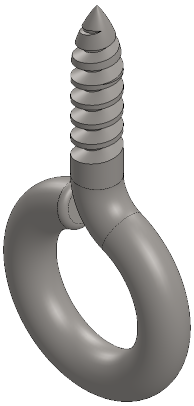
Chapter 15

CO2 Rail Car
Eye Screw



A. Sweep Path Sketch.

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**.

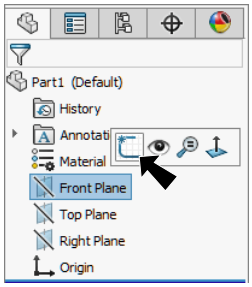


Fig. 1

Step 3. Click **Centerline** in the **Line flyout** on the Sketch toolbar.

Step 4. Sketch vertical centerline down to the Origin and another back up an angle, **Fig. 2**.

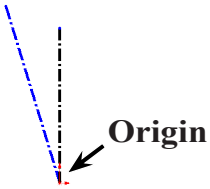


Fig. 2

Step 5. Click **Centerpoint Arc** (**S**) in the **Arc flyout** on the Sketch toolbar.

Step 6. Sketch a slightly open arc starting from the Origin, **Fig. 3**. To sketch the arc, click the Origin to place the center of the arc. Start the first endpoint at top endpoint of vertical centerline, then swing the arc to the right around counterclockwise. Click to place the second endpoint on angled centerline.

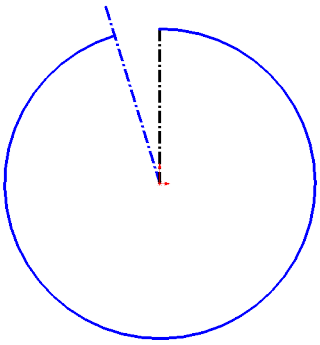


Fig. 3

Step 7. Click **Line** (**L**) on the Sketch toolbar.

Step 8. Sketch line up from the vertical centerline, **Fig. 4**.

Step 9. Click **Smart Dimension** (**S**) on the Sketch toolbar.

Step 10. Add dimensions, **Fig. 5**.

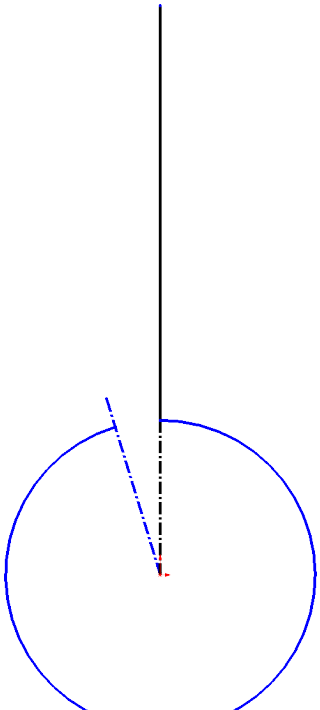


Fig. 4

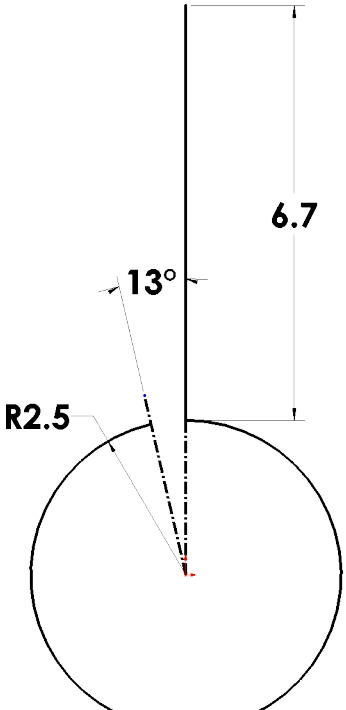


Fig. 5

Step 11. Click **Sketch Fillet** (**S**) on the Sketch toolbar.

Step 12. In the Sketch Fillet Property Manager set:
under Fillet Parameters, **Fig. 6**

Radius **1.5**
click intersection of line and arc, **Fig. 7**

click OK **twice**.

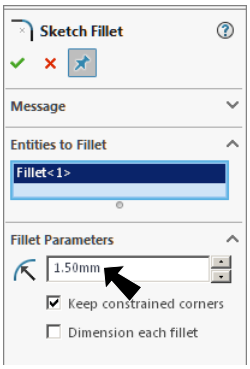


Fig. 6

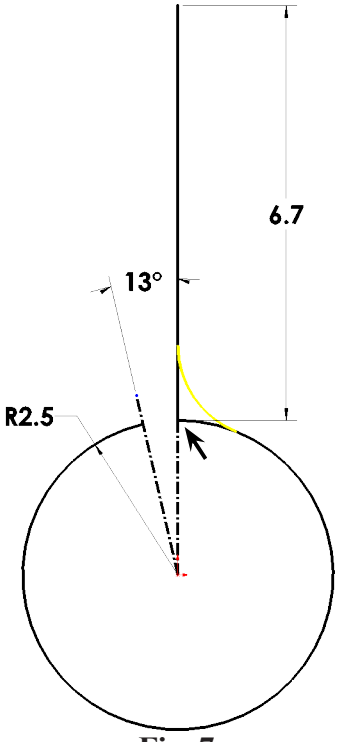


Fig. 7

B. Save as "EYE SCREW".

Step 1. Click File Menu > Save As.

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

C. Sweep.

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

Step 2. Click **Features** on the Command Manager toolbar.

Step 3. Click **Swept Boss/Base** on the Features toolbar.

Step 4. In the Swept Boss/Base Property Manager:
under Profile and Path, **Fig. 8**
select **Circular Profile**

Path click any geometry in Sketch1

Diameter **1.4**

click OK .

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

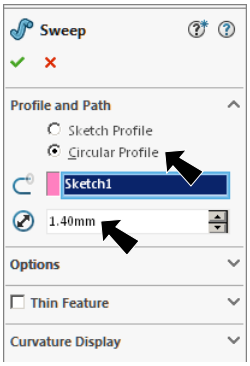


Fig. 8

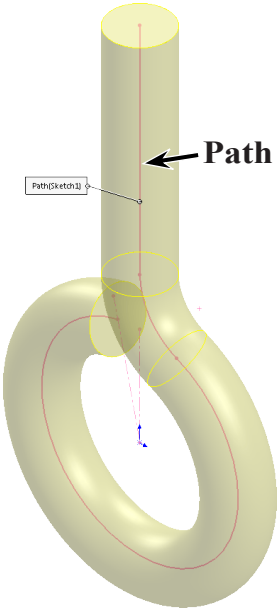


Fig. 9

D. Fillet Edge.

Step 1. Click **Fillet** 

on the Features toolbar.

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 10**

Radius .2
click **edge at bottom end of sweep**, **Fig. 11**

click OK .

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

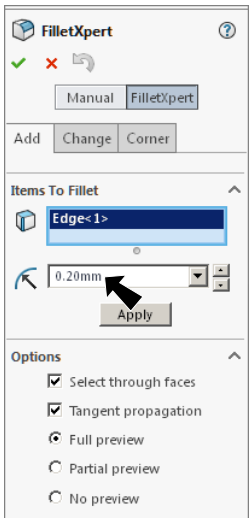


Fig. 10

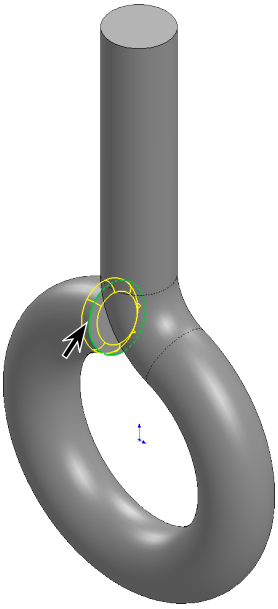


Fig. 11

E. Cut Revolve.

Step 1. Click **Front Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 12**.

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

Step 3. Zoom in around **top end of Eye Screw**, **Fig. 13**. To zoom, place the cursor over the top end of Eye Screw and spin the wheel on mouse back. While spinning the wheel keep cursor on top of Eye Screw.

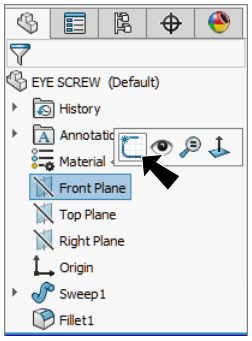


Fig. 12

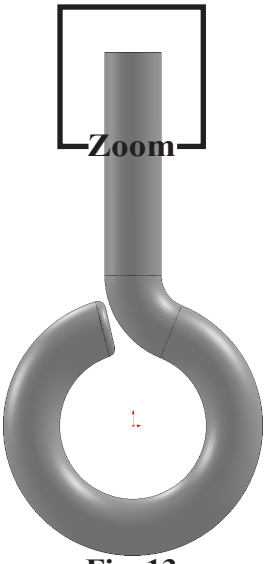


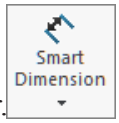
Fig. 13

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

Step 5. Sketch 3 Point Arc from midpoint of top end of the sweep to edge of sweep, **Fig. 14**.

Step 6. Click **Line** (**L**) on the Sketch toolbar.

Step 7. Sketch **three lines**, **Fig. 15**.

Step 8. Click **Smart Dimension** (**S**) on the Sketch toolbar.


Step 9. Add dimensions, **Fig. 16**.

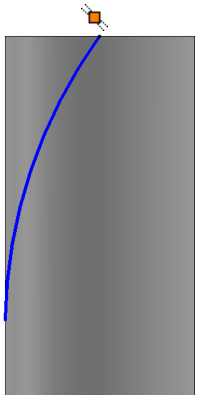


Fig. 14

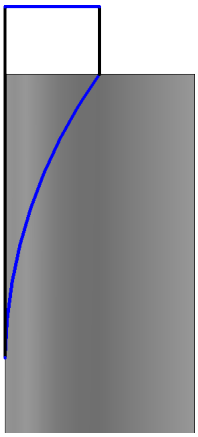


Fig. 15

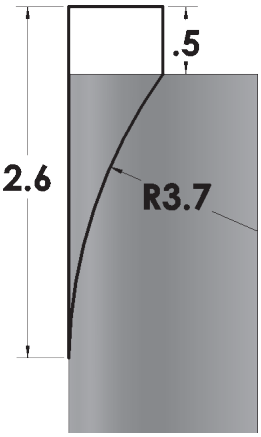


Fig. 16

Step 10. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

Step 11. Click **Features** Features on the Command Manager toolbar.

Step 12. Click **Revolved Cut** Revolved Cut on the Features toolbar.

Step 13. In the Cut Revolve Property Manger set:

under Axis of Revolution
click **vertical line at midpoint of sweep**, **Fig. 18**
click OK .

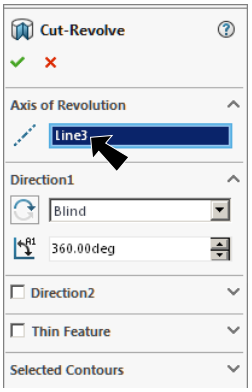


Fig. 17

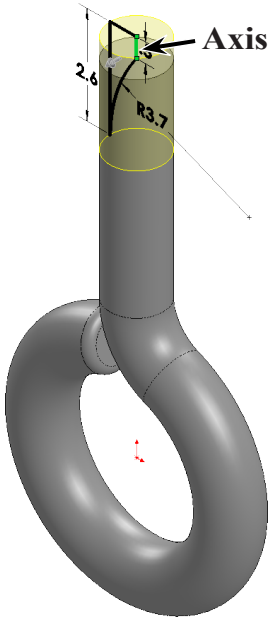


Fig. 18

F. Thread Wizard.

Step 1. Click **Thread** Thread in the **Hole Wizard** Hole Wizard on the Features toolbar.

Step 2. In the Thread Property Manager set:

under Thread Location, **Fig. 19**

for Edge of cylinder
click **edge of sweep at sketch fillet**, **Fig. 20**
check **Offset**
Offset .5

Start Angle **180**

under End Condition

Depth **5**

under Specification

Type **Inch die**
Size **#4 - 40**

click OK .

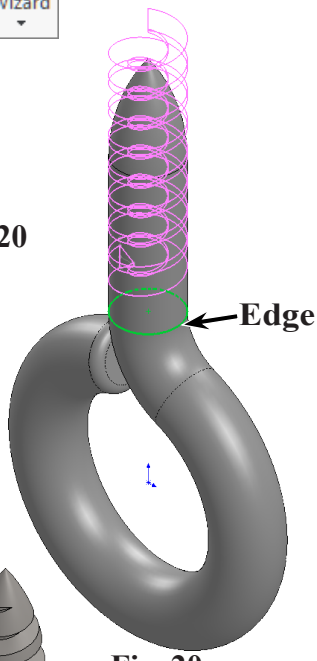


Fig. 20

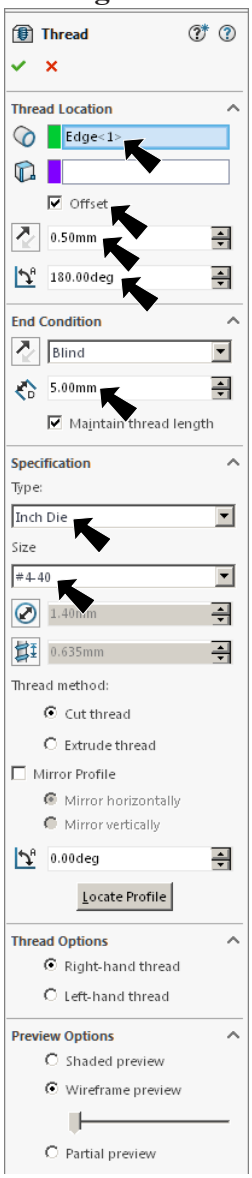


Fig. 19

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

G. 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**.

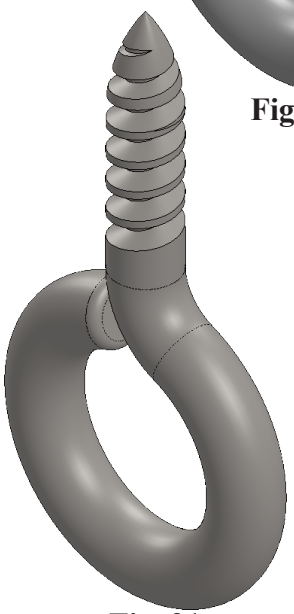


Fig. 21

H. Open Assembly File.

Step 1. Open your RAIL CAR ASSEMBLY file.

Step 2. Click **BODY** in the Feature Manager and click **Open Part**  on the context toolbar, **Fig. 22**.

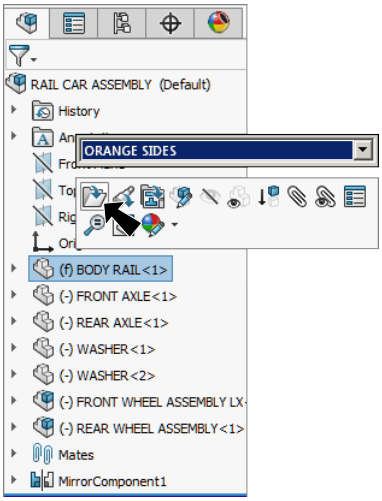


Fig. 22

I. Hole Wizard.

Step 1. Click **Bottom**  on the Standard Views toolbar (**Ctrl-6**).

Step 2. Click **Wireframe**  on the View toolbar.

Step 3. Click **Hole Wizard**  on the Features toolbar.

Step 4. In the Property Manager, on the Type tab set:
under Hole Type , **Fig. 23**
click **Hole** 
under Standard:
select **ANSI Metric**
under Type:
Drill sizes
under Size:
select **.9**
under End Condition
Blind Depth Hole  **1.5**
click **Positions tab**  at top of Property Manager.

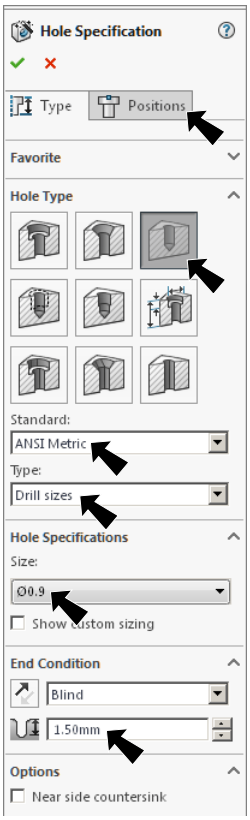


Fig. 23

Step 5. Click **bottom face of Body** one time as face for hole, **Fig. 24**.

Step 6. Click to place hole in the center of Body **forward of Front Axle** and click **rear of the Rear Axle**, **Fig. 24**.

Step 7. **Right click graphics area and click Select** from menu to unselect Point tool.

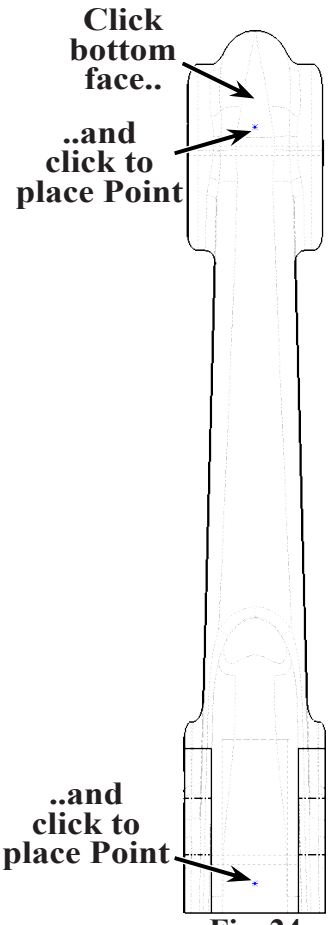


Fig. 24

Step 8. **Ctrl click** both points and midpoint of rear edge to select. Release Ctrl key and click **Make Vertical**  on the context toolbar, **Fig. 25**.

Step 9. Click **Smart Dimension** 

(S) on the Sketch toolbar.

Step 10. Add dimensions, **Fig. 26**.

Step 11. Click OK ✔ in the Hole Wizard Property Manager.

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

Step 13. Save. Use **Ctrl-S**.

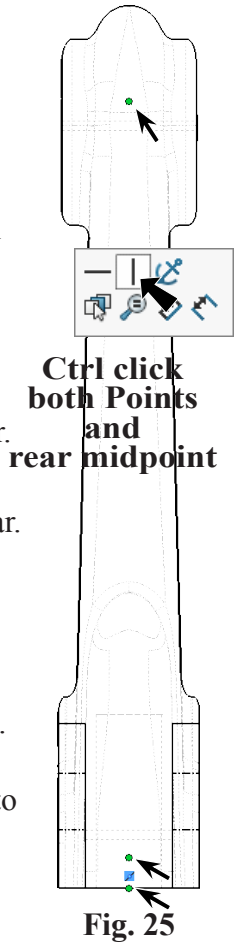


Fig. 25

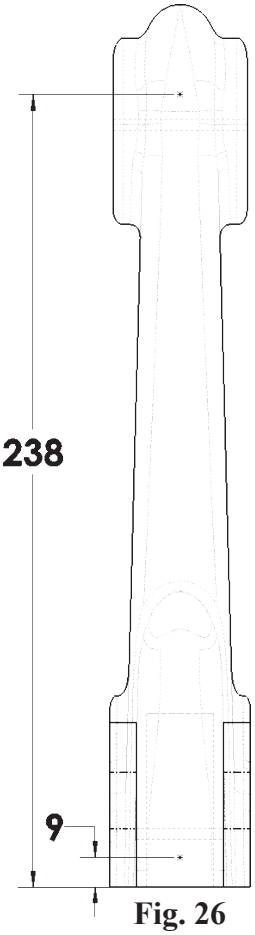
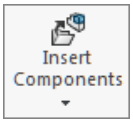


Fig. 26

J. Insert Eye Screws into Assembly.

Step 1. Switch back to the ASSEMBLY file. Use **Ctrl-Tab**.

Step 2. Hold down middle mouse button (wheel) and drag to **rotate view to view bottom**, **Fig. 27**.

Step 3. Click **Insert Components** 

on the Assembly toolbar.

Step 4. Click **Keep Visible**  in the Property Manager.

Step 5. Click **Browse** in the Property Manager, select your **EYE SCREW** file and click Open.

Step 6. Insert two Eye Screws approximately where the Eye Screws are positioned in **Fig. 27**. Click OK ✔ in the Property Manager when done.

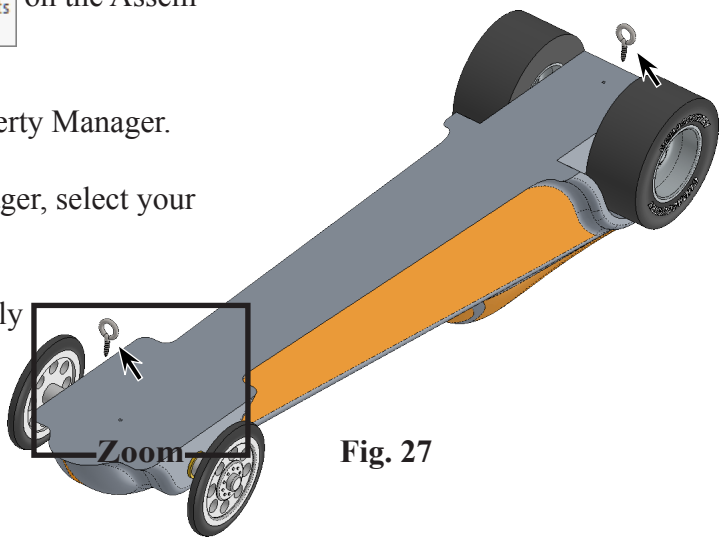


Fig. 27

K. Mate: Eye Screws and Body.

Step 1. Zoom in around **front Eye Screw and hole**, **Fig. 28**. To zoom, place the cursor over the Eye Screw/hole and spin the wheel on mouse back. While spinning the wheel keep cursor on Eye Screw and hole.

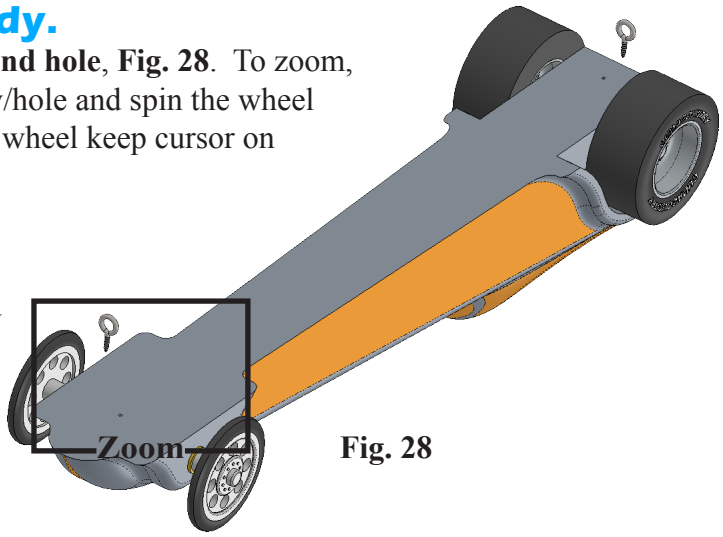


Fig. 28

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**, **Fig. 29**.

Tip: Turn on **Filter Faces**  **(X)** on the **Selection Filter toolbar** at the bottom of the display, **Fig. 30**. If necessary, use **F5** key to display the toolbar.

Step 4. Check **Lock Rotation** and Add/Finish Mate  in Mate pop-up toolbar to add a **Concentric** mate, **Fig. 31**.

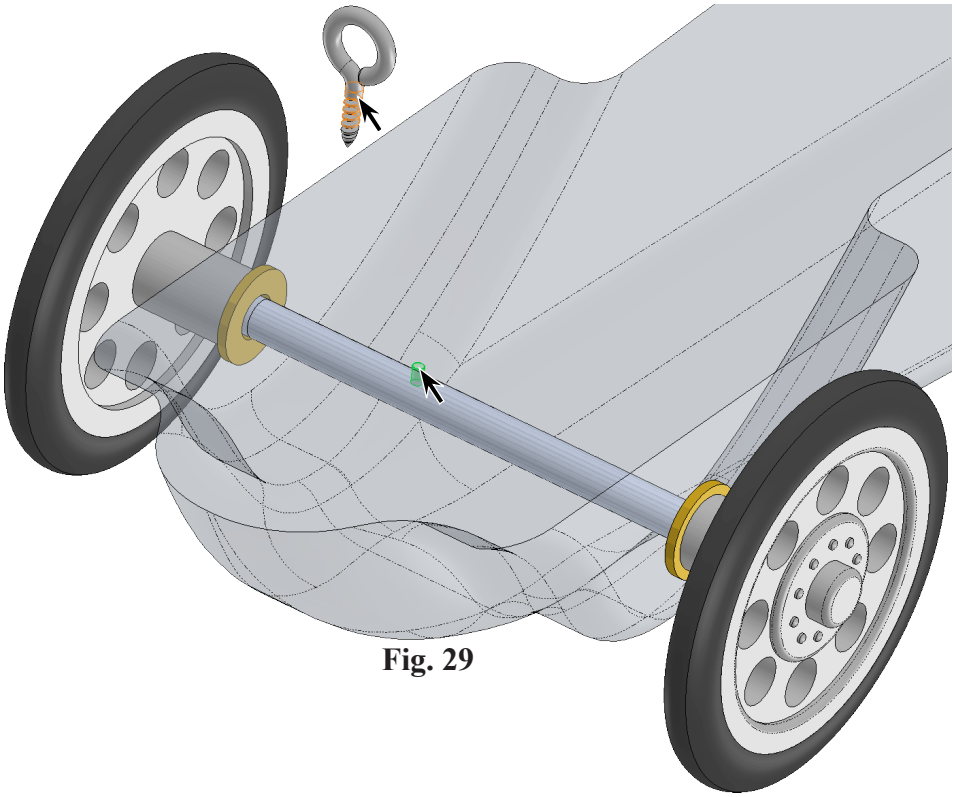


Fig. 29

Fig. 30

Fig. 31

Step 5. Turn **off** Filter Faces. Click **Filter Faces** (**X**) on the **Selection Filter toolbar** at the bottom of the display, **Fig. 32**.

Fig. 32

Step 6. Click **bottom face of the Body** and **circular edge of the Eye Screw**, **Fig. 33**.

Step 7. Click Add/Finish Mate in Mate pop-up toolbar to add a **Coincident** mate, **Fig. 34**.

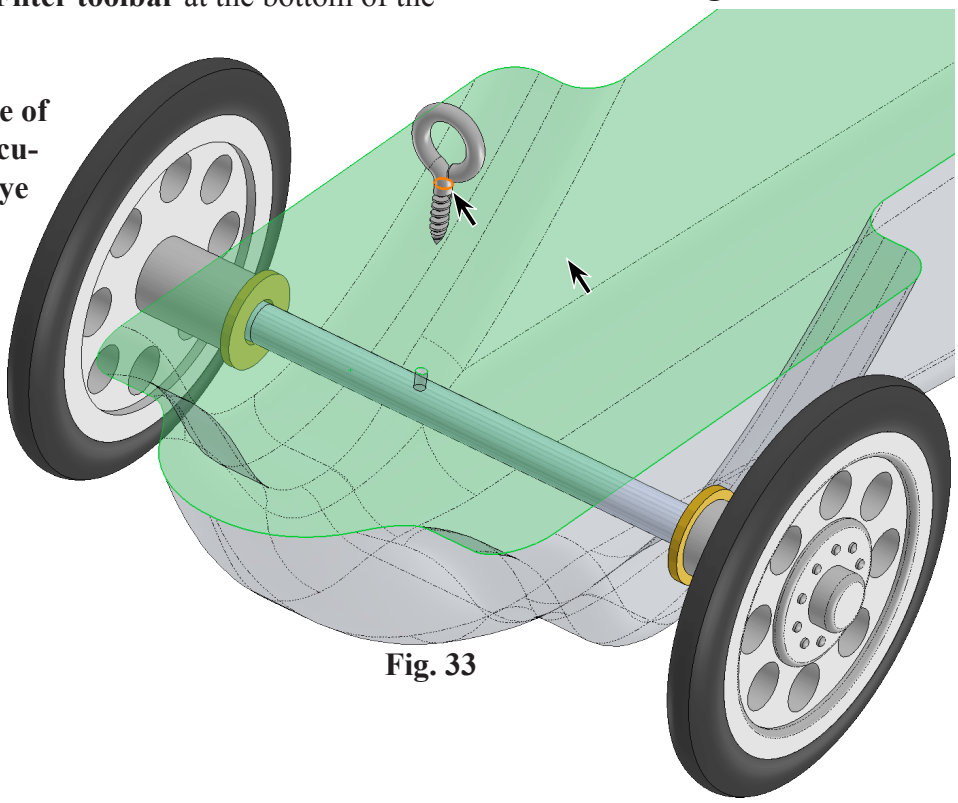


Fig. 33

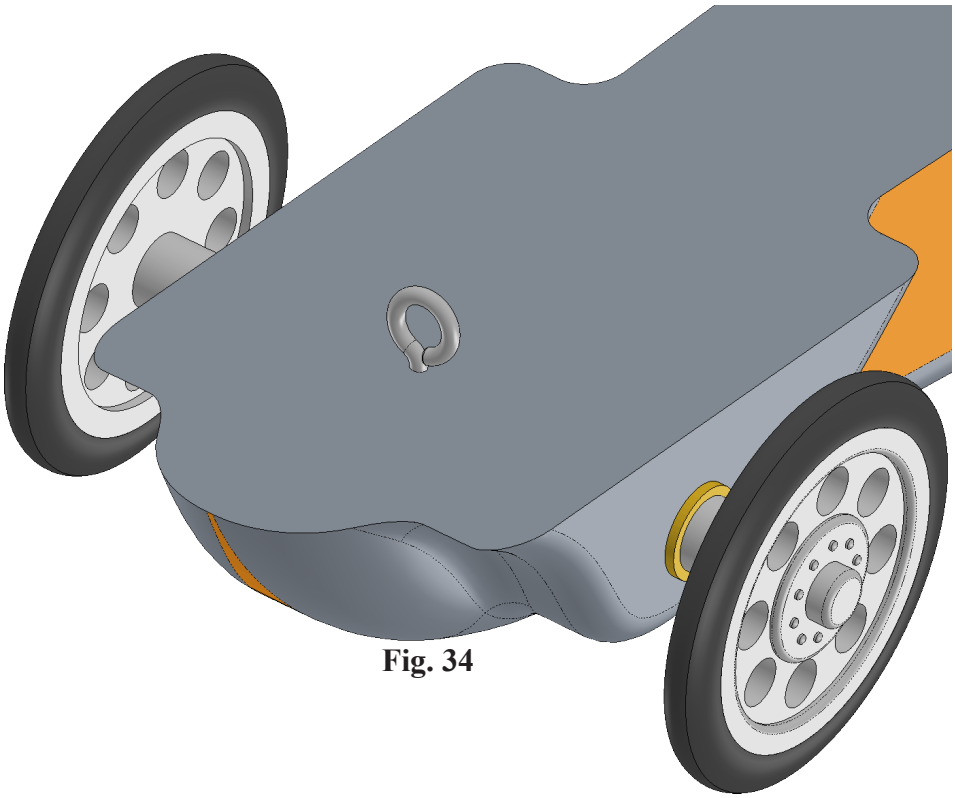


Fig. 34

Step 8. Use **Ctrl-Left Arrow** key to pan to rear Eye Screw, **Fig. 35**.

Step 9. Click **cylindrical inside face of the hole in Body** and **cylindrical face of Eye Screw**, **Fig. 35**.

Step 10. Click **Lock Rotation** and Add/Finish Mate  in Mate pop-up toolbar to add a **Concentric** mate, **Fig. 36**.

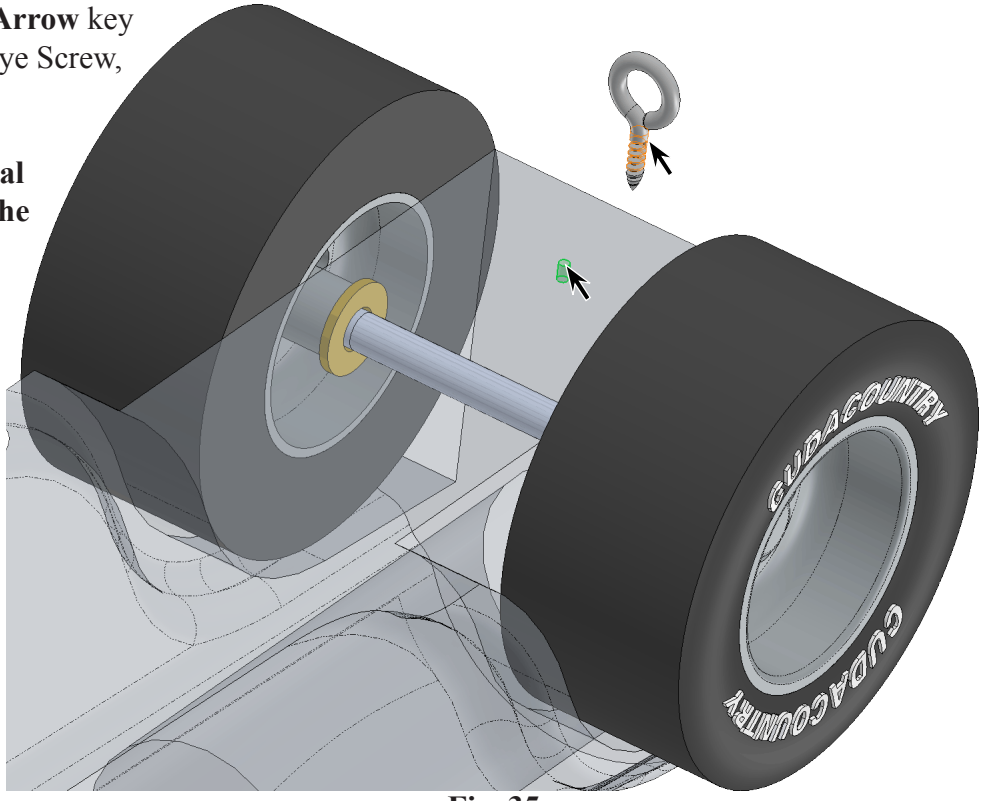


Fig. 35

Fig. 36

Step 11. Click **bottom face of Body** and **circular edge of the Eye Screw**, **Fig. 37**.

Step 12. Click Add/Finish Mate  in Mate pop-up toolbar to add a **Coincident** mate, **Fig. 38**.

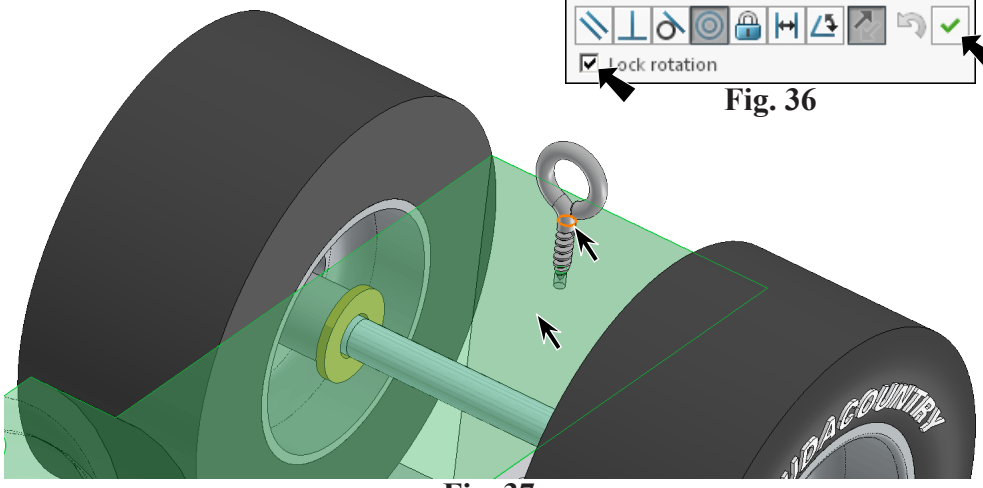


Fig. 37

Step 13. Click OK  in the Property Manager when done.

Step 14. Save. Use **Ctrl-S**.

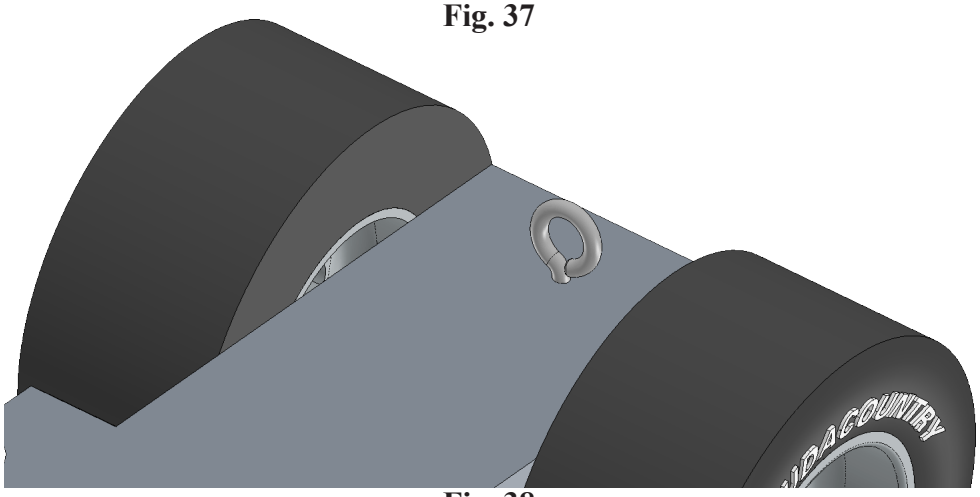


Fig. 38