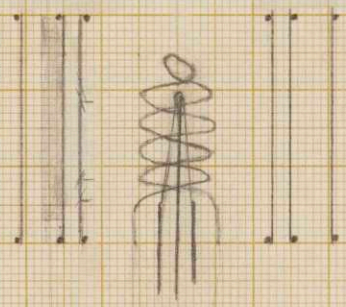
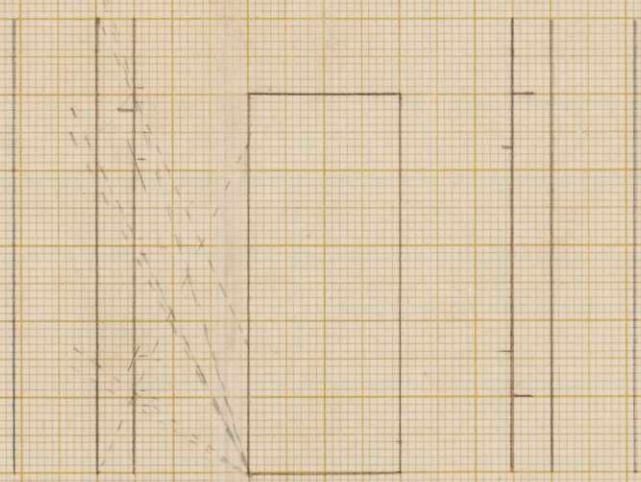
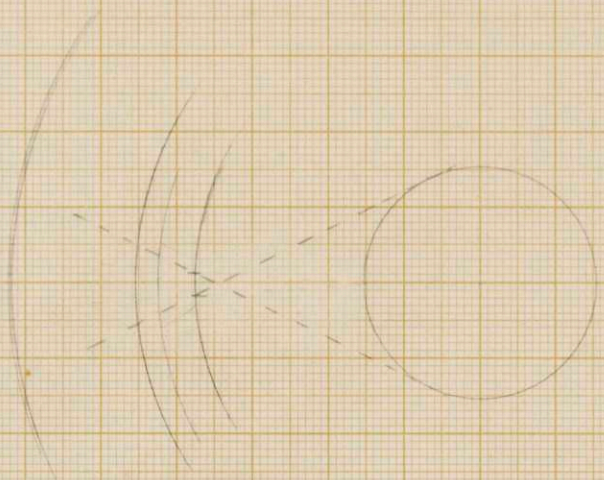
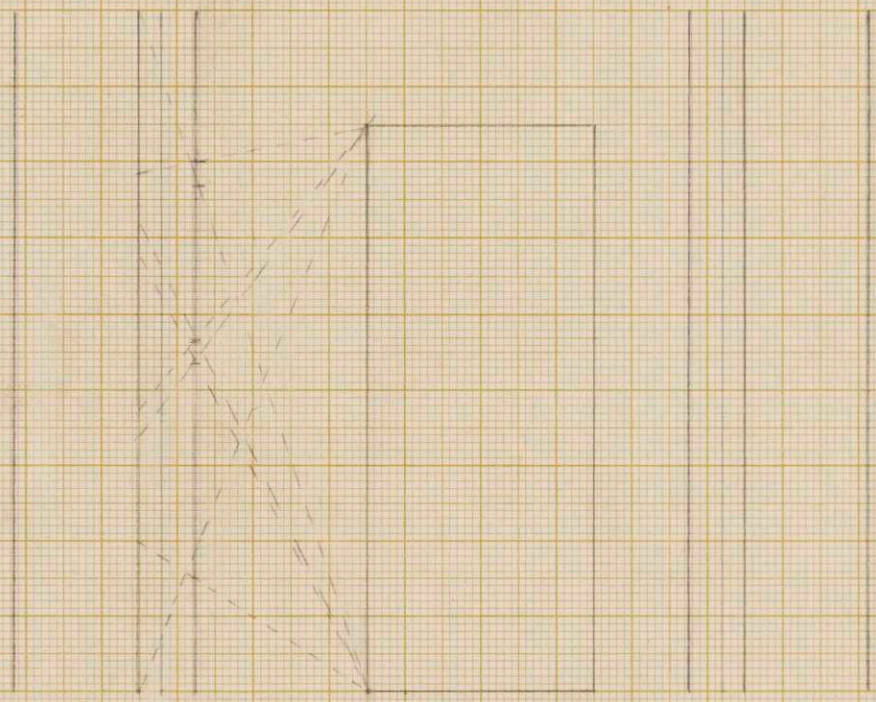
MC 241
Box 2 Folder 30

Ionization Gauge, 1948-49



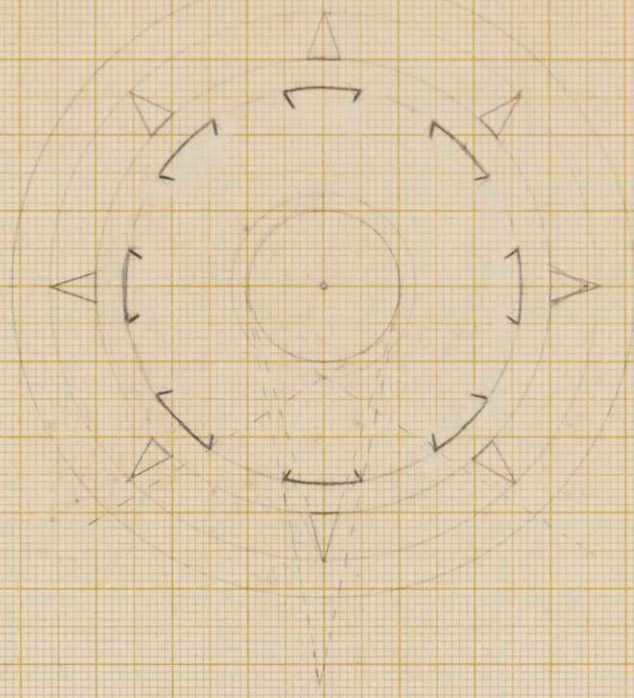


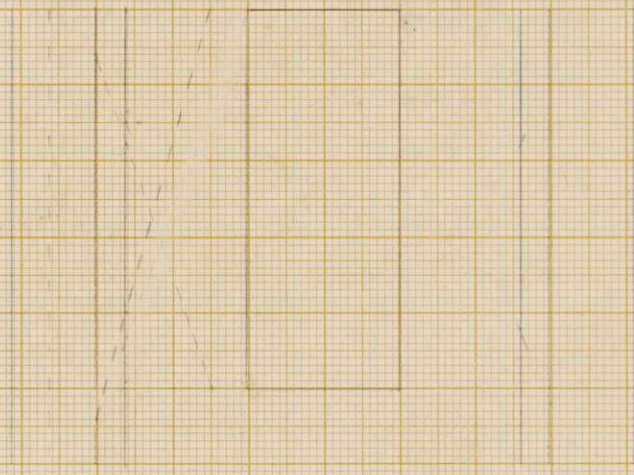




Preliminary sketch to determine size of opening of open areas were series of holes instead of slots

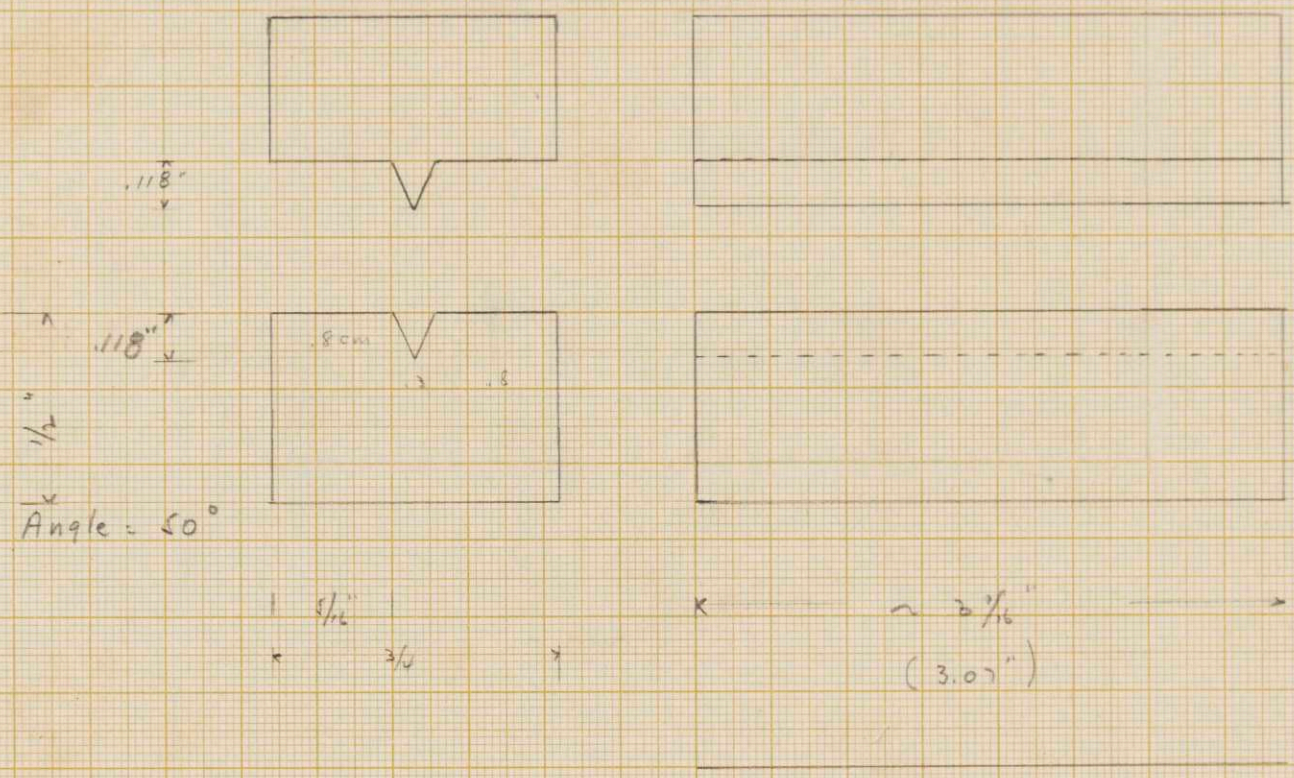
3× actual size



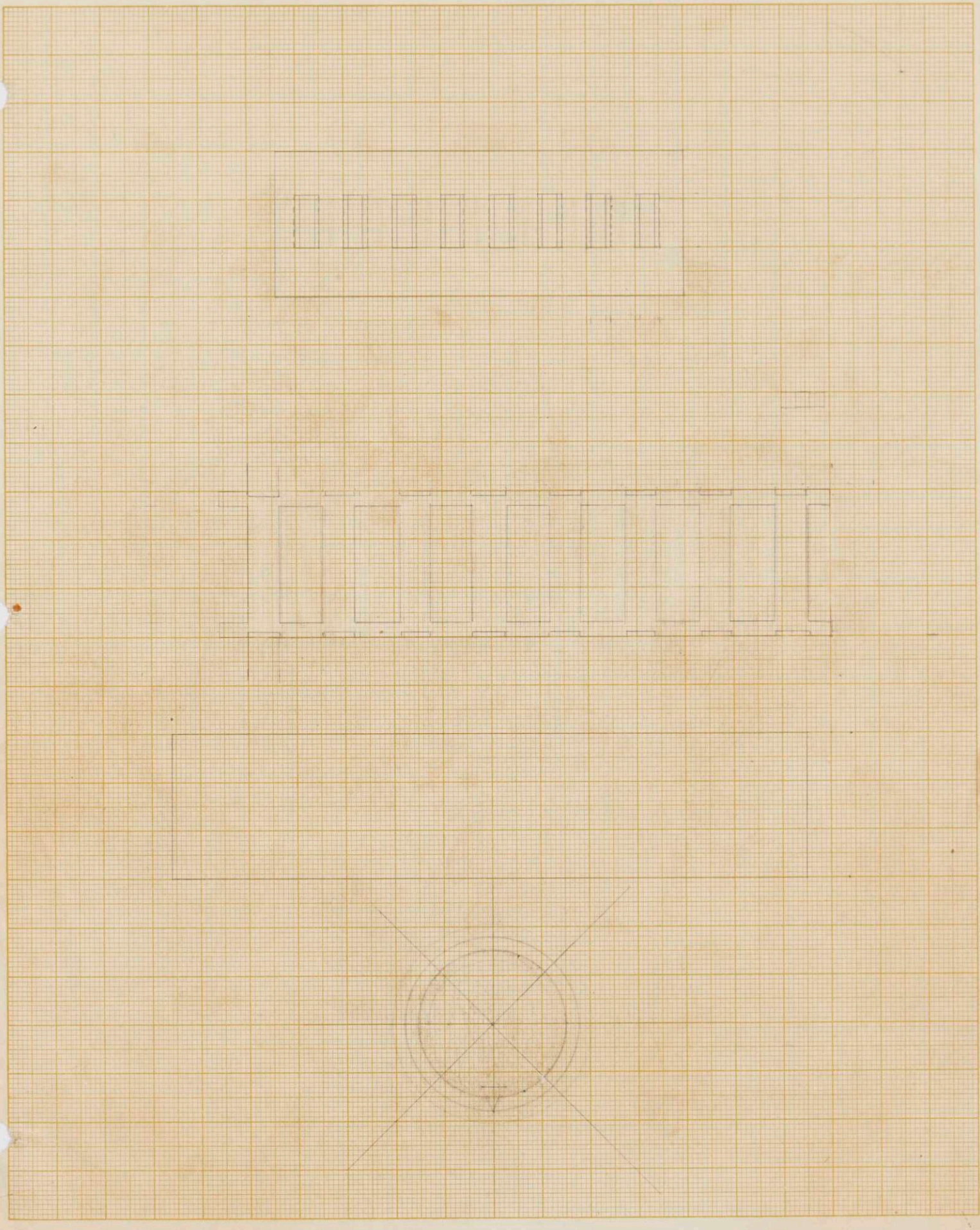


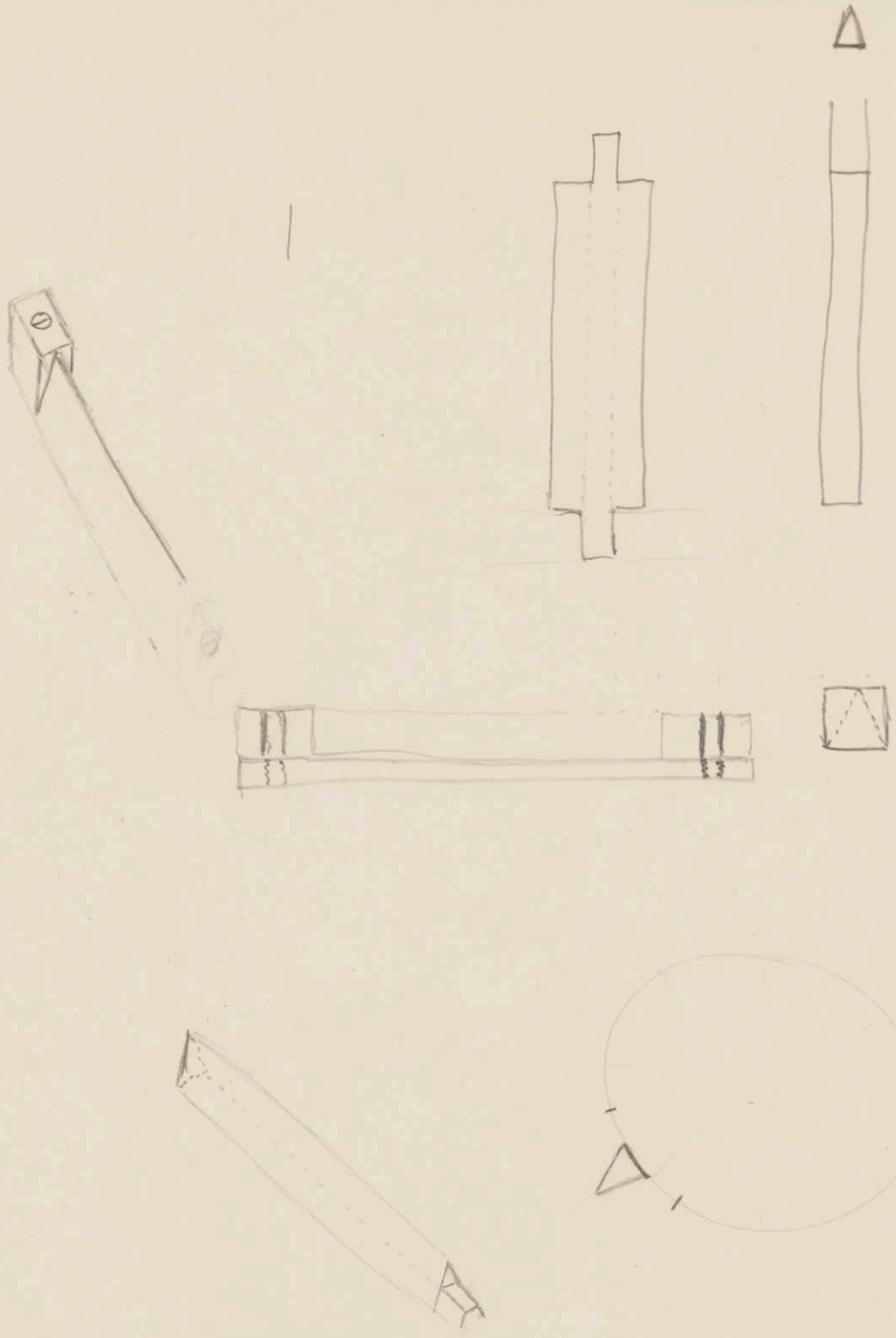
Arrangement of slots and
length of openings to hide
middle collector from grid
2 x actual size

111

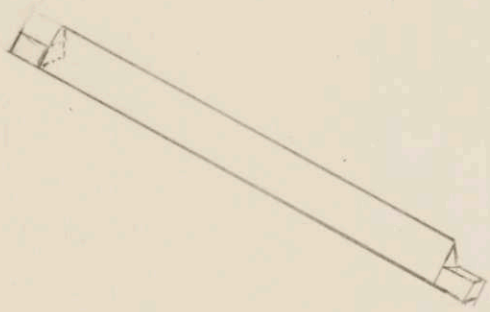


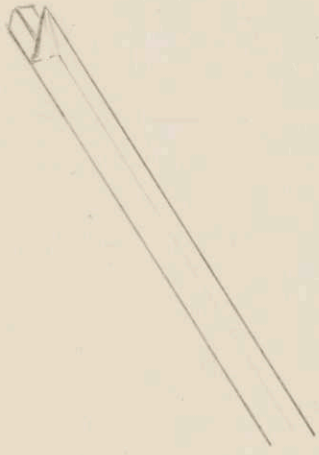
Die for bending collector
2x Actual Size





A

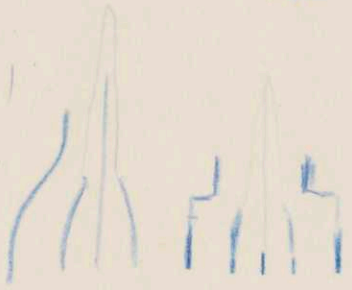




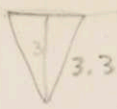
3 1/2

1 1/4

1 9/16



$d = \sqrt{8}$



if perpendicular is 3 mm

$x^2 = 3^2 + 1.5^2$

$x^2 = 9 + 2.25$

$x^2 = 11.25$

$x = 3.36$

$c = 2r \sin \frac{1}{2}\theta$

$3 = 6.6 \sin \frac{1}{2}\theta$

hypot. = 3.5

leg = 2.6

$3.5^2 = x + 2.6^2$

$12.2 = x^2 + 6.5$

$\frac{6.5}{5.7} = x^2$

$x = 2.4$

2.6
2.6

156
52

676

~~.3cm = .118in~~

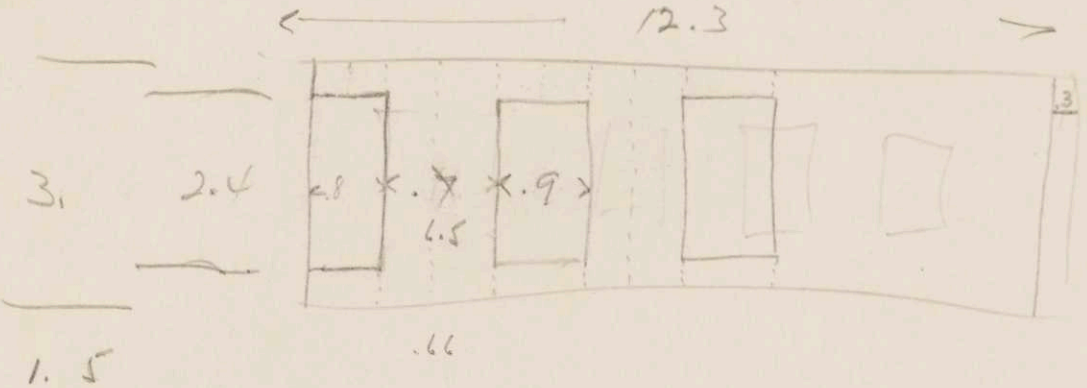
.24cm = .094

.35 = .137

.26 = .102

4.1
3.0
---
2 | 1.1
2 | .55

.27

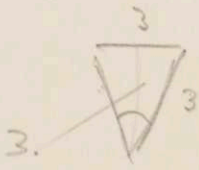


1.5
8
12.0
3

8 openings

.26
2
.52 cm

1.2
.3
.9



3 8

.08
8
.64

1.50
3
1.6

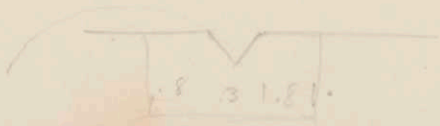
Cent. inch

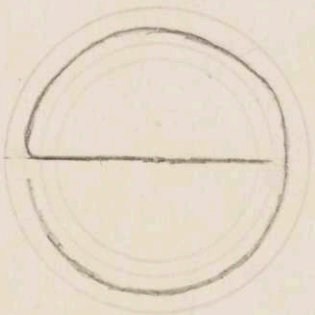
.3 = .118"

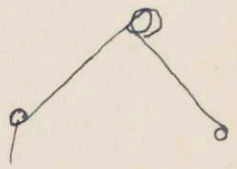
.33 = .130

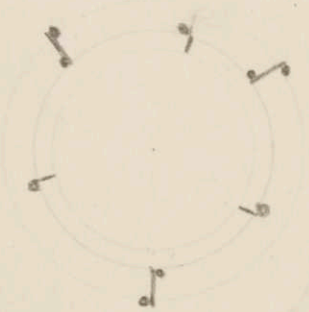
3.0 = 1.18

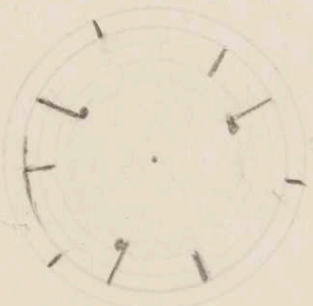
1.9











Experimental Ionization Gauge

✓ 1. Plan view arrangement of slots & collectors

✓ 2. Side view to determine length of openings in collectors

3. Layout for Ta sheet for cutting.

4. Plan view arrangement of beaded supports

5. Plan view arrangement of press & supports for grid & filament.

$\theta = 31.5^\circ$

4.5
1.6
27°
45
72°

9.4
.72

8 | 9.4
1.17
27
.97

1.2
1.2

1.17
.27
.97

3
9

1
96

9.42 circum.
1.6 cm Total

8 | 7.82
.97

10
9

$\theta = 31.5$
1.8
2520
315
56.78

8 | 94
1.17

Navona

4.8
4.1
.7

3/8"

1. Size of glass envelope
   i.e. How much clearance
2. can inside & outside
   be connected internally
   this would eliminate
   3 supports

1.1
1.1
.5
1.5

3.14
2.5
1570
628
7.850
3
23.45

3.14
3
9.42
3
28.26

4.1
2.8
2 | 1.3
.65
15
.50

2.8
.2
3.

8 | 8.1
1.01

9.42

9
2
3
2
14

3.14
4.1
3.14
1256
12.874
.23
13.10 x 3

3.14
3
9.42
.28
9.70 x 3 middle

3.14
2.6
1884
628
8.164 cm
.24 — overlap.
8.40 x 3 cm inside
outer

area of inside cam

mandrel diameter 2.6 cm

$2.6 \times 3.14 = 8.164 \times 3 = 24.49$

size of openings $1.1 \times .5$ cm $.55$

$.55 \times 8 = 4.40 \text{ cm}^2$

Effective area $24.49 - 4.4 = 20.09 \text{ cm}^2$

area of outside cam

mandrel diam. 4.1

$4.1 \times 3.14 = 12.874 \times 3 = 38.622 \text{ cm}^2$

5/12/48

Blank for Redesigned gauge

Blank with top press on which is mounted the filament and grid sealed on system for purpose of annealing glass, testing for tightness of glass and for outgassing and annealing grid and filament and check on distortion under heat.

9:00 Ovens ~~ope~~ for high temperature bake to 500°C. Tube was sealed on system 5/11/48 and pumped overnight.

P = +3.5 cm stick.

11:00 T = 500°C

11:30 500°C

12:00 500°C

12:05 Liquid air on trap

12:30 Heat off ovens down.

12:45 Filaments heated. Current increased slowly to:—

i_f	T_{Pt}	i_g	T_{Pt}
3.8 a	1975	9. a	1775

When heated separately —

3.8	2000	9. a	1750

1:25 P = +4.0 cm.

Pumps off.

5/17/48

5/18/48

Outgassing Collector & Inside Can for Ionization Gauge.

2:30 Blank containing bucket (To) with parts inside (Bucket has top & bottom covered) sealed on system.

3:00

~~2:45~~ Pressure ok. with pumps on

3:30 Ovens on for bake

3:45 Discovered thermometer had broken inside oven Shut off heat and cleaned oven platform to get rid of loose Hg.
To late for bake before closing time. Left pumping oven night.

5/18/48

8:15 Back pressure high. Pressure in system higher than 6×10^{-2} as a result.
Started fore pumps. Note: check stop cocks before final bake

8:25 P = + 3.5 cm stick

8:30 Ovens on for bake

9:00 T: 420°C

9:10 = 480°C

9:17 T: 500°C (Changed from 230 V to 115 V D.C.)

9:25 T: 480°C P. 2×10^{-6}

11:25 T: 490°C

11:30 Trap oven off & down.

11:40 2 L on trap.

11:50 ovens off

Outgassing with R.F.

1:40 P = + 3.5 cm stick

1:55 After intermittant bombing up to Pyrometer temp Readings of 1400°C P = + 1.5 cm Hg.

Inside 1450°C

" 1500°C

5/20/48

Redisigned Tetrode Ionization Gauge #52048

11:00 Stopcocks regreased
4:00 Tube sealed on system & checked for leaks
4:30 Hg pumps on.

Pumped over night

5/21/48

8:30 Back pressure high but not seriously so.
P = +1.5 cm stick
Fore pump started

8:45 Ovens fit at pins heated to test it's operation. - OK.

9:00 Ovens on for bake
9:45 T = 510°K

11:45 L.A. on traps.
12:00 Heat off
12:10 Ovens down
1:15 T = +4.5 cm stick

First operation of gauge.

i_a	G_{cn}	MV	Δ
8.7	4.7	3 7.4	
8.5	4.7	4 43.	
12 min Flash	off scale		2 5.4

5/24/43

Outgassing metal cans.

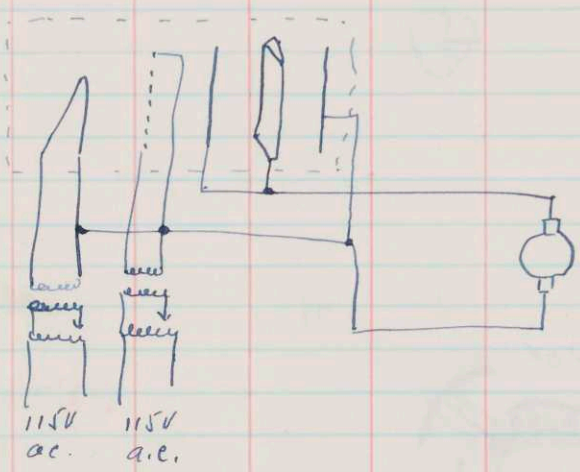
The middle and inside collectors were connected together and to the positive of 900 v D.C. Negative of D.C. connect to grid and to filament both of which were operated as filaments and the source of electrons R.F. was applied to outside can. This hookup was not sufficient to get the inside can hot enough and less than 50 ma. of electron current was drawn

1/24/48

(2)

52048

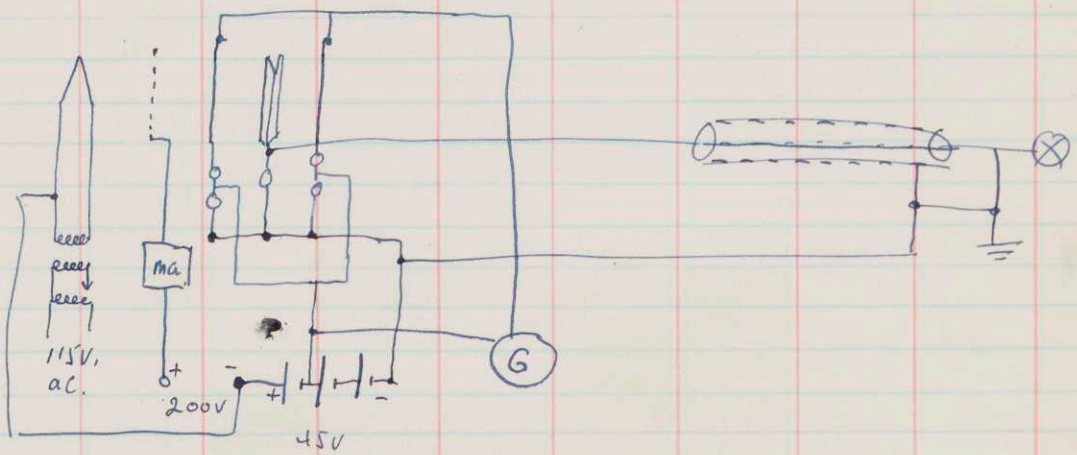
The outside can was then also connected to the negative of the D.C. source and an electron current of 90 m.a. was obtained. The inside can marked an estimated temp of 1000°C.



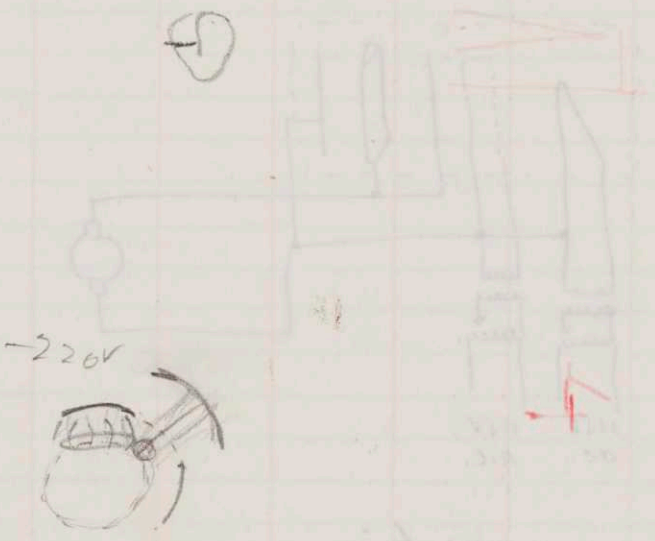
Gauge operation

	i_e	Gcm
2:30	10 ma	.01 1.4
		.1 11.25

Tube oscillated a low emission microamp to ~ 13 ma.



2:55	10 ma	" 8.85
	Adjusted zero on galvanometer	
2:58	10 ma	" 13.5
3:25	"	12.4


220V

5/24/48
(3)

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	i_c G_{cm} Δ	
5:00	P = +2. cm stick	
	Tube into oven for all night bake	
		5/25/48
8:15	after all night bake T = 500°C	
	P = +2.0 cm stick	
	Trap oven turned off + lowered.	
8:40	L.G. on trap	
9:15	Heat off. oven lowered.	
9:30	Filament turned on for gauge reading	
	10 ma / 5.	
10:20	10 ma / 1.95 (still oscillates at 13 m.a.)	
10:55	" 1.5	
12:00	" 1.5	
1:10	" 1.4 McCleod = +5.cm	
8:40	10 ma / 1.6	5/26/48
8:45	Lower amp fil. heated to clean it off	
8:50	10 ma / 2.5	
52	" / 2.2	
	.1 / .2	
9:02	flash on " 23. 21. Take flash at 5 amps. (30	
	6a.	
9:05	off	
	Flash both fil. connected in series.	
9:07	.1 / .15	
	.01 / .0	

~~flash~~ The upper fil. failed to heat with 5 amps. with both filaments connected in series. The upper filament is .012" tungsten but the lower filament it is recalled has been subjected to conditions which have undoubtedly reduced the wire diameter to less than its original .01" diameter.
It will be necessary to operate these on separate transformers. It takes about 9 amps to heat upper fil.

$$\frac{1}{2}$$

$$\frac{1}{2}$$

$$\frac{1}{2}$$

$$\frac{1}{2}$$

5/26/48

(2)

5 2048

i_c Gcw Δ

Aux filament runs connected separately with individual Transformers. Flash valve – Lower 5 amp. Upper 9 amp.

Both Filament. .3

2 min.	11:38	flash	10ma	1.55	1.25
	11:40	off			
				.15	
18 min.	11:58	flash	10ma.	1.2	1.05
	12:00	off			

i_{fs} i_{fw} i_a Gcw Δ

	12:00	flash tryed both snapping on varian switches. cause galv. to kick in wrong direction. Subsequent flashes will be made by turning up dials.			
	12:04	off	off		
				10ma 1.7	
5 min.	12:09	5a.	9a.	7.4	5.7
	12:11	off	off		
				1.8	
2 min.	12:13	6a	9a	11.5	9.7
	12:15	– off –			
	12:16			1.8	
2 min.	17	5a	9a	6.7	4.9
	12:19	– off –			
	12:23			1.7	
5 min.	12:24	5a	9a	5.8	4.1
	12:26	off			
~~10 min.~~	~~12:35~~				
	~~12:36~~	~~5a~~	~~9a~~		
	12:38	← Start timing off period			
	12:49			1.6	
12 min.	12:50	5a	9a	4.1	2.5
	5r	off			

1.5
4.8
1.5
3.25

16 ✓ ✓

15 min. flask upper with lower cold
leave on for 2 min
turn off for 1 min.
flask lower
leave on for 2 min + flask upper with lower still hot

2.7

√/26/48

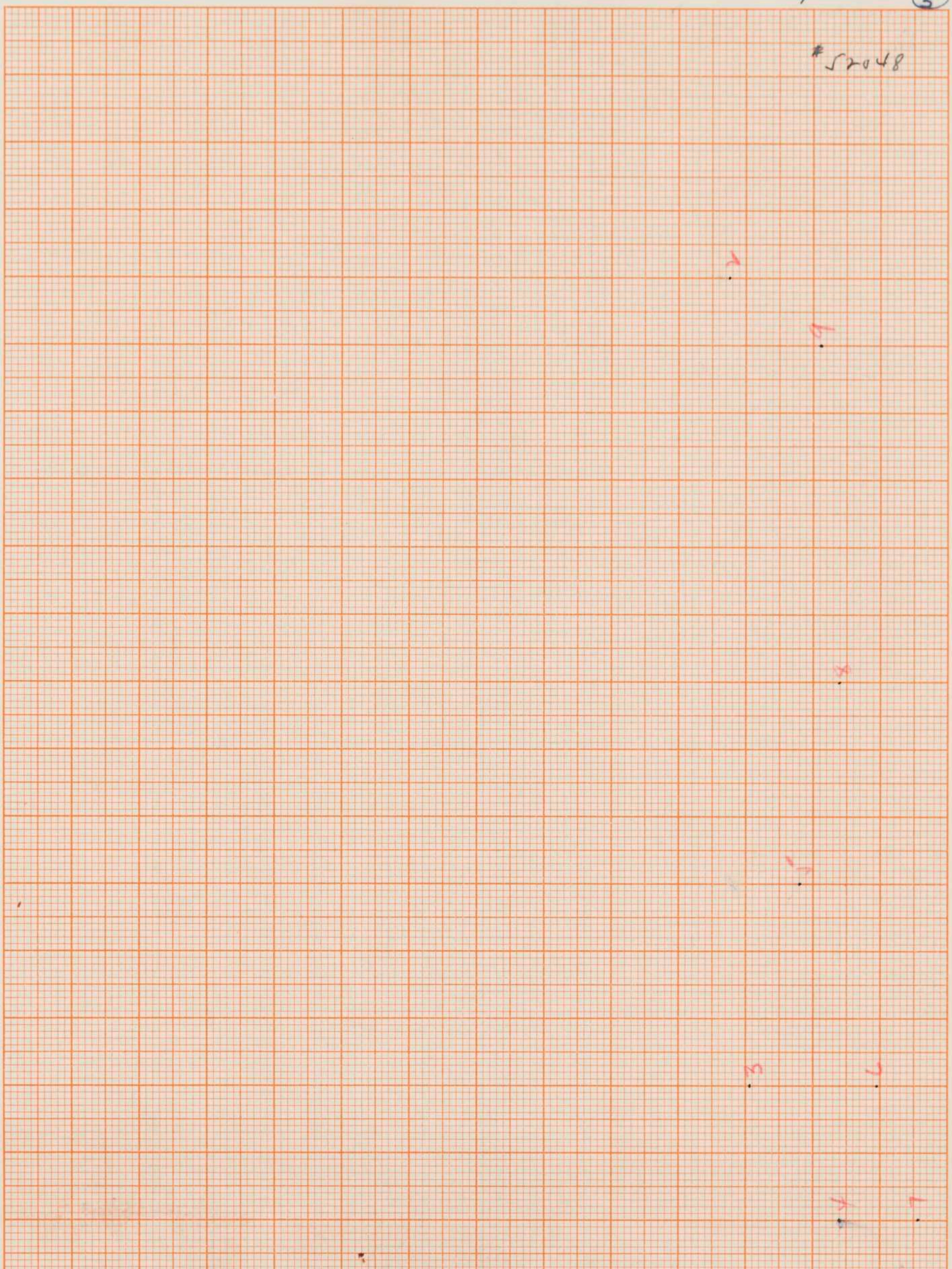
(3)

√2048

		i_{fl}	i'_{fu}	i'_2	G_2	Δ
2 min.	12:√4	√a	9a		1.6	
				→	2.2	.6
	2:√6	off				
	√					
32 min.					1.5√	
	1:28	√a	9a	10ma	4.8	3.2√
	1:3r	— off —				
	1:39				1.√	
8 min.	1:40	√	9		4.45	2.9√
	1:4r	— off —				
					1.6	
4 min.	1:4L	√	9		3.2	1.6
	1:48	— off —				
					1.6	
14 min.	2:02	√	9		3.8	2.2
	2:04	off				
					1.65	
8 min.	2:12	√	9.		2.7	1.05
	2:14	— off —				
					1.65	
4 min.	2:18				2.1	.45
	2:20	off				
					1.5√	
20 min.	2:40	√	9		3.15	1.6
	2:42	— off —				
					1.6	
30 min.	3:12	√	9		3.√	1.9
	3:14	— off. —				

5/26/48 (3)

#52048



KEUFFEL & ESSER CO., N. Y. NO. 359-11
20 × 20 to the inch, 10th lines heavy.
MADE IN U. S. A.

upper fil. is #1
Lower fil is #2

5/26/48
(4)

#52048

		i_{f_1}	i_{f_2}	i_a	G_{cm}	Δ
					1.6	
15 min.	3:29	9	0	10ma	2.1	.5
	31	off				
					1.6	
18 min.	:32	0	5		2.9	1.3
	~~:37~~				1.2~~5~~	
	:34	9	5		4.7	3.5
	:36	— off —				

The above run beginning with the off period at 3:14 pm. consisted in allowing both filaments to remain cold for 15 min. Then —

1 - upper filament was flashed
2 - Left hot for 2 min. and turned off.
3 - Lower fil. flashed 1 minute later
4 Upper fil flashed 2 minutes later with Lower fil. still hot.

Repeat of above

					1.7	
15 min.	3:51	9	0		2.1	.4
	3:53	off				
					1.6	
	53:30					
	3:54	0	5a		2.8	1.2
	~~3:56~~				1.2	} 1 min instead of 2 min.
	3:55	9	5a		4.0	2.8
	3:57	off				
					1.6	
20 min.	4:17	9	0		2.1	.5
	4:19	off				
					1.6	
	4:20		5		2.7	1.1
	22		5		1.4	
	4:22	9	5		4.2	2.8
	24	— off —				

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(1)

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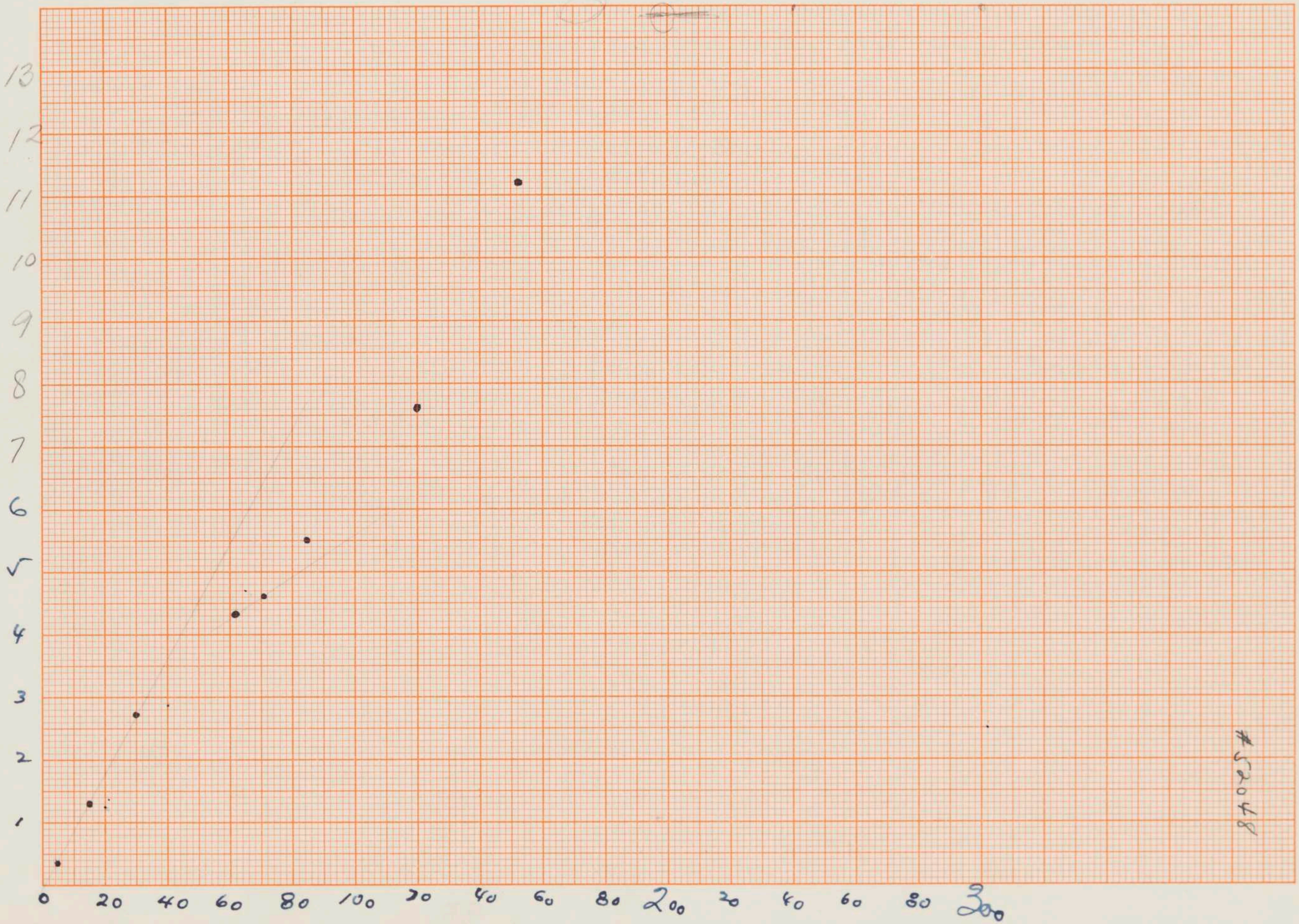
		i_f	i_{f_2}	i_e	G_{cm}	Δ	
				Gauge not running overnight			
	8:25			10ma	1.4		
					1.4		
	:27		5a	10ma	2.95	1.55	
	:20		5a		.75 (hot)		
	28:30		5a		.95 (hot)		
	29	8.5	5a		14.8	13.8	
	:15	8.5	5		1.7		
	:30	8.5	5		1.4		
	:31	off	5		1.4		
	15	"	5		1.35		
	32	"	"		1.15		
	05		3		~~1.~~		
	15		3		1.		
	33		3		1.1		
	41		3.	10ma	1.15		
	:30		3.	5ma	.5		
				11ma	oscillation		
	9:00		3	10	1.3		
30 min.	9:01	9	3		4.	2.7	
	9:03	off	3				
					1.2		
15 min.	9:18	9	3		2.5	1.3	
	9:20	off	3				
			3		1.3		
72 min.	10:32	9	3		5.9	4.6	
	:34	off	3				
			3		1.2		
5 min.	10:39	9	3		1.55	.35	
	:41	off	3				
			"	8	1.0		
153 min.	1:14	9	"		10	9.0	(11.2)
	:16	off					
			"		1.0		
62 min.	2:18	9	3	8.	4.4	3.4	(4.3)



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5/27/48

5/27/48

(2)

#52048

		i_{f_1}	i_{f_2}	i_e	G		
	2:20	off	3a	8ma	1.0		
					.9		
85 min.	3:45	9	3		5.3	4.4	(5.5)
	3:47	off					
					.9		
120 min.	5:47	9	3	8 ma	7.0	6.1	(7.6)

5/28/48

Tube operated over night fil. + HV on.
Fil # 2 running at 3 amp.

(15 hr. 10 min.)			3	8 ma	1.		
9 10 min.	8:57	9			off scale probably to 30 cm		
					~29.	(36.0)	

Main filament (but not aux. fil. #2) was off momentarily during morning several times while changing over ranges.

				8ma	1.		
30 min.	1:59	8	3		3.	2.	(2.5)
	2:01	off					
					1.		
20 min	2:21		3		2.	1.	(1.25)
	2:41	off					
			3		1		
21 min	2:45	9	3		2.1	1.1	(1.37)
					1.	1.	
65 min	3:50	9	3	8	4.85	3.85	(4.7)
	52	off					
					.9		
	4:32	9	3		3.2	2.3	(2.88)
	:34	off					

6/1/48

6/2/48

#52048

10:00 Hg pumps off. System will be let down to air and a U tube liquid air trap will be set in between flow pumps and. A flask of argon and a flask of nitrogen will be sealed in at U tube cut off

4:00 Completed above
Foreline pump on & check for leaks - ok.
4:30 Hg pumps on
5:15 P = +3.
Left pumping over night

6/2/48

8:30 Discharge tube indicates high back pressure
McCleod P_2 +.5
8:45 Ovens on for bake.

9:15 T = 520°C Change to 110 v DC.
Torched out Hg bottles on McCleod & cut off.
9:55 T = 480°C
11:15 T = 520°C P = +2.5 cm
11:15 Trap oven off.
11:22 Trap oven down.
11:30 L.A. on trap
11:55 all heat off. Oven down.
12:03 P = +4. cm

	i_e	G_{cm}
1:30	8ma	3.2
1:40	"	2.8
1:48	"	1.7

Both arc files were flashed.
2:02 1.7

6/2/48
(2)
6/3/48
#52048

3:00 Outgassing metal parts.

i_f	i_g	i_a	RF
4 a.	10 a.	100 ma	3.6

Two inside cans connected together and to positive of DC generator ~ 900 V D.C. Negative to fil. & grid, each heated by a-c.

Outside can heated with R.F.

Both ans fil. hot during entire outgassing.

Hot P = 4×10^{-6}
Cold = + 1.

4:10 Fil & H.V. on for gauge measurement

	i_a	G_{cm}	
4:13	8 ma	1.0	This is same as standby value on 5/27 before system was let down to air.

9 ma oscillation

4:50 Tube in oven for all night bake

6/3/48

8:40 Back pressure high. Fore pump started

Trap oven off.

8:50 L.C. on Trap
Heat off on all ovens but main oven left up.

6/3/48

(2)

52048

10:00 Filaments slightly discolored from baking at high pressure

10:15 all filament heated for ~ 5-10 min.

10:30 gauge on and allowed to run to clean up.

11:30

			i_a	Gas
11:30			8ma	1.6

11:45 all filament heated & RF on.

11:50 off.

11:52 Gauge on

12:00			8ma	1.2
1:20			8ma	.7
3:15			8ma	.9
			.1	.1
4:17	0	5a	"	.5 .4
				.3
4:18	9	5		.9 .6
4:22	off	3		
			"	.1
10 min 4:32	9	3	"	1.45 1.35
4:35	off			

Sudden change in standby is suspicious #2 fil. turned off. and normal standby of .9 cm returns.

#2 fil. connected to ground. Deflection of .9 cm with filament at 3 amp.

7 min 4:42				.8
~~44~~	~~off~~ 9	3		1.65
:44	off			

Gauge off overnight.

1/4/48
(1)

52048

		i_f	i_{f_2}	i_e	G_{cw}	Δ	$\times 1.25$
	8:30			8ma	1.		

Test made for stopcock leakage.
Required 2 stopcocks.

	10:45			8ma	1. .9		
					1.0		
	10:46		flash 5a.		14.8	13.8	(17.3)
	48		3		.9		
	48	9a.	3		24.3	23.4	(29.2)
	10:50	off	3				
			3		.7		
10 min	11:00	9	3		1.5	.8	(1.25)
	11:02	off	3				
			3		.9		
5 min	11:07	9	3		1.4	.5	.6
	11:09	off					
	11:18		3		.8		
10 min	11:19	9	3		1.5		
	11:19:10	off					

On this test #1 filament had been connected to ground as with #2. On the flash the galvanometer swung upto 1.5 and then violently swung in opposite direction. Filament turned off. and ground connection removed.

	11:29		3	8ma	.8		
10 min		9			1.4	.6	.75
	11:31	off					

The galvanometer swings upto flash value and swings direction very abruptly almost as though an oscillation was taking place.
Will try a longer off period and watch for this effect.

32 min	12:02				.85		
	12:03	9	3		3.25	2.4	3.
	12:05	off	Deflection normal				

60
60
40
160

60
60
40
160

447 - 60

[illegible]

1.25
3.7
875
375
4.625

P4
P5

5/19/49

(2)

i_f	V_c	V_e	i_-	mv	i_+
2.3	22	40	.076	57.3	.87 $^{-10}$
"	"	60	.078	262.0	3.97
			.077	11.9	3.77 $^{-10}$
2.35	"	60	.106	17.	5.4 $^{-10}$
		40	.106	4.2	1.33
		60	.108	17.6	5.6
2.4		60	.145	23.9	7.6
		40	.143	5.5	1.75
2.45		40	.225	7.7	2.44
		60	.73	36.5	11.6
2.5		60	.32	50	15.9
		40	.305	10.5	3.33
2.55		40	.43	13.9	4.4
		60	.46	67.7	21.5
2.65		60	.77	105.7	33.5
		40	.74	19.7	6.25
2.75		40	1.25	28.9	9.15
		60	1.30	174	55.2
2.85		60	2.6	276.5	87.5
		40	2.2	40	12.7
3.0		40	3.12	48.5	15.4
		60	3.9	341.5	108

(20.6 21 cp 5:12)

5:24

1.63×10^{-6}

$L + 2 \times 10^{-6} = \rho$

$L = 8.20 \times 10^{-7} + 2 \times 10^{-6} =$

$\frac{7500}{366} = 20.6$

8.3×10^{-5}

8300×10^{-9}

$\frac{8.3 \times 10^{-9}}{10^{-4}} =$

$\frac{3.6 \times 10^{-9}}{10^{-7}} =$

3.6×10^{-6}

3.40×10^{-7}

min/day

1460
3
4380
4320
4080
40

Normal increas is 10 per 1000 min
Expected increa 40 is in fair
agreement with 405 − 340 = 65 } depending
on 405 − 360 = 45 }
on which value is used for 5/20/49

2880
160
2720
27

→ at 5/25 expected mean 27
observed 18

Should study: clean up at 40 50 60 2080 100

Vita

#307

5/20/49

	i_f	V_c	V_e	i_-	MG	i_+	i_+/i_- × 10⁷
2:40	2.02	22	200	.0093	^{3}9.3	2.95 $^{-10}$	317
2:46	2.17			.03	32.7	.04	317
	2.8			.082	^{3}86.2		335
	2.45			.23	^{2}102		
R_2 11.7				.23	^{1}8.7		378
	2.58			.55	19.5		355
	2.69			1.06	36		340
	2.8			2.0	65		325
	2.45			.238	^{2}100		360 x
	2.3			.086	^{3}86		316 x

x shows effect of clean-up.

3:07	3.18 ←		0				
5/23/49							
11:00 AM	2.68			1.06	^{1}43		405
	3.17		0				
5/25 49 8:20AM)	2.6	22	200	.685	29		423
	3.17						
5/26/49 5:00 PM.	2.65	22	200	.91	40.1		441
	3.17						
June 9/49 5:05 PM	2.65	22		1.0	^{1}75		750
	3.17						
June 13/49 5:00 P.M.	2.65	22	200	1.03	82		795
	3.17						
6/15/49 9:00 AM	2.66	22	200	1.0	^{1}83		830

Pressure about 2×10^{-6} ← 1.5 → Pressure about 2×10^{-5}

6/14/50 3:09 PM	0	22	200	0 x T6			
3:10:30 "				100	^{1}83.5		8350
3:12		"	"	100	81.8		
3:36				100	64.7	← clean up	
3:41							

off at this time to be examined again in October 1950

4/25/49

Ionization Gauge #42549

Standard triode with one test filament
main filament or cathode .007" hairpin
Grid .015 double helix
Collector .003" Tantalum
Test filament 7 turns of .007" tungsten wound on .062" mandrel.

8:45 Sealed on system
9:00 Fore pumps on; test for leaks ok.
9:10 Hg pumps on.
9:35 +2.0
9:45 Ovens on for short bake.
12:00 T = 440° C.
12:05 Heat off tube oven. Heat still on Trap and way ovens.

4:30 P = +2.
Heat off all ovens. Stress the intention to outgas the parts during afternoon but opportunity did not present itself.
System fixed for overnight pumping.

8:30 P = +2.
Trap and way ovens turned on
Comments made for outgassing all the filament with R.F. on coil.

4/26/49
9:15 Test filament at 3.4 amp.
main " " 3.5 amp.
grid " 9.0 amp.

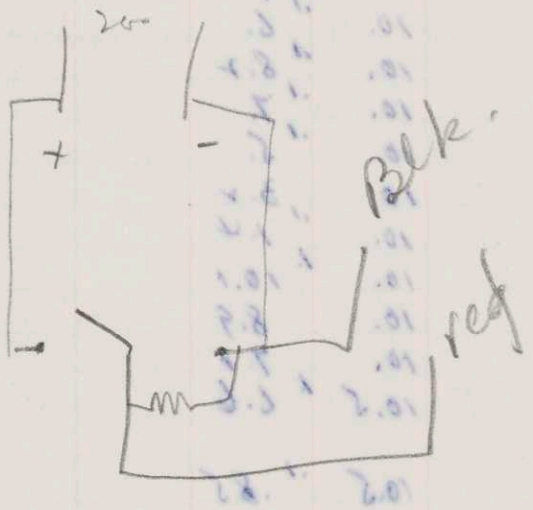
all filament and collector hot for ~ 5 min.

10:00 Tube in oven for bake
10:30 T = 440°C oven current cut ± 20 amp.
P = +1.8 hot.

10:55 Liquid air on trap.

4/26/49
(2)

T		i test fil.		i_	Gen	
11:32		Fil. on		20 v. on grid		+
	:15			.5ma	" 5 cm	
	45			.97	6.2	
33:05				2.1	11.5	
	:30			2.1	6.	
	45			4.1	12.	
34:18				4.2	" 3.1	
	45			4.2	" 13.	
35:15				4.1	9.	
	35			10.	" 6.	
	45			10.	" 8.2	
36:30				10.	" 7.	
	:45			10.	" 5.	
37:15				10	3.2	
38:15				10.	" 1.4	
39:15				10.	" 10.1	
40:15				10.	8.9	
41:15				10.	7.1	
43				10.5	" 6.6	
	~~flash~~			10.5	" .85	
45		3 amp flash			" 8.9	
	10				" .75	
	30			10.5	" 6.	
46		3.5				
	05				6.5	
	10				6.8	
	15				6.2	
	30				5.5	
47		.0		10.2	5.0	
	10"			10.2	3.35	
	30"				3.2	Note this change on cooling of filament.
48:20		3	flash		3.2	
	30				4.2	
	40				3.2	
49					3.3	
		~~[illegible]~~				Big flash because variac turned in wrong direction
	25	0			4.1	
	30				3.8	


+
−
Blk.
red

4/26/49

(3)

		Lp	L ma	Com	
11:51			10.4	3.8	
		flash			
	10		10.4	3.8	
		0 off		3.9	both no decrease in
				3.9	turning off filament.

With milleameter on 1000 position, Tube oscillates at 10 m.a. Eliminated with meter in 10 ma full scale also none on 100 ma. full scale

Oscilation at 12 m.a. on 100 scale

at 20 m.a.	.001	-6.	(100 scale on meter)
30		-25.	
	10.5	2.7	(10 scale)
	5.3	1.1	
	9.8	2.4	
		2.5	
12:00:	3.0 flash		2.5
:30	0.		
12:05		10.1	2.3

:05 200 Volts turned off.

~~12:~~

12:59	200 v. on		
		10.8	4.
:05		10.8	5.2
:40		10.	2.5
1:00		10.3	1.3
:01	200 v. off.		
1:01	200 v. on		
:10		10.1	2.3
30			2.4
40	3. flash		2.8
55			2.4

4/26/49

	bf.	L-	Gem	
		10.	2.4	
1:07	0. off		2.0	zero of galv. off.
1:03			2.5	
	3. flash		2.5	
20	200 Volts off.			
1:07	0. off			
2:40	Outgassing			
	Current through all filament and grid R.F. in collector coil.			
3:35	Heat off collector and grid Two filament left on until gauge readings are taken.			
3:45	3 H.V on	5.7	1.6	
30		10.		
40		10.	2.2	
50			2.1	
	0 off			no effect in turning B6 flash fil.
	H.V. off.			
3:47	H.V. on	10.1	~~2.1~~	
10			2.1	
15			2.	
	3. flash		2.	
10			2.	
15	0 off		2.	no effect
40	H.V. off.			
2:55	Constriction heated and reduced in size			
	Heat on for ~~second~~ second outgassing.			

4/26/49

(4)

	i_{tf}	i_-	Gm	
3:55	All power off. Tube sealed off without being allowed to cool off.			
5:06	200 volts on			
	Leakage current 42 μa @ 200 volts filament to grid.			
5:08		1ma	1. .35	
:30		10ma	3.7	
:40			3.2	
09			2.8	
30			2.2	
10			2.1	
		10ma	.1 .25	
5:11:30	3		.1 4.3	
:45			2.5	
12:30	off		1. 2.1	
:35			1. 2.0	
			2.	
13:30	3a		2.8	
45			2.1	
:1~~4~~	3.5		2.8	
30				
5:15			2.0	
:30	3.		3.2	.7 second to get up to this value.
45			2.3	
16:30	off			
			2.0	
5:17:30	3		4.9	
18:30	off		2.7	(hot)
:37			1.9	
~~19 30~~			1.8	
19 30	3		2.2	First time flash value is not big.
20 30	off		2.1	
:37			1.95	

4/26/49
(3)

	i_{ff}	i_-	C_{cm}	
		10 ma		
5:21:30	3		1.95	
+			2.35	
45			2.0	
22:30	off		2.	
:45			1.8	Probably zero shift of galv.
24:30			1.85	
			2.1	
25:30	3.		2.8	
45			2.1	

Oscillation about same as when on system
i.e. ~ 12 ma

main filament current 3.35 amp.

6:10		10	1.7	

Tube to be allowed to run all night
Test filament on @ 2.9 amp.
H.V on grid. 200 v.

4/27/49

8:12 AM	~~off~~ 3.0		1.95	
+	off		1.95	
8:15			1.95	Shows no condensation
+	3.0		1.95	in 3 min.
8:16	off.		1.95	
9:47			1.90	
9:48			1.90	No flash effect after
+	3.0		1.90	
9:49	off.		1.90	92 min.
10:51		200 v 10	1.80	
+ i_f = 3.32		0 0	0.1	(Photo current)
17:59 178 min.		200 v 10	2.4	on for 25 sec.
2:11 200 min.		200 v 10	2.9	on for 10 sec.

18.77
9.44
4.28

240
28
368

Tube 4/25

4/27/49

	i_{ef}	i_-	Gcm	
~~2:11~~	~~200V~~			
	3			
2:16		10		
10"			2.9	
30			2.8	
60			2.65	
2:17+	3.0 Flash		2.65	after 268 min off. Shows no flash effect.

Tube put into big box for measurements.

5:45	$i_f = 3.29$		V	i_{ef}	MV	
			0	0	5 62	Photo current
:49			200	10	3 87	Tube has been operated at 200 V for trial and present situation is fairly will clean up.
:53			"	"	3 85.5	
:54	(220 min)				85.5	
	5sec. 3a flash.		"	"	90.0	only 2 is real flash effect rest photo effect
	40 "				88.0	
:55			0	0	3 3.0	due to photo el. from elect. fil.
	3a.		0	0	3 5.0	Increase because of photo current from light of filament.
6:07	3.5		200	10	3 135	Shows real gas coming out when flash fil is on.
:08			200	10	119	
6:10	3.5		200	10	117	
6:11	3.0		200	10	94	Charge comes at once
:12	3.0				93	
:13	3.0				89	

15 77
7 57
8 20

3×1440
4320
480
20
4820
12040
17160

1440
720
305
2465
17160
19625

21065
1400
22465

720
147
867

1440
5760
150
860
6770

8 36
6.14
2.22

1440
160
1280

$$\frac{66\times10^{-9}}{9.7\times10^{-3}} = \underline{\underline{6.8\times10^{-6}}}$$

6.8 ions per million el.

X ray level.

$$\frac{2.7\times10^{-9}}{10^{-2}} = 0.27\times10^{-6}$$

.27 ion per million el.

Assume for N_2 0.16×10^{-6} for 10^{-8} pressure.

X ray equiv. $= \frac{.27}{.16} = \underline{\underline{1.7\times10^{-8}}}$ mm.

$\frac{6.8}{.16} = \underline{\underline{42.5}}\times10^{-8}$ at $\underline{\underline{5.6}}$ days

Probably 0.2×10^{-6} is better value for 10^{-8}

425

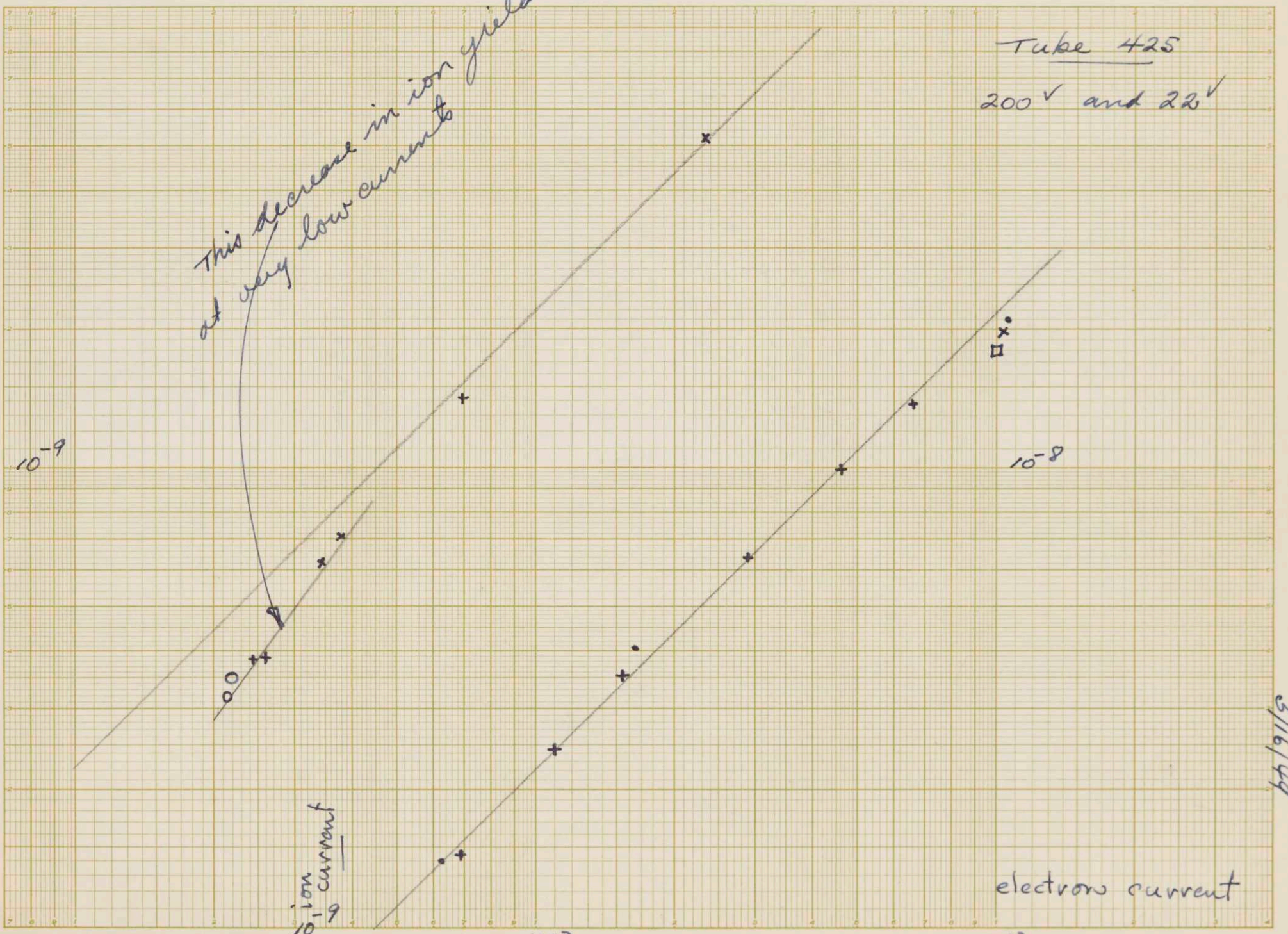
		i_{aux}	i_f	V	i	mv	
4/27/49							
	6:14 PM o	o	3.29	0	0	3 3	
4/28/49							
	8:37 AM 862 min.		"	200	9.9	323	on about 10 sec. Tube 307 would have been 350 at this time.
5/2/49							
	11:07 6770 min.			200	9.6	54	(56) (Equ 3/730)
5/3/49	8:27 8050 Min.			200	9.7	66	(68) (Eq. 3 2120)
5/4/49	8:27 9490			200	9.7	76	(78)
5/5/49	8:37 10940			200	9.5	86	(90)
5/6/49	7:57 AM 12,340		3.29	200	10.4	105	(101)
5/9/49	4:17 PM 17,160			200	9.9	134	(135)
5/11/49	9:22 AM 19,625			200	10.0	156	
5/12/49	9:22 AM 21,065			200	10.4	170	(164)
5/13/49	8:42 22,465			200	10.1	176.5	(175)
	8:47			200	1.04	21	(200)
	8:49			200	3.7	76	(205)
	8:52			200	7.4	133	(180)

Under these conditions about 18 ma needed for oscillation.

5/16/49	3:07			200	10,6	210	(198)
	4:30				1.65	40.5	(245)
	4:32				.635	14	(220)
					.22	3.5	(160)
					.215	3 100	(145)
	4:42		3.27		10.2	198	(194)

3, 2
264
48.

On basis of experience with the Ether tube (#307) 40 should have been expected.



		i_{fil}	√	i	mv.		
5/16/49 cont		3.2	200	6.6	'138		(209)
	4:49	3.1		4.6	99		(215)
	:51	3.0		2.9	64		(221)
		2.9		1.5√	35.√		(229)
		2.8		1.1	24.5		(223)
				.69	'14.2		(205)
31.1	4:58	2.7		.695	3444	14.1	(203)
Total 31.5		2.~~5~~		.26	119	3.78	(145)
	5:22	2.√		.242	120	3.81	(157)
		2.58		.342	197	6.25	(183)
		2.6		.38	3224	7.1	(187)
	5:27			2.35	'52		(221)
	5:40	3.27		10	'180		180

The above readings show that clean up is going on but that in addition there is a real non-linearity.

5/20/49							
	3:10 PM.	2.78	22√ 200	.945	'25.2		267
				9.2	217		236
				3.6	98		272
				.93	24.5		264
		3.27	0				
5/23/49	~~11:00 AM~~	2.68	22√ 200	.90 ~~10.4~~	78		312
	11:10	3.27	0				
5/24/49	3.26 PM	2.68	22/ 200	.57	'19.6		344
				1.02	34.9		341
5/25/49	8:15 AM Lift on at →	2.80	0				
		2.80	22/200	1.02	35.3		346
		3.27	0				

(425)

5/26/49

	i_f		i_e	mv	net	i_+/i_-
5/26/49						
4:00 PM	2.8	22/200	1.05	37.2		354
	3.27	0				
	2.59	10/20	.005	21		
		20	.2	30.8	9.8	
5:21		0		21.0		
		0		21.0		
5:28		10 25	.205	107.5	87.5	
		0		19.0		
		0		19.0		
(17.3)		30	.208	480	460	
Take R_S=660			.210	28		
R_T=11,400 meg		35	.189	86.3	85.3	
		0		1.		
		40	.191	201	200	
5:52		45	.192	344.5		
(3.42)			.197	103		
			.192	343.5		
		50	.194	154		
(6.18)			.196	25.1		
			.195	155		
		50	.196	25		
		60	.200	44.5		
		70	.208	66.0		
	2.55	80	.204	83.5		
	2.54	100	.200	116.		
		125	.210	162		
	2.50	150	.179	143		
		35	.204	96		
6:17 PM	3.27	0				

$$\frac{93.2 \times 10^{-3}}{660 \times 10^{-6}} = 1.41 \times 10^{-10}$$

$$\frac{1.41 \times 10^{-10}}{.196 \times 10^{-3}} = 7.2 \times 10^{-7}$$

$$\frac{3.2 \times 10^{-3}}{11.4 \times 10^{9}} = 1.93 \times 10^{-12}$$

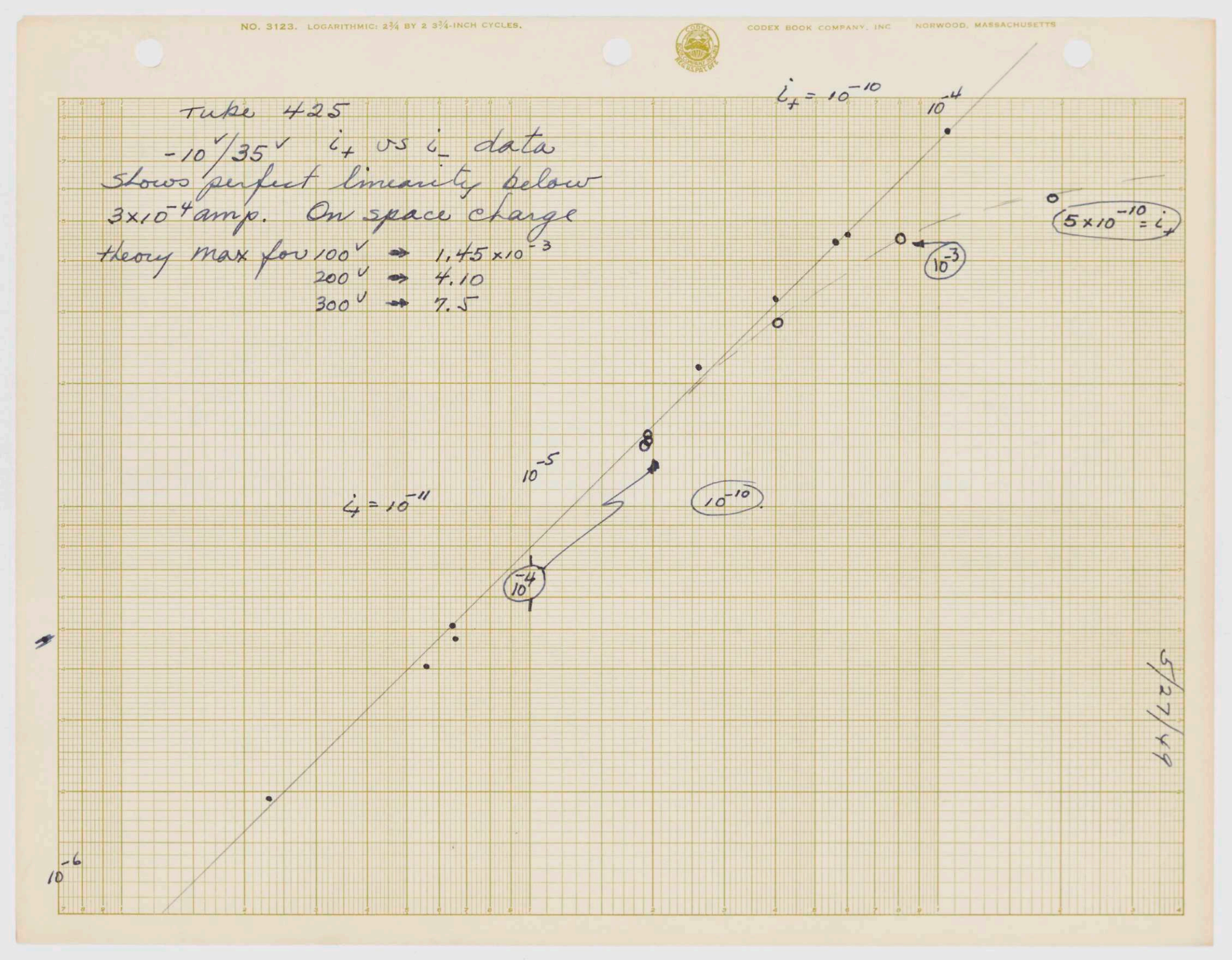
$$\frac{1.93 \times 10^{-12}}{2.3 \times 10^{-6}} = 8.37 \times 10^{-7}$$

425

5/27/49

5/27/49	i_f	V_c	V_e		i_e	Mer	Net	i_+	i_+/i_-
8:52 AM	2.59	10	350	(.192)	.196	95.2	93.2	141	7.74
	2.49		350	(.105)	.109	55.8	55	83.5	7.9
				(056)	.059	30	29.4	44.6	8.0
Changed meters for i_e				(.06)	.0625	31	30.4	46.2	7.7
	2.34			(04)	043	21.8	21.2	32.2	8.0
			350	(026)	029	14.8	14.3	22	8.4
	2.1			(0056)	0096	53	46	4.04	7.2
			350		0043	8.5			
			350	(0065)	.0101	64	58.5	5.15	7.95
9:43	0		35		003	2			
24					0029				
				.0023	.0052	23.2	22	1.93	8.37
					.0029				
			35	(0066)	.0099	61.2	54.2	4.75	7.2
			35	.0033	0033				
10:57	2.59				.195				
				(.194)	.198	97	95.5	145	7.48
	0		35						

× 5 × 4



5/27/49

	i_f	V_c	V_e	i_-	Reti$_-$	mo	net	i_+	i_+/i_-
1:47 PM	2.57	10	35	.193	.189	100	599	150	7.94
	0		35	004				-12	
			0			1			
1:48	2.7		35	.405	.40	188	186	282	7.03
	2.8		35	.81	.805	302	298	451	56.0
	0		35	.004		4			
	3.0		35	1.90		385	376	570	30.0
			0			9			
2:23									
	3.0	10	100	2.4	2.375	1 42.3			
	0			-3 .024					
	2.9			1.48	1.46	28.0			
	2.8			1.0		19.1			
(12.6)				1.0		2 242			
			~~1.00~~	1.02	1.00	19.7			
3:41 →			~~.79~~	.81	.79	2 200			
			~~.503~~	.525	.503	130			
	0			.022					
	.263			.275	.255	2 70			
				020					
				.110	.090	2 24.9			
				.115		3 65			
				~~.116~~		~~2 24.9~~			
				.116	.096	2 25.5			
				02					
4:03 PM 5/27/49				.120	.100	3 70.7			
ON at 3:27 = 0 f				.068		3 34			
				035	.016	3 12			
				019					

Increase in pressure in 1 year 11.4 times

$\frac{i_f}{i_i} = 65 \times 10^{-6}$

$\frac{i_f}{i_i} = 740 \times 10^{-6}$

Pres $= 3.7 \times 10^{-5}$ mm

Pressure rise in 364 days. 3.4×10^{-5}

or 9.0×10^{-8} per day

$24 \times 60 = 1440$

Average rise $= 0.6 \times 10^{-8}$ per 100 min

$1.5 \times 1440 = 2160$

$\frac{2+6}{2400}$

$\frac{3.5 \times 10^{-6}}{2400} = 1.46 \times 10^{-9}$ per min.

2×10^{-7} per min. $= 1.4 \times 10^{-8}$ per 100 min

$10^{-8} \approx$ pres rise

$\therefore$

$\frac{\Delta i}{i} = \frac{3.5 \times 10^{-9}}{10^{-3}}$

$10^{-8} \frac{65 \times 10^{-6}}{.2 \times 10^{-6}} = 3.25 \times 10^{-6}$ pres.

425 June 9 '49

	i_f	V	200	i_c	mv
June 9 '49					
5:10 PM	2.8	22	200	1.02^{-3}	'57
	3.27				
June 13 '49					
4:56 PM	2.8	22	200	1.0	'62
4:57	3.27		0		
6/15/49					
9:02 AM	2.8	22	200	1.01	65.5

6/14/50

						net current	
3:00 PM	0	22	200	79×10^{-6}	0		leakage over press.
3:03	2.5	22	200	4200^{-6}	90.4		745
:05				200	88.2	171×10^{-3}	
:07					83.5		
:08			0				
3:							