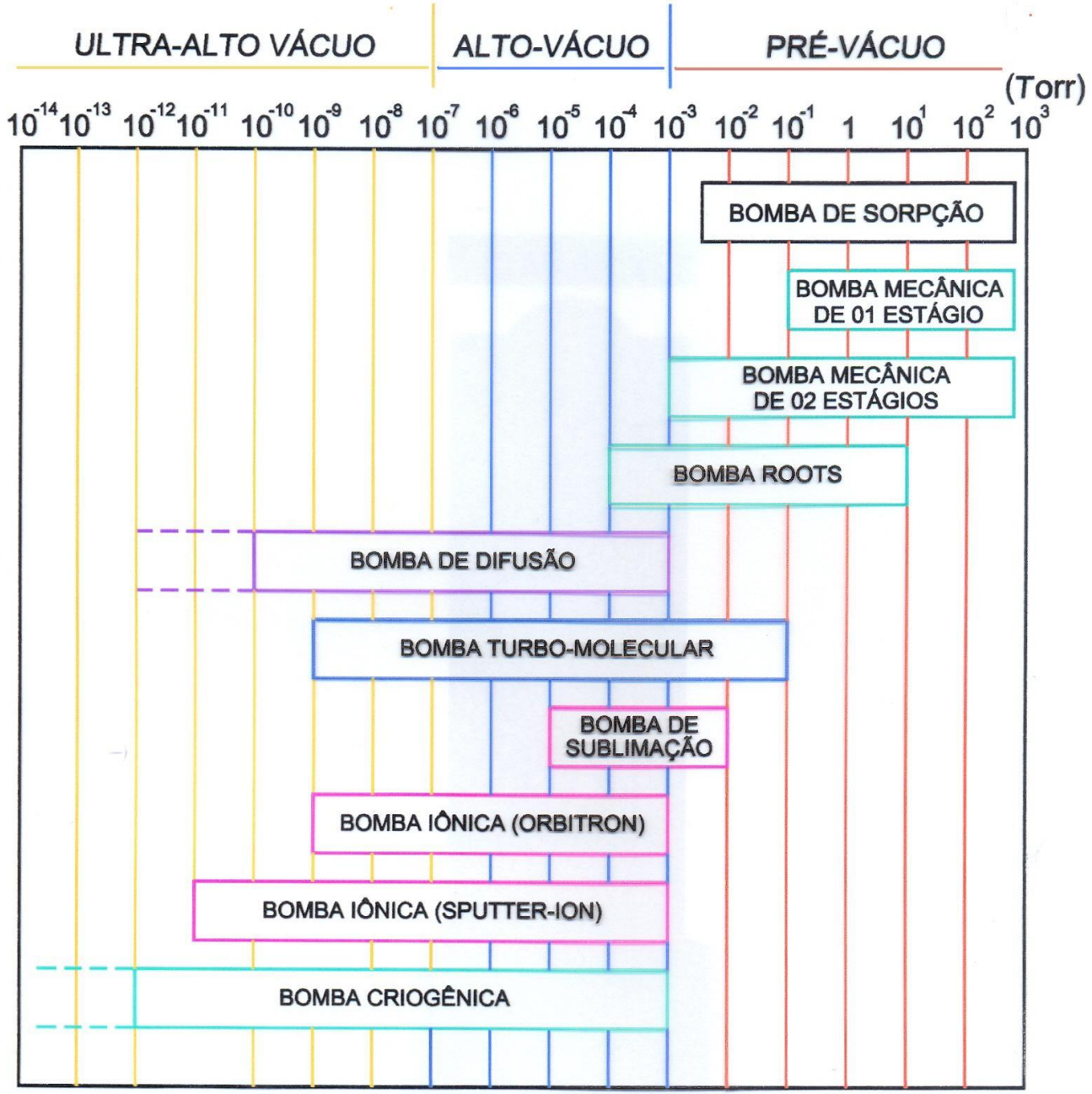
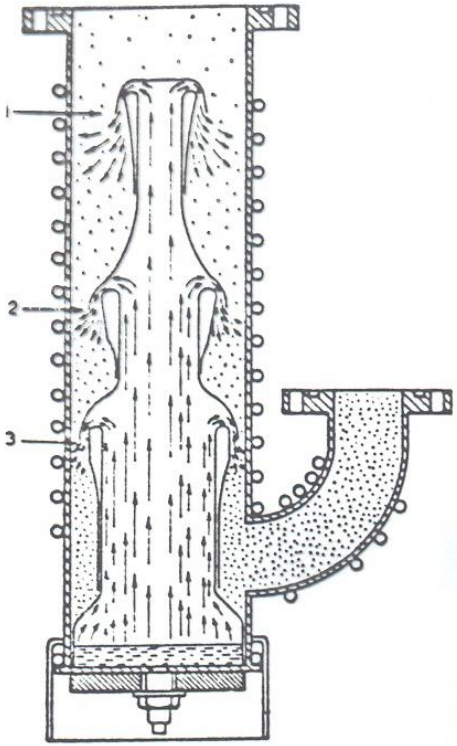
BOMBAS DE VÁCUO - 2

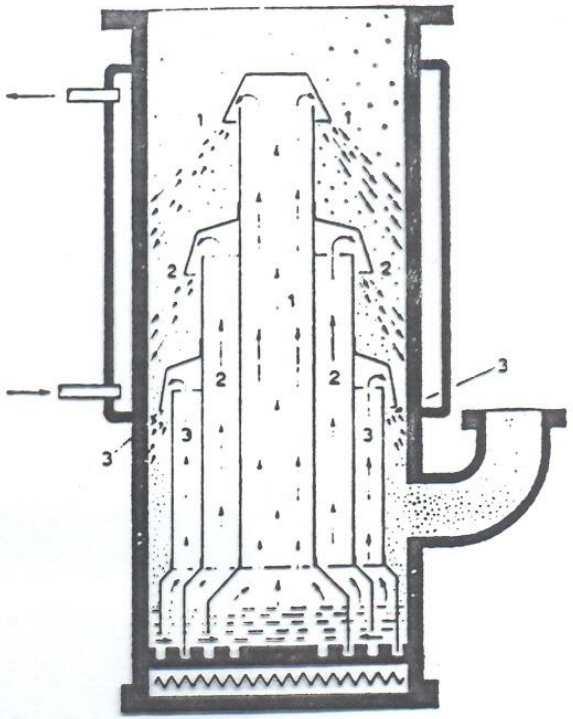
12 - ABRIL - 2016

USP - INSTITUTO DE FÍSICA


ULTRA-ALTO VÁCUO
ALTO-VÁCUO
PRÉ-VÁCUO
(Torr)
10^-14 10^-13 10^-12 10^-11 10^-10 10^-9 10^-8 10^-7 10^-6 10^-5 10^-4 10^-3 10^-2 10^-1 1 10^1 10^2 10^3
BOMBA DE SORPÇÃO
BOMBA MECÂNICA DE 01 ESTÁGIO
BOMBA MECÂNICA DE 02 ESTÁGIOS
BOMBA ROOTS
BOMBA DE DIFUSÃO
BOMBA TURBO-MOLECULAR
BOMBA DE SUBLIMAÇÃO
BOMBA IÔNICA (ORBITRON)
BOMBA IÔNICA (SPUTTER-ION)
BOMBA CRIOGÊNICA



(a)

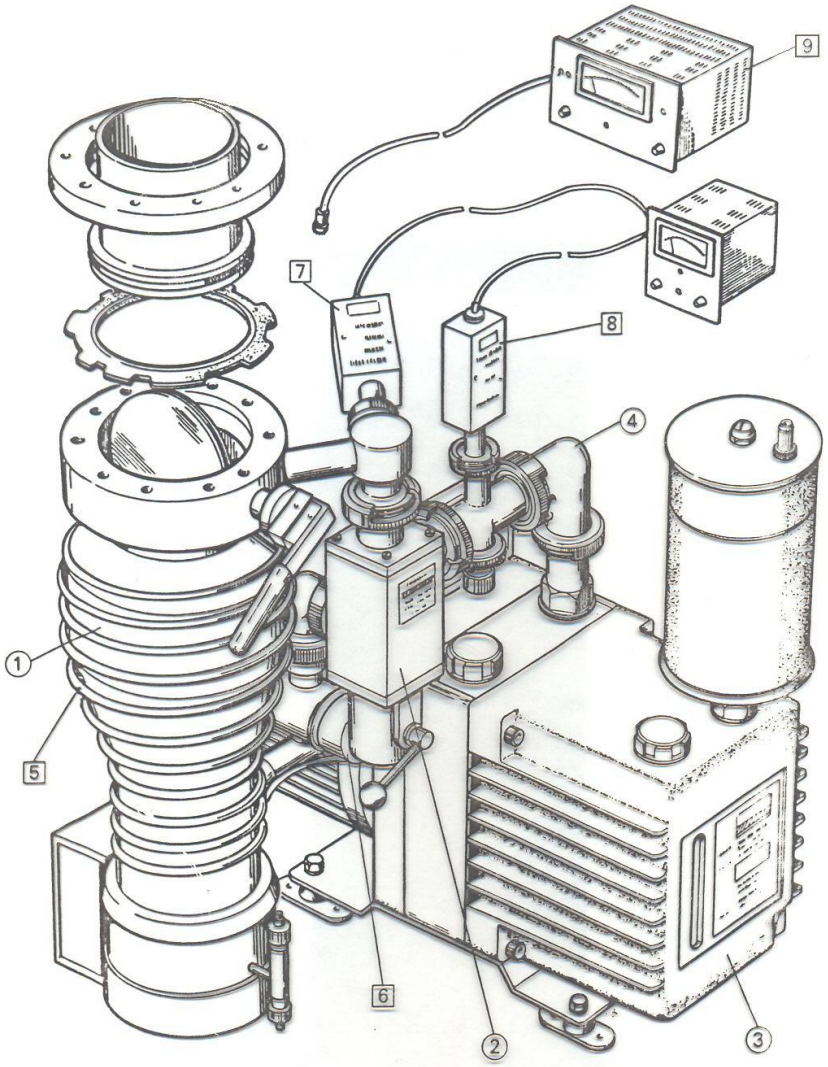


(b)

Esquemas de Bombas de Difusão de três estágios

a) desenho mais antigo; o óleo aquecido não sofre nenhum precesso de purificação

b) com tubos concêntricos permitindo a purificação do óleo por - destilação fracionada, durante o funcionamento (o vapor de óleo mais aquecido e limpo sai pelo chapéu ("nozzle") 1.



Conjunto para Alto Vácuo (Edwards)

1 - Bomba de Difusão com válvula acoplada ("Diffstak")

2 - Válvula de isolação (3 vias)

3 - Bomba Mecânica (acoplamento direto)

4 - Componentes modulares

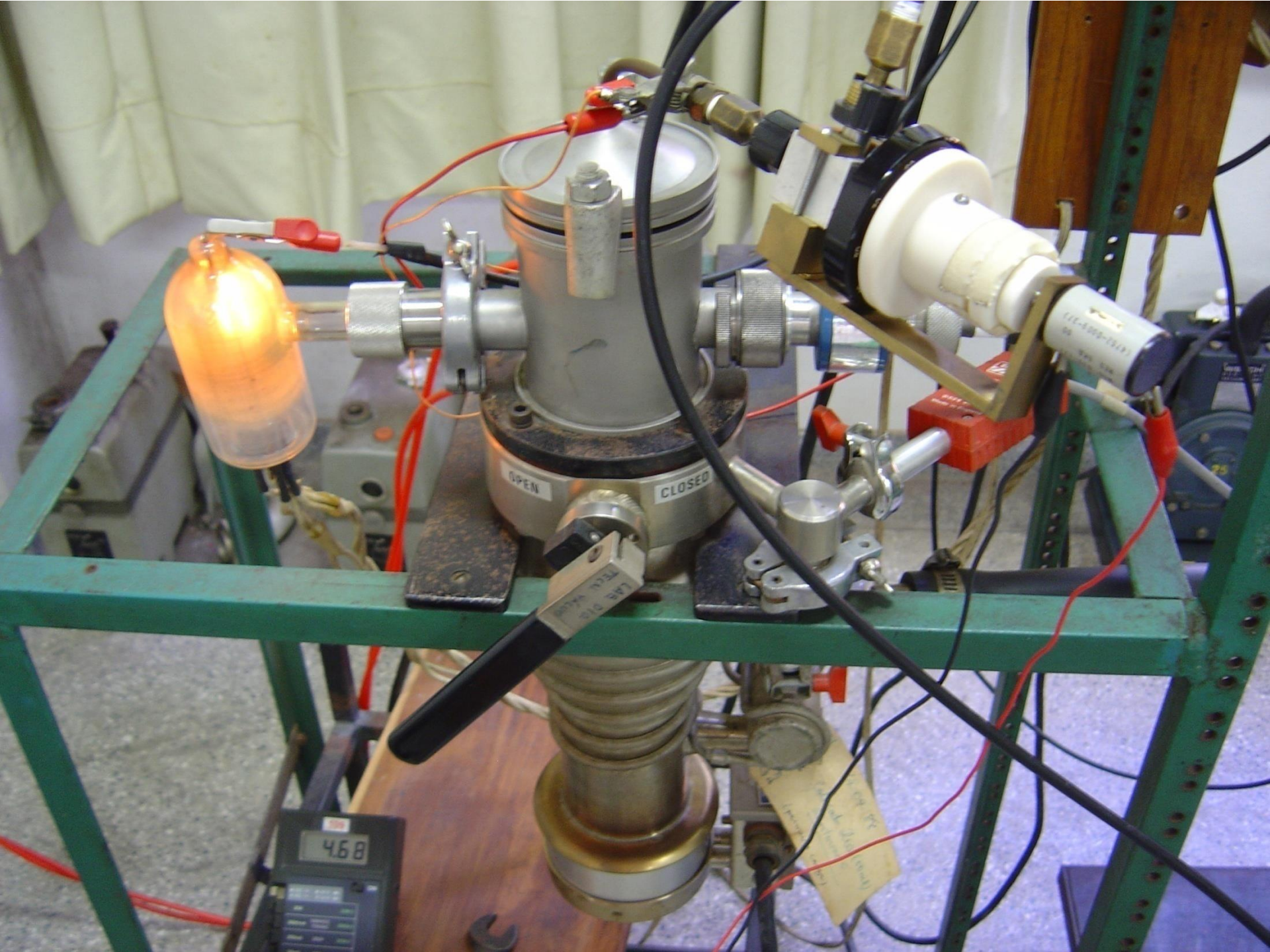
5 - Serpentina de refrigeração

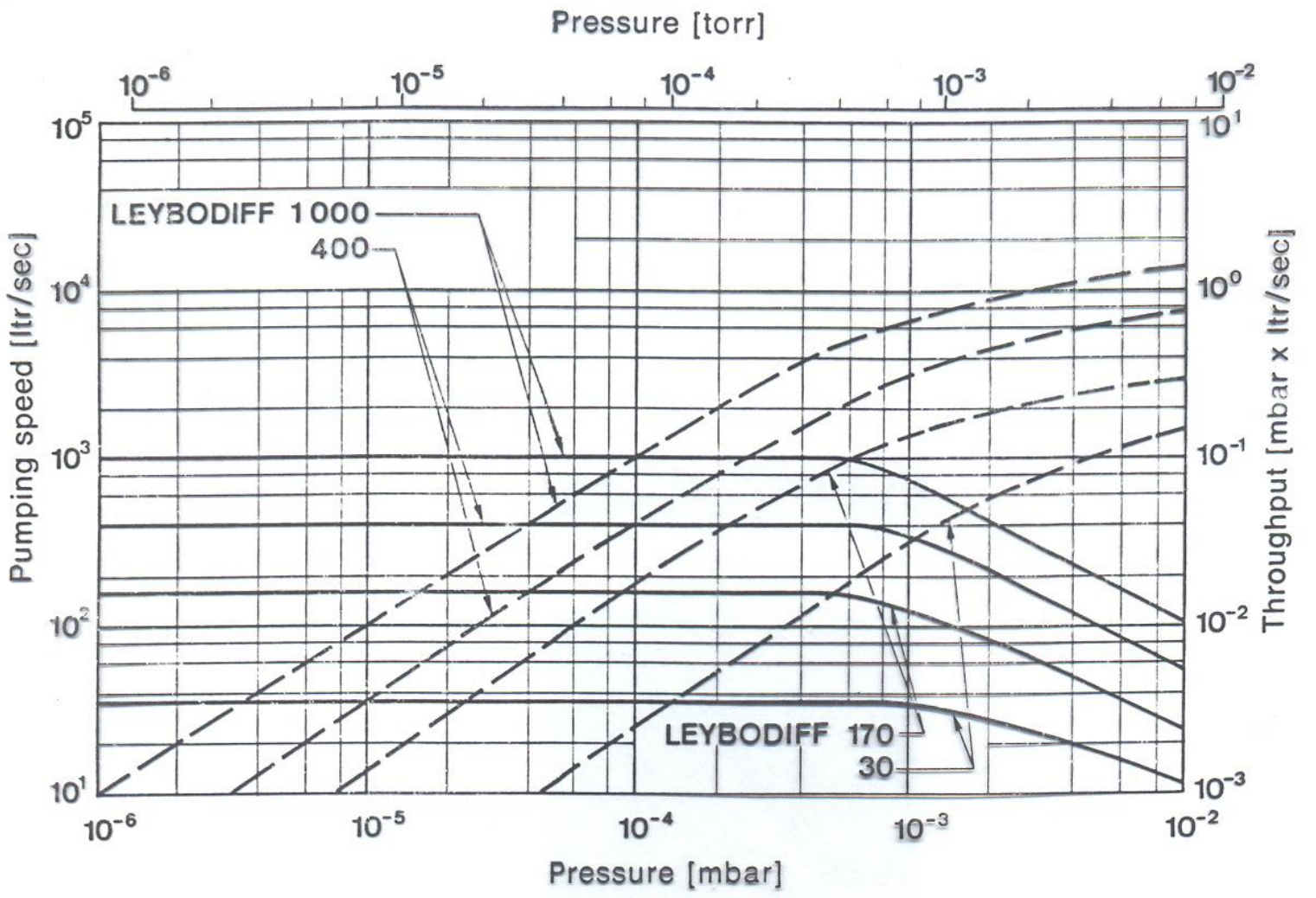
6 - Interruptor térmico

7 - Medidor de pré-vácuo (Pirani)

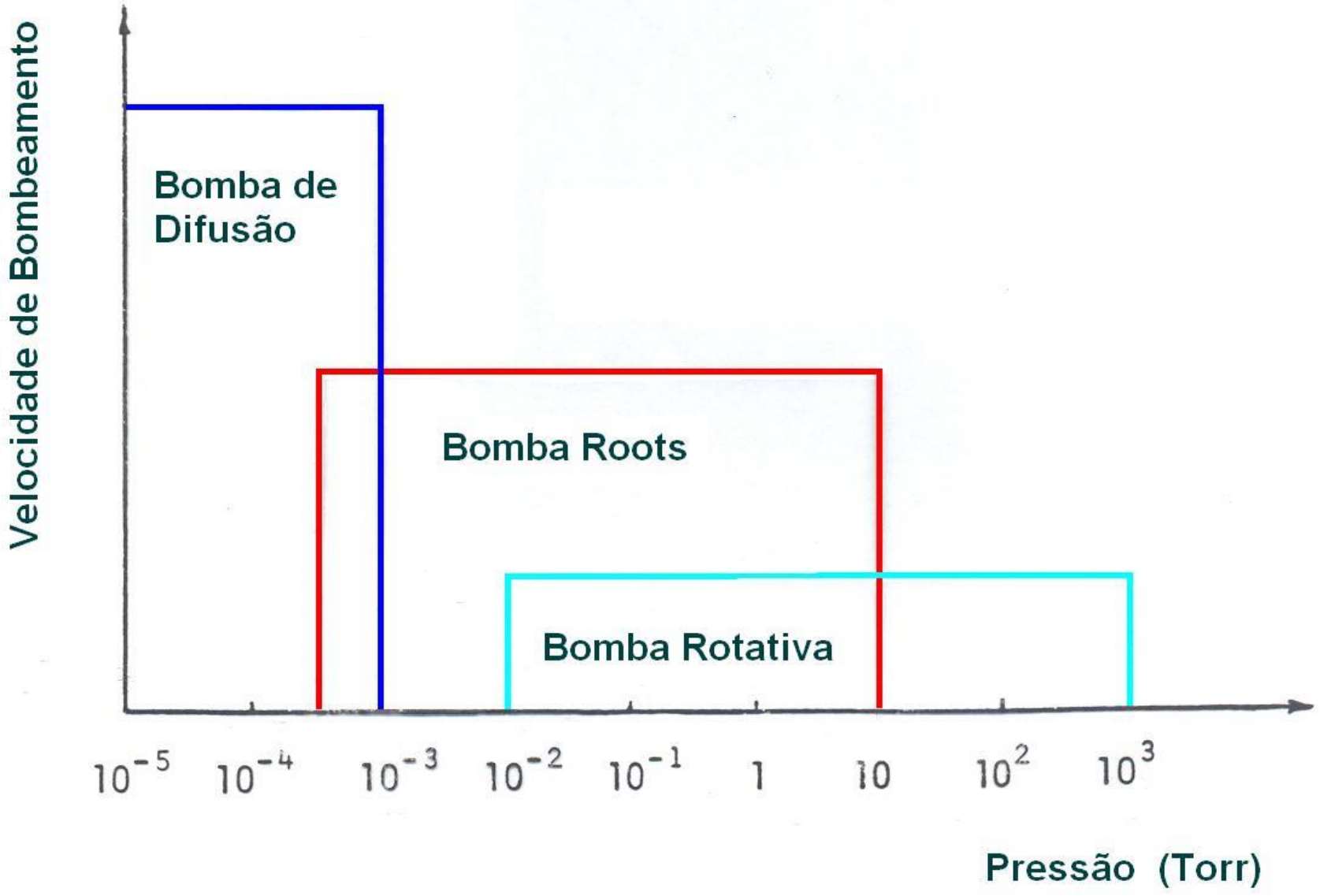
8 - Medidor de pré-vácuo (Pirani)

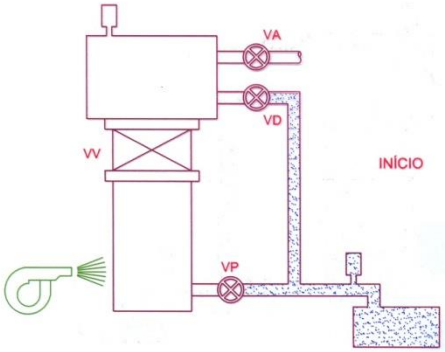
9 - Medidor de alto-vácuo (Penning) (o sensor fica na câmara)


OPEN
CLOSED
4.68



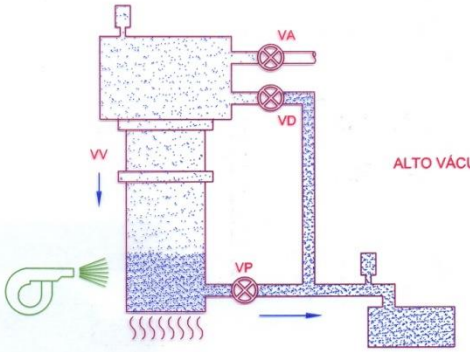
Pumping speed (left) and throughput (right) of LEYBODIFF pumps as a function of intake pressure


Velocidade de Bombeamento
Bomba de Difusão
Bomba Roots
Bomba Rotativa
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
10^{2}
10^{3}
Pressão (Torr)



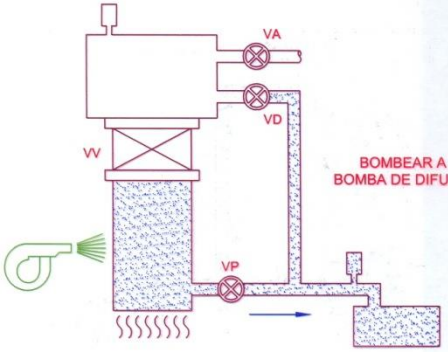
INÍCIO

1. TODAS AS VÁLVULAS FECHADAS
2. LIGAR BOMBA MECÂNICA
3. VERIFICAR PRESSÃO



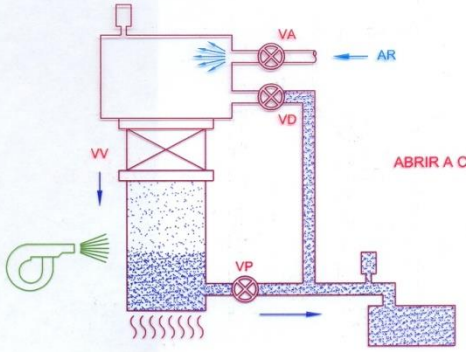
ALTO VÁCUO (USO)

1. FECHAR VD
2. ABRIR VP
3. ABRIR VV



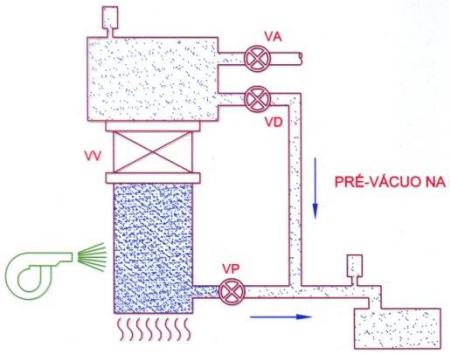
BOMBEAR A
BOMBA DE DIFUSÃO

1. ABRIR VÁLVULA VP
2. PRÉ-VÁCUO NA BOMBA DE DIFUSÃO
3. LIGAR AQUECIMENTO
4. LIGAR VENTILADOR / ÁGUA DE RFERIGERAÇÃO



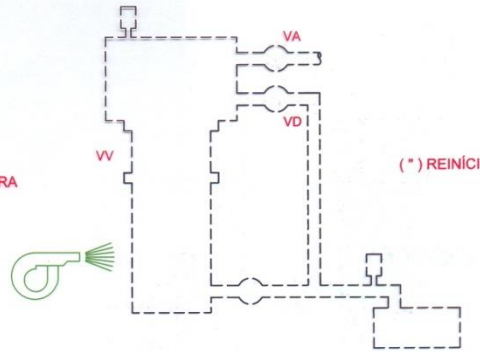
ABRIR A CÂMARA

1. FECHAR VV
2. ABRIR VA PARA AREJAR A CÂMARA



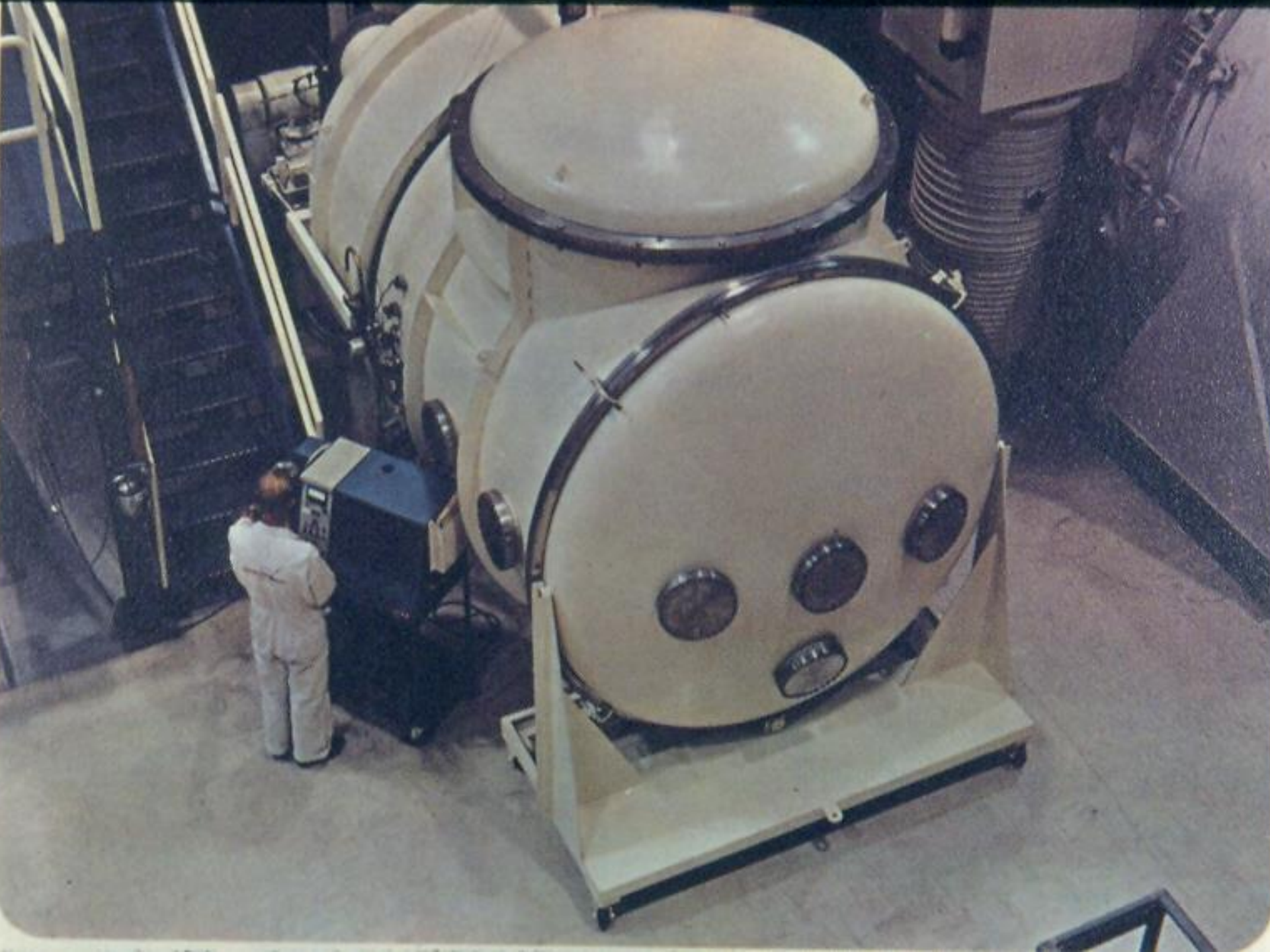
PRÉ-VÁCUO NA CÂMARA

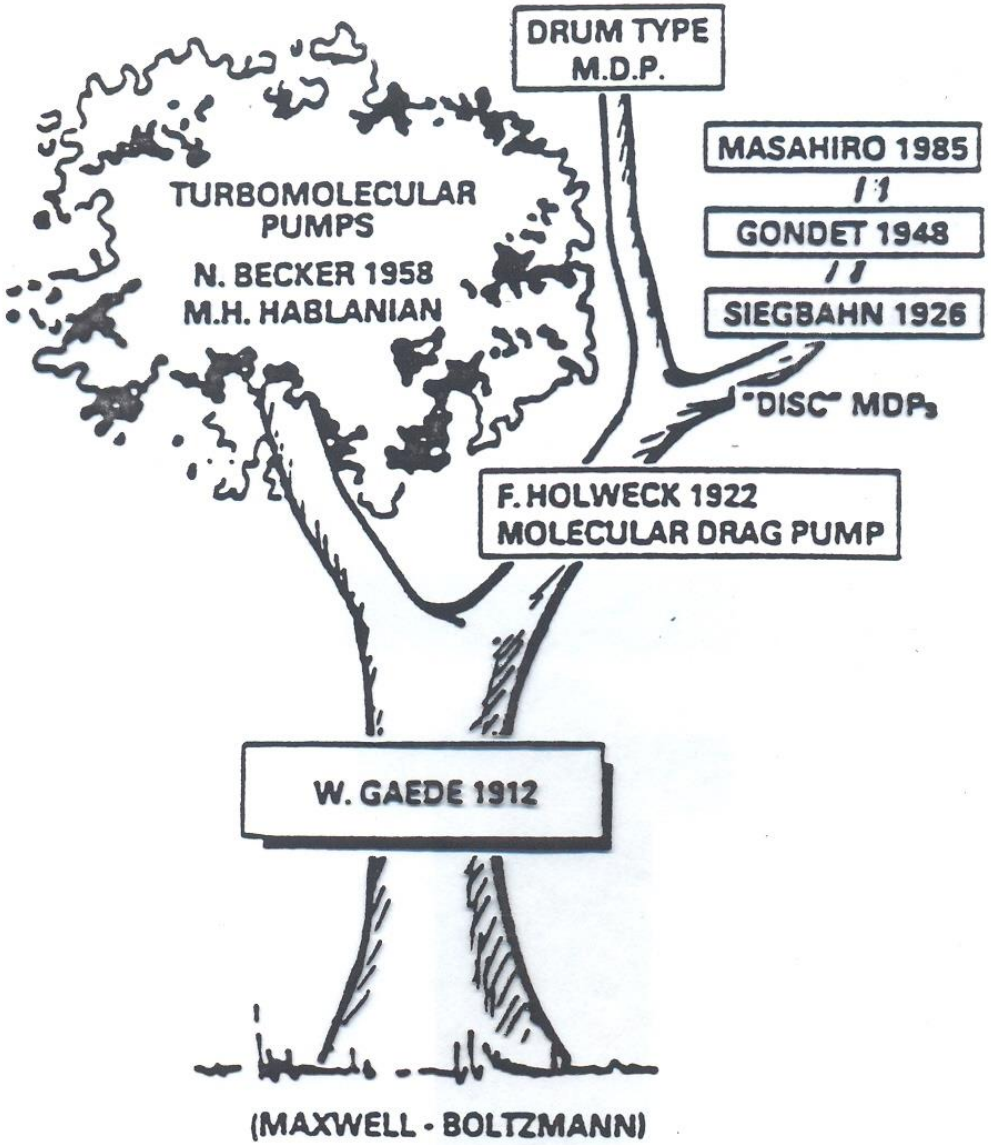
1. FECHAR VP
2. ABRIR VD
3. BOMBEAR A CÂMARA ATÉ < 0,1 mbar
4. LIGAR VENTILADOR / ÁGUA DE RFERIGERAÇÃO



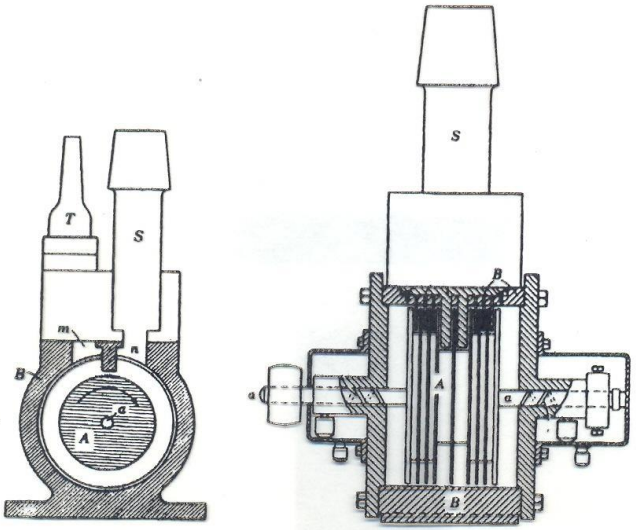
(*) REINÍCIO

1. FECHAR VA (AR)
2. FECHAR VP
3. ABRIR VD
4. BOMBEAR CÂMARA ATÉ < 0,1 mbar

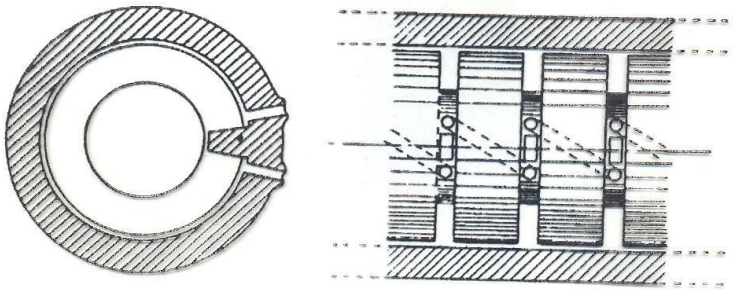




The mechanical molecular vacuum pumps family tree.



(a) (b)

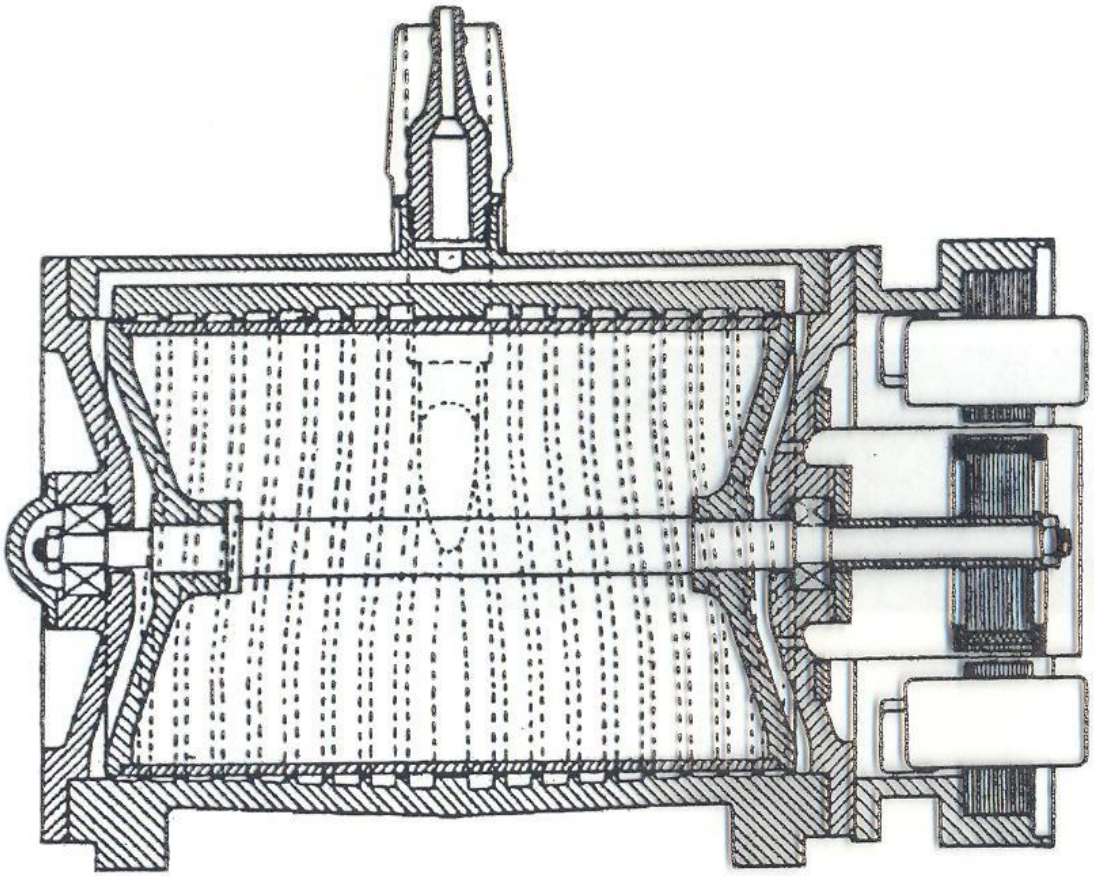


(c)

Bomba Molecular de Gaede

a) vista frontal em corte; b) vista lateral em corte;
c) desenho mostrando vários estágios da bomba.

A - rotor com vários estágios
B - corpo da bomba
m - região de maior pressão
n - região de menor pressão
T - saída para a bomba de pré-vácuo
S - entrada da bomba



Bomba Molecular de Holweck. As moléculas do gás entrando pelo centro são empurradas para os lados pelo rotor em alta velocidade.

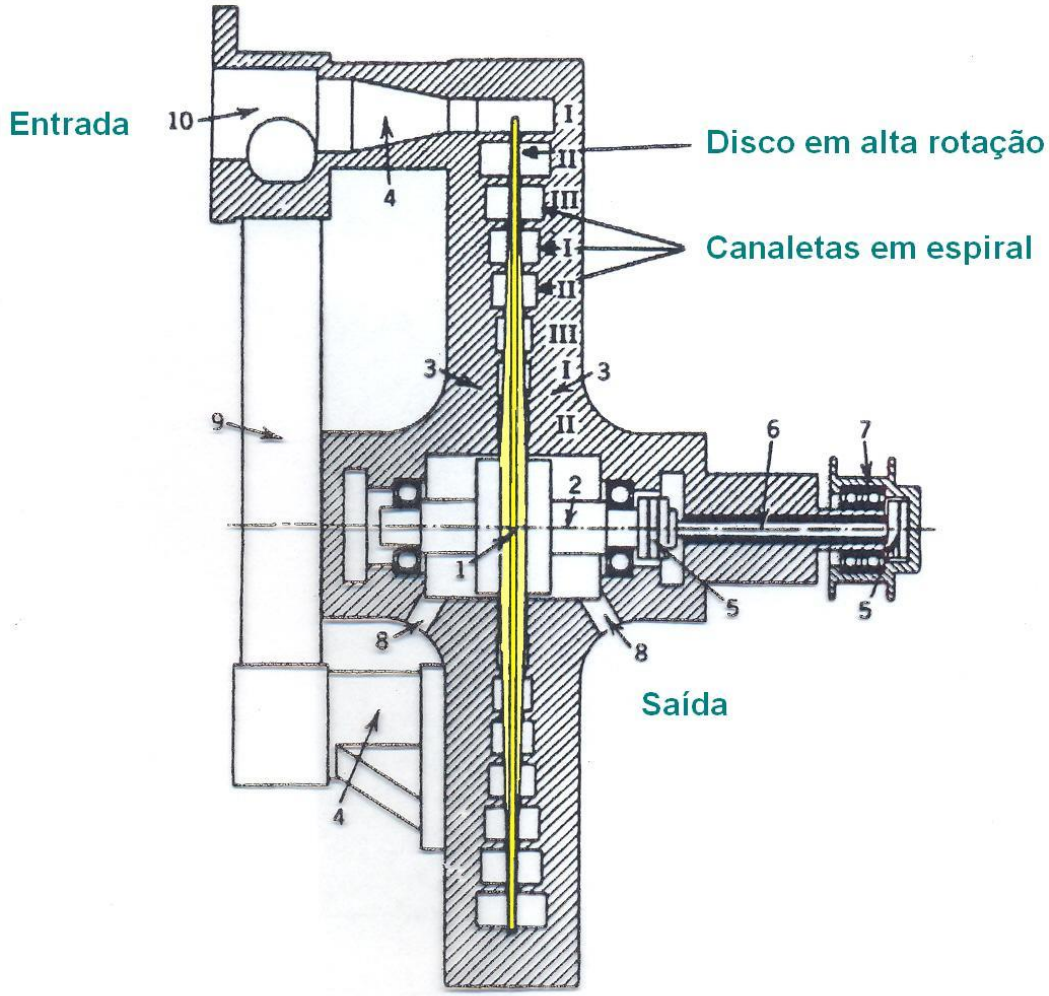
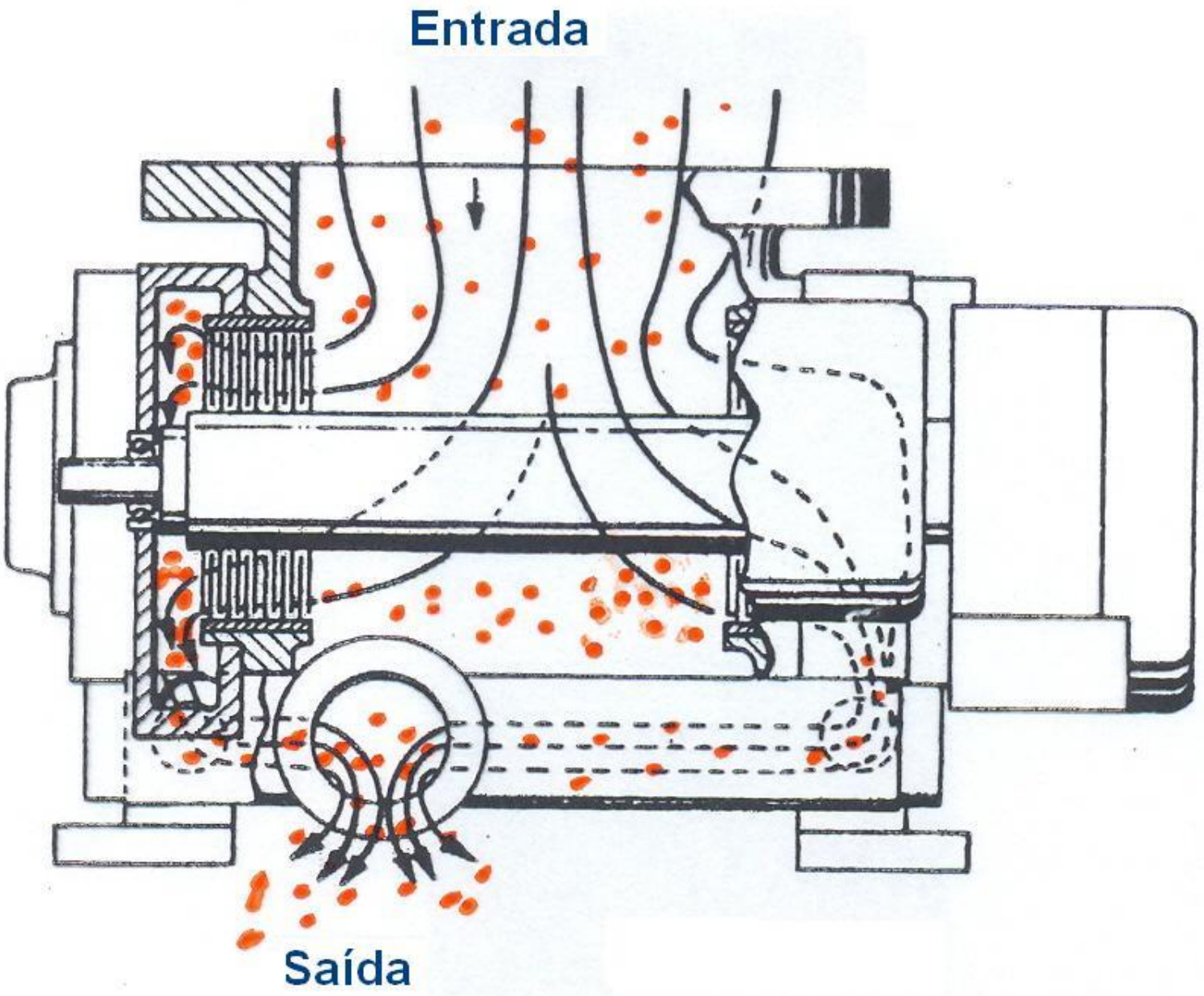
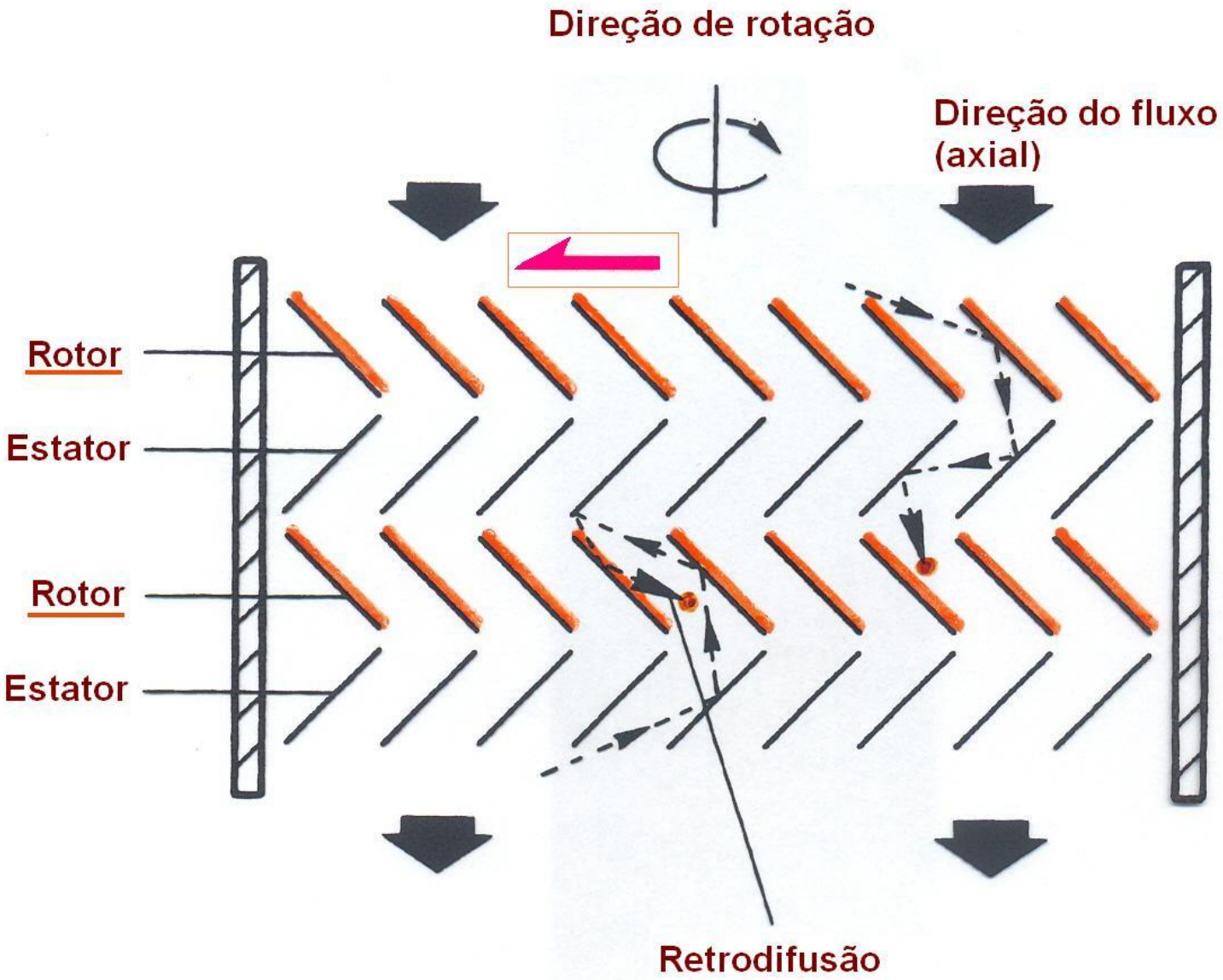


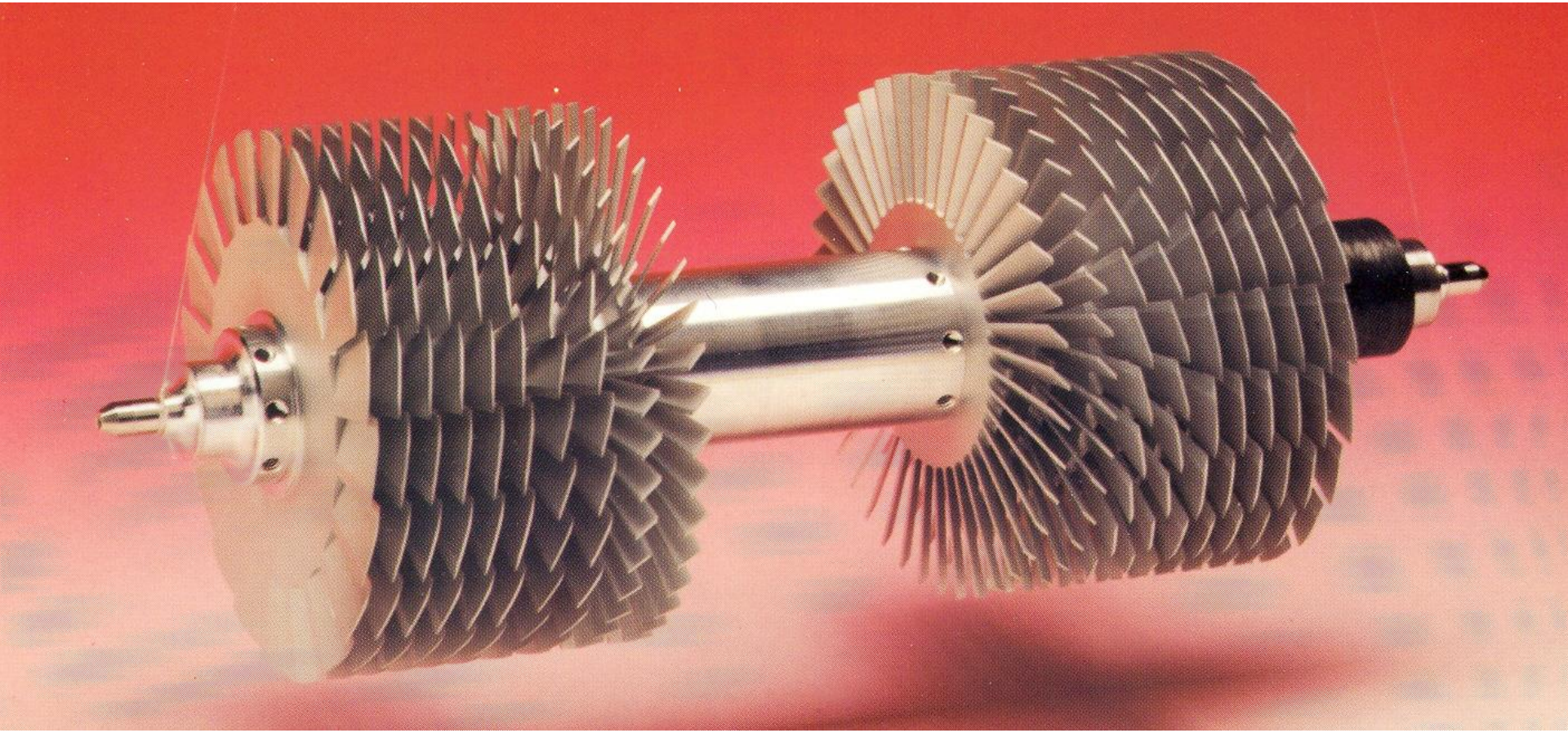
Diagrama esquemático da Bomba Molecular de Siegbahn
(diâmetro do disco: 54 cm)

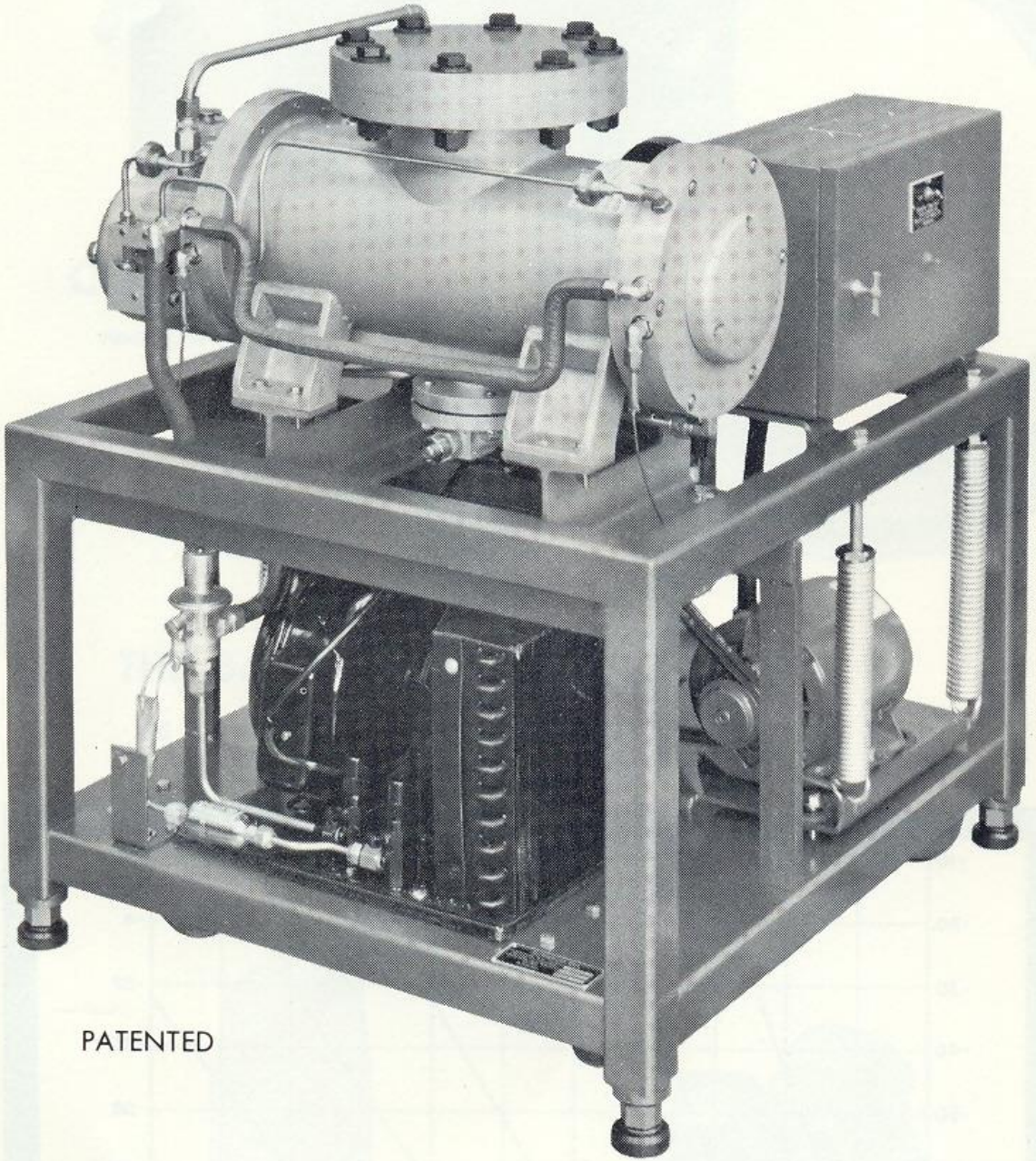


BOMBA TURBOMOLECULAR

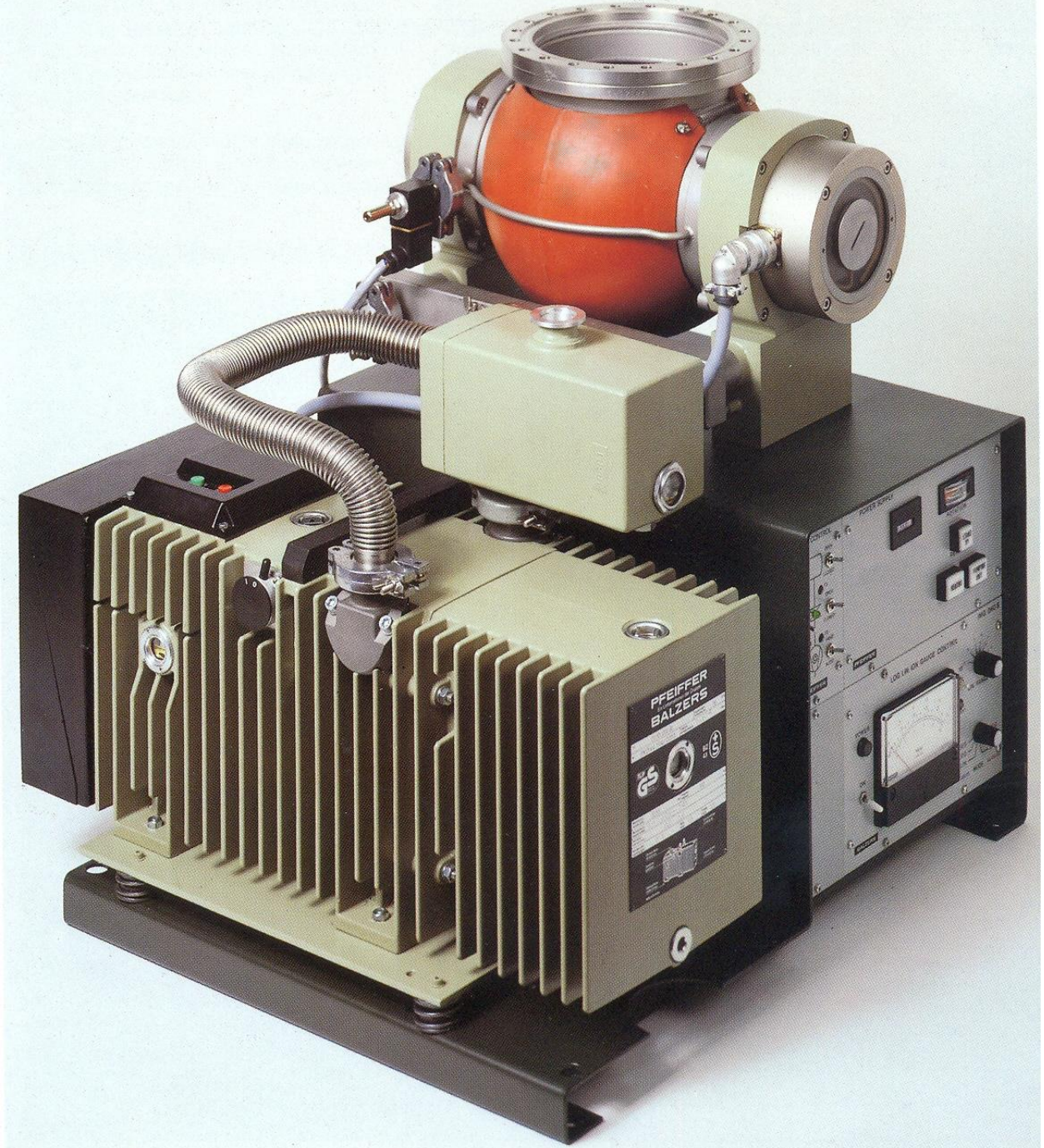

Direção de rotação
Direção do fluxo
(axial)
Rotor
Estator
Rotor
Estator
Retrodifusão

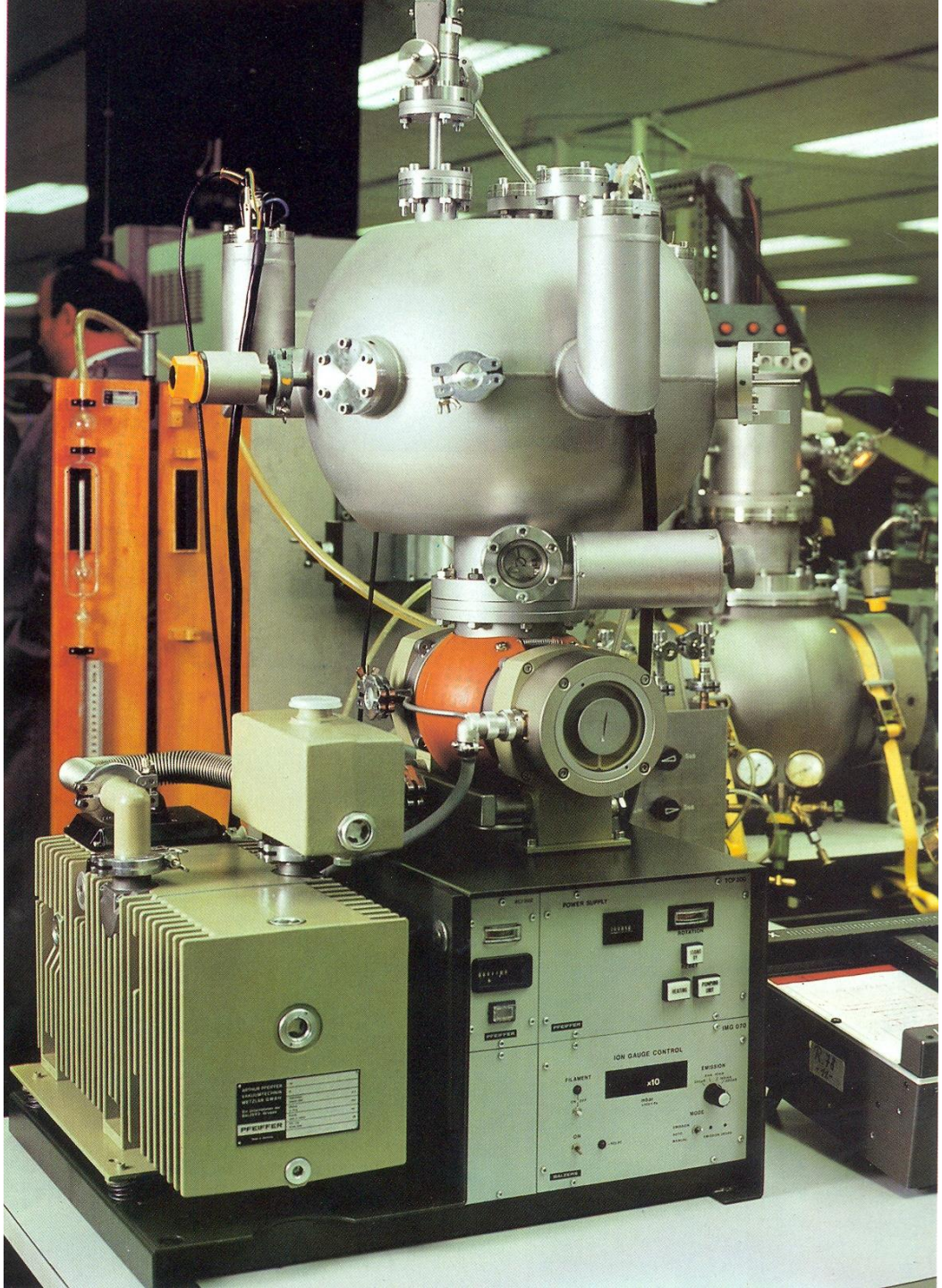
BOMBA TURBOMOLECULAR (HORIZONTAL) - ROTOR

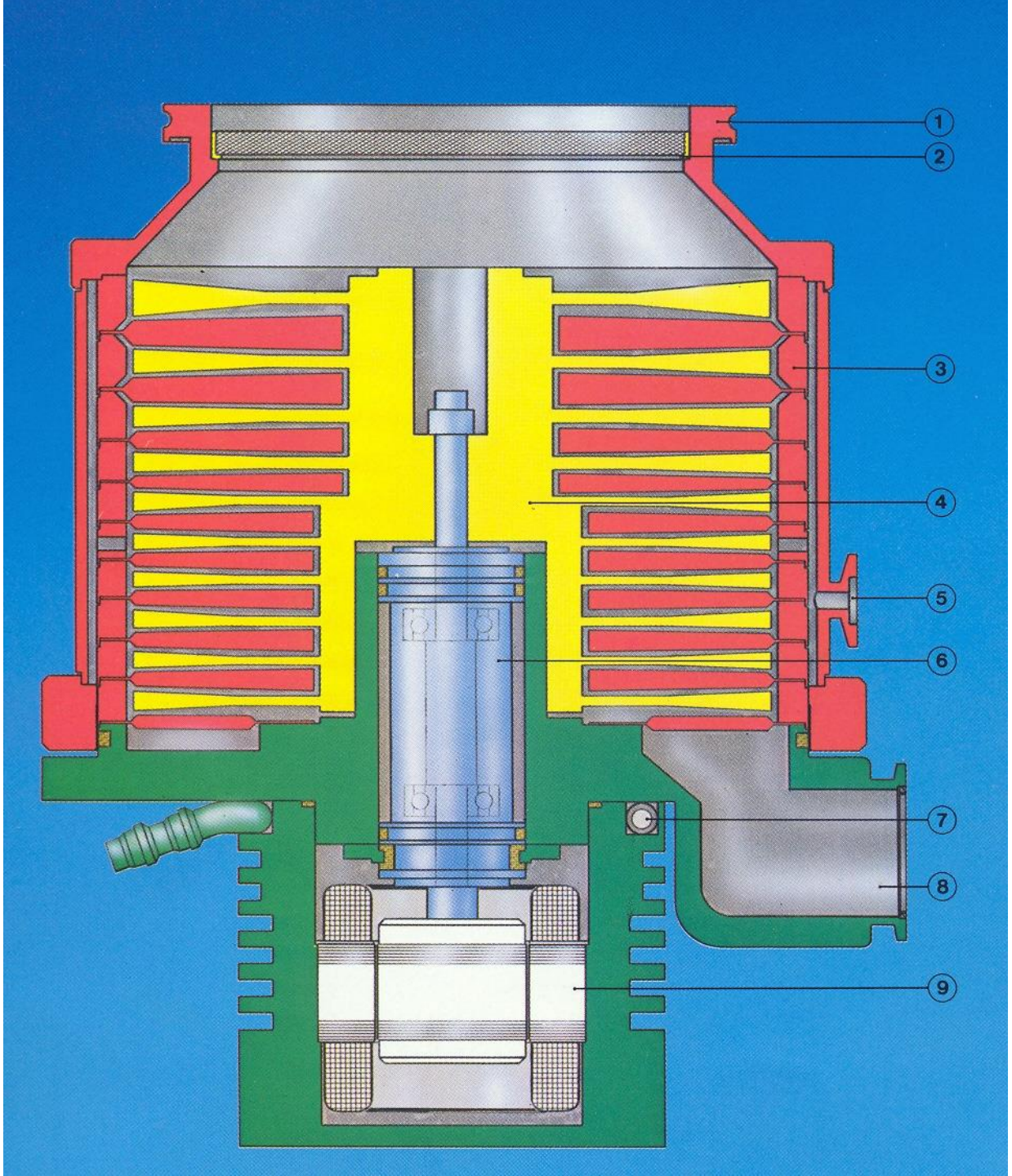


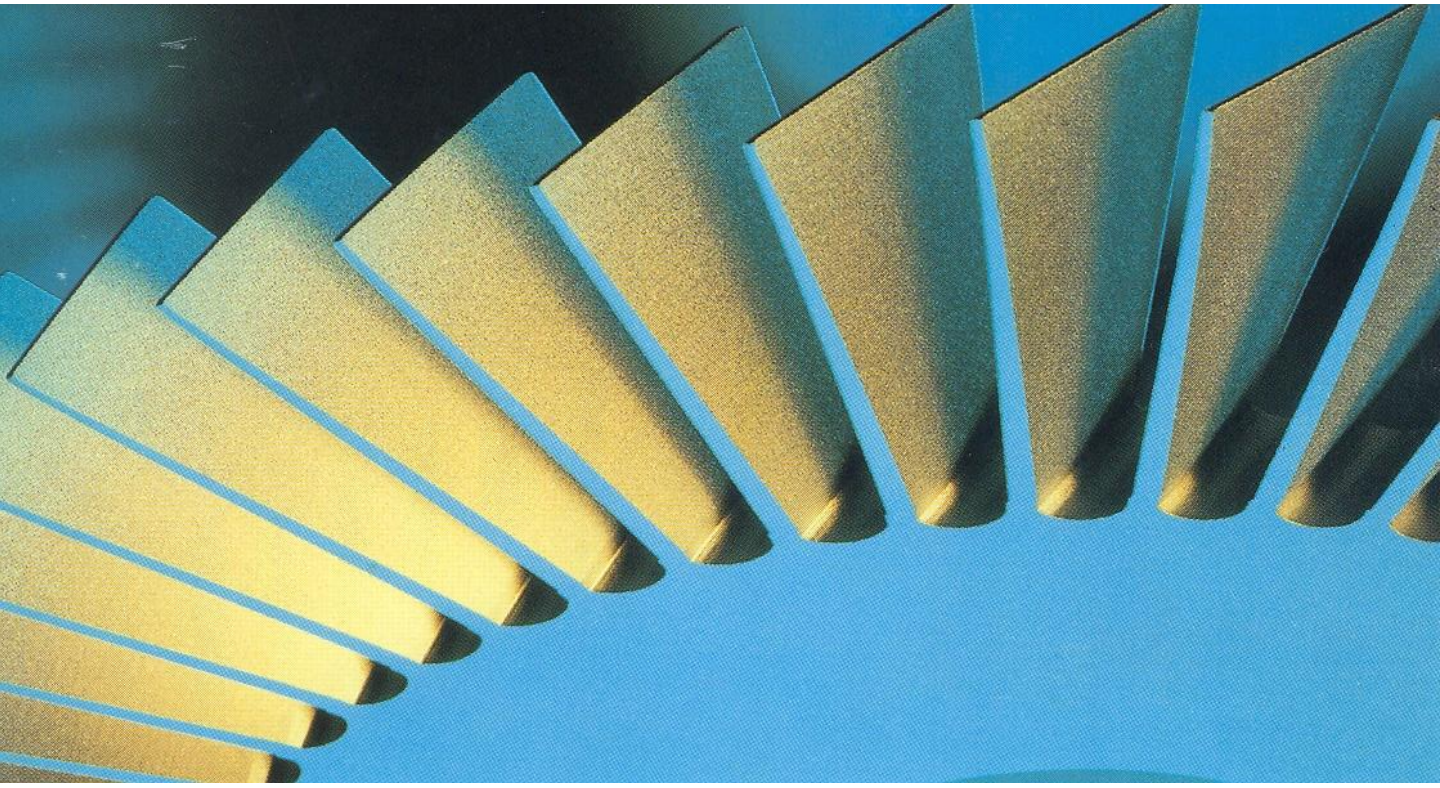


PATENTED

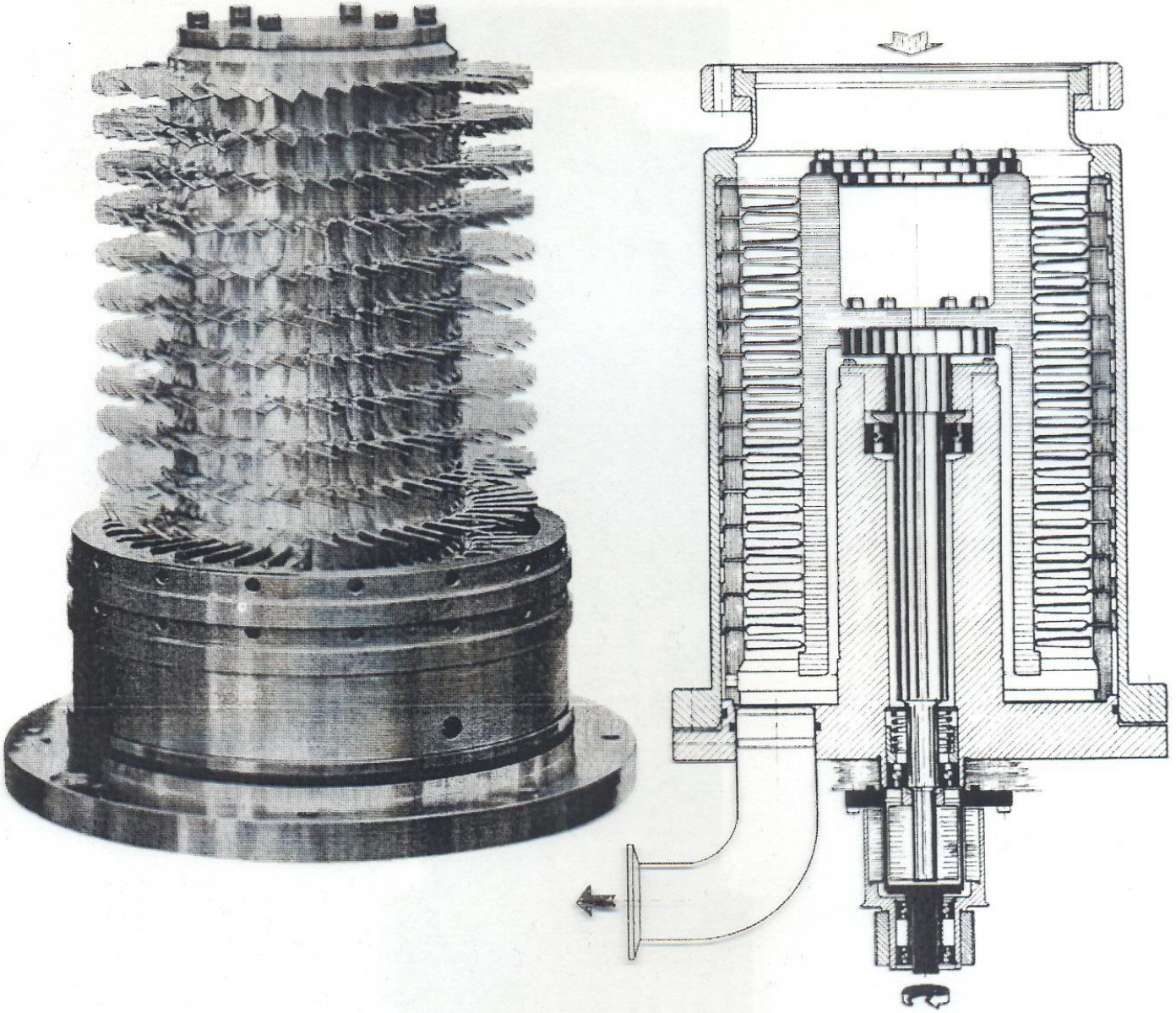

PFEIFFER
BALZERS


POWER SUPPLY
ROTATION
ION GAUGE CONTROL
FILAMENT
EMISSION
MODE
x10
PFEIFFER

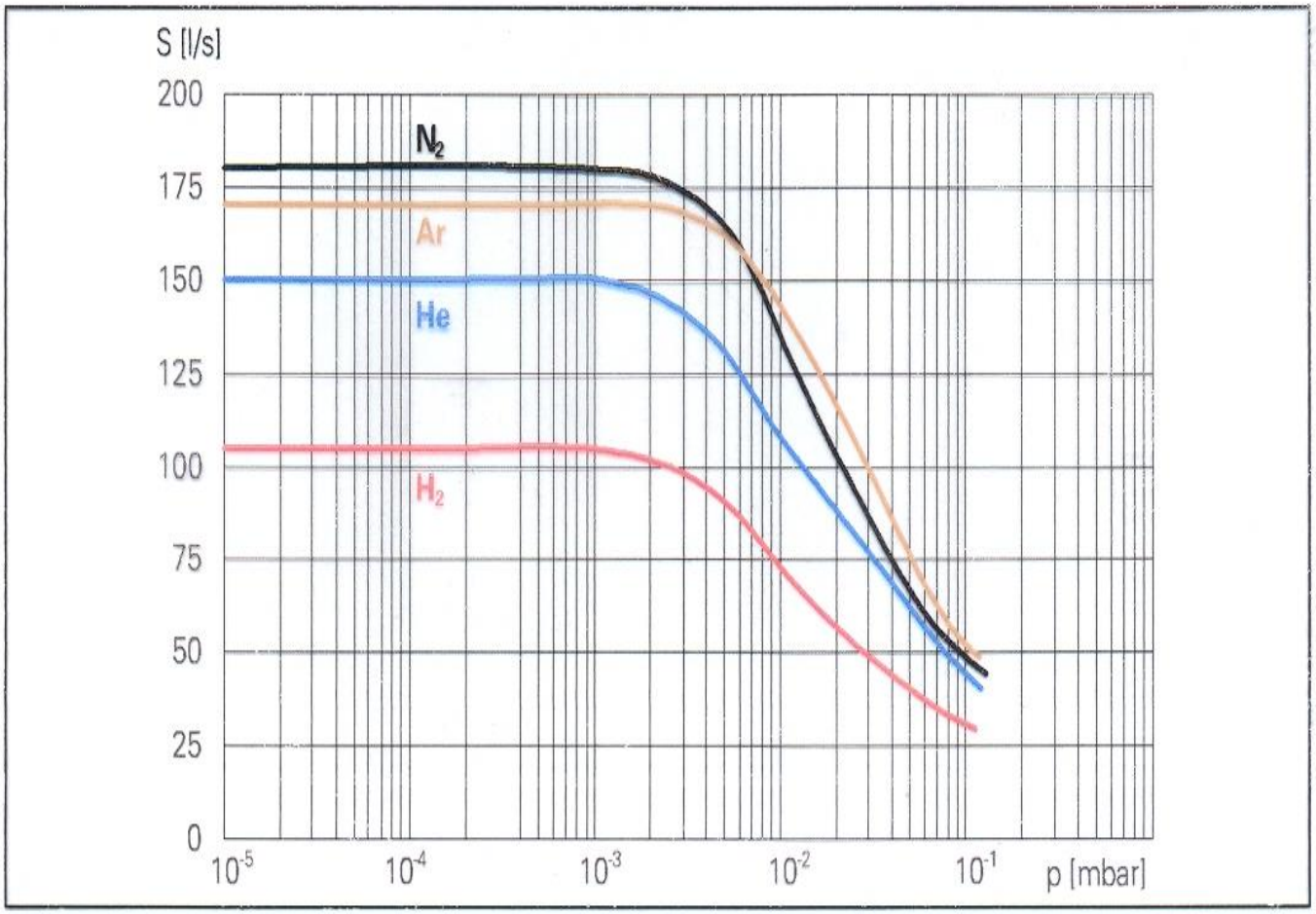

1
2
3
4
5
6
7
8
9

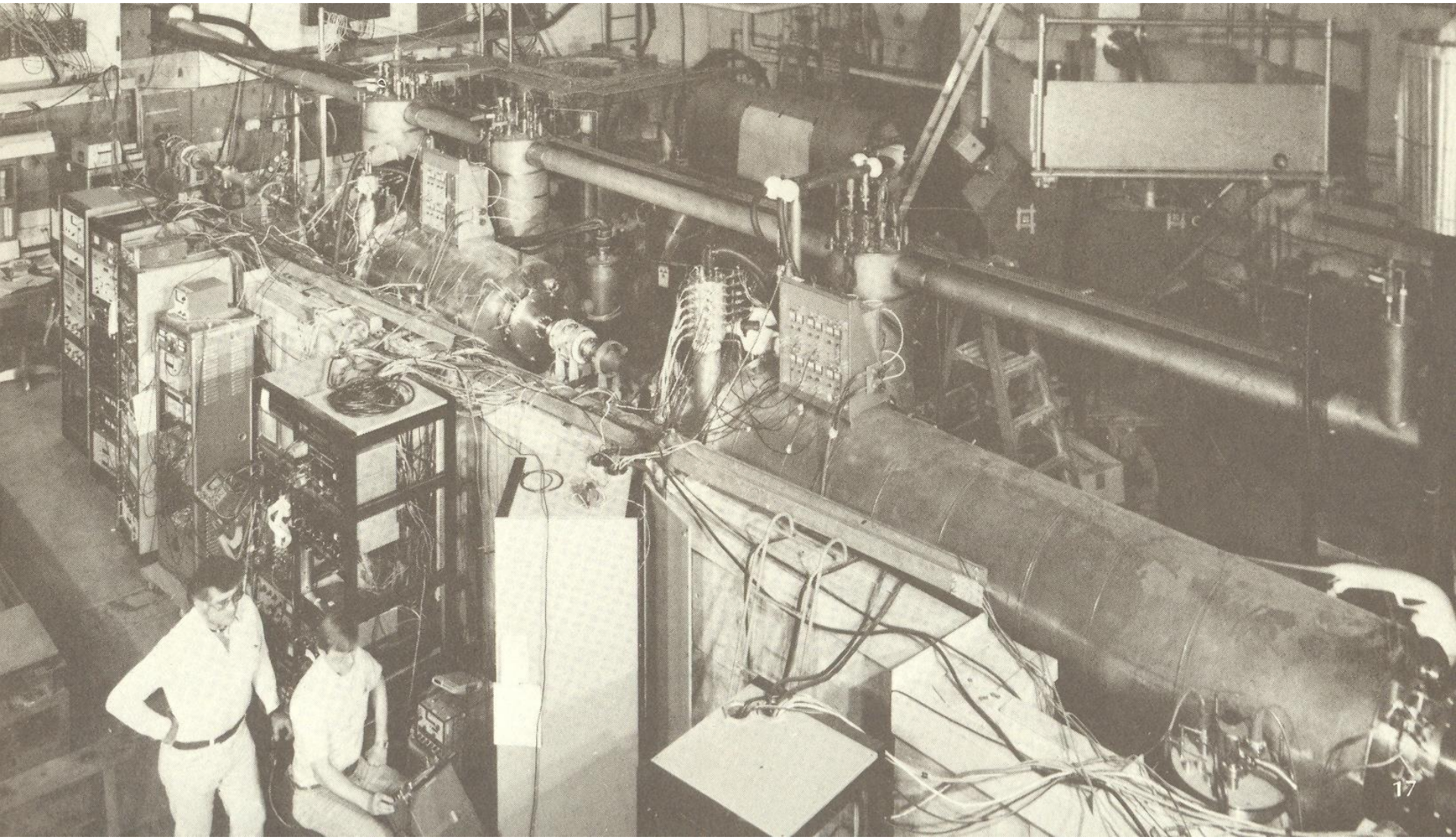



PFEIFFER
BALZERS

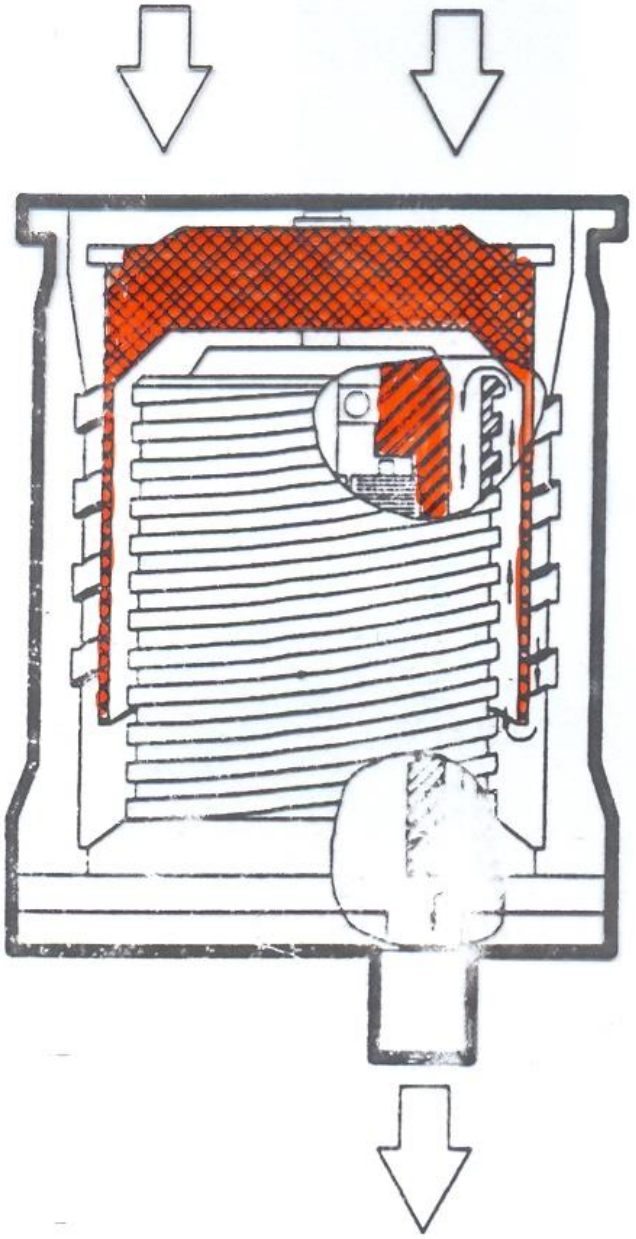


Pumping speed

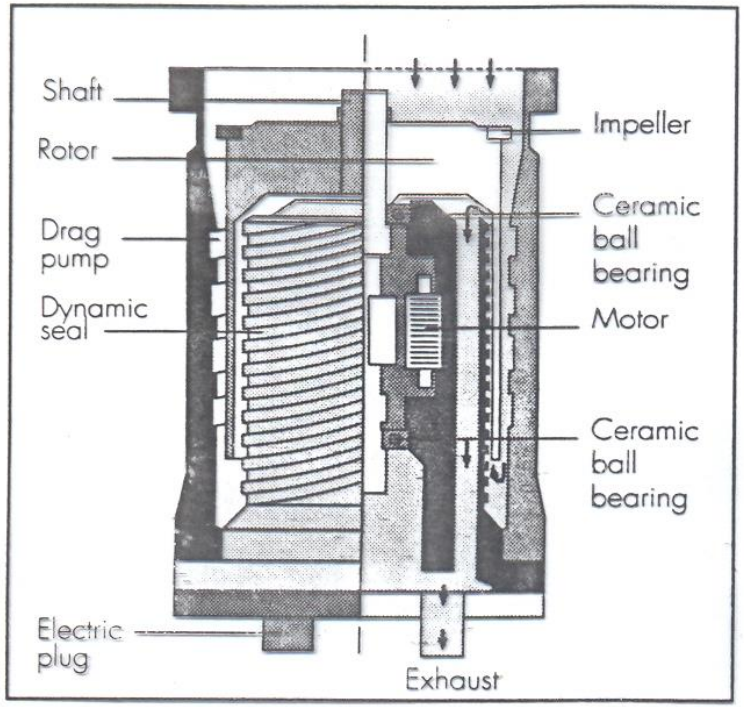




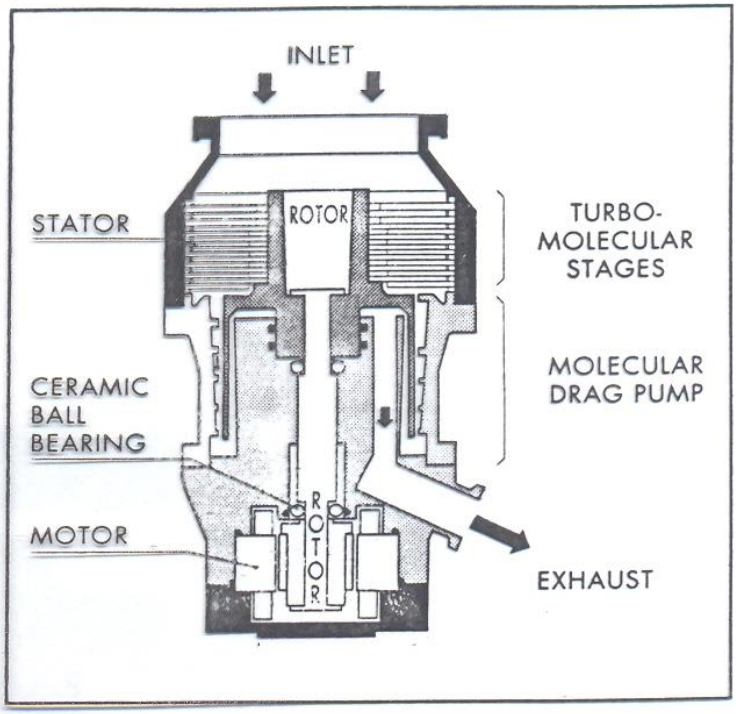
BOMBA MOLECULAR (HOLWECK) - MDP



BOMBA MOLECULAR (MDP)



BOMBA TURBOMOLECULAR
+
MDP

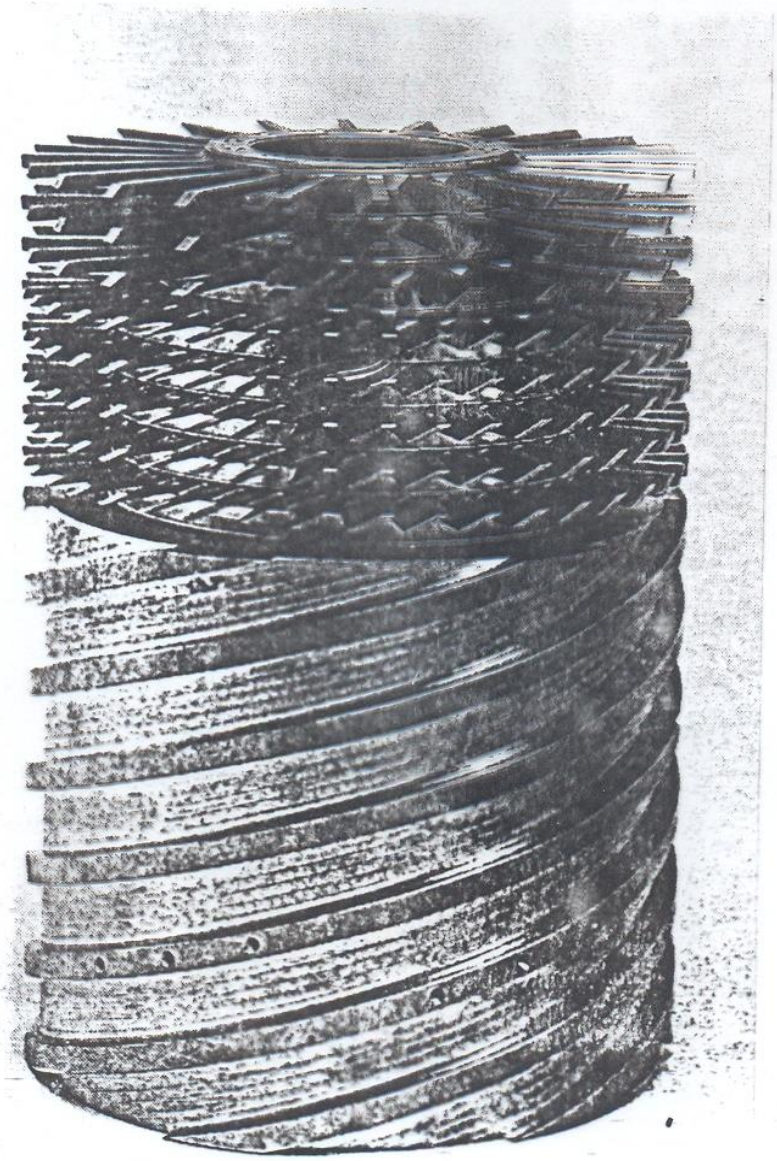


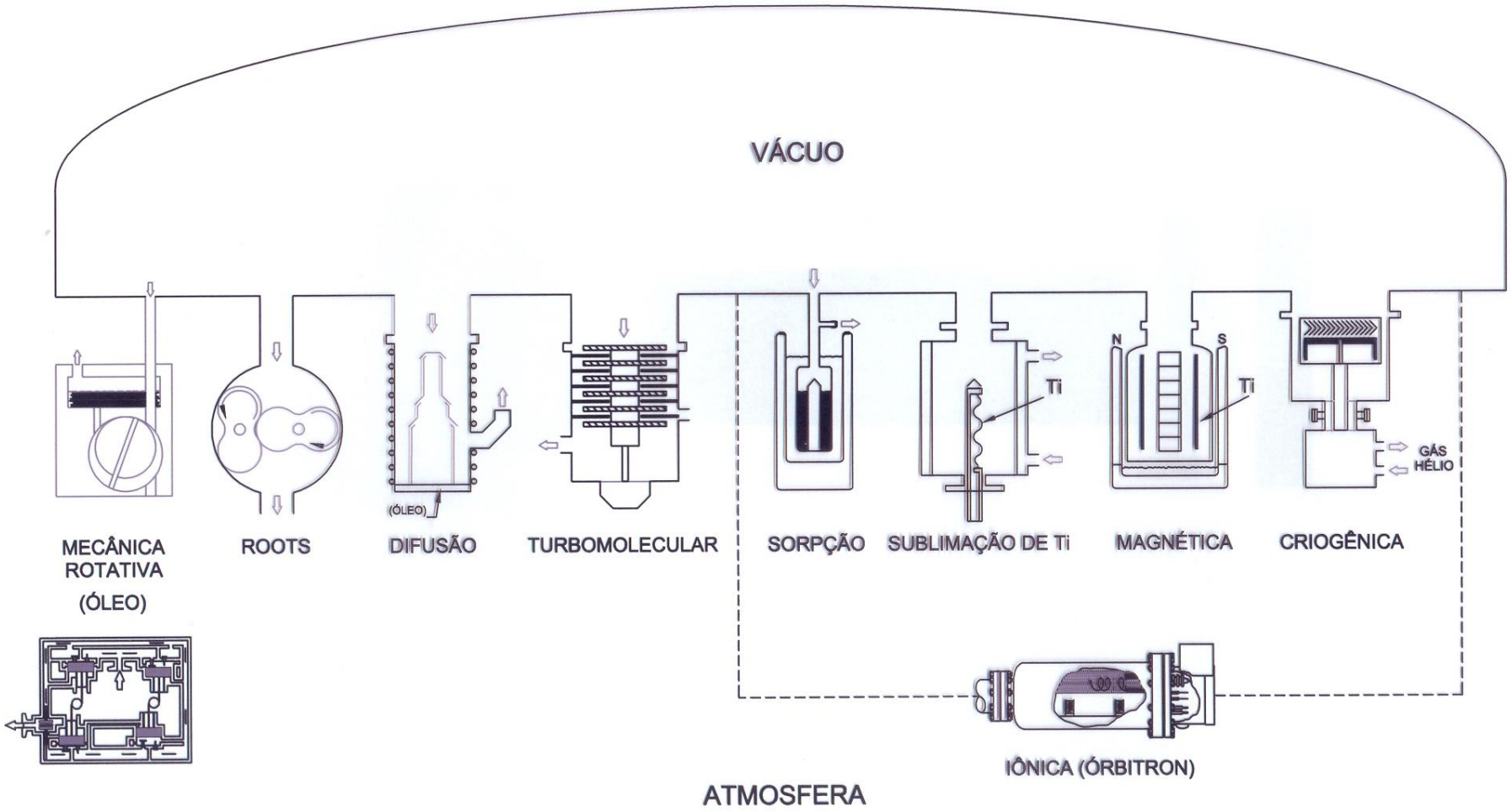
TURBO

+

MDP

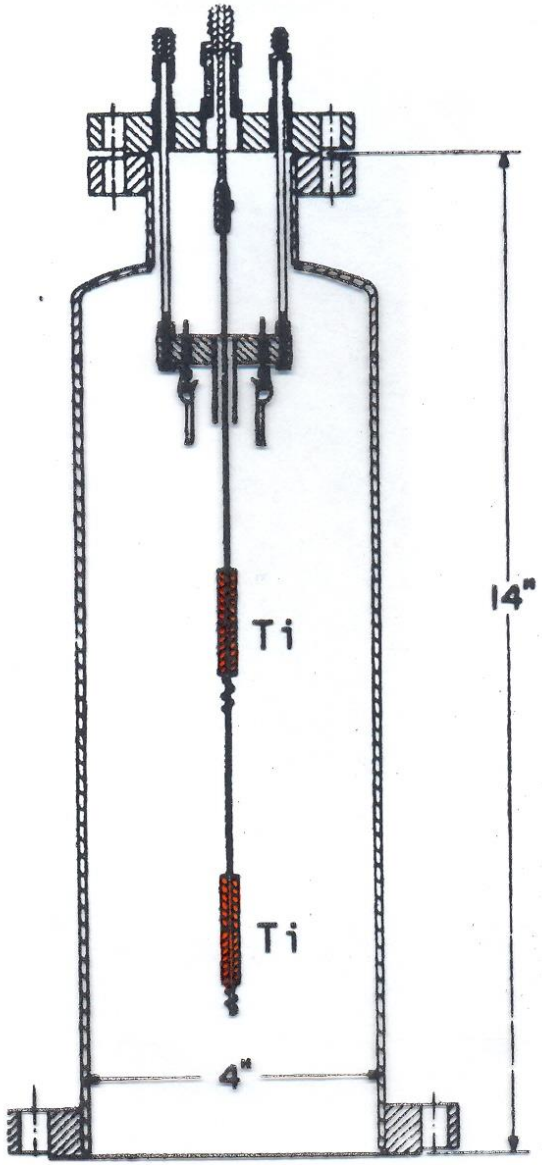
(ROTOR)

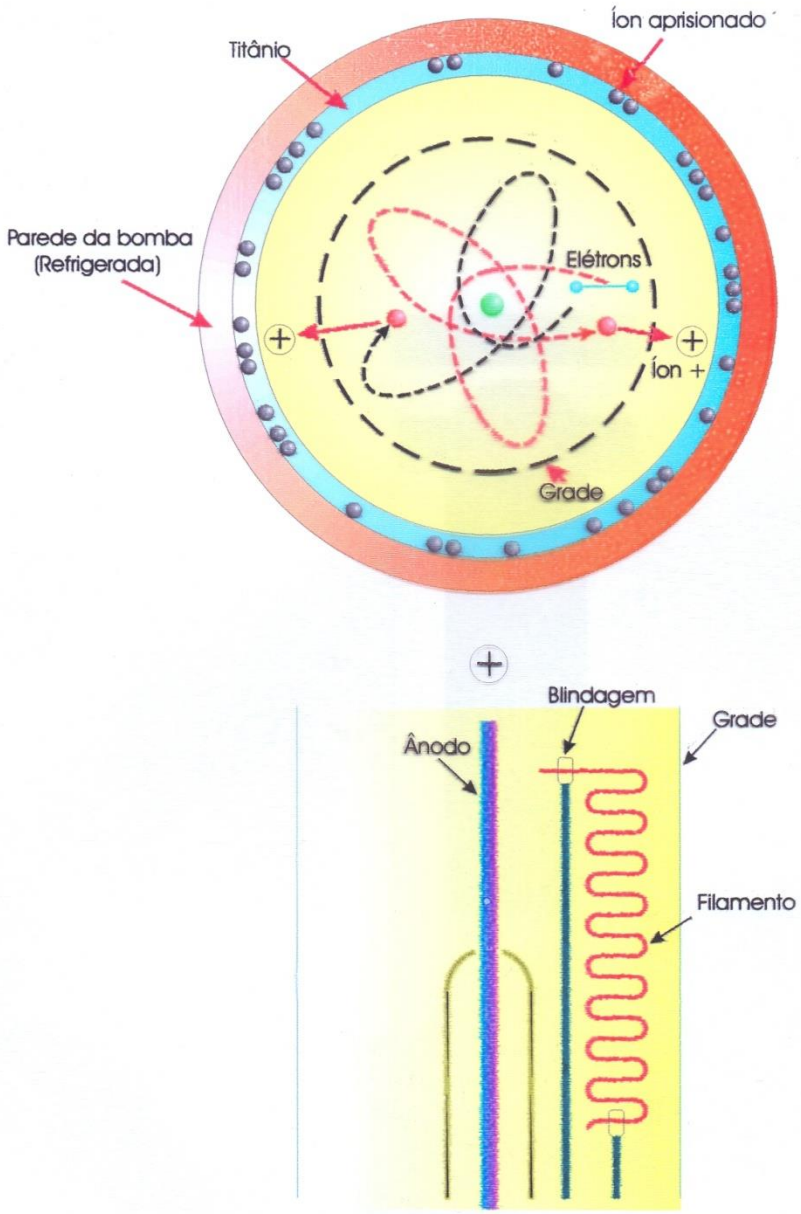



VÁCUO
MECÂNICA ROTATIVA (ÓLEO)
ROOTS
DIFUSÃO
(ÓLEO)
TURBOMOLECULAR
SORPÇÃO
SUBLIMAÇÃO DE Ti
Ti
N
S
Ti
MAGNÉTICA
GÁS HÉLIO
CRIOGÊNICA
IÔNICA (ÓRBITRON)
ATMOSFERA

BOMBA IÔNICA

ÓRBITRON

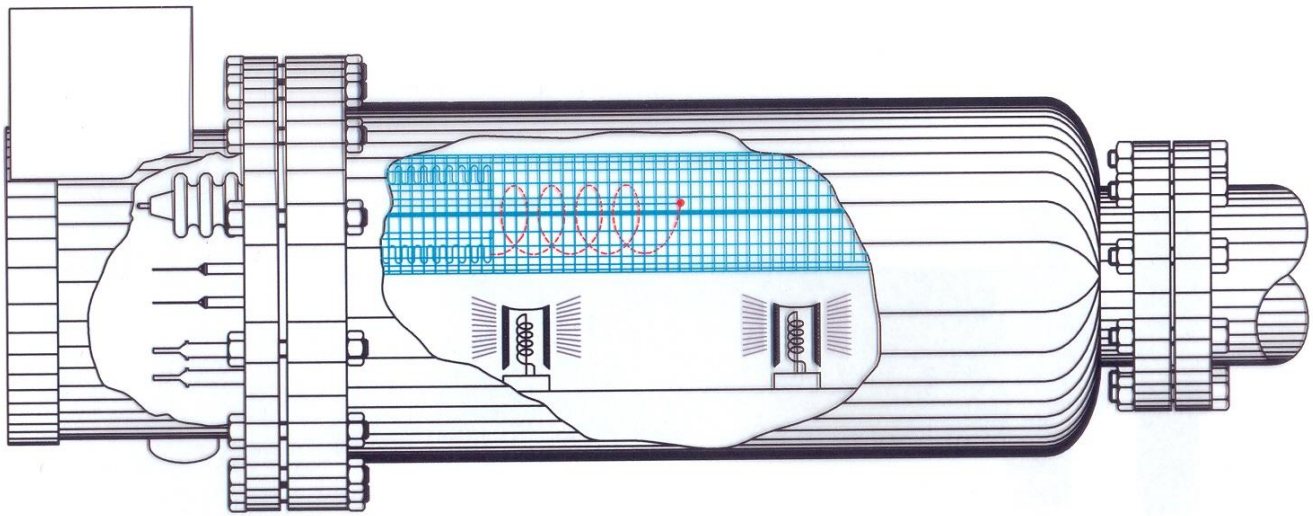


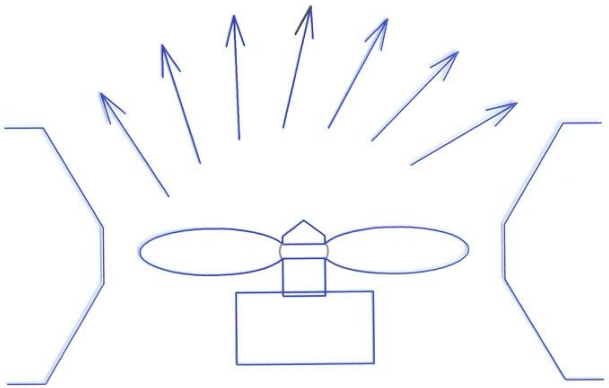

Íon aprisionado
Titânio
Parede da bomba
(Refrigerada)
Elétrons
Íon +
Grade
Blindagem
Grade
Ânodo
Filamento

NEC GETTER-ION PUMP

MODEL 4DG4-3 (4" Inlet, 400 l/s)

MODEL 4DI4-3 (6" Inlet, 800 l/s)

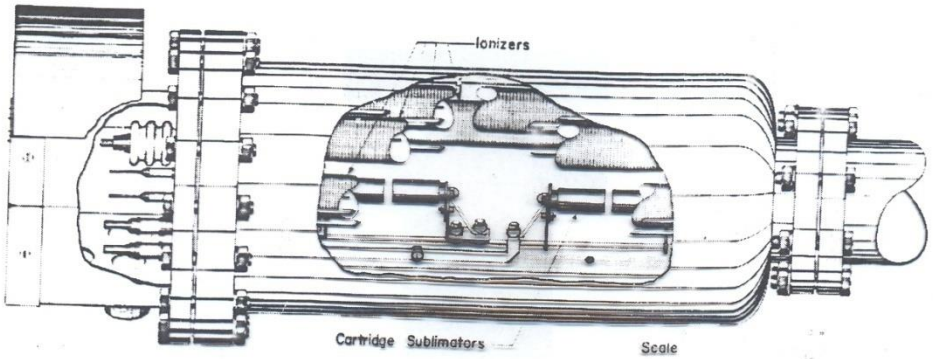


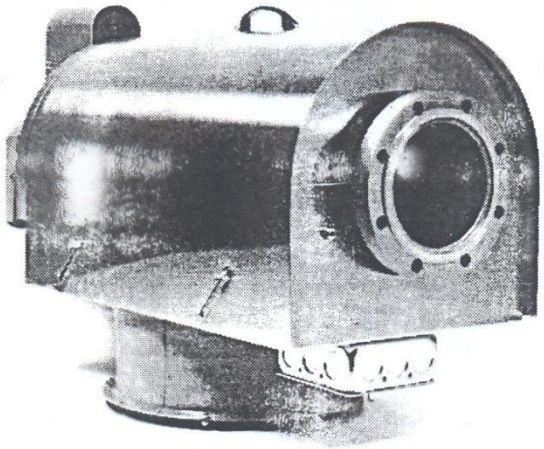


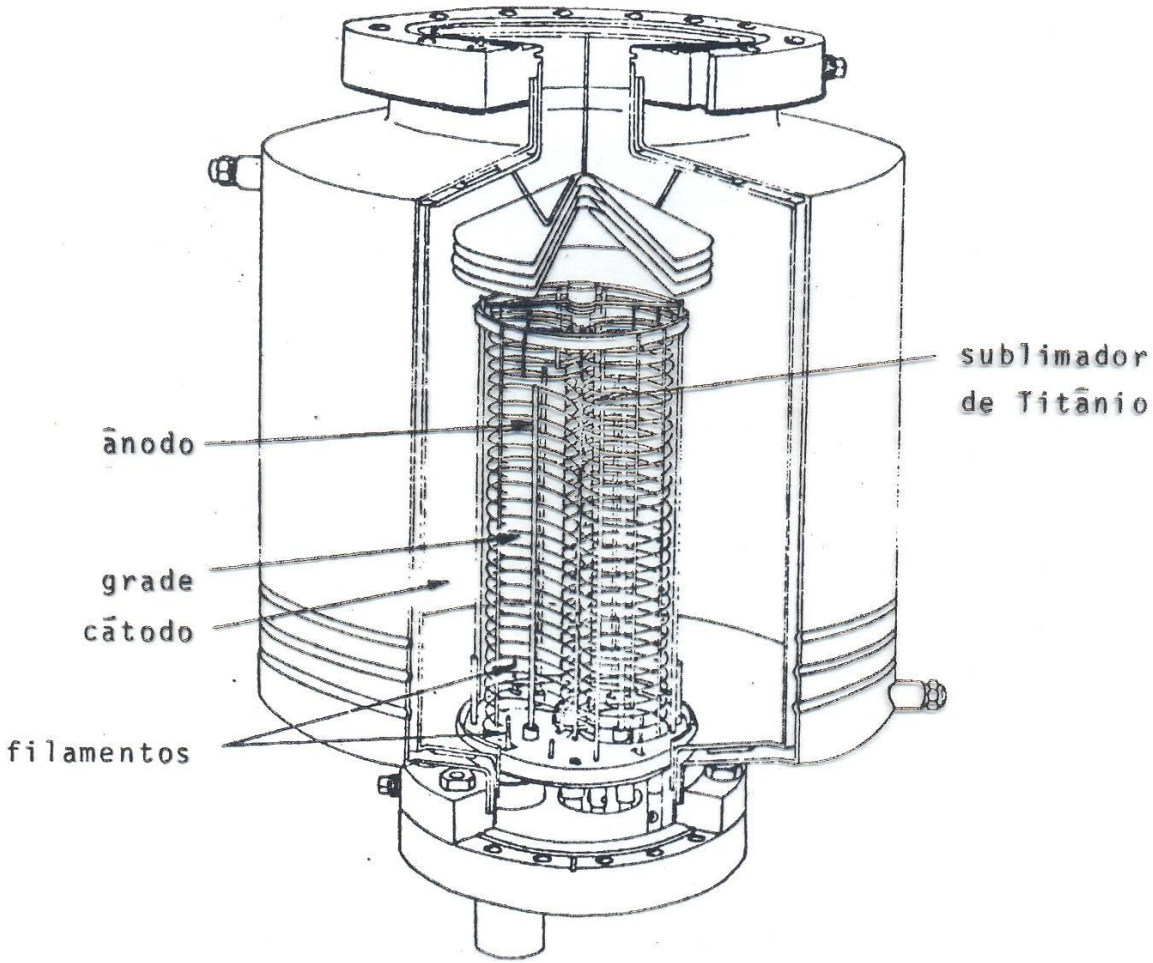
NEC GETTER-ION PUMP

MODEL 4DG4-3 (4" Inlet, 400 l/s)

MODEL 4DI4-3 (6" Inlet, 800 l/s)

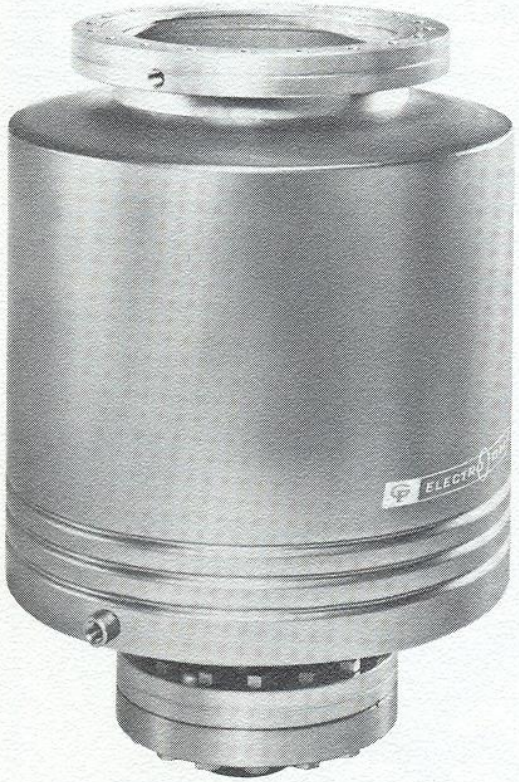


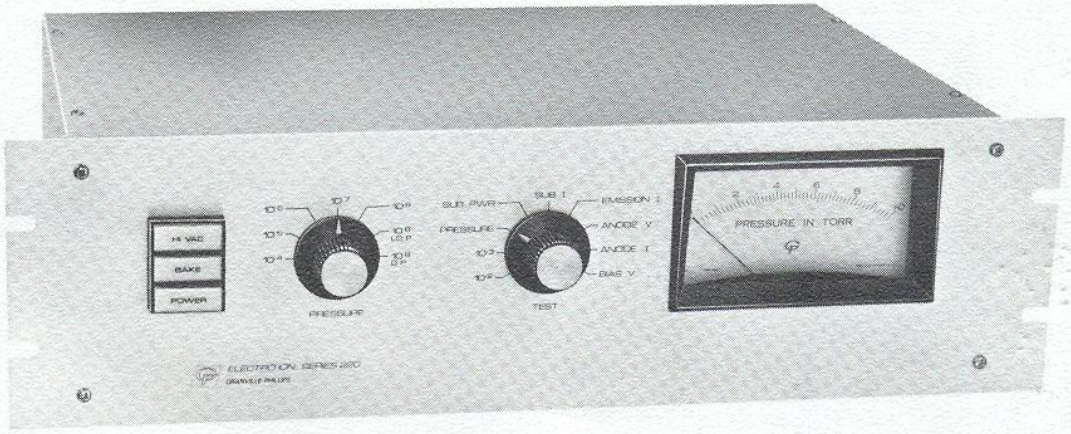




Bomba Iônica do tipo "getter-ion" (tríodo). Dão quatro órbitrons com grade polarizada circundando um único sublimador central, independente (Granville-Philips)

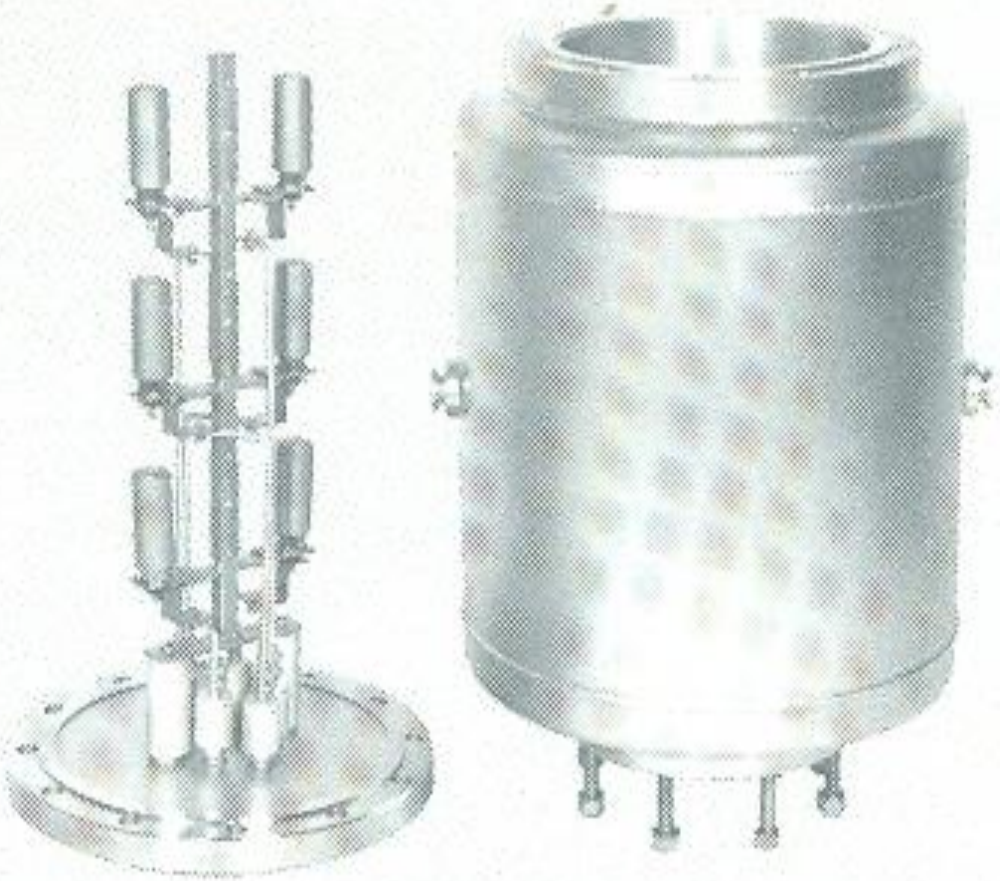
Electro Ion®
Vacuum Pump
Series 220





BOMBA DE

TITÂNIO



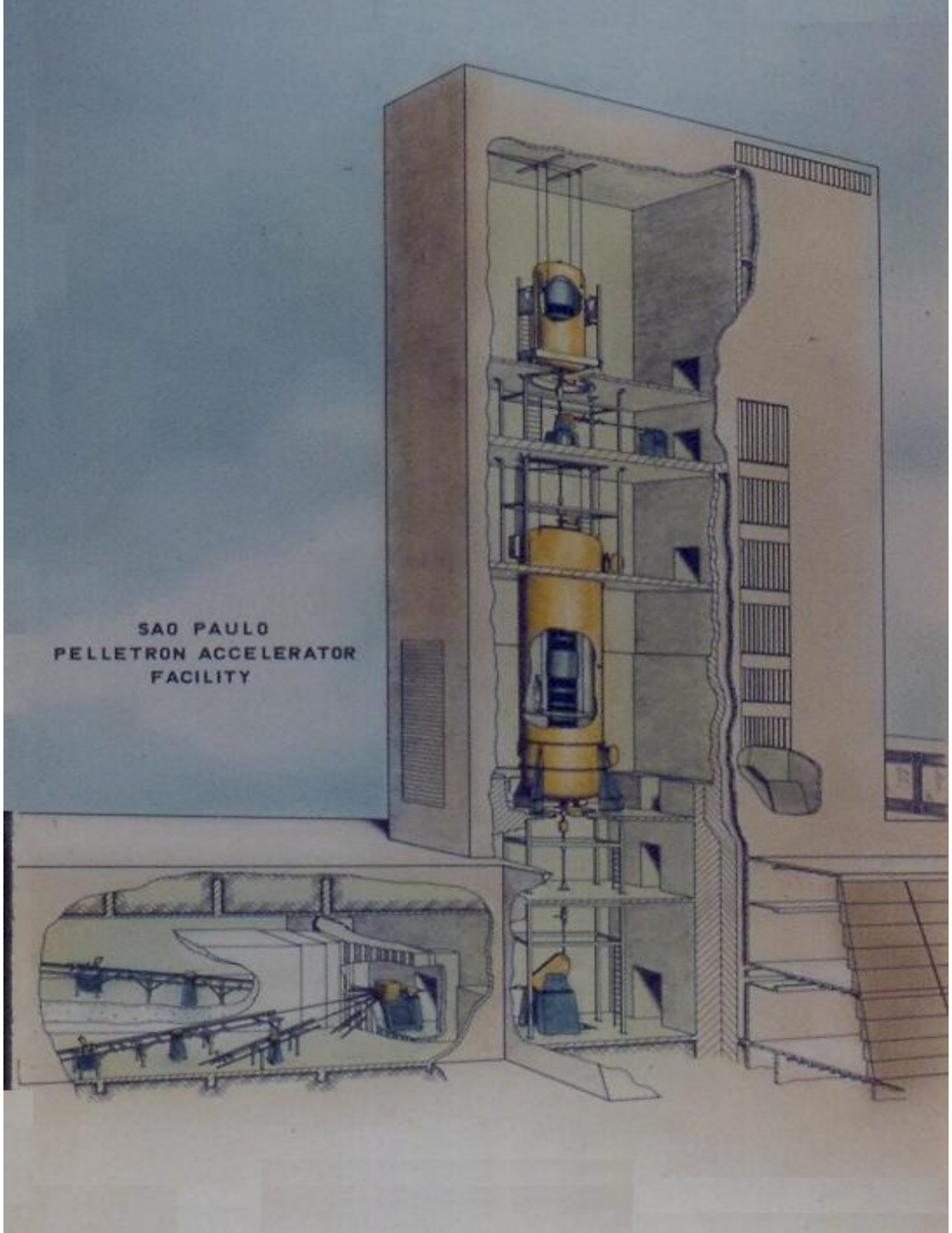
Model 6DGO-2

Features inverted feedthroughs to accommodate minimum length constraint. Used to handle ion source gas efflux in 3UH-HC Pelletron accelerator.

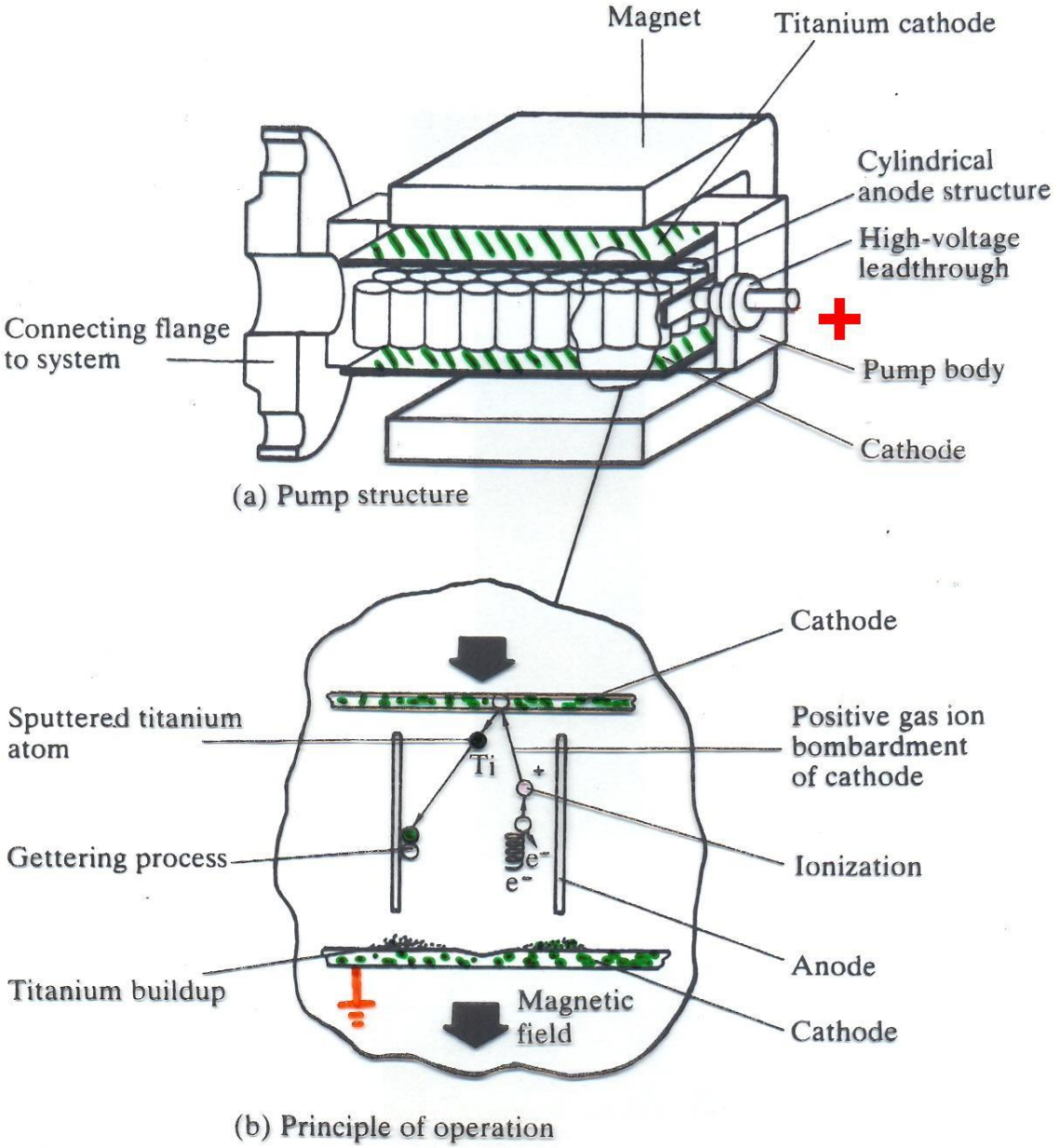
BOMBA DE SUBLIMAÇÃO DE TITÂNIO

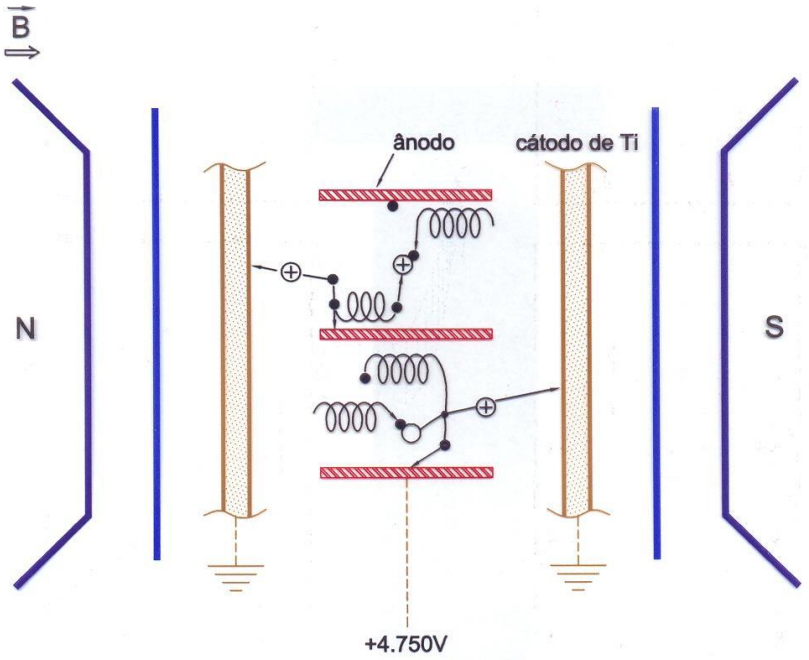
DURAÇÃO DOS FILAMENTOS DE TITÂNIO (SUBLIMÁVEIS):

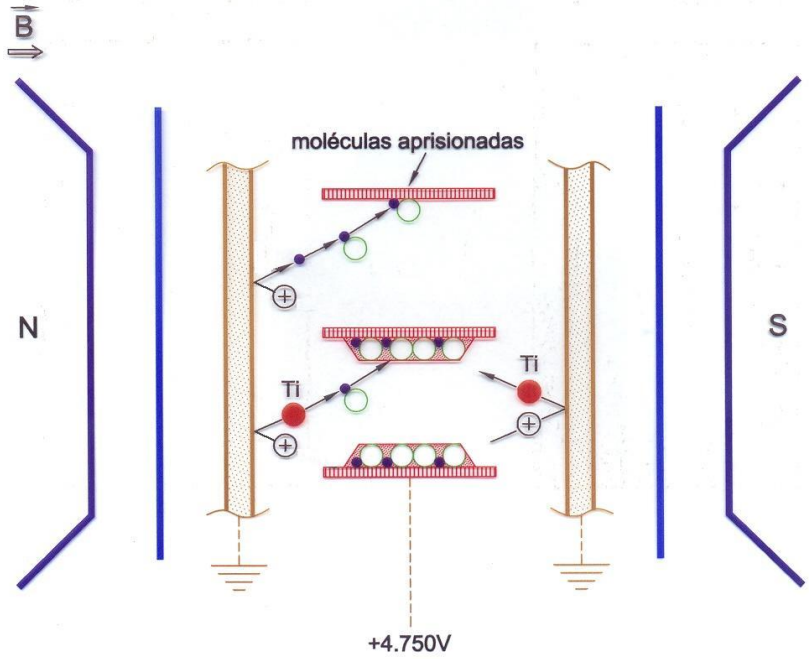
10E03 Torr	**DIAS**
10E06 Torr	**SEMANAS**
10E07 Torr	**MESES**
10E08 Torr	**ANOS**

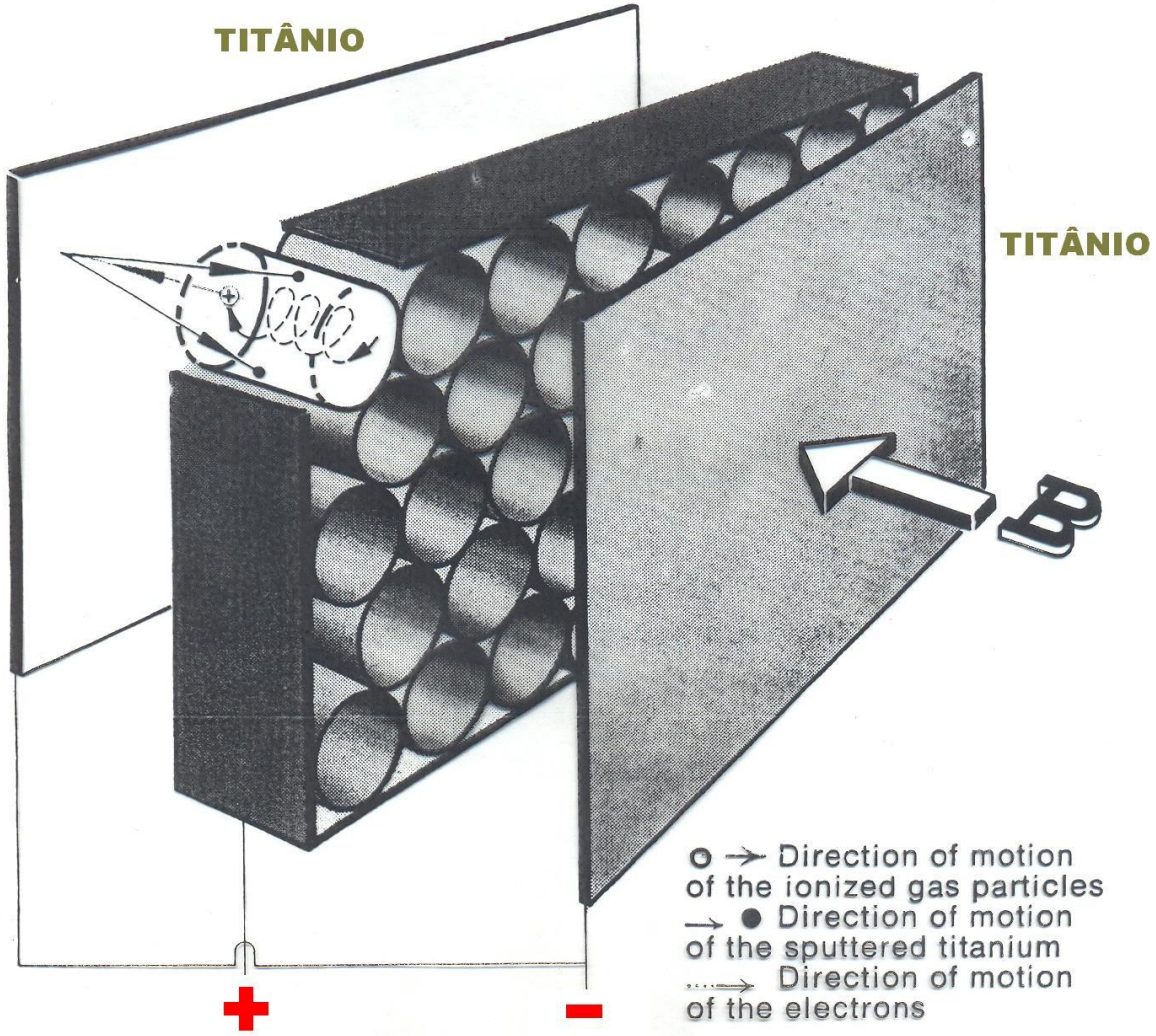

SAO PAULO
PELLETRON ACCELERATOR
FACILITY

BOMBA IÔNICA MAGNÉTICA



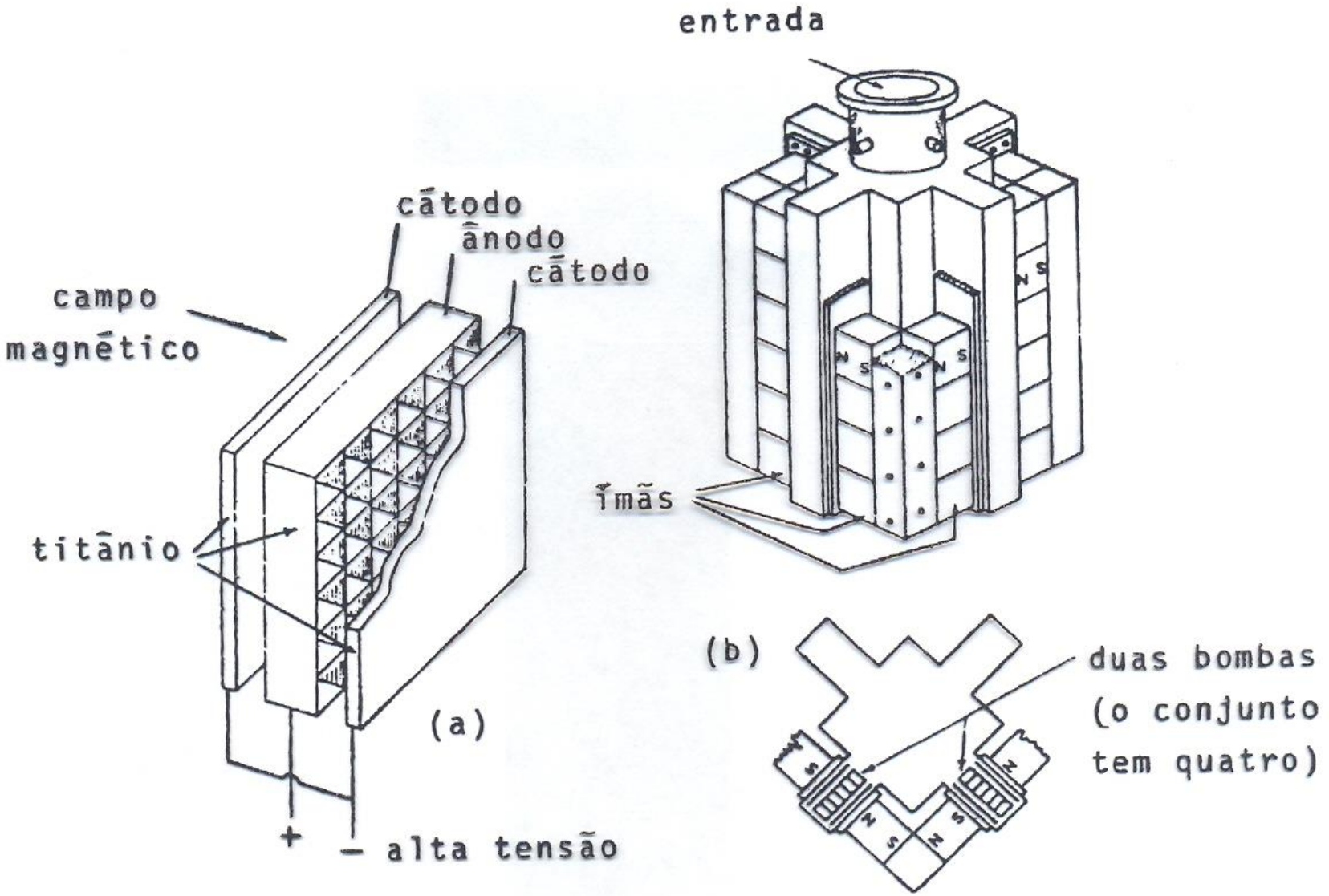

B
ânodo
cátodo de Ti
N
S
+4.750V

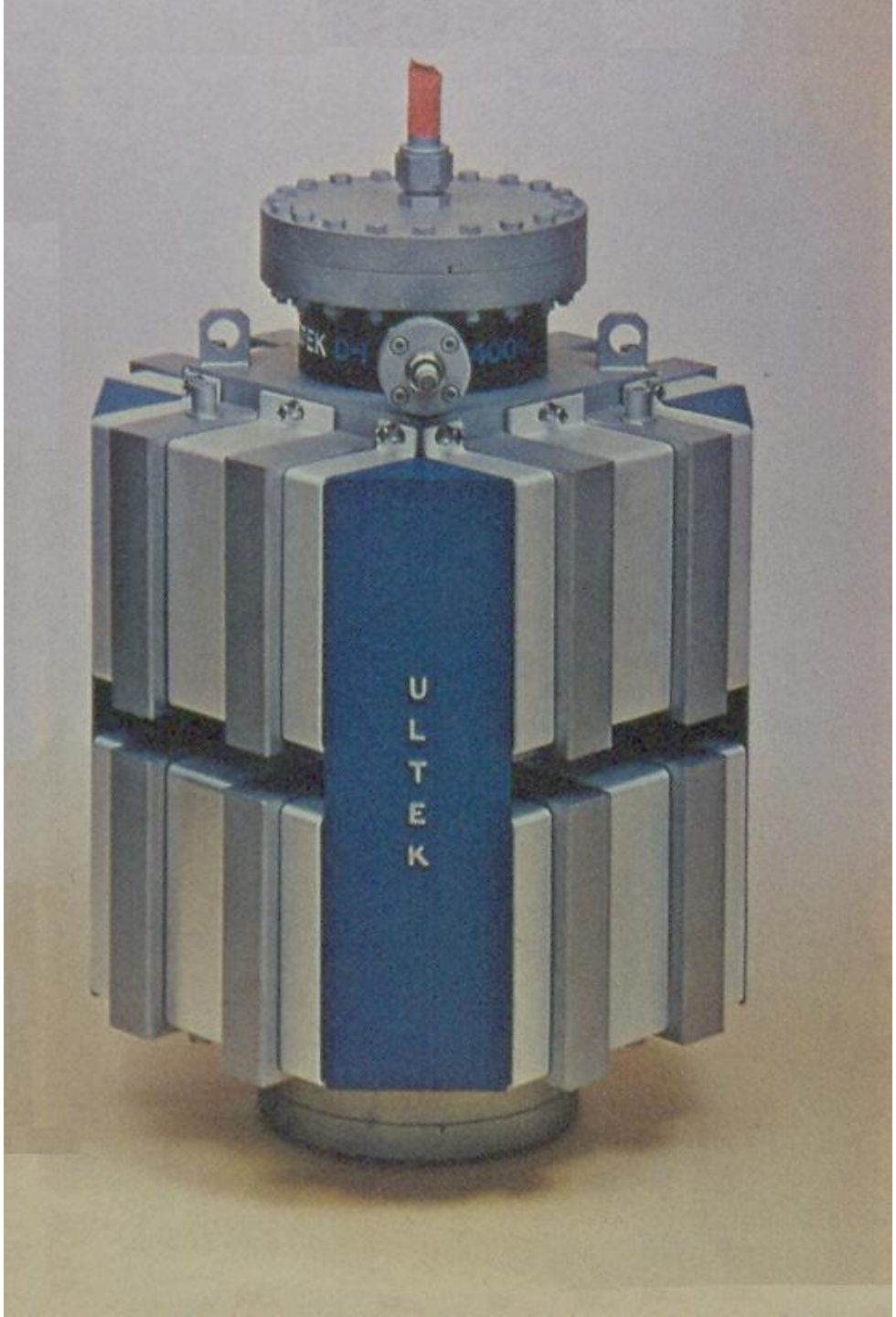

B
moléculas aprisionadas
N
S
Ti
Ti
+4.750V

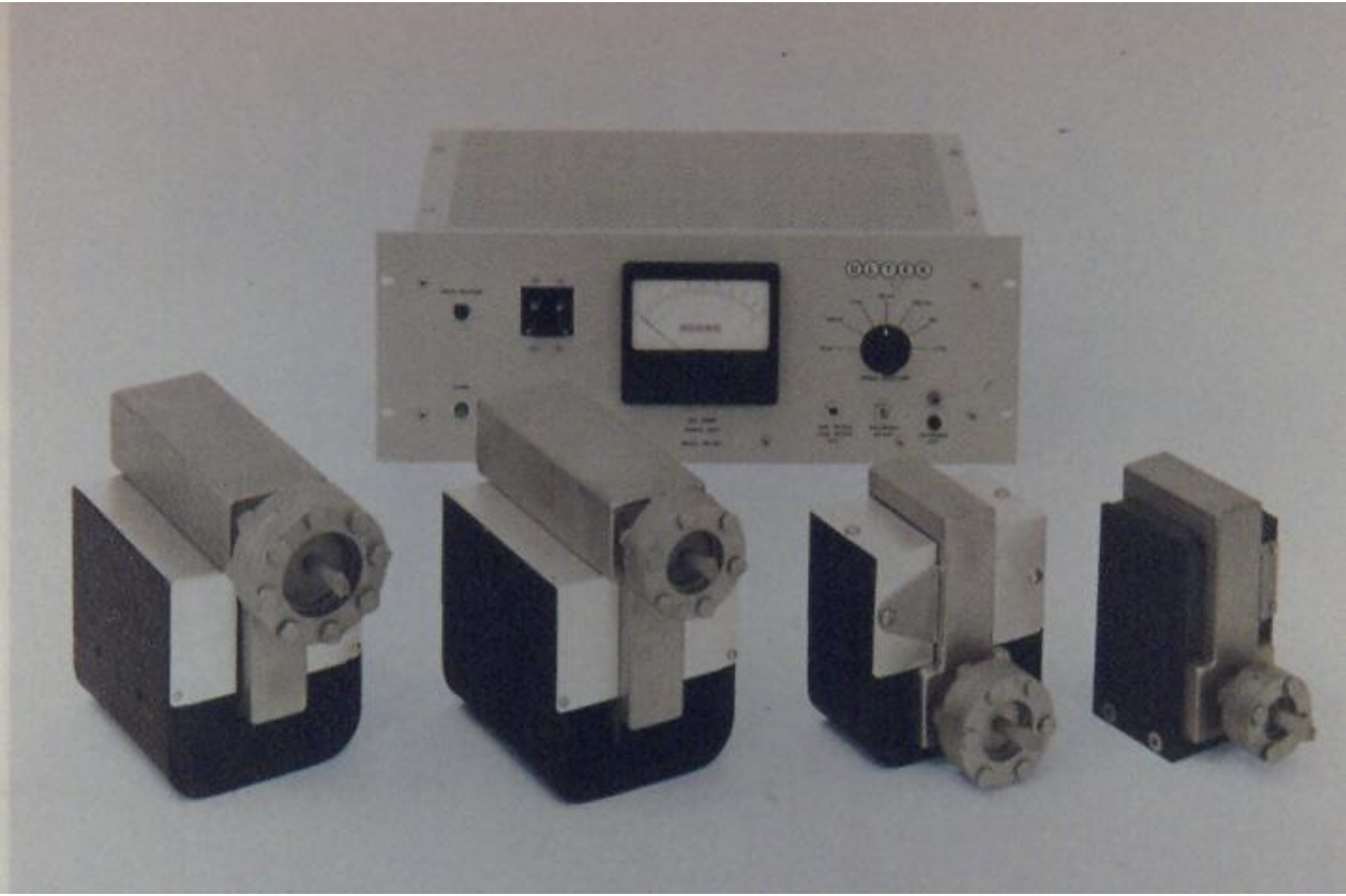


Mode of action of the sputter-ion pump

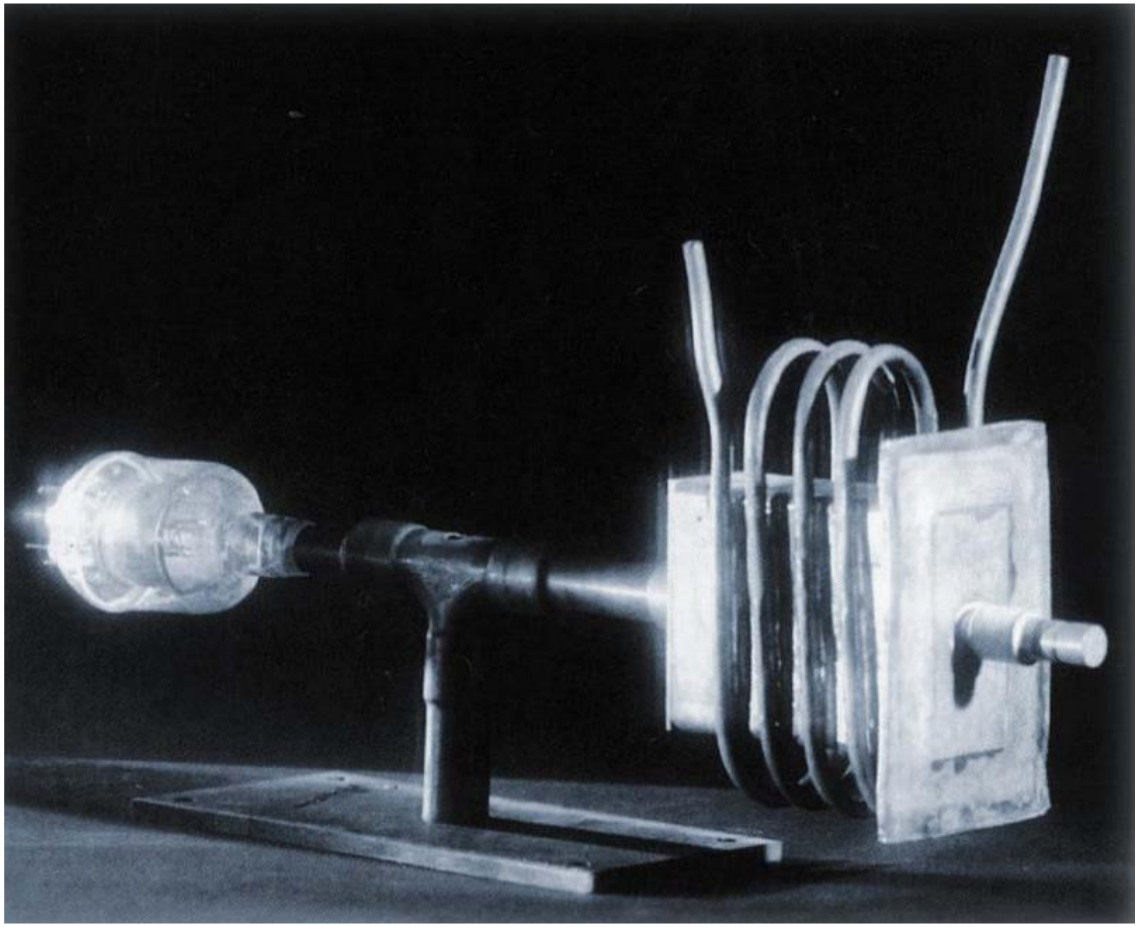
BOMBA IÔNICA MAGNÉTICA



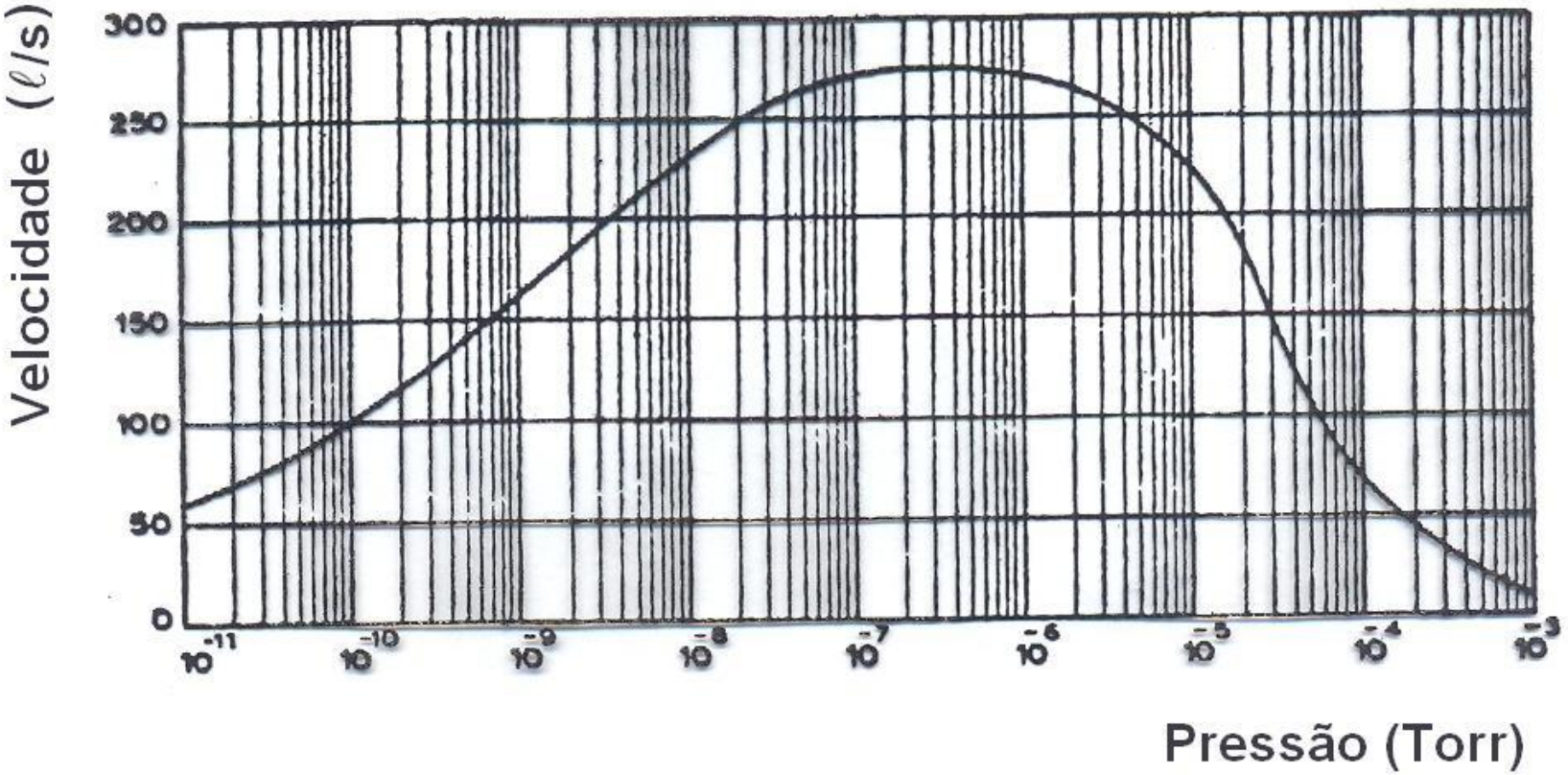

ULTEK

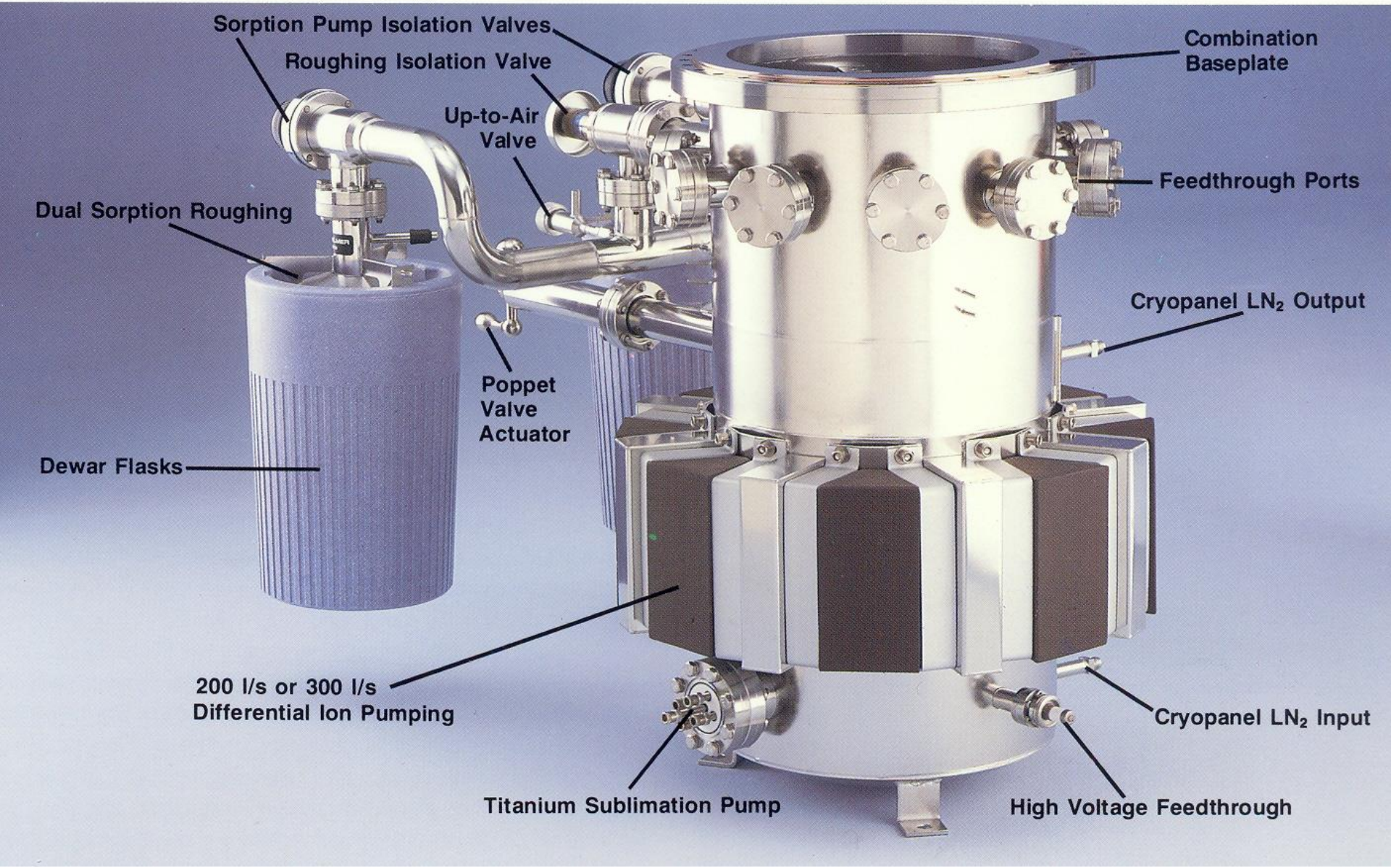


PRIMEIRA BOMBA IÔNICA VARIAN

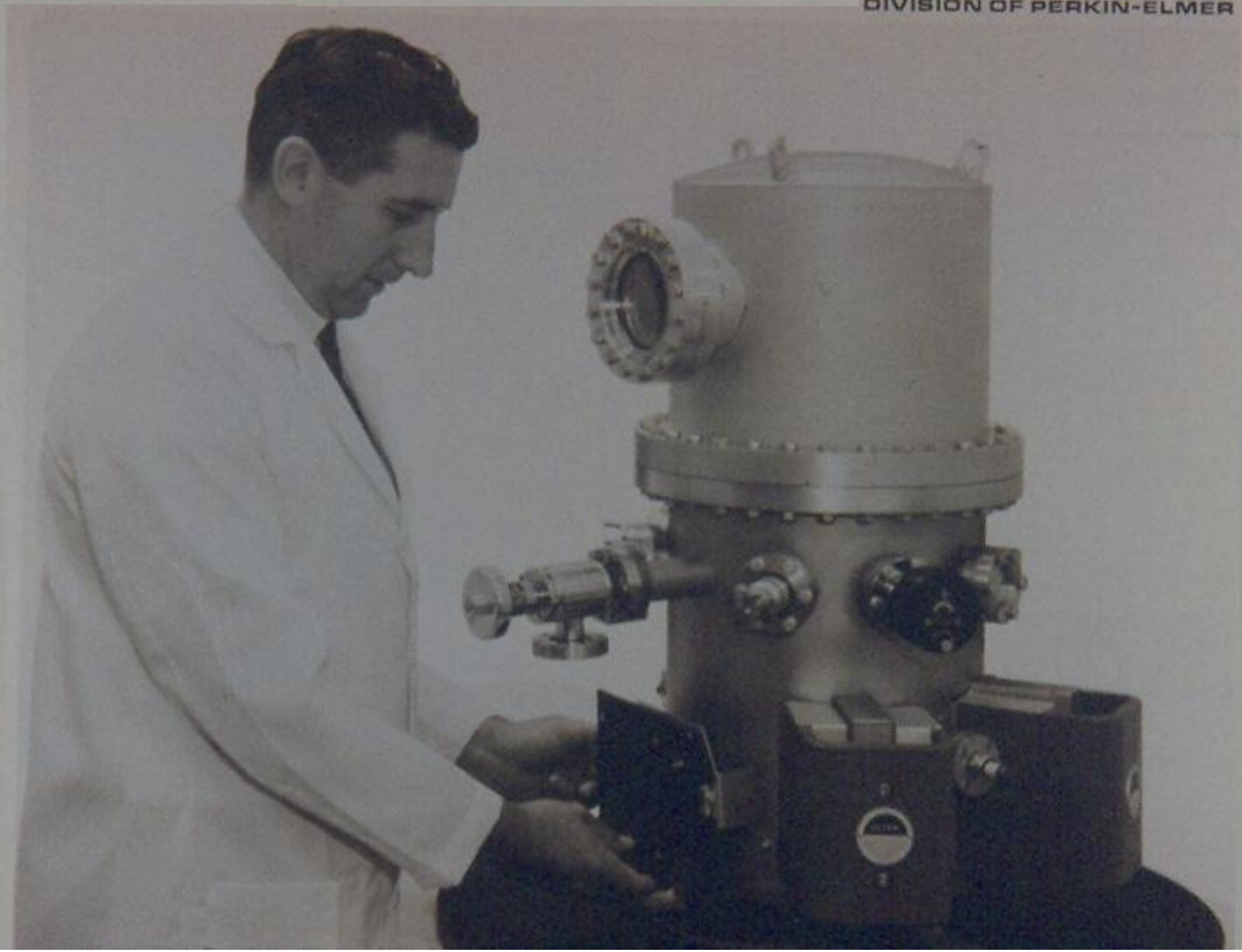



PERKIN-ELMER
Vacuum Products
ION PUMP CONTROL
(DUAL VOLTAGE)
amp hour
200nA
2mA
200μA
20μA
200mA
1 AMP
TORR
10KV
RANGE
PERKIN ELMER
Vacuum Products

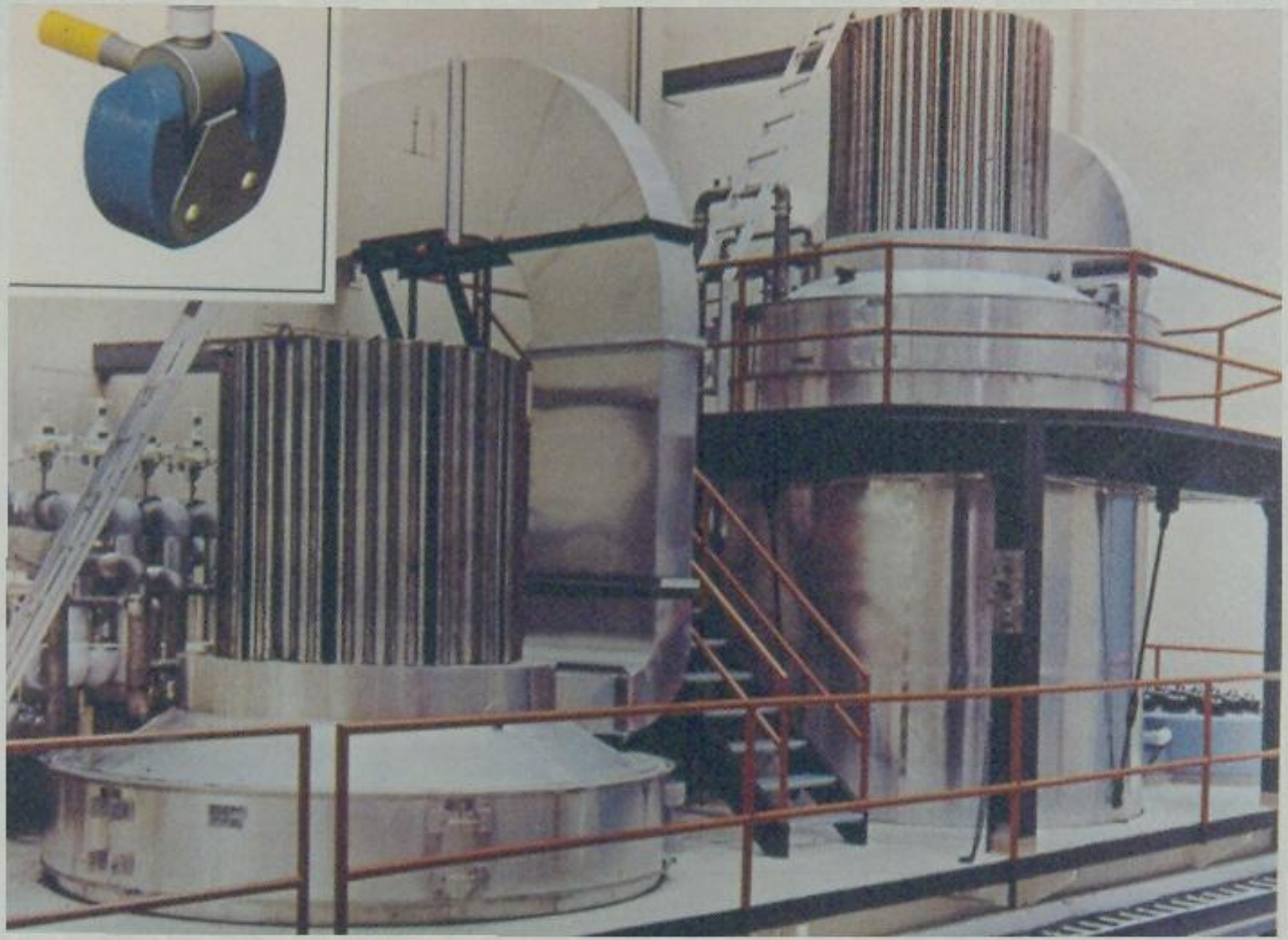

Velocidade (ℓ/s)
300
250
200
150
100
50
0
10^-11
10^-10
10^-9
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
Pressão (Torr)

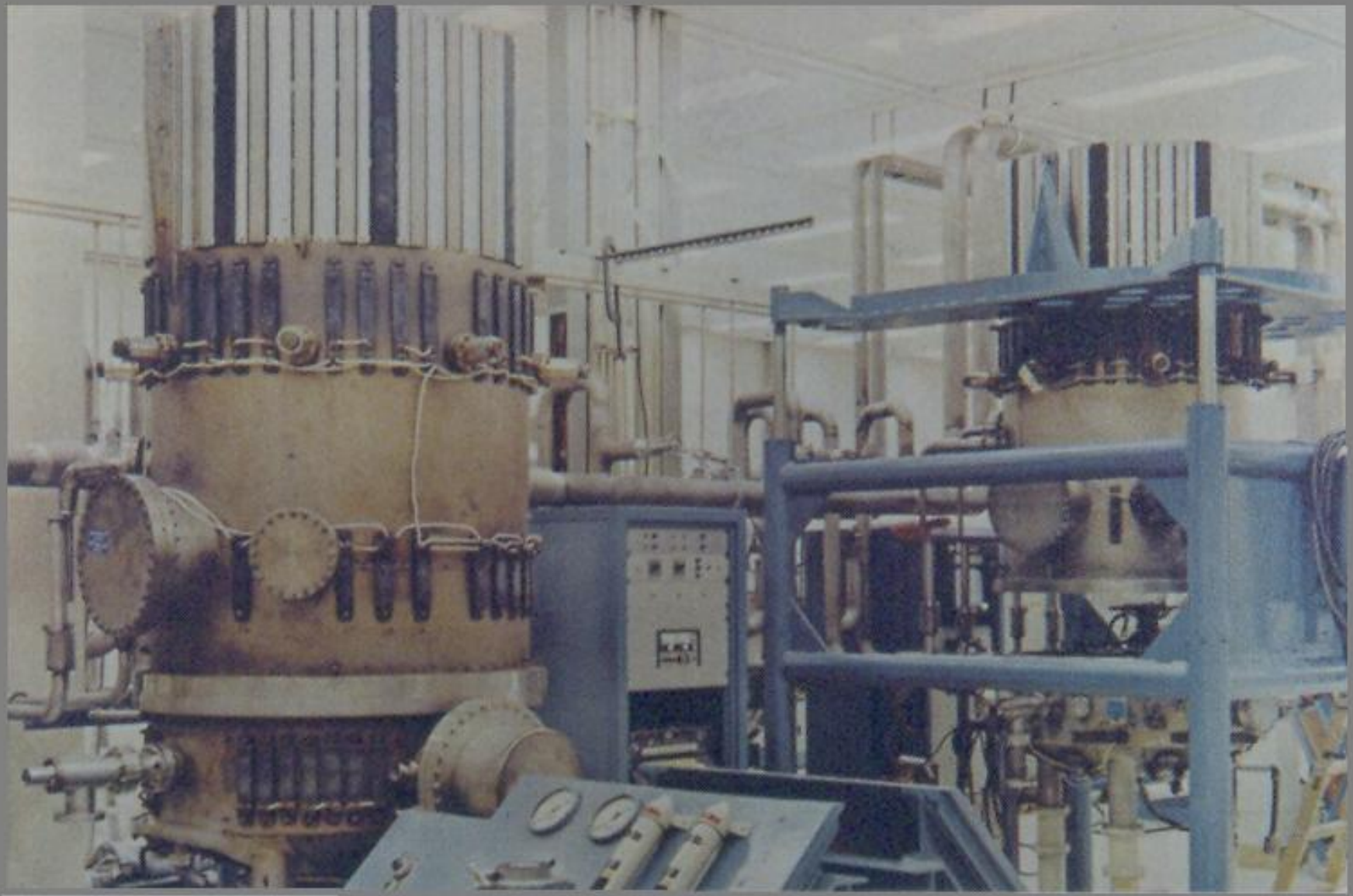

Sorption Pump Isolation Valves
Roughing Isolation Valve
Up-to-Air Valve
Combination Baseplate
Feedthrough Ports
Dual Sorption Roughing
Cryopanel LN_2 Output
Poppet Valve Actuator
Dewar Flasks
200 l/s or 300 l/s Differential Ion Pumping
Cryopanel LN_2 Input
Titanium Sublimation Pump
High Voltage Feedthrough

DIVISION OF PERKIN-ELMER

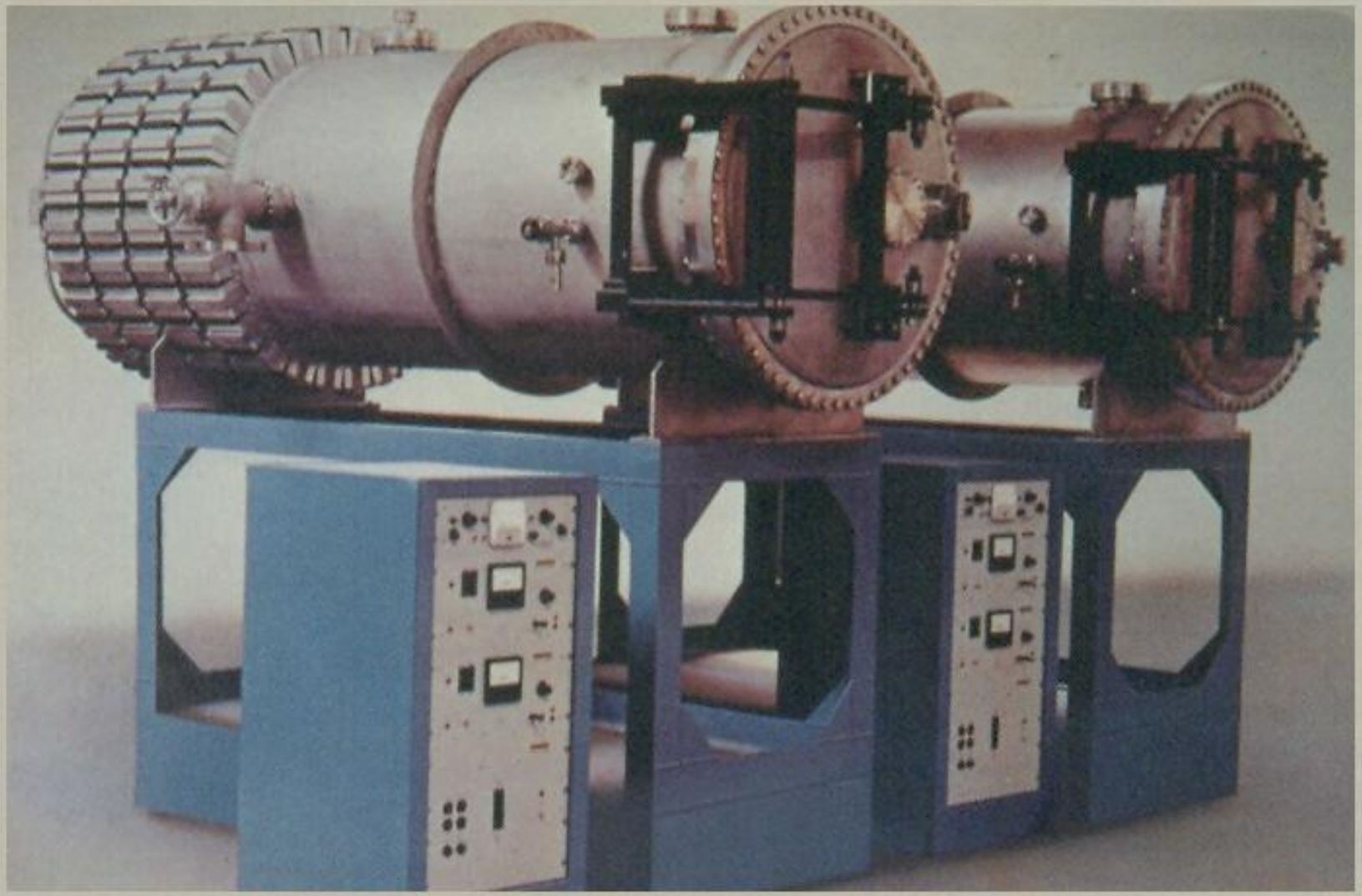


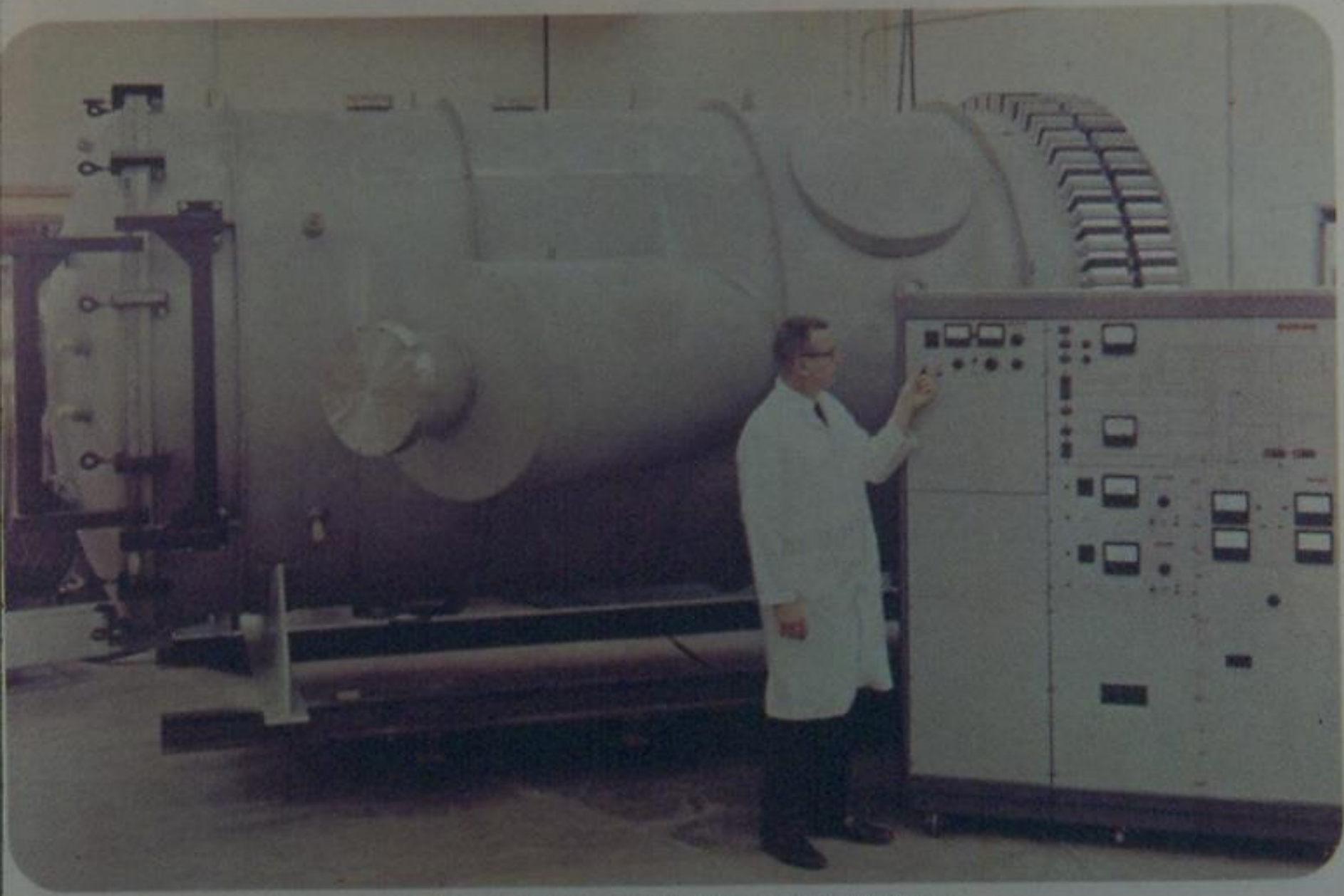
3.





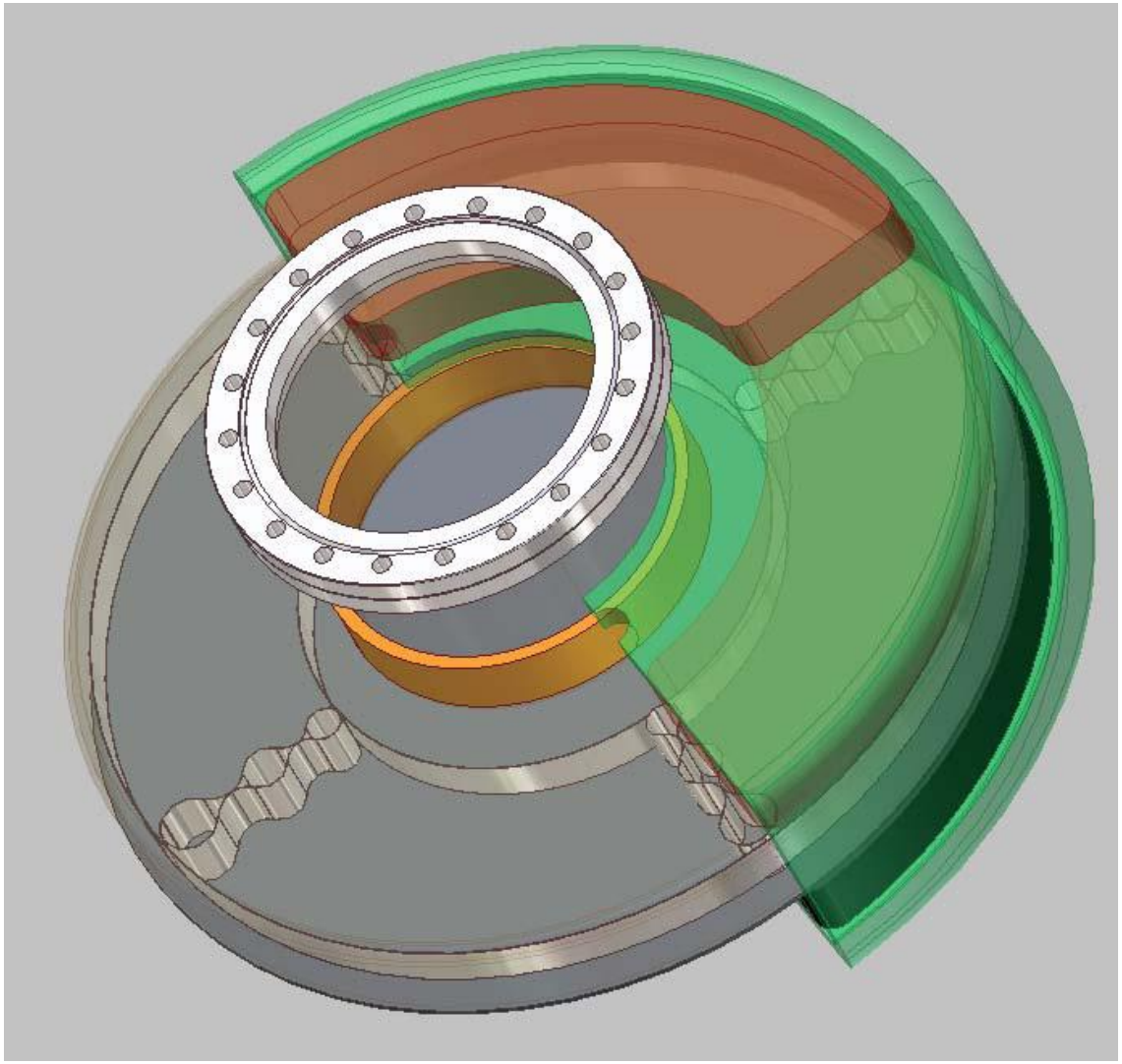
' dia. x 6' chamber for material evaluation and bearing testing: 10^{-12} torr ultimate pressure.



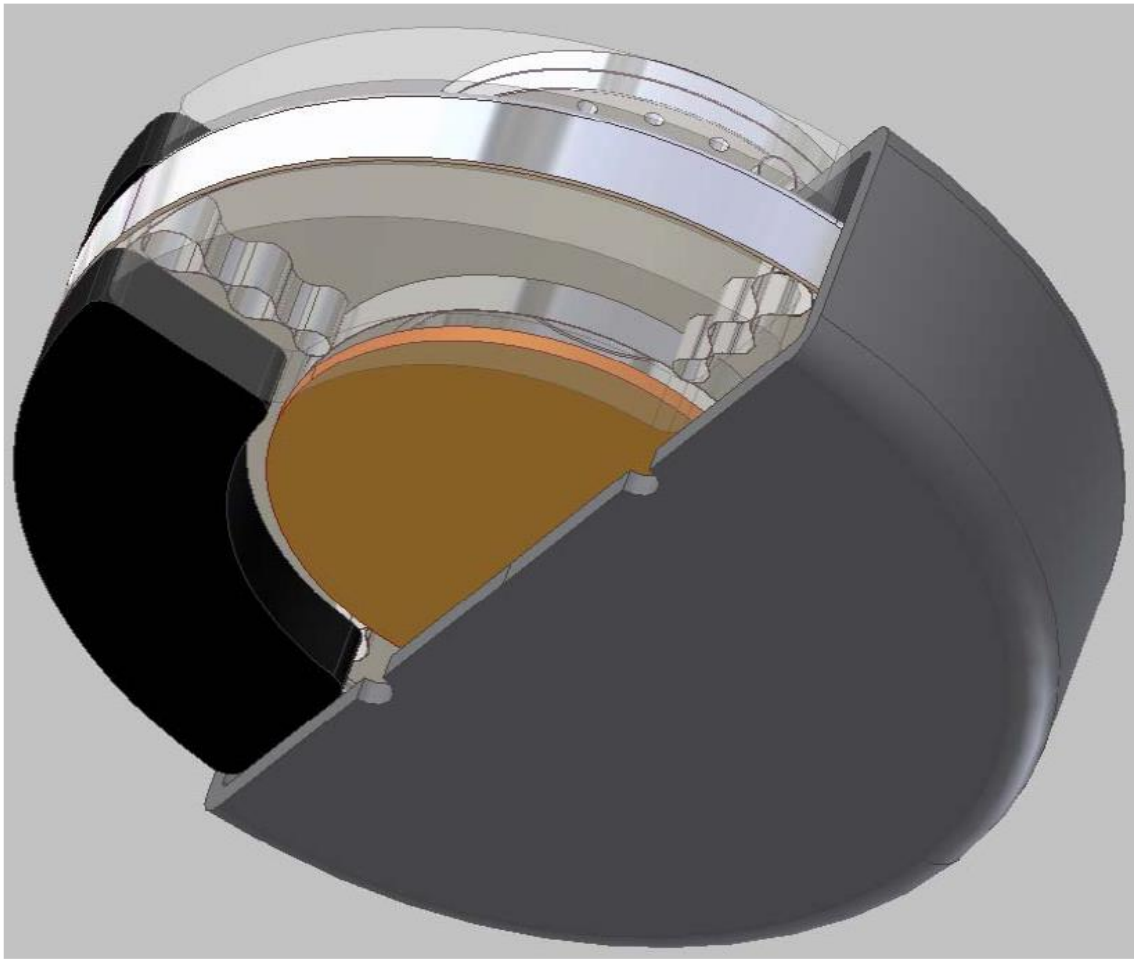


6½' dia. x 15' chamber for testing components and sub-assemblies of satellites; ultimate pressure 5×10^{-10} torr.

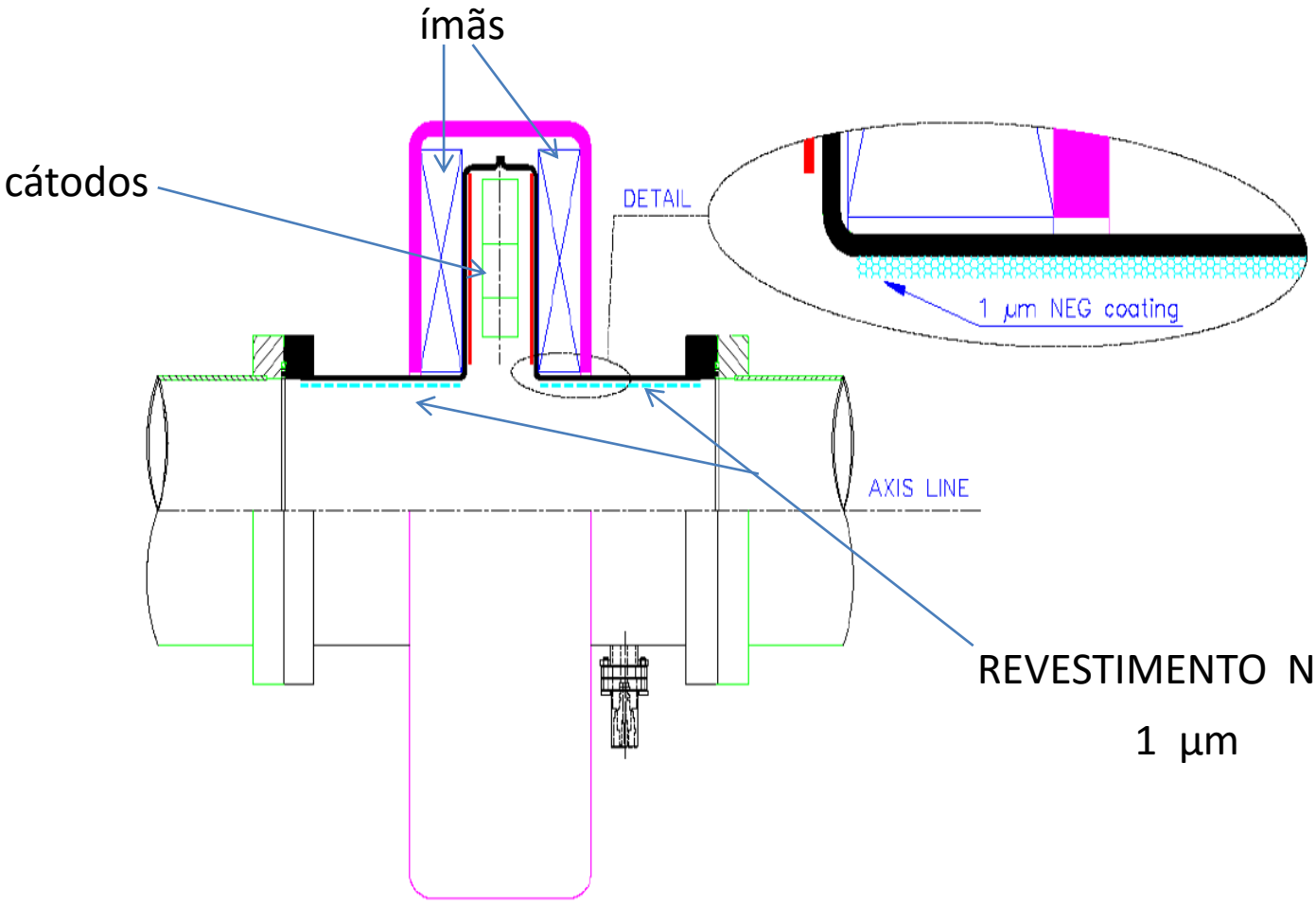
BOMBA IÔNICA RIP (ROUND ION PUMP)



BOMBA IÔNICA RIP - VISTA INFERIOR



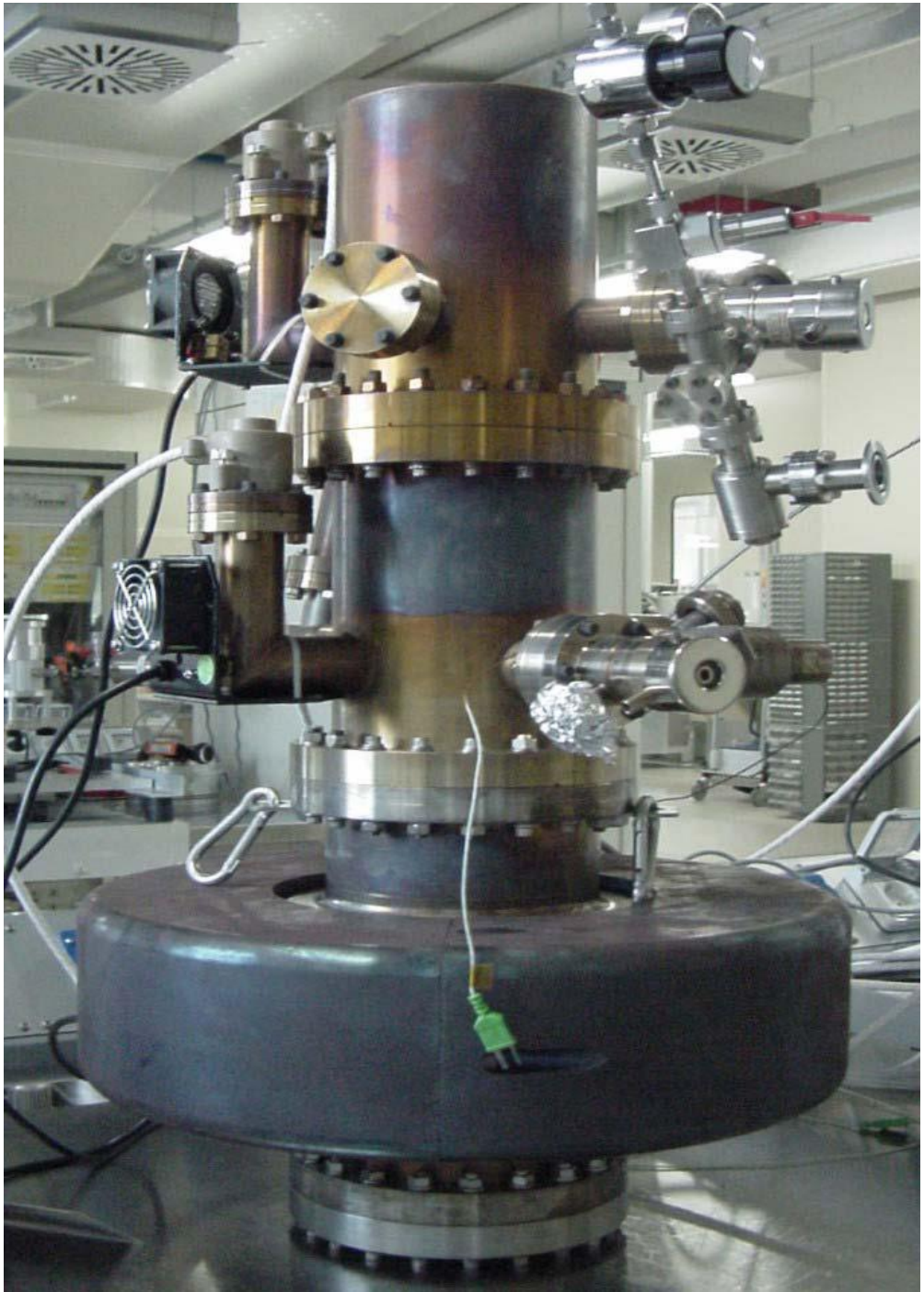
BOMBA IÔNICA RIP + NEG



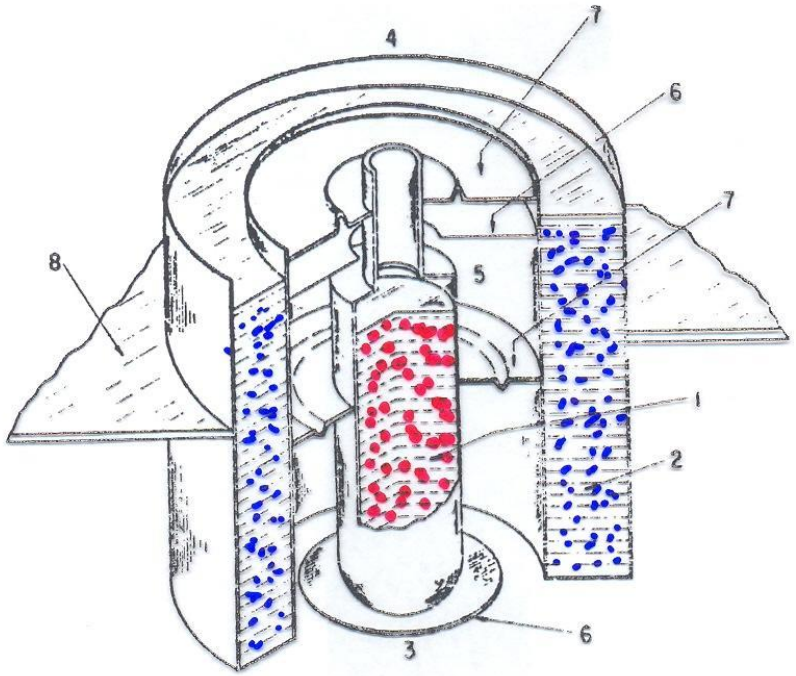
BOMBA IÔNICA RIP

+ NEG (Zr + V + Ti 1µm)

+ Paládio (150 nm)



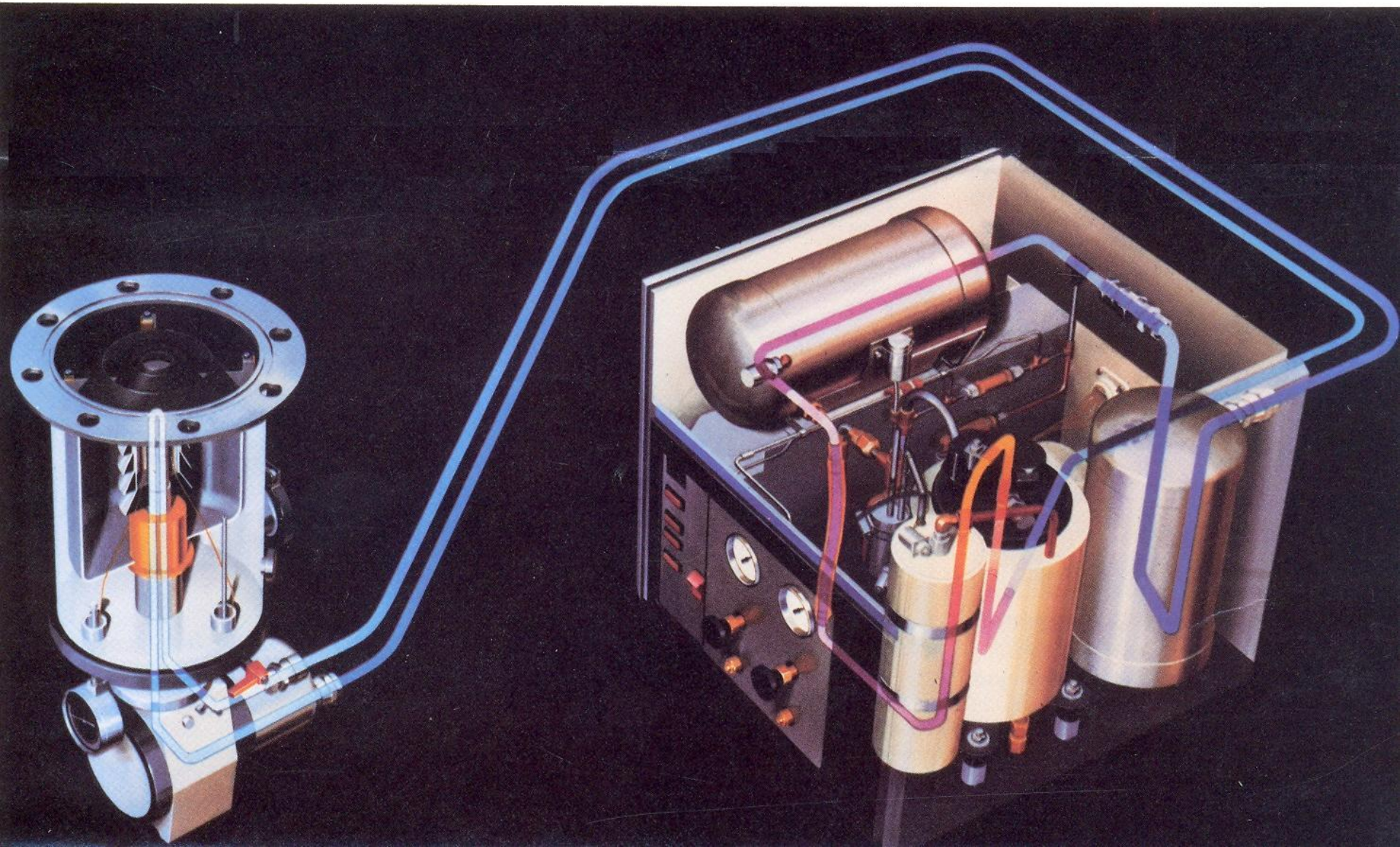
BOMBA CRIOGÊNICA

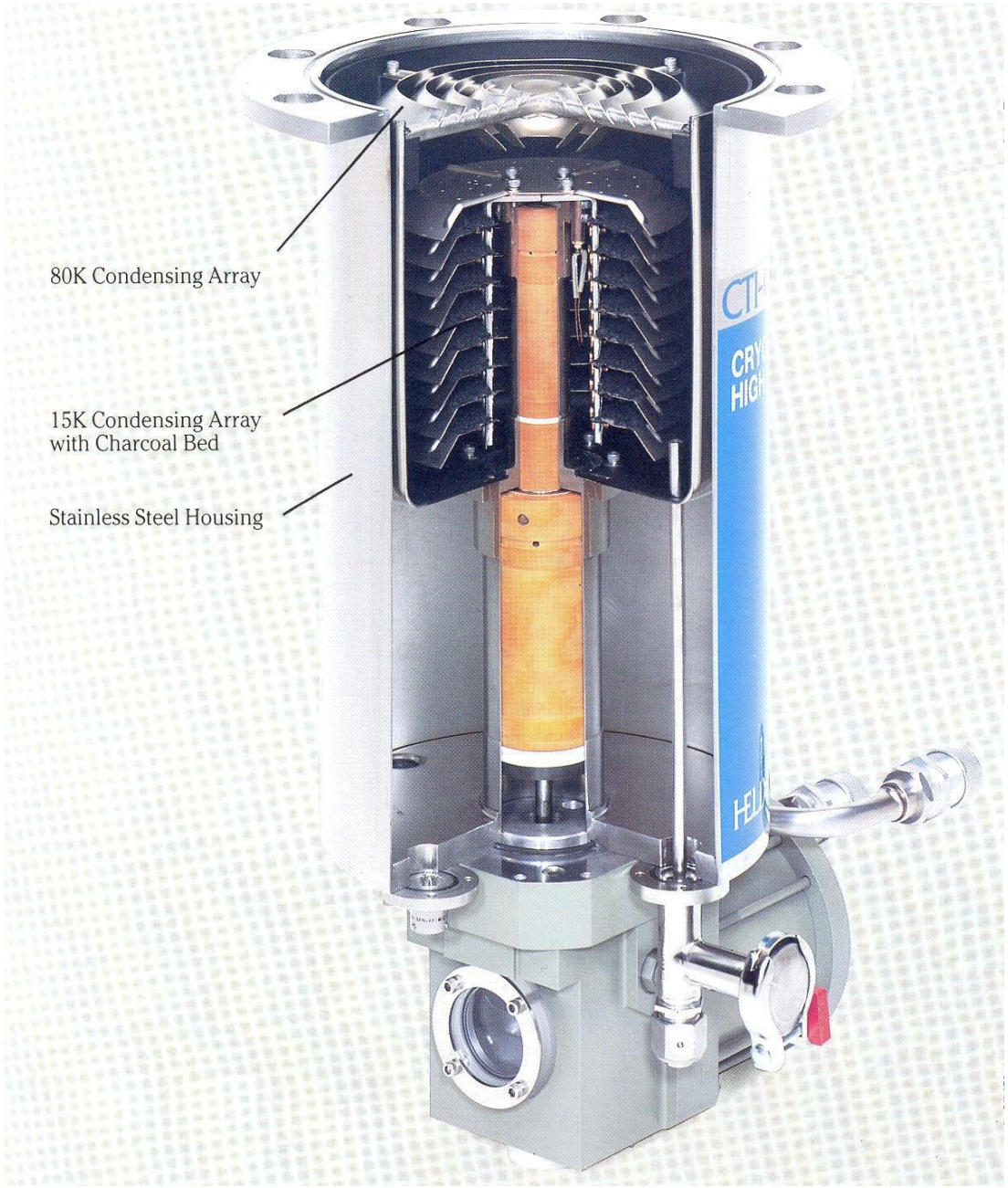


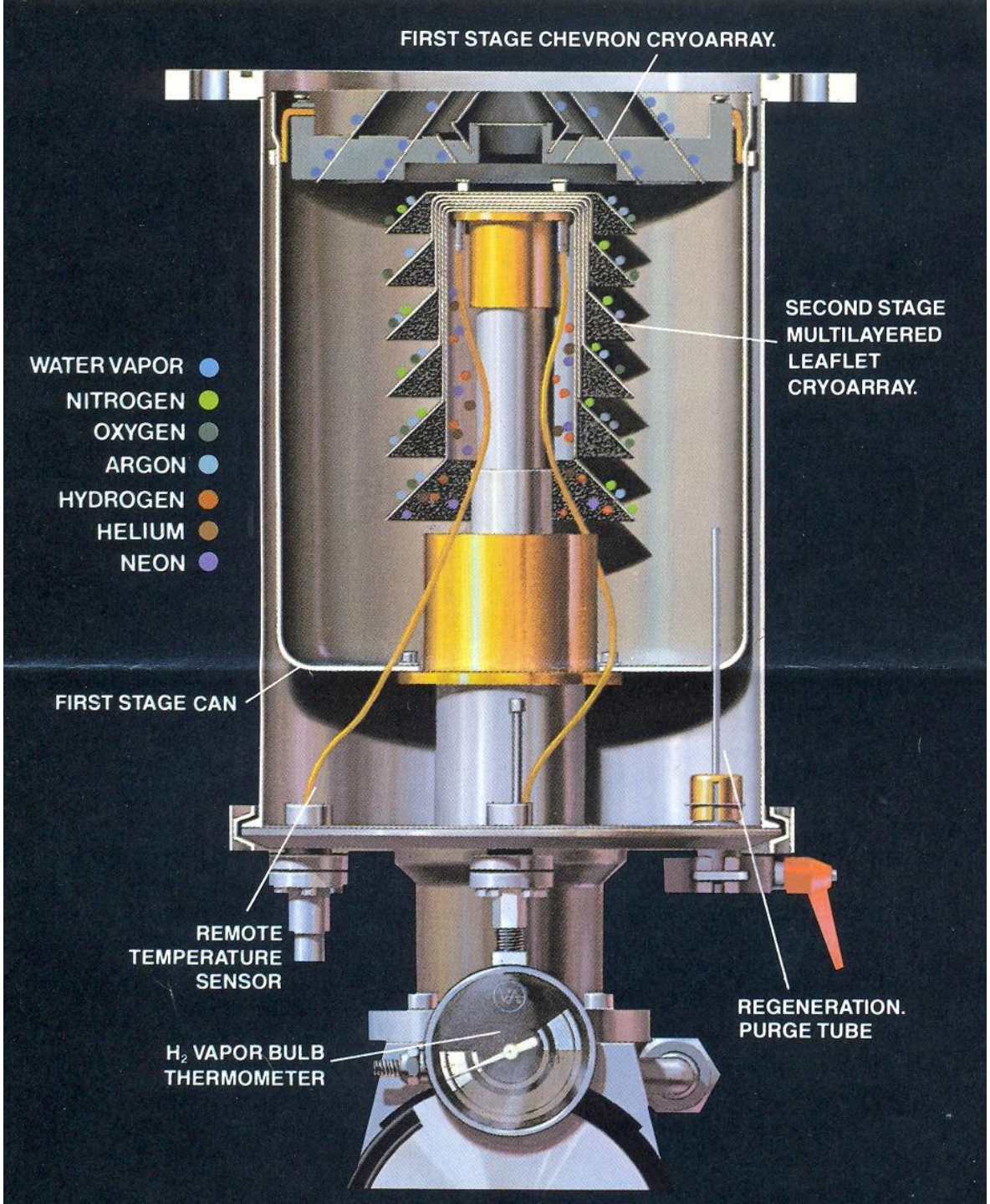
Desenho esquemático de uma bomba criogênica.

1 - Hélio líquido •
2 - Nitrogênio líquido •
3 - Região de ultra-alto vácuo
4 - Pressão atmosférica
5 - Região de vácuo (isolada)
6 - Refletor de calor
7 - Separador
8 - Parede da câmara (onde está instalada a bomba)

BOMBA CRIOGÊNICA




80K Condensing Array
15K Condensing Array
with Charcoal Bed
Stainless Steel Housing


FIRST STAGE CHEVRON CRYOARRAY.
SECOND STAGE MULTILAYERED LEAFLET CRYOARRAY.
WATER VAPOR
NITROGEN
OXYGEN
ARGON
HYDROGEN
HELIUM
NEON
FIRST STAGE CAN
REMOTE TEMPERATURE SENSOR
REGENERATION. PURGE TUBE
H_2 VAPOR BULB THERMOMETER


C
B
D
A

Ø da flange	Varian VK-12C 8"	Edwards CRP8 8"
água	4.100 l/s	4.200 l/s
ar	1.050 l/s	1.150 l/s
argônio	950 l/s	1.050 l/s
hidrogênio	1.150 l/s	1.400 l/s
nitrogênio	1.050 l/s	-
hélio	-	750 l/s
potência	1,8 kW	1,8 kW