

KidWind / Know Energy

VI. Gears

Definitions

- Torque- rotational motion
A high torque motor generally turns with a lot of force but not much speed
- Speed-the rate at which a shaft spins
A high speed motor generally turns with speed but not much force or torque

Definitions Continued

- Gear teeth-indentations on a gear wheel which link to the teeth on another gear wheel making that one spin also
- Gear ratios-a comparison of the two diameters of two interactive gears. A gear ratio can also be determined by comparing the number of teeth on each of two interactive gears.

Definitions Continued

- Driver gear-the gear attached directly to the motor (a.k.a. the input gear)
- Driven gear (a.k.a. the output) -the gear that is turned by the driver gear
- Gear train or gear box- a device connecting more than two gears together

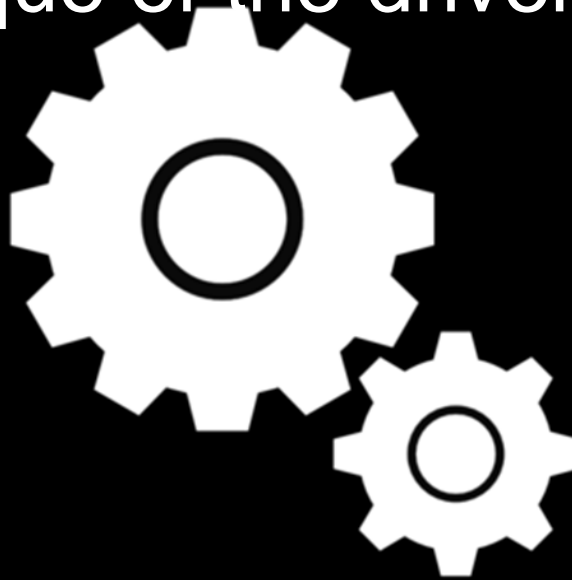
Function of Gears

- Gears can be used to increase torque,
- Gears can be used to increase speed,
- Gears can be used to change the direction of rotation

Gear Math 1

Assume the larger gear is attached to a motor (driver gear)

- Calculate the gear ratio (driver/driven)
- Determine whether this system will increase the speed of the driven or output gear or the torque of the driven gear.



Gear Ratio

Number of teeth of driver gear = 12

Number of teeth of the driven gear = 8

$$\text{Gear ratio (driver/driven)} = \frac{12}{8} = 1.5$$

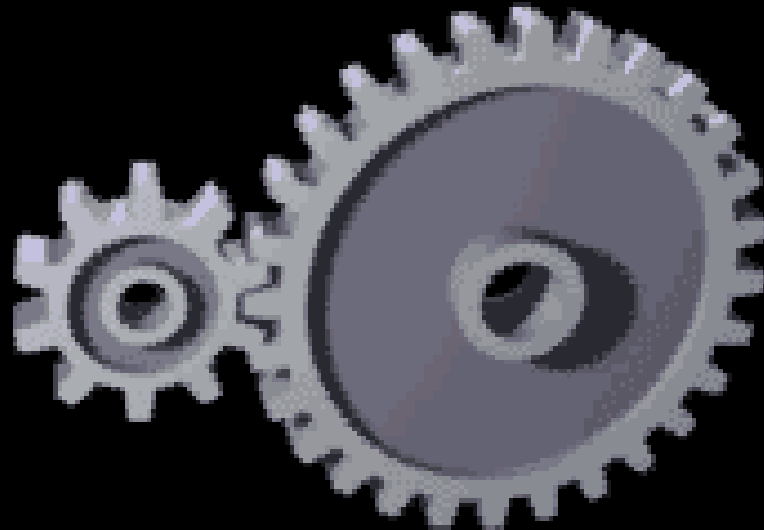
What does that ratio mean?

- It means that for every revolution the big gear (driver gear) makes, the smaller gear (driven gear) will make $1\frac{1}{2}$ revolutions
- That means further, that whatever the small gear is connected to will turn faster than the large gear, but will have less torque

Gear Math 2

Assume the smaller gear is the driver gear

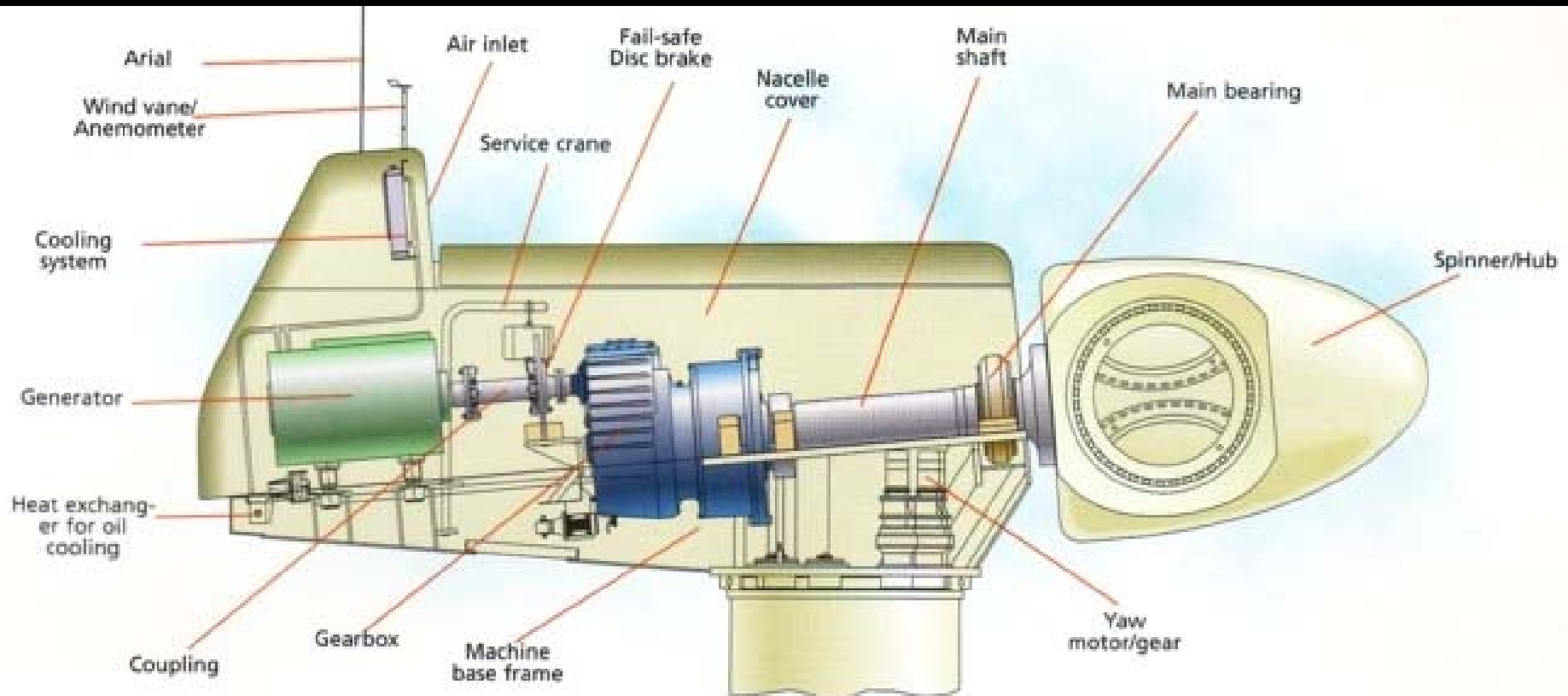
- Calculate the gear ratio (driver/driven)
- Determine whether the driven gear will have more speed or more torque.



Gears in Wind Turbines

- The blades on a large wind turbine turn very slowly
- To generate the type of electricity needed by modern homes, the generator shaft needs to spin very fast
- A gear box is placed in the nacelle that has up to a 100:1 ratio meaning the generator shaft will turn 100 times faster than the blade shaft.

Inside a Wind Turbine



End of Part VI