Proof of concept

Spring launching

$m_{balls} = 0{,}08\ kg$

$s_{springs} = 0{,}078\ m$

$s_{travel\_balls} = 1\ m$

$n_{springs} = 3$

$m_{min.weight} = 0{,}3\ kg$

$$V_{launch} = \sqrt{s_{travel\_balls} \cdot 9{,}81} = 4{,}43\ m/s$$

$$\frac{1}{2} \cdot m_{min.weight} \cdot V_{launch}^2 + m_{balls} \cdot s_{travel\_balls} \cdot 9{,}81 = n_{springs} \cdot \frac{1}{2} \cdot k \cdot s_{springs}^2$$

$$\downarrow$$

$$k \cdot 0{,}0091 = 3{,}73$$

$$\downarrow$$

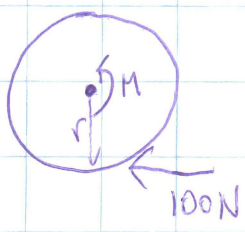
$$k = 410\ N/m$$

$$F_{total} = n_{springs} \cdot k \cdot s_{springs} \approx 96\ N$$

We will be doing all the strength calculations with 100 N and will take a certain factor for friction and other effects in account.

$$r_{gear} = \frac{s_{springs} + 0{,}015}{2 \cdot \pi} \approx 0{,}0135\ m \quad \rightarrow \text{for milled away teeth}$$

Picked a gear that is 0,03 m Ø (d2)



$$M = 100 \cdot r = 1{,}5\ Nm$$