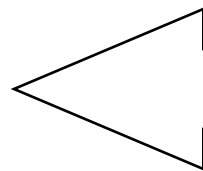


- GEEL, Belgija
- Workshop on Sample Preparation and Homogenization for Food And Feed Analysis
- Trace elements, Antibiotics, Allergens, Mycotoxins, Acrylamide
- Institute for reference materials and measurements (Joint Research Centre)

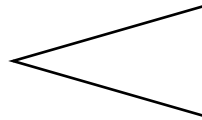
Usitnjavanje

usitnjavanje

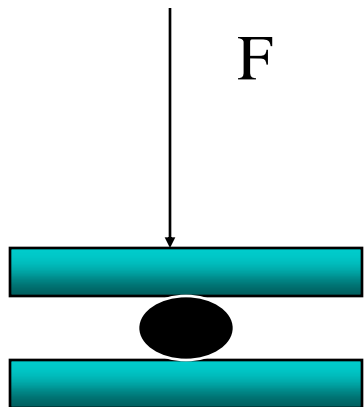
- Sjeckanje
- Drobljenje
- Mljevenje
- Drobljenje



Grubo drobljenje: Čeljusne i
Konusne drobilice
0,3-0,5 do 0,15-0,1m



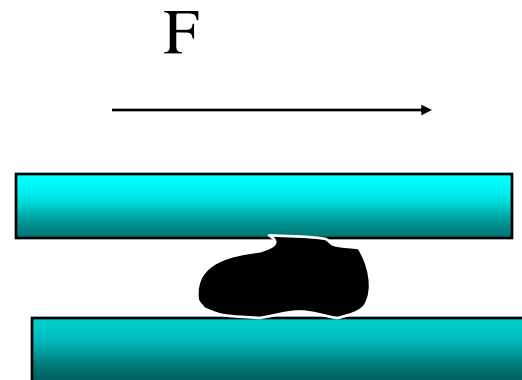
Srednje i fino drobljenje-
drobilice na valjke, zvonaste drobilice,
žrvnjevi i čekičari 0,1 0,15-0,1 do
0,03-0,4m



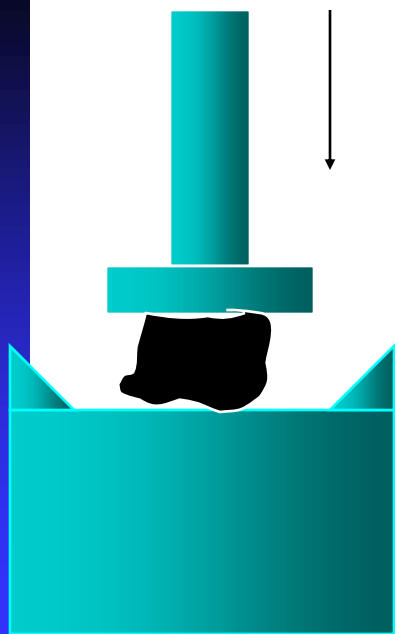
tlak



smik



trenje



udar

mljevenje

- Jednostavno
- Složeno

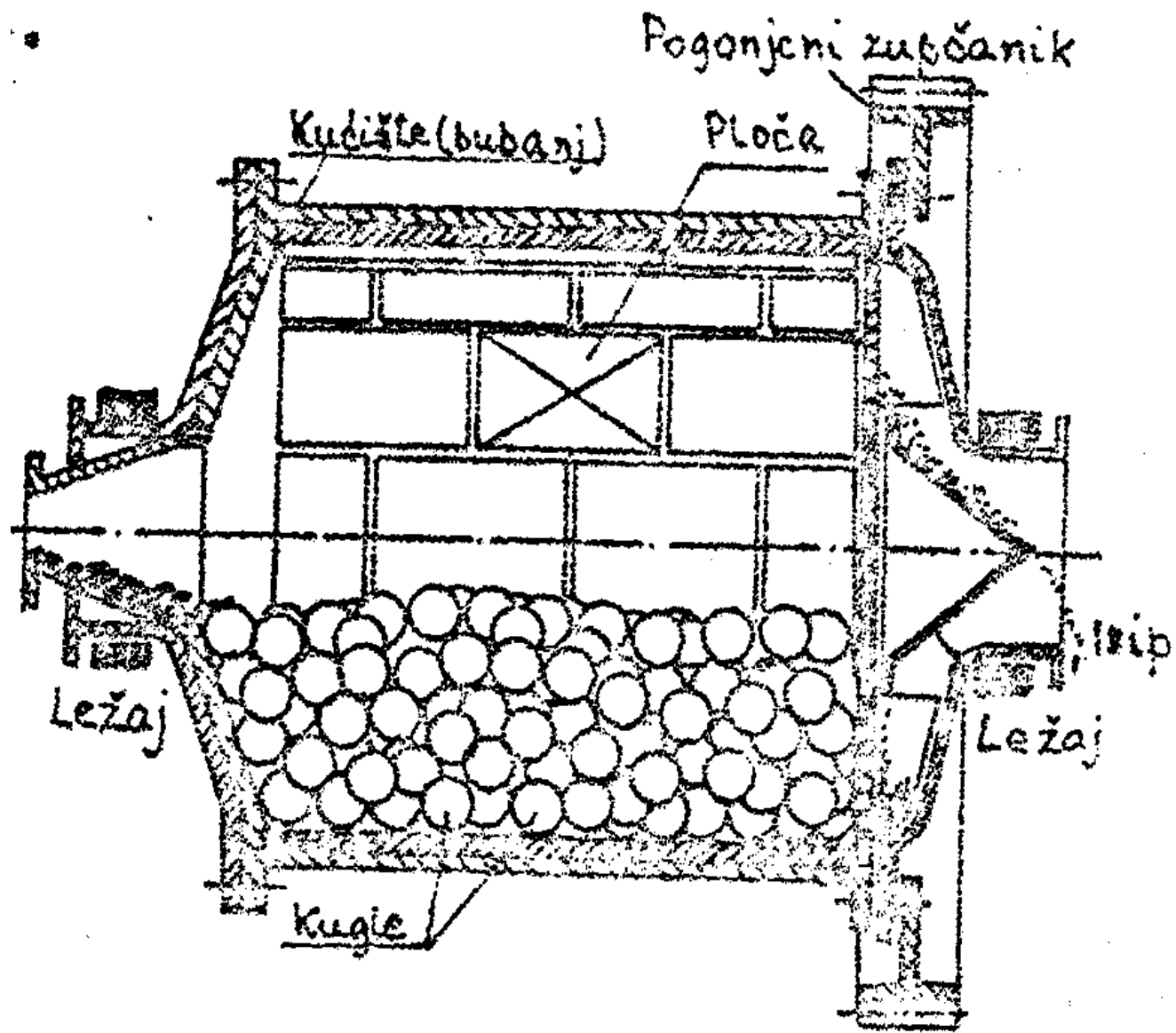
- Mlinski kamenovi, mlinovi sa valjcima, mlinovi sa kuglama, centrifugalni mlinovi, čekićari sa unutarnjim klasiranjem, mlinovi na strujnu energiju fluida

Strojevi za mljevenje

- Grubo
- Srednje
- Fino
- Mlinski valjci, mlinski kamenovi, dezintegratori, dismembratori, kuglični mlinovi, vibracioni mlinovi
- Koloidni mlinovi: smični, smično-tarni i kavitacioni

Kuglični mlin

- Bubanj rotira i unutar njega su kugle
- Tvar se uvodi kroz osni dio bubnja
- Kugle melju udarom i trenjem
- Bok bubnja u obliku sita
- Kontinuirano
- Usitnjava dovrlo malih dimenzija



MIJEŠANJE

MIJEŠANJE

- Tehnološka operacija kojom se smanjuje koncentracijski ili temperaturni gradijent ili oba istovremeno.
- Medij je savršeno pomiješan ako se u beskonačno malom volumenu smjese , komponente ravnomjerno rasporede i imaju jednake temperature

- Često se na području tehnike miješanja uzima kao kriterij sličnosti Re-broj
- U Re-broj osim poznatih fizičkih parametara ulazi d_m (promjer mješalice, lopatice, propelera, turbine) i obodna brzina v

$$\mathbf{Re} = \frac{v \cdot d_m \cdot \rho}{\mu}$$

$$v = \pi \cdot d_m \cdot n$$

- Na snagu utječu slijedeći parametri (osim prije spomenutih):
 - Promjer aparata d_a
 - Visina tekućine l_t
 - Visina lopatice, propelera ili turbine h

$$P = (KK_2) \cdot d_m^5 \cdot n_3 \cdot \mu \text{ [W]}$$

KK_2 = konstantna veličina za određeni tip mješalice

- Optimalni broj okretaja mješalice ovisi o:
 - Svrsi miješanja
 - Tipu mješalice
 - Linearnim dimenzijama mješalice
- Optimalan broj okretaja se postiže onda kada je radijalna komponenta brzine čestica *jednaka ili veća od brzine taloženja*

MIJEŠANJE KAPLJEVINE I PLINA

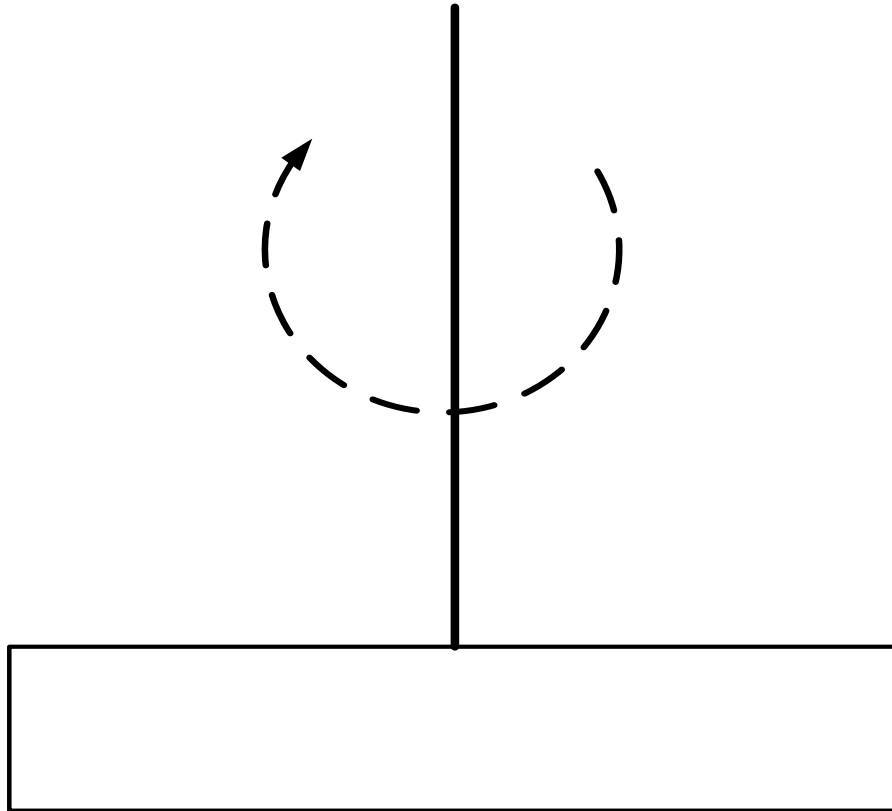
- Kod fermentacije se često u kapljeviniu (kominu) injektira zrak (kisik)
- Najčešće se zrak uvodi u kominu kroz mješalicu uslijed stvaranja podtlaka iza lopatica, izazvanog rotacijom mješalice

- Snaga koja se troši za miješanje kapljevine i plina je skoro jednaka snazi koja se troši za miješanje same tekućine
- Srednji promjer mjehurića d koji nastaje kod miješanja ovisi o:
 - broju okretaja mješalice n
 - linearnim dimenzijama mješalice
 - dinamičkoj viskoznosti tekućine i plina μ
 - gustoći ρ
 - površinskoj napetosti tekućine ζ

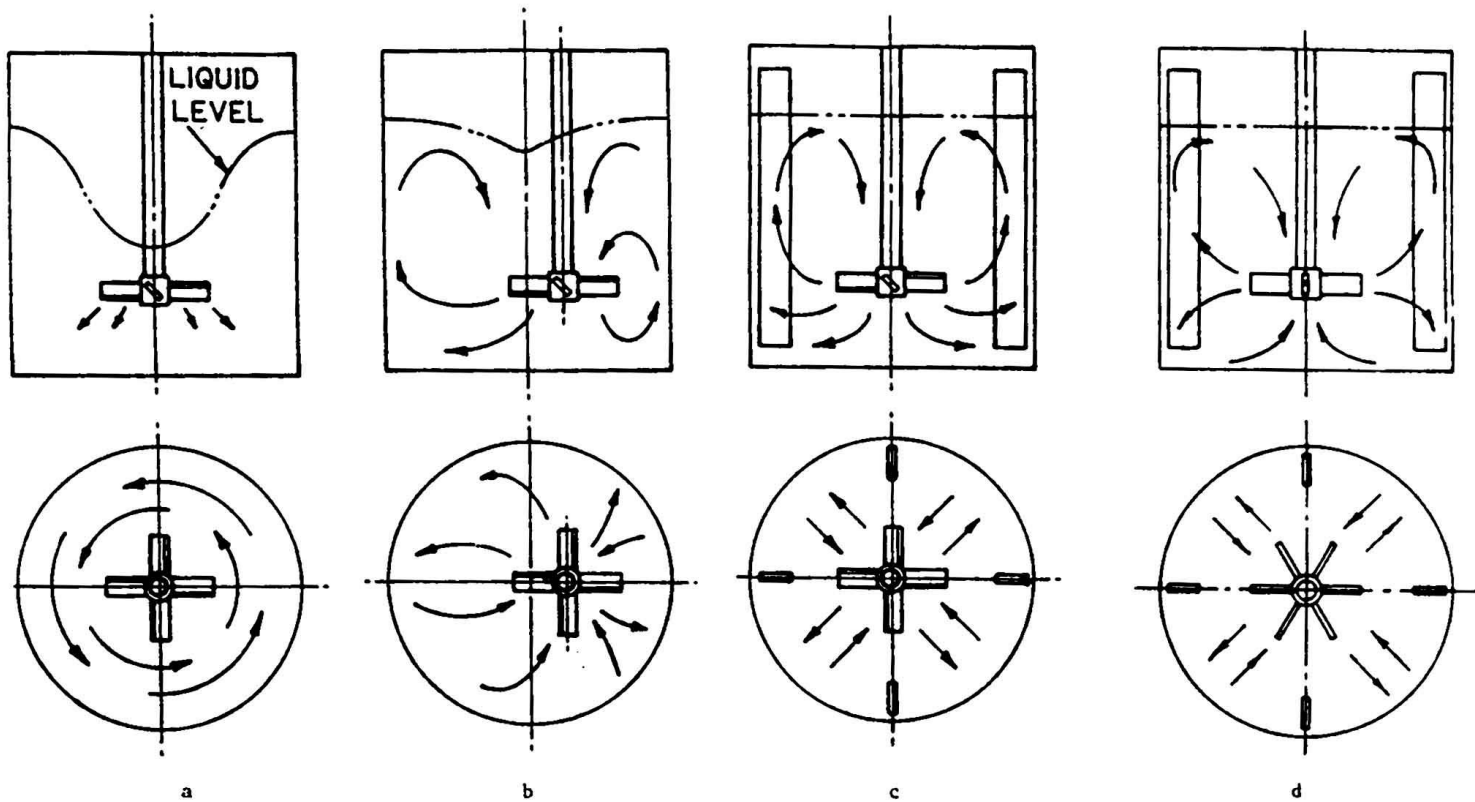
- Miješanje tekućina se može vršiti i propuhavanjem sitnih mjehurića plina (zraka) ili pare
- Takvo se miješanje zove *barbotiranje*, a uređaji *barboteri*

MJEŠALICE

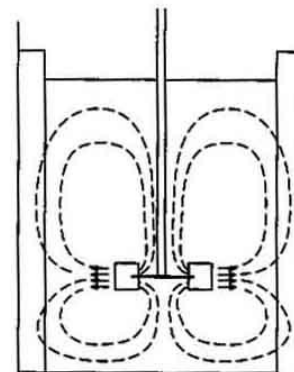
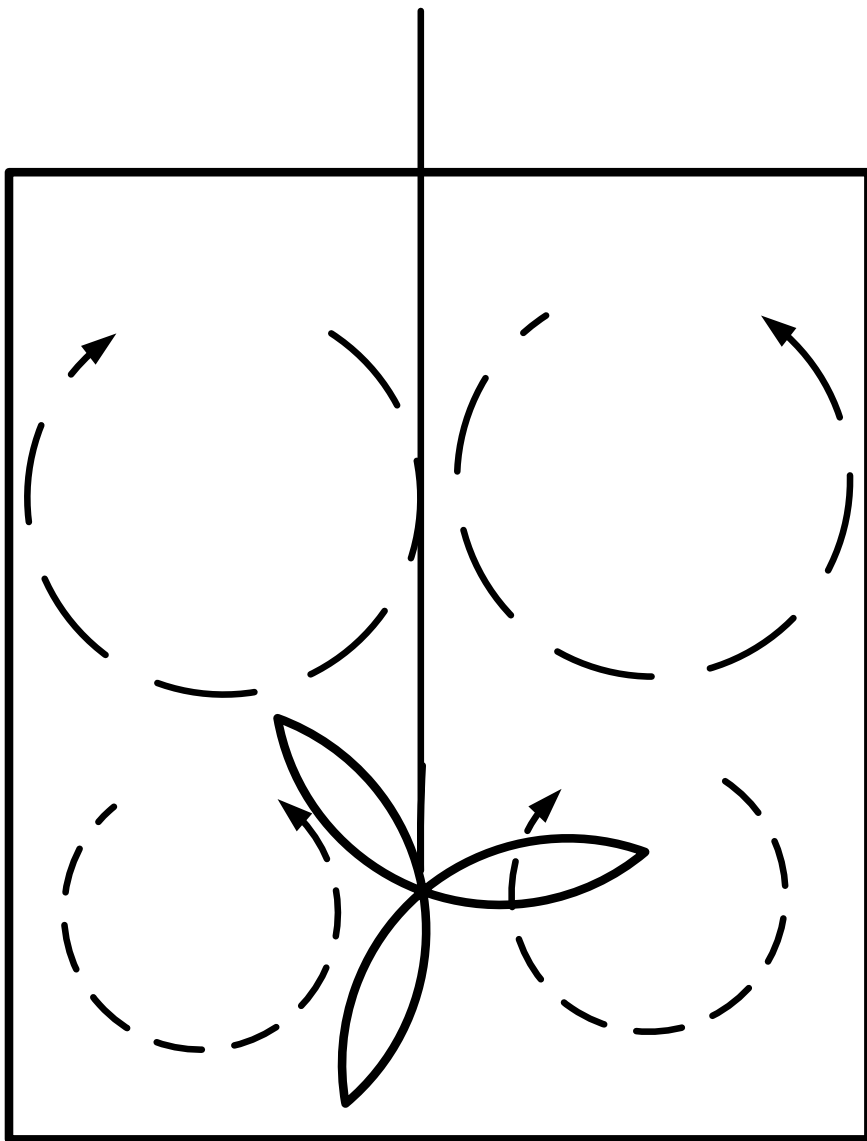
- Mehaničko miješanje služi za miješanje kapljevina koje nastaje uslijed rotacije mješalice
- Mješalice tlače tekućine, dio čini krug u smjeru rotacije mješalice, dio optiče rub lopatice i miješa se s okolnom tekućinom



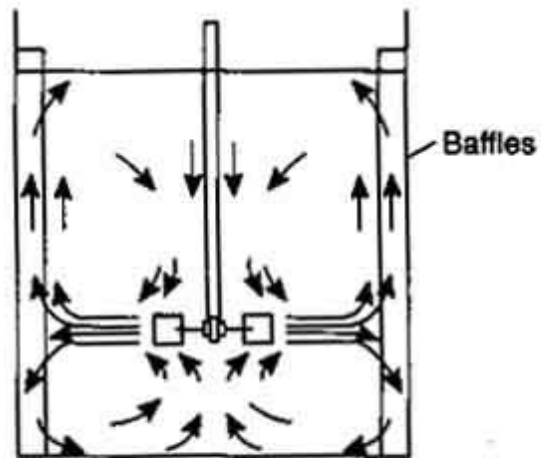
Tangencijalno gibanje



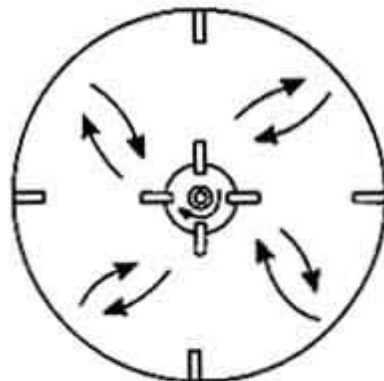
Tangencijalno gibanje



*Radijalno
gibanje*

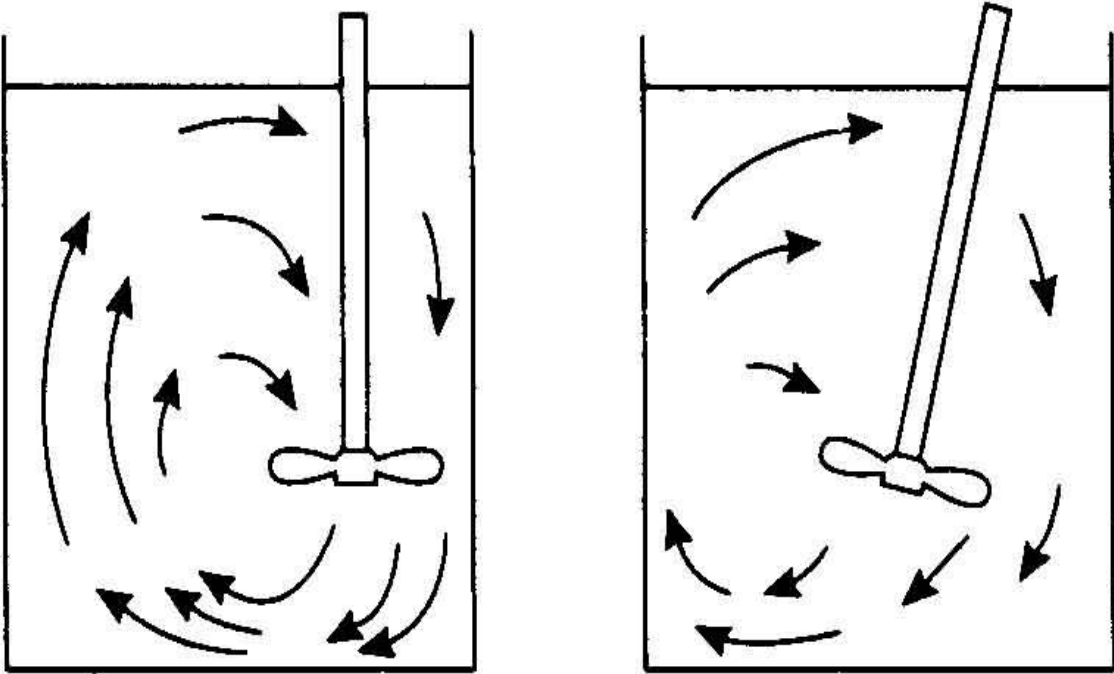


Side view

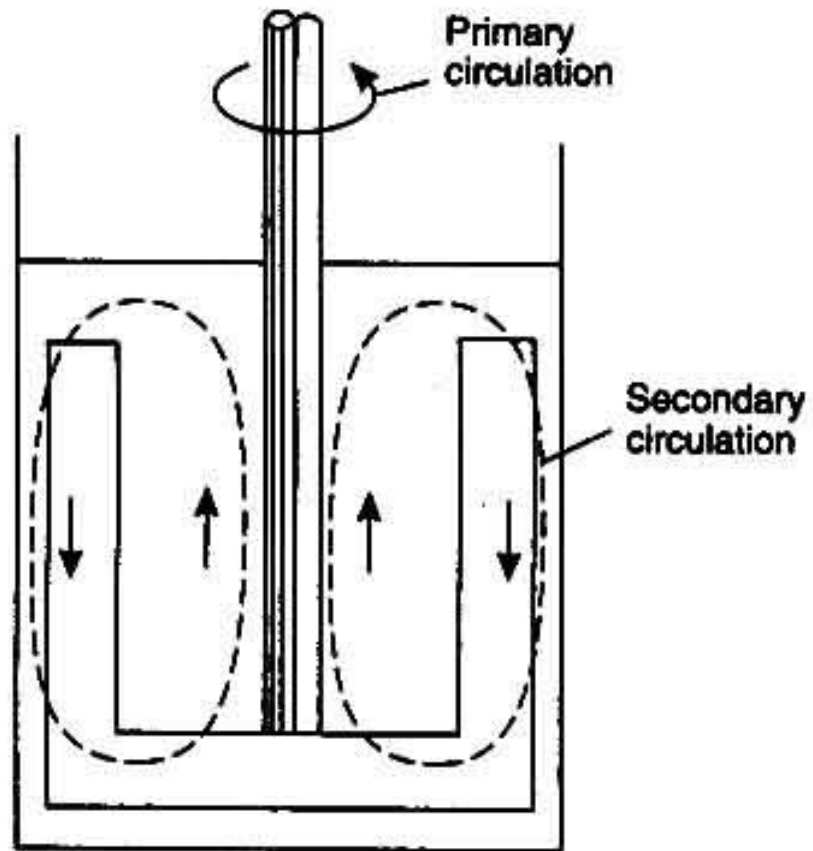


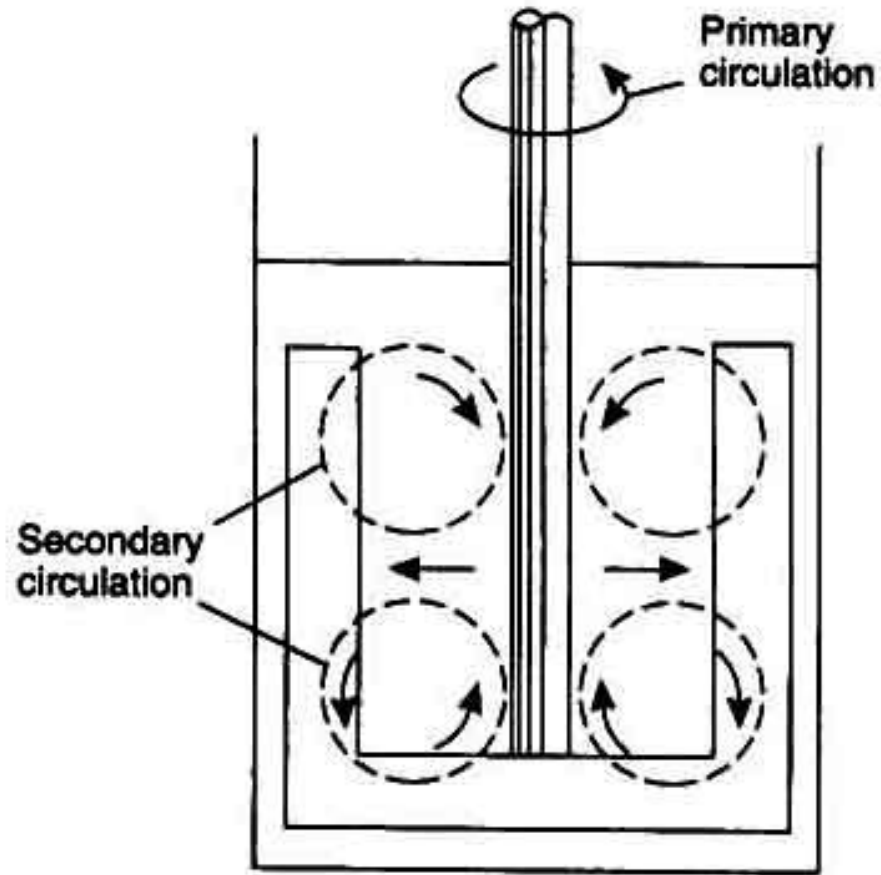
Bottom view

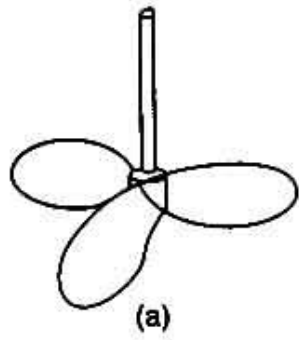
*Radijalno
gibanje*



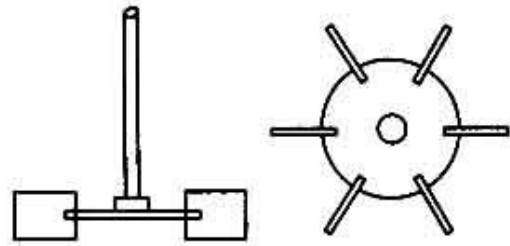
**Off-centre top-entering
propeller position**



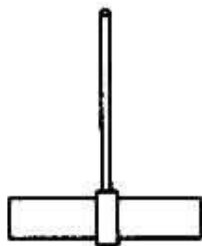




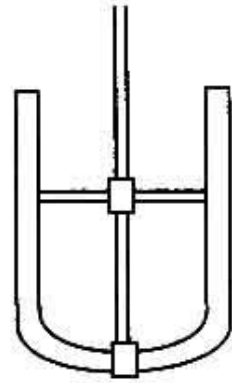
(a)



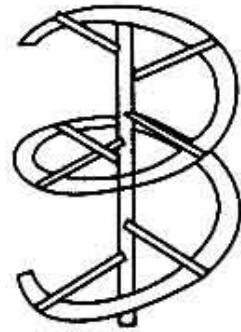
(b)



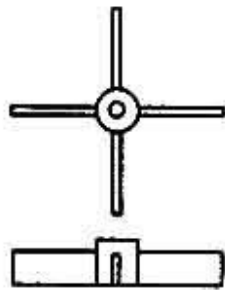
(c)



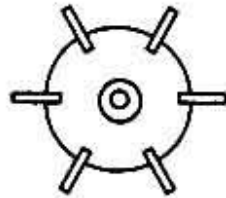
(d)



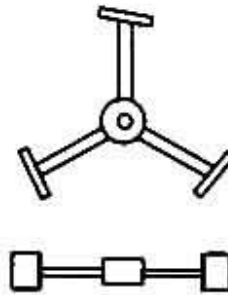
(e)



(a)



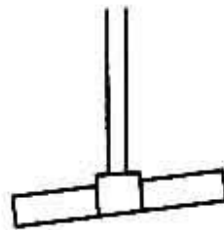
(b)



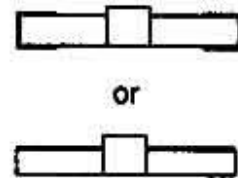
(c)



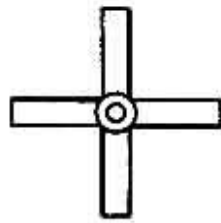
(d)



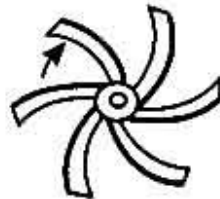
(e)



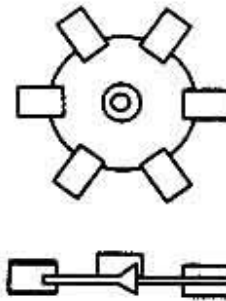
(f)



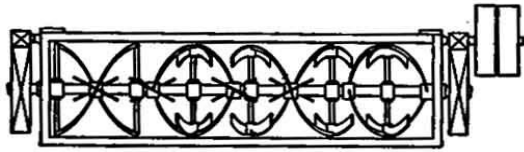
(g)



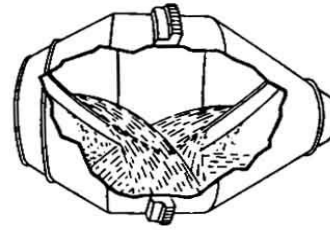
(h)



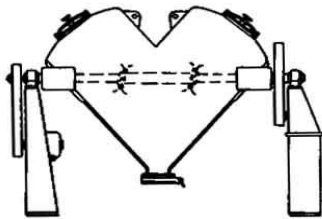
(i)



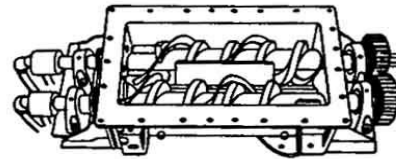
(a)



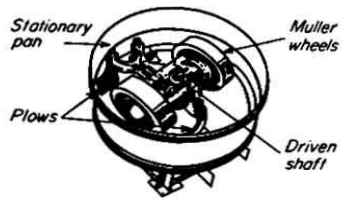
(b)



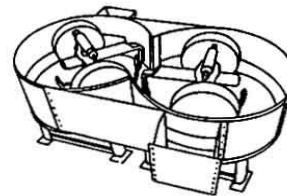
(c)



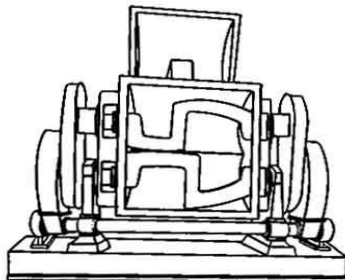
(d)



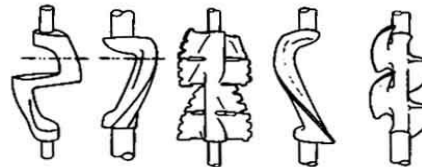
(e)



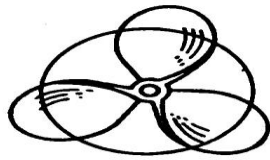
(f)



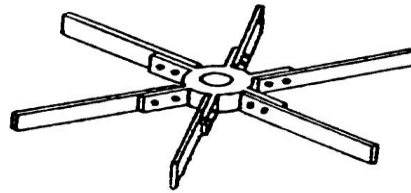
(g)



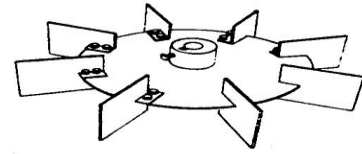
(h)



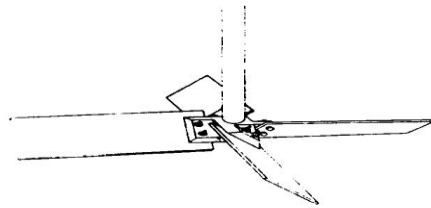
(a)



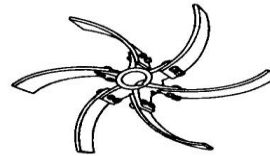
(b)



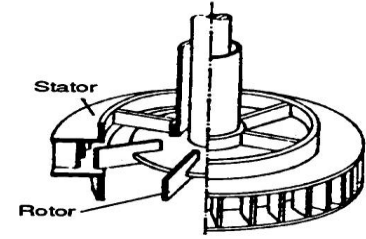
(c)



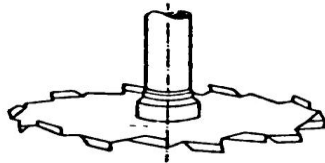
(d)



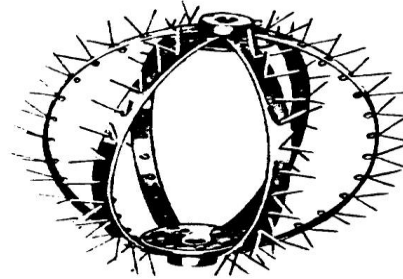
(e)



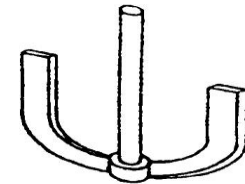
(f)



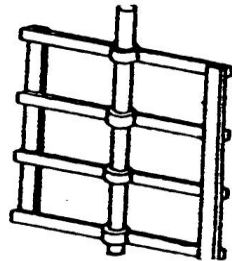
(g)



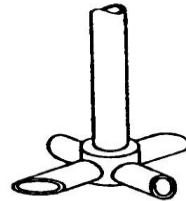
(h)



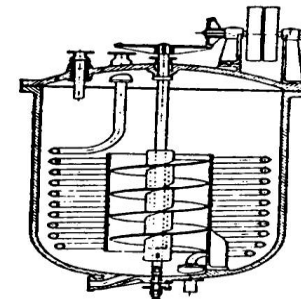
(i)



(j)



(k)



(l)

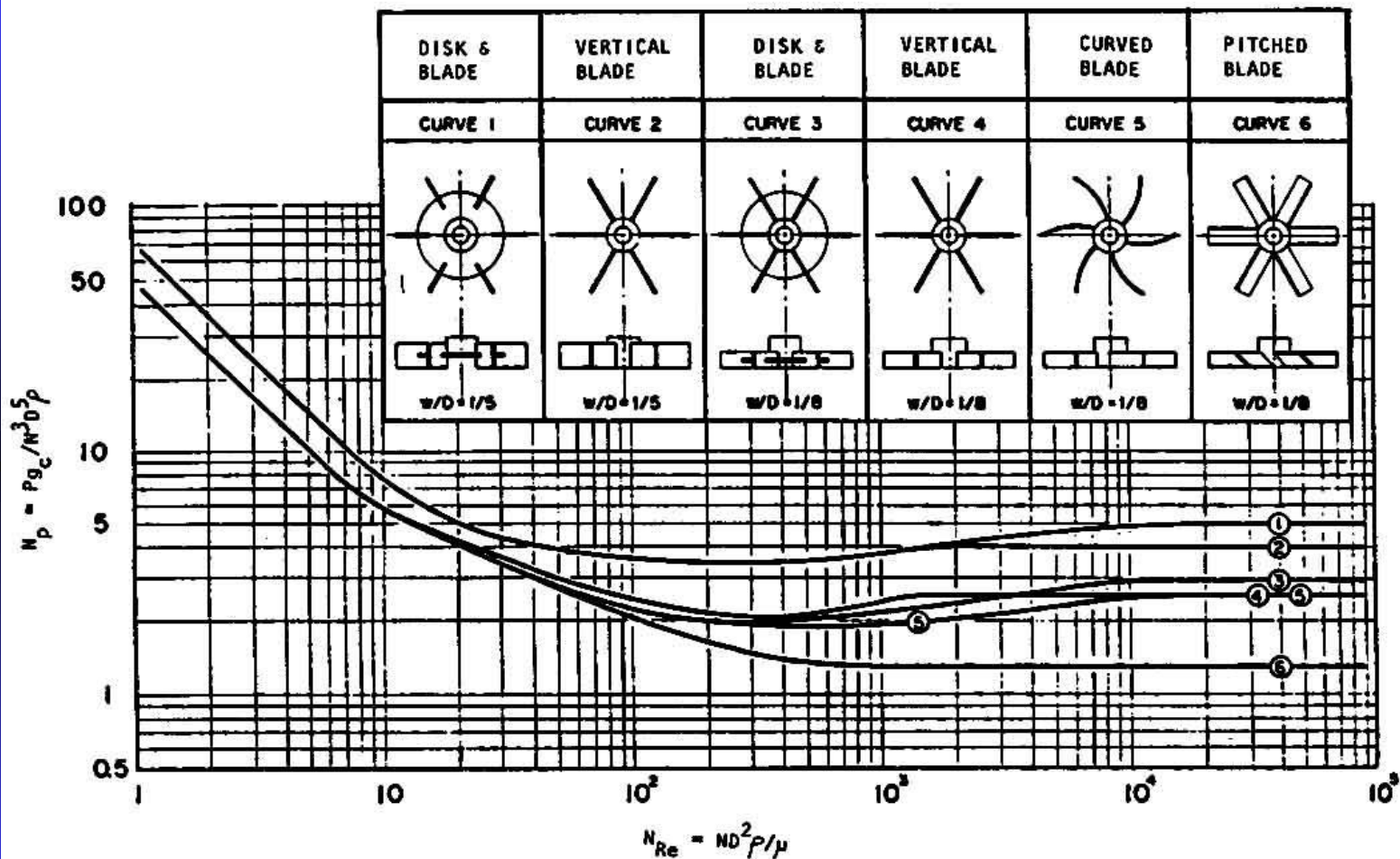
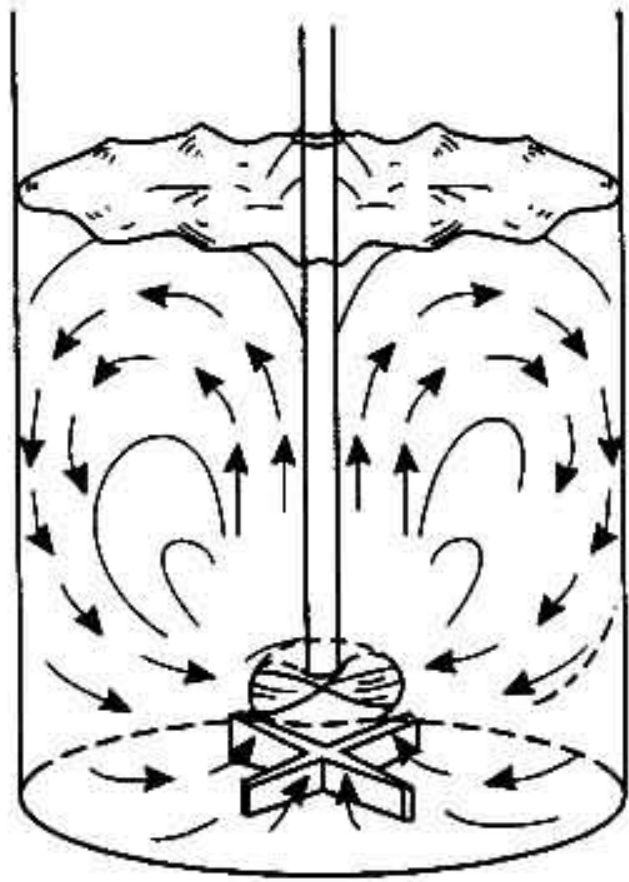
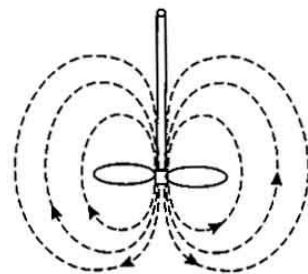
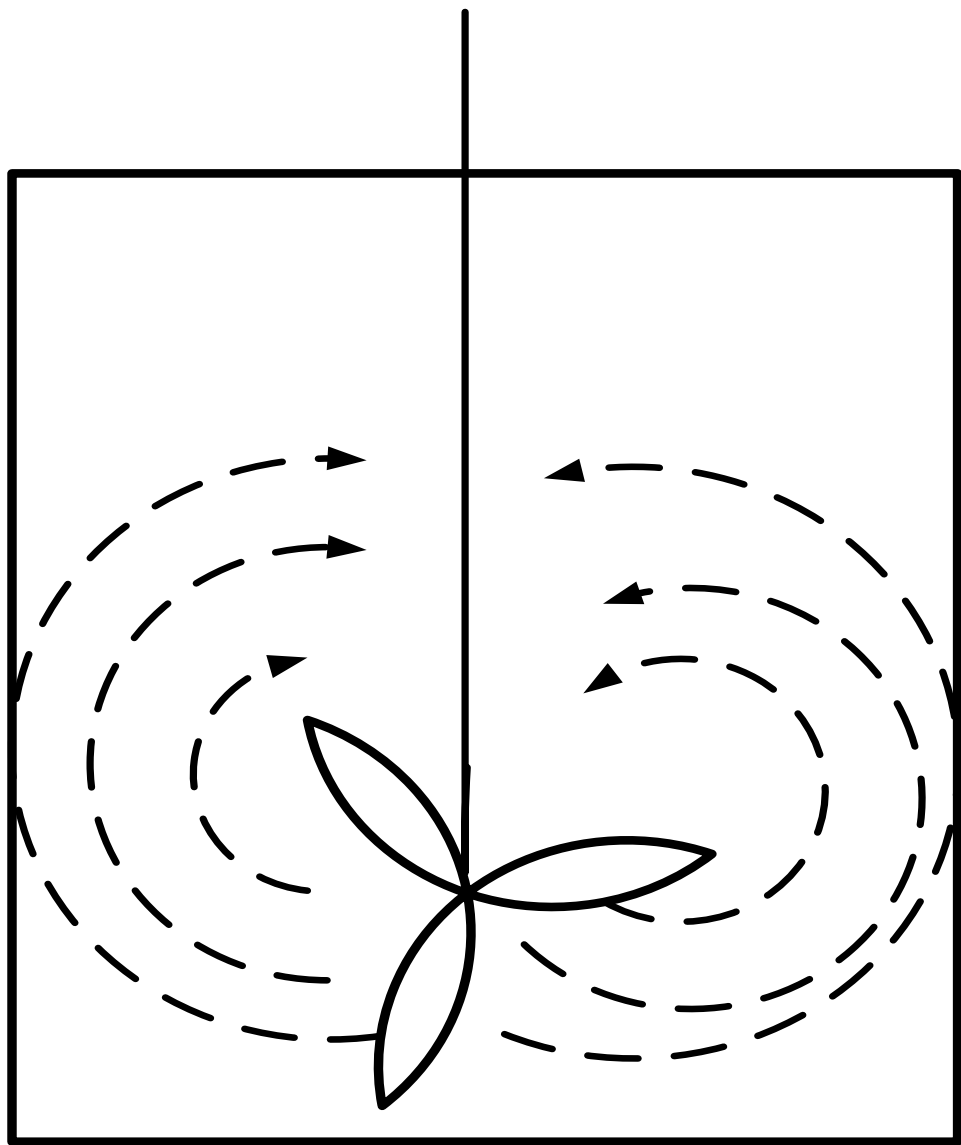


Figure 10.6. Power number against Reynolds number of some turbine impellers [Bates, Fondy, and Corpstein, Ind. Eng. Chem. Process. Des. Dev. 2(4) 311 (1963)].





*Aksijalno
gibanje*

TIPOVI MJEŠALICA

- Po *obliku* mješalice dijelimo na:
 - Lopataste
 - Propelerske
 - Turbinske

- Prema *broju okretaja*:
 - Sporohodne
 - Brzohodne

