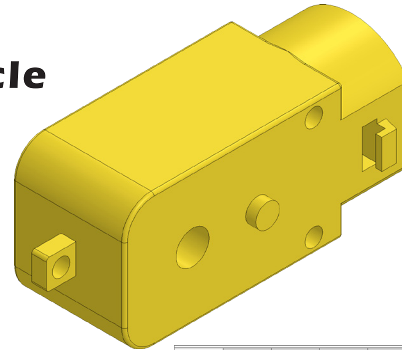
Chapter 15

Cluster Wheel Vehicle

Gearbox



A. Extrude1.

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**.

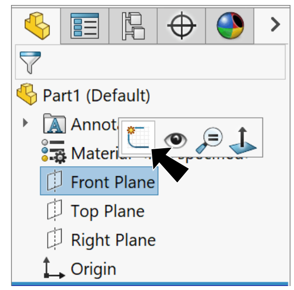


Fig. 1

Step 3. Click **Center Rectangle** in the **Rectangle flyout** on the Sketch toolbar.

Step 4. Sketch **center rectangle at Origin**, **Fig. 2**.

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

Step 6. Add dimensions, **Fig. 3**.

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

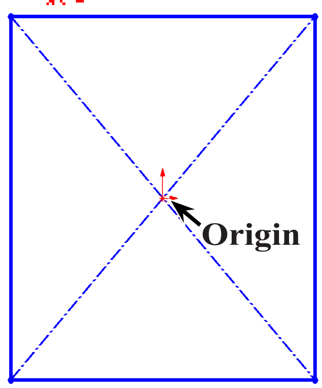


Fig. 2

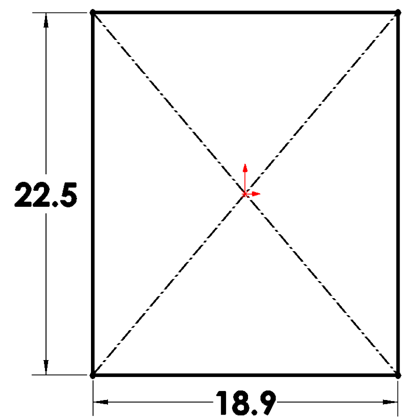


Fig. 3

Step 8. Click **Extruded Boss/Base** on the Features toolbar.

Step 9. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 4**
End Condition **Blind**
Depth 37
click OK .

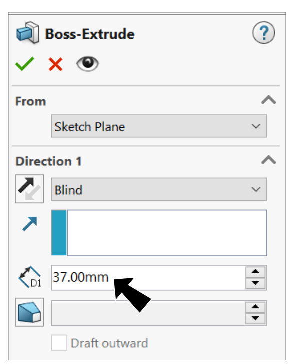


Fig. 4

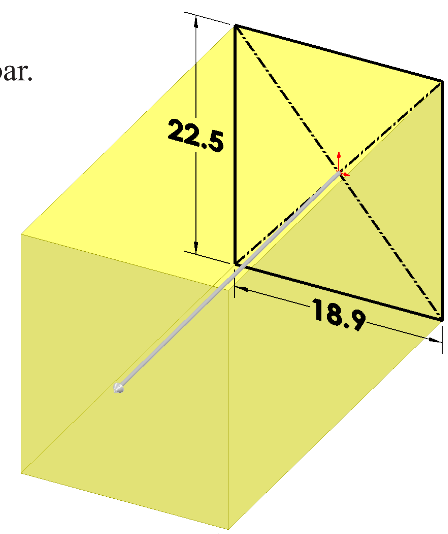


Fig. 5

B. Save as "GEARBOX".

Step 1. Click File Menu > Save As.

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

C. Extrude2.

Step 1. Click **Front Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 6**.

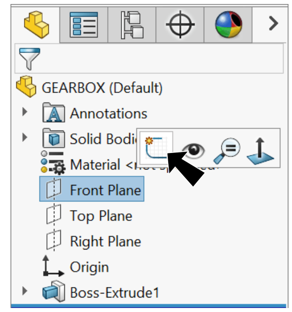


Fig. 6

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

Step 3. Click **Convert Entities** on the Sketch toolbar.

Step 4. In the Convert Entities Property Manager:
under Entities to Convert, **Fig. 7**
click **rear face**, **Fig. 8**
click OK .

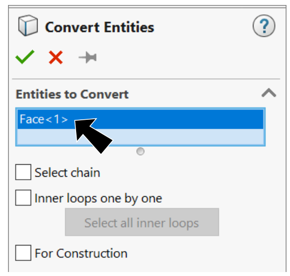


Fig. 7

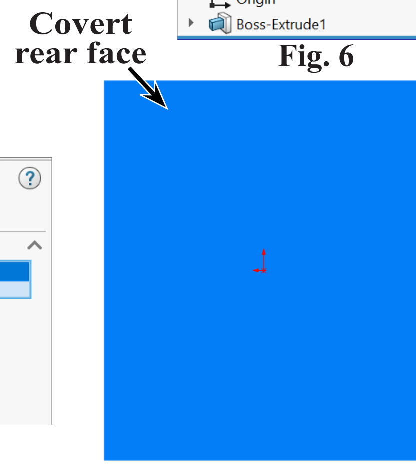


Fig. 8

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

Step 6. Sketch circle at Origin and Tangent to **top edge converted line**, **Fig. 9**.

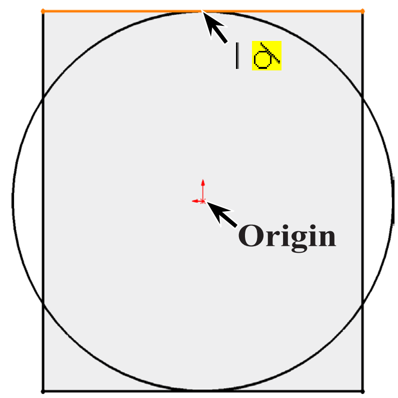


Fig. 9

Step 7. Rotate view to view slightly. Use **Right Arrow key** and **Down Arrow key** , **Fig. 10**.

Step 8. Click **Features** on the Command Manager toolbar.

Step 9. Click **Extruded Boss/Base** on the Features toolbar.

Step 10. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 10**
Depth **11**
Reverse Direction
under Selected Contours
click **contour inside circle**, **Fig. 11**
click OK .

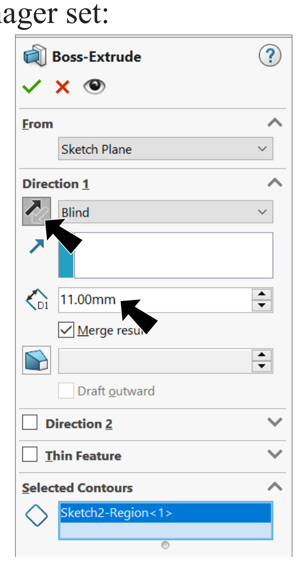


Fig. 10

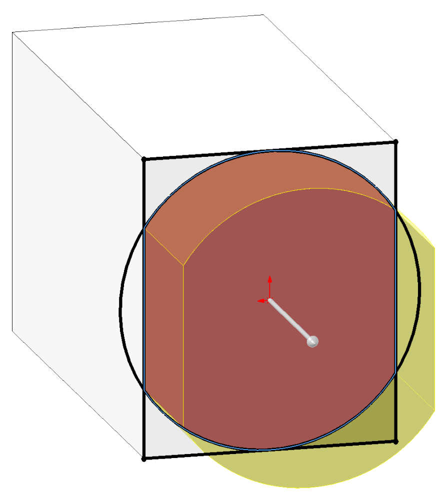


Fig. 11

Step 11. Save (Ctrl-S).

D. Cut Extrude1.

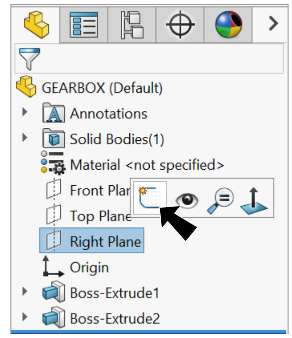


Fig. 12

Step 1. Click **Right 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. Click **Centerline** in the **Line flyout** on the Sketch toolbar.

Step 4. Sketch **horizontal centerline** from Origin, **Fig. 13**.

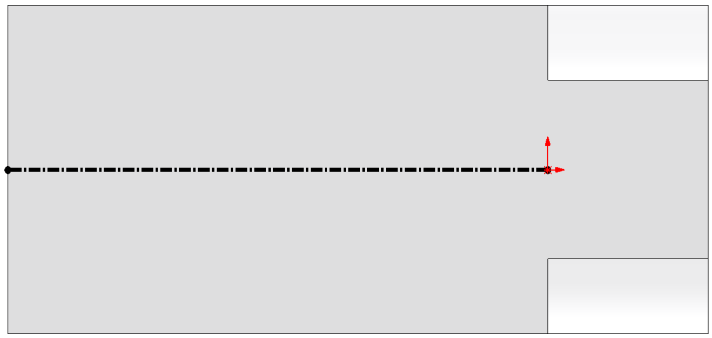


Fig. 13

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

Step 6. Sketch **two circles**. Circle on centerline and a circle above centerline, **Fig. 14**.

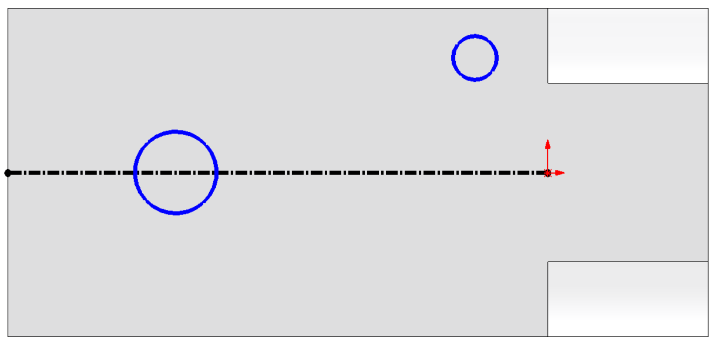
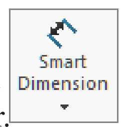


Fig. 14



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

Step 8. Add dimensions, **Fig. 15**.

Step 9. **Unselect Smart Dimension**. To unselect, right click graphics area and click Select from menu.

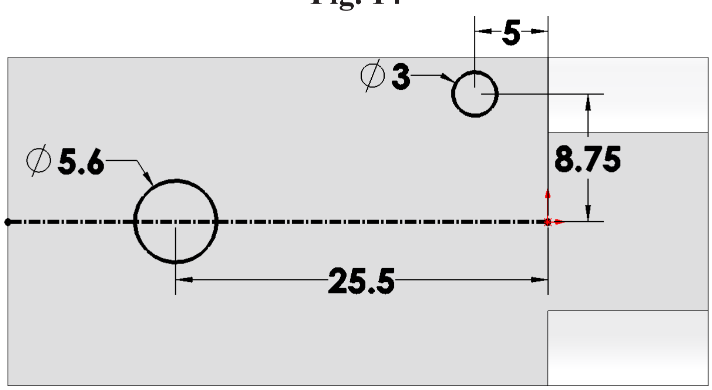


Fig. 15

Step 10. Drag a selection **to left across centerline and small circle** to select both, **Fig. 16**.

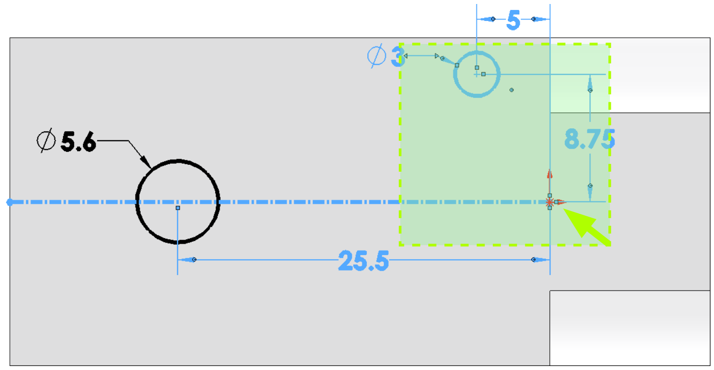


Fig. 16

Step 11. Click **Mirror Entities** Mirror Entities on the Sketch toolbar.

Step 12. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

Step 13. Click **Features** Features on the Command Manager toolbar.

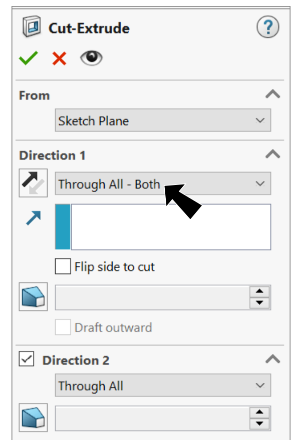


Fig. 17

Step 14. Click **Extruded Cut** Extruded Cut on the Features toolbar.

Step 15. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 17**
End Condition
Through All - Both
click OK .

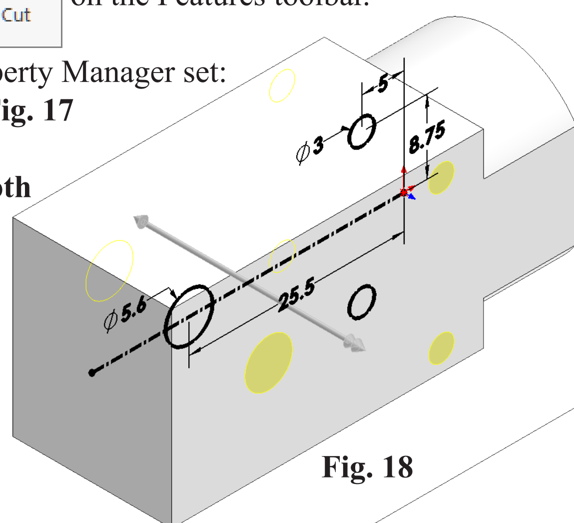


Fig. 18

E. Extrude3.

Step 1. Click the **side face** and click **Sketch** on the context toolbar, **Fig. 19**.

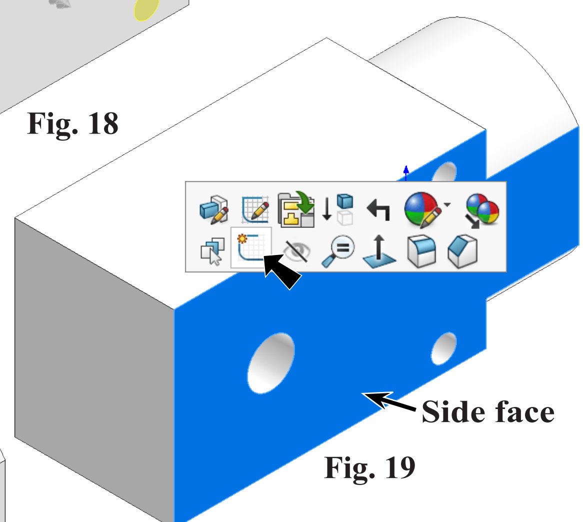


Fig. 19

Step 2. Click **Circle** (**S**) on the Sketch toolbar.

Step 3. Sketch circle, **Fig. 20**.

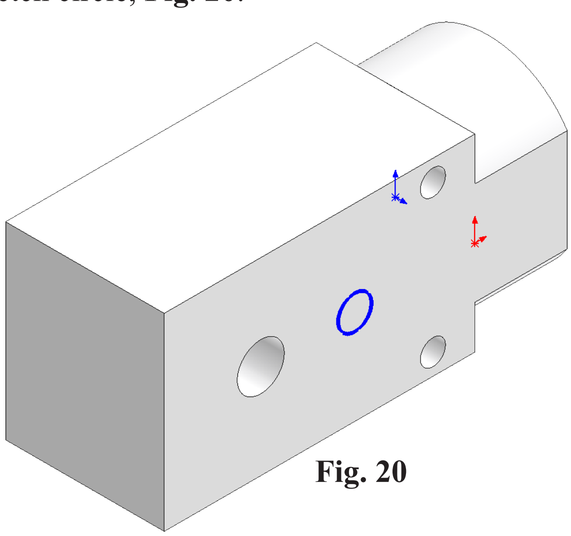


Fig. 20

Step 4. **Unselect Circle tool**. To unselect, right click graphics area and click Select from menu.

Step 5. **Ctrl click circle centerpoint** and **Origin** (**blue**) to select both. Release Ctrl key and click **Make Horizontal** on the context toolbar, **Fig. 21**.

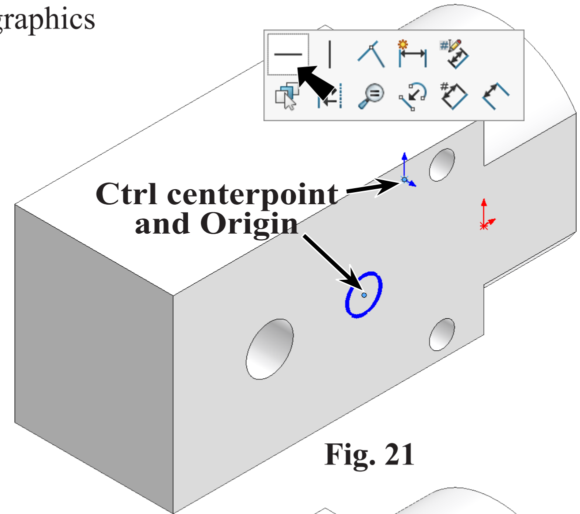


Fig. 21

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

Step 7. Add dimensions, **Fig. 22**. Dimension the 14.5 to the **Origin** (**blue**).

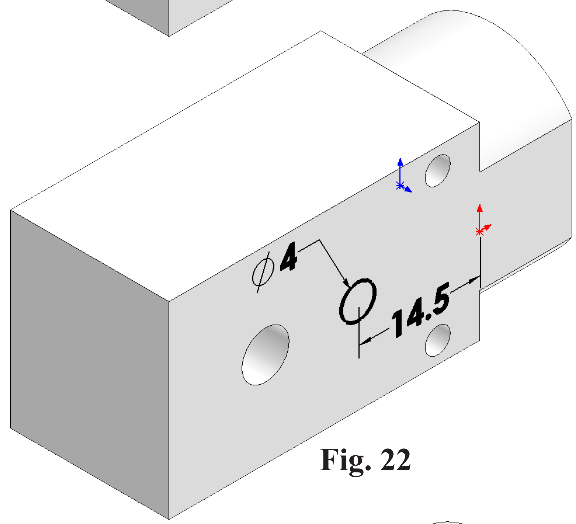


Fig. 22

Step 8. Click **Features** on the Command Manager toolbar.

Step 9. Click **Extruded Boss/Base** on the Features toolbar.

Step 10. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 23**
End Condition **Blind**
Depth **1.7**
click OK .

Step 11. Save **(Ctrl-S)**.

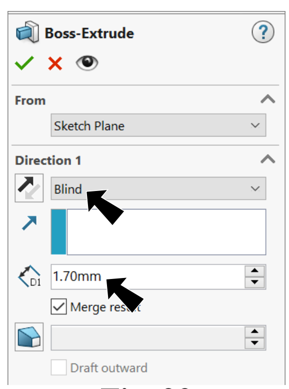


Fig. 23

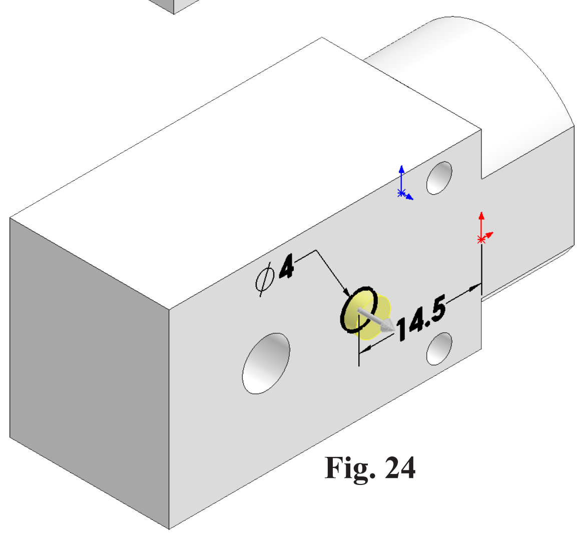


Fig. 24

F. Cut Extrude2.

Step 1. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 25**.

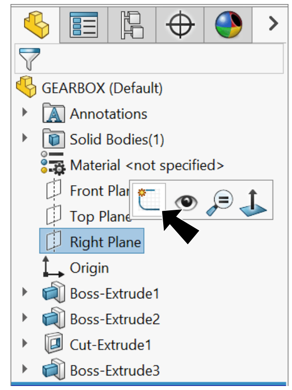


Fig. 25

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

Step 3. Click **Center Rectangle** in the **Rectangle flyout** on the Sketch toolbar.

Step 4. Sketch **center rectangle to right of Origin**, **Fig. 26**.

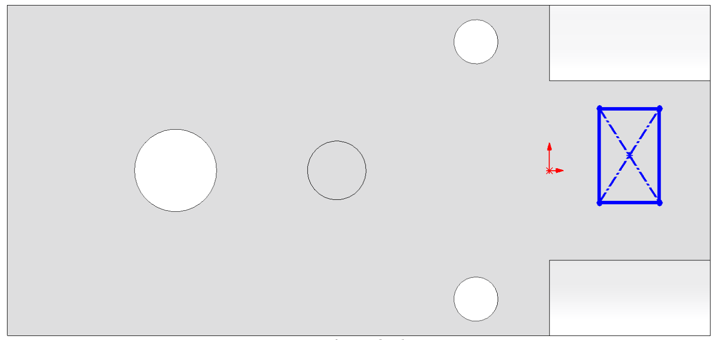


Fig. 26

Step 5. **Unselect Rectangle tool**. To unselect, right click graphics area and click Select from menu.

Step 6. **Ctrl click rectangle centerpoint** and **Origin** to select both. Release Ctrl key and click **Make Horizontal** on the context toolbar, **Fig. 27**.

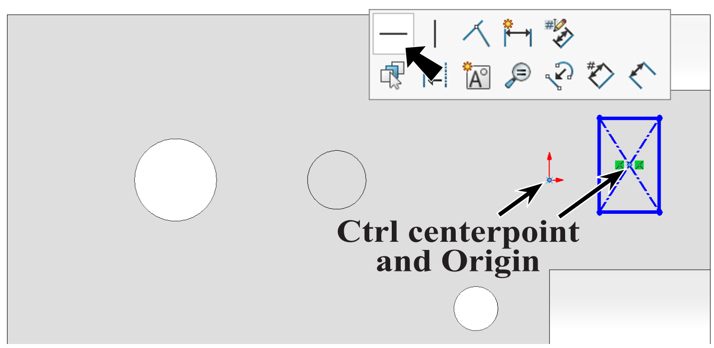


Fig. 27

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

Step 8. Add dimensions, **Fig. 28**.

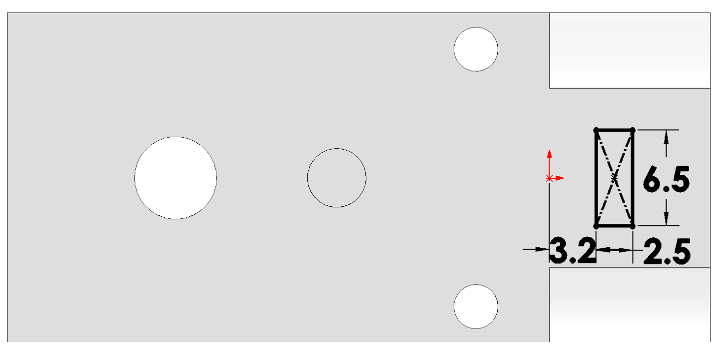


Fig. 28

Step 9. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

Step 10. Click **Features** Features on the Command Manager toolbar.

Step 11. Click **Extruded Cut** Extruded Cut on the Features toolbar.

Step 12. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 29**
End Condition
Through All - Both
click OK .

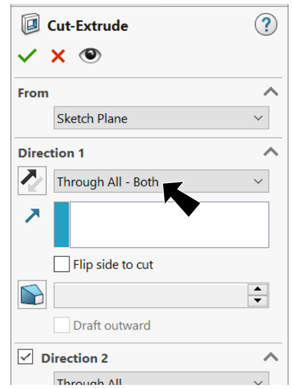


Fig. 29

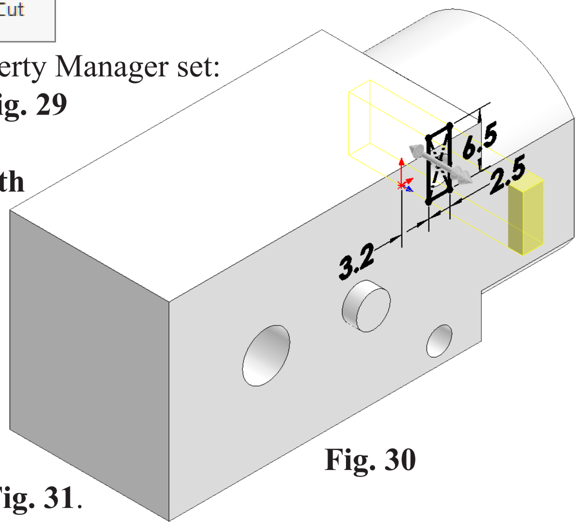


Fig. 30

G. Extrude4.

Step 1. Click **Top Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 31**.

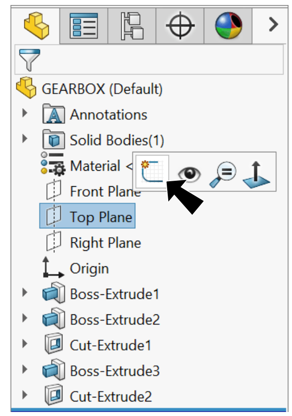


Fig. 31

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

Step 3. Click **Convert Entities** Convert Entities on the Sketch toolbar.

Step 4. In the Convert Entities Property Manager:
under Entities to Convert, **Fig. 32**
click **top right edge**, **Fig. 33**
click OK .

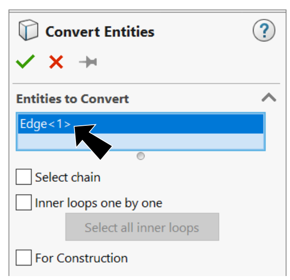


Fig. 32

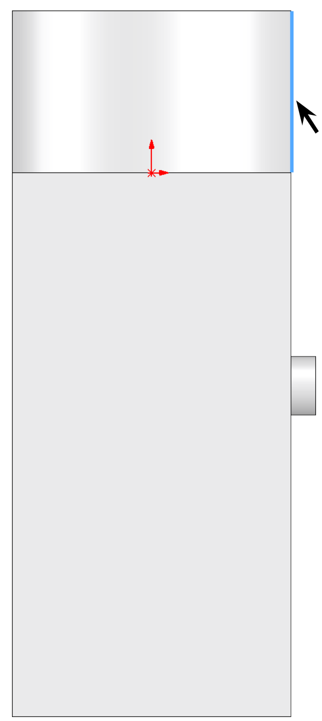


Fig. 33

Step 5. Click **Line** (**L**) on the Sketch toolbar.

Step 6. Sketch the **5 lines**, **Fig. 34**.

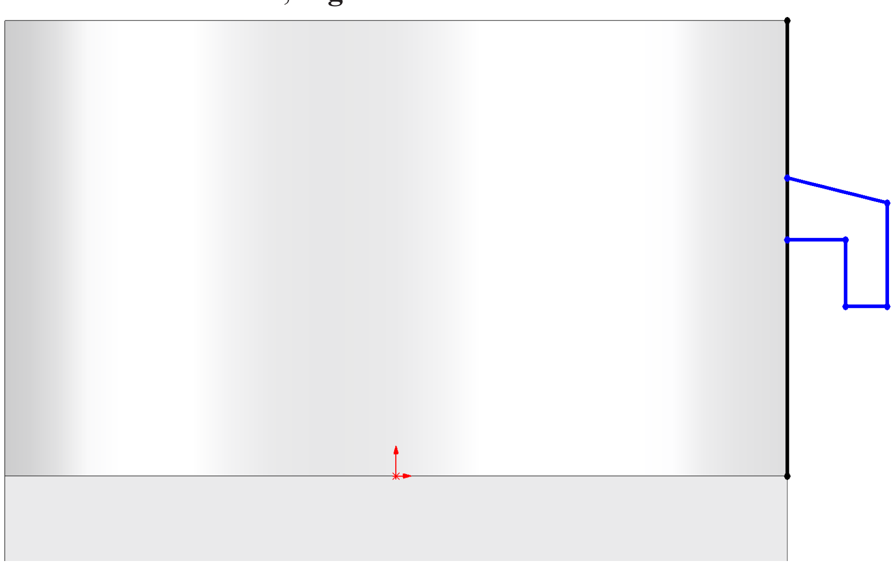
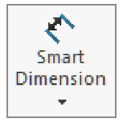


Fig. 34

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

Step 8. Add dimensions, **Fig. 35**.

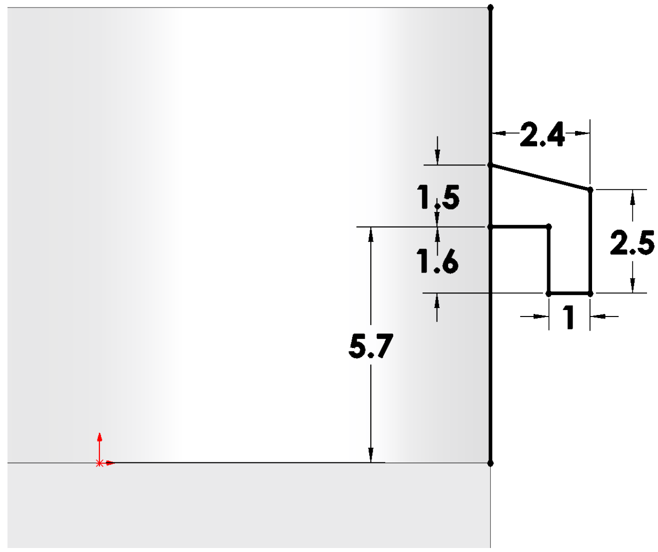
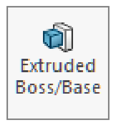
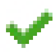


Fig. 35

Step 9. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 10. Click **Features**  on the Command Manager toolbar.

Step 11. Click **Extruded Boss/Base**  on the Features toolbar.

Step 12. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 36**
End Condition **Mid Plane**
Depth  **5**
under Selected Contours
click **contour**, **Fig. 37**
uncheck **Thin Feature**
click OK  .

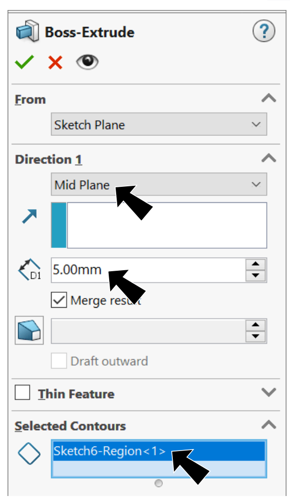


Fig. 36

Step 13. Save  (**Ctrl-S**).

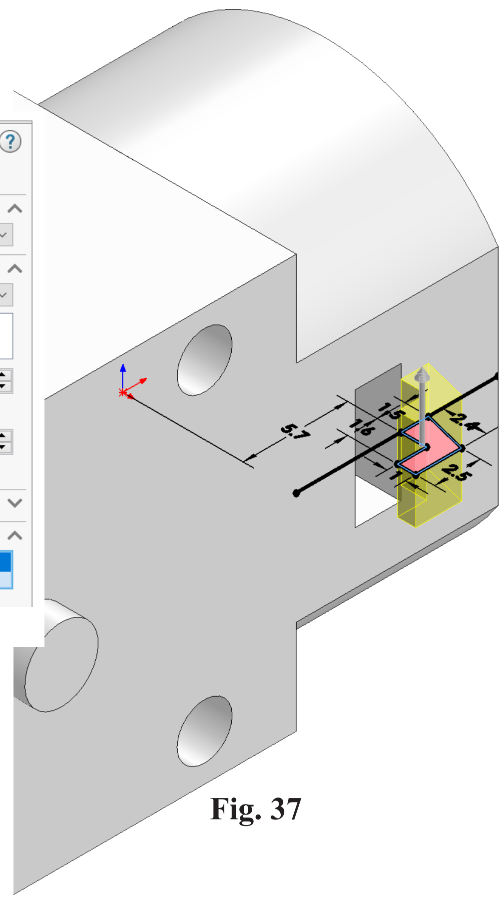


Fig. 37

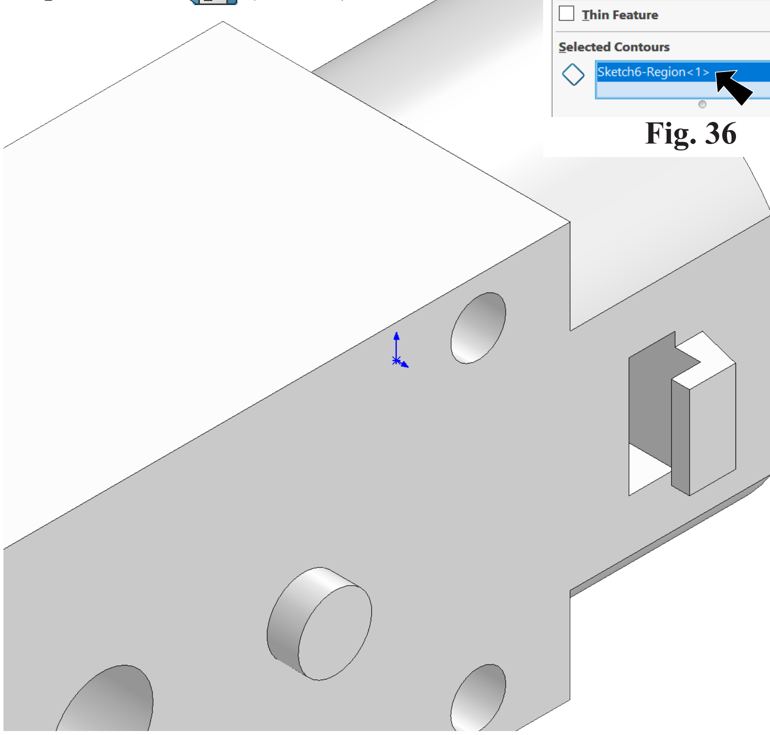


Fig. 38

H. Mirror Extrude4.

Step 1. **Ctrl click Right Plane** and **Boss-Extrude4** to select Plane and feature, **Fig. 39**.

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

Step 3. In the Mirror Property Manager click OK, **Fig. 40**.

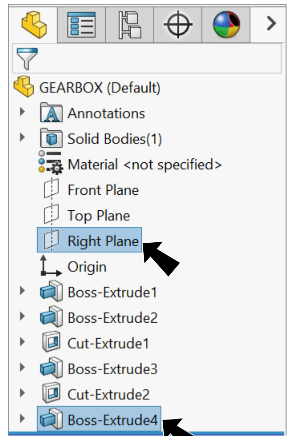


Fig. 39

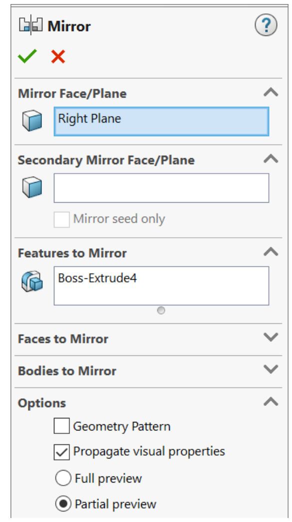


Fig. 40

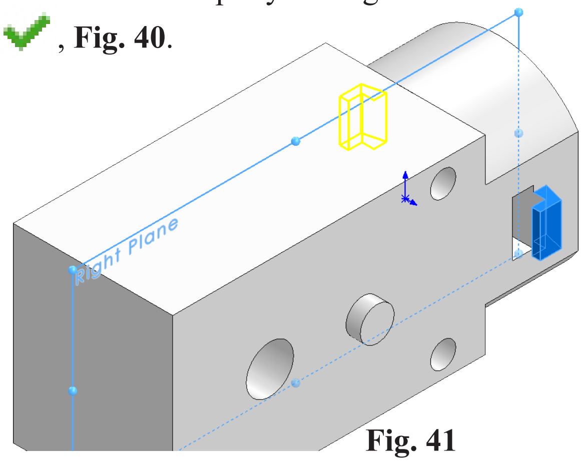


Fig. 41

I. Extrude5.

Step 1. Click **Right Plane** in the Feature Manager and click **Sketch** on the context toolbar, **Fig. 42**.

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

Step 3. Click **Center Rectangle** in the **Rectangle flyout** on the Sketch toolbar.

Step 4. **Sketch center rectangle on left side of body with right edge coincident with edge**, **Fig. 43**.

Step 5. **Unselect Rectangle tool**. To unselect, right click graphics area and click Select from menu.

Step 6. **Ctrl click centerpoint of rectangle** and **Origin** to select both. Release Ctrl key and click **Make Horizontal** on the context toolbar, **Fig. 44**.

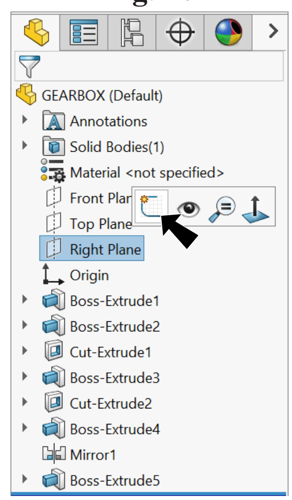


Fig. 42

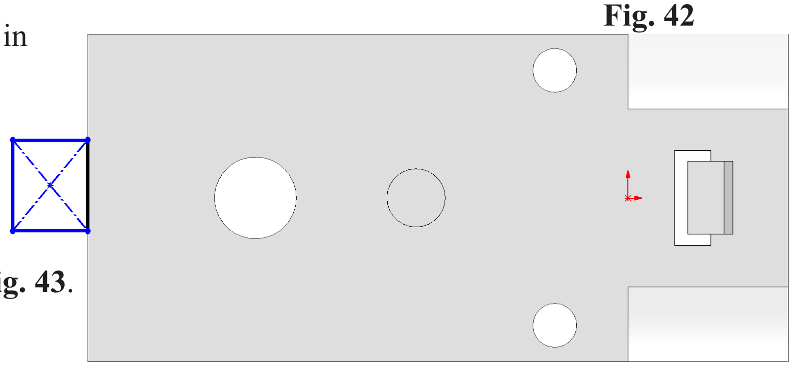


Fig. 43

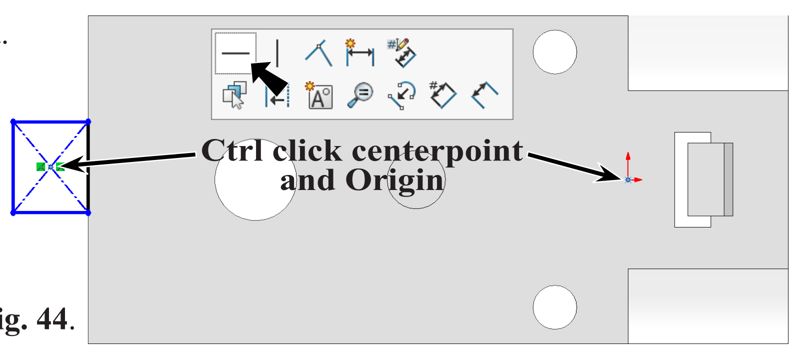


Fig. 44

Step 7. **Ctrl click two adjacent lines of rectangle** and click **Make Equal** on the context toolbar, **Fig. 45**.

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

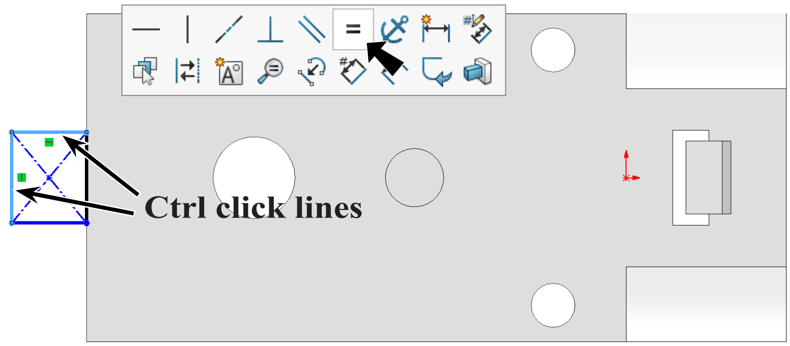


Fig. 45

Step 9. Sketch circle at centerpoint, **Fig. 46**.

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

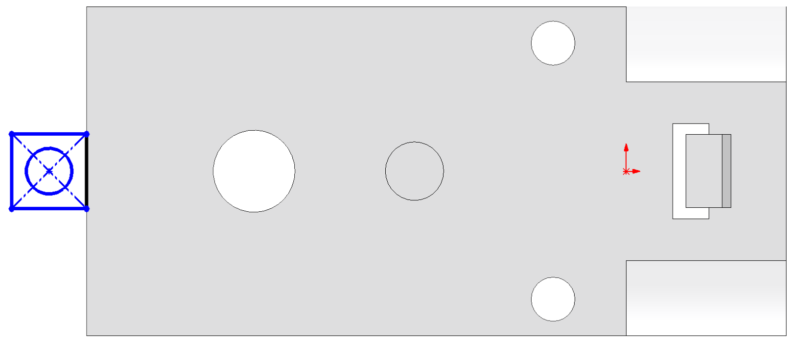


Fig. 46

Step 11. Add the dimensions, **Fig. 47**.

Step 12. Click **Isometric** on the Standard Views toolbar. (**Ctrl-7**)

Step 13. Click **Features** on the Command Manager toolbar.

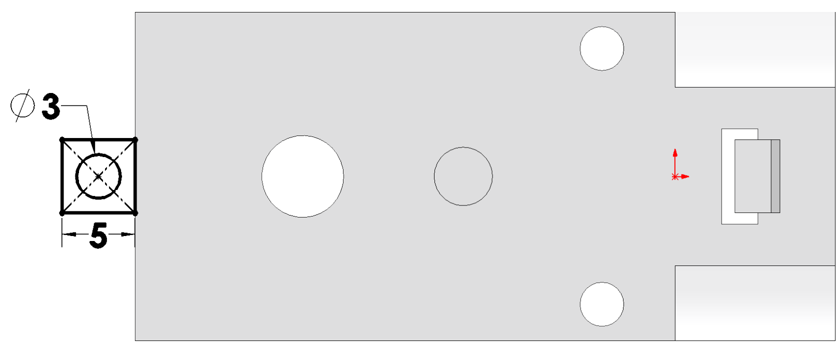


Fig. 47

Step 14. Click **Extruded Boss/Base** on the Features toolbar.

Step 15. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 48**
End Condition **Mid Plane**
Depth **2.5**
click OK.

Step 16. Save (**Ctrl-S**).

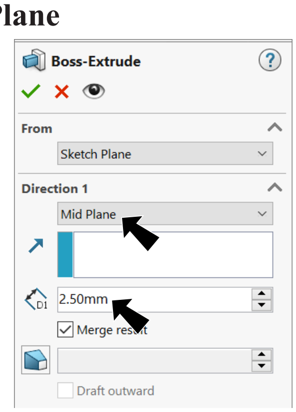


Fig. 48

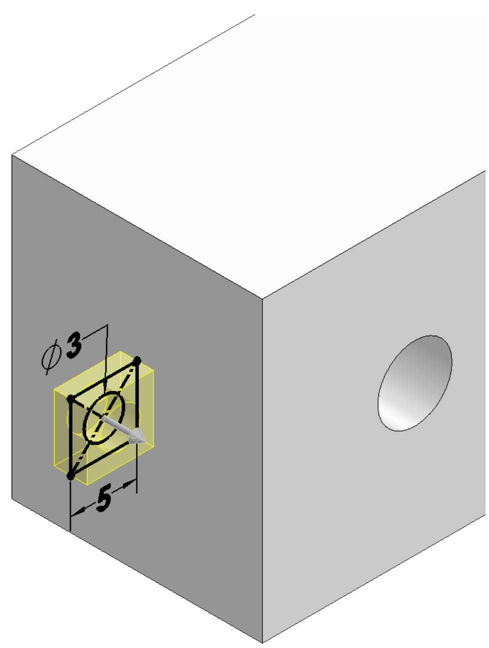


Fig. 49

J. Fillet Edges.

Step 1. Click **Fillet** on the Features toolbar.

Step 2. In the Fillet Property Manager set:
select **FilletXpert**, **Fig. 50**

① **Radius** 5
click **front top and bottom edges (2), Fig. 51**
click **Apply**

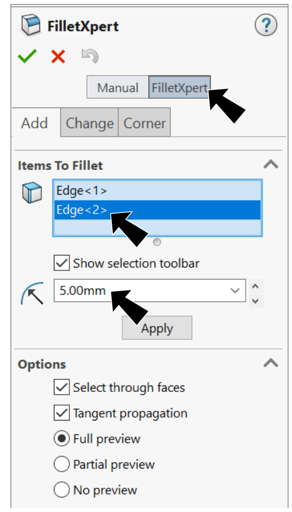


Fig. 50

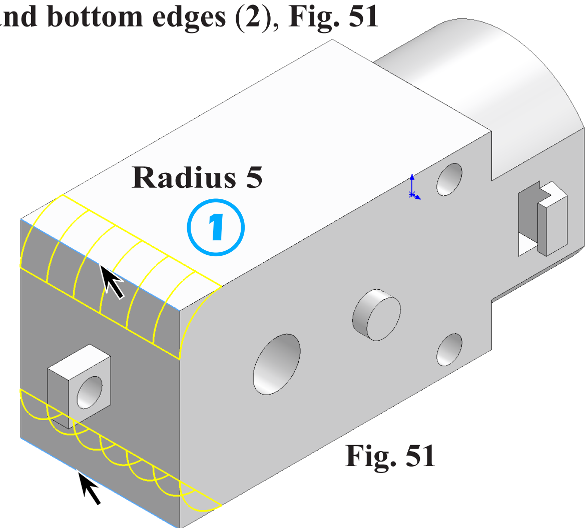


Fig. 51

② **Radius** .5, **Fig. 52**
click an **edge on Extrude1**, **Fig. 53**
click **Internal to feature** **13 edges** on the Fillet pop-up
click **Apply**

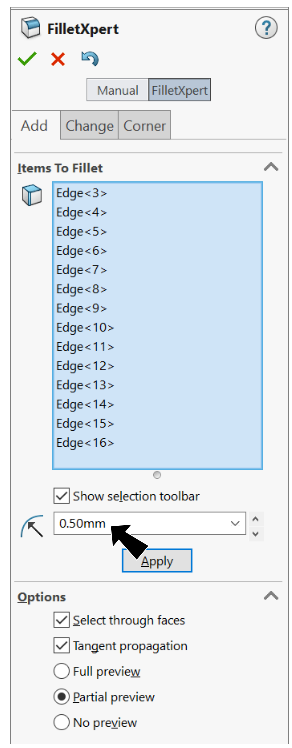


Fig. 52

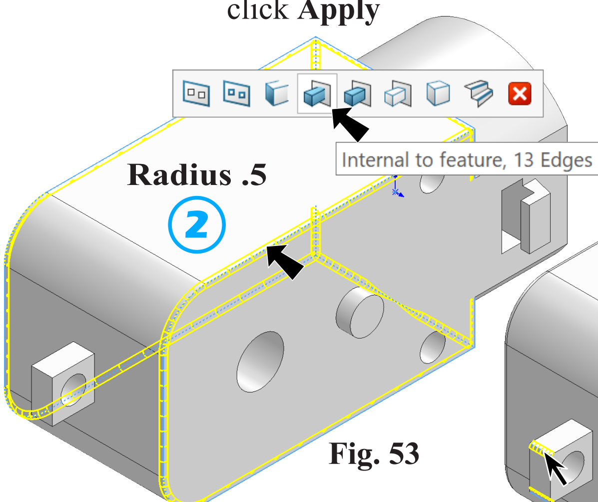


Fig. 53

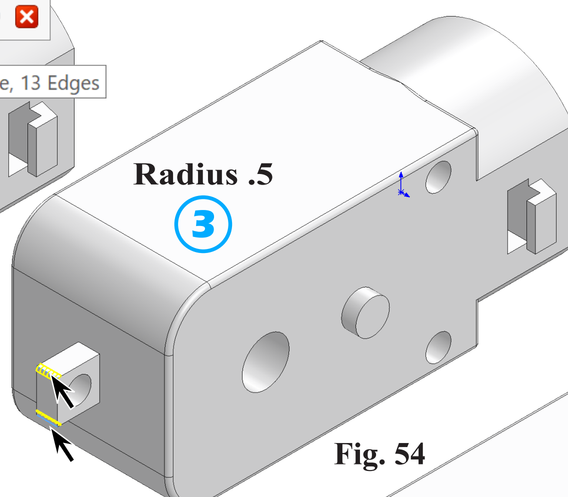


Fig. 54

③ Click **top and bottom front edges on Extrude5 (2), Fig. 54**
click OK .

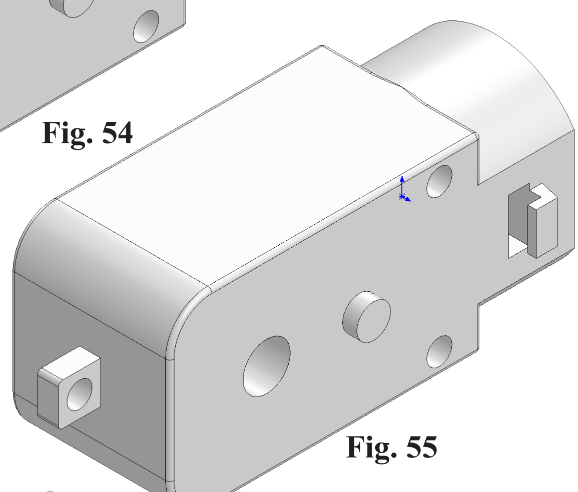


Fig. 55

Step 3. Save **(Ctrl-S)**.

K. Appearance Yellow.

Step 1. Click the Gearbox to select part, click **Appearances Callout** on the context toolbar and click **Gearbox**, **Fig. 56**.

Step 2. In the Appearances Task pane, expand **Plastic**, click **High Gloss** and in the lower pane select **yellow high gloss plastic**, **Fig. 57**.

Step 3. In the Appearances Property Manager:
under Color, **Fig. 58**
set **RGB values:**
R 255
G 228
B 51
click OK .

Step 4. Save **(Ctrl-S)**.

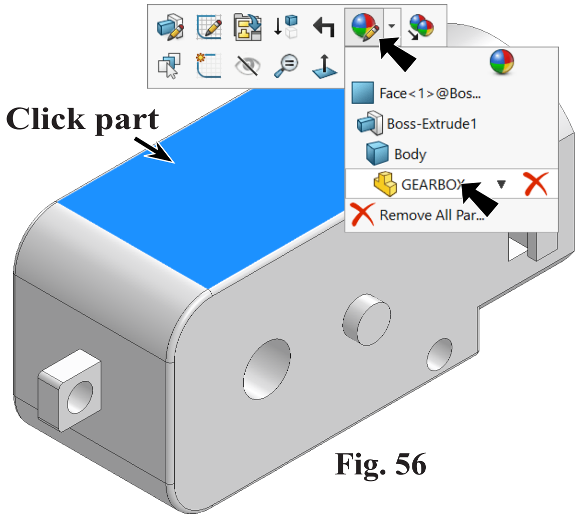


Fig. 56

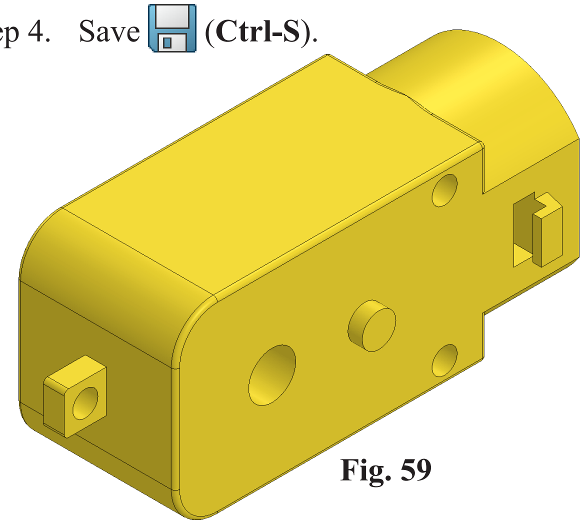


Fig. 59

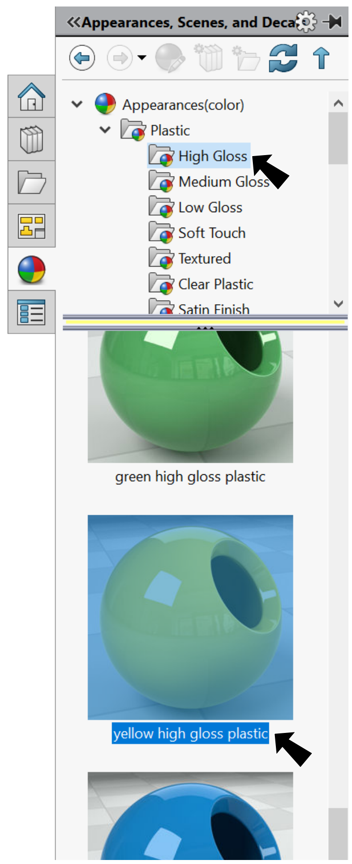


Fig. 57

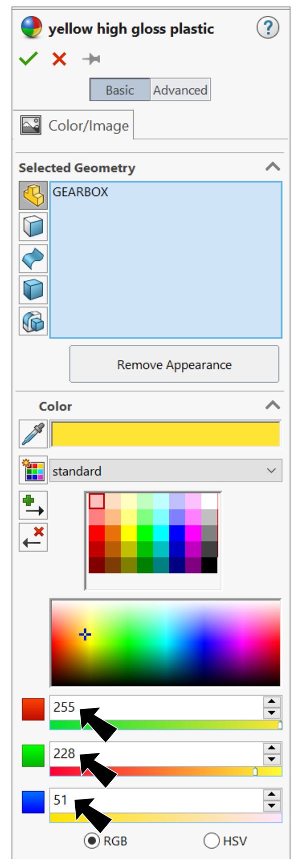


Fig. 58