HAROLD E. EDGERTON

PAPERS

MC 25

Series III

Laboratory Notebooks

Number 26

Dated May 14, 1960 to Jan 18, 1962

Massachusetts Institute of Technology

COMPUTATION BOOK

NAME HAROLD EDGERTON

Number 26

MIT 4-405
CAMBRIDGE MASS USA

Course .....

Used from MAY 14 1960, to JAN 18 1962.

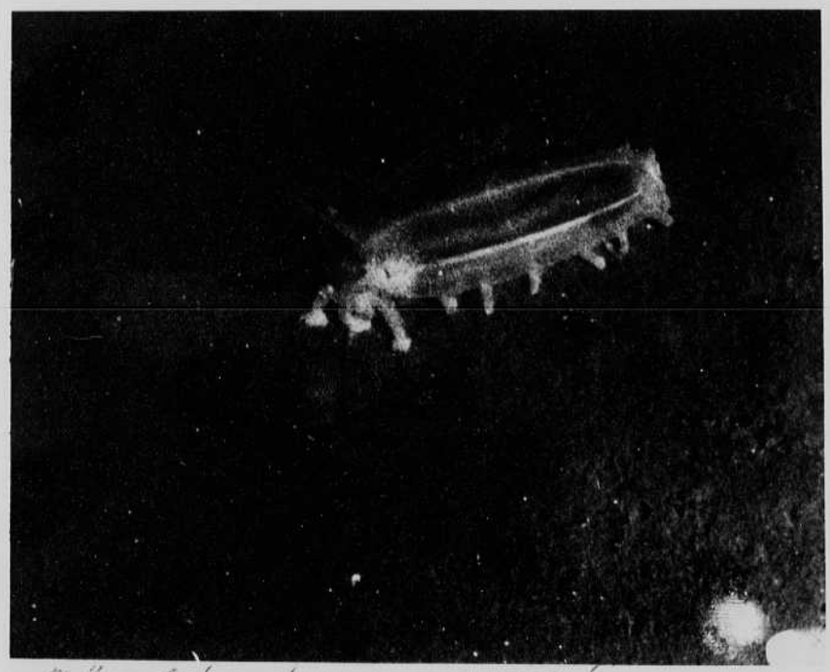
KIRKLAND 7-6063

100 MEMORIAL DRIVE CAMBRIDGE MASS.
Home ~~205 SCHOOL ST~~ VN 4 4790
~~BELMONT MASS. WANHO 4 4869.~~

Book No. 26
May, 1960
to
Jan. 18, 1962

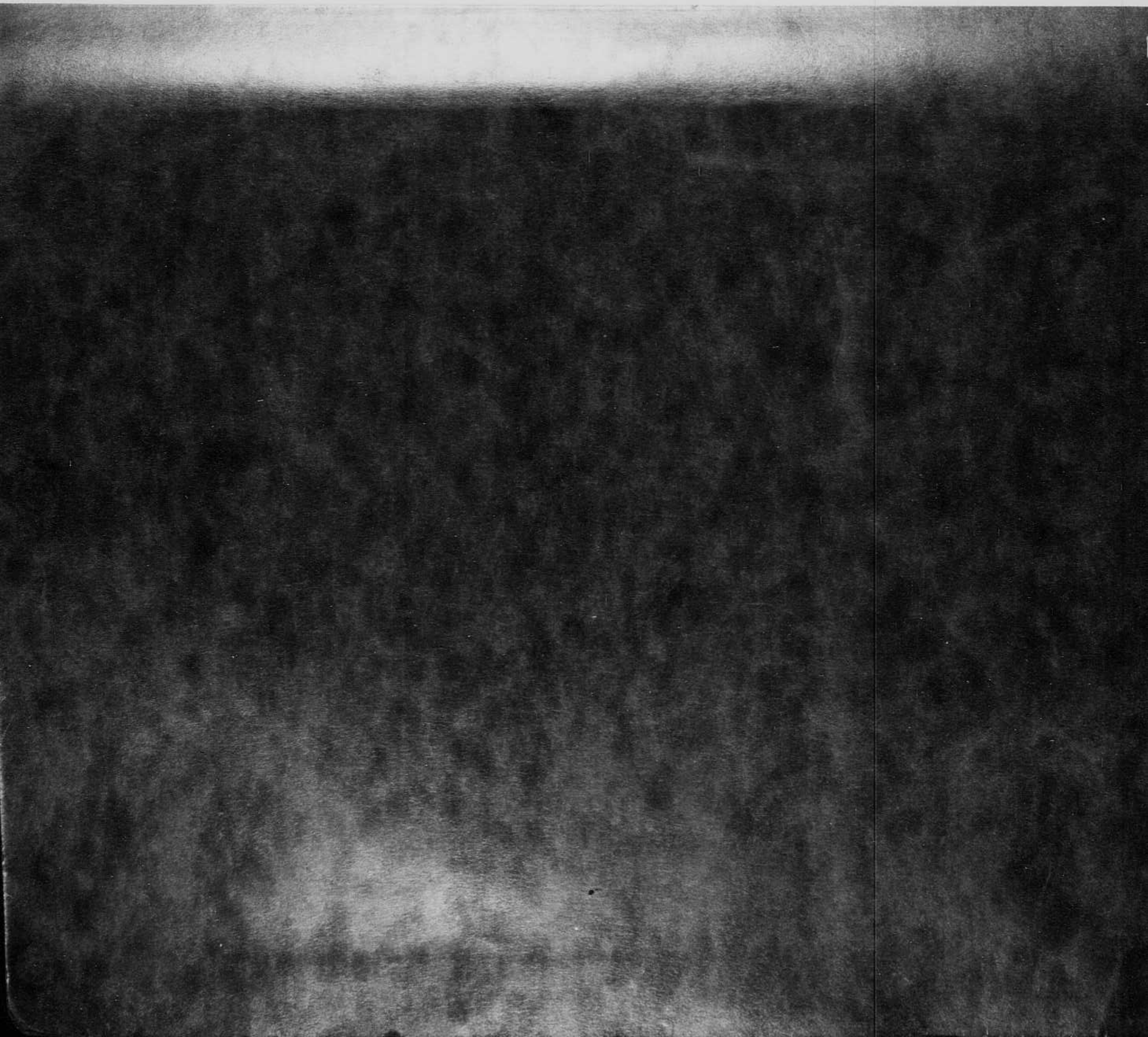
Harold E. Edgerton
4-405
M.I.T.
Cambridge Mass
May 14, 1960.

Romanche Trench
Chain #17
EXPEDITION
from Dick Pratt



7" Chantz — 4000 fms

Deep Thumper 18
Pros Tests 43
Boomer Design 117
Oscillograms 117.



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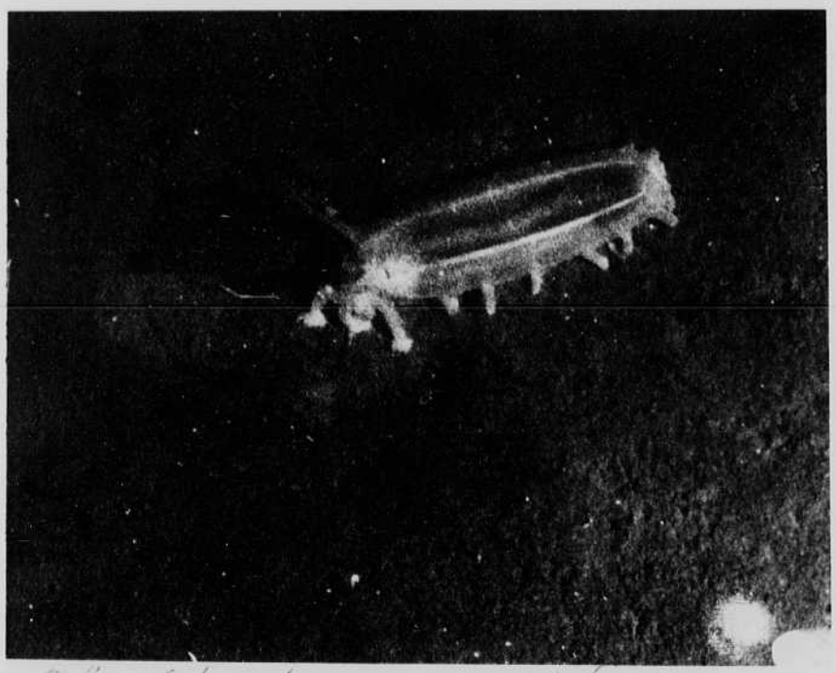


7" Chamber — 2000 Atms

Deep Thumper. 18
Pro Cert. 43
Boomer Design 117
Ballogram 117.

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."

* * * * * * * "

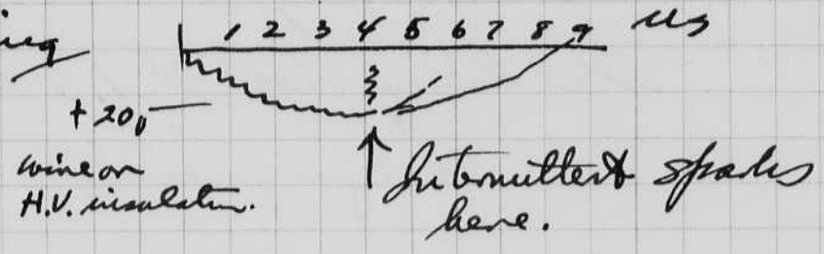
TECHNOLOGY STORE
HARVARD COOPERATIVE SOCIETY, Inc.
40 Massachusetts Ave., Cambridge 39, Massachusetts

May 4, 1960 Air flash.

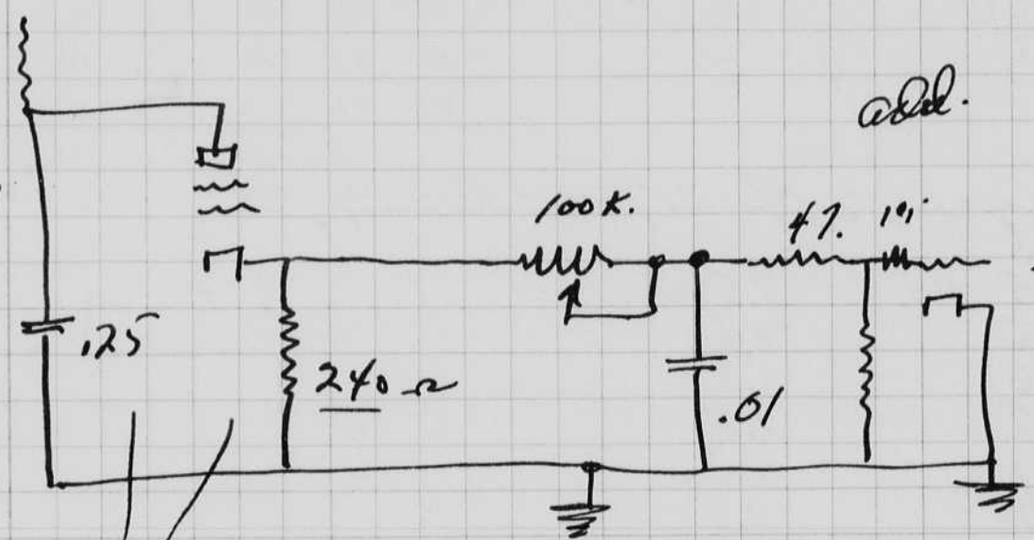
Harold Edgerton.

Test of time delay.

Spark in housing



No signal comes to .3C45 grid when time delay is cut in.



added.

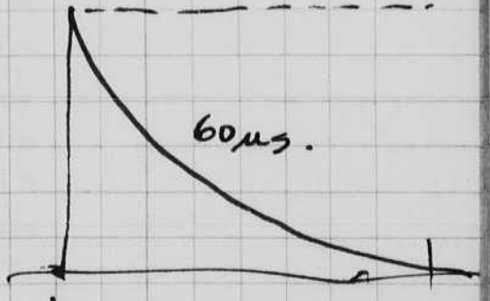
$20 \times 10^{-12} \times 10^{4}$
20×10^{-8}

$RC = \frac{.25 \times 10^{-6}}{240} = 60 \mu s.$

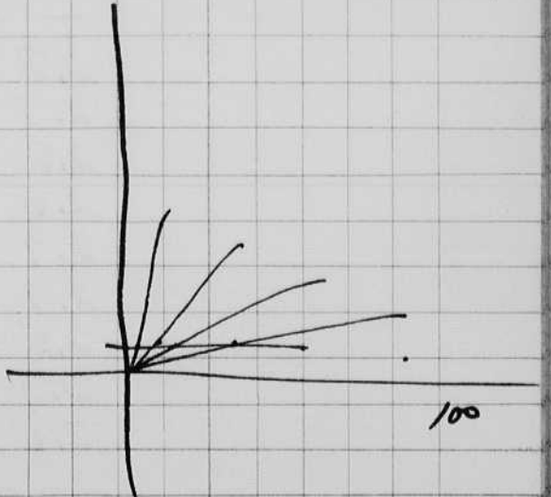
$\frac{}{600 \times 10^{-6}}$

$10^{5} \times .01 \times 10^{-6} = .001 \text{ sec.} = 1000 \mu s.$

~~$10^{5} \times .01 \times 10^{-12}$~~



min delay. Trigger thyratron to
Flash of 2nd thyratron
0,3 μs.



2

Edgerton
Tredwell

May 14 '60

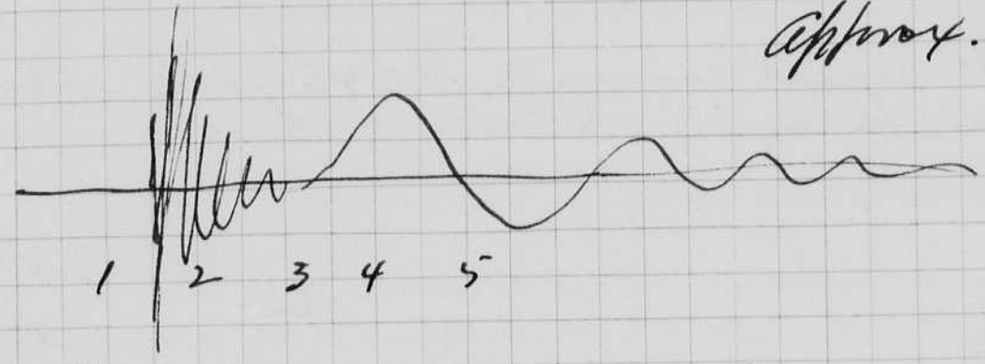
Time Delays.

30 volt positive pulse.

1.2 or 1.3 μs delay to 2D21.
0.2 μs delay in 3C45

Total delay about 1.5 μs to start of spark.

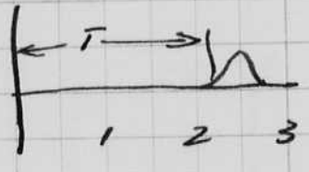
Coil frequency = about 1 m.c.



Approx.

Light goes off 2.7 μs delay.

	μs	
1	2.5 μs.	2.5 μs
	2.5	2.4
	2.6	3.0
	2.8	2.5
	2.7	miss
	3.2	2.5
	2.4	2.6
	2.5	2.4
	2.5	miss
	— miss	2.6
	— miss	2.5
	2.8	2.4
	2.7	2.4
	2.6	2.4
	2.6	2.3
	2.7	2.3
	2.7	2.4
	2.5	2.3
	2.7	2.4
	2.6	2.4

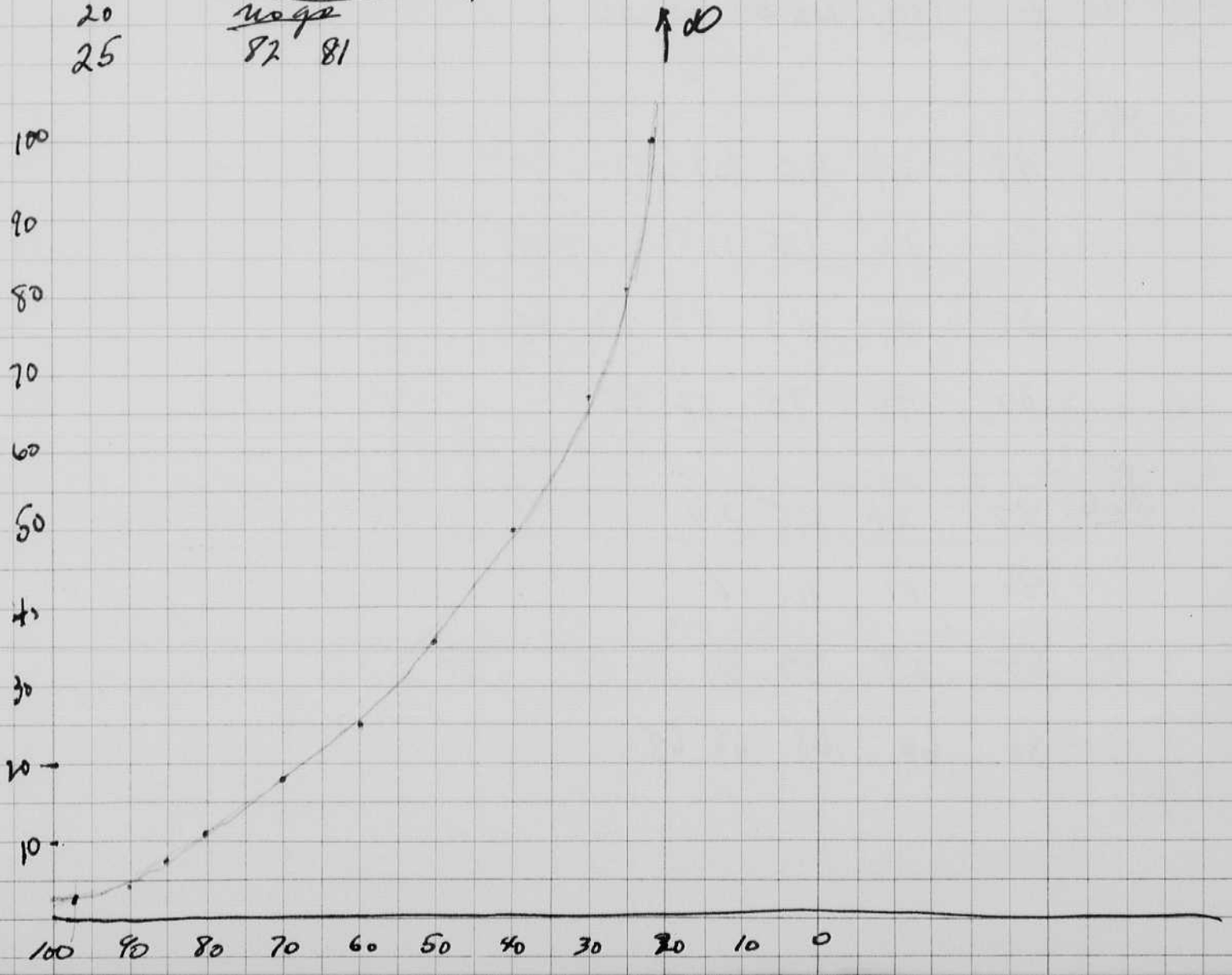


This tube has had 5000 flashes. + 1" gap. on Pyrex.

Dial setting	Delay μs.
97.	2.5
90	3.6
90	min 3.6
85	7.6
85	8.5
85	8.0
80	8 missed
80	11.2
80	11.2
70	18.5
70	18.0
70	17.8
70	18.0
60	25 25 25
50	34 36 36
40	50 60 50
30	67 68 66
20	no go
25	82 81

Line volts about 105 volts.

2 2 100 105 95



Voltage influence on Calibration.

108 volts.

Dial				
	97.	2.8	2.8	2.6
	80	15	16	14
	50	37	38	36
	30	76	76	72

122.

97.	2.4	2.4	2.3	2.4	
80	10	(5M)	10	10	
50	30		30	30	
30	(10M)	~~10~~	50	45	50

98 V.

97.	2.7	3.0	2.7	2.7	
80	12	12.5	12.5		
50	39	43	43	43	39
30	90	95	92	95	

Line.

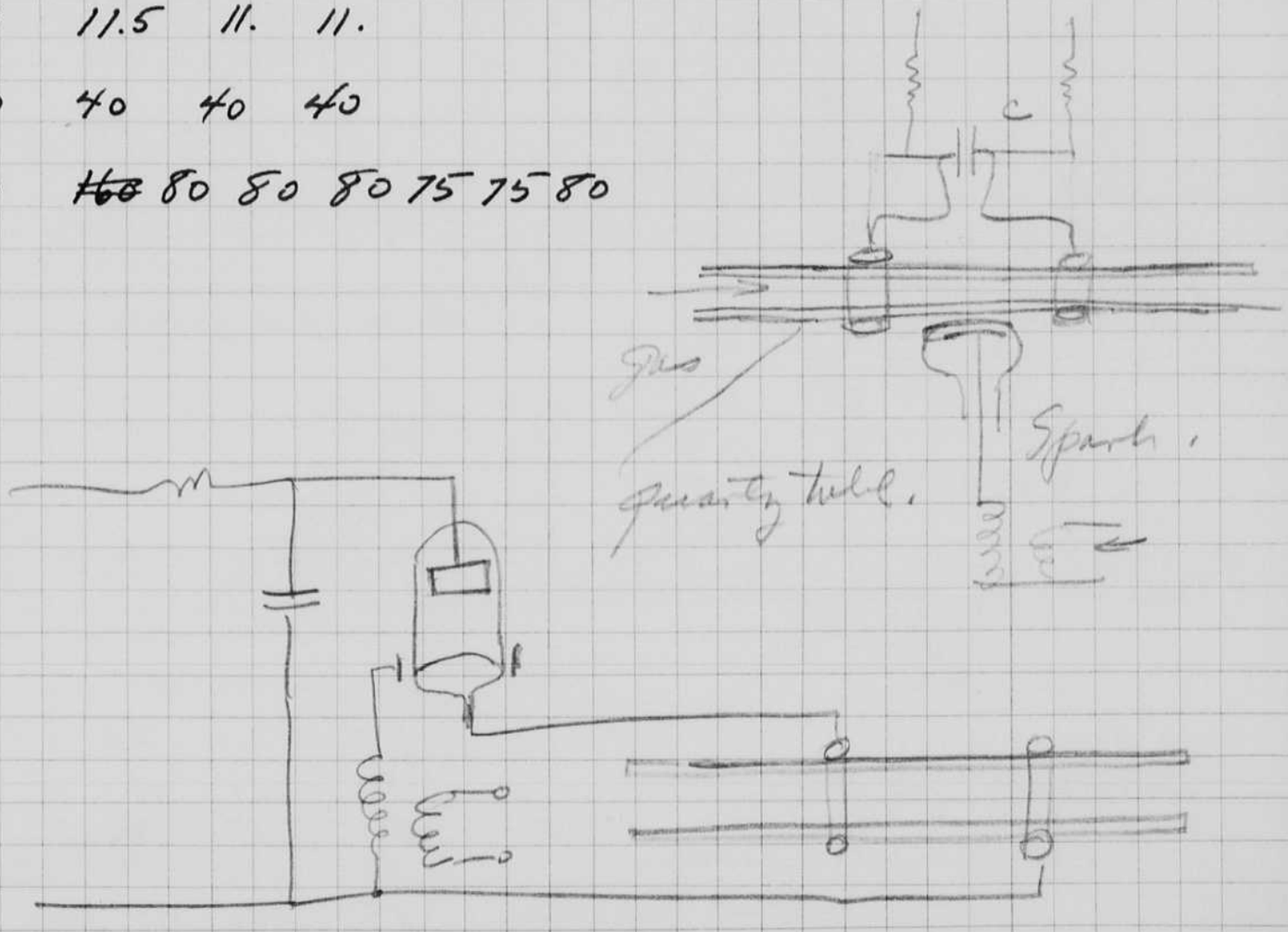
97	2.4	2.5	2.4	
80	11	11	11	
50	37	37	37	
30	66	68	68	68

See page 5 for final setting

Life test of tube shows
Some white deposits after 5000+ flashes.
Glass shows wear, evaporation where the
arc goes. #16 wire was used as electrodes. It
was bent into a V.

1 meg in 6C35 grid removed.
Test for delay on line voltage.

77	~~2.5 2~~	2.5	2.4 2.5
80	11.5	11.	11.
50	40	40	40
30	~~60~~ 80	80	80 75 75 80



This arrangement will spark over many times the static voltage distance.

6

K4. Holdover tests - Trigger circuit

J.T. Prior delay tests were with 240 Ω.

R	Delay.		
240 + 638	98	2.4	2.4
	80	10	10
	50	30	30 30
	30	44	44 44 42

Operation o/k

240 + 1500 = 1740 Ω

98	2.4	
80	10.5	
50	29	Operation o/k,
30	42.	

240 + 3300 = 3540

98	2.4	
80	10.5	
50	25	Operation o/k, with 80 Holdover.
30	42	

4700 / 240 = 4940 Ω

Capacitor is now .02

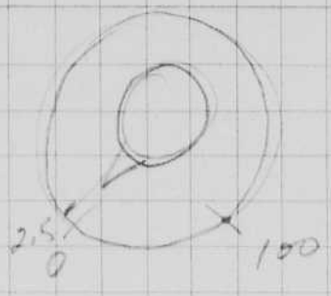
R = 240 + 220 = 460

97	2.6	2.5	2.5
80	19	19	18
50	78	78	77
30	155	155	155
25	185	185	180

C = .02

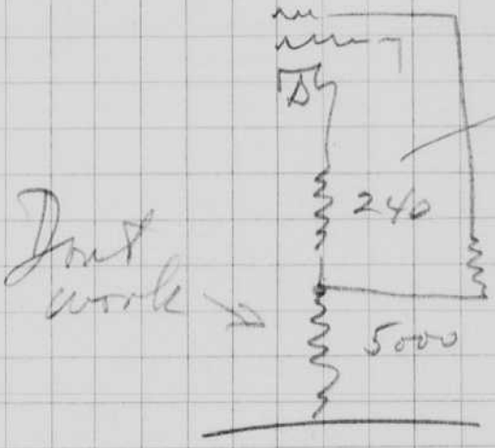
R = 1000 Ω

97	2.6
80	18
50	60
30	95
25	105
65	40



0-100 ms. C = .22
0-1000 ms. R = 1000

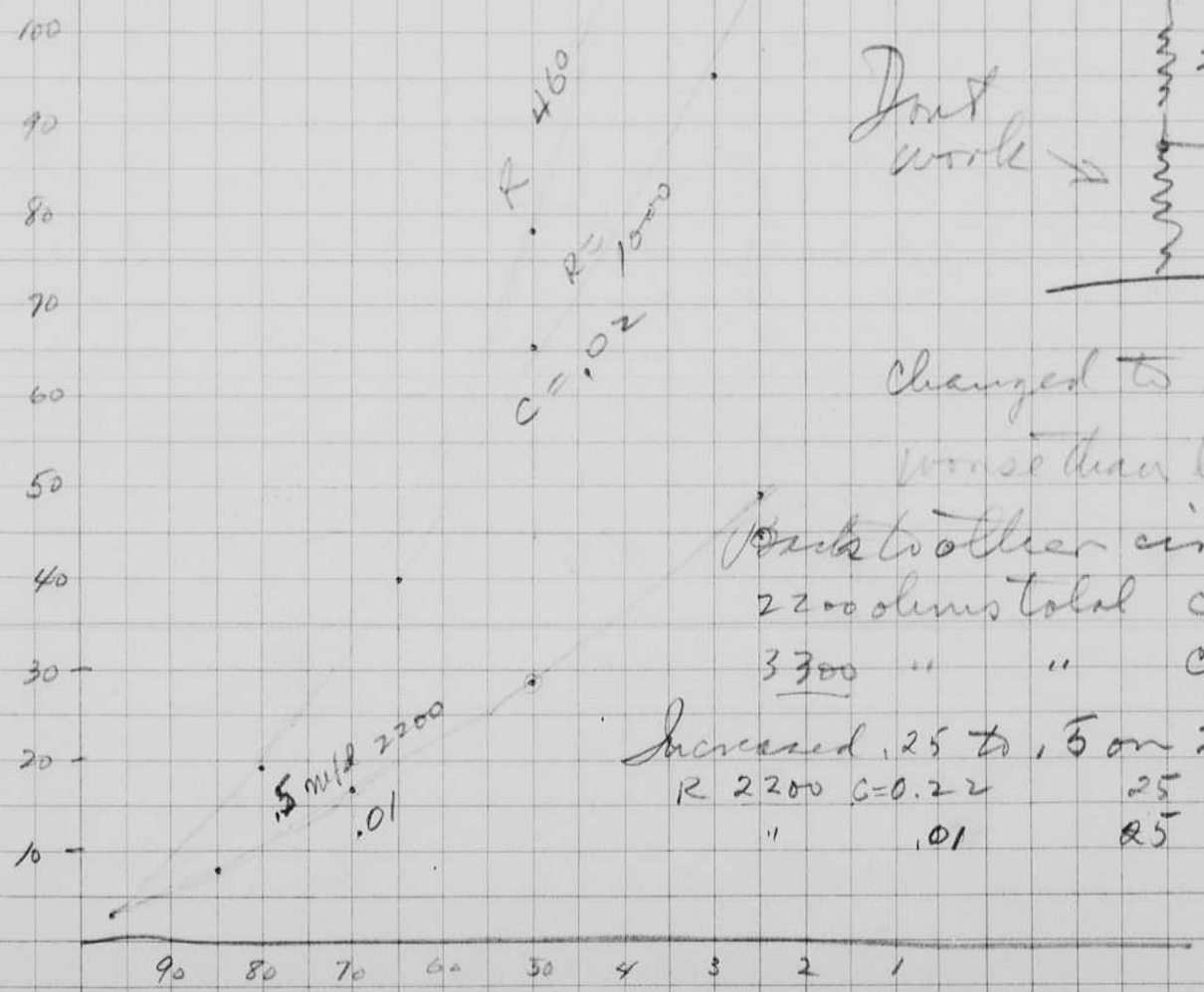
Disk
91 = 2.5
80 = 2.10
60

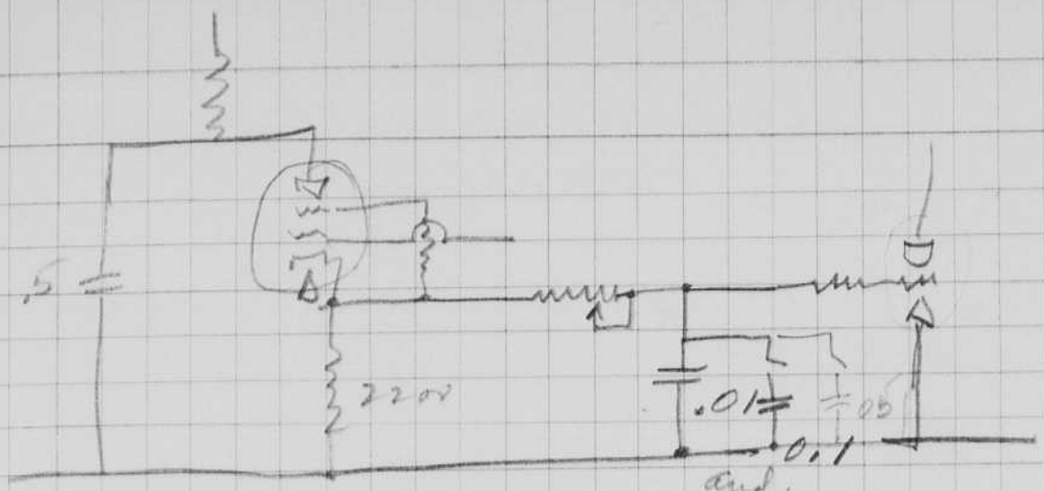


Don't work →

Changed to 1000 ohms.
worse than before,
back to other circuit.
2200 ohms total C=0.22 ok
3300 " " C. 0.22

Increased .25 to .5 on 2021
R 2200 C=0.22 25 — 1600 ms
" .01 25 44





.015 fast
.120
.135 slow

90 2.4

80

Increased to 0.15

0.16 mfd

0.11 mfd

0.01

50 μs
40
30
20
10

100 90 80 70 60 50 40 30 20 10

May 15 1960 Color Balloons
H Edgerton
Harold Edgerton
Steve Benton

Wires
22 long Rifle.

New air flash with .05 at 18 KV.
2½ ft to Subject

f 11 on B&W Panatomic X exposure ok.
10 min DK 50

Color Super Ektrachrome
f 5.6 Balloons yellow against Red.
f 8 on arc.
close up at f 5.6 also of wires

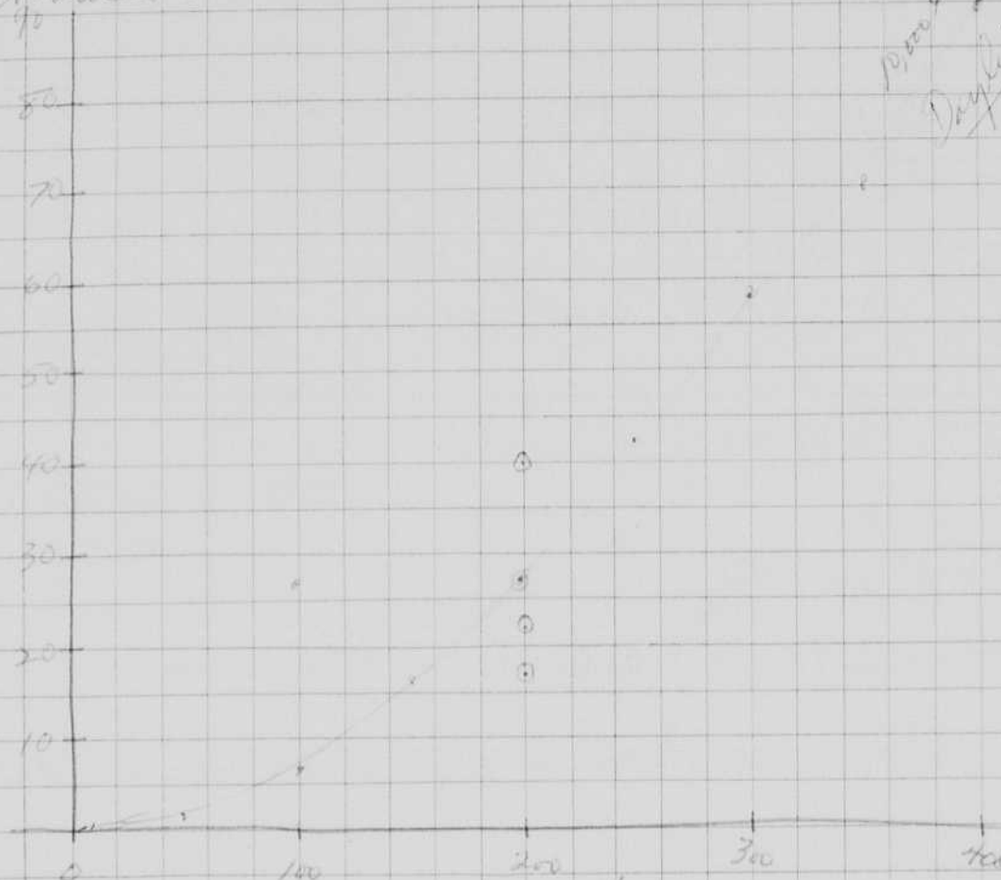
Exposure ok on Super Ektrachrome ASA 160.

May 17, 1960

A.E.E. Gyllstrom

John Treadwell.

935 characteristics



1000 lumens/sq ft. Daylight.

400 candle ft. supply 1500V

Should be higher

.01

3/100

$i = C \frac{\Delta E}{\Delta t}$.

$0.1 = .01 \times 10^{-6} \frac{\Delta E}{\Delta t}$

$\frac{\Delta E}{\Delta t} = \frac{0.1}{.01 \times 10^{-6}}$

$= 10 \times 10^6$ v/sec

1 mc 10 v/sec

Peak light $\frac{2.6 \times 10^6}{D^2} = 10{,}000$ lumens/sq ft. Daylight.

$D^2 = 2.6 \times 10^6 \times 10^{-4} = 260$.

$D = 1.6$ ft. → X (16 feet)

$\mathcal{F} = \frac{10{,}000}{144}$ lumens.

Tube
#14 (935) 2nd

V	V	I = V/R
196	2.7	27. ma.
100	.7	7 ma.
250	7.2	42.0
300	5.8	58.0
350	1.4x5 = 7.0	70. ma.
400	1.8x5 9.0	90.
450	2.1x5 10.5	105
500	2.5x5 12.5	125
60	1.2x.2 .24	2.4
150	3.2x.5 1.6	16.0

200v Tube #14 2.6v 26 ma.
Tube #3 2.2v 22
0 1.7 17
#12 4.0 40
0 1.8 18 check.
#14 2.7 27. ✓

Continue with Tube #14 by 935

300	2.5x2 = 5.0	50 ma.	
400	1.7x5	8.5	85
500	2.3x5	11.5	115
600	3 x5	15.	150
700	3.5x5	17.5	175
800	4.1x5	20.5	205
900	2.3x10	23	230
1000.	2.5x10	25.	250

Instead change to 25.5 ma/ma 127.

200	2.x1	2.v	20
300	2.2x2	4.4	44
400	3.6x2	7.2	72
500	1.8x5	9.0	90
600	2.3x5	11.5	115
700	2.6x5	13.0	130
800	2.9x5	14.5	145
900	3.3x5	16.5	165
1000	3.5x5	17.5	175

Light now at 3.7" 1/4 Daylight

400	3.1 x 2	6.2	62 ma.
600	1.7 x 5	8.5	85
700	2.1 x 5		105
800	2.2 x 5		110
600	1.8 x 5	9.0	90
500	1.5 x 5	7.5	75
700	1.8 5		90
60	1.8 x .2	.36	3.6
100	3.5 x .2	.70	7.0
150	2.6 x 5	1.30	13
200	2.2 x 1	22	22

Light now 1/10 filter x 1/4 = 1/40 Daylight

	1.1	5.5	5.5
200	~~2.6 x 5~~	~~13~~	~~26.5~~
400	2.6 x .2	5.2	5.2
600	2.7 x 2	5.4	5.4
150	3. x .2	6	6.0
1000	24		5.5

Light 18" no filter x 10 filter = 1/10 Daylight

1000	4 x 5	20	20 ma.
600	3.9 x 5	19.5	19.5
300	3.8 x 5	19.0	19.
100	1.4 x 5	7.0	7.
200	3.1 x 5	15.5	15.5

Light 12.5" with x10 filter

1000	4. x 1	4	40
600	3.8 x 1		38
400	3.3 x 1		33
300	3.1		31
200	2.0		21
100	.7		7.

Light 8.5" x10 filter

1000	4 x 2	8.0	70 ma.
600	3.8	7.6	76
400	2.7	5.4	54
300	1.9 x 2	3.8	38
200	1. x 2	2.0	20

Close 6" x10 filter

1000	2.8 x 5	13.0	130
600	1.9 x 5	9.5	95
400	1.2 x 5	6.0	60
300	.7 x 5	3.5	35

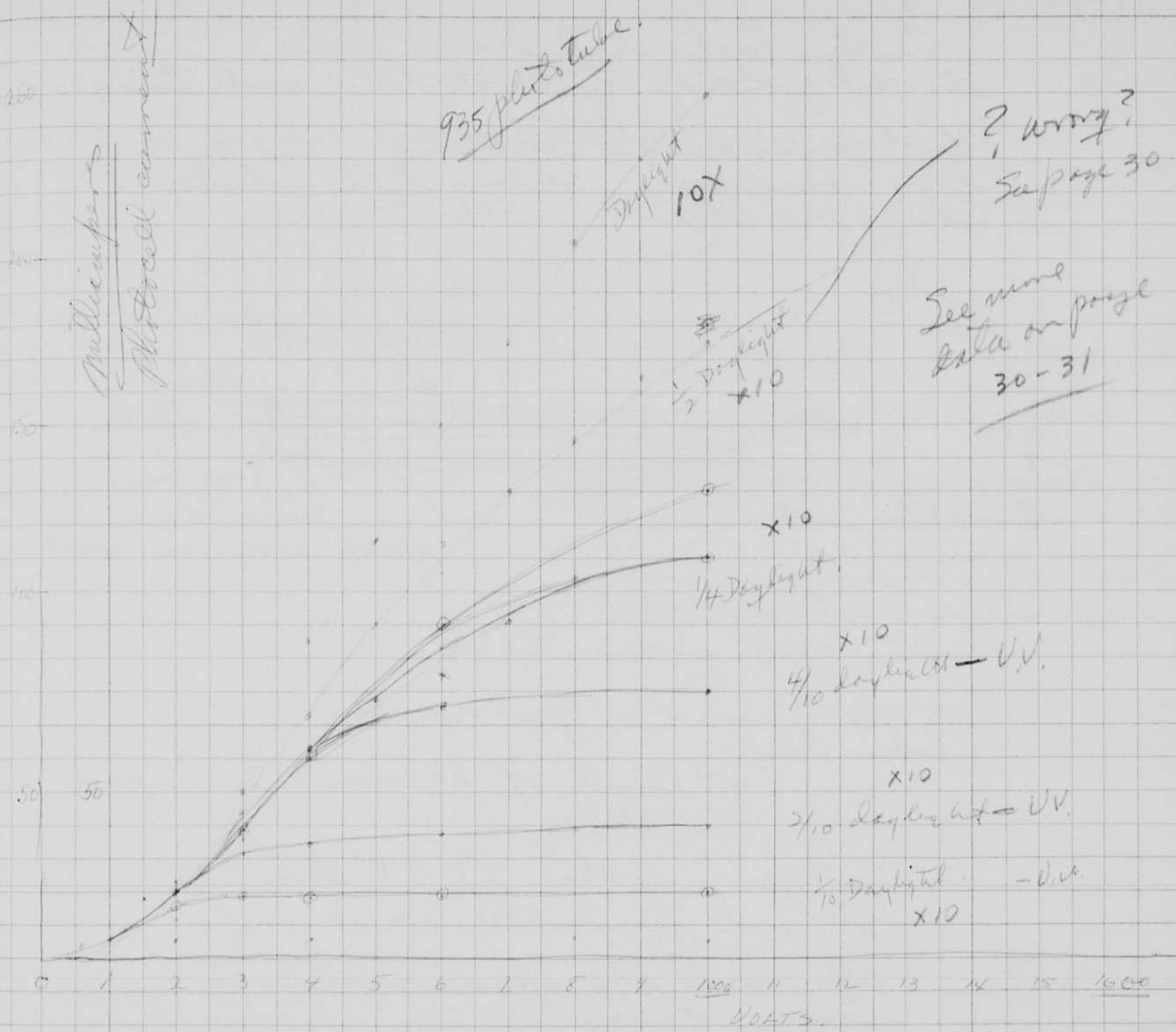
Tube seems to have lost sensitivity when filter was removed

18" no filter

600 V	2.3 x 5	11.5	115

without filter curve seems higher!

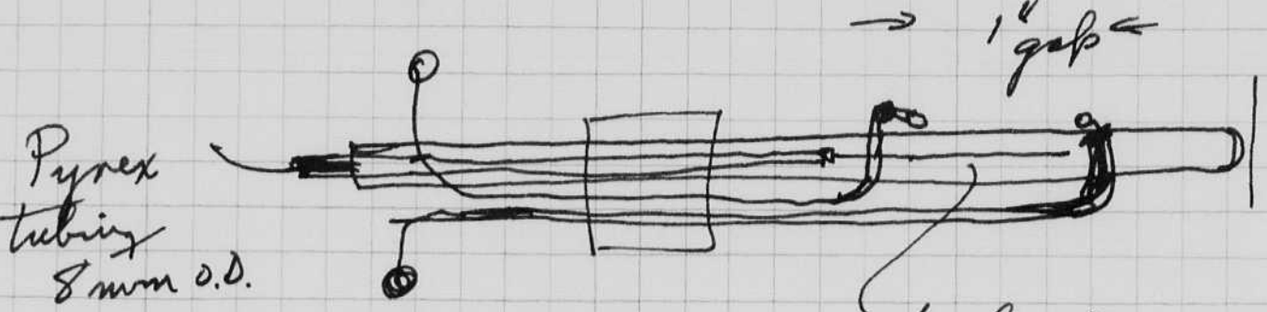
Due to U.V. Ultra Violet light?


935 photo Tube.
Daylight
10X
? wrong ?
See page 30
See more data on page 30-31
½ Daylight
×10
×10
¼ Daylight.
×10
4/10 daylight — U.V.
×10
2/10 daylight — U.V.
1/10 Daylight. — U.V.
×10
Millimicrons
Microseconds
50
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
HOURS.

14 Sat. May 21 1960
Harold Edgerton. 1/3 µs Air flash.

Further tests and design of the air gap outside cladrode tube made today.

Photos made last weekend of the bullet were wonderful. 22 long rifle photos show no blur.

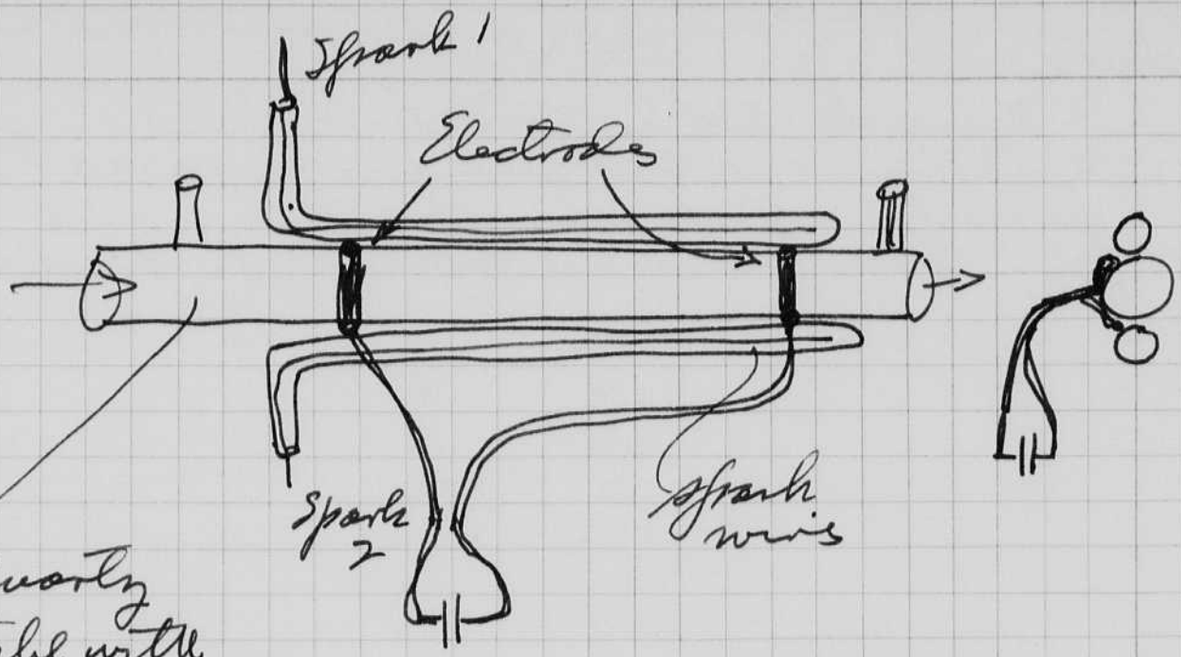


.05 mfd at 15 KV.
gives good output.

a glass cover is put over the assembly.
4" length of 22 mm O.D. Pyrex test tube.

3/16" sponge rubber 2 1/2 x 1" taped to the end keeps the noise in!
Other wise the spark makes a large noise.

Explained to and understood by me on the 15th day of June, 1960.
Lt Cadwallader



Quartz tube with subject to be radiated.

The spark triggers could be fired in sequence. Then the alternate arcs would be on opposite sides of the quartz tube.

Explained to and understood by me on the 13th day of June, 1960

R L Caldwell Jr

16 May 24, 1960.

Harold Edgerton.

This is the last day of the term. I had a 6:20 class in electronic control and measurement with help from Dick Schwartz in class and John Bredwell in the laboratory. 20 students.

May 25 1960
Howard G Edgerton Geo L. Mayo Left Eye. Dx LIPOPROTEINOSIS
Dr. Searle Radio

Photo No. Positive fine grain film 5302-3/4-46 M P417

	Test. Aperture R	
1		
2.	8	80
3	8	80
4	8	60
5	8	60
6	15	100
7	15	100
8	15	100
9		100
10		90
		80
		70
		60
		50
		50
		100

all blur!

Staphyloma Left Blastomycosis Cornea

May 26 46 Mr. Seller.

8	100	control
8	100	
8	80	
8	90	
8	70	
Sinuft		
8	70	after Sinuft.
8	80	
8	90	
8	100	
15	100	
15	100	Blank Stare
15	100	

Underexposed

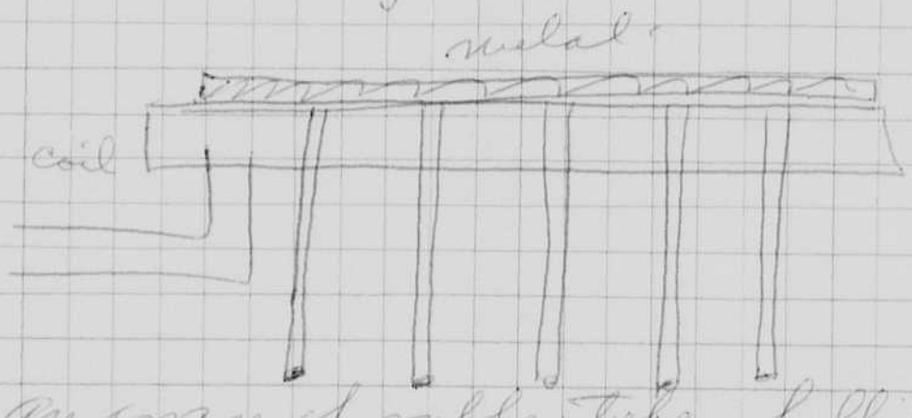
May 26 1960

Trip to Edgerton

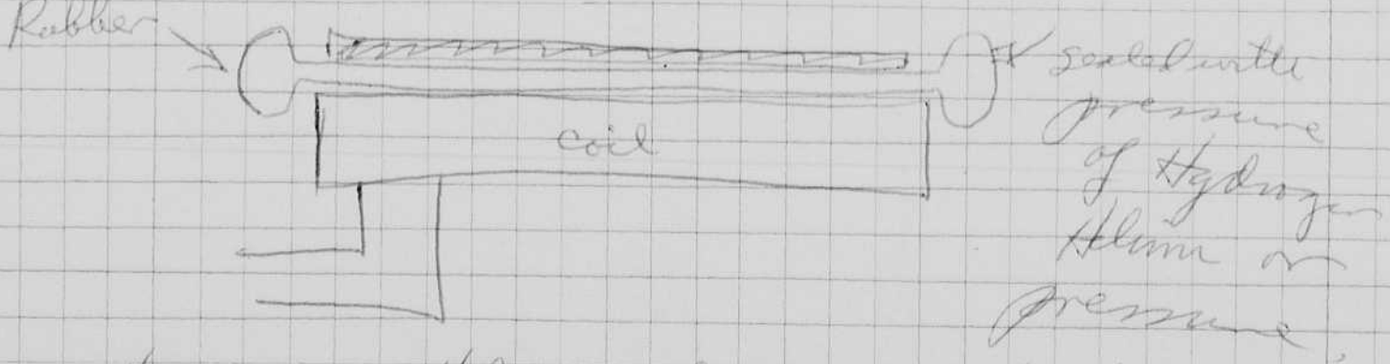
Sam Raymond & Dany Heywood returned yesterday with the deep thumper (500 W.S.). They found that it did not work with depth when they tried it off the Bear in deep water.

Apparently the thumper must have cavitation on the rear surface to work! When the transducer is put ~~down~~ deep this cavitation starts at a ~~lower~~ higher pressure. So we must think of some scheme to get the plate to move.

It seems that air back of the plate will do the job. One scheme.

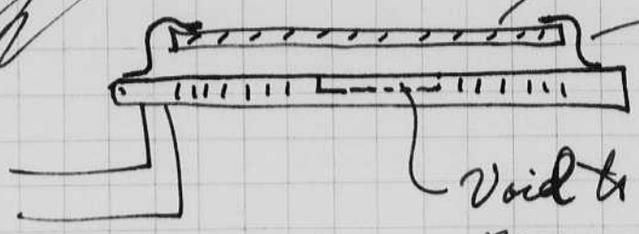


An array of rubber tubes full of air the ends away from the plate will be sealed to keep the air in air.



Hydrogen or Helium will expand faster than air.

Mon 26 Cont



Void to hold air to handle pressure and expansion.

Pressure of 1500 fathoms.

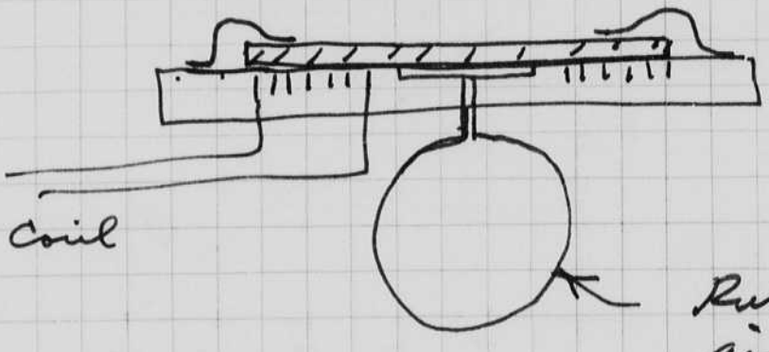
6

32 | 36,000 feet. 9000 feet ~~15~~ +350 000

1,130 atmos. ~~30~~ ft. ~~60~~ ft. 300 atmospheres. ~~60~~ ft = 1 atmos.

32 32

1,130 x 15 = 17,000 p.s.i.



Donut shaped rubber cemented to metal ring and to coil.

Rubber reservoir for air needed to submerge.

Volume reduction for the reservoir.

$\frac{300 \text{ atmos}}{1} = \frac{300}{}$. at 9000 feet deep.

Another solution to the problem would be to introduced a volitle liquid with absorbed gases or particles to facilitate evaporation: This liquid would be sealed in a rubber cover as per above.

Explained & understood by me on or about Monday 26, 1960.

Signed on June 13, 1960

Ken Coldwell Cooley

20 May 26 1960

Microscope Illuminator

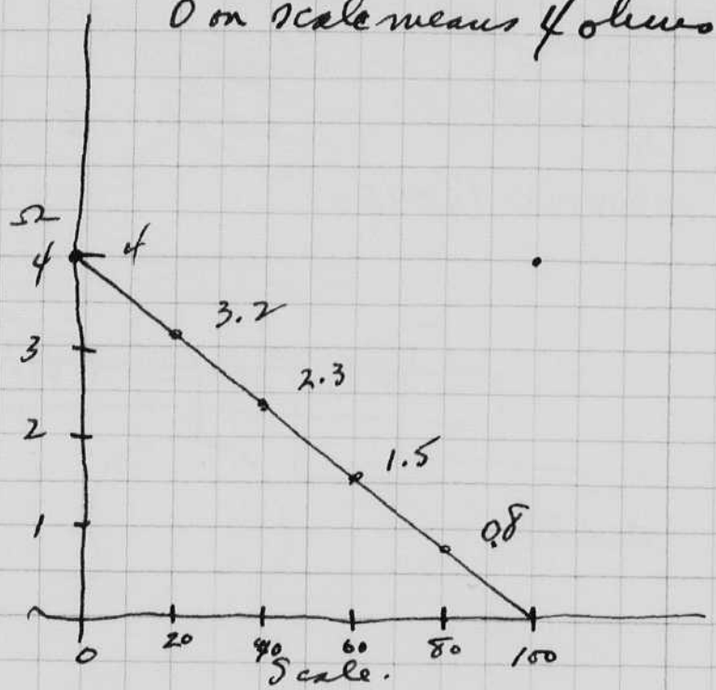
100 ws at 900 ∫ into 1½" from I.D. tube.

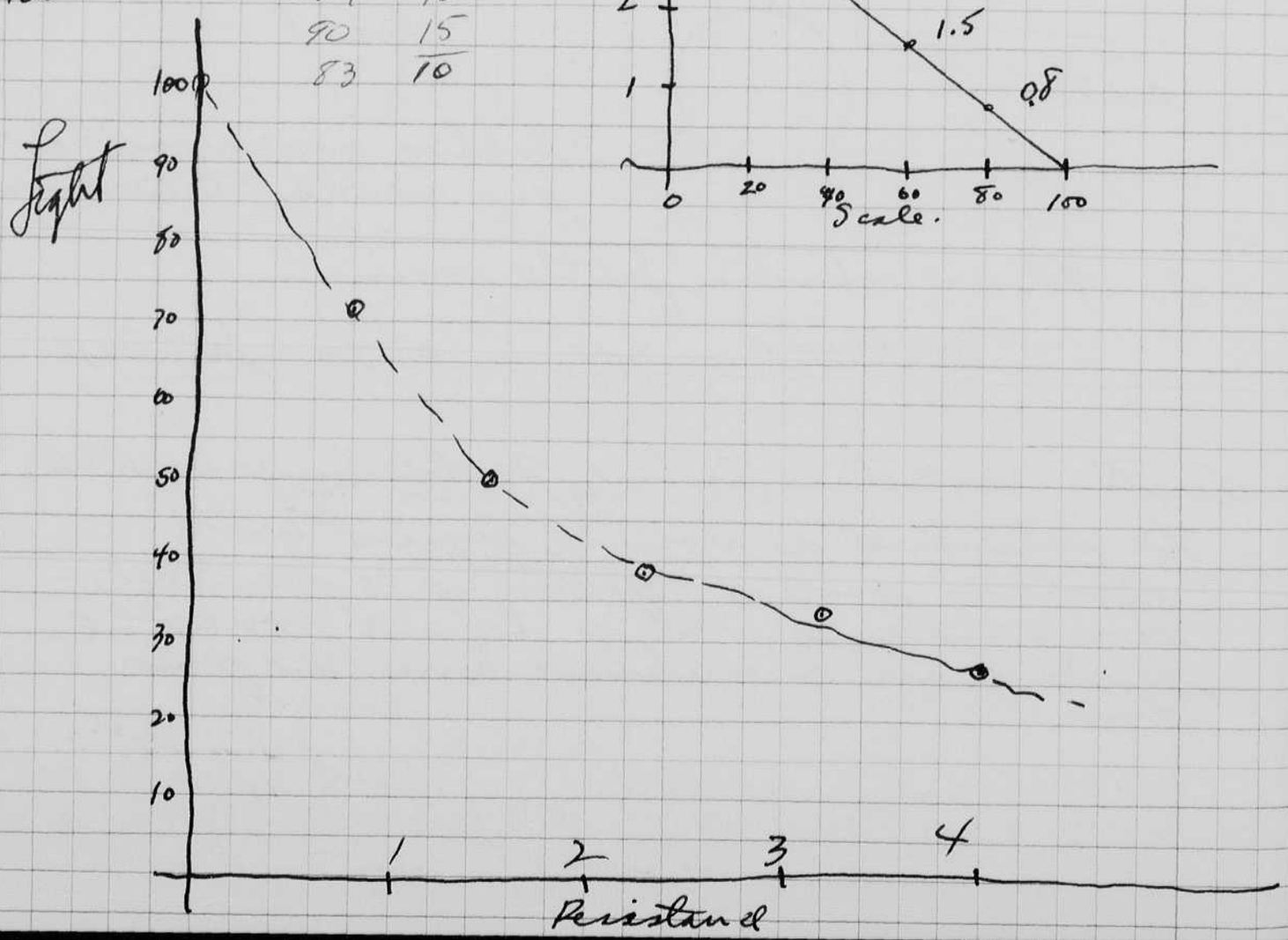
90				
27	24 90	0 -	20	after 10 sec charge.
34	30	20	25	
39	35	40	29	
50	44 ~~30~~	60	57	
71	64	80	53	
100	89	100	74	10
		100	89	15 sec.
		100	89	"
		100	92	30 sec
		100	92	45 sec
		100	92	30
		100	83	10
			86	15
			84	15
			86	15
			87	15
			87	10
			90	15
			83	10

Lens clean

2 ft to meter X1

0 on scale means 4 ohms.





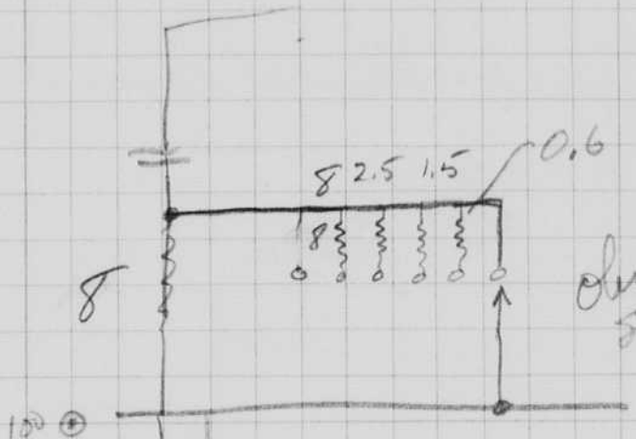
May 28 1960
H.E.Edg

Light Switch for intensity changes.
1½" Xenon gap on 900 volts with two 525 mfd capacitos in series.

1.5 ohms for 50% light.
4 ohms for 25% light.

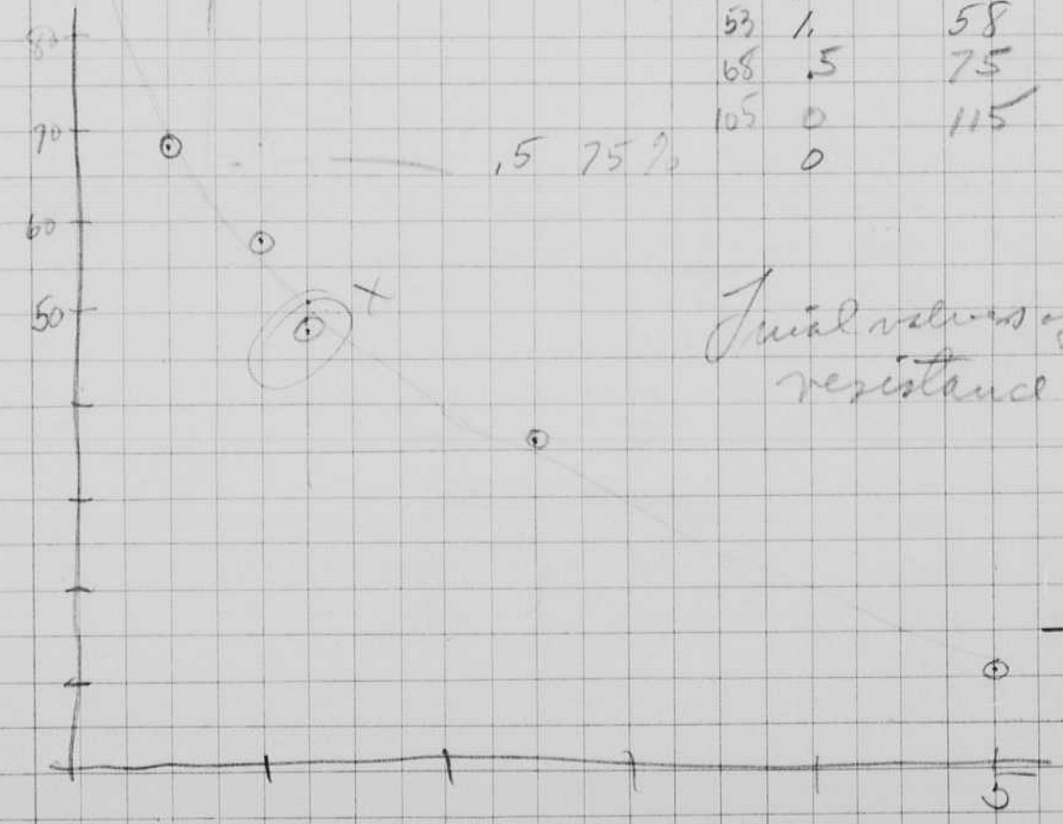
1	0	100 %
2	.6 ohms	75 %
3	1.5 "	50
4	2.5 "	38 %
5	4 "	25
6	∞	

ohmite switch
Model 111 Power tab



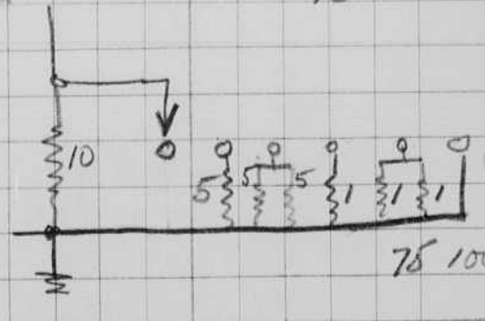
ohmite Brown Devil
0.6 ohm 20 watt

	R	M		
(100%)	0	110	2+2+2+.	100
33	2.5	36		
11	5	12	0	110
X 48	1.25	53. X	2.5	32
53	1	58	1.25	51 ✓
68	.5	75		
105	0	115 ✓		
		0		



Initial values of resistance

.5
1.0
2.5
5.0
10



Light R microscope illum

100
67
34
33
27
11

} final values on Switch

Tests of Thumper Supply #3 on 220 line.

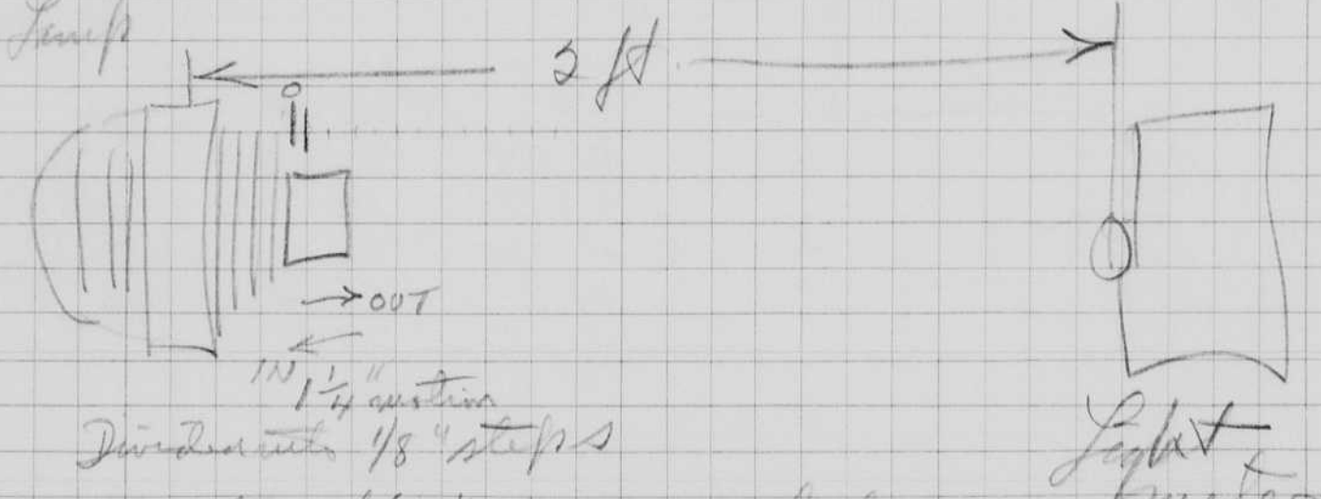
890 W 160 mfd 3300 1/per sec

520 80 mfd 3600 1/per sec.

FT-17 flash lamp vertical without blower.

520 watt sec

Started about 1/pm.



Diaphragm with 1/8" steps

Illum O Tungsten at 6/8 + 1/16 from all in. best focus

BCPS.

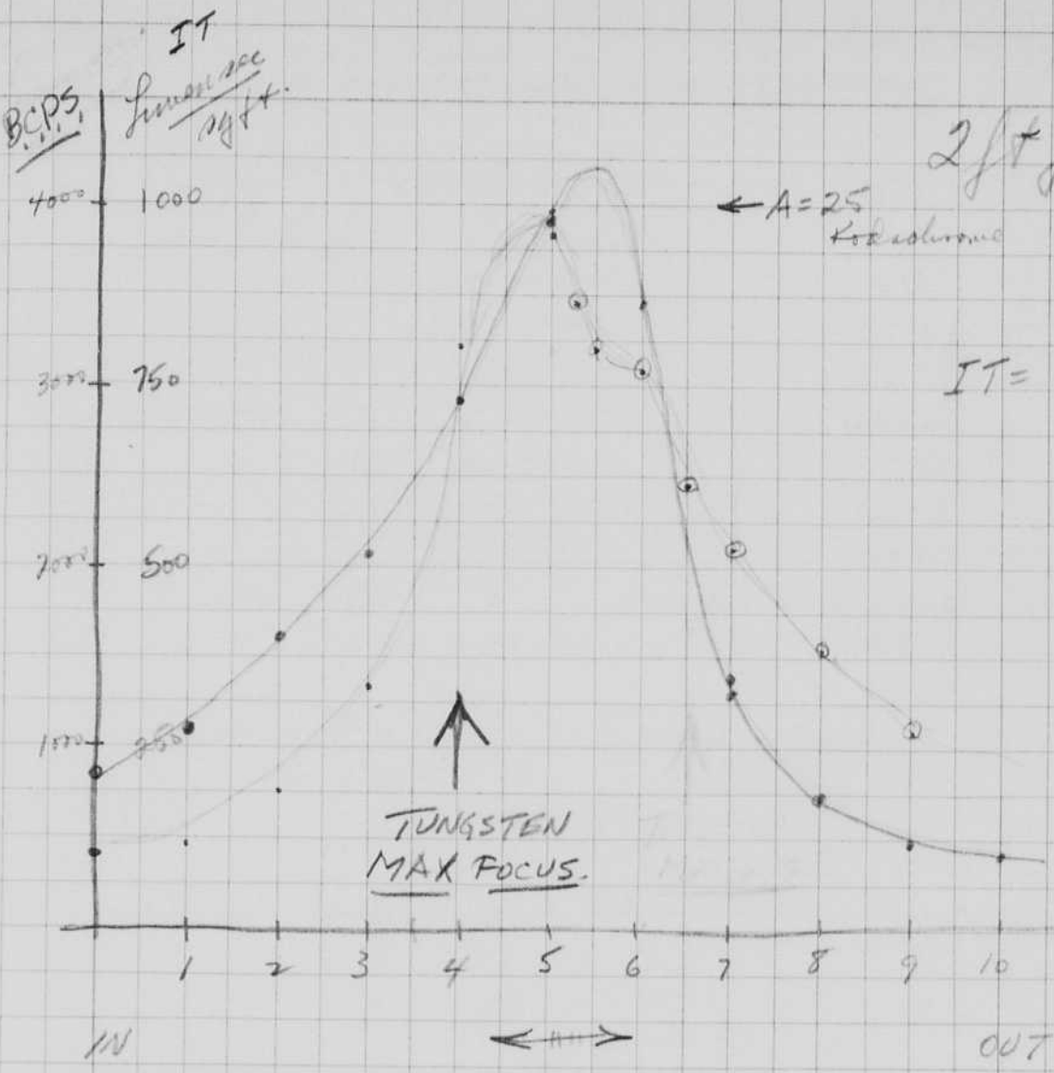
0	55 x 4 x (2 ft)²	880	
1	72 x 4 x 2²	1150	
2	100 16	1660	
3	132 16	2120	
4	185 16	2960	
5	200+ 4x2²	3200+	
~~5~~	122 8x2²	3900	
~~6~~	107 8x2²	3400	
~~7~~	40 8x2²	1280	
~~7~~	86 4x2²	1370	
8			

8	46 x 4 x 2²	737	
9	31 x 4 x 2²	495	
10	25 "	400	

~~Illum O~~

0 34 x 4 x 2² 4/pm + 3 1/2 min

545.



2 ft from lamp.

← A = 25 Reduction

$IT = \frac{BCPS}{D^2} = \frac{A^2 C}{S}$

$D^2 A^2 = \frac{BCPS \cdot S}{C}$.

$A^2 = IT \frac{S}{C}$

$A = \sqrt{IT \frac{S}{C}}$

IT = 1000
S = 10
C = 15

A = 25.8

11 plates

$A = \frac{25.8}{4} = 6.5$

actual.

Position of 2 ft. BCPS.

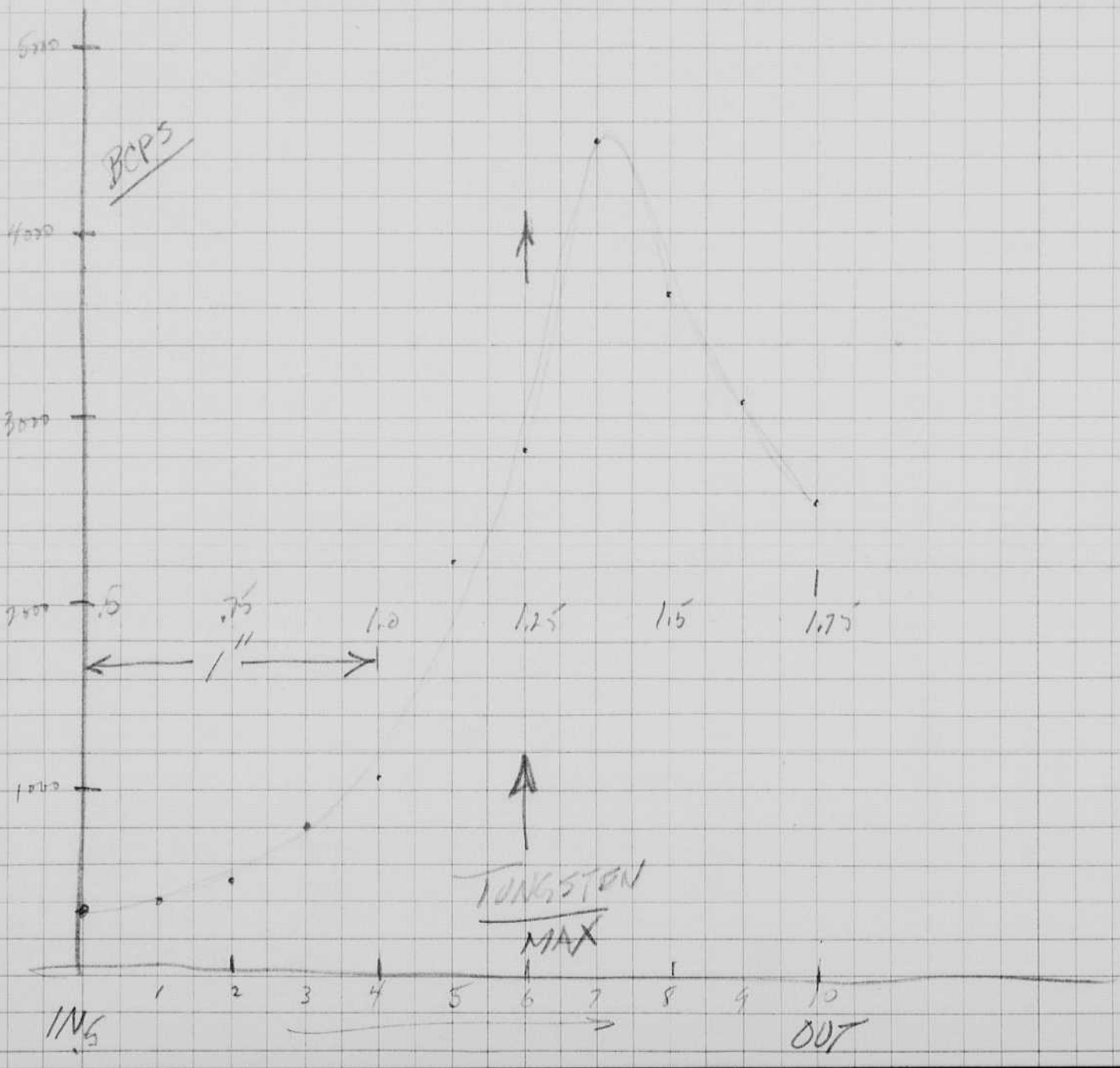
0	22 × 4 × 2²		
0	25 "		
0	25 "		
5	122 × 8 × 2²		3900
6	93 "		3000
5	120 "		3840
5.5	100 "		3200
5.25	107 "		3420
5.0	118 "		3780
6.5	75 "		2400
7.0	67 "		2140
8	45 "		1540
8	94	4 × 2²	1500
9	72 "		1150

0	23 × 4 × 2²	=	370
1	28 "		450
2	47 "		750
3	86 "		1380
4	200 "		3200
4	102	8 × 2²	3260
5	124	8 × 2²	3960
6	94	8 2²	3000
5.5	109	8 2²	3500

Lamp 1 foot from center of lamp.

Tungsten #6

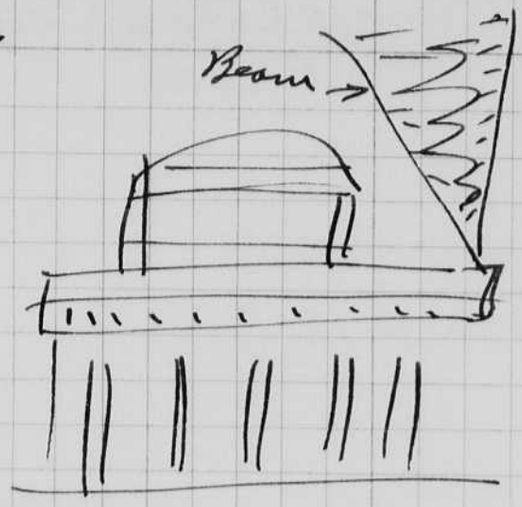
0	22 X 16 X 12		3500
1	25 X 16		400.
2	32		510
3	50		800
4	72		1150
5	137		2200
6	200+		~~8~~
6	120	32	3840
7	140	"	4500
8	115	"	3680
9	98	"	3130
10	80	"	2550



May 30, 1960
H. Edgerton.

MIT photos with beam from 500 w3 strobes on roof.

Super Ektrachrome. ASA 160.



Subject.	Exposure chapel.	
chapel	f2	1 sec.
"	"	10 sec.
"	"	30 sec.
Dome	f2.	1
	f2	~~to~~ 3
	f4	1
Faraday	f2	1
	f2	10
Dome	~~f3.5~~	2
Faraday f16 →	~~f3.5~~	10
	~~f3.5~~	32
Dome	f3.5	1
	"	10
	"	30

no flashes in field.
" " " "

35 mm lens.

" "

<Trial exposures>

26 may 30 1960 Photoflash Characteristics

calibration of Scope
D 6 feet!

10 mfd 1800 volts
Peak light = 2.7×10^6 c.p.
Deflection at 6 feet = 1.2 cm x 5
= 6.0 volts
Load resistance = ?

Distance for direct calc

$6 / \sqrt{\left(\frac{2.7}{1.2}\right)} = 9$ feet.

Experiment shows 10 feet about right for reading in volts = mega c.p.

B.R. Stroboluxe

Low 0.2×10^6 c.p. peak 15 ms duration

Mega 1.9×10^6 c.p. peak. 40 ms duration.

10,000 lumen/sq ft.

1 c.p. produces 4π lumens

$= \frac{4\pi \text{ c.p.}}{4\pi D^2} = I = \frac{\text{lumens}}{\text{sq unit}} = \frac{1.9 \times 10^6}{100}$

$= 1.9 \times 10^4$ lumens / sq ft.

High about Double daylight at 10 feet, 1,9000.

14.14 feet for

$1.9^{x10} \times \left(\frac{D^2}{10^2}\right) = 10,000$

$D^2 = \frac{10^4 \times 10^2}{1.9 \times 10^4}$

$\left(\frac{1.9}{1}\right) = \left(\frac{D}{10}\right)^2$

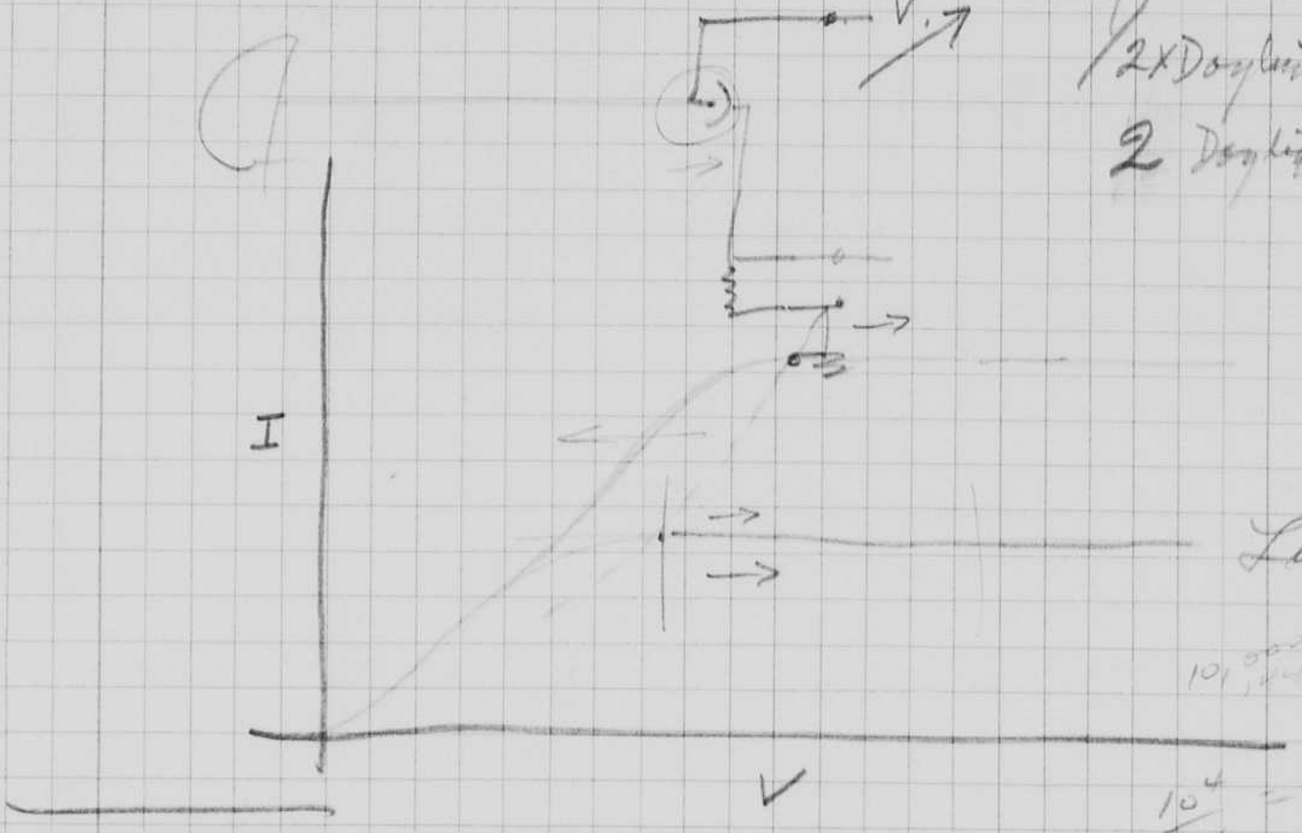
$D = \sqrt{1.9 \times 10} = 1.38 \times 10 = \underline{13.80 \text{ feet}}$

Low $\frac{0.2\times10^6}{D^2} = 10^4$ $D = \sqrt{D^2} = \sqrt{\frac{.2\times10^6}{10^4}} = \sqrt{20} = 4.5$ ft.

.21 → 4.58 ft.

½ × Daylight = 6.5 ft.

2 Daylight = 3.25 ft



$\frac{10^4}{144} = 69.5$ lumens.

$\frac{4000}{69.5} = 57.5$ ma/lumen

Low light $.21\times10^6$ cp. peak

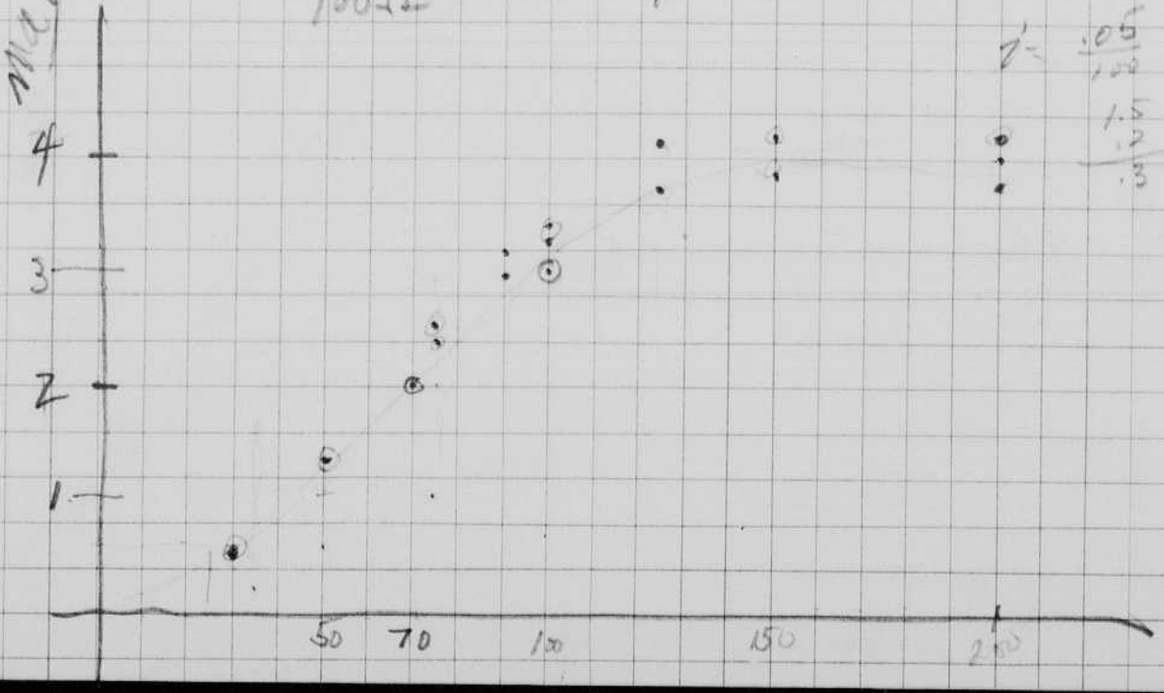
D = 4.58 feet $\frac{.21\times10^6}{4.58^2} = 10^4$ lumens/sq ft / daylight

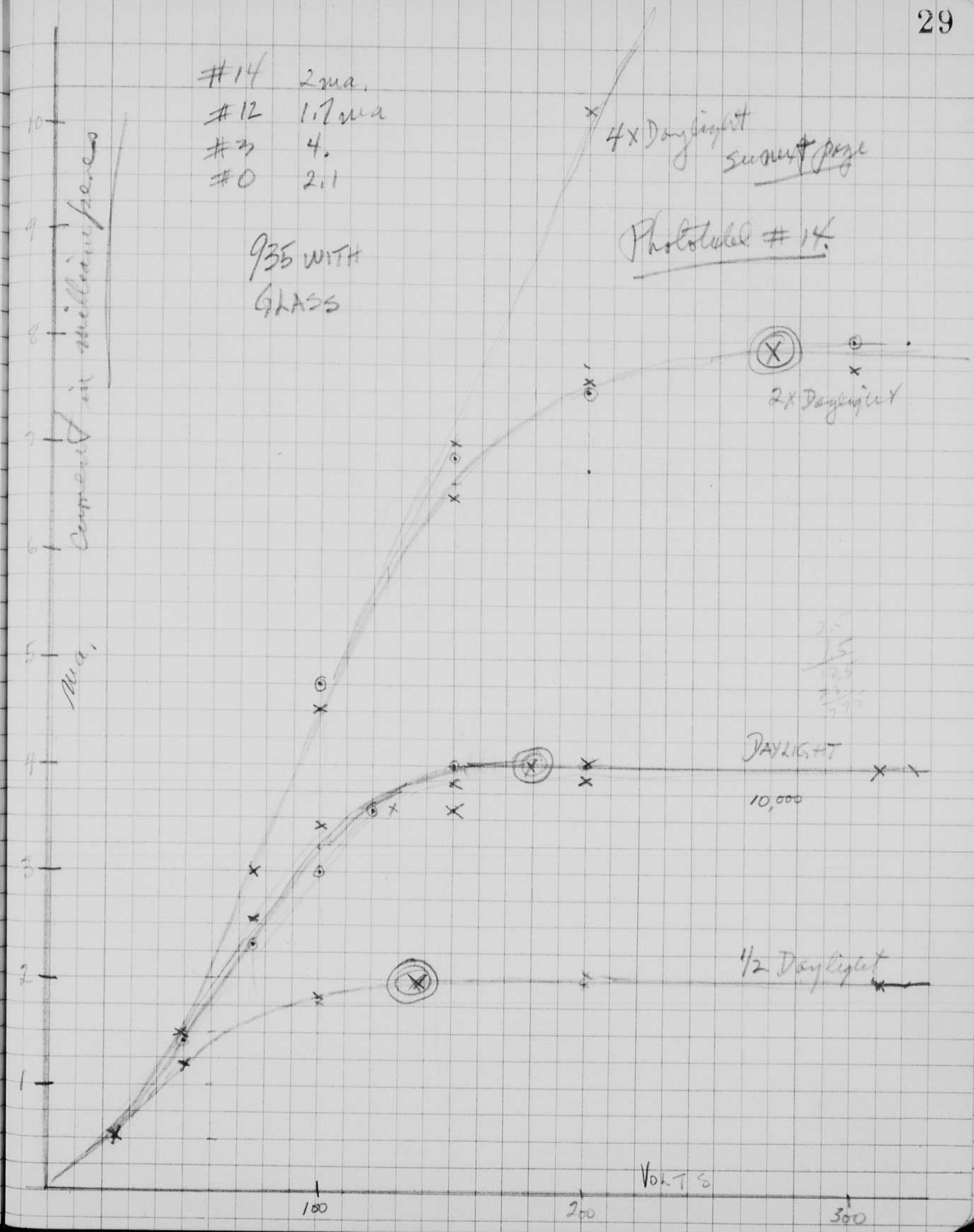
$i = \frac{.4 \text{ volts}}{100\Omega} = .004$ amp = 4 ma = 4000 ma.

$i = \frac{.05}{100} = .0005$

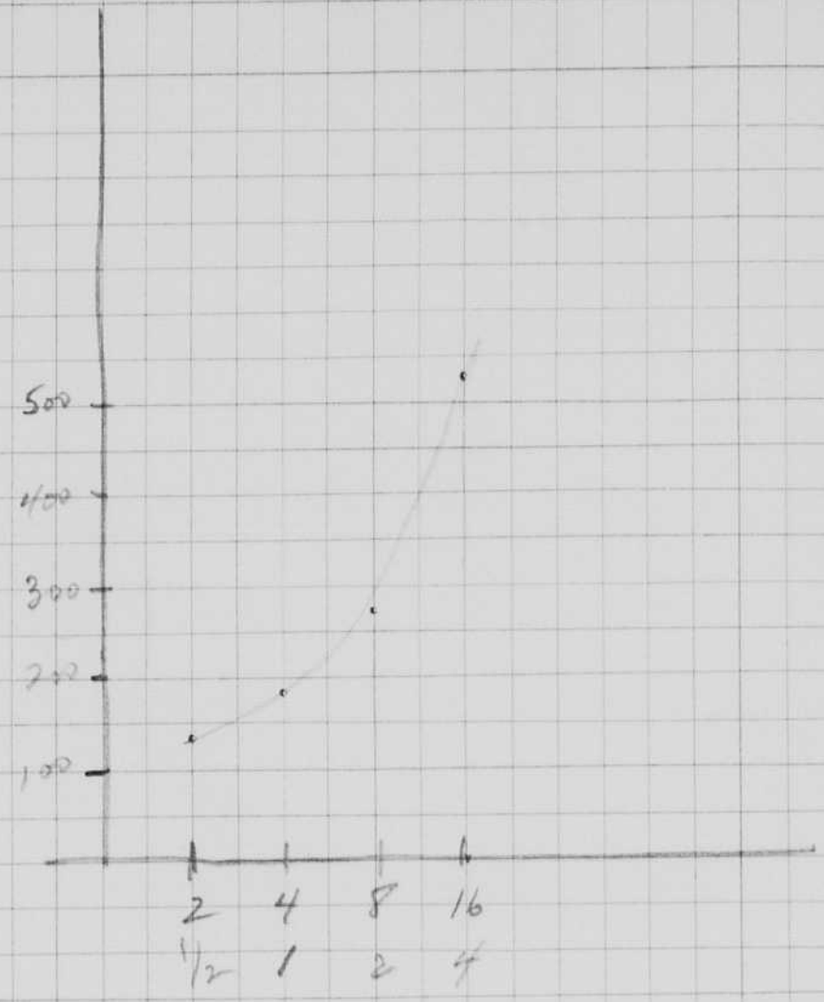
1.5
.2
.3

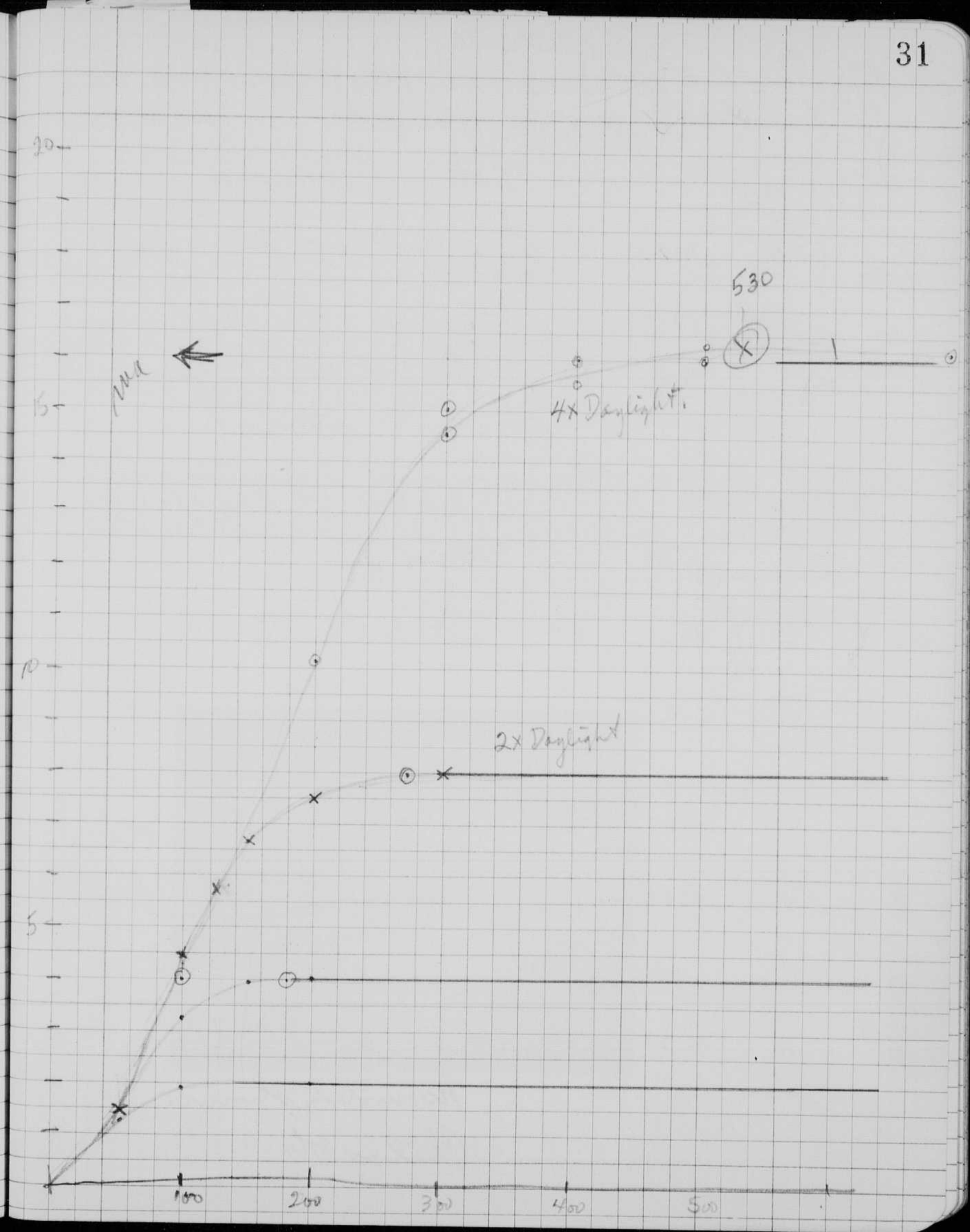
57.5 ma/lumen




#14 2 ma.
#12 1.7 ma
#7 4.
#0 2.1
935 WITH GLASS
4X Daylight
Phototube #14.
2X Daylight
DAYLIGHT
10,000
1/2 Daylight
Current in milliamperes
ma.
VOLTS
100
200
300

m_a	E_s
2.	140
4	180
8	270
16	530




20
15
10
5
530
1
4x Daylight
2x Daylight
100
200
300
400
500

32 June 1 1960
H. Edgerton
John Fredwell
Chas. Tuggs
Polaroid f

Bullet photography
Watertown arsenal Bldg 41 Range
50 caliber 5000 ft/sec bullet.
.400" diam Bullet.

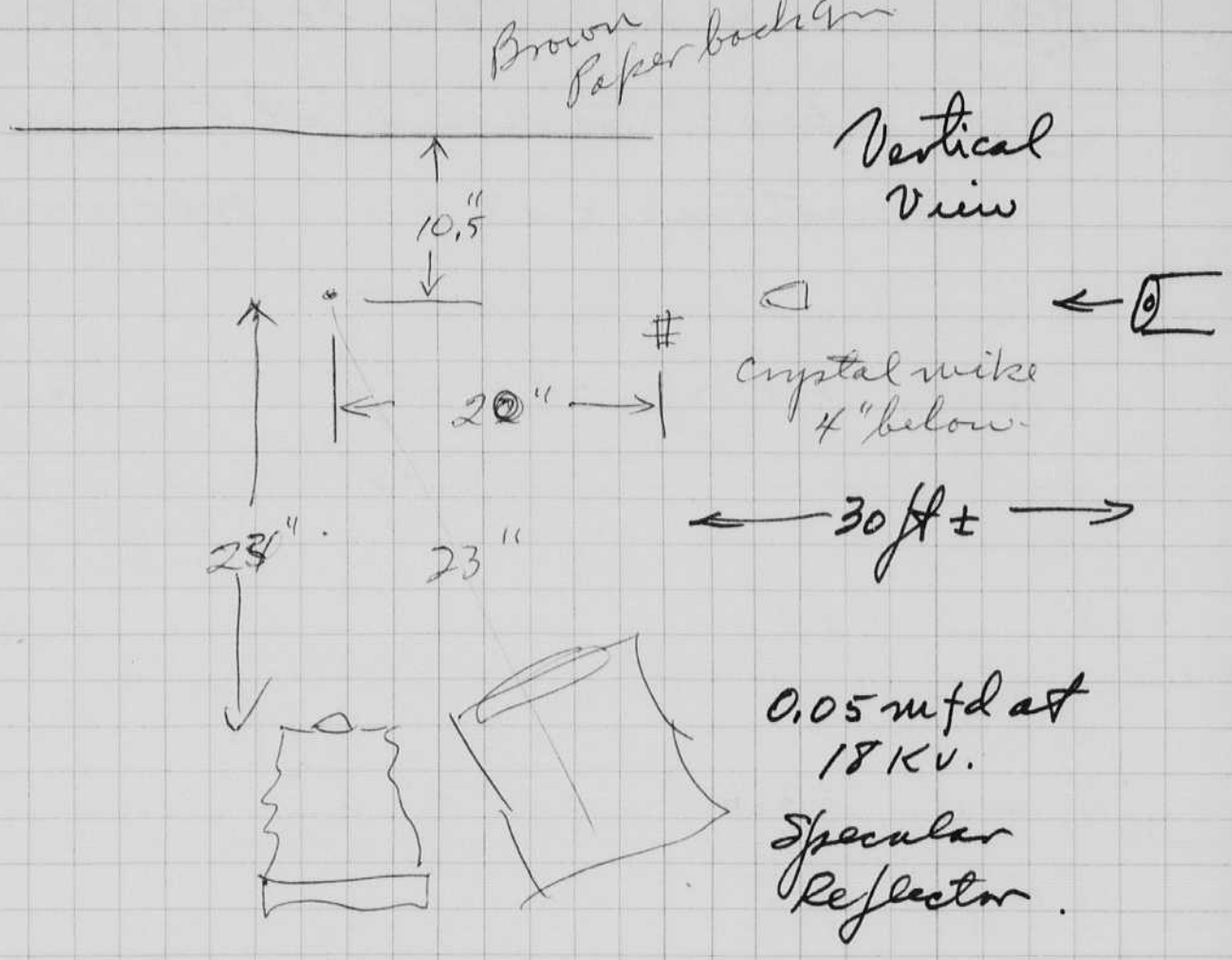
Burton Parker
John J. Hannon
WA 8540 (710)

Brown wrapping paper background

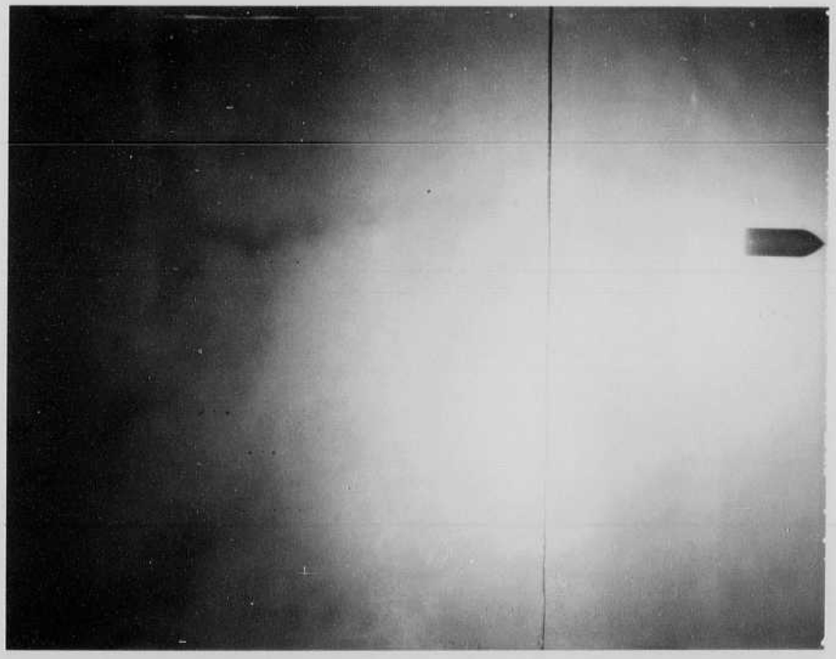
Dens.

#1	f8	3820	66	Bullet tumbling — Double flash and low.
#2	f8	4925	60	String picked. Late Double flash
#3	f8	4940	50	Mike moved 6" towards gun Late. due to mike setting.
#4	f8	4930	50	More mike 6" ~~more towards gun~~ up 1½" into line of gun. Tail turning on film.
#5	f8	4960	60	~~Double flash~~
#6	✓ 8	4925	67	Late bullet on photo. (first)
#7	11	4930	67	more mike towards gun 3"
	Panatomic X film			
8.	11	4990	67	Same setting but more camera down from
9	11	4985	67	Same. Broke string! first time. Photo ok.
10	11	4980	67	" camera moved towards gun 3"
11	11	4890		

No motion shown.
Photos ok.


Brown paper backing
Vertical View
10.5"
#
20"
crystal mike
4" below
30 ft ±
23"
23"
0.05 mfd at
18 KV.
Specular
Reflector.

9



32 June 1 1960
H. Edgerton
John Tredwell
Chas. Tuggas
Polaroid f

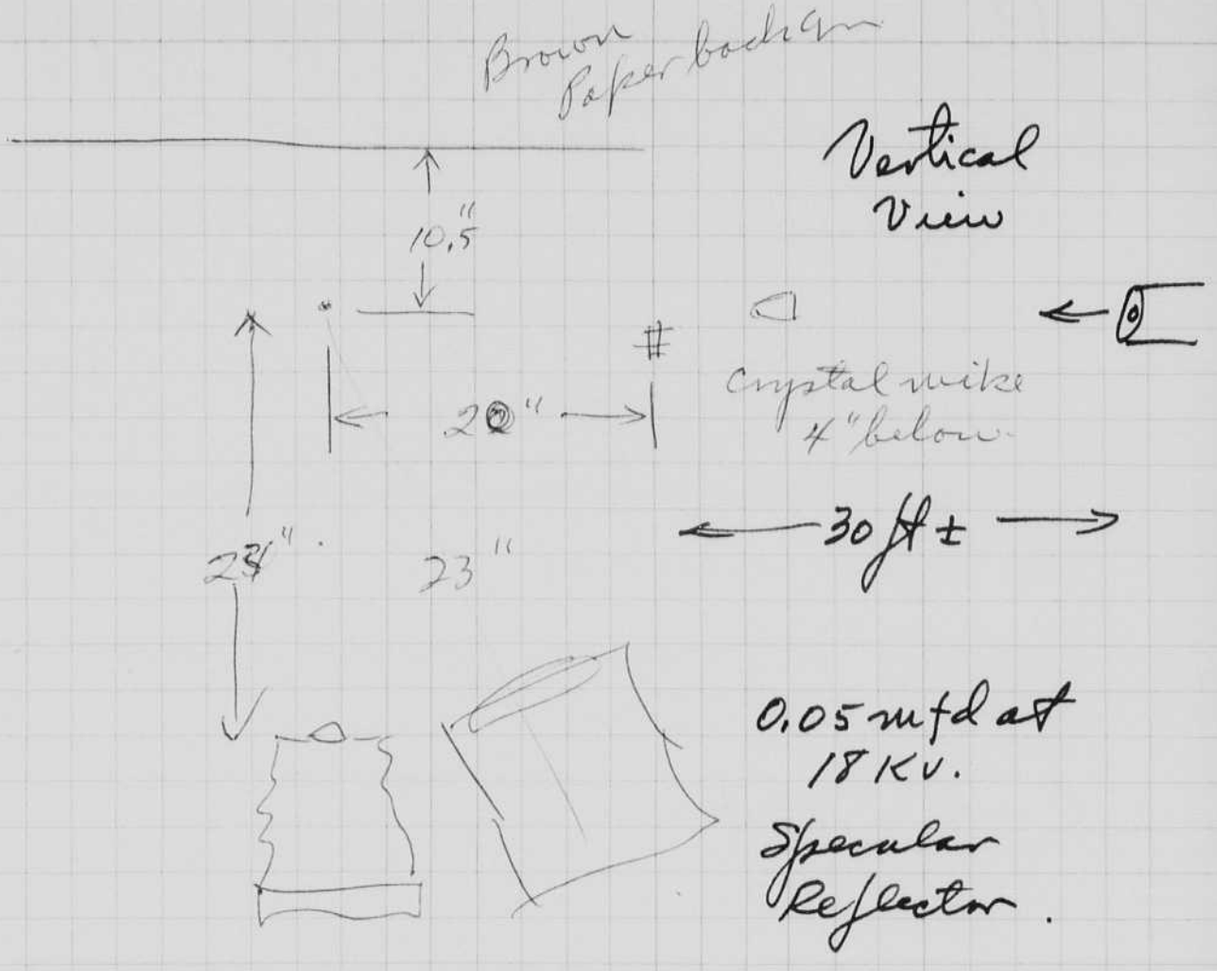
Bullet photography
Watertown arsenal Bldg 41 Range
50 caliber 5000 ft/sec bullet.
.400" diam pellet.

Burton Parker
John J. Hannon
WAA 8540 (710)
Open (stopping paper background)

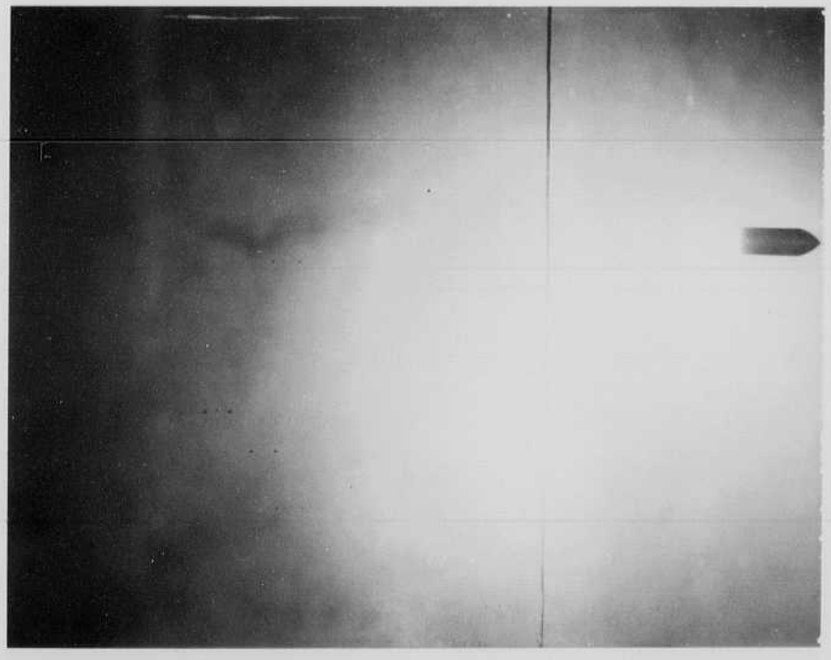
Dens.

#1	f8	3820	66	Bullet tumbling — Double Jack? and low.
#2	f8	4925	60	String pulled. Late Double flash
#3	f8	4940	50	Mike moved 6" towards gun Late. due to mike setting.
#4	f8	4930	50	More mike 6" ~~towards~~ gun up 1½" into line of gun. Tail in window film.
#5	f8	4960	60	~~Late bad~~
#6 ✓	8	4925	67	Late but complete (just)
#7	11	4930	67	more mike towards gun 3"
	Panatomic X film			
8.	11	4990	67	Some setting but more can and down stream
9	11	4985	67	Same. Probe string! first time. Photo ok.
10	11	4980	67	" camera moved towards gun 3"
11	11	4890.		

No motion shown.
Photos ok.


Brown paper backdrop
Vertical View
10.5"
20"
#
Crystal mike 4" below
30 ft ±
23"
23"
0.05 mfd at 18 KV.
Specular Reflector.

9



June 4 1960 Color Examples.

#3 Cards & bullets 22 long Rifle.

Color. Super Ektrachrome at f 5.6 and f 11

Panatomic x at f 11 exposure time.

Heavy Trouble + Pocketpiece

7 Heads f 11 Super-EK. 15 ft. 2 flashes!

8 yellow angle bulb off from Body.

9

10 f 8.

Jade f 8 1 ft back

Green f 5.6

King f 8

Orange f 5.6 Background White 1 ft back.
Lbs of juice!

Balloon f 5.6 closer view of exit of range. 7 or 8" Balloon
White 1 ft back.

Light Blue f 5.6 Dark Blue 10" Back.

June 7 1960

Balloon f 5.6 3 ft and 2 ft, Lamps

Just Budd.

Dark

Tip

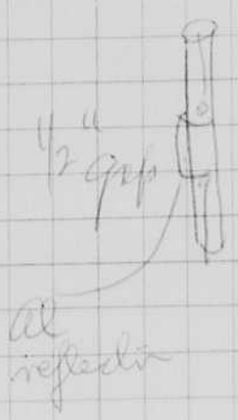
Blue 1/8 Ban

1/8 1/4 1/2

cc 50 Y Victor.

June 9 1960

256 mfd 900 volt. wire to Microscope.



26.5	6.65	60	10
40.0	10.	40	30
35	8.9	45	
50	12.5	32	50
		32	
70	17.5	23	70
		23	
133.	33.3	12	90
		90	Small capacitor
16.1	4.0	100	25 mfd
		90	900 V. 25 mfd

JR meter

25 at 1 ft (10/12)

Go loaned to Howard Babbitt.

Pittsfield man Tel 7-7601

Hillcrest 2-9577 24 hour

" "

70 Holmes Road.

Filter for Air Flash

June 14, 1960

Dexter It appears that CC 50Y is about right for the air flash 0.05 mfd at 15KV with air.

f4 at 2 ft distance gives correct exposure on super ektrachrome film.

Chace Wm. G. Ed Callington and Saawi(?) were here from Bedford to discuss flash photography.

June. 17. 1960

June 15. Visit to arco. Joe Hull.
Dear Theophanis.

June 16. Visit to air force Res. center Bedford.

Wm Chase
Ed Callington. etc to visit
Exploring mine facilities.

John Tedwell went with me on both trips.

Went to B.V. at 10 30 to take flash photos of Hamster and frog blood in allen.

Alpha Camera 1/50 sec.

5305 film Exposure ok but photos NG. too much contrast.

Fred Maynard
607-1200 456
Geo Fulton.

Pan X - Underexposed

Tri X Brain Pos. Underexposed. no. Frog. but ok. High Contrast.

Plus X Frog. 10 eyepiece 50 obj ok 100 ws.

Plus X Hamster 10 50

See bumper.

I left when these photos were being made.

June 18 1960 Pressure test.

Howard Hyatt.

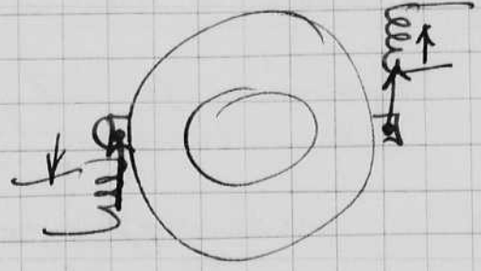
With Breslau and Hayward I assembled the 16 inch shell for pressure testing of the underwater cameras etc. This equipment showed enable us to test to 20,000 p.s.i.

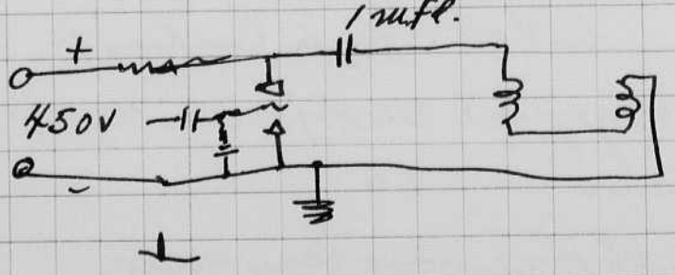
June 20 1960 Equipment leaks due to holes cracks in the welds on the nose plug. after several rewelding attempts we hoke to try again tomorrow.

Hayward and Morey went to W.H.O.I this noon with the 1000 foot deep thumper. It has a reservoir of air in an auto tire. Also two other thumpers are being delivered to W.H.O.I., another thumper is being delivered to Lamont Lab.

Fast Shutter there is a need for a shutter that opens fast, for example in a millisecond.

I propose to use the method used in our deep sea camera, except to use a stiffer spring on the blades. We also need two magnets to pull symmetrically.





400 mfd 6v

$\frac{CE^2}{2} = \frac{400}{2} 36 \times 10^{-6}$

0,072000 WS.

$\frac{400^2 C}{2} = 0.1$ WS.

$C = \frac{0.2}{16. \times 10^4} = 1$ uf

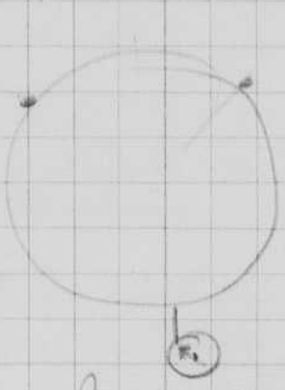
Letter is to be sent to Wollenson for samples.

June 21, 1960
K. E. Egerton

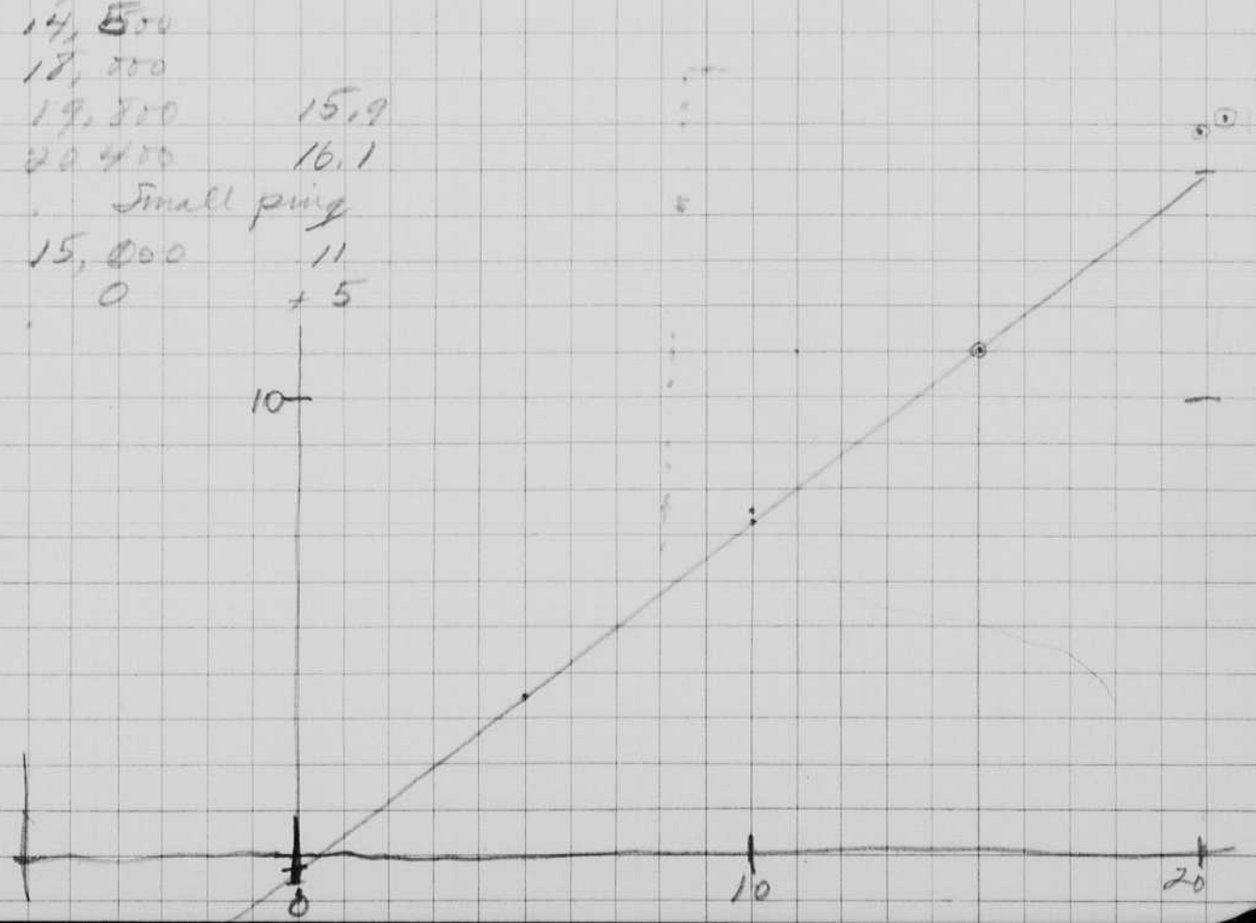
20,000 P.S.I. Tester.

Yesterday we had trouble with welds in the nose plug of the 16" shell. Today we got the pressure up to 20,000 for 5 minutes, then the O ring of the nose cone let go with a ping and the pressure decreased slowly.

Time	Pressure	Deflation 1/1000	
850	0	0	
	5000	3.5	
	6000	4.5	
	0	-.5	
	6000	4.0	
	10,000	7.25	
	0	-.5	
	10800	+ 7.5	
917	14500	11.75	
	10,000	7.5	
	5000	3.6	
	0	-1.75	Valve in dutch
920	0	-.25	Pile driver
925	10,000	+ 7.5	
930	14,500		
935	18,000		
938	19,800	15.9	
939	20,400	16.1	
945	Small ping		
46	15,000	11	
47	0	+ 5	



Indicator.



Light on yacht
Thumper # ST8 #3.
2 H.P. Light meter 306.

Bare lamp 17 Lumens/sq ft x 8
In Reflector 38 " " " x 8

B.C.P.S. = 38 x 8 x 7² = 15,000

This lamp was put on the Nantucket, WAL 534, of the Coast Guard Station at Boston on the night of June 30. Thursday. A 500 mm barrel lens was used on the 65 ft foremast of the slip.

An incandescent beacon of 500,000 cp was on the stem mast. It had 6 24 volt airplane beacon lamps in a frame that rotated.

Commander E. H. Lawrence Harwood
Chas B Read, M Cams, A Ricci John Tredwell
went in a small launch for 5 miles. Can't
money stayed on the slip.

The blue lights are very distinctive and
steplein getting. ~~There~~ It was suggested
that a series of flashes, say 3 at 1/2 sec. at
intervals would be useful for bearing purposes.

Pressure Tester 20,000 16" Navel Shell

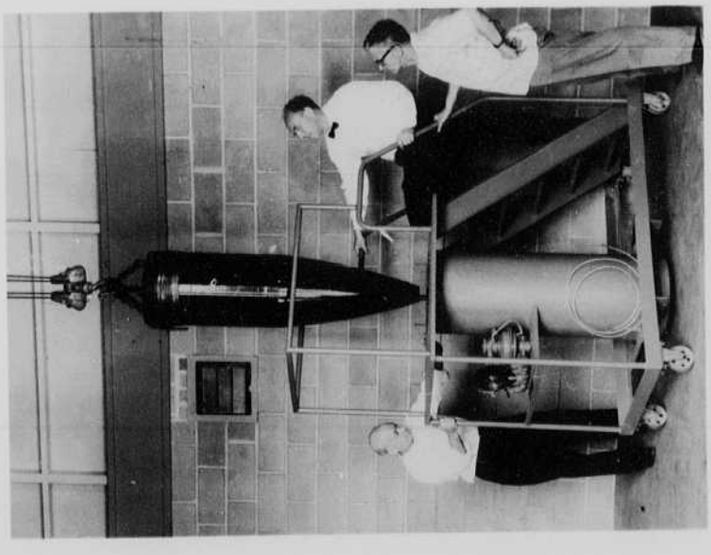
July 10 1960
A. Edgerton See page 39.

A new nose plug was made after trouble with the welding and O Rings. The O rings of the new end core also blew at 20,000 P.S.I. so we froze the end part in liquid air before screwing it in tight. This seems to hold ok.

The breach end now was stuck and the O ring had flown into the crack. The shell was heated with a torch to get it to break open.

The brass ring was polished to active flatness. also the breach part was honed flat so that it hit all around. There were some high spots on it.

I have been up to 10,000 P.S.I. on several tests. Each time, there is a thread of rubber extruded from the O ring. I am now waiting for some durometer 90 O rings (instead of 70) 9½ O.D. 9" I.D. These may solve the problem.



Light and Spot

Thumper # ST8 #3.

2 H.P. Light Motor 306.

Bare lamp 17 Lumens per sq ft x 8

In Reflector 38 " " " x 8

B.C.P.S. = 38 x 8 x 7^2 = 15,000

This lamp was put on the Nantucket, WAL 534, of the Coast Guard Station at Boston on the night of June 30. Thursday. A 500 watt bipost lamp was used on the 65 ft. fore mast of the slip.

An incandescent lamp of 500 cp was on the stern mast. It used 6 24 volt airplane beacon lamps in a 12 volt circuit.

Commander of H. Lawrence Hartlove
Chas B Reed, Mc Comas, & Ricci John Cotwell went in a small launch for 5 miles. Last many stayed on the slip.

The blue flashes are very distinctive and attention getting. Flash It was suggested that a series of flashes, say 3 per ½ second intervals would be useful for beaming purposes.

Pressure Tester 20,000 16" Naval Shell

July 10 1960
A. Edgerton

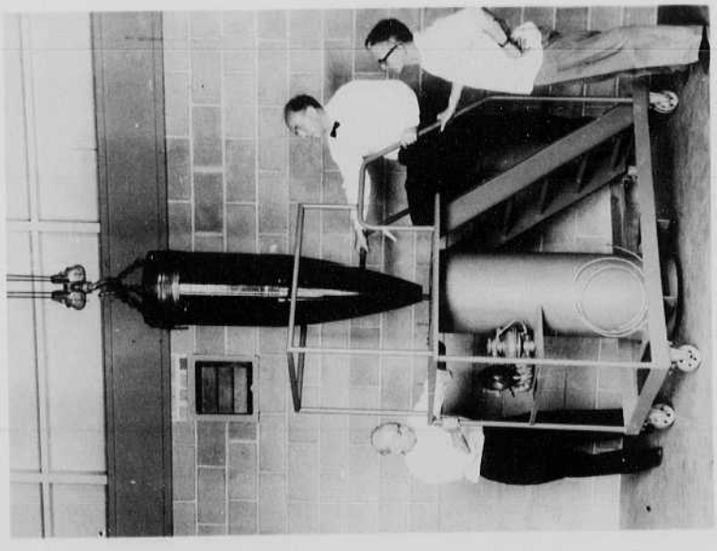
See page 39.

A new nose plug was made after trouble with the welding and O Rings. The O rings of the new end core also blew at 20,000 P.S.I. so we froze the end part in liquid air before screwing it in tight. This seems to hold ok.

The breach end now was stuck and the O ring had flown into the crack. The shell was heated with a torch to get it to break open.

The brass ring was polished to active flatness. also the breach part was honed flat so that it hit all around. There were some high spots on it.

I have been up to 10,000 P.S.I. on several tests. Each time, there is a thread of rubber extruded from the O ring. I am now waiting for some durometer 90 O rings (instead of 70) 9½ O.D. 9" I.D. These may solve the problem.

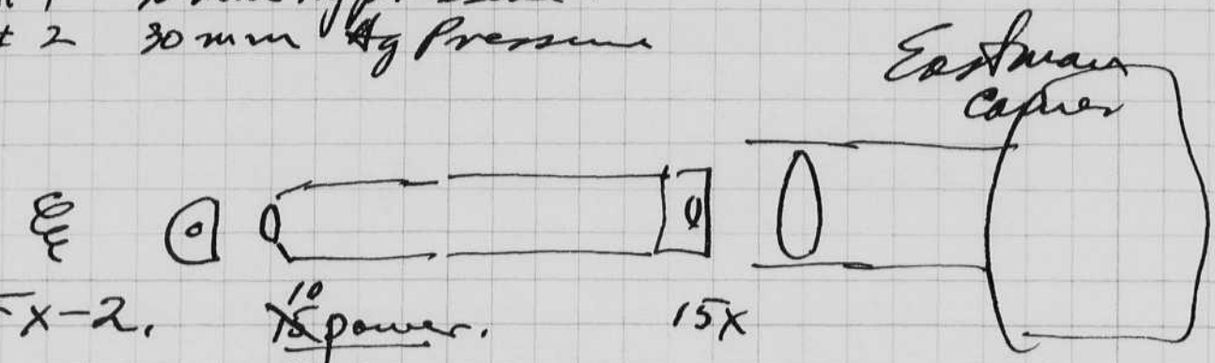


A.E. EDGERTON

Blood flow

S.E. Chrom 3114
86-389.

Film #1 10 mm Hg pressure.
#2 30 mm Hg pressure



FX-2. 10 power. 15X
16mm 150 mag.

20 on Resistor
115 volts.

SO 260 Color Film
0-260-124-33.

2-50 ft rolls from a 100 ft roll.
#1 .05 mfd + Incandesc
#2 .02 mfd no Incand.

BG&G 501 lamp.

Pressure time curves

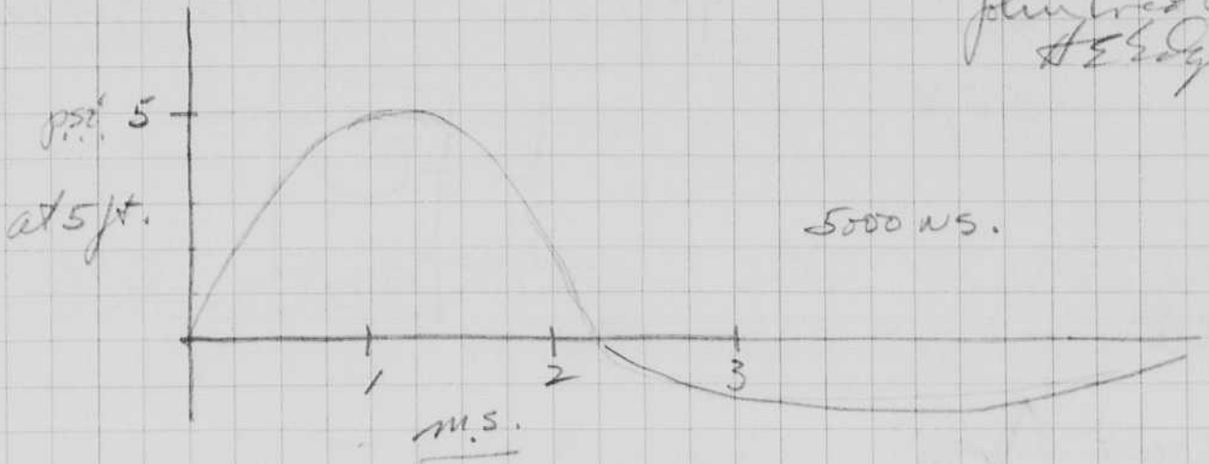
5000 W.S. Thumper & Dynamite Caps

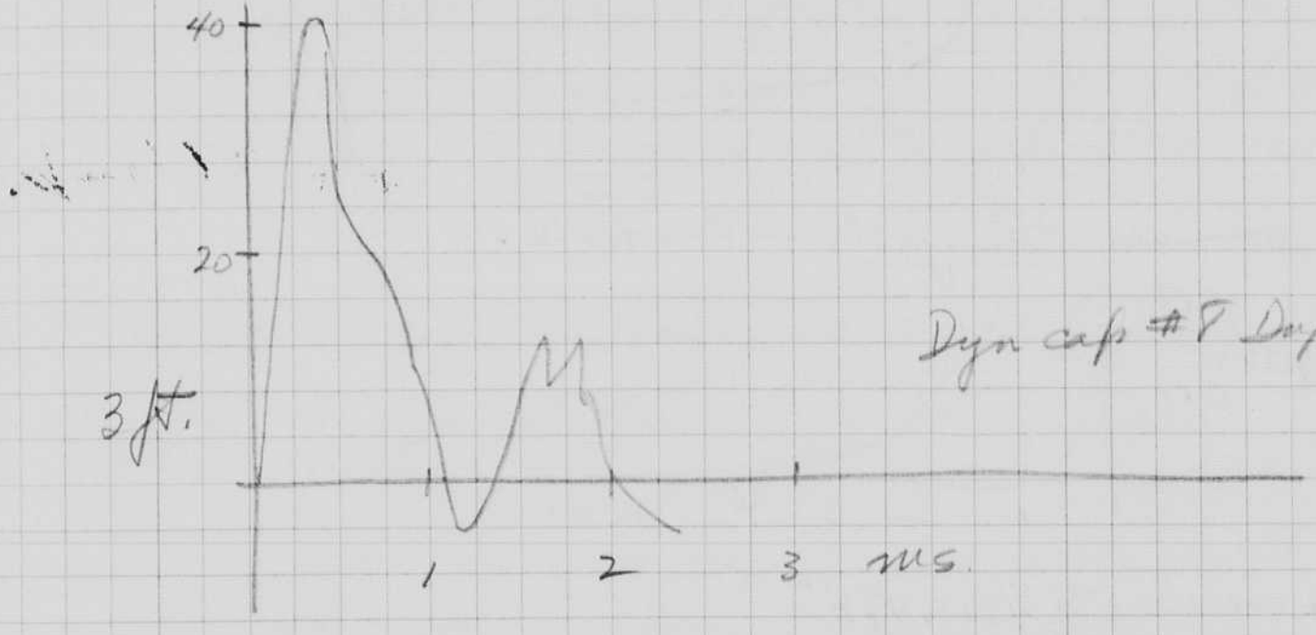
made June 29 60 made July 5 1960

Carl Mooney

John Treadwell

#2 Edgerton





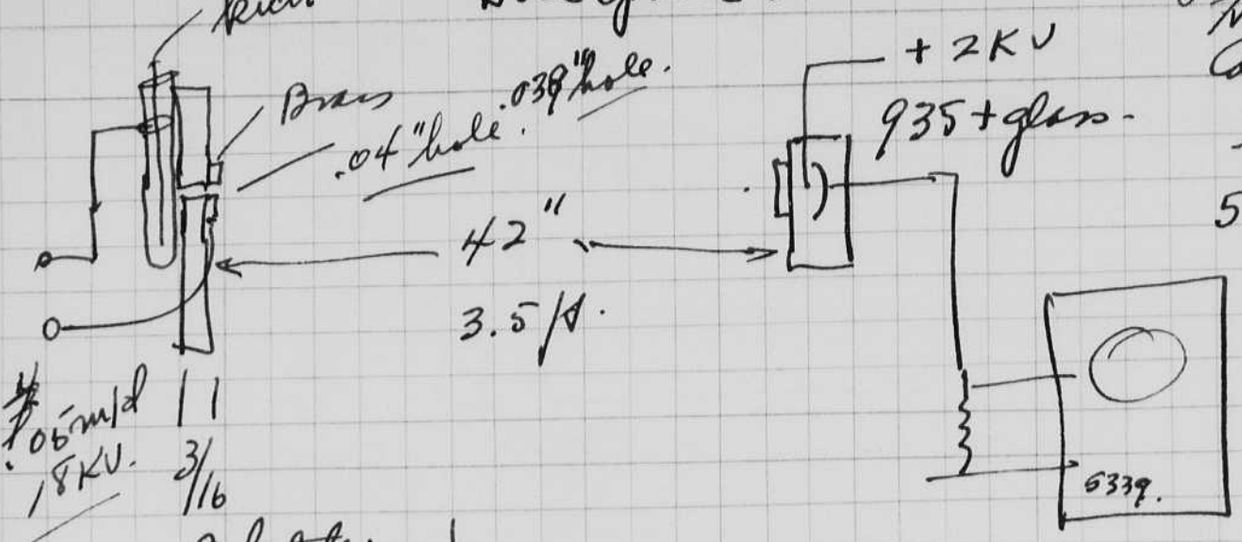
$E_{energy} = p^2 \times T$

$5^2 \times 2.5 = 62.5$ 5000 WS Thumper.

$\left(\frac{3}{5}\right)^2 40^2 \times 1 = 575.$ Dyn caps energy

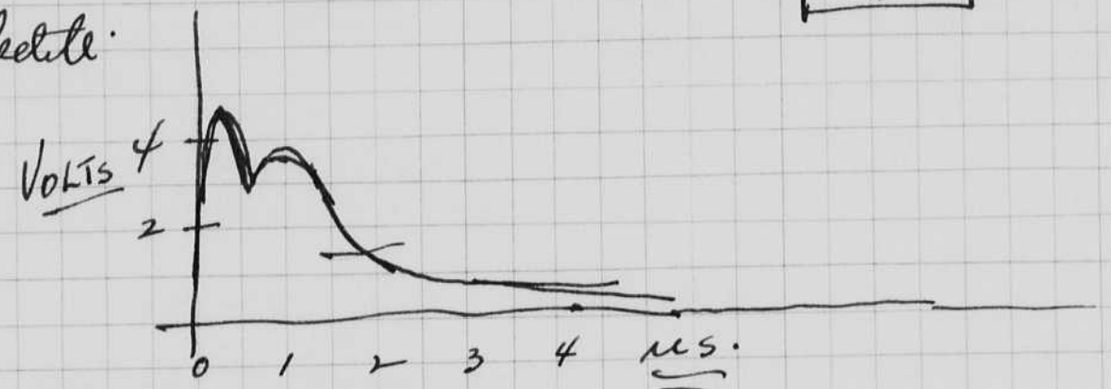
July 13 1960
H. Edgerton
Carl Morey

Kick Hole Spark on

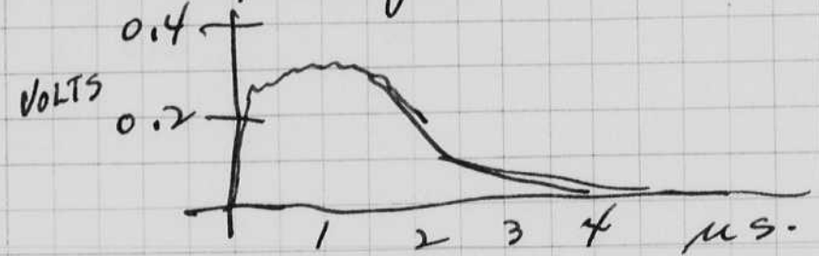


Technicut.
545 No. 9059.

Bakelite.



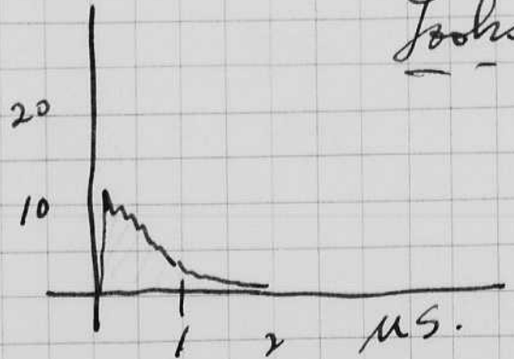
~~Hole increased~~ Glass just over the Hole.



Hole increased to 3/32 = .094"

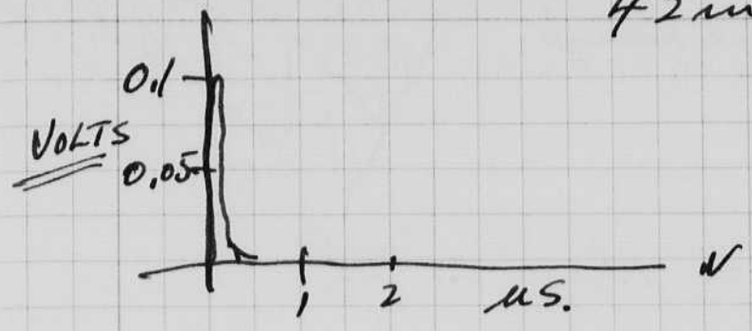
Looks good

42"



Double flash

42 inches into 735 on tank scope. all conditions same



Silhouette photo taken with equip as per bottom of page 44. 10 volts out put at 42" and 1 MS.

Light to Bullet 5 feet. EK Contrast Process film
Bullet to Film 1 foot.

#1 Photo excellent of 22 long Rifle
#2 " of bullet into Bakelite. ok.

Reflector now installed on lamp Airflash 1" gap
Airflash 50 volts. at distance of 19' 1½ inches peak.

Duration is less than ½ MS with small trailer.

60 volts sometimes 65 depending upon arc.

Calibration. FX-1 10.5 mfd 2000 volts.

42 inches from FX-1 to photocell.
2½ x 10⁶ c.p. from Data on FX-1.

17 volts to scope.

$C.P. = e d^2 (k)$.

$2.5 \times 10^6 = 17 (3.5)^2 k$. $\quad k = 1.201 \times 10^4 = 12{,}000$

200 12.25

Double flash Bare lamp.

Note: data in Cologne congress paper by Edg shows 18,000 c.p.

$e = 0.1$

$d = 3.5$

$C.P. = 12{,}000\ 0.1\ 3.5^2$

$= 1.47 \times 10^4 = 14{,}700$ C.P.

Air flash Shadow

.094" → ←

.047 R.

$\pi R^2 = .00695$ sq inches

$= .0449$ sq cm.

$e = 10$

$d = 3.5$ ft

$C.P. = 1{,}470{,}000 = 1.5 \times 10^6$.

$\frac{C.P.}{\text{sq cm.}} \quad \frac{1.5 \times 10^6}{.0449} = 33.4 \times 10^6$ stilb.

Air flash in Reflector

$e = 60$

$d = 19$ ft.

$450 \times 60 = 245{,}000$

Beam $\quad CP = 12{,}000\ 19^2\ 60$

$264{,}000{,}000$ Beam C.P.

9.12 ft for 1 mlt $= 1 \times 10^6$ c.p.

$\frac{\pi C.P.}{\pi d^2} = \frac{C.P.}{d^2} =$ lumens/sq ft.

$\frac{C.P.}{d^2} = \frac{1.5 \times 10^6 \times 10^{-6}}{5^2} = \frac{1.5}{25} = .06$ ft candles

lumens/sq ft.

Air flash.

264,000,000 c.p. × $1/3 \times 10^{-6}$ = 80 BC.PS

G factor = D × A = $\sqrt{80 \quad \frac{3500}{15}}$ ←

D × A = 130

D = 3

A = $\frac{130}{3}$ = 44

John Tredwells 15" extender on the air flash.
2 volts at 20 ft. 1/2 ms duration —

C.P. = 12,000 2V 20^2 = $\frac{12000}{7,600,000}$ = 7 million c.p.

I propose to use this on the daylight experiment on the roof.

Flash as used for daylight shadow photos on roof of Bldg 20 several years ago
D = 12 ft E = .05 volts.

C.P. = 12,000 × .05 × 12^2
Dur. = 0.7 ms.

144
.05
7.20
12000.
284
72
100400

The 1/3 ms light is about 50× peak and about half as long.

100,400 c.p. peak.

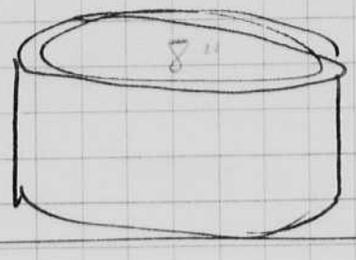
I suggest we put a stop on the flash lamps to reduce the area. This will increase the shadow definition.

July 14 1960

Pinger transducers.

Harrison — 200 turns nickel
$L = 4$ mh.
$Q = .28$

Navy. — 65 turns
285 Turns.
$L = .285$ mh.
$Q =$



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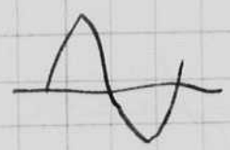
2 mfd. $\quad f = \dfrac{1}{2\pi\sqrt{LC}}$

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



$$L = \frac{1}{C\,4\pi^2 f^2} = \frac{1}{2\times10^{-6}\ 40,144.000}$$

80
12,000,000
11.520

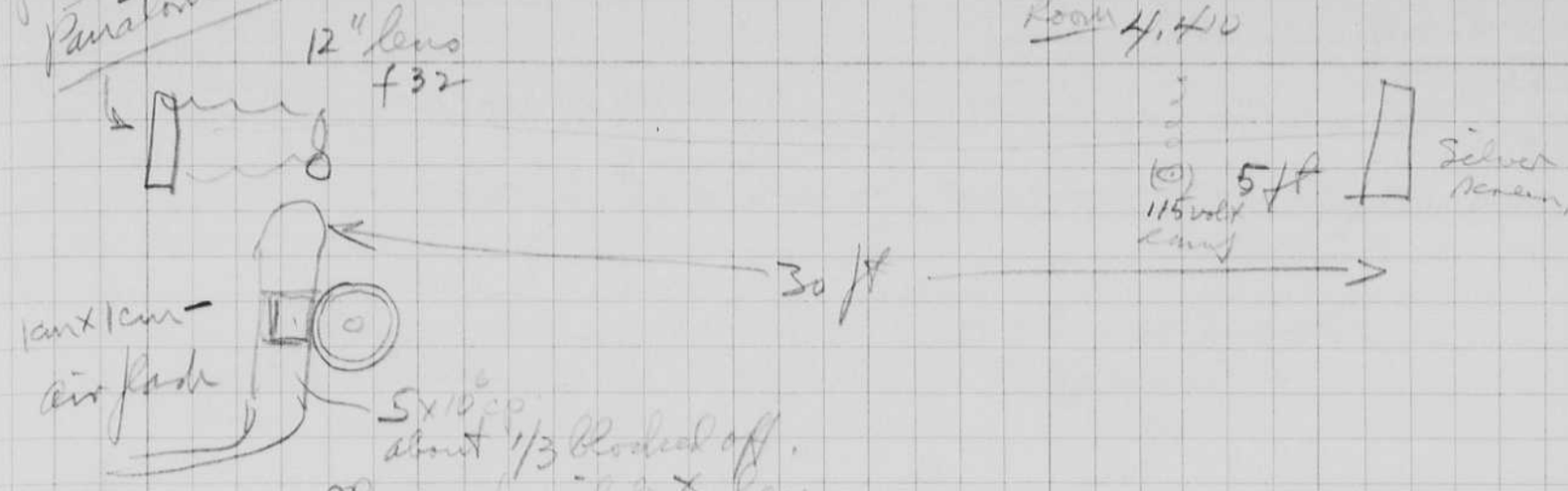
$$= .01 \times 10^{-3} h$$

.000.01

$$= .01 \text{ mh.}$$

Sketch Light Photo,

Panatomic X



Very weak exposure

Royal X tried at f 32 some fog not much more exposure.

Moved equipment out into the hall at 60 ft distance

Royal X at f 11
Rebuilt lamp near lens.
White Silver Screen of new material.
Dectol 3:1 in tank at 6 minutes.

75 watt reflector lamp
at 10 ft from screen for subject

1/400 sec at f 11. Two exposures made one

Care Nurey 38 Special
Extra load ammo Peters
Ruger
Revolver 10 ft from Screen.
f 16 exposure dark.
f 22 exposure ok.

Notebook # 26

Filming and Separation Record

____ unmounted photograph(s)

____ negative strip(s)

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

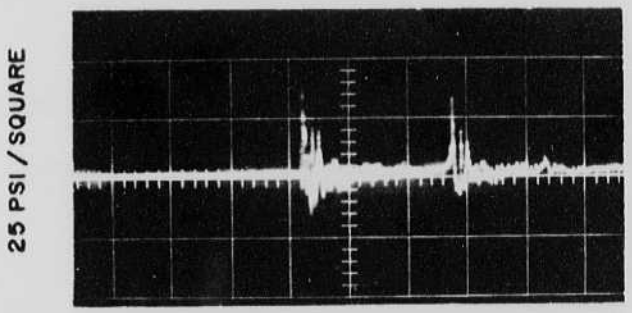
was/were filmed where originally located between page 48 and 49.

Item(s) now housed in accompanying folder.

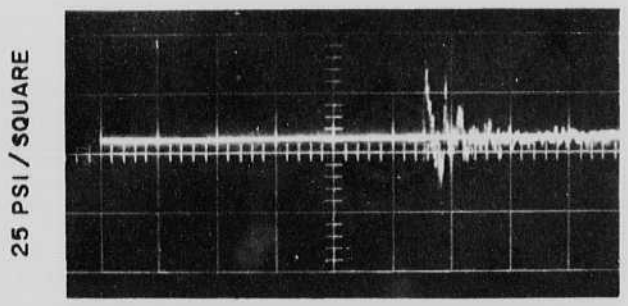
PRESSURE TIME DATA ON DUPONT #8 DYNAMITE CAPS

Equipment

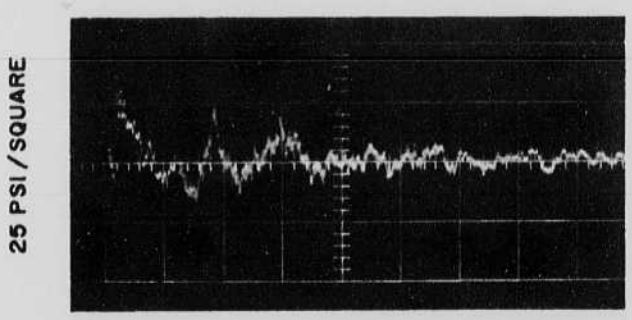
Data was taken with a Type BC-30 (Atlantic Res. Corp.) hydrophone positioned three feet from the dynamite cap. Both the dynamite cap and the hydrophone were five feet below the surface. The output of the hydrophone was displayed on a TEKTRONIX Type 545 Oscilloscope.



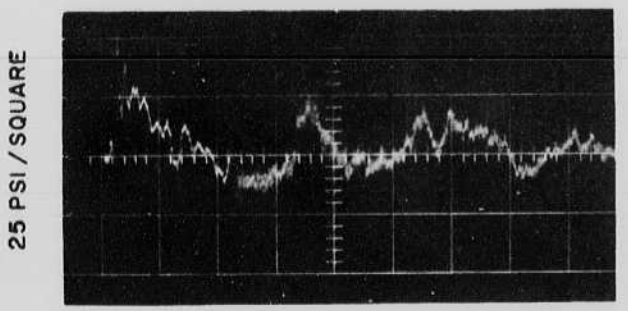
10 milliseconds/square



5 milliseconds/square



1 millisecond/square



0.5 millisecond / square

EDGERTON, GERMESHAUSEN & GRIER, INC.
160 Brookline Ave. Boston, Mass.

H. Edgerton 15 Flashes

July 18, 1960
4 - 410 M.I.T.

marie agluwaid worked for me in the office last week while miss Jean Mowery was on vacation.

Photos taken last week or so show variable light and multiple images on later photos in stream of bullet.

Changed tubes 3 and 4 (HA 100) which had shown self flashing. #4 and 2 now occasionally self flash.

Photocell and oscillograph set up at 9.12 ft so 1 volt = 10^6 c.p. peak.

Peak light is about 40 x 10^6 c.p. peak = 40 volts. with reflector. Inside flash with end.

Last images weak with 30,000 cycles.
Suspect back firing of mercury tubes.

5000 ft. ok #4 is 30% lighter due to arrangement.

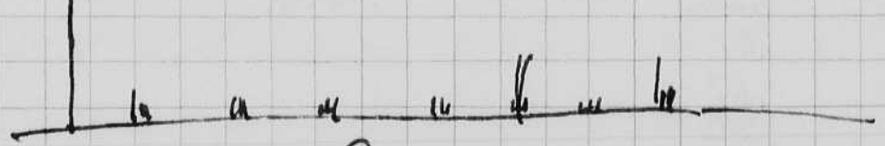
10,000 #3 is weak

20,000 #3 is double #4 missing
12 - 13 14 15 drop off in series to about 1/4 light. Erratic.

30,000 Last are weak showing back firing.

50,000 Ditto but worse

100,000



(multiple images due to back firing)

Multiple Microflash

H. Edgerton
July 20, 1960

Jim Nee has been experimenting with the HA100 mercury arc tubes. These were made by Hamlin.
Small diam tubes.

We went back to the N.E. tubes yesterday for test after the above failed to deionize above 30 KC±.

also the N.E. Capacitor unit failed to deionize above about 30 to 40 KC. They definitely were better but not much.

Jam now trying the NE tubes with lower voltage to see what can be done to get 100,000 cycle operation.

90 on ~~dial~~ voltmeter

70 Operation is OK 90% of the time at 100 K.C. only an occasional deionization.

OK ✓✓✓✓✓✓✓✓✓✓✓✓✓ There were some NG. but not this time
NG

#1	.17 x 10^6 cp.	6 OK	
	.32	1 NG.	
	.31		
	.27		
	.26		
	.25		
	.23		
	.21		

80 on meter

LS 10 B.
PS-35 80 on meter.

OK ✓✓✓✓✓✓
NG ✓✓✓✓✓✓

#1 .25 x 10⁶ cp.
~~Holborn~~
2 .4
3 .38
4
5
6
7 .3
8 .3.

This definitely is no good
the mercury arc tubes
self fire due to deionization.

Try 70 again

OK ✓✓✓✓ ✓✓✓✓
NG ✓ ✓

these NG shots only showed one
low reading of light.
I say the peak was about 0.1 x 10⁶ c.p.

at 60 Operation seems to be OK.

#1 0.1 x 10⁶ cp.
2 .2
3 ⋮
⋮ ⋮
8 .15

Spacing is not
uniform. For example
#3 is delayed by
about 2 microseconds.

Now connected the ~~Hamlin~~ tubes at 60

60 NG they did not deionize.

50 NG.

40 ~~OK~~. No Lamp also shifted.
#2 mercury tube misses some

70 ~~SE~~ tubes ok 100 Kc

80 ok ✓✓
NG ✓✓✓✓✓✓ 100 Kc

80 ✓✓ ✓✓✓✓✓✓✓ 50 Kc.

90 on R, 53 KC.

(self flash.

ok ✓ ✓

NG ✓✓✓ ✓✓ ✓✓✓

90 25 KC

ok ✓✓ ✓✓✓ ✓✓✓

NG ✓ · ✓ ✓✗ ✓✓

80 25 KC

ok ✓✓✓✓✓✓✓✓✓✓✓

NG, ✓

80 33 ok ✓✓✓✓✓✓✓✓✓

NG

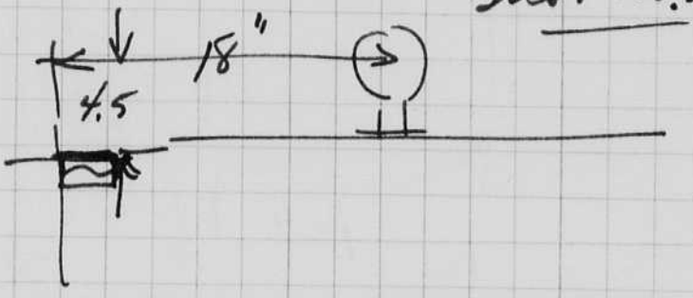
Ballet Photos

July 21 1960

Lamp bulb Harmony House 100 watt.
30 caliber ball ammo:
Shows ball spread on target.

#1. Paratomic X f 5.6
2. " 5.6 Late. Pushed up developer.
3. f 11 Mike moved 6" forward.

Shot no. 3.

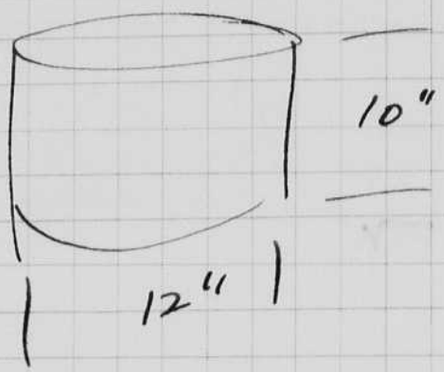


Exposure ok.
Color also Super Ektachrome ok at f 5.6

H. Sharfstein
Carl Moreg.
Jack O Raymond.
July 22, 1960.

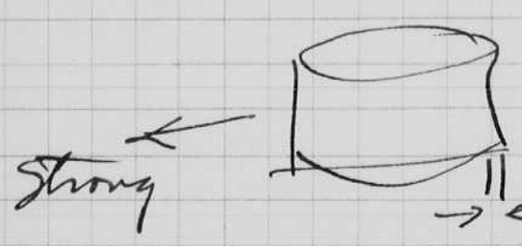
Prigers.

U.S. Navy cy
XV-1298 Serial no 1 from
Permadur transducer for USN USL
New London Conn.



BC 30 at 30"
volts = ~~.02 peak~~
.06 volts peak

Nickle donut. 7½ inches

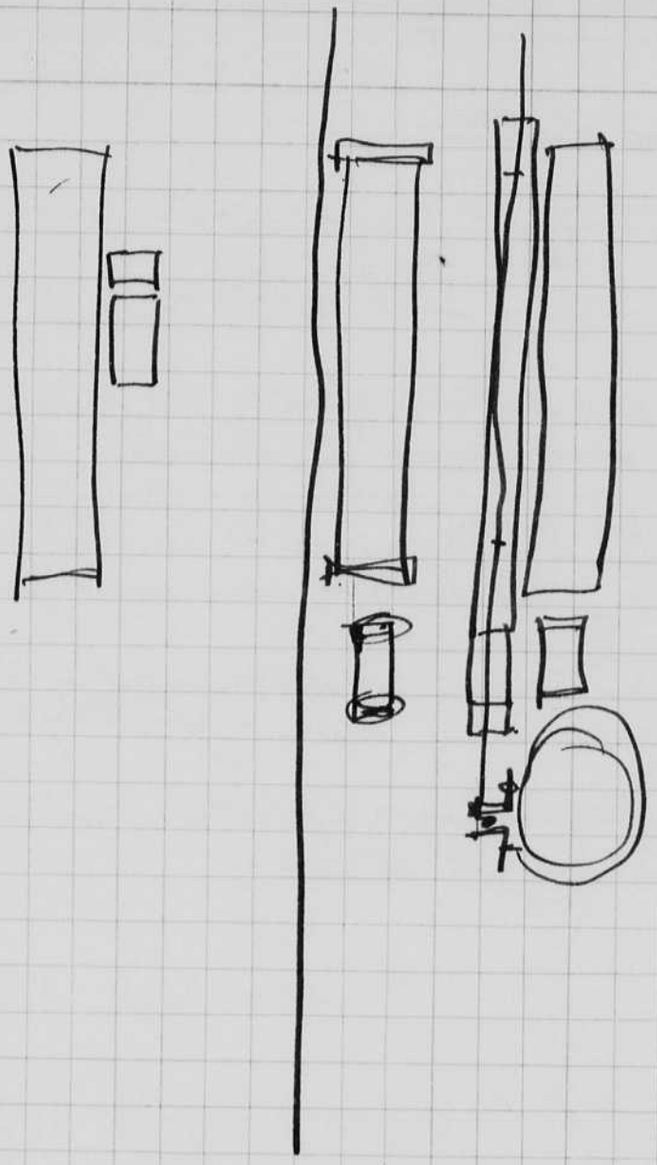


Peak voltage = 0.24 volts.
f. = ~~4 ms/half pulse~~
0.65

Ditto.

peak volts 0.2
.4 ms/half pulse.

Δ



July 26 1960
H. Edgerton
Carl Worley

Shutter delay

Rapax 1/400 shutter.

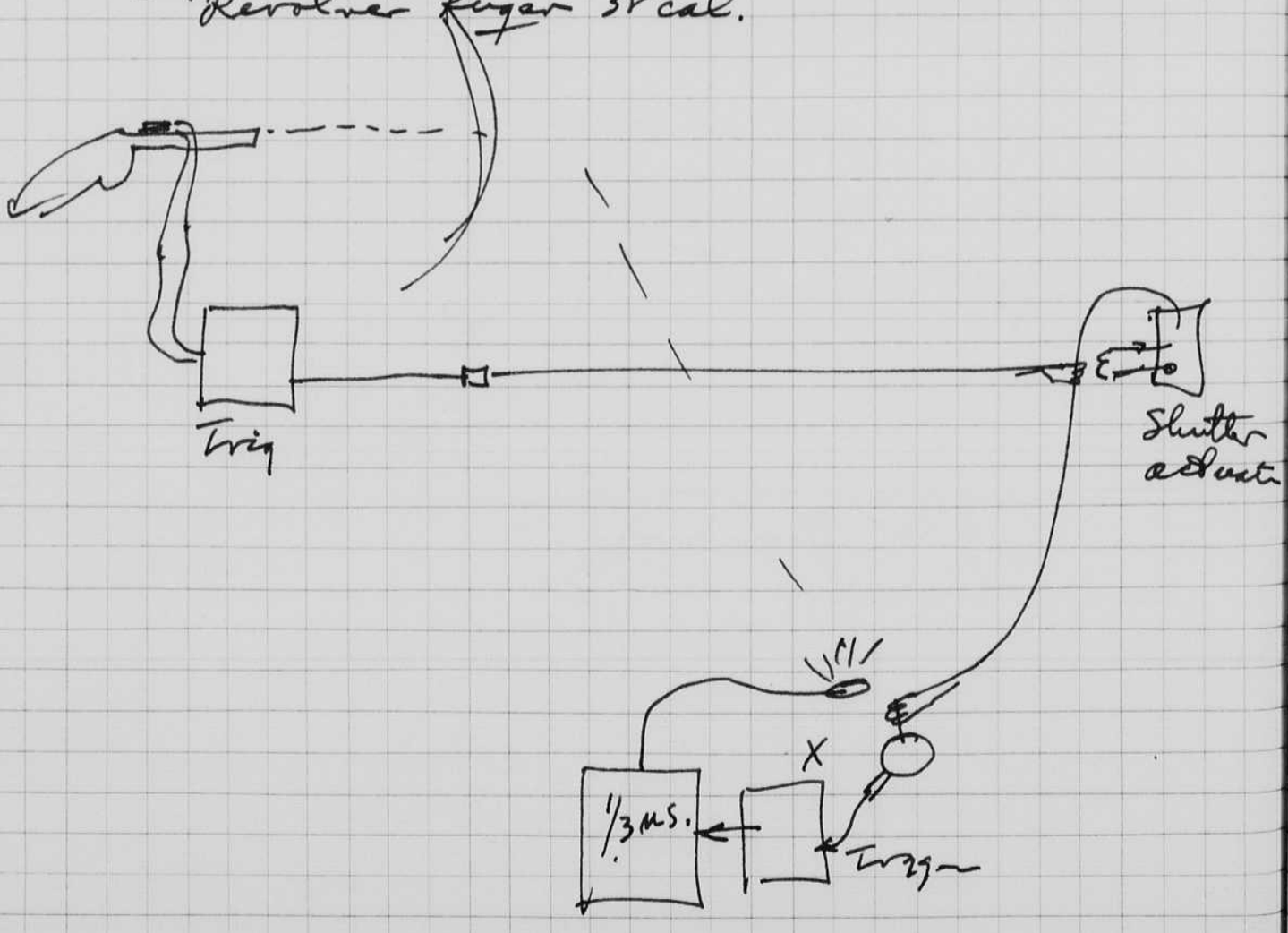
Delay from trigger 5 mfd 450 v. = 8 ms.
2D 21 tube.

Now a crystal was scotch taped to the pistol barrel right above the revolver cylinder.

With zero delay the bullet was still in the gun.
with 900 us delay the bullet was out about 1 ft.

Now the sensitivity was increased — I noted that the hammer was now partly tripped.

1000 cycle multiflash shows 4 photos. Hammer of Revolver Ruger 38 cal.



Increased trigger to 8 mfd on shutter 400 volts
Delay 7.5 ms.

Photos taken at night. on Aug 1 of Pistol

#1 f16 Panx film 50 on delay dial thru
#2 f11 " " " " "
#3 f11 Royal x " " " Ok.

Aug. 2 - with Dave Eldridge - on Roof:
300 foot candles

f11 Panatomic X no strobe Exposure ok.
3 Scotch screens in Blade & Idler.

f11 Panatomic X with Strobe.

f11 Royal x with Strobe.

The distance for the above was 60 feet.

now changed to 30 feet.

Type 57 Polaroid film 5 pm.
Cloudy weather.
1/400 sec f11 Exposure ok with flash
no exposure due to daylight.
three photos were made all ok.

60 August 21 1960.

Harold Edgerton.

Last week was busy with the Seminar on Electronic Flash and High Speed Photography. We had some thing 60 people from all over the country here. Mornings were spent in lectures and afternoons in labs. Each man had 15 laboratories, 3 a day of 1 hour each. I had about 30 people helping me in the effort. I think it was a success.

Lab Experiments

Electronic Flash and High-Speed Photography 6.51S
M.I.T., Cambridge, Massachusetts - August 15-19, 1960

No.	Subject	Location	Staff
1.	Stroboscope	4-410	Eldridge
2.	Waddell Camera	4-402	Waddell
3.	Drop Splash (Strobotac & Time Delay)	4-410	Eldridge
4.	Beckman & Whitley - Hyzer	4-402	Shoberg - Hyzer
5.	Magneto-optic Shutter	4-409	MacRoberts
6.	Wollensak Cameras	4-402	Emens
7.	1/3 Microsecond and Silhouette	4-410	Treadwell
8.	Avco - Kerr Cell Shutter	10-155	Theophanis - Gagnon
9.	Multiflash (Rapid)	10-155 (10-109 Darkroom)	Wyckoff
	Double Flash		
10.	Avco-Rotating Mirror	10-155	Theophanis - Gagnon
11.	Light Measurement	10-105	Pitts
12.	Underwater Photo Systems	4-409	Breslau
13.	Fairchild Cameras	4-402	Morio
14.	Shock Wave	Roof above 4-410	Morey
15.	Strobe High-Speed Movies 501	4-410	H. Edgerton
	Prism Camera Speed Control		Cahlander

Extra Experiments

16.	Millimike Oscilloscope	4-410	Roberts - Sec
17.	Multiflash of Trampoline	Armory, Mass. Avenue Wednesday at 8 p.m.	H. Edgerton Cahlander

Notebook # 26

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 60 and 61.

Item(s) now housed in accompanying folder.

Summer Seminar Staff

Electronic Flash and High-Speed Photography 6.515
M.I.T., Cambridge, Massachusetts - August 15-19, 1960

Edgerton, Harold E., M.I.T., Room 4-405, 77 Mass. Avenue, Cambridge, Mass. KI 7-6063
205 School Street, Belmont, Mass. IV 4-4869
Augustin, Ralph, Polaroid Corporation, 730 Main Street, Cambridge, Mass. UN 4-6000
Barstow, Fred, EG&G, Inc., 160 Brookline Avenue, Boston, Mass. CO 7-9700
Breslau, Lloyd, M.I.T., Room 4-405, 77 Mass. Avenue, Cambridge, Mass. KI 7-6063
Cahlander, Dave, 48 Mass. Avenue, Cambridge, Mass. UN 8-8187
Courtney-Pratt, J.S., Bell Telephone Laboratories, Murray Hill, New Jersey CR 3-6000
Edgerton, Bob, 205 School Street, Belmont, Mass. IV 4-4869
Eisendrath, Dave, 37 Garden Place, Brooklyn, New York MA 4-3222
Eldridge, Dave, 96 Chestnut Street, Andover, Mass. Dial 11 GR 5-1579
Emens, Fred, Wollensak Optical Co., 850 Hudson Avenue, Rochester, New York CO 6-1000
Farber, Ed, Rolog, Inc., 4217 West North Avenue, Milwaukee, Wisconsin UP 1-8300
Fitzmorris, Mike, General Radio Company, 22 Baker Avenue, Concord, Mass. CL 9-8900
Gagnon, Bob, Avco Research & Development, 201 Lowell St., Wilmington, Mass. LA 3-2029
Hull, Joe, Avco Research & Development, 201 Lowell St., Wilmington, Mass. LA 3-2029
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Mooney, Jean, M.I.T., Room 4-405, 77 Mass. Avenue, Cambridge, Mass. KI 7-6063
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Morio, Gerard, Fairchild Camera and Instrument Corporation, 580 Midland Avenue,
Yonkers, New York GR 6-0201
Morgan, Henry, Fabric Research Laboratory, Inc., 1000 Providence Highway,
Dedham, Mass. DA 6-5500
Perrin, Don, c/o Cinema Department, University of S. California, Los Angeles, Calif.
Pitts, Larry, General Radio Company, 22 Baker Avenue, Concord, Mass. CL 9-8900
Roberts, Bernie, EG&G, Inc., 160 Brookline Avenue, Boston, Mass. CO 7-9700
Seacord, Dan, EG&G, Inc., 160 Brookline Avenue, Boston, Mass. CO 7-9700
Seo, Hideo, Spencer-Kennedy Laboratory, Inc., 1320 Soldiersfield Road,
Brighton, Mass. AL 4-5400
Shoberg, Bob, Beckman & Whitley, San Carlos, California LY 3-7824
Slomski, Stan, General Electric Company, Nela Park, Cleveland, Ohio GL 1-6600
Sultanoff, Mort, Ballistic Research Laboratories, Aberdeen Proving Ground,
Aberdeen, Maryland
Theophanis, George, Avco Research & Development, 201 Lowell Street,
Wilmington, Mass. LA 3-2029
Tredwell, John, M.I.T., Room 4-405, 77 Mass. Avenue, Cambridge, Mass. KI 7-6063
Waddell, John, 33 Loretta Drive, Syosset, New York WA 1-5469
Wyckoff, Charlie, EG&G, Inc., 160 Brookline Avenue, Boston, Mass. CO 7-9700

Lab Groups

Electronic Flash and High-Speed Photography 6.516
M.I.T., Cambridge, Massachusetts - August 15-19, 1960

Group	
A	Adams, Anderson, Austin, Ball, Blinder
B	Blizard, Connaughton, Charron, Crow, Cudworth
C	Dahn, Ebaugh, Erf, Fletcher, Folz
D	Forster, Gatley, Gelford, Gershon, Goodwin
E	Hall, Hamilton, Hanson, Hearon, Hellmers
F	Houidobre, Jacobs, Kaplow, Kelly, Keto
G	Laney, Leakins, Ledoux, Lee, Levenick
H	McLaughlin, Mirarchi, Pearson, Pilsworth
I	Plentzas, Poxin, Pritchard, Quinlan
J	Riley, Rowe, Rudnick, Schlueter
K	Schwinghamer, Selvidio, Sihvonen, Silverstein
L	Snyder, Sober, Sopstyle, Strick
M	Summerhayes, Sykes, Tamm, Tanenholtz
N	Thompson, Trimble, Tomkinson, Treible
O	Webster, Verner, Yoder, Young

16
25)400
25
150
150

15
28)400
28
120
140

Notebook # 26

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 62 and 63.

Item(s) now housed in accompanying folder.

FT-617 4700

FT-617A. 5500

---

at 20 ft.

The Coast Guard have requested the loan of a flash lamp as an experimental light house

I plan to send a thumper supply of 1000 watt second energy.

FT-617 tube (4½ turns).	4700 h.c.p.s.	at 20 feet as measured with a G.R. light meter of the small type Amer Speed light.
FT-617A tube (5½ turns)	5500 h.c.p.s.	

This equipment is the same type as was used in the spring tests on the Nautical light ship.

2/Lt. J.A. Ciccolella.

Sept 18 1960

Harold Edgerton

Test of Film Sample from E.K.
Emulsion no.
John Niemeyer 30 48745-1-113.
Blue Phosphor recording.

Plus x as comparison.
DK 50 full strength 5 min dev. 72±°.

Plus x 1.58
Plus. 1.24

Log	Plus x		Plus.	
	0.~~10~~.295		.14	
1	.81		~~.58~~ .55	
2				
3	.91		~~.56~~ X	
4		.24=Δ		.34=Δ
5				
6	1.05		.92	
		.52	~~1.27~~	.35
12	1.57		1.27	
		.30		.31
18	1.87		1.58	

Comment Slower than old Plus x.
contrast about the same.

Strobotac 1531A with Scotchlite.

Tests for Los Alamos Photo Dept.

D = 30 feet.

Density = 1.2 on image with slow speed light 100/min.

7×10^6 c.p. $\times$ 2.5 ms = 17.5 c.p.s. without reflector

Reflector factor is 30 to 70.

---

at high speed 25,000 the c.p. drops by a factor of

$$\frac{0120 \times 10^6}{7.0 \times 10^6} = .03 \text{ or } (3\%)$$

$\sqrt{33} = 5.75$ change in guide factor.

$\sqrt{70} = 8.4$ change in G.F with removal of reflector.

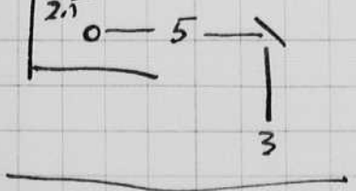
$\frac{f16}{8.4} = f.2.$

G.F. = 30 x f16 plus x film. = 480 against scotch light.

could be stretched to 700 maybe.

$700 \times \frac{1}{5.75} = 120$

Elmer Hilton. Distance = 10.5 ft. $\frac{120}{10.5} = 11.5$ apertures.



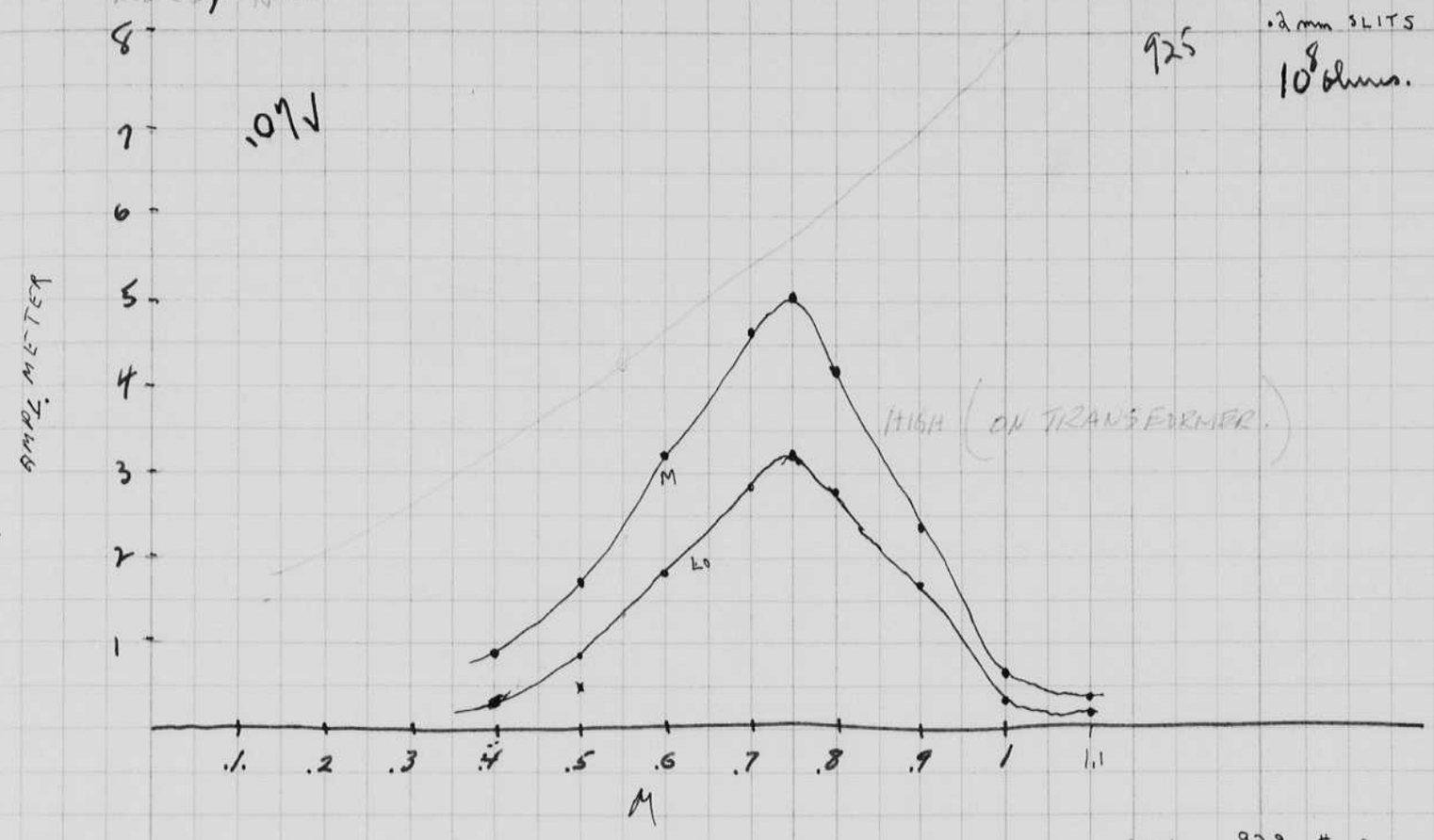
Sept 22 1960

H. Edgerton.

925 characteristics.

925 .2 mm SLITS

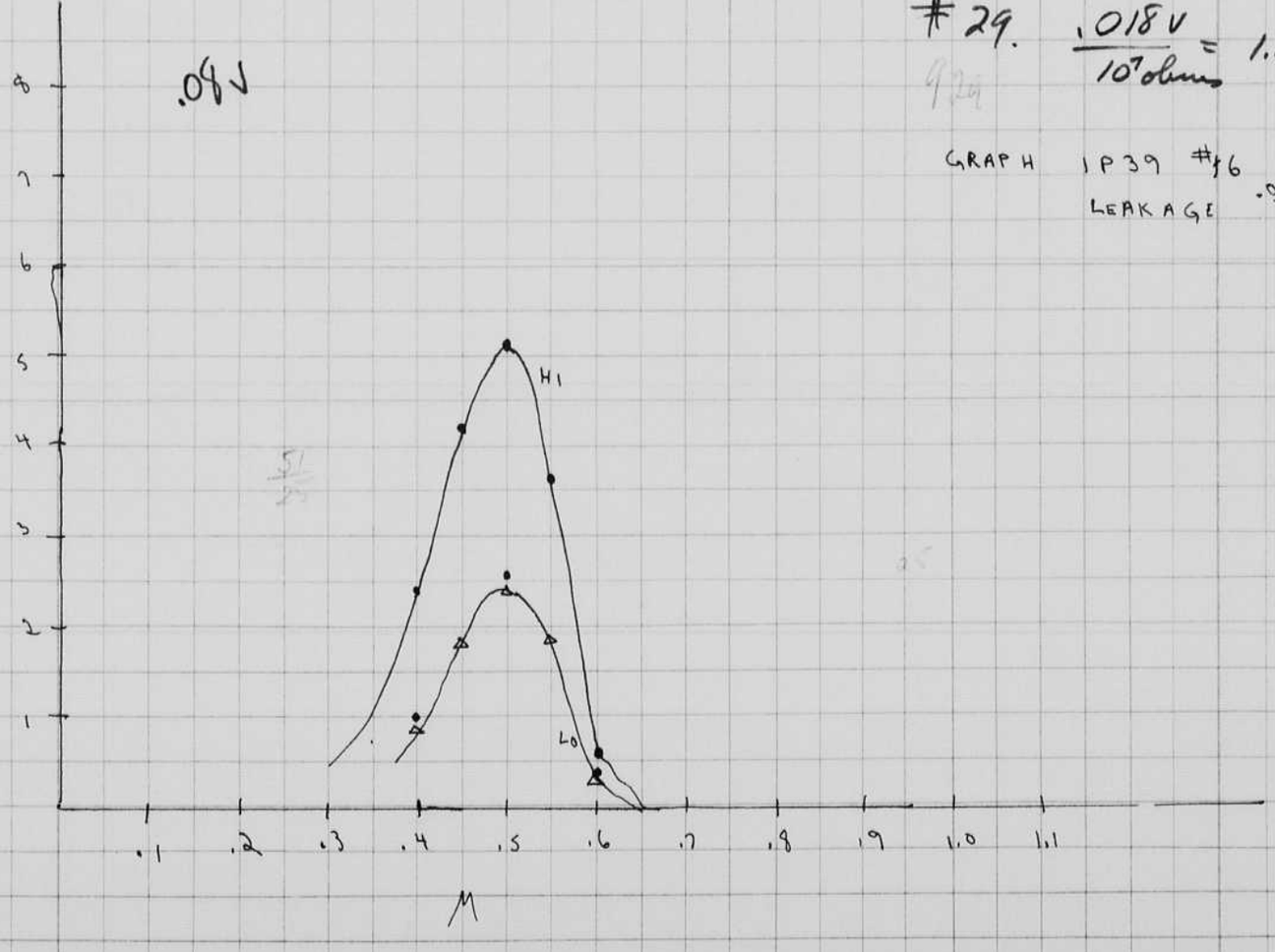
10^8 ohms.



PHOT. 929 #29

.2 mm SLITS

#29. $\frac{.018V}{10^7 ohms} = 1.8 \times 10^{-9}$ amps.



GRAPH 1P39 #16

LEAKAGE $\frac{.022V}{10^8} = .22$ ma

925

JUNG. LIGHT
.2 mm

2600
BLACK
BODY

925 data.

40

LO

1 2 3 4 5 6 7 8

.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

20 — 0.5 — 20

μ

FLASH
.3 slits

Charged .01 μfd caps.
Flash 97 μfd – 1 kv ∓ 10%

1 2 3 4 5 6 7 8

.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1

μ

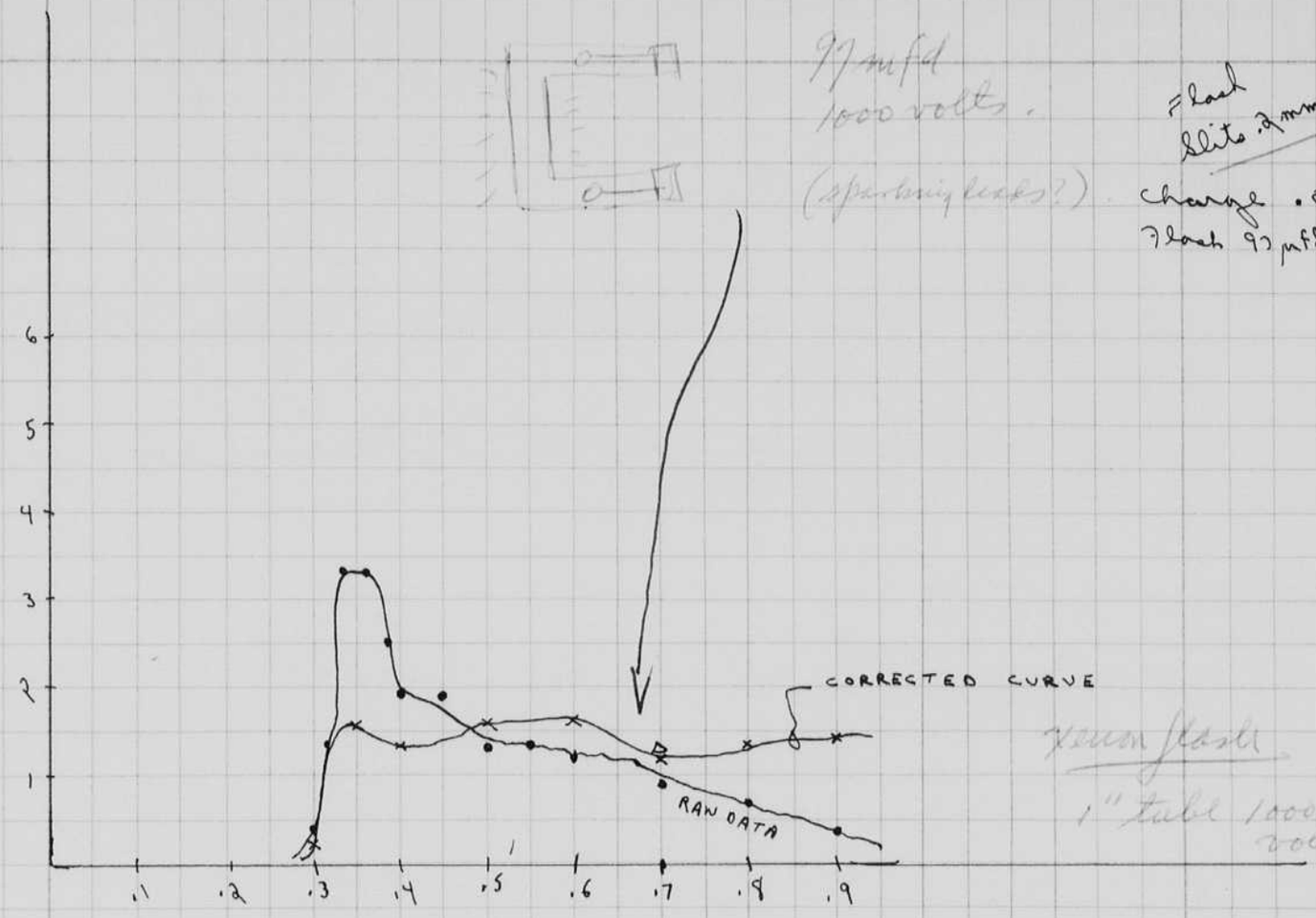


Figure one wave light. Fred. Hamburg

BC 1538

XhS-4.

Sept 24 1960

Bullet Photo

At 2:30 p.m. Bowler store

Saturday

Color High Speed Ektachrome f 5.6 at 1/4 sec. 20 candles

Same with CC 50Y filter 35 mm.

B&W Panatomic X. DK 50 12 min. f 11 same at f 8 and f 5.6 with

30 caliber bullet at 6 ft from Muzzle.

Same Year

Two shots at 1/2 sec. delay between them to show Year.

There was very little Year, Contrast Low.

Changed to Royal Pan at f 8 with Velvet Background.

Color CC 50Y filter at f 5.6 on most shots.

Radish with 30 cal.
Cards " " " Jack ♡
" " " " King ♡.
Soap " " "
cigarette smoke - Bullet. missed.

Sept. 25, 1960.

Sunday Marked negative envelopes.

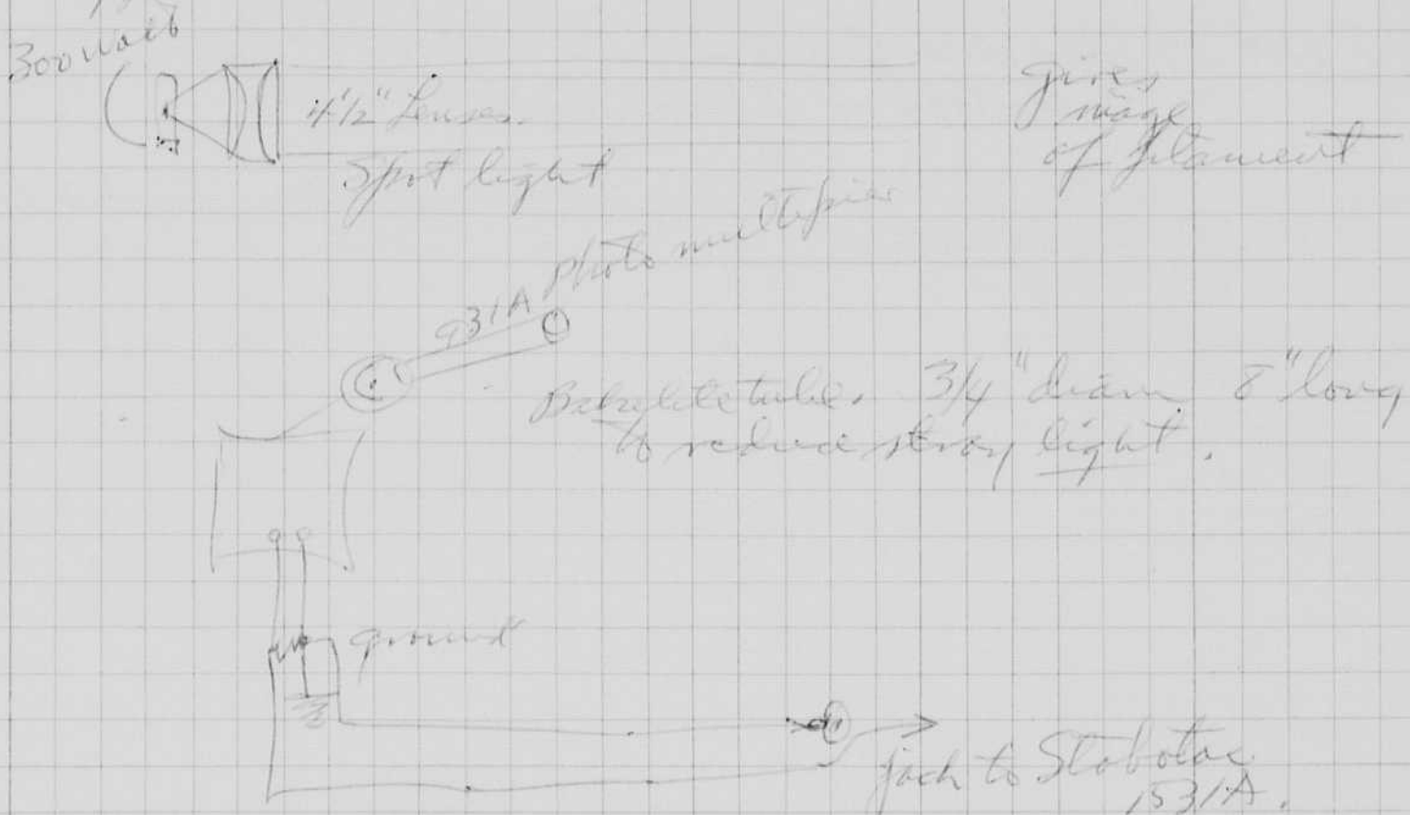
Oct 1 1960

Howard Eagle

Bat Trigger system -

Clean up in 4-40 today with Steve Benton

after 3 pm I set up system for bat trigger test



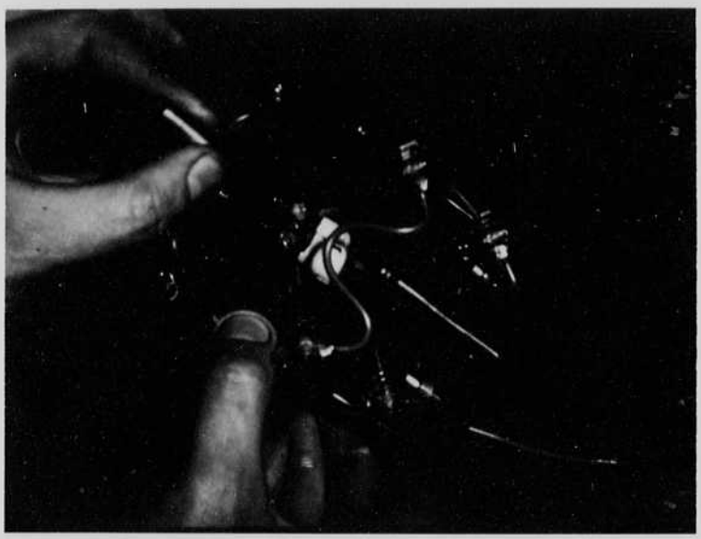
Stobtac operates with + signal of about 1 volt.

Operates on return trip when + signal hits the stobtac.

70 Oct 25 1960
H. E Edgerton.

Last week in Washington at the 3rd Congress of High Speed Photography. Gave a paper with John Tredwell and Ken Cooper on Short Duration flash Sources.

Oct 29 1960 with Benton
Worked on 15 flash unit.



Nov. 3 1960
H. E. Edgerton.

Data on Beacons from
Bill Ward at EG&G.

Input	current	flash.	
12 v	.025 amp.	10 sec.	4 watt sec?
12	.05	15.	"

Nov 5 1960 Microscope Illum
HES
MacR.

	d	M	Handlens	870 volts. 320 mfd. FX-33.
	.56	14 x 32	445	
	1.0	46 x 32	1472	
	1.25	135. x 32	4320	
1 3/8	1.	183. x 32	5856	
	1.5	161 x 32	5152	
	1.75	101 x 32	3232	

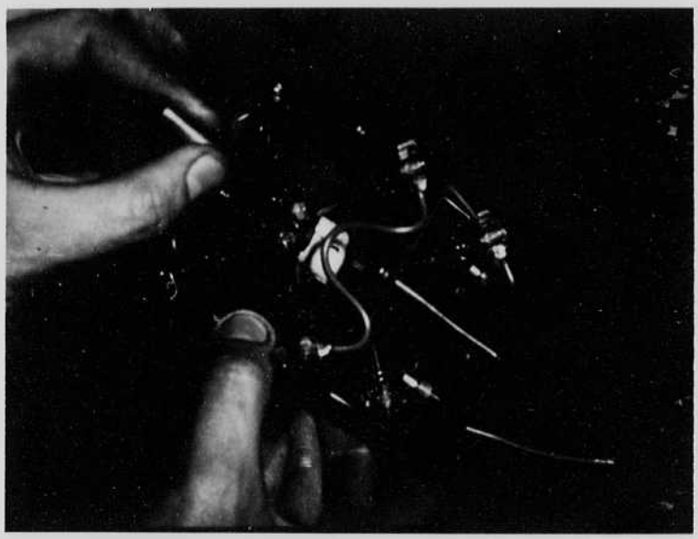
	.56	2 1/2 x 6	Spot size
	.75	2 x 5	
	1.0	1.5 x 3.5	
	1.25	.25 x 2.75	
→	1.3/8	0.5 x 2.	
	1.5	.75 x 1 3/4	
	1.75	1.3/8 x 1 3/8	

1 3/8" Jones light 55 cps x 32 10 seconds.
55
32

70 Oct 25 1960
H. E Edgerton.

Last week in Washington at the 3rd Congress of High Speed Photography. Gave a paper with John Tredwell and Ken Cooper on Short Duration flash Sources.

Oct 29 1960 with Benton
Worked on 15 flash unit.



Nov. 3 1960
H. E. Edgerton.

Data on Beacons from
Bill Ward at EG&G.

Input	current	flash.	
12 v	.025 amp.	80 sec.	4 watt sec?
12	.05	15.	"

Nov 5 1960 Microscope Illum
HF2
MacR.

	d	M	Readings	870 volts, 320 mfd, Ex-33.
	.56	14 x 32	445	
	1.0	46 x 32	1472	
	1.25	135 x 32	4320	
1 3/8	1.	183 x 32	5856	
	1.5	161 x 32	5152	
	1.75	101 x 32	3232	

.56	2 1/2	x 6
.75	2	x 5
1.0	1.5	x 3.5
1.25	.25	x 2.75
→ 1.3/8	0.5	x 2.
1.5	.75	x 1 3/4
1.75	1.3/8	x 1 3/8

Spot size

1 3/8" Jones light 55 cps x 32 10 seconds.
55
32

Bat Photos.

Sat.
Nov 6 1960
Dave Chalander

Mr. Webster House
62 Coolidge Ave
Cambridge Mass.

Tri X 70 mm in Hulcher 10/sec camera.
TX477

f 22 Developed 20 min in DK 76 +.

Blue Background.

Background.

top view

2 or 3 ft

Cycles.

5 ft.

Cycles	
5	
10	
15	
30	
60	
120	

Super-Etc

	Background	Light	Lens
25 ft	Blue (Light)	200 w.s. one lamp.	f 16

Dr. R. Saxe.
Queen Mary College
London England.
gave a talk to the 6.202 students on

Mullard 1C Image Converters

Slow when too much voltage is applied.

5×10^{-9} sec pulse into Liq.

Spark voltage from liquid with breakdown stopped.

Pre-breakdown in gap with 3rd electrode
Spark seeds out pulse of hot gas
which quits delay in breakdown.

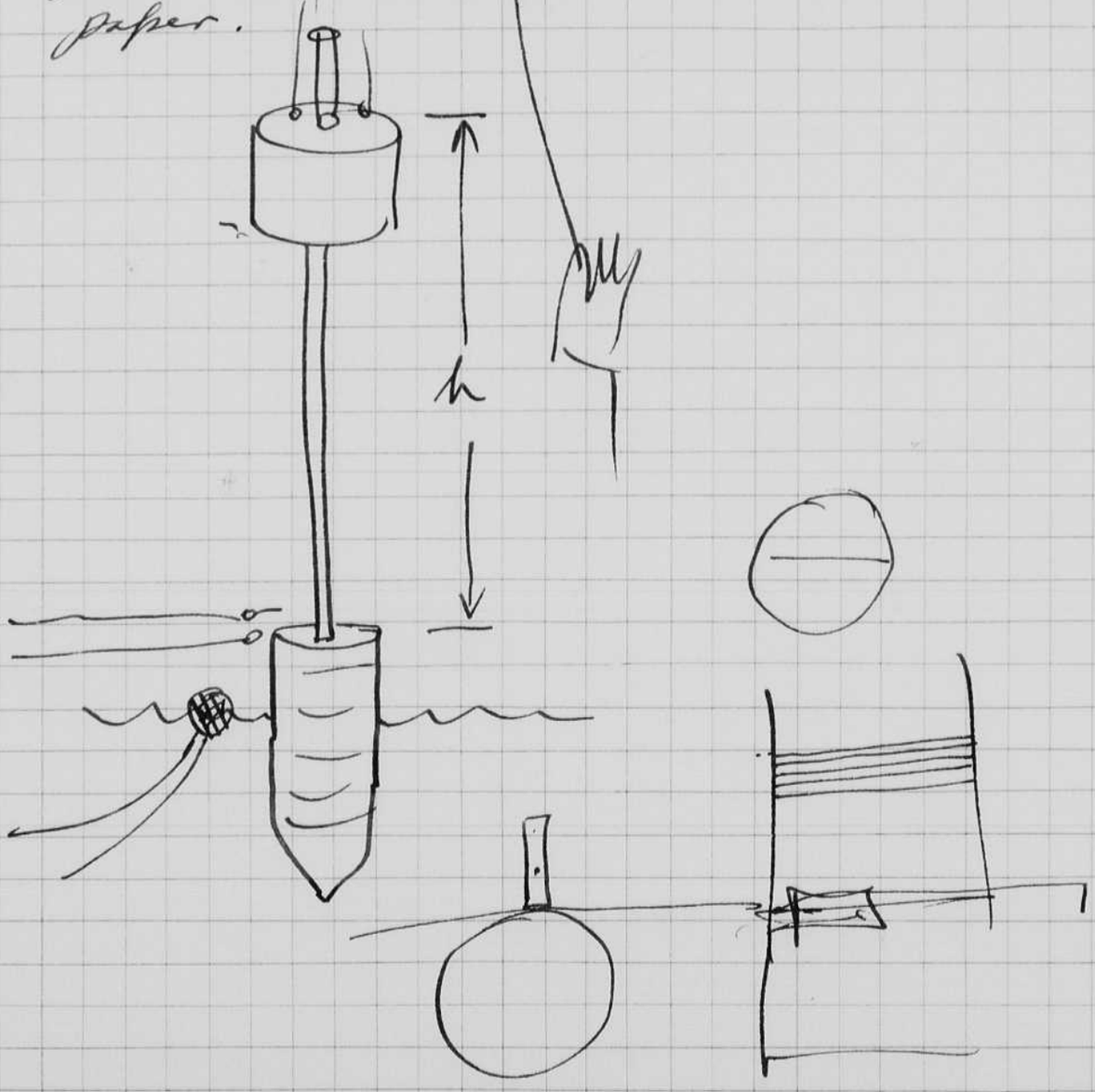
74 Nov. 23, 1960
Harold E. Edgerton

Sound Prospecting.

A good recorder of a portable type is needed for sound prospecting. The sounds could be made by a falling weight striking a metal post in the ground. The problem is to get the action to repeat and then to have quiet afterwards so the echo can be amplified.

Possibly the older recorder could be made with a stop and start arrangement so that the record is triggered by the impact. In this way, precise timing of the blows are not needed.

A linear motion stylus could be made to start when the blow is received across the paper.



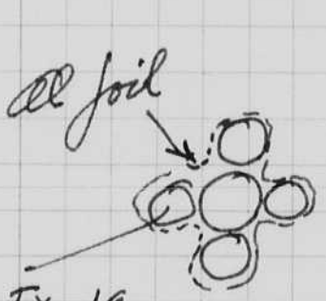
December 5, 1960.
Harold E. Edgerton

See note book of Mile (Perry) for data on Ruby crystal stimulation with the xenon flash. I suggested 4 FX-19 tubes to be placed in a square formation around the crystal. the length of the crystal was 2 inches and the flash tube length corresponded.

Perry and I are writing a paper describing the experiments. It was found that stimulation started at 400 watt seconds ±. The crystal did not operate when it was hot.

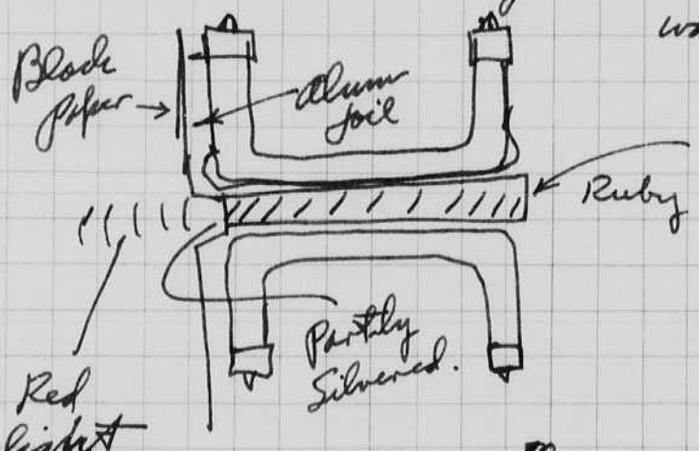
A single straight tube FX-33 with 200 watt seconds caused stimulation. a sheet of aluminum was wrapped around the ruby and the flash tube.

Dr. J. Courtney-Pratt was in Boston on one day last week to see the above experiments and to try out his ruby. The continuous radiation did not come out of this ruby. but there was lots of peaks.



4 FX-19 tubes in series on 80 mfd

0.1 cm⁻¹



$1\mu = 10^{-6}$ cm.
$10{,}000\,A° = 1\mu = 10^{-10}$

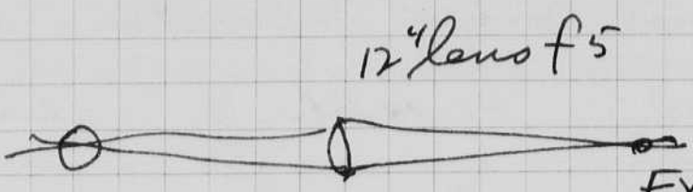
6923×10^{-10} cm.

$\frac{10^{10}}{6923} = 10^{6}$ cm^{-1}

7 76 Dec 6 1960

H. E. Edgerton
K. J. Germeshausen
Harold Edgerton

Gasoline Flame Photo
to show Carbon



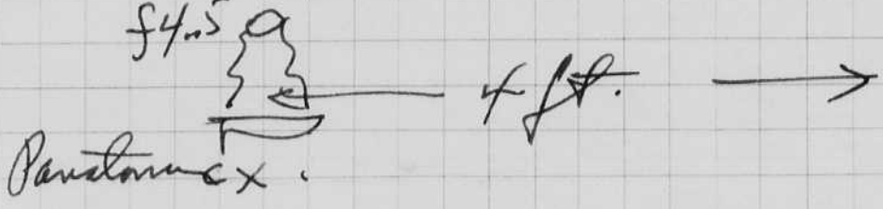


Photo shows spot on edge of gas from jet.
Also shows carbon above flame.

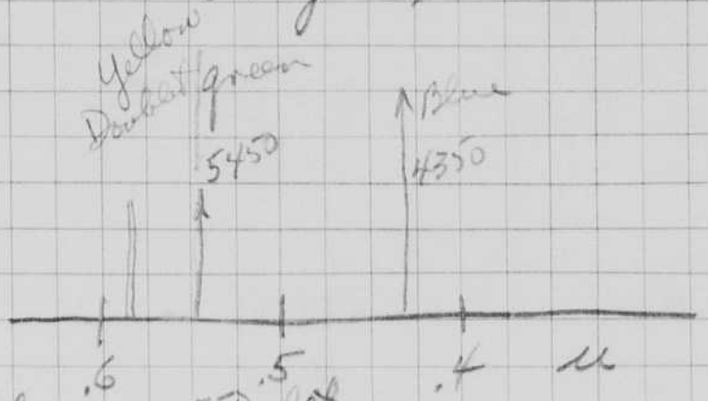
2nd test. 1/8" slot only about 4" from flame.
Lamps at 4 ft distance.
f 4.5 on Panatomic X film. 1/400 sec
Exposure too much on flame.
(1) Shutter exposure.
(2) Blue filter
(3) Blue Sens film.

Mercury arc lamps

Dec. 11, 1960

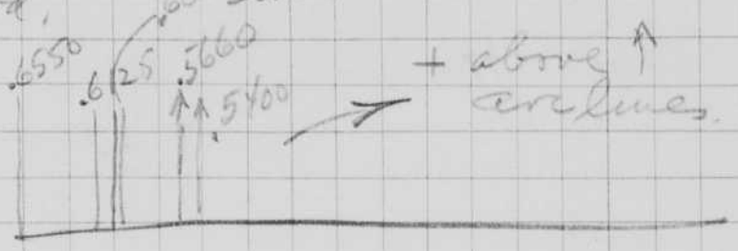
Hanalin tube
1" arc length Iron anode,
3 1/2" long. 1/2" diam Pyrex

Spectrum shows



DC arc lines.

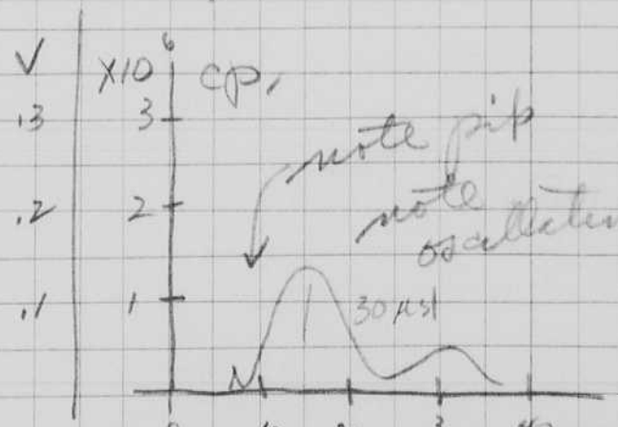
with 900 V and 15 mfd.



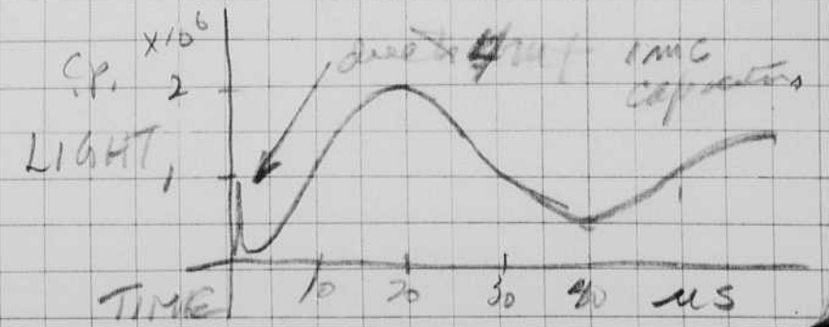
new lines with condenser discharges.

900 V 33 mfd Many diffuse green and blue lines.

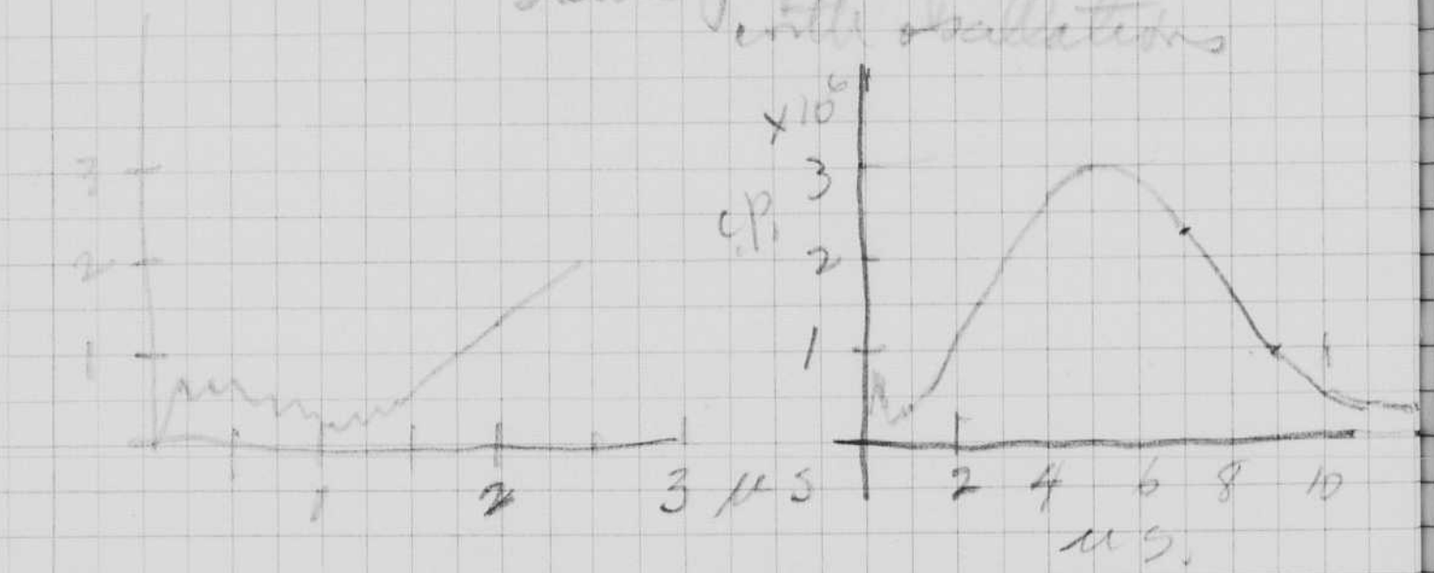
Oscillographs 37" 10 V per 10^6 cp.
3 mfd 900 V,
in switch-capacitor box as per Knife switches.



3 mfd 900 V
.4 hf condenser in parallel with lamp terminals



Mean 14.5 mfd 900 V.



Lamp tester #-409 ~~Helix~~
Bad Snow Storm Yesterday! Dec 13 1960
Cool - 16" Snow - Drifts.

Gaps.	Res Dial	V KV
1/20"	94	3.65
2/20	65	7.3
3/20	26	10.9
3.25/20	0	12+

V_s	V_a
94	600
65	370
60	350
40	340
106	2KV+
100	"
94	750
40	500

Assume 30,000 V/cm

12

$\frac{30{,}000 \times 2.54}{(20)} = 3650$

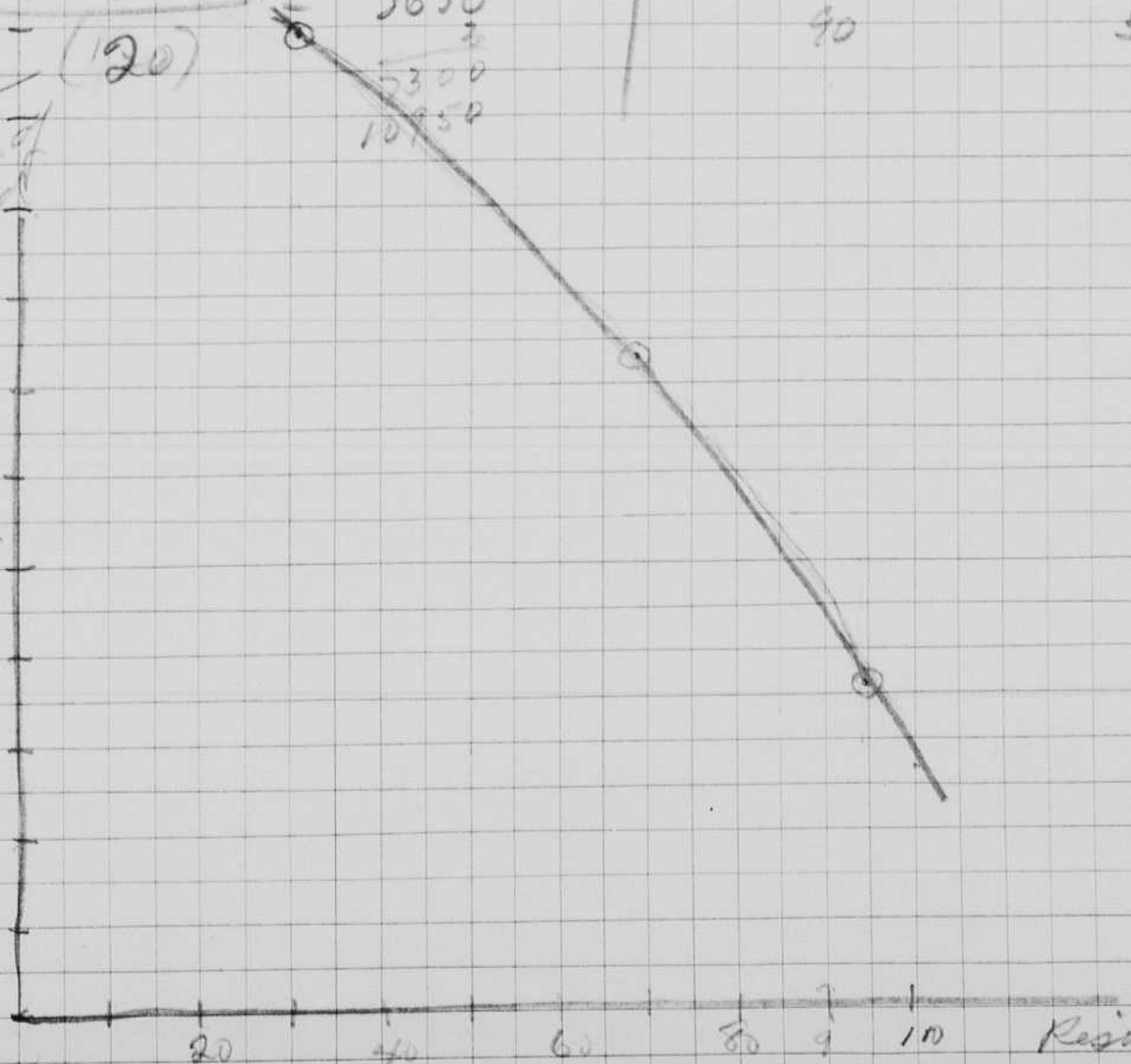
3300

10,950

To Hum of Hum

7

5



HERE WE COME STROBOSCOPING

Here we come, stroboscoping
Among the holly green;
Here we come, a-flashing,
So brightly to be seen.

Chorus:

Candlepower come to you,
And to you your strobe light too;
And God bless you and send you a happy new year,
And God send you a happy new year.

WE THREE STROBES

We three strobes of M.I.T. are;
Flashing bright, the darkness we mar.
Ionizing, oft surprising,
Photos we take afar.

Chorus:

O - Strobe of xenon, strobe of might,
Strobe with spectral beauty bright,
Fail us never; flash forever.
Guide us with thy perfect light.

Merry Christmas
from the
Strobe Lab

John Treadwell
M.I.T. 1960
4-405

Dec. 18, 1960 — Laser Exciter System.

Harold Edgerton

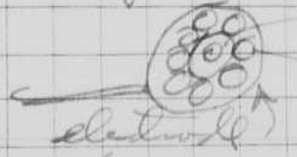
I have been helping Perry Miles with his experiments on the laser flash system the system I proposed and which would fire, consists of 4 flash lamps which are put in parallel with the crystal ruby as shown before on p 75.

there is a need to stimulate the ruby in a very short time. For this the arc on the surface of the ruby may be a most important method. This will be like the tube that John Treadwell and I developed for the micro flash equipment for bullet photography.

One problem is "How to start the arc?" For the system, there would be a problem of sparks bigger. We want the main arc to be on the crystal.

(1.) The ruby could have a hole in it for the spark voltage terminal. This is different to do to the ruby?

(2) another suggestion. Make series of ruby rods around a glass sparker



(3) a third system would be to use the mercury arc tube to help start the long discharge directly over the surface of the ruby.

Visitors to Lab. = Jerrold Zacharias, Edgerton, Germeshausen, Grier Assembly. Dec 16 '60.

Jan 1 1961
H. Edgerton
Carl Mooney.

type 550 and 551
Microflash S.N. 1.

Tubes.

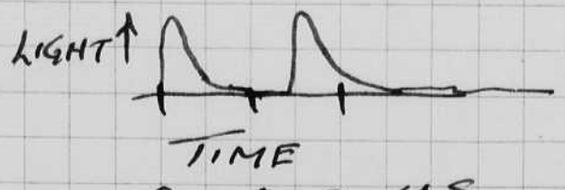
(1) Broke spark gap by flashing too fast.

(2) check of time delay.

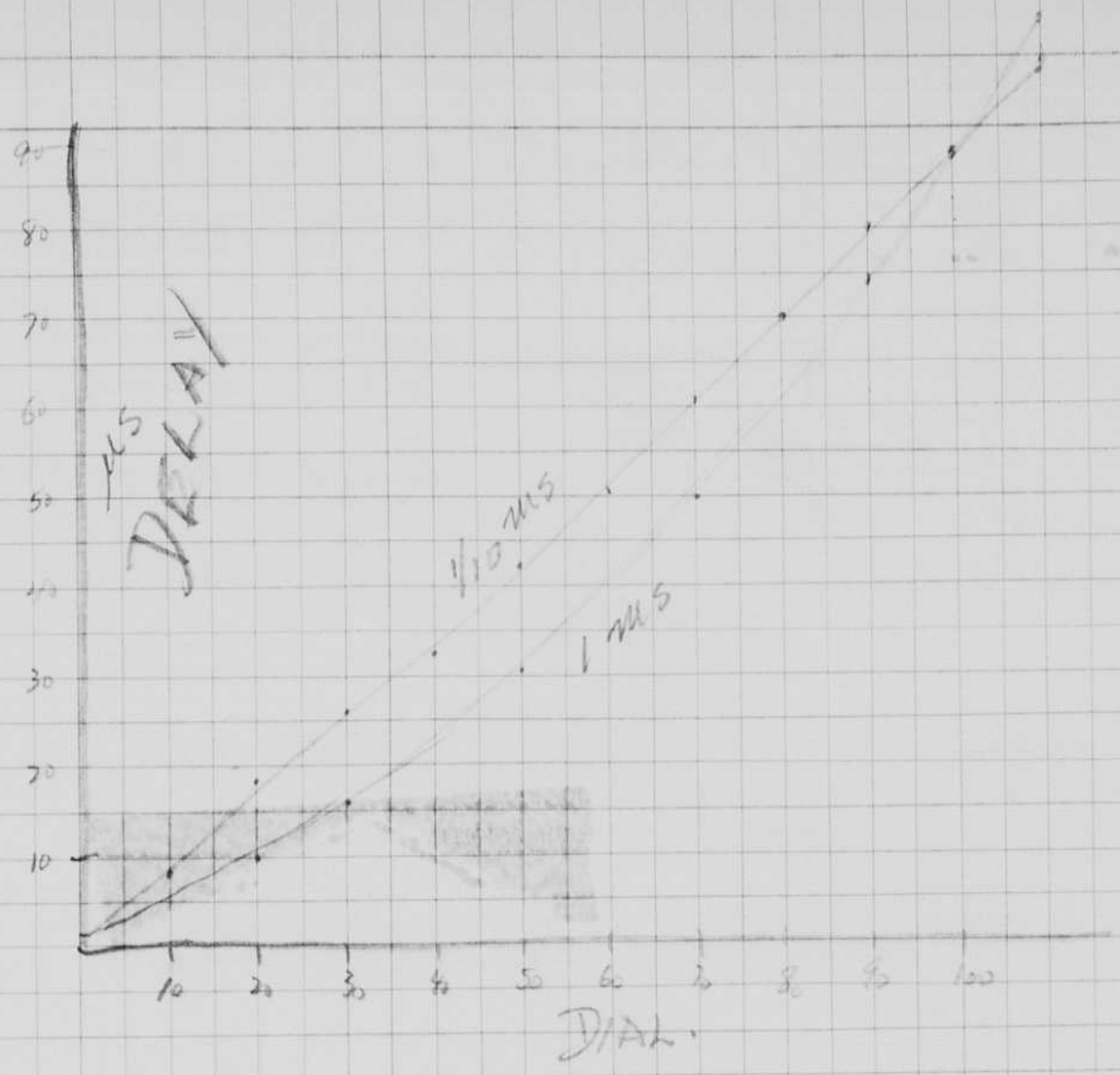
Scale		μs.	
X 1/10	~~20~~ 10	8	Broke glass insulator again. Blew fuse. 1 amp. replaced tube and fuse.
	20	18	
	30	26	
	40	33	
	50	43	
	60	51	
	70	61	
	80	70	
	90	80	
	100	90	
	max	100	

			μs
X1	max	1060 μs	
	10	.4 x 100 =	400
	20	1. x 100 =	100.
	30	1.6	160
	50	3.1	310
	70	5	500
	90	7.4	740
	100	8.9	890
	100	4.6 x 2	920
	max.	5.8 x 2	1160

Minimum ~~pls~~ delay with setting of zero = 1.5 μs,



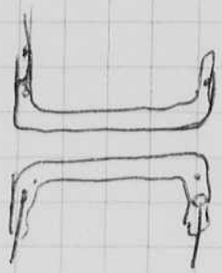
With weak light from #1 unit delay can be 5 or 10 μs.
Arrange for good look at flash lamp #1.

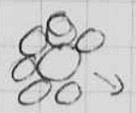

90
80
70
60
50
40
30
20
10
μ5
DELTA I
1/10 MS
1 MS
10
20
30
40
50
60
70
80
90
100
DIAL.

Laser Driver

Jan 9 1961
H. Edgerton
Bill MacRoberts

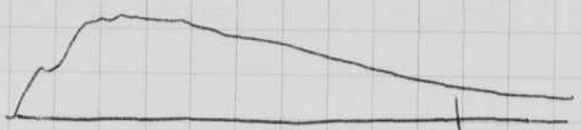
Completed last night a driver with 10 tubes type 100 down to 6 with a 1/4" crystal 5, 4, 3, 2, or 1 can be used.





6 tubes installed all in series

160 mfd 3000 volts



6 tubes in series

#1 x = 100 μsec per cm.
y = 1 volt/cm
2 KV. 160 mfd.

#2 x = 100 μsec/cm.
y = 5 v/cm.
3 K.V. 160 mfd.

#3 x = 100 μsec/cm.
y = 10 v/cm.
4 K.V. 160 mfd.

— 0?

6-tubes – 2 strings of 3 in series.

x = 100 μsec/cm.

#1 y = 5V/cm.
2KV.

#2 y = 20 V/cm.
3 K.V.

#3 y = 20V/cm.
4 K.V.

Full power 180 mfd 6 tubes.

KV	Peak V	Tube
2	2	

Jan. 15, 1961. The laser driver was tried by Perry Mills yesterday. He also was using 9 flashlamps of 9" length in parallel.

John Treadwell helped me take over 350 mfd 4 KV to add to his driver circuit.

Notebook # 26

Filming and Separation Record

2 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.

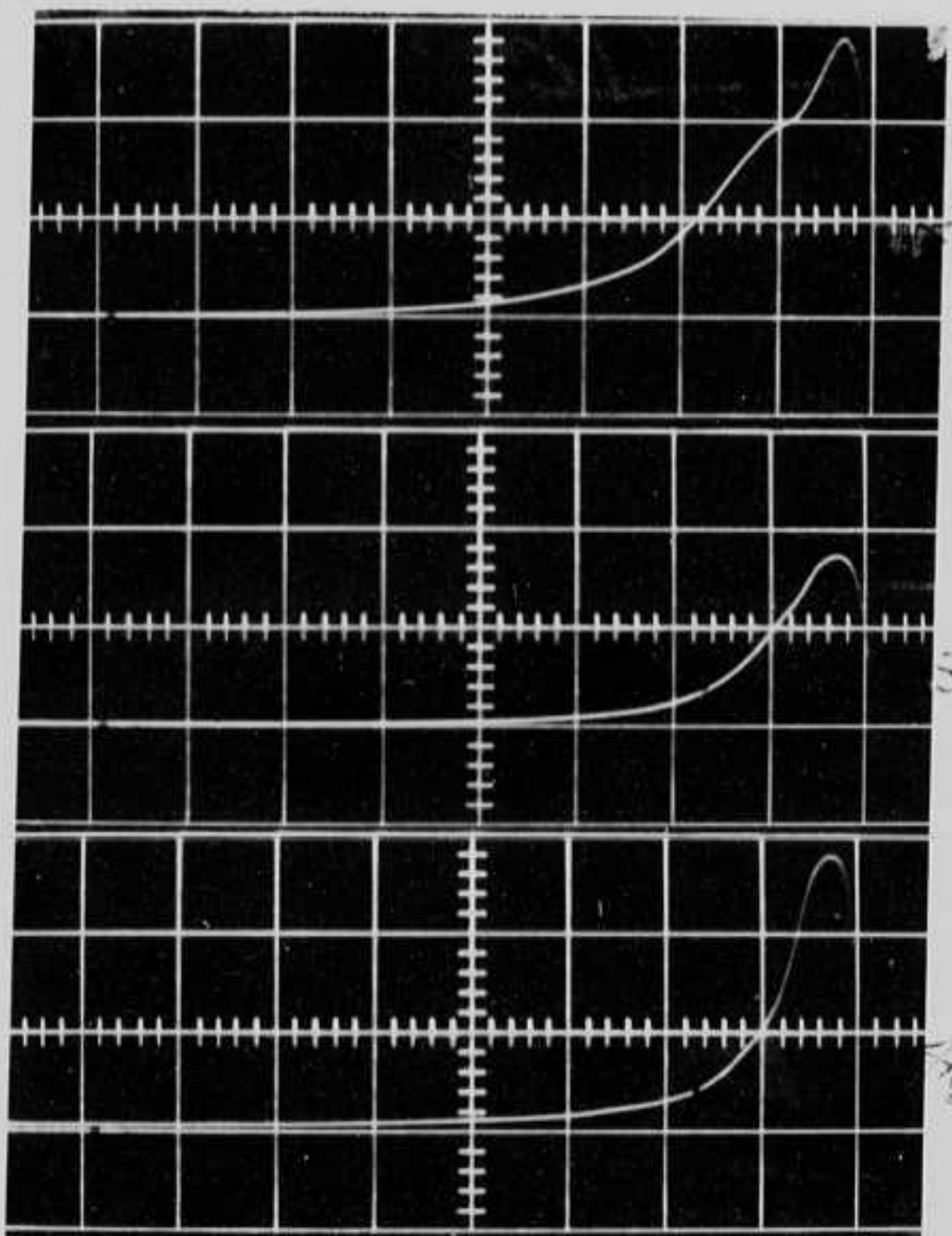
full power, 6 tubes

series

#	peak W	time down to 2/3 peak	
2	2	70 μ sec	1900
3	10	900	4000
4	20	300	6000

series/parallel

#	peak W	time down	
2	15	200	3000
3	35	150	5250
4	55	100	5500



6 tubes
series/parallel
Cathode

$\alpha = 0.1$ w.s.c

#1 2000 volts

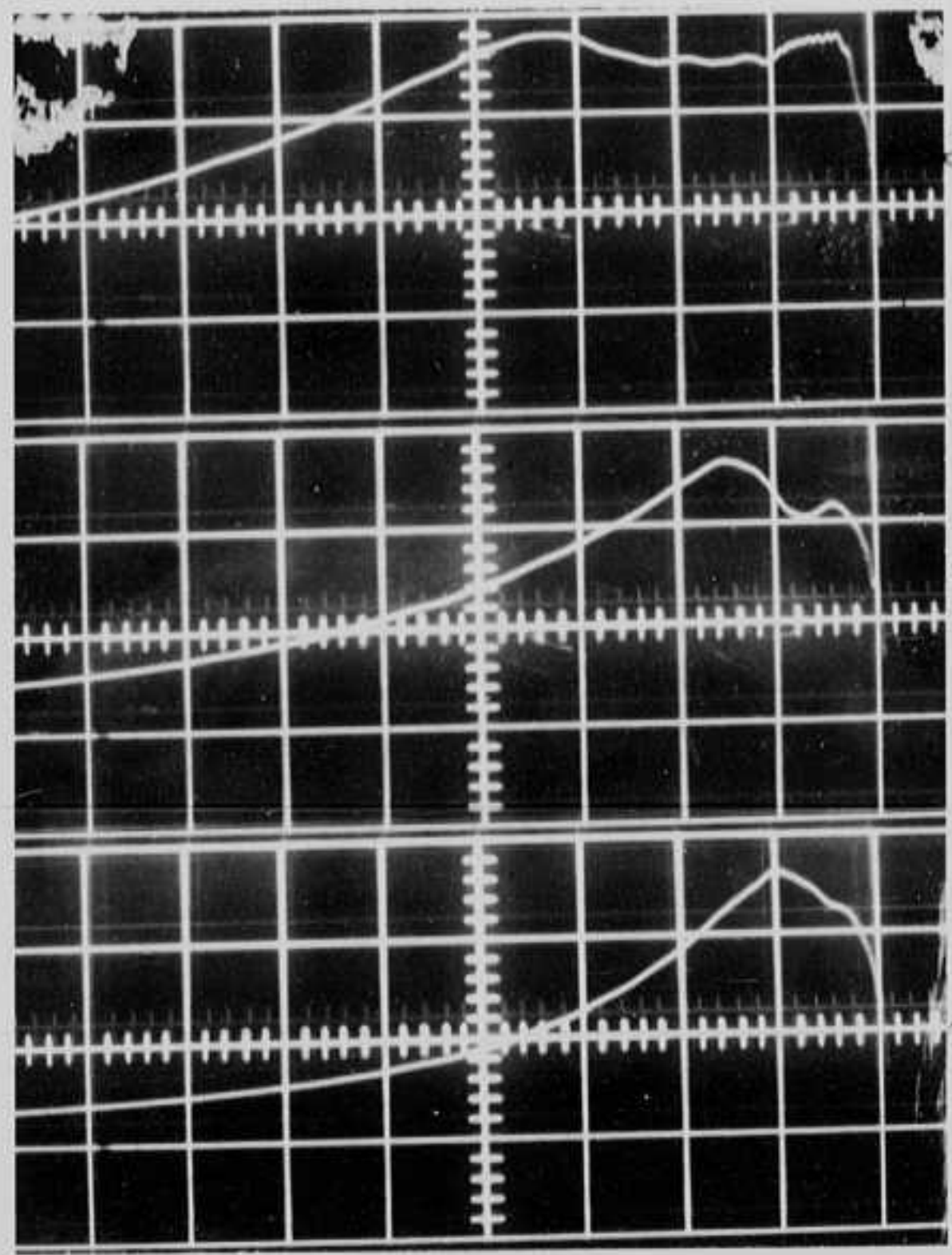
$\gamma = 5$ volts/cc

#2 3000 volts

$\gamma = 20$ volts/cc

#3 9000 volts

$\gamma = 20$ volts/cc



full power 6 tubes in series

X = .1 m sec

#1 V = 2000 volts

Y = 1 volt/□

#2 V = 3000 volts

Y = 5 volts/□

#3 V = 4000 volts

Y = 10 volts/□

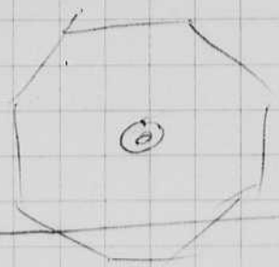
86 Jan 11 1961 Ed. Blank.

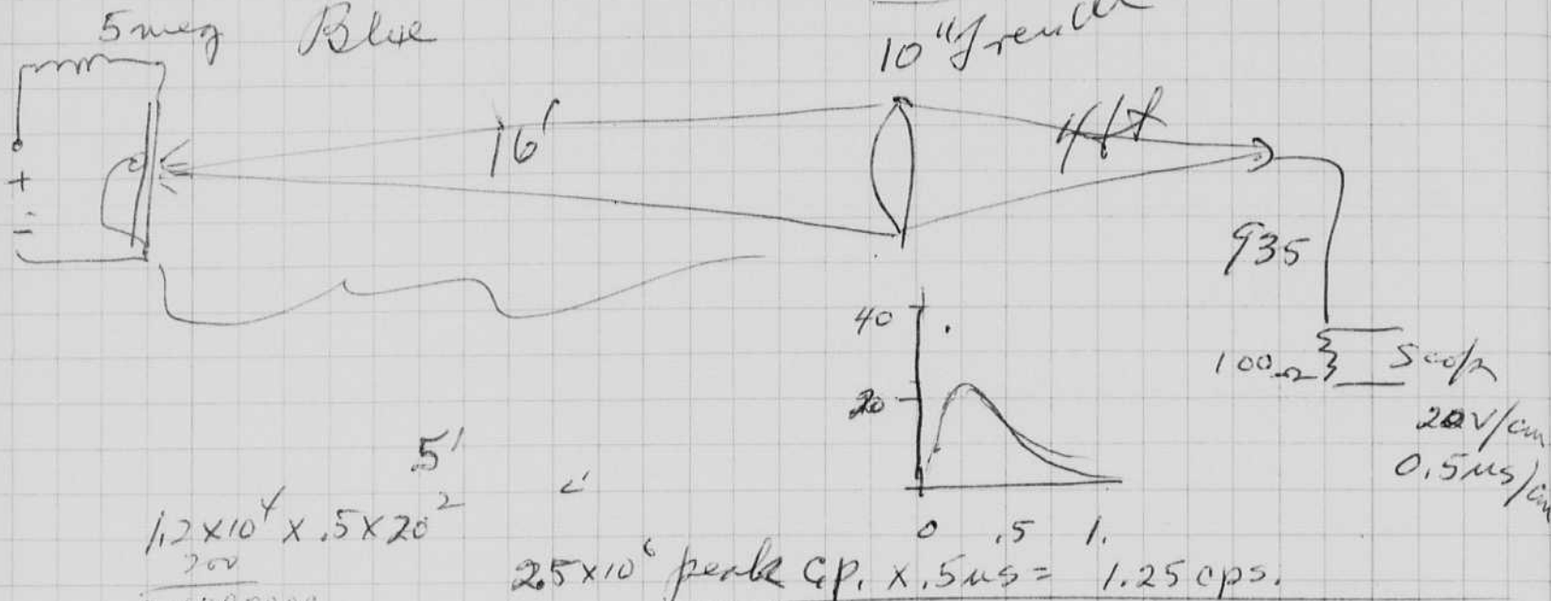
Ft Edgerton - Tube Deutschman condenser,

7.5KV Blue jab 0.086 $\frac{7.5^2 .086}{2} = 2.4$ watt sec

Self sparkover,

Brown. 0.085





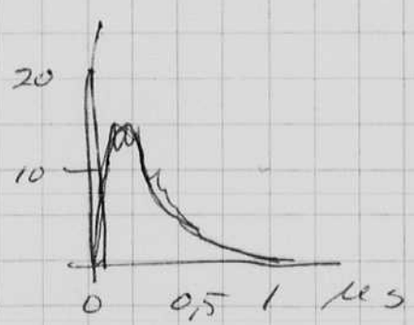
5'

$\frac{1.2 \times 10^4 \times .5 \times 20^2}{2 \text{ cv}} = 2{,}400{,}000$

2.5×10^6 peak CP. $\times .5\mu s = 1.25$ cps.

Brown. 5.7 KV.

0.085 mfd.



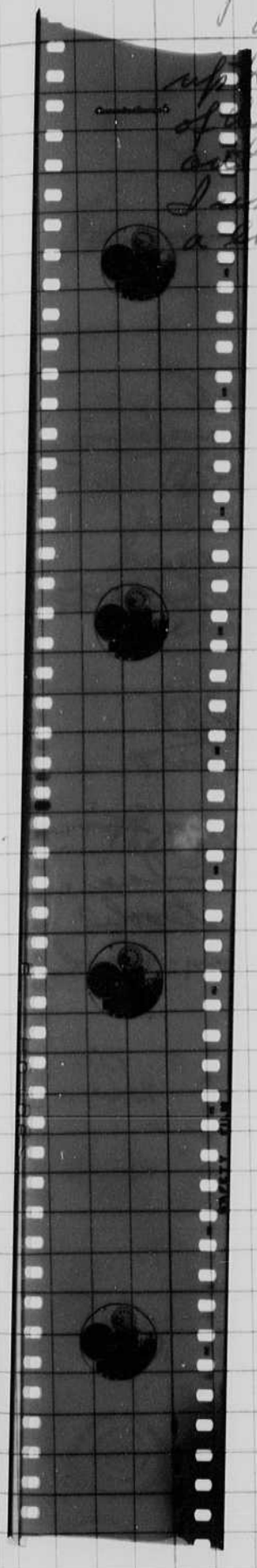
Jan 15 1961
H. E. Edgerton

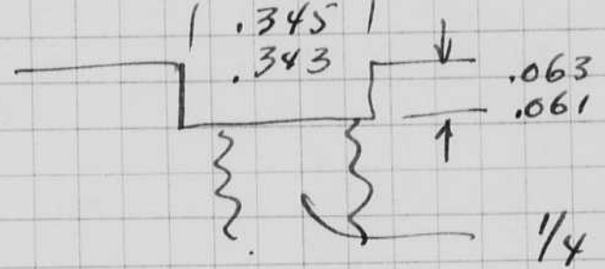
Pressure test.

a pressure test of camera no. 5. was made up to 17,000 p.s.i and return. Data was taken of the gage in the camera and on the out side. The inside gage reads slightly high. I used some ice to cool the chamber but need a bit more.

Plus x film f 3.5 25 volts input.
DK50 6 minutes.

Joy Plug.
Stainless steel type
X8372-103
314,976.





1/4 28
UNF 2B
7/16" min
depth.

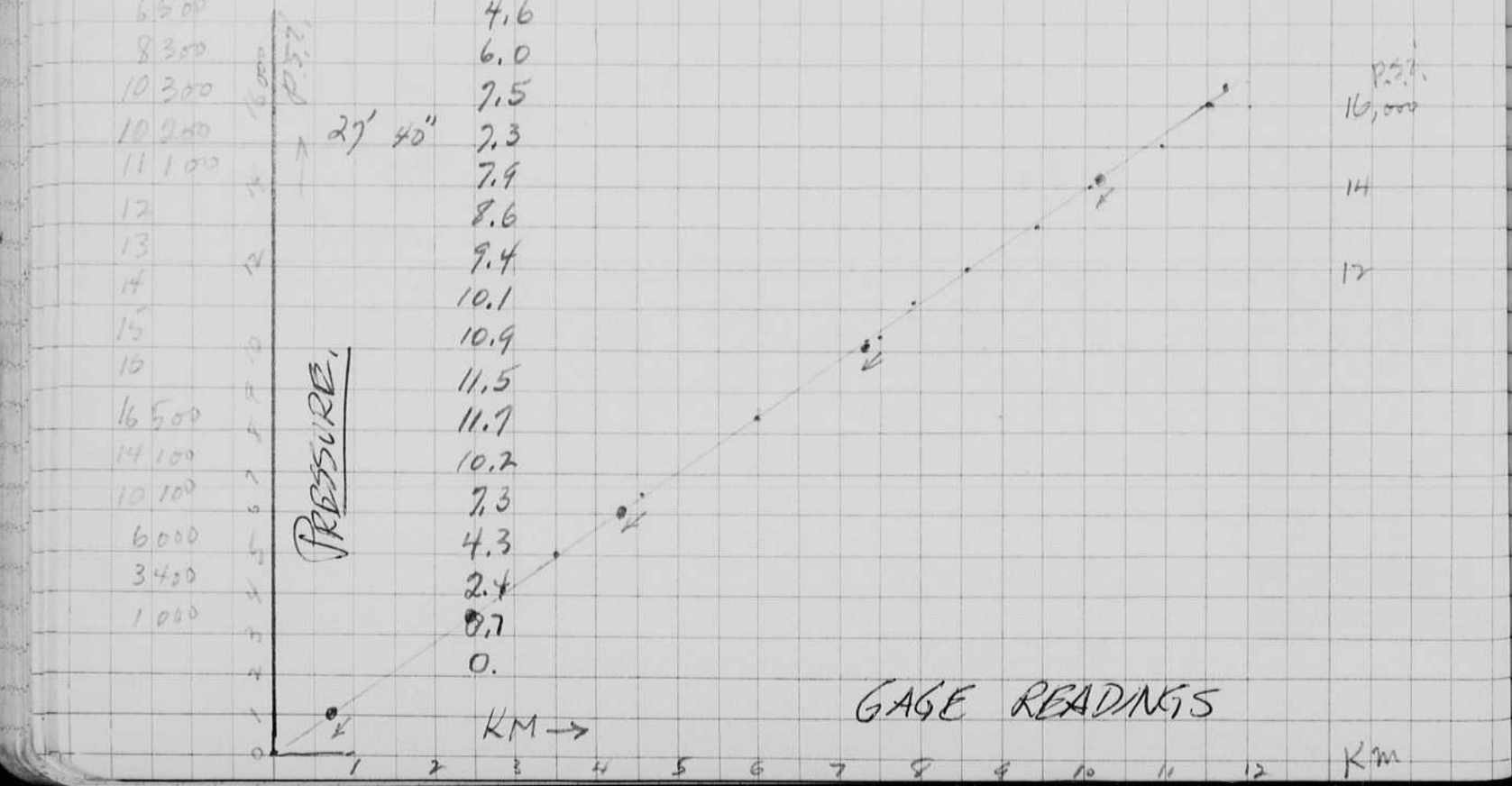
Jan 30 1961.
Harold E Edgerton.

Left Jan 25 for Cleveland at 7.30 am.
Lectured at Physics club at Case and stayed as invited by Fred Reines.
Fred is an old friend from Los Alamos and Eniwetok connections.
Jan 26 at G.E. Co Cleveland with Red Elmendorf, etc.
Jan 26 at Rochester N.Y. Wollensak Co - then EK Research Lab (Staud & Learnaker) also saw Julian Webb and others at the new Physics lab.
Saw Bob and Kin at new house on Westminster St near East ave opposite the Eastman house.

Tested 4 21" cylinders at 21,000 p.s.i.
17-4-pH castings, all came out fine.

Geo Keller of the Hydro Service was in Boston yesterday.
He visited the strobe lab with Sam Raymond.

Time		Km.
0		
4100	22h 22' 15"	2.8
5000	57	3.5
6500		4.6
8300		6.0
10300		7.5
10240	27' 40"	7.3
11100		7.9
12		8.6
13		9.4
14		10.1
15		10.9
16		11.5
16500		11.7
14100		10.2
10100		7.3
6000		4.3
3400		2.4
1000		0.7
		0.

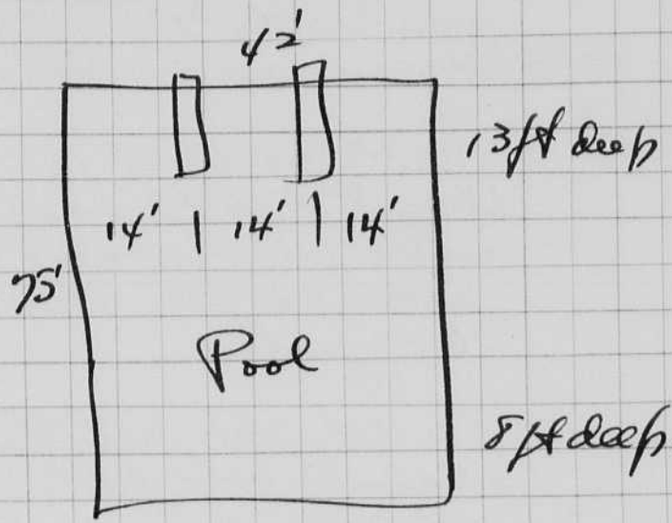


Jan. 30 1961
H.E. Edgerton

Gary Hayward and I went down to the Alden Co in Brockton to inspect the new Poor Mans Recorder that is due for delivery next week. Gary also wanted to see a spectrum device that was due to be delivered to the U.S.

Feb 5 1961 Dimensions of Swim Pool M.I.T.

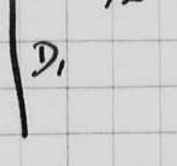
14' x .75 = 10.5'
13' x .75 = 9.75'



The camera is focused for 6 to 8 f/8. which should be ok for this test of the pool wall. f 4.5.

The camera ran fine. Focus is out at center of the field. Good at the edges. probably due to small aperture effect!

10.3 cm = 1 inch .75
7.5 cm = ?
.75 x 7.5/10.3 = .546/.728" = 1.38/1.85 cm. Image size of 1 meter rule on film.



12'/F = 100/1.85 1.38
F = 12' 1.85/100 = 1.38 .166 ft. x 12 = 1.99 inches.
2.66"
1.222
6.75 cm
= 4.88 cm.

Feb 16 1961

Harold Edgerton.

Feb 12 Brunswick Naval Air Base for flight in plane & observe a strobe light on the Submarine Croaker.

Depths of 0, 60, 150 and 260 were run with the strobe operating at 4 second intervals.

At 60 and 150 feet deep the range was about 8 to 10 miles on a dark night with an overcast at 1,500 feet. The range seemed the same both at 500 and 1500 feet.

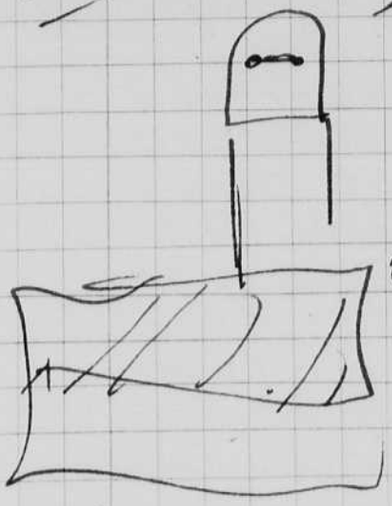
At 260 feet the lighted area was about 100 feet in diameter in appearance from the air plane.

The system seems to have great promise for signaling and for distress.

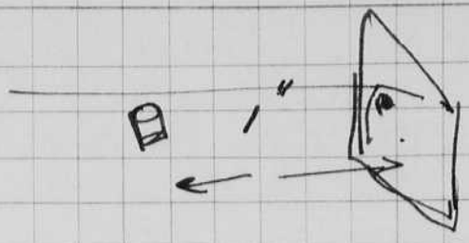
Cond. Newton from the New London submarine base was the observer on the plane. Mr. David from the Bur of Ships was from Washington to help with the tests. Lt Bells was the pilot.

Feb 20 1961
H. E. Edgerton.
Dave Eldridge.

Strobotac



4 ft.



~~Japan~~
Superhypan

Large light causes blur.

Feb 22 1961
Harold Edgerton

Gordon Mattrick and Dave Calender set up the IR Strobotac to measure distance last night
A 4 inch reflector was placed on the end of building of Bldg 26 at about 500 feet away. a voltage of 40 volts across 1000 ohms was obtained when the strobotac (7000 rpm) was put at the focal point of a 30" 24" reflector.
1000 V
1500 V.
Even with the standard Strobotac reflector about 4 volts was obtained?
a reflectance was obtained from the light brick wall of Bldg 24 at 300 feet using the strobotac and a photomultiplier at 1000 volts

This morning Gordon Brown and Engineering staff meet from 930 until 12 45 in Gregg to discuss Feedback and Metallurgy.

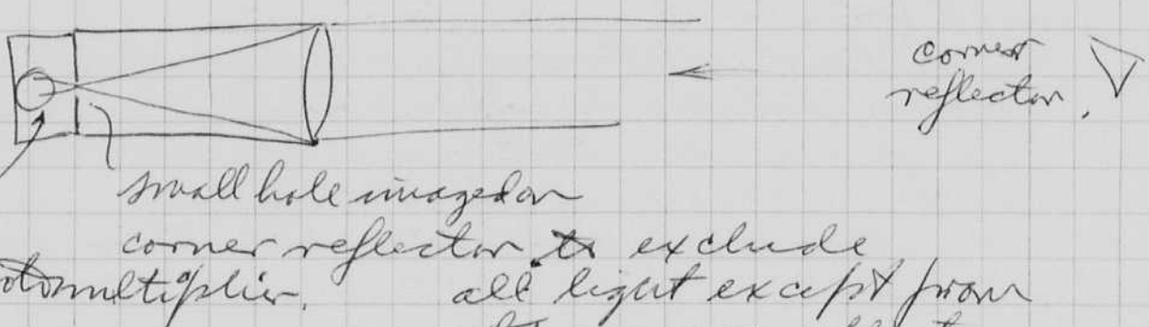
I worked with Perry Miles this afternoon on photography of a laser crystal, Data is recorded in his note book. He showed me his 2 inch ruby laser and oscilloscope taken of its stimulation,

Feb 26 1961

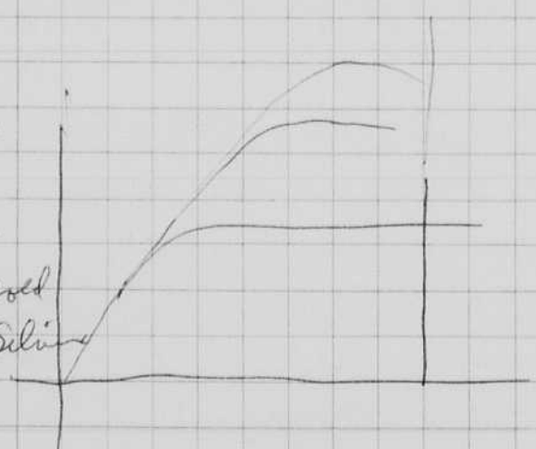
V. Dexter

The deep sea cameras and lights (200 WS size) are about finished for the FNRS III. I am testing all items to 20 000 for 12 hours. Now I am installing 1/32" Buna rubber gaskets of durometer 90 rubber. After a pressure test of 17000 p.s.i., the excess rubber that extrudes is cut off so the lamp can go into the glass.

Buttrick is continuing the work on the beam of light and the time of flight of light. We plan a longer path for the longer test.



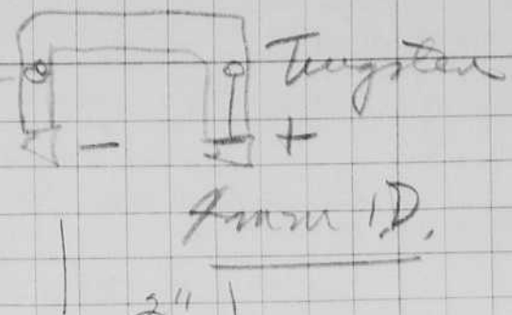
0 Brown
1 Black
2 Red
3 Orange
4 Yellow
5 Green
6 Blue
7 Violet
8 Gray
9 White



Nov 5/96 Osc of Type 100 flash Tube
~~#50 Letter~~

Osc. 20 ms/cm 2.5 c.p. x 10⁶ / cm

V = 1400
C = 100 mfd.



4 and 5

2.7 cm
2.5 cp x 10⁶/cm
135
54
6.75 x 10⁶ c.p. peak from 100 mfd at 1400 volts.

Peak Duration = 4 x 20 = 80 micro seconds.

1	100	about 1 sec exposure of Reticules
2	85	
3	65	Scope 545 9059
4	50	Tektronix.
5	100	f1.5 lens at f 3.5
6	75	Plus x film.

Scale set at 25% for 5 to 1 sec exposure f 3.5.

Spread of all pegmatites taken at
100 mfd at 1400 volts.
20 ms/div
2.5 cp/div x 10⁶

Exposure seems ok. on all

Spark 50 ms/div.
.5 volts/div into 10/1 divider.

70,000
2.6 1000 Ω 4.8 V 60
6.3 80
8.1 100
10. 120
11. 140
12. 260

$i = \frac{12V}{1000} = \frac{1}{100}$ ma = 10 ma.

$\frac{10,000 x}{144 x 2} = 35$ lumens.

$\frac{10,000 \text{ ma.}}{35 \text{ lumens}} = 286$ ma/lumens.

94 March 6 1961 Maser laser experiment

H. Edgerton
Perry Miles.

Set up 80 mfd with 4 type 100 lamps in 4-410 m apt.

The EG & G ruby with Silor ends gave a brilliant pulse of light on the wall.

Several experiments were tried of exposure with and without a lens. A Red filter is needed!

March 7, 1961
Perry Miles
H. Edgerton
Gordon Gullmark

Crystal with coating from Billings was tested by Miles. The threshold was 2.5 kV with 80 mfd and 4 type 100 lamps.

The pulses were about 1/5 μs in duration. This is about the limit of the Tektronic 545 scope amplifier.

Perry Miles H. Shapiro 4-410

March 9th 1961

Ruby crystal comparison.

925 with Red filter #29?

Distance 150 cm.

Film No	Crystal 2" × ¼" (dielectric multilayers)	R	V/cm	μs/cm	Capacitance 80 μfd at voltages.
1		100	2.	1 μs	2.5 KV.
2.		100	2	1 μs.	3.0 KV.
3		100	2	5 μsec	3.0 KV
4		100	10	5 μs	3.0 KV.
5		100	5	20 μs.	3.0 KV.
6.		100	10	20 μs.	3.5 KV
7		100	5	100 μs	3.5 KV.
8.		100	5	100	4.0 KV

(A) 3 KV Super-pan Press film type B. for contact spot plates at 3.80 meter
Red filter one Tissue.
the filter was added Ruby and subject leave listened the explain

(B) 2.8 KV Repeat with no filter at 3.8 meters.
7 minutes Fine DK50

Mar 9 1961
G. Stafford
Dick Shelton

Stabistor output

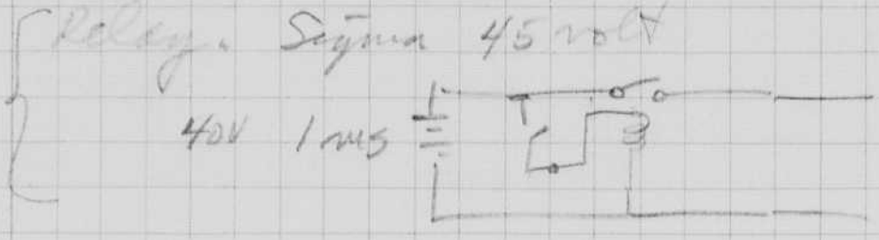
939 plotatube 3" input of SR Stabistor 631B
Low Speed amp

R	V/cm	ms/cm	
100K	10	10	Shows effect of capacity on output.
10K	1	10	
1K	.2	10	
0.1K	.05	10	

545 Scope input 1.5 volt with Snap Switch.

1 Same,
2 " "
3 " "

Relay. Sigma 45 volt

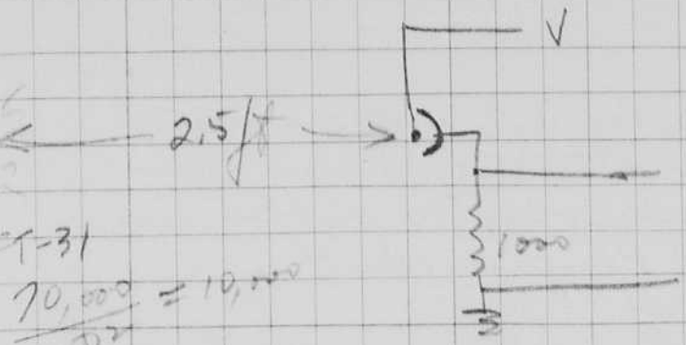


Clair Relay, on marking o/p. 20V 1 ms/cm.

Raytheon on 1 ms/cm
Sigma off

Plotatube 939 100K Resistance
RC = 14 ms.
$C = \frac{14 \text{ ms}}{10^5} = 140 \text{ mmf.}$
Input to Scope = 20 mmf.

SR Stabistor 1531 on 3600 scale
1000 Ω 5V 1 ms/cm



300 − 4.2 X 5 = 21 volts.
160 − 3.8 X 5 = 19 volts
140

$I = \frac{E}{R} = \frac{21}{1000} = 21$ ma.

FT-31
$\frac{70,000}{D^2} = 10,000$

Ditton tubs used Salmite at 100 volts with 15 ma.

$15 \text{ ma} = \frac{15000 \text{ ua}}{75} = 200 \text{ ua/lumen.}$

200 mfd at 400 volts with FT-31 at 2.5/ft.

Oscillogram 0.2 v/cm 5 ms/cm.

925 + 106 1K

$\frac{.6 \text{ v}}{1000} = .6 \text{ ma}$ with filter $\frac{160,000}{}$

the filter factor is about 16 $\frac{600 \text{ ua}}{35} = 18 \text{ ua/lumen}$

18 ua/lumen if lamp is 160,000

March. 31. 1961
Harold Edgerton.

Left Mar. 22 for Berkeley after the annual meeting of EG&G. (Sheraton Hotel). this was our first annual meeting following the public issue.

Mar 23 Berkeley at Physics meeting on masers - quantum mech.

Mar 24 Santa Barbara to inspect EG&G. met many from city, Humphry (Raytheon) (Hoffman) Potter (Gen Motors) etc.

Mar 25. Again at Berkeley.

Mar 26. Sunday at San Diego with D.C. Jensen, Andrew Rechnitzer & talk Bailey's triple camera installation.

Mar. 27 Cont. at San Diego at N.E.L. also visited Wyle lab in Los Angeles.

Mar 28 arrived in Boston 825 on TWA Jet via Baltimore.

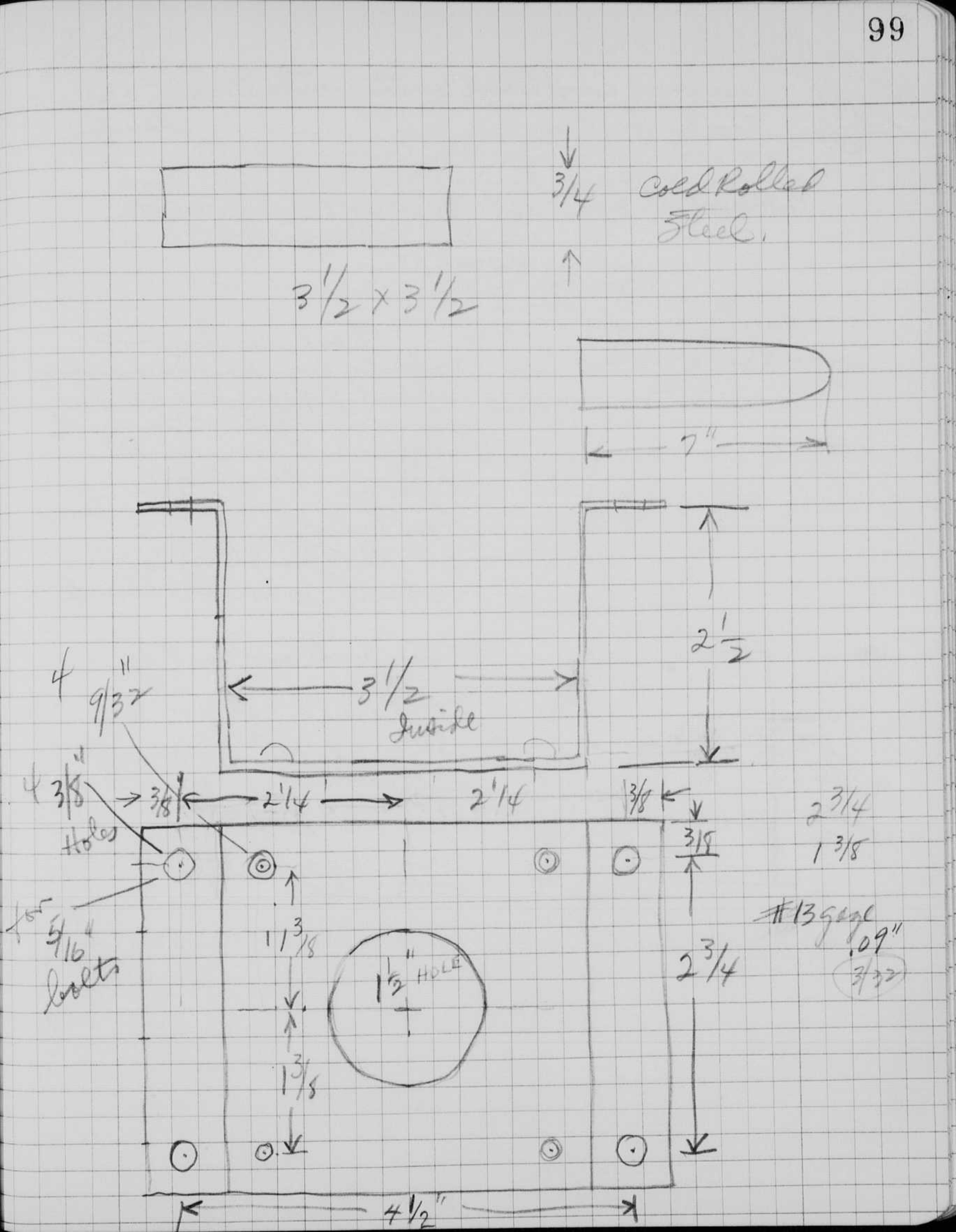
Lamp designed for Bailey triplet
3/4" cold rolled plate
1 1/8" I.D. Pyrex 7" end to end.
300 watt 30 volt. T-10 lamps DZ
Projection bulbs.

(500 watt 30 V T-20 bulb also available - Regina. longer glass. 2 1/2" diam)

Triplet. 1 1/2 - 7 3"

(700 watt 30 700 T-20 9 1/16 length.)

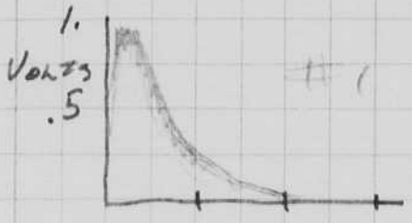
3100 (100 watt 20 V (PH 100 T-185C) 3 5/8
BYD. 25 hour.
7/8" diam)

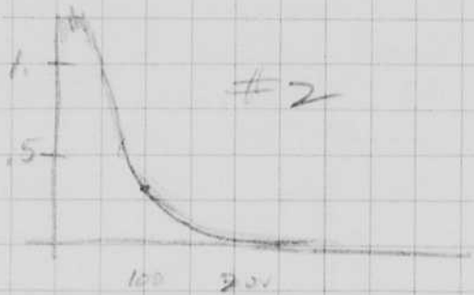

3/4
Cold Rolled Steel.
3 1/2 x 3 1/2
7"
2 1/2
4 9/32"
3 1/2 Inside
4 3/8" Holes
3/8
2 1/4
2 1/4
3/8
3/8
2 3/4
1 3/8
#13 Screw .09" 3/32
for 5/16" Rivets
1 3/8
1 1/2" HOLE
2 3/4
1 3/8
4 1/2"

April 3 1961 Photo output.

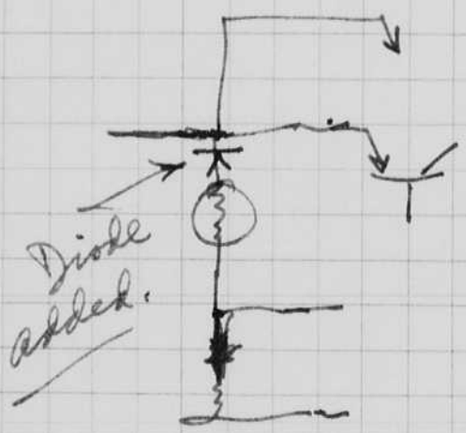
~~H~~ Bird units with new FX 33 lamps

Photocell at 3 ft. C.P. = 3.42 x voltage. x 10 filter.
100 ohms. (new unit)
Visual filter.





These units were made by Ray Swanson about 5 years ago for Greenewalt. The units were not finished because the flash duration was considered ~~to~~ long.
The Duration is about 70 microseconds



the peak output is
1 volt x 3.42 c.p. x 10 (filter) x 10^6
on subject at 3 ft. = $\frac{34.2 \text{ c.p.} \times 10^6}{70 \times 10^{-6}} = \frac{34.2 \times 10^6}{\text{peak}}$
23940 c.p.s. ~~at 3 ft~~.

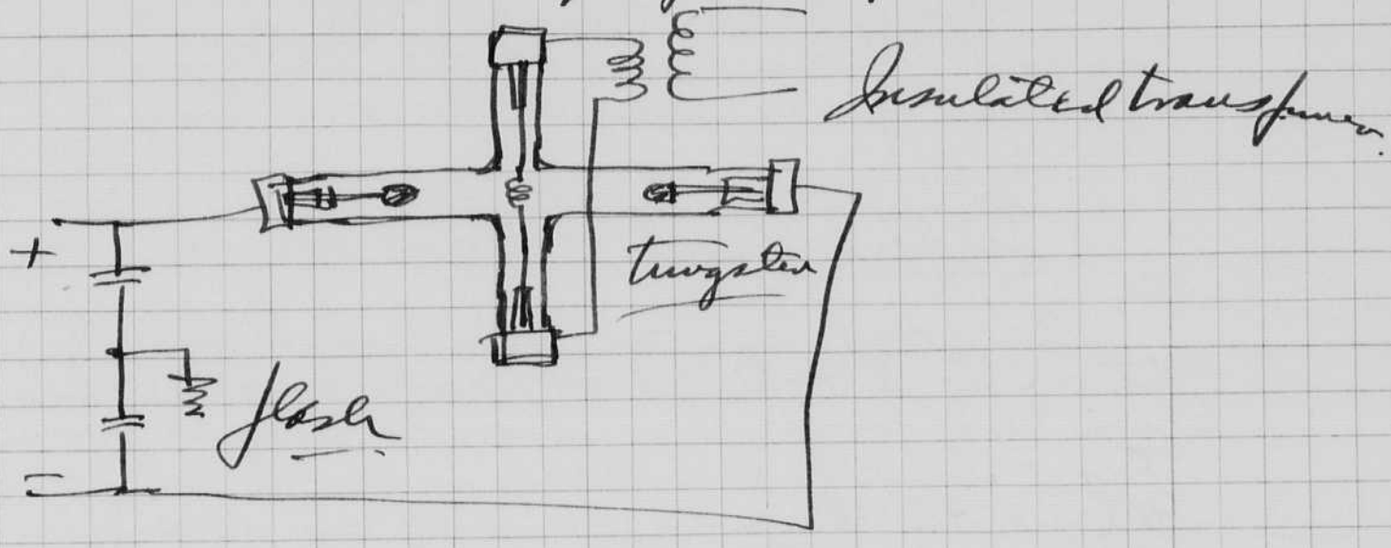
Avg. 2400 c.p.s. output.

April 8, 1961.
H. E. Edgerton.

100th anniversary of M.I.T. now going on.

The microscope illuminator does not work very well with phase microscopes at high power. The tungsten and xenon are too far apart.

Combined design of lamps.



 April 20, 1961

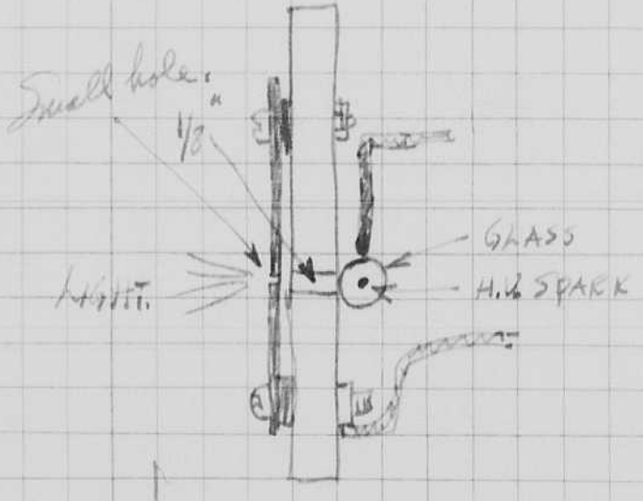
Harold E. Edgerton.

Yesterday I went on the 8am plane to Washington. At the Nat. Geo. Society I saw all my friends and then went with Constant, Dugan, M. Grosvenor, Payne, Simons, Ruth Dugan, etc to the white house. Here Pres. Kennedy gave Constant the Hubbard medal on the lawn of the White house.

Mary Ellen Payne, my niece was at the luncheon at the Statler Hotel. This party was given by the N.G. Society.

Light output of point source.

An adapter was finished today to fit on the 549C microflash unit which would produce a small bright source. First the regular lamp is removed from the unit, then a gap with an absorbing hole is inserted. A glass insulated rod is used to insulate the trigger potential.



Lamp-photocell = 5ft

0.4 volts peak.

1 kilohm

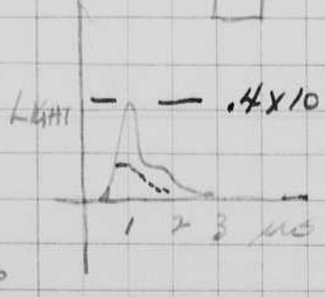
929 phototube

Wratten 106 filter

Peak cp = 0.38×10^6 cp.

Duration = 1 μs

Output = 0.4 c.p.s.



5×10^6

$.5 \times 10^6$

2.5 cps instantaneous

There was about a 2 to 1 variation probably due to the space variation of the arc.

On April 17 I was in Philadelphia at the Geographical Society of Phil where a ~~[illegible]~~ dinner was held for Cousteau. I sat next to Louise Boyd

210 Post St San Francisco.

She had made many arctic expeditions. 1931 - 33 37 38 41

Admiral Colbert & Co. C.
Pierre Balland - French Consul
Emil ~~[illegible]~~ Bagnan - Liquid
Mack McLean
Mrs. Marie Peary Stafford.
Dr Walter A Wood. Pres. Amer Geo Soc. N.Y.

The students at M.I.T. pulled off a surprise party for me on Tuesday April 15. at 4 pm a big cake appeared with a colored bullet flurt on the top! Then ice cream came out for a real party. It was a belayed birthday party.

Apr. 26. Cousteau showed the Silent World in Kresge at 5 pm at M.I.T. then there was a dinner at the faculty club and he showed movies of the amphibia and the diving saucer. about 100 people were there.

104 MAY 1, 1961. 4-405 Spark Gaps.
H. Edgerton. M.I.T.
Cambridge Mass.

Fine Grain Release film. ASA 16?).

no.	Exp.	f			
1.	10 sec	2	2"	3X	Gap of 1/8" short. – no flash Paper
2	1 sec	2	2"	3X	" " " " no flash. "
3.	10 sec	2	2"	3X	" "
4	1 sec	f	12.5	3X	Background only – .05 mfd 76,000 v
5	10		12.5	"	Spark.
6.	5		12.5	"	Spark.
7			12.5		Zero delay
8			12.6		Zero delay.
9			12.5		10
10			12.5.		10

Line up on axis of light.
off axis.

11.			12.5	10 on Delay dial x 0.1 ms.
				0
				5
				10
				15
				20
				0

---

f 3.5 35 mm lens now neutral density.

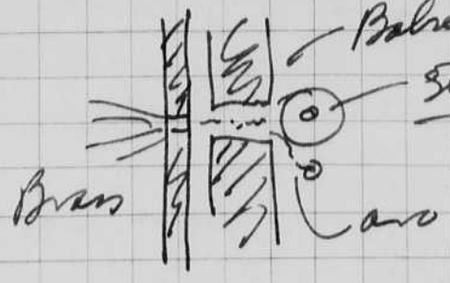
12	5 sec	f 3.5	Paper back of arc.	no body light.
		–6.3 Stell	"	
		6.3.	"	
		18.	"	

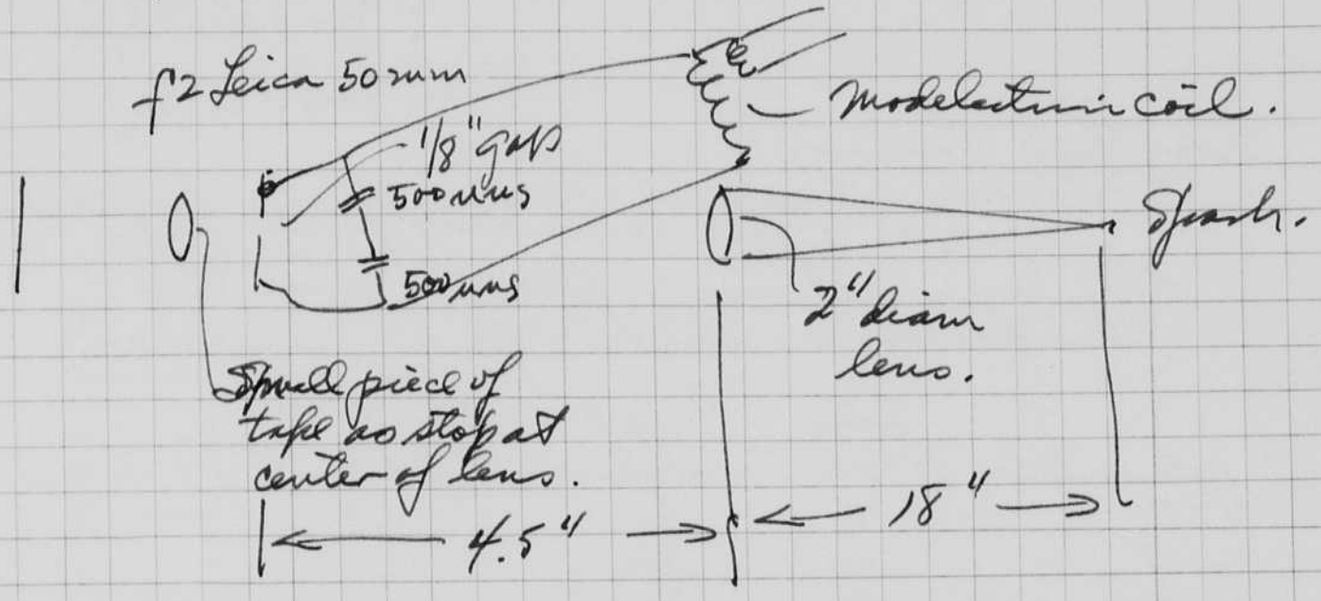
5	18	no paper no back.	0 delay
5	18	Back light	0 delay
5.	6.3.	" "	0 delay.
	18		0 ms.
	18.		3 ms

May 7 1961 4-405 MIT

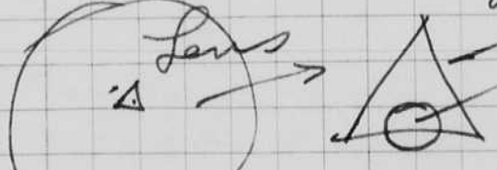
A E Edgerton. Spark gaps.

Cont. Cranz's experiment. Idea - Reduce aperture of spark light. Do this since the spark gap has a depth of light.





Spark image on tape stop on objective lens was focused sharply, then the spot was moved to the edge for some light.

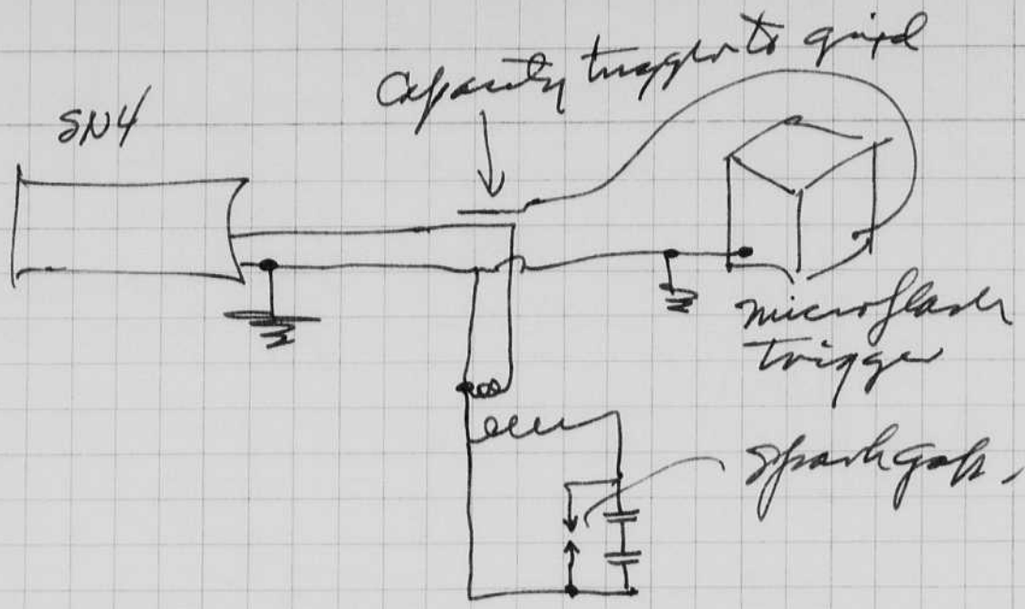


Iris	open.	Filter.	Delay.	Light
2-6	9	Pos.	0	
7-10	"	Slow.	"	more light.
11-15	"	"	"	Less.
16-19			10	"
20-25			20	
26-31			30	
31-36			60	

Dial	μs.
10	= 14
20	= 27
40	= 49
60	= 73
0	= 5 ?±

Photos at "0" show shock wave. Light Spark is dull. Try better trigger for primary.

June 7 '61
cont.



Another change

The spot of tape was taken off the front of the lens. I now plan to use the diaphragm edge.

	f	Delay	Light
1-5	12.5	0	~~High~~
6-11	"	10	Same.
12-15	"	20	Same
16-20	"	30	Same.
21		0	Less light
22		10	"
23		20	"
24		30	"
25-32		0	none
33-36		0	Same

f Trigger level set close to self fire.

3 15

Infra Red Camera.

f 2.8 focus at 12 feet, Visual.
Hico unit 4 - 250 mfd capacitors at 450 V.

Infra Red film HIR 417. High Speed. Kodak.
Dark filter 87c?

14 ft to door.
24 ft to back wall

Camera was set on the ventilator on the north wall.

8 minutes. in ~~DK~~ Dectol 1:1.

The last few photos were made with ordinary light in the room.

Lugust "OL 3 1000.575.

Army Chem Center.

capacitors 100 WS, 10KV, midtap Grounded Aerovox PX50 I 17 60523616.

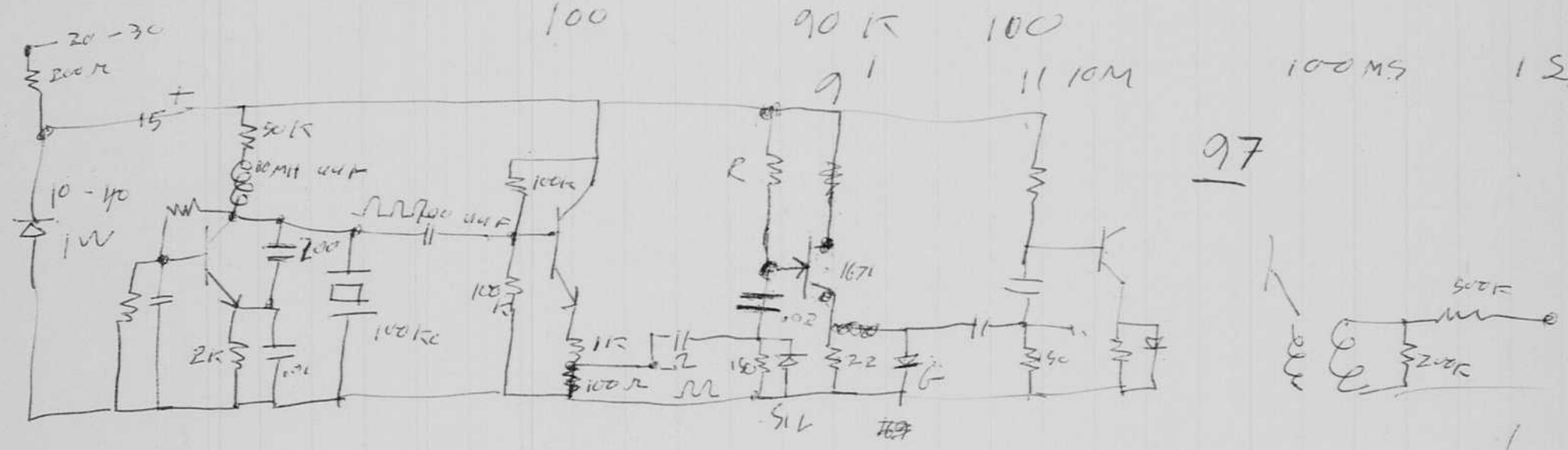
as used by John Tredwell. 2 us flash. 200 WS, 10KV, 2 2 10KV. aerovox PX 5055 60442891

at Arm Chm center.

7200 joules.
10 us flash.
Long afterglow. in tube.

$\frac{2 \times 10000^2 \times 10^6}{2} = 100$ with sec.

output pulse for



100 90 K 100

9 1 11 10M 100 MS 1 SEC

97

2N117
SIL
@ 9½

2N1694
2½

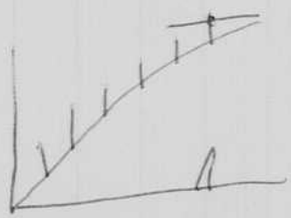
$V_p = \eta V_{BB} + V_D$

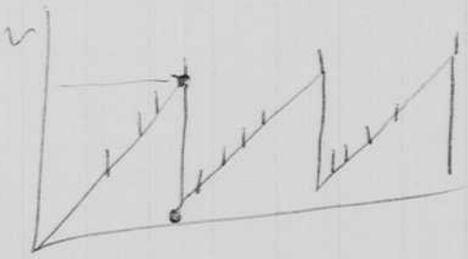
1.000040

6-E
1671 B

η = .47 - .63

R_{BO} 4.7 KΩ - 9.7 KΩ





S/M/C

5 UNIT
1 BUFF
1 OSC
1 XTAL
1 ZENER
1 TRANS

1) WRITE ~~RINGER~~ TIME PAPER
2) ENG PROP ROCK
3) CONST ROCKS
4)

Luigust" OL 3 1000.575.

Army Chem Center.

capacitors 100 WS ⟂ 10KV ⟂ ⟂ 10KV midtap Grounded Aerovox PX50 J17 60523616.

as used by John Trowbridge. 2 us flash. 200 WS ⟂ 10KV 2 2 10KV. aerovox PX 5055 60442891

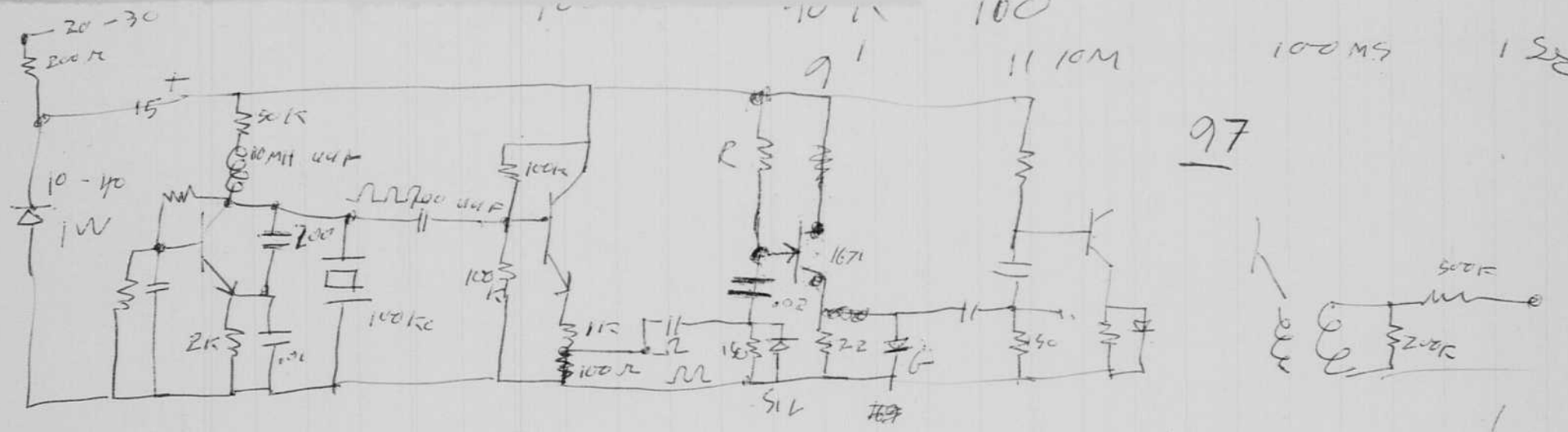
at Army Chem center.

- 7200 Joules.
- 10 us flash.
- Long afterglow in tube.

$\frac{2 \times 10000^2 \times 10^{-6}}{2} = 100$ watt sec.

50 FATHOM SWEEP.
chart feed 1.6" / min

output pulse from Lloyd's timer



2N117
SIL
@ 9½

2N169A
2½

$V_P = \eta V_{BB} + V_D$

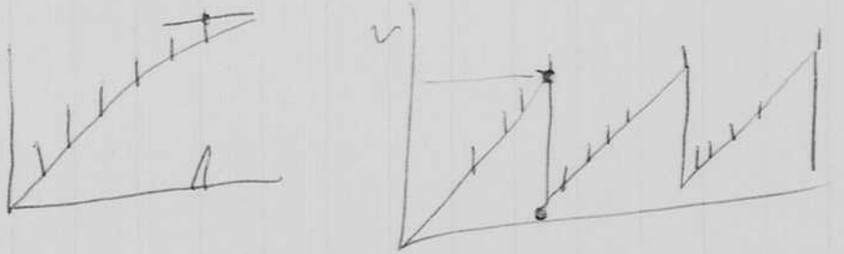
GE
1671 B

η = .47 - .63

R_{BB} 4.7 KΩ - 9.7 KΩ

1,000,040

8/M/C



5 UNIT
1 BUFF
1 OSC
1
1 XTAL
1 ZENER
1 TRANS

1) WRITE FINGER TIME PAPER
2) ENG PROP ROCK
3) COAST ROCKS
4)

Linguist" OL 3 1000.575.

Army Chem Center.

capacitors 100 WS, 10KV, 10KV — midtap Grounded — Aerovox PX50 I 17 60523616.

as used by John Trachtvell. 2 us flash. 200 WS, 10KV, 2, 2, 10KV — aerovox PX 5055 60442891

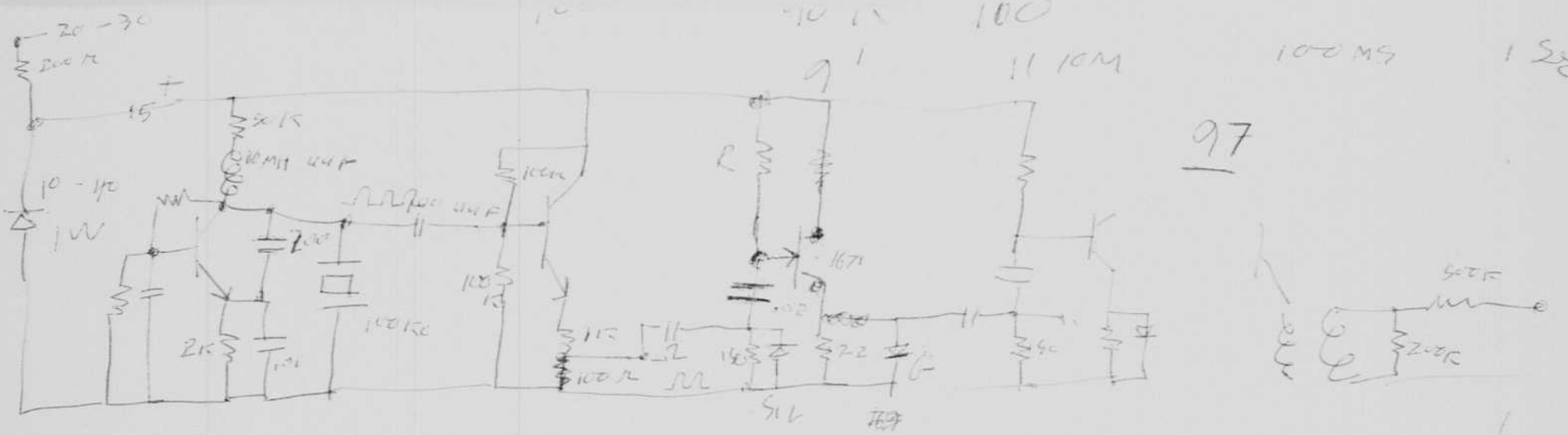
at Aberdeen Chem center.

7200 Joules.
10 us flash.
long-afterglow in tube.

$\frac{2 \times 10000^2 \times 10^6}{2} = 100$ with sec.

50 FATHOM SWEEP.
Chart feed 1.6" / min

output pulse from Lloyd's timer



2N117
Silicon
η_2

2N1671A
$2\frac{1}{2}$

$V_P = \eta V_{BB} + V_D$

1-E
1671 B

$\eta =$ .47 - .63

R_{BB} 4.7 KΩ - 9.7 KΩ

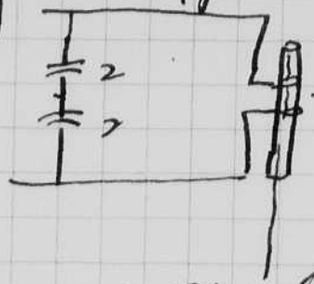
5 UNIT
1 BUFF
1 OSC
1 XTAL
1 ZENER
1 TCXO

1) WRITE BUFFER TIME PAPER
2) ENG PROP RACK
3) CONST RACKS
4)

May 16, 1961.
Harold E. Edgerton.

John's experiments. (Tredwell)

200 WS.



peak light = 80,000,000 c.p.
Duration = 1.5 μs duration.

~~Lord.~~ Prof. Lars. Lindqvist & Height visited Lab.

Arkiv for Kemi Band 11 nr 60 1957
40 KV 2.5 mfd oil lamp Quartz.
$\frac{CV^2}{2}$ = 1800 joules. 15 mm I.D.
20 cm long.
Uses Emi 9552 mtp 5000 v.

Sat May 27 1961. H.E. Edg & Mack.

Naval Electronics Lab. Strobe burning fixed motor.
BB 1422 E484 Drawing IN1566 (30)

Changes (1.) Full wave from 1/2 wave. (also solid state rectifier)
(2). Choke 10 h 85 ohms. Triad no. HSM-319.
(3) Lamp FX-29 instead of 6 mm

Output with Reflector

$D = 5$ feet $\quad R_L = 1000 \quad V = 6$ volts. $\quad K = 38 \times 10^6$

$$\text{Acp. (Dora)} = K \frac{VD^2}{R_L}$$

$$= 38 \times 10^6 \frac{6 \; 64}{1000}$$

$$= 14{,}590{,}000$$

64
6
384
38
2072
3072
1152
14592

Duration of flash = 60 μs.

Output $14 \times 60 = 840$ C.P.S.

Input = 12 mfd 2000 volts $\frac{CE^2}{2} = \frac{12 \times 10^{-6} \times 4 \times 10^6}{2}$

$= 24$ watt sec.

June 2 1961 AB

I was in WHOI yesterday to deliver equipment
Pinger modified with 12 KC nickle ring
with 46 turns (40) of #14 wire. Also a side cable
clamp was installed for rough handling.

The pressure peak is about 1/10 or 1/12 of the
Edo type.
The pressure is .025 volts peak to peak with
an BC 30C hydrophone
Volkman unit is .016 volts. " " "
with a 2 or 3 cycle ring time.

The one we made rings twice as long ±.

Lost camera

28 Feb 1960	20.07	) begin
	66.36	)
Puerto Rico Trench,	20.05	) end.
	66.32	)

3300 fathoms.

June 2 - left at 1130 for Omaha Nebr with Esther and her mother
June 6 Returned last night from Omaha (Aurora Nebr)
by plane. DC 8 Jet.

July 11 1961

Harold Edgerton.

Returned July 7, Friday, on the Chain ~~cut~~ voyage 19 to W.H.O.I. Left W.H.O.I. on the 13 of June. J.B. Hersey was chief scientist. Our goal - to photograph and dredge for rocks in the 3rd layer down where outcrops were suspected in the Puerto Rico trench. We were successful. A nice rock was broken off. Also other interesting rocks were obtained.

Conf. with Bill and Sam on transducers and other items on Sat.

Yesterday - trying to get caught up with correspondence and other items.

Transducer design comments.

Barry Haywood's double coil transducer gave excellent results with 5000 W.S. in 3000 fathoms. The penetration was greater than 2000 feet on the Chain 19 voyage.

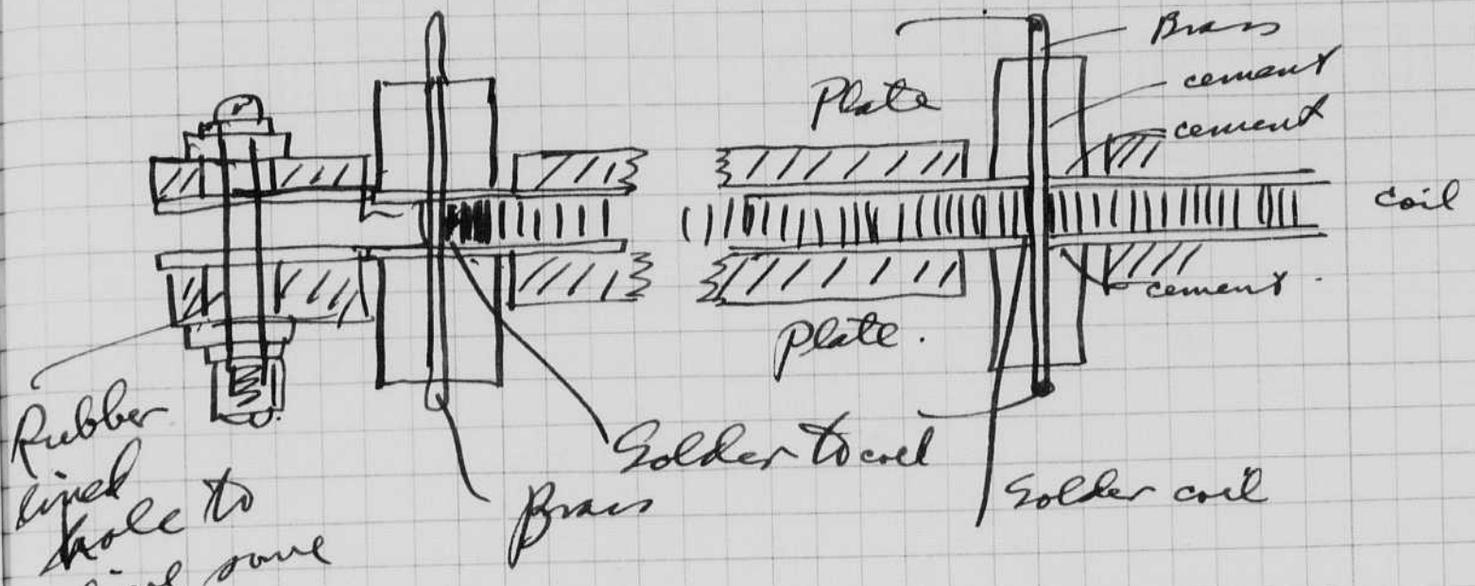
(1.) The main ~~only~~ reason for the double coil was the fracture of the coil imbedment. There is some need for increased inductance?

(2) Another reason is the lead wire problem. With the double coil the leads can come out the edge.

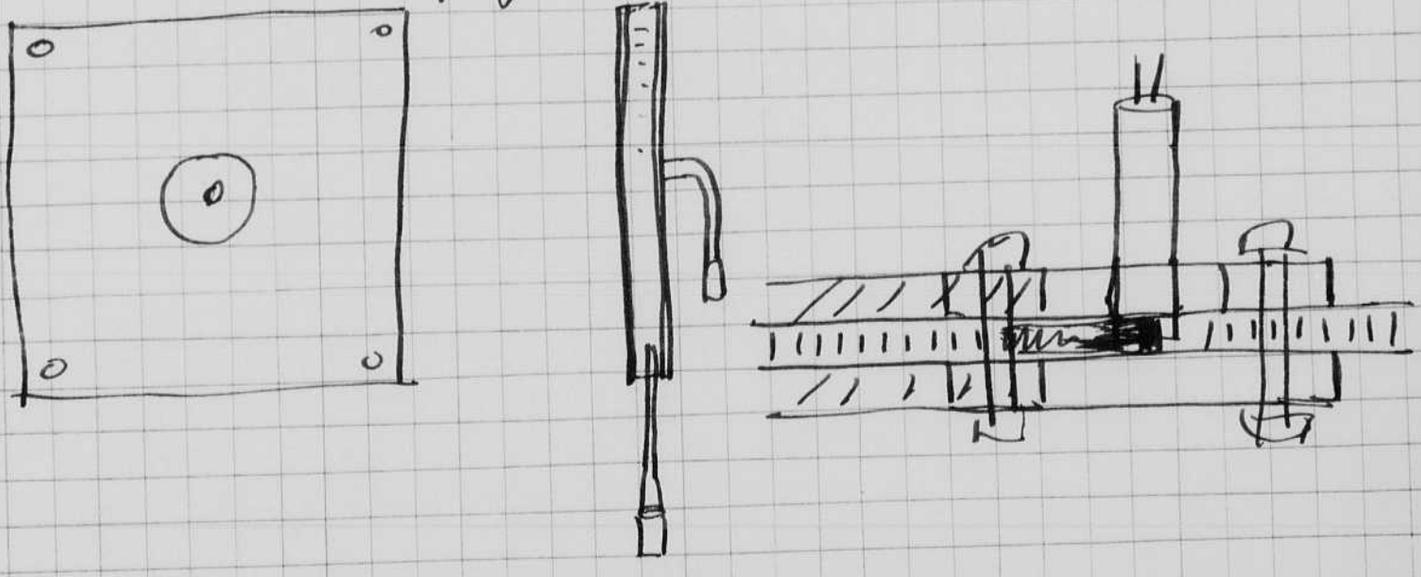
I now think it advisable to go back to the single coil so that greater coupling efficiency can be enjoyed. The skin depth at 6 cycles is about ½ of an inch in copper. A double plate assembly on a single coil

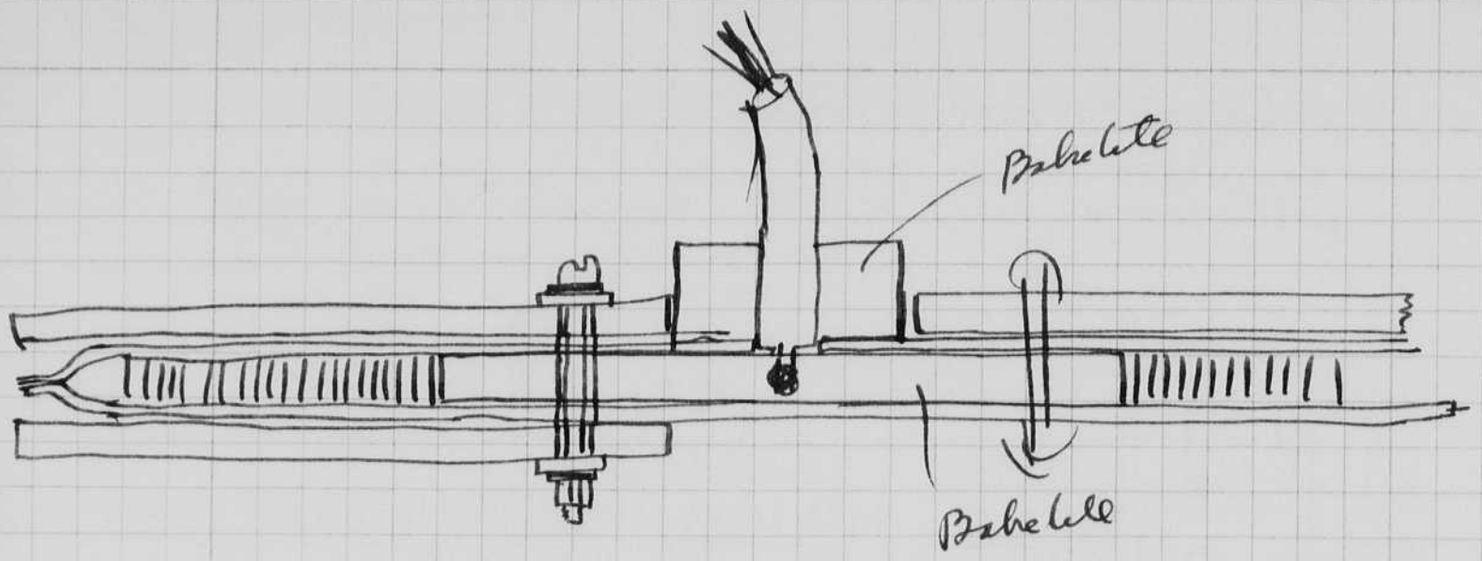
Should give excellent results.

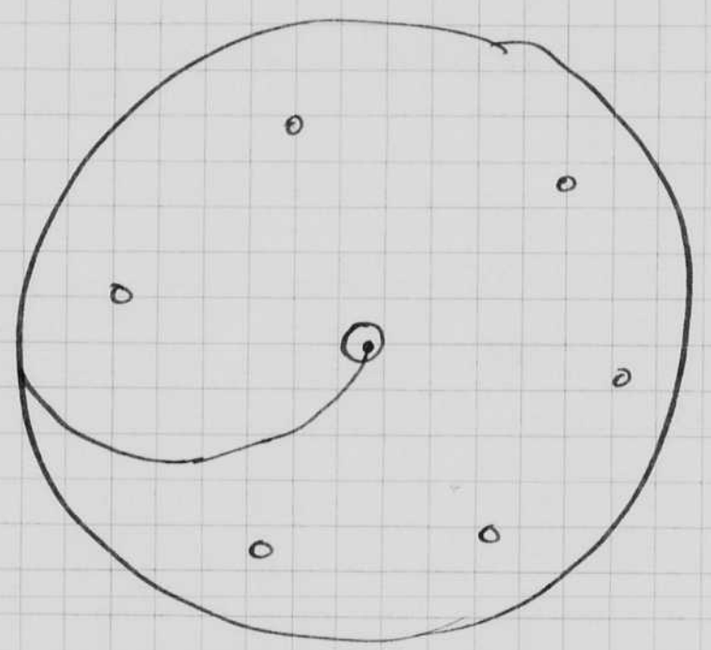
Solutions. (1) Center connection on coil with rubber insulation



2 another solution. Big center hole in the connection and center clamp of plates.




Bakelite
Bakelite



July 24 1964
U. S. Hydrol.

Gary returned today from the "Explorer" Coast & Geodetic survey ship out of Boston Left Wed or Thursday last week.

Byron Hale
Mark. Goodheart.

3 camera lowerings

1. Intermittent operation due to camera battery plug.

2. Pinger jumped in trigger. Gary did not have trouble?
Bad ground. or terminal.

Thumper leads broke due to insufficient copper or no slack release.

Thumper fish M.G. (John) from Braincon Co.

One in Hull worked ok but down by 2° D.D. Transducer showed be lower. or hull.

Alden recorder off and now in 750 Commonwealth.

Jays Harports - Rocket fish worked ok. Seems to be a good idea.

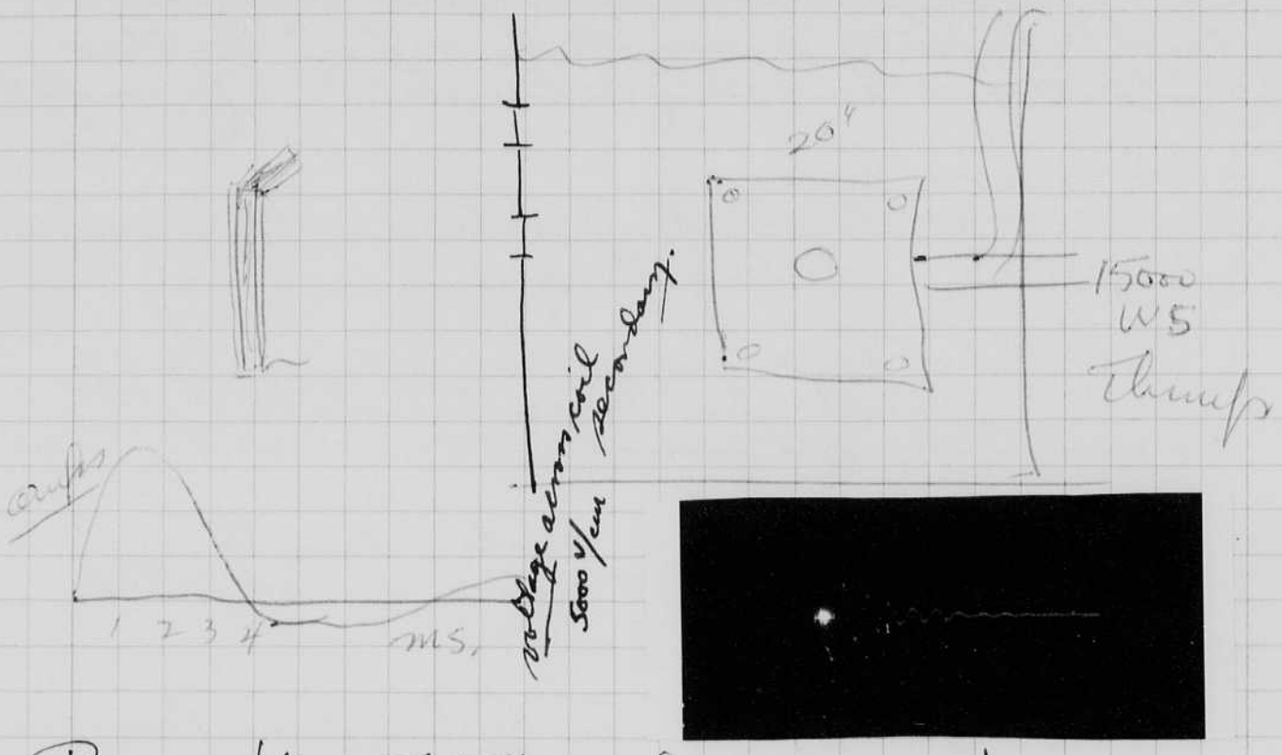
One Compass lost due to weak C ring.

Preamp will be built by Jay.
Ship was noisy. ? Jay.

Camera: Broken jones plug.
Ground connection not soldered.

July 25 1961
H. Edgerton.
20D009.

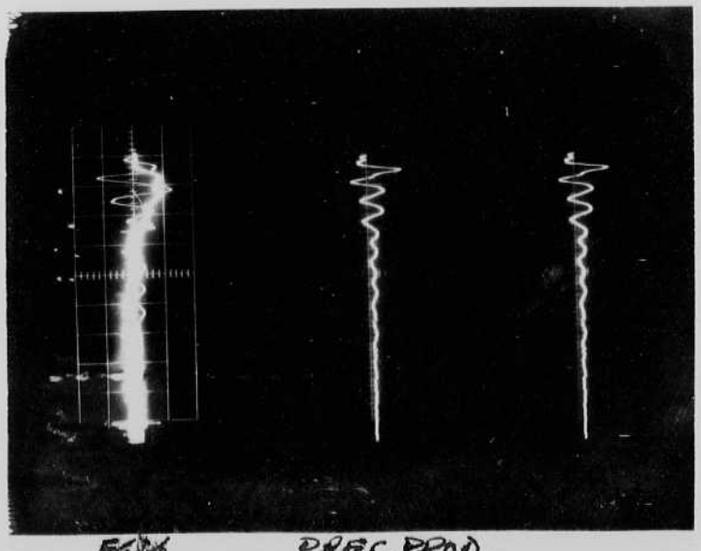
Meas of Plate deflection of 20" Double plate Double coil Transducer #1.



Pulser with E G & G transformer. 100 μs/cm

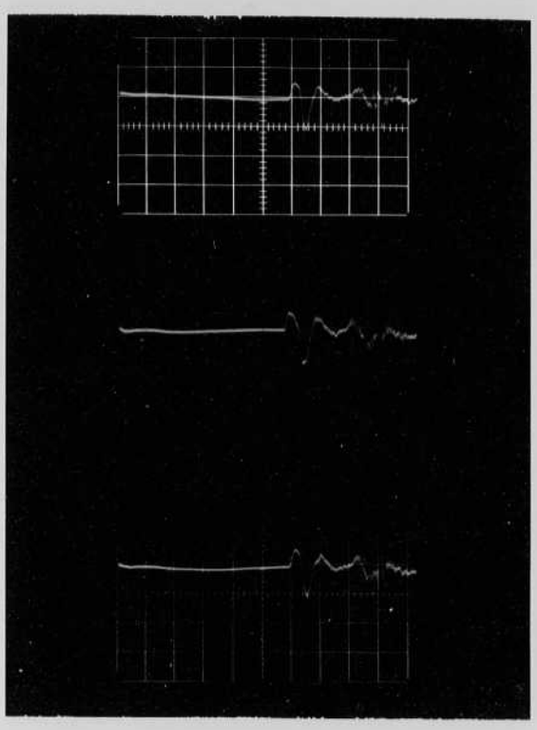
Pulser with Precision Electronics, Marshfield Mass. 22

1 volt/cm	2.4 cm	Mike 2 ft away from the face of the Mike.
100 μs/cm	1.6 cm	

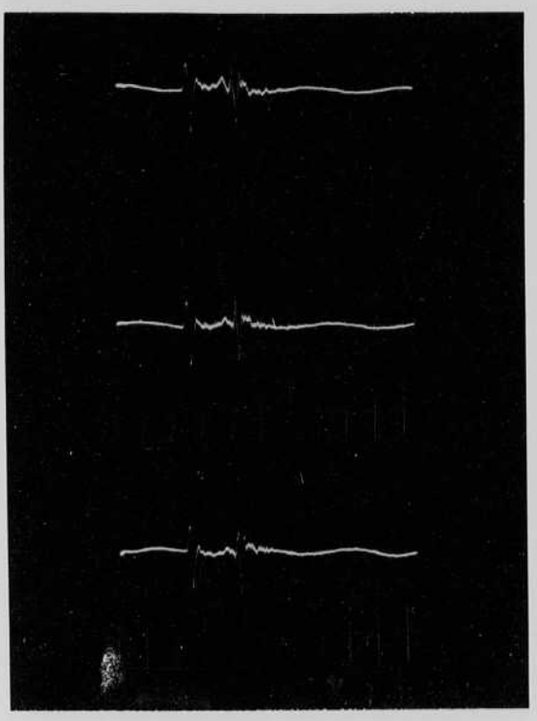


E&G PREC. PROD.

Oscillograms taken on Chain 19 by Burkhardt & Lloyd Breeden.

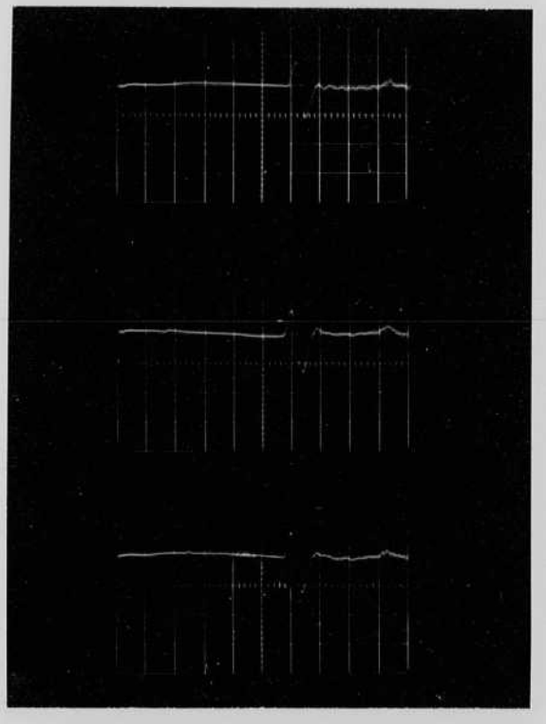


3000 joule thump.
2 ms/cm.
.05 V/cm. BC10



5000WS

5 ms/div.
.05 v/div.

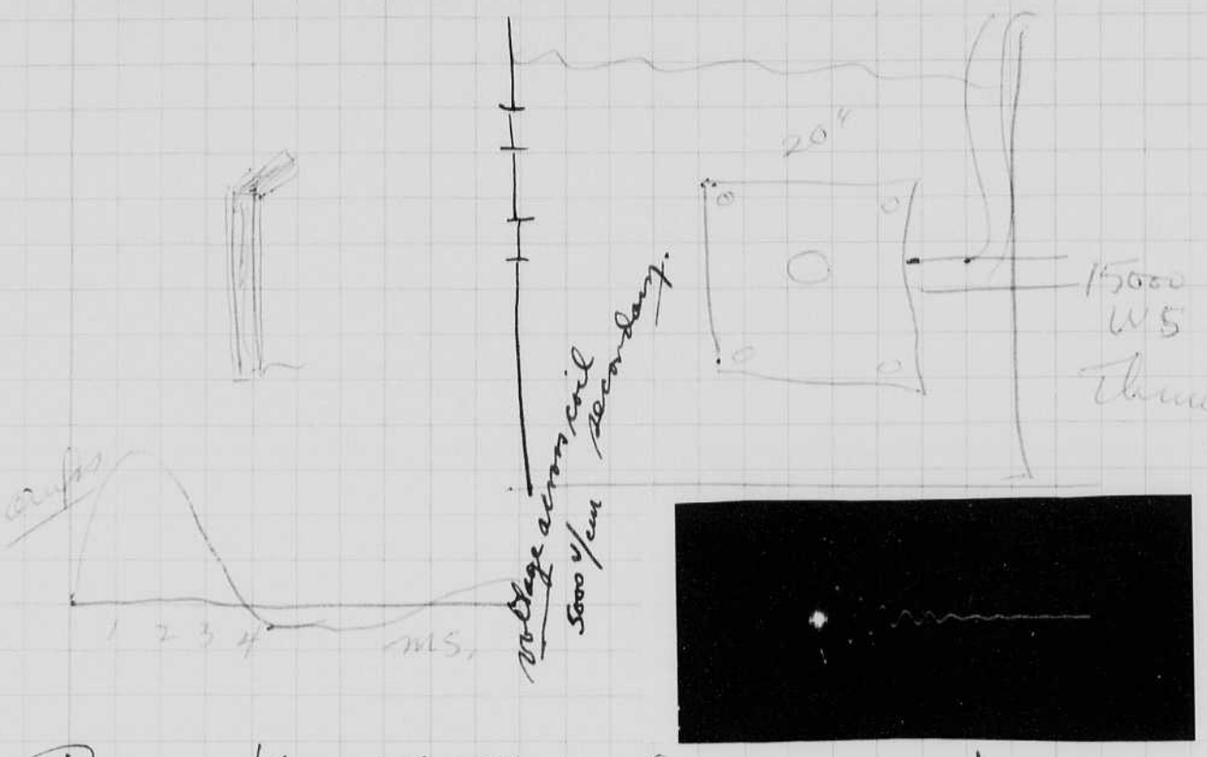


5000WS

2 ms/div
0,05 v/div

July 25 1961
H. Edgerton.
20D009.

Meas of Plate deflection of 20" Double plate Double coil Transducer #1.



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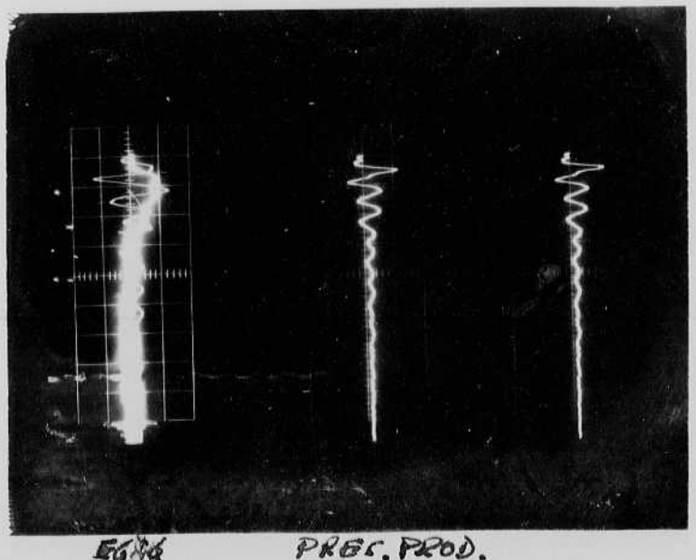
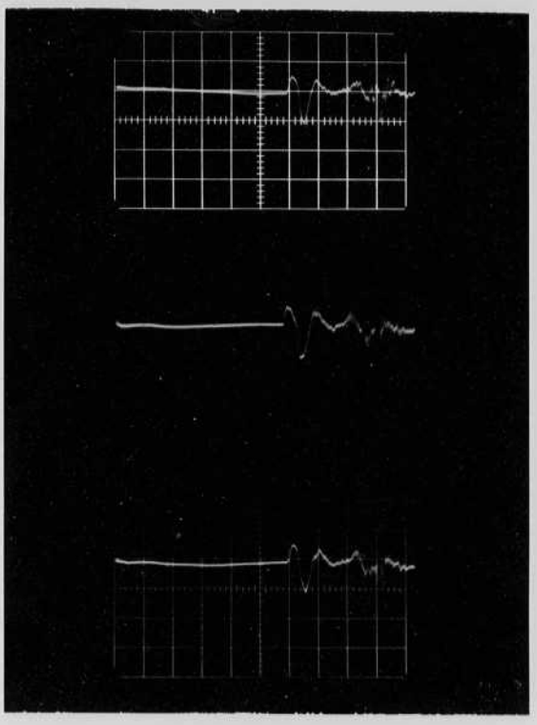
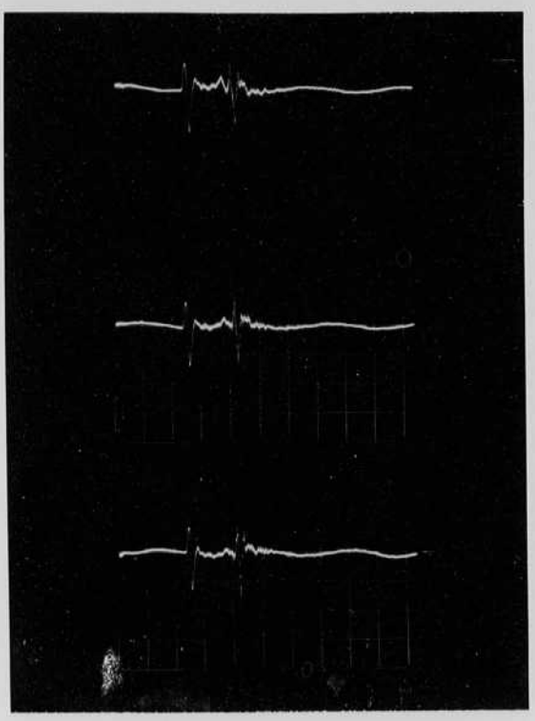


Oscillograms taken on Chain 19 by Burkhart & Lloyd Brown.

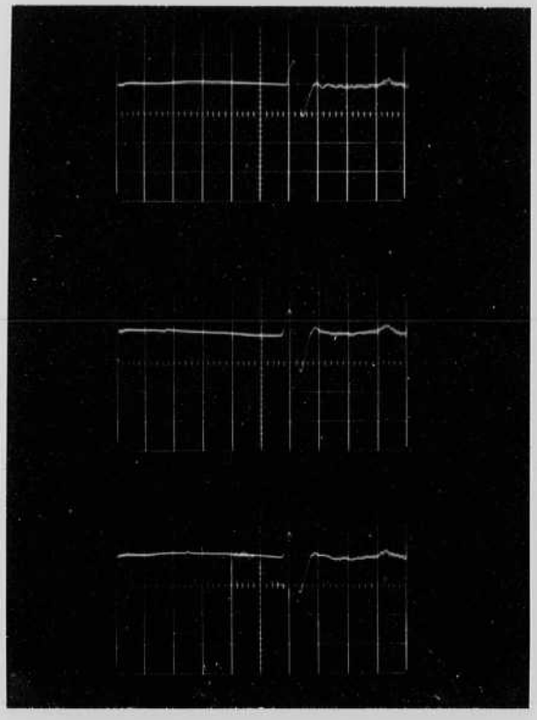


3000 joule thump.
2 ms/cm.
.05 V/cm. BC10



3000WS

5 ms/div.
.05 V/div.



2 ms/div
0,05 V/div

3000WS

Notebook # 26

Filming and Separation Record

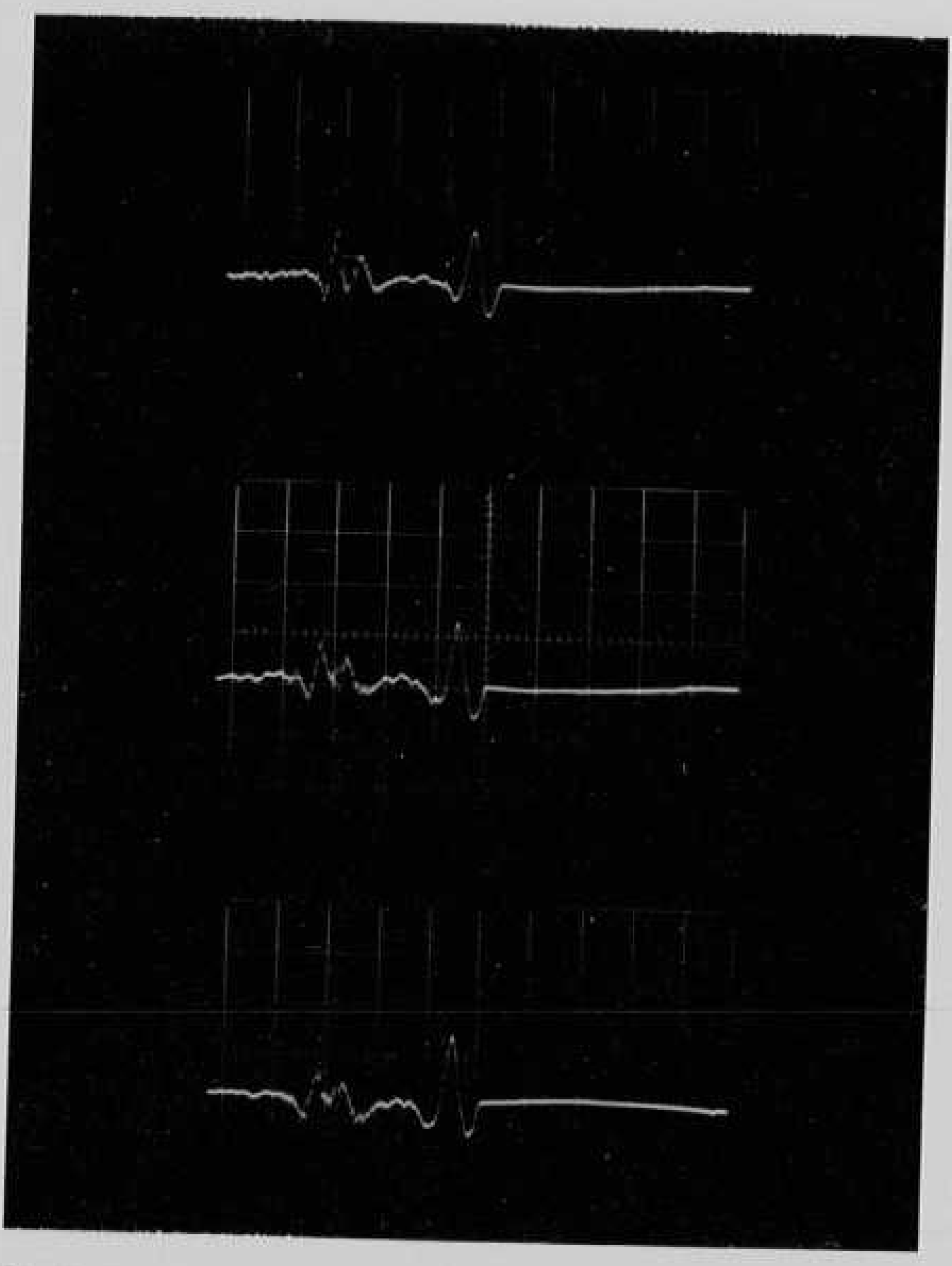
3 unmounted photograph(s)

____ negative strip(s)

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

was/were filmed where originally located between page 116 and 117.

Item(s) now housed in accompanying folder.



#2

JUNE 23 61

CHAIN 10

KNOTT - EDGERTON

300 JOULE THUMP

ECG #1

RANGE RATIO 1/18

12 SEC INTERVAL

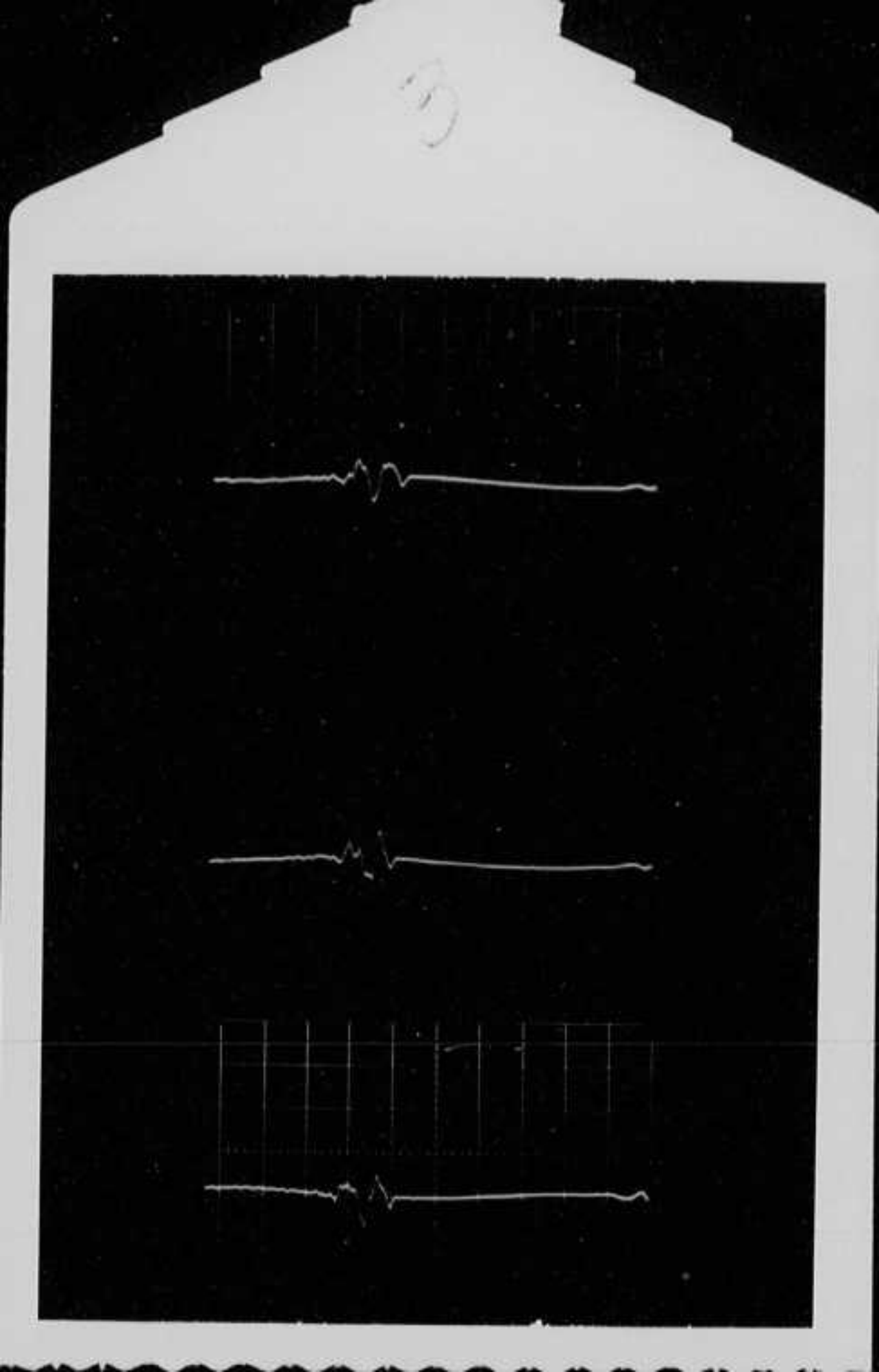
SCOPE TIME 2 MS/CM

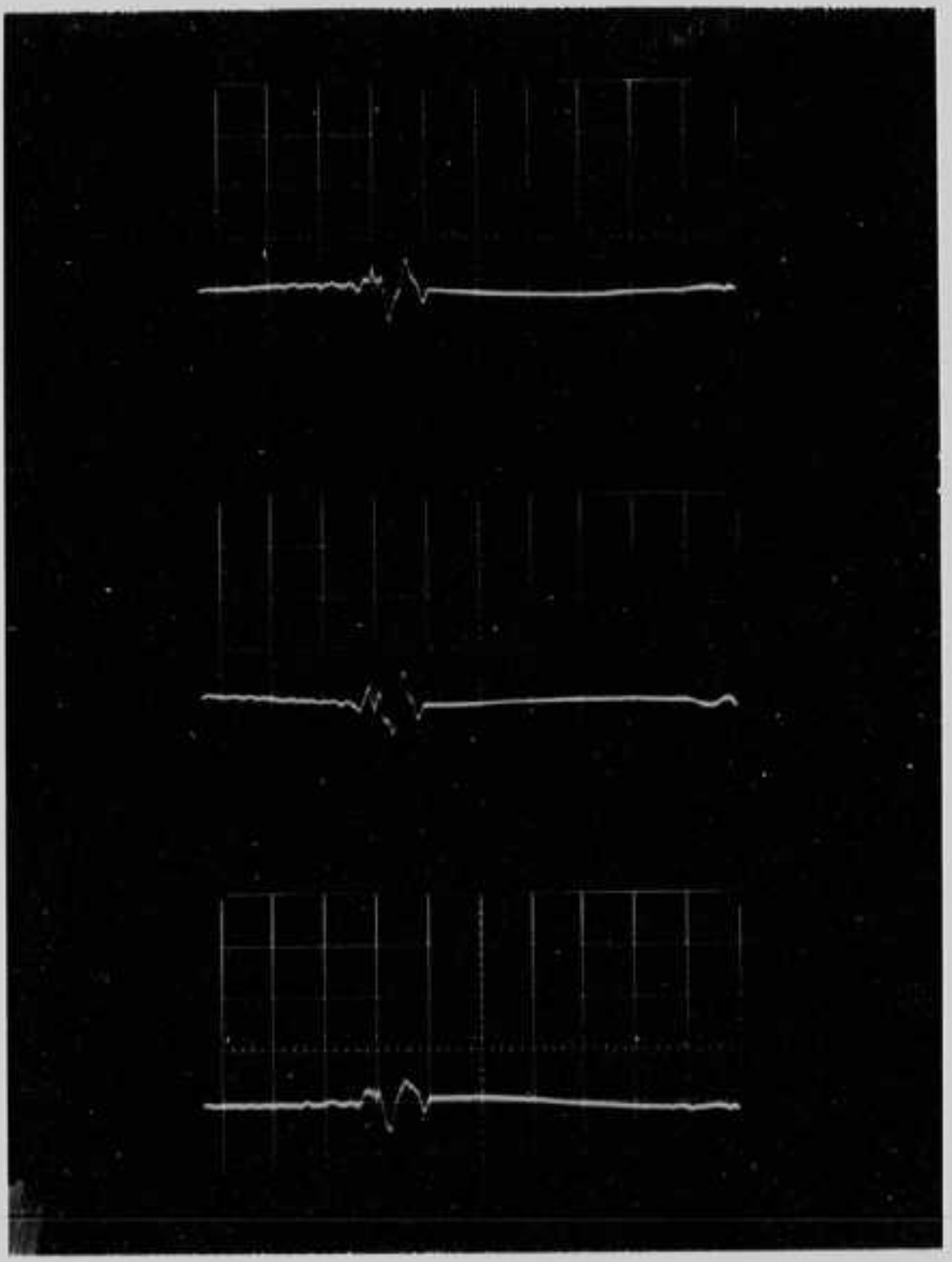
VOLTS .05 V/CM

USING BC 10

FEEDING TEKTRONIX

515A





July 26 1961

Harold Edgerton MIT 4-405.

I was on CHAIN 19 voyage from Key West to the Puerto Rico Trench in June - July for about 3 1/2 weeks.

We made a hydrographic survey, photographs of the north wall, and dredged for rocks. It was a successful expedition. Dr. J.B. Hersey was the Scientist in charge.

A 5000 W.S. thumper with the Double Plate design was used for the first time in the deep ocean. Seismic Profiles were obtained from 2000 ft below the surface in 3000 ± fathoms.

Photos of the same transducer with 15000 WS were taken last night P116. Underexposed last same action. Prints ↓ ÷.

Thumper Conference.
July 26, 1961.
170
B.T. Egerton.

Kearsley. Van Reenan.
Colson. Jay Harford
Gary Hayward Carl Wallace
Sam Raymond. O'Rourke.

Deep thumper. Gas type.
Cavitation. 30 hours with new plates. Gary.

Plate movement.

13,000 watt second unit. Double plate.

July 27-28 moved Oceanographic group to 750 Commonwealth Ave.
Gary Hayward, Earl VanReenan Jay Harford
Sam Raymond.

13000 W.S. tests on old #1 transducer caused breakage.

Bob Schildknaut and Carl Morey were in the Stobie lab Sat night. I helped to time up the 20 flash unit (it had only 12 flashes installed)

Worked ok to 100,000 f.p.s. but required .55 on meter setting. Each light was about 3×10^6 c.p.

This will be taken to Grumman aircraft in Long Island for some experiments.

July 31 1961
M.I.T. 4-405

Transducers.

Conf. with Bob Barry.

2-cables. Hersey sent to fit thumper.

Aug 2 1961 Yesterday at Hilton Statler P.P.A. convention Bob Schuldt kindly helped me with demonstrations.

Point Source for Microflash

0.145" diameter Dur = 1 MS.

Peak light .5 to 1 x 10^6 C.P.

Output = .5 to 1 C.P.S.

$$\text{area} = \frac{(0.145 \times 2.54)^2 \pi}{4} = \frac{.368^2 \pi}{4} = 0.105 \text{ sq cm.}$$

$$\frac{10^6 \text{ C.P.}}{1} = 10^7 \text{ C.P. / sq. cm.}$$

Sept 14 1961

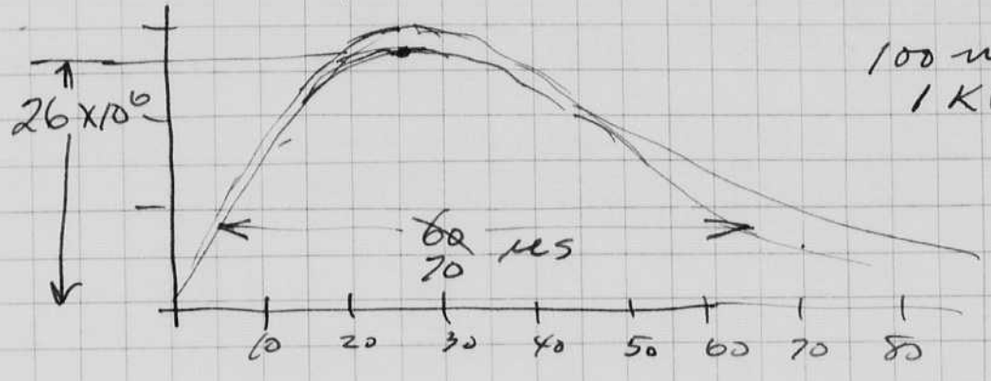
H. F. Ogelvie:

Rcvd from Honolulu about 2 am on Friday last week after 3 nights sat Carl Bak Conyer on Bat Photos into Paul Spangle.

Sept. 16. 1961 Trustum Lecture in Kresge Friday at 2:45 pm

3 lamps received for EG&G type 38 with tungsten and sintered electrode.

Do Utg. 929 with filter.
4.' 7½" to FT-38. R_L = 1K. 10^6 CP/0.1 volt.



100 mf.
1 KV

$\frac{CE^2}{2}$ = 50 watt sec.

Voltage up to 1400
C = 200.

Peak light
80 x 10^6 c.p.
Duration = 160-180 ms.
22 ms to peak.

Anode shows darkening
cathode Ok.

Advance added 16 [illegible] of #16 wire on a 2" diam
about 25 turns,
60 ms to peak.

200 mf
190 ms. 200 ms.
50 x 10^6 peak.

Notebook # 26

Filming and Separation Record

2 unmounted photograph(s)

___ negative strip(s)

2 unmounted page(s)
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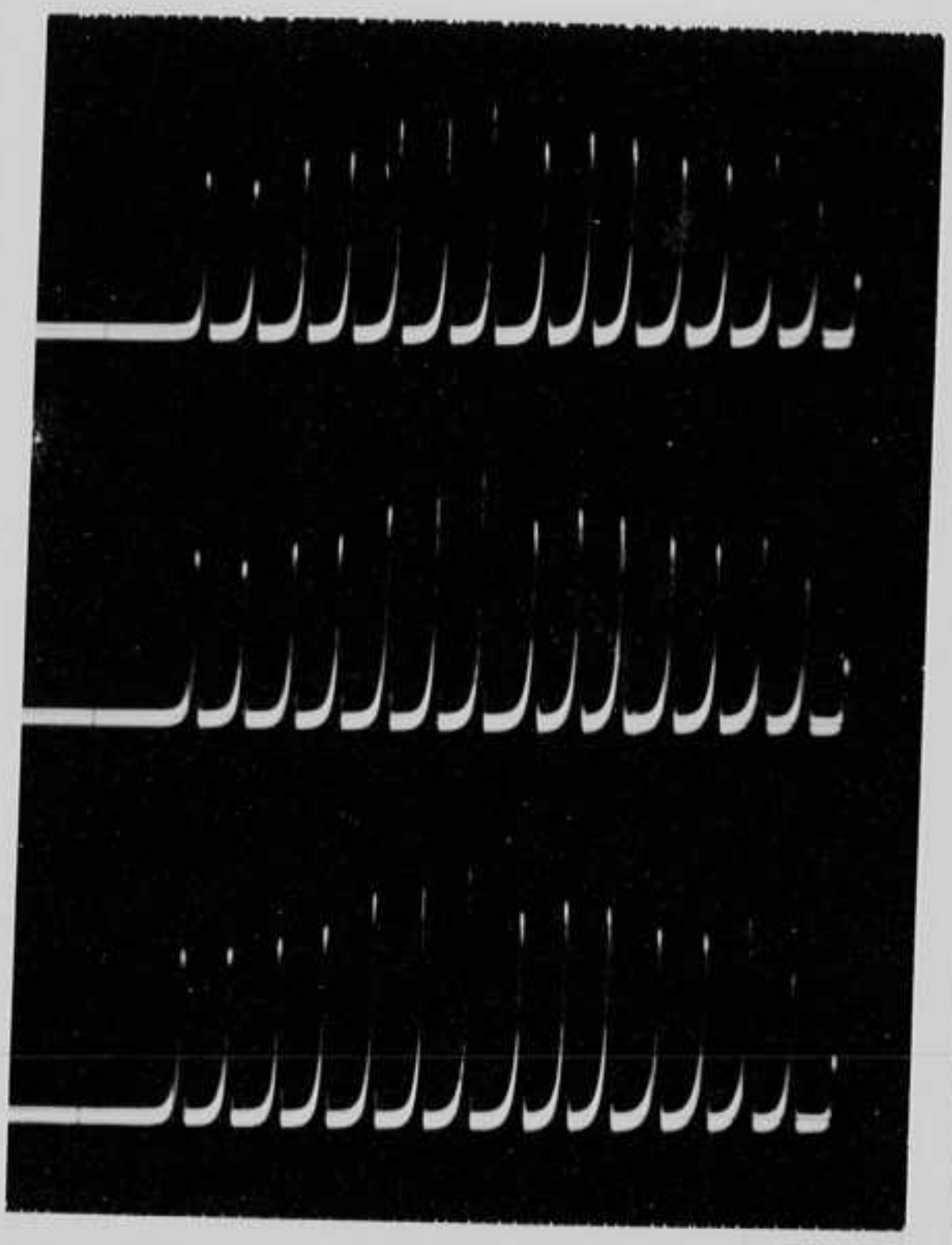
was/were filmed where originally located between page 120 and 121.

Item(s) now housed in accompanying folder.



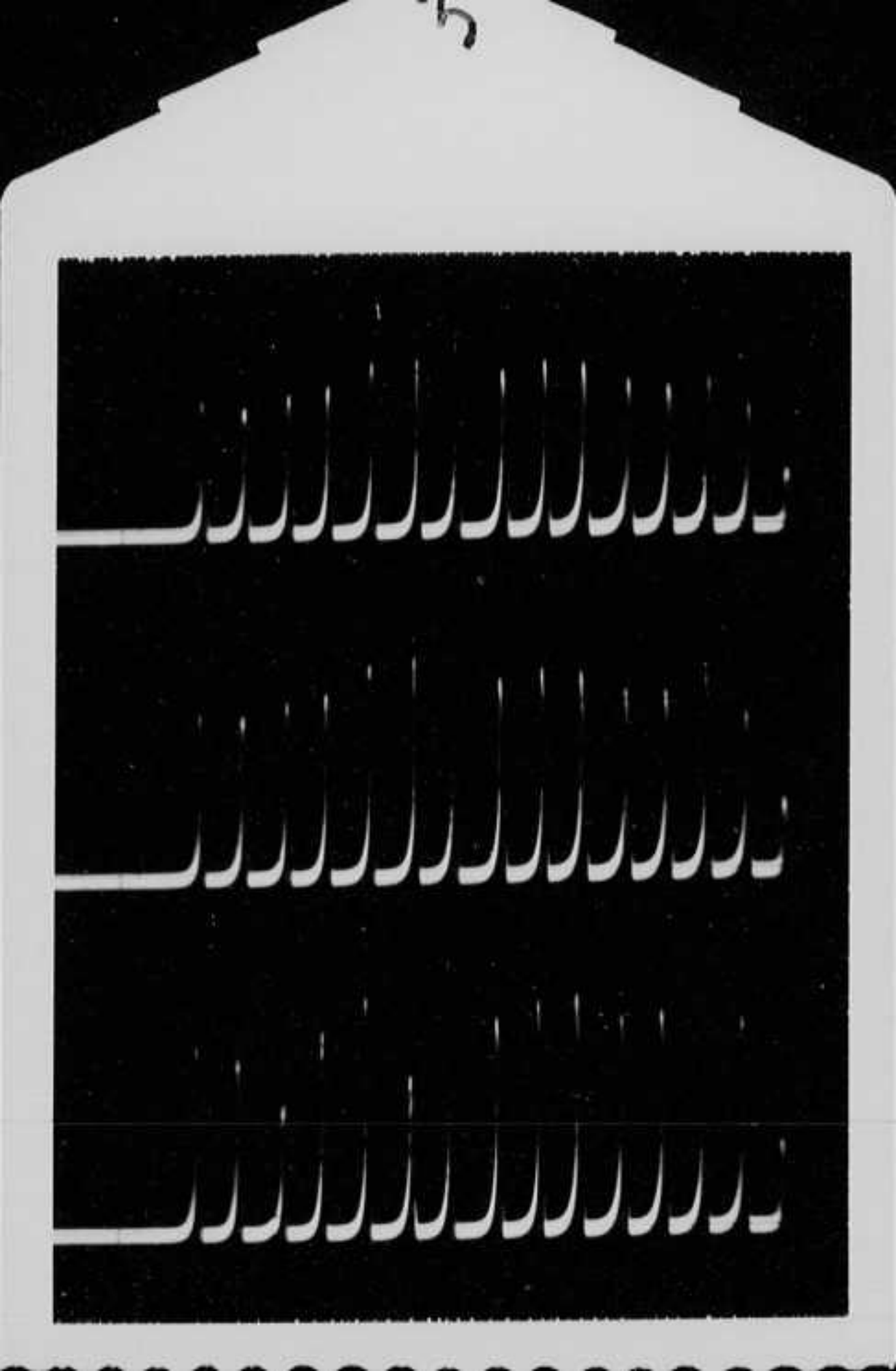
Oct 29 1960

&E

50

100,000 cycles

LS-10



Oct 29 1760

KB

50

55

60

Rocks from the Depths

The most accessible part of the earth's interior is at the ocean's bottom, where the crust is thin. Project Mohole, the U.S. attempt to reach the boundary layer between the earth's crust and mantle by drilling off the coast of Mexico, so far has penetrated only ordinary, surface-type rocks. Last week, the Woods Hole Oceanographic Institution reported far better success with another method. From the

GEOPHYSICIST HERSEY (RIGHT) & AIDES
Down where the ocean grew.

fractured north wall of the Puerto Rico Trench, its research ship *Chain* has dredged up the first samples of "third layer" rock ever gathered by man.

When geophysicists tag the rock strata under the ocean, they call the ocean water the first layer. On the bottom is the second layer: sediment and sedimentary rock averaging 1 km. thick. Below it lies the third layer, which seismic waves have proved to be made of unusually heavy rock. The third layer is normally unreachable, but scientists making a seismic survey in 1959 got hints that it might be exposed on the sides of the Puerto Rico Trench. In 1960 Dr. Earl Hays of Woods Hole took photographs showing fractured rock on the trench's north wall.

Misplaced Pacific. To geophysicists, the Puerto Rico Trench is one of the most interesting places on earth. Lying north of Puerto Rico, it is something like the Grand Canyon sunk under three to four miles of water. Like other deep ocean trenches, it is believed to be a place where the earth's crust is sinking into the interior, perhaps carried down by slow, enormous currents in the plastic mantle. Since trenches are characteristic of the Pacific Ocean, where they abound, some geophysicists consider the Puerto Rico Trench a part of the Pacific that has bulged into the Atlantic between North and South America. Another bit of bulging Pacific may be the trench-bordered Scotia Sea south of South America.

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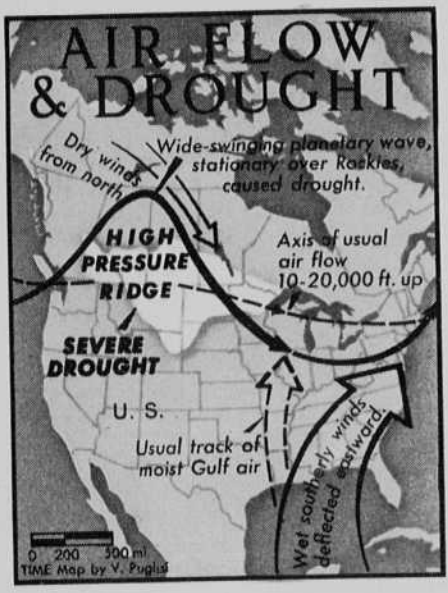
When Woods Hole scientists took a closer look at the Trench, they found by echo sounding that its north wall is scored by fractures where deep-down rock seemed to be freshly exposed. Photographs showed the rock too, but bringing it to the surface was no easy task. Any sort of dredging in deep water is difficult; pulling a dredge among rocks and crags at the end of many miles of cable looked almost impossible.

Trick Dredge. The problem was solved by Woods Hole's Andrew Nalwalk, who designed a special dredge that would flip itself free if it got snagged on a boulder. Three hundred feet up its cable it carried a "pinger," whose sound could be detected by the *Chain* four miles above. The interval between the pinger's sound and its reflection from the bottom told the scientists when the dredge was on the bottom and moving with its cable at a proper angle. This eliminated "kiting" (sailing above the bottom) and snarl-ups caused by letting out too much cable.

After many tries, the trick dredge brought up chunks of strange, heavy rock from four miles down. Some of the surfaces were dark brown, showing that they had been exposed to the iron and manganese oxides that slowly deposit from sea water. Other surfaces were fresh and light green. Dr. John B. Hersey, chief scientist of the cruise, believes that the chunks with fresh faces were broken by the dredge out of the mysterious third layer. If so, they may show what the crust of the earth was like billions of years ago, before the infant ocean rained sediment on it.



area and its drought-producing effects. The moist winds from the Gulf were deflected to the Eastern seaboard.

Last week the pesky ridge finally moved westward toward the Pacific—at least temporarily—permitting moist air to reach the high plains and letting a little rain fall. The Weather Bureau's 30-day forecast, issued late last week, predicts that the ridge will move farther out into the Pacific, allowing more than normal rain to moisten the droughty area.

.0181

V	C	L	P	c.p.	Dur.
2000	200	16'	100×10^6	200 KS.	

$\frac{200 \frac{200^2}{2} \times 10^6}{400 \text{ W.S.}}$

Anode shows melting.

Still starts at 500 volts.

This is a 3" gap xenon lamp with a 0.4cm diameter inside beam tungsten anode - Sintered cathode.

Slight volute on inside wall

Operation ok at 200 watt seconds, anode melts at 400 watt sec.

Sept. 19, 1961
H. E. Edgerton

Dick S. and Border Gallrich

Masters theses. afterglow in Neon and other gases.

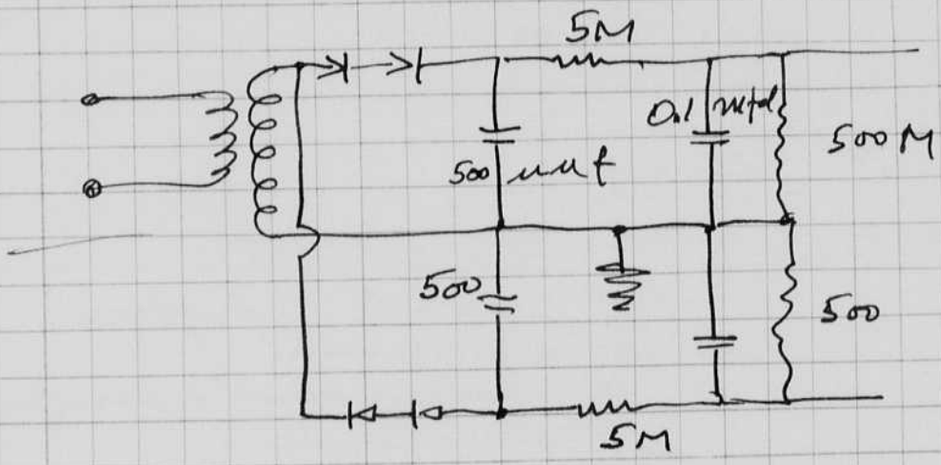
Spectral output.

Temperature.

Positive information

Stimulated emission.

Microflash Power Supply.



1/2 voltage.

5 megs	6.6
1 meg.	7.6 KV
0 meg	8.2

with sparkgap load.

without gap load.

5	7.4
1	8.0
0	8.5

Sept 20 1961 750 Commonwealth Ave

Harold Edgerton

Weekly conferences 8 am. Wednesdays.

Keyes Cox
Jan Deman
Gary Hayward
Jay Harford.

Thumper Development.

Small Thumper Snapper. (1000 ft).
1. Pressure tank
Hydrophone.
Scope 310 Allie Mabee.
H. S. Camera.

.02 Sodium
4500 amps
500 W.S.
5500 at 1000 W.S.

Development. Thumper.

Problems (1.) Break
(2) cavitate. 4 spots.
(3) High Power.
(4) Plate Support & Damping
Higher Power.

now going to round plates.
round form.

Pinger Prop. to depth. W.H.O.I. Jay & Wayne. 604.
Pot to charge resistance.
counter.

Transponder for pinger. most worked out.
W.H.O.I. possible customer for dredge.

Data Chamber Salinity.
Temp.

Buoy light Lifeguard type 5/sec. intensity
30 or 40. Mercury switch.
Wilcox. Dave Sakolov.

Buoy 0.6 watt sec. 2 flashes/sec.
6 volt ~~EX~~-6A sealed job.
Richardson W.H.O.I.
1½ watts. 3 to be delivered.

Navy Job - Bid scuba divers.
Trieste sonar 8 - 12 KC.
50 feet in sediment
1 per minute rate.
2500 fathoms (15000 feet).
Readout inside Trieste.
Shall we bid? I say no.

Torpedo light. Bid to be sent out.
circuit.
Pochazerin
Parts list.
Ok by. MacClelland.

U.S. Corp of Engineers New Orleans. Van Mississippi.
time limit. 30 day. ?

Recorder.
Pinger triggered - 10 · 200 ft.
Hydro phone.
Filter
20 feet deep in mud.

Coast Surveys

Ewing - Lamont. ASW antisub.

French mil mission model 230. aug 14.

Proposed Flocks.

Transducers.

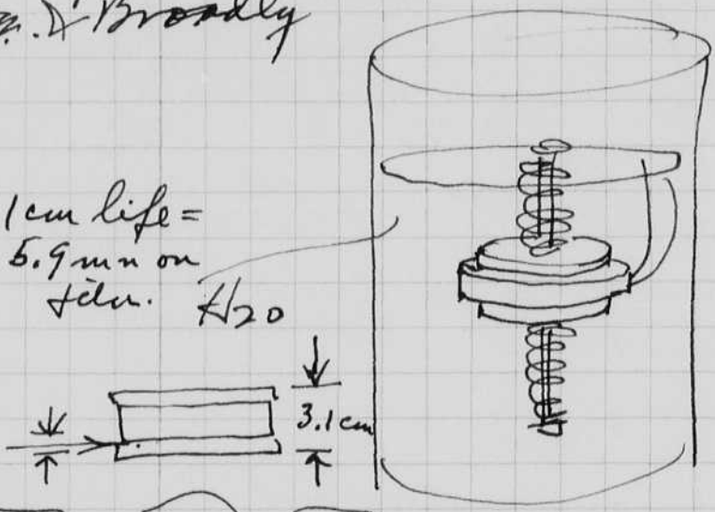
4 1000 ws. thumpers.

2 5000 ws thumpers and fish.

2 extran transducer 1000

2 " " 5000.

Photos of thumper Snapper.
Sept 23 1961
H. D. Broadly



first two photos taken at 4000/sec. on Sound recording film.
f 1.9.
.01 mfd at 8 KV.

100 mfd at 3000 volts. into coil until series sparkgap.

3rd shot.
3.2 KV on Snapper — broke the glass jar.
4000 f.p.s. on H.S. Pos. film.
f 4. no reflector on lamps. .01 mfd.

0.2 = 0	1.8	1.6	1.0	.8	
0.3 .1	1.75	1.55	.9	.7	
0.65 .45	1.75	1.55	.85	.65	
0.8 .6	1.75	1.55	.8	.6	
1.3? 1.1	1.75	1.55	.65	.45	
1.2 1.0	1.75	1.55	.65	.45	
1.4 1.2	1.75	1.55	.55	.35	
1.5 1.3	1.7	1.5	.5	.3	
1.55 1.35	1.7	1.5	.45	.25	
1.6+ 1.4+	1.7	1.5	.35	.15	
1.6 1.4	1.6	1.4	.25	.05	
1.55 1.35	1.6	1.4	.25	.05	
1.45 1.25	1.6	1.4	.25	.05	
1.45 1.25	1.5	1.3	.25	.05	
1.55 1.35	1.4	1.2	.25	.05	
1.65 1.45	1.35	1.15			
1.75 1.55	1.25	1.05			
1.7 1.5	1.2	1.0			
1.75 1.55	1.11	.91			

.525 x 1 mm

$\frac{31}{59} = .525$

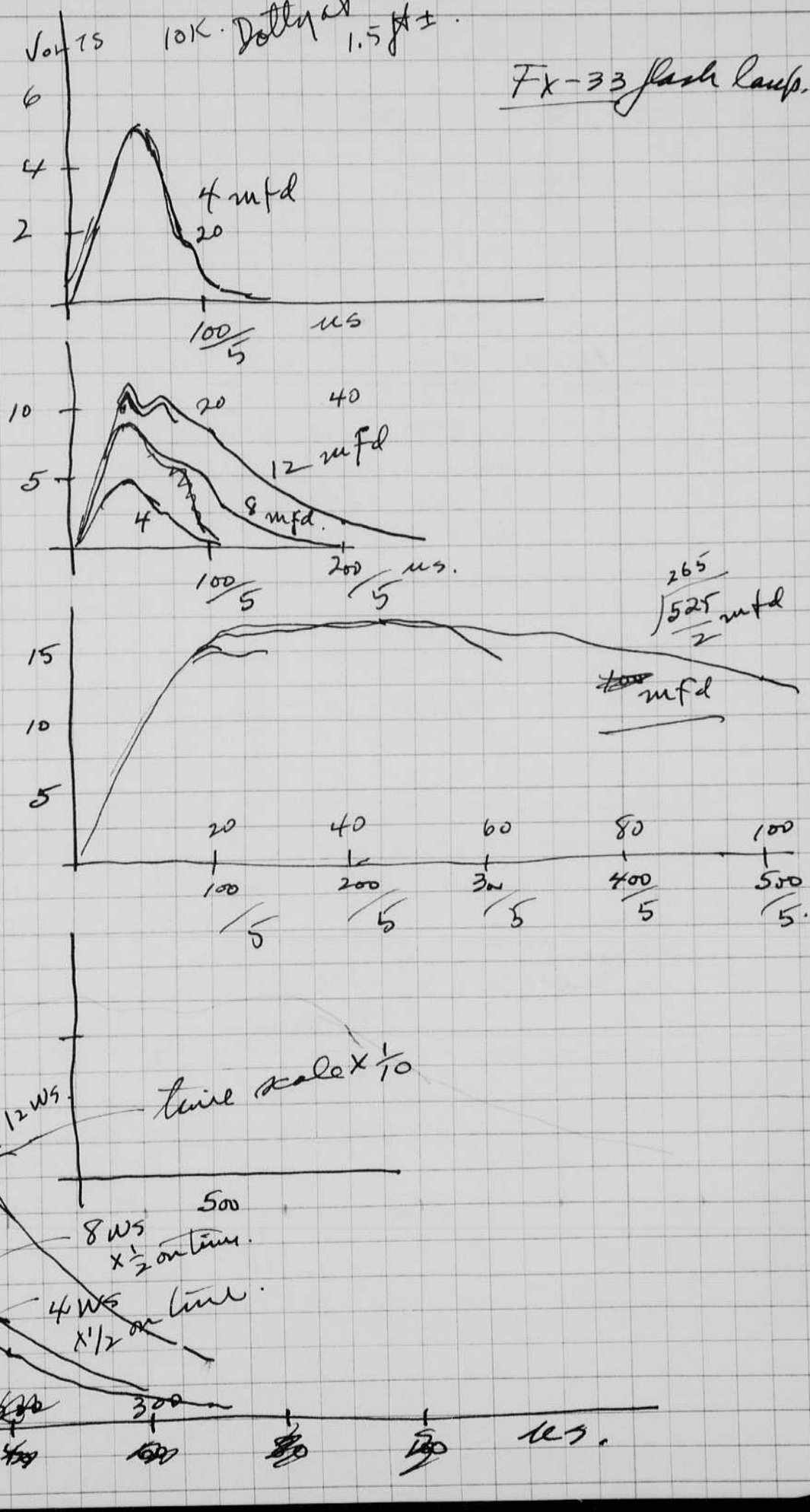
cm	cm	cm	cm	cm
0	.655	.813	.525	1. .026
.0525	.655	813	.478	
.236	.707	.787	.368	
.374	.76	.787	.342	
.575	.813	.787	.315	
.525	.787	.730	.236	
.63	.813	.735	.236	
.68	.84	.735	.184	
.707	.813	.683	.158	
.738	.813	.630	.132	
.758	813	.603	.100	
.707	.813	.551	.078	

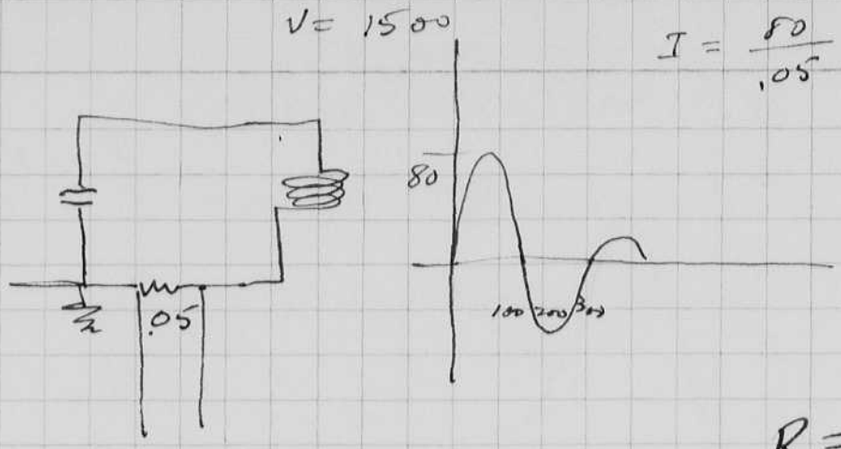
W. E. Edgerton
Sept 23 1961

Short flash adapter for microscope illuminator

10K. Dollyat 1.5 μf ±.

Fx-33 flash lamp.





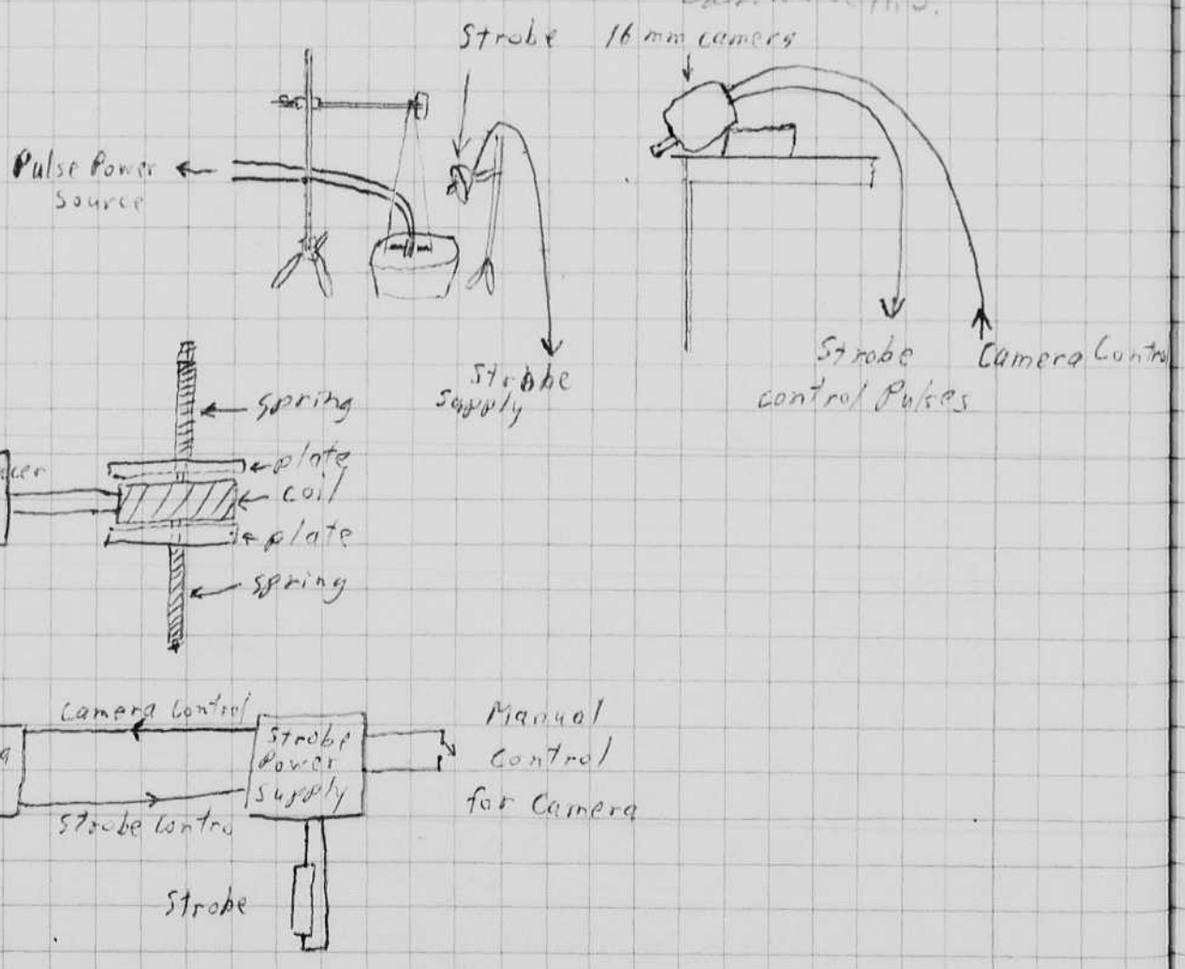
$I = \frac{80}{.05} = 1600$ amps.

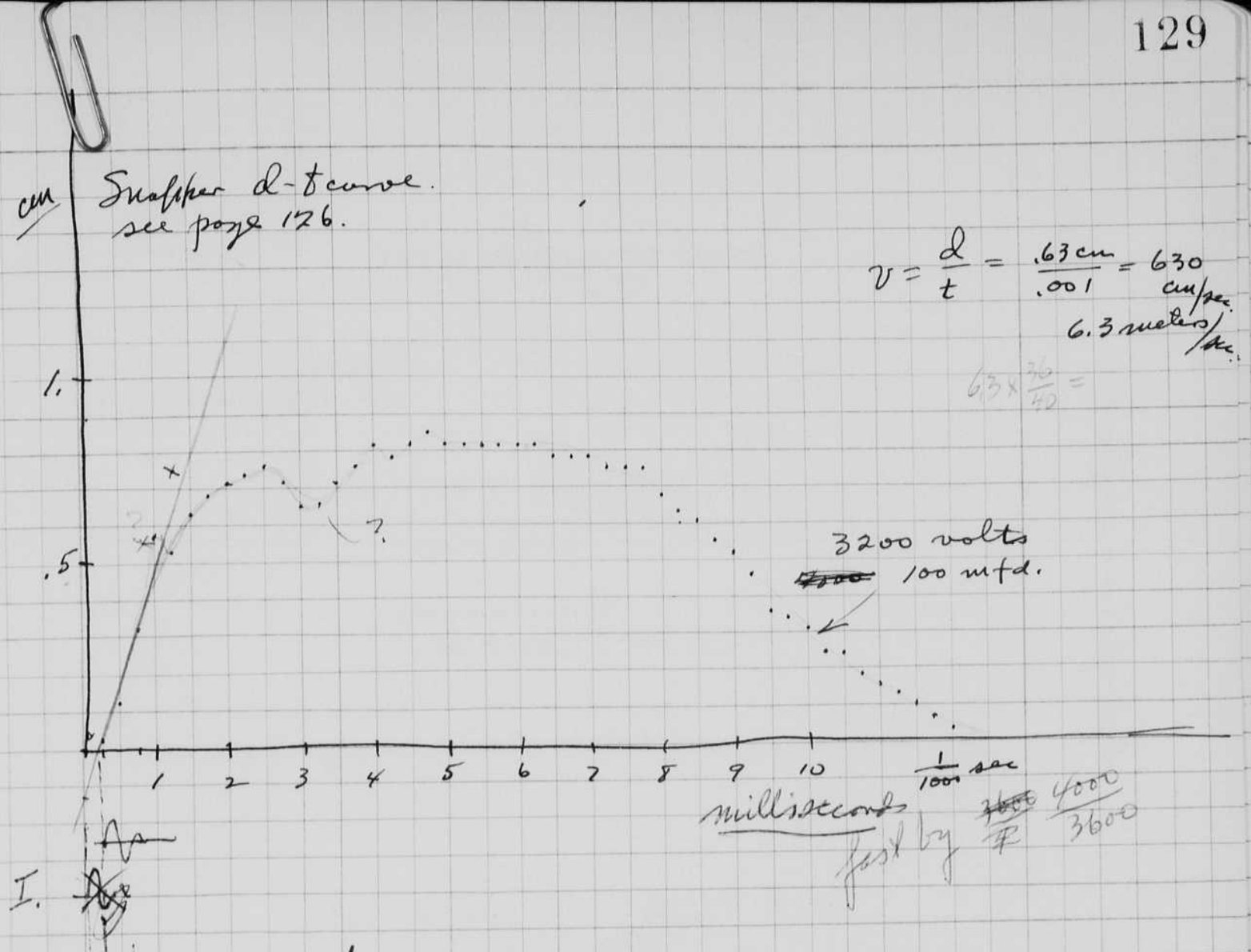
$L_{plate} = 29\ \mu h.$

$L_{no\ plate} = 14$

$R = .02\ \Omega \pm.$

Movies 16 mm
f 2.7
Light to subject distance – 1'
Camera to subject distance – 5'
1st run 3200 v.
2nd run 3500 v





$$v = \frac{d}{t} = \frac{.63\text{ cm}}{.001} = 630 \text{ cm/sec.}$$

6.3 meters/sec.

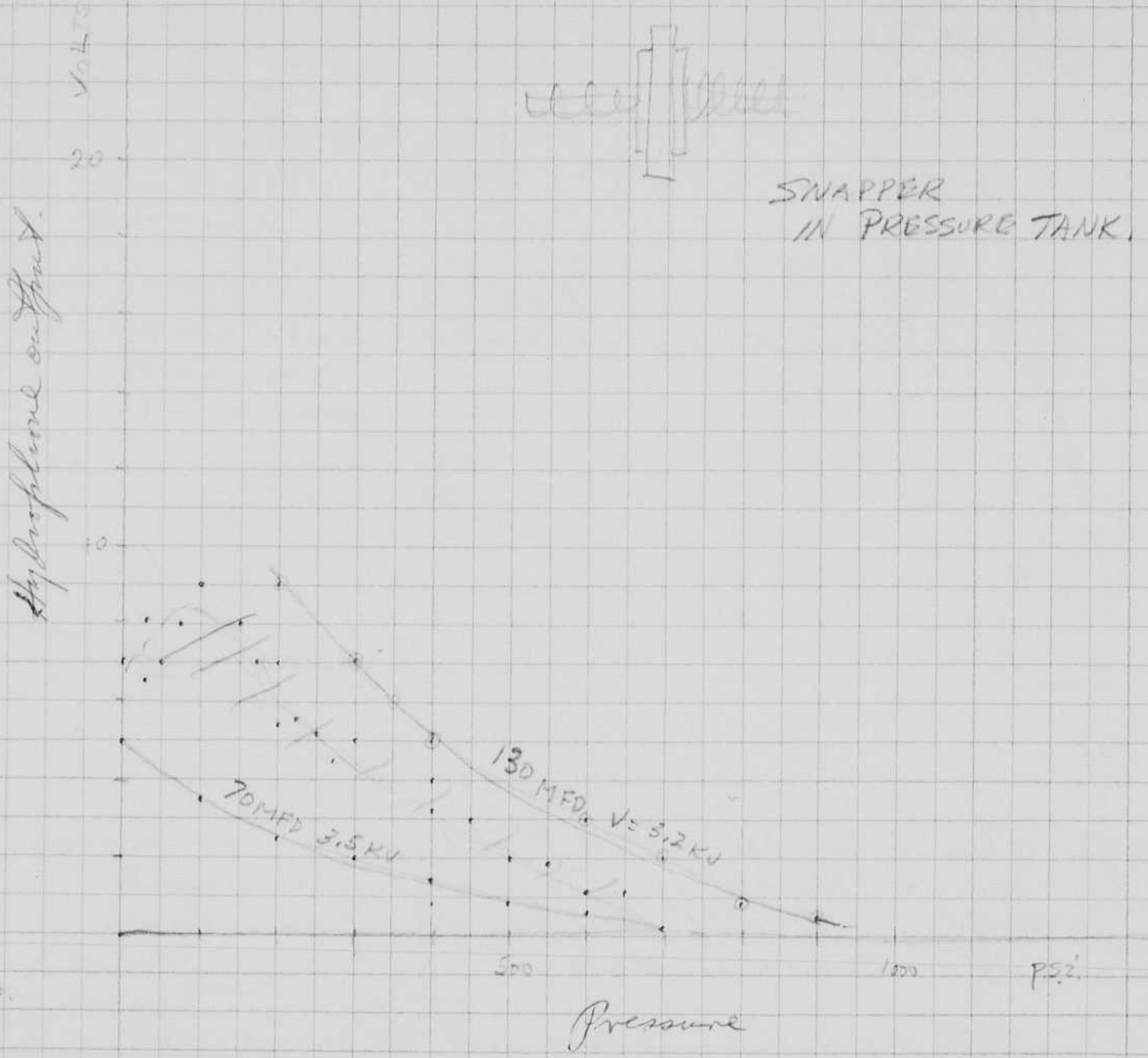
$6.3 \times \frac{36}{40} =$

~~4000~~ $\frac{4000}{3600}$

Sept. 25, 1961 Phoned Jim McGinnis of EG&G about microflash lamps. He is trying to get away from quartz tubing since it creates HCl gas which absorbs water vapor.

See new charge circuit on page 123 as worked out by Mac Roberts.

SNAPPER
IN PRESSURE TANK.



Oct 8, 1961
Harold E. Edgerton

Sonar Today at Bayou Park Church at 9:30 and at 11.

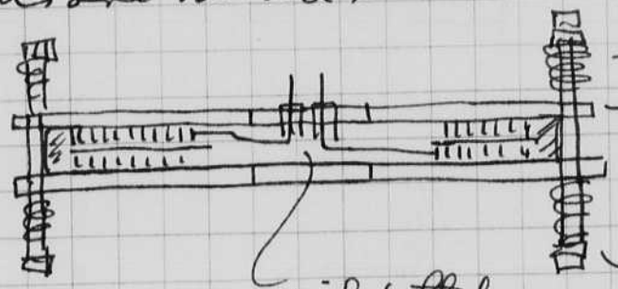
Yesterday and on Friday tests with oscillograph and camera were made at 750 Commonwealth and Boston on the thumper equipment up to 9000 watt seconds.

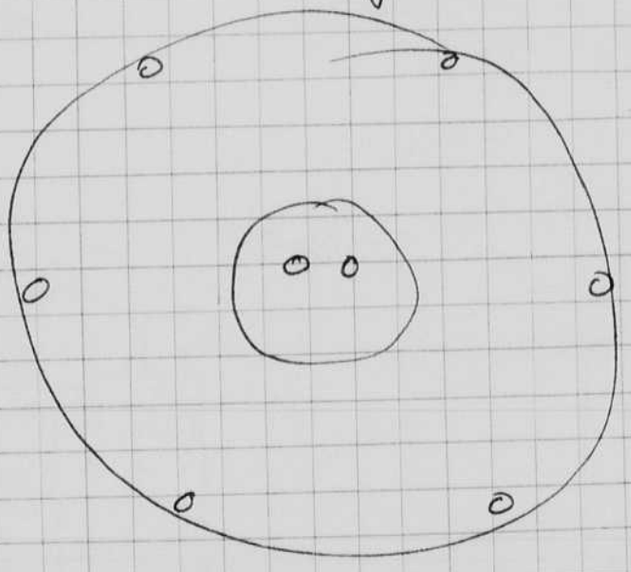
Love Light Instrument missed

1 MS. 1000
5 — 200 #

5 MS. = 200 #.
2 = 500 #.

The new design of thumper driver is round and symmetrical, there are 4" holes in the center of the alum. plates. The connections are on the inside





Oct 6 1961
#1 7000 WS Springs.
2 7000 Rubber.
3 7000 Rubber tight
4 " " "
to O.

I ran this for a 100 or so shots on Sat night. There was a very slight cavitation wear on the inside surface of the al plate about 1" from the inner hole. No marks were seen on the end of the leads. The soft bubbly epoxy around the leads showed some effect of cavitation.

Notebook # 26

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 130 and 131.

Item(s) now housed in accompanying folder.

SOVIET CONSIDERS 5 EARTH PROBES

Plans Call for Drilling 6 to 9 Miles at Separate Sites

Special to The New York Times.

MOSCOW, Aug. 30—The Soviet Union is studying an ambitious plan for probing the earth's interior to a depth of six to nine miles at five places within its territory.

In a meeting at the Ministry of Geology last week, Soviet scientists proposed general areas for the large-scale drilling. They are the Caspian Sea, Karelia, the Ural Mountains, the Caucasus and the Kurile Islands, according to Komsomolskaya Pravda, Communist youth newspaper.

Disclosure of the conference details followed the publication of articles by Soviet scientists. They urged the Government, under the proposed twenty-year party program, devote a greater share of scientific effort to exploration of the earth's interior.

Work Held Neglected

Academician Andre A. Trofimuk, petroleum geologist, said in Pravda, leading party paper: "Study of the deep-seated zones of the earth and their processes has been relatively neglected. Together with further expansion of space studies, the time has come to attack the interior of the earth.

"Direct penetration of the depths of our planet would enable science to make another leap forward in the exploration of the universe."

One drilling operation proposed at the ministry meeting is designed to match the United States Project Mohole, which is intended to probe the Mohorovicic discontinuity. This is a rock layer assumed to lie nine to forty miles below the surface of the continents and four miles below the ocean floor.

The layer forms the boundary between the earth's crust and the rocky shell surrounding the planet's metallic core.

Named for Yugoslav

The Mohorovicic rock layer is named for a Yugoslav scientist who discovered a discontinuity, or sharp break, in the behavior of earthquake waves at that depth.

The layer is believed to be the source of earthquakes, volcanic activity and mountain-forming processes. Metallic ores, diamonds and other minerals are also thought to be formed there before traveling upward to the earth's surface.

The United States approach has been to drill from a floating rig through the ocean floor. A test boring last March reached two miles into the floor of the Pacific, near Guadalupe Island off the west coast of the United States.

Soviet scientists have expressed preference for a drilling site on land. The place chosen at the recent meeting is the volcanic Kuriles, off Siberia's west coast. There the crust is believed to be thinnest among the continental areas, or about nine miles.

According to the youth newspaper, however, the scientists more than a limited Mohole effort. They said they also sought to gain a comprehensive understanding of the major types of rocks making up the earth's crust.

Three layers of rocks are involved: A sedimentary surface layer of sandstones, shales and similar formations reaching to a depth of six to nine miles; a granite layer, found mainly at the base of continents, and a basalt layer, occurring chiefly below the ocean floor.

In addition to the Mohole boring in the Kuriles, four holes have been proposed to investigate representative sections of the earth's crust within the Soviet Union.

The first, near the northern shore of the Caspian Sea, would traverse one of the thickest accumulations of sedimentary rocks and reach the continental basement at a depth of seven to nine miles.

This operation is expected to establish the lowest possible limit of petroleum deposits, which occur predominantly in sedimentary rocks.

A second hole is to be driven into the crust in Karelia in northwest European Russia.

In this area the granite basement of the Eurasian continent crops cut at the surface forming a geological shield.

The Karelian drilling operation would be designed to probe through the earth's granites, whose age is believed to exceed 3,500,000,000 years.

The hole, expected to reach a depth of nine miles, may help shed light on key geological problems, such as the formation of continents and the origin of magmatic rocks, such as granites. These are believed to have risen in molten state from the interior.

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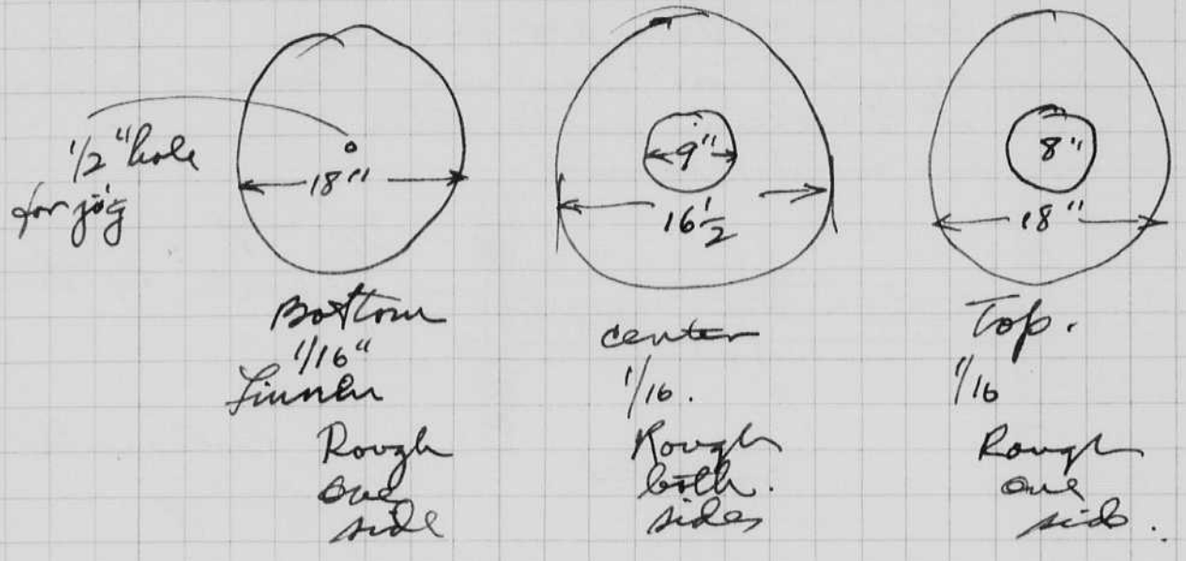
132 Oct 9 1961
H. Edgerton Round 9000 W.S. transducer

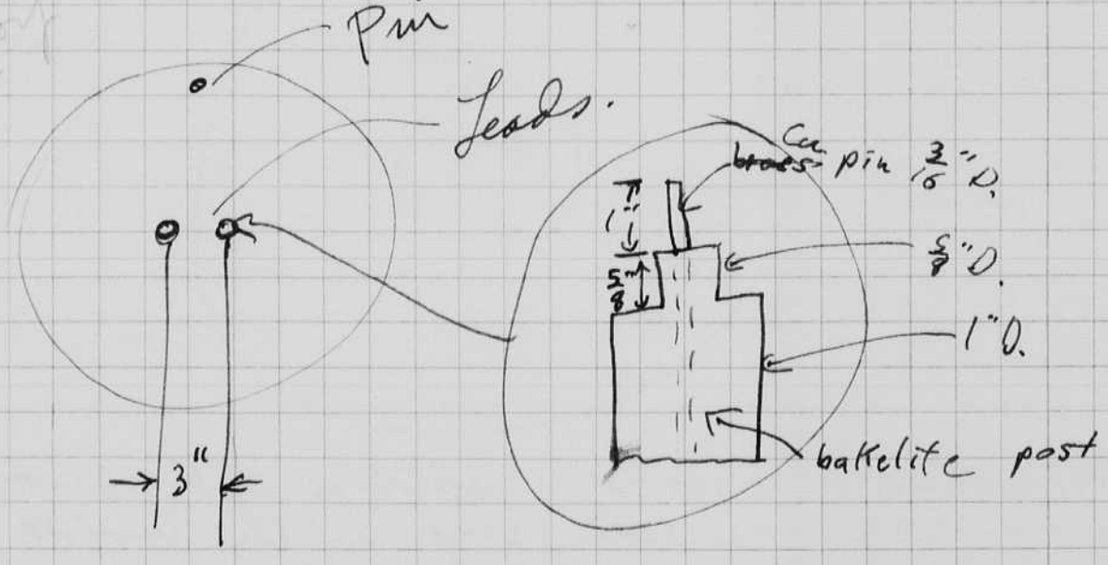
Hole increased to 8 1/2 (?) from a 4" hole.
coil O.D. 16 1/2" wide x .025 copper D.C.C.
I.D. 10 Two coils.
Bakelite 1/16" in center and on both sides
make new ~~2" mica~~ Bakelite 8



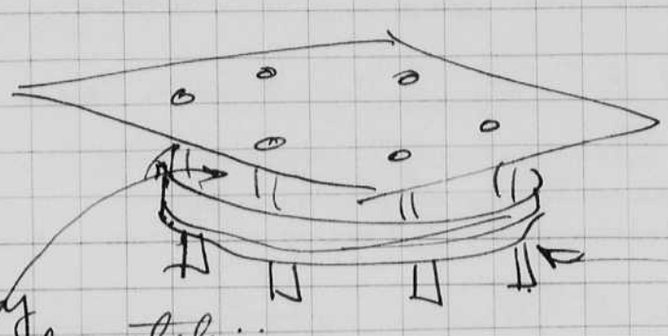
Bottom 1/16" Finish Rough one side

center 1/16. Rough both sides.

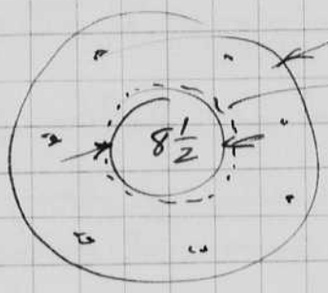
Top. 1/16 Rough one side.



After 200 pops, the lead connection showed a spark.
Equipment taken out of the water for inspection.
Cavitation in 6 spots off next to bolts on side opposite wood.



very slight cavitation



Al plate.
Liquid after 200 pops.

3/8
Al. 6061

New plate 1/2" 6061 18 3/4 bolt circle 6 holes
3/4 holes.
8 1/2 I.D.
20 O.D.

This design N.G. due to unbalanced forces on the transducer.

134 Oct 12 1961

Harold E. Edgerton
Gary Hayward.

750 Commonwealth Ave
Boston E G & G. Basement
over Grease Pits.

Exp. #1 1/2" 6061 plate 20" diam 8" hole. 9000 WS +
3.8 KV.

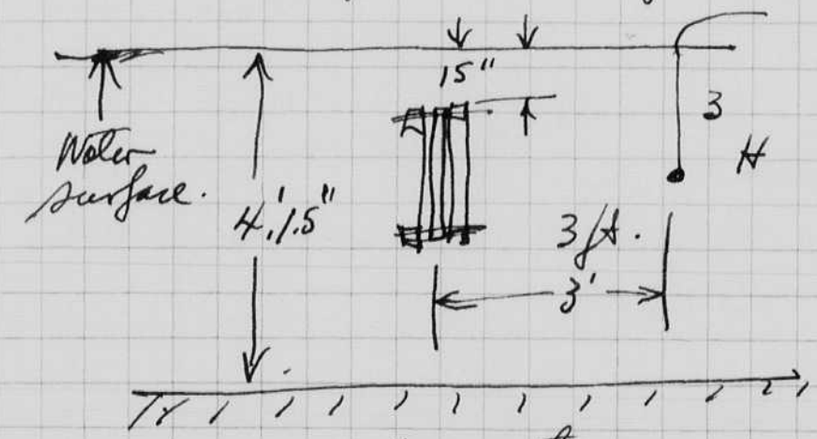
Springs 3" 1/8 wire 1" O.D. stainless.
after 10 Bangs - springs were
permanently deformed
Comment: Spring diam was too large!

There is a 8" diam vortex ring that
goes clear over to the wall some 15 feet.

Exp #2 1/2" 6061 plate 20" Delta 8" hole 9000 WS

2" diam rubber. 3" long Durco
Spaced 6 around ring at 18 3/4" hole center.

3 oscillograms now taken at 3', 6' and 9'
3 ft one is best since echos are not superimposed
on the main pressure cylinder.



Oscillogram taken 2 volts/cm vs 3 ft.
5, 1, 1/2 ms/cm.

#3. 1½" Rubber 3" long 5/8" hole Dur 60+.

after 6 bangs two of the rubbers went over the 1¼ washers.!
We cut the rubber off. or diam to get free from washer.

There was a ½" vortex for the first few bangs. When the rubbers slipped the vortex disappeared

New Washers installed 1¾" or Rubber. Vortex appears again.

Pressure about the same in any duration – if anything more towards the wood side!

Life test started about 2pm while we go out to lunch. 14 sec interval / power supply changes to 3.4 to 3.5 KV. when bangs.

Returned from lunch at 3pm. Equipment was stopped due to center of coil being blown out.

Conference. (1) Try leads on outside edge.

(2) maybe hole in center.

(3) Vertical symmetrical mount. mark bars

Notebook # 26

Filming and Separation Record

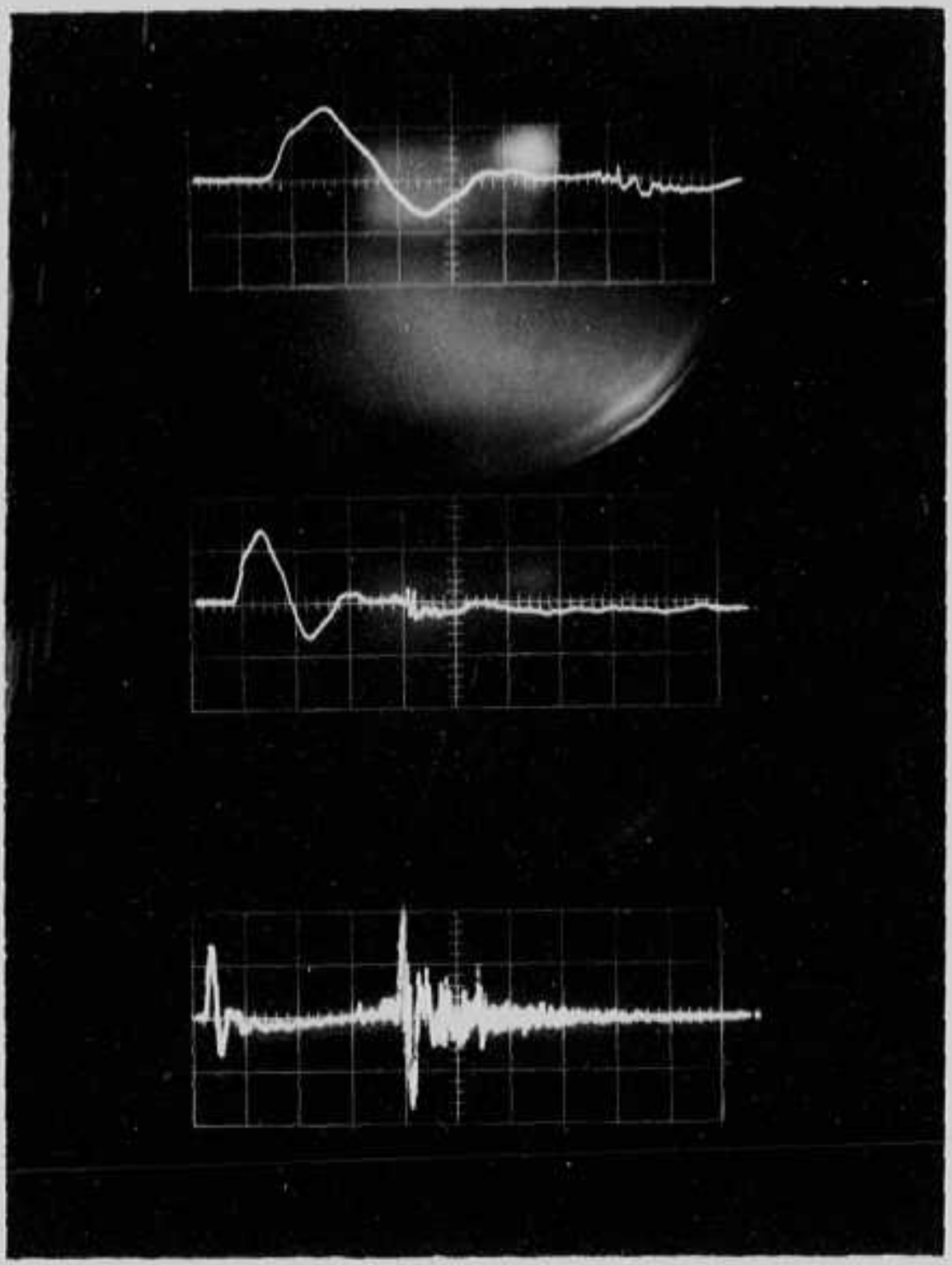
1 unmounted photograph(s)

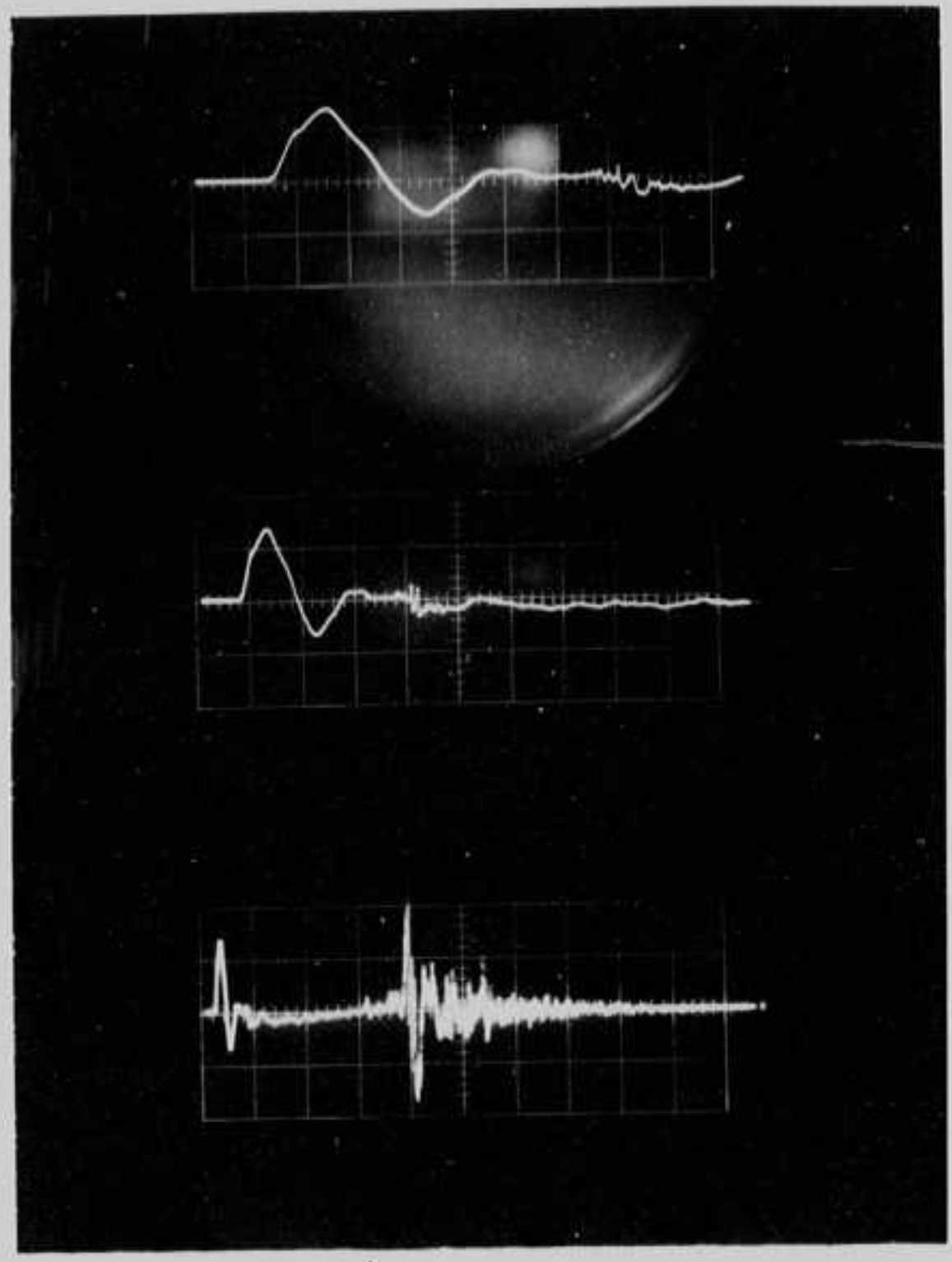
____ negative strip(s)

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

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

Item(s) now housed in accompanying folder.





9000 W.S.

$\mu = 2V.$

3/4

$\chi = 5, 1, 1.5$

mg.

1/2 plate.

1 1/2 Rubber.

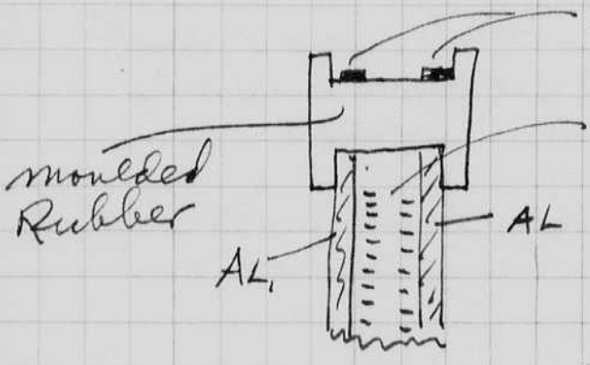
 Oct. 18. 1961

Harold Edgerton

Gary Haywood has gone to Mississippi with Earl Van Reenan to try the pingers and Bangers in the Mississippi river & fluid concrete mattresses.

Last week or the week before Gary suggested a rim of rubber around the round transducer.

This could be of shaped moulded rubber and held on with steel bands, there would be some currents in the bands but stainless steel is of high resistivity and I believe the losses would not be excessive.



This constuction would prevent the water from entering the outside edges of the plate. This should be an advantage.

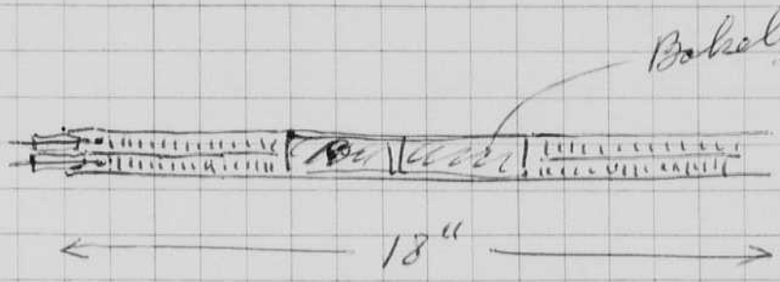
The center of the coil could be cut out as well as the center of the plate, so that the cavitation would only list water.

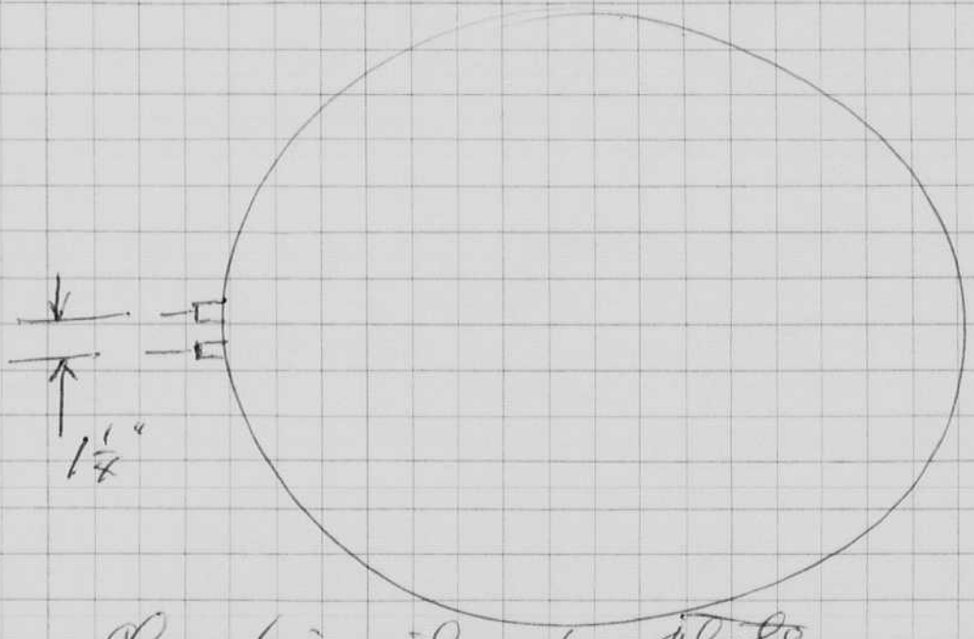
Oct 21 1961
H. E. Edgerton.

Transducer designs
for Whomper.

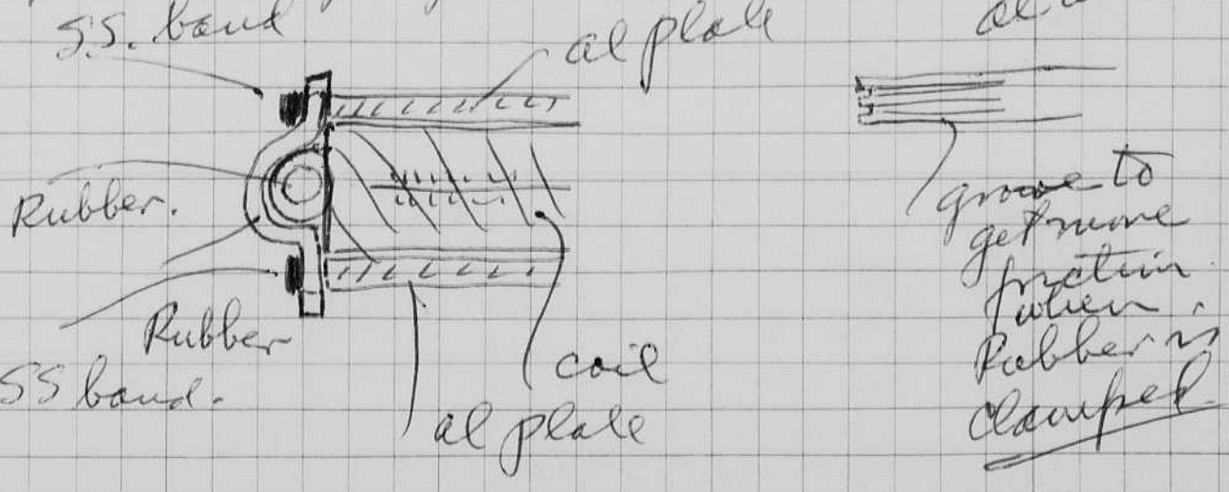
A new coil was finished by Claes Ecklunds group yesterday.

70 turns of copper 1/16" plates near coil
one was fiber glass in epoxy.
Assembly is 1 5/16" thick



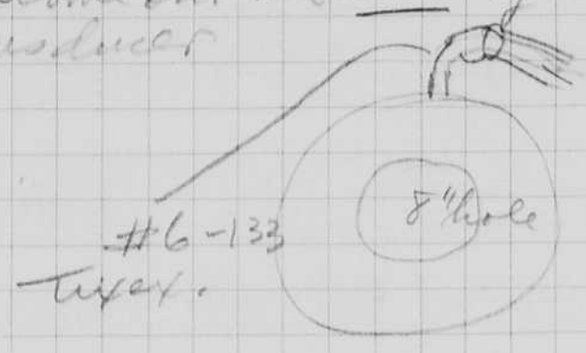


new clamping idea for plate.



~~Edgerton~~ Mike Devlin Sat. 7:50 Commonwealth Ave.

Process Left test of 1/2" Al 6061 plate 18" diam
80 turns 1/2" copper flat tape.
3/20 volts. 12 sec interval.
Leads come out the side of this
transducer



Power 10 min (3:10 pm set up still going strong).

off for Thanksgiving

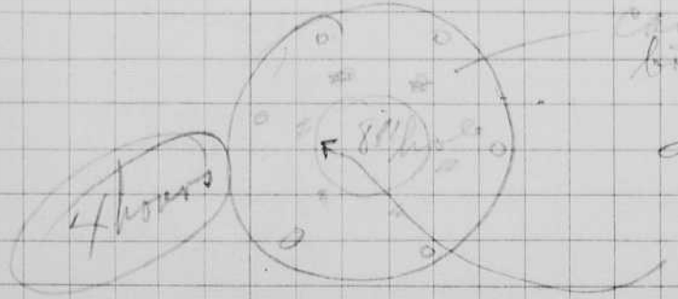
#1 Pedestal 3500 fps 60 ft/sec

#2 Interferometer.

Trigger freq for Sarah Rowe.

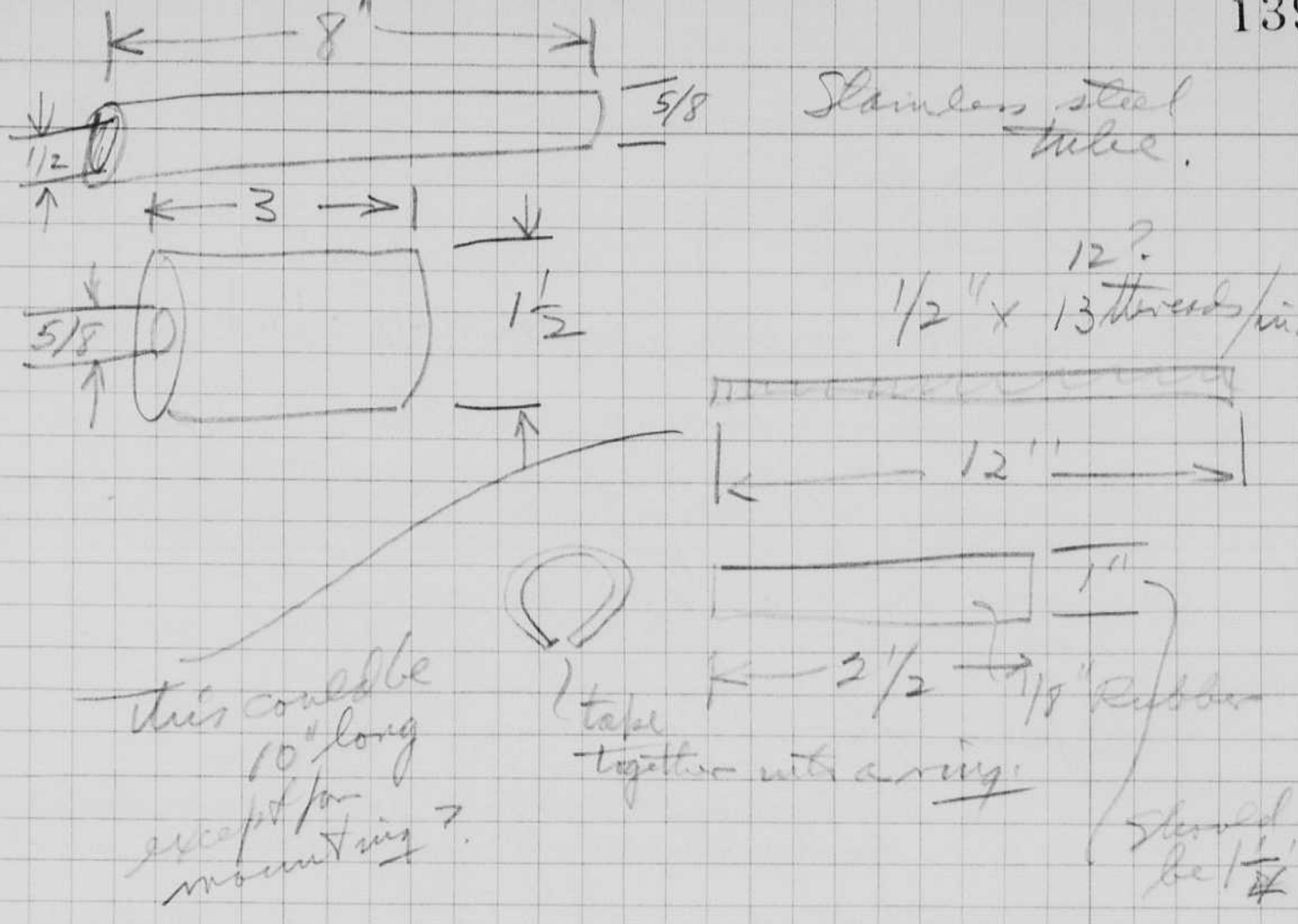
5:40 Dave going to Lafayette Square
Still going. Will be back

8:30 pm Looks ok. Could hear it as soon as I got into the front door at 7:50 Commonwealth



Inner edge of 8" hole always pounding which increases the gap between the coil and the plate.

Started again at 7:30



10:10 PM phone call from Dang in New Orleans Louisiana
Ld 379 Room 331
Fountainbleau Hotel
4000 Tulane Ave
3 days work in Mississippi River
Bid results on asphalt mattress
Some records of bed surface Sapped down Rhizotec
Ping and festin with the same add head worked fine

Oct. 22, 1961 Sunday. Turned the Life test off at 11:10 am / 5/min
$\frac{12}{60}$ / $\frac{60}{60}$

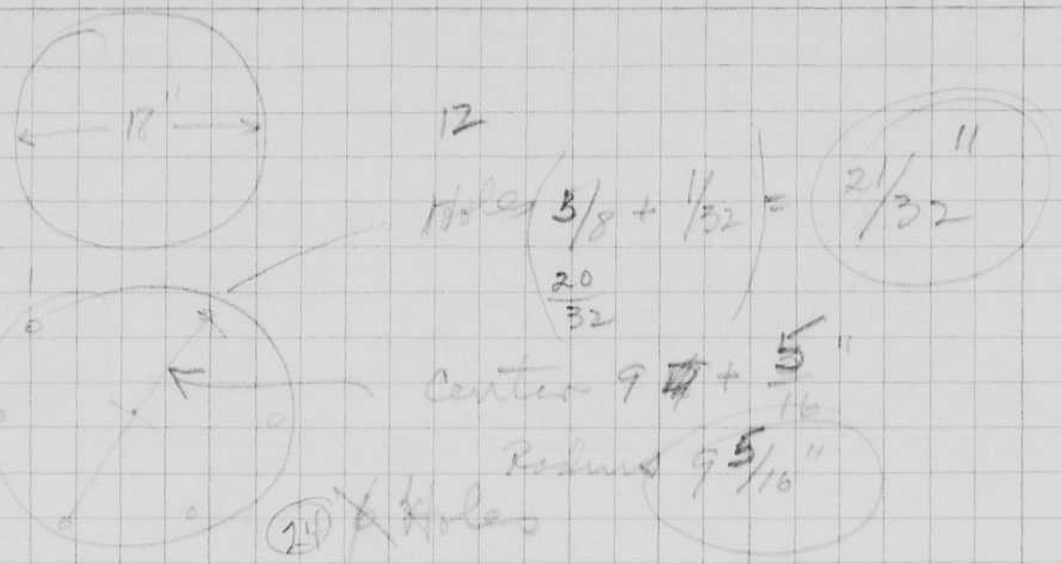
4 hours. 000 21 apt.
12 } to Oct 22
1.5

17.5 hours. at 12 sec. $\frac{60}{300}$ = 5/min 300/hr

$\frac{17.5}{5250}$ Whamps

5,250 whamps obs.

Need bolt specifications.
cost?



Repairs after 17 hour run.

1. Filed inside surface where cavitation had roughened and flattened surface.

2. Put Epoxy Eccobond 26 into holes 3 holes had gone completely through!

Sunday night.
6 30 pm started on additional life test.

740 pm off for inspection. Epoxy has been jarred out of the bad holes.

N.G.

Next move go to 12 bolts
with 3" length 1 1/4" rubbers 5/8" holes.
(to get 12 spots?)

Oct. 24, 1961. 10-1/2" plates 20" diam have been ordered.
Radius of centers 9 5/16" for 24 holes.
21/32" holes 5/8 + 1/32.
24 rubber parts came in today from Green Rubber.
Load test made by Mackoberts on 1 1/4" Rubber with 5/8

Load	Deflection.
30.75 lbs.	5/32"
73 lbs.	5/16"

Single rubber part.
Durometer 60.

Oct 28 1961. Sat.
H. Edgerton

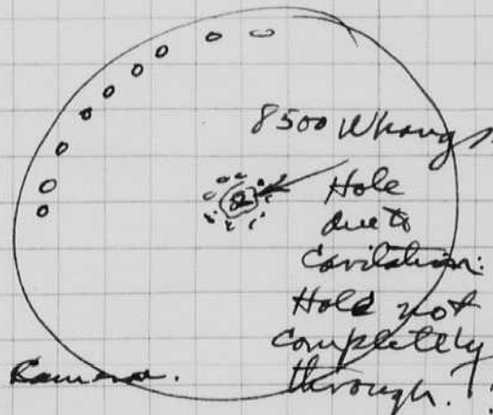
Whanger Lifetest.

18
10
18.5

The new transducer with the following features was run from 4:30 last night until 10 am today. It was also run the night before for 10 hours. Total 28.5 hours.
Whangs. = 8550 $\frac{300}{8550.0}$ Pangs/hour.

Wear. - Hole at center of aluminum disc on both outside edges.
One of the nuts holding the mounting straps had come off. also the nut underneath was loose.
note. last night at 12 o'clock, I came over to inspect. all 4 nuts on the holding straps were off. I put them on with lots of teflon and with lock washers.

12 Bolts (24 holes in disc).
Rubber 3" x 1¼ x 5/8 hole
½" discs T-6 6061 aluminum.
no center hole



~~Take #~~ 1 9000 W.S. 3500 f.p.s.
Round Plate. XXX in Eastman Kamra.
Angle views taken to show edge of plate, Rubber, Straps and the cavitation in the background.

I plan to leave Nov 17 for Paris.
15, 19 Paris Bull & Courtesan
20 Marseille Laban
21 Toulon Honort
22-24 Monaco. to join the CHAIN while there returns to W.H.O.I. by Dec. 10.

Frank and Edwin Massa were at M.I.T. for lunch and at 750 commonwealth to observe the Whanger 11,000 W.S. We also discussed transducer design for the Pringer.

K.E.S.

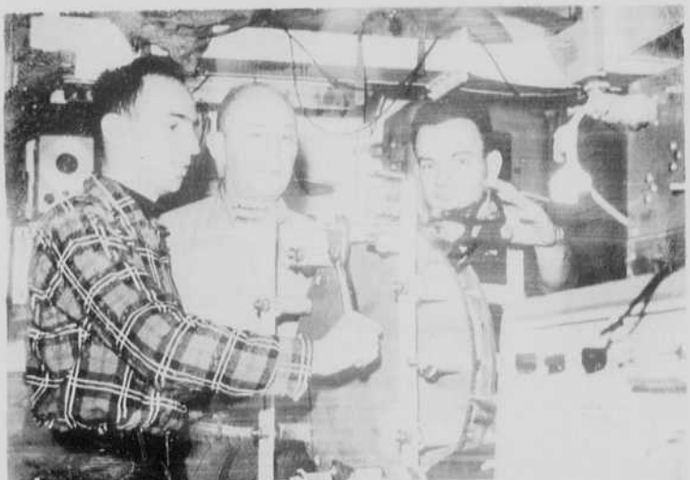
Returned Dec 18 1961 at 9am to WHOI at Woods Hole on Chain 21 cruise. Left Monaco Nov 24 1961

Made 18 seismic profiles in Atlantic with Earl Hays.

As measured Boomer coil by Class Eidsonat EG&G. L = 280 uh Q = ~~2~~ 1000 R_{DC} = 0.09 ohms. with plates.

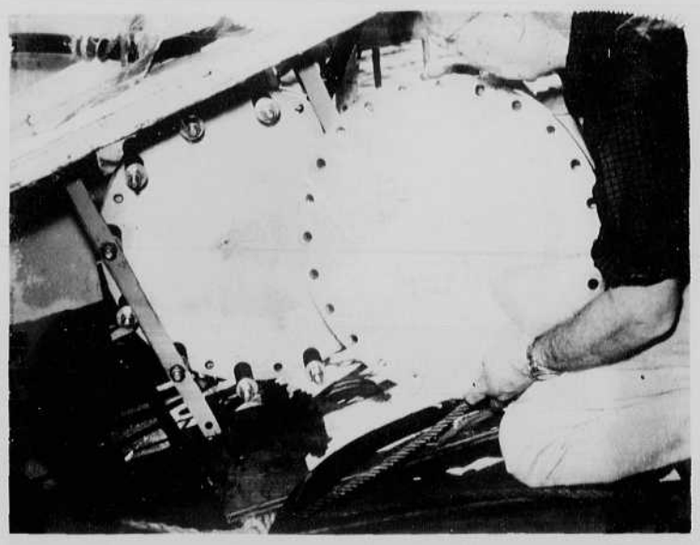
Aluminum 6061 metal. L = 2900 uh Q = 50 without plates.

Andy Nalwalk mounted cameras and strobes on the Pinger frame. This was used twice on dredging operations.



Breslau Edgerton ? from d.o Monaco

Boomer transducer as used on Chain 21



Boomer plate with cavitation Damage

Jan. 1, 1962

Harold Edgerton

Louis Trzcinski from Lincoln Nebr
was here 27, 28, 29 for some multiflash
photography of
Viola Paul Doleton.
~~Ole~~ Cello Suzanne le Carpentier
Violin Louis T.

We tried several techniques with
multiflash including a
bulb on the end of the ~~bow~~ bow
to give a streak photo.

Robt Snyder of Campbell Mithun Inc
was here 27, 28, 29
to take photos of
golf balls and
tennis balls at high
speed

600/sec of club.
1000/sec of club.
1/2 µs single shot of ball and
club head.
5000
3000
4000/sec. of shaft waves.

this was over the Wilson Sporting Goods Co
Chicago

Snyder took negs to Chicago Dec 30 Sat on
1130 airplane.

K.E.S.

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Made 18 seismic profiles in Atlantic with Esso Hogs.

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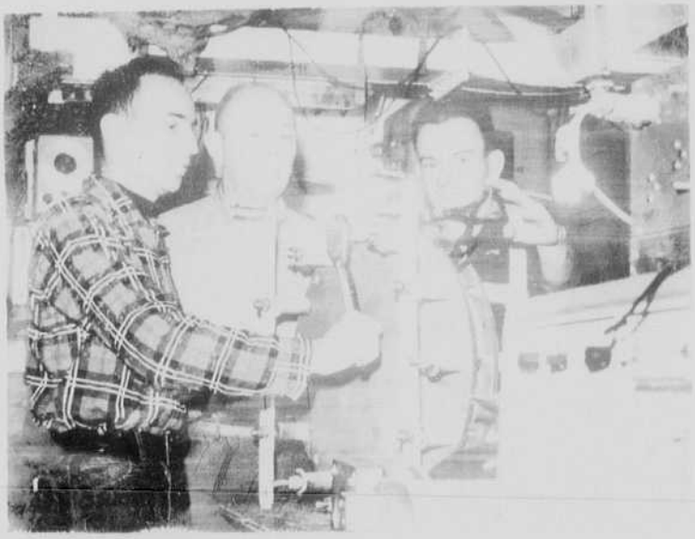
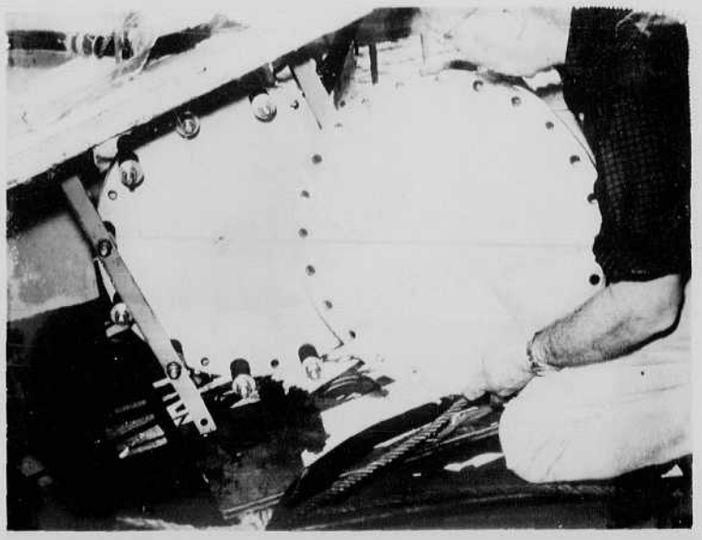


Breslau Edgerton ? from R.V. Monaco

Boomer transducer as used on Chain 21



Boomer plate with sanitation Damage

Jan. 1, 1962

Harold Edgerton

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was here 27, 28, 29 for some multiflash
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Viola Paul Doleton
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1/2 us single shot of ball and
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5000
3000
4000/sec. of staff waves.

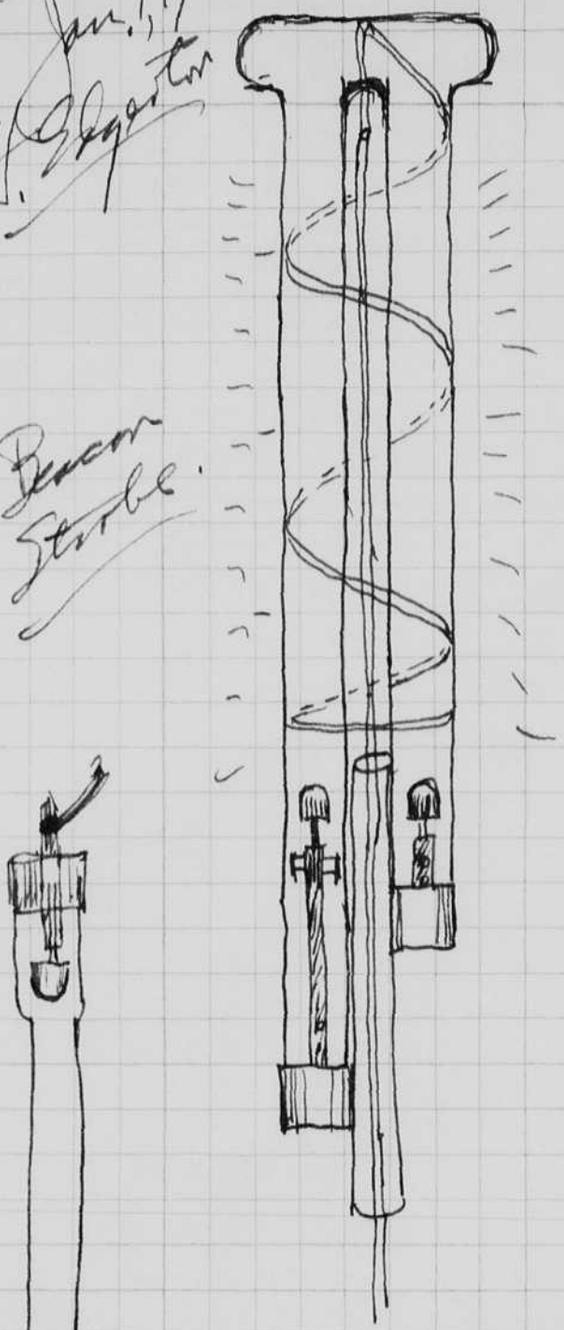
this was over for the Wilson Sporting Goods Co.
Chicago

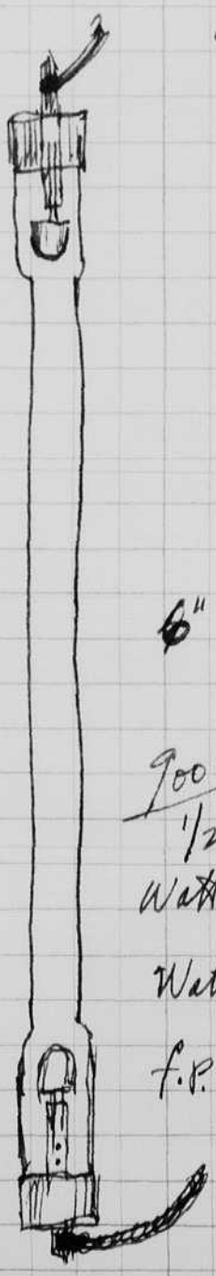
Snyder took negs to Chicago Dec 30 Sat on
1130 airplane.

Jan. 1, 1961

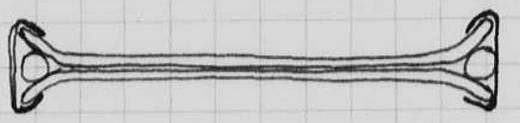
H. Shorter

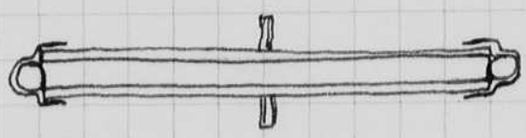
Beacon Strobe.

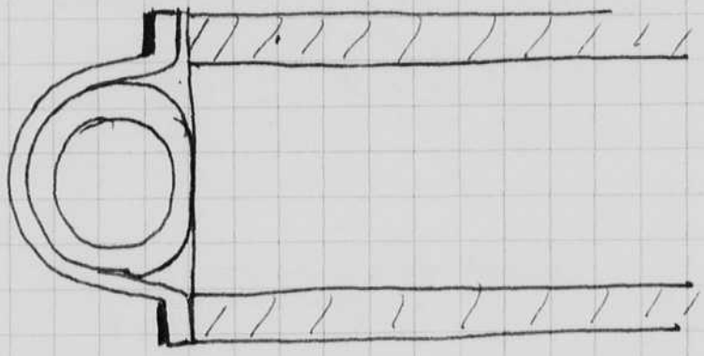


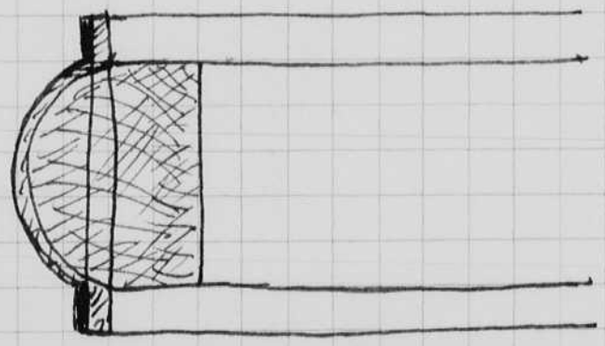


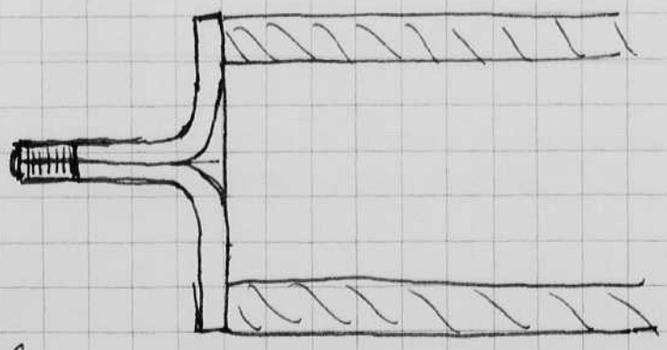
Boomer











6" 9 mm O.D. = $\frac{2}{4} = \frac{1}{2}$ ohm.

$\frac{900 V}{1/2}$ = 1800 amp.

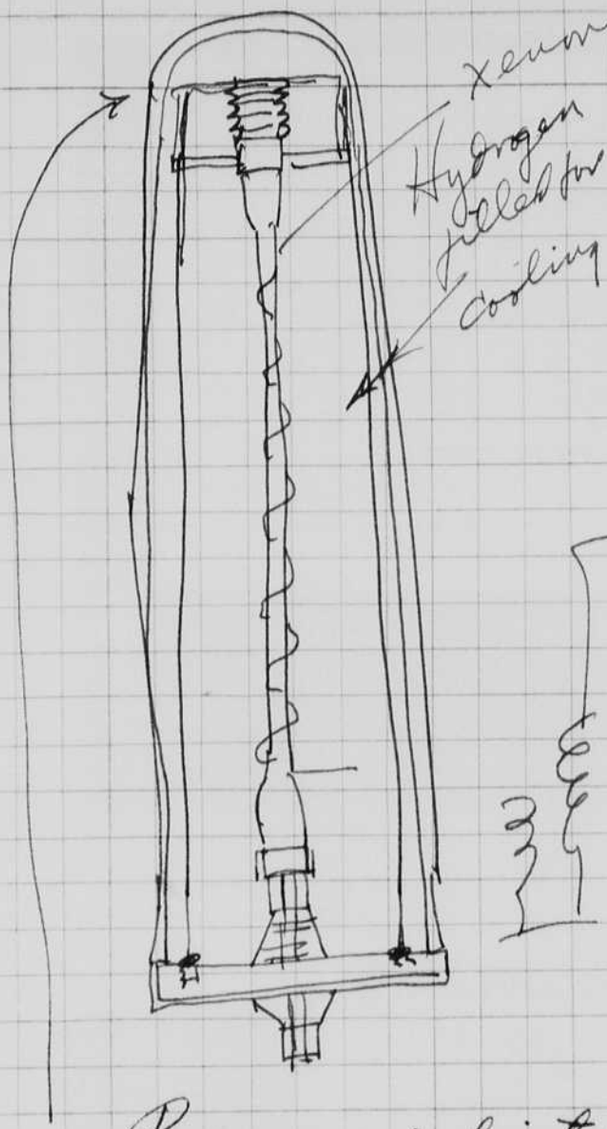
Watt sec. = 40

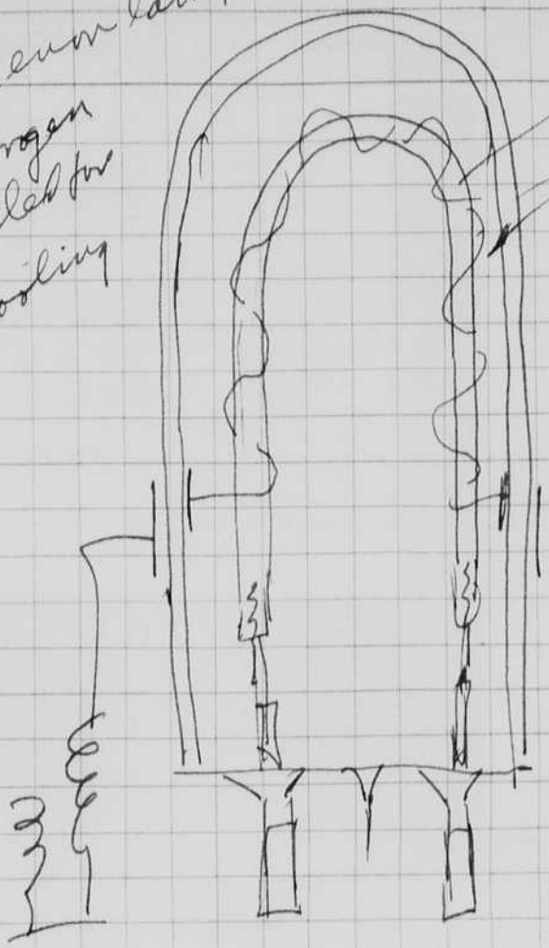
Watts = 80.

f.p.s. = 2/sec

$C = \frac{40 t^2}{900^2} = 99.$ mfd.

$\frac{RC}{2} = \frac{1}{2} \frac{1}{2} \times 100 \times 10^{-6} = 25$ ms.



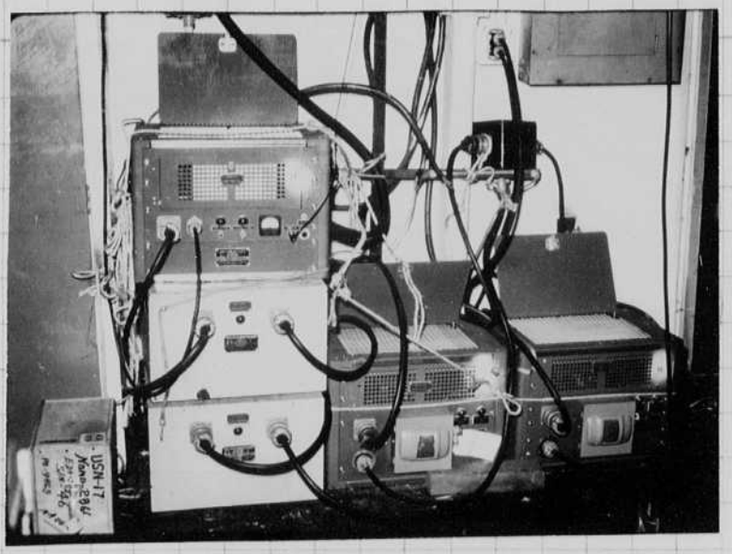


Pressure indicator. Showed the Hydrogen pressure decrease from 2 to 1 atmosphere the lamp will be automatically disconnected.

Cylindrical copper diaphragm with internal spring to work against pressure. The device moves when the pressure changes.

Note capacitor spark connection through outer envelope to ~~obtain~~ one wire through the glass envelope.

5000 W.S. Boomer

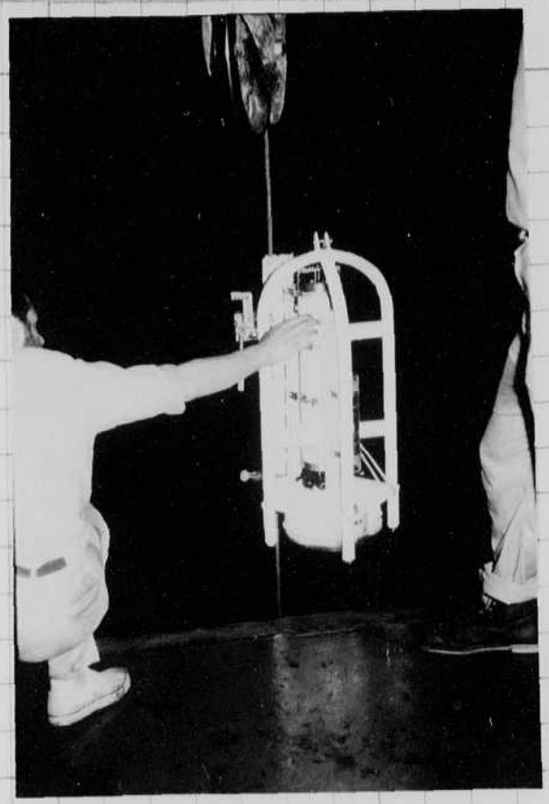


5000 WS
Boomer

Bud Knott
J. B. Hersey

Camera rig
f 4.5 lenses
100 W.S.
20 ft+

Puerto Rico trip.



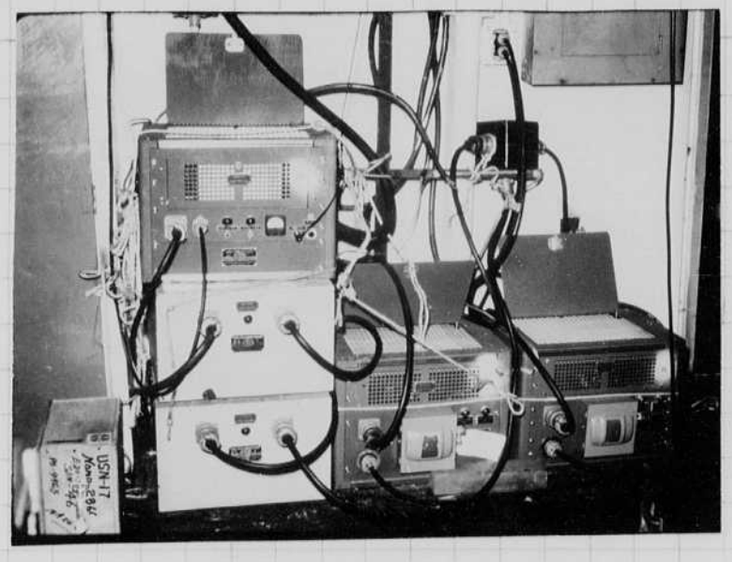
Pinger on clamps.

Clamps for pinger

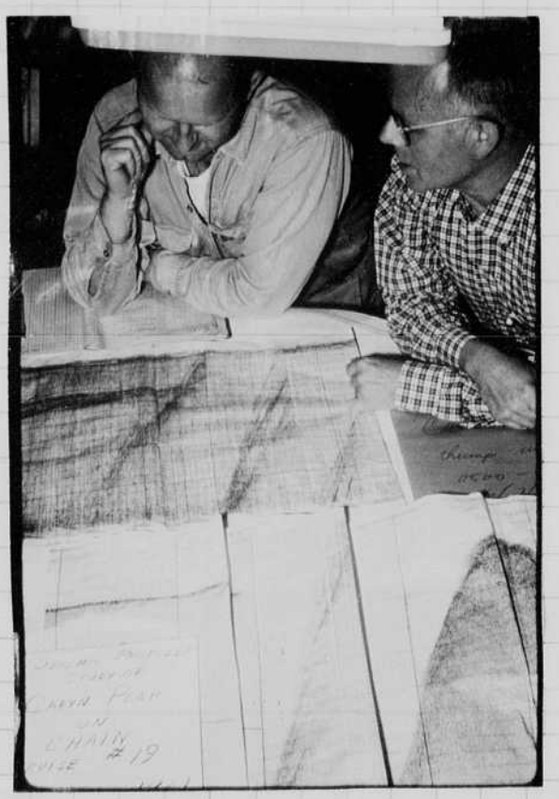
J.B. Hersey.

Dave Falgui at with pinger record.

5000 W.S. Boomer

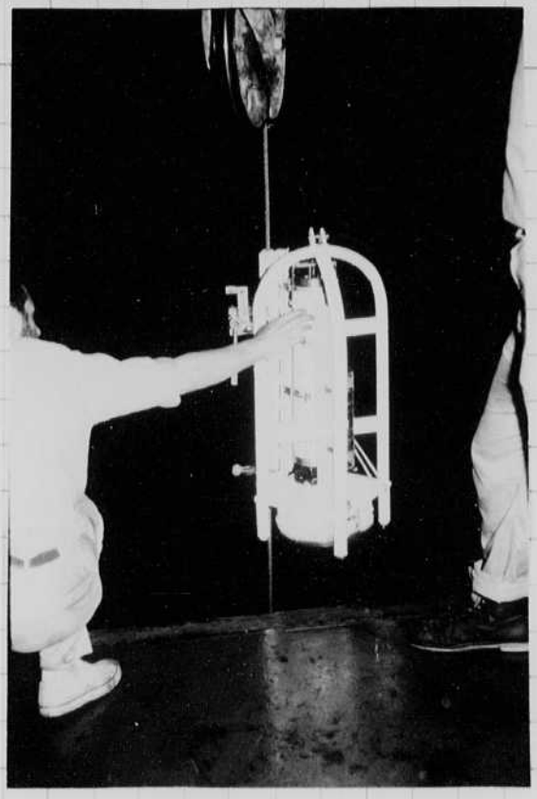


5000 W.S
Boomer



Bud Knott
J. B. Hersey

Camera rig
f 4.5 lenses
100 W.S.
20 ft+



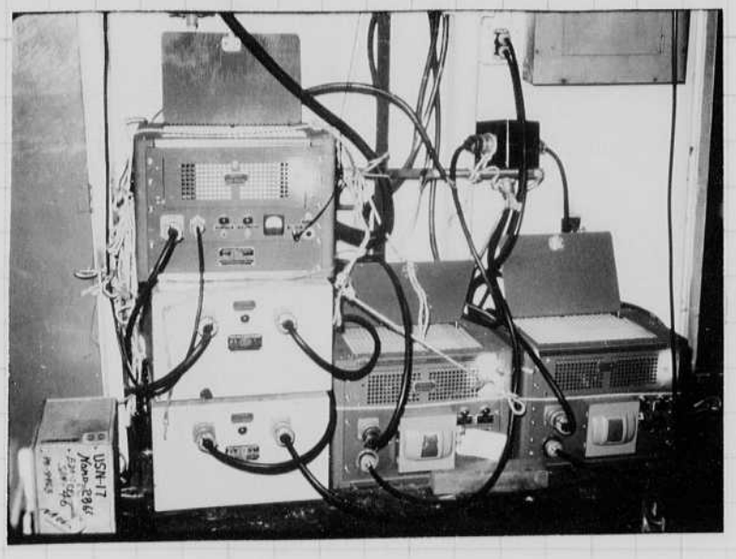
Pinger on clamps.

Clamps for pinger

J.B. Hersey.

Dave Talquist with pinger record.

5000 W.S. Boomer

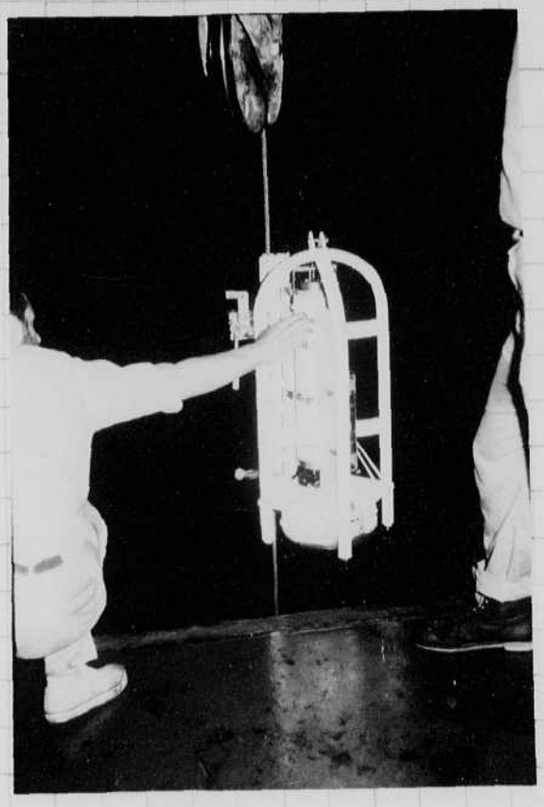


5000 W.S
Boomer

Bud Knott
J. B. Hersey

Camera rig
f 4.5 lenses
100 W.S.
20 ft+

Puerto Rico trip.



Pinger on clamps.

Clamps for pinger

J.B. Hersey.

Dave Talquist with pinger record.

Clay samples from Puerto Rico.

Barbara Tenzig

Breslau

Lucien Bull

D. P. Constitution

D. P. Constitution

Allen

Jan. 4, 1962
H. Edgerton

Experiment for 6.202 class

1531 Strobotac
at 60 cycles with
out reflector.

Bank fans =
10^4
$\sqrt{10^4} = 100$
$5 \times 10^{-13} \times 10^4$

30,000 C.P. peak at 33 ft & PM. table.

1000 V	.015 V	1.2 meg.
1100	.02	
1200	.05 V	
1300	.1	
1400	.2	

$i_0 = \frac{.015}{1.2 \times 10^6} = .01$ ua

1.58
1.05
.35
3.04 Density.

Sensitivity. voltage =

$$\text{Light} = \frac{30{,}000}{\left(\frac{33 \times 12}{400}\right)^2} \times \frac{1}{1000} = \frac{30{,}000}{16\ 10^4\ 1000} = 1.87 \times 10^{-4} \text{ lumens}$$

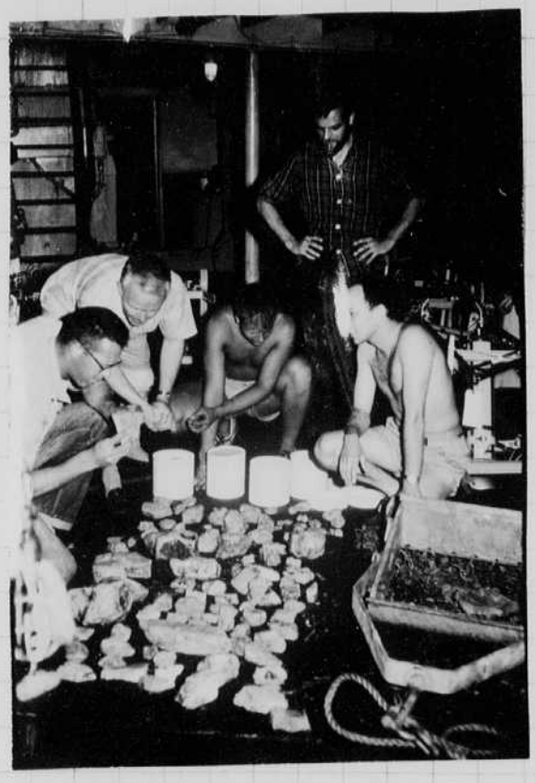
$$i = \frac{0.07 \text{ volts}}{10^3 \text{ ohms}} = 70 \text{ microamps.}$$

$$\frac{i}{\ell} = \frac{70 \times 10^{-6} \text{ amps}}{1.87 \times 10^{-4} \text{ lumens}} = 37.4 \times 10^{-2} = 0.37 \text{ amp/lumen.}$$

S. B. Hersey was in the lab on Sat Jan 6 with Sam Raymond and Barry Hayward. We discussed Boomers etc. Sam showed Hersey the pressure boomer device with the air nozzle and rubber foot.

Jan 12 1962 at 5:30 at 750 Commonwealth ave —
Conference Kearsley. Raymond Hayward Hartford. Van Reenan Edgerton. } discussed Beacons — Cameras Prizes Boomers. etc.

Clay samples from Puerto Rico.



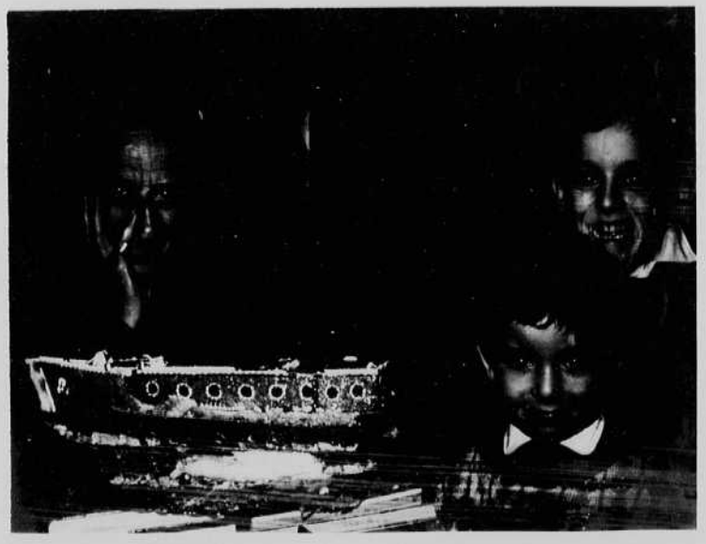
Barbara Feezy

Breslau

Lucien Bull

D. P. Coulter

D. P. Coulter



Allen

Jan. 4 1962
H. Edgerton

Experiment for 6.202 class

1531 Strobotac
at 60 cycles with
out reflector.

Band pass =
10^4
$\sqrt{10^4} = 100$
$5 \times 10^{-13} \times 10$

30,000 C.P. peak at 33 ft & P.M. table.

1000 V	.015 V	1.2 meg.	$i_0 = \frac{.015}{1.2 \times 10^6} = .01$ ua
1100	.02		
1200	.05 V		
1300	.1		
1400	.2		

1.58
1.05
.35
3.04 Density.

Sensitivity. voltage =

$$\text{Light} = \frac{30{,}000}{\left(\frac{33 \times 12}{400}\right)^2} \times \frac{1}{1000} = \frac{30{,}000}{16\ 10^4\ 1000} = 1.87 \times 10^{-4} \text{ lumens}$$

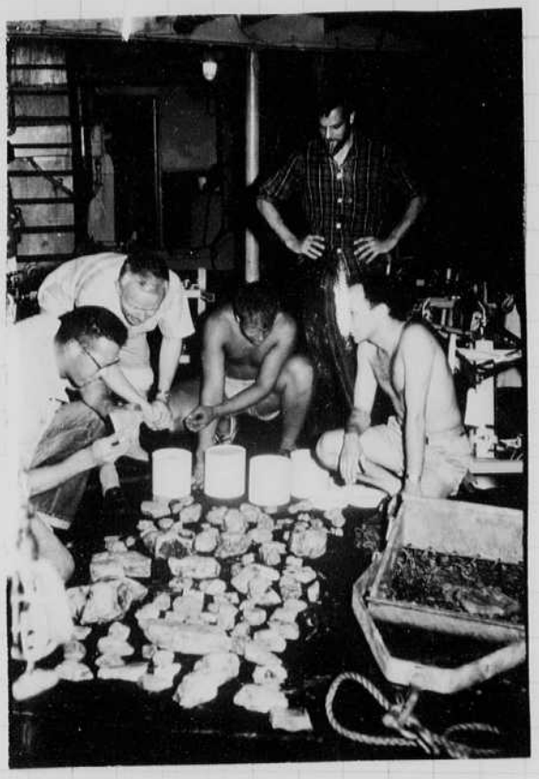
$$i' = \frac{0.07 \text{ volts}}{10^3 \text{ ohms}} = 70 \text{ microamps.}$$

$$\frac{i'}{l} = \frac{70 \times 10^{-6} \text{ amps}}{1.87 \times 10^{-4} \text{ lumens}} = 37.4 \times 10^{-2} = 0.37 \text{ amp/lumen.}$$

S. B. Hersey was in the lab on Sat Jan 6 with Sam Raymond and Barry Hayward. We discussed Booms etc. Sam showed Hersey the pressure boom device with the air release rubber foot.

Jan 12 1962 at 8:30 at 750 Commonwealth ave —
Conference Kearsley, Raymond, Hayward, ~~Hartford~~, Van Keuren, Edgerton. } Discussed Beacons — Cameras Prizes Booms. etc.

Clay samples from Puerto Rico.

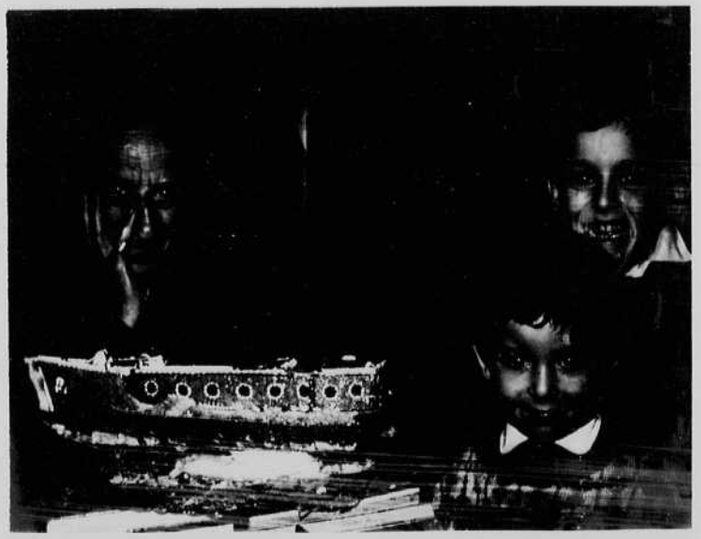


Research Survey

Breslau

Lucien Bull

D. P. Constitution



D. P. Constitution

Alcoa

Jan. 4 1962
H. Edgerton

Experiment for 6.202 class

1531 Strobotac
at 60 cycles with
out reflector.

Bank fans =
10^4
$\sqrt{10^4} = 100$
$5 \times 10^{-13} \times 10$

30,000 C.P. peak at 33 ft & P.M. table.

1000 V	.01~~5~~ V	1.2 meg.	$i_0 = \frac{.015}{1.2 \times 10^6} = .01$ ma
1100	.02		
1200	.05 V		
1300	.1		
1400	.2		

1.58
1.05
.35
3.04 Density.

Sensitivity. voltage =

$$\text{Light} = \frac{30{,}000}{\left(\frac{33 \times 12}{400}\right)^2} \times \frac{1}{1000} = \frac{30{,}000}{16\ 10^4\ 1000} = 1.87 \times 10^{-4} \text{ lumens}$$

$$i = \frac{0.07 \text{ volts}}{10^3 \text{ ohms}} = 70 \text{ microamps.}$$

$$\frac{i}{l} = \frac{70 \times 10^{-6} \text{ amps}}{1.87 \times 10^{-4} \text{ lumens}} = 37.4 \times 10^{-2} = 0.37 \text{ amp/lumen.}$$

J. B. Hersey was in the lab on Sat Jan 6 with Sam Raymond and Barry Hayward. We discussed Boomers etc. Sam showed Hersey the pressure boomer device with the air release rubber foot.

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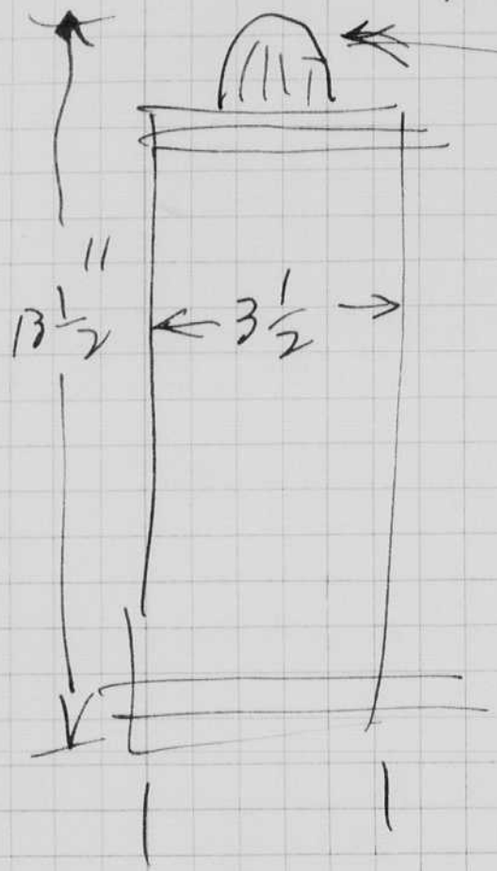
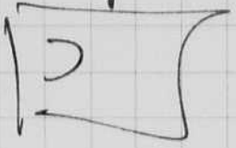
Jan 13 1962
4-405 M.I.T.
Strobe lab.

Boston Camera club visited the Strobe lab last night. About 200+ people were here. Those who helped were Jean Roberts. Calalander, Buttrick, Schlesinger. Haywood. We had the place cleaned up and everything going.

Dave Zolkoff brought over an a.c. strobe beacon.

FXBA flash lamp at 1.5 sec interval.





Pickup to 2 Visual.

929+ Wratten
106 Filter.

1000 ohms.

10^{a} for 2 cm deflection
$.05 \times 2 = 0.1$ volts.

$M.C.P. = KV d^2 / R_L$ $K = 47 \times 10^6$
d in feet.
V = volts
R_L = ohms

$M.C.P. = \frac{47 \times 10^6 \; 0.1 \; (\frac{10}{12})^2}{1000}$

$= 30 \times 100 = 3000$ peak

Duration = 5 microsec

Taken in M.I.T. Pool.

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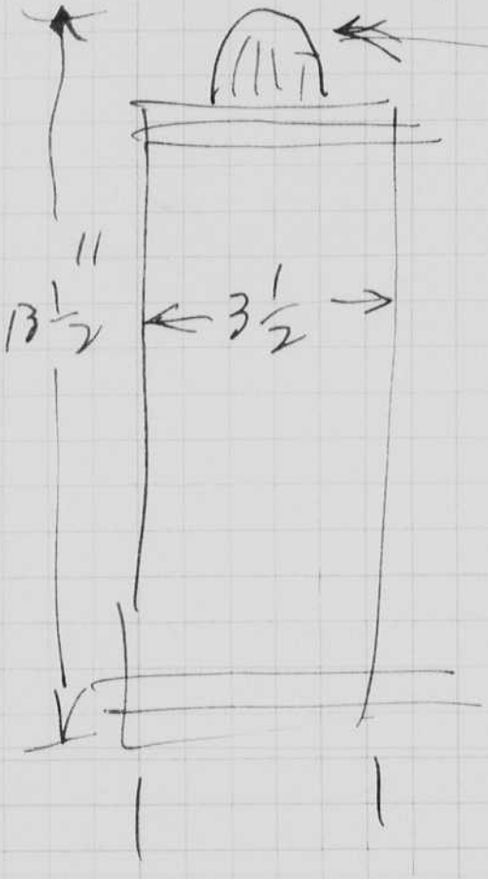
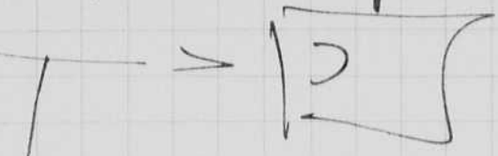




Pickup to 2 Visual.

929+ Wratten
106 Filter.

1000 ohms.

10" for 2 cm deflection
.05 x 2 = 0.1 volts.

$M.C.P. = KVd^2/R_L$ $K = 47 \times 10^6$
d in feet.
V = volts
R_L = ohms

$M.C.P. = \frac{47 \times 10^6 \, 0.1 \, (\frac{10}{12})^2}{1000}$

$= 30 \times 100 = 3000$ peak

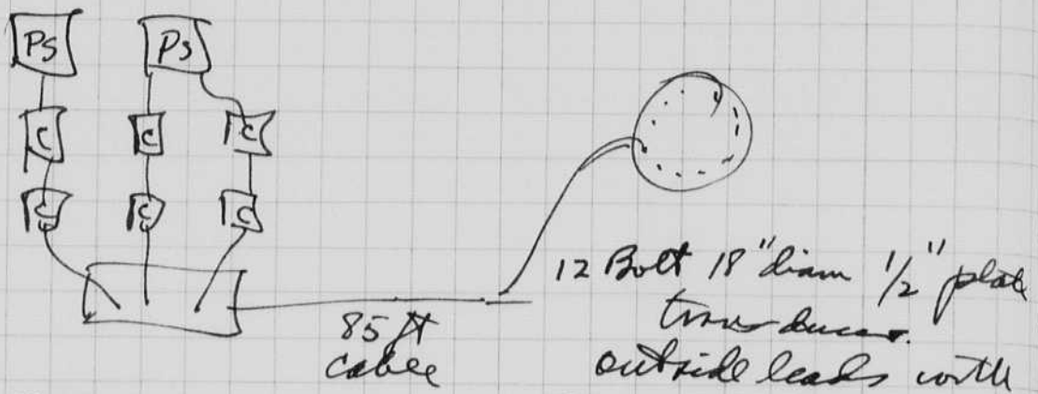
Duration = 5 microsec

Taken in M.I.T. Pool.

152 Jan 14, 62 Boomer Lift test
H. Edgerton

8:45 Start at 10 sec intervals - 13,000 W.S.

8:50 cover blew off spark box. arced over to low voltage blew out fuse



9:25 going ok.
wear can be seen on the plates at the center.

9:35 one arc over to bolt on inside of cover over the spark gap. & covered this with Black Scotch tape.

10.00 am off for examination.
Spark cover was off at back.
Hole in 18" plate are 1/2 to 1" diam and about half through. Edges are very rough.

11.05 test stopped, still going ok. Holes through both plates but quite small. no effect on operation.
cover on spark gap covers off all the time. need
(1) Pressure release holes
(2) Clamps to hold on.

Jan 18 1961 Ed Link was here yesterday Discussed Pingers, Boomers, recorders. etc.

Index

Bat. Photography. p69 Trigger.

CONTINUED
ON
NEXT REEL