1 KW ARC-JET ENGINE: *EXPERIMENTS WITH ARGON*

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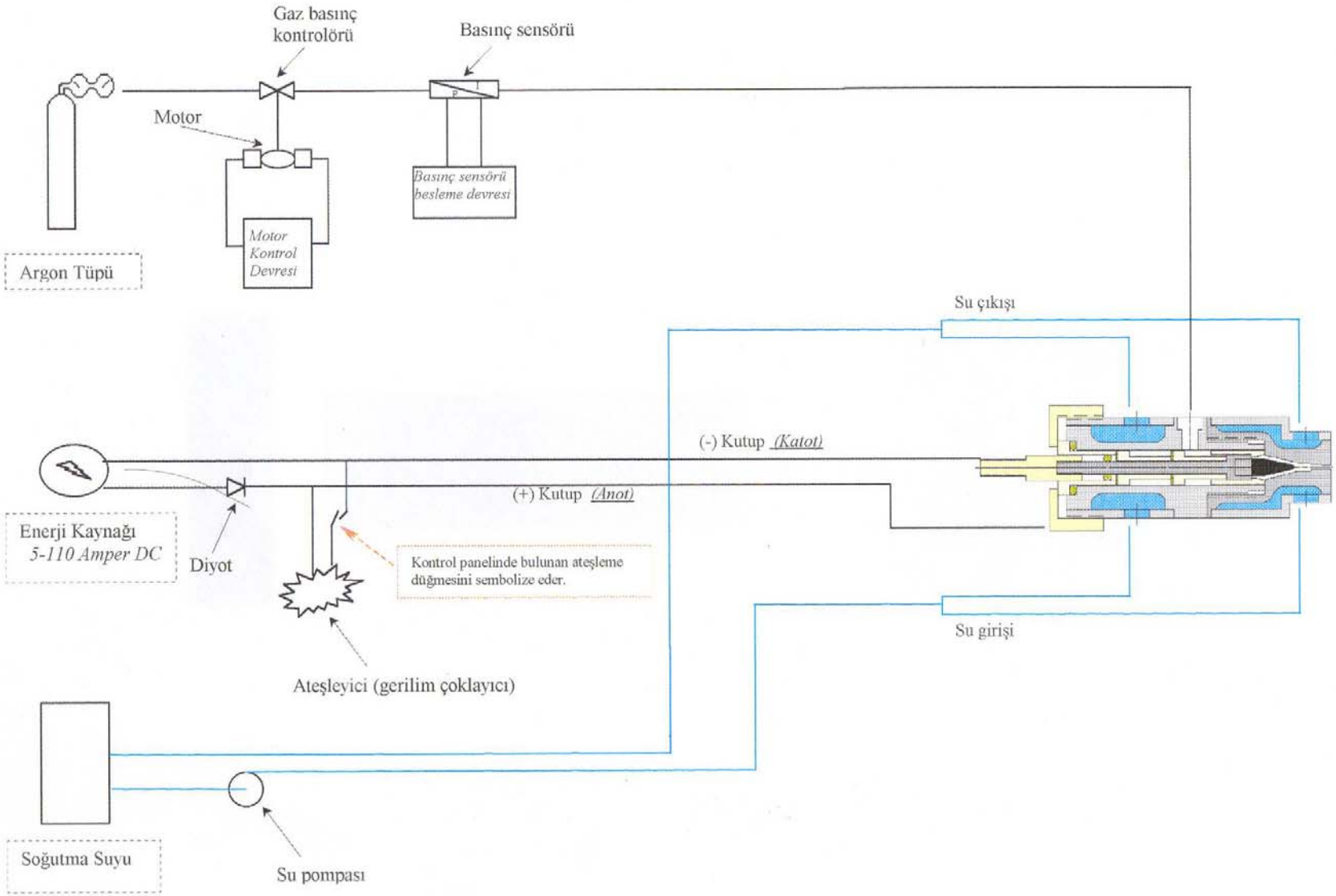
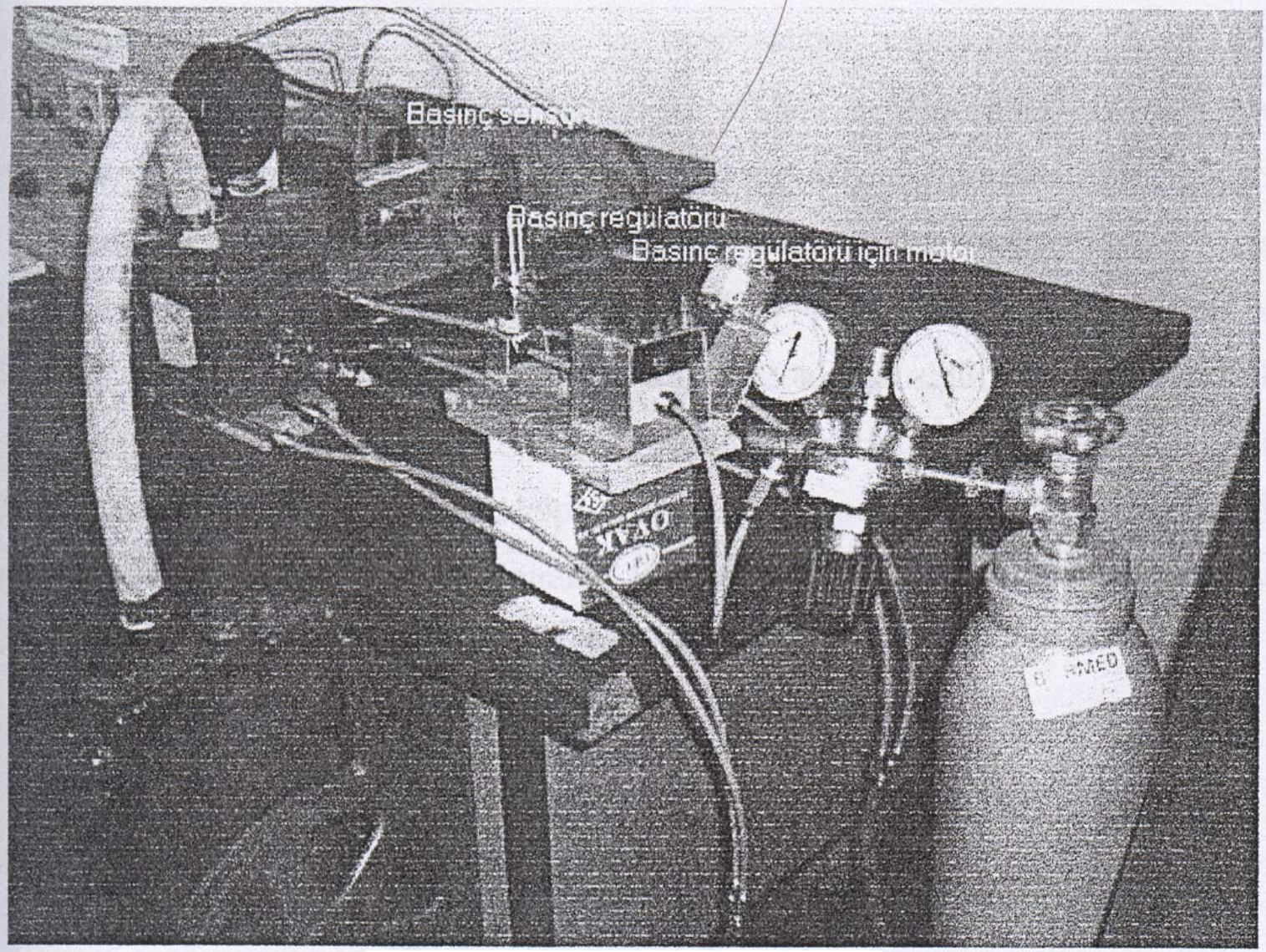
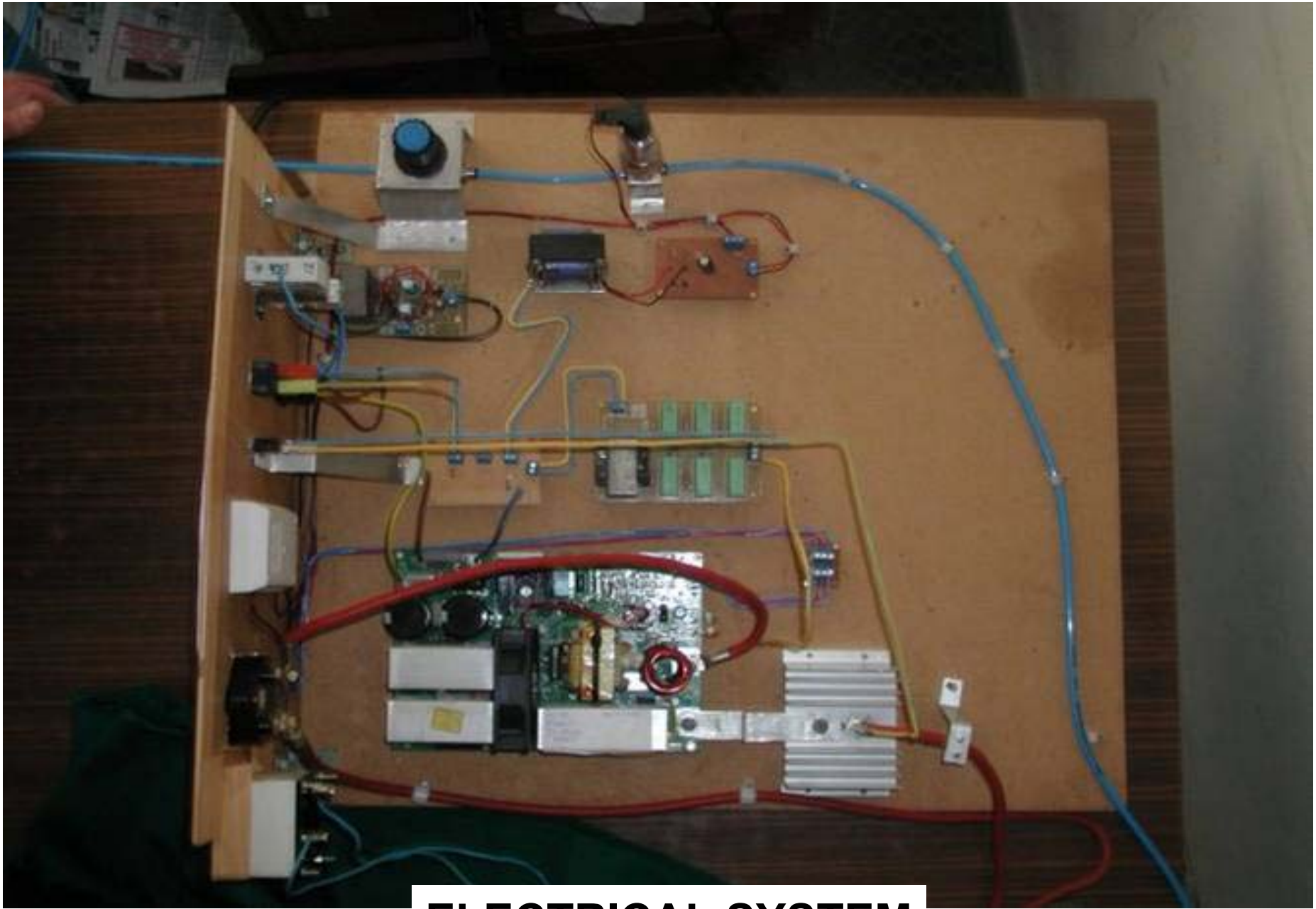


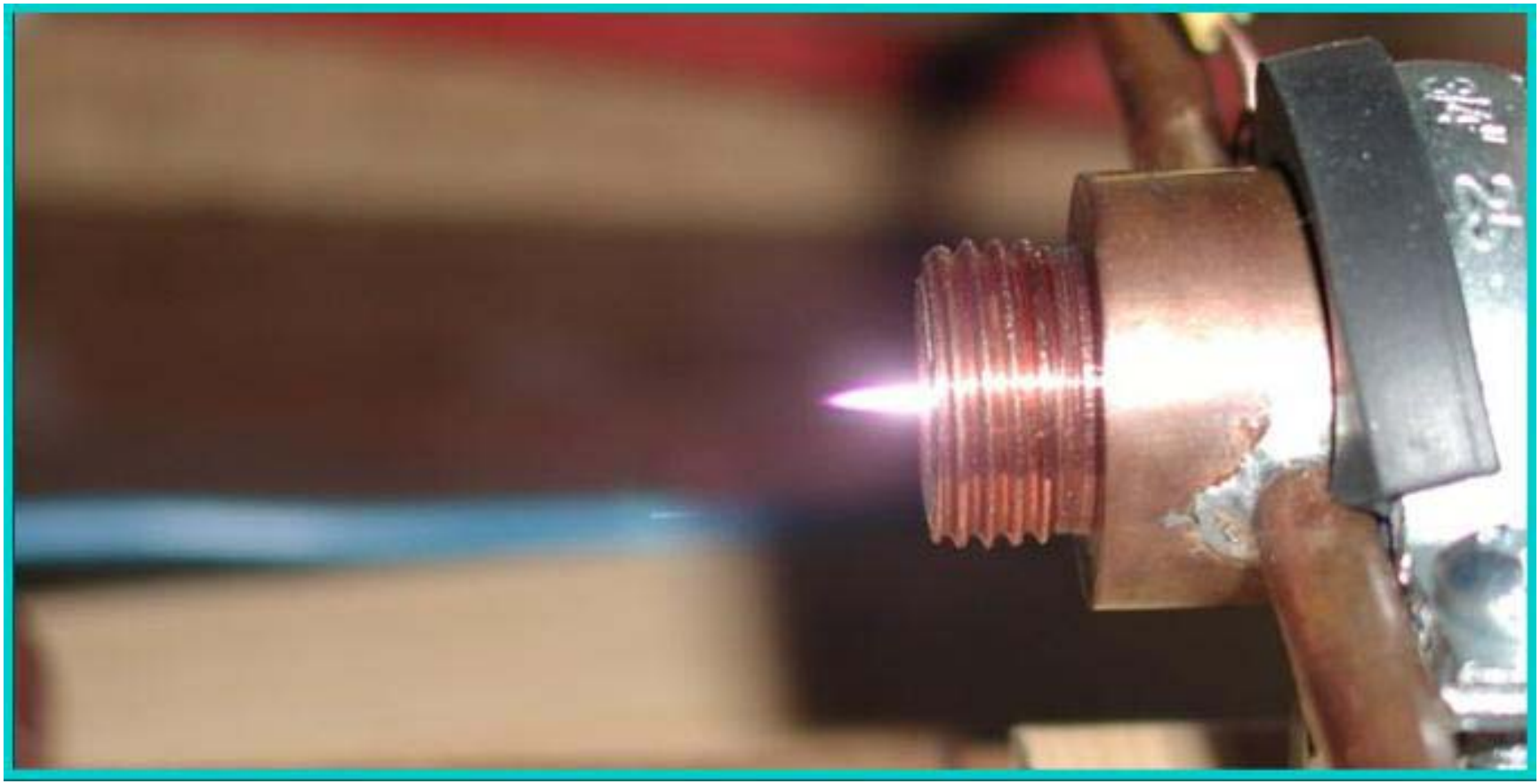
SYSTEM LAYOUT



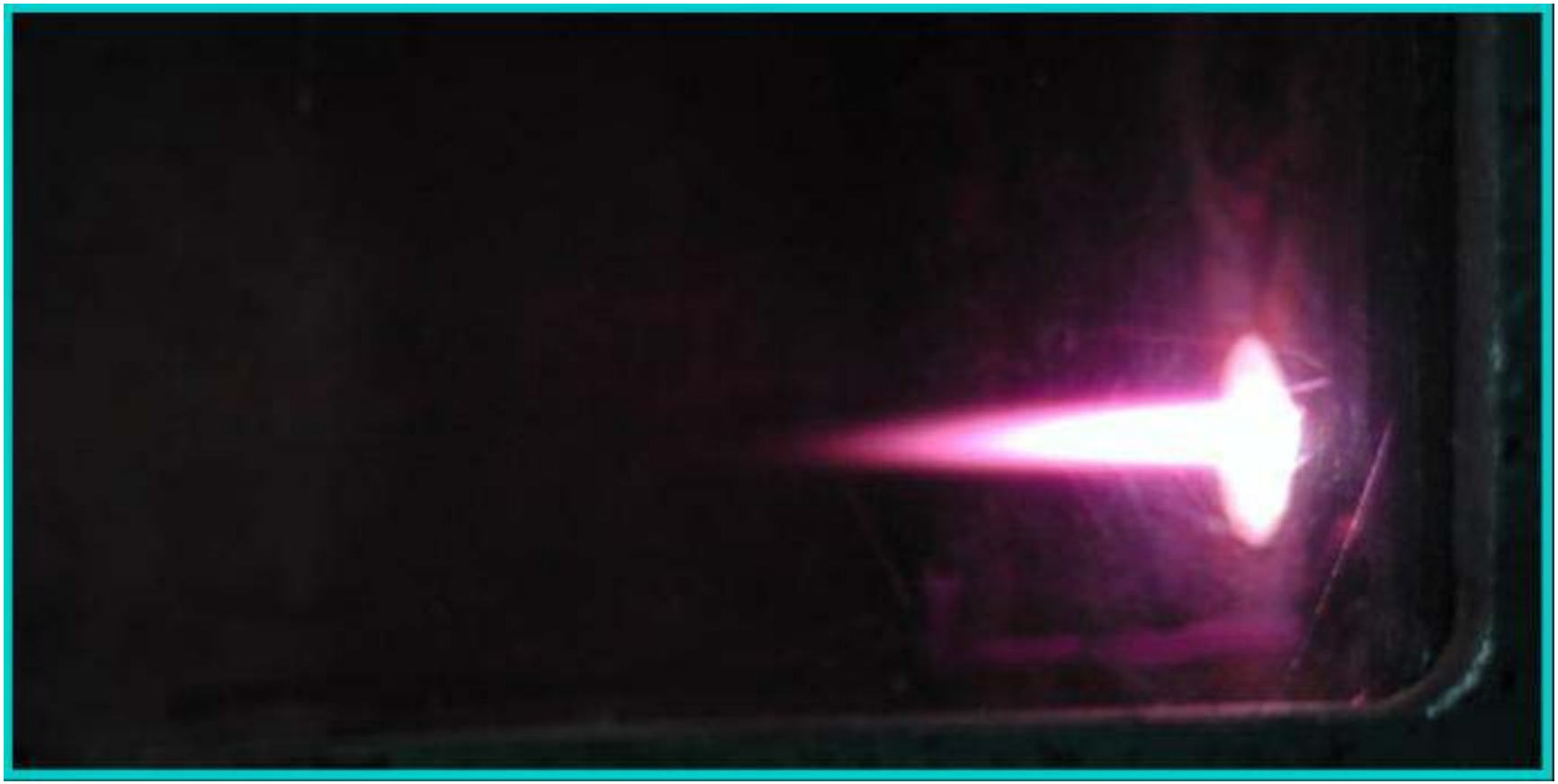
GAS SUPPLY SYSTEM



ELECTRICAL SYSTEM



MAIDEN FLAME



FLAME IN THE VACUUM

MASS FLOW RATE MEASUREMENTS

		23.11.2000	28.03.2001	20.04.2001	08.05.2001
0,625 atm	ϕ 0.25 mm	-		21 *mg/s*	
	ϕ 0.50 mm				80 *mg/s*
	ϕ 1.00 mm		321 *mg/s*		
1,25 atm	ϕ 0.25 mm	28 *mg/s*		29 *mg/s*	
	ϕ 0.50 mm				111 *mg/s*
1,875 atm	ϕ 0.25 mm	36 *mg/s*		36 *mg/s*	
	ϕ 0.50 mm				156 *mg/s*
2,5 atm	ϕ 0.25 mm	-		40 *mg/s*	
	ϕ 0.50 mm				180 *mg/s*
3,125 atm	ϕ 0.25 mm	-		62 *mg/s*	
	ϕ 0.37 mm		118 *mg/s*		
	ϕ 0.50 mm				260 *mg/s*
3,75 atm	ϕ 0.25 mm	69 *mg/s*		66 *mg/s*	
	ϕ 0.37 mm		141 *mg/s*		
	ϕ 0.50 mm				275 *mg/s*
4,375 atm	ϕ 0.25 mm	76 *mg/s*		75 *mg/s*	
	ϕ 0.37 mm		150 *mg/s*		
	ϕ 0.50 mm				293 *mg/s*
5 atm	ϕ 0.25 mm	80 *mg/s*		-	
	ϕ 0.50 mm				320 *mg/s*
5,625 atm	ϕ 0.25 mm	-		83 *mg/s*	
	ϕ 0.50 mm				345 *mg/s*
6,25 atm	ϕ 0.25 mm	101 *mg/s*		-	

VACUUM MEASUREMENTS

Gaz basıncı	Pasif Sistem	Aktif Sistem	
	Vakum ölçer	Ampermetre	Vakum ölçer
1 atm	50 mmHg	20 A	30 mmHg
1.625 atm	60 mmHg	20 A	30 mmHg
2.25 atm	85 mmHg	30 A	30 mmHg
2.875 atm	110 mmHg	30 A	40 mmHg
3.5 atm	130 mmHg	14 A	60 mmHg
		30 A	40 mmHg
		36 A	40 mmHg

COLD GAS MEASUREMENTS

Basınç (atm.)	*Debi (mg/s)*	*Kuvvet (gr)*	*Hız (m/s)*
0.625	80	1	125
1.25	111	2	180
1.875	156	4	256
2.5	197	5	253
3.125	260	7	269
3.75	275	9	327
4.375	293	10	343
5	320	11	343
5.625	345	12	347

CALCULATIONS (High Temp. limits)

Specific Heats: $c_p = c_v + R$, $c_v = (\ .\ ) R$

$$V_e \cong \sqrt{2 c_p T_0}$$

Monatomic gas: $c_v = \frac{3}{2} R$

Diatomic gas: $c_v = \frac{7}{2} R$

Polyatomic gas: $c_v = \frac{3}{2} R + (3\ s - 5)\ R + R$ (linear)

$c_v = \frac{3}{2} R + (3\ s - 6)\ R + R$ (non-linear)

EXPERIMENTAL VALUES for ARGON (throat vel.)

P = 0.625 atm

$\dot{m} = 321$ mg/s

I = 8 A

F = 0.15 N

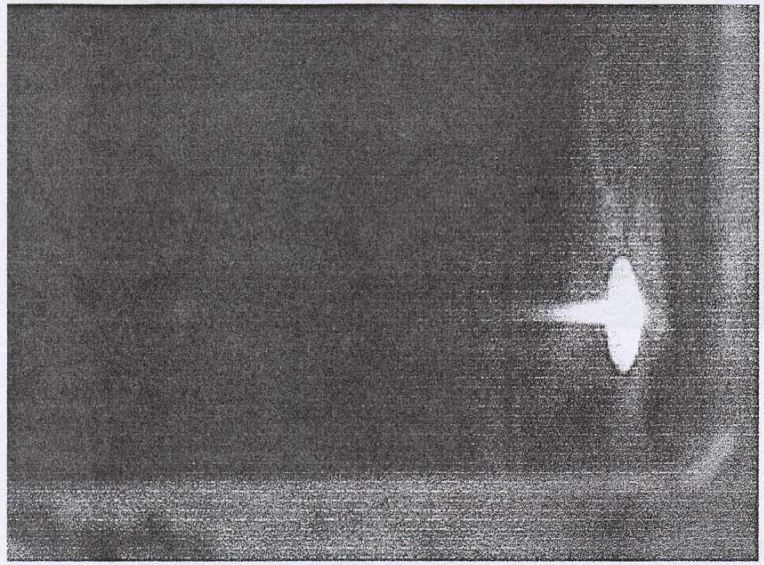
$V_e = \frac{F}{\dot{m}} = 467$ m/s

P = I x V = 8A x 17V = 136 Watts

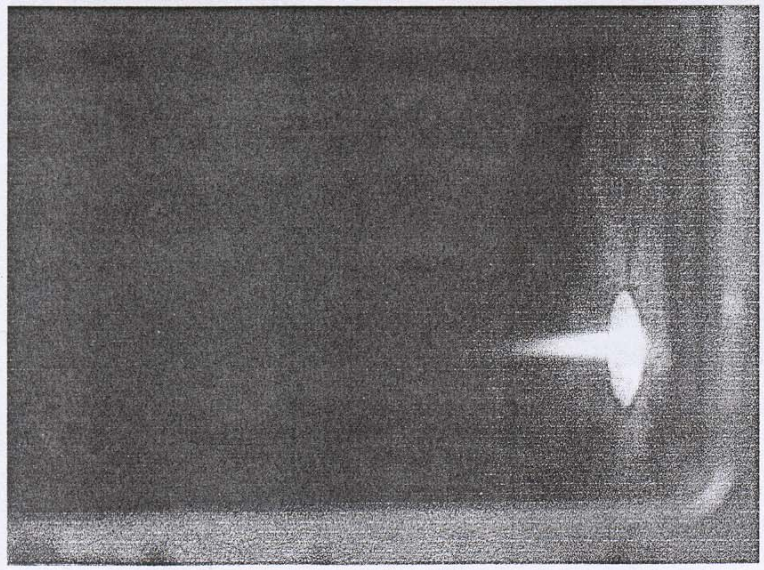
$\eta = \frac{\dot{m} V^2}{2P} = 25\ \%$

FLAME STABILITY

CHAMBER PRESSURE 1.0 - 1.625 atm
VACUUM PRESSURE 30 – 30 mmHg
FLAME LENGTH 28 – 33 mm

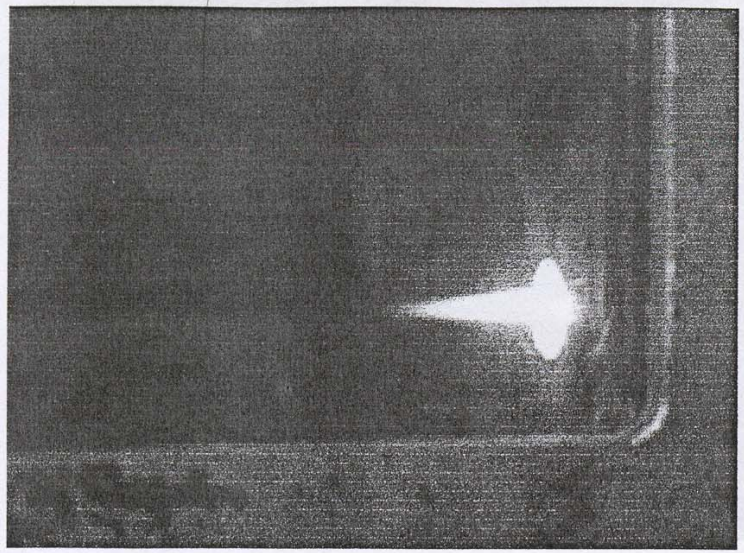


Şekil E.1. Gaz basınc : 1 atm.
Dış basınç : 30 mmHg
Akım : 20 A
Alev boyu : 28 mm

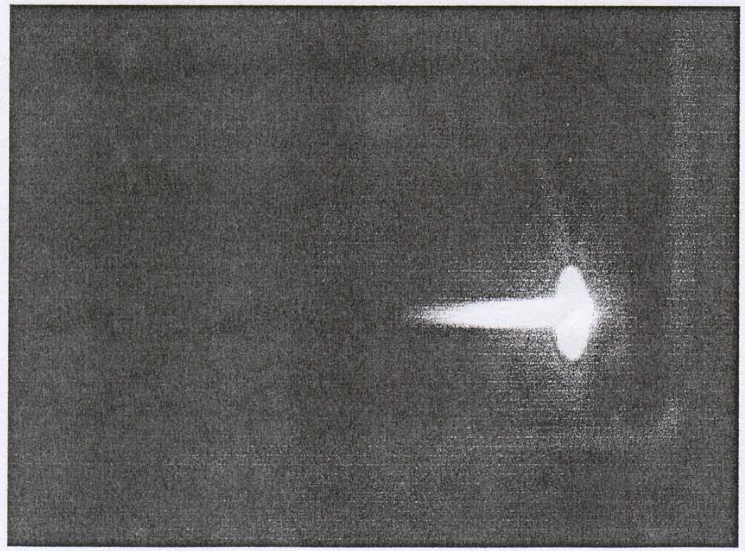


Şekil E.2. Gaz basınc : 1.625 atm.
Dış basınç : 30 mmHg
Akım : 20 A
Alev boyu : 33 mm

CHAMBER PRESSURE 2.25 – 2.875 atm
VACUUM PRESSURE 30 – 40 mmHg
FLAME LENGTH 36 – 42 mm

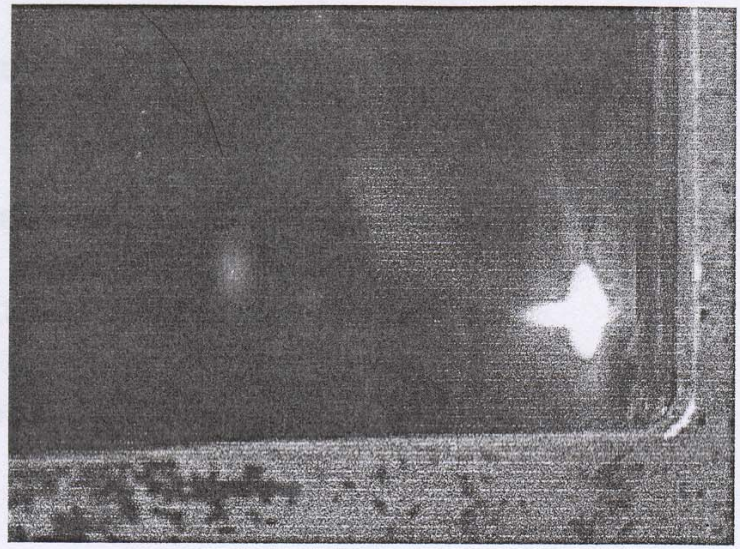


Şekil E.3. Gaz basınc : 2.25 atm.
Dış basınç : 30 mmHg
Akım : 30 A
Alev boyu : 36 mm

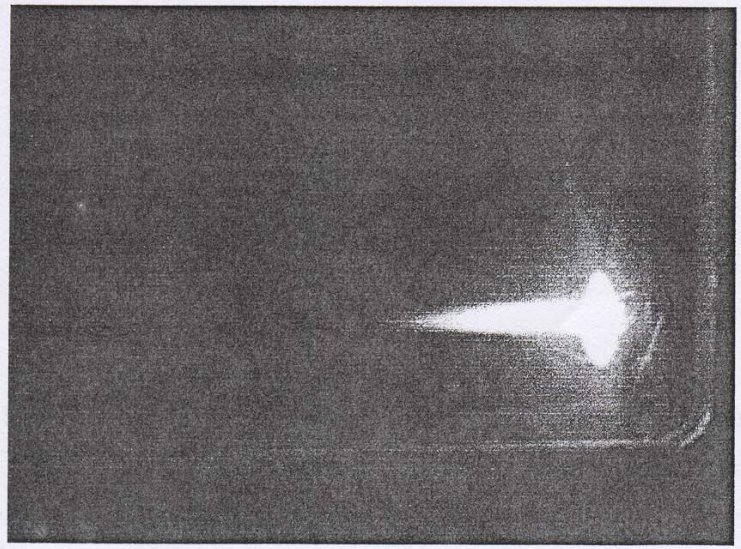


Şekil E.4. Gaz basınc : 2.875 atm.
Dış basınç : 40 mmHg
Akım : 30 A
Alev boyu : 42 mm

CHAMBER PRESSURE 3.0 – 3.0 atm
VACUUM PRESSURE 60 – 36 mmHg
FLAME LENGTH 18 – 62 mm



Şekil E.5. Gaz basınc : 3 atm.
Dış basınç : 60 mmHg
Akım : 14 A
Alev boyu : 18 mm



Şekil E.6. Gaz basınc : 3 atm.
Dış basınç : 40 mmHg
Akım : 36 A
Alev boyu : 62 mm

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