AUTODESK

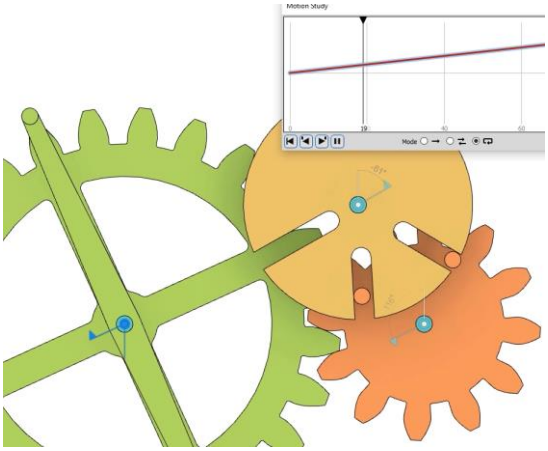
Step-by-step guide

Create digital assemblies

Use a sketch to create a solid body, then use joints and links to replicate mechanical motion.

Learning objectives:

- Create and remove assembly components.
- Use joints to create assembly motion.



The completed exercise

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1. Upload and open the supplied *Reversing Geneva Device.f3d* file.

Figure 1. Open the supplied file

2. Expand the Browser and notice the various joints, sketches, bodies, and components.

Figure 2. Explore the Browser

3. Click the gear icon in the screen's bottom right corner, then activate the Component Color Swatch option.

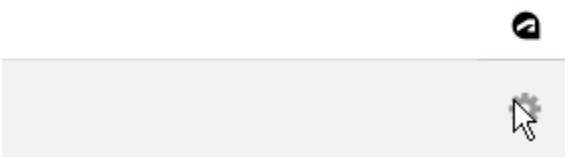

Figure 3. Turn on the Component Color Swatch option

4. Notice that each timeline feature has a corresponding color swatch. The same color swatches are applied to the Browser's components. The blue timeline features were used to create the Browser's blue component. This is an easy way to identify timeline features belonging to a component.

Figure 4. Inspect the color swatches

5. Deactivate the Component Color Swatch by clicking the gear icon in the screen's bottom right corner.

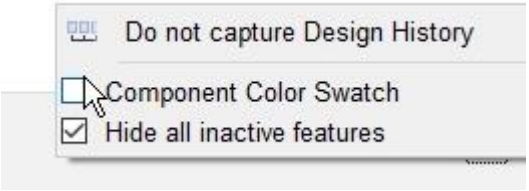

Figure 5. Turn off the Component Color Swatch option

6. Click Inspect> Display Component Colors.

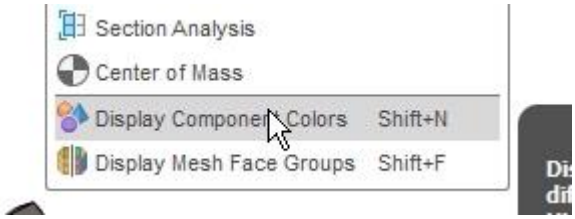

Figure 6. Open the Display Component Colors tool

7. Notice that the color swatches return to the Browser in the timeline but are also applied to the components in the Canvas area.

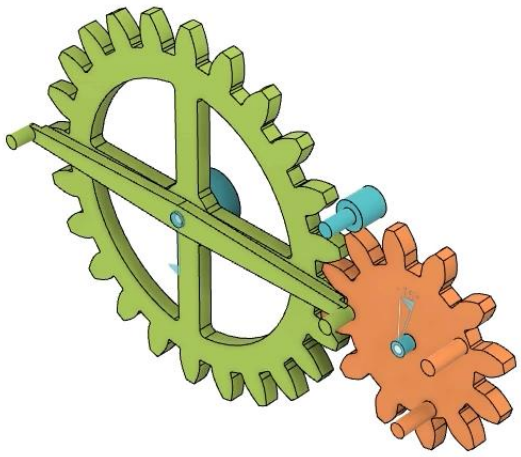

Figure 7. Inspect the color-coded components

8. The motion of the two gears can be linked by creating a Motion Link. Click Assemble> Motion Link.

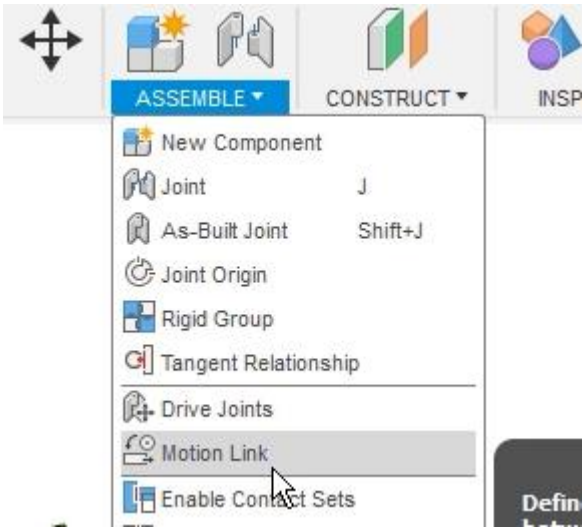

Figure 8. Open the Motion Link tool

9. For the dialog's Joints selections, choose the two joint icons shown in the image on the right. First select the large gear's joint, then select the smaller gear's joint. Notice that the two gears turn to illustrate their joints. The rotation direction is correct but the smaller gear needs to be turning faster.

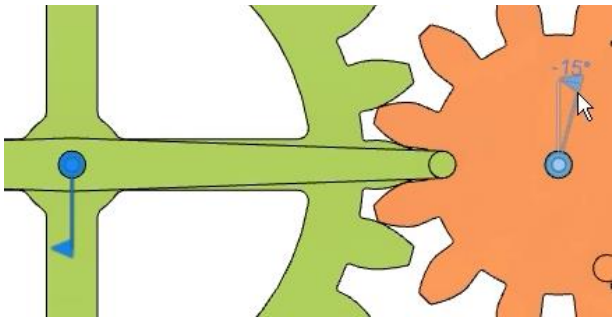

Figure 9. Choose the joints

10. The large gear has 24 teeth and the small gear has 12 teeth, which means the small gear should be turning twice as fast. Enter **180 deg** into the first Angle box, then enter **360 deg** into the second Angle box. These numbers indicate that the small gear will turn 360° every time the large gear turns 180°. Activate the dialog's Animate option and watch the animation. Notice that the gears are turning at the correct speed, then OK the dialog. Using a Motion Link to create a relationship between the gears is much easier for Fusion 360 to calculate than using contact sets.

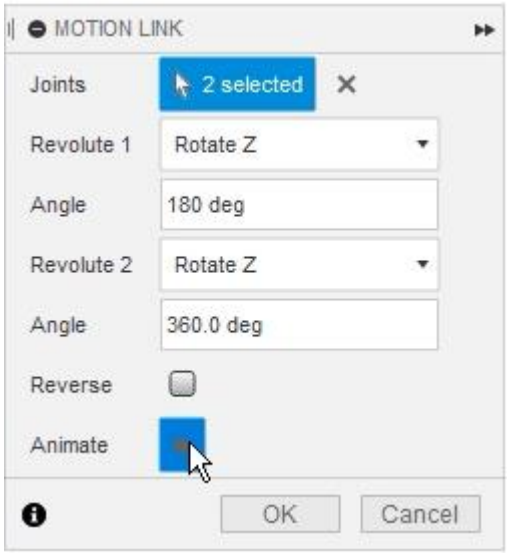

Figure 10. Configure the Motion Link

11. In the Browser, notice that each component has a Bodies folder. Fusion 360 tracks the origin for each component but not for each body. Checking the origin is what allows the components to move inside the Canvas area. Turn on the visibility for the Browser's origin folders by clicking the eyeball icon next to them.

Figure 11. Explore the Origin folders

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12. Click and drag the large gear and notice that the planes and coordinate system turn with the gear. The planes and the coordinate system are inside the Origin folder.

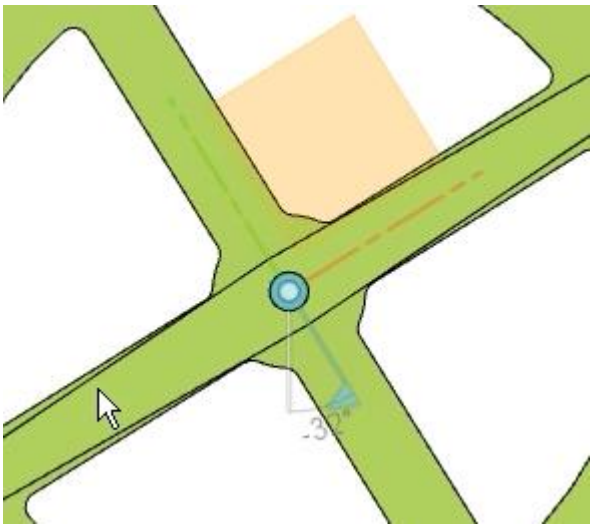

Figure 12. Inspect the component's origin

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13. Return the gears to their original position by clicking Position> Revert Position.

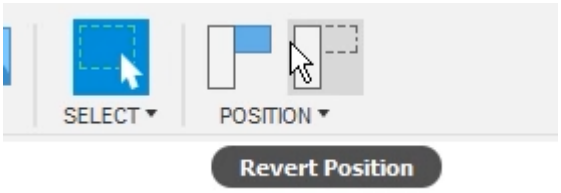

Figure 13. Return the gears to their original position

14. Turn on the visibility for the Base sketch. This sketch will be used to create a Geneva gear that needs to move with the assembly. This part needs to be created as a component.

Figure 14. Show the Base sketch

15. Activate the Browser's top level by clicking the radio button next to it. Create a new component by clicking Assemble> New Component.

Figure 15. Create a new component

16. Enter **Geneva Gear** as the new component's name, check the Activate option, then OK the dialog.

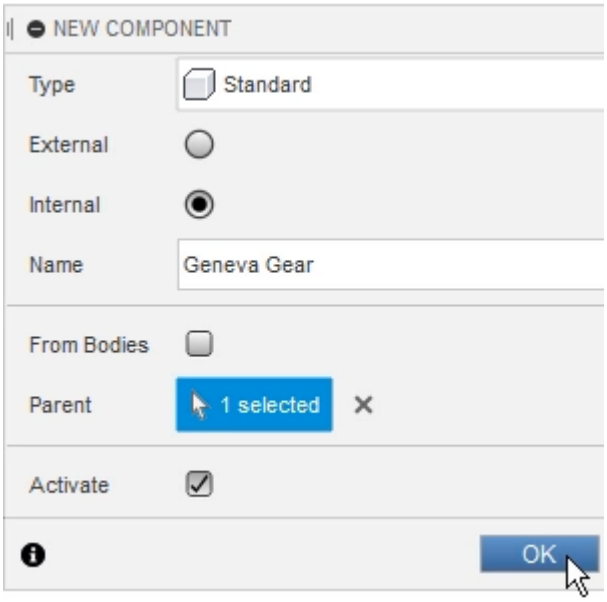

Figure 16. Configure the new component

17. The new component is created and is automatically activated because of the option you checked in the previous Step. The nonactive components are now displayed with reduced opacity to make it easier to see the active component. Open the Extrude tool by pressing E.

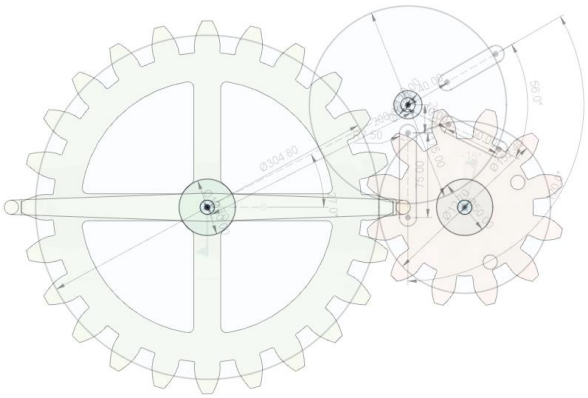

Figure 17. Open the Extrude tool

18. For the dialog's Profiles selection, hold Ctrl (Windows) or Command (MacOS) and select the seven regions shown in the image on the right.

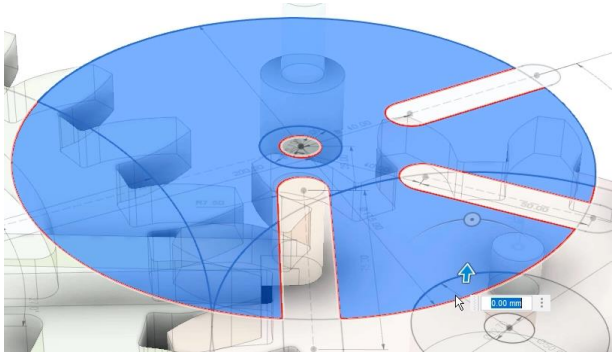

Figure 18. Select the seven profiles

19. Choose the Object option from the dialog process Start menu, then select the existing boss's small face shown in the image on the right as the Object selection. The extrude will begin at this height.

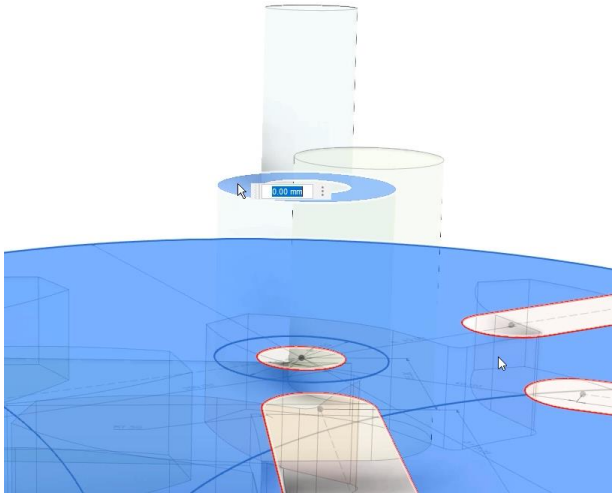

Figure 19. Determine where the extrude will begin

20. Enter **10 mm** into the dialog's Distance box, make sure the New Body option is selected in the Operation menu, then OK the dialog.

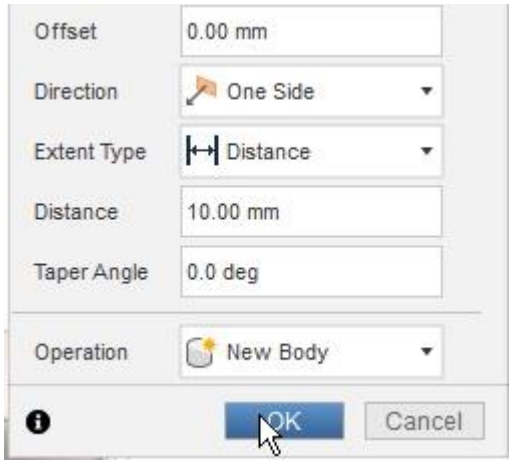

Figure 20. Determine the extrusion's height

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21. Activate the Browser's top level by clicking the radio button next to it.

Figure 21. Activate the Browser's top level

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22. Create an As-Built Joint by clicking Assemble> As-Built Joint.

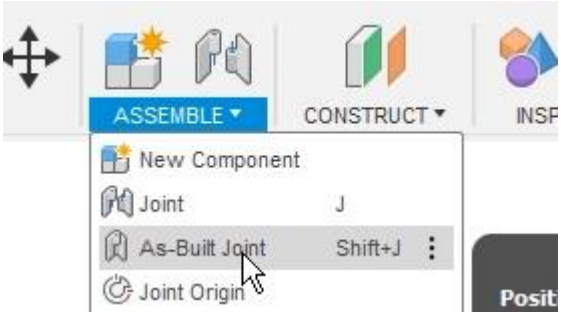

Figure 22. Open the As-Built Joint tool

23. Choose the Revolute option from the dialog's Type menu.

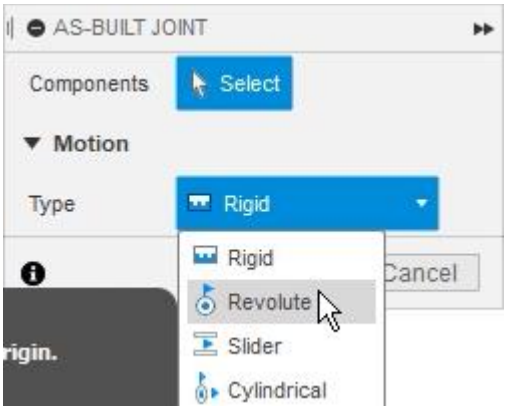

Figure 23. Choose the joint type

24. For the dialog's two Component selections, choose the Geneva gear you created and the existing pin body that passes through the center of the gear. After selecting the two bodies, choose the center of the pin as the dialog's Snap location. After selecting the Snap location, the Geneva gear will rotate to illustrate the degrees of freedom. OK the dialog.

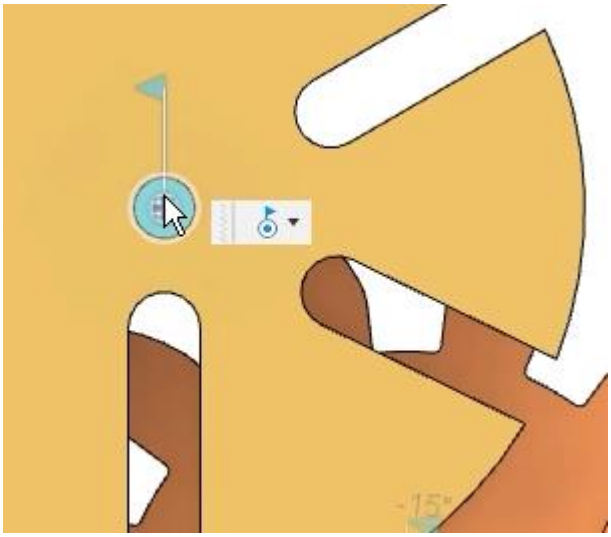

Figure 24. Configure the joint

25. Rotate the Geneva gear slightly so that the large gear's pin is aligned with the Geneva gear's slot feature.

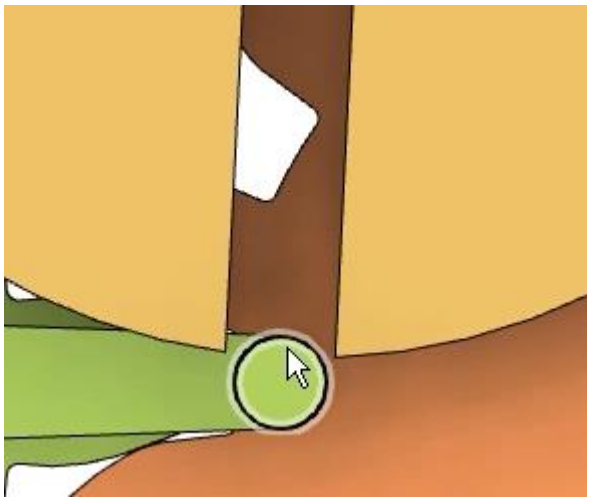

Figure 25. Rotate the Geneva gear

26. Capture the Geneva gear's new position by clicking Position> Capture Position.

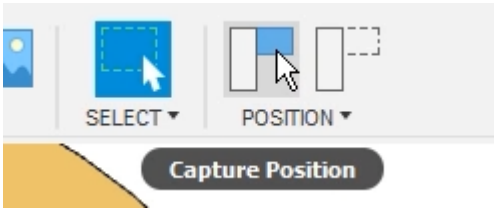

Figure 26. Capture the Geneva gear's position

27. Open the Enable Contact Sets tool by clicking Assemble> Enable Contact Sets.

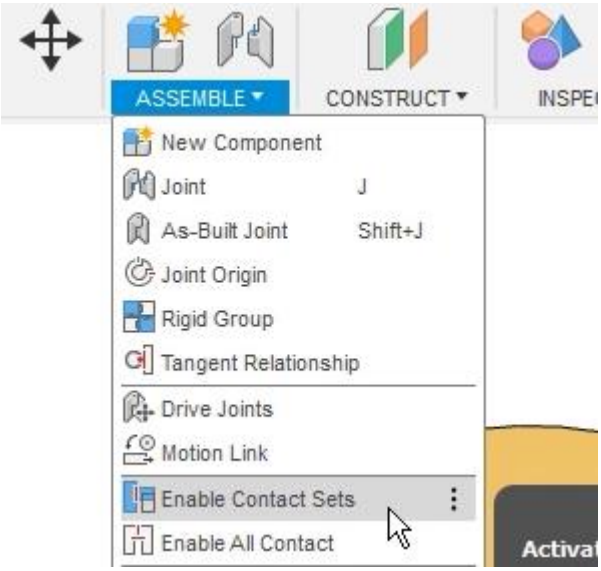

Figure 27. Open the Enable Contact Sets tool

28. Right-click the Browser's Contact: sets folder and choose New Contact Set from the menu.

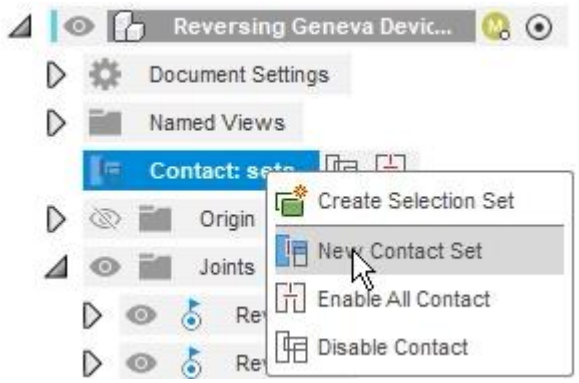

Figure 28. Create a new Contact Set

29. Choose the large gear and the Geneva gear as the dialog's Bodies or Components selection. OK the dialog.

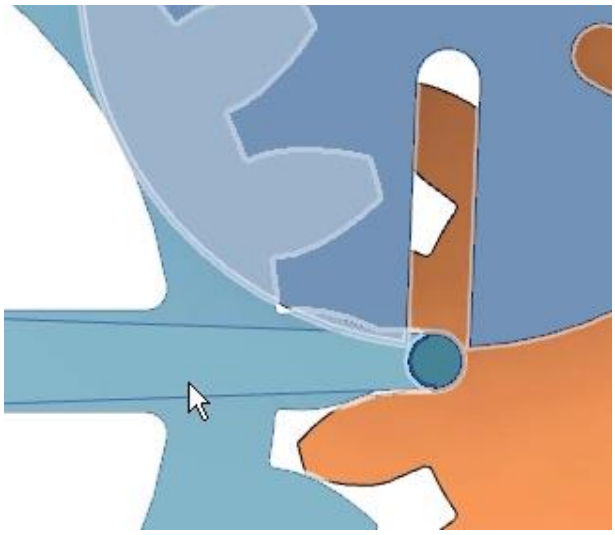

Figure 29. Select the components

30. Create another new Contact Set by right-clicking the Browser's Contact: sets folder and choosing New Contact Set. Choose the Geneva gear and the small gear as the dialog's Bodies or Components selection. OK the dialog.

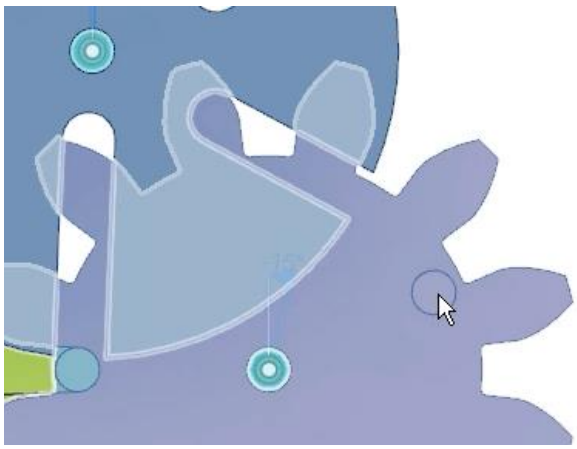

Figure 30. Create a new Contact Set

31. Click and drag the large gear to turn it. Notice how the large and small gears work together to toggle the Geneva gear's direction. Return the gears to their original position by clicking Position> Revert Position.

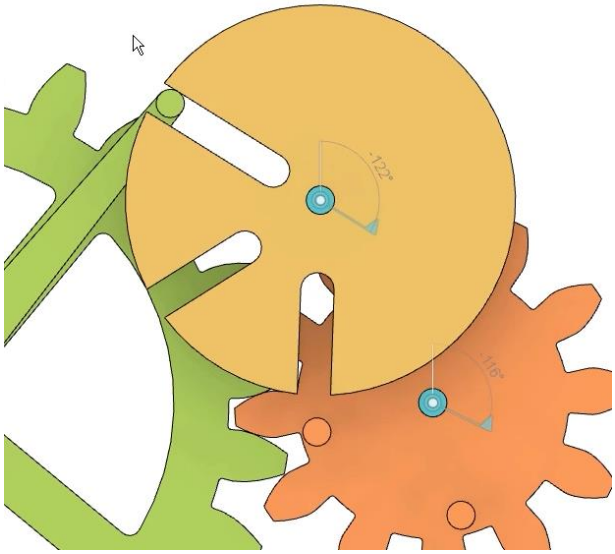

Figure 31. Inspect the result

32. Create a new Motion Study by clicking Assemble> Motion Study.

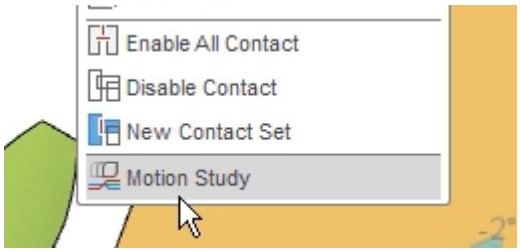

Figure 32. Open the Motion Study tool

33. Select the large gear's joint icon.

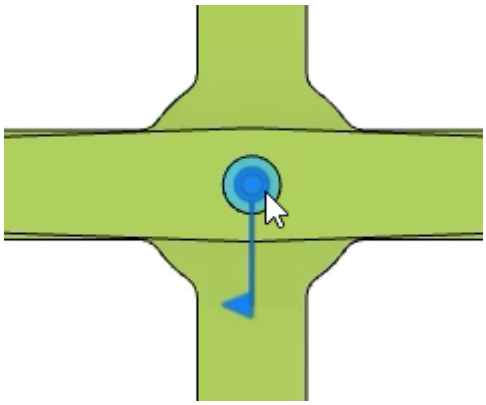

Figure 33. Select the joint

34. Inside the Motion Study dialog, click to place the timeline marker at the end of the study's timeline. Enter **360** into the Angle box. This indicates that the large gear will rotate exactly one time during the study's duration.

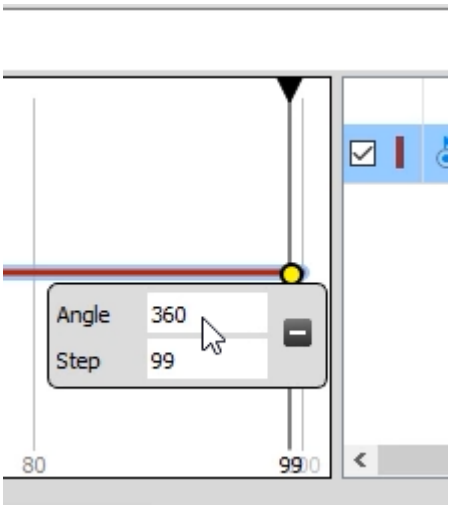

Figure 34. Configure the Motion Study

35. Activate the Motion Study's loop option, then press the Play button. Watch the animation and notice how the Geneva gear alternates its direction.

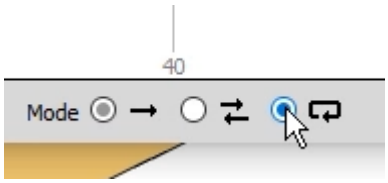

Figure 35. Play the Motion Study

36. OK the Motion Study dialog after you finish watching animation and notice that the Motion Study is added to a folder inside the Browser. Save the file.

Figure 36. Notice the study is added to the Browser