Tasks
Model 1 – Manual generator / Muscle power

Construction task

Build model 1 according to the instructions. Observe the following points while building:

- The gear drive should move easily. The spur gears may not get stuck on the axle bearings, so as to prevent any unnecessary frictional loss. The axes may not shift in either a radial or axial direction.
- The red cable of the solar motor generator is connected to the input jack on the LED marked with a + (plus pole).
- The LED is only designed to show how the solar motor can be used to generate electricity. It may be operated with a maximum of 2 V direct current. Higher voltages will immediately destroy it.

The solar motor generator is the heart of this model. It is driven with the help of a gear drive.

Each gear converts the movement of a drive into the movement of one or more drives. The manual generator has two parallel axes. One is the input (crank) and the other is the output.

The Z40 gear of the input axle interlocks with a Z10 gear on the drive axle. The Z40 gear of the output axle, in turn, interlocks with a Z10 gear on the motor shaft of the generator.

The fischertechnik solar motor (0.5-2V) is a DC machine and can both convert the rotational energy produced into electrical current (generator function) as well as be operated with direct current itself (motor function).

In our model, the rotational energy generated by activating the hand crank is converted into electrical energy by the generator. As you can easily see, the small Z10 gear on the generator must turn extremely quickly to make the LED light up. The manual generator, therefore, is designed as a two-stage transmission gear.

Topic task

1. How often does the small Z10 gear turn on the generator when you turn the hand crank one time? Calculate the gear ratio for this two-stage gear. Note: In general, the gear ratio of a multi-stage gear is the product of the gear ratios for the individual stages.
2. Turn the hand crank counter-clockwise as well. Why can't the LED light up with this direction of rotation?

3. What forms of energy conversion do you use with the manual generator model?
4. What other forces can the power of your muscles replace and use a generator to generate power?
5. What term is used to graphically describe the relation between the two variables of current and voltage of electrical components?

Experimental task

1. Complete measurements to determine from what voltage U in V and current I in mA the green LED lights up. What conclusions can you already draw from your measured values?
2. Optional: Repeat the experiment with different colour LEDs.