

Understanding the need

The gondolas need to rotate with the axle in order to remain level. For the most part, the weight of them is sufficient to turn the gears. For precision, the gearing system is specially designed with two three identical large and two smaller gears to provide a smooth and controlled rotation.

Each end of each caisson is supported on small wheels, which run on rails on the inside face of the 8 m (26 ft) diameter holes at the ends of the arms.



The rotation is controlled by a train of gears. It includes an alternating pattern of three 8 m (26 ft) diameter ring gears and two smaller idler gears, all with external teeth, as shown above. When the motors rotate the central axle, the arms swing and the small gears engage the central gear. The smaller gears then rotate at a higher speed than the wheel but in the same direction.

The smaller gears engage the large ring gears at the end of the caissons. This drives them at the same speed as the wheel but in the opposite direction. This cancels the rotation due to the arms and keeps the caissons stable and perfectly level.

Source : <https://interestingengineering.com/coming-full-circle-the-falkirk-wheel>

Answer in your own words AND quote the text to justify your answer

1) What is the purpose of the gears in that application?

2) What could happen if they weren't there?

Understanding the movements

It is never easy to understand the rotation of gears when the centre of a wheel moves as well as the wheels rotate around their centres. This is called epicyclical movement.

To see what happens you will proceed with the following manipulations and observations.

1) Let's observe the movements with respect to a part where all the gear centres are idle.

Build the model shown beside with the provided parts.

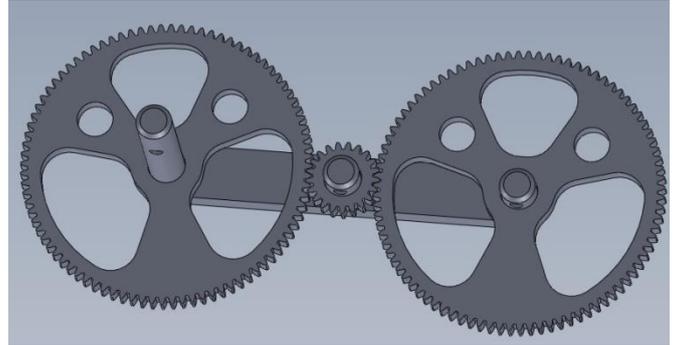
Dedicated vocabulary to learn:

With respect to

Cw

Ccw

Magnitude



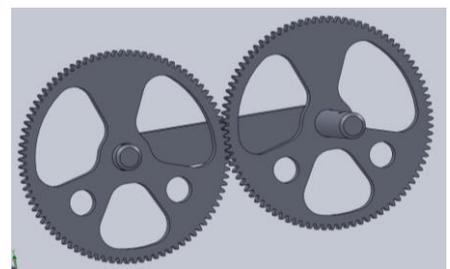
Hold the bar and move one big wheel clockwise.

What can you say about the rotation of the small wheel? (Sense & magnitude)

What about the sense and the magnitude of the other big wheel rotation, compared with the one you have moved by hand.

Show your observations by drawing curved arrows on the drawing above.

If there were only the two big wheels gearing together what would happen? (use the sketch to illustrate)



What is the purpose of the small wheel?

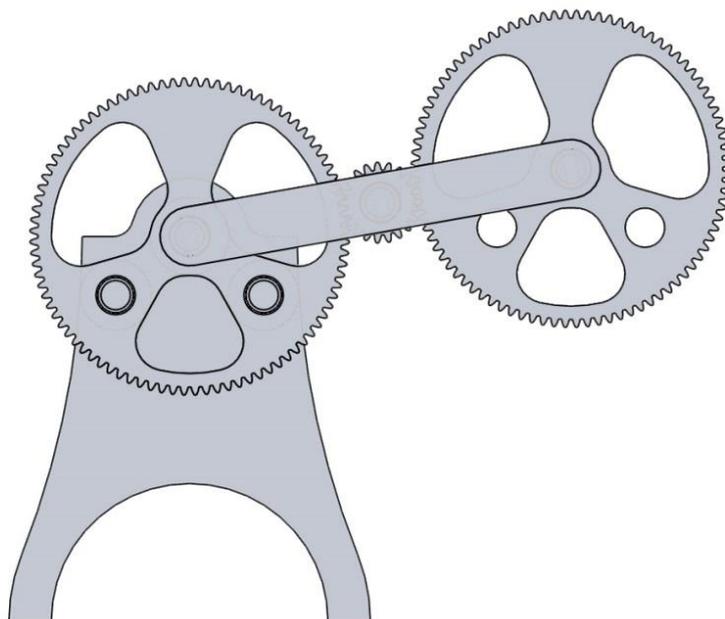
2) Let's change our point of view.

What do we want as a rotating movement for the second wheel on our machine?

How can we achieve that?

Built it with the parts given and check your answer.

Draw the arm and the outer wheel when the arm has been rotated 90° anticlockwise



Label the wheel that acts like one gondola on the real machine