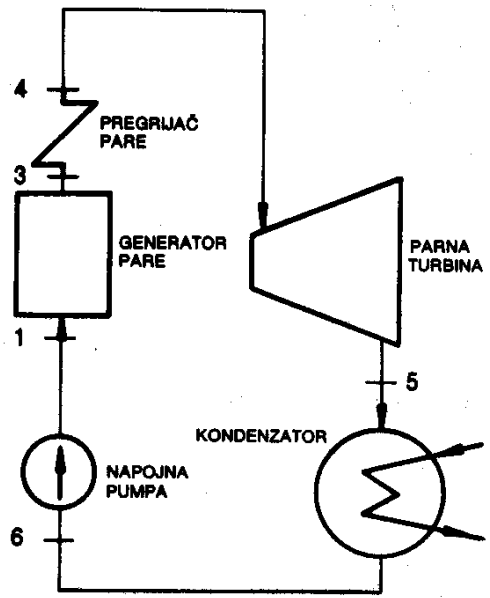
Brodske parne turbine

TIPOVI (Podjela)

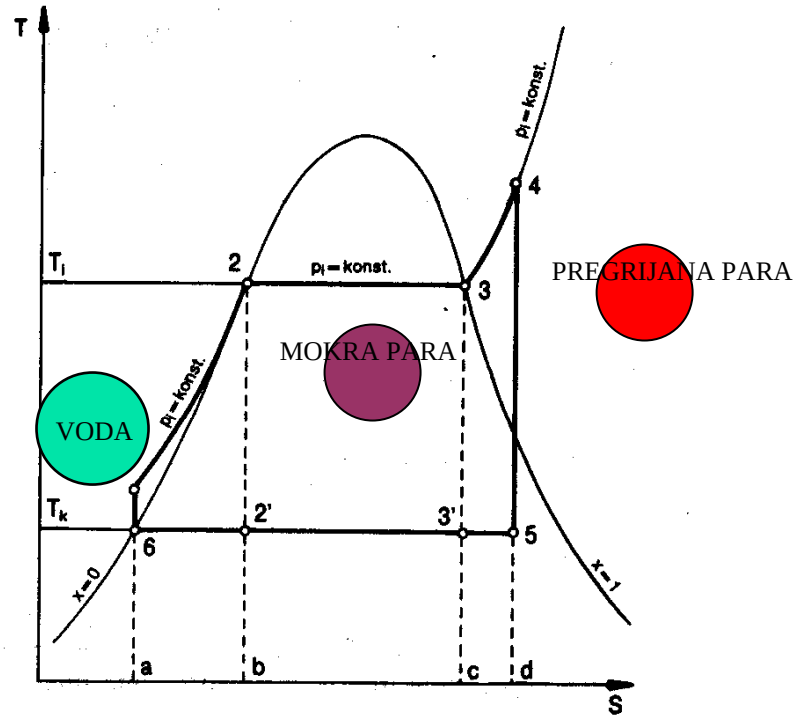
- Akcijska (de Laval) – 1883.
- Reakcijska (Parsons) – 1884.
- Sa stupnjevanjem brzine (Curtis)
- Jedno- i višekućišne
- Radijalne i **aksijalne**
- Glavne i **pomoćne**
- **Kondenzacijske** i protutlačne

PARNI PROCES

$$\eta_t = \frac{L}{Q_{dov}} = \frac{D(h_4 - h_5)}{D(h_4 - h_1)}$$



OSNOVNA SHEMA PARNOG PROCESA

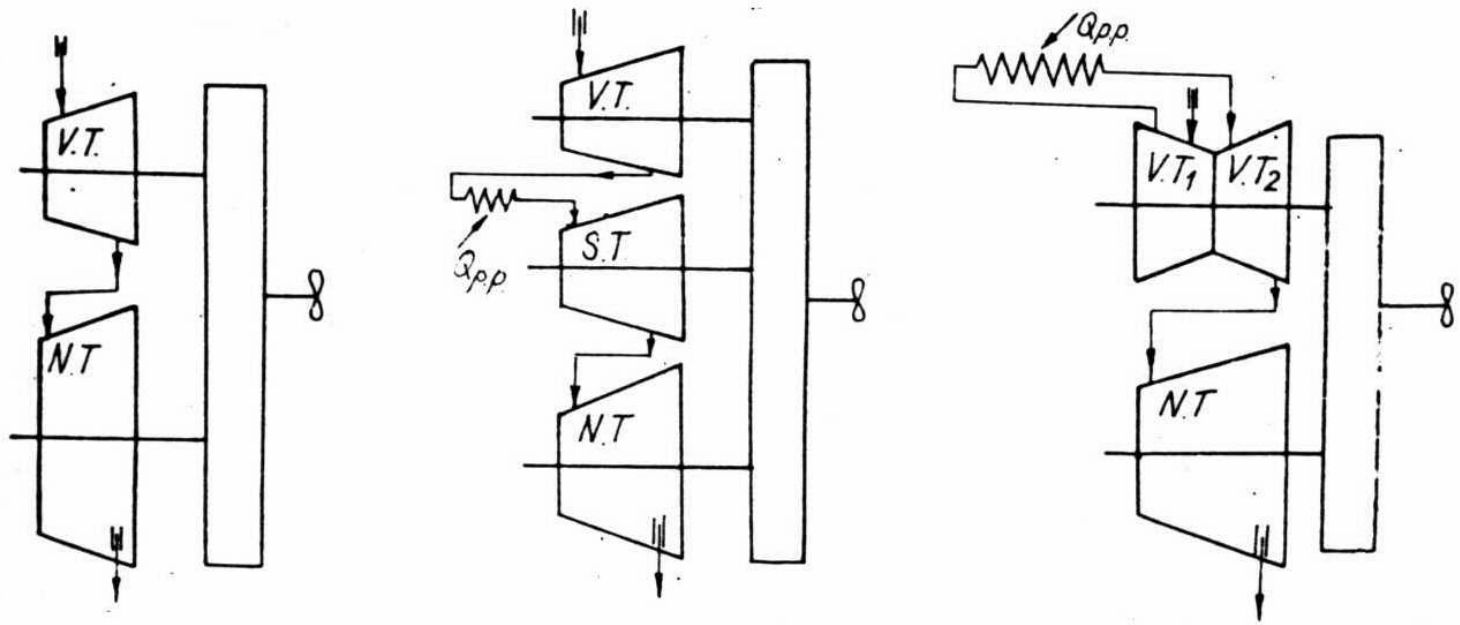


T-s DIJAGRAM PARNOG PROCESA

Porivne

- Više kućišta
- Višestepene - Parsons
- Curtis za vožnju krmom
- Kombinacije s plinskim turbinama
- Danas: EM porivi

Porivne – više kučišta



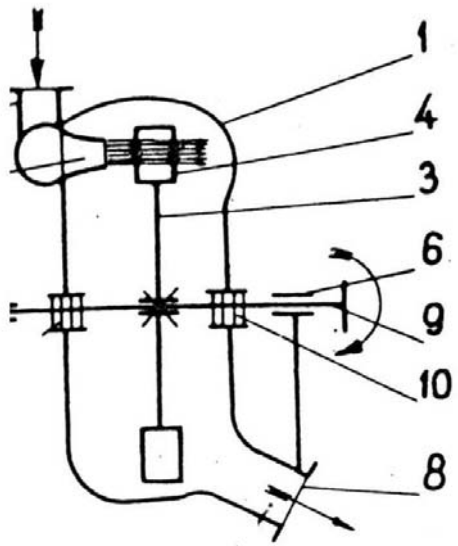
De Laval

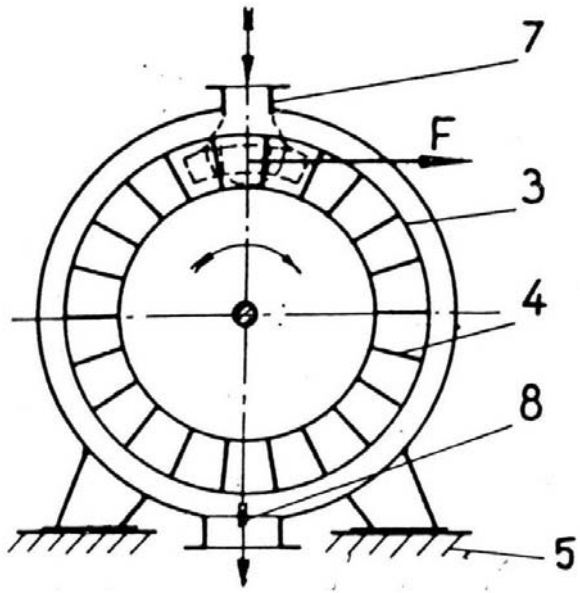
Male snage

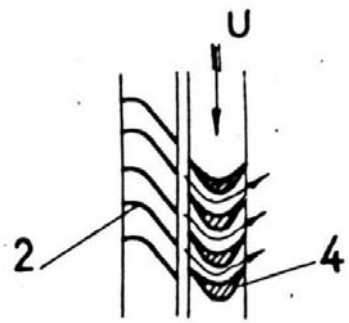
Pogon pumpi i generatora

Prvi stupnjevi višestepenih t.

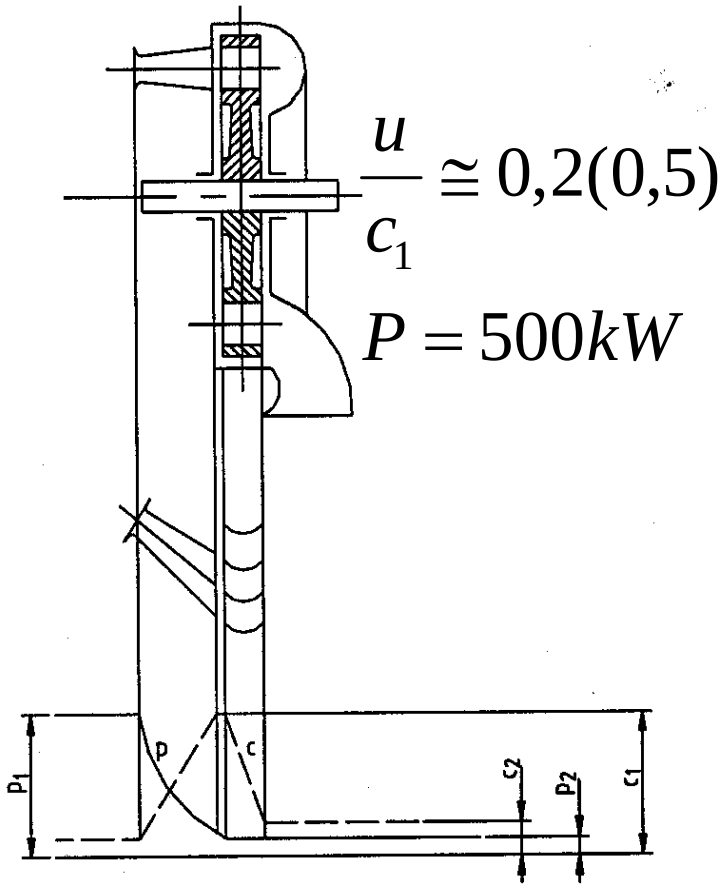
10000-30000 min^{-1}, η_e=0,3-0.4







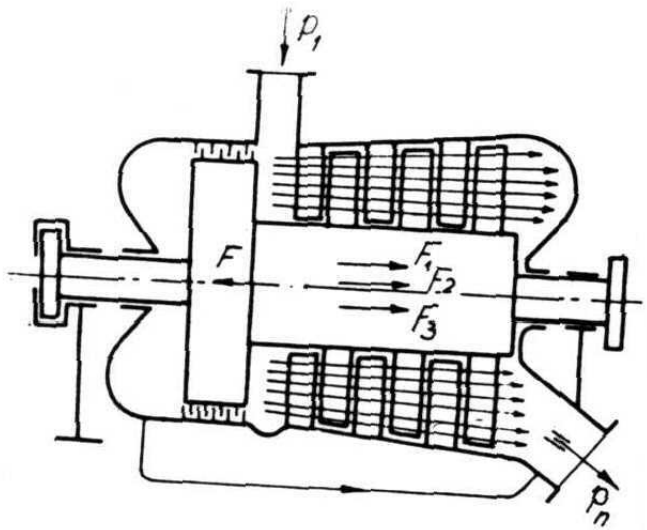
De Laval

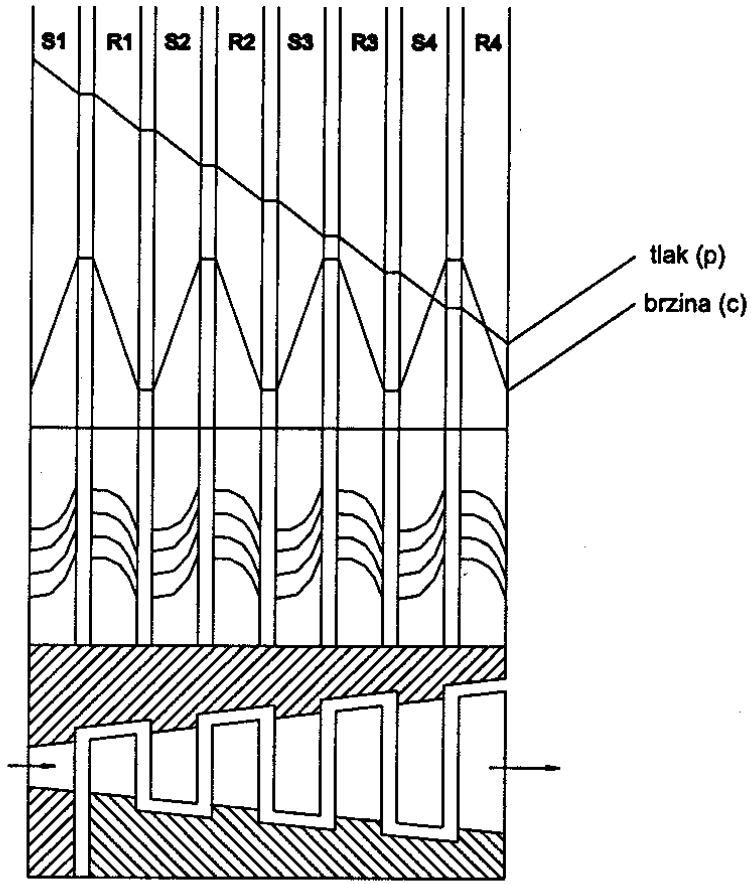


$$\frac{u}{c_1} \cong 0{,}2(0{,}5)$$

$$P = 500kW$$

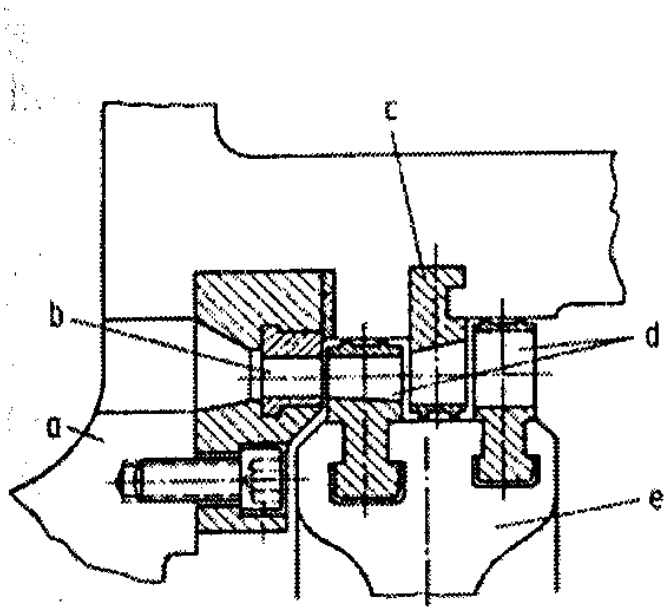
Parsons – višestepene turbine

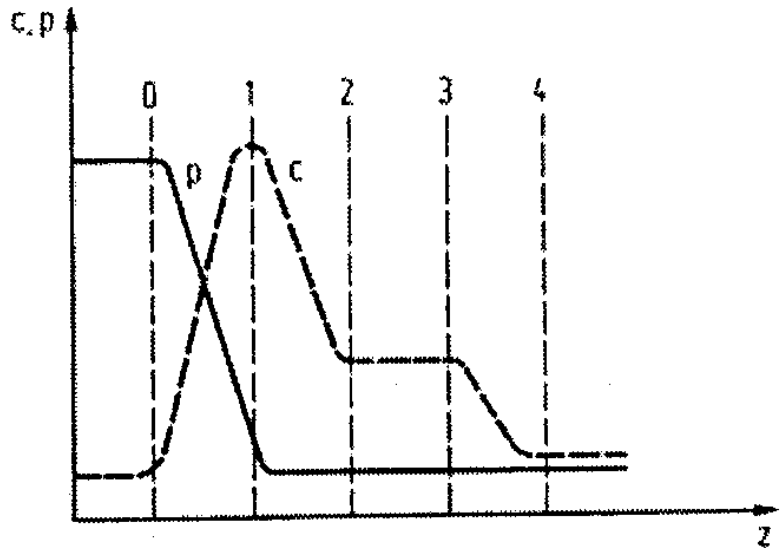




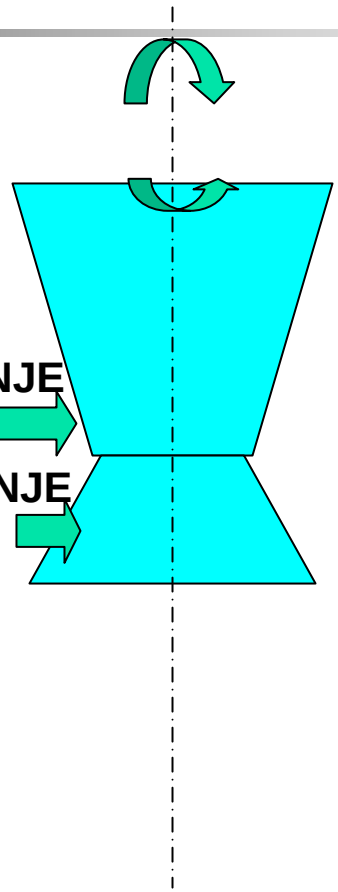
Curtis kolo – 1900.

3000-10000 min^{-1}, η_e =0,4 i više





Vožnja naprijed / nazad



ULAZ PARE KOD VOŽNJE NAPRIJED

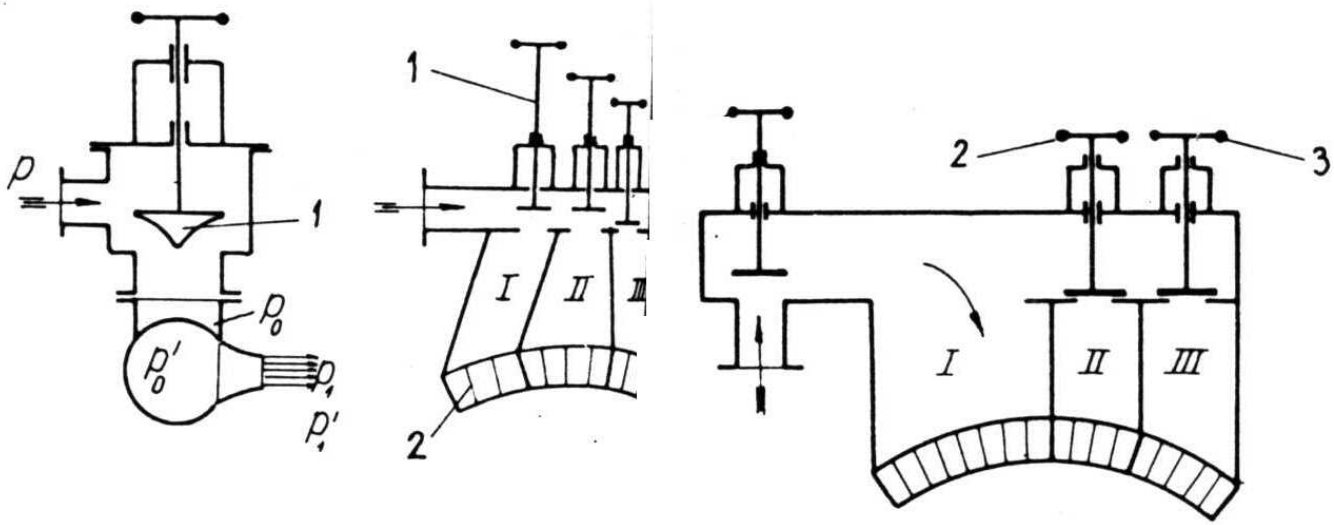
ULAZ PARE KOD VOŽNJE U NAZAD

Povećanje iskoristivosti

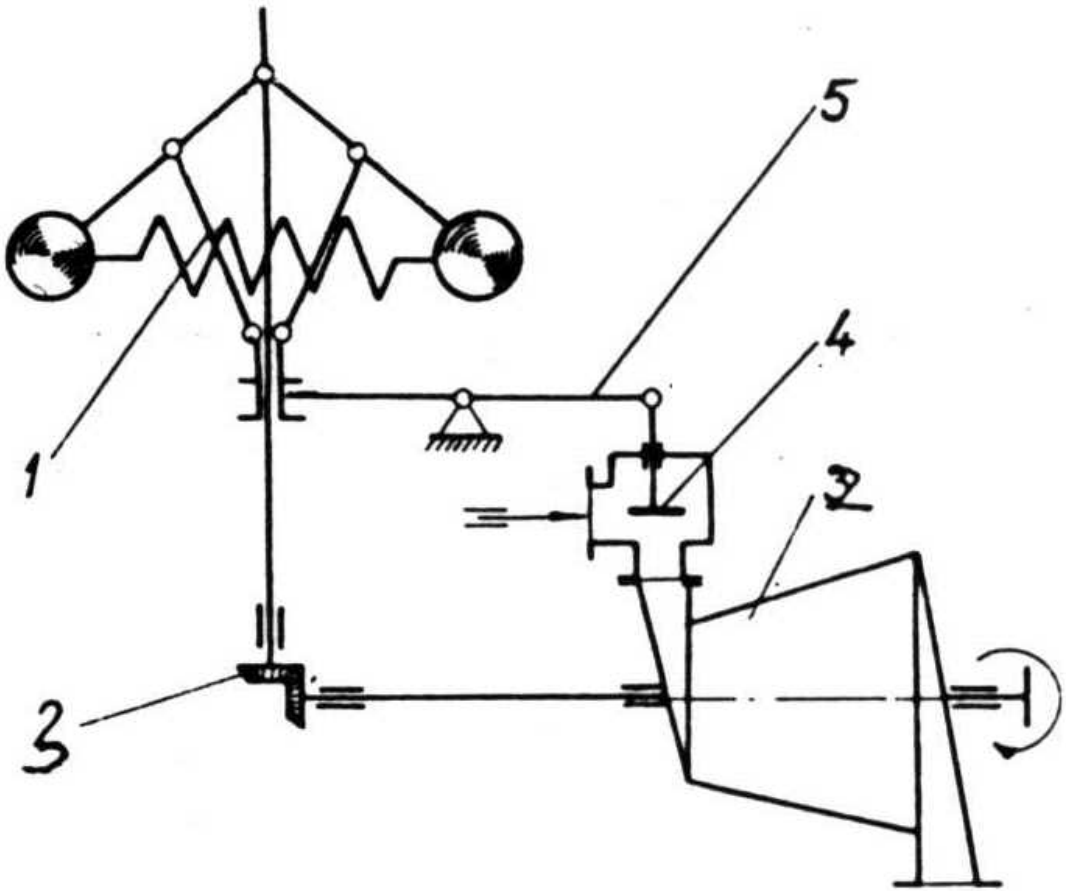
- Viši tlakovi
- Više temperature pregrijanja
- Međupregrijanje pare
- Niži tlakovi u kondenzatoru

REGULACIJA

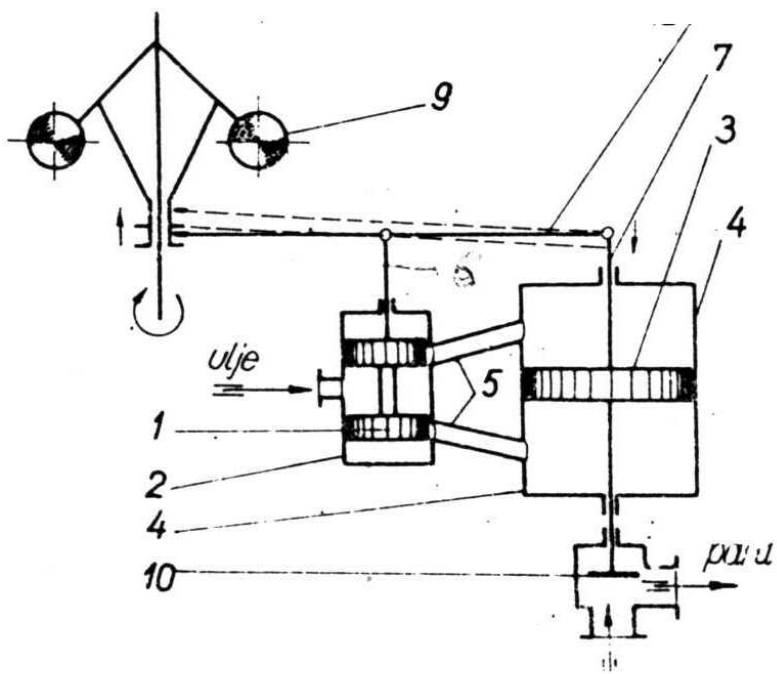
- PRIGUŠIVANJEM (TLAKOM)
- KOLIČINSKA
- KOMBINIRANA

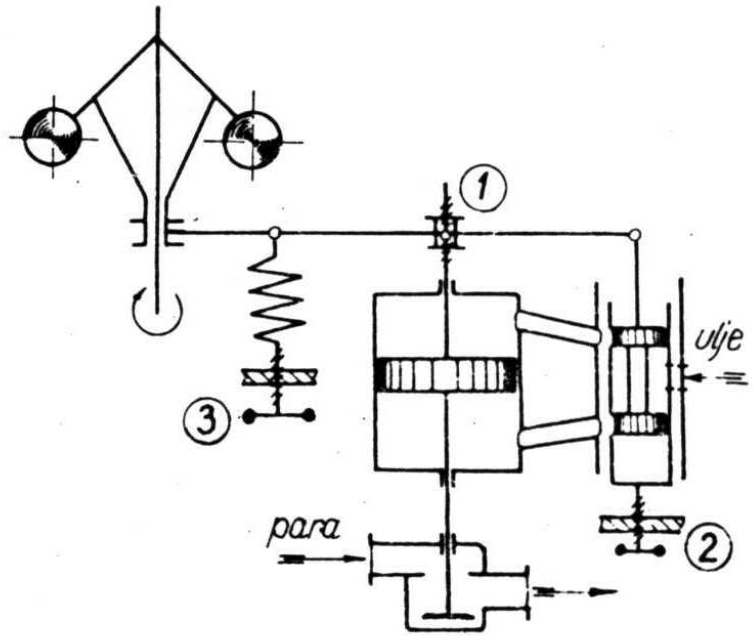


REGULACIJA -mehanička



REGULACIJA - hidraulička

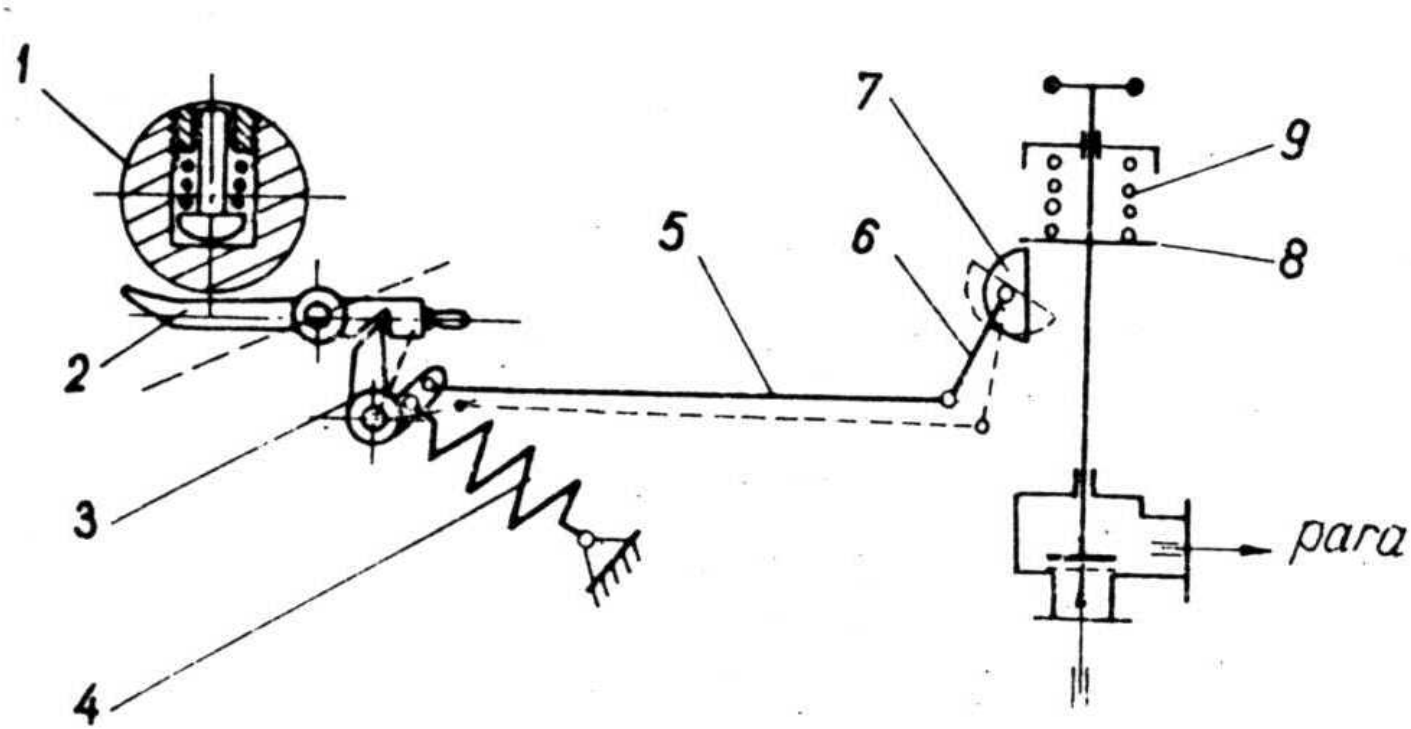




ZAŠTITA

- Tlak pare u kondenzatoru
- Tlak ulja za podmazivanje
- Vibracije
- Prekoračenje brzine vrtnje
- Aksijalni pomak (0,8 mm)
- Greška na kotlu
- Sustav ulja
  - Gravitacijski tank
  - Tlačno: privješena pumpa, elektromotorom pogonjena, u nuždi

ZAŠTITA (centrifugalni izvrstioc)



Priprema za pogon

- “Dreniranje” cjevovoda pare
- Pumpa predpodmazivanja ležajeva turbine
- Pumpa rashladne vode kondenzatora
- Ejektor kondenzatora i labirintna para
- Na 60% podtlaka – para u turbinu
- Šumovi i vibracije
- Postepeno povećanje opterećenja
- Trajanje: nekoliko sati (BGP?)