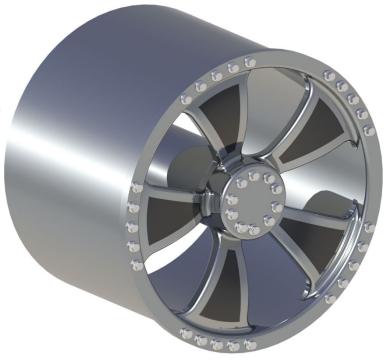
Chapter 8

CO2 Rail Car
Rear Rim Spokes



A. Sketch Hub.

Step 1. Click File Menu > New, click **Part Metric** and OK.

Step 2. Click **Front Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 1**.

Step 3. Click **Corner Rectangle** **(S)** on the Sketch toolbar.

Step 4. Sketch a rectangle starting at the Origin, **Fig. 2**.

Step 5. Click **Smart Dimension** **(S)** on the Sketch toolbar.

Step 6. Add dimensions, **Fig. 2**.

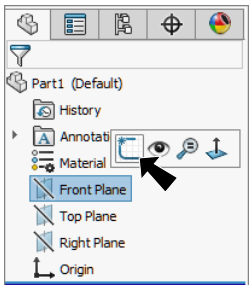


Fig. 1

Fig. 2

B. Save as "REAR RIM SPOKES".

Step 1. Click File Menu > Save As.

Step 2. Key-in **REAR RIM SPOKES** for the filename and press ENTER.

C. Sketch Rim.

Step 1. Click **Line** **(L)** on the Sketch toolbar.

Step 2. Sketch the lines above rectangle, **Fig. 3**. Use the inferencing line, the dotted line that appears when you draw to keep lines vertical or horizontal.

Fig. 3

Step 3. **Right click drawing and click Select** from menu to unselect Line Tool.

Step 4. **Ctrl click** the **right line of the rectangle** and the **right vertical line** to select both. Release Ctrl key and click **Make Collinear** on the context toolbar, **Fig. 4**.

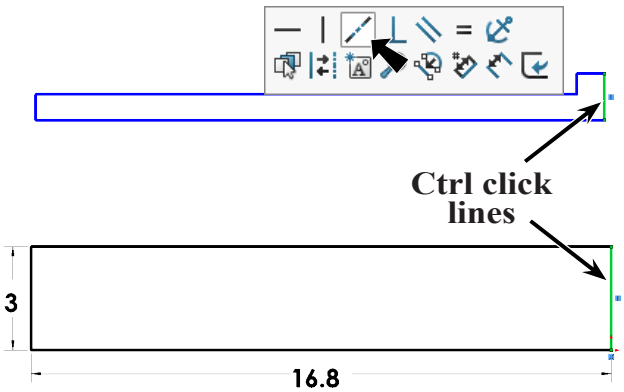


Fig. 4

Step 5. Click **Smart Dimension** (**S**) on the Sketch toolbar.

Step 6. Add dimensions, **Fig. 5**.

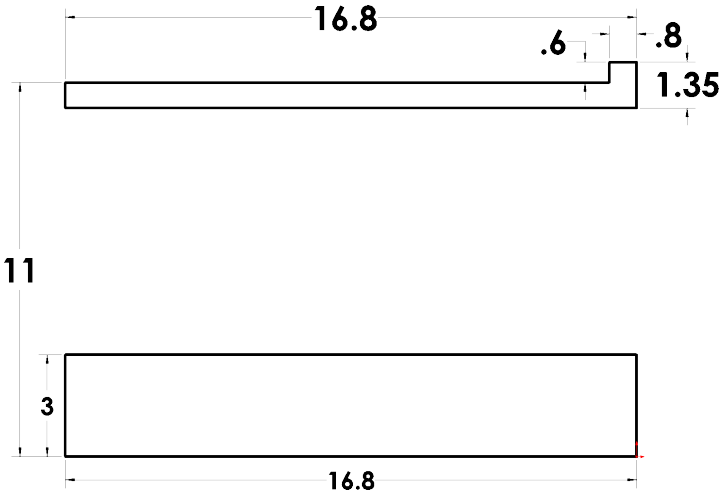


Fig. 5

D. Revolved Rim.

Step 1. Click **Features** Features on the Command Manager toolbar.

Step 2. Click **Revolved Boss/Base**

on the Features toolbar.

Step 3. In the Revolve Property Manger set:

under Axis of Revolution click **bottom line of sketch**, **Fig. 7**

click OK .

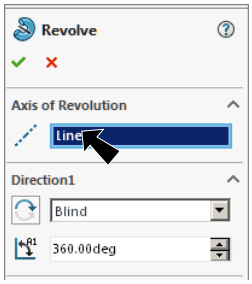


Fig. 6

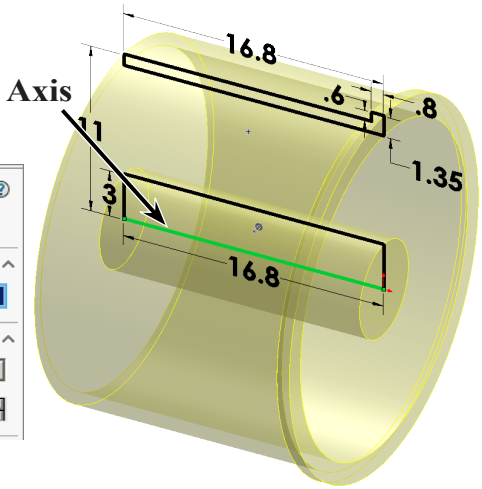


Fig. 7

Step 4. Click **Zoom to Fit** (**F**) on the View toolbar.

Step 5. Save. Use **Ctrl-S**.

E. Spoke.

Step 1. Click **Front Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 8**.

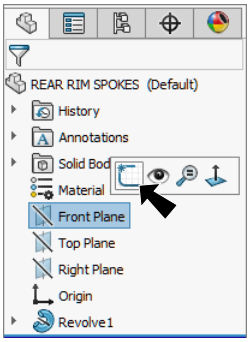


Fig. 8

Step 2. Click **Normal To** on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Wireframe** on the View toolbar.

Step 4. Click **3 Point Arc** (**S**) in the **Arc flyout** on the Sketch toolbar.

Step 5. Sketch arc between Position 1 on revolve edge, Position 2 on revolve edge and Position 3, **Fig. 9**.

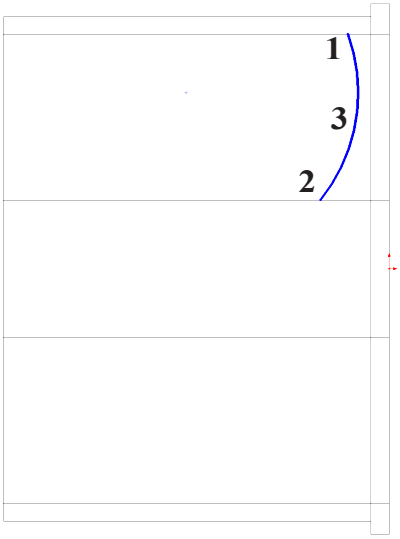


Fig. 9

Step 6. Click **Smart Dimension** 

(**S**) on the Sketch toolbar.

Step 7. Add dimensions, **Fig. 10**.

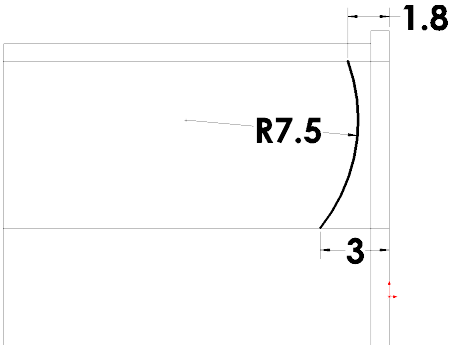


Fig. 10

Step 8. Click **Offset Entities** 

on the Sketch toolbar.

Step 9. In the Offset Entities Property Manager set:
under Parameters, **Fig. 11**

Distance  **1**
check **Reverse**
click **arc**
check **Cap ends**
select **Lines**

The yellow offset should on right side of original arc, **Fig. 12**. If it is not, uncheck Reverse.

click OK  .

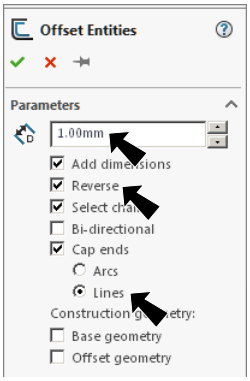


Fig. 11

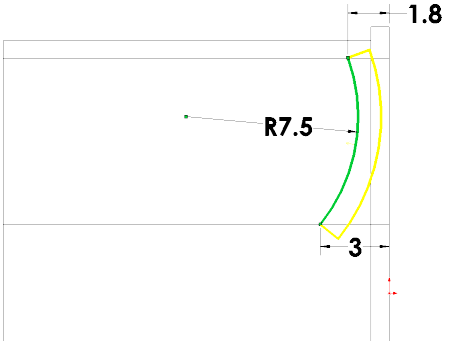


Fig. 12

Step 10. Click **Centerline**  in the **Line flyout**  on the Sketch toolbar.

Step 11. Draw **horizontal centerline** from Origin  , **Fig. 13**.

Step 12. Save. Use **Ctrl-S**.

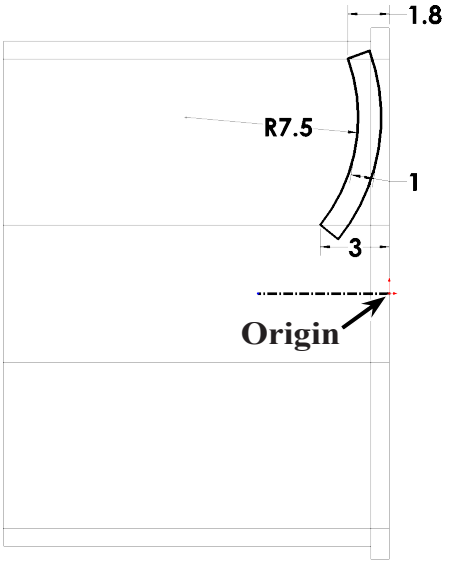


Fig. 13

F. Revolved Spoke.

Step 1. Click **Shaded With Edges** on the View toolbar.

Step 2. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

Step 3. Click **Features** Features on the Command Manager toolbar.

Step 4. Click **Revolved Boss/Base** Revolved Boss/Base on the Features toolbar.

Step 5. In the Revolve Property Manger set:
under Direction 1, **Fig. 14**
Revolve Type **Mid Plane**
Angle **34°**
click OK .

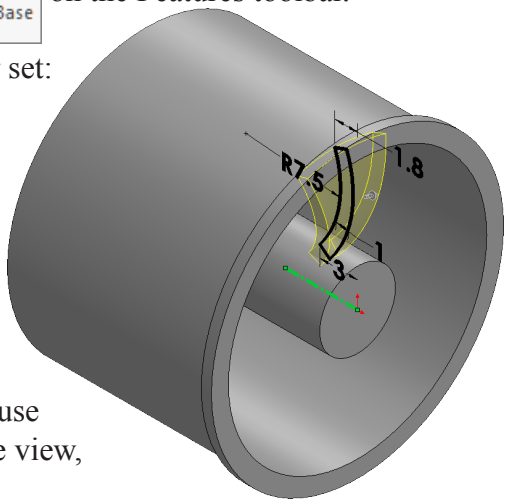


Fig. 15

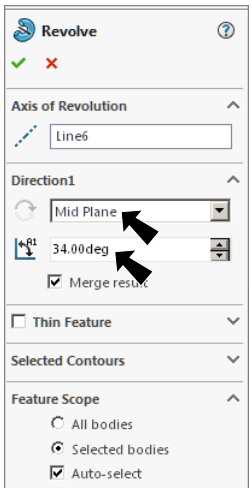


Fig. 14

G. Fillets.

Step 1. Rotate view **to get better view of spoke**, hold down middle mouse button (wheel) and drag to rotate view, **Fig. 17**.

Step 2. Click **Fillet** Fillet on the Features toolbar.

Step 3. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 16**
Radius **1.3**
click **corner of spoke at center revolved body**, **Fig. 17**

and click **Connected to start face, 3 Edges** on the Fillet pop-up toolbar

click **Apply**.

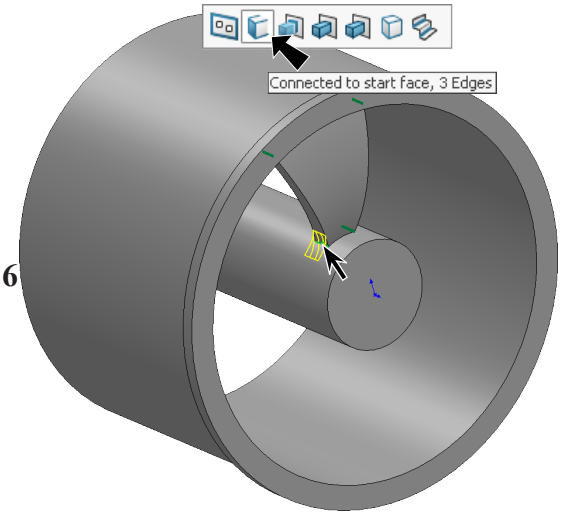


Fig. 17

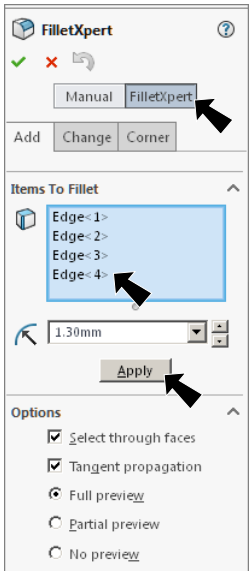


Fig. 16

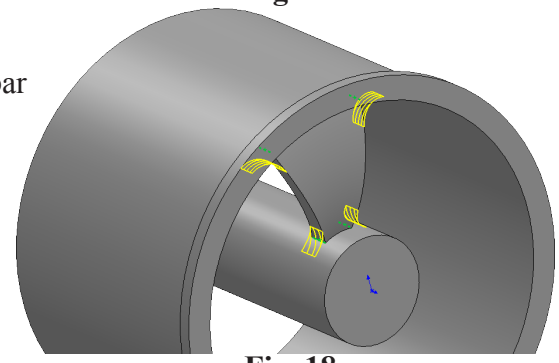


Fig. 18

Step 4. **Radius** **.3**

click **side edge of spoke**, **Fig. 20**

and click **Right feature**, **15 Edges** on the Fillet pop-up toolbar

click OK .

Step 5. Save. Use **Ctrl-S**.

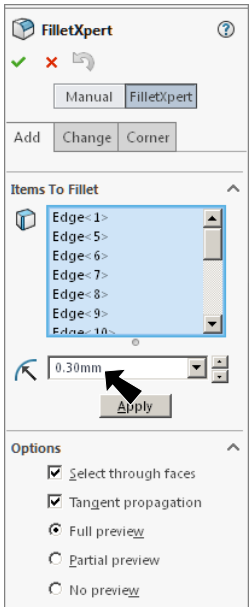


Fig. 19

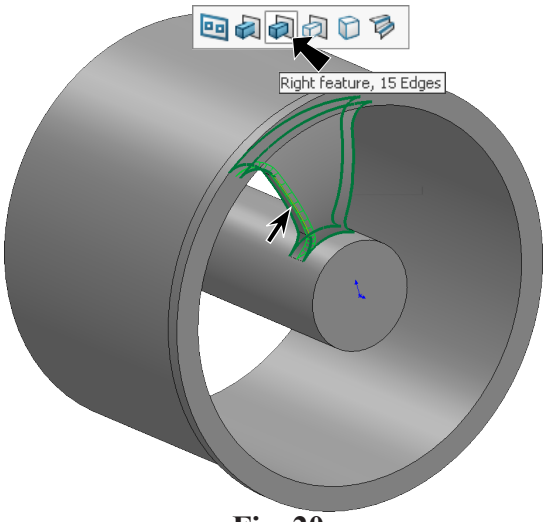


Fig. 20

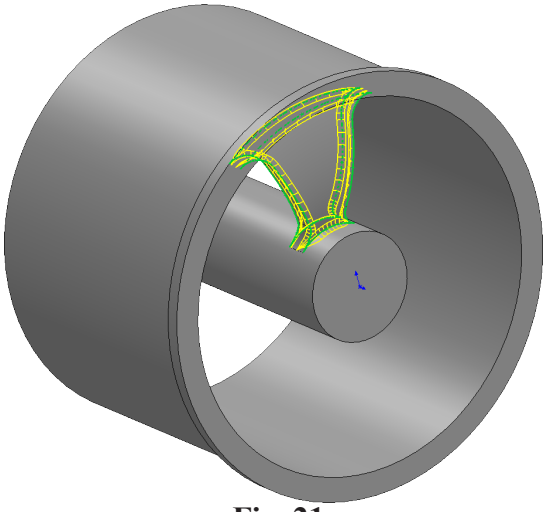


Fig. 21

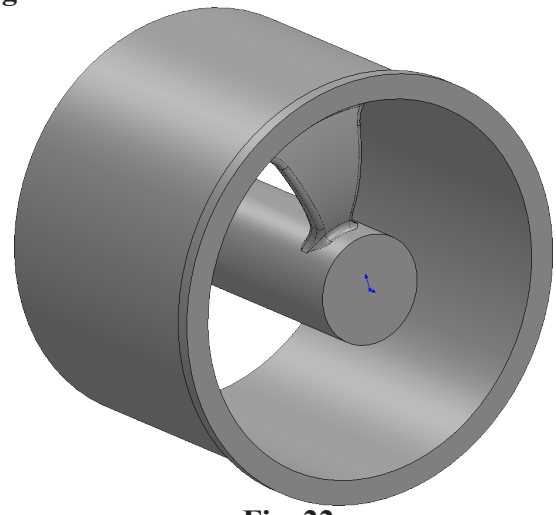


Fig. 22

H. Split Line.

Step 1. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 23**.

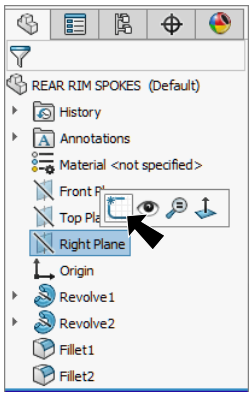


Fig. 23

Step 2. Click **Offset Entities** on the Sketch toolbar.

Step 3. In the Offset Entities Property Manager set:
under Parameters, **Fig. 24**
Distance **.55**
check **Reverse**
uncheck **Bi-directional**
click **face of spoke**, **Fig. 25**
The yellow offset should be inside. If it is not, uncheck Reverse.
click OK .

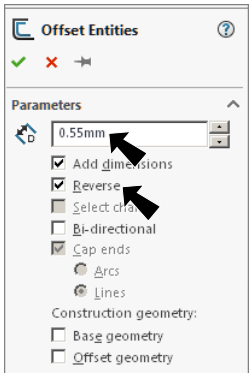


Fig. 24

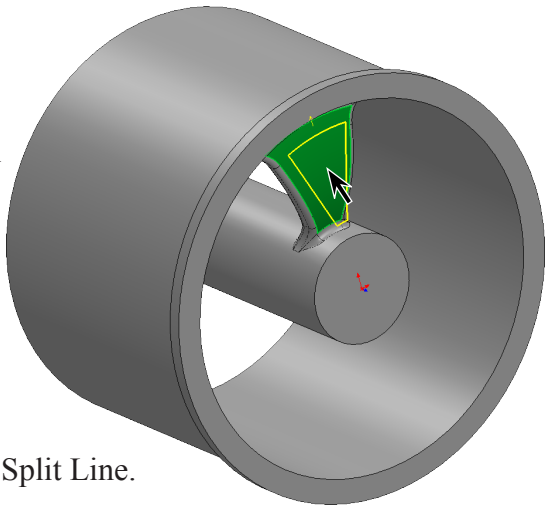


Fig. 25

Step 4. Click Insert Menu > Curve > Split Line.

Step 5. In the Split Line Property Manager set:
under Type of Split, **Fig. 26**
select Projection
under Selections
current Sketch should be selected
in Faces to Split box
click **spoke face**, **Fig. 27**
click OK .

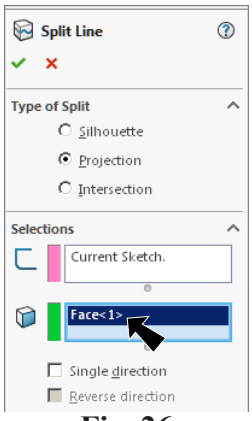


Fig. 26

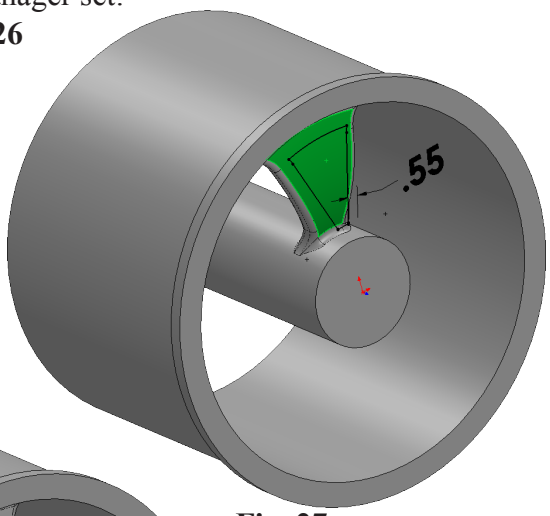


Fig. 27

Step 6. Save. Use **Ctrl-S**.

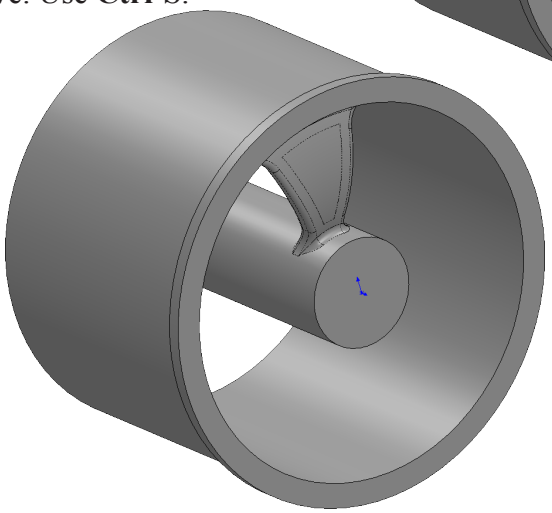


Fig. 28

I. Circular Pattern Spoke.

Step 1. **Ctrl click Revolve2, both Fillets and Split Line1** features in the Feature Manager to select the 4 features, **Fig. 29**.

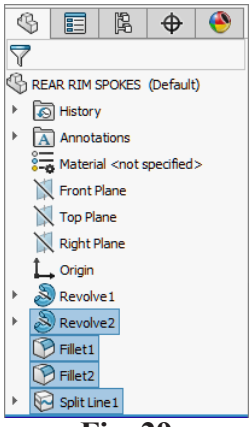
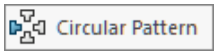


Fig. 29

Step 2. Click **Circular Pattern** 

in the **Linear Pattern flyout** 

on the Features toolbar.

Step 3. In the Circular Pattern Property Manager set:

under Features and Faces, **Fig. 30**

Revolve2, both Fillets and Spit Line features should be selected

under Parameters

click in **Pattern Axes** box

click **cylindrical face Rim**, **Fig. 31**

Number of Instances  **5**

check **Equal spacing**

click OK  .

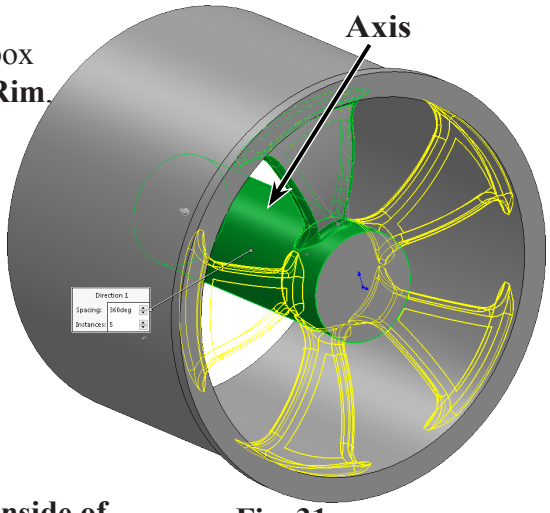


Fig. 31

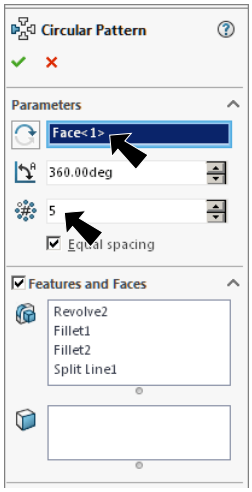


Fig. 30

Step 4. Save. Use **Ctrl-S**.

J. Hole for Axle.

Step 1. Rotate view slightly to view **inside of rim**, hold down middle mouse button (wheel) and drag to rotate view, **Fig. 32**.

Step 2. Click **inside face of hub** and click **Sketch**  on the context toolbar, **Fig. 32**.

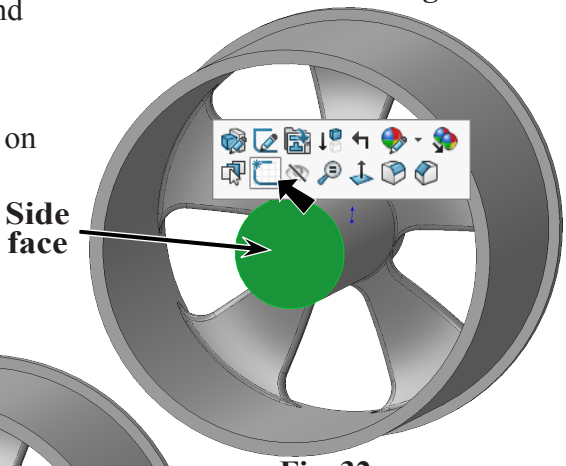


Fig. 32

Step 3. Click **Circle**  **(S)** on the Sketch toolbar.

Step 4. Draw a circle for the hole starting at Origin  , **Fig. 33**.

Step 5. Click **Smart Dimension** 

(S) on the Sketch toolbar.

Step 6. Dimension **diameter 3.5**, **Fig. 33**.

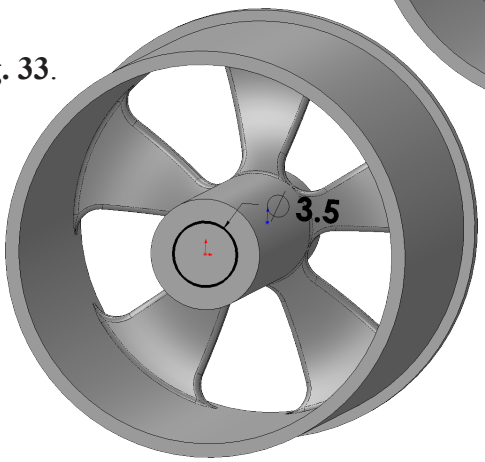


Fig. 33

Step 7. Click **Features** Features on the Command Manager toolbar.

Step 8. Click **Extruded Cut** Extruded Cut on the Features toolbar.

Step 9. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 34**
Depth D1 **10.5**
click OK .

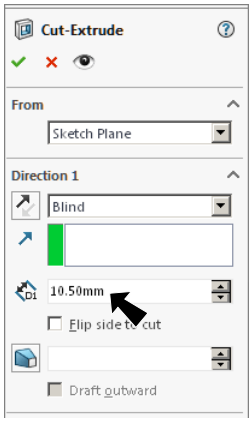


Fig. 34

Step 10. Save. Use **Ctrl-S**.

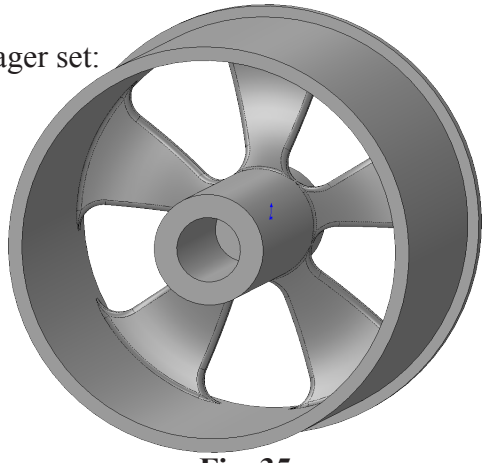


Fig. 35

K. Bolt Hole Wizard.

Step 1. Click **Right** on the Standard Views toolbar. **(Ctrl-4)**

Step 2. Click **Hole Wizard** Hole Wizard on the Features toolbar.

Step 3. In the Property Manager on the Type tab set:
under Hole Type, **Fig. 36**
select **Hole**
under Standard:
select **ANSI Metric**
under Type:
Drill Sizes
under Size:
select **.5**
under End Condition:
Blind Depth Hole **.54**

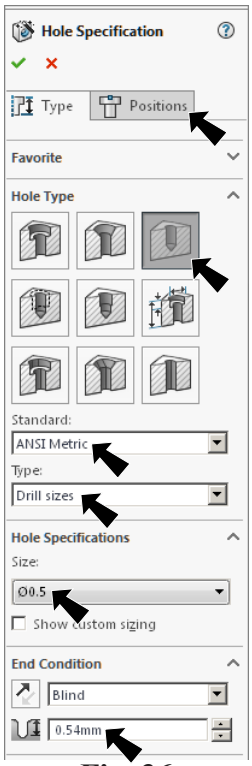


Fig. 36

Click **Positions tab** Positions at top of the Property Manager.

Step 4. Click **outer Rim face** one time as face for holes, **Fig. 37**. **Don't** click a second time or you will add Point.

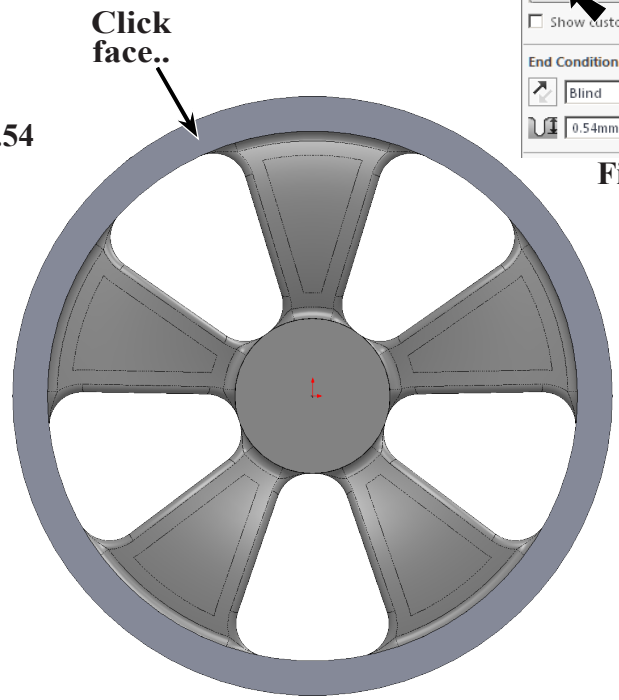


Fig. 37

Step 5. Click **Circle** (**S**) on the Sketch toolbar.

Step 6. Sketch a circle from Origin almost out the edge of Rim, **Fig. 38**.

Step 7. Click **Smart Dimension** (**S**) on the Sketch toolbar.

Step 8. Dimension **.6 circle to edge of Rim**, **Fig. 38**. To dimension, select edge first.

Step 9. Click **Line** (**L**) on the Sketch toolbar.

Step 10. Sketch **3 radial lines** from Origin to circle **one being vertical line**, **Fig. 39**. To terminate chain, double click back on the line you have just sketched.

Step 11. Click **Point** on the Sketch toolbar.

Step 12. Click to **sketch a Point on top endpoints of each radial lines**. And **sketch a Point on most left angled line near Origin**, **Fig. 40**. Don't place any extra Points.

Step 13. Click **Smart Dimension** (**S**) on the Sketch toolbar.

Step 14. Dimension **angles 8º** and **2.1** Point to Origin, **Fig. 41**.

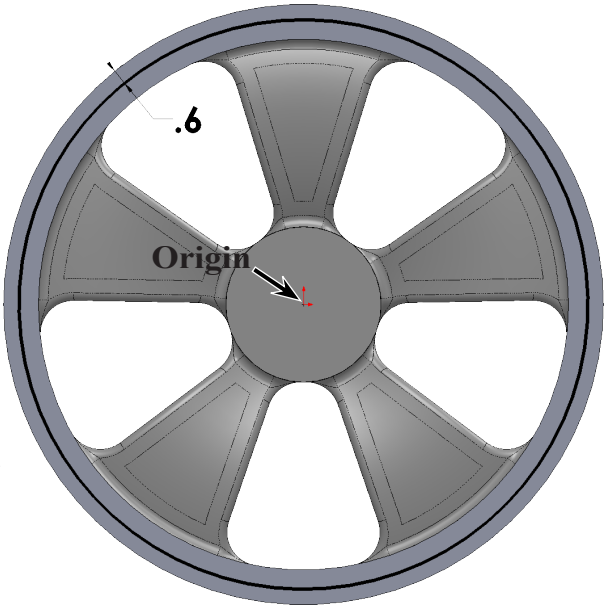


Fig. 38

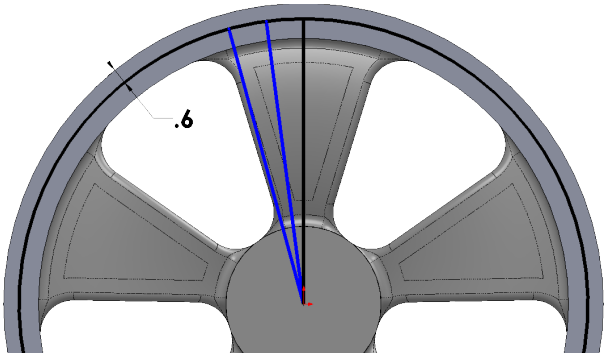


Fig. 39

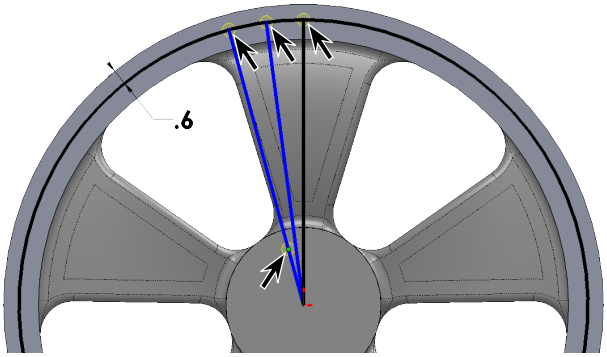


Fig. 40

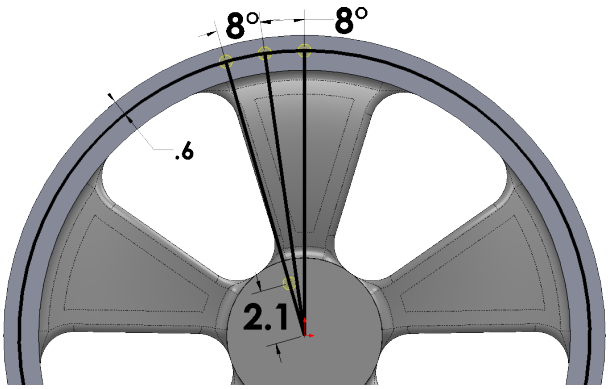


Fig. 41

Step 15. **Right click drawing and click Select** from menu to unselect Smart Dimension.

Step 16. Click **vertical radial line** and click **Construction Geometry**  on the context toolbar, **Fig. 42**.

Step 17. **Ctrl click the two Points on angled radial lines**, **Point near Origin** and **vertical centerline**, **Fig. 43**.

Step 18. Click **Mirror Entities** 

on the Sketch toolbar, **Fig. 44**.

Step 19. Click OK  in Hole Property Manager..

Step 20. Save. Use **Ctrl-S**.

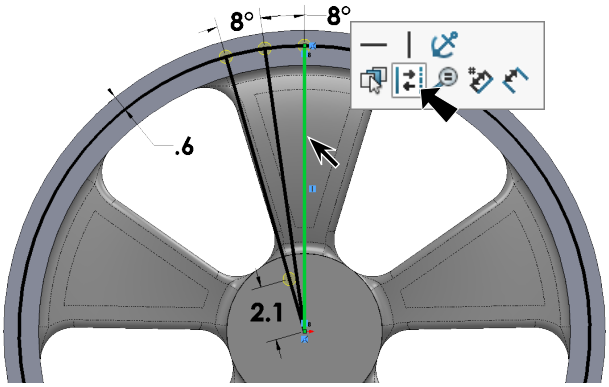


Fig. 42

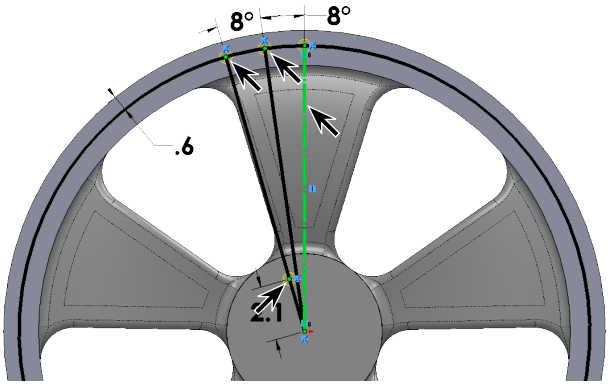


Fig. 43

Fig. 45

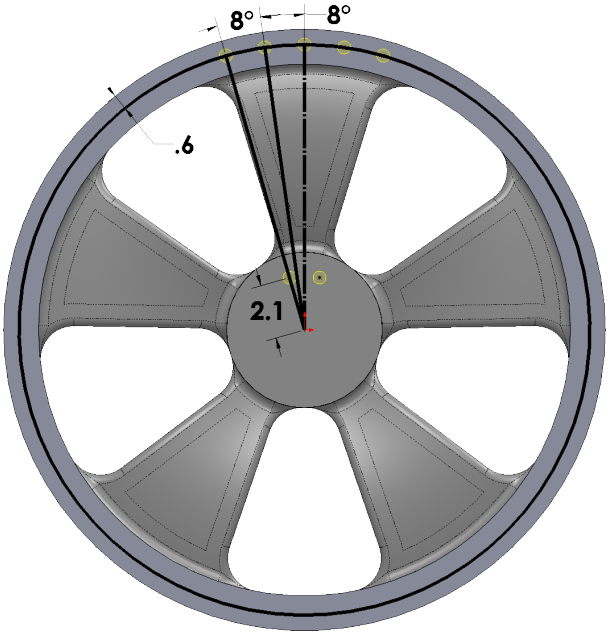
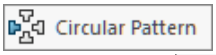


Fig. 44

L. Circular Pattern Bolt Holes.

Step 1. Rotate view slightly to view a **cylindrical face**, hold down middle mouse button (wheel) and drag to rotate view, **Fig. 47**.

Step 2. Click **Circular Pattern** 

in the **Linear Pattern flyout** 

on the Features toolbar. Click the **flyout arrow**  to select Circular Pattern.

Step 3. In the Circular Pattern Property Manager set:
under Features and Faces, **Fig. 46**
click **Hole Wizard** in graphics area, **Fig. 47**
under Parameters
click in **Pattern Axes**  box
click **cylindrical face Rim**
Number of Instances  **5**
check **Equal spacing**
click OK  .

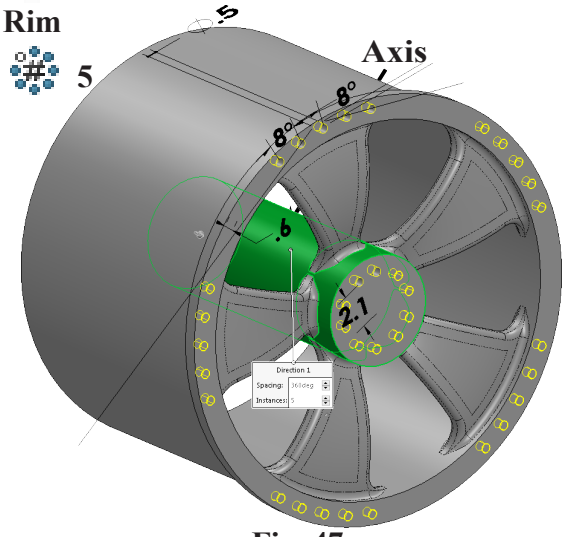


Fig. 47

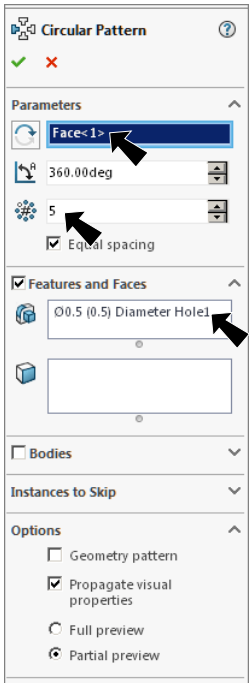


Fig. 46

Step 4. Save. Use **Ctrl-S**.

M. Fillets3.

Step 1. Click **Fillet** 

on the Features toolbar.

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 48**
set **Radius**  **.3**
click **edge of hub** and click **inside cylindrical face**, **Fig. 49**
click OK  .

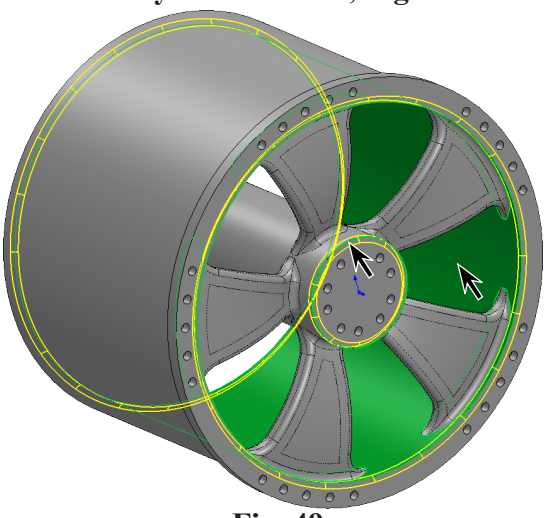


Fig. 49

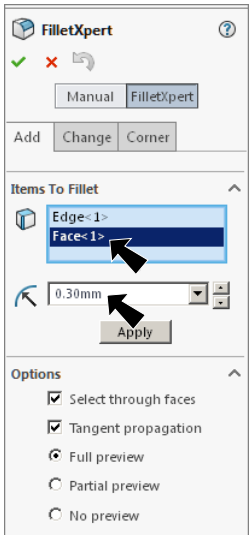


Fig. 48

Step 3. Save. Use **Ctrl-S**.

N. Material Chrome Stainless Steel.

Step 1. **Right click Material** in the Feature Manager and click **Edit Material**, **Fig. 50**.

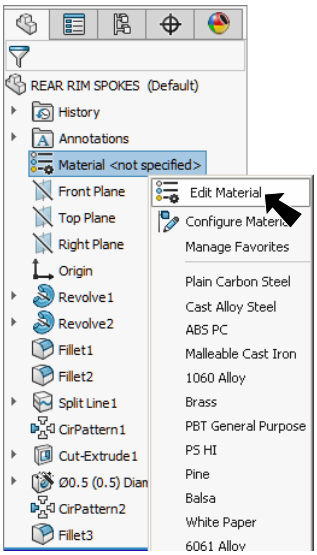


Fig. 50

Step 2. **Expand Steel** in the material tree and select **Chrome Stainless Steel**. Click **Apply** and **Close**.

Step 3. Save. Use **Ctrl-S**.

O. Split Line Appearance Color.

Step 1. Click Split Line face, click **Appearance Callout** on the context toolbar and click **Face 1 Split...**, **Fig. 51**.

Step 2. In the Appearances Property Manager:
under Selected Geometry, **Fig. 52**
click the **other four Split Line faces**, **Fig. 54**

under Color
click **Black** swatch
click OK .

Step 3. Save. Use **Ctrl-S**.

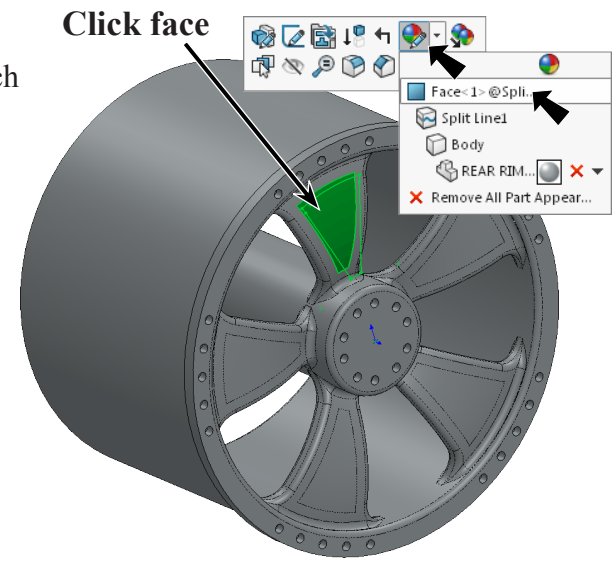


Fig. 51

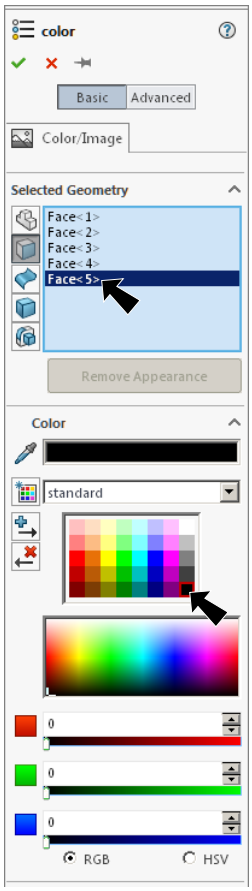


Fig. 52

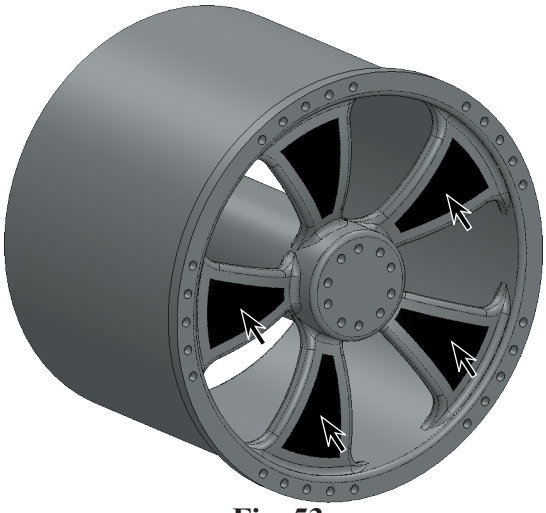


Fig. 53