HAROLD E. EDGERTON

PAPERS

MC 25

Series III

Laboratory Notebooks

Number 25

Dated April 29, 1958 to May 14, 1960

Massachusetts Institute of Technology

COMPUTATION BOOK

NAME	Number
HAROLD EDGERTON	25

M.I.T. 20D-102
CAMBRIDGE MASS.

Course .....

Used from APRIL 29 1958, to May 14 1960

K17 6063

HOME 205 SCHOOL ST
BELMONT MASS 1V4-4869.

Book No. 25
April 29, 1958
to

Tube 20D102 to 4-405
made in Sept 1958

A.S.

Harold E. Edgerton
20D102
M.I.T.
Cambridge Mass.
Apr. 29, 1958

Sonar - Coltype p 76.
" " p 85-92
96-97
Tin Can Sonar. 113-114-116
Thumper 1700 lbs. 135

Countermeasures p 65
97 cycle strobe 99

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

COMPUTATION BOOK

GENERAL INSTRUCTIONS

In all work in which *accuracy* and *ease of reference* are important, much depends upon carrying out the computation in a systematic manner. The following instructions, taken from the *Engineering Department Figuring Book of the Allis-Chalmers Co., serve as a guide in this matter.*

"All computations, of whatever kind, are to be made in these books, except in cases where special blanks may be provided for specific kinds of computation. Computations may be made in ink or pencil, whichever may be more convenient. Pencil figuring should be done with a soft pencil. All the work of computation should be done in these books, including all detail figuring."

"Each subject should begin on a new page, no matter how much space may be left on the previous page. The subject, with the date of beginning it, should be plainly written at the top of the first page of the subject."

"Work should be done systematically, and as neatly as consistent with rapidity. The books are, however, intended for convenience, and no unnecessary work should be done for sake of appearance only. Errors should be crossed off instead of erased, except where the latter will facilitate the work. Work should not be crowded. Paper costs less than the time which would be expended in attempting to economize space in making erasures."

"Where curves drawn on section paper (or sketches) are necessary parts of a computation, they should be pasted in the book, except where specifically otherwise provided for."

"Computations should be indexed, in the back of the book, by the person using the book."

* * * * * * * "

TECHNOLOGY STORE
HARVARD COOPERATIVE SOCIETY, Inc.
40 Massachusetts Ave., Cambridge 39, Massachusetts

April 29 1958

Harold Edgerton.

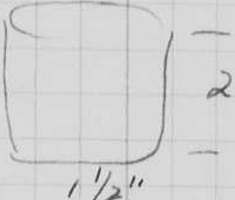
A photo of a dynamite cap was made last night with the double flash. A piece of steel was put next to the cap to show spray of the metal. The photo was not clear enough to show any spray if there was any present. The unit delay may not have been enough to show the effect.

May. 13, 1958. 64 Movie Light 64 per sec. Several Photos. Microsecs

8 watt sec.
6 mfd
1500 volts.

$\frac{6.8}{8.}$
502 watts.

E.G.&G.
1 1/2 Turn 6 mm Drawing no. BQ 1194 4.7.58
Quartz
3.5 cps/watt. about 80% of FT-218.

Transformer oil in beaker → 

Gets hot in 10 seconds.

Light output = 30 C.P.S.

M = 8

B.C.P.S. = 240

$GF = \sqrt{\frac{10}{15} 240} = \sqrt{160.0} \equiv 13$

$15\overline{)\frac{16}{2400}}$
15
90

1/50 sec. f 12

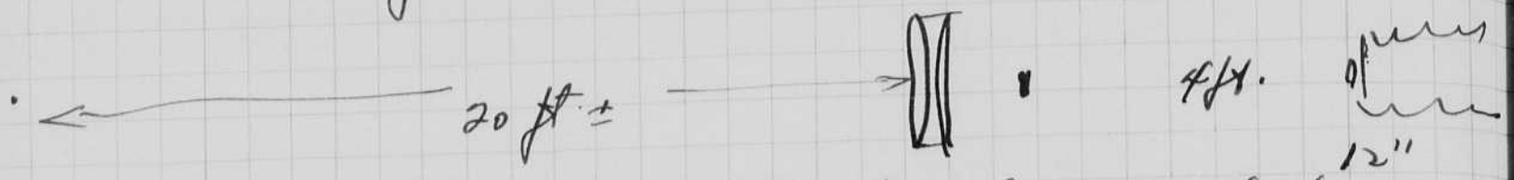
Air cooling?

Small tube.

May 17 1958
Harold E. Edgerton

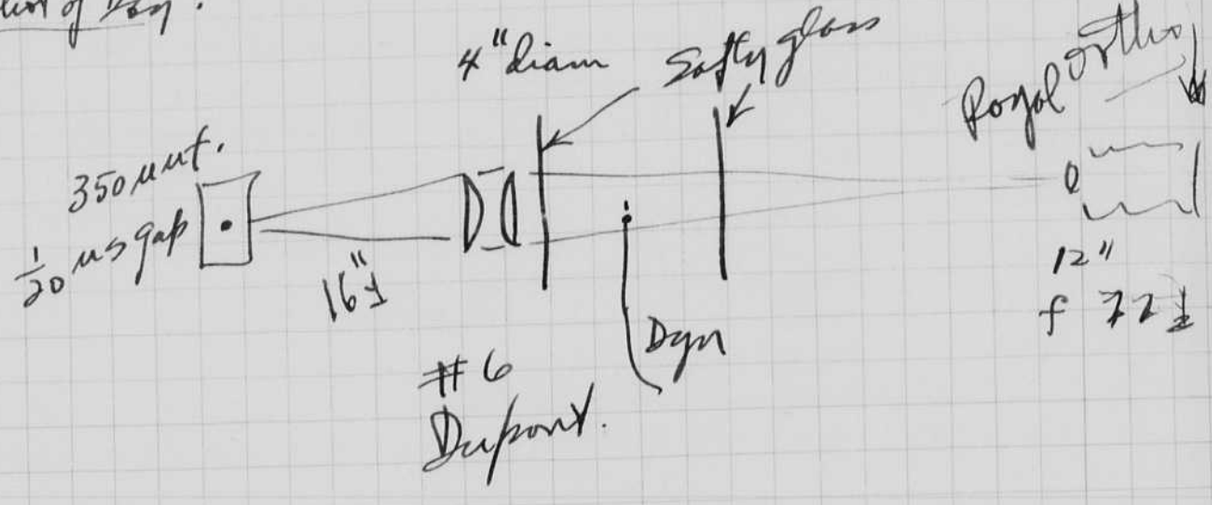
Dynamite Cap Photography.
Vinny Sundra 680 student.

Sundra has data on the caps with the 9 2/3" lens. For these we used the second flash of the Double flash EG&G unit.



Film underexposed for this close up shot. Royal Pan and on the bottle used.

Last Shot of Day.



Phoned Jamel Osler May 19 about ~~Hg~~ Mercury arc tube driver for spectroscope. Labeling was out. Brehm wants unit longer.

6.20 class Spring 1958.

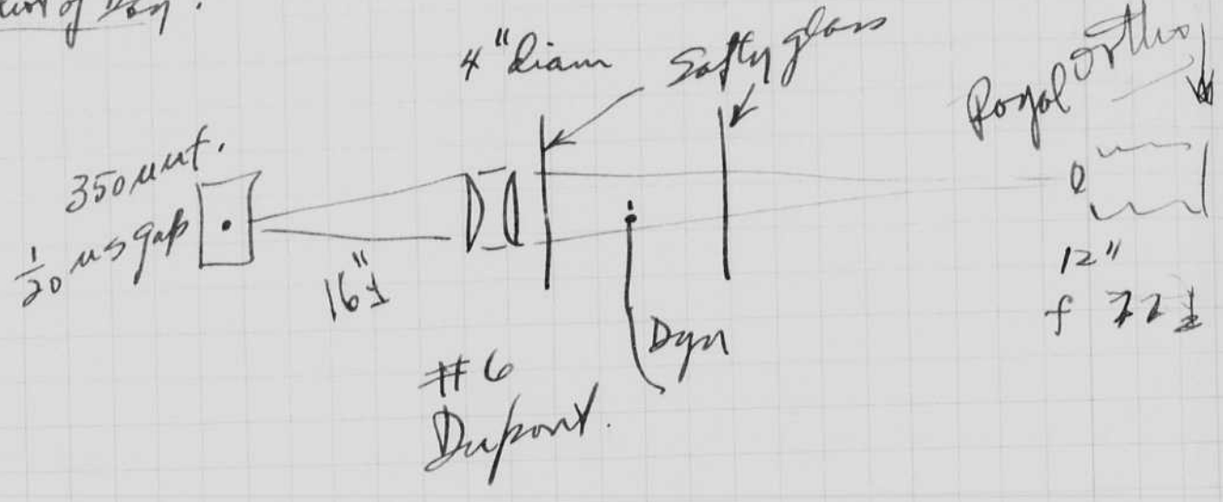
May 17 1958
Harold E. Edgerton.

Dynamite Cap Photography.
Vinny Sundra 680 student.

Sundra has data on the caps with the 9 3/8" lens. For these we used the second flash of the double flash EG&G unit.

Film underexposed for this close up shot.
Royal Pan and or the Bold used.

Last Shot of Day.



Phoned Jamel Ashe May 19 about mercury arc tube driver for spectroscope. Labeling was out. Brehm wants unit longer.

6.20 class Spring 1958.

Notebook # 25

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 __2__ and __3__.

Item(s) now housed in accompanying folder.

SPAULDING-MOSS CO. BOSTON
SEMCO T-105

10/22/57

~~2303~~ 2307 DOUBLE FLASH UNIT

Customer	Date	S/N	Inv. No.	Amt. of Invoice
	1952			
Aberdeen Prov. Ground, Md.	6/30/52	-	191	3,000.00
Camp Detrick, Md.	6/30/52	-	189	2,100.00
	1953			
Aeroprojects, Inc. Penn.	6/23/53	4	952	1,850.00
DuPont de Nemours, Dele.	7/7/53	8	989	1,850.00
Ludwig Hormuth - Germany	9/25/53	7	1359	1,850.00
M.I.T.	10/20/53	6	1487	1,500.00
Springfield Armory, Mass.	7/7/53	5	990	1,850.00
Naval Research Lab., D.C.	6/18/53	3	927	1,850.00
	1954			
Research Inst. of Nat'l. Def., Sweden	6/14/54	9	2102	1,850.00
Frankford Arsenal, Penn.	2/26/54	12	1893	1,850.00
	1955			
M.I.T. (Type 2307C1-3)	3/21/55	11	3767	1,800.00
Owens Corning Fiberglass Corp., Ohio	2/28/55	10	3635	1,850.00
	1956			
*Brown Univ., R.I.(Mod.Type 2307)	3/28/56	14	6454	2,450.00
Randsburg Electro Coating Co.	5/14/56	13	6747	1,850.00
	1957			
Aerojet-General Corp. Azusa, California	1/23/57	15	8108	1,850.00
U. S. Army--Watertown Arsenal, Mass.	8/16/57	19	8658	2,000.00

~~#256~~ Movies. High Speed

May 30, 1958.

Byron Blanchard.

Wollensak
Infrared film neg.

Balloon

~~25~~ #1 30 ft Dastar film 5K camera. 10-60 130V
action at 6000 fps.

~~26~~ #2 30 ft " " " 40-90 130V
action at 2200 f.p.s. 6 frames.

~~27~~ #3 50 ft Dastar. Prism lens 130V 42000 fps
.5 sec for speed up. missed action

~~28~~ #5 50 ft Dastar. .3 sec to speed up to 130 V

~~29~~ #6. 100 ft Dastar 0.5 sec for speed up 130 V.
Explosive action
End speed 5500 fps

Smith Bros.

f 5.6 30 ft 5K 40-70 130V Dark.

f 8. 30 ft 5K 40-90 130V. ok action fair.
motor 1/30 r.p.s.
in frame.
2400 f.p.s. ±

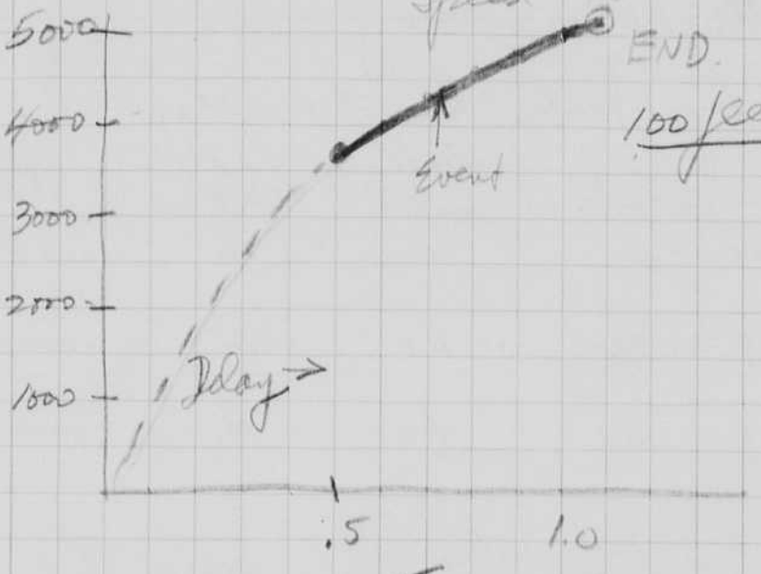
6000 fps / 40 f/s. = 150 ft/sec.

June 8 1958
H. Edgerton

Movie Retakes.

Shot no.	aper.	film	Camera	V	Delay	R.T.	
1	2.8	Tri-X 2K	Fastax	115	.5 sec	.4 sec.	45° Key Lites
2	2.8	"	"	"	"	"	60° Top light Spotty.
3	2	931 Dupont Wollensak	"	"	"	"	

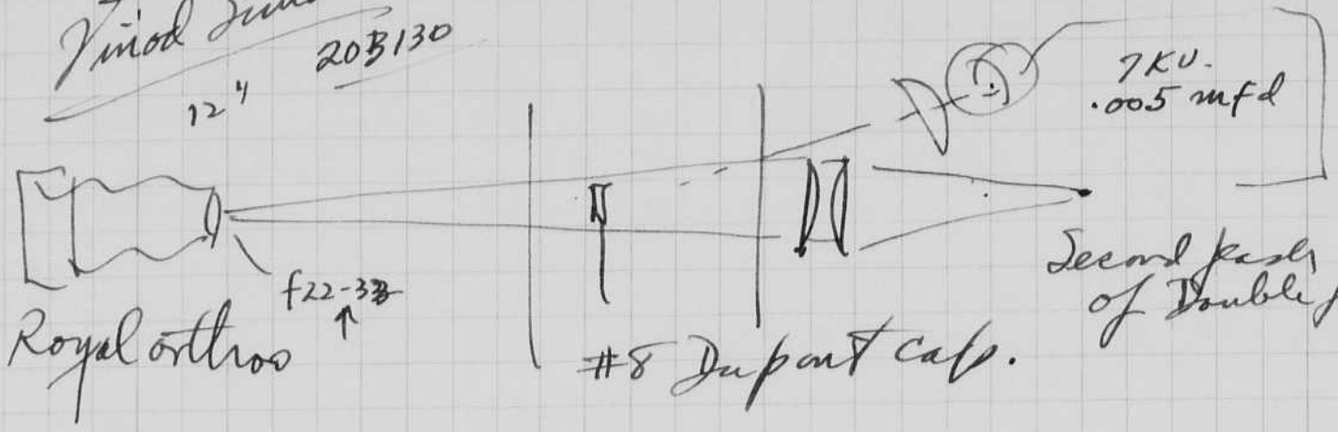
Speed 4000 ±. Exposure action ok.



100 feet of film Fastax
no Prism
115 volts on motor.

June 12 1958.
H. Edgerton
Vinod Sundra
20B130

Dyn. Cap. photos.



#1 Two photos taken with 30 ms delay.

Light Data by Jack Christensen.

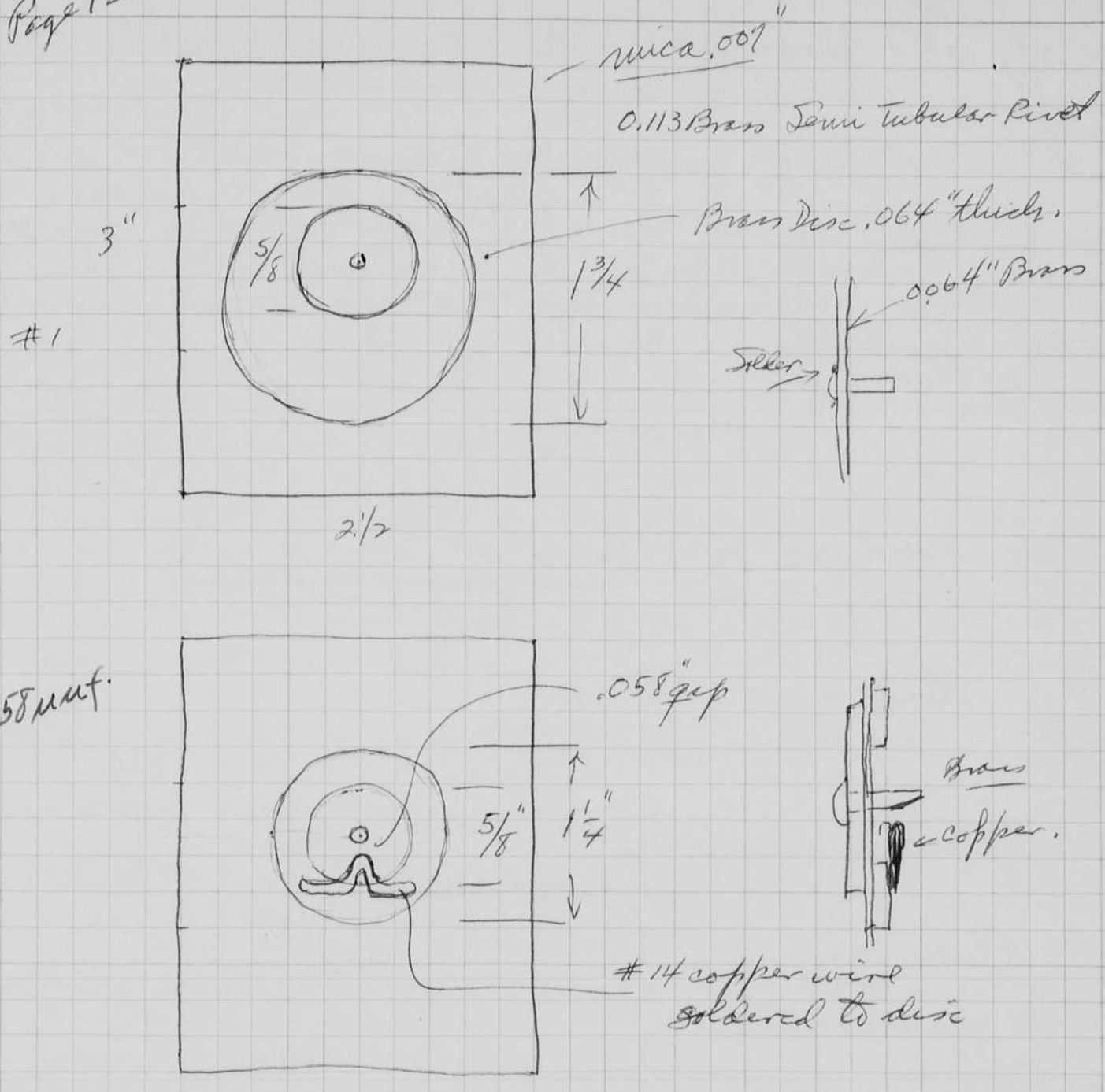
	C	Peak.	Peak. mus	1/3 peak mus	CPS.
#2 Old Gap.	346 μμf ±	40	10	16	.0005
#1	395 μμf.	29.4	6.6	16	.00038
#2	167 μμf	52.	4.5	11.	.00045

I decided to try gap #2 on the flash and the two photos above seemed to be very much over exposed.

#3. 167 μμf. 11 mus flash #8 dyn cap
f22 setting on outside scale of 12 3/4" lens
Royal Ortho film, DK 60A Dev 5 min.
25 ms. delay into Double flash
Short of second flash to short flash unit.

Photo excellent!! Slight underexposure around edge of lens. Try large lens tomorrow.

From MacRoberts Book #IV
Page 120



8 June 2 1958

Harold E. Edgerton.

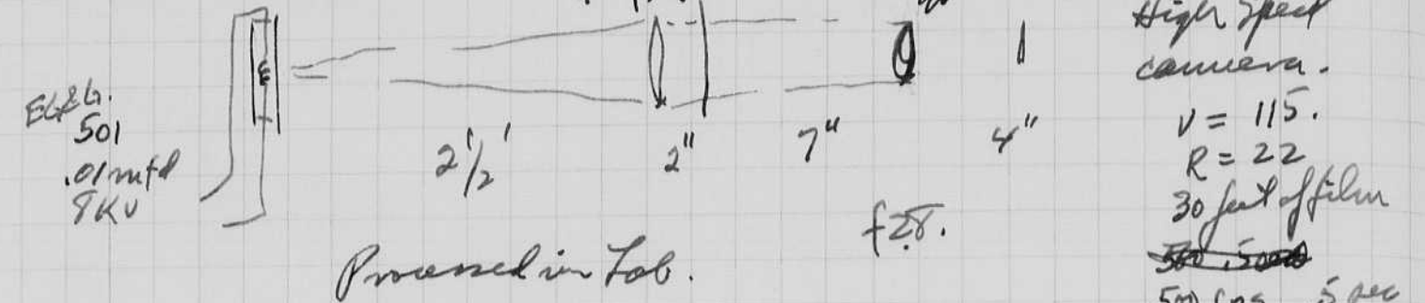
Movies of Calap coexpods? at 1000 fps.

ASA 32 Day.
ASA 25 Arc.

Copepods

Dupont film 914A. 16 mm Filgrain. (# 2706 Emmel).
Dektol 124 ½ min. Exposure Ok.

#1. 500 to 1000 fps. action good but slow.

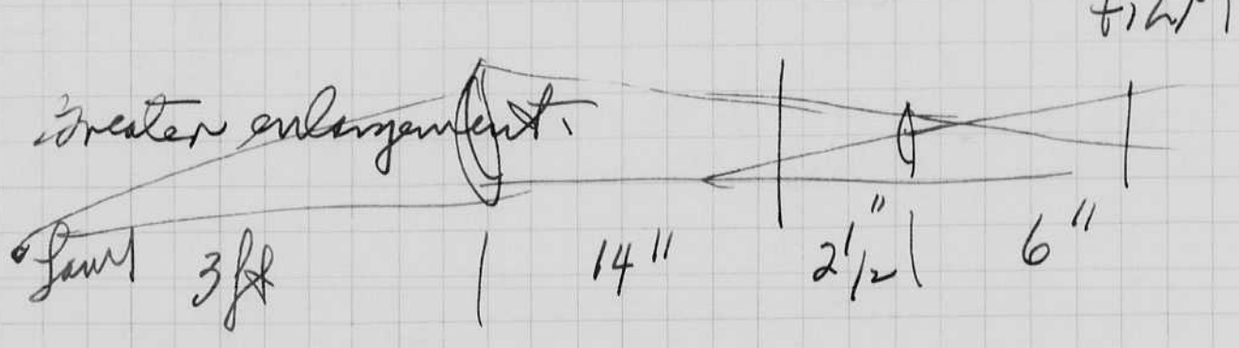


Processed in Lab.

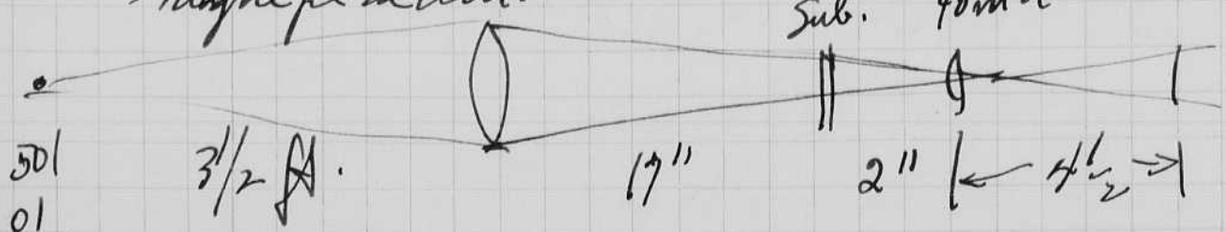
#2 about same as 1 Double light by better focus of condenser

#3. about same as 1 "

#4 Greater enlargement.



#5. 40 mm lens in place of the 2.1/2 for greater magnification.



June 28, 1958.
H. E. Edgerton

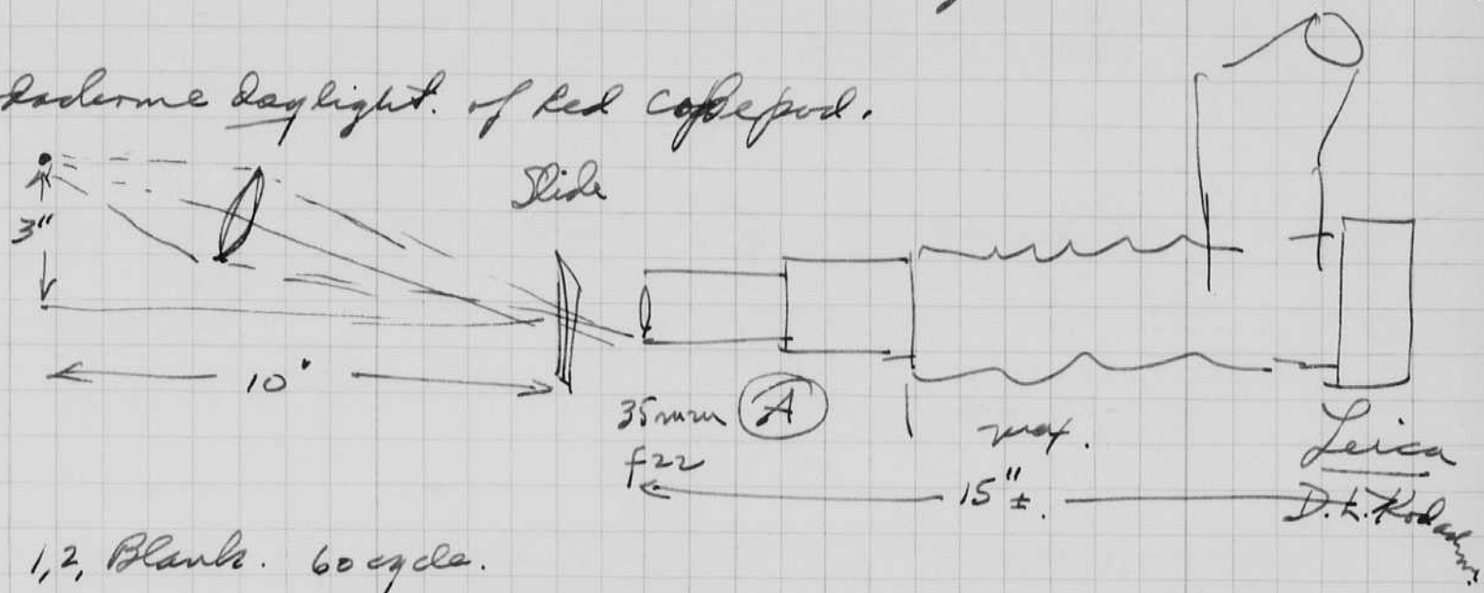
Still Photos of Copepods

Set up first for B&W with Eastman, film no. 5302 fine grain release.

Results tend to be too contrasty. A back lighted at a small angle so that the direct light from the lamp would not be in the field. On some of the photos the edges of the field of the camera was in view. Need more all over exposed.

100 W.S. with max Resistor gave ample exposure.

Kodachrome daylight of red copepod.



1, 2, Blanks. 60 cycle.

3-12 100 WS min. without extension (5")

13-17 " " max

27-30 White field back lighted.

Extension added.

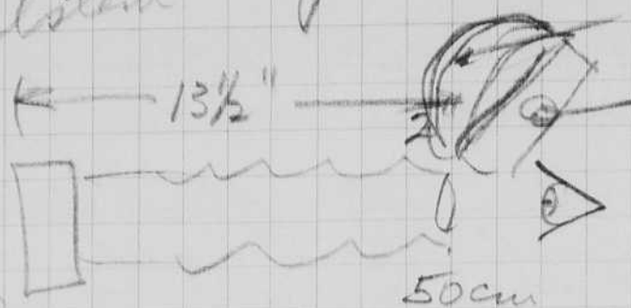
31-36 100 watt sec max.

Titles White paper. 2 f.c. 24 inches.
Dupont 914A film f1.9
8 f.p.s. (D.R. .32 ASA 25 1/16 sec)
Dark exposure.

10

Hand Examples
Dr. P. Kuhlken
Dr. A. Finkelstein

Eye Photos - Jon Ditzel



50cm
f 11-16

Robert B. Brigham
Boston. Mass
Parker Hill Avenue.

Brig
Schaub Leica
1/30 sec.
Plus X film

Blank 2" 50 mm
f 11-16 100 WS max.
f 16
f 22

Black f 8
11
16
22
35 mm
Sync off on 1/30 sec.
5302 film f 22 3 eye photos
f 11
Patrolmen
new film Plus X 35 mm f 8 3 photos each
11
16
22
50 mm 12
22

Sync seems to be ok on 1/40 sec
Mb on 1/30

Roll 5302 film. 1/40 sec.

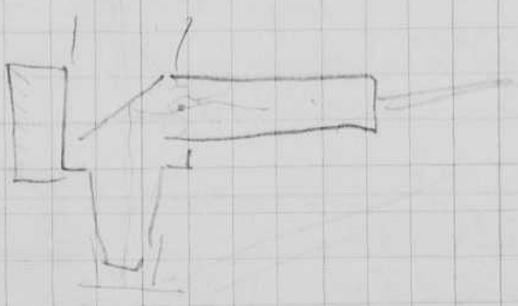
#1 1/30 f12 50mm lens. Hico. 5302 film
1/30 f12 "
1/40 f12 "
1/40 f5.6 "
1/30 f5.6 "

1/30 f8 35mm. Hico. 5302 film.
1/40 f8 "
1/40 f4 "
1/30 f4 "

1/40 f4. 35. 100 W.S. Incandescent max.
f8
f16. General.

Portrait 40mm B&L objective no flash

5302 35mm f8 panel of Mayer Ostorff.



July 4, 1958

Harold Edgerton

Considerable effort has been expended in the past week on eye photography. Dr. Kulka and Dr. A. Finkelstein were here on Monday June 31. We used a 50 mm and a 35 mm Leica lens in an attempt to get photos of the blood vessels in the conjuntiva.

I used the microscope lamp with 100 W.S. into the end on lamp. The image of the lamp was projected into the eye with a lens. Exposures were ok on 5302 film (E.K.) at f 22. and f 16. f 8 depending upon enlargement on the negative. We used the Leica viewer with the bellows so that the lens to film distance was about 25 cm.

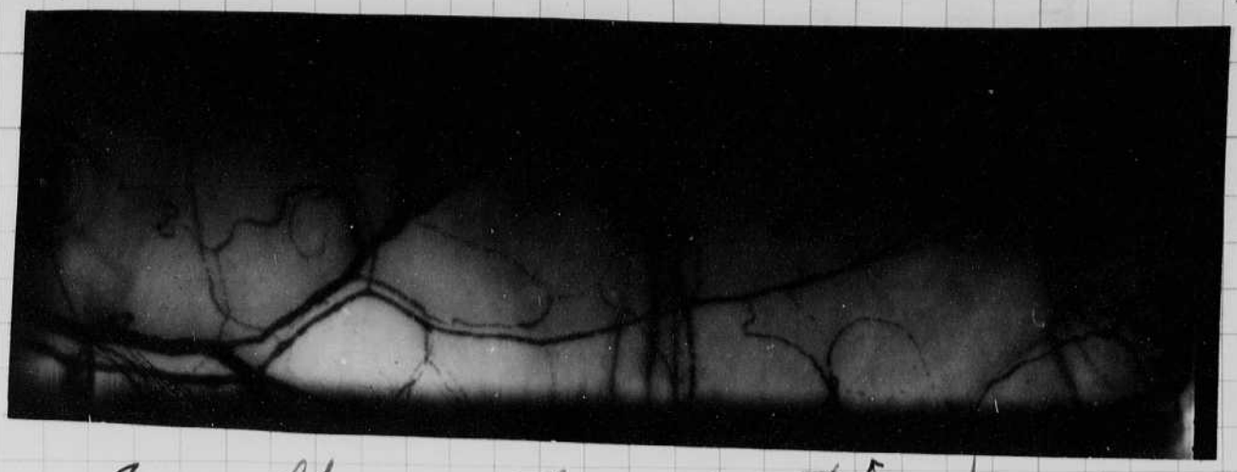
Prof Hardy came over to inspect the arrangements and to discuss impressions. He suggested the Aprochromat lens of 16 mm f.l. I made some tests with a 16 mm B & L lens, not the aprochromat. The subject was a cope pod. The results were very good. much better than with the 35 mm, but the depth of field was very small.

Front light — 16 mm B.&L. Lens. Light Ring of 1 mm I.D. tubing in a 1/2" circle around the lens. 3 mfd at 2 KV with a series Hg tube. 5302 film

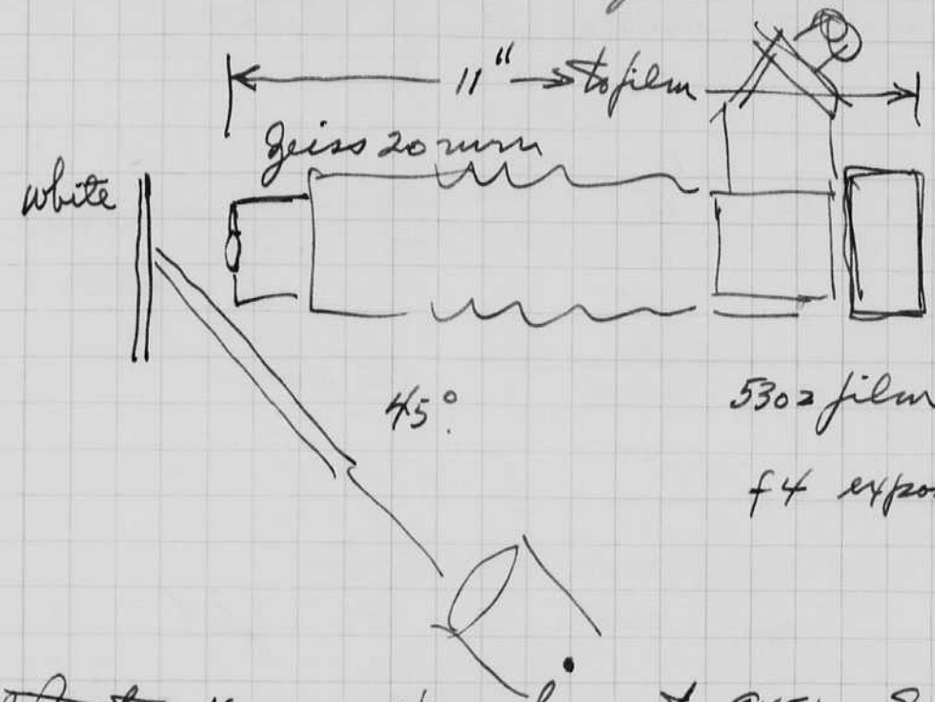
Back light — 16 mm .. .. Microscope illumination about 4 ft back of the subject. 100 W.S. gave ok exposure on 5302 film.

I use 5302 film since I think it has the same effective speed as Kodachrome.

Dr. Kulka Yesterday brought a 16 mm Zeiss Aprochromat # 9451 and a 20 mm Planar 1. 4.5 DRP 92313 Carl Zeiss No 84340.



35 mm lens. Fragment from one of the negatives taken June 31. Kulka has the negatives. note blood particles.



5302 film 7 min in 4:1 Dektol.
f4 exposure ok.

2nd test 16 mm aprochromat 9451. Setup same as above
Front 45° 5-10 100 WS. max. 45°
11-15. 100 WS max.
Back light. 100 WS max
" min.
all overexposed

sige

thin
" ok.

3rd test 16 mm aprochromat Spot from lamp interposed to cut spot.
Back 5-16 100 watt max
5-25 " avg.
27-37 " min

4th 35 mm Elmar at f11 100 WS max. Heavy
100 WS min. thin but ok
f16 100 WS max ok.

12 July 4, 1958
Harold Edgerton

Considerable effort has been expended in the past week on eye photography. Dr. Kulka and Dr. A. Finkelstein were here on Tuesday June 31. We used a 50 mm and a 35 mm Leica lens in an attempt to get photos of the blood vessels in the conjuntiva.

I used the microscope lamp with 100 W.S. into the end of lamp. The image of the lamp was projected into the eye with a lens. Exposures were made on 5302 film (E.K.) at f 22. and f 16. f 8 depending upon enlargement on the negative. We used the Leica viewer with the bellows so that the lens to film distance was about 25 cm.

Prof Hardy came over to inspect the arrangement and to discuss impromptu. He suggested the Aprochromat lens of 16 mm f.l. I made some tests with a 16 mm B & L lens, not the aprochromat. The subject was a copepod. The results were very good, much better than with the 35 mm, but the depth of field was very small.

Front light — 16 mm B.&L. Lens. Light Ring of 1 mm I.D. tubing in a 1/2" circle around the lens. 3 mfd at 2 KV with a series Hg tube. 5302 film

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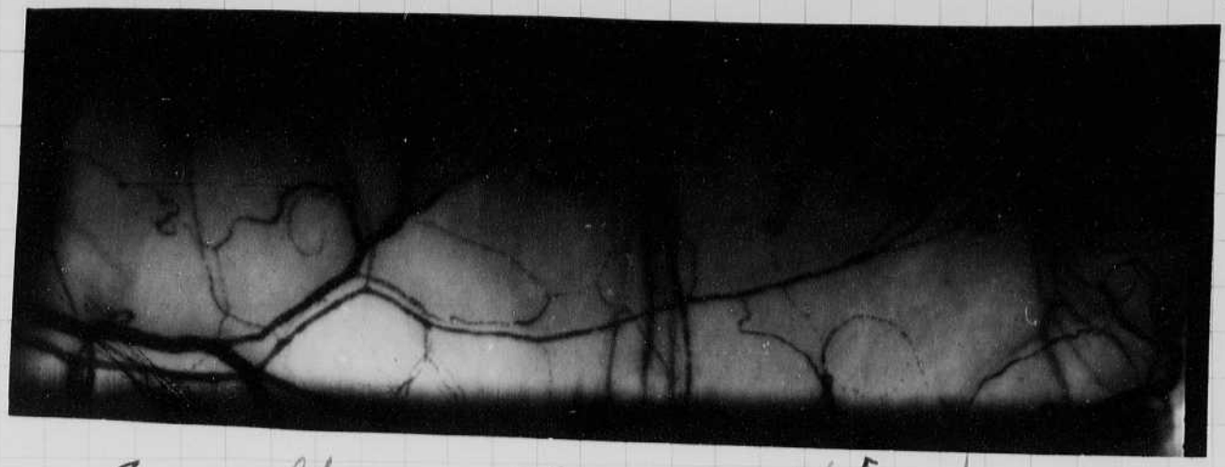
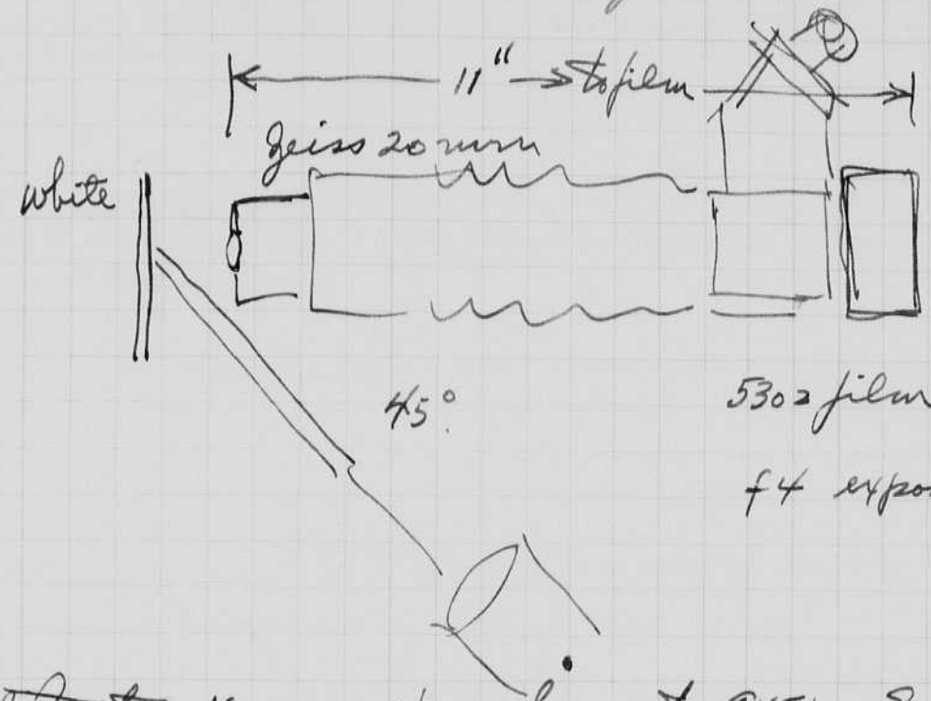


35mm lens. Fragment from one of the negatives taken June 31. Kulka has the negatives. note flood particles.



5302 film 7 min in 4:1 Dektol.

f4 exposure ok.

2nd test 16mm aprochromat 9451. Solution same as above

Front 45°	5-10	100 WS. max.	45°
	11-15.	100 WS max.	
Back light.		100 WS max	

all overexposed

.. min.

size

thin

" ok.

4th test 35 mm Elmar at f11 100 WS max. heavy thin but ok

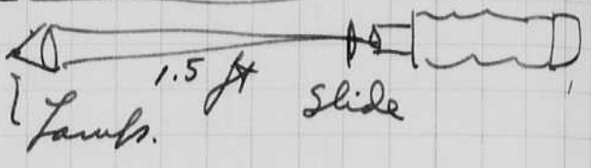
100 WS min.

f16 100 WS max ok.

14 July 4 1958 Kodachrome of mouse ears to show arteries and veins

~~H.E. Edgerton~~
20D10f M.I.T.

Obs	Film no.	Lens	f.	Dist.	W.S.	Rheo.	Remarks.
best	1	35	16	9" =	100	max.	45° Light from L. white paper behind.
↑	2		11	23cm.			
over	3		8				
	4		5,6				
↓	5		4				
best	6		16				
Dark	7		22				
over	8	16mm		10"	100	15 max	Ditto.
↓	9					11	
	10					6	
	11					0 min.	
over	12	16mm		10"	100	15	
↓	13					11	
	14					6	
	15					0	
OK	16	20mm		4	100	max	45° again
OK ~~Dark~~	17			8			
Dark.	18			11			



Red Copepods.

19.	20mm 10"	f 4	100	max	45° light.
	20m 10"	f 4	100	max	Back.
		f 8	100	"	160°? ±

36	10	f 11	100	" 180° Back
37.				

July 8, 1958

Harold E. Edgerton

Sonar & camera

Assembled the deep sea camera which has been used for 1955, 56, 57, summer efforts at deep sea photography, including the Romanche 25,000 foot photos of 56.

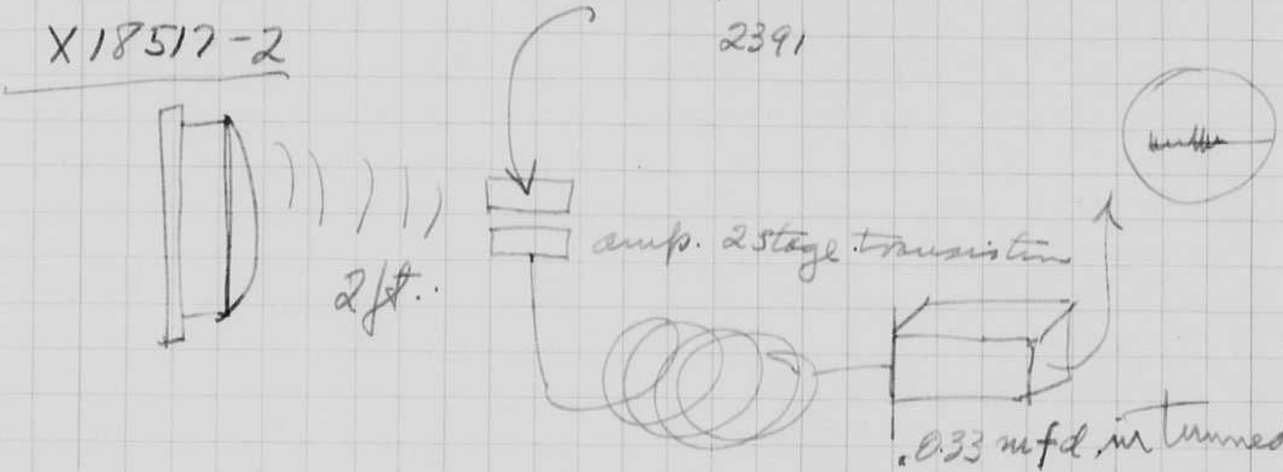
A new coupling transformer was built by Douglas Sinclair. This was mounted on a wood frame to prevent losses from eddy currents.

Details of transformer.

OSC 1

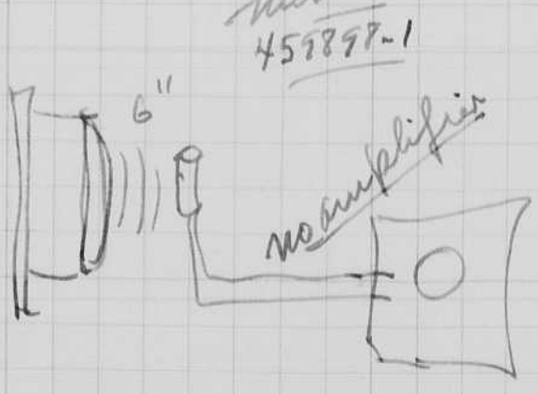
EDO

X18517-2



Each signal triggers the amplifier.

OSC-2.



Notebook # 25

Filming and Separation Record

4 unmounted photograph(s)

____ negative strip(s)

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

was/were filmed where originally located between page 14 and 15.

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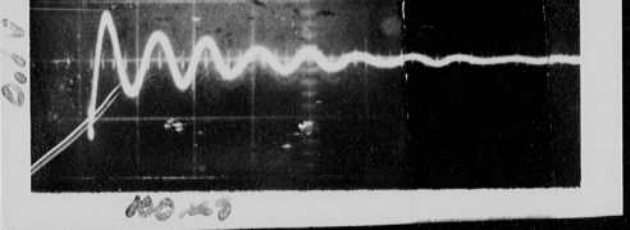
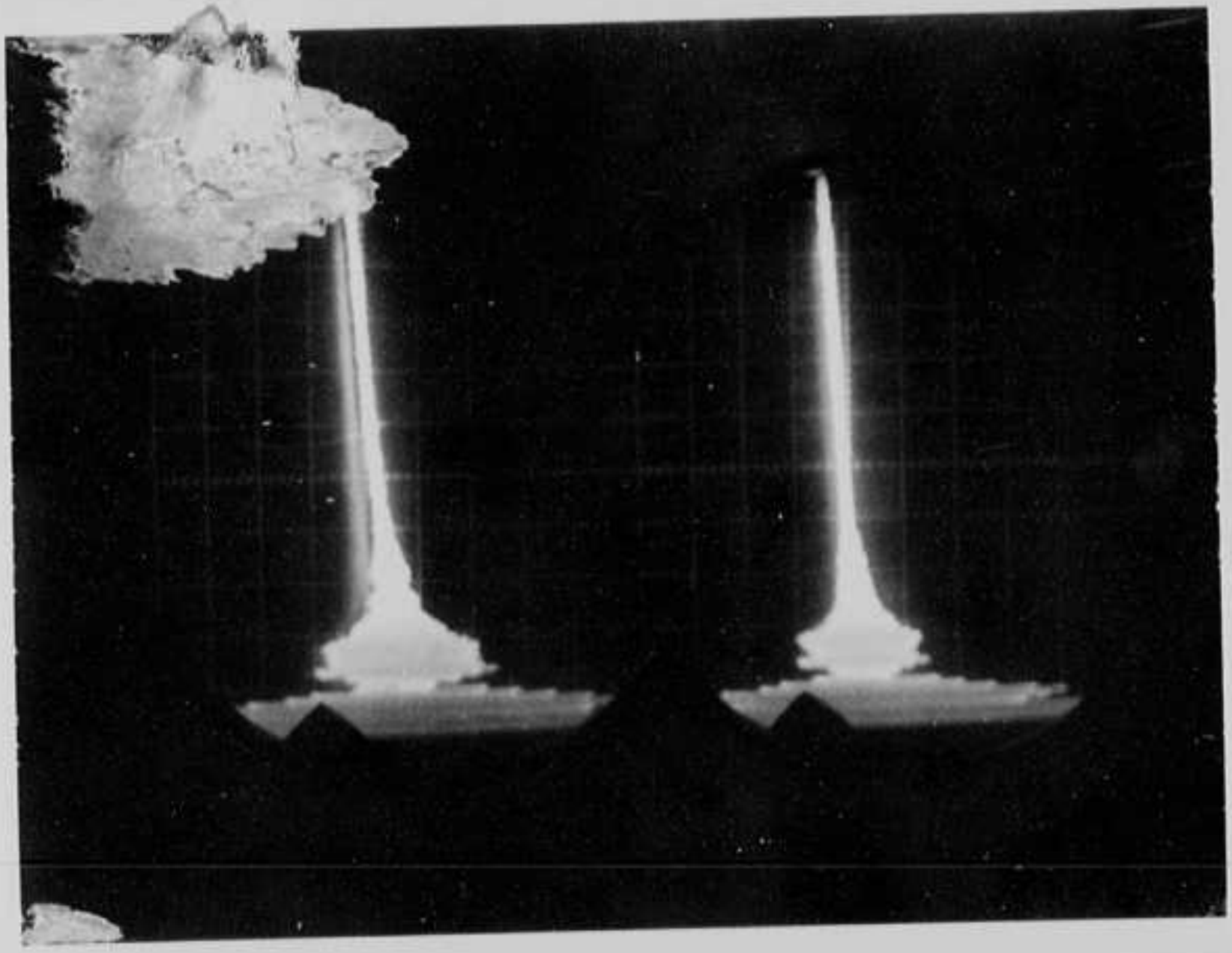
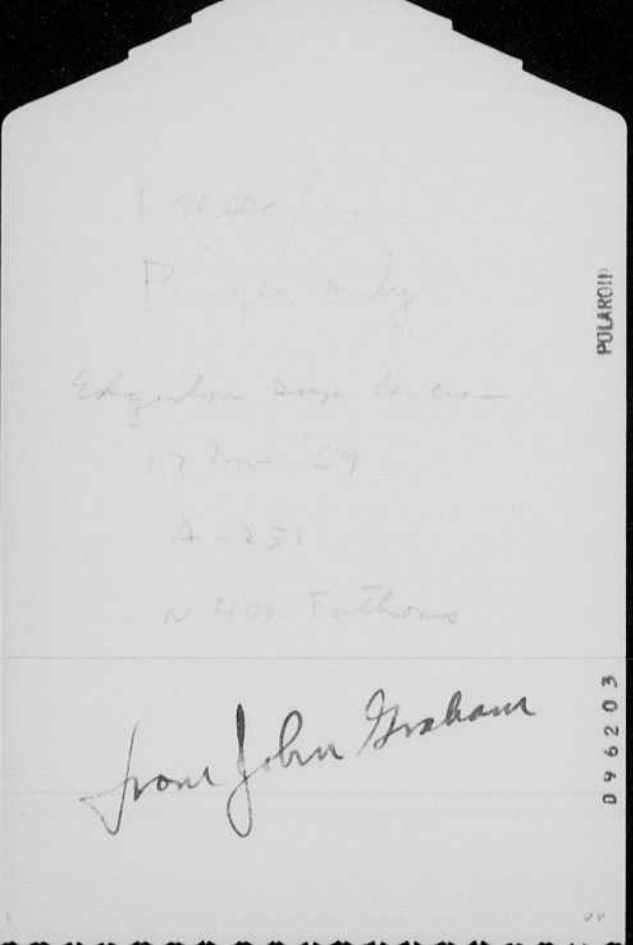
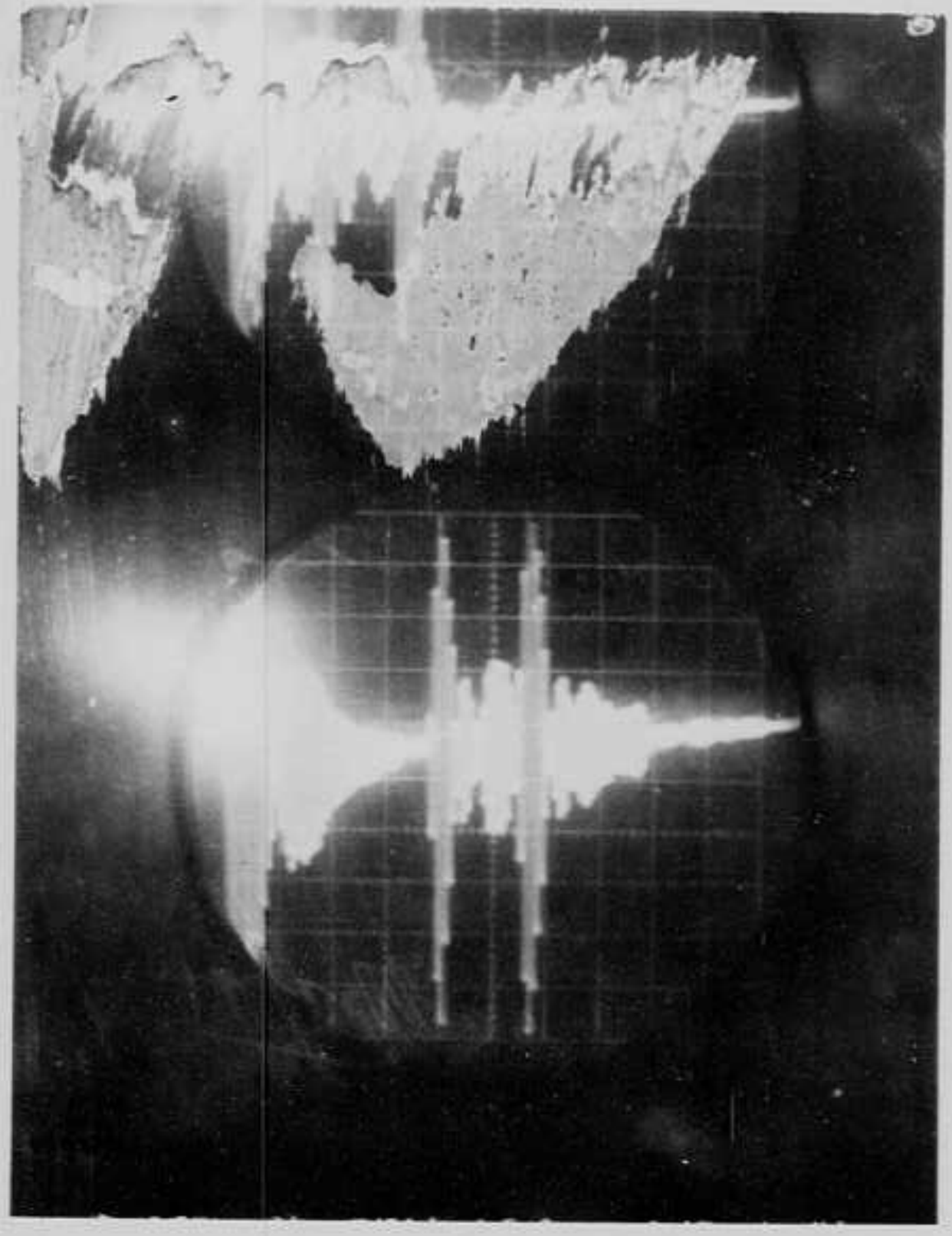


.5 MS/cm. SOLAR




POLAROID
D96203



[illegible]

[illegible]

17 [illegible] 51

[illegible]

[illegible]

POLAROID

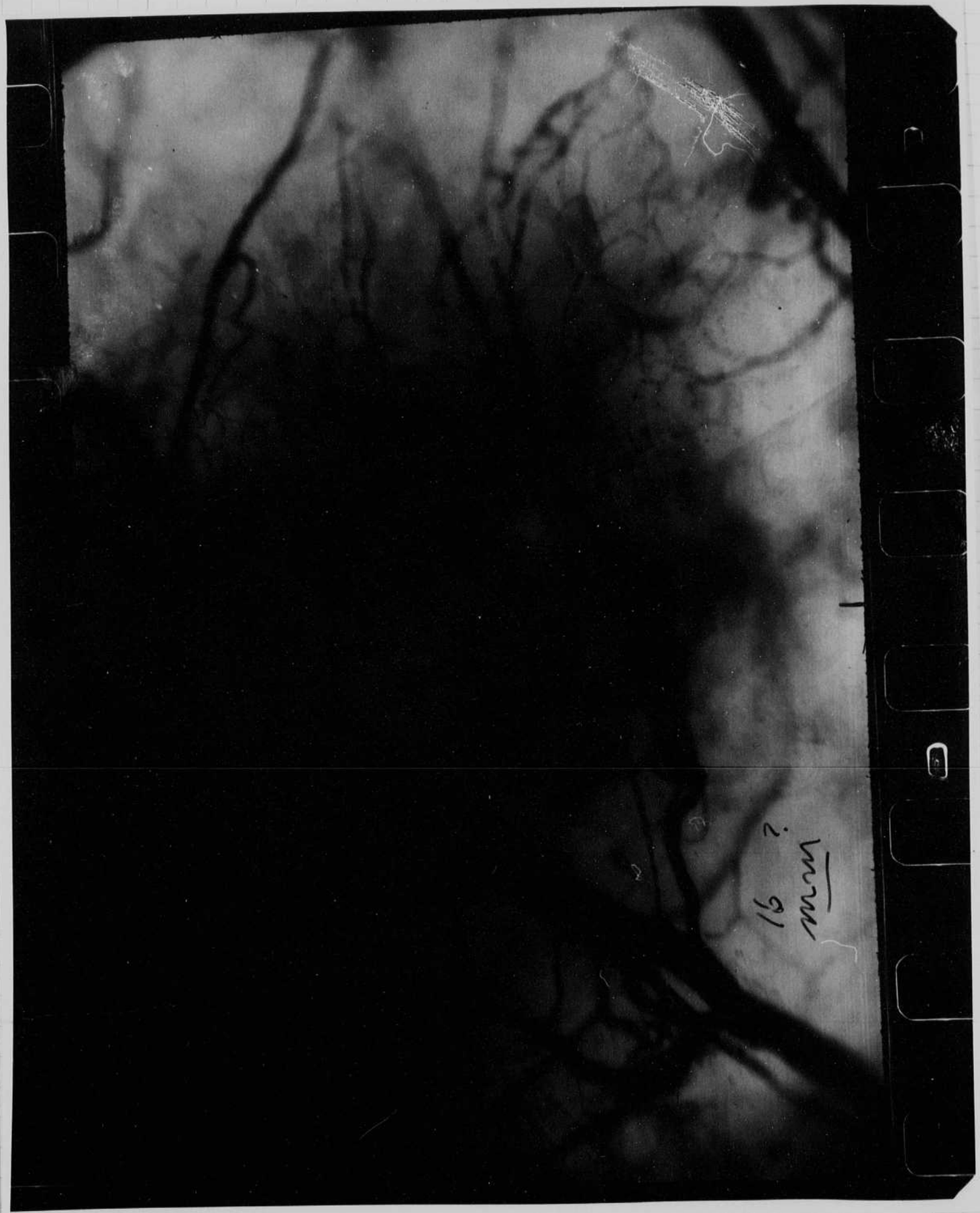
D96203

Anne John Graham

Mouse Ear.

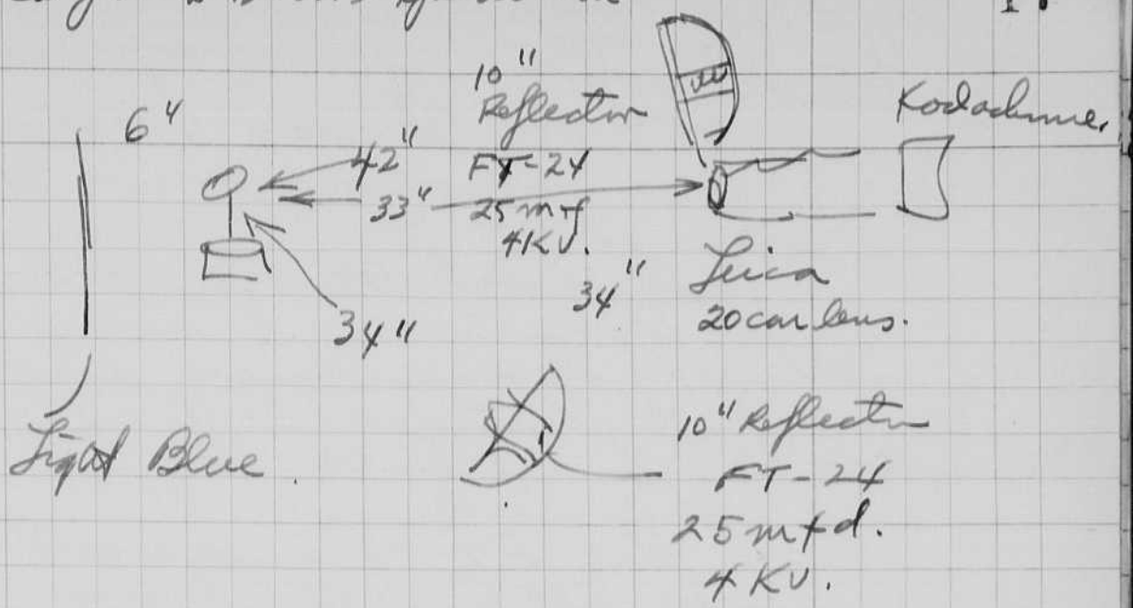
16 mm objective See page 13.

EK 5302 film
100 WS auto
2 cm spot on
the object



Kodachrome tests for X Bird expedition

July 12 1958
XEE.



1. f11
2 16 best.
3 22.

4 11 Both lamps & camera at 40"
5 16
6. 22 Same camera distance. best.

7 11 Lamps at 36" and 15 degrees.
8 16 camera back at 60 inches. best. 5.8 on meter #2
9 22 80 on meter #3.

Output. #3 with 4 mfd 540 BCPS.
#2 " 6 mfd 1440 BCPS.
#2 25 mfd 5760.
#3 25 mfd 5582.

$DA = \sqrt{\frac{6000 \cdot 10}{25}} = 49.$ with one lamp.

July 19 1958
f16 looks fine

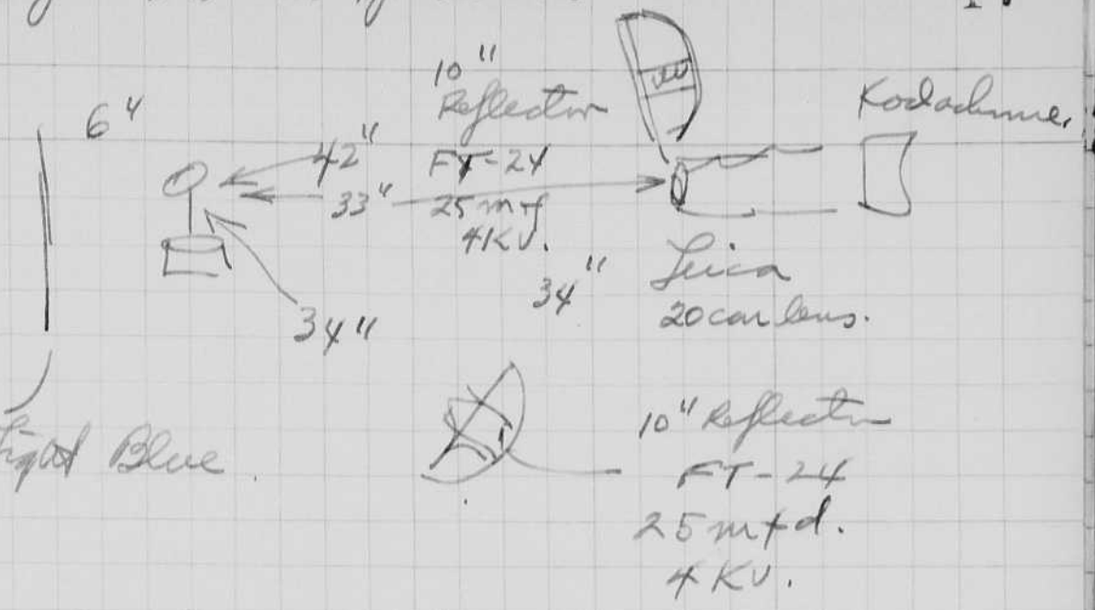
Mouse Ear.

16 mm objective See page 13.

EK 5302 film
100 WS outto
2 cm ~~depth~~ on
the subject

Kodachrome tests for H Bird expedition

July 12 1958
HEE.



1.	f11	best.
2	16	
3	22.	
4	11	Both lamps & camera at 40"
5	16	Same camera distance. best.
6.	22	
7	11	Lamps at 36" and 15 degrees.
8	16	camera back at 60 inches. best.
9	22	

5.8 on meter #2
80 on meter #3.

Output. #3 with 4 mfd 540 BCPS.
#2 . 6 mfd 1440 BCPS.
#2 25 mfd 5760.
#3 25 mfd 5582.

$DA = \sqrt{\frac{60000}{25}} = 49.$ with one lamp.

July 19 1958
f16 video final

July 13, 1958 cont.
Harold Edgerton

Microscope tests by
Thomas Rinaldo. Framingham
1620? Grove St.

He used EK 5302 film as a substitute for Kodachrome. a series of tests with Kodachrome came out ok for exposure but flash was too long for the cilia on some animals.

The FX-19 was used for this test with 525/2 mfd at 900 volts. an end-on tube was used for this test. I used a series resistor of ohms for the minimum light. For this the discharge is longer.

The equipment was used with a filter over the lamp for all test that cut out 0.9 per cent of the light.

Conclusion. (1) Design for shorter flash with 1/10 of the light.
(2) use a B.D.L. lamphouse that can be lined up for the centering.

July 14 1958
Harold Edgerton Camera tests in the Pool.

Sonar #2 in 1956 "Romanche" camera.
Face towards mike
Camera hung from the "high" diving board.
1½ sec between pings.

4 volts p to p from mike at opposite end of pool.
Elenco mike in thru 2 stage transistor amplifier into tektronic scope. Voltage at scope terminals.

The camera ~~with~~ was then turned 180° with the face towards the east wall of the pool.

Osc.

1 c
~~2V~~ 20 ms
0.1V

1 b
~~2V~~ 10 ms
1V

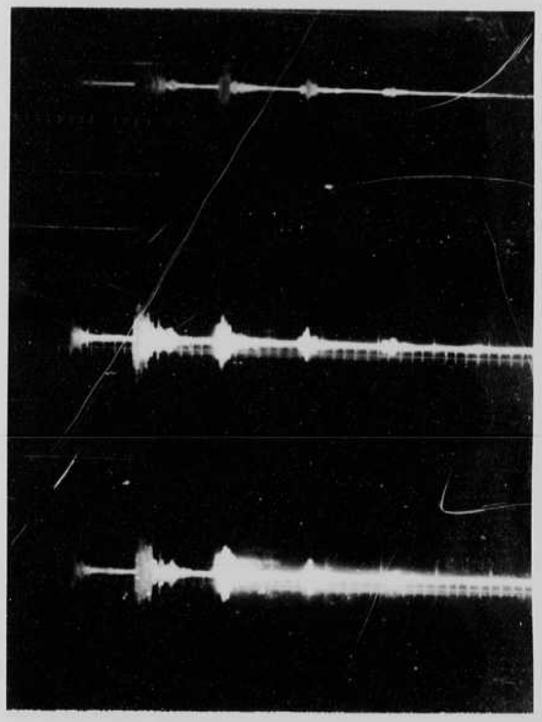
1 a
2V 10 ms.

4 volts signal.

2c
1V 20 ms

2b
1V 20 ms

2a
1V 20 ms



July 13, 1958 cont.
Harold Edgerton

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Osc.

1 c
~~2V~~ 20 ms
0.1V

1 b
~~2V~~ 10 ms
1V

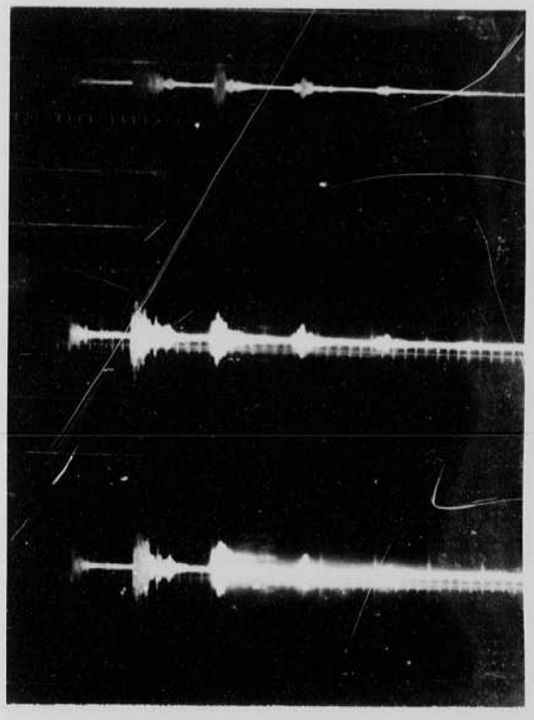
1 a
2V 10 ms.

4 volts signal.

2c
1V 20 ms

2b
1V 20 ms

2a
1V 20 ms



20 July 15, 1958

Frog Tongue. Eyp. tests.

J.H. Fulton.

Leno 24 mm. Leitz.

J.D. Fuller

5302

6	24mm	12	100 WS	
7	"	"	"	
8	"	closed?	"	
10	24mm	2	"	
11		6	"	
12		12	"	
13		12	200 W.S.	✓
14		12	300	
15.	20mm	f4 open	100 W.S.	
16		f11	100	
17		f16	200.	
18		11	200 new field.	
19		16	200	
20		16	300.	
21	24mm	12 (not f)	200	over exp.
22				
23				
24				
25	24mm	12	200	new field
26		6		
27		12	100	Eyepiece + field
28			"	
29			"	
30		6	"	

These numbers are not ⇒
aperture.
2 means f 11 ?
6 " f 16 ?
12 " f 22 ?
a guess

Exposure o/k.

5302 film.
5 mm 1.2 Daylight
Exposure fine.

Fade chamber.

17.	daylight	Blank Reflex			
18 19	24mm	12	200	W.S. 1/100 sec.	
20	"	"	100	" "	
21	"	6	"		
21	20	16	200		11 X
22	20	16	200	unit size.	20 OK
23	20	16	200	" " new field	21 too small
24	20	11	200	" "	22 - OK
25	24	12 (not 5)	100	" " daylight (only 3.5 inches)	23 OK
27-26	24	12	100	" " change focus	24 5 OK

Cold water

24mm stop

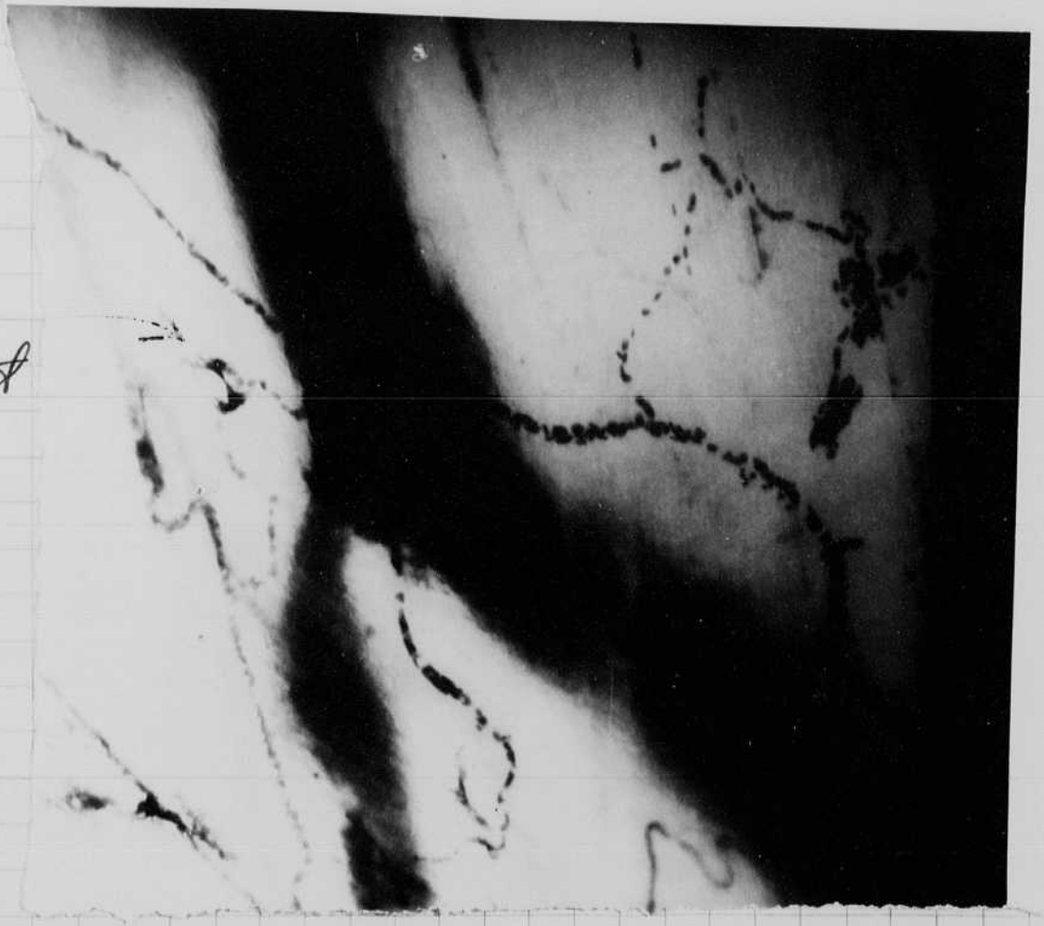
19	11	12	100	frog
21	11	12	100	
24	11	12	200	
25	"	"	200	
23	11	12	100	eye
29			100	
35	24mm	12	100	Mechanics eye.
4			200	
10			200	
21	24	water	100 max	frog
22	4	Hobbs	200	frog
23	4	"	100 min	frog
		10 bath		

Long vessel

26 Exp ok 100 W.S.
27
28 Eye over with 200

28 } Exposure
30 } Surgical.
31
32
33 ok but over.
34 over
35 ok exposure.

Enlargement from Sparrow 13 p 20



Pigment

Note blood corpuscles of frog tongue.

20 July 15/1958 Frog Tongue. Exp. tests.

Leica 24mm. Leitz.

6	24mm open	100 ws spot.		
7	" "	"		
8	" closed	"		
10	24mm	"		
11	6	"		
12	12	"		
13	12	200 ws. ✓		
14	12	300		
15.	20mm	100 ws.		
16	f11	100		
17	f16	200.		
18	11	200 more field.		
19	16	200		
20	16	300.		
21	24mm	12 (20 f)	200	over exp.
22				
23				
24				
25	24	12	200	
26	6			
27	12	200		
28	"	"		
29	"	"		
30	6	"		

These numbers are not operative.
2 means f 11 ?
6 " f 16 ?
12 " f 22 ?
all wrong

Exposure 0/2.

5302 f16 5mm 1:2 Exposure fine.

Vaseline.

17.	Blank Reel			
18 19	24mm	12	200	106 Vaseline.
20	"	"	100	
21	"	6	"	
21	20	16	200	11 X
22	20	16	200	20 OK
23	20	16	200	21 over
24	20	11	200	22 - OK
25	24	12 (6 + 5)	1 ∞	Light reading 3.5 inches 23 OK
27-26	24	12	1 ∞	Change focus 24 & 5 OK

Colon

water

24mm stop

11 12 100
11 12 100
11 12 200
" " 200
11 12 100
100
24mm 12 100
240
200
1000 max
200
100 min

frog

eye

mechanical eye.

frog
frog
frog

26 Exp 8K 100 W3.
27
28

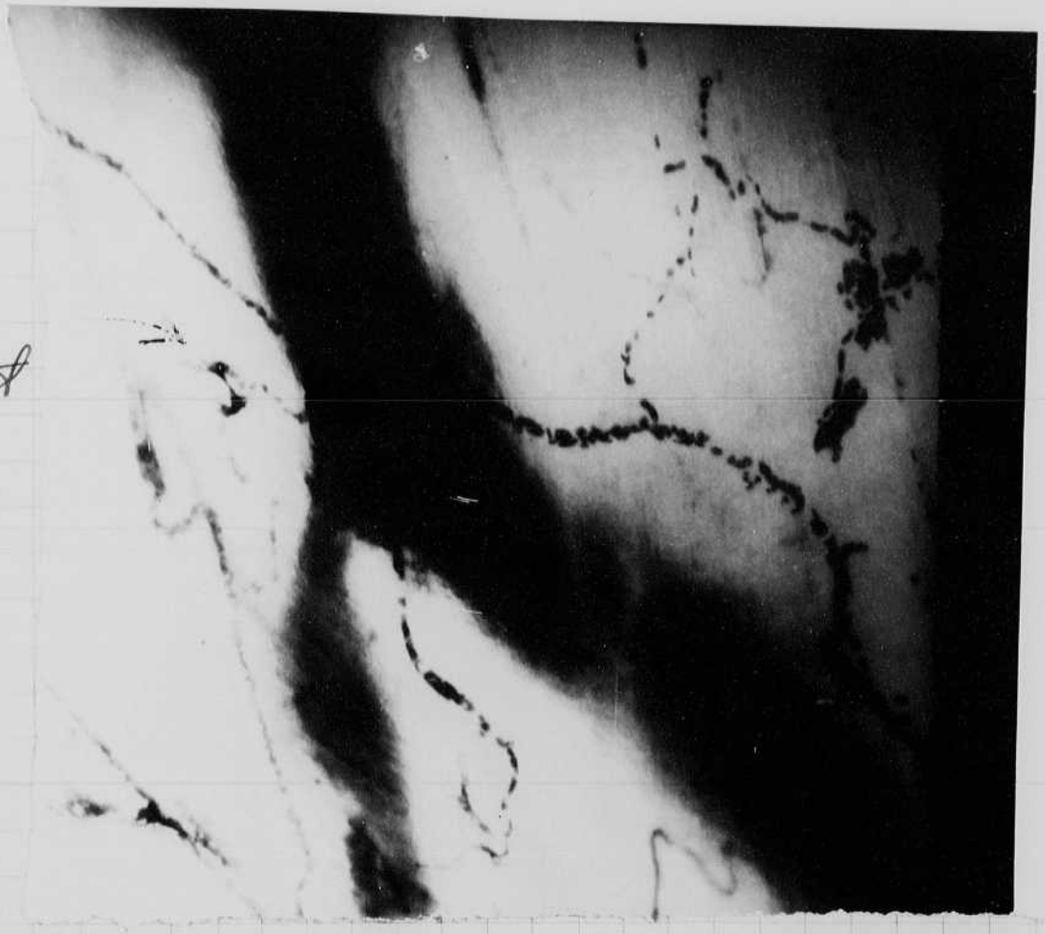
29
30
31
32
33
34
35

Exposure tongue.

OK but over
over
all exposure.

Sarcolemma

Enlargement from
Plate 13 D 20



Pigment

Note blood corpuscles of frog tongue.

Monel Case Design.

USN Monel 400 foot depth 20 sec.

An 8" Sch 40 pipe slimmed to it.

8.625
7.981 .322 wall t/d = .04

Power unit 6" 6.625
6.065 0.28 wall t/d = .047

Shaughnessy

Norma
31 Smith
VN4 14 31
McFa.
Skidpan
and
pod

For 8" pipe curves show 2800 p.s.i. collapse pressure

Safe depth = 2800 feet. factor 2.2

6" pipe curves show 3500 p.s.i.

End plate for 3000 p.s.i. 17-4 ph steel.

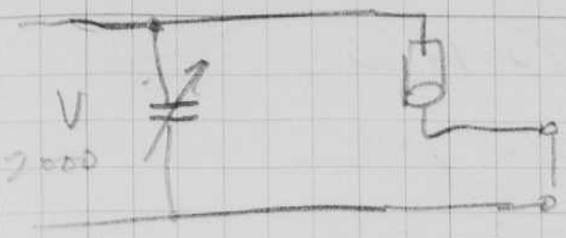
t/d = .06 d = 8 t = .06 x 8 = 0.48 ½ inch

8" Schedule 80 8.625 .5" wall
7.625 .5/8 = .0625

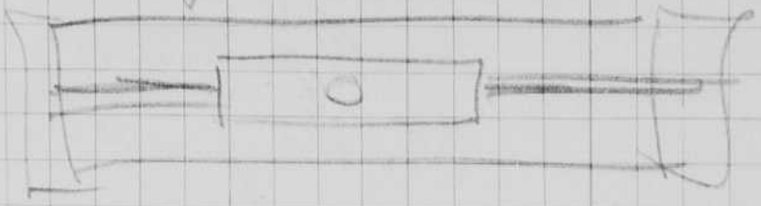
3:1 curves show 4000 p.s.i.
or 4000 feet 2.2 factor

17-4 ph end plate .09 = t/d
t = .09 x 8 = .72"

Lamp tests.



Xenon gap tube
from Tuttle EG&G.



1/4 .25 .25 mfd
.50 .75
1.0 1.75
2.0 3.75
4.0 7.75

1/2" 4mm I.D Xenon tube

.25
.75
1.75
3.75
7.75

FX-1 2000V 1
10
100 mf.

1/10,000 sec exposure

0 .3 .6 .9 1.2 1.5 1.8 0 1. 2. 3 2 1 0
KT Graded Strip. Left.

F35. mm lens mag 3±?
10 min in DK50 all over exposed. f22 5302 EK
use filter next time. felen

#8 Dyn cap photos Dupont
made last week.

Leader particle	9830 ft/sec
Small particles	7600 ft/sec
Shade front.	2500 ft/sec.

Hummingbird photos made in Holderness N.H.
~~[illegible]~~ Monday (yesterday) Bob and
Lizanne over from West Bridgewater, Vt.

$4.1 \text{ cm} \times \left(\frac{5}{6.6}\right) \text{cm} = 3.11 \text{ cm in 10 ms.}$
$= 3.110^{00} \text{ cm/sec}$
$= 3110 \text{ meters/sec.}$
$= 9800 \text{ ft/sec.}$

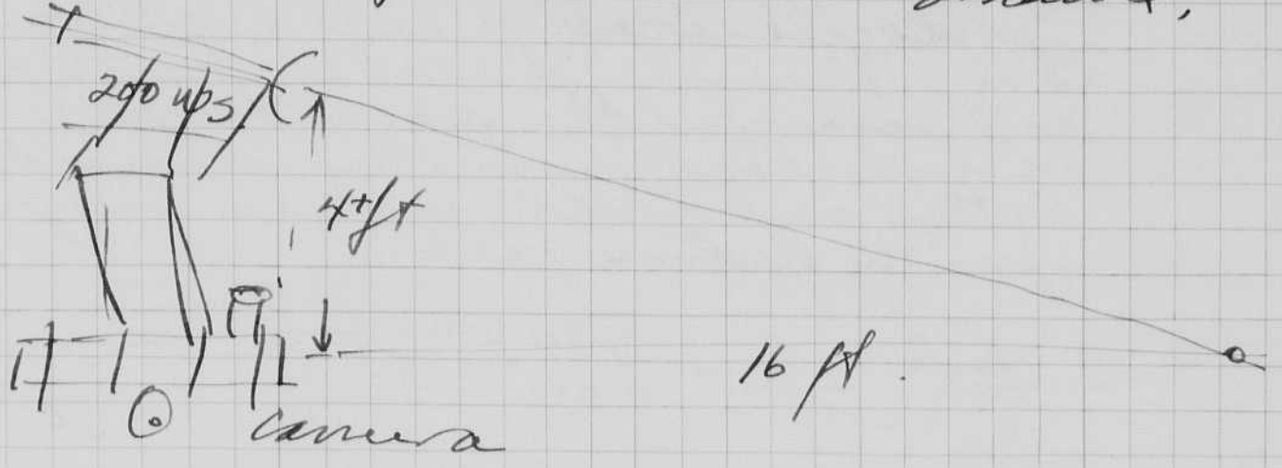
$23\text{g.} = \frac{5}{6.6} \times \frac{1}{3.1} \times 10^5 = \text{ft/sec}$

3.6 cm	8600 ft/sec
3.1	7400
2.5	6000
2.3	5500

July 21 Esther & I met Bob and Liz Lowe at Holderness N.H. at the Lawrence Webster home. Our objective was to take N bird photos.

July 24, 1958.
Harold Edgerton. Tests of camera. Underwater

Lamp focused at 16 ft.
20" spacers increase lamp-camera distance.



Photos at f 4.5
Tri-X film 8 min DK 50 show end of pool faintly.
Photos at 15 and 20 feet over exposed on a person in water.
Looks good for the remote photo.

Notebook # 25

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 24 and 25.

Item(s) now housed in accompanying folder.

F81163

July 21, 1958

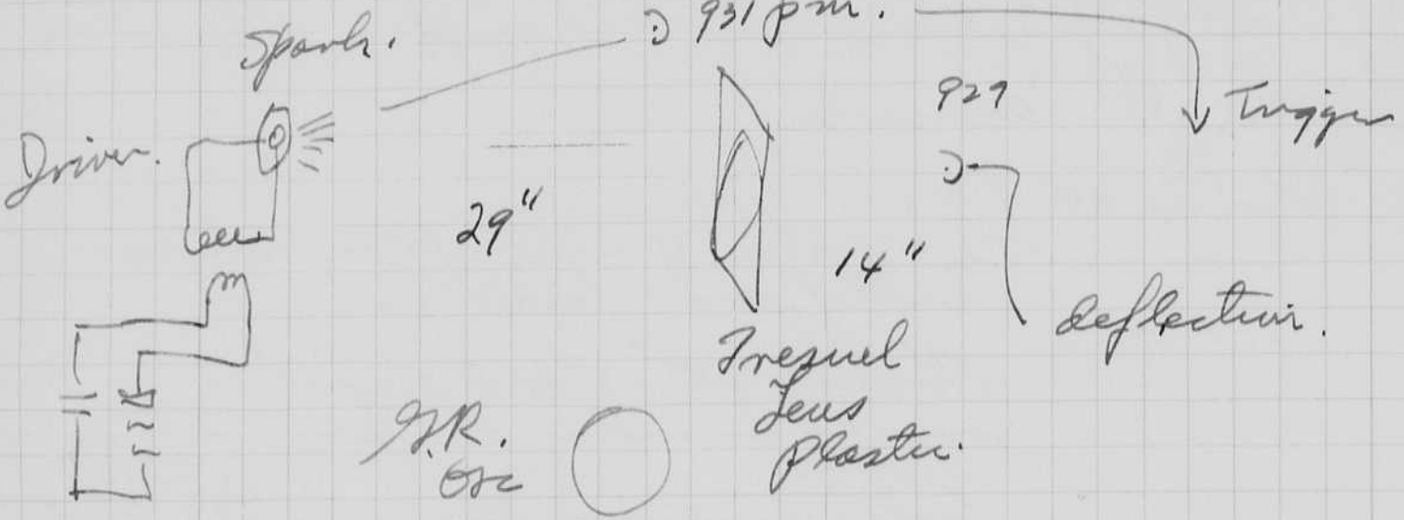
Holderness

N. H.

July 25 1958

Harold Edgerton. Short Flash Lamps.

I have had difficulty in triggering the #426. scope with voltage or ~~light~~ into a photocell. Now I have a photomultiplier tube. However I need a positive surge! So I reversed the ground lead! a 100 ohm load resistor allowed me to do this and avoid pickups trigging from the electric fields.



			H	F	I	Sweep Stab	Sympan
Osc. No. 1. 167 Mcf	100 mc. Pos 4 Spark. Pos 5.5 Sweep speed 4	20 KV	3.5	4.3	6.6	7	9.5
Osc #2 Sweep 4 Spark 4 167 Mcf	100 mc. Pos 4. 5.5	20 KV	4.3 4.3	5.5 5.5	9 9.2	5.2 6.0	
Osc #3. 4 Light 4	100 mc. Pos 4.5 5.5	20 KV	4.3	5.5	9.5	6.	

Excellent. more timing room closer. Trig 4.5

Sync heavy.

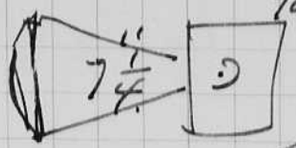
Sync Heavy

Osc #4.

V

6
5.7
5.3
5.

29"



929.

Timing ok

167 MC.

No deflections ?!!

M6

Timing 4
100 mcs.

Osc #5. 6
6.7
5.3
5

Repeat but with "1.5 mA on Photomultiplier tube

Signals ok.

No timing

4 100 mcs timing. Did not record

~~.02~~ 2 mfd. capacitor in Glass Bottle airfilled

Osc #6, Sweep Spect C.D.R. Servo stab V H Foc Int

osc.	4	HI	9.5	6	5	3	4.5	5.6
Timing	100 MC 4				4			

Osc #7

	4	5
Repeat	4	4

#4 & 5.
#16 Junct
#15 to Lens.

Oct 8. 1/8" gab.

16" to Seus

16 1 on 1 4
mf 2 4
3 4

oxygen 4 4
fuel 5 4
tank 6 4 gas trace.
7 4 100 mc timing mark

Osc # 9 5,5 } 28"
340 ~~360~~ mf 5. } three flashes
28" Air 4,1 }
3.5 timing 100 mc.

Osc # 10 5,5 } 28"
340 ~~360~~ mf 5,0 } oxygen 3 tests
oxygen 4,1 }
3,5 100 mc timing

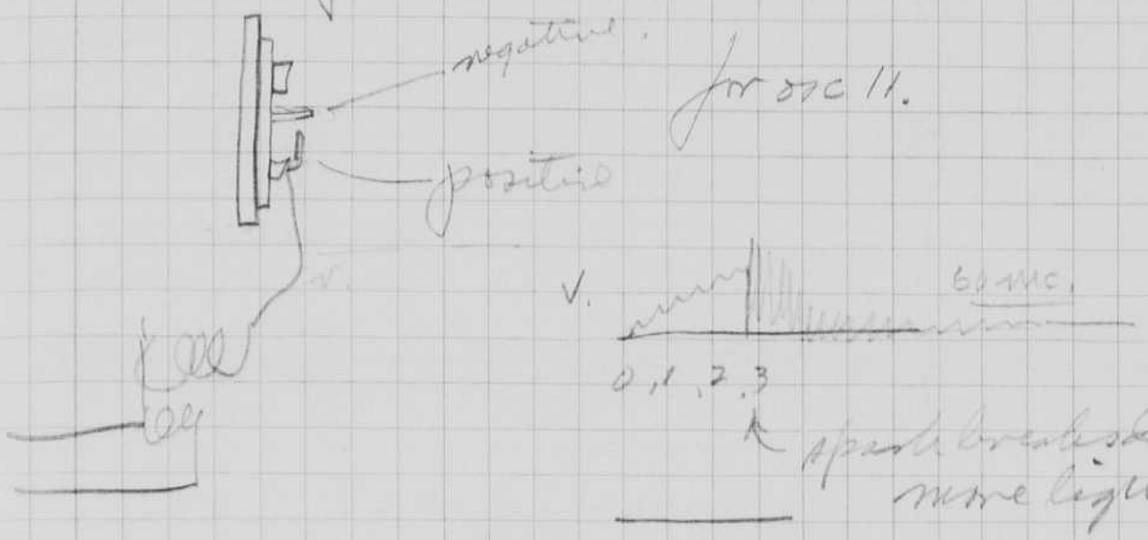
Actual 340 ~
mf
measured

Argon was now introduced into the tube. The light decreased, during about the same. Then light became very small and ~~a~~ moving over the surface of the mica, not in the gap. Also noticed corona in the tube. Very interesting!

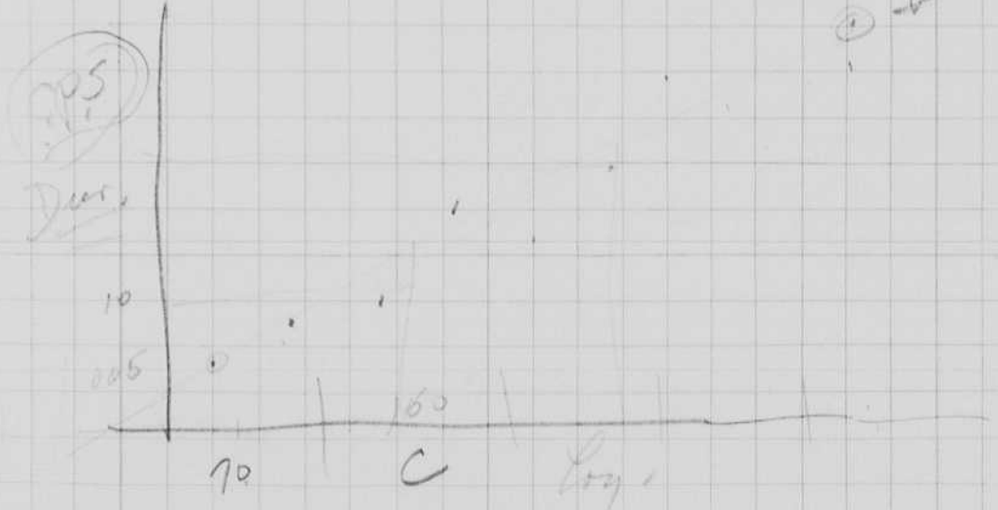
July 28, 1958.
H. E. Edgerton

#100
EG&G 3440
with transformer.

	Cap.	grp.	Dist.	Sweep	H. V	Sens	Stab	focus	Int	FV.
11	70 μμf	1/8"	19"	trans	4	3	5.5	9.5	2.5	2.2	5.1	20
	100 mc. Tuning						5					



Spacing leads interchanged less light when ~~tower terminals~~ ?



7/30/58

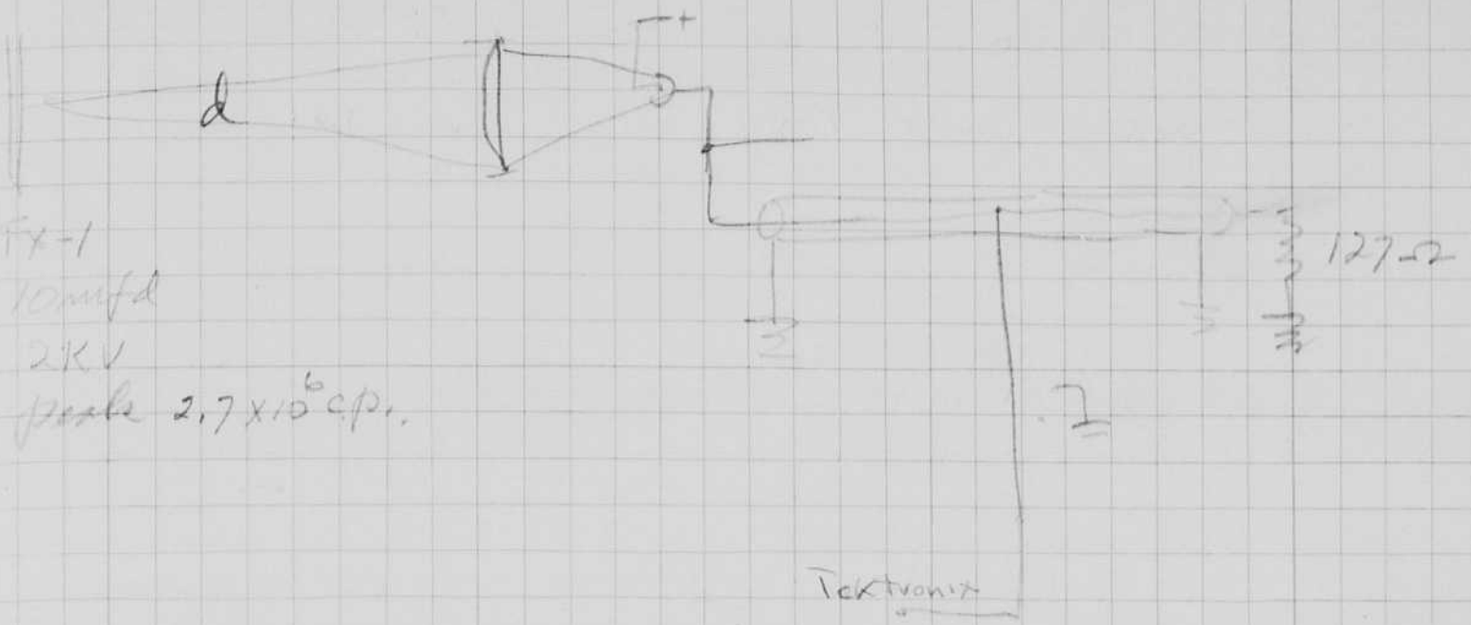
#12	167	1/8	19" Trans.		6 (timing) 5.5 (pulse)
#13	167	1/8	38" trans		6 5.5
#14	340	1/8	38" trans		5.5 5
#15	580?	3/16	38" Trans		5.5 5

7/31/88 VDS

#16	580	3/16	76"	trans	5½ 5
#17	Double Flash		38"	10 megacycle timing	trans
#18	"		19"	"	"
#19	"		19"	"	no trans.
#20a,b,c	"		19"	"	trans, no trans, timing all in one picture
[illegible]	"		19"	"	no trans (rep [illegible] #19

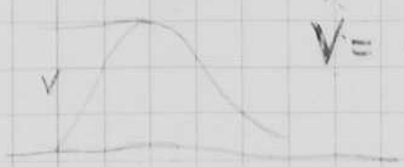
#12 See p 32

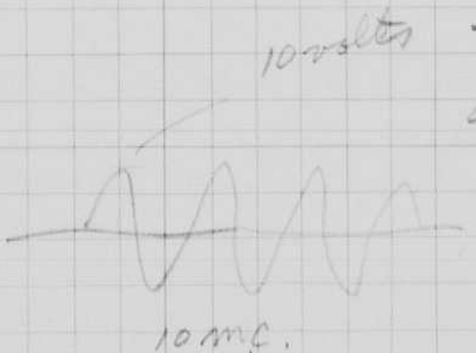
Calibration



c.p. =

$V = \left(\frac{c.p.}{d^2}\right)[\text{assembly}] = IR$





def = kV

=

Procedure:

1. Flash FX-1 at photopickup and measure volts on tektronix
2. Measure oscillator voltage on ~~tektronix~~ GR VTVM and measure deflection on EEG scope.

CALIBRATION

1 Aug 1958
DLS

FX-1 ALL BUT 2.4" COVERED 76" AWAY — PHOTO pickup GIVES 10 V. pulse across 118 ohms

osc # 22
1 (rms) = 2.82 v(pp)
1 volt 10 megacycle wave (measured on GR 1600-A VTVM RLE #836-831)

FX-1 → 10^6 cp (10 μf 2000 v covered as above)

10^6 cp. → 10 v.

presumably 10^5 cp → 1 v at 76"

and 10^5 cp → 4 v at 38" (10^4 cp → .4 v)

and 10^5 cp → 16 v at 19" (10^4 cp = 1.6 v)

Freq 2 Calibration.
FX-21 tube with .07 mfd at 2 KV±. Bare.
Peak light = 0.3×10^6 c.p. (compared to FX-1 with 10 mfd at 2 KV).

osc # 23

10 mc timing wave on Sweep 2 Intensity 4.
Lamp FX-21 at 19 x 3½ inches " " " "
.167 mf at 19" " (3.) " 5?

note that last photo is on different Sweep.

24. Ditto 23 except ~~4~~ Both light curves on sweep 2
10 mc timing wave.
Intensity 4.2 2.6.

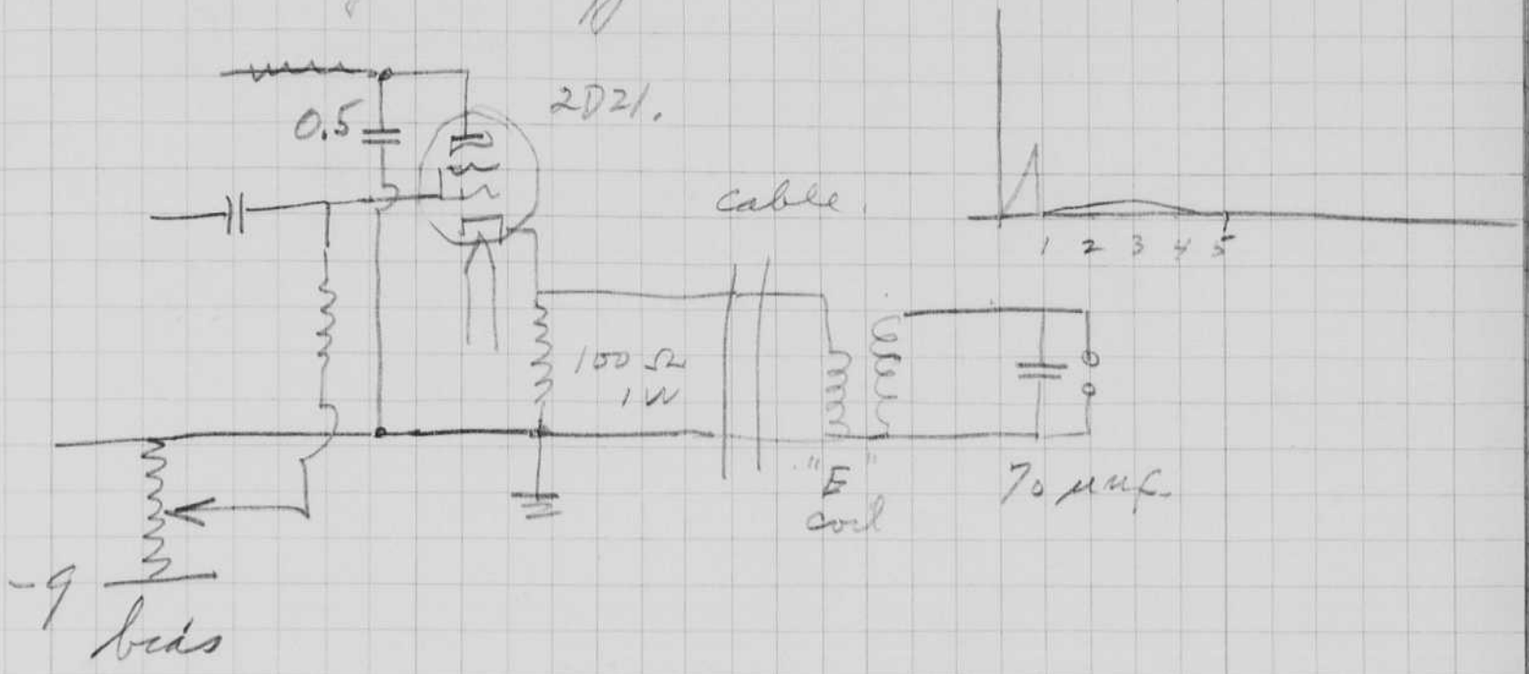
Aug 2 1958

Small spark gap lamp

Harold Edgerton

a driver for the 70 mmf spark source was tried as follows,

Multiflash trigger circuit



Delay 0.7 μs. ± .025 μs. jitter.

$\frac{300,000 \text{ CP}}{\text{def \#1}} = \frac{X \times 9}{\text{def \#2}}$

$X = \frac{300,000}{\text{CP}} \frac{\text{def 2}}{\text{def 1.}} = 33,333 \frac{8}{4.7}$

1600 p.c.p.

Cap. μμf	Dep mμf	Peak CP.	cps ×10⁻⁶
70 μμf	10	2600	26
167	15	11700	175
362 (340)	25	22,500	1800
580	45	82500	3700
Double flash. 5,000.	150	17,500	2600
Spark. 4500 V	100,000	300	450,000	120,000

Db
120 cycles

5/V. db?

105 (95) – 250 dynes/sq cm microbars

83

-6 db / 2 mb dist.

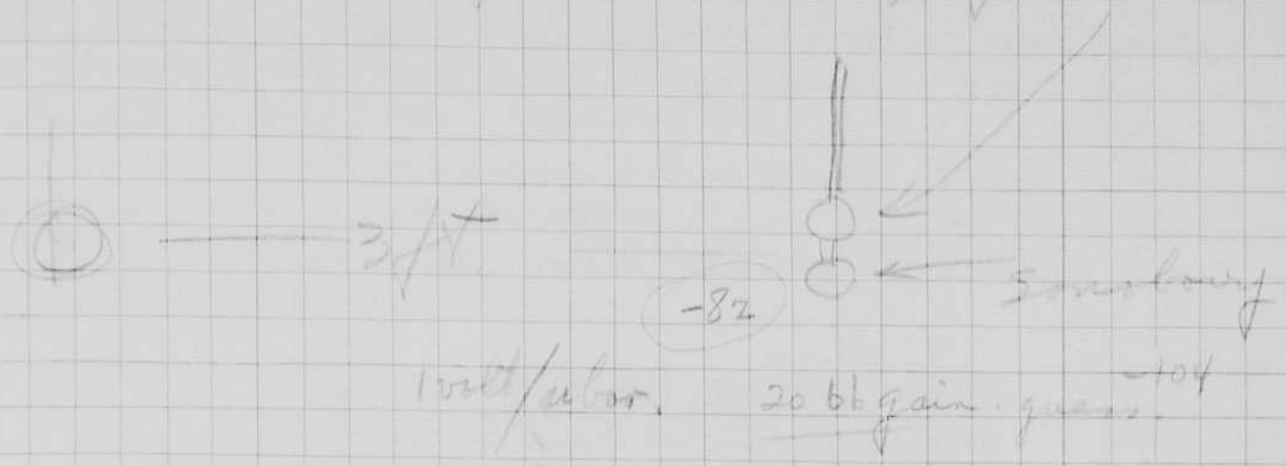
5 ft	+8½ db.	75 mv.
50	+63	
500	+42	
5000	+23	
50.000	+3 db.	

83

+3 db

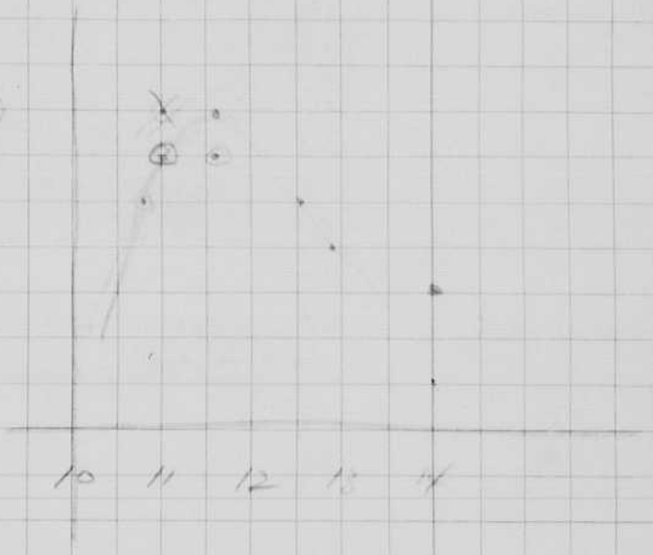
ADP Hydrophone AN/PQM-1A noise measurement.

Mike test. Sonar probe 2 stage c/f transistors



75 μ volts per μ bar at (11.6 peak)

10	
10	-X -1
11.6	0
12	-1
13	
14	
12.5	-2
12.5	-3
14	-4
10.5	-2
10	-9



also, 100 ft. +3 db 250 μ v. 20 db.
(75 μ v per 0 db)

Note add 3 db to above.

XXX.1 mu at 0 db

36 Oct 5 1956 8

Move from 20D-102 to H-405 was made in Sept 1958

Harold Edgerton.

Left Sept 1 Boston to nice France P.A.A.
arr. Sept 2 nice met by Constean Hotel Bristol Monaco.
Monte Carlo.

" 3 Equipment arrived.
4 " unpacked
5 ~~Cofaskor~~ "Jutin" nice.
6 "
Sunday. 7. Paris
8 Victor Emile Zeze
9. "Minneretta Singer"
10
11 5pm for Geneva.
12 at Geneva "Russell"
13 Swiss Glaser Nice - Lutin
Dimanche 14
15.
16 Calypso and Sled. nice
17
18. Two 400 foot reels.
19. Seeban shooting movies Towed camera
20
Dimanche 21. Leave for Köln Allemagne
22 Int. Cong. High Speed.
23
24.
25.
26.
27. Photokina. Leave Duesseldorf P.A.A. flight 9.
28 Boston.

Weinberger

Cont. Photos were made this aft. at Bell Branch Norman Cambridge Mass for Dennis Noiseux with a double flash unit. The spark gap of the double flash was lengthened to give more light. R. M. Swanson and John Fredwell went with me on this trip.

Used Polaroid film in the 4x5 pack. a 12" lens was used and the 10" Wide French lenses for the field lens.

The subject gave so much spark light that no photo ~~was~~ was taken.

Sept. 1958. Nice

Sechan
Serge Bertino

Moved from 20D102 to H-405 in Sept 1958? yes ✓

36 Oct 5 1956 4

Harold Edgerton.

Move from 20D-102 to H-405 was made in Sept 1958

Left Sept 1 Boston to Nice France P.A.A.
arr. Sept 2 Nice met by Constean Hotel Bristol Monaco.
Monte Carlo.

" 3 Equipment ~~arrived~~.
4 " unpacked
5 ~~Expedition~~ "Latin" Nice.
6 "

Sunday. 7. Paris
8 Victor Emile Feze
9. "Minneretta Singer"
10
11 5pm for Geneva.
12 at Geneva "Russell"
13 Friggle Glaser Nice - Latin

Dimanche 14
15.
16 Calypso and Sled. Nice
17
18. Two 400 foot reels.
19. Section shooting movies Towed camera
20

Dimanche 21. Leave for Köln Allemagne
22 Int. Cong. Higher Speed.
23
24.
25.
26.
27. Photokina. Leave Duesseldorp P.A.A. flight 9.
28 Boston.

Weinberger

Cont. Photos were made this apt. at Brattleboro Vermont Cambridge Mass for Dennis Noisaux with a double flash unit. The spark gaps of the double flash was lengthened to give more light. R. M. Swanson and John Rockwell went with me on this trip.

I used Polaroid film in the 4x5 pack. a 12" lens was used and the 10" Schneider Tronder lenses for the field lens.

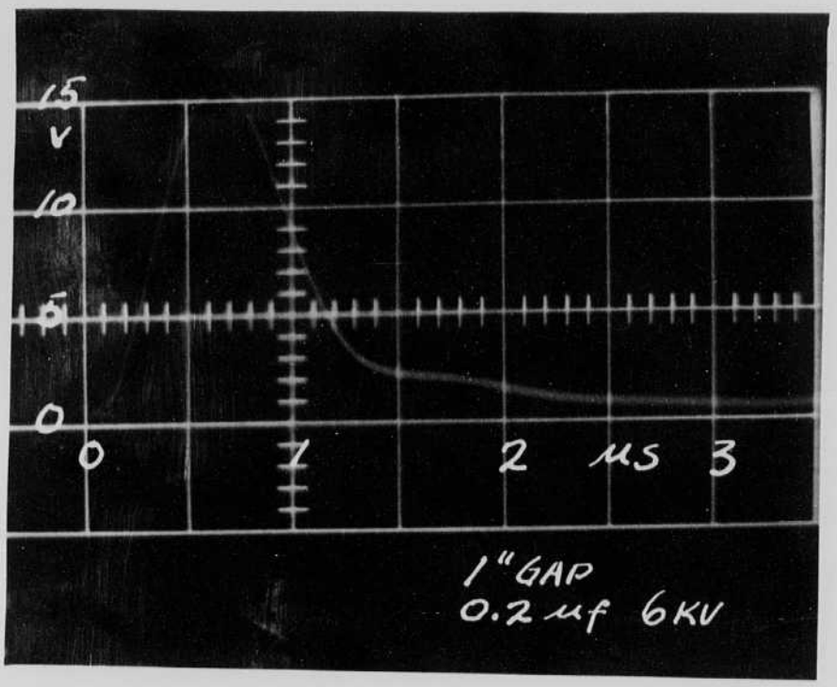
The subject gave so much spark light that no photo ~~does~~ was taken.

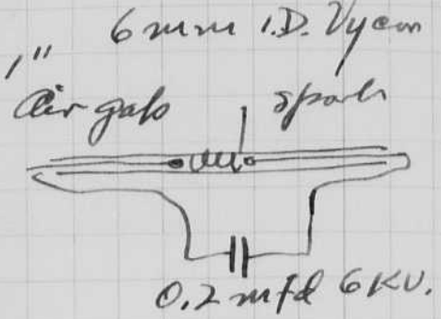
Sept. 1958
Nice

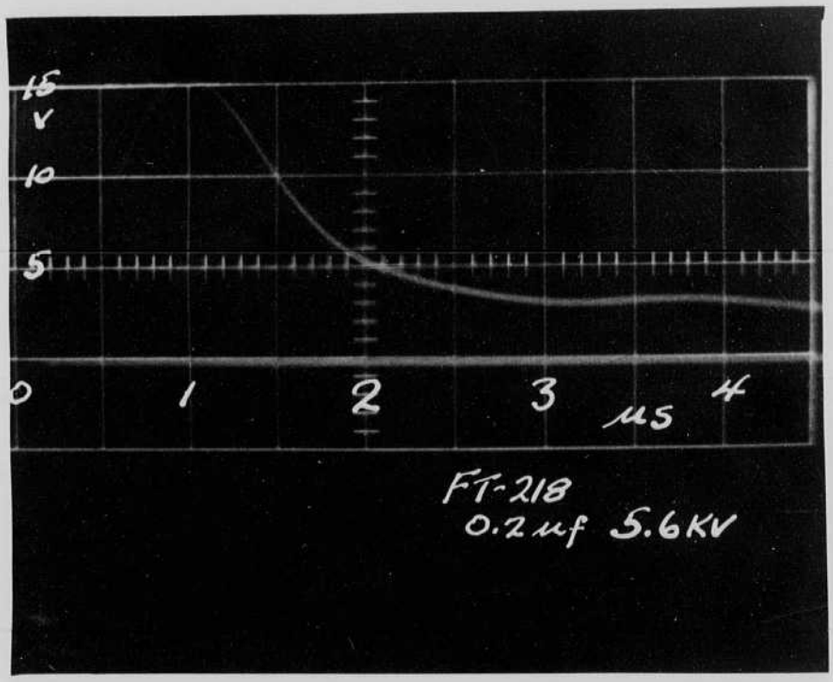
A2. Sechan
Serge Bertino

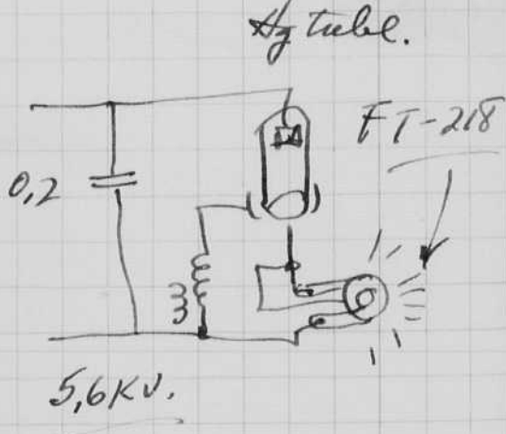
Moved from 20D102 to H-405 in Sept 1958? yes ✓

Oct. 20, 1958. H.E. Edgerton
John Tredwell.
Short flash experiments.









Nov, 1. 1958
Harold Edgerton

Arthur Bosquet was in the 620 classes on Friday.
5886 tube in electrometer and light meter.

$e = 2$ volts.
$c = 005 \times 10^{-6}$

$e = c \int i\,dt$

$de = c\, i\, dt.$

$i = c \frac{de}{dt} = .005 \times 10^{-6} \frac{2.}{10^{-6}}$

Current reqd for square wave = .01 amps

Actual current peak will be 3 x this in 30 ma.

Look up data in Page. 30 ma off scale
for 90 volts. $i_{sat} = 3$ ma.

$.003 = \frac{.005 \times 2 \times 10^{-6}}{T}$ $\quad T = \frac{.005 \times 2 \times 10^{-6}}{.003} = \frac{.010}{.003} \times 10^{-6}$

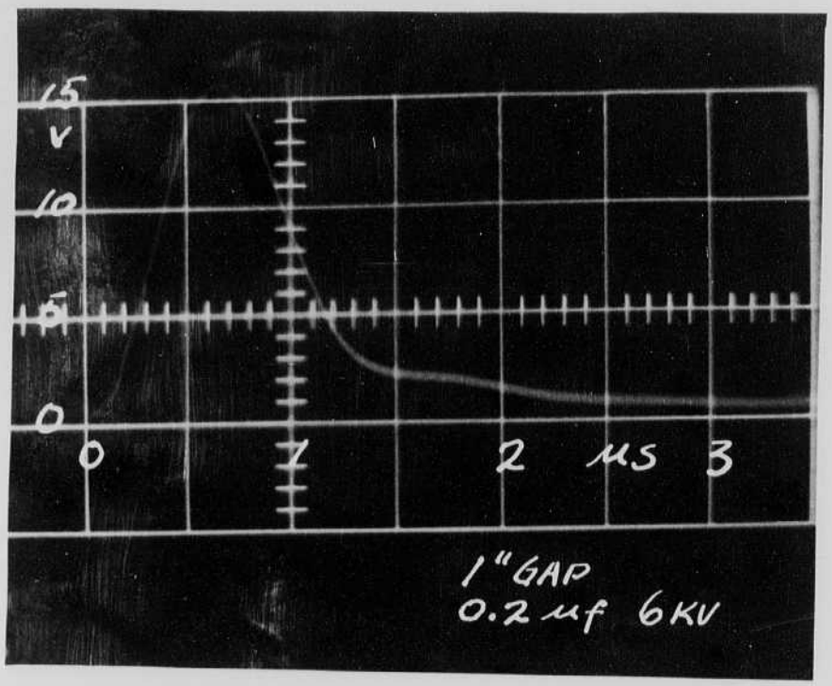
$= 3 \times 10^{-6}$

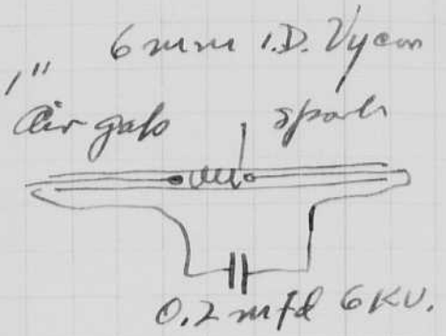
Allow for 3x peak.

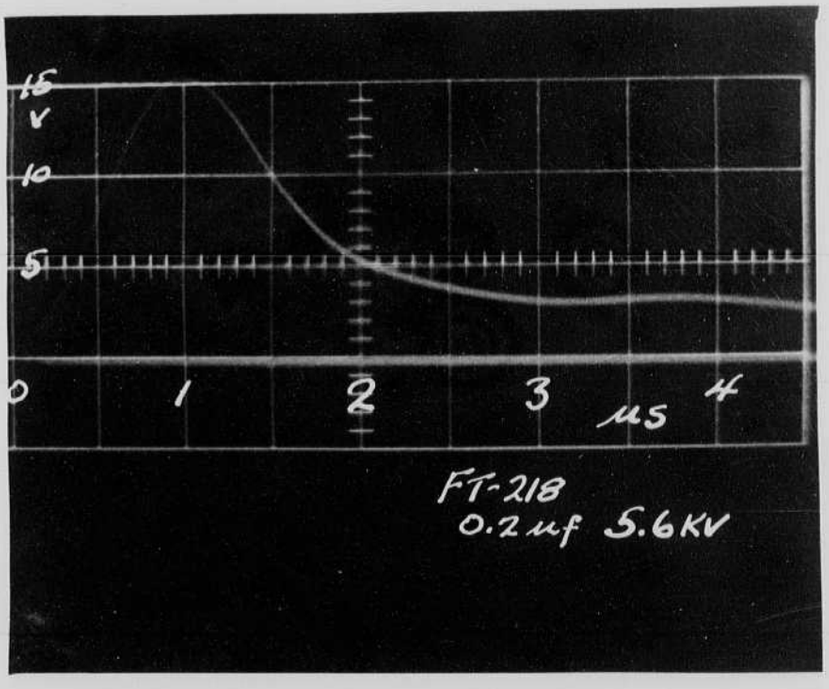
$T = 10 \times 10^{-6}$ seconds 10 μs

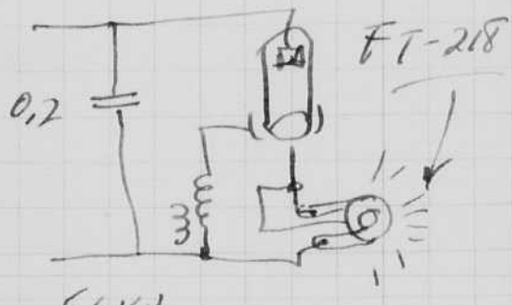
Nov. 7, 1958. 620 class Demonstration by Seymour Goldberg
Bill Ward and Dick Hackenberger.
E&G Scope T.W. with T.V. Kintel viewers etc.

Oct. 20. 1958. H. E. Edgerton
John Tredwell.
Short flash experiments.









Nov, 1. 1958
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$de = c\,i\,dt.$

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Current reqd for 1 grave mine. $= .01$ amps

Actual current peak will be 3 x this in 30 ma.

Look up data in Paper. 30 ma off scale
for 90 volts. $i_{sat} = 3$ ma.

$.003 = \frac{.005 \times 2 \times 10^{-6}}{T}$ $\quad T = \frac{.005 \times 2 \times 10^{-6}}{.003} = \frac{.010}{.003} \times 10^{-6}$

$= 3 \times 10^{-6}$

Allow for 3x peak.

$T = 10 \times 10^{-6}$ seconds $\quad 10\ \mu s$

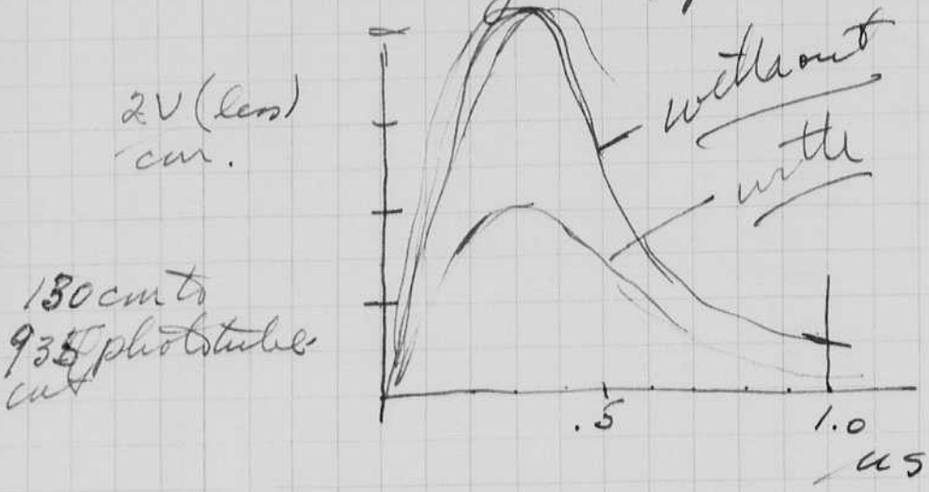
Nov. 7, 1958. 620 class Demonstration by Seymour Goldberg
Bill Ward and Dick Hockenberger.
E66 Scope T.V. with T.V. Kinetel viewers etc.

Nov. 15 1958

4-410

H. Edgerton John Tredwell

0.03
0.1 mfd at 14 KV. into two circle lamps in field. Proposed connection.



- now the connection copper wire was changed to 2 ohms of ribbon resistance wire.

Conclusion: Resistance does not cut down after glow according to the oscillogram

2 ohms reduced the peak light to 1/2.

Apparently no improvement over a single lamp.

1" gap 4 mm I.D. Single tube used. Shows small light at 1 μs. about 1/2 or 1/4 that of the above. I mean by this the ratio of after glow to peak. 1/2 μs.

Single tube 0 at 0.05 μs
2 cm peak at 0.2 μs
1/4 cm at 1 μs. 1.0 μs
2 cm at 0.4 μs.

Duration (roughly 1/3).

18 volts peak

$q^2 = \frac{1}{40}\ 18\ \left(\frac{130}{100}\right)^2 =$ 0.75 std table.

Fld. 0,8 lamps. ~~120 cm~~ 100 cm as used by 620 students Nov 14 1958 to photograph a 22 caliber bullet.
.2 40 volts D.C.
.6000V
Light on film = 5×10^6 candle power. $\times .8 \times 10^{-6}$ = 4. c.p.s.

$5. \times .75 \times .5 = 1.9$ c.p.s. $\doteq$ 2 c.p.s. 16 KV .03 mfd.

How fast will relay go to 16 KV. peak = 22 volts 0.3 ms.

CR tube moved to 200 mm.

1" gap.	12KV	5V.
04 mm I.D. Pyrex.	14.	7.5V
	15.	10.
	16	12

0.03 mfd.

Gap increased to 1.5" from 1".

12KV.	4V.
14.	~~4~~ 7.5
15	9
16.	9.5

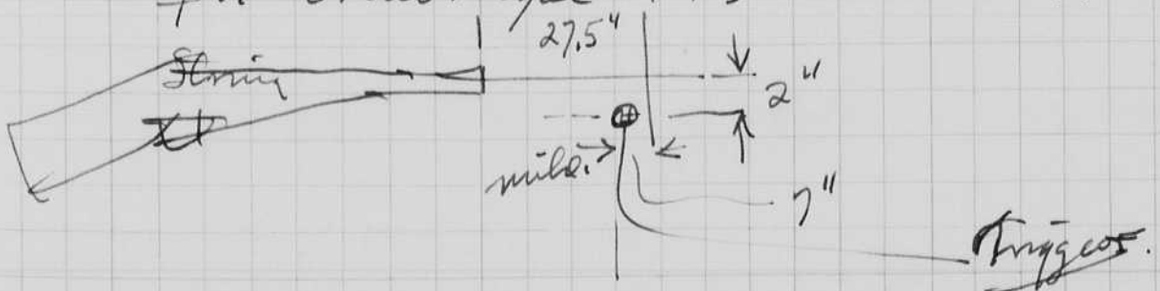
Gap decreased to 5/8" from 1.5"

12KV.	4V
14	7V
15	7
16	9

Back to 1" gap.

12	5
14	7.5
15	9
16	11
16	9+
16	10

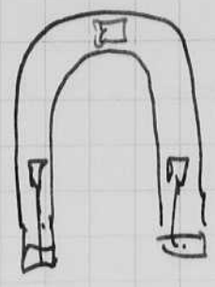
Pivots of 22 Swift bullet. .03 at 16KV
f11 ortho Royal 4×5 camera 1 to 1



42
nov 20 1928 B & L Lamp

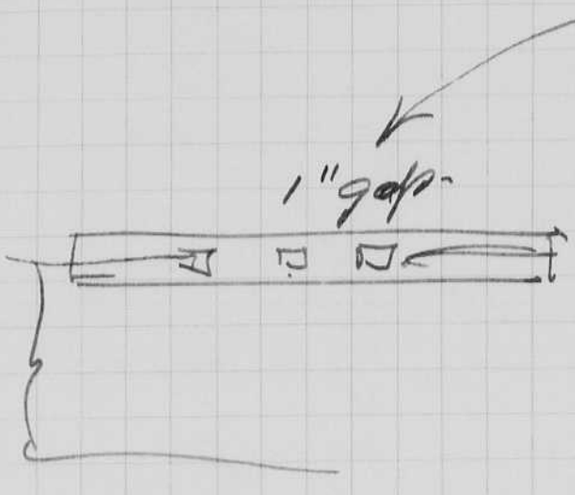
Edgerton
John Eadwell Needs plume fall from Suede.

Wants straight lamp.



or 2"
3"

300 Ws



1" gap.

1st Test of Microphone unit assembly Westinghouse
3 tube amplifier

100 Ws	15	1 ft.	¼" length of tube.	
100	24	1	no R	
100	10	1	with Series R.	R = 3 ohms.
200	57	1	no R.	
200	22	1	with R	
300	94	1	no R.	
300	32	1	with R	

1" gap Heyden arc

100	5	1	3 ohms.
100	14	1	R = 0
"	16	"	"

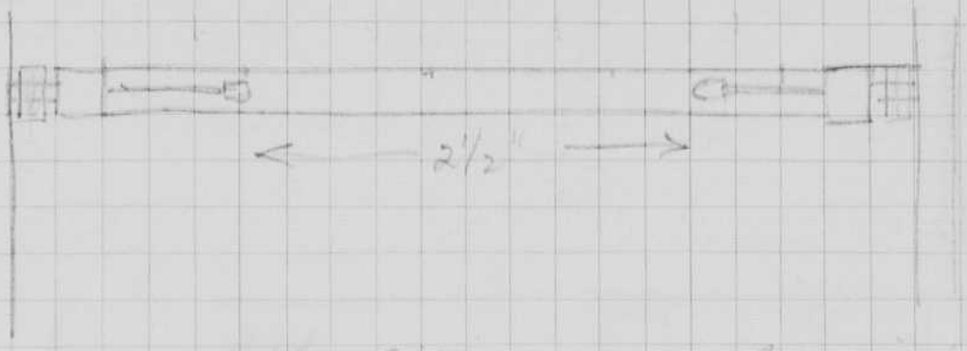
3 tube amplifier

100	24	1	no R
100	12	1	R 3 Ω
200	57	1	no R.
300	55	1	"

1¼ tube Wanoka

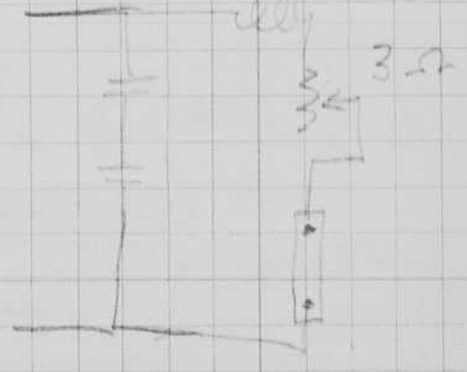
100 WS.	34	1/4. (1/4 Klamp).	2 to R,
100 "	14		3 Lamp.
100 "	39		1 to R.
200 "	24		3 Lamp.
200 "	87		1 to R.
200 "	55		" "
200 "	84		" "
200 "	25		3 Lamp
200 "	79.		1 to R.

Same sheet pour quality.



3" tube, 100 WS. 62. 2/5. 2 to R Two window
" " 64 " " "
" " 75 3 Lamp. Total light.

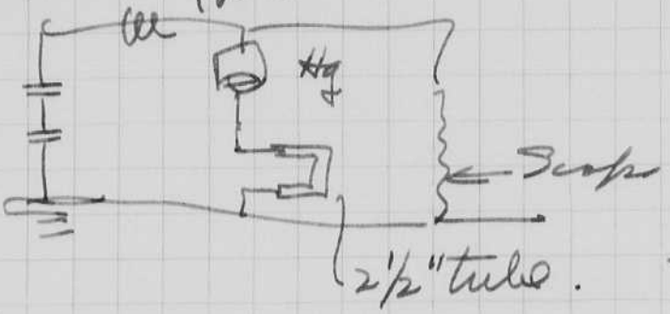
1¼ tube 100 40 " 1 to R.
100 16 " 3 Lamp.
200 32 " 3 Lamp.
200 97 " 1 to R.
200 100 " 1 to R.
200 55 " "

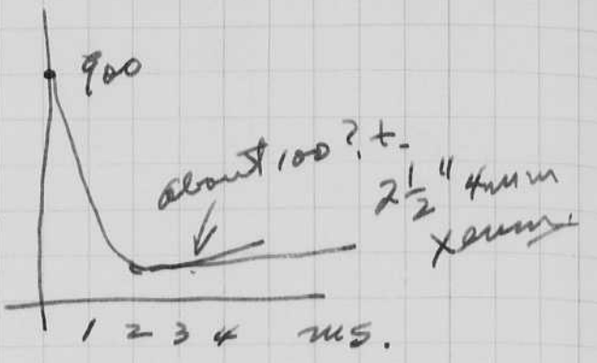


44 Nov 22 1958 **Bright Sources**

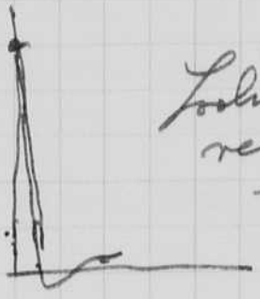
Does the voltage reverse on the Electrolytics ?? in the microscope illuminator.

100 MS. 150 mh.



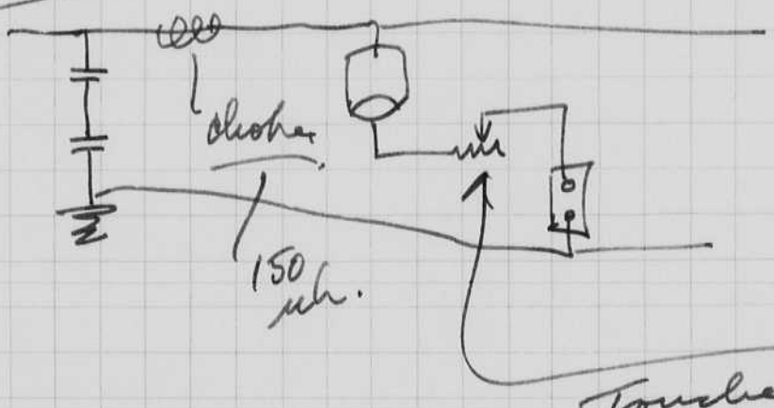


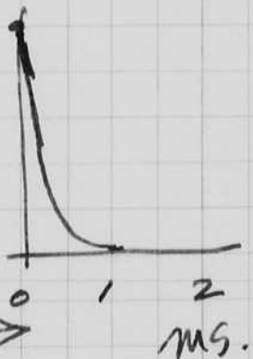
1" tube.



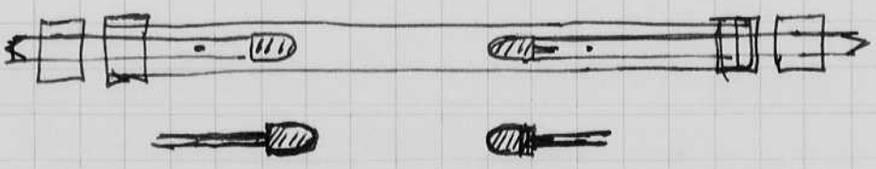
Lobo like reverse.

½" tube.

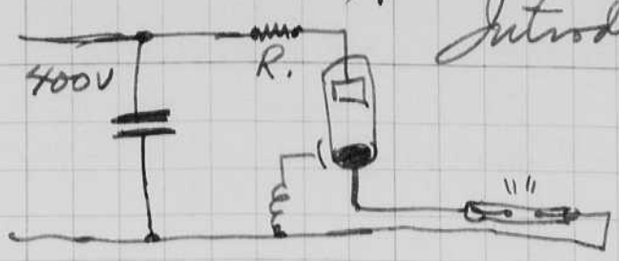




Touches Zero with about 1 ohm.



Circuit to try.



Introduce R so that circuit including tube is not oscillatory. This will save the electrolytics.

R = depends upon L in the circuit.

Peak current.

At Howe 9pm Calc of circuit with out resistance.

Present circuit has 6 50 ws capacitors in a series parallel combination.

900 volts 3 × 265 mfd for full steam ahead.

$\frac{265}{3}$ / 795 mfd.

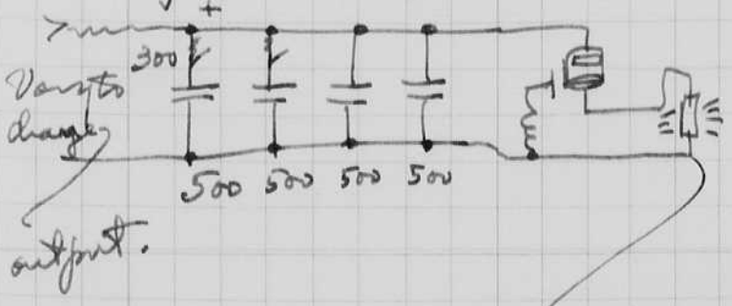
the lamp is 3" long. $\frac{RC}{2} = \frac{900 \times 10^{-6} \times 1 \text{ ohm}}{2} = .4 \times 10^{-3}$ sec.

I propose to reduce the voltage to 300 volts and use a 1 inch lamp. The energy should also go down to 1/3.

$\frac{900}{3} = 300$ amps peak.

$\frac{CE_1^2}{3} = C_2 E_2^2 = \frac{300}{3} = 100$ ws.

$\frac{300^2 C}{2} = 100 \qquad C = \frac{200}{300^2} = \frac{200}{.09} \times 10^{-6} = 2000 \times 10^{-6}$ farads.



Lamp length = 1 inch

$R = \frac{2}{6} \times 1 = \frac{1}{3}$ ohm.

$\frac{RC}{2} = \frac{1}{3} \frac{1}{2} 2000 \times 10^{-6} \cdot 300 \times 10^{-6} = .0003$ sec.

1 inch lamp.

4 mm I.D.

Xenon 1 atmos.

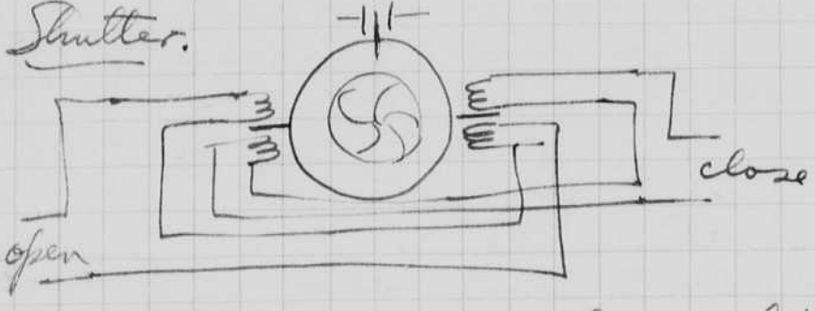
Peak current $= \frac{300}{1/3} = 900$ amps.

Peak per capacitor $= \frac{900}{4} = 225$ amps

New York.
November 24, 1958.

N.Y. Saw Jimmy Dugan 245 East 21 st. at 4 pm.
Dinner with Heinz Fester 270 West End ave.
9 pm at Mus. Modern Art for opening of exhibit
of photography.
Ansel Adams.
Roman Vishniac & wife.
Harold Zahl, & wife.
Willard Morgan and wife
Bruce Davis
Dennis Throck & Miss Roosevelt.
Fritz Bruber Photokina.
Steichen.
Eisenstadt.

Shutter.



Symmetrical coils and ~~vanes~~ vanes
for force on the disc. Damping
necessary. Spring release or pulse
force from a capacitor discharge.

George Faud, Speery Engineering Review Vol 11 no 3 Oct. 1958.
Excellent survey article on Sonar.

Sperry
Sonar Calc.

Ft. Eade N Subfb
Code 466.

Massa
Wilbur Cairns conn
Woodbury conn

Ico Road
Devine

WQN 108 db.
4 kc. Bandpass
2 kc ?

N_w = 21.6 db + 2 log 12,000

≡ 104 db. (12 kc)

Signal = 83 db.
-21 at surface pressure,

noise o sea -73
3 -59.

M.I.T.
Receiver in water -82 db/μbar. to microvolts Mass.

How many volts 7 μV.

104
82
-182
83
-103

10 microvolts
and where
this ??

ASW detectable voltage = 10 or 20 μV.

Times Facsimile Co/ Recorder
Teletype paper.
350 Kcs ∨ 55 N 4
152 ∠ 57 Wash
NN

Brush. Rochelle $ elv.
Kings Labs Salt Lake City

48 Nov. 25 1958

4-405 M.I.T.

H. Edgerton. Microsec Problem Bd L Lamps.

Low use 300 W sinks FX-25.

1/8" gap 4 mm I.D. 6" = 2.2 $\frac{1}{8}$ = $\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$ ohm

$KC = \frac{660 \times \frac{1}{12}}{24} = 0.12$ MS.

Doubling max. lumens = T = 300.

C	V	ST	ET	Peak light	Dur.		50,000 lumens
			1/8	2' H2V	120 MS	50 ft.	50.
	600	200	1"	2' .75	800	200/ft	25.
4 x 525	250		1"	2' 1 x .25	1/60	400/ft	50
"			1/8	4 x .2			
"			1/8	3 x .2	200	120	120
1/4 x 525	200		1/8	3 x .2	500		
				4 x .2	500	400	400
"	250			3 x .5	400	600	
3 x 525	250		1/8	2.5 x .5	400	500	
4 x 525	300		1/8	4.5 x .5	600	1350	
4 x 525	325		1/8	4.5 x .5	550		

50 MS to reach peak light. Lots of jags on light curve

525/2	900	end	1.5 x .5	400	300
525	400		2 x .5	800	800
			2.2 x .5	550 x 2 =	1210

100 WS	25	21
200	63	
300	88	
4X500	394 V	
"	300	125
"	200	73
"	300	109
	350	142
4X500	210*	48
	150*	21
	200*	39
	200 Stage	43
	250	64
	FX-11	
	200	
	250	39
	250	41
	200	38
	250	62
	250*	65
	300	59
	300	89
3X5255	300	73
	250	49
	350	100
250	250	29
	300	40
	350	56
	400	65

This microscope lamp was shown to Henry Lester and Zieler at M.I.T. 4-405 on Monday Dec 1 1952.

H. E. Edgerton.

48 Nov. 25 1958

4-405 M.I.T.

H. Edgerton Microsecond Problems B&L Lamps.

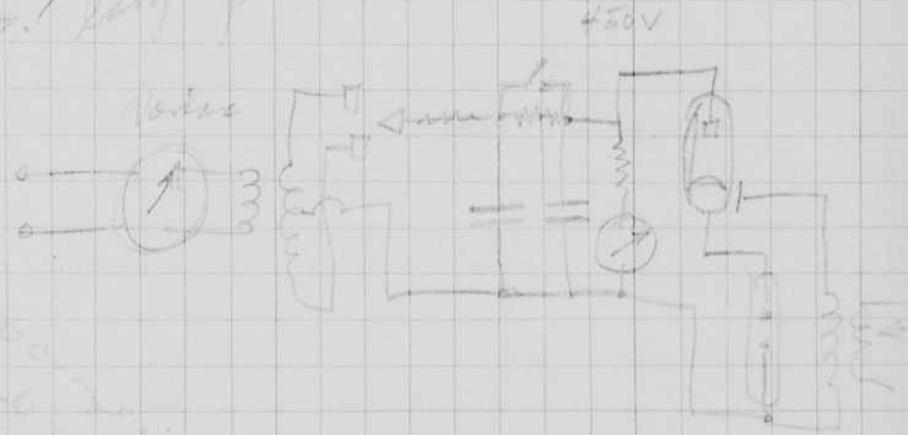
Low use 300 WS into FX-25.

C	V	Set	FT		Peak light	Dur.		Candle Power
			1/8	2'	H.V	120 μs	51.4/	50.
			1"	2'	.75		200/	25.
			1"	2'	.25		400/	50
			1/8		4 X 2			
			1/8		3 X 2	200	120	120
			1/8		3 X 2	500		
					4 X 2	500	400	400
	250				3 X .5	1200	600	
	250		1/8		2.5 X .5	400	500	
	300		1/8		4.5 X .5	600	1350	
	325		1/8		4.5 X .5	550		

Same to reach peak light. Lots of jags on light trace

525/2	400	Good	1.5 X .5	400	300	
525	400		2 X .5	800	800	
			2.2 X .5	550 X 2 =	1210	

100 WS	28	31
200	63	
300	88	
34V		
300	125	
200	93	
300	109	
350	142	
210X	48	
150X	21	
300X	39	
200	43	
250	64	
FX-11		
200	34	
300	39	
250	41	
200	35	
150	62	
350X	65	
300	57	
300	59	
300	73	
250	49	
350	100	
150	29	
300	40	
350	56	
400	65	



This microscope lamp was shown to Henry Lester and Zieler at M.I.T. 4-405 on Monday Dec 1 1952.

H. E. Edgerton.

Notebook # 25

Filming and Separation Record

____ unmounted photograph(s)

__1__ negative strip(s)

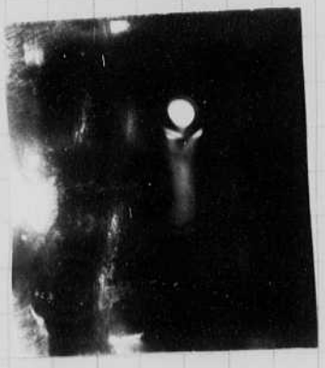
____ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 48 and 49.

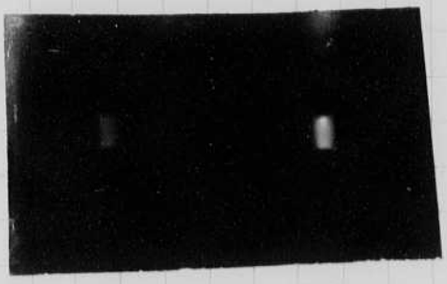
Item(s) now housed in accompanying folder.

Dec. 2. 1955.

John Tredwell experimented today with the mercury-arc tube as a rectifier using the spark voltage as an exciter. The charging time was too long for the 0.03 mfd 16 KV unit.



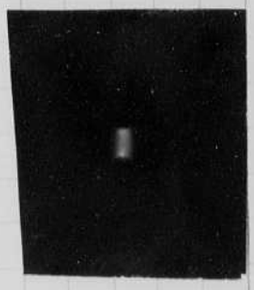
300 WS
f 32 D4 filter
End view Lamp.
Panatomic x film



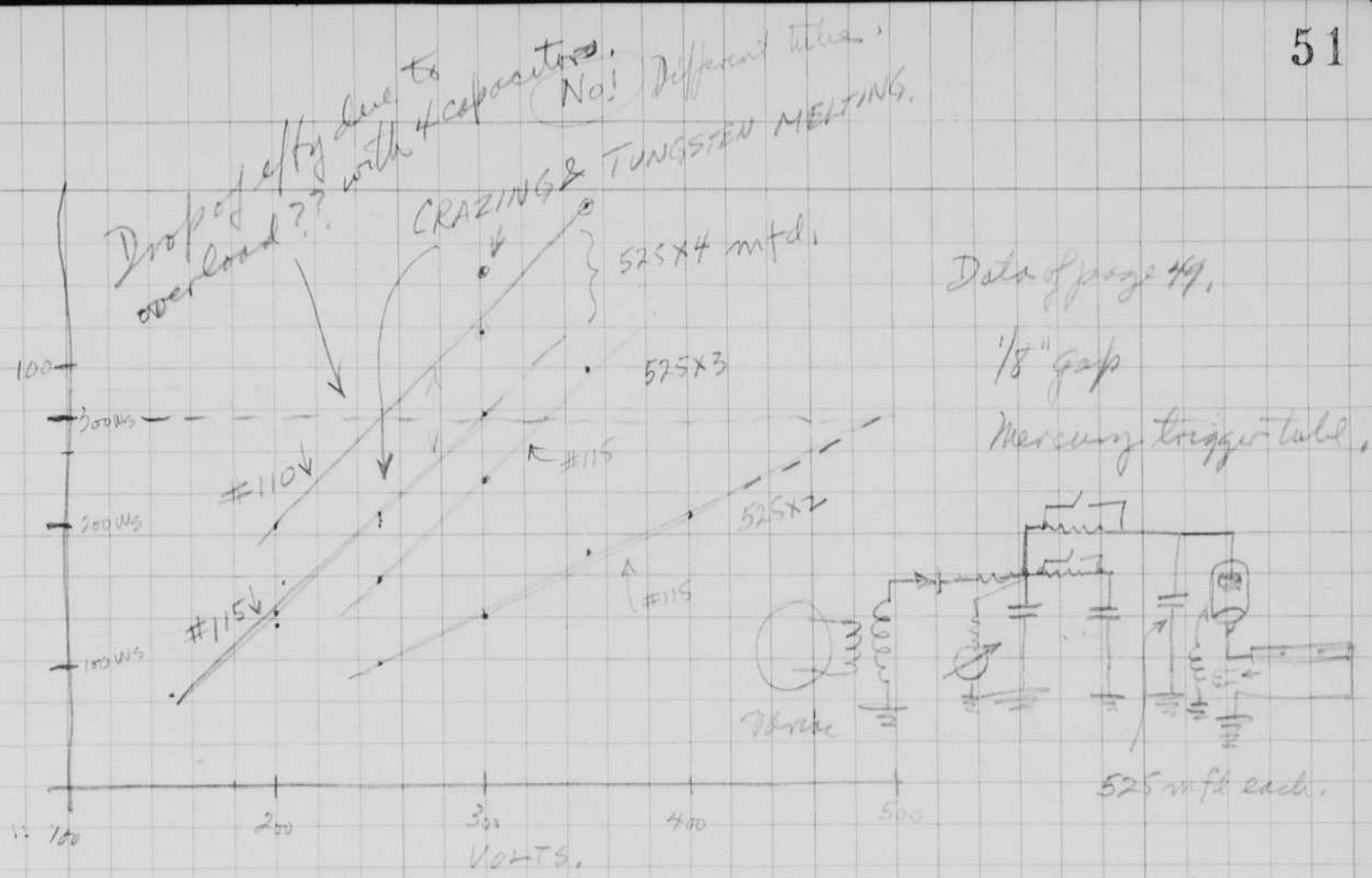
300 V
2 x 525 mfd

400 V
2 x 525 mfd

Fx 11 no 110



350 V
2 x 525 mfd
Fx-11 no 115



Note 100, 200 and 300 W.S. points on the CPS axis these were measured on the micros with illuminator that has a 60 cycle continuous beam and a superimposed flash.

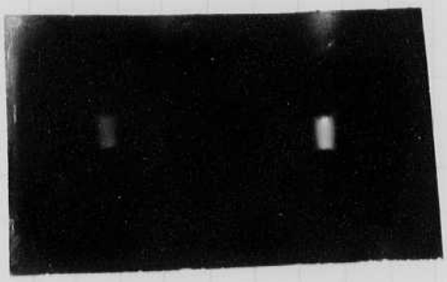
B&L. claim to use the 300 WS with a series resistor for the eye camera (Retina).

I propose that they use the FX-11 with a Variac to control the voltage and a series mercury arc tube to control the starting. Another Hg tube and small capacitor can switch the 60 or 120 cycle pulses for viewing.

Dec. 2. 1954.

John Tredwell experimented today with the mercury-arc tube as a rectifier using the spark voltage as an exciter. The charging time was too long for the 0.03 mfd 16KV unit.

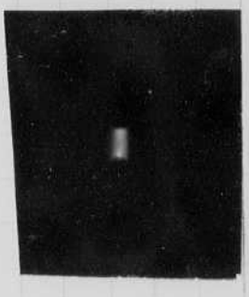
300 WS
f32 D4 filter
End view Lamps.
Panatomic X film



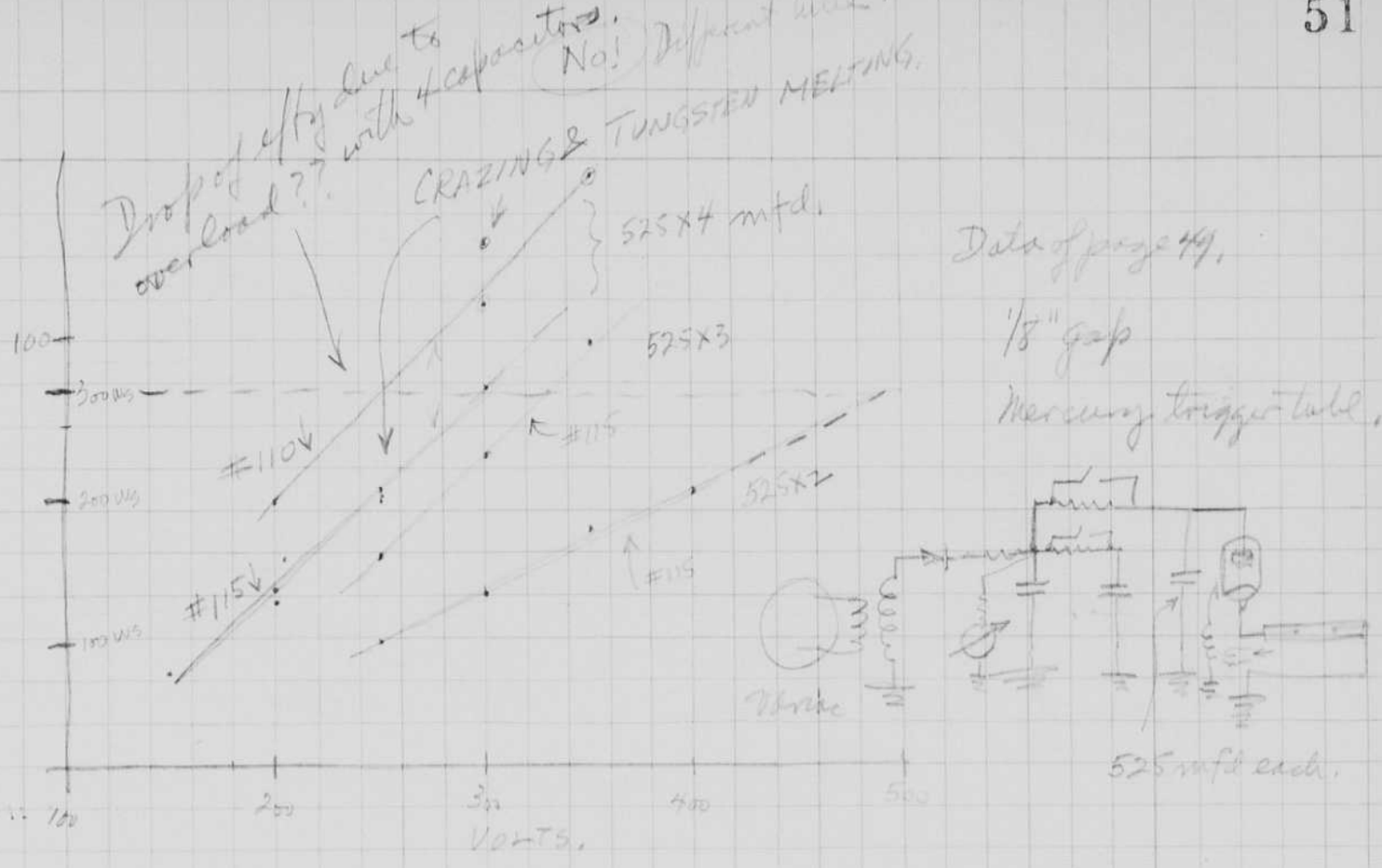
300V
2x 525 mfd

400V
2x 525 mfd

Fx11 no 110



350 V
2x 525 mfd
Fx-11 no 115



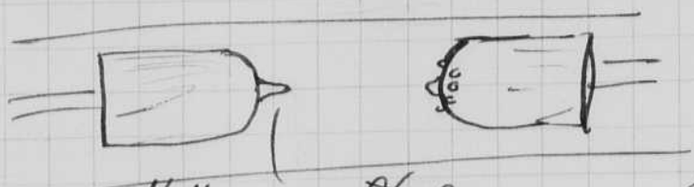
Note 100, 200 and 300 W.S. points on the CPS axis's these were measured on the micro-wave illuminator that has a 60 cycle continuous beam and a super imposed flash.

B&L. claim to use the 300 WS with a series resistor for the eye camera (Retina).

I propose that they use the FX-11 with a Variac to control the voltage and a series mercury arc tube to control the starting. Another Hg tube and small capacitor can switch the 60 or 120 cycle pulses for viewing.

Dec 14 1958
4-405 M.I.T.
Cambridge Mass

FX-11 tube driver completed and tested. With #14 leads (3ft ±) the tungsten electrodes show melting. The molten tungsten runs the anode and cathod show projections ?!



1/8" melted metal.

Why did it go in this shape ? ?

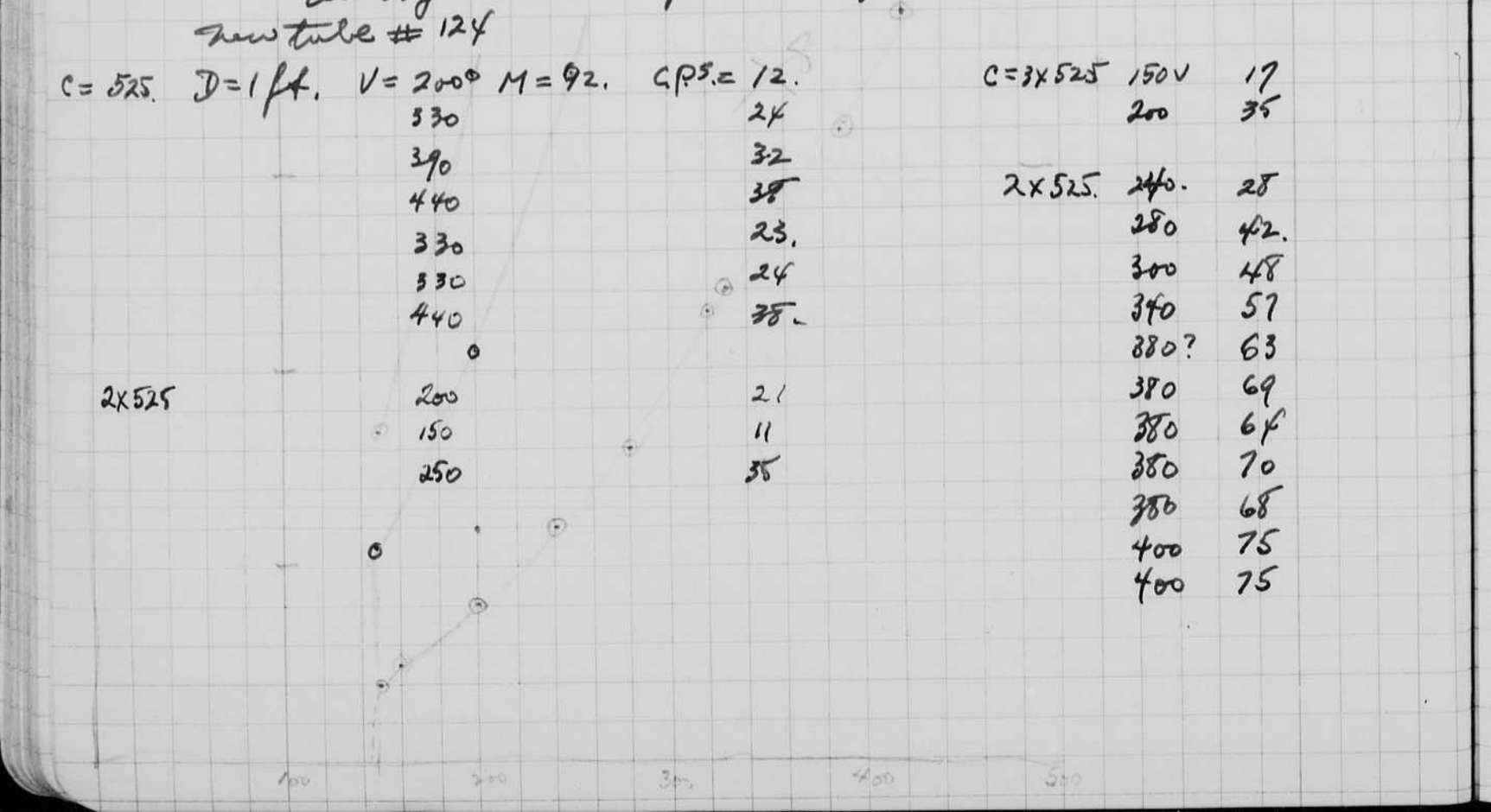
3 - 525 mfd capacitors.
actual 660 mfd.

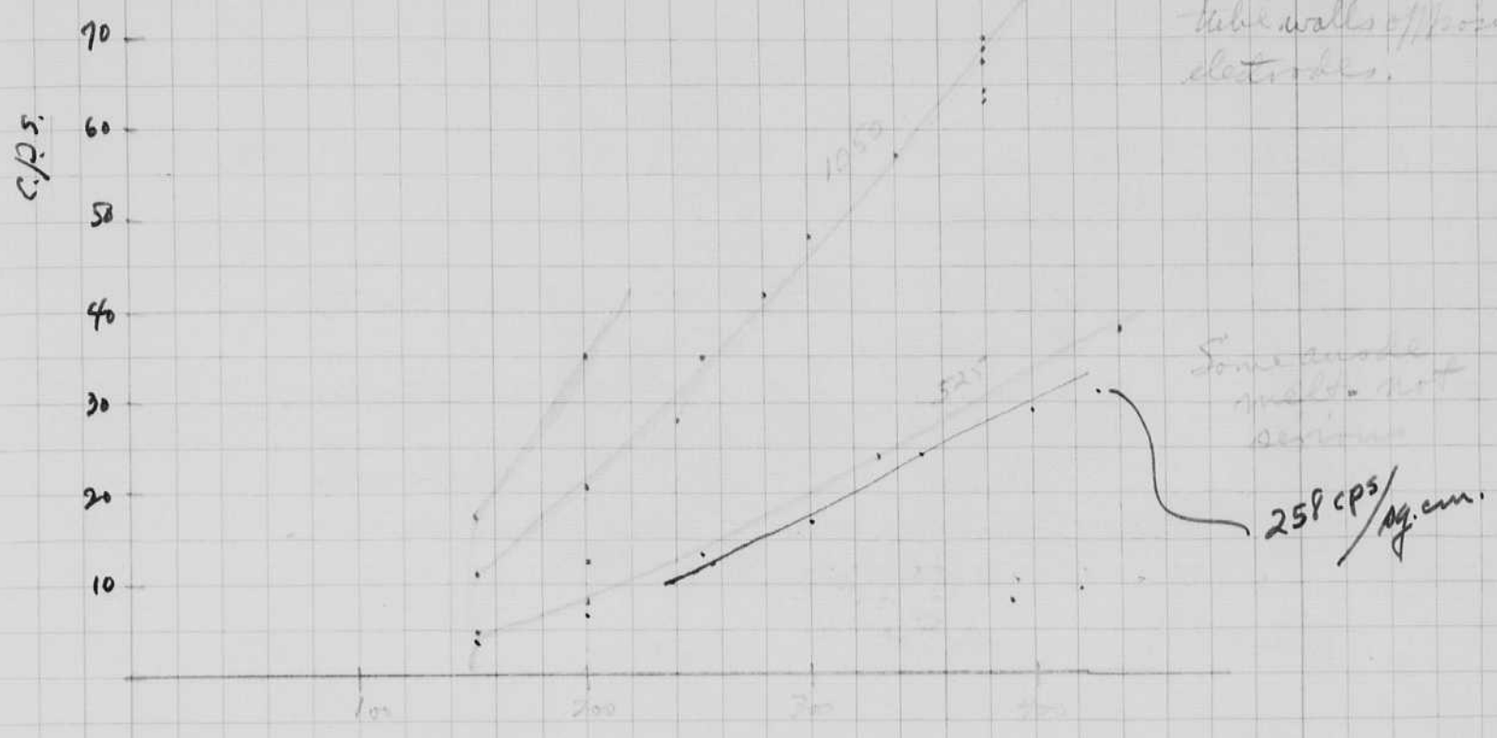
Run up to 450 (-) volts.
this is too much for the FX-11.

New tubes coming immediately for further tests.

Dec 16. 920 pm 1958.
testing new Driver for FX-11 as per above.
new tube # 124

C = 525.	D = 1 ft.	V = 200	M = 92.	cps = 12.	C = 3 x 525	150 V	17
		330		24		200	35
		390		32			
		440		38	2 x 525.	240.	28
		330		23.		280	42.
		330		24		300	48
		440		38.		340	57
						380?	63
2 x 525		200		21		380	69
		150		11		380	64
		250		35		380	70
						380	68
						400	75
						400	75





tube #		c.p.s.
525 Mfd	150 V	4.
	200	7.
	250	14
	300	17
	350	24
	400	29
	430	31

Dec 17. 1959. Life test. 2×525 400 V. 72. Start 8.07 2 flashes per minute.
Quit in afternoon about 4 pm ~~some darkening~~
some anode-cathode melting. ~~but~~ but not bad.

Dec. 18. Aluminum reflector added.

Life test FX-11

With aluminum 1/2 round reflector

	Counter				B.C.P.S.
9:20 am.	31342	2×525	400 V.	tube #124.	95 100
6 pm.	31789	"	"		72.

447 flashes.

tube still works ok but begins to show signs of stress.

1. Drops of tungsten on electrodes.
2. Dark and white deposits
3. Cracking of the glass on [redacted] wall.

tube #187		2×525	400	87.

Tests of 1 inch tube.

200	525 mfd	
250	"	
300	"	82
350	"	121
400	"	160

Tom Simon 620 Dec 58
mclaw Cradwell Daughter Son-in-law Daughter
Bunker Colapso

HB

Bonk.

Grasby

Aug 12/59
Accepted
Was raised

Novick Heckwisser Jerry Miller Rice Duszki
Alter cooper.

Life test FX-11

with aluminum 1/2 round reflector

	Counter			tube #124.	B.C.P.S.
920 am.	31342	2×525	400 V.		95 100
6 pm.	31789	"	"		72.

447 flashes.

tube still works ok but begins to show signs of stress.

1. Drops of tungsten on electrodes.
2. Dark and white deposits
3. Cracking of the glass on [redacted] wall.

tube #189 2×525 400 87.

Tests of 1 inch tube.

200	525 m/μ	
250	"	
300	"	82
350	"	121
400	"	160

Tom Simon 620 Dec 58
nelson Fredwell Dayton Longacre Bunker Colapo

Bowlz.

Hershey

Dog 12 1977
Nov 1977
11-1 Cassell

Novick Heckman Davy Altar Miller Rice Duszki cooper.

Life test FX-11

with aluminum 1/2 round reflector

	Counter			tube #124.	B.C.P.S.
920 am.	31342	2×525	400 V.		95 100
6 pm.	31789	"	"		72.

342
447 flashes.

tube still works ok but begins to show signs of stress.

1. Drops of tungsten on electrodes.
2. Dark and white deposits
3. Cracking of the glass on wall.

tube #189	2×525	400		87.

Tests of 1 inch tube.

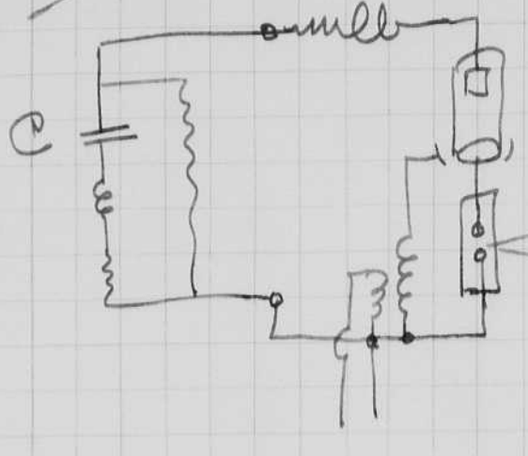
200	525 m/a	
250	"	
300	"	82
350	"	121
400	"	160

Tom Simon 620 Decoy 58
nelson Bredwell Dayton Jorgensen Bunker Colapo

Bonk.

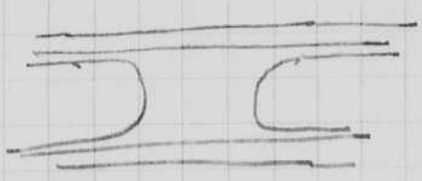
Norwich Headwaiter, Dairy Bar miller Rice Duszki cooper.

John Jones
Harold Edgerton. Dec. 24, 1958



$\frac{CE^2}{2}$ energy.

$\left(\frac{C.P.S}{area.}\right)$



A Size of active ~~coil~~ Volume

B. Pressure.

C. Gas flow.

Dec 30 1958.

Dynamite caps aluminum from Dupont #8

.01 mfd 7KV Double flasher
f 2 lens (? f1.5?).
10 inch B.W. lens.
f 32 on 6 1/4" Wollensak lens.
Panatomic X film ASA 32.

It was necessary to put the caps in an atmosphere of nitrogen so that the aluminum would not burn.
Photo with 15 μs delay shows high speed jet.

6" ~~about~~ nickle wound on a 1 1/2" core (.040 thick strip).

12 turns of #14 wire.

$L = 25\ \mu h$ at 1000 cycles. $Q = ?$

$L = 25 \times 10^{-6}$

Pulse at 6 Kc.

$$\frac{1}{6000} = 2\pi\sqrt{LC}. \qquad \text{Solve for } C.$$

$$\frac{1}{f^2} = 4\pi^2 LC. \qquad C = \frac{1}{4\pi^2 f^2 L}$$

$$= \frac{1}{4 \times 10 \times 25 \times 10^{-12} \times 6000^2} \qquad \begin{array}{r} 25 \\ 25 \\ \hline 125 \\ 25 \\ \hline 675. \\ 40 \\ \hline 27,000 \end{array}$$

$$= \frac{1}{.027 \times 10^{-6}}$$

$$C = \frac{1}{4\pi^2 6000^2 25 \times 10^{-6}} \qquad = \frac{10^6}{27000 \times 10^{-12} \times 36 \times 10^6}$$

$$= \frac{1}{4 \times 10 \times 36 \times 25,} \qquad = .\frac{1}{27000} \times 10^{-6}$$

$$\frac{40}{1000}$$

$$\frac{1}{36,000} = \frac{1}{.036 \times 10^6} = 30 \times 10^{-6} \text{ farads} \qquad = 10 \text{ farads}.$$

Jan 6 1959. Underwater Camera Conf.
Harold Edgerton.

From Woods Hole Al Vine
Bill Backus
Tom Gifts
John Graham.

From M.I.T.
Breslau
MacRoberts
Calilendar
Elliott E.G.G.
Edgerton.

Discussion depths 1000 meters.
6,000 meters
11,000 meters.

Shutter.

Cost of film.

Lens types.

Data: Pressure
time.
Signals from surface.

Cases – Aluminum
– Steel.

Backus wants shallow camera with rewind and shutter control.
He will supply the lamps with a low current running circuit.

MacRoberts is working on a new deep sea job to replace the one that was lost this fall.

We discussed the design of a universal camera mechanism that would do most projects.

M.I.T. STROBE LAB 4-405

OPEN HOUSE

(To the tune of "Keeper of the Eddystone Light")

Our flashing beacon,
Like a star,
Leads all wise men
From afar.
(REFRAIN)

A Tektronix 'scope
Beside the door
Welcomes all in
To see much more.
(REFRAIN)

So to your friends
Please spread the word;
And one last thing --
Refreshments served!
(REFRAIN)

REFRAIN

Yo Ho Ho
Electrons flow free
Oh for the life
Of Stroboscopy

by John Tredwell and Ray Swanson

January 9, 1959

Jan 6 1959. Underwater Camera Conf.
Harold Edgerton.

From Woods Hole
Al Vine
Bill Backus
Tom Gifts
John Graham.

From M.I.T.
Breslau
MacRoberts
Calculendar
Lilliott E.G.&G.
Edgerton.

Discussion depths
1000 meters.
6,000 meters
11,000 meters.

Shutter.

Cost of film.

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Data: Pressure
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Oh for the life
Of Stroboscopy

by John Tredwell and Ray Swanson

January 9, 1959

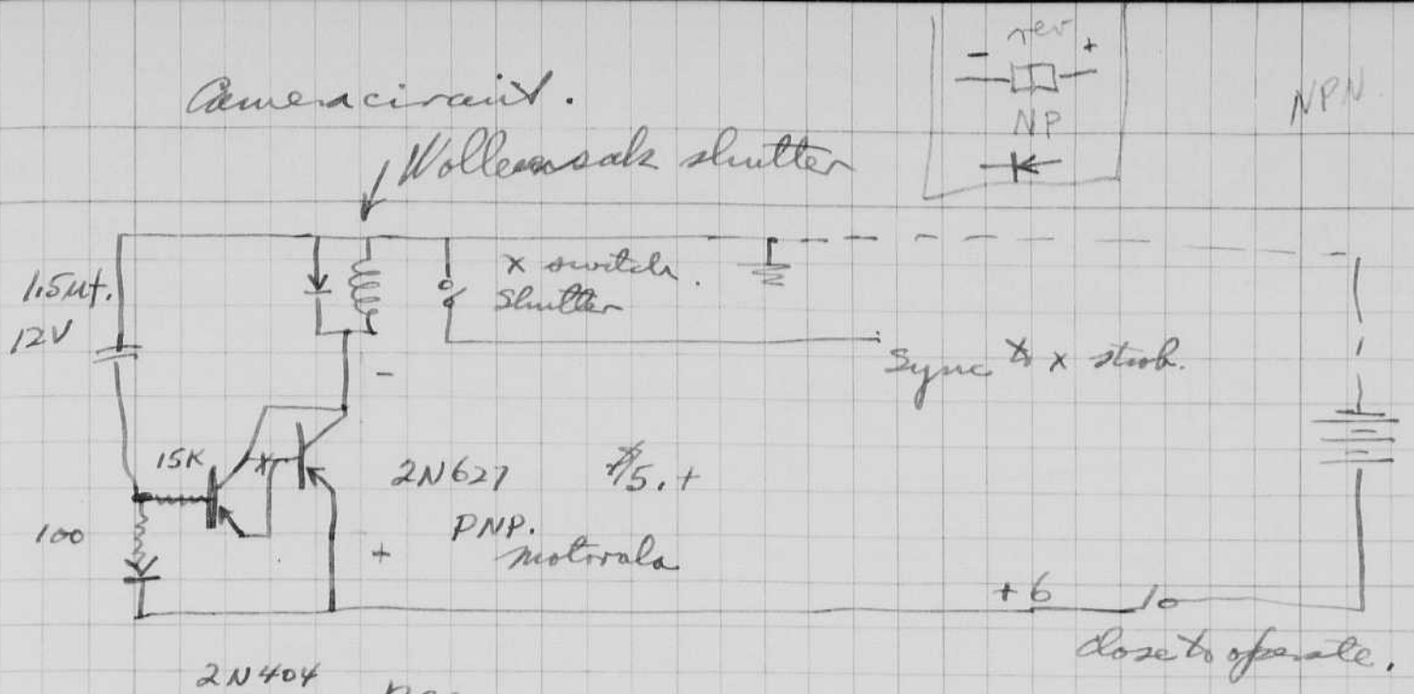
Jan 10 1951.
H E Edgerton.

Photos of gas cannon at Bold Bermuda and Newman were made this morning. There was too much light from the Helium gas going into the vacuum.

We (Sundra) used Royal Pan film with the double flash and the lens from B.D. a 12" lens was used.

Jay Ball and Dennis Noiseau were the men at B.B.D.N.
Hope to reshoot with better optics.

Camera circuit.



Shutter time = ?

Delay = ?

Voltage sensitive?

Series resistance sensitive?

Develope similar circuit for the motor.

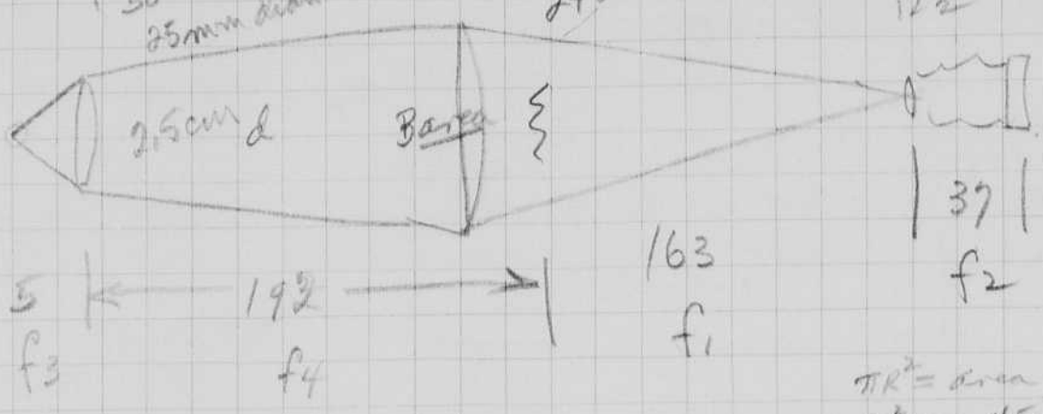
Effect of series resistance.
will shutter open when
load goes off?

62 Jan 16 1959

Exposure Calc.

Hank Ogata
Hall Clarke
Jim Co Evandale Ohio.

Evandale
Jack Ervin
Emil Dowell
Dick Wentworth
Lynn.



πR^2 = area

$12^2\pi = 450$ sq cm

$$Eff = \frac{\pi \, cps \, 2.5^2 \, 163^2}{4 \, 5^2 \, 450 \, 37^2} = \frac{\pi \, cps \, d^2 \, f_1^2}{4 \, f_3^2 \, B \, f_2^2} =$$

$12^2\pi$

$$cps\left(\frac{2.5 \; 163}{2 \; 5 \; 37}\right)^2 = cps(1.10)^2 = 1.21 \; cps.$$

Double flash / finish = 3000×10^{-6} cps.

$IT = 3630 \times 10^{-6}$

$IT = .00363$ lumen sec / sq meter

$$cps\left(\frac{2.5^2 \; 163^2}{2^2 \; 5^2 \; \frac{12^2}{100^2} \; 37^2}\right) = IT$$

$$\left(\frac{2.5 \; 163}{\pi \; \frac{12}{100} \; 37}\right)^2$$

$(9.25)^2 =$

85. cps. = IT

$3000 \times 10^{-6} \times 85 = .255000 = IT$

This is 1/2 or Panatomic X. ✓

Evandale optical system

$IT = 3IT$

48

Jan 20 1959

Harold Edgerton

Freeman of the Ft. Belvoir Va was here most of the day. He wants a 2.5 KW strobe for use with an image converter.

Pulse length 10 μs.

Beam 8° x 1° vert.

Range 2000 yards.

Discussed with Germeshausen, Goldberg Bonz and Woolaver at 160 Brookline ave.

Jan 25 1959. Worked yesterday with John Tredwell on

1. Shotgun 12 gauge #6 shot with new 1/2 μs flash unit.
2. circuit for the illumination for the B&W 25000 fps camera.

Spec. f11 at 2×10^{-6} sec exposure.

Rise time 30 μs.
to 1 stop down - .005 sec.

Fast drop off in light.

We tried 2 FT-151 tubes in series on 400 volts from a 5000 mfd capacitor.

Duration was about right.
Rise time was about 100 μs. ok.

Peak light should be 2×10^6 c.p. for ASA 100 film.

Suggested mercury relay to cut off.
Flash time was .04 seconds too long.

Tried Regular relay - time was too quick?

The peak light is important.

$$DA = 2ff11 = \sqrt{\frac{S}{C} M C.P. Sec}$$

S = ASA number. $= 4 \times 121 = \frac{100}{20} 10 C.P. 2\times10^{-6}$

$\frac{20 \cdot 544}{2\times10^{-6}\ 10} = 10^6$ c.p. required. S = ASA 100, $C = 20$

Each lamp must give 500,000 c.p. peak at the start.

Test of light 10 mfd 2 KV FX-1 2.6×10^6 C.P. peak for calibration.

5000 mfd 4/30 V 2 FT-151 tubes in series.
peak light = $.12\times10^6$

We need 10^6 factor of 8.!!

Could do it with 1 foot distance and M = 20

Feb 8 1959
Harold Edgerton.

Jan 26 - talk to Ind. Phot. assn Cincinnati ~~Feb 9~~.

Jan 28 left by TWA for Cincinnatti for talk at G.E. Co evendale plant at 10 am. Milt Dowell (Page 62) born. Jan 29.

Jan 30. morning at G.E. Co. Nela Park.
Elmendorf - Slomsky.

Jan 31 aurora nebraska.
~~Jan~~ Feb 1. " " " .
Feb 2. Left for Boston with class Garrett.

Feb 3. Grade conferences.

Feb 5 left at 10 am for Rochester N.Y.
Bausch and Lomb factory
Irving Lueck. To try Fx-21 tube.

Experiments show 1200 mfd at 400 volts seem to be satisfactory.

Series resistance to reduce light.

0.5 ohms	60%
1.5	35
3.0	25
5.0	15

Feb 6 continued with B&L. then visited Wollensak. to talk shutters and lenses.

Feb 7. Retd to Boston at 12 25 after spending morning at U of R with Hopkins etc. Tuttle, Dalton, Zinsser.
noon Feb 6!

66 Feb 12 1959

H E Edgerton
4-405 M.I.T.

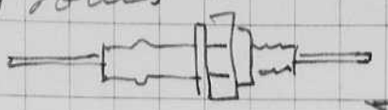
Yesterday in Washington at the National Geo Society.
meeting of the Research Committee. Constant Dugan
Equipment urged for 1959

6 Cameras, 2 Strobes.

2 500 watt strobes.

Sonar camera (already sent to France).

~~Jones~~. Joy Mfg. 1201 Macklind Ave St Louis 10 Mo.

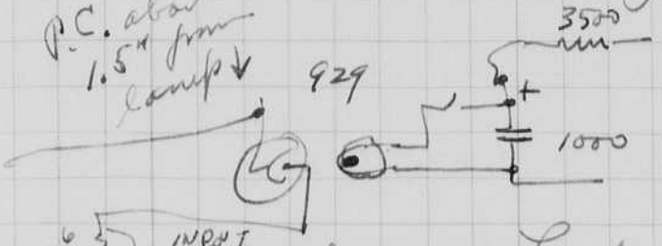


X8372-17 Female conn
/1A062F/ Length 8 ft.
EP1306-3/18-1C/CUT 8FT.

X 8372 21
terminal RD 31

Light Output of 2V lamp # 49.

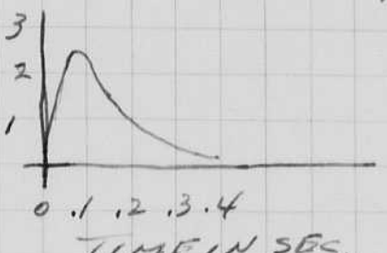
P.C. about 1.5" from lamp



Sprague atom TVA1133 1000 mfd 12 V dc. 15 V surge.

Input volts.	peak.
7V	2.5 volt.
6.5V	2.2
6	1. volt jitter
6.	1.5
8	5 V

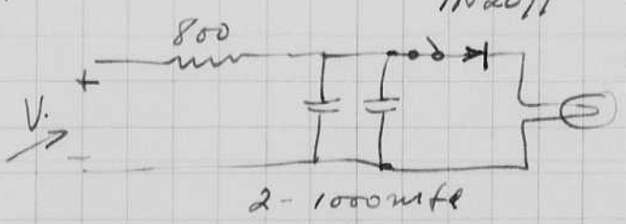
Light V



Now with 2000 mfd.

Input.	peak light
5V.	1 volt. jitter.
5	2 volts
6	2.5.
7	4+ jitter.
7.	5. ok.

Feb 14 1959 Conv



TI 908
IN2071

3/4 amp avg.

P.S. 49.

Input 8 volts 2000 mfd

peak current = $\frac{8\text{V}}{10 \text{ ohms}} = 8$ ma at 1 1/2" distance

Duration 0.~~4~~ sec.
0.3.

7.7 V on 2000 mfd. 7 ma. with Rect.
7.7 " " 10 ma without Rect.

with 1000 mfd, Duration = 0.15 sec.

The IN2071 reduces the peak by a factor of about (2).

Feb 22, 1959
Harvard Expedition

Made tests of Deep Sea Camera today with Edda Section. Seems to work very well! f 2.5 lens 13 mm lab & dawn data, 2000 mfd 6 volts into No 49 bulb through a resistor ( ), the flash time is about 1/10 or maybe 1/5 of a second, no blur unless fingered ~~twice~~. before the motor stops.

Cousteau was here on Thursday afternoon for a lecture at Harvard in Burr Hall at 8 p.m.

then he lectured at MIT on Friday Feb 20 at MIT in Kresge at 5-7 pm.

The Skin Divers had a big convention in the Bradford Hotel on Feb 21 and 22. Banquet on the 21. Helpers were

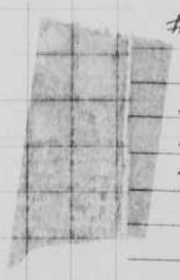
Otis Wright Sunday 3-5
Vinny Sundra
Lanzar. Sat 1-3
Mike Dudley, 1-3 Sunday
Glen Miller 3-5 Sat.
Douglas Steele Sat 1-3.
Breslau Sat 5-1.

Feb 28 1959 4-410

H2 Agents

David Eldridge Film apar Dist motor

#1	Ballbearing. xxx yellowcard board. Lamp at camera above lens 0.01 mfd. (501)	f4. 2"	4ft.	80V	2400	Exposure OK on all 50% over dev at Gamma = 1.
#2	Ditto	except.		60V	1500	
#3	Ditto closer	f4	3ft	90V	3600	
#4	Ping Pong 4ft.	f4	2½	110V	4600	
#5	Ping Pong 4ft	f4	2½'	115V	4650	
#6	Golf Ball Lamp job Beaded Screen background	f3.5	12' 35 mm	60V	2520	
#7	Ditto but in the less height Ball goes out of frame.				2070	



#	frames/sec	volts
1	2400	80 V.
2	1500	60 V.
3	3600	90 V.
4	4600	110 V.
5	4680	115 V.
6	2520	60V
7	2070	60V

70 Nov 8 1959
Ed Engvall
Subj: Tittell.

Movies for Ed Service group
Zacharias.

	Subj	Film	a/p	Dist	camera	Etc
8	1/4 Steel Ball on Glass	"	XXX	2.7	5	Eastman 24R. 1/2 sec. .01 mfd.
9	"	"	"	"	"	.01 mfd. 40R
10	"	"	"	"	"	"
	Camera on 4" box					
11.	"	"	f4	4ft	"	60R.
	3" Evap on Glass plate.					
12	Ping Pong Ball 5ft.	"	f4	4ft	"	90R
13	Marble medium XXX 3 ~~slot~~ Ball		f4	~~8~~ ft.	"	60R
14.	Repeat 12 Ping Pong Ball 5ft. Background Gray at 10ft.		f4	4ft	20 ~~3~~ 4	90R.
15.	Golf Ball 20ft		f4		20	40R
	f2.7 Lamp at camera Beaded Movie Screen background.					
16.						
17						

Mar 8 1959
H E Edgerton.

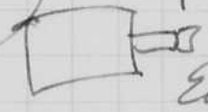
I was in Albuquerque N. Mex. on Mar. 2 with Klein, O'Keefe, Grier, Fusk to visit Virgil Luckett and Hereford at the A.E.C. Office. Left Boston Mar 1 at 12.45. Retd Berlin March 3 at 8:15 on T.W.A.

Tested new camera with data chamber on Mar 6 in the pool with Hopkins Lens It is about 35 m.m in the water. Doug Steele (Brahm and Lloyd Breslau helped.

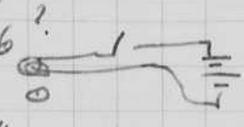
Mar. 15 1959 4-405 M.I.T.
E Edgerton & Fitzell.

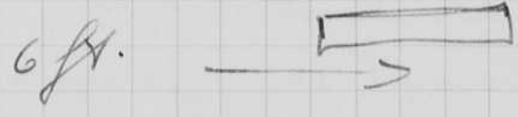
914A
Dupont film.

#1.



Steel.
1/4" ball.





~~Flash~~ 20
Run 40 on Rheo ~~flash~~
.01 mfd. Lamps. 2 ft. Focus on it.

#2. 2" Rubber Ball.
10-70 Resistance
Flashed & Popped out.
No good.

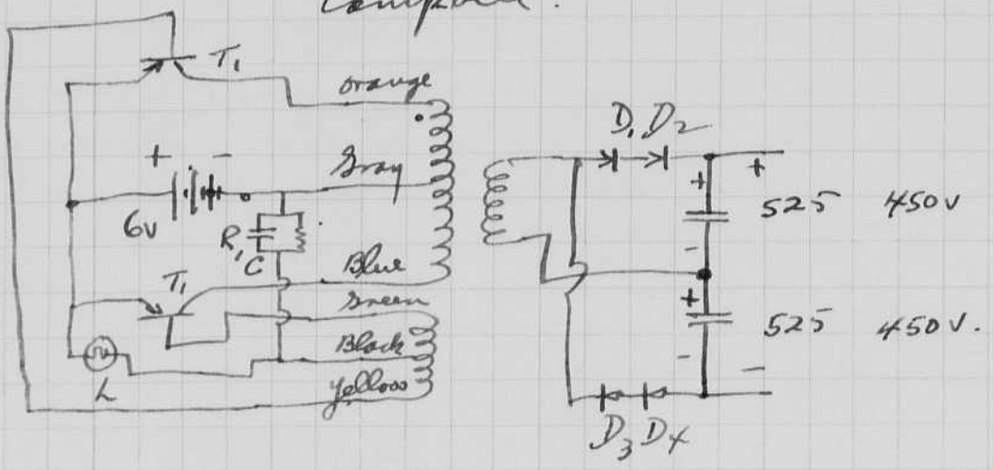
3. 2" Rubber ball Bounce.
~~10-40~~ Resistance 10-50
0.4 sec Delay
2 sec Run. 0 1/2,

#4 3 Balls Bounding.
10-45 Res.
f 2.7
Lamps 3 ft away.
Camera 7 ft. ..

H. Edgerton
March 22 1959

test of transistor oscillator and charger.

Transformer designed by Dave Cahlander Campbell.



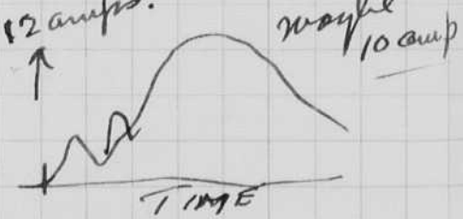
L Moyda no 43.

T Motorola 2N627

D Texas Inst 1N2071

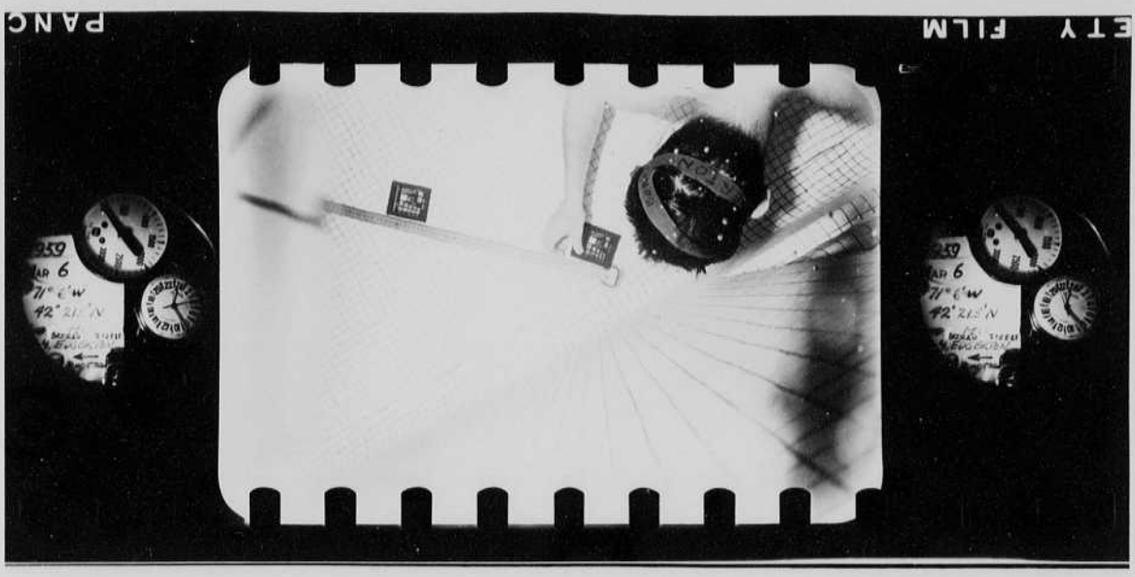
C 50 mfd 12 V. Sprague TE 1133

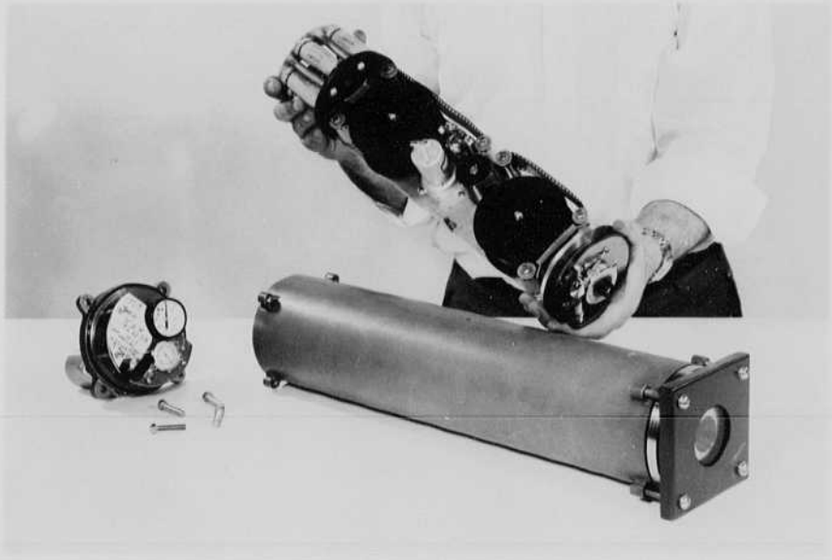
R1 47 Ω 3 watt wire wound



Peak current about 12 amperes.

Running current 1.3 amps 960 volts output.

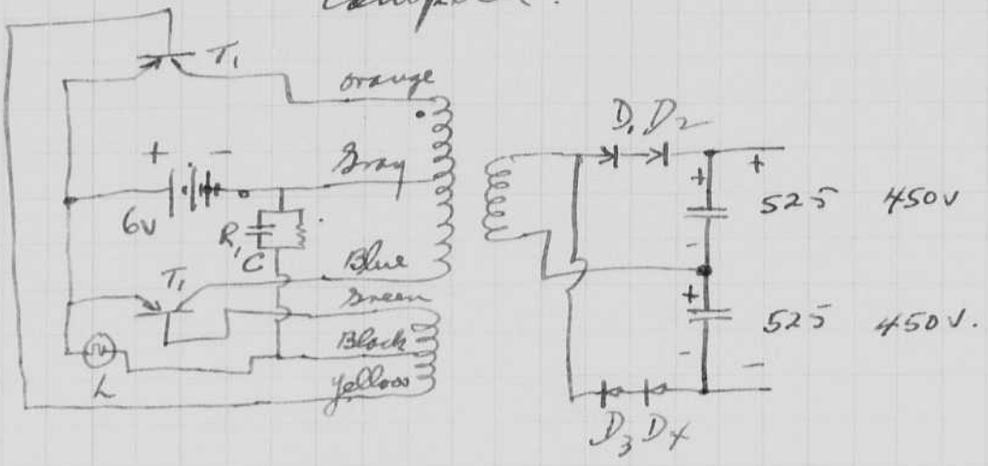

PANC
ETY FILM



H Edgerton
March 22 1959

Test of transistor oscillator and charger.

Transformer designed by Dave Cahlander Campbell.



L Mayda no 43.

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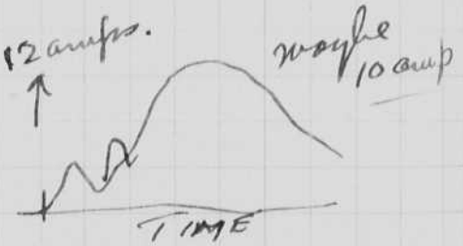
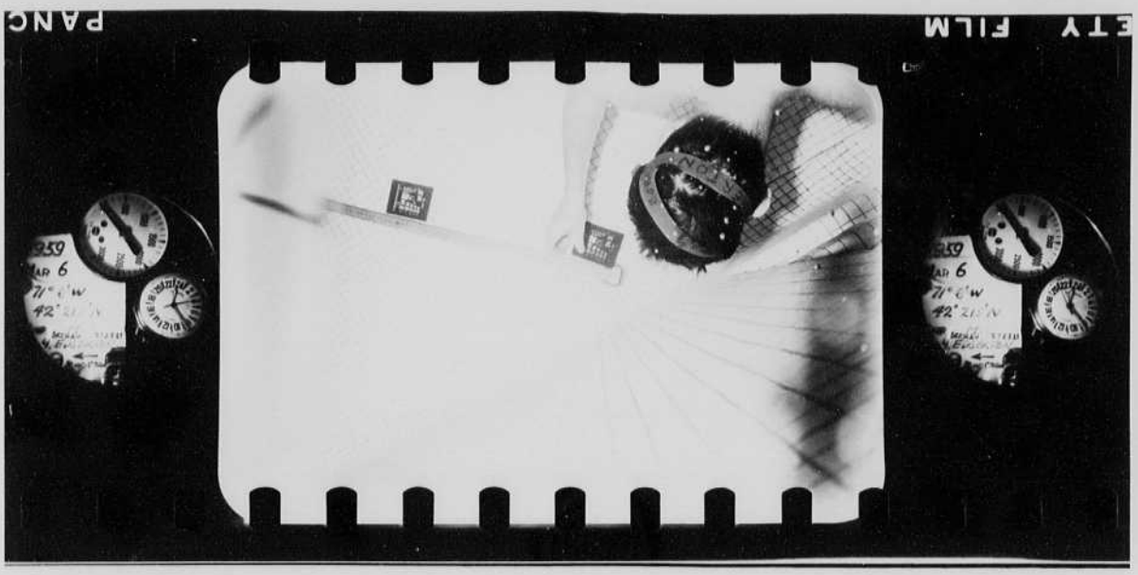
C 50 mfd 12 V. Sprague TE 1133

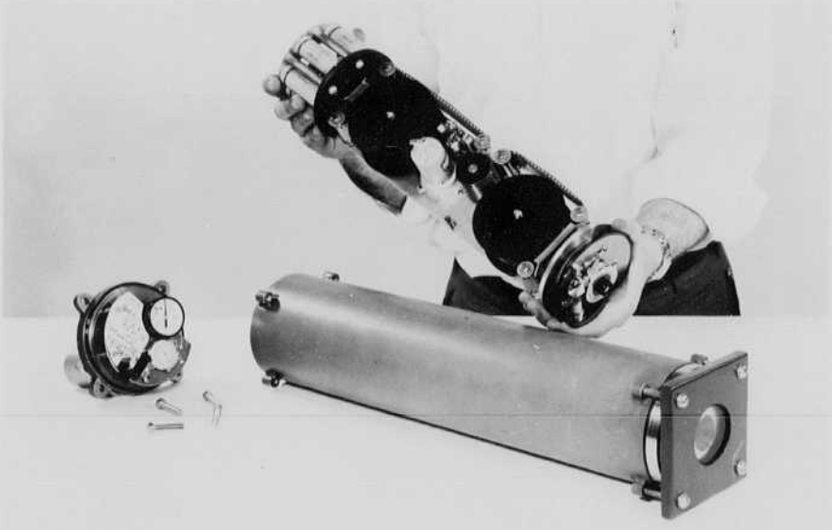
R1 47 Ω 3 watt wire wound



Peak current about 12 amperes.

Running current 1.3 amps 960 volts output.


PANC
ETY FILM



Notebook # 25

Filming and Separation Record

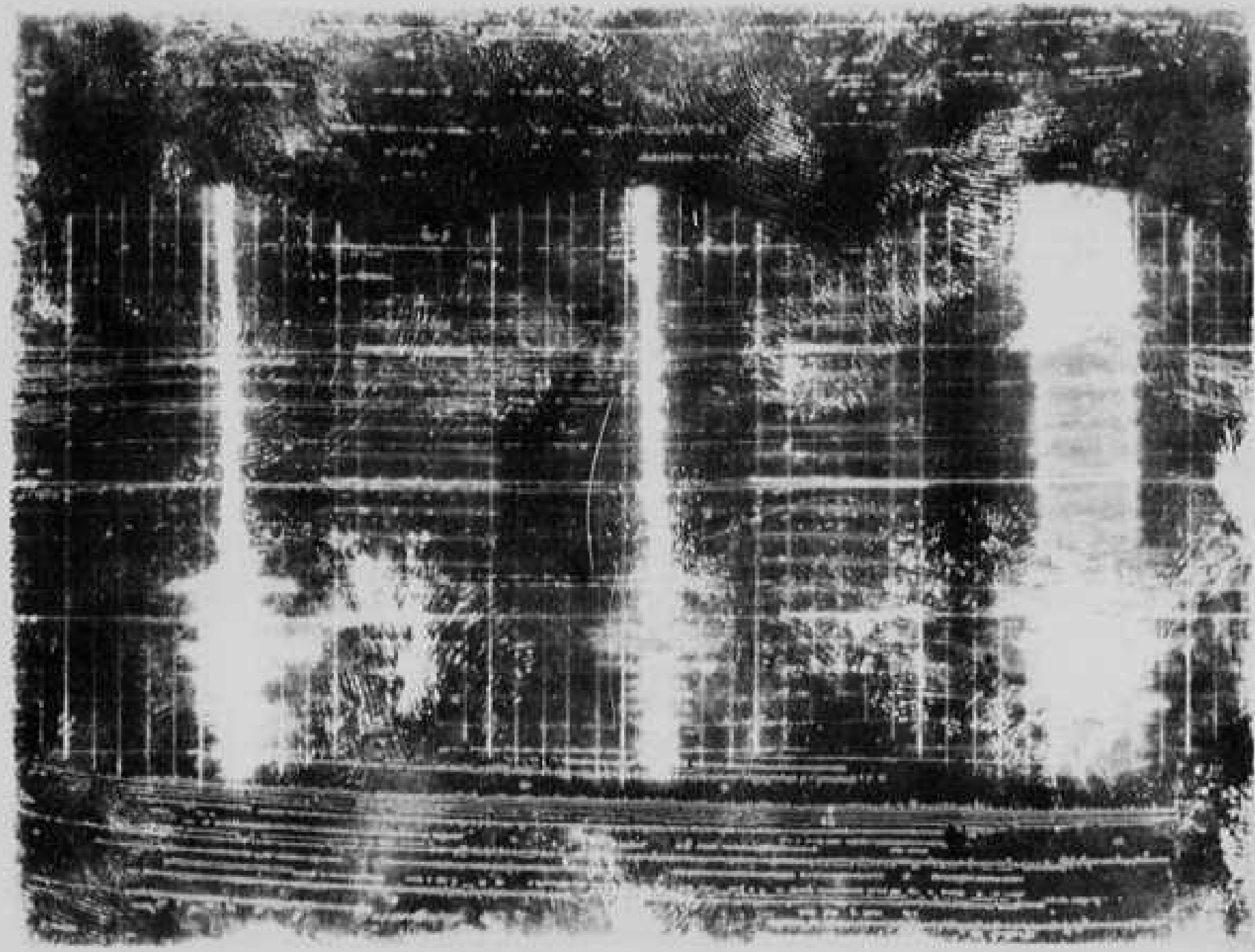
1 unmounted photograph(s)

____ negative strip(s)

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

was/were filmed where originally located between page 72 and 73.

Item(s) now housed in accompanying folder.



74 March 22, 1959
Harold E. Edgerton. Dave Beveridge

							Lamps.	Res.
#1	3 ball machine	Dupont 931. 100 Tmns (56 ft±).	f	2.7	3 ft	.01		0-30
#2	Rubberball Bounce. 2½" ball	931 100 Tmns	f	2.7	2 ft	.01	1.5 sec.	20-60
#3	"	931 100 Tmns	f	2.7	2 ft	.01	1.5	20-70
#4	Steel Ball on Glass. Red Boach Tung & Stock	"	"		" less	.01	2 sec	20-40
#5.	~~Ball~~ White Backgrnd Tungsten & Steel.	"	"		"	"	"	10-30
#6.	Small steel Ball dropped 2" by hand.	"	4		1 ft	.01	2 sec	10-30

Beuzel

Adams

Backe

74 March 22, 1959
Harold E. Edgerton. Dave Beveridge Lamps. Rec.

#1	3 ball machine	Dupont 931. 100 Tmx (50 ft±).	f 2.7	3 ft	.01		0-30
#2	Rubberball Bounce. 2½" ball	931 100 Tmx	f2.7	2 ft	.01	1.5 sec.	20-60
#3	"	931 100 Tmx	f2.7	2 ft	.01	1.5	20-70
#4	Steel Ball on Glass. Red Book Tungsten Steel	"	"	" lens	.01	2 sec	20-40
#5.	" White Background Tungsten Steel.	"	"	"	"	"	10-30
#6.	Small steel Ball dropped 2" by hand.	"	4	1 ft	.01	2 sec	10-30

Benzel

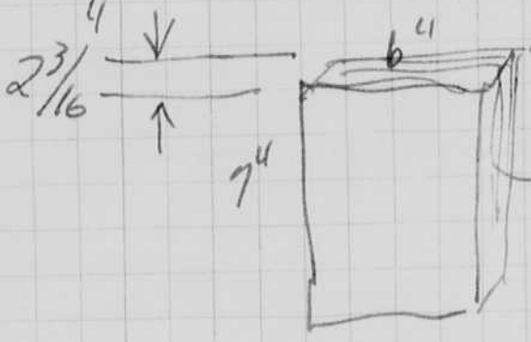
Andrus

Backe

Sonar design.

Report from WHOI camera lost in 2600 fathoms off Bermuda.
Sonar worked excellently.

New unit delivered March 31 1959 Dick Pratt spent day with me on tests. I delivered unit Mar 31.



nickel .018" thick laminations.

82. 20 weigh 6 11½ oz.

4

about 25 lbs.

52.

Heavy wire stock. 1½ size

13" long.

2 - 3/8 bolts

18 turns of #18 wire plastic 1/3 inch.

Tune for 6 KC.

$T = 2\pi\sqrt{LC}$ $T^2 = 2^2\pi^2 LC$ $T = \frac{1}{6000}$ sec.

$T^2 = \frac{10^{-6}}{36}$

$C = \frac{T^2}{4\pi^2 \times 3 \times 10^{-6}} = \frac{\times 10^{-6}}{\pi \times 12 \times 3 \times 10^{-6}}$

36.

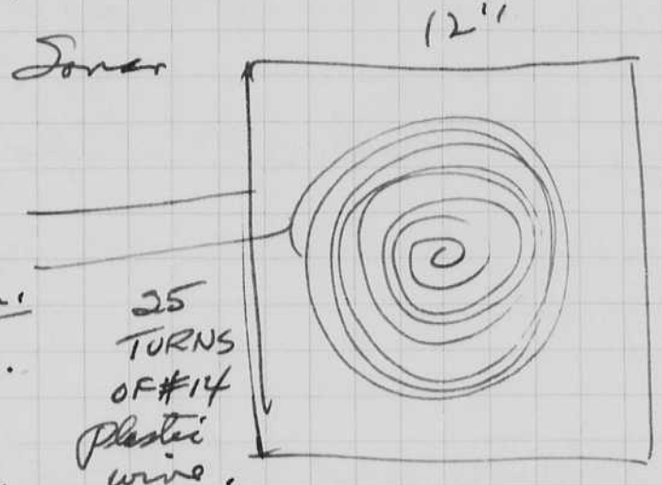
12 00
14,400
3
.040,000 = 25, mfd.

25 mfd.

Turns to 24 total L = 160 μh
DQ = 4.

5.3 μfd in par with coil 5900 cycles/sec

~~Hard~~ 4 tests.

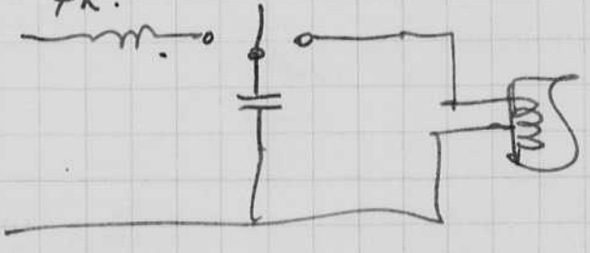


pay board.

100 μh.
DQ = 1.
D.R.
Bridge.

25 TURNS OF #14 Plastic wire.

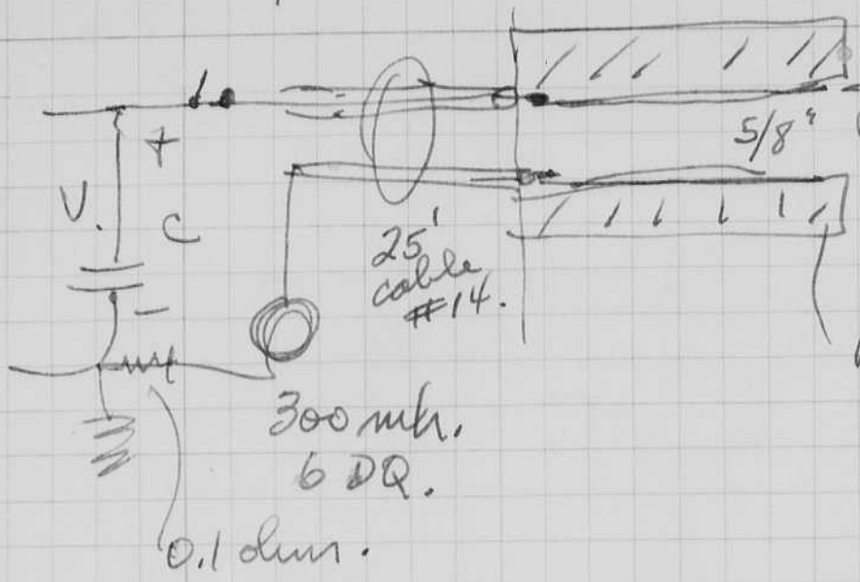
Excited with 2 mfd. upto 2 KV.
22 mfd
37 mfd
81 mfd.



crystal naked

Short ringing time!
frequency a function of C.
I put it in a can of water.
37 mfd. 500 volts maldest ~~Co~~ Co. 12 KC

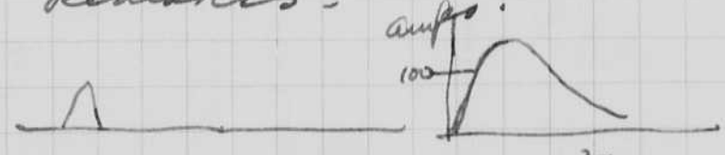
78 Apr 5 1929 #Eddy Spark Savers

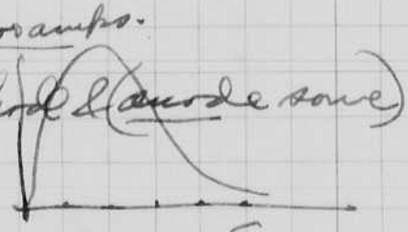


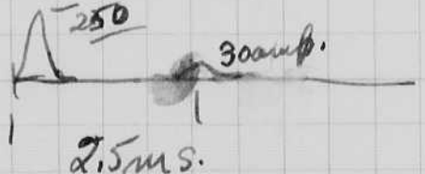
Negative electrode shows red spots of fire for low voltage - cap condition.

Blue fire also first on negative electrode.

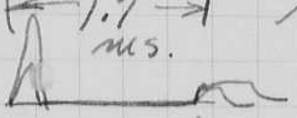
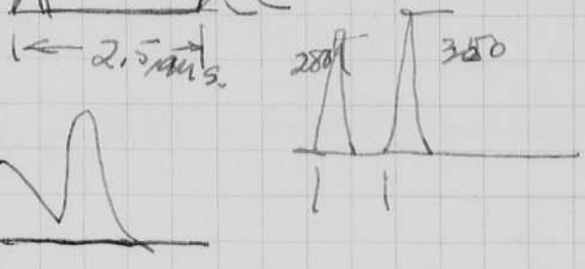
C.	V.	Peak current amp.	Remarks.
25.	2000.	~~150~~ 120 X2	
25.	3000	~~200~~ 200 X2	
25.	4000	260 X2	
50	2000	160 X2	Red fire.
50	3000	220. X2	noise Red fire cathode & (anode zone)
50	3500	290 X2	"
50	4000	300 + ? X2	"
100	1000	100 X2	Bubbles from both electrodes
100	1000	90 X2	Red mostly from cathode.
100	2000	180 X2	"
100	2000	250 X2 + second	"
100	3500	310 X2 +	" Blue? noise!







1" gap length 5/8 gap.

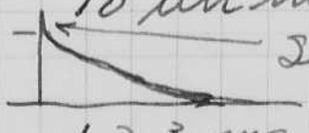
C mfd	V	Peak current	Remarks
			Gaps now 1" length of electrod 5/8" gap. (1/2)
100	1000.	100.	
100	1500	150	
100	2000.	200	 second peak.
100	2500	280.	

If arc is in air the peak current is more than 400 amps! — throws water around!

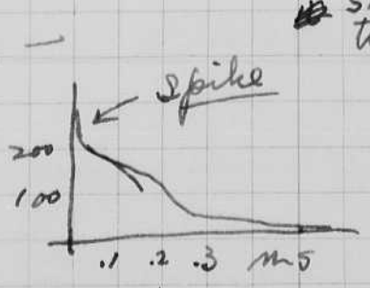
arc somewhat ~~black~~ blue but also red.

25.	1000.	90	no noise
25.	1500	120	noise
25	2000	200	"
25	3000	280	two pops of current
25.	4000	400	

10 uh instead of 300 now used.

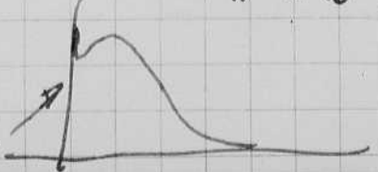
25	2000	220 amps	 Seems to have spike
25.	3000	300+	spike also 50 or 100 amps. Duration 10 μs or less.
25	4000	400+	Noise arc red on both electrodes.

50	1000	120	
50	2000	220	not exponential
50	3000	350	"
50	4000.	550	" noisy!

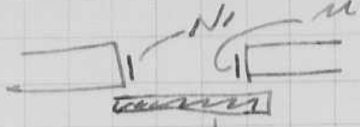


5 μs time const of spike

note rise in current



I put a brass plate (1/8 thick) near the ~~two~~ electrodes - The arc starts over to the brass



Brass showed arc holes and discoloring of copper color.

Replaced Brass with ~~Bakelite~~ Bakelite - 1/4" thick.

~~100 1000~~

50 . 1000 100 amp spike of 50 amps.

50 2000 200 noise.

50 3000 300

50 4000 off scale noise. Arc over. Spacing was less for this.?.!!

92L Lamp FX-21

Chas Phillips

See page 65

Series Hg tube.

450 volts.

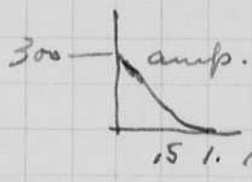
1050 mfd rated (650 actual x 2)?

	Series R	Light meter G.K.		400/READING	C.P.S. ×D² CALC.	DUR M.S.	%
25 ft.	5 ohms	60	5	6.7	410	5	11.0%
	3.0	40	4	10.0	62.5	3	16.5%
	1.5	25	3	16.0	100.0	1.5	26.3%
	0.5	13	2	30.8	192.0	1.0	50%
	Ω 0	OFF SCALE		—			
3 ft	0.0	9.5	1	42.3	380.0	.5	100%

Light from Hg tube = 4 cps for point 1
1 cps for point 2.

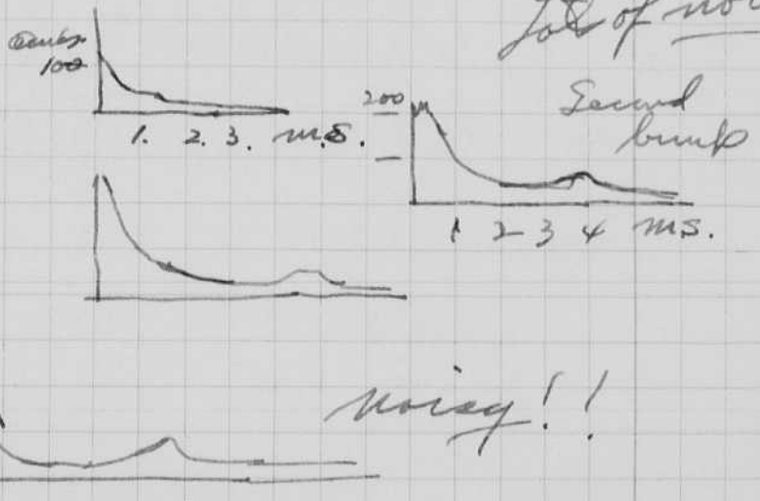
Gap increased to 1 1/4" (about double).

50 mfd.	3000	300
50 mfd.	3500	400



Lots of noise

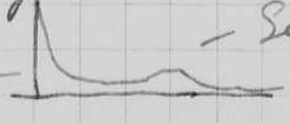
100	1000	110 non linear.
100	2000	220
100	~~2500~~	250+
100	3000	310



noisy!!

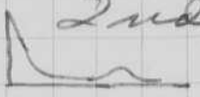
Length of nickel electrodes increased to 2" from 1" in length. The spacing is now 1/4" as before.

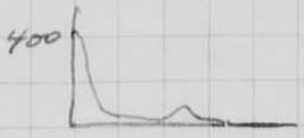
100	1000	150	no noise.
100	2000	300	noise
100	3000	400	"



Bar mag is 2 1/2" with a 2" length of 1/4" rod .018" thick.

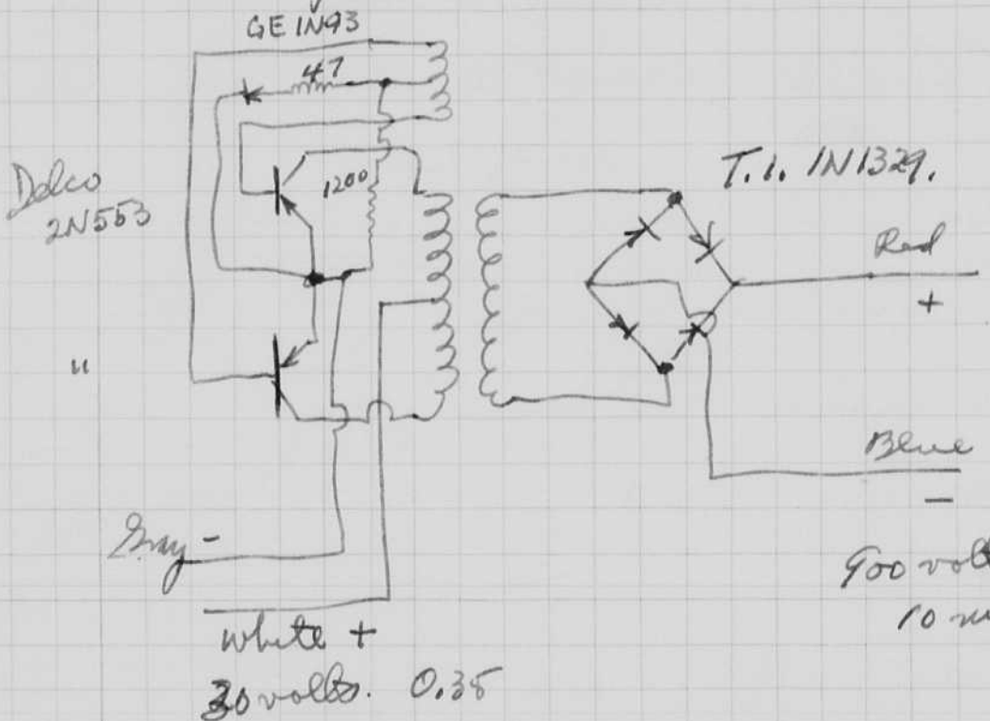
	mfd	V	I	
10 μhy	100	2000	300	Noise weak. 2nd peak.
	100	3000	400	
10 μhy	100	3000	400	





Power Supply from USASRDL

Bedrosian



~~Hubert Schardin was a visitor today~~. Lunch at Walker, then visited lab. He showed 200,000 p.p.s. of glass breaking and 30,000 p.p.s. of plastic with a long range Drum camera with ~~6~~ sparks in a row that ran at ~~50,000~~ 5,000 cycles. The drum was 1 meter in circumference.

Test of Power supply. 24 V input battery.

7 mfd capacitor on open circuit peak = 1000 + V

2. Electrolytic capacitor 525 mfd 450 volts in series

15330
1-300 Input. ~~50~~ 24.9 volts

Output. 785. volts.

6 sec to 700 volts.

Input. 25.9 0.105 amps. ✓

output. 795 0 (leakage).

charge peak 1.5 + (maybe 2 amps!). for 1 sec.

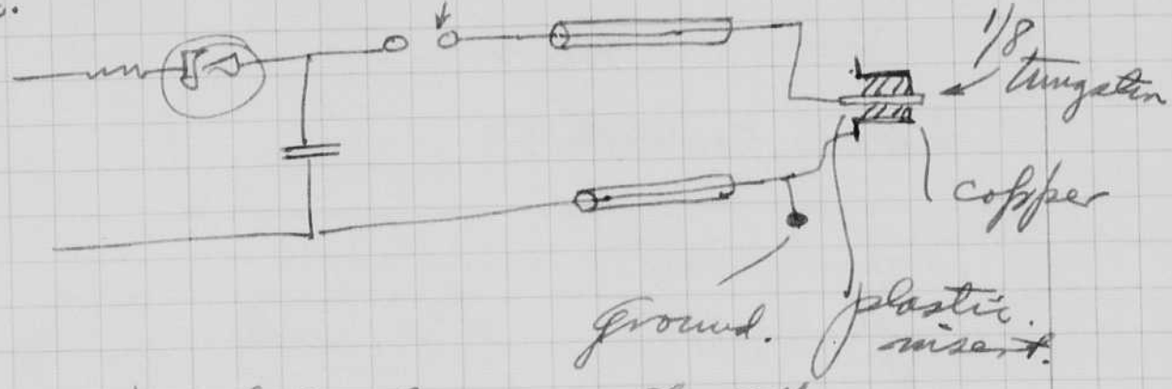
84 April 17 1959
H. Edgerton

Visit to "Chain" at Bethlehem Steel Hulk yard East Boston.

"Chain" is due to leave for the Mediterean tomorrow noon. Capt. Olivy.

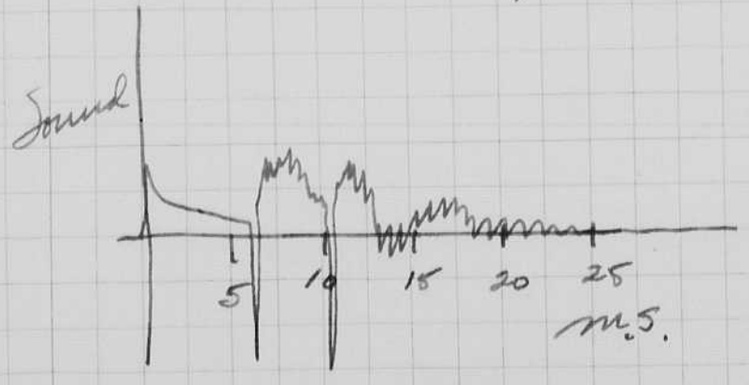
Dick Pratt showed me the Spark transducer.
Sivac 253 rectifier into
6 to 10 mfd at 14 KV.
Series gap to drive spark.
RG 8U cable ~~Double~~ Two wire
1000 ft and 60 feet.

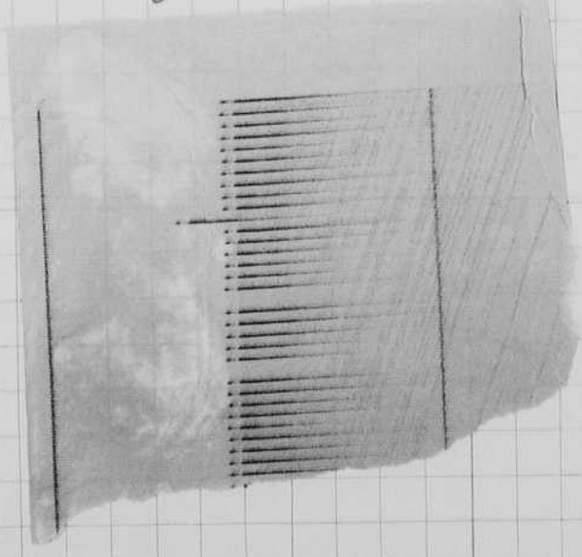
10 mfd
15 KV
= 1200 watt sec.



Faulkner and Sandra went with me to see the Alden recorder and the Sonar drivers.

Spark at surface of water
Mike in water at 10 feet ±. Signal on tektronic scope.



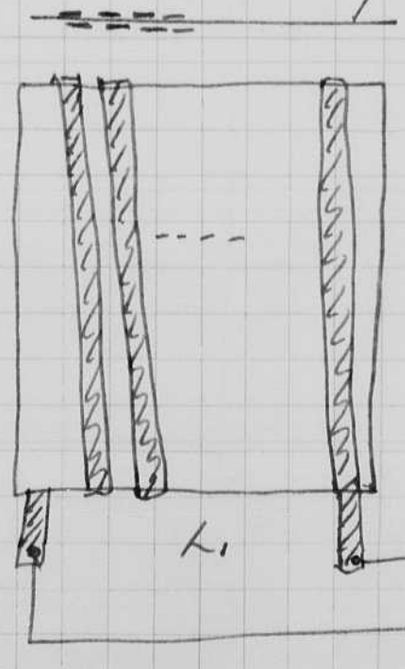


Tested Stereo camera last night in the M.I.T. pool. Helpers were Tredwell, Cooper, Jacobson. The Leica Elmar f 3.5 lenses with Baker correctors were used & set the focus at 5 or 6 feet in air. Dupont film of the 3 mil variety was used.

Today more tests with Sonar transducers. I tried the two strip device with 4 KV at 62 mfd. It makes a bang with 4 bright spots. Two are reddish, the other two blue. The bucket gave quite a bang.

Also tried the coil type of transducer again. The surge disturbs the aluminum foil. This should be glued to the support.

Flat wire should give a good coupling to the water.



Bare wire in the water can be used. The flat strips tend to repel since the current is in opposite directions. Coupling to the water shunted the good.

Let C = 9 mfd

f =

frequency = double that of the circuit

$$f = \frac{2}{2\pi\sqrt{LC}} = \frac{1}{\pi\sqrt{LC}}.$$

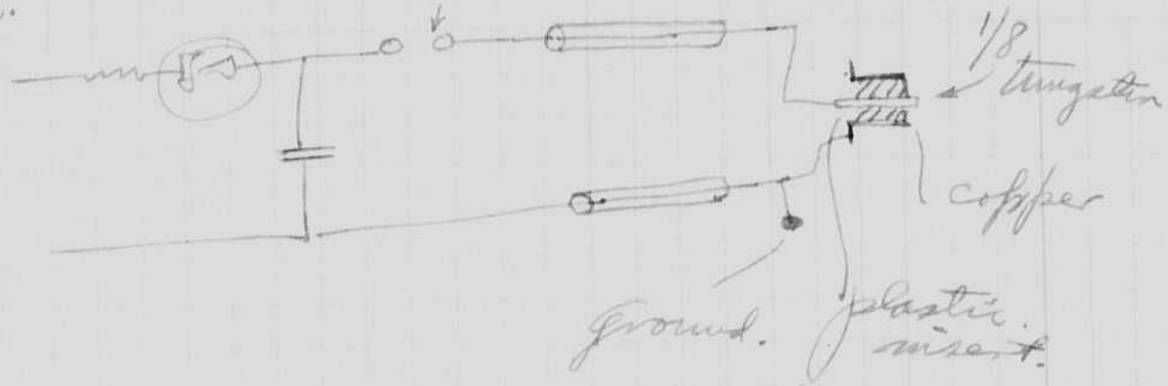
84 April 17 1959
H. Edgerton

Visit to "Chain" at Bethlehem Steel Ship yard East Boston.

"Chain" is due to leave for the mediterrean tomorrow noon. Capt. Olivy.

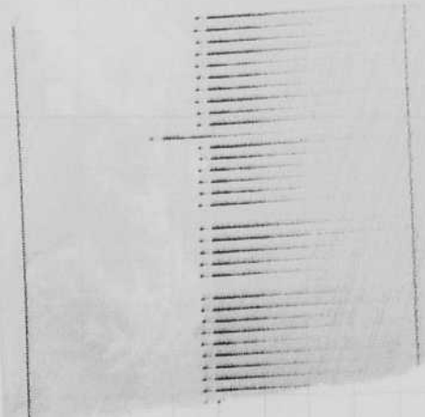
Dick Pratt showed me the Spark transducer.
Sivac 253 rectifier into
6 to 10 mfd at 14 KV.
Series gap to drive spark.
RG 8U cable ~~Double~~ Two wire
1000 ft and 60 feet.

10 mfd
15 KV
= 1200 watt sec.



Landsman and Sandra went with me to see the Alden recorder and the sonar drivers.

Spark at surface of water
Mike in water at 10 feet ±. Signal on tektronic scope.



Apr. 19. 1959.

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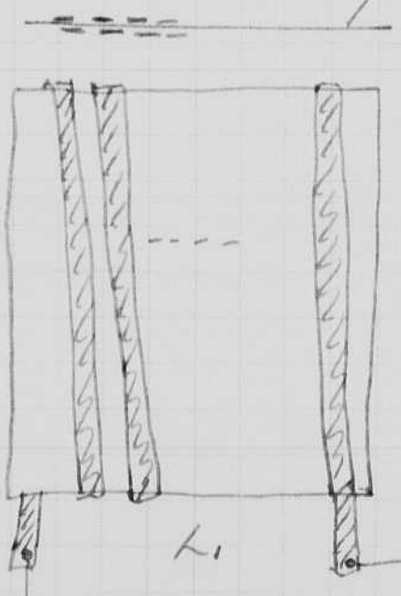

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Let C = 9 mfd

f =

Notebook # 25

Filming and Separation Record

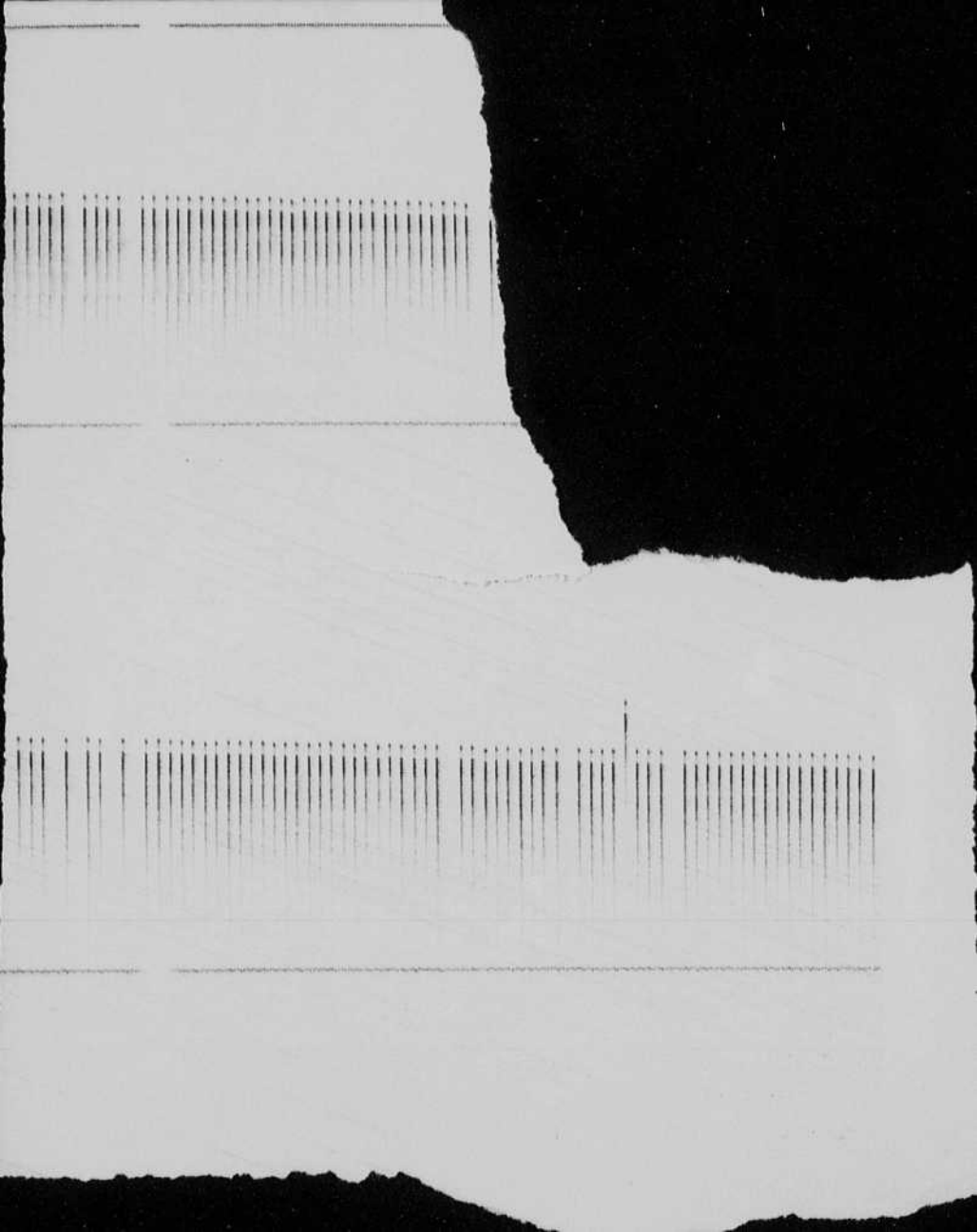
____ unmounted photograph(s)

____ negative strip(s)

__1__ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 84 and 85.

Item(s) now housed in accompanying folder.



$L = 100 \times 10^{-6}$ henries.

$C = 60 \times 10^{-6}$ farads.

$$f_m = \frac{1}{\pi\sqrt{LC}} = \frac{1}{\pi\sqrt{6000 \times 10^{-12}}} = \frac{1}{\pi\ 78.\times 10^{-6}} = \frac{1}{.2\times 10^{-3}} = \frac{5000}{\text{cycles}}.$$

$$\frac{1}{200}^{\frac{3}{2}}$$

For 500 cycles Let $C_{5000} = 10^2 C_{500}$

$$C_{500} = 6000 \text{ mfd.}$$

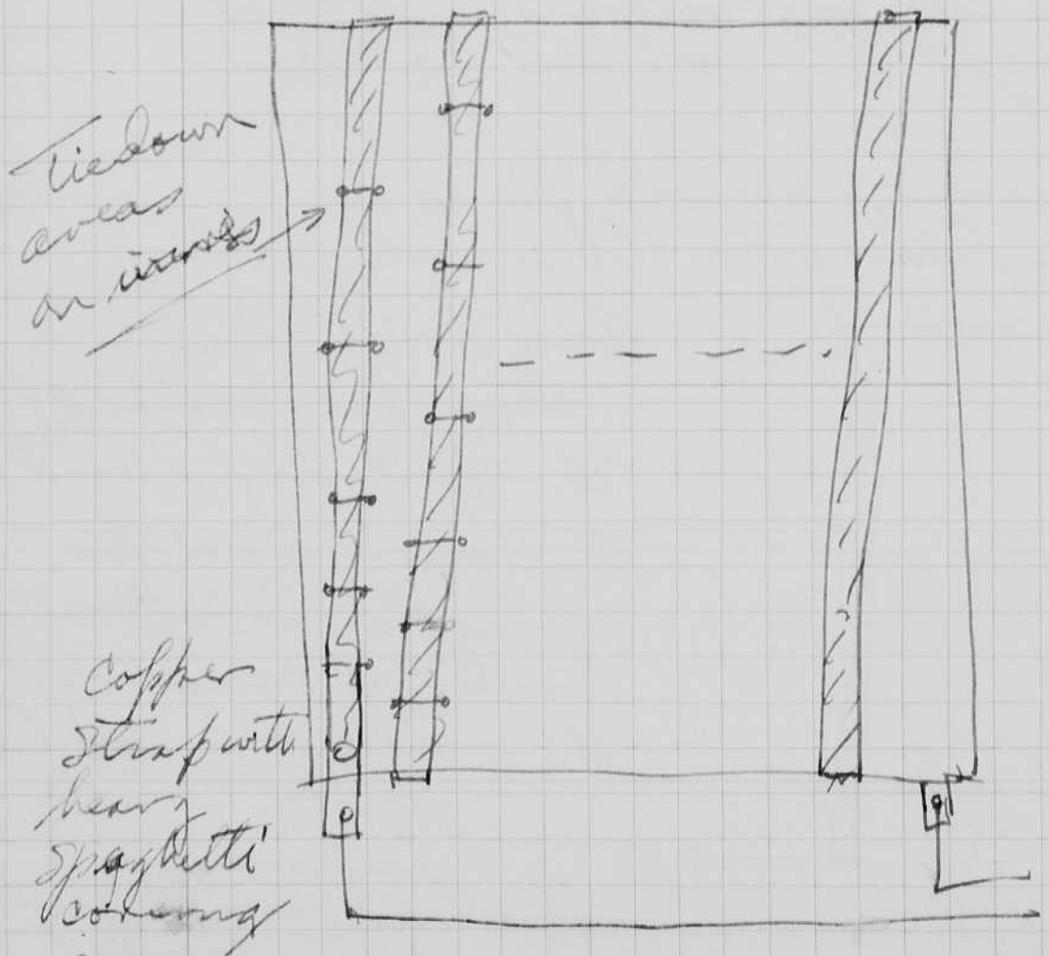
The coil should have some inductance.

Say let $L = 1000 \times 10^{-6}$ henries.

$C = 600 \times 10^{-6}$ farads.

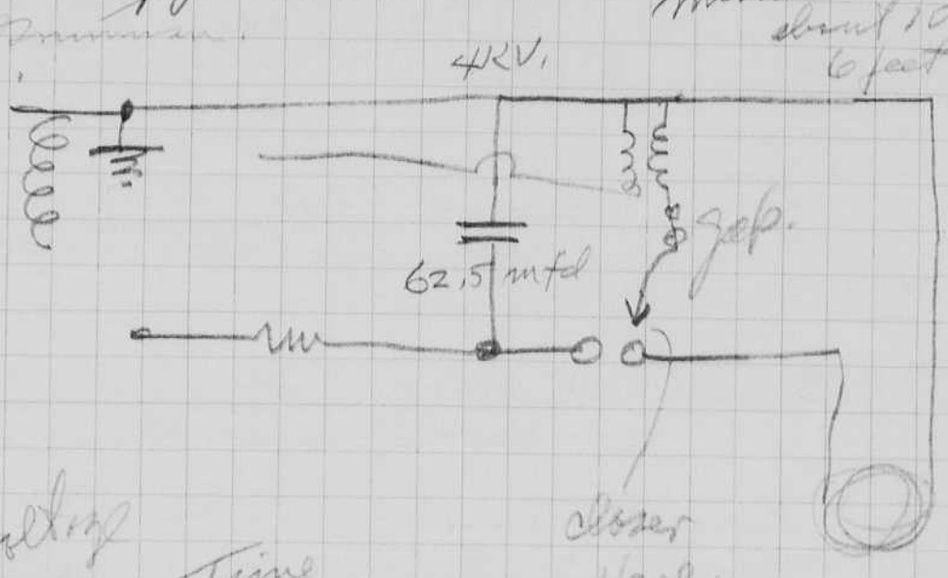
$f = 500$ cycles.

R



Jacques Morhange came back from W+01 on Friday Apr. He plans to go to N.Y. on Tues or Sunday Apr. 20. Morhange is working for Cousteau.

Apr 20, KSA to Bob Frith, Norman, Paul, Stinson, D. Hersey, H. Edgerton

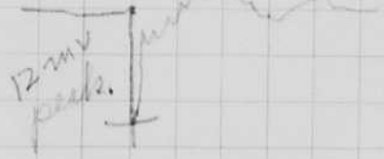


mike to coil about 10 feet 6 feet deep.

Osc #1 rolling Time

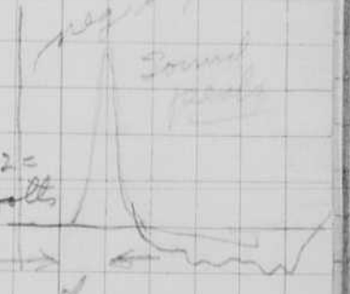
12 #1 2 mv/cm 0.5 ms/cm

Source and mike on the wood frame work.
4M ~~X~~ out distance,
two alum plates on coil
Single Edger coil
See page 77



12 2 Expanded time
2 mv/cm 100 ms/div ?
exp. Scale

Same as osc #1



2. #3, Coil without the alumm Plate amp is now 2 div instead of 12.
2 mv/cm 100 ms/div exp scale

2- #4 2 mv/cm .5 ms/div same as 3 without plate
.015

6.1 #5 Alumm foil on both sides 1/2 of #1 amp.
2 mv/cm .5 ms/div

#6 One alum Plate on coil side toward mike
2 mv/cm 0.5 ms/div ~~Back of the screen~~

32 #7 10 mv/cm 0.5 ms/div .030 volts peak

88

Meter Reading	FILM NUMBER.	Volts	Time
16	8.	5 mv/cm	10 ms/cm
Off scale.	9	1 mv/cm	10 ms/cm
—	10	2 mv/cm	2 ms/cm.
20	11	~~5 mv/cm~~	~~.5 ms/cm~~ 1 ms/cm
20	12.	5 mv/cm.	.2 ms/cm

nickel – 110 db
1 watt/meter,
special coil
longer than calib. coil

Film #5 coil
with al. plate.

20 deg

→ until explosion.

4 × 5 = .02 volts.

Spark

Return to Original condition titled #1
Two Al plate discs

16.5	13.	5 mv/cm	.2 ms/cm.	peak 4 × 5 = 20 mv.
15	14.	5 mv/cm	1 ms/cm.	

Spark Gap.

50	15	50 mv/cm	5 ms/cm.	30 mv first peak 275 mv large peak after 4 ms

time

16 Titled with other apparatus.

17	50 mv/cm	1 ms/cm	
18	50 mv/cm	1 ms/cm + magni 0.2 ms/cm	

0 4 ms.

Peak MVS

Green coil with one al. plate
62.5 mfd at 4 KV.

max Ring time.

Green coil.

85 19. 50 mv/cm 1 ms/cm.

100. 20 50 mv/cm 5 ms/cm

100 21 50 mv/cm 1 ms x mag. (.2 ms/cm)

Heavy rays 1 volt from 180 with dots
Knots rays ½ volt " "

Rotation 90° of transmitter

80 22. 50 mv/cm 1 ms/cm Transmitter rotated 90 degrees

80 23 50 mv/ 10 ms/cm " " " " 28ms

mike moved to 8 meters.
instead of 4.

45 24 50 mv 1 ms.

6.5 25 .052 plate removed Square plate of .005" al
taped to the Green coil. 45°
Peak down by factor of 10.

5 mv 1 m.s.

1/4" al (5724) plate used. down by 1/2 from .052"

26 50 1

Plate .052" aluminum.
reduced from 1/4" diam to 6/8" diam

No. Dam
27 50 2.

Seepage 80
from obs 28 29

Stickles

95 27 50 mv/cm. 1 ms/cm

100. 28 50 " 1 ms/cm x 5 (.2 ms/cm) 26

100 29 50 " 10 ms/cm

110 30 50 " 1 180° change shows 115 mv better!! 8ms

40 x 3 31 20 " 10 " Distance now 3 x to miles. 4 x 3 = 12 miles

40 x 3 32 50 " 5 " " 5ms

15 x 6 33 10 " 5 " " " 6 x 4 Miles. 3.

Signal should be 10 x larger than this.
Single pulse width should be?

(1 prong spark gives 1/2 wid).
explosives are 70 lbs.

27

Ripples are probably echos
maybe other reason.
Cavitation shown on the disc
larger size indicated.
Hole in disc has effect?.

Voltage should be 1 volt.
10^6 to 10^9 dynes.
at a yard from the source.
today. 0.1 volt. → 90 db above a dyne.
10^5 dynes/sq cm

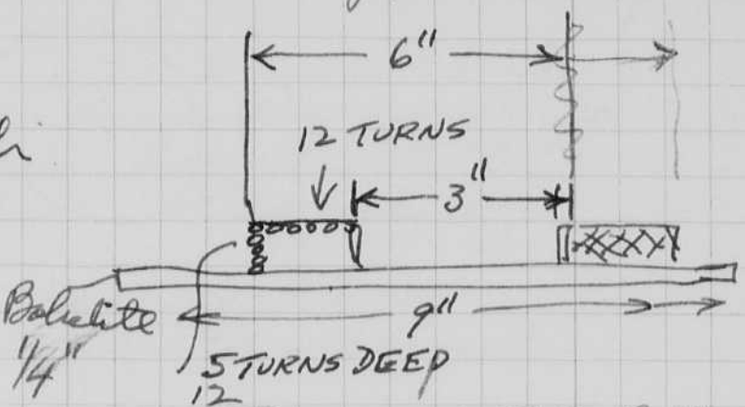
Dec 28 29
of page 89.
others are with Hersey U.H.O.1.

Apr 21 1959
H. Edgerton.

0.05"

"Green" coil with 6" al disc as used for osc nos 27 to 33.
L = 145 mh.
DQ = .7

(measured with cable #16 300 volt Zip cord.)



Without Disc removed
L = 310 mh
DQ = 2

12
60 Turns. #16 ? plastic covered wire.

Note Disc shows cavitation marks on inside. These could be from the previous tests. Disc looks bowed in some towards the coil.

The disc was held by tape against the coil.

There was also cavitation around the outer surface of the disc. This was patchy. It shows that the force was opposite the windings. I saw no evidence of cavitation on the side towards the coil except at the center as mentioned above.

Notebook # 25

Filming and Separation Record

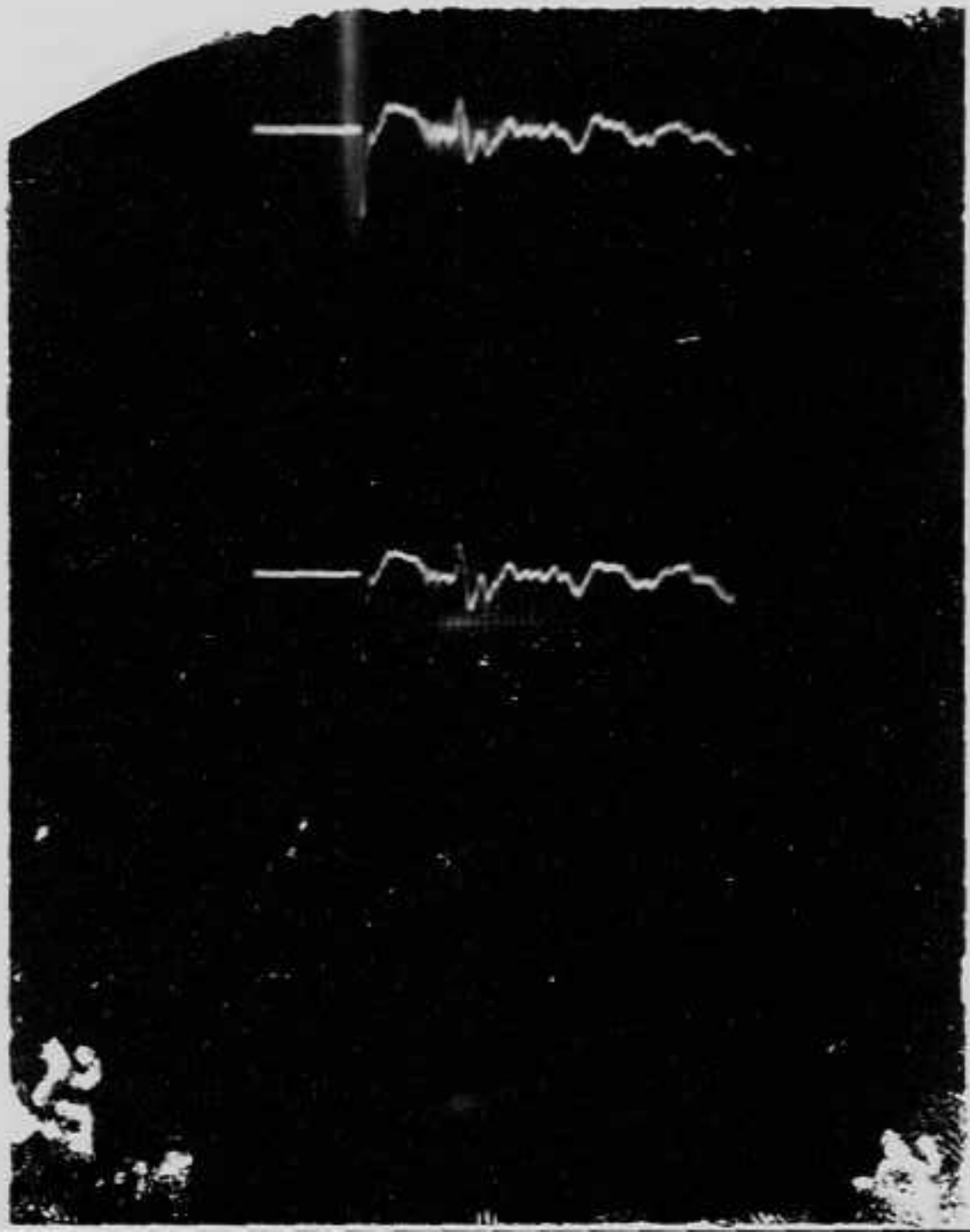
____ unmounted photograph(s)

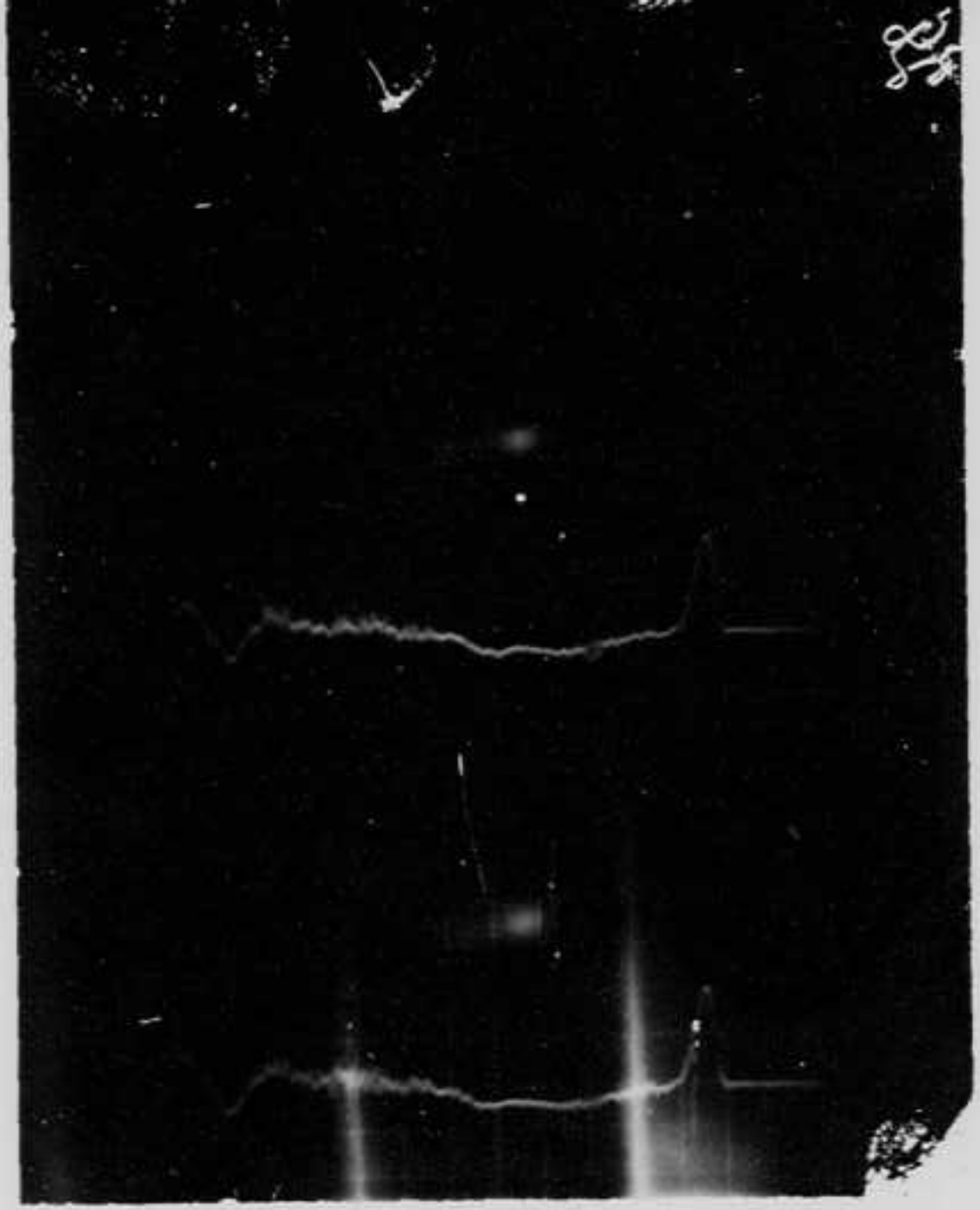
2? negative strip(s) inside envelope mounted on page 90

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

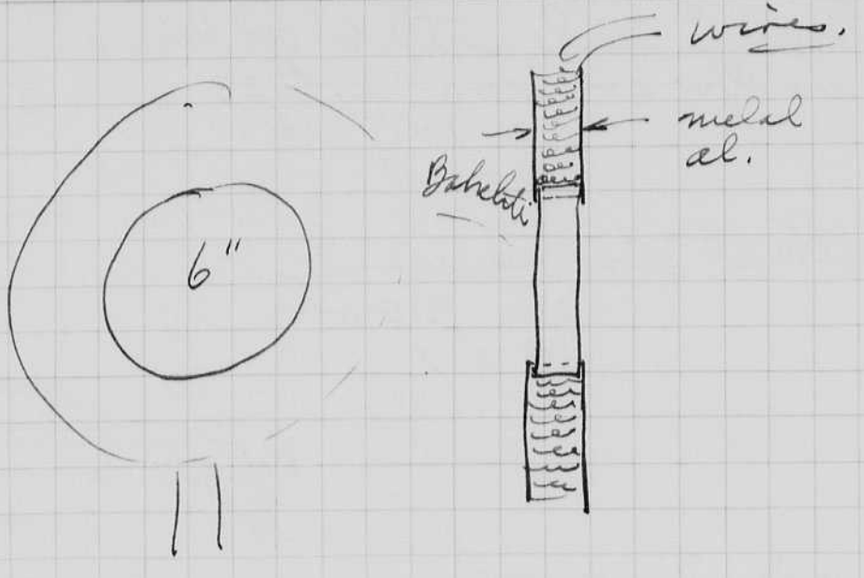
was/were filmed where originally located ~~between~~ on page 90 and -.

Item(s) now housed in accompanying folder.





April 21, 1959
H. Edgerton. Transducer design.



Try parallel wires in water trailing out behind the ship.

Use minimum insulation between the wires

A magnetic material could be used between the wires.

Some attention is necessary to prevent eddy current losses.

Apr 24, 1959. Last week Bill made me a coil on a Bakelite form. I tried soft aluminum but it buckled where it was close to the coil. I then tried some 24ST Aluminum. Some of about 0.1 and some of .05. Both made a lot of noise in the water.

I used 100 mfd at 4. + kv with a series switch.
The pulse looks good on the oscillograph.

Apr 29 1959.
H.E. Edgerton

Dr T.S. Gray & Prof Wilder were in the lab yesterday to see the vel. of light experiment and the under water sound source. I pinged two models with 100 mfd at 4 KV. There was a lot of noise.

Jacobs man and I tried to pick up the sound with out too much success since we had a lot of pickups. Hope to get this with the M.I.T. port for other tests.

May 4 1959. Open House at M.I.T. May 2 12-5. Many visitors to the Strobe Lab in 4-405 4-410 with a special showing in 10-275.

Jack Pogue, 13 yrs old, from Washington was here for the open house. He is my sisters boy. (Mary Ellen Pogue).

May 7, 1959.

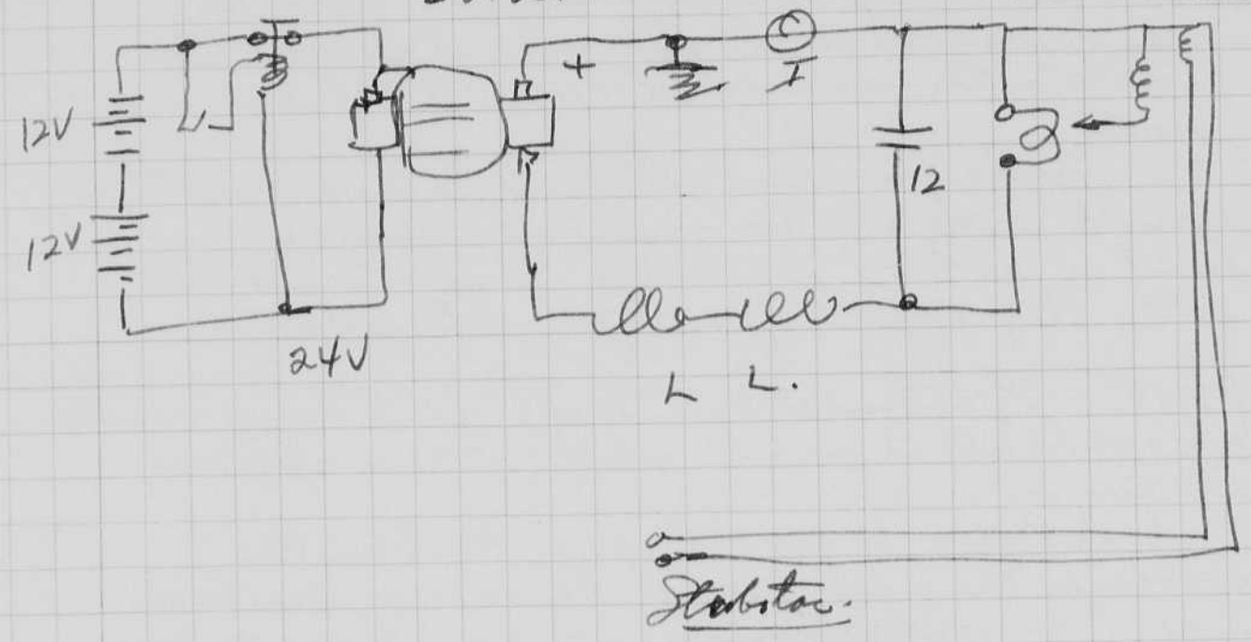
48 cycle ~~Strobe~~ for

H E Edgerton. Movie camera.

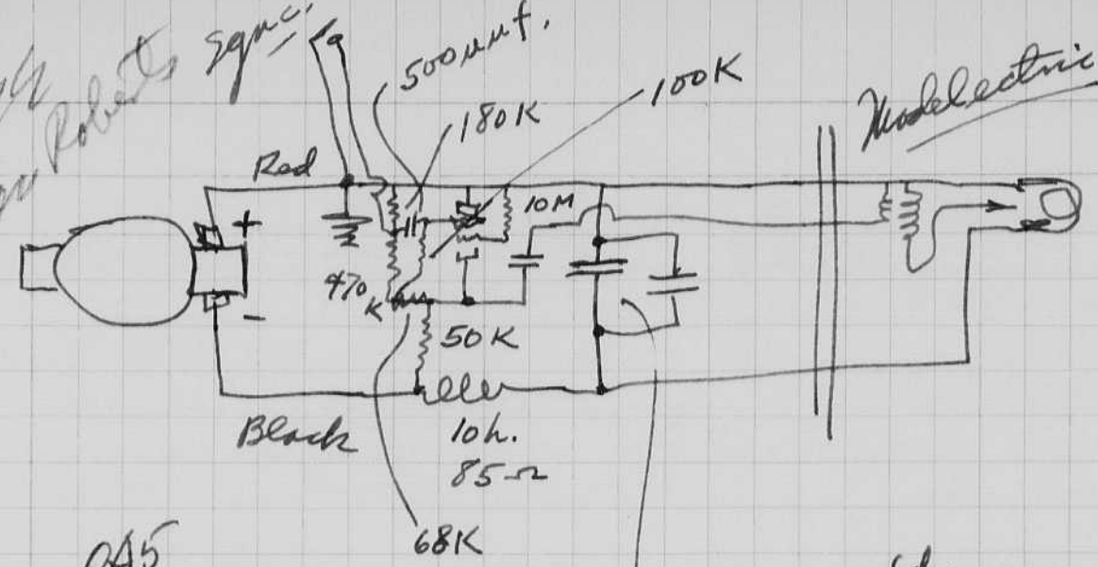
Carter. output 800 0.5 amps. 4100 RPM

B8050P

Serial. 1754D



f	C =	L.	Idc.
24/ sec.	1 mfd	2 - 12h in parallel 8C43	0.45 .5 cold.
24/	1 mfd.	2 Triad H5M319 10h 300 ma. in parallel	0.51 cold.
24/	8 mfd	1 H5M319	0.32
48/	8	1 "	.66
48/	6	1 H5M319	.45
48	6	2 in parallel H5M319	.44
48	8	"	.55.



48/sec. 5.50 pm start of heat test. on
1 choke 10h Triad HSM 319
8 mfd. at 1200 volt.
D.C. current. ~ 8 amps

Ran two minutes then
Glass broke around the Camps

I need a larger bubble. I had a bubble about 2 or 3 sq cm for the beginning.

6.45 new Glass Installed 1" of air with rubber tube
1 min rim stirred the oil.
1 " off
1 min run
1 " off.
2 " on
3 " on.

.3x9 amps 8 mfd 10h. 48/sec

$\frac{225}{4}$

$\frac{5 \times 1500^2}{2} = \frac{4500}{}$ W.S.

30 min operation ok,
a few strobotron skips.

Mon. 8, 57
Wash.
N. Y.

f	L	C	I	
1/8	10h.	12 mfd	0.7	Show bubbles of gas on the coil
1/8	10h	8	0.5	Some bubbles on tube, but probably o.k.
1/8	10h	10	.53	

March 18 1959

Wash.

Graham from WHOI was here this noon to discuss cavers, sonar, etc about summer activities.

I showed Prof Woodson the Elder-Geyer Prieger with 100 mfd at 1KV in the plates. I used the unit I made for washing bulk of aluminum (hardened) cylinder & bakelite core.

I made a copper plate 1" x 12" with a 25 turn coil of #20 wire on a 6" diameter. 100 mh DQ = 0.8

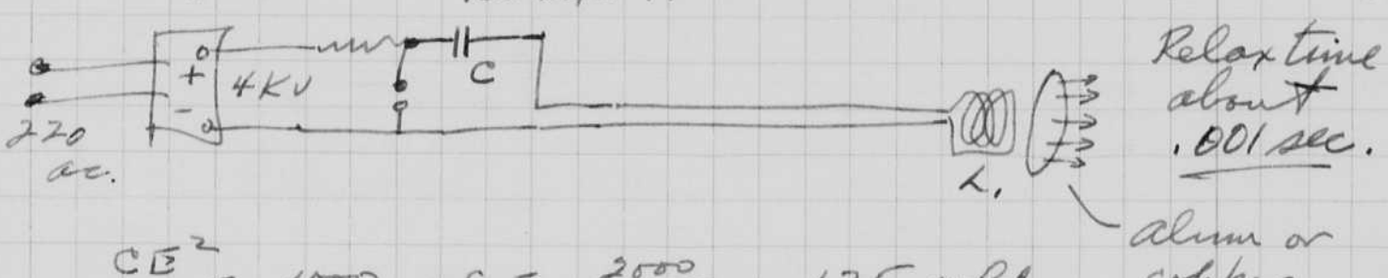
Resonance cale at 3 mf for 12 KC.

I ran up to 100 mfd at 3000 volts. This was enough to pull on my coil from the copper. I used it attached on with the metal tape

May 19, 1959
Harold E. Edgerton

Several weeks ago Hersey and I designed the construction of an electromagnetic transducer for use by the WHOI ships. I plan to use the 4KV power supply from the Eg&g 501 movie equipment. This will charge about 1000 w.s. of capacitors to 4KV and then dump once a second.

I may put the capacitors and trigger into a case for use in the sea or the bottom. However, to start I will probably let the transducer hang into the water or trail back of the ships.



$\frac{CE^2}{2} = 1000 \qquad C = \frac{2000}{16,\times 10^6} = 125.\ \mu fd.$

$f = \frac{1}{2\pi\sqrt{LC}} \qquad LC = \frac{1}{4\pi^2 f^2}$

$f = 6000$ cycles.

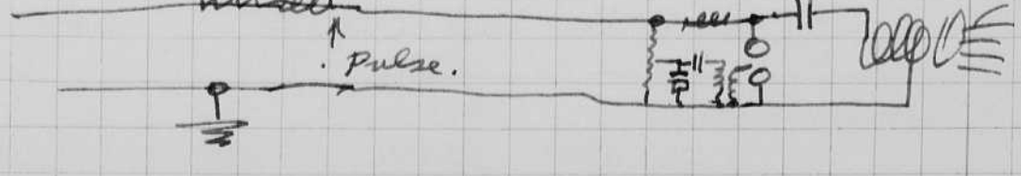
$L = \frac{1}{C 4\pi^2 f^2}$

$L = \frac{1}{125 \div 10 \cdot 36 \times 10^6 \times 10^{-6}} = \frac{1}{.144 \times 10^6}$

,125000

$\equiv 7.\ \mu h.$

This is a very small inductance. The leads will be important.



May 20, 1939.

$10\frac{5}{8}$" diam $\frac{3}{16}$" 6-1/4-20 Bolts on 5" diam.

9 turns on 7 1/2" diam wood core 1/4".

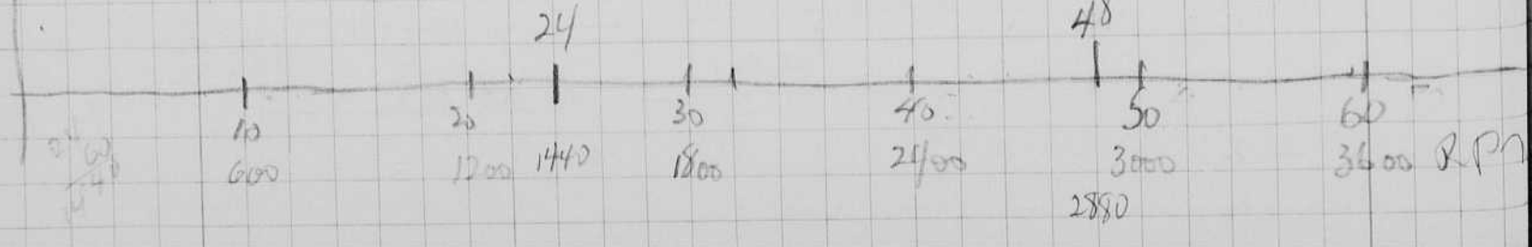
Inductance 7 uh. 0.35 DQ.

100 mfd at 2KV. I coved feel the edge move when flashed.

$$T = \pi\sqrt{LC} = 3.14\sqrt{100\times10^{-6}\times7\times10^{-6}}$$

$$3.14\sqrt{700\times10^{-6}} = 80\times10^{-6}\ \text{sec.}$$

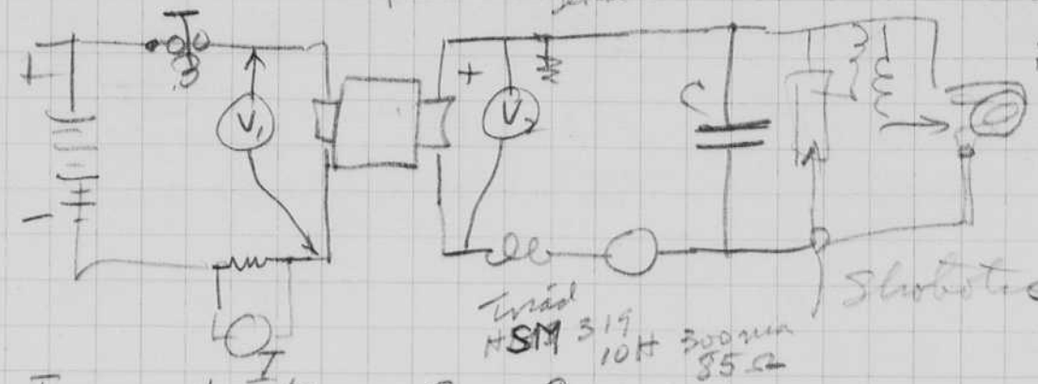
25
25
125
50



May 21 1954
H. E. Edgerton

48/sec Strobe.

Carter type E8050P 24V – 800V 0.5a Serial 1754D.



	V_1	I_1	V_2	I_2	C	f.		
710	25.	21.5	710	.48	8	2880 ~~48~~.	535/340	649.
733	25	21.4	710	.46			535/324	62.4
	25.2	19.	720	.39	8	2400.	480/280	58.5
	25.3	17	740	.34	8	2000	430/252	57
	25.5	15	760	.275	8	1600		
	25.5	14	770	.24	8	1440		
759 off.								
	25	20.5	710	.44	16	1440	2L	
	25	20.5	675	.43	16	1440	2L.	two L's
	25	20.5	710	.43	16	1440	1L.	
	24.8	22	695	.45	16	1600		1 Induct
	24.8	21.8	690	.48	16	1800		
	24.8	23.4	680	.52	16	1800		
	24.6	24.5	670	.57	16	2000		
	25.0	20.3	710	.43	16	1440		
	25.2	18.0	730	.37	16	1200		
803 off								
	25.3	15.5	750	.29	12	1200	1L	
	25.1	17.0	740	.335	12	1400		
	25.0	18.6	720	.37	12	1600		
	24.9	20.	710	.42	12	1800		
	24.9	21.3	695	.46	12	2000		
	24.7	22.5	690	.495	12	2200		
	24.7	23.6	670	.53	12	2400		
	24.6	24.5	660	.56	12	2600		
810 off for power meter.				oil is hot.				
	25.0	21.3	710	.47	8	2880	1L	
820	24.8	21.2	695	.455	8	2880	10h 1L.	
833	25.6	21.5	720	.475	8	2880	10h 1L.	

Lamp looks ok. – hot.
Apex tubes barely warm
Carter barely warm
Inductance very cool!

Lighting Apparatus Barn tube FT-29 in 10-4-40

D = 1.5 f/N. meter 30 f SR.

$11 \times 1.5^2 =$ 24.75 EPS. 2.7 = 11 C.P./W.S.

c = 8 mfd $\frac{CE^2}{2} = 9.$

V = 1500.

24×1.5

c = 16

V = 1500

3. = 11.

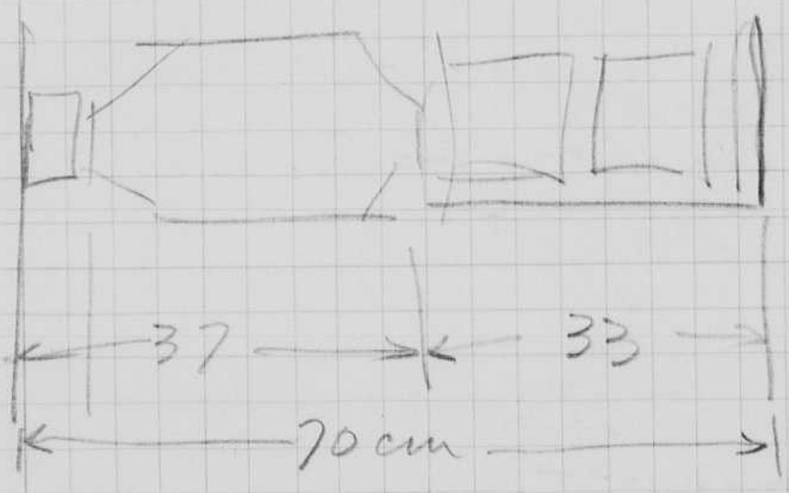
Suppose Ref factor = 10. Then BCPS = 250 CP

= 500 CP

$DA = \sqrt{250 \frac{200}{15}} = \sqrt{2500}$

$= 50$

For D = 6 f/N then f 8 for lens



Light tests.

GL Projector
PH/500 T20-30V
DET
med Base 500 W T-20 C13 filament.

S.R. light meter 3.5 at 3 ft 1/5 sec.
reads 40. Light = $\frac{400}{40} = 10$ lumens.
B.H.
C.P. $5 = 10 \times 3^2 = 90$.
CP $= 90 \times 5 = 450$.

next with Strobe at 45/sec.
meter reads 38

Strobe unit is efficient since the shutter is closed 50% of the time.

Sonar 8" Disc Soft copper .04"
5" Wood 3/4 thick
7" Hard Al 2457. .04
90 turns #18
430 uh
0.7 Ω.

6000 cycles $= \frac{1}{2\pi\sqrt{LC}}$

$2\pi^2 36 \times 10^6 = \frac{1}{LC}$ $\quad C = \frac{10^{-6}}{4\pi^2 36\ 430 \times 10^{-6}} \times 10^{-6} = 1.2$

1400
64 100

May 29 1951
W. E. Leguton

EL&G Sonar Transformer

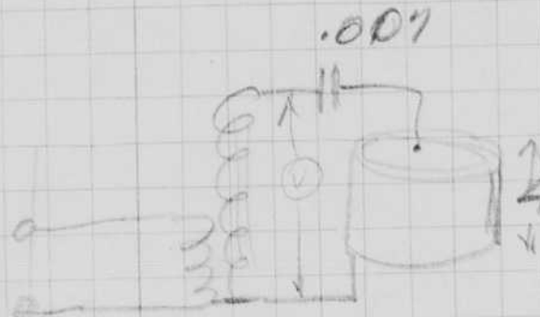
See Rad. White 26.5 mh. DR = 1.9 /.

Pri Blue White 30 mh. = 1.4 ?

Sprague 11.98 KC.

12,300 Elect. KC
11.97 Mech. KC.

Resonant trans at 90 KC
3.7 KC with Sprague
Better response.

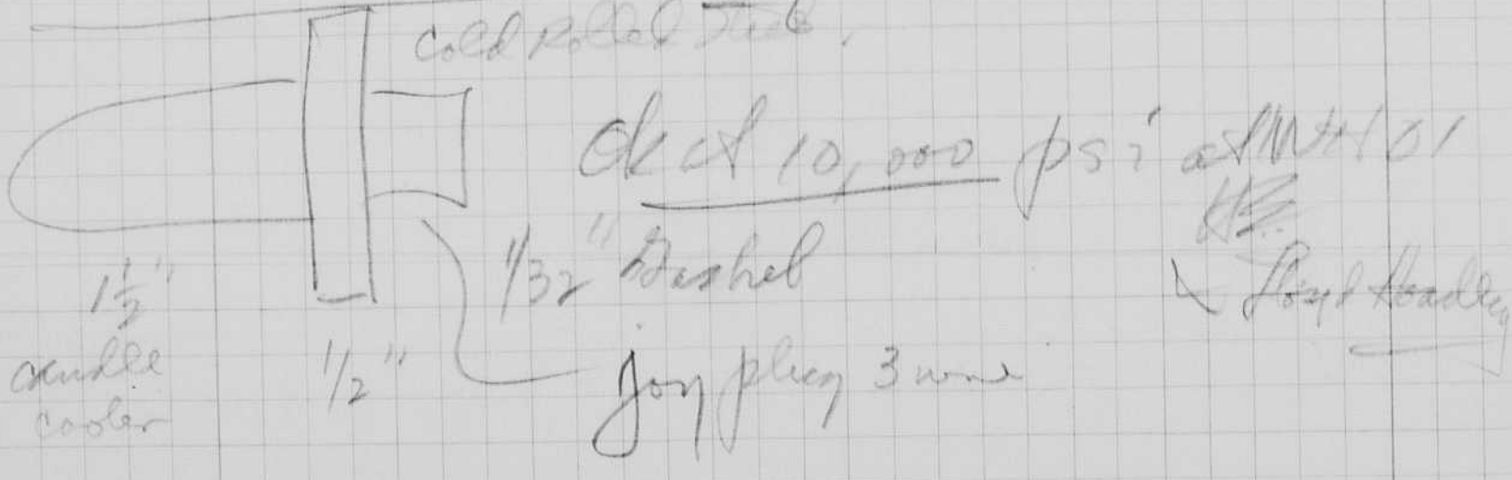


Sprague = .073 mfd.

12,500 Peak
12,200 Peak
11.98 Dip
11.90 Peak.

Design inductance. 4" long.

$$L = \frac{1}{4\pi^2 C f^2} = \frac{1}{4\pi^2 .078 \times 12000^2} = .0022 \text{ henry}$$



June 6, 1959

Bird Unit

H.S. Doyle Jr.
Dive Calculator

Weather proof.
Long running time 6 hours. 200 flashes.
Short Exposure. 2 100 ms
W.S. 200 & 200.
Tubes FX-29 or FT-506.
Volts 900.

$\left(\frac{RC}{2}\right) = 100 \times 10^{-6}$ Sec $R = 1$ ohm FX-29.

900 v $C = \frac{200 \times 10^{-6}}{1} = 200$ mfd. [200 Watt 900 v 525 amp]

900 $\frac{CE^2}{2}$ = 80 watts.

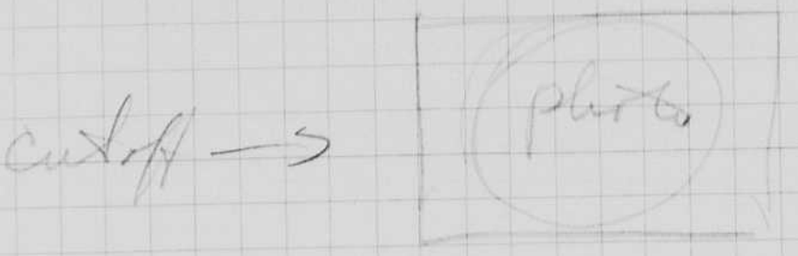
1800 = 320 watt sec. Assuming FX 29 = 1 ohm tube.

Compromise 1800 v 160 watt sec.

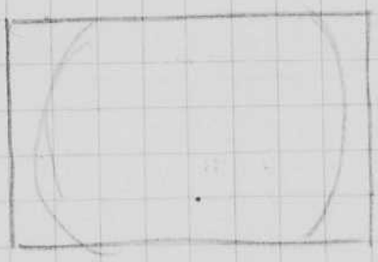
Camera test.

11,000 meter - Optical cut off.

2" hole 1¼" Glass. 1" Steel with 1¼" hole
Hopkins lens in the hole in the shutter.

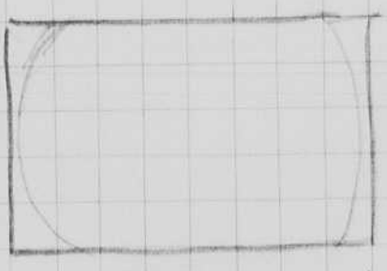


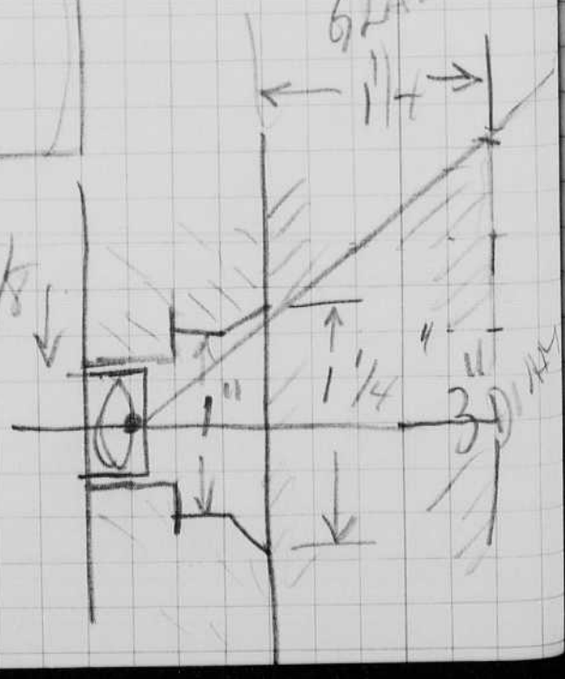
2" hole 1" glass. Ditto Steel. 2 Lens.



2" hole ½" glass. Ditto above

The outer-hole is not cutting off now. It is the 1¼ hole in the steel.





½" glass 2" Hole in face plate
½" " " "
1 glass 2.75" " "
1¼ " 3.2" Hole. " "

June 13 1959
Harold Edgerton

Productive yesterday at M.I.T.

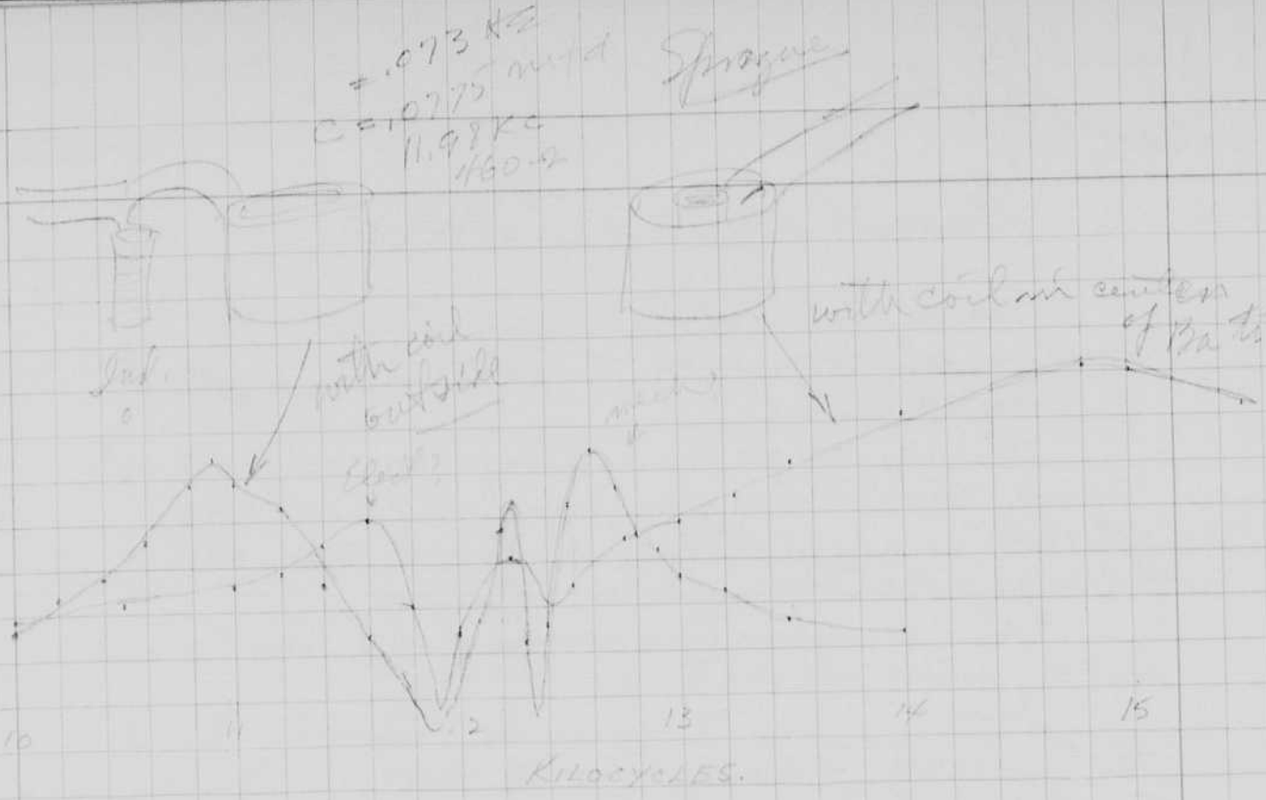
Much testing of Pressure chambers for deep sea photography. Trips to WHOI June 3, 8, May 29, June 1,

The boy plugs are cutting. One opened at 20,000. Two others crumbled at 12,000 p.s.i. The wires are not symmetrical. They bit the edge when the rubber extrudes.

Low temperature may help. Test next batch with ice water.

June 8 – trip to Symonds Riverton R.I. to test pump. Then return to W.H.O.I. Conclusion the 16" shell has a leak.

The windows now hold ok. The trouble was with dishing of the 1" steel ends. We now have a 1/2" bearing around a 1 1/4" hole. Seems to hold with 1 1/8" glass over this area. with O ring at 2 1/2".


Sprague
with coil in center of Ba Ti
10
11
12
13
14
15
KILOCYCLES.

June 25 1959.
H.E. Edgerton.

My parents were here last week for a few days. Robert Edgerton returned on Sunday from Rochester where he is a graduate student in the physics dept specializing in optics. He is going to work with me this summer on high speed movies. Today he worked with Angabi taking movies at 2000 per second of the fracture of a cement panel. There were 35 m m photos. 3/4" high and 1" wide.

EG&G are busy with the manufacture and sale of 20 deep sea cameras. Ten are for 2000 meters and ten for 11,000. The 11,000 design are in some trouble because of plugs. However the windows seem to hold ok.

July 5 1959 Cousteaus 48 sec unit was given to air France June 24, AWB 620-5356. This shipment was transferred to Seaboard and Western because of strike.
Jabar called July 3. - not arrived.
I phoned cousteau July 4. Phoned Air France yesterday and today. Mr. Bentz
212 OX6 5800 New York
He says he is cabling Paris every hour and will report

July 19 1959. Mary Jon Dixon her husband Chas. Janice.
Bill and Mary Ann
arrived 935 on July 16 from Hickory N.C. for a summer visit. Chas is going to Cobb a summer course at Harvard Law School.

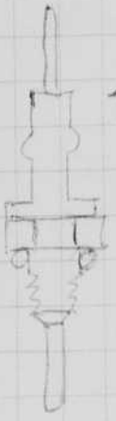
Cable arrived from Floyd - "Missing box found, 4 cameras arrived all ok."

The Calypso is supposed to leave July 20 but may be postponed.

July 19 1959

Harold Edgerton

Bob Edgerton & I spent Sunday July 19 at W.H.O.I. We tested a 3 pin 7107 jog male insert at 10,000 psi for 1/2 an hour, ok.



a new type 8723(2) was run up to 20,000 at room temperature. During our 1/2 hour absence it relaxed itself!

We then tried another at 13,000 psi which is enough for the Puerto Rico trench, (Bronson), test for 1 hour was ok.

Then got some ice to cool the 16" shell and ran the small jog to 17,000 psi for an hour, test jog was ok. Temp was 4°C on the

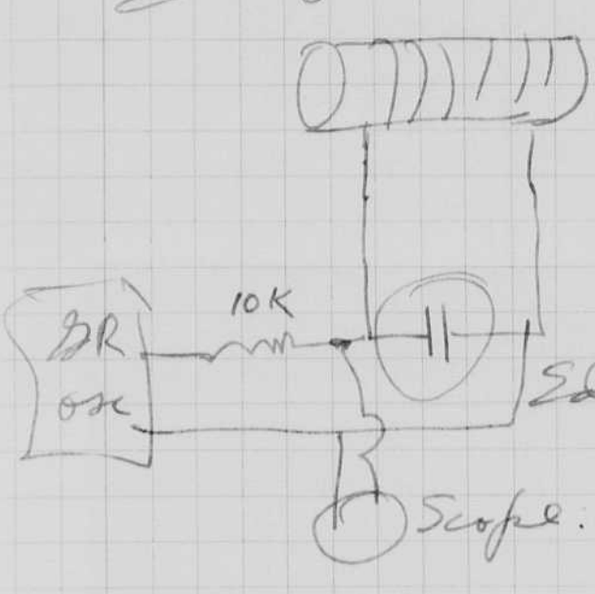
Apparently a cold temp helps to withstand the pressure.

Tested a sonar transformer up to 20,000 psi. There was a 50% loss in the signal. This may have been caused by the corona on the H.V. wire, Hadley had these wires to bring in the wires to the transformer.

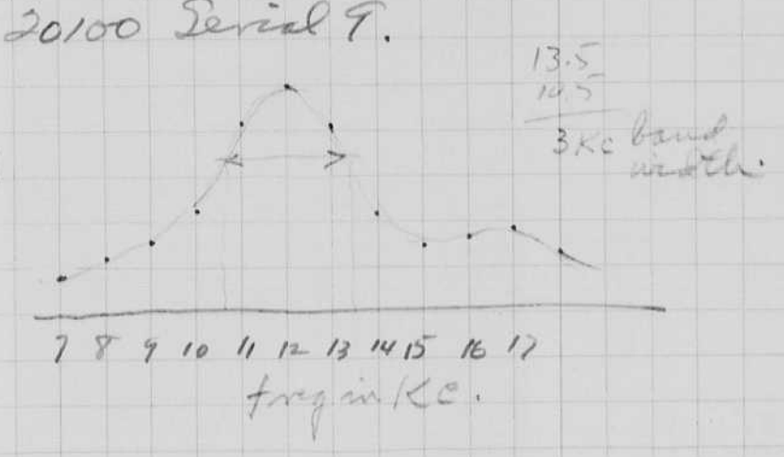
July 25 1959

Harold Edgerton.

Sonar tuning.



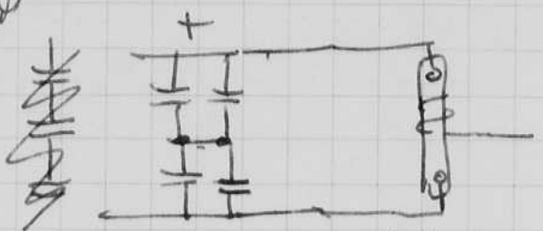
Inductor 28 mh.
made by Chas Fichou
at E & G. Y. yesterday



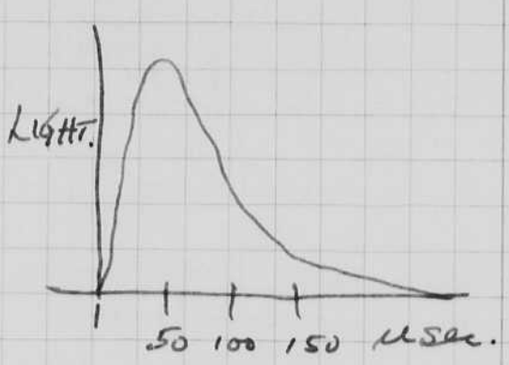
Harold & Bob
Edgerton
July 28 1959

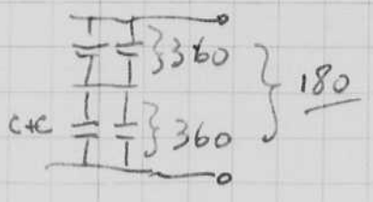
1" Gap in 4 mm I.D. tube.
Xenon EG&G

Green leads
used for # bird.



4 180 μf capacitor

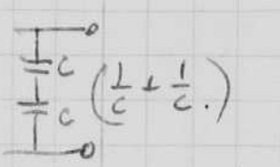


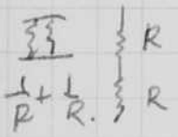


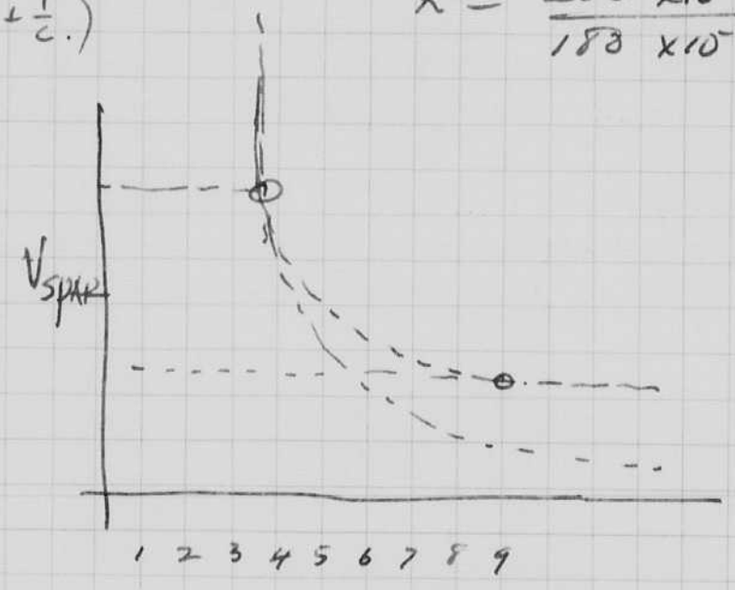
4 energy.

$\frac{RC}{2} = 100 \times 10^{-6}$

$R = \frac{200 \times 10^{-6}}{183 \times 10^{-6}} = 1 \text{ ohm.}$



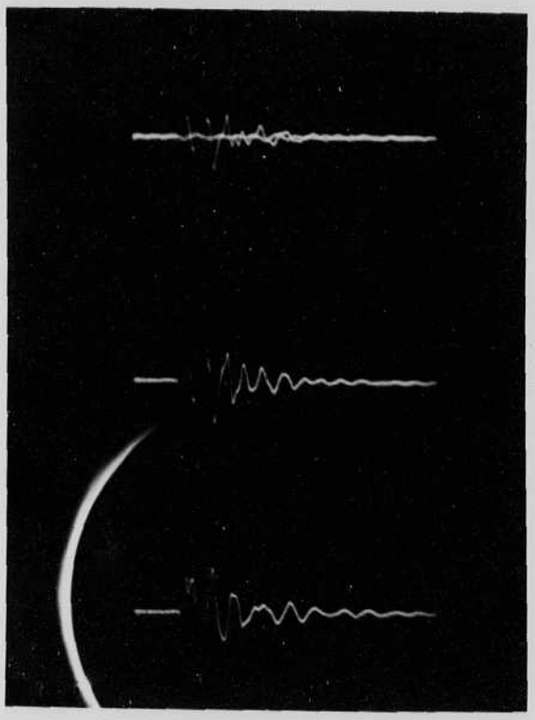




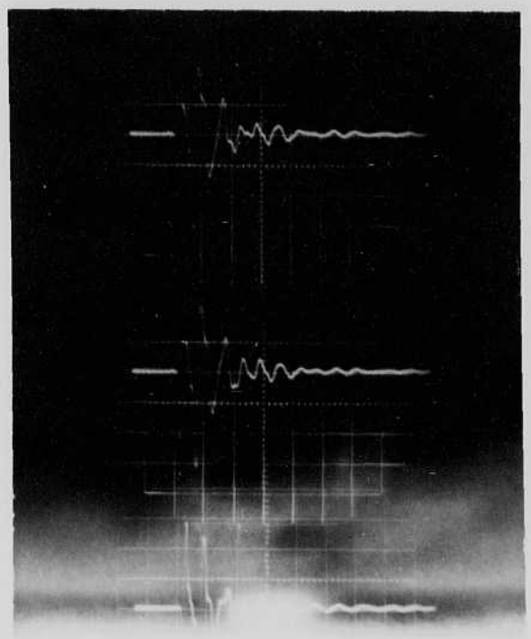
Aug. 12, 1959
H. Edgerton. Sam Raymond, Dorkin Volkman

BC 52 mike?

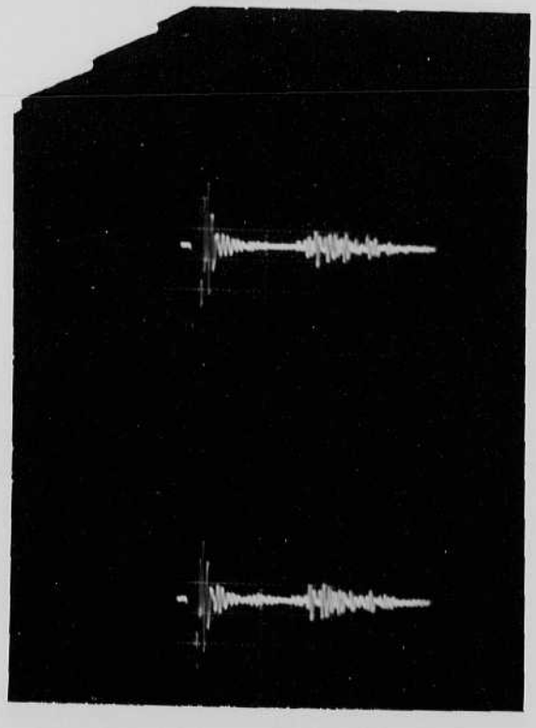
Experiment at WHOI on Indian ocean ? with 4 mfd 500 volts auto pinger Edo. type at 1 per second.



0.1V/cm
0.1 MS/cm



0.1 V/cm
0.1 MS/cm
.3 V peak
Direct Signal



Where recorded??

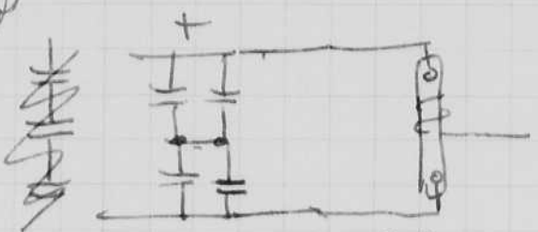
0.2 Volts/cm
0.5 MS/cm
Bottom .01 volts peak.

110

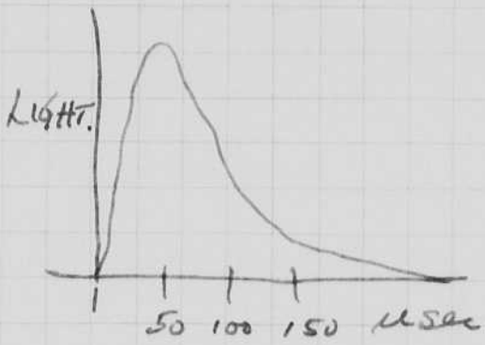
Harold & Bob
Edgerton
July 28 1959

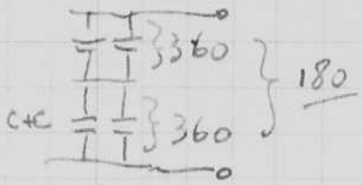
1" gap in 4 mm I.D. tube -
Xenon EG&G

Green leads
Red for # bird.



4 180 μf capacitor

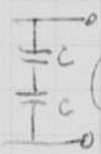


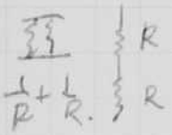


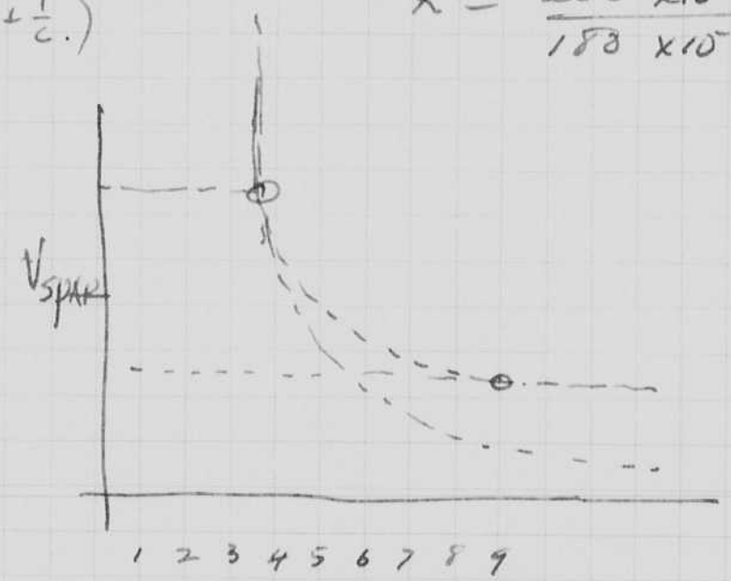
4 energy.

$\frac{RC}{2} = 100 \times 10^{6}$

$R = \frac{200 \times 10^{6}}{183 \times 10^{-6}} = 1 \text{ ohm.}$





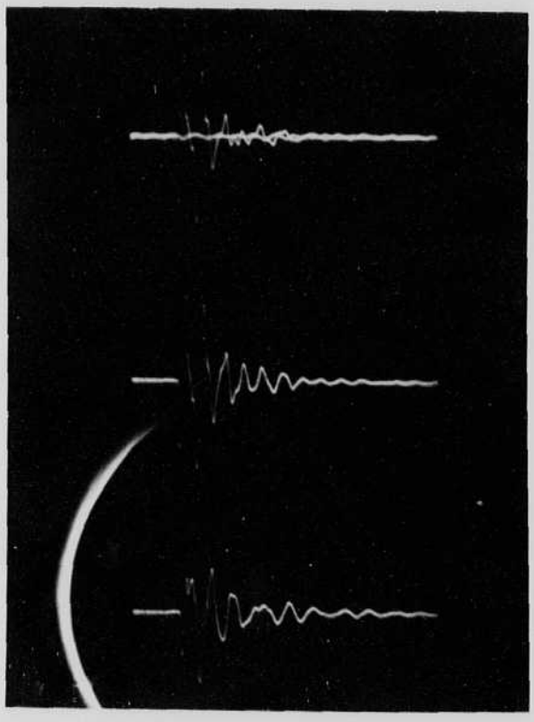


Aug. 12, 1959

H. Edgerton. Sam Raymond, Dirkin Volkman

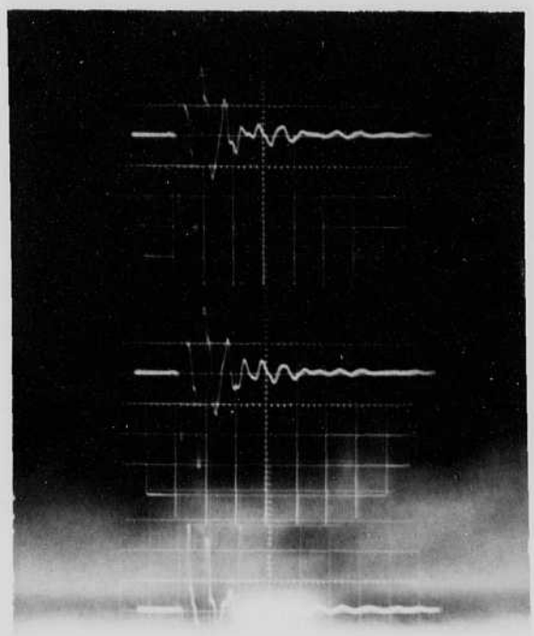
BC 52 mike?

Experiment at WHOI on Indian ocean 7 with 4 mfd 500 volts auto pinger Edo. tape at 1 per second.



0.1 V/cm

0.1 ms/cm

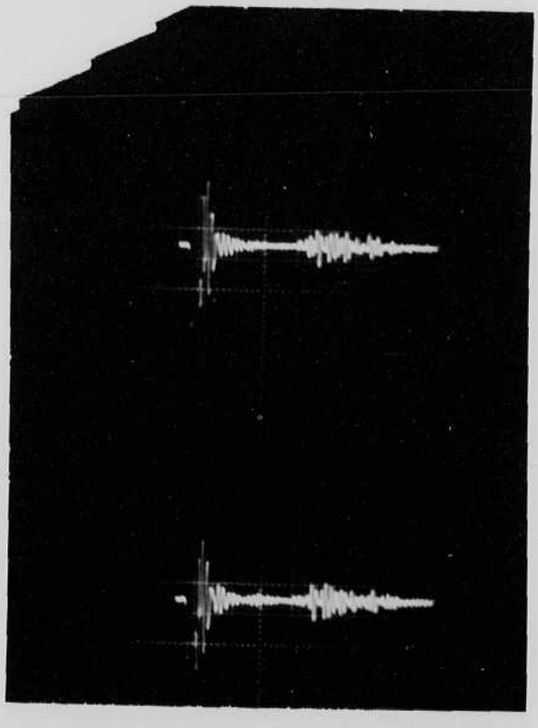


0.1 V/cm

0.1 ms/cm

.3 V peak

Direct Signal



Where transmitter?

0.2 Volts/cm

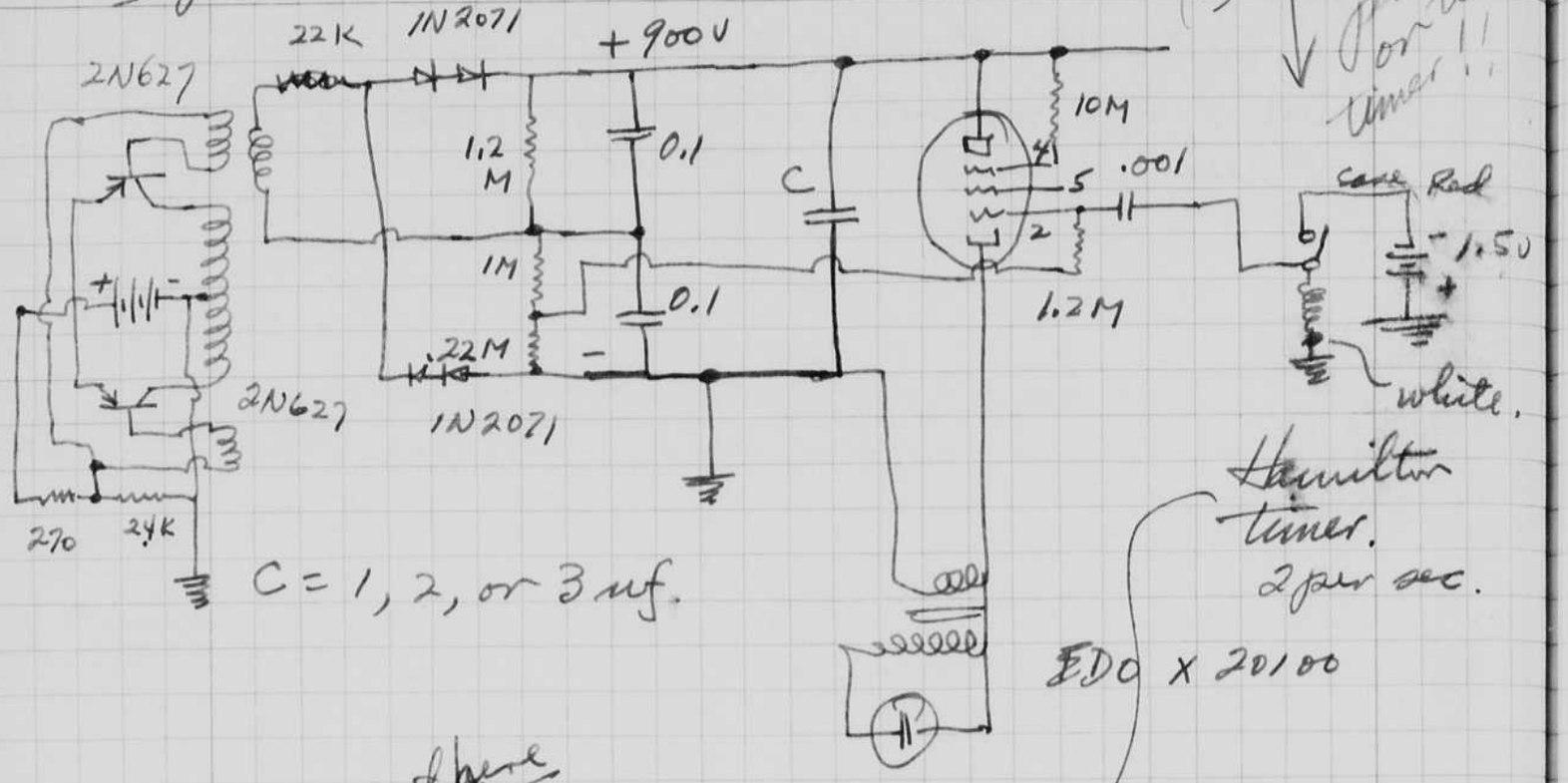
0.5 ms/cm

Bottom .01 volts peak.

112 Aug 13, 1959.
H. Edgerton

Sonar. 2 per sec.

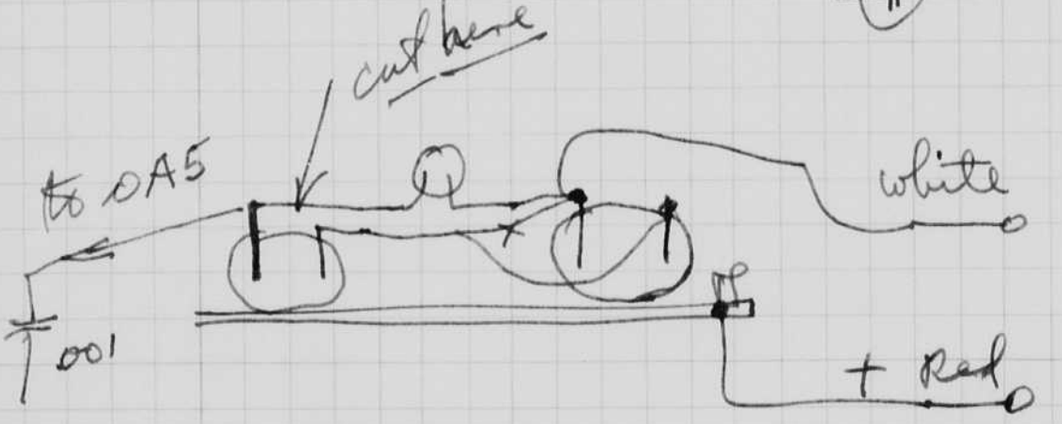
Note Aug 27
contacts
pitted
for this
timer!!

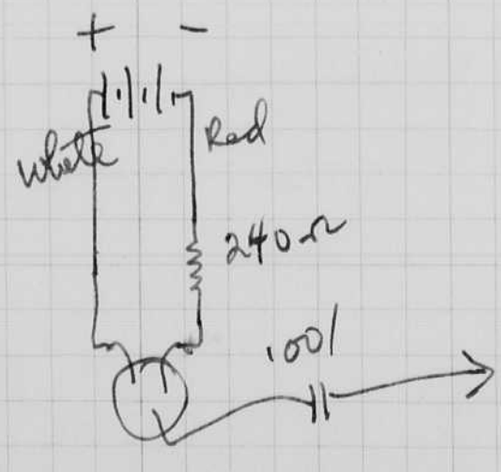


Hamilton timer.
2 per sec.

EDO x 20100

Disconnect diode.



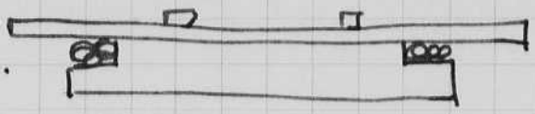


Aug 15 Bob Edgerton
Liz Lowe
married in New York.
at 3 pm.

Aug 17 1959. Sonar Tin Pan.

Harold Edgerton.
Gary Halgrond.

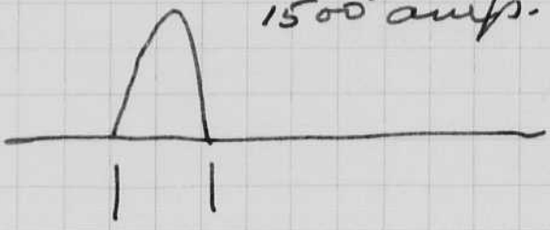
Copper .086" thick. 10" diam 140 mh.

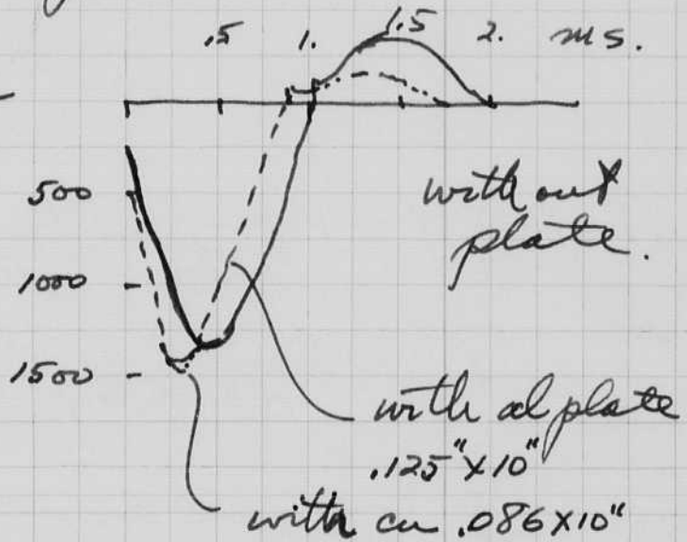


1/16" Rubber.

cable .02 ohms. 30 mh. 75 ft ± ?

Capacity 300 mfd. at 2000 volts.
Series spark gap
1500 amps. peak.





Pressure - Hall thesis calibration of Wilcoxon water mike → 5 volts peak — 300,000 dynes.

Gary measures → 20 volts. — 1,200,000 dynes

This should be

Aug. 19 1959

Harold Edgerton.

Went monday to W4101 with Gary Haywood to test sonar. The copper disc seemed to be the best of all the discs tried.

The peak output was about 30 m/s with the BC 30 microphone at 10 feet. The duration was about 1/4 to 1/2 a m.s.

Aug 22
New setup 7" diam coil
5 turns
1.2 mh with 75/ft coil and 3/16 plate of 14" x 4/ft 6061 aluminum
6061 T-1 alum.

Aug 23, 1959 Repairs on Bausch and Lomb. Microscope and Retina light Source

X 1. Ground ~~off~~ Glass holder - this sparked to the hot end of the lamp to ground.

X 2. ~~Tapped~~ the ~~metal~~ to hold ~~off~~ voltage

3. Connected ~~from~~ H.V. end of lamp to the ~~Reflector~~ ~~or~~ the FX-21.

✓ 4. Put Ground on the lamp House.

Removed Mercury arc tubes.

Increased Spark cap from 0.25 to 0.35 m/f

Light from Tungsten bulb.

Light meter #306.

50 Lumen sec/sq foot. in 4 or 5 seconds. Tungsten

say $\frac{50}{5\text{ sec}} = 10$ f.c. ~~per sq ft~~ f.c.

Lamp is then $1^2 \times 10 = 10$ c.p.

No – since light in room gives same reading in 7 sec.

Daylight $\frac{50}{7} = 7$ f.c.

Due to Tungsten $10 - 7 = 3$ f.c.

Lamp = $3 \text{ c.p.} \times 1^2 = 3$ candlepower.

Seems ~~weak~~ low

10% 27 ~~ft.~~ Lumen sec/sq.ft..

~~2~~5% 32

25% $32 \times 2 = 64$

50% $40 \times 4 = 160$

100% $58 \times 4 = 232$

$32 \times 8 = 256$

$\frac{4.50^{2}}{2} \times 1050 = 106$ watt sec

$\frac{256}{106} = 2.4$ c.p./watt

Lamp exploded!!!

New Tube.

10% 54 (Double output of older tube!)

~~10~~ 9% $28 \times 2 = 56$

15 $44 \times 2 = 88$

25 $32 \times 4 = 128$

50 $37 \times 8 = 296$

100 $54 \times 8 = 432$

Aug 26 1959.
H. Edgerton

Sonar.

Refer to Gary Haywards notebook for extensive experiments on the sonar pinger for low frequency and high Pressure.

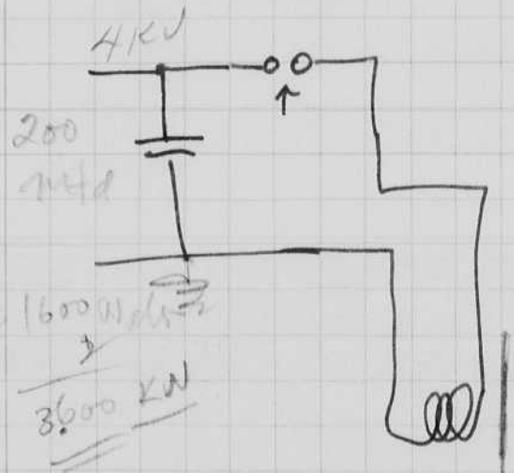
Now at the MIT sailing pavillion we have the following unit mounted 4 ft below the surface

50 turns of #14 plastic insulated wire on a 8" diam wood core.
6061 T-6 plate. aluminum.
3/16" x 14" x 48"

4 ~~shot~~ at 230 mfd..

Oc. 0.1 volts/div. 1 ms/div.

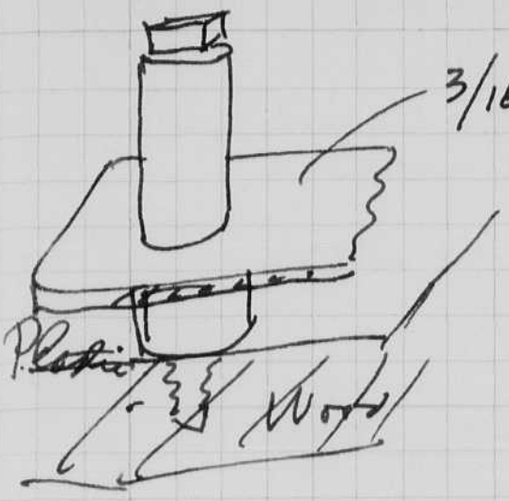
BC-30 mike on long cable located below the Pinger. Pinger is 4' below surface
mike to Transducer 7' about!



$CE^2 = 70^2 \cdot 8 = 1600$ (11)
x
3600 KV

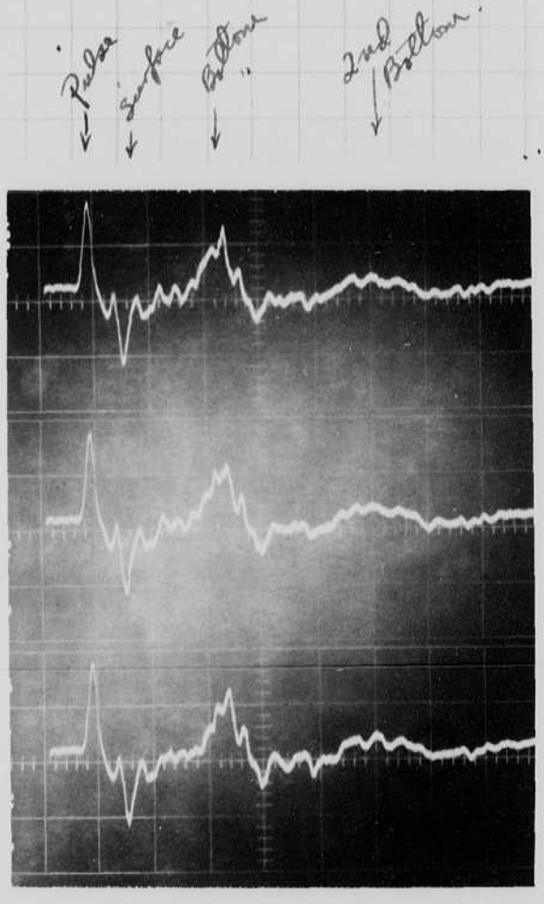
Remove the solid bolts and put in lag screws with the Rubber. 2" lengths

Perhaps the signal will be longer in duration and stronger.

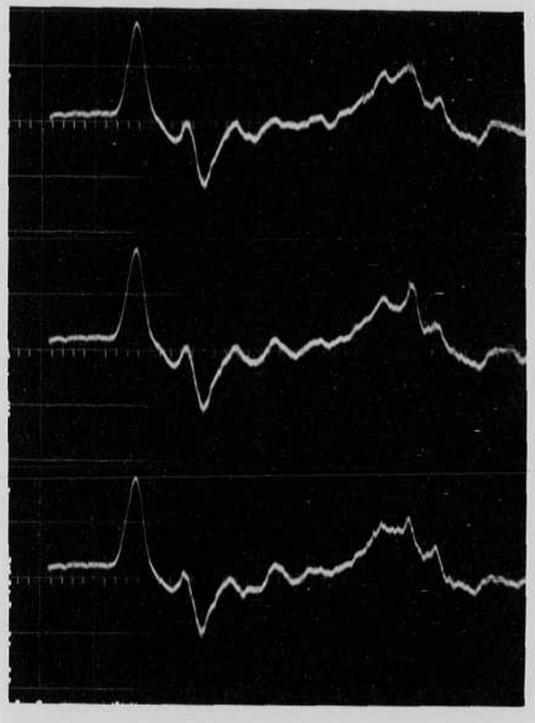


3. 0.1/div. 2 mS/div

4 0.1 1 ms/div.



3



4

Aug 26 1959.
H. Edgerton

Sonar.

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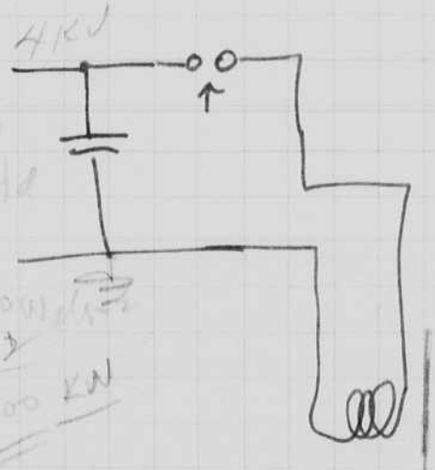
3/16" x 14" x 48"

4 ~~kv~~ at 230 mfd..

Oc.

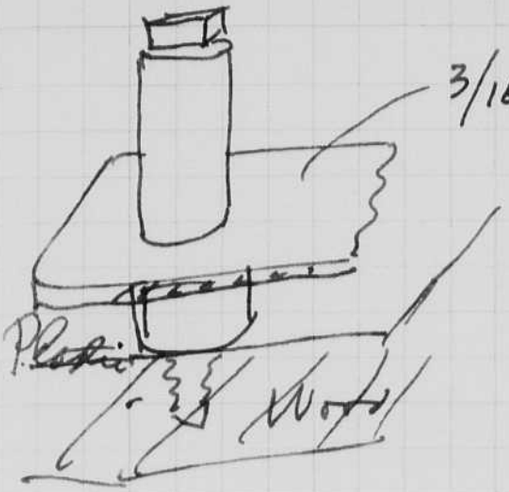
0.1 volts/div. 1 ms/div.

BC-30 mike on long cable located below the Pinger. Pinger is 4' below surface
mike to Transducer 7' about!



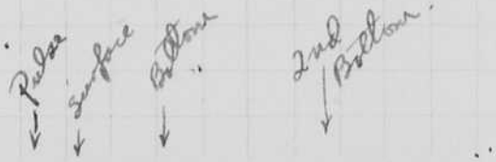
Remove the solid bolts and put in lag screws with Rubber. 2" lengths

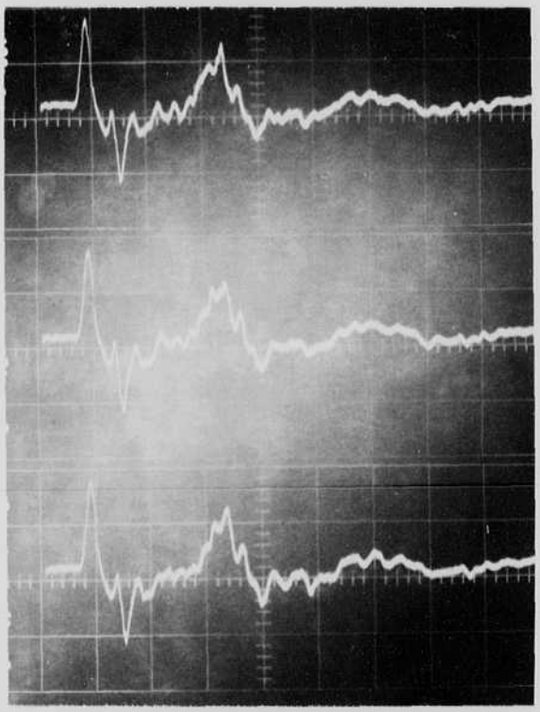
Perhaps the signal will be longer in duration and stronger.



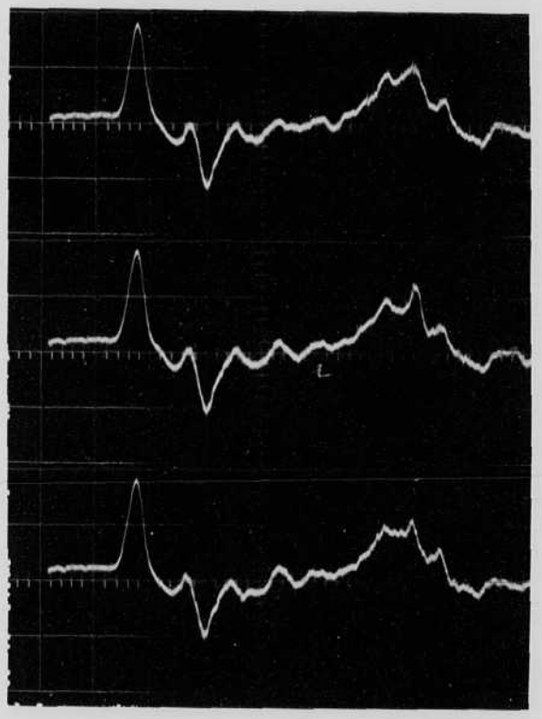
Y 0.1 /div. 2 mS/div

X 0.1 1 ms/div.





3



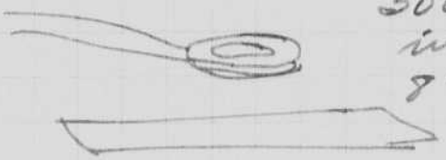
4

Aug 26 1959.
H. Edgerton

Sonar.

Refer to Gary Haywards notebooks for extensive experiments on the sonar pinger for low pregnency and high Pressure.

Now at the MIT sailing pavillion we have the following unit mounted 4 ft below the surface



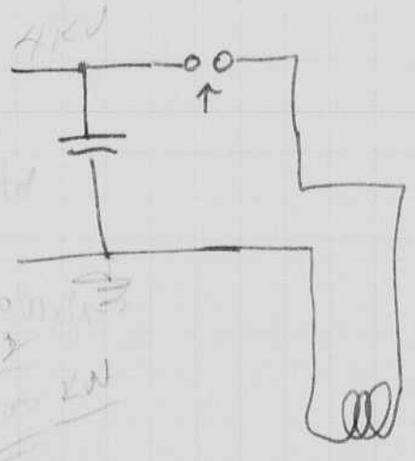
50 turns of #14 plastic insulated wire on a 8" diam wood core.
6061 T-6 plate. Aluminum.
3/16" x 14" x 48"

+ 4 at 230 mfd.

Oc.

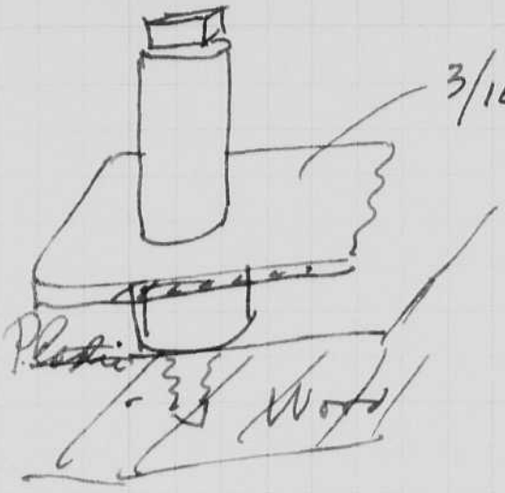
0.1 volts/div. 1 ms/div.

BC-30 mike on long cable located below the Pinger. Pinger is 4' below surface
mike to Transducer 7' about!



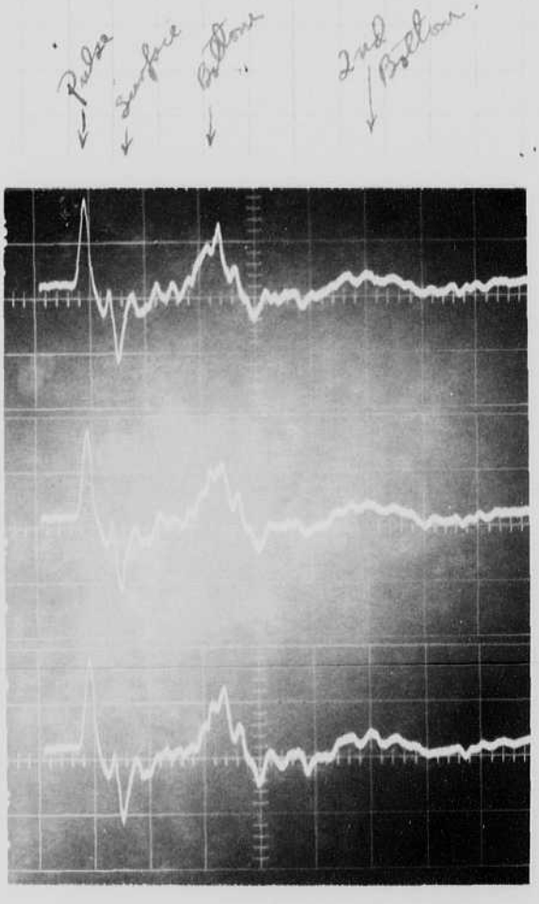
Remove the solid bolts and put in lag screws with Rubber. 2" lengths

Perhaps the signal will be longer in duration and stronger.

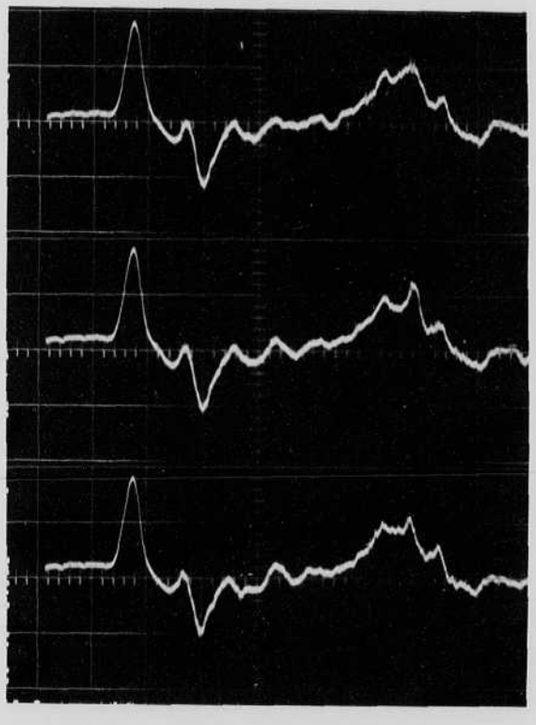


3. 0.1 /div. 2 mS/div

4 0.1 1 ms/div.



3

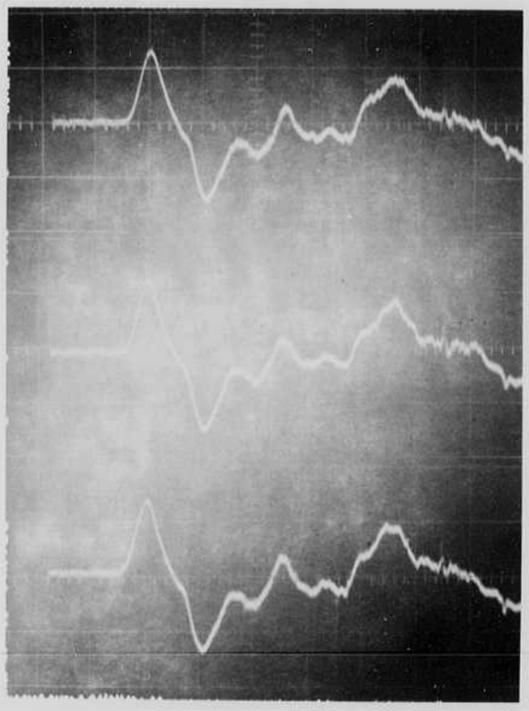


4

Aug 26 1959

Rewound coil after warped board pulled loose.

8 1/4" diam
86 turns #14 Plastic -
3 mh. 0.66 ohms.
230 mfd 4KV.
#5 0.1 ~~volts~~ 1 ms.



5

Aug 28 1959.

Report of Gary Haywood.

Left Aug 27. 630 am. arrived WHOI at 9 am
asterias to the Bear off Vineyard Sound.

Took 4KV. 230 mfd 86 turn coil #14 or 8 1/4" diam
3/16 6061 T-6 plate 4' x 14"

Hydrophone - Large 2 ft long. about 400 or 450 ft.
Purge
4 feet down.
> 100 - 150 ft from ship.
or surface.

4.

Trouble with fuses and coil.

note. This power supply was bad for high peak
currents since it consisted of two
half wave rectifiers not on the
same transformer.

Some sub echos at 600 feet were observed
by Gary. the rep. rate should be
increased.

It seems to me that we should
now make a bigger plate so the
low frequency component would
be increased.

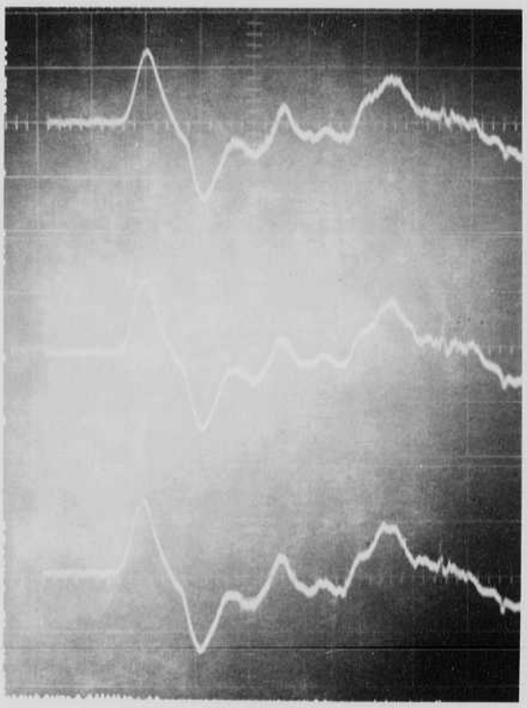
Suggest 3 x 3 ft for next model
with 4 coils in parallel, each
with 500 watt seconds.

There was difficulty with the last
model in towing where the plate was
4 feet down. I think we can reduce the
depth to 2 feet.

Aug 26 1959

Rewound coil after warped board pulled loose.

8 1/4" diam
86 turns #14 Plastic -
3 mh. 0.66 ohms.
230 mfd 4KV.
~~#5~~ 0.1 ~~volts~~ 1 ms.



5

Aug 28 1959.

Report of Davy Haywood.

Left Aug 27. 630 am. arrived WH01 at 9 am
asterias to the Bear off Vis yard Sound.

Tools 4KV. 230 mfd 86 turn coil #14 or 8 1/4" diam
3/16 6061 T-6 plate 4' x 14"

Hydrophone - Large 2 ft long. about 400 or 450 ft.
Purge
> 100 - 150 ft from ship. 4 feet down.
or surface.

4.

Trouble with fuses and coil.

note. This power supply was bad for high peak currents since it consisted of two half wave rectifiers not on the same transformer.

Some sub echos at 600 feet were observed by Davy. the rep. rate should be increased.

It seems to me that we should now make a bigger plate so the low frequency component would be increased.

Suggest 3 x 3 ft for next model with 4 coils in parallel, each with 500 watt seconds.

There was difficulty with the last model in towing where the plate was 4 feet down. I think we can reduce the depth to 2 feet.

Aug 29 1959
4-40⁵
M.I.T.

1" gap 4 mm I.D. 1/2 atmosphere?

Jun B & L Eye Retina unit -

525 mfd x 2 with series resistance.

See page 115.

meter 306 shows excessive grid or leakage current.

meter 113.

		Light C.P.S.
10%	52 x 1	52
	25 x 2	50
15	40 x 2	80
25	70 x 2	140
50	127 x 2	254
50	64 x 4	256
100	120 x 4	480
100	125 x 4	500
50	63 x 4	252

Sept 5, 1959
H. E. Edgerton

July Photo Method Industry
List of Stockholders.

Attended the 1st Ocean Congress at U.N. Bldg in N.Y. last week and will return tomorrow for a few days more. Ray Jarman and John Tradutell went with me and helped to set up an exhibit in the 1st basement of the U.N Bldg. We had the Rouandre French camera, a new stereo unit and an open model so that one could operate by push button.

Mikhail Lomonosov, large Russian Oceanographic ship was at the Pier 48 in New York city.
N.L. Jenkerwilder showed me a deep sea camera.

Carl Shipek U.S.N.E. Lab San Diego discussed cameras and flash.
A. S. Laughton - England - cameras.
J.M. Peres. France. - sonar.
The Calypso was on hand at pier 54. French Line.
Jacques Yves Cousteau
François Saôut
André Laban
Jean Mollard
Armand Dafliso
Albert Falco
Maurice Léandri
Auguste Léandri
Henri Plé pursar
Antoine Lopez.
Maurice Bourne-Chastel engineer
Clibon
René Robino
Pierre ~~Ben~~ Bernard Engr
Pierre Marcelin elect
Jacques Roux elect eng.
Gilbert Le Doublé mov.
Jean Morgan chef.
J.M Pères Endoume Marine Station
Ballan
Fraisse

Sept. 19, 1959.
Harold Edgerton.

Calypso in W.H.O.I. Sept 13. I sent my work clothes and tools aboard. also spare parts for cameras and sonar.

Washington Sept 17 to see Payne and discuss problems with Cousteau. I plan to meet the calypso in San Juan Sept 25 for an expedition to the Bronson deep north of Puerto Rico.

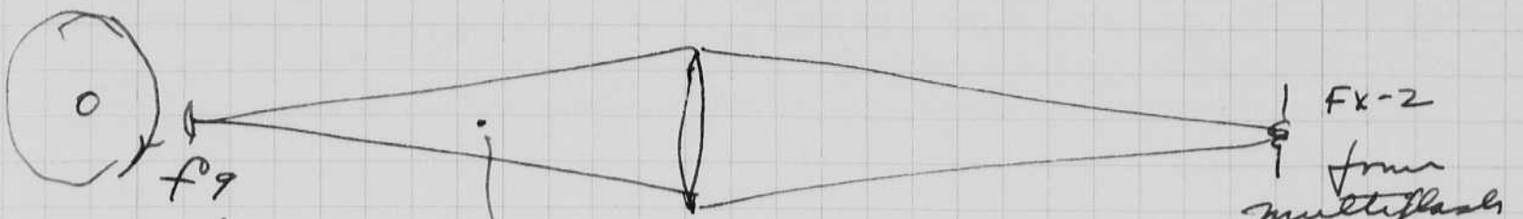
Sept. 21. 1959. I am due Sept 28 at San Juan. Paul Gray will meet my 620 classes after the first week of school. Today is registration day at M.I.T.

Last week we tested the multiflash unit that was just finished by Jim Mee at EG&G. Photographs 100 KC pictures made. Several of bullets striking wires were made of 22 long rifle at 30 KC.

Bullet photos Multiflash

#1 Coppercoine 22 Swift 65,000/sec

#2 Wood white pine 13/16" 22 Swift 65,000/sec. 20 mm. Royal X film f 56, Lens f/4.



f9 lens 2"
5305 film.
5400 r.p.m.
1" drum Drum

0.2cm .009"
5cm long.
40 mfd 4 KV. approx.

Head

Strobe at 30,000 f.p.s. Exposure ok,
Wire over exposed —

Shot 2 0.45cm Brass 5cm long.
about 1/8 ohm series resistance.
f9. a Paper diaphram was put
5305 film in front of the wire to exclude
5400 rpm light into the lens.
60,000 f.p.s..

---

14 μs delay
Shot 3. Ditto but with 1.5 density filter
to show early stages of explosion
5305 film
60,000 f.p.s. ok.

Sept 25 Shot 4 14 μs delay
5305
100,000 f.p.s.

Sept 25 Shot 5
5305 with 1.5 Density
100,000 0.45 brass with 0.5cm spiral circle
at center.

Shot 6.
Circle of 0.45 Brass. 5cm long.
50,000 fps
5400 rpm.
1.6 filter.

TS

.10,1959

+

GENERAL
ELECTRIC
FLASH TUBE
FT-30

—

6

eveland Ohio

ors

IPPLY AVAIL.

RIBLE RECT.

— SURPLUS AVAIL.

5.00

November 2, 1959.

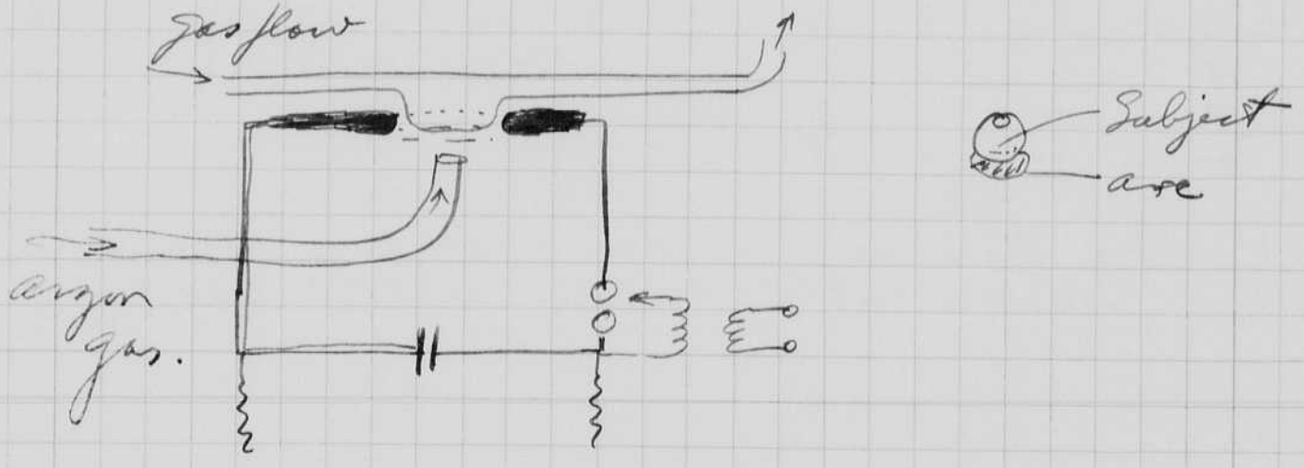
Retd. Fri. Oct 30 from Martinique where I left the Calypso after ~~[illegible]~~ joining her at Puerto Rico in Sept. on the 26th.

Nov 6.

Brashell Hersey was here yesterday. Also Ray Mackland and Peter Stackpole of life magazine to talk deep sea photography.

Nov. 15, 1959. Bob and Liz were here last night and today until noon. Then they returned to Rochester where he is a student at the Univ of Rochester. Liz works at the museum. Bob had given a demonstration at the Physics professors meeting on Sat in Southampton. Mass of the stereoscope.

Radiation device for high temperatures.

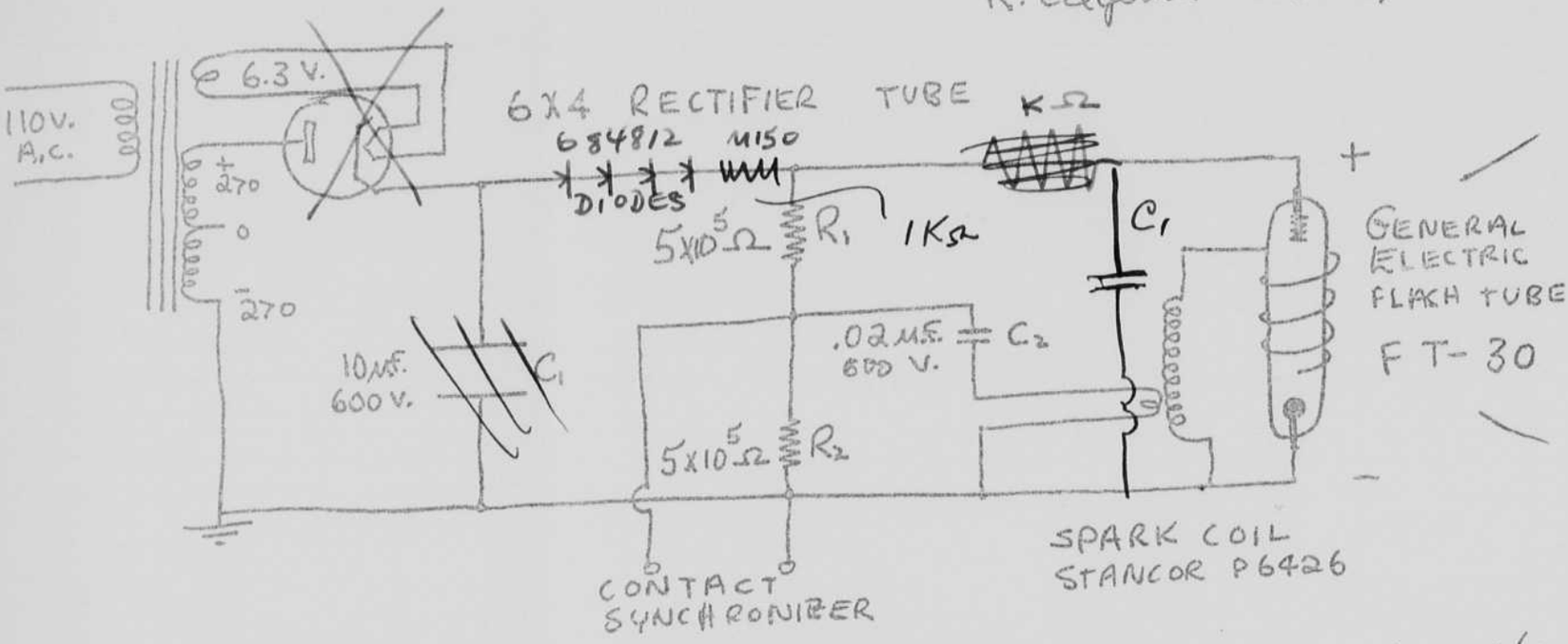


Shot 6.

Circle of 0.45 Brass. 5cm long.
50,000 fps
5400 rpm.
1.6 filter

INEXPENSIVE MULTIFLASH FROM COMMON COMPONENTS

R. Edgerton Nov. 10, 1959



FLASH TUBE	4.32	Photo Lamp Dept. #281 Cleveland Ohio
SPARK COIL	2.78	Stancor Chicago Illinois
CAPACITOR C1	~ 1.00	OIL FILLED SURPLUS SUPPLY AVAIL.
RECTIFIER	~ .87	6X4 OR ANY COMPARIBLE RECT.
TRANSFORMER	~5.00	POWER TRANSFORMER — SURPLUS AVA
MISC $R_1 R_2 C_2$	~1.00	
TOTAL	~ 15.00	COST OF UNIT < $15.00

Edgerton

November 2, 1959.

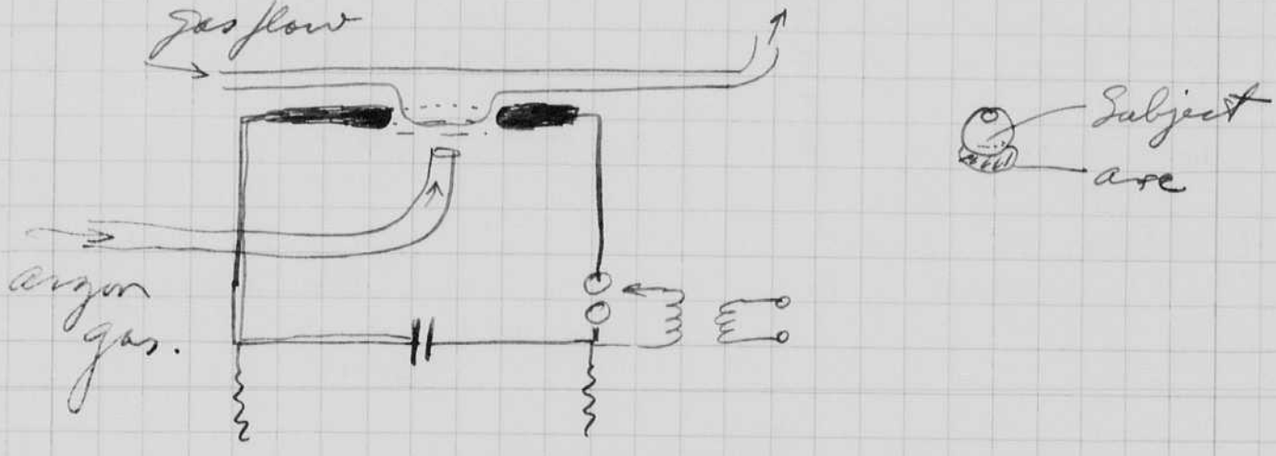
Retd. Fri. Oct 30 from Martinique where I left the Calypso after ~~two~~ joining her at Puerto Rico in Sept. on the 26th.

Nov 6.

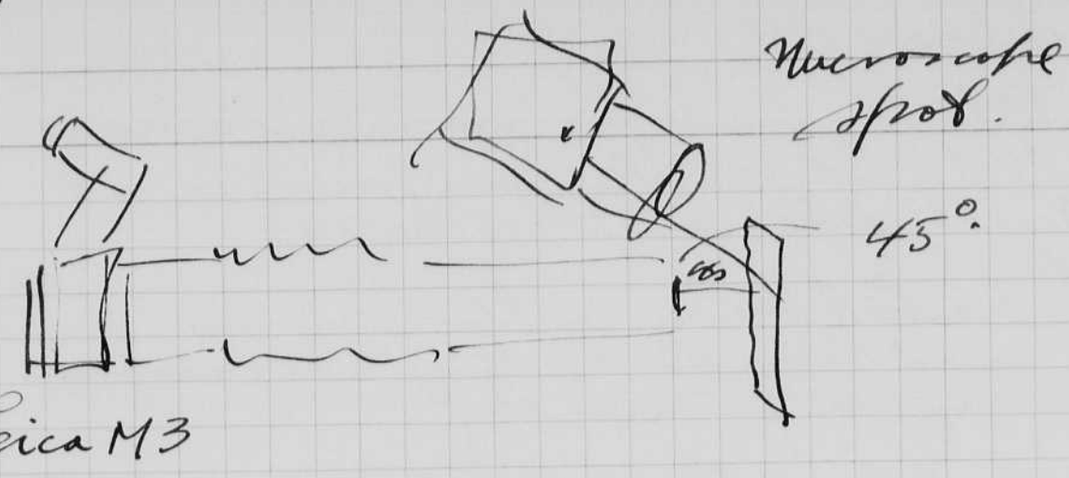
Bradley Hersey was here yesterday. Also Rockland S— and Peter Rockpole of life magazine to talk deep sea photography. Ray Maxland

Nov. 15, 1959. Bob and Liz were here last night and today until noon. Then they returned to Rochester where he is a student at the Univ of Rochester. Liz works at the museum. Bob had given a demonstration at the Physics professors meeting on Sat in Northampton Mass of the stroboscope.

Radiation device for high temperatures.



Dec 5 1959



Film	#		apt.
5302	10	Blank.	f22
	11	100 WS max	f22 ~ ok.
	12	"	16
	13	"	16
	14	"	16
	15	"	11
	16	"	11
	17	"	11
	18	"	8
	19	"	8
	20	"	8

MODEL - RAY WILKINS - L. EYE L. LAT. EDGE of CONJUNCTIVA
CENTRAL SPOT FOCUSED ON EXT. CANTHUS - LAT EDGE
1/4 off CONJUNCTIVA.

Film 2.

EXPOS. 1-4 f22 LAMP 45°
5-9 f16

3rd film.

# 3	100 WS.	f22	Lamp at 65°.
# 4	"	"	
# 5	"	"	

Marked on Film as:
A1
A2
A3
A4
A5

200 ~

Blank.
200
200
200

f22

These were excellent. with 200 WS.

Changed to 80° to cut out reflection

1
2
3
5

Roy Wilkins 29 yr

Kodachrome

no.	35mm · W.S.	Enlargement	80° light.
~~18~~	f.no.		
18	3.5	0 on scale. about 5x	
19	5.6	"	
20	11	"	
21	16	"	
22	22.	"	
23	3.5	10 on scale about 10x	
24	5.6	"	
25	11	"	
26	16	"	
27.	22	"	
28	16	200	
29	16	200	
30	16	300	
31.	16	300	
32	f56 50mm	100	
33	f8 50 m	100.	

128 Dec 8 1959 Mrs. Bail Ketch. Left Eye. 24 yrs old
Dr. S. Rees. Eye Photography. 32 ~~30~~ week.
4 weeks to go

Nikon f. & W.S. Lens

0						
1.	Panatomic X	22	1/30	100.	50 mm. Leica. Just bellows extension	
2.	"	22	"	100	50 mm.	
3	"	22	"	100	Dud. ——	— Blanks. —
4.	"		"	100		
5.	"	22	"	100		
6.	"	22	"	100		
7		2 Blanks f 16 sign in camera				
9.	"	16.				
10						
11						
12						
13	"	16	"	100	50 mm	
		2 BLANKS + Back of Lid				
18		f 22	1/30	100 ws.	35 mm Lens.	
19		"	"	"		
20		"				
21		"				
22		"				
23		f 16	"	"	"	
24						
25						
26		Blank				
27		f 11	1/30	100 ws	35 mm Lens.	
28		"				
29		"				

Dec 14 1959 Tamboy. MIT
H. Edgerton

Crawford Greenewalt brought in his Hummingbird photo mint for new lamps. He has made 10,000 photos with it during the past few years. Now has a book about to come out on the 100 + species.

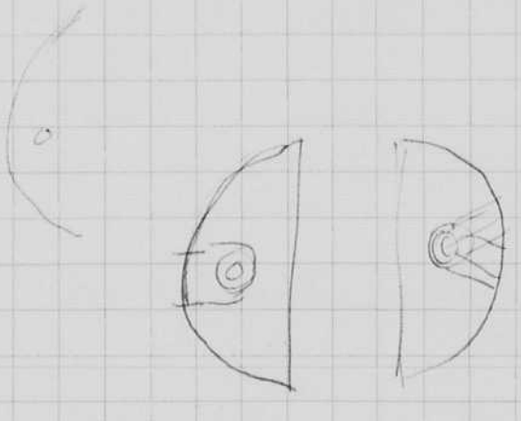
3 lamps FT-218 from 14 mfd at 2500 volts. ac supply from 100 volts, DC. from a 6 volt battery with a relay cut off to stop the charging.

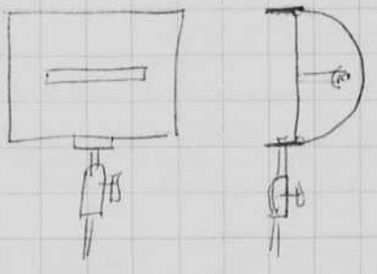
The 218 lamps go white due to over-load. I suggest quartz lamps or multiple type 218 bulbs.

Exposure data

3 lamps about 7 to 10" from camera lens as shown below.

f 32 on Kodachrome film with lamps at a given distance.





H. Edgerton
John Bredwell
Dec 8, 1959

New Strobotac #10000
Peak and Duration meas.

Standard lamp 693 FT-214. 2.5×10^6 c.p. taken as value.

Input 112 volts
Simpson model 260

1 volt on 2.5×10^6 c.p. 10 ft from source (Sensat 80% of full)
Light from Ex-6A Perpendicular to arc column.
60 cycle. no reflector.

			Peak light $\times 10^6$	Duration $\times 10^6$	1/3
60 cycle.	"	"	$2.7 \times 1 \times (\frac{1}{10})^2$	.027	1.5 μs
Slow 100	"	"	$\frac{2.8}{14.0} \times 5 \times (\frac{1}{10})^2 \times 10^6$	0.14×10^6	2.5 μs
Slow 900	"	"	$\frac{1.7}{8.5} \times 5 \times (\frac{1}{10})^2 \times 10^6$	0.015	2.6 μs.
Int 600	"	"	$\frac{2.2}{4.4} \times 2 \times (\frac{1}{10})^2 \times 10^6$	$.044 \times 10^6$	1.2 μs
" 4200	"	"	$2.4 \times 1 \times (\frac{1}{10})^2 \times 10^6$	$.024 \times 10^6$	1.2 μs.
High 4000	"	"	$2.3 \times \frac{1}{2} \times (\frac{1}{10})^2 \times \frac{1}{10}$	.0115	0.7 μs.
High 25000	"	"	$\frac{1.9}{3.8}$ $\frac{2.1}{4.2} \times .2 \times (\frac{1}{10})^2 \times 10^6$	.0042	0.7 μs

Flash all moved to 2 ft from Strobo refl
without reflector

60 cycle. no ref $3.9 \times .2 \times (\frac{1}{10})^2 (\frac{1}{2})^2 10^6$ $.031 \times 10^6$ 1.4 μs.

60 cycle. Reflector head on $\frac{1.1}{1.65} \times 10 \times (\frac{1}{10})^4 \times 10^6 = 1.65 \times 10^6$

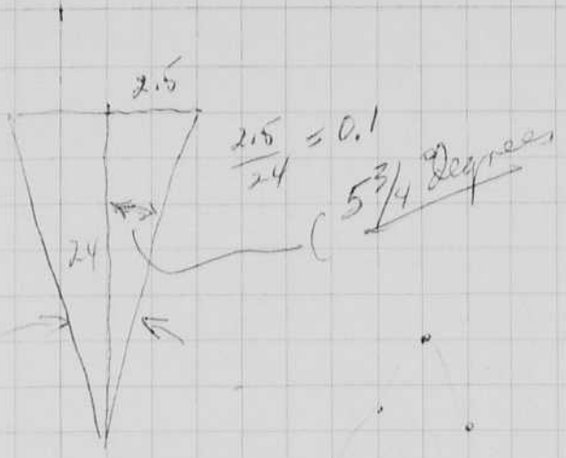
Reflector factor about 50% at 2 ft.

53.2

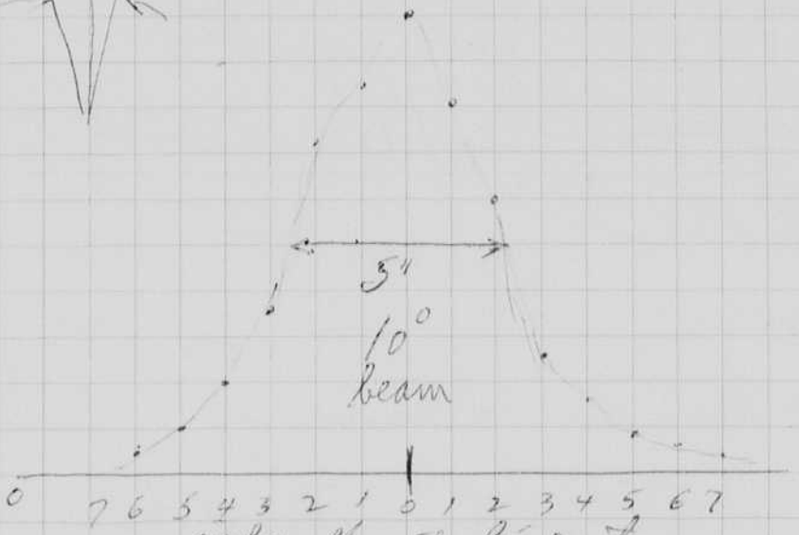
90° turn no Reflector $\frac{1.7}{6.8} \times .05 \times (\frac{1}{10})^2 4 \times 10^6$
$2.2 \times .05 \times \frac{1}{10} \times 4 \times 10^6 =$
.340

90° Reflector $\frac{2.3}{20.4} \times 20 \times \frac{1}{10}^4 \times 10^6 = 2.07 \times 10^6$
$= 2.15 \times 10^6$
$\frac{2.7 \times 20}{216}$

Beam angle of new Strobotac. 1531-A



0.	100%		100
1" East	80%	1" west	85
2"	60%		62
3"	25%		35
4"	17%		20
5	9		10
6	6		6
7	3		3
		8"	2.5



Old Strobolac.
Type ~~631A~~ 631B 7102.

22
12
44
22

Measured at 2 ft from lamp center with Reflector. Calibration same as before.

600 rpm very small peak

1 ft. $1.7 \times .05 \times (10)^2 \times 10^{+6}$

.05
.85 .008500 = 8500 peak. duration 40 u.s. .34 B.C.P.S.
40

340000

1531A

The new Strobotac measures 1.2 u.s. x 2.2 = 2.64 B.C.P.S.

Later 2/5

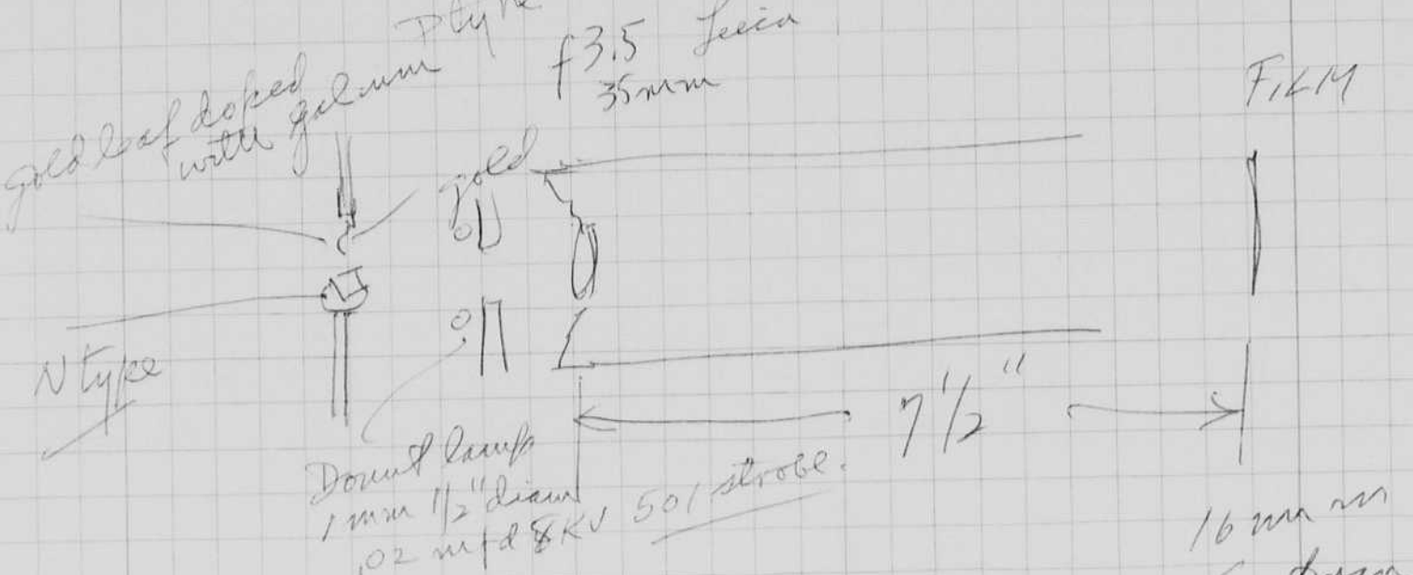
132 Dec 19 1959

H.E. Edgerton

V. Sundara.

Closeup photos of Diodes

Clevelite IN251 Diodes



16 mm ss Eastman 20-40

Shot 1. 20-20 Broke film.

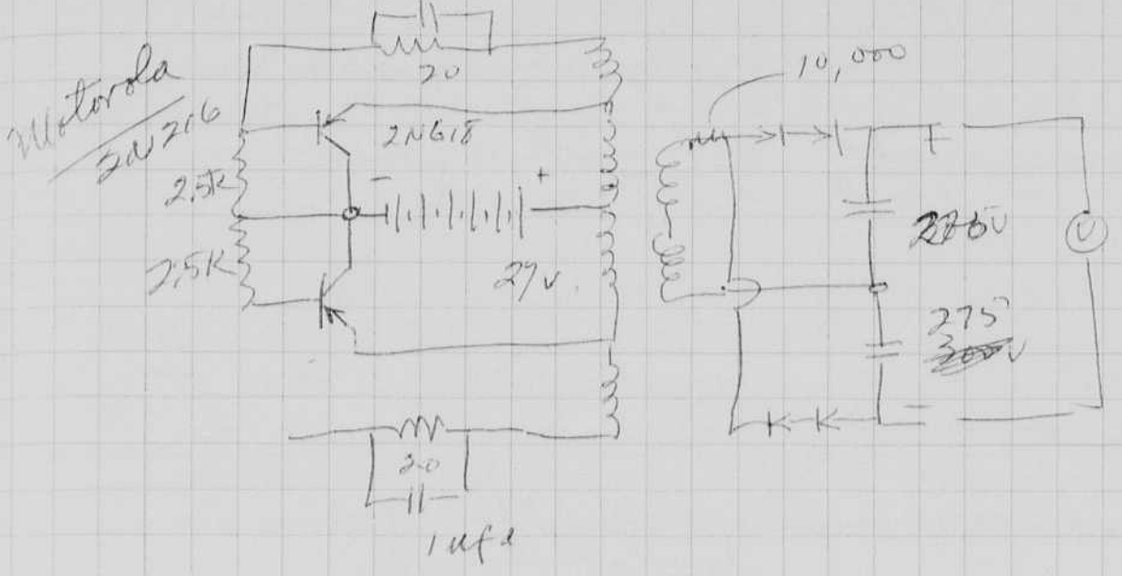
f 5.6 Shot 2 20-20 ok. Actin showed smoke.

f 4 Shot 3 20-40 not processed Diode ok

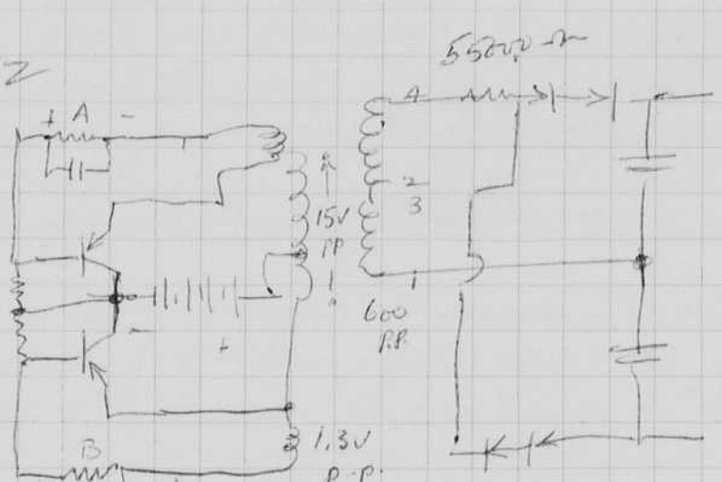
f 4 Shot 4 20-40 " " Diode ok.

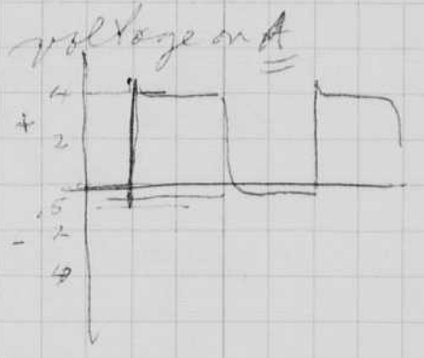
Bally scaple power supply 24 volt for "Triste" and FNRS IIII.

Exp 1 TX-91 common collector.



Exp 2 TY-92





$\frac{.5V}{20} = .025$ amp. 25 ma.

$\frac{4V}{20} = .20$ amp 200 ma

voltage at B appears same.

output de points Rx 3 - peak to peak = 600 volts

$f = \frac{1}{170}$

$170 \overline{)1,000,000}$ (5882 Ω)

100 μs = 10,000.

200 = 5,000

170 = 5100 cycles.

Input 29 v output 525/2 mfd 900 v 725 v current 0,39 amp peak 2,5 amp

(2 × $\frac{525}{2}$ mfd 900 v)

Input. 31 630 v additional capacitors old ones with same voltage. 1.8 amps. 2,85 amp

.55

.45

Dec 21 1954

24 volt Power Supply

TY-94 Ratio $\frac{30 \text{ V ac Sec}}{1.5 \text{ V pri}} = 17.9$

Primary 5-7

Sec. 1 2 3 4

$25 V \times 17.9 = 500$ volts

$\frac{21.5}{3} = 7.17$

Thesis Students

Paul R Payne - Working at Lloyd Res Corp. James Hetherington.

Dave Eldridge.

John Tredwell. Short flashes.

Michael I. Liechenstein Elect. Audio Sweep Gen.

Kaye Ross - Sonar meas.

Jan. 16, 1960
Harold Edgerton

Equipment was sent recently to Guam for the "Trieste" dives to great depths. 4 Strobes (100 WS) and 2 cameras all tested to 24,000 psi for 24 hours. Andy Rechnitzer and Jacques Picard and Walsh were doing the work at Guam under the N. E. F. Sponsorship.

The Eye photography is going fine. Dr Rees has asked me to make an equipment to use at the Deaconess Hospital. This is under way. Pete Barstow is helping with the project. We hope this item will be useful for medical work.

A 1000 WS pinger of about 1000 cycle pulse width is being finished by Gary Hayward for U.S.N.O.I. 2307. Job no E.G.&G. The device can operate at one ~~flash~~ ping per second.

Jan. 18, 1960 Gary Hayward and I took the "Tin Pan" sonar to W.H.O.I. ~~last night~~ yesterday to install it on the Atlantis for a sea test. Many fun went along for the ride. She stayed with Julian Podowiez family at Pocasset 2 nights. LO 3-5802

The equipment has a 15" diameal disc driven with a 4KV 16x10 mfd capacitor at 1 per sec.

The sparker at WHOI has 12 mfd at 15KV. 1344 watts sec.

Jan 22 1960

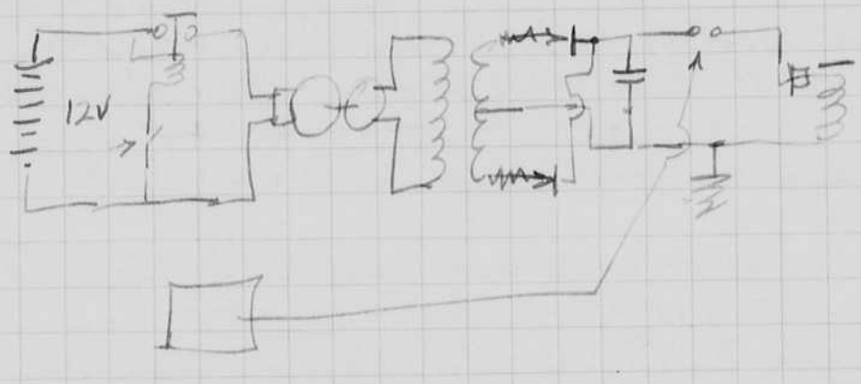
Harold Edgerton.

I picked up Gary Hayward on Tuesday morning at 8 am at W.H.O.I. The results of monday's cruise on the Atlantis were very good. Harvey was pleased with operation. Rate 1/sec at 1000 W.S.

The oscillograph showed 0.5 x 10^6 dynes/cm^2 at 3 ft from the transducer and a duration of 0.15 millisecond. The noise was a distinct "thump" instead of a crack as heard with the sparker.

16 mf 2x10^6 100 mf 4 KV

Harvey wants a 500 WS "thumper" to operate at 1000 fathoms for 2 hours from a battery. The rate will be 10 seconds.



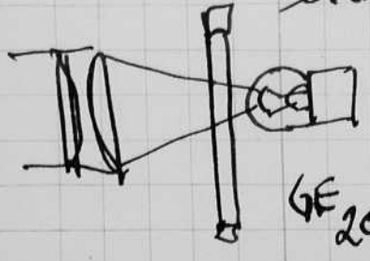
Jan 23 1960 Eye photo output of 100 WS FX-19 no lens at 8" from GR meter #113. 110 lumen sec/sq ft.

New Flash unit. FX-21 100 WS. into choke and with 1/x length aperture at 8"

60 lumen sec/sq ft

Jan 30 1960 Yesterday Dr Searle Rees brought over the Leica again. This time we tried 100 WS into a FX-21 with a series inductance to prevent breakage. A 6 volt 1.8 amp automobile lamp was used for illumination of the eye for focus.

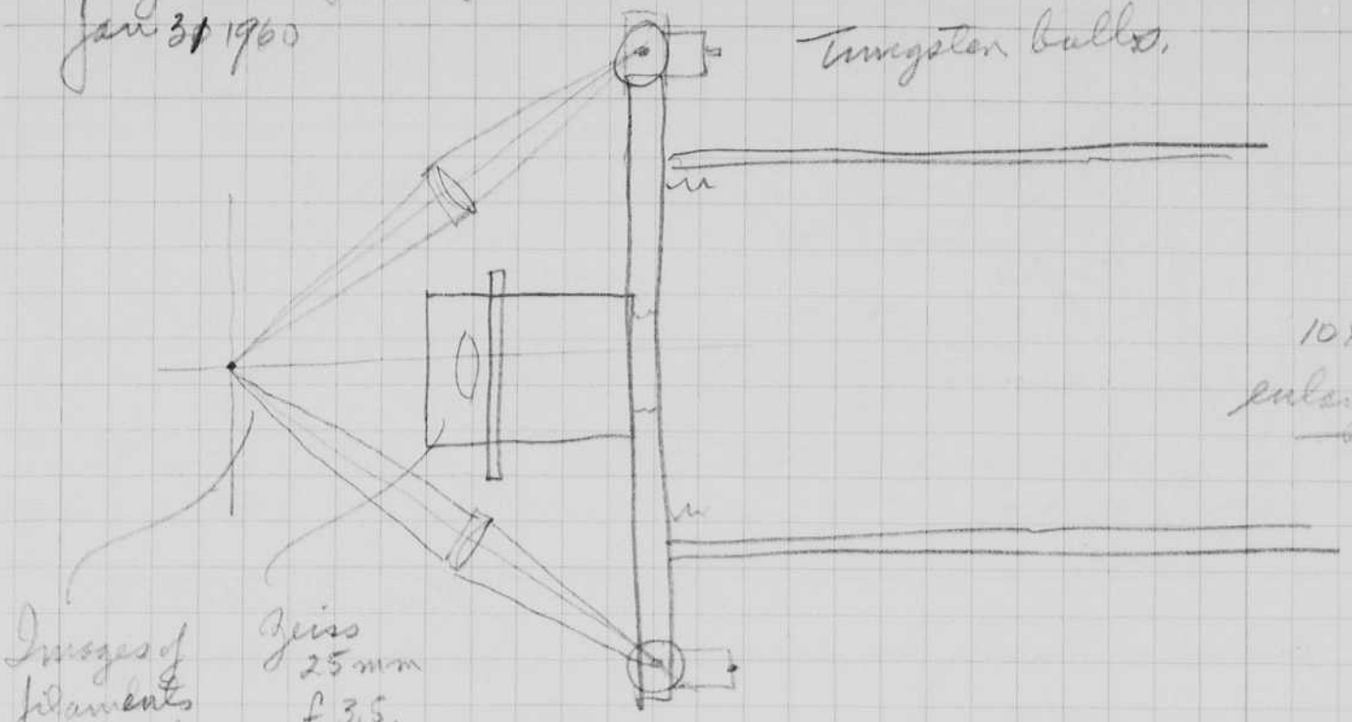
I used a 25 mm f 3.5 Zeiss lens for imaging the conjunctiva at a magnification of 295/25.



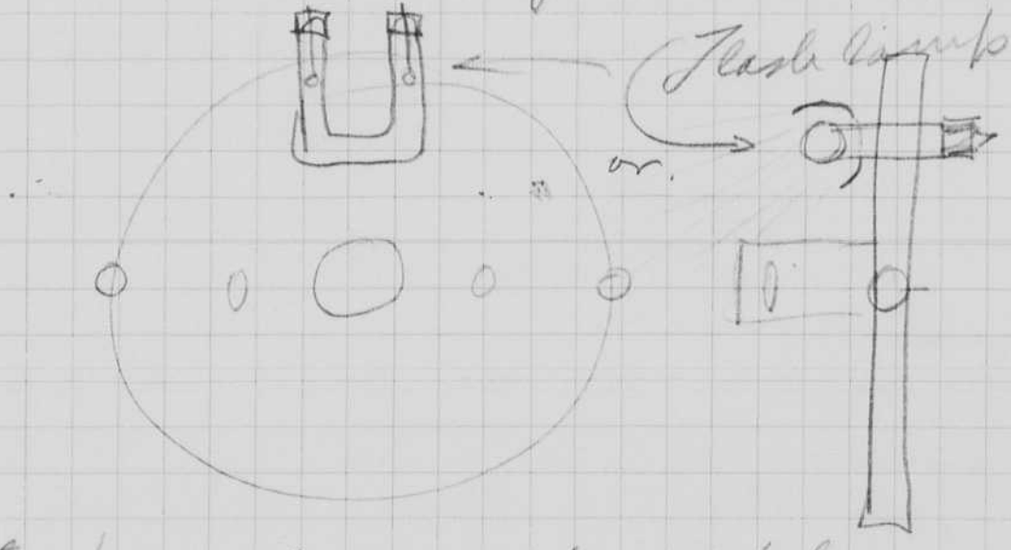
GE 209 lamp.

Eye Photographing Camera

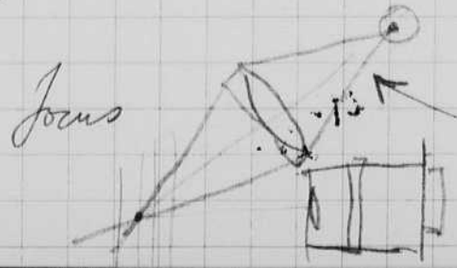
Jan 31 1960



To use. Move entire camera back and forth until images blend together, then shoot photo. The electronic flash can be mounted on the plane board so the lighting will be constant.

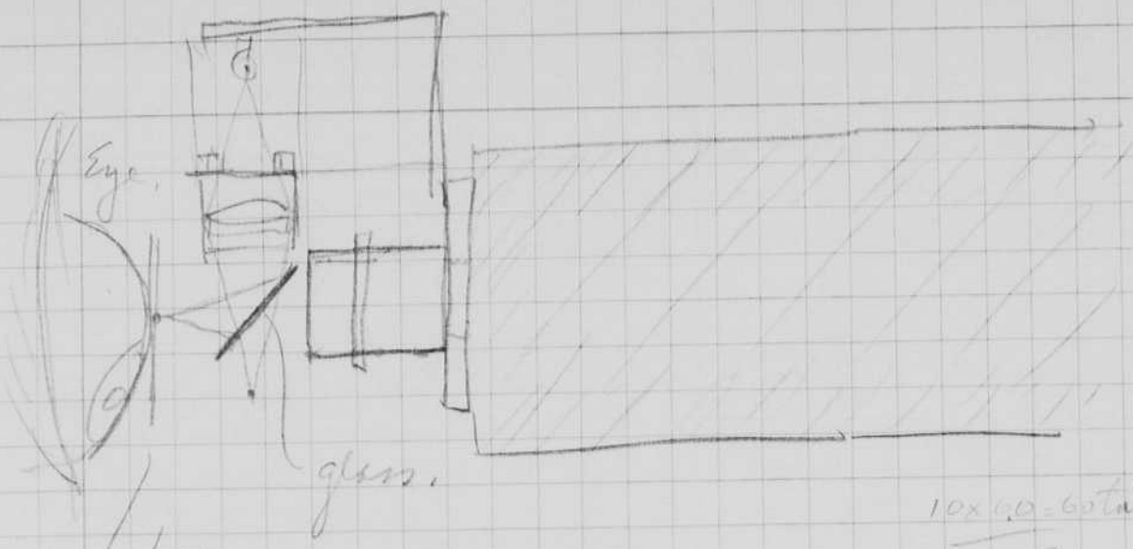


the focus adjustment might be accomplished with a single lens of wide aperture so that sharpness of an image could be used.



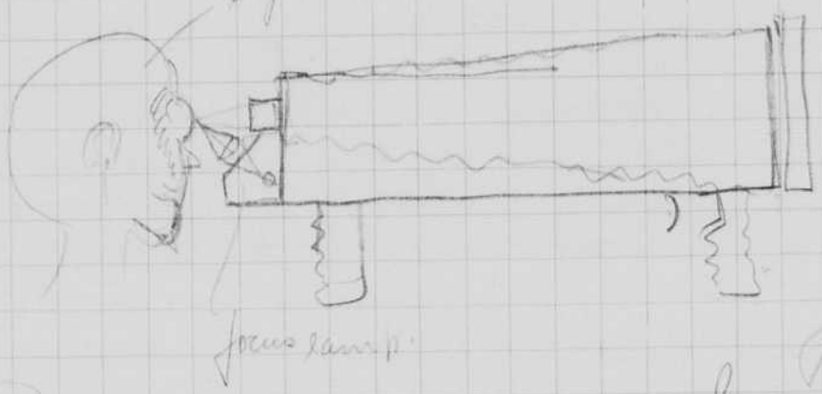
For example use f 2.7 13 mm lens as used in 16 mm movie cameras.

13 x 2 = 26 mm



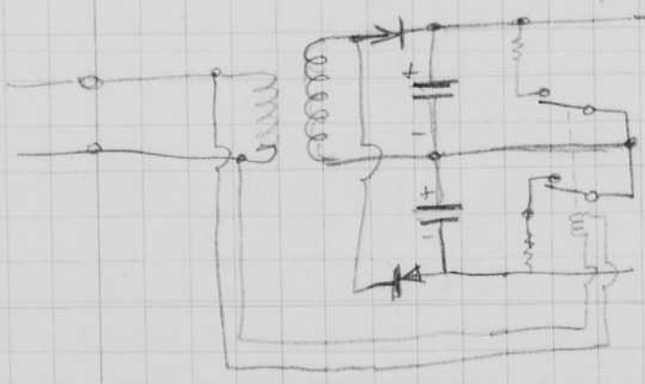
10 x 10 - 60 tungsten wire gauze

Polaroid
4 x 5 film



Hand held camera. Operator pulls trigger when image of filament is focused and at correct apert.

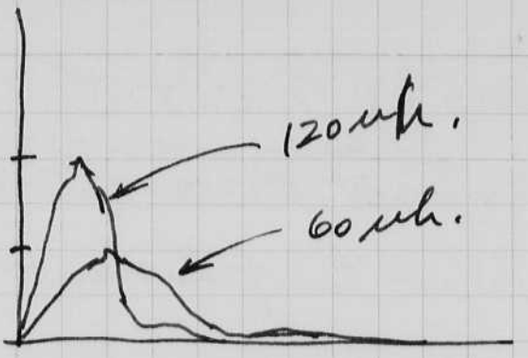
Relay to lamp
capacitors for charging flash lamp.



E-405 M.I.T. Microscope Illuminator

H. Edgerton
Neal Roberts.

120 uh
525/2 mfd.



FX-21 tube 1/2" inch Xenon gap Wanode
BaW cathode.

Worked ok with 120 uhs.
started to skip after several flashes with 60 uh.

Feb. 4, 1960 Thu Yesterday tested Thumper at Raytheon
Melvin S. Wilson SL 8-2721 2551
Al. Turner

A. Ron and Barry Hayward went with me.
Polar pattern is almost symmetrical. 22 to 1.5.
Peak pressure is very high.

Shadow Photo

2000 c.p. $\times .01 \times 10^{-6}$ c.p.s.

Contrast Process ortho. (0.5 M.C.S.) Density =

Film-Lamp distance = 4 cm. .04 meters.

$$\frac{20 \times 10^{-6} \text{ c.p.s.}}{(.04)^2} = 1.2 \times 10^{-2} \text{ m.c.s.}$$

16×10^{-4}

10 exposures superimposed to get density ?

0.12 M.C.S.

Lt. Distance = 1 meter.

$$\frac{\text{c.p.s.}}{1^2} = 0.1 \text{ m.c.s.}$$

c.p.s. = 0.1 required for exposure.

0.1 mfd 16 KV. ok at 5 ft on Contrast ortho with 1/8" hole or spark.

Double flash at 4 ft – no exposure.

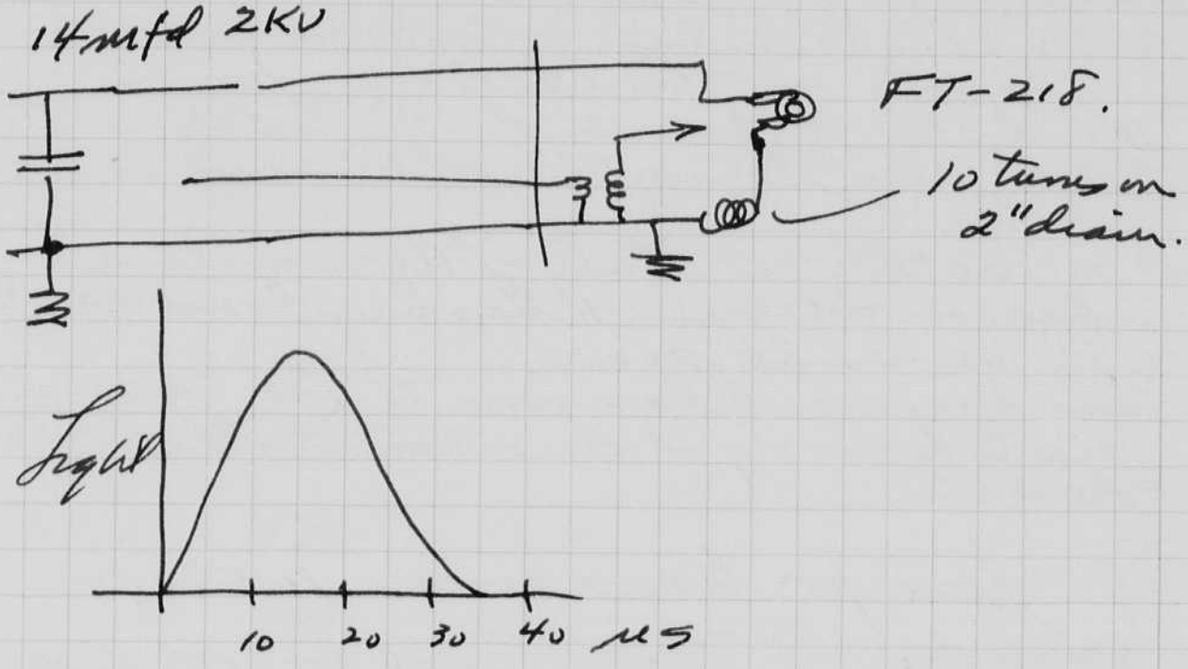
" " " Panatomic x thin.

" " " Royal ortho thin.

Greenewalt flash unit.

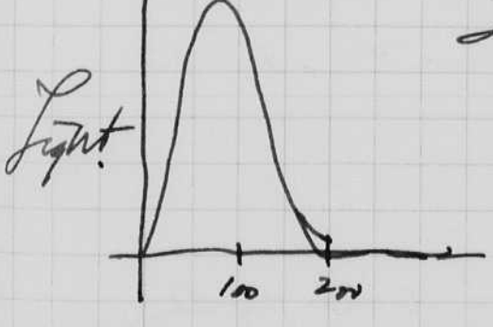
now here for lamps development.

Lamps now need to be changed after 1000 flashes.
Lamps go white on outer rim due to
evaporated glass from inner arc path.



Inductance increased to 10 turns on 4" diam.
Peak now at 25. Duration about 40 μs.

With 300 uh. the light lasts 100+ μs.
Suggest this be life tested to see
if efficiency changes after
1000 flashes.



March 9, 1960

Harold Edgerton.

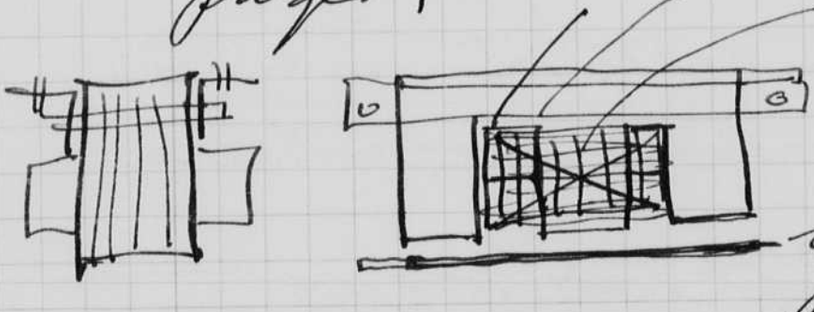
Retd from Puerto Rico Mar 3 by air just in time to hit the big blizzard and snow storm. 30 inches in Boston. The plane DC-7 landed in Baltimore instead of Idlewild and I had to go to Boston by train arriving about 10 30 on Sunday Mar 4.

I was on the CHAIN from Woods Hole for 10 days taking deep sea photos in the P.R. trench.

March 12, 1960 A study of the negatives taken on the chain 11 has been made. Prints will be made soon.

Sam Raymond has gone to L.A. to make a photo survey of the ocean bottom for the A.E.C.

Idea for transducer 12 KC. for pinger.



The Iron must not saturate, keep the copper losses low.

Let excitation be 900 volts

C = 2 mfd.

L = ?

$$f = \frac{1}{2\pi\sqrt{LC}} = 6000 \text{ cycles/sec}$$

$$\sqrt{LC} = \frac{1}{2\pi 6000}$$

$$LC = \frac{1}{36}\frac{1}{36\times10^6} = \frac{1}{109}$$

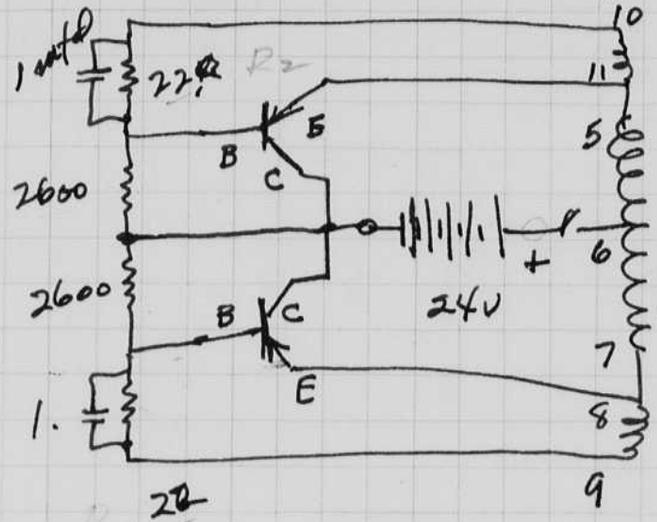
$$L = \frac{1}{10^9} \times \frac{1}{2\times10^{-6}} = \frac{1}{2.0\times10^3} = .500$$

.0005 henries = .5 mh

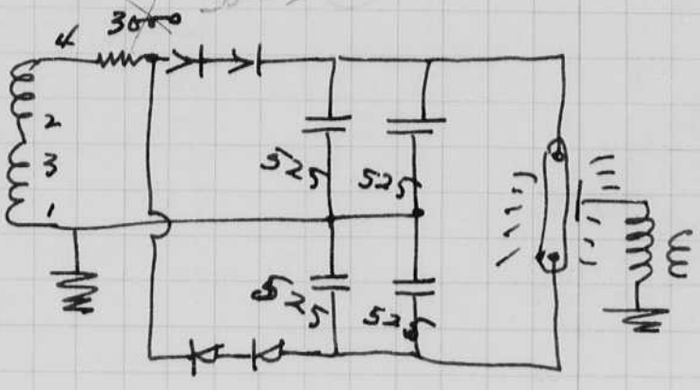
Coupling will reduce the inductance. Suggest 700 mh.

Refer to p 133. — mar 12 1960 — Battyscaphe Stroble.

Clevite Transistors 2N 268 A



TRIAD #92



~~22.5V → 680V~~

.38 amp 26.V V 880 V

discharge started at 940
April 2 1960
RE 2 meas R.

880 860 in 10 seconds,
850 in 10 sec.

200WS 160 after discharge. FT-217

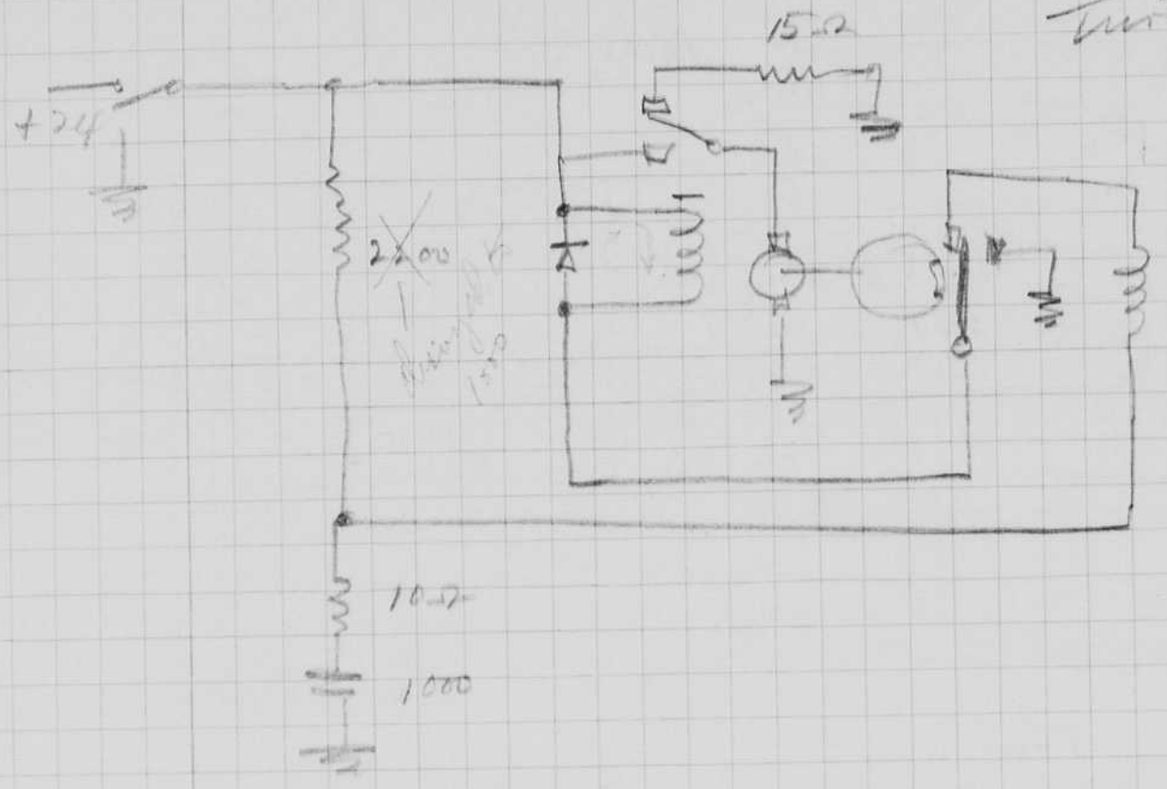
R_1 changed to 3600 ohms.

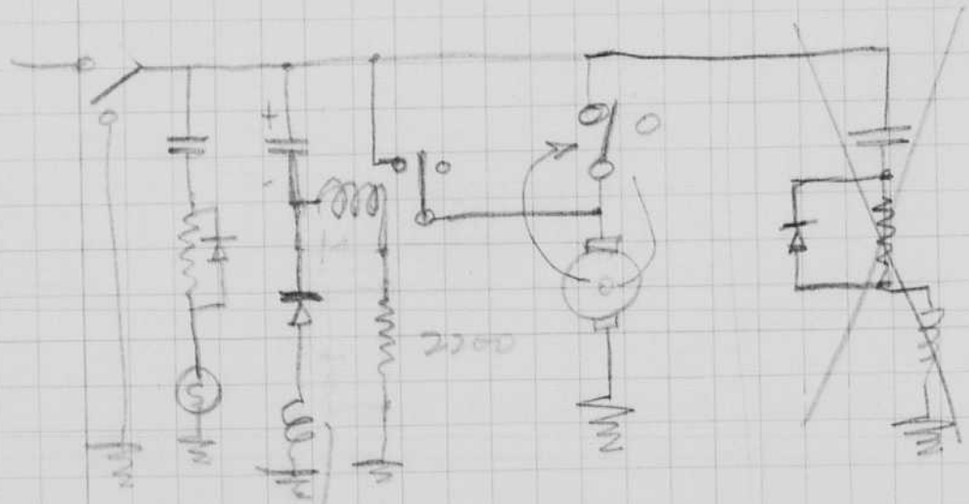
0.1 885 500 ohms in chg circuit.
0.2 $R_1 = 3600$ $R_2 = 32$ 885 500 ohms in chg circuit
0.2 $R_1 = 5600$ $R = 47$ 885 500. "

March 31 1960

French Bally Graphic test.

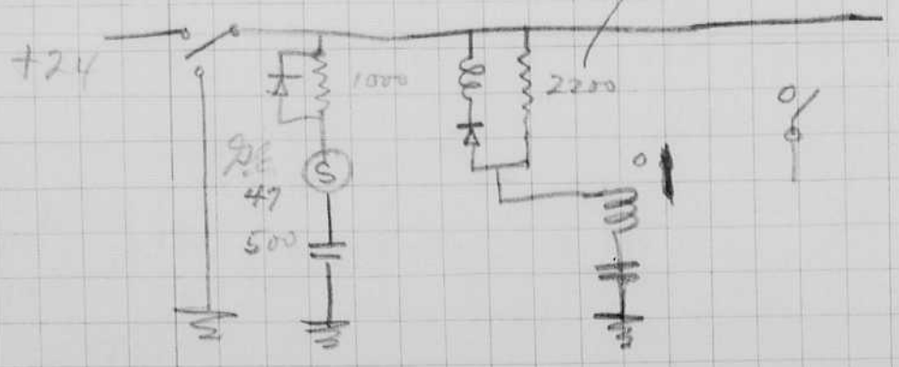
Used in Turtle camera.





Shutter

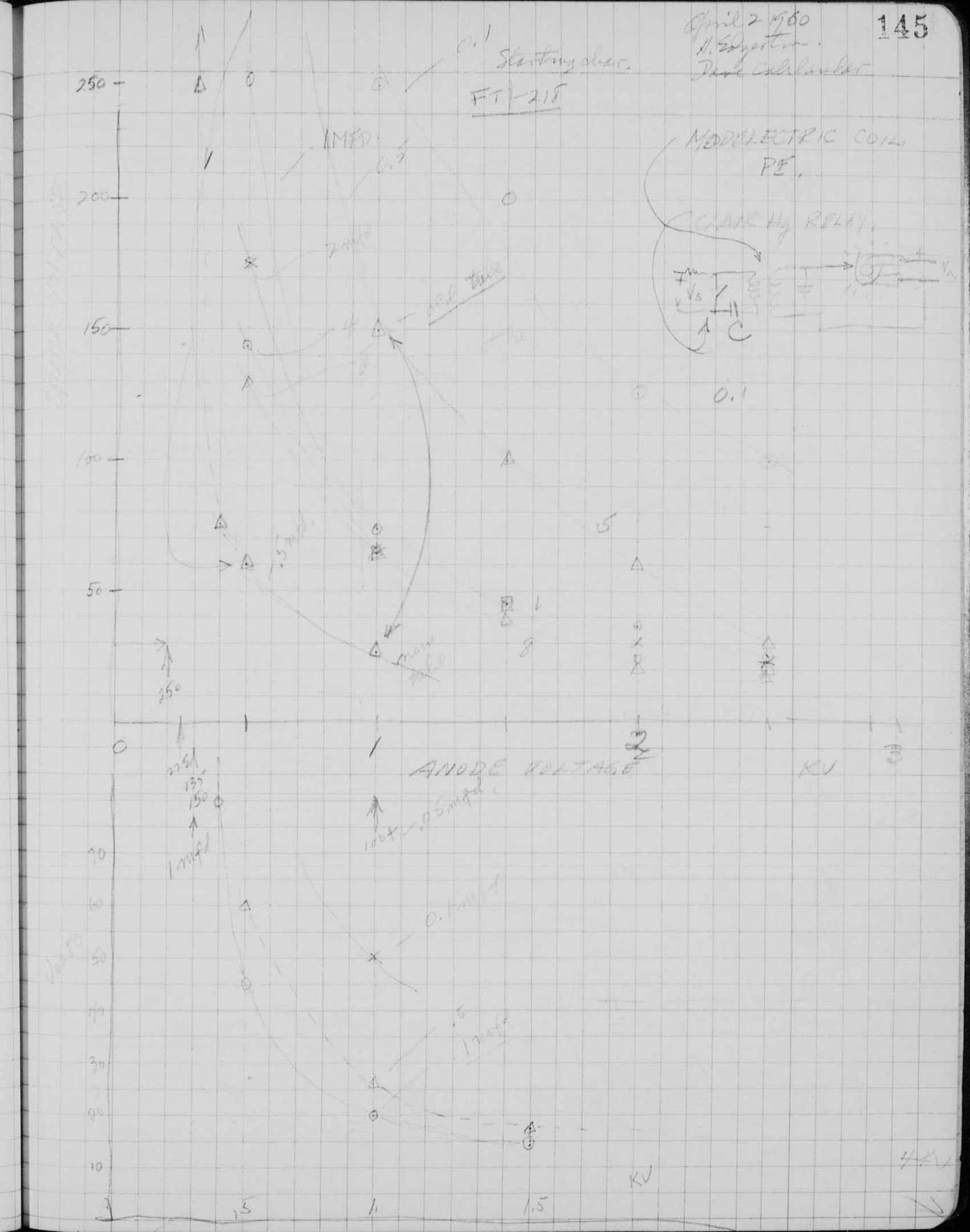
Power.



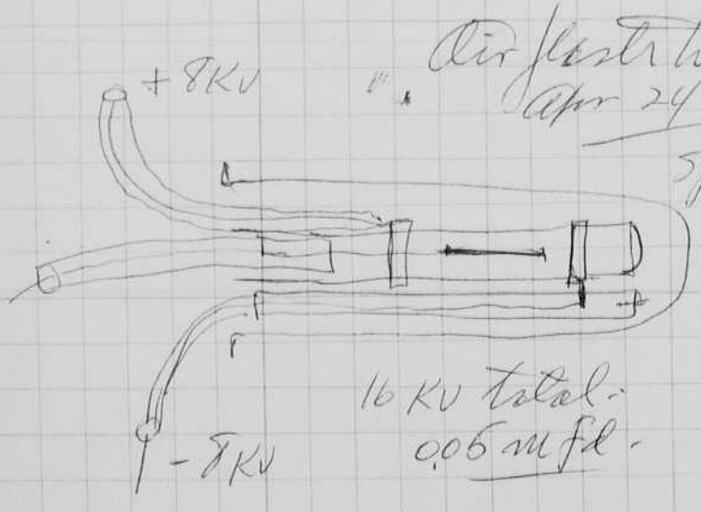
April 2 1960
H. Edgerton.
Dave Cahlander

Starting char.

FT-218



FT-151



Air flash tube
Apr 24 1960
Spark inside of tube.

16 KV total.
0.005 mfd.

April 19 1960
Harold Edgerton

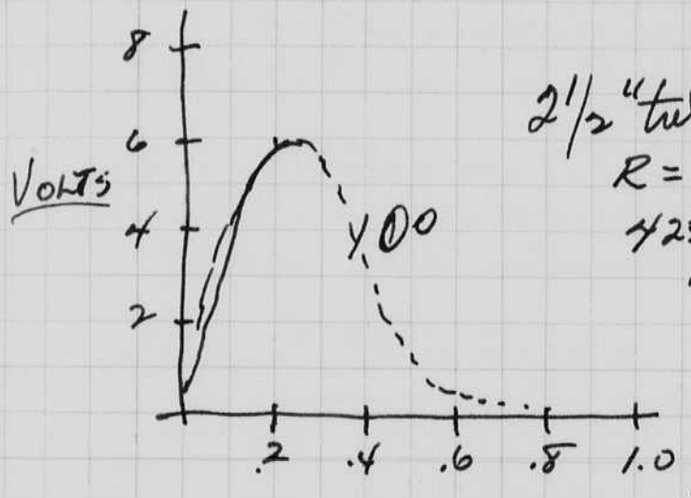
The thumper delivered several weeks ago to WHOI seems to be working fine as reported by Hayward and by letters from Hersey. Reparations have been made. Clear destinct echos are being received from the bottom and from subbottom layers.

A thumper was sent by air France & Constean at Marseille on apr. 15 for use in France.

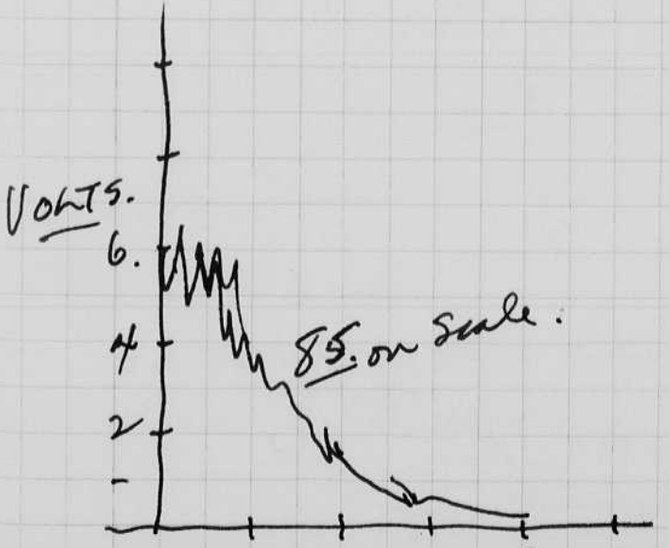
April 23 1960 Sat. Parents' weekend at M.I.T. Many visitors in Strobelab 4-405 M.I.T.

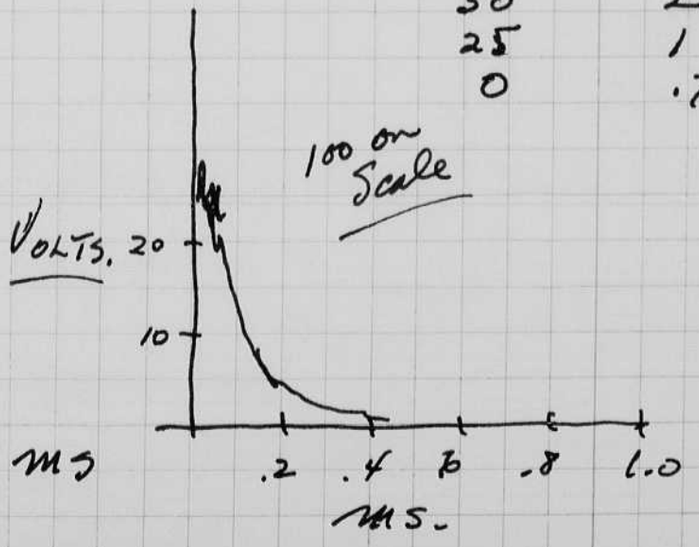
microsoft illumination with 2½" xenon gap tube.
25 cm xenon.
Tungsten anode
alloy cathode.

2½" tube plus choke.
R=0
425/2 mfd at 900 volts.
8 ft to Scope photocube.
Microsoft 1/2 focus.



Scale.	Peak	Dur. MS / MS
100	25V	x150.
85	6	375
70	4	400
50	2	600
25	1	800
0	.7	1000.





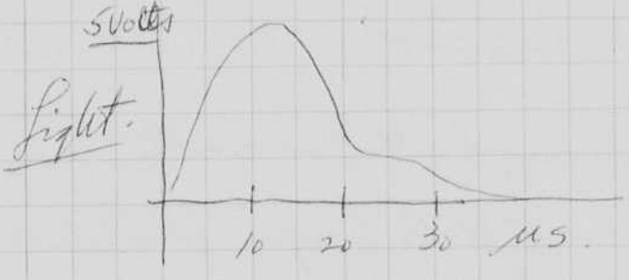
April 26 1960
H. G. Snyder.

Effy of long lamps.

Lamp.	C	V	P.R.	H.d sec.	d	cps d²
9mm 20"	10	2 KV	400	1.0	6'	
	10	4	50	.09	6'	
	50	2	45			
G.E. lamp with pressed seals.	10	2KV	400+	—	—	
to used in	50	2KV	40	0.1	6'	
assoc units	50	2	42.			
for the	50	2	40	0.1	6'	3.6
Printing industry						

about same effy

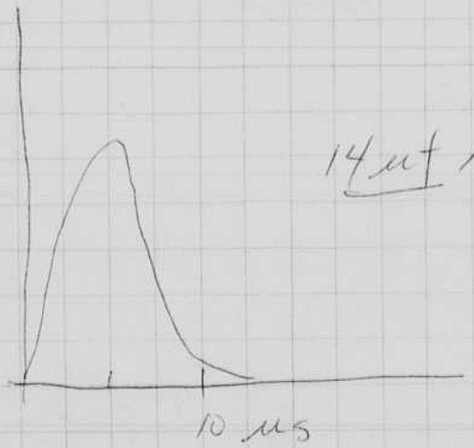
Short flash unit
10 mfd in test unit into ½" xenon gap. FX-21



4 ft into plan.

10 mfd with circuit Inductance

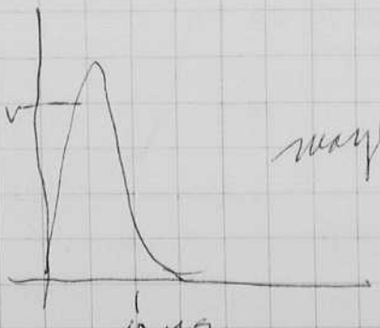
Tube shows darkening after 50 flashes



14 mf DC capacitor.
900 volts.

$\frac{CE^2}{2} = \frac{14 \times 1000^2}{2} = 7$ watt sec.

Tube 1½" long



maybe a bit longer flash peak light less.

May 3 1960.
Harold Edgerton

Vanderstein has been taking eye photos. Today I showed the micrograph eye lamps to people at EG&G. Clark, O'Keefe, Adena, Purrington, Jorgensen, etc. etc. All seemed interested. Bentley suggested mint & fit other reflectors. Jorgensen suggested longer cable. O'Keefe said to bring unit in next week with photos of examples.

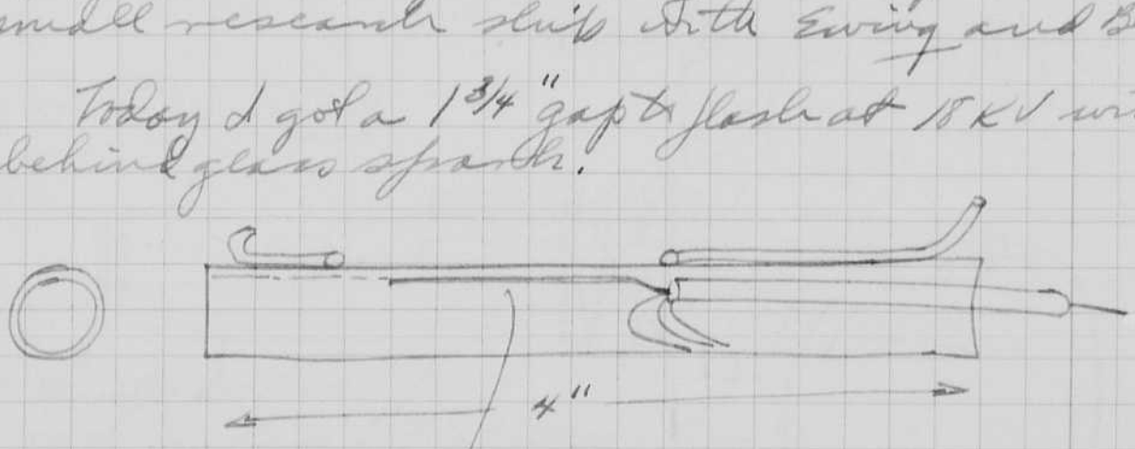
Tredwell, Shildkraut and Morey have been shooting with Frank Bauman. photos of high jumpers. They plan to shoot throws tonight at 8 pm in the M.E. armory.

May 5. 1960 I went to the AAAS convention at Providence RI

Yesterday where Hazelgaard gave a paper on protection of underwater instruments.

Gary Hayward went to Alpine N.J. last night in my station wagon to try a thumper on a small research ship with Ewing and Beckman.

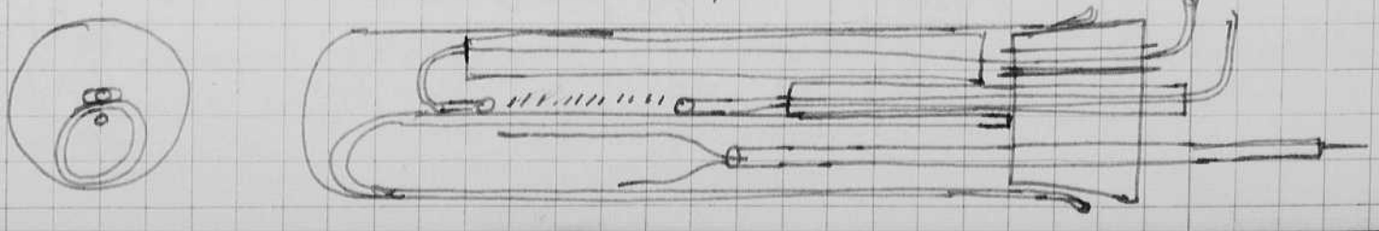
Today I got a 1 3/4" gap to flash at 18 KV with a behind glass spark.



one filament of a strand on inside of quartz tube.

1/2" gaps over glass breaks down with 18 KV

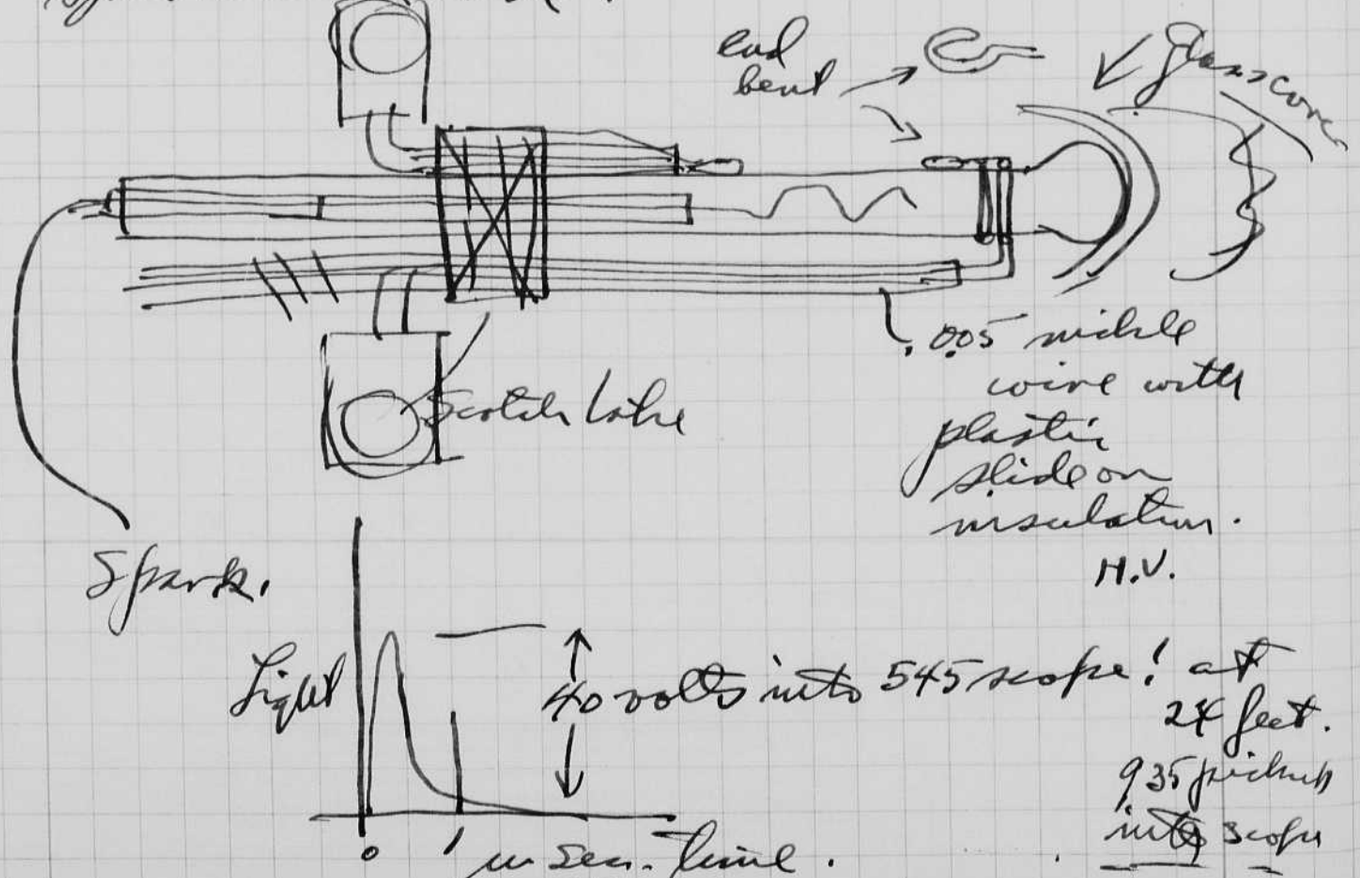
$\frac{1\ 3/4}{1/2} = \frac{7/4}{3/4} = 3.5 \times$ gap.

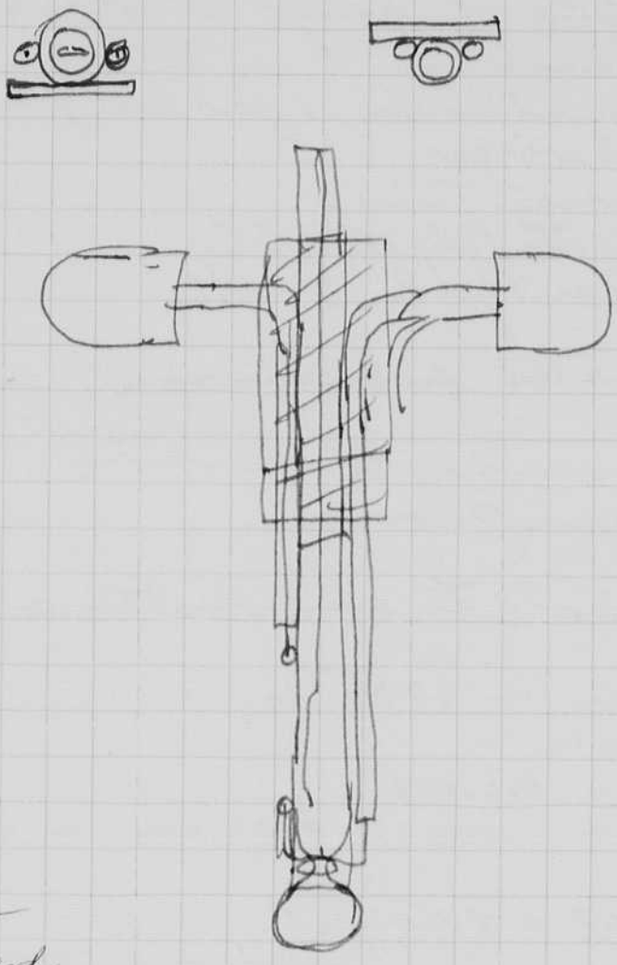


Dr. Searle Reas and Dr. Dietzel (~~Denmark~~ Denmark)
were in the lab last night to take xya photos
Ted Vandlerstein helped. We took photos
with a Zeiss 40 mm lens at setting 2, 4
and 8 with several values of light.
up to 100 watt sec at 900 volts into a
1 1/2" gap tube. The tube seems to take
the light o.k. Enlargement was about
10 on the negative.

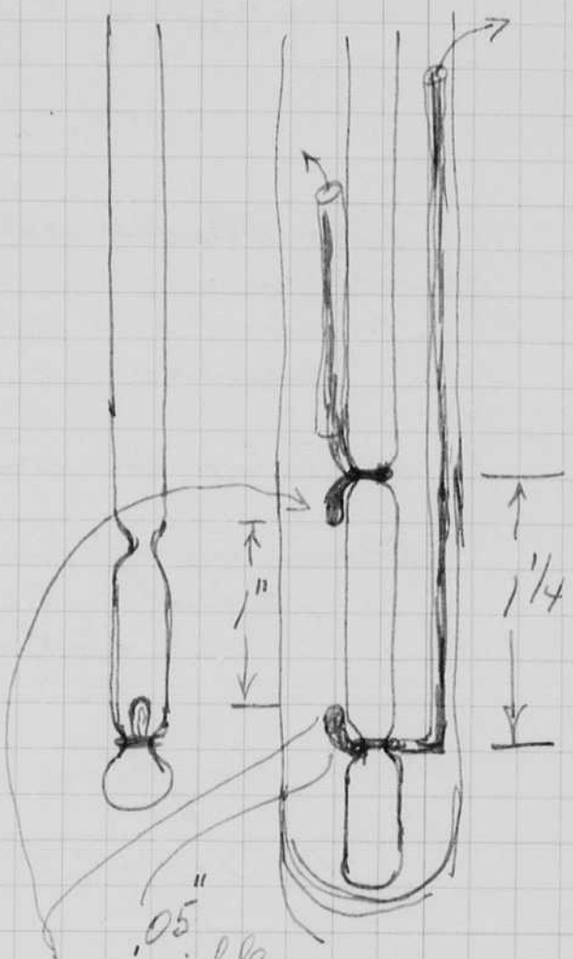
May 7 1960 ~~H~~ E Egerton . John Tredwell. 4-405 M.I.T.

Ice current work on Swallow
1/3 microsecond flash unit in John
Tredwell's book.
Lamp made yesterday broke down
electrically through insulation.
Blew fuse and cracked the glass mantle
on one of the leads.
Made another lamp today
with an open end - no cork. The
gap was 1 inch on the outside of
a 10 mm glass tube to hold the
spark electrode.





Probe
Coast Guard
Battery
2 year cycle 2.12 V/cell
1.95
300 amp hours.



Bent over end to present a smooth end.

May 12 1960

This lamp worked fine for 5000 flashes at 10 second intervals. There was some white deposits on the tube - but not serious as far as light absorption. The report was taken to EG&G today.

W. Beckman of Alpine was here today. I showed him the flumper with Hayward. Also saw Sam Raymond & O'Keefe, etc.

Position Indicator

May 12 1960

H. E. Edgerton

Method of precise position indication.

Precision timing of pings or flashes by accurate timers.

Increasing countdown 1 per sec from 20,000 cycles.

Behringer
General Time.
107 Lafayette St.
New York 13 N.Y.

This should solve the submarine problem.

1. Timer on submarine to operate signals for comparison.

2. Timer on missile to give distance.

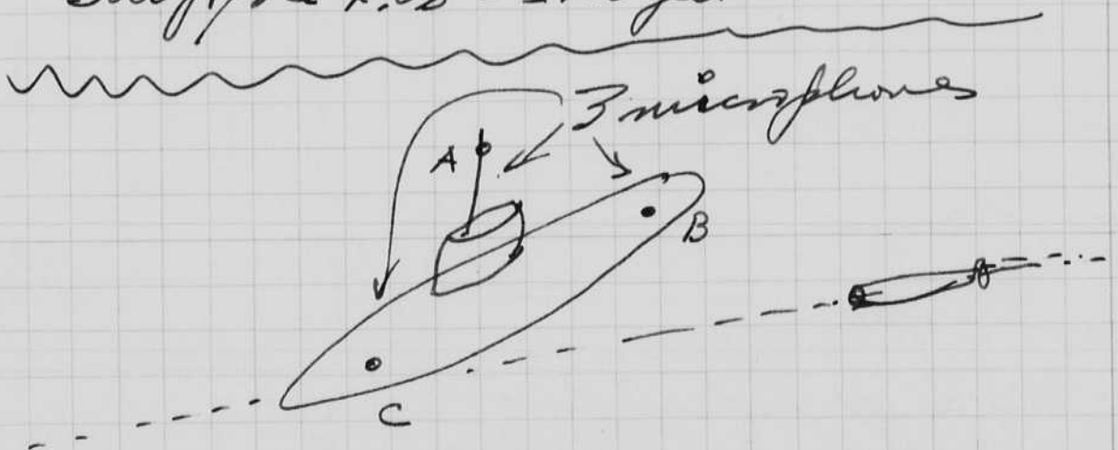
accuracy of timer = .005%

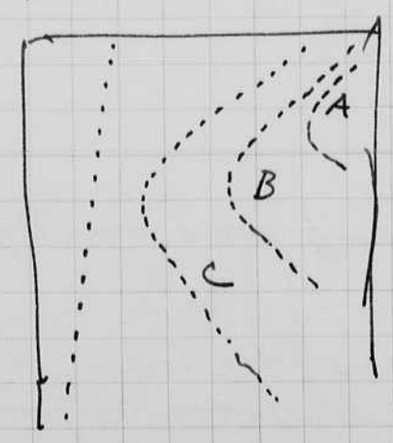
1 hour = 60 sec =

1% of 60 = 0.6 sec.

.005 = .006 x 5 = .03 sec in hour.

5000 ft/sec x .03 = 150 feet





Recorder.