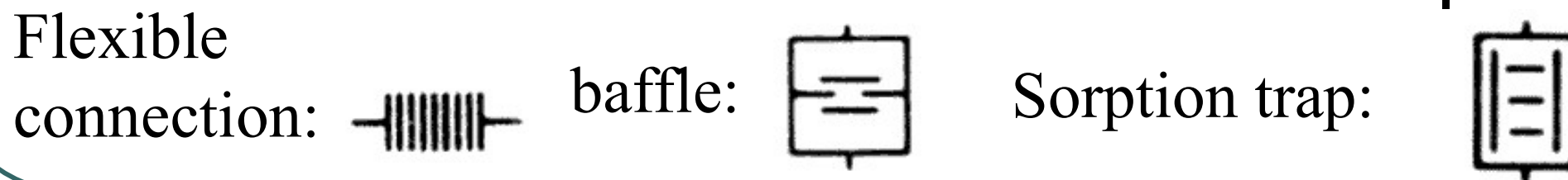
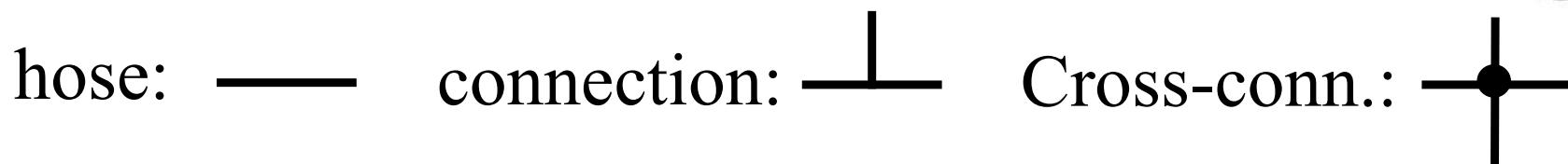
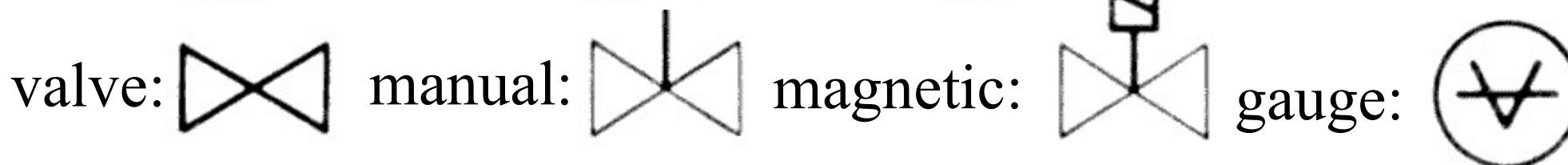
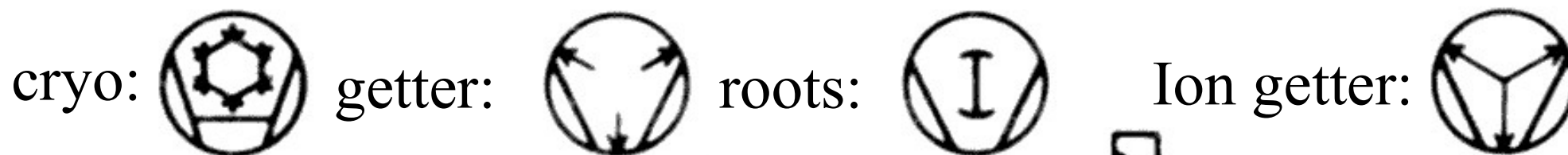


# Vacuum technology

## High vacuum systems

Csonka István  
Frigyes Dávid

# Schematics



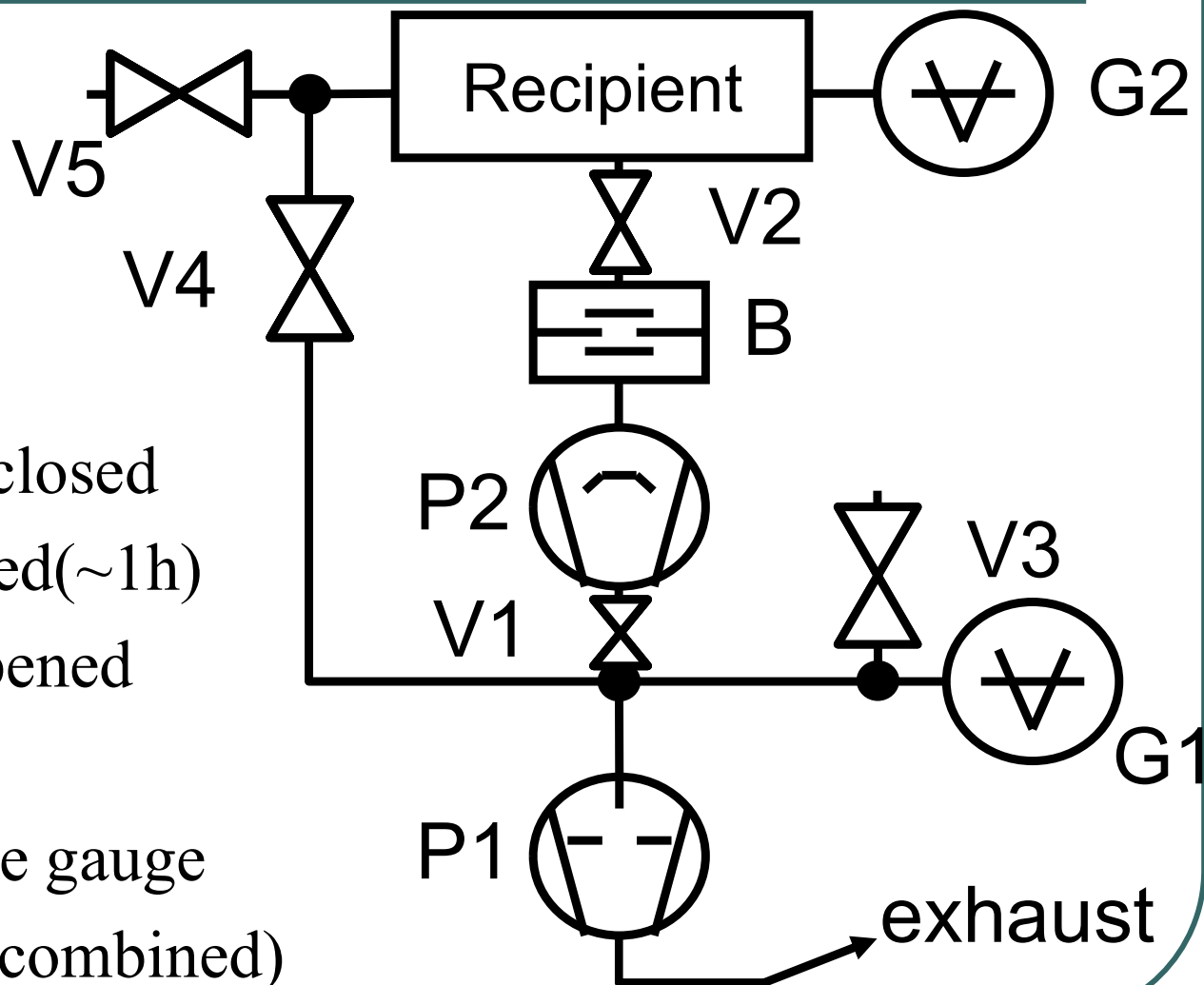
# Simple diffusion system

Switch on:

1. V3 closed
2. V1, V4 closed
3. P1 started
4. V4 opened (G1!) – closed
5. V1 opened, P2 started (~1h)
6. (rough again) V2 opened
7. (1/4 h) G2 opened

G1: Pirani / thermocouple gauge

G2: Ionization/Penning (combined)



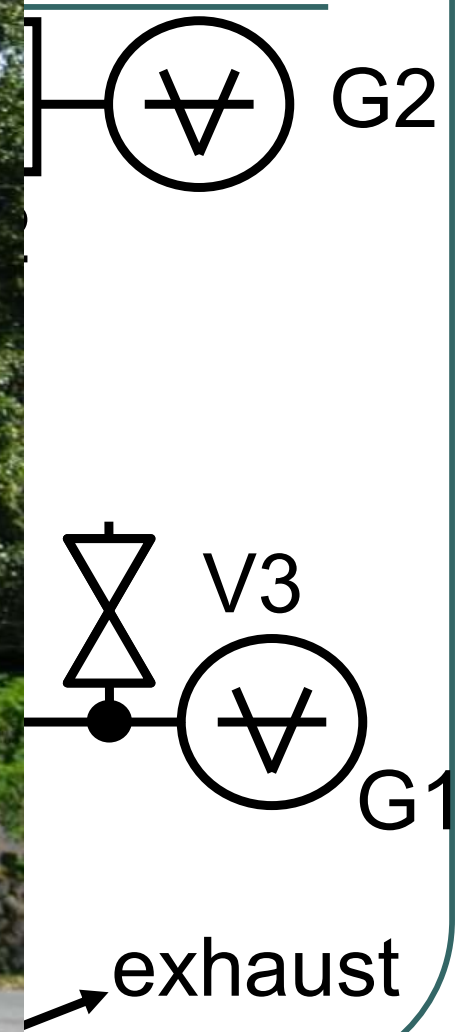
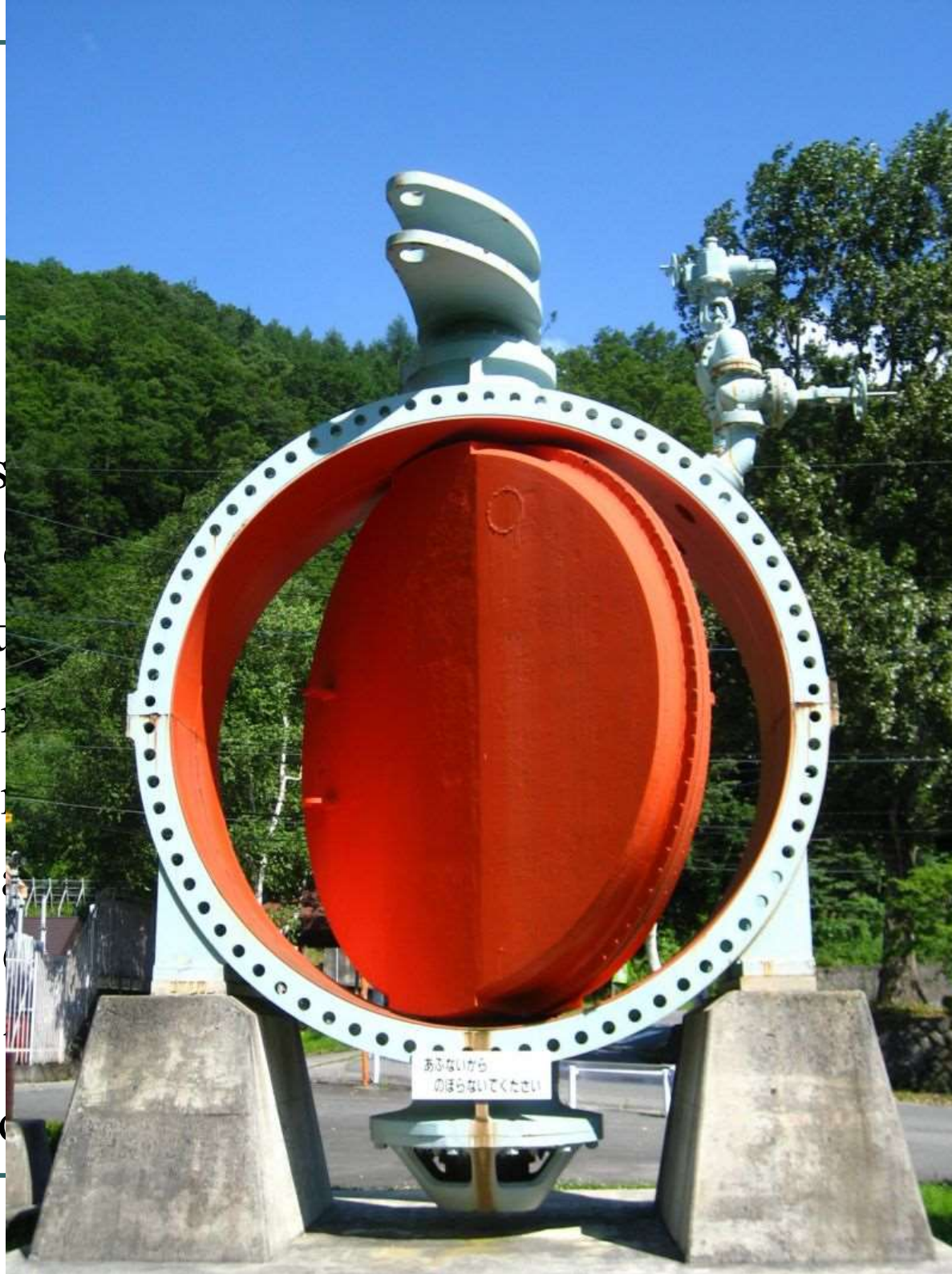
# Simpl

## Switch on:

1. V3 closed
2. V1, V4 closed
3. P1 start
4. V4 open
5. V1 open
6. (rough a
7. (1/4 h)

G1: Pirani /

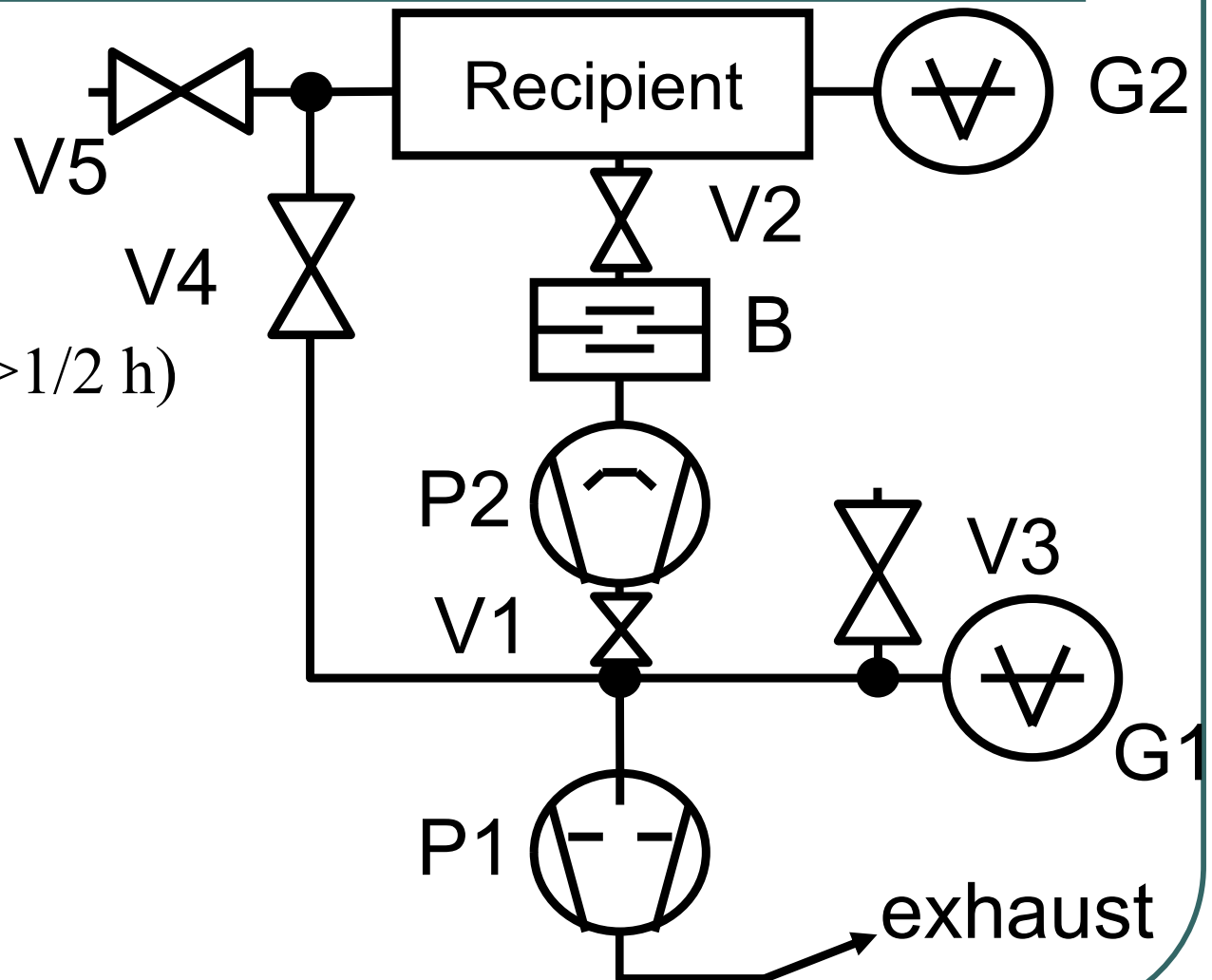
G2: Ionizati



# Diffusion system (folyt. 1)

## Venting:

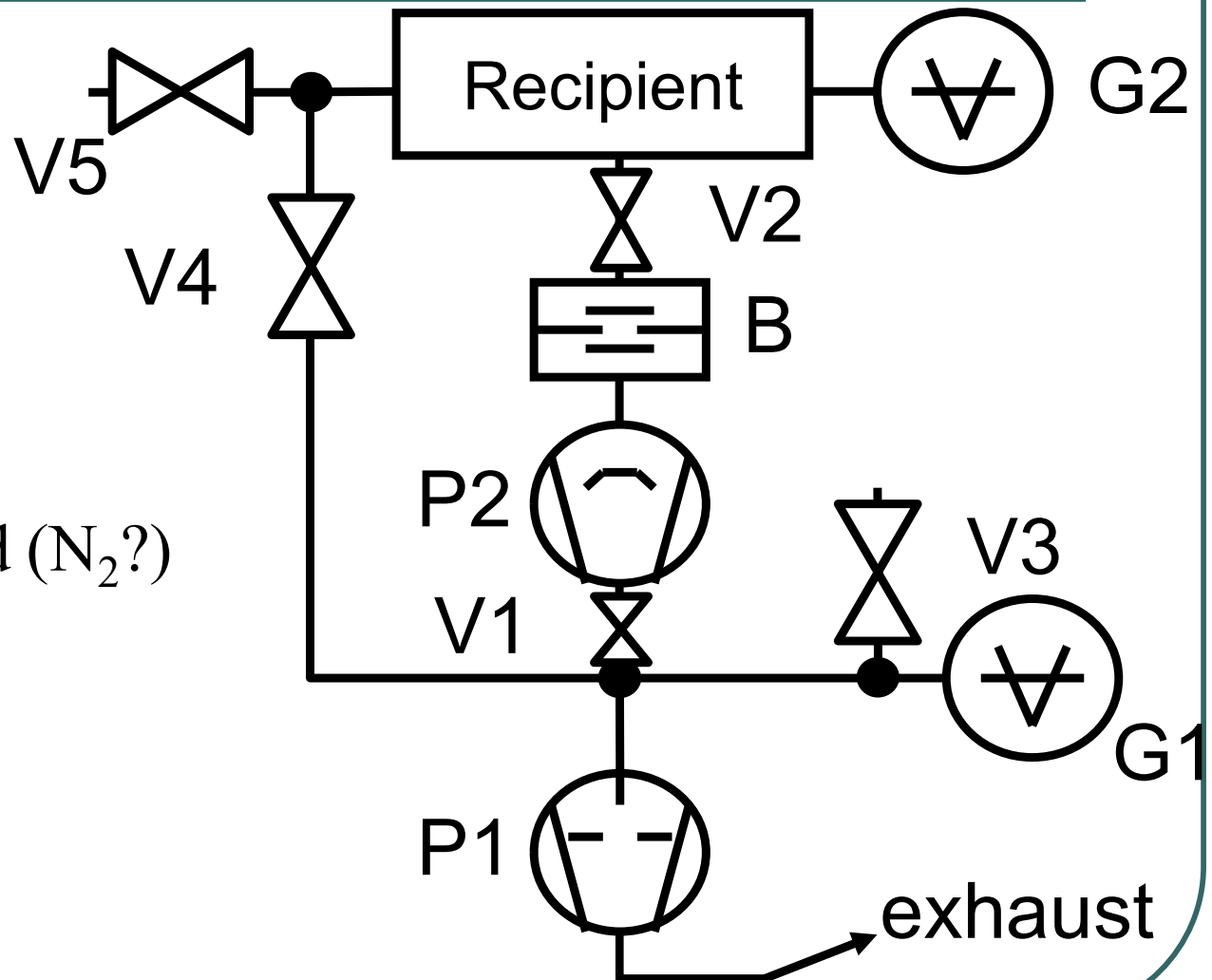
1. G2 off
2. V2 closed
3. P2 off, cool down ( $>1/2$  h)
4. V1 closed
5. P1 off
6. V3 opened (...)



# Diffusion system (folyt. 2)

Partial venting  
(e.g. ion source  
replacement):

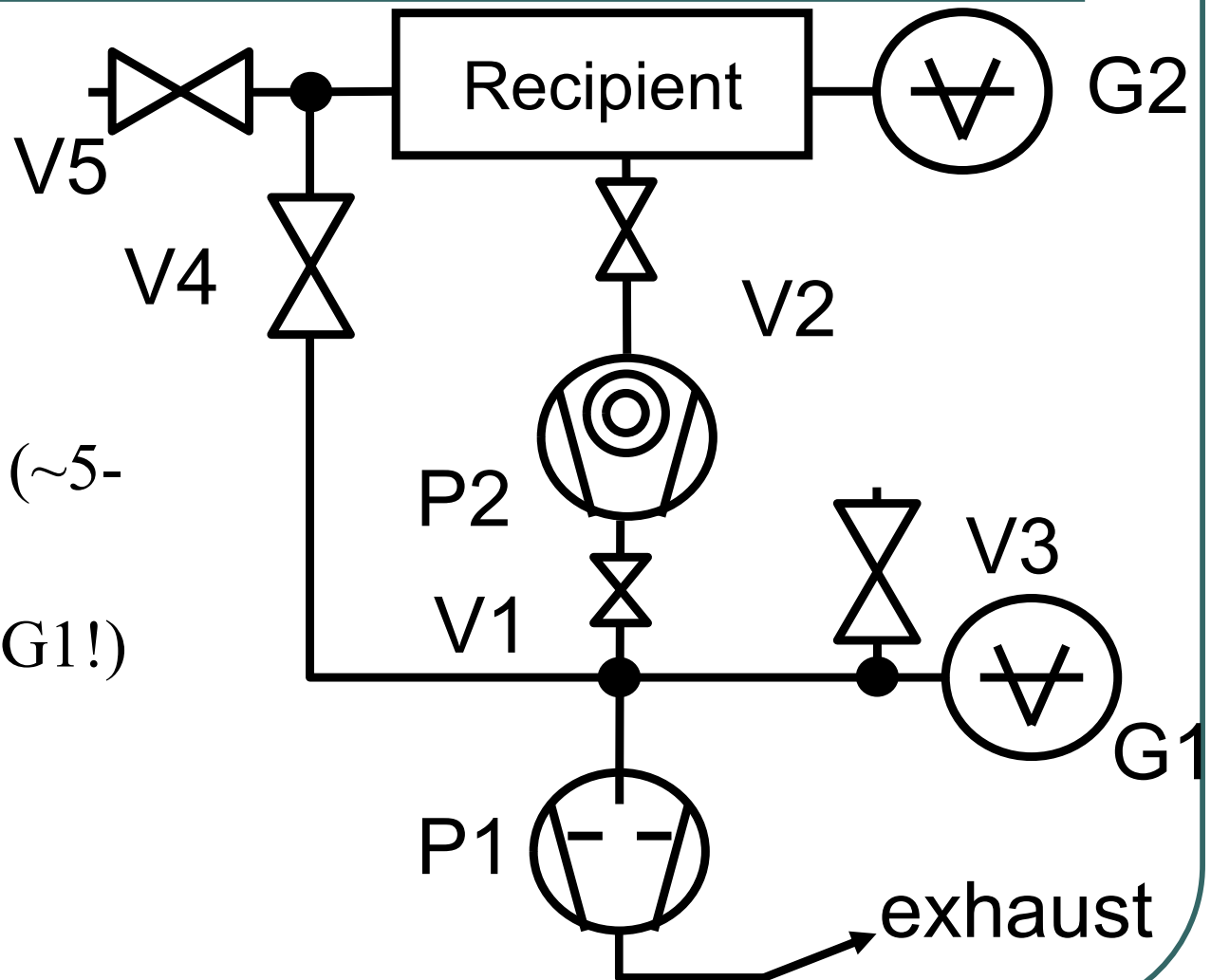
1. G2 off
2. V2 closed
3. V5 carefully opened ( $N_2$ ?)  
(G1 is checked!)



# Turbo molecular pump system

## Switch on:

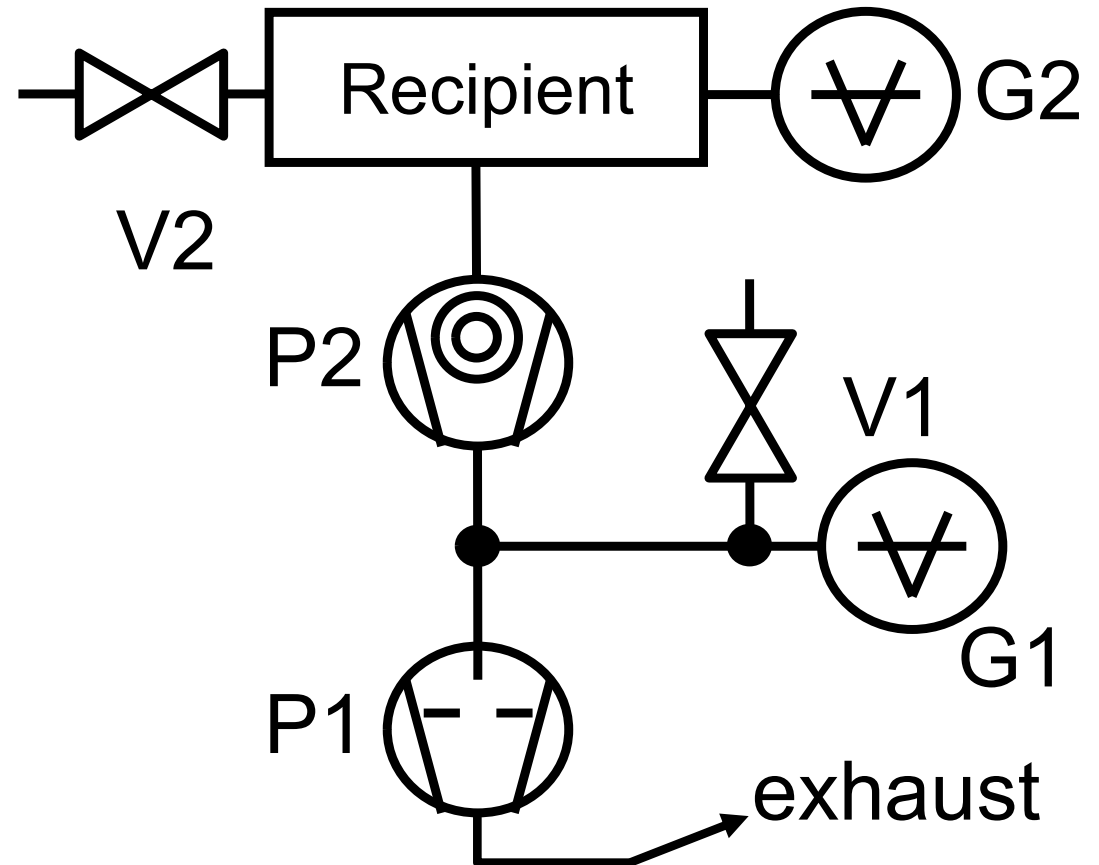
1. V3 closed
2. V1, V4 closed
3. P1 start
4. V1 opened, P2 start (~5-10')
5. V1 close, V4 open (G1!)
6. V4 close, V1 open
7. V2 open
8. (1/4 h) G2 opened



# Simpler turbo system

## Switch on:

1. V1, V2 closed
2. P1 start
3. P2 start
4. G2 on



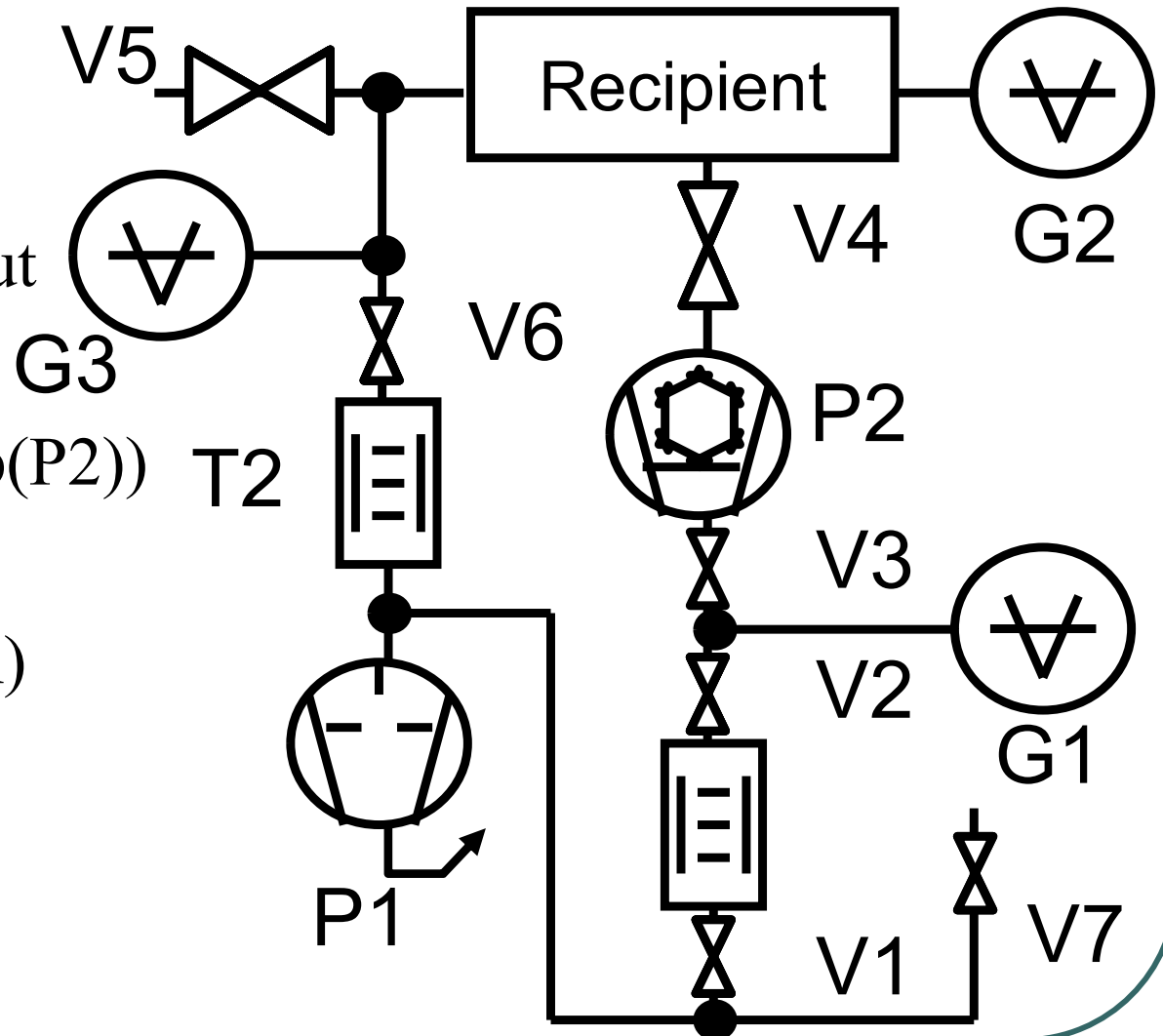


# Cryo system

## Switch on

(all valves closed):

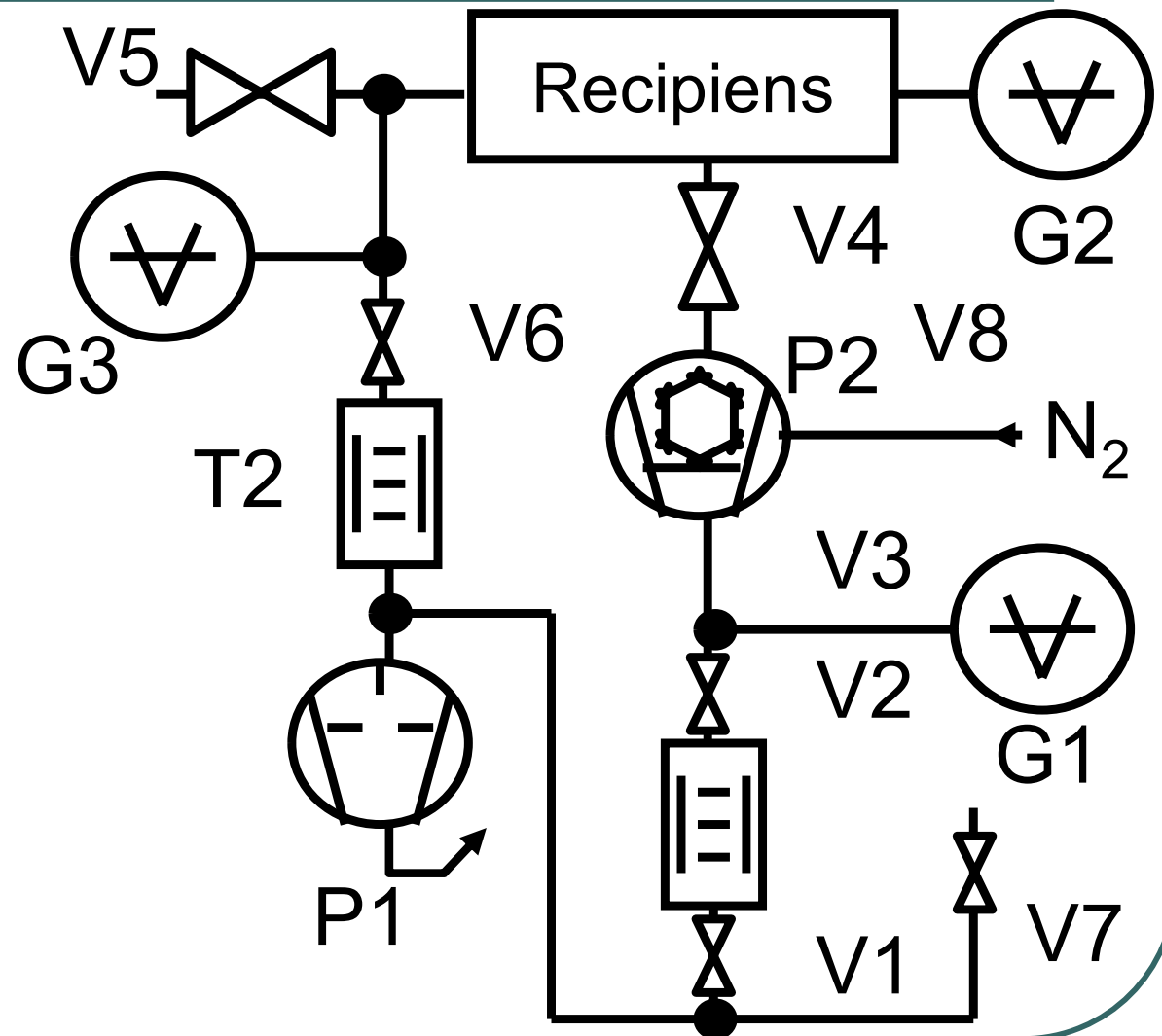
1. P1 on, V1 open; bake out
2. V2 opened (G1!)
3. V2 closed, V3 opened (p(P2))
4. V1, V2 closed
5. Cryo start (wait for 20K)
6. V6 opened (G3); closed
7. V4 opened
8. G2 on



# Cryo system

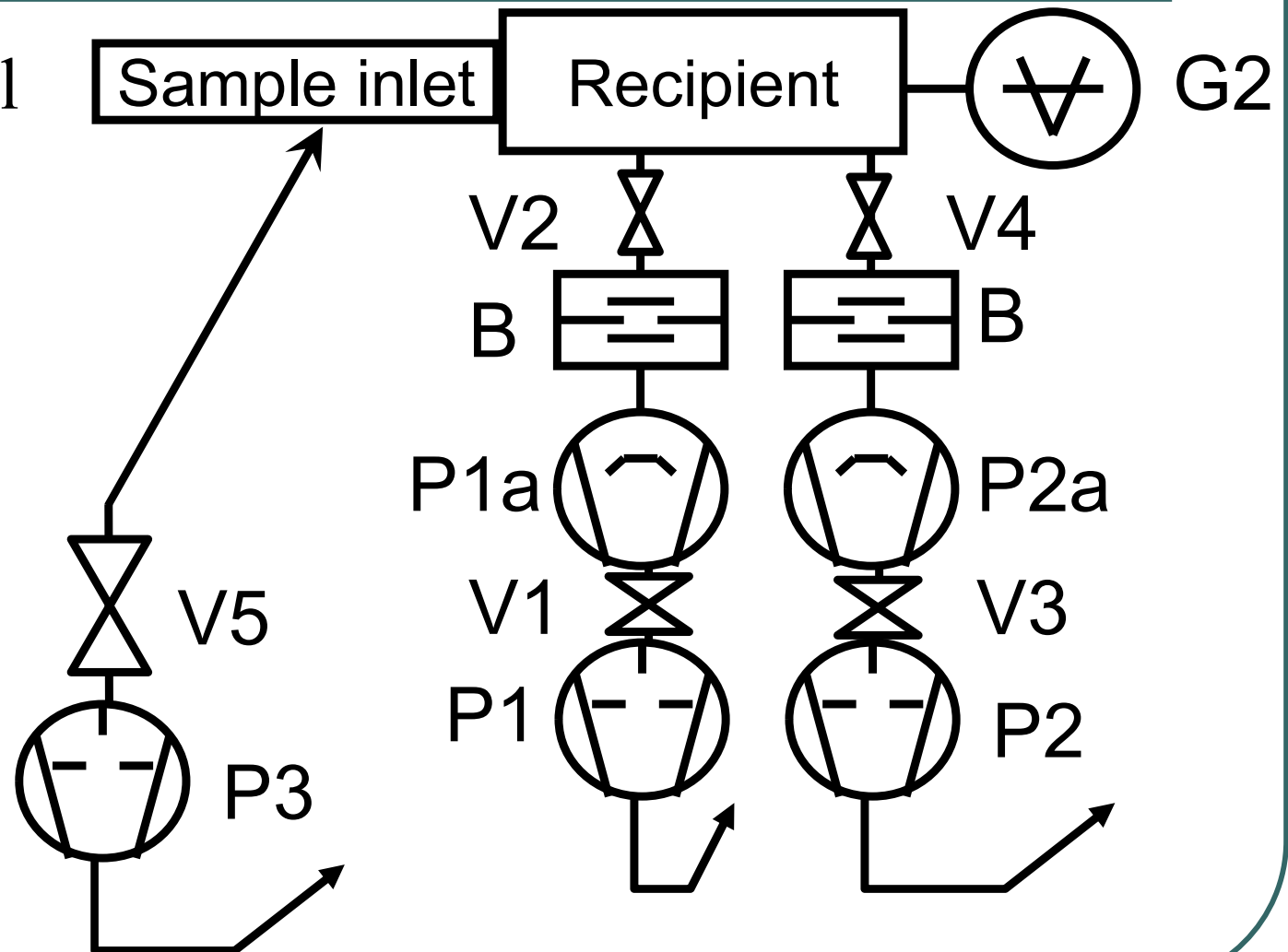
## Regeneration:

1. G2 off, V4 closed
2. P2 (compressor) off
3. V3 closed, V8 open
4. Trap regeneration
5.  $P2 \rightarrow 10^{-2}$
6. Compressor start

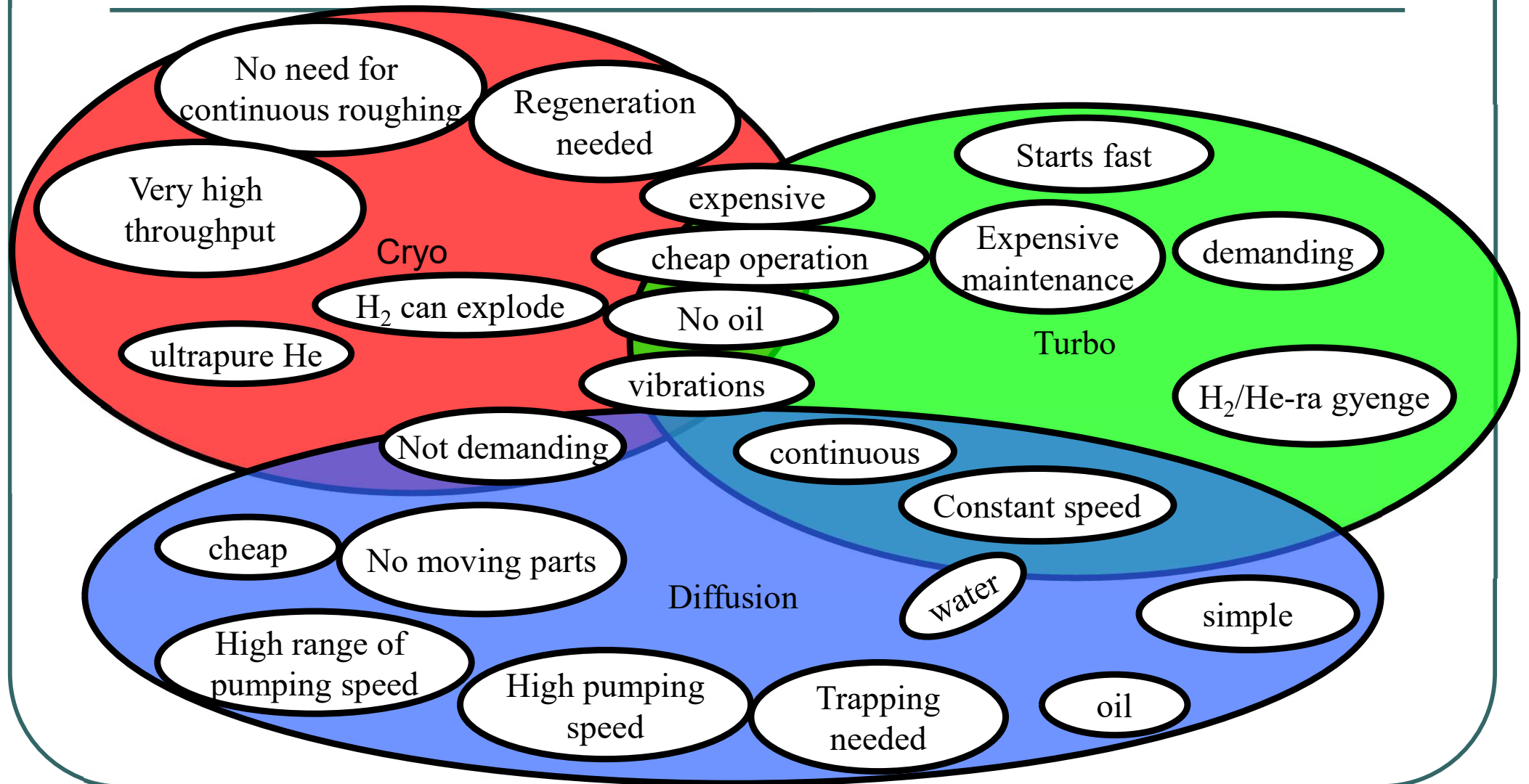


# Multi pump systems

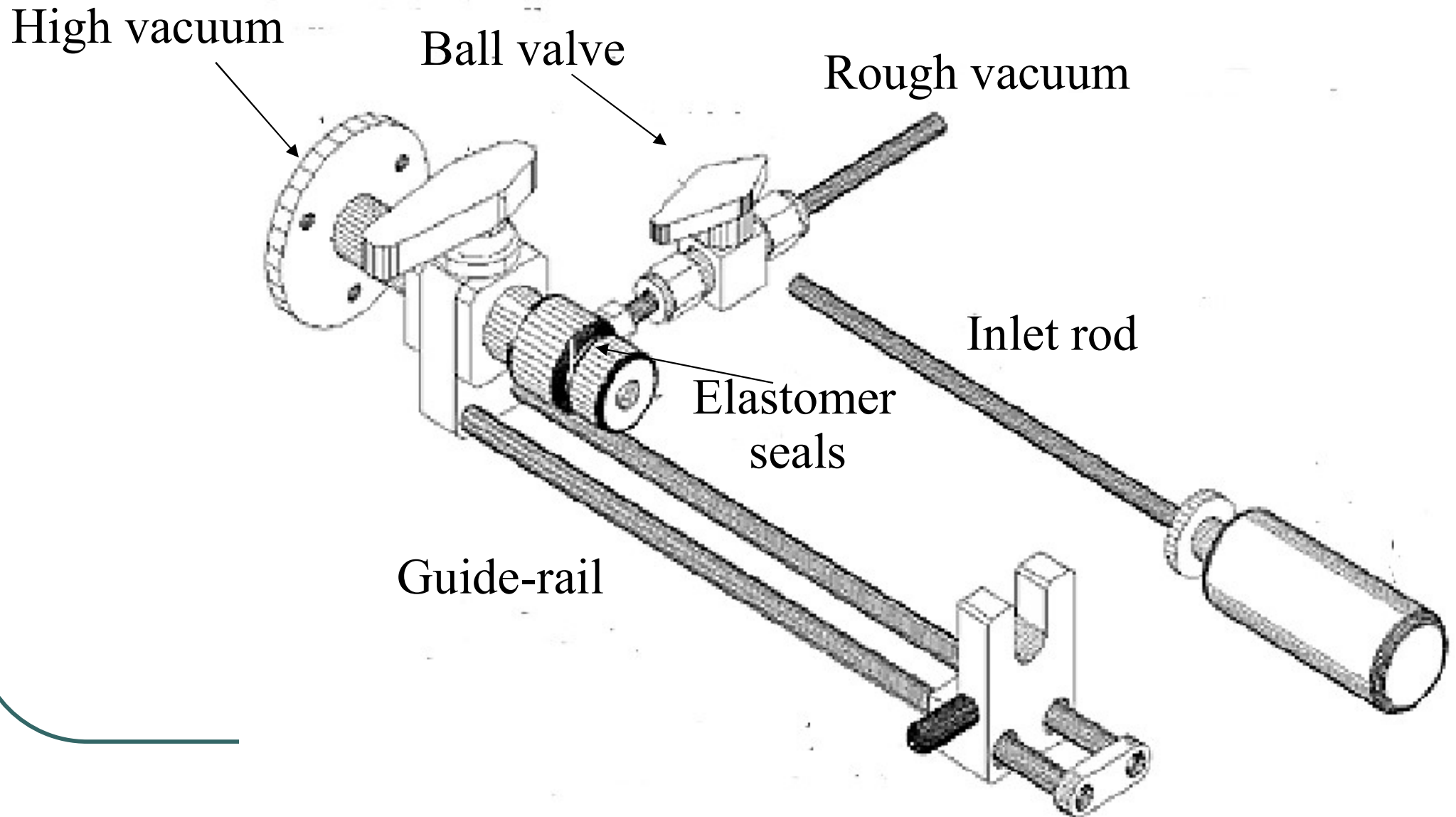
- This is the typical arrangement



# Comparison of pumps



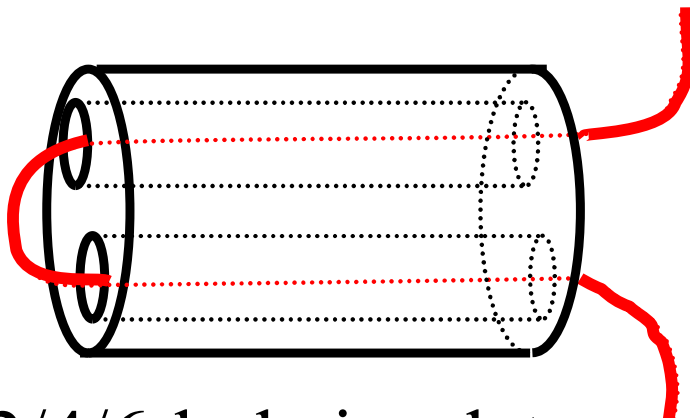
# Sample inlet



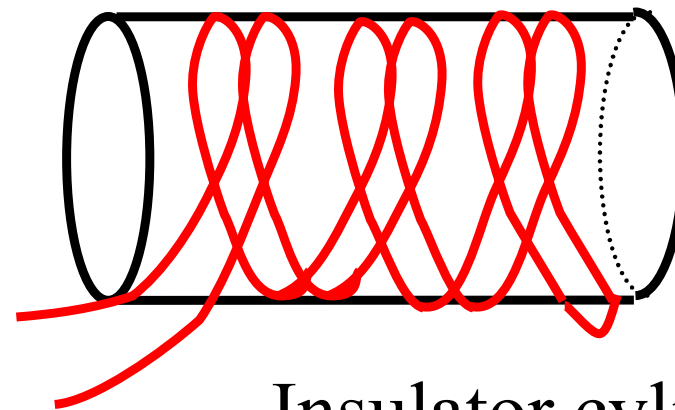
# Heating

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- filament: W, Re, kanthal (FeCrAl – least oxygen sensitive)
- In order to decrease magnetic field: special arrangement:



2/4/6-hole insulator  
(ceramics) block



Insulator cylinder

## Heating 2.

---

- Close contact between the heated body and the heating element ( $\sim$  heat conductance of gases)
- The heated parts can be coated by a reflective metal foil in order to decrease heat radiation
- High temperature: electron bombardment: the heated metal part is on high positive potential. Electrons from the filament heat the metal.

# Particle beams

---

- Electron beam

- Electron microscope
- Auger elektron spectroscopy (AES)
- Electron impact MS (EIMS)
- Low Energy Electron Diffraction (LEED)

- Photon beam

- Elektron spectroscopy
- Laser spectroscopy

- Ion beam

- Secondary Ion Mass Spectrometry (SIMS)

- Atom beam

- Fast Atom Bombardment (FAB)
- Atomic „cleaning” of surfaces

- Molecular beam

- High resolution spectroscopy

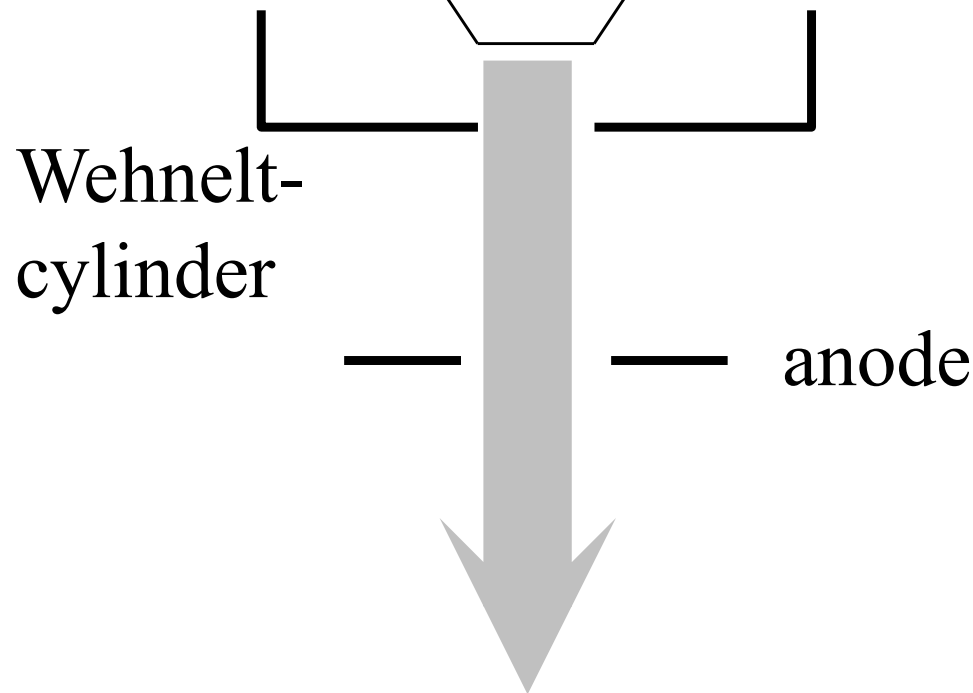


# Electron gun 1.

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- thermionic

cathode



- Cathode: W ( $\Phi=4,5\text{eV}$ )  
vagy  $\text{LaB}_6$  ( $\Phi=3\text{eV}$ )

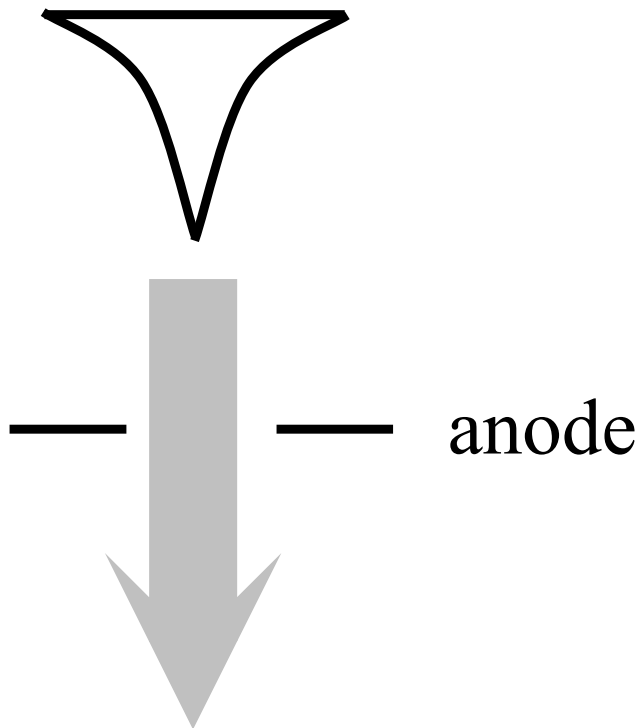
$\Phi$ : work function

- Temperatures above 1200K
- Thermal emission

## Electron gun 2.

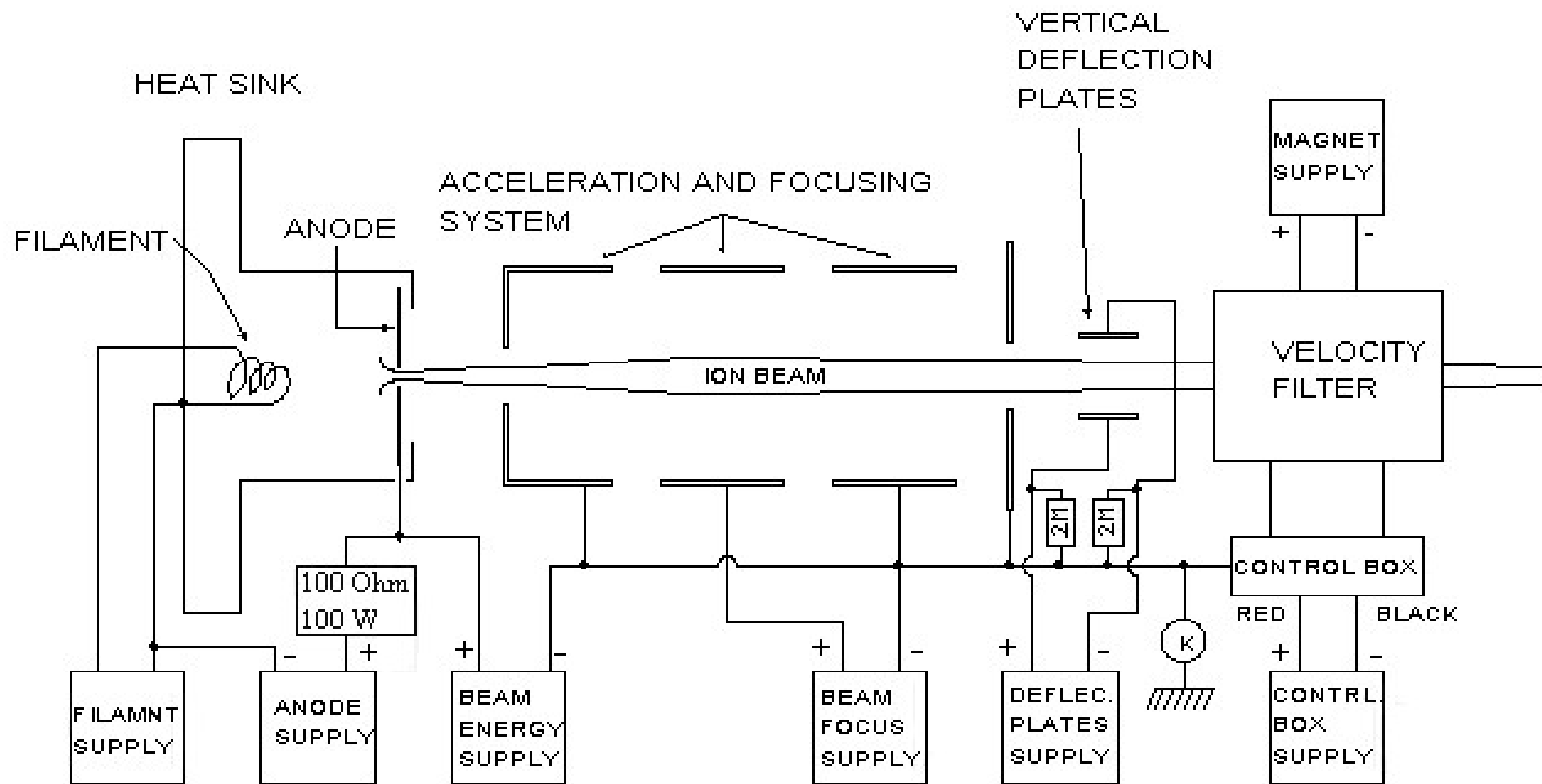
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- Field emission



- No thermal emission
- Point effect, high voltage, high field strength
- UHV

# Ion gun



WITHOUT DECELERATOR Normal operation is to ground point K.

# Atom gun

