Environmental friendly technologies
KEE/ENT

ESF II project of the University of West Bohemia in Pilsen

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Lecture 5

Electrical separators

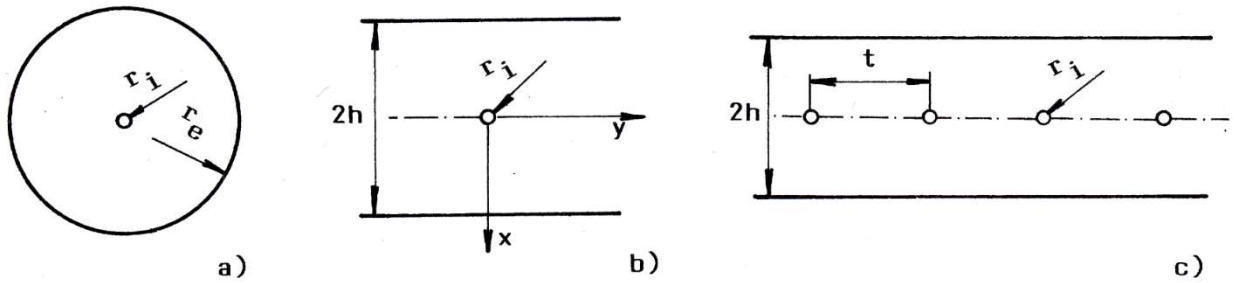
Ing. Milan Bělík, Ph.D.

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Electrical separators

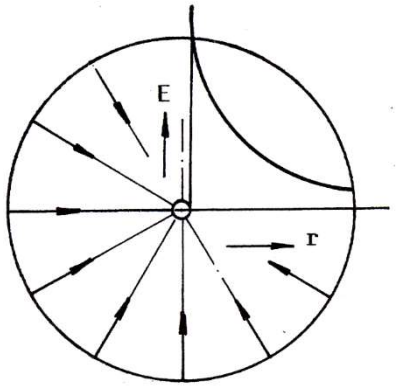
- Tube design
- Flat design
- Chamber design

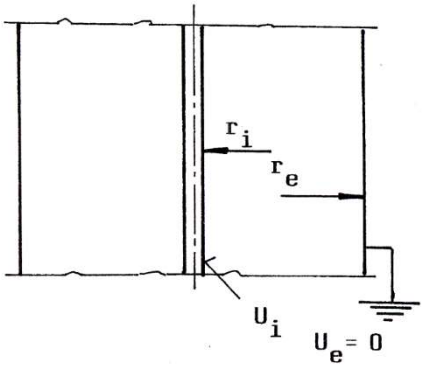


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Electrical separators





$$\vec{E} = -\vec{\nabla}U = -\overrightarrow{gradU}$$

$$\overrightarrow{gradU} = \frac{dU}{dr}$$

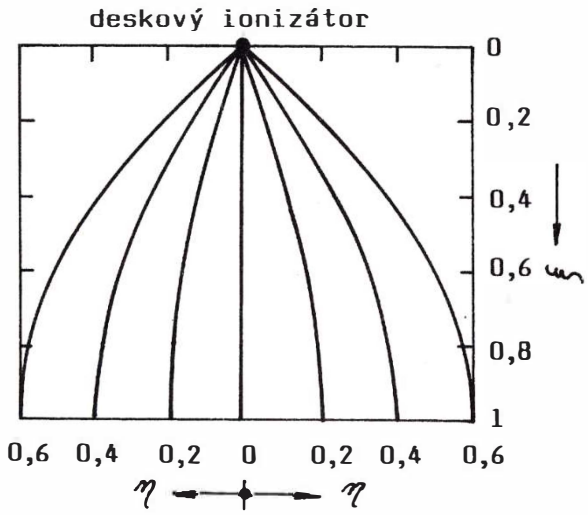
$$\frac{1}{r}\frac{d}{dr}(rE) = 0$$

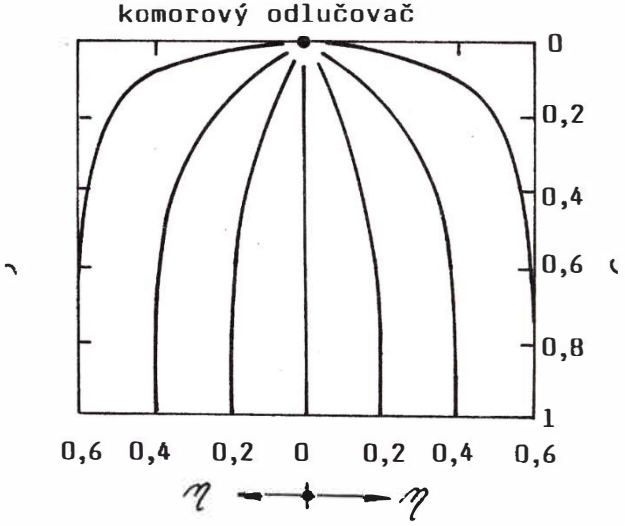
$$E = \frac{U}{r \ln \frac{r_e}{r_i}}$$

$$E_{max} = \frac{U}{r_i \ln \frac{r_e}{r_i}}$$

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$$E_{\max} = \frac{U}{r_i f}$$

$$f = \ln \frac{4h}{\pi r_i}$$

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Corone discharge

- Negative corone – negative ionts

$K_1 \approx 3{,}1 \cdot 10^6$ V/m a $K_2 \approx 0{,}0308$ m$^{1/2}$

- Industrial separators – HV electrode - negative
- Positive corone – positive ionts

$K_1 \approx 3{,}37 \cdot 10^6$ V/m a $K_2 \approx 0{,}0242$ m$^{1/2}$.

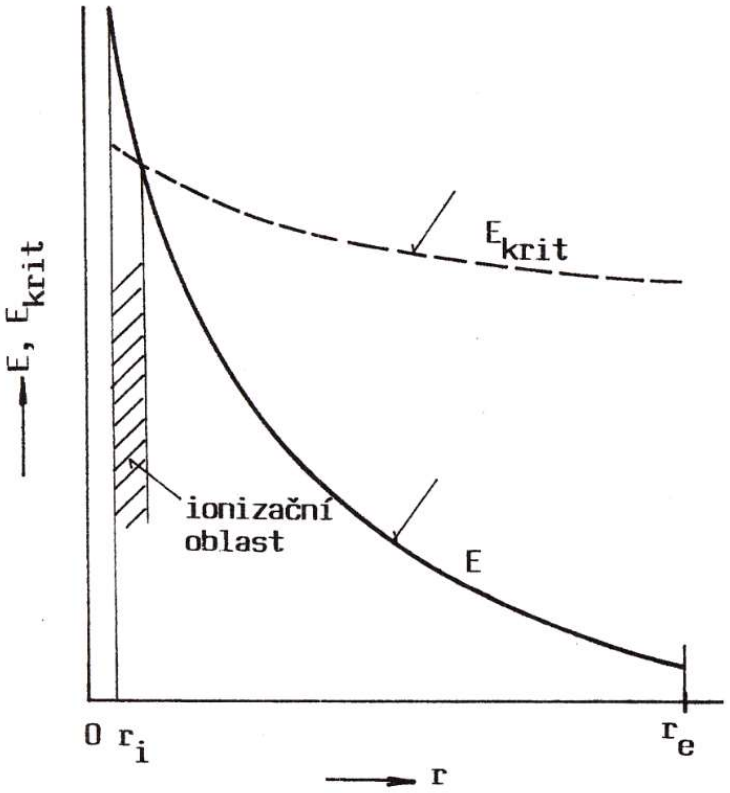
$$E > E_{krit}$$

$$E_{krit} = K_1 \beta_\rho \left(1 + \frac{K_2}{\sqrt{\beta_\rho \, r_i}} \right) \qquad \beta_\rho = \frac{p}{p_N} \frac{T_N}{T}$$

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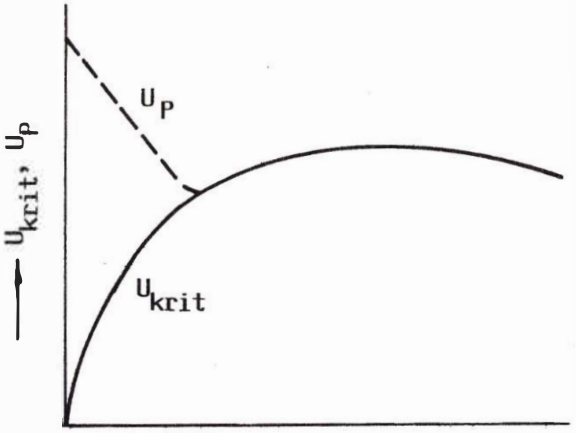
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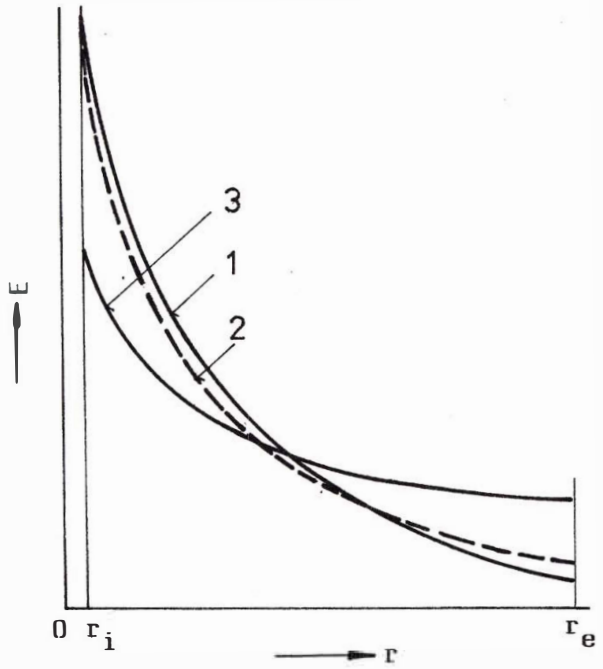
Corone discharge



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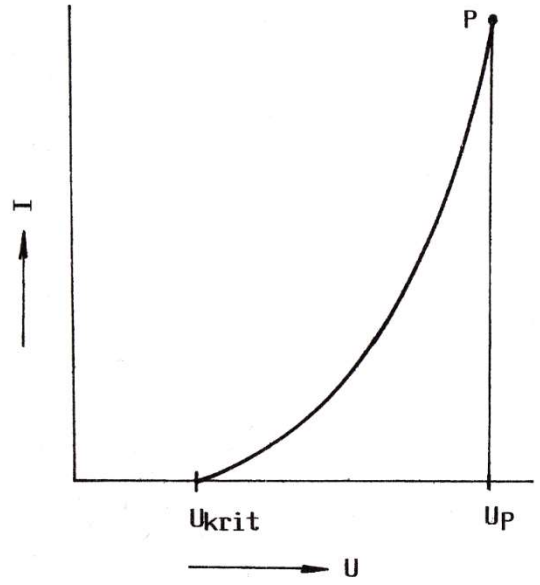
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- Electropositive gas
  - easy ionisation (cations)
- Electronegative gas
  - free e (aniónts)
  - SO_2 (0,5 %), O_2 (2 %), H_2O (5 %), CO_2

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VA characteristics



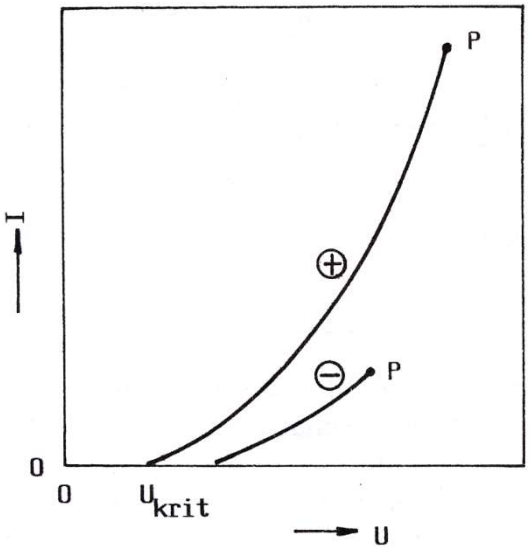
$$I_1 = \frac{8\pi\varepsilon_0 b_i}{r_e^{\,2} \ln \frac{r_e}{r_i}} U(U - U_{krit})$$

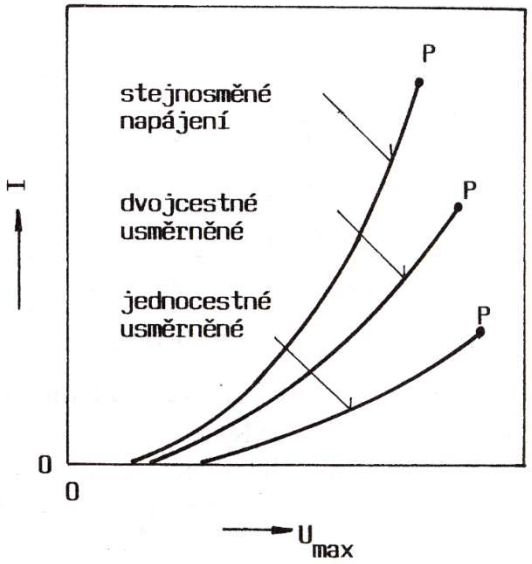
$$I_1 = \kappa_1 b_i U(U - U_{krit})$$

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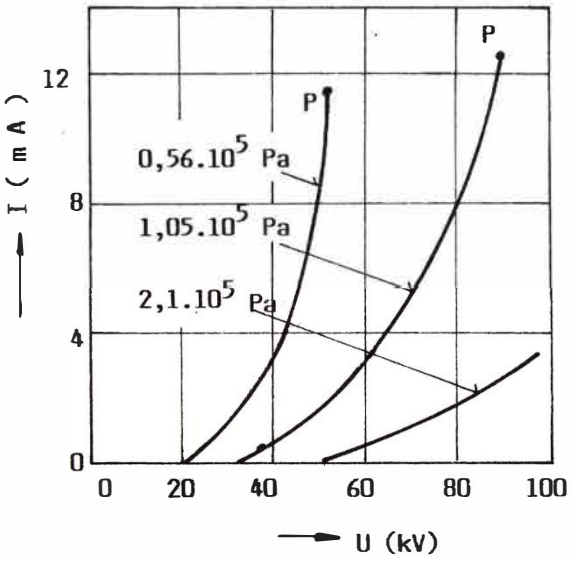
Operational characteristics

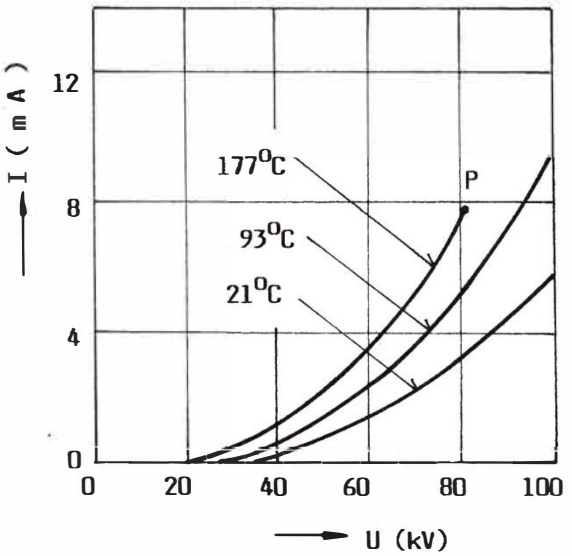




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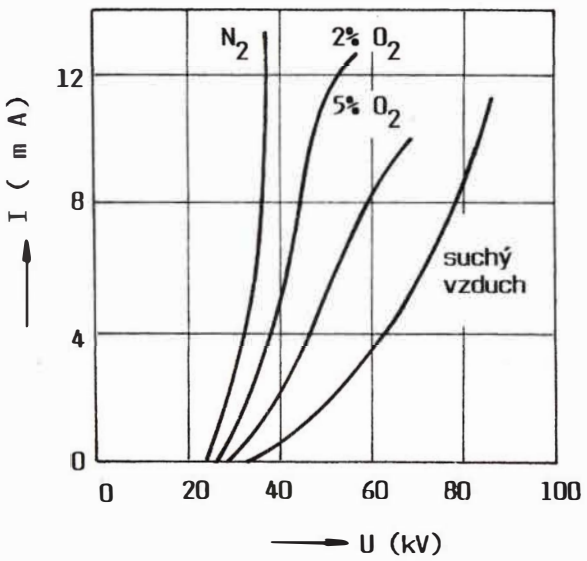
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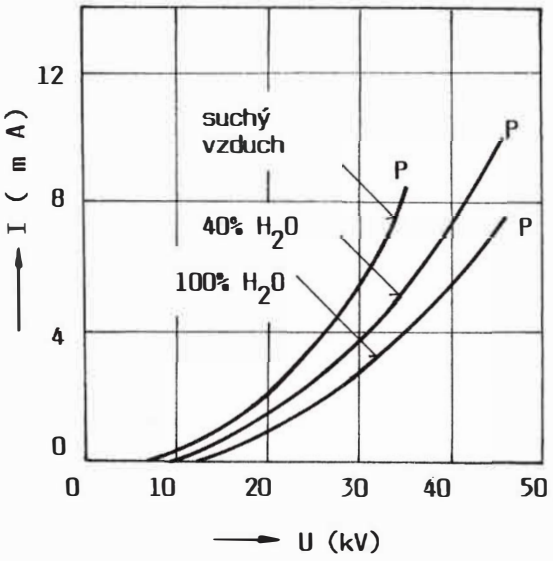




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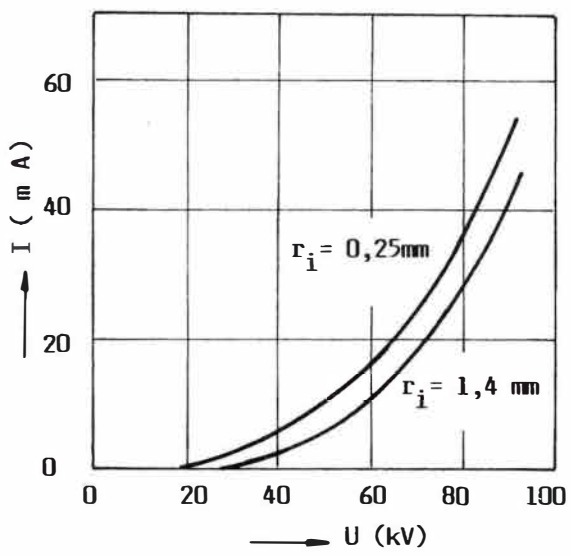
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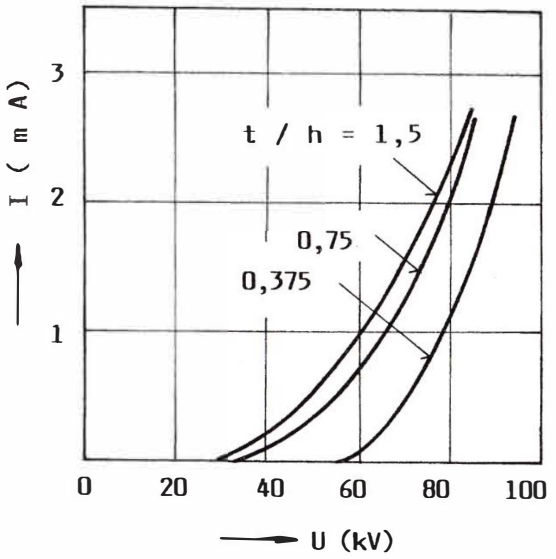




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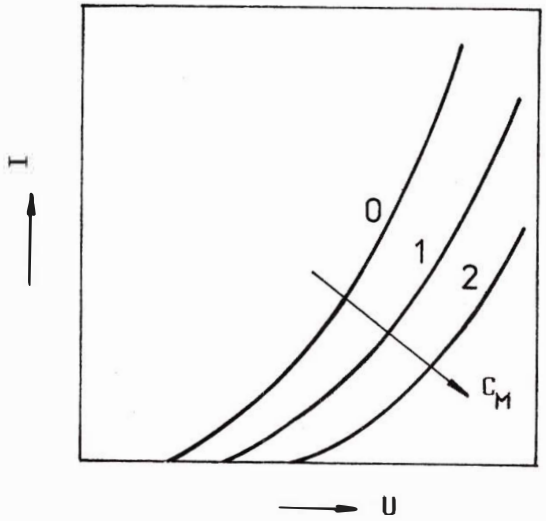
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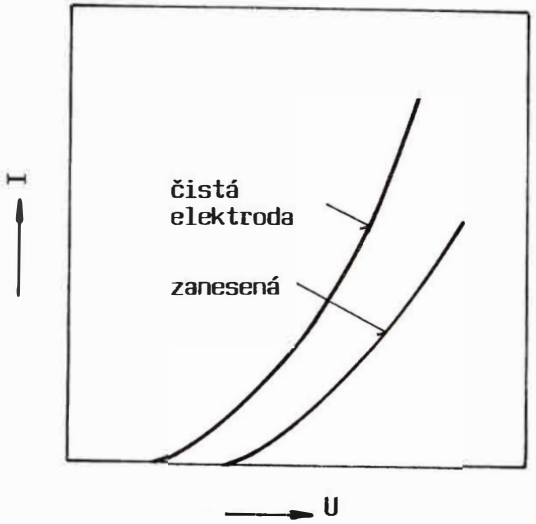




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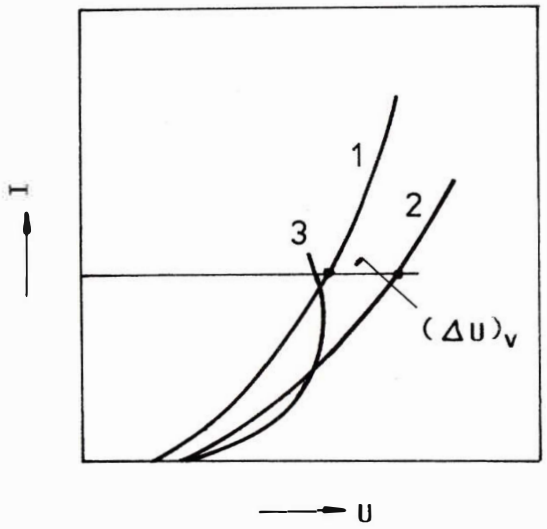
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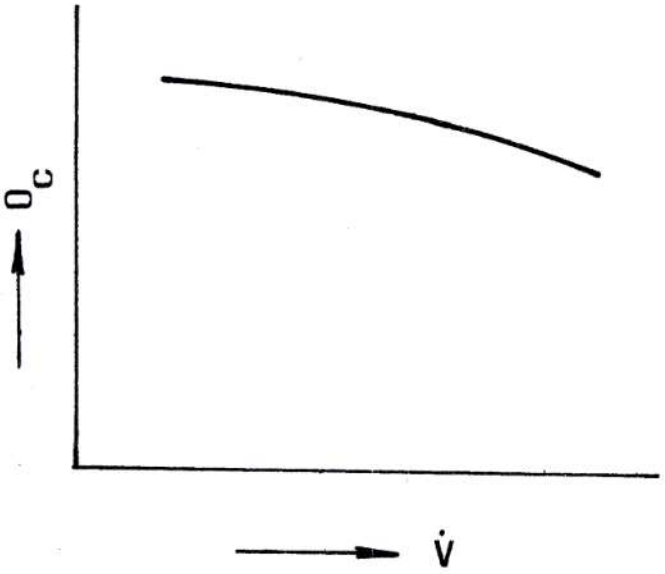
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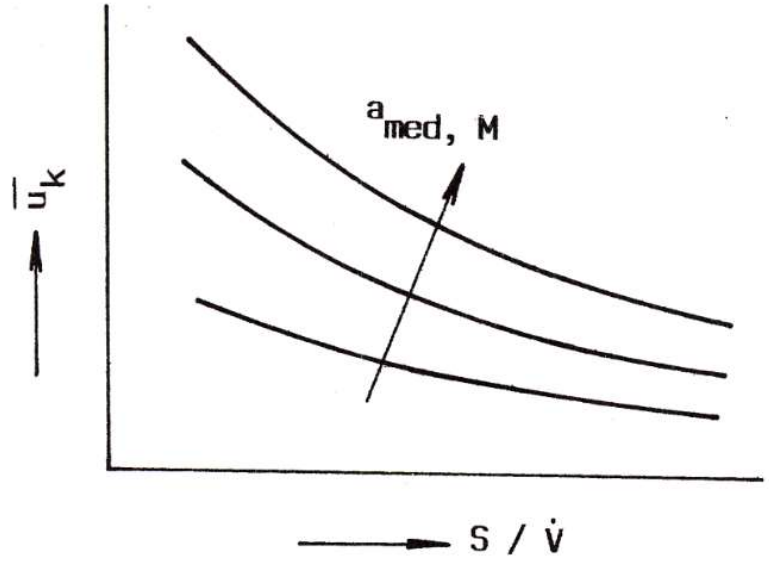


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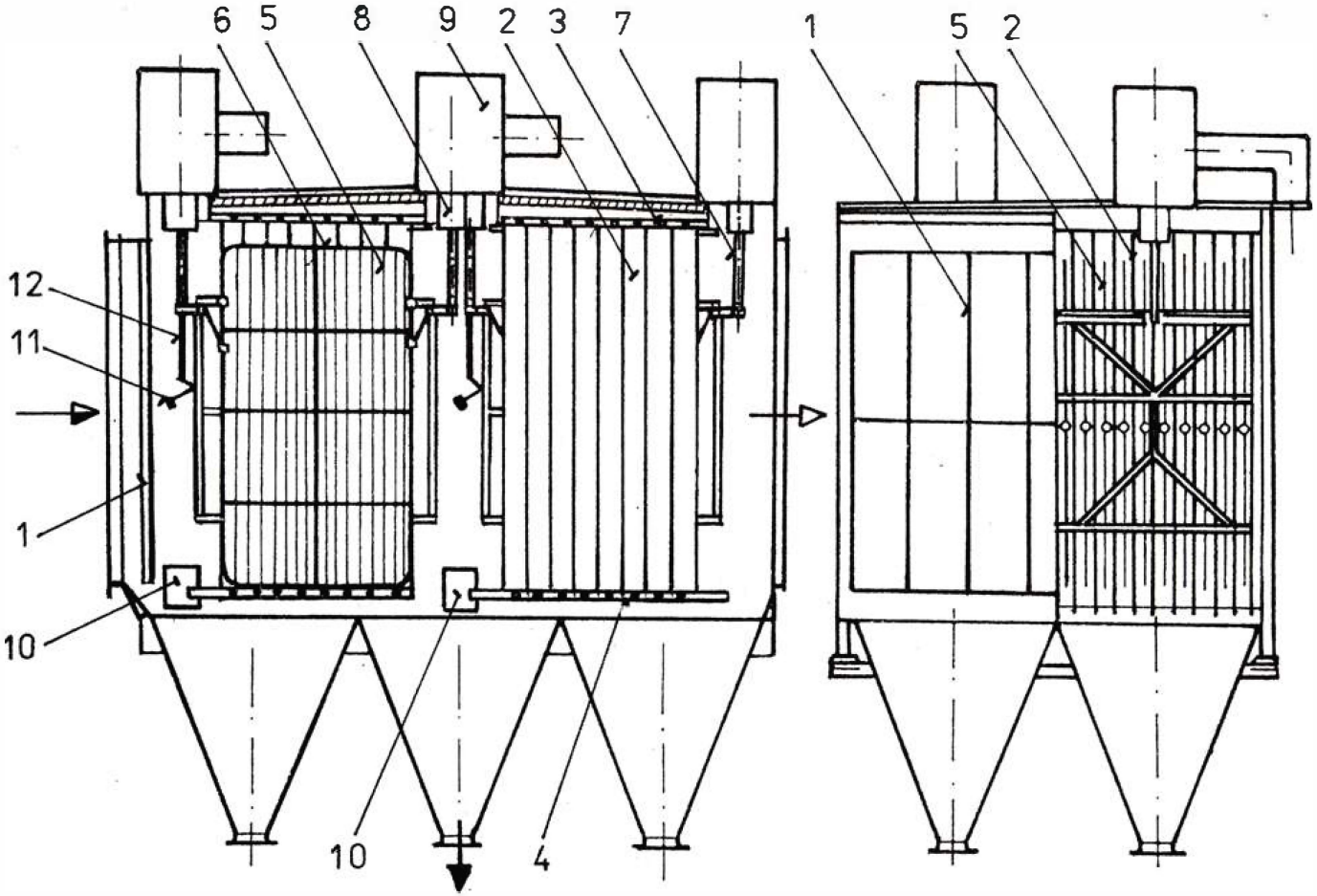
Odlučivost





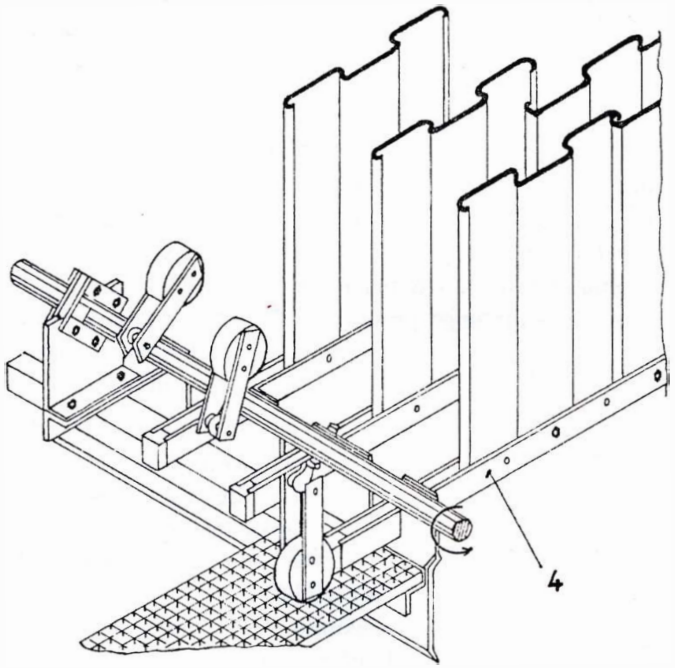
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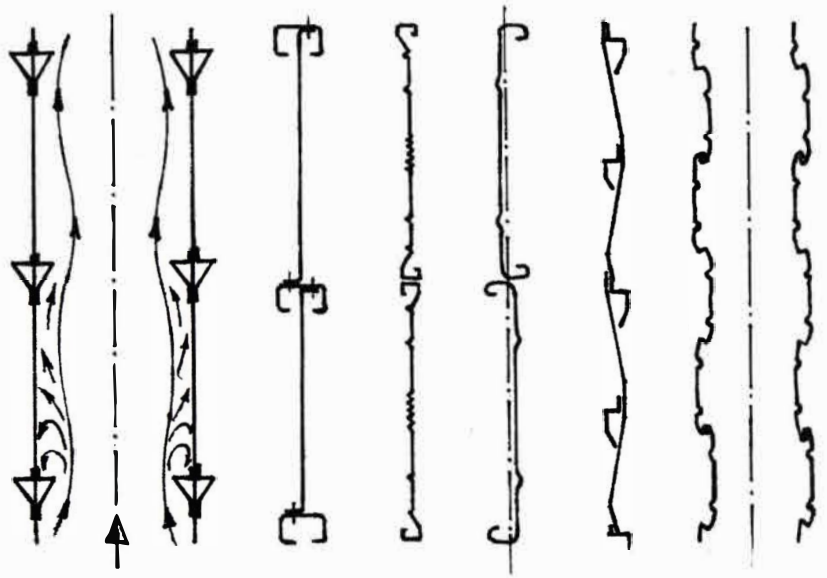
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