Kontinuitätsgleichung:

$$A \cdot v = \text{konst.}$$

<u>Bsp.:</u> Aorta $3\,cm^2 = A_0$

$v_0 = 30\,cm/s$

Kapillare $d = 6\,\mu m = 0{,}006\,mm$

$r = 0{,}003\,mm \Rightarrow A_K = 3 \cdot 10^{-7}\,cm^2$

$v_K = 0{,}05\,cm/s$

Wie viele Kapillare?

$$A_0 \cdot v_0 = n \cdot A_k \cdot v_k$$

$$n = \frac{A_0 \cdot v_0}{A_k \cdot v_k} = \frac{3\,cm^2 \cdot 30\,cm/s}{3 \cdot 10^{-7}\,cm^2 \cdot 0{,}05\,cm/s}$$

$$= 6 \cdot 10^9$$

$$= \underline{\underline{6 \text{ Milliarden}}}$$

<u>Bsp.:</u> Wasserhahn

$A_0 = 1{,}2\,cm^2$ $\qquad R_V = 34\,cm^3/s$

$\Rightarrow v = \frac{R_V}{A_0} = 28{,}6\,cm/s$

in 1 m Tiefe:

Beim Verlassen des Hahnes wirkt auf das Wasser die Erdanziehungskraft!

$\Rightarrow$ freie Fall nach unten

$$\boxed{v = v_0 + g \cdot t}$$

$$1\,m = s = \frac{1}{2} g \cdot t^2$$

$$t = \sqrt{\frac{2s}{g}}$$

$$v = v_0 + g \cdot \sqrt{\frac{2s}{g}}$$

$$= v_0 + \sqrt{2sg}$$

$$= 28{,}6\,cm/s + \sqrt{2 \cdot 1\,m \cdot 9{,}81\,m/s^2}$$

$$= \underline{\underline{471{,}5\,cm/s}}$$

Kontinuitätsgleichung:

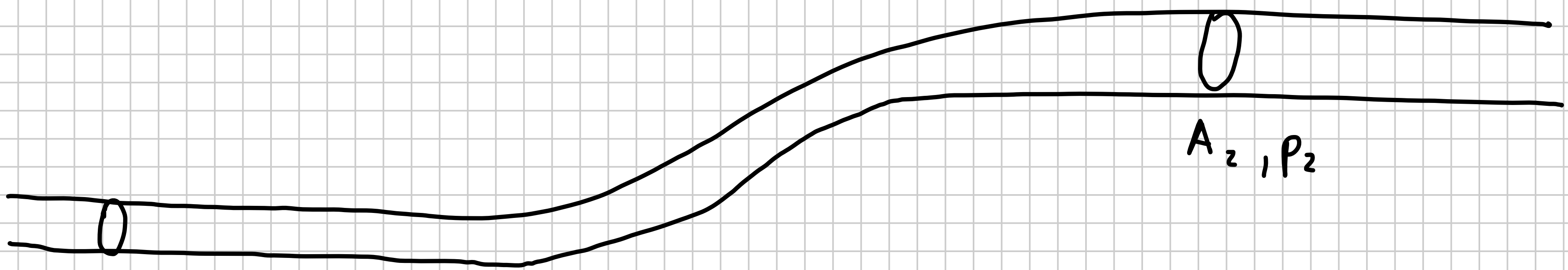
$$A_0 \cdot v_0 = A_1 \cdot v_1$$

$$A_1 = \frac{A_0 \cdot v_0}{v_1} = \frac{1{,}2\,cm^2 \cdot 28{,}6\,cm/s}{471{,}5\,cm/s}$$

$$= 0{,}0728\,cm^2 = 7{,}28\,mm^2$$

$\square$

Daniel Bernoulli um 1700:



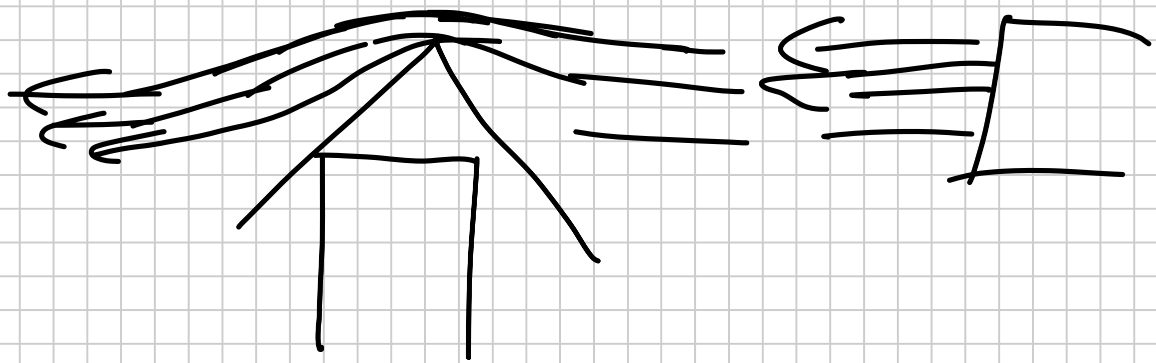
„Bernoulli-Gleichung"

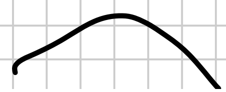
$$p + \underbrace{\frac{1}{2}\rho \cdot v^2}_{\text{dynamische Druck}} + \underbrace{\rho \cdot g \cdot h}_{\text{Schweredruck}} = \text{const.}$$

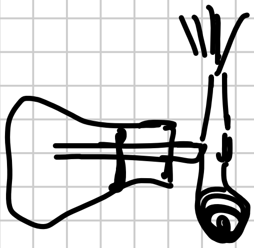
stat. Druck

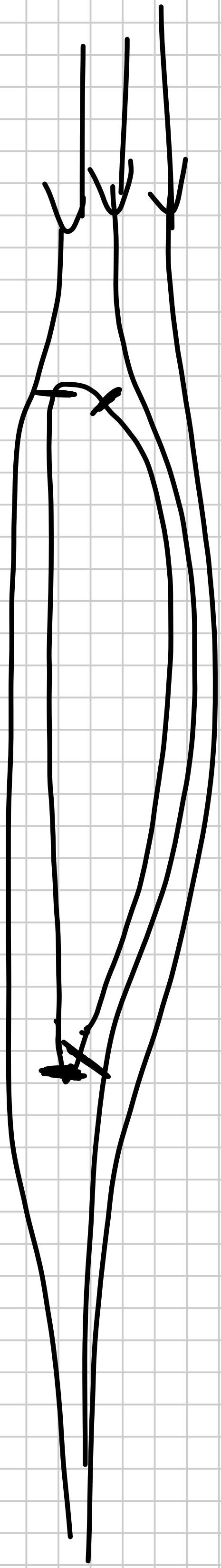
$$p_1 + \frac{1}{2}\rho_1 v_1^2 + \rho_1 g \cdot h_1 = p_2 + \frac{1}{2}\rho_2 v_2^2 + \rho_2 \cdot g \cdot h_2$$

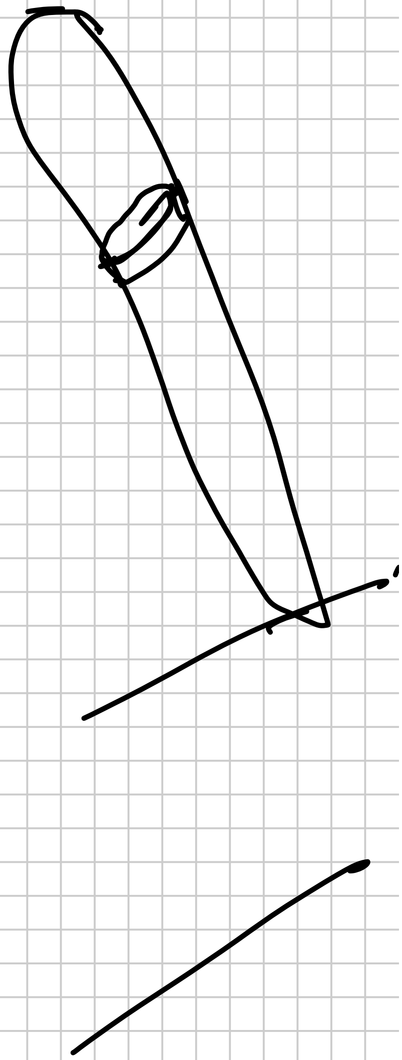
$\Rightarrow$ Wenn die Geschwindigkeit eines Fluids zunimmt, dann muss der Druck des Fluids abnehmen!



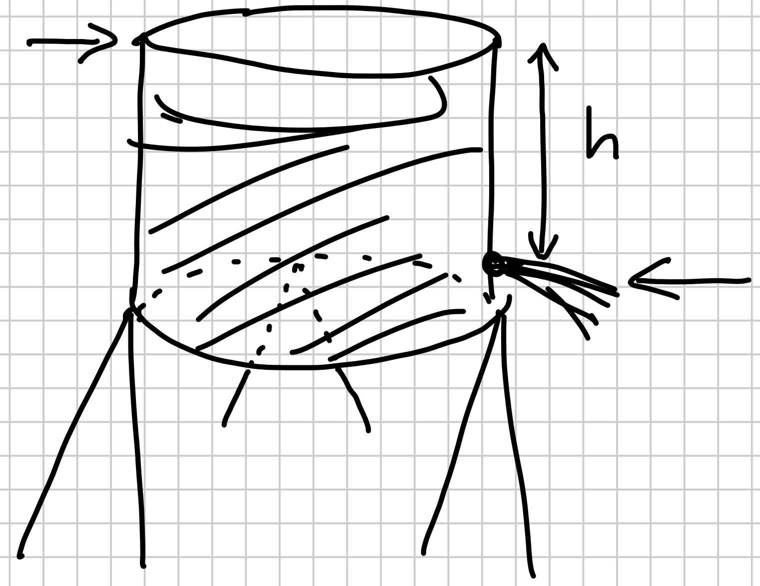








Bsp:



$$\cancel{p_0} + \frac{1}{2} \rho \cdot v_0^2 + \cancel{\rho g \underbrace{h_0}_{=0}} = \cancel{p} + \frac{1}{2} \rho v^2 + \rho g \cdot h$$ „Füllhöhe"

$$\frac{1}{2} \rho \cdot v_0^2 = \frac{1}{2} \rho v^2 + \rho g \cdot h$$

v_0 fast = Null $\qquad v_0 \simeq 0$

$$\Longrightarrow \quad 0 = \frac{1}{2} \rho v^2 + \rho g \cdot h$$

$$\Rightarrow \quad \frac{1}{2} \cancel{\rho} v^2 = + \cancel{\rho} g \cdot h$$

$$g \cdot h = \frac{1}{2} v^2$$

$$v^2 = 2 g \cdot h$$

$$v = \sqrt{2 g \cdot h}$$