HAROLD E. EDGERTON

PAPERS

MC 25

Series III

Laboratory Notebooks

Number 28

Dated Nov. 18, 1963 to May 30, 1965

Massachusetts Institute of Technology

HAROLD E. EDGERTON

COMPUTATION BOOK

NAME	Number
Harold E. Edgerton	28

4-405 M.I.T.

Course MIT STROBE LAB. KNP 6063

Used from Nov 18 1963, to MAY 30 1965.

HOME 100 MEMORIAL DRIVE 5-8A UN.4.4790
CAMBRIDGE MASS.

Harold E. Edgerton
Strobe Lab 4-405
M.I.T.
Cambridge mass
Nov. 18, 1963.

Graves light Bell p 118 Jan 9 1965 moved to MIT 1974

Notebook # 28

Filming and Separation Record

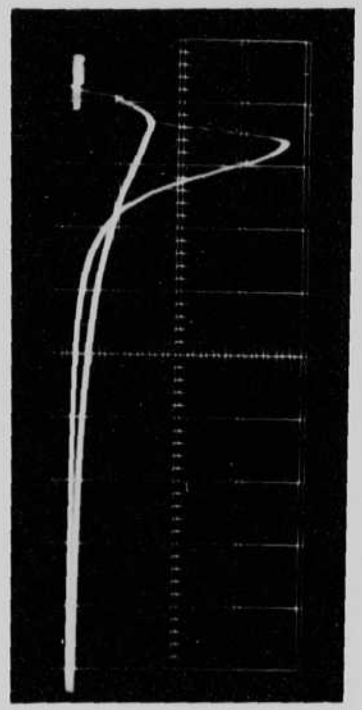
1 unmounted photograph(s)

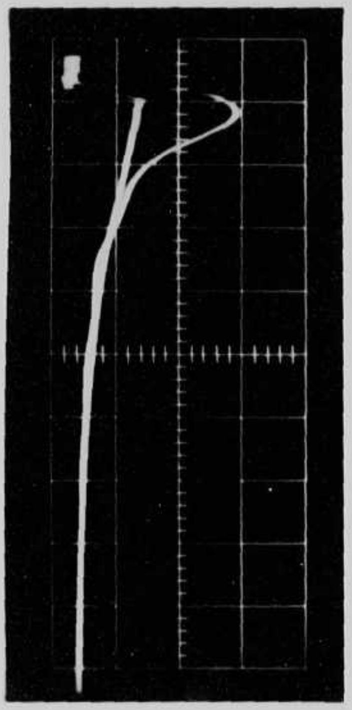
10? negative strip(s) { 4? inside first loose envelope
5? inside second loose envelope
2? inside third loose envelope

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

was/were filmed where originally located between page ____ and ____.
inside front cover

Item(s) now housed in accompanying folder.





Light Current

2.2×10^6 1000 amp

$50 \mu s$

Steve G.

EG&G Boston, Massachusetts

Inter-Office Correspondence

date Feb. 10, 1965

~~to C. Ellis~~

MIT LAB

~~from~~ TO H. Edgerton

subject Boomer # IV Sent over Feb 9·1965

150 turns cut E cone
Square 8" plates, 1/8" thick

4 KV	8 mfd	e = 0.45 volts p to p	f = 2400	
	16 mfd	= 1.075	= 2000	over 8 ball Hydrophone
	24 mfd	= 1.35	= 1000	

open cir. 5.3 mh R = 0.03
~~wotj ½;ate~~ with plate 2.4 mh.

Steve G.

Boston, Massachusetts

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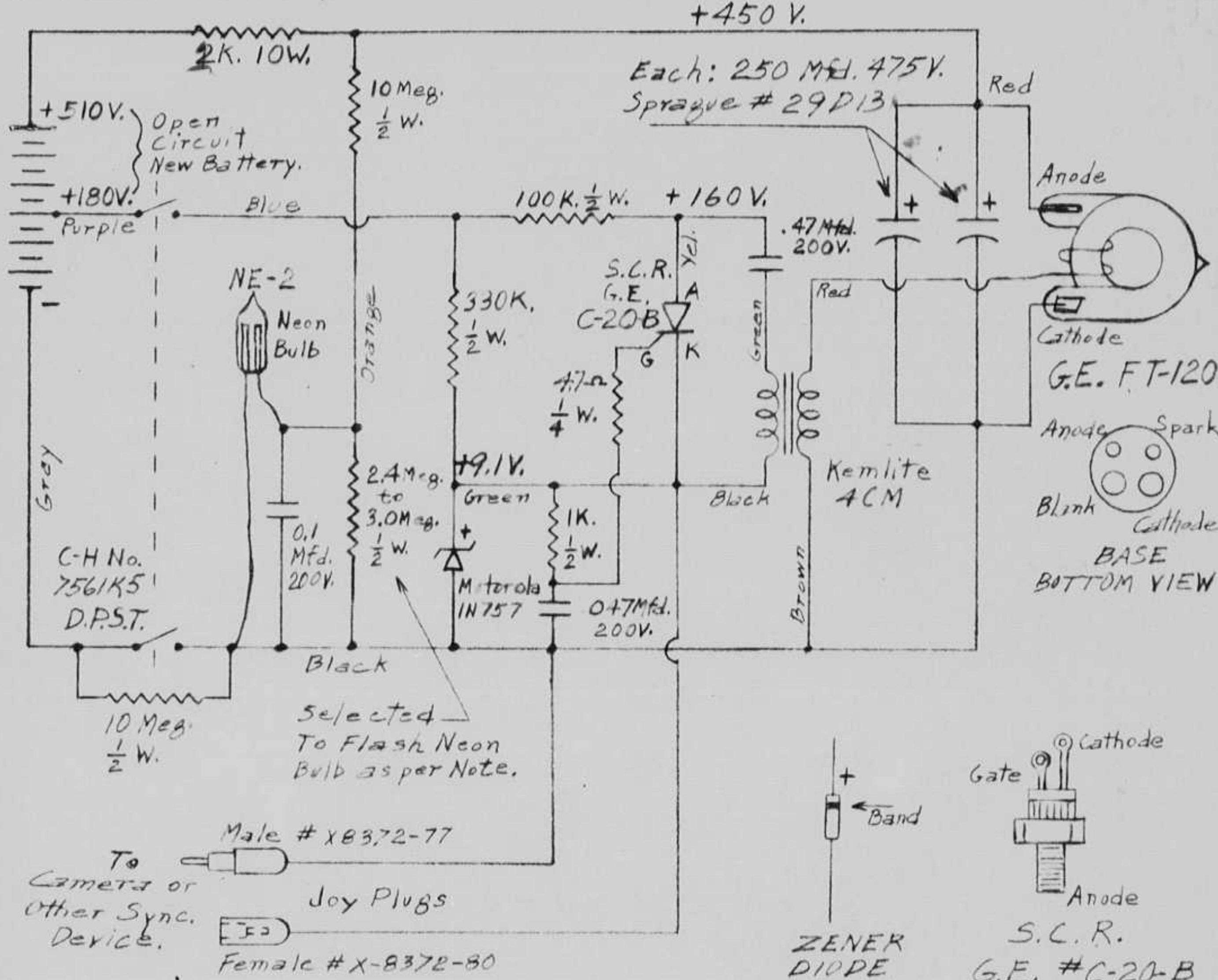
CROSS INDEX

BATTERY
Eveready - No. 497.
Burgess - No. U-320.
Mallory - No. PF-497.

Calypso flash.



NOTE: Nominal Voltages Given. Neon Bulb First Flash 350 to 375 Volts on main capacitors.

USED ON ASSEMBLY # ______

LETTER	REVISIONS	CHNGD	DATE

MATERIAL	FINISH SPECS.	NO. REQ'D PER UNIT

TOLERANCES UNLESS SPECIFIED ABOVE:
THICKNESS & DIA. OF STOCK
STD. COMM. SIZES APPLY
FRACTIONAL DIMENSIONS
DRILLING LOCATIONS ±1/64
MACHINING ±1/64
OTHER ±1/32
DECIMAL DIMENSIONS ±.005
ANGULAR DIMENSIONS
MACHINING & DRILLING ±0° 15'
FORMED OR BENT PARTS ±0° 30'
NO. & LETTER SIZE DRILLED HOLES
LOW LIMIT — DIA. OF DRILL SPEC.
HIGH LIMIT — DIA. OF NEXT LARGER SIZE

	INITIALS	DATE
DRAWN	V.E.M.	11/14/63
CHECKED	H.E.E.	
PROJ. ENG.		
ORIGNT'D BY	V.E.M.	11/14/63
PRINT ISSUED		

TITLE
CALYPSO FLASH.
50W.S. UNDERWATER UNIT.

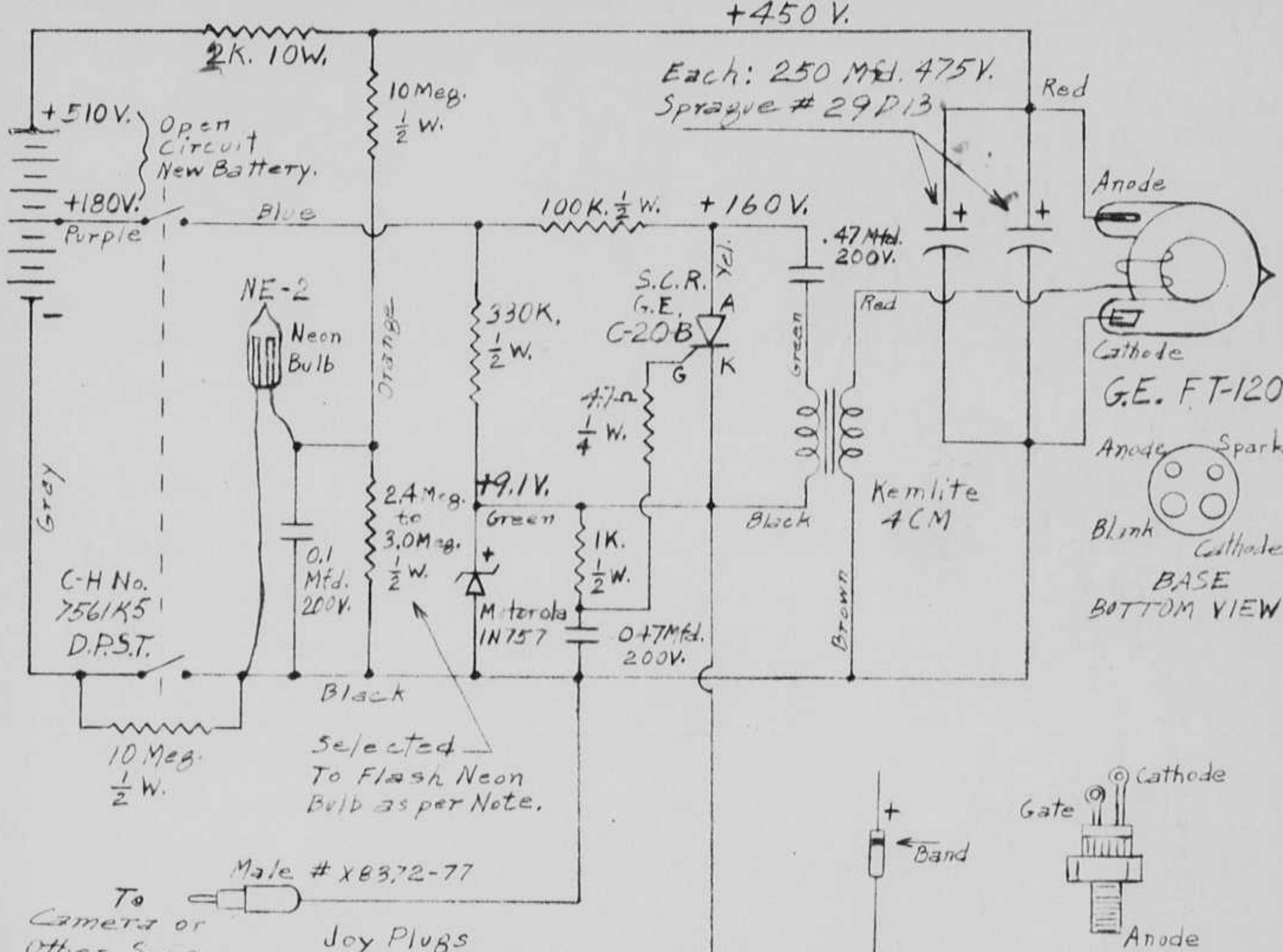
EDGERTON, GERMESHAUSEN & GRIER, INC.
BOSTON, MASS.—LAS VEGAS, NEV.—SANTA BARBARA, CALIF.

SCALE	DWG. NO.	REVISION

Calypso flash.

CROSS INDEX

BATTERY
Eveready – No. 497.
Burgess – No. U-320.
Mallory – No. PF-497.



ZENER DIODE Motorola #IN757 9.1 Volts

S.C.R. G.E. #C-20-B Can Use C-20-C or C-20-D

NOTE: Nominal Voltages Given.
Neon Bulb First Flash 350 to 375 Volts on main capacitors.

LETTER	REVISIONS	CHNGD	DATE

USED ON ASSEMBLY #

MATERIAL	FINISH SPECS.	NO. REQ'D PER UNIT

TOLERANCES UNLESS SPECIFIED ABOVE:
THICKNESS & DIA. OF STOCK
STD. COMM. SIZES APPLY
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LOW LIMIT — DIA. OF DRILL SPEC.
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	INITIALS	DATE
DRAWN	V.E.M.	11/14/63
CHECKED	HEG	[illegible]
PROJ. ENG.		
ORIGNT'D BY	V.E.M.	11/14/63

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BOSTON, MASS.—LAS VEGAS, NEV.—SANTA BARBARA, CALIF.

SCALE	DWG. NO.	REVISION

B. L. M., INC. NO. C198L

DIMENSIONS IN INCHES—DO NOT SCALE PRINT

EDGERTON, GERMESHAUSEN & GRIER, INC.

INTER-OFFICE MAIL

DO NOT SEAL UNLESS NECESSARY

Date	Name	Bldg. No.
~~11/29~~	~~F. Tamer~~	
~~12/2~~	~~Howard Kelly~~	~~88~~
~~12-2~~	~~Ed Desborough~~	~~Vegas~~
	~~G. Pappas~~	~~Boston~~
8/31	Betty Lothrop	Acctg.
~~9-1~~	~~H. Godlewski~~	~~Bedford~~
~~9/1~~	~~Betty Lothrop~~	~~Acctg~~ Bedford
~~9-3~~	~~Olga Kuchar~~	~~Boston~~
~~9-3~~	~~Betty Lothrop~~	~~Bedford~~
~~9-9~~	~~E. Sampson~~	~~Boston~~
~~9/9/64~~	~~Betty Lothrop~~ ~~Bedford Acct.~~	
~~9-15~~	~~A. Demone~~	~~Boston~~
9/16	BOB LELIEVRE	170

H. Edgerton
M.I.B ~~28~~
P147

MAY ~~16~~ 15 65
Ed [illegible]

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

OJL
Brower.

May 15 1965
P147
NB 28
H. Edgerton

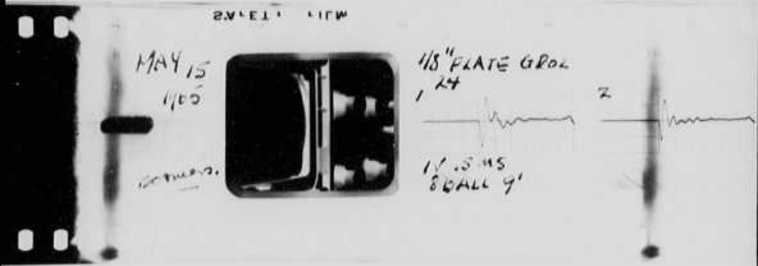
INTER-DEPARTMENTAL

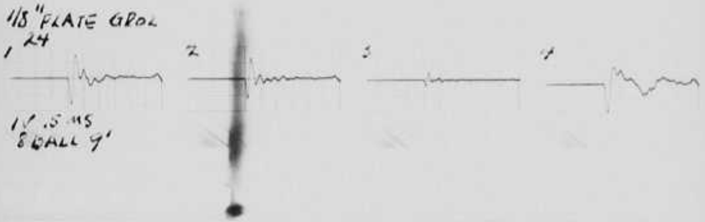
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

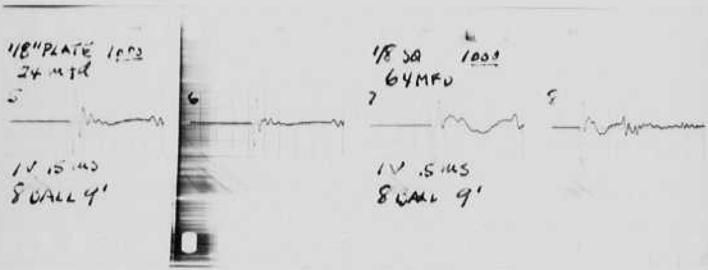
OK.
Boomes.

May 15 1965
P147 NB 28
H. Edgerton

INTER-DEPARTMENTAL


MAY 15
1105
1/8" PLATE GROL
24
1
2
1V .5 MS
8 BALL 9'

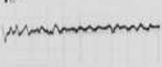

1/8" PLATE GROL
24
1
2
3
4
1V .5 MS
8 BALL 9'



1/8"PLATE 1000
24 mfd
5
6
1V .5 ms
8 CALL 9'
1/8 SQ 1000
64MFD
7
8
1V .5 ms
8 CALL 9'

9

10



11

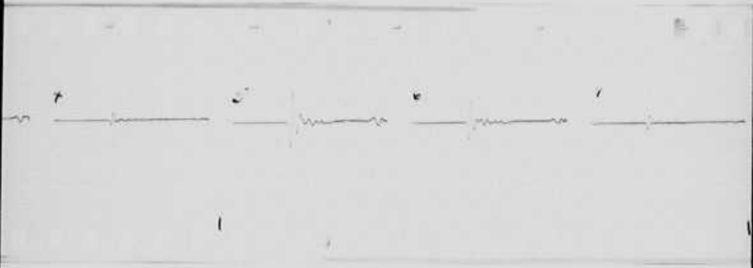
MAY
15
1965
[illegible]
J. T.
[illegible]

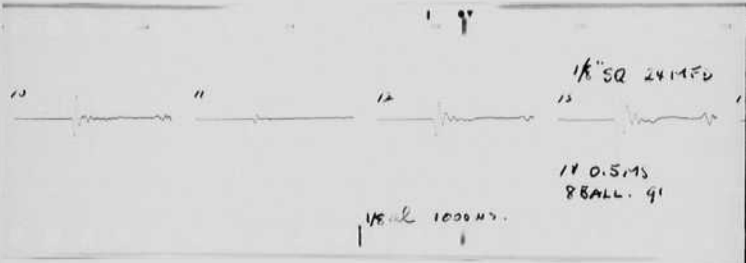
1/4 ROUND 24 MFD

1 2 3 4

1 V 0.5 MS
SCALE 9'

[illegible] 0.5'




1/8" SQ 24 MFD
10
11
12
13
1# 0.5MS
8BALL. 9'
1/8 1000 HZ.

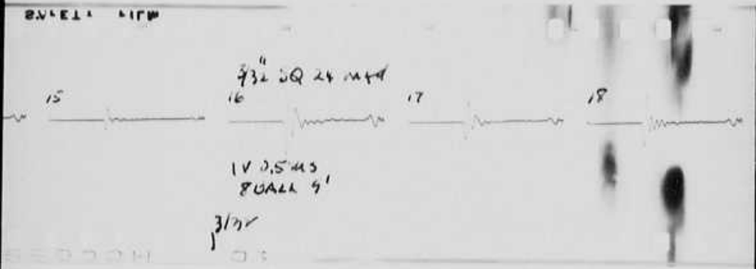
1/8" SQ 24 MFD

7/32" SQ 24 MFD

1V 0.5MS
8BALL. 9'

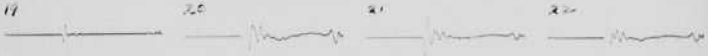
1V 0.5MS
8BALL 9'

3/75



SAFETY FILM
15
9/32" SQ 24 MHz
16
17
18
1V 0.5 μs
8 UALL 5'
3/3

1/16" SQ 24 MFD



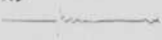
1 : 0.5 ms
8 BALL 9'

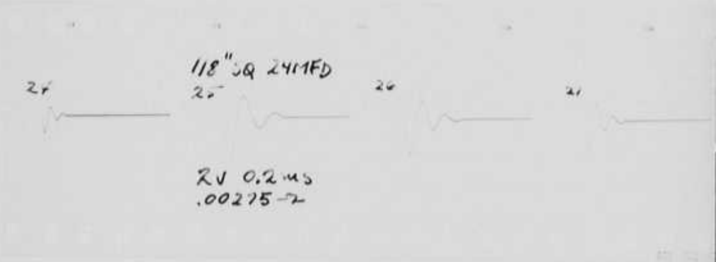
1/16"

21

22

23





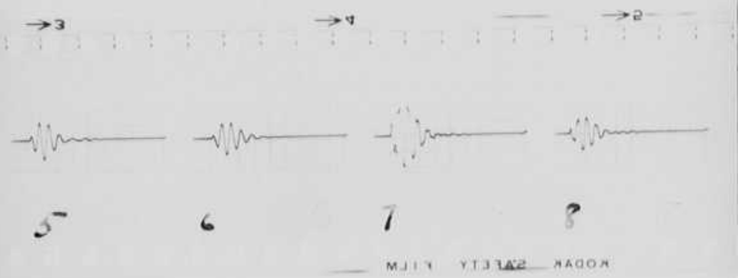
1/8" SQ 24MFD
24
25
26
27
RV 0.2 ms
.00275-2

118" SQ 2411FD

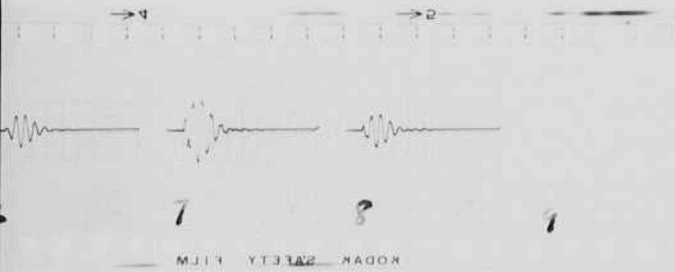
RV 0.2 ms
.00275 Ω

→1 →2

1 2 3 4



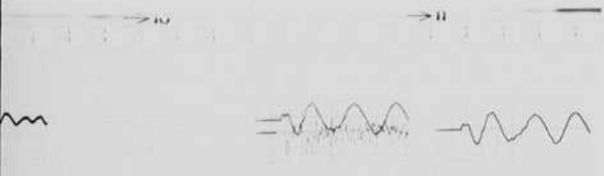
3
4
5
6
7
8
KODAK SAFETY FILM



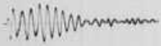
10 11 12 13

→8 →9 →10

13 14 15 16

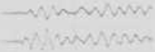


16 17 18



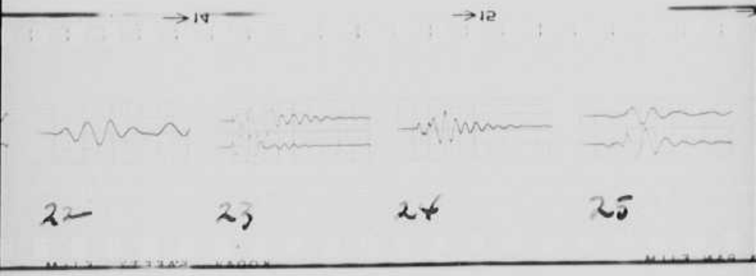
19

20

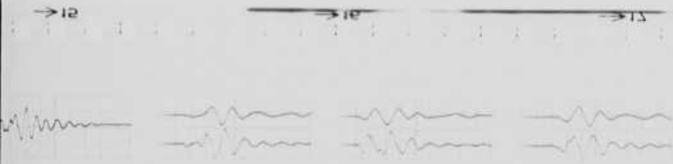


21

22



→14
→12
22
23
24
25

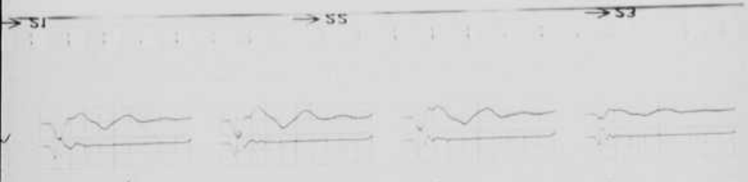


4 25 26 27

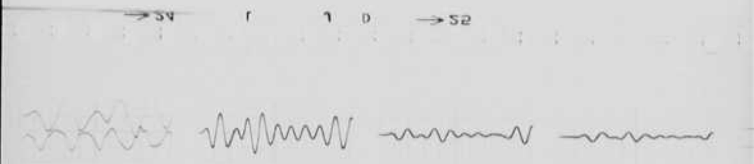
28 29 30 31 3

→50 →51

31 32 33 34 3



34 35 36 37



38 39 40 41

→ 26 → 27 → 28

42 43 44

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

Nov 18 1963
H. Edgerton
14-409

Tests of FX-33 1" Special and Standard FX-33 1½" gap.

S-1 PHOTOTUBE

From note book 27

	WS	VOLTS	C.P.S. 1"	C.P.S. 1.5"	CPS/length 1"	CPS/length 1.5"	us Dur 1	us Dur 1.5
300 mfd →	31	450	92	112	92	74.7		
600	62	450	172	244	172	163.	150	
300/2	62	900	124	176	124	117		80

Duration tests Pickup #6 S-1 CE 30V-C ~~[illegible]~~ 1K 3'2" V = 0.1V/cm for 10^6 c.p.

(10^6 c.p. = 1 cm R = 1K V = 0.1V d = 6'4")

Lamp.	WS	C	Volts	Dist	Fil	V/cm	us/cm	Load R		
#1 1"	62	300/2	900	3'2"	D2+	0.1	20	1K	D2 x100	x4
2							50			
3							50			
4							50 focus now at ¼ out as per John Carson.			

Exposures were ok. focus fair Grid on 3 too heavy.

	WS	C	Volts	Dist	Fil	V/cm	us/cm	Load R		
1. 1"	~~62~~ 62	300/2	900	3'2"	D2	0.1	50	1K		
2	~~62~~ 62	Ditto	"						2.0	100
3 1"	62.5		~~900~~ 450	3'2"					1.75	170
4	31		450						1.1	140
5	62.5		450							

1½" tube

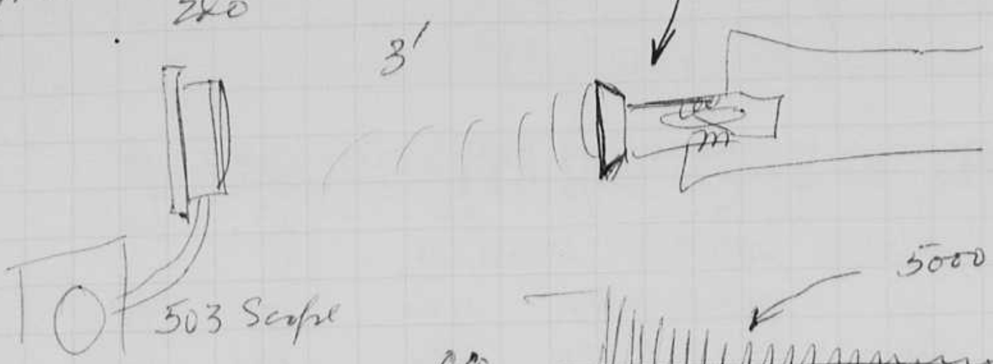
	WS		Volts	Dist			us/cm			
1. 1½	62		450	"			50		1.75	250
2.	31		450				50		1.2	200
3.	62		900	.			50		2.7	125
4	62		900	"			50			

Light calibration
0.1 volts = 10^6 c.p.
so 1 division = 10^6 c.p.

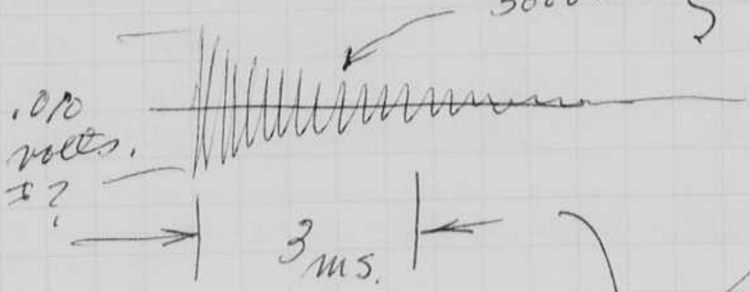
VOLTS.	62 ws 1"	62 ws 1.5"	31 ws 1"	31 ws 1.5"
~~900V~~				
900 V	100	125		
450V	170	250	140	200

Nov. 19, 1963
H. Edgerton.

TR. 144 SQS-23 transducer element

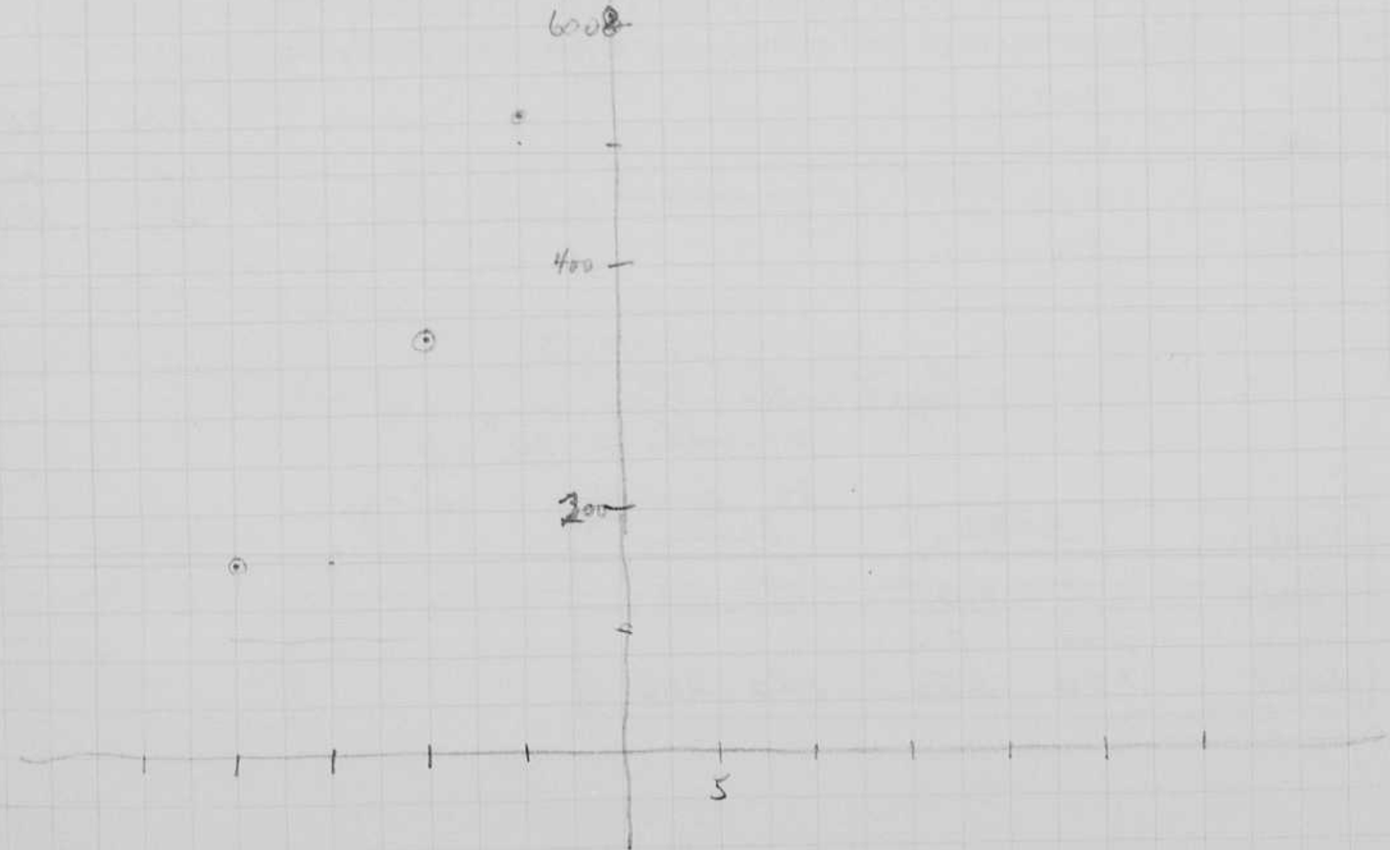


In Air



See page 15 for operation in Pool
Pulse is over in 1 m.S. in water.

Nov 20 1963
3 pm.
HEE & Marc Roberts.
9 feet. degrees 10

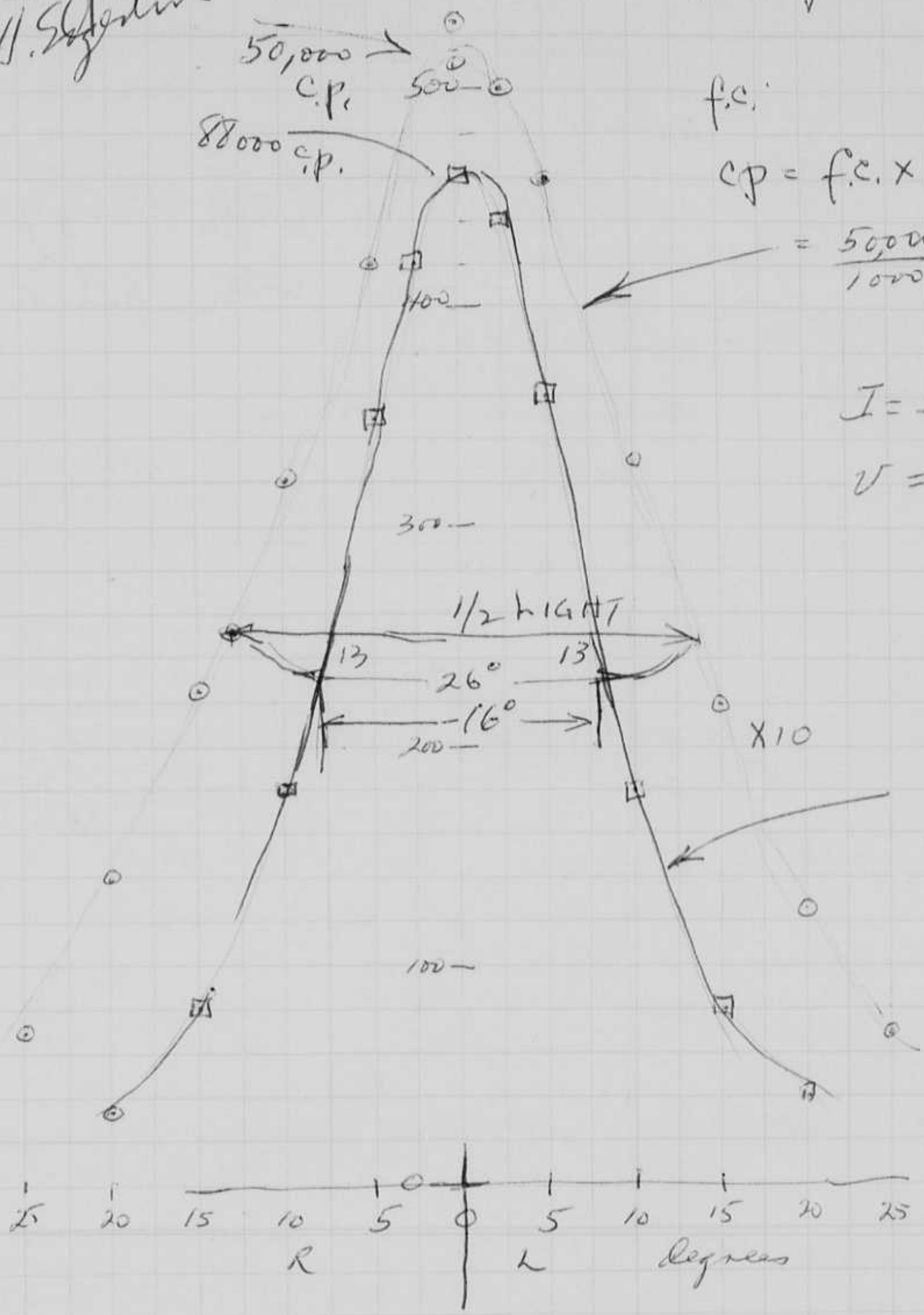


H. Edgerton
John Yules
H. Edgerton.

1000 watt Sylvania Lamps -

without glass cover

D = 10 ft.



f.c.

cp = f.c. × 100

= 50,000 c.p. / 1000 watts. #1 hole Back.

$I = \frac{33}{4} =$

V = ~~115~~ volts
112

X10

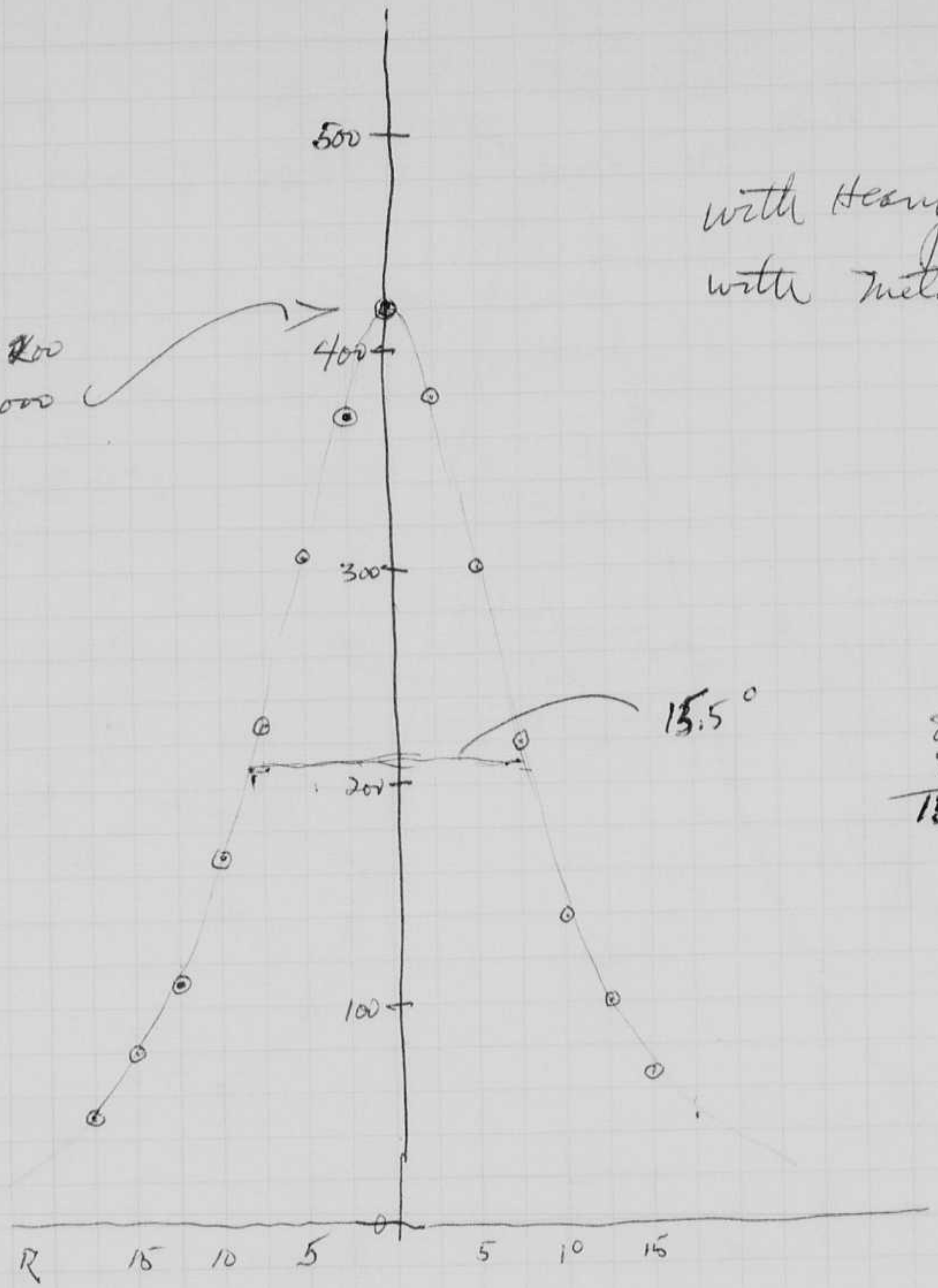
440 ×
200
88,000 c.p. at 14.14'

1/2 inch into Lamps.

Weight

wt in air 8 lbs
" " water 6.1/4

Nov 21 1963
H. Edgerton



with Heavy glass
with metal band.

cp = 42 × 2000
= 84,000

15.5°

8
7.5
15.5

1000 WATT
DXN SYLVANIA
120V 16 HOUR

Nov. 23 1963

H.E.Edg & R.Wells
Nov. 22, 1963

at "RBBH"

Light Ratio

X1 ~~75 84~~ FX-33 1½" gap Std
61, 57, 61.
Sequence 50 one shot at 3/sec.
50
57-57.

32 + 7.5 = 39.5 mfd
Hg switch.
L = 8" Diam
10 turns (or 11)
#8 wire.

6"

G.R. METER
#539.

Zeiss Flash unit installed in Fundus Camera

X1
20-18-24 I — Same
67-56-62-64 II
94-91 III
187-187-152 IV
Pilot
192 after 30 sec after pilot
200+ " 1 min — Did not go again. — Skipped once

X1 62 65 64 — check of FX-33 1½" Standard

X1 80 72 69 80 72 — 1" FX-33

X1 80 72 74 74 74 1½

(New) capacitor Added + 38 ufd to prior of 39.5

X1 139 135 — FX33 1½
110 - ~~1500~~ Ω
115 - 1000 Ω
122

$\frac{CE^2}{2} = \frac{5000^2}{2} \times 120$
= 240 watt sec.

38
39.5
40
117.5 mfd

1045 phoned for 40 mfd of capacitors to be sent to P.B.B.H. from M.I.T. Mac Roberts

Eletra Olimie X 64 ok -
H 160 ok 60

2.8
480
120

Aim: To match output Zeiss at Blitz #4 (185±)

X1 39.5 mfd FX-33 1½" Inductance out.
48-50-48.

need → 168. for Eletra X

X1 75 75 75 with ~~of~~ Inductance. 39.5
X1 142 137 135. " " 77.5
122 125 -

X1 170 154 153 160 150 140
after 3. ½ sec

7.3
32

39.3 mfd added.

Replace tube - FX 33 1½"
120 One flash out of sequence.
165
140. 5000 ohm charging. 135.

120×10^{-6}

$\frac{1500 V^2}{2}$ 170 mfd = 192.0 watt sec paper

4

Nov 21 1963
H. Sdy[illegible]

RETINAL PHOTOGRAPHY
RHEOLOGY LABORATORY
PETER BENT BRIGHAM HOSPITAL

Patients Name:__________
History No.__________ Location__________
Age__________ Date of Study__________

Diagnosis and Rationale for study:__________

CP =
=

Prior Ophthalmoscopic Exam:__________

Film Used:__________ Camera:__________
Magnification:__________

Mydriatic:__________ Time Given:__________
Miotic:__________ Time Given:__________

NO:	EYE RT.	EYE LEFT	LIGHT ENERGY	COMMENT	INTERPRETATION
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Developed by:__________
Date:__________
Location Film:__________

Charged to:

Signature Operator:__________

Patient Lab. Data:

Nov 23 1963
Harold Edgerton

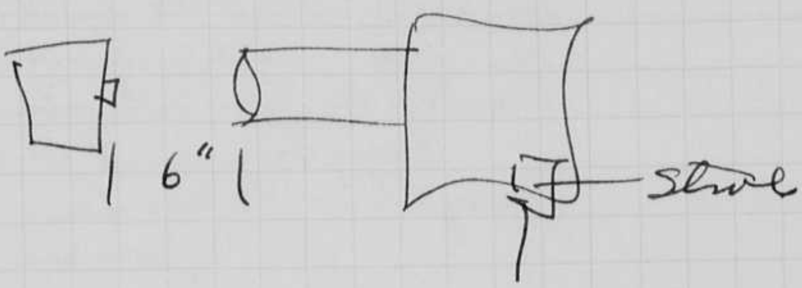
Pres Kennedy was shot yesterday in Dallas Texas!

Yesterday morning I worked with Roe Wells at the ~~Peter~~ Bent Brigham Hospital on the rapid flashing lamp for the Zeiss Fundus camera.

I seem to have misplaced the notes that I took while there.

A G.R. light meter # 534(?) was used at 6" from the ~~...~~ outlet lens. to measure the light.

The FX-33
with about 40 mfd read
about 60 lumen sec / sq foot.



Then the Zeiss lamp was re installed.

These are the numbers I recall

I	40 ?
II	60 ?
III	100 ?
IV	150 to 200

The 1" FX-33 seemed to give 10 or 20% more light.

I added 40 mfd more to double light (almost)
Inductance 11 turns 8" diam # 8 wire
in series with 40 mfd increases light!
color shift from Blue to white.

Then 40- mfd more was sent from M.I.T.
which brought the output up to 150 lumen/sq ft.

The equipment was tested 10 flashes at this loading at 2 or 3 per sec with 500 ohms charging.

Wells will try with photography.

constant ... around last night for Washington.

Dec 14 1963
H. Edgerton

My father Frank Eugene Edgerton died on Nov. 25 Monday in the morning. He was age 88 Burial was at Aurora Nebraska on the 27. My sister, Bob and family, Esther my wife were there as well as many friends.

I was in San Diego Calif at the NEL on Dec. 2. to inspect the Bathyscaphe with Comd Keach. EG&G are to help with the sonar and the cameras.

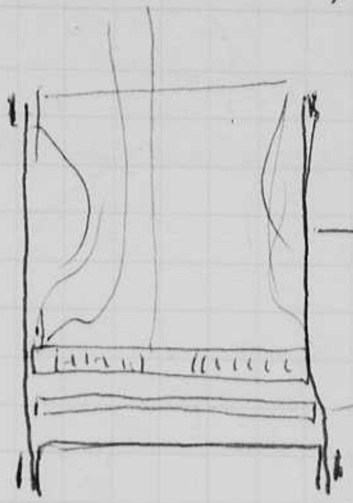
Directors meeting was held in Santa Barbara on Dec. 3. also the building was dedicated there on Wed. Retd to Aurora on ~~Friday~~ Thurs morning early then to Boston Sat about noon with my mother.

Mary Lou and Chas Dixon have a new Daughter, Ellen Lee.

(Born Dec 5 1963)

Dec 14 1963
PB
MacR.

Boomerette Coil #1 alum tape 15/32 tape 0.01" 90 turns
11/16 I.D. 3 3/8" O.D.



Sketch in Mac Roberts notes.

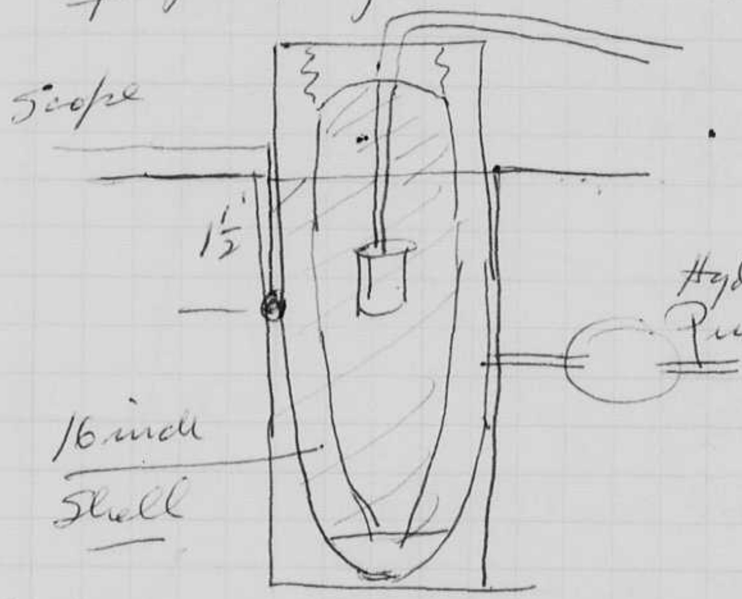
Rubber. 1/16" rubber

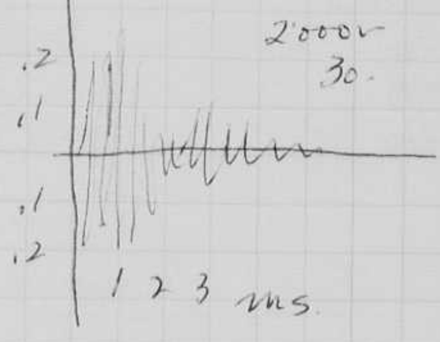
3 3/4" diam

1/8" copper with holes (30 1/16" holes) for air reserve;

1/16" soft.

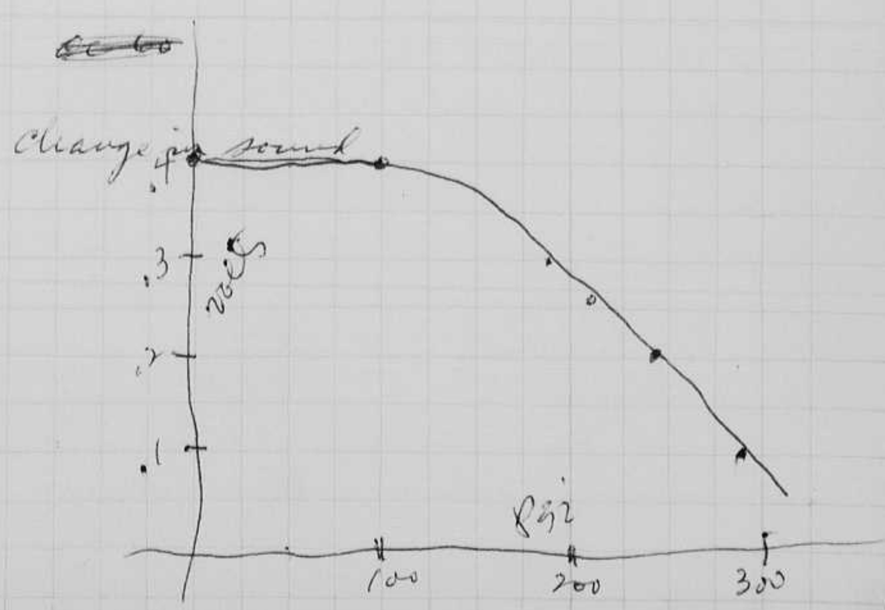
Boomerette #1 Installed in pressure tank 20D009
Hydrophone oyster Clevite 1 1/2 foot down from surface



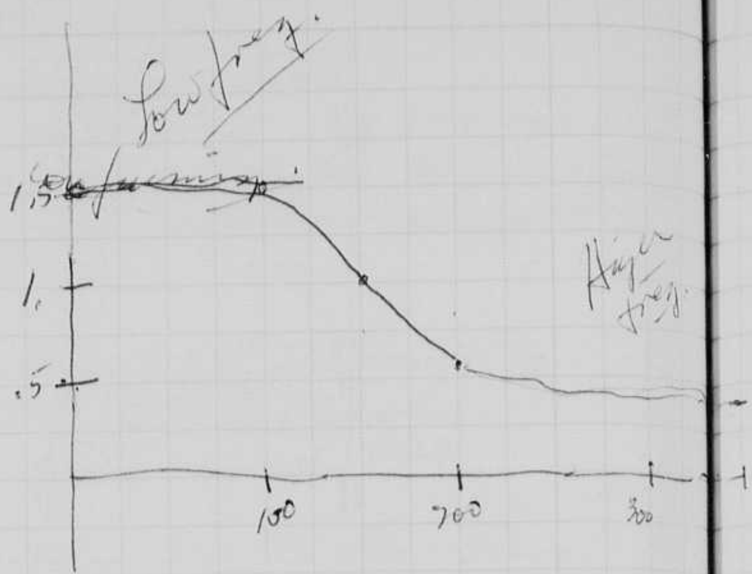


Pressure psi	Volts	C.	Signal, volts (p to p)	
0	1000	30	2 x .05 =	.1
	1500	"	2.2 x .1	.22
	2000	"	4 x .1	.4
	2000	"	3 x .1	.3
	2000	"	4 x .1	.4
34	2000	"	4	.4
0	2000	"	4	.4
150	2000	"	"	.4
180	2000	"		.3
300	2000	"	1 x .05	.05
250+40	"		2 x .05	.1
200+40	"		4 x .05	.2
175+40	"		2.4 x .1	.24
0	"		4 x .1	.4
115+40			2 x .1	.2

		volts
142+40	3 x .1	.3



Pres	c	volts		volts
190+40	100	2000	3 x .2	.6 volts
400+40	100	2000	1 x .2	.2
0	"	"	4 x .2	



Gage is better now!

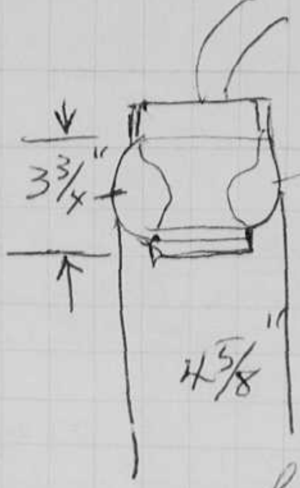
PSI

54	50	100	2000		
140	140	"	"	2 x .5	1
	0	"	"	3 x .5	1.5
	50	"	"	3 x .5	1.5
	100	"	"	3 x .5	1.5
	150	"	"	2 x .5	1.0
	200	"	"	3 x .2	.6
	250			3 x .2	.6
	~~300~~ 200			2.4 x .2	.48
	300			2.2 x .2	.44
	350			2.3 x .2	.46
	400			2.2 x .2	.44

Open water 1 ft away. 30 mfd 2000 volts.

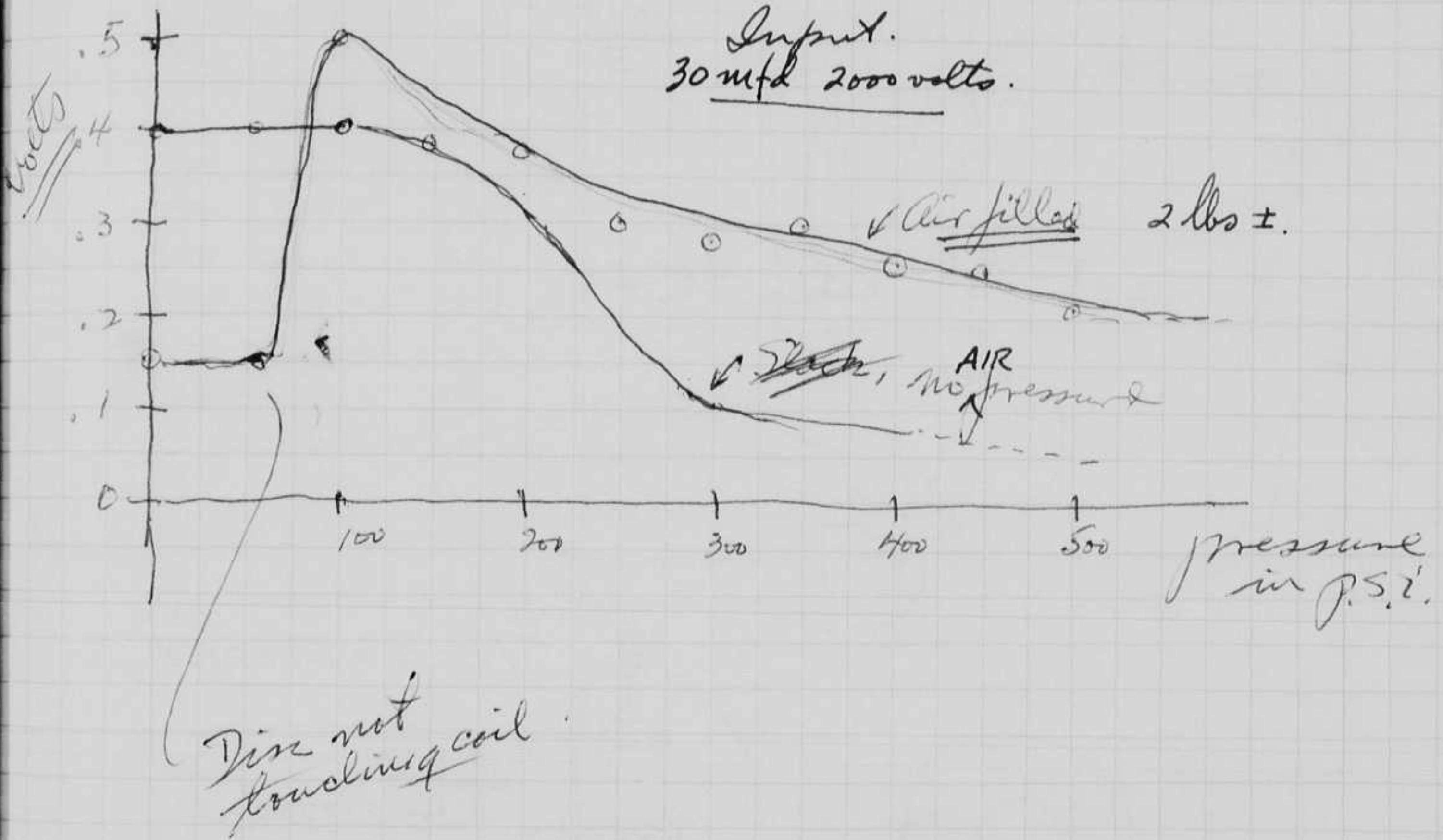
40 peak to peak with Clevite Hydrophone in water 1 ft away ±.

Pressure	C	V	volts from Hg	
0	30	2000	3 x .05	.15 volts.
52			3 x .05	.15
100			5 x .1	.5
150			3.8 x .1	.38
200			3.8 x .1	.38
250			3 x .1	.3
300			2.8 x .1	.28
350			3 x .1	.3
400			2.6 x .1	.26
450			2.5 x .1	.25
500 other page			2.1 x .1	.21 plus?



with air pressure of 2 or 3 pounds

Volume of air is about Double.

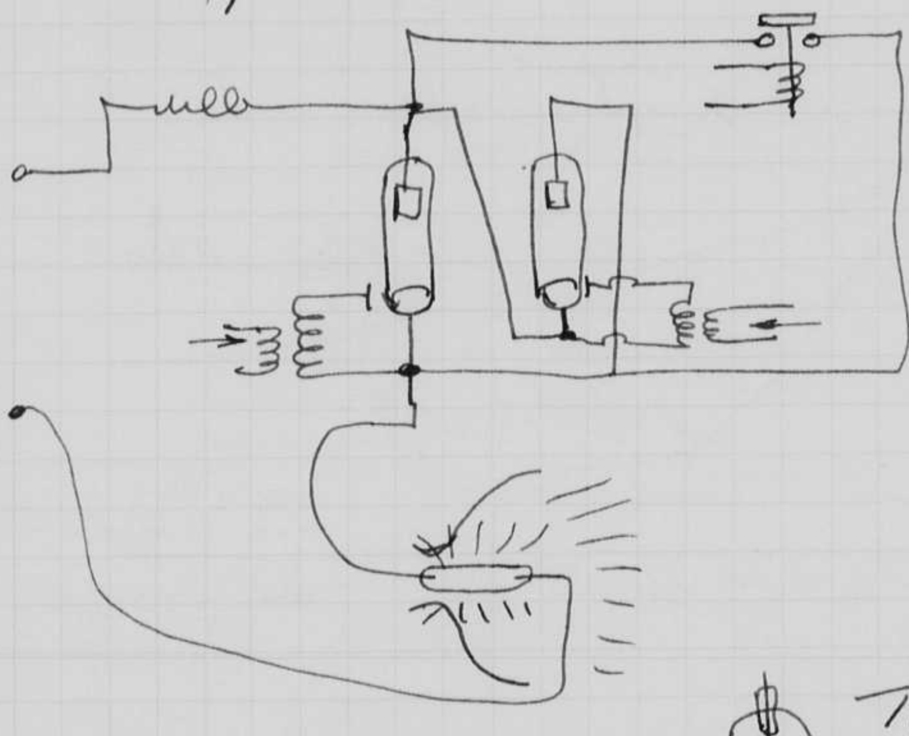


 Dec 23 1963

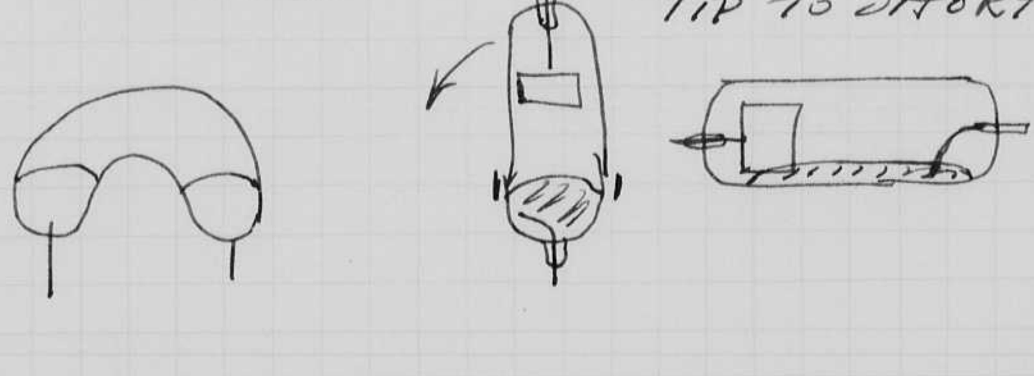
Harold Edgerton. Xenon lamp starting system.

Xenon lamps are very hard to start but once the electrodes and lamp are hot, then they operate easily with out a starting pulse.

I propose a mercury switch lamp which enables the starting pulse to enter the circuit easily with out losses. then the mercury arc switch lamp can be tipped to act as a switch or it can simply be shorted by a relay.



TIP TO SHORT.

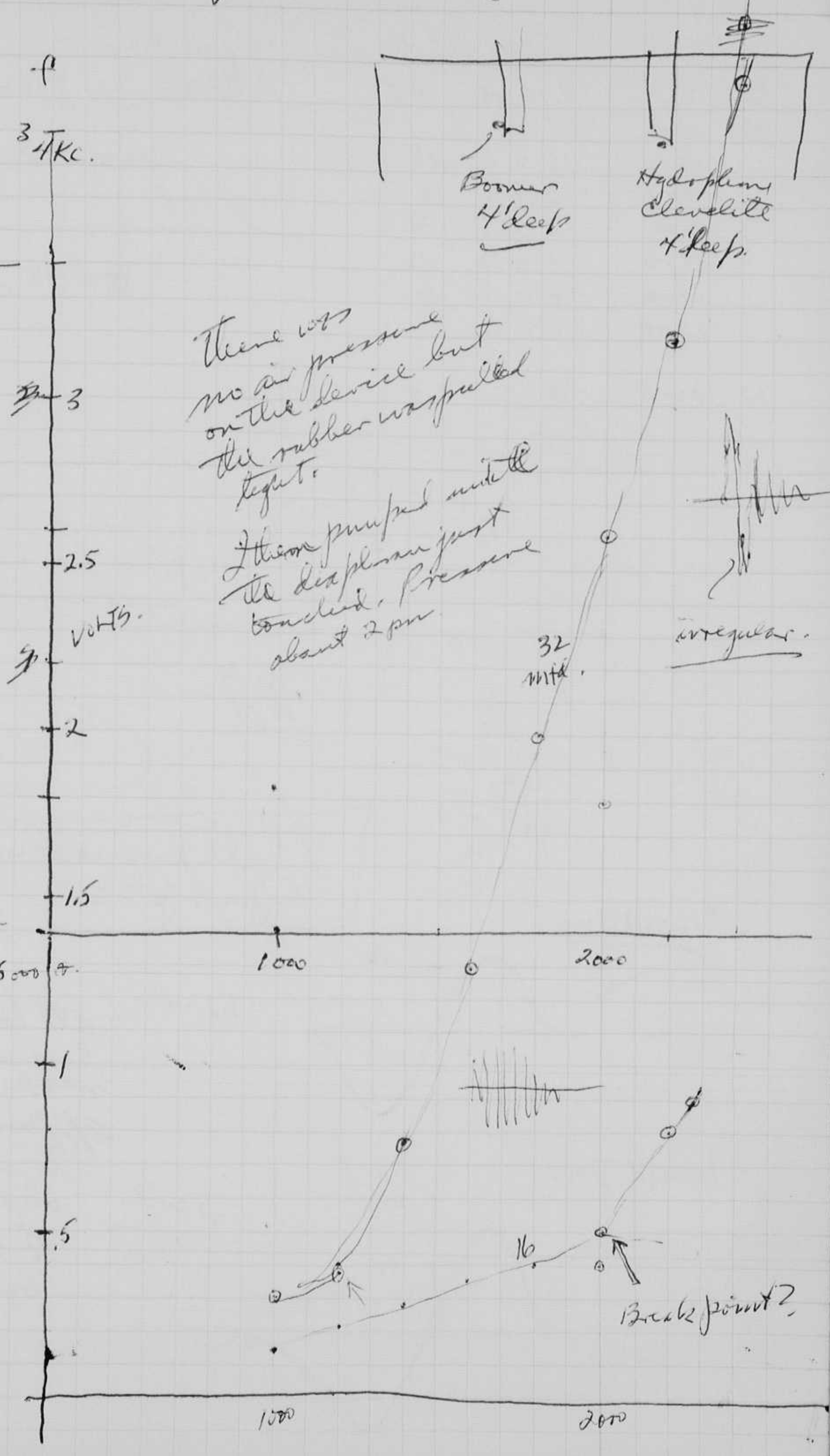


Dec 30 1968. M.I.T. Pool test of 4" Boomerette

v	volts.	
2000	1.5x.1 =	.15
2000	3 x.1	.3
"	3.2x.2	.64
"	3 x 1	3.0
1000	1.5x.2	.3
1200	1.9x.2	.38
1400	3.9x.2	.78
1600	2.6x.5	1.30
1800	4.0 .5	2.0
2000	2.6x1	2.6
2200	3.2x1	3.2
2400	3.4	
1000	.14x.1	0.14
1200	.21x.1	.21
1400	2.8x.1	.28
1600	3.6x.1	.36
1800	4.x.1	.4
2000	2.5x.2	.5
2200	4 x.2	.8
2275	2 x.5	1.0

...ed in Rubber case

2000	2.0x.2	.4

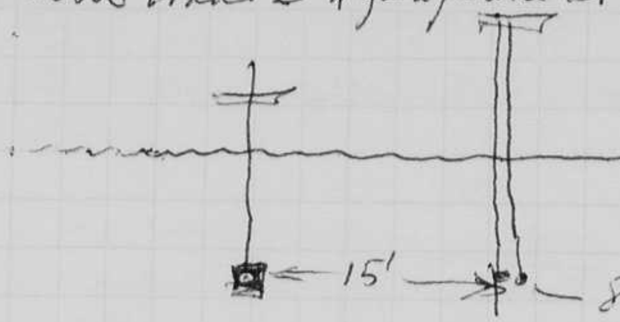


There was no air pressure on the device but the rubber was pulled tight.

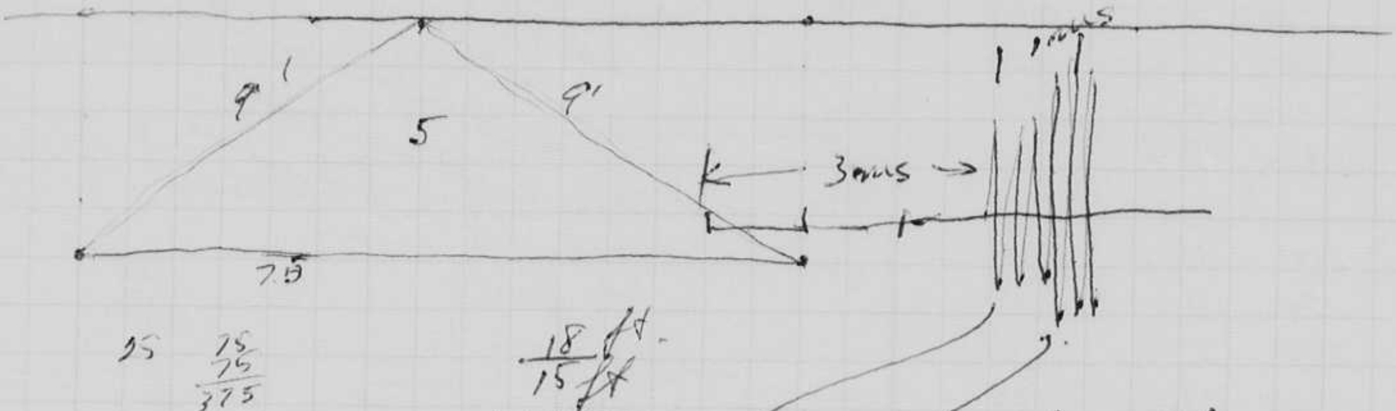
I then pumped until the diaphram just touched. Pressure about 2 psi

15'
Volts into Clevite
12' from trans
Both trans & Hydrophone at 5'

C	V.		
		2.7 x .05	.135
16	1000		
	1200	1.8 x .1	.18
	1400	3.0 x .1	.3
	1600	3.6 x .1	.36
	1800	2.3 x .2	.46
	2000	3.0 x .2	.6
	2200	3.8 x .2	.79
32	2000	1.8 x 1	1.8



8 ball
Clevite oyster

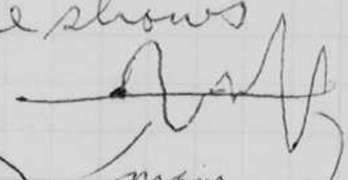


25 75
75
375
525
56
25
$\sqrt{81} = 9$

18 ft.
15 ft

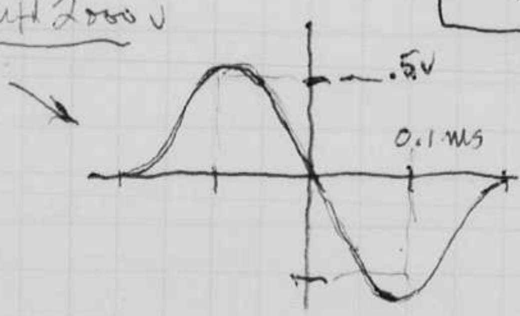
18' travel from Surface
15' travel.

8 ball hydrophone shows different picture



main
reflected from Surf.

32 mfd 2000 v

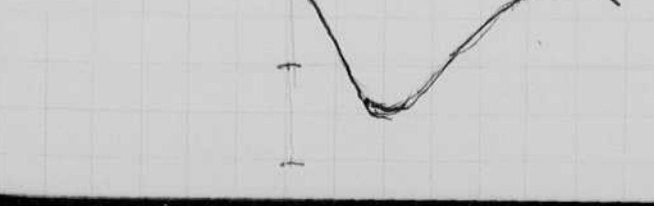


1.2 volts

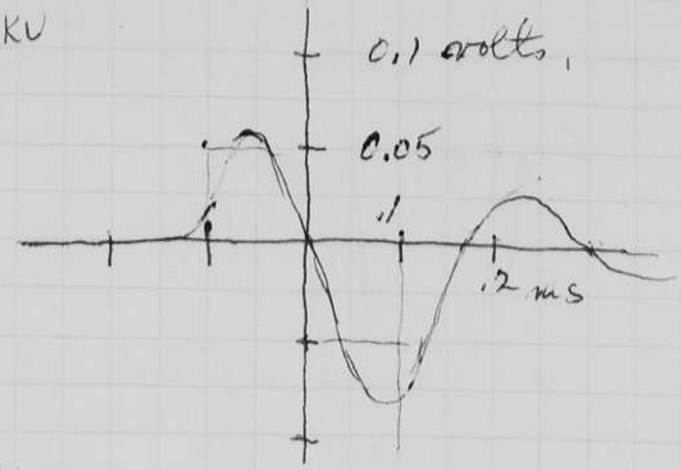
all tests from here on were made with the 8 ball. Apparently the Clevite is not damped. It shows a long oscillation of 4000 cycles from the boomer

16 mfd 2000 v

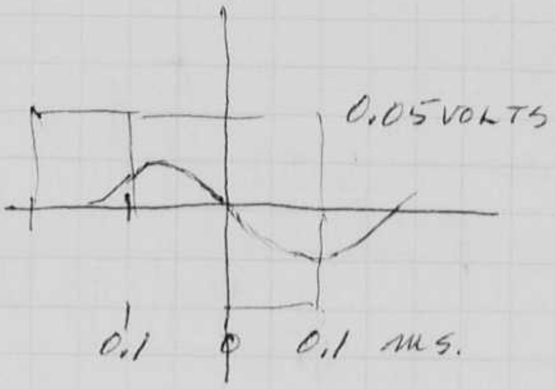
0.3 volts.



8 μfd 2KV

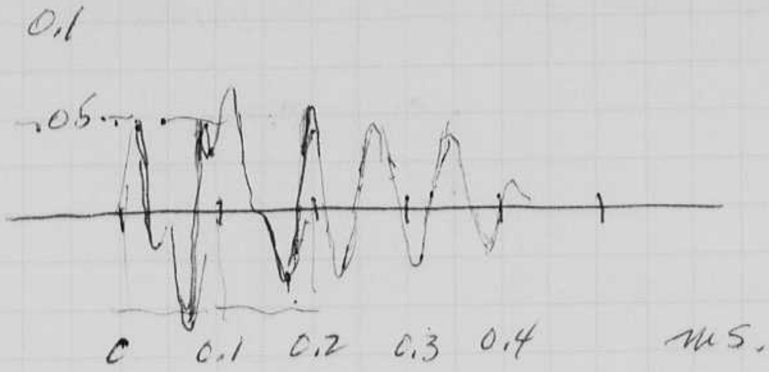


μfd 2KV



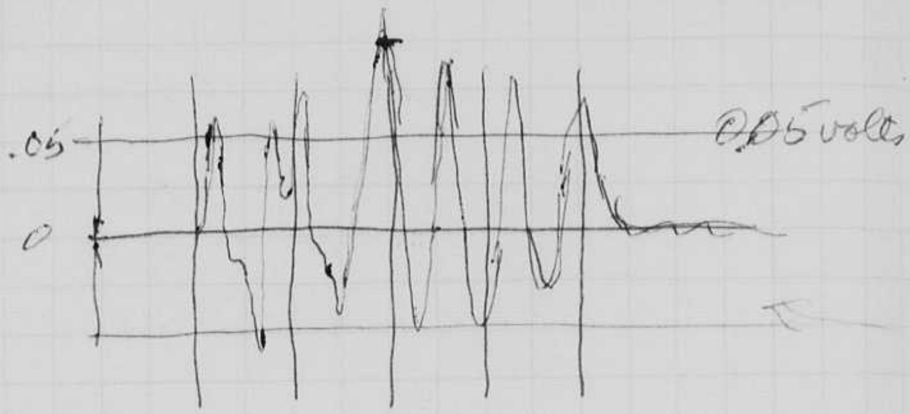
Pinger

1 mfd short



1 mfd long

Amplitude greater
Signal about
same.

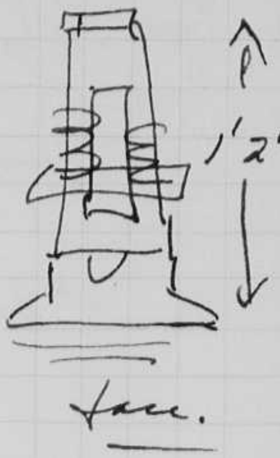


$\frac{5\text{ cycles}}{.4} = 12000\sim.$

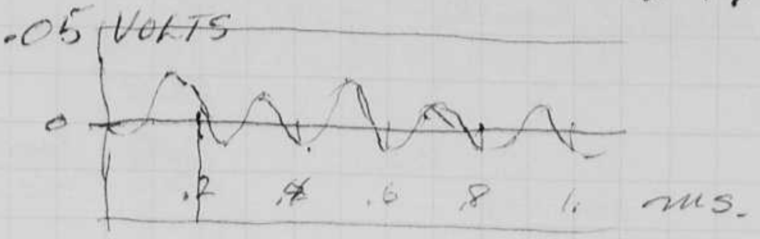
$\frac{1}{12000} = \frac{1}{1.}$

Magneto Striction transducer

Navy type 6KC?
#17

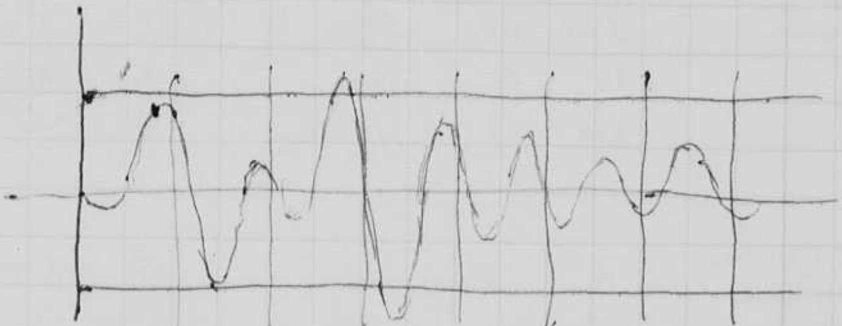


0.5 Short.



0.5 Long.

1. Long



2 Long. Power output

H. E. Edgerton

Jan 1. 1964 Recap of Results. p 12 – 17.

Device.	V KV	C mfd	W.S.	"8 ball" Volts ptop.	1 cycle time. ms.	
4" Boomer.	2KV	32	64	1.2	0.4.	one cycle signal.
	2KV	16	32	.3	0.4	
	2KV	8	16	.13	.3	
	2KV	4	8	.05	.3	
mud pen.	.9KV	1	Long. 0.405	.15	.06	(.4 Total).
	.9	.5	" 0.2	.	"	(1. ")
8" Boomer.	3 KV	64	290.	4.1	.3 ms.	→
	3.6	32	195	2.5	.3	
	3.75	16	113	1.5	.25	
6KC magnetic navy type.	.9	.5 Long	0.2	.4	(.2 ms)	1 ms total.
	.9	1. L	0.4	.42	"	"

Saturates with more energy used.

Discharge time for 4" Boomer. as read on scope

4 mfd	60 us
8	90
16	132
32	—

1963

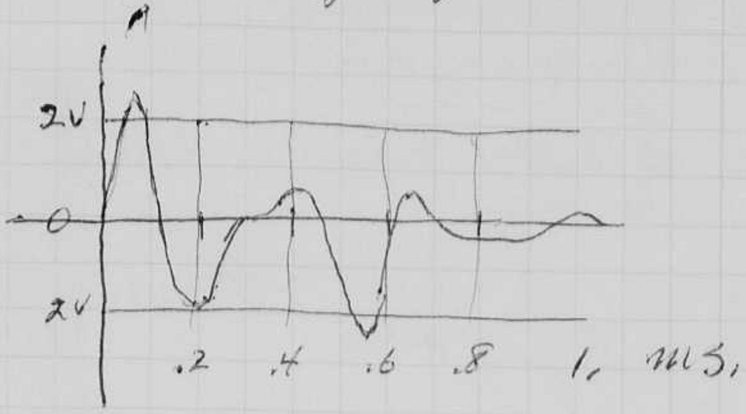
t.
...ter
...ac Roberts
... Yules,
...ld Rogers.

8" Boomer – Submersible Rubber-Diaphram Boomer.

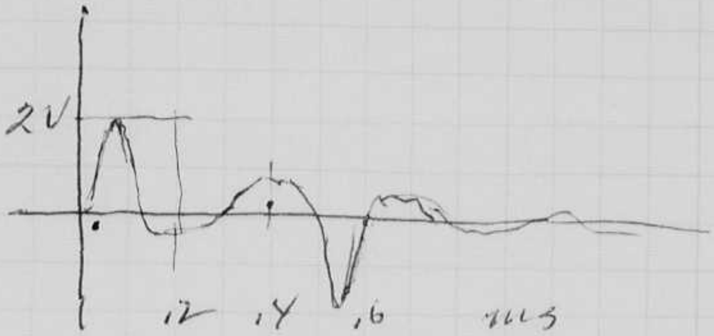
15 ft to 8 ball Hydrophone,

512 watt sec,

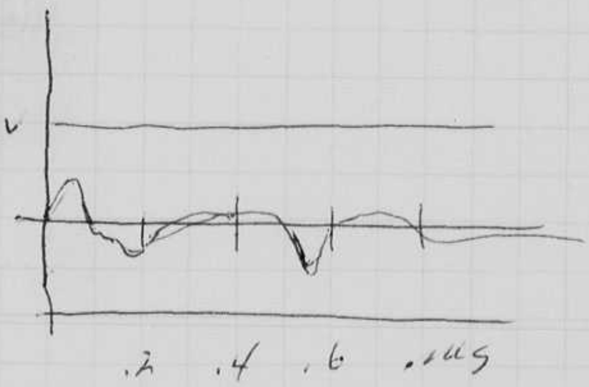
64 mfd
3000 v, guess ±
1 sec interval



32 mfd
3500 volts.



16 mfd
3750

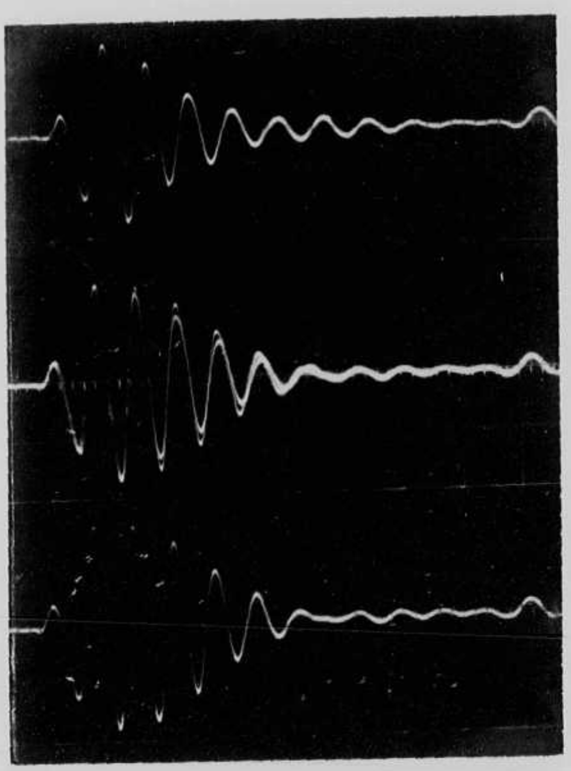


January 2, 1964 HEE, M. Klein, J.Y.
Tests in Swimming Pool

Pinger on fish
aluminum box
& pall hydrophone
15' away

oscilogram #1

	V/cm	p-p volts	micro sec/cm
① 2μf Long	0.2	.6	100
② 1μf Long	0.1	.32	100
③ ½μf Long	0.05	.17	100



①

② & ③

③

Edo Pinger Short switch
Resistor across output.

Oscilogm. #2

	P-P VOLTS	
① 2μf S 0.1 V/div.	.34	100 μsec
② 1μf short 0.1V/div	.22	100 μsec
③ ½μf short 0.05	.11	100 μsec

January 2, 1964 HEE, H. Klein, J.Y.
Tests in Swimming Pool

Pinger on fish
aluminum box
& ball hydrophone
15' away

oscilogram #1

	V/cm	P-P volts	micro sec/cm
① 2 μf long	0.2	.6	100
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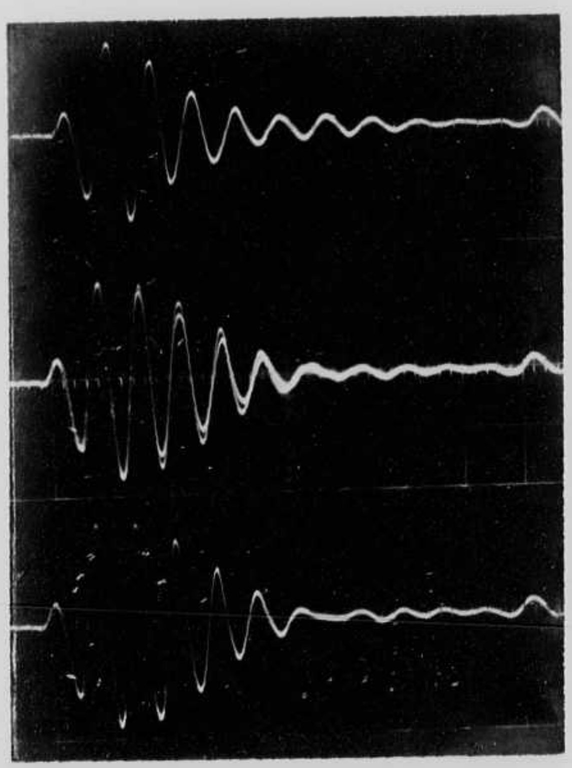
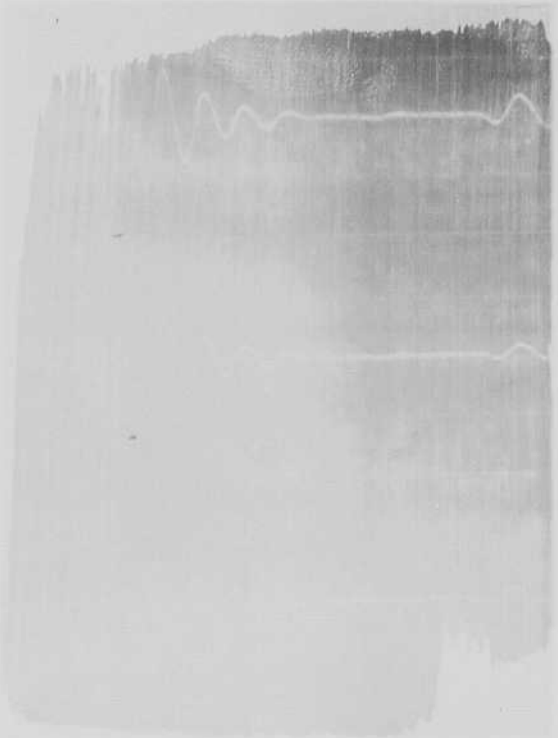
③ ½ μf long	0.05	.17	100



Edo Pinger Short switch
Resistor across output.

Oscilogm. #2



	P-P VOLTS	
① 2 μs 0.1 V/div.	.34	100 μsec
② 1 μf short 0.1 V/div	.22	100 μsec
③ ½ μf short 0.05	.11	100 μsec

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oscilogram #1

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① 2 µf long	0.2	.6	100
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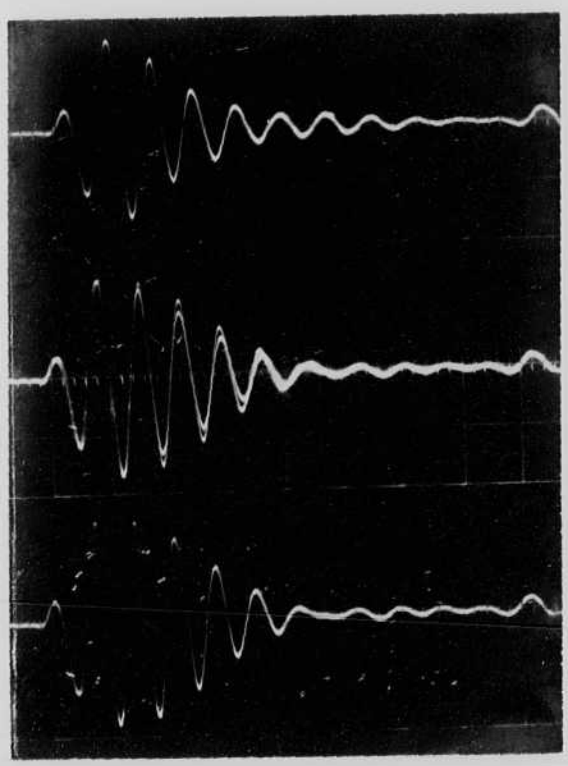
③ ½ µf long	0.05	.17	100



①

② & ③

③

Edo Pinger Short switch
Resistor across output.

Oscilogm. #2

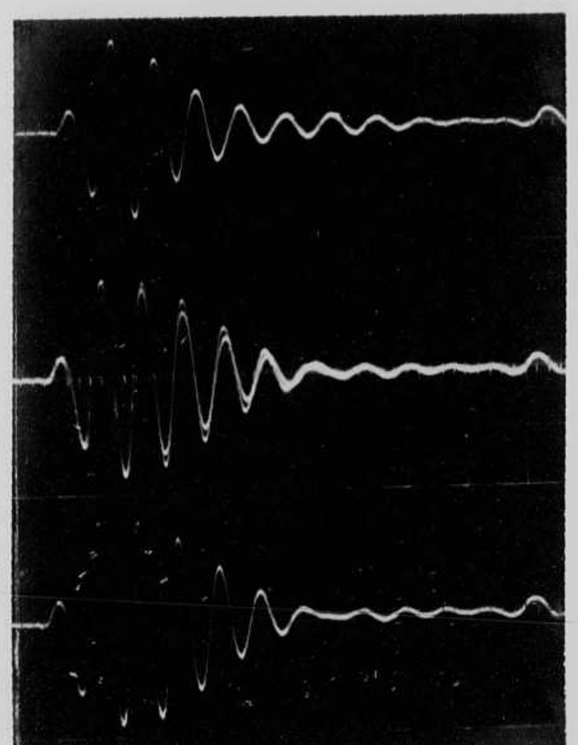
	P-P VOLTS	
① 2μs 0.1 V/div.	.34	100 μsec
② 1μf short 0.1 V/div	.22	100 μsec
③ ½μf short 0.05	.11	100 μsec

January 2, 1964 HEE, M. Klein, J.Y.
Tests in Swimming Pool

Pinger on fish
alumin box
& ball hydrophone
15' away

oscilogram #1

	V/cm	P-8 volts	micro sec/cm
① 2μf long	0.2	.6	100
② 1μf long	0.1	.32	100
③ ½μf long	0.05	.17	100



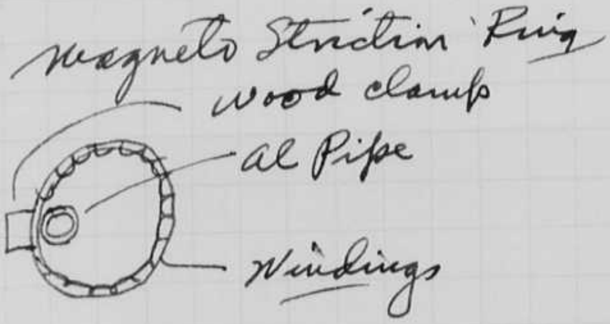
① ②&③ ③

Eko Pinger Short switch
Resistor across output.

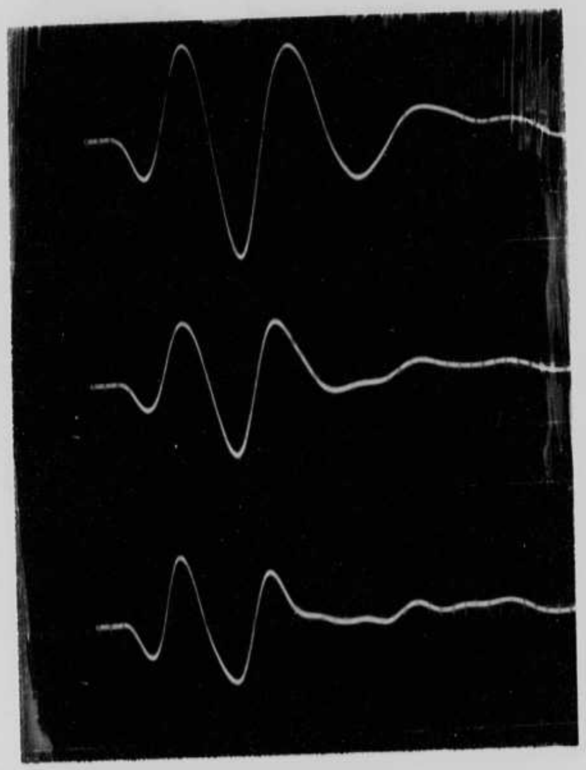
Oscilogm. #2

	P-P VOLTS	
① 2μf S 0.1 V/div.	.34	100 μsec
② 1μf short 0.1V/div	.22	100 μsec
③ ½μf short 0.05	.11	100 μsec

2μf L	.38	.1V/cm	100μsec
1μf L	.23	.1V/cm	100μsec
½μf L	.11	.05V/cm	100μsec

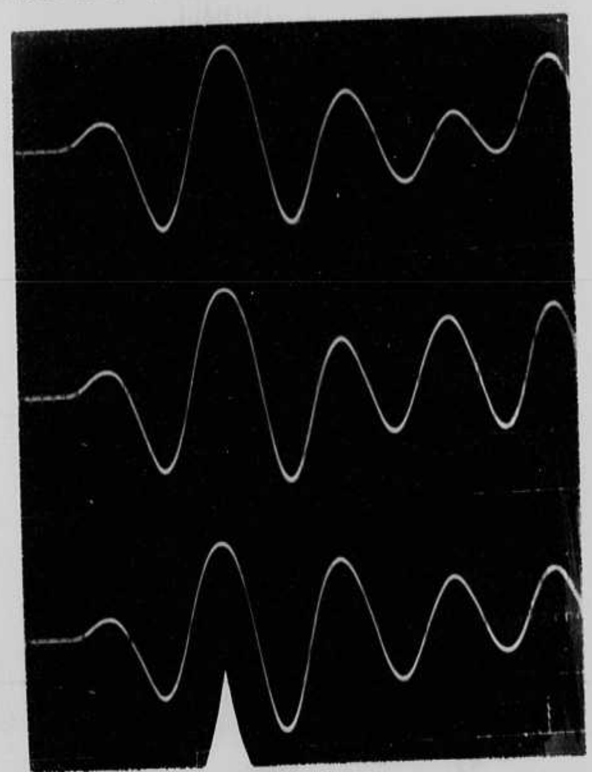


Oscillogram #2



#4 magneto strictive (Navy)

	volts		
2μf long	.62	.2V/div	100
1μf long	.66	.2V/div	100
½μf Long	.62	.2V/div	100

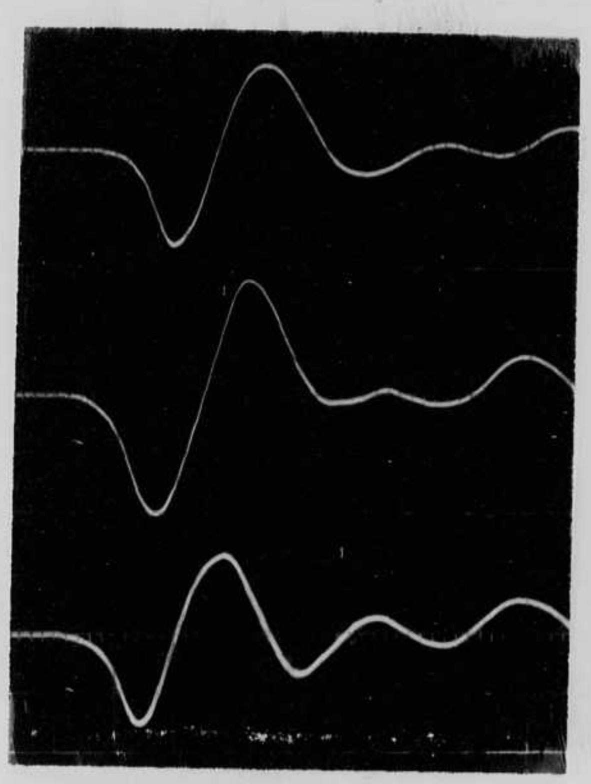


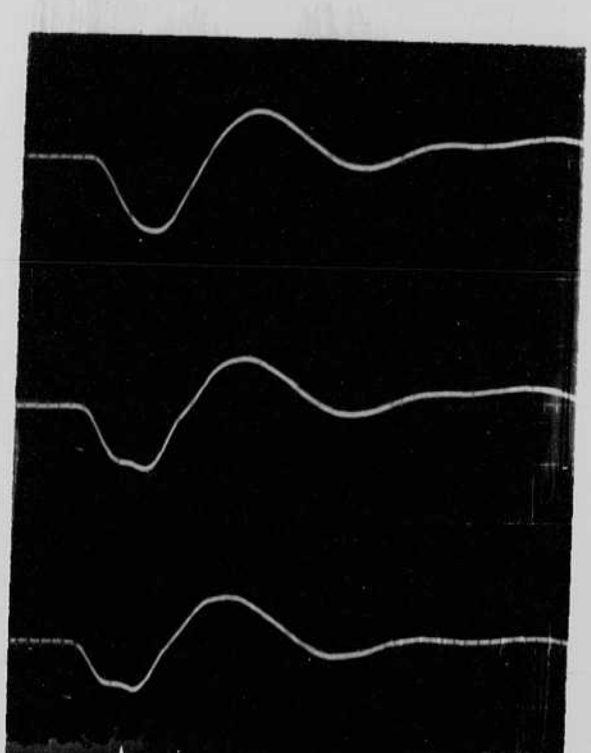
Output reduced when polarity reversed due to Permanent magnet.

4" Boomer. Rubber type

Constains Boomer

Oscillogram #5





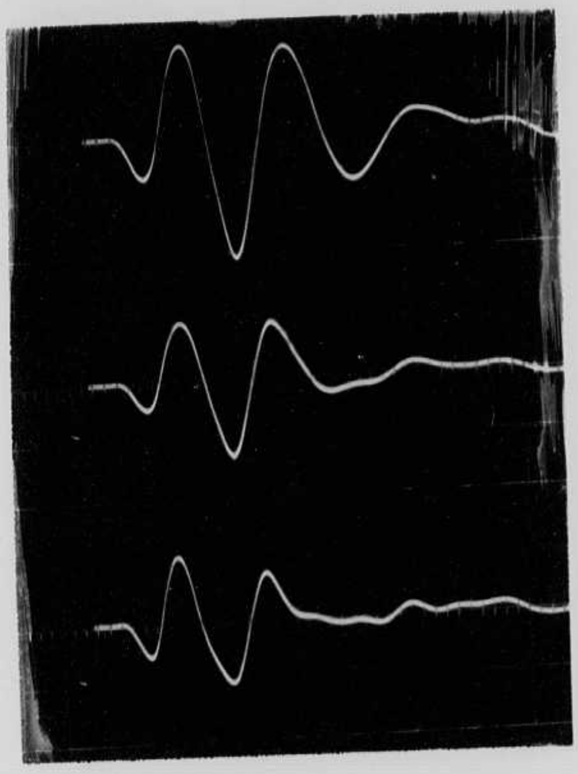
	Volts	µSec/div
① 32µf 2200V 1.6	0.5	100
② 16 µf 2000 V .39	0.1	100
③ 8 µf 2000 V .14	0.05	100

8" Boomer with boot

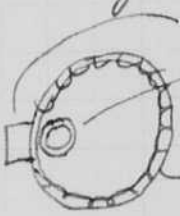
V/div	T/div		
0.2V .42	100 µs	32µf 2kV	①
0.1 V .19	100µs	16µf 2kV	②
0.05V .08	100µsec	8µf 2kV	③

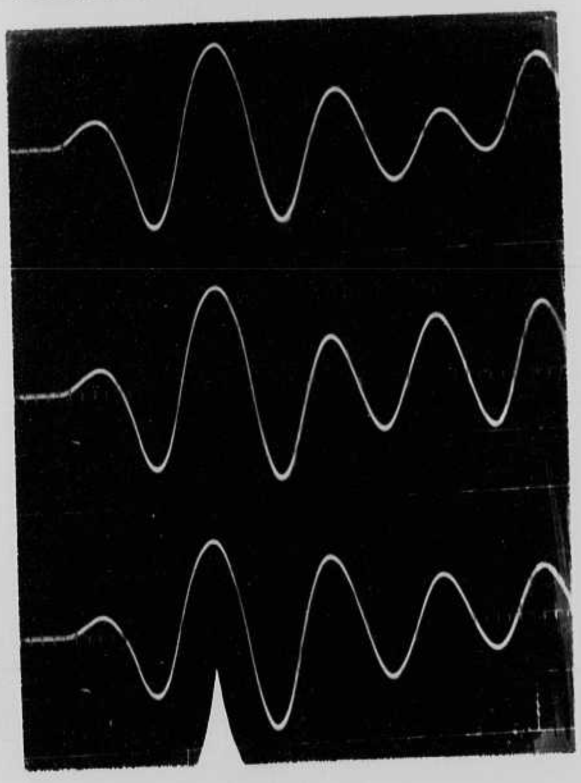
2µf L	.38	.1V/cm	100µsec
1µf L	.23	.1V/cm	100µsec
½µf L	.11	.05V/cm	100µsec

Oscillogram #2



magneto Striction Ring





#4 magneto strictive (Navy)

	volts		
2µf long	.62	.2V/div	100
1µf long	.66	.2V/div	100
½µf Long	.67	.2V/div	100

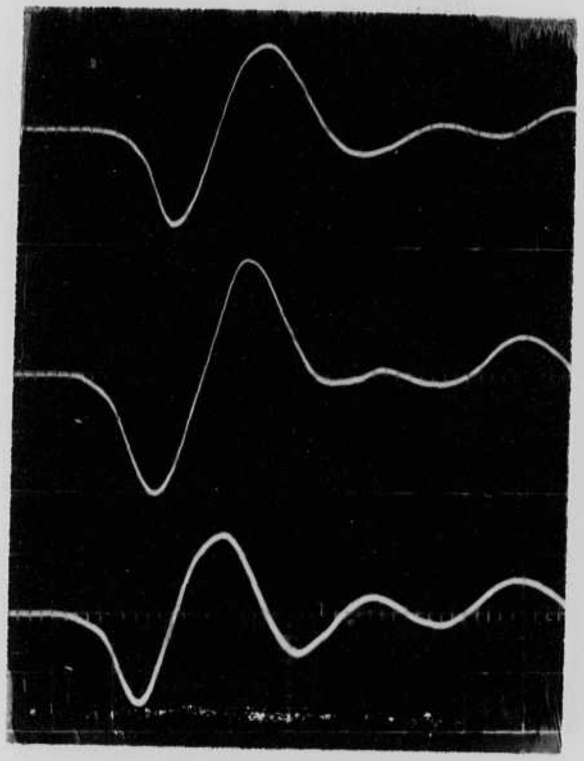
Output reduced when polarity reversed due to Permanent magnet.

21

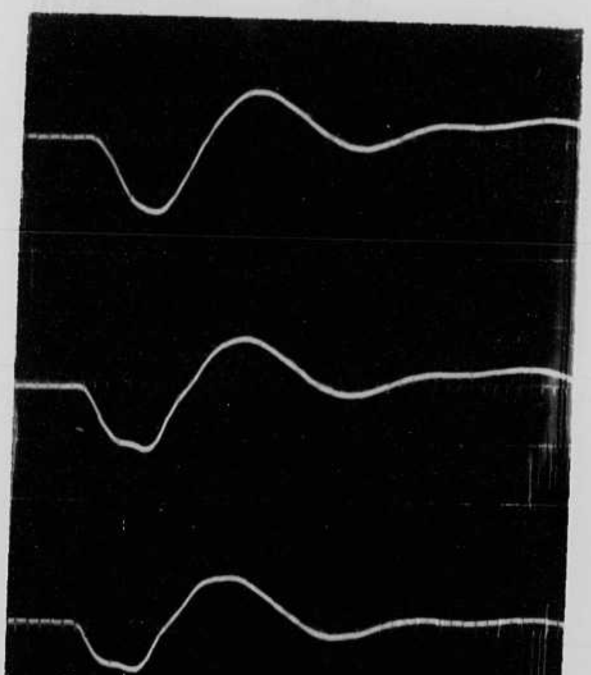
4" Boomer Rubber type

Constains Boomer

Oscillogram #5



		Volts	µSec/div
①	32 µf 2200V 1.6	0.5	100
②	16 µf 2000 V .39	0.1	100
③	8 µf 2000 V .14	0.05	100

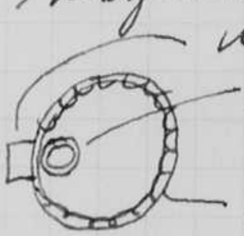


8" Boomer with boot

V/div	T/div		
0.2V .42	100 µs	32 µf 2kV	①
0.1 V .14	100 µs	16 µf 2kV	②
0.05V .08	100 µSec	8 µf 2kV	③

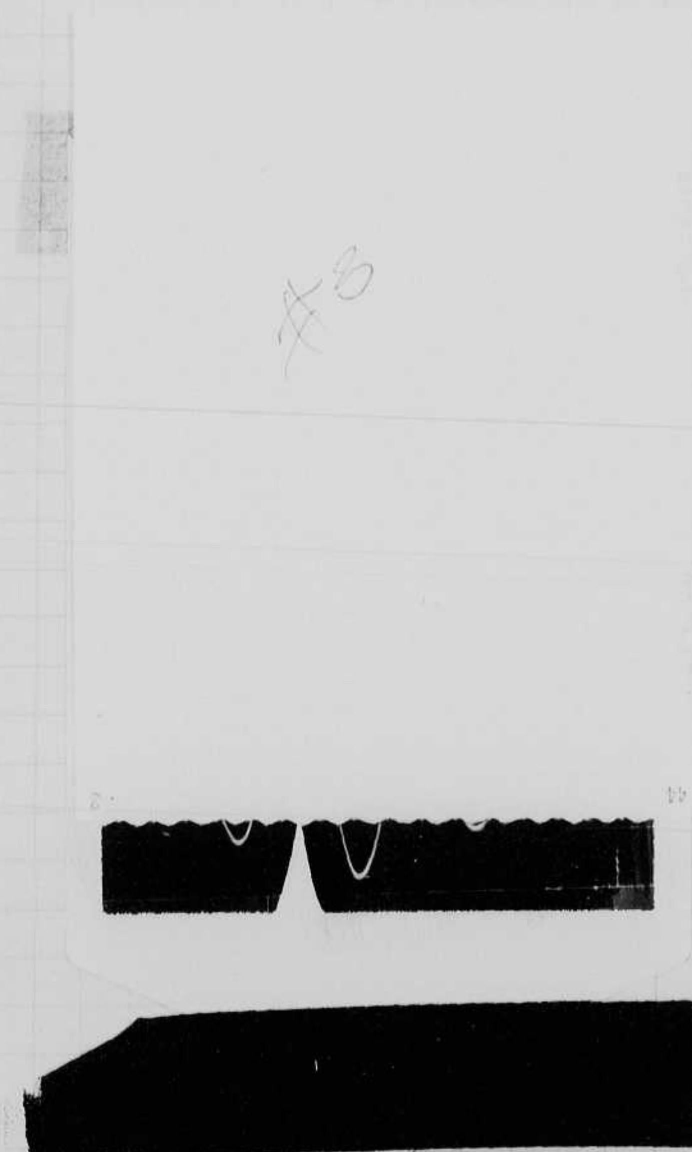
Oscilogram #3

	P-8 volts		
2μf L	.38	.1V/cm	100μsec
1μf L	.23	.1V/cm	100μsec
½μf L	.11	.05V/cm	100μsec



#4 magnetoo strictive (Navy)

	volts		
2μf long	.62	.2V/div	100
1μf long	.66	.2V/div	100
½μf Long	.62	.2V/div	100

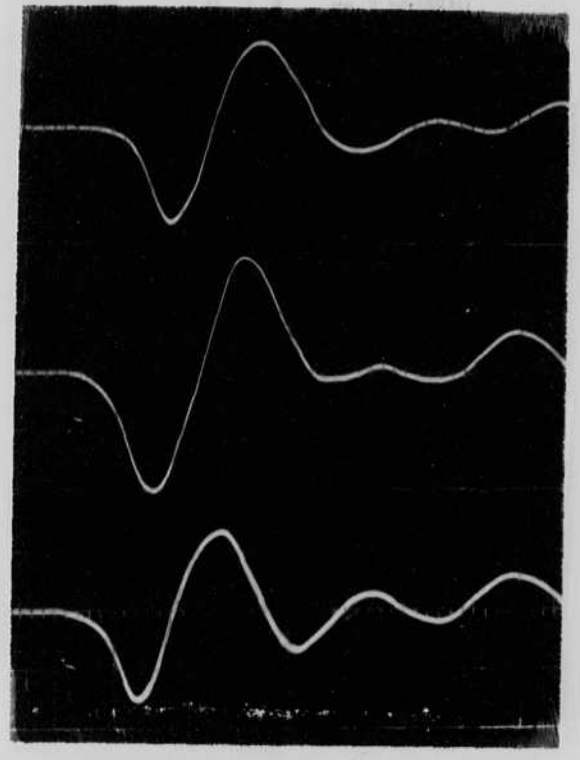


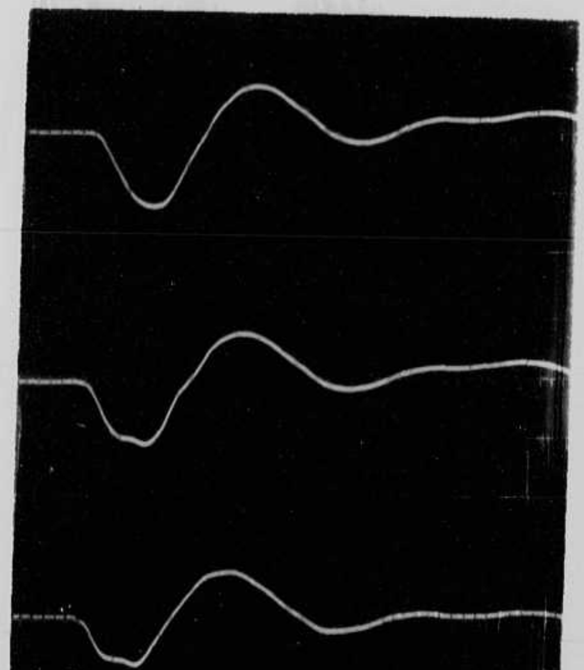
Output reduced when polarity reversed due to Permanent magnet.

4" Boomer Rubber type

Constanis Boomer

Oscillogram #5





			Volts	µSec/div
①	32 µf 2200V	1.6	0.5	100
②	16 µf 2000 V	.39	0.1	100
③	8 µf 2000 V	.14	0.05	100

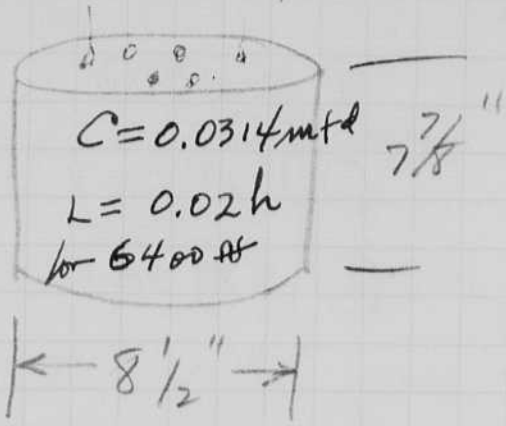
8" Boomer with boot

V/div		T/div		
0.2V	.42	100 µs	32 µf 2kV	①
0.1 V	.19	100 µs	16 µf 2kV	②
0.05V	.06	100 µSec	8 µf 2kV	③

Jan 4 '64 EG&G J.Y. Edo transducers arrived

Model 636

#1



$C = 0.0314$ mfd

$f = \frac{1}{2\pi}\frac{1}{\sqrt{LC}} = 3200$ ~.

$C = .0314$

$L = .0794_4$ henries

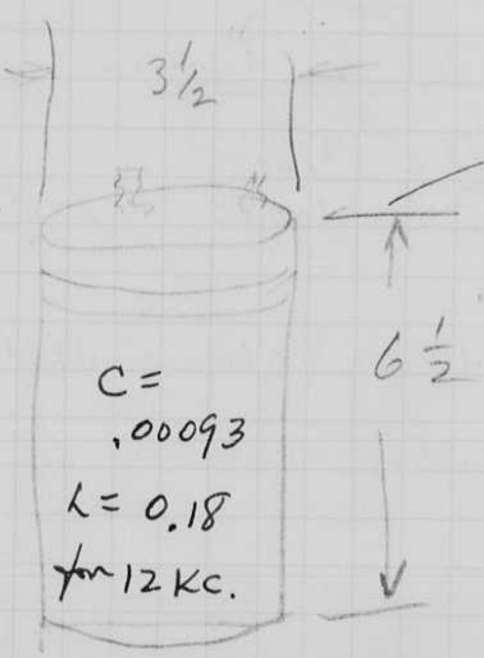
$f = 6400$ ~ $L =$ ~~.03076~~

$= .0198$

$= .02$ h.

Pinger Edo transducer .006 to .007 mfd L = .030 henries

Inductance of the Pinger transformer.

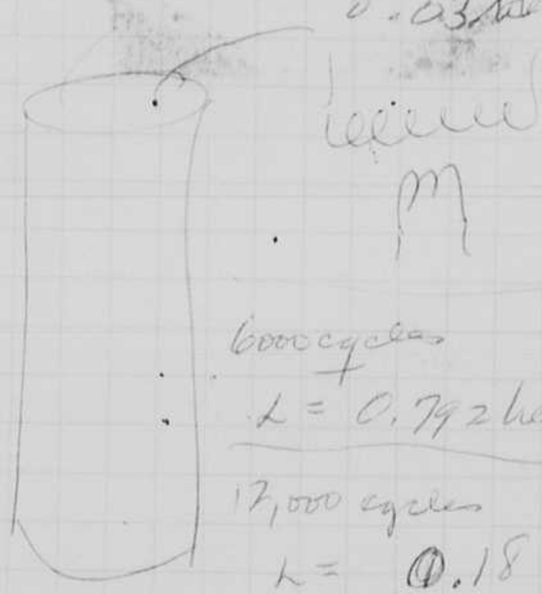


$C =$ ~~0.---~~ mfd

$= 0.00093$ mfd

EG&G transformer

0.03 henries



6000 cycles

$L = 0.792$ henries

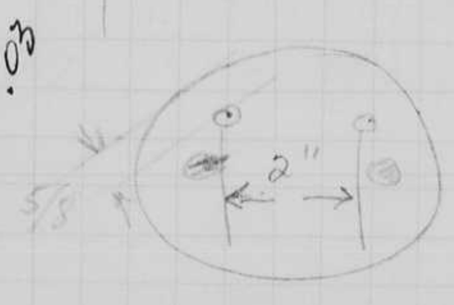
17,000 cycles

$L = 0.18$

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

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

$= .0292 \cong .03$



C = .006

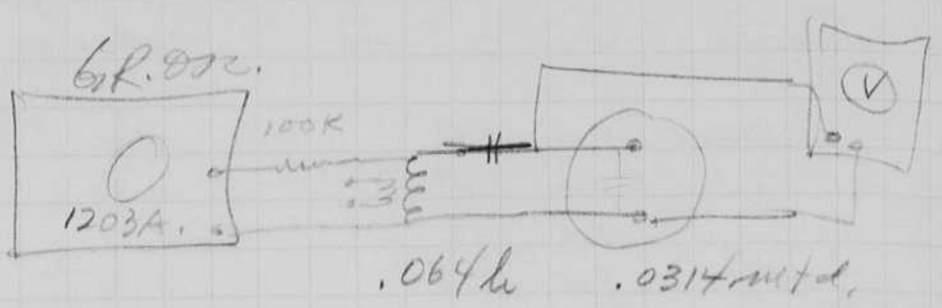
Jan 3 '64 ReCap of data of Jan 2

All taken at 1 per second rate

8 ball Hydrophone

P.	Device	V	C	WS	Volts p-p	1 cycle time ms.	ν	Duration
p18-19	Edo pinger	900	2 L		0.6	.07	14,300	
		900	1 L		0.32			
	(Need Pen.)	900	.5 L		0.17			
		900	2 S		0.34			
		900	1 S		0.22			
		900	.5 S		0.11			
20	Ring Mag.	900	2 L		0.38	0.18	5,550	
		900	1 L		0.23			
		900	.5 L		0.11			
20	Navy Mag.	900	2 L		0.62	0.22	4,540	
		900	1 L		0.66			
		900	.5 L		0.62			
p21	4" Boomer	2000	32		1.6	.38	2630	
			16		.39	~~.42~~		
			8		.14	.33		
p21	8" Boomer	2000	32		.42	.42	2380	
			16		.19	.42		
			8		.08	.41		
p25.	6.4 KC EDO Ring L = .064 (p24)	900	2 L		.50	.2	5,000	
			1 L		.28			
			.5 L		.15.			
p25	4" Pinger EDO 12 KC L = 0.064 (p24)	900	.75		.05	.14	7,140	Tuning of transformer was too low for 12KC.
		900	.5		.11			
		900	.25		.08			

Edo tests. Res Ins

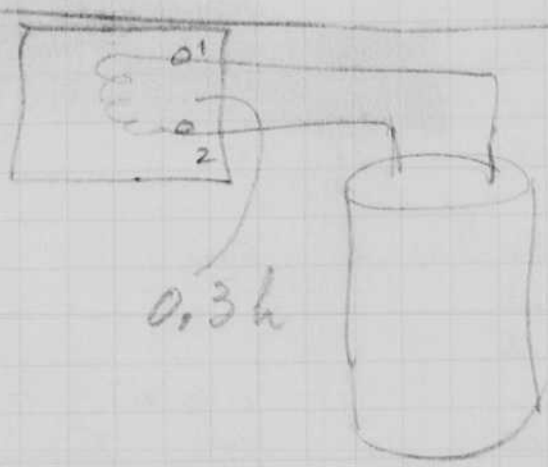


Voltmeter reads max
at f = 5,400 cycles.
f = 8,800 cycles

Precision Electronics
type ...401 ...
Marshfield Mass

Comp → 5400 cycles → 6400

f goes to 5800



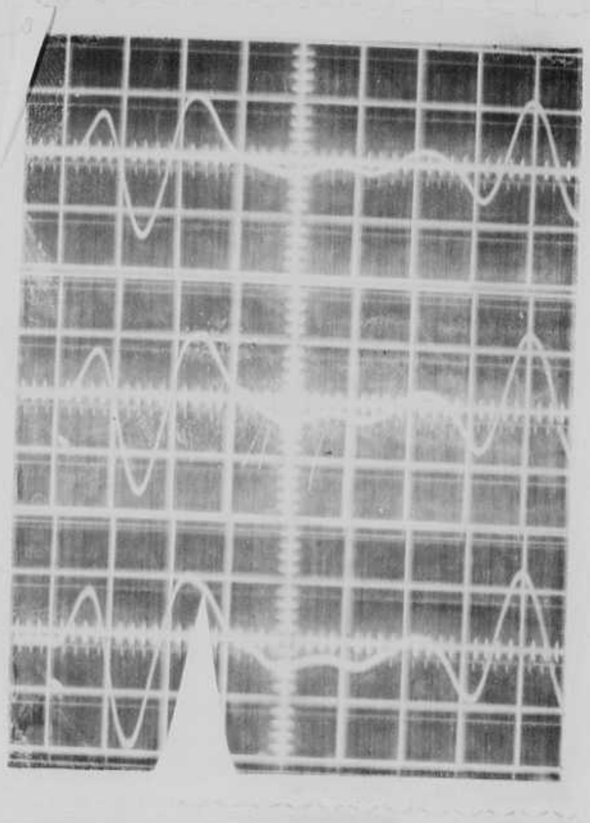
M.I.T. Two Transducer received from Edo.

January 4, 1964 #EE & J.Y.

6.4 Kc

Swimming Pool - Same set-up

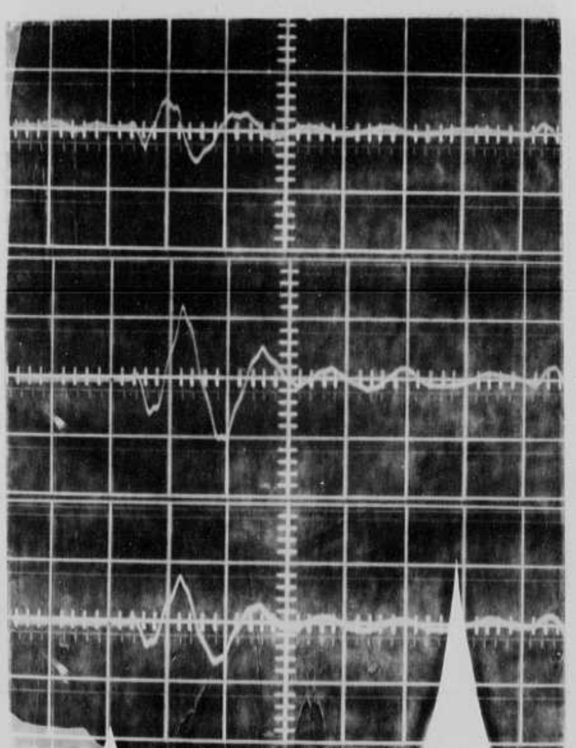
Test of EDO 6.4kc Ring Xducer



#1

				volts/p-p.
(1)	2 L	0.2 V/div	100 µs/div	.5
(2)	1 L	0.1 V/div	100 µs/div	~~.28~~ .28
(3)	1/2 L	0.05 V/div	100 µs/div	.15

#2 Small 12 kc. Xducer



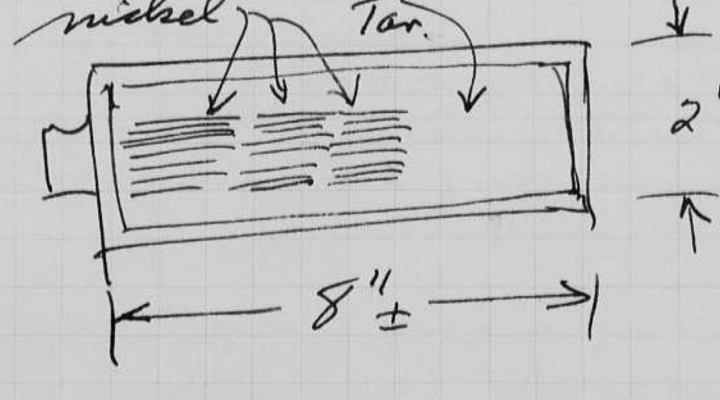
Some Pings were larger! Trans Sparks?

			volts P.P
3/4 L	0.05 V/div	100 µs	0.05
1/2 L	0.05 V/div	100 µs	0.11
1/4 L	0.05 V/div	100 µs	.08

white co magneto Transducer

.005 volts p-p on 8 ball at 15 feet

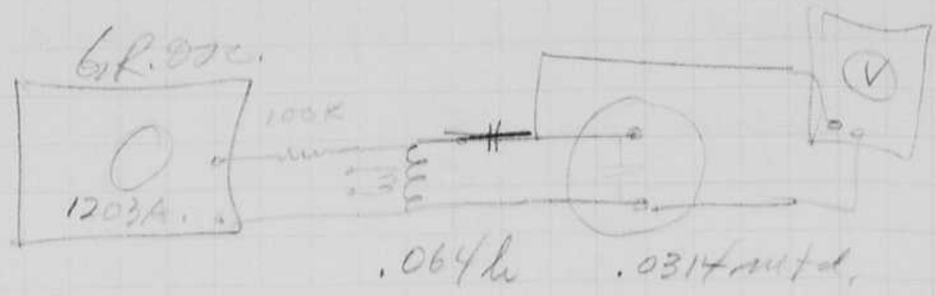
about 30 kc ± ?



[redacted]

Edo tests. Res Fre

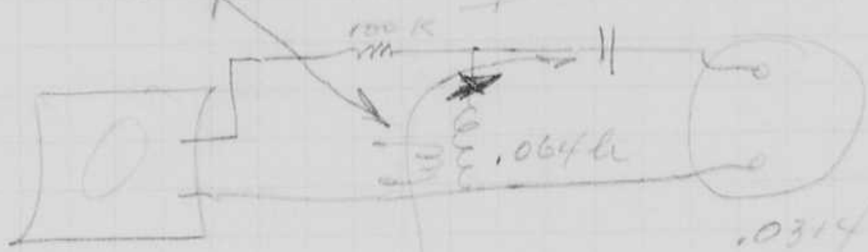
6.4K cty...



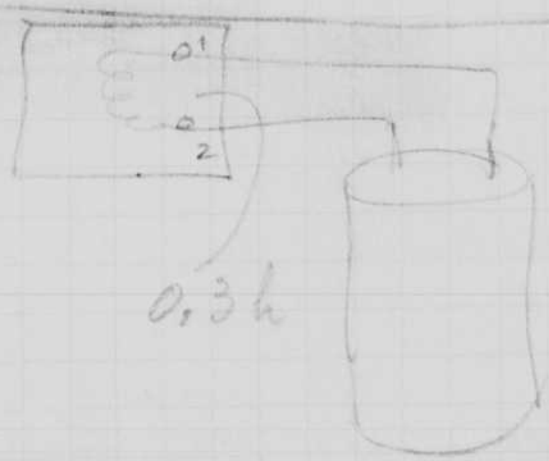
Voltmeter reads max
at f = 5,400 cycles.
f = 8,800 cycles

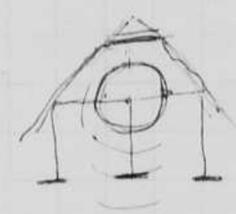
Precision Electronic
type 88101 ...
non-shield mass

Comp → 5400 cycles → 6400



f goes to 5400





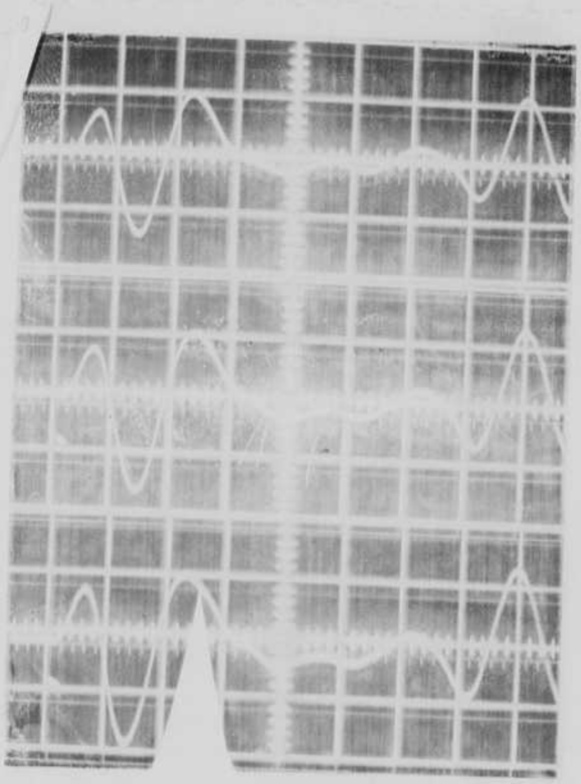
M.I.T. Two Transducer received from Edo.

January 4, 1964 #EE & J.Y. (6.4 KC)

Swimming Pool - Same Set-up

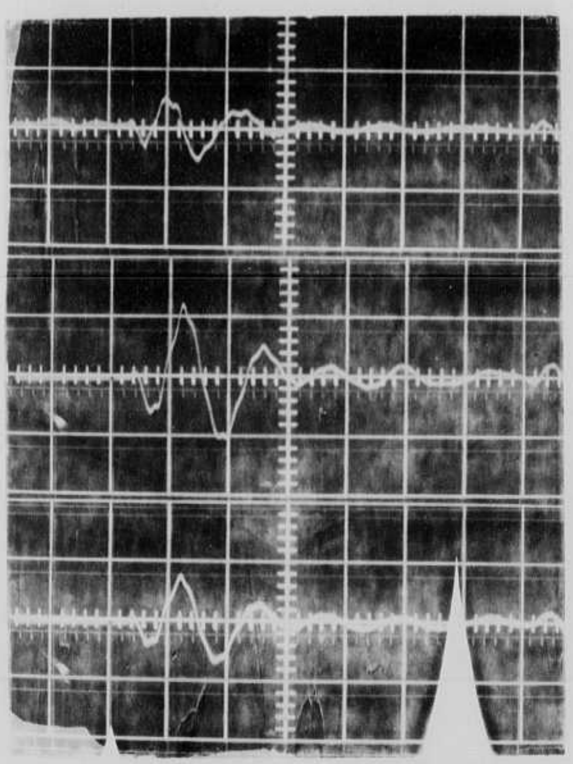
Test of EDO 6.4 kc Ring Xducer

#1



				volts/P-P.
①	2 L	0.2 V/div	100 μS/div	.5
②	1 L	0.1 V/div	100 μS/div	~~.28~~ .28
③	1/2 L	0.05 V/div	100 μS/div	.15

#2 Small 12 kc, Xducer



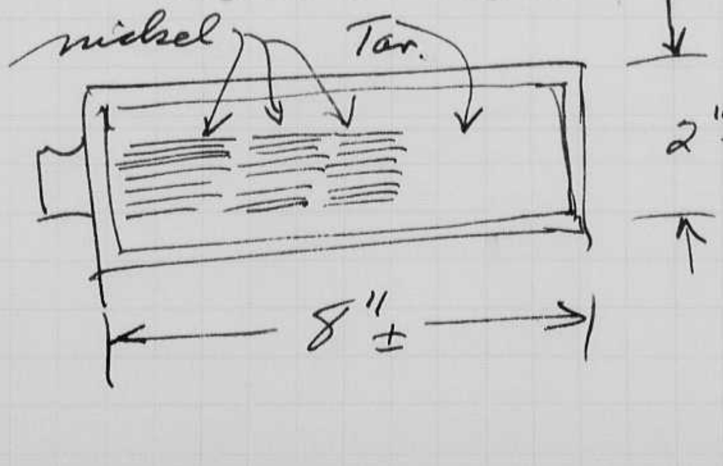
Some Pings were larger! Trans Sparks?

			volts P.P
3/4 L	0.05 V/div	100 μS	0.05
1/2 L	0.05 V/div	100 μS	0.11
1/4 L	0.05 V/div	100 μS	.08

White Co magneto Transducer

.005 volts p-p on 8 ball at 15 feet

about 30 kc ± ?



[redacted]

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

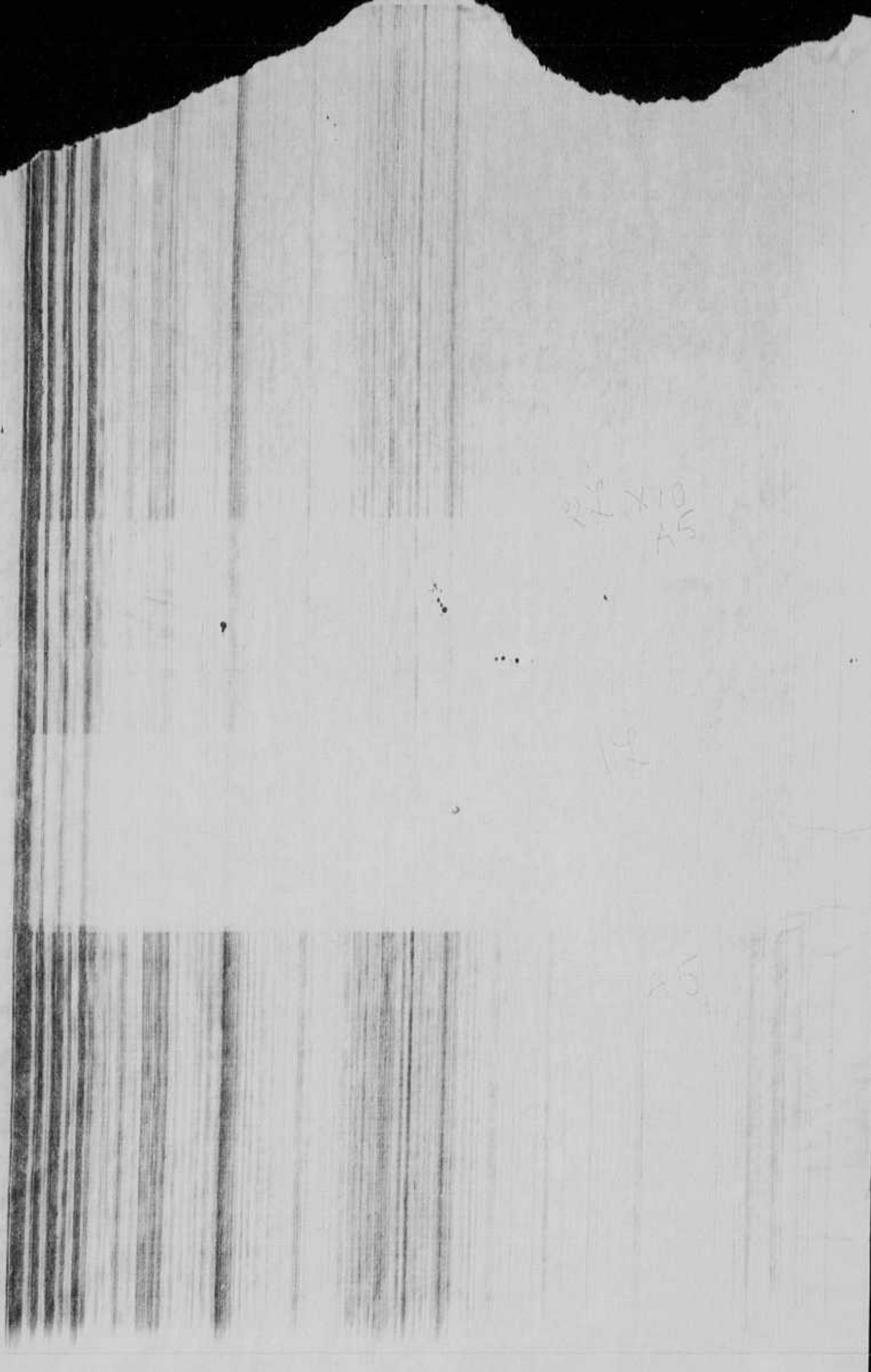
____ negative strip(s)

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

was/were filmed where originally located between page 24 and 25.

Item(s) now housed in accompanying folder.

4" EDO
12Kc
Elect Cont Trn



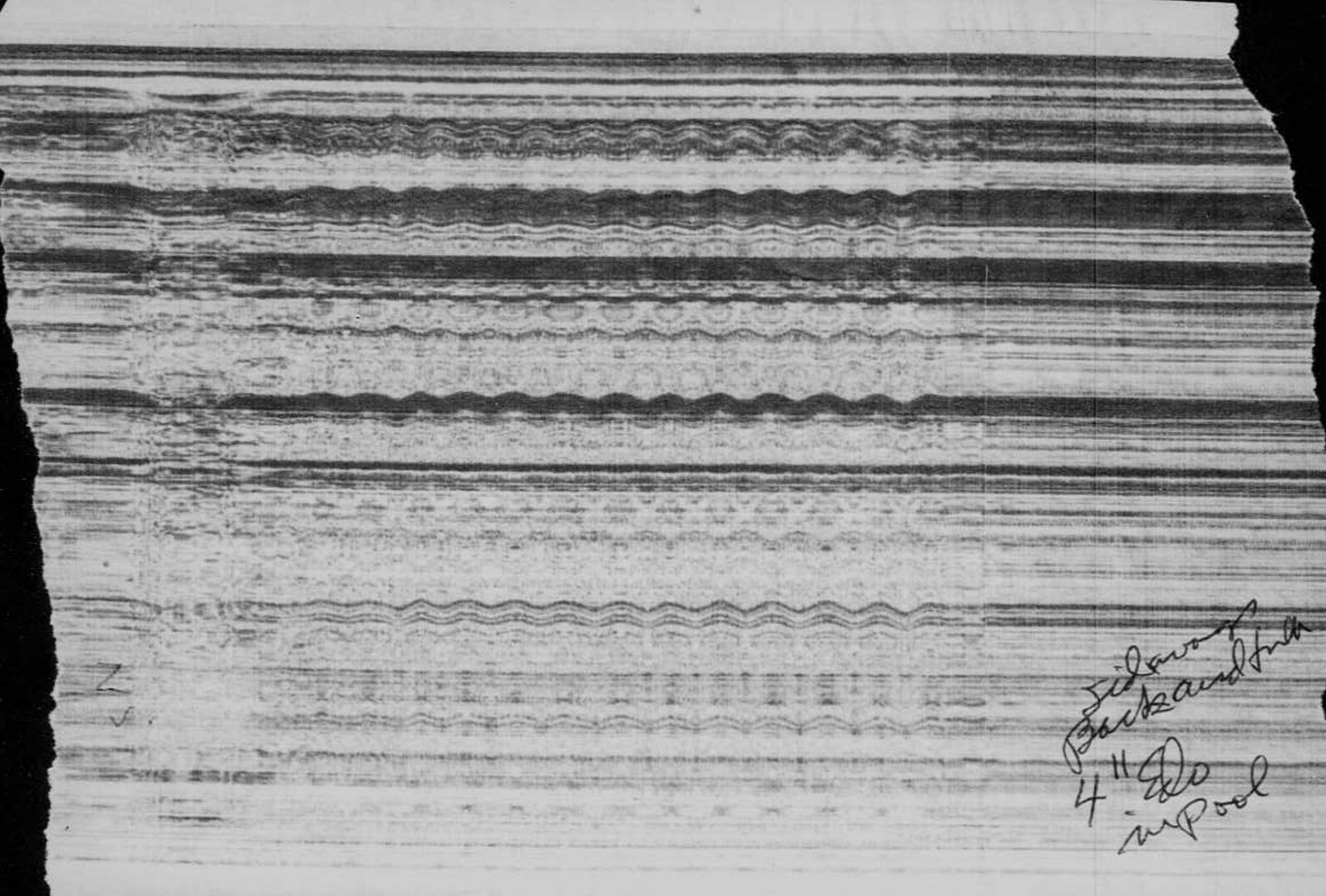
2L X10
A5

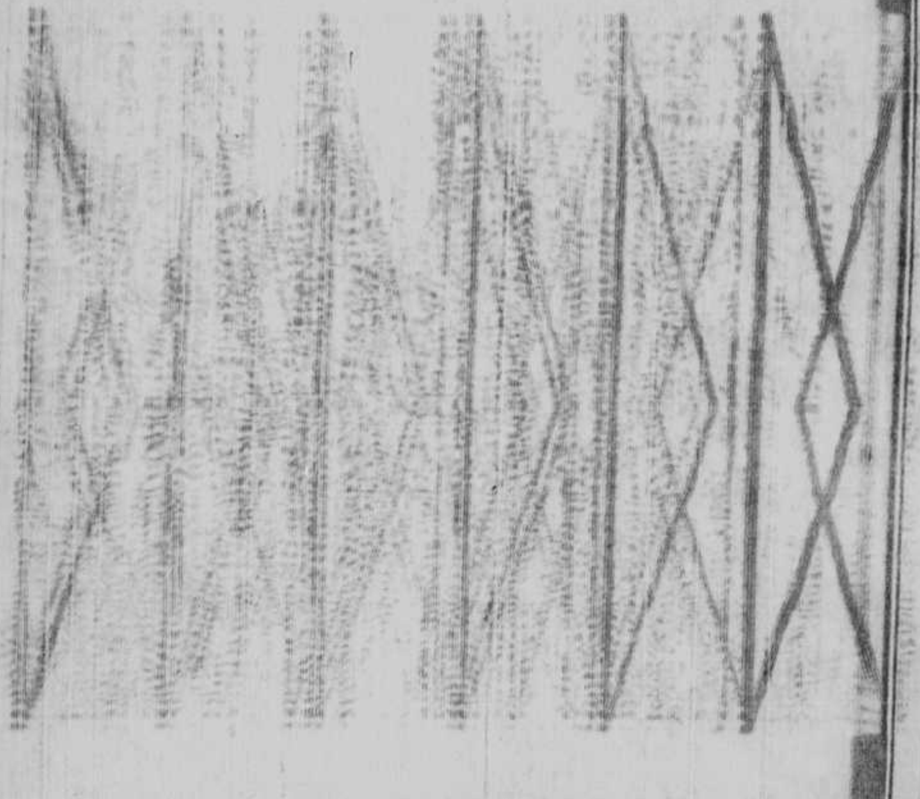
1/2

A5

1/2 Long X10 A10

Jan 4 64
G.HKCEDO
Cylinder


Z
Sideways
Back and forth
4" Eel
in Pool



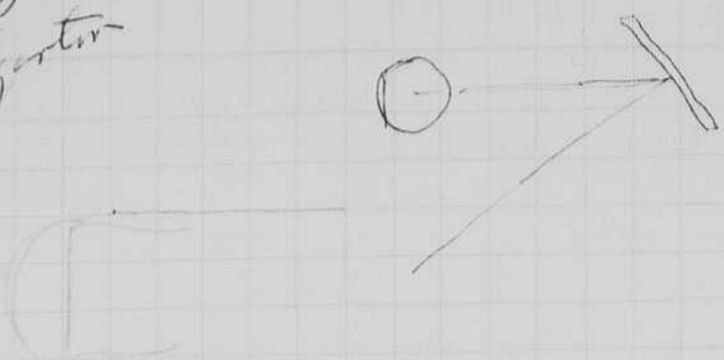
 Reflector Design

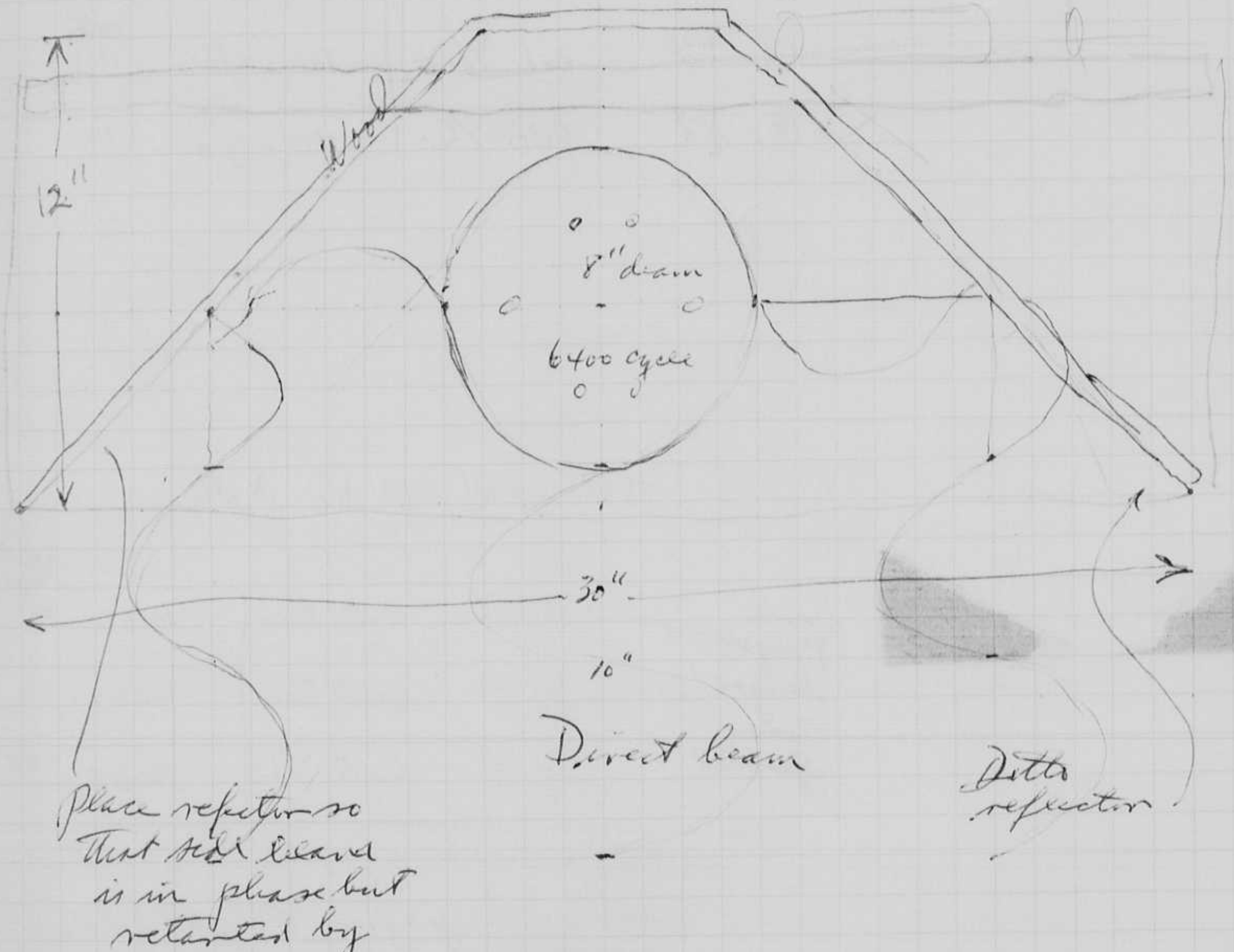
Jan 5 1963
[illegible]

$f = 6400$ cycles

$\frac{5000 \text{ f/sec}}{6400} = 0.78'$

9.37"



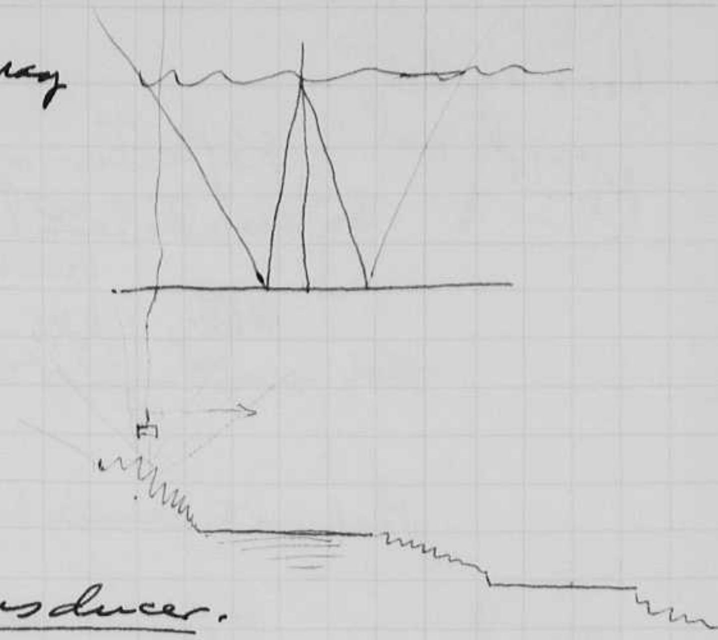


Place reflector so that [illegible] beam is in phase but retarded by one cycle.

If the phase of the ~~reflection~~ reflected signal is reversed in sign then the reflectors need to be spaced 1/2 wave length, 5", further away from the edge of the transducer.

Jan 7 64
Mapes   Flor

$\boxed{\text{SQS 23.}}$ may

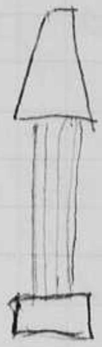


LM 12

SQS?

8Kc.

10lbs.



$Q = 10$ or 12.

LM 8 A transducer.

~~Jan 9 1964~~

Special Inductor transformers.

$L = .143 \quad Q = 1.75$
$(.15 \quad Q = 1.7)$ Chas Eichman.
1100 turns #40 HF

} for use with 12 KC 4" Projector
.00093 mfd.
$\boxed{f = 13.4}$ KC

$L = .017 \quad Q = 5.2$
$(17.4 \quad 4.8)$.
360 turns #31 HF

} for use with 6.4 KC. ~~crystal~~ Ceramic
~~0.013~~ mfd.
.0314   5.85 KC
8. KC

$2\pi\sqrt{LC} = \sqrt{.143 \times .00093 \times 10^{-6}}\ 2\pi = \cancel{834}$

$.132 \times 10^{-11}$

$.13 \times 10^{-9}$

1.3×10^{-10}

$1.14 \times 10^{-5}\ 2\pi = 7.15 \times 10^{-5} = 71.5 \times 10^{-6}$ sec. $\frac{1}{71.5} = 14,000$ cycles/sec.

~~$\sqrt{LC} = \sqrt{.017 \times .0314 \times 10^{-3}} = \sqrt{5.3 \times 10^{-4} \times 10^{-3}} = 4.29 \times 100 \times 10^{-3} = 429 \times 10^{-6}$~~

~~$2\pi\sqrt{LC} = 6.28 \times 429 \times 10^{-6} = 270 \times 10^{-6}$ seconds~~   ~~$f = 3700$ cycles/sec~~?

$\sqrt{.017 \times .0314} = \sqrt{5.31 \times 10^{-4}} = 2.31 \times 10^{-2}$

$2\pi\ 2.31 \times 10^{-2} \times 10^{-3} = 145 \times 10^{-6}$ seconds $f = 6900$ cycles.

 Jan 11 1964

H. Edgerton

M.I.T. Pool.

6.4 KC Edo with
Special transformer (.017h.)

Reflector of 1/2" plywood made as per p 26 by Max Roberts on Sat.

with 1 p.p.s. at .5 mfd at 900 volts on pinger the voltage of the 8 ball was .14 volts p to peak.

1. mfd .25 volts

2 " .45 volts

Peak volts seem to be slightly lower.

Jan 18, 1964 The new Hydrophone LS-57 from Atlantic Res. came yesterday. Al Falk was here from Mudd College in California. He was at me on the mine committee. He helped me try the new Hydrophone in the pool compared to the 8 ball.

8 ball 6000 cycles ?

LS-57 20,000 cycles.

The output voltage from the iron (mag) transducer is about the same except the output has more high frequency ripples with the LS-57.

N.B. Marshall and Geo. Clarke (Harvard) were here on Jan 13.

Marshall is analyzing photos taken by Hersey at Eden

Example 6.85 fathoms

1000 meters square

2000 photos

1 fish every 25 sq meters

19 species of fish.

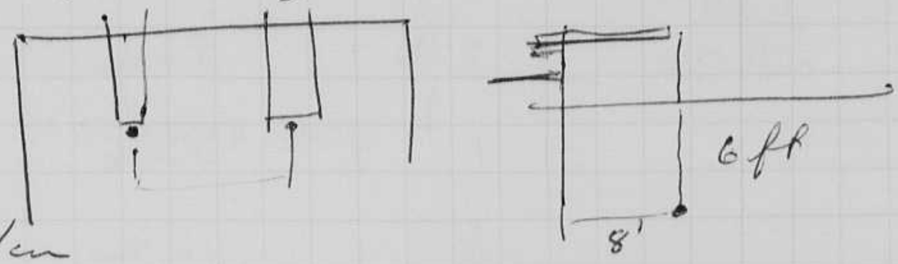
Nickle - Sommers Bros - Waterbury Conn

for Transducers.

Jan 19 1964 M.I.T. Pool 830am Transducer test.

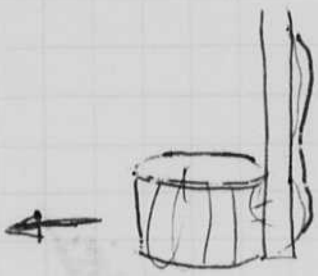
H E Edgerton
John Yules

Hydrophone LC-57 (Atlantic) 1.5 V/cm -93 db

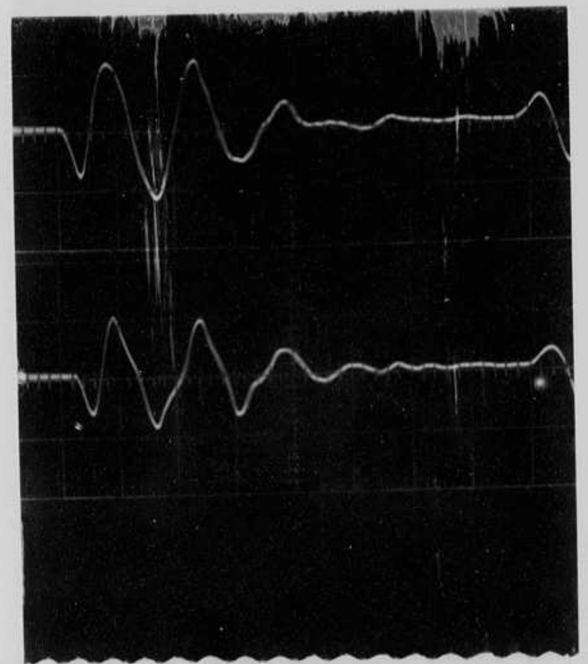


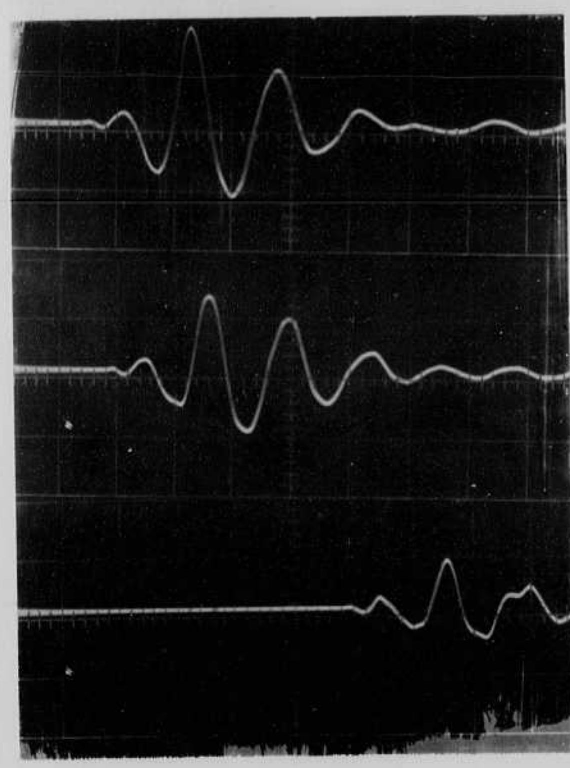
Trans. V C V/cm sec/cm

	Ring		
Ring (Magnetostrictive with pole)	2	.1V/cm	.1 millisec/div
	1	"	"
pole away from hydrophone	$\frac{1}{2}$	"	"



Output is twice as great on side away from pole as when pole faces hydrophone





	Long		
	2	.1V/cm	.1 m sec/cm
sound varies by factor of 2 when transducer turned 180°	1	.1 V/cm	"
	$\frac{1}{2}$	.1V/cm	"

Jan 11 1964

H. Edgerton

M.I.T. Pool.

6.4 KC Edo with Special transformer (.017h.)

Reflector of 1/2" plywood made as per p 26 by Max Roberts on Sat!

With 1 p.p.s. at .5 mfd at 900 volts on pinger the voltage of the 8 ball was .14 volts p to peak.

1 .mfd .25 volts

2 " .45 volts

Peak volts seem to be slightly lower.

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8 ball 6000 cycles ?

LS-57 20,000 cycles.

The output voltage from the ring (Mag) transducer is about the same except the output has some high frequency ripples with the LS-57.

N.B. Marshall and Geo. Clarke (Harvard) were here on Jan 13.

Marshall is analyzing photos taken by Hersey at Eden

Example 685 fathoms

1000 meters square

2000 photos

1 fish every 25 sq meters

19 species of fish.

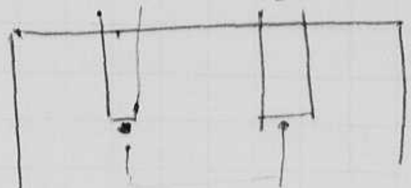
Nickel - Sommers Brass - Waterbury Conn

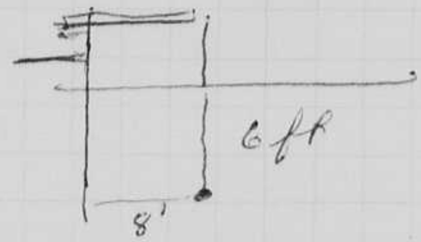
for Transducers.

Jan 19 1964 M.I.T. Pool 830 am Transducer test.

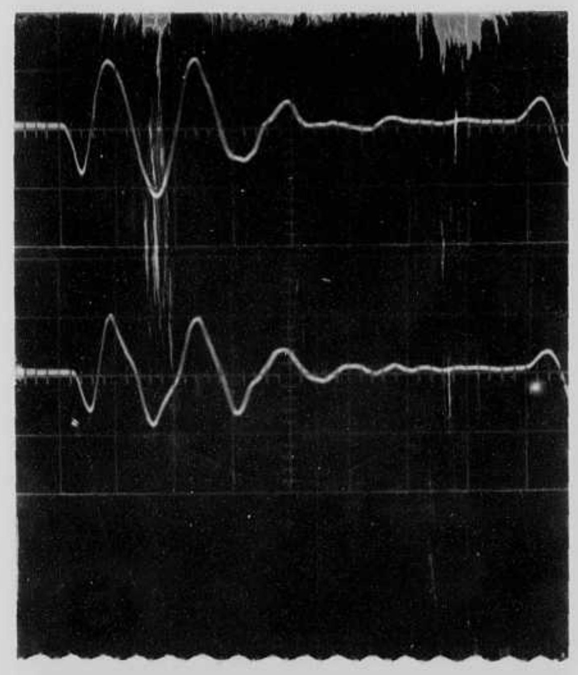
H E Edgerton
John Yules

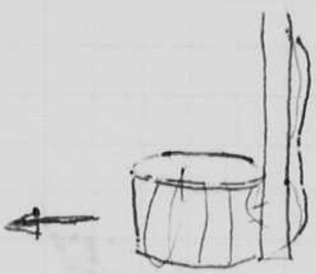
Hydrophone LC-57 (Atlantic) 1.5 V/cm -93 db



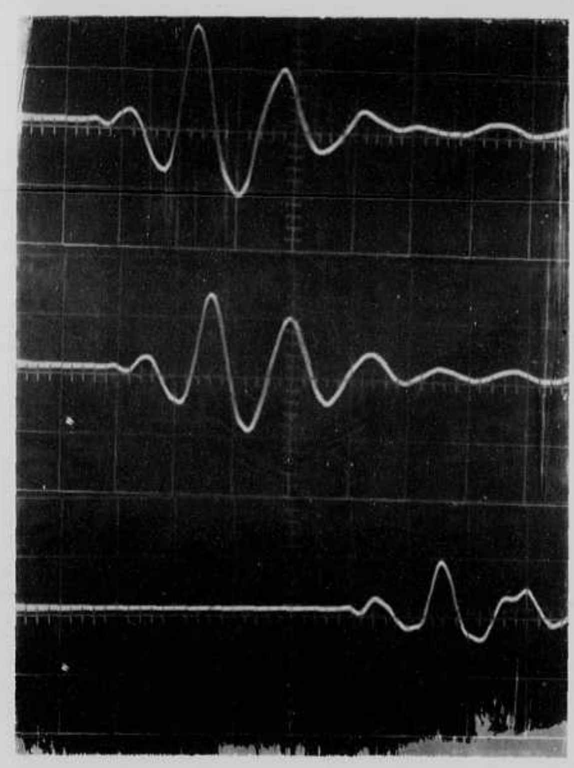


Trans.	V	C	V/cm	sec/cm
		Long		
Ring (Magnetostrictive with pole)		2	.1 V/cm	.1 millisec/div
		1	"	"
pole away from hydrophone		1/2	"	"

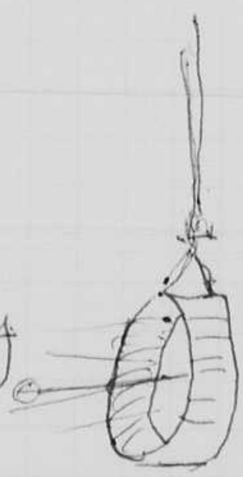




Output is twice as great on side away from pole as when pole faces hydrophone



Ring



	Long		
	2	.1 V/cm	.1 m sec/cm
sound varies by factor of 2 when transducer turned 180°	1	.1 V/cm	"
	1/2	.1 V/cm	"

Notebook # 28

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 28 and 29.

Item(s) now housed in accompanying folder.

$\longleftrightarrow$

7'

Notebook # 28

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 30 and 31.

Item(s) now housed in accompanying folder.

Boomer tests.

first cycle

Jan 17 1965
H. E. Edgerton
8 balls at 6 ft.

	Osc. no.	Trans.	C	e_{max} p-p.	T_{cycle} ms.	f.			
.0272	16	I	8	0.38	0.19	5280	.22 or .32?		
1.31	14	I	16	2.5	0.21	4750	.30		
8.3	18	I (1000)	24	4.6	0.25	4000	.4		
11.7	3	I	32	6.6	0.27	3700	.46		
27.0	5	I	80 low volts	8.8 ~~22~~	0.35	2860	.7x2=1.4		
63.0	8	I	80	13.2	0.35	2860	.75x2 = 1.5		
81.0	10	I	160	14.0	0.41	2440	1.75x2 = 3.50		
.51	34	II 8" flat coil	8	1.55	0.21	4800 *	f = current f = 8000? 1cyc = .12	, see ac. f = 8300	
2.90	36	II	16	3.5	0.24	4200 *	1cyc = .17	f = 5900	
6.0	38	II	24	5.1	0.23	4400 *	1cyc = .2 ms.	f = 5000	
.120	47	III square core form	8	.56	0.38	2650		.76 ms.	1310
.35	48	III	16	.74	0.64	1560		1.20	830
.58	49	III	24	0.84	0.82	1220		1.4	710
.086	42	IV E out	8	0.45	0.42	2380		.85	1170
0.608	44	IV (1500)	16	1.075	.52*	1920		1.2	835
1.72	45	IV	24	1.35	.95	1050		1.6	625
0.17	20	V E full	8	.66	.39	2560		0.52	1970
.96	24	V 98 T	16	1.5	.42	2380		0.74	1320
1.22	26	V	24	1.65	.45	2220		0.92	1080
		VI full E 50 T al	8	.64	.26				
		VI	16	1.75	.34				
		VI	24	2.20	.35				

copper VII full E 50 T copper.

* not symmetrical.

Boomer tests.

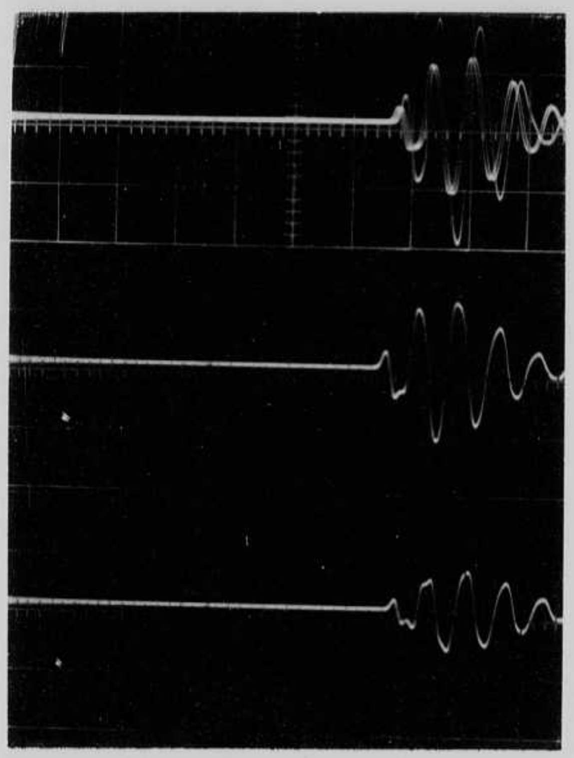
Jan 17 1965
A.E. Egerton
8 ball at 6 ft.

first cycle.

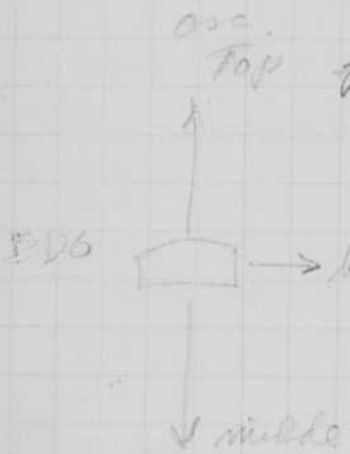
	Osc. no.	Trans.	C	$e_{max.}$ p-p.	T_{cycle} ms.	f.			
.0272	16	I	8	0.38	0.19	5280	.22 or .32?		
1.31	14	I	16	2.5	0.21	4750	.30		
8.3	18	I 1000	24	4.6	0.25	4000	.4		
11.7	3	I	32	6.6	0.27	3700	.46		
37.0	5	I	80 low volts	8.8 ~~22~~	0.35	2860	.7x2=1.4		
63.0	8	I	80	13.2	0.35.	2860	.75x2 = 1.5 ~~1.75x2 3.50~~		
81.0	10	I	160	14.0	0.41	2440	1.75x2 = 3.50		
.51	34	II 8" flat coil	8	1.55	0.21	4800 *	current f = 8000? f = 1cyc = .12	, 500 ac. f = 8300	
2.90	36	II	16	3.5	0.24	4200 *	1cyc = .17	f = 5900	
6.0	38	II	24	5.1	0.23	4400 *	1cyc = .2 ms. f = 5000		
.120	47	III square core form	8	.56	0.38	2650	.76 ms.		1310
.35	48	III	16	.74	0.64	1560	1.20	3.7 2 7.4	830
.58	49	III	24	0.84	0.82	1220	1.4	2.65 2 1320	710
.085	42	IV E out	8	0.45	0.42	2380	.85	5.3 2	1170
0.605	44	IV 1507	16	1.075	.52*	1920	1.2	2.4 2	835 13.0
1.72	45	IV	24	1.35	.95	1050	1.6	3.2 2 2.4 2.3 x2	625 31
0.17	20	V E full.	8	.66	.39	2560	0.52	2.8 5 140	1920
.96	24	V 98 T	16	1.5	.42	2380	0.74	.255 2 5.10	1320 3 2 45
1.22	26	V	24	1.65	.45	2220	0.82		1080 2 5.6
		VI Full E 50 T	8	.64	.26			215 5 1075	6.4 2 12.8
		VI al.	16	1.75	.34			35 5 165	27 5 135
		VI	24	2.20	.35			104 2 208	
		copper VII Full E 50 T copper.						3.3 .2 .66	

* not symmetrical.

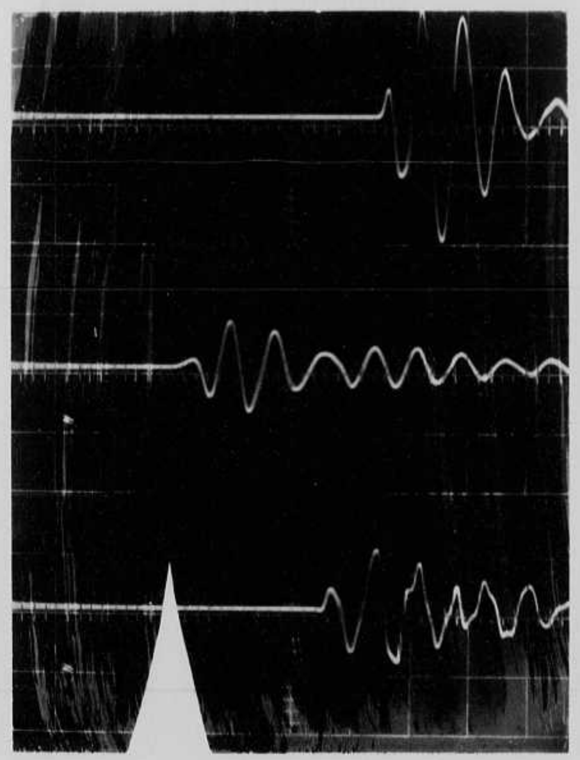
	C	V/cm	time/cm
EDO Xducer	2 L	1	.1 msec
	1 "	1	.1 msec
	1/2 "	1	.1 msec



2L



Top 2	1. V	0.1 ms
Bott 2	.05	0.1 ms
mid 2	.05	0.1 ms



EDO

all short. V/cm

2	1V	0.1ms
1 (2 records)	1	0.1
1/2	~~[illegible]~~ 1	0.1
1/4		

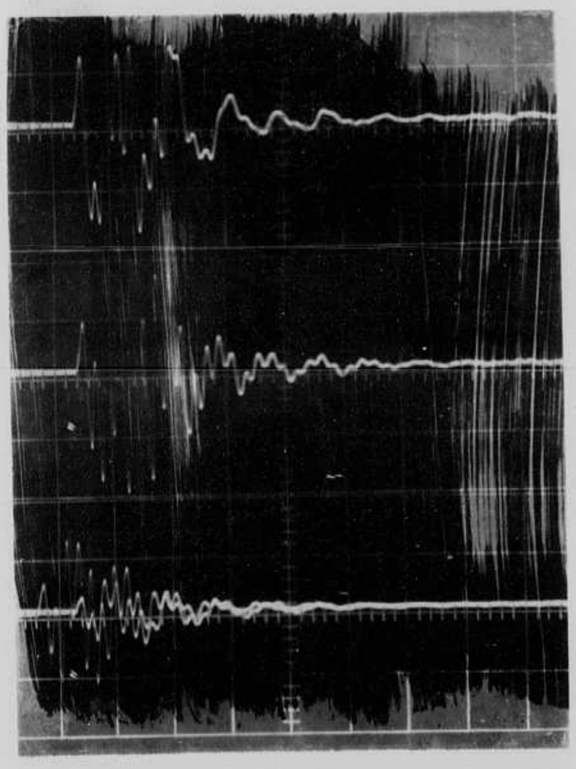
also 2

EDO - small "12 kc"

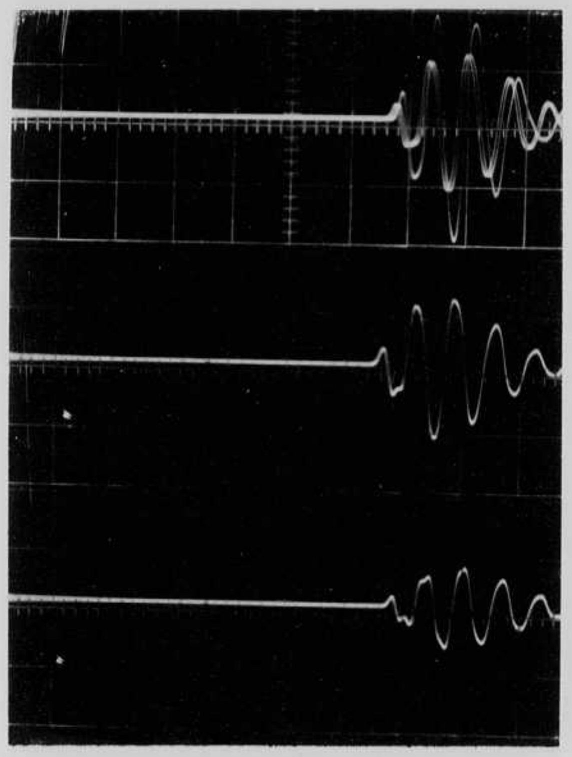
2L	.2 V/cm	.1 ms
1L	.2 V/cm	.1 ms
1/4 L + 1/2 L	.2 V/cm	.1 msec

Transformer: 150 mh
Q = 1.7

12 kc Small Edo
as Hydrophone P.P. 8 volts
from 6.4 KC Edo at 15 ft
2 m fd long!



	C	V/cm	time/cm
EDO Xducer	2L	1	.1 msec
	1 "	1	.1 msec
	1/2 "	1	.1 msec



2L

osc. Top	Top 2	1. V	0.1 ms
	Bottom 2	.05	0.1 ms
EDO → bot			
	mid 2	.05	0.1 ms
↓ middle			

EDO   V/cm

all short.

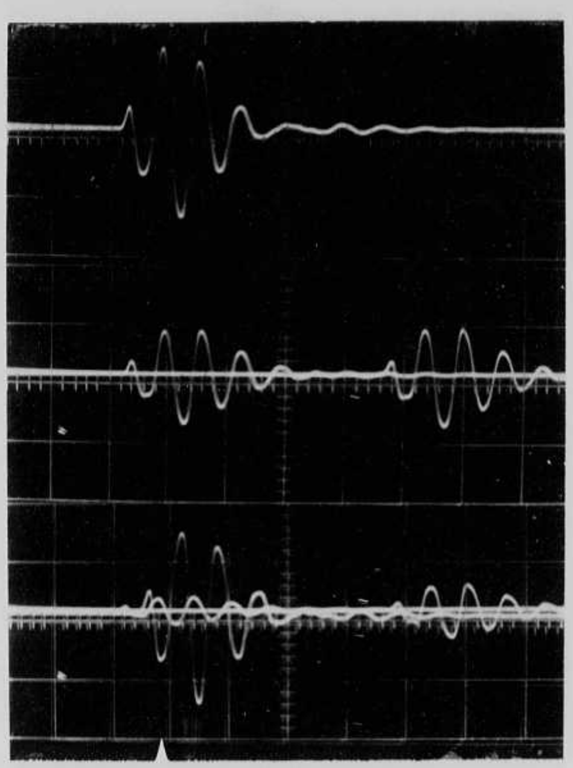
2   1V 0.1ms

1 (2 seconds)   1   0.1

1/2 } ~~   ~~ 1   0.1

1/4 } ~~   ~~

also 2



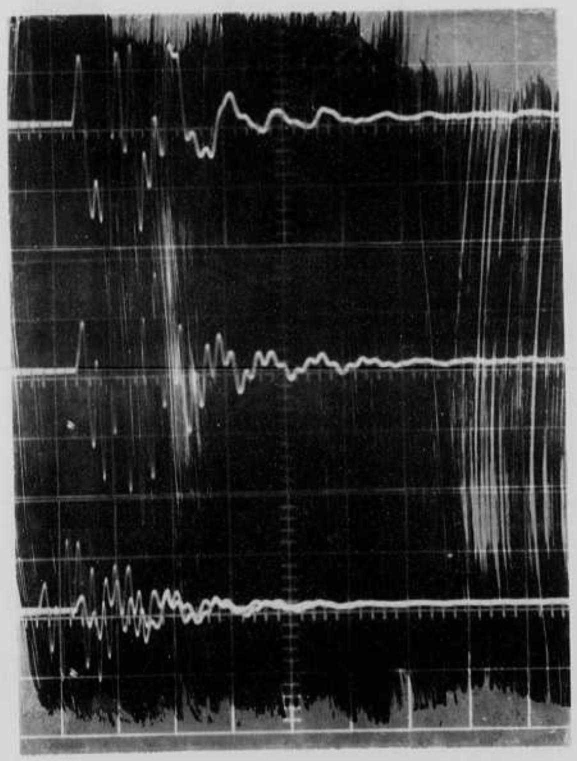
EDO - small "12 kc"

2λ   .2V/cm   .1 ms

1λ   .2V/cm   .1 ms

1/4λ + 1/2λ   .2 V/cm   .1 msec

Transformer: 150 mh
Q=1.7

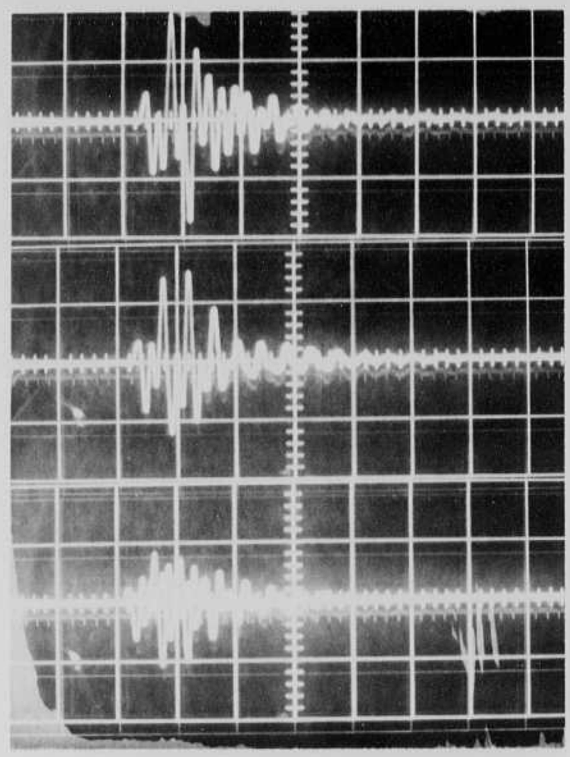


12 kc Small Edo
as Hydrophone   P.P. 8 volts
from 6.4 KC Edo at 15 ft
2 msd long!

Xformer:
17.4 mh
4.8 = Q

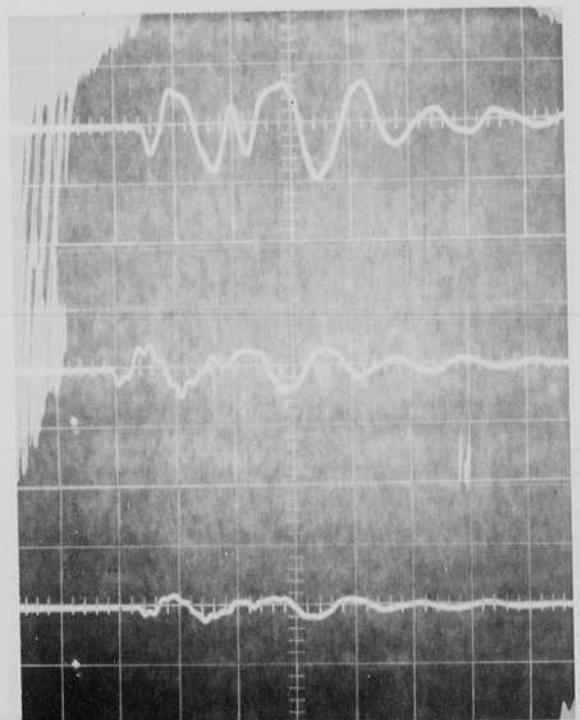
Small Edo

2L	.5 V/cm	0.1 m sec
1L	"	"
½L	"	"
¼L	"	"

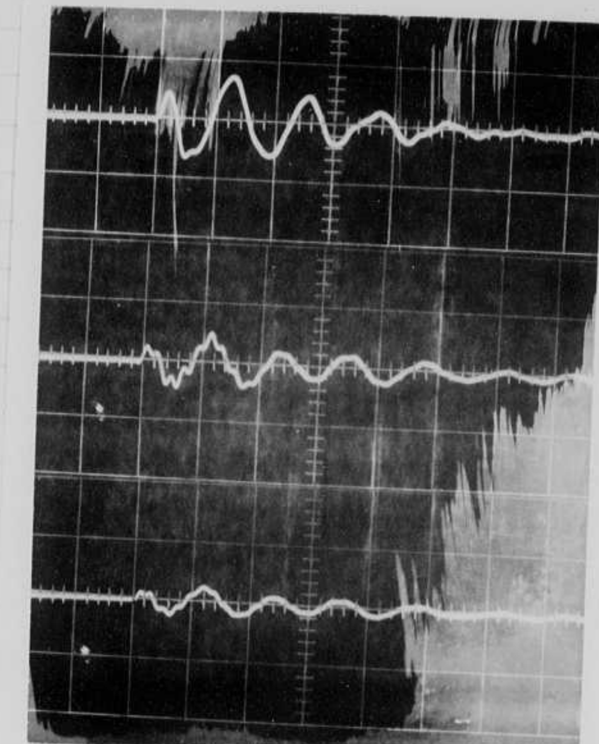


6KC EDO

2L	.5	.1	.85
1L	.5	.1	.35
½L	.5	.1	.2

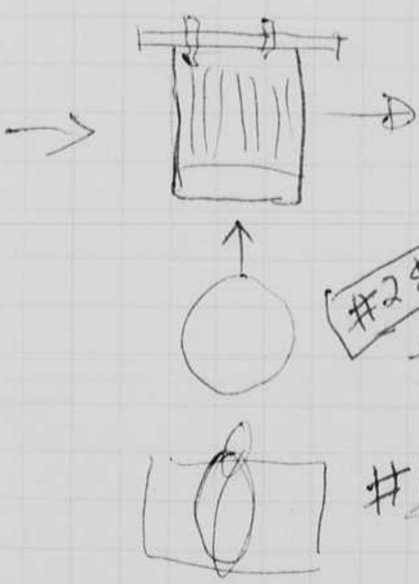


2L	.5	.1	.2
1L	.5	.1	.4
½L	.5	.1	.70 volts



Direct to Back about 4 to 1
also side.

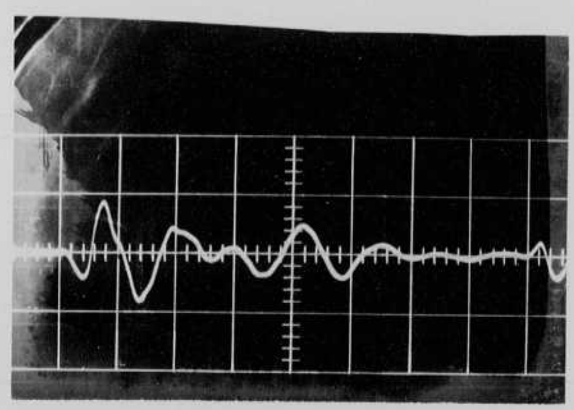
6 KC EPO



side view 2L
.2 V/cm .1

#2 & #3
loader .2 V/cm .1

#1 side horizontal .2 V/cm .1

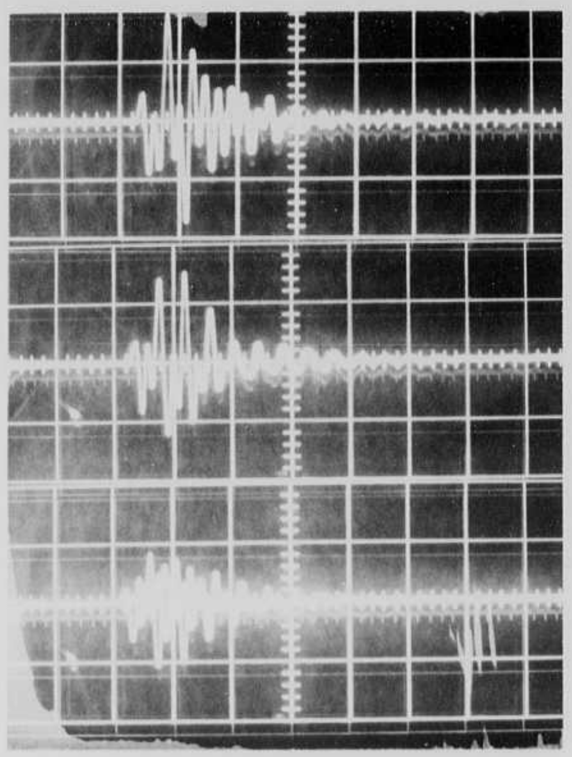


about same signal in
all directions.

Xformer:
17.4 mh
4.8 = Q

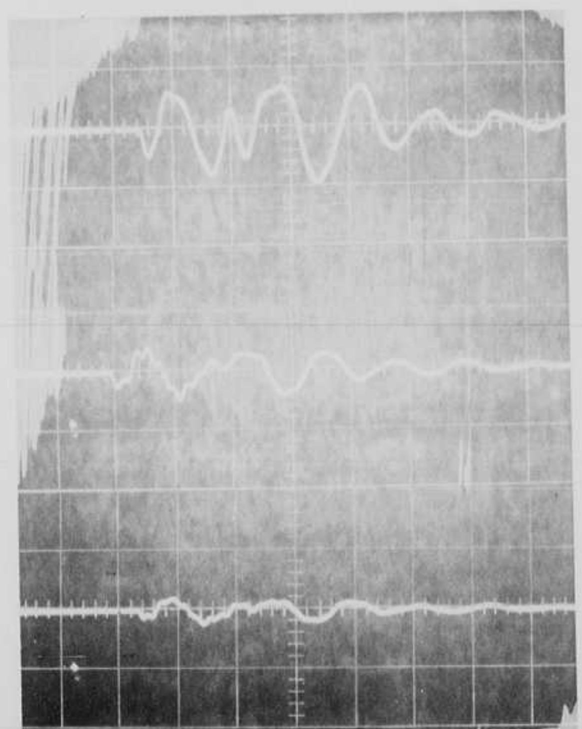
Small Edo

2L	.5 V/cm	0.1 m sec
1L	"	"
½L	"	"
¼L	"	"

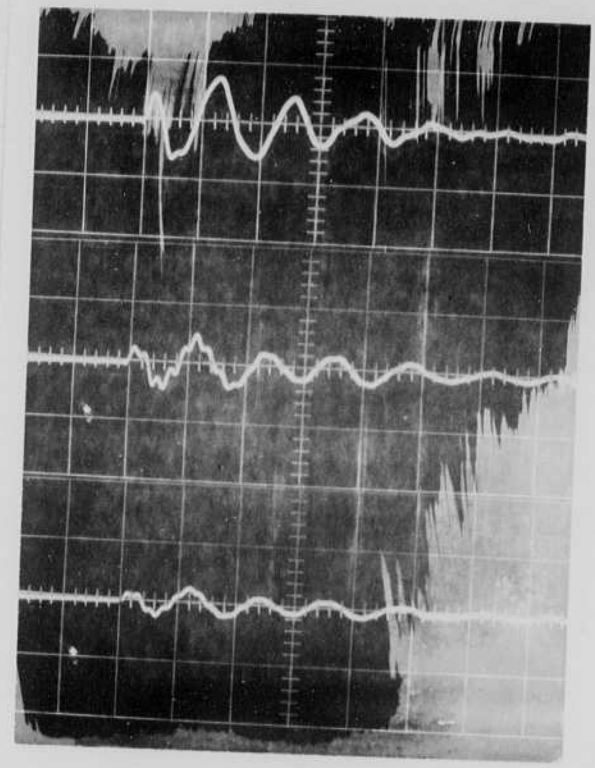


6KC EDO

2L	.5	.1	.8
1L	.5	.1	.35
½L	.5	.1	.2

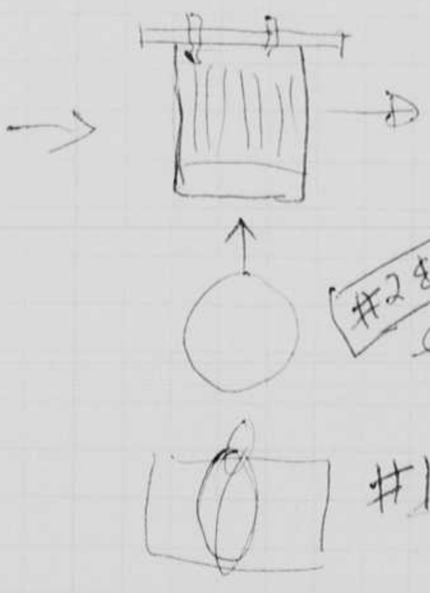


2L	.5	.1
1L	.5	.1
$\frac{1}{2}$L	.5	.1



Direct to Back about 4 to 1
also side.

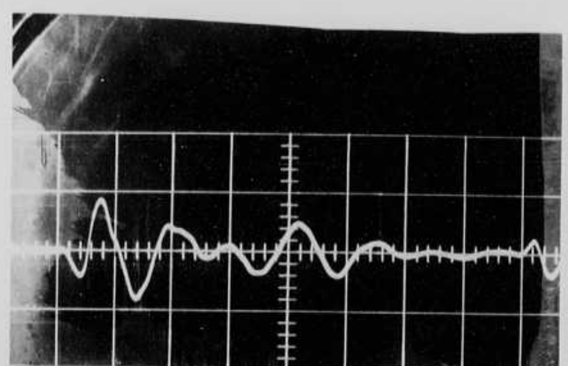
6 KC EPO



side view 2L
.2 V/cm .1

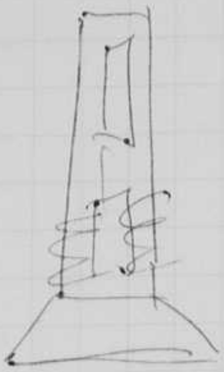
#2 & #3
lead or .2 V/cm .1

#1 side horizontal .2 V/cm .1



about same signal in
all directions.

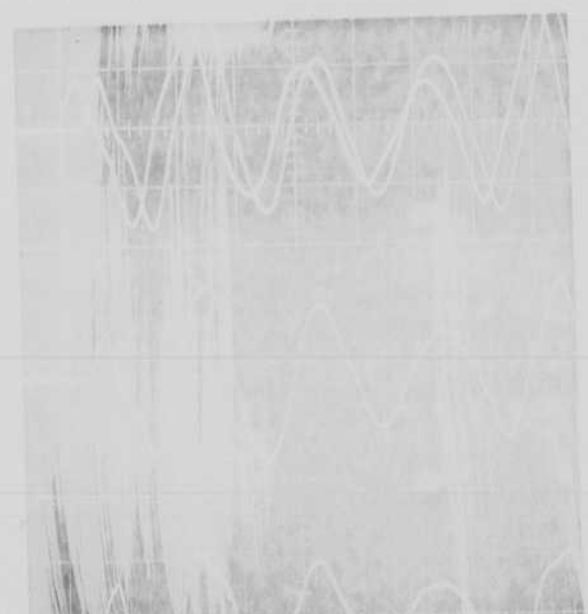
many Nickel



2L	.1 v/cm	.1 m sec/div
221	"	"
1/2	"	"

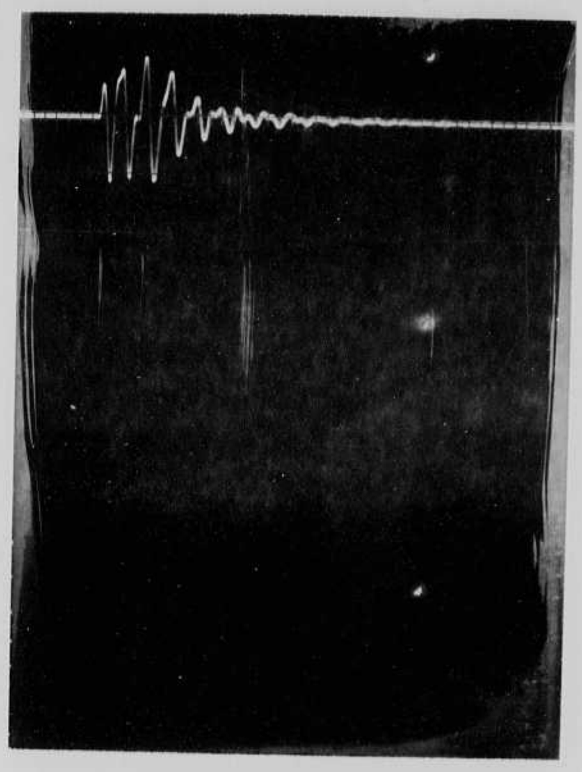
↓10 to 1
Signal
front to back.
5 to 1 side.

2L & 1L	.1	.1 m sec
$\frac{1}{2}$ L	.1	.1 m sec
$\frac{1}{4}$ L	.1	.1 m sec

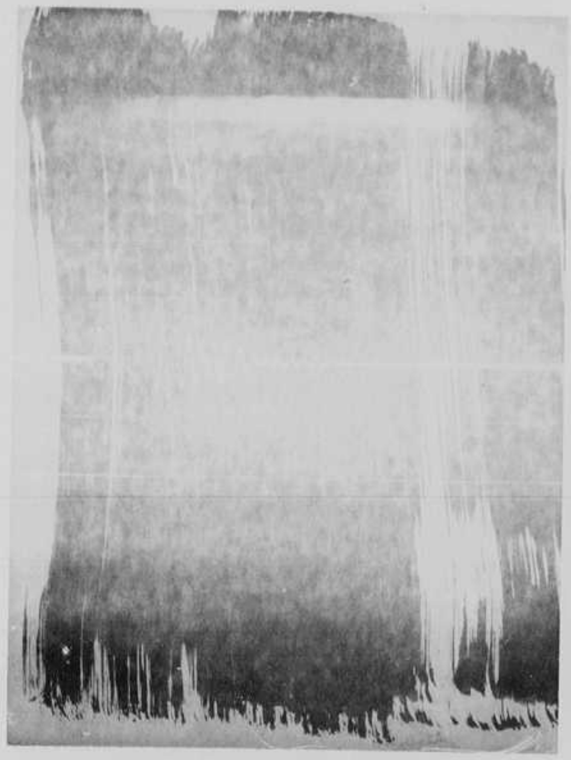


high frequency
magnetostriction

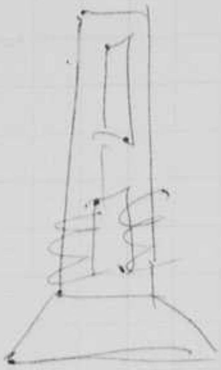
2L .2 .1



$\frac{1}{2}$L .2 .1



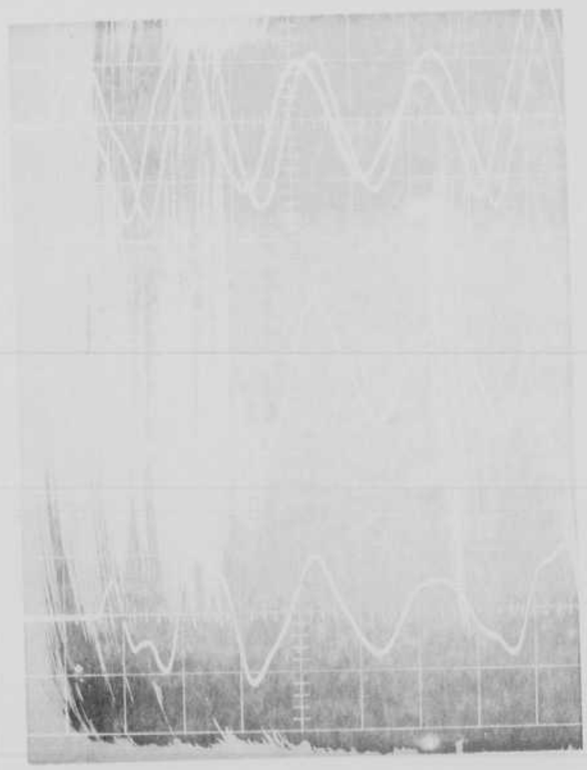
Many Nickle



27	.1 V/cm	.1 μ sec/div
221	"	"
1/2	"	"

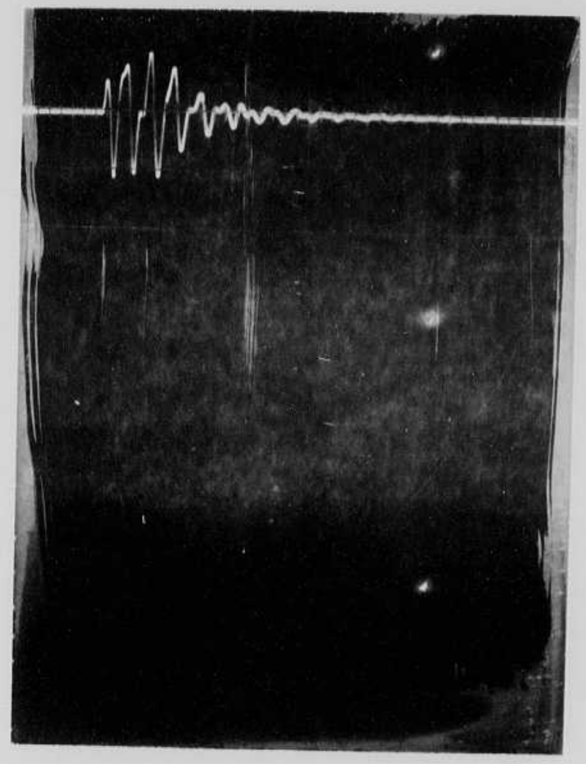
↓10 to 1
Signal
front to back.
5 to 1 side.

2L & 1L	.1	.1 μ sec
$\frac{1}{2}$ L	.1	.1 μ sec
$\frac{1}{4}$ L	.1	.1 μ sec

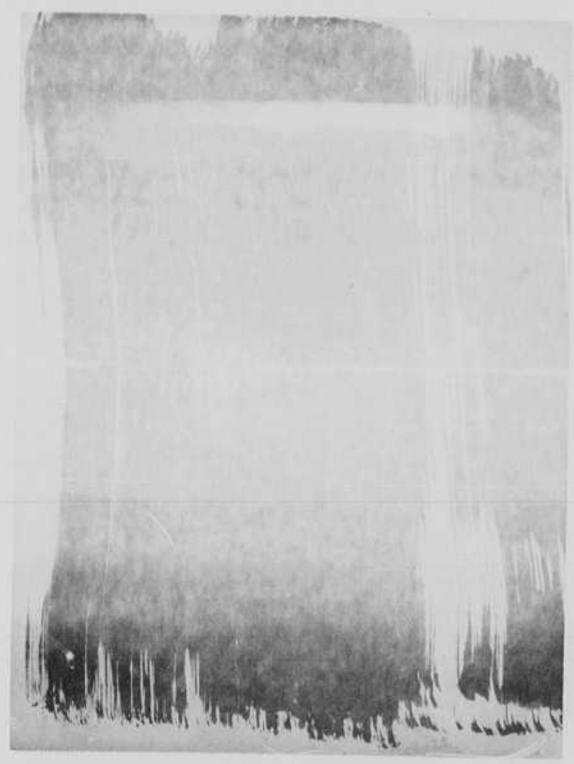


high frequency
magnetostriction

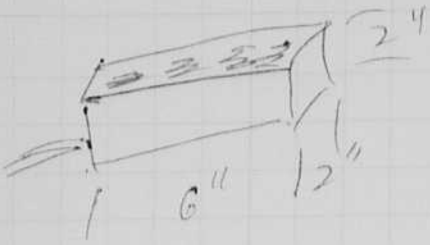
2L .2 .1



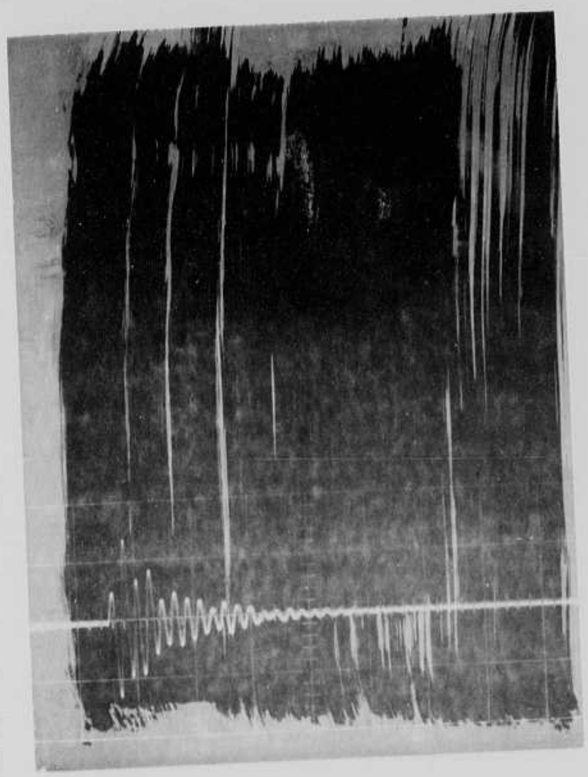
1/2 L .2 .1



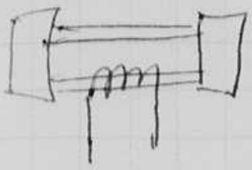
White co
40 Kc magneto Striction



$\frac{1}{4}\lambda$ .2V/cm, 1 msec

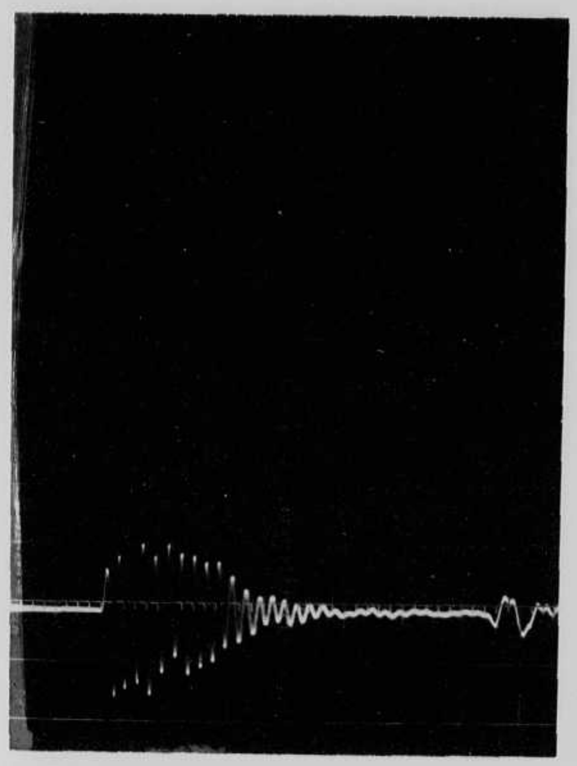


Harris
Dumbbell



.05 0.1

C=.25

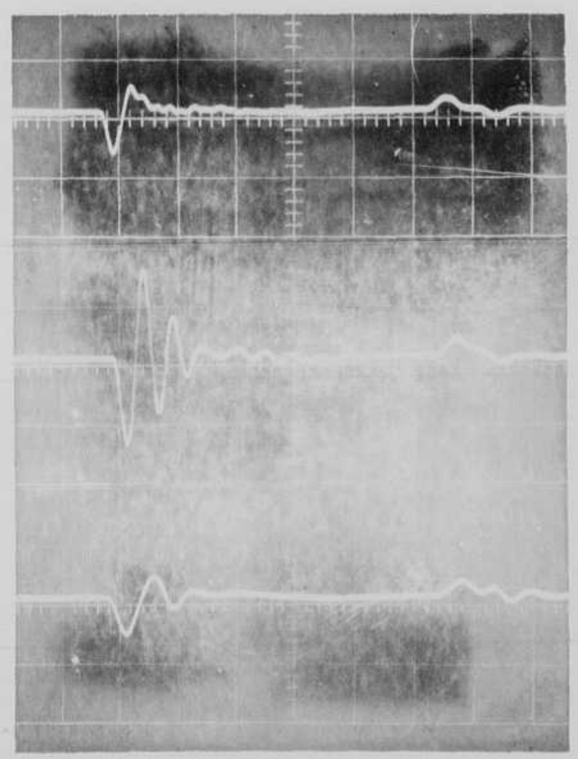


8" Boomer

4 μf 2000 V .1V/div .1 m sec

8 μf 2000 V .2V/div .1 m sec

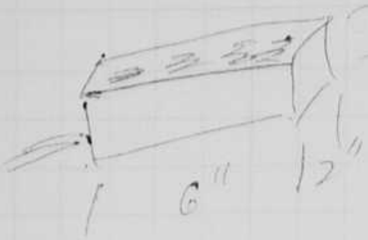
16 μf 2000 V .5V/div .1 m sec



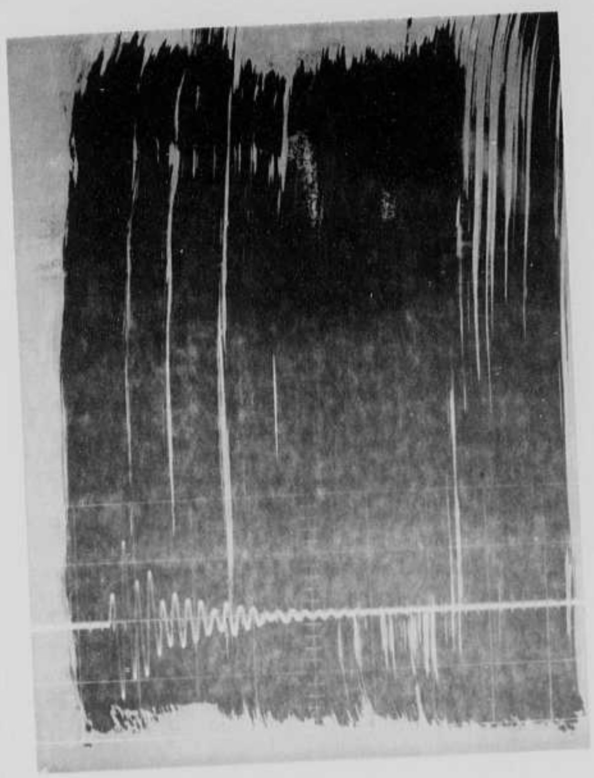
aimed end plate towards
Hydrophone

White Co

40 Kc magneto striction



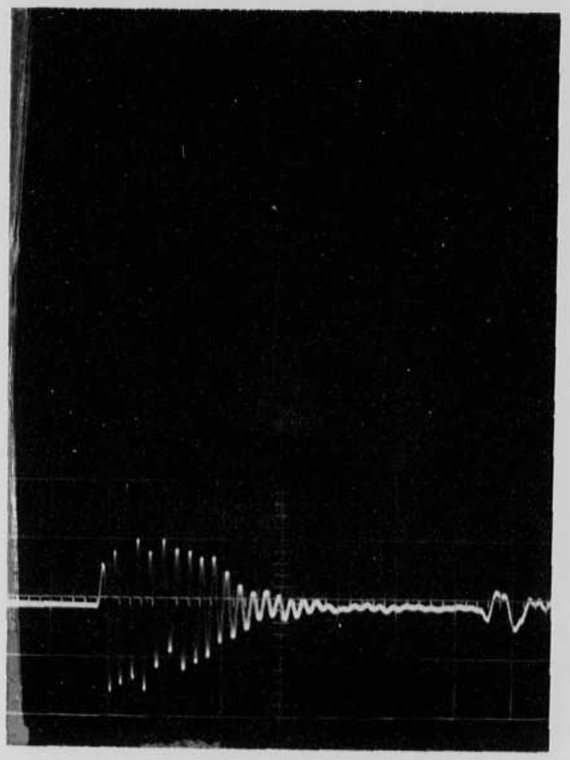
$\frac{1}{4}\lambda$ .2V/cm, .1msec



Harris
Dumbell

.05 0.1

C=.25

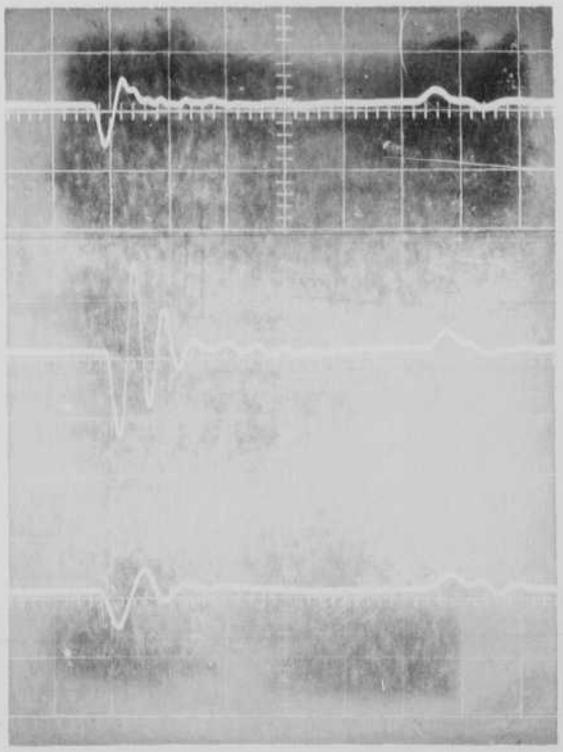


8" Boomer

4 μf 2000 V .1 V/div .1 msec

8 μf 2000 V .2 V/div .1 m sec

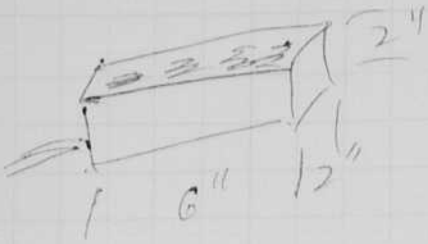
16 μf 2000 V .5 V/div .1 m sec



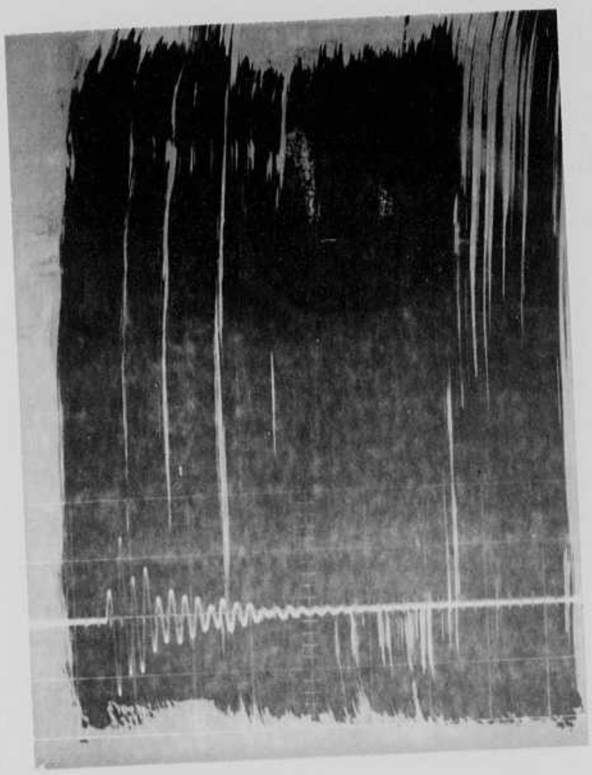
aimed wood plate towards
Hydrophone

White co

40 Kc. magneto Striction



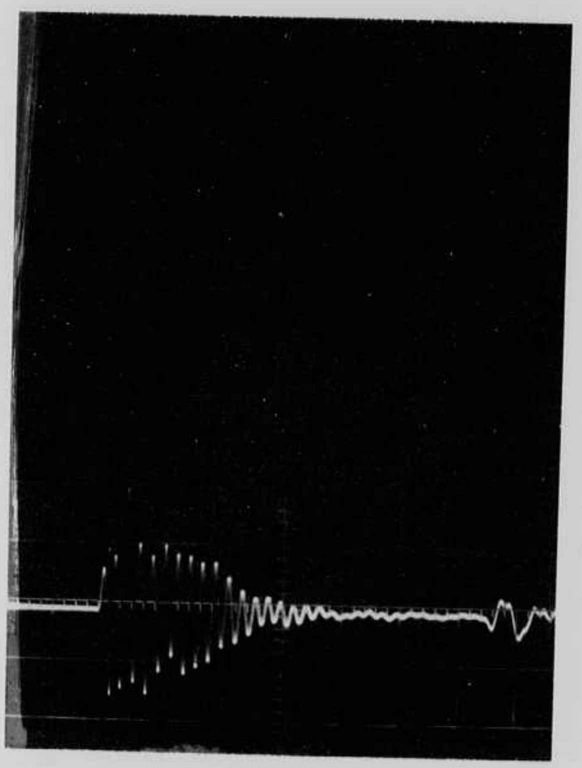
$\frac{1}{4} L$ .2 V/cm, .1 msec

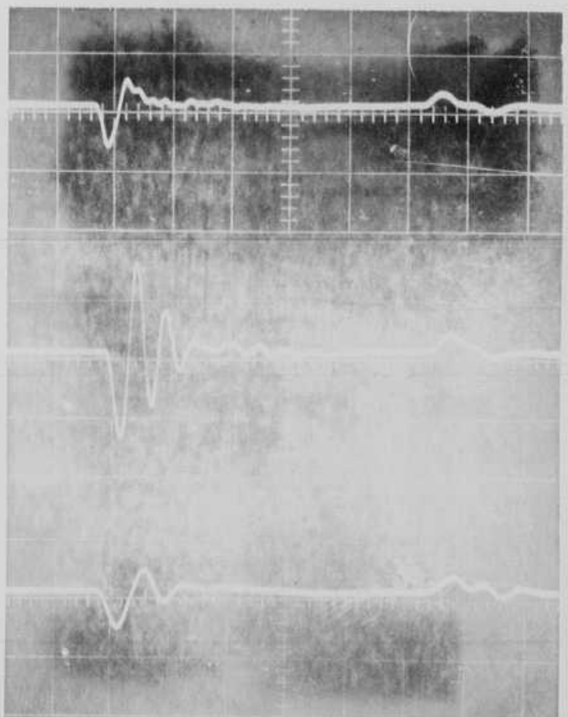


Harris
Dumbell

.05 0.1

0.25





8" Boomer

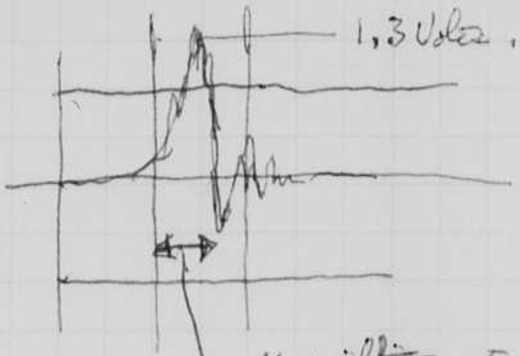
4 μf	2000 V	.1 V/div	.1 m sec
8 μf	2000 V	.2 V/div	.1 m sec
10 μf	2000 V	.5 V/div	.1 m sec

aimed red plate towards
Hydrophone

4" Boomer

16 μf 2000 V. 100 ~~milli~~ microseconds/division

1V/~~centimeter~~ division



~~1/2~~ ~~milli~~ 50 microseconds.

8 μf 2000 V

.5 V/div

100 microseconds/div

8 ball?

Jan. 19, 1964.
H. E. Edgerton
John Yules.

	V	C	Volts P-P	f	ΔT ms	
	900	2	.25	7700	.4	
		1	.19	"	"	
		2	.28	"	"	
		1	.24	"	"	
		.5	.13	"	"	
EDO 12KC 		2	3.8	13000	.3	
		1	2.3	14000	.3	
		.5	1.4	14,000	.3	
		2.5	2.9	14000	.25	
		1.5	1.6	16000	.25	
		.55	.8	16000	.25	
		.255	.4	16000	.25	
EDO Small 12KC?		2	.64	42000	.3	
		1	.84	42,000	.3	
		.5	.46	42,000	.3	
EDO 6.4KC		2	.70	7700	.5	In Box
ceramic Ring.		1	.40	7700	.5	
		.5	.20	7700	.5	
Ditto 		2	.32	7700	.5	
		2	.35	5000	.8+	
		1	.29	5000	.8+	
		.5	.29	5000	.8+	
		.25	.23	5000	.8	
White H.F.		2.	.41	23,000	0.2	Beats
		.5	.60	40,000+	0.2	
		.25	.54	45,000	0.2	
Harris Dumbbell		.25	.13	40,000	0.25	coil on one leg.
8" Sub Boomer	2KV	4	.13			
	"	8	.60	20,000	0.15	?
	"	16	.50?			
4" Boomer	"	16	1.70	20,000	0.06	?
	"	8	.80	25,000	0.10	

~??

Dumbell Hydrophone

—Before we had 16 turns on one leg
now we have 16 turns on each leg — series adding,

330 pm Data analysed. See attached paste in sheet.
Results look fishy especially 20,000 ~~ft~~ for Boomer??

(1) We plan to re-run these results.

(2) Repair light leak in scope camera. new film.

(3.) ~~Inform others the project~~
Boomers ? ? ?

Jan 24, 1964.

H. E. Edgerton

During the week many photos were taken with Mikhail Ivanov 4469. of the Textile dept of a Singer Sewing machine.

Some 10 exposure photos were taken at 10,000 f.p.s.

There is some suspect of the data from the hydrophones or the oscillograph. I made a static test of the Hydrophone LC 57 It seems to be O.K. So we will try it again.

Feb. 7. 1964

Harold Edgerton

See John Yules book for more transducer data. lobster fishing

Wed We went into the Harbor at Boston on Feb 5 in KATHY a boat owned by Michael Meninno 246 Everett St East Boston Mass.

Yules, Payson & I were the group operating the mud Penetrator.

We use three transducers.
(1) Edo 12KC
(2) Stave Edo 6KC.
(3) magnetostriction (navy loan). 6KC.

Results seemed best for the old Edo 12KC. The other transducers had no directivity especially the Stave one.

Design a reflector for the stave Edo as per sketch. ——→

Feb 9

Cousteau gave a lecture at Kresge on Feb. 8, 1964 at 8 pm. ~~Full~~ Full house. Showed movies of Excellent program!
1. Flip station.
2. Shore station #1 Marseille
3. " " #2 Red Sea.

- We spent day with Kearsley, Curley, Hargford at EG&G in Bedford and at 95 Brookline ave.

Specs for pinger for sonoscope were drawn up.

 Feb 9 1964

Cont. H.E.E.

Constant wants a boomer or sparker for 300 foot penetration on his sled.

There will need to be a 1500 foot cable to the transducer

FEB. 1964

FIBERGLASS CYLINDERS.

Douglas Cortelou with Fiberglass cylinders Spaulding Fiber Co.

Xenon Signal lights to be put on the Prudential Bldg.

~~Data~~ meas Feb 8 1964. 6 ft to phototube

$cp = KV(ft)^2$ $K = 10^4$

$C.P.S = 36 \times 1.4 \times 10^4$

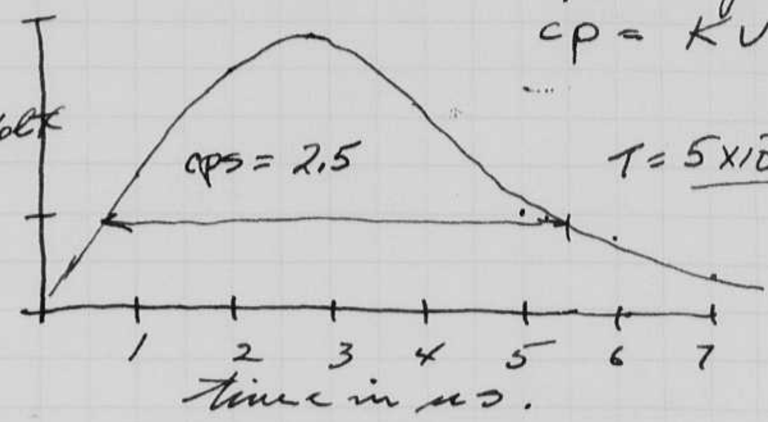
14
144
36

$= 50.4 \times 10^4$

$= .5 \times 10^6$ c.p.

$IT = .5 \times 5 \times 1 = \underline{\underline{2.5 \text{ c.p.s.}}}$

Ⓐ



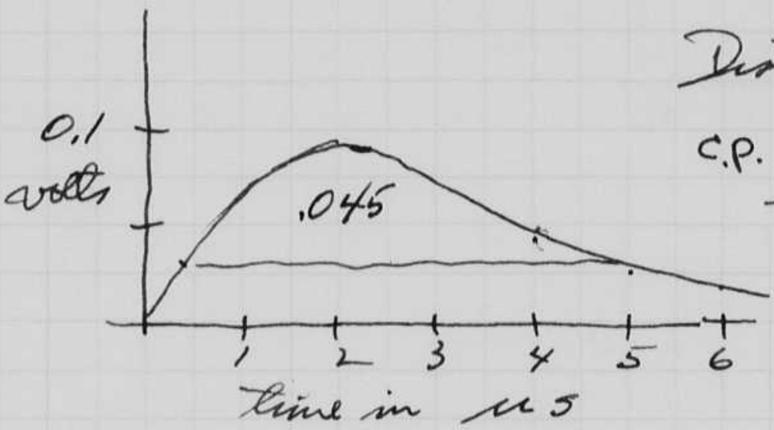
$T = \underline{5 \times 10^{-6} \text{ sec}}$

Large lamp

600 volts.
4. mfd.
0.72 watt sec

2 flashes sec.

Ⓑ



~~Distance~~ = 3 ft.

$c.p. = 3^2 \times .1 \times 10^4 = .9 \times 10^4$

$T = 5 \times 10^{-6}$ sec.

$c.p.s \; .9 \times 10^4 \times 5 \times 10^{-6} = \underline{\underline{.045}}$

$\boxed{\frac{2.5}{.045} = \underline{55} \times \text{ ratio}}$

Feb 22 - 1964 H.E.E. These beacons are still going, they are ~~out~~ in a window on the 41 floor aimed towards M.I.T.

The Ⓐ model is about the same as the red light of 50 watts (maybe 100?). However it is more easily seen when looking at an angle. Viewed from 9th floor of 100 Memorial Drive. Apt 8-3-A.

The Ⓑ model is invisible from my apartment at 100 Mem Drive.
I can see the B model when I am on the Boston end of the Harvard Bridge.

The next trial beacon will be about 4× brighter. The rate of 2 per second seems fine.

 Feb 9 1964

Cont. [illegible].

Constant wants a (or sparker) boomer for 300 foot penetration on his sled.

There will need to be a 1500 foot cable to the transducer

FEB. 1964

FIBERGLASS CYLINDERS.

Douglas Cortelou with Fiberglass cylinders Spaulding Fiber Co.

Xenon Signal lights to be put on the Prudential Bldg.

Data meas Feb 8 1964. 6 ft to phototube

$cp = KV(ft)^2 \quad K = 10^4$

$C.P.S = 36 \times 1.4 \times 10^4$

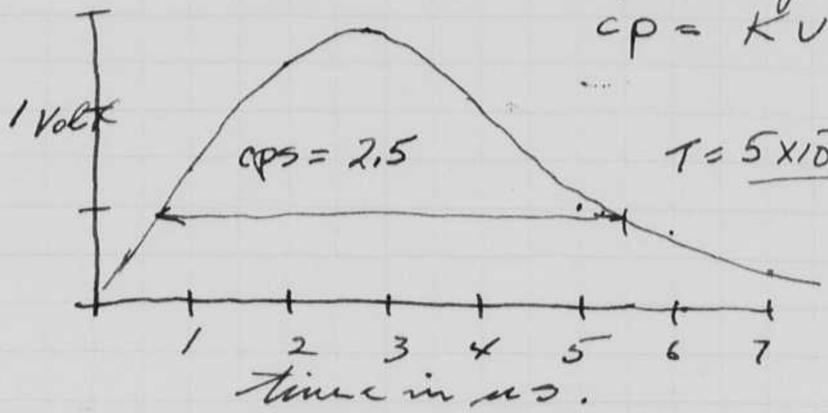
$\begin{array}{r} 14 \\ \hline 144 \\ 36 \end{array}$

$= 50.4 \times 10^4$

$= .5 \times 10^6$ c.p.

$IT = .5 \times 5 \times 1 = \underline{\underline{2.5 \text{ c.p.s.}}}$

A



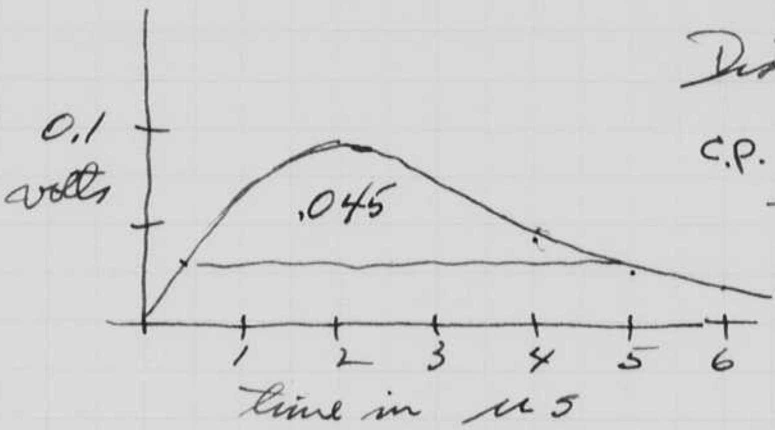
$T = \underline{5 \times 10^{-6}}$ sec

Large lamp

600 volts.
~~.25~~ 4. mfd.
0.72 watt sec

2 flashes sec.

B



Distance = 3 ft.

$C.P. = 3^2 \times .1 \times 10^4 = .9 \times 10^4$

$T = 5 \times 10^{-6}$ sec.

$C.P.S \quad .9 \times 10^4 \times 5 \times 10^{-6} = \underline{\underline{.045}}$

$\boxed{\frac{2.5}{.045} = \underline{55} \times \text{ ratio}}$

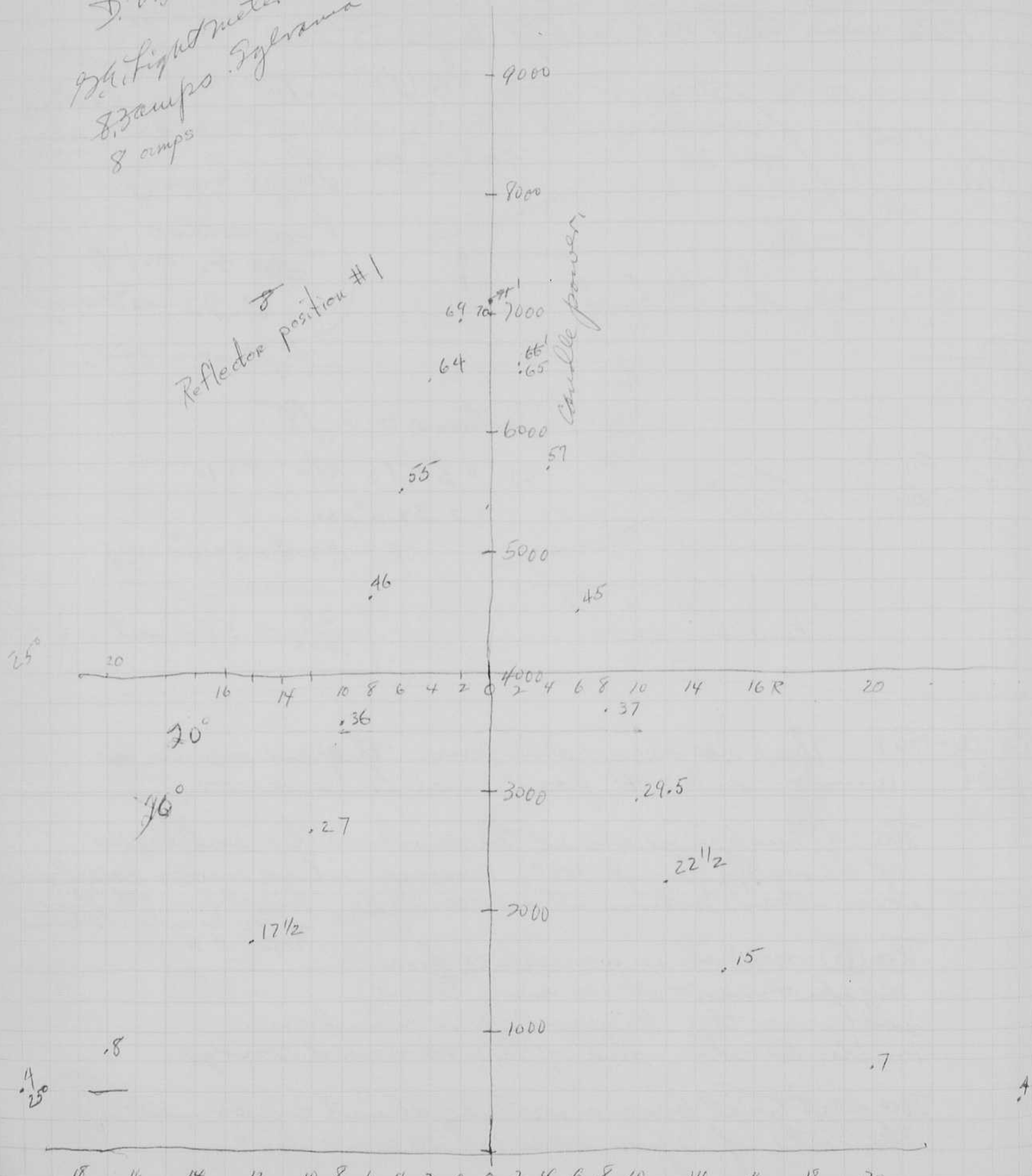
Feb 22 - 1964 These beacons are still going, they are ~~out~~ in a H.E. window on the 41 floor aimed towards M.I.T.

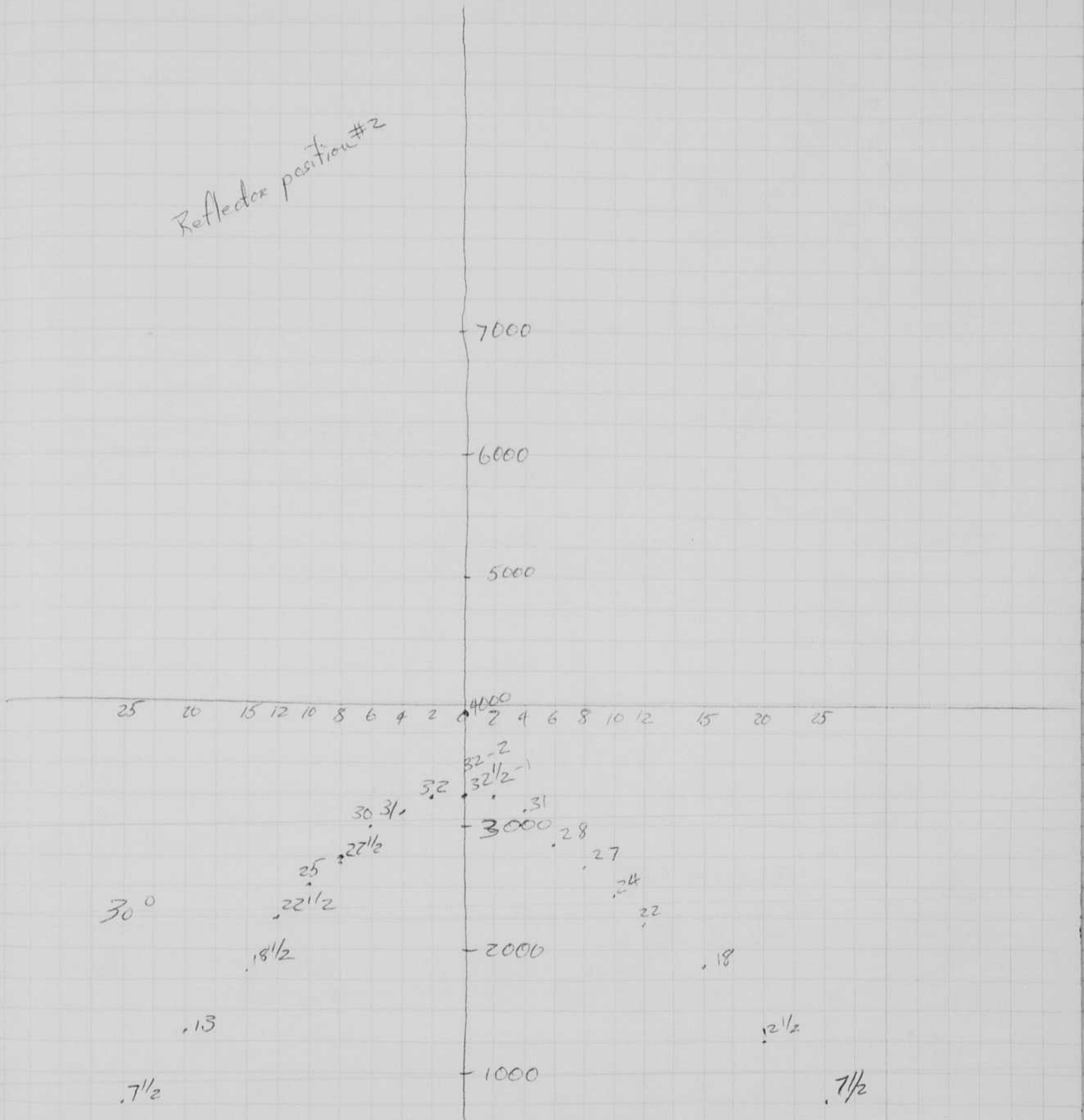
The A model is about the same as the red light of 50 watts (maybe 100?). However it is more easily seen when looking at an angle. Viewed from 9th floor of 100 memorial Drive. Apt 8-3-A.

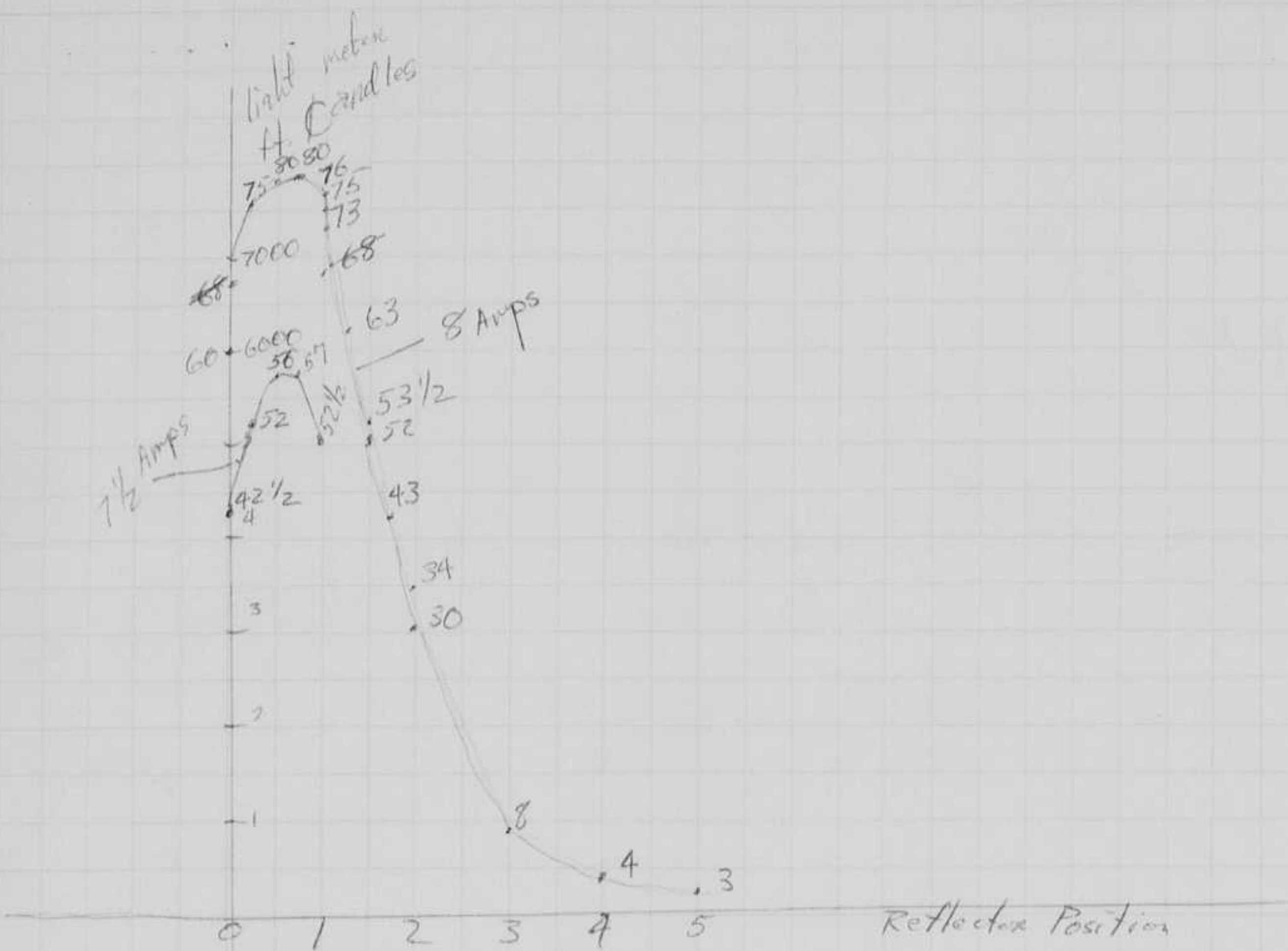
The B model is invisible from my apartment at 100 mem Drive.
I can see the B model when I am on the Boston end of the Harvard Bridge.

The next trial beacon will be about 4 x brighter
The rate of 2 per second seems fine.

Feb 14 1964
~~H. Edgerton~~
D. Troutner,
4-405 MIT
$9\frac{1}{2}$ light meter old Handmodel.
8.3 amps Sylvania 1000 watts
8 amps

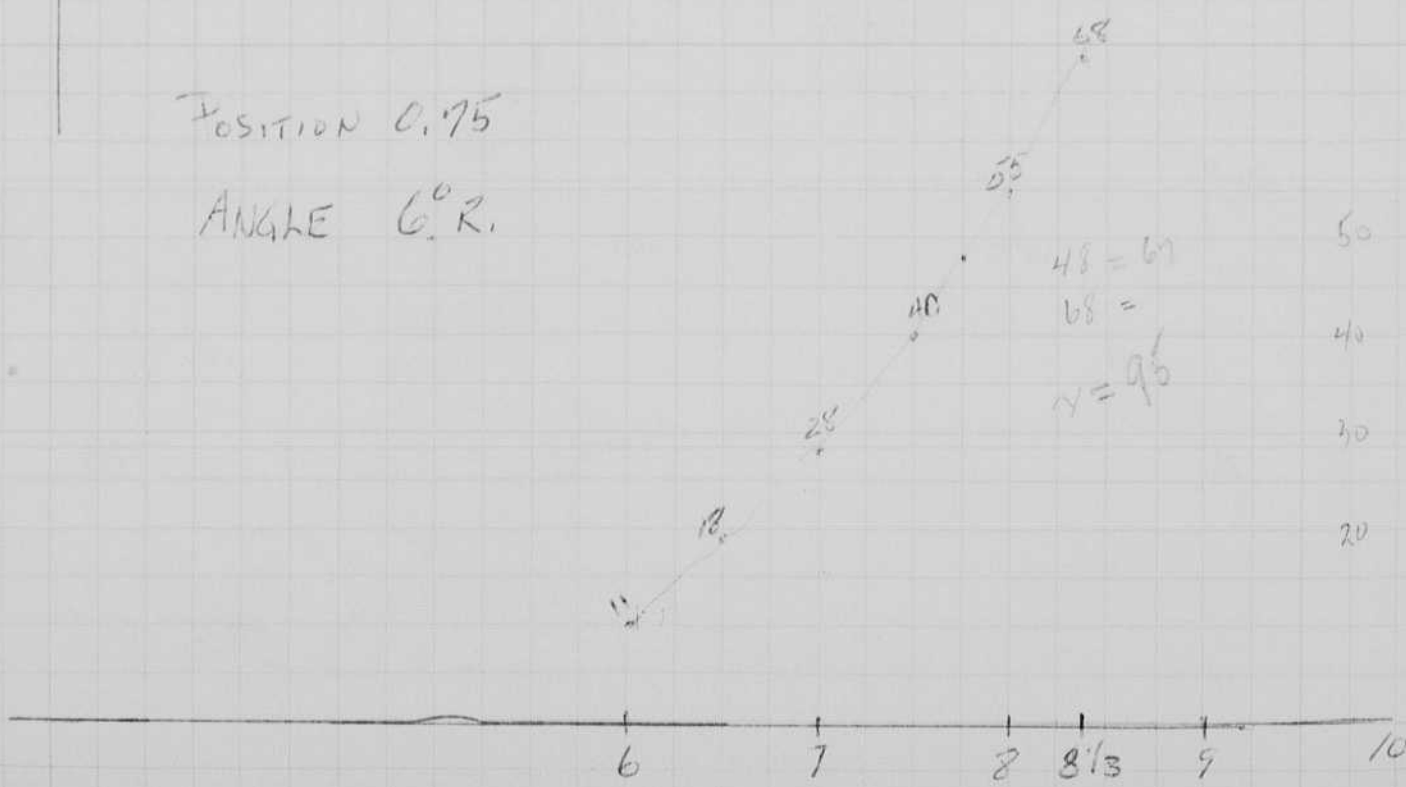



Reflector position #2
7000
6000
5000
4000
3000
2000
1000
25 20 15 12 10 8 6 4 2 0 2 4 6 8 10 12 15 20 25
32-2
32 1/2 -1
32
30 31
31
28
27
27 1/2
25
24
22 1/2
22
30°
18 1/2
18
13
12 1/2
7 1/2
7 1/2



Position 0.75

Angle 6° R.



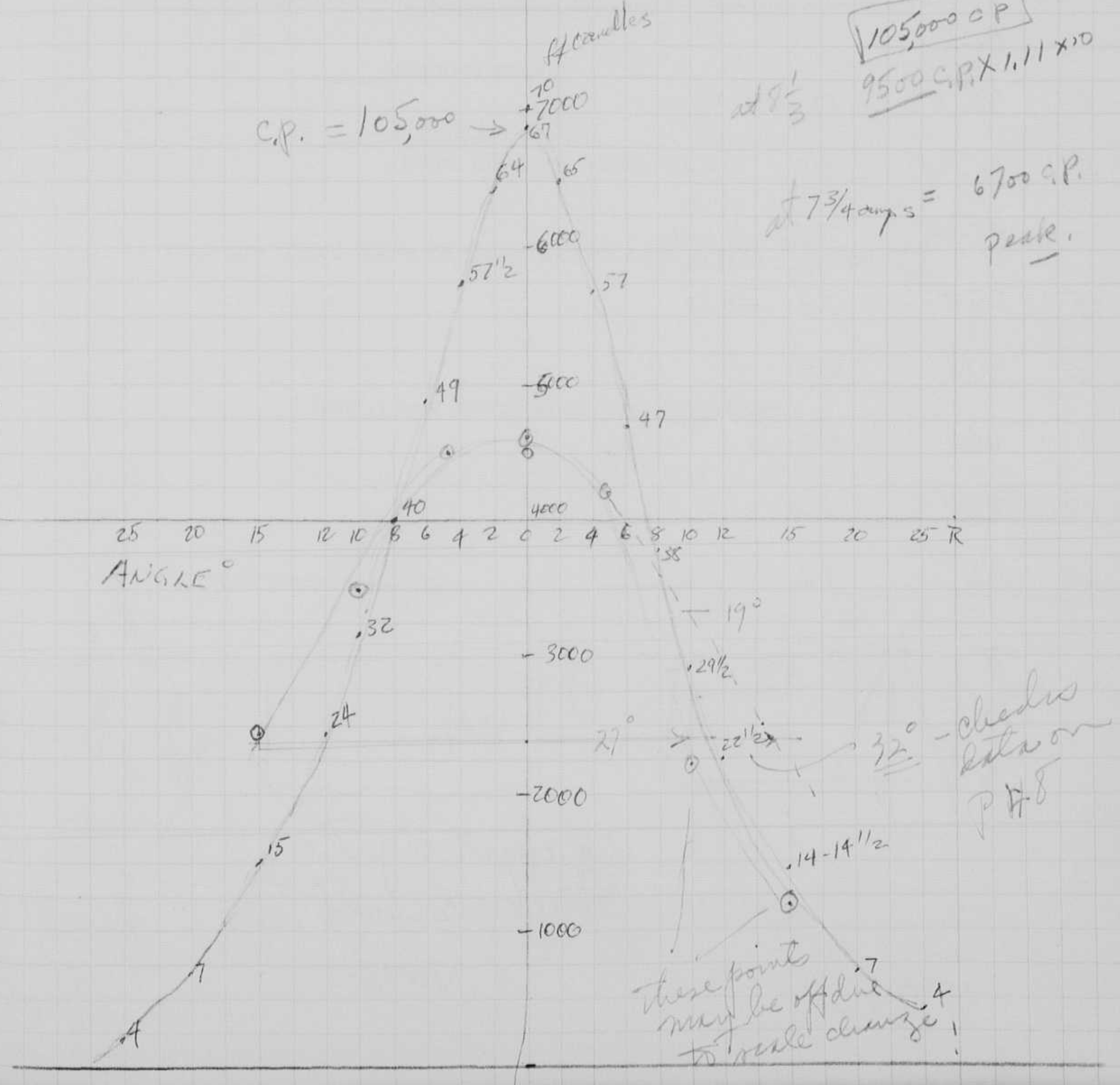
[redacted]

Reflector at 3/4

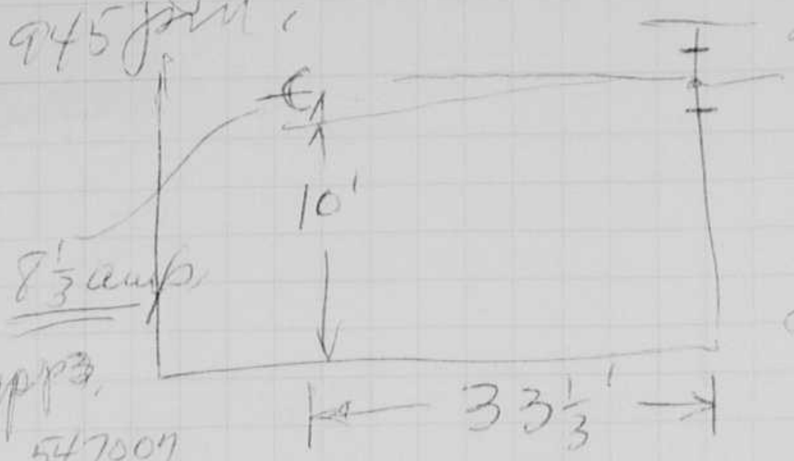
$\boxed{105,000 \text{ cp}}$

at $8\frac{1}{3}$ — 9500 C.P. X 1.11 x 10

at $7\frac{3}{4}$ amps = 6700 C.P. peak.



at MIT Pool
945 pm.



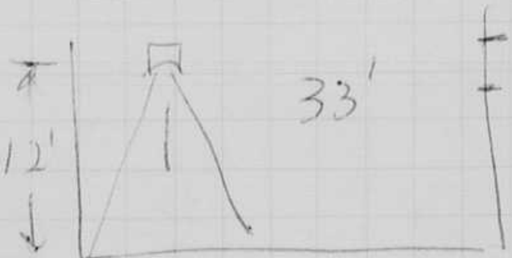
meter
~~30~~ 40-45
depending on
waves

In Air

95k, type 3,
547007
meter 10 amp.

Reananged angle for best visual angle.

°	Dial		
0	71°✓	45	(40-50)
5	76°✓	45	"
10	81✓	35	31-38
15	86✓	24	22-26
0	71✓	47	
5	66✓	42	
10	61✓	22	
15	56	12	



3 ft apart objection
the back wall.

Top view

16.5°

33°

whereas in air was 19 degrees

1135 pm.

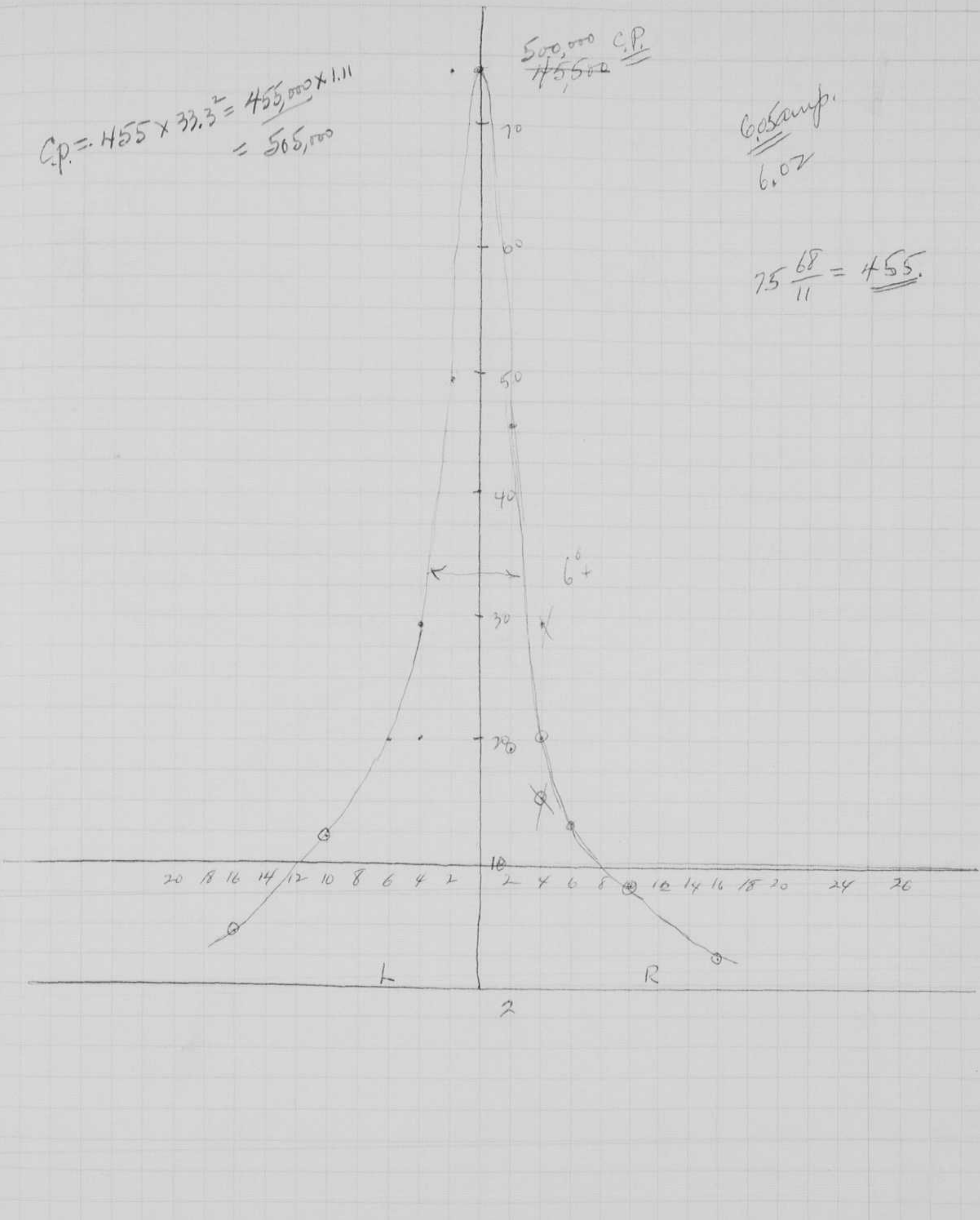
C.P. = 455 × 33.3^2 = 455,000 × 1.11

= 505,000

6.05 amp.

6.02

$75 \frac{68}{11} = 455.$



Notebook # 28

Filming and Separation Record

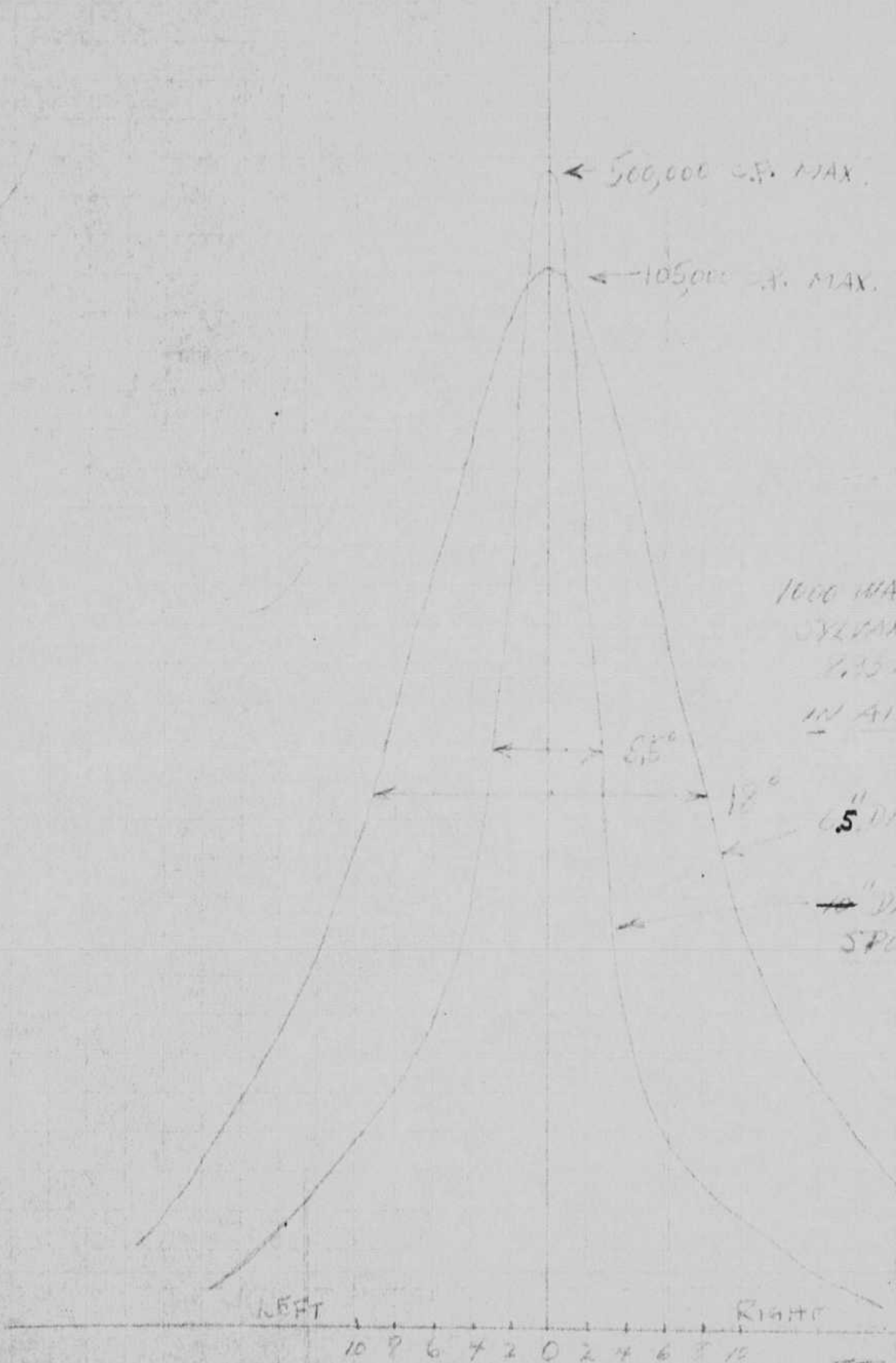
____ unmounted photograph(s)

____ 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.



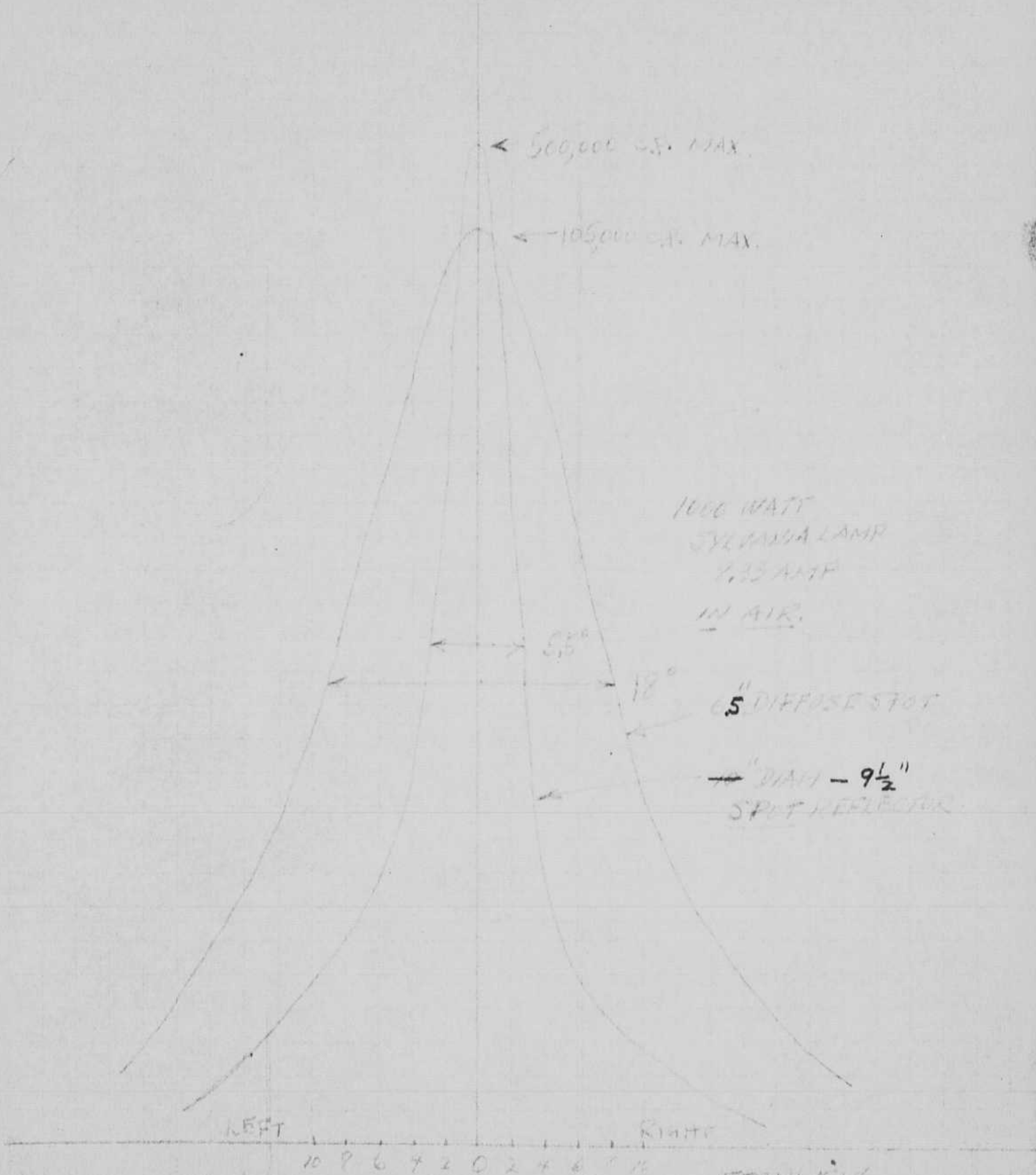
1000 WATT
SYLVANIA LAMP
8.33 AMP
IN AIR.

6.5" DIFFUSE SPOT

~~10~~" DIAM – 9½"
SPOT REFLECTOR

PG 48 49 BOOK 28.

FEB 14 1964
H. EDGERTON
K. TROUTNER
V. MACROBERTS.



P 48 49 BOOK 22.

FEB 14 1964

Feb 16 1964
H Geyzaler
Dick Trowther.

33'

Og measuri
Sel.

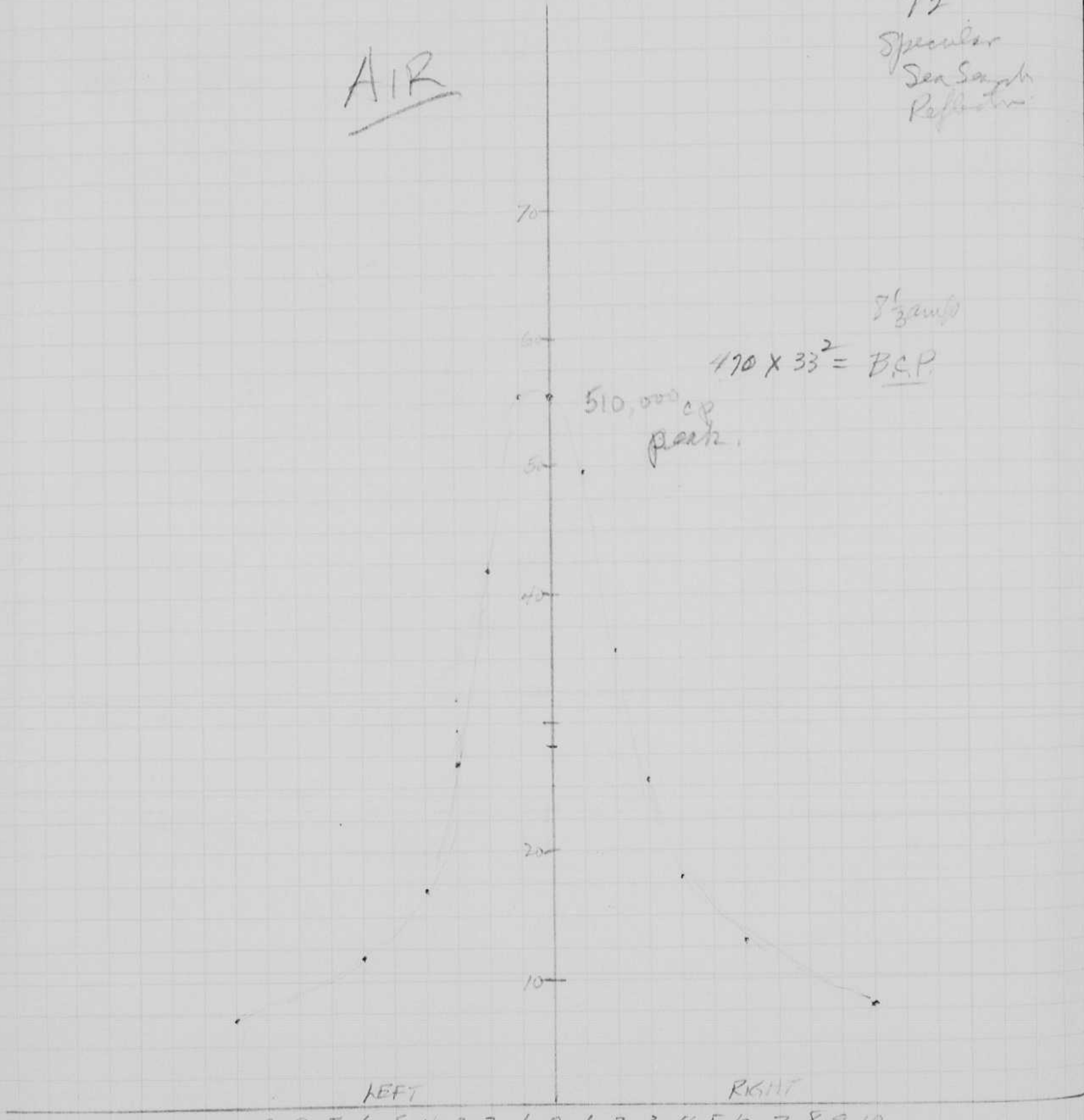
9½" Specular

5.75 amps 55 f.c.s

9½"
Specular
Sea Search
Reflector

8⅓ amps

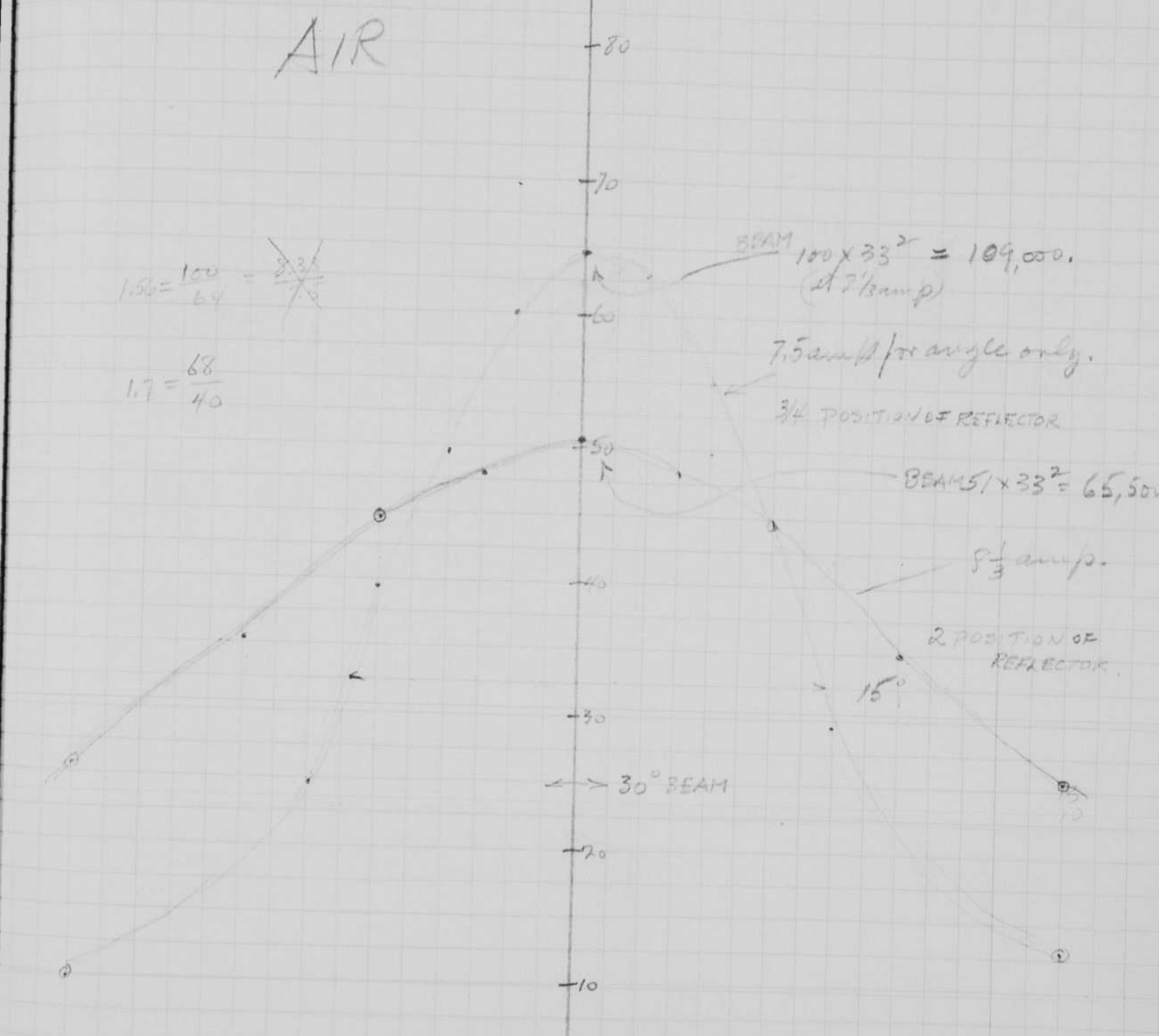
$470 \times 33^2 =$ B.C.P.



6.5" Diffuse Reflector

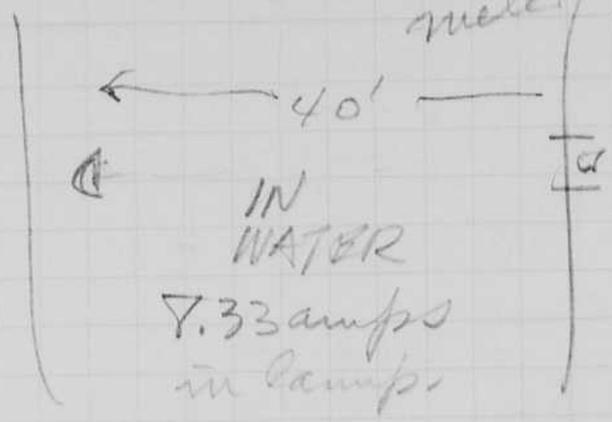
8⅓ amp

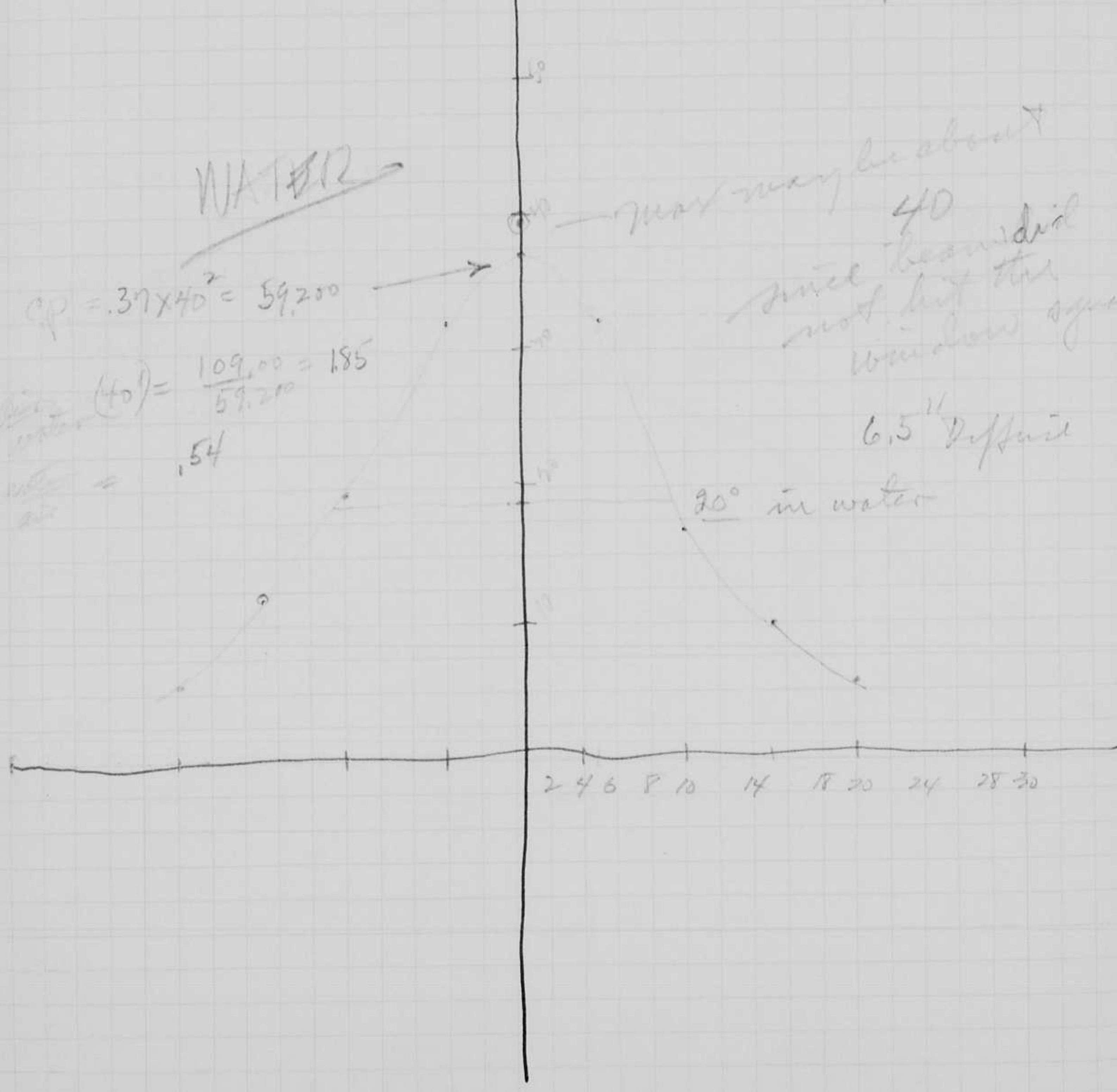
= 100 x 33²



Feb 16 1964
@ MIT pool
[illegible] 9:15 pm
D. Frombner.

G.E. light meter.





WATER

$CP = .37 \times 40^2 = 59{,}200$

$\frac{air}{water}(40') = \frac{109{,}00}{59{,}200} = 1.85$

$\frac{water}{air} = .54$

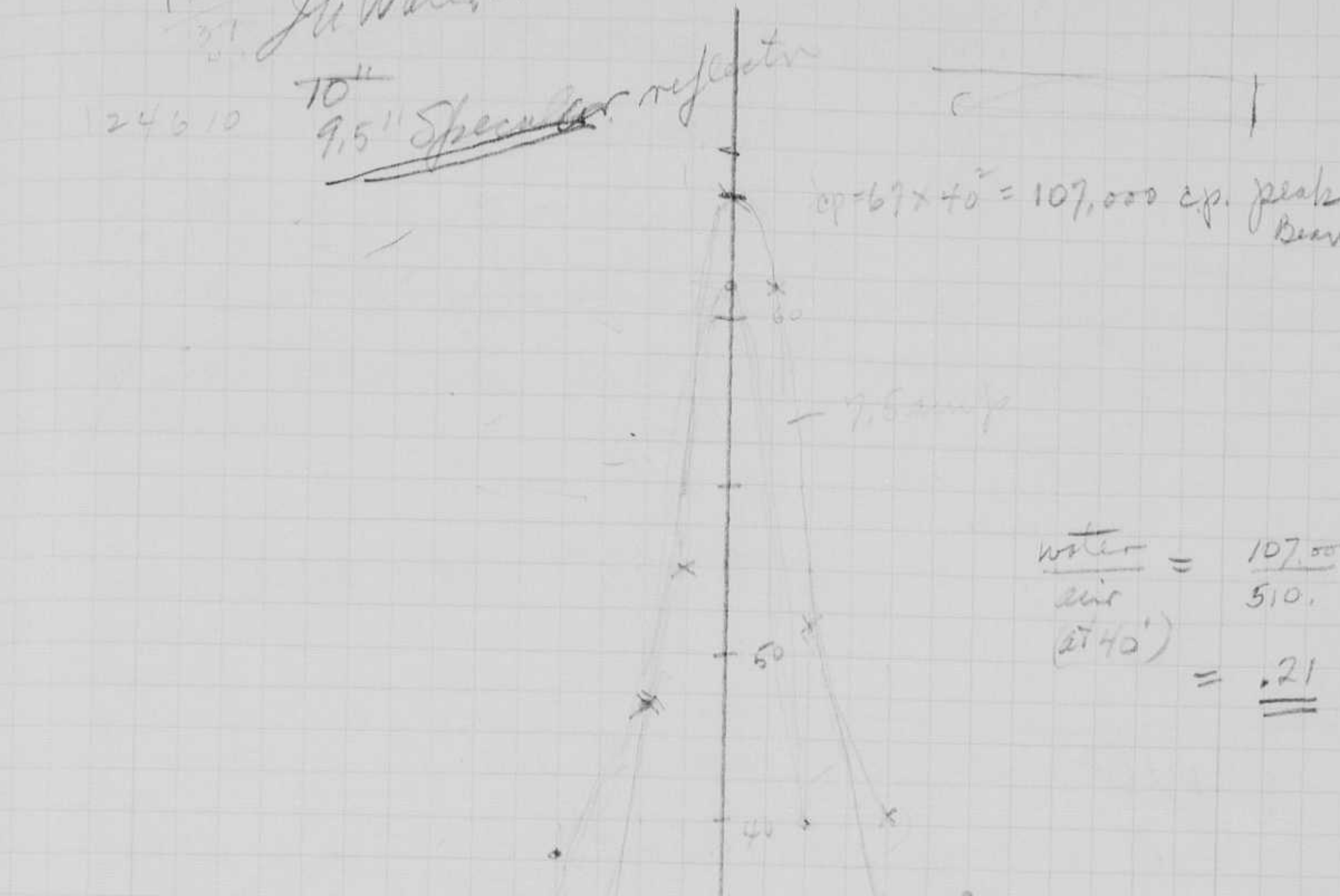
12,0x10 — peak

Pool.

In Water.

~~10''~~ 9.5'' Specular reflector

$cp = 67 \times 40^2 = 107{,}000$ c.p. peak in Beam p.



$\frac{\text{water}}{\text{air (at 40')}} = \frac{107{,}000}{510.} = .21$

Feb 22 1964 Airplane Beacon for Prudential Bldg.

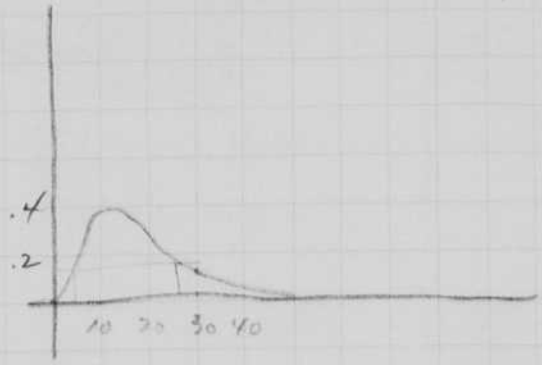
Lamp FT-251 DG.

2 per sec

5 mfd at 900 (±) volts. = 2 watt sec

10 ft at

via
previous
written 106



$$c.p. = \frac{KVD^2}{R_L} \qquad K = 38 \times 10^6$$

$$= \frac{38 \times 10^6 \cdot .4 \cdot 100}{10^4} = 14.2 \times 10^4 = .14 \times 10^{+6}\ c.p. \quad ?$$

Dur = 22 μs. $cp \times T$ = 3.08 cps.

14
88
22
308

$$cp = KVD^2 \quad K = 10^4 \quad V = .3 \quad D = 8$$

$$= 10^4 \cdot .3 \cdot 64 \times 64 = 11568 \times 10^4 = 11 \times 10^6 \cdot 22\ \mu s = 24.2\ cps$$

old 2KV 935

open circuit	840
at 5 mfd at 2 per sec	800
10	700 volts.

10 mfd.

Beacon - FT-251 6' distance (2KV Phototube 931)

8 flashes/5 sec (130V) V = 1.38 cp = .50 cps = 15. cps
D = 30 μs

$$cp = 6^2 \times V \times 10^4$$

36
1.4
144
36
504

5 mfd V = .8V cp = .27 cps = 5.4 c.p.s
(130V) D = 20 μs

130V

20 mfd V = .7 cp = .25 12.5 Less than with 10 mfd
D = 50

10 V = .19 1.22 6.6
D = 36

Light Pedants #1	D	R	K	V	C.P. $\frac{KVD^2}{R}$	Strobotac on 60 # 104
Dora # 1 V_2	5 1½"	10^4	38×10^6	0.1	$.01 \times 10^6$	
Diana # 4 S4	6' 10¾	1000	2.1×10^6	0.27	.024	
28V # 0 S5	38"	100?	10^4?	(60V = 1 cp x ...) .3	.03	
Denise 5 S-4	~~7' 5½"~~	~~100~~	~~1.8×10^6~~	~~.3V~~	~~.003~~	Replaced divider!
" 5 S-4	7' 5½"	1000	1.8×10^6	.28	.028	R

$$\begin{array}{r}36\\1.6\\\hline 216\\36\\\hline 5.76\end{array}$$

$$\begin{array}{r}57\\40\\\hline 2280\end{array}$$

Initial set up
$V = 1.6$
$D = 40$ μ sec
20 mfd at 800 V - ?

5.76 × 2 per sec

C.P. $= .576 \times 10^6$ C.P.S. $= 22.8$ C.P.S.
$T = 40 \times 10^{-6}$

FT-251

Flash Unit now on Prudential

$V = 1.4$ FX-6A 4 mfd at 600 V?
$D = 5$ μ S.

This lamp appears to be about the same visually as the 50 watt tungsten with a red filter.

4.45 pm
Cont Feb 22 1964
H. Edgerton

Just returned with Bill MacRoberts and John Yules from the 31 floor on the Prudential Bldg.

We installed the Beacon mentioned on the previous page on the north side of the N.E corner on the 31 st floor.

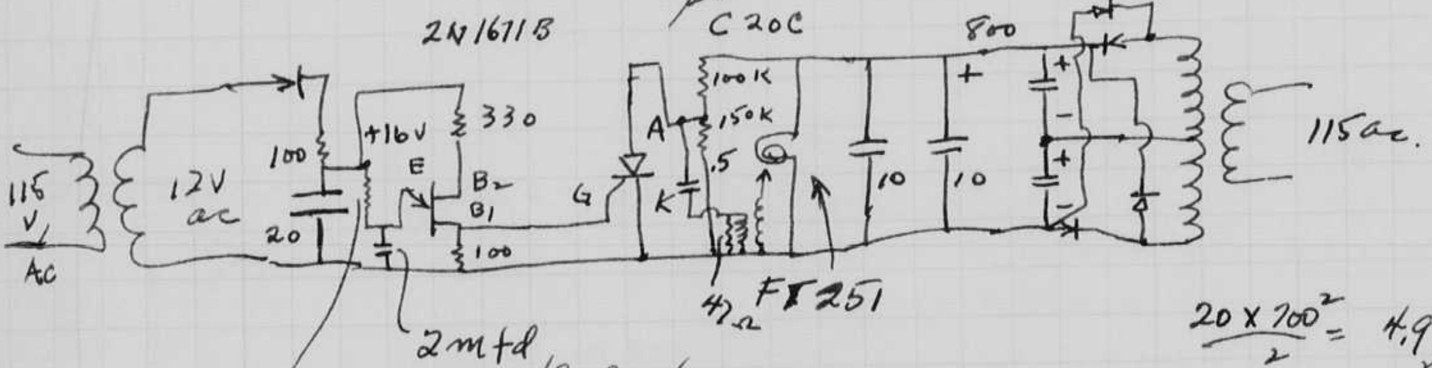
The light output is 22.8 cps. as measured with a 935 phototube (p55). 20 mfd at 700 volts discharges into an FT-251. An aluminum reflector is placed behind the lamp which increases the output by a factor of 50%.

C.P.	factor
22.8	9.1x
2.5	55.x
.045	

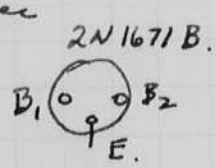
We could see the lamp in daylight when we arrived at M.I.T. the sky was cloudless and the sun was bright.

It was impossible to see the 2.5 cps lamp even from the other (Boston) end of the bridge in daylight.

The new circuit ~~flashes~~ as 2 per sec.



$$\frac{20 \times 700^2}{2} = 4.9 \text{ watt sec per flash}$$



I took down the small strobe lamp (.045 cps) since I could not see it at night from the apartment at 4500 feet away. The 2.5 is about as visual as the red lamps.

Operated 38 days
60x60x24x38
= 3,283,000 seconds
x 2/sec = 6,566,000 flashes

H.E.M. April 10 → Stopped April 1 1964 when slipping was noticed. Unit seems ok here.
Light 6 f/4 3.5x.2 = 25.2 cps
original 34.2
loss = 9.0/34.2 = 26%

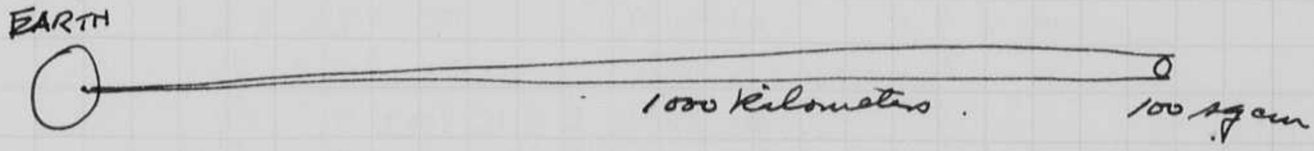
Satelite photography.

Phone call from Courtney Pratt. Bell. Tel. Lab.

Corner reflectors on Satelite
100 sq cm effective.
1/2 light in 20 sec beam on return.

Laser 6" 3/8" diam Ruby.
40" Focal length lens
1 in 1000?
Flashes one per minute.

Distance 1000 kilometers.



$\frac{C.P.}{1000^2}$ = lumens/sq meter at satelite.

$\frac{CP}{1000^2} \times \left(\frac{100}{10^6}\right)$ = C.P. $\times 10^{-12}$ lumens at satelite.

sq cm

Feb 23, 9 am

The 22.8 c.p.s. lamp was very difficult to see on this bright clear morning. The river was frozen and covered with white snow. At first I could not see the strobe. Then by shielding my eyes from the snow and by concentrating on the spot which I knew on the building — I could see it about half of the time.

 Feb. 24 1964 Morley[?]

Photocell Pickup Check,

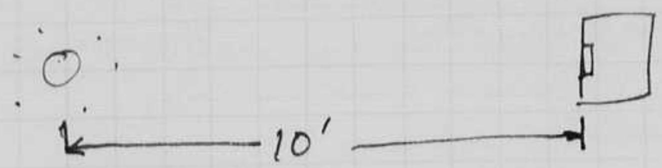
All checked for voltage of Power unit

$K = \frac{(C.P.) R_L}{V D^2}$

Standard FT-217 lamps 100 mfd at 2000 V,
10 ft distance.

2.45 c.p. ~~peak~~ 7×10^6 peak

Pickup	~~R~~	R	Def	C	V	K	
#7 Daisy	S-1	1K	2.8 × .5		1.4	1.75×10^6	
			3.0 × .5		.1.5	1.63×10^6	.16.3
#1 Dora	V_λ	1K	1.6 × .5		.8		
			1.7 × .5		.85	29×10^6	29.0
#4 DIANA	S-4	1K	2.4 × 5		12.0		



D = 10 feet
R = 1K for all units

			Def.cm	C	V	K
#1	DORA	S-4 & 106 $\underline{V_\lambda}$	1.4	0.5	0.7	3.5×10^7 / 3.8×10^7
#3	? OLLY	S-4 & 106 $\underline{V_\lambda}$	1.3	0.5	0.65	3.8×10^7 / 4.5×10^7
#4	DIANA	S-4	~~.5~~ 2.1	~~5~~ 5	~~10.5~~ 10.5	2.3×10^6 (2.1×10^6)
#5	DENISE	S-4	2.5	5	12.5	1.95 2.0×10^6 / 1.8×10^6
#6	——	S-1	2.4	0.5	1.20	2.1×10^7 / 2.5×10^7
#7	DAISY	S-1	2.6	0.5	1.30	1.9×10^7 / 2.2×10^7

35mm Osc f8 Plus X.

Recalibration - ~~[illegible]~~ $\cancel{2.8}$ 2.48 $\times 10^6$ HCP Lamp GE # L-5908-~~[illegible]~~ 2

10 feet, 1K   2KV - 100nf

Pickup		cm	V/cm	V	K	Picture #	
#7	S-1	1.6 ✓	1.0	1.6	1.6×10^7	1	INTENSITY 5
		1.6 ✓	1.0	1.6		2	" 5
		1.6	1.0	1.6		3	4.9
#6	S-1	~~1.6~~ 1.5	1.0	~~1.6~~ 1.5		4	4.9
		~~1.6~~ 1.5	1.0	~~1.6~~ 1.5	1.65×10^7	5	-
		~~1.6~~ 1.5	1.0	~~1.6~~ 1.5		6	
#5	S-4	~~2.7~~ 2.8	5	~~13.5~~ 14		7	
		~~2.7~~ 2.8	5	~~13.5~~ 14	1.77×10^6	8	
		~~2.7~~ 2.8	5	~~13.5~~ 14		9	
#4	S-4	2.3 ✓	5	11.5		10	
		~~2.4~~ 2.3	5	~~12.0~~ 11.5	2.16×10^6	11	
		~~2.4~~ 2.3+	5	12.0		12	
#3	V_λ	~~1.2~~ 1.4	0.5	~~0.6~~		13	
		1.4	0.5		3.5×10^7	14	
		1.4	0.5			15	
#1	V_λ	~~1.4~~ 1.5	0.5	0.75		16	
		~~1.4~~ 1.5	0.5	0.7	3.3×10^7	17	
		~~1.4~~ 1.5	0.5	0.7		18	

Built in unit on 545 Scope 10 ft. 2.48 $\times10^6$ CP ~~[illegible]~~ cal.

		cm	V/cm	V	K	Picture #
		2.3 ✓	1.0			19
		~~2.4~~ 2.3	1.0			20
		~~2.4~~ 2.3	1.0			21
#2 Dotty	V_λ	~~1.2~~ 1.3	0.5	.65		22
		~~1.2~~ 1.3	0.5	.6	3.8×10^7	23
		~~1.2~~ 1.3	0.5	.6		24

Unit Dated Aug 6, 1960 Unit with 935 @ 2200 V. 1,000 r. with diffuser

cm	V/cm	V	
2.2 ✓	0.5	~~1.0~~ 1.1	25
2.2 ✓	0.5	1.1	26
2.2 ✓	0.5	1.1	27

5903

$c.p. = \frac{KVD^2}{R^4}$ $K = \frac{1.1\ 100}{1000 \times 2.8} = .394$ as calibrated with FT-214 #

peak = 2.8×10^6 c.p.

New England Metal Spinning
121 Madison St
Malden
321 1900 1901 Mr. Sowden $\frac{9}{60}$

Al pan 10" flat Bottom with 45°
angle to 9 3/4" deep with a bead
on the open end from 0.091 thick 1100-0 Al.

---

measured by Doug Cortelyou

Pinger meas. Edo 6.6×10^{-9} ±.1 D = .01
Edo. 6.7 " .01
Edo 6.6 " .05 old Triest model.
without oil.

Pulse transformer T-27. L = 24 mh ± .5 mh. Q = 4.

$$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{6.28\sqrt{6.6 \times 10^{-9} \times 24 \times 10^{-3}}} = \frac{1}{79.0 \times 10^{-6}} = \underline{12,700 \text{ ft.}}$$

159×10^{-12}

12.6×10^{-6}

$\frac{20}{60}$
1200

---

add capacitance for 6 KC. 6.6 × 3 = 19.8 mf.
add 6.6
26.4 total with Transducer

6.6×10^{-9} $\sqrt{2}$ freq change
13.2×10^{-9}. 2 " "

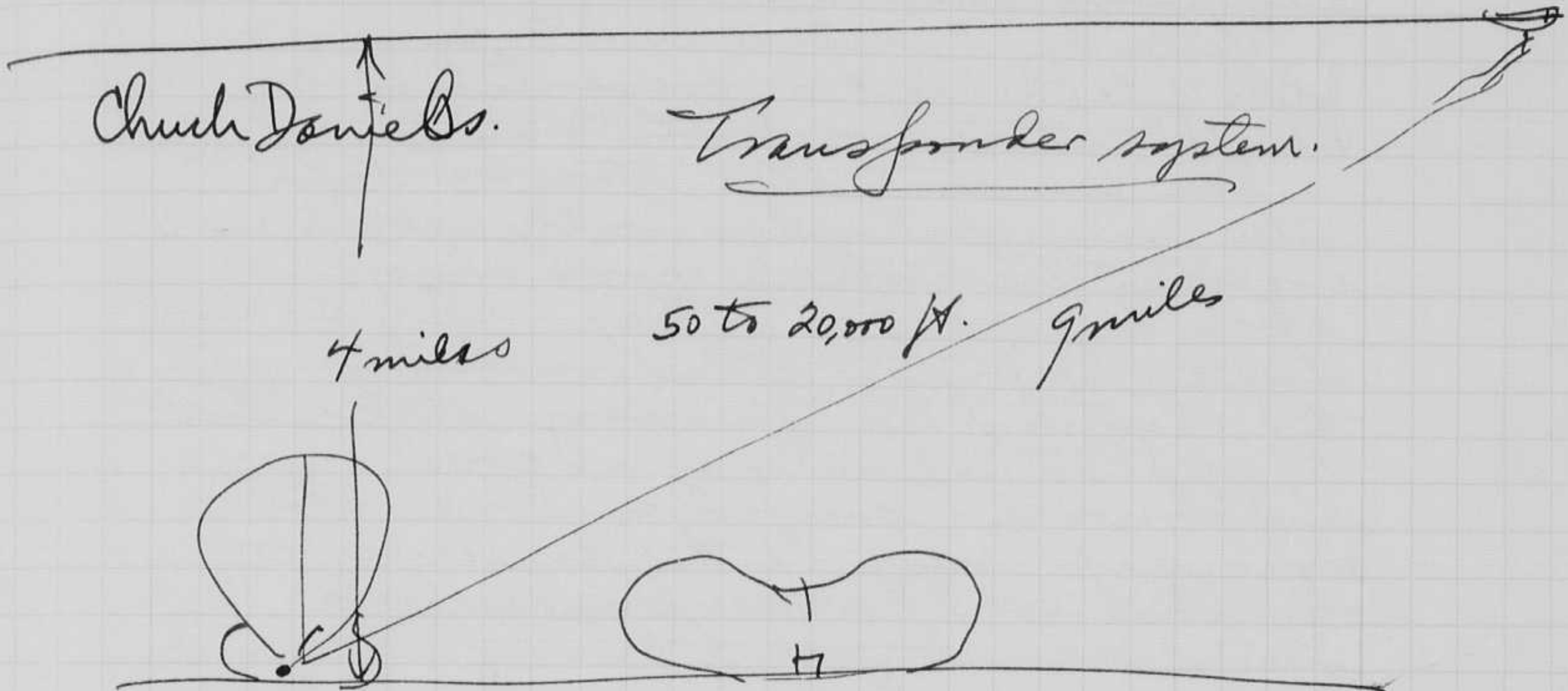
Sparker in Pres Tank. Feb 26 1964
Don Stewart.

500 p.s.i. ±
{ Volts - same
amp. .
amp. . 450 amp Zero pressure / 500

500 watt sec 4000 volts.
(200 " " " " also).

Church Daniels.

Transponder system.



March 6 1964 Sparker Studies by Don Stewart.

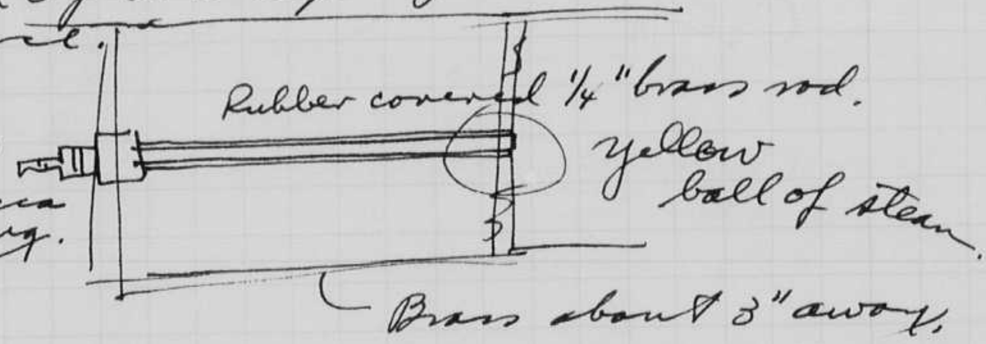
~~Harold Edgerton~~

I have arranged for Stewart to make a series of experiments on the "yellow" and the "blue" spark sound sources in the pressure tank. The goal is to obtain understanding of the phenomena so that we can design a sound source for the Cousteau sled and for the soucoupe diving saucer.

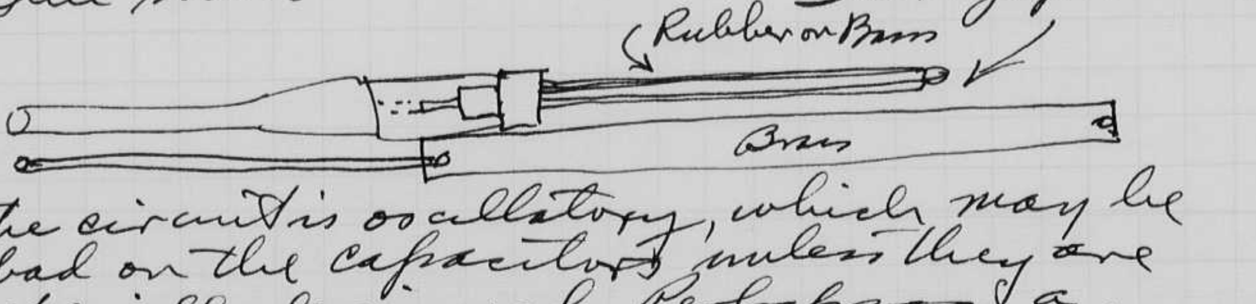
Yesterday I invited Dr. J. B. Hersey and John Yules to hear a presentation by Don on his experiments to date.

Don has some "blue" sparker data with brass electrodes rather close together that show good signals even to 3500 p.s.i. This may be due to the evaporated metal from the electrodes. Hersey states that the exploding wire is a good underwater sound source. The close gap may be the answer to the design of a deep sparker sound source.

"Yellow" source.



"Blue" source



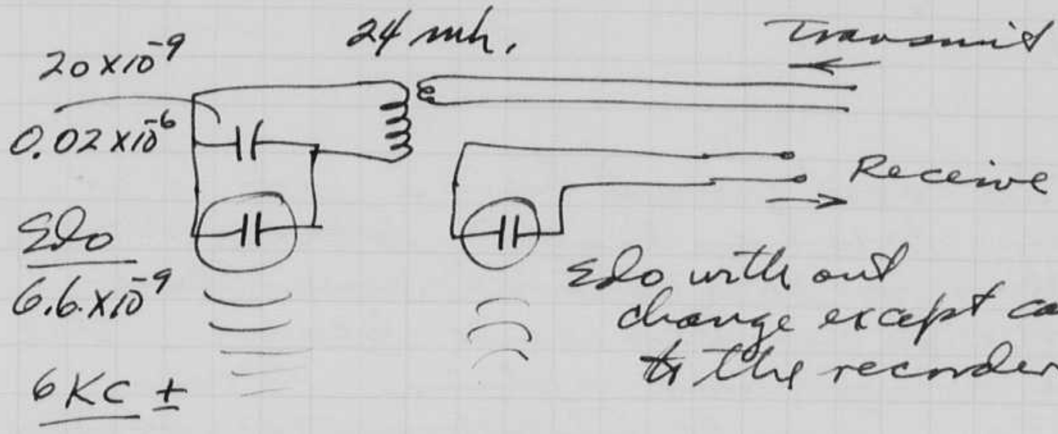
The circuit is oscillatory, which may be bad on the capacitors unless they are specially designed. Perhaps ~~as~~ a small damping resistance would be of benefit?

Mar 8 1964 Sonar

H Edgerton

Yesterday with MacRoberts and Yules tuning up the Edo to 6KC by the addition of 0.02 mfd in parallel with the transducer.

We found that the 50 ft of cable would not support the high voltage across oscillator. I assume this system would be satisfactory if we had a cable with enough insulation.



The gear was moved to the M.I.T. Sailing pavillion about 3 pm for water tests.

We plan to do experiment to show the penetration of the 6KC signal into the bottom and for side pinging.

Mar 11 ~~12~~ 1964
~~Harold Edgerton.~~ Beacons.

(Mar 5)

(1). the FX-6A stopped on last thursday. It first missed some flashes for about a day.

Start Feb 22 → (2) the FT-115 151 is still going strong at 2 per second on the Prudential.

(3) the FT-115 151 (400 volt) 20 watt sec

Start Feb 29. — 1 flash per second is going strong on the roof at M.I.T. It was started on Feb 29.

(4.) the coast guard have a 1000 w.s. strobe on Graves light. ~~Grace~~ Goncz says this is 30 to 60 times smaller than the incandescent beam. the strobe is without optics. Goncz suggests a small lamp with optics.

Last week the energy was increased to 2000 watt seconds.

Before I left last sunday for Wash, Phil, and N.Y. I gave Bill MacRoberts a circuit which would turn off the flasher during daylight. The scheme showed a semiconductor light cell that reduced the trigger voltage when it was illuminated.

Mar 9, I was in Washington - Saw Wisherd Payne, Grosvenor, Garrett, Sartwell etc. I gave a talk at the Engineers Club in Phil that night before the IEEE.

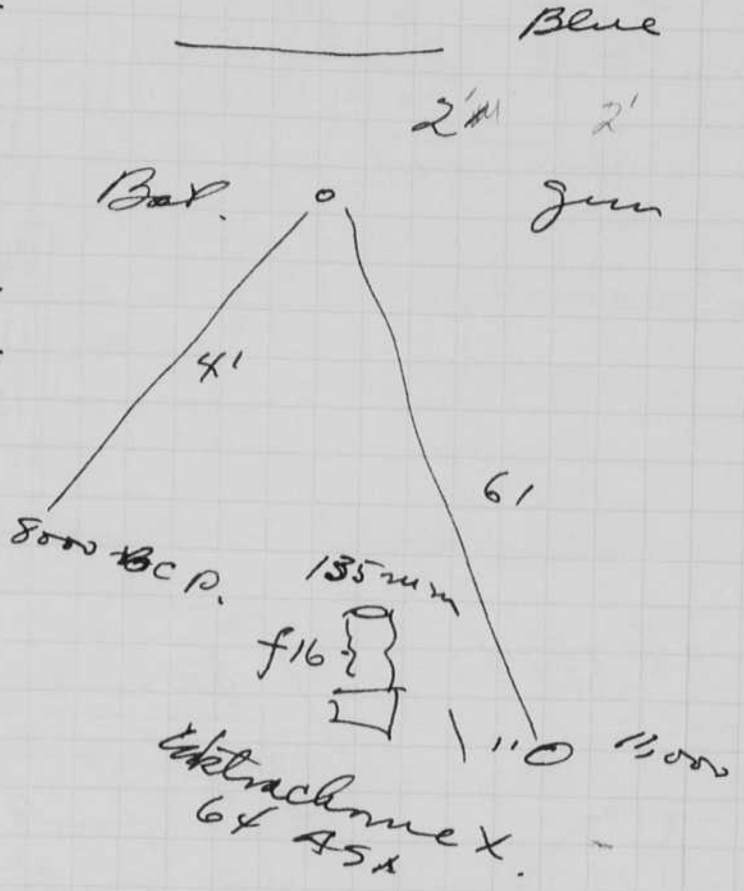
On Mar 10 I gave a talk before students at N.Y. university on the strobe cameras and pingers in the sea.

Mar 21 1964
H. Edgerton
Scott Keneman

Bat photos.

2 flashunits 11,000 BCPS. Turtle
100 watt sec 8,000 "
510 volt Bat

for 35 mm film.



1. Unit too heavy
for light tripods.
(a) Design change.
(b) Heavy tripods.

2. alignment
difficult.

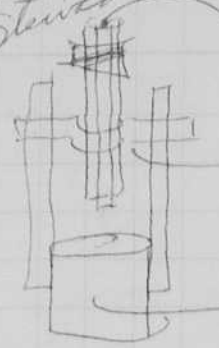
3. Coverage may be
too small.

a/pr

Exposure was OK on bat — Background too light and Spotty.

Mar 23 1964
HEE
D Stewart

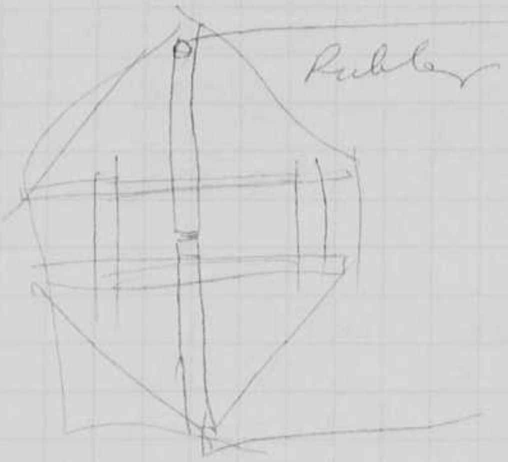
Tungsten in contact with bottom Elec.



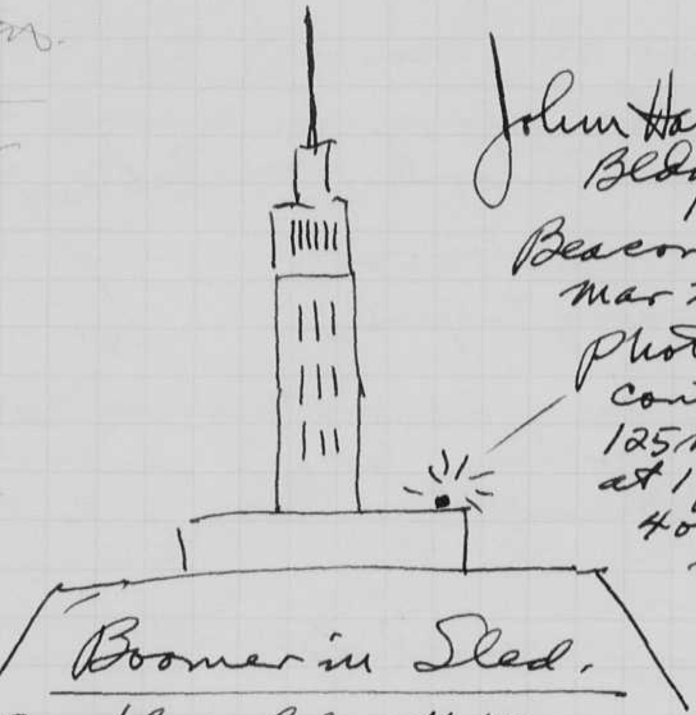
Loose to touch.

Tunston.

① Object get vaporized metal into the bubble.



Rubber

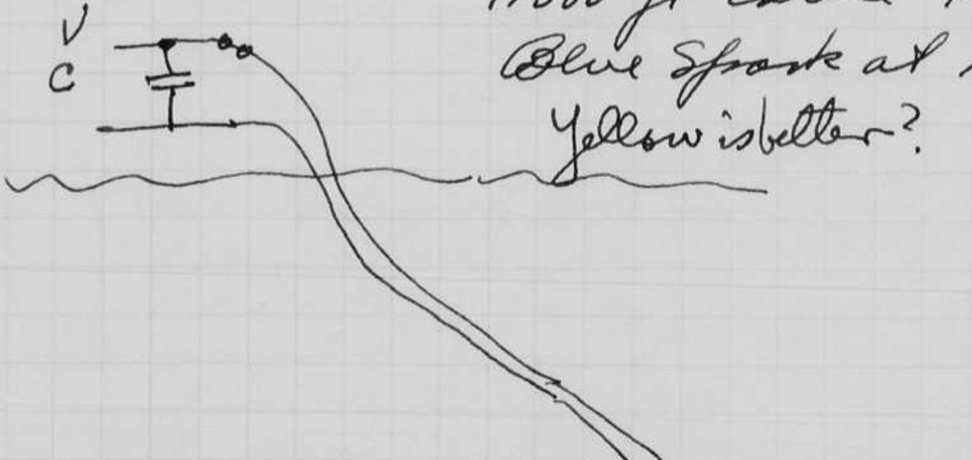


John Hancock Bldg.

Beacon installed Mar 23 with Phototube control.
125 mfd FT-215 x 51
at 1 per sec.
400 volts in Tripplar.

Mar 24 1964
Don.

1500 ft cable #10
Blue Spark at 1000 ft 500 psi?
Yellow is better?



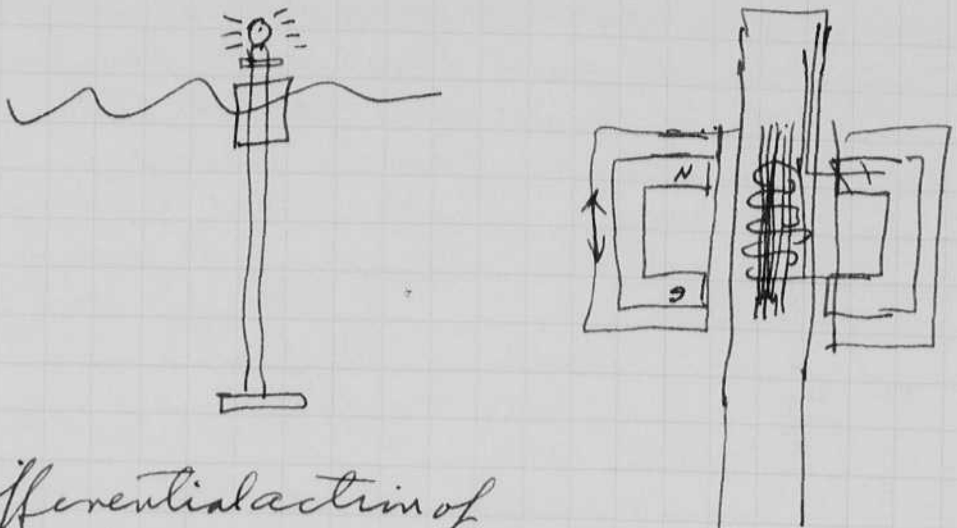
Mar 25. 64

Stewart reports excellent action of this electrode.

Mar 25 1964

Harold Edgerton

~~Wage~~
Generator from Waves.



Permanent magnet.

Differential action of float carrying magnet creates voltage in coil inside pole.

April, 7, Roy Rather drove to Clayt's yesterday. Visited EG&G Mazilli Curley Harford. Don Stewart went with us.

April 7. 64 Birthday party for yesterday 61! going fast. Ice cream, Cake Everybody here.

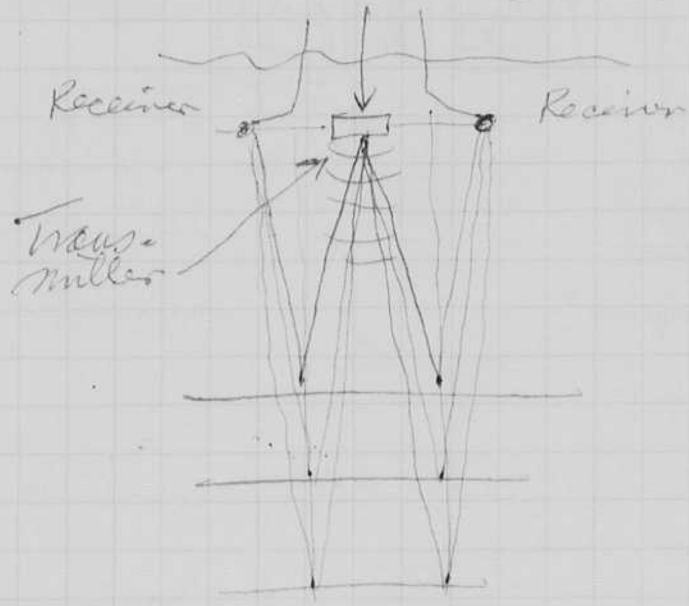
Apr 11, 1964 More work on beacons. One for Prudential has been flashed 6 million times at 2/sec. It skipped there, at M.I.T. it works fine. Why?
Skips at 104 volts and lower. Do you suppose the voltage is low at the Prudential Bldg?

On Apr 10 Fri I was at the FAB establishment in Atlantic City at the air port. Discussed air port lighting with Harrison Daly. — — — & Phillipsette. I showed them a beacon with the flash (xenon) and with a tungsten lamp in the charge circuit.

April 17 1964
H. Edgerton.

Sonar

The use of two receivers and a single transmitter should give excellent performance in sub bottom transmission since the signal from the lower levels would be greater due to angle effects, The hydrophones should feed into a phase sensitive amplifier so that the signals add and the mutual noise cancells,



The same result could be obtained with two transmitters and a single receiver.

A ring of transmitters around a hydrophone should be excellent. Likewise a ring of hydrophones around a single transmitter should work fine.

April 17 1964.

Microscope camera See page 5.

Final set up had 1500 volts (guess) and 170 mfd paper with inductor and mercury-arc tube into a FX-33.

$\frac{CE^2}{2} = 170 \frac{1500^2}{2} \times 10^{-6} = 190$ watt seconds. 5 flashes/sec.

Running time 10 seconds is all that is needed.

See Wells about this system!

April 18 1964

(1) Beacon on Big Blue Hill. 10WS FT-215 with 450 volts. Photo stopper blocked so the flashes occur all day & night.

(2) Beacon on Earth Science Bldg installed on north side. One has been going nights since Wednesday ±. The second one quit at 11 pm ± after installing it at noon. No chance to investigate as yet.

April. 19 64. Designed more of Bird-Bat unit with Scott Kuneman. We plan to put the lamp and coil on the tripod with the rest of the equipment on the ground or bottom of the tripod.

Fish-unit shows 1400 microseconds duration
2000 B.C.P.S. from reflector.
FT-120 4 pin flash lamp.

Apr 27 and 28 in New York at the Americana Hotel 7th and 52 nd. for SPSE Convention.
Paper with Carson on Closeup Photography.

May 21 1964 H. E. Edgerton

6.202 and Sem 11 students will photograph Prudential Bldg tonight at 8 or 9 pm using 3000 mfd at 4 KV with an FT-629 flash lamp.
The lamp will be on Bldg 6.
The camera will be on Bldg 54

Distance to Prud Bldg - 1 mile, mile
camera - lamp - 260 feet ± 4%

The camera will trigger a Strobolume. 4×10^6 c.p. peak

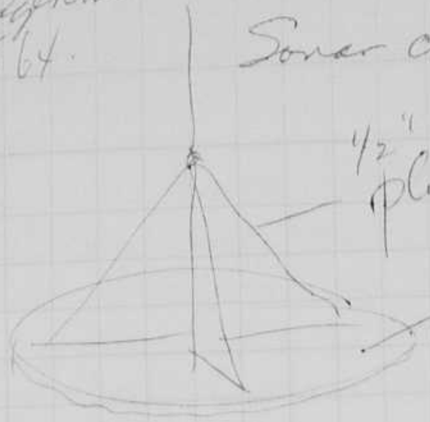
Trigger will be a 6" lens with a 929 and a 2D21 trigger.

May 25 1964 Exposure was ok on Polaroid 3000 at f 4.5
over " " 10,000 " "
under on Royal X " 4.5.

The building is light colored which aided the exposure.

H E Edgerton
May 25 64.

Sonar corner reflector.



This was seen at 150 feet with the #1 11" recorder and Edo Side Jugger from the MIT Dock.

The reflector was hung at 6 feet deep in the water.

I plan to build it from 1/2" aluminum. Then to glue rubber on to it. This is the air foam rubber such as used in diving suits. Disadvantage - the air collapses when lowered to depth.

May 27. 64. (1) Revising design of Edo for streamline model
(2) Sound reflector with metal.
(3) finish 6KC system and recorder.

Thesis students. Robt P Popalic - Sonar calc.
Marcus H Cohen Jr. Sparks
Douglas H Cortelyou Chas River Sonar
Joe Pardresky. Starting of flash lamps

6.702 last class yesterday 14 students.
John Carson - assistant.

Sem 12 " " " 10 students.

May 26. Directors meeting at Bedford - I was late due to classes. Tour of plant. Back by 4 to see group from Sold.

July 1 1964
Harold Edgerton.

Mexico - Under water Soc of america convention.

Wedding of June Barbara Robinson to John ~~Aaron~~ Aron
June 26 at Wilmington Del.

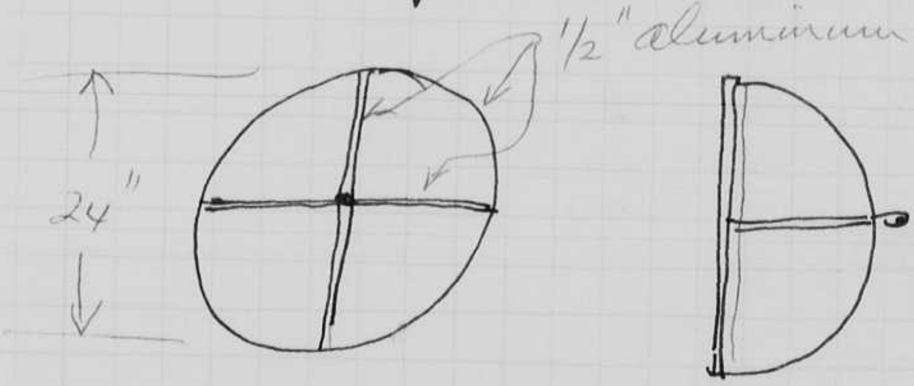
At Worlds Fair in New York with Chas Dixon
Mary Lou, Jan, Bill and Mary anne
Ellen stayed home! She is one.
June 28, 29.

Climbed Liberty Statue June 30 in
morning with kids and charlie.

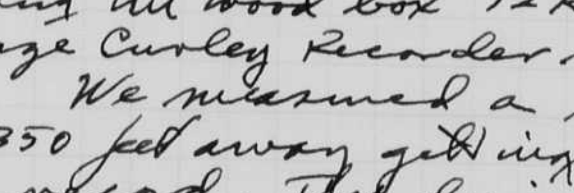
My mother came from Aurora to
Chadds Ford with Esther & I to attend
the Wedding.

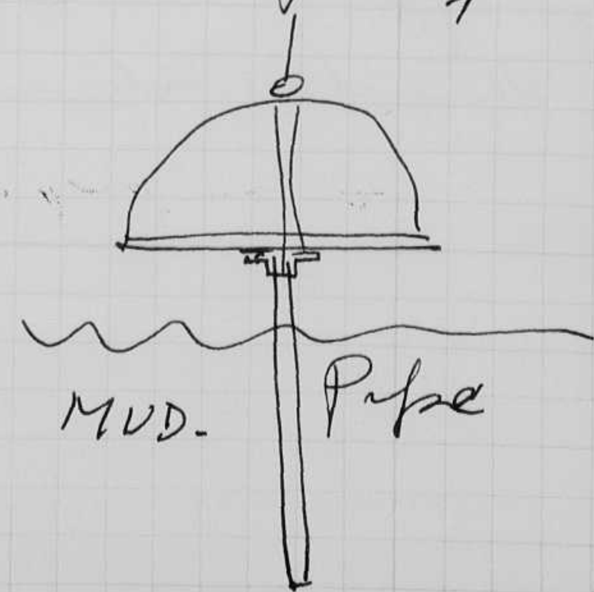
July. 6, 1964. John Yules and I worked with the Pinger
using the wood box 12KC Edo and the
large Curley Recorder model #1.
We measured a side corner reflector
at 350 feet away getting a very good line on
the record. The dimensions of the
corner reflector are

We could not see
this in the mud
since it went
completely under



a pipe about 1",
and 5 feet long.



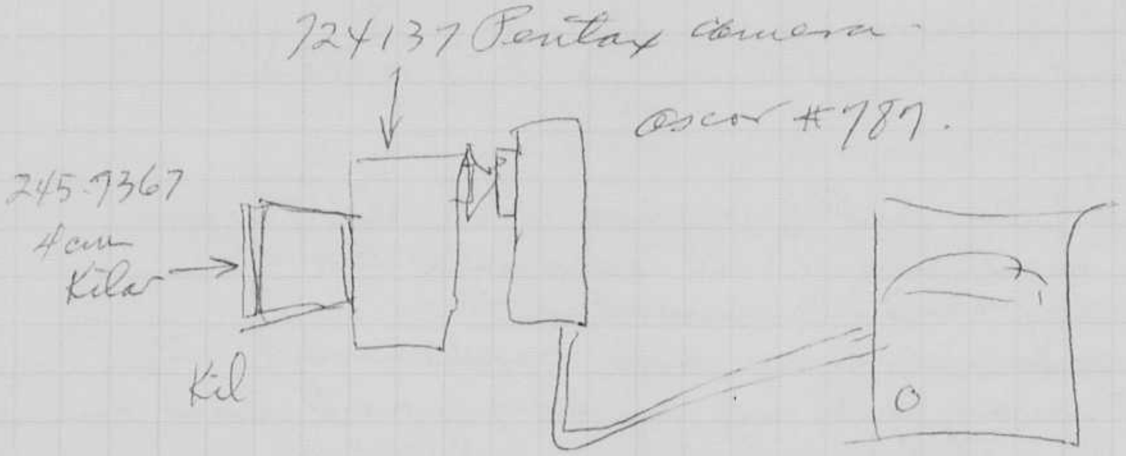


July 19 1964
H.E. Edgerton.

Preparing for 6.515 High Speed Photo Seminar which starts ~~tomorrow~~ Monday July 20 1964.

July 25 1964. The H.S. Seminar is finished. I believe it was a big success.

My finger goes to London tonight. Esther and I go tomorrow night at 8 pm. Our first stop after arriving in London will be the N.I.O. Then we go to Scotland for some experiments. Next to Germany Kiel. Finally to Monaco.



$\frac{400}{I} = \frac{\text{lumensec}}{f\#^2}$

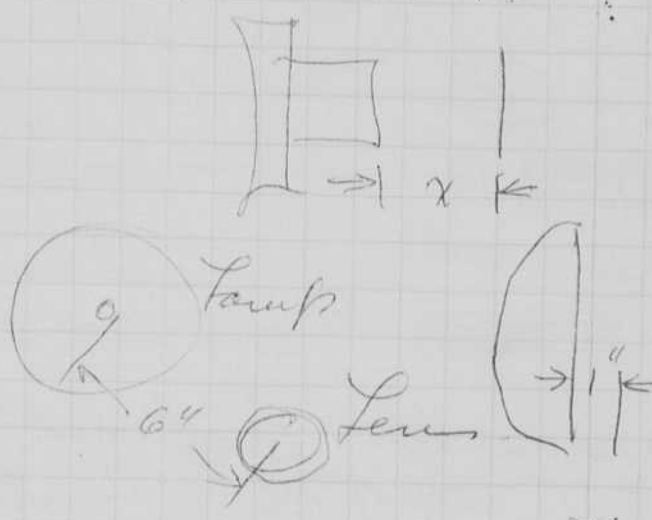
G.F.	Distance to white card 3x4 ft	f for H.R.	I meter reading	
	10' slant!	f5.6	50.	~~8~~
	5' slant!	f11	20.	20
	2.5 feet.	~~f22~~ f11	10	40
55	2.5	~~34~~ f22	34	

Realigned the background.

Distance Lamp to Screen	Lamp to camera ℄	for lens.	focus Distance	Exposure meter	fcs.	G.E.
D Lasts screen 2 1/2'	9 1/2"	f 22.	2.5 ft.	32	17.5	55.
1'	"	f 22	1'	28		
6" 7 1/2"	"	f 22		39.		
4" 2x	3± onside bracket.	f 22		8+ off scale.		

Scale.

1.1.1.	2"	" Lens front to subject
1:2	3 1/4	
~~2.4~~ 1:3	5 1/8	
1:4	7	
1:5	8 1/2	



	30"	31	6"	f 22	2.5 ft	22	19.	
1/5	8 1/2	9 1/2	6"	f 22	8 1/2	8	50	
1/3	5 1/8	"	"	"	5"	9	48.	
1/2	3 1/4	"	"	"	3"	12	33	
1/1.1	2"	"	"	"	2"	21	19.	ok for.
1/1.1	2"	"	"	16	2"	13	34.	Ektadome X 64
								Kodadome II 25
1/5	8 1/2		6 3/4	f 22		12	33.	
1/5	8 1/2		6 3/4	f 22	Lamp at 15° left	20	20	Looks to be ok.
1/3	5 1/8	"	"	"	"	18	22	" " " "
1/1	2"	"	"	"	"	38	14	underexp.
"	"	"	"	"	Zero angle	28	14.	Slight under exp.

Johns Eye f 22 16 22 Edge f 22 Ektradome X.
150 15° 0° / 0°

Notebook # 28

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 72 and 73.

Item(s) now housed in accompanying folder.

1964

№ 13132

1964

№ 13127

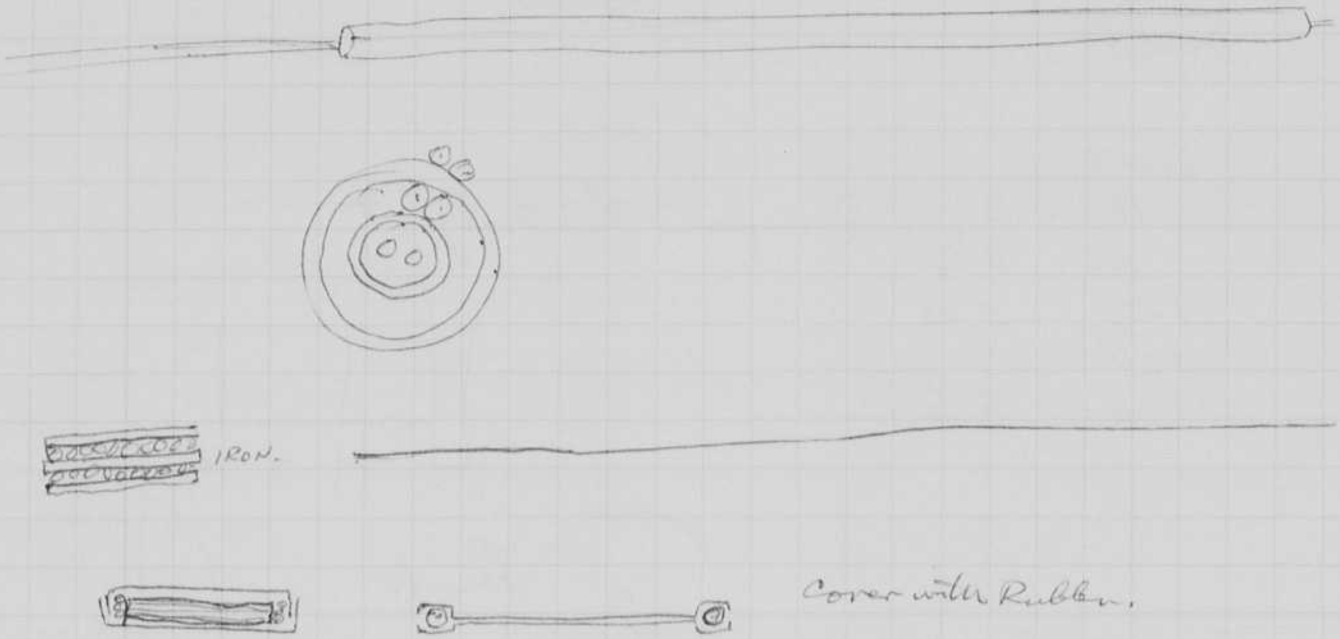
1964

№ 13131

 Sept 18 1964

Harold Edgerton

Ret'd on Wed Sept 16 from London on PAA57 flight after a trip to Scotland (Tobermory) Germany (Kiel) Italy La Spezia and Monaco. Details in note books on 1964 Summer trip.



Sept 26 1964 HE. Inspected the two flashers on the top of the Green Bldg. The one on the north has been going since Apr. In May or June it was converted to Day & night flash by covering the photo tube. Today I took the tape off so it does not run in the day time. The lamp is cloudy but still is in good shape.

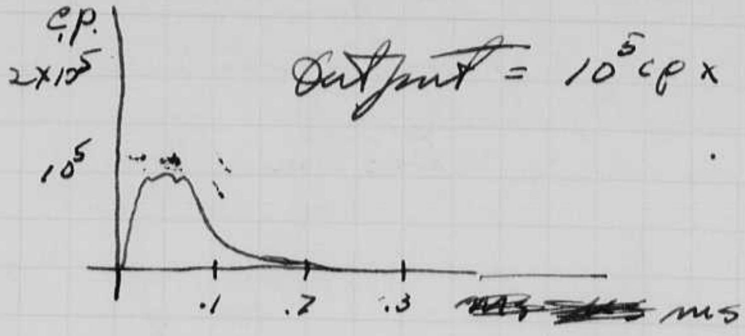
Discussed production of beacon with Perope, Rubinstein, Heron, etc at EG&G yesterday they will make 10 for us to continue the life tests. Also they will prepare estimates of costs etc.

MacRoberts will send over latest drawings of circuits and some Hardware such as water proof parts.

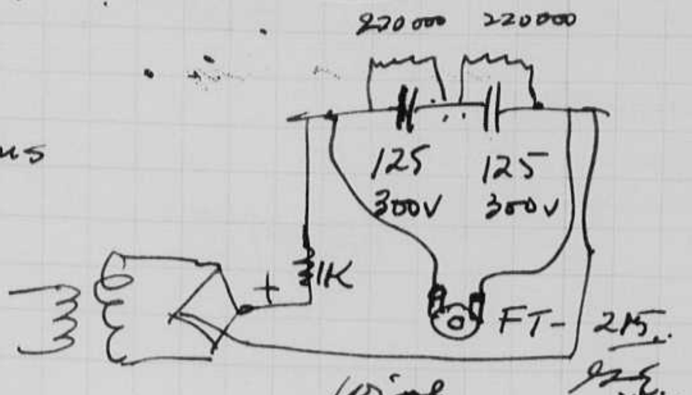
Now use G.E. ~~215~~ FX-215 with two capacitors in series to reduce the internal resistance and to get long life.

Sept 26 cont.

Out put as measured on scope



$$\text{Output} = 10^5 \text{ cp} \times \frac{100}{\cancel{}} \times 10^{-6} = 10 \text{ c.p.s.}$$

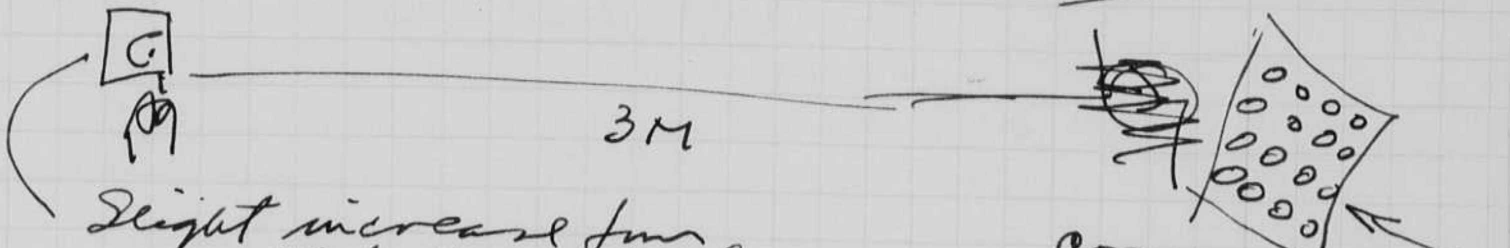


Wire Starter.

octal base

Corner Reflectors

3 meters



Slight increase from
0.1 volt to .3 volt when
corner reflectors are used.

Corner reflectors

The factor should be 16X for 16 corner
reflectors over lamp to photo tube distance.

Transformer

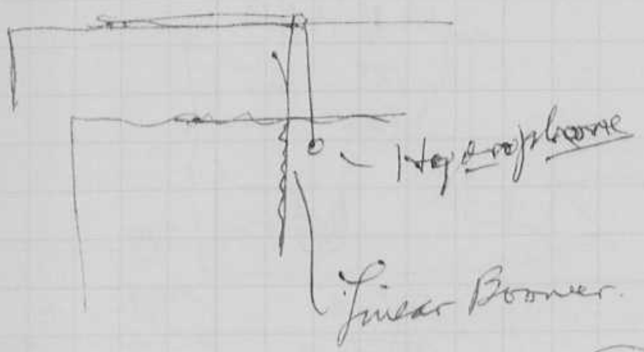
115 - 375 $\boxed{\text{T - 1062}}$ EGG
Reluctance type

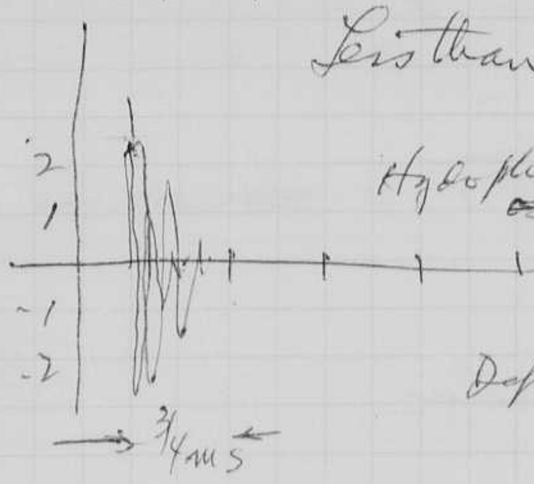
Oct 9 1964 Whip-Snake-Boomer

M.I.T. Pool
H.E. Edgerton John Yules 1/2" aluminum 30" long Scotch tape
62.5 mfd 3400 volts with 30 ft of #12 Twin Conductor
Pyrex.

Pool test.

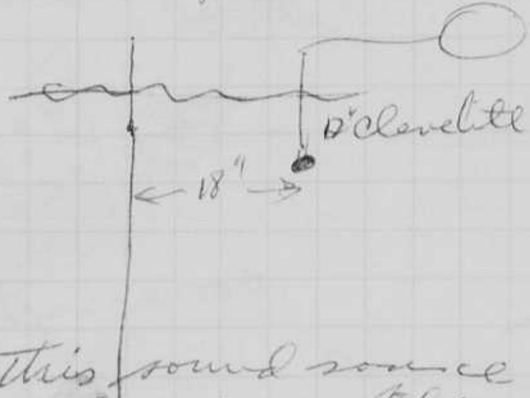
Less than 1/2 ms.





Hydrophone about 18" from Linear Boomer.

Depth of Hydro 12"



3 volts peak to peak.

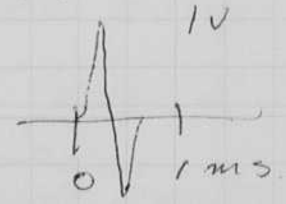
This sound source will be ideal for seismic profiling at shallow depth and in spots that require high resolution in depth. It will be better than the pinger (12 kc) for depth and will have better resolution than the Boomer.

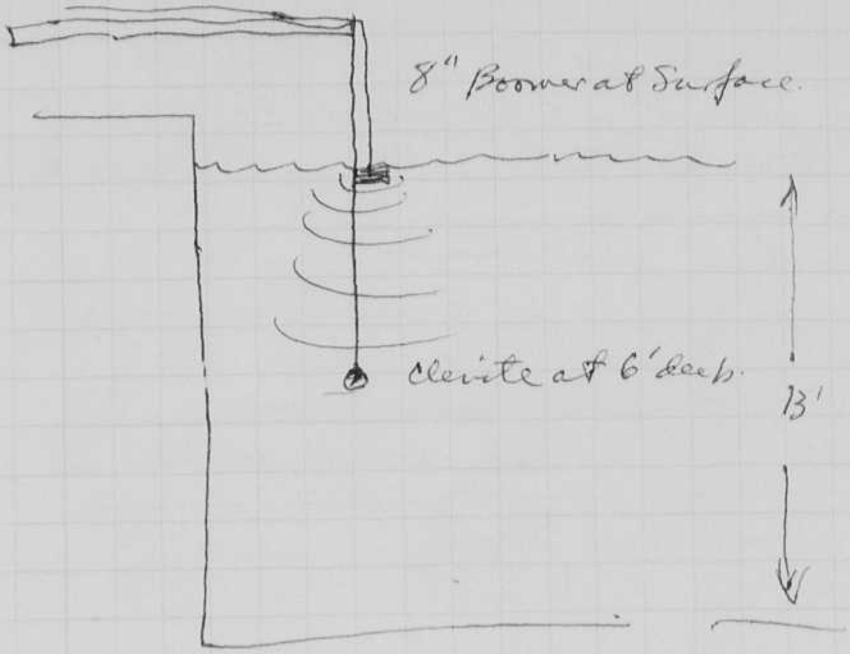
8:30 pm HEE & John Yules.
Whip snap 3 ft al 1/2"
Hydrophone CH17A Clevite.

14 ft. 62 mfd 3.4 KV 0.4 volts p.p. 0.5 ms ±

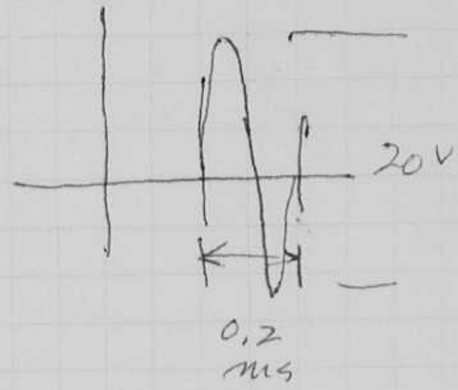
10 ft 3/4" Copper .015' plus 25' of 4 #10 cable, Spark gap.
14 ft 62 mf 3.4 0.5 + pp. 0.7-1.0 ± ms. signal

8" Boomerette 14 ft 62 mfd 2.2 volts 1/2 ms. Looks good.



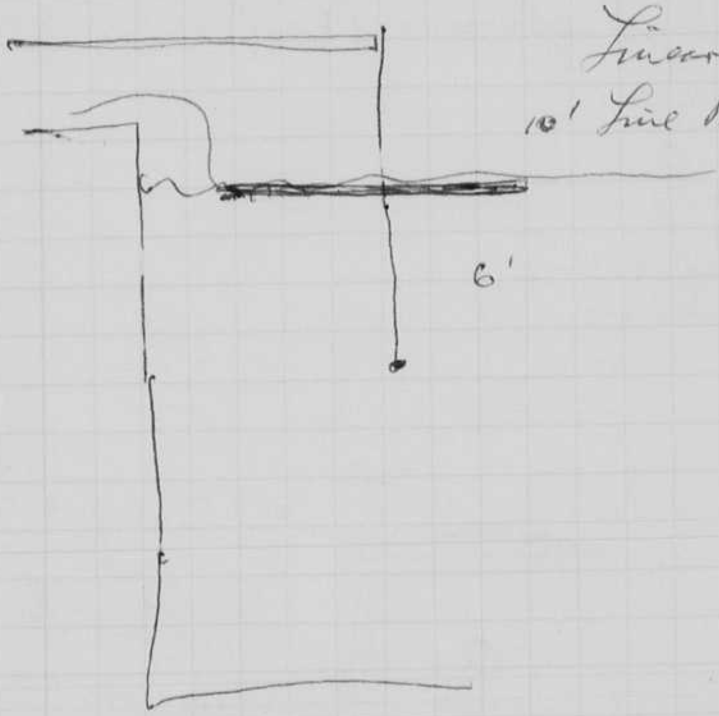


p to p voltage = 20 volts.



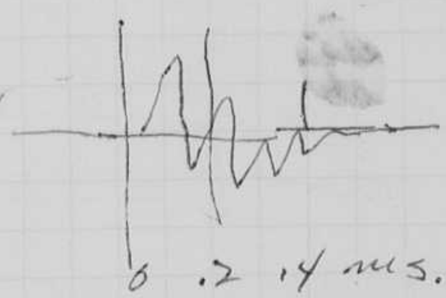
Linear Boomer.

10' Line Boomer.

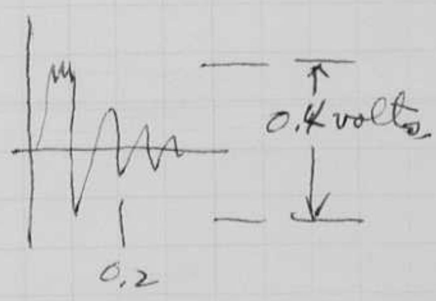


p-p volts = 2

6 mfd



10 mfd.



Oct 10 1964

Harold Edgerton
John Yules
Eric
Jan Dmitroney

MS 5833E

Help from Divers

Left Kellys Landing at 10 am with Boomer 8", 10 ft line Boomer Recorder EG&G 254.

Records made south and east of Perry Island where rock layers are 100 feet below clay or sand.

10' line Boomer had problems - Shorted?

8" diam Boomer works fine 100 ft penetration

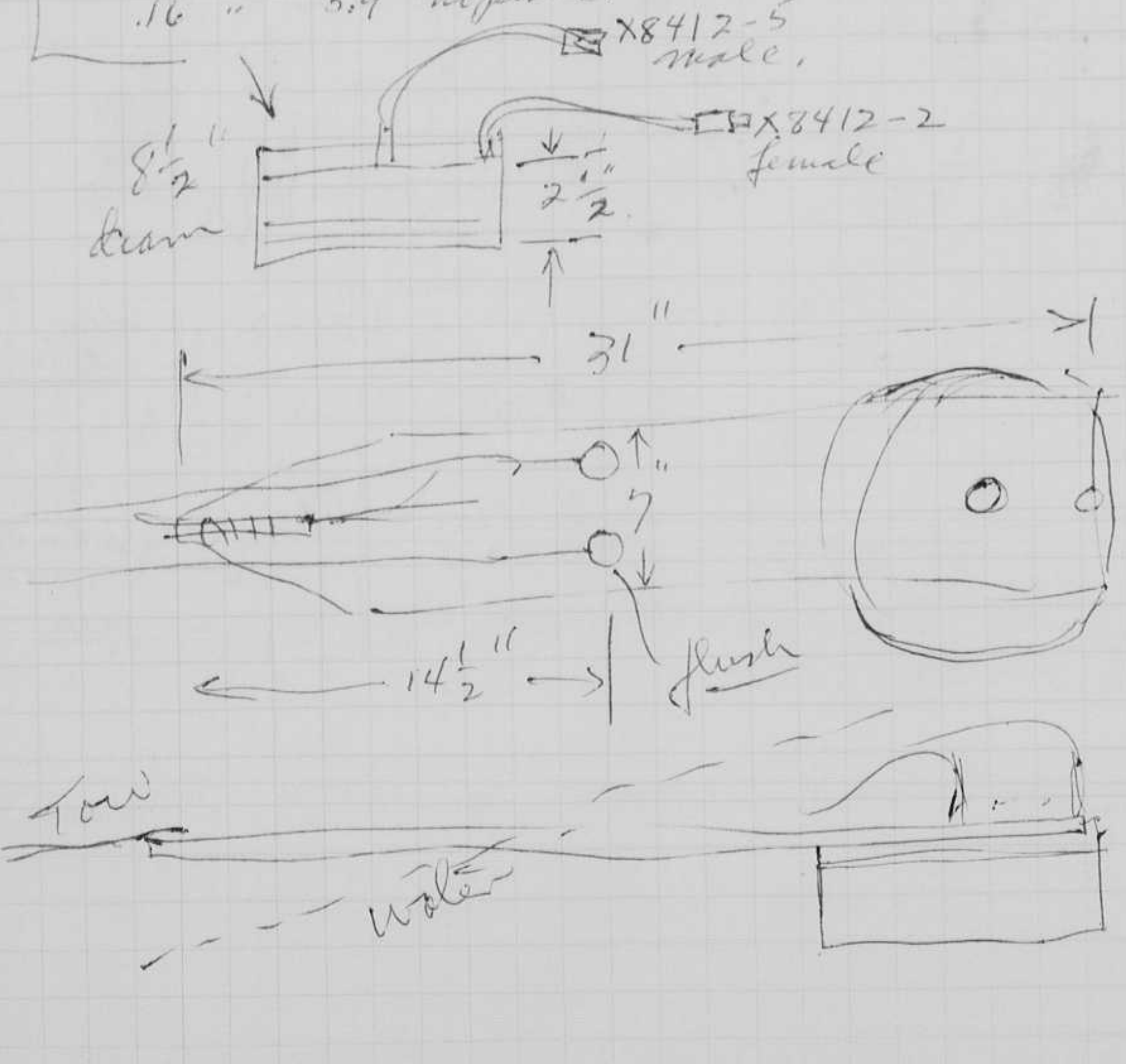
17A Clevite ~~transducer~~ Hydrophone
gain 10 X 230   200 - 20,000 c/s.

Some noise from Stato.

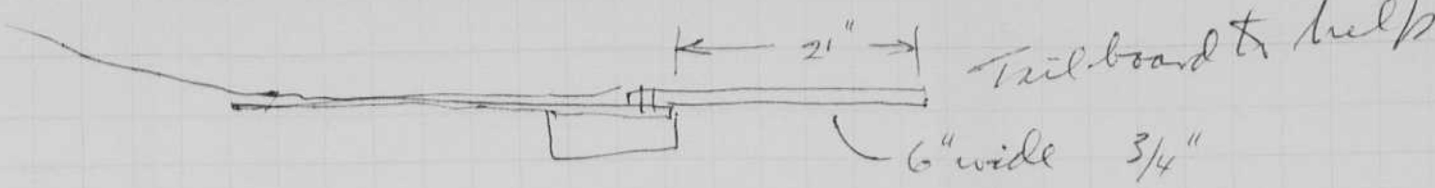
At 1242 gain 10 X 300   Penetration 120 feet.

At MIT 4pm — making fish for 8" diam Boomer. with two hydrophones Clevite 17A & 17AR.

	mh	Q	
L	0.04 mh.	0.76	with al plate
	.16 "	5.9	no plate.



This did not go well in the water because the bow came out.



We went out again on Oct 12. with a combined Boomer & pickup assembly. Pickup was bad.

The results were very interesting. Penetration up to 100 feet in spots. The rocks gave a rough record due to irregular surface. A strong record of the Glacial period was evident in the area East of Graves light

 Channel Study Group. Dover ENGLAND Sept 14 1964 Date of Photos.

Harding Welcome

E. Marples England Marc Jacquet France

Klein Edgerton Van Reenan

Dover Harbor

~~Hill~~ Don Smith

Van Reenan

Marty Klein

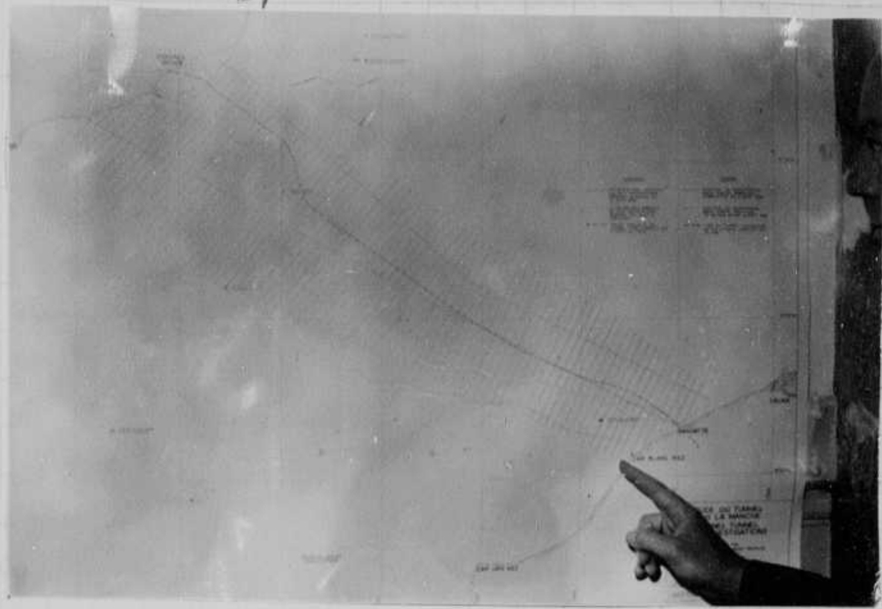
Pinger Sparker

Van R.

Klein

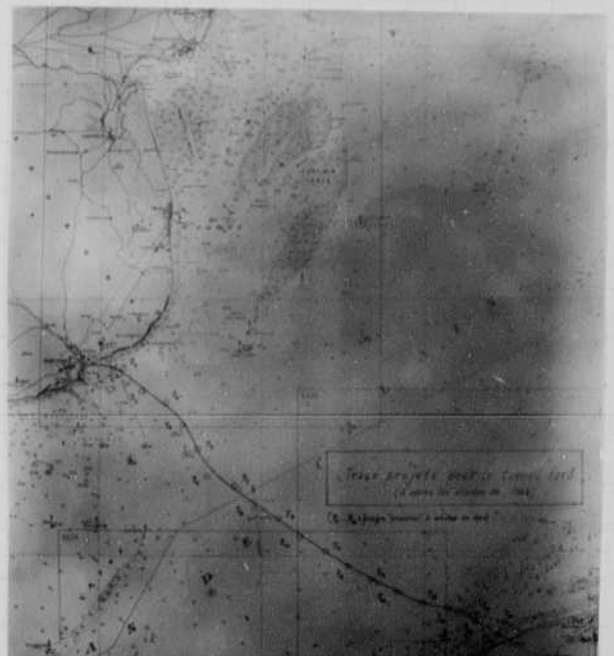
Peters
Capt of Mary Lou

Sparker courses

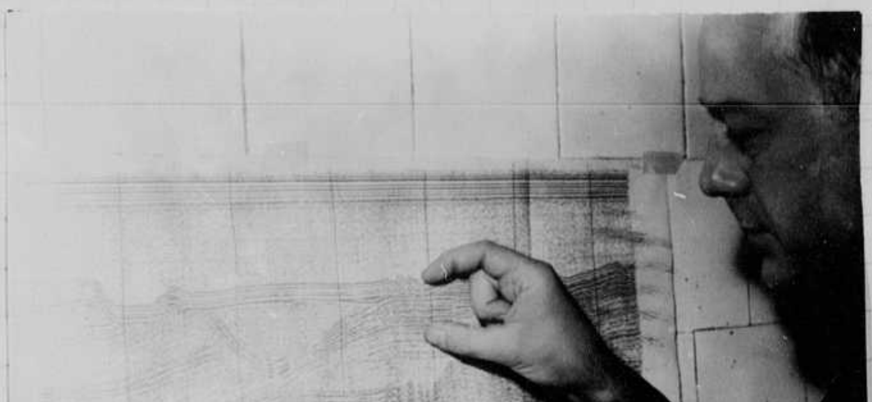


chalk &
Van Reenan

Van with Record.



Proposed
Site



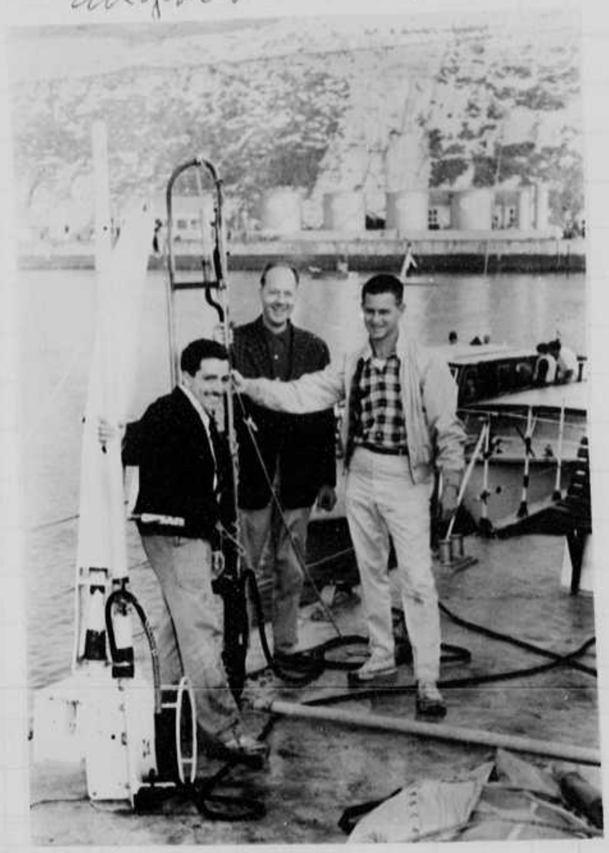
500 WS Boomer Record.
Sparker
3 candles in
parallel

 Channel Study Group. Dover ENGLAND Sept 14 1964 Date of Photos.

Harding Welcome

E Marples England Marc Jacquet France

Klein Edgerton Van Reenan



Dover Harbor

~~Hill~~ Don Smith

Van Reenan

Marty Klein

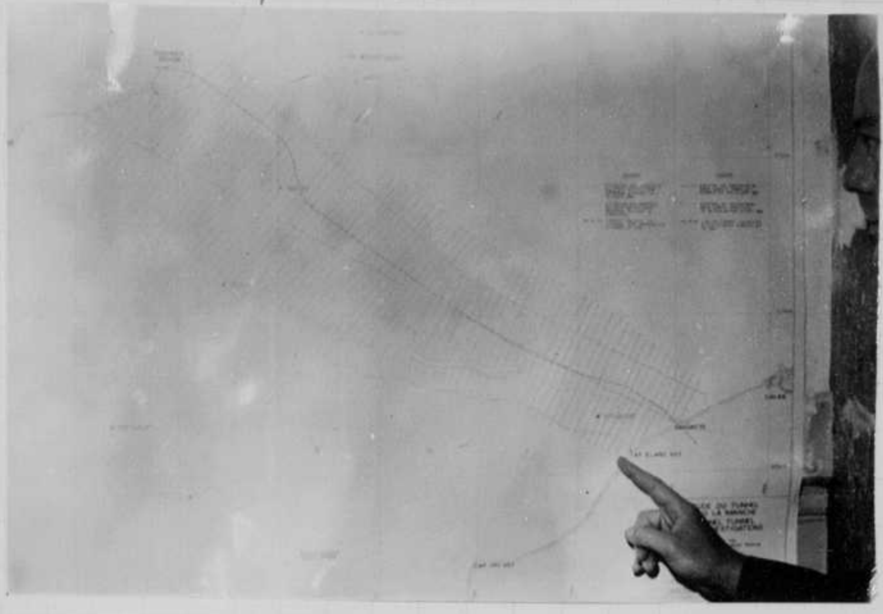
Prigger Sparker

Van R.

Klein

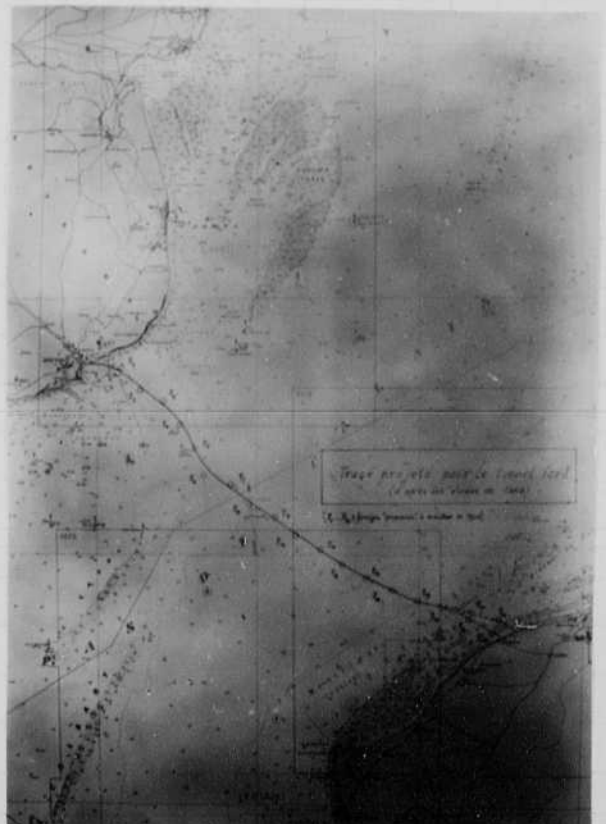
Peters Capt of Mary Lou

Sparker courses

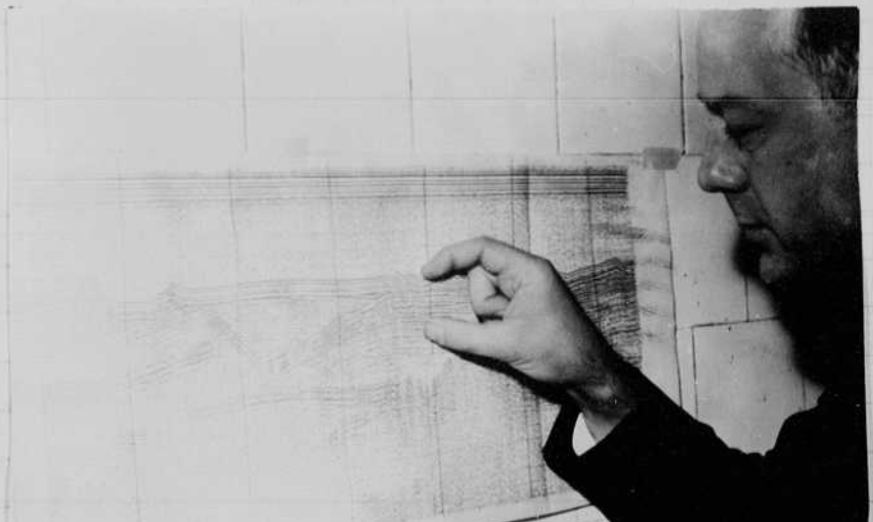


chalk &
Van Reenan

Van with Record.



Proposed
Site



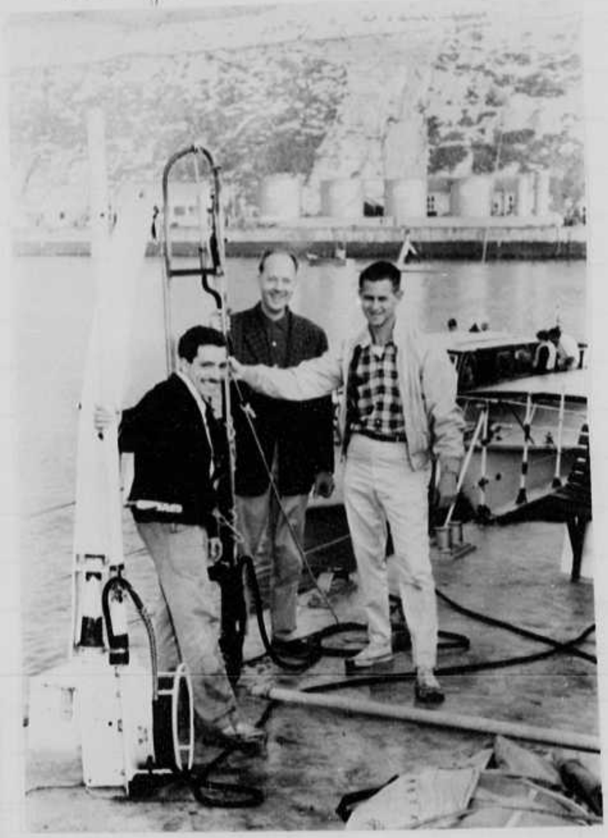
500 WS Boomer Record.
Sparker
3 candles in
Parallel

80 Channel Study Group. Dover ENGLAND Sept 14 1964 Date of Photos.

Harding Welcome

E Marples England Marc Jacquet France

Klein Edgerton VanReenan



Dover Harbor

Don Smith
~~Hill~~

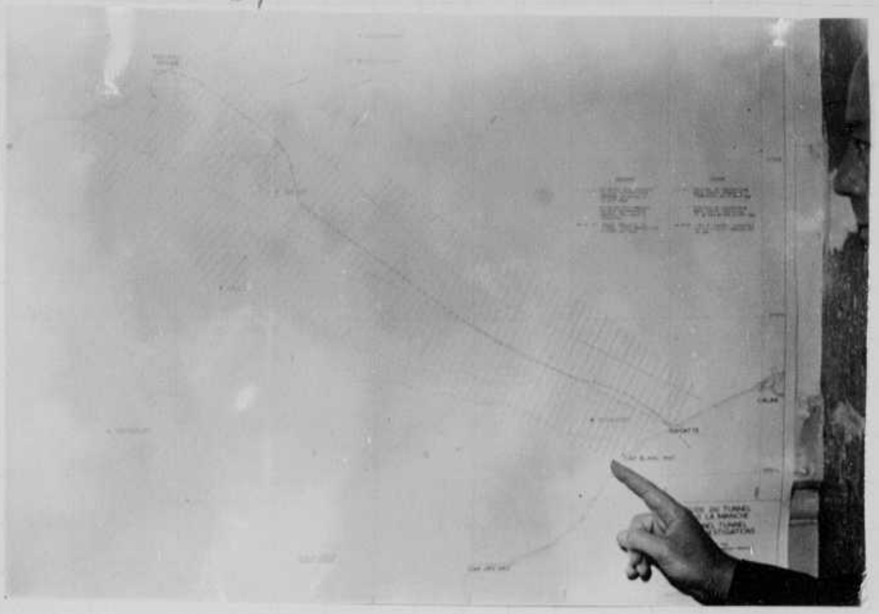
VanReenan

Marty Klein

Pinger Sparker

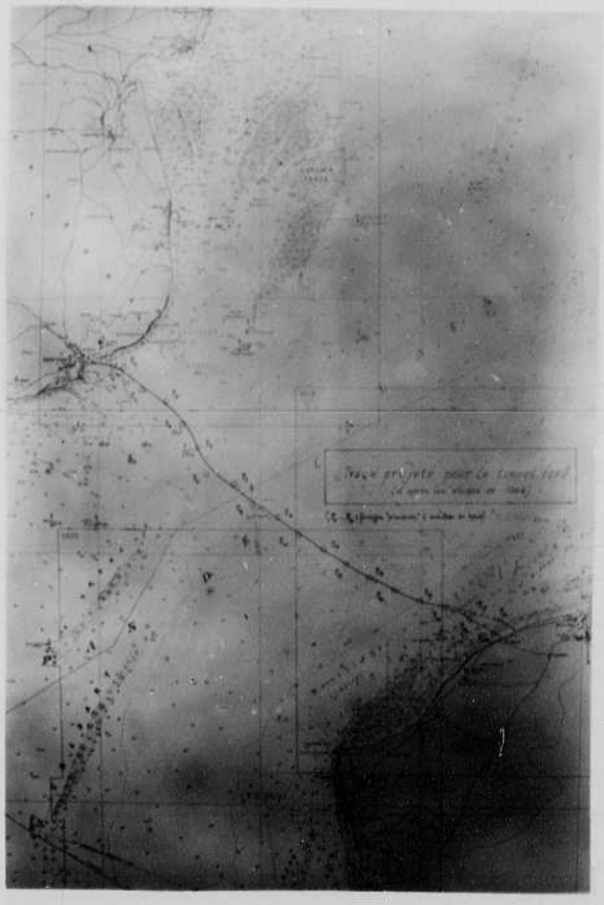
Klein VanR. Peter Capt of Mary Lou

Sparker courses

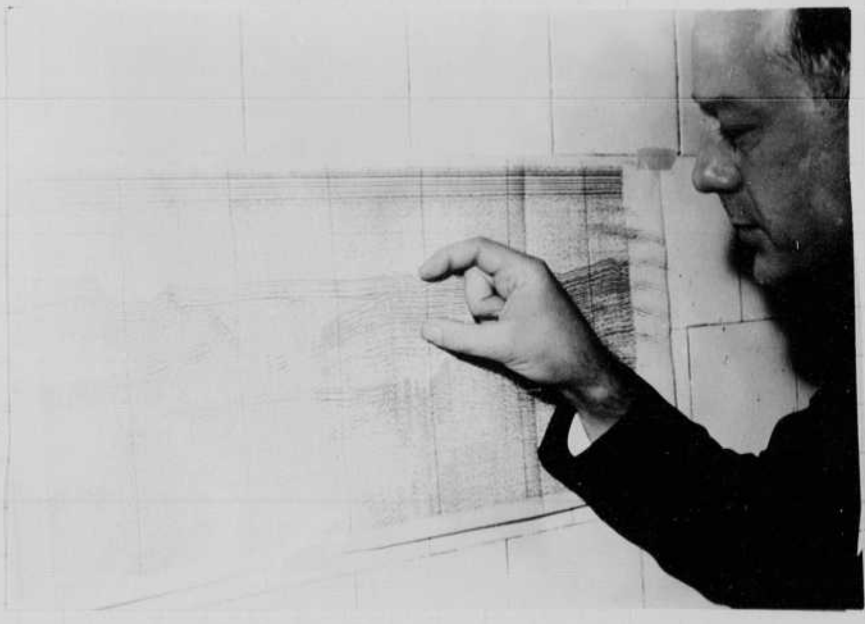


chalk &
Van Reenan

Van with Record.



Proposed
site



500 WS Boomer Record.
Sparker
3 candles in
Parallel

Oct. 17, 1964.

Trans Design John L at E.G.G.
Cleo Eckhorn.

Pri 115 volts
Sec 3200 " with midtap.
T-1070 Transformer
500 watts.

Oct. 21, 1964

Straight lamp in cylindrical reflector 2' long in Pyrex

11,200 BCPS 224 watt sec.
26.4×10^6 C.P. 425 us

FT 38	80	"	
FT 215	27.5	"	10

Oct 26 1964. Lecture yesterday at Phillips Exeter School. then morning with Science class in school. Arthur Compton.
S. ___ , ___ . Bates.

John Yules and I took MS 5833E out to Boston Light with a 32 mfd 2KV Boomer. I used two hydrophones push pull type.
The boomer coil shorted to ground. Records were not good. Try again after repairs.

This is a Boomer ... the ...

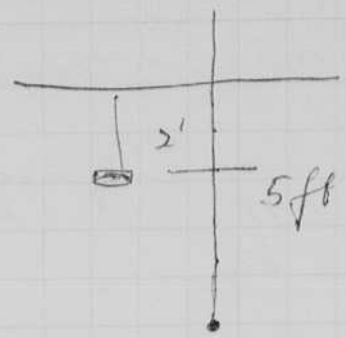
7
3
21

13.5
3
40.5

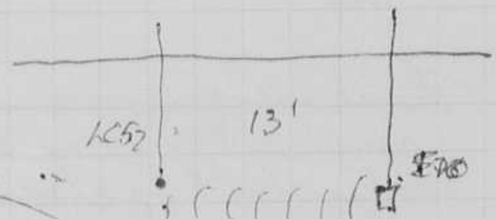
Boomer trips on MS 5833E ship with Payson & McCarthy Wed Oct 2?
32 mfd into 8" water trans, at ~~600~~ 250' scale 1 in 5
Burned out transformer.
Records show pattern of lines!

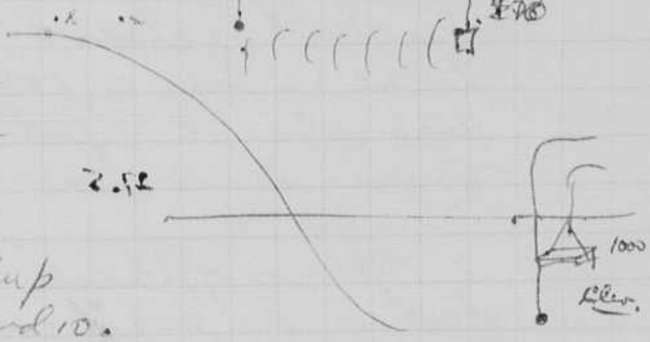
Oct 31 1964 Small Boomer Tests in M.I.T. Pool

Harold Edgerton, Dave Rathner?, John Yules, Osceno?



#	Hydro	Trans.	C.	V.	Sens. volts.	Time ms	
1.	LC32	Boot 8"	6.	2800.	0.1	0.1	
2	8 Ball	"	"	"	0.2	0.2	
3	Clev	"	"	"	0.5	0.2	
4	Clev	"	"	"	0.5	0.1	
5.	LC32	4" Boot	6	2800	.1.	.2	
6	LC 57	"	"	"	.5	.2	
7	8 Ball	"	"	"	.2	.2	
8	Clev-17AR	"	"	"	.2	.2	
9	Clev-17A	"	"	"	.2	.2	
✓ 10	LC57.	Edo 12 KC	5¼	600 V	.5	.1	
✓ 11	Clev-17AR	1000 WS Boomer.	16	4 KV	.05	.2	
✓ 12	"	"	32	"	.05	.2	
✓ 13	"	"	64	~~4~~ 2.8	.05	.2	

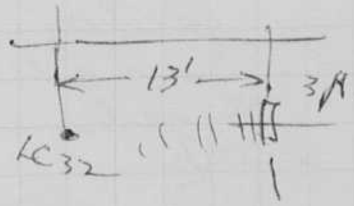


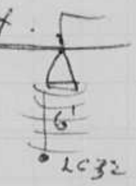


HP = Hewlett Packard.

11.50 am cont. Amp H.P. #M246 with 5 meg input imp put into circuit gain of 100 and 10.

#	Hydro	Trans.	C.	V.	Sens. volts.	Time ms	
✓ 14	LC-32	1000 WS	16	4 KV	5.0	.2	40 db (100).
✓ 15	"	1000 "	32	3.4	10.0	.2	
✓ 16	"	"	64	2.8	10.	.2	
17 ~~15~~	LC-32	1000 WS	64	2.8 KV	2.	.2	20 db. (10). Vertical 2 ft.
18 ~~16~~	"	"	32	3.4	2	.2	" "
19 ~~17~~	"	"	16	3.6	2	.2	" 25 ft of 4 cond #14
20 ~~18~~	8 Ball	"	16	3.6	10	.2	? "
21 ~~19~~	Clev-AR17R	"	16	3.4	10	.2	~~0.1~~ "
~~22~~ ~~20~~	AR17	"	"	"	"	"	0.5 "
13 ~~21~~	LC-32	8" open stiff	16	3.6 KV	2.	.1	40 ft 4 cond #12
14 ~~22~~	"	"	"	"	2.	.2	Beautiful signal
15 ~~23~~	"	"	32	3.4	5.	.2	
16 ~~24~~	"	"	64	3.6	5.	.2	
17 ~~25~~	"	" weak springs	64	"	"	"	looks same.
19 26		8" Vinal	64	3.6	5	.2	looks great.
✓ 19 27		"	32	3.4	5	.1	? changes?
30 ~~28~~			16	3.6	?	.	? Due to water inside?





 Nov. 1, 1964. Analysis of Oct 31 Sonar tests.

Harold Edgerton

Double elect.

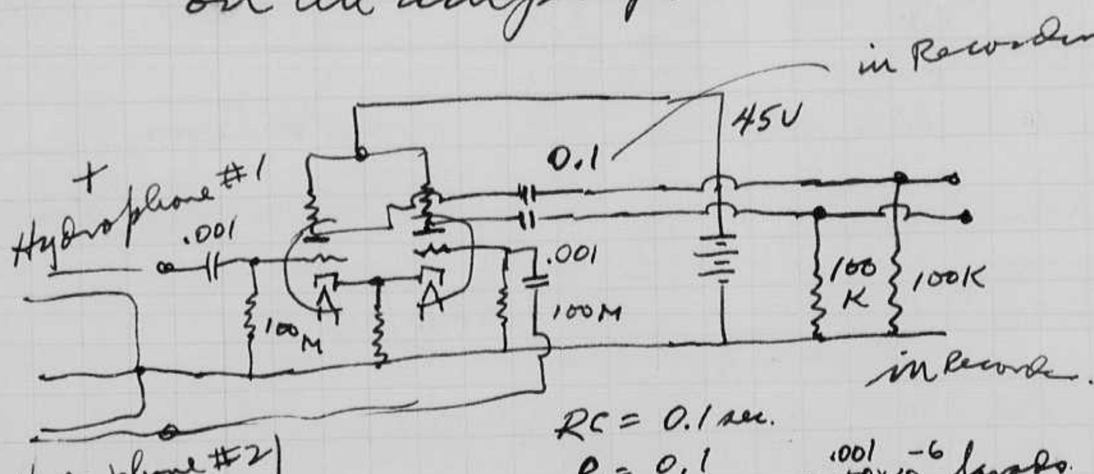
$f = \frac{2}{2\pi\sqrt{LC}}$

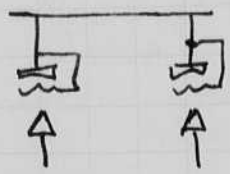
Osc. no.	Transducer.		p-p volts.	1/2 cycle time.	$f = 1/T$	
19	Square "1000 ws"	16 mfd	3.6 v	0.19 millisec	5260	
18	"	32	7.8	0.28 "	3660	
17.	"	64	7.2	0.4 "	2500	
24	8" open	16	7	0.11	9100	6200
25	"	32	9.5	.15	6670	2520
26.	"	64	13	.19	5250	1800

these were measured with an LC 32 hydrophone connected to a 5 meg input resistance amplifier Hewlett Packard type? Gain of 20 db = 10. The LC 32 has a 100 ft cable. The hydrophone was about 6 feet below the transducer. The transducer was about 2 feet deep.

None of these sources show the banding that is so evident in the seismic profile data. I am now suspicious of the amplifiers in the recorder or in the geometry of the booming set-up.

Apparently we need a high input impedance to hold up the low frequency signals. Also we may need a non linear signal compression to prevent overload on the amplifiers in the recorder.

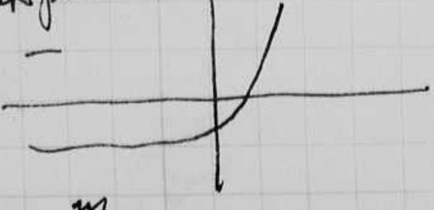




Variable gain?

$RC = 0.1$ sec.

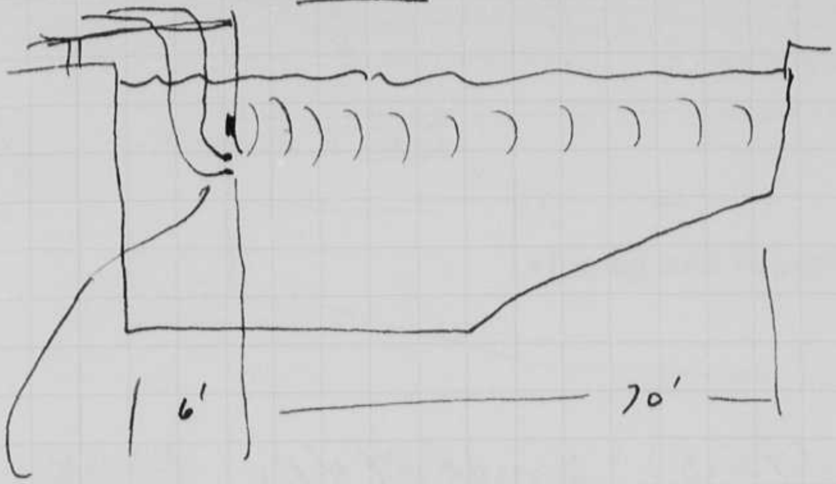
$C = \frac{0.1}{100 \times 10^6} = .001 \times 10^{-6}$ farads.

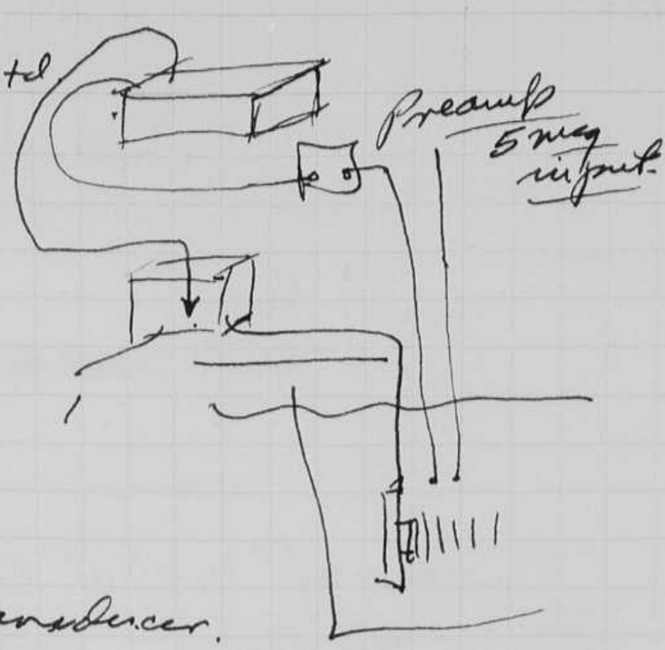


m

Proposed tests.

Boomer 8" at 16-32-64 mfd



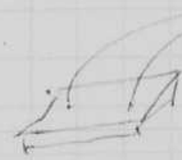


Push pull Hydrophones near transducer.

Measure C of Hydrophones.
" R of recorder input push pull.

See what recorder shows on the wall Bounce
amplifier problem ?.
Hydrophone problem ?.
Recorder problem ? Recorder $RC \doteq 5\times10^{-9} \times 10^{5} = 5\times10^{-4}$ sec 8 ball
$5\times10^{-9} \times 5\times10^{6} = 25\times10^{-3} = .025$ sec

	C.	D
8 ball -	4.6×10^{-9} f 4.6×10^{-9}	.014 .024 -
CH17AR	2.75×10^{-9}	.32
CH 17	$.26\times10^{-9}$ 2.45	3.8 4.0
LC32	8.6×10^{-9}	.007
LC57	6.65×10^{-9}	1.3
MP-8 Geo Space	20×10^{-9}	.04



1000 WS Boomer with plate
200 uh 2.1 Ω.

8" Boomer with the plate.
70 uh. 2.3 Ω

$T = 2\pi\sqrt{LC} = 6.28\sqrt{200\times10^{-6}\ 32\times10^{-6}} = 6.28\ 80\times10^{-6} = 500\times10^{-6} = .0005$ sec
1/2 cycle

200
6400
8
5024

1000 WS into 32 mfd.

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

6? negative strip(s) (inside loose envelope)

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.

 Nov. 1, 1964 Harold Edgerton. Analysis of Oct 31 Sonar test.

Double elect.

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Osc. No.	Transducer		P-P volts	1 cycle time		f = 1/T	
19	Square "1000 ws"	16 watt	3.6 V	0.19	millisec	5260	
18	"	32	7.8	0.28	"	3660	
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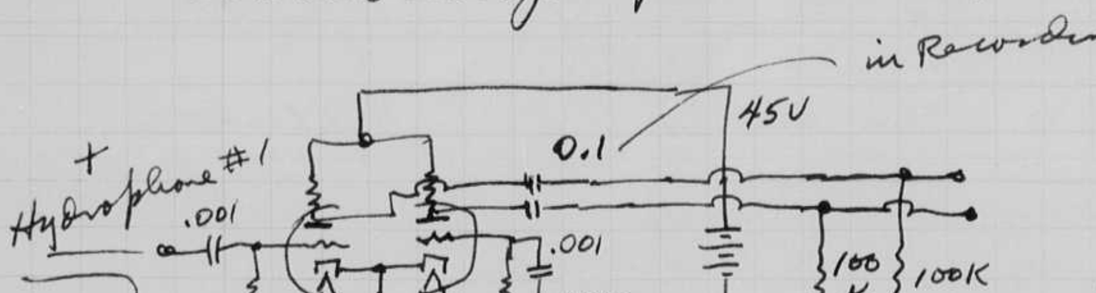

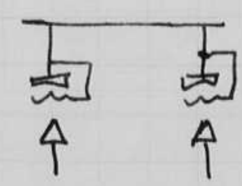

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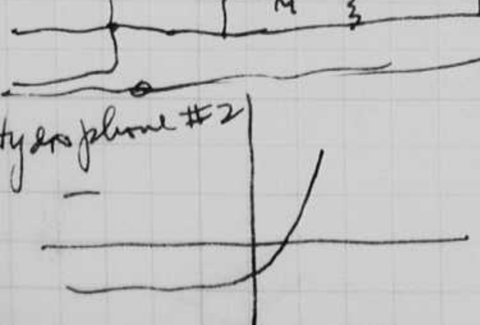
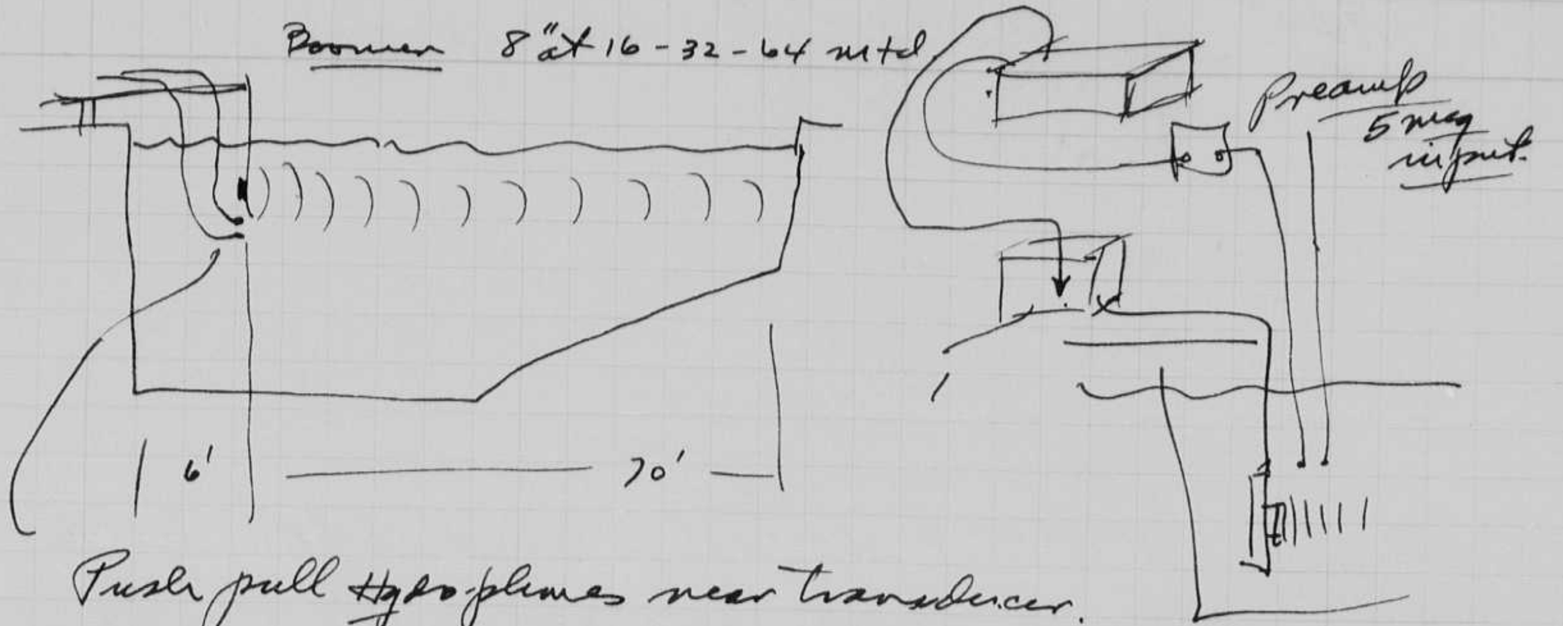


Proposed tests.



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Hydrophone problem.?
Recorder problem? Recorder $RC = 5\times10^{-9}\times10^{5} = 5\times10^{-4}$ sec 8 ball
$5\times10^{-9}\times5\times10^{6} = 25\times10^{-3} = .025$ sec

	C	D
8 ball -	4.6×10^{-9} f 4.6×10^{-9}	.014 .024 -
CH17AR	2.75×10^{-9}	.32
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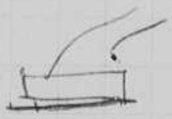
LC57	6.65×10^{-9}	1.3
MP-8 Neo Space	20×10^{-9}	.04

1000 WS Boomer with plate
200 uh 2.1 Ω.



8" Boomer with plate.
70 uh. 2.3 Ω

$T = 2\pi\sqrt{LC} = 6.28\sqrt{200\times10^{-6}\ 32\times10^{-6}} = 6.28\ 80\times10^{-6} = 500\times10^{-6} = .0005$ sec
1000 WS into 32 mfd. 64.00 5024 1/2 cycle

Notebook # 28

Filming and Separation Record

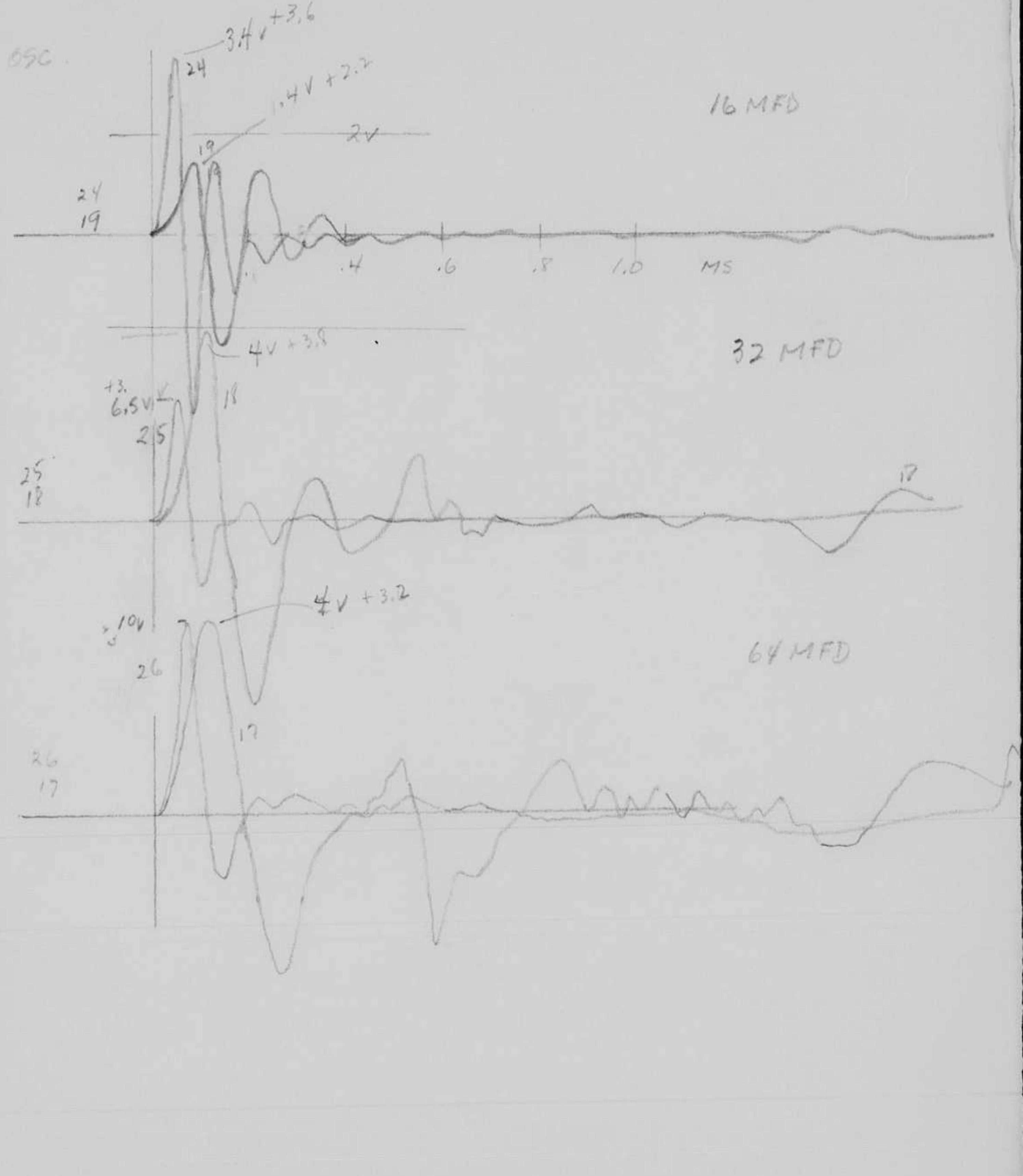
____ unmounted photograph(s)

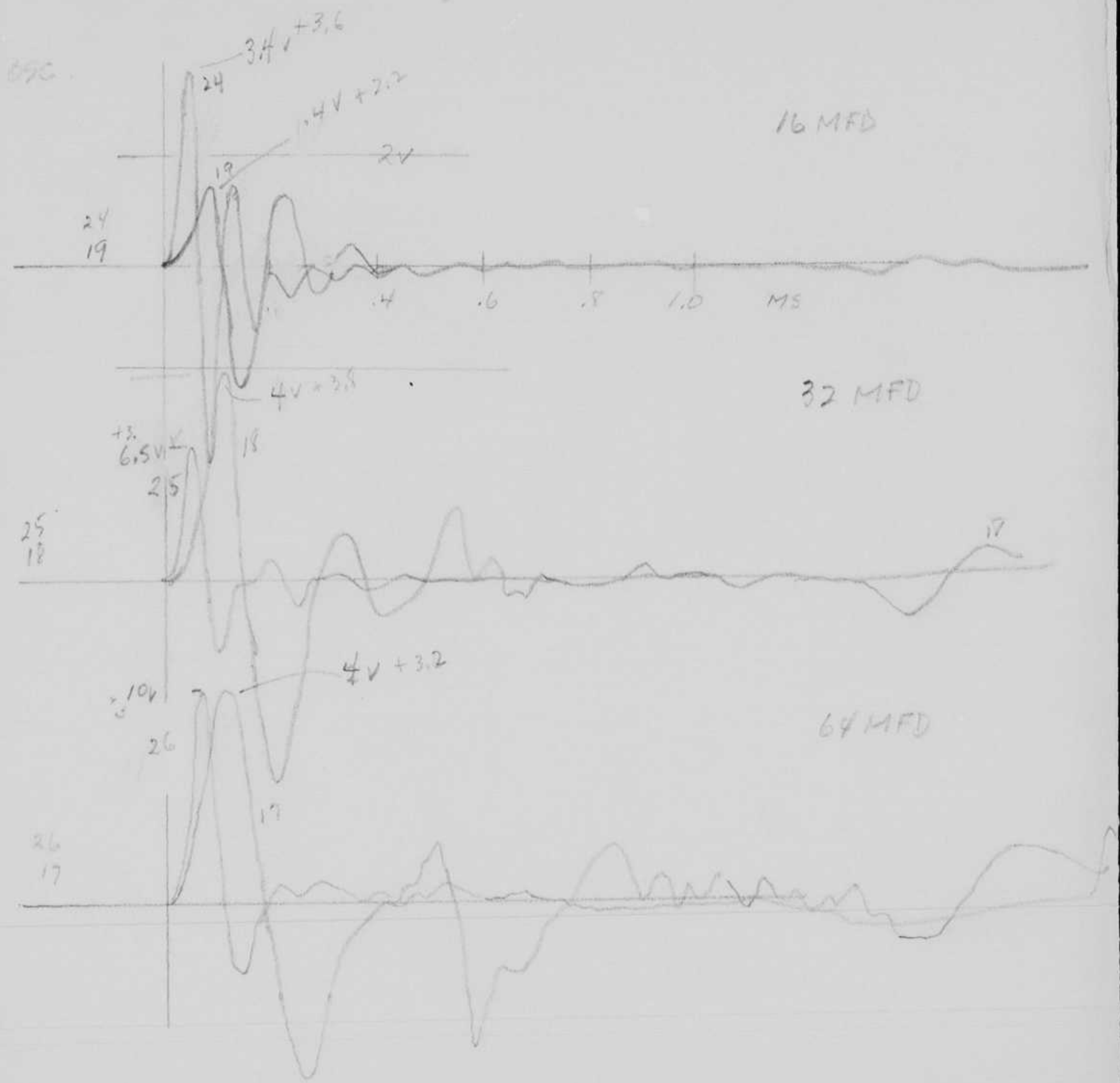
6? negative strip(s) (inside loose envelope)

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.


OSC.
16 MFD
32 MFD
64 MFD
3.4v +3.6
1.4v +2.2
2v
4v +3.8
4v +3.2
6.5v
10v
.4
.6
.8
1.0
MS



OSC.
3.4v +3.6
24
1.4v +2.2
16 MFD
2v
19
24
19
.4
.6
.8
1.0
MS
4v +3.8
32 MFD
+3.
6.5v
25
18
25
18
17
4v +3.2
10v
26
64 MFD
17
26
17

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

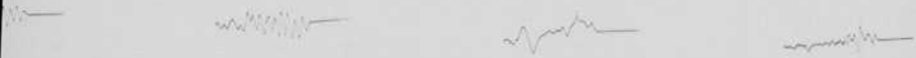
Boomers "1000 W's size 8"

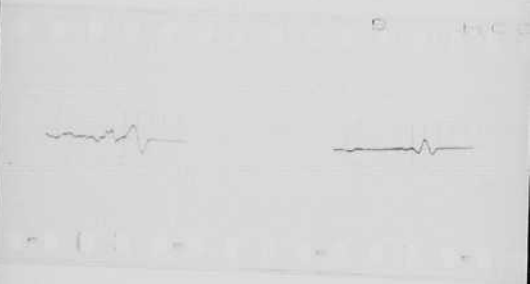
Oct 1964 M.I.T. Pool.
Prieger also.
N.B. Book 28 page 83.

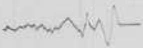
H. Edgerton
John Yules.
David Kettner.

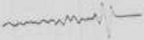
#10 Elo 0.1 ms/div .5V/cm
LC 57 hydrophone.

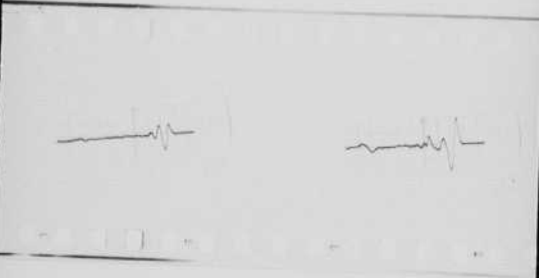
INTER-DEPARTMENTAL

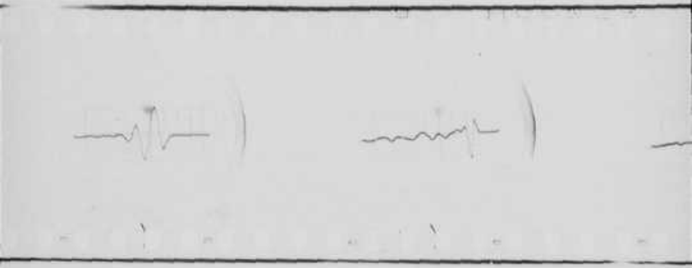


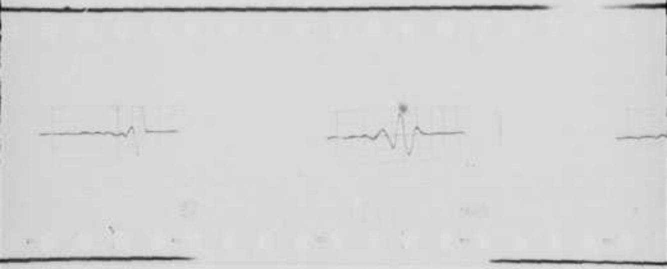


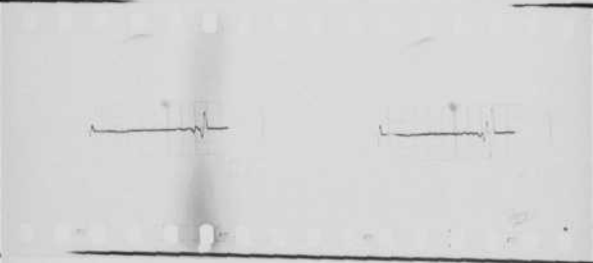


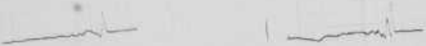












Notebook # 28

Filming and Separation Record

___ unmounted photograph(s)

3 negative strip(s) (inside loose envelope between page 86 and 87)

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

was/were filmed where originally located between page 86 and 87.

Item(s) now housed in accompanying folder.

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

H. Edgerton.

Boomers 8" water
1000 WS old type.

Nov. 2, 1964.
MIT Pool

P86 N.B. 28.

INTER-DEPARTMENTAL

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Filming and Separation Record

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Nov. 2, 1964.
MIT Pool

P 86 N.B. 28.

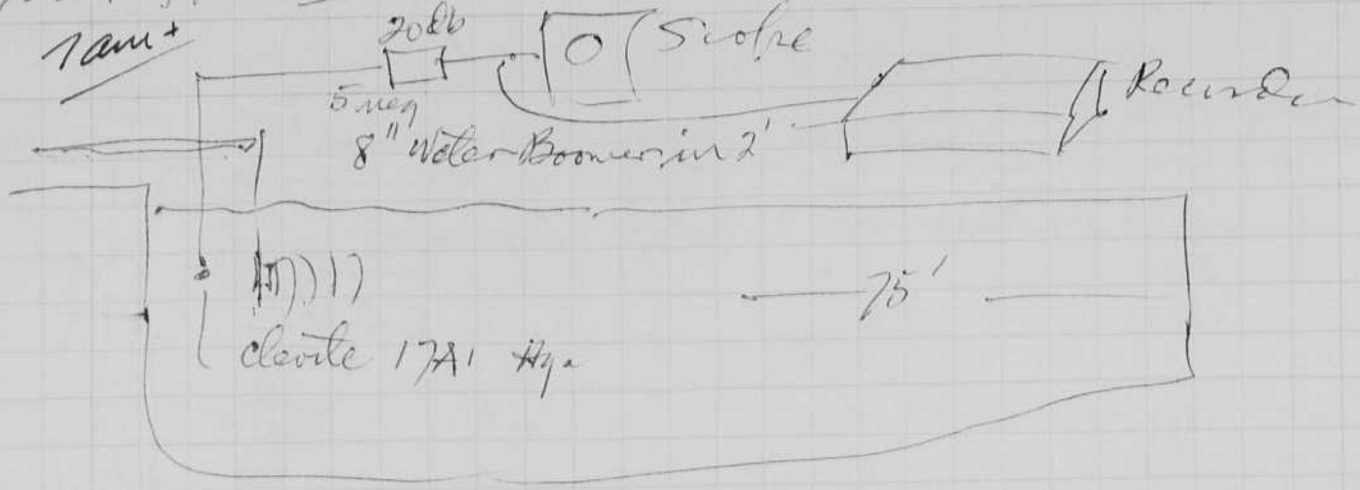
INTER-DEPARTMENTAL

[illegible]

[illegible]

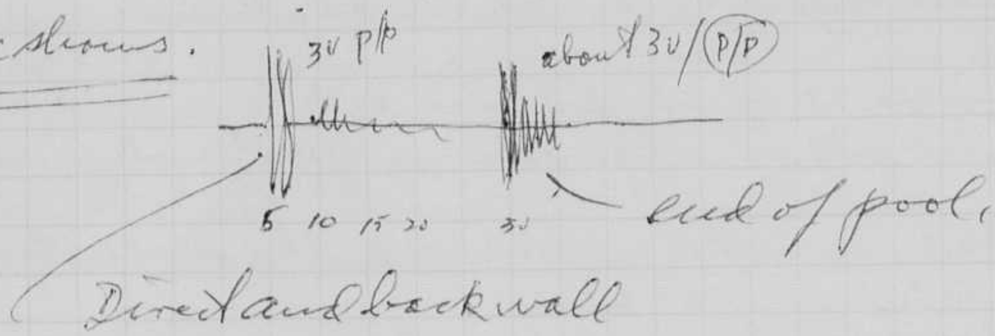
Nov. 2, 1964 Pool

1 am +



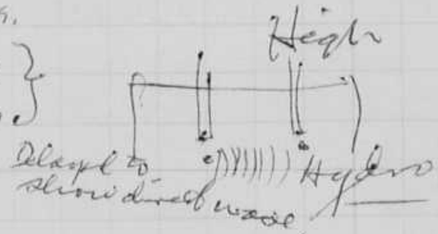
Recorder at 1 X 40 B.P. 250' (1 mil 5) 16 mfd at 4 KV 12 in/10 sec.

oscillations.



Osc

1	CL17A	8" Water	16 mfd	4 KV	1/sec	0.1 V/cm	5 ms/cm
2	"	"	"	"	"	"	"
3	"					"	1 ms
4	"					"	1 ms.
5	"					1V	1 ms }
6	"					1V	1 ms }
7	"	"	"	"		1	0.1
8 Blank							
9	"	1000 ws	"	"		.5	0.1
10	"		32			.5	0.1
11						.5	0.1 ms
12						.5	5 ms
13						.5	5

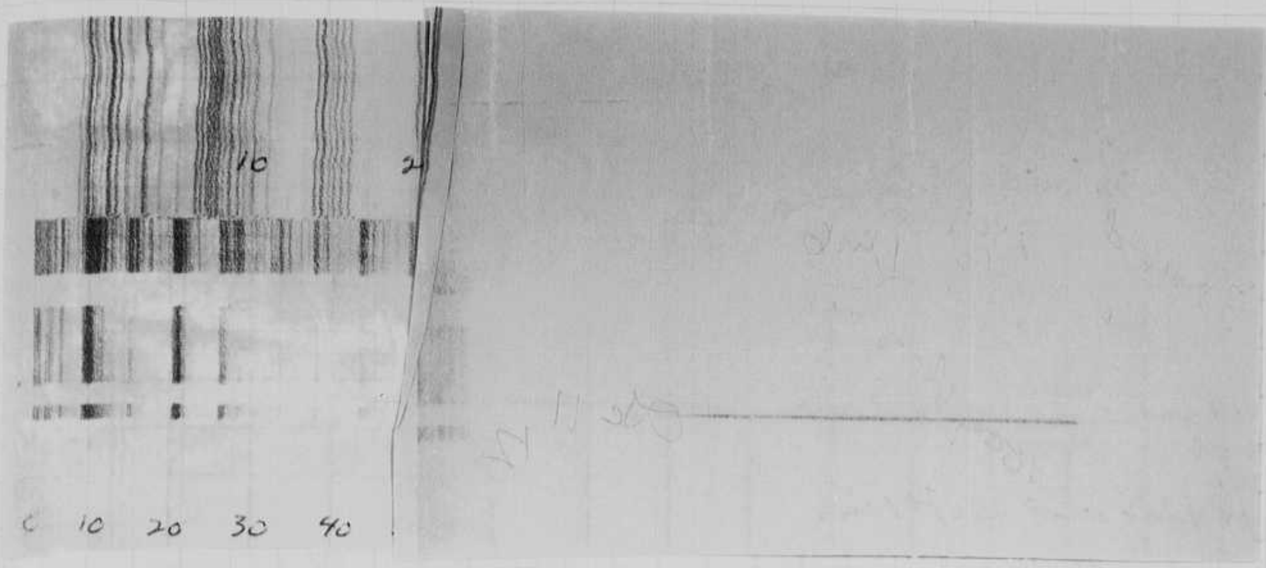


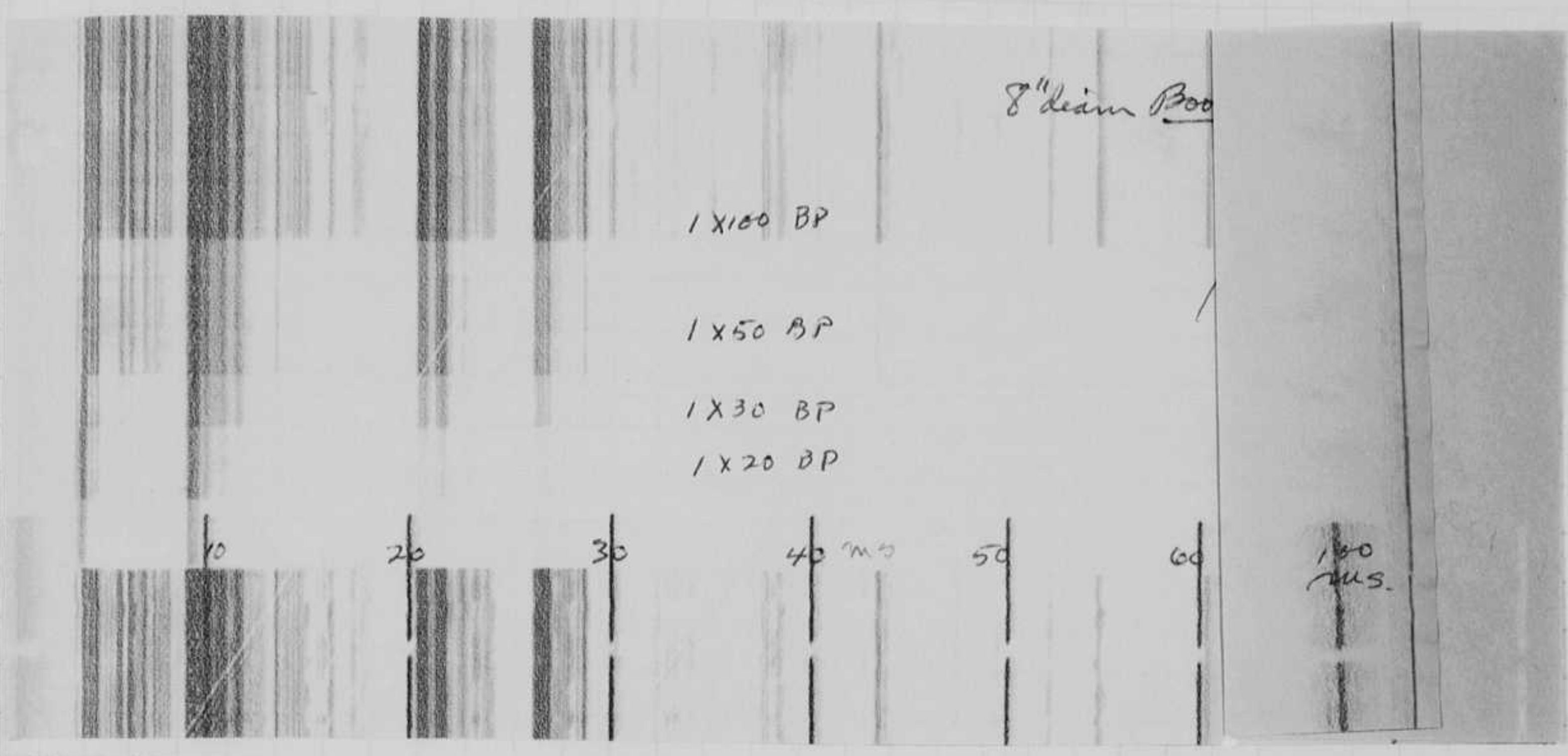
Nov. 2, 1964 8 pm Conclusions

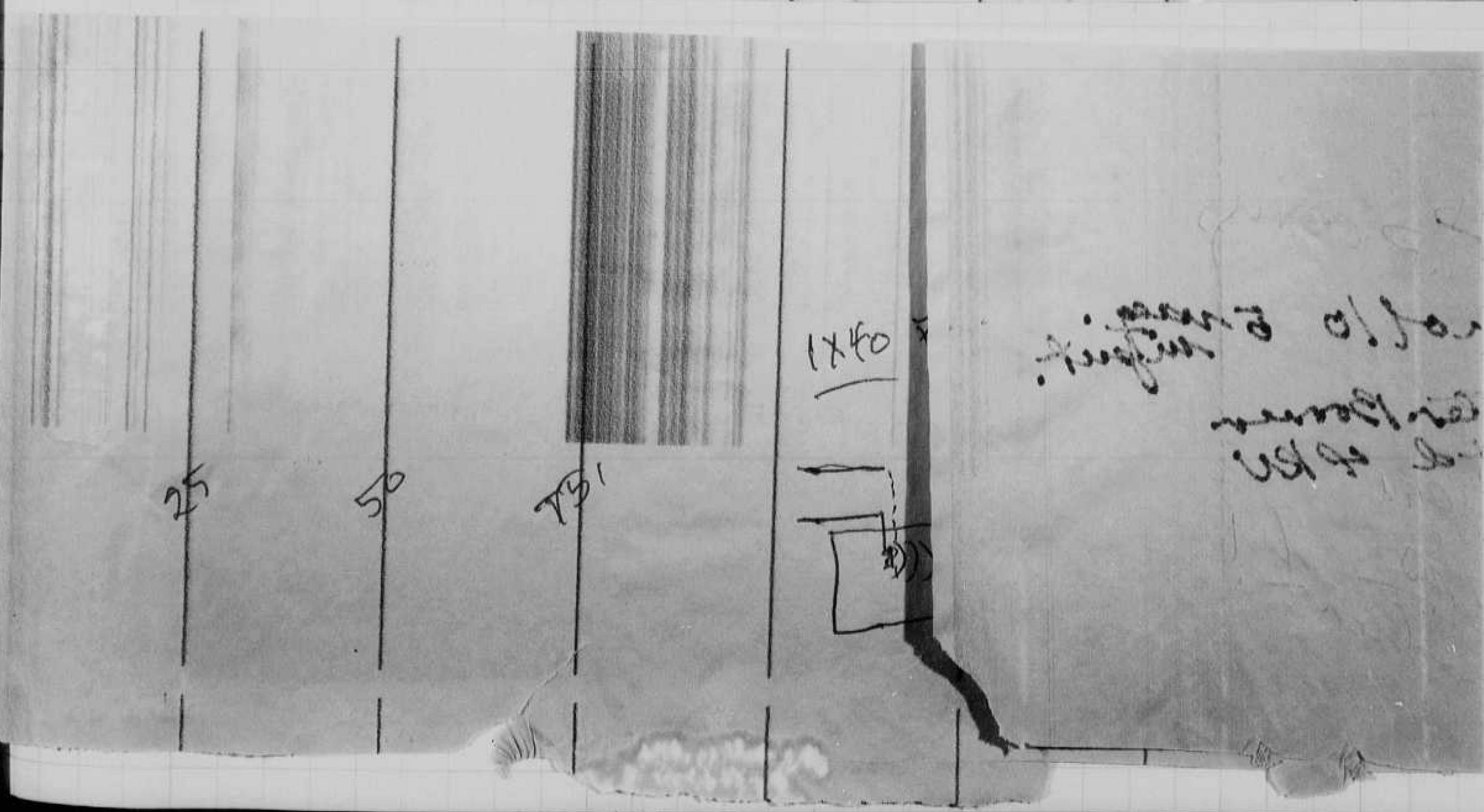
(1) The Transducers are directional. It is important to aim them at the subject!

(2) The hydrophones into 100 K have an RC of $\frac{1}{4000}$ sec. $2.5 \times 10^{-9} \times 10^{5} = 2.500 \times 10^{-4} = .00025$ sec. We should get the input R to 1 meg or greater.

(3). There may be oscillations in the structure of the Boomer holder. Suggest damping of edge of the plate.

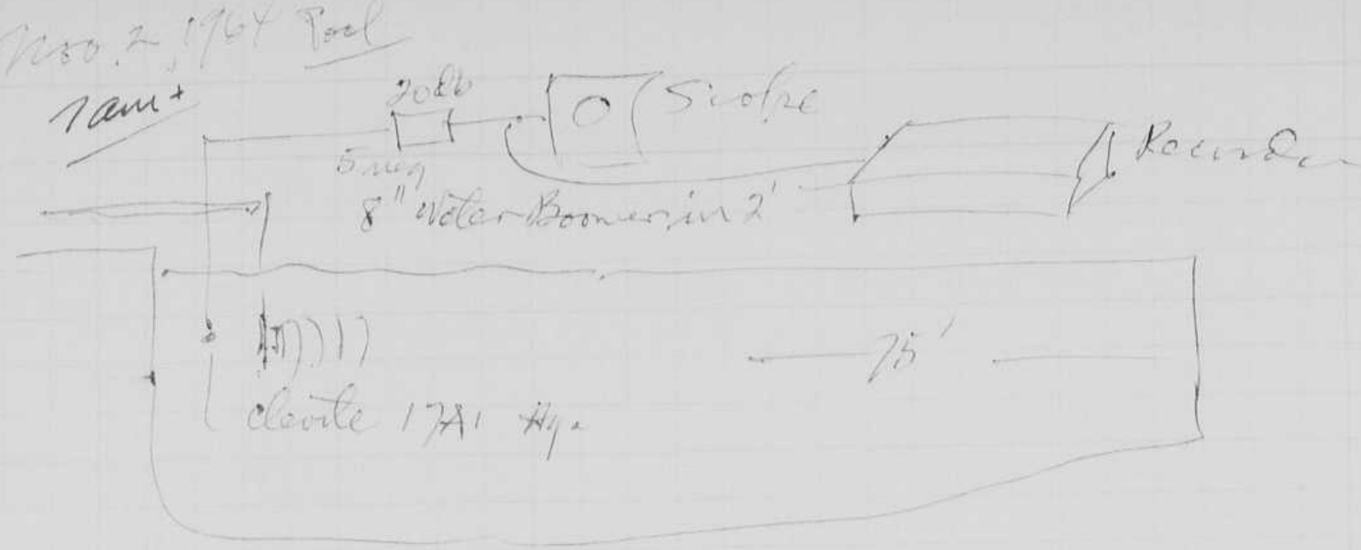

10
c 10 20 30 40


8" diam Boo
1 X100 BP
1 X50 BP
1 X30 BP
1 X20 BP
10
20
30
40 ms
50
60
100 ms.


1X40
25
50
75

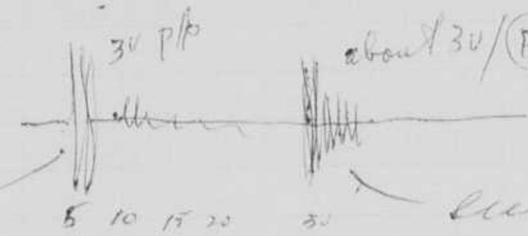
Nov. 2, 1964 Pool

1 am +



Recorder at 1 X 40 B.P. 250' (1 ms) 16 mfd at 4 KV 12 in 10 sec.

oscillations.

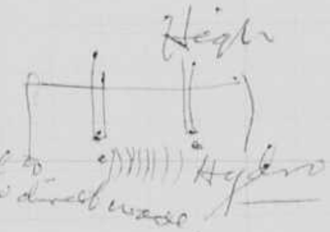


end of pool.

Direct and backwall

Osc

1	CL 17A	8" Vetter	16 mfd	4 KV	1/sec	0.1 V/cm	5 ms/cm	
2	"	"	"	"	"	"	"	
3	"					"	1 ms	
4	"					"	1 ms.	
5	"					1V	1 ms	
6	"					1V	1 ms.	
7	"	"	"	"		1	0.1	Changed to show direct wave.
8	Blank							
9	"	1000 WS	"	"		.5	0.1	
10		"	3?			.5	0.1	
11						.5	0.1 ms	
12						.5	.5 ms	
13						.5	5	



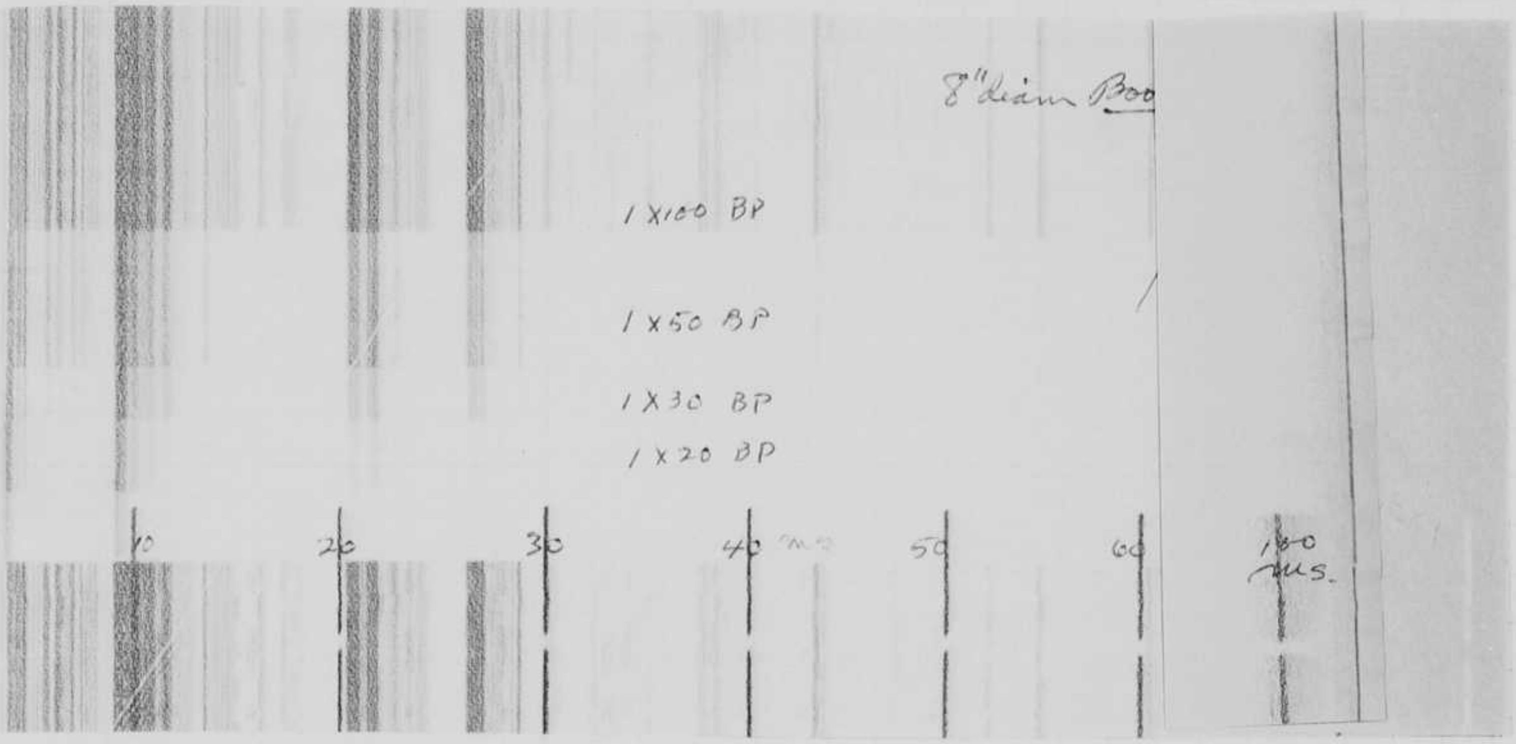
Nov. 2, 1964 8 pm conclusions

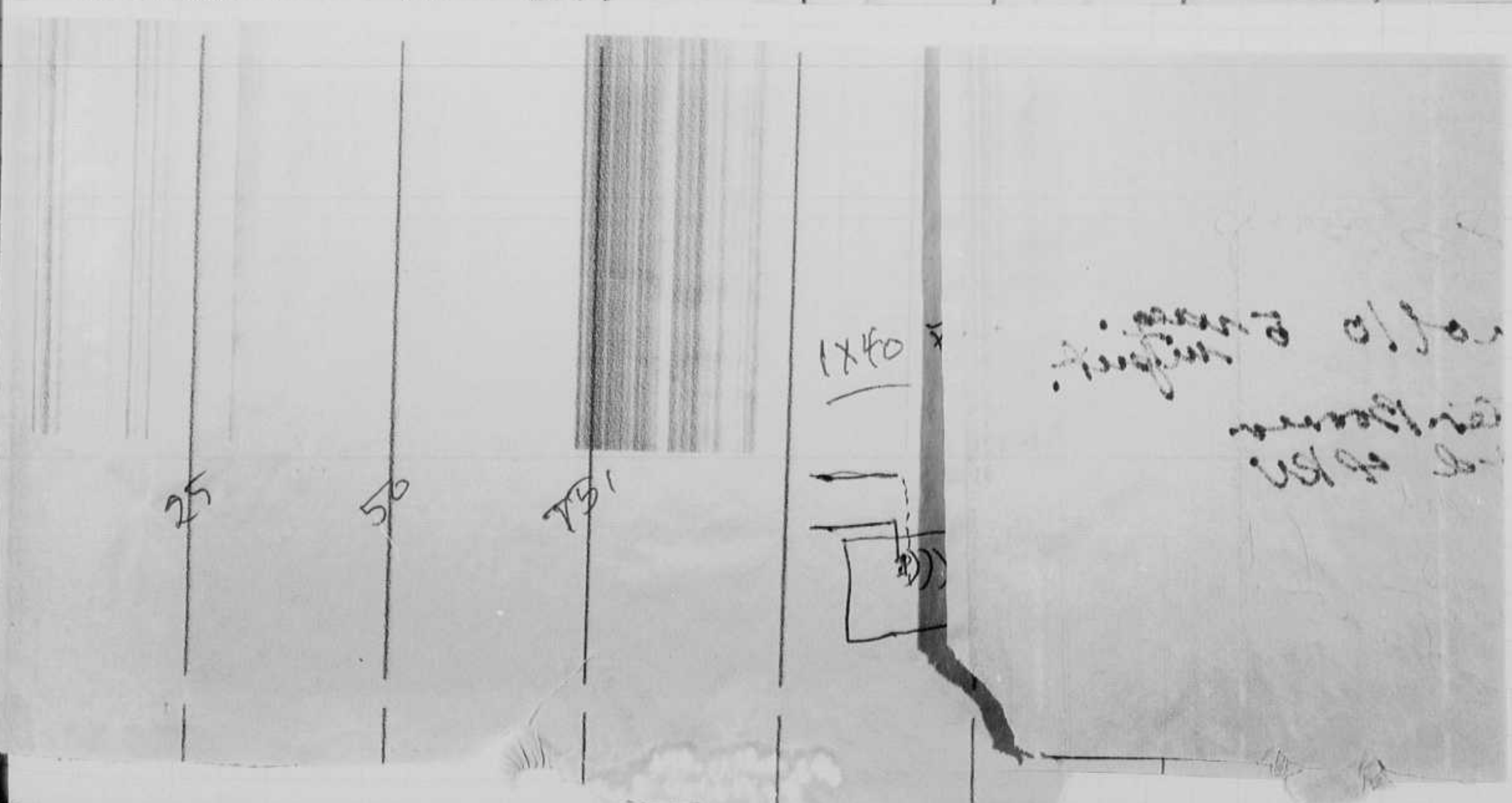
(1) the transducers are directional. It is important to aim them at the subject!

(2) The hydrophones into 100 K have an RC of $\frac{1}{4000}$ sec. $2.5 \times 10^{-9} \times 10^{5} = 2500 \times 10^{-4} = .00025$ sec. We should get the input R to 1 meg or greater.

(3). there may be oscillations in the structure of the Boomer holder. Suggest damping of edge of the plate.

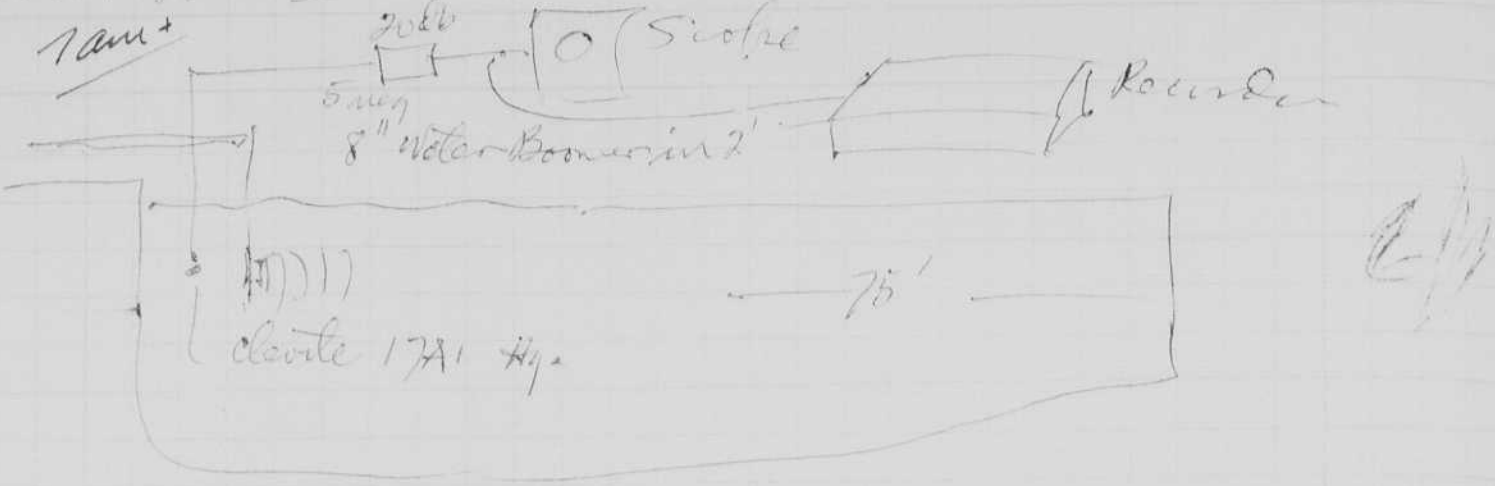

10
10 20 30 40


8" diam Boo
1 X 100 BP
1 X 50 BP
1 X 30 BP
1 X 20 BP
10
20
30
40 ms
50
60
100 ms.


1X40
25
50
75

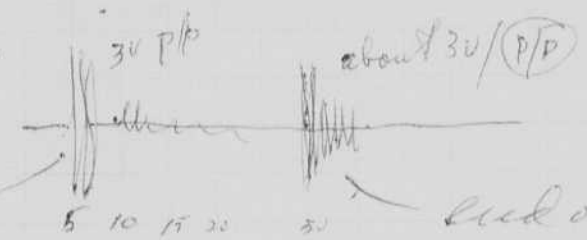
Nov. 2, 1964 Pool

1am+



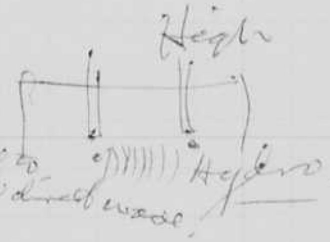
Recorder at 1X40 B.P. 250' (1 in 5) 16 mfd at 4KV 12 in 10 sec.

oscillations.



Osc

1	CL17A	8" Water	16 mfd	4KV	1/sec	0.1 V/cm	5 ms/cm	
2	"	"	"	"	"	"	"	
3	"					"	1 ms	
4	"					"	1 ms.	
5	"					1V	1 ms }	
6	"					1V	1 ms. }	
7	"	"	"	"		1	0.1	Delayed to show direct wave.
8	Blank							
9	"	1000 ws	"	"		.5	0.1	
10		"	32			.5	0.1	
11						.5	0.1 ms	
12						.5	5 ms	
13						.5	5	

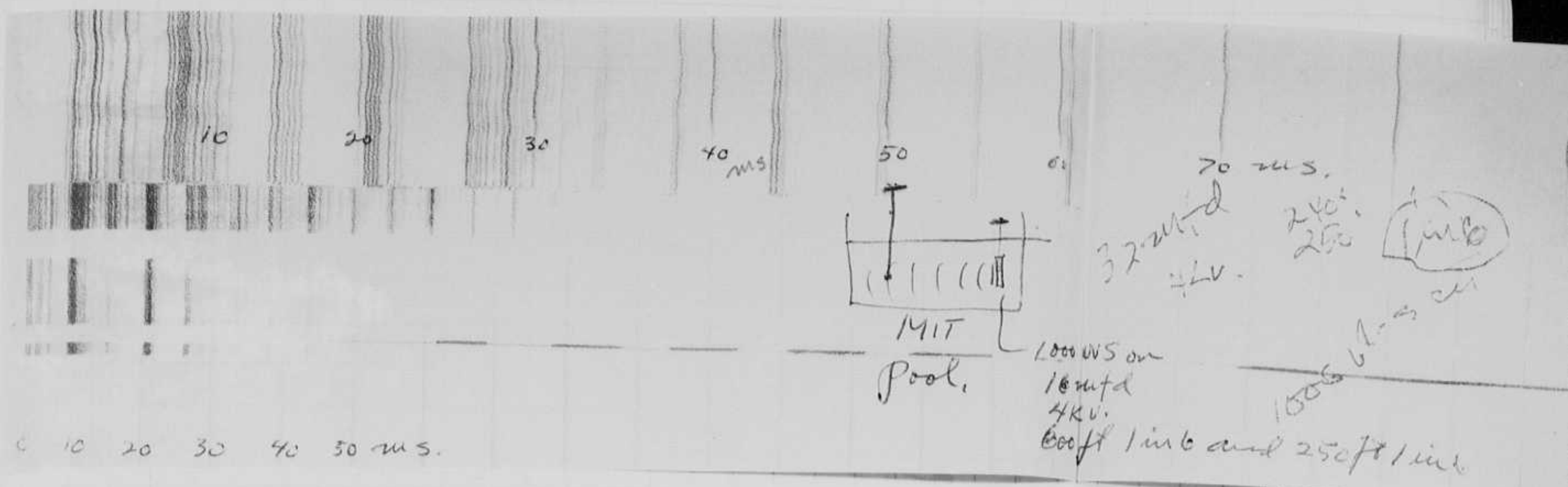


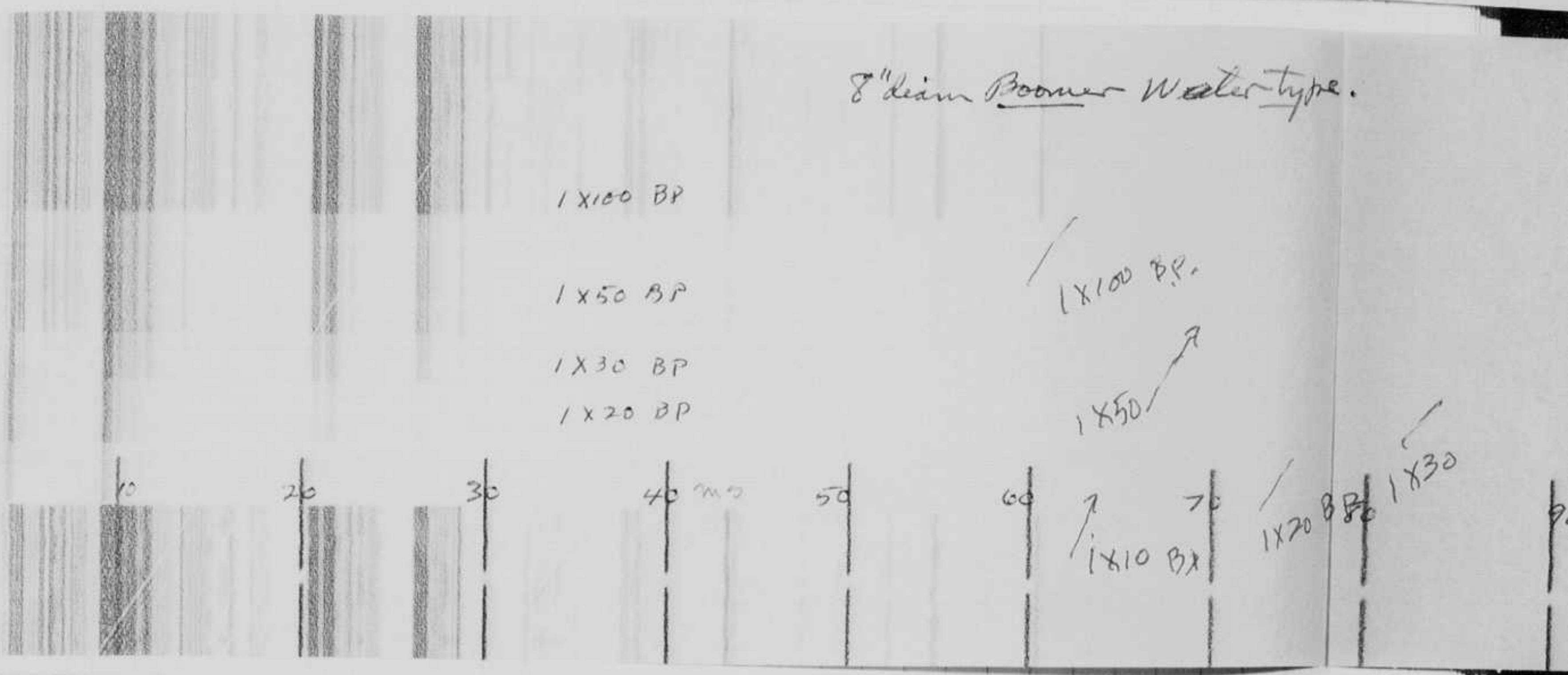
Nov. 2, 1964 8pm Conclusions

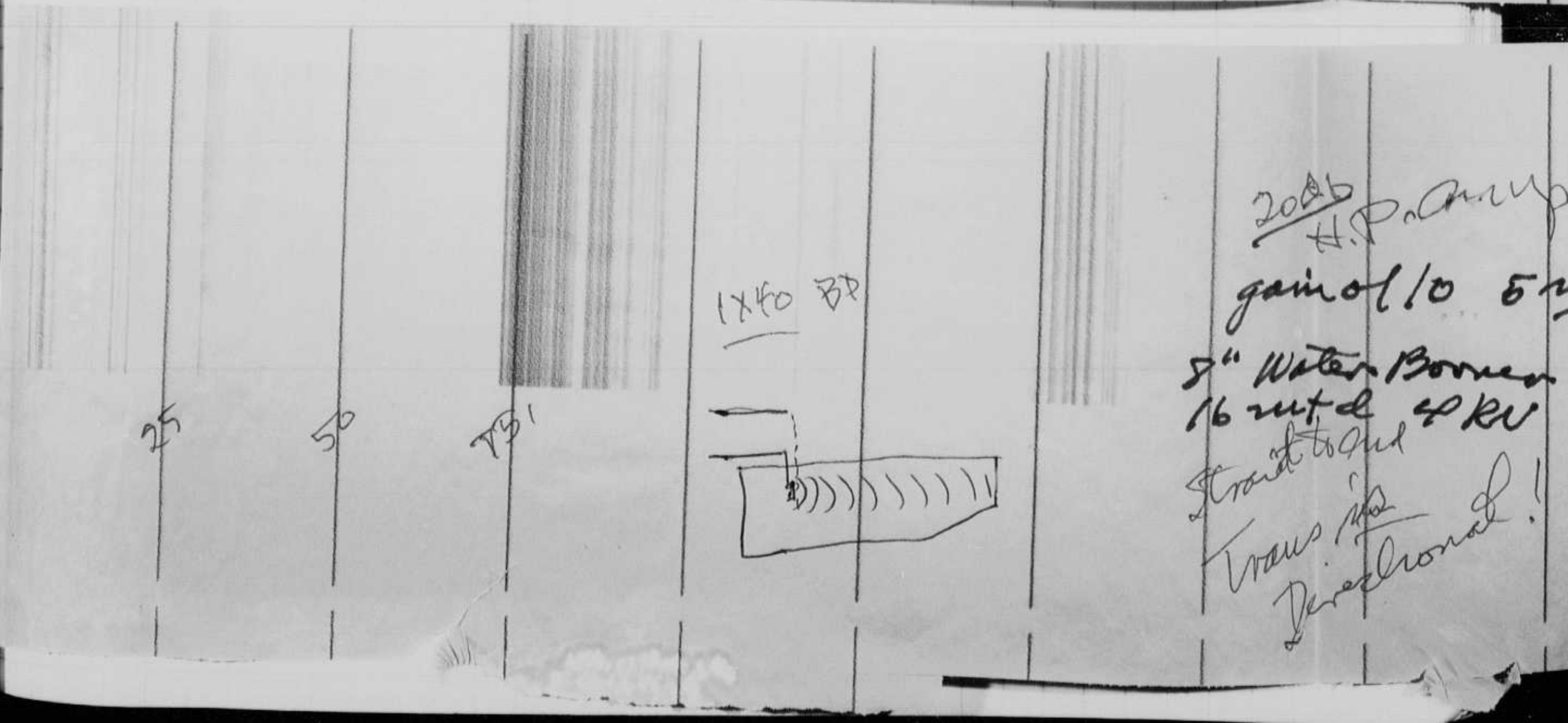
(1) the transducers are directional. It is important to aim them at the subject!

(2) The hydrophones into 100K have an RC of $\frac{1}{4000}$ sec. $2.5 \times 10^{-9} \times 10^{5} = 2.500 \times 10^{-4} = .00025$ sec. We should get the input R to 1 meg or greater.

(3). there may be oscillations in the structure of the Boomer holder. Suggest damping of edge of the plate.

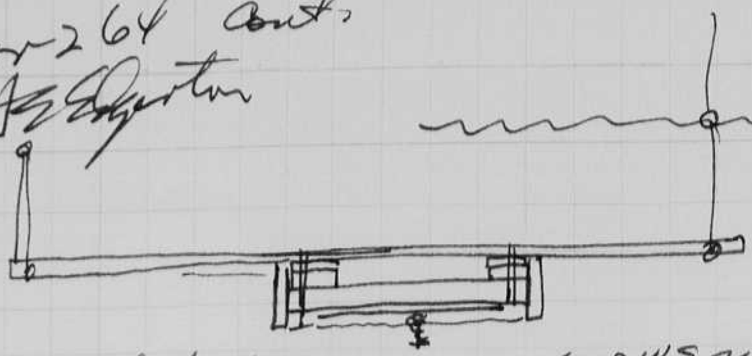

10
20
30
40 ms
50
70 ms.
32 mfd
4 KV.
240'
250'
1 in 6
MIT
Pool.
1000 WS on
16 mfd
4 KV.
600 ft 1 in 6 and 250 ft 1 in.
0 10 20 30 40 50 ms.

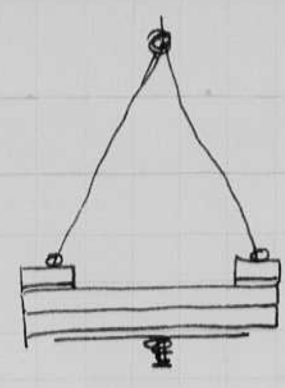

8" diam Boomer Water type.
1X100 BP
1X50 BP
1X30 BP
1X20 BP
10
20
30
40 ms
50
60
70
1X100 BP.
1X50
1X10 BX
1X20 BP
1X30


1X40 BP
25
50
75
20db
H.P. Amp
gain 1/10
8" Water Boomer
16 mfd 4 KV
Trans is
Directional!

Nov 2 64 cont.

H E Edgerton





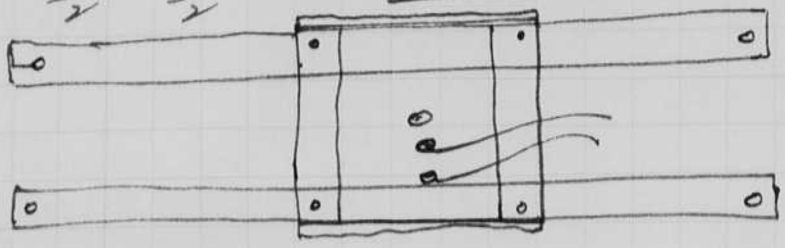
1000 WS model.

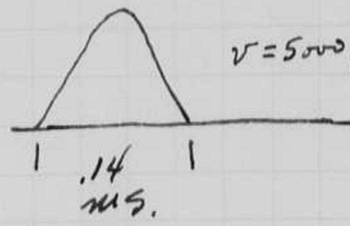
32 mfd at 4KV

$\frac{CE^2}{2} = \frac{32}{2} \times 4^2 = 256$ watt sec

2 ft

$v = \frac{d}{t}$





$v = 5000$ ft/sec.

$d = vt = 5000 \times .14 \times 10^{-3}$

$= 5 \times .14$

$\underline{\quad 5}$

$.70$ foot.

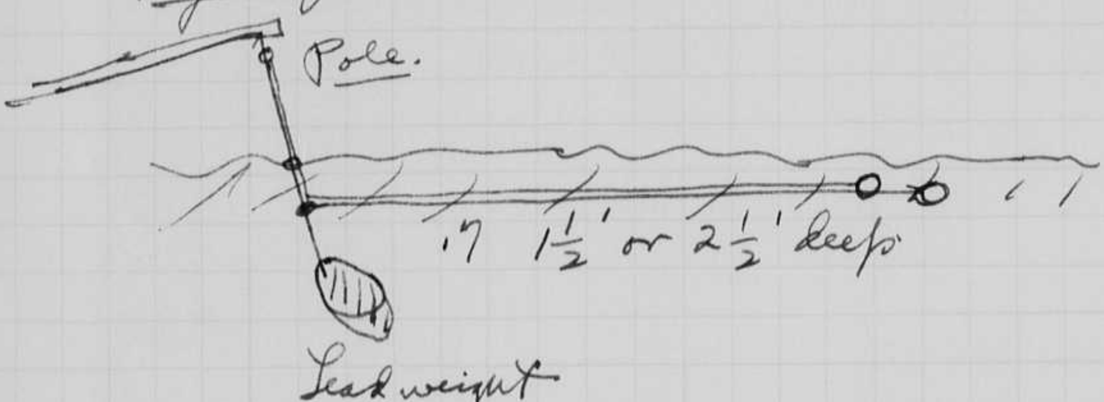
wave length = 1.4 ft.

.7 ft   1/2 wave

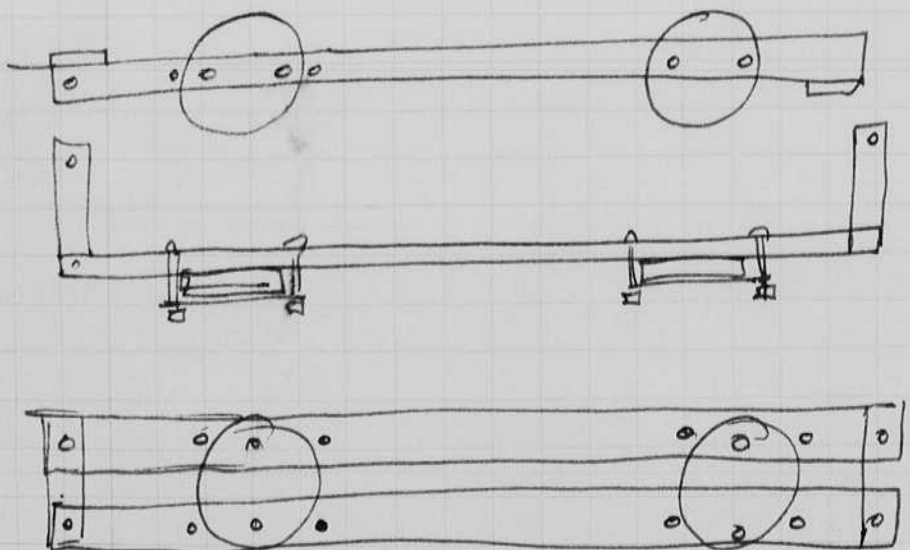
2.1 ft.   1 1/2 "

3.5 ft   2 1/2 "

1M Hydrophone.



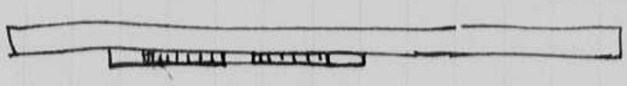
8" Boomer.



E

1 cycle in 0.3 ms

f = 3330 ~

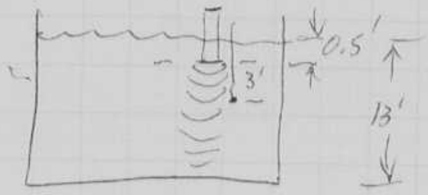


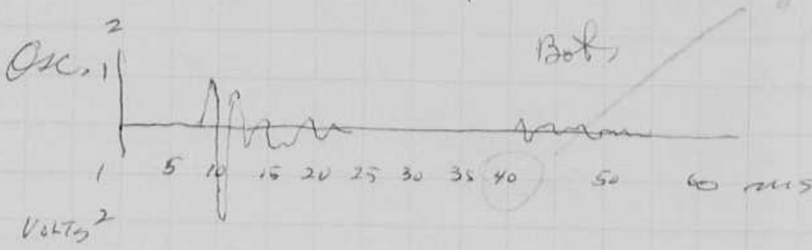
HE

Nov. 4 1964 Wed MIT Pool 730 am. Test on 7' 2X4 boards with 1000 WS Transducer

240' scale on Recorder. 10 ms timer.
1 X 50 B.P. CL 17A. 3 ft below

Shunted by 4 ms





254 Recorder all records ok at 1 X 100 2nd bot

.5 volt ok 1 X 10
but no reflection

1st bottom weak. 1 X 20

Osc #								
1	CL17A 1000WS	32 mfd	on scale. 3.2KV.	1.2/sec ± 600' scale 1 in 3	2V	0.5 ms.	6" Trans depth	
2					2	0.1	"	
3					2	0.1	"	
4		64	"	" " 1 in 6	2	0.1	"	
5		64	"	" 1 in 6	2	0.1	3 ft deep	
6.		"	"		2	0.2	3 deep	~~Hydro 4' 3' below~~ 4'/24
7		"	"		2	~~0.1~~ ~~0.2~~ .2 (ok)	3 deep	~~Hydro at 3 ft~~
8		"			2	0.1		
9		"			5	0.2		

a (X10) 20 db HP amp was inserted signal looks same on scope

11:15 am.

10		16	Scale 3.8V	(120' scale 1 in 6)	0.2	0.2
11		32		240' / in 6	~~1~~ VOLT	0.1
12		32		"	1	0.1
New supply #8 13	1000 WS CL17A at 3 ft	16	meter 2.5 KV		2 V	.1 ms	8" deep
14		32	2.5		2	.1
15		64			2	.1
16		64			5	.1
17		96	2.4		5	.1
18		128	2.5		5	.1
19		160	2.5		5	.1

Reads low

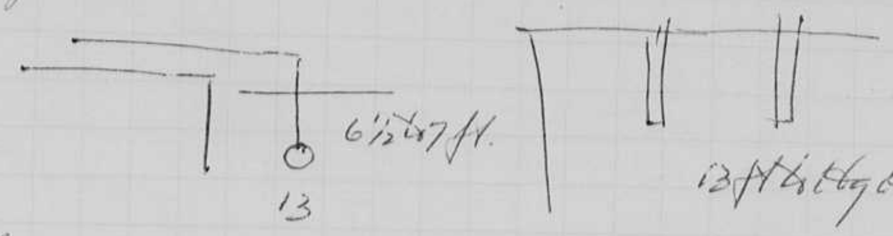
Trip to Europe
July 26 - September 16, 1964

Kiel, Germany: August 15	Week of work with Dr. Eugene Seibold, University of Kiel; Dr. W. Ohle, Max Planck Instit, Plon, Germany; Dr. Kurt Wollbrecht, Dr. Eckard Walger, and many others, in Kiel Canal, Eckenforder Bay, Kiel Bay, etc.
Korser, Denmark: August 25	Made observation trip on AGILE, American Mine Sweeper, to see Mine Classification Sonar CMK 1X (C) in action. R. C. Stanley, Jerry Salzman, Robert Gustasen, Quigley, Israel (Westinghouse). Many of these people were from the Panama City Navy Station in Florida. Navy Contract with Westinghouse NOBS 77074, 1 February 1964. The equipment was being demonstrated in England, Denmark, France to NATO Naval Officers as possible operational equipment to search for mines.
La Spezia, Italy August 31	Worked sonar penetration equipment in the harbor with Dr. Lloyd Breslau at SECLANT ASW Base (NATO). Repaired and adjusted Boomer and Sparker.
Monaco: Sept. 7	Worked with O. Leenhardt on Boomer, Sparker and Mud Penetrator.
Dover, England: Sept. 14	Attended Conference as EG&G representative at Tunnel meeting in Dover.
Sept. 16	Returned to Boston My recorder, Type 254, and pinger were left in Monaco. Dr. Breslau took them to La Spezia for further experiments. The equipment was returned on October 19, 1964, to Boston.

Nov 11 1964
H. E. Edgerton
Bill Pope
Dave Kattner
Steve Mrodzinski

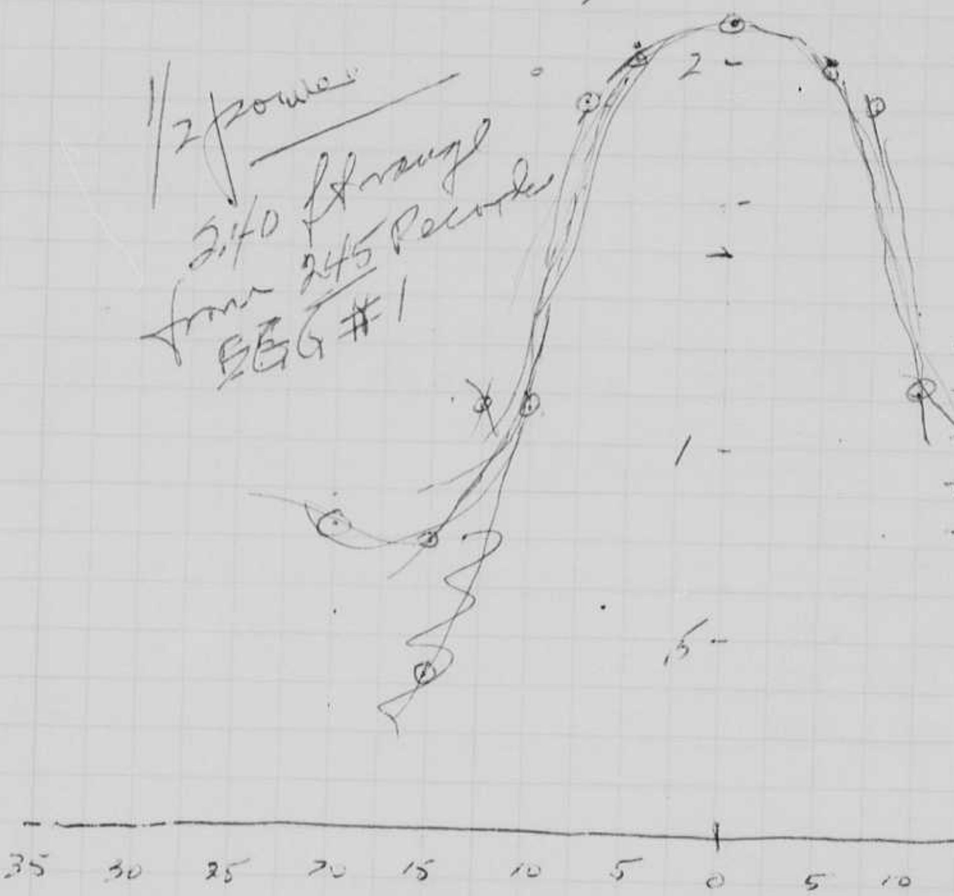
M.I.T. Pool.

Chinese Hat. angle meas.



13 ft to hydrophone KC 57

Scope 545 # 1 meg 20 μμf. 9059 scope.



Zero to 13 ft KC 57

0	2.2 volts p to p.		
-5	2.1	0	2.1
-10	1.9	5	2.
-15	.85	10	1.3
-20	.85	15	.75
-25	.8	20	.40
-30	.75	25	.4
-40	.45	30	.3
-60	.2	60	.1
-180	.01		

neg. counterclockwise

0	2.2 v		
-10	1.2	+10	1.6
		+10	1.3
-10	1.2	+10	1.4
-5	2.	+5	1.9
-7.5	1.75	+7.5	1.
-15	.75	+15	.9
-20	.8	+20	.6

Cone

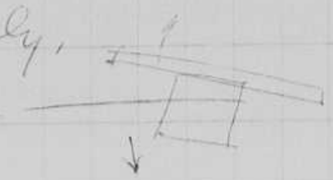
Oscillograms #13 ~~Full scale~~ 1 V/cm Full ping 600 scale
type 545 # 58623. 0.2 ms/cm
#14. same but 1/2 ping.
#15 repeat.

13 feet to KC-57.

Cone removed from the transducer — 1/2 power 0.6 volts. #17 0.5 V/cm 0.1 ms/cm.
1 power .99 volts. osc #16 0.5 V/cm 0.1 ms/cm.

Transducer only.

zero



75 ft - 6 in Pool to far wall
1 X 100 full power to see for wall only
1 X 350 for 2nd.

No Reflector

½ power 0 -	0.55		
-5	.56	+5	0.56
-10	.52	+10	.54
-15	.44	+15	.48
-20	.40	+20	.42
-30	.35	+30	.28
		+30	.29
-40	.33	+40	.23
-50	.30	+50	.19
-60	.22	+60	.22
-70	.16	+70	.24
90	.		
120	.14		

1 power.

0	1.0		
-5	.95	+5	.975
-10	.82	+10	.95
-20	.70	+20	.70
-30	.60	+30	.48
-40	.56	+40	.40
-50	.48	+50	.34
-60	.36	+60	.36
-70	.28	+70	.4
-80	.24	+80	.38
-90	.	+90	.32

2.6 · 0° at 16 mfd (2.6) means 4 KV. 8" Square plate Boone.

$\frac{CE^2}{2} = 8 \times \frac{16}{8} = 124$ watt sec.

2.2 at 1 mfd .400. = $\frac{CE^2}{2} = \frac{1}{2} \times .16 = .08$ watt sec.

$\frac{124}{.08} = 150$ ratio of efficiencies.

Nov. 13, 1964.
H.E. Edgerton

Old coil 0.16 Q = 14. thicker wire

0.18 mh Q = 2.7 2 coils in Series subtractive. ~~additive~~. 70 turns copper $7\frac{1}{2}$"

1.64 Q = 1 2 coil in Series additive

.43 ~~.043~~ Q = .08 A coil one only

.430 mh. ~~.042~~ Q = .08 B coil one only.

.450 Q = 20 A coil.

~~0.016~~

0.16 Q = 3.2

~~.156~~ Q =

.125 Q = 6. A coil with al plate

Coil tests	35 oz coil in series subtractive	jumps 3"	105.
16 mfd. 4 KV tests	$9\frac{1}{2}$ oz. al plate Round soft	jumps 9.5 20"	190.
	35 oz coil Shorted.	19.5 4"	140

LC-50 — Repair Hydrophone 5.07 ~~mμf~~ = 5070 μμf.

50 ft of cable 1.69 ~~mμf~~ μμf = 1690 μμf
6760 Total.

$RC = 10^5 \times 6{,}760 \times 10^{-12} = 6{,}760 \times 10^{-4}$ sec. (10^5)

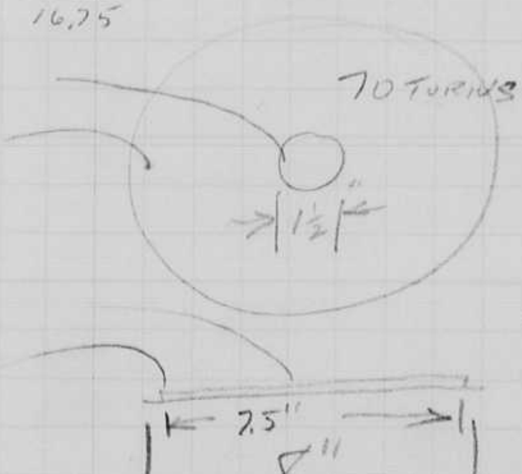
$= 10^6 \times 25 \times 6{,}760 \times 10^{-12} = 16.75 \times 10^{-2} = 0.167$ sec.

6.7
2.5
335
134
16.75

Final job
Nov 14 64
50 ft. 6700 μμf.
.0045 = D.

LC 57 ✓
~~6500 μμf~~
D = 1.6 ??
~~C = 4000~~
D = 1.7

70 TURNS 3/16" × 1/32" copper D.C.C.



Open L = 445×10^{-6} h Q = 22. R = .124

Al plate L = 134×10^{-6} h Q = 1.65 high scale (3)

Shorted Second coil. L = 154×10^{-6} Q = 2.8 high scale.

2 coils in Series opposed (Inside to outside) L = 195×10^{-6} Q = 2.1 high scale.

2 coils series add. L = 1580×10^{-6} Q = 34.

Nov 15 1964
H. Edgerton

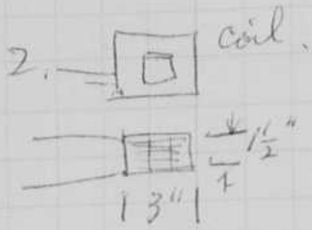
Boomer (Small) experiments.

445 μh Q = 22

1. new Coil of 3/16 × 1/32 copper 70 turns 7½" diam 1½" center hole

Flat coil	7 oz alum Disc 8"	1 meter high	16 mfd 4000 v	
Pancake	9 oz. " "	62 cm	" "	2.6 on meter of Blue unit

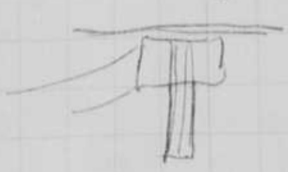
2. coil. L = 1730 μh Q = 20 7/8" square hole #14 wire. ~~15 turns~~ 15 layers



7 oz alum plate 150 cm.

9 oz 120 cm.

with laminations 7 oz al plate 220 cm 200

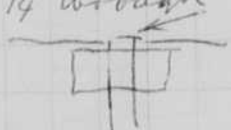


9 oz " " 200 cm.

It appears that the ~~steel~~ laminations of iron do some good.

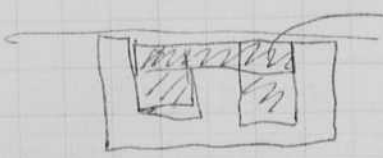
flush 9 oz with 1 3/8 hole 135 cm } Not accurate!

¼" through



9 " " " 145 "

7" oz plate 280 ~~meter~~ cm

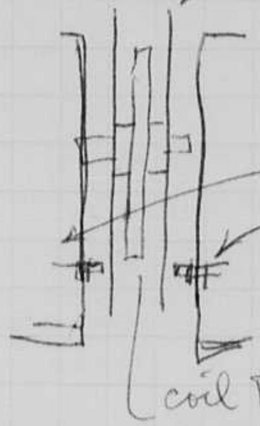


T1080 coil and core

Boomer as Bell

25" Plates of Alum. 1/2" thick.

128 to
1000 WS at 4KV
16 to 160 mfd.



Bolts lift when the
plates are repelled.

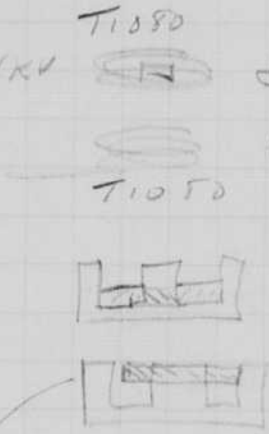
coil Double.

Plates ring
when they lift the
bolts.

2" Between plates

This is a wonderfull Bell. I plan to in stall it
at Bedford out side of the administration Bldg.

Nov 17 1964



T1080

16mfd 4KV — Iron Core — 70g — 260 cm — 3000uh. 40?

without iron — 70g. — 200 cm — 2700uh. 70=?

T1050

11,500uh 40

← at top

5,300uh

Primary Coil T1080 now sealed with plastic with
Iron in center.

Dec 5 Photo on p 113

A bell made in 1864 for the U.S.
Lighthouse service was purchased
from Robt "Abab" Caron on Dec 1 1964.
The bell was delivered to Bldg 20 at
M.I.T. where I have it on a chain hoist
The bell weighs 485 pounds.

 Nov. 28, 1964 FX33 lamp tests. for Humming Bird equipment
Harold Edgerton
Bill MacRoberts.

Pickup #1 929 with filter

Scale
1 Time ½ sec exposure. Steady Signal
2 11 one sweep of signal Intensity at 5. 1 ms/cm 50 v/cm
10
9.75
9.5 Intensity tests.
9.25
8. ← (Best) ½ sec on scale

10 ft. Series wire 6 wire cable # ~~[illegible]~~ or 23 old stock.

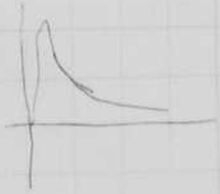
666 mfd 450 V FX33 2 ft clip leads

200 μs long? ,25 x 10⁴ c.p.s 56. c.p.s.

1. 5 V/cm .2 ms/cm. 1½" FX-33
2. 5 V/cm .1 ms/cm
3. 5 V/cm .1 ms/cm 2 cord in parallel (10 ft cable). 20 ft. (0.22 Ω)
4. cuts down peak to ½.
↑ above was on x10 , .5 V/cm

5. 5x(10) = .5 V/cm 0.1 ms/cm. 1" lamp. } ?
(2 Blanks)
321 mfd 450 ~~volts~~
6 .5 V/cm 0.1 ms/cm 1" lamp

2 caps in series (343, 321 ~~in series~~) 2 ~~9~~ D 13 Sprague, 1"
7. 0.5/cm 0.1 ms/cm 600 volts. 1"
0.5 " 0.1 " 700 1"



0.5	0.1	600	FX-33
.5	0.1	700	FX33 off scale
1.0	0.1	700	FX-33

[Paper 94 Sprague] capacitor

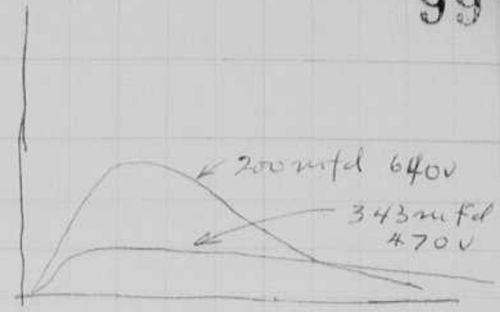
1.0	0.1	700	FX-33 !

1.0	0.1	935 V	FX-33 off scale.
2.0	0.1	935.	"
2.0	.02 (20 μs/div)	935	
2.0	.02	935	FX-33 with 0.22 Ω R

Paper 200 Sprague.

Blank → 2.0	.02	~~450~~ 540? (640)	FX-33 ? wrong
1.0	.02	640	

1.V/cm .02 ms/cm 343 mufd Elect. Fx-33 470 V.



1V/cm .02 ms/cm Fx-33 470.

1V/cm .02 Fx-33 450

1V/cm .1 ms/cm " "

.5V/cm .1 ms/cm " "

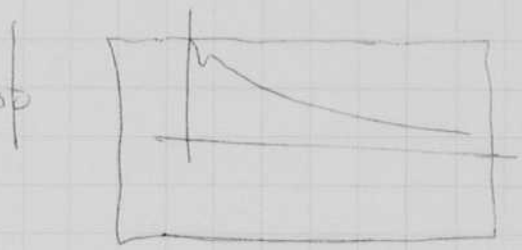
666 mufd

.5V/cm 0.1 ms/cm " " flat top. wave

voltage meas.

500 V/cm 0.1

200 V/cm 0.1 Fx-33 450



Dec 1964

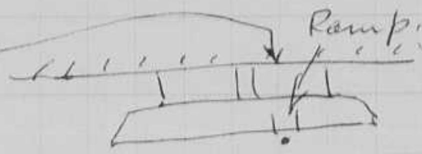
Lamp.	V	Cap.	Ser. Res.	CP 10^6	$\frac{CE^2}{2}$ watt sec	cps	H.C.P.S.	n / Duration
FT-120	450	600 (620)	0				204	(5) ~~+.1~~ .2 (9)+.2 .2
FT-120	450	300 (310A)	0	.36	120	43	88	(3)+.1 .5 (4)+.1 .2
FT-120	450	600	0.22	.36	570	205	180	(7)+.1 .2 (8)+.2 .2
FT-120	450	300 (310A)	0.22	.24	210	50	80	(6)+.1 .2
FT-120	900	310/2	0	~~1.45~~ ~~1.15~~	~~220~~ ~~140~~	~~161~~ 320	200	(2)+.1 .5
FT-120	900	310/2	.22	~~1.2~~ 1.3	~~140~~ 240	~~168~~ 310	176	(1)+.1 .5 (NO RES)
								(12) .1 .5 Blank 3040.
FX-33	450	600 (310A 310B) 620	0	1.2	280	336	208	(11) .1 .5×10^6
FX-33	450	300 (310A)	0				80	(5) .1 10^6 (6) .1 .5×10^6 (7) .1 .2×10^6
FX-33	900	300/2	0 (0.22)				120	(14)(24) .1ms .5×10^6
							144	(3)+.1ms .5×10^6 4 .1ms 10^6
FX-33	450	600 (620)	.22	.64	430	282 (9)	148	(9) .1 .2×10^6 (10) .1 .5×10^6
FY-33	450	300 (310A)	.22				64	(8) .1 .2×10^6
1"	450	600 (620)	0	1.3	180	234	152	(13) .1 .5×10^6
1"	450	300 (310A)	0	.64	170	110	64	(18) .1 .2×10^6
1"	900	300/2 (310)	0	1.6	120	194	96	(19) .1 1×10^6
1"	900	310/2	0.22	1.4	100	140	80	(20) .1 1×10^6
1"	450	620	.22	.6	280	168	104	(14) .1 .5×10^6
1"	450	310A	.22	.35	270	77	48	(15) .1 .5×10^6 (17) .1 .2×10^6

(16) Blank Skip.
(21) Blank no scale

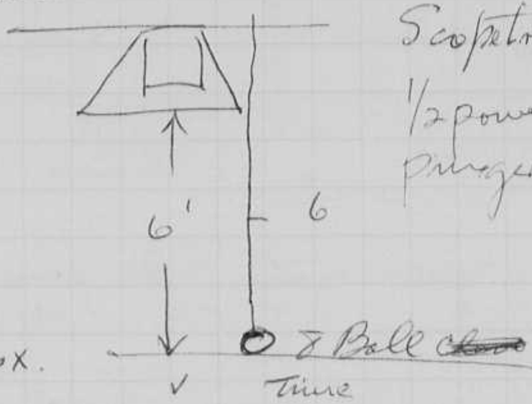
M

Dec. 5, 1964. Sat am Harold Edgerton

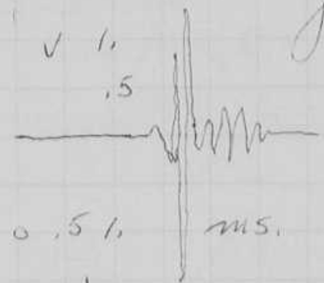
MIT Sail Par Shop. 10 oz al



6 kc at Surface



Scope triggered with elect signal
1/2 power signal on pinger

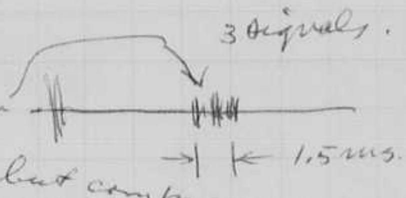


Pulse length 1/2 ms.
3 volts p-p. at 6 ft.

Bulb f5.6 Plus X.

1 Several of above .5V/cm. 0.5 ms/cm.
2,3,4,? 1 shot
5 .5V/cm 2 ms/cm
6. .2V/cm 2 ms/cm

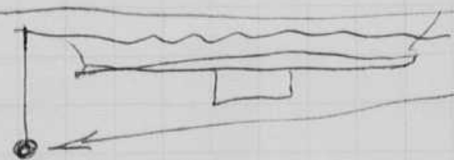
Hydrophone moved to Surface.
7. .1V/cm 1 ms/cm. To show Reflection
.1V/cm 2 ms/cm. same but compressed.



Clevite CZ R. at surface of water.

8. .1V/cm 2 ms/cm

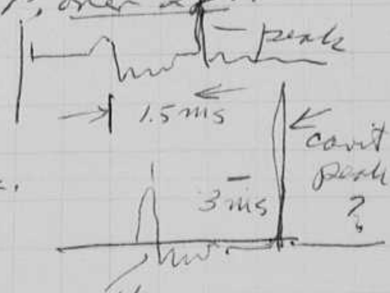
9. Same but 1 foot deep. .1V .2 ms/cm



Boomer 16 mfd 4Kc. al plate Holes! 3" deep,
8 ball at 1 ft deep. at end of board
10 Direct signal is low freq. Bottom is high?
10 NG since pinger was also on!!
11 Blank

12. 0.1V 2 ms/cm. clevite 17AR.
3" deep. Small 7" Boomer al Plate (Holes) at 1 ft deep.
600 ft depth on scale 1 in 6 phase.

13 Wave form with 8 Ball at 6 ft deep, over 2 ft.
.5V 1 ms
14 Ditto with clevite 17AR, .5 1. ms



16 oz Copper. 16 mfd 4KV drive. 1 in 2 sec.
15 Clevite 17AR with X5 amp 25 meg input 2V. 1 ms.
~~15.~~
16 22 oz copper Repeat – Cavit about same Signal about same
17. ac into ~~coil~~ coil 20V/cm pickup 1 ms/div.
One Rubber band instead of two. Result looks same.

(1943 copper)

17AR. D.C.
Clevite + amp

(18) 16+22 copper plates on coil 16 mfd 4KV.
Cavitation is less and wider 2V 1ms.

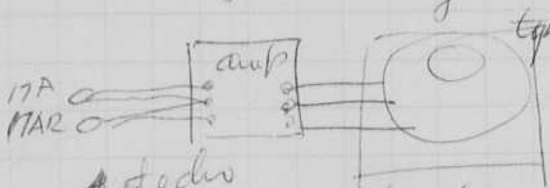
(Tyrone) + 19½ alum.

(19.) 16+22 copper + 19½ alum. 2v 1ms
Fewer cavit pulse.
Depth is about 8" in water

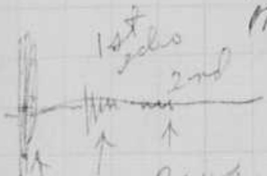
(20) 1" Below Surface again with all weights.
2v 1ms

After Lunch (Two) Clevite 17A and 17AR | 6KC Pinger
(21) Printed edged together..

type 503 Scope
#2076.



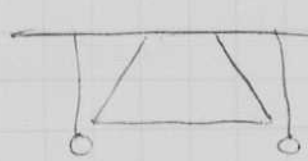
2V 2ms.



1st echo = 6 volts pk to peak.

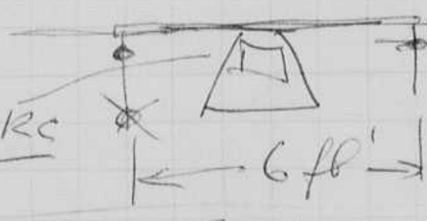
1st echo peak to peak 4 volts!
1'

~~1 MS~~ .7
$D = vt$
$= 5000 = \frac{35}{\cancel{14}}$



.014
5000
70000 ft
$\frac{35}{2} = 17.5$

22
23



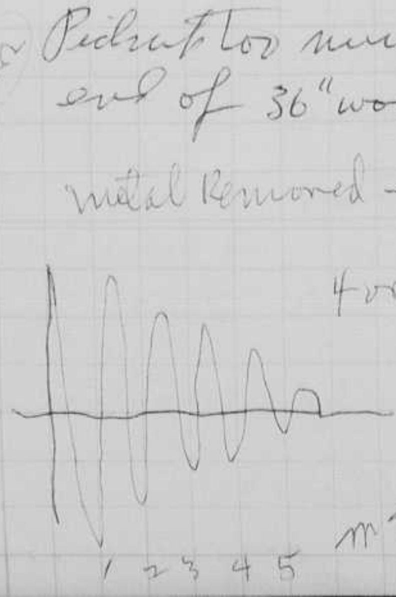
Boomer Experiment

8" with 22 + 16 + 9½ + 10 oz
copper alum

$L = 3000 \times 10^{-6}$ hen
$C = 16 \times 10^{-6}$ farads
$\sqrt{\frac{L}{C}} = \sqrt{200} = 14.2$

Pedestal on mud ~~also~~ with Hydrophone on end of 36" wood board 7½" ¾"—

Metal Removed – Wires Separated – Some improvement.



4 or 5 cycles

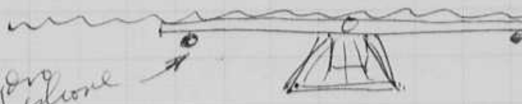
$R^2C = 4L$ Damped Crit

$R = 2\sqrt{\frac{L}{C}} = 14$ ohms

(try 5 ohms)

Dec 5 1964
Harold Edgerton
continued.

The day was spent on pingers and Boomers at the MIT Sailing pavillion. The best pinger arrangement seemed to be a two hydrophone assembly on the 6KC cone with one hydrophone on each end of a 6 ft rack as shown.



I need some sash weights and clamps to load the assembly for deep tests where the penetration might be better.

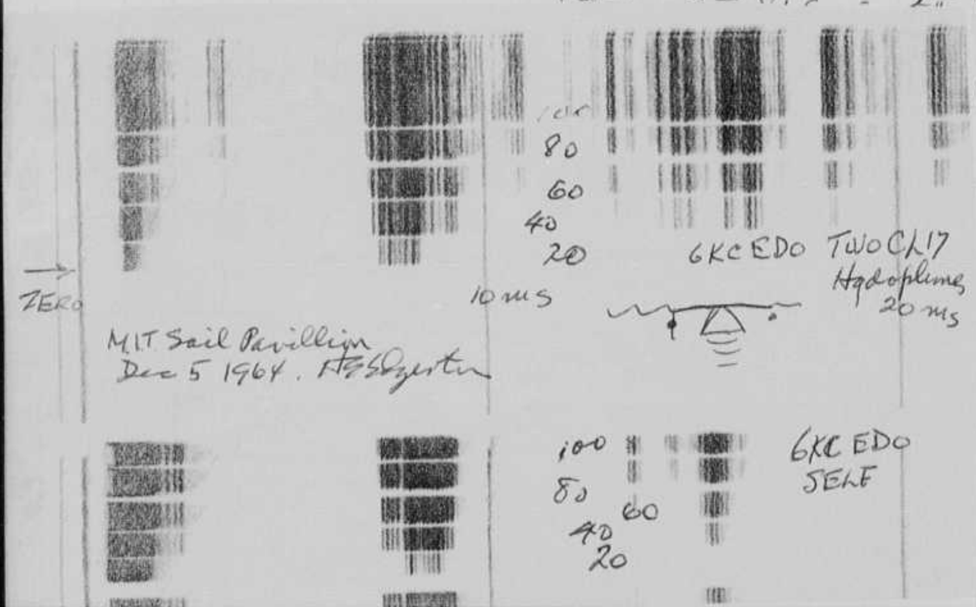
Several tests were made with the small Boomer using several hydrophones as above. The Boomer is the one designed on Page 97 using a T 1080 primary and a stack of laminations in the center. The inductance is about 3000 microhenries.

$2\pi \sqrt{3000\times10^{-6}\ 16\times10^{-6}} =$

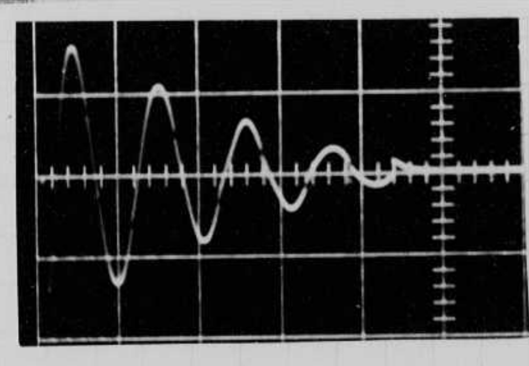
$\sqrt{48{,}000} \times 10^{-6}$

2.40×10^{-6}
$6.$
$14.40.$ 15.0×10^{-6} sec.

$f = 1/T = 600$ ~.



from OAC 17 page 101



1.0 ms/div

voltage across Driving coil 16 mfd into 8" Boomer with wound coil and 22 oz copper plate.

1943 copper

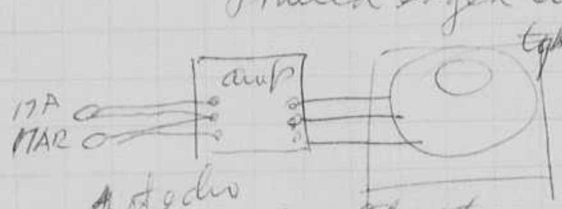
17AR. D.C.
Clevite + amp

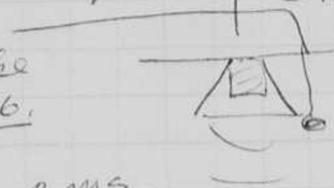
(18) 16 + 22 copper plates on coil 16 mfd 4 KV.
Cavitation is less and wider. 2V 1 ms.
(Try more). + 19 ½ alum.

(19) 16 + 22 copper + 19 ½ alum. 2V 1 ms
Lower cavit pulse.
Depth is about 8" in water

(20) 1" Below Surface again with all weights.
2V 1 ms

After lunch (Two) Clevite 17A and 17AR | 6KC Pinger
21 Printed edged together.





2V 2 ms.

1st echo = 6 volts pk to peak.

1st echo Peak to peak. 4 volts. ~~.7~~

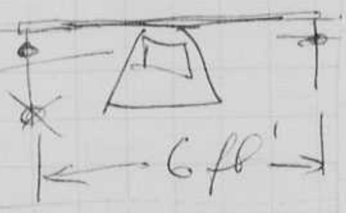
1'

$D = vt$
$= 5000 = \frac{35}{\cancel{K}}$

22

23

6Kc



Boomer Experiment

8" with 22 + 16 + 9 ½ + 10 oz
copper alum

Pickup too much ~~also~~ with Hydrophone on end of 36" wood board 7½" ¾"

$L = 3000 \times 10^{-6}$ henry
$C = 16 \times 10^{-6}$ farads
$\sqrt{\frac{L}{C}} = \sqrt{200} = 14\Omega$

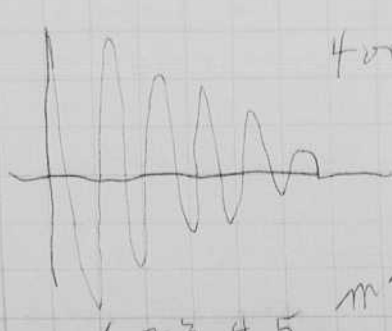
Metal Removed - Wires Separated - Some improvement.

4 or 5 cycles

$R^2C = 4L$ Damped Ckt

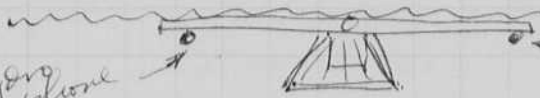
$R = 2\sqrt{\frac{L}{C}} = 14$ ohms

(Try 5 ohms)



Dec 5 1964
Harold Edgerton continued.

The day was spent on pingers and Boomers at the MIT Sailing pavillion. The best pinger arrangement seemed to be a two hydrophone assembly on the 6KC cone with one hydrophone on each end of a 6 ft rack as shown.


Hydrophone.
Hydrophone
30" cone

I need some sash weights and clamps to load the assembly for deep tests where the penetration might be better.

Several tests were made with the small Boomer using several hydrophones as above. The Boomer is the one designed on Page 97 using a T 1080 primary and a stack of laminations in the center. The inductance is about 3000 microhenries.

$$T = 2\pi\sqrt{LC} = 2\pi\sqrt{3000\times10^{-6}\ 16\times10^{-6}} =$$

10^{-3} sec.

$\pi\sqrt{LC}$

$(2\pi)^2 LC$.

$$\frac{T^2}{(2\pi)^2}\frac{1}{C} = \frac{10^{-6}}{40\ 16\times10^{-6}}$$

$\frac{1}{640} =$

$\sqrt{48{,}000}\times10^{-6}$

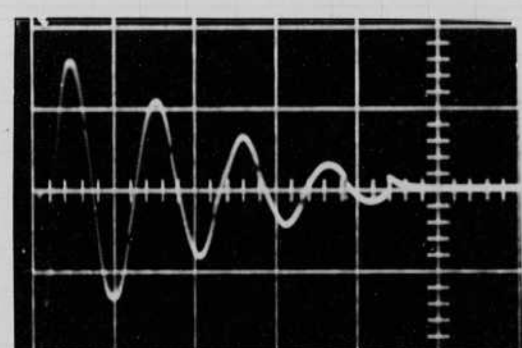
2.40×10^{-6}

$6.$

$14.40.$ $\quad 15.0\times10^{-6}$ sec.

$f = 1/T = 600$ ~.

from
OAC 17 page 101



voltage across
Driving coil 16 mfd into
8" Boomer with wound coil
and 22 oz copper plate.

1.0 ms/div

(1943)

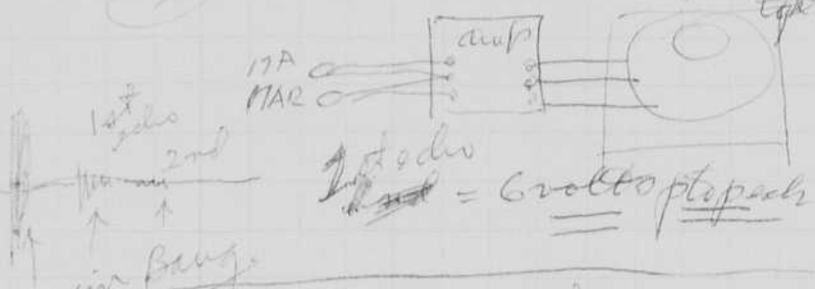
17AR. DC
Clevite + amp

(18) 16+22 copper plates on coil 16 mfd 4KV.
Cavitation is less and wider 2V 1ms.
(Try more). + 19½ alum.
(19) 16+22 copper + 19½ alum. 2v 1ms

Lower caint pulse.
Depth is about 8" in water

(20) 1" Below Surface again with all weights.
2V 1ms

After Lunch (Two) Clevite 17A and 17AR | 6KC Projector
21 Printed edged together..



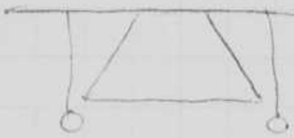
type 503 Scope
#2076.

2V 2ms.

1st echo = 6 volts pk-to-peak.

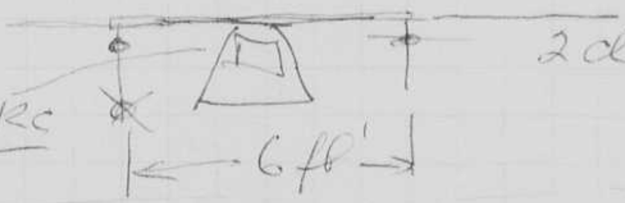
1st echo
Peak to peak.
4 volts.
1'

~~17ms~~?
$D = vt$
$= 5000 = \frac{35}{x}$ ft.



.014
5000
70000 ft
$\frac{35}{2} = 17.5$

22
23



2 Clevite

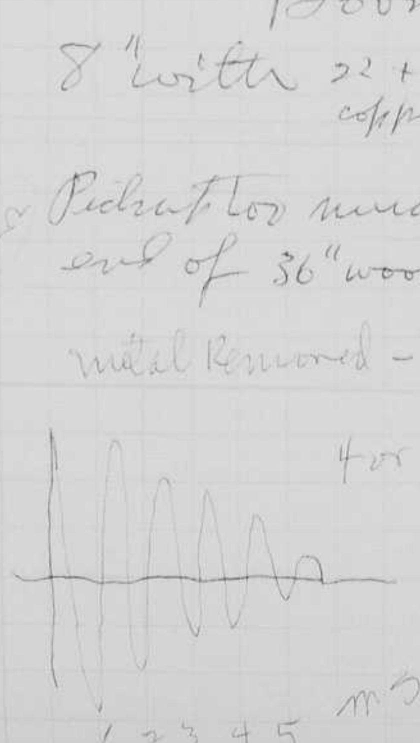
Boomer Experiment

8" with 22 + 16 + 9½ + 10 oz
copper alum

$L = 3000 \times 10^{-6}$ henr
$C = 16 \times 10^{-6}$ farads
$\sqrt{\frac{L}{C}} = \sqrt{200} = 14$

Picked up too much ~~echo~~ with Hydrophone on end of 36" wood board 7½" ¾"

metal Removed - Wires Separated - Some improvement.



4 or 5 cycles

$R^2C = 4L$ Damped Cct

$R = 2\sqrt{\frac{L}{C}} = 14$ ohms

Try 5 ohms

Dec 5 1964 Harold Edgerton continued.

The day was spent on pingers and Boomers at the MIT Sailing pavillion. The best pinger arrangement seemed to be a two hydrophone assembly on the 6KC cone with one hydrophone on each end of a 6 ft rack as shown.

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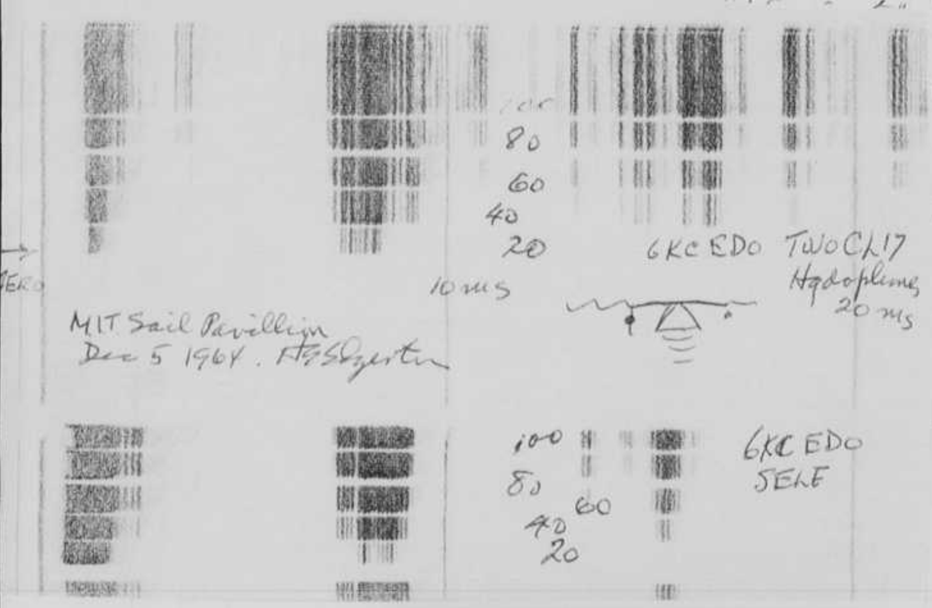
$T = 2\pi\sqrt{LC} = 2\pi\sqrt{3000\times10^{-6}\ 16\times10^{-6}} =$

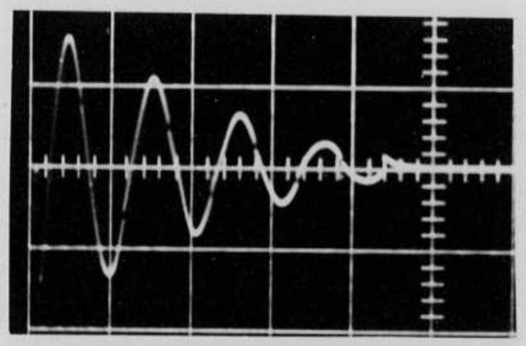
$\sqrt{48,000}\times10^{-6}$

2.40×10^{-6}
$6.$
$14.40.$ $\quad 15.0\times10^{-6}$ sec.

$f = 1/T = 600 \sim.$



from GAC17 page 101



1.0ms/div

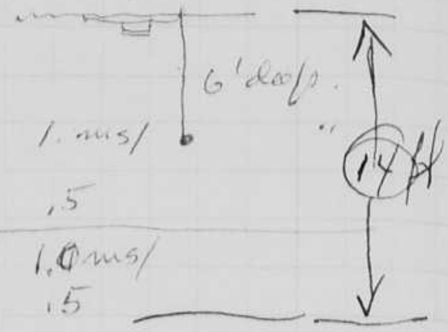
voltage across Driving coil 16 mfd into 8" Boomer with wound coil and 22 oz copper plate.

des.

HEE
Dec 7 1964 M.I.T. Sail Pav. Shop 630 pm | Loop Elo Stave. | T-927. 6 KC 17.8 mh.

Test of Boomer 8" transducer with Steel core
15 ohms in parallel

#1 Jogged. 16 mfd 4KV. Surface 22 oz copper. 0.1 V/cm 1.0 ms/cm Clevite 17A



			.05	1. ms/
2				
3			.05	.5
4	32	4KV	.2	1.0 ms/
			.2	.5
5				
6	64		.2	1.
7			.2	.5

Returned for Repairs

The Atlantic LC-57 is n.g. due to loose connection, Conference with reps today. Payson, Yules, Kretscher.

Dec 8 1964 830 pm Sail Pav. ~~BC-30~~ LC-30 Hydrophone 6700 uuf.
BC 32
into Scope
8 Blank for marker

1,670 ft 1.4V 9 16 mfd 4KV 1 in 2 sec. .05 V/cm 0.5 ms/cm 22 oz copper One Rubber band.
one Rubber band NO RESISTANCE across transducer.!

	10	16	4KV	"	.05V	0.5 ms.	No Res.
	11	32	4KV		.05	0.5	No Res.
	12	"	"		.05	1.0	No Res.
	13	"	"		.05	1.0	15 ohms.
	14	"	"	Aluminum 9 oz	.05	.5 ~~.5~~ ~~1.0~~	15 ohms
1,540 ft 3x1	15	"	"	al 9 oz	"	.5 " ~~1.0~~	No Res
2000 ft .25V	16	16	4	al "	.05	.5	No Res.
4000 ft .15V	17 ?	16	4	"	.05	.5	Res

8 Ball Hydrophone

2000 ft 1.5V Marker 18 16 4 al 9 oz. .5V .5 ms No Res.

Dec 13 1964

#18 Looks very good
16 mfd 4KV with coil with Light Al 10 oz square.

8 Ball Hydrophone,
1.5 volts at 6 ft
2000 cycles

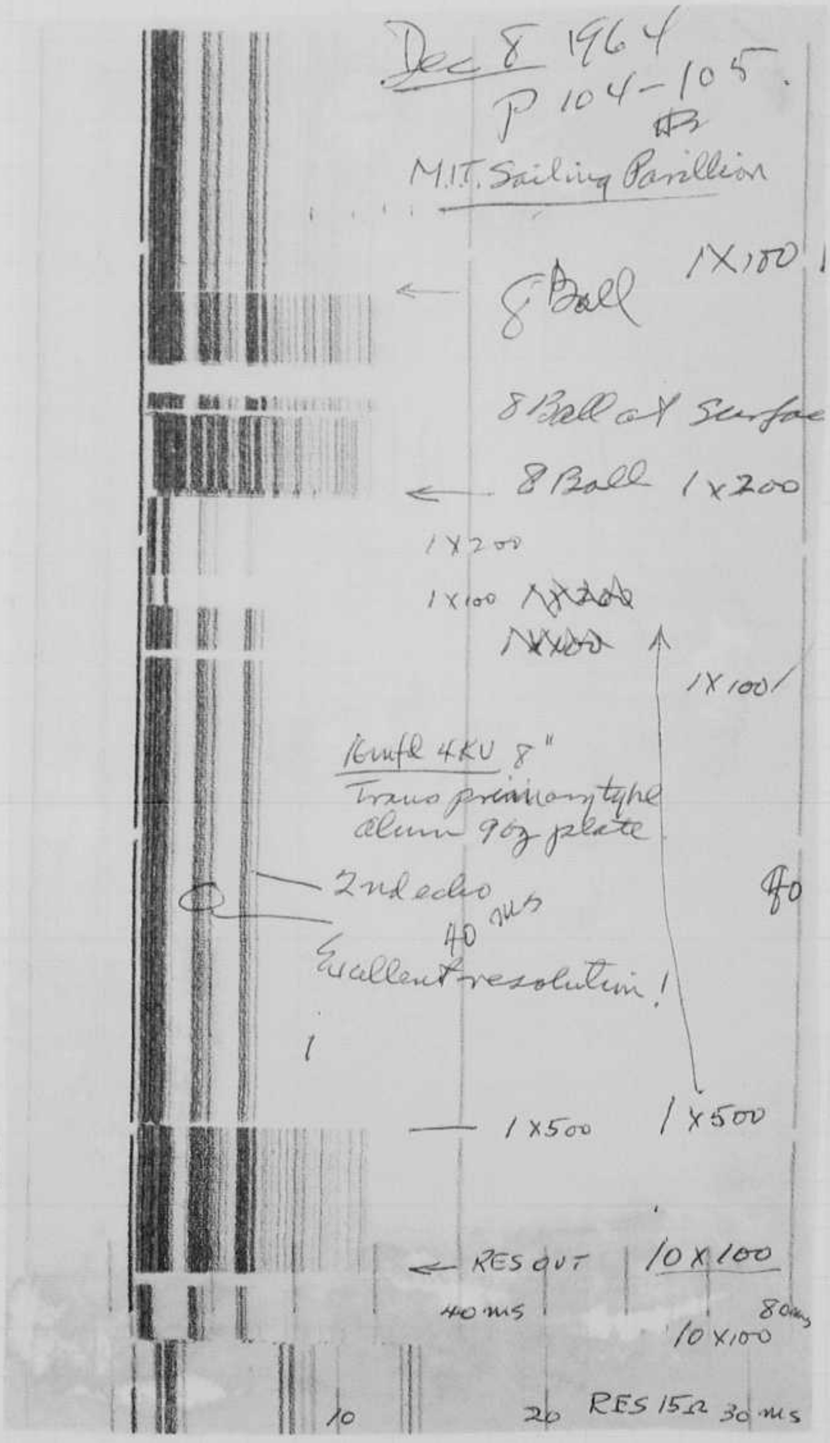
M

Results look very good
8 oz al plate (Holes).

Can work in 10 feet of water,
Signal about 1/2 ms.

8 Ball is more than 5 x more sensitive
than the LC-30.

15 ohm on circuit at 16 mfd reduces output
by factor of about 5 and gives 1/4 ms signal
~~can~~
Damped can works 4 feet! Excellent.



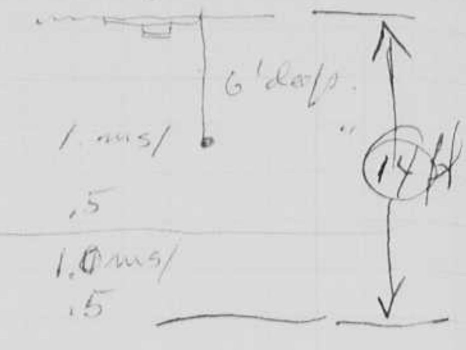
See page 103 etc.

Note. The current
oscillates at about
1000 cycles/sec.
The sound pressure
oscillates at about
2000 ~/sec.

Dec 7 1964 M.I.T. Sail Pav Shop 630pm [illegible] 220 Stave. T-927. 6 KC 17.8 mh.

Test of Boomer 8" trans prim with Steel core
15 ohms in parallel

#1 fogged. 16 mfd 4KV. Surface 22 oz copper. 0.1V/cm 1.0 ms/cm Clevite 17A



			.05	1. ms/
2				
3			.05	.5
4	32	4KV	.2	1.0 ms/
			.2	.5
5				
6	64		.2	1.
7			.2	.5

the Atlantic LC-57 is n.g. due to loose connection. Conference with the reps today, Peyson, Yules, Kritscher.

Dec 8 1964 830pm Sail Pav. ~~BC-30~~ or LC-30 Hydrophone 6700 uuf.
BC 32

into Scope
8 Blank for marker

1610 ft 1.4V 9 16 mfd 4KV 1 in 2 sec. .05V/cm 0.5 ms/cm 22 oz copper one Rubber band.
one Rubber band NO RESISTANCE across transducer.!

	10	16	4KV	"	.05V	0.5 ms.	No Res.
	11	32	4KV		.05	0.5	No Res.
	12	"	"		.05	1.0	No Res.
	13	"	"		.05	1.0	15 ohms.
	14	"	"	Aluminum 9 oz	.05	.5 ~~.5~~ ~~1.0~~	15 ohms
1,540 ft	15	"	"	al 9 oz	"	.5 ~~1.0~~	No Res
2000 ft .3 x1	16	16	4	al "	.05	.5	No Res.
4000 ft .25V .75V	17 ?	16	4	"	.05	.5	Res

8 Ball Hydrophone

2500 ft 1.5V marker 18 16 4 al 9 oz. .5V .5 ms No Res.

Dec 13 1964 #18 Looks very good
16 mfd 4KV into coil with Light al 10 oz square.

8 Ball Hydrophone,
4.5 volts at 6 ft
2000 cycles

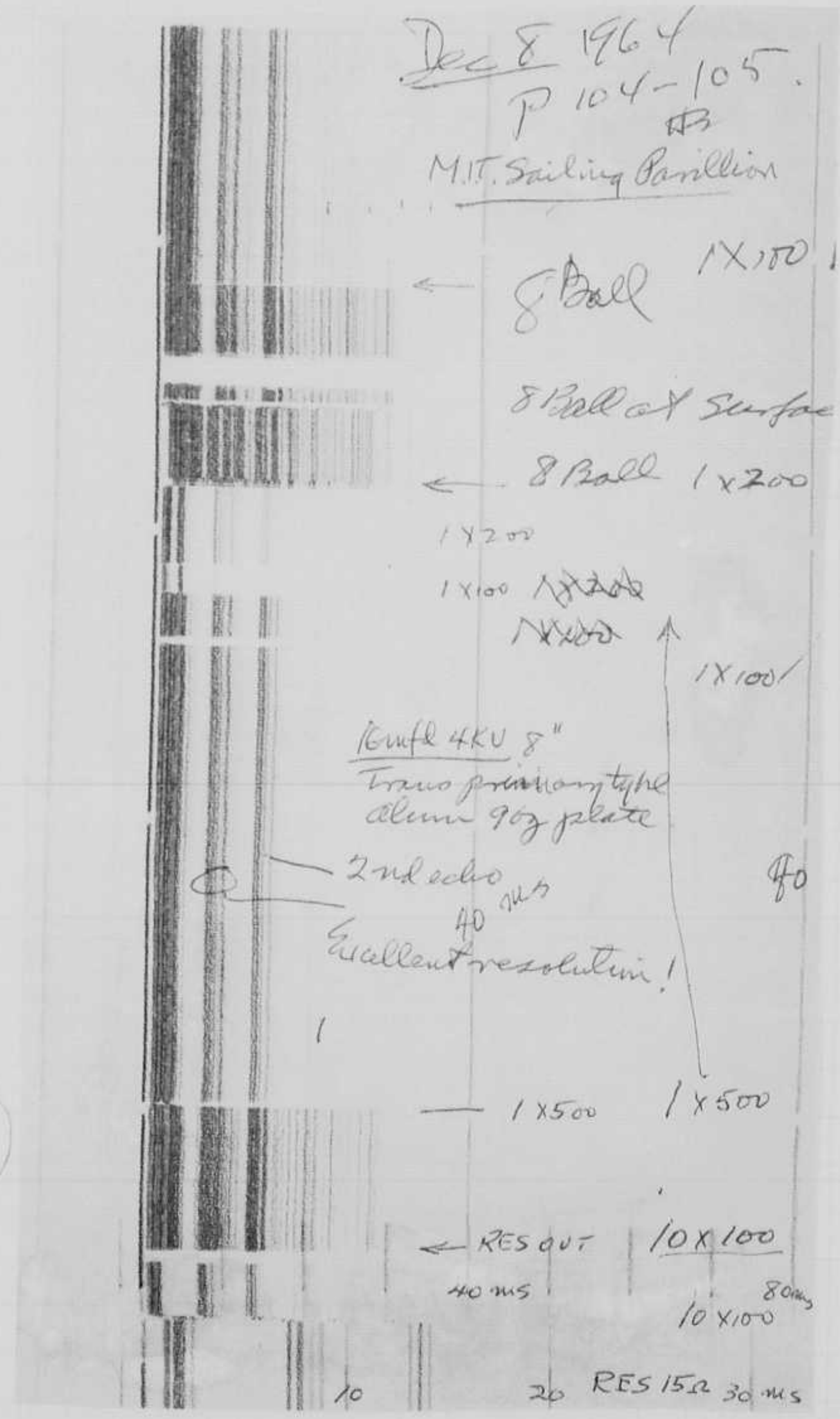
Results look very good
8 oz al plate (Holes).

Can work in 10 feet of water,
Signal about 1/2 ms.

8 Ball is more than 5 x more sensitive
than the LC-30.

15 ohm on circuit at 16 mfd reduces output
by factor of about 5 and gives 1/4 ms signal
~~can~~

Damped can work to 4 feet! Excellent.



See page 103 etc.

Note: The current
oscillates at about
1000 cycles/sec.
The sound pressure
oscillates at about
2000 ~/sec.

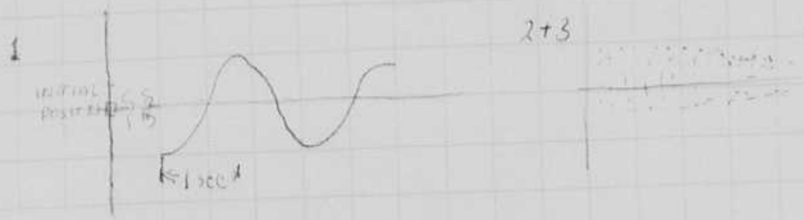
Dec 16 1964

Hamilton E L Shumway G Menard H W. Shipek C J
1956 Acoustic and other phys properties of Shallow Water Sediments off San Diego
JASA v 28 p 1-15.

Dec 17, 1964 Spring experiment.

KARLA HEARST
JOSHUA CORAN

Measurement of damping in air
1) sin wave using solder (approx no damping)



4, Changed to movie Tripod.

Dec 20 1964 HEE

Beacon for Chesapeake Bay

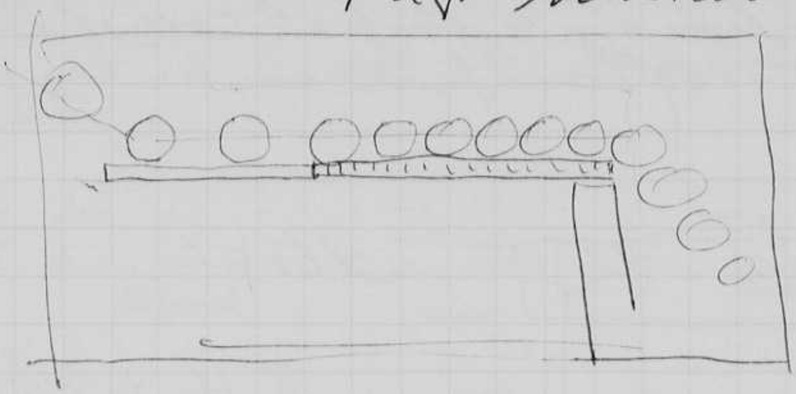
FX-80?

MacRoberts has put ~~the~~ first sample lamb in a 4" Pyrex housing ~~to~~ make it water tight.

after 12 hours operation on Sat Dec 19 there was a small amount of darkening on the cathode end about 1.0 cm from the electrode. Otherwise operation at 800 ws at once per second is excellent.

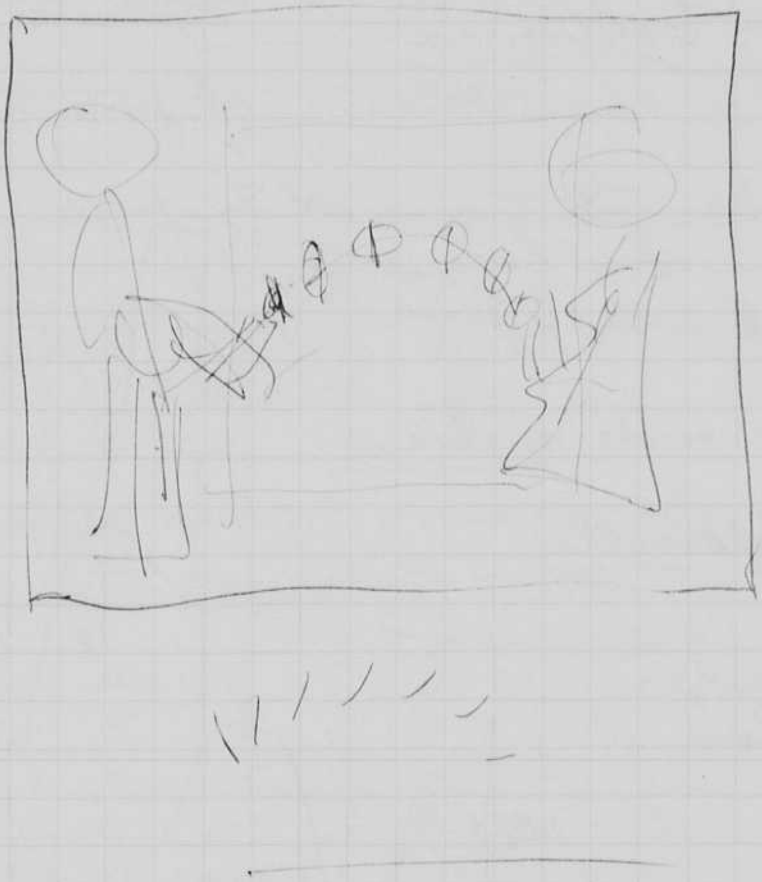
Note.
Jan. 2, 1965 this lamp is now a hard Starter & skips! Repump?

Rolling Ball. Taken for Boom. Am on Dec 19.



Bo. Clark and Mrs Roberts helped.

Tennis ball 30/sec



Gyroscope 30/sec.

Royal X Old Strobe on CW at 6 to 10 feet from white Subject –

Dec 22 – Dec 29 Wabasso Florida to work with 6KC finger on "Cabin" wrecks with "Pinetree" & "Wedge" wrecks.
Kip Wagner, Jack Cannon, etc
Pennwood Motel – Chas Weigart, Manager Wabasso.

Notebook # 28

Filming and Separation Record

3? unmounted photograph(s) (bits of photograph inside loose envelope)

___ negative strip(s)

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

was/were filmed where originally located between page 106 and 107.

Item(s) now housed in accompanying folder.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

Scotch lite.

INTER-DEPARTMENTAL

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

Scotch lite.

[redacted]

INTER-DEPARTMENTAL

The last shot was
better, but it is still
hard to seperate the
periods due to the
horrizontal motion of
the spring.

Thank you very
much. You really
do not know how
much I appreciate
this

Josh Coran

The last shot was better, but it is still hard to seperate the periods due to the horizontal motion of the spring.

Thank you very much. You really do not know how much I appreciate this

Josh Coran

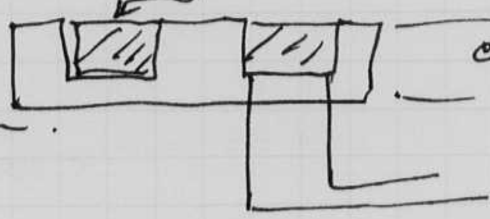
 JAN. 1, 1965 M.I.T. Swimming Pool 10.47 am

Harold Edgerton
Phil Gallagher

Tests of Small Boomer.

This boomer has an E shaped core of laminated Iron and a T 1080 transformer coil

Plate
8x8" 3/32"
(?) Soft aluminum.

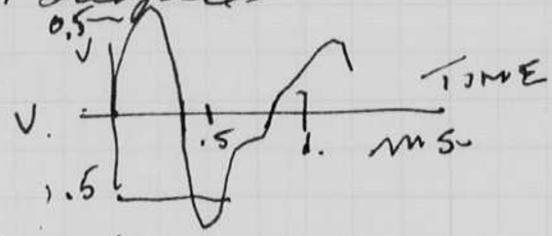


8, 16, + mfd at 4KV. with Spark Switch.

Scope # 9095 type 545 tecktronix.

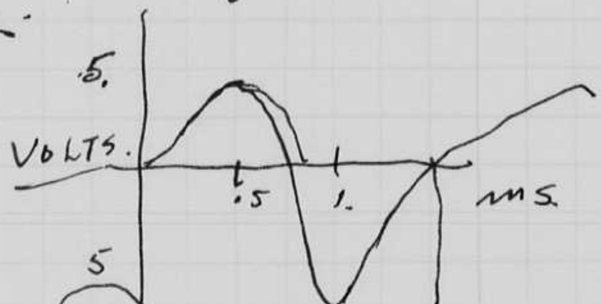
8 ball $4.6 \times 10^{-9} \times 10^{6} = 4.6 \times 10^{-3} \cong .005$ ok for test.

8+16 mfd at 1 per sec no Res. into Trans at Surface -
8 ball Hydrophone at 6' below
$v = 2.3 \times .5 = 1.15$ volts p/peak

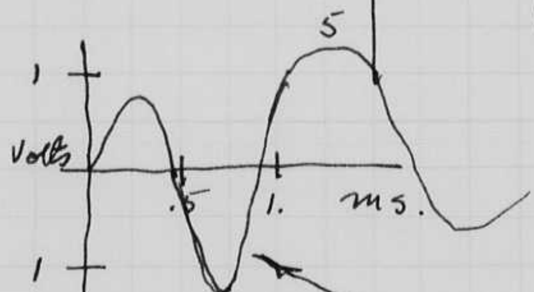


8+16 mfd no Res
Geo-Space Yellow ends no trans.

v 1,8 × 5. = ~~90~~ 9. volts

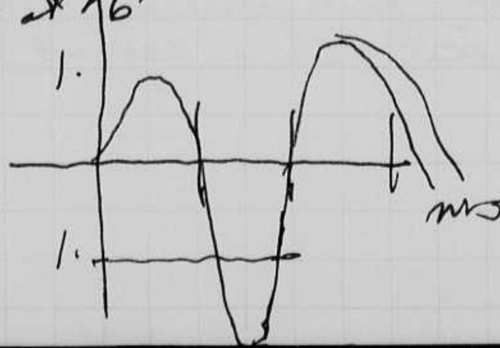


16 mfd + 15 ohms Damp
Geo Space at 6' below.



The Rubber return section was reduced in pressure to see if the wave form would be different in the negative pressure region.

16 mfd 15 ohms Geo Space at 6'



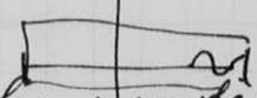
f4 on Plus X film.

BC32 ~~BC-37~~ is the Elab Repaired hydrophone may be an BC-30??

1 per sec Rate -

OSC NO.	C.	V_R (3.6=4090) V/div	R	~~condition~~ ms./div.		Hydr	Comments.
1	16	3.7 KV ~~4~~	15	1.	1 ms. ~~0.5~~	Geo	Weak Rubber spring setting 8" al 1/8" ~~3/32~~
2.	Ditto.						
3	16	3.7	0	2.	1 ms.	Geo.	"
4	8	3.7	0	1	1	Geo.	"
5	Blank.						
6.	24	3.7	0	5	1	Geo	"
7	24	3.7	15	5	1	Geo.	"
8.	24	3.7	15	.05	1	BC-37?	
9.	24	3.7.	0	.05	1.	BC-37.	
10	24	3.7	0	.5	1.	8 Ball.	"
11	16			.5	1.		
12	8			.5	1.		
13.	16	3.7	0	.5	.2	8 Ball	" to show waveform
14	16	3.7	0	.05	.2	BC-37 ?	
15	16	3.7	0	2 ~~2~~	.2	Geo	
16.	16	3.7	0	2.	.5	Geo	

Plate A



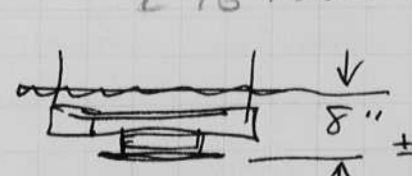
Developed all ok some over exposed.

After Lunch Extra large plates made. above plate

Plates.

A 8" square 3/32" al
B 30 cm Round 1/8" 24ST al
C 12" square 1/8
D 16" Round 1/8" al
E 16" Round 1/32+ al

#							Plate
1 A	16	3.7	15Ω	.05	.5	BC-37?	A.
2 A	16	3.7	15	.05	.5	(BC 30?)	
3 A	16	3.7	0	.05	.5		
4 A	16	3.7	0	.05	.5	BC-37-?	C
5	16	3.7	15	.05	.5	"	"
6	8+16	3.7	0	.05	.5	"	"
7	8+16	3.7	15	.05	.5	"	"
8	16	3.7	0	.05	.5	"	E
9	16	3.7	~~15~~	.05	.5	"	"
10	24	3.7	0	.05	.5	"	-
11	8	3.7	0	.05	.5	"	"
12	8	3.7	0	1.0	.5	Geo	E



note plates A and E showed slight cavitation effects on the surface at the outer center.

(A) a larger plate seems to make no appreciable difference to the received signal at 6 ft from the transducer.

(B) The new MP-6 ~~Geoplane~~ Geo Space hydrophone has more output than the 8 ball but the frequency is lower.

Jan 2 1965

MP-8 pressure Hydrophone
13304-G - GeoSpace corp Tickell TICKELL
5803 Glenmont Dr. Houston Texas.

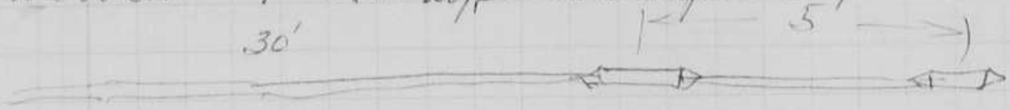
M.I.T. 4-405

$C = 2 \times 10$ mf. $= 20 \times 10^{-9}$ farads. See page 85 $RC\ 10^6 \times 20 \times 10^{-9} = 20 \times 10^{-3} = .02$

$D = .04$

write to GeoSpace Tickell

Suggest two hydrophones on same string one + and the other -. Then differential input to recorder.



Shielded wire and 4 conductors.

Inductance of T 1070 coil with out iron formations as assembled by Max Roberts Dec 1964

open circuit without plate 5,3 mh. = 5300 uh
with plate 1/8" Al 2,4 mh. = 2400 uh.

$T = 2\pi\sqrt{LC}$ for one cycle
$T_{1/2} = \pi\sqrt{LC}$ for 1/2 cycle,

$8 \times 10^{-6} \times 2400 \times 10^{-6}$

$\sqrt{19{,}2\,10^{10}} = 138 \times 10^{-6}$ sec
$3{,}1416$
$423 = 435$

2f	C	$T_{1/2}$	f cy/sec	$T_{1/2}$	f
2300	8	~~450~~ us.	1,150	435 us	
1626	16	~~655~~ us	813	616	
1330	24	~~780~~ us.	665	753	

$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{6.28\sqrt{8 \times 10^{6} \times 2400}}$

$\sqrt{19{,}200}$
435×10^{-6}

This should be the frequency of the pressure pulses which are double the frequency of the current pulses in the primary.

Page 109

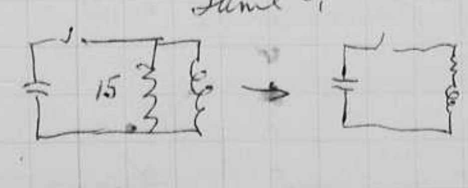
Osc			$T_{1/2}$
4	8 Mfd	shows	0.41 ms
3	16	"	0,6
6	24	"	0.7

measured values from oscil

which checks the calculated values.

There is pickup when the current goes through zero

Jan 2,



Damping condition Critical.

$R = 2\sqrt{\frac{L}{C}} = 2\sqrt{\frac{2400\times10^{-6}}{8\times10^{-6}}} = 2\sqrt{300} = \frac{1.7}{\frac{2}{34}} = 34.$ ohms.

17.
17.
119
17
289.

and for 16 mfd. R = 24.
24 mfd R = 19.6

Resistance of the coil is .03 ohms.

$RC = 15\times8\times10^{-6} = 120\times10^{-6}$ sec

Redesign of circuit

5 mfd — 6000
— 3000 ↑ sound,
— 2000
— 1000

1. Find C for 3000 cycle sound pulse
~~1500~~ cycle electrical

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

$C = \frac{1}{(2\pi)^2 f^2 L} = \frac{1}{(6.28)^2\,1500^2\,2.4\times10^{-3}} = \underline{4.7\times10^{-6}}$ farads.

↑ 213

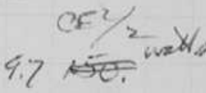
Crit Damping resistance $= 2\sqrt{\frac{2400}{4.7}} = 2\times22.6 = 45.\Omega$

Try 20 ohms to start for short pulse of ~~#~~ 1.5 cycles ac.

			R/crit.	$CE^2/2$ watt sec.
6000 ↑ sound requires	4.7 x 4 = ~~[illegible]~~	1.2 mfd ~~[illegible]~~	22 ohms	9.7 ~~150.~~
1500 " " "	4.7 / 4 = ~~[illegible]~~	18.8	90 "	150 ~~9.7~~
3000 " " "	4.7 = ~~4.7~~	~~18.8~~ 4.7	45. "	37.6

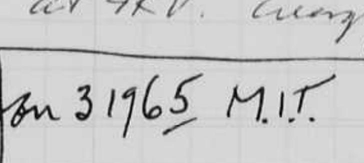
at 4KV. Energy $= \frac{CE^2}{2} = C\,\frac{16}{2}\times10^{6}$

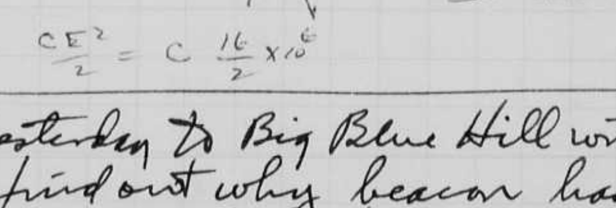
Jan 3 1965 M.I.T. Yesterday to Big Blue Hill with John Yules to find out why beacon had ~~stopped~~. It was OK! but ice in bottom! then it did not run when the ice was melted. Returned today to replace the spark coil. Dr. Boody was working on his gas measuring device. Yesterday Dr. Noxon helped us with a heater. Lamp now going at 1 per sec from 4 30 pm. to 8 am. Rubber and tape was used to keep water out of the crack between the cover and the damping ring



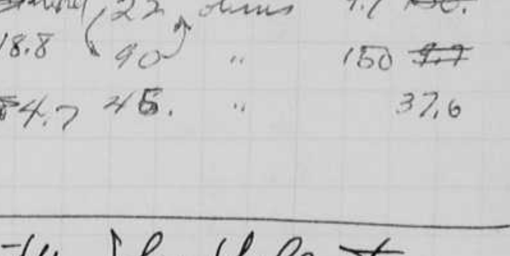
MP-8 Geo Space Hydrophone thump test with hand.

Tap test





Hand thump at sens spot



Shows longer pulse with 1 volt out?

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

4? negative strip(s) 2? inside first loose envelope
2? inside second loose envelope

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

was/were filmed where originally located between page 110 and 111.

Item(s) now housed in accompanying folder.

INTERDEPARTMENTAL

From Page 109 note book 28

Building and Room Jan 1 1965 H. Edgerton.

T-1080 Boomer. with 8" plate
Osc 1 to 16 al 1/8"

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From B28 p 109 Jan 1 1965

Building and Room MIT Pool Boomer tests

H. Edgerton

Osc 1A to 12A Inc.

BC-30

hydrophone

Three sizes of plates used. output about same.

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Page 109 note book 28

Building and Room Jan 1 1965 H. Edgerton.

T-1080 Boomer. with 8" plate

Osc 1 to 16 al 1/8"

To

Building and Room

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Osc 1A to 12A Inc.

BC-30

hydrophone

Three sizes of plates used. output about same.

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Page 109 note book 28

Building and Room Jan 1 1965 H. Edgerton.

T-108 Boomer. with 8" plate
Osc 1 to 16 dl 1/8"

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From B28 p 109 Jan 1 1965

Building and Room MIT Pool Boomer tests

H. Edgerton

Osc 1A to 12A Inc.

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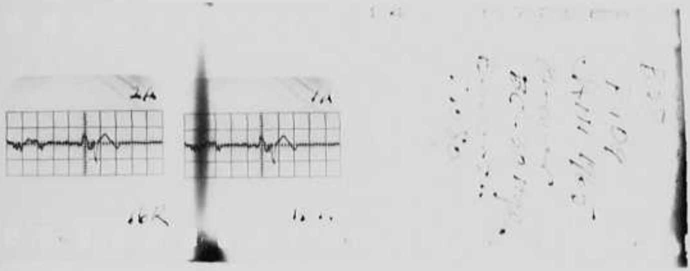
hydrophone

Three sizes of plates used. output about same.

To

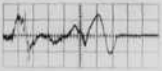
Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY




6A
5A
4A
3A

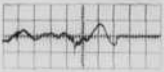
10A



9A

8A

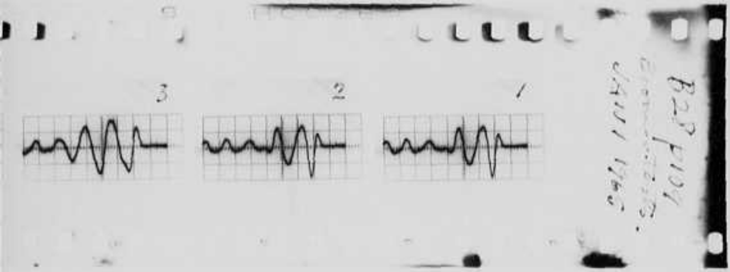
7A



16

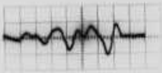
24

12A 11A 10A

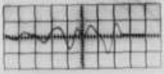

3
2
1
B2P104

7

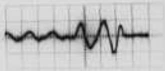
6

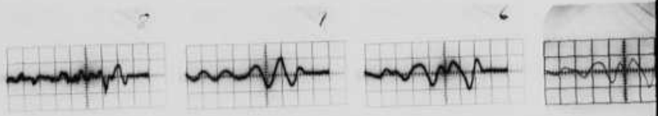


5



4





16

15

14

13

Notebook # 28

Filming and Separation Record

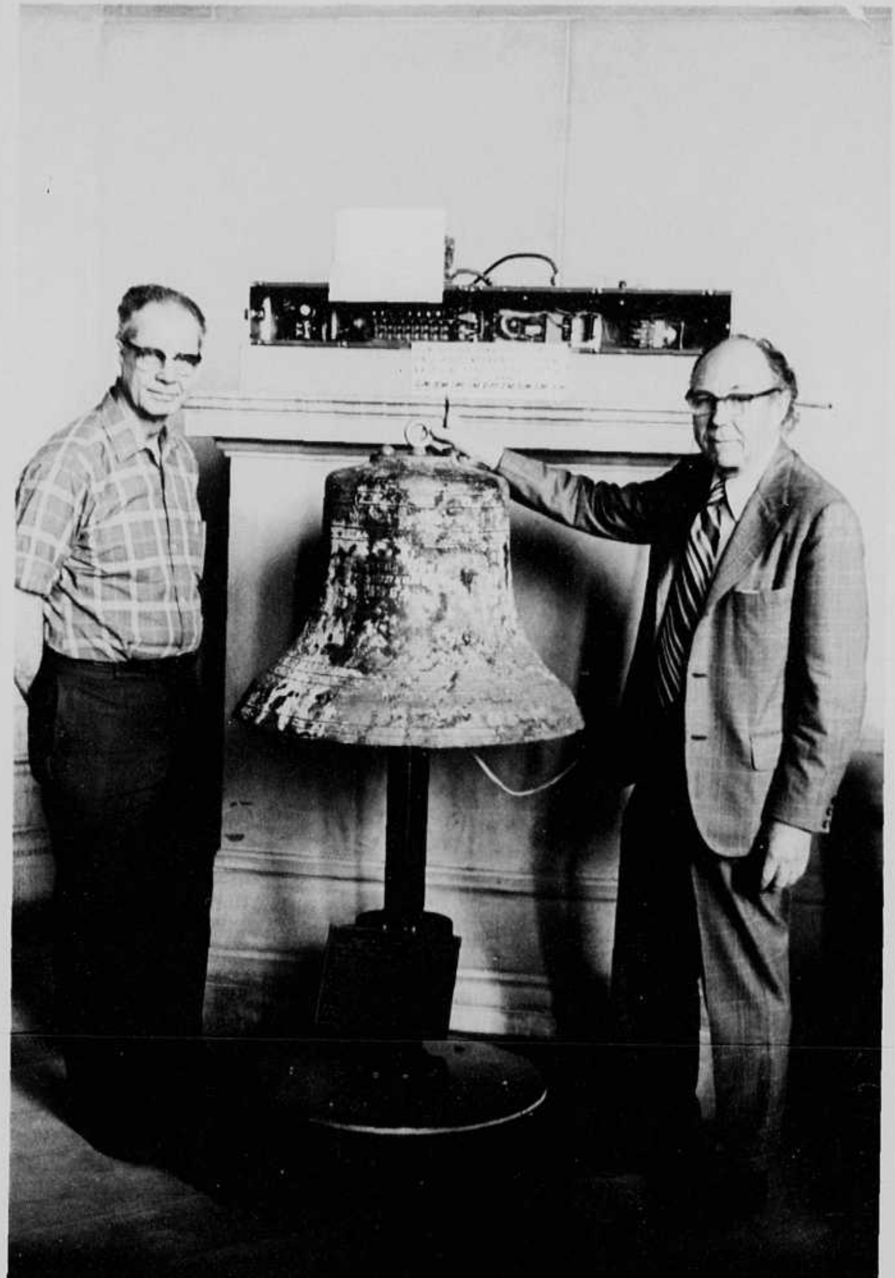
1 unmounted photograph(s)

3? negative strip(s) inside loose envelope

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

was/were filmed where originally located between page 112 and 113.

Item(s) now housed in accompanying folder.



H. Edgerton – V.E. MacRoberts
1974

INTERDEPARTMENTAL

From Page 112 Jan 4 1965 Book 28

Oscillograms

Harold Edgerton

Building and Room MIT Pool.

Boomer 8" with flash tron

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Page 112 Jan 4 1965 Book 28

Oscillograms

Harold Edgerton

Building and Room MIT Pool.

Boomer 8" with flash Iron

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Page 112 Jan 4 1965 Book 28 Oscillograms Harold Edgerton

Building and Room MIT Pool.

Boomer 8" with flash Iron

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Page 112 Jan 4 1965 Book 28

Building and Room MIT Pool.

Oscillograms

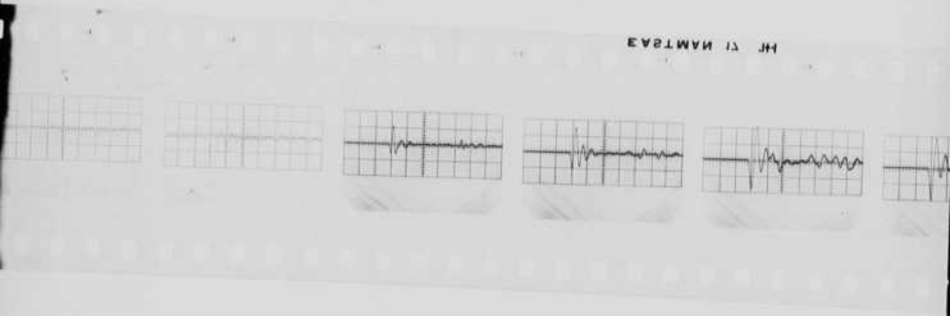
Harold Edgerton

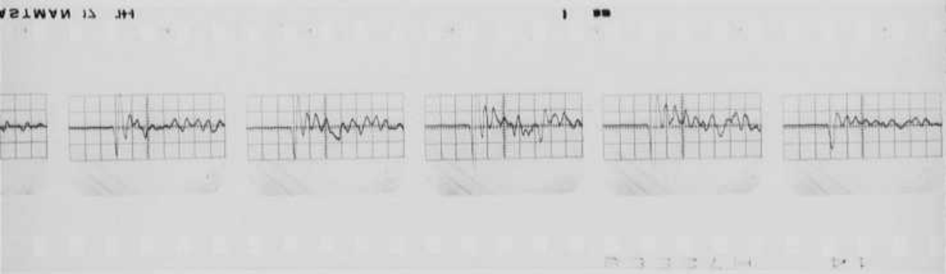
Boomer 8" with flash lamp

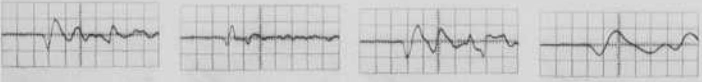
To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

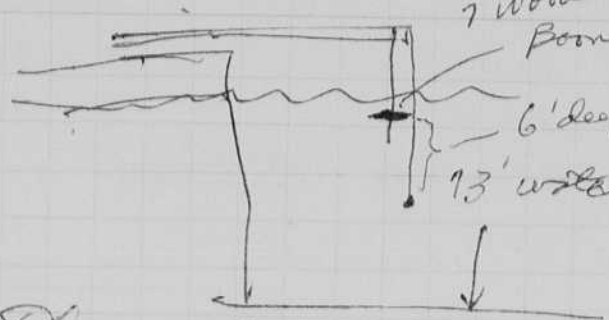

EASTMAN





 Jan 4 1964 7:15 am HE Edgerton   1000 WS Boomer test   old type EG&G.

MIT pool.

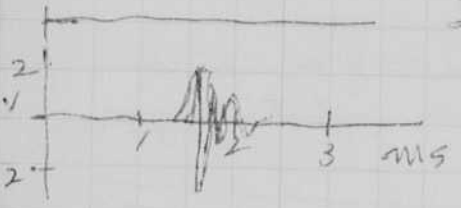


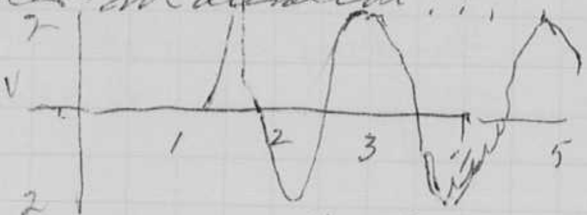
16 mfd 4000 volts ~~Geospace~~ Hydrophone
Showed 10 ms signal ~~lasting~~ of about ? 1000 ft.

32 mfd 4000 volts. GeoSpace .4 V peak to peak of 10 ms duration.

---

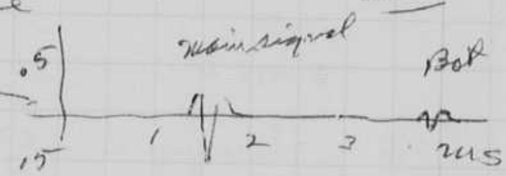
now tried 8 ball hydrophone
Signal is shorter in duration!!!

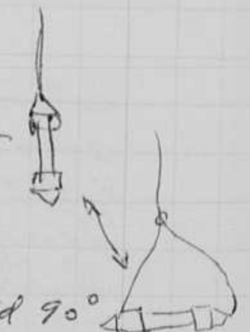




Down to 1/2 signal in 10 ms.

Osc no.	C	V	'/persec.	V/div	ms/div.	Hydrophone
1	16	4KV	1	0.5	.5.	8 ball
2	32	4	1	2.	.5	8 ball.
3	64	4 -		2.	.5	8 ball
4	96	4 -		2	.5	8 ball.
5	96	4	Slow	2	.5	8 ball off scale.
6	"		Slow	2	.5	8 ball
7	"		Slow	5	.5	8 ball
8	32	4.	1	2.	.5	8 ball
9	32	4	1	2	.5	GeoSpace } repeat.
10	32	4	1	2	.5	"
11	32	4	1	0.1	.5	BC 30





12 - 8:36 am Blank.
13 plate. GeoSpace signal looks same when the GeoSpace hydrophone is oriented 90°
changed to T1080 with E core 8" al 1/8" plate.   3" deep in H_2O

14	32	4	1	0.1	.5	BC 30
15	16	4	1	.05	.5	"
16	16	4	1	.2 ?	.5	8 ball

changed to small power driver.

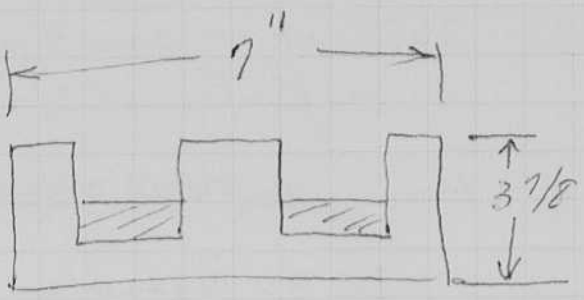
17	~~16~~ 8	4	1	~~.5~~	.5	8 ball.
18	8	4	1	.5	.5	"
19	24	4	1	.5	.5	BC

125 20 24 4 1 5 .5. Geo Space.

Jan 9 1965 Boomer

coil 90 turns
T-1104 # 10 Solid.

	L_h	Q.	Q.
coil only	$.85 \times 10^{-3}$		20
coil & core	4.9×10^{-3}		33
coil core plate	$.96 \times 10^{-3}$		4.4



1/8" Aluminum 12" diam 3 holes to match core

1864 Bell 485 pounds.

Mounted in yard at Bedford. Bldg. plant.

Note Sept 1974
4-405

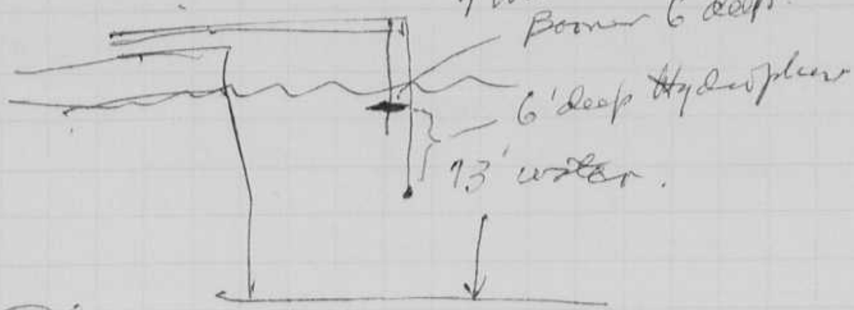
This bell was brought to M.I.T. in the spring of 1974. Now it is in Bldg 4 on the 4th floor. An automatic bell operation device is used to ring it.

A digitized circuit is being designed by a student, using a crystal to measure the time.

Harold E. Edgerton

Jan 4 1964 7:15 am H E Edgerton — 1000 WS Boomer test — old type EG&G.

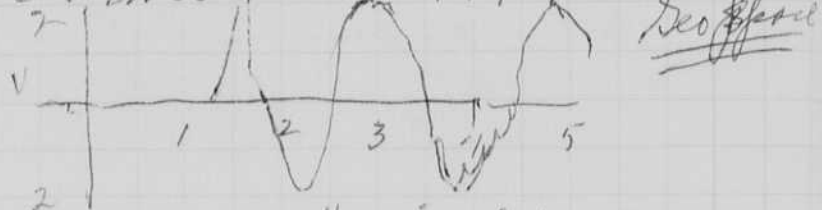
MIT pool.



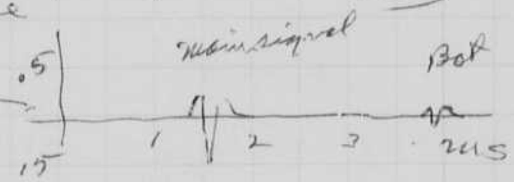
16 mfd 4000 volts ~~Geoffrace~~ Geo Space Hydrophone
Showed 10 ms signal ~~lasting~~ of about ? 1000 ℋ.

32 mfd 4000 volts. Geo Space .4v peak to peak of 10 ms duration.

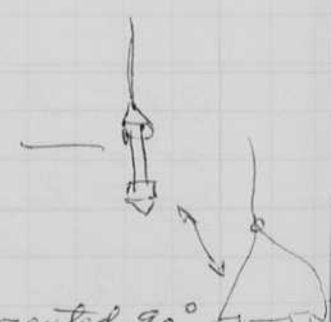
now tried 8 ball hydrophone
Signal is shorter in duration!!!



Down to 1/2 signal in 10 ms.



Osc. no.	C	V	1/per sec.	V/div	ms/div.	Hydrophone	
1	16	4KV	1	0.5	.5	8 ball	
2	32	4	1	2.	.5	8 ball.	
3	64	4 -		2.	.5	8 ball	
4	96	4 -		2	.5	8 ball.	
5	96	4	Slow	2	.5	8 ball	off scale.
6	"		Slow	2	.5	8 ball	
7	"		Slow	5	.5	8 ball	
8	32	4.	1	2.	.5	8 ball	
9	32	4	1	2	.5	Geo Space	} repeat
10	32	4	1	2	.5	"	
11	32	4	1	0.1	.5	BC 30	



12 8:36 am Blank.
13 plots Geo Space signal looks same when the Geo Space hydrophone is oriented 90°
changed to T 1080 with E core 8" ∅ 1/8" plate. 3" deep in H_2O

14	32	4	1	0.1	.5	BC 30
15	16	4	1	.05	.5	"
16	16	4	1	.2 (?)	.5	8 ball

changed to small power driver.

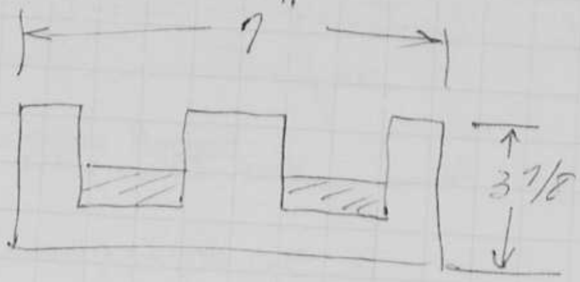
17	~~16~~	4	1	.~~2~~ 5	.5	8 ball.
18	8	4	1	.5	.5	"
19	24	4	1	.5	.5	"

125 20 24 4 1 5 .5. Geo Space.

Jan 9 1965 Boomer

coil 90 turns
T-1104 #10 Solid.

	L_h	Q. Q.
coil only	$.85 \times 10^{-3}$	20
coil & core	4.9×10^{-3}	33
coil core plate	$.96 \times 10^{-3}$	4.4



1/8" Aluminum 12" diam 3 holes to match core

1864 Bell 485 pounds.

Mounted in Yard at Bedford Bldg. plant.

Note Sept 1974 4-405 This bell was brought to M.I.T. in the spring of 1974. now it is in Bldg 4 on the 4th floor. an automatic bell operation device is used to ring it.

A digitized circuit is being designed by a student, using a crystal to measure the time.

Harold Edgerton

Jan 6 1955
H E Edgerton
Ed Curley

Sonoscope Recorder 5" alden

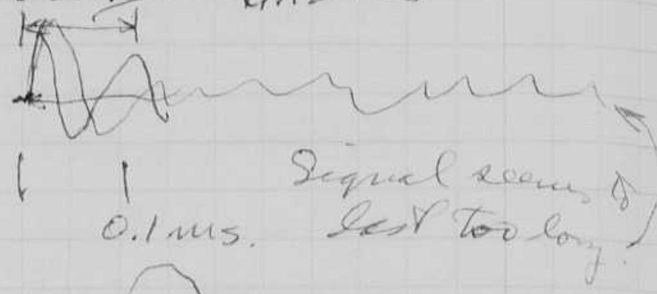
Initial tests. M.I.T. Pool

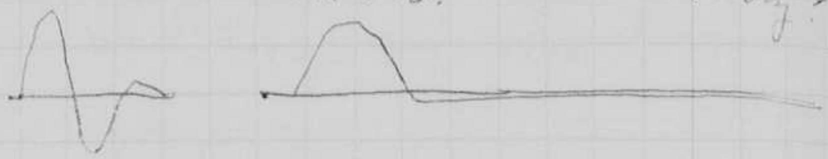
1. Vertical – can't read bottom due to many reflections (?) in circuit

2. Horizontal towards window.

BC 30 Hydrophone.

on high board.



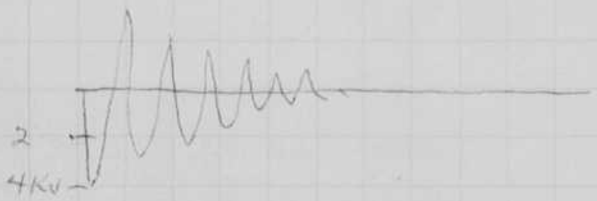


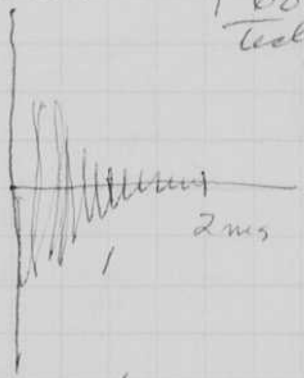
Comments: 1. need shorter pulse

2.

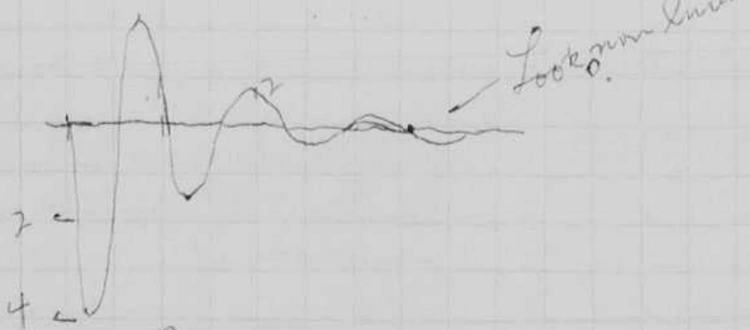
10.20 am moved to M.I.T. Lab 4-405.

P6015 20KV units
Tek Scope 4217
type 581A.





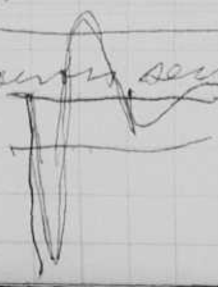
Damped with 10,000 ohms across Edo to dispose.



cable cap = 1300×10^{-9} f
Edo = 6500×10^{-9} f

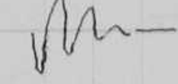
$1.3 \times 10^{-9} =$

5000 ohms across secondary of trans



Damping resistance on Primary . 250 Ω. — ——— cut duration by $\frac{1}{2}$

125 —

70. — cuts down max. 

Jan 12 1964

Cousteau's Soucoupe 5" Alden came in last week ~~...~~ Jan 7.
with Ed Corley — Tests in Pool.
Damping resistance of 5000 and 10,000 ohms
used across the transducer.

Osc 1	distance 15 feet	v	ms
1	10,000	.05	0.1
2	"	"	
3	"	"	
Blanks.			
5	∞	.05	.1
6	∞	.05	1.0

Does not check the film
other exposures made.
BC 30 was used off
Hi-p Board

Elo 6.5×10^{-9} farads,
Cable. 1.07×10^{-9} farads,
VF-#8

Repeat on page 117

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

2? negative strip(s) inside loose envelope

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

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

Item(s) now housed in accompanying folder.

INTERDEPARTMENTAL

From Jan ~~11~~ 7 1965 Toucoupe Ed Curley. H. Edgerton.

Building and Room ~~P~~ 115 T28

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Jan 7 1965 Tcucoupe Ed Corley, H. Edgerton.

Building and Room p 115 T28

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

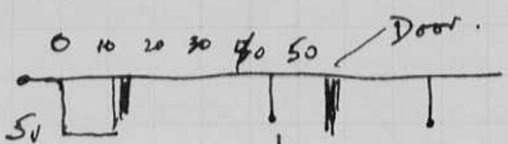
[illegible]

 HEE Jan 14 1965

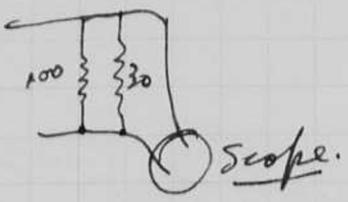
Soucoupe Sonar Pinger.

Changes. 1. 5K in parallel with output.
2. Slower speed on the takeup.

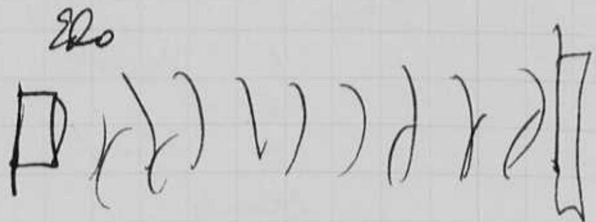
100 meter Sweep.



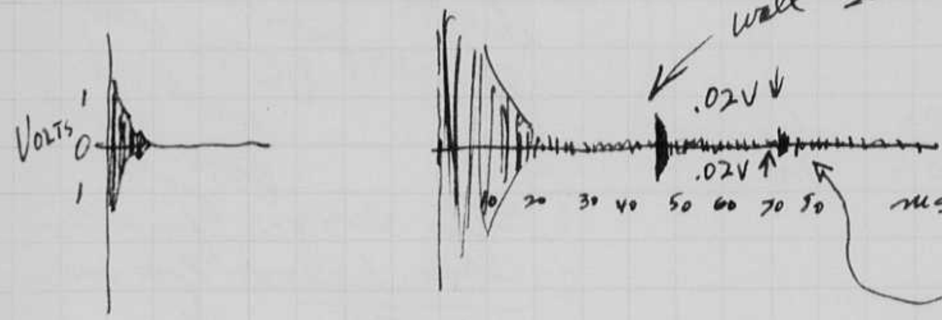
Door into 4-405



Echo



wall 30 ft away



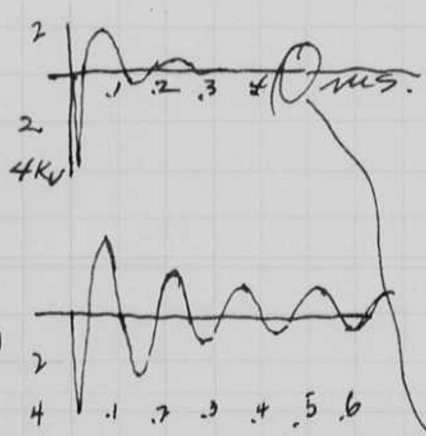
1.4 x .02 = .028 volts p to p.

.4 x .02 = .008 volts just writes on 100 meter sweep

noise .003 volts p-p.

Timing pips at 33 ms.

Input to crystal from the transformer.



with 5KΩ across the crystal.

7 cycles in 1 ms.

$T = \frac{1 \times 10^{-3}}{7}$

$f = \frac{1}{T} = \frac{7{,}000}{1}$ cycles.

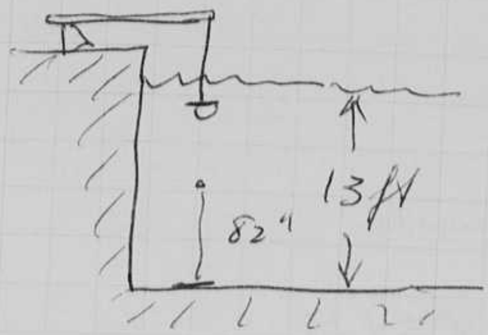
~~5.5 cycles in .4 ms~~

5.5 cycles in .4 ms $f = \frac{5.5}{.4} = 14{,}000$ cycles

Jan 19 1965
AM

M.I.T. Pool.
Soncarpe Recorder 12 volt DC Bat

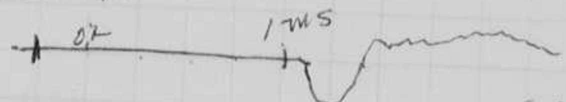
and Boomers.



Osc No.	V	T	Soncarpe
1	~~.2~~ .2 V	0.2 ms	Long Pulse. (16 mfd 4KV 1 per sec) BC 32 # 129. Hydrophone just rec'd. 12" deep ±.
2	Blank.		
3	~~.05~~ .2	0.2	
4	~~.05~~ .2	0.1	
5	.2	0.2	Short Pulse
6	.2	0.1	"
7	.05	1.	"
8	.05	1	Long. to Show bot of pool.
9	.2	.1	Short pulse same from " " "
10	.2	.1	Long. " " "

T-E&L.S. Ecore Boomer. Just pinned. (16 mfd)

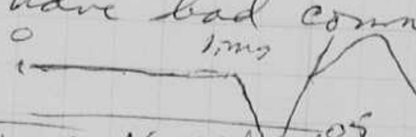
11	.05	~~.2~~ .2	why negative?
12	.2	1	to show correct zeros
13	"	1	
14	"	1	

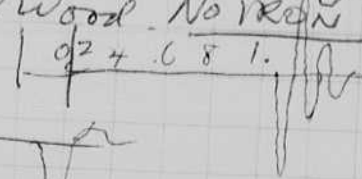


1 cycle = 0.8 ms
f = 1250 ~ elect
2500 ~ sound

note Looks same with 25 meg input system.

15	5.0	.2	Geophone
16	5.0	2.0	" 5½ ft below hung on Diving board.
17	5.	2.	Geophone wire up from bottom.
18	.5	1.	8 bell
19	.05	.2	BC-32 - 129 16 mfd 4KV, per sec. Seems to have bad connection.
20	.05	.2	32 mfd 4KV 1 per sec.
21	.2	.2	8" with Square plate and Wood. NO IRON 16 mfd
22	.5	.2	32 mfd.
23	.5	.2	64 mfd
23+	.2	1.	64
24	.1	.2	64 ~~mfd~~ mfd
25	.1	2	64 ~~16~~ E flash 8" square job 16 mfd
26	.05	.2	16 "
27	.05	2	16





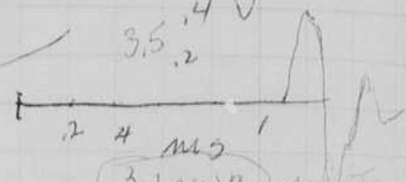
Which Hydrophone?

.12 volt

#129
BC-32

p-p

on.			Std	
(28	0.1	.2	{1000 watt sec Square unit with 20" dia	
(29	0.1	~~2~~1	16 mfd 4KV 1 per sec.	0.2 volts
(30	0.1	.2	{32 mfd	0.35
(31	0.1	1		
32	.2	.2	64	0.4 +
~~33~~	.2	1.	64	
34	1.0	.2	16 8 Ball at 5+ ft	3.5 .4 V .2
? 35	1.0	.2	32	
36	2.	.2	32	

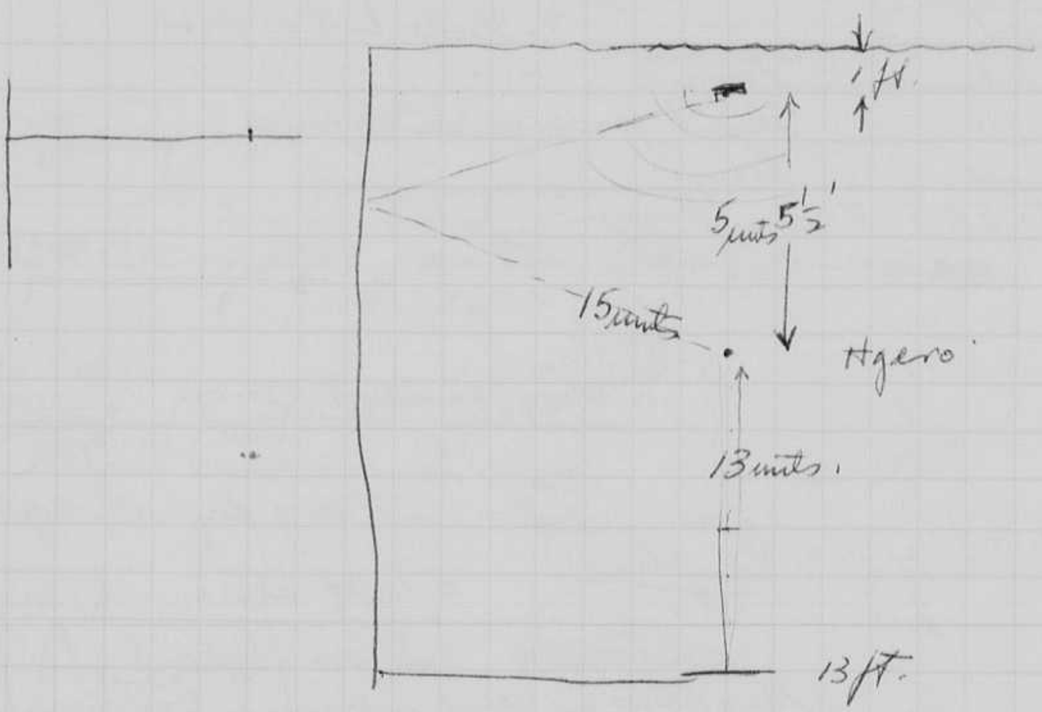


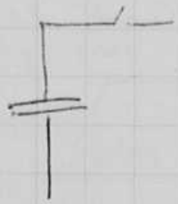
A very good signal

f = 4500   T = .22 ms

.04500.
12)1.00
88
120

Hall Sears 9200 Phone MP.8.





Let $C = 16 \times 10^{-6}$ farads.

$T = 0.2$ seconds for ½ cycle.

$T = \frac{2\pi}{2}\sqrt{LC} = \pi\sqrt{16\times10^{-6} L} = 0.2^2 \times (10^{-3})^2$

$10\sqrt{16\times10^{-6}} L = 0.04\times10^{-6}$

$L = \frac{0.04 \times \cancel{10^{-6}}}{160 \times \cancel{10^{-6}}} = \frac{.01}{40} \cancel{\times 10^{-6}} = \frac{.001}{4} = .00025 = .25\times10^{-3}$

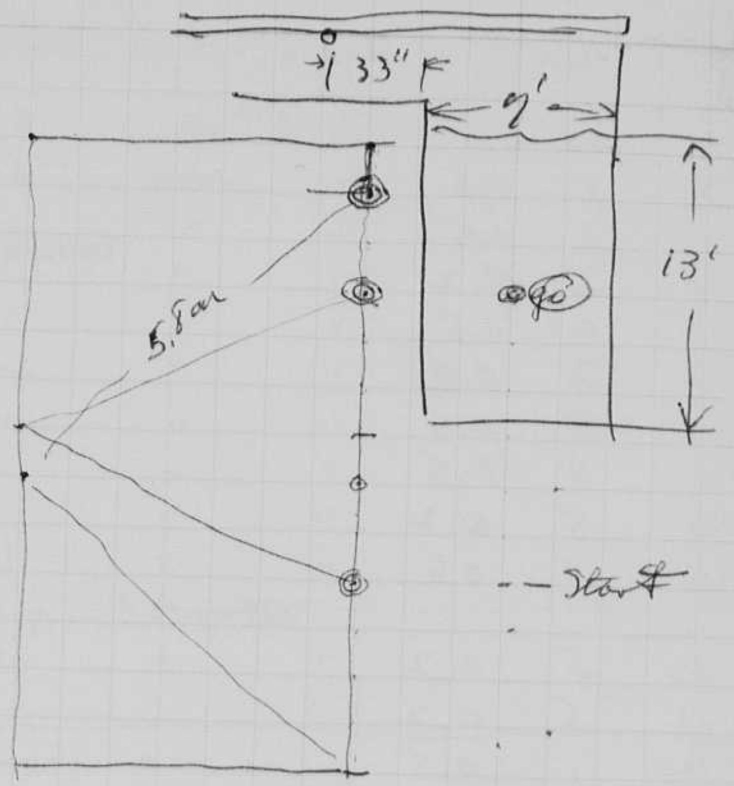
the full E with 98 turns is $1.\times10^{-3}$

L varies with N^2

So cut turns to 50

Transducers.

Name	with plate. L.	
I 1000 W.S. Bromer.		
II 8" Flatcoil		
III 8" square core, iron.		
IV 8" Cut E.	2.4×10^{-3}	
V 8" Full E 98 T	0.96×10^{-3}	
VI 8" Full E 50 T	0.25×10^{-3}	



◄· Surface wave
< Bottom Ref.

Jan, 17. 1964. Testsible made.

A. Soundout put - BC-32 (old) 1 megohm and 0.1 meg
8-Ball. into 1 megohm " 0.1 meg.

1000 WS - ~~8~~ 16 - 32 - 64 - 128 - 160 mfd.
into BC-32 and 8 Ball.

Full E 98T 8-16-24 mfd.
BC-32 and 8 ball.

(A) Series to obtain I 1000 WS - with 16, 32, ~~64~~ 80 (500) - 160 (1000) mfd.
Pressure time with
8 ball at 6 feet.

(B) new E 8 ball 16 - 32 mfd

(C) " " 8 ball 8-16-24. new Driver.

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

4? negative strip(s)

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

all inside loose envelope

was/were filmed where originally located between page 118 and 119.

Item(s) now housed in accompanying folder.

28	1000WS
	16mu
30	32
32	64

INTERDEPARTMENTAL

From P117 NB25 Jan 10 1965

Building and Room MIT Pool

Soucoupe transducer
1000 W.S.
Boomers small.
Oscillograms

BC-32
8 ball
Geophone

To

Building and Room

H. Edgerton

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From P117 NB25 Jan 19 1965

Building and Room MIT Pool

Sonoscope transducer
1000 W.S.
Boomers Small.
Oscillograms

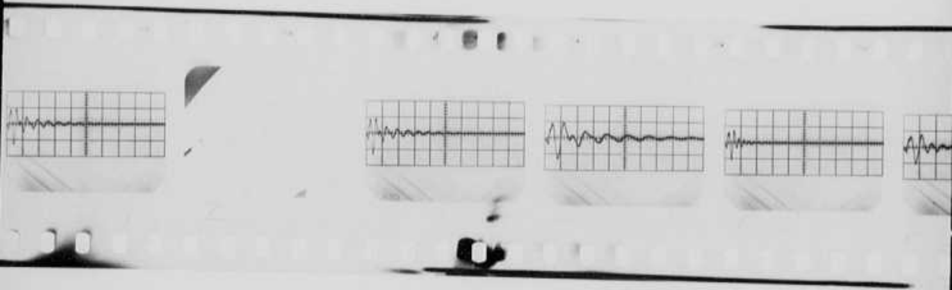
BC-32
8 ball
Geophone

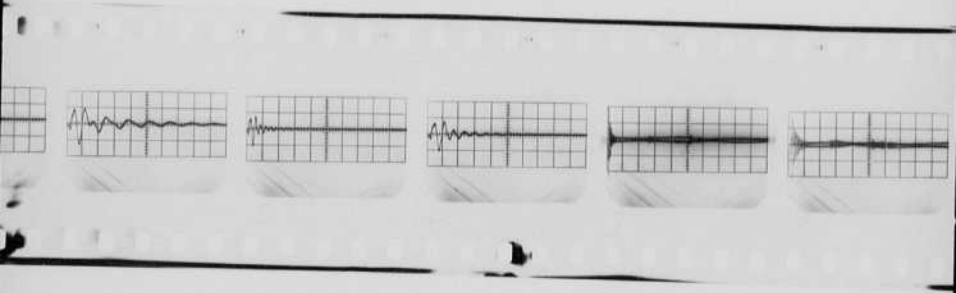
To

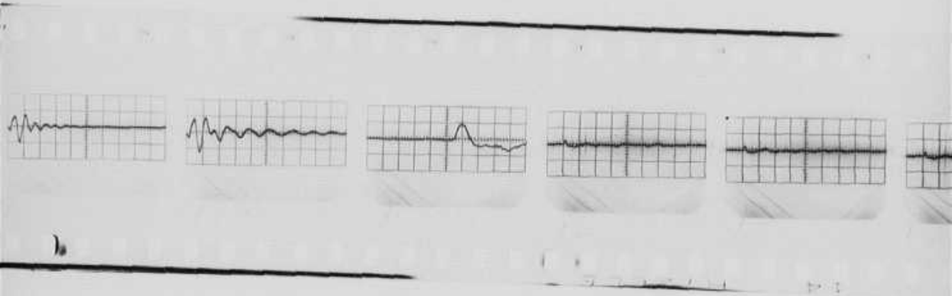
Building and Room

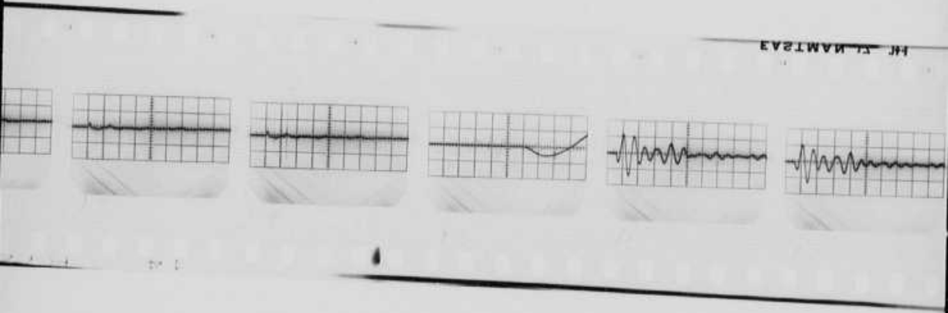
H. Edgerton

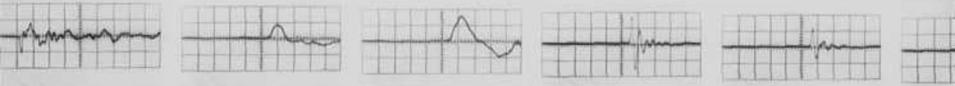
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

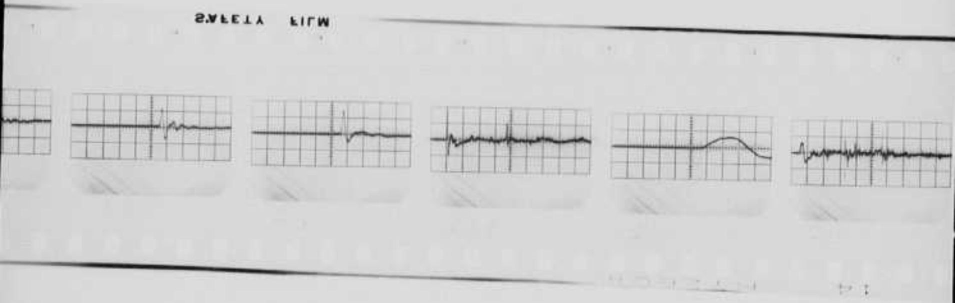


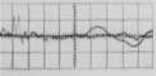


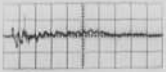






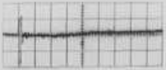

SAFETY FILM





27

28



29

30

31

31

32

33

34

35

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

6? negative strip(s) inside loose envelope

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

was/were filmed where originally located between page 120 and 121.

Item(s) now housed in accompanying folder.

INTERDEPARTMENTAL

From Jan 17 1965 Book 78 p 120

Building and Room H. Edgerton

Boomer test 8 Bell Hydrophone

I - 1000 WS Boomer
II - Square no horn. 8' plate.
III Square 8' ~~[illegible]~~ iron cone center.
IV E cut type.
V E full type 12" plate

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From Jan 17 1965 Book 78 p 120

Building and Room H. Edgerton

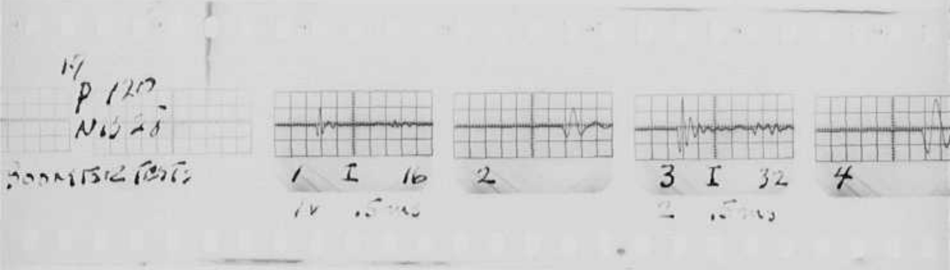
Boomer test 8 Bell Hydrophone

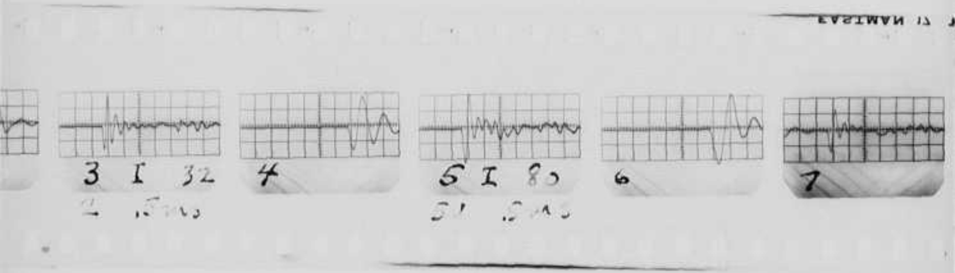
I - 1000 WS Boomer
II - Square no hum. 8" plate.
III Square 8" ~~—~~ mm cone center.
IV E cut type.
V E Full type 12" plate

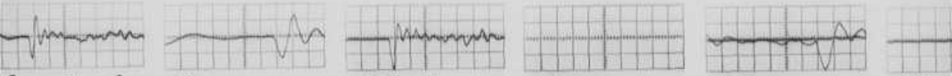
To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

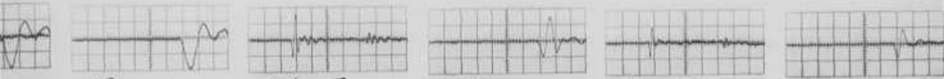

P 120
1 I 16
2
3 I 32
4


3 I 32
4
5 I 80
6
7



8 I 80 9 10 I 160 11 12 13

51 .5 sec 51 .5 sec



13

14 I 16

.14 .5 ms

15

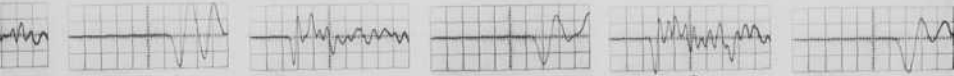
16 I 8

.21 5 ms

17

18 I 24 19 20 V 8 21 22 23

2V .5ms .2V .5ms



23

24 V 16
.5V .5ms

25

26 V 24
.5V .5ms

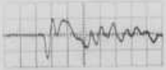
27

28

29

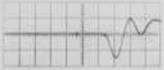
30

31



32

33

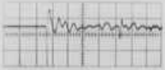


33

34 II 8

.5V .5ms

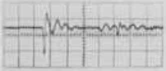
35



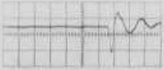
36 II 16

1V .5ms

37

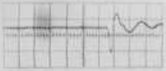


38 II 24
2V .5



39

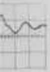
40



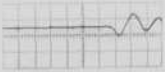
41

42 II 8
.5 V .5 ms

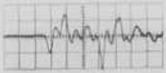
43



42 VI 8
.5 V .5 ms



43



44 IV 16
.5V .5 ms

45 IV 24
.5V .5 ms

46

47 III 8
.2V .5ms

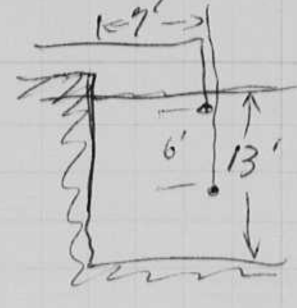
48 III 16
.2V .5ms

49 III 24
.2V .5ms

50

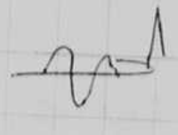
Jan 17 1965 Sunday 11am
M.I.T. Pool — Storm Snow outside!

Scope 9059 545 Tek

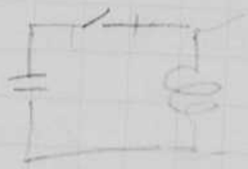


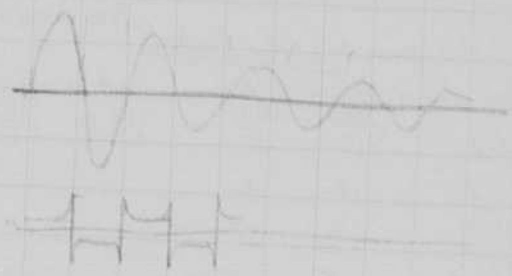
Osc no.	V/cm	T/cm ms	Hydro	Trans	Distance	C	V	Remarks
Print 1	~~1~~	0.5	Tball	I 1000	6'	16	4KV	1 per sec,
2	1	0.2	"	1000	6'	16	"	"
✓3	2	0.5	"	"	"	32	"	"
4	2	0.2	"	"	"	32	"	"
✓5	2	0.5	"	"	"	80	" –	" (2.2/2.7) × 4 KV.
6	2	0.2	"	"	"	80	" –	"
7	5	0.5	"	"	"	80	4KV	~~1 per sec~~ 10 sec } 2.70 m meter
✓8	5	0.5	"	"	"	80	"	"
9	5	0.2	"	"	"	80	"	"
✓10	5	0.5	"	"	"	160	4KV	"
11			Blank?			160		
12	5	0.2	"	"	"	160	"	" Several traces
13	5	0.2	"	"	"	160	"	"
✓14	1	0.5	"	"	"	16	4KV	1 per sec Small Power Supply.
15	1	.2	"	"	"	16		"
✓16	.2	.5	"	"	"	8		"
17	.2	.2	"	"	"	8		"
✓18	2.	.5	"	"	"	24		"
19	2.	.2	"	"	"	24		"
✓20	.2	.5	"	V 12" Disc on E	"	8		" Trans at 6" ±
21	.2	.2	"	" (full)	" +	8		"
22	.2	.5	"	"	"	8		" Tran at 12" ± deep
23	.2	.2	"	"	"	8		" "
✓24	.5	.5	"	"	"	16		" "
25	.5	.2	"	"	"	16		" "
✓26	.5	.5	"	"	"	24		" "
27	.5	.2	"	"	"	24		" "
28	.2	.5	"		"	8 + 15Ω		" "
29	.2	.2	"	(2×4)	"	8 + 15Ω		" "
30	.5	.5	"	"	"	16 + 15Ω		" "
31	.5	.2	"	"	"	16 + 15Ω		" "
32	.5	.5	"	"	"	24 + 15		" "
33	.5	.2	"	"	"	24 + 15		" "
✓34	.5	.5	"	II 8" Square al motion	6	8		" " Shows spike
35	.5	.2	"		6	8		" "
✓36	1.0	.5	"		"	16		" "
37	1.0	.2	"		"	16		" "
✓38	2.0	.5	"		"	24		" "
39	2.0	.2	"		"	24		" "
40	2.	.5				24 + 15Ω		
41	2.	.2				24 + 15Ω		

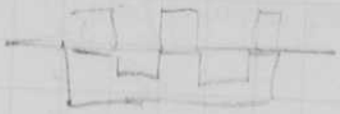
Osc no	V/cm	T/cm ms.	Hydro	Trans	Dist	C	V	Remarks.
✓ 42	.5	.5	8 ball	#IV p119 cut E	6'	8	4KV	1 per sec
43	.5	.2	"		"	"	"	"
✓ 44	.5	.5	"		"	16	"	"
✓ 45	.5	.5	"		"	24	"	"
46	.5	.5	"		"	24+15 Ω	"	"
✓ 47	.2	.5	8	III p119 Square 8" plate	"	8	4KV	"
✓ 48	.2	.5	8		"	16	"	"
✓ 49	.2	.5	"		"	24	"	"
50	.5	.5	"			24	"	"
51	.2	.5	"			24 + 15 Ω	"	"



Long way







1-18-'65 Transducer #VI

$\frac{16}{400}$ 64.0

E type core, center leg 1 3/4 square

50 turns #16 plastic insulated wire.
8 turns per layer, 6 1/2 layers.

$T = \pi\sqrt{16\times10^{-6}\times400\times10^{-6}} = 80\times10^{-6}$ sec.

L = 190. μh. Q = 5 no iron

L = 393 μh. Q = 4 with iron and 12" plate.

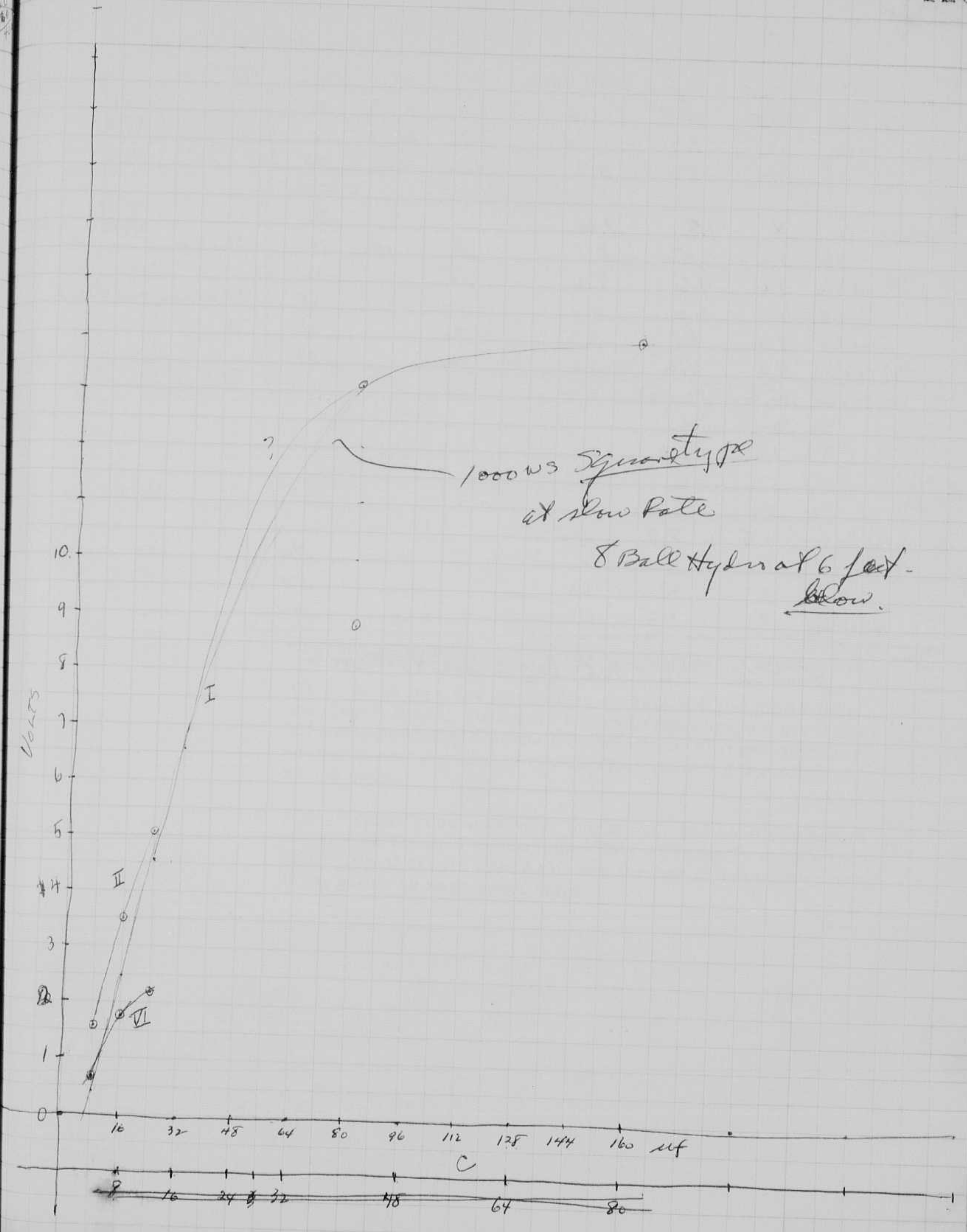
L = μh no plate with Iron.

7:40 pm M.I.T. Pool

Oscillo	V/cm volts	T/cm ms	Hydro	Trans	Dist.	C	V	Remarks.	Low Board. 1 dec 6
√1	√.2	.5	8 ball	VI	6'	8	4	1 per sec.	
2	.2	.2				8	4		
3	.2	.5				8	4		
√4	.5	.5				16	4		
5	.5	.2				16	4		
√6	1.0	.5				24	4		
7	1.0	.2				24	4	" 6" deep	
√8	1.	.5				24	"	" one foot	
9	1.	.2				24	"	" " "	

Returned to Lab 4-405. Put 16" al disc 1/4" behind the Iron part of the E core.

10	.2	.5	8 ball	VI	6'	8	4
11	.2	.2				8	4
12	.5	.5				16	4
13	.5	.2				16	4
14	1.	.5				24	4
15	1.	.2				24	4


1000 ws Squaretype
at slow Rate
8 Ball Hydra at 6 feet.
below.
VOLTS
10
9
8
7
6
5
4
3
2
1
0
I
II
VI
16
32
48
64
80
96
112
128
144
160 uf
C
8
16
24
32
48
64
80

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

47 negative strip(s) inside loose envelope

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

was/were filmed where originally located between page 122 and 123.

Item(s) now housed in accompanying folder.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASS.

Jan 24 1965
MB 28 P1242
1000 W.S.

INTER-DEPARTMENTAL

SAFETY FILM

1 2 2a 5 4 5

I 16 1V .5ms I 32 6' 2V .5ms I 32 2V .2 I 32 2V .5ms I 32 3 Deep 2V 0.5ms I 32

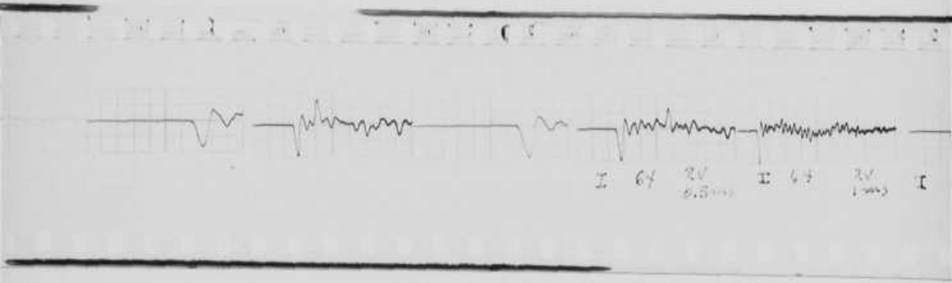
JAN 24 1965 M.E. EDUCATION! 7/25 129

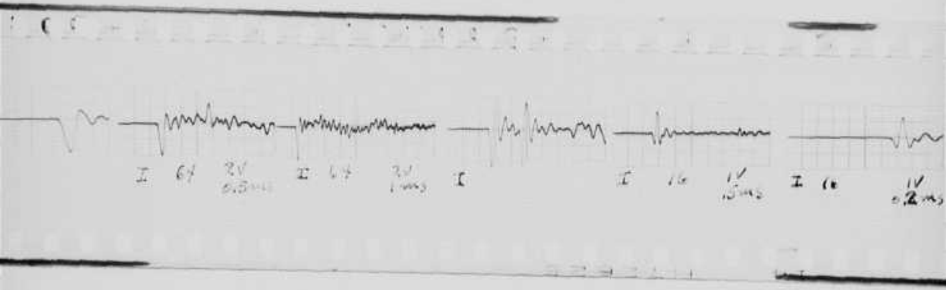
SAFETY FILM

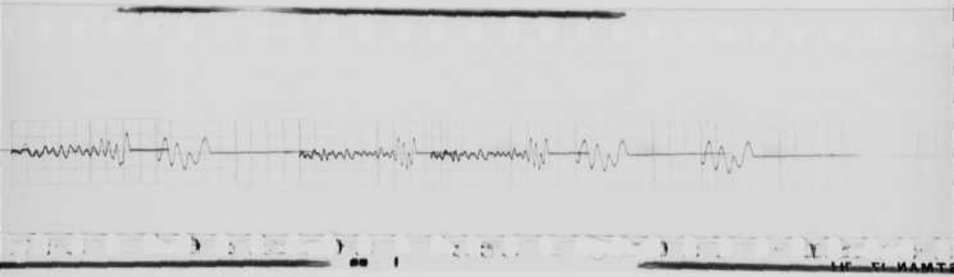
45 ✓ 54 65 26 ✓ #

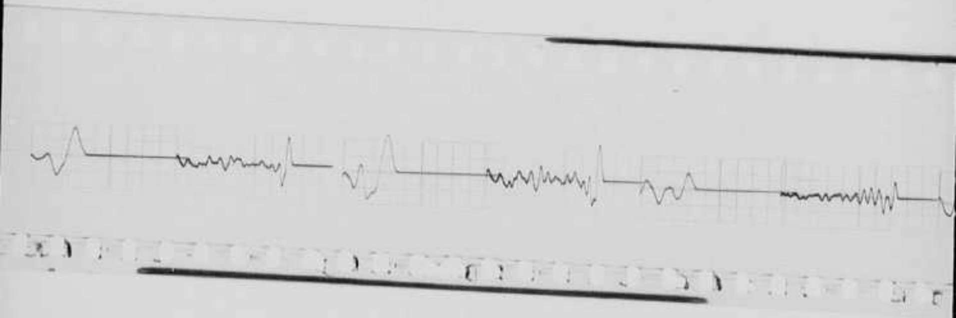
2V .2 I 32 2V .5ms I 32 3 Deep 2V 0.5ms I 32 LC32 0.1V 0.5ms I 32 LC32 0.1V 0.5ms I 32 8B 2V 0.5ms

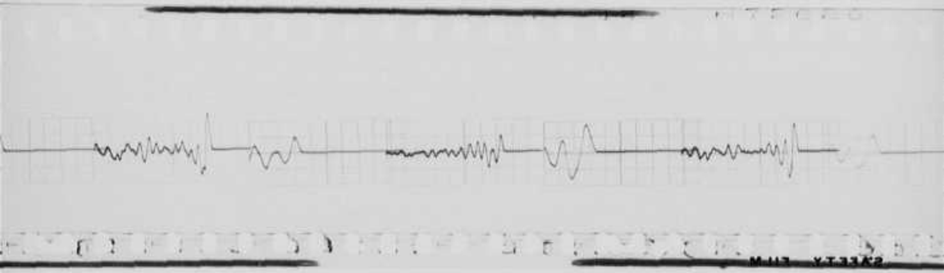
P12F 129




I 64 2V 0.5ms
I 64 2V 1ms
I
I 16 1V .5ms
I 16 1V .2ms

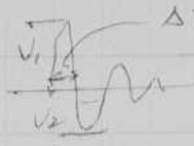






Jan 19 1965

1000 W8. I

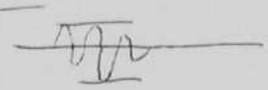


ΔT_1 first 1/2 cycle

ΔT_2 second 1/2 cyc.

Small	C	V^1_{peak}	V^2_{peak}	V_1+V_2	ΔT_1 ms	ΔT_2	1cyc.	1 per sec
	8	0.15	0.08	.23	0.1	0.18	.29	3540
	16	.75	1.2	1.95	~~0.06~~ 0.12	~~0.07~~ 0.14	.26	3850
	24	1.6	2.3	3.9	0.12	0.12	.24	4170
Large	16	.8	1.2	2.0			.22	4550
	32	2.6	3.5	6.1	.15	.14	.29	3450 Good sine signal. 3400
(48)	32+16	3.6	4.6	8.2	.18		.32	3120
	64	4.0	5.0	9.0	.20		.38	1½ cycles, excellent.
	16+64	4.4	4.8	9.2	.20		.38	2 "
(96)	32+64	4.3	4.6	9.9	.21		.38	2640
(96)	32+64	75.5	73.5 47	9.2				Long duty time.
	32	~~3~~	~~4~~					
	32	2.9	3.4	6.8				
1.1 1.2	64	5.5	6.	11.5				
1.4 60 1.3	96	7.0	6.0	13			.38	2640
1.5 1.2 (112)	16+96	7.5	7.6	14.5				
1.6 (128)	32+96	8.0	7.0	13.			.40	2500
1.7 (144)	48+96	7.5	5.0	13.5			.42	2380
1.9 160	64+96	9.5	4.5	14.0 (osc 15)			.44	2270

~~Bleach~~ Sheet	Yen	1cm	v	1/2	ms.	C.	V.	Pole
1x ~~2~~	.2	.5	.48	.26	VII cop.	8	4.	1 per sec.
~~2~~	.2	.2						
3x	.5	.5	1.25	.3.		16		
4x		.2						
5x	.5	.5	2	.35		24		
6x		.2						
7x	.5	.5	3.	.32		32		
8x	.5?	.5	3.2	.38		48		
9x	~~.5~~ 1.	.5	4.9	.39		64		
10x	~~.5~~ 1	.5	4.9	.		80		
11x	2	.5		.		80	30 seconds	
12x Soucoupe	.5	.2			Short.			Vertical.
	.5	.2			Long.			
~~13x~~	.5	.5.			Long.			Shows bottom Reflection.



Soucoupe with E.O.

Xalted.

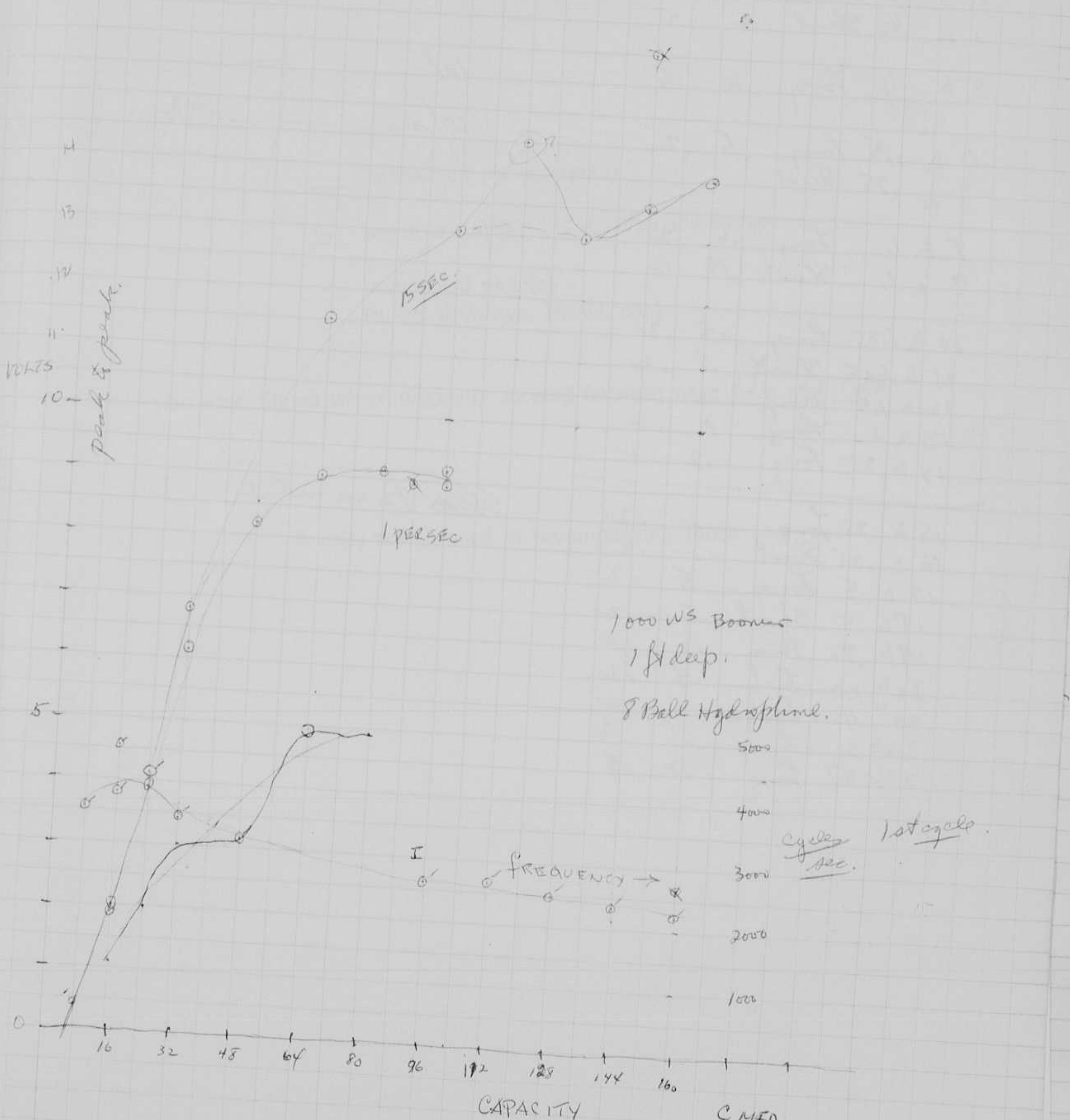
SOUCOUPE

chassis AN3102-18-16S

cord, AN3106B-18-16S

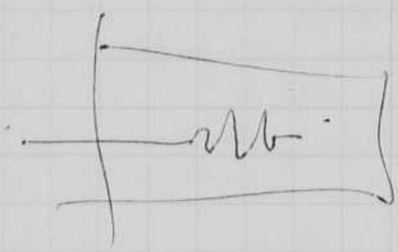
High voltage plug'

Sep 129


VOLTS
peak to peak
15 SEC.
1 PER SEC
I
FREQUENCY →
1000 WS Boomer
1 ft deep.
8 Bell Hydrophone.
Cycles/sec.
1st cycle.
CAPACITY
C MFD

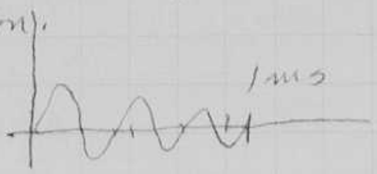
Jan 18 1968
[illegible]

			1/a	T/cm.	EKC	Trans. Cone
#1	A	1/4 Long	.2	.5		30/sec
2		1/4 Short.	.2	.5		
3	A	1/2 Lon	.2	.5		30/sec
4	A	1/2 Short	.2	.5		
5	A	1/2 Long	.2	.5		10/-
6	A	.75 Long.	.5	.2		10/sec
7	A	.75 Short				
8	A	1. Long	.5	.2		
9	A	1. Short	.5	.2		
10	A	1.25 Long	.5	.2		
11	A	1.25 Short	.5	.2		
12	A	1.5 Long	.5	.2		
13	A	2. Long	1.	.2		
14	A	.25 Long.	.2	.2		
15	A	.25 Long.	.2	.2		E[illegible] 12 in metal
16	A	.25 Short	.2	.2		
17	A	.5 Long	.5	.2		
18	A	.5 Short	.5	.2		
19	A	.75 Long	.5	.2		
20	A	1.0 Long	.5	.2		
21	A	1.5 Long.	.5	.2		
22	A	2. Long	.5	.2		
23	A	1/4 Long	.2	.5		

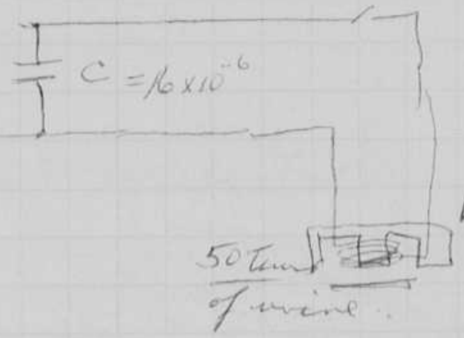


Conference on Boomer
Jan 23 1964

1. Goal. – efficient 3KC signal about 1 ms long,
for penetration.



2. Design



$f = \cancel{6000}\ 1500$ cycles

$= \dfrac{1}{2\pi\sqrt{LC}}$

$L = \dfrac{1}{4\pi^2 C f^2} = \dfrac{1}{40\, C\, 36\times10^6}$

$= \dfrac{1}{1600 \cdot 16\times10^{-6}\times10^6}$

$= \dfrac{1}{625600} = 400\times10^{-6}$ henries

note # VII full F. 50 turns copper measured ~~400~~ 400 henries.
~~if $L = N^2$ then the turns should be $\frac{50}{3} = 17$ turns etc.~~
~~$\frac{50}{3} = 17$ turns~~

Design of VII or VI looks to be ok.

3. Try different plate

Bakelite plate

meas of VII

1. no plate
   $L = 4.0$ mh $Q = 15$
2. Square copper plate
   $L = 0.36$ $Q = 5.8$
3. Copper ring
   $L = 0.49$ $Q = 4.8$

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

6 negative strip(s) inside loose envelope

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

was/were filmed where originally located between page 126 and 127.

Item(s) now housed in accompanying folder.

INTERDEPARTMENTAL

From NB 28 p122 124 125 Jan 1965

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

Building and Room

123 Transducer VI Full E 50 Turns #16 L = 393 e = 4 with 12" al plate.
124 VII " " " copper square plate & Doucoupe 1
126 6KC and 12 KC Edo with old mud penetration air circuit. 1

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From NB 28 p 122 124 125 Jan 1965

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

Building and Room

122 transducer VI Full E 50 turns #16 h = 393 e = 4 with 12" al plate.
124 VII " " " copper square plate & Doucoupe 1
126 6 KC and 12 KC Edo with old mud penetrator aircircuit i

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

1x

8 myel .2V
VII cr .5ms

2x

8 .2V
VII cu .2ms

3x

16 .5V
VII cu .5ms

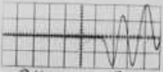
4X

16 .5V
V11cu .2ms

✓ 5X

24 .5V
V11cu .5ms

6X



24 .5V
V11cu .2ms

✓ 7x

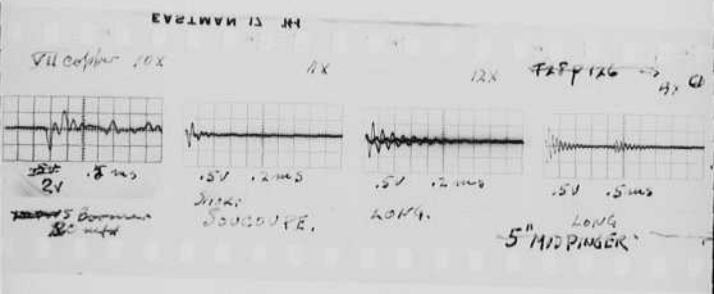
32 .5V
VII cn .5ms

✓ 8x

48 .5V
VII cn .5ms

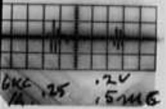
✓ 9x

64 1V
VII cn .5ms



10X
12X
2V
.5V .2ms
SOUCOUPE.
LONG.
.5V .2ms
.5V .5ms
LONG
5" MIDPINGER"

1 2A



2 3A

3 4A

6KC CONE B×8 p126. MODPEN .5"

4 5A

5 6A

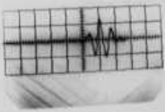
6 A 7

6 A Not wired?

8A

6KC .5V
8A. 1. .2 ms

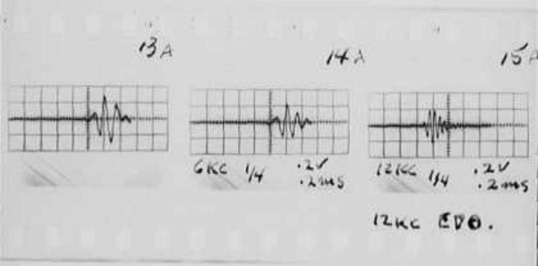
9A



10 A

11A

12


13A
14A
15A
6KC 1/4 .2V .2ms
12KC 1/4 .2V .2ms
12KC EDO.

14A

1/4 .2V .2ms

15A

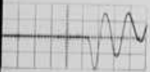
12KC 1/4 .2V .2ms

16

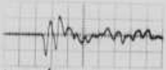
12KC EDO.

JAN 18 1965
B28 p 122
Trans VI

5



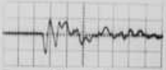
6



6 V1 24
1.V .5ms

7

8



5 V1 24
1V .5ms

SAFETY FILM

9

10

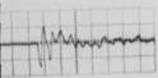
11

.2

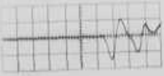
.3

14

14



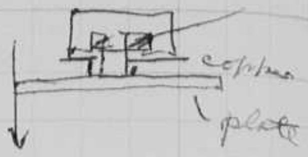
15



16

Jan 24 1965 ASE

9:45 am MIT Pool Small Boomer tests. see page 127,
50 turns on E core with copper driver
into 10" diam 3/8" Bakelite plate.

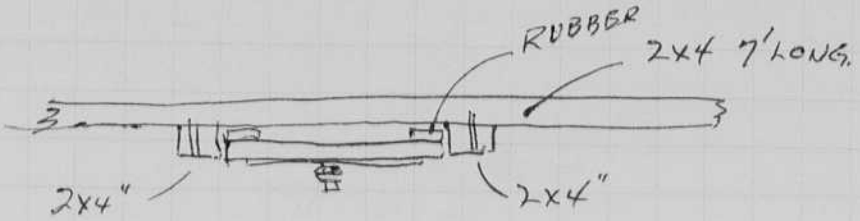


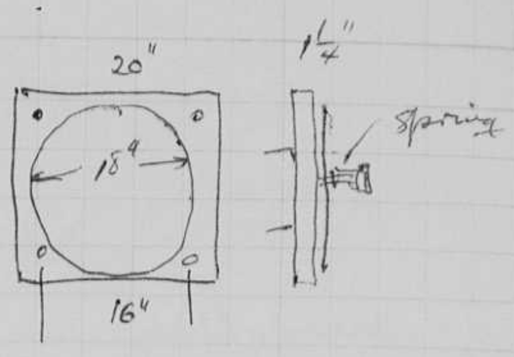
Osc no	C	V Ball per sec	V/cm Volts	T/cm ms	Hydro Trans.	Remarks.
1	8	4 1	.2	.5	8 ball VIII	Hydro below at 6' from face
2	8		.2	.2		
3	16		.5	.5		
4	16		.5	.2		
5	24		.5	.5		
6	24		.5	.2		
7	16		.5	.5		Large 1000WS Supply.
8	16		.5	.2	Camera Skipped	
9	32		.5	.2	Tore sprocket holes	
10	32		.5	.2	Cannot identify.	
11	48		1.0	.5		
12	48		1.0	.2		3 volts p-p
13	48		1.0	.5		Trans lowered to 1½ ft ±.
14	48		1.0	.2		
15	64		1.0	.5		
16	64		1.0	.5		Trans lowered to 45" below surface.
17	64		1.0	1.0		
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						

M.I.T. pool tests

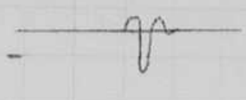
1000 W.S. Boomer

Wood Support





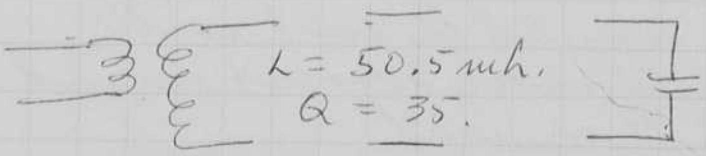
oscill	C		V/cm	T/cm		
1	~~64~~	1 per.	2.	.5	8 ball I	Surface
					Equipment blew. Spark does not trigger?	
2	16	1	1	.5	8 ball 6 ft I.	at Surface.
					film stuck in camera Robot!!	
	16		.6 V_+	1.1 V_-	1/2 cap. f.	Surface.
	32		1.2	1.9	1.5 x 2 = 3	3330



New film put into camera.

1	16	1 V	.5 ms.	8 ball I	at surface.
2	32	2	.5 ms.	8 " 6 ft I	at surface.
~~3 & 3A~~	~~32~~	~~2~~	~~.5 (.3), .2 3x.~~	~~8 " at 9 ± ft~~	~~" "~~
4	32	2	.5	8" 6 ft below	3 ft. deep.
5	32	.2	.5 0.1	LC 32 below on pole.	neg. voltage - open circuit?
6	32	.2	.5 0.1	LC 32 " " .	Trans I at Surface. (4") down
7	32	2.0	.5	8 ball at 6' ± below at same	Tran I at Sur (4") ±

Soucoupe tests.



$L = 50.5$ mh.
$Q = 35.$

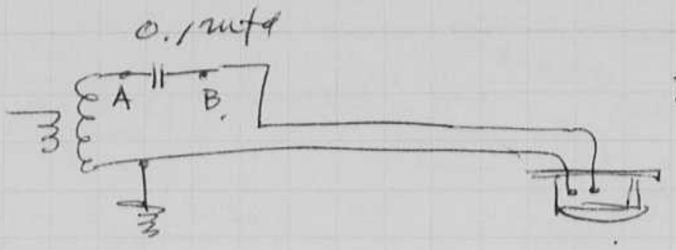
$C = 8 \times 10^{-9}$ $D = .01$

$f = \frac{1}{2\pi\sqrt{LC}} = \underline{8000}$ cycles

Similar coil T1079 has $L =$ 112. mh at 50.
Ed Curley took off turns to tune to 8000 cycles.

See page 124

 Jan 24 65 cont 6pm Sonicoupe.



$8 \times 10^{-9} = .008 \times 10^{-6} \cong .01$

Meas of frequency. $\frac{6 \text{ cycles}}{.84 \text{ ms}} = 7140$ cycles/sec.

$\frac{6}{.86} = 7000$ cycles.

.01 $\frac{8}{.84} = 9500$ cycles/sec.

Jan 28. 1965. 100 mem Drive Camb-Mass.

Recorder system.

The alden wet paper system has been used for years in our oceanographic devices for seismic recording. The advantage is the instantaneous readout of the data.

Photographic methods have not been used very much due to the processing problems.

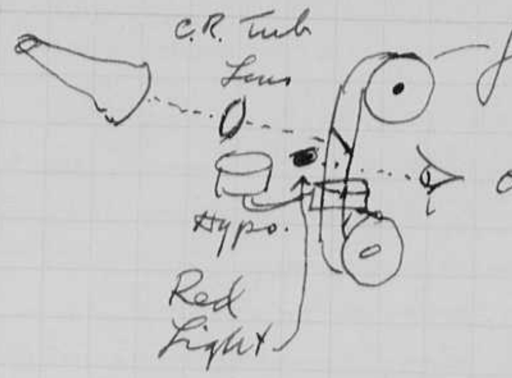
I propose that a blue sensitive thin ~~ele~~ emulsion similiar to the "positive" motion picture type be use so that quick chemical action would result.

The emulsion would be wet with a developer solution. Moist would be a better word than wet.

Development would result immediately when the blue light from the C.R. tube struck the emulsion.

Viewing would be by red light. so the result could be seen promptly.

The film then would enter a hypo acid bath to stop the action and clear the film for study later.

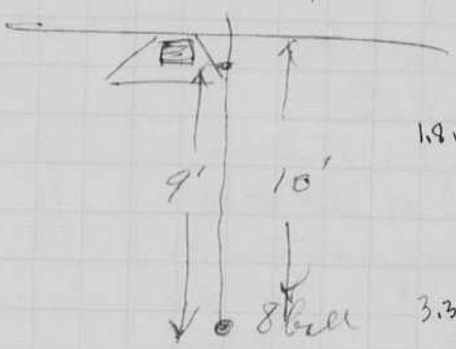


Discussed Feb 1965 with Don Krotser Centas Warren Moon.

Fast processing film for recorder using developer moistened blue sensitive film and a red light viewing system.

8.58 am at M.I.T. I called Chas Wyckoff about this we had a long discussion. He is going to make some experiment so we can get a model into action.

M.I.T. pool 9.25 30" reflector

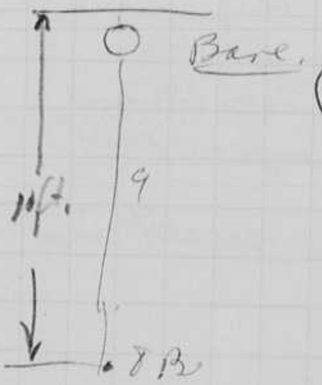


Osc

1 1/2 power
2 "
1.8 v p.p. * 3 "

4 full Double Sweep
5 "
6 "
3.3 V p-p. * 7 full one sweep
8 " "
9 " "

Scope
1 Volt/cm.
200 μsec/cm.



10 Blank
11 Blank

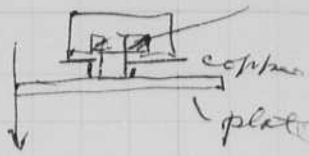
Bare
12 1/2 power one sweep
13 " " " "
0.6 V pp. 14 " " " "
15 full " " "
1.2 V p-p. 16 " " "
17 " " " "

Bare transducer

18 1/2 power " "
19 " " " " } double exp?
20 " " " " }
21 " " " "
22 full " " "
23 " " " "
24 " " " "
5 Volt per cm. { 25 " " " "
26 " " " "
27 " " " "

ext. triggered sweep 500 μsec per cm.

Jan 24 1965 ASE
9.45 am MIT Pool Small Boomer tests. see page 127.
50 Turns on E core with copper liner
into 10" diam 3/8" Bakelite plate.



Osc no	C	V Roll per sec	V/cm volts	T/cm ms	Hydro Trans.	Remarks.
1	.8 4 1		.2	.5	8 ball VIII	Hydro below at 6' from face
2	8		.2	.2		
3	16		.5	.5		
4	16		.5	.2		
5	24		.5	.5		
6	24		.5	.2		
7	16		.5	.5	Camera Skipped Tore sprocket holes Cannot identify	Large 1000 WS supply.
8	16		.5	.2		
9	32		.5	.2		
10	32		.5	.2		
11	48		1.0	.5		
12	48		1.0	.2		3 volts p-p
13	48		1.0	.5		Trans lowered to 1½ ft ±
14	48		1.0	.2		
15	64		1.0	.5		
16	64		1.0	.5		Trans lowered to 45" below surface
17	64		1.0	1.0		
18						
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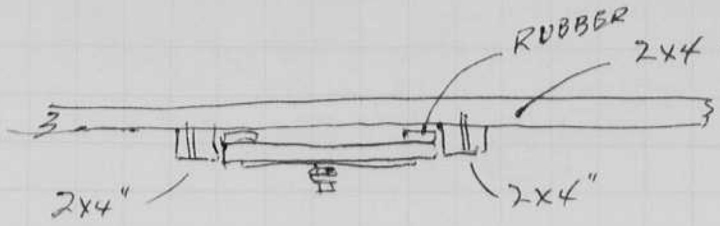
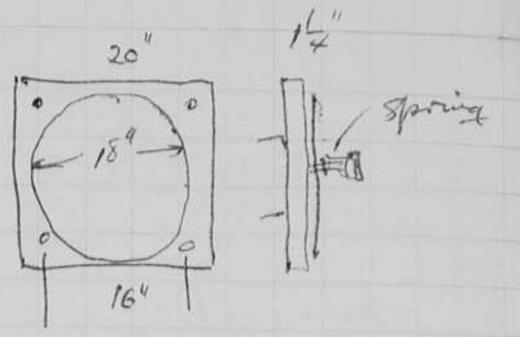
29						
30						
31						
32						
33						
34						

M.I.T. pool tests

1000 WS. Boomer

Wood Support





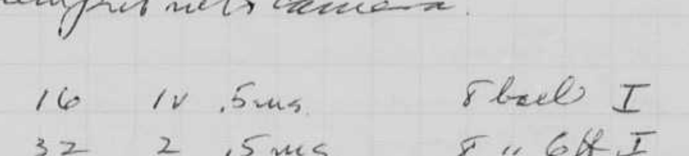
oscw C V/cm T/cm

1	~~64~~	1 per. 2.	.5	8 ball I	Surface
				Equipment blew. Spark does not trigger?	
?					
2	16	1	1 .5	8 ball 6 ft I.	at Surface.
				film stuck in camera Robot!!	
	16	.6	1.1	1/2 exp. f.	Surface.
	32	1.2	1.9	1.5x2 = 3	3330

New film put into camera.

1	16	1v	.5 ms.	8 ball I	at surface.
2	32	2	.5 ms.	8 " 6 ft I	at surface.
3 & 3A	32	2	.5 .2 3x.	8 " at 9± ft	" "
4	32	2	.5	8" 6 ft below	3 ft. deep.
5	32	.2	.5 0.1	LC 32 below on pole.	neg. voltage - open circuit?
6	32	.2	.5 0.1	LC 32 " " "	Trans I at Surface. (4") down
7	32	2.0	.5	8 ball at 6' ± below at same	Trans I at Sur (4") ±

Ioncoupe tests.



$L = 50.5$ mh.
$Q = 35$.

$C = 8 \times 10^{-9}$ $D = .01$

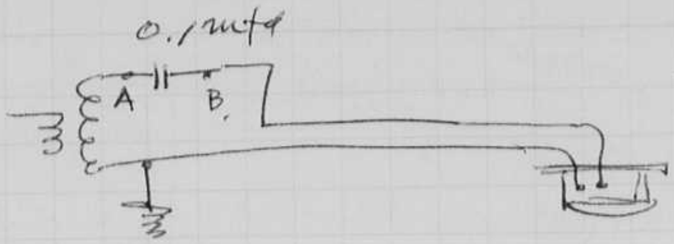
$f = \frac{1}{2\pi\sqrt{LC}} = \underline{8000} \text{ cycles}$

Similar coil T1079 has L = 112. mh at 50.

Ed Curley took off turns to tune to 8000 cycles.

See page 124

 Jan 24 65 cont 6pm Sonecope.



$8 \times 10^{-9} = .008 \times 10^{-6} \cong .01$

meas of frequency. $\frac{6 \text{ cycles}}{.84 \text{ ms}} = 7140$ cycles/sec.

$\frac{6}{.86} = 7000$ cycles.

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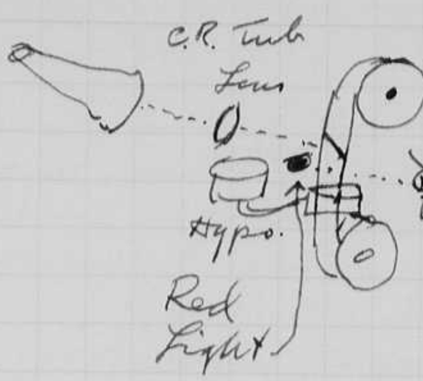

Discussed Feb 1965 with Don Kratsos Centers Warren moon.

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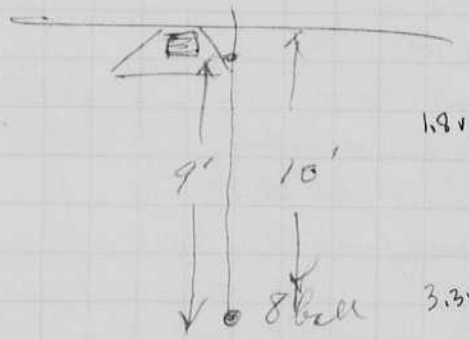
M.I.T. pool 9.25 . 30" reflector



osc

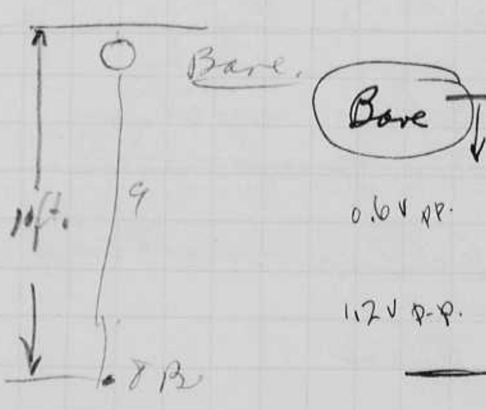
1 1/2 power
2
1.8 v p.p. * 3 "

4 full Double Sweep
5 "
6 "

3.3 v p-p. * 7 full one sweep
8
9 " " "

Scope
1 Volt/cm.
200 μsec/cm.

10 Blank
11 Blank



Bare

12 1/2 power one sweep
13 " " " "
0.6 v p.p. 14 " " " "
15 full " " "
1.2 v p-p. 16 " " "
17 " " " "

Bare transducer

18 1/2 power " "
19 " " " " ? } double exp?
20 " " " "
21 " " " "
22 full " " "
23 " " " "
24 " " " "
5 Volt per cm. { 25 " " " "
26 " " " "
27

ext. triggered sweep
500 μsec per cm.

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

5 negative strip(s) inside loose envelope

____ 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.

INTERDEPARTMENTAL

From

Building and Room

Edo

Barrel Stave

6KC Sonar
p131 NB28
Jan 1965
H. Edgerton

To

Building and Room

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

INTERDEPARTMENTAL

From

Building and Room

EGG

Barrel Stone

6KC Sonar
p131 NB28
Jan 1965
H. Edgerton

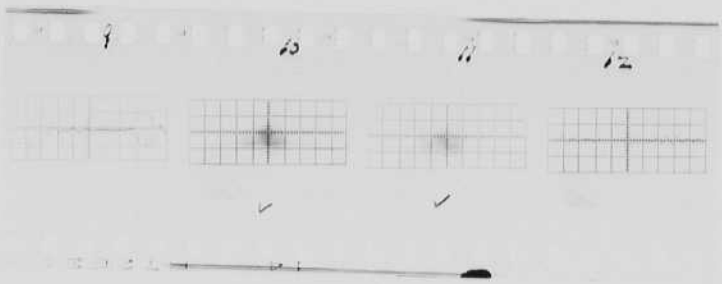
To

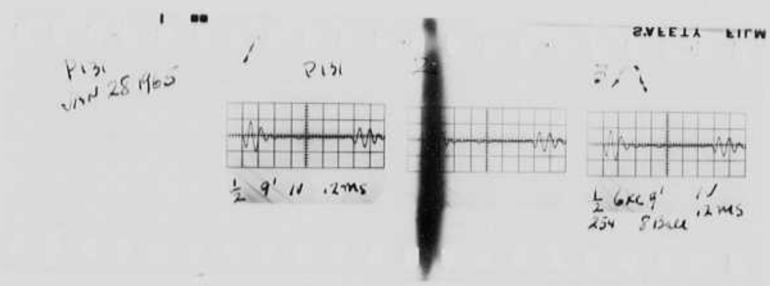
Building and Room

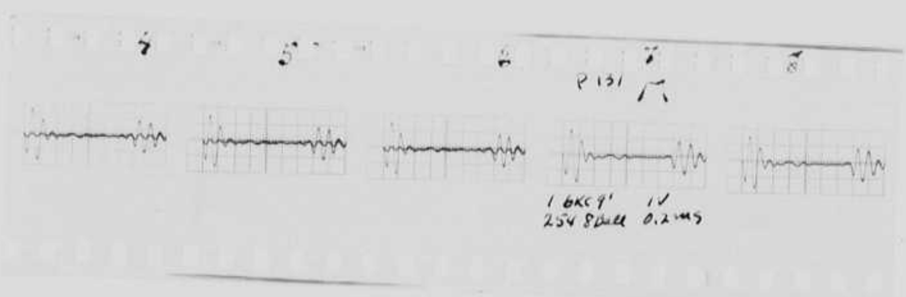
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

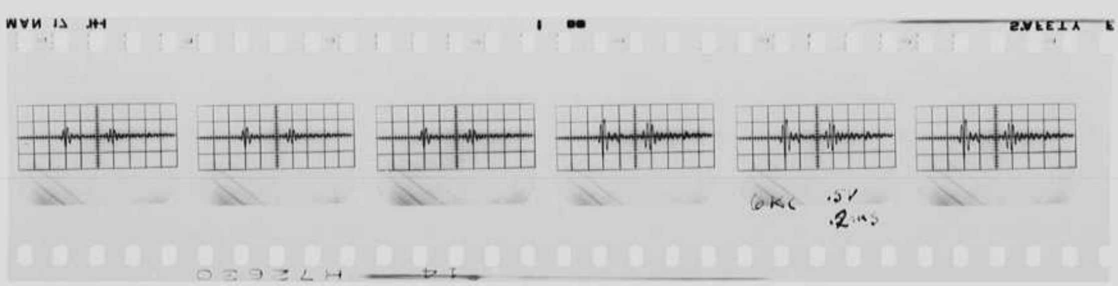
1 $\frac{1}{2}$ power 30") Reflector
7 1 power 30")
14 1/2 " Bare) Bare
16.1 " Bare)

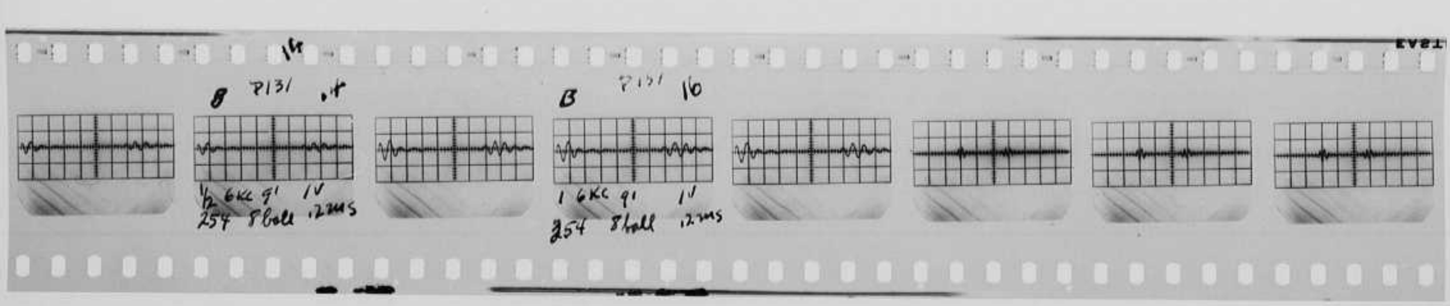
1 $\frac{1}{2}$ power 30") Reflector
7 1 power 30"
14 1/2 " Bare) Bare
16.1 " Bare)


9
10
11
12


P131
JAN 28 1965
1
P131
½ 9' 1V .2ms
½ 6KC 9' 1V
254 8Ball .2ms


4
5
6
7
8
P131
1 6KC 9' 1V
254 8Ball 0.2ms


6KC .5V
.2ms


14
8 P131 .4
½ 6KC 9' 1V
254 8Ball .2ms
B P131 16
1 6KC 9' 1V
254 8Ball .2ms

Jan 3 1965
M.I.T.

Reorganized desk -
cleaned some files.
Mat Roberts worked on camera.
conf with Wells & Schildknecht
Phil Gallagher goes to Wash.

I leave for England at 8 pm on PAA,
monday Feb 1 to Dover to confer with
Mr. Pirie and Prof Bradshaw about
~~the~~ Channel survey.
Feb 2 talk to the Roy. Photo. Society
about electronic flashes.

Feb. 6 1965. ~~Retd~~ yesterday on P.A.A. 57 7$\frac{1}{4}$ hours from London.

Searle Rees wants movies as per phone call
734-7671-

Specs for movies 16 f.p.s.
16 mm
Direct Pos
Diafine Dev
40 mm at #4
magnification 3X
& 6X
Rate more? no.

On Feb 4 thurs at 5:30 I talked to the
Photo society in the Physics Bldg
on the 6th floor. John Mills was there
to help me with the S.R. equipment.

Atlantic City microcirculation meeting
Dr. Fulton is chairman
Block is ~~to~~ to be there.

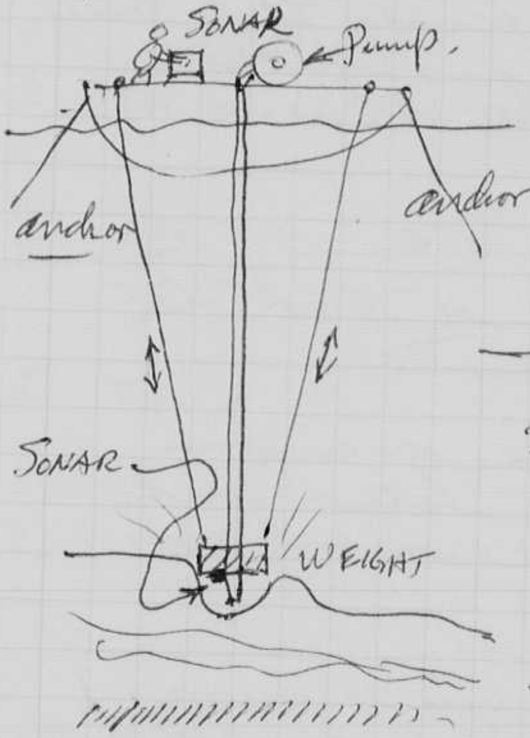
Feb. 9, 1965 M.I.T. 4-405
Harold Edgerton.

Mud Digging System.

Last week I had a lot of discussion with John Mills in London about methods of digging in the sand. The special problem is the uncovering of the sub bottom signal at Tobermory bay in Scotland.

I proposed a hose with a high pressure nozzle to squirt into the mud. The first system was a ~~solid~~ stiff pipe which would be held by the ship in position. The second was to use a hose with a weight on the bottom.

It now appears that a sonar on the bottom would be useful for holding the equipment and for evaluating the progress of the work.



Unsymmetrical pulling will cut the sides of the hole. The weights will oppose the force of the jets.

Then the assembly can be raised 10 feet or so to give the sonar a chance to survey the progress of the digging.

In other words the sonar will give some sense to the excavation effort without the necessity of men going down to the silt.

Read and understood
Feb. 10, 1965.
V. E. MacRoberts.

Feb 10 1966
Harold Edgerton

Underwater tungsten Lamp

Conf with Dick Troutner of EG&G on underwater lamps.

New Idea - Quartz Iodine lamps must have 250°C on inner surface of quartz for the iodine cycle to work. In water the conventional lamp is too cool due to heat transfer. Underwater lamps have an air space and a pressure resisting glass cover to permit the quartz lamp to become hot.

Another way to accomplish this temp is to increase the thickness of the quartz wall so that the inner lamp is adequate.

Another way is to increase the power per unit volume so that the lamp again is adequate.

This lamp would be a great improvement for under water work since the weight and size would be greatly reduced.

If quartz were compounded to lower i.r. passage, the heating of the quartz surface would be augmented further.

R.T.T. Read and understood - Richard T. Troutner

Feb 13 1965

H. E. Edgerton Morning. Sat. Moon is working in the 20 009 annex on the pingers.

Don Stewart and I took the H.S. movie camera & Bldg 48 to shoot the sparkers in the tank. Trautner and Daniels assisted in the setup. Data is in Don's book.

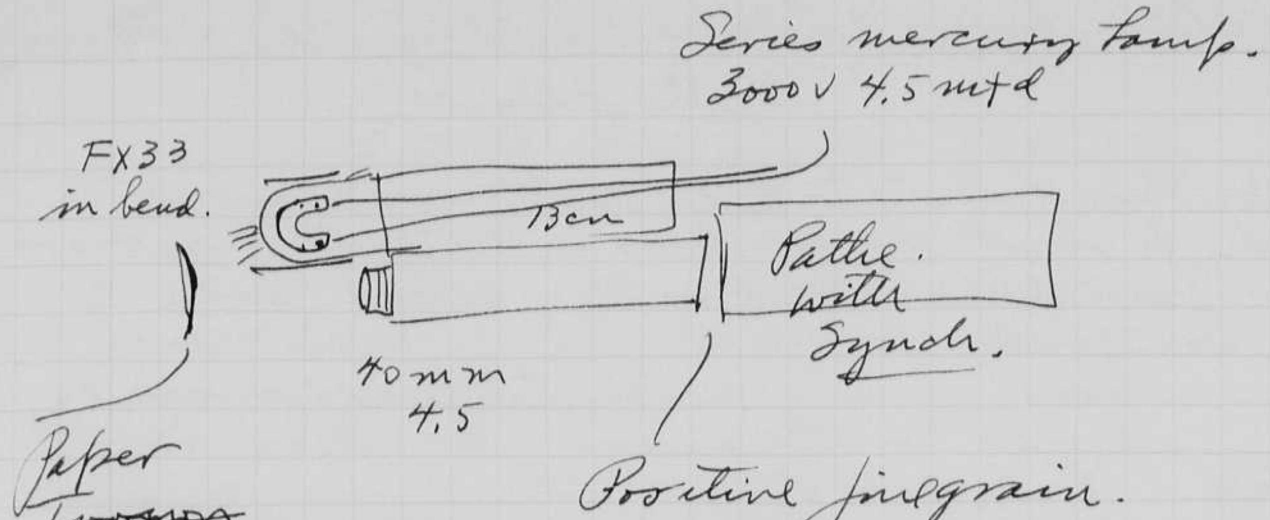
Switch fired Boomer at 50!

no	type	V.	A	W.S.	
1	Plus x	125	f2.8	1000 on one	close to window 1½ feet. 2 lamps 1000 watt reflection.
2	Tri x	125	f2.8	1000. on one	One lamp back of sheet.
3.	Tri x	125	f2.8	5000 on three.	Lamp back of sheet.
4.	Plus x	"	"		
5	Tri x	"	"	7000 WS on three	
6	Dupont 931A	"	"		

tood

t.

 cont. Microscope set up



~~Lo~~
Torn edge for subject.

ok at 16 f.p.s. } contrast and
ok at 24 f.p.s. } density could be
improved.

Suggest high speed positive and
stop down 2 stops.

March 2 1965 Transformer for beacons
5 WS / per sec.
T-1062 remodified
as follows
pri 115 Sec 275 (It was 375?)
Phoned Otis Eichorn order for 10 units.

Mar 6 1965
HE Edgerton
John Turner
Warren Moon

Test of Souncouple Trans.

Osc	Hydro	V	T	D
		V	ms	ft
1	8 new	.5	.2	6' front
2				
3				
4	Blank.			
5				
6				
7.		.5	.2	6
8	Blank,			
9	LC 32 old. short lead.	.1	.5	6'
10				
11	LC 32 new	.1	.5	6'
12	(open)			
13				
14	Blank			
15				
16	8 ball	.1	.5	6'
17				
18	8 ball	.5	.5	6'
19	new,			
20				
21	Blank			
22	clevite			
23	CH 17A	1.0	.5	6'
24				
25	clevite	1.0	.5	6'
26	CH17AR			
27				
28	NAVY	.05	.5	
#1 29	No tape			
30				
31	NAVY	.05	.5	
32				
#2 33	TAPE			
34	Geo	.1	.5	
35	Phone			
36				

Same (for 1–7)

Trans

Trans 3 ft deep Long.

note the second pulse is longer than the first.
Triggered on first pulse.

Notebook # 28

Filming and Separation Record

____ unmounted photograph(s)

1 negative strip(s) inside loose envelope

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

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

Item(s) now housed in accompanying folder.

EDGERTON, GERMESHAUSEN & GRIER, INC.

INTER-OFFICE MAIL

DO NOT SEAL UNLESS NECESSARY

Date	Name	Bldg. No.
	Edgerton MIT	
	Photo - Bldg	95.
	12KC Ringer Record.	

B&W. T.V. film 32/sec. Fibers # 2 on lens. 2.32 mfd. 22nd. 2.32 mfd
20 ft made of paper fibers.
Schiltrant 24/sec. 2,32 mfd.

.77
1.55
2,32

Feb 27. Sildebrant 24/sec. " & HS Edgerton

Feb 24. Rees objects. Sick Boy. Dr. Brie allat 24/ 2.32 mfd.

EDGERTON, GERMESHAUSEN & GRIER, INC.

INTER-OFFICE MAIL

DO NOT SEAL UNLESS NECESSARY

Date	Name	Bldg. No.
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Dr. Edgerton MIT

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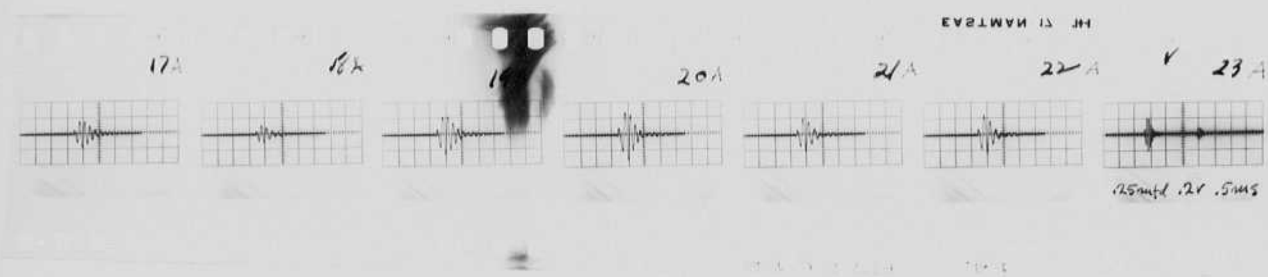
20 ft model of paper fibers.
Schilkraut 24/sec. 2.32 mfd.

Feb 27. Schildkraut 24/sec. " - & H.E. Edgerton

Feb 24. Rees ~~S~~ objects. Sick Boy Dr. Gire all at 24/ 2.32 mfd.

.77
1.55
2,32



3-25
p 124.

gain at "50"

Sunday March 14 1965

Harold Edgerton

During the past month many experiments have been made with movies at 24/sec of the white of the eye. Both Dr Wells and Dr ~~Rees~~ Rees have brought patients to the lab.

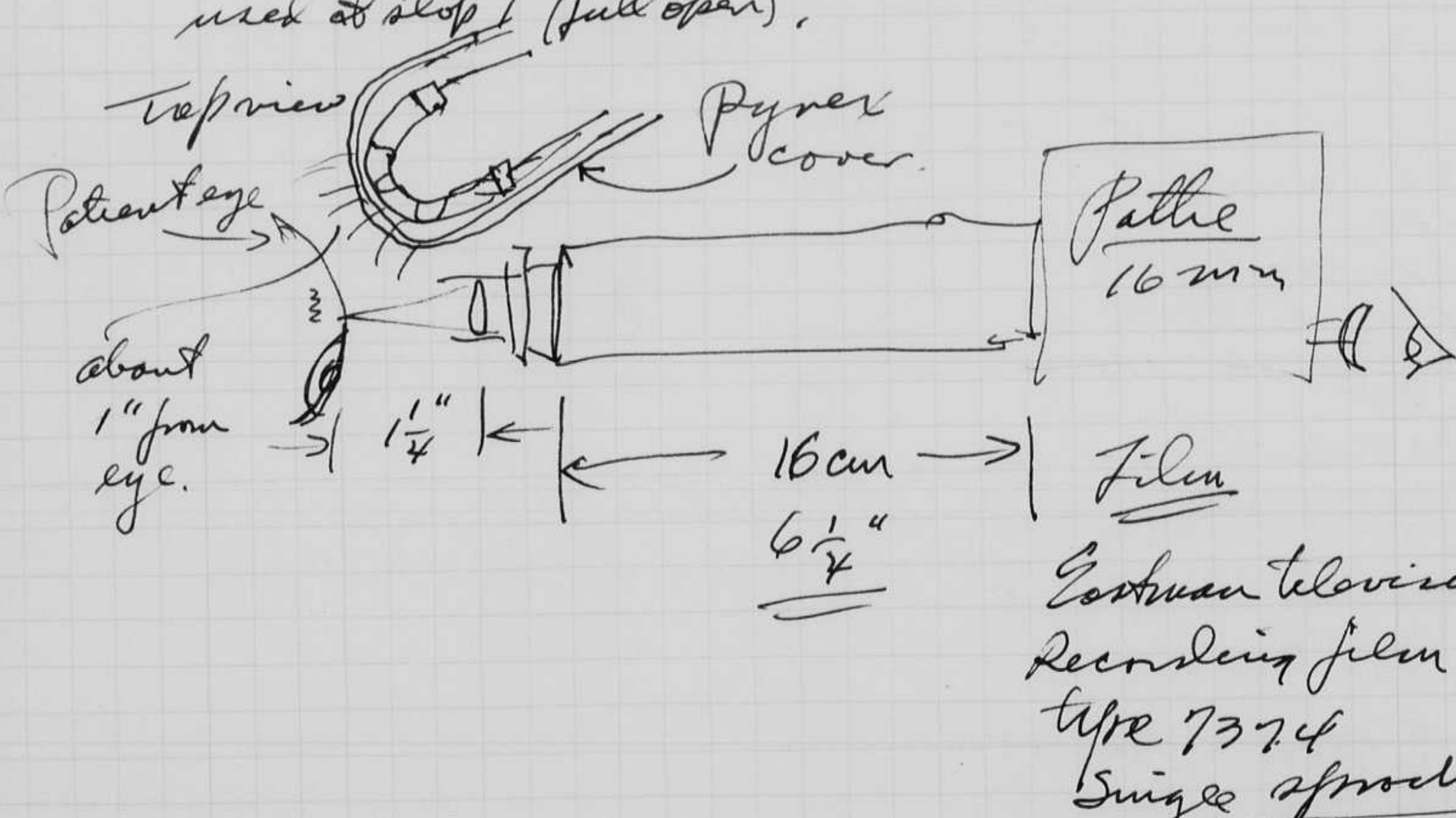
One of the best pictures was of [illegible] left eye - Very irregular flow was shown.

Mrs. Sipe (Helen) was in on March 11 1965 with Dr Rees.

Mr. Hayward was in with Dr. Wells on the next day.

Movies were made with a U shaped FX-33 from a 2.55 mfd capacitor at about 1800 to 2000 volts. There was regulation at 24/sec. A Hg tube was used for watching.

A 40 mm Carl Zeiss objective 2211686 was used at stop 1 (full open).



Film

Eastman television Recording film type 7374 Single sprocket

R S Marchel EK

Eastman Kod
200 Park Ave Room 2910

Conjunctiva films.

Mrs. Lipe Mar 11.

Scene 1. Highlight on side
2. Excellent focus.
3. Focus on & off.

} Jitter due to eye motion.

All should be recopied to show circulation of Blood.

Mrs Hayward.
1. ok.
2 focus shifts.
3 Shows ~~film~~ lagoon film on eye after blink.

Prints and movie copies made. There is jitter due to the eye. It is difficult to compensate for this. HE

Mar 16 other photos taken of Miss Brudase.

Mar 18 1965 Harold Edgerton Robert Root 4-405 MIT.

Multiflash unit just made 120 cycle 60 30 20 10 5. High ~~Spee~~.

4 flashes High 10/sec. Light meter D539 at 3.13 ft.

10/sec

$$\frac{80 \times 3.13^2}{4} ?.5 = \underline{200} \text{ cps. in per flash}$$ Floodlight Reflector

$$\frac{32}{4} 3.13^2 \; 5 = 80 \text{ cps per flash}$$

FT-24 in Flood Reflector at 3.1 ft

5/sec.

$$\frac{60 \times 3.13^2}{4} = 150. \text{ cps/flash}$$

$$\frac{25}{4} \times 3.13^2 = 62, \text{ cps / flash.}$$

20/sec

$$\frac{60}{4} \times 3.13^2 = 150.$$

$$\frac{25}{4} \times 3.13^2 = 62.$$

10/sec

$$\frac{60}{4} \times 3.13^2 = 150$$

$$25/4 \times 3.13 = 62$$

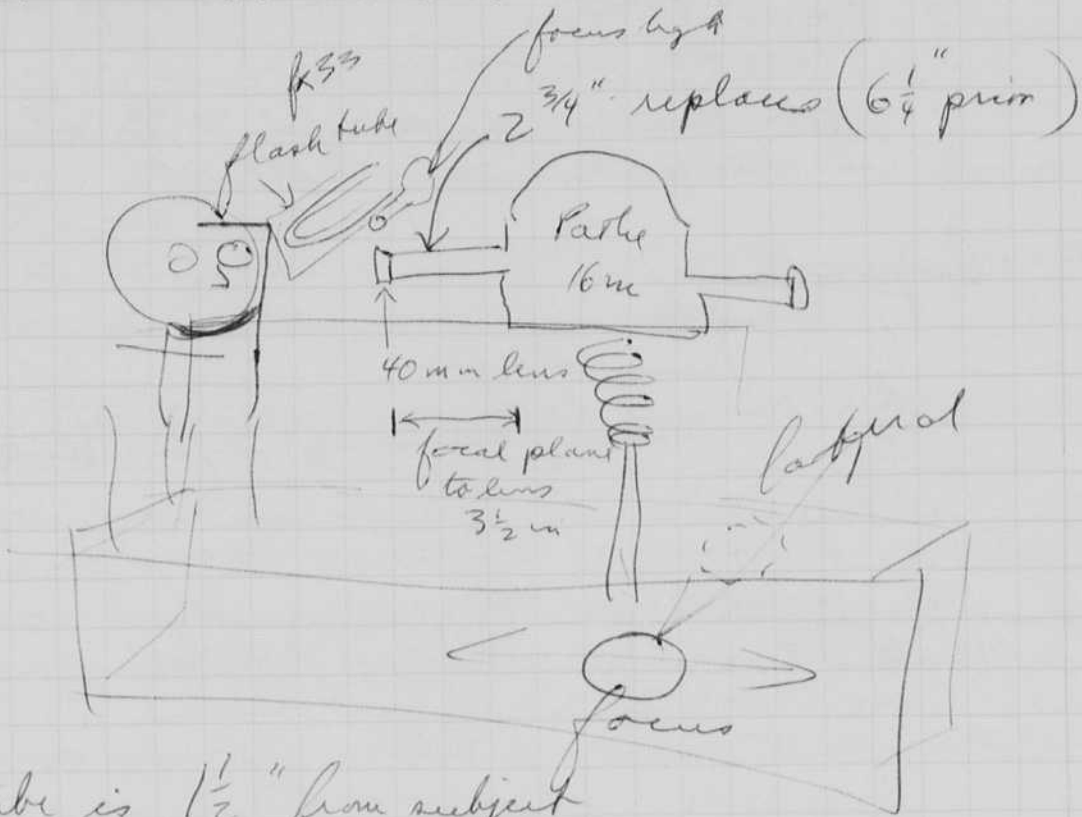
4-409 M.I.T.

March 20, 1965

R
H E E
W

Eye movies - new lens tube - shorter

film
16 mm
TV recording
EK #7374



flash tube is 1 1/2" from subject

~~Acros~~ lens surface to eye approx 3" = working dist

1) first film (data card on 3/4" lens) photo
2) Subj REW. lens open 2 HEE
3) " " " 3 "
4) 4 x2
5) 1 — ok but overexposed.

Best exposure and contrast mar 23 1965 HEE RW.

Processed 5 min. in (1 Dektol 2 water) ok.

Scene 5 was dark. my favorite was scene 2.
f11 on data card ok.

No circulation "lumps" in Wills Eye.

Mar 26 Left at 530 for Minneapolis - plane late
We arrived about 1.30 am. Bob Feig made reservation at airways motel. Rented Hertz in morning then to Northfield for visit at 216 1/2 Union St.

Bob had his department in for an evening.

Prof ~~Raiss~~ Robert Reitz Illinois
Dr. Wm Butler Ill.
Tom Phillips }
Philipps? }
Princeton
Russel Farlin. Technion

St Olaf's college for Sunday noon dinner then to Aurora via Omaha. Rented Hertz at Omaha.

Mar 31 Lv Boston of 625 pm plane for Omaha.

The strobe beacon on the county court house has operated since it was installed except for the time it was disconnected during the Christmas decoration period.

It is mounted on the west side of the court house. It operates at night.

More movies were made with the eye set up. Now use #2 on the 40 mm lens with an extension of

April 6. 1965 Meas of output at 24/sec as used in eye movie
C = 2.32 mfd. 2.32
Distance = 1 ft Dora # 1 Vis. curve 1000 ohms.
peak 1.6 cm x 2 = 3.2 volts.

Distance changed to 5.13 ft so the scope is direct reading
1 V/cm for 10^6
3.3 cm x 0.1 volts.) 61.5" so c.p. 0.33×10^6 c.p.
1000 ohms.
Duration = 10 us. cps = 3.3.

D.C. Power supply volts 2100 before flashing
Capacitor volts at flash 1200 at 24 f.p.s.

Apr 13 1965

Edo 6KC
CO 1857
EDO.53151 Ser No. 2

Recd. Apr. 12 1965 from Edo for ~~re~~ replacement.

Apr 16 '65
V.G.M.
H.E.E.

X-FX-80 flash tube

Has had 10×10^6 flashes at 2000 w.s.

Peak light output measured with Shaffner pickup #1 "Dora" at 123 inches. (Visibility curve)
(1000 ohm load.)

P.C.P. = 24×10^6
Duration = 125 μsec 1/3 peak.

$24 \times \cancel{10^6} \times 125 \times \cancel{10^{-6}} = 3000$ H.C.P.S

Measured with G.R. Type 1501-A light meter Ser. No. 113.

Integrated light output = 2500 H.C.P.S. at 10 ft.

→ This P.M. we installed a similar flash tube XFX-80 enclosed in a Pyrex glass tube on the roof of the Prudential Building in Boston.
Boomer Power supply
80 mfd. 4000 V. max.
flash rate one per second.

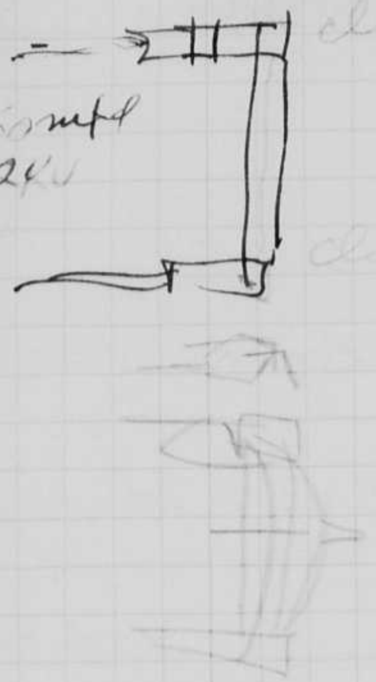
Will be turned on evening of Apr. 18, 1965. Approx 8.30 P.M. by Bill Patten P.R. man for Prudential.

Edo. 6KC. C = .0295 mfd   .23 mh. sec. / .035 mh pri. } pulse trans.
#2 reed
Channel 12
from Moon, Warren

FX 100 flash lamp. 50 mfd paper. 38 μs duration ~~1.25 × 10^6~~ 1.1×10^6 c.p. Eye pickup #1 Dora.
40 cps.
(30 cps on meter from previous meas).

Apr 29. 1965

Yesterday Prof Keight and Dr McGitt from Camb Eng came in to get a Kerr cell shutter. Instead I suggested a lead fuse to open. After some tries I ended with a sheet aluminum foil strip which collapsed and worked.



Discharge of [illegible] starts & collapses and [illegible] [illegible] a slot in the aperture [illegible]

The delay is about 85 microseconds!

May 9 1965 H.E. Edgerton

Yesterday Gideon Amador Israel Geologist was here to make boomer tests also 6KC records of Mass River Basin.

Don Stewart helped.
Warren Moore.
Steve Goodiasky.
Mike Cocorlos.

we took Boston Whaler 33334 into the Boston harbor for some pinging records

May 15 1965
H. Edgerton
Jack Turner.

Tests with Sonar Boomers.

Tests at MIT Sail Pavillion off dock in 14 feet of water.

output volts. first peak. osc. no.	A	Standard 1000 ws unit with 24 mfd. 8 ballast 9' -	1.5 volts
	B.	New plate on Std.	1.5 -
	C.	" clamped instead of center bolt.	1.7
	D	1/8" al. Square	2.4
16	E	3/32 " "	2.1
20	F	1/16 " "	2.5

Apparently the 1/8" al (soft) square 20" plate with 4 bolts at corners seems to be ok.

Signal on negative swing is greater? why??
frequency is about double the ac freq.

#25

The frequency is too fast with the old 1000 ws unit.

$f = \frac{1}{2\pi\sqrt{LC}}$. Suggestion - increase capacitance

$3.8\,cm \times .2 = .76\,ms.$ for 2 cycles.
1 cycle $= .38\,ms.$
$f = \frac{1}{.38} = 2640$ current.
acoustic $= 5280$ cycles/sec

$\frac{5280}{3000} = 1/\frac{\sqrt{24}}{\sqrt{x}}$ $x = \left(\frac{5280}{3000}\right)^2 24 = 3.08 \times 24 = 74\,mfd$

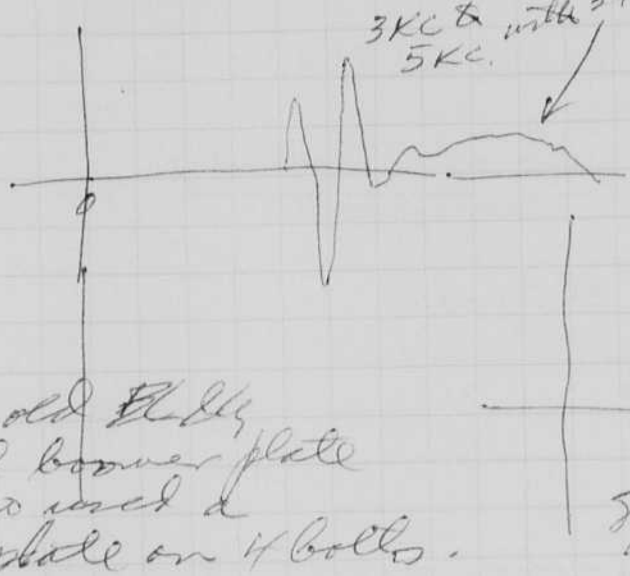
$4 \times 3 = 12$ boxes

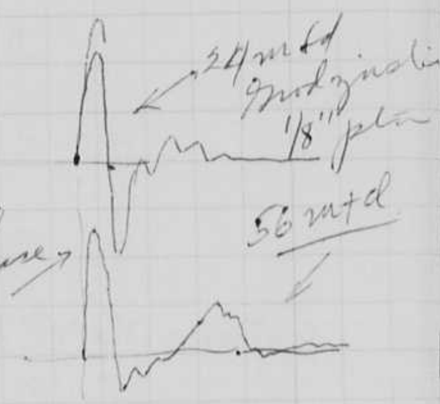
May 16 1965.

[illegible]

Additional capacity was put on the Boomer at the Sail Pav. yesterday. 16x3 = 48 mfd. Many oscillograms were made using an Elsec hydrophone at 9 feet.

Increased capacity causes a different signal delay? perhaps the hydrophone overloads?. A second bump becomes obvious.





I also used the old Elsec 1000 watt second boomer plate driver. Also used a 1/8" soft Al plate on 4 bolts.

Similar performance.
Slight increase in + surge
Decrease in - surge
Low freq - pulse on + side.

John and Esme Duncan are visiting from New Castle ... England

Boomer May 15 1965

Osc no	V cm	T/cm	C	V	Plate, etc.
1	1	0.5 ms	24	3700	1/8" plate 20" square Grodzinski coil!
2	1	.5 ms	16	3700	
3	1	.5	8	3700	
4	1	.5	56		
5.	1	.5	24	3700	1/8" square plate old 1000 WS Boomer
6	1.	.5	16	3700	
7	1	0.5	64	3200	
8	1	1.0	64	3200	
9	1.	.5	24	3700.	

$$\frac{48}{16}{64}$$

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

$\frac{1}{\pi\sqrt{LC}}$

5 .5 Hammer on 1/4" Disc. Drukelman

.5 Hydrophone on top. 24 mfd Grodzinski 1/8" square plate Impulse coil

(phase test)

#1 Long
2 Short
3 Long
4 Short
5 Long
6 Long, .5 1 ms 300 " " " but Mundell to scope
7. Short .2 1 ms 300
8 Short .2 1 ms " Hydro at 12 feet below trans noise in the
9. Long .2 1 ms "
10. Short .2 1 " " Hydrophone at 15 ft.
11 Long .5 2 ms " Voltage across zener diodes | Hydro at 12 feet. To show input from
12 Short 2 2 ms "
13 ——— fail
14 Long 0.1 2 ms 300 (A) input to 2N2222 } gain at 30
15 Long 1.0 2 ms B input to 2N2907
16 Long 0.2 2 ms C input to 1S8-18

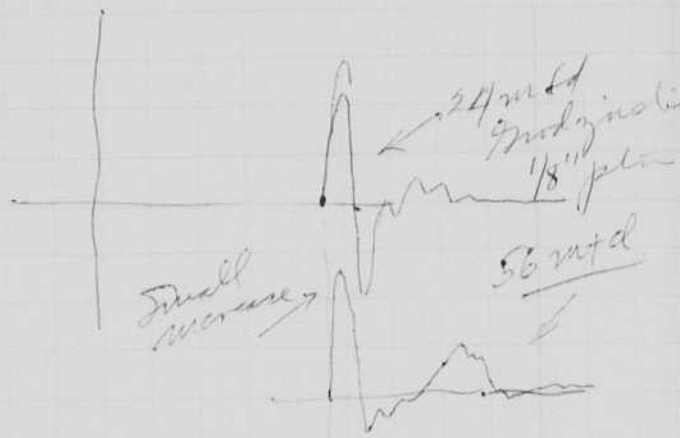
Light exposed blank

May 16 1965.

Harold Edgerton

Additional capacity was put on the Boomer at the Soil Pan yesterday. 16x3 = 48 mfd. Many oscillograms were made using an EG&G hydrophone at 9 feet.

Increased capacity causes a different signal delay? perhaps the hydrophone overloads?? A second bump becomes obvious.



I also used the old EG&G 1000 watt second boomer plate driver. Also used a 1/8" soft Al plate on 4 bolts.

Similar performance.
Slight increase in + surge
Decrease in - surge
Low freq - pulse on + side.

John and Esme Duncan are visiting from New Castle Univ England.

Boomer May 15 1965

Osc. No.	V in	T/cm	C	V	Plate, etc.
1	1	0.5 ms	24	3700	1/8" plate 20" square Brodzinski coil
2	1	.5 ms	16	3700	
3	1	.5	8	3700	
4	1	.5	56		
5.	1	.5	24	3700	1/8" square plate old 1000 ws Boomer
6	1.	.5	16	3700	
7	1	0.5	64	3200	
8	1	1.0	64	3200	
9	1.	.5	24	3700.	

48
16
64

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

$$\frac{1}{\pi\sqrt{LC}}$$

5 .5 Hammer on 1/4" Disc. Dondelson

.5 Hydrophone on top. 24 mfd Brodzinski 1/8" square plate separately coil

phase lost.

#1 Long
2 Short
3 Long
4 Short
5 Long
6 Long, .5 1 ms 300 " " " but Mendelson scope
7. Short .2 1 ms 300
8 Short .2 1 ms " Hydro at 12 feet below trans noise in the
9. Long .2 1 ms "
10. Short .2 1 " " Hydrophone at 15 ft.
11 Long .5 2 ms " Voltage across zener diodes. Hydro at 12 feet. To show output from
12 Short 2 2 ms " "
13 ——— Fail
14 Long 0.1 2 ms 300 (A) input to 2N2222 } Gain at 30
15 Long 1.0 2 ms B input to 2N2905
16 Long 0.2 2 ms C input to 1S8-18

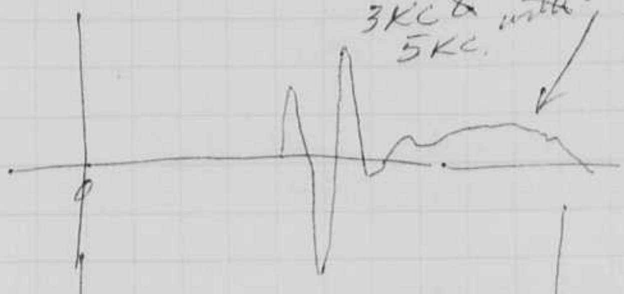
Light exposed blank

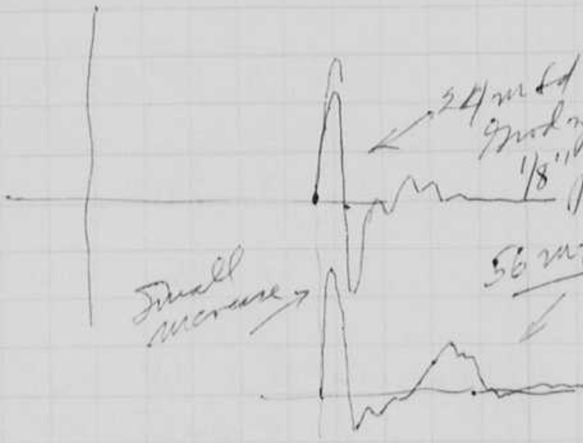
May 16 1965.

Harold E. Edgerton

Additional capacity was put on the Boomer at the Soil Pav. yesterday. 16x3. = 48 mfd. Many oscillograms were made using an E G & G hydrophone at 9 feet.

Increased capacity causes a different signal.. why? perhaps the hydrophone overloads!? A second bump becomes obvious.





Also used the old EG&G 1000 watt second boomer plate driver. Also used a 1/8" soft Al plate on 4 bolts.

Similar performance.
Slight increase in + surge
Decrease in - surge
Low freq - pulse on + side.

John and Esme Duncan are visiting from New Castle on Tyne England

B[illegible] .15 1965

C?? [illegible]
.740 [illegible]

1
2
3

May 11 1965 MIT Boat House
Sonscope unit. 2" deep.
Steel ball at 6 ft from front surface

#1	Long	.5V	200 us	300 m scale.	high on axis
2	Short	.5	200	"	low on axis.
3	Long	.5	200	300	on Zero axis.
4	Short	.5	200	300	
5	Long	.5	1 ms	300	Shows bottom echo.
6	Long.	.5	1 ms	300	" " " but Moved to scope
7.	Short	.2	1 ms	300	
8	Short	.2	1 ms	"	Hydro at 12 feet below trans. noise in H.O
9.	Long	.2	1 ms	"	" " "
10.	Short	.2	1 "	"	Hydrophone at 15 - ft.
11	Long	.5	2 ms	"	Voltage across zener diodes. Hydro at 12 feet.
12	Short	2	2 ms	"	" " To show input from
13	—			fail	
14	Long.	0.1	2 ms	300	A input to 2N2222 } Gain at 30
15	Long	1.0	2 ms		B input to 2N2907 }
16	Long	0.2	2 ms		C input to 1S?-18 }

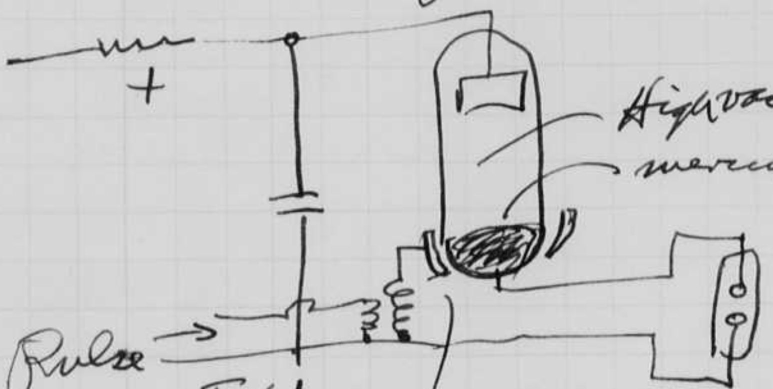
Light exposed blank

May, 26, 1966 Harold Edgerton.

Lamp Starting circuit.

A low pressure mercury tube has great ability to start a high-pressure lamp under difficult conditions. I showed such a device to McCarty from Nela Park yesterday. We started a lamp (sealed) whose self breakdown was above ~~5~~ KV on less than 500 volts

The idea uses the through spark from the spark band directly into the high pressure lamp. See below



Indium Iodide lamps from Nela Park

FIG 1

Spark coil output puts surge onto the lamp through the capacity of the spark band to the mercury.

Starter circuit for D.C. system.

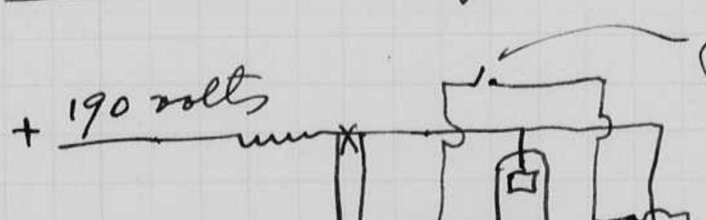


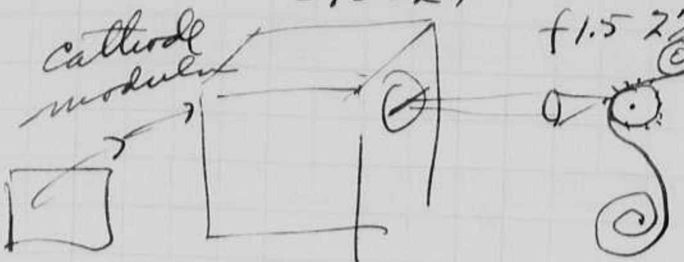
FIG. 2

FIG. 3

Read and understood V. E. MacRobert May 26, 1966

Camera for Analysing Geology Boomer Record.

May 27 1965
H E Edgerton



motor - camera
furnished by Bill MacRoberts after Coates design and experiments.

#1 time 3.30 pm
330 pm on Speed full ~~Sweep~~ Sweep 500 ms (.5 sec). Intensity 1 Exposure dense
6.15 pm off.
2 hours - 45 min 165 min.
Film through = 32 cm $\frac{32}{165} = 0.194$ cm/min. (Fastest speed)
There was some speed variation. Why? Rubber Belt maybe.

May 29 1965 Further tests 1 1/2 times Initial.

#2 time C.R. Sweep. aper film

2:09 pm $\boxed{503}$ .5 sec. f4. plus X.
Intensity to show no circle

3:15 Changed to 80 from 100

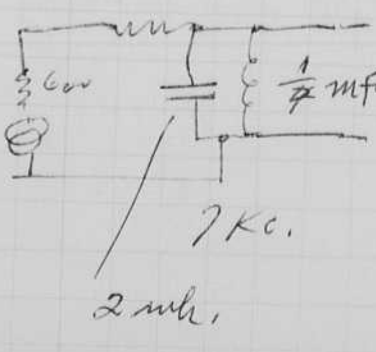
Underexposed

5.25, Off and out.

Grid = .001 $\times 10^{-6}$ into $.75 \times 10^{+6}$ RC = .00075 sec. Tests in 4-405 with Sonscope and Tape.

May 29 1964
Don Kotsch focus goes to pt for > 20 or 30 v. input voltage use 20 v p-p ~ 10 v.
asymmetry @ 1200 cps ~ about 10° phase lag
3 3/4 ~~ft~~ in/sec. on Crown 6CSX model Phone input Scale dir 4 channel #1
(Bias on channel 2 needs attention.

7KC tank circuit,



Shows some promise on signal from tape machine ~~[illegible]~~ 2 mv signal.

Put H.P. amplifier in circuit between filter and C.R. tube.

Tape made in Lab. with Soncoupe.

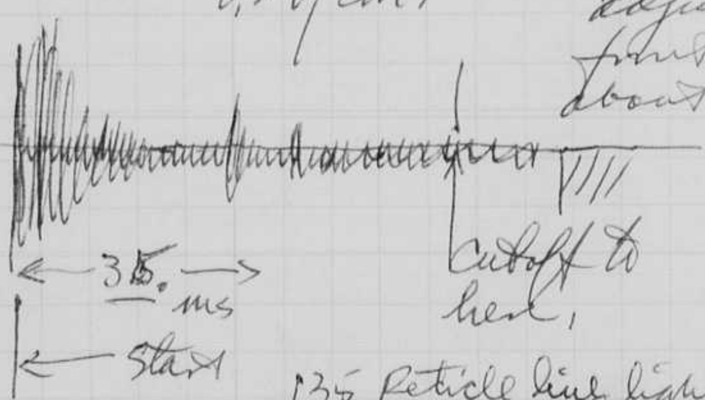
Plus X film 100% Speed f 2 on lens.
1 1/4 turns for fog.
Zero level 1/4 cut off Intensity about 50% full.
Sweep 10 ms/div.
Tape on Screen Zero is about 1/4.

#3 Start 11:57 "Tape 3 3/4"/sec
Channel 1 4 setting
output 2.05 mh.
.24 mf.
amp gain 100 after filter.
Vert 0.2 v/div
Hor. 10 ms/div.

overexposed but useable try again at f 4.

#4 Start. 1.22 pm Start same material
as before
10 ms/div
0.2 v/cm.

This record had a lot of noise from the DC to ac converters of the Soncoupe unit. I adjusted the cut off tape on the front of the C.R. tube to just allow about 1/5 of the light through



1.35 Reticle line light turned off.
1.37. " at reticle on dot.
1.42 Black velvet used to shade the scope and camera
1.44 Speed up to slow trace.
1.56 no signal observed
Velvet removed.
1:57 Room lights on
57½ Sweep on no signal for 1 minute
9 Room lights off.

Motor speed was lower due to motor

1715
piece of 8
from Kip
Wagner.
See Nat. Geo. Mag
March ±. 1965

Wabasso Florida

Closed May 30 1965
MIT 4-408

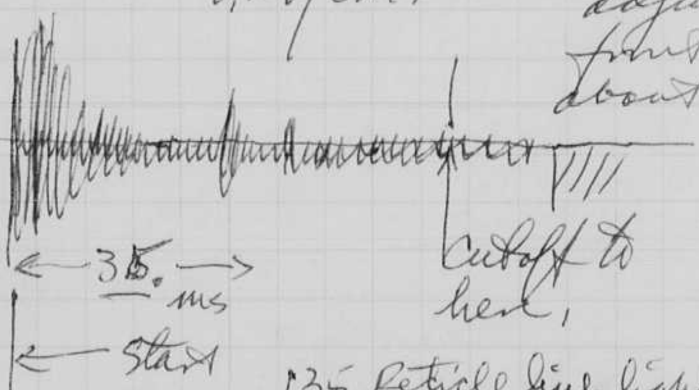
Tape made in Lab. with Sonacope.

Plus X film 100% Speed f 2 on lens.
1 1/4 turns for fog.
Zero line 1/4 cut off Intensity about 50% full.
Sweep 10 ms/div.
Tape on Screen Zero is about 1/4.

#3 Start 11:57 "Tape 3 3/4"/sec
Channel 1 4 setting
output 2,05 mh.
.24 mf.
amp gain 100 after filter.
Vert 0.2 v/div
Hor. 10 ms/div.
Overexposed but useable try again at f 4.

#4 Start. 1.20 pm Start same material as before
10 ms/div
0,2 V/cm.

This record had a lot of noise from the DC to dc converters of the Sonacope unit, I adjusted the cutoff tape on the front of the CR tube to just allow about 1/5 of the light through



1.35 Reticle line light turned off.
1.37. " at reticle on dot. —
1.42 Black velvet used to shade the scope and camera
1.44 Speed up to slow trace.
1.56 no signal observed
Velvet removed.
1:57 Room lights on
57½ Sweep on no signal for 1 minute
9 Room lights off.

Motor speed was lower due to motor!

1715
piece of 8
from Kip
Wagner.
See Nat. Geo. Mag
March ±. 1965

Wabasso Florida

Closed May 30 1965
MIT 4-408

Notebook # 28

Filming and Separation Record

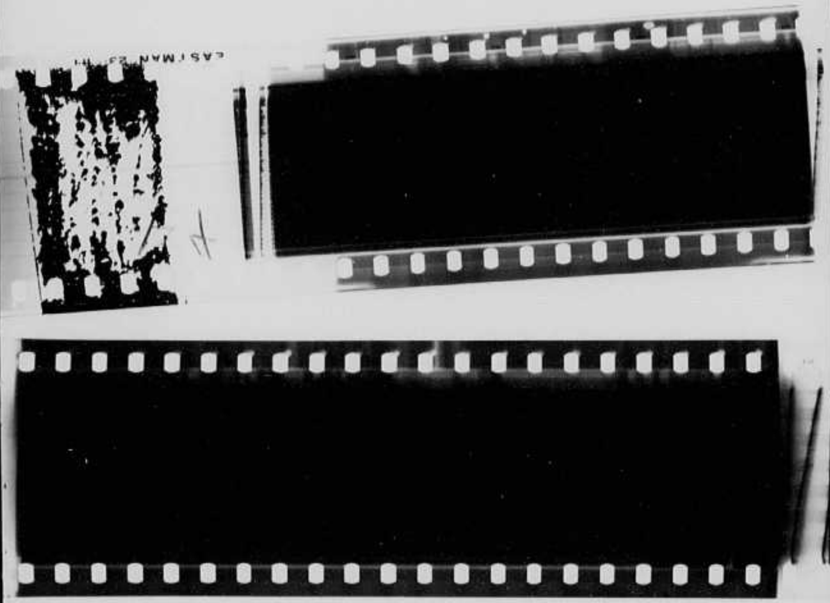
2 unmounted photograph(s)

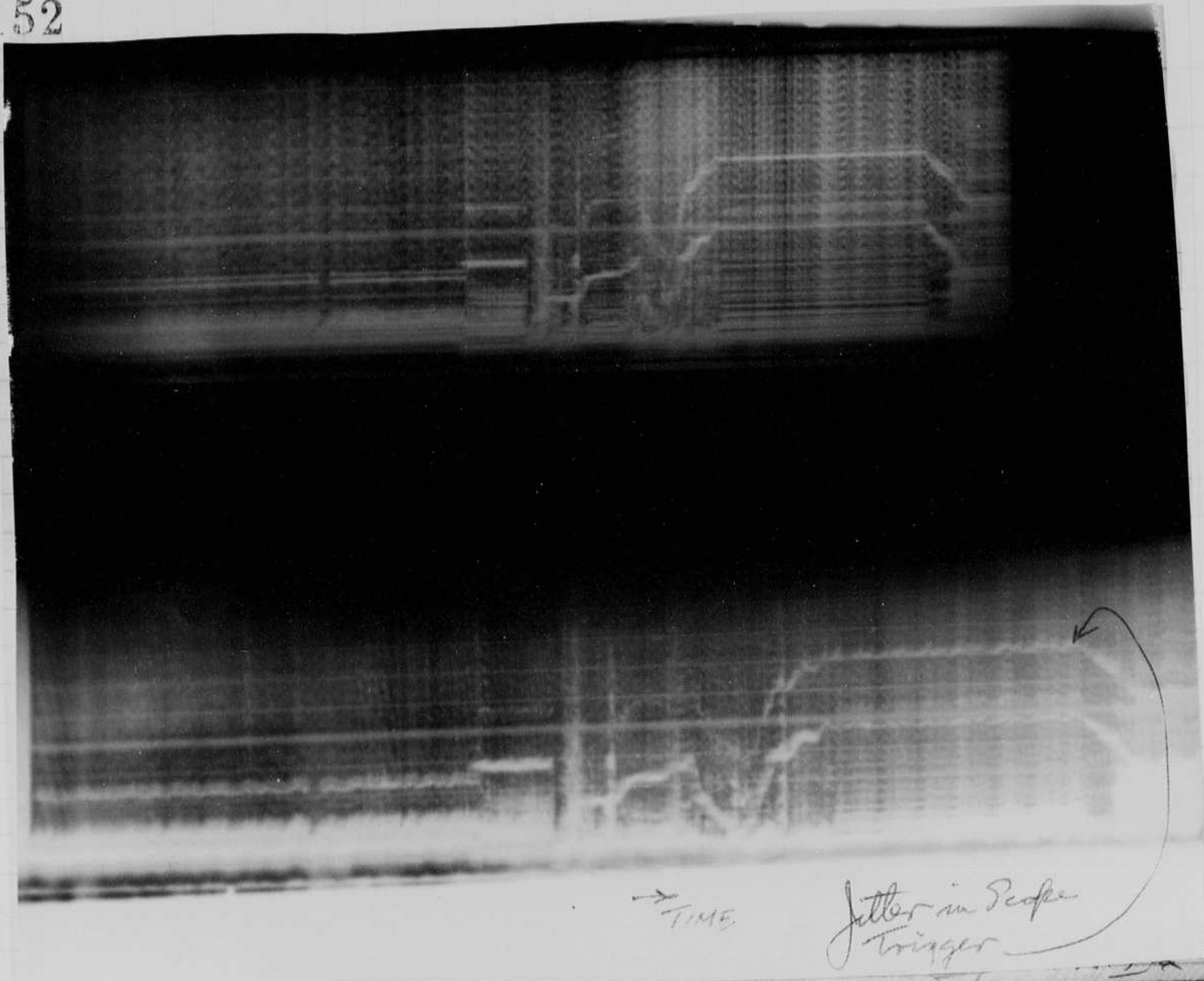
2 negative strip(s) located on back side of pg 151

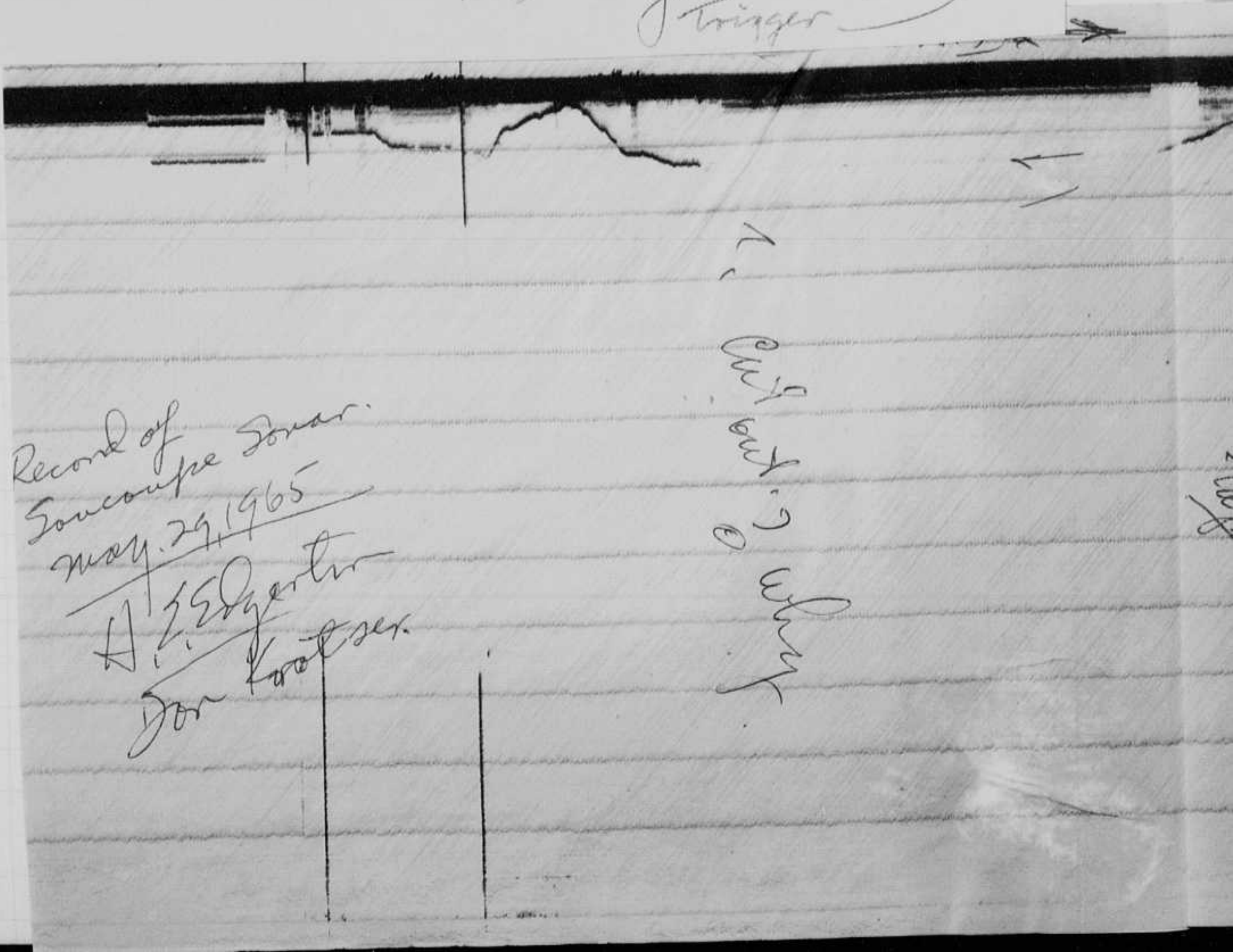
___ unmounted page(s)
(notes, drawings, letters, etc.)

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

Item(s) now housed in accompanying folder.



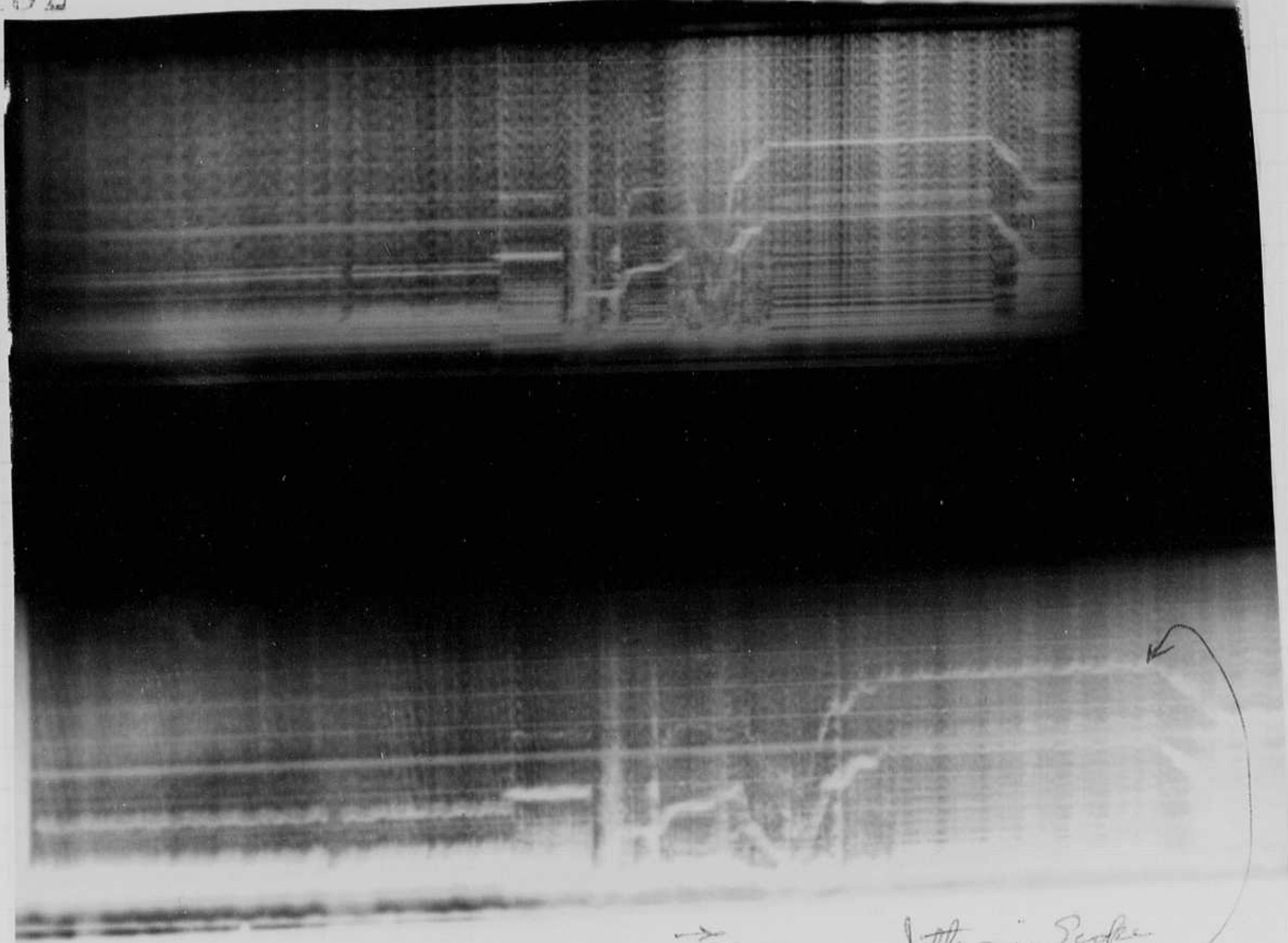

→ TIME
Jitter in Scope Trigger


Record of Soucoupe Sonar.
May 29, 1965
H. E. Edgerton
Don Kroetser.
? Cut out? Why

P-43 Xenon Beacon ~ Prudential.

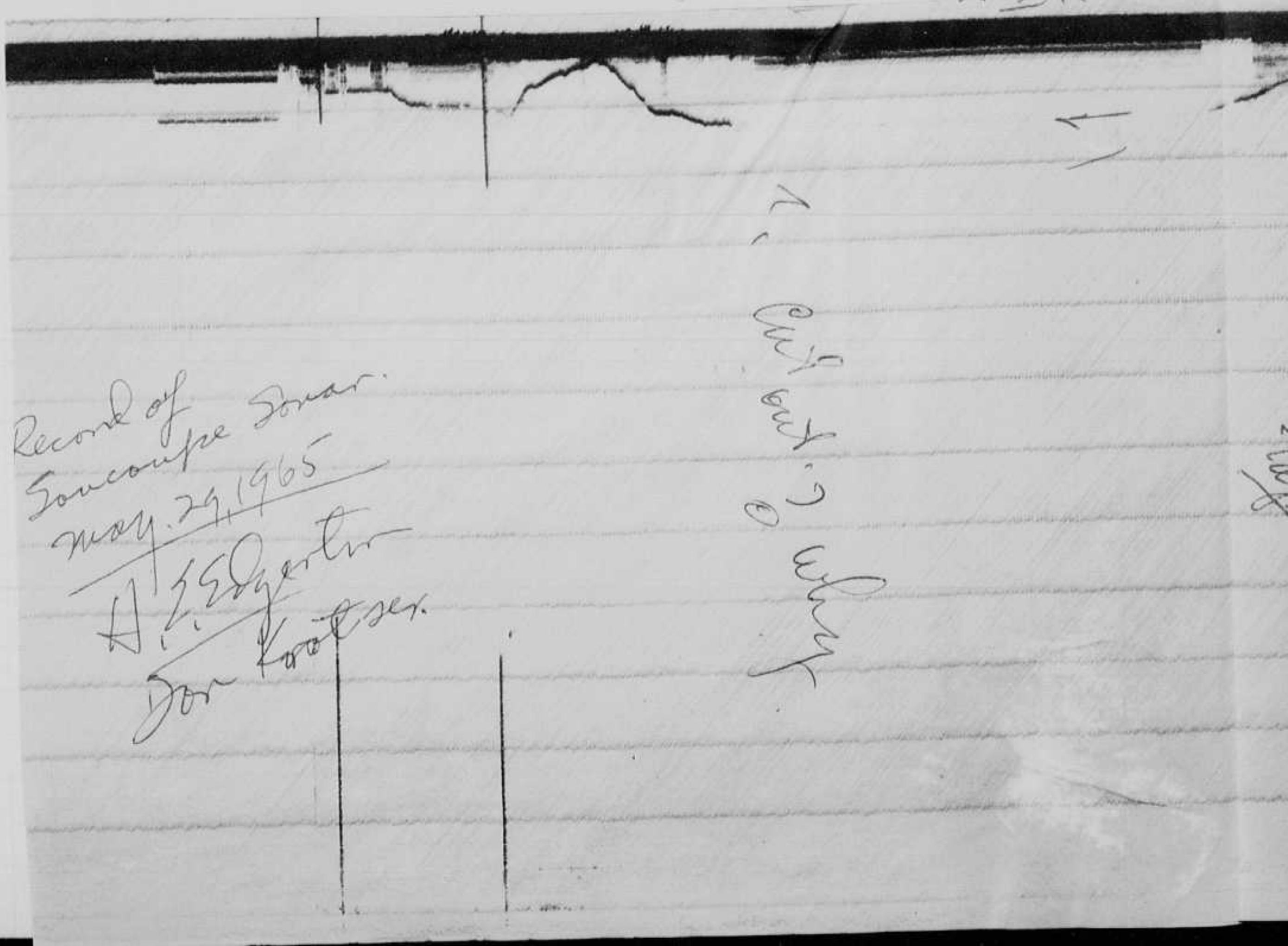
P-143 300 W.S. BEACON ON PRU.

End of Tape.



→ TIME

Jitter in Scope Trigger



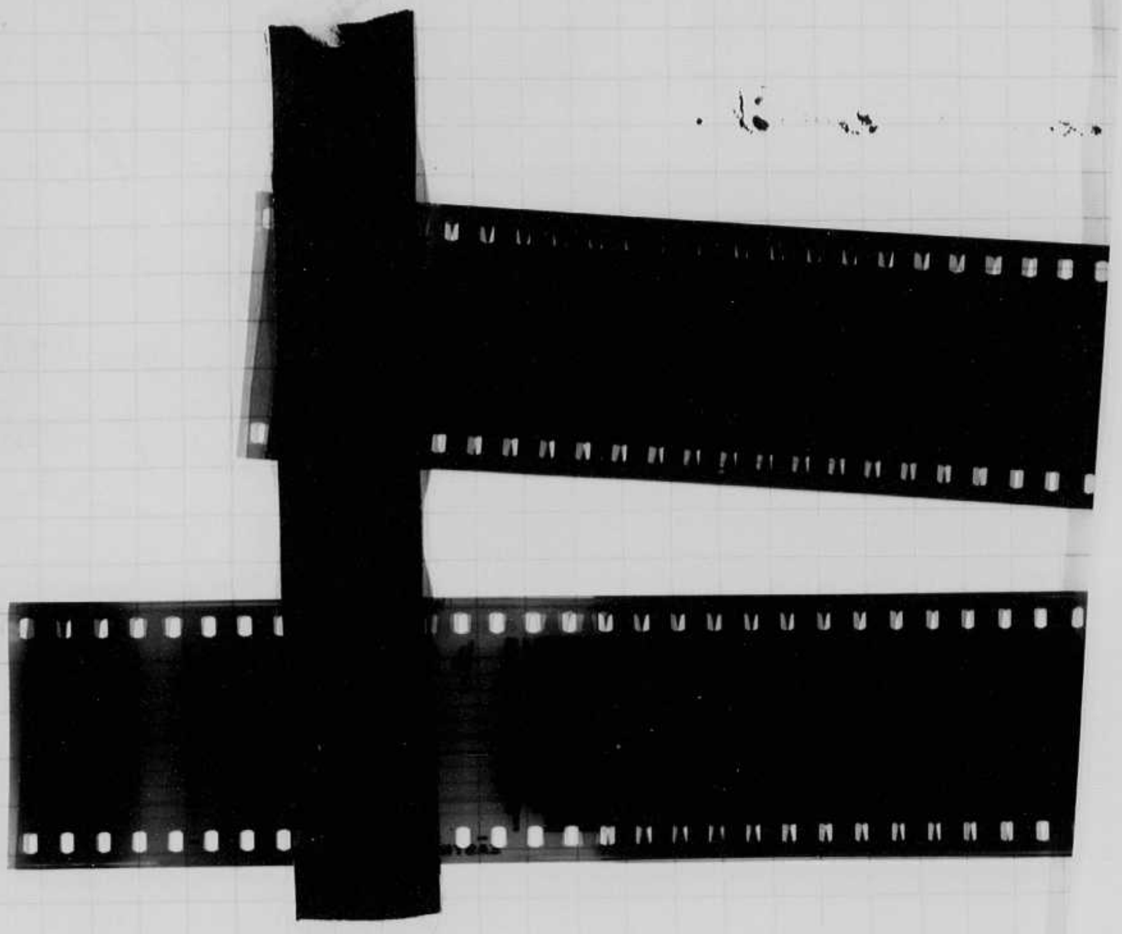
Cut out? why

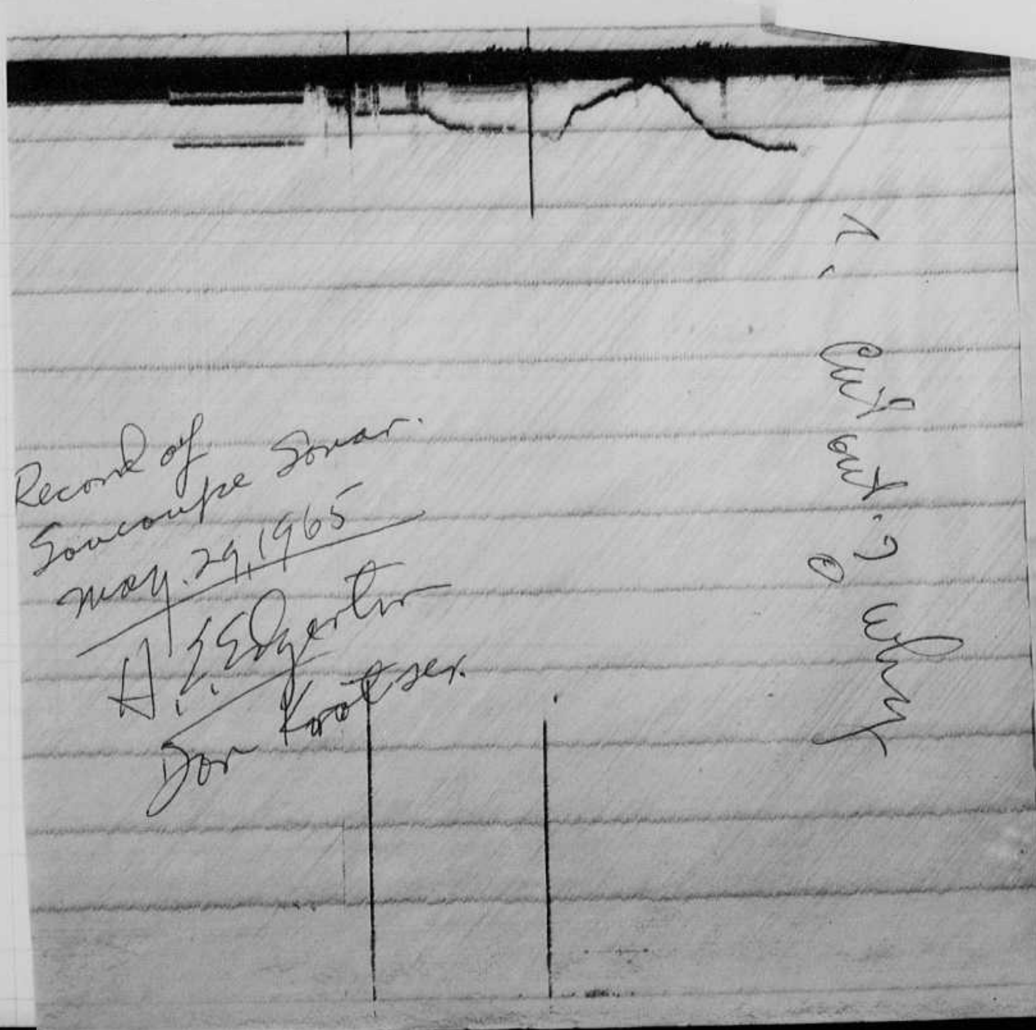
Record of Soucoupe Sonar.
May 29, 1965
H. E. Edgerton
Don Kootser.

P-43 Xenon Beacon ~ Prudential.

P-143 500 W.S. BEACON ON PRU.

End of Tape.

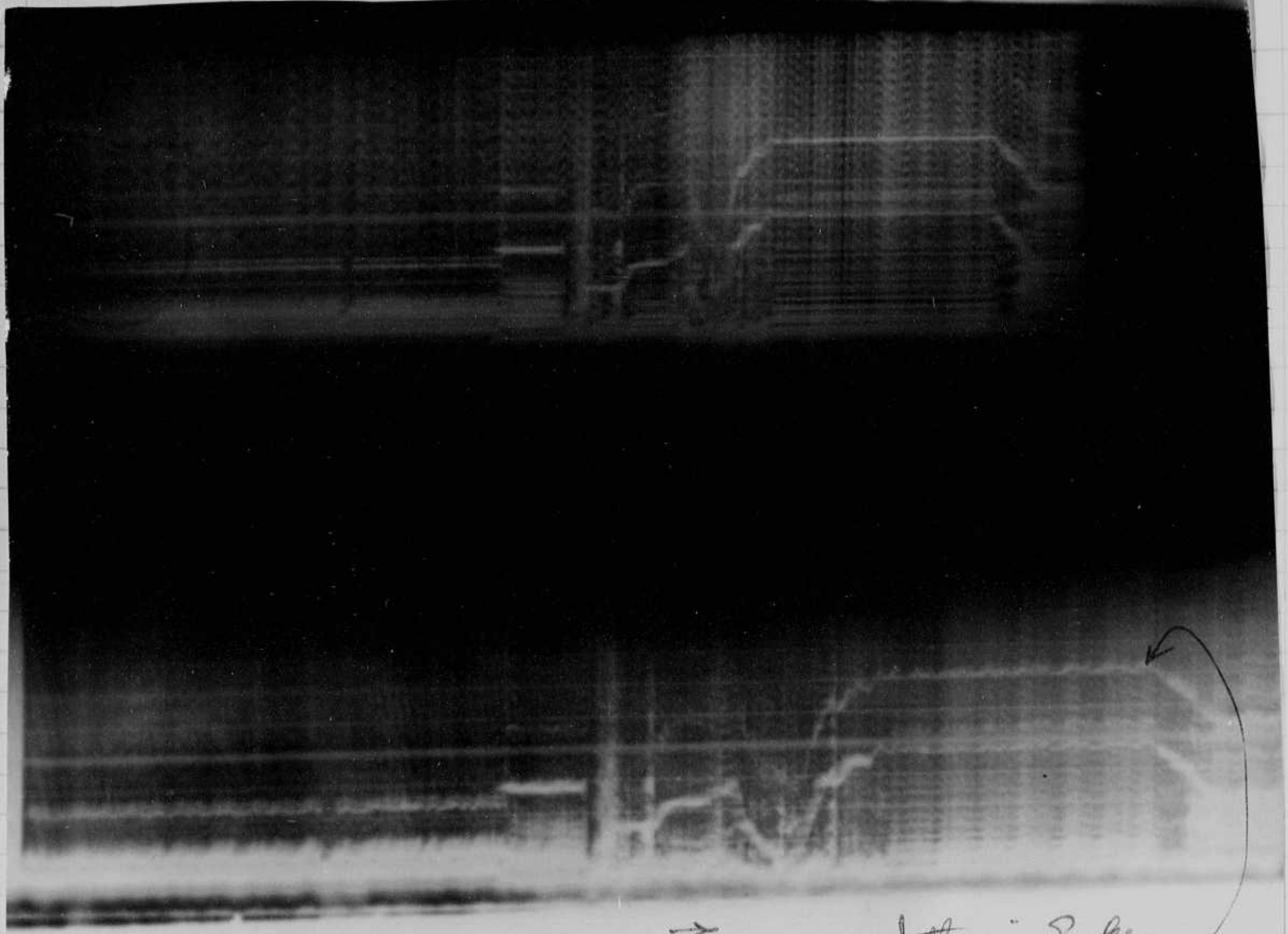




Record of
Soucoupe Sonar
May 29, 1965
H. E. Edgerton
Don Kooltser.

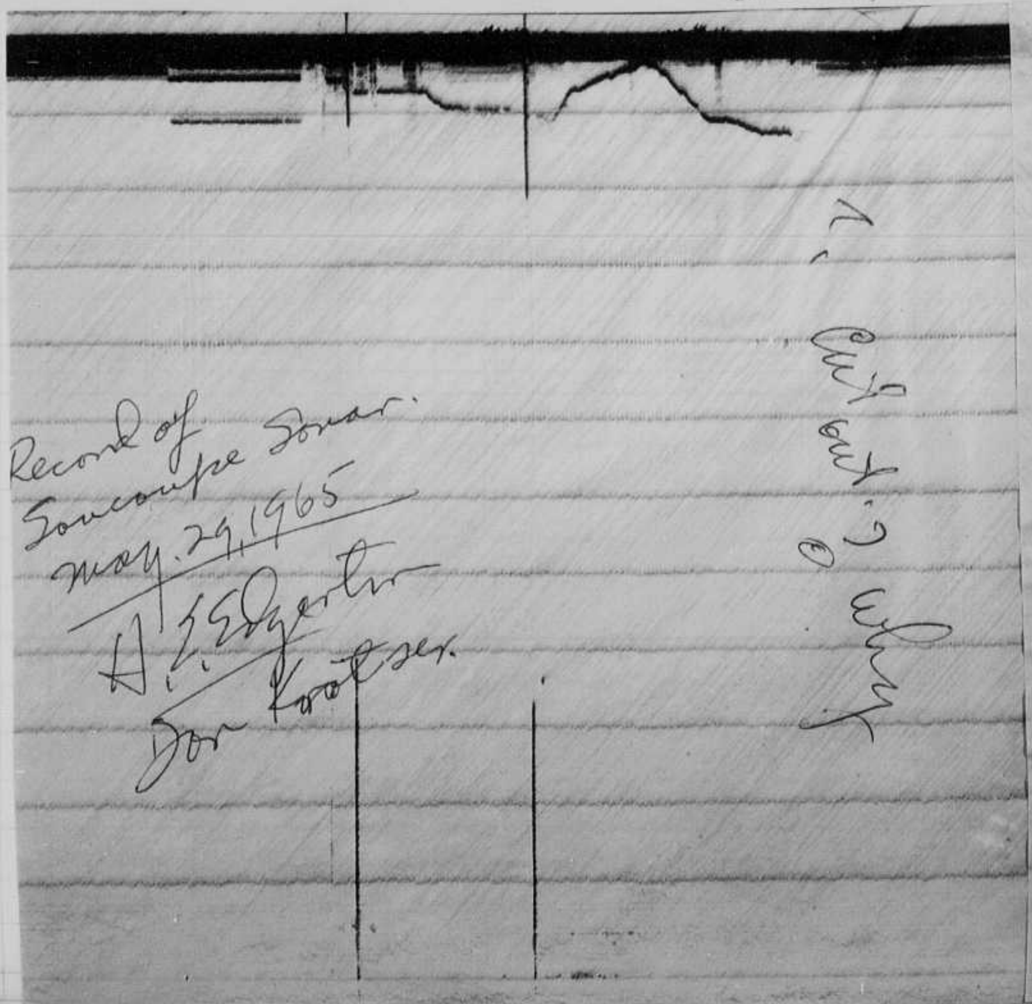
...ew - Prudential.

...u. S. BEACON ON PRU.



→ TIME

Jitter in Scope Trigger —



Record of Soucoupe Sonar.
May. 29, 1965
H. E. Edgerton
Don Kootser.

? Cut out? Why

P-43 Xenon Beacon ~ Prudential.

P-143 500W. S. BEACON ON PRU.

Hydrophones. Clevite Oyster
Sens -89.7 db.
Serial A224.

CIC 8 Ball Chesapeake
49099 -87 db.

CL 17A

CL 17AR.

Capacitance of Hydrophones p 85

CONTINUED
ON
NEXT REEL