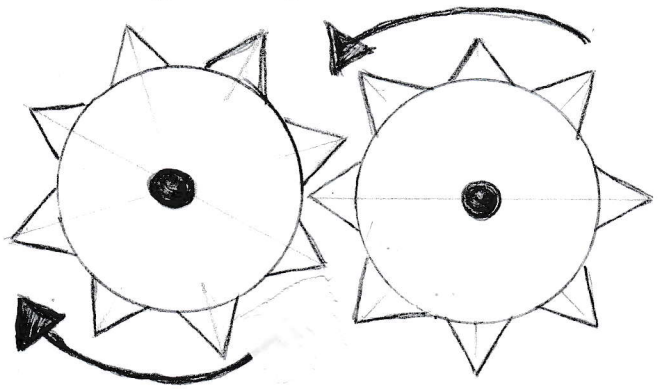
Gears, Pulleys and Wheels

Time Based Sculpture - Svoronos

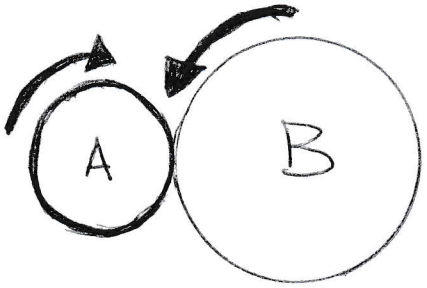
The **gear** is essentially a wheel and axle covered in levers. Rotational motion of one induces rotational movement in the other through leverage on the gear teeth. This will only occur if the gear teeth mesh properly, and the torque applied to the **drive gear** (the one supplying motion) is sufficient to move the load placed upon the **slave gear** (the one being moved).



TOOTHED GEARS ALWAYS TURN IN OPPOSITE DIRECTIONS

Gear, Pulley and Wheel ratios

The **circumference** of machine elements in **rotation** greatly influence the outcome of motion

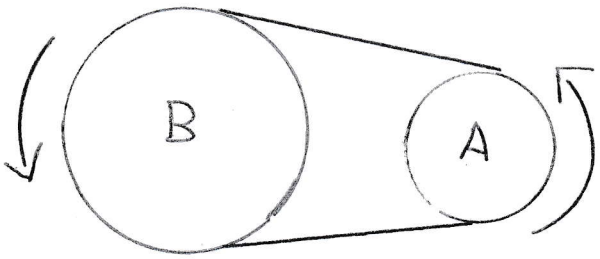


An example:
- wheel A has a circumference of 2"
- wheel B has a circumference of 10"
- for every **one** rotation of B,
  A will rotate **five** times.

The rotational relationship between the two can be expressed as:

(drive wheel circumference)/(slave wheel circumference) =
(# of rotations of slave wheel when drive is turned once)

The same fact holds true when using belts to connect wheels and pulleys



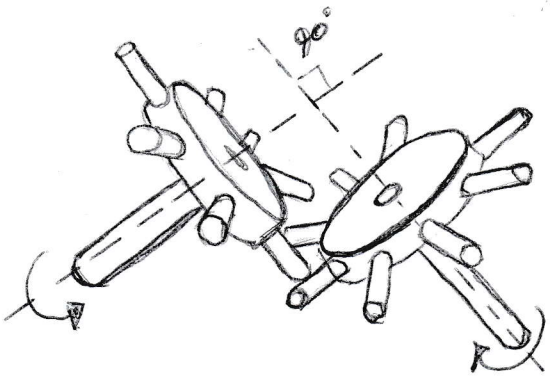
BELT CONNECTED PULLEYS & WHEELS ALWAYS TURN THE SAME DIRECTION

Changing Direction of Rotating Motion

The direction of rotational output can be altered in a variety of ways, some examples being; long toothed gears, friction wheels and cams.

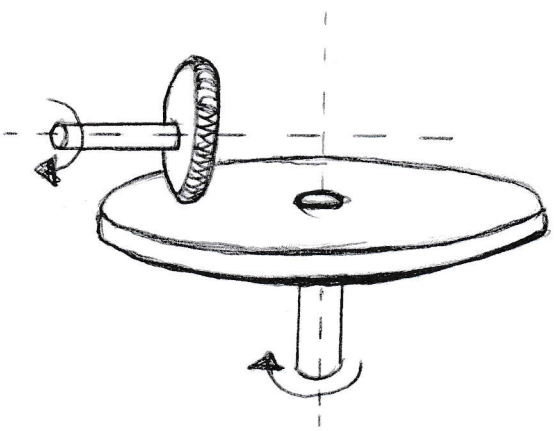
Long Tooth Gears

Can interlock at odd angles, including 90 degrees, to change the direction of the axle.



Friction Wheels

One wheel riding on top of or against the face of another wheel, will allow it to change speed and direction, based on positioning.



An example:

Fig.1

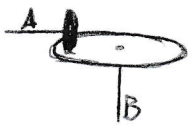


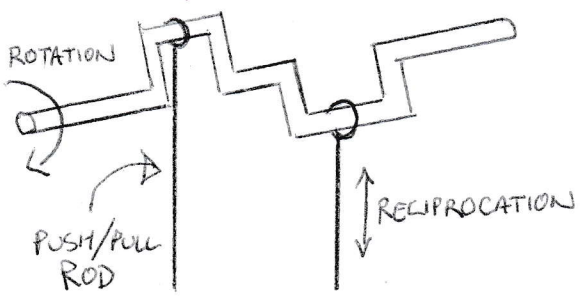
Fig.2

- If wheel B is driving wheel A: Fig. 1 will drive A <u>faster</u> than Fig. 2
- If wheel A is driving wheel B: Fig. 1 will drive B <u>slower</u> than Fig. 2

* The position and point of contact between the wheels, determine a different "circumference" of contact.

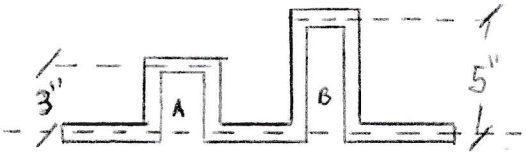
Cams and reciprocal motion

Cams can be thought of as a series of levers, rotating like wheels. They are used to change **rotation** into **reciprocation** (a back and forth motion) **using push or pull rods**. Examples can be seen in car engines and train wheels.



*the distance of reciprocation is twice the distance of the cam's off set from rotational center

An Example:



- if cam A is offset 3" from center, its full stroke length is 6'.

- if cam B is offset 5" from center, its full stroke length is 10"

-However, it will take more force (torque) on the axle to move the same load on cam B, as opposed to cam A due to the increased length of the lever that the cam creates.