HAROLD E. EDGERTON

PAPERS

MC 25

Series III

Laboratory Notebooks

Number 12

Dated Dec. 4, 1941 to Aug. 24, 1942

Massachusetts Institute of Technology

COMPUTATION BOOK

NAME	Number
HAROLD E. EDGERTON	12

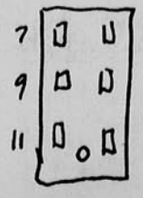
ROOM 4-117 4-111 (LAB).

Course .....

Used from DEC. 4, 1941, to AUG. 24 1942

N.E. C.R. Oscillograph diagram. p 106

Camera plug.



7-8 motor
11 Ground.
9 Button Start
10 comm.
12 Timer.

Harold E. Edgerton
Mass. Inst. of Tech 4-117.
Dec. 5, 1941.

Harold E Edgerton
Dec. 5, 1941.

Spent most of morning yesterday with Bunker, and Schmitt in Biology dept discussing and observing trikosists(?), the barbs that paramecia send out when stimulated.

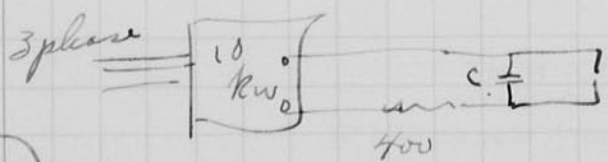
A blue dye was used in the water to excite the action. It also killed the animal but he ejected his darts before passing out.

Then an inductorium was obtained and connected to pass a current through the material with the animals. A single ~~sh~~ shock was ample to excite the action.

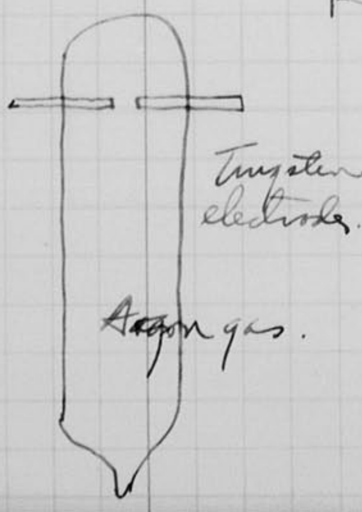
The same experiment was again performed with the geology microscope that had polarizing provisions so that the darts could be easily seen.

The afternoon was spent connecting and experimenting with the movie apparatus so that an attempt to shoot the subject in high-speed could be attempted.

A spark gap was used as before.



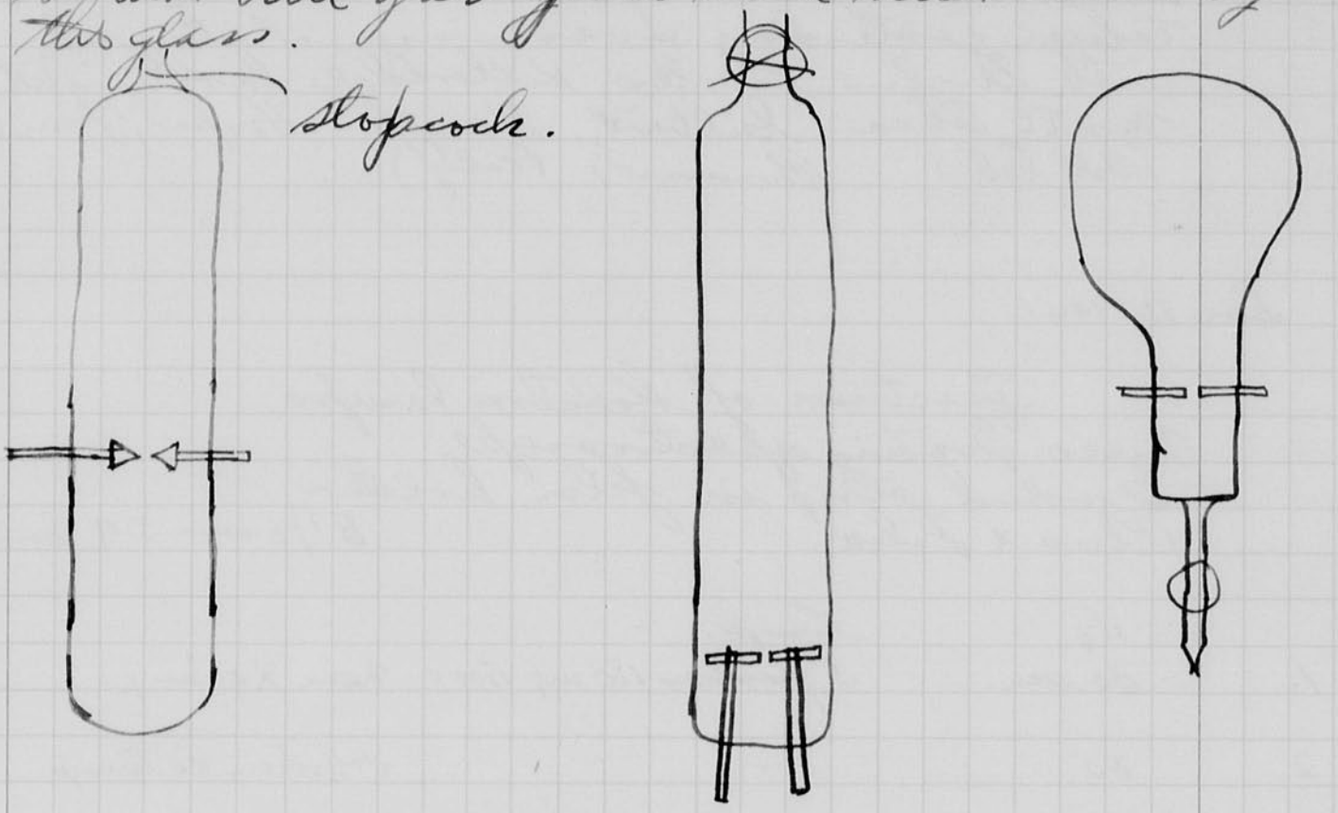
I also tried an argon filled tube that had a 1/2" gap.

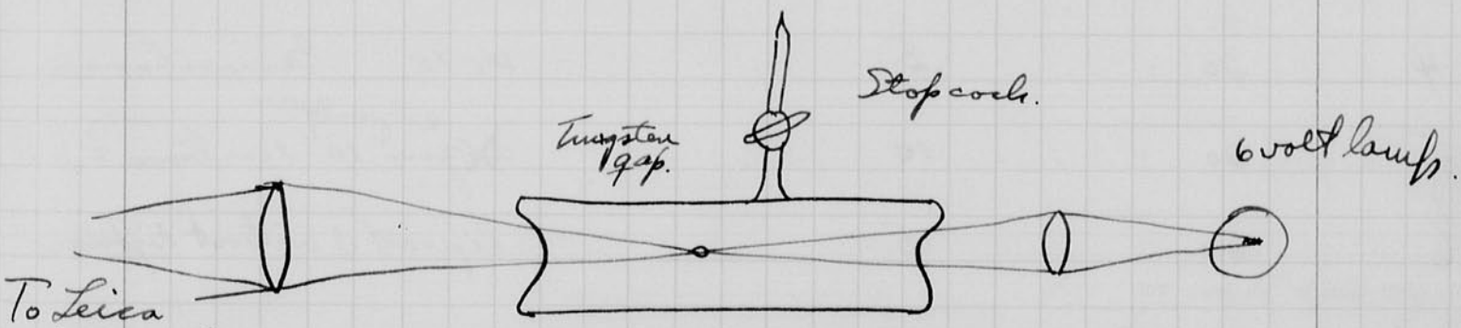


It gave more light than the air gap. I then repumped it after melting the sides and pushing in the electrodes to reduce the gap size. It was filled again to 1 atmosphere.

0.5 mf at 1200 per second was used. Also 2 mf at 600.

The next model will have a stopcock so that it can be run under pressure. Also the gap should be low in the bulb so that the gas flow will heat none of the glass.





Dec 6.

Sat. 4 films taken at 900 frames/sec.
Shock to excite paramecium.
1 mf. 1400 volts neg. Plus x film 100 mag. no eyepiece or lens or polaroid.

Dec. 5, 1941
Harold E. Edgerton.

I returned today from New London where I helped a group from Columbia run at the Sub. Navy yard. Both still and multiflash pictures were taken yesterday evening. I stayed with Gordon Procter Kitteredge last night at Mr. T.E. Shea (Bell lab.) Gilbert, Knapp. (Paramount). Hooper (from Warden, (calif).

Dec. 11, 1941

Spectrum of Kodatron lamps.
Cenco Grating spectroscope.
Graded strip in film holder.
Plus x film. 5 1/2 min D19 about 68°

	Hz.	Lamps.			
1.	30 sec.	5 flashes 180 mf 1800 v.			Nela Xe lamp.
2.	20 "	"	"	"	Hoboken Xe lamp.
3.	20 "	10	"	"	Ar. 1 1/2 gap 1 cm wide ± Weak
4	20 "	5	"	"	Kr Xe. Gemeshausen.
5	20 "	10	"	"	Kr from Sperton 10" 1 cm diam ±
6	20 "	5	"	"	Repeat 3 without diffuser.

Mr. Lynch of G.E. Co. Hoboken was here on Friday Dec 5 with Mr. Snyder of the Boston office. He brought 10 tubes Kodatron Xenon type. One was a leaker and two had loose inside.
Six were sent to Rochester for test. Three kept here. One of these was tested with 112 mf at 1/2 min intervals for a day. On 180 mf at " " " it began to self flash after 2 hours operation ±. Otherwise O.K.

1- 100 watt ~~bare~~ Hg lamp.
high pressure 5 sec
exposure
064 slit setting.

#8 Portable 5 flashes.
28 mf 2000 V.
Xe lamp just
received from
Nela Park.

Dec. 15, 1941

Harold E Edgerton

Tried Kodachromes yesterday
with new lamps, etc from Hoboken.

Bantam film daylight. (in 2¼ x 3¼ Camera).
Haze filter.
Photoservice + Kodatron units for lighting.
2 front lights (Hoboken etc).

f 11 exposures were best.

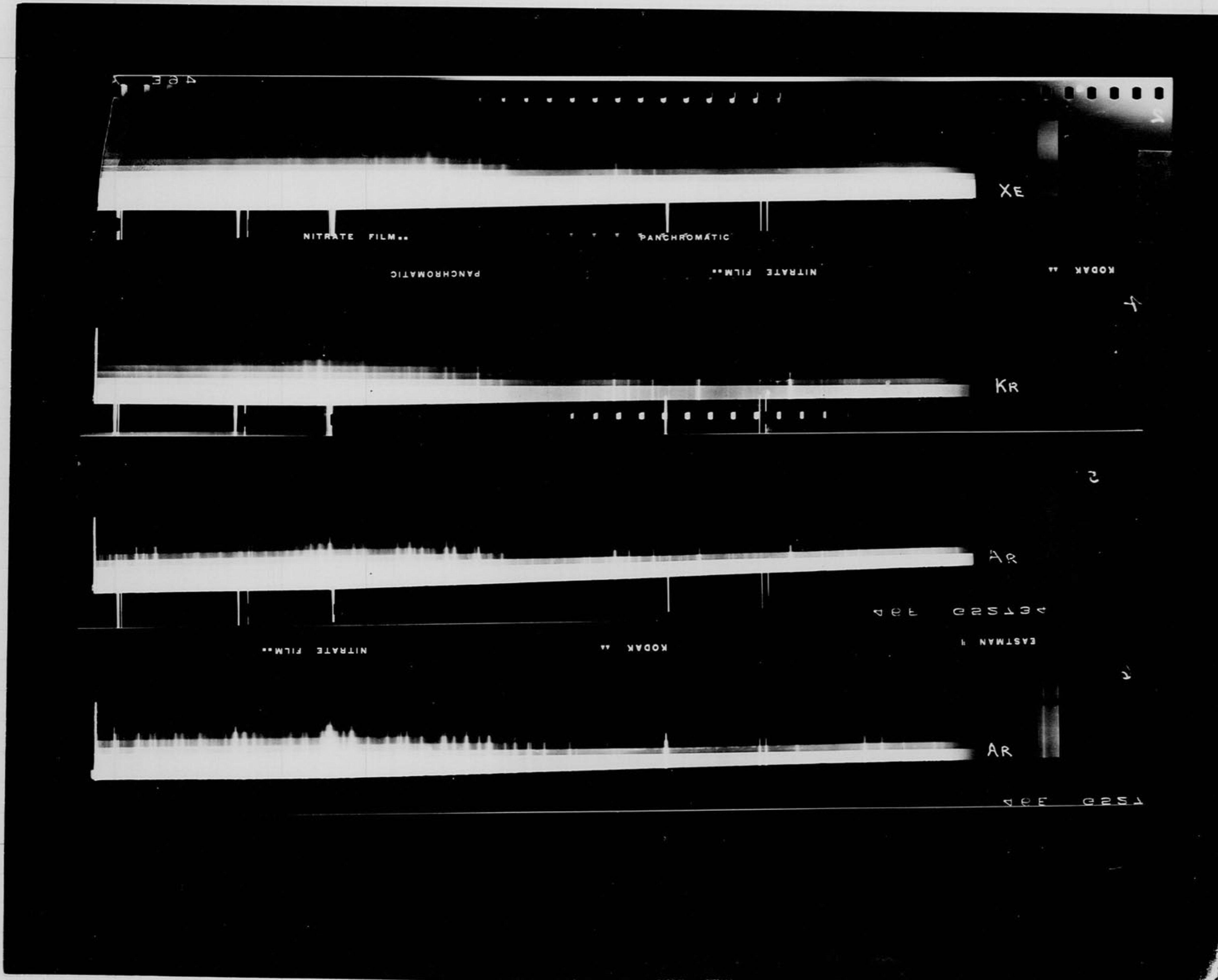
Daylight Kodachrome

Haze

#1 unit f3.6
8
11 side half
16 side profile

Wm — 11
Ralph — 11

Error in marking? Kr. in old tube large size.



Kr. X

3650 Hg. | Hg. 4358 | 5460 Hg. | Hg.

Dec 15 1941
HE Obs Fred Barlow.

#9 north sky about noon few scattered clouds Slit 064 reading. (no diffuser).
15 min exposure Plus X 4 min dev. D19.

#10 4000 volt Quartz tube. Kr. gas. MIT pumped
1950 mf. → DIC 6016 #1 13 cm press.
1 flash.
Diffuser on slit
Lamp to slit 17"
Lamp in black box.

Spectrogram No.	V	C	no flashes.	Tube.
11	4000	500	1	DIC 6016 #1 (Kr)
✓ 12	4000.	1000	1	"
✓ 13	4000	~~2000~~ 1450	1	"
✓ 14	4000	500	2	"
✓ 15	2000	500	8	"
✓ 16	2000	1000	4	"
17	2000	2000	2	"
18	2000	500	8	DIC 5925 8cm Xe. G.E.
✓ 19	2000	1000	4 (plus 1 flash at 1300 volts)	"
✓ 20	2000	2000	2	"
✓ 21	4000	500	2	"

22

1850	100	1600	1700	Mercury and argon?
1600		1500	1100	
2850 S.		1850	2000	Farber lamp.
2000		1000	1100	
1600		1450	1400	
2000 S		1450	1300	
2000 111111 (same power)		1400	1200	
1300		1250	1300	
1200 1400		1350	1500	
2000 1400		1350	1700	
1100 2 1550		1500	1400	

✓ 23. 2000± 100 mf. 10 per sec. 5 sec. U tube SR type Mercury ~~Hot.~~

Dec 16 1941
H.E. Edg.

24 Daylight 12:25 am. Direct sun on front of M.I.T. Diffuser and 064 slit as in experiments of yesterday. Plus X film 7 min D19 70° F

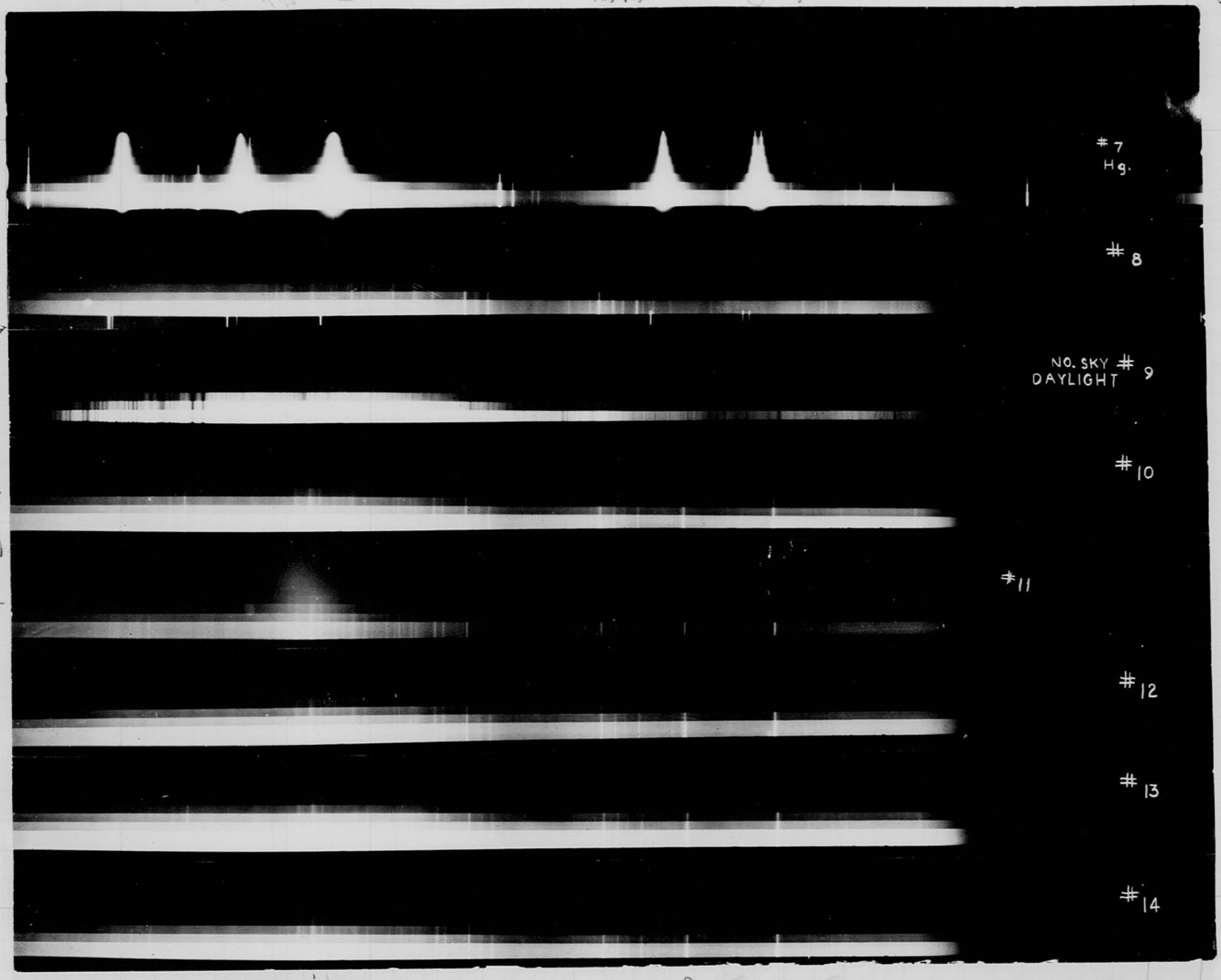
Fogged	25	2000 -	180 mf.	10 flashes.	Xe tube	Hoboken.	~~Haze~~ filter.
Fogged	26	2000	180	10 "	"	"	no filter.
	27	2000	180	20 "	Xe	"	Haze.
	28	"	"	" "	"	"	no filter
	29	2000	180	5	"	"	no fil
	30	2000	180	5	"	"	Haze filter.

Dec. 17, 1941

~~Fogged~~	~~31~~	~~2000~~	~~180~~	~~5~~	~~Kr.~~	~~no filter.~~
NG.	~~32~~	~~"~~	~~"~~	~~"~~	~~"~~	~~"~~
	33.	"	"	"	Argon? S lamp.	"

Dinner at Sigma Nu house Ken. ~~Shiveo~~ Schied - Wilson - Deake

Lamp vertical and 1½" from diffuser film for photos 29 to 33.


100 watt Hg lamp 5 sec.
#7 Hg.
Xe Portable 5 flashes at slit Hg cal
#8
NO. SKY DAYLIGHT
#9
North Sky. 15 min.
#10
2000 mf 1000 J Kr Dil. 1 flash.
V C FL
4000 500 1
#11
4000 1000 1
#12
4000 1000 1
#13
4000 2000 1
#14
4000 500 2

Notebook # 12

Filming and Separation Record

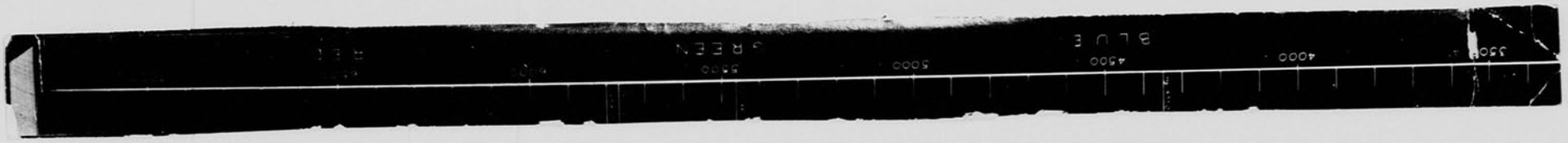
1 unmounted photograph(s)

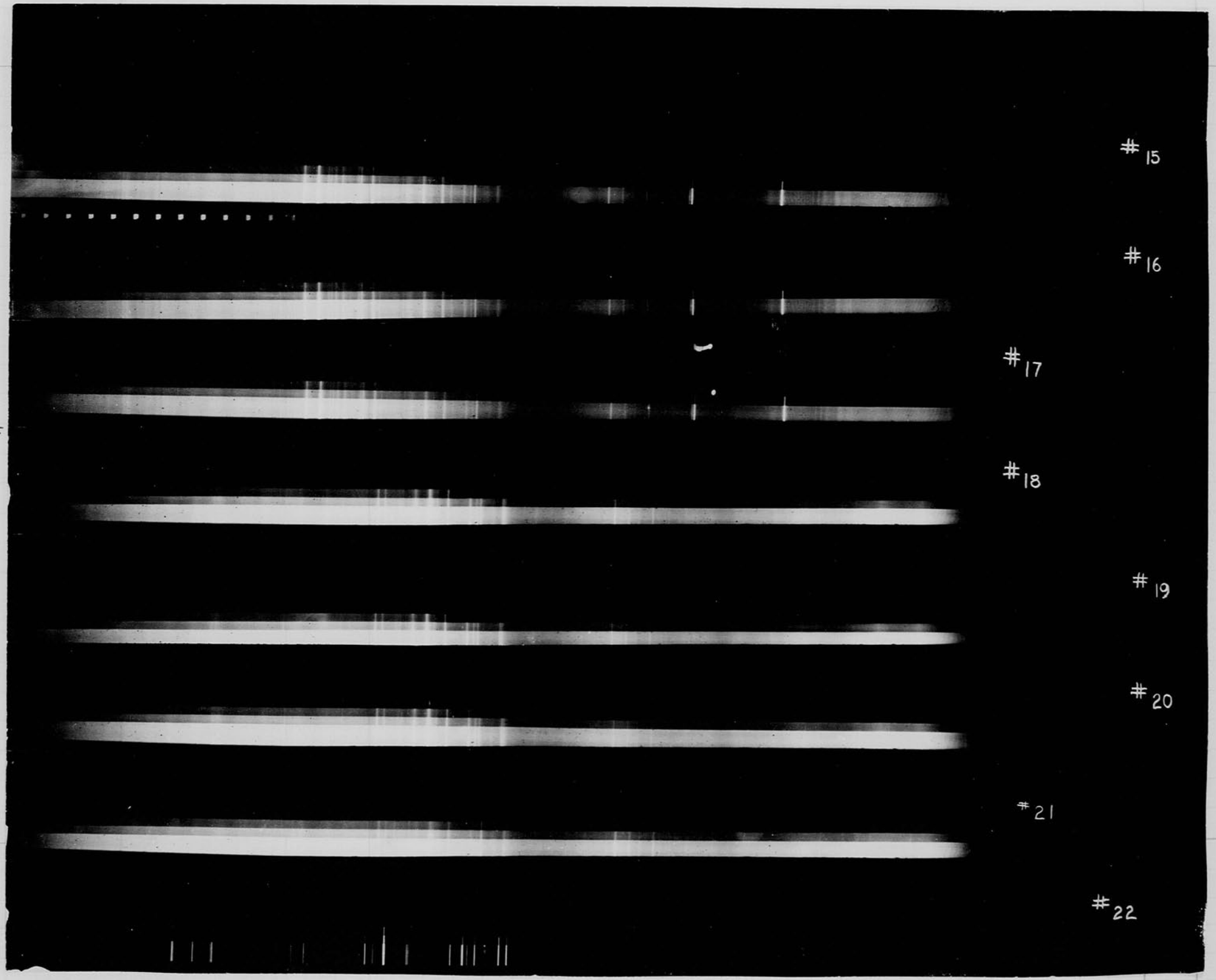
____ negative strip(s)

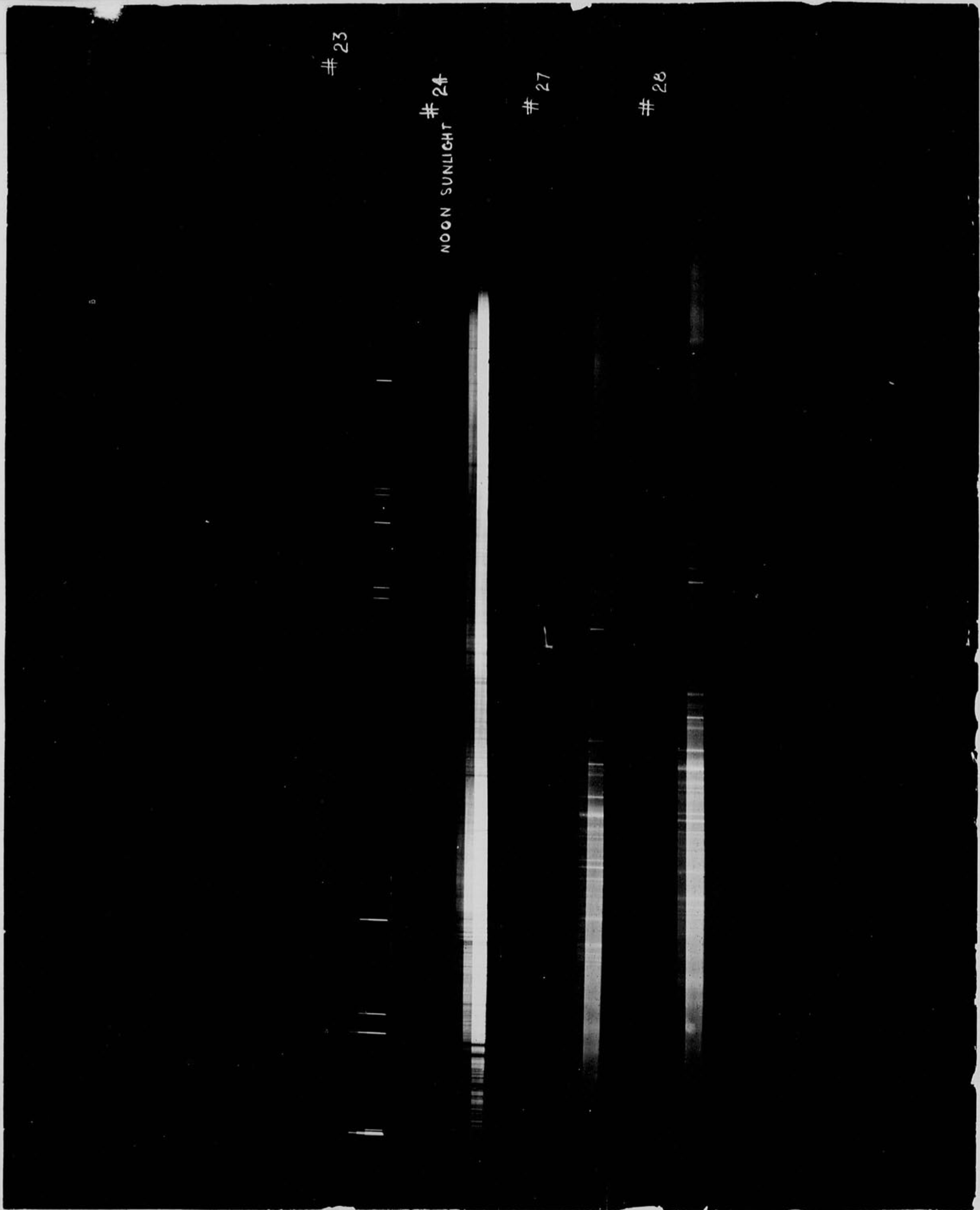
____ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 10 and 11.

Item(s) now housed in accompanying folder.


BLUE
GREEN
4000
5000


2000 500 8
2000 1000 4
2000 2000 2
Xe 8cm
2000 500 8
2000 1000 4
2000 2000 2
4000 500 2
Jarber
Hg - lamps.
?
#15
#16
#17
#18
#19
#20
#21
#22
6182
6318



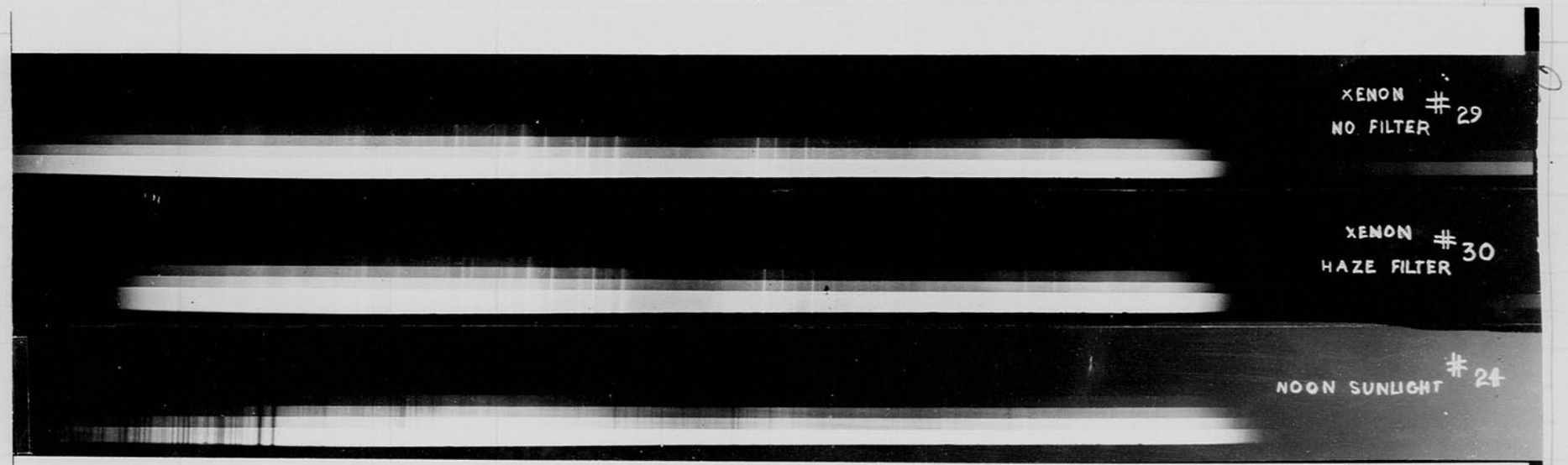
Hg U tube
G.R. tape
100 mif.
2000 s.

Xe
2000 180 5
Haze Filter

Xe.
2000 180 5
no filter.

Xe
5492

0500

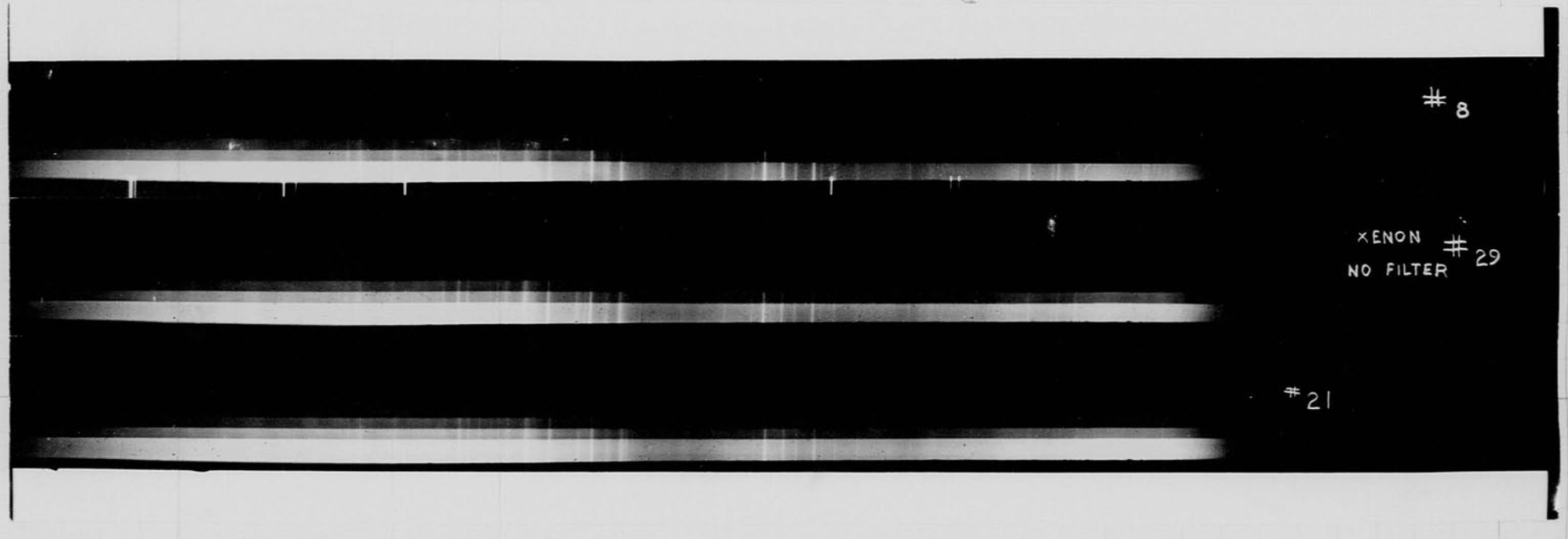


CA+
3933
3968

Blue

Green

Yellow



Portable.
28 mf
Hg
~~Std~~ Spiral
180 mf

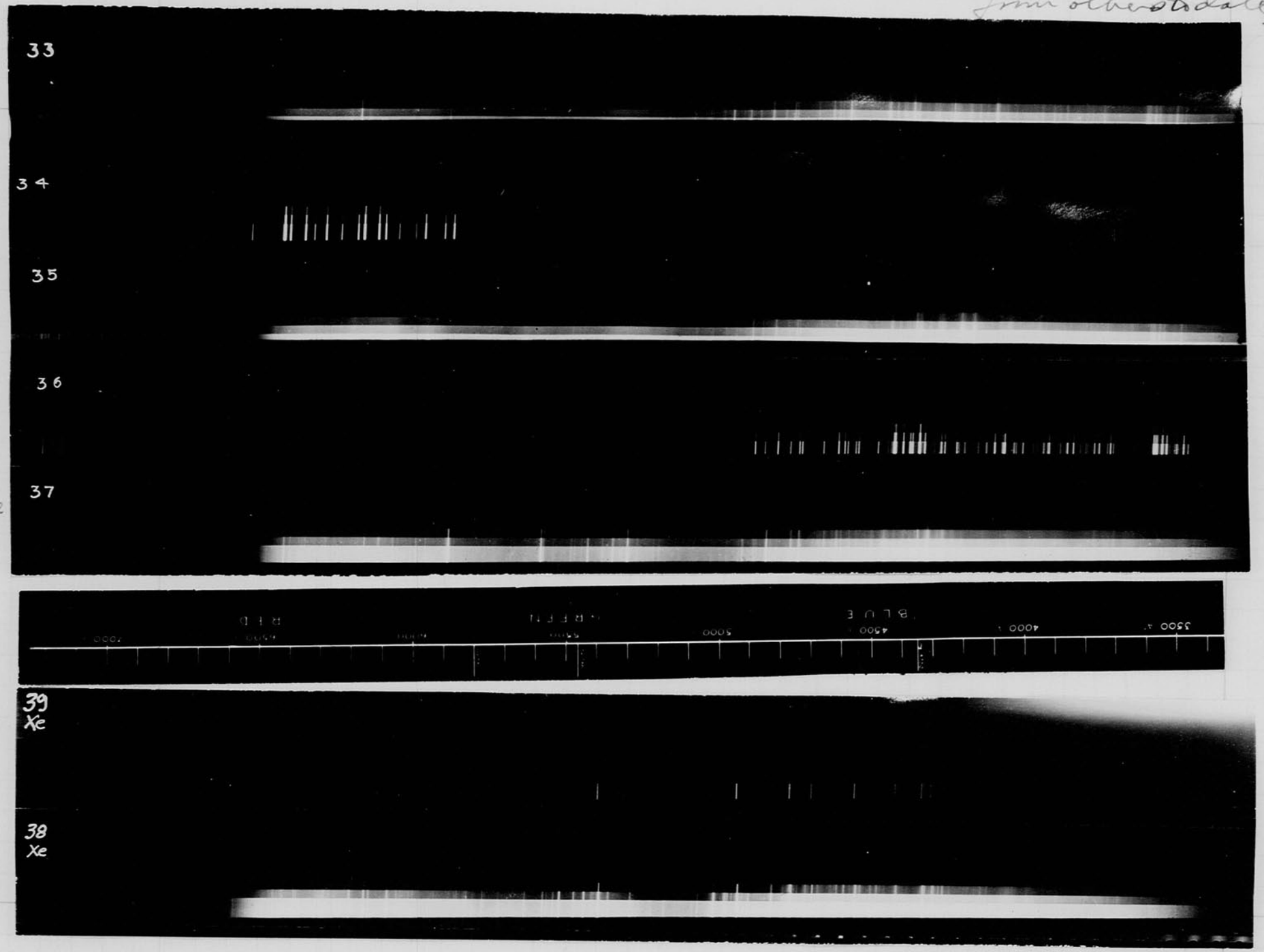
500 mf
4000 V.

Blue

6500
Red

RED ——————— BLUE.

note that these are reversed from other data.



Dec 17 1941

Harold E. Edgerton

Repumped two Standard Kodatron type flash tubes that were accidently broken a few days ago.

#1 tube neon 2 cm pressure.

#2 " argon (tank) 10 cm press.

Baked ½ hour -
Flashed 10 times or more on pump. Flushed and refilled with fresh gas.

Spectrogram				
# 34	2000 v	180 mf	neon 2 cm. 2 flashes. (tube N.G.)	
35	"	"	Argon 10 cm 5 flashes.	
36	"	28	argon 8" tube FA 2. 10 flashes.	
37	"	180	(Kr.-Xe) 5 flashes. Kodatron lamp with mixture of gases.	
38	2000 v.	28 mf.	20 flashes. Xe lamp	400 ohms.
39	2000 V	2 mf	90 " " "	3,000 ohms
Dec 18 Very Weak → 40	2000 V	2 mf	100 " argon 10 cm	"
41	"	180	1 " " "	
42	"	"	10 flashes Xe Infrared film	
43	"	"	" Ar 10 cm " " "	

Dec 19 1941 ——

Rotated grating to include more infra red to 8000-8500.
44 Used 88 filter over slit. 10 flashes Xe - (filter fell off) N.G.
Slit zero .029 Setting for photos to #3 .064. 64 / 29 / 35 div.
45. Slit set at .134 10 flashes Xe filter I.R. film. 88a filter in spectroscope. 3 / 10 5 / 29 / 134.

GREEN
Yellow
6000
7000
8000
9000
48 Xe IR FILM
Hg
49 Kr
50 KR
51 AR.
SECOND ORD. BLUE

Red.
Blue

Dec 19 cont.

Prints 40 & 46 on sheet 152

46. Ditto #5 except argon spiral (10 cm).
this shows more infra red lines than the Xe.

Assuming then that argon will produce more infra red light than Xe, I obtained some 4 x 5 S.R. film and took two identical pictures of a graded strip scale with the two lamps.

Lamp to scale 4 ft. no reflector.
Filter 88A. back of Ektar #5 (set at f 8.).
Film #11 argon. 10 cm. (Both single flash from a
" #12 Xe 7 cm. Kodatron 850 mf unit.).

there was no appreciable difference in the exposure of the two lamps as shown by the above experiment.

Possibly one stop

Spec #7.

8 x 10 S.R. film cut to fit spec.
Portable Xe ? 20 flashes. 88A filter.
Printing related further than for #6.
Slit 0.135.
Fg. spec. (no record except 1 line).

out

48 10 flashes Xe lamp no filter.
also Hg lamp. " " for calib.

49. 10 flashes Xe lamp 88A filter.

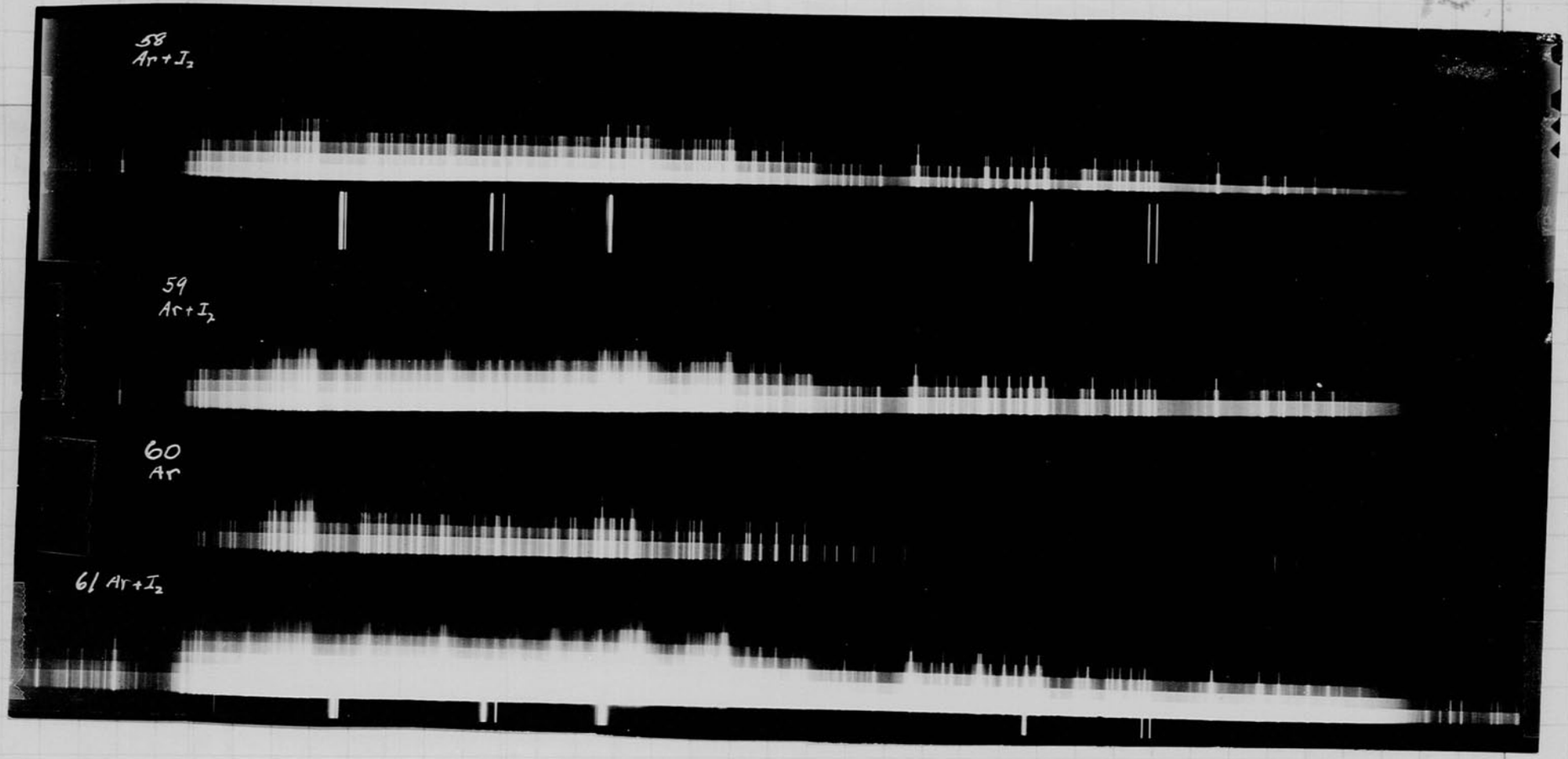
Bottom no filter (5 flashes).
the blue (2nd order) overlaps the infra red. 88A will cut out blue component.

50 10 flashes Kr 88a filter 2 flashes no filter

51 " Ar. " 2 " " "

out 52 " Kr-Ne " " " " Shows only Kr lines.
out 53 2 Neon (2cm) 21 mf 2000 to 4000 v. Hard start tube. (no exposure!!)
54 4 flashes 21 mf 4000 volts neon Plus X film no filter

Blue ——— Red.



dg

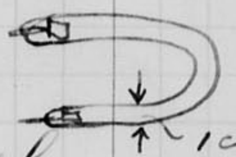
Dec 2ɸ 1941
HE Edgerton

No	V	C	FLASHES.	Gas.	Film.	Filter.		
out 55	{ 4000.	21	20	AR	I.R	88A.	Graded strip.	appears same as 51 except less exposure.
	"	"	2	"	"	NONE.		

Dec 22

out. 56	4000	21	20	AR 1cm + Iodine	88A	"
			10	ar " I_2	none.	

this is in a U tube of the large style



A large spiral (5925) was pumped last week with Iodine, It did not work very well, probably gassy. Only two weak lines show in infra-red. There is considerable

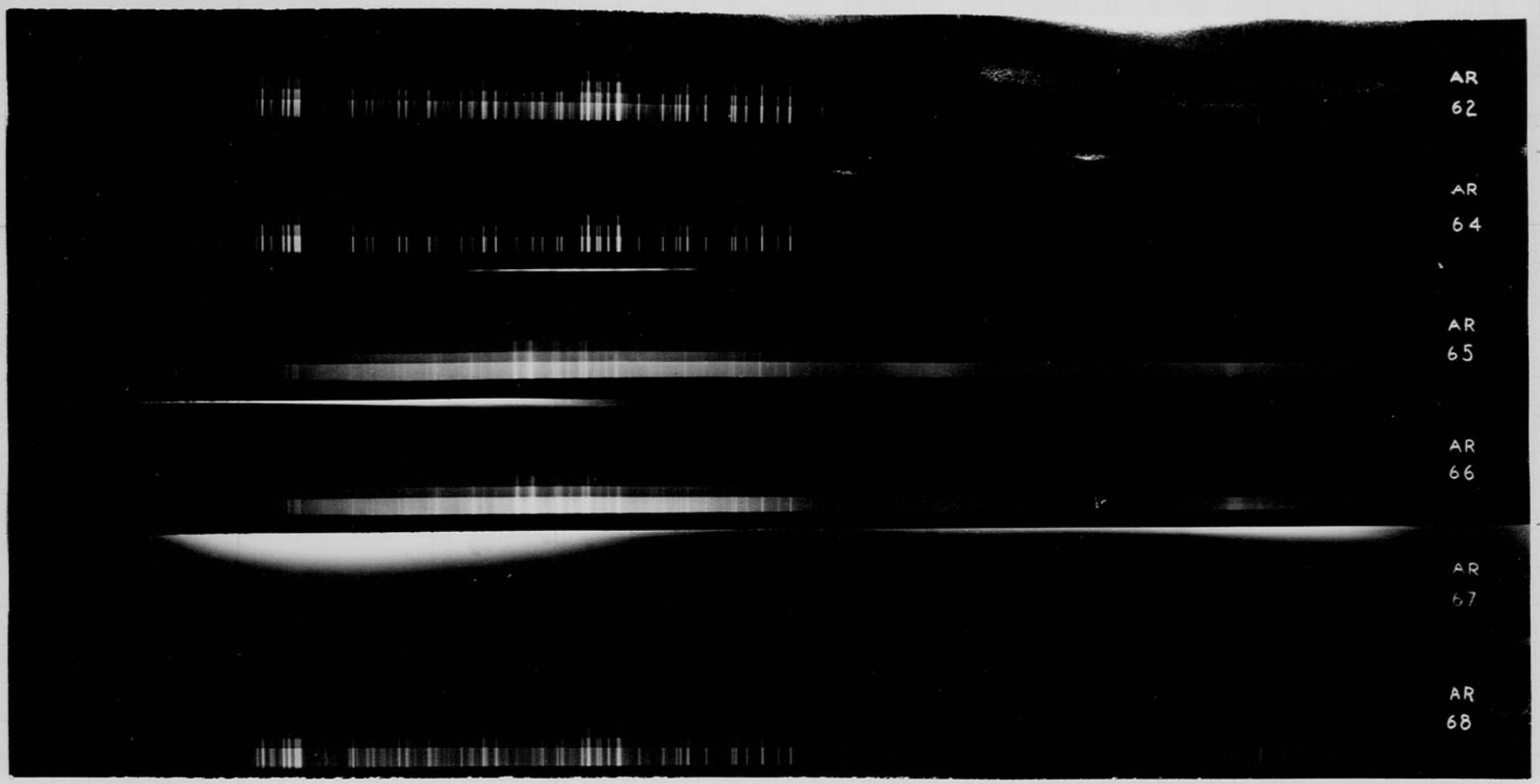
out. 57 4000 21 10? ar + I_2 Plus X film

✓ 58. 4000 21 10 ar + I_2 Kodatron film.
The grating was changed so that the visible was in the center of the ~~ft~~ scale.
Slit reduced to 065.
5 sec Hg for calibration. **Scale reversed**

59 4000 21 10 ar + I_2 Plus X film. also Hg.

60 1000 to ~~3~~000 21 ~~2~~ 12 ± argon tube 16 cm long between electrodes. FA2.
1.4 cm diameter
10 or 15 cm of argon.

61 4000 21 10 argon + I_2 hotter.



3 mf

128 mf

128
2000

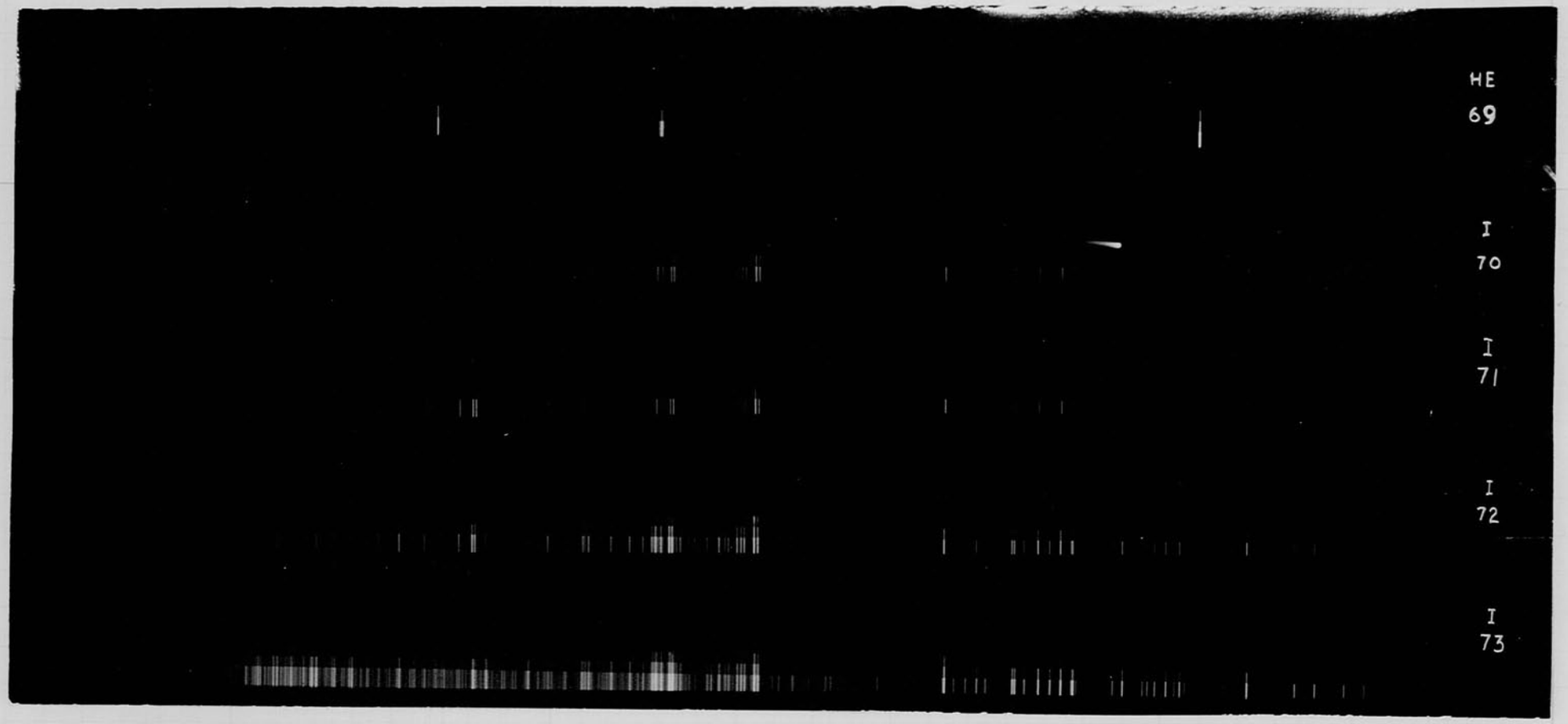
FA2

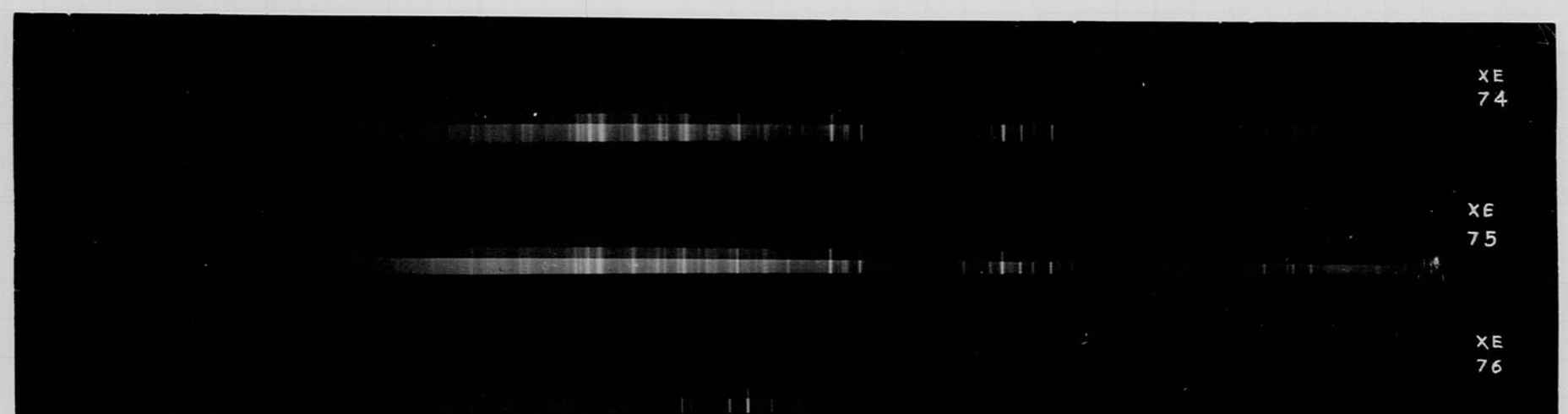
105
2000

105
3200

Dec. 22, 1941

	V	C	flasher	gas	tube	film	distance	
62	2000	21	8	Ar		+x	1"	
63	2000	3		Ar		+x	1"	
64	2000	3	40	Ar		+x	1"	
65	2000	128	3	~~Ar~~	Spiral	+x	1"	diffuser over slit
66	2000	128	36	Ar	Spiral	+x	12"	diffuser over slit
67	2000	105	2	Ar	FA2	+x	1"	
68	3200	105	1	ar	"	+x	1"	
69	1000 ±	70 ±	50	Helium	press? (1cm.)	Similar to FA2.		
70	1500-2200	71?	8	I_2	1½" gap (warm)"		none.	
71	900-1400	21	15	I_2	"	cold		
72	1200	470	6	I_2	"	"		
73	1800	471	4	I_2	"	Warm.		
Dec. 24. 1941								
74	8000	3	~~3~~		Spiral	xe Hoboken.		
75	3000	21			"	"		
76	650	471			"	"		
77								





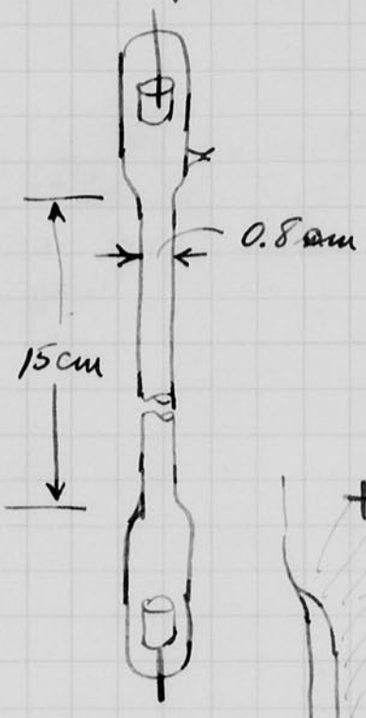
21 mt
3000 v.

471 mt
650 v.

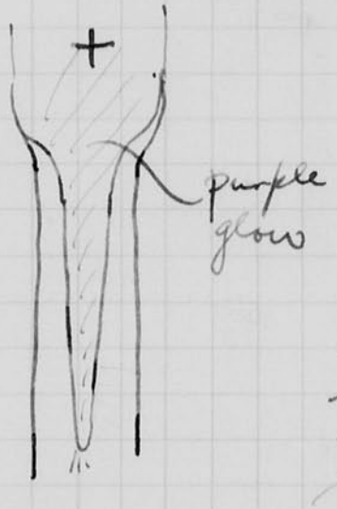
Dec. 23, 1941

Harold E. Edgerton

Pumped straight tube and filled with Iodine crystals in vacuum. A double seal off was used.



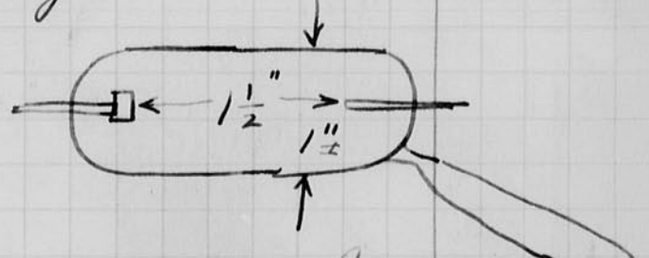
Pointed glow in middle section increased from positive end of tube towards cathode. Condenser discharged when the point reached the other surface of the constriction.



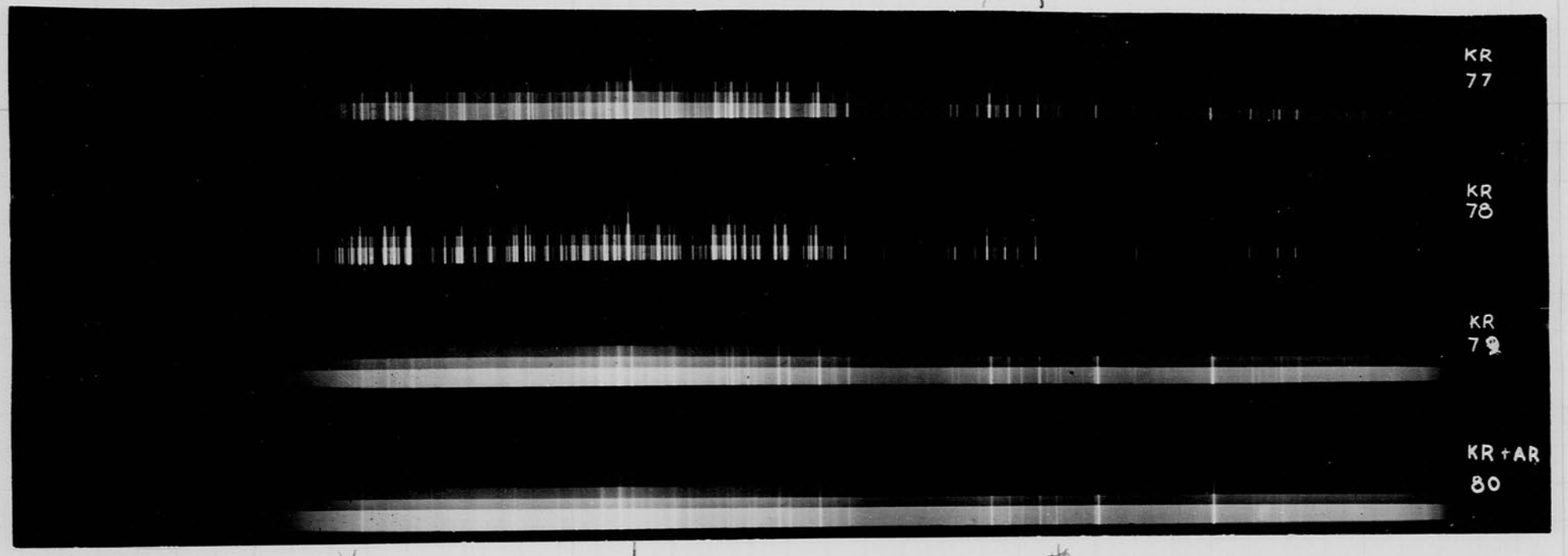
When tube was slightly warm the glow above started about 2000 volts.

The external sparker did not seem to start the tube even if the glow had already started.

A gap tube as sketched below was ~~made~~ pumped and filled with Iodine



Spec 70 to 73 Ions with this tube.



1cm

0.3

3.0

3 + 4

Dec 24 1941

Harold E. Edgerton. Breakdown.

Argon Spiral Std.	7cm	no excitation - Breakdown	3000 V ±
" "	10		7200
" "	7 1/2"		over 8000
Xe "	7cm	" "	8000 V.

~~Dr.~~ Minute of Trade called yesterday and got a liter of Xenon and a 1/4 liter of 80 Xe - 10% Kr. Also a liter of argon.

Xe 81
Xe 82
Xe 83
Xe 84
Xe 85
Xe 86
Xe 87

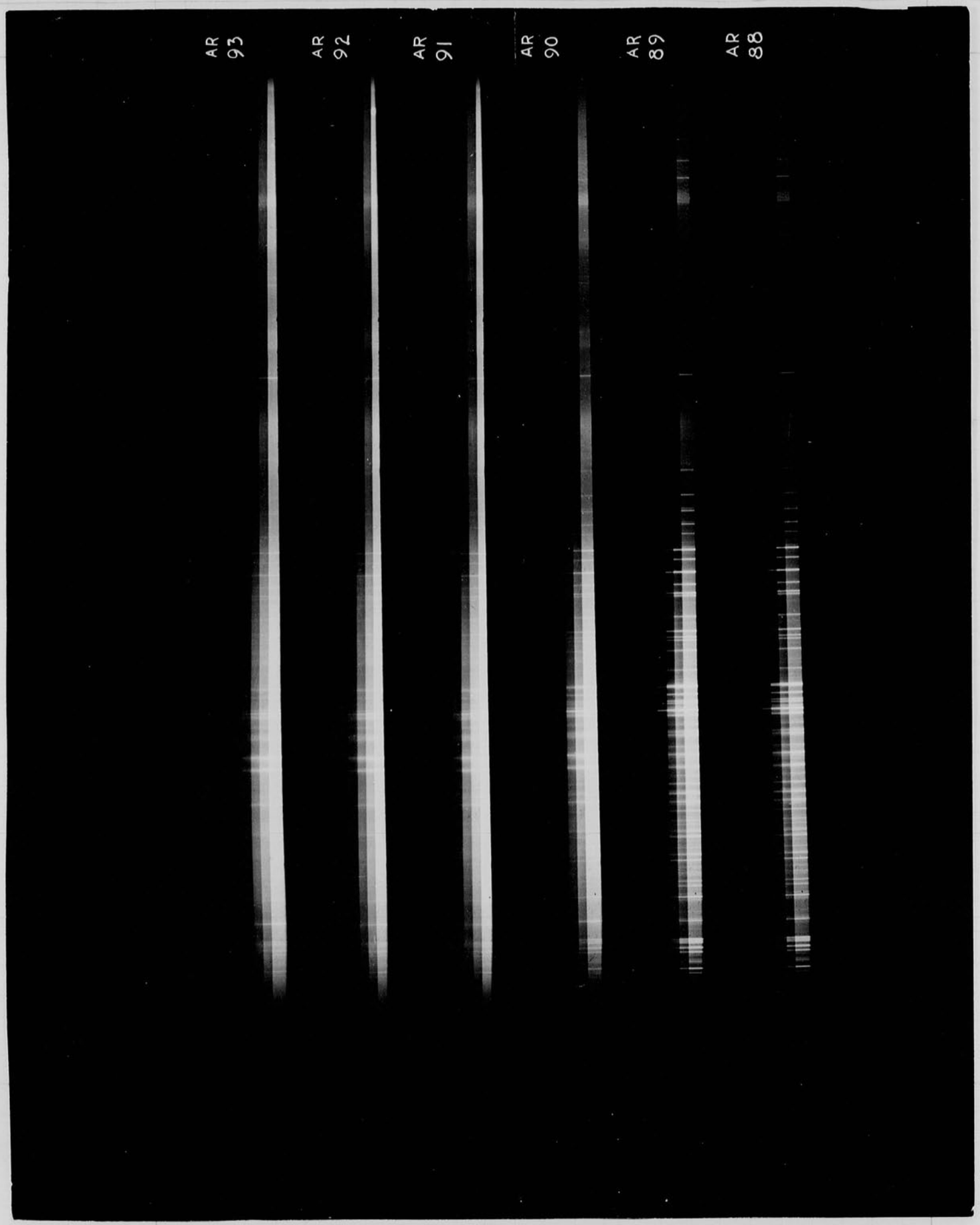
Dec 26 1941

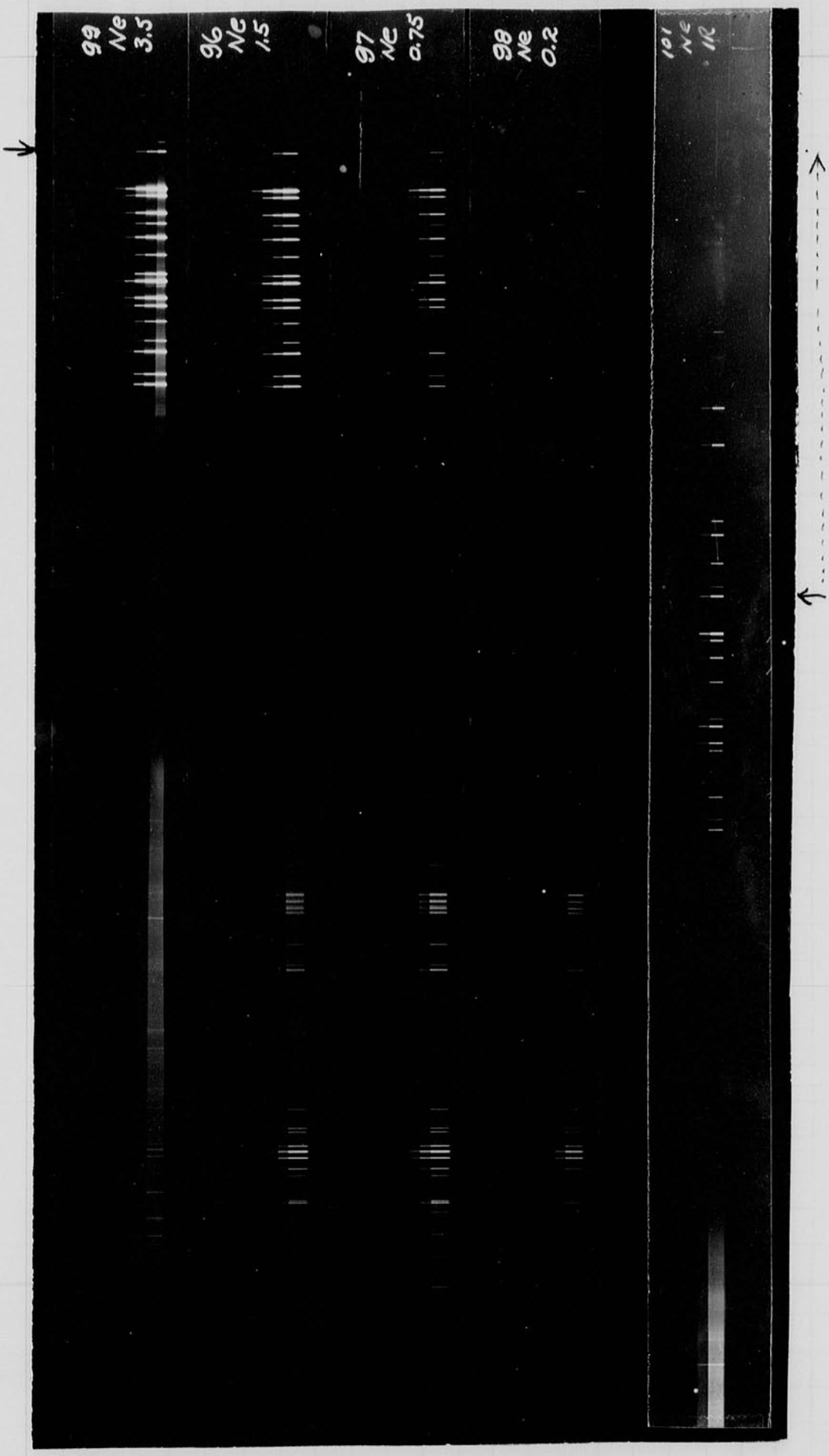
Harold E Edgerton

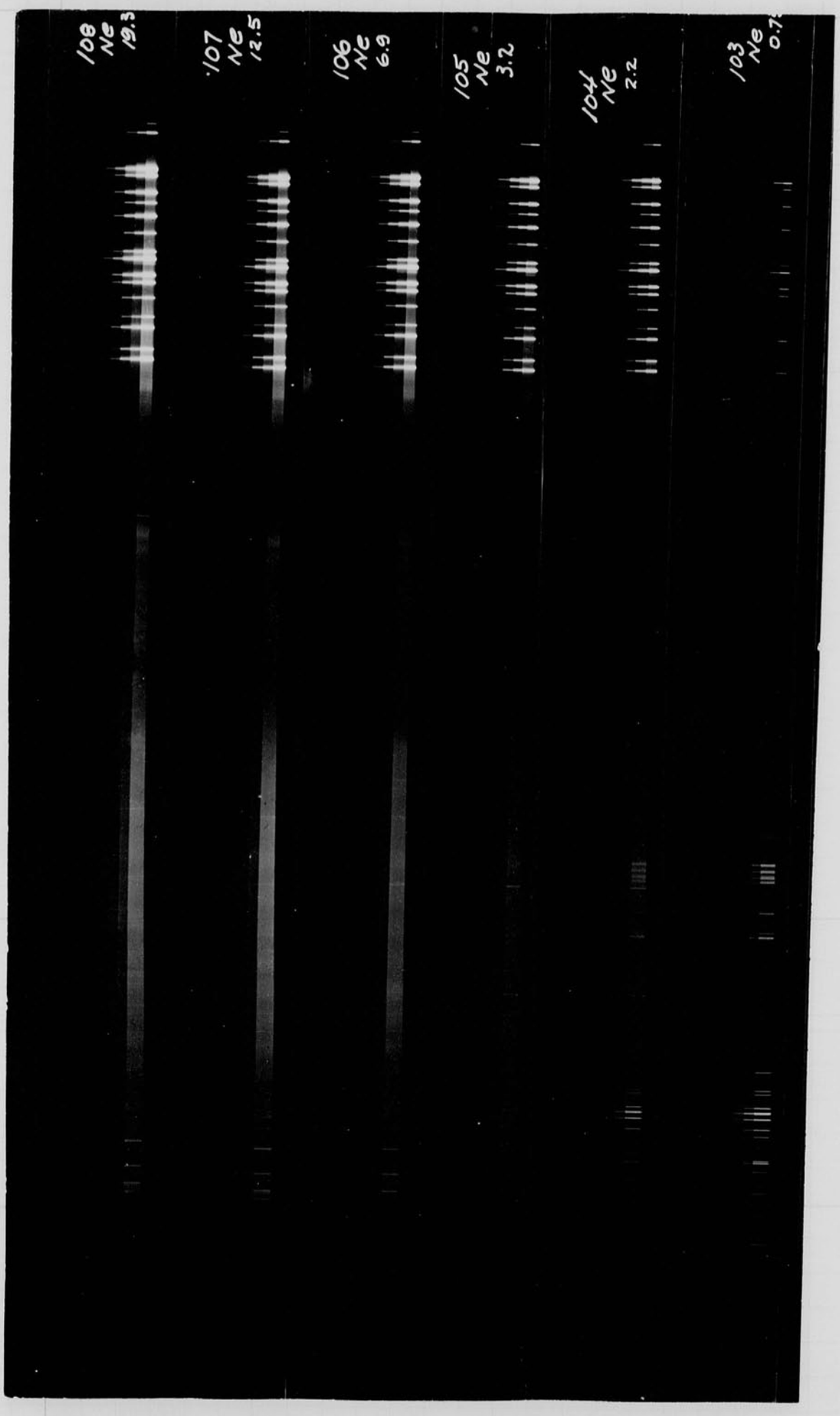
Spec test of tube or pump

the system has argon Kr and Xe gas. Specimen will be examined with different pressure of these gases, a rotation power unit is used to flash. 180 mf 1800 volts with a standard discharge coil.

Spec No	Volts	Cap.	FLASHES 10 sec. intervals	Gas	Pressure	tube	distance	film
77	1800	180	10	Kr.	1 cm	Std spiral	5"	Plus X.
78	1500±?	"	14	Kr.	0.3	"	"	"
	after 3 flashes at 1800 V the tube self-started at 6 sec interval I estimate the voltage was about 1200-1600 for breakdown.							
79	1800	180	10	Kr.	3 cm	"	"	"
80	1800	180	10	Kr & AR.	3 + 4	"	"	"
81	1800	180	10	Xe	6 3/8" 16 cm	"	"	"
82	1800	180	10	Xe	10 3/4" 26.4 cm	"	"	" misses 1 in 10
83	1800	180	10	Xe	10 cm	"	"	"
84	1800	180	"	"	6	"	"	"
85	"	"	"	"	3			
86	"	"	"	"	1.5			
87	1800-1900. Some self-flash at 4 sec.	"	13	"	.75.			
88	2 self flash. 2-6 sec. dig. time.		15±	Argon	1.5			
89	"		1.5" min	"	1.5	"	"	" Pumped 10 min then kept until new gas.
90	Self flashes 4-6 sec.		15± 1.5 min	"	3.0	"	"	"
91	1800		10	"	6.0	"	"	" 1 self flash @ 6 sec.
92	"		"	"	12			
93	"		10	"	21.5	"	"	" Did not flash at 24 cm.


AR 93
AR 92
AR 91
AR 90
AR 89
AR 88


99
Ne
3.5
96
Ne
1.5
97
Ne
0.75
98
Ne
0.2
101
Ne
IR


108 Ne 19.3
107 Ne 12.5
106 Ne 6.9
105 Ne 3.2
104 Ne 2.2
103 Ne 0.7

Dec 2/ 1941

Harold E Edgerton. Spec. tests with neon gas.

Spec no	Volts.	Cap.	Flashes	Gas. Press	Tube	Plus X film 6 min dev. D 19.
out 94	1800	180	10	neon	4 or 5 cm	Std. Spiral. Some self flash (not the identical tube that was used yesterday but similiar)
out 95	"	"	10	Neon	3 cm	System flushed.
96	"	"	"	"	1.5	Some self flash of first
97	"	"	"	"	.75	
98	"	"	"	"	0.2	
99.	"	"	"	"	3.5	does not start at higher press
out 100	"	"	40	"	3.5	Infra red
101	"	"	250	"	3.5	Infra red. 3 turns shift of grating.
	Fresh D 19 Developer. 6 min dev.					
Jan 1, 1942 102	1800	180	5	Xe	10 cm	Plus X film. in U tubes 1½" inside diam 7" long + starting is not positive.
103	"	"	10	Neon	0.75	Std spiral Grating returned to visible System flushed between 103 and 104
104	"	"	10	"	~~1.5~~ 2.2	" Some self flashing.
105	"	"	10	"	3.2	"
106	"	"	"	"	6.9	"
107	"	"	"	"	12.5	"
108	"	"	"	"	19.3	"
out 109	"	"	"	Ne 5 cm + Xe 11.6 = 16.6 cm.		Film slightly fogged
110	"	"	"	Repeat 109.		Ne 5. 11.6
	Pumped down to 6.2 cm then filled with neon to 11.5 cm					1.8+ 4.3
111	"	"	"	See above. Xe and Neon.		5.4 / 7.2 + 4.3
	Pumped down to 5 cm. then filled with neon to 19 cm.					
112	1800	180	10.			17.1 1.9

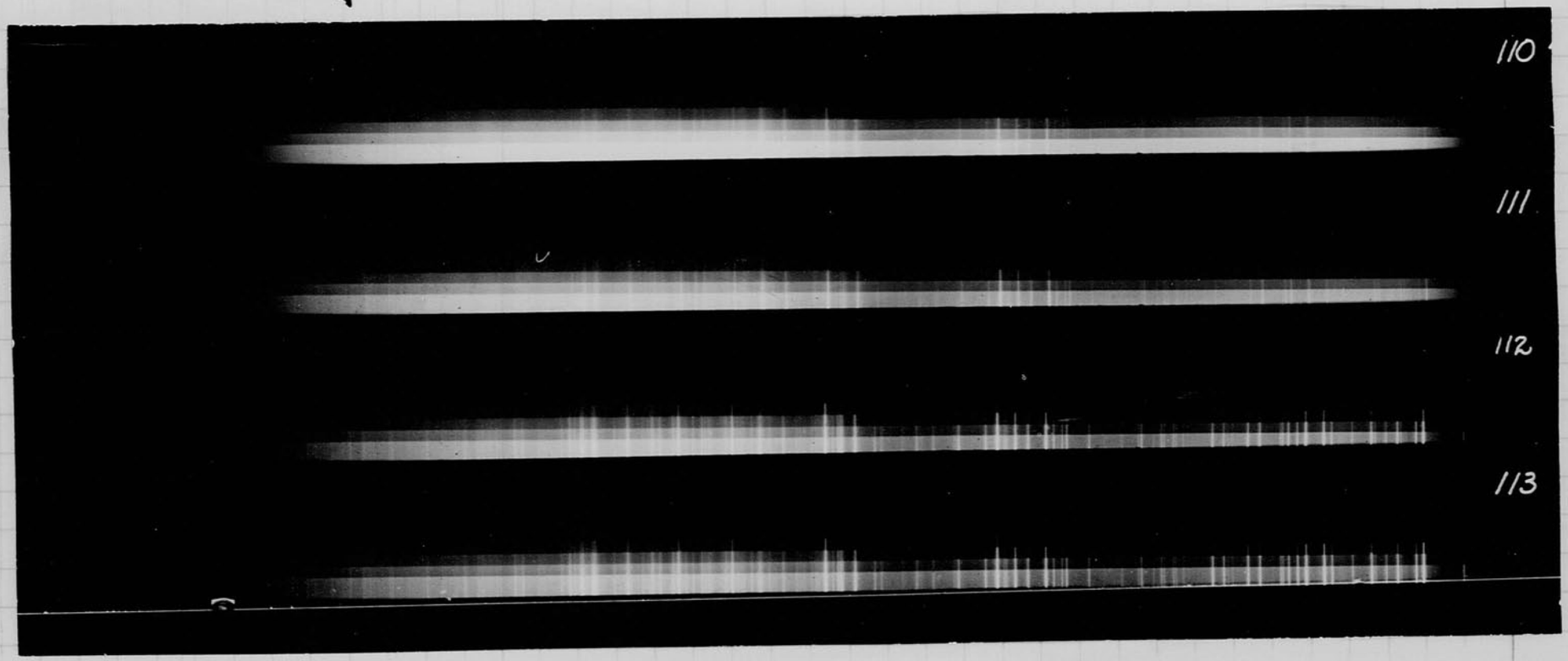
Belita in a Spin. Boston Garden Dec. 29. 1940 10 mf 2000 volts. Quartz spiral. Hg lamps.
The camera was swung so that separate images would not overlap. f 5.6-8

Put in Jan. 1941.

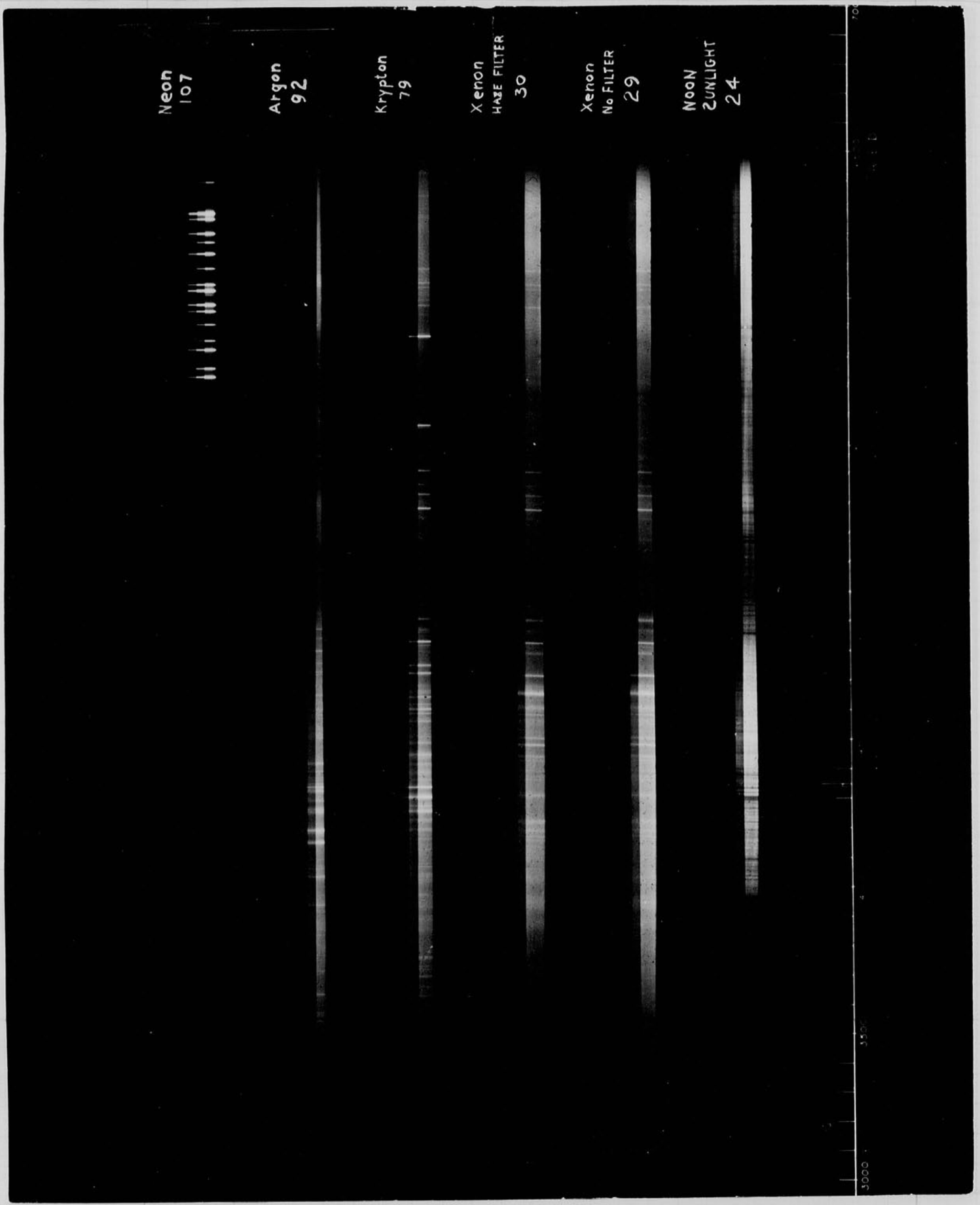
note line missing
see page 26.

this line is Hg.

NEON & XENON. MIX.



5cm
Xe.


Neon
107
Argon
92
Krypton
79
Xenon
HAZE FILTER
30
Xenon
No FILTER
29
NOON
SUNLIGHT
24
3000
3500

Jan 1 1942

Harold E. Edgerton. Neon.
Wyckoff
Barstow.

A new supply of neon (1 liter) was obtained from "air reduction" and put on the pump yesterday. I also found that the system had a leak. Today I plan to repeat spectrograms for neon gas. The oven is now on a standard spiral tube. See page 31 for entries on pump.

Spec No.	Volts	Cap.	Flashes.	Gas.
113.	1800.	180	10	Neon added to 28cm on top of left over of 112. (11⅛" total.)

Tube sealed off under conditions of #113.

Lamp 9 ft from Eastman Band Kodachrome film

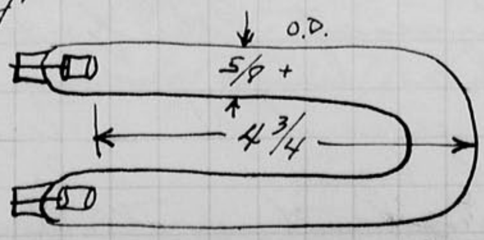
	R	G	B	1	2	3	4	5	6.	C	M	Y
Std Kr. tube	1.32	1.43	1.45	1.16	1.27	1.42	1.59	1.76	1.94	1.72	1.62	1.46
Xe U tube 10 cm	1.43	1.54	1.50	1.23	1.35	1.52	1.70	1.81	2.00	1.76	1.70	1.55
Neon Xe #113	1.28	1.35	1.37	1.08	1.18	1.34	1.54	1.68	1.85	1.66	1.56	1.41

Camera test. Xe U vs. Spir 112 mf 2100 volts ±
10 ft to Eastman chart. Kodachrome film f8 at 4 ft.

Spiral Xe	.59	.69	.82	.98	1.09	1.20	1.31	1.42	1.54	1.64
U Xe	.600	.67	.81	.94	1.04	1.16	1.26	1.36	1.49	1.55.

Jan 4 1942

The above tests show that the U tube with 10 cm of Xe is almost as efficient as the standard Xe spiral. However the flash time is less, since the tube makes a distinct click when it flashes. This is due to the high current. It was observed that this U tube did not "craze". A similar tube with argon or krypton would have crazed at 100 mf at 2000 volts.



Pyrex. Cath anode nickel with inside screen Ba.O. paint?

Jan 5 1942 Kenneth J. Germeshausen
Herbert E. Grier

Jan 4 1942 cont
Harold E Edgerton.

Kitredge and Rifkin from A Trumbull New London conn were here yesterday to discuss under water photography and to design lighting equipment, submersible.

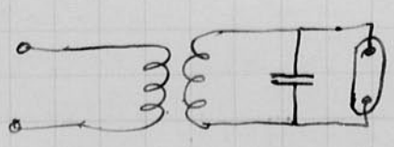
Kit called on the phone several times yesterday to further discuss the possibility of doing the work here in the swiming pool. We also suggested lamp design using a cylinder of lucite or glass for submersion. I required a 3 ft length plus a foot for the control lamp and coil.

I came in last night and tried lamps to see if they would work on the sunie apparatus. A Kr lamp 4 ft long held over even with 1650 ohms at 1 mf. I also tried 3 and 5 mf with better luck. (about 60 cycles.)

Next I made a tube of 17 mm pyrex 3 ft long and filled with 3.2 cm of xenon gas. This gave more light and ran o.k. with 500 ohms and 1 mf.

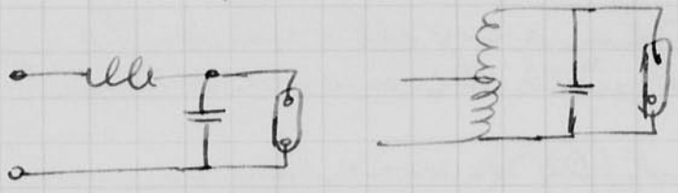
I also tried the U tube (page 36) 19 cm Xe, it had more light than the 3 ft tube. Possibly the 3 ft tube would give more light if the pressure were increased.

I am certain that xenon gas is an efficient medium for the production of photo light from electrical energy. The efficiency increases when the current becomes high. The high pressure is also necessary in the efficient lamp. However when high pressure is used in a tube it becomes difficult to start without the



cont.

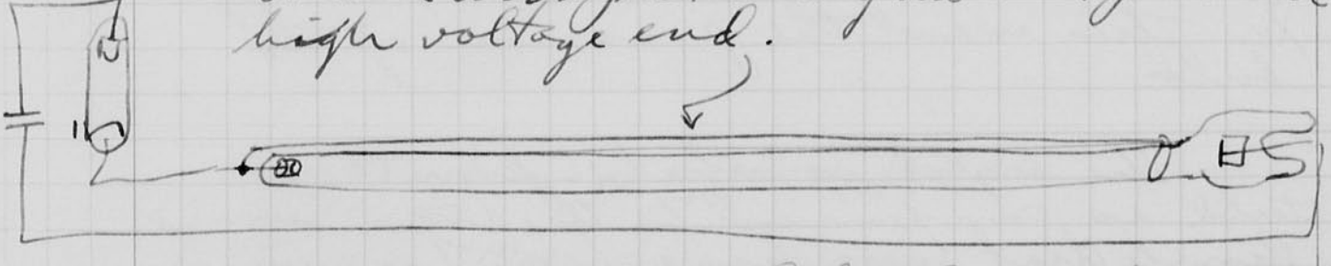
Application of a high voltage or the presence of thermion ionization. The circuit shown on the previous page may have some possibilities. By resonance, the voltage across the condenser builds up to a value when it breaks down the gas. Then the series leakage resistance of the transformer or coil limits the current. By proper balance the tube will go out but be ready for the next half cycle flash



Experiment with movie apparatus - Power supply 866 tubes and relay rack assembly.

Xe tube 3 ft long 17 mm diam 3.2 cm pressure. Some flipping and slight tendency to hold over if resistance less than 1000 ohms with 1 mf.

a wire was put along the tube from the high voltage end.



this helped a great deal in steadying the tube when observing the commutator at 150 and 300 flashes per second. the arc from the cathode to the 1/3 of the anode was against the wire and steady. the rest of the arc was on the opposite side of the tube and erratic in action.

Jan 6 1942

Howard E Edgerton.

Yesterday I pumped several tubes and filled them with xenon gas.

1. 3 ft 15 mm lamps for under water movies. 3 cm xe
2. U tube 14 mm of old type. 4 cm xe
3. 2 movie lamps quartz lined. 4 cm xe.

These tubes were all run on the pump with the movie outfit

I tried the movie lamps at 1, 2, 3, and 4 cm. The light increased with the pressure but some misses were encountered at the 4 cm pressure.

Two "leaker" movie lamps were repaired and pumped with ~~the~~ one of the movie lamps above. all three were filled with 1.9 cm of xe. this was the pressure of the bulb.

The light is white from the xe tube as compared to the argon movie lamp that we have been using up to now. I plan to use these xe movie lamps for all pictures from now on so that their performance can be determined.

Kittredge and Geo arrived at 4 pm from New London. With Jope and Peterson we examined the swimming pool for under water photography.

Jan 6 1942
H E Edg.

spec no	V	C	flashes	Lamps	Gas	pressure.	Lamps over slit and 1" from slit. Diffuser over slit
Jogged 114.	2000	0.5	300/sec 1.5 sec.	movie	Xe	4 cm.	plus X film DK 6 min.
Jogged 115	"	"	3 "	"	"	"	"
116	"	1.0	2± "	"	"	"	"
117	"	1.0	3±	"	Argon	20 ? + H_2	"

Jan 8 1942.

the long tubes (p 36 37) do not operate satisfactorily. they tend to fire late, also skip, and some holdover.

I repumped one of these today. At lower pressure than 3 cm the operation is improved. However the amount of light seems less. At a mm or so the color is green. I sealed the tube off at 1 cm of Xe from a new bulb.

As I write this two other ~~pump~~ tubes are on the pumps, a movie lamp and a straight tube. The straight lamp is 12± inches long

Data from Johnson on phone Jan 7 1942
output

Kodatron #2 17000 lumen seconds.

Portable 25 mf 4600 " "
" 56 " 9600 " "

this phone call was made during Dr Engels' visit. We called to get some action on the portable in a sealed off bulb. The delay has been in the base.

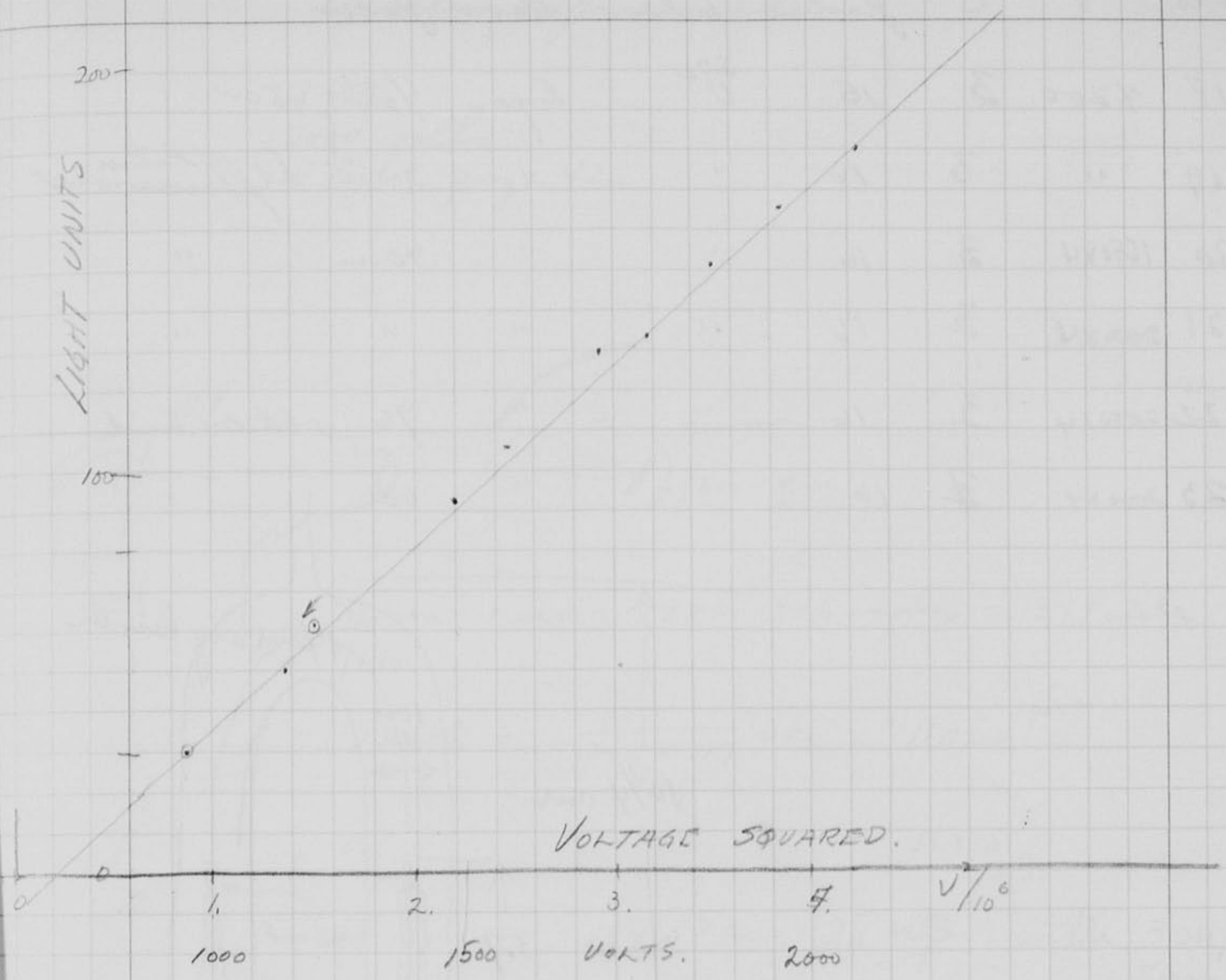
Jan 8 1942
Edg & Barstow

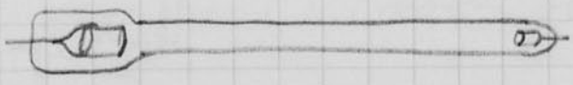
C	V	GAL	X	LIGHT	V^2/L	922 cell 1 ft from tube Xe 14" long. 1.7 cm.	$V^2/10^6$
97	1175	50	1	50	275		1.38
	1480	93	1	93	237		2.19
	1560	53	2	106	229.		2.43
	1715	65	2	130			2.94
	1785	67	2	134	237		3.18
	1875	76	2	152			3.52
	1955	83.5	2	1670			3.82
	2060	90	2	180	236		4.25
	1230	61.5	1	61.5	247		1.51
	915	30	1		277.		.840
	1220	88	5	440	342	Cell moved closer.	
	910	38	5	190	435		
	910	68	3	196	422		
	1720	91	10	910	325		
	1630	84	10	840	317	Press	
	1965	88	2	167.0		1.7 cm. cell away	
	1950	76	3	228.0		2.8	
	1960	82.5	3	247.5		3.4	
	1960	79.0	3	227.0		6.2	
	1960	77.	3	221.0		6.2	
	1970	78.5	3	225.5		9.6	
	1970	79	3	237.0		9.6	
	1975	79.5	3	238.5		12.9.	
	1980	67.0	3	191.0		12.9	
	1950	80.0	3	240.		12.9	
	1950	70.	3	210.		"	
	1945	66	3	198		" after 4 flashes.	
	1930	81	3	243		7.6	
	1930	78	3	234		7.6	
	1945	77	3	231		7.6	
	1950	83	3	249		5.9	
	1950	83	3	249		5.9	
	1950	76	3	228		5.9 Spark reduced. Several flashes.	
	1960	81	3	243		5.9	
	1950	77	3	221		5.9	
	1960	78	3	234		3.5	
	1960	81	3	243		3.5	

1955	68	3	204	1.9	
1970	69.5	3	208.5	1.9	
1970	38	3	114.	.6	
1970	56	2	112	.6	
1970	55	2	110	.6.	
1970	32	1	32	.1 ±	
1960	74	3	222	3.4	
1960	86	3		3.4	
1955	84	3	252	3.4	
1955	76	3		3.4 (3.8).	
1960	87	3		"	
1960	84.5	3		"	
1970	85	3		"	
1950	77	3		"	

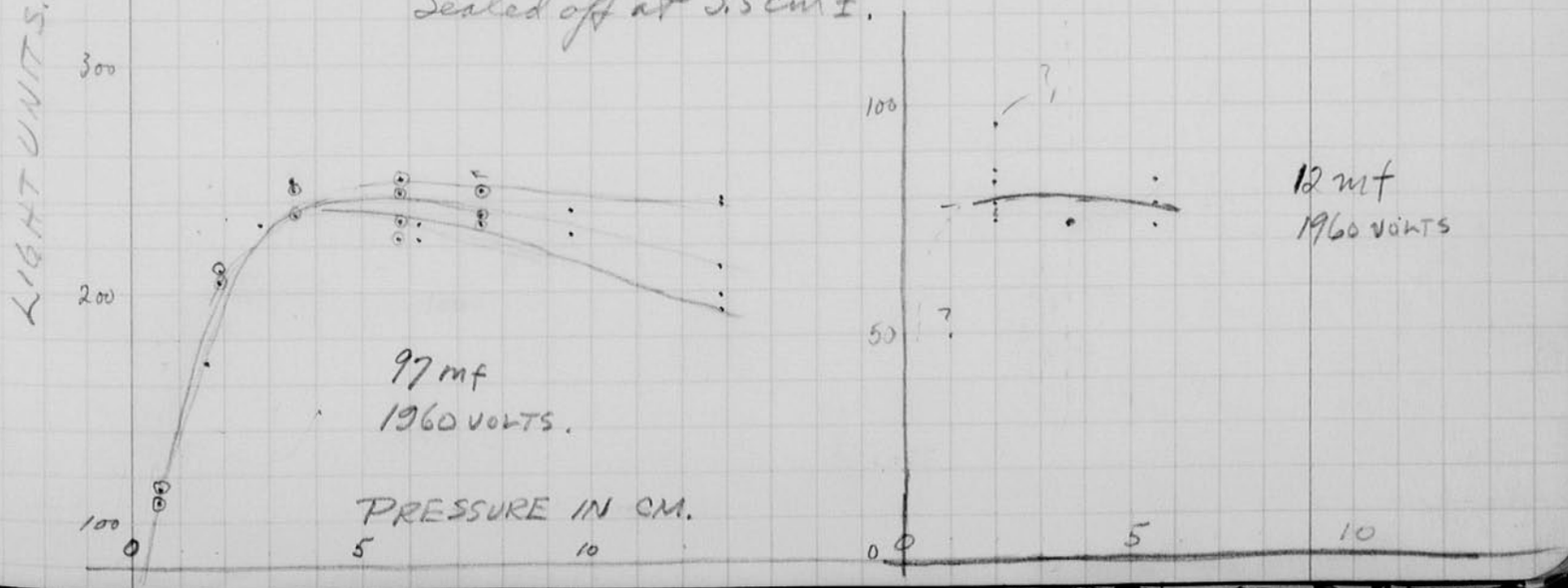
Res volts 55°

1960	73	1	73	3.6-	12 mf cell closer.
1960	73	1	73	"	
1960	83	1	83	5.6	
1960	78	1	78	"	
1960	73-77	1	—	"	
1960	-97	1	97.	2.0	
1960	86 79 76 83 79 81 77 78			2.0	



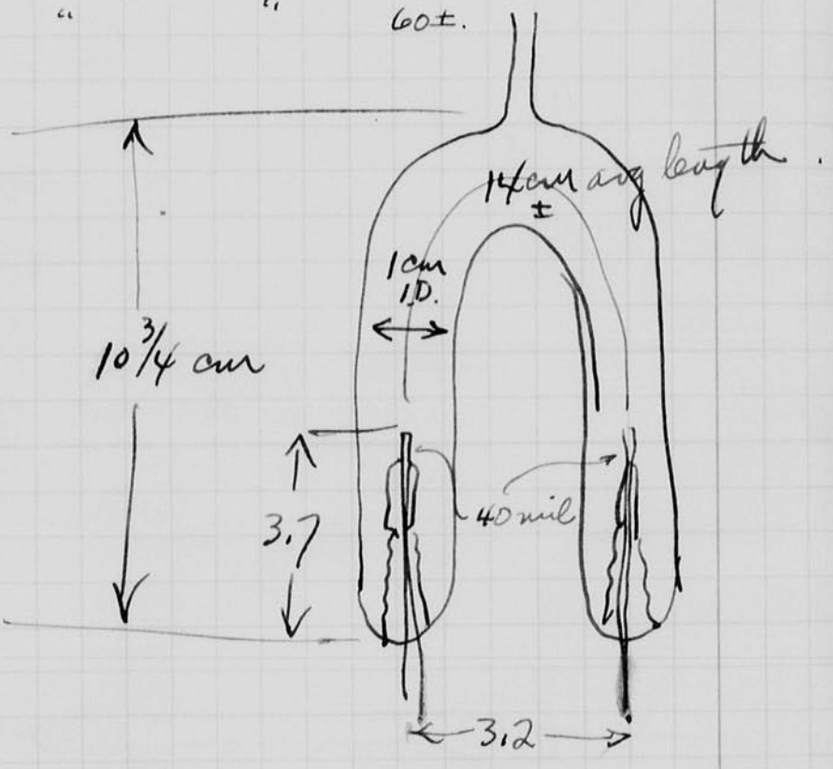


Sealed off at 3.5 cm ±.



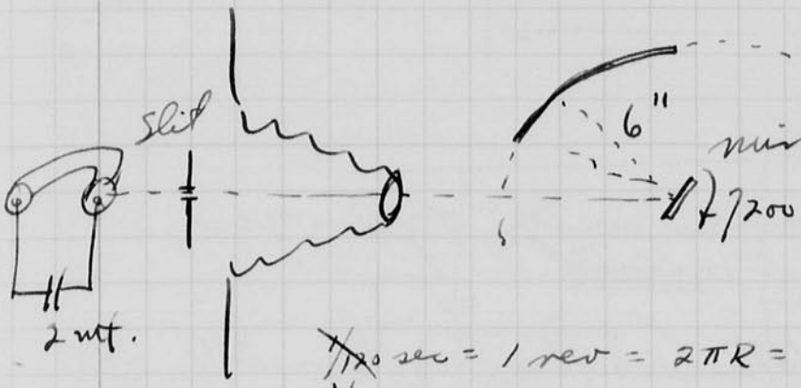
Jan 8 1942
H. E. Edgerton & Bruck.

Spec no.	V	C	flashes	Tube	Gas	Press.	
118	×200	3	16	SiO_2 U	Argon	1/3 atm.	28 cm.
119	"	3	16	"	"	"	Diffuser + film
120	1650×4	3	16	"	"	40 cm	"
121	2000×4	3	16	"	"	"	"
122	2000×4	3	16	"	"	76	Started ikonol.
123	2000×4	3	16	"	"	60±.	



Duration experiment

2 mf.
8000 volts.
U tube page 42. "



1/240 sec = 1 rev = 2πR = 2π6 inches = 37.7 inches.

1 inch = $\frac{1}{240 \times 37.7}$ sec = 1.10×10^{-4} = .
9000

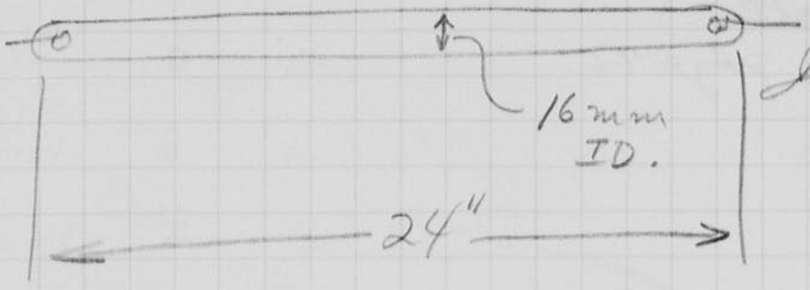
0.1 " 1.1×10^{-5}

.25 inch = 2.5×10^{-5} = 25 μs. with 3 mf
8000 v.

Less than 0.1 inch blur. > 10. μs.

Jan 9 1942
H. Eby

Movie lamps on pumps.



Iron electrode.

Torched
Burned electrode with hydrogen
to reduce rust.

Press. on	Light (as read with G.E. meter.)	
1.6	11	
2.4	12 jumpy.	Photocell about 4 ft or 5 from lamps on pumps.
1.7	11-12 ok!	
1.3	13	
0.9	13.5	
.6	13.5	
.4+	14.	
.4-	13.5	
.2	7 obscure	

Resurfaced and refilled

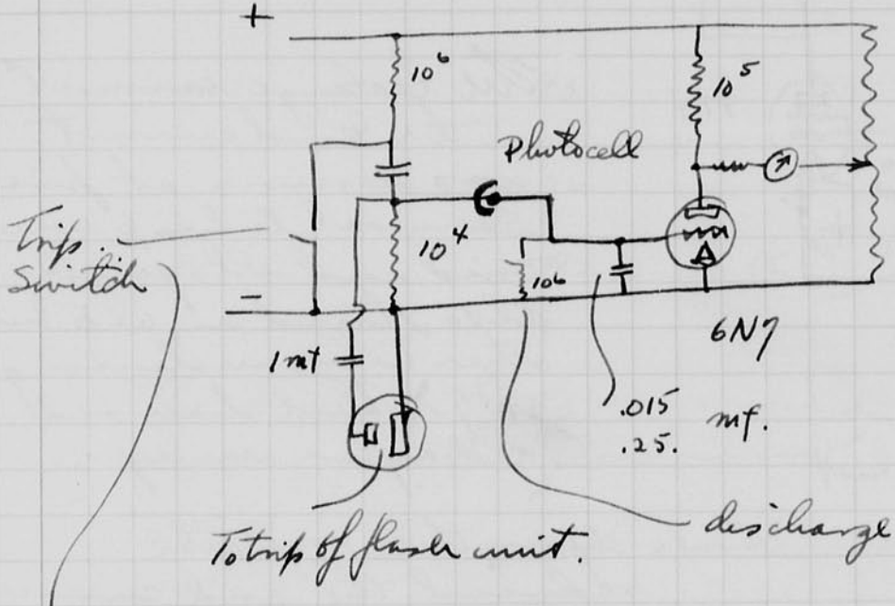
1.85 -.2	15
1.15 -.2	13.5
1.0 -.2	14.5
.7 -.2	14.5
.9 -.2	14. — Sealed off.

3 unfused for the above tests.

Jan 12 1942

Harold E Edgerton.

I worked last night with Fred Barstow on a photocell integrator with a vacuum tube to read the amount of light from a flash lamp. We connected up the following circuit for experimentation.



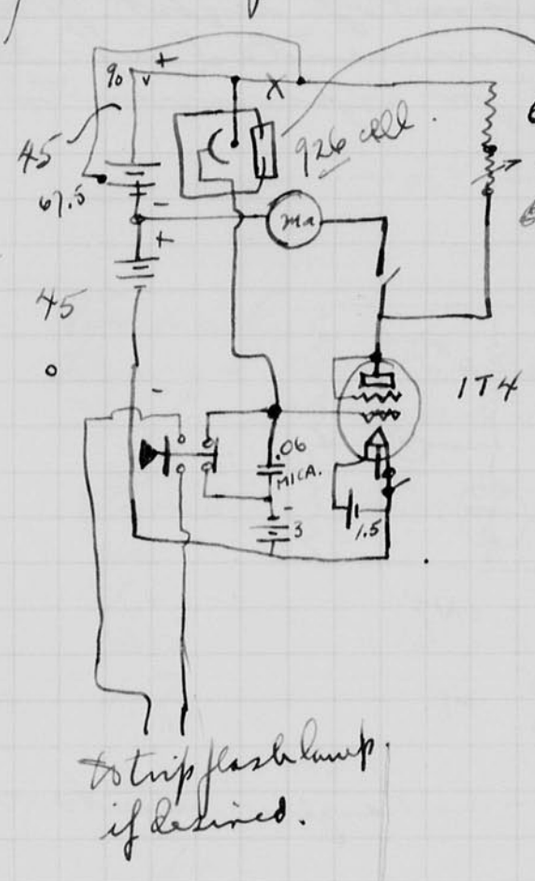
This switch puts potential on the photocell for a 1/100 second at the instant of flash. A circuit was discussed to produce a square wave form for this purpose instead of the exponential one made by the above.

The trip switch caused variable readings on the meter even with the photocell disconnected.!

Jan 15 1942

Harold E. Edgerton. Light Integrating Apparatus.

The following was connected up yesterday with Mr. Grier.



22.5 v / 70,000 = .322 ma.

67.5 − 45 = 22.5

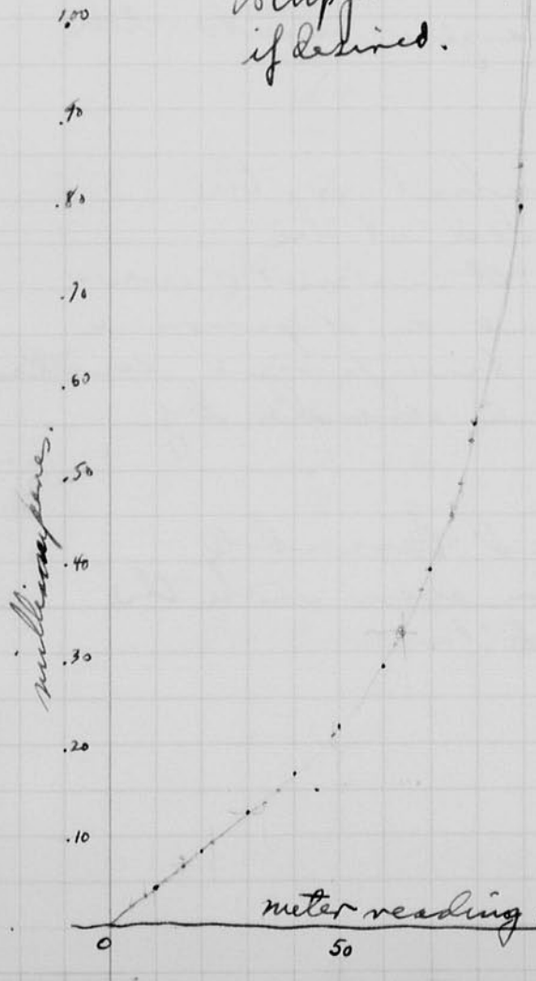
The leakage current in the grid circuit was serious at first. Several tubes, 6, were tried and all equally bad. Also I tried a 6C6 and other tubes including the 6N7 that I used a day or so ago.

Aging the 1T4 tube reduced the grid current. Data as follows shows this effect

$E_g = E_p = 67.5$

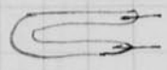
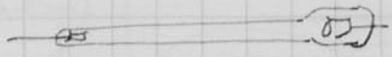
Time.	Elapsed time to swing from 0 to 80 ma.
4.	12 sec
5.20	23 sec
5 55	28
6 10	44 after use and tests
6 45	36 after zero bias
6 55	60 " use.

all with .015 mf in grid.



The grid capacity was increased to .06 mica so that grid current would not cause swing. Also plate current reduced to 45 volts as shown above.

Tests of lamps.

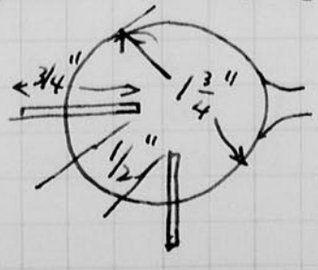
Aper	distance	cell	reading.	Lamp.
f 16	12'	92	29.	Kr. Kodatron no jacket
16	12	..	42	Xe spiral in jacket Hobaker
16	12	..	48	 U tube Xe 10 cm. (see page 35)
..	..	..	46	 3.5 cm. Xe (see page 41).
			43	" 3 ft tube 1 cm Xe page 37 repumped.
			46	" 28" tube 3 cm Xe
			42	 Xe. 4 cm. large U tube.

these above tests were made with a 0.1 mf condenser in the grid circuit. It is now 0.06 mica.

Tests of flash bulbs with 2 inn.

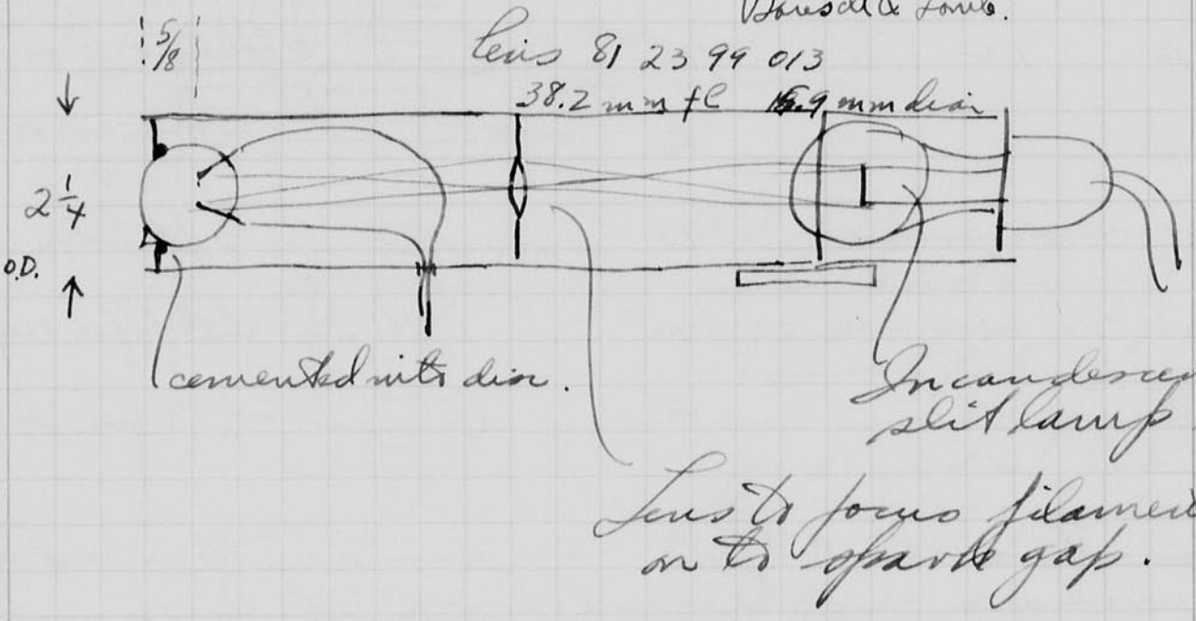
f11	12'	50	S.M. lamp.	1/50 sec shutter.
11	12'	90	Xe Kodatron.	
22	12'	30	#5 bulb. S.E.	
22	12'	29	Xe Kodatron.	29/116 12/48

I pumped a special lamp ~~tube~~ to be used in the B 2 L ~~stit~~ lamp for Dr Kruse and Dr. Tiedale. a sketch is shown below. Filled with Xe at 13.5 cm pressure. Tungsten electrodes. It ran at 1200 flashes per second with a Kg. control tube at 0.5 mf.



cont.

~~This~~ sphere lamps to produce a line source will be mounted in an optical system as shown below. The entire arrangement will fit into a B&L slit lamps



Discussing with Joe Boyce.

Infra Red

7059 Barium.

5535 Strongest line.

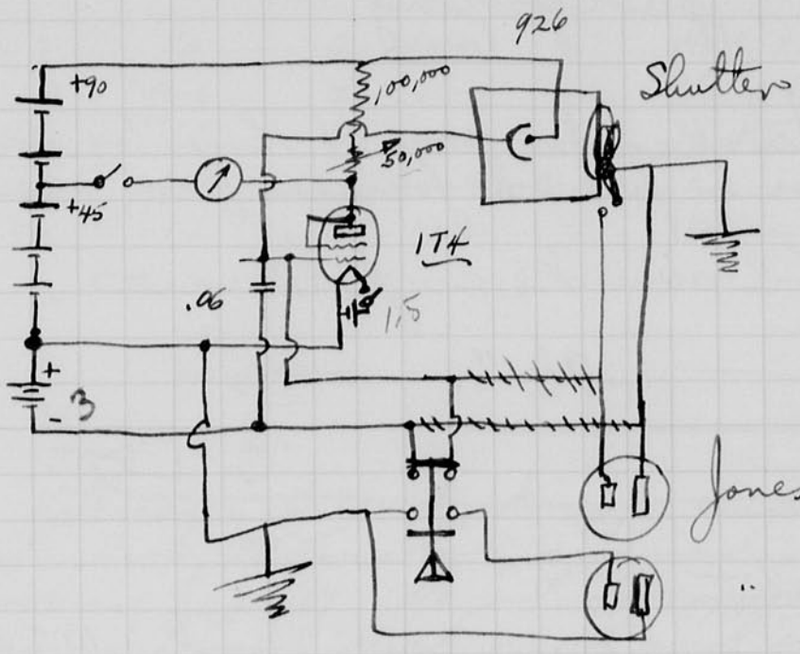
10,400 Strm

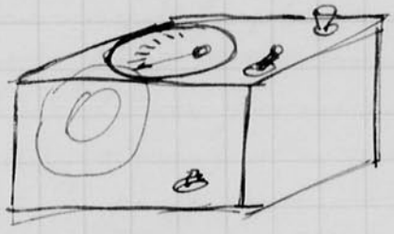
8500. Calcium.

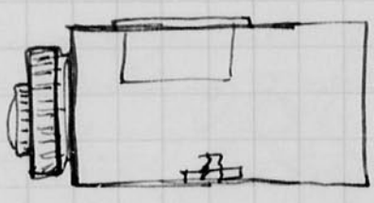
Magnesium.

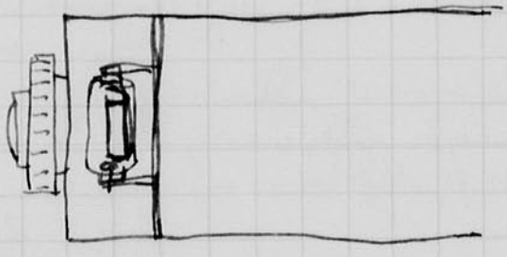
4600. } Sulfur
6700 }
7600 }

Redrawn circuit of page 46.









Movie tests of Xe lamps
4 cm pressure.

Graded scale card 30" from
lamp house with diffuser
120 volts or motor 200 frames ±.
1600 ohms 1 mf.
Tests were made both with
negative and positive film.

Xe fastest for negative
Ar " for positive. Sound Recording

Movie lamps.
Photocell readings of
output. Bare lamps

dist apart	meter	Gas	C mf.
15" f4.7	24	Xe	4
" "	19	Ar.	1
" "	21	Ar	1
	30	Xe	1
	64	Xe	2

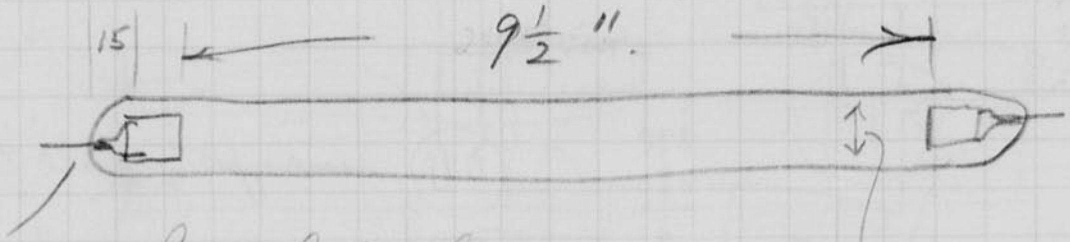
Jan 17 1942

Hz Edgerton
Chas Wyckoff.

movie tubes for underwater photography.

the two lamps page 44 have too long arc exposure for 2000 frames per second.

4 tube made as follows.



Iron electrodes
40 mill
13 mm length
13 " diam.

I.D. 13.5 mm.

Hydrogen cleaned.

Flight test on pump.

Distance	Aper.	Reading	tube	C.	V.	Pres cm	correction Gas cm	
30 inches	f 47	50-55	alone	3	1600*.	15.5-3	1.25	Xe.
"	"	52		3	"	2.5	2.2	
Run as movie lamp 15 frames ok.								
"	"	55 56 54	"	"	"	3.2	2.9	Xe.
		57 50 60				4.8	3.9	"

Sealed off 4 cm Xe.

Two more made and sealed off at 2 cm Xe.

Two more made and sealed off at

"	"	55	"	3	"	1.9-3	1.6	Xe
		58				1.3-3	1.0	
		35-52				.85-3	.55	
		35-40				.5	.2	
		28				.45	.15	
		25				.4±	.1	
		10				.35±	.05	

new gauge
cm
1.15
1.45-3.

DIST.	aper.	Reading	C	V.	Lamp.
6"	4.7	50	2	1000	No 3 Xe Kodatron.
6"	4.7	40-60	2	1000	1/2" gap Xe at 13.5 cm.
6"	16	58	7	1000	no 3. Xe.
6"	32	78	27	1000	"
6"	32	14	27	1000	1/2 Gap.

Jan. 23. 1942.

Kittredge, Gilbert, Knapp, and others from New London, & Trumbull, arrived at 12 pm on monday Jan 17. We set up apparatus in the swimming pool that night and worked till morning. On Jan 18 night we also worked all night, taking in all 50 movie shots at 200 per second. Plus x film f 2. two lamps Xe 1 cm pressure (dimensions page 50) 3.5 mf 1000 ohms on new movie outfit. Lamps about 4-8 ft from subject. The action was 30 ft from the camera in the port hole in the wall of the pool.

The prints were finished yesterday and sent to New London on the 9 pm train.

Feb 2 1942

Harold E. Edgerton

Anderson? See Astrophysical Journal 1925
1/4 mf 6000-8000 v.
Sulfur. 0.1 mm
4 mm tube.

On Jan 23 and 24? Chas Wyckoff and I worked all night taking more high-speed movies of objects in the MIT pool for Columbia University. The negatives were developed by Brewster at Harvard and printed on 16 mm film. These were sent to New London on the 4 oclock train on Monday Jan 26.

I left by car on the 26 at 5 pm for a trip south. I reached the Ymca on 34th st about 12 pm and stayed there that night. At 11 in the morning I gave a talk on stroboscopic light at the Amer Nat Hist Museum. Dr. Lutz. Mili was there. We then left for the mus of mod art and saw Mili's dance photo exhibit. I then left by car for Phil arriving about 4.30. Went immediately to the Frankfort arsenal to see Col Kirk, F.E. Myers, Capt. M.B. Chatfield.

K.W. Beattie. Bald Loco. Eddystone Pa.

A talk was given that night at the Engineers club to the A.S.M.E. I stayed with Mr. Peters in a northern suburb that night.

In the morning I went to Ft Monmouth ~~near~~ Red Bank. ~~at New Lon~~ Col Gillette was there in charge of the educational movies. I met Col. Shaw. Levensen (Warner Bros. sound). Sloan (a Hollywood director) Kinsbeart & Hutchins former students. McDougal Lt. very much interested in single flash photography. Smith. animation. Putnam - asst to Gillette. Dick Sears - movie Pathe.

I left for Washington about 5 pm. Spent night at New Castle. Arrived about noon at Wash and went directly to the Potomac Power Co. Fred Willcutt saw me and arranged everything for the meeting of the A.I.E.E. that night. Had lunch with Welch Pogue my brother in law who now is chairman of the Civil Aeronautic Authority then went to see Admiral Furer who had sent a message yesterday to H. Norwood. He was not there but ~~Mr.~~ Comd. Sylvester and H. Rouse saw me. From their discussion I assumed that the navy was not interested in knowing more about the recognition signal method for air craft using our lamps. I did talk to Mr. Piggot about the under-water photography ~~that~~ Mr. Ewing at Woods Hole is trying.

I then had a short visit with Major Le Man at the signal corp. I tried to see Col. Schosberg but was unable to make an appointment.

Next I went to the C.A.A. and ~~saw~~ Pearson and Metcalf about the beacon flasher experiments. Their reports ~~[illegible]~~ that the lamps did not have a life of more than a few hours.

After the A.I.E.E. meeting I left at once for Boston after staying all night with Margaret. Arrived home ~~[illegible]~~ night at 10.30 Jan. 30.

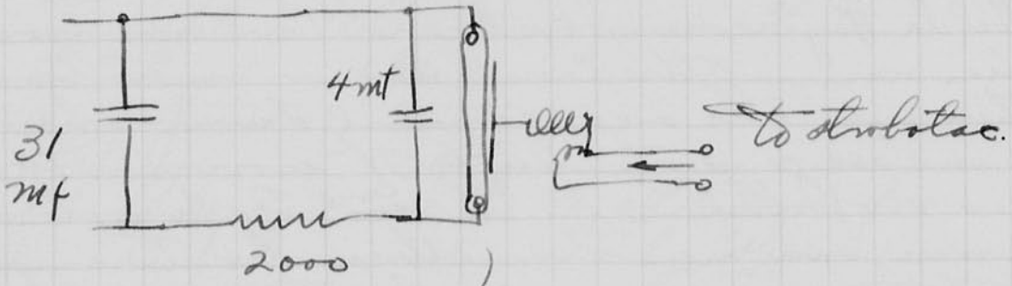
A call was put in to Kittredge concerning more under water photography with more lamps. He wanted to shoot Monday night. I told him that this was almost impossible. He called again the next day suggesting Wednesday night.

On this trip I went by auto. I took the battery operated portable, a [illegible], a photo all [illegible], the multiflash, the microsecond, and a strobotac.

Feb 2 1947
Harold E Edgerton.

Stroboscope lamp.

Herb and I set up the following among other tests.



4 cm Xe gas.
See page 50
12" long. 13.5 mm I.D.

This has occasional tendency to hold over when run long at that the cathode is hot. Will run up to 100± cycles per second.

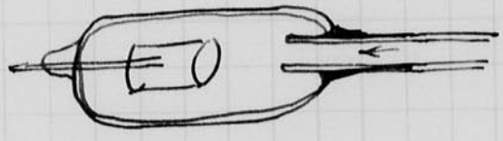
The flash time is about 1/20,000 sec 50 microseconds.

After 1 hour of the above there was a slight discoloration of the cathode end of the tube. The useful life would therefore be some 10 hours ±.

Feb 3 1942
Fred E Eggerton.

Apparently for an discharge, a cathode is needed which is large so that it does not get hot. An easy emitter surface is a help as it lowers the cathode drop and keeps the cathode from heating.

Sputtering of the cathode can be controlled by the use of a re entrant structure such as used on the strobolux lamps.



the glass tube can fit down into the cathode cylinder as in the strobolux lamps.

When the discharge occurs the gas in the tube expands, blowing the sputtered metal towards the back end of the lamp where it does no harm.

Dr Sperback.
Ann Arbor Mich.

Quartz tube 35 mm long.
1.5 mm internal diam.

16 mf 24 per sec 1600 volts

power = $CE^2f = 16\times10^{-6}\times1.6\times10^{6}\times24 = 925.$ watts.

Feb 12 1942
H.E. Edg.
Barstow

Temp.	C	V		Aper	Reading			
oval.	25	2000		4.5	8 16	3.	1.6	.4
"	56	2000		4.5	8 16	8.7	4.	.9
1/4	16mm	56	2000	.9cm	4.5	8 16	4.1	2.4	.6
"	"	"	"	2 cm	4.5	8 16	5.9	2.8	.75
"	128	"	"	"	4.5	8 16	off scale	5.8	1.6
"	"	"	4"	"	4.5	8 16	"	7.2	2.2
"	56	"	"	"	4.5	8 16	6.6	3.05	0.8
"	28	"	"	"	"	"	"	2.2	.9	.3
"	"	"	10"	"	"	"	2.7	1.15	.4
"	56	"	"	"	"	"	"	7.0	3.3	.9
"	128	"	"	"	"	"	"	off scale	8.4	2.15
Kr. Spiral	"	"	—	"	"	"	"	6.6	1.6
"	56	"	—	"	"	"	7.3	2.7	.7
"	28	"	—	"	"	"	1.3	.65	.2

Voltage Changed?

Quartz Army Sp.	Kr	28	"	—	"	"	"	1.3	—	—
"		56	"	—	"	"	"	4.1	1.6	—
"		128	"	—	"	"	"	—	4.6	1.1
Kr Spiral	"		"	—		"	—	7.0	—	
"	"		"	—	f32		3.9			
Xe Army	"		"	—	4.5	8 16	6.1	1.7		

RCA 926

— RCA-929
926

Feb 12 1942
H E Edgerton
Jack Kelly

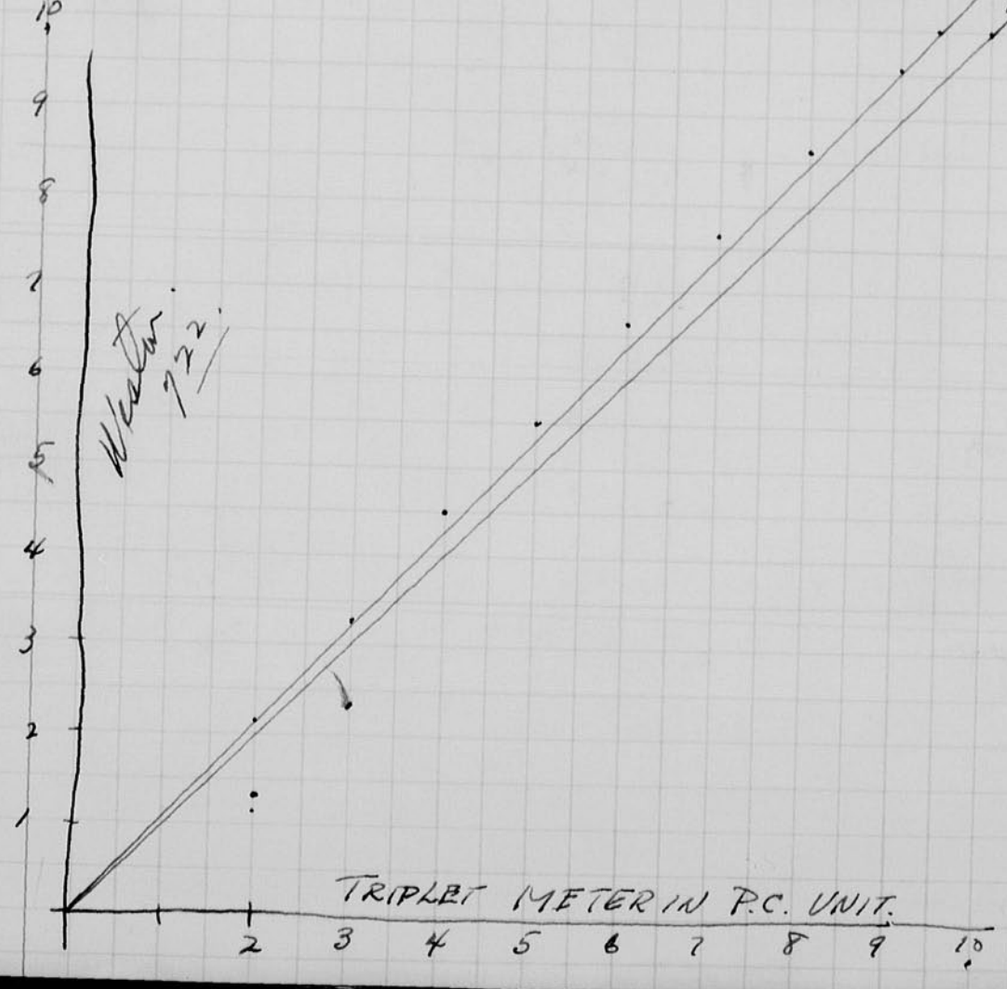
P.C.M.	APER	C	V	pressure gas	Dist
2.4	4.5	max	20000±	1.9 cm Xe.	2.5 ft from P.C.M. lamp
3.1	"	"	"	4.1 " "	Quartz isp.
3.4	"	"	"	6.4 " "	" "

Sealed off.

7	1.5-6-9 "	52 inch 8 cm bore tube for Navaro
9	.7 "	
4.25	2± Kr.	64" tube

Below 1 mm the tube holds over in the 60 cycle stroboscope. the color for low pressure is green. It is white at 1 cm.

10. 2 m.m Xe 52 inch with Freon gas. Sealed off. this tube is for Austin Navaro to try in the strobo sheet straightener.



TEST Nº 1

Feb. 13 1942

H. E. Edgerton
Elliot Mycroft.

LIGHT SOURCE / FILTER USED	Portable Kodatron #2 tube 28 mfd - 2000 v.		Grier's unit 10 mfd. - 2000 v. small capillary quartz spiral 6 cm		North daylight 2:00 P.M. 1/25 sec. shutter		Spherical tube Xenon 16 cm. 28 mfd 800 v.		direct sun 1/25 4:15 P.M.	
	APERTURE	READING	APERTURE	READING	APERTURE	READING	APERTURE	READING	APERTURE	READING
Wratten 29 (F) red	f:11	6.4-6.6	f:11	4.2	f:4.5	1.3	f:4.5	3.3	f:4.5	4.7-5.7
Wratten 61 (N) green	f:11	3.2-3.3	f:11	4.2	f:4.5	1.0	f:4.5	2.3	f:4.5	1.8 1.6 1.8
Wratten 49 (C4) blue	f:11	3.3-3.5	f:11	5.8	f:4.5	1.0	f:4.5	2.9	f:4.5	1.3 1.3 1.3
23% transmission	f:11	9 × 1/23 = 39. 9.0	f:11	9.2 × 1/23 = 41.7 9.6	f:4.5	2.7 × 1/23 = 11.7 2.7	f:4.5	6.8 × 1/23 = 30 6.7-7.1	f:4.5	6.7 × 1/23 = 2.9 6.7
23% trans	two tube 28 mfd 800 v. f:4.5	6.7 × 1/23 6.7	"U" tube xenon —	28 mfd 2000 v. 10 cm. spir. 8.5	9 C. Kodatron #2 56 mfd 2000 v. f:4.5		9 C. Kodat #2 128 mfd 2000 v. f:11	6.5	9 C. Kodat #2 128 mfd 2000 v. slightly off scale f:8	4.2
29 red	f:4.5 photocell 32" away	3.5	photocell 64" away	4.3	f:4.5	8.4	f:11	4.3	f:11	2.8
61 green	f:4.5 photocell 32" away	2.3		3.3	f:4.5 photocell 64" away	3.8-3.9	f:11 photocell 64" away	2.	f:11 = f:8 =	5.1 1.2 2.4
49 blue	f:4.5 photocell 32" away	2.8		4.0	f:4.5 photocell 64" away	4.3	f:11 photocell 64" away	2. +	f:11 f:8 photocell 64" away	1.7 3.5
heat 49					f:4.5	3.7 ?	f:11	1.8	f:8	3.+

Light source / filter	3 cm Xenon 1.4 cm I.D. 128 mfd 2000 v.		Argon spiral 10 cm pres 128 mfd 2000 v.		Argon spiral 10 cm pres 128 mfd 2000 v.		FA-2 Argon 10 cm 56 mfd 2000 v		small capillary quartz 28 mfd 2000 v.	
23% trans	f:11 = photocell 64" away	5.2-5.9	f:11	4.7	f:11	5.1	f:5.6	4.3		
red 29	f:11	2.7	f:11	2.7	f:11	2.7	f:5.6	1.6	f:5.6	5.1
green 61	f:11	1.7	f:11 =	1.2	f:11 =	1.1	f:5.6	.8	f:5.6	4.1
blue 49	f:11	2.	f:11	1.6	f:11	1.8	f:5.6	1.95	f:5.6	4.5
blue + heat	f:11									

light source / filter	small cap quartz 56 mfd 2000 v.		Small cap qtz 56 mfd 1000 v.		small cap qtz. 128 m 500 v.	
red	f:8	7.4	f:56	2.9543	f:4.5	2.2
green	f:8	6.1	f:56	2.55	f:4.5	1.7
blue	f:8	7.	f:56	2.90	f:4.5	2.3

Test No 1

Light source		Xenon source 12" long 2 cm. gap 128 mfd. 2000 v.			Xenon 12" long 4 cm. 128 mfd 2000 v.			Xenon 12" long 4 cm magnetic field 128 mfd 2000 v (6 turns of copper wire)			Xenon 12" long 4 cm gap 128 mfd 2000 v. longit. mag. field		
		apert.	dist	reading	f:	dist	read	f:	dist	read	f.	dist	
filter	red 29	8	64"	4.5	11	64	4.5	11	64	4.3	11	64	2.6
	green 61	8	64	3.7	11	64	2.9	11	64	2.6	11	64	1.5
	blue 49	8	64	4.3	11	64	3.4	11	64	3.1 -	11	64	1.6
	23%	8	64	9.6	11	64	7.9	11	64	7.4	11	64	5.5

Date Feb. 14, 1942
Observer Edgerton
Dykoff
Remarks

	LIGHT LUMEN SECONDS	3 Meter Reading	4 Factor	10 Distance d. in inches	1 Aperature	5 $(\frac{f}{d})^2$	8 Photocell type	2 Filter	9 Shutter time	11 Capacity microfarads	12 Voltage	6 Pressure cm. hg.	7 Gas	13 Tube Type: Length tube type	Diameter	Shape	Material
I		10.+ 9.4 4.0 5.		30"	f:4.5			23%T 29R 61G 49B		30	2060	3.2 ~~3.2~~ 3.2-.5 2.7	Xe				
II		~~5.6~~ 5.5 4.3 5.7			f:16 f:4.5		926	23%T 29R 61G 49B	1/20 sec.	30	2060	5.8 -.5 5.3cm	Xe	10 cm. "U" tube	0.7cm. I.D.	"U" shape	Pyrex
III		2.5 3.8 4.8 6.2			f:16 f:4.5			23%T R G B	1/2	30	2060	9.8 -.5 9.3cm	Xe				
IV		3.9 6.1 5.1 6.7			16 4.5			23%T R G B		30	2060	16.85 -.5 16.35cm	Xe				
V		5.6-5.6 5.1-5.0 6.0-5.8			4.5			R G B				9.5 -.5 9.0					
VI		5.5 5.3 6.2			4.5			R G B									
VII		6.05 4.6 4.0			4.5			R G B				9.9 -.5 9.4cm					
VIII		5.4 4.8 6.2			4.5			R G B									
IX		5.7 4.95 5.8			4.5			R G B									
X		5.2 4.8 6.2			4.5			R G B									
XI		8.3 5.9 7.1			4.5			R G B				10.0 -.5					
XII		6.7 5.4 6.8			4.5			R G B				10.5 -.5					
XIII		6.6 5.4 6.9			4.5			R G B				10.0 -.5					
XIV		9.0 5.9 7.3			4.5			R G B				before → 11.5 -.5 after → 11.85 -.5					

~~VII~~ VII was discharged with the spark coil until ~~cool~~ hot.
VIII allowed to cool for 20 min.
IX discharged with coil
X discharged with coil
XI fresh gas was put into tube
XII warmed up due to flashing & the pressure raised 5%
XIII cooled down & press. dropped to 10.
XIV fresh gas pumped into tube. In three flashes the press. increased .35 cm.
XV A wait of 10 min. & press. before flash = 11.65 cm -.5 Press after flashing went to 11.85 -.5
R = 8.6
G = 5.95
B = 7.2

Tube was sealed off at 11.75 cm -.5

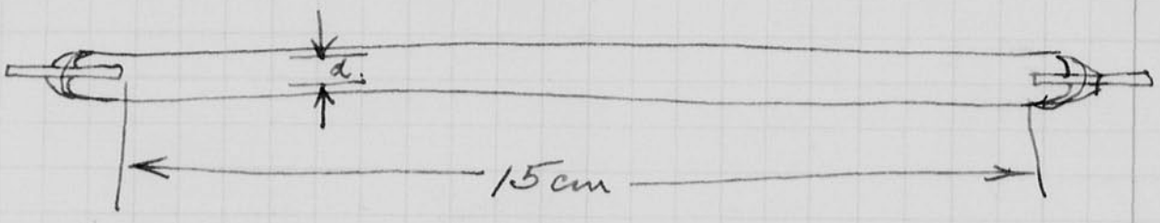
18 89 70
Kn 11.75

Date Feb 16 1942
Observer H E Edg & Chas. Wyckoff.
R/B = 2.08 G/B = 1.55
Remarks Daylight.

Test Number	Aperture	Filter	Meter reading	Lumen seconds	Pressure cm Hg	Gas	Capacity mfds.	Voltage	Shutter time	Distance - inches	~~Power~~ watts	$(\frac{f}{d})^2$	Photocell type	Tube Dimensions: Length	Inside diam.	~~Shape~~	Condition Identification	Remarks
1	16 5.6 5.6 5.6	R G B	3.1 2. 1. 1.55		35	Kr	112	2000+	1/200	14			926	20"	—	P.S. Spiral		
2	16 5.6	R G B	7.8 3.2 1.7 1.9		7	Xe	"	"	"	"			"	"	"	"	#139	
3	16 5.6	— R G B.	7.2 3.05 1.65 1.8		7	Xe	"	"	"	"			"	"	"	"	First Hoboken sample	Note that the red is low this clearly observations of yesterday.
4	16 5.6	— R G B	4.6 1.9 1.- 1.2			Xe	"	"	"	"			"	"	"	"	#139	6.25 pm - 6.37 at 30 sec intervals
5	16 5.6	— R G B	6.7 3.05 1.5 1.5			Xe	"	"	"	"			"	"	"	"	Same as 3	
6	16 5.6	— R G B	6.3 2.9 1.5 1.65			Xe	"	"	"	"			"	"	"	"	#139	7:30 Tube and power supply cooled for 1 hr.
7	16 5.6	— R G B	6.5 3.0 1.5 1.7			Xe	"	"	"	"			"	"	"	"	Same as 3	8:00
8	16 5.6 16	— R G B	7.4 3.0+ 1.5 1.7 6.9			Xe	"	"	"	"			"	"	"	"	#139	8:00 Power supply heated by overworking for 20 min. Tube was cool.
9	16	—	7.1			Xe	"	"	"	"			"	"	"	"	#139	Tube heated in Bunsen Burner
10	16	—	6.3			Xe	"	"	"	"			"	"	"	"	#139	Tube flashed 10 times
11	16 5.6	— R G B	7.1 3.1 1.5 1.7			Xe	"	"	"	"			"	"	"	"	#139	30 sec interval between readings
12	5.6 5.6 5.6	R G B	8.7 3.9 4.3															

Feb 17 1942
Harold E Edgerton

A series of straight lamps have just been made by Ryan for experimentation with pressure and capacity.



d. 2.14 mm.

3.81

5.82

8.88

13.5

24.0

Jack Reilly and I worked last night on the exposure meter which was used here. the capacity was changed to .102 mf on the 10× scale which was used for here on. the ×1 scale uses a condenser of .0102±. Both of these condensers are mica. the paper and oil condensers show an objectional drift of some 10 or 15 % in the first second after the meter comes up. Some go fast some —.

note that P.C. now has an integrator and condenser in 0.84 mf grid in place of 0.6 that has been used in all tests up to now.

Feb 19 1942

H E Edgerton.

Yesterday afternoon with Commander Roop to Woods Hole.

4 quartz tubes removed from H.E. for slit lamp illumination.

f	LIGHT	Press cm.	C.	V.	d
4.5	6.7	1.8-.45	30	2020	38"
4.5	9.2	4.3-.."	"	..	..
5.6	8.6	6.25-..	..	..	..
"	9.8	7.9-	..	..	..

Sealed off.

The lead on this lamp broke off before it could be tested in the slit lamp.

P.	Δ.
9.5	1.6
7.9	1.5
5.4	1.3
4.1	1.3
2.05	2.05

Feb 20 1942.

Pumped another quartz tube as per above. Run in the lamps with 130 ma at 2100 volts and 5 or 6 cm of Xe·Kr.

Sealed off with 10.1 - .5 = 10.6 cm

Std spiral near at 10 cm pressure.

cm
2.05
4.10
5.9
7.70

Feb 21 1942 Pumping another quartz tube and another new spiral. I forgot to bombard the cathode of the new tube yesterday. For this reason it was gassy.

	cm.	
47"		
4.5	5.3	4.5
	8.8	8.
	9.8	16.6
	16.6	9.8

130 20 20 47" neon Std Spiral

20° angle t

(Pumped out gas - (neon at 1 or 2 ± mm gives a dim purple flash) ⊙

8-11	1.1	1 cm.
	1.7	2 cm
	2.35	3
	3.0	4
	3.8	6.7
	4.95	10.2
	5.9	18.8

.. .. ..

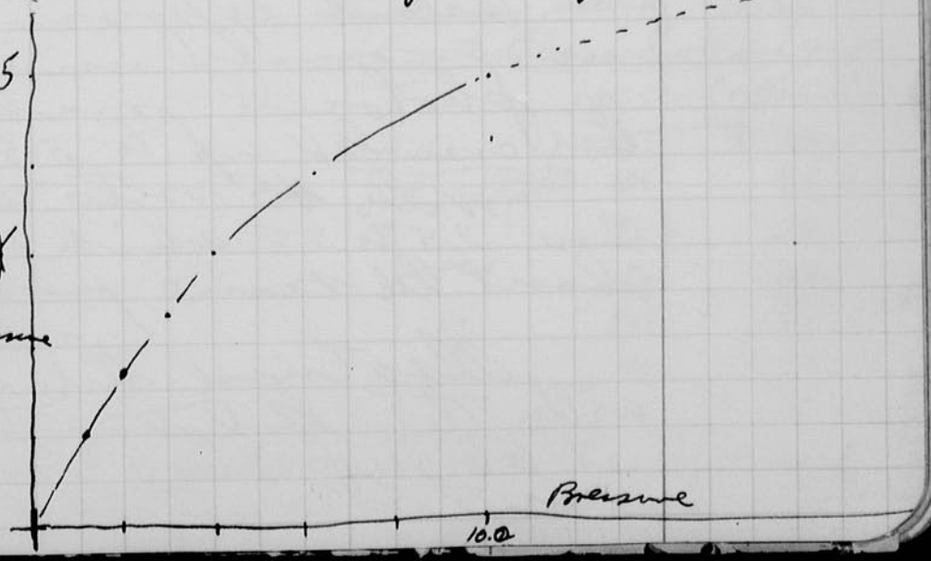
some self flashes. 5

.. .. ..

.. .. ..

Starts hard - some glow before light

Sealed off at 18.8 cm pressure



Quartz tube for slit lamp.

f	photcell	Press	Gas	volt	Cap.	Distance.
11	1.6	2.5 - .5	Xe-Kr	2020	130	45" 20° angle
11.	1.8	4.5 - .5				
..	2.0	6.2 ..				
		Pumped out - filled with new gas				
11	1.5	1.8 - .5	Some self flashes.			
5.6	6.0	1.8				
..	6.1	2.2				
..	7.0	4.15				
..	7.3		no changes.			
"	7.1					
		6.05 - .5	sealed off at this pressure.			

this tube shows a white deposit around both anode and cathode. Apparently this is quartz that has been evaporated.

.38	R	.94
.3	G	.60
.34	B	.70

Feb 22 1942
HEE.

I was in New York on Sat with Drs Kruse, Tisdale, Stiel, McCreary and Mr. Pearce. All but the first is in the C.R.A.F. Borrowed unity flash unit for color photography of eyes at Bellevue Hosp.

Tested exposure meter with mercury arc unit. With 90 volts on photocell - reading 3.8 to 4 which then crawled up to 5.5 or 6.

With 45 volts the reading was less 2.5 to 3.5 which also crawled up about the same percentage.

Also tried the same experiment with the Kodatron type of lamp at 56 mf 2000 volts. Results in table on next page

10 ft to pc at f11 1/200 sec shutter

	45 V.	90
Xe	5.7	6.3
Kr.	4.3	4.6
AR	3.6	3.95
Ne.	1.8	1.95.

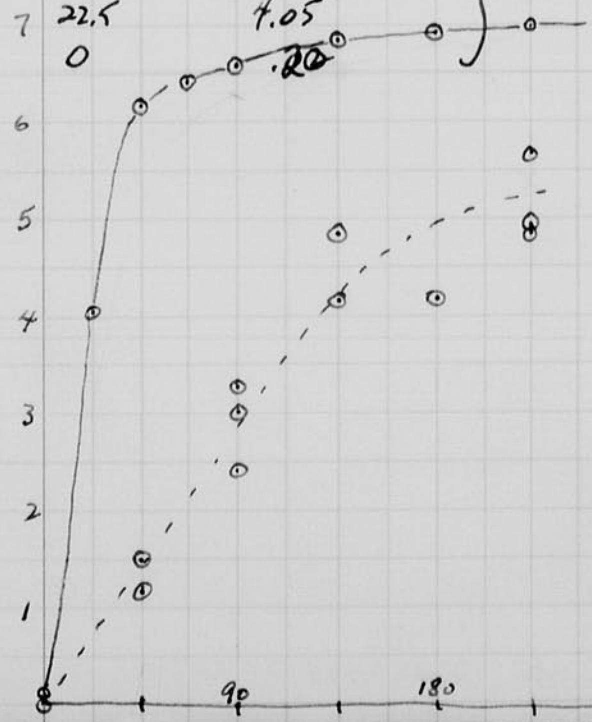
this shows that space charge in the photocell is one of the limiting factors, the photo cell voltage should be increased until the readings are constant for further increase.

this was found to be due to an exhausted bias ~~battery~~ battery that was momentarily polarized by the large peak currents

I do not understand why the photo cell should give a gradual increase for a few seconds when the short flash microsecond unit is used

P.C. Volts	P.C
90 ~~58~~	6.6
135	6.8
180	6.9+
225	7.0+
90	6.5+
66.5	6.4
45	6.2
22.5	4.05
0	.20

} Bucked by external batteries.



S.E. Spark Xe .56 mf 2000+ v 1/200 sec f11 7 ft. 926 cell.

microsecond light	
22.5	0.6
46.0	1.5 + crawl.
67.5	2.3 + "
90	2.5 + "
135.	2.7 + "

A 4 mf condenser was put across the 3 volt bias ~~condenser~~ battery. This eliminated the crawl and zero var.

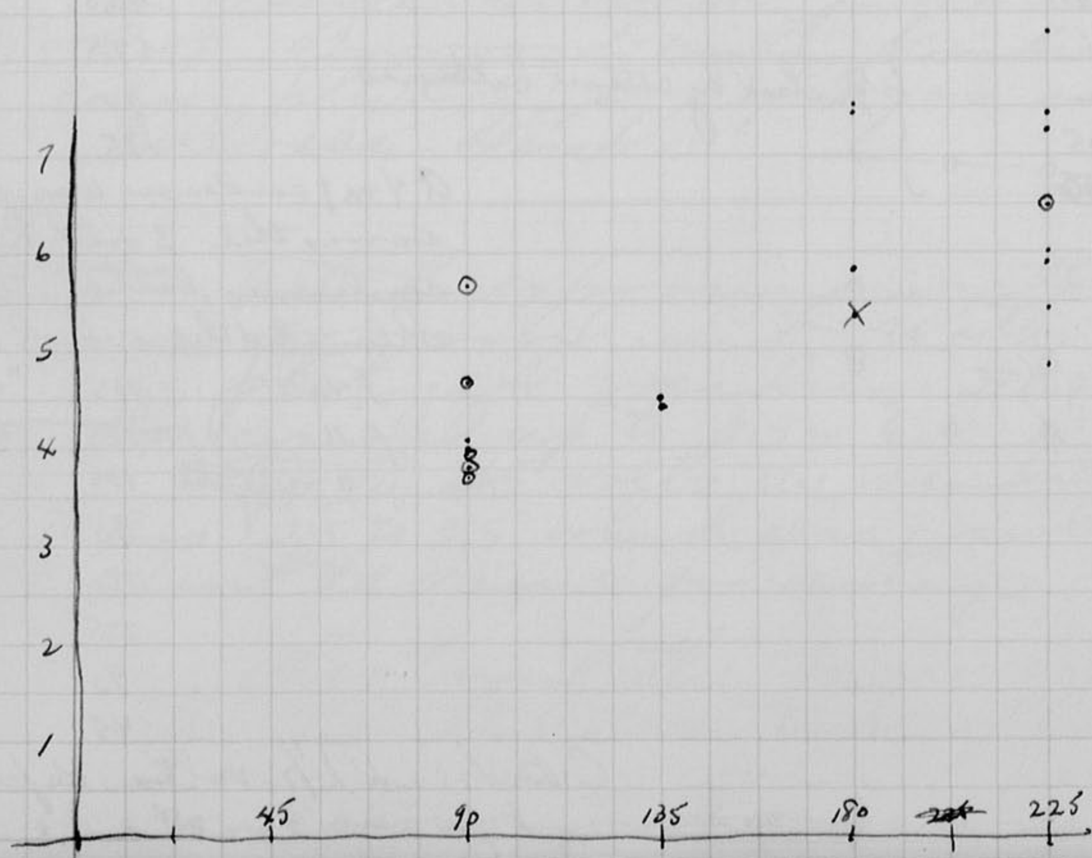
f 4.5	135	"off scale".
f 11	~~135~~	~~1.9.~~
11 readjusted	135	4.8 4.2
	90	2.5
	180	4.2
	225	4.9 5.7 4.8
	90	3.3 2.4
	45	1.5 1.2

C Bat read 1 1/2 volts. Replaced by a new 3 volt one.

 Feb 22 1942 cont.
HE Edg

V	P.C.	
90	3.7	f 8 1/200 microsec. at 6'
135	4.5	
180	6.0 creeps to 5.8 slowly.	
225	9.5	
135	7.6	—
135	7.4	new microsecond
135	4.5	
90	4.1 3.8 4.0	
180	5.8 7.4 7.5	
225	5.8 6.5 5.4 4.8 6.5	?
225	6.3 5.4 6.0 8.3 6.0 8.	condenser (2 mf) across batteries.
"	7.5 [8.3 (drops to 7.3 in 2 or 3 sec.)]	"
"	8.3. 7.4 6. 7.3.	"
90	4.7 5.7 3.9 3.8 3.7.	"
90	4.7 4.6 5.6	no condenser

Gustavson called on the phone from Indianapolis. The quantity elongated spirals have sputtered badly after 10,000 flashes. He says for station #3 lamps have run 200,000 flashes. could go million. Will send parts by air express.



Feb 23 1942

Notebook # 12

Filming and Separation Record

____ unmounted photograph(s)

____ negative strip(s)

1 unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 66 and 67.

Item(s) now housed in accompanying folder.

Date Feb. 15, 1942
Observer C. H. Wyckoff

Test number	Aperture	Filter	Meter Reading (Camera Seconds)	Pressure cm Hg	Gas	Capacity microfarads	Voltage	Shutter time	Distance in inches	Factor	$(\frac{f}{d})^2$	Photocell Type	Tube Dimensions: Length	Inside Diam.	Shape	Material	Condition	Remarks
1	f:8	23%T R G B	6.4 2.8 1.6 1.2					1/25										11:35 A.M. Looking South at sun through window Very weak clouds
2	f:8	23%T R G B	2.1 1.2 .6 .5					1/25										11:40 Ditto
3	f5.6	23%T R G B	4.8 3.1 1.1 .9					1/25										11:45 Outdoors looking south at Sun
4	f:11	23%T R G B	4.4 2.7 1.5 1.3					1/25										11:50 Outdoors looking south at Sun
5	f:4.5	23%T R G B	6.8 3.1 2.05 2.4					1/10										12:00 Looking at North Sky through window
6	f:5.6	23%T R +G +B	5.1 2.55 4.9 8.1					1/10										12:15 Ditto. This time a reading was made thru R. On top of this reading the G was made & on top of this total the B was made
7	f:4.5	R G B	2.9 1.7 1.9					1/10										12:30 Tests 7 - 13 were made all reds, all greens and then all blues. # 9 is questionable. R & G were made at 1/10 while B was made by 4 × 1/10 exposures, the final reading being divided by 4. This latter procedure was followed in tests 11-13 North Sky through window slightly cloudy.
8	f:5.6	R G B	2.65 1.55 1.7					1/10										
9	f:8	R G B	1.55 1.22 1.1					1/10 1/10 See note										
10	f:11	R G B	1.1 .71 .75					See note in remarks										
11	f:16	R G B	.6 .4 .4															
12	f:22	R G B	.3 .2 .22															
13	f:32	R G B	.16 .1 .1+															
14																		
15																		
16																		
17																		
18																		

4.9
2.55
2.35
3.2

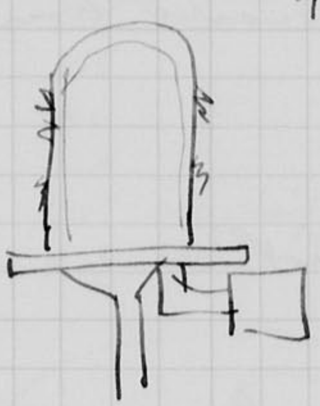
8.1
4.9
3.2

45 90 135 180 ~~22x~~ 225

Feb. 23, 1942

Harold E. Edgerton

Tubes and holder for army beacon received from Sorstang by air express today.



I pumped a tube with 6 cm Xe of the standard spiral type. the anode end was changed so that it would fit the holder. the socket plug was eliminated.

By accident I first connected the lamp with the anode or tungsten wire to the negative. after 5 min at 60 per min there was darkening at this end of the tube. In 5 minutes the tube was failing to ignite 60 mf 1900 volts 1 per sec.

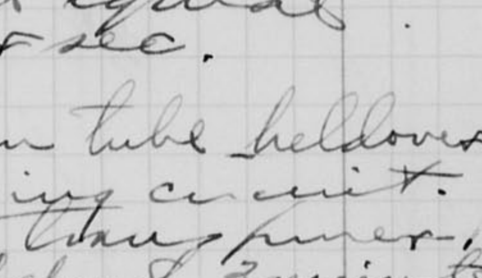
Polarity changed. then tube held over with 500 ohms in the charging circuit. 2-866A tubes direct from a transformer. added 2000 ohms. Ran about 3 minutes before skipping began again.

Out to supper 3/4 hour ±. tube and socket cooled

Started with a thermocouple under the glass about 1 inch from anode. Lamp skips probably due to impurities and temp. A towel was wrapped around the words between the bulb and the socket.

TIME	TEMP (F.)
726	32
733	175
737	200 -
741	210.

Missing about 1 in 1 or 1 in 2.



March 21 1942
the lamps sent Sorstang were filled about 4 cm of Xenon.
Germeshausen has sketch of lamp.

charging resistance changed to 2000 ohms.
Starting band increased on opposite side.

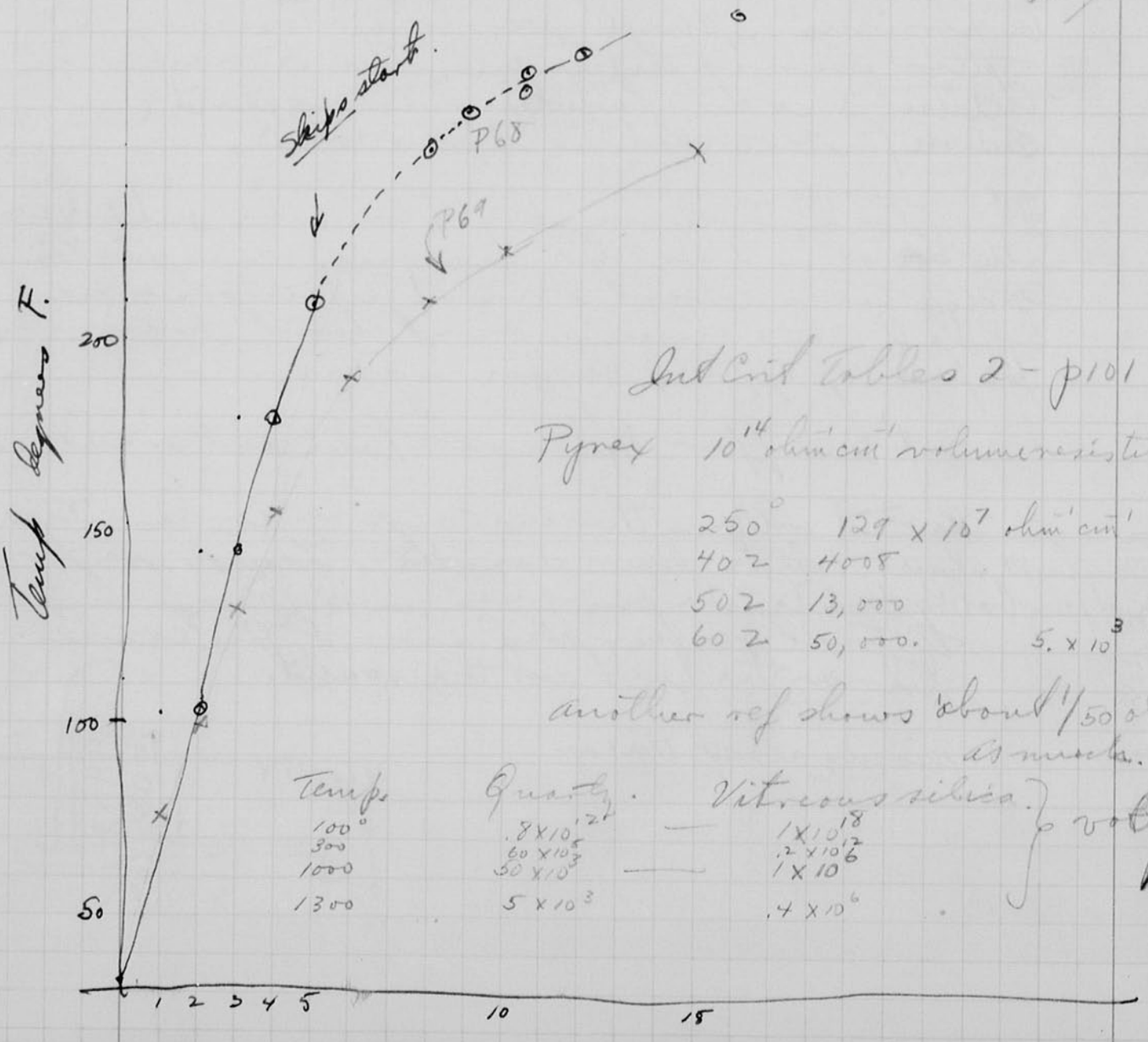
Time	F.
P.M.	100
hrs. min	
8.00	33
8.02	102
8.03	145
04	180
5	210
8	250
9	260
10½	265
12	275
16	285

Spark voltage increased. Now is ok.

Skips start too hot.?

skipping badly. every other flash.

no darkening of cathode!



Ind Eng Tables 2 - p101

Pyrex 10^{14} ohm cm volume resistivity

250°	129×10^7 ohm cm
402	4008
502	13,000
602	50,000.

$5. \times 10^3$

another ref shows about 1/50 at 600° as much.

Temps	Quartz.	Vitreous silica.
100°	$.8 \times 10^{12}$	1×10^{18}
300	60×10^5	$.2 \times 10^{12}$
1000	50×10^3	1×10^6
1300	5×10^3	$.4 \times 10^6$

vol 6 p 340

V.C.T.

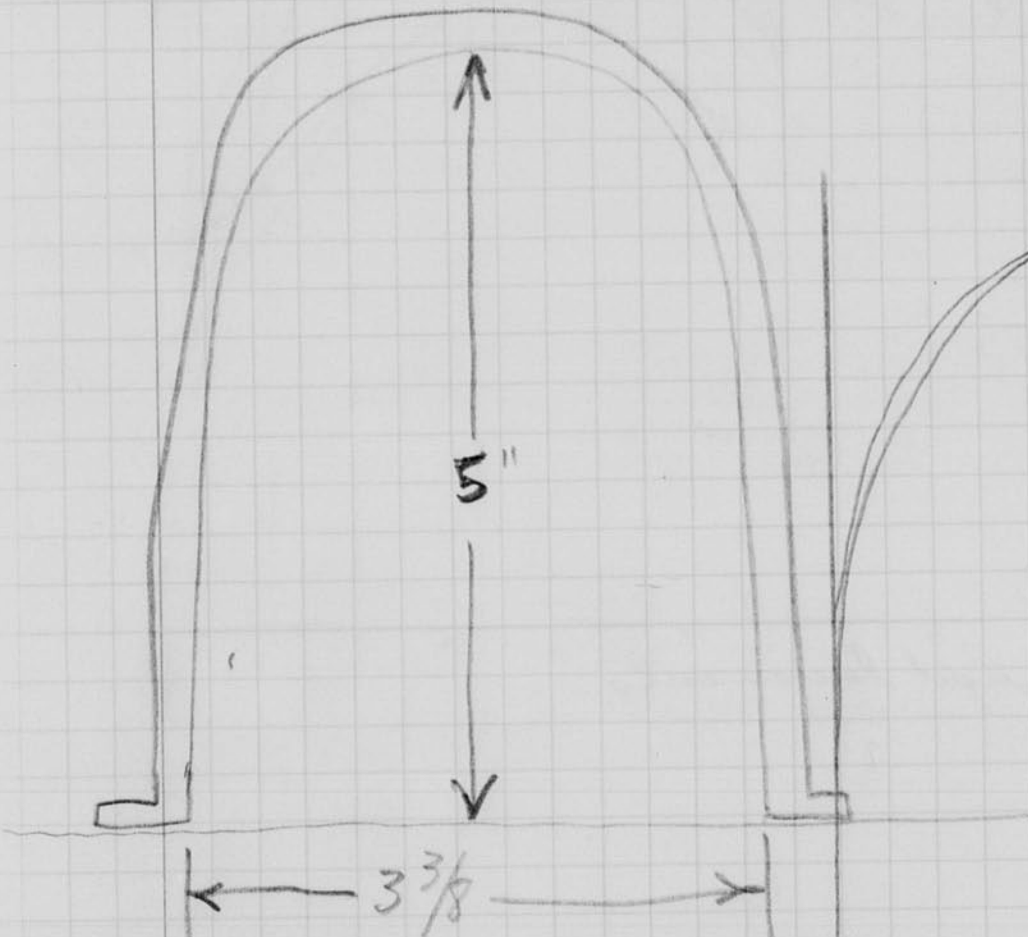
Beacon. Temp tests (cont.).

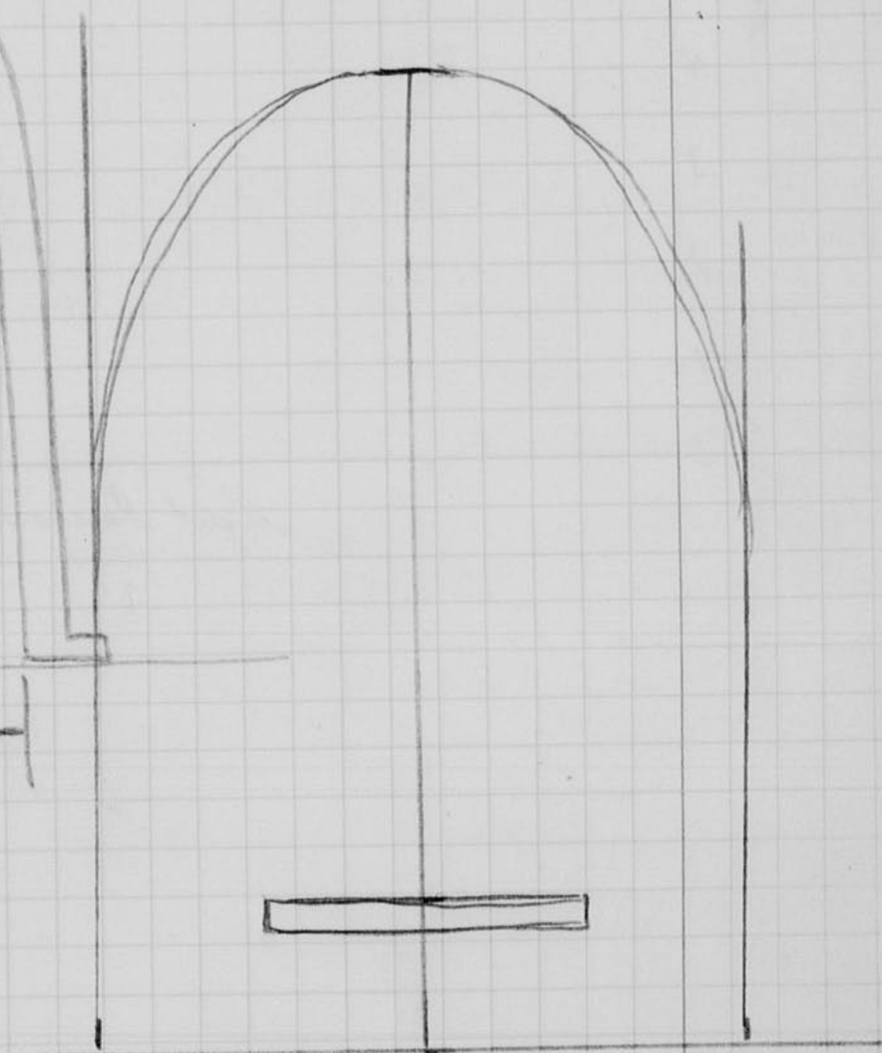
P.M. 8-51	32
52	75
53	100
54	130
55	155
57	190
59	210
9 01	225 no strips
06	250 " "

Quartz elongated spiral made by GE East wells.
60 mf 1900+ volts 2000 ohms. 1 per sec.

Thermocouple probably closer to wall than for other test of page 68.

but tube dark on tungsten cathode end.





Area $= \pi\left(\frac{3.5}{2}\right)^2 5 \doteq 50$ sq inches.

$\frac{56\text{ mf } 2000^2}{2} \times 1 = 106$ watts.

$\frac{106}{50} = 2$ watts/sq inch.

---

4 1/4 diam x 8

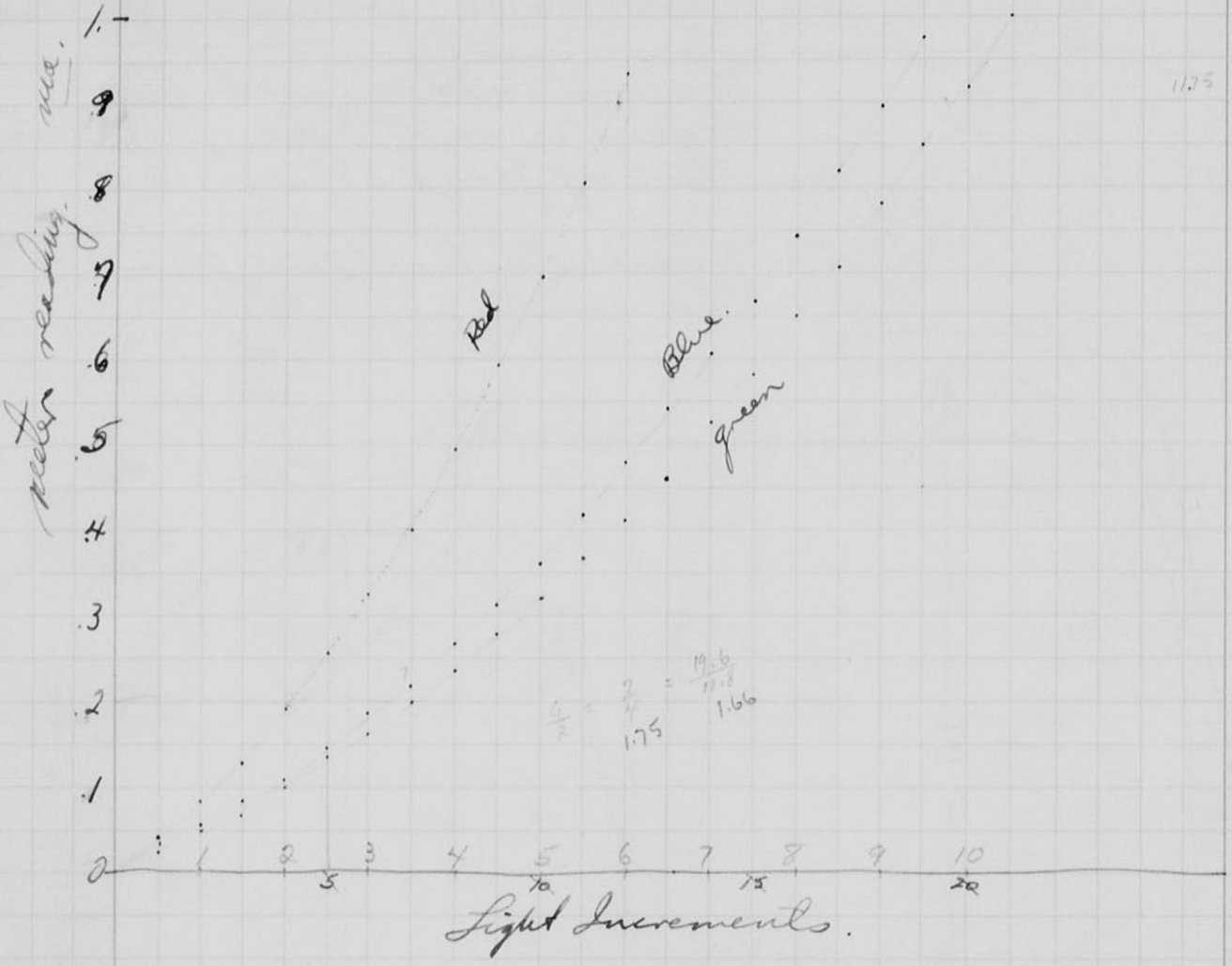
area $= \pi\left(\frac{4.25}{2}\right)^2 8 = 105.5$ sq inches

$\frac{200 \; 3.^2}{2} \times \frac{1}{2.5} = 360$ watts.

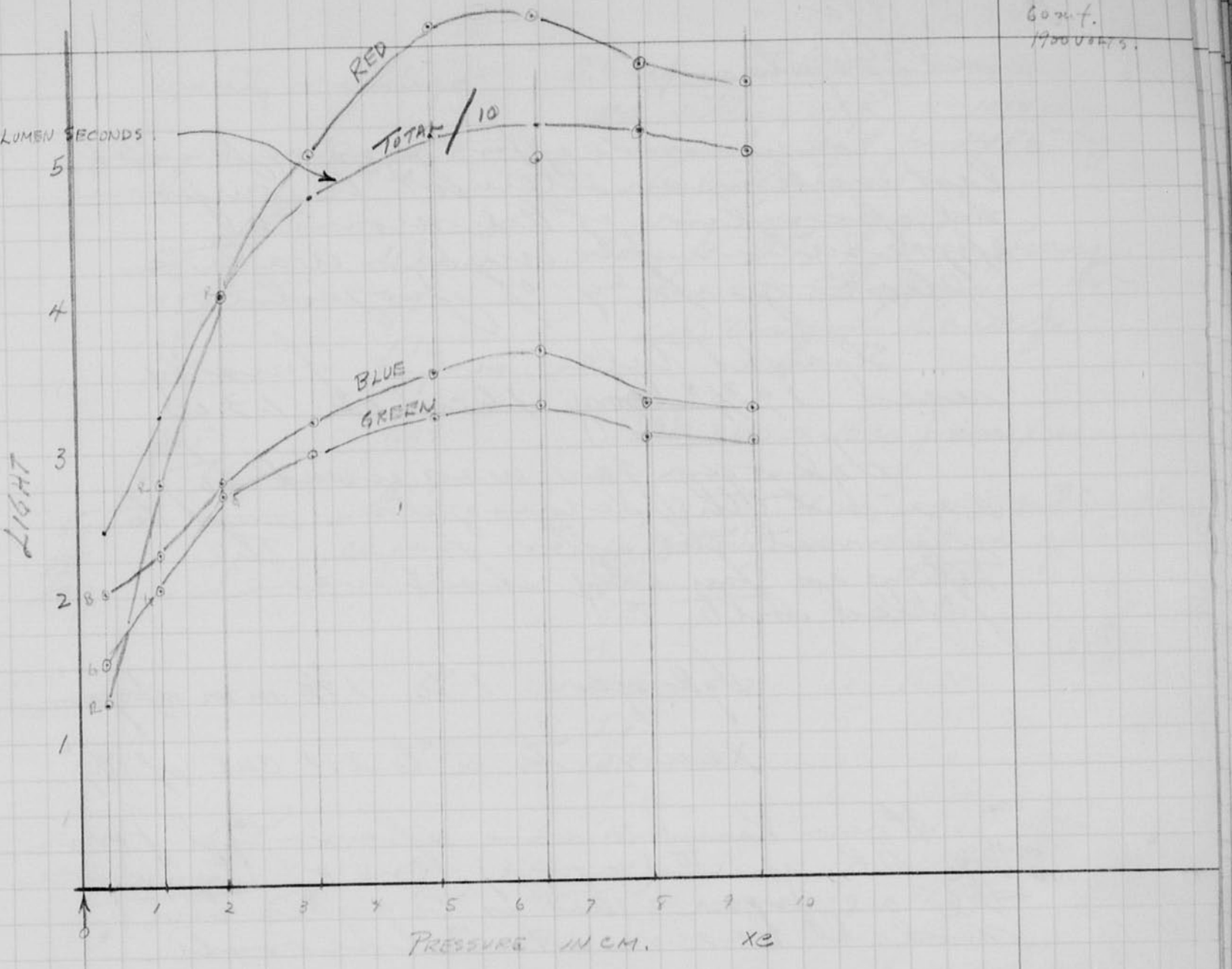
$\frac{360}{105.5} = 3.25$ watts/sq inch.

(1 flash sec. 80 mf 3000 volts) 360 watts.

Intensity calibration of Photocell integrator



60 ~ f.
1700 Volts.



March
~~Feb~~ 2, 1942
David E. Epstein

Considerable effort was expended last week in an attempt to improve the operation of the movie apparatus for under water photography of projectile.

Straight tubes were finally used 9 3/4" long 1.6 cm. O.D. 1.3 I.D.

Hydrogen gas was used to assist the deionization and to eliminate the after glow. The tubes as finally used were filled with

Hydrogen 1 to 1 3/4 mm ~~of gas~~

Xenon to 2 to 2.1 cm. of Hg.

Four lamps were operated from the E.R. units (movie). One of these was the one ~~from~~ that is to go to the model basin at Carderock.

Mr. Kaye of the model Basin was here Thurs, Fri, Sat. and Sunday and worked with us. We set the apparatus up in the pool on Sunday night and took trial photographs. See Chas Wyckoff's note book for details.

Density readings

Pos film	neg film
.59	1.3
.49	1.27
.28	1.16
.26	1.1
.265	1.04
.195-.225	1.04
Fog .08	.54

11.4

0.5 mf in ER camera.
#2 setting of R - 1000 ohms.
Governor set for 1485 by (strobotac).

Lamp 3 feet from Gray Scale. Diffuser on all Argon lamp.

$25\frac{1}{2} \times 60 = 1530$ frames/sec.

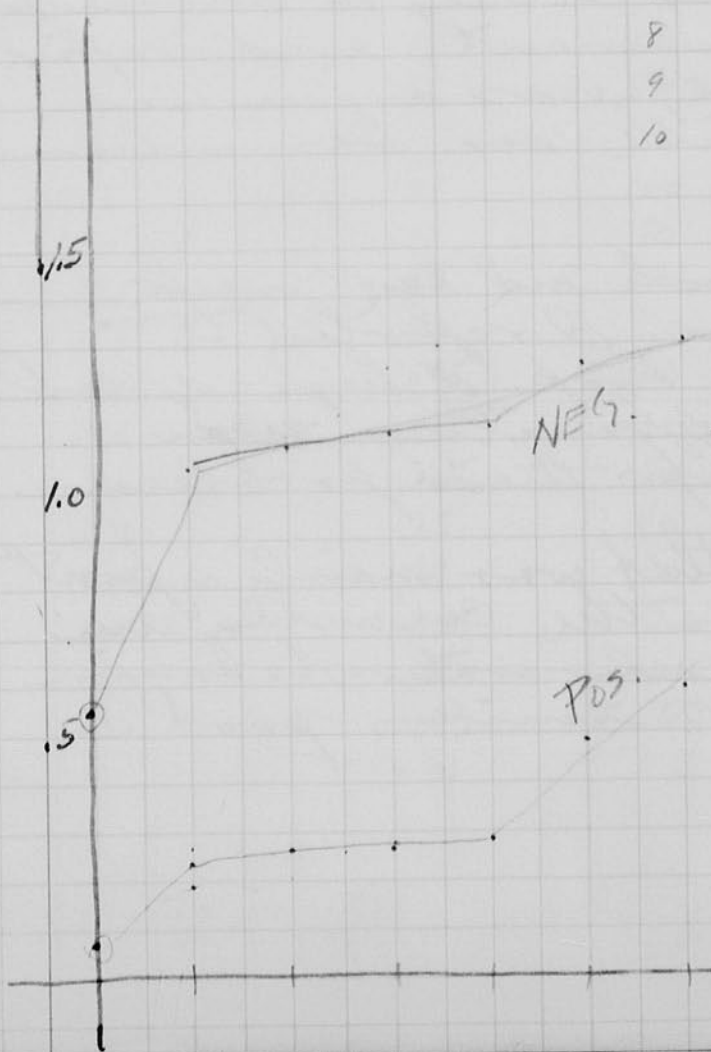
Framing record. from splice — Positive film

	mm		
1	18.9	11	18.90
2	18.95	12	18.90
3	19.0 —	13	18.85
4	19.0	14	18.90
5	18.95	15	18.95
6	18.95 18.80	16	19.0
7	18.80	17	18.95
8	19.0	18	18.90
9	19.0	19	18.95
10	19.0	20	18.95
		21	18.9

.15 / 19.05

Read with meas eyepiece

22	18.95
23	18.90 —



Governor data

Turns	f.p.s.
1/4 + start	229
1/2	370
1	655
1 1/2	880
2	1015
2 1/2	1315
2 3/4	1485
3	1650

March 17 1942
Harold E. Edgerton

Germeshausen told me today that his experiments with hydrogen filled tubes for the radiation lab. has been successful for thyratrons operating as a pulse generator at 4000 cycles per second. A 50 ohm load is used for these tests. 10,000 ± volts on the plate.

I was present when Mr. Germeshausen made his first tests on oxide coated cathodes with a hydrogen gas filling of the tubes. If the peak current was too great a cathode bright spot would appear on the cathode. This experiment was performed about a month ago.

The application of the hydrogen thyratron, with its ability to successfully carry high peak currents, and rapid deionization time, was discussed this morning with Mr. Germeshausen and Mr. Brier.

I was in Carderock and last week at the Model Basin. I reported to Commander W.P. Roop. A high-speed motion picture apparatus was delivered to them for their problems.

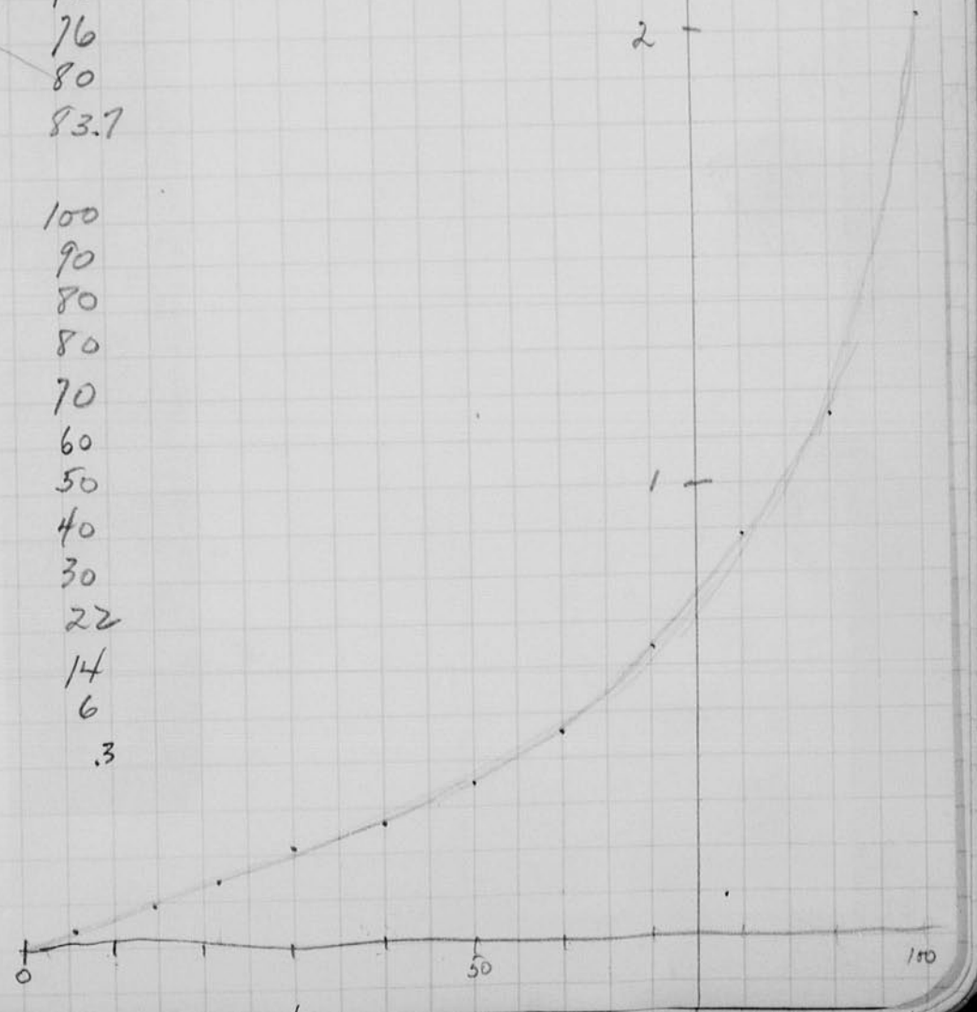
The week before that was mainly spent with the Group from the Columbia University working upon the underwater behavior of objects in the M.I.T. swimming pool.

March 17 1942

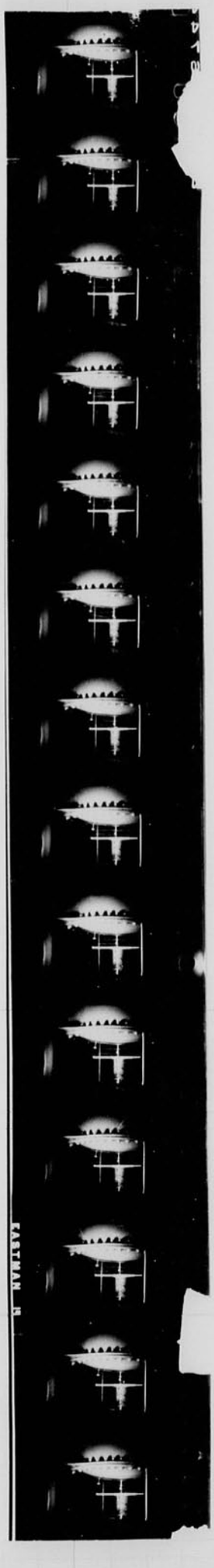
Harold E Edgerton

Calibration of meters used in Photocell Light measuring unit.

Weston model 772 "Ohmmeter" ma	Triplett model 221	Weston 301 with non-linear scale
0.0	-.01	.0+
0.2	.2+	33
.3	.355	53
.4	.515	66
.5	.675	74
.6	.845	80
.3	.22	35
.4	.315	49
.5	.41	59
.6	.52	66.5-
.7	.62	72
.8	.735	76
.9	.84	80
1.0	.96	83.7
2.03	—	100
1.30	—	90
.89	.84	80
.885	.84	80
.631	.585	70
.465	.425	60
.36 -	.325	50
.276	.25	40
.205	.19 -	30
.145	.135	22
.092	.08+	14
.035	.03	6
0	-.01	.3



Strip prints of Model Basin movies.



1 oz TNT in water tank in pit.

To show strings in action.

← explosion about here.

Film can (35 mm) 10" from Dynamite cap.

Explosion about here.

Posted on March 18, 1942.

Row of salve cans on surface.

← note glow from explosion duration.

Top view of water surface for 1 oz. TNT explosion.

Data on experiments in Wyckoff book.

Enlargement of eye photo taken in New York at Bellevue Hospital with Drs Fonseca and Tisdale. Feb 20th. 1942

March 18 1942

Harold E Edgerton.

Discussion with Gene and Herb on subject of aircraft beacon in response to telephone call from Secretary.

The flashing rate should be 1 per second.

the energy per flash should be 80 mf x 3. 3000 volts.

There should be 3 power supplies and units. each fused. for reliability.

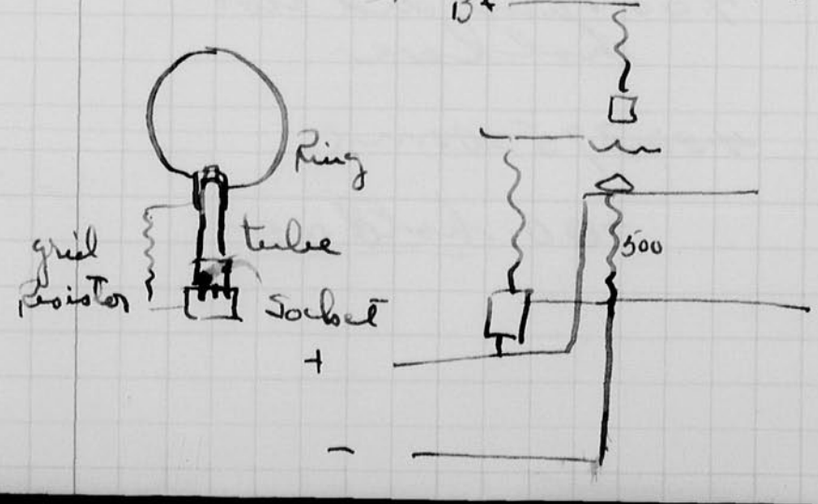
A strobotron was made with Xe 89% Kr 11% last night at a pressure of 0.7 cm. It held over in the regular Strobotac circuit, most of the time. When it did operate the light was white and roughly equivalent in volume to the neon strobotron.

The meter in the exposure measuring device was changed from the triplet to the Weston 301 (modified). See page 75 for current comparisons.

March 20 1942.

Discussed possible use of high-speed photography for measuring production velocity of bullets from sub machine guns. Mr. Lewis of Chrysler.

1. Photocell trip.
2. Ring (electrostatic) for trip.



March 25 1942

Harold E Edgerton.

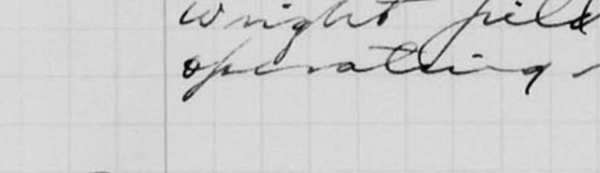
Attended AIEE talk last night in Walker by Prof Wilbur on the Wind generator 1000 kw near Rutland Vt.

Maxwell Krasno of Electronic labs was here yesterday and the day before. We had a conference on the design of beacon apparatus and other devices utilizing stroboscopic lamps. A series of comments were ~~made~~ noted by Germeshausen of the various items covered.

Of particular interest is the completion of the development of the large beacon for airplane use. The present tubes sputter at the cathode using a moly electrode in a quartz tube. One electrode of thoriated tungsten, scintered, was delivered to Wright field and seems to be operating very satisfactorily.

March 26 1942.

Barstow tested flash unit last night D.I.C. 6016.



Quartz lamp.

450 ohms did not hold over.

~~400~~ 375 some

320 hold over.

March 2/1942

Harold E. Edgerton.

Set up Jenkins camera yesterday and took a few sample pictures of an incendary bomb for exposure. The bomb casing was about 4 ft long and 8" in diameter. It was painted with white ~~oil~~ casine paint.

Film	Jenkins aper	Speed	Remarks.
Pos. Sound.	4.5	300	faint exp 10 min dev. D19.
Super XX.	4.5	~~1~~800	over ~~exposed~~ 10 min D72 4:1.

NM We plan to use aper 2 and develope in D76 for experiments today.

March 27, 1942
HE Edgerton

Speed time cameras.
Jenkins camera at Howard ave.
200 ft piece of film.

↓	t		fps.
freq	0.	4	240
	0.1	8 1/2	
	0.2	5	300
	0.4	12 1/4 1/2	360+

skips? yes.

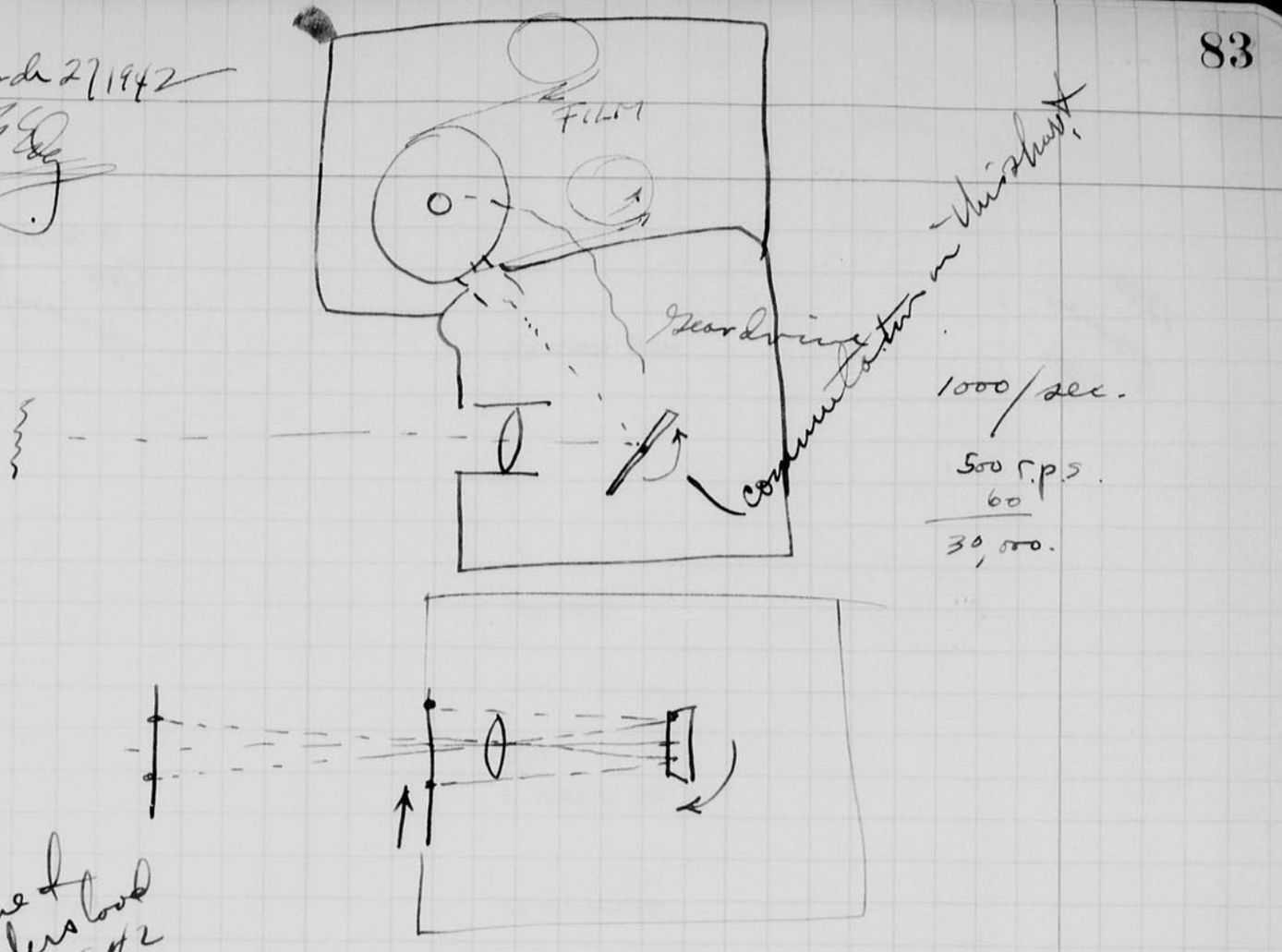
Shot #3 (Tenths of seconds)

14 3/4
16
17 1/4 ← explosion
18 1/4
19 1/4
20 1/4
21
21 3/4 +
22 +
23 +
22 3/4
21 1/2
20
10
9 1/4
8 1/2
7 1/2
7
6
5 1/4
4 1/2
3 3/4

Shot #1 (Distance in inches between sparks) (frames per 1/60 sec)

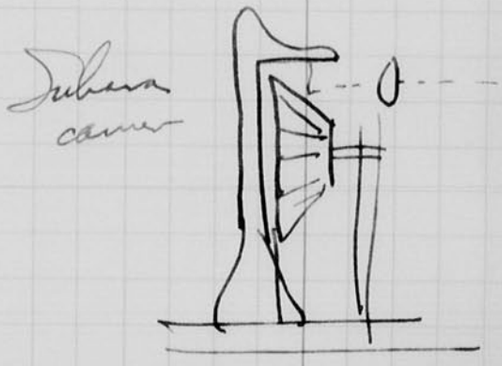
Distance		frames
18 5/8"	12 3/4 explosion	24.9
18 7/8"		25.2
18 3/4" +		25
spark missed here		
19"		25.3
19 1/8"		25.4
19 1/8		25.4
20"	last (end of film)	26.7

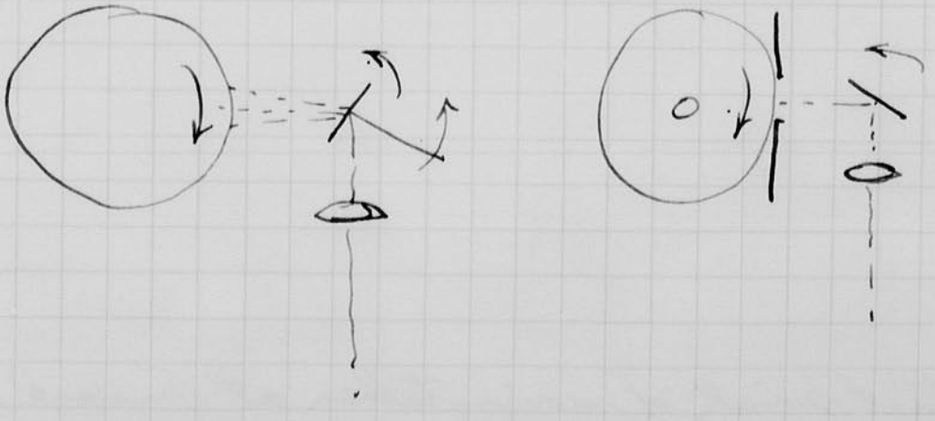
March 27 1942



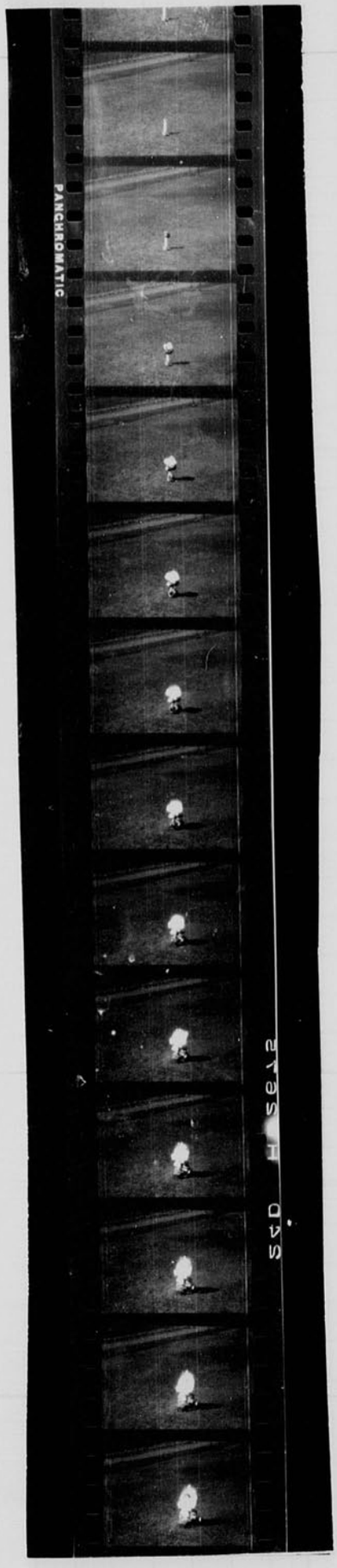
Explained and understood March 28 1942 Herbert E. Ives

High-speed camera with ~~minimum~~ shutter to eliminate most of continuous light

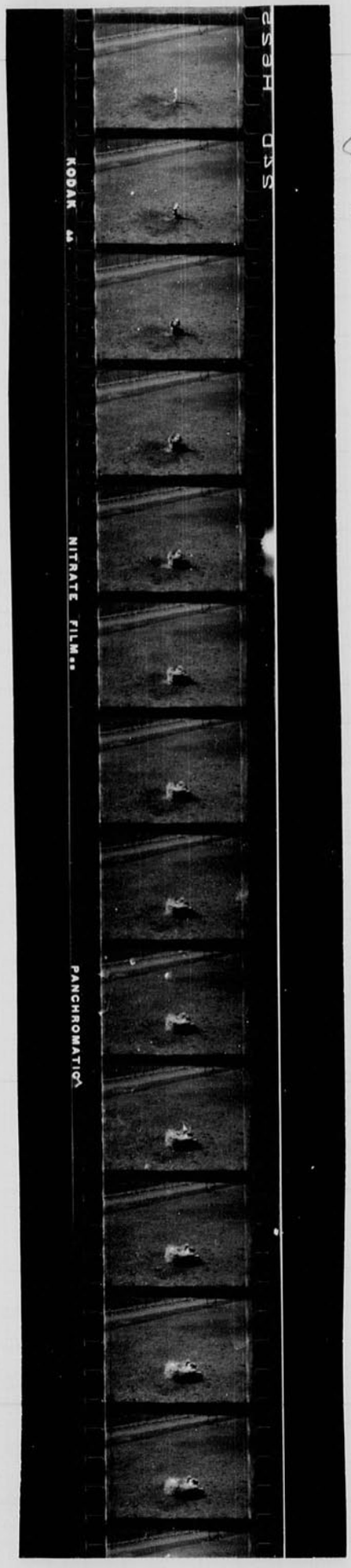




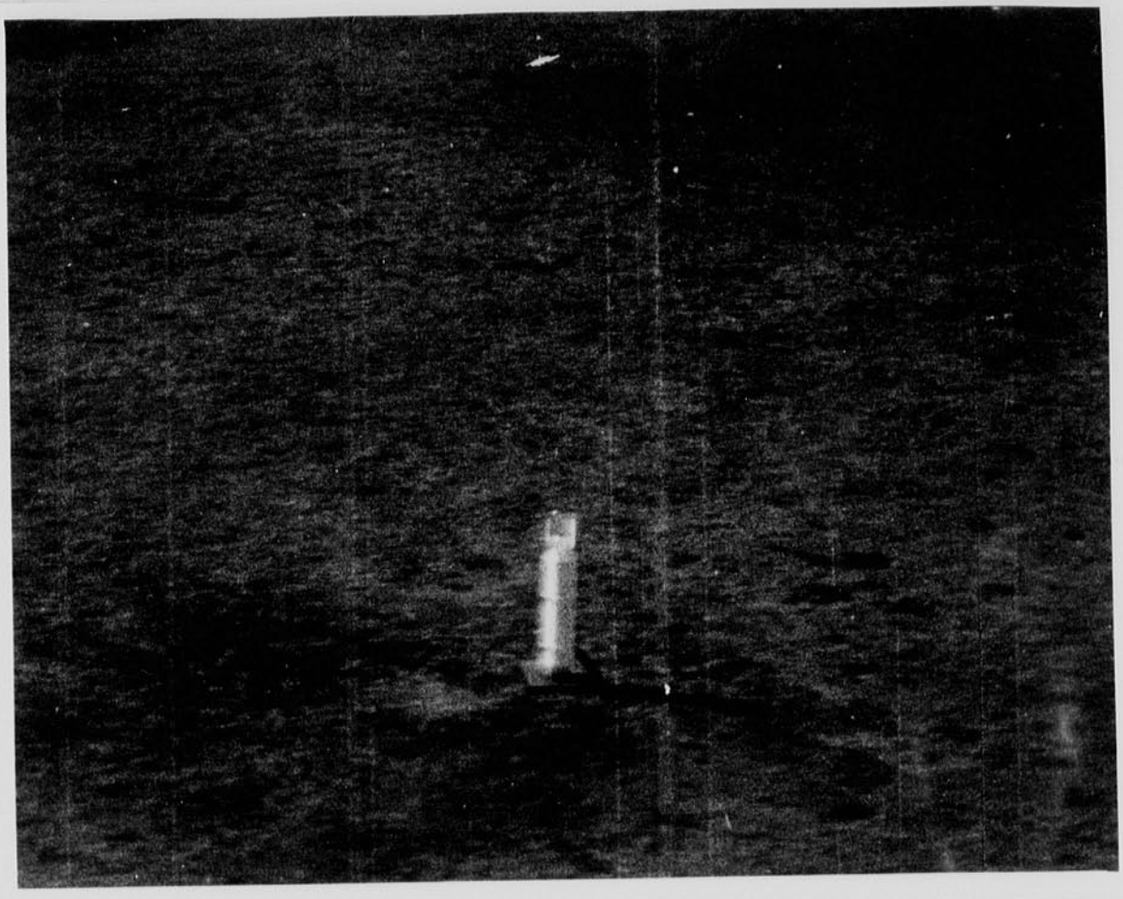
1250 frames/sec



800 frames/sec.



Contact prints of movies taken at Harvard near the Stadium for Prof. Fieser Mar 27. 1942.
Hirschberg.



Cathode ray 15000 cycle strip. Trimmer

movie strips

Dahlgren

Model Basin.

Notebook # 12

Filming and Separation Record

____ unmounted photograph(s)

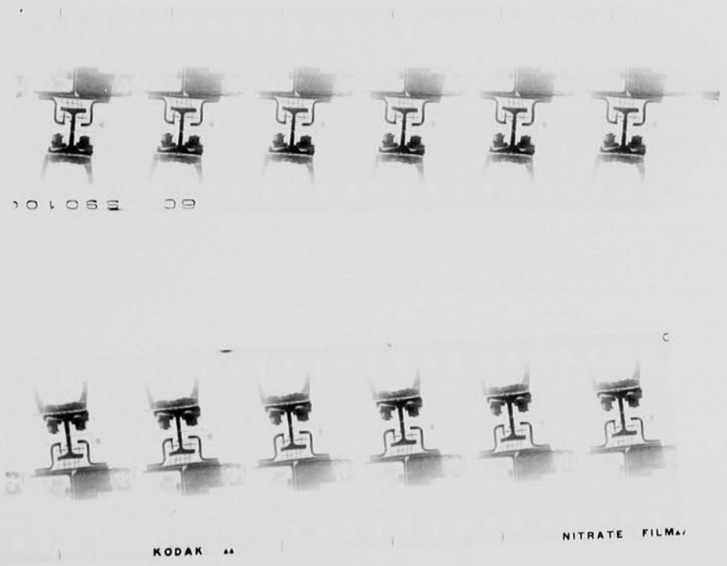
5? negative strip(s) inside envelope mounted on page 85

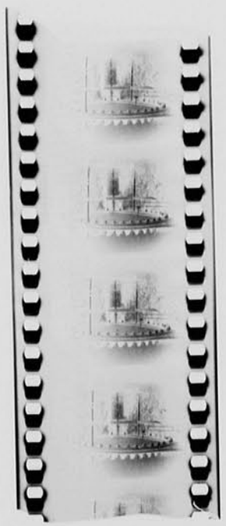
____ unmounted page(s)
(notes, drawings, letters, etc.)

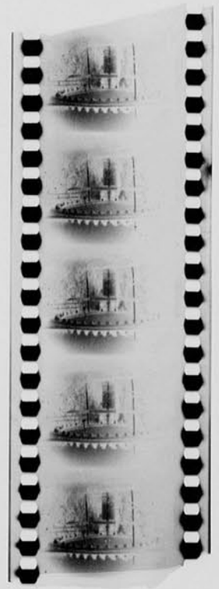
was/were filmed where originally located ~~between~~ on page 85 and —.

Item(s) now housed in accompanying folder.


Eastman Super XX
PANCHROMATIC

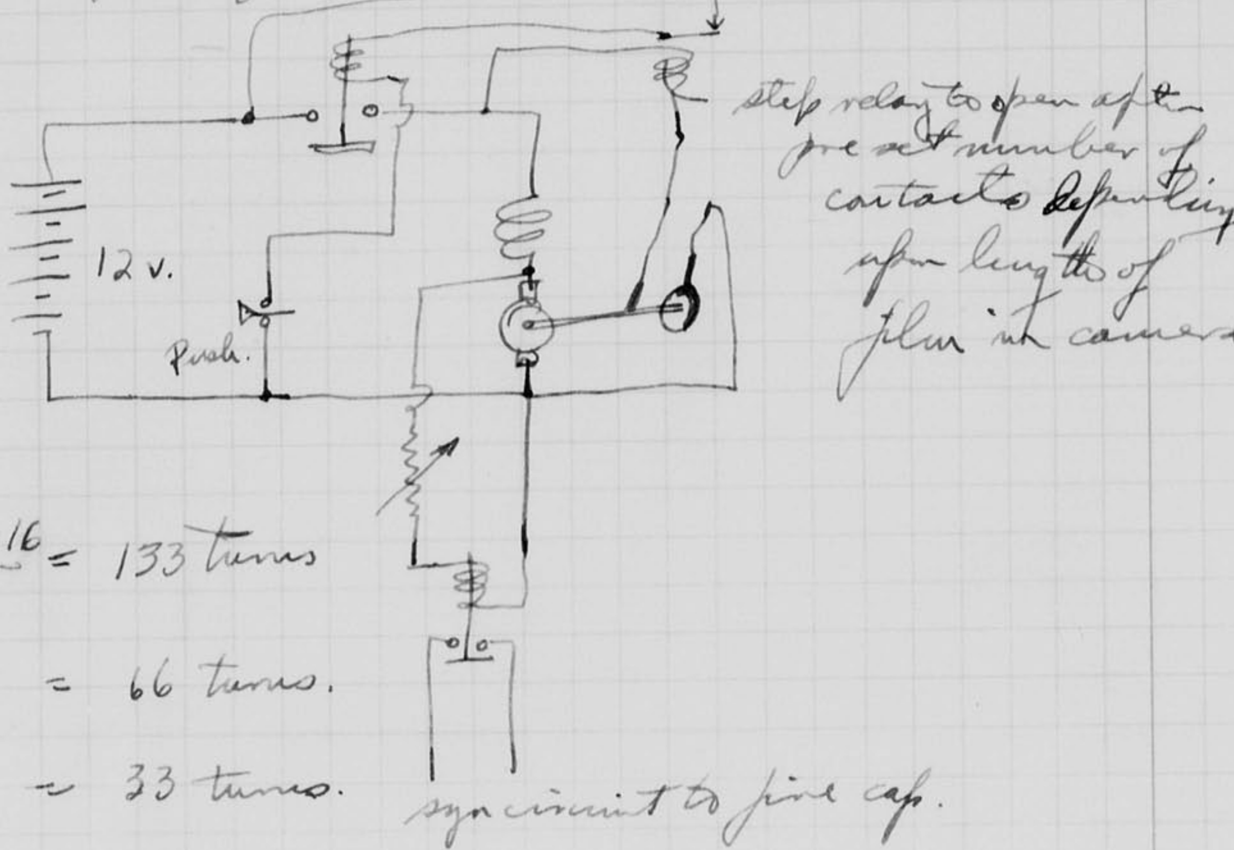

KODAK
NITRATE FILM





March, 30. 1942
Harold E. Edgerton

Discussed relay problems with Dick Taylor for Jenkins camera.



$\frac{400 \text{ ft} \cdot \times 16}{48} = 133$ turns

200 ft = 66 turns.

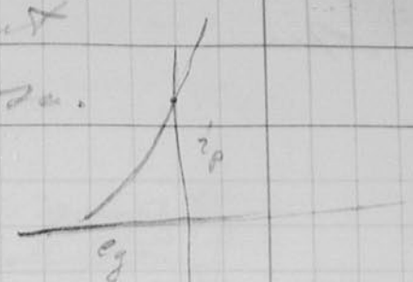
100 ft = 33 turns.

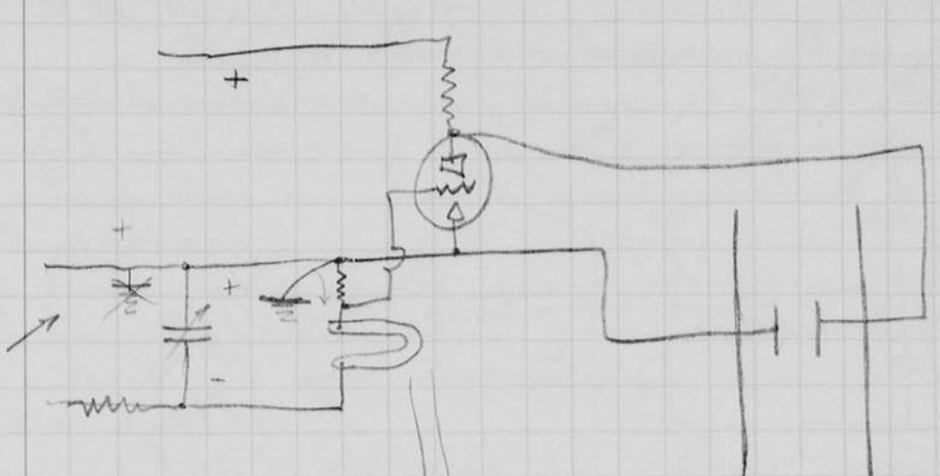
March 31 1942 – Last night at Grad House Talk to IIA students on high-speed photography. Owen (Schdy).

Received 200,000 cycle oscillator from Hewlett co in Calif.

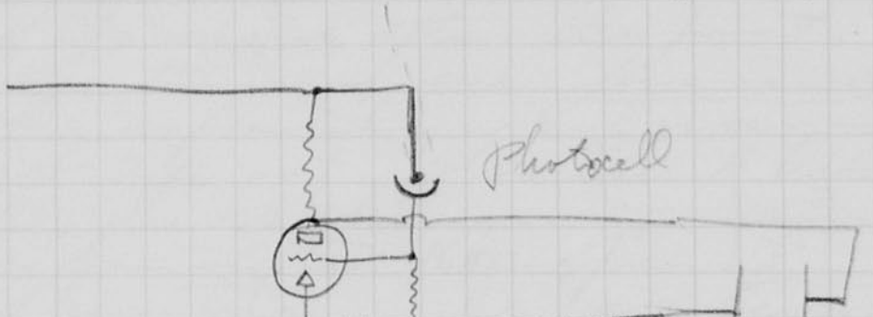
Mar 31 1942
Cont

Current Measurement
with a Cathode-Ray Osc.





Current



Light

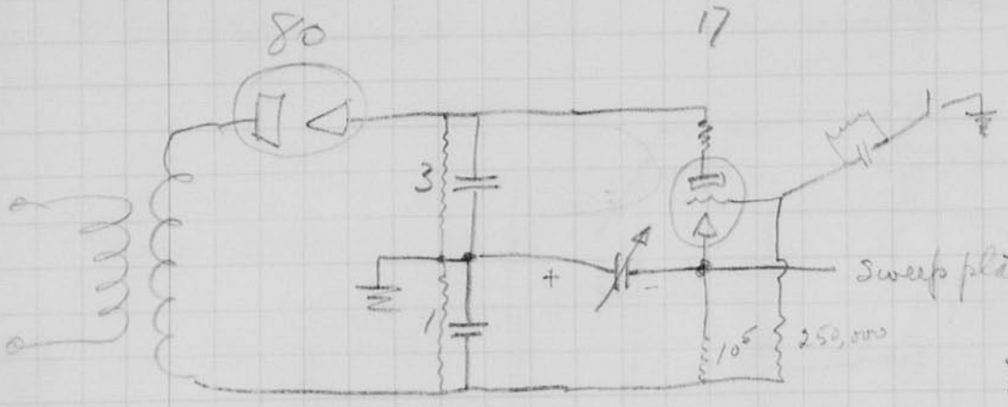
Voltage.

March 31 1942

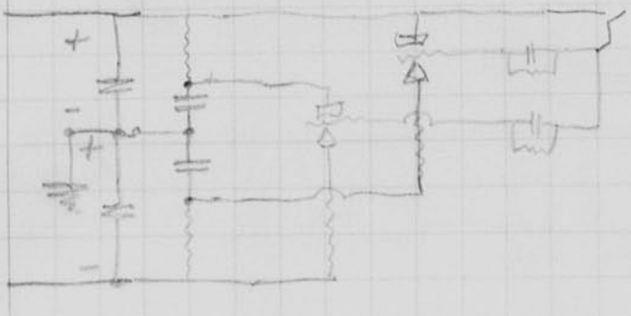
Cont.

Sweep circuit for CR tube.

3 element W.E.



this sweep circuit is ok but puts beam out of focus on edge of bulb. the voltage needs to be same on both plates to eliminate wedging.



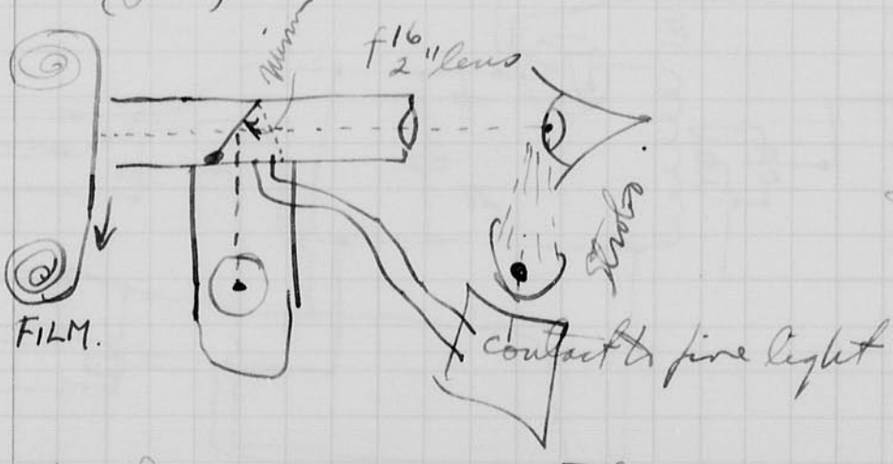
April 8 1942
Harold E. Edgerton

Helped Germeshausen pump quartz spiral beacon lamp for Sonotron Electronics. Tests on the pump were made and are recorded in the data book.

The tube was mounted today in the beacon unit that Electronics sent to us for tests.

It was run for 1 hour with 80 mf at 3 second intervals with a 2nd flash at 1/2 second after the first. No appreciable sputtering was present. Then the capacity was increased to 160 - 240 mf. The lamp held over with 500 flashes changing. Resumed capacity to 160 operation ok. Same operating cycle as before.

Several pictures were taken with Miss Wicks to observe eyes in connection with slit lamp photographs. The photographs show more than the eyes since the depth is greater.



Slide camera back and forth until filament image is on desired spot to photograph.

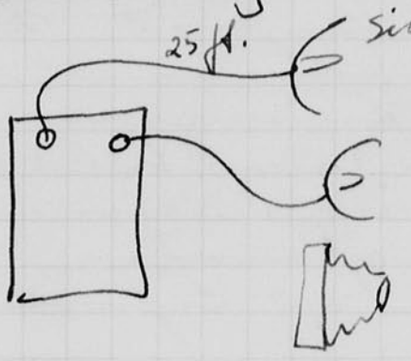
Explained Understood
Herbert E. Grier
4-9-42

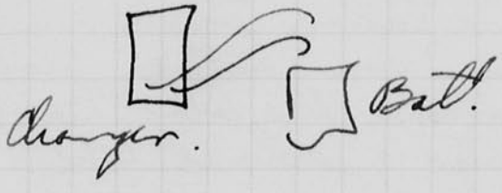
April 20 1942 (Monday)
Harold E Edgerton

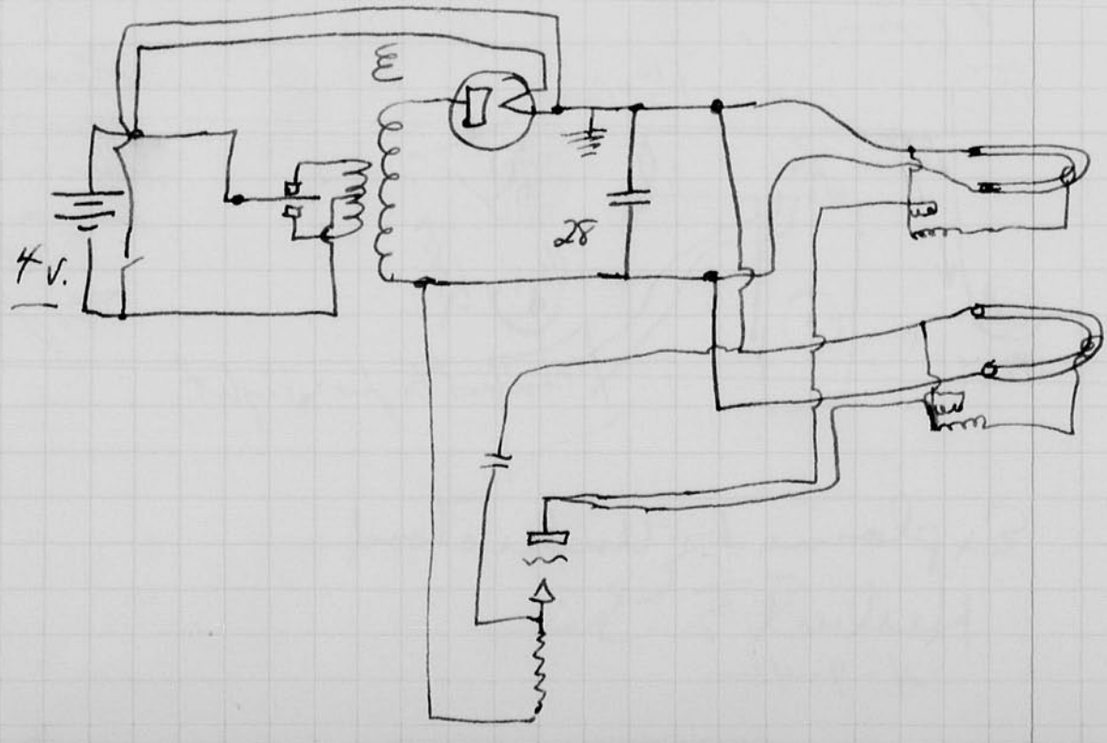
Last week was spent in Washington at the Model Basin. Experiments with explosions were prepared for Commander Koop. Mr. Wyckoff accompanied me and a full account of the trip is recorded in his note book.

Portable design.

a possible solution for the portable is the following.

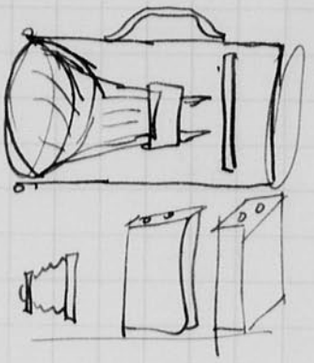






Apr 21 1942

Harold E. Edgerton.



minimum single unit

2000 v } ?
10 mf }

3/160.
exp. number. 53.

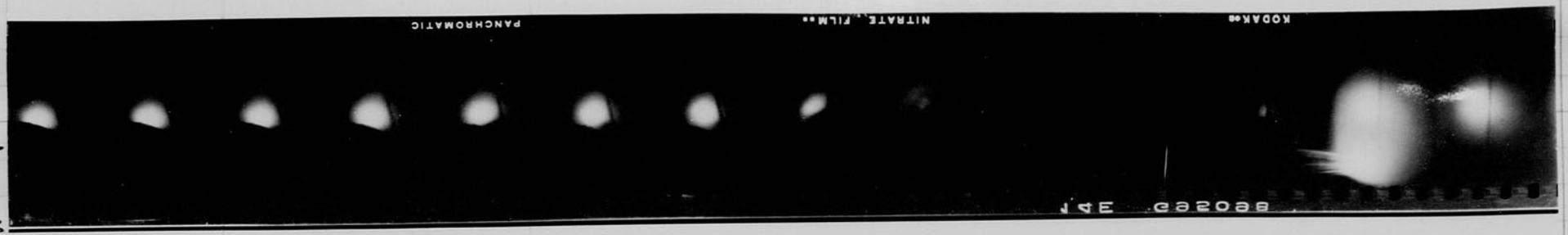
10 ft. f 4.5.

This can be built into a single unit to fit on the camera — or the camera can be fit onto the lamp unit.

April 22 1942.

Pumped two movie lamps with xenon gas at 3.5 cm. Seem to run ok at 25 mf 1000 ohms. 1200 frames/second. With 2 lamps at 3 or 4 ft. exposure is ok on white subject on positive film.

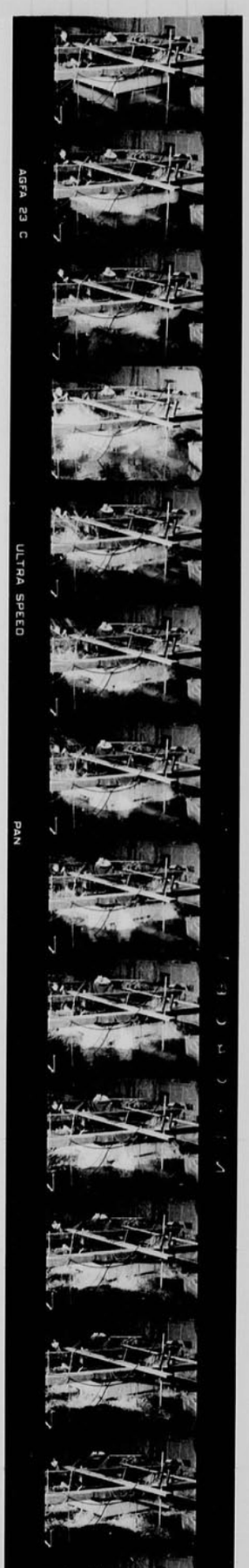
underwater. Explosion



Gas bubble.

Wave in string caused by impact of water on string? → 10" diaphragm with string.

Marine with model Camera



These are a few of the pictures brought from the model basin. Others are in Wychoff's note book with a description of the tests.

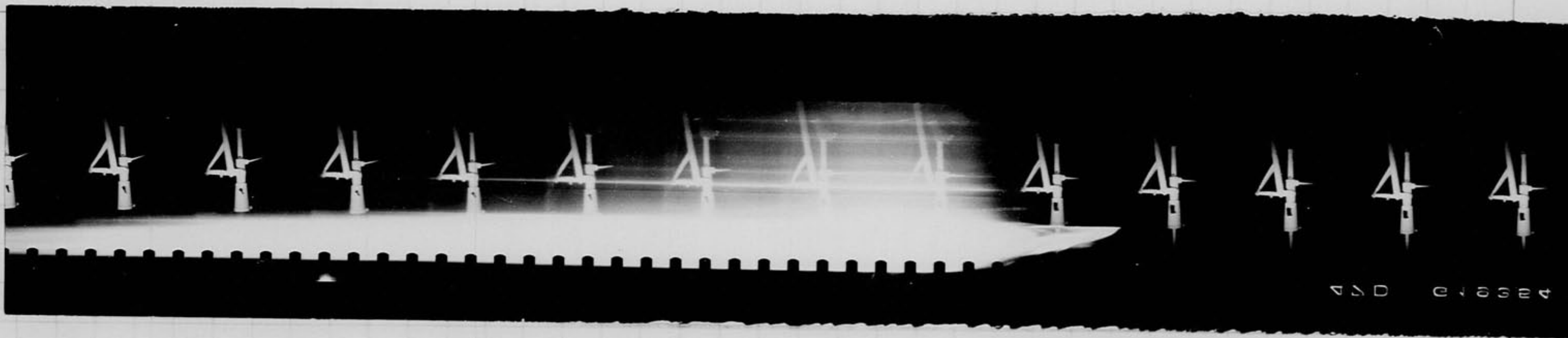
May 2, 1942.
Harold E. Edgerton

On Friday May 24 I was in Erie Pa. at the G.E.Co. plant. I took the movie apparatus by express. Shot 1000 ft of film. See opposite page for sample.

~~March~~ April 25 - M.I.T. Banquet at the Hotel Statler.

April 27. Graduation at Symphony Hall. Roof and Campbell film of model Basin. Washington here to examine film. Dinner at Hartwell farms.

Yesterday, I was at the Vaught-Sikorsky plant at Bridgeport. I took the G.R. camera for recording cathode ray oscillograms of vibrations.



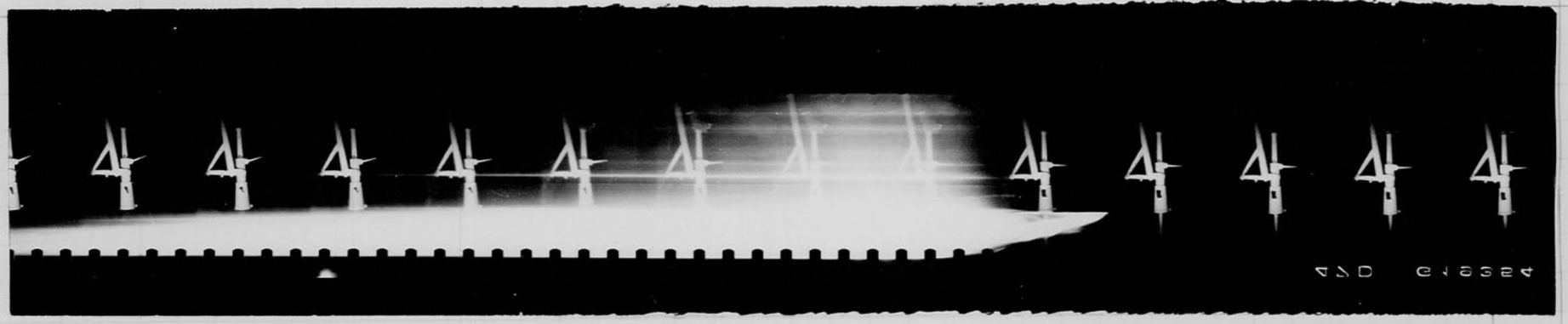
Friday April 24 1942
H.E. Edgerton.

proj. 2.9 lbs | 275 ft./sec. 270-277.
barrel 10.0 lbs.

98-676 100 [illegible]
Tanner.

98-676
apr 30

Center 3088.



Friday April 24 1942
P.E. Edgerton.

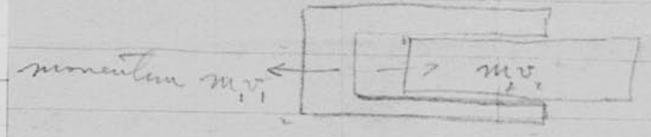
proj. 2.9 lbs
barrel 10.0 lbs.
Trunnion 5. lbs.
Tripod 20. lbs

275 ft./sec. 270-277.

time to leave gun

10 gage shell.
Some black powder.

5 3/4" proj travel.
0.0046 seconds.



$f = ma$ $a = \frac{f}{m}$

$v_1 = \int \frac{f}{m_1} dt.$

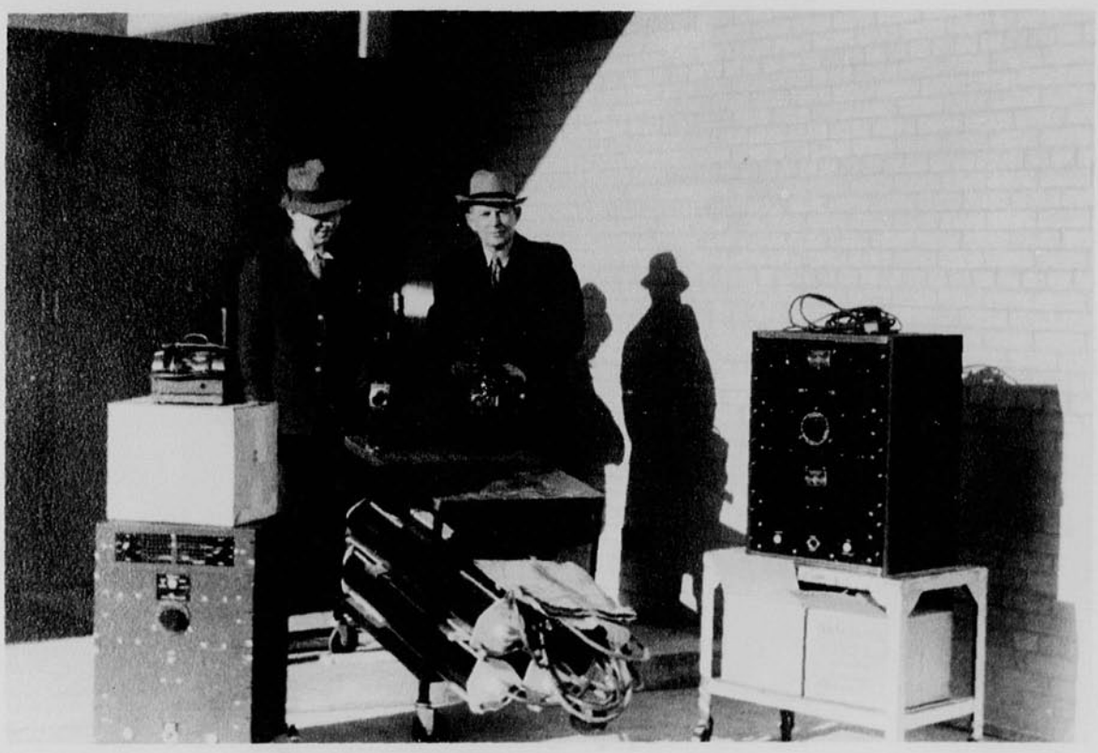
$v_2 = v_1$

$v_2 = \int \frac{f}{m_2} dt.$

$m_1 v_1 = m_2 v_2$

$v_2 = v_1 \left(\frac{m_1}{m_2}\right)$

2.9



Mr. Kaye of
the Middle East Basin.

Notebook # 12

Filming and Separation Record

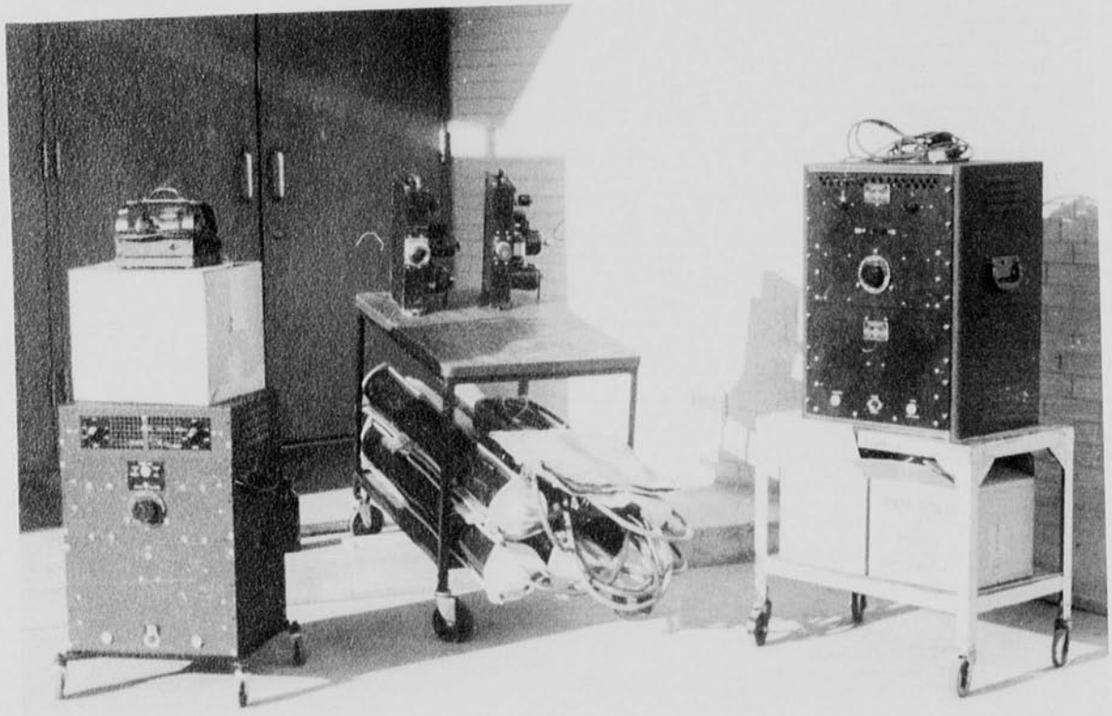
1 unmounted photograph(s)

____ negative strip(s)

____ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 96 and 97.

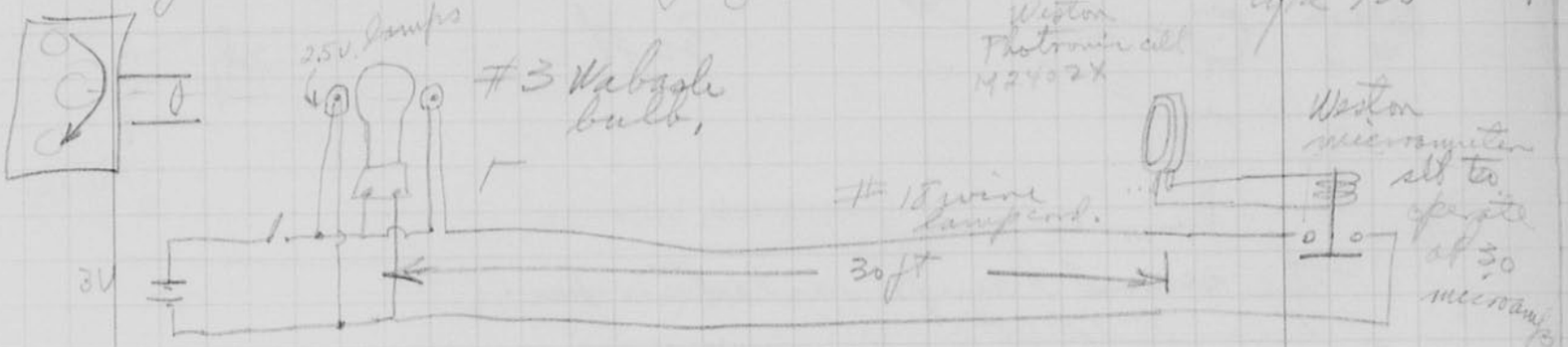
Item(s) now housed in accompanying folder.



Dept of E. Edgerton
May 3, 1942.

Tests of flash bulb and photocell relay

Yesterday afternoon Jack Reilly helped me set up the circuit below to test the time delay of a flash bulb and relay system.



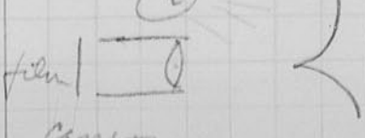
Positive sound recording film used in camera at f 6.3. Bulb (flash) over exposed. The 2.5 V lamps were not bright enough to record. A slow bulb was used for timing. It was too dim to record on the film.

The flash bulb did not operate the relay to flash the second bulb as far as I could see. The contacts of the relay stick in the closed position showing that a contact has been made. They did not stick for this first experiment.

The relay was modified by soldering a small copper wire on the stop so that the circuit was closed when 30 microamps flowed in the circuit. Resistance about 45 ohms in the coil.

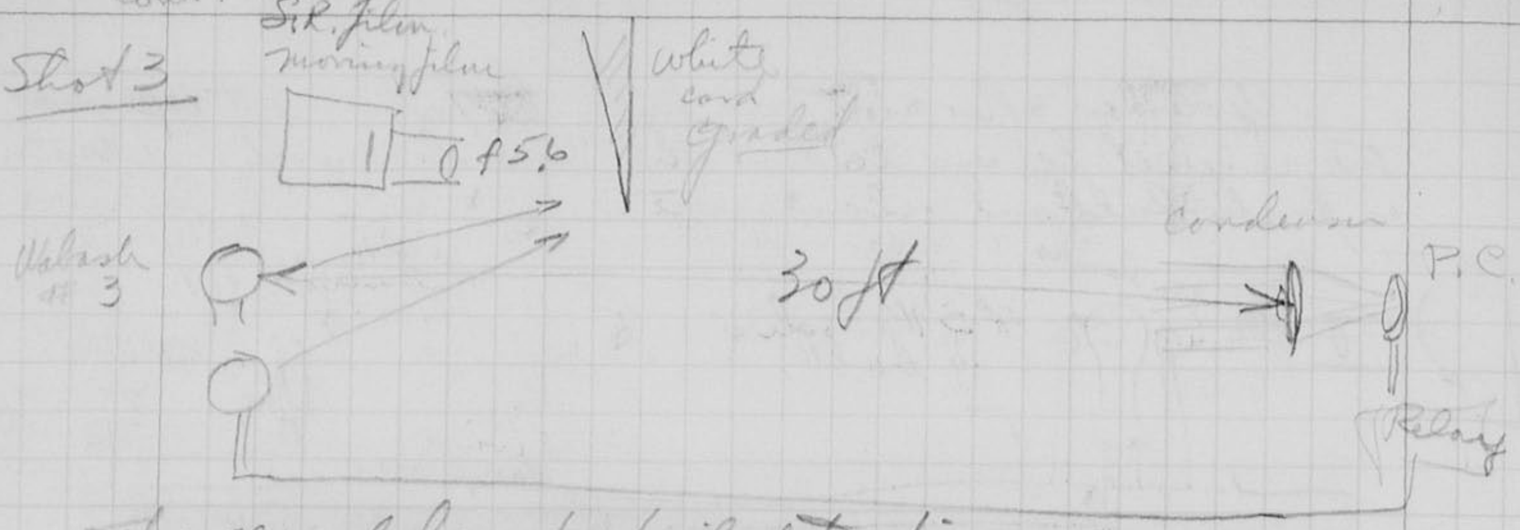
30 microamps corresponds to 40 foot candles on P.C. as measured by a Sek. exposure meter - Photo flood lamp #2.

Second trial. Arranged a 4" condenser to focus the light on the photronic cell. Shot a second flash bulb (#3 Wabash). No operation of the relay by stick test. Used slower camera than above test. A card in front of lens reflected the light.



cont.

Shot 3



the second lamp failed to fire.
Relay did not close the circuit.

Shot 4. Photo cell moved closer (15 ft.)
Shield was necessary to exclude light from window. Camera drop speeded up 85 volts on motor, 60 cycle timer accurately.
~~Shot 4 ft off~~. A wider .459 white card was used as a graded strip. f 2.7 on lens.

Shot 5. Repeat of shot #4 (95 volts on motor)
Aperature f 4
2 Bulbs #3 Wabash
15 ft Photocell to Lamp (flash)
Cell shaded so that ordinary light would not trip relay. (40 ft. candles)

film shows 4/60 sec delay = .066 seconds.

Notebook # 12

Filming and Separation Record

___ unmounted photograph(s)

7 negative strip(s)

___ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 98 and 99.

Item(s) now housed in accompanying folder.

EASTMAN

KODAK

NITRATE FILM

EASTMAN

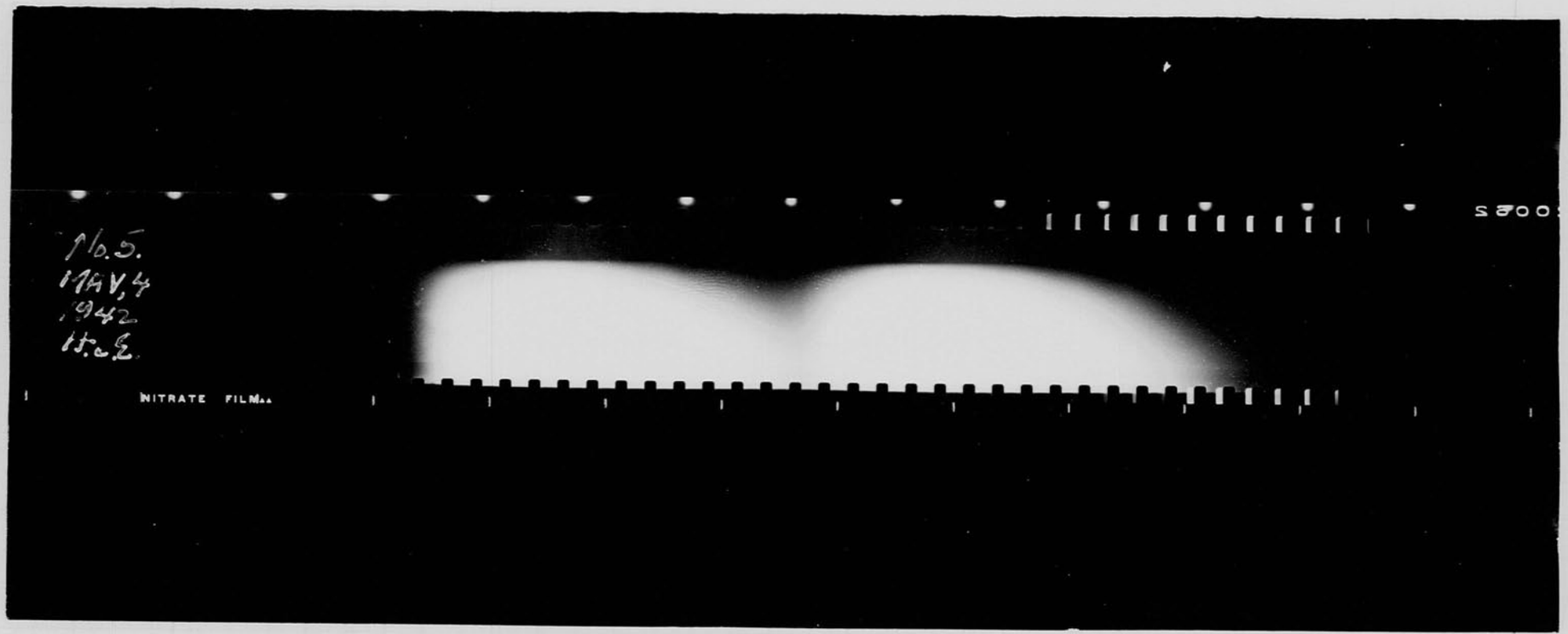
NITRATE FILM

NITRATE FILM

No. 5.
MAY 4
1942
U.S.E.

NITRATE FILM

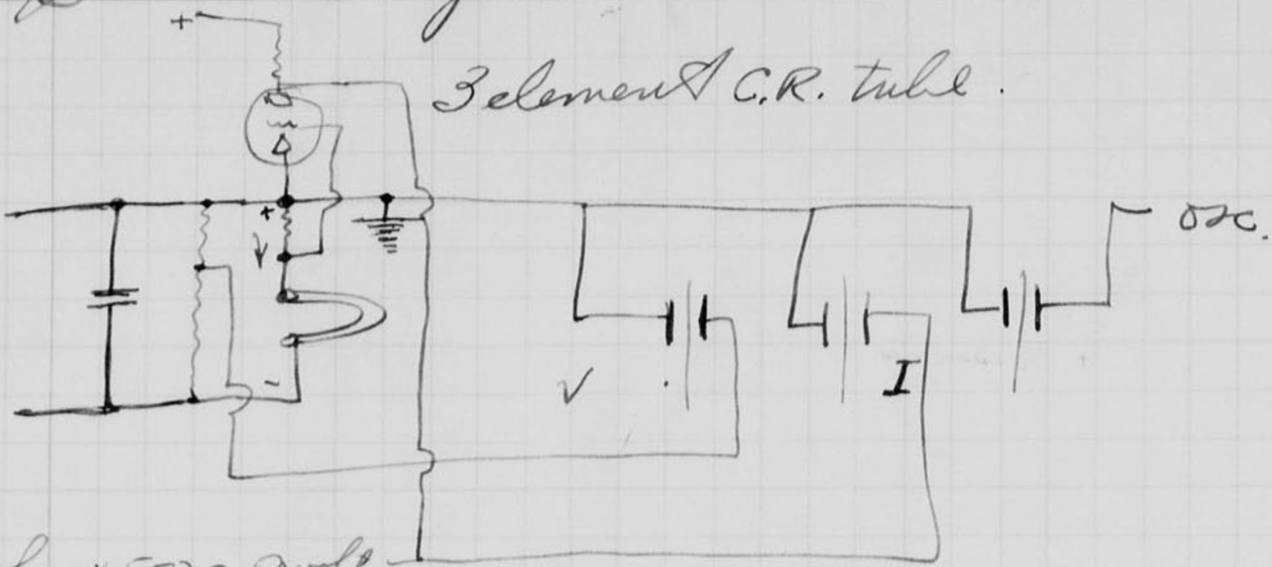
BEFORE


No.5.
1144,4
1942
U.S.E.
NITRATE FILM

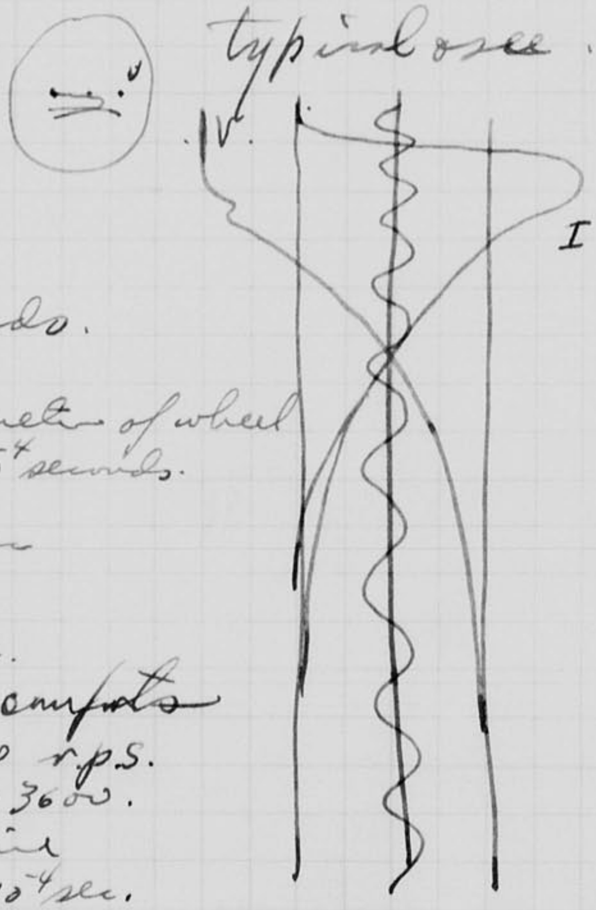
May ~~5~~ 6, 1942 Tuesday.

Harold E. Edgerton

3 element C.R. tube.



.1 ohm × 500 = 50 volts.
.01 ohm × 500 = 5 volts.
5 × gain of 10 = 50



1" = 10^{-4} seconds.

12 × π = diameter of wheel
1 rev ~~E~~ in 12π 10^{-4} seconds.

$\frac{10^4}{12\pi}$ in 1 sec
3.14

0330. in 1 sec.
~~too fast for comfort~~
~~try~~ ~~360~~ 60 r.p.s.
or 3600.
Should give
1/5" = 10^{-4} sec.

Drum diam. 11 7/8

1. Sample oscillogram

Plus x film f 4.5 lens 105 mm.

2 kv on oscillograph
10,000 cycles full out put 100 x 100
put Hewlett packard osc.

3 elements in parallel
1/100 sec exposure.
3600 rpm (1/60) sec per rev.

D 72 3:1 5 min development.

Exposure ok but weak.

2 Sample. Data above except 3.5 KV on CR tube.

Exposure ok.

3 Portable. 25 mf spiral lamp in RHO Bulb.
10^4 cycles lamp worse ~~3600~~ or 1800 RPM

4. Kodatron 150 mf
10^4 cycles tungsten waves.

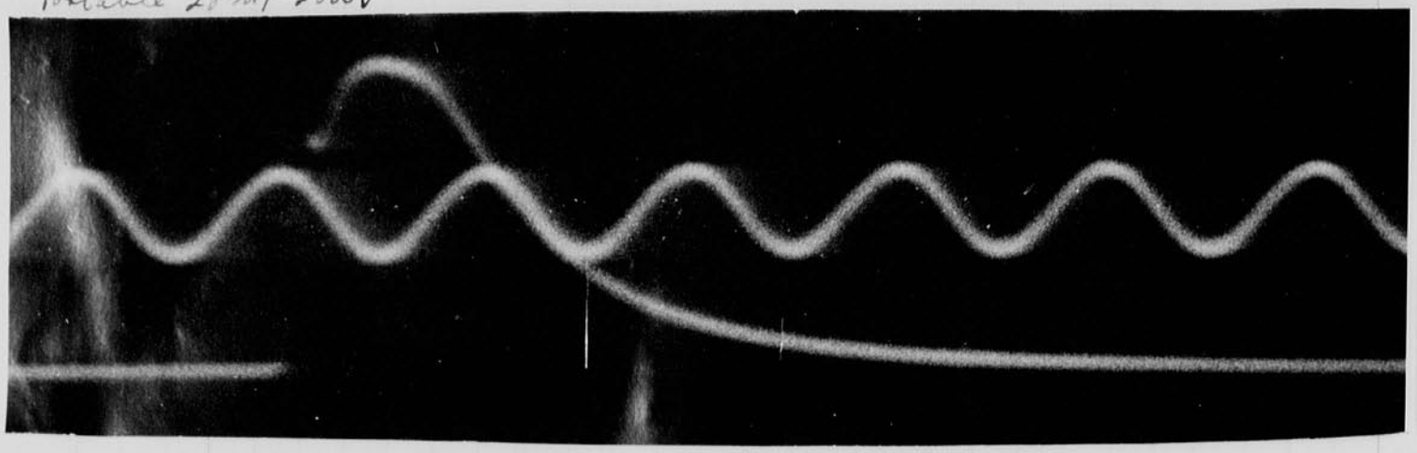
6. Kr-Xe Strobolux lamp flashed from 10 mf.
2000 volts.

7. Microsecond unit.

See prints on next page.

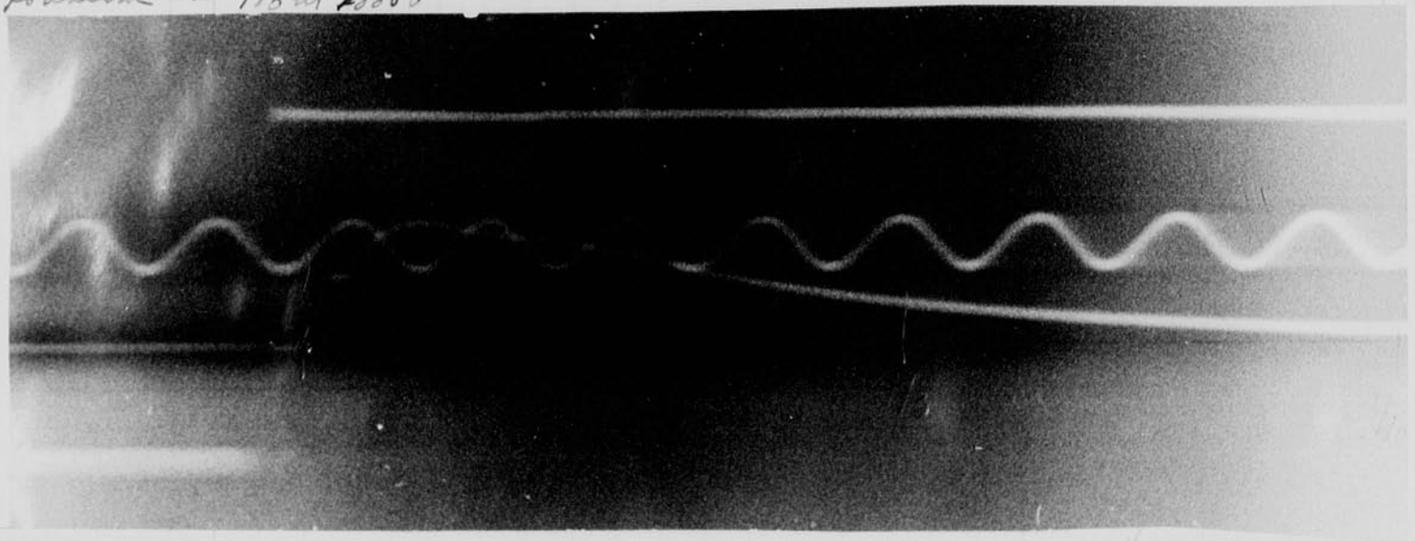
Portable 28 mt 2000 V

3



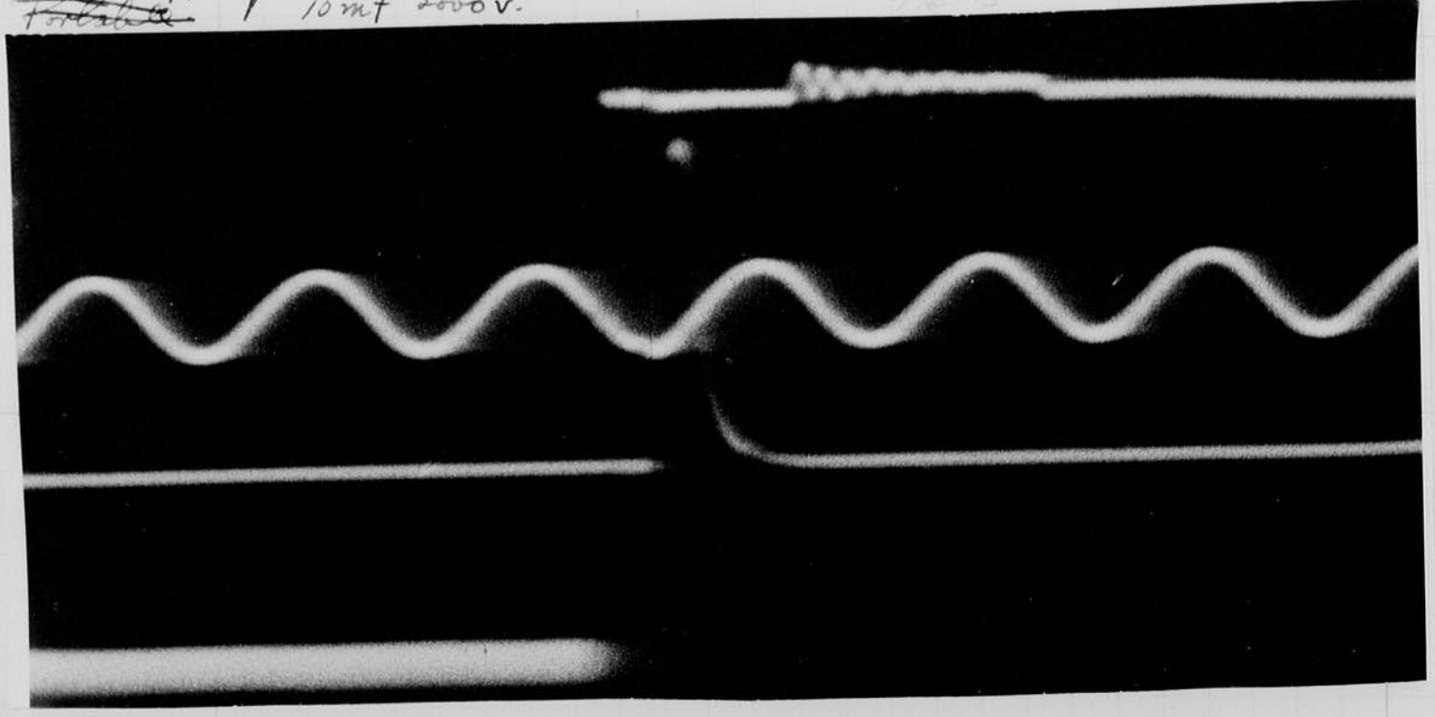
Kodalux #2 18 mt 2000 V

4



~~Portable~~ Strobolux Lamp. 10 mt 2000 V.

6



Notebook # 12

Filming and Separation Record

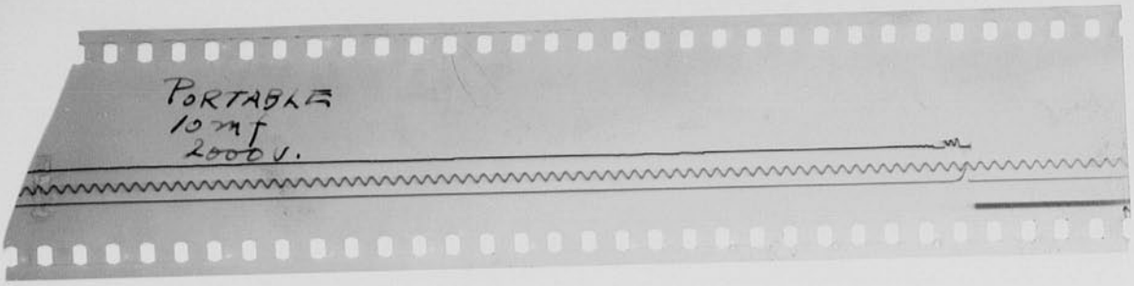
____ unmounted photograph(s)

6 negative strip(s)

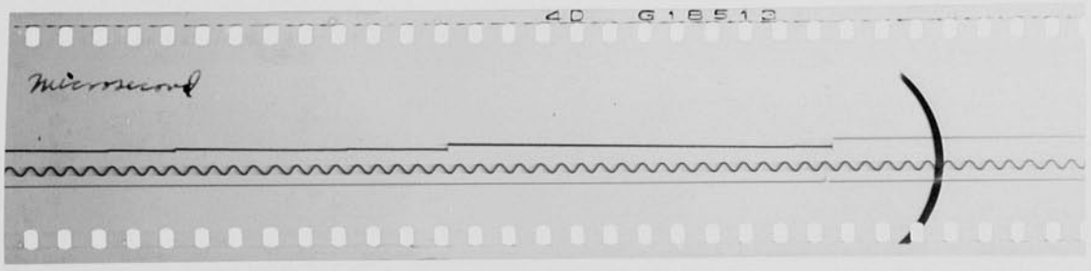
____ unmounted page(s)
(notes, drawings, letters, etc.)

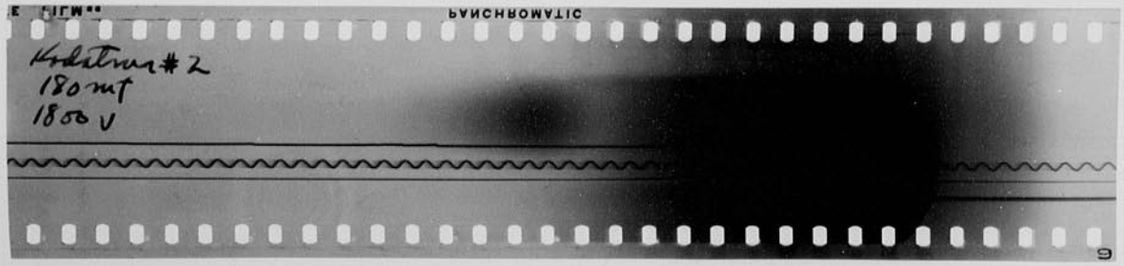
was/were filmed where originally located between page 102 and 103.
in envelope on page 103

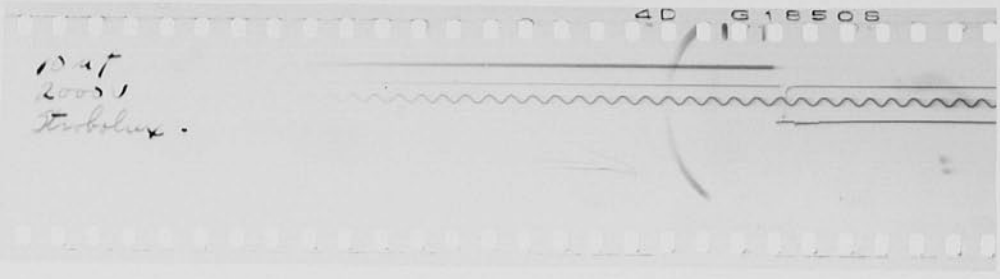
Item(s) now housed in accompanying folder.

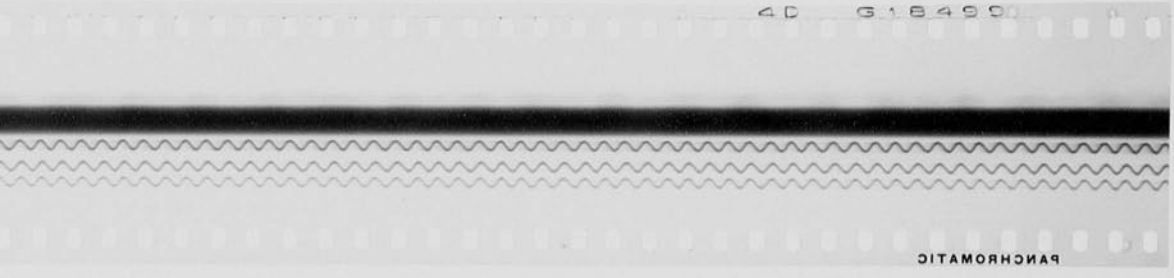

PORTABLE
10 mf
2000 V.

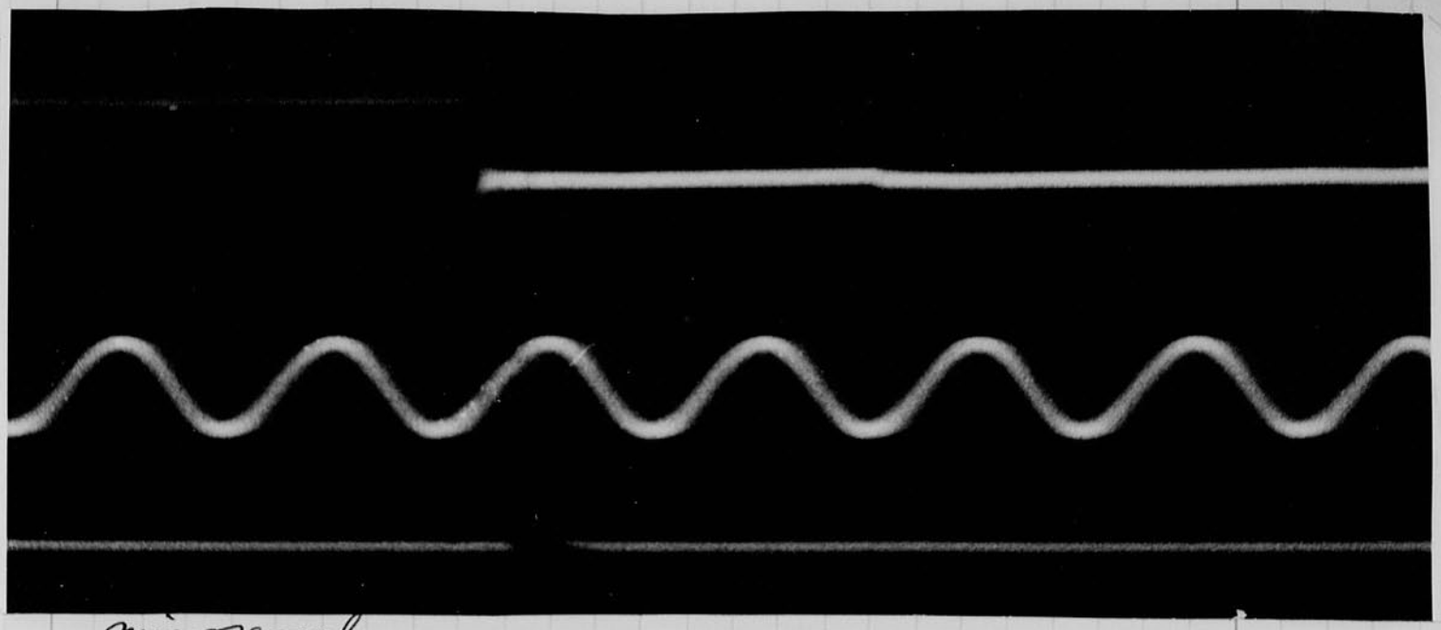

Portable
28 mf
2000 V


Microsecond


Kodatron #2
180 mf
1800 V


4D G18506


4D G18499
PANCHROMATIC



4

Microsecond unit. 1/3 mf 2000 v.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
77 MASSACHUSETTS AVENUE
CAMBRIDGE, MASS.

from Timing wave. $1.375\text{ cm} = 5\times10^{-4}$ sec.
$1\text{ cm} = 3.65\times10^{-4}$ sec.

$\frac{1}{30}$ sec = π 12 2.54 cm — 10000 cycles

3.52×10^{-4}
~~3.46×10^{-4}~~ = $\frac{1}{30\ \pi\ 2.54}$ = 1 cm.
11.875

Negs of CR. with drum camera at 1800 r.p.m.

May 7 1942

Calc of argon lamp for Aberdeen from J of AP article Dec 1941.

Fig 72 length = 17 cm
diam 0.7 cm
press 10 cm
R = 0.7 for 10 mf, 2000 v.

From Fig 16 length = 17
diam 1.4
press 10 cm
R = 0.3 7 for 10 mf 3000 v

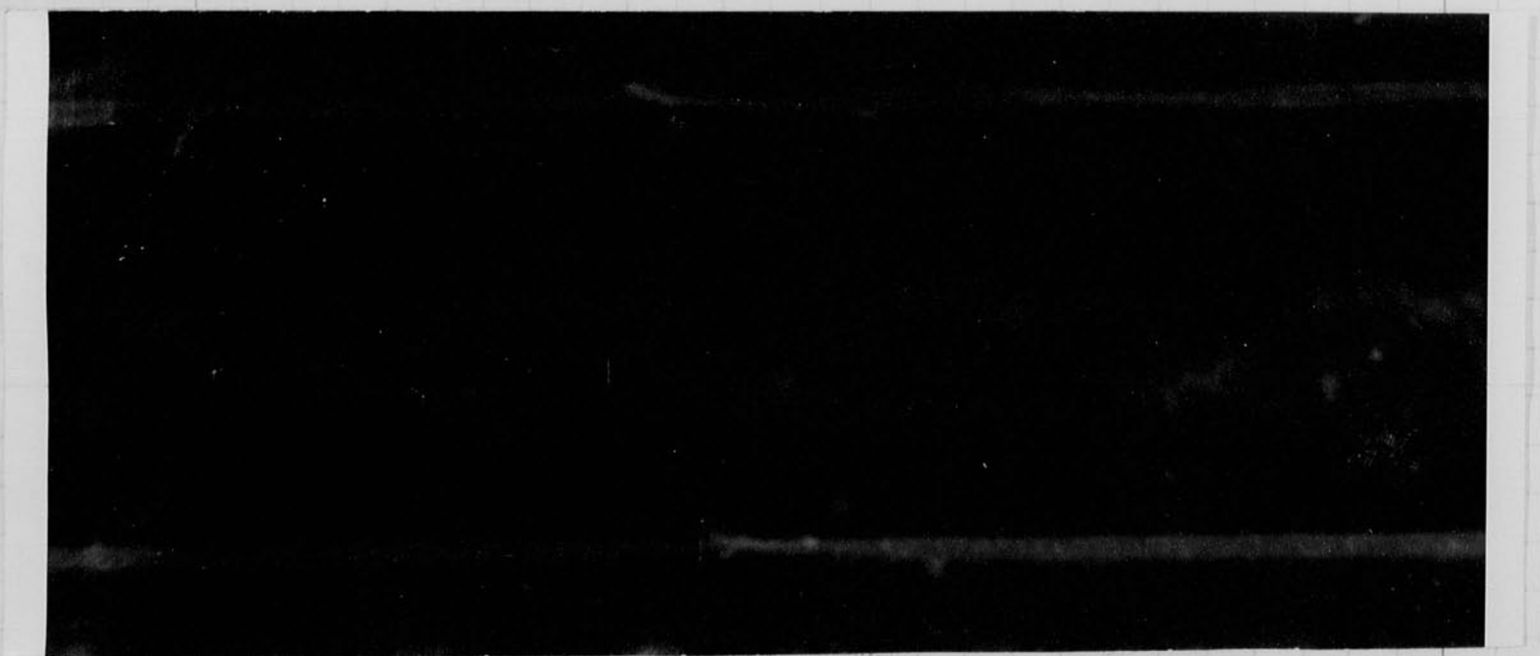
Fig ? length 8 cm
diam .7 cm

Duration experiment

Xe quartz tube made by G.E. for eye photography. 10 cm.

0 to 1/3 peak 13 μs.
0 to 1/10 peak 22.2 μs.

length 10.5 cm — 10 mf
diam (I.D.) 0.5 cm ± — 2000 volts.
plain W electrodes.



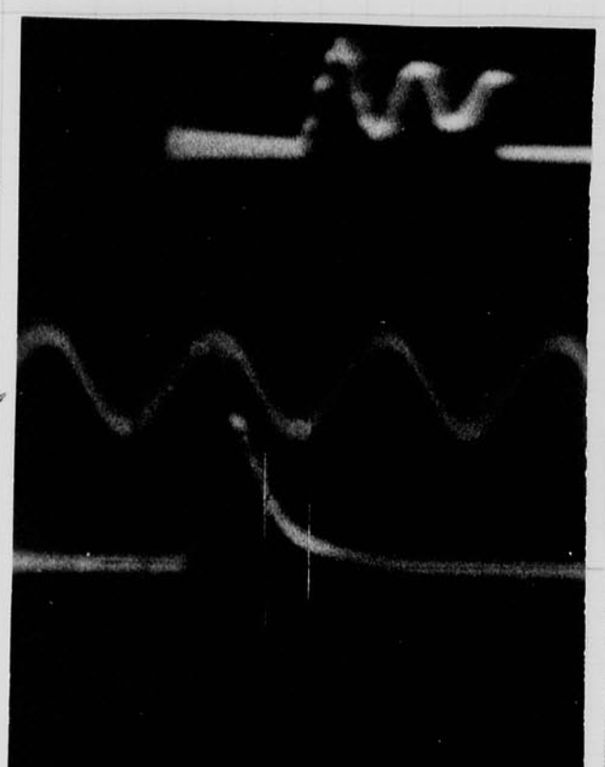
0 — 7 — 12 — 22.2 μs. 1/10 peak
13 μs 1/3 peak

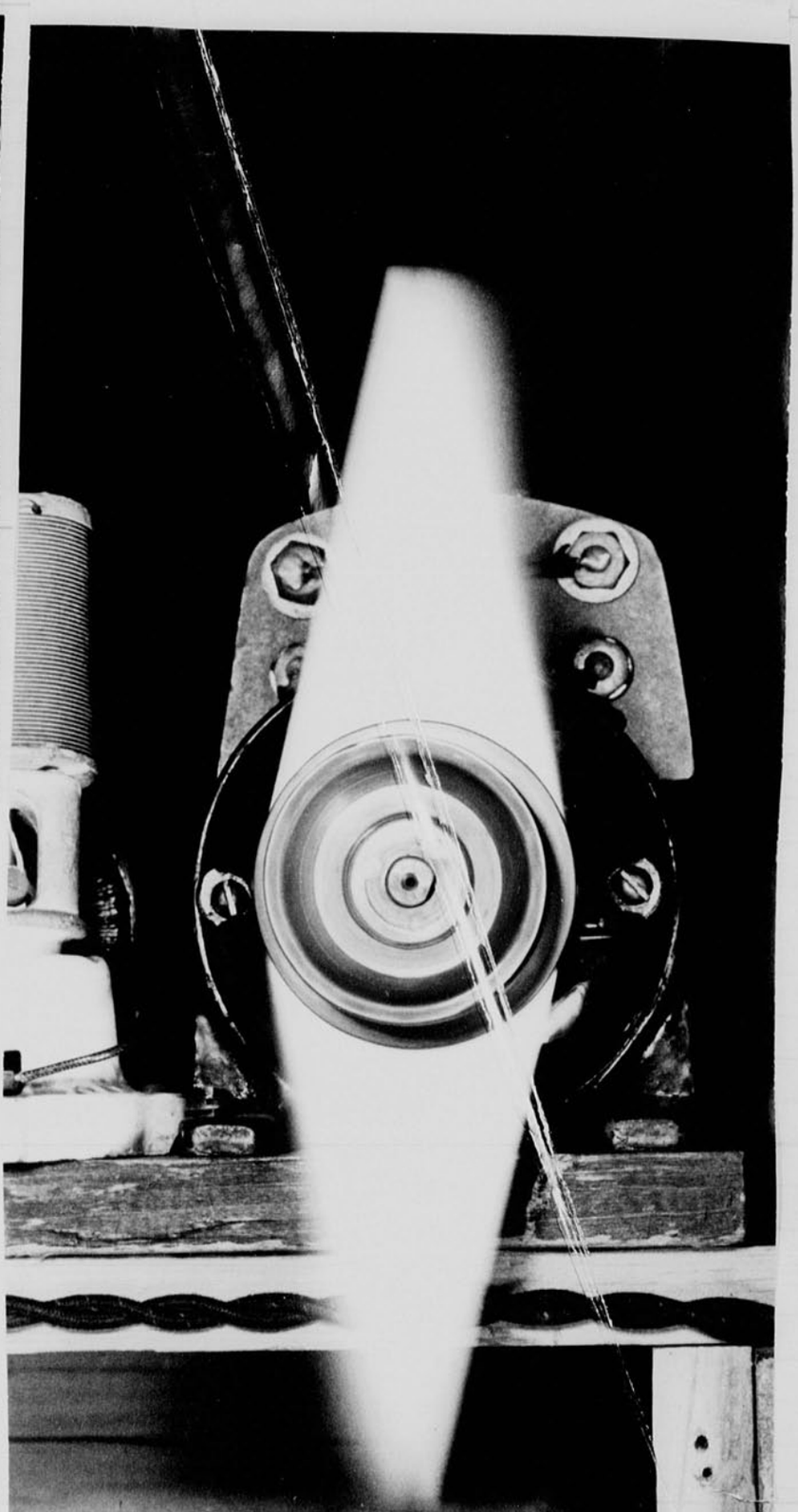
2.4 cm = 10th sec.
5. to 0 29 μs.
0 to 1/3 peak 48 μs.
0 to 1/10 peak 73 μs.

trip line.

10th cycles

light.





Kodatron portable lamps on 4 mf at 2000 volts in unit supplied by Erie to Eastman

Pointed index rotating at 4700 r.p.m. 9 1/4" diam.

two portables with photocell at 15 ft.

May 12, 1942
Harold E. Edgerton

Cathode ray tube.
W.E. 330 C
↑ Blue

Cathode ray circuit.

Some time has been spent the last few days on a suitable cathode-ray sweep circuit for duration and characteristics determination of flash tubes.

The 3 element tube (Western Electric) requires a balanced set of voltages on the sweep for suitable focusing of the spot.

This needs to be linked with the intensity so that the sweep will coincide with the emission of the cathode spots.

Cathode-ray basing. W.E.

1. focus electrode.
2. Modulator A.
3. Heater
4. Modulator B.
5. Modulator C
6. Heater
7. cathode

1.R. acc. electrode.
2R 13R. Def plates;

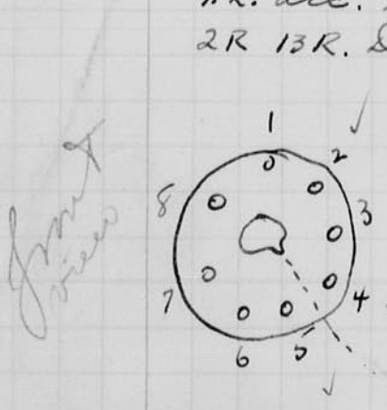
	Plates.	
A	5-12	7-8
B	4-3	6-2
C	10-11	13-9.

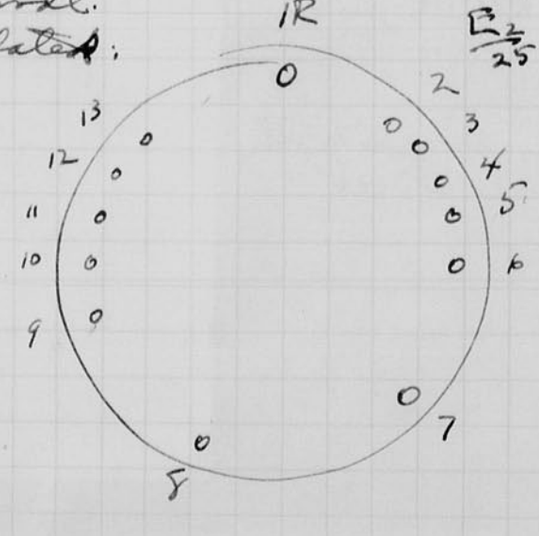
$\frac{E_m}{E_2}$ = 0.012 - 0.025 to ex. spot

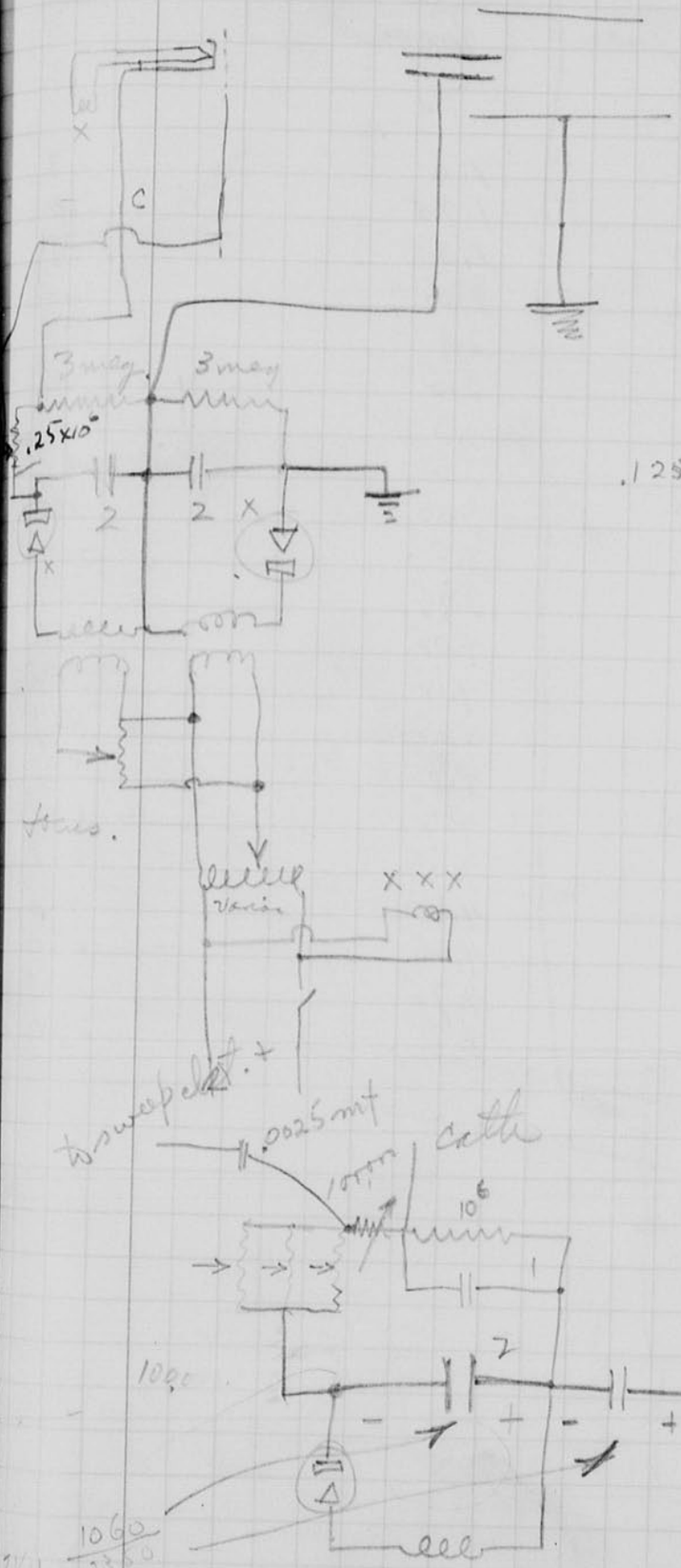
E_2 = 5000

E_m = 5000 × .012 = 60 volts. to cut off.

$\frac{E_2}{25} = E_R$ = 200 volts/inch.





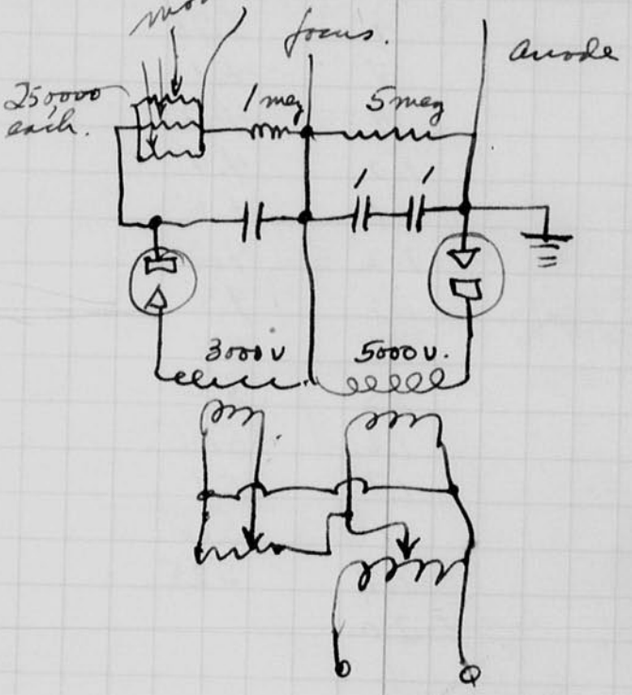


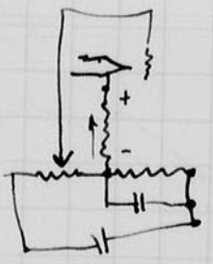
W.S. Cathode Ray Osc.

Circuit shown in W.S. folder on 330 AB&C tubes.

mod cathode.

A Green
B Long per.
C. Blue.





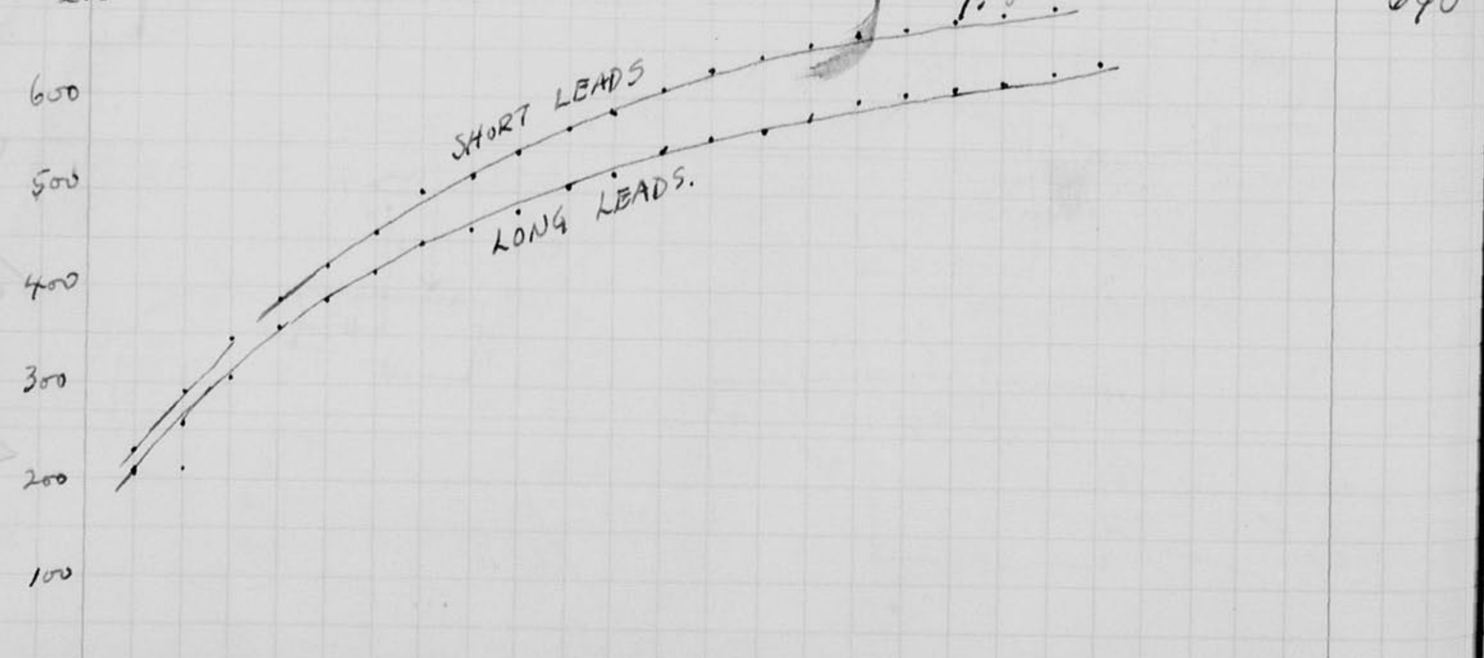
May 12 1942

Harold E Edgerton

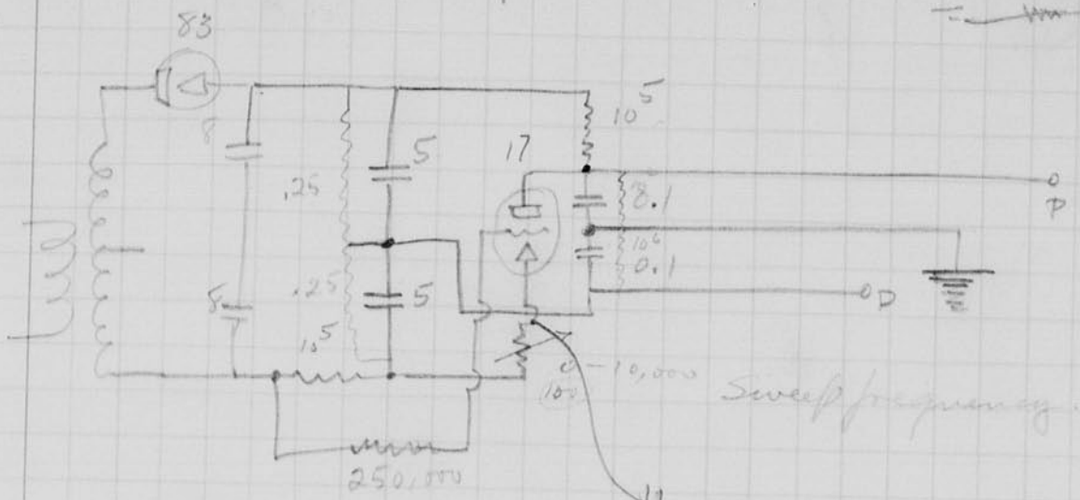
Chas Wyckoff

Short leads to Battery | Long leads to Bat.

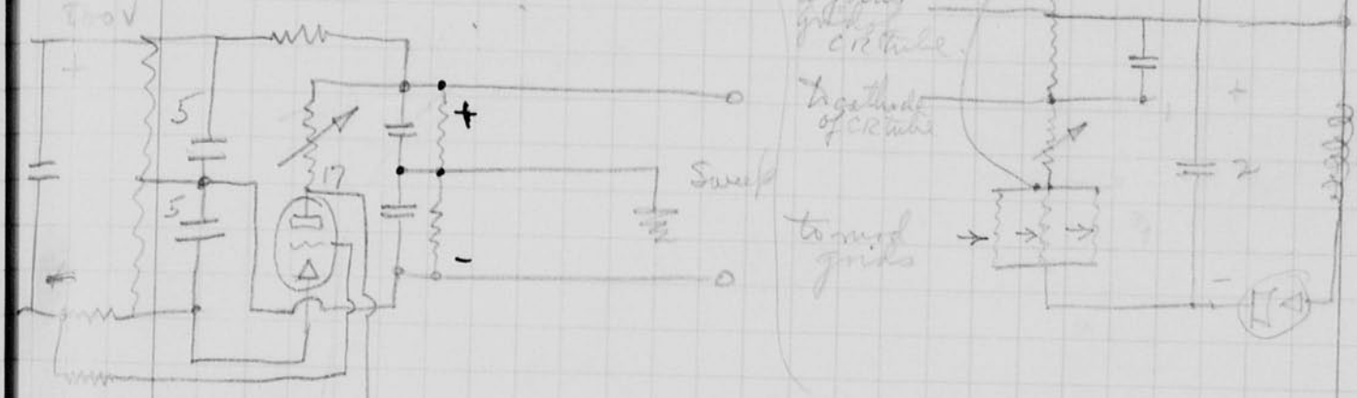
time.	in/.001 sec.	ft/sec.	frames/sec.	in in 1/100 sec.	f/sec.
0.	1.75		234.	1.6	213
0.1	~~2.25~~ 2.175		290	1.95	260
0.2	~~2.65~~ 2.60		347	2.3	307
.3	~~3.05~~ 2.9		387	2.65	360
.4	3.2		427	2.9	387
.5	3.5		467.	3.15	420
.6	3.75		500.	3.3	440
.7	3.90		520	3.5	467
.8	4.1		547	3.65	487
.9	4.3		573	3.8	507
1.0	4.4		587	3.95	527
1.1	4.6		614	4.05	540
1.2	4.7		627	4.15	554
1.3	4.8		640	4.25	567
1.4	4.9		653	4.4	587
1.5	5.0		666	4.5	600
1.6	5.05		674	4.55	607
1.7	5.1		680	4.60	614
1.8	5.15		687	4.65	620
1.9	5.25		700	4.75	633
2.0				4.8	640

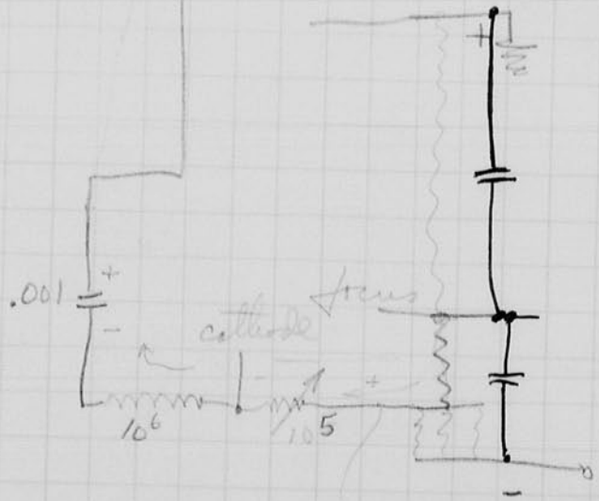


Transient Sweep

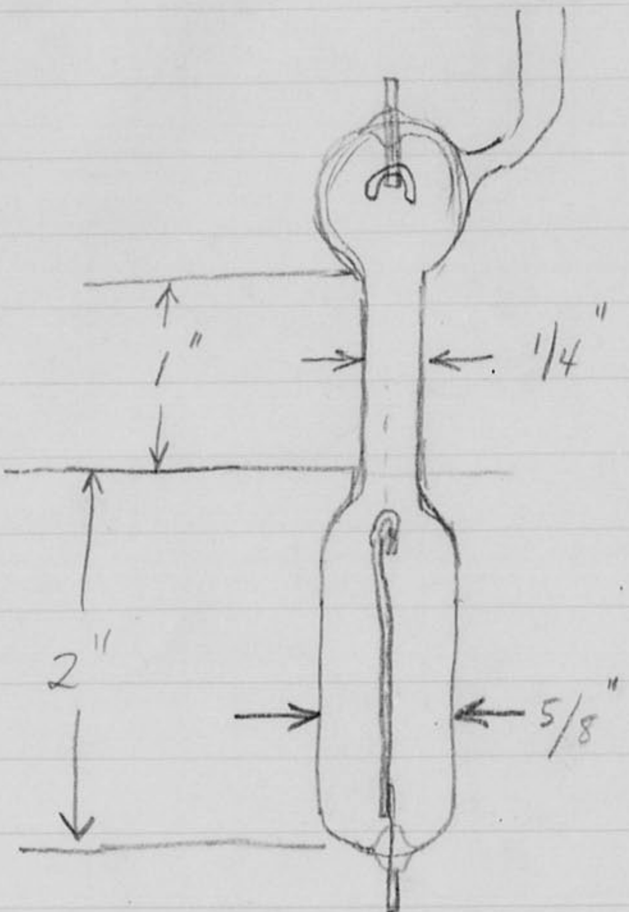


Sweep RC = $.05 \times 10^{-6} \times 10^4 = .0005$ sec.
= $.001 \times 10^{-6} \times 5 \times 10^5 = .1$





May 22 1942
Samuel Edgerton



~~1/2 cm~~
1 cm of H_2
10" of Argon
tank.
~~tested at~~
7000 Vt.

H.E.E.

make 2.

To try at Aberdeen and
tomorrow for short
flasher.
for John Burlew.

June 1 1942

Harold E Edgerton.

I took out old microsecond unit (with frog type tube) to aberdeen on the federal night of may 27. arrived Thursday morning at 6 30 am. also took 2 tubes as shown on p 110 for use in the regular microsecond unit.

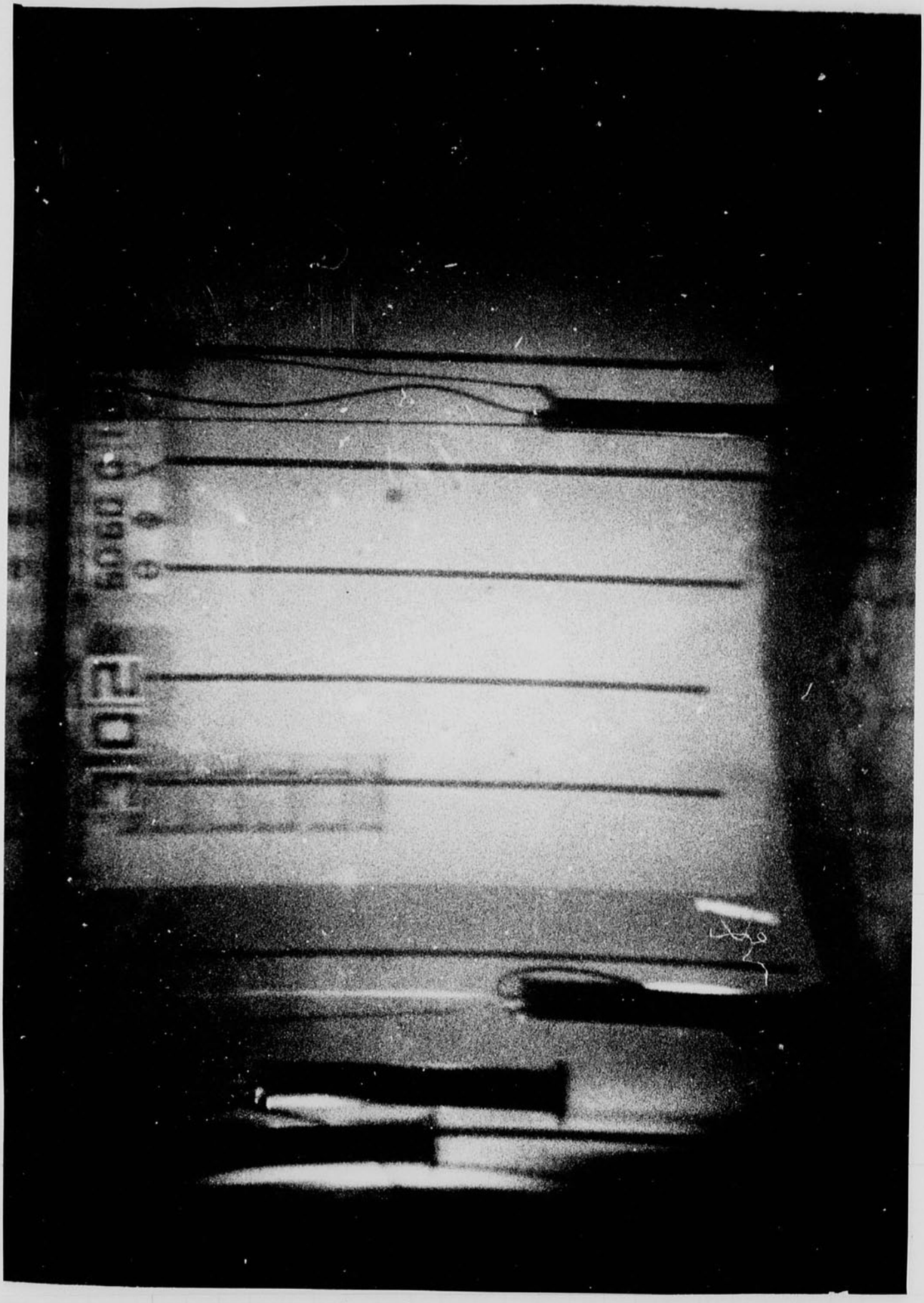
Spent morning of 28 th may with Charles, Hodge, Carr and others. J.H. Miller arranged the shooting party on a concrete closed range some 1/2 miles out from the main gate.

A series of photographs were taken of 37 m/m shells at 4400 f.p.s. See page 117

Burlew and England came at 5 pm with S.R. unit. Put in new tube in place of old spiral which self fired. Photos seemed ok.

Chas Wyckoff and I took h.s. movies with Jenkins camera at Piney Point Maryland with for Naval Ord. Lab on May 19 and 20. Left Boston by auto on May 17, arrived Wash. May 18 for plans. Chas shot 16" gun at Dahlgren on May 21. while I worked on movies at Navy Aero station at Anacostia. Left for home on May 21 and 21.

Preston of Lanco here with thermostats for movies!



called Fitteredge on phone June 1 or 2
also talked to Hooper.
New London Conn.

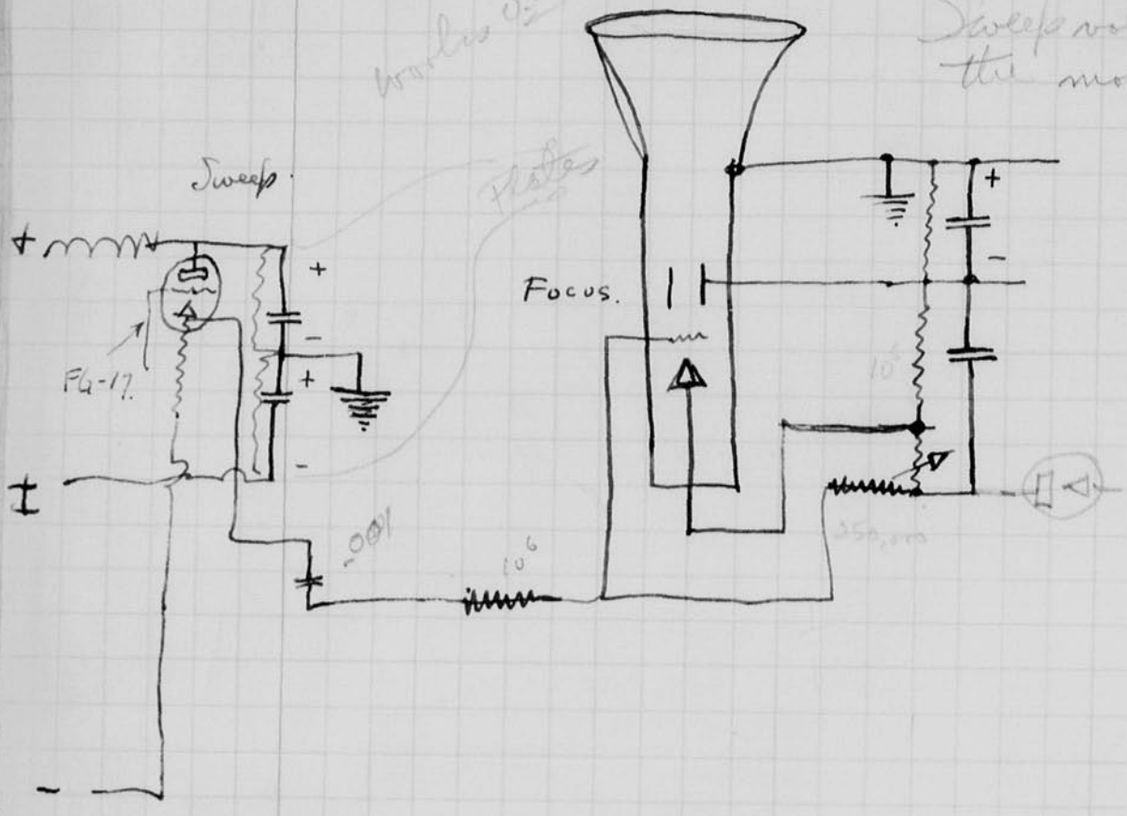
Photos taken at swimming pool at M.I.T. for Columbia Univ.

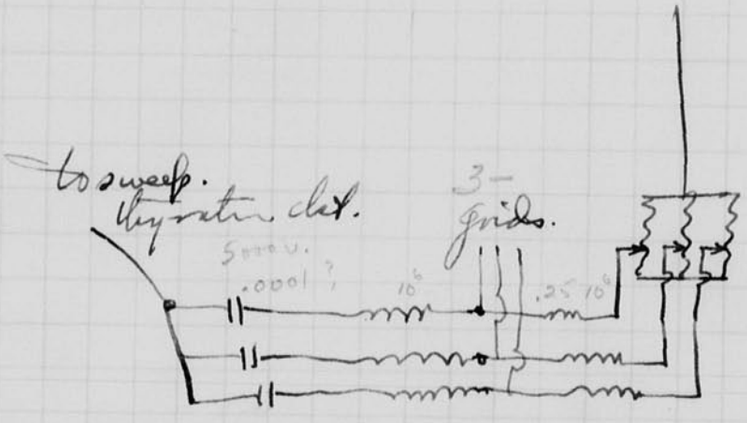
June 3 1942

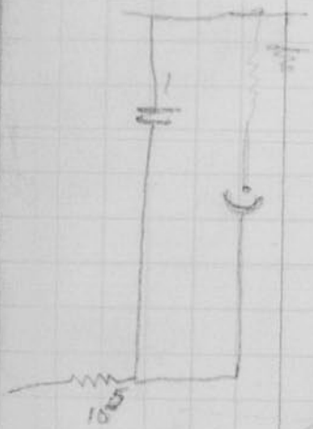
Harold E. Edgerton

cont p 109. C.R. circuit with sweep and beam intensifier.

Sweep voltage turns on the modulating grid.







method of modulating all three grids at once.

the focus of the tube is better at one side of the tube than the other.

Notebook # 12

Filming and Separation Record

____ unmounted photograph(s)

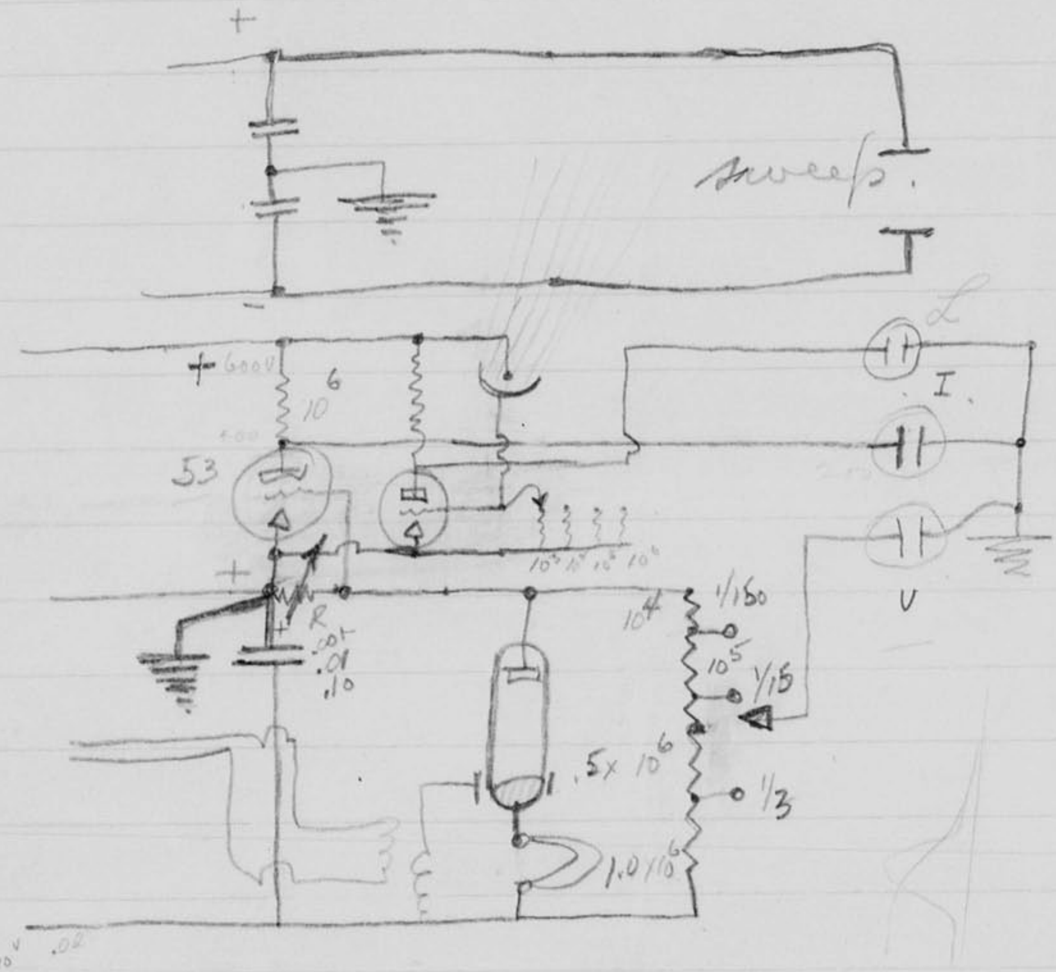
____ negative strip(s)

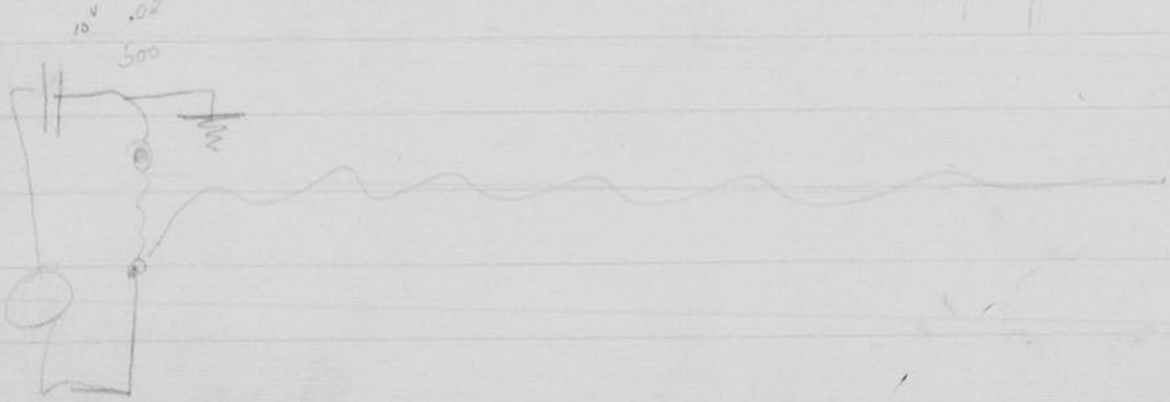
2 unmounted page(s)
(notes, drawings, letters, etc.)

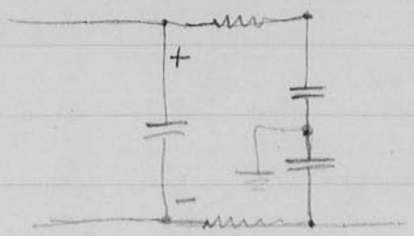
was/were filmed where originally located between page 114 and 115.

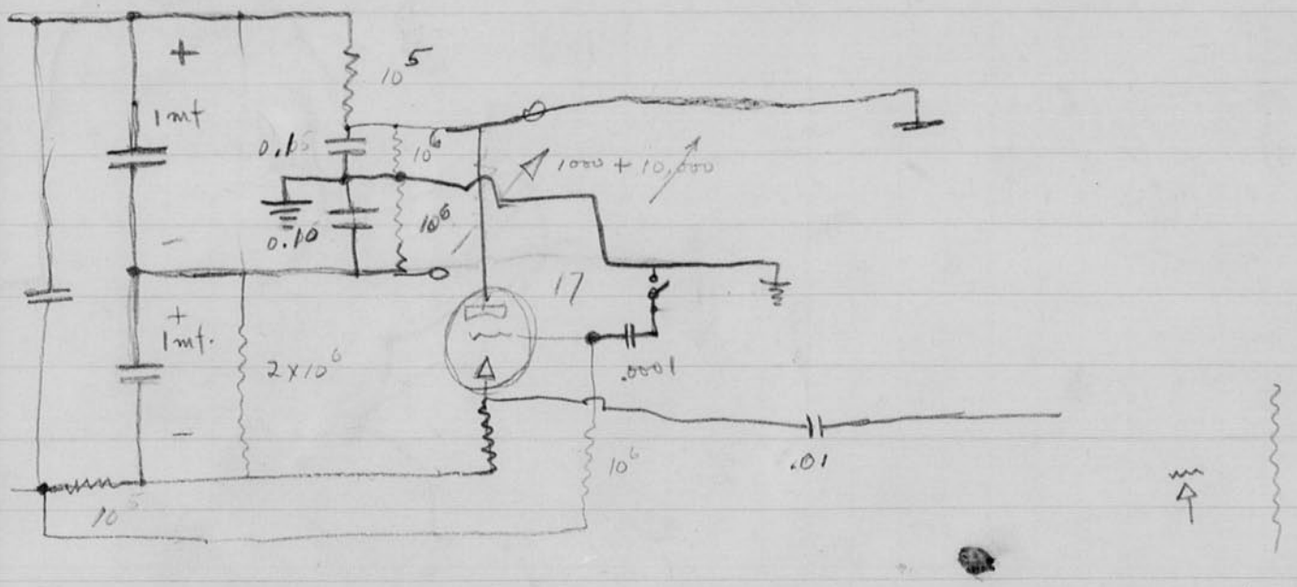
Item(s) now housed in accompanying folder.

 June 3 1942


+
sweep
-
+ 600V
6
10
53
L
I
U
R
.001
.01
.10
1/150
10^4
10^5
1/15
.5x 10^6
1/3
1.0x10^6


500

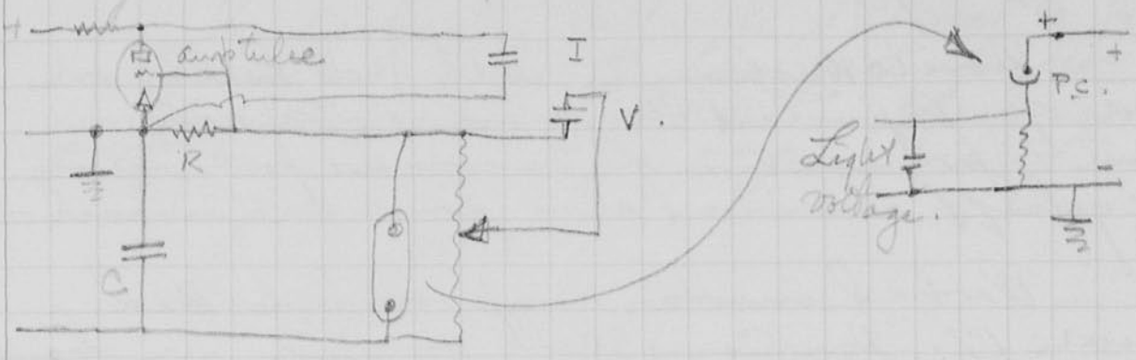

+
−


+
1mf
−
0.10
10^5
10^6
10^6
1000 + 10,000
17
+
1mf.
−
2×10^6
.0001
10^6
.01
10^5

June 4 1942

Harold Edgerton

Lamps tests with C.R. osc.



June 24 1942
Harold E. Edgerton

Drove to Washington with Jack Reilly on June 7. Reported to Model Basin June 8 for contract services for navy. Wyckoff arrived also from Cleveland.

Worked under Roof until Wed June 17. Don Campbell ensign in charge. See Wyckoff's note book for details of experiments and Model Basin Records.

I left with Richard Pogue on June 17 about 8 pm. Arrived in Bridgeport about 2 pm at auto ordnance plant to work for Ruger. Movies and stills of a machine gun were taken.

Wm. Ruger.

Photo shows arrangement.

Films were taken to N.Y. on Friday June 19 for processing. Deluxe lab. + Shown in Barnum Hotel that night.

Left before 8 June 20 for Boston arrived at 205 School Belmont about 12 noon.

Movie 1/4 mt. Plus X film f 3.2 with diffuser off and hot spot on action. Negs o.k.

Left for N.Y. with continuous motion film camera at 8 am Sunday. Shot dances with Mili in studio at 6 East 23rd N.Y. Home on night train.

cont

In Washington last week I talked to John Burlew about a short flash lamp for very high-velocity bullets. It was suggested that one be developed for bullet photography.

Energy now in flash is $\frac{CE^2}{2} = \frac{1}{3}\frac{7000^2 \times 10^{-6}}{2} = 8.19$ joules

this is enough to photograph at f 8 on fast film under.

If voltage is increased 3 times to 21,000 volts then the capacity can be 1/9 of this value or $\frac{1}{27}$ mf or 0.037 mf.

The discharge time could then be about 1/10 of its present value.

afterglow is responsible for most of the ~~afterglow~~ smear or trailer that is shown. See below photograph.

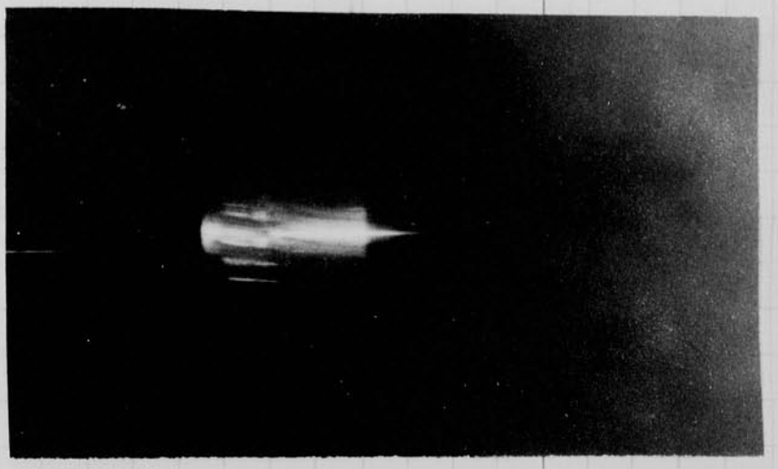
$\frac{4400 \times 12}{10^6} = .0528$ inches motion in 1 micro second

Photo #5 64686
shows string after bullet has passed.

→ 4400 f.p.s.

37 mm

#11 NDRC 64675 shows
#30 copper wires after bullet has passed.



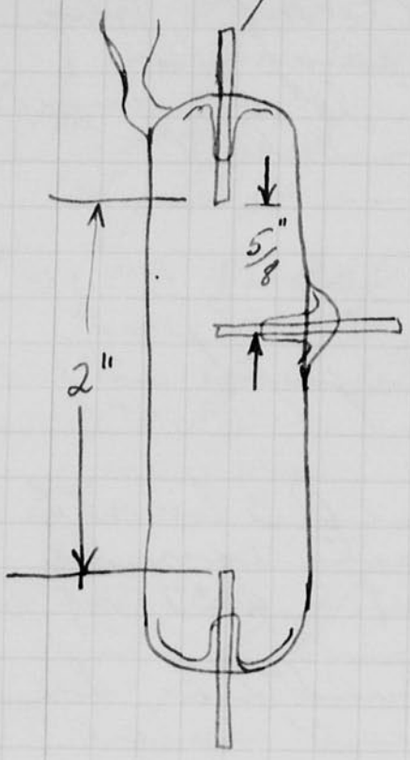
64682

Micro-Flash Photograph of 37 M/M, Special Proof Slug. By: Edgerton Photograph #11

Taken at Aberdeen maryland.

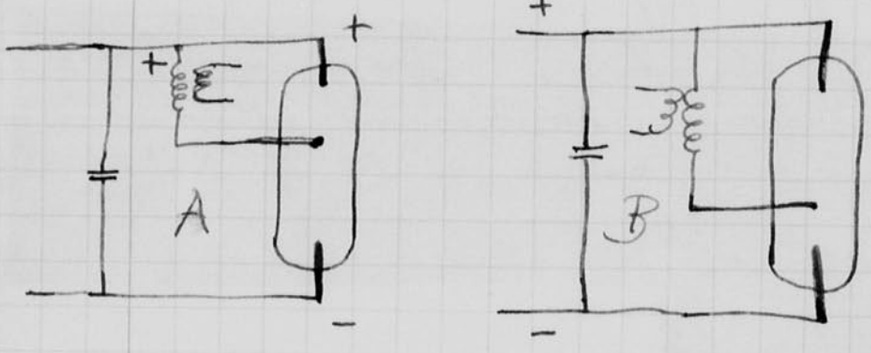
June 25 1942

Harold E Edgerton



Filled with argon tank. 27½ cm.

Flashed with 125 mf 2160 volts.



When tube begins to flash hand the spark coil may shunt through to the condenser negative terminal.

With 3rd electrode starter — the pressure could be
15 cm with connection A.
or 30 " " " B.

With an external wire starter the pressure could be 40 or 50 cm.

Sealed off a second tube with 25 cm argon. Mounted in a Glass projecting bulb with a 5 prong giant base. This tube put on life test with 56 mf

at 4:20 P.M. 2 flashes per minute.

Increased cap. to 112 at 4.42 tube blew up on second flash.

Slight discoloration at ends of tube with 4 flashes at 56 mf.

There was no cable length between the condensers and the lamps for the above test, as there will be with the ~~rotation~~ unit.

Ennis will make two more tubes tomorrow.

40 mil tungsten wire were used for seals and electrodes. the anode gets much more damage than the cathode. I believe the anode end melts slightly with 112 mf at 2000 volts.

no starting electrode

Test of Portable battery

	Ammeter	Weston 25813.	
2:55 pm	3.4 volts	2.45 amp.	coasting with condenser charged.
	2.8 "	2 amps	peak on charge
	3.7 "	-1.1 amp.	charge.
2.50	2.9 "	2.1 amp.	coast.
2.52	2.6+ "	2.1	" fails to start relief.
2.58	3.6 "	— no load.	
		changed battery	
3.55	3.8	no load	off.
	3.95	-.75	charge
3.00	3.70	2.6	Coast.
	3.40 min.	11.0 amp peak	Charge
3.30	3.7	2.6	Coast. 10 flashes after
3.51	3.55	2.6	Coast
4.08	3.5	2.6	Coast turned off

Sunday
June 28 1942
A.E. Egerton

Cont. test of Portable. Sample of lot of 300.

am			
9:12	3.6 v	2.6 amp.	Const with condenser charged.
9:25	3.55	2.6 amp.	"
9:45	3.5	2.6	"
11:09	1.9 v	1.4	" Bot of red on scale
11:10	3.6 v	-1.35 amps	charge.
11 26	3.8	-.92	"
12 10	4.0	-.95	"
12 47	4.05	-.85	"
1.25	4.1	-.85	"
2:04	4.05	-.85	"
3.30	4.1	-.85	"

off for night.

June 29 1942

Experimented further with cathode ray oscillograph (3 element) continued from page 114. The three modulating grids were energized by the ~~spec~~ sweep circuit as per P. 114. Capacity of .001 and .00025 were used in the grids. The .001 leaves the spot on too long for same purposes.

Barstow and Grier are finishing the assembly of large flash unit for the air Corps under D.C. 6016 4000 volt 4000 mf unit with 2 quartz lamps for 5 sec. flashing rate. Roy Fiedst came thursday from Wright field.

Weighed in Steam lab with 2 scales July 3, 1942.

Large flasher unit	Large condenser less reflector and relay	1633
	M.G. set without reflector	1274
	Dolly for Large reflector	317.

June 29 1942
H E Edgerton

Life test of Portable.

(voltmeter on overnight)

TIME.	BAT. VOLTS.	BAT. AMP.	
8.41 am.	3.9	-.9	charge.
10:35	4.1	-0.63	"
105		-0,68	"
3.00	4.0	-0.25	"

June 30 1942.

10.00 am.	3.75 v.	2.8	Coast with condenser charged.
1.55	1.6 v.	.9	"
1,55	3.3 v.	-1.35	charge
550	4.05	-.75	" 4 hours.

July 1 1942

12:20	3.8	-.90	Charge cycle.
			"
920 pm		-.75	" off. 9 hrs. 13.

July 2 1942

11 : 11		charge started.
9 25		stop 9 hrs 20 min

July 4 1942

Discharge test

	Weston 772 meter		
noon 12 : 00	start. ~~3.97~~	3.93	Charge condenser then coast. Top of green ~~on~~ start.
12 10	~~3.95~~	3.90	Coast on disch. Dropped to 3/4 green in 5 min.
12 35	~~3.93~~	3.86	"
12 51	~~3.925~~	3.84	"
1.05	~~3.91~~	3.82	"
1.50	3.72		" Green 1/2 -
2.20	3.61		"
230	3.57		" Green 1/4
240	3.50		"
250	3.41		" Green 1/10
3.05	2.72	off at 305.	Red 3/4+
315	3.40	on "	Green 0 +
322	3.8	with circuit off.	

July 5 1942

		off over night.
9.39	3.9	no load
9:40	3.63	coast on ~~charge~~ ~~discharge~~ condenser Green 1/2 -
950	3.59	
10 02	3.42	
10 25	1.8	

July 5 1942

Portable tests.

3×10^{6}
100×10^{-6}

Weston 772 Voltmeter.

AM. 10:29	3.8 volts.	charge cycle.
12 05	4.22	"
2 00	4.25 ~	"
4.00	4.3	" off.

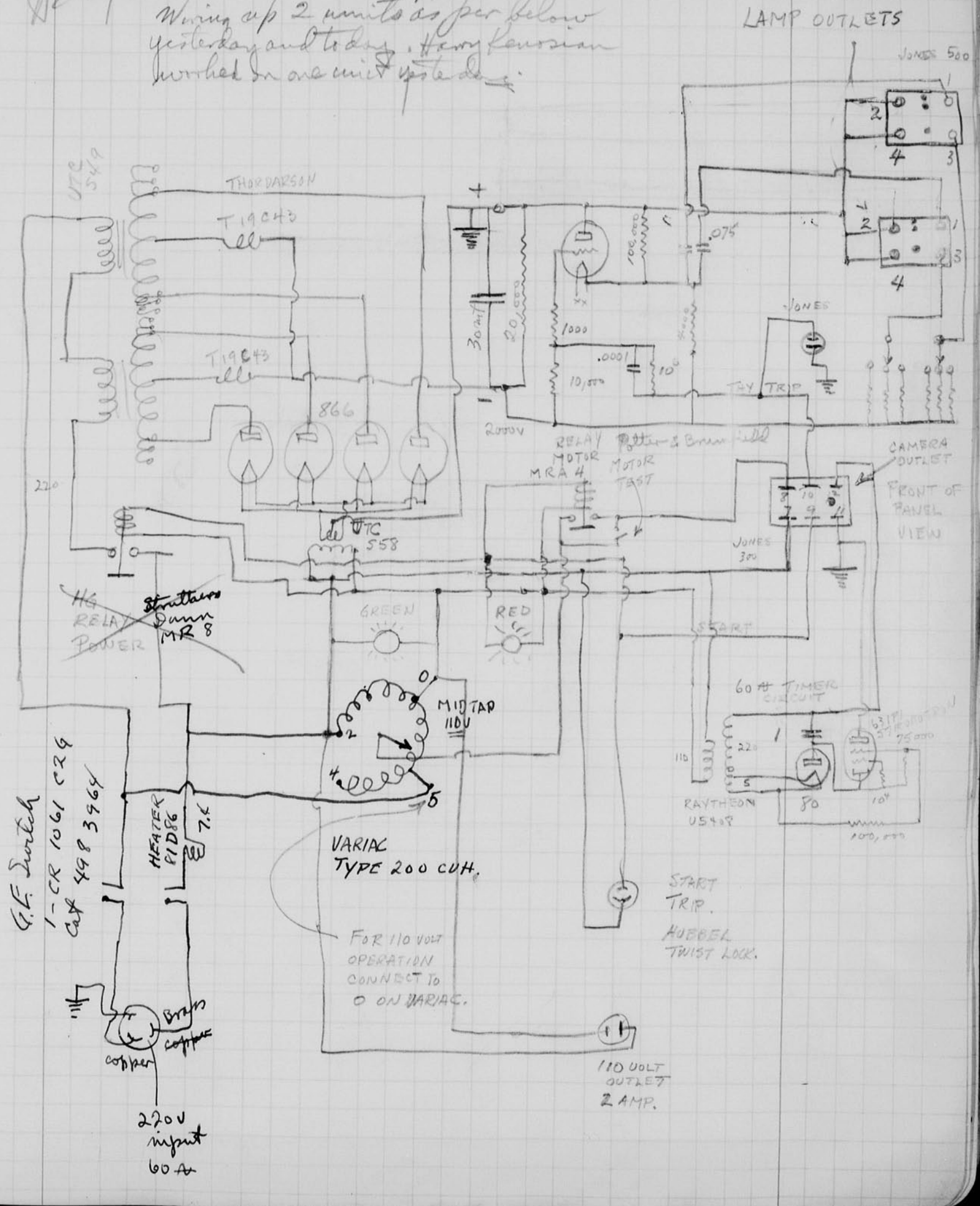
July 6 1942

8:50	4.05 v.	Bat voltage.
8:52	4.2	Charge start.
1:30	4.38	" —

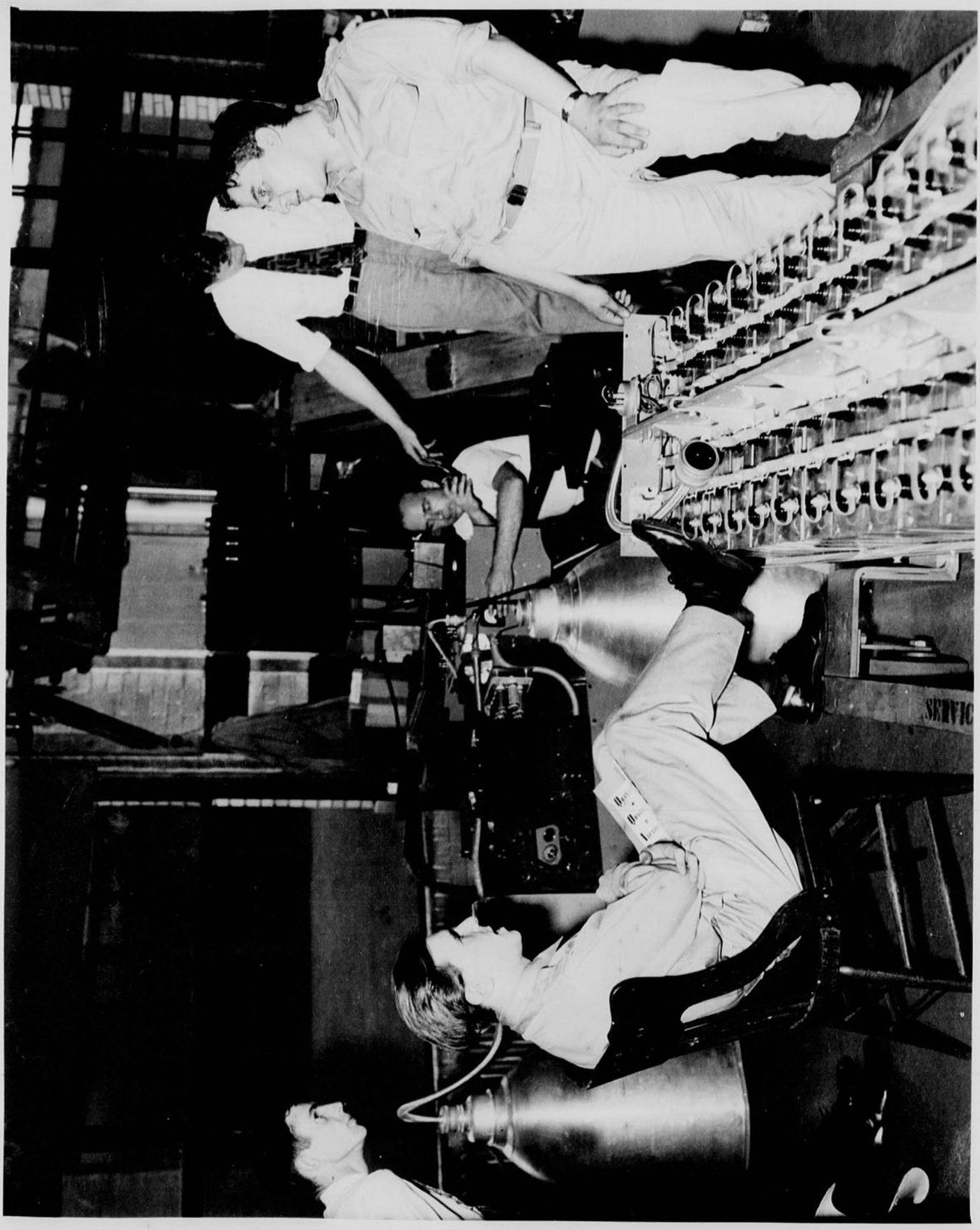
July 5 1942
J. E. Dyer to

Wiring diagram of movie apparatus.

Wiring up 2 units as per below yesterday and today. Harry Kaufman worked on one unit yesterday.



124 July 6 1942 Photographs taken last week of trials of
H. E. Edgerton D.I.C. 6016 project for Air Corps.
4000 volt 4000 mf flasher 5 sec. interval.



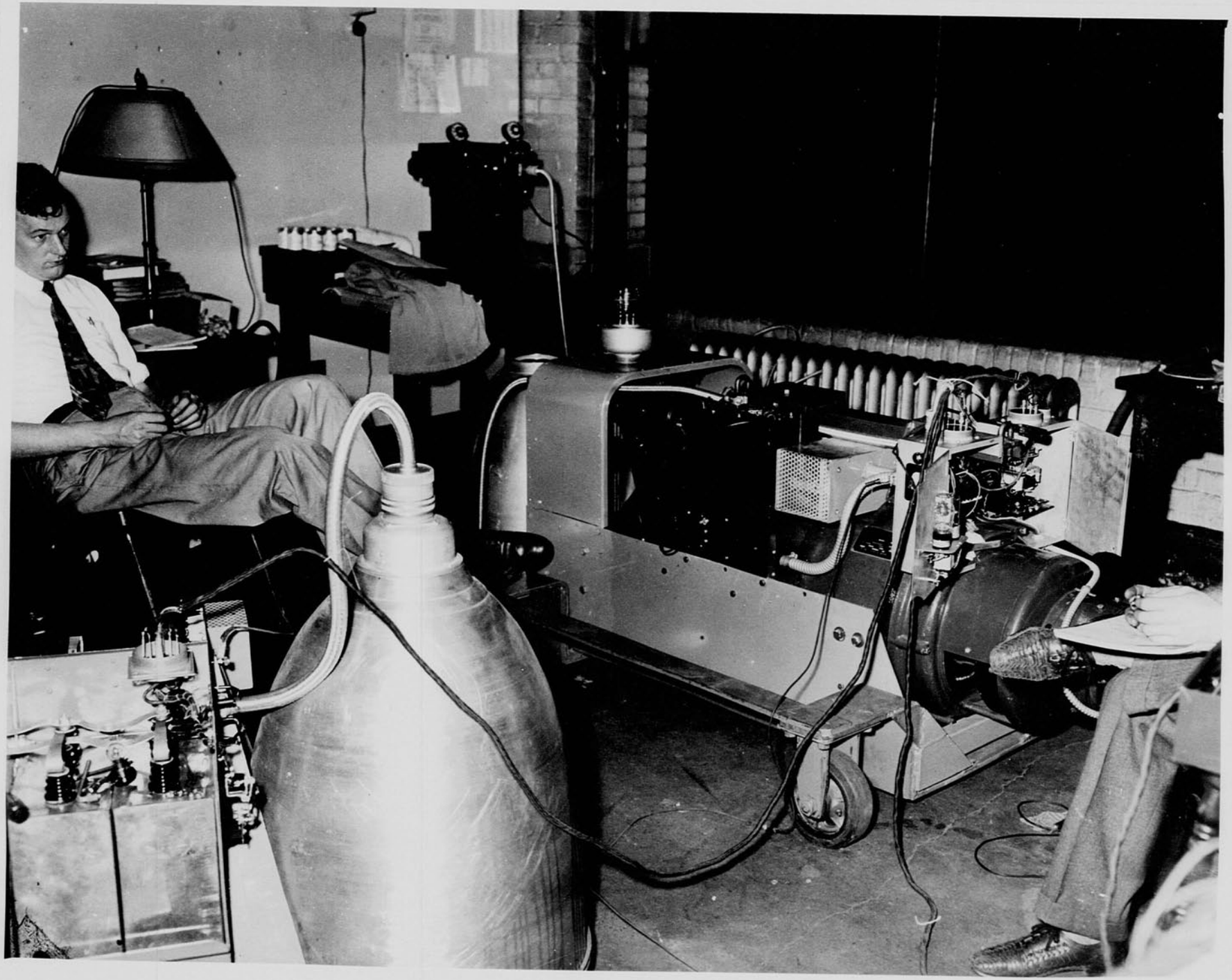
Camera with control box

SiO2 lamp on Rotisserie

Herb Brier

Oven. 4000 volt M.G. set

Barstow



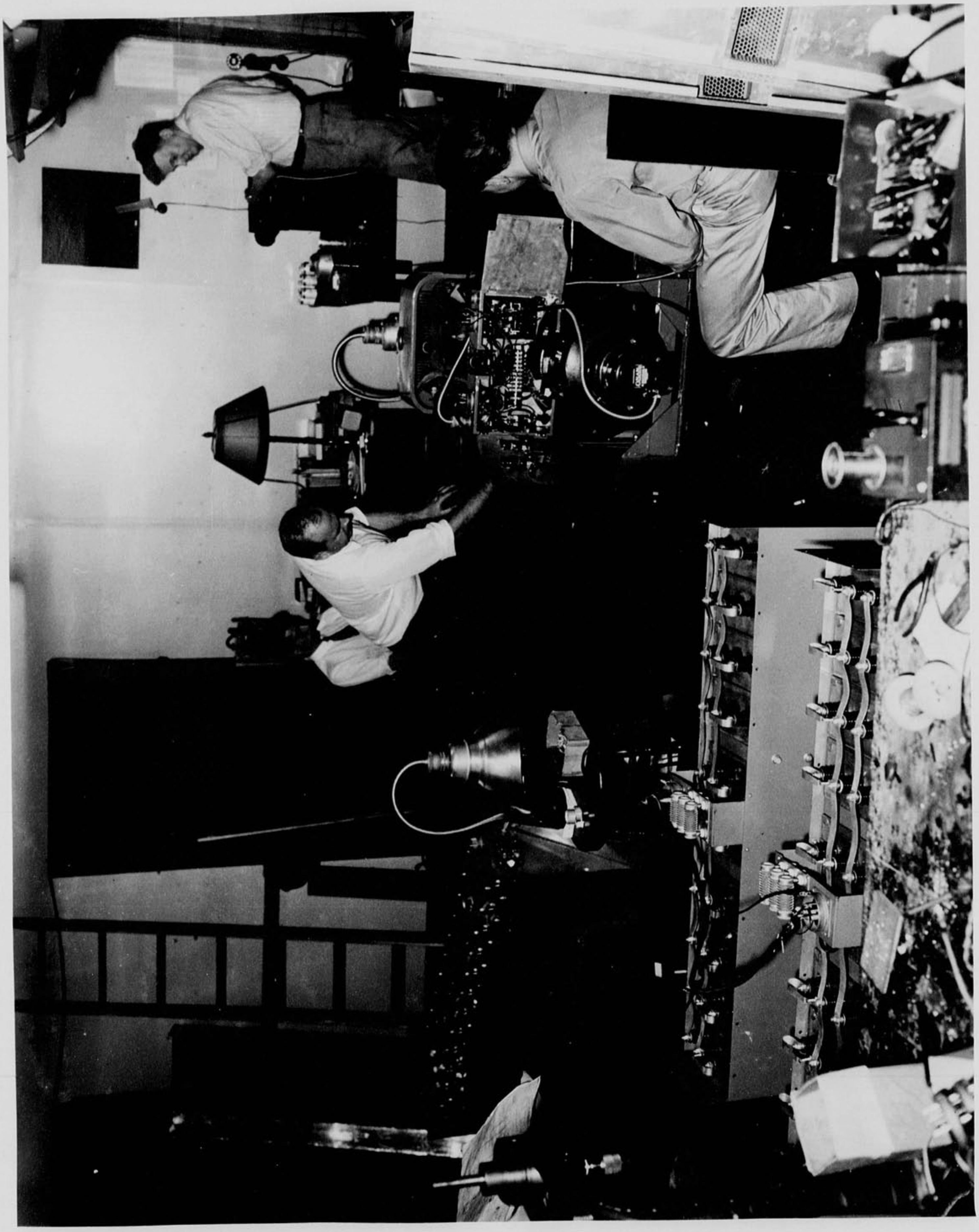
Grierat control

Boston

Doors open on Mike Switch Box.

Evans.

Upcraft



this picture was flashed by hand after the lamp flasher operated. Note glow on floor under reflector and lighted lamp on relay. ↑

f4 Kodatron Portable in R40 Bulb.

Main Condenser Rack.

1633 pounds

80 mf 4000 volt in each can

26
80
1280 mf.

July 6 1942
H. E. Edgerton

Exposure made in Photo service with new short flash lamp (see page 118). the third electrode was not used.

Two pictures were taken of a 9¼" diam pointer rotating at 3600 r.p.m. (p 105).

#1 Short flash f8 Lamp in Kodatron reflector at 3 ft distance.

#2. Standard #2 lamp f22 "

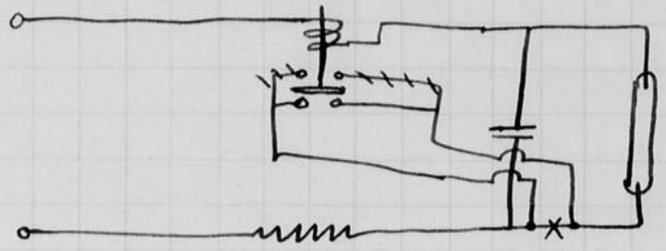
Another test made on a single film.

Center Exp. 1. f22 lamp Kodatron 6 ft away 0 speed
" 2 f22 " " " " 3600.
3 f22 " argon shunt 6 ft " "

July 6 1942
H. E. Edgerton.

During the past week Grier, Barstow, Wyckoff and Germeshausen have been trying out the D.I.C. 6016 air corp flash unit which is pictured on pages 124-127 inc.

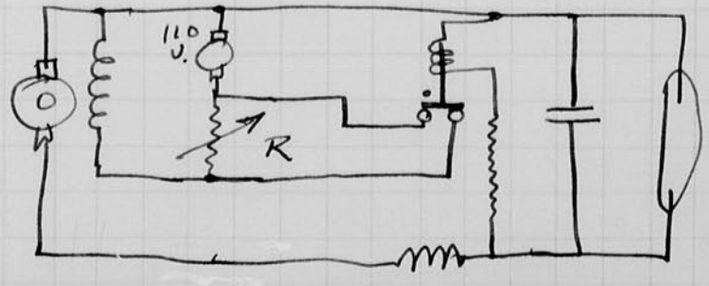
To overcome holdover a relay in the discharge current was used as shown below.



The delay of the relay was to keep the contacts in touch until the current in the discharge path had dropped to the steady state value.

Some sparking was experienced but not serious. An incandescent bulb was put across the coil of the relay to delay the operation.

On July 7 the following circuit was considered while discussing the problem. A relay in the bleeder circuit across the condenser is arranged to open the field circuit momentarily and thereby reduce the tube current. The resistance R shown below is adjusted until operation is satisfactory.



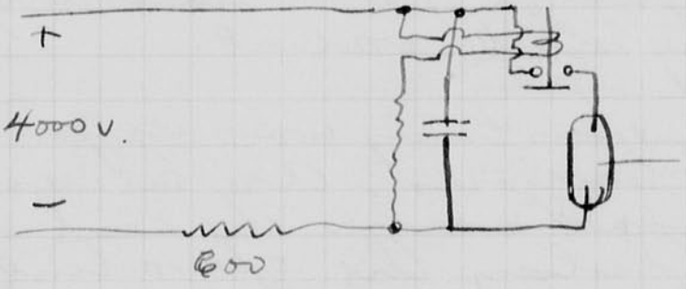
Several modifications were discussed at length today with Grier and

cont

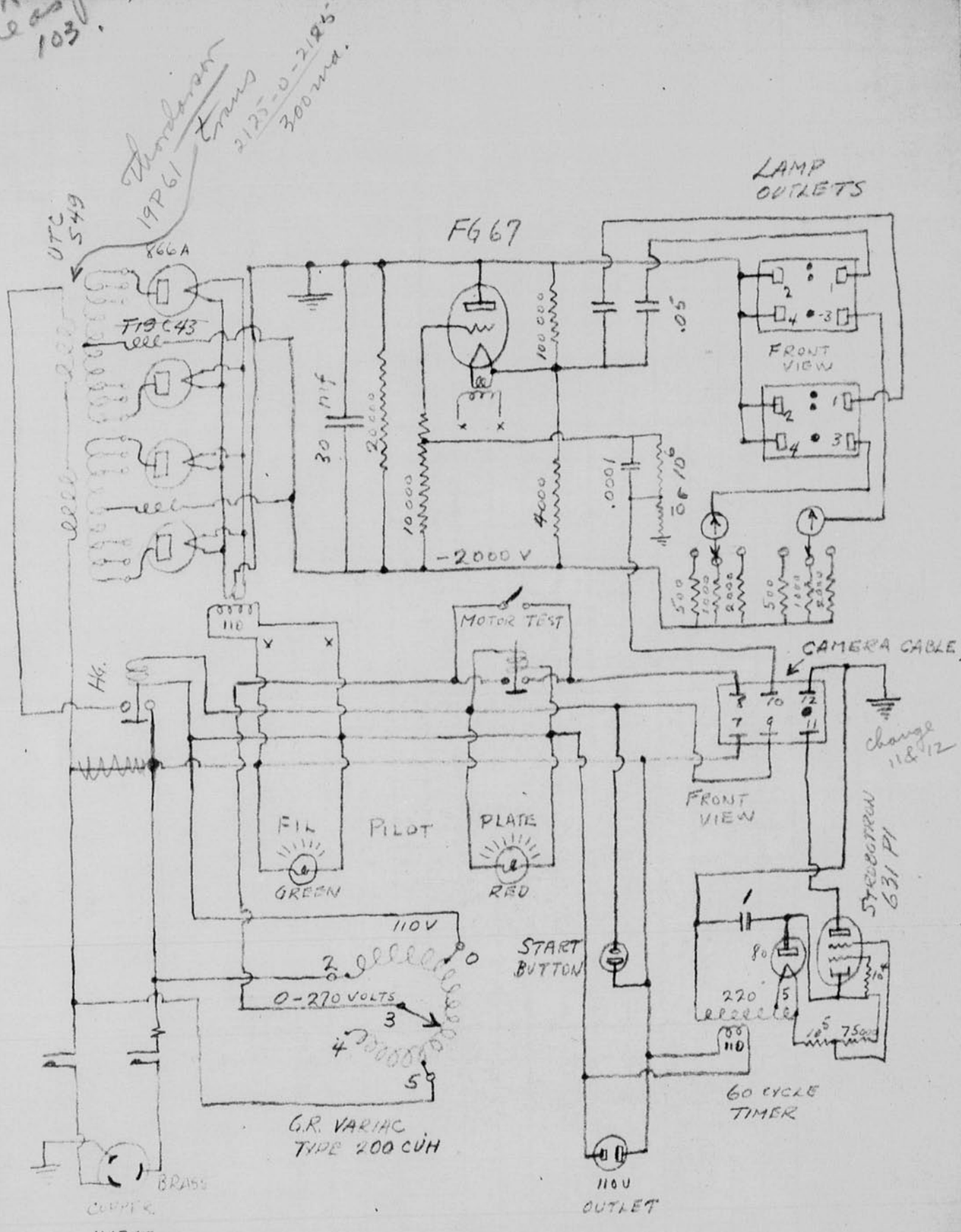
Berglow. Several Relays have been found that have almost the desired characteristics. Tonight as I write this they are connecting up the unit for trial.

Grier is fearful that the charging time of the condensers is going to be too long. He was in favor of going for rapid with the relay in the main circuit. If the field arrangement cannot be made to work then the other will be perfected over our previous efforts.

A positive pull in should be used for this duvet relay.



July 7 1942
Same as page 103.

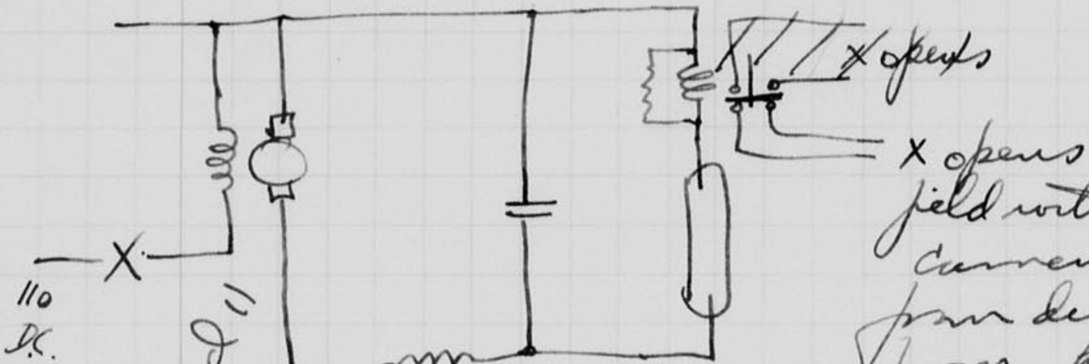


WIRING DIAGRAM
HIGH-SPEED MOTION-PICTURE
CAMERA POWER-SUPPLY
JULY 5 1942 H.E. EDGERTON

July 11 1942
Harold E Edgerton.

Considerable effort was spent the past week by Barstow and Grier on the protection problem for the large D.I.C. 6016 flasher. (See page 129).

A conference with Dick Taylor on the 9 or 10 brought out the following design using a re built automatic electric relay.



field with pulse of current in relay from discharge or from hold over.

Coil specs. 70 turns #14 copper wire resistance 0.03 ohms. Pull in current 3.4 amps. Drop out current 1.7 ..

Copper slug covers half of volume to give a delay in opening - estimated ~~at~~ 0.1 or 0.2 seconds.

Shunt across coil ~~0.06~~ 0.1 ohms.

Two relays will be used - one in each lamp discharge circuit. The control circuit will be in series with the contacts of both relays.

This scheme was tried July 10 and 11 with 2 lamps one of which misfired on occasion. All the lamps were protected very satisfactorily.
Herbert E. Grier
July 13, 1942

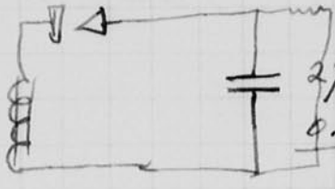
July 11 1942

Filter and Chg data.

816 rating peak inverse 5500 volts max.
" plate I 0.8 amp "
Surge 2.5 " "
Average 0.13 " "

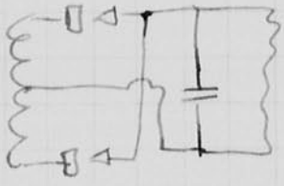
fil 2.5 volts 5 amp.

halfwave.



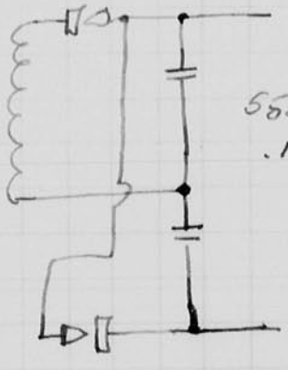
= 358. watts.

full wave.

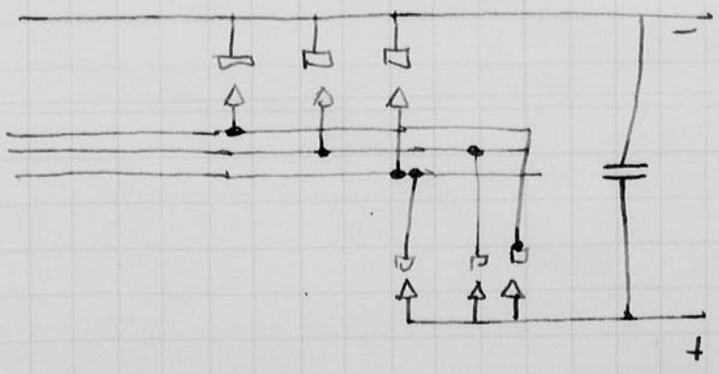


= 716 watts.

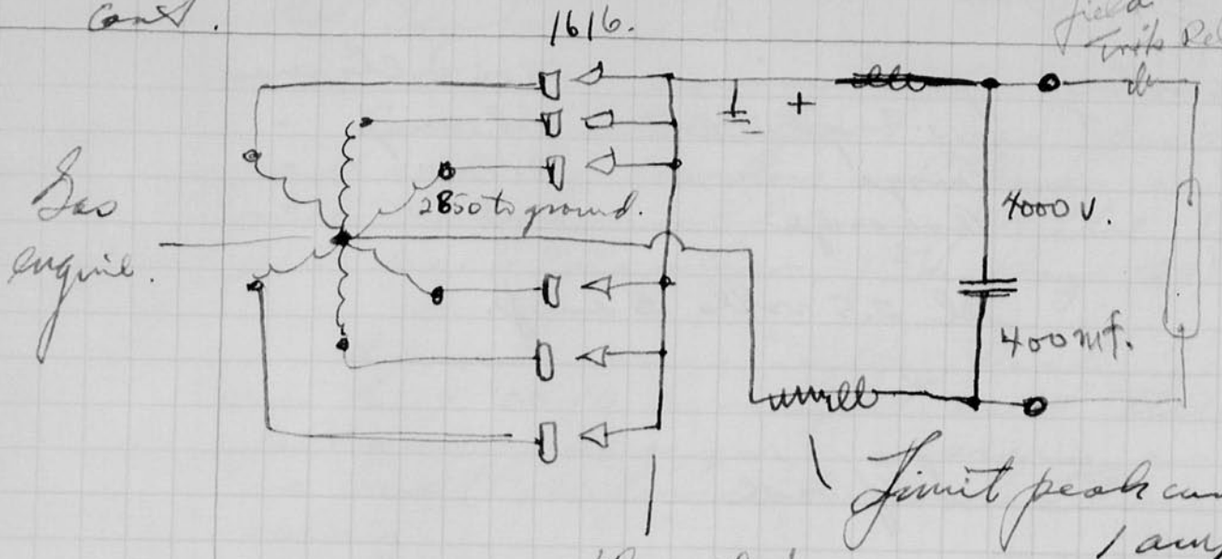
~~3 phase~~ Voltage doubler.



= 716 watts.



cont.



Limit peak current to 1 amp.

$\frac{CE^2}{2} \times \frac{400 \times 16}{2} = 3200$ watts

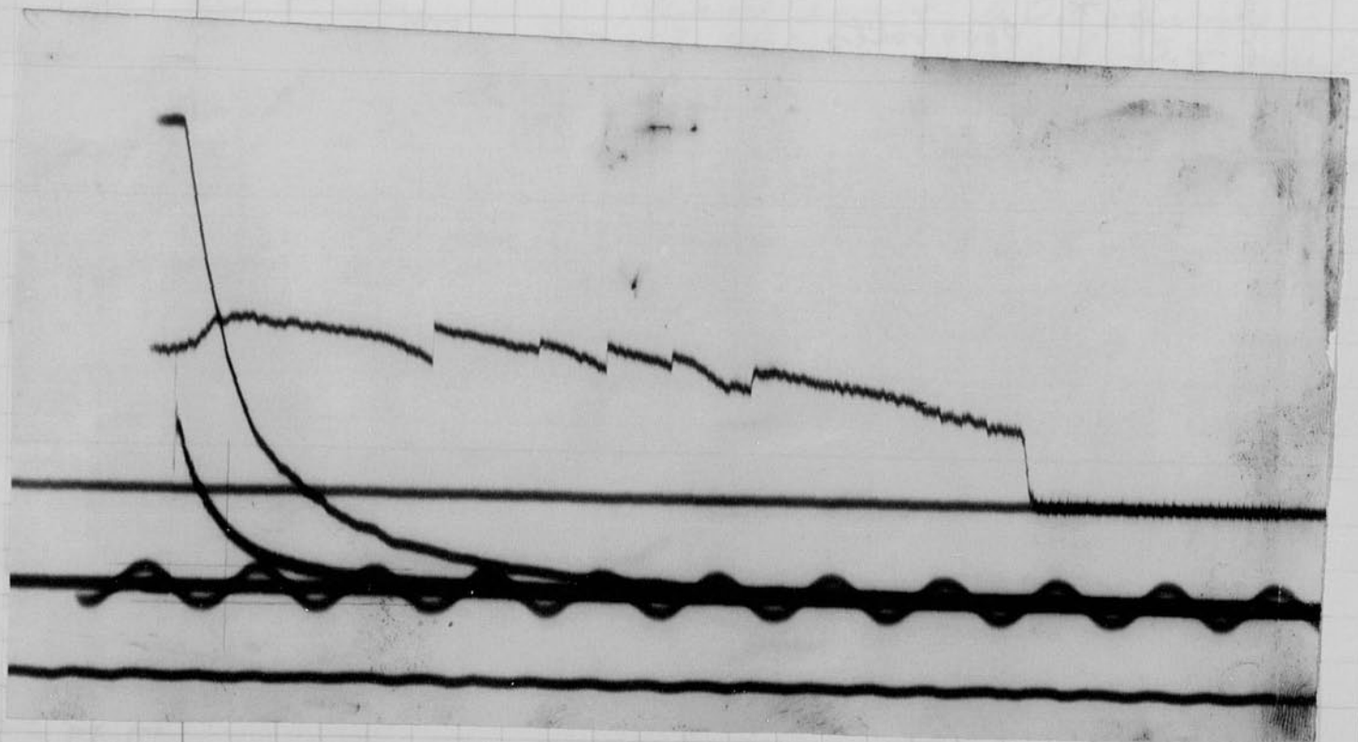
filaments from 6 V. battery. Series parallel.

to starter and Generator

switch for start.

$I^2R = 25 \times \frac{1}{5} = 5$ watts.

use 20 watt resistor.



Notebook # 12

Filming and Separation Record

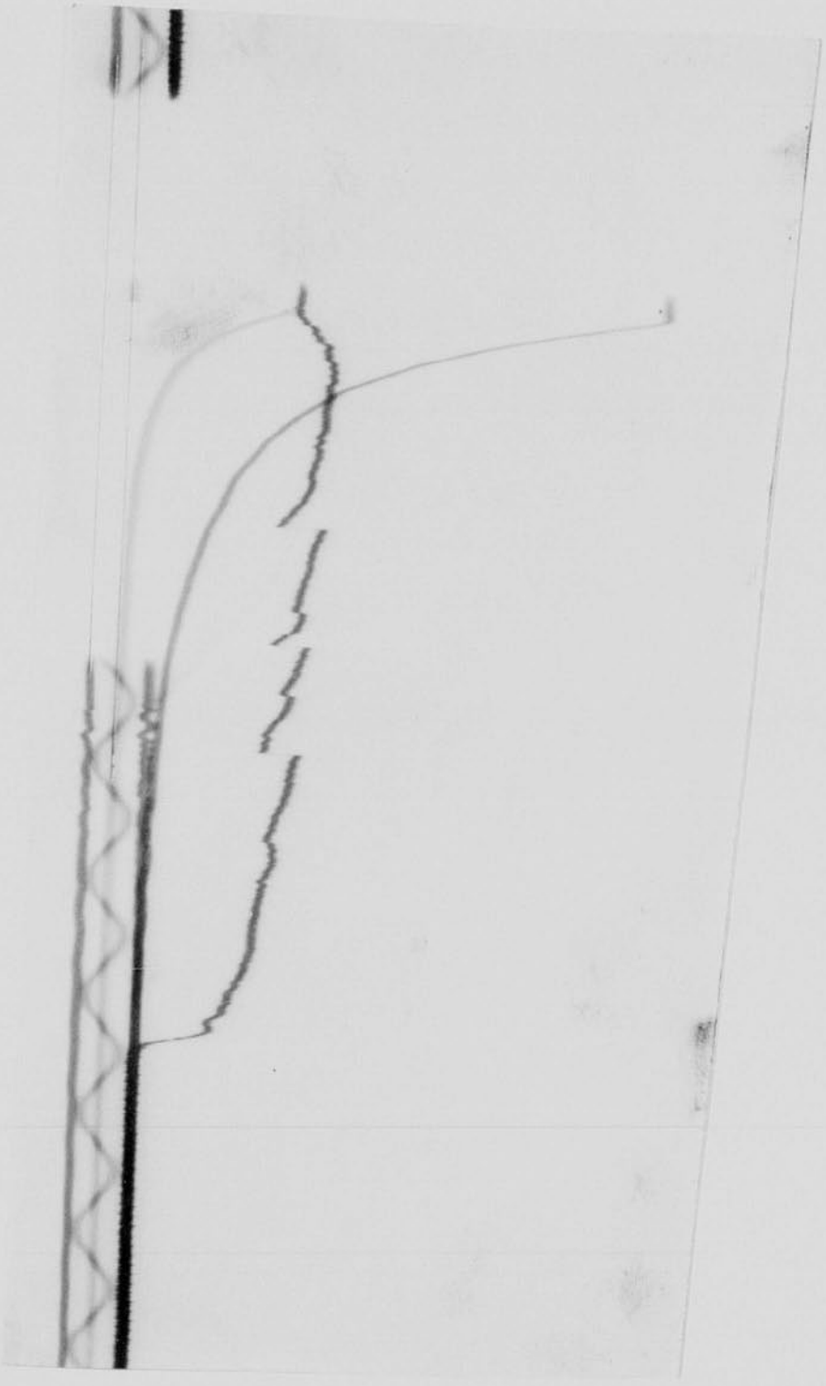
1 unmounted photograph(s)

____ negative strip(s)

____ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 134 and 135.

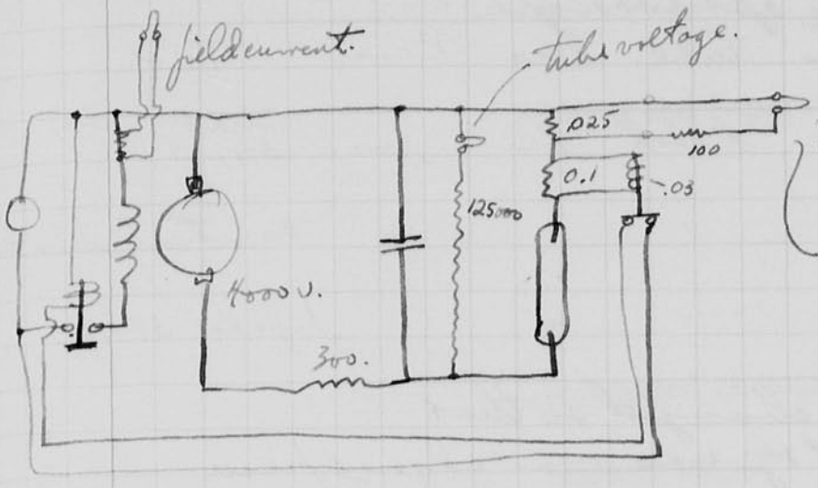
Item(s) now housed in accompanying folder.



July 13 1942

H. E. Edgerton

Oscillograph tests of flasher



calibration $\frac{5}{10}$ volts 250 ohms.

0.55 cm = $\frac{2 \times 2 \times \frac{5}{10} \text{ volts}}{250 \text{ ohms}}$ = $\frac{.1135 \text{ amp.}}{2}$

1 cm = $\frac{.206}{2}$ amp.

Peak current 2.22 x cm = $\frac{.457}{2}$ amp.

$I_c = \frac{.457 \times 100}{2 \; .025} = \frac{1828}{2}$ amp. = 914 amps.

$R_{tube} = \frac{4000}{1828}$ = 2 x 2.18 ohms. 4.36 ohms.

$RC = 2280 \text{ mf} \times 2.18 \text{ ohms} = .0099$

1.6 cm = 1/60 sec.

.76 cm = time constant of current.

$= \frac{1}{60} \times \frac{.76}{1.6} = .00792$ seconds.

Current oscillogram shows some high frequency oscillations.

7.7 cm = 4000 volts.

1.3 cm residual voltage

$\frac{4000 \times 1.3}{27} = 675$ volts.

another oscillogram shows. $\frac{4000 \cdot 8}{7.92} = 404$ volts

July 14 1942

Harold E Edgerton Spectral tests.

cont from page 42 Apparatus returned by Buck from physics dept.

Spec No. Enco grating spectroscope.

Spec No.	Volt.	Cap.	Flashes	Tube.	Gas Press		FILM
124	1800	180	5	#2 Kod	Xe	7 cm.	Tri X aero film. 5217-14-1
125	"	"	"	"	"	"	#10 Eastman Type K Infra Red.
126	"	"	"	"	"	"	Infra Red 54-18-3.

D72 2:1 5 min.

Grating angle changed so that green line of Hg was near edge of film.

127	"	"	"	"	"	"	"

July 19 1942

128	4000	2000	1	SrO_2	Xe	15	Infra Red.
129	Ditto but with #8 89 a filter + 1 flash no filter #3						
130	Ditto 54 filter 3 flashes. #8 setting.						
131	"	"	4 flashes.				Infra Red
132	Grating shifted to resolve						
	4000 v	2000	1 flash	SrO_2	Xe	15	Infra Red film.
133	"	"	1	"	"	"	Tri X film.

Bausch exposure on Back at 6 ft 1 flash.

134	"	"	"	"	"	"	" distance to Spec increased by 3 times.

[redacted] 110, | #1 | Hg. 0 | ar. 1 atmosphere | × these two self

Notebook # 12

Filming and Separation Record

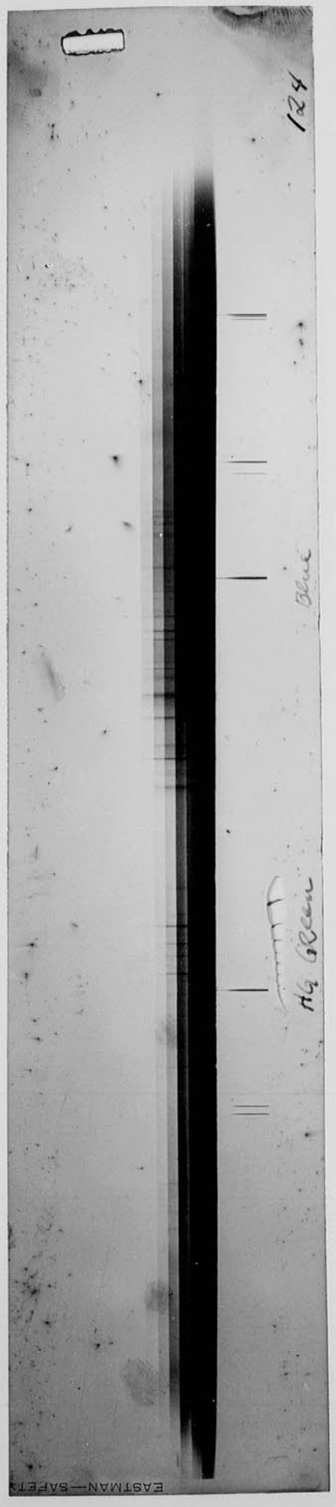
____ unmounted photograph(s)

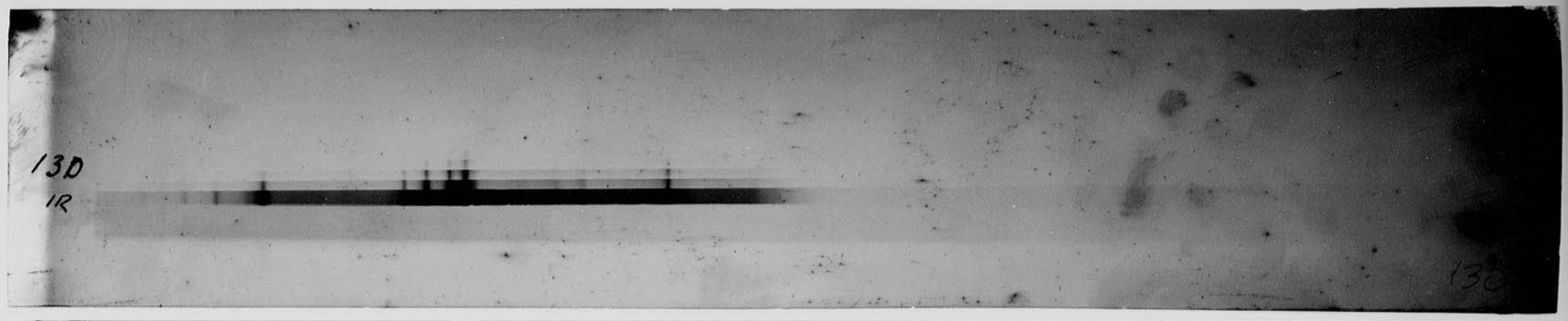
6 negative strip(s)

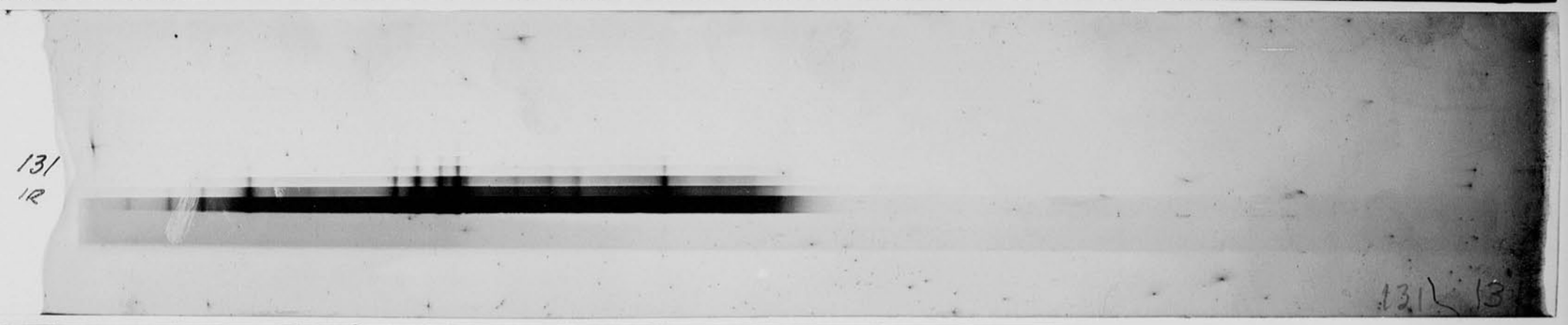
1 unmounted page(s)
(notes, drawings, letters, etc.)

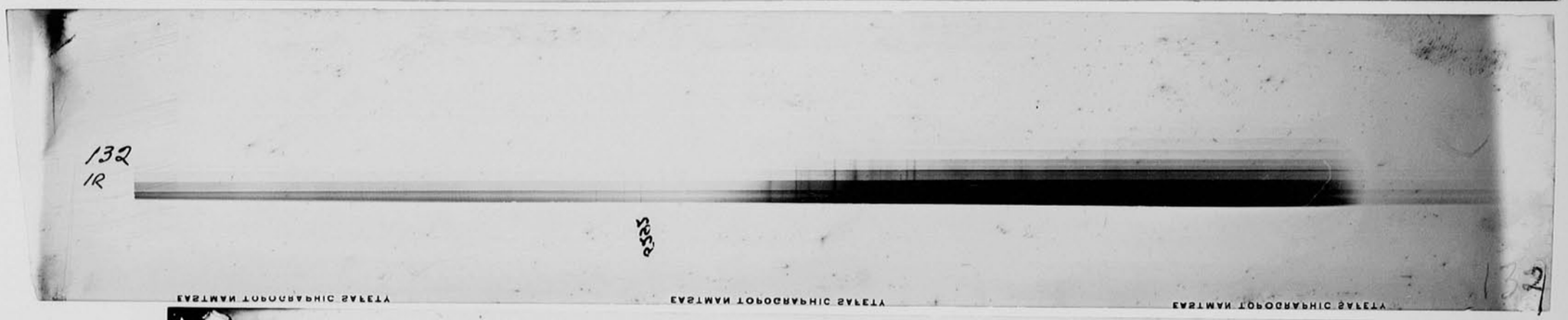
was/were filmed where originally located between page 136 and 137.

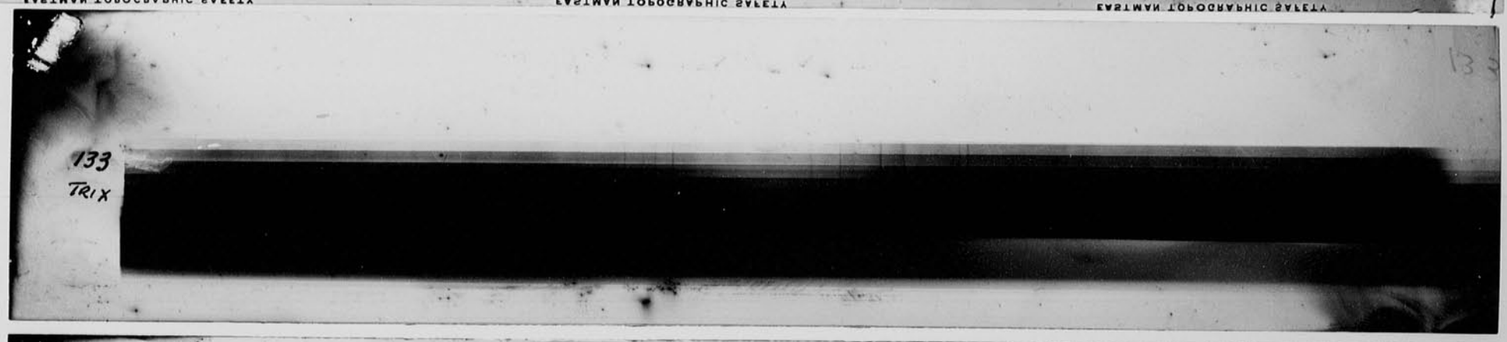
Item(s) now housed in accompanying folder.

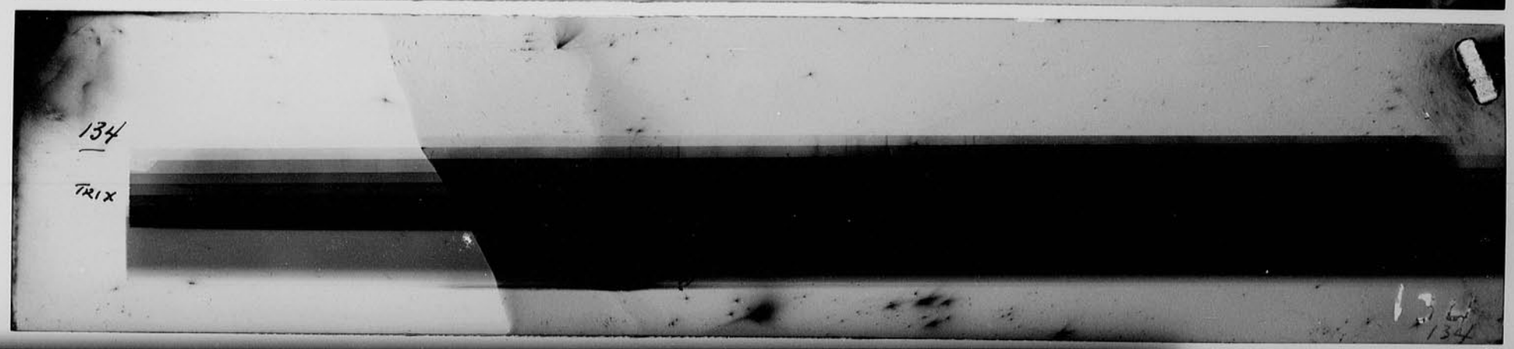

124
Blue
Hg Green
EASTMAN—SAFETY


130
IR


131
IR


132
IR
EASTMAN TOPOGRAPHIC SAFETY
EASTMAN TOPOGRAPHIC SAFETY
EASTMAN TOPOGRAPHIC SAFETY


133
TRIX


134
TRIX

136

NAVY DEPARTMENT
OFFICE OF CHIEF OF NAVAL OPERATIONS
WASHINGTON, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300

July 22 1942

Harold Edgerton.

Lamps page 110

	Hg.	Ar.	
#1	0	1 atmosphere	x These two self flash
2	0.7 cm	"	x
3	1.5	"	
4	3.0	"	

Sat July 18 - Watertown arsenal taking pictures with micro second unit of 37 m m bullets hitting stings and wire. the experiments show that a flash of light is produced when the wire is hit. the flash is of very short duration. this explains the pictures that were taken May 28 at Aberdeen. Capt Mathews.

Sunday July 19 Chas. Wyckoff and Geo. went to Worcester in my car to set up movie camera at Wyman Gordon shop. I worked with Fred Barton on the flasher taking spectrum shots on #136 and plotting graphs out window of 4-111.

Stook the 11 pm train to Worcester and stayed at the Bancroft hotel. Got up at 5.30 to work at the forge shop with Charlie. Returned to Boston at noon.

Freight from Wright field arrived Monday for experiment on the new flasher 400 V 4000 m fd.

July 23 1942 the B2 from Wright field came yesterday about 3. Kenyon Jan cook and Freight were in this morning. Barsley called about noon on the phone before going over to the air field.

~~Sunday July 26 1942~~

~~Harold Edgerton~~.

Col. Baisley
Maj. Borden
Bob Feichit
John Hancock
Kerayon

Installed 6016 D.C. flasher in B24 on last week end. It was taken to Boston air port on ~~Thursday~~ Wed afternoon and stored in the M.I.T. hangar. The plane came thurs. day and unit fitted. The final trial was made on Saturday; then the unit was taken out and the ~~pile~~ plane left about 5 pm for Chicopee (Westover field). Fred is going in a truck tomorrow morning to Chicopee with the apparatus.

Chas W. Wyckoff and I worked with Columbia Univ group at pool from 6 30 to 4 30 am. We have been assembling and testing lamps for this work for the past 3 weeks ±. A total of 6 lamps were to be used on the tests. However one of them leaked last night and had to be taken out of service.

Camera f2 lens Cooke 1" film Eastman Plus X.

Lamps 6 to 10 ft from subject.

Those present. Hooper. Kittredge, Neale, Sepovitch and two men from pool Al Turner and John.

August 17 1942
Harold E. Edgerton

Returned yesterday from trip to Wright field to test the large flash unit.

Also shot Jenkins movies of oxygen tanks for Col. Fink with mili. Data below. 200 ft shots 12 volt airplane Battery.

Capt Turner
Sidney Winton
Eastman
Col. Fink
Capt P.M. Thomas.

Patterson field tests
Oxygen tank with 50 cal tumbled bullets.

			50 cal AP Tumble.				
1	AUG. 13, 1942	Jenkins	f 4,5	170 f.c. plus X	8 ft.	G1 cylinder.	Ox 400#
2	14	990 fps.	150±		Low press.		400
3	14	1150	"		"		"
4	14	1150	"		"		"
5	14	1100?	Back light.		High press		1800
6	14	1100	"		"	did not break.	1800
7	14	990	4pm "		"	"	1800
8	14.	1200	f 4.5.	Shade. 75 pc white back.	8	C1	1800
9				50 pc		C1	1800
10				50 pc		G1 Low	400

W. L. Enfield
Ed. B. Noel
Taken at Cleveland
Mela Parks.
DE Co.
Two lights

Taken at Cleveland
airport.

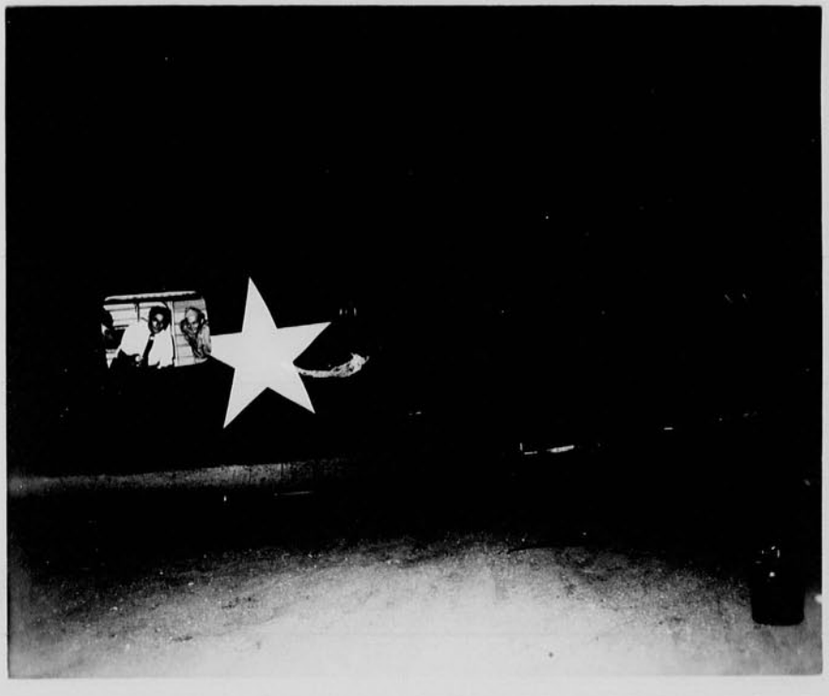
Quartz lamps with Ubifoss seals.

Taken at Wright field.

Jack Taylor and Lt. Kenyon.

B-24 with Kosher.

Taylor is holding photocell.



Aug. 17, 1942
H. E. Edgerton

Propeller Stroboscope

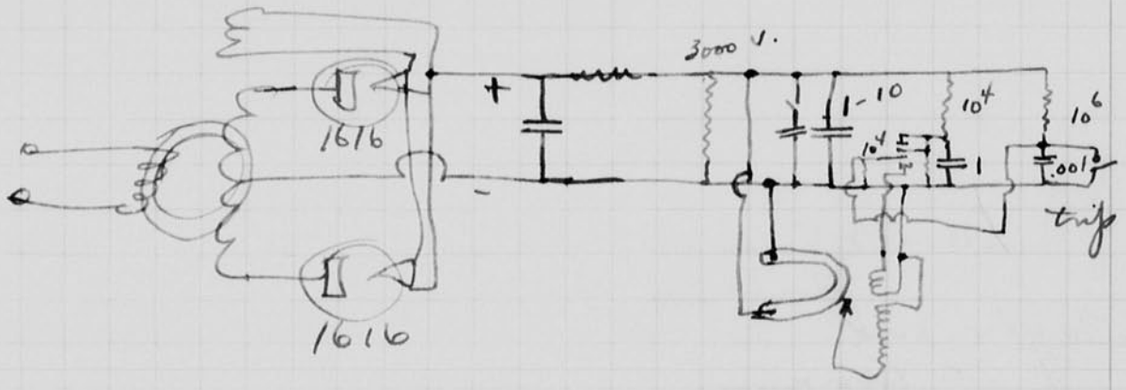
Treseder and R. F. Conner.
Col H. H. Couch. Propeller lab.

Eclipse type 778 converter Model 2.

Load	0	118 watts. 400 cycle a.c.
Volts.	160	147 volts
amps.	0	0.79 amps

Ground - B 26 volt 400 ~.
Ground - D 24 volt input d.c.
A - C 115 volt 400 cycle.

Battery voltage 27.5 volts. regulated.
28.5. ?



RC = .01 sec.
$R = \frac{.01}{1 \times 10^{-6}} = 10^{-2} \times 10^{6} = 10{,}000.$

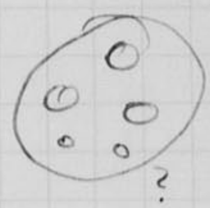
30 flashes / sec.
6 ft distance.
f 11 Black Props.
photographs.

Major DeFoist H Siegfried - armament group.
high-speed camera inquiry at Wright field.

Lt. Dane Dr. Wattendorf - Wind tunnel.

Mr. E.E. George Leland Electric Co.
Dayton Ohio.

Generator 3102 36 2p plug AN



I_f = 6 amp.
E = 52
I_a = 100
z =

12 pole 4000 r.p.m.
400-800 cycle time const 0.1 sec.

See M.M. Hubbard MIT Radiation Group.

A 20 airplane 2600 rpm props
2000 - 3600 r.p.m.

Contactor Leach Mfg Los Angeles Calif
Mr. Paul Henry.

August 23rd

Wiring up converter see page 142

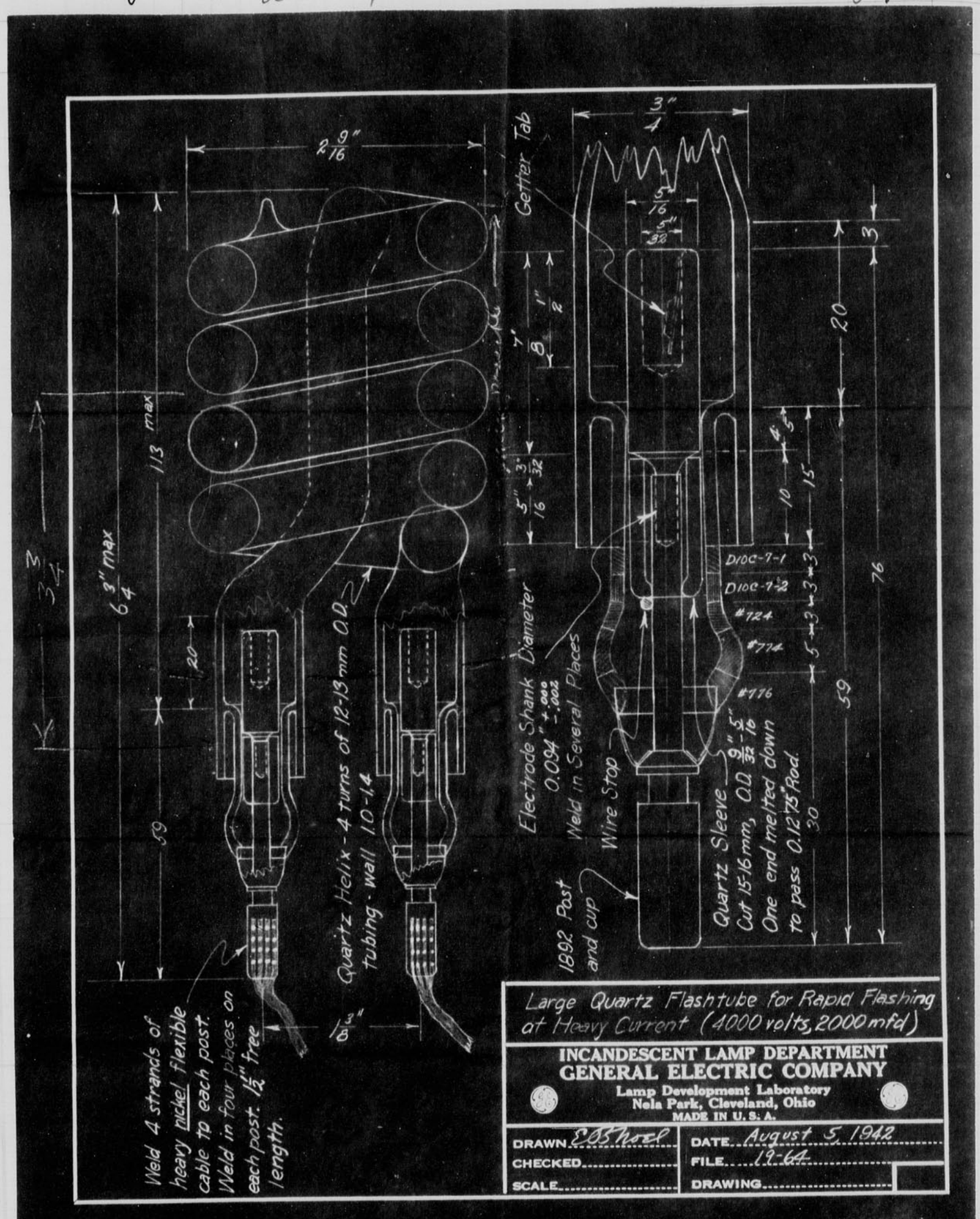
~~AC - 10.5 ohms. ac output~~ -

~~Ground D 7.5 ohms dc input~~

A is ground. AD less than 1 ohm?

input 25 volts dc
output to transformer U5449 147 volts
3.2 on 2.5 volt winding

144 Aug 17. 1942 From Noel G.E. Co last week.
a modified drawing was received today from Noel.



Large Quartz Flashtube for Rapid Flashing at Heavy Current (4000 volts, 2000 mfd)

INCANDESCENT LAMP DEPARTMENT
GENERAL ELECTRIC COMPANY
Lamp Development Laboratory
Nela Park, Cleveland, Ohio
MADE IN U. S. A.

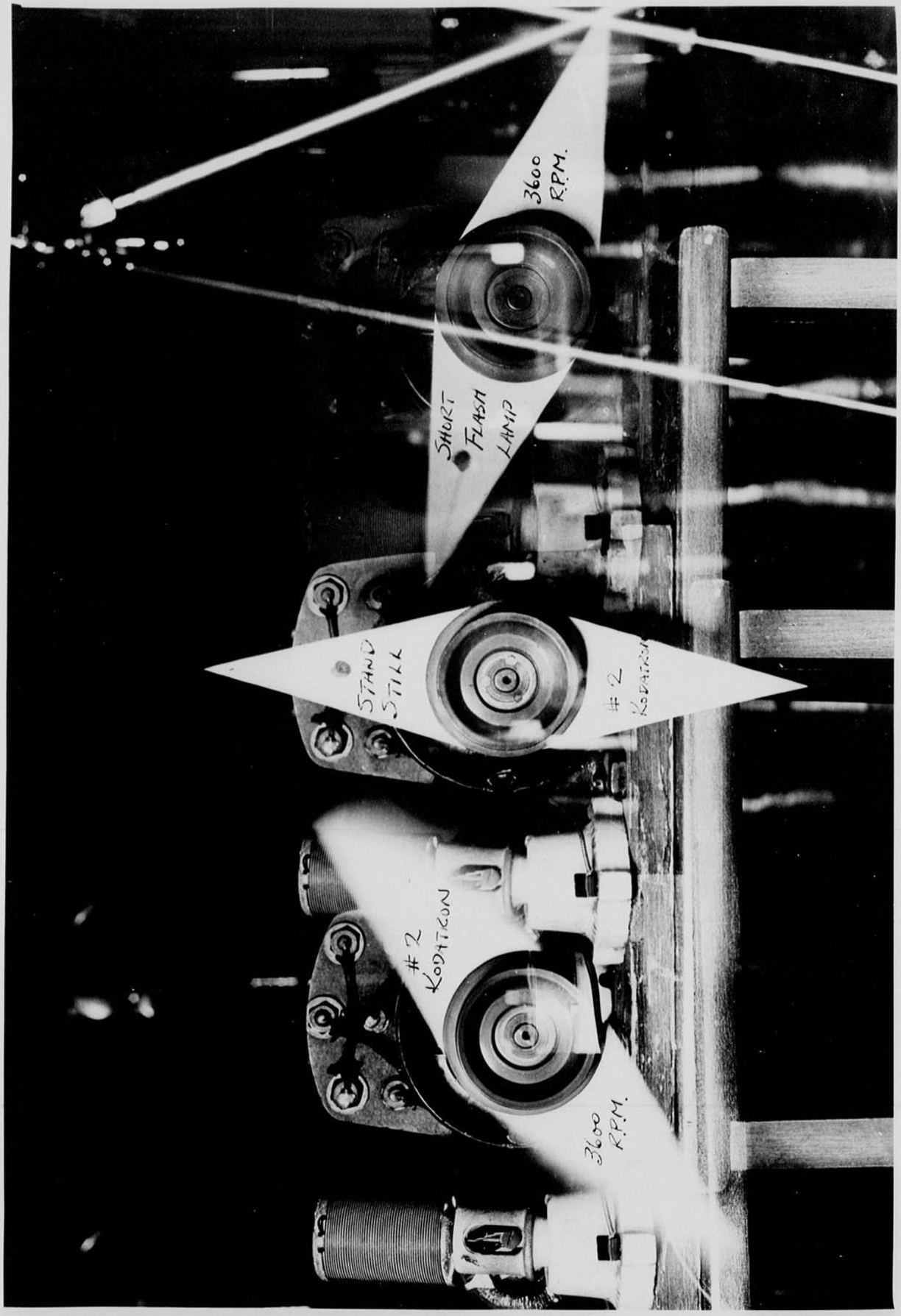
DRAWN E.B. Noel	DATE August 5 1942
CHECKED	FILE 19-64
SCALE	DRAWING

↑

P-12 prop at full speed - taken at Wright field. This was an attempt to show vapor at blade tips on a damp morning. The effect was not pronounced when this photo was taken.

H. E. Edgerton
Aug. 19, 1942.

See Page 128.

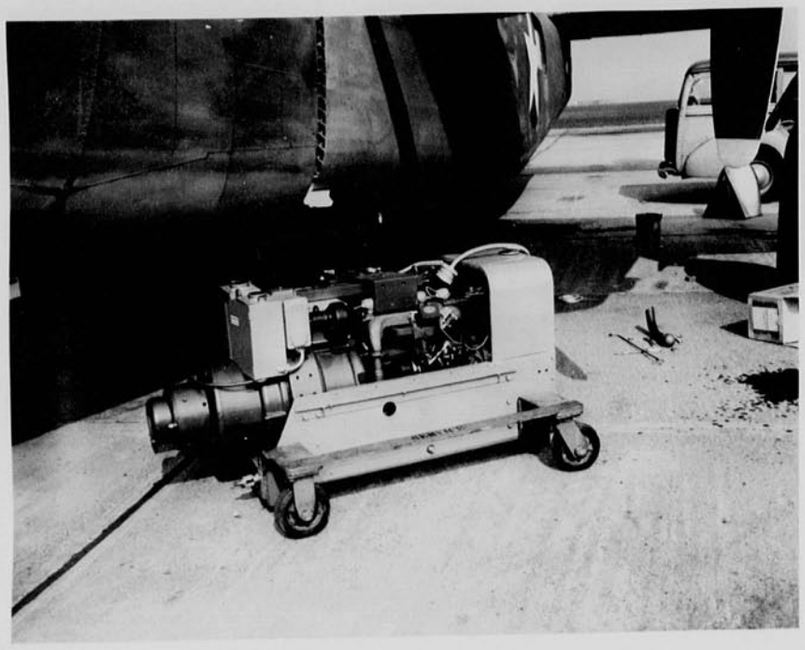


Aug 24 1942

Brier
Borden Maj
Borden col
Kenyon Lt
Hancock
Barstow
Feicht ?

Photos taken at Boston airport while fitting large flash unit to a B 24 airplane # 11171 ~~11717~~ ?

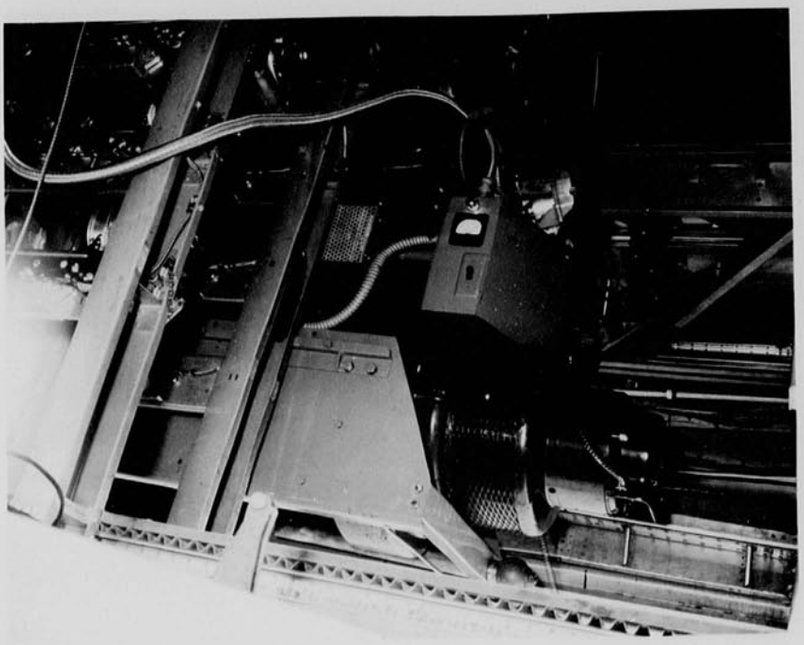
Condenser being lifted with Bomb shackle into B24..



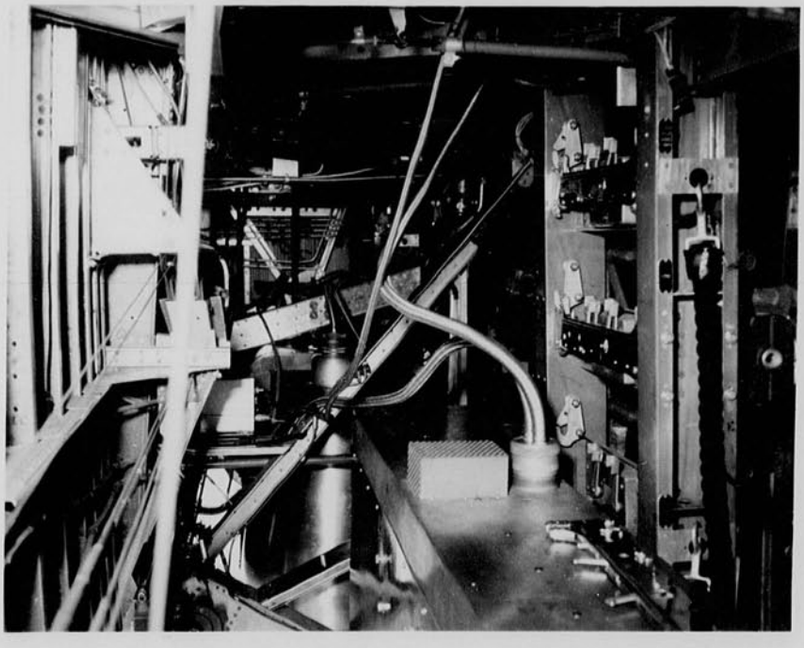
Onan motor-generator set

Ditto - other side

Motor generator in place and in operation.



Looking forward from back of bomb bay showing motor generator with protection attached.



Aug 24 1942

Harold Edgerton.

Lengthy discussion with Herb Grier and Fred Barston this afternoon concerning new design of photography apparatus for 1500 ft low altitude photography from an A 20 B plane.

There are several possible sources of power.

I. Separate motor (gasoline) generator set. advantages 1 can fit in any A 20 plane without modification
2. Can be operated without operating the engines on the air plane.
3. Field control can be used on the generator for deionizing the tubes.

disadvantages
1. Weight

II. Generator on plane motor
advantages.
1. Light weight.
2. Economical power from main plant.

disadvantages.
1. Will require generator change on the air plane.

2. May require wiring changes to use A.C. generator as standby generator for battery.

Notebook # 12

Filming and Separation Record

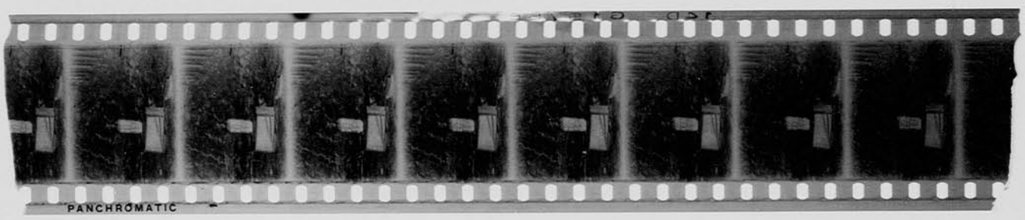
___ unmounted photograph(s)

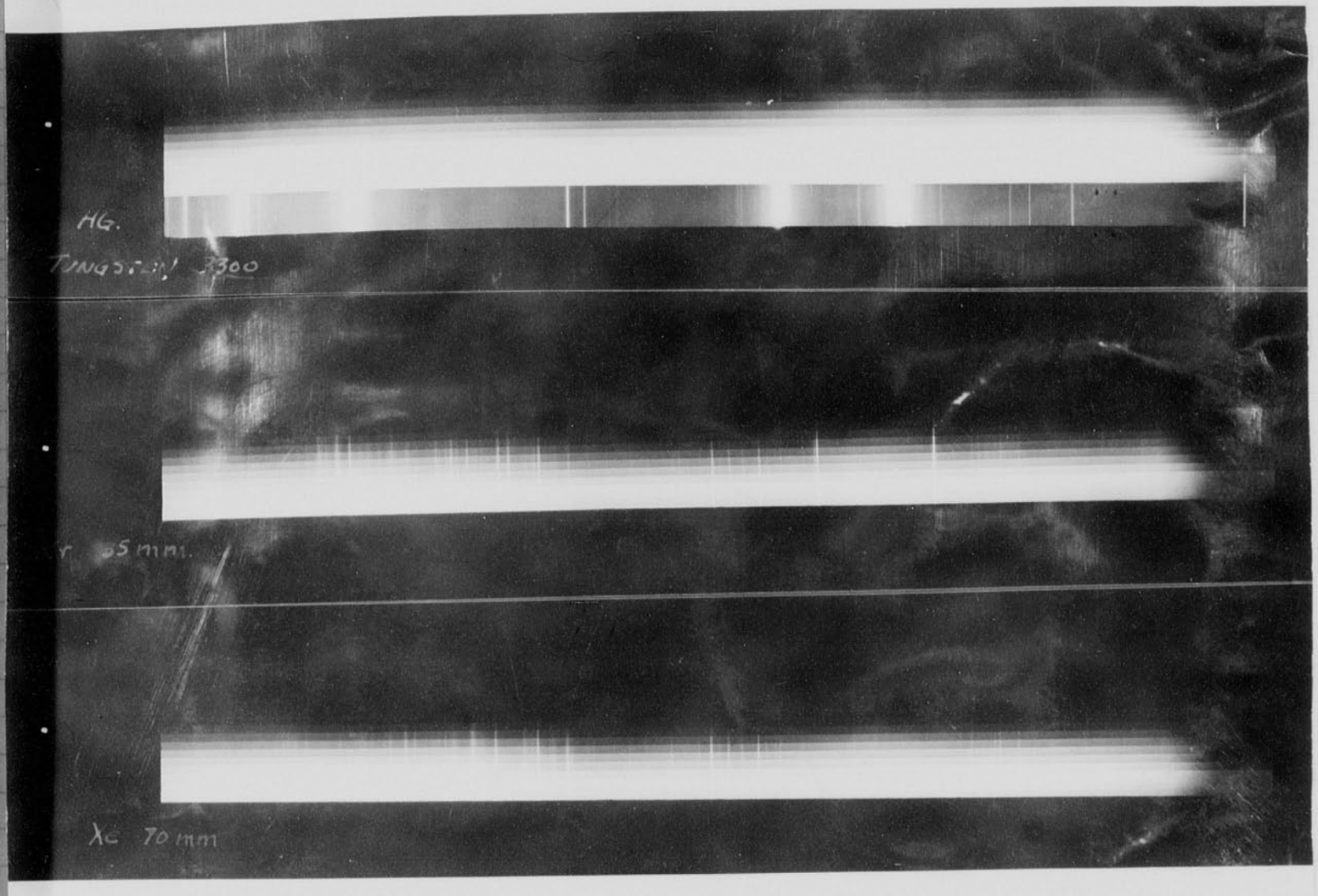
_1_ negative strip(s)

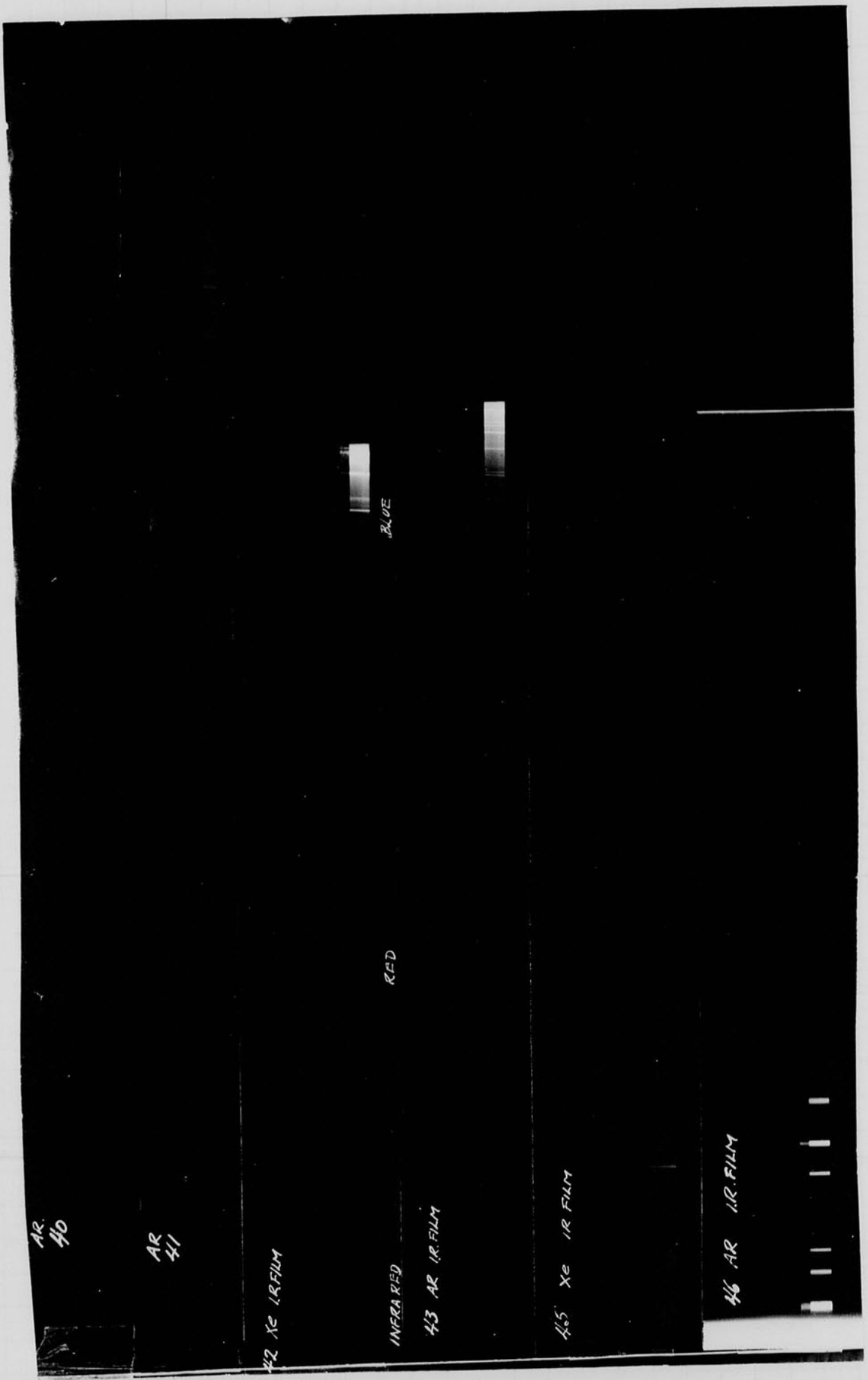
___ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 150 and 151.

Item(s) now housed in accompanying folder.


PANCHROMATIC


HG.
TUNGSTEN 3300
.05 mm.
70 mm



See page 16, 17.

Excerpts from paper published in the Photographic Society of America Journal, written by J. Warren Gillon of Eastman Kodak Company

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Table I

"Effective Photographic Exposure"* of Kodatron Speedlamps

Lamp	Rel. Exposure at 1 meter (no reflector)	Rel. Axial Exposure at 1 meter. Lamp in reflector**	Effective photographic exposure at 1 meter from light source
500 w. 3200°K	100	100	59 m.c.s.
Lamp #1 (now in use)	970	14,550	8,600 m.c.s.
Lamp #2 (New type)	1,290	19,300	11,400 m.c.s.

*Effective photographic exposure as used herein is in terms of the number of meter-candle seconds of exposure required with a 3200°K. tungsten lamp to produce the same density on Kodatron Film as the Kodatron Lamp would produce when operated at 2000 volts and 112 mf. at 1 meter.

**Axial reflector factor = 15 (measured by Tuttle and Brown).

Table II

Filter Factors of the 2A and 88 Filters When Used with the Kodatron Speedlamp

Emulsion	2A Filter (Ultraviolet absorbing)			88 Filter (Infrared transmitting)		
	3200°K.	Lamp #1*	Lamp #2**	3200°K.	Lamp #1*	Lamp #2*
Cine Positive	2.0	3.2	3.3	-	-	-
Kodatron Pan	1.2	1.8	1.6	-	-	-
1-N Plate	1.4	2.5	2.5	4.8	16.5	25

*Lamp now being used

**New type lamp

Table IV

Guide Exposure Numbers for Kodatron Speedlamp Photography*

	Kodatron Panchromatic Film	Prof. Kodachrome Film Daylight Type[1]	35-mm. Kodachrome Film Daylight Type[2]	Infrared Sheet Film[3]
Kodatron Speedlamp	440	40	32	12
Kodatron Portable Speedlamp	220	20	16	6

*Data given for new type lamp

1. With No. 1 Haze Filter over lens
2. With CC15 Filter or No. 1 Haze Filter over lens
3. With No. 87 Filter over lens

B-18 Engine. 2 1/2" x 2 1/4".
2 cylinder air cooled.

Crosley. 3" x 2 3/4".