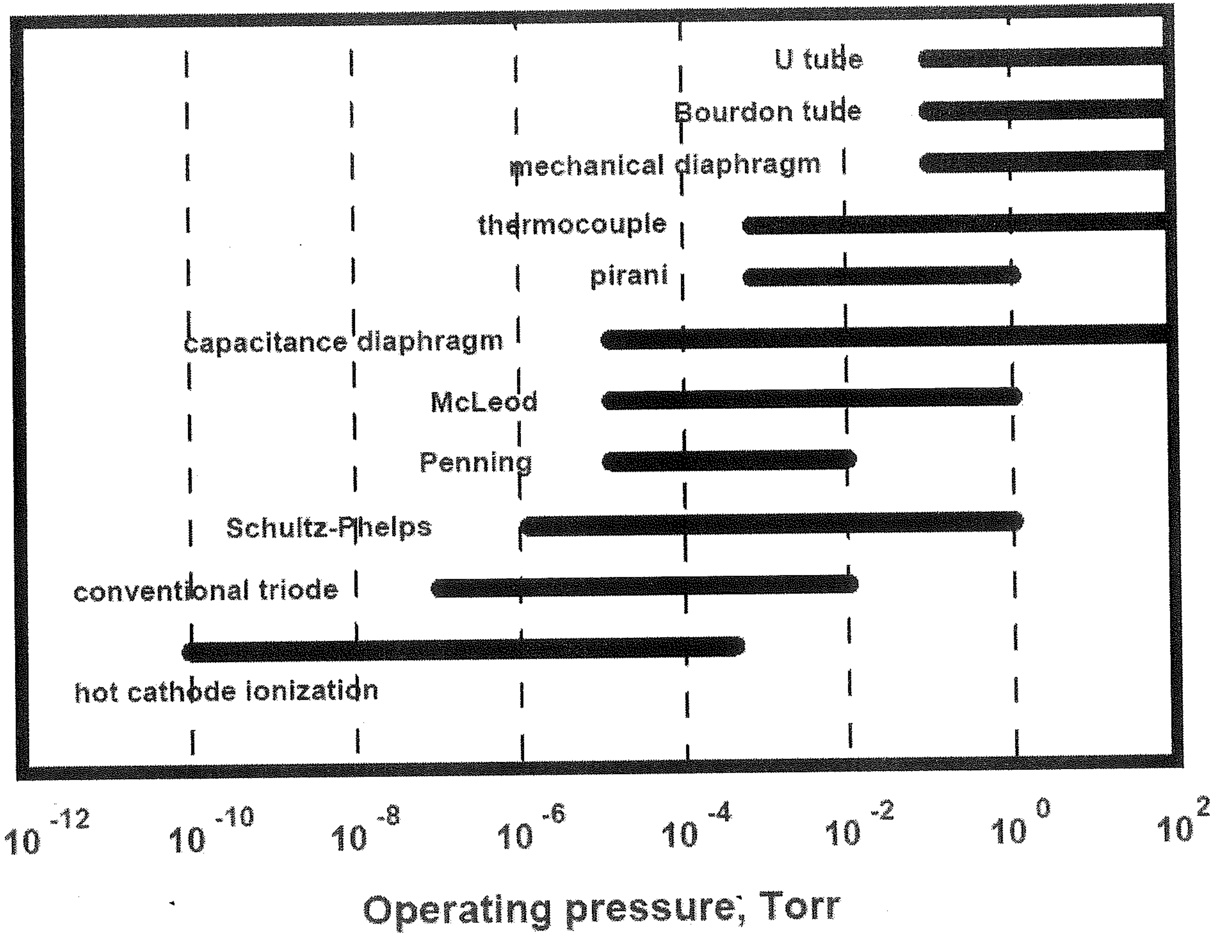
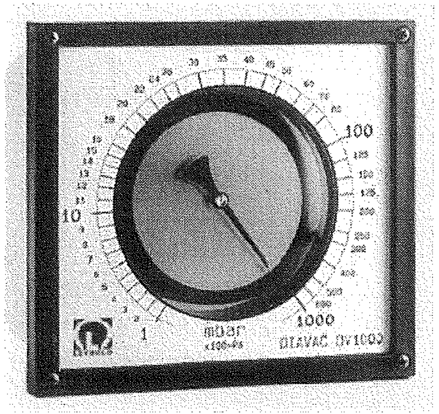
# MANÔMETROS DE VÁCUO E MEDIDORES DE FLUXO DE GÁS

# Diversos tipos de manômetros de vácuo

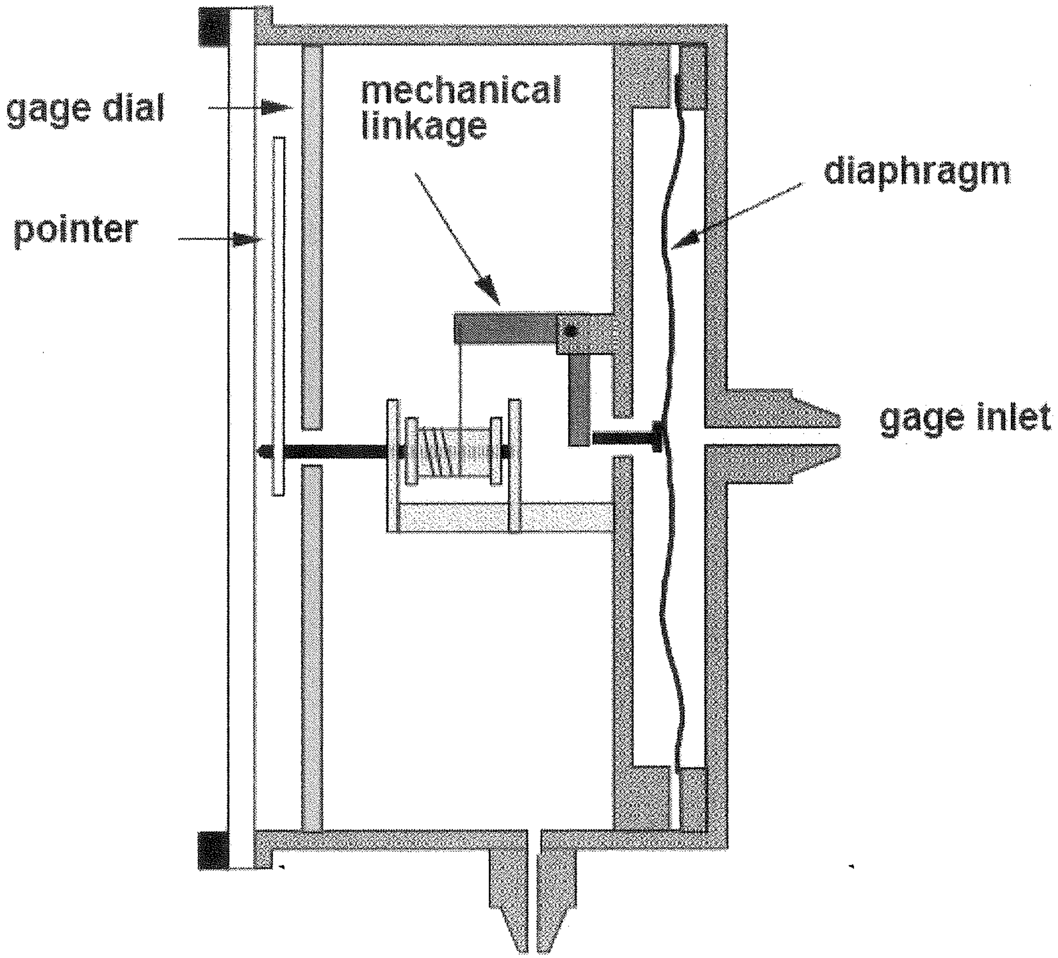


# Classificação dos manômetros segundo seu princípio de operação

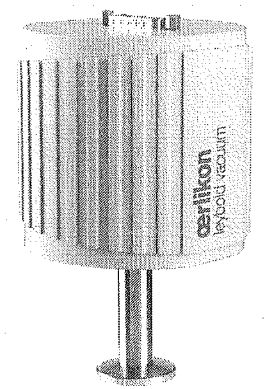
| | | |
|---|---|---|
| **Force Measuring Gauges:**<br>U-Tube manometer<br>McLeod gauge<br>Bourdon tube gauges<br>Capacitance manometers | | **Momentum Transfer Gauges:**<br>Spinning rotor gauge |
| **Thermal Conductivity Gauges:**<br>Thermocouple gauge<br>Pirani gauge | | **Gas Ionization Gauges:**<br>Hot cathode ion gauge<br>Cold cathode ion gauge |

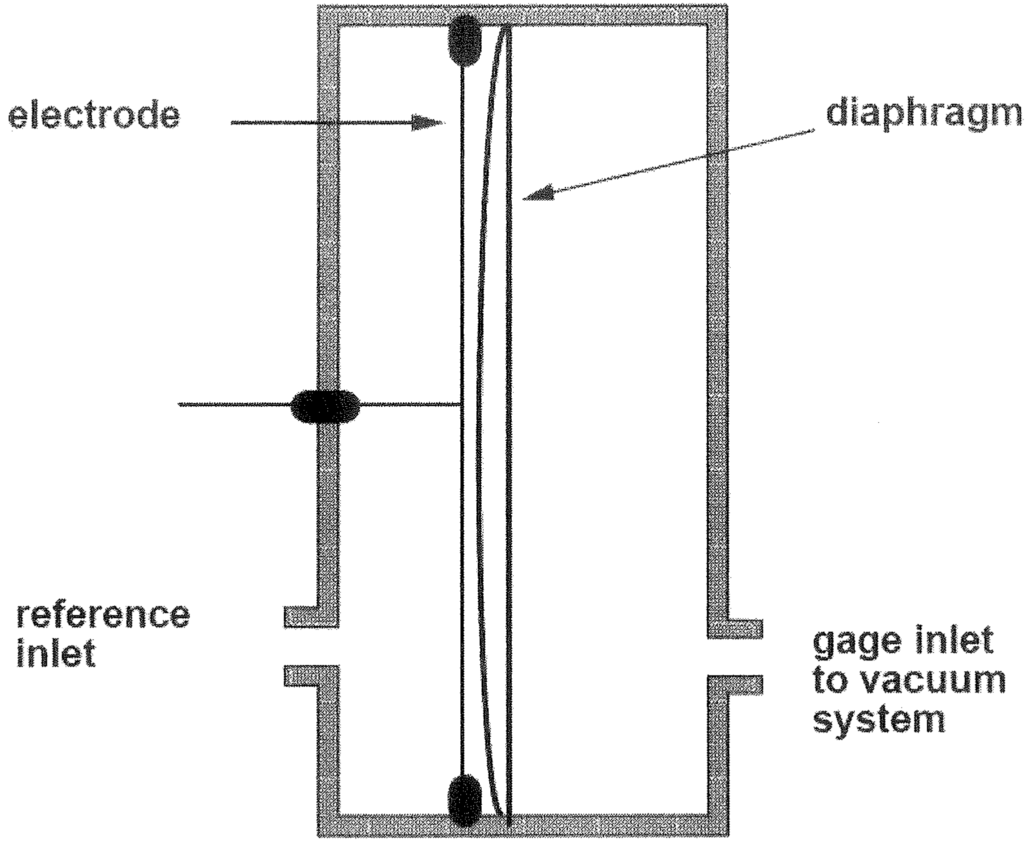


# Mechanical Diaphragm Gauge

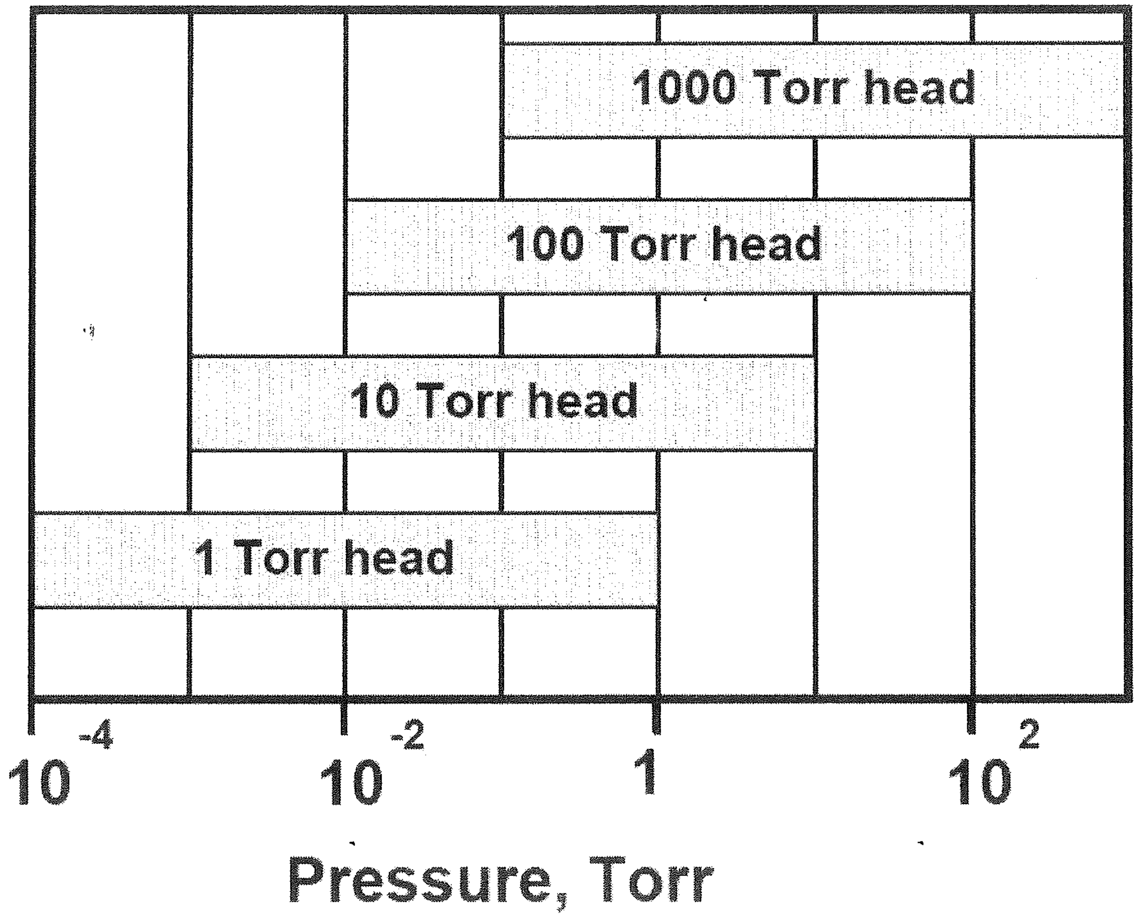


# Capacitance Diaphragm Gauge

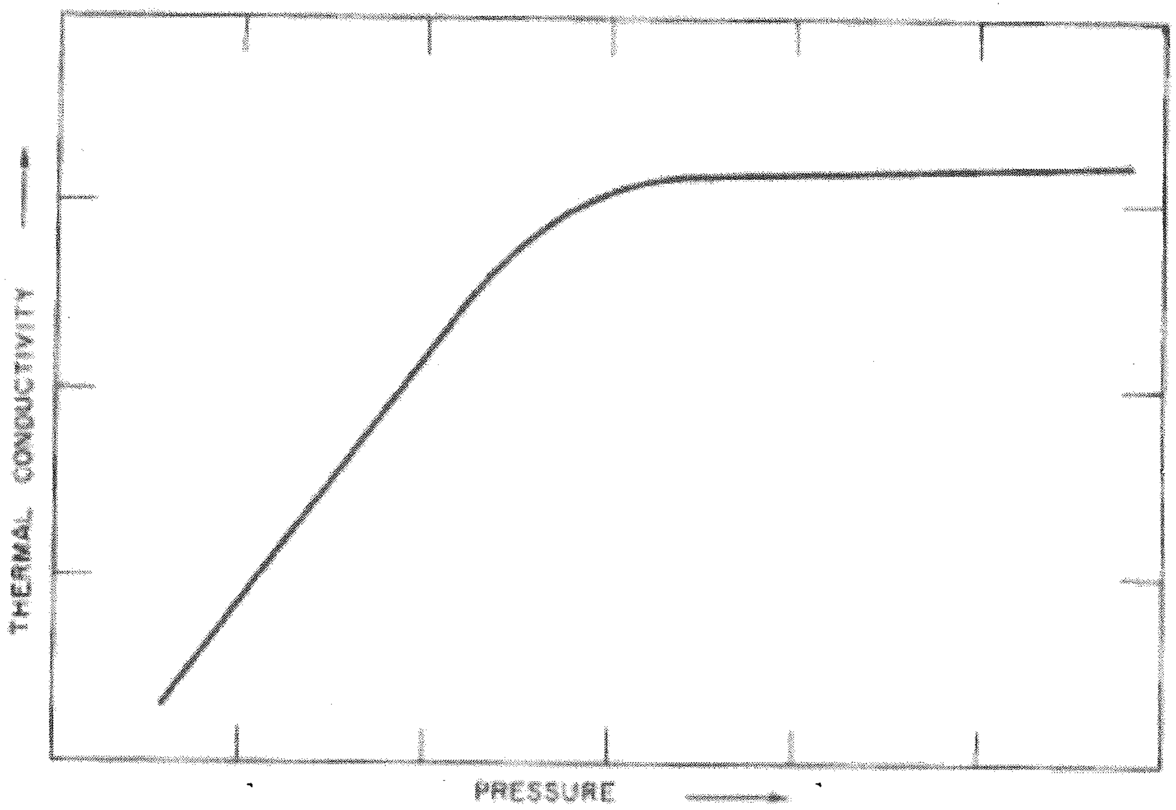


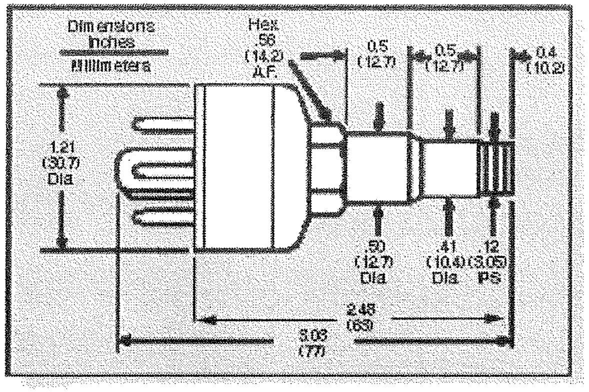
Intervalos de pressão de operação para manômetros de capacitância

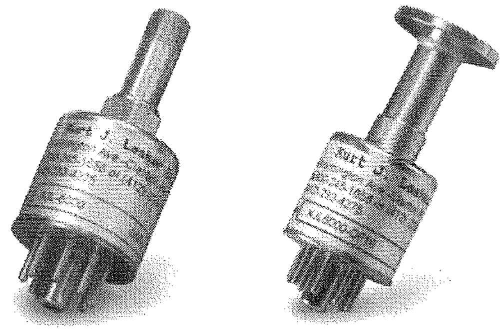


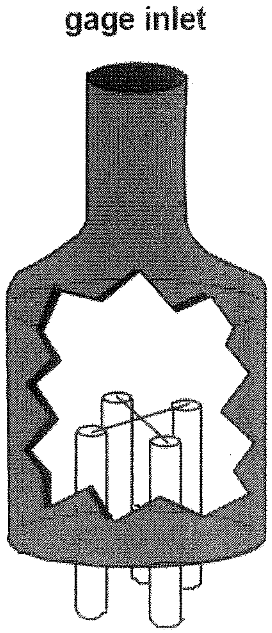
# FORMA GERAL DA CURVA DE CONDUTIVIDADE TÉRMICA DE UM GÁS VS PRESSÃO

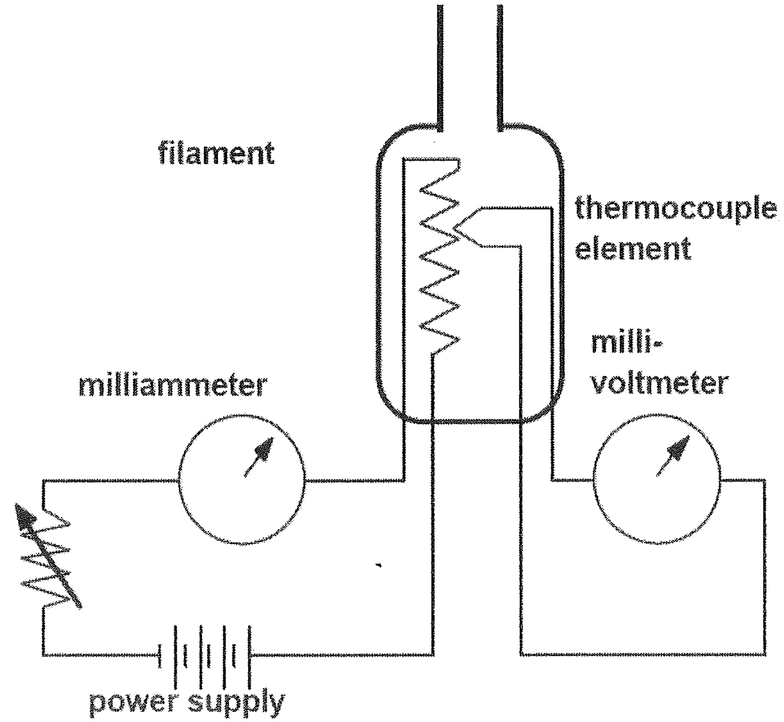


# MANÔMETRO DE TERMOPAR

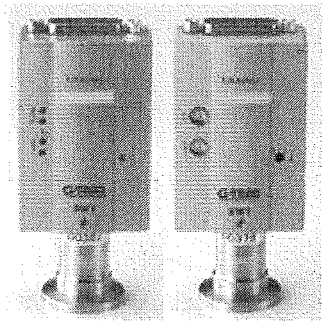


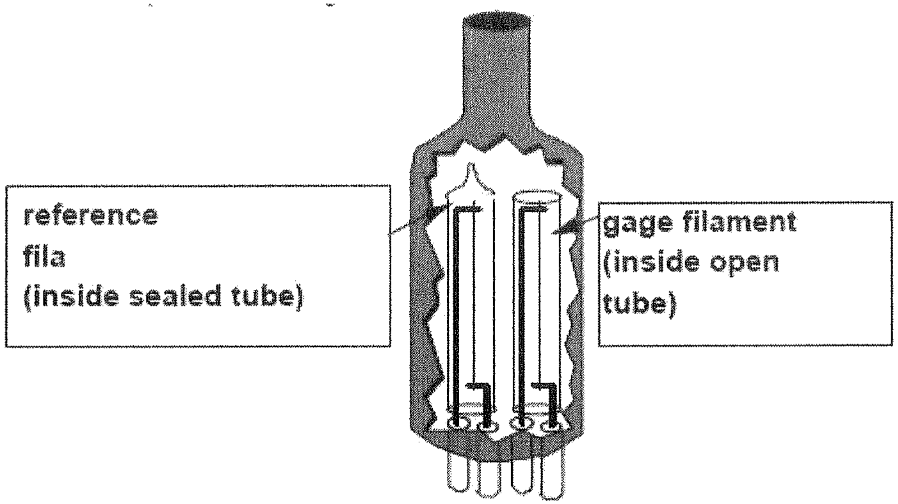



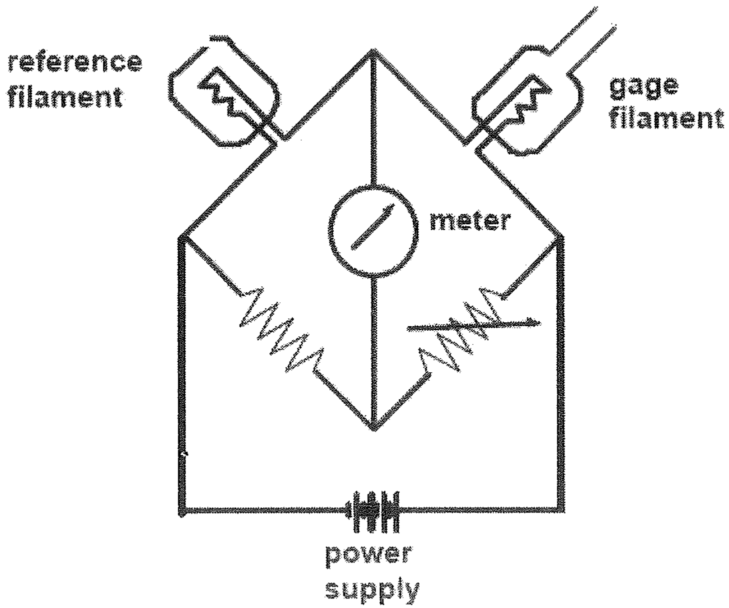


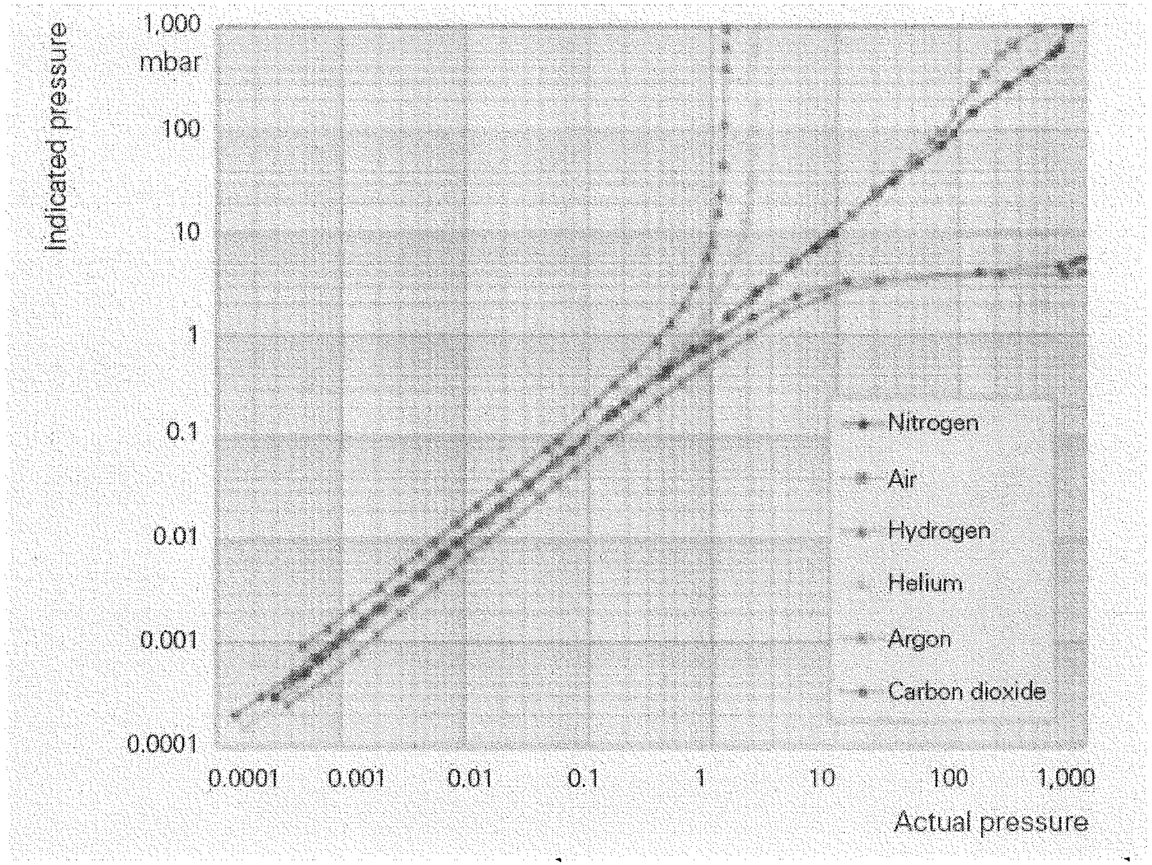
# MANÔMETRO PIRANI





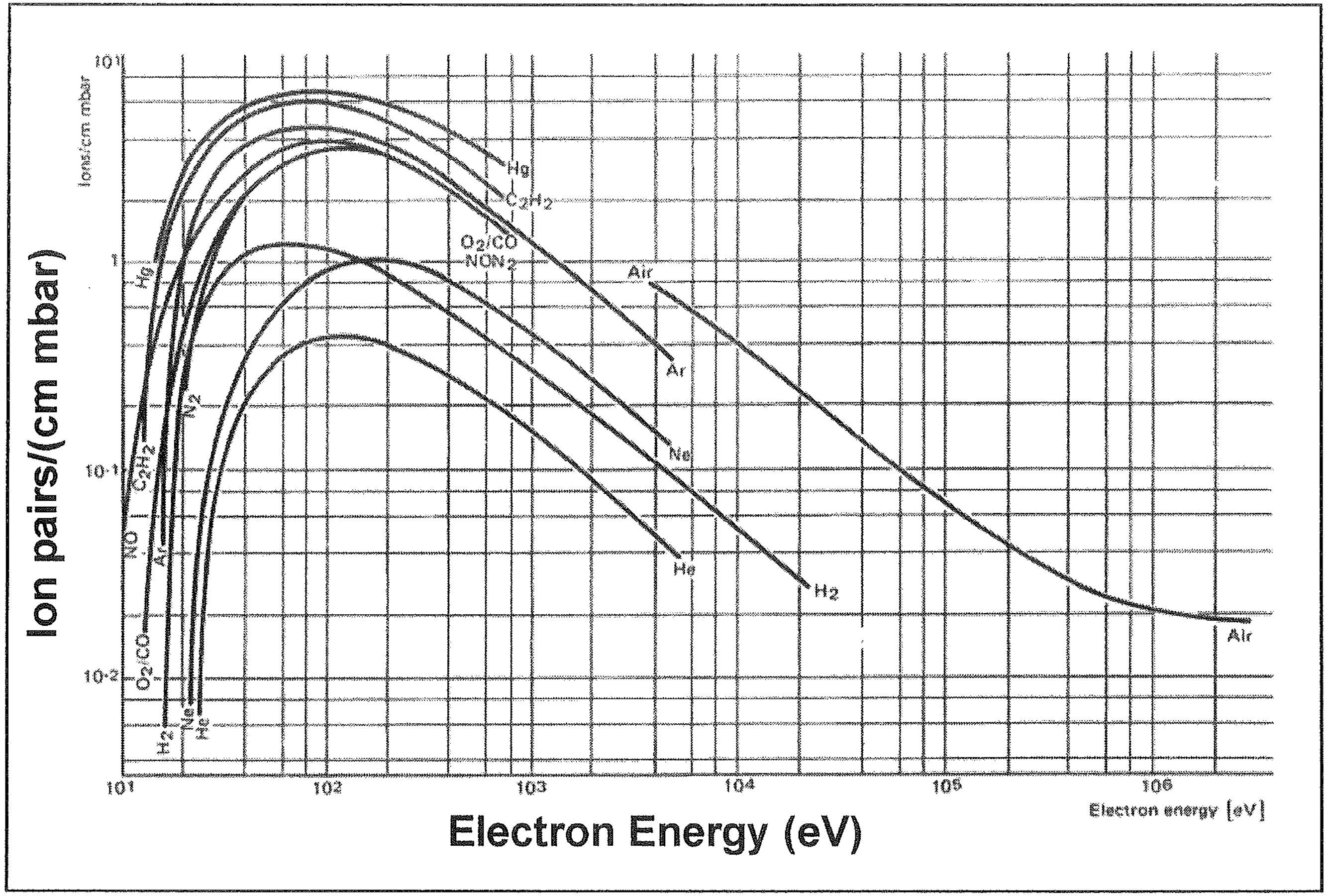



# Curva de Calibração para Medidores Térmicos



# Medidores de Ionização

Os medidores assim chamados baseiam-se na ionização dos gases.
Um campo elétrico coleta os íons, e a corrente iônica detectada, $I_+$, é uma função da pressão, P.
Medindo-se $I_+$, e conhecendo-se $I_+ = f(P)$, determina-se P.




**Number of ions formed per second (ion current):**

$i_+ = i_- L\, s\, P$ [A]

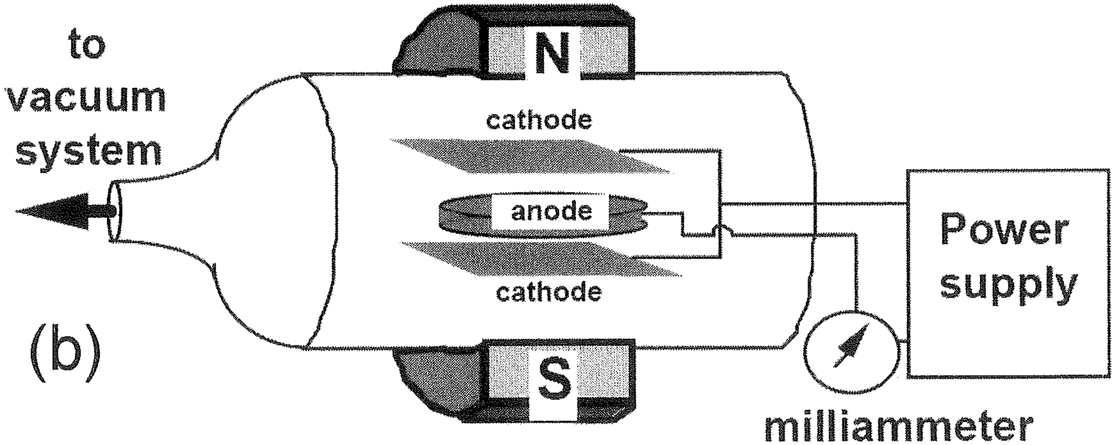
$I_-$ = ionizing electron current [A]

$L$ = length of electron path (cm)

$S$ = ionization probability (cm$^{-1}$ mbar$^{-1}$)

$P$ = gas pressure (mbar)

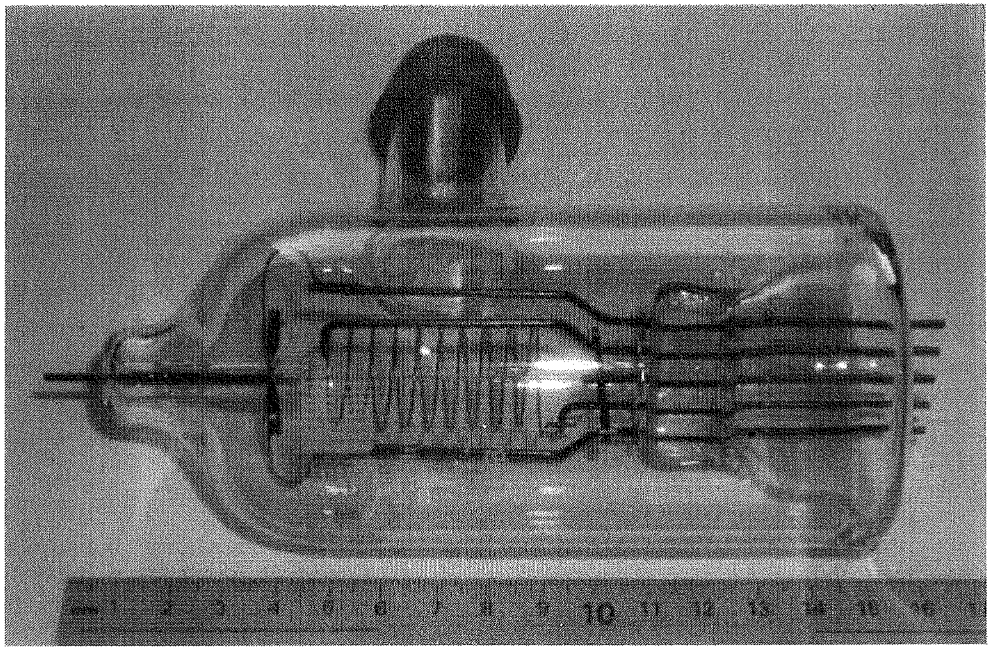

(a)



(b)

Figura 13. Manômetro Penning . (a) Cabeça. (b) Eletrodos e respectivo circuito elétrico.

# Medidor de Ionização de Bayard-Alpert



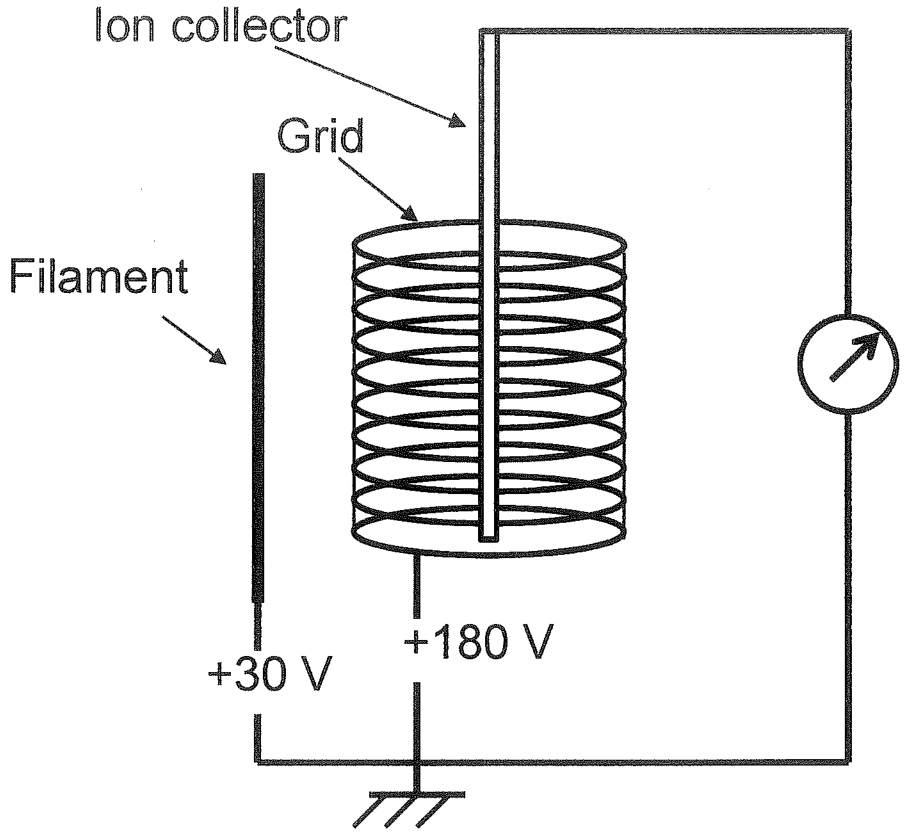



Figura 12. Conexões elétricas num sensor de Bayard-Alpert

# Mass flowmeter – schematic representation