



Appendix B – Part 4 without CA46

Introduction








The rough masonry has been done and now needs detailing.

In this part, we create half pillars, a fireplace, alcoves, buttresses and an elaborated door frame.

Half pillars

A single pillar can be drawn as a square or a circle but often you find half pillars attached to a wall.

Adding half pillars, suggesting an arch, where the straight walls of the nave meet the curved walls of the sanctuary will smooth the transition between the 5' thick circular walls and the 3' thick linear ones.

1. Click **C**. If the green grid is visible, remove it by clicking **G** (see sidebar)
2. Use the **Line** tool  with the **Endpoint**  modifier (or hit function key **F5**) to draw a line segment joining the endpoints of the inner arc
3. Click the **Move** icon . Select the line and right-click **do it**. Type **0,0** then **0,-2.5**. This translates the line 2.5 units down (half of 5', the global width of the arch)
4. Click on **W**. Use the **Draw**→**Offset**→**Offset One** (**OFFSET1**) tool and type **2.25** for the offset distance. Click on the orange construction line then pick the upper side by clicking anywhere above the line
5. Select again the orange line. Pick this time the lower side by clicking anywhere below the line. Right-click to end
6. Use the **Draw**→**Offset**→**Offset One** (**OFFSET1**) tool and type **0.25** for the distance. Select the left straight wall inner (right) line and pick the right side
7. Select the right wall inner line and pick the left side. Right-click
8. Trim both of these new vertical lines to the new black horizontal lines with the **Trim To Entity**  (**TRIMTO**) tool
9. **Break**  (**BREAK**) the horizontal lines between the vertical ones with the **Endpoint**  modifier (**F5**), and break the initial vertical lines between the horizontal ones.
10. Use the **Draw**→**Offset**→**Offset One** (**OFFSET1**) tool and type **2** for the offset distance. Click on the orange construction line then offset to both sides as in steps 4. and 5.
11. **Trim To Entity**  (**TRIMTO**) both these new horizontal lines to the vertical ones from step 6. and 7.
12. **Draw**→**Offset**→**Offset One** (**OFFSET1**) the vertical lines from steps 6. and 7. to **2'** inward.
13. Repeat steps 8. and 9. with the four new lines (from steps 10. and 12.)
14. If you want a nice architectural effect, start again step 10. with a distance of **1.75**, step 11., step 12 with an offset distance of **0.25** and step 13.
15. Save as Chapel04.fcw

Working out of the grid

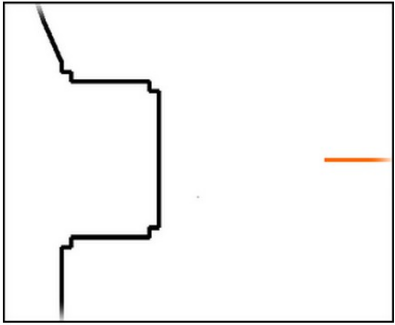
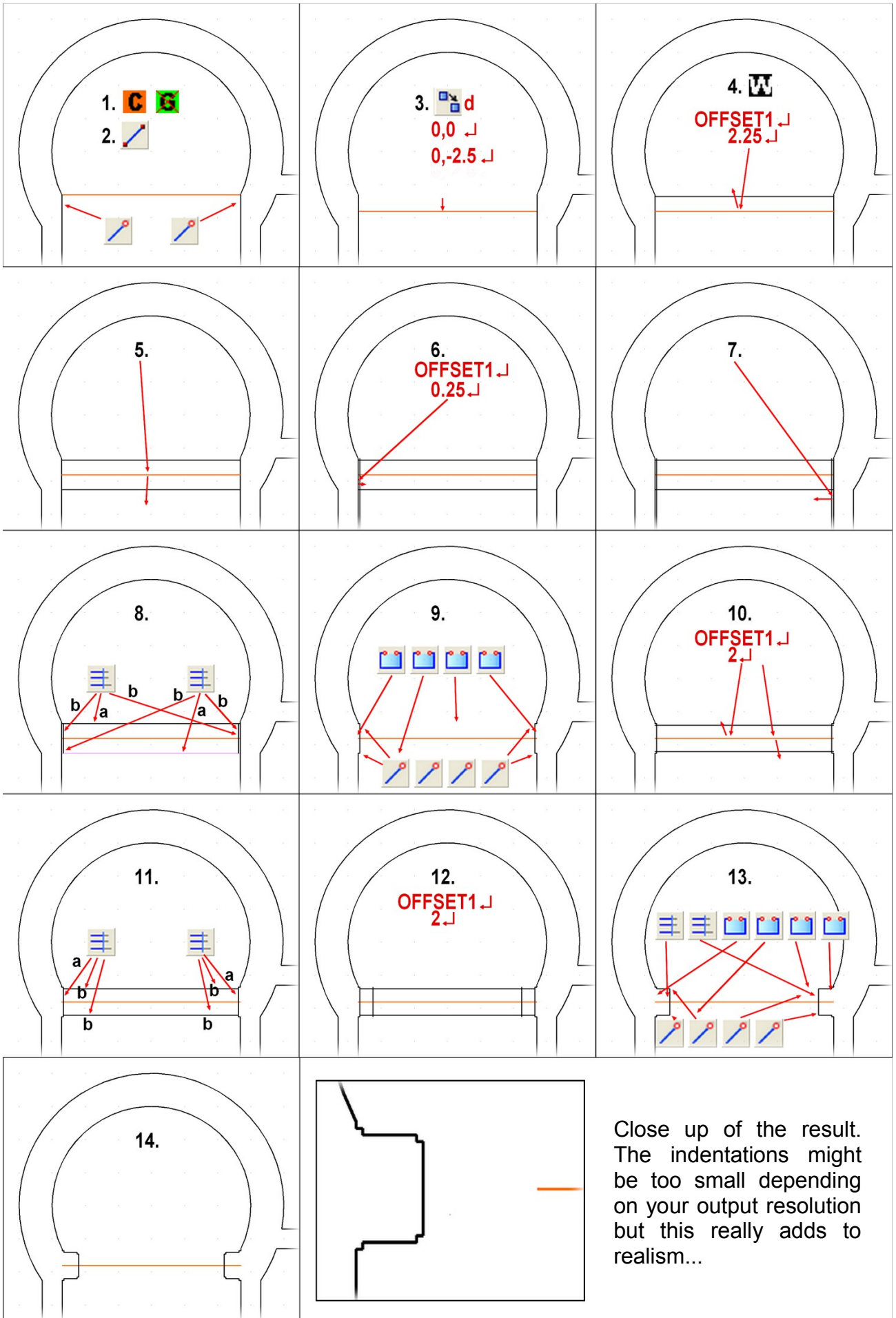
Sometimes you will find yourself with entities that don't fit simply on the grid. This is particularly the case when dealing with circles and arcs.

Finding the intersections of a line and a circle, or of two circles, involves solving quadratic equations which rarely leads to exact numbers.

It doesn't mean that you cannot deal with such cases, only that both the CC3 internal grid and our green grid are here useless.

The modifiers, especially the **Endpoint** (**F5**) and the **Intersection** (**F6**) modifier, find the root of these equations for us.






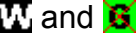












Close up of the result. The indentations might be too small depending on your output resolution but this really adds to realism...

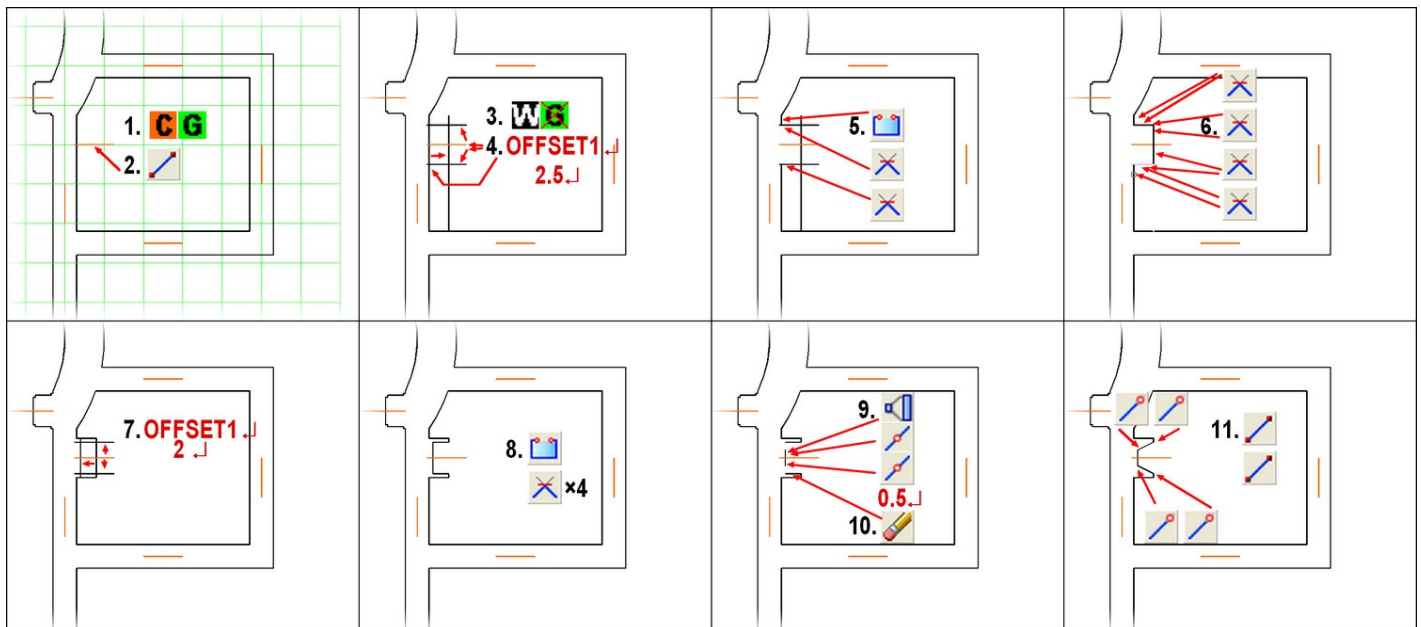




Fireplace

A fireplace can be added the same way, first by pulling the wall outward, then pushing a smaller part inward. Scaling and editing further shape the wall around the foyer:

1. Construction mode **C** and show grid **G**
2. Short **Line**  to define fireplace axis
3. Click **W** and **S** 
4. Invoke the **Draw**→**Offset**→**Offset One** (**OFFSET1**↵) tool and type **2.5**↵ for the distance. Offset the orange line on both it's sides and the wall line to it's right.
5. **Break**  (**BREAK**↵) the wall line between the new horizontal lines with the **Intersection**  (**F6**) modifier.
6. Trim the corners with the **Trim to Intersection**  (**TRIMINT**↵) tool
7. Use the **Draw**→**Offset**→**Offset One** (**OFFSET1**↵) tool and type **2**↵ for the distance. Offset the construction line on both it's sides and the new vertical line to it's left
8. **Break**  (**BREAK**↵) the front of the fireplace wall line between the new horizontal lines then **Trim to Intersection**  (**TRIMINT**↵) the corners
9. Click on **Scale** , select the back wall of the fireplace and hit **d** (or right-click **do it**). Use the **Midpoint**  modifier (**F3**) to select the line's midpoint as scale origin, and again as scale reference point. Move your mouse till you have an adequate size then click, or type **0.5**↵ which automatically scales the line by half.
10. **Erase**  (**ERA**↵) the dangling lines.
11. Join the unconnected lines with **Line**  and the **Endpoint**  modifier (**F5**). Alternatively to steps 10. and 11. you can **Node edit**  the dangling lines, also combined with the **Endpoint**  modifier (**F5**), instead of erasing them and draw new ones.
12. save as Chapel05.fcw





Adding alcoves (recesses) to the curved sanctuary wall

If you look at the sketch page i. you see that we need 8 alcoves evenly spaced along the inner curved wall. As each alcove is obtained by rotating the previous one, the angle of this rotation must be calculated.

1. Perform an **Info**→**List** (**LIST**↵) command on the target arc to get the following information:

```
T List
+---Sheet: WALLS -----
2D Arc: color 0 (black) layer 319 (WALLS)
  line style 0 (Solid) fill style 0 (Hollow)
  line width 0.00000 tag # 20109 pen :0.000 mm 2nd color 0
  center at 70.00000,50.00000, radius 15.00000
  starting angle 334.15807, angle width 231.68395°
  arc length 60.65472
```

2. Round the angle width down to a suitable value (see sidebar). Divide the rounded angle width by the number of alcoves: $230^\circ \div 8 = 23.75^\circ$
3. Click **C** then **G**
4. Draw a vertical line from the arc's center up (you can use the **center** modifier **F4** but the center is a grid node so the snapping is enough).
5. Click and use the **Intersection** modifier (**F6**) to set the center at the intersection of the inner arc and the orange line. Type **@2.5,0**↵ to create a 2.5 radius circle.
6. **Break** (**BREAK**↵) this circle, selecting first the upper part to keep than both it's **Intersection** with the inner arc.
7. **Break** (**BREAK**↵) the inner arc between the **Endpoints** of the broken circle.
8. **Rotate** the orange line from step 4. by 10.91184° around the sanctuary center.
9. Repeat steps 5. to 7. typing **@1/6,0**↵ instead of **@2.5,0** and keep the lower part of the circle.
10. **Rotate** the orange line from step 4. by -21.82368° around the sanctuary center. Repeat step 9 with the new position of the construction line.
11. **Rotate** the alcove arc, the frame arcs (radius 1/6) and the parts of the inner arc in between by 100.625 around the sanctuary center.
12. Use the **Circular Array** tool (right-click or **CARY**↵). Hit **p** to select the prior selection, hit **d** and type **8**↵ for the number of strokes **1**↵ for the number of rings (or right-click or to accept default) click on the sanctuary center for the array center click anywhere for the origin point **-28.75**↵ for the angle between spokes. Be sure to have a negative value

Even and odd number of alcoves

If you have an even number of alcoves, as 8, there is no vertically aligned axis and the nearest axes from the vertical are at half the angle width for a single alcove:

$$28.75^\circ \div 2 = 14.375^\circ$$

For every other alcove add 28.75° . The last is at:

$$14.375^\circ + 3 \times 28.75^\circ = 100.625^\circ$$

With an odd number of alcoves, there is a vertical axis and every further axis must be rotate by the alcove angle width. Proceed the same way as we need the last axis to obtain all the other with the **Circular Array**.

For example, if you want 9 alcoves, round the global angle width to 230.4 , or even 225 (because you can easily divide them by 9) . Never round up or the wall might be to short to take all the alcoves.





$$230.4^\circ \div 9 = 25.6^\circ$$

so the last axis will be at an angle of :

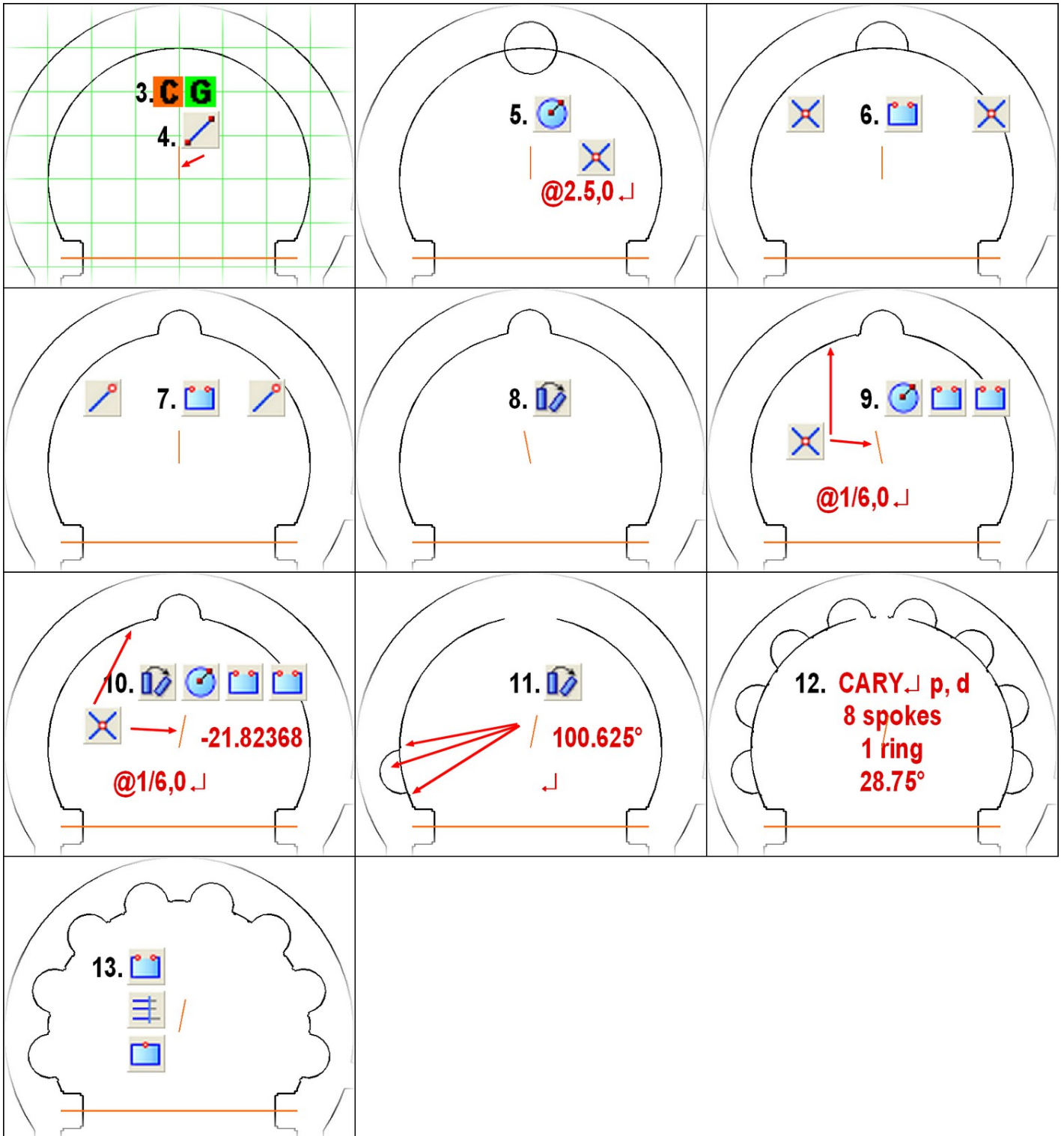
$$25.6^\circ \times 4 = 102.4^\circ \text{ to the vertical.}$$





13. Use combinations of **Break**  (**BREAK**↵), **Trim To Entity**  (**TRIMTO**↵) and **Split**  (**SPLIT**↵) to erase the parts of the inner arc between the **Endpoints**  of the smallest circles. Arcs are not easy to trim due to the complexity of the equations to solve. Sometimes you have to click on the part to erase instead of the part to keep when trimming. Only experience will get you more comfortable with this...

14. Save as Chapel06.fcw













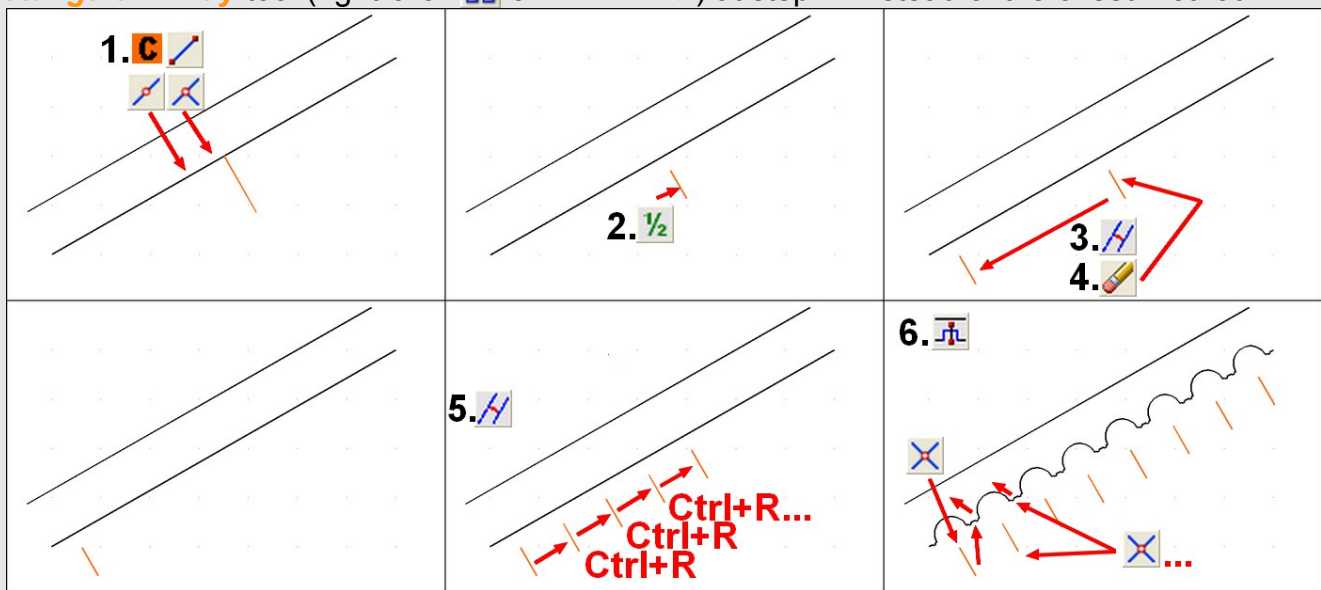
Inserting alcoves along a straight wall

The best way is to stick to the grid. If this is not an option, you can adapt the method described for the circular wall.

Instead of using the angle width, you divide the wall length by the desired number of alcoves to get the interval width.

1. Using the **Midpoint**  modifier (**F3**) and the **Perpendicular**  modifier (**F12**) draw a line  from the midpoint of the wall line, going outward.
2. Use the **Center Line Scaling** tool  to ensure this construction line does not touch the wall.
3. Select the **Draw**→**Offsets**→**Offset One**  (**OFFSET1**↓) tool. Type the calculated amount of displacement (see the **Even and odd** sidebar). For example, to place 8 alcoves, you need to multiply the interval by 3.5. To place 9 alcoves, multiply by 4. Click on the construction line then pick a side.
4. Erase the centered construction line.
5. Select the **Draw**→**Offsets**→**Offset One**  (**OFFSET1**↓) tool. Type the calculated interval. Click on the construction line, than on the relevant side. Type **Ctrl+R** to redraw the map and show the new line. Offset this line, **Ctrl+R** and so on till the last axis. Right-click to exist the command.
6. Insert the alcoves with the method described for the circular wall... The alcove width, including the columns if you chose to add them, must fit the interval length.









Note: if the wall is vertical or horizontal, you can use the **Move**  command at step 3. and the **Rectangular Array** tool (right-click  or **REPEAT**↓) at step 4. instead of the offset method.



Buttresses

A buttress is a structure jutting from the wall (or built against it) that provides support against outward forces generated by the building's height or roof.

The center of the leftmost alcove can conveniently provide the first axis:

1. Start a line  from the sanctuary's center to the **center**  (**F4**) of the leftmost alcove
2. Use the **Draw**→**Offset**→**Offset One** (**OFFSET1**↓) tool and type **1.5**↓ for the distance than offset the line from step 1. on both it's sides. Offset the outer arc.
3. **Trim To**  the lines to this new arc and draw a Start a line  joining their **Endpoints**  (**F5**)
4. **Trim**  the lines to the outer arc of the sanctuary. **Erase**  (**ERA**↓) the offset arc
5. Use the **Circular Array** tool (right-click  or **CARY**↓). Select the three lines making the





buttress, hit **d** and type

7↵ for the number of strokes (the right-most buttress is replaced by the lodging wall).

1↵ for the number of rings (or right-click or to accept default)

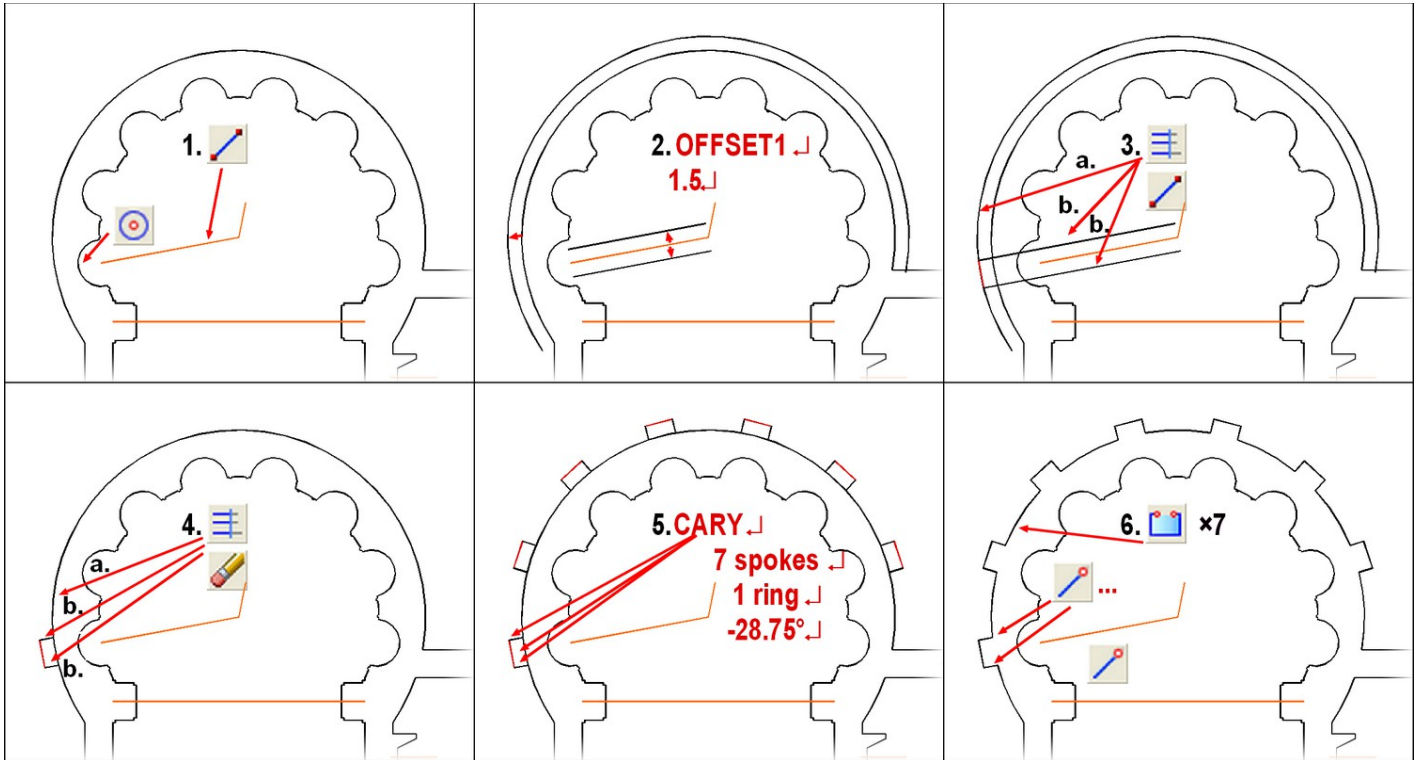
click on the sanctuary center for the array center

click anywhere for the origin point

-28.75↵ for the angle between spokes. Be sure to have a negative value








6. **Break**  (**BREAK**↵) the outer arc between each buttress lines.

7. Save as Chapel07.fcw



Elaborate door frames

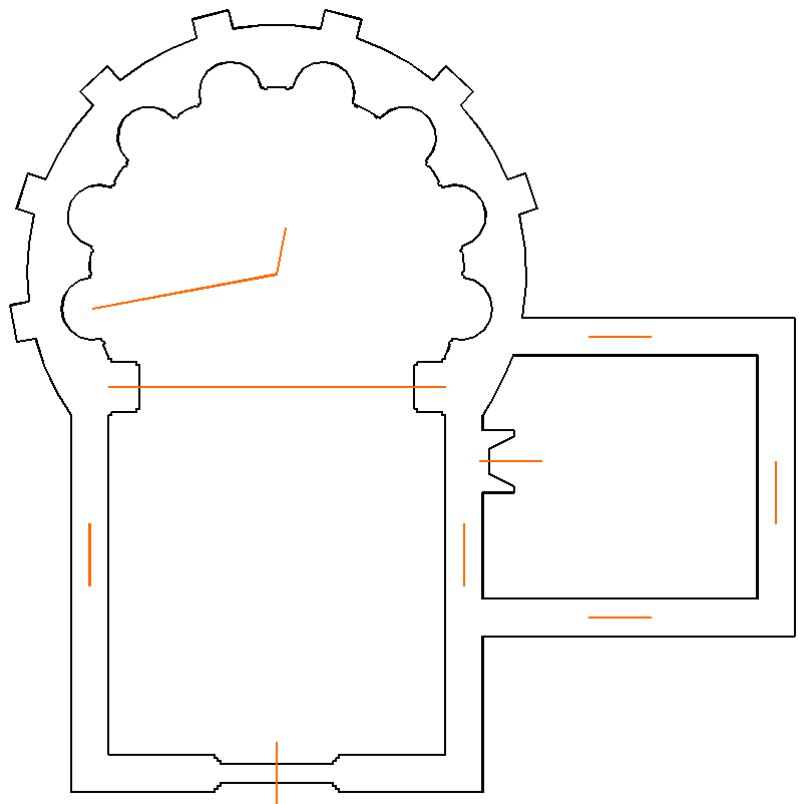
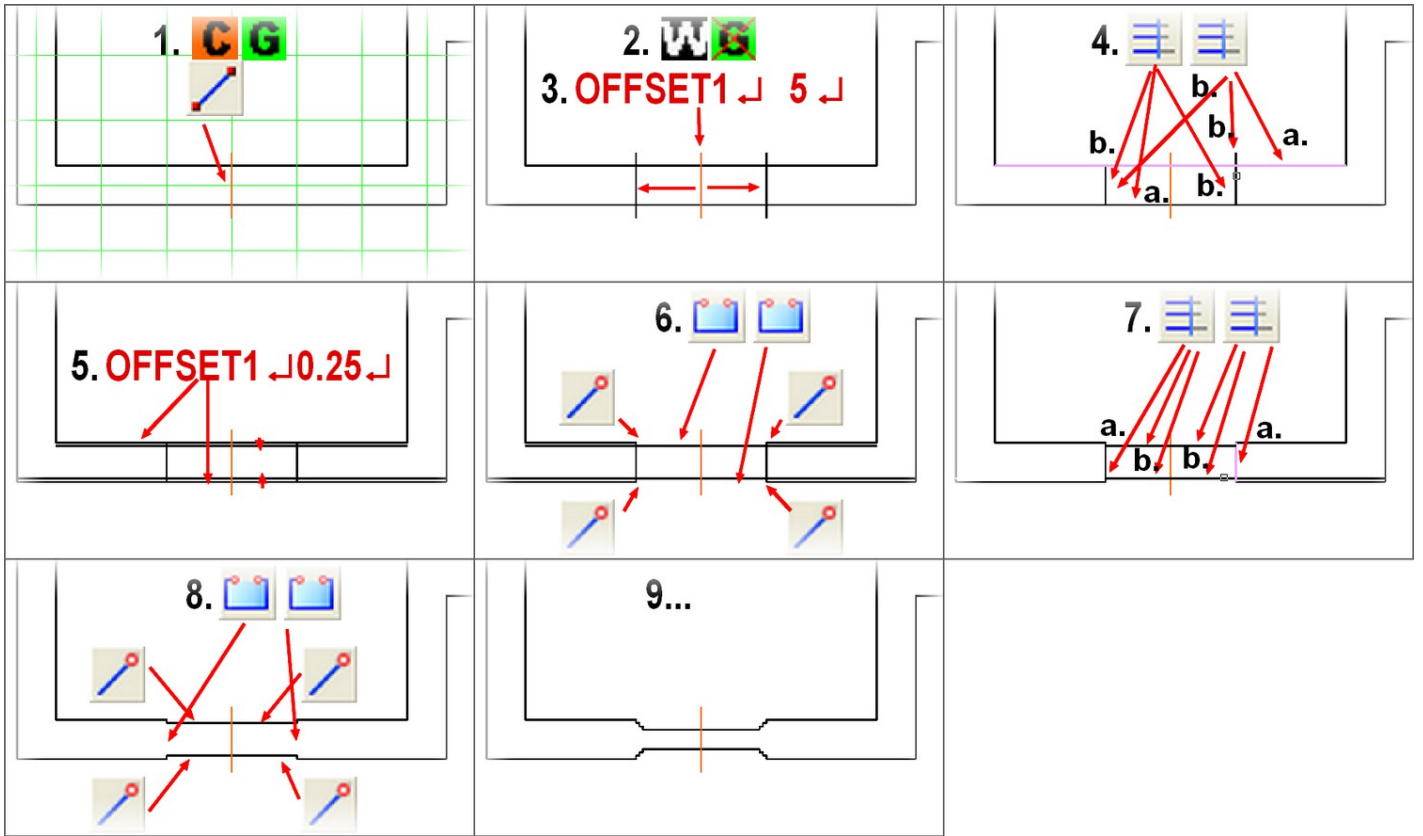
Adding multiples frames to a doorway can be done by creating a bunch of rectangular alcoves on each side of the location of the future door. For an 8' wide door, make for example pairs of alcoves 10', 9.5' and 9' wide, each 0.25' deep. The 8.5' wide arch and the doorway will be drawn in the next part (part5 or Appendix C)

1. Click **C** then **G**. Draw a vertical line  above the future door's midpoint.
2. Click **M** and **S**.
3. **Draw**→**Offset**→**Offset One** (**OFFSET1**↵) this line on both it's sides by **5**↵(half of 10')
4. **Trim**  the two offset lines to the outer wall line first, then to the inner wall line so only the part inside the wall remains
5. **Draw**→**Offset**→**Offset One** (**OFFSET1**↵) wall lines by **0.25**↵ inward
6. **Break**  (**BREAK**↵) these wall lines between the vertical lines from step 3. using the **Endpoint**  modifier (**F5**) to specify the break points
7. **Trim**  the new horizontal lines to the vertical ones.
8. **Break**  (**BREAK**↵) the vertical lines between the **Endpoints**  (**F5**) of the horizontal ones.
9. Repeat twice steps 3. to 8. changing the offset distance to **4.75**↵ and **4.5**↵ at step 3.





10. Save as Chapel 08.fcw



Conclusion

The walls have a more architectural look, by the addition of all the features described herein.

In the next part openings (doors and windows) will be added and the walls will be turned into filled shapes.

