Model 14
Windshield wiper - concurrent

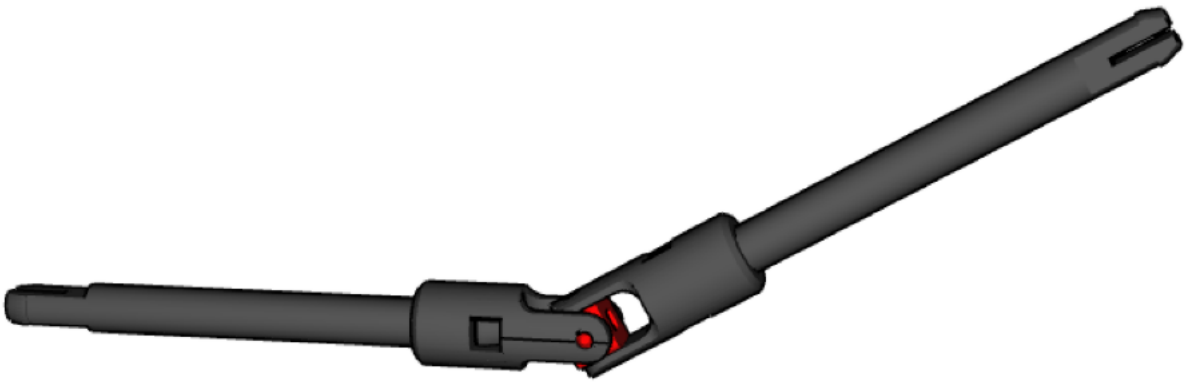
Date

Name

Class

DESIGN TASK

Before you assemble the model, take one of the universal joints, insert two snap-fit axles into both ends, and test the function of the universal joint by hand.



1. Try turning the two axles and see how the rotational movement is transmitted—not only straight, but also "bent."

   What about the direction of rotation of the axles?

   _____

2. Can the cardan be "bent" as far as desired so that the rotational transmission still works?

   _____

3. First construct the model according to the building instructions, starting with the articulated crank.

THEMATIC TASK

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This is how the force flows from the crank joint to the "wiper blades":

1. From the crank to the gear mechanism: The movement first goes to a larger red gear Z20 with 20 teeth. The transmission runs via a smaller black gear Z10 with 10 teeth. A medium-sized Z10 only reverses the direction of rotation: Two adjacent gears rotate in opposite directions, the third again like the first.
2. The eccentric as the key mechanism: The eccentric—here a black plate with an axle in Z20—converts the uniform rotation into a back-and-forth movement. Its "eccentric" point transmits the movement via the I-strut 45. Simple, but effective!
3. The first crank: The back-and-forth motion reaches the first crank, which moves back and forth accordingly.
4. The parallel crank mechanism: The movement is transferred to a second crank via the I-strut 90. This follows the first crank almost without deviation.
5. Movement "around the corner": Since the windshield wipers are mounted at an angle to the windshield, a universal joint transmits the rotation from the horizontal gear.
6. The windshield wipers: The wiper blades move synchronously, both up and down at the same time – precisely and reliably.

Tasks:

1. Adjust the eccentric: Set how far the attachment point of the I-strut 45 is from the pivot point of the drive axle. The further away (the more "eccentric"), the greater the swivel range of the windshield wipers. Move component 7.5 so that the wipers swing all the way down without the mechanism jamming.

2. How many turns of the crank are needed for the wipers to complete one cycle – back and forth? And why?

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3. The two "wiper blades" (the two black I-struts 90) overlap when they are horizontal at the bottom.

a) Which one must be on top and which one underneath?

_____

_____

_____

b. What happens if the wipers are placed on top of each other in the wrong order?

_____

_____

_____

c) Describe in complete sentences why this problem occurs.

_____

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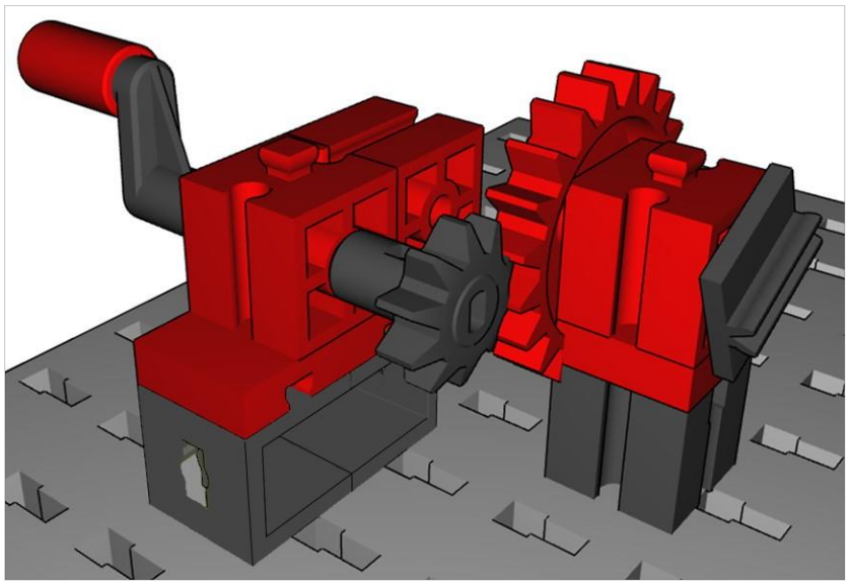
_____

EXPERIMENTIERAUFGABE

Date

Name

Grade



1. Remove the middle gear Z10. Then move the bracket of the first Z10 so that it engages directly with Z20, as shown in this image:

   Turn the crank. What has changed?

2. Adjust the eccentric so that the attachment point of the I-strut 45 is extremely far away from the pivot point of the drive axle ("increase the eccentricity"). What happens when you crank?

_____

_____

_____

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3. Try to "reverse" the drive: Turn one of the wipers itself. Swing the wiper back and forth. What do you observe?

_____

_____

_____

Additional task

Build the model with a motor and test it.

ANLAGEN

Further information

[1] Wikipedia: Spur gear.

[2] Wikipedia: Eccentric.

[3] Wikipedia: Coupling gear.

[4] Wikipedia: Universal joint.