Automation & Robotics Virtual Learning

7th & 8th Mechanisms Day 5

April 10th, 2020

PLTW: Automation & Robotics
Lesson: Mechanisms Day 5 [April 10th]

Objective/Learning Target:
Students will be introduced to flow of power and direction of travel while they continue their review of the basics of mechanisms, and the relationship between gear ratios, speed and torque.

Warm-up

Until today all of our mechanisms have had rotary inputs and outputs.

Can you list the three other types of movement?

1.

2.

3.

*If you need help check lesson #1.

Do you think we will learn about a mechanism that will not use rotary movement at all? (circle/highlight one)

Yes   No   Maybe   I'm not sure

Explain your answer:

_____

_____

_____

_____

New Information
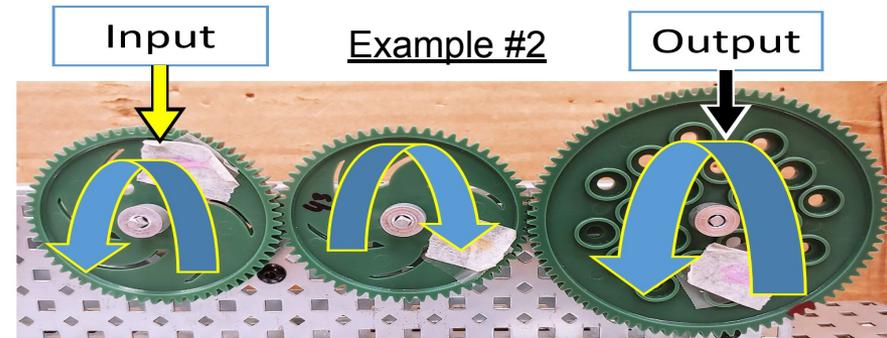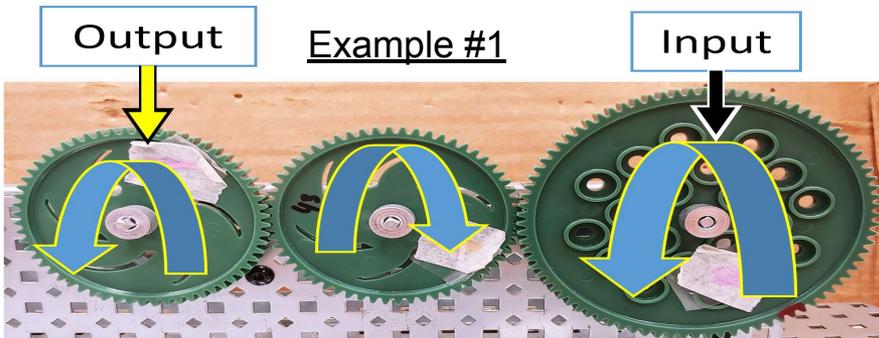
Use the following Focused note pages to take notes over pages

When a mechanisms is in **motion** it has a **power source** and a **direction** that it moves. Some mechanisms can change their power source and still work and/or their direction and still work.

Because both the input and output move in a circular motion the gears can be turned Clockwise and Counterclockwise, which means you can change the mechanism's direction. This means the Direction of Travel is reversible.

And because both the input and output move in a circular motion the mechanism will work if you switch the input and output gears. This is called Flow of Power.

Topic/Unit:	Mechanisms Day 4	Name:
		Class/Period:
		Date:

I can… explain and give examples of Mechanisms, types of movement, gear ratios, speed, and torque

| Questions/Main Ideas:	

Summary/Reflection

Leadscrew

In a Leadscrew the input is a series of worm gears all on the same drive shaft, the gears are circular in shape therefore the movement is Rotary. The input can be turned both clockwise and counterclockwise, therefore the direction of travel is reversible

The output is a slider on a metal rack that is moved along the rack as the drive shaft is turned. The slider and only go in one direction, depending on if the shaft is turned clockwise or counter clockwise. Therefore, the output movement is Linear. The flow of power cannot be reversed since the slider could not move the worm gears.

Since the input has one continuous tooth and the output has not teeth there is no gear ratio and no change in torque and speed.

Input
1 continuous tooth

Output
No teeth

A.
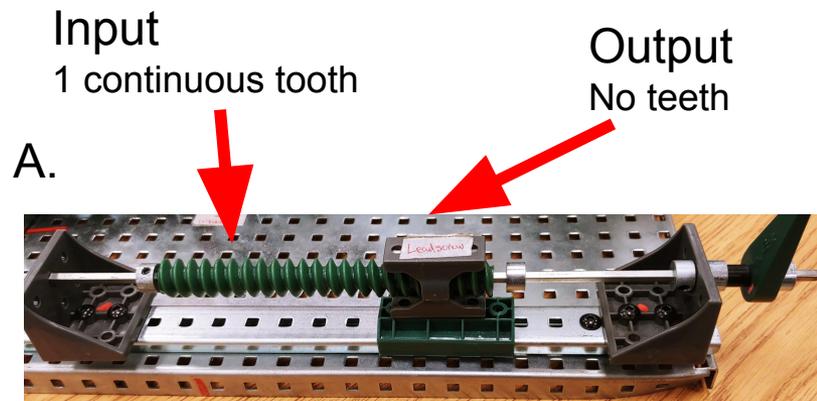
Where Can You Find a Leadscrews?

Common places you might find a leadscrew is in:

- Jack

- Vice

- 3D Printers

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*Lead screws change rotary movement into linear movement.
*A person can put little force into turing the handle of a jack and lift a car.

Rack and Pinion

In a Rack and Pinion the input and output shafts meet at a 90˚ angle.

In example A. the input gear is circular therefore the input gear's movement is Rotary.
The output gear is rack of teeth in a straight line, therefore output movement is Linear.

Both the input and output are similar, in that they both have teeth, this allows the direction of travel and the flow of power to be reversible.

Pinion
Input 24 teeth

Rack
Output 38 teeth
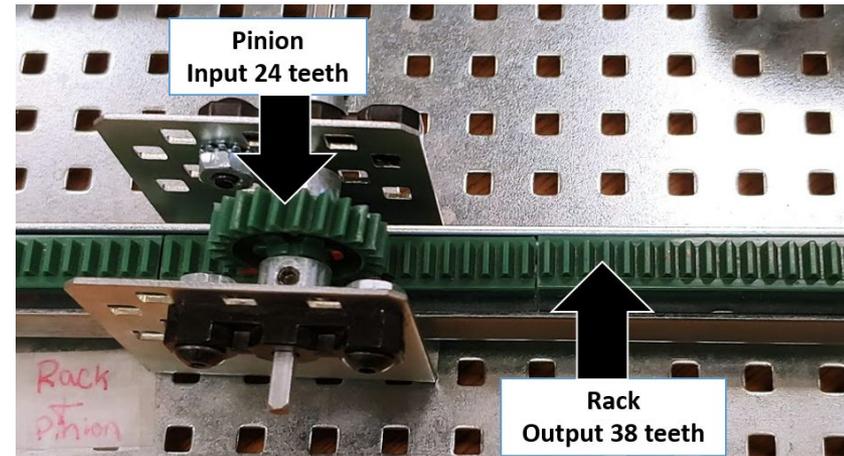
What is happening to speed and torque in Example A?
Simplified Gear ratio = 12:19
Speed is decreasing
Torque is increasing

Where Do You Find a Rack and Pinion?

Common places where Rack and Pinion might be found are:

- Steering systems of cars
- Some ice cream scoops

Check out an up close look at the steering system of a car.

- Rack and pinion is used to convert rotary and linear motion.

- The gear provides reduction to make it easier to turn wheels.

Rack & Pinion:Practice

- What type of movement does the Input gear do?

- The output gear?

- What is the simplified gear ratio in the Rack & Pinion B?

- Describe speed and torque

B. Pinion Output 24 teeth — Rack Input 57 teeth
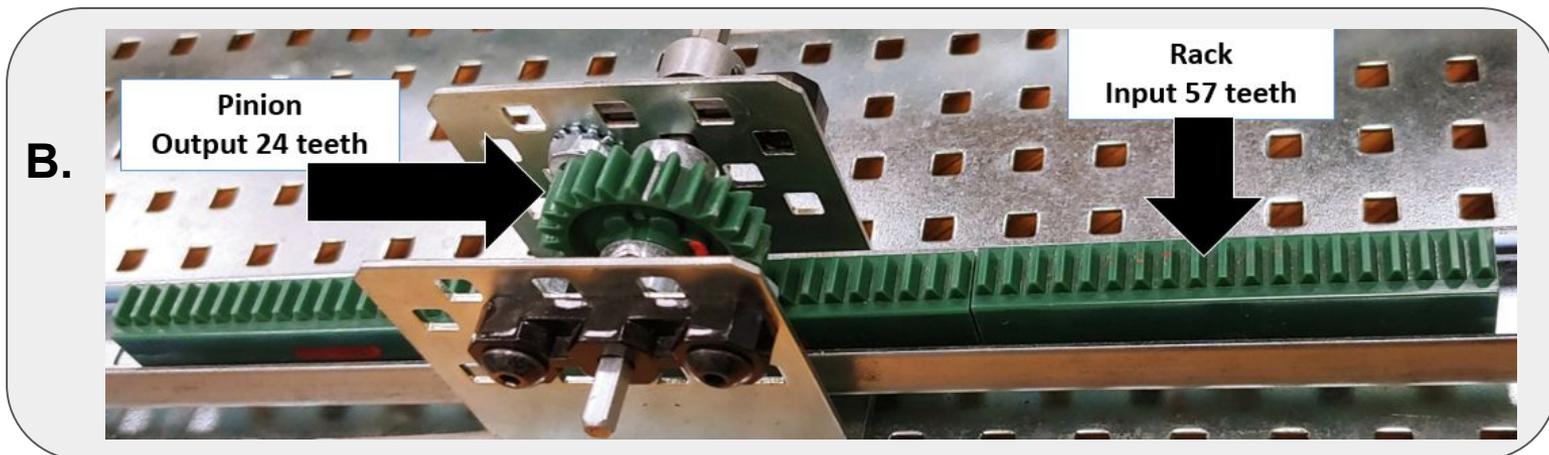
Rack & Pinion:Practice ANSWER KEY

- What type of movement does the Input gear do?

Linear because the teeth are arranged in a straight line

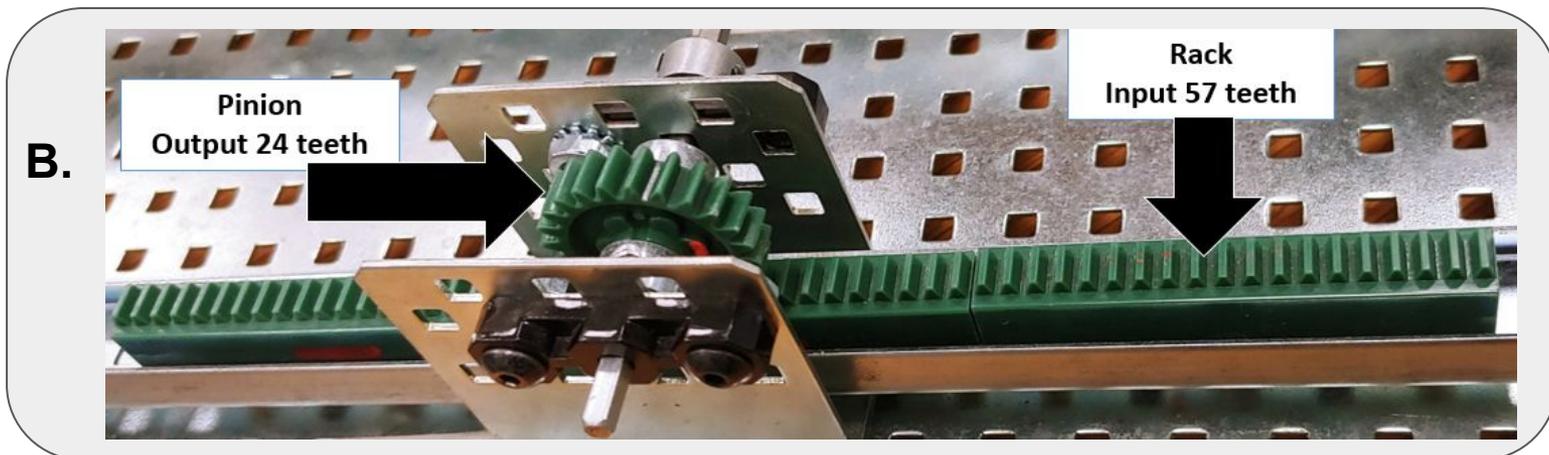- The output gear?

Rotary because the gear is circle shaped

- What is the simplified gear ratio in the Rack & Pinion B?

$$\frac{57}{3}:\frac{24}{3} = 19:8$$

- Describe speed and torque

Speed is increasing

Torque is decreasing because the output gear is smaller than the input gear

B.

(Pinion Output 24 teeth, Rack Input 57 teeth)

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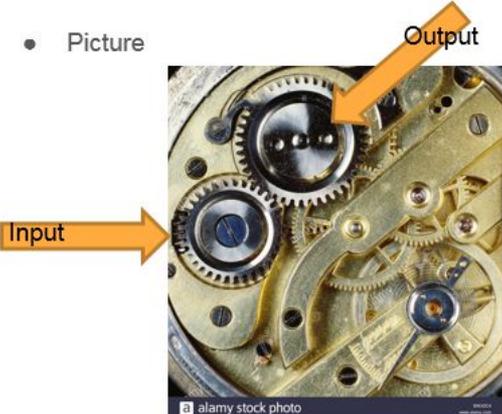
You will then label the input and out of that mechanism and answer the questions on the page.

Here is an example of a completed self assessment page.

Leadscrew

- 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

Rack & Pinion

- 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?

- What to know more about the different types of lead screws? Check this [webpage](#) out.
- What to know more about rack and pinion steering read this [article](#)!