

## Model 6

### Planetary gear



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Name

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## DESIGN TASK

Fig. 1 shows a coaxial gear with bevel gears. Build the gear. Task: What change in motion does it cause?

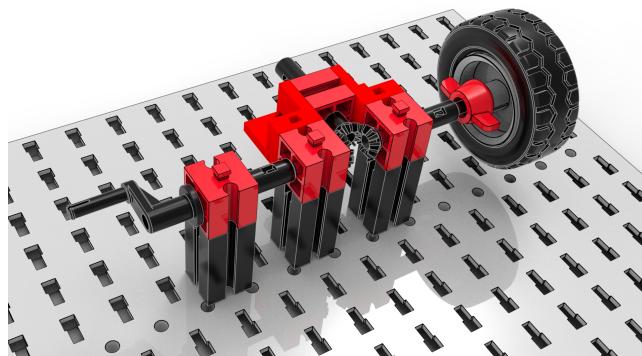


Fig. 1: Differential gear

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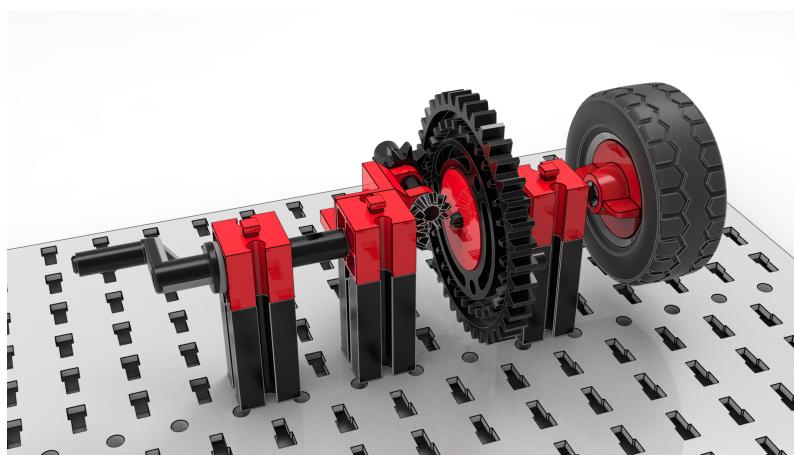
A coaxial gear can also contain a transmission ratio. The gear in Fig. 2 uses a crown wheel gear. Build it.

Task: What transmission ratio does it achieve?

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Date

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Name

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Class

Fig. 2: Coaxial reduction gear with crown wheel

## THEMATIC TASK

Planetary gears are a special type of coaxial transmission gear. They are usually designed as spur gears, i.e., the teeth of the gears are perpendicular to the axis (shaft). Planetary gears consist of

- a "sun gear" (a gear wheel in the center),
- several "planetary gears" that "orbit" around the sun gear and whose shafts are connected to each other via a bridge, and
- a "ring gear" in whose internal gear teeth the teeth of the planetary gears engage.

Planetary gears can be designed to be very compact. Depending on which of the three shafts of a planetary gear—the sun gear, the bridge, or the ring gear—is mounted "fixed," a different transmission ratio is achieved.

First, examine and design the following planetary gear with a fixed bridge and the sun gear on the drive shaft (Fig. 3):

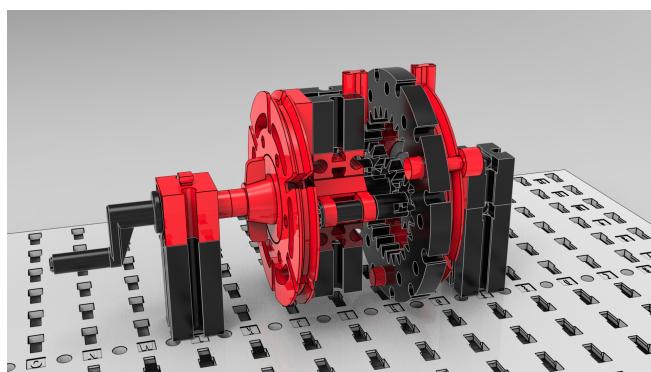


Fig. 3: Planetary gear with fixed planet carrier (carrier) and sun gear drive



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The transmission ratio of this planetary gear is identical to that of a simple spur gear (Fig. 4):

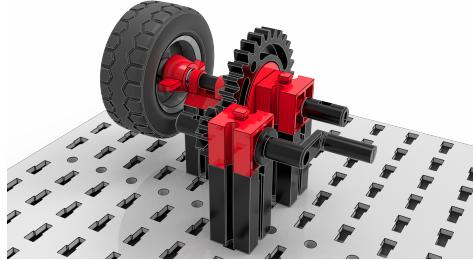


Fig. 4: Spur gear equivalent to planetary gear

Task:

Why is this the case? Explain. What transmission ratio does the planetary gear with a fixed bridge and the sun gear as the drive achieve?

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Date

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Name

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Class

## EXPERIMENTAL TASK

1. In the planetary gear in Fig. 3, the bridge is fixed. Design another planetary gear in which either the sun gear or the ring gear is fixed.

2. What transmission ratios can be achieved with fischertechnik spur gear planetary gears with the internal gear Z30? Complete the following table:



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## EXPERIMENT

1. In the planetary gear system shown in Fig. 3, the bridge is fixed. Design another planetary gear system in which either the sun gear or the ring gear is fixed.
2. What gear ratios can be achieved with fischertechnik spur planetary gearboxes with the internal gear Z30? Complete the following table:

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Date

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Name

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Class

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Fixed	Drive	Output	Transmission ratio	Reversal of direction
Bridge	Sun gear	Pinion		yes/no
Web	Pinion	Sun gear		yes/no
Ring gear	Sun gear	Bridge		yes/no
Hollow wheel	Bridge	Sun gear		yes/no
Sun wheel	Bridge	Pinion		yes/no
Sun gear	Pinion	Bridge		yes/no

As you have seen, some of the gears cause a reversal of direction. We mark them with a minus sign ("−") in the transmission equation.

3. Large gear ratios can be achieved by "connecting" planetary gears in series. Consider the three different planetary gears. Which two (different) gears would you connect to achieve the largest possible gear ratio for slow speeds?

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