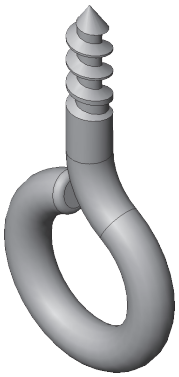
Chapter 10

Rail Car E

Eye Screw



A. Sketch Centerpoint Arc.

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

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

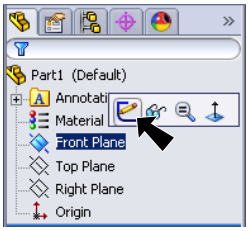


Fig. 1

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

Step 4. Draw a slightly open arc starting from the Origin, **Fig. 2**.

To draw the arc, click the Origin to place the center of the arc. Start the first endpoint directly above the Origin, then swing the arc to the right around counterclockwise. Click to place the second endpoint leaving a small gap in the arc, **Fig. 2**.

Use the inferencing line, the dotted line that appears when you draw the arc.

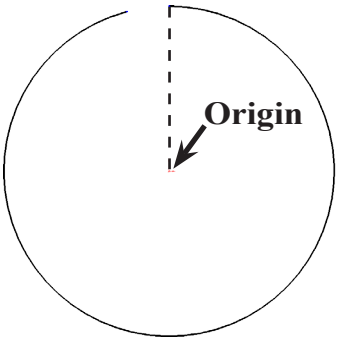


Fig. 2

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

Step 6. Dimension radius of the arc **2.2** as shown in **Fig. 3**.

Step 7. Click Zoom to Fit (**F**) on the View toolbar.

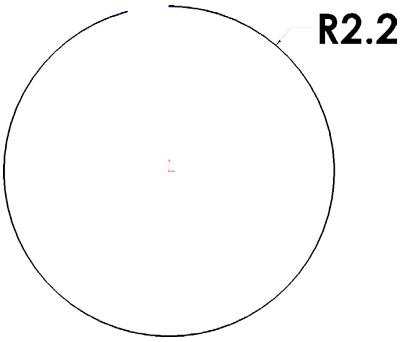


Fig. 3

B. Save as "EYE SCREW".

Step 1. Click File Menu > Save As.

Step 2. Key-in **EYE SCREW** for the filename and press ENTER.

http://www.cudacountry.net email:cudacountry@hotmail.com

C. Line.

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

Step 2. Draw line as shown in **Fig. 4**. Draw the line up from the arc endpoint that is directly above Origin.

Step 3. Click **Smart Dimension** 

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

Step 4. Dimension arc gap **.5** and the line **6** as shown in **Fig. 5**. To dimension the gap in arc, click both endpoints of arc, then move cursor out away and click. To Smart dimension the line, click the line, then move the cursor out away from the line and click.

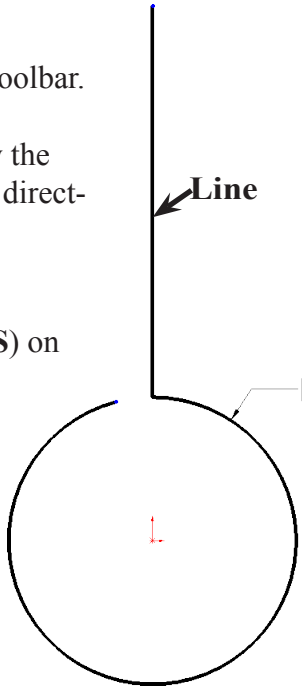


Fig. 4

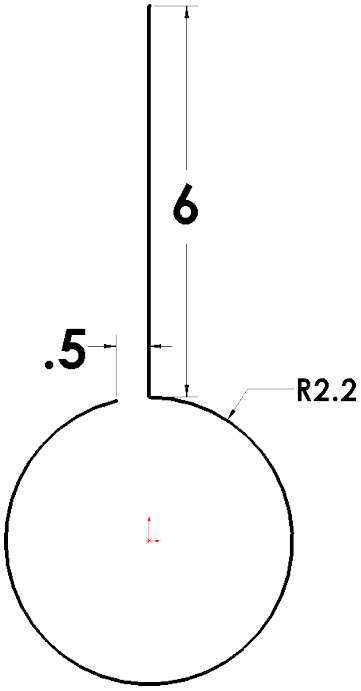


Fig. 5

Step 5. Click Zoom to Fit  (**F**) on the View toolbar.

D. Sketch Fillet.

Step 1. Click **Sketch Fillet**  (**S**) on the Sketch toolbar.

Step 2. In the Property Manager set:

Radius  **2**, **Fig. 6**

click **corner** shown in **Fig. 7**

click OK **twice**  .

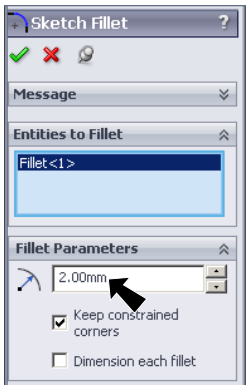


Fig. 6

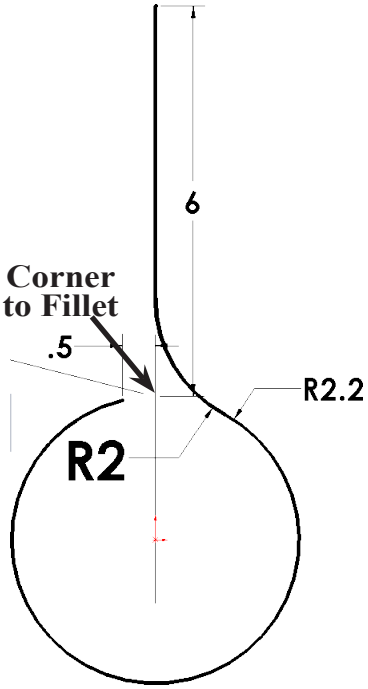


Fig. 7

Step 3. Click **Exit Sketch**  on the Sketch toolbar.

E. 3D Sketch Profile.

Step 1. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 2. Click **Top Plane**  in the Feature Manager, **Fig. 8**.

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

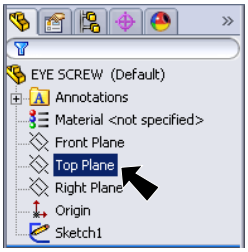


Fig. 8

Step 4. Click **3D Sketch** 

in the **Sketch flyout** 

on the Sketch toolbar. Be sure to click the **flyout arrow**  to select 3D Sketch.

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

Step 6. Draw a circle starting at the top endpoint of the line in sketch, **Fig. 9**.

Step 7. Click **Smart Dimension** 

(S) on the Sketch toolbar.

Step 8. Dimension the circle **1.2** diameter as shown in **Fig. 9**.

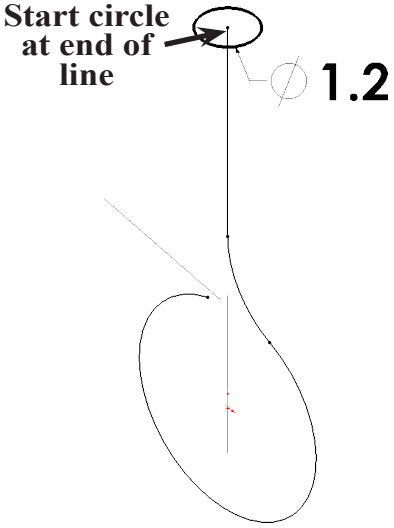


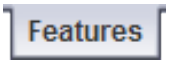
Fig. 9

Step 9. Exit the **3D Sketch.** To Exit, click 

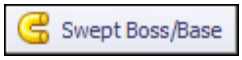
in the **Sketch flyout** 

on the Sketch toolbar. Click the **flyout arrow**  then 3D Sketch.

F. Sweep.

Step 1. Click **Features** 

on the Command Manager toolbar.

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

on the Features toolbar.

Step 3. In the Swept Boss/Base Property Manager:

for **Profile**  field, click **circle** in the 3D Sketch**, Fig. 11**

for Path  field, click any geometry in **Sketch1 (line, arc or fillet)**, **Fig. 11**

click OK 

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

Fig. 10

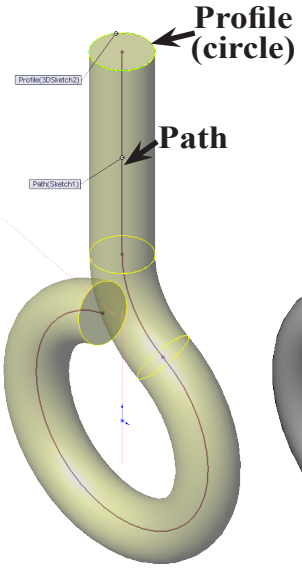


Fig. 11

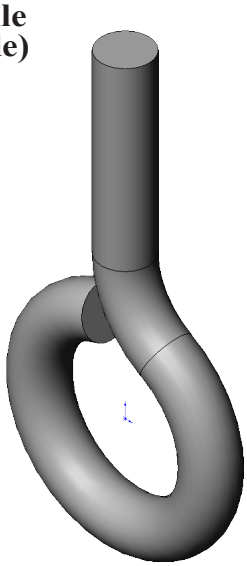


Fig. 12

G. Fillet Edge.

Step 1. Click **Fillet** 

on the Features toolbar.

Step 2. In the Fillet Property Manager set:

Radius  **.2**, **Fig. 13**
click inside edge at end of sweep
click OK  .

Step 3. Click inside edge at end of sweep and click OK  in the Property Manager, **Fig. 14**.

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

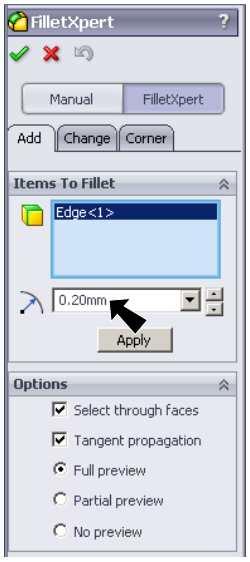


Fig. 13

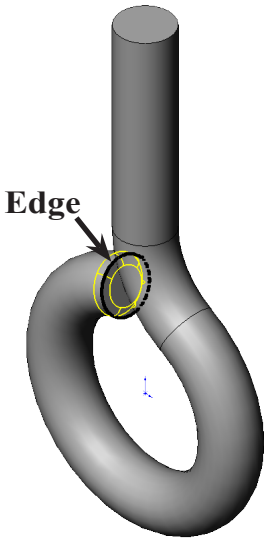


Fig. 14

H. Threads Sketch for Sweep Cut.

Step 1. Click the **top face** and click **Sketch**  on the Content menu, **Fig. 15**.

Step 2. Click **Offset Entities** 

on the Sketch toolbar.

Step 3. In the Offset Entities Property Manager set:
Distance .27

The yellow offset circle should be on the inside of the face, **Fig. 17**. If it is not, check Reverse.
Click OK  .

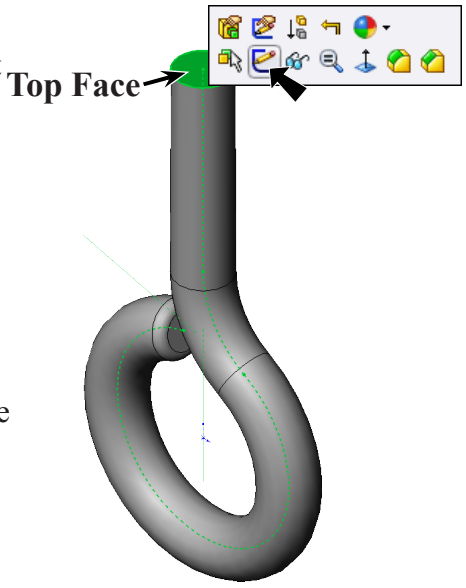


Fig. 15

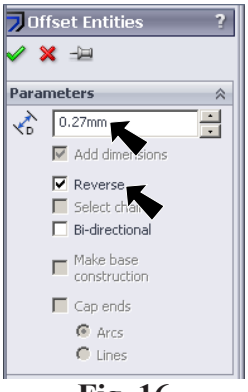


Fig. 16

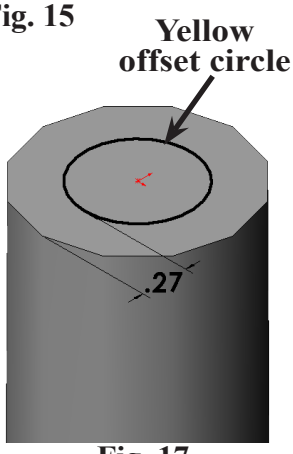


Fig. 17

I. Helix for Sweep Cut.

Step 1. Click Insert Menu > Curve > Helix/Spiral.

Step 2. In the Helix/Spiral Property Manager set:

under Defined By
select **Pitch and Revolution**

under Parameters
select **Variable Pitch**

under Region Parameters
set **Pitch to .7 all rows**
click in Row 2 of Rev column and set to 4 and Dia .66
click in Row 3 of P column and set to .7, Rev 5 and Dia to 1.2

check **Reverse direction**

Start angle to 270

check **Counterclockwise**

click OK  , **Fig. 18**.

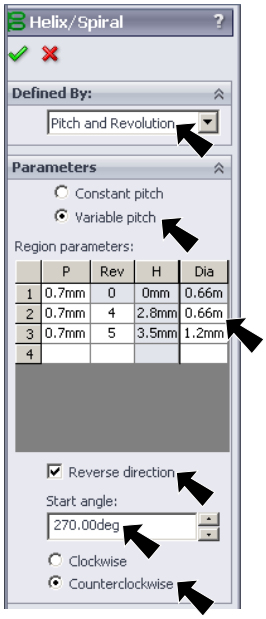


Fig. 18

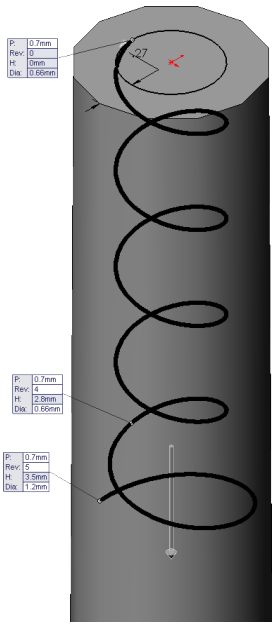


Fig. 19

J. Sketch Thread Profile.

Step 1. Click **Front Plane**  in the Feature Manager and click **Sketch**  from the Content toolbar, **Fig. 20**.

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

Step 3. Zoom in around **top end of the eye screw**, **Fig. 21**. To **zoom**, hold down **Shift key** and drag with middle mouse button (wheel). To **pan**, hold down **Ctrl key** and drag with middle mouse button (wheel).

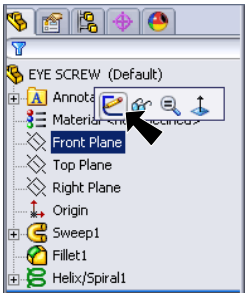


Fig. 20

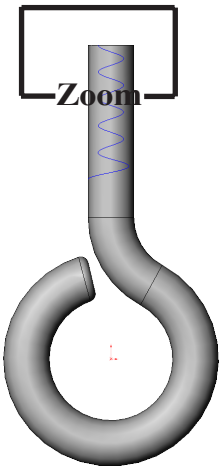
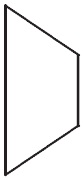


Fig. 21

Step 4. Click **Line** (**L**) on the Sketch toolbar.

Step 5. Draw four lines as shown in **Fig. 22**. Draw the side lines vertical. Keep sketch out in space and not attached to the eye screw.



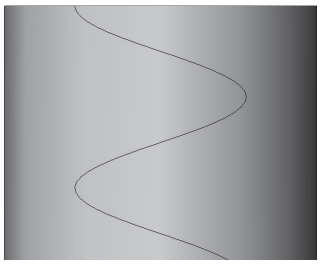


Fig. 22

K. Add Equal Relations.

Step 1. **Right click drawing and click Select** from menu to unselect Line tool.

Step 2. **Ctrl click top and bottom lines** to select both lines.

Release Ctrl key and click **Make Equal** on the Content menu, **Fig. 23**.

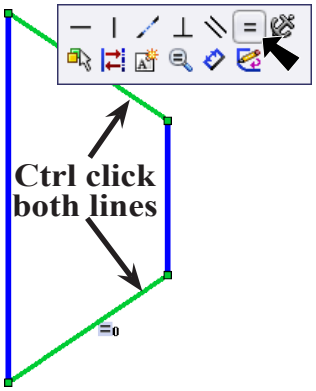


Fig. 23

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

L. Smart Dimension.

Step 1. Click **Smart Dimension** (**S**) on the Sketch toolbar.

Step 2. Dimension the left line **.65** and the top **.28** as shown in **Fig. 24**.

Step 3. Dimension the angle **56° degrees** between the left line and bottom line as shown in **Fig. 25**. To dimension the angle, click both lines then move the cursor inside and click. Key-in **56** for the dimension and press ENTER.

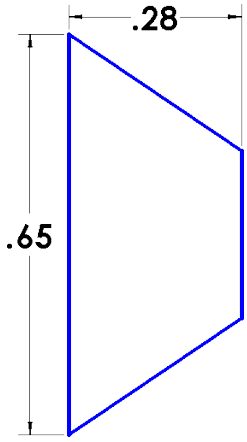


Fig. 24

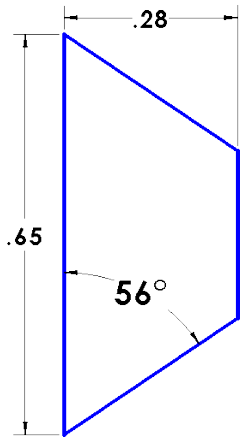


Fig. 25

M. Add Pierce Relation.

Step 1. **Right click drawing and click Select** from menu to unselect Smart Dimension.

Step 2. **Ctrl click bottom right endpoint of the sketch and helix** to select endpoint and helix (not the endpoint of the helix).

Release Ctrl key and click **Make Pierce** on the Content menu, **Fig. 26**. Make Pierce adds a Pierce relation between sketch and helix, **Fig. 27**.

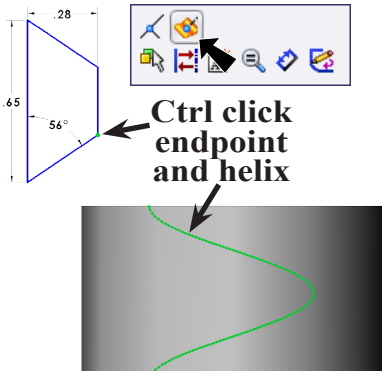


Fig. 26

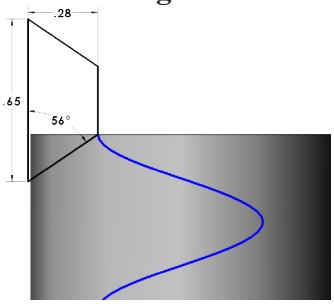


Fig. 27

Step 3. Click **Exit Sketch** on the Features toolbar.

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

N. Sweep Cut Helix.

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

Step 2. Click **Swept Cut** on the Features toolbar.

Step 3. In the Cut Swept Property Manager:

for **Profile** field, click **sketch, Fig. 29**

click in the **Path** field and click helix

click OK

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

Fig. 28

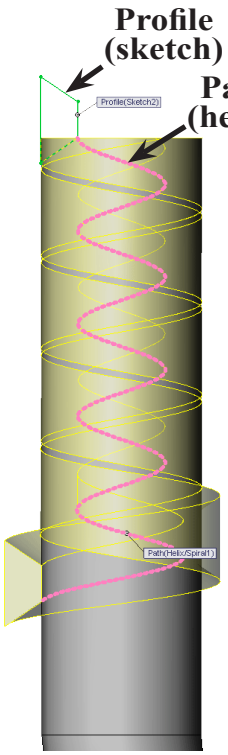


Fig. 29

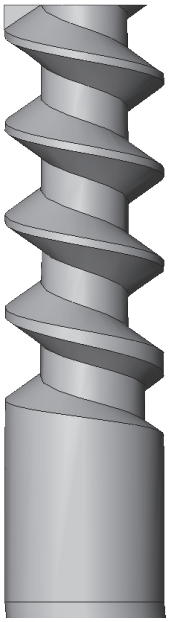


Fig. 30

O. Chamfer.

Step 1. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

Step 2. Roll the rollback bar to above the **Cut-Sweep**. To rollback Cut-Sweep, click Cut-Sweep in the Feature Manager and click **Rollback** from the Content toolbar, **Fig. 31**.

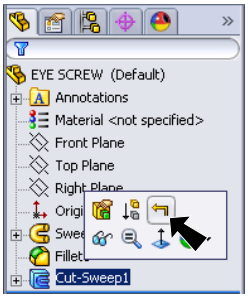


Fig. 31

Step 3. Click **Chamfer** on the Features toolbar.

Step 4. In the Chamfer Property Manager set:

Distance distance

Depth 1 **.9**, **Fig. 32**.

Depth 2 **.6**

click the **top edge** of the eye screw, **Fig. 33**

click OK , **Fig. 34**.

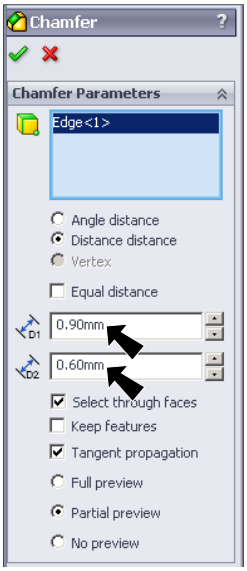


Fig. 32

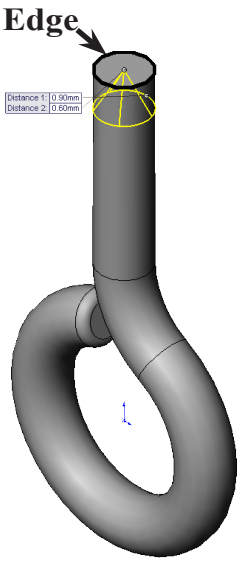


Fig. 33

Step 5. Roll forward to display the Cut-Sweep. To roll forward, **right click** Cut-Sweep in the Feature Manager and click **Roll Forward** in the menu, **Fig. 35** and **Fig. 36**.

P. Material Steel 304.

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

Step 2. Expand **Steel** in the material tree and select **Steel AISI 304**. Click **Apply** and **Close**.

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

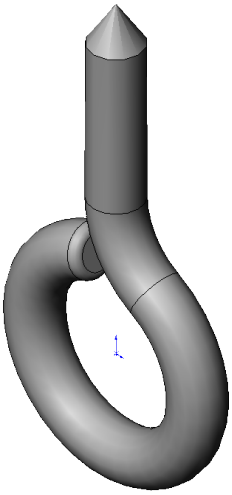


Fig. 34

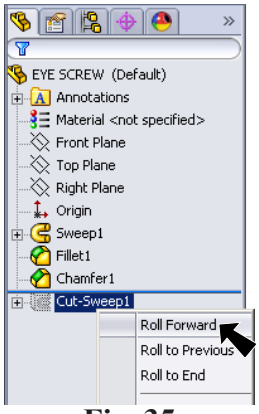


Fig. 35

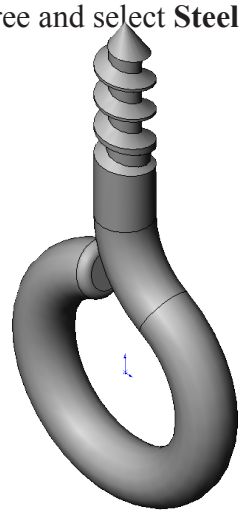


Fig. 36

Q. Open Assembly File.

Step 1. Click File Menu > Open. Select your ASSEMBLY file and click OK.

Step 2. Click **BODY RAIL E** in the Feature Manager and click **Open Part** from the Content toolbar, **Fig. 37**.

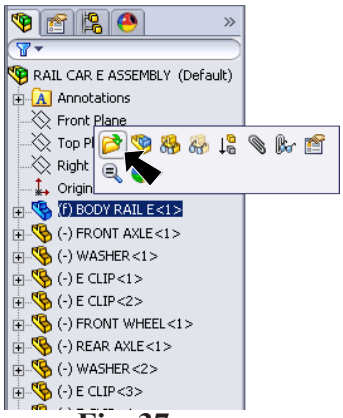


Fig. 37

R. Holes.

Step 1. Click **Top Plane** in the Feature Manager and click **Sketch** from the Content toolbar, **Fig. 38**.

Step 2. Click **Bottom** on the Standard Views toolbar (**Ctrl-6**).

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

Step 4. Click **Centerline** (**S**) in the **Line flyout** on the Sketch toolbar.

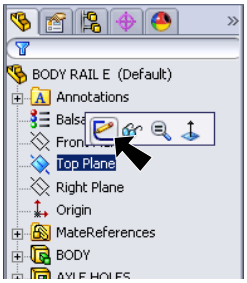


Fig. 38

Step 5. Draw a centerline from the midpoint on the bottom edge up through the sketch, **Fig. 39**.

Step 6. Click **Circle** (**S**) on the Sketch toolbar.

Step 7. Draw two circles on the centerline as shown in **Fig. 40**.

Step 8. **Right click drawing and click Select** from menu to unselect Circle tool.

Step 9. Select **both circles equal**. First, **Ctrl click** both circles to select both. **Release Ctrl key** and click **Make Equal** on the Content menu, **Fig. 41**.

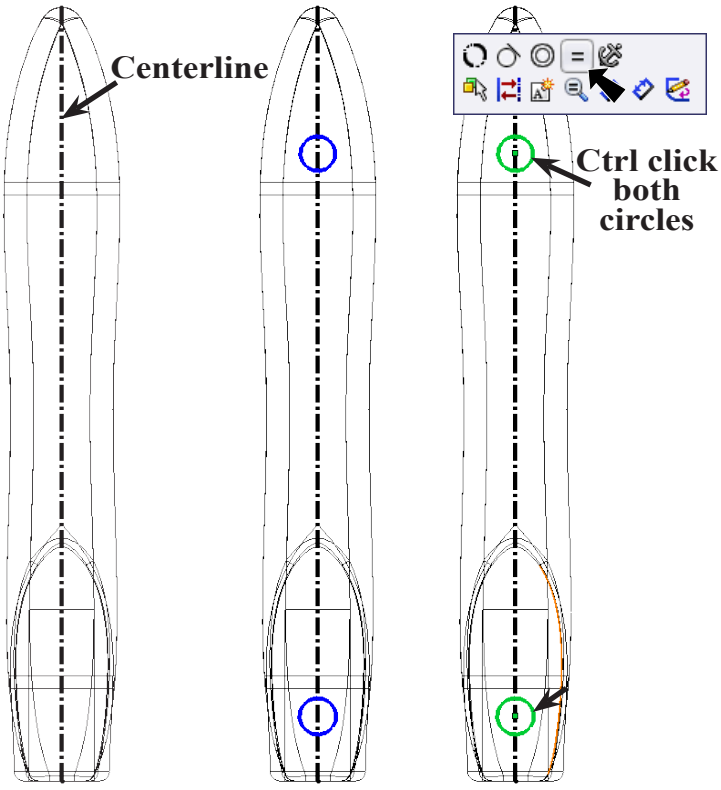


Fig. 39 Fig. 40 Fig. 41

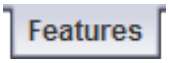
Step 10. Click **Smart Dimension** 

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

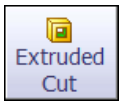
Step 11. Add the dimension shown in **Fig. 42**. Then, dimension the diameter of a circle last, **Fig. 43**.

Step 12. Click **Shaded With Edges**  on the View toolbar.

Step 13. Hold down middle mouse button (wheel) and drag to **rotate view** as shown in **Fig. 45**.

Step 14. Click **Features** 

on the Command Manager toolbar.

Step 15. Click **Extruded Cut** 

on the Features toolbar.

Step 16. In the Property Manager:

The Direction arrow should point towards body, Fig. 44. If arrow is pointing in wrong direction,

under **Direction 1**

click **Reverse Direction**  , **Fig. 45**

Depth  **5**, **Fig. 45**

click OK  **Fig. 46**.

Step 17. Save. Use **Ctrl-S**.

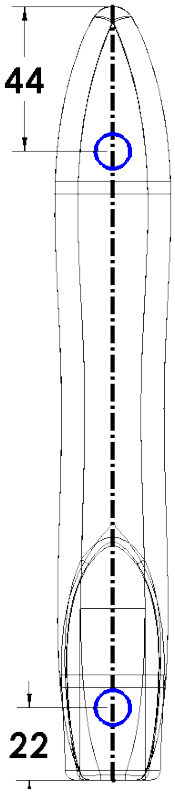


Fig. 42

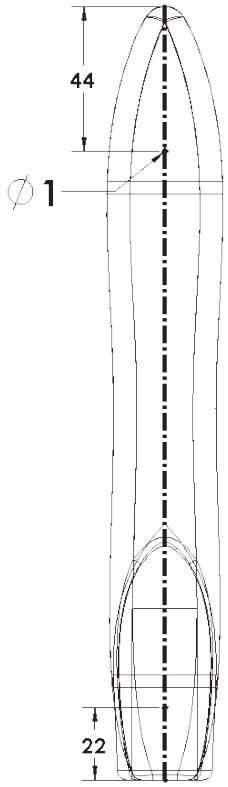


Fig. 43

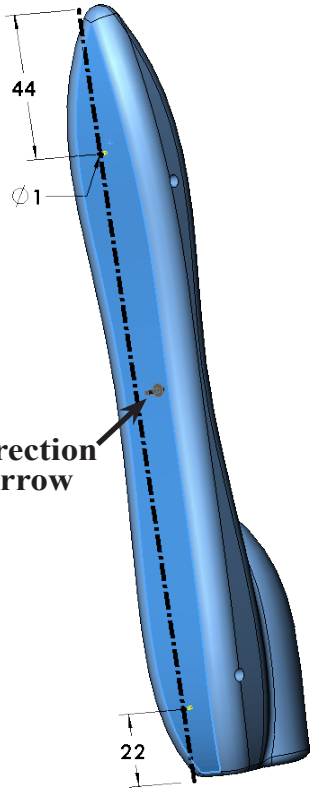


Fig. 44

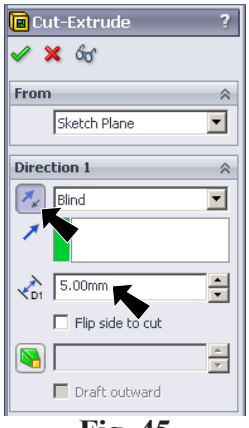


Fig. 45

Fig. 46

S. Insert Eye Screws into Assembly.

Step 1. Switch back to the ASSEMBLY file. Use Window Menu > RAIL CAR E ASSEMBLY.SLDASM.

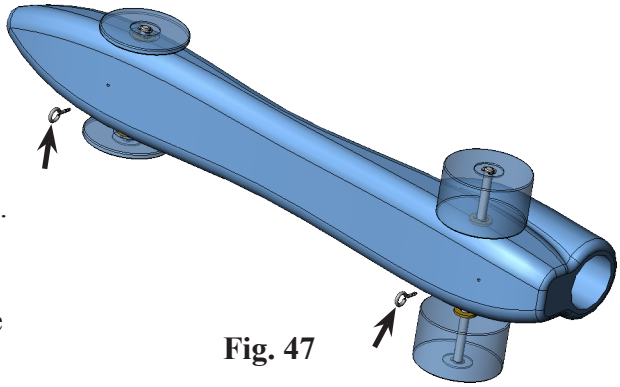
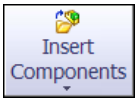


Fig. 47

Step 2. Hold down middle mouse button (wheel) and drag to **rotate view** as shown in **Fig. 47**.

Step 3. Click **Insert Components** 

on the Assembly toolbar.

Step 4. Click **Keep Visible**  in the Property Man- ager.

Step 5. Click **Browse** in the Property Manager.

Step 6. Select your **EYE SCREW** file and click Open.

Step 7. Insert two eye screws approximately where the eye screws are positioned in **Fig. 47**. Click OK  in the Property Manager when done.

T. Mate: Eye Screw and Body.

Step 1. Zoom in around **front eye screw and hole**, **Fig. 48**. To **zoom**, hold down **Shift key** and drag with middle mouse button (wheel). To **pan**, hold down **Ctrl key** and drag with middle mouse button (wheel).

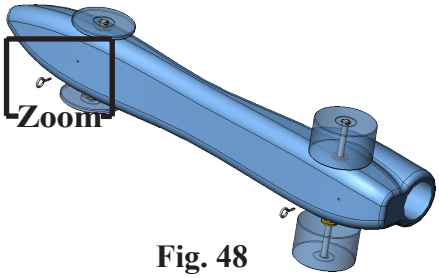


Fig. 48

Step 2. Click **Mate** 

on the Assembly toolbar.

Step 3. Click **cylindrical inside face of the hole in body** and **cylindrical face of eye screw** just above the threads, **Fig. 49**.

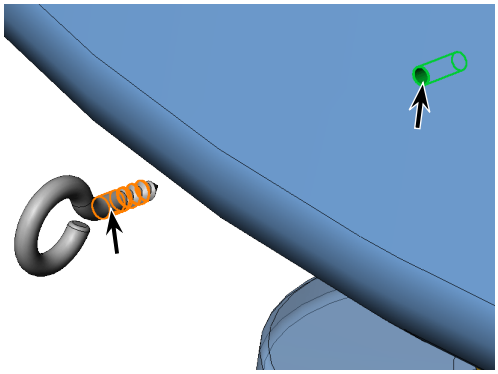


Fig. 49

Step 4. Click Add/Finish Mate  in Mate pop-up toolbar to add a **Concentric** mate.

If the eye screw becomes hidden inside the body, first close Mate Property Manager. Click the part in Feature Manager (first eye screw). Then, click Move Component 

on the Assembly toolbar and **drag out in drawing area away from any part**. Do not drag on any part. Click OK  in the Property Manager when done with move.

Step 5. If necessary, click **Mate** 

the Assembly toolbar.

Step 6. Expand the Design Tree (click +) in the top left corner of the drawing area, **Fig. 50**.

Step 7. Click **Top Plane**  , **Fig. 50**.

Step 8. Expand **EYE SCREW1** and click **Top Plane**  , **Fig. 50**.

Step 9. Click **Distance**  in Mate pop-up, **Fig. 51**. Set **distance to 1** and press ENTER. The Eye Screw should align to the body, **Fig. 53**. If positioned in opposite direction, click **Flip Dimension**  in the Mate pop-up, **Fig. 51**. Click Add/Finish Mate  to add Distance mate.

Step 10. Click **Right Plane**  , **Fig. 54**.

Step 11. Expand **EYE SCREW1** and click **Right Plane**  , **Fig. 54**.

Step 12. Click Add/Finish Mate  in Mate pop-up toolbar.

Step 13. Click Zoom to Fit  **(F)** on the View toolbar.

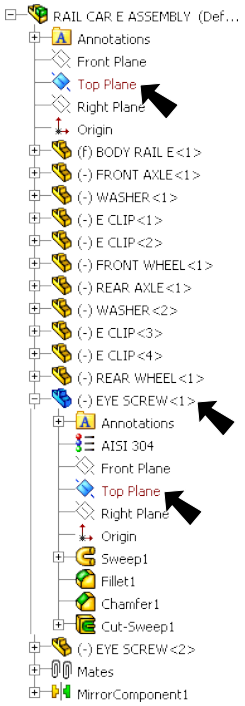


Fig. 50

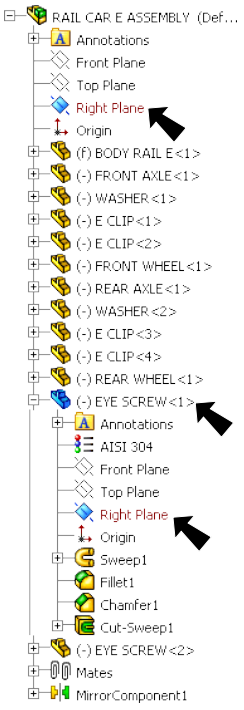


Fig. 54

on 

Fig. 51

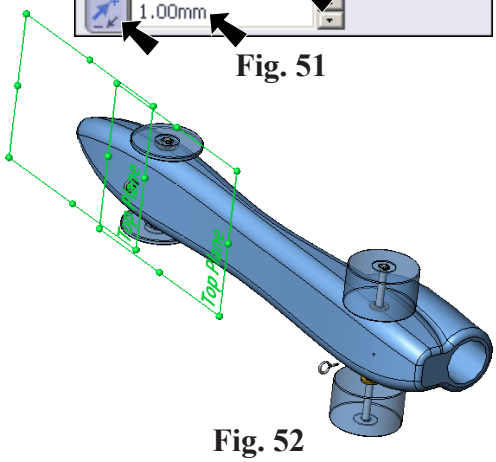


Fig. 52

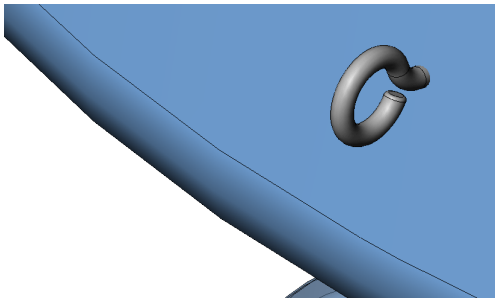


Fig. 53

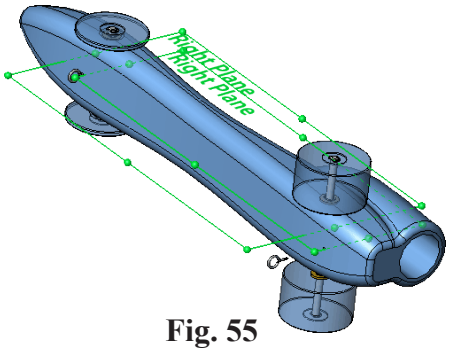


Fig. 55

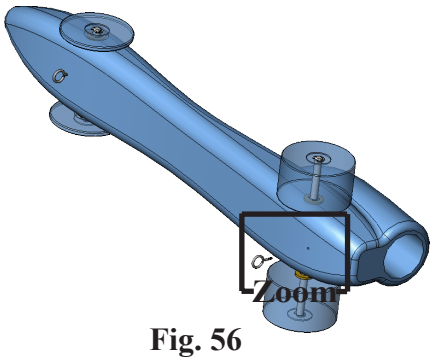


Fig. 56

Step 14. Zoom in around **rear eye screw and hole**, **Fig. 56**. To **zoom**, hold down **Shift key** and drag with middle mouse button (wheel). To **pan**, hold down **Ctrl key** and drag with middle mouse button (wheel).

Step 15. Click **cylindrical inside face of the rear hole in body** and **cylindrical face of Eye Screw2**, **Fig. 57**.

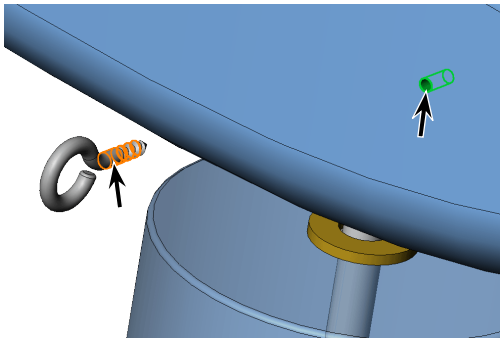


Fig. 57

Step 16. Click Add/Finish Mate  in Mate pop-up toolbar to add a **Concentric** mate.

If the eye screw becomes hidden inside the body, first click OK  to close Mate Property Manager. Click the part in Feature Manager (second eye screw). Then, click Move Component  on the Assembly toolbar and drag out in drawing area. Do not drag on any part. If eye screw does not drag out of the body, check that the eye screw is selected in the Feature Manager before you click Move Component.

Step 17. If necessary, click **Mate**  on the Assembly toolbar.

Step 18. Expand the (click +) in the top left corner of the drawing area, **Fig. 58**.

Step 19. Click **Top Plane**  in the Design Tree, **Fig. 58**.

Step 20. Expand **EYE SCREW2** and click **Top Plane**  , **Fig. 58**.

Step 21. Click **Distance**  in Mate pop-up, **Fig. 59**. Set **distance to 1** and press ENTER. The Eye Screw should align to the body, **Fig. 61**. If positioned in opposite direction, click **Flip Dimension**  in the Mate pop-up, **Fig. 59**. Click Add/Finish Mate  to add Distance mate.

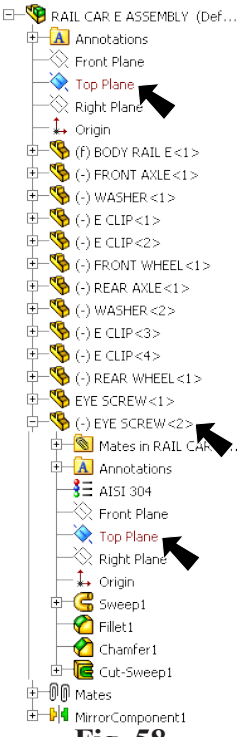


Fig. 58

Fig. 59

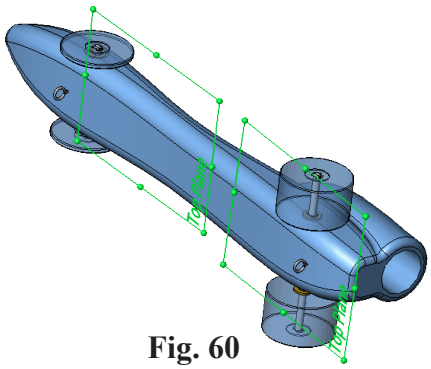


Fig. 60

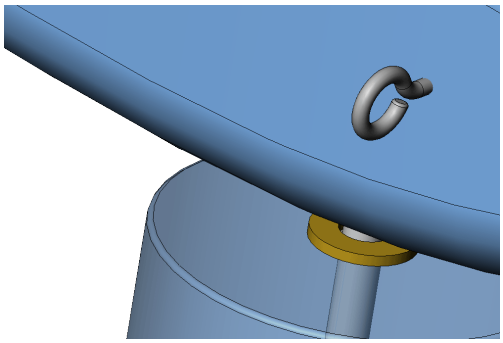


Fig. 61

Step 22. Click **Right Plane**, **Fig. 62**.

Step 23. Expand **EYE SCREW2** and click **Right Plane**, **Fig. 62**.

Step 24. Click Add/Finish Mate in Mate pop-up toolbar to add a **Coincident** mate.

Step 25. Click OK in the Property Manager when done.

Step 26. Click Zoom to Fit (**F**) on the View toolbar.

Step 27. Save. Use **Ctrl-S**.

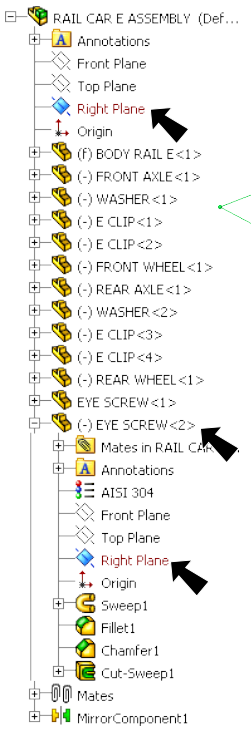


Fig. 62

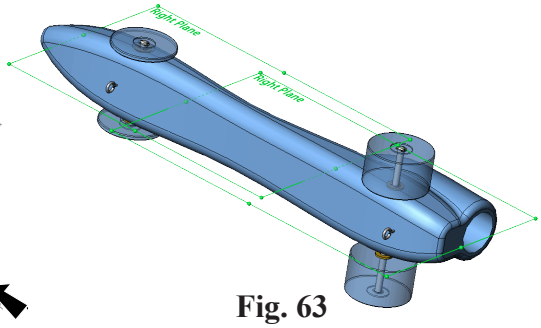


Fig. 63