

Lesson 10 Cam Mechanism

Learning Objectives

Students will:

1. learn about cam mechanisms;
2. design a simple cam mechanism.

Preparation:

1. A sample cam mechanism
2. Pre-cut box materials
3. Engraving materials: 3mm basswood sheets
4. Wood glue
5. **LaserBox**

Session 1 Lead-in

Showcase students how a sample cam mechanism works and invite them to try it out.

Ask students a question: "**Do you know why the rod above the box keeps moving up and down?** "

Possible answer: "It's because when we turn the rod on the right-hand side, it will lead to the rod on top of the box moving up and down."

Ask students another question: "Then why is the rod on the box moving up and down and rotating at the same time while the rod on the right-hand side keeps circling?"

Give students time to think about this question.

Explain to students: "In this project, a transmission system is applied. So we need to know what a transmission system is. A transmission system transmits power from one part of a machine to another. All the components that make a machine or parts of a machine move or rotate constitute a transmission system."

Session 2 Show Examples

Ask students: So can you think of any transmission systems in our daily life?

For instance, in a watch, gears are commonly used as a transmission system to drive the minute and hour hands. This is a typical application of a transmission system.



Chain transmission systems are used in bicycles.



Transmission systems are quite common in our daily life. We hardly see how these transmission systems work simply because they are often wrapped inside.

Session 3 Introduce Cam Mechanisms

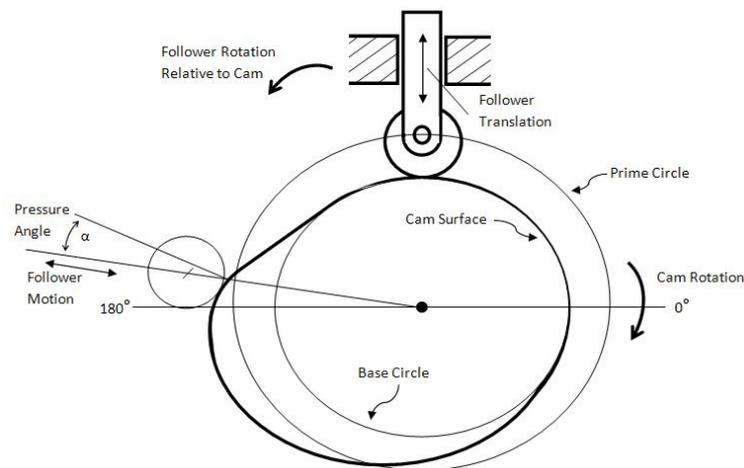
Today's lesson is about a transmission system - **Cam Mechanism**.

A cam mechanism generally comprises three elements, a **cam**, a **follower** and a **fixed frame**.

A cam is a component that gives a specific motion, by its rotation, to the follower. A follower is a component which is in reciprocating or swinging motion. Cam mechanisms are widely applied in automatic and semi-automatic machines.

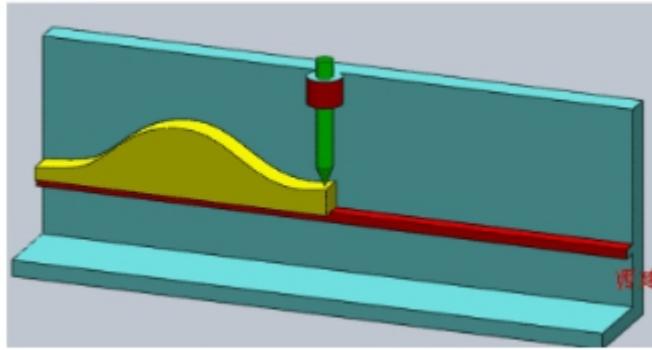
There are three types of cam mechanisms: Plate Cam, Translating Cam and Cylindrical Cam.

Plate Cam: The plate-shaped cam rotates to drive the follower to move in a specific way. In the following picture, the cam is rotating off-center, instead of around the central center.



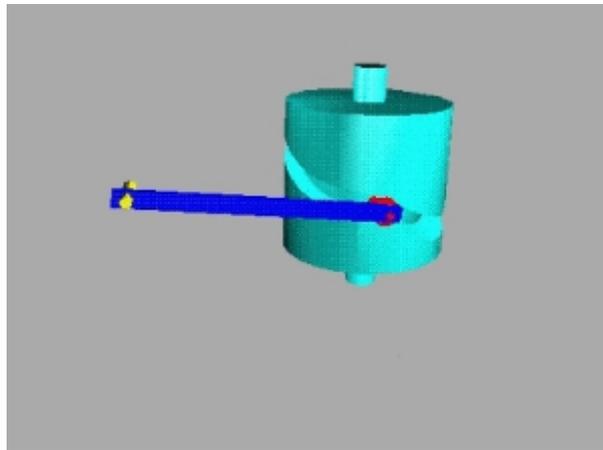
Source: https://en.wikipedia.org/wiki/Cam#/media/File:Cam_Profile.JPG

Translating Cam: The motion of the follower changes in accordance with the shape of the cam.



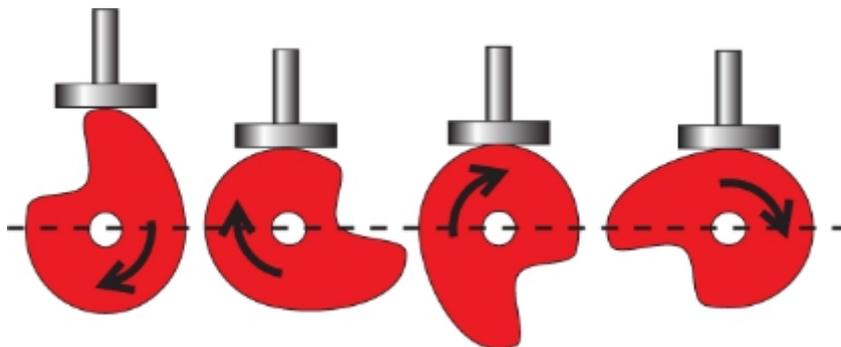
Source: http://www.360doc.com/content/16/0723/06/8862802_577696269.shtml

Cylindrical Cam: The follower moves in the groove of the cylinder.



Source: http://www.360doc.com/content/16/0723/06/8862802_577696269.shtml

How does a cam mechanism work?

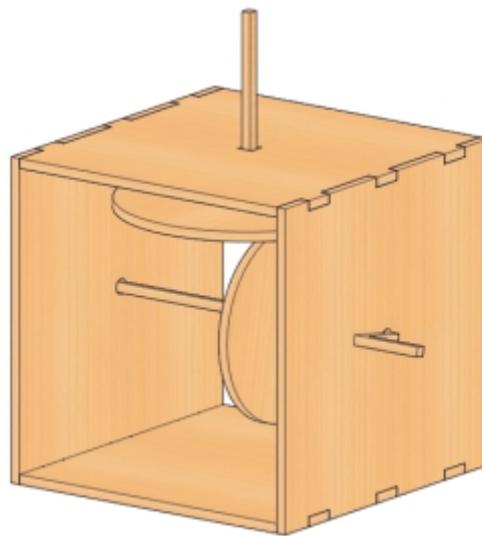


From the diagram above, we can see how a cam pushes the follower.

Session 4 In Class Task

Introduce the task to students: "In the following 2 class periods, we're going to use **LaserBox** to design a box including a cam mechanism that looks like the one I showed you earlier. We will use a plate cam to drive the follower in this box. But before we work on our design, we should know how the shape of cam mechanism influences the movements patterns of the follower."

Tell students that they can try two different ways to design their plate cams, either an eccentric circular cam or a triangle-shaped cam. Students can design an **eccentric circular cam** which looks like the sample cam. The cam doesn't rotate around the central center of the circle. Instead, the center of rotation is distant from the circle center so the motion route of the follower doesn't follow a regular circle pattern. Of course, students can create a **triangle-shaped cam** that drives the follower to rise and fall. Have students work on the designs in groups. Give ready-made boxes to students and tell them to add cam mechanisms to the boxes.



Demonstrate:

- Showcase a sample cam mechanism
- Explain the design concept

- Analyze the motions of the cam mechanism
- Build up structural parts

Materials necessary for making a simple cam mechanism:

Ready-made Box X1 (get this ready for students)

Circular wheel X1

Wood rod X 1

Controlling rod X1 (have students design this one by themselves)

Cam X 1 (have students design this one by themselves)

What students should focus on:

The shape and the position of the cam mechanism.

Session 5 Share

Ask students to show how their cam mechanisms work.

Session 6 Wrap-up

Summarize today's lesson: "In today's lesson, we used **LaserBox** to make a cam mechanism. A cam mechanism comprises three elements, a cam, a follower and a frame. The cam shape influences the motion style of the follower so we can try to make different types of cams to see how they work.

Session 7 Extension

Have students explore other types of mechanic transmission systems and try to use **LaserBox** to make a project by themselves.

