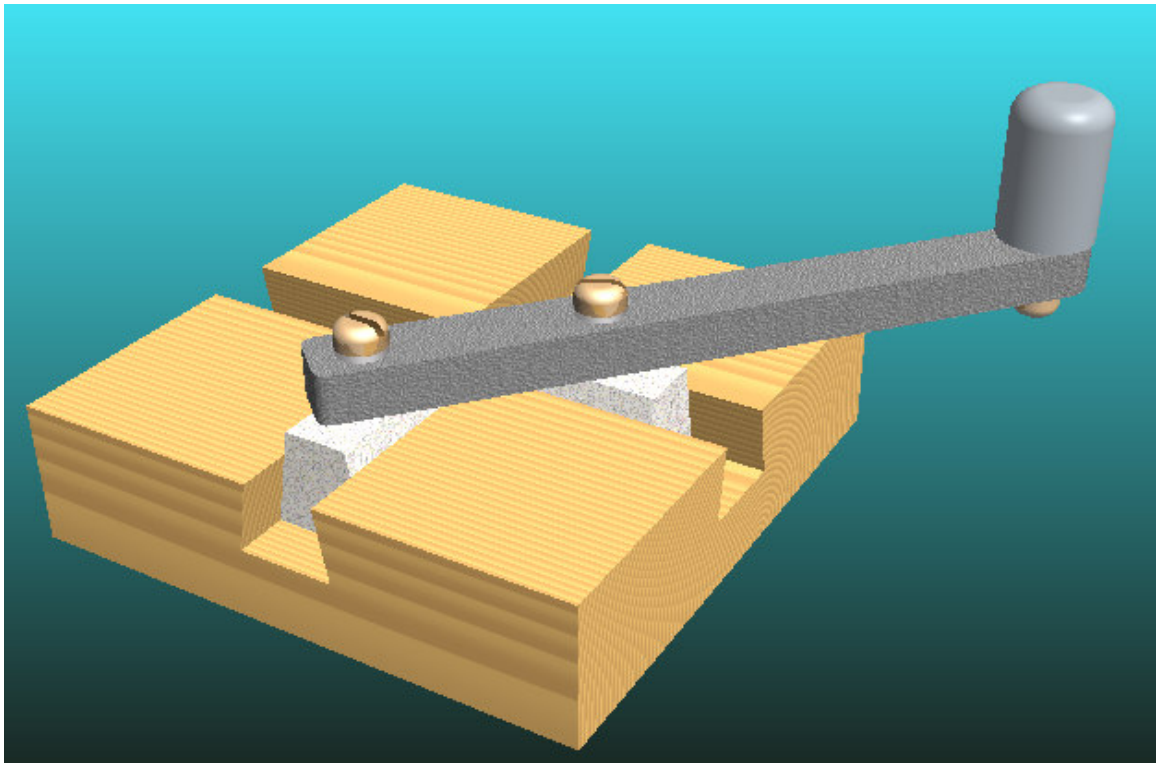
Dovetail Grinder

Pro/DESKTOP version 8

Subject – Design and Assembly

Prepared by: James Siggaard



What you should be familiar with before starting this tutorial.	**What you will learn by completing this tutorial.**

➢ Windows OS and PCs
  ○ Left-click
  ○ Right-click
  ○ Double-click
  ○ Middle-click or scroll-wheel use
➢ Basic ProDESKTOP tutorials
➢ X, Y, Z coordinates
➢ Saving files
	➢ Pro/DESKTOP 2000i GUI
	➢ Opening new Pro/Desktop 2000i file
	➢ Simple sketches
	➢ Simple extrusions
	➢ Constraints
	➢ Selecting different viewing options
	➢ Assembling parts
	  ○ Mate
	  ○ Align
	  ○ Center Axis

This tutorial has been designed to reinforce fundamentals of Pro/DESKTOP 8 GUI. The goal of this project is to complete a multi-part project and assemble the parts. When you complete the parts to this project you will be shown how to modify the design by applying the modifying features. Once all of the parts have been designed to specifications, an assembly design will bring the parts together to complete the project. Good luck!

Conventions of this Tutorial

Since most people who attempt this tutorial will have had little exposure to Pro/DESKTOP, there are extensive descriptions operations and concepts. When features are first introduced, the tutorial will show the operations using icon-based instructions. Subsequent instructions will introduce keyboard shortcuts . These will be shown as capital letters within brackets [**]. Feature commands (extrude, revolve, etc.) will also be shown in brackets but with the Control key or Alternate key followed by a plus sign (+) as a preface, and multiple key strokes will be separated by a comma (,).

Example: to create an extrusion using keys rather than the icon, one would first press down the Alt key, then while holding it, press and release the R key once, then press and release the E key, and finally release the Alt Key.
In notation form, extrusion looks like this: [Alt + R, E].

Sequential operations will be indicated by commands separated by an arrow [>]. For example, the following command "[C] > Drag a circle" means – type the letter "C" key on your keyboard to select the circle sketching tool, and then drag a circle.

Set Up

There are a few things you will need to do to get your computer ready for this tutorial. This project has been done in INCHES. The first thing you will need to do is make sure that the unit of measurement on your computer is set to inches.

FIRST

Open **Pro/DESKTOP**
Start > Programs > **PTC Pro/DESKTOP 8**
(or double click on the computer desktop icon).
From the **Tools** menu > go **Options**.
Select the Units tab > change the units to Inches in both fields > OK.

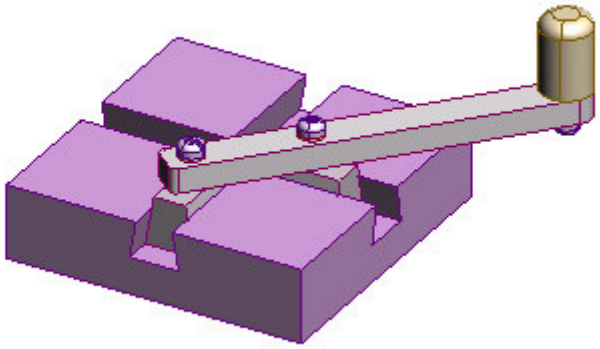
OPEN a new design

Select "File," then "New," and "Design" from the pop up menu [Ctrl N]. This will start a New design for you.

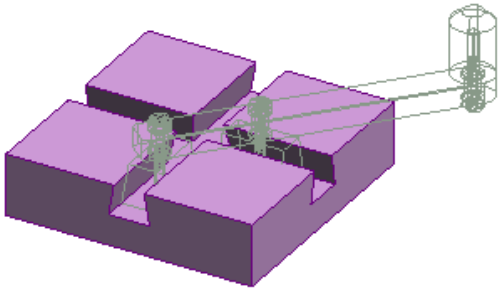
End Product

This is what your final project will look like. It consists of six different parts.

(1) 1 – block
(2) 2 – sliders
(3) 1 – handle
(4) 1 – knob
(5) 3 – screws
(6) 6 – washers
(7) ---Assembly



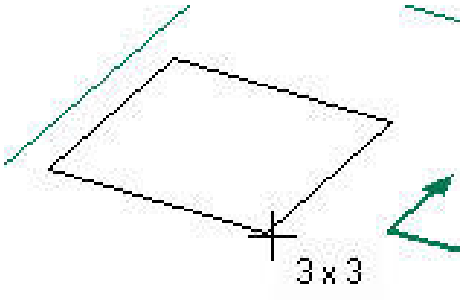
On the next few pages you will create each of the parts separately. Similar parts like the washers only need to be designed once but will be "brought into" the assembly six times. In the final part of the tutorial you will assemble all the parts to make the final project. Assembling parts is a manufacturing process.



BLOCK

1. Create a Square

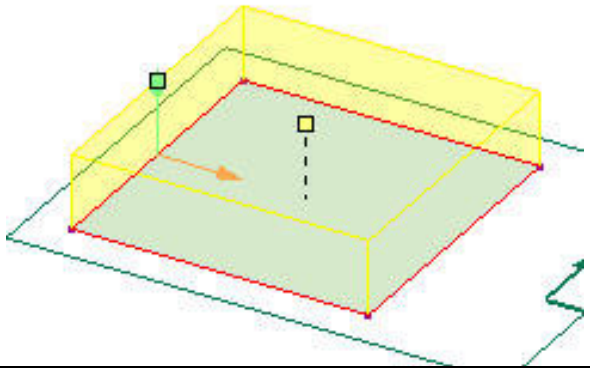
- Click on the rectangle tool , [R] and [shift] > drag a square. By holding the shift key while you drag you will get a square. The courser-tracking tool will tell you when your square is 3".



2. **Extrude the square**

- Click on the extrude tool  , [Alt R + E] to bring up another dialog box.

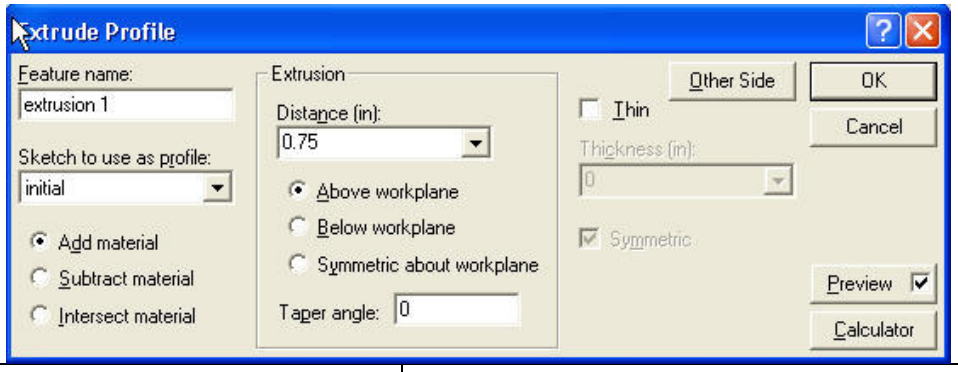
Note: Find the yellow handle inside the square. Click and drag this handle to make the square 3-D. This is one method you can use to size your block.



More accurately you can look in the dialog box (below) to enter the values for the height of the block. Enter these values into your dialog box:

- Add material: distance 0.75
- Above the workplane
- OK.

There should be a three-dimensional block 3"X3"X3/4" on your computer screen.

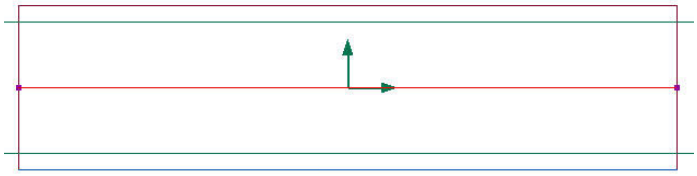


3. **Dovetail grooves**

- Click on the Select faces tool  , [F] > select one of the 4 short sides of the block.
- Right click and select "New sketch" from the menu.
- Name the sketch "dovetail 1" and the workplane "side 1" enter "OK.

4. Construction lines

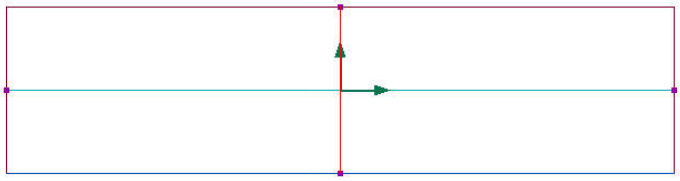
- [Shift W] to view onto workplane.
- [Shift A] or auto-scale to fill the screen.
- Click on the straight-line tool  , [S] and draw a line from the midpoint of the left side to the midpoint of the right side.



Note

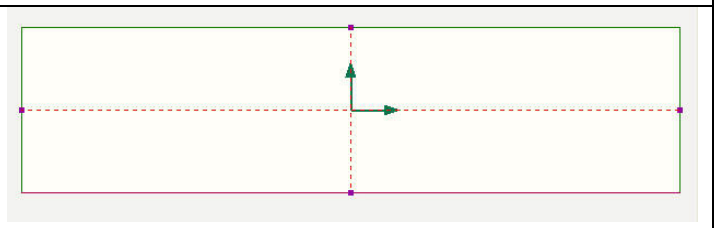
- You can tell when the midpoint is selected by the large black Square that appears at the midpoint of the line.
- It is easier to create the vertical and horizontal line by holding the [Shift] while dragging the line.

5. Repeat the steps to make a vertical line through the top and bottom midpoints.



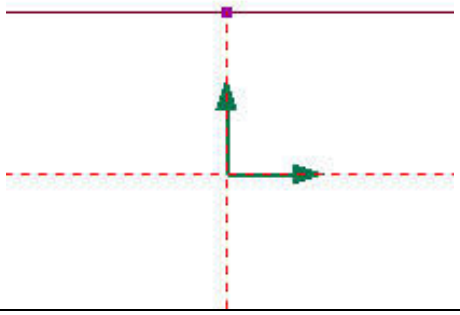
6. Convert to Construction Lines

- Click on the select line tool  **[L]** then hold **[Shift]** and select both lines.
- From the file menu select "line" and "Toggle Construction" **[Ctrl + G]**.



7. Zoom

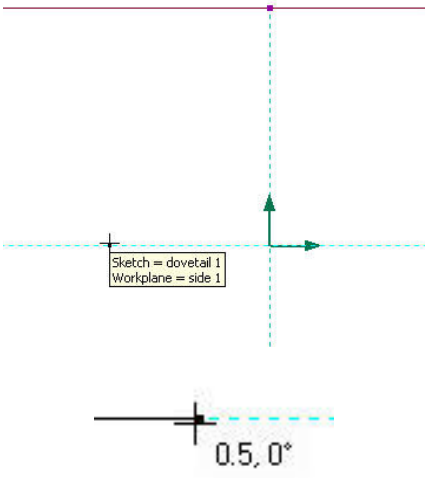
- Click on the zoom tool  **[Shift + Z]** to enlarge the middle of the block or roll the wheel on your mouse if it is equipped with one.



8. Dovetail sketch

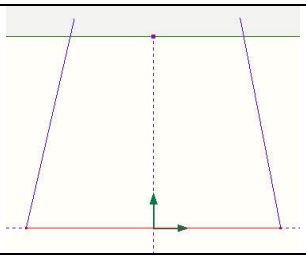
- Click on the straight-line tool , **[S]** and find the point on the horizontal construction line so the snap to grid records On Line (-0.25, 0). Start your line.
- Finish the line at On Line (0.25, 0).

Notice the courser readout.
It tells you that the line is 0.5" long at zero degrees.



9. Angled lines

- Draw two lines angled like the ones in the picture.

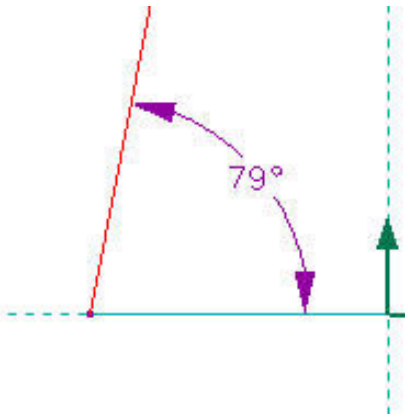


10. Toggle fix

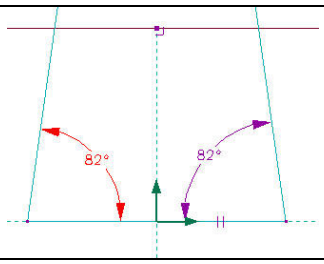
- Select the bottom line (it will be red) then from the file menu select "constraints" and toggle fixed [Ctrl + F]. This will assure that the horizontal line does not move.

11. Constraining angles

- Click on the "Sketch Dimension" tool , **[Z]**. Select the bottom line then select one of the angled lines > drag an angular dimension.
- Click on the select constraints tool , [N] and double click on the dimension box > A dialog box will appear.
- In this dialog box enter 82 as the angle then "OK".

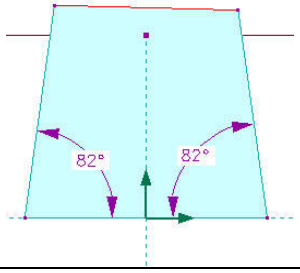


12. Repeat the steps for the other angle



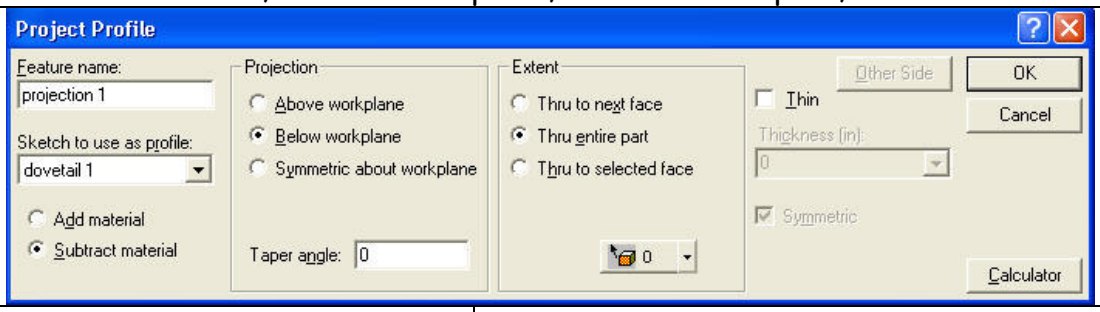
13. Valid Profile

- **[S]** > Connect the tops of the angled lines with a fourth line to complete a valid profile. If your profile is valid the inside will become shaded.



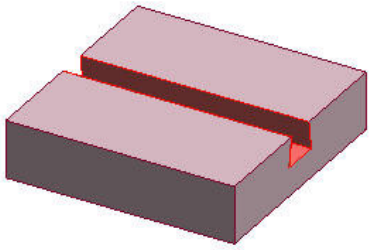
14. Project a Profile

- Click on the "Project Profile" tool  , **[Alt + R, J]**. Enter the values "Subtract material," "Below workplane," "Thru entire part," and "OK" as below.



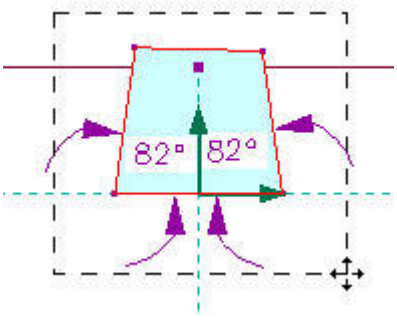
15. View Trimetric

- **[Shift + T]** to view at a trimetric angle. Now you can see the groove all the way through the block.



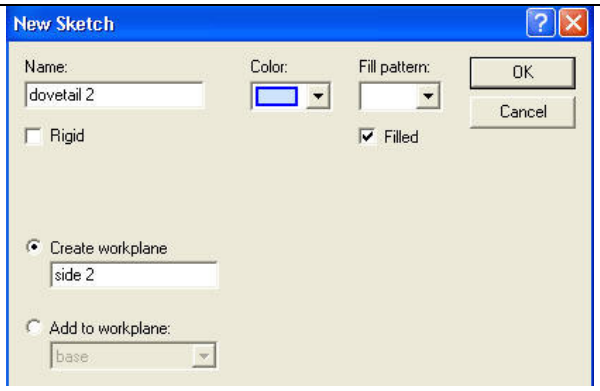
16. **Repeat or Copy**

- Repeat the steps for making the groove on an adjacent side or [Shift + W] to view onto workplane > [Shift + A] to autoscale > then click on the select line tool  , [L] and drag a box around the dovetail, [Ctrl + C] will copy it.



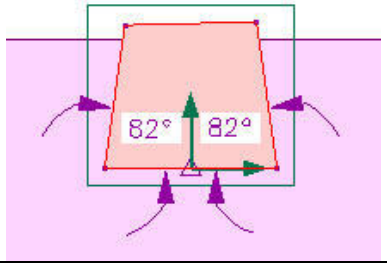
17. **Select adjacent side**

- Type [Shift + T] > [Shift + A] > click on the Select faces tool  , **[F]** and select an adjacent side face. Right click and select "New Sketch." Name the new sketch "dovetail 2," and the workplane "side 2" and click "OK."



18. **Paste the dovetail**

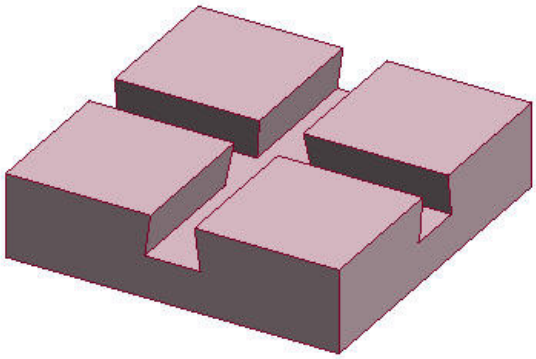
- **[Ctrl + V]** to paste the dovetail onto the new sketch then select the



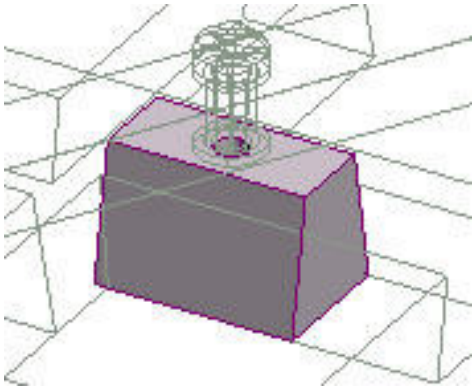
19. Click on the project profile tool  , **[Alt + R, J]**. Enter the values "Subtract material," "Below workplane," "Thru entire part," and "OK".

20. Save it in a folder

- Open a new folder where you will find it easily, name it "Dovetail Grinder"
- [Ctrl + S] to save. Call it **block** and save in newly created folder.



By now it should be evident that when you see a tool icon (such as ) you may either click on this icon or type in the keyboard shortcut. For this reason, the words "click on the" will be eliminated from the text box. The tool name, icon, and keyboard shortcut will still appear in that order.



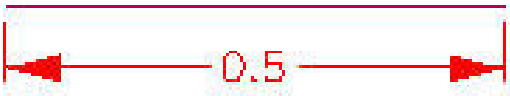
SLIDE

1. Slider

- Start a new design: [Ctrl + N]
- Straight line [S] > hold [Shift] and drag a line 0.5" from left to right.

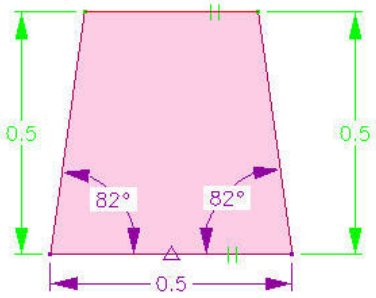
2. Adjust workplane position

- [Shift + W] > [Shift + A]
- Sketch dimension [Z], select the line and drag the dimension.
- With the line selected, toggle fix lines [Ctrl + F] to fix the line in one position.



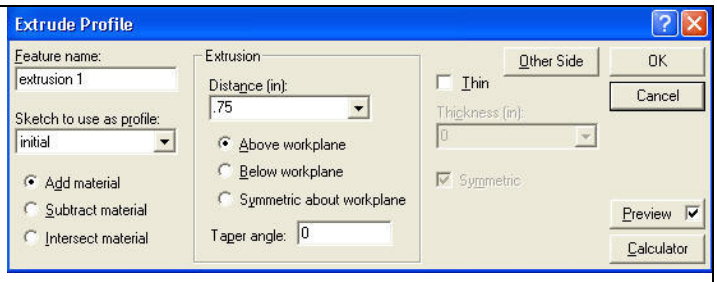
3. Draw angled lines

- Straight Line [S] > From each end of the horizontal line drag a line that is angled connected by a forth line at the center-top.
- Sketch dimension [Z] and dimension as pictured.



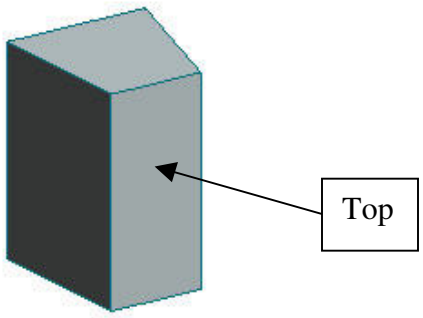
4. Extrude the profile

- Extrude profile [Alt + R, E] and enter the values "Add material," at a distance of "0.75," "Above workplane," and "OK."



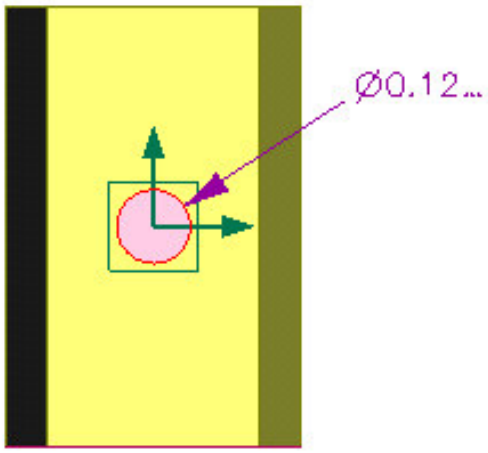
5. Add a New Sketch

- Select face [F] > Click on the top face.
- Right click > Select "New sketch." Name the sketch and the workplane "Hole" and "OK."

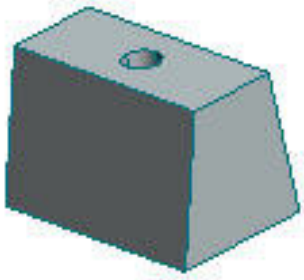


6. Drag a circle and extrude a shaft

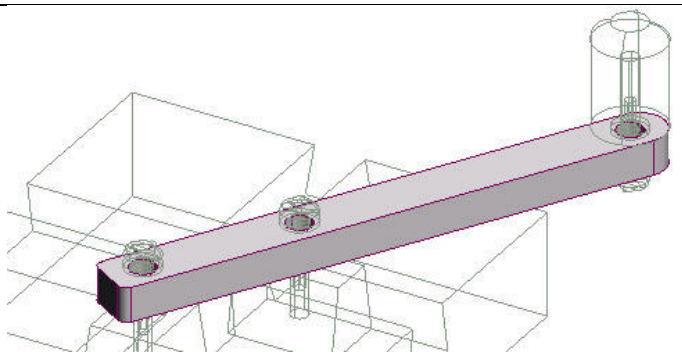
- Adjust workplane position [Shift + W, A].
- Circle [C] and drag a 0.125 (1/8) inch circle from the green axis lines.
- Sketch dimension [Z] if you cannot drag accurately.
- Extrude profile [Alt R, E] Subtract material, distance: "3/8," below the workplane, OK.



Save Slider to Dovetail Grinder folder.

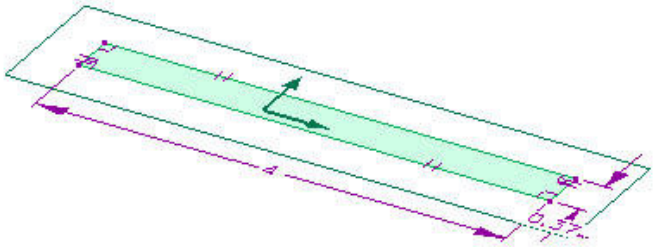


HANDLE



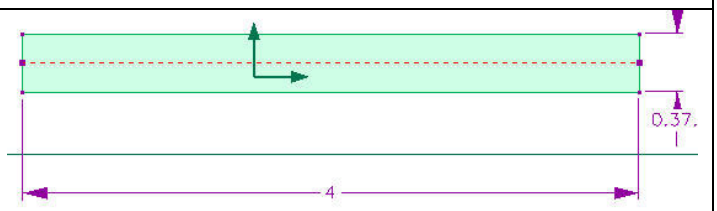
1. Open a new design

- [Ctrl + N]
- [R] > Drag a rectangle
- [Z] > Set the constraints to 4" and 0.375" as in the picture above.



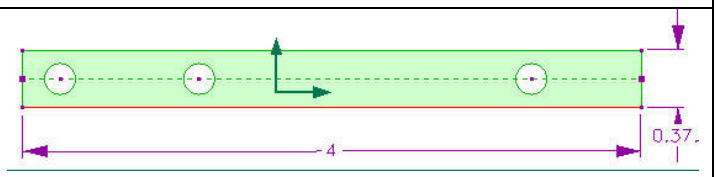
2. Construction Mid-line

- [S] > Drag a line from midpoint to midpoint along the length of rectangle.
- [Ctrl G] to toggle construction.



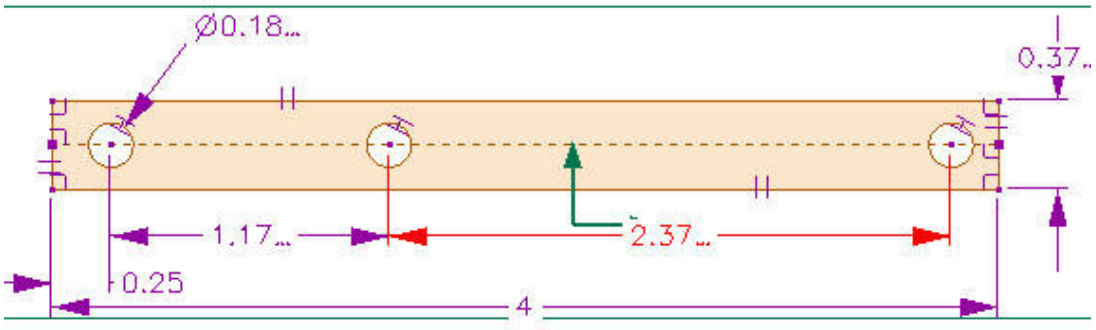
3. Circles

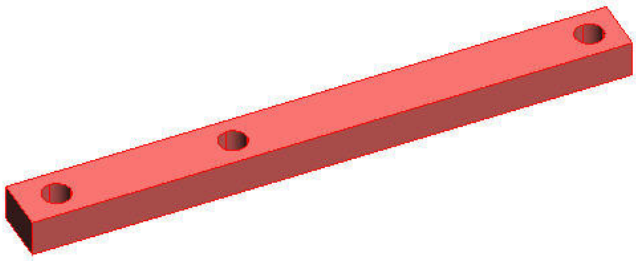
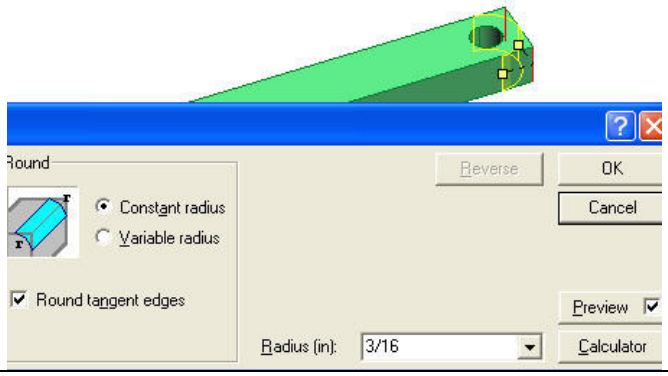
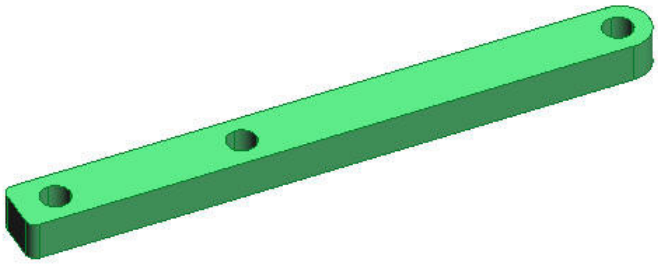
- [C] > Hold [Shift] >Drag three circles starting on the construction line, any diameter
- [Z] > Set diameter to .1825

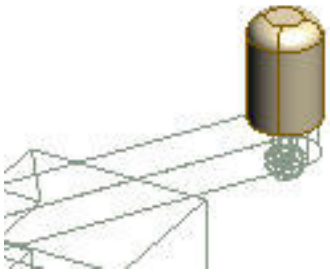


4. Set the distances for the circles

- [Z] Sketch dimension and set the distances between holes at 0.25, 1.175, and 2.375 inches as in the picture below.



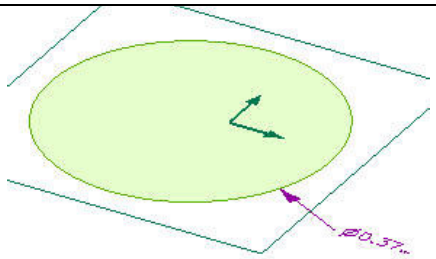
5. Extrude the handle ➢ [Alt R, E] ➢ Add material ➢ Distance: .25 ➢ Above workplane ➢ OK.	
6. Round the ends ➢ [E] > Click on the vertical edges of the handle on the side with the single hole. ➢ [Alt + R, O] and set the radius to 3/16. ➢ OK.	
Repeat these steps for the other end of the handle only set the radius to 1/16".	
7. Save ➢ [Ctrl + S] > Save Handle to the **Dovetail Grinder** Folder	



KNOB

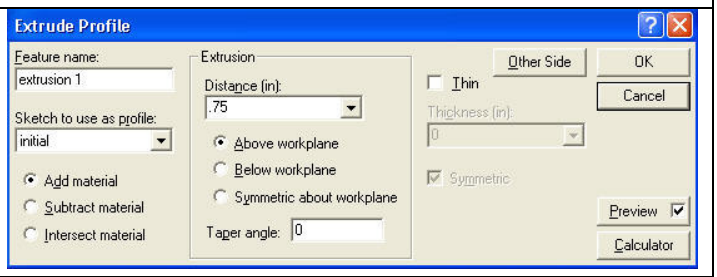
1. Drag a circle

- [Ctrl + N] to open a new design
- [C] > Drag a circle
- [Z] > Sketch diameter to 0.375".



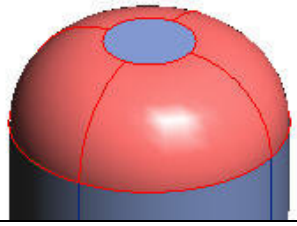
2. Extrude the circle

- [Alt R, E]
- Add material
- Distance: .75"
- Above workplane
- OK.



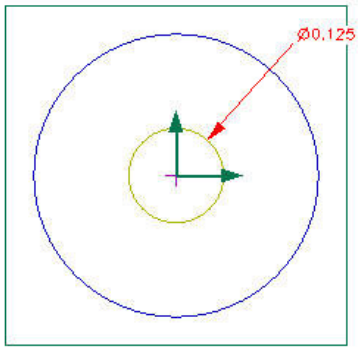
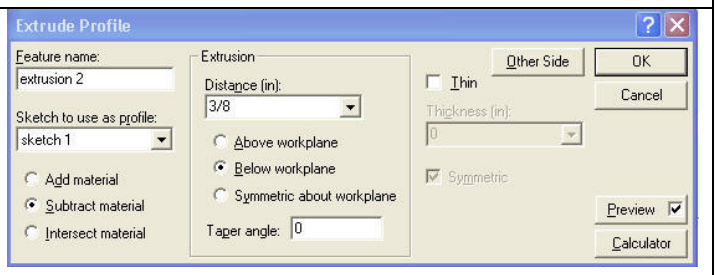
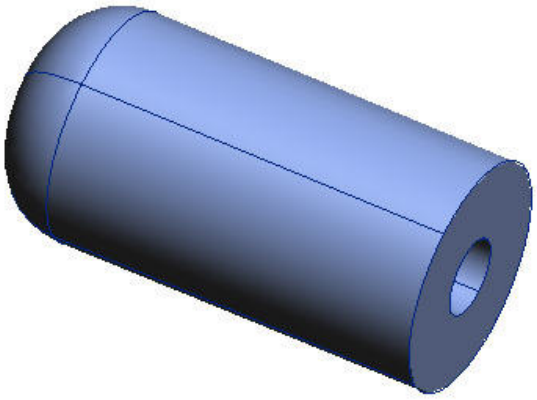
3. Round Top Edge

- [E] > Select the top edge > [Alt + R, O]
- Radius value to 1/8" (below).

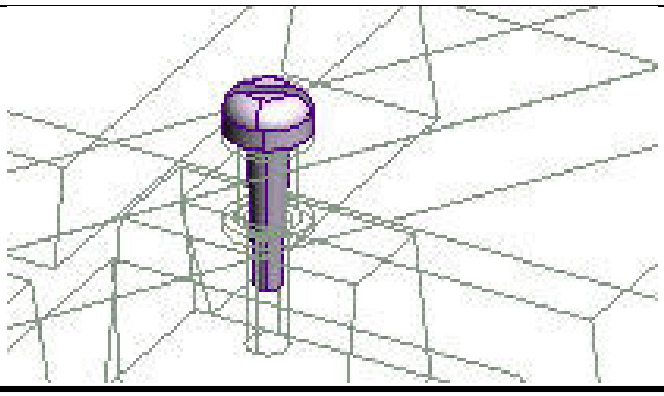


4. Create an New Sketch

- Rotate the dowel (arrow keys) until the bottom side of the dowel is visible.
- [F] > Select the bottom face > Right click and select "New sketch."
- Name both the sketch and the workplane "Hole."

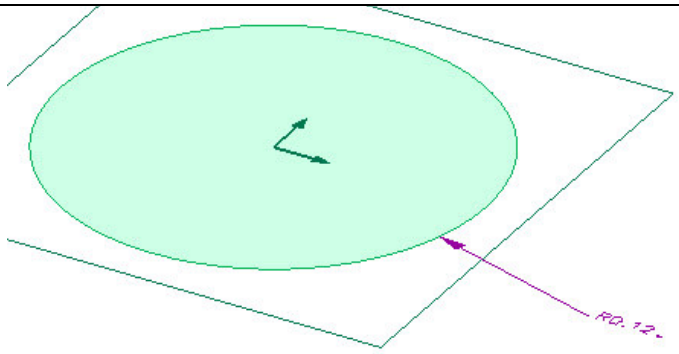
5. Drag a Circle ➢ [C] > Drag a circle from the center of the first circle. ➢ [Z] > Sketch dimension, diameter: 1/8".	
6. Extrude profile ➢ [Alt R, E] ➢ Subtract material ➢ Distance: 3/8" ➢ Below workplane ➢ OK.	
7. Save ➢ [Ctrl + S] > Save Knob to the **Dovetail Grinder** Folder	

SCREW



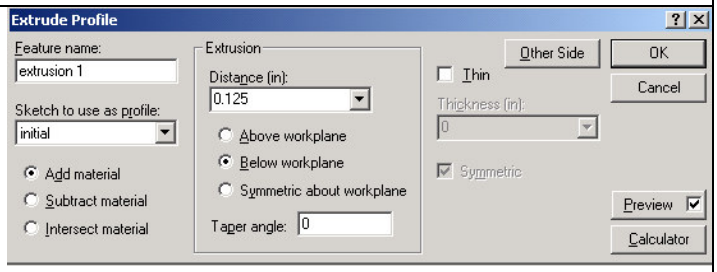
1. Draw a circle

- [Ctrl + N] to open a new design
- [C] > Drag a circle
- [Z] > Dimension circle to .25"



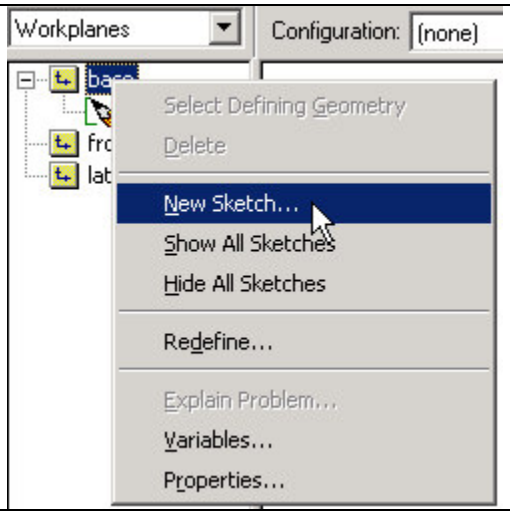
2. Extrude Profile

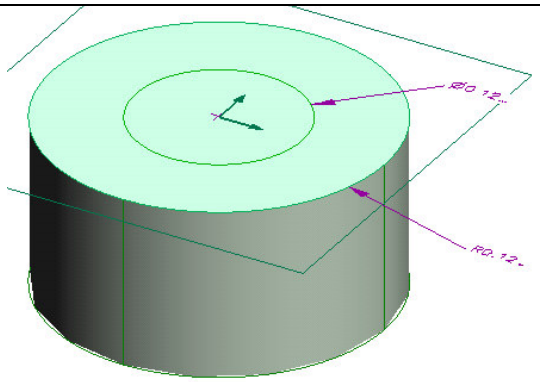
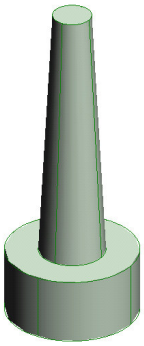
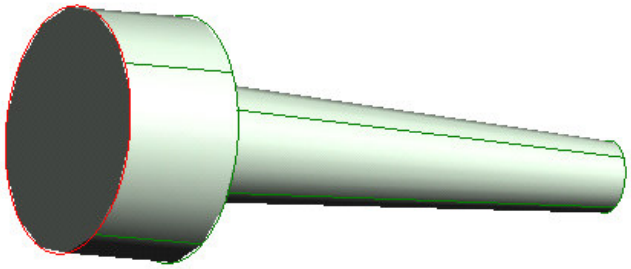
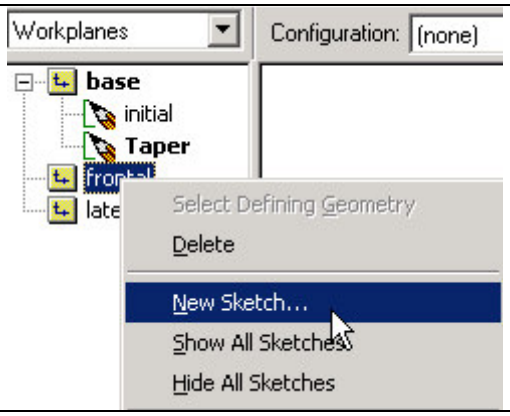
- [Alt + R, E]
- Add material
- Distance: 0.125
- Below workplane
- OK.



3. Add a new sketch

- From the object browser on the left hand side of the page, right click on the "base" workplane and select "New sketch."
- Name the new sketch "taper."

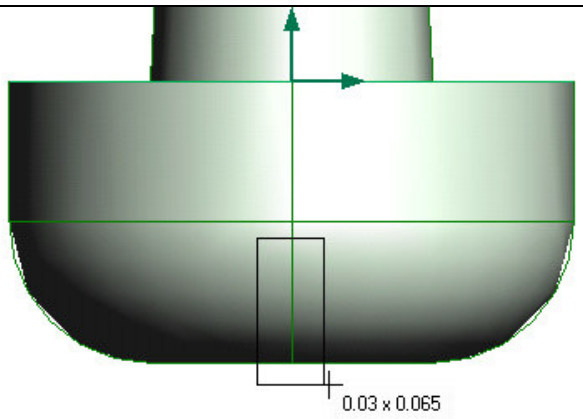


4. Drag a Circle ➢ [C] > Drag a circle from the center point of the first circle ➢ [Z] > Dimension circle diameter: 0.125".	
5. Extrude Profile ➢ [Alt + R, E] ➢ Add material ➢ Above workplane ➢ Distance: .5" ➢ Taper angle; 3 ➢ Ok.	
6. Round the head ➢ Rotate the screw to get a better look at the head. ➢ [E] > Select the top edge of the cylinder > Right click and select Round Edges ➢ Radius 1/16"	
7. Project a slot ➢ Right click on the frontal workplane in the object browser. ➢ Select "New sketch" and name it "slot." ➢ Now orient your drawing [Shift W] to view onto workplane > [Shift + A] to autoscale.	

8. Sketch a Rectangle

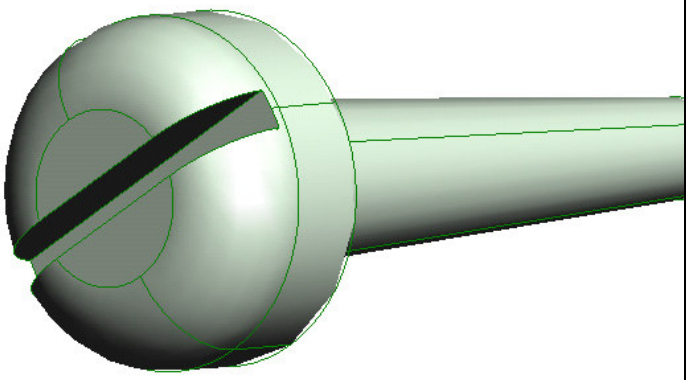
- [R] > Drag a rectangle onto the screw head to create a slot for the screwdriver.
- Start where the snap to grid setting is 

and drag to 0.03x0.065 as pictured.



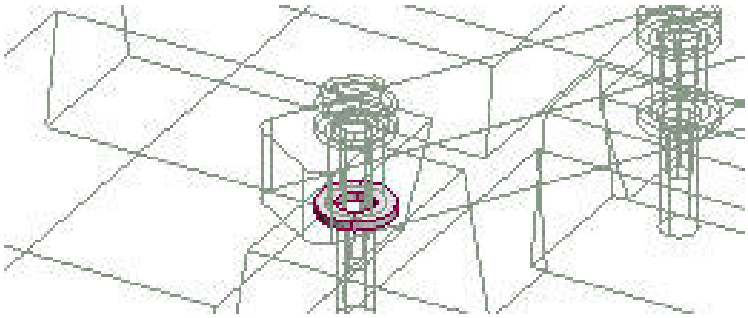
9. Project profile

- [Alt + R, J]
- Subtract material
- Symmetric about workplane through entire part
- OK.



10. Save

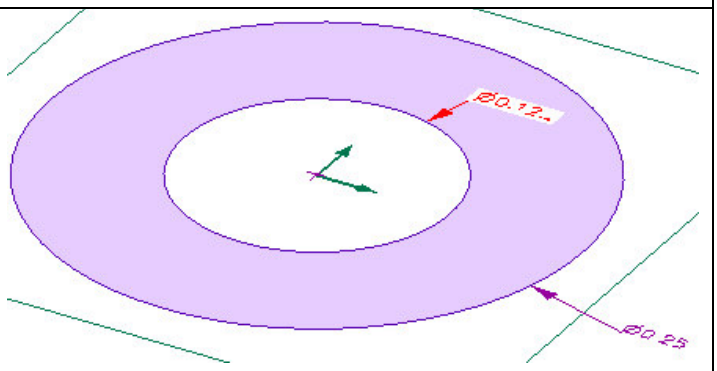
- [Ctrl + S] > **Save Screw to the** Dovetail Grinder **Folder**



WASHER

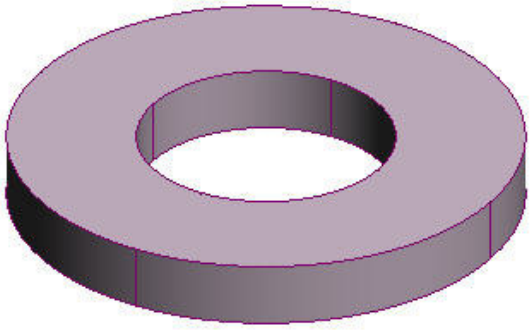
1. Sketch two concentric circle

- [C] > Drag a circle, diameter: 0.25"
- Drag a second circle from the center of the first, diameter: 1/8" diameter
- [Z] > Sketch dimension of each circle



2. Extrude Profile

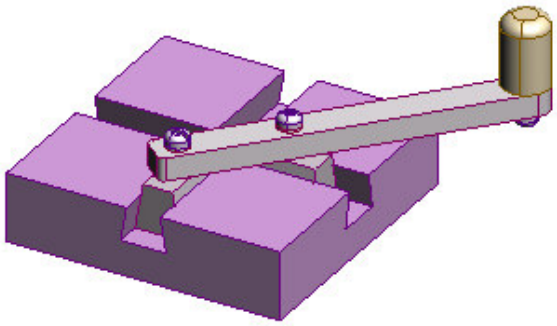
- [Alt + R, E]
- Add material
- Distance: 1/32"
- Above workplane
- OK.



3. Save

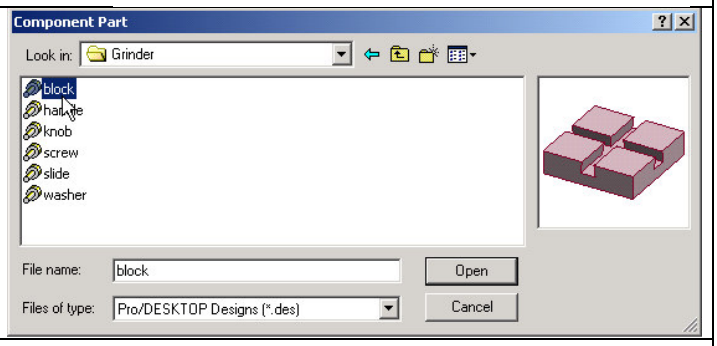
- [Ctrl + S] > Save Washer to the **Dovetail Grinder** Folder

ASSEMBLY



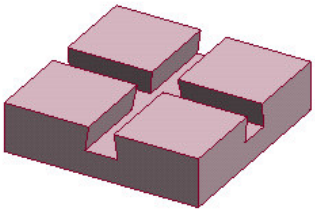
1. Open a new design

- [Ctrl + N]
- [Alt + A, A] to add a component
- From the Dovetail Grinder folder, open Block.



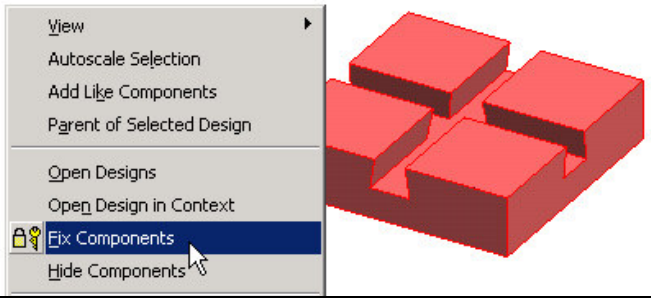
2. Position Block

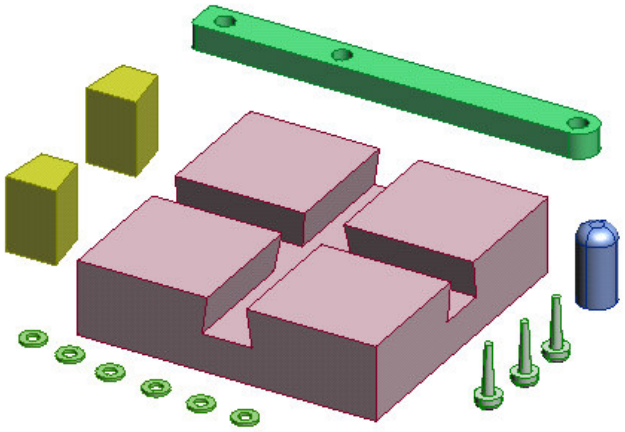
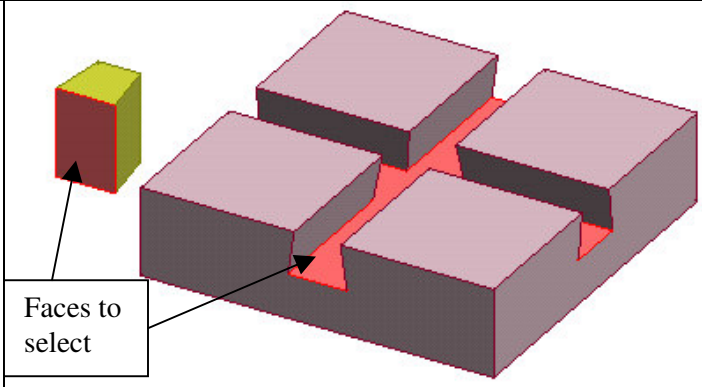
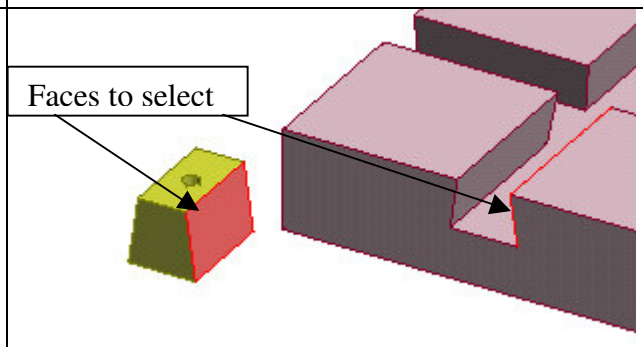
- Drag the block to one side of the design area.
- This step will help keep other parts from being hidden by the block when they are added.

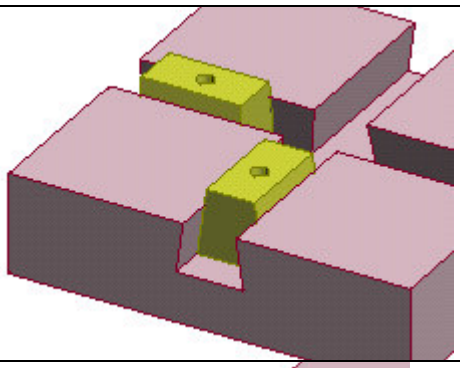
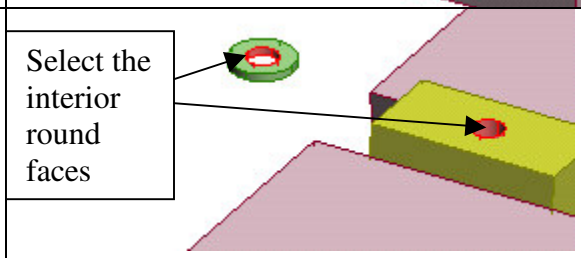
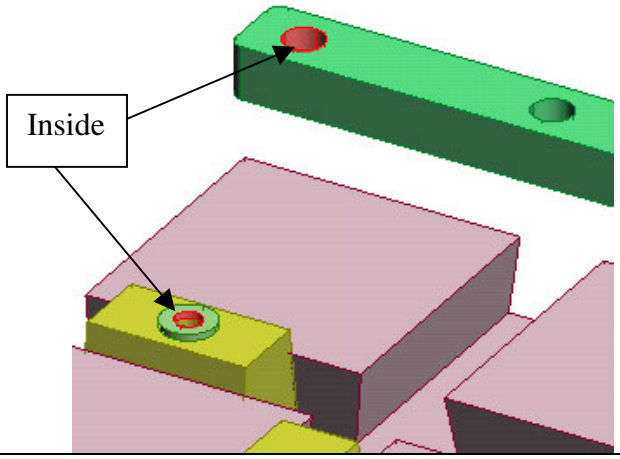
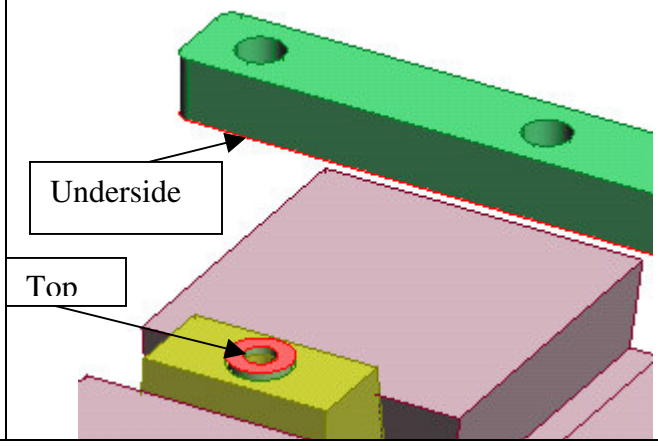


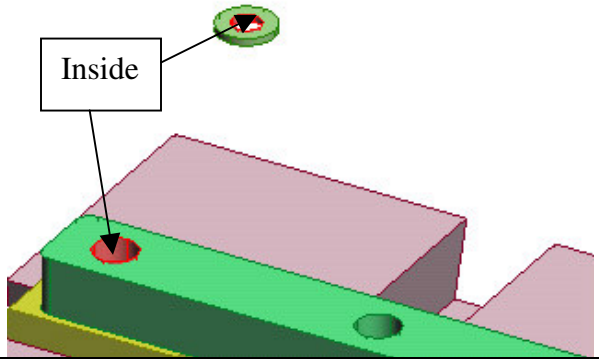
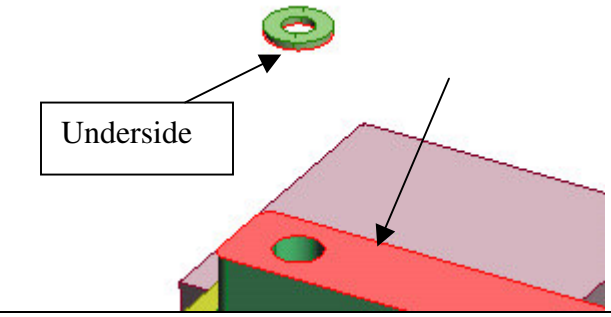
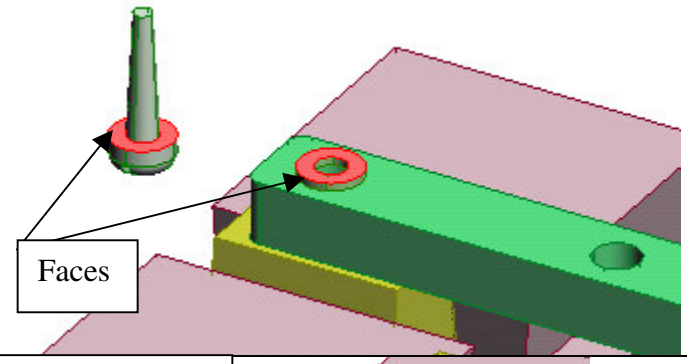
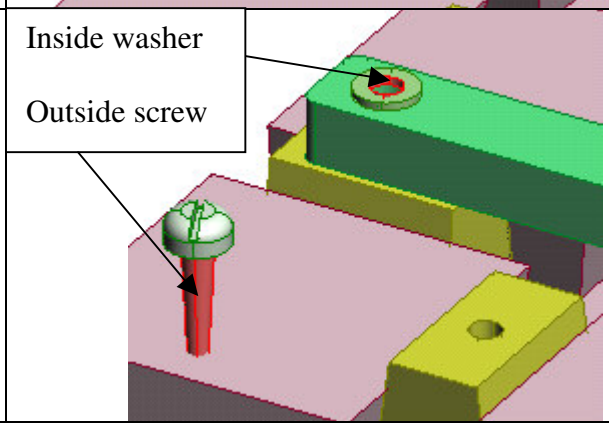
3. Fix component

- [P] > Select the block.
- Right click and select "Fix Components."

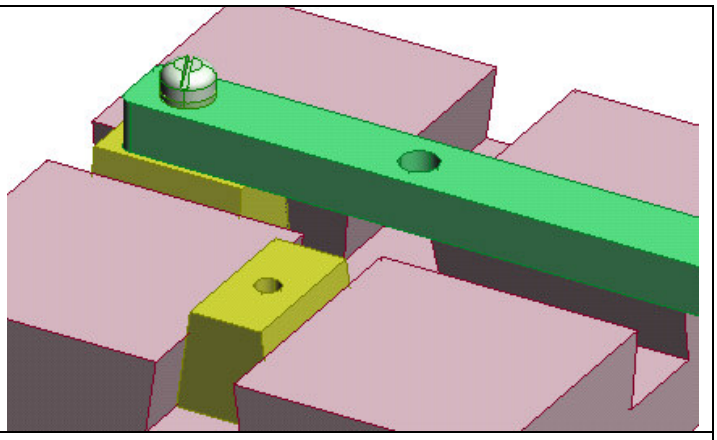


4. Add the slider ➢ [Alt + A, A] ➢ Select the **Slide**. **Note:** If you move each part as you add them to the assembly they will not overlap causing you to "loose" pieces.	
5. **Continue to add components** ➢ Using the previous steps add the following parts: ➢ (1) Slide ➢ (1) Handle ➢ (1) Knob ➢ (3) Screws ➢ (6) Washers. You should have all the components as shown in the picture.	
6. Mate the slide to bottom of Groove ➢ [F] > Hold [Shift] and select the faces indicated in the picture. ➢ Right click > Select Mate **Note:** Future directions will simply say – Select indicated faces.	
7. Mate Slide to right side of Groove ➢ [F] > Select indicated faces > Right click > Select **Mate** ➢ [P] > Click once on the slide to select it > Drag it into the groove on the block.	

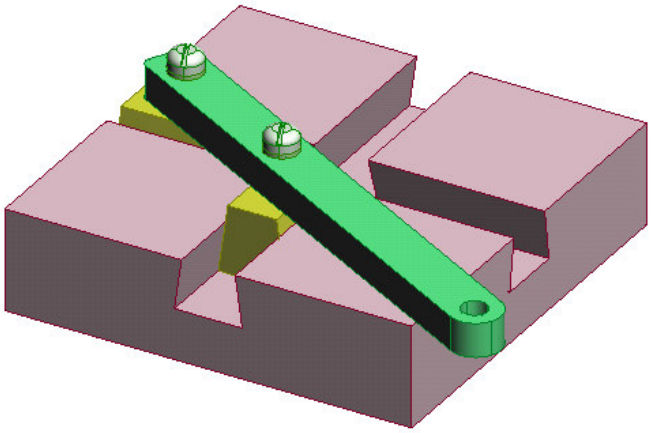
8. Repeat ➢ Repeat steps **6** and **7** to mate the other Slide to the other dovetail groove.	
9. **Constrain Washer** ➢ [F] > Select indicated faces > Right click and select **Center Axes**. ➢ [F] > Select the bottom of **Washer** and top of **Slide** > Right click > Select **Mate**.	
10. Constrain the Handle ➢ [F] > Select indicated faces > Right click > Select **Center Axes**.	
➢ [F] > Select indicated faces ➢ Right click > **Select Mate**.	

11. Constrain another Washer ➢ [F] > Select indicated faces > Right click > Select **Center Axes**.	
➢ [F] > Select indicated faces ➢ Right click and select **Mate**.	
12. Constrain Screw ➢ [F] > Select indicated faces. ➢ Right click and **Mate**.	
➢ Select indicated faces. ➢ Right click select **Center Axes**.	

13. Repeat Steps **9** thru **12** to assemble a screw and two washers through the handle into the other slide.

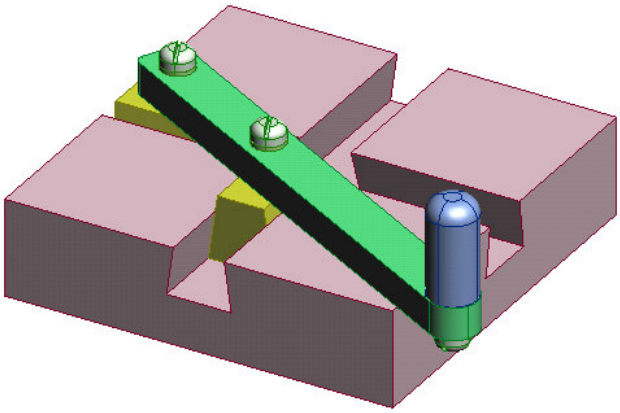


When all the steps have been repeated, the grinder should look like the picture.



14. Repeat Steps **9** thru **12** once more with the knob. The screw goes up from the bottom and the knob sits on top of the handle.

15. [P] > Grab and drag on the knob. If your assembly is correct, the grinder handle and sliders should move.



Congratulations! You have finished the GRINDER BLOCK using PRO/Desktop 8

By: James Siggaard