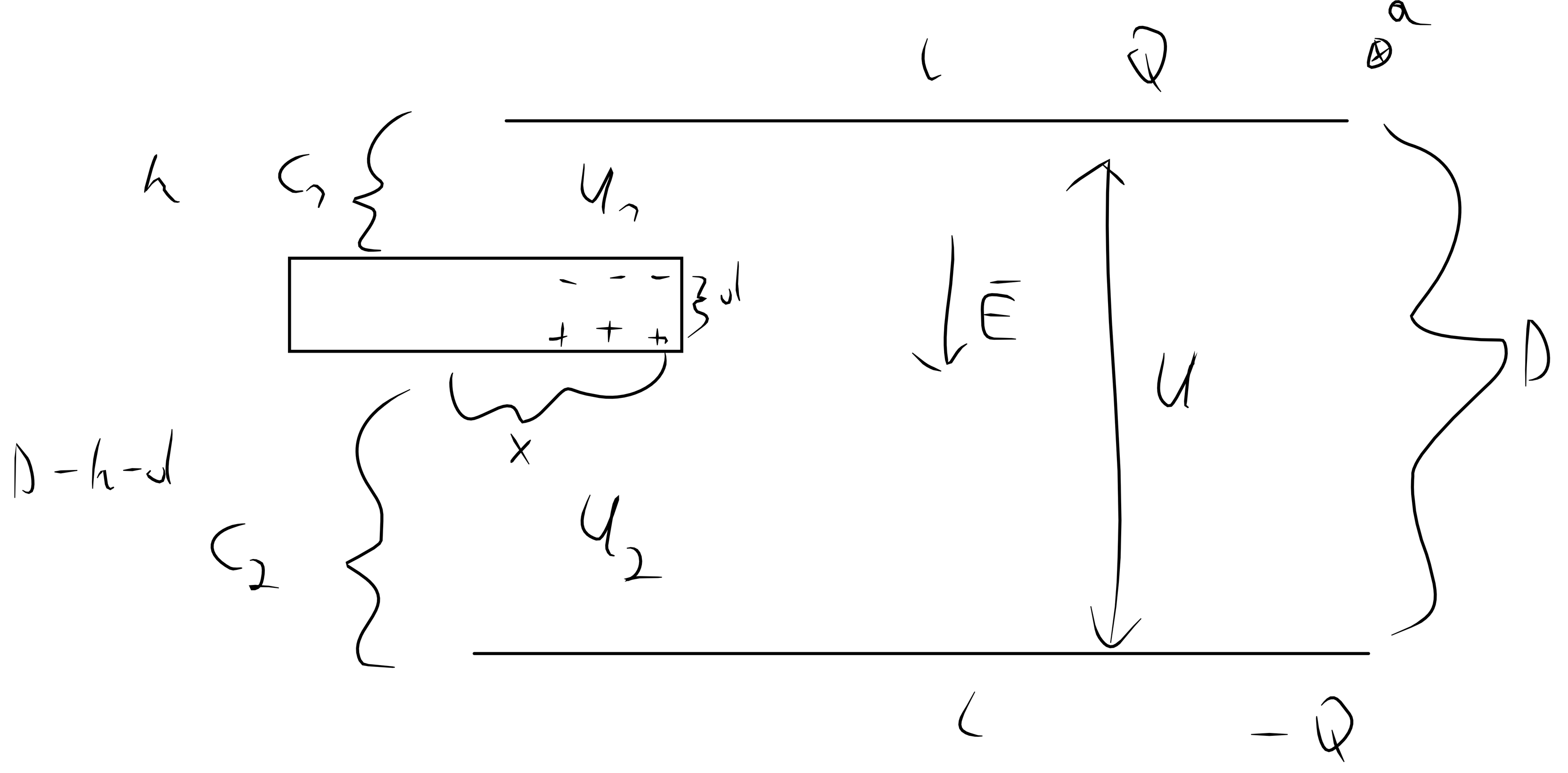


$S = al$

$C_0 = \varepsilon_0 \frac{S}{D} = \varepsilon_0 \frac{al}{D}$ $\quad a = \frac{C_0 D}{\varepsilon_0 l}$

$\frac{1}{C_{12}} = \frac{1}{C_1} + \frac{1}{C_2}$

$\frac{1}{C_{12}} = \frac{1}{\varepsilon_0 S_1}(h + D - d - h)$

$C_{12} = \frac{\varepsilon_0 S_1}{D-d}$

$C = C_0' + C_{12} =$

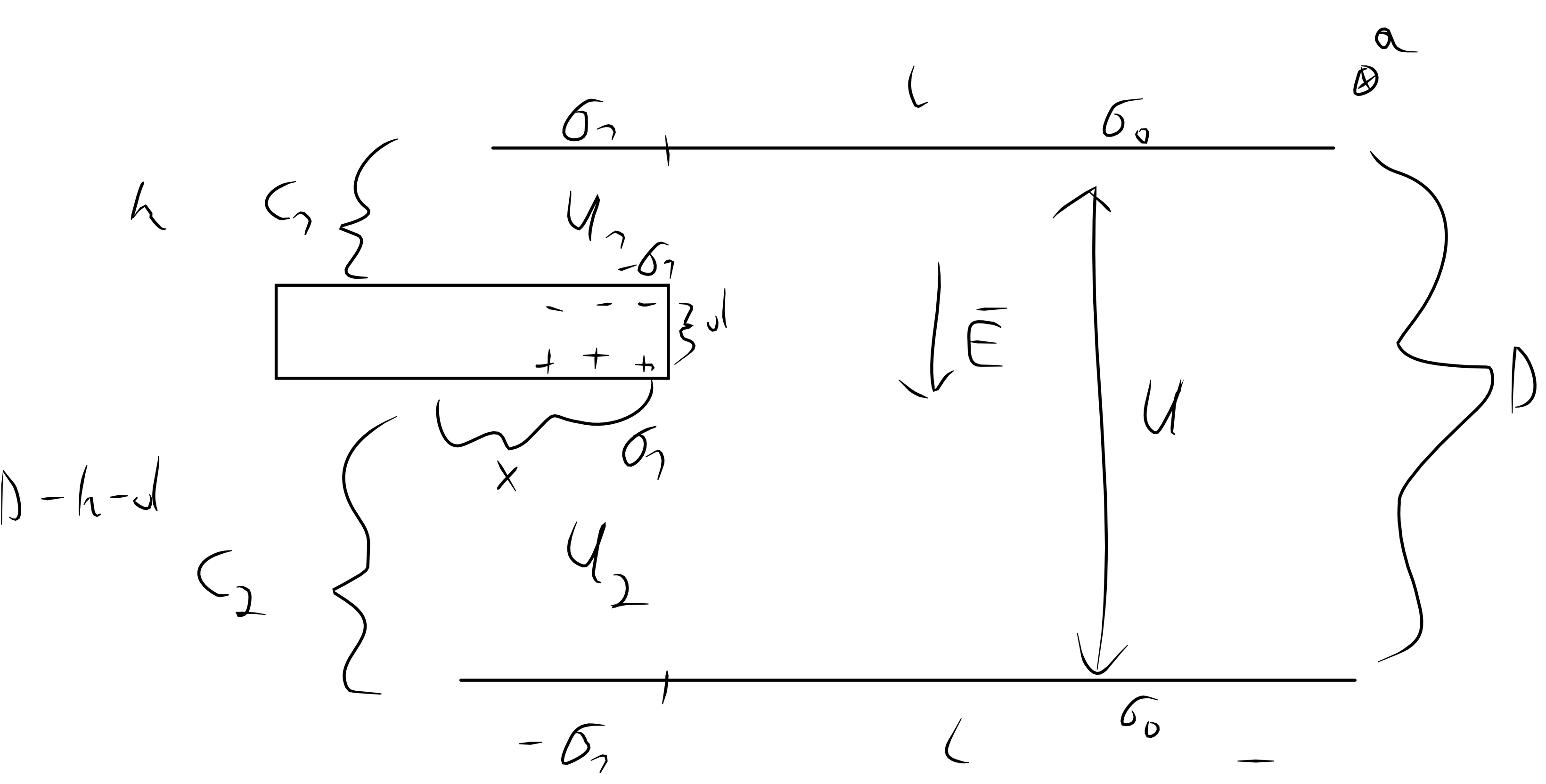
$= \frac{\varepsilon_0 a(l-x)}{D} + \frac{\varepsilon_0 a x}{D-d} =$

$= \varepsilon_0 a \frac{Dx + (l-x)(D-d)}{D(D-d)} = \cancel{\varepsilon_0} \frac{C_0 \cancel{D}}{\cancel{\varepsilon_0} l} \cdot \frac{\cancel{Dx} + lD + xd - \cancel{xD} - ld}{\cancel{D}(D-d)} = \frac{C_0}{l}\left(l + \frac{xd}{D-d}\right) = C_0\left(1 + \frac{xd}{l(D-d)}\right)$

$W = \frac{1}{2}\frac{Q^2}{C}$

$W(x) = \frac{Q^2}{2C_0} \cdot \frac{\frac{l}{d}(D-d)}{\frac{l}{d}(D-d) + x}$ $\quad W(0) = \frac{Q^2}{2C_0}$ $\quad W(l) = \frac{Q^2}{2C_0}\left(1 - \frac{d}{D}\right)$

$-\frac{dW}{dx} = \frac{Q^2}{2C_0} \frac{\frac{l}{d}(D-d)}{\left(\frac{l}{d}(D-d) + x\right)^2}$ $\quad -\Delta W = \frac{Q^2}{2C_0}\frac{d}{D}$



Pojemności zostają takie same, zmienia się ładunek.

$U_0 = E_0 D = \frac{\sigma_0 D}{\varepsilon_0}$ $\quad \sigma_0 = \frac{U_0 \varepsilon_0}{D}$

$\Rightarrow \sigma_1 = \sigma_0 \frac{D}{D-d}$

$U_1 + U_2 = U_0 = \frac{\sigma_1 h}{\varepsilon_0} + \frac{\sigma_1}{\varepsilon_0}(D - h - d) = \frac{\sigma_1}{\varepsilon_0}(D-d)$

$C = C_0\left(1 + \frac{xd}{l(D-d)}\right)$

$W_{całk}(x) = \frac{1}{2}U_0^2 C = \frac{1}{2}U_0^2 C_0\left(1 + \frac{xd}{l(D-d)}\right)$ – całkowita praca, więc praca podczas wsuwania + praca źródła

$W_{źr}(x) = U_0 \Delta Q$

$Q_0 = \sigma_0 a l$

$Q_1(x) = \sigma_0 a(l-x) + \sigma_1 a x = a\sigma_0\left(l - x + \frac{D}{D-d}x\right) = a\sigma_0 l + a\sigma_0\frac{d}{D-d}x$

$\Delta Q = a\sigma_0 \frac{d}{D-d}x = \frac{C_0 \cancel{D}}{\cancel{\varepsilon_0} l} \cdot \frac{U_0 \cancel{\varepsilon_0}}{\cancel{D}} \frac{d}{D-d}x = C_0 U_0 \frac{x}{l}\frac{d}{D-d}$

$W(x) = W_{całk}(x) - W_{źr} = \frac{1}{2}U_0^2 C_0\left(1 - \frac{xd}{l(D-d)}\right)$

$W(0) = \frac{1}{2}C_0 U_0^2$ $\quad W(l) = \frac{1}{2}C_0 U_0^2\left(1 - \frac{d}{D-d}\right)$ $\quad -\Delta W = \frac{1}{2}C_0 U_0^2 \frac{d}{D-d}$

$-\frac{dW}{dx} = \frac{1}{2}U_0^2 C_0 \frac{d}{l(D-d)}$