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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INTERNATIONAL CENTRE FOR SCIENCE AND HIGH TECHNOLOGY

H4.SMR/540-9

Second Training College on Physics and Technology of Lasers and Optical Fibres

21 January - 15 February 1991

GAS LASERS II

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Sealed-off Laser

Problem: Dissociation

Products CO, O_2

→ i) Addition of H_2O vapor

$CO^* + OH \rightarrow CO_2^* + H$

ii) Electrode material

$CO + O \xrightarrow{Pt} CO_2$

(catalytic reaction)

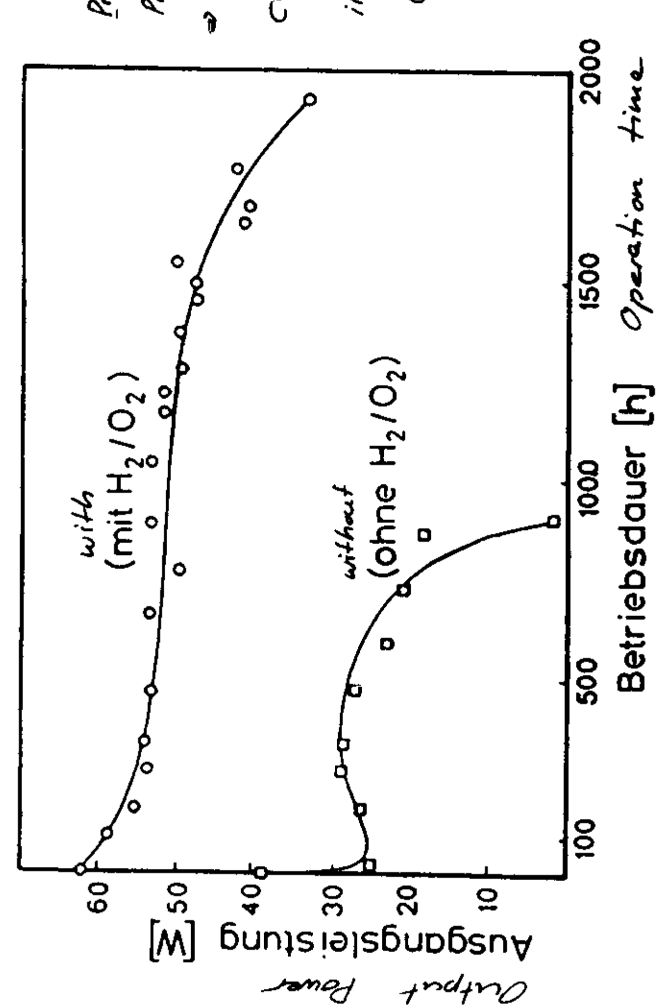


Fig. 12-16 Ausgangsleistung als Funktion der Betriebsdauer von abgeschlossenen CO_2-Lasern [nach Witteman 1967]

Waveguide CO_2 Laser

Higher gas pressure (~100 mbar)

Gain width ≲ 1 GHz

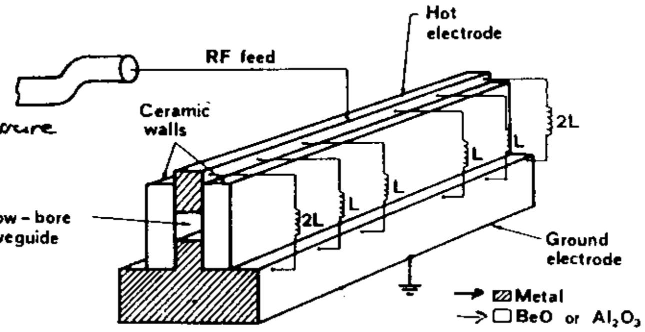
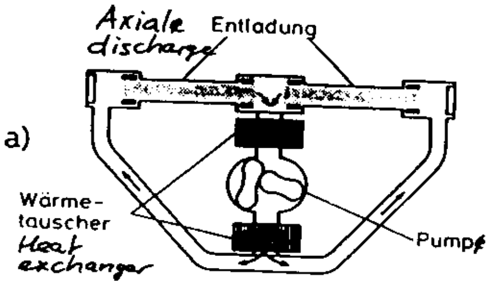


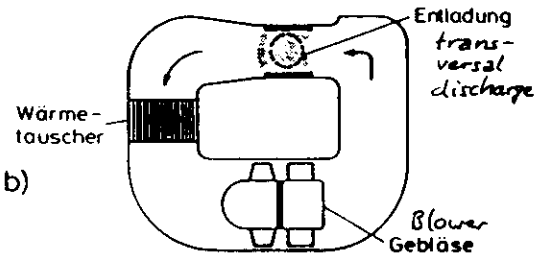
FIG. 6.18. Schematic diagram of a rf excited waveguide CO_2 laser.
(Ref.: Svelto)

Convection cooled high power CO_2 lasers

a) Fast axial flow



b) Fast transverse fl

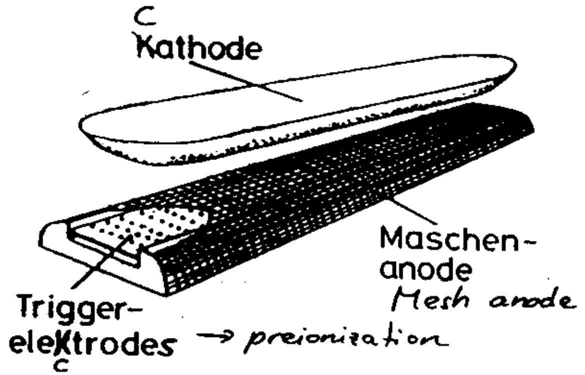


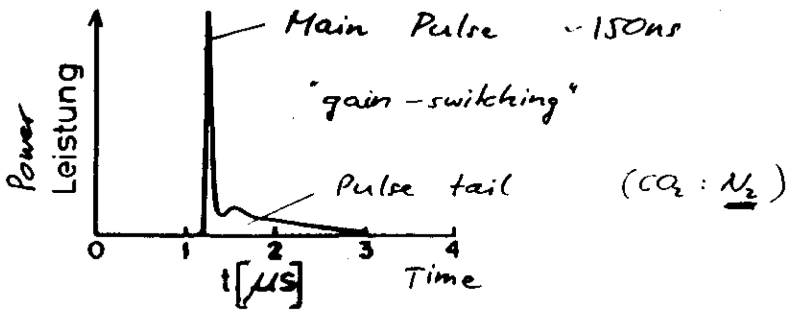
TEA CO_2 Laser

Glow discharge becomes unstable at high gas pressures (arcing)

→ short excitation pulse (some 10ns), preionization, transversal discharge

→ pulsed laser operation also at $p > 1 bar$



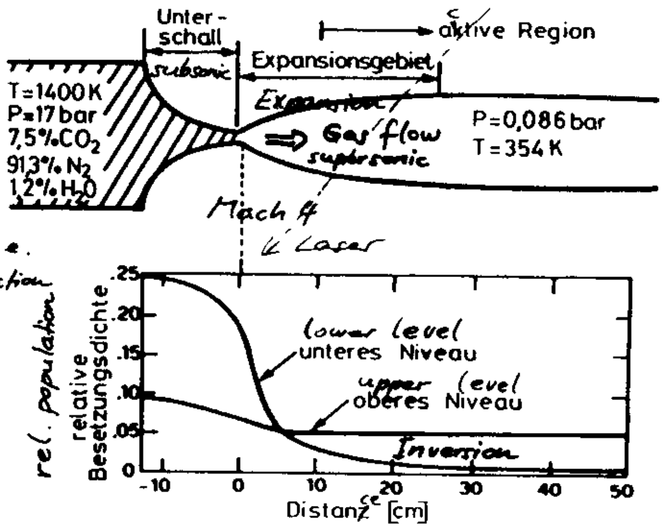


- Gasdynamic CO_2 Laser

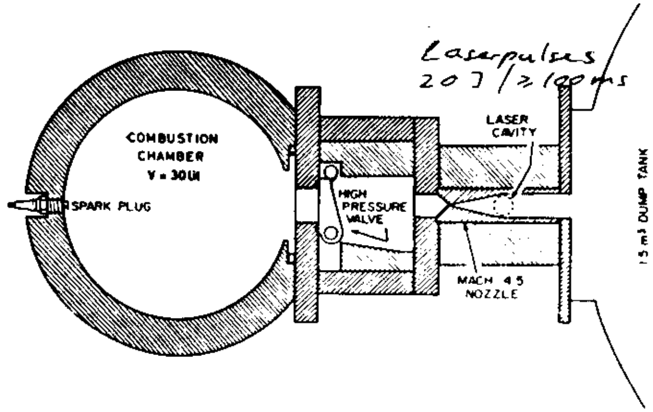
Expansion, i.e. p- & T-reduction

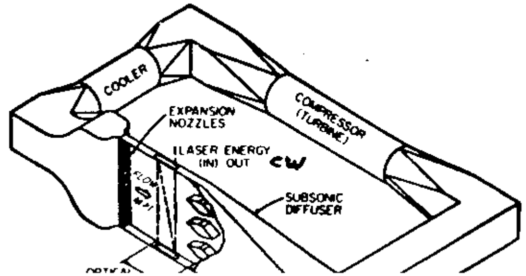
in $t < \tau_2$

$t > \tau_1$

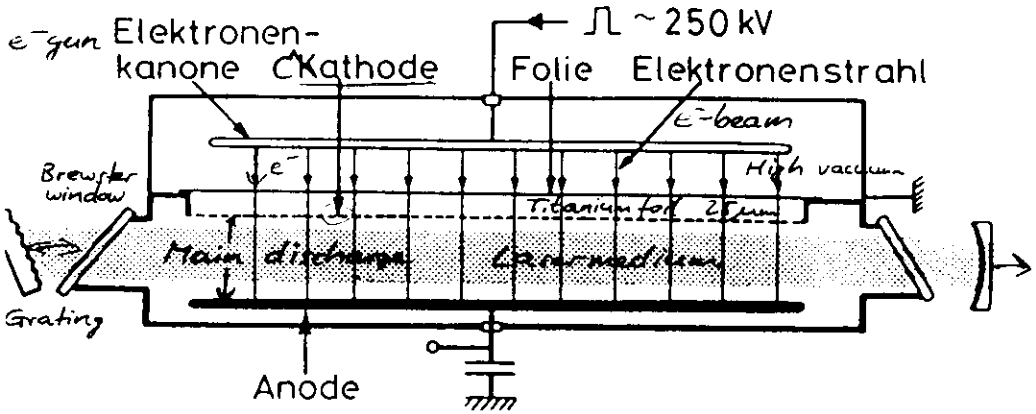


$\tau_2 > \tau_1$





• Electron - beam controlled CO_2 Laser



g. 12-21 Elektronenstrahl-kontrollierter CO_2-Laser
[nach Jaeger & Wang 1987]

Advantageous for: high gas pressures (several bars)
large volumes
long laser pulses $\simeq 50\mu s$

• Continuously tunable high pressure CO_2 Lasers

$p \gtrsim 10$ bars → continuous tunability within P- & R- branches

Ultrashort pulses : $\Delta t \propto 1/\Delta\nu$

Excitation : - UV or X ray preionization
- e⁻ beam controlled