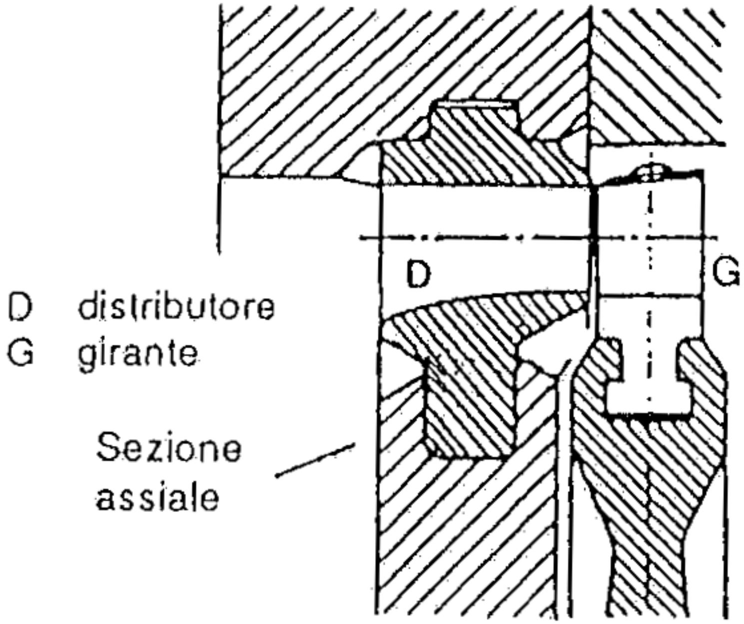
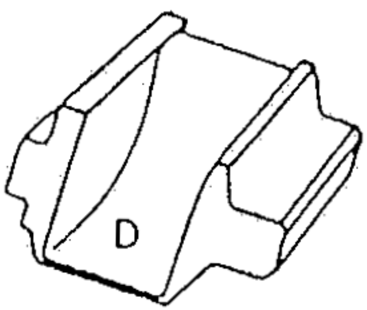
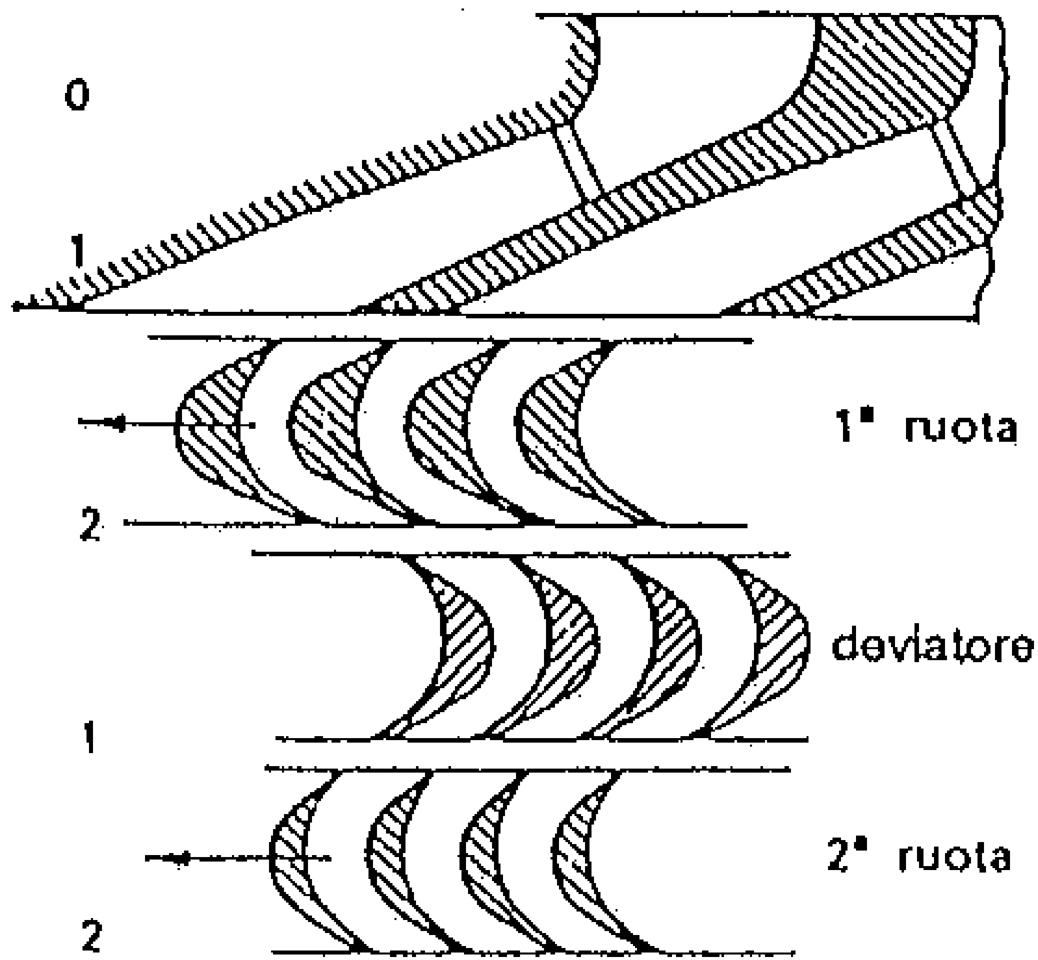
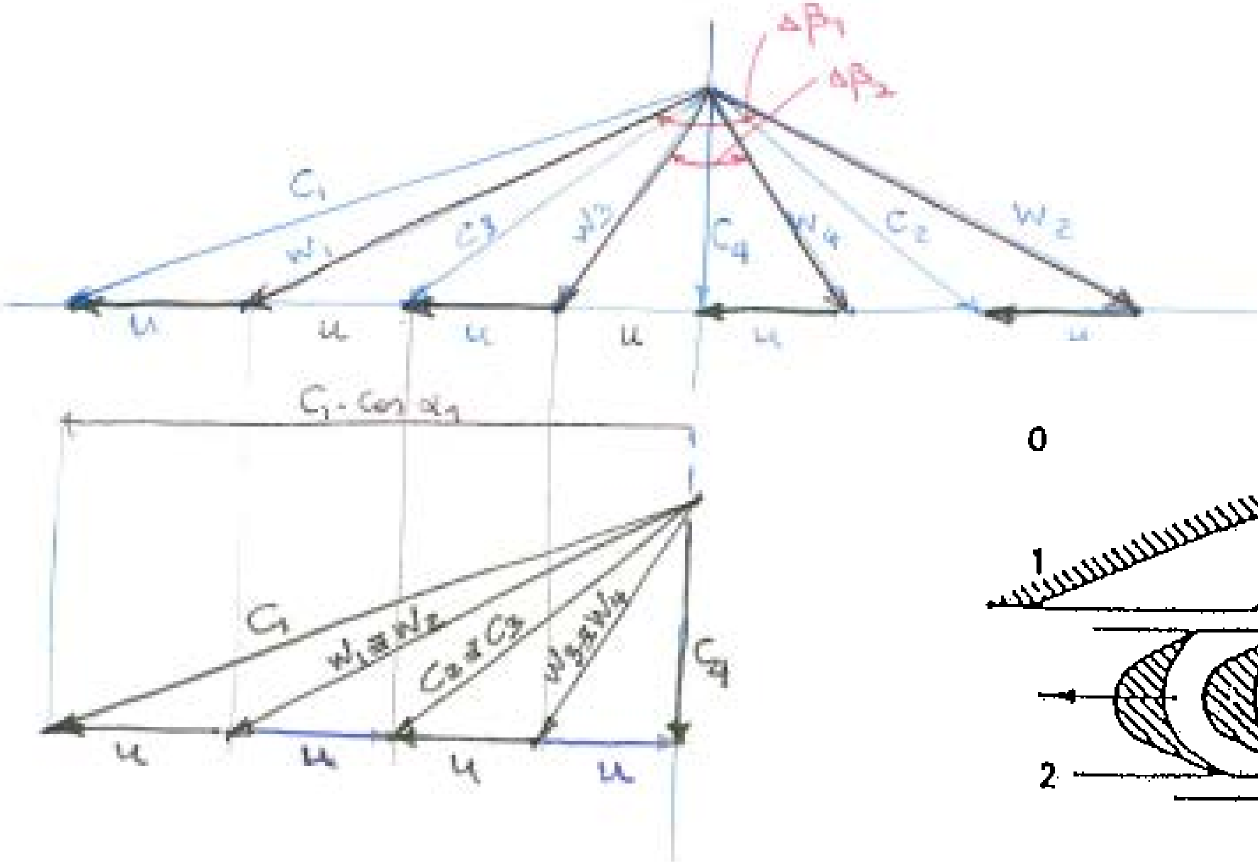
Turbina ad azione a salti di velocità: Turbina Curtis

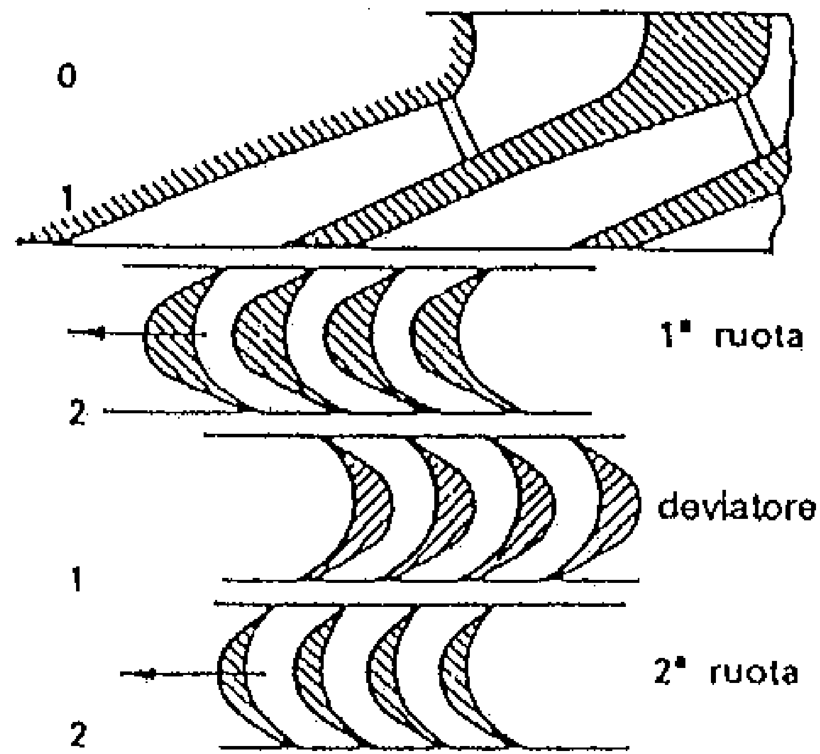




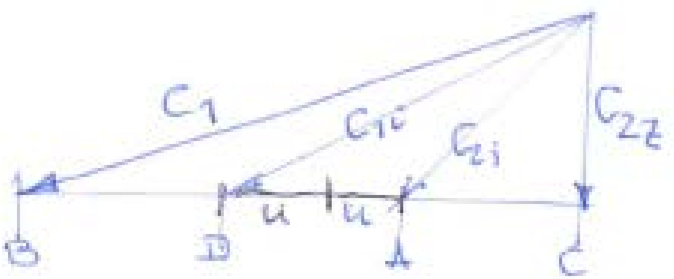




$$C_1 \cos\alpha_1 = 2u \cdot z$$



Ripartizione della potenza nella turbina Curtis



$$P = \frac{c_1^2 - c_2^2}{2} + \cancel{\frac{u_1^2 - u_2^2}{2}} - \cancel{\frac{w_1^2 - w_2^2}{2}}$$

$$P_i = \frac{c_{1i}^2 - c_{2i}^2}{2} = \frac{c_{1i}^2 - c_{2z}^2}{2} - \frac{c_{2i}^2 - c_{2z}^2}{2}$$

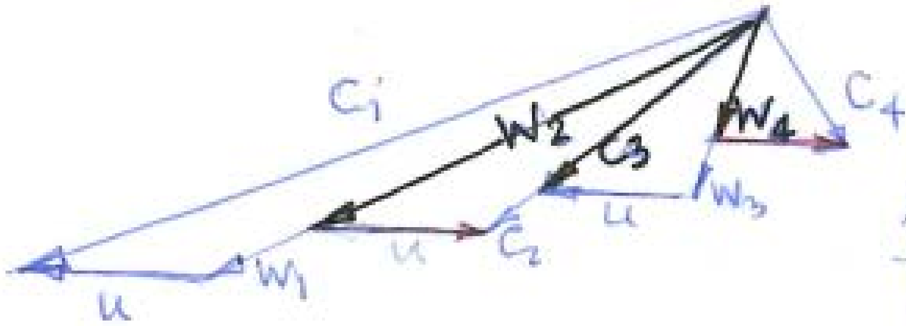
$$c_{1i}^2 - c_{2z}^2 = \overline{DC}^2 \qquad c_{2i}^2 - c_{2z}^2 = \overline{AC}^2$$

$$P_i = \frac{1}{2}\left(\overline{DC}^2 - \overline{AC}^2\right) = \frac{1}{2}\left\{\left[2u(z-i+1)\right]^2 - \left[2u(z-i)\right]^2\right\} = 2u^2(2z-2i+1)$$

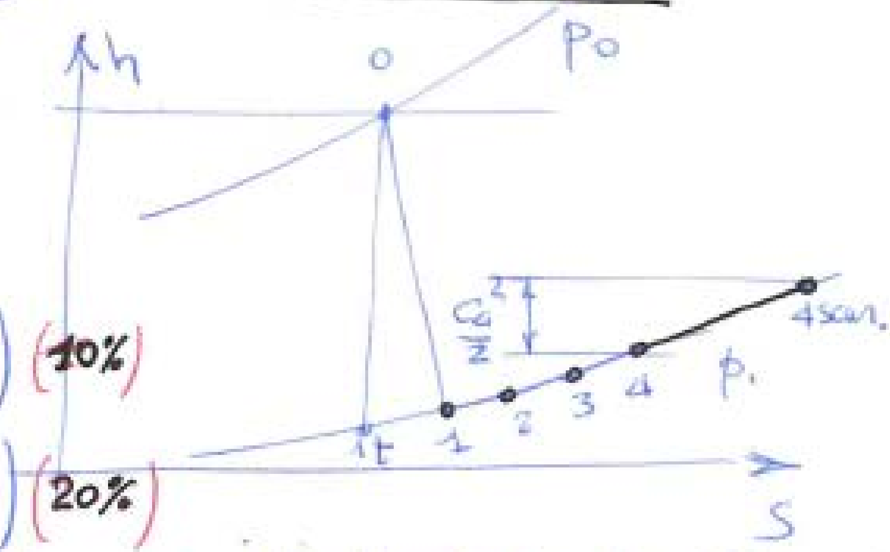
$$P_{tot} = \frac{c_1^2 - c_{2z}^2}{2} = \frac{\overline{BC}^2}{2} = \frac{(2uz)^2}{2} = 2u^2 z^2$$

$$\frac{P_i}{P_{tot}} = \frac{\cancel{2u^2}(2z-2i+1)}{\cancel{2u^2} z^2} = \frac{2z-2i+1}{z^2}$$

Al crescere di z. Le potenze captate dagli ultimi stadi diventano una frazione minima



triangoli di velocità nel caso reale



Perdite entalpiche

statore $h_1 - h_{1t} = \frac{c_{1t}^2 - c_1^2}{2} = \frac{c_{1t}^2}{2}(1-\varphi^2)$ (10%)

rot. 1 $h_2 - h_1 = \frac{w_1^2 - w_2^2}{2} = \frac{w_1^2}{2}(1-\psi_1^2)$ (20%)

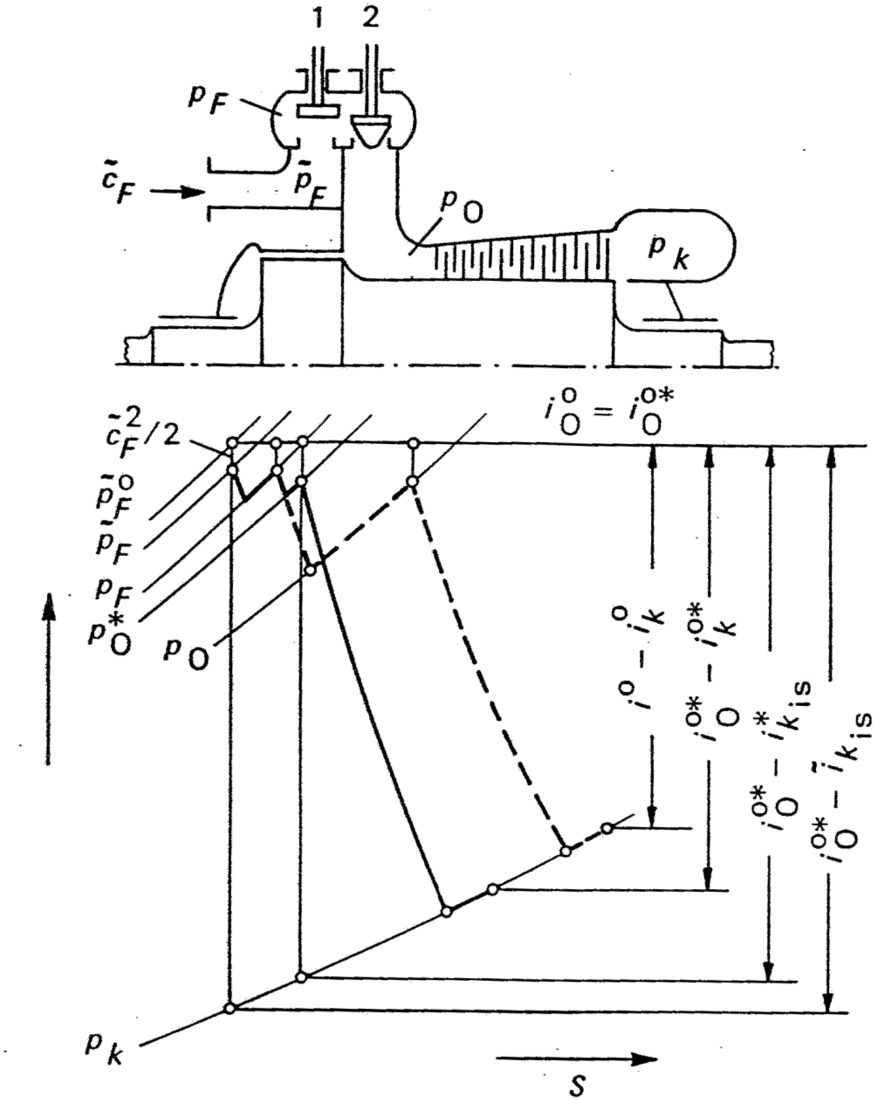
dev. $h_3 - h_2 = \frac{c_2^2 - c_3^2}{2} = \frac{c_2^2}{2}(1-\psi_D^2)$ (7%)

rot. 2 $h_4 - h_3 = \frac{w_3^2 - w_4^2}{2} = \frac{w_3^2}{2}(1-\psi_2^2)$ (4%)

$\psi_2 > \psi_D > \psi_1$ perché

$\Delta\beta_2 < \Delta\beta_D < \Delta\beta_1$

Regolazione per parzializzazione



Regolazione per laminazione

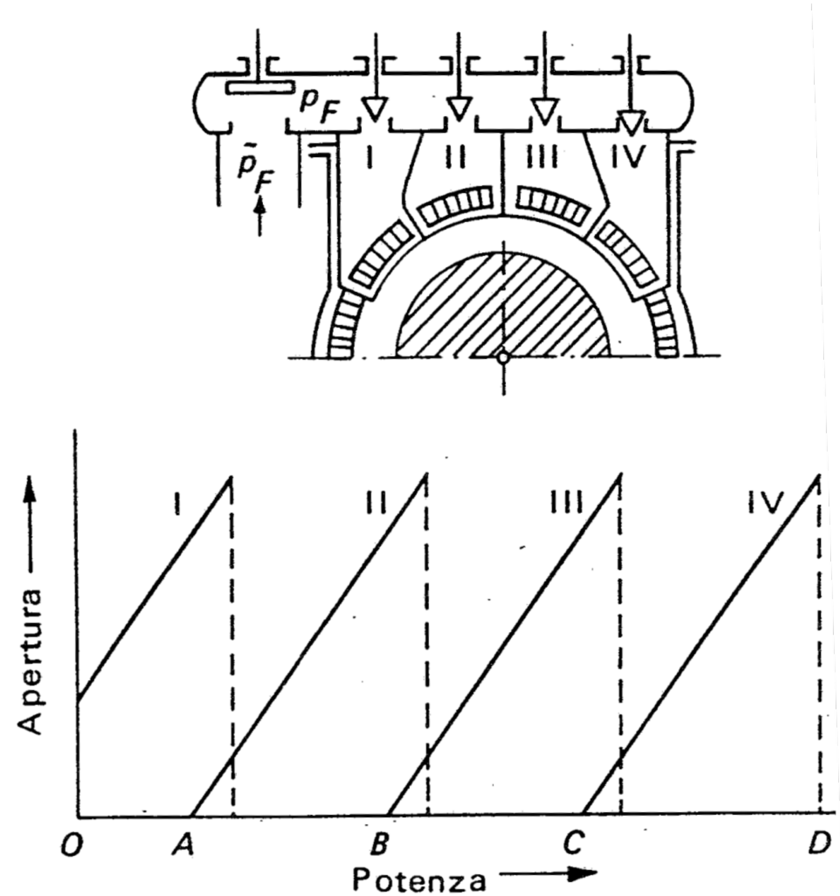


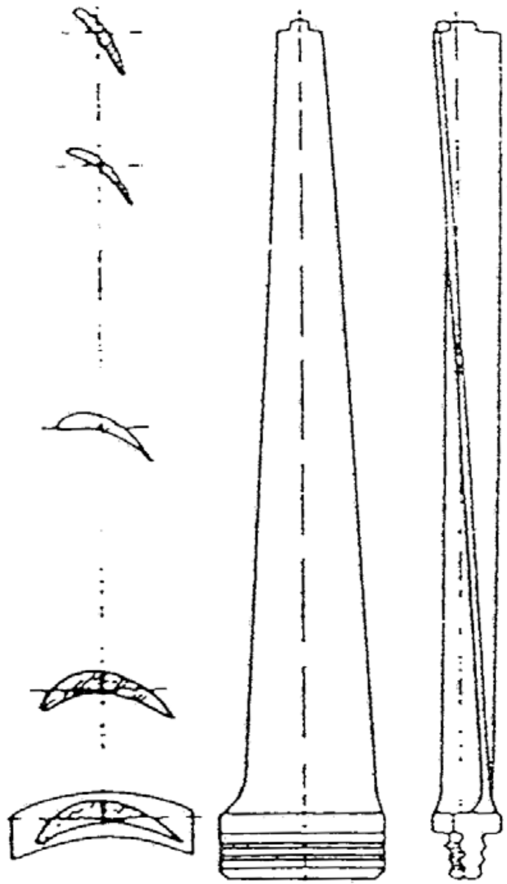
Fig. 221

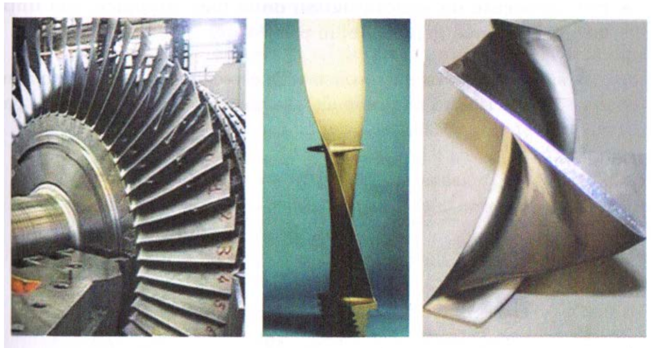
1 Valvola di sicurezza;
I, II, III, IV Valvole di parzializzazione.

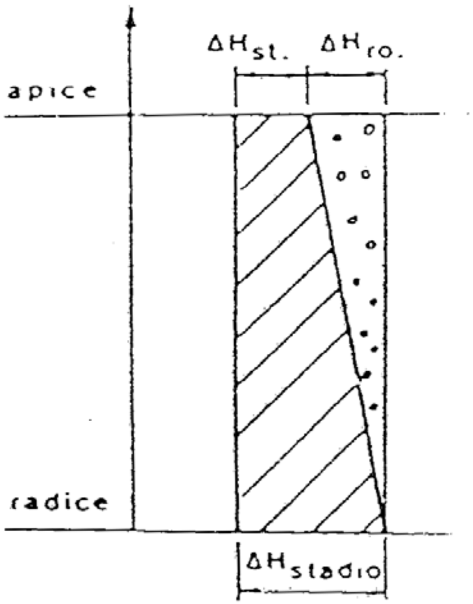
Svergolatura della pala rotorica

Pala statorica

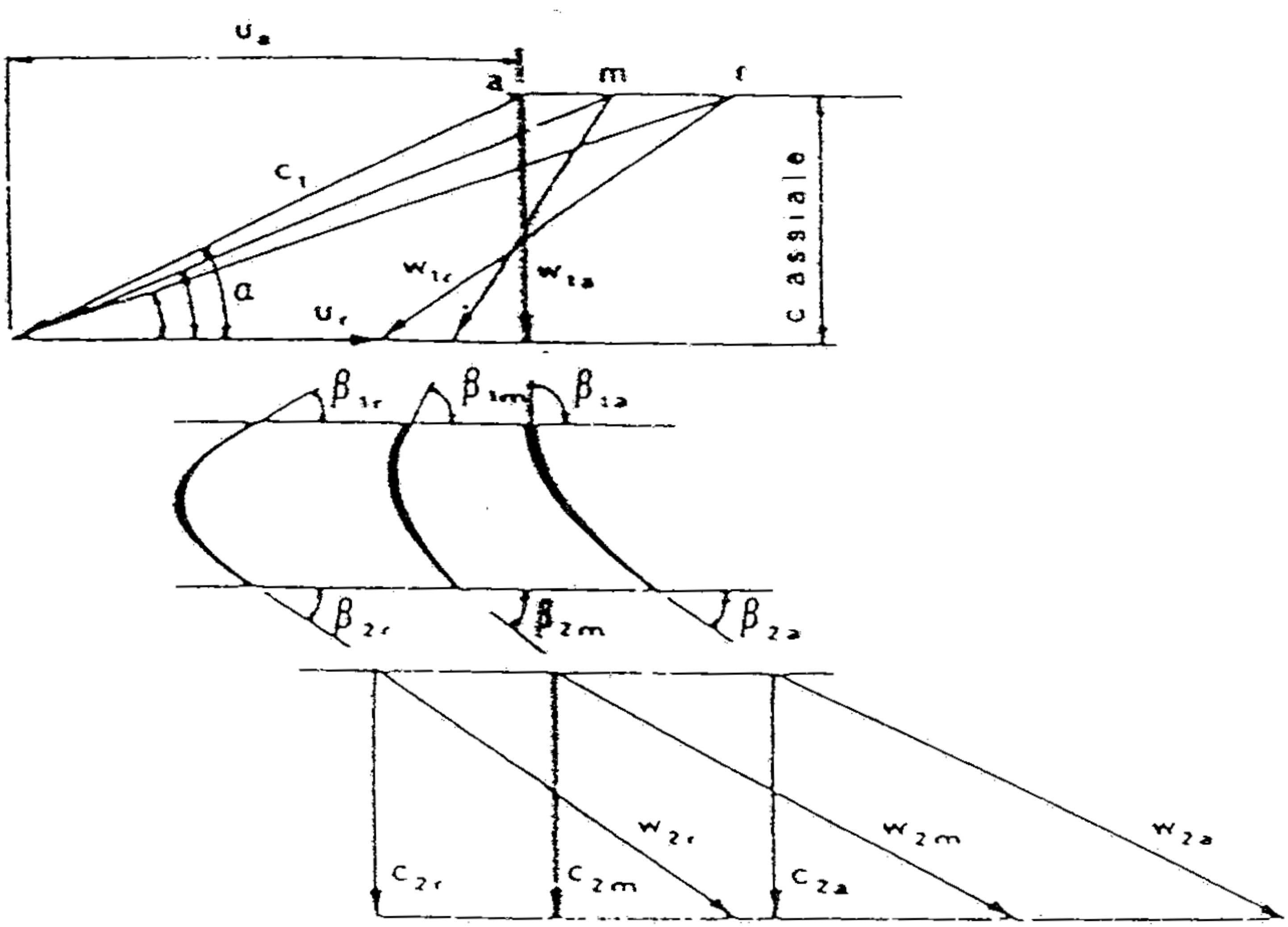
Pala rotorica



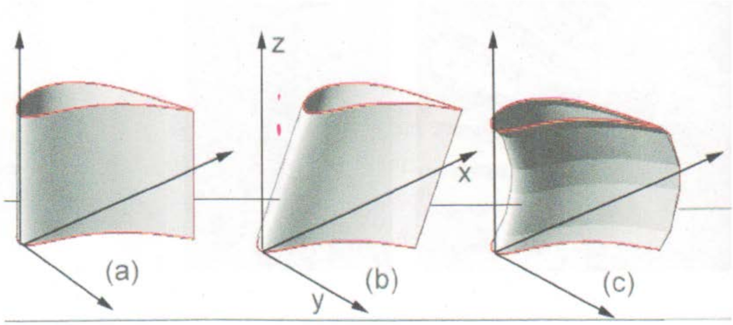




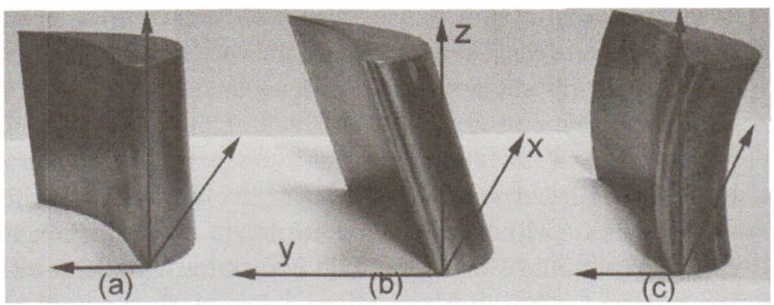
Svergolatura della pala rotorica

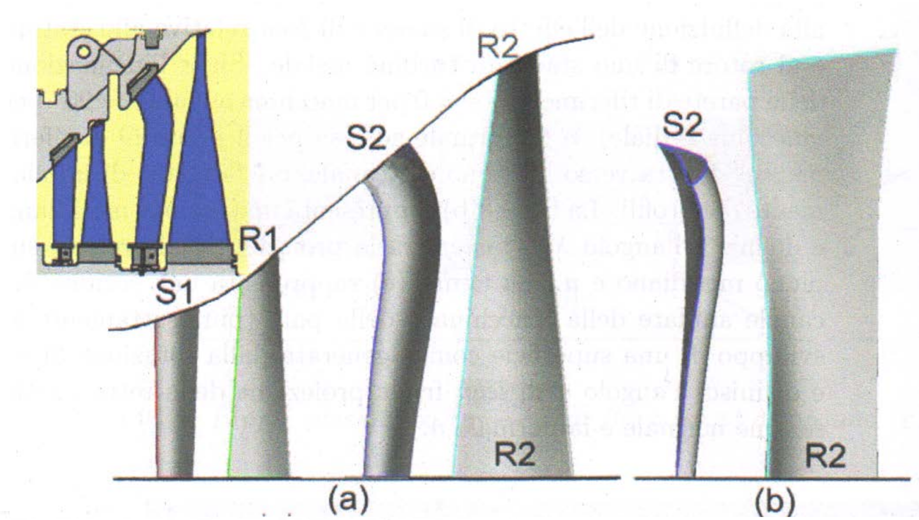


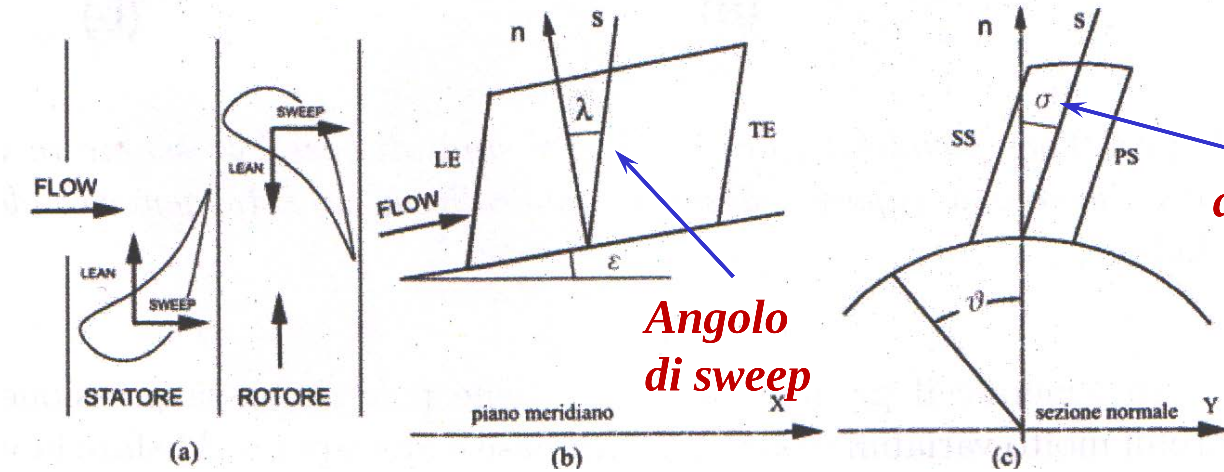
Pale con sezioni uguali ma impilate lungo linee generiche



Prismatica ***Leaned*** ***Bowed***



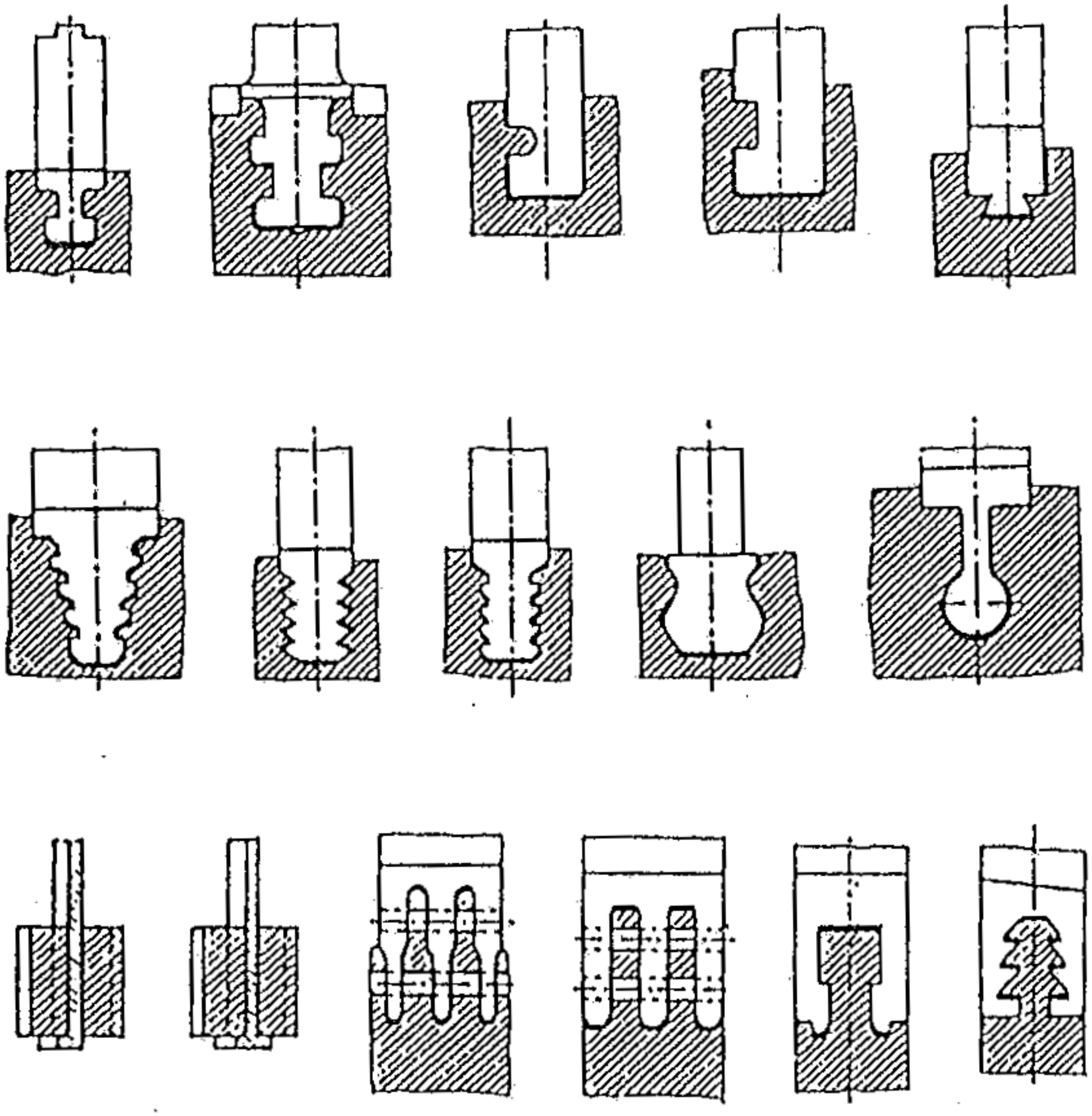




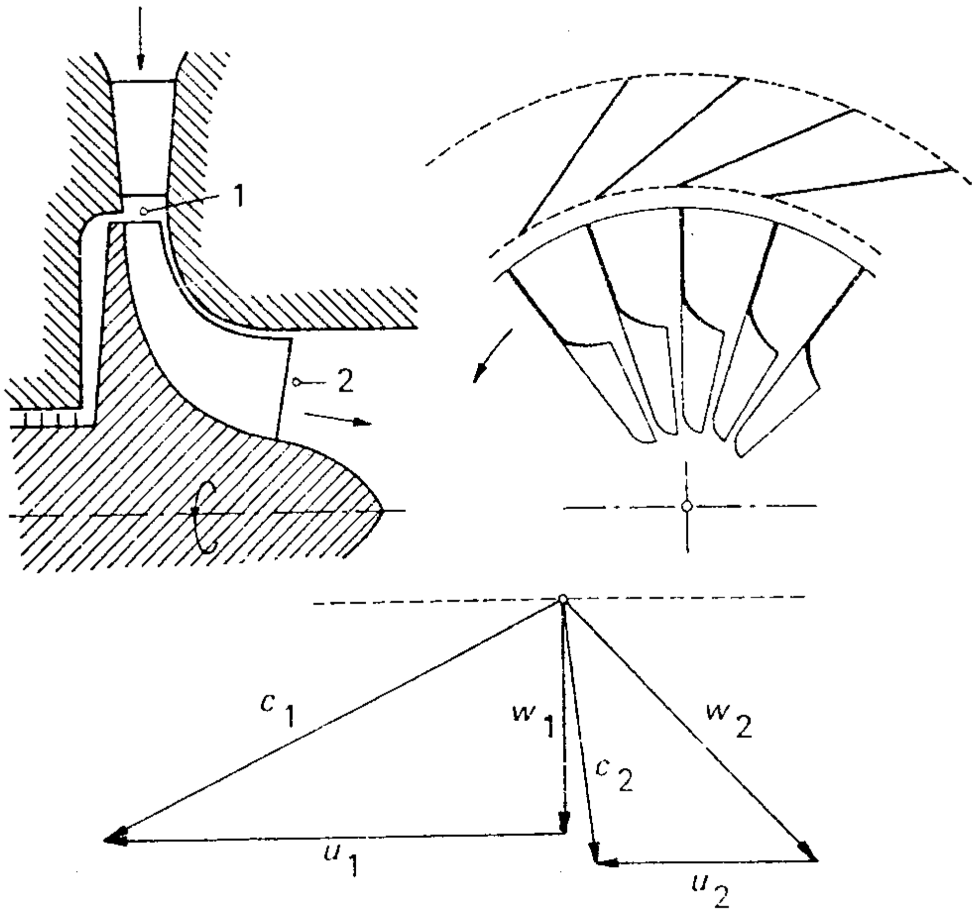
Angolo di sweep

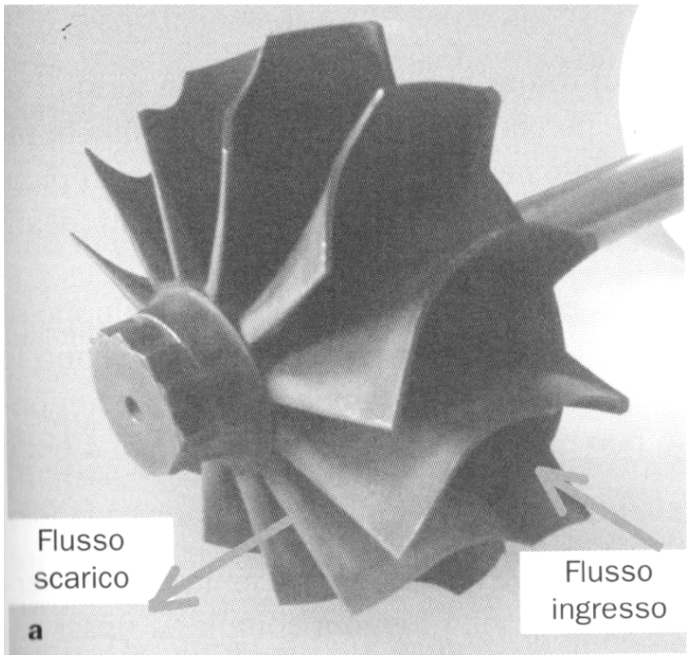
angolo di lean

Attacchi delle palette di macchine assiali



Turbina Centripeta





$$l_e = \frac{c_1^2 - c_2^2}{2} + \frac{u_1^2 - u_2^2}{2} - \frac{w_1^2 - w_2^2}{2}$$

$$u_1 > u_2$$

Turbina Ljungstrom

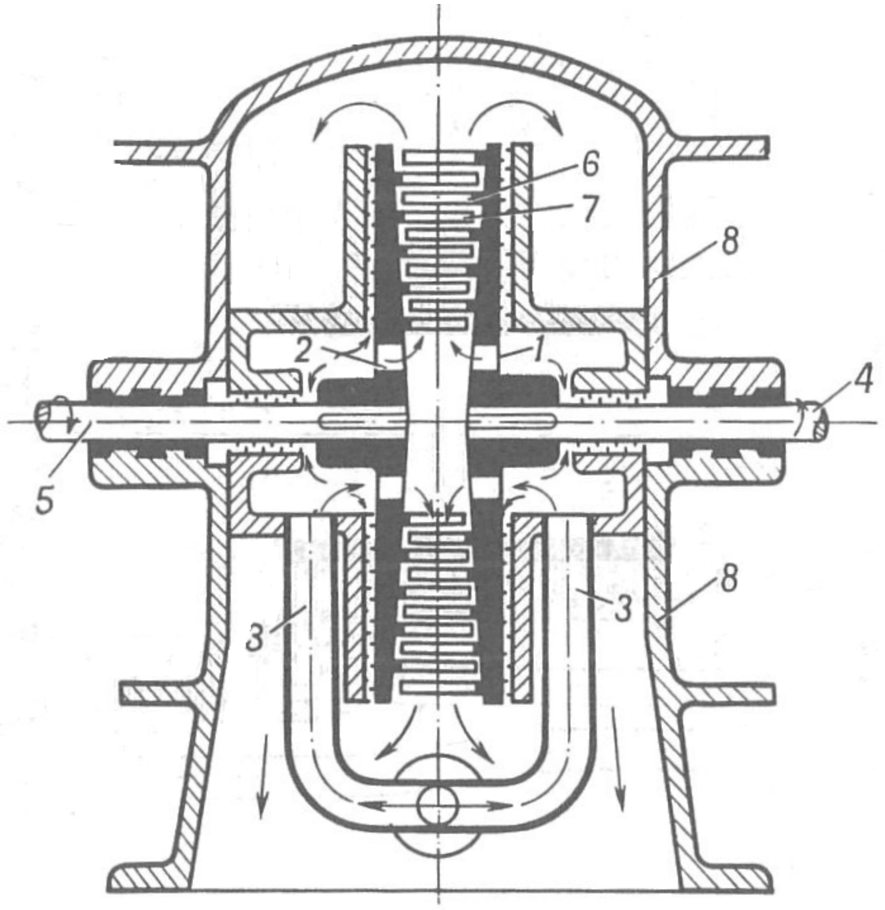
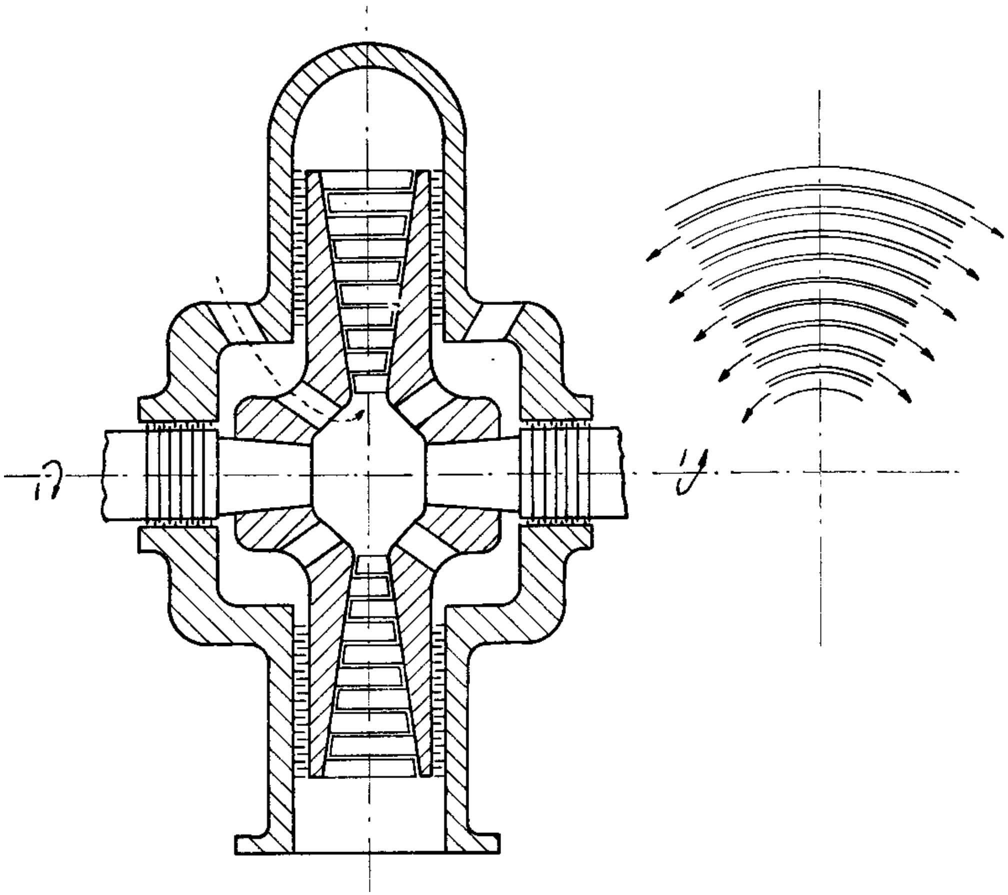
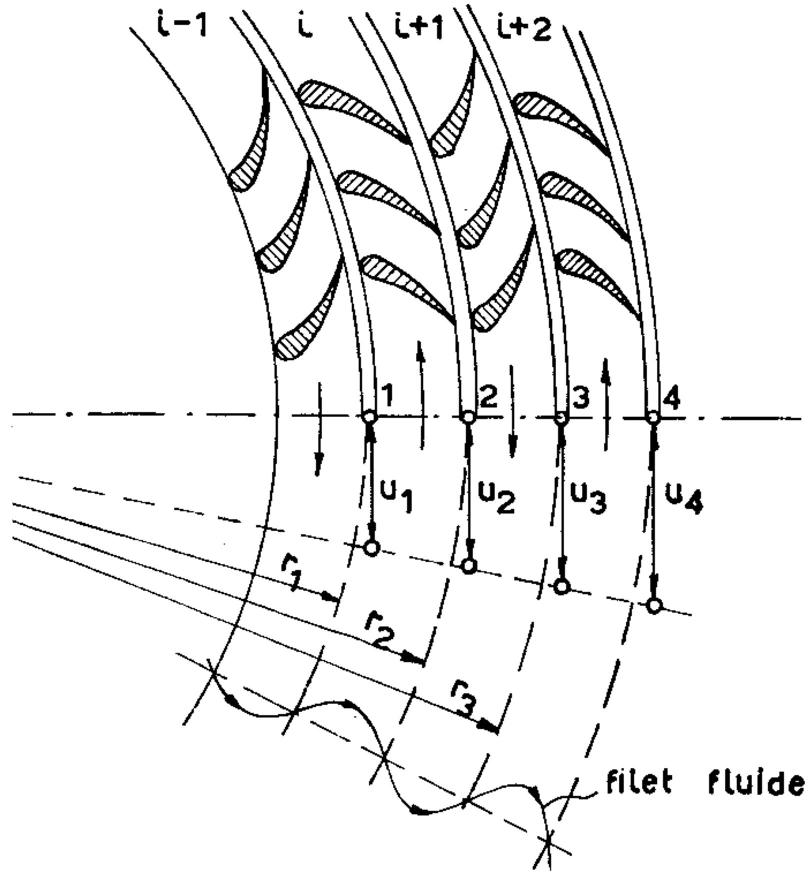


Fig. 1-3. Dibujo esquemático de la turbina radial de rotación en sentido inverso (Ljunström).

1, *2*, discos de la turbina; *3*, conductos de vapor vivo; *4*, *5*, árboles de la turbina; *6*, *7*, paletas de los escalones intermedios; *8*, cuerpo.

Turbina Ljungstrom





Turbina Ljungstrom