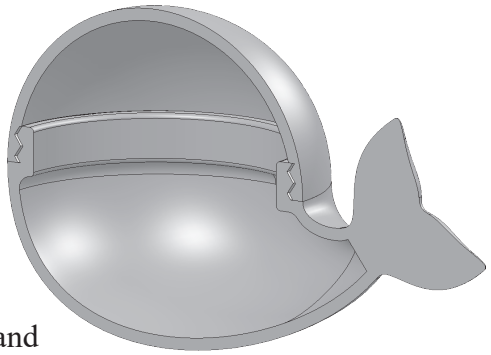
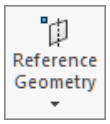
Chapter 3

Whale
Threads Sweep



A. Create Plane5.

Step 1. If necessary, open your **WHALE** part file.

Step 2. Click **Reference Geometry** 

on the Features toolbar and **Plane** from the menu.

Step 3. In the Plane Property Manager set:
under First Reference, **Fig. 1**
click **top face of Extrude1**, **Fig. 2**
Offset distance **2**
click OK .

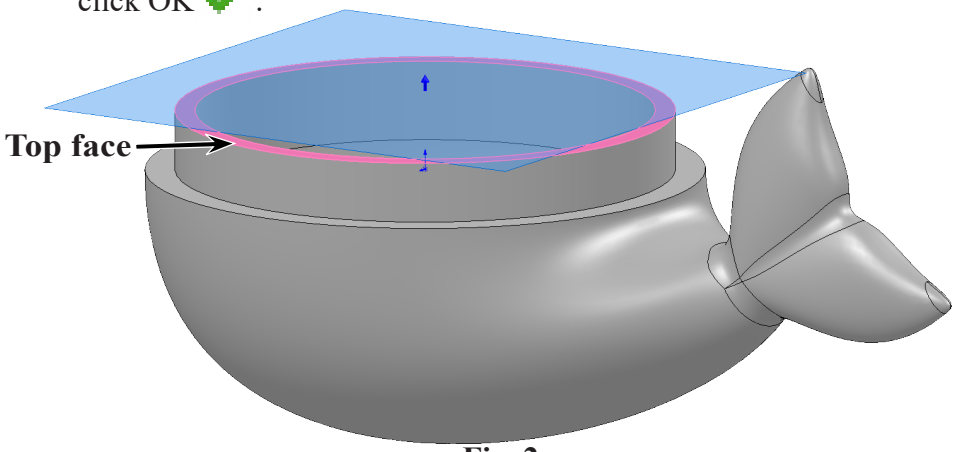


Fig. 2

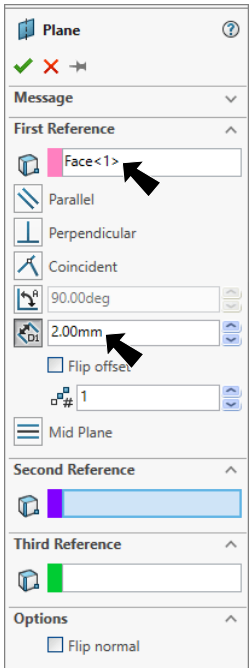


Fig. 1

B. Helix Sketch.

Step 1. **Hide Plane5** . To hide Plane5, Click **Plane** in the Feature Manager and click **Hide** on the context toolbar, **Fig. 3**.

Step 2. Click **Plane5** in the Feature Manager and click **Sketch** on the sketch toolbar, **Fig. 4**.

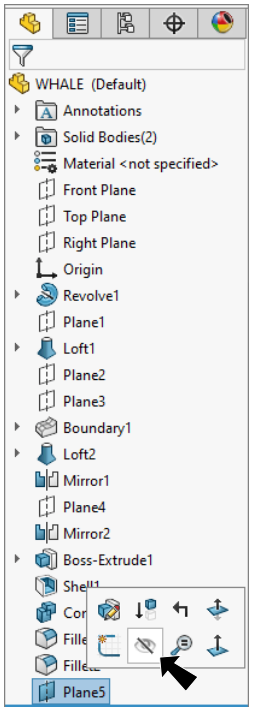


Fig. 3

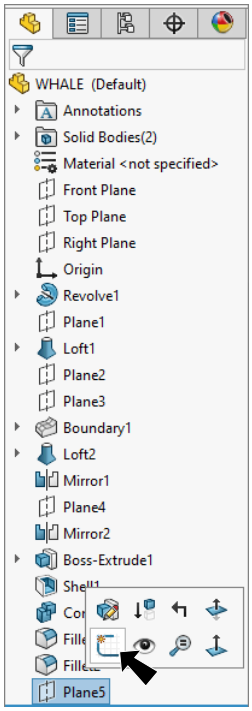


Fig. 4

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Step 3. Click **Convert Entities**

on the Sketch toolbar.

Step 4. In the Convert Entities Property Manager:
under Entities to Convert, **Fig. 5**
click **outside edge of Extrude1**, **Fig. 6**
click OK ✔ .

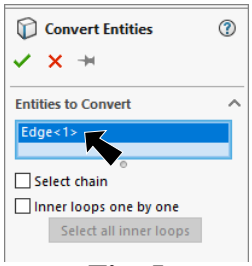


Fig. 5

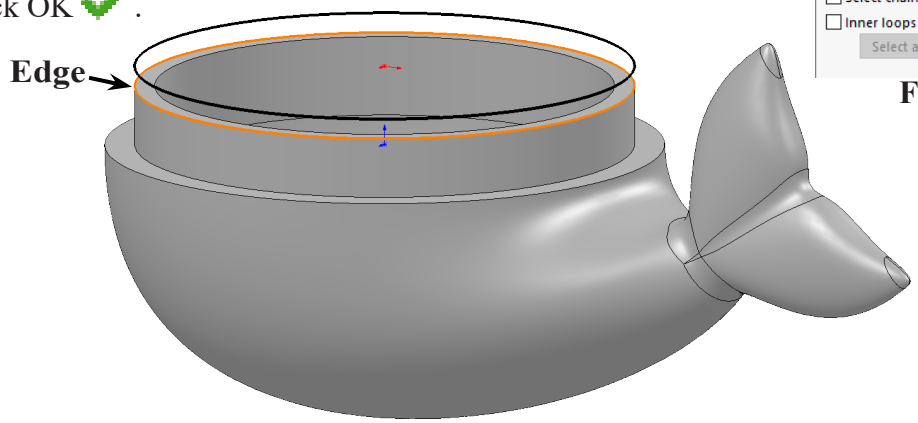


Fig. 6

C. Helix.

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

Step 2. In the Helix/Spiral Property Manager set:
under Defined By, **Fig. 7**
select **Pitch and Revolution**
under Parameters
select **Constant Pitch**
Pitch: 3.5
check **Reverse direction**
Revolutions: 2.8
Start angle 0
select **Clockwise**
click OK ✔ .

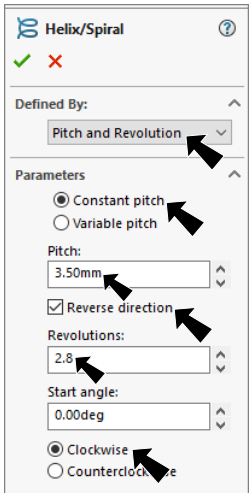


Fig. 7

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

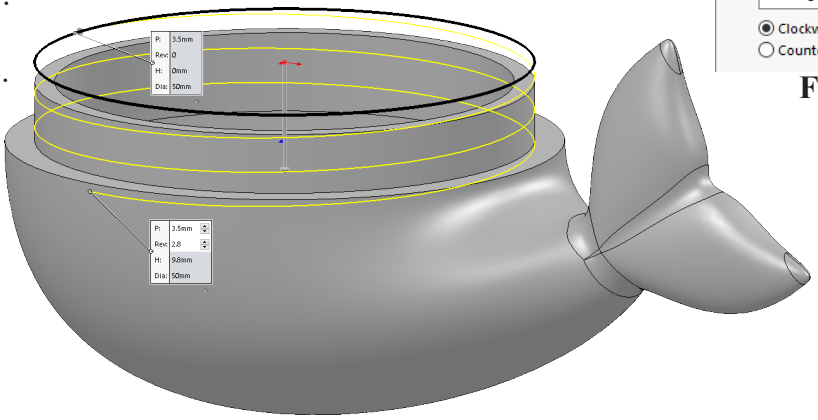


Fig. 8

D. Thread Profile Sketch.

Step 1. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 9**.

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

Step 3. Zoom in around **top left of Extrude1**, **Fig. 10**. To zoom, place the cursor over the flukes area and spin the wheel on mouse back.

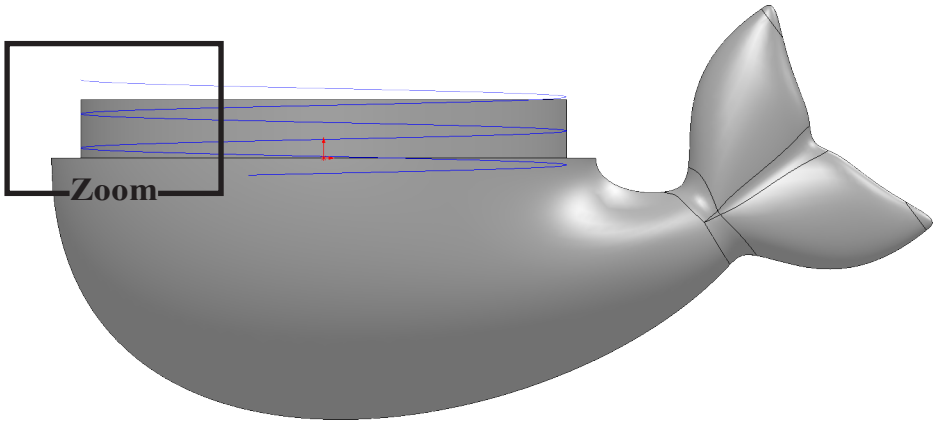


Fig. 10

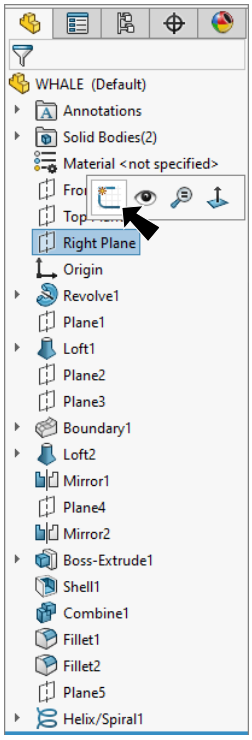


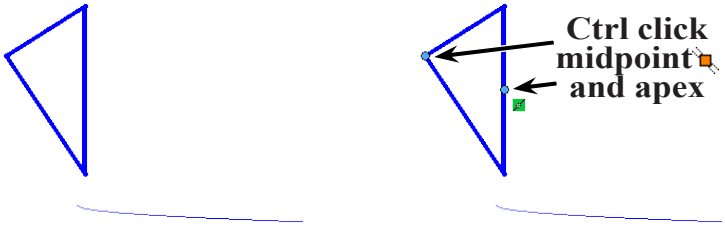
Fig. 9

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

Step 5. Sketch **triangle with vertical base just above the helix**, **Fig. 11**.

Step 6. **Right click graphics area and click Select** from menu to unselect Line tool.

Step 7. **Ctrl click midpoint of vertical line and endpoint at apex** to select both. Release Ctrl key and click **Make Horizontal** on the context toolbar, **Fig. 12**.



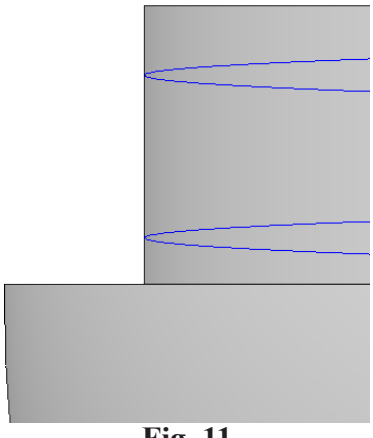


Fig. 11

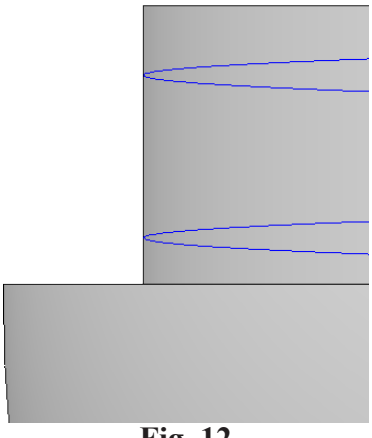


Fig. 12

Step 8. Click **Smart Dimension**

(S) on the Sketch toolbar.

Step 9. Dimension **3.6** and **33.7º**, **Fig. 13**.

Step 10. **Right click graphics area and click Select** from menu to unselect Smart Dimension.

Step 11. **Ctrl click midpoint of vertical line and helix** to select both. **Release Ctrl key** and click **Make Pierce** on the context toolbar, **Fig. 14**. Make Pierce adds a Pierce relation between profile sketch and helix.

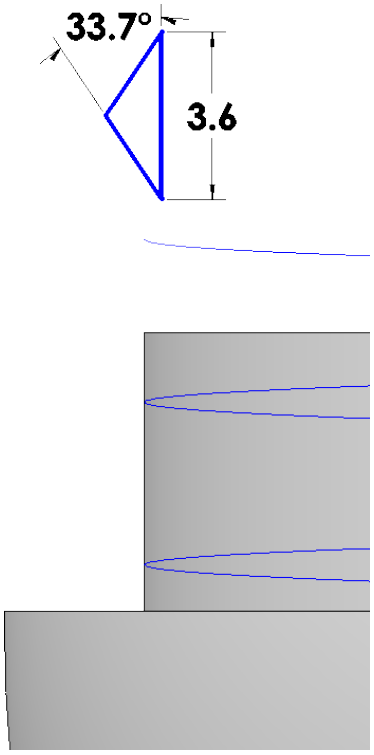


Fig. 13

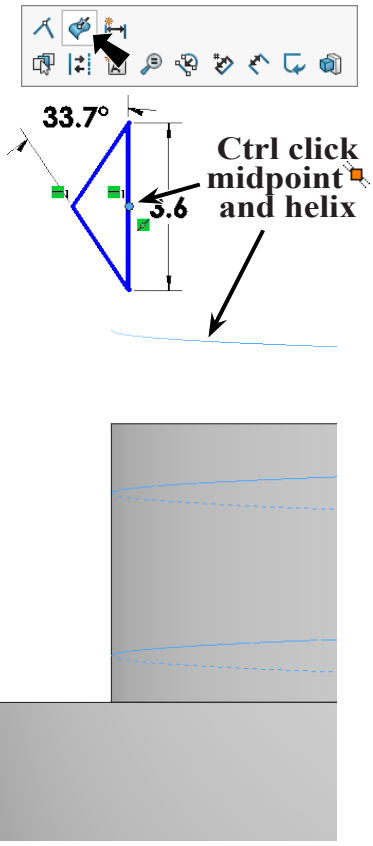


Fig. 14

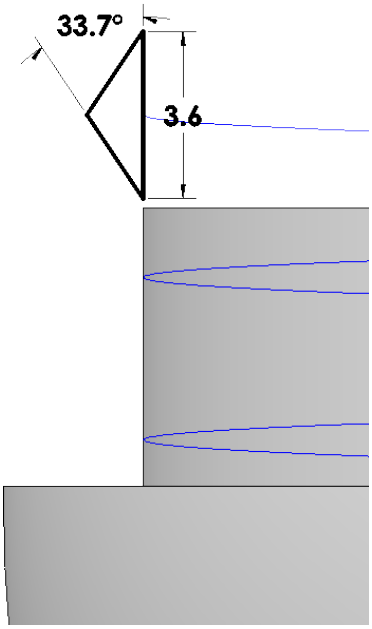


Fig. 15

E. Sweep Threads in Base.

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

Step 2. Click **Swept Boss/Base** Swept Boss/Base on the Features toolbar.

Step 3. In the Swept Boss/Base Property Manager:
under Profile and Path, **Fig. 16**

Profile click **triangle**, **Fig. 17**

Path click **helix**

click OK .

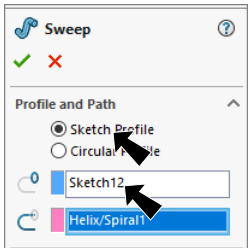


Fig. 16

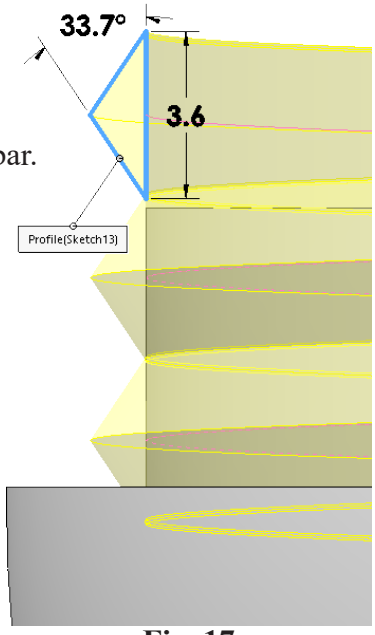


Fig. 17

F. Revolve Cut Sweep in Base.

Step 1. **Hide Helix1** . To hide Helix1, Click **Helix1** in the Feature Manager and click **Hide** on the context toolbar, **Fig. 18**.

Step 2. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 18**.

Step 4. Click **Wireframe** on the View toolbar.

Step 5. Zoom out to see all threads, **Fig. 19**.

Step 6. Click **Corner Rectangle** in the **Rectangle flyout** on the Sketch toolbar.

Step 7. Sketch **two rectangles:**
1) bottom line coincident with top horizontal silhouette edge of Extrude1, Fig. 19

2) top line coincident with the inside bottom horizontal silhouette edge of Shell1, Fig. 19.

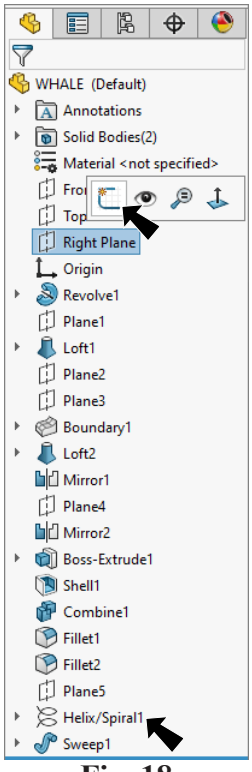


Fig. 18

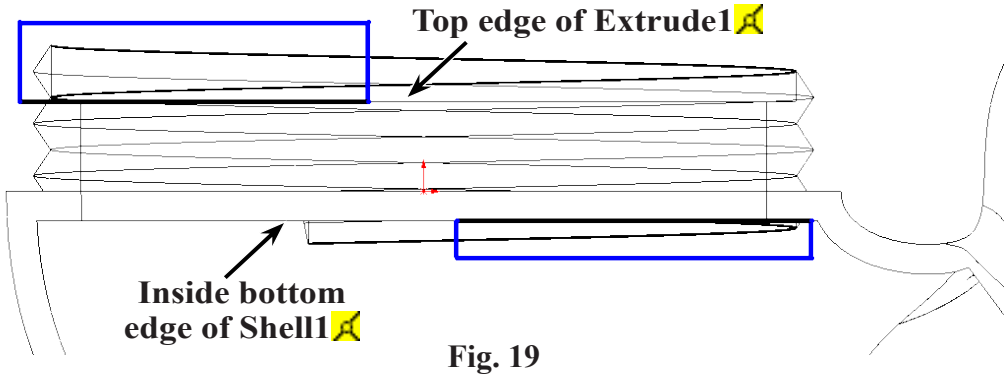


Fig. 19

Step 8. **Right click graphics area and click Select** from menu to unselect Line tool.

Step 9. **Ctrl click right vertex of top rectangle, left vertex of bottom rectangle and Origin** to select all three and click **Make Vertical** on the context toolbar, **Fig. 20**.

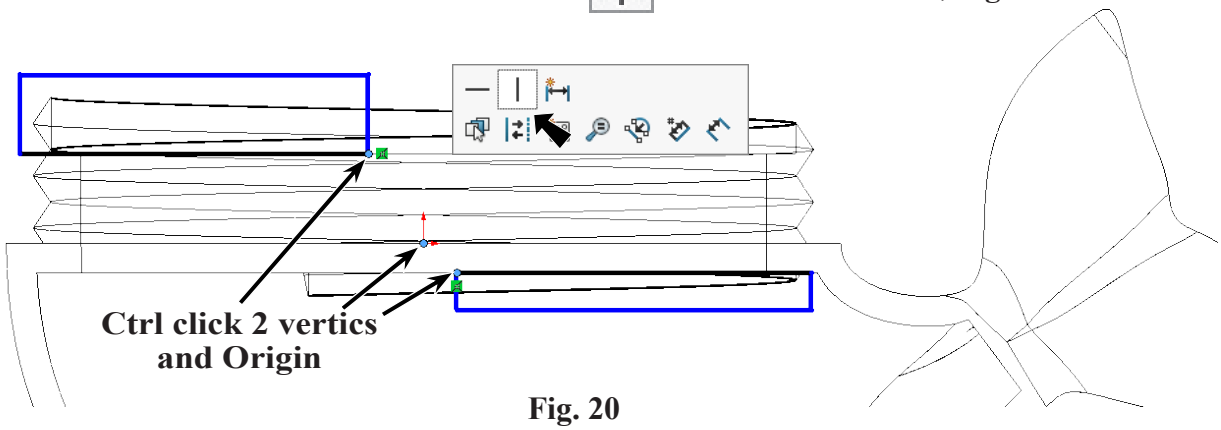


Fig. 20

Step 10. Click **Smart Dimension** (**S**) on the Sketch toolbar.

Step 11. Add dimensions, **Fig. 21**.

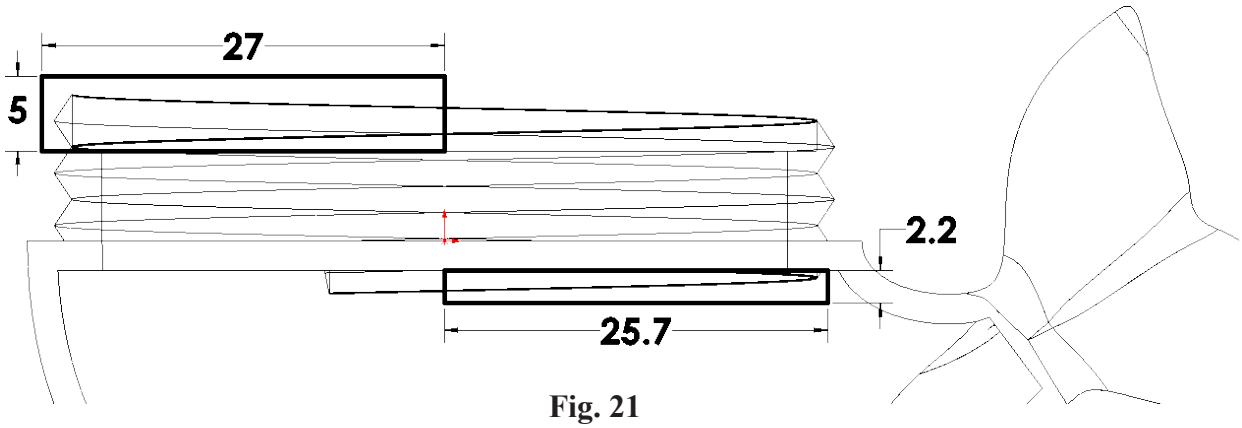


Fig. 21

Step 12. Click **Features** Features on the Command Manager toolbar.

Step 13. Click **Revolved Cut** Revolved Cut on the Features toolbar.

Step 14. In the Cut-Revolve Property Manager:

click in the Axis of Revolution box, **Fig. 22**
click **vertical line at Origin**, **Fig. 23**
click OK .

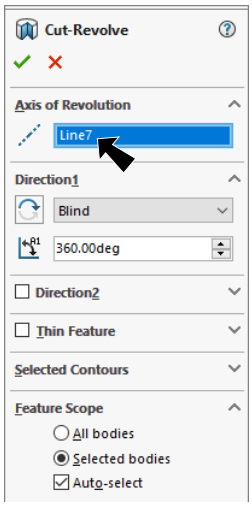


Fig. 22

Step 15. Save. Use **Ctrl-S**.

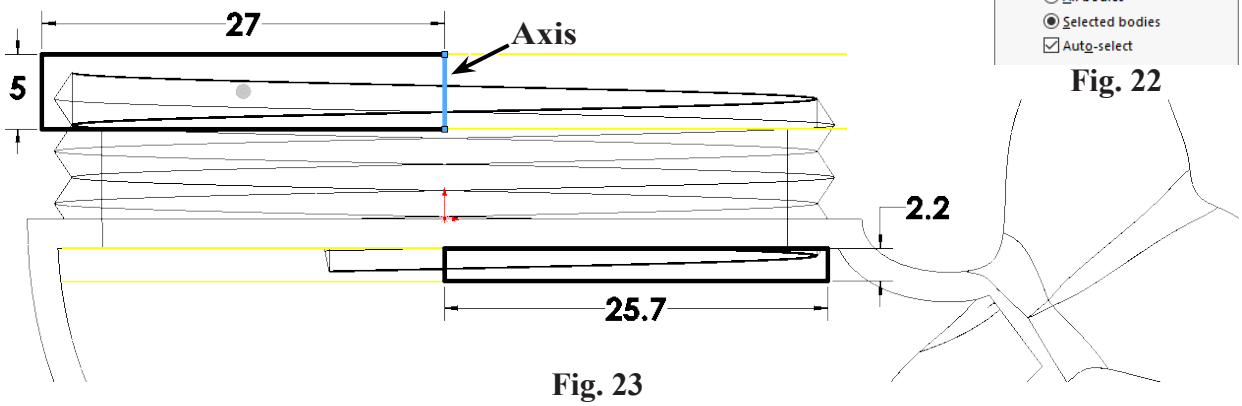


Fig. 23

Step 15. The Revolved Cut leaves a little of the Swept threads, **Fig. 24**. We could use Delete Face to remove the five faces, but fortunately a Fillet will clean sweep up nicely. Fillets will be added at end.

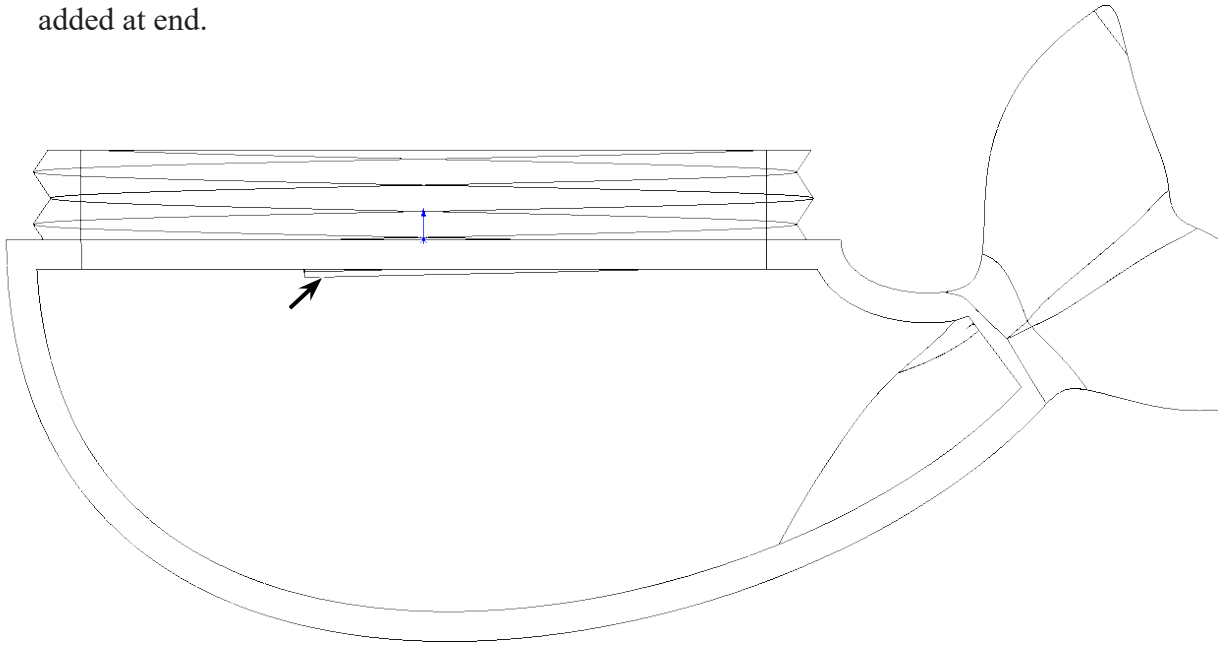


Fig. 24

G. Swept Cut Threads Profile in Lid.

Step 1. **Show Sketch12** (Sweep profile). To show, expand Sweep1 in the Feature Manager, click Sketch12 and **Show** on the context toolbar, **Fig. 25**.

Step 2. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 25**.

Step 3. **Zoom back in on Sketch12**, **Fig. 26**.

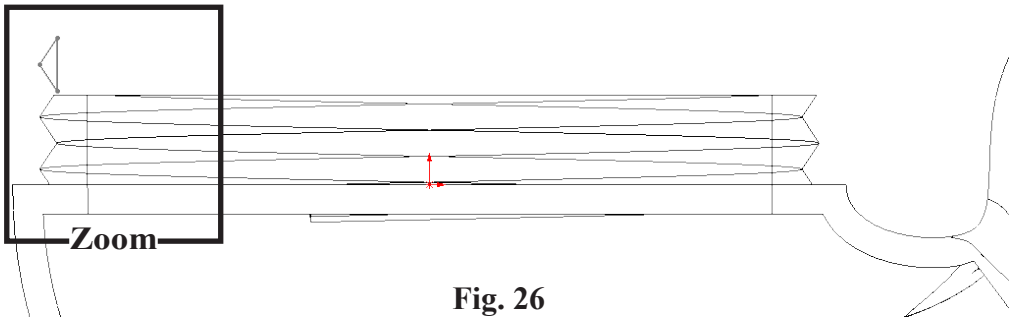


Fig. 26

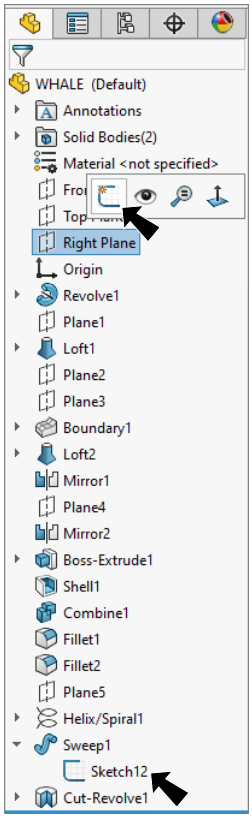


Fig. 25

Step 4. Click **Convert Entities** on the Sketch toolbar.

Step 5. In the Convert Entities Property Manager:
under Entities to Convert, **Fig. 27**
click **vertical line of triangle**, **Fig. 28**
click OK .

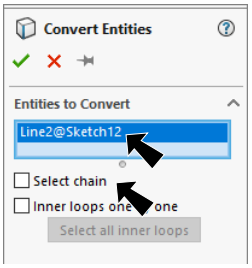


Fig. 27

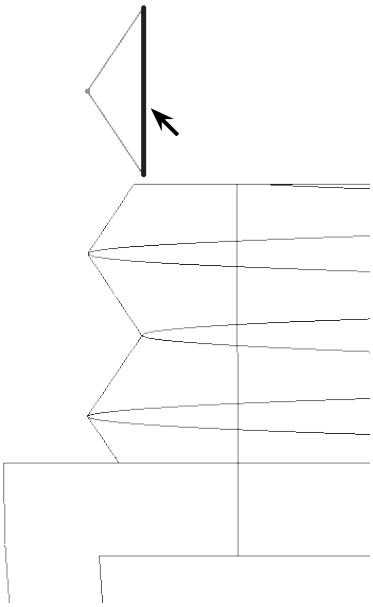


Fig. 28

Step 6. Click **Offset Entities**

on the Sketch toolbar.

Step 7. In the Offset Entities Property Manager set:
under Parameters, **Fig. 29**

Distance .36
check **Reverse**
uncheck **Select chain**
click **both legs of triangle, Fig. 30**
The yellow offset should be outside. If it is not, uncheck Reverse.

click OK .

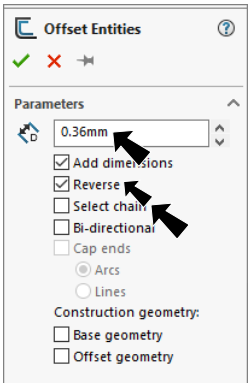


Fig. 29

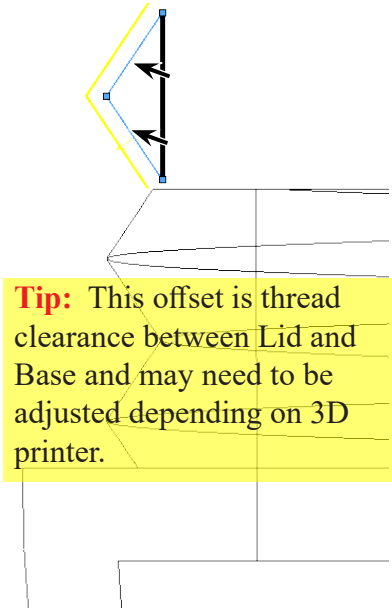

Tip: This offset is thread clearance between Lid and Base and may need to be adjusted depending on 3D printer.

Fig. 30

Step 8. Click **Trim Entities**

(S) on the Sketch toolbar.

Step 9. In the Trim Property Manger:

select **Corner** , **Fig. 31**
Trim **leg to base at both vertex points**, **Fig. 32**.
Click leg then base to trim.
Results shown in **Fig. 33**.

Click OK when done.

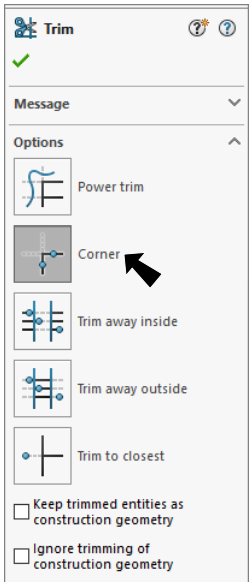


Fig. 31

Step 10. Click **Exit Sketch**

on the Sketch toolbar.

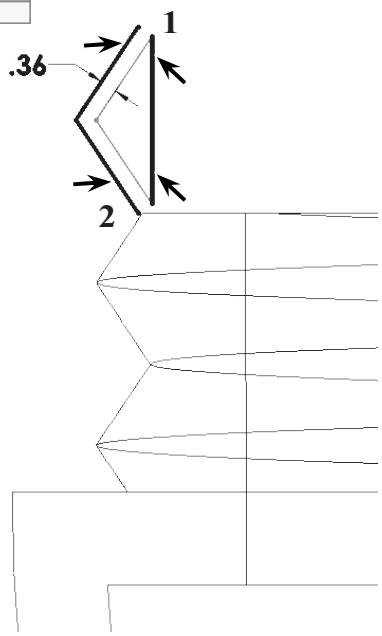


Fig. 32

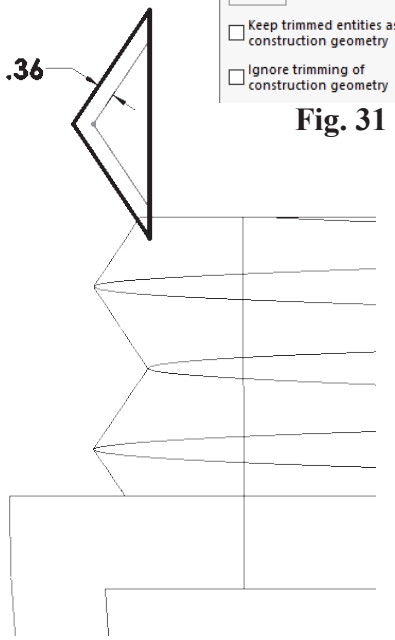


Fig. 33

H. Swept Cut Threads in Lid.

Step 1. **Show LID** body. To show, move the cursor over Lid body in graphics area and press **Shift - Tab** to show, **Fig. 34**.

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

Step 3. Click **Swept Cut** Swept Cut on the Features toolbar.

Step 4. In the Cut-Sweep Property Manager:
under Profile and Path, **Fig. 35**
Profile click **triangle (not sweep profile)**, **Fig. 36**
Path expand flyout Feature Manager design tree and click **Helix1**, **Fig. 37**
under Feature Scope
uncheck **Auto-select**
click **Lid** in graphics area
click OK .

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

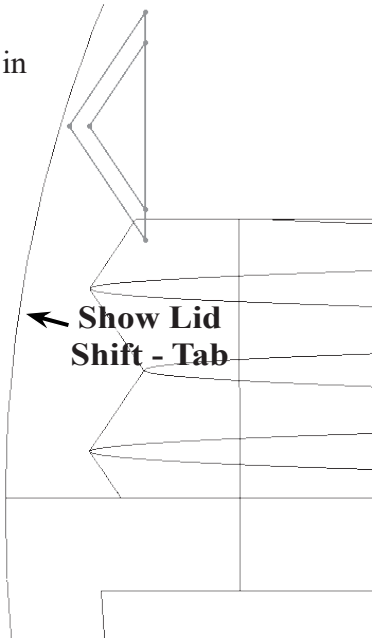


Fig. 34

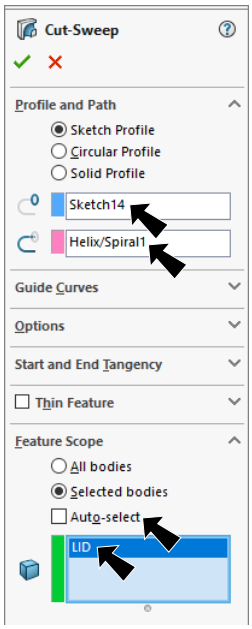


Fig. 35

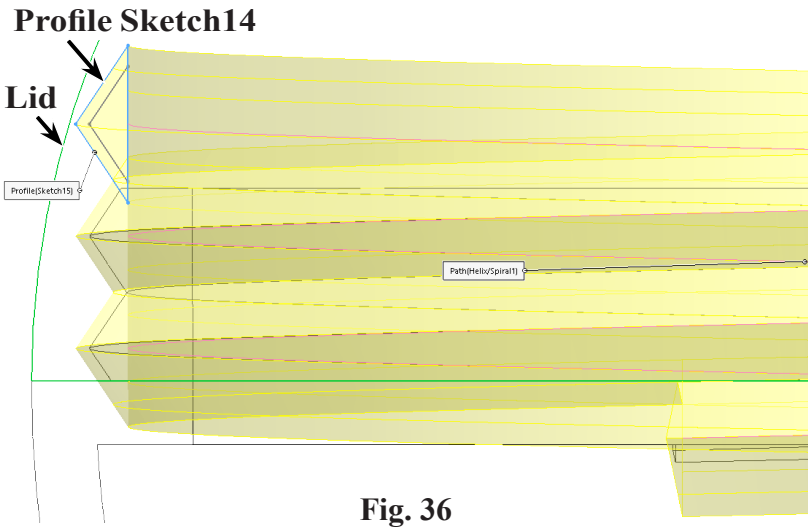


Fig. 36

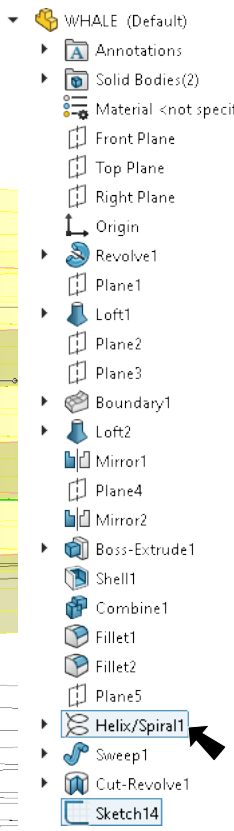


Fig. 37

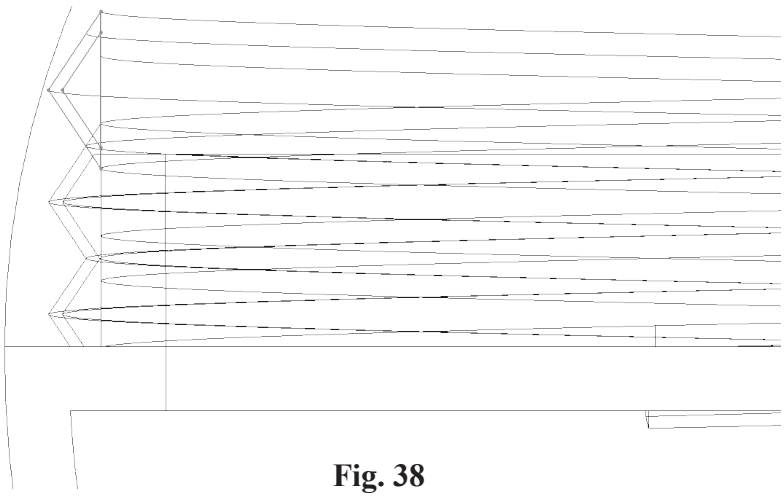


Fig. 38

I. Revolve Unwanted Threads in Lid.

Step 1. **Hide Sketch12** (Sweep profile). To hide, expand Sweep1 in the Feature Manager, click Sketch12 and **Hide** on toolbar, **Fig. 39**.

Step 2. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 39**.

Step 3. Zoom out.

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

Step 5. Sketch **vertical line from up Origin** **up to arc edge**, **Fig. 40**.

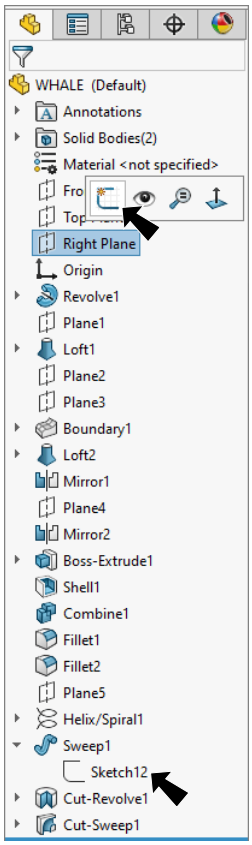


Fig. 39

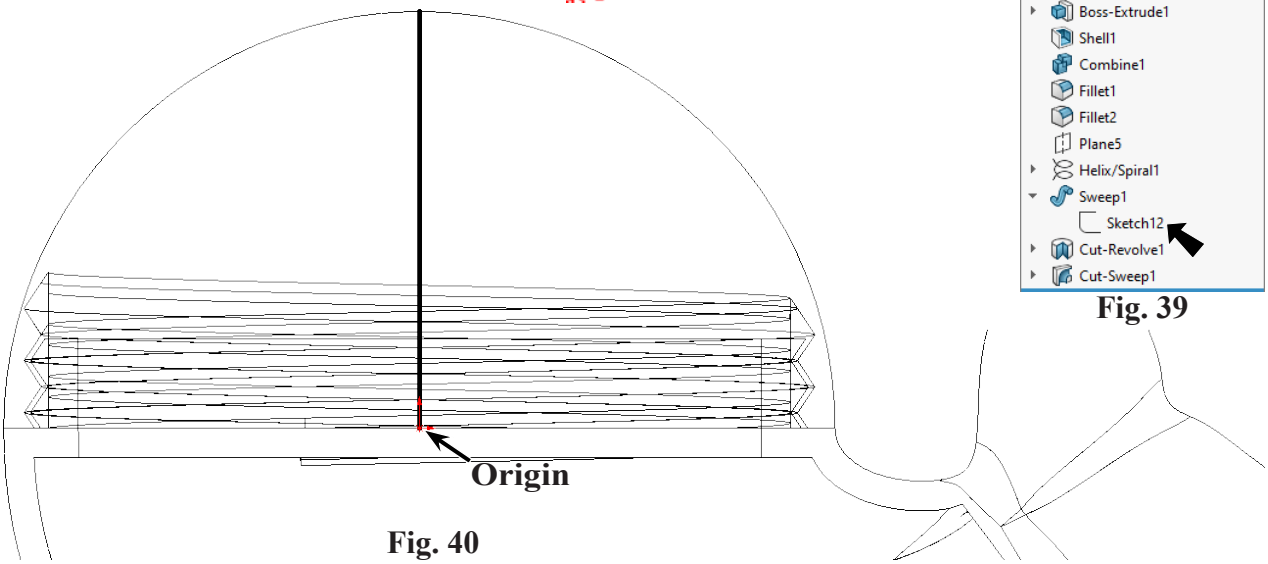


Fig. 40

Step 6. Hover over the **top horizontal silhouette edge Extrude1** in the Base, **Fig. 41**.

Step 7. Sketch a **horizontal line coincident with vertical line and coincident with top edge of Extrude1** , **Fig. 42**.

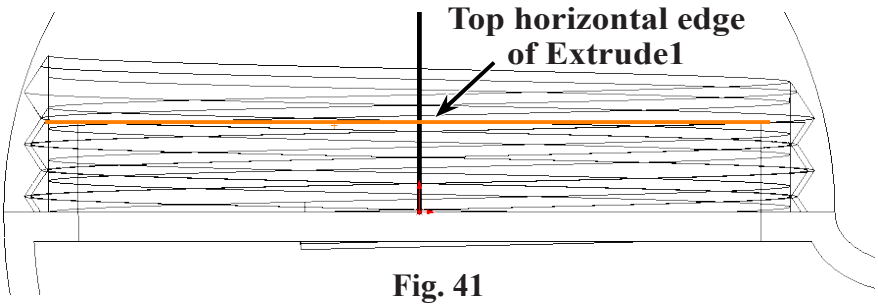


Fig. 41

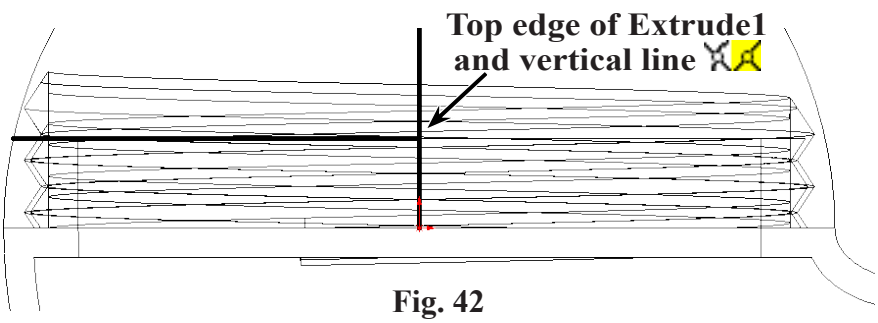


Fig. 42

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

Step 8. Sketch **circle** from Origin to coincident to thread swept cut in Lid, **Fig. 43**.

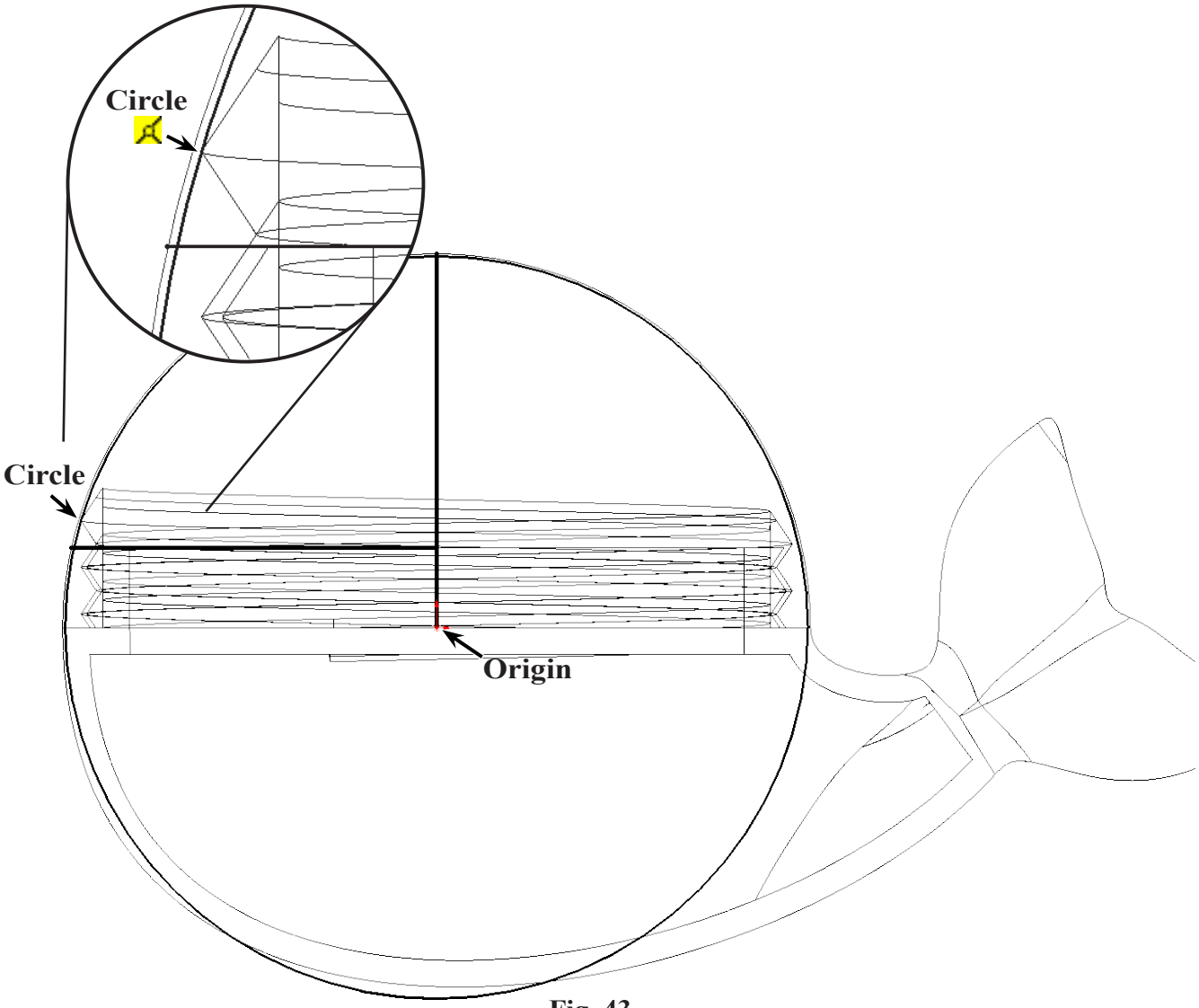


Fig. 43

Step 9. Click **Features** Features on the Command Manager toolbar.

Step 10. Click **Revolved Boss/Base** Revolved Boss/Base on the Features toolbar.

Step 11. In the Revolve Property Manger set:

click in the Axis of Revolution box, **Fig. 44**
click **vertical line**, **Fig. 45**
uncheck **Thin Feature**
under Selected Contours
click in Selected contours box
click **region inside entities**
under Feature Scope
uncheck **Auto-select**
click **Lid**
click OK .

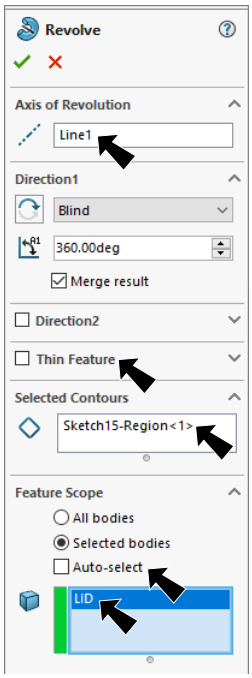


Fig. 44

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

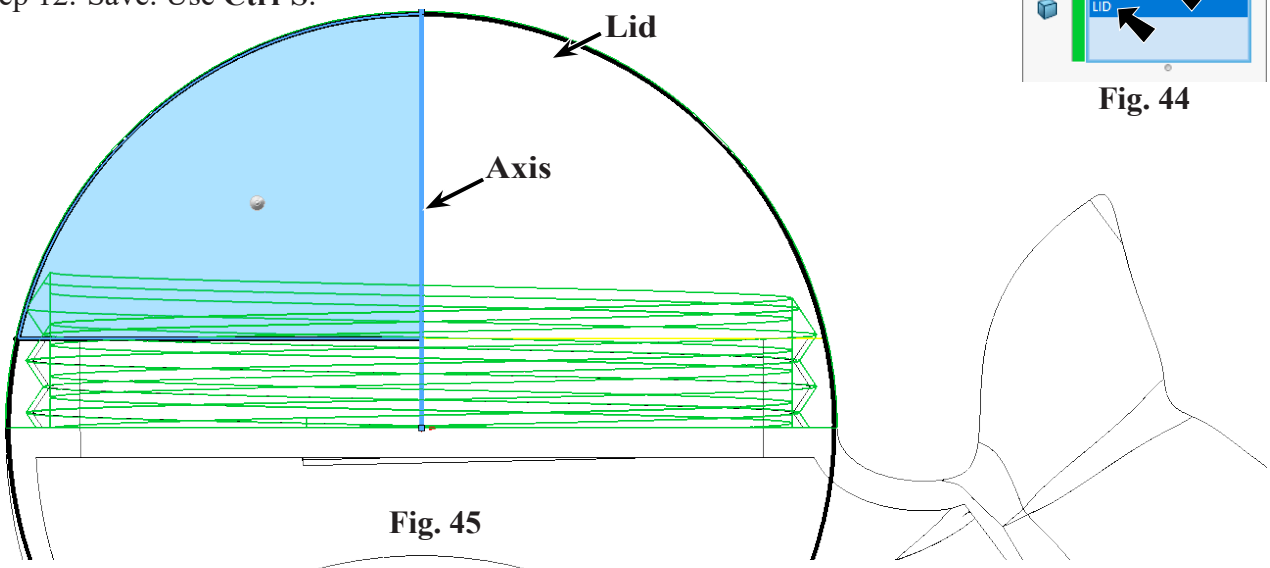


Fig. 45

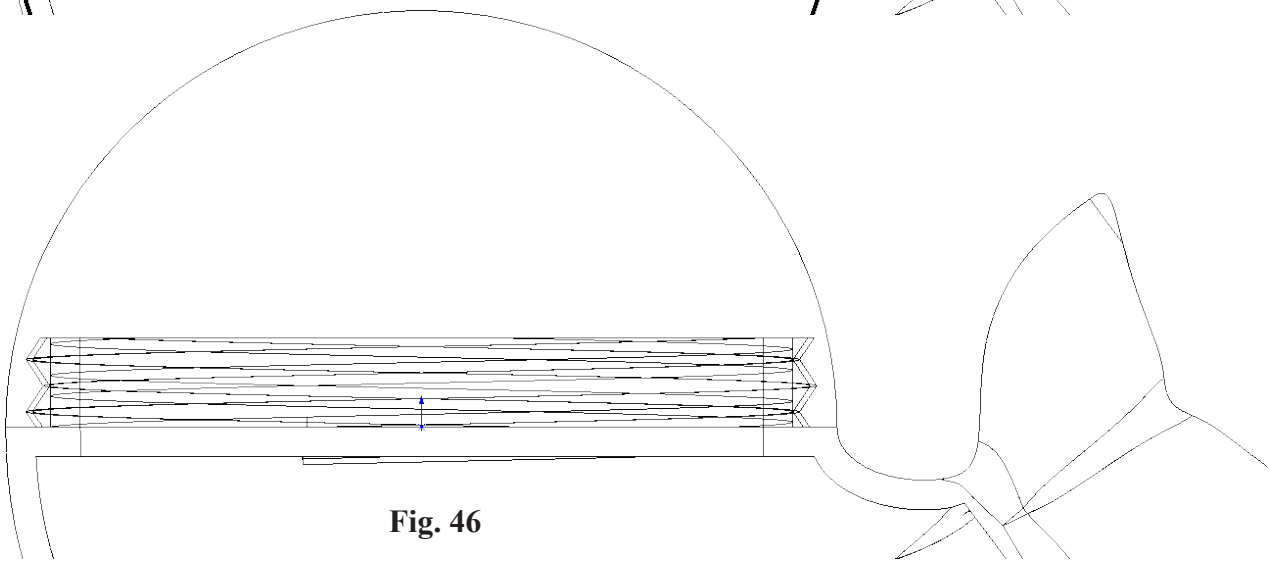


Fig. 46

J. Revolve Cut Lid.

Step 1. **Hide BASE** body. Move cursor over the Base body and press **Tab** key, **Fig. 47**.

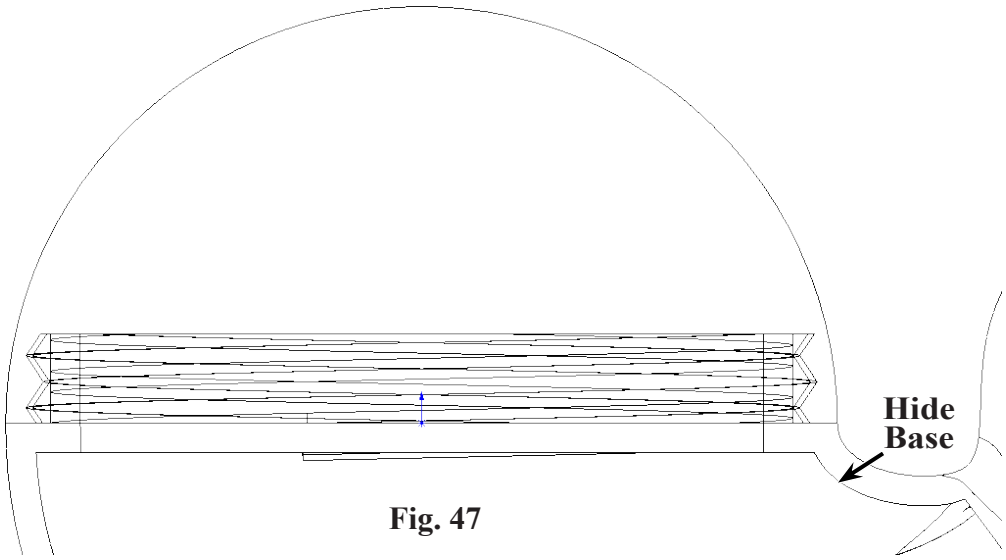


Fig. 47

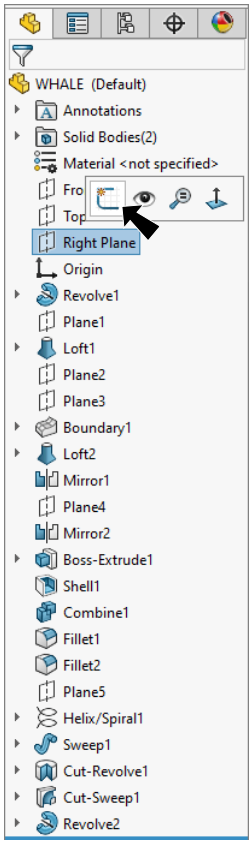


Fig. 48

Step 2. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 48**.

Step 3. Click **Line** **(L)** on the Sketch toolbar.

Step 4. Sketch **vertical line up from Origin** **up to arc edge**, **Fig. 49**.

Step 5. Sketch **horizontal line coincident with vertical line and coincident with top silhouette edge cut threads**, **Fig. 50**.

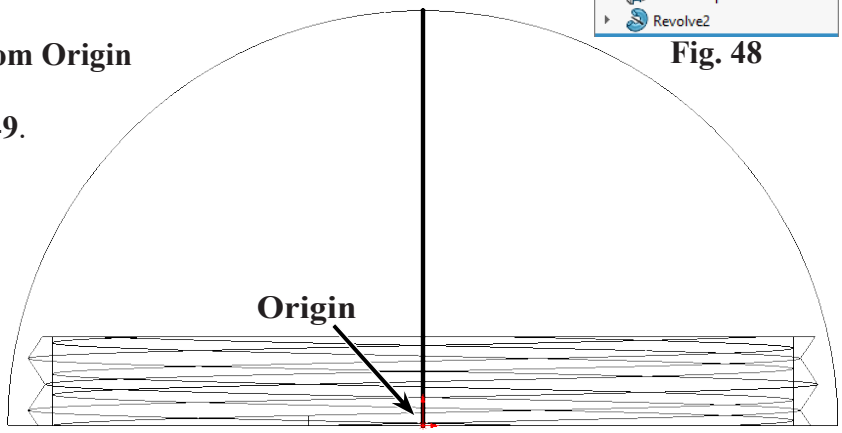


Fig. 49

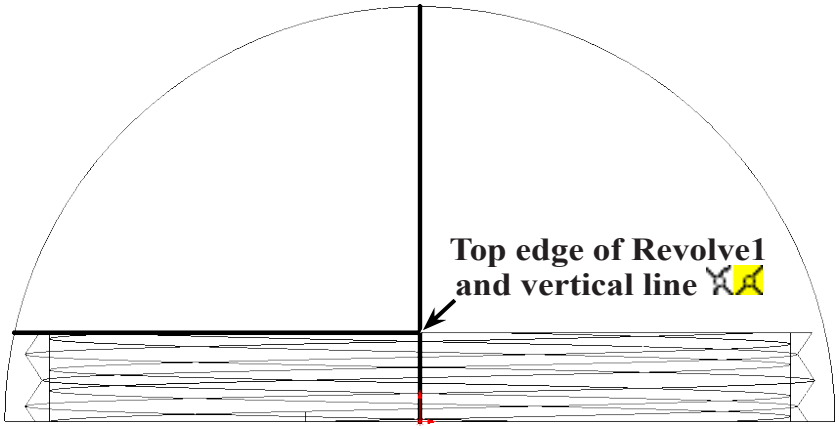


Fig. 50

Step 6. Click **Offset Entities**

on the Sketch toolbar.

Step 7. In the Offset Entities Property Manager set:
under Parameters, **Fig. 51**

Distance **2**
check **Reverse**
click **arc edge of Lid, Fig. 52**
The yellow offset should be inside the edge
If it is not, uncheck Reverse.
click OK .

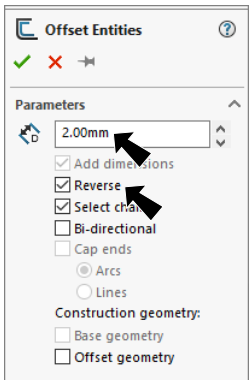


Fig. 51

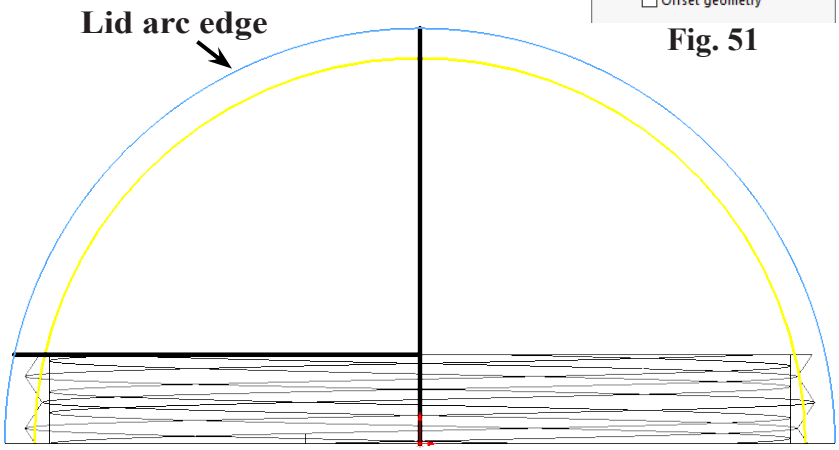


Fig. 52

Step 8. Click **Features**

on the Command Manager toolbar.

Step 9. Click **Revolved Cut**

on the Features toolbar.

Step 10. In the Cut-Revolve Property Manger set:

click in the Axis of Revolution box, **Fig. 53**
click **vertical line**, **Fig. 54**
uncheck **Thin Feature**
under Selected Contours
click in Selected contours box
click **region inside converted entities**
click OK .
(Bodies to Keep next page)

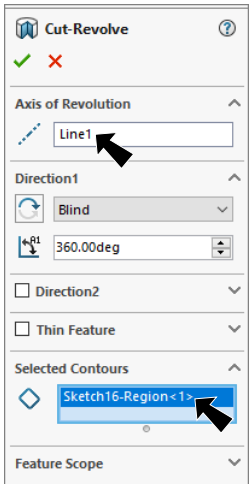


Fig. 53

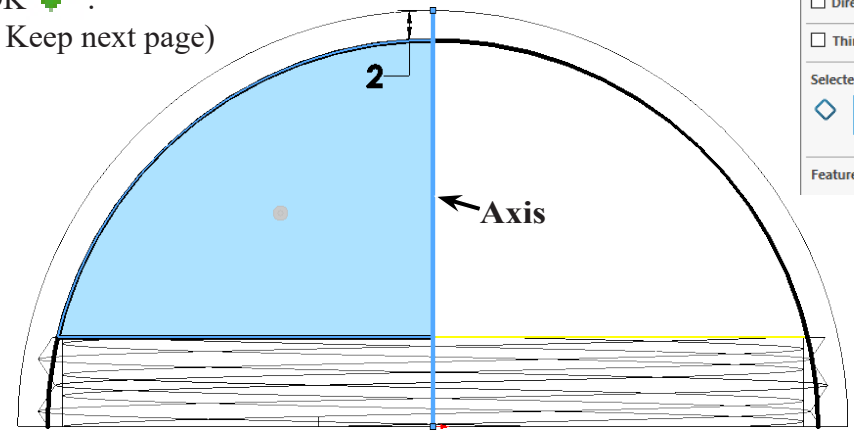


Fig. 54

Step 11. In the Bodies to Keep dialog box:
under Bodies, **Fig. 55**
select **Selected bodies**
check **Body 1**
click OK.

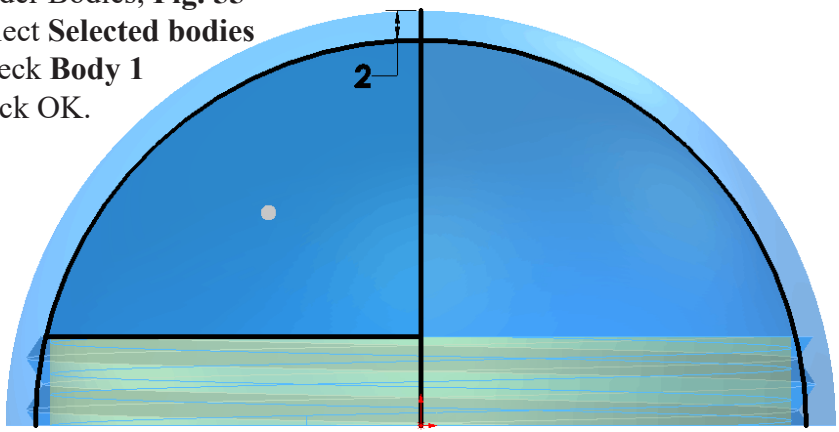


Fig. 56

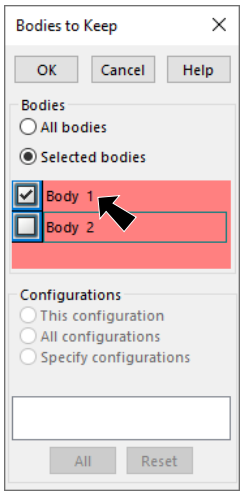


Fig. 55

K. Section View.

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

Step 2. **Show BASE** body (**Shift-Tab**).

Step 3. Click **Section View** in View toolbar. Or View > Display > Section View.

Step 4. In the Section View Property Manager:
under Section 1, **Fig. 57**
click **Right Plane**
click OK .

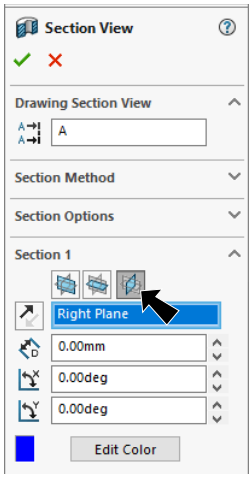


Fig. 57

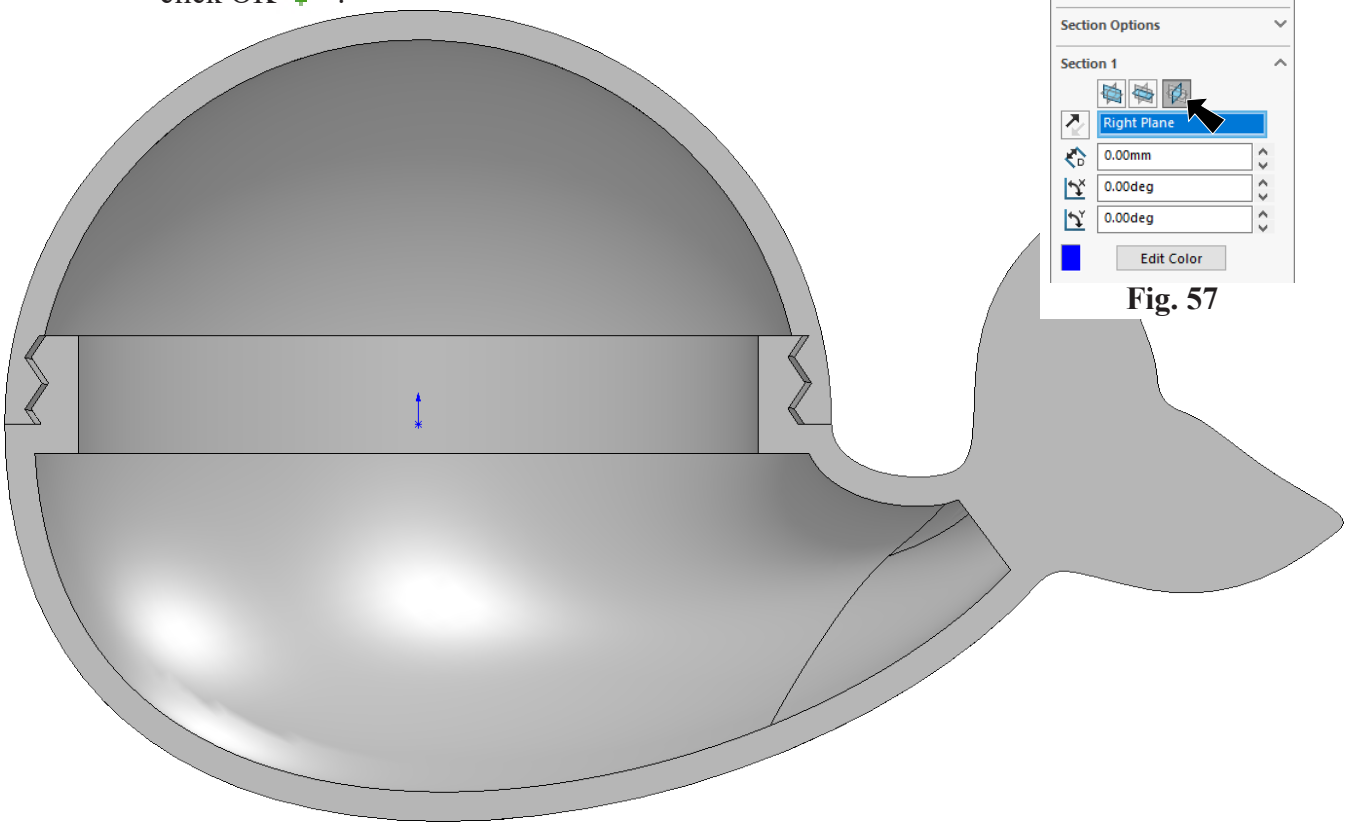


Fig. 58

L. Fillet Inside Base Extrude.

Step 1. Click **Fillet**

on the Features toolbar.

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 59**

Radius **.75**
click **both inside cylindrical edges of Extrude1**, **Fig. 60**
click **Apply**

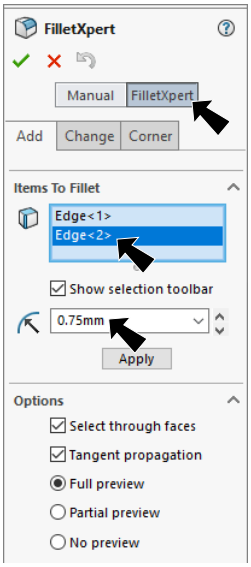


Fig. 59

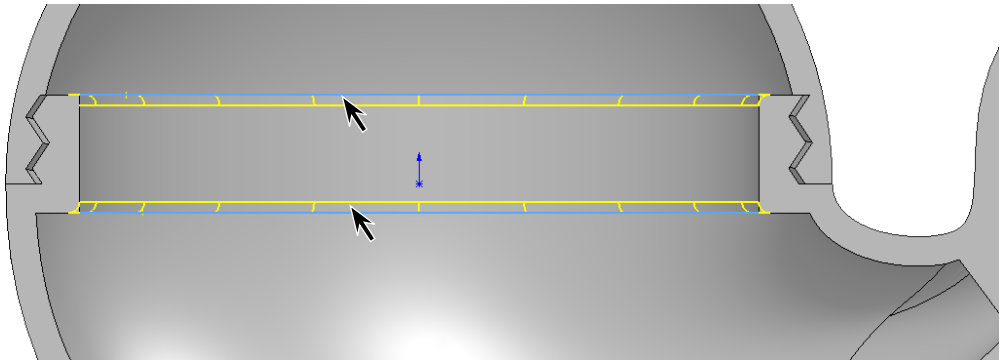


Fig. 60

Radius **2.15**, **Fig. 61**
click **inside cylindrical edge under BaseExtrude1 (lip)**, **Fig. 62**
click OK .

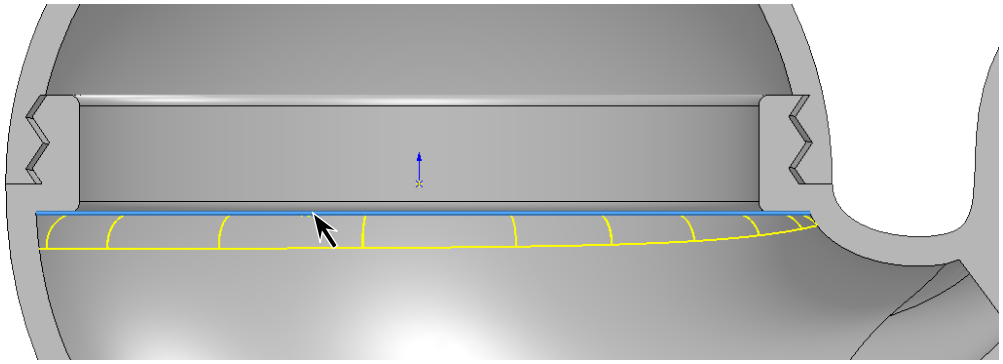


Fig. 62

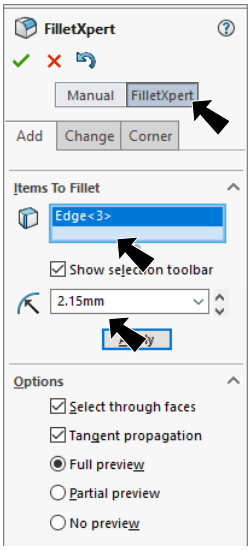


Fig. 61

Step 3. **Turn off Section View** in View toolbar. Or View > Display > Section View.

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