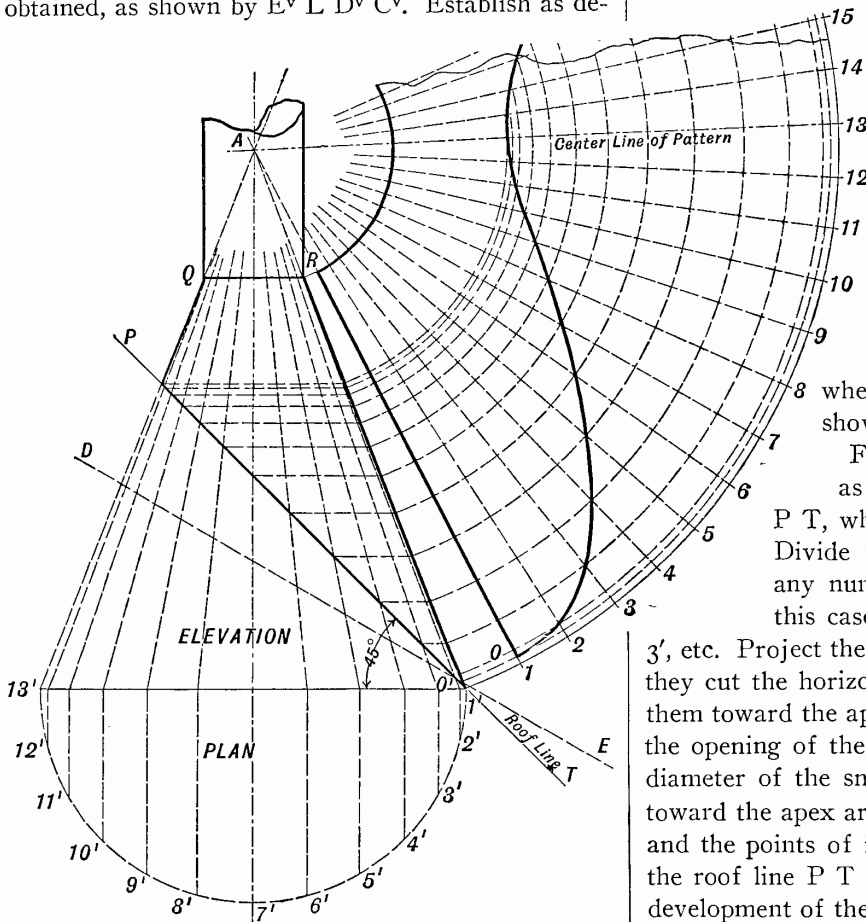


Fig. 291.—Method of Laying Out Pattern of Conical Roof Flange

For half the pattern, set the dividers to the length  $A 1'$  and describe an arc as shown by  $1' 7 13$ , which divide into twelve spaces, each equal to one of those on the half plan, and from these points draw the elements toward the apex  $A$ , as shown. Now set the dividers to the length of the spaces from  $A$  to each of the points on  $R 1'$ , and draw arcs to intersect the lines of like number drawn from points  $1, 2, 3, 4$ , etc. The intersection of these arcs with the lines of corresponding number gives the points on the pattern. A line drawn through the points thus obtained gives the lower side of the pattern or the part which rests on the roof. With a radius  $A R$  describe the arc from  $R$ , which gives the upper part or opening in the top of the pattern.

If the pitch of the roof were the line  $D E$ , the process of developing the pattern would be the same. The horizontal lines in this case would be drawn from the points on the line  $D E$  instead of from those on the line  $P T$ .

The half pattern is indicated from the line  $A-1$  to the line  $A-13$ .

### ROOF PLATE AND CONICAL BASE ON A DOUBLE PITCHED ROOF.

#### Solution 73

The method of obtaining the patterns for a conical roof base on a double pitched roof, the conical base setting to one side of the center of the ridge

**ONE HALF PATTERN FOR ROOF FLANGE**

or comb, is as follows: Referring to Fig. 292, we have a double pitched roof whose angle is indicated by  $C S D$ . Through the apex of the roof at  $S$  draw the vertical line  $S, a$ , as shown. Draw the elevation of the conical base in its proper position as shown by  $E-F-7-1'$  being part of the frustum of a right cone, shown by  $E F 7^{\circ}-1$ . Extend the sides of the cone until they meet the center line at  $X$ . Below the elevation draw the half plan,  $1-4-7$  representing a half section on the line  $1-7^{\circ}$  in elevation. Space this

of the cone until they meet the center line at  $X$ . Below the elevation draw the half plan,  $1-4-7$  representing a half section on the line  $1-7^{\circ}$  in elevation. Space this

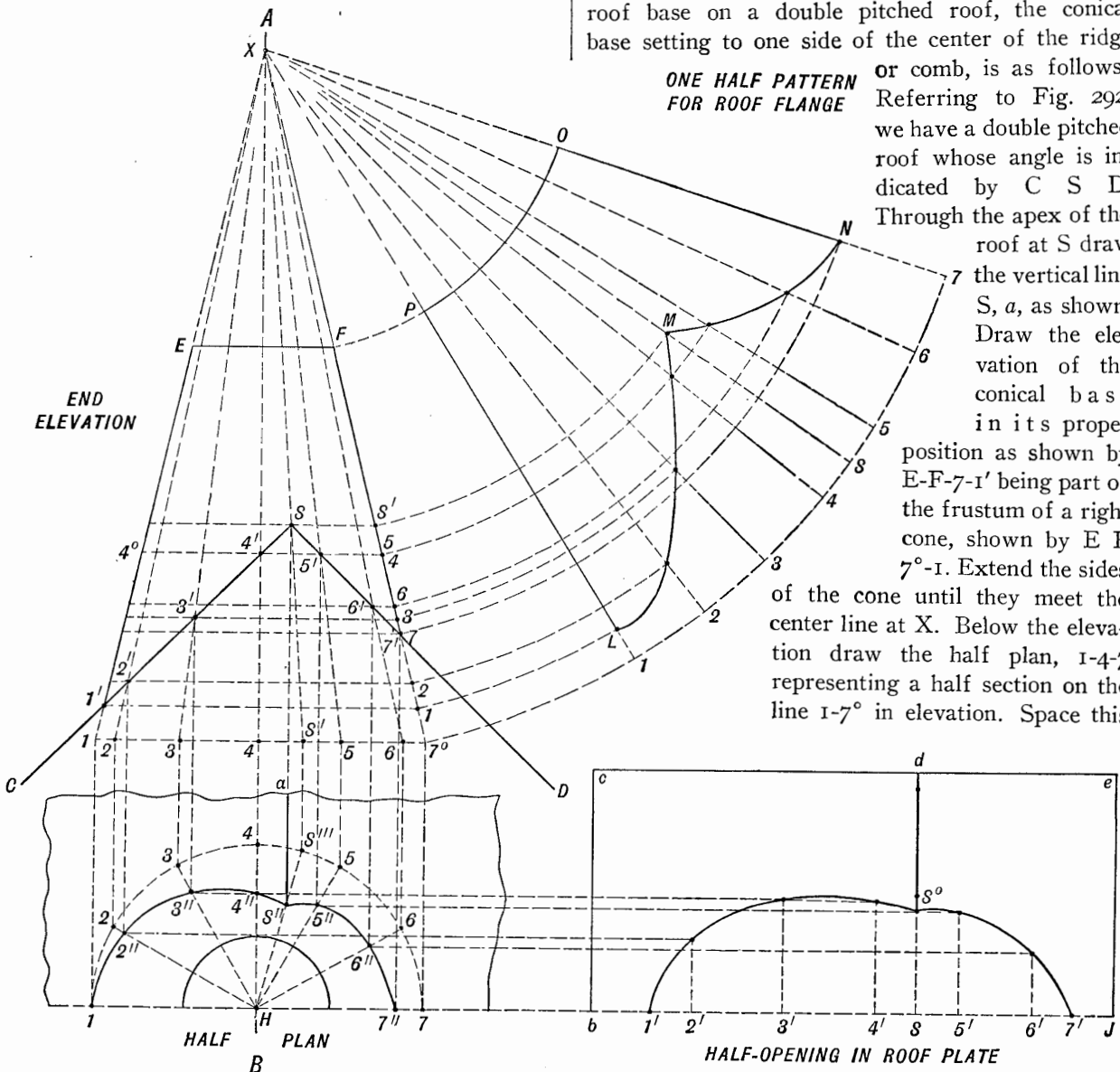


Fig. 292.—Patterns for Roof Plate and Base, Setting to One Side of Ridge on a Double Pitch Roof

semi-circle into an equal number of divisions, as shown by the small figures 1 to 7, from which figures draw radial lines to the center H. From similar points 1 to 7 in the semi-circle erect vertical lines cutting the base line 1-7° in elevation, as shown by similar numbers 1 to 7°, from which radial lines are drawn to the apex X, crossing the double pitched roof from 1' to 7'. As none of these elements or radial lines just drawn pass through the apex S of the roof, then draw a line from the apex X of the cone through the apex S of the roof, extending it until it meets the base line of the cone at S'; from this point a line is dropped vertically until it cuts the half plan of the base at S''. From S'' draw a radial line to the center H, meeting the ridge line a in plan at S'', the point desired.

To complete the half plan of the intersecting line between the cone and roof, project vertical lines from the intersections 1' to 7' on the roof line C S D, until they intersect similarly numbered radial lines in plan at 1, 2'', 3'', 4'', 5'', 6'' and 7''. Trace the miter line from 1 to S'' to 7'', as shown. This miter line is used only for obtaining the opening in the metal roof plate, as will be described.

The one-half pattern for the roof base is now in order. Using X as center, with radius equal to X 7°, draw the arc 7°-7. Take the girth of the semi-circle 1 to 7 in plan and place it as shown by similarly numbered divisions from 1 to 7 in the pattern. From these points draw radial lines to the apex X. Take the distance from 4 to S'' in the half plan and set it off from 4 to S in the pattern and draw a radial line from S to the apex X. From the intersections 1' to 7' on the double pitched roof line C S D draw lines at right angles to the center line A B until they intersect the side of the cone F-7°, as shown from 1 to 7 including S'. Using X as center, with radii equal to the various divisions on F 7°, draw arcs which intersect similarly numbered radial lines in the pattern. Again using X as center, with X F as radius, describe the arc P O, intersecting the radial lines drawn from 1 and 7 in the pattern. Trace a line through points already obtained, as indicated by L M N. L M N O P gives the one half pattern for the roof base.

The pattern for the roof plate is obtained as follows:

Extend the line 1-7 in plan as 1 J, upon which place the girth of the intersection 1' to S to 7' on the double pitched roof C S D in elevation, as shown by similar numbers and letters on 1 J. At right angles to and from these points 1' to 7' on 1 J, draw lines; intersect these lines by lines drawn parallel to 1 J

from similarly numbered intersections 1 to S'' to 7'' in the miter line in plan. A line traced through points so obtained, as shown from 1' to S° to 7', will be the half opening to be cut in the roof plate to miter with the cut L M N in the half pattern for roof base. Add sufficient material around the roof plate opening, as indicated by b c d e J. Flanges should be allowed along the miter cut L M N of the roof base and along 1' S° 7' in the plate opening.

### TAPERING BASE AND ROOF FLANGE ON THE RIDGE AND HIPS OF A PITCHED ROOF

#### Solution 74

In Fig. 293 is given a finished view of a circular ventilator with a tapering base, which is to set over

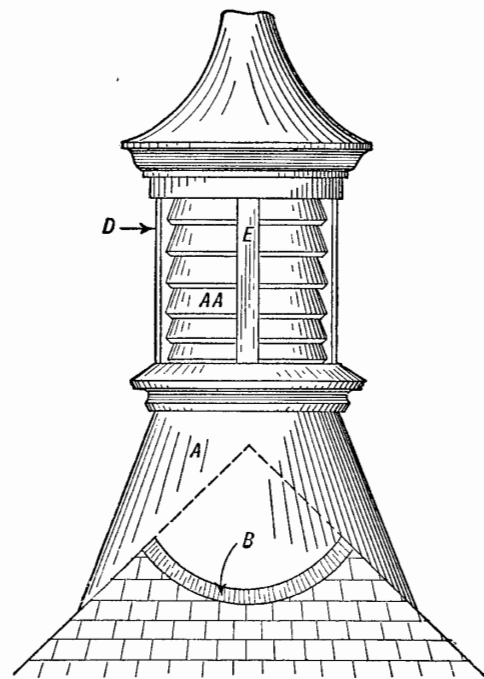


Fig. 293.—Round Tapering Ventilator on Ridge and Hips of Pitched Roof

the ridge and hips of a pitched roof. The pattern for the base A as well as for the roof flange B will be developed as shown in Fig. 294. In this figure A B C D gives the outline of the roof plan, A E and E B representing the hips and E I the ridge line. F 1' H in elevation shows the pitch of the roof, while I K J 4' shows the elevation of the tapering base. In practice it is necessary to draw but one half of the plan and elevation here shown. The method, as illustrated, for obtaining the patterns is a

short one, inasmuch as the side elevation is omitted. Extend the sides of the base until they meet in the apex L, through which the center line L E is drawn. Using E in plan as center, describe the large dotted circle representing a section on the line I 4' in elevation, while the smaller circle in plan shows a section on the line K J in elevation. In this case, where the large circle crosses the hip line B E, number that intersection 6, as shown. Space the large circle in plan in an equal number of divisions, as shown by the

small figures, 1 to 8, from these points draw radial lines to E and from similar points, 1 to 8, erect vertical lines cutting the base line I 4' in elevation, also shown by the small figures 1 to 8. From these points lines are drawn to the apex L, cutting the roof line H 1' at 1' to 8', as shown. From these intersections, 1' to 8', horizontal lines are drawn to intersect the slant line of the base 4'-J at 1<sup>x</sup> to 7<sup>x</sup>. As that part of the base, shown in plan by 6-7-8, intersects the front pitch of the roof, it will be practicable to obtain the miter line in elevation if it be desired, by projecting horizontal lines from 8' and 7' on the

roof line H 1' to intersect similarly numbered radial lines as shown, thus obtaining the miter line shown by 6'-7'-8, but this miter line is not essential to the pattern for the base.

The half pattern for the base may now be laid out. Using L as a center, with radii equal to L 4' and L J, draw the arcs 4'-8 and J O, respectively, and on the arc 4'-8, set off the same number of divisions as are contained in the large semi-circle in plan, shown from 1 to 8, all as shown by similar numbers 1 to 8 in the pattern, from which radial lines are drawn to the apex L. Then, using L as center with radii equal to the various intersections between 1<sup>x</sup> and 8', draw arcs to intersect similarly numbered radial lines in the pattern, thus obtaining the intersections 1<sup>v</sup> to 4 to 6<sup>v</sup> to 8, through which the miter cut is traced. N O 8 6<sup>v</sup> 4 1<sup>v</sup> N will be the desired pattern, for which laps should be allowed for soldering and riveting. In using this method no side elevation is necessary; but care must be taken to follow the numbers closely, since the numbers

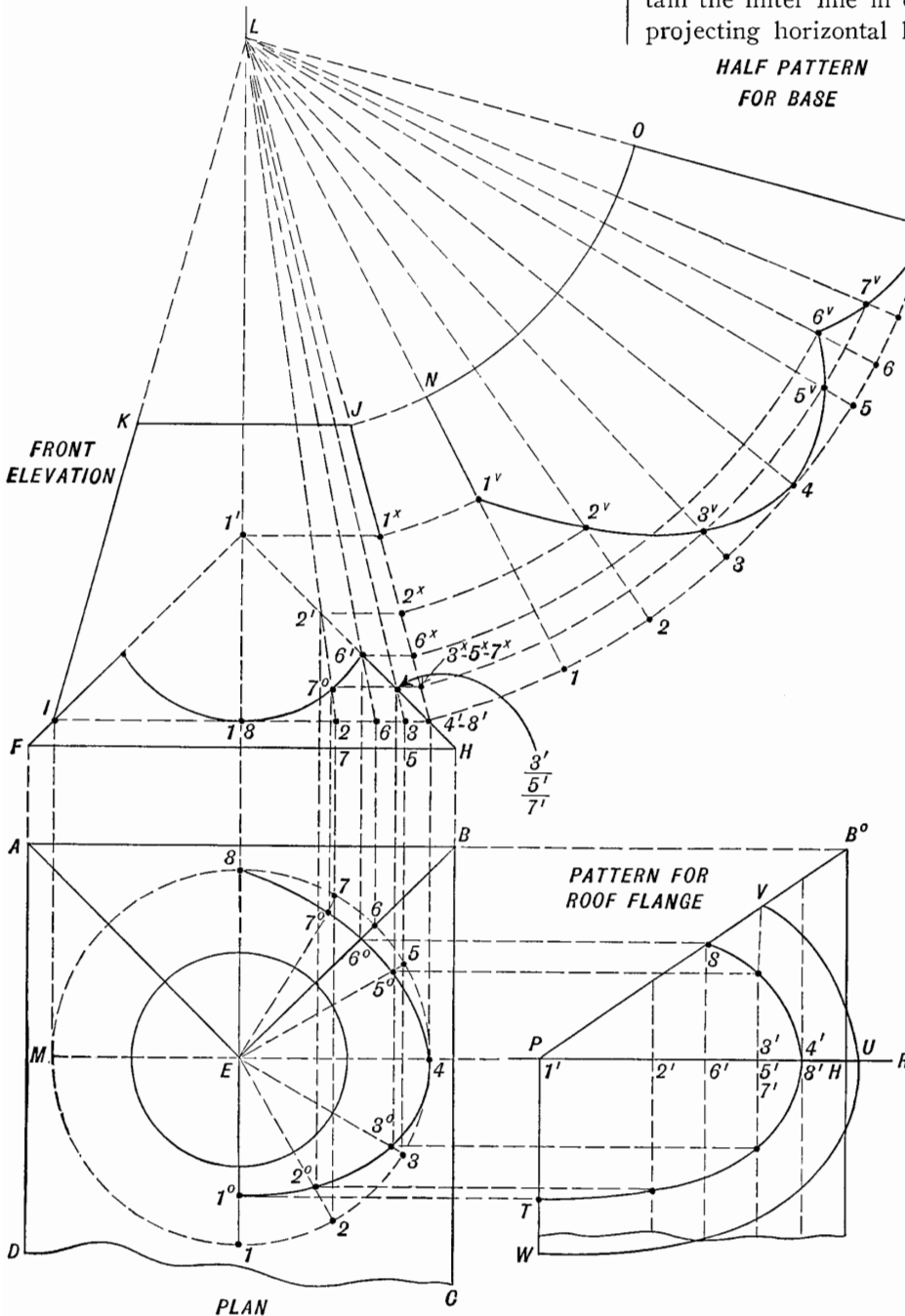


Fig. 294.—Patterns for Tapering Base and Roof Flange on Ridge and Hips of Pitched Roof

1 and 8, 2 and 7, also 3 and 5 are on one line in plan.

**ROOF FLANGE FITTING AROUND A TAPERING BASE INTERSECTING THE RIDGE AND HIP OF A PITCHED ROOF**

**Solution 75**

To obtain the pattern for the roof flange on the front and sides of a pitched roof, indicated by B in the view of Fig. 293, the line of intersection between the tapering base and roof must be found in plan, as shown in Fig. 294. From the various intersections 8, 7° and 6' in elevation, lines are projected vertically in the plan, cutting radial lines having corresponding numbers, thus obtaining the intersection points 8, 7° and 6°, as shown; these points represent the miter line of the base and one half of the front of roof in plan, as shown. Where the various radial lines in elevation, shown by 5, 4', 3, 2 and 1 on the line I 4', cross the roof line H 1', vertical lines are projected into the plan, to intersect similarly numbered radial lines at 5°, 4, 3°, 2° and 1°; the point 1° being obtained by taking the horizontal distance from 1' to 1<sup>x</sup> in elevation, and setting it off on the ridge line in plan from E to 1°. A line traced from 6° to 4 to 1° in plan gives the miter line between the base and side of roof.

The pattern for the flange may now be laid out as follows: Extend the line E 4 in plan as P R and upon this place the girth of the spaces contained on the roof line 1' H in elevation, as shown by similar numbers on P R. At right angles to P R and through these small figures, draw lines and intersect them by lines drawn parallel to P R from similarly numbered intersections in the miter line from 8 to 6° to 4 to 1°. Trace a line through points so obtained, as shown from S to 4' to T. Set the dividers apart a distance equal to the width of the flange required and draw a line parallel to S 4' T, as shown by V U W. S 4' U V then gives the pattern for one half the flange on the front of the roof, and S 4' T W U V the pattern for the flange for the sides of the roof. Allow laps for soldering and riveting.

**HOOD OVER VENTILATOR**

**Solution 76**

Fig. 295 presents a view of a ventilator hood. The method of development of the patterns is alike in the case of both square and rectangular work. Re-

ferring to Fig. 296, first draw the section of the hood, as indicated by A, and in line therewith to the right draw the plan view, as shown by B C D E. In this case the full plan has been drawn; this however, is not necessary in practical work, all that is required being the one miter end, making the hood as

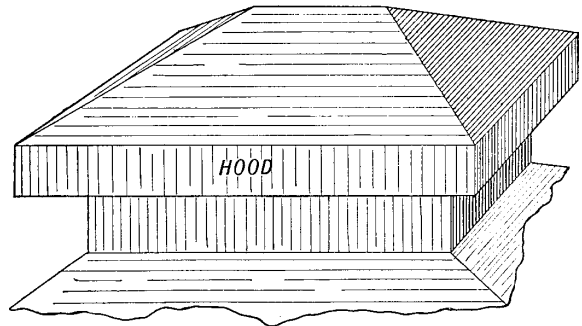


Fig. 295.—View of Ventilator Hood

long as desired by reversing the miter cut to the opposite end. From each of the four corners in plan draw lines at angles of 45 degrees, intersecting at F and G, as shown. Connect the ridge line F G. At right angles to E D draw the girth line a b; on this place twice the girth of the half section A, as shown from 1 to 4 to 1 on a b. Should the full girth of the hood A take up more material than the stock sizes of the sheets will allow, only the girth from 1 to 4 is employed. At right angles to a b and

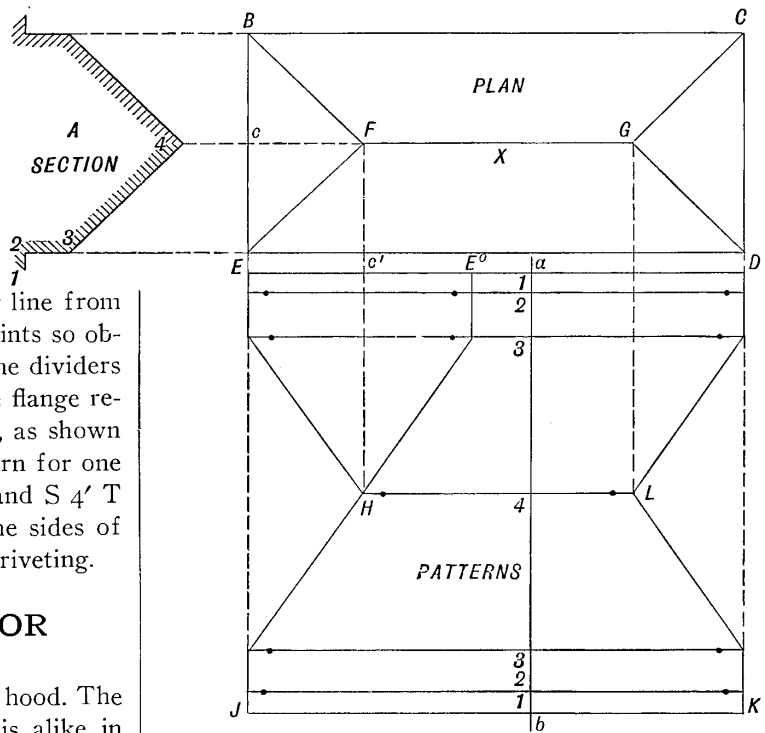


Fig. 296.—Patterns for Diamond Panel and Ventilating Hood

through the small figures 1 to 4 to 1, draw lines and intersect these by lines drawn from similar points on the miter lines E F and G D in plan and parallel to *a b*. Trace a line through these points; the resulting E D L K J H E will be the full pattern.

For the pattern of the miter heads at the ends,

take the distance from *c'* to E in the pattern and place it, as shown, from *c'* to E°, completing the cut E° H alike to E H. This miter head can be thus obtained, since *c' E* in the pattern is similar to *c E* in plan, which latter is one half of B E. Allow laps for riveting or soldering.

PART IX

PATTERNS FOR COPINGS, HEAD BLOCKS, HIP RIDGES, FINIALS AND SPIRES

MOLDED HEAD BLOCK, INTERSECTING PEDIMENT COPING.

Solution 77.

FIG. 297 is a view of a molded head block intersecting a pediment coping and mold, as along *a b c*. These copings are usually made of sheet copper and give dependable service. They do not leak at the joints as does stone. The method of laying out these

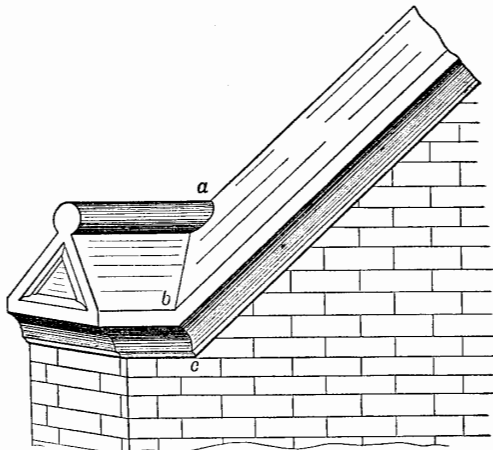


Fig. 297.—View of Molded Head Block Intersecting Pediment Coping

patterns is shown in Fig. 298, where A represents the end view of the head block (only one half of which is it in practice necessary to draw), and 9°-8-B the bevel of the pediment. At right angles to the pediment pitch 8-B, draw a section through the coping, as indicated by D, taking care that the width from 6" to 6" is equal to 6-6' in the end view, and that the profiles 6" and 6" in the side view are similar to the profile shown in the end view. Draw the bevel of the coping between 6" and 6" in the section as shown. Bisect the angle of the pediment 9°-8-B as follows: Using *a* as center with any radius, describe the arcs cutting the angle lines at *b* and *c*. Using *b* and *c* as centers with any desired radius, intersect arcs at *d*. Draw the miter line *d 5'*. Divide the mold from 5 to 11 in the end view into an equal

number of spaces and from these points project horizontal lines to the right until they cut the miter line *d 5'*, as shown. Divide the bead in the head block in the end view into an equal number of divisions, as shown in the right half from 1 to 4. Take a tracing of this upper bead and place it in central position over the coping in the section D, as shown by similar numbers from 1 to 4; from these points lines are projected at right angles to the lines of the coping until they cut the beveled coping also from 1 to 4. From these divisions and parallel to the lines of the coping, lines are drawn and intersected by lines drawn parallel to the lines of the head block, from similar intersections 1 to 4 in the end view, thus resulting in the miter line shown between 1' and 5'. Finding this miter line is the principal and most difficult part of the operation; after this is achieved the patterns are in order.

To obtain the one half pattern for mold and roof over head block, draw any line at right angles to X 1' in the side view, as shown by O N, and on this place the girth of the half top and mold shown in the end view from 1 to 11, as shown by similar numbers on N O. Through these small figures and at right angles to N O draw lines; intersect these lines by lines drawn parallel to N O from similarly numbered intersections in the miter lines, between 1'-5'-11 and 5<sup>T</sup>-9° in the side view. A line traced through points thus obtained as shown by T, S, U, R and P, 6, 1 will be the desired pattern.

To obtain the pattern cut for one half the coping and mold for the pediment, draw any line, as G H, at right angles to F E. Take the girth of the pediment mold in the end view from 11 to 5 and place it on the line G H, shown from 11 to 5; to this add the girth of the intersections obtained on the coping from 5<sup>a</sup> to 1 in the section, as shown from 5 to 1 on G H. Through these small figures and at right angles to G H, draw lines and intersect them by lines drawn parallel to G H from similarly numbered intersections in the miter line in the side view, all as