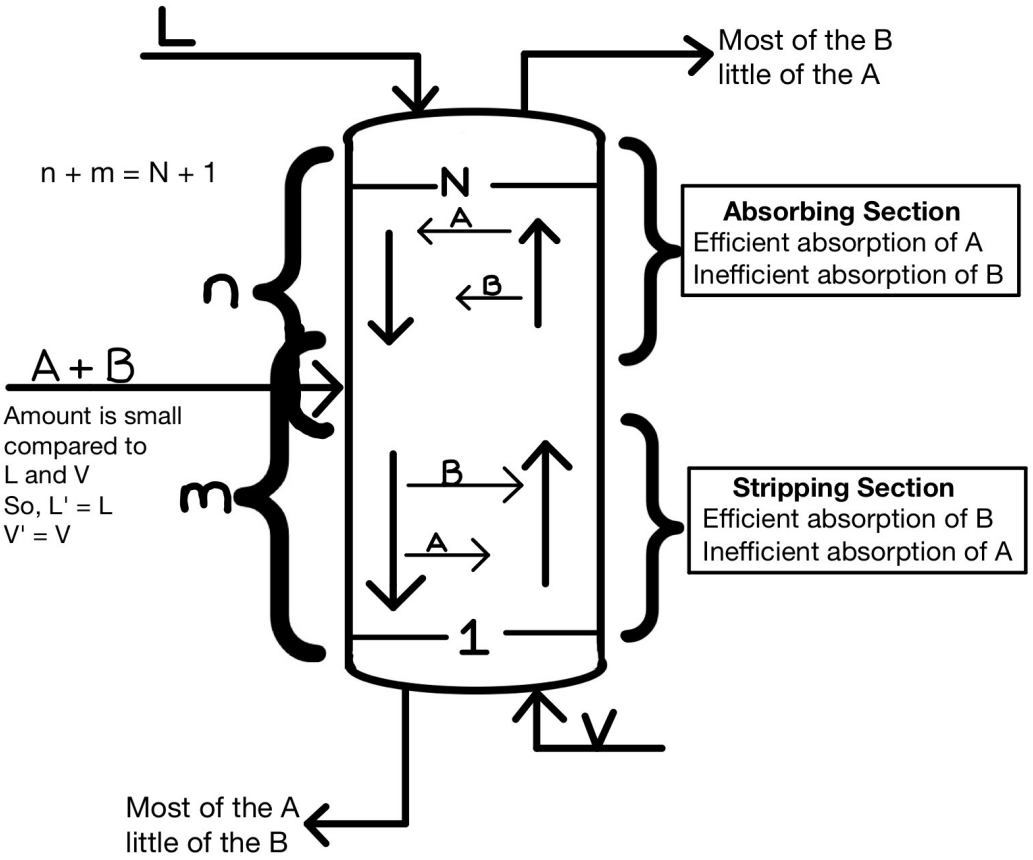
Special Topics Related to Staged Processes

Two section absorber/ stripper for the fraction of mixture A and B

For $K_B > K_A$:



Reduces to absorber form of KSB equation if m = 1, n = N and $y^*_{out} = 0$

Two section KSB equation:

$$\frac{V_{i,N}}{l_{i,1}} = \left(\frac{KiV}{L}\right)^n \left[\frac{\left(\frac{KiV}{L}\right)^m - 1}{\left(\frac{KiV}{L}\right)^n - 1}\right]$$

Top section:

Efficient absorbing of A

$$\frac{L}{K_A V} > 1 \Rightarrow \frac{L}{V} > K_A$$

Inefficient absorbing of B

$$\frac{L}{K_B V} < 1 \Rightarrow \frac{L}{V} < K_B$$

Bottom section:

Efficient stripping of B

$$\frac{K_B V}{L} > 1 \Rightarrow \frac{L}{V} < K_B$$

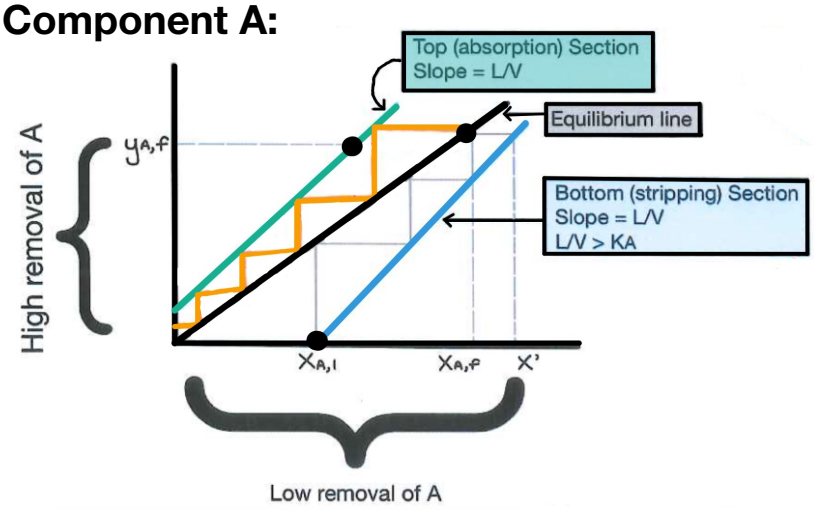
Inefficient stripping of A

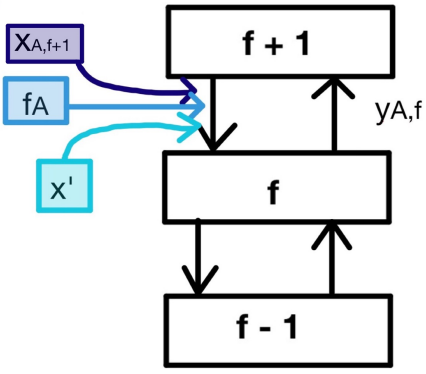
$$\frac{K_A V}{L} < 1 \Rightarrow \frac{L}{V} > K_A$$

All 4 conditions are satisfied if: $K_B > \frac{L}{V} > K_A$

Often the optimal value for $\frac{L}{V}$ is given by: $\sqrt{K_A K_B}$

Component A:

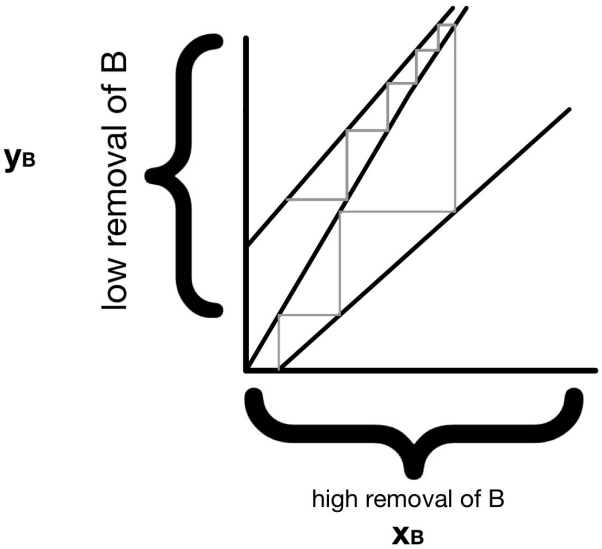


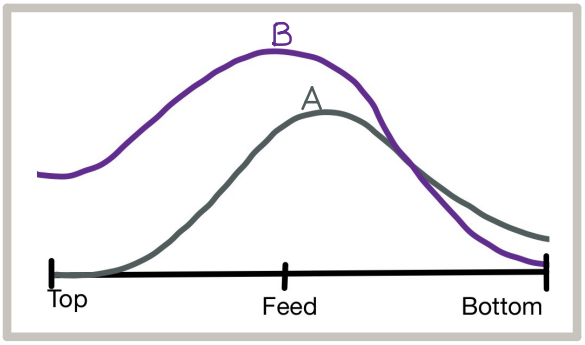


Material balance at feed point

$f_A + (x_{A,f+1})(L) = x' L$

Component B:

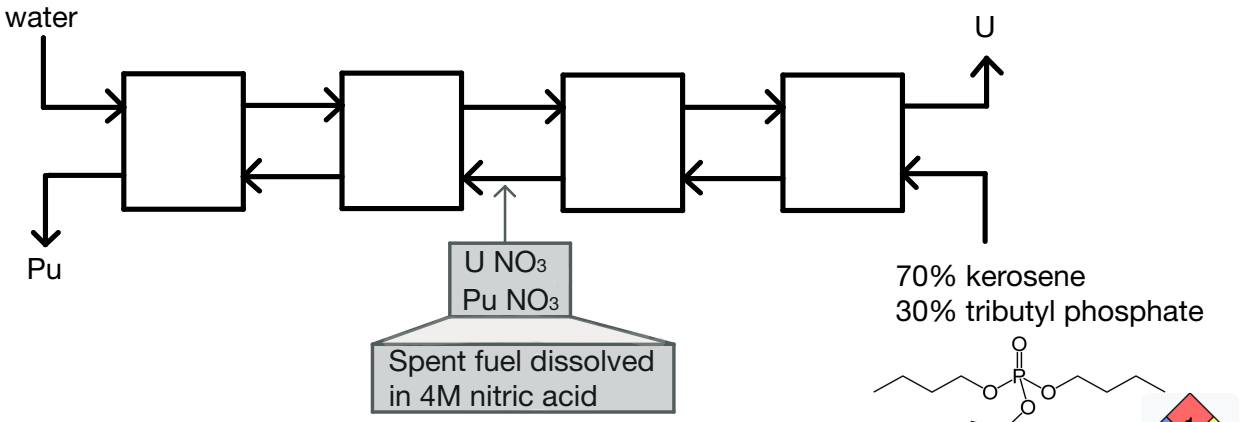


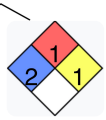


Staged extraction for fractionation of solutes

Examples:

PUREX Process-
Plutonium Uranium Extraction





Just for fun

Production of Streptomycin (an antibiotic)

Final step is the removal of Streptomycin B from the active form (Strep. A)

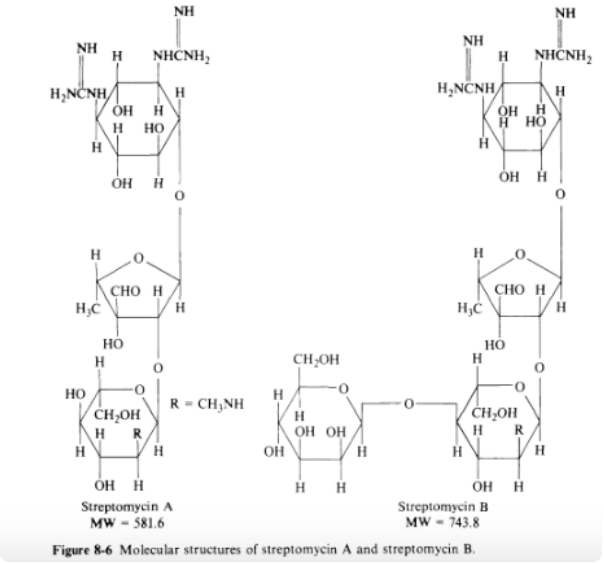
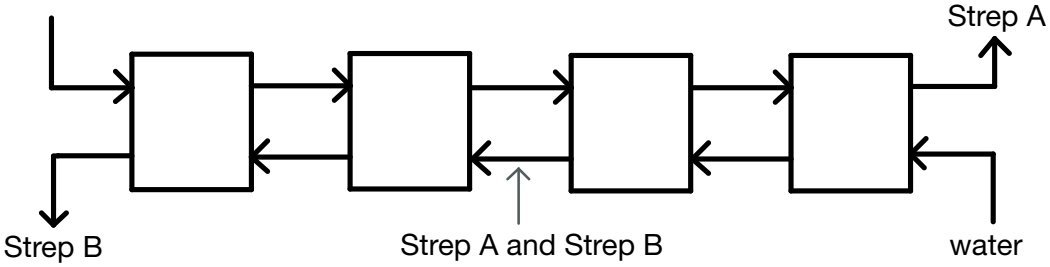


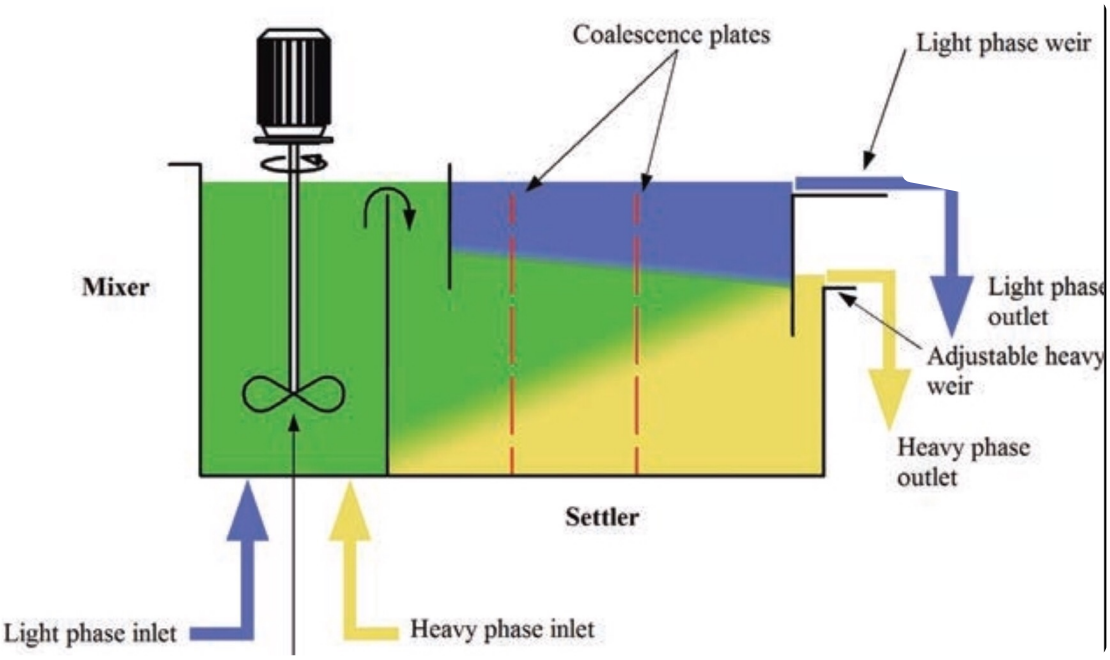
Figure 8-6 Molecular structures of streptomycin A and streptomycin B.

amyl acetate

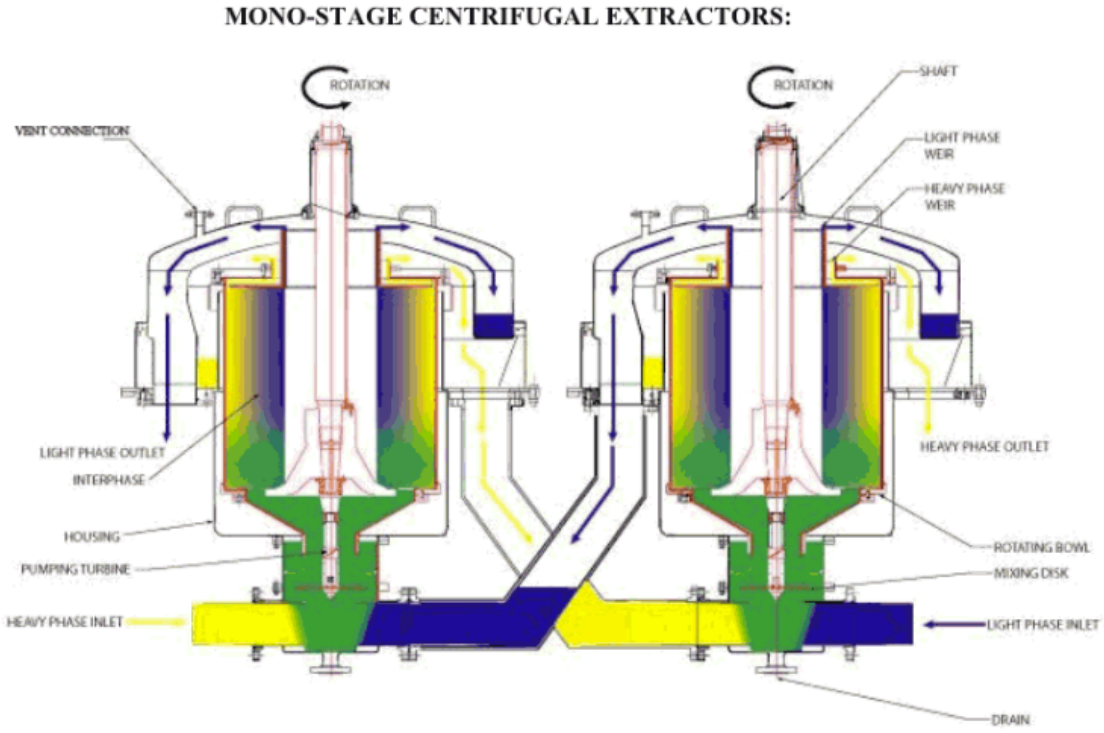


Extraction Equipment

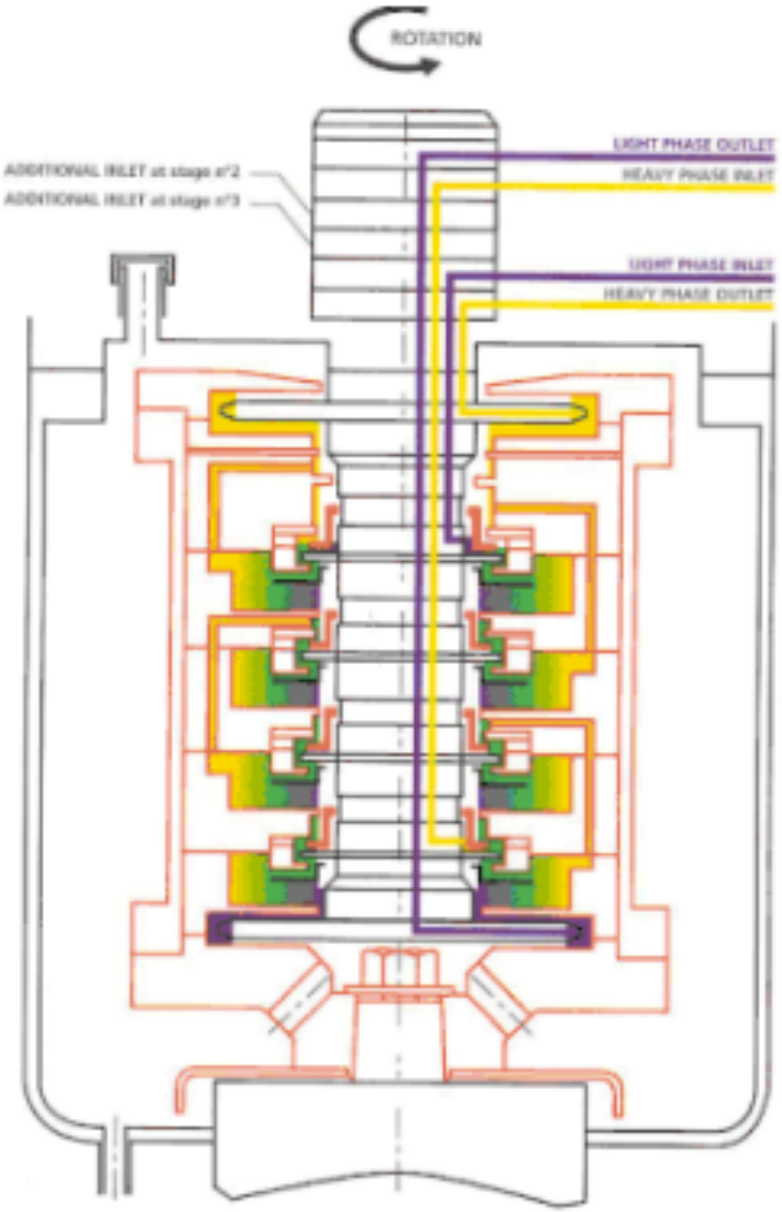
Mixed- Setter:



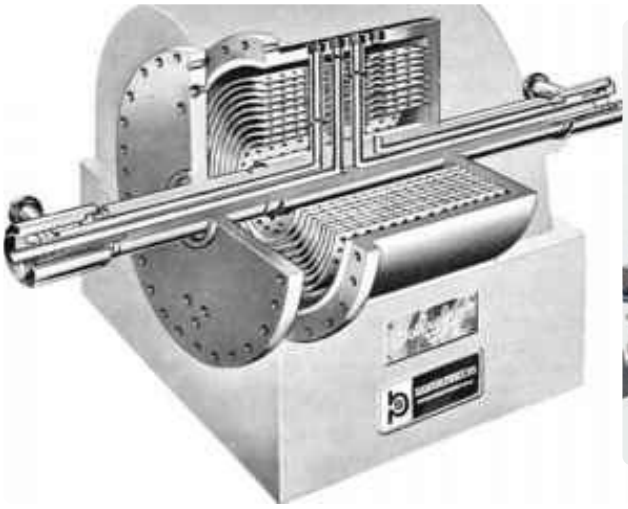
Centrifugal Extractor:

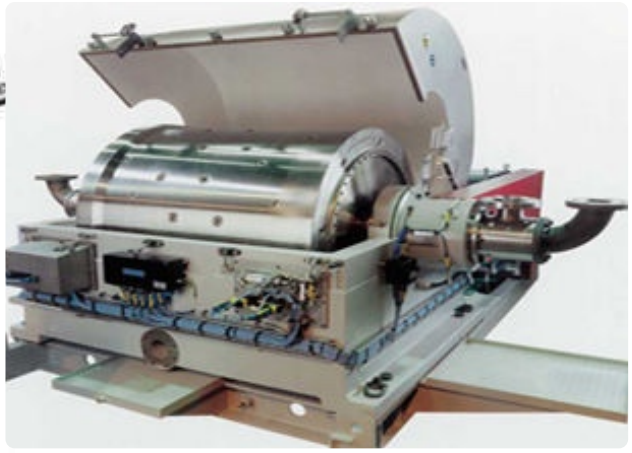


Cross section sketch of 4 stage centrifugal extractor



The Podbielniak extractor
Invented by Walter J. Podbielnick

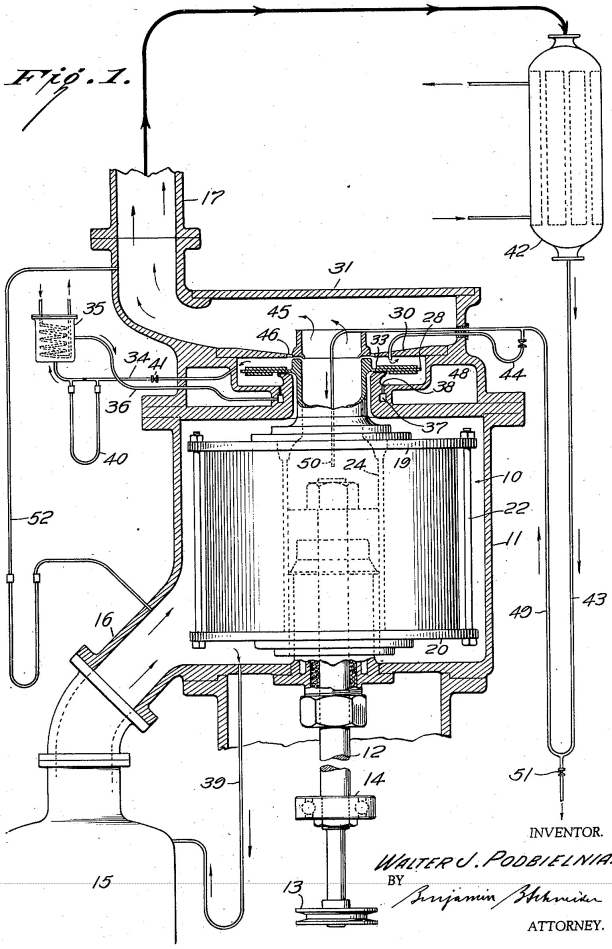




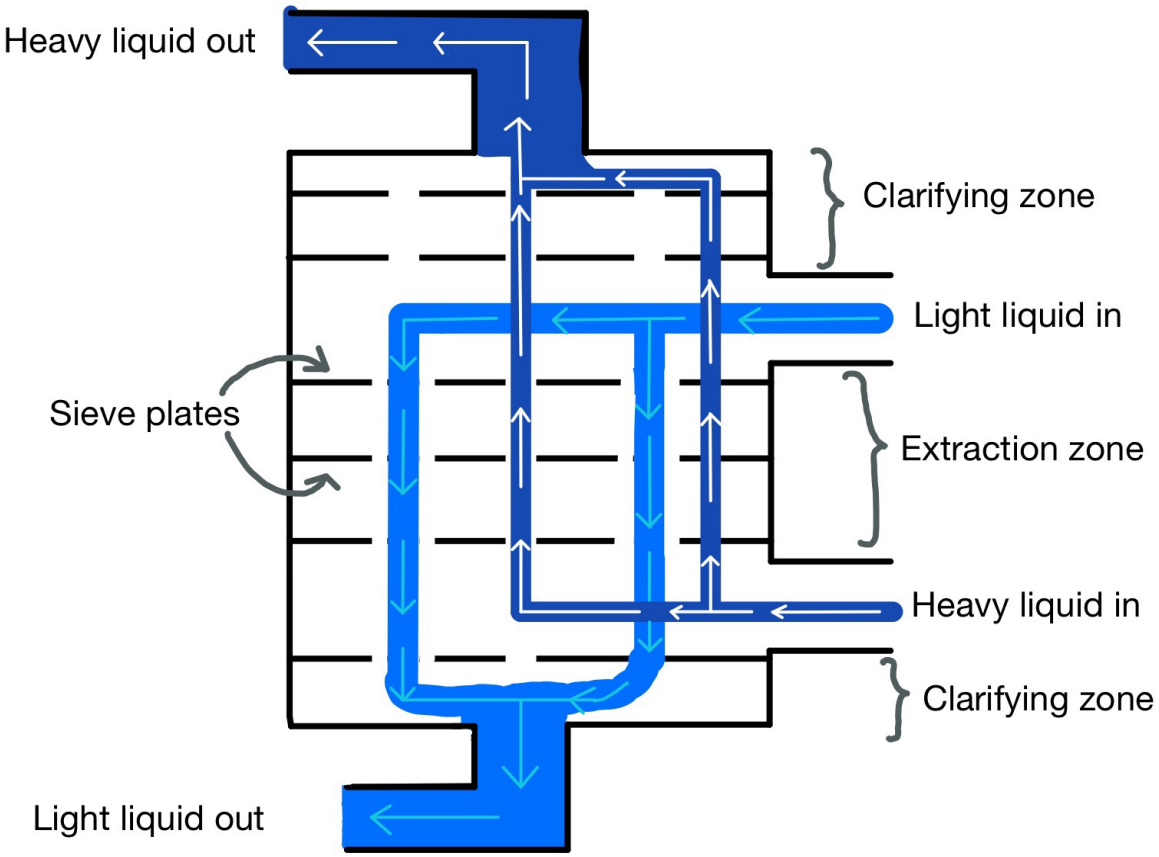
April 11, 1939. W. J. PODBIELNIAK 2,153,640

SEAL FOR CENTRIFUGAL FLUID TREATING APPARATUS

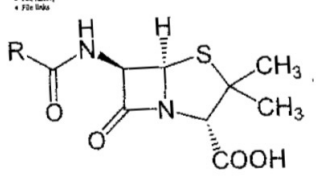
Filed June 25, 1936 2 Sheets-Sheet 1



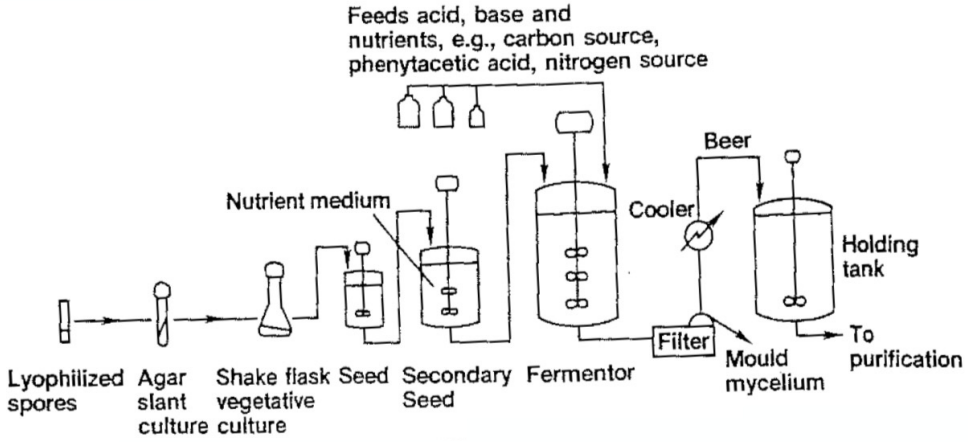
Operates like a sieve plate tower



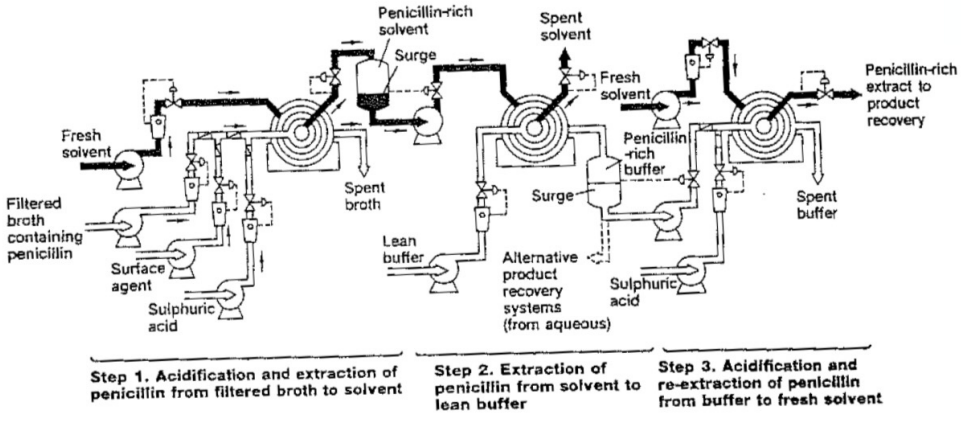
File:Penicillin core.svg



Penicillin



(a)



(b)

Figure 8.7. *(a) Penicillin fermentation flow sheet, illustrating the inoculum stages. (b) The recovery train for penicillin.*