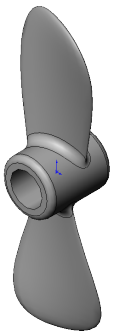
Chapter 16

Boat
Propeller



A. Base for Blade.

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

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

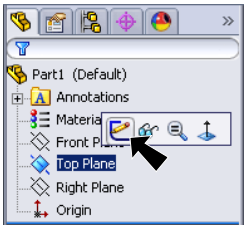


Fig. 1

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

Step 4. Starting from the Origin draw ellipse, **Fig. 2**. To draw ellipse, **click Origin to place the center** of the ellipse. **Drag out to right** and click to set the major axis. **Drag down** and click again to set the minor axis.

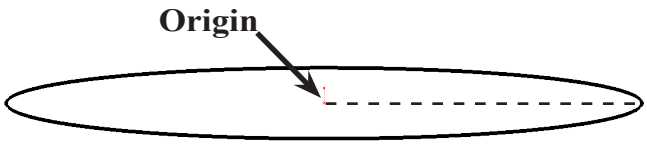


Fig. 2

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

Step 6. **Dimension ellipse** as shown in **Fig. 3**. Zoom in and adjust dimensions as shown in **Fig. 3**. Use **F** key to Fit and **Shift-Z** several times to zoom-in.

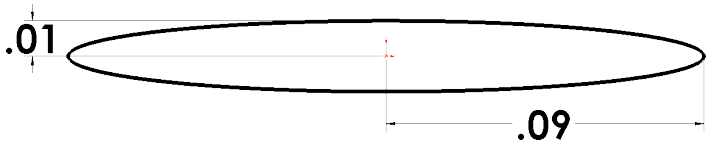


Fig. 3

Step 7. Click **Exit Sketch** on the Sketch toolbar.

B. Save as "PROPELLER".

Step 1. Click File Menu > Save As.

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

© Cudacountry.net Tech Ed
http://www.cudacountry.net email:cudacountry@hotmail.com

C. Create Plane.

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

Step 2. Click **Top Plane** in the Feature Manager, **Fig. 4** and **Fig. 5**.

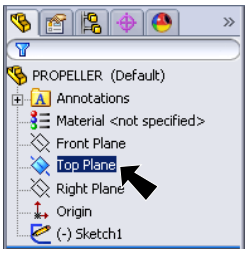


Fig. 4

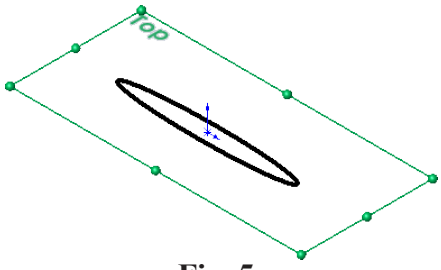


Fig. 5

Step 3. **Ctrl drag edge of Top plane** in drawing area up and release, **Fig. 6**. To Ctrl drag, hold down Ctrl and drag plane up.

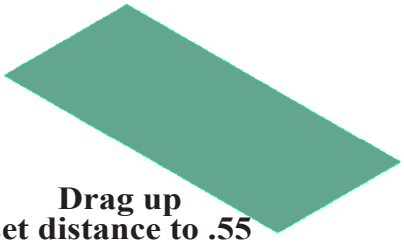
Step 4. In the Plane Property Manager set:

Distance **.55** and press **ENTER**, **Fig. 7**

click **Zoom to Fit** on the View toolbar

the new plane should be **above sketch**, **Fig. 9**, if in wrong direction, check Flip, **Fig. 7**.

click OK , **Fig. 6**



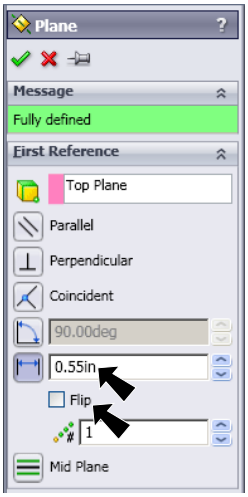


Fig. 7

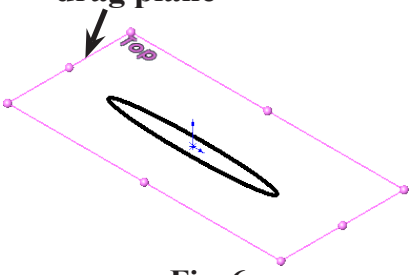


Fig. 6

D. Create Sketch in Plane 1.

Step 1. Click **Plane 1** in the Feature Manager and click **Sketch** from the Content toolbar, **Fig. 8**.

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

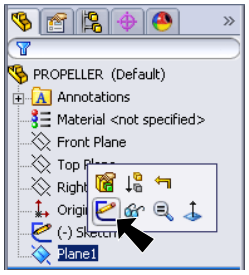
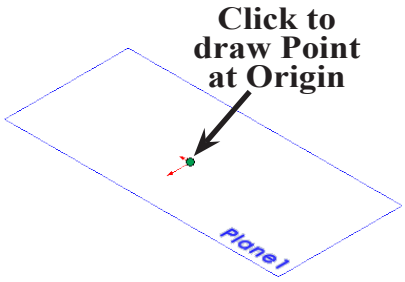


Fig. 8



Step 3. Draw a Point at the Origin , **Fig. 9**. Don't draw any extra Points.

Step 4. Click **Exit Sketch** on the Sketch toolbar.

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

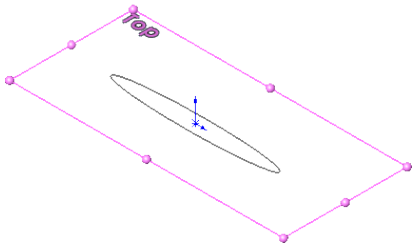


Fig. 9

E. Loft.

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

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

Step 3. In the Surface-Loft Property Manager:
under **Profiles**
click:
Point in Sketch2
Ellipse in Sketch1, **Fig. 11**

expand Start/End Constraints, **Fig. 10**

under Start/End Constraints:
set **Start constraint:**
Normal to Profile
set **Start Tangent Length: 10**

set **End constraint:**
Normal to Profile
set **End Tangent Length: 1.2**
click OK .

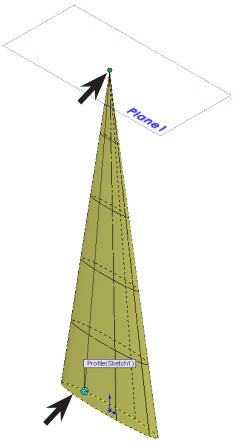


Fig. 11

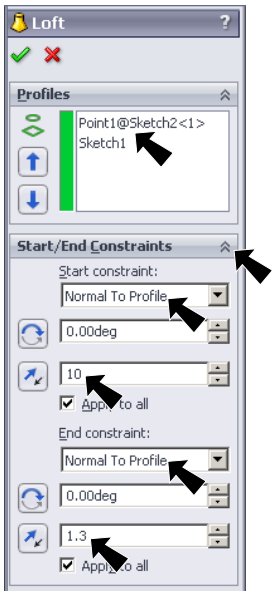


Fig. 10

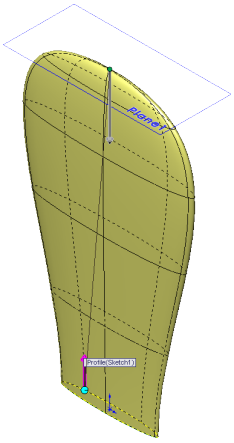


Fig. 12

F. Hide Plane1.

Step 1. **Plane1** in Feature Manager click **Hide** on the Content menu, **Fig. 13**.

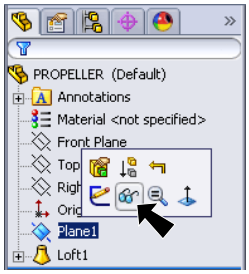


Fig. 13

G. Flex Blade.

Step 1. Click Insert Menu > Features > Flex.

Step 2. In the Flex Property Manager:
under **Flex Input**
click the **Loft in drawing area**
Fig. 15
select **Twisting**, **Fig. 14**
Angle **-40 degrees**
click OK .

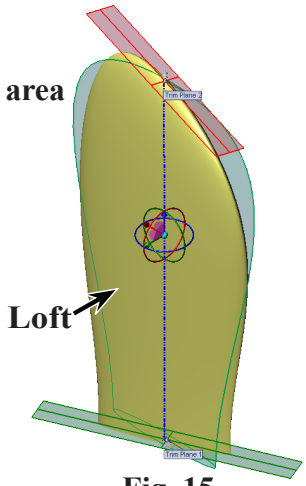


Fig. 15

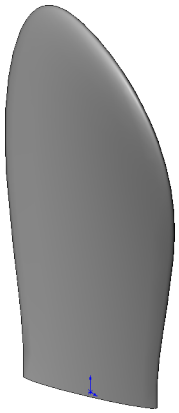


Fig. 16

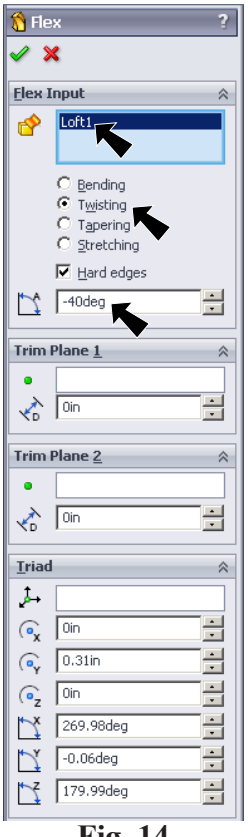


Fig. 14

H. Hub.

Step 1. Click **Front Plane** in the Feature Manager and click **Sketch** from the Content toolbar, **Fig. 17**.

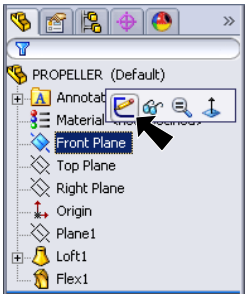


Fig. 17

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

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

Step 4. Draw a circle for the hub starting at Origin , **Fig. 18**.

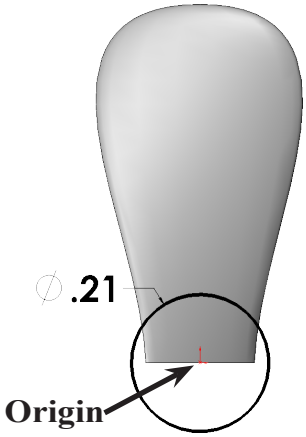


Fig. 18

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

Step 6. Dimension circle **diameter .21** as shown in **Fig. 18**.

I. Extrude Hub.

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

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

Step 3. Click **Isometric** on the View toolbar. (**Ctrl-7**)

Step 4. In the Property Manager set:

End Condition to **Mid Plane**

Depth to **.25**

click OK , **Fig. 19** and **Fig. 20**.

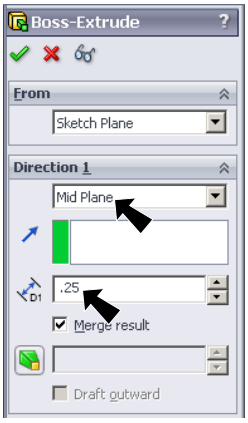


Fig. 19

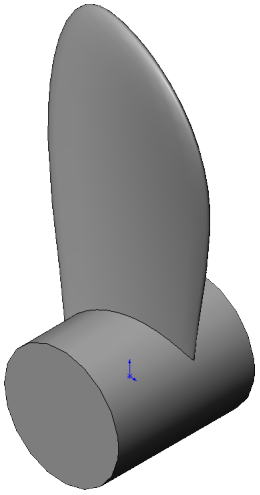


Fig. 20

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

J. Fillet Blade at Hub.

Step 1. Click **Fillet**

on the Features toolbar.

Step 2. In the Fillet Property Manager set:

Radius to **.03**

click edge of blade at hub, **Fig. 22**

click OK .

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

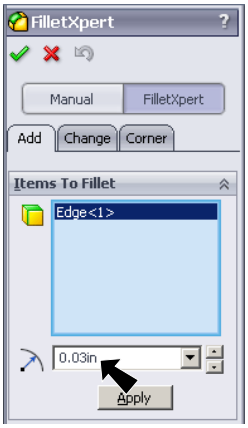


Fig. 21

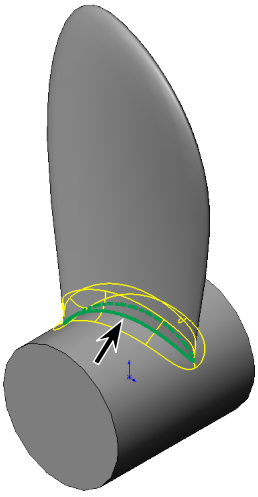


Fig. 22

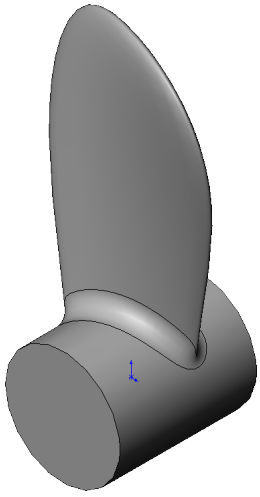


Fig. 23

K. Circular Pattern for Blade.

Step 1. Click View Menu > Temporary Axes. (**Alt-V X**)

Step 2. Click **Circular Pattern**

in the **Linear Pattern flyout**

on the Features toolbar. Be sure to click the **flyout arrow** to select Circular Pattern.

Step 3. In the Circular Pattern Property Manager set:

under Parameters,

Pattern Axis

click **Temp axis** in drawing, **Fig. 25**

Number of Instances to **2**

check **Equal spacing**, **Fig. 24**

under **Features to Pattern**

click **blade and fillet**, **Fig. 25**

under **Options**

check **Geometry pattern**, **Fig. 24**

select **Full preview**

click OK , **Fig. 26**.

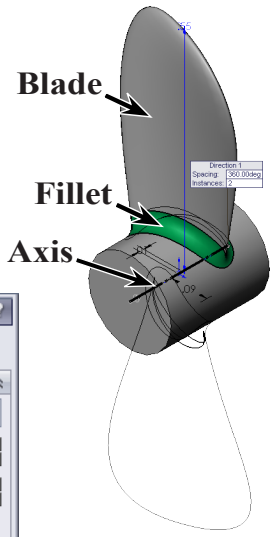


Fig. 25

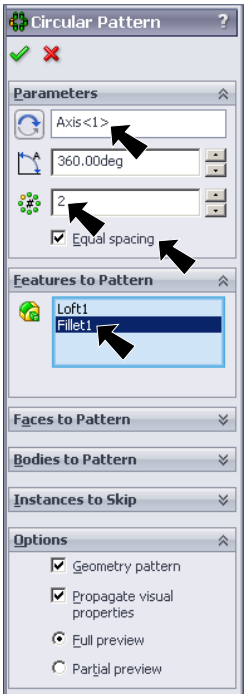


Fig. 24

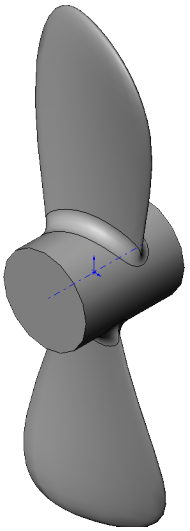


Fig. 26

L. Hole.

Step 1. **Turn off** Temporary Axes. Click View Menu > Temporary Axes. (**Alt-V X**)

Step 2. Click **front face of hub** and click **Sketch** on the Content menu, **Fig. 27**.

Step 3. Click **Normal To** on the Standard Views toolbar.

Step 4. Click **Circle** (**S**) on the Sketch toolbar.

Step 5. Draw a circle for the hole starting at the Origin, **Fig. 28**.

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

Step 7. Dimension the **diameter .13** as shown in **Fig. 28**.

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

Step 9. Click **Extruded Cut** on the Features toolbar.

Step 10. In the Property Manager set:
End Condition to **Through All**
click OK, **Fig. 29**
and **Fig. 30**.

Step 11. Save. Use **Ctrl-S**.

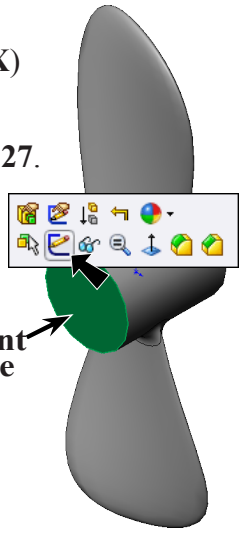


Fig. 27

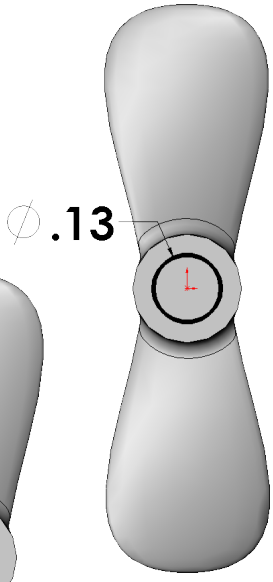


Fig. 28

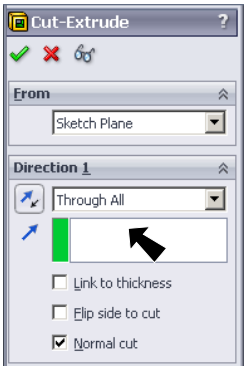


Fig. 29

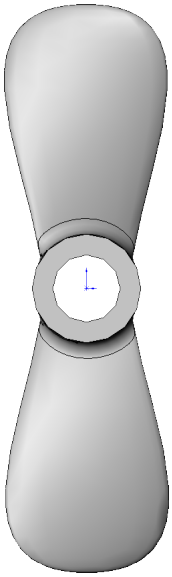


Fig. 30

M. Fillet Hub Edges.

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

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

Step 3. In the Fillet Property Manager set:

Radius to **.02**
click **front and back edges** of hub, **Fig. 32**
click OK.

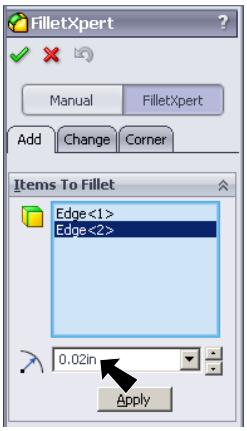


Fig. 31

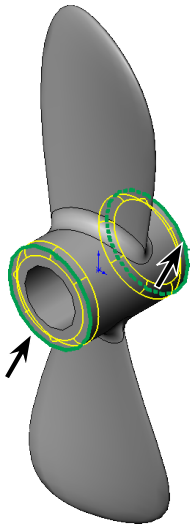


Fig. 32

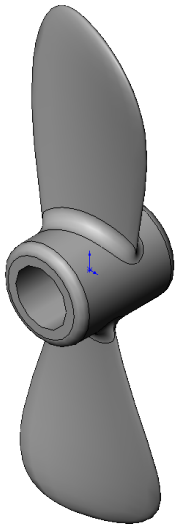


Fig. 33

N. Material POM Acetal Copolymer.

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

Step 2. **Expand Plastics** in the material tree and select **POM Acetal Copolymer**. Click **Apply** and **Close**.

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

O. Insert into POWER TRAIN ASSEMBLY: Propeller Shaft, Coupling and Propeller .

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

Step 2. Rotate view as shown in **Fig. 34**. Hold down middle mouse button (wheel) and drag.

Step 3. Click **Insert Components** on the Assembly toolbar.

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

Step 5. Click **Browse** and insert **Prop Shaft**, **Coupling** and **Propeller** as positioned in **Fig. 34**.

Step 6. Use the **Zoom to Area** in the View toolbar to drag a zoom window around the **Motor shaft and Prop**, **Fig. 34**.

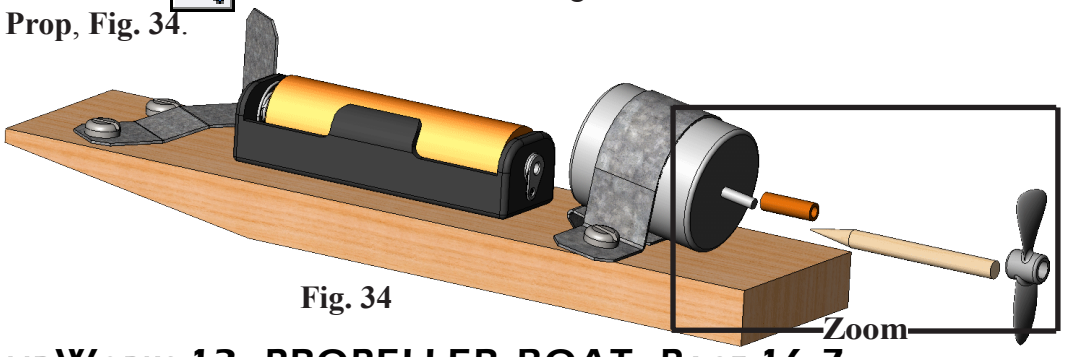


Fig. 34

P. Mate: Prop Shaft, Coupling and Prop.

Step 1. Click **Filter Faces** (**X**) on the **Selection Filter toolbar** at the bottom of the display, **Fig. 35**. If necessary use **F5** key to display the toolbar.

Fig. 35

Step 2. Click **Mate** on the Assembly toolbar.

Step 3. Click **cylindrical face of Prop Shaft** and **inside cylindrical face of Prop hole**, **Fig. 36**.

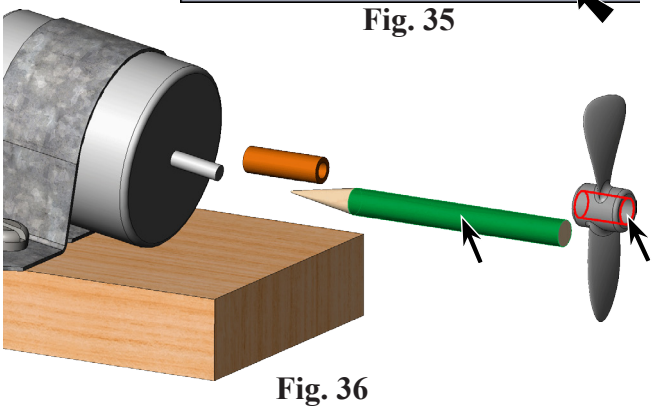


Fig. 36

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

Step 5. Click **end face of Prop Shaft** and **end face of Prop**, **Fig. 37**.

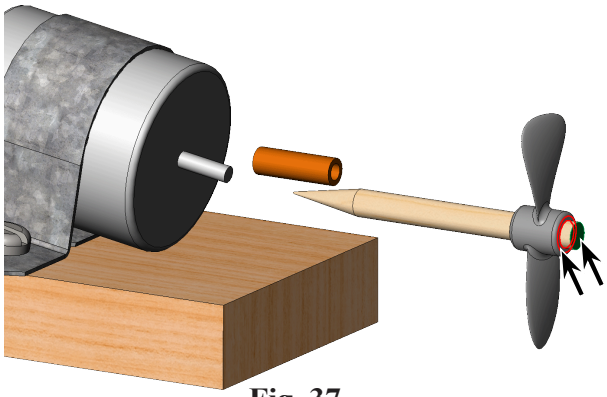


Fig. 37

Step 6. Click Add/Finish Mate to add **Coincident** mate.

Step 7. **Right click cylindrical face of Coupling** and click Select Other from the menu, **Fig. 38**.

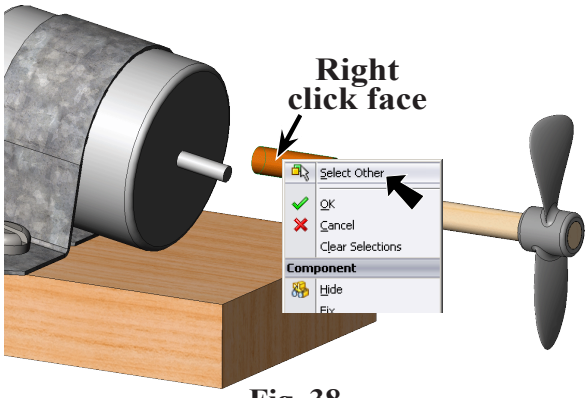


Fig. 38

Step 8. Click **front face of Coupling and back face of Motor**, **Fig. 39**.

Step 9. Click **Distance** in Mate pop-up, **Fig. 40**. Set **distance to .05** and press ENTER. The Coupling should **extent .05 from Motor**, **Fig. 41**. If positioned in opposite direction, click **Flip Dimension** in the Mate pop-up, **Fig. 40**. Click Add/Finish Mate to add Distance mate.

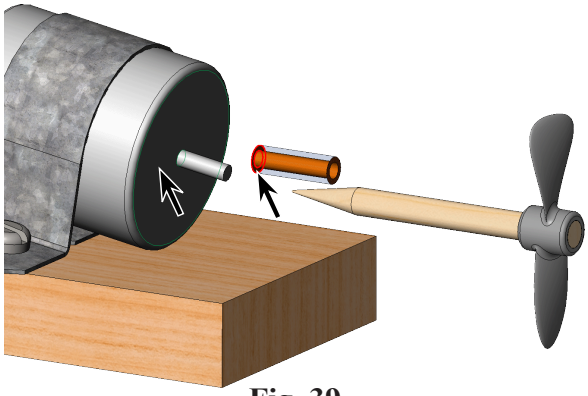


Fig. 39

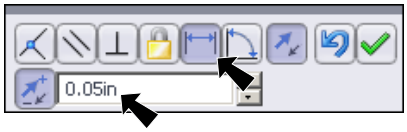


Fig. 40

Step 10. Click **cylindrical face of Motor Shaft** and **inside cylindrical face of Coupling hole**, **Fig. 41**.

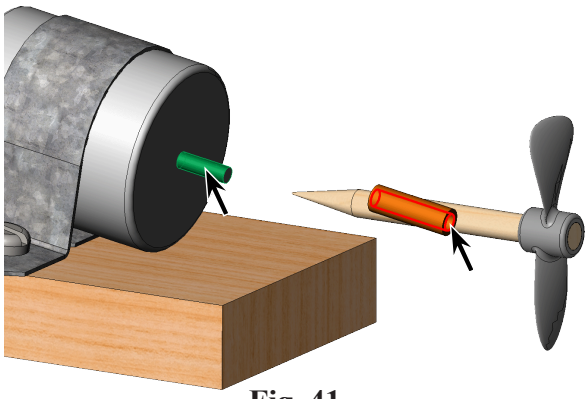


Fig. 41

Step 11. Click Add/Finish Mate in Mate pop-up toolbar to add a **Concentric** mate.

Step 12. Turn **off** Filter Faces. Click **Filter Faces** (**X**) on the **Selection Filter toolbar** at the bottom of the display, **Fig. 42**.

Fig. 42

Step 13. Click **cone face of Prop Shaft** and **inside edge of Coupling hole**, **Fig. 43**.

Step 14. Click Add/Finish Mate in Mate pop-up toolbar to add a **Coincident** mate, **Fig. 44**.

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

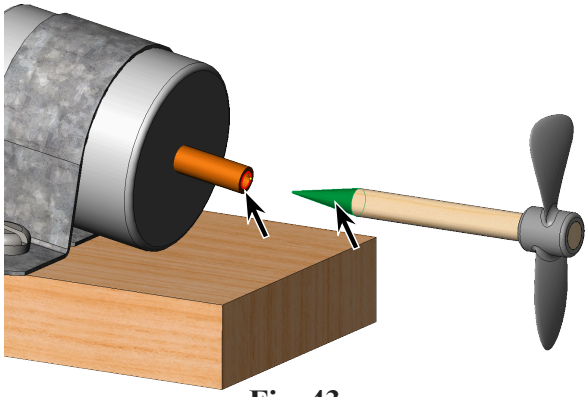


Fig. 43

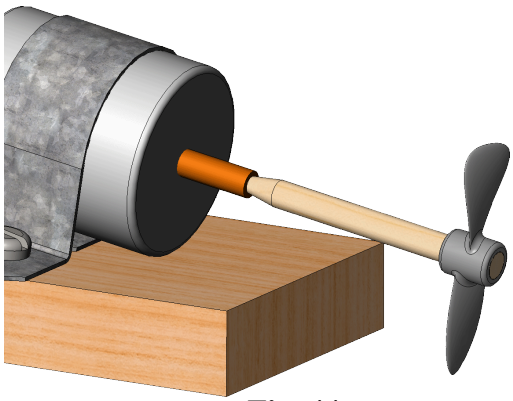


Fig. 44