



Automation & Robotics Virtual Learning

7th & 8th Mechanisms Day 7

April 14th, 2020



PLTW: Automation & Robotics
Lesson: Mechanisms Day 7 [April 14th]

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

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

Today our mechanisms will use reciprocating motion.

Explain the difference between Linear and Reciprocating motion.

*If you need help check lesson #1.

Explain your answer:

Questions/Main Ideas:

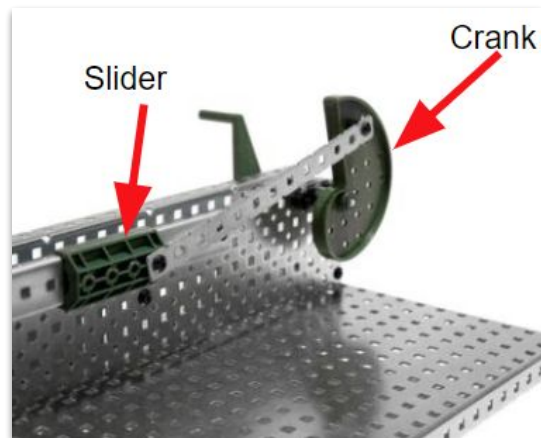
Summary/Reflection

Crank and Slider

In a Crank and Slider the input is always a gear called a cam which is shaped similar to a half moon. The gear moves 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 output is a slider on a metal rack that is moved along the rack as the drive shaft is turned. The slider moves forward and then backward every time the input makes a full rotation. Therefore, the output movement is **reciprocating**. The **flow of power cannot be reversed** since the slider could not move the cam in a complete circle.

Since the input and the output are not similar and do not have teeth there is **no gear ratio** and **no change in torque and speed**.



Where Can You Find a Crank and Sliders?

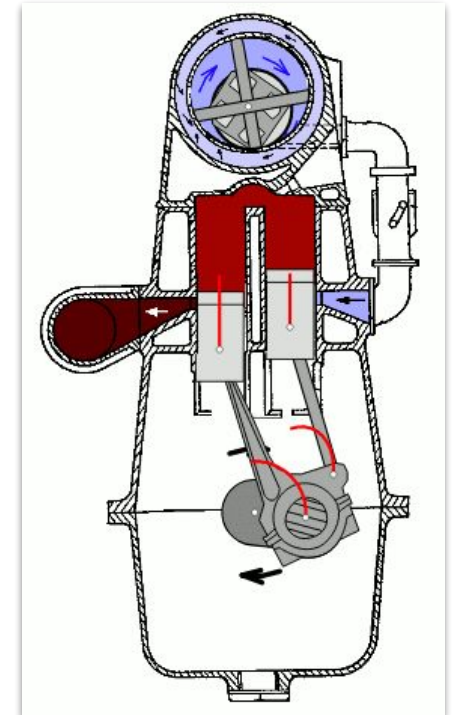
Common places you might find a Crank and slider is in:



- Steam trains
- Internal combustion engine

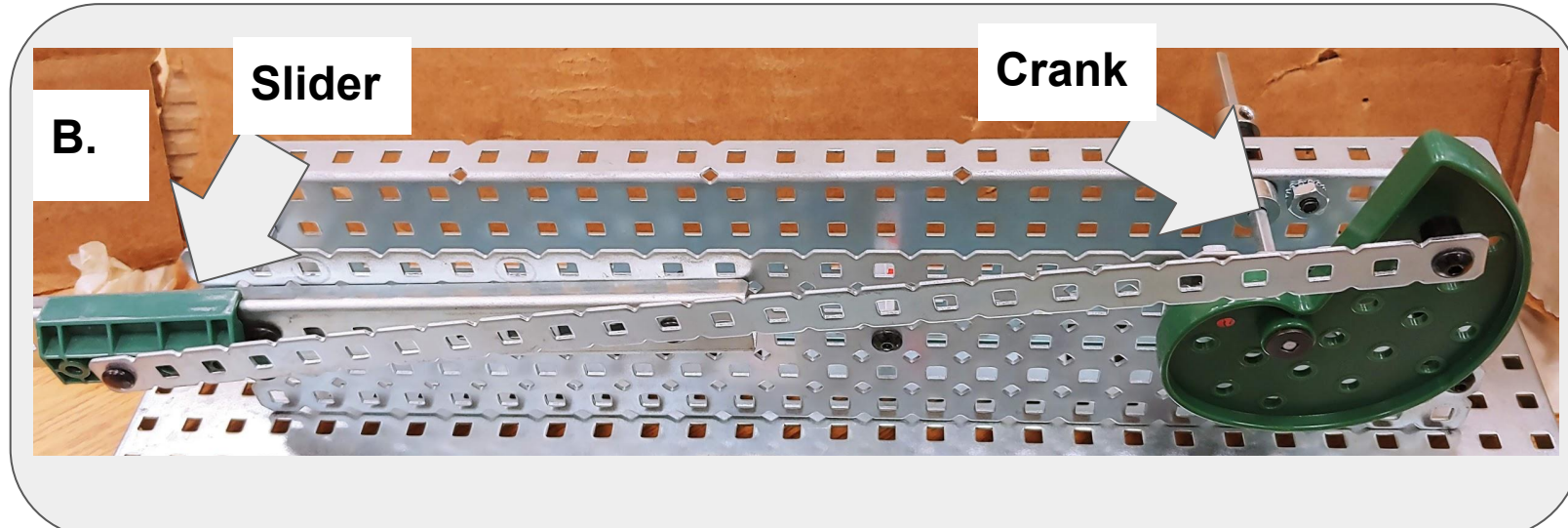
*Crank and sliders convert rotary movement into reciprocating.

*If you want the slider to move farther each rotation you must increase the size of the cam.



Cam and Follower: Practice

- What type of movement does the Input gear do?
- The output gear?
- If the current slider only moves two inches back & forth each time you turn the crank, how can you make it go a larger distance?
- Is the direction of travel reversible?



Cam and Follower: Practice ANSWER KEY

- What type of movement does the Input gear do?

Rotary because the gear moves in a circle

- The output gear?

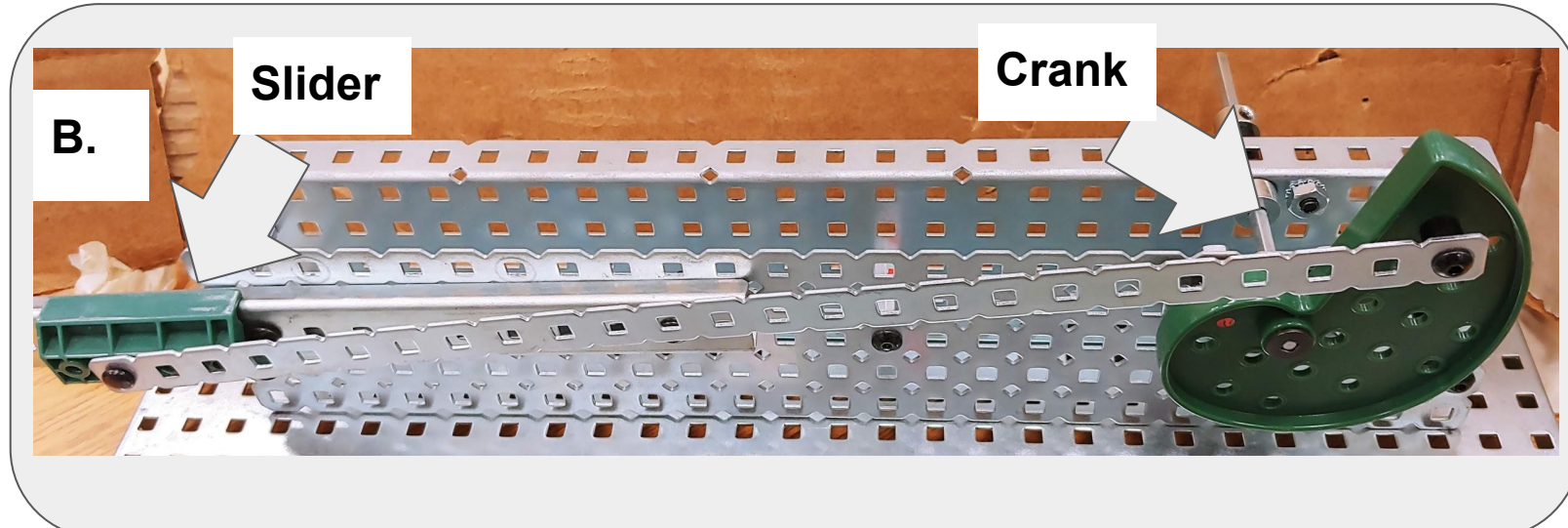
Reciprocating because the slider moves back and forth in one rotation of the crank.

- If the current slider only moves two inches back & forth each time you turn the crank, how can you make it go a larger distance?

Make the crank bigger.

- Is the direction of travel reversible?

Yes it is reversible.



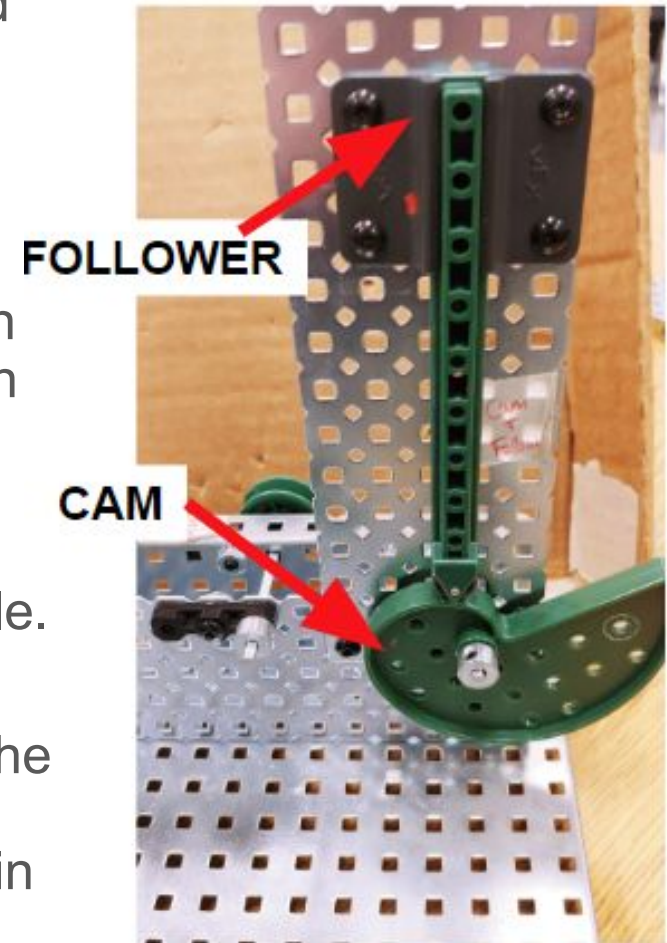
Cam and follower

A Cam and Follower is very similar to a crank and slider. The input is always a gear called a cam which is shaped similar to a half moon. The gear moves in a circle therefore the movement type is **Rotary**.

The output is a follower held up by the cam and in line with a track. The follower moves up and down in every time the input makes a full rotation. Therefore, the output movement is **reciprocating**. The **flow of power cannot be reversed** since the follower can not move the cam in a complete circle.

The **direction of travel is not reversible** in the mechanism to the right because of the shape of the cam, it does not allow the cam to be turned counterclockwise because the follower would be in the way.

Since the input and the output are not similar and do not have teeth there is **no gear ratio** and **no change in torque and speed**.



Where Can You Find a Cam and follower?

Common places you might find a Crank and slider is in:

- **Cam shafts**

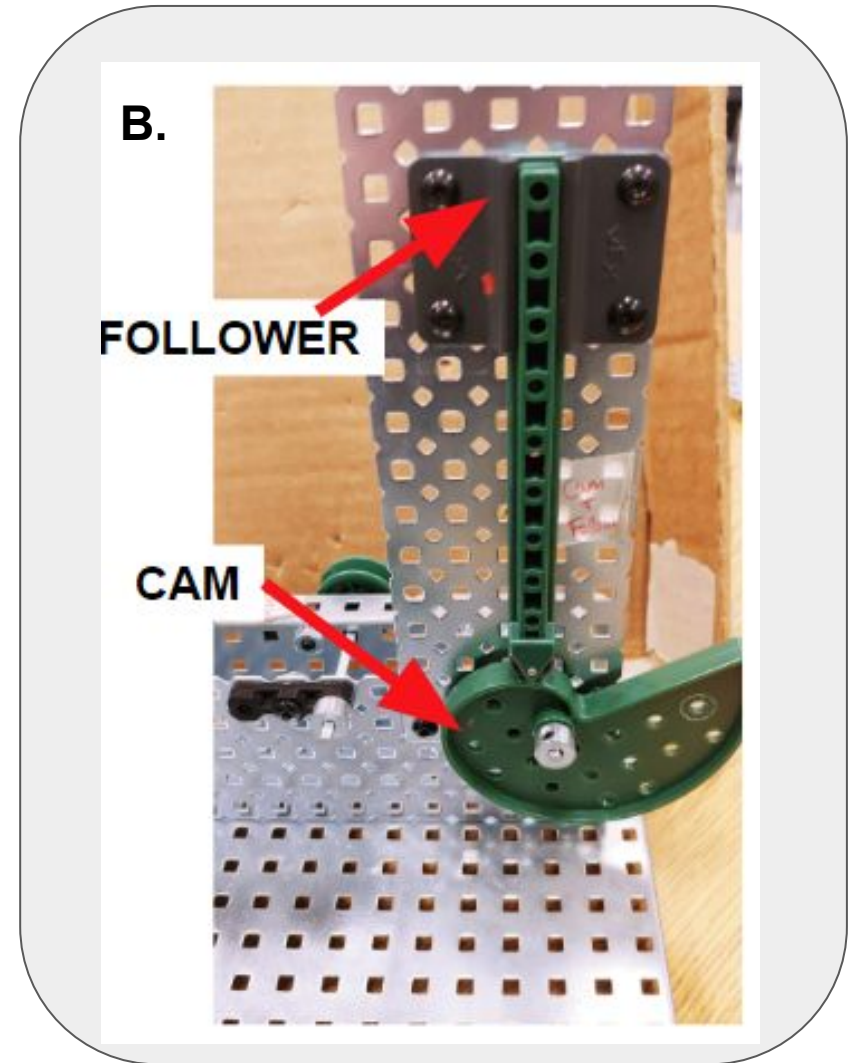


- The cam pictured here would be reversible, as it is symmetrical (the same on both sides, if cut in half).

*As a cam rotates, the flat follower is raised and lowered converting rotary movement to reciprocating movement.

Cam and Follower: Practice

- What type of movement does the Input gear do?
- The output gear?
- If the current follower only moves two inches up & down each time you turn the cam, how can you make it go a shorter distance?
- Is the direction of travel reversible?



Cam and Follower :Practice ANSWER KEY

- What type of movement does the Input gear do?

Rotary because the gear moves in a circle

- The output gear?

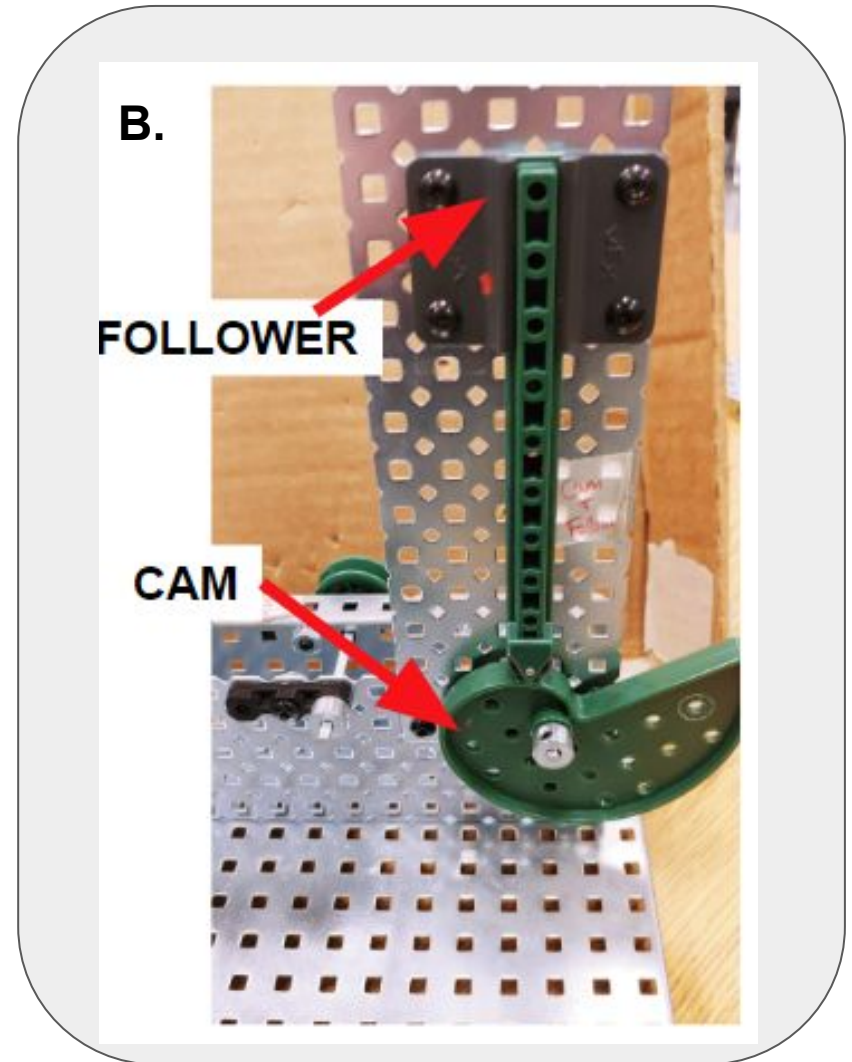
Reciprocating because the follower moves up and down in one rotation of the cam.

- If the current follower only moves two inches up & down each time you turn the cam, how can you make it go a shorter distance?

Make the the cam smaller.

- Is the direction of travel reversible?

No, because the cam is not symmetrical and will be stopped by the follower.



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.

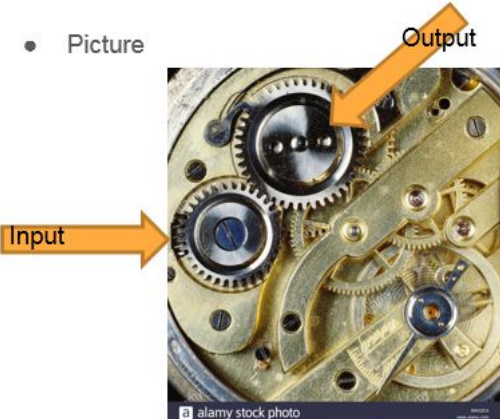
You will then label the input and out of that mechanism and answer the questions on the page.

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 its function (what is its 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

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Crank and Slider

- 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

Cam and Follower

- 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?

- Watch and Crank and Slider in motion [here!](#)
- What to know more about the different types of Cam and Followers? Take a look at this [video!](#)