



Automation & Robotics Virtual Learning

7th & 8th

Mechanisms Day 8

April 15th, 2020



PLTW: Automation & Robotics
Lesson: Mechanisms Day 8 [April 15th]

Objective/Learning Target:

Students will review of the basics of mechanisms, and the relationship between gear ratios, speed and torque.

*To complete the Warm-up, notes and practice electronically, click [here](#)

Warm-up

Today we will learn about our last two mechanisms for Automation & Robotics, the Differential Gear and the Universal Joint.

Take a look at this [video](#) to get us started with a Differential Gear.

What if the spider gear wasn't there, what do you think would happen to the inside tire as a car turned.

Explain your answer:

Questions/Main Ideas:

Summary/Reflection

Differential Gear

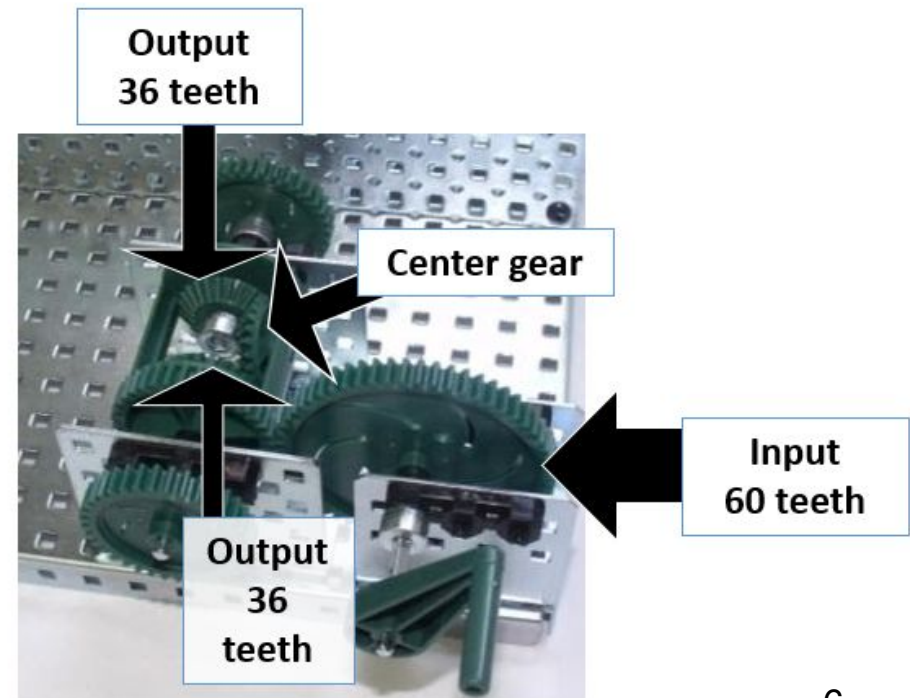
A Differential Gear uses bevel gears to allow both the outputs to spin at different speeds.

Both the **input and output shafts turn in the same direction** because due to the bevel/spider gear in between them.

All gears move in a circle therefore the movement type is **Rotary**.

The input can be turned both clockwise and counterclockwise, therefore the **direction of travel is reversible**

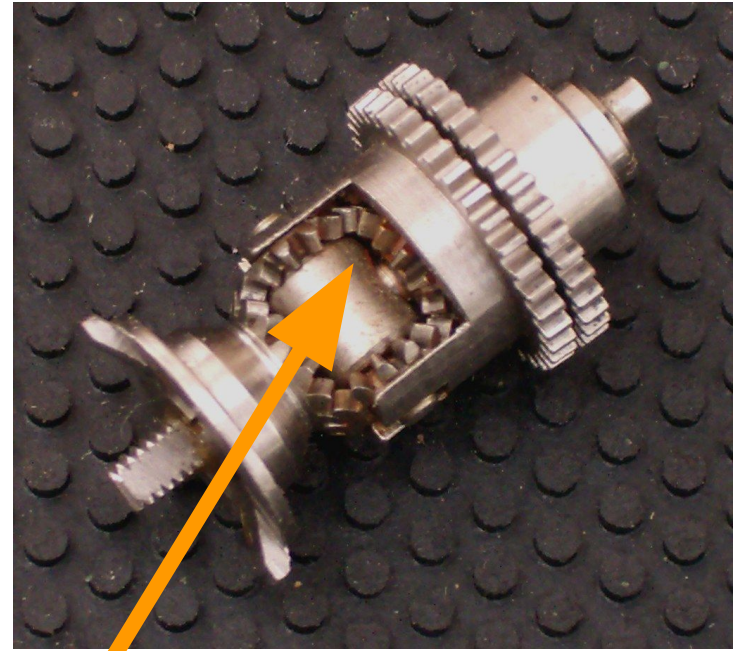
The **flow of power can be reversed** since each gear is a circle but is not the primary use.



Where Can You Find a Differential Gear?

Common places you might find a differential gear is:

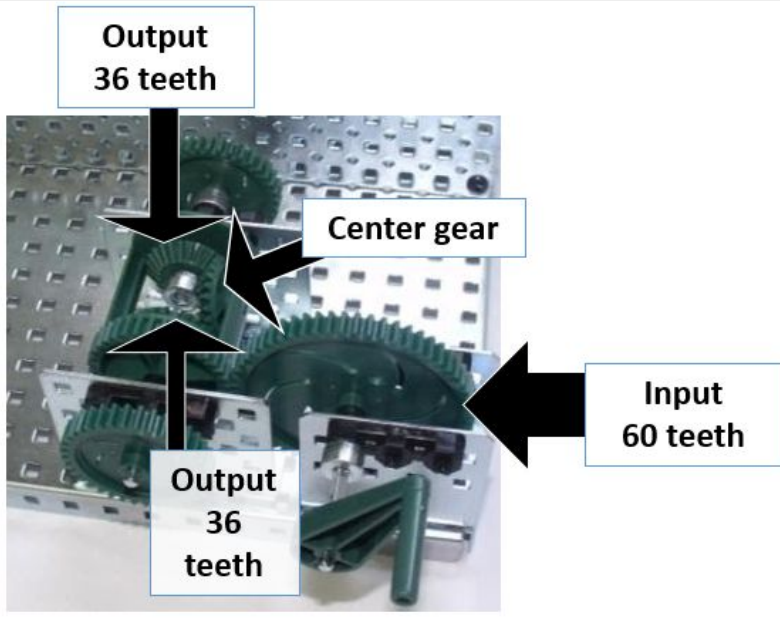
- **Turning mechanisms in vehicles.**



- Without the center gear, the two side gears would not be able to turn at the same time.
- The side gears are allowed to turn at different speeds allowing vehicles to make turns without dragging a tire.

Differential Gear : Practice

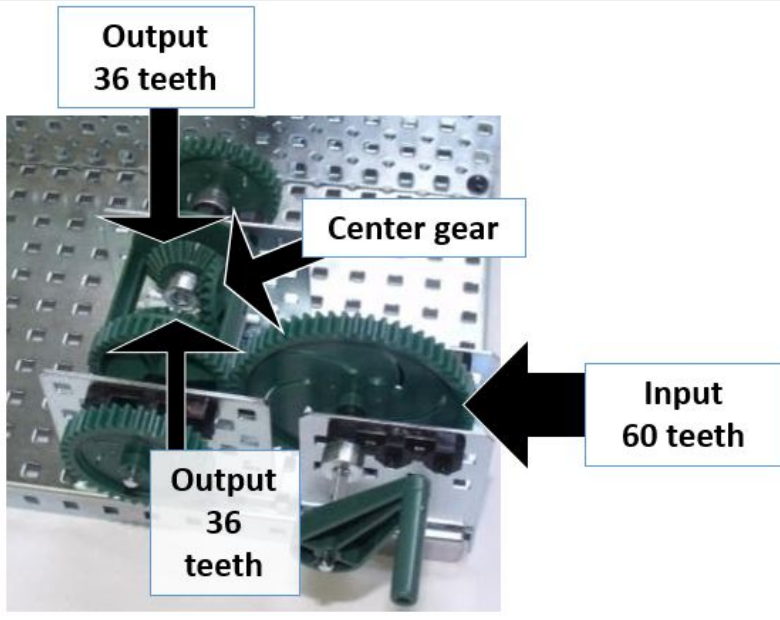
B.



- What type of movement does the Input gear do?
- The output gear?
- What is the simplified gear ratio for Differential Gear B?
- What is happening to speed and torque?
- Is the direction of travel reversible?

Differential Gear : Practice ANSWER KEY

B.



- Is the direction of travel reversible?

Yes, because both the input and output gears are circles.

- What type of movement does the Input gear do?

Rotary because the input gear is a circle

- The output gear?

Rotary because the output gears are circles

- What is the simplified gear ratio for Differential Gear B?

Differential Gear B.

$$\frac{60:36}{12 \ 12} = \boxed{5:3}$$

- What is happening to speed and torque?

Speed is increasing

Torque is decreasing

Because the output gear is smaller than the input gear.

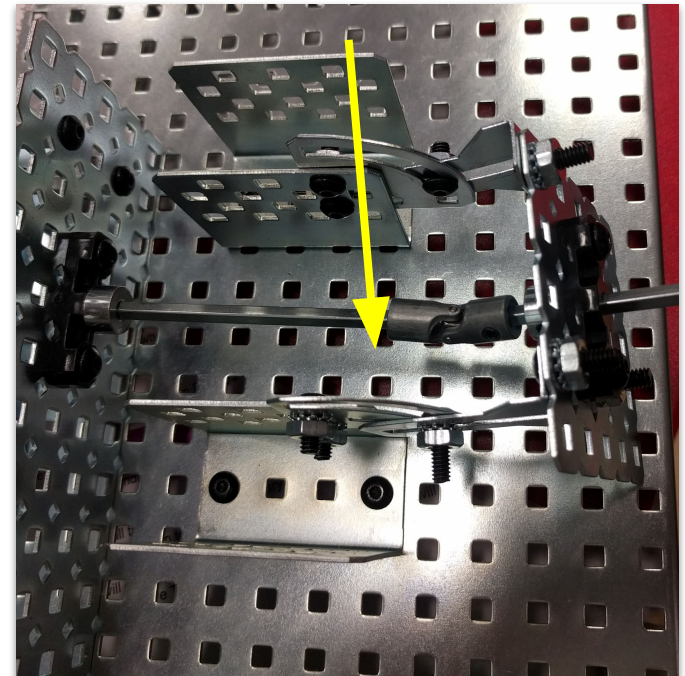
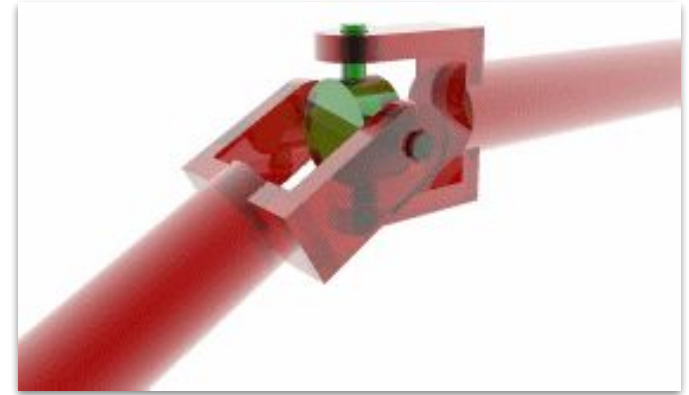
Universal Joint

In a Universal Joint there are no teeth or meshed gears.

Instead there are two yolks and a cross. The yolks are attached to shafts. The shafts will turn in the **same direction**.

Universal Joints allow mechanisms that are at an angle to each other to be connected. Universal Joints work with **angles $> 90^\circ$ and $< 270^\circ$** .

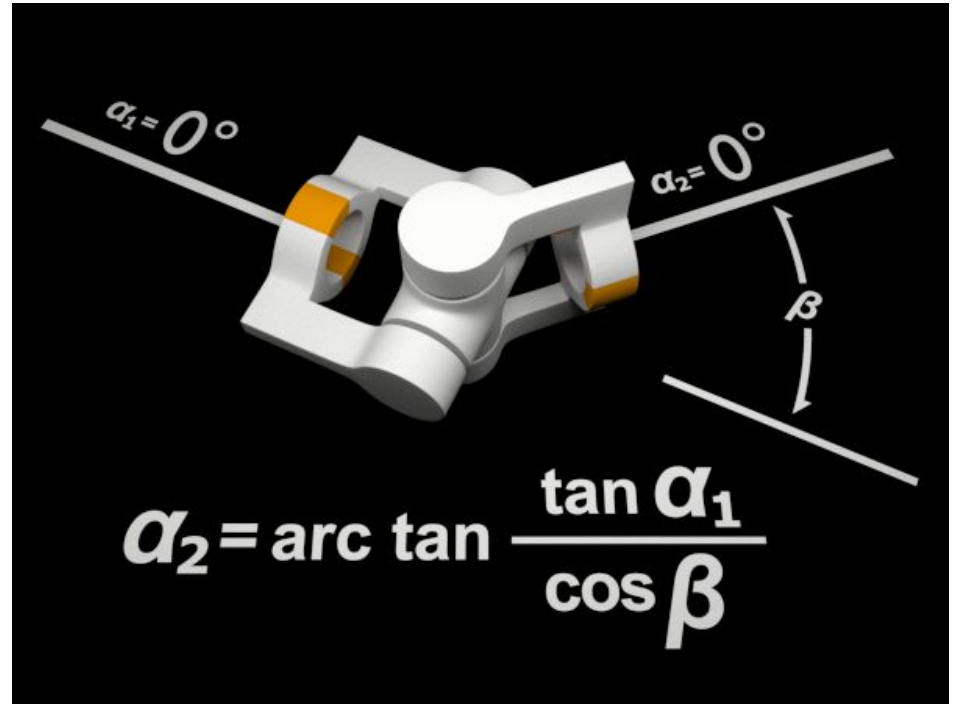
The **speed** and **torque** are **constant** and the **flow of power** is **reversible**.



Where Can You Find a Universal Joints?

Common places you might find a Universal Joint is in:

- Drive shaft of vehicles
- Power take-offs



- Universal joints are used to transmit rotary movement at an angle that isn't 90° .



Click the picture to see this universal joint in action.

Self Assessment Instructions

For this on the following pages you will find/take a picture of the required mechanisms that you have found out in the world.

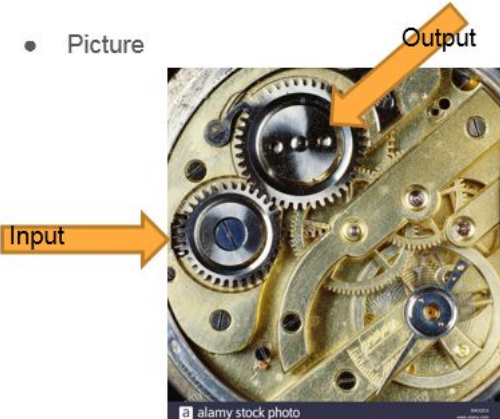
You will then label the input and out of that mechanism and answer the questions on the page.

Here is an example of a completed self assessment page.

Simple Gear Train

- Where can you find this mechanism outside of the classroom?
 - A simple gear train can be found inside of a watch
- What is it's function (what is it's purpose)?
 - The function of the gears is to make the arms on a watch move.
- In your picture what is happening to Torque and Speed?
 - Torque is Increasing and the Speed is decreasing
- Why?
 - Because the Output gear is bigger than the Input gear.

- In your picture label the Input and Output
- Picture



Input

Output

alamy stock photo

Differential Gear

- Where can you find this mechanism outside of the classroom?
- What is its function?
- In your picture what is happening to Torque and Speed
- Why?
- In your picture label the Input and Output
- Picture

Universal Joint

- Where can you find this mechanism outside of the classroom?
- What is its function?
- In your picture what is happening to Torque and Speed
- Why?
- In your picture label the Input and Output
- Picture

Extend your learning

Which mechanism was easier to find?

Why do you think it was easier to find?

Hypothesize: if it was harder to find one of the mechanisms what does that possibly say about its usage in the world?

- For more details and uses for the Differential Gear check this [webpage](#) out.
- To see a Universal Joint in action checkout this [video](#)!