HAROLD E. EDGERTON

PAPERS

MC 25

Series III

Laboratory Notebooks

Number 27

Dated Jan. 18, 1962 to Nov. 18, 1963

Massachusetts Institute of Technology

COMPUTATION BOOK

NAME	Number
HAROLD E. EDGERTON 4-405 M.I.T. CAMBRIDGE MASS	27

STROBE LAB.

Course ....

Used from JAN 18 1962, to NOV 18 1963.

KI-7-6063

HOME: 100 MEM. DRIVE
UN4 4790

Harold E. Edgerton

M.I.T. 4-405

Cambridge, Mass.

Strobe Lab.

Notebook # 27

Filming and Separation Record

2 unmounted photograph(s)

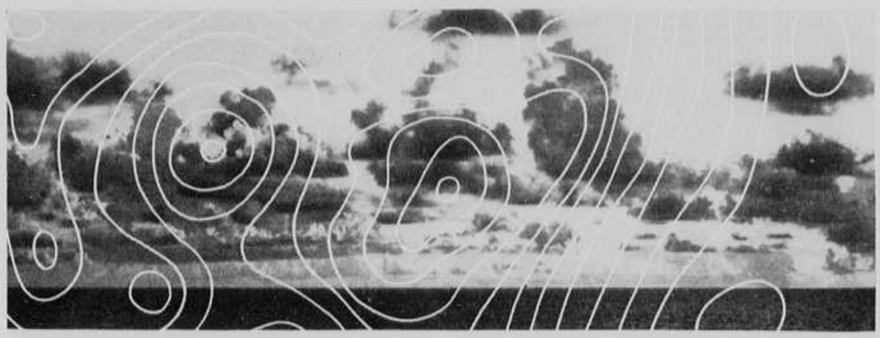
____ negative strip(s)

3 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.

Trend Of Affairs



How Predictable Is Weather?

IF SMALL perturbations can give rise to cyclones, a meteorologist once remarked, one flap of a sea gull's wings can alter the sequence of weather events forever. Many students of the weather do not accept this idea, but Professor Edward N. Lorenz of M.I.T. recently reported findings that seem to favor the gull.

Professor Lorenz has been studying the predictability of hydrodynamic flow, and that of the weather especially. He noted, in an address to the New York Academy of Science in January, the still unsatisfactory results of efforts to predict it subjectively, dynamically, and statistically. Without belittling subjective forecasting, he dealt mainly with the two latter methods—and described studies of them performed by electronic computers.

Since fast computers became available, encouragingly good 24-hour forecasts have been made by solving dynamic equations that appear to govern the weather's behavior. Statistical prediction, by formulas derived from past observations, also has produced some gratifying results. Neither method, however, has proven as satisfactory thus far as was anticipated, and the subjective method is still widely used.

Professor Lorenz' work has led him to believe that a dynamical or quasi-dynamical method is likely to be superior to a statistical method. But this, he warns, is a preference for theory over observation which is based on theoretical work.

To evaluate the capability of the statistical method, a hypothetical atmosphere was set up a few years ago in a General Precision LPG-30 computer in the M.I.T. Department of Meteorology. This model was nothing but numbers. These numbers did not represent measurements of the real atmosphere at any time or place. With them, however, it was possible to compute the state of an imaginary atmosphere at intervals corresponding to six hours for a period corresponding to 20 years in the real world.

The hydrodynamic flow which was thus simulated numerically was governed wholly by equations that were similar to, but simpler, than those needed to forecast real weather dynamically. This flow, therefore, was intrinsically predictable from the equations, and the experimenters' objective was to see whether such a flow also could be predicted by statistical methods. They found the answer was "yes" at short ranges, but not at long ranges.

While doing this work, the meteorologists sometimes wanted to repeat parts of previous computations. So they took values that the computer had reported and re-entered them as new initial conditions. Subsequent events then sometimes turned out to be different than those which previously had followed such conditions. This seemed strange, but the explanation was quickly found: Numbers which contained six significant figures had been rounded off to three. So the new initial conditions were not quite the same as former ones, and constituted small disturbances that proceeded to grow.

The researchers then let the computer make a number of pairs of runs from nearly but not quite identical initial conditions—and in every case the pairs of solutions eventually diverged and finally lost all resemblance to each other.

There always will be errors and gaps in observations of the real atmosphere, Professor Lorenz reminded the New York scientists, and his findings with the model suggest that the time required for such errors to result in worthless predictions may be highly variable. If there are any errors or gaps in observing the initial state, he said, neither dynamic nor statistical methods can predict nonperiodic flow perfectly—even at short range—and as the range becomes infinite the predictability of the flow falls to zero.

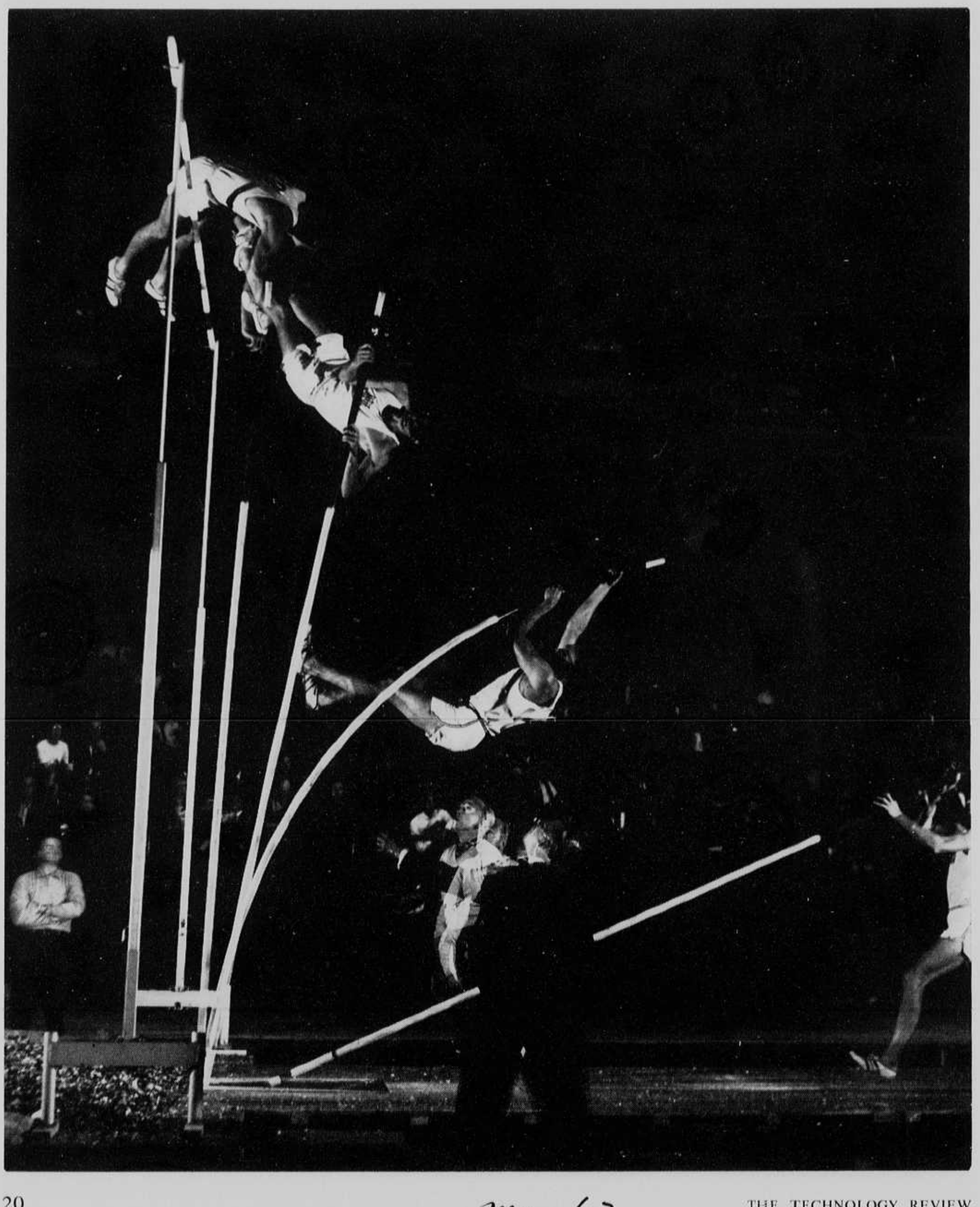
"In the real atmosphere," Professor Lorenz said, "average initial errors can increase by a factor of five before a forecast becomes generally poor. Over regions like the United States and Europe, where observations are plentiful, the tolerable amplification is considerably larger; over the oceans it is presumably smaller.

"If the results of recent numerical studies are at all applicable to the atmosphere, they suggest [that] . . . good forecasts several days in advance do not seem to be prevented simply by current errors in measurement. If, however, we are genuinely interested in forecasting a few weeks in advance, we should give serious consideration to enlarging our network of observing stations, particularly over the oceans." But possibly, he added, significant events occur much swifter in the real atmosphere than those represented in the numerical model, and the maximum range at which present errors in measurement allow good predictions may already have been reached.

The work thus reviewed was sponsored by the Geophysics Research Directorate of the Air Force Cambridge Research Laboratories.

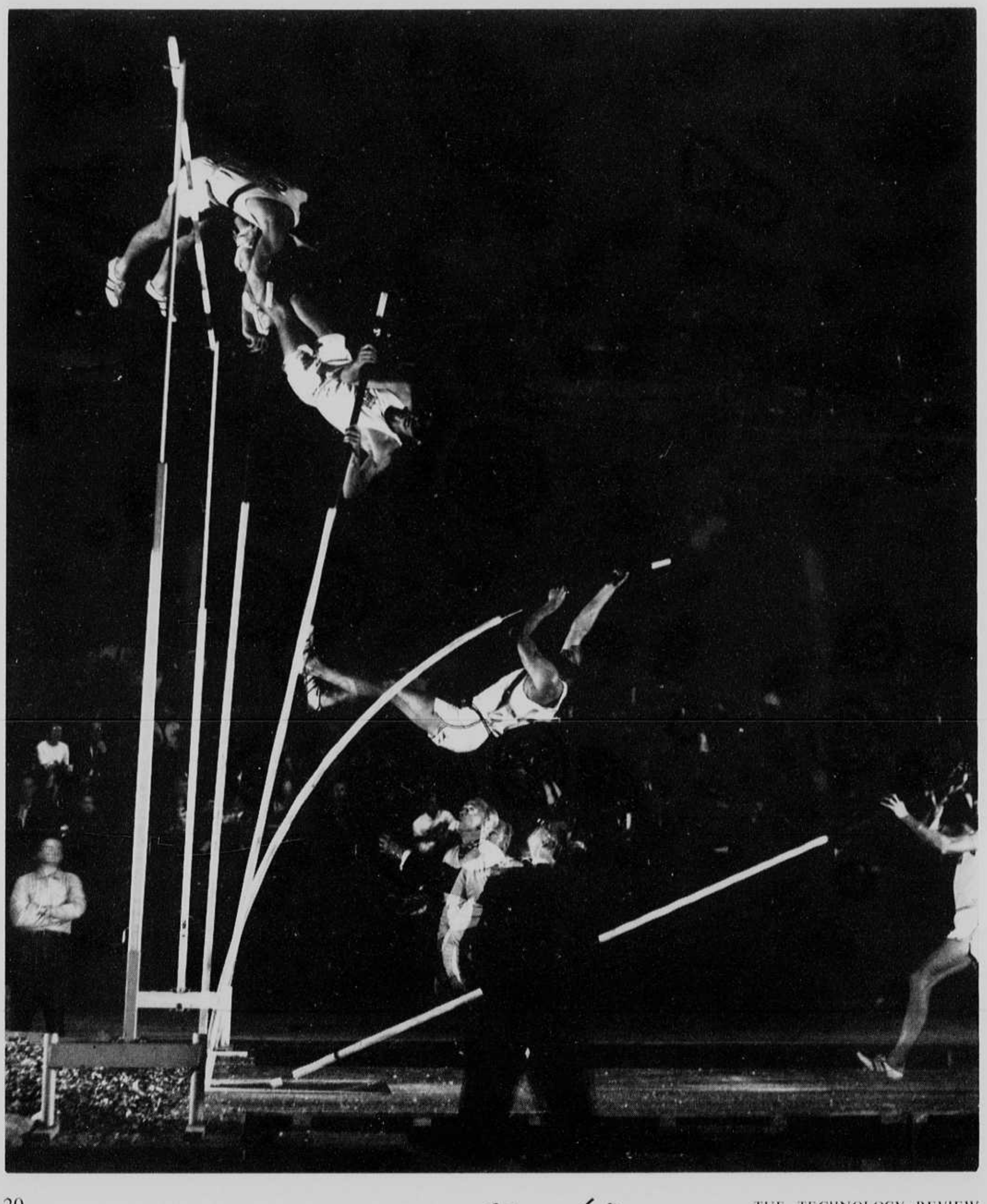
How the Pole Is Bent

MULTIPLE FLASH photographs usually are made in a darkened place so that the shutter can be open for a sequence of flashes. There was so much light in the Boston Garden during the Knights of Columbus meet this winter that this was not practical. But Professor Harold E. Edgerton, '27, wanted to show the bend in the pole as a vaulter goes up. So he used a fast-recycling shutter that could be opened by hand, for 1/200th of a second about three times a second, and fast-charging strobes that flashed whenever the shutter was fully open. His film was Panatomic X, and he lighted the subject from two sides with G.E. FT-24 (same as FT-503) flash lamps and 30-degree, 10-inch reflectors. The vaulter, Henry Wadsworth, was using one of the new fiberglas poles. There were no M.I.T. entries because of the dispute between the Amateur Athletic Union and the National Collegiate Athletic Association which had not then been settled.



How the Pole Is Bent

MULTIPLE FLASH photographs usually are made in a darkened place so that the shutter can be open for a sequence of flashes. There was so much light in the Boston Garden during the Knights of Columbus meet this winter that this was not practical. But Professor Harold E. Edgerton, '27, wanted to show the bend in the pole as a vaulter goes up. So he used a fast-recycling shutter that could be opened by hand, for 1/200th of a second about three times a second, and fast-charging strobes that flashed whenever the shutter was fully open. His film was Panatomic X, and he lighted the subject from two sides with G.E. FT-24 (same as FT-503) flash lamps and 30-degree, 10-inch reflectors. The vaulter, Henry Wadsworth, was using one of the new fiberglas poles. There were no M.I.T. entries because of the dispute between the Amateur Athletic Union and the National Collegiate Athletic Association which had not then been settled.



Oct. 1955.

Flash tube energy balance.

Input = $\frac{CE^2}{2}$ watt seconds. $= \frac{100\,(2000)^2}{2} = 200$ watt sec.

Number of molecules. V = volume. cubic cm. $= \frac{\pi D^2 l}{4}$

$27. \times 10^{18}$ molecules / c.c. at N.T.P.

no of molecules in a tube at pressure p.

$$N = V \; 27 \times 10^{18} \; \frac{p}{76} \text{ molecules}$$

Ionization energy $= V_i \, N \, e$ watt sec. for entire tube.

Xenon. $V_i = 12$ volts.

$D = .4$ cm.

$l = 6 \times 2.54$.

$= 12 \, N \, (1.59 \times 10^{-19}$ coulombs$)$

$= 12 \; \frac{\pi D^2 l}{4} \; 27 \times 10^{18} \; \frac{20}{76} \; 1.59 \times 10^{-19}$

$= 12 \;\; 1.92 \;\; 7.1 \times 10^{18} \;\; 1.59 \times 10^{-19}$

$= 26.$ watt seconds.

$V = \frac{\pi D^2}{4} l = \pi \, .04 \; 6 \times 2.54$

$= 1.93$ cubic cm.

energy $\rightarrow$ heat. / $\rightarrow$ Radiation

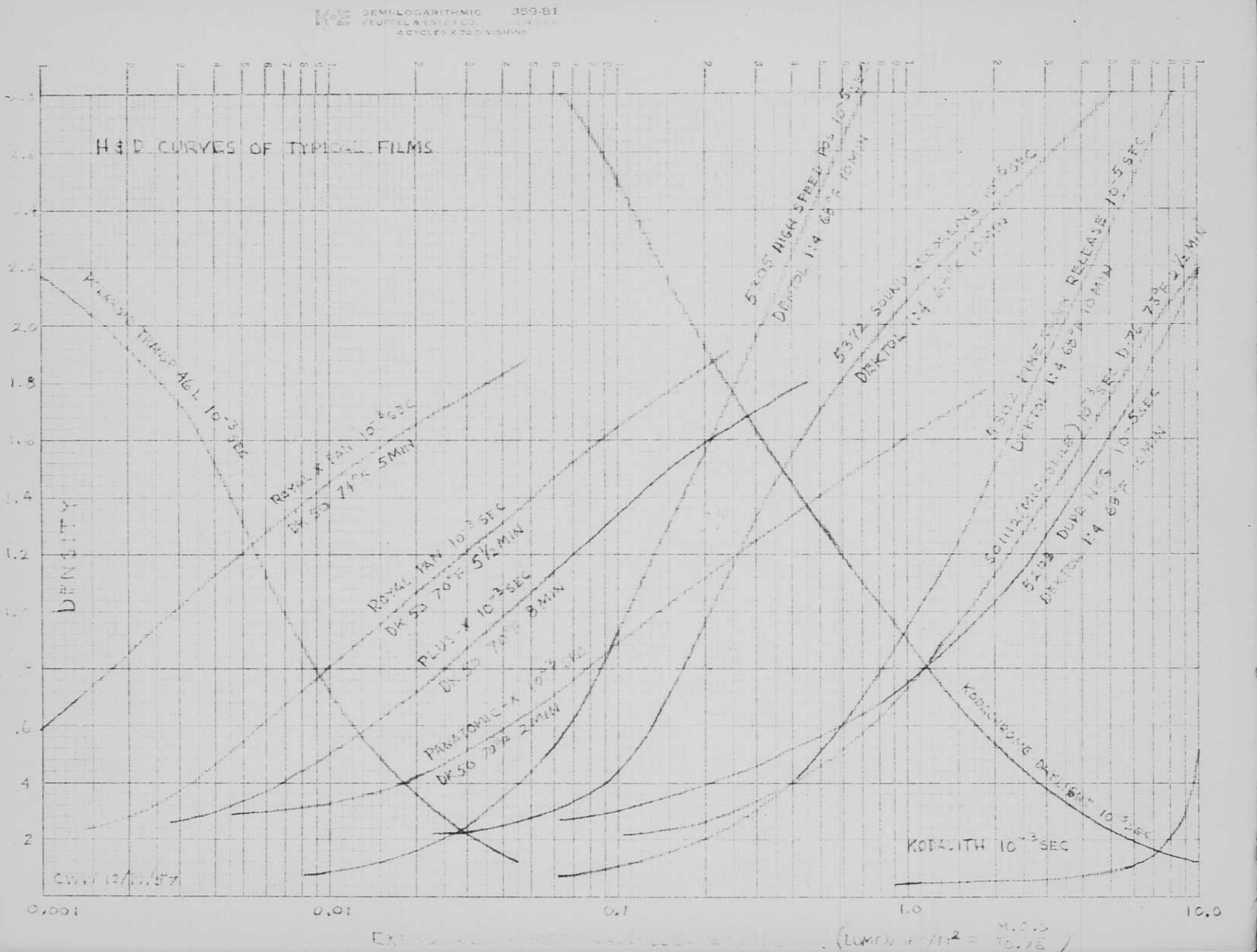
assume kT = energy per molecule.

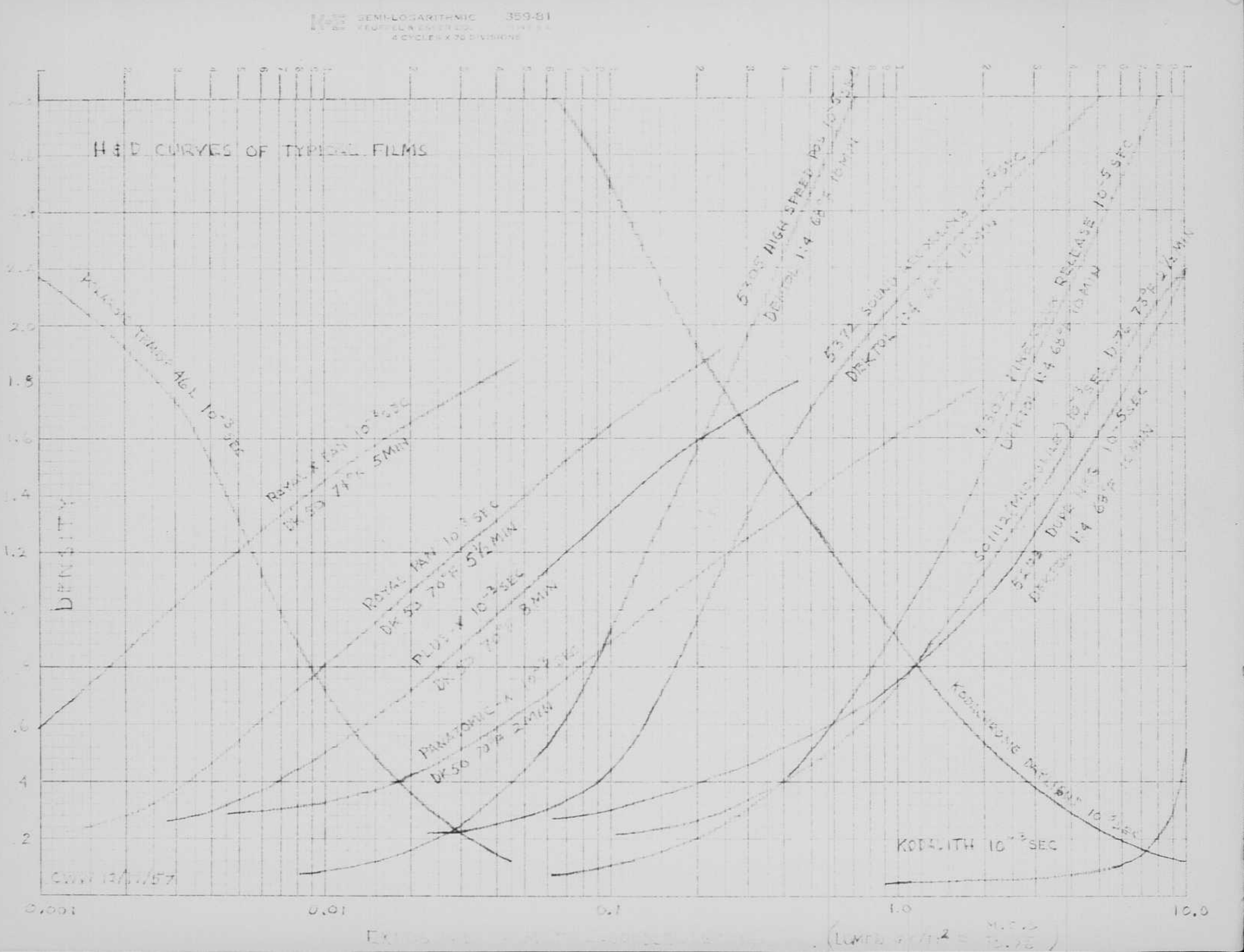
then NkT = total energy = 200 watt sec.

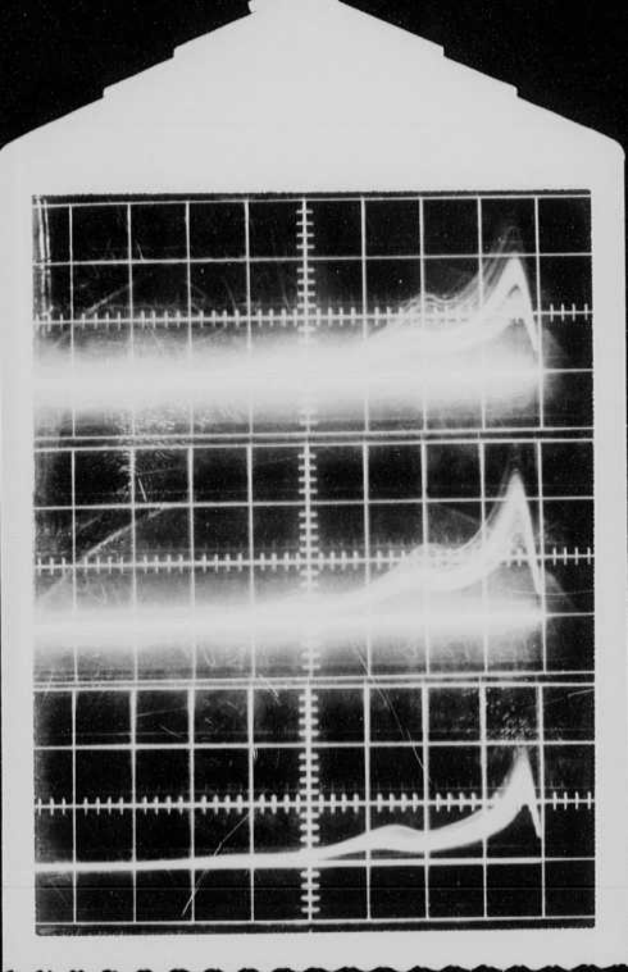
$$T = \frac{W.S.}{Nk} = \frac{200}{7.1 \times 10^{18} \;\; 1.37 \times 10^{-23}}$$

$k = 1.37 \times 10^{-23}$ watt sec / deg K.

$= \frac{200}{10 \times 10^{-5}} \times 30 = \frac{200}{10^{-4}} = \ldots$


SEMI-LOGARITHMIC 359-81
KEUFFEL & ESSER CO.
4 CYCLES X 70 DIVISIONS
H & D CURVES OF TYPICAL FILMS
DENSITY
ROYAL-X PAN 10^-3 SEC
DK 50 74°F 5 MIN
ROYAL PAN 10^-3 SEC
DK 50 70°F 5½ MIN
PLUS-X 10^-3 SEC
DK 50 70°F 8 MIN
PANATOMIC-X 10^-3 SEC
DK 50 70°F 2 MIN
5305 HIGH SPEED POS 10^-5 SEC
DEKTOL 1:4 68°F 10 MIN
5372 SOUND RECORDING 10^-5 SEC
DEKTOL 1:4 68°F 10 MIN
5302 FINE GRAIN RELEASE 10^-5 SEC
DEKTOL 1:4 68°F 10 MIN
5203 DUPE NEG 10^-5 SEC
DEKTOL 1:4 68°F 10 MIN
KODALITH 10^-3 SEC
2.0
1.8
1.6
1.4
1.2
.6
.4
.2
0.001
0.01
0.1
1.0
10.0


SEMI-LOGARITHMIC 359-81
4 CYCLES X 70 DIVISIONS
H & D CURVES OF TYPICAL FILMS
DENSITY
1.8
1.6
1.4
1.2
.6
.4
.2
ROYAL PAN 10^-3 SEC
DK 50 70°F 5½ MIN
PLUS-X 10^-3 SEC
DK 50 70°F 2 MIN
DK 50 74°F 5 MIN
RELEASE 10^-5 SEC
DEKTOL 1:4 68°F 10 MIN
KODALITH 10^-3 SEC
0.001
0.01
0.1
1.0
10.0

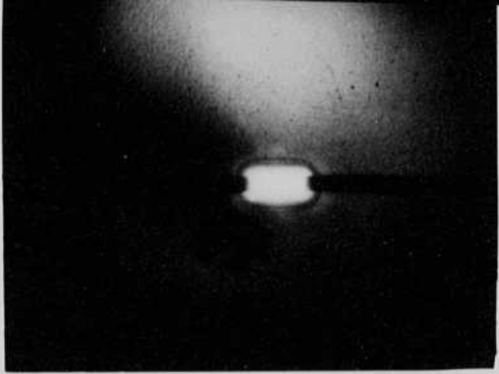


Ex-21
June 23 1962
H. Edgerton

,02 2000 A $0.01 cp \times 10^6/$ 6

,02 1000 $0.1 cp/cm \times 10^6$ 5

,01 1000 $.05 \times 10^6 cp/cm$ 4



Dave Kocher

1963

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

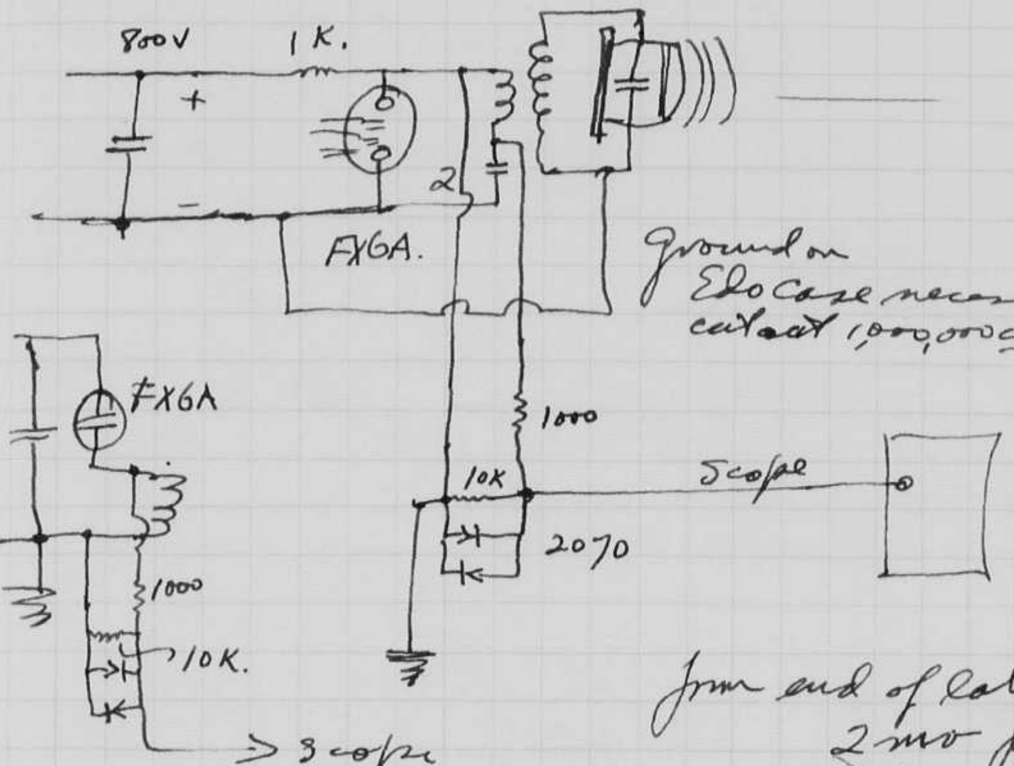
$1.45

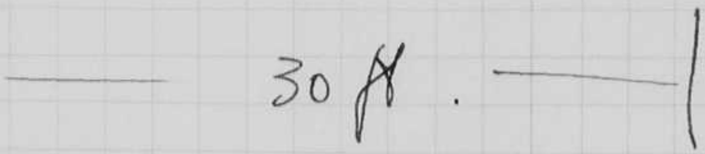
Jan 19 1962 Pinger Transreceiver.

Harold Edgerton
Gary Hayward.
4-405 9:20 pm.
M.I.T.

Adjustment of the system for underwater archeology etc is now complete after several days of work.

12KC EDO





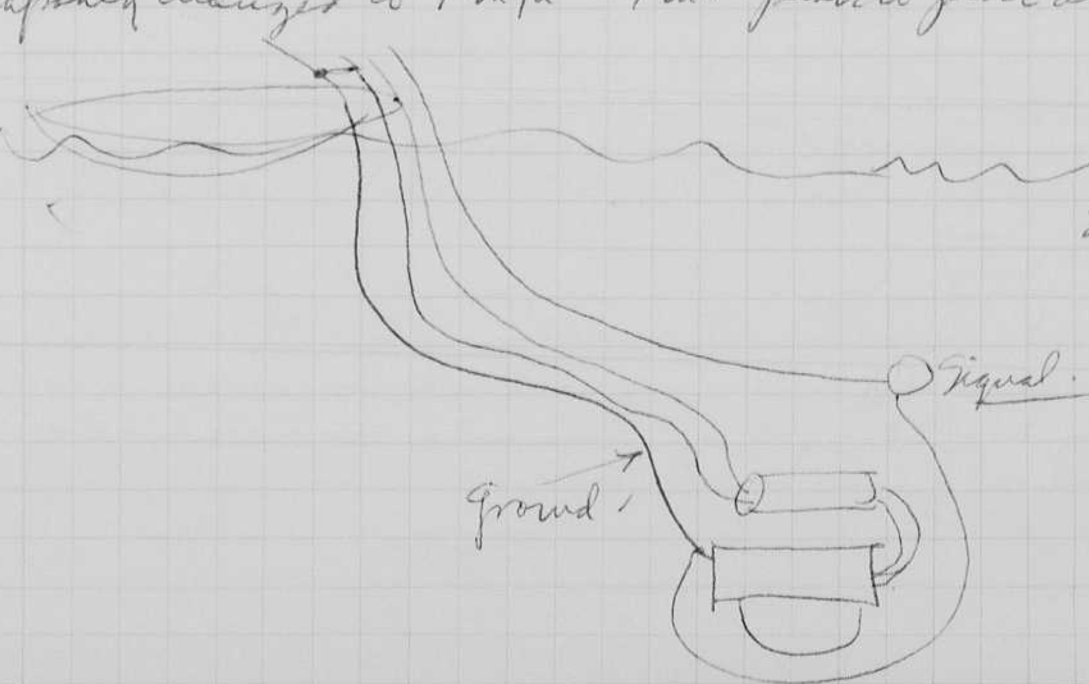
Ground on Edo case necessary & cut at 1,000,000 cycle?

Type D plugin for Tektronix
× 15 ms sweep in

from end of lab 30
2 mv peak to peak.
~~35~~ 40 ms down and back.

Phoned John Alden in Wellesley. He will come in Monday with a 5" recorder and a matching amplifier for making tests.

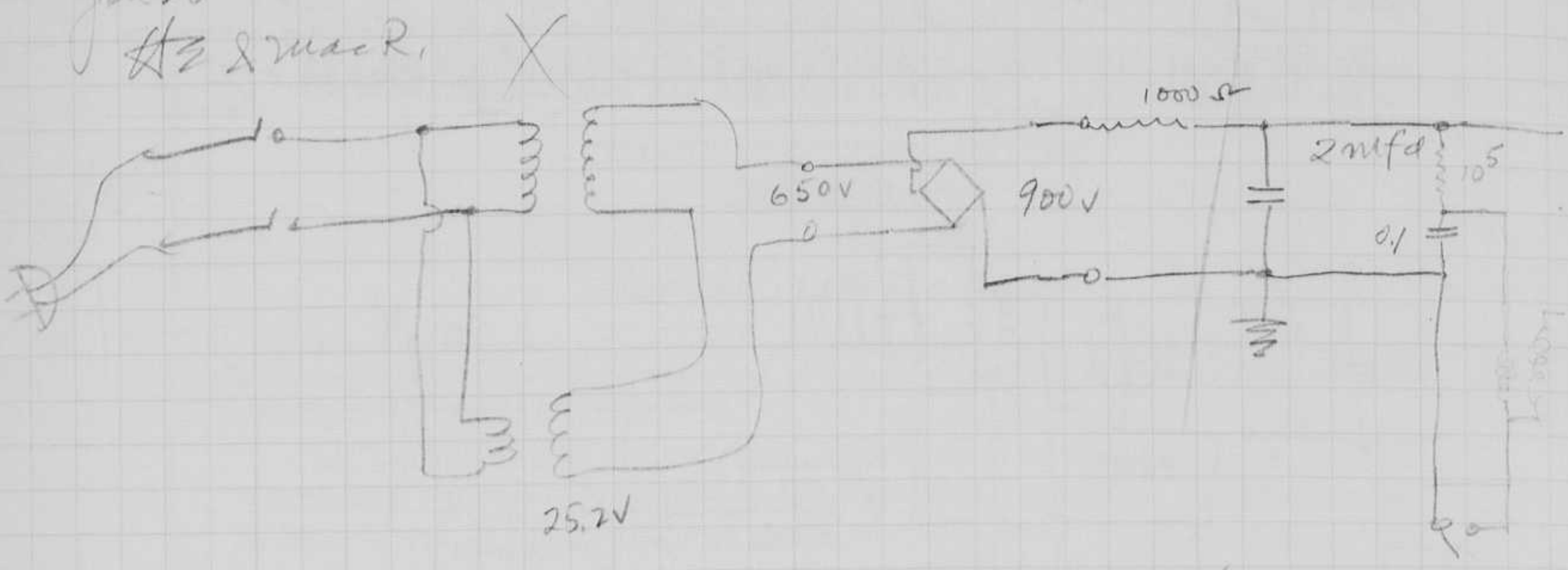
Capacity changed to 1 mfd 1 mv peak to peak at ~~35~~ 40 ms down & back.

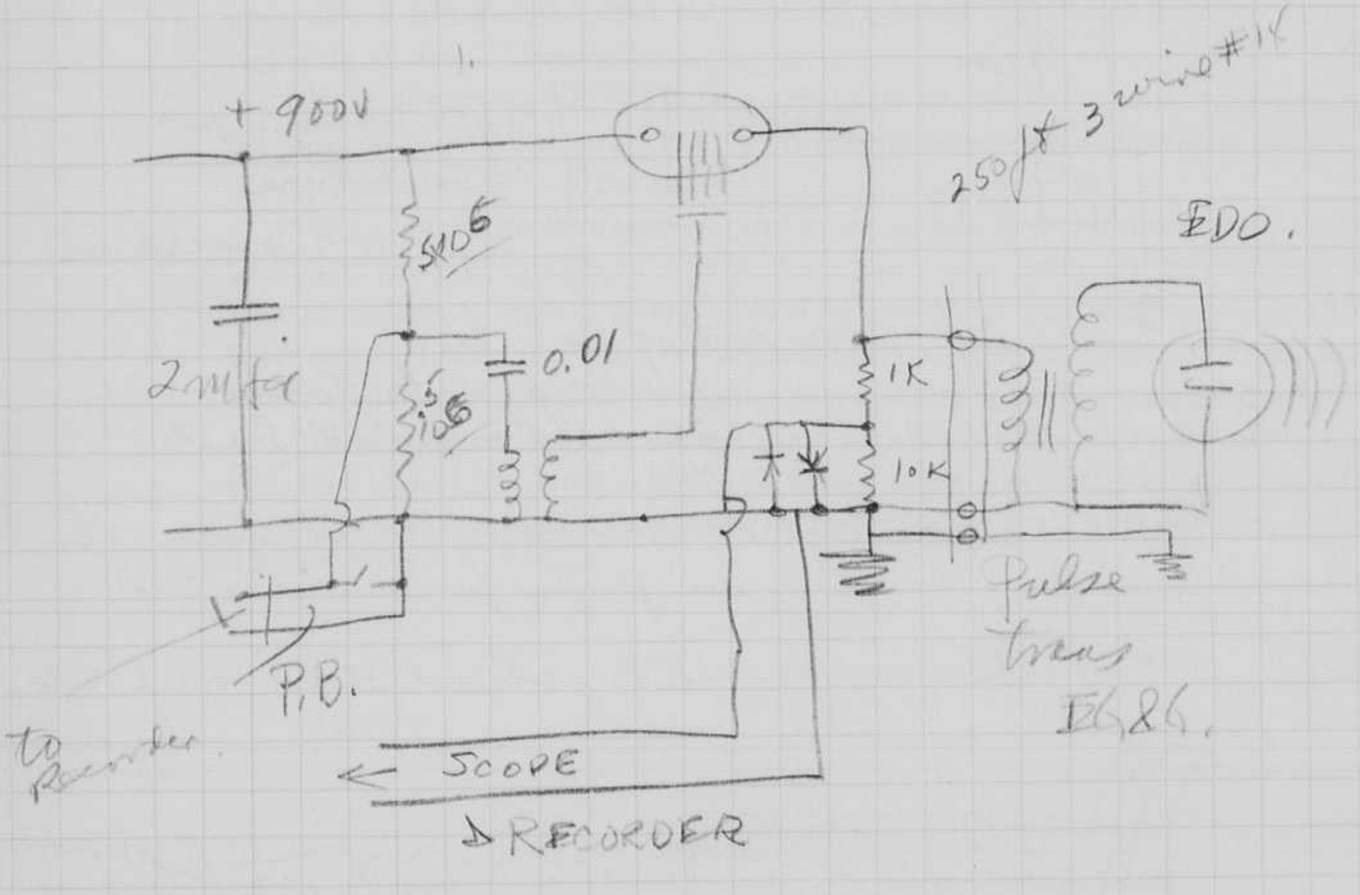


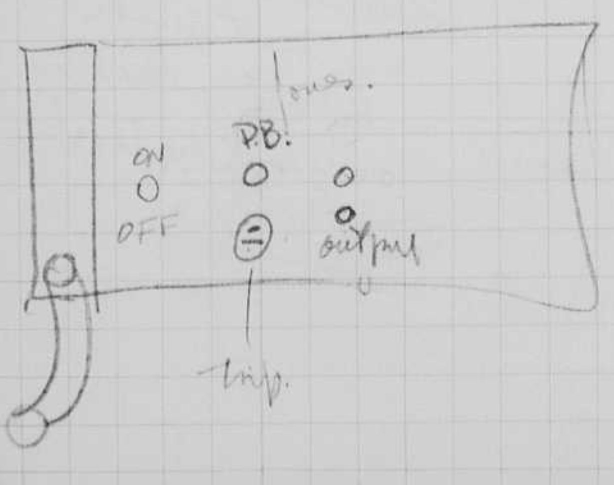
2 ohms in discharge circuit makes 10 to 15 % change in signal on the scope.

Cable 3 #14 wires to transducer.
1¼ for 500 feet 2.5 Ω/1000 ft.
250 foot of #14 3 wire.

Jan 20 62.
HE & Mack.





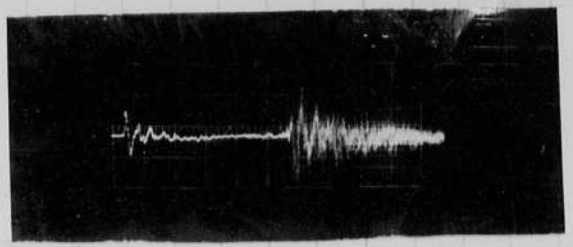


E²/R = 500

Boomers 18" disk 6061
1/2" thick.
BC 30 Hydrophone
at 6 ft.
2V/cm
5 ms/cm.

Taken at 750 Commonwealth Ave
Boston at EG&G.

2V/cm.



5 ms -> TIME

Jan 21 1962 Sunday.

Party last night of EG&G people at the Bradford Hotel in Boston. About 900 attended. Pierre Cathou and his wife brought us home to 100 Memorial Drive.

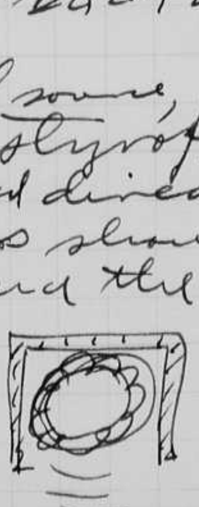
MacRoberts wired up the circuit yesterday page 2 but there was a 60 cycle pickup of about 0.2 millivolts. This was due to the proximity of the transformer and the output circuit. Does the magnetic field influence the circuit such as the diodes? Maybe it was simple ac field coupling.

I put in a 6 wire cable of about 100 + feet long. The wires were doubled on ground and two cables for the transformer circuit. The pickup was about 20 millivolts! of a high frequency. Why? I am going to try shielded cable next.

Jay Harford & Wayne Kearsley helped me this afternoon with the transducers, (Boomer) at 750 Commonwealth Ave. We took movies at 4000/sec also color of the equipment etc.

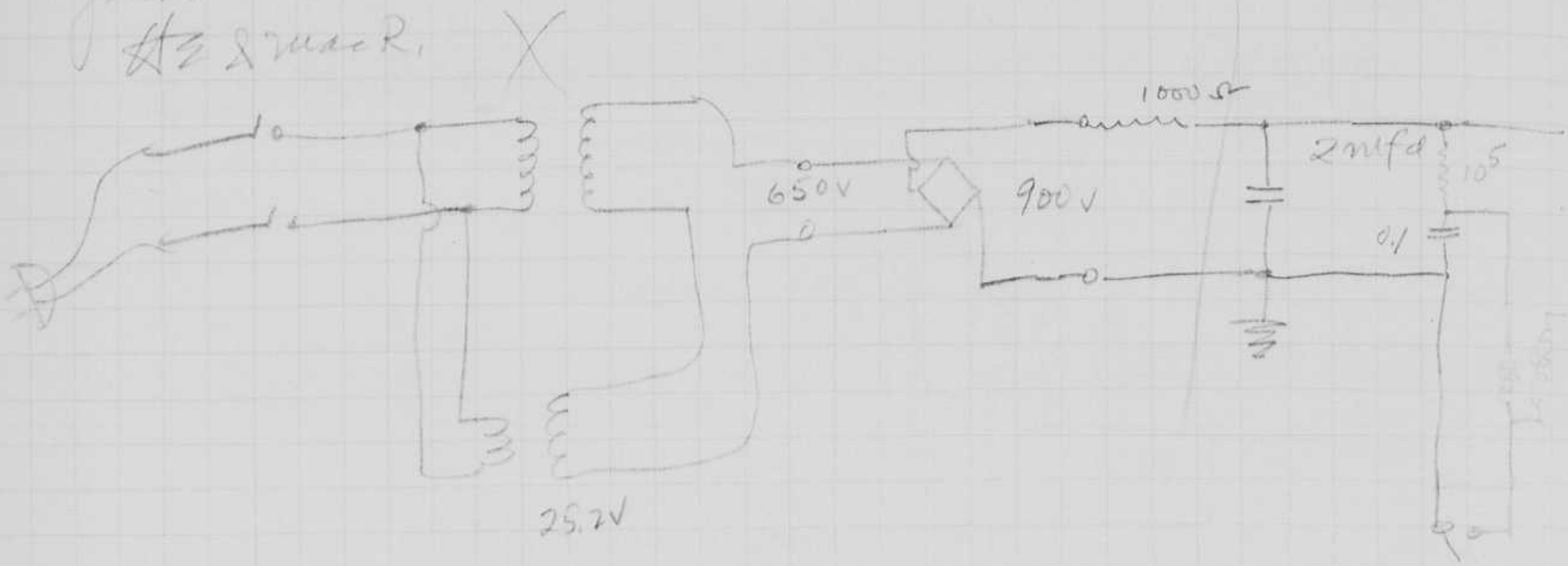
Sam Raymond is going to the West coast, also Florida for EG&G to sell underwater gear.

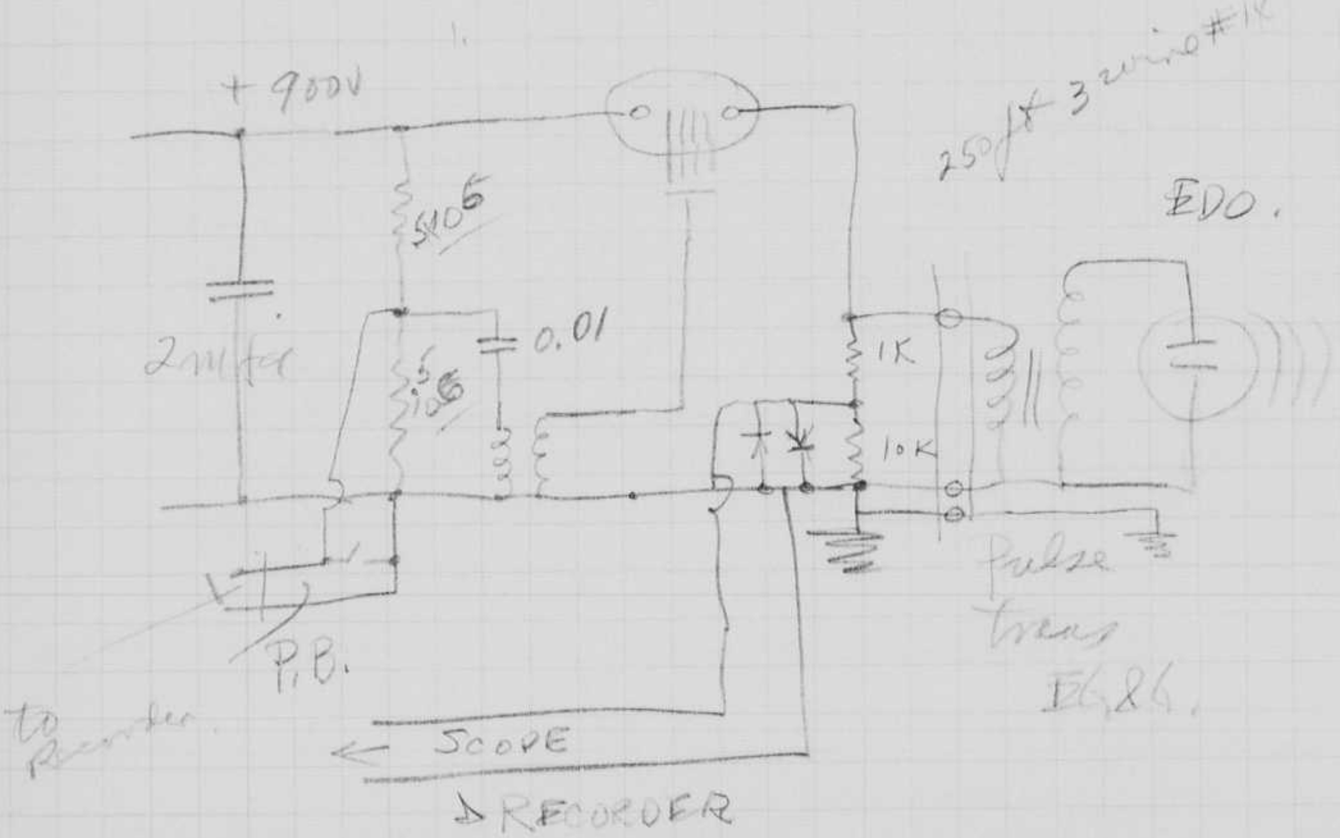
Sound source, directional. Pad the sides and back with styrofoam to absorb energy except in the desired direction. The nickel ring transducer should be excellent for closeup pinging since the motion can be damped.

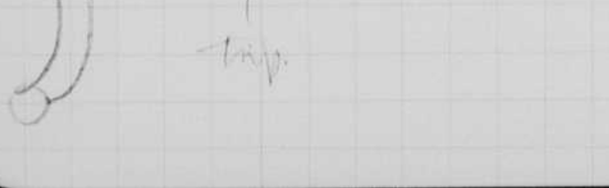


Cable 3#14 wires to transducer.
1¼ for 500 feet 2.5 Ω/1000 ft.
250 foot of #14 3 wire.

Jan 20 62.





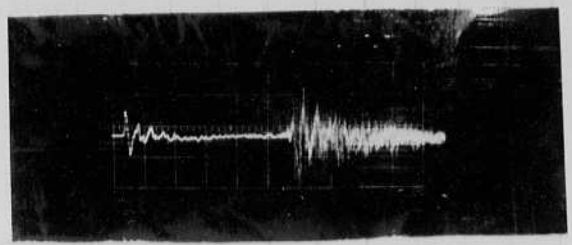


$\frac{E^2}{R}$ 500

Boomers 18" disk 6061
1/2" thick.
BC 30 Hydrophone
at 6 ft.
2V/cm
5 ms/cm.

Taken at 750 commonwealth ave Boston at EG&G.

2V/cm



5ms -> TIME

Jan 21 1962 Sunday.

Party last night of EG&G people at the Bradford Hotel in Boston. about 900 attended. Pierre Cathou and his wife brought us home to 100 memorial Drive.

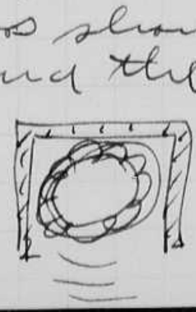
MacRoberts wired up the circuit yesterday but there was a 60 cycle pickup of about 0.2 millivolts. This was due to the proximity of the transformer and the output circuit. Does the magnetic field influence the circuit such as the diodes? Maybe it was simple ac field coupling.

I put in a 6 wire cable of about 100 + feet long. the wires were doubled on ground and two cable for the transformer circuit. the pickup was about 20 millivolts! of a high frequency. why?. I am going to try shielded cable next.

Jay Hanford & Wayne Kearsley helped me this afternoon with the transducers, (Boomer) at 750 commonwealth ave. We took movies at 4000/sec also color of the equipment etc.

Sam Raymond is going to the West coast, also Florida for EG&G to sell underwater gear.

Sound source, directional. Pad the sides and back with styrofoam to absorb energy except in the desired direction. The ~~[illegible]~~ nickel ring transducers should be excellent for closeups pinging since the motion can be damped.



Jan. 24, 1962

HE Edgerton
Guy Hayward.

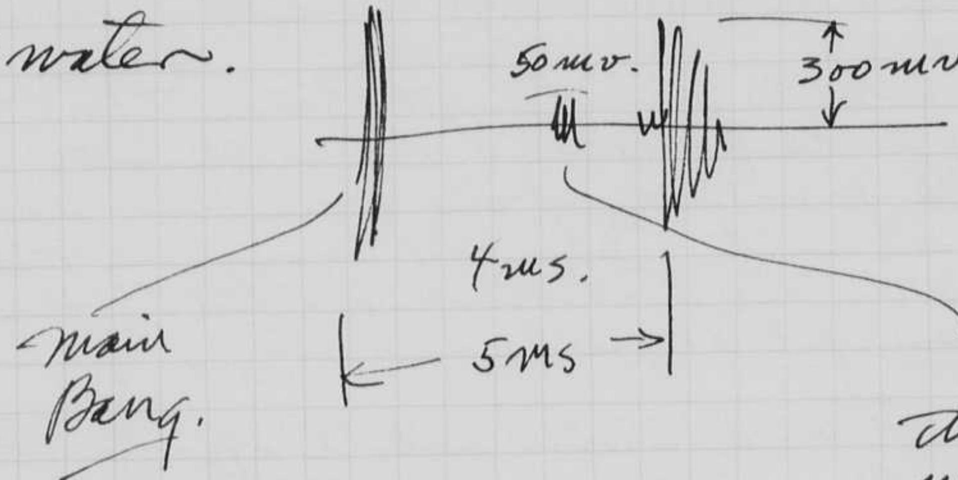
M.I.T.
Boathouse

Finch RA3 9311 Office
RA4 4900 Home
Binghamton N.Y.

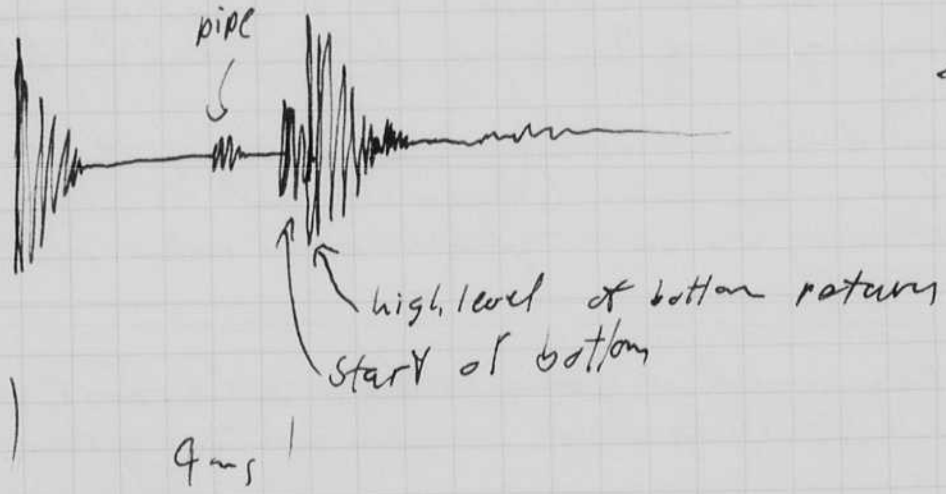
Yesterday John Alden Fred Simpson were here with 5" Moved to Boat House after (5pm) considerable experimentation

Wall in air at 10 ft. peak reflection 5 mv
chair 1/2 mv.

In water.



this has lead weights every 10 feet. We can see these with the pinger!



Bottom hit with 20 lb magnet stirs up bubbles
We can see the bubbles rise 50 ms signal.

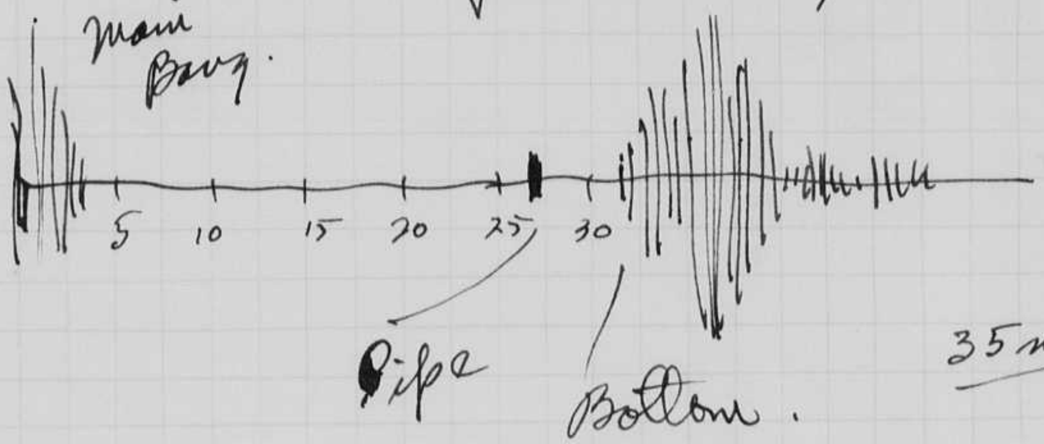
Alden Recorder 5" retd to MIT 4-405
new pulley installed which now gives 30-r.p.s.

38 x 50 = 1900 ms.
50
1900

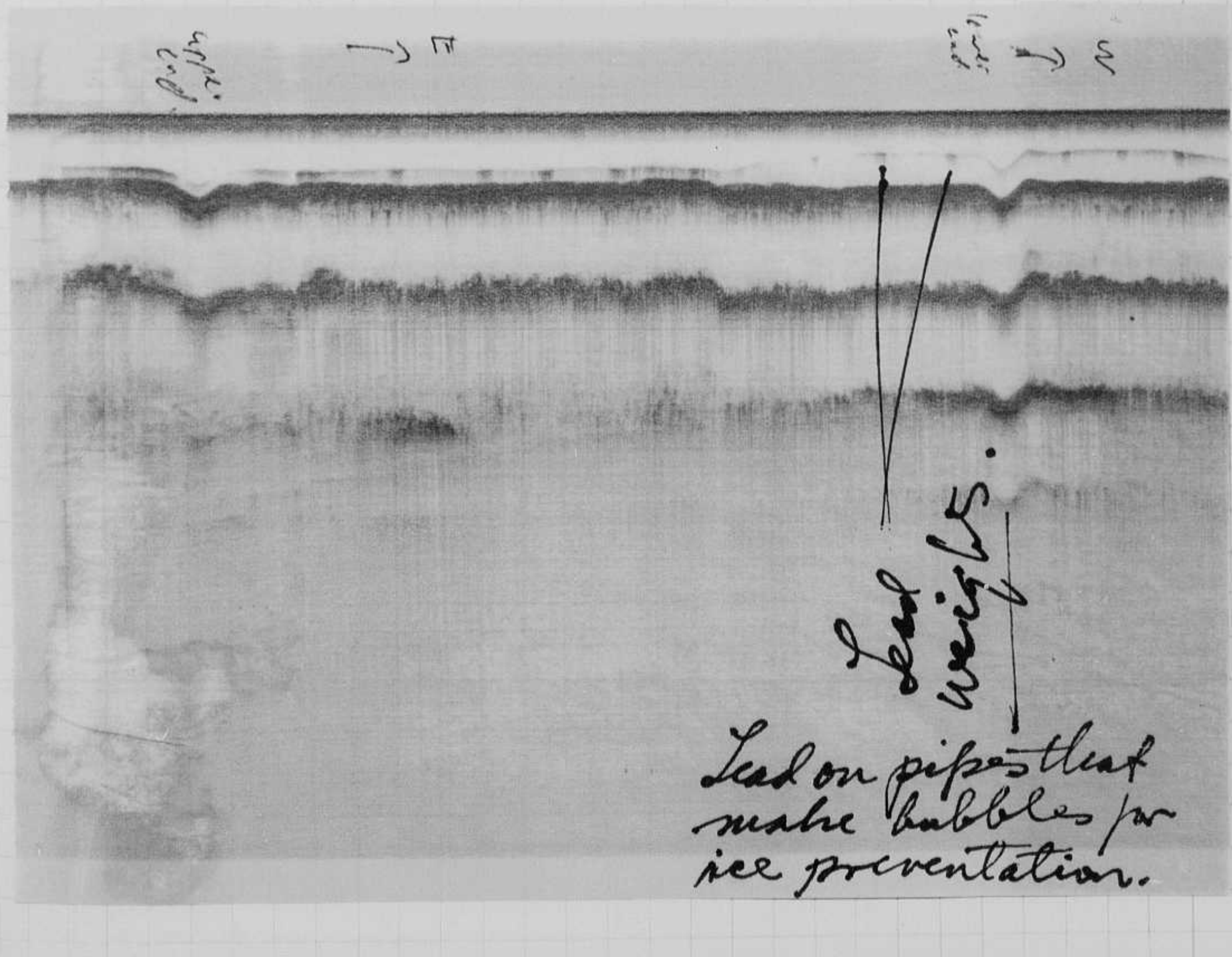
Paper tears some.

Pinger at surface

25 ms stop gives record on a
5/8" pipe at 27 ms 27 millisec.
Bottom mud gives 300 ms stop
from main signal.



35 ms.



Lead on pipes that
make bubbles for
ice preventation.

Jan 24, 1962

M.I.T.
Boathouse

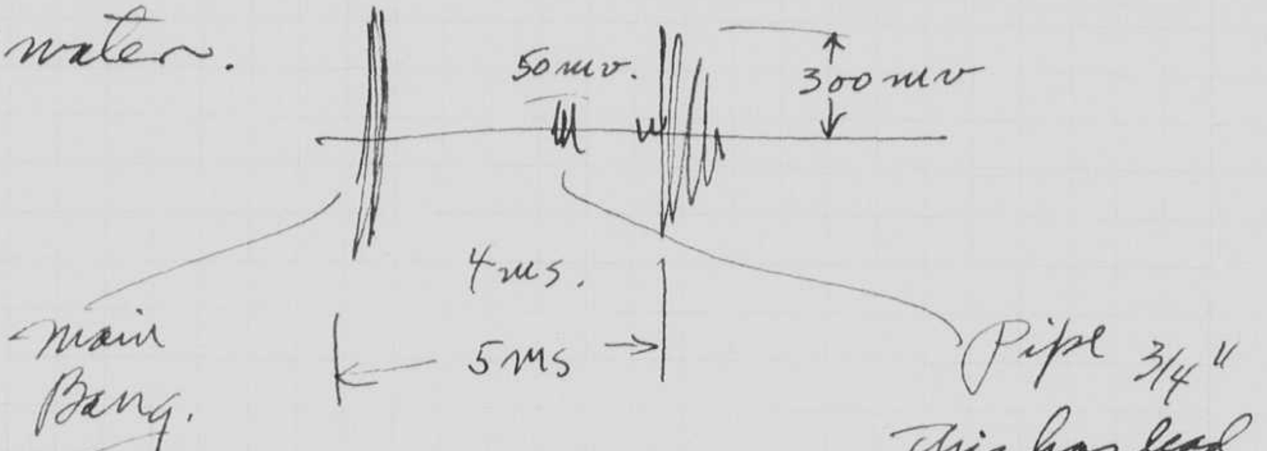
H S Doyle
Guy Hayward.

Fulm RA 3 9311 Office
RA 4 4900 Home
Binghamton N.Y.

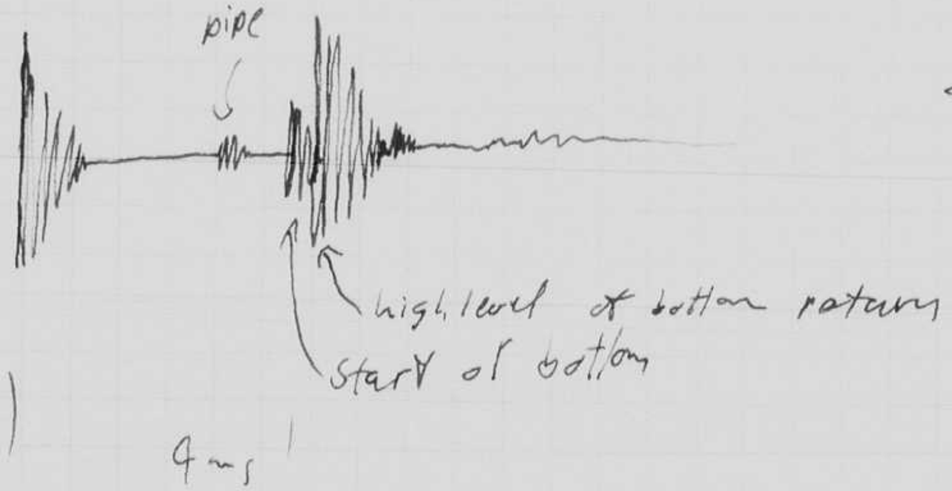
Yesterday John Alden Fred Simpson were here with the 5" Moved to Boat House after (5 pm) considerable experimentation

Wall in air at 10 ft. peak reflection 5 mv
Chair 1/2 mv.

In water.



this has lead weights every 10 feet. We can see these with the pinger!



Bottom hit with 20 lb magnet stirs up bubbles
We can see the bubbles rise 50 ms signal.

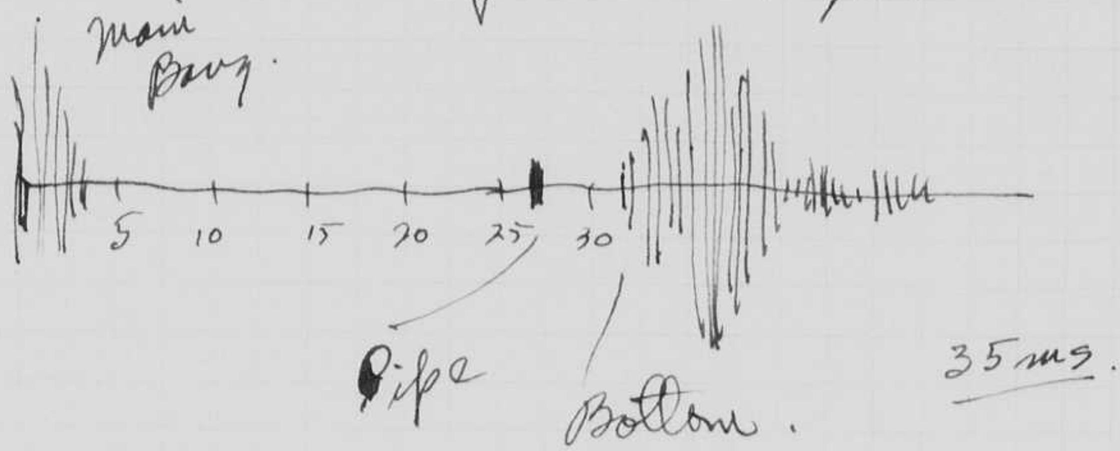
Alden Recorder 5" retd to MIT 4-405
new pulley installed which now gives 30-r.p.s.

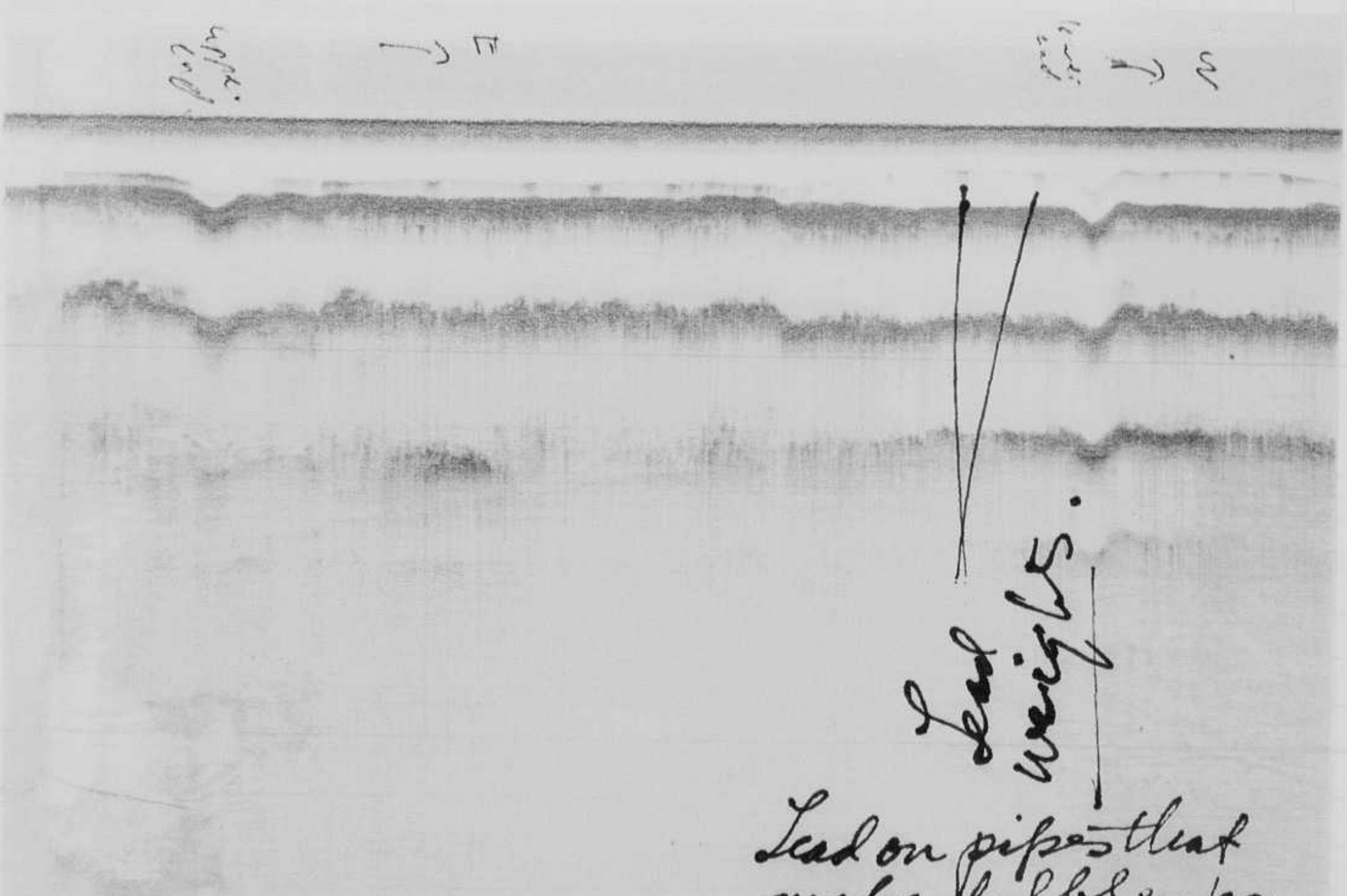
38 x 50 = 1900 ms.
50
1900

Paper tears some.

Pinger at surface

25 ms stop gives record on a 5/8" pipe at 27 ms 27 millisec.
Bottom mud gives 300 m v stop from main signal.





4

Jan 24, 1962 M.I.T. Boathouse

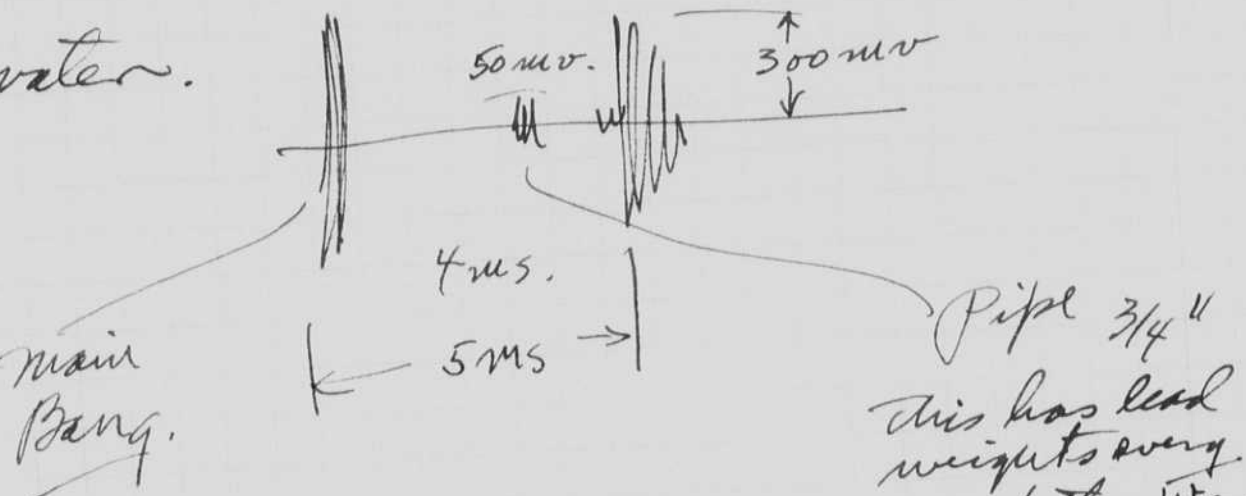
HE Edgerton
Barry Hayward.

Fink RA3 9311 Office
RA4 4900 Home
Brighton N.H.

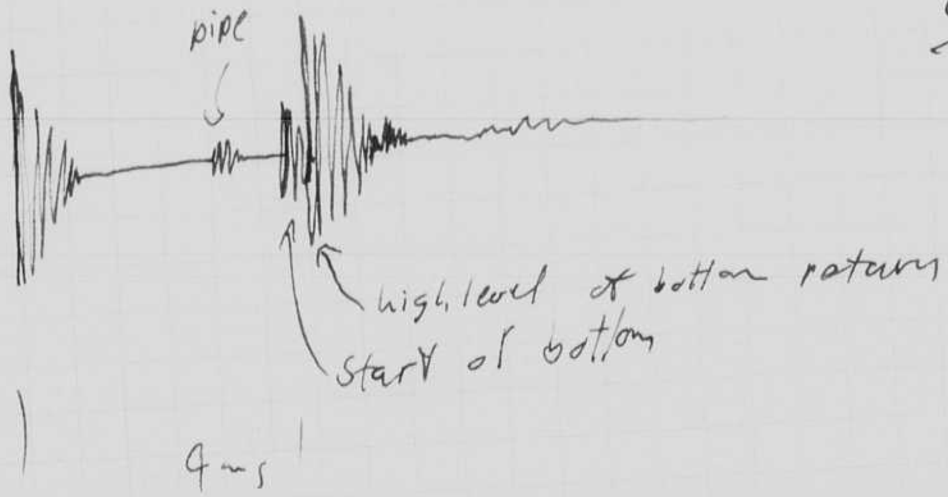
Yesterday John Alden Fred S Simpson were here with 5" moved to Boat House after (5 pm) considerable experimentation

Wall in air at 10 ft. peak reflection 5 mv
Chair 1/2 mv.

In water.



this has lead weights every 10 feet. We can see these with the pinger!



Bottom hit with 20 lb magnet stirs up bubbles
We can see the bubbles rise 50 ms signal.

Alden Recorder 5" retd to MIT 4-405
new pulley installed which now gives 30-r.p.s.

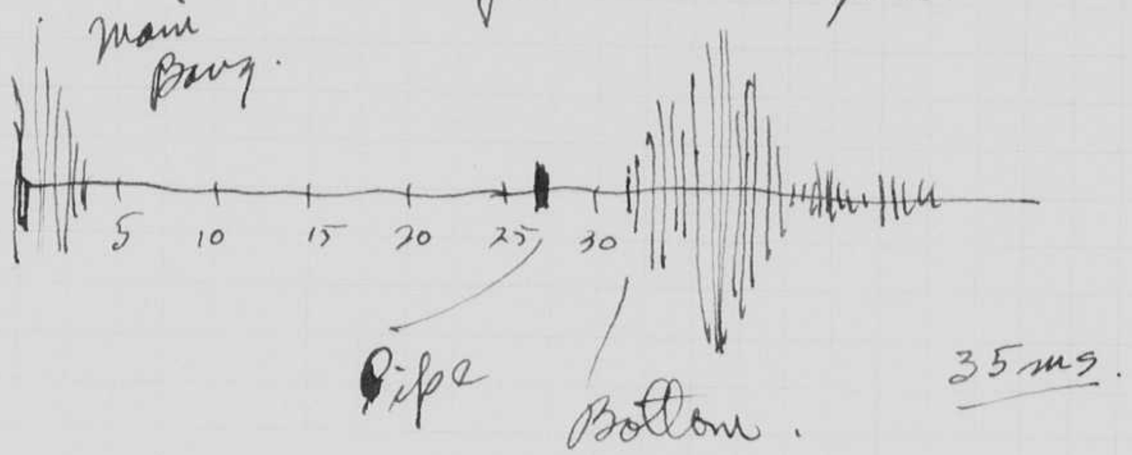
$38 \times 50 = 1900$ cm s.

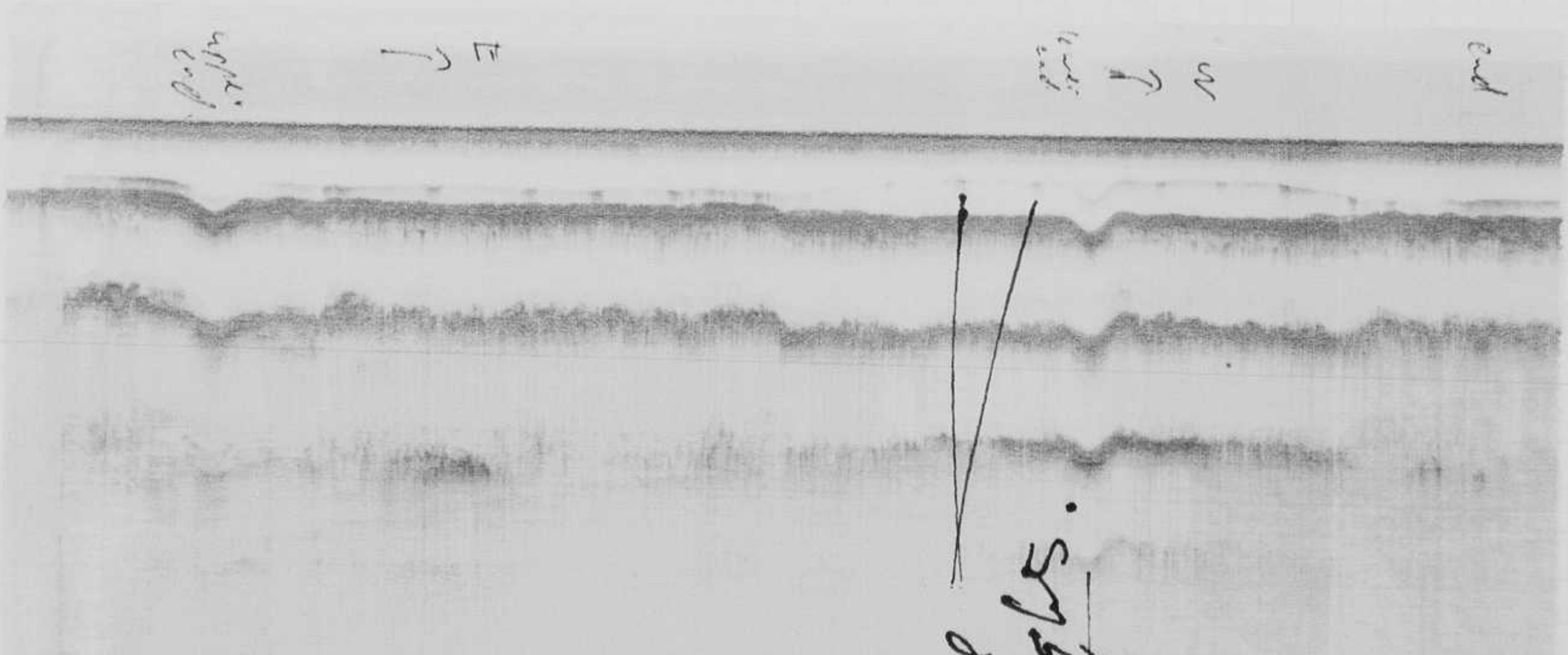
$$\begin{array}{r} 38 \\ \underline{50} \\ 1900 \end{array}$$

Paper tears some.

Pinger at surface

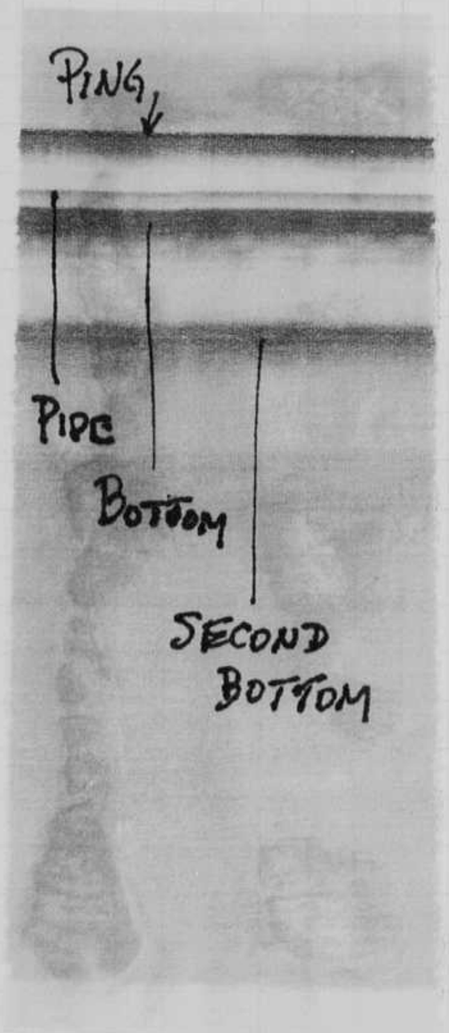
25 msec p top gives record on a 5/8" pipe at 27 ms 27 millisec.
Bottom mud gives 300 msec p top from main signal.

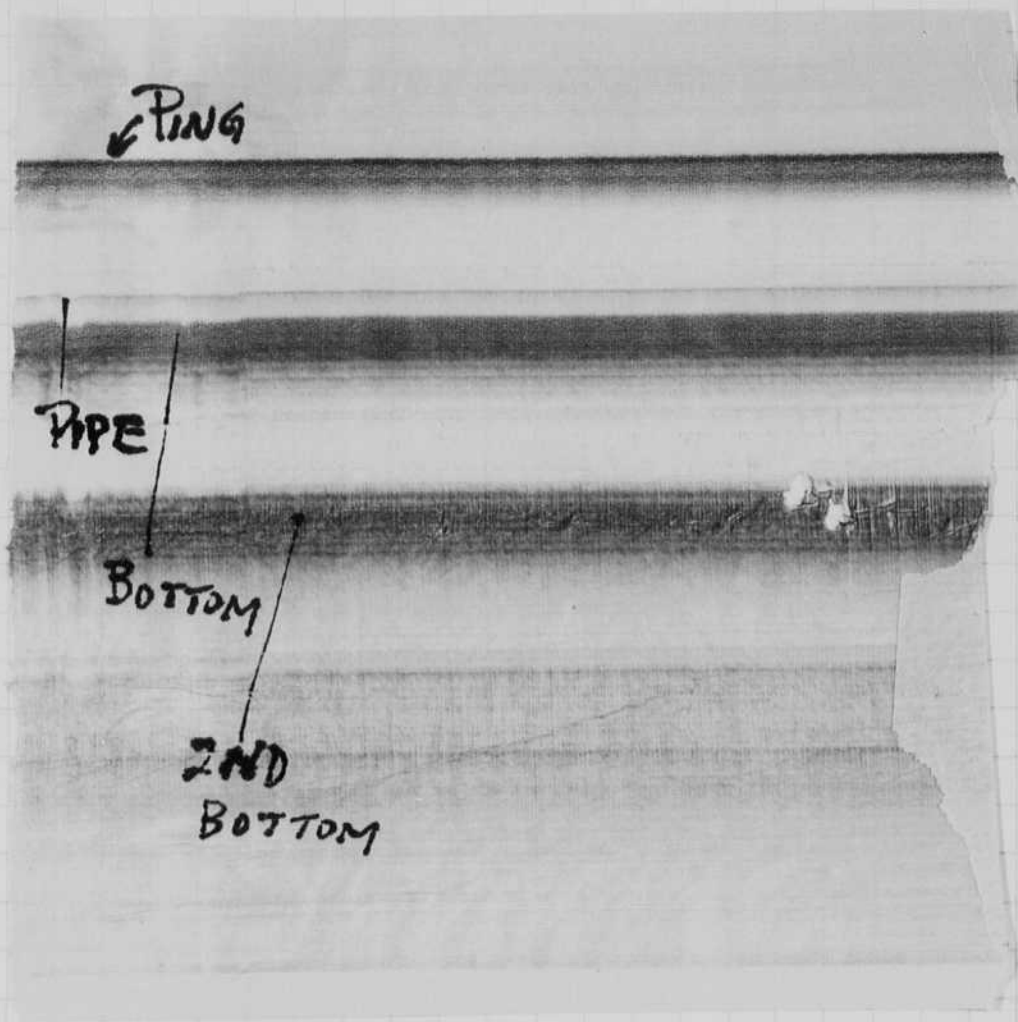




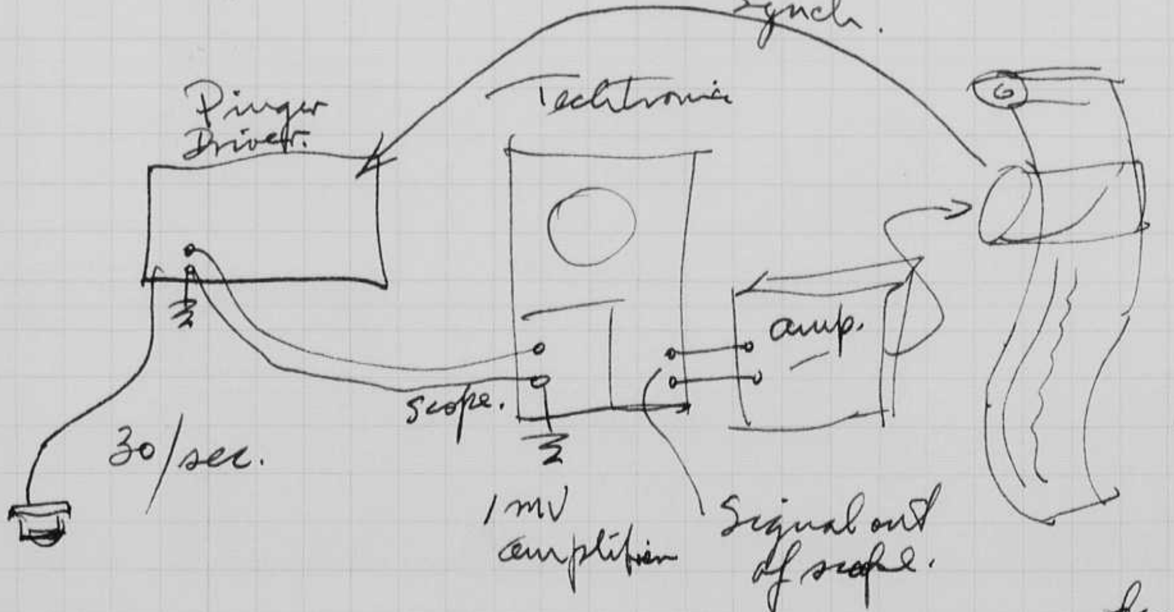
15 f.p.s.
Drum Speed
900 R.P.M.

about 1800 R.P.M.
Double Speed of Drum.





Bill MacRoberts put on another pulley which speeded up the drum to about 1600 r.p.m. the advance motor needs to be speeded up an the tension needs to be reduced.



$\frac{1}{30}$ sec = t

$d = vt = 5000 \text{ ft/sec} \times \frac{1}{30}$

$= 166. \text{ ft}$

$\times 2$

$d = 332$ feet.

down and back distance in 1/30 sec.

1800 F.P.M. 900 RPM

332 feet = 5" Double

66 feet. = 1" Double.

166 ft = 5" single

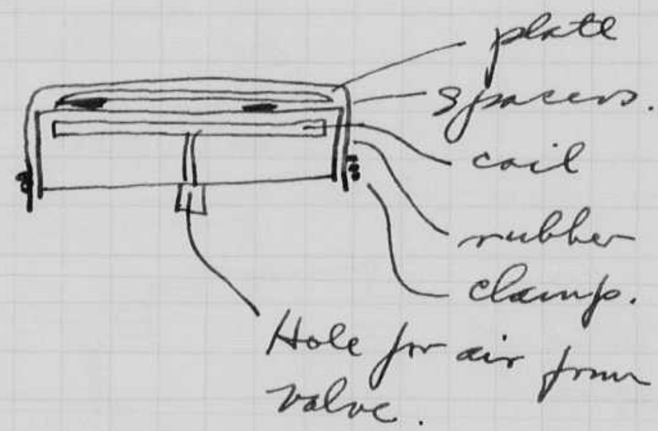
33 ft. = 1"

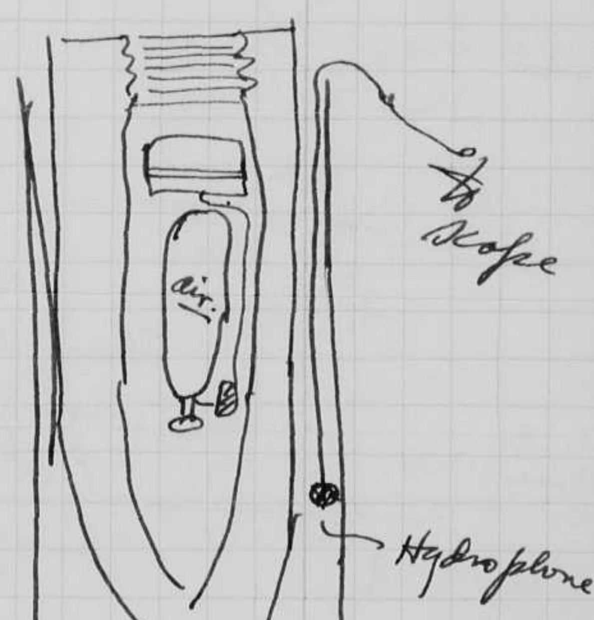
66' = 1" on chart.
16' = 1/4" on chart.

Feb. 1, 1961
Harold Edgerton
4-405 M.I.T.

Sam Raymond and I ran some experiments on tues night Jan 30 on his air supported diaphram in the pressure facility in Bldg 20. The max pressure used was ~~2000~~ 1000 pounds since this was the limit of the air in the tank.

There were 1/8" spacers under the alumnina plate. A rubber diaphram was pulled over the plate and the coil.



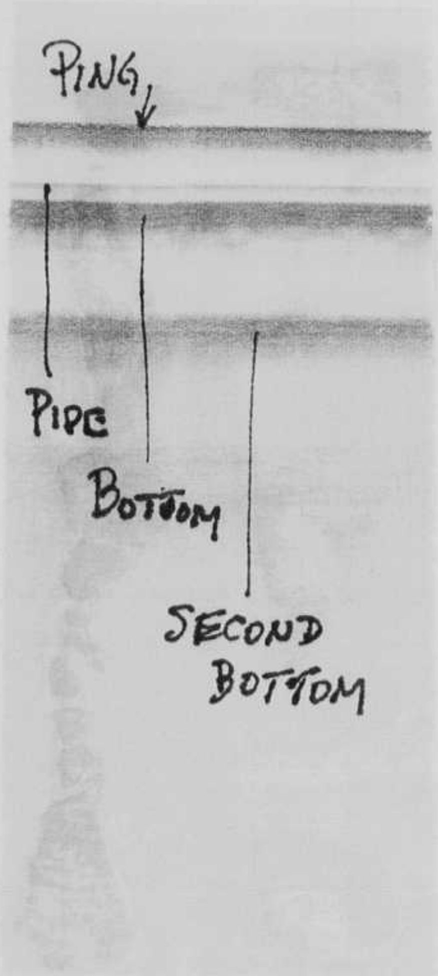


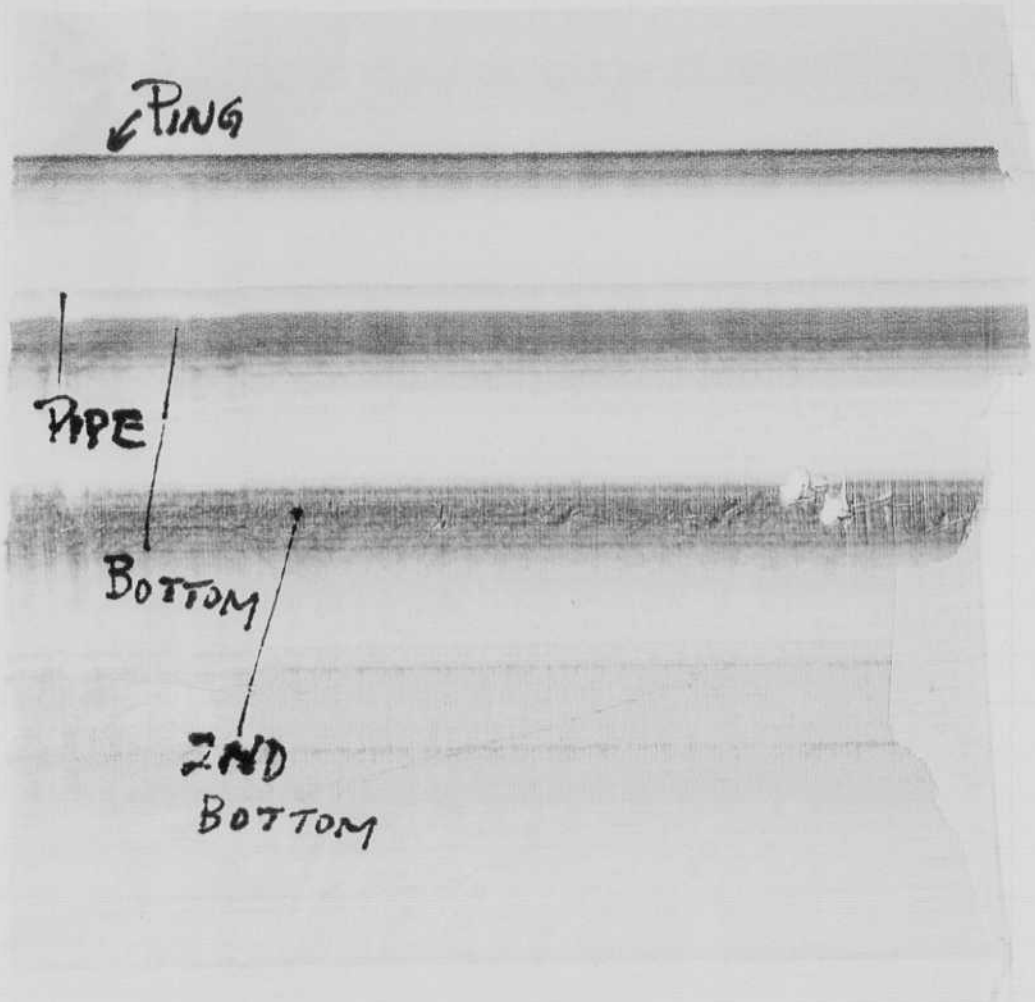
The electrical signal went up when the pressure was increased from 30 lbs to 500. Then there was a small decrease up to 1000. Oscillograms were made. The changes were small between tests

The power may have been decreasing due to the batteries going down in charge.

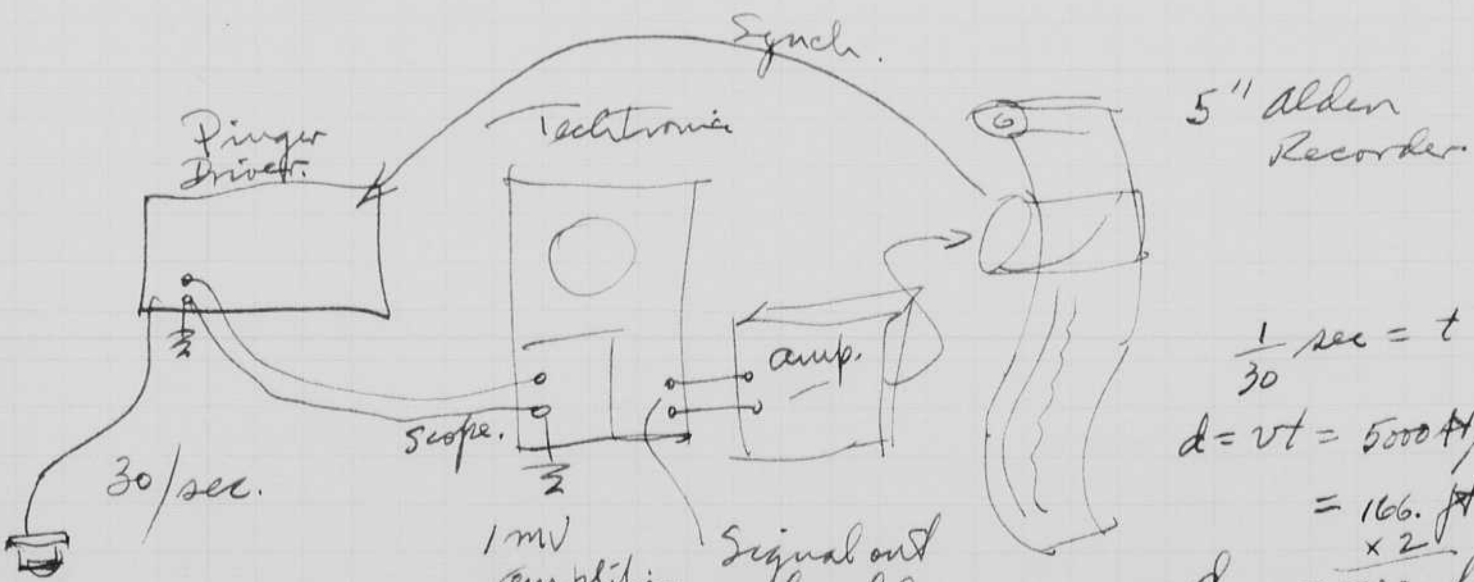
15 f.p.s.
Drum Speed
900 R.P.M.

about 1800 R.P.M.
Double Speed of Drum.





Bill MacRoberts put on another pulley which speeded up the drum to about 1600 r.p.m. the advance motor needs to be speeded up an the tension needs to be reduced.



$\frac{1}{30}$ sec $= t$

$d = vt = 5000\ \text{ft/sec} \times \frac{1}{30}$

$= 166.$ ft
$\times 2$

$d = 332$ feet.

down and back distance in 1/30 sec.

1800 R.P.M.

332 feet = 5" Double

66 feet. = 1" Double.

166 ft = 5" single

<u>33 ft.</u> = <u>1"</u>

900 RPM

66' = 1" on chart.

16' = 1/4" on chart.

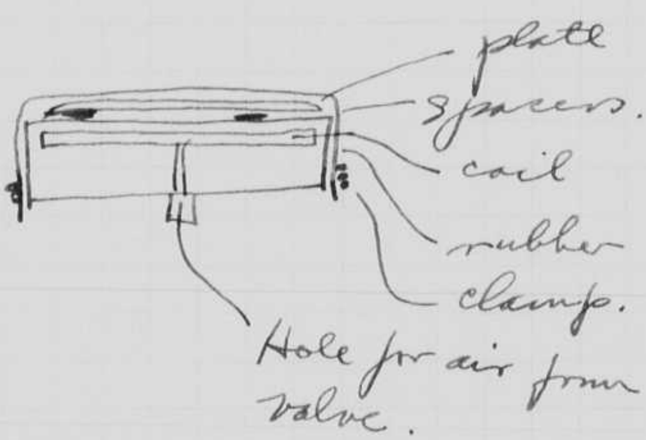
Feb. 1, 1961

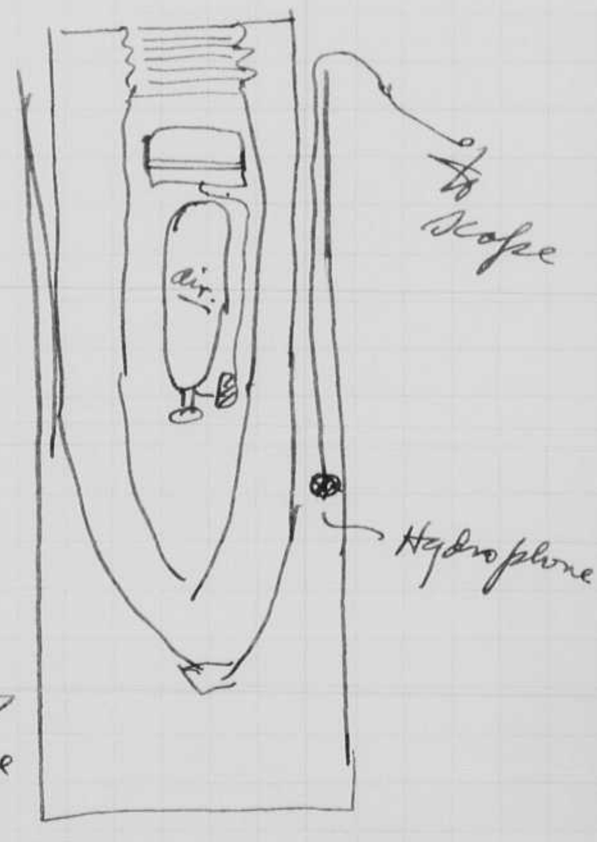
Harold Edgerton

4-405 M.I.T.

Sam Raymond and I ran some experiments on tues night Jan 30 on his air supported diaphram in the pressure facility in Bldg 20. The max pressure used was ~~2000~~ 1000 pounds since this was the limit of the air in the tank.

There were 1/8" spacers under the alumina plate. A rubber diaphram was pulled over the plate and the coil.





The electrical signal went <u>up</u> when the pressure was increased from 30 lbs to 500. Then there was a small decrease up to 1000. Oscillograms were made. The changes were small between tests

The power may have been decreasing due to the batteries going down in charge.

Notebook # 27

Filming and Separation Record

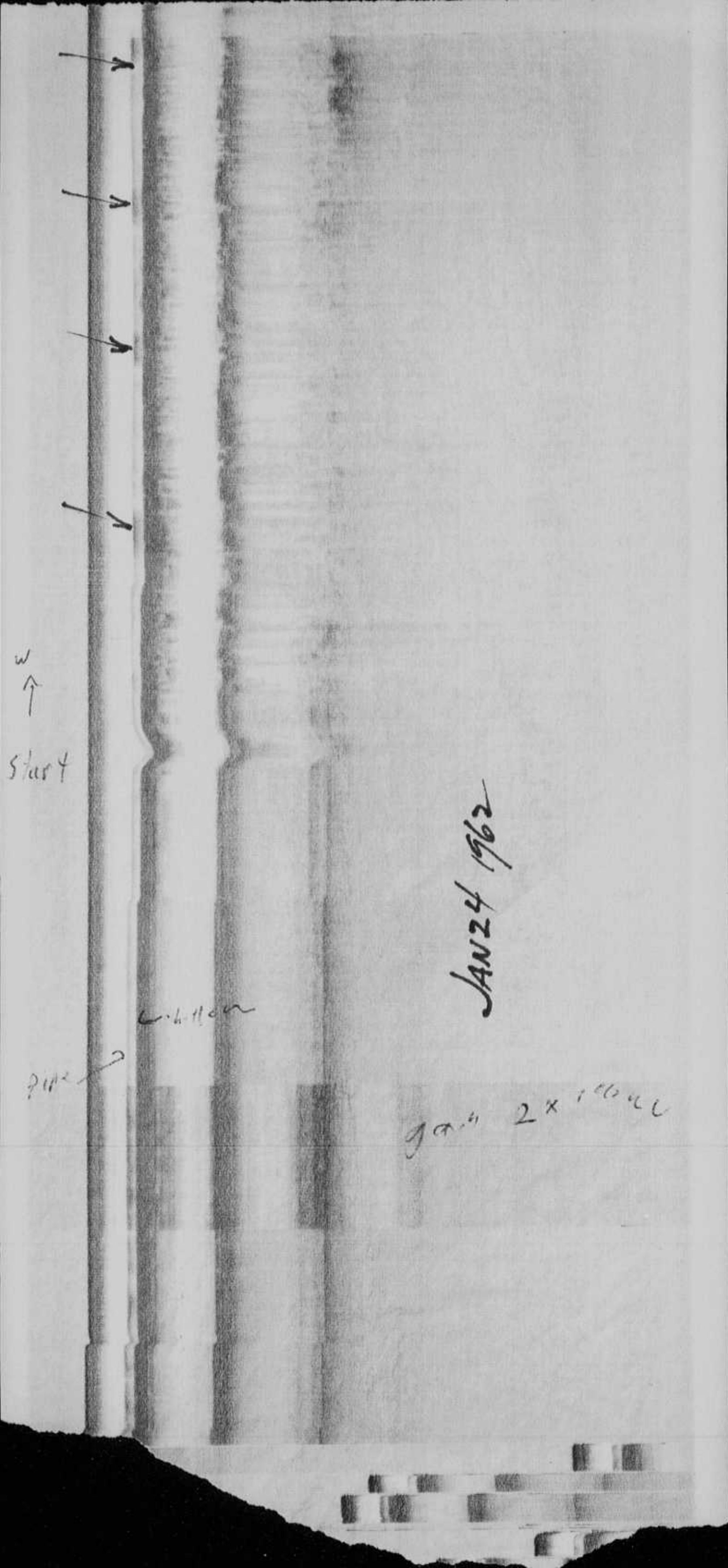
____ unmounted photograph(s)

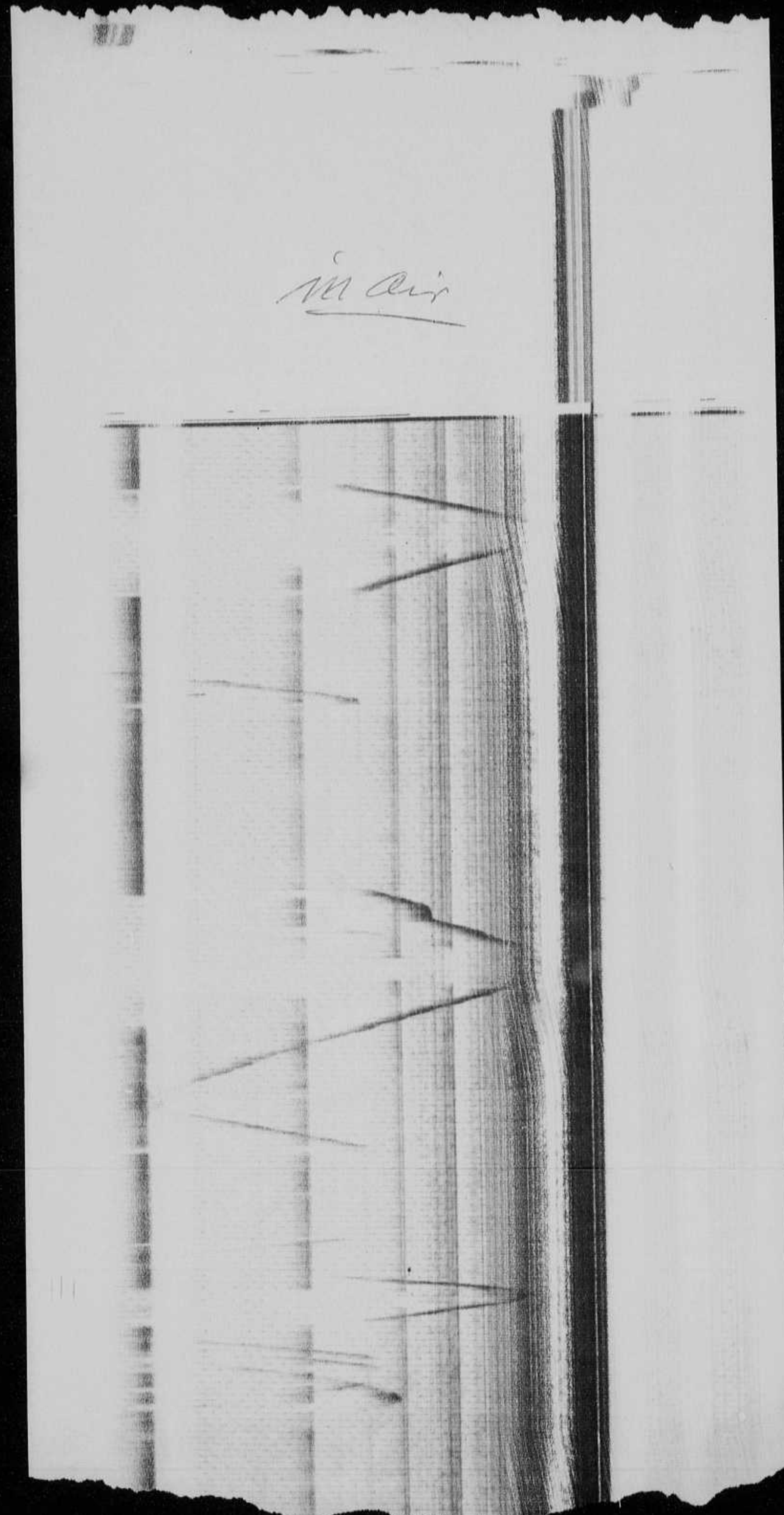
____ negative strip(s)

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

was/were filmed where originally located between page 6 and 7.

Item(s) now housed in accompanying folder.


W
Start
JAN 24 1962

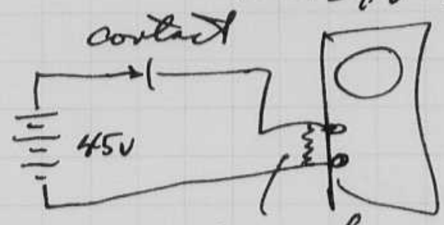

in air

Feb. 26, 1962
Harold E. Edgerton

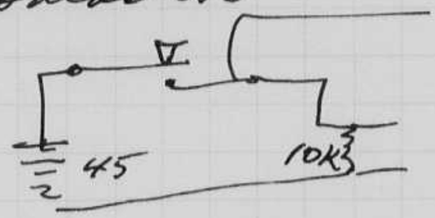
This book was at 160 Brookline Ave in Boston at EG&G plant. See record book for other records.
6.70 lab

Mar. 2, 1962. 6.70. experiment. Tek. 545 # 9059

5 Plus x f6.3 100 μs 20V



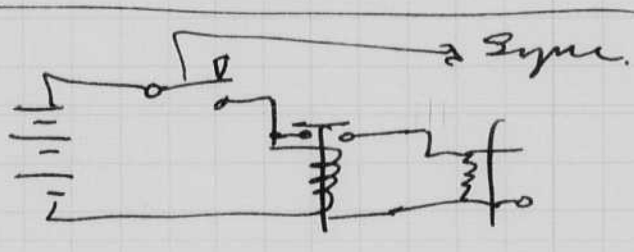
5 10 μs 20V. ~~Relay~~. Contactor



5 100 μs 20V.

~~Motorola~~
Relay
Phil
6800 Ω
45700

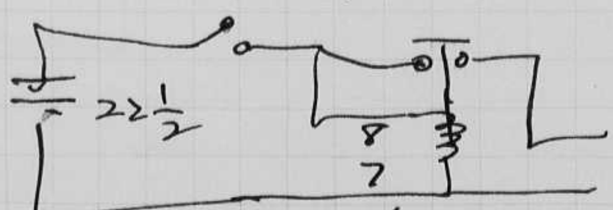
2. 10 ms 20 V
Shows delay time of Relay to ~~start~~.
Pull in 60 ms.



2 Drop out 10 ms. 20 V
10 ms drop out

Mercury wetted relay Western Electric
GA 53646 L-1

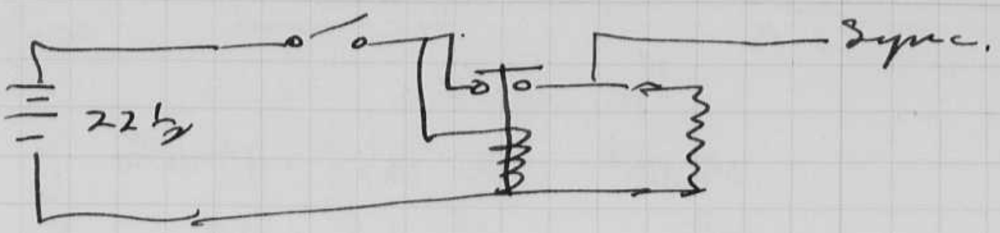
4 photos



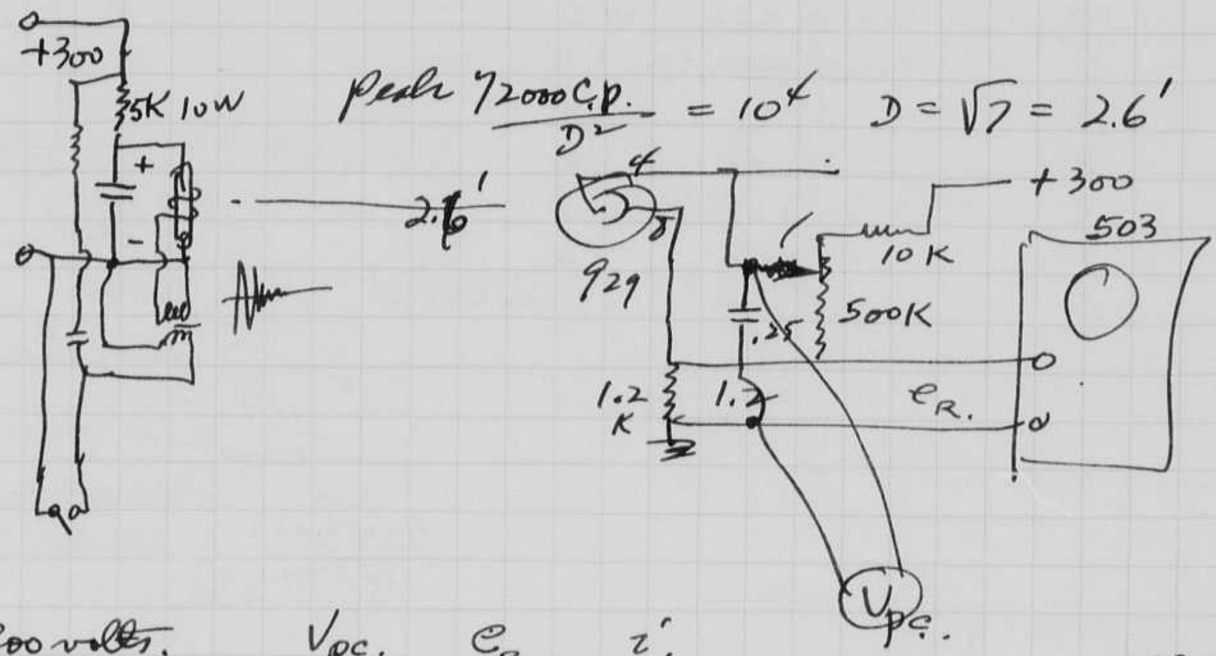
1000 Ω
7 neg
8 pos 22½ volts
1 N.O.
3 common
5 N.C.

3 × .5 = 1.5 ms. 0.5 ms/div

contact closure



March 3 1962 6.70 Lab.



Peak $\frac{72000 \text{ c.p.}}{D^2} = 10^4$ $D = \sqrt{7} = 2.6'$

25.

300 volts. C=180 mfd	V_{pc}.	e_R	i.
	200	.3	
	100	.3	
	50	.3	
	25	.3	
	10	.25	
	5	.15	

400 volts 72000 c.p.
0.5 volts
1.2K.

$\frac{.5v}{1.2K} = .47 ma$

R.C.

$a\ C\frac{de}{dt} = i$

$.25 \times 10^{-6} \frac{1 \text{ volt.}}{10^{-3}} = i = .25 \times 10^{-3} \text{ amps}$

Lamp gives 72000 cp.
400 volts as per Shaffner. 1960
.5 volts across 1.2 K
at $1\frac{1}{2}$ feet.

at 300 volts $1.5 \times .2 = .3$ volts across 1.2K. at 1.5 feet.

$C.P. = \frac{3}{5} 72{,}000 = 43{,}000$ $\frac{43000}{D^2} = 10000$

$D^2 = \sqrt{4.3} = 2.05$ ft

current $= \frac{.3}{1.2} = .25 ma. / \cancel{10^4} = 25\ \mu a/\text{lumen}$.

new Style close diode Ph. Cetum

Special P. C.

$\frac{10 \text{ volts}}{1.2\ K.}$ 42,000 cp at 1.5 feet.

V_{pc}	e_R.	
39.	2.2 x 5 =	11.0 volts.
25	1.8 x 5	9.0 ✓
15	8. x 5	4. ✓
15	~~X~~ x 5.5 x 1	5.5
10	4.6 x 1	4.6
5	~~5 x 1~~ 1.9 x 1	1.9
5	1.9 x 1	1.9 ✓
4	1.6 x 1	1.6
2	1.8 x .5	.9
1	1.8 .2	.36
0	1.5 .2	.3 volts.

$\frac{.3 \text{ volts}}{1,200 \text{ ohms}} = .28$ ma

$\frac{11}{12 \text{ ow}} = \frac{10 \text{ ma.}}{\text{~~10,000 lumens~~ } 38 \text{ lumens.}} =$

300
$\frac{10,000\ \mu a}{38 \text{ lumens.}}$

.3 x

Photo tube 5-4 929 #1.

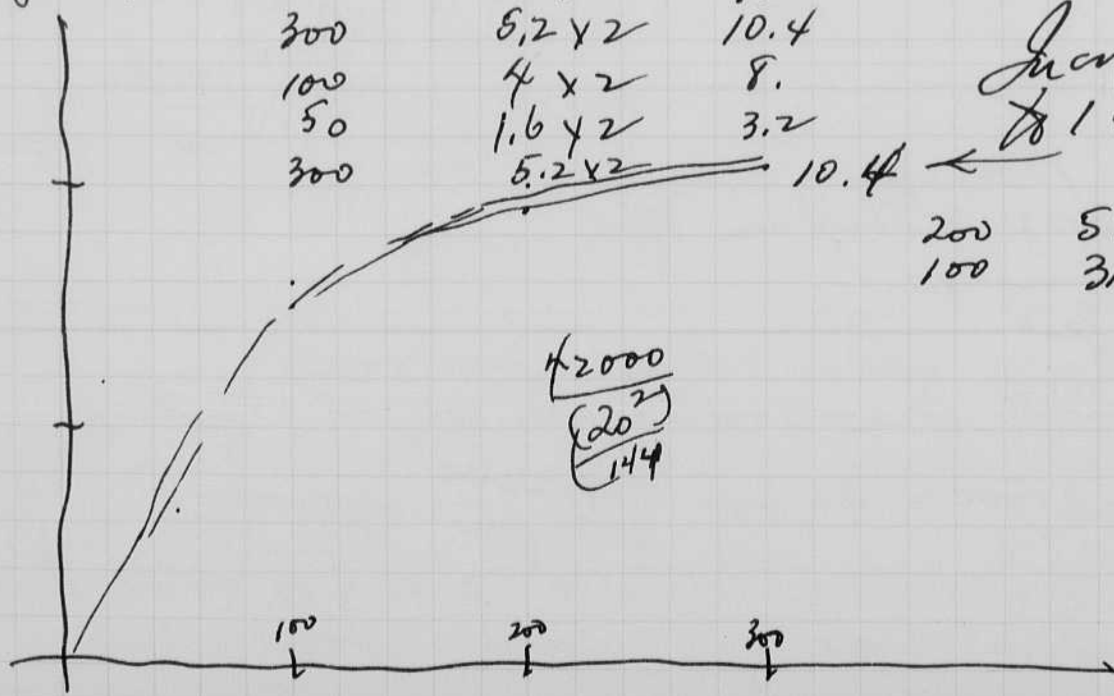
300 volts
150 mfd
42,000 peak cp.

V_{pc}	e_R.		I_{pc}.
200	4.5 x 2 =	9. volts	7.5 ma.
100	3.8 x 2	7.6	
300	5.2 x 2	10.4	
100	4 x 2	8.	
50	1.6 x 2	3.2	
300	5.2 x 2	10.4	

Increased filter to 1 mfd from .25

200	5 x 2 =	10
100	3.8 x 2	7.6

$\frac{42000}{\left(\frac{20^2}{144}\right)}$



Lamps 300 volts 300 volts on p.c.
FT-31
180 mfd.
as before.

Tube #	e_c across 1.2K	
#1	5.2 x 2 =	10.4 volts
2	5.1 x 2 =	10.2
3	3.2 x 2	6.4
7.	3.8 x 2	7.6
N.G.	.27 x .1	.27
Close plate 5	5.8 x 2	11.6 volts.
—	5.2 x 2	10.4
—	5.2 x 2	10.4.

Pick up #5 929 54

KV^{d^2}/R_L $K = 1.8 \times 10^6$

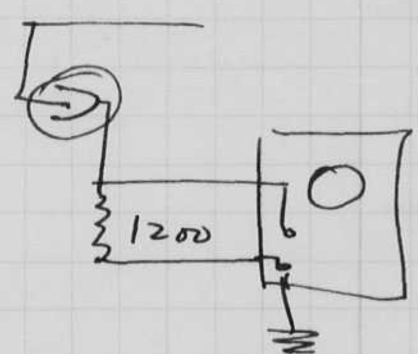
5.2 x .5 = 2.60 volts. 100 Ω.

C.P. peak = $\frac{2.6 \times 1.8 \times 10^{\cancel{6}\,4} \times 1^2}{\cancel{100}}$ = 4.7×10^4 = 47,000 c.p.

---

300 volts.
180 mfd
FT-31 flash lamps

— 929.



Trial exposure
f5.6. Plus X film
Screen inc lamps
-45° from fullon.
1 sec to 5 sec. exposure.
also 60°.
Intensity. almost full on, then back to 30° and 45°

Sweeps 50 us/div. ~~60 volts~~
Voltage.. 2 volts/div.

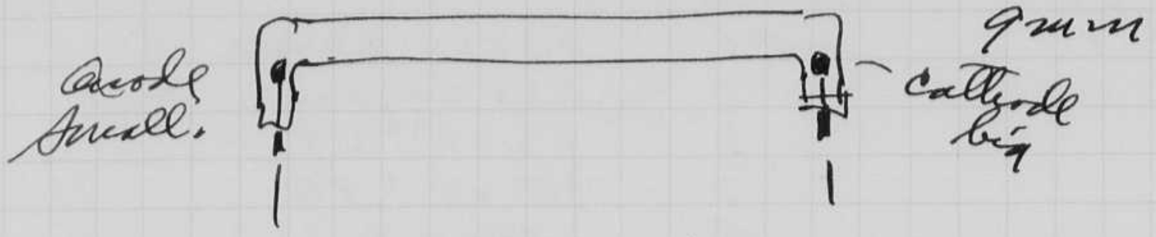
Blank exposure,
90° on Red lights.
60° back on intensity.

this was thin at
f5.6 on Plus X
at 1:1 Dektol. 4 min

March 9, 1962

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

Laser Flash lamps for Perry Mile.



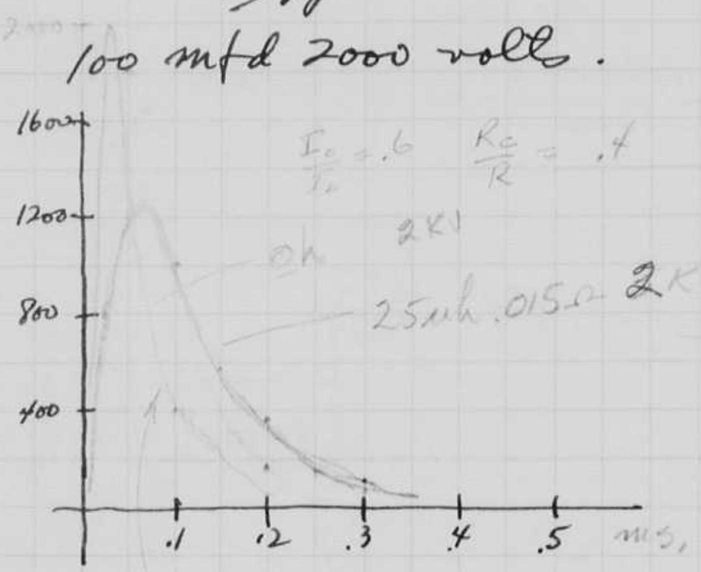
100 mfd 4000 volts with 25 uh 0.015 ohms.
Some self fire at 3600 volts on 2nd time up.
Some hot metal from anode onto walls.

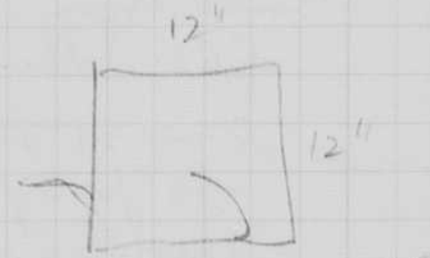
This shows that the 1/8" tungsten electrodes are too small in size — they must be bigger.

100 mfd 2000 volts.

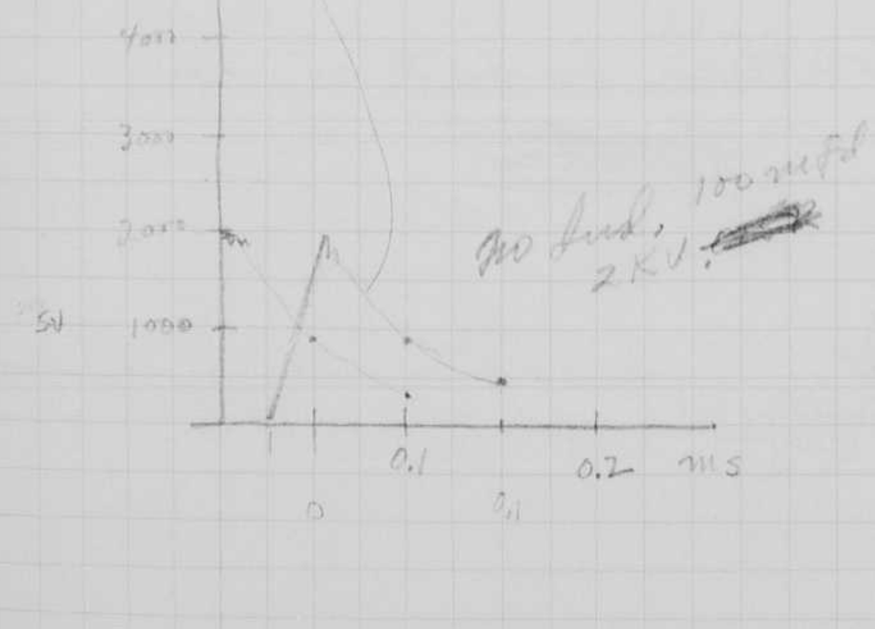
$\frac{I_c}{I_r} = .6$ $\frac{R_c}{R} = .4$ $R_c = 2\sqrt{\frac{L}{C}} = 2\sqrt{\frac{25\times10^{-6}}{100\times10^{-6}}} = 2\sqrt{\frac{1}{4}} = 1$ ohm.

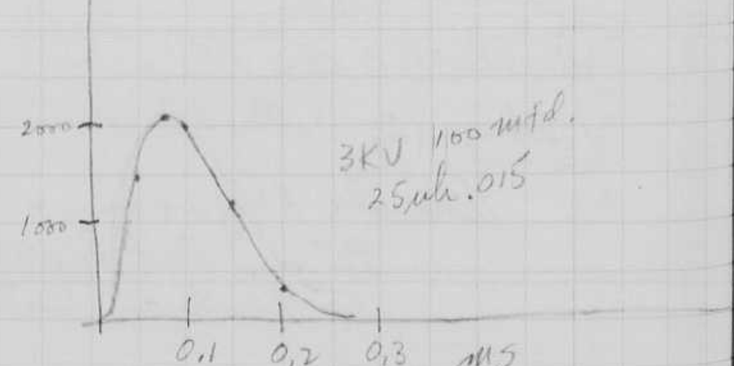
$R_t = 0.6$
$R_L = .015$
$R = .8$ about right.





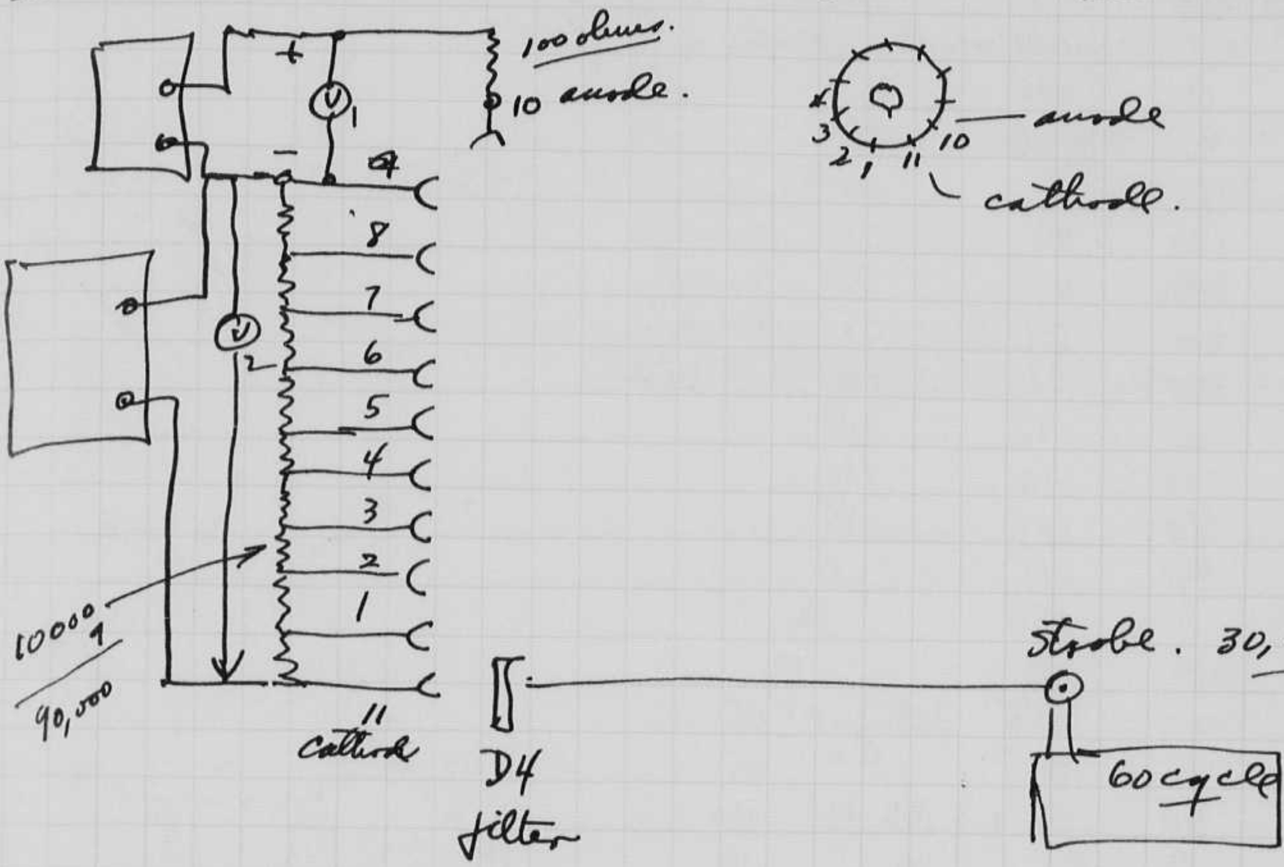
Inductance 8 Turns #8 stranded





Sonar transformer for Rochelle Salt transducer.
L = 2.97 mh.
Q = 10.

Mar 11 '62 Photomultiplier experiment. 4-409.

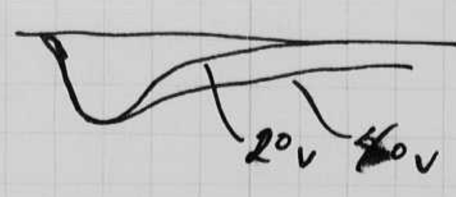


Strobotac #104 with reflector at 10 feet. 60 cycle with reflector?
25000

Output. — V_1	V_2	V_0	I_0 ua.	e. noise peak to peak.	
180	600	00.025	250	.025	
120		"	"	"	
60		"	"	"	
20		"	"	"	more noise?
0		" –	"	"	Down some?
300		.03	300	"	

change of light.

0	900	.2	2000	.02 ±.	1800 ~~REEP~~ RPM on Strobotac
20	900	1.5	15000	.05 to 0.1	
40	Same but the wave changes.				



changed load resistor to 1000

30,000 p.c.p. ?

6000 Strobolac no reflector: .000.070

R	V_2 9 dynodes.	V_1	V_{out} peak 1000 Ω	I peak	noise
1000	600	180	.07	70 ua	.02V
100	"	"	can't read on scope at 10 feet.		
1000	600	0	.035	35	.02
		40	~~.045~~ .045	45	"
		90	.06	60	
		120	.07	70	
		140	.07	70	
		200	.07	70	
	700	200	.11	110	.025.
		160	.10	110	
		120	.10	100	
		80	.085	85	
		40	.075	75	
		0	.050	50	
	800	0	.100 –	100	
			.085 fatigue?	85	
			.075 "	95	
		20	1.8 x .2 = .36	360	
		0	.8 x .2 .16	160	
		0	.6 x .2 .12	120	
		20	1.8 x .2 .36	360	
		30	2 x .2 .4	400	
		40	2 x .2 .4	but tail changes.	

$\frac{.0004V}{1000\,\Omega} = 400\,\mu a.$

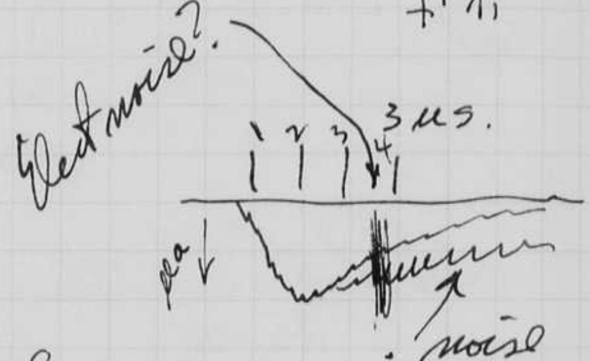
$\frac{30,000}{(20)^2} = \frac{30,000}{400} = 100$ ft candl

$\frac{100}{144}$ lumens / sq in

$\frac{100}{144} \times \frac{1}{2} = \frac{100}{288} \cong \frac{1}{3}$ lumen

$i = 260\,\mu a$ / $\frac{1}{3}$ = 780 ua x lumen

$\times 10^4$. 7,800,000 ua / amp / lumen



Lamp moved to 20 feet away 60cyc no Ref.

R	V_2	V_1	V_{out}	I	noise	
	800	0	.5 x .1 = .05	50 ua	.02	.02
		10	1.2 x .1 .12	120	0.5 x .1 =	.05 v peak to peak.
		20	1.3 x .1 .13	130	.6 x .1	.06
		30	1.5 x .1 .15	150	.6 x .1	.06
		40	1.6 x .1 .16	160	.6 x .1	

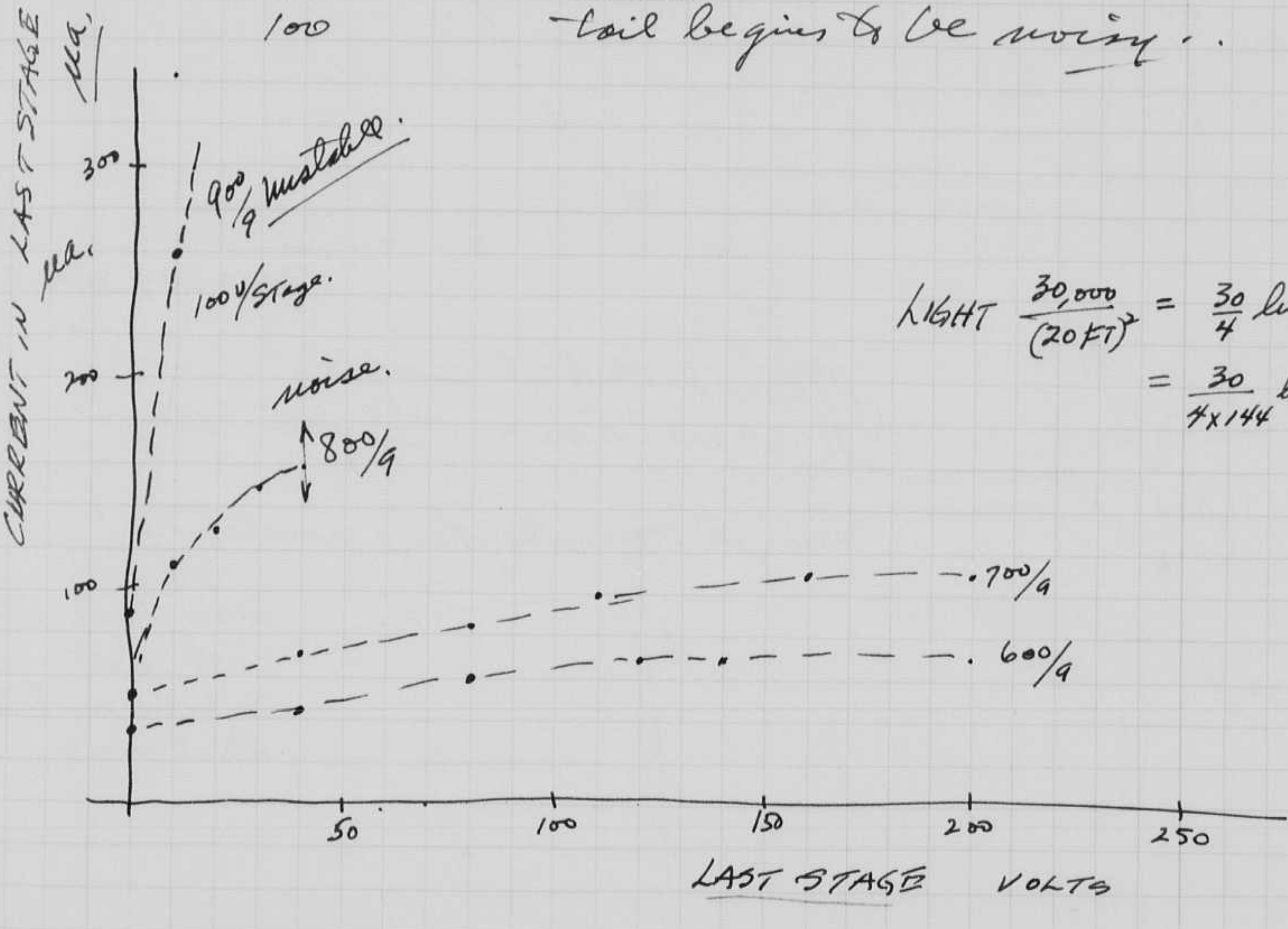
but lasts longer noise in tail.

V_2	V_1	V_{out}		I	noise
800	0	.55 x .1	.055	55.	.2 x .1 = .02
900	0	.9 x .1	.09	90	.3 x .1 = .03
900	10	2.6 x .1	.26	260	.5 x .1 = .05
900	0	.9 x .1	.09	90	.4 x .1 = .04
900	10	2.6 x .1	.26	260	.5+ x .1 = .05

3 mf capacitor put on V_1 Supply.
trying to reduce negative peaks at start of signal
this filter helped some?

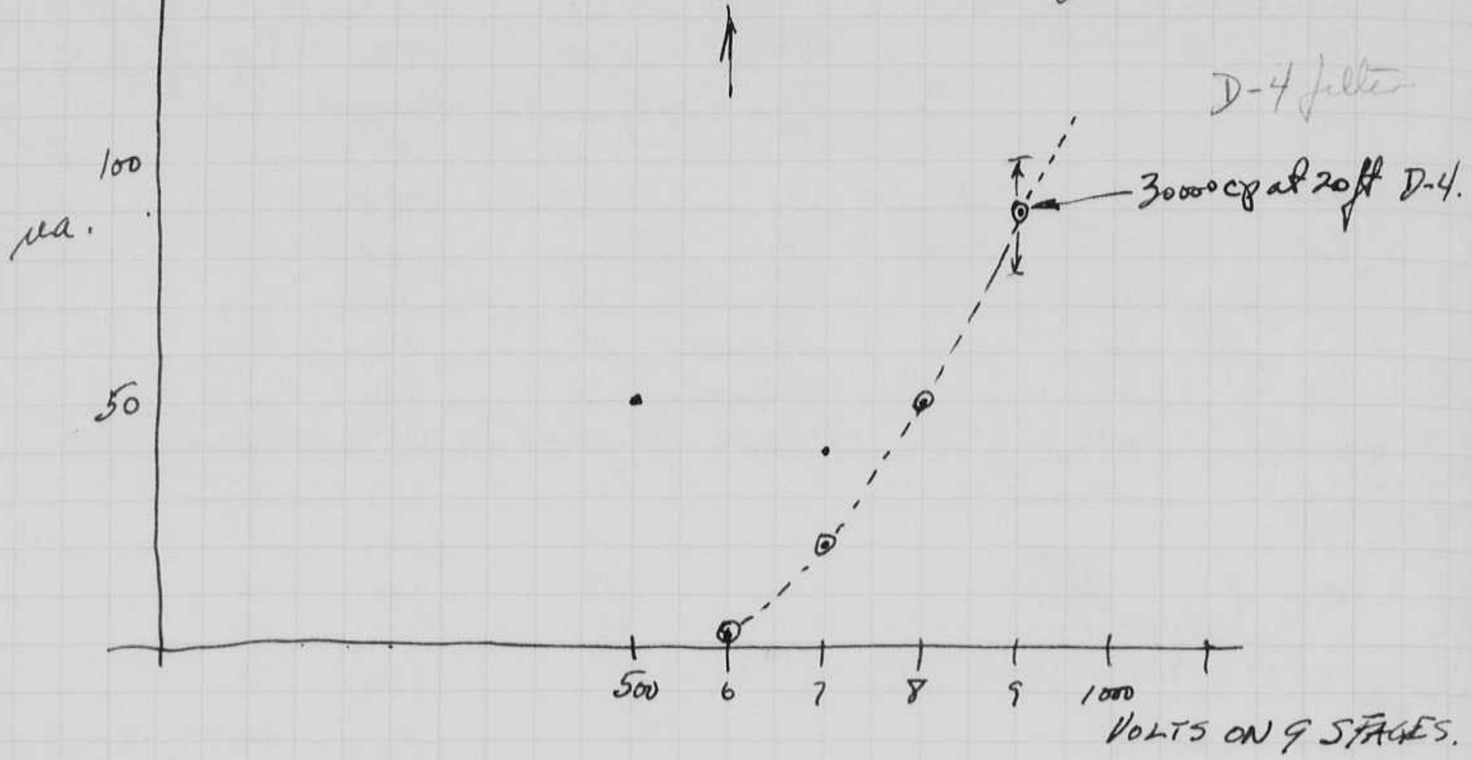
electrical noise why? here?

V_2	V_1	V_{out}	I_{peak}	noise amp.
1000 900.	0	.8×.1 = .08	80 μa.	.4×.1 = .04
900	10	2.6×.1 = .26	260	1.×.1 = .1
	20	Same		
~	30	Same.		
	50	Same.		
	100	tail begins to be noisy..		

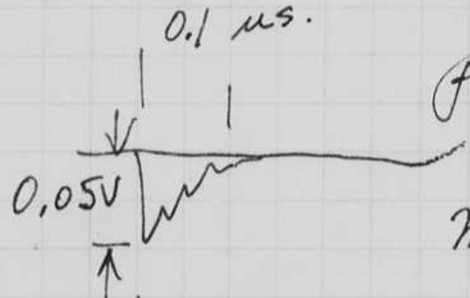


LIGHT $\frac{30,000}{(20\,FT)^2} = \frac{30}{4}$ lumens/sq ft.
$= \frac{30}{4 \times 144}$ lumens/sq inch

Connected O.C. to strobotac to another more distant outlet. The noise is almost gone.

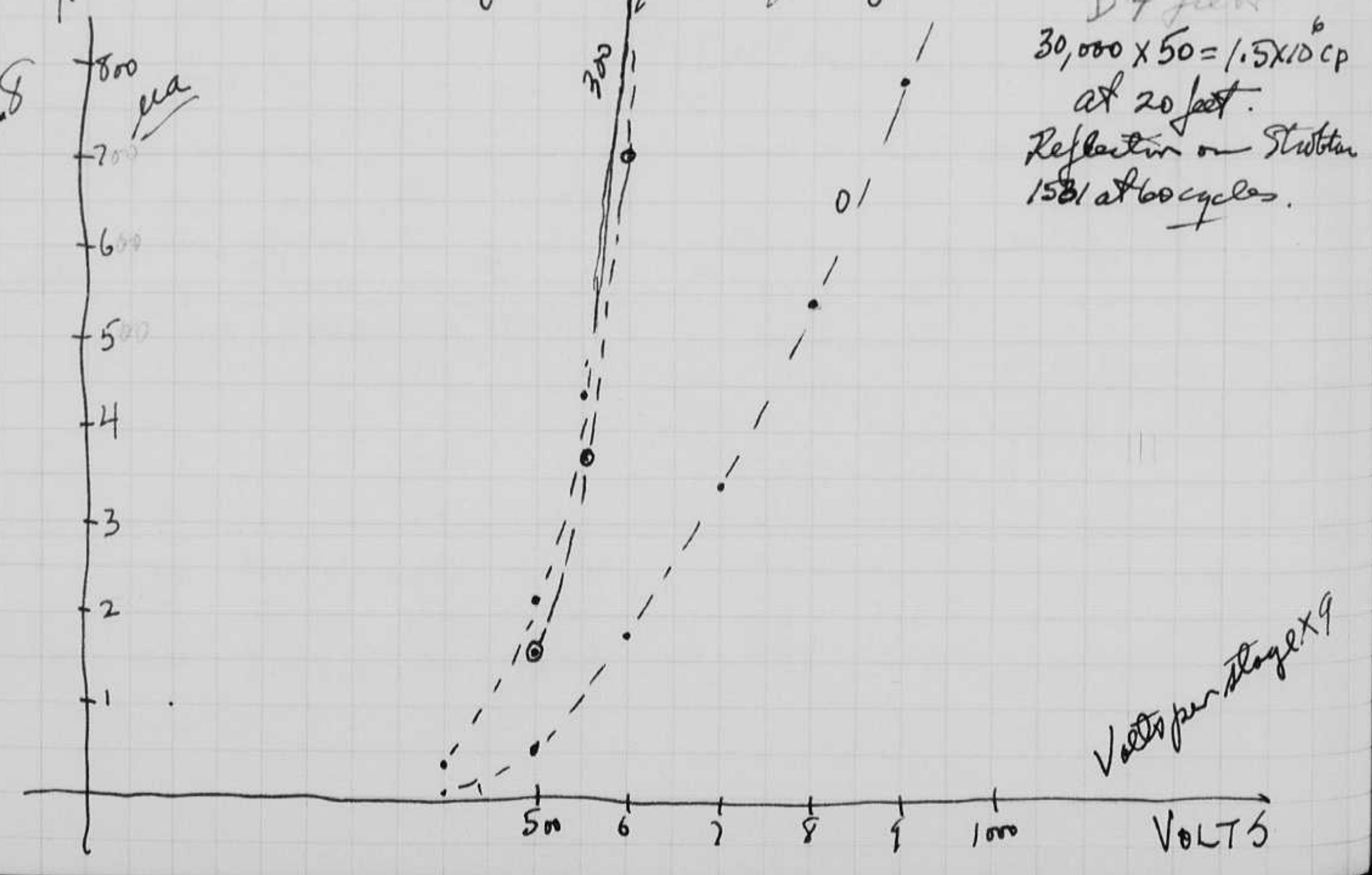


000.05
000.18



Pulses due to dark current.
none below $\frac{750}{9}$ volts/stage.

Many at 1000 volts/stage unstable!



$30,000 \times 50 = 1.5 \times 10^6$ cp at 20 feet.
Reflection on Strobotac 1531 at 60 cycles.

$4 \times .2 = 000.8$

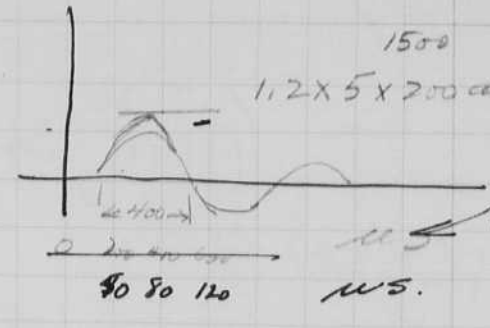
FX-33
Flash lamp.
H. Edgerton
4-405 M.I.T.

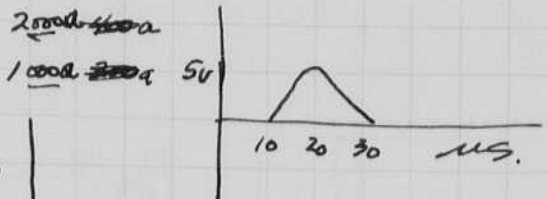
16 mfd. 2KV FX33
25 μh .015 Ω. #8 wire.

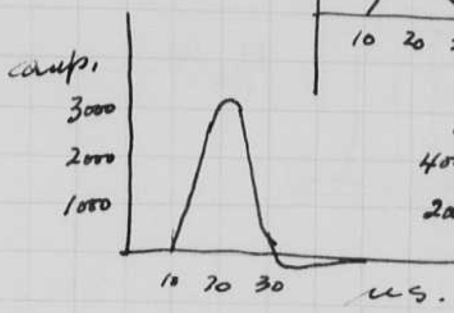
$\frac{CE^2}{2} = 50$ w.s.

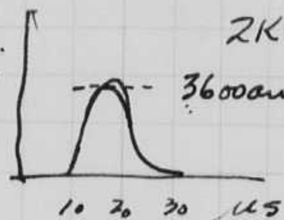
C = $\frac{50 \times 2}{2^2 \times (10^3)^2} = 25 \times 10^{-6}$ farads.

FX33 16 mfd 1KV no. ind.

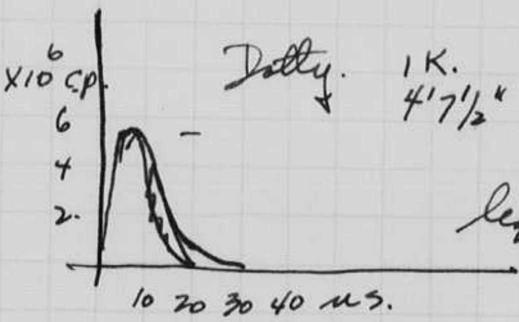








2KV no ind.
3600 amps peak.

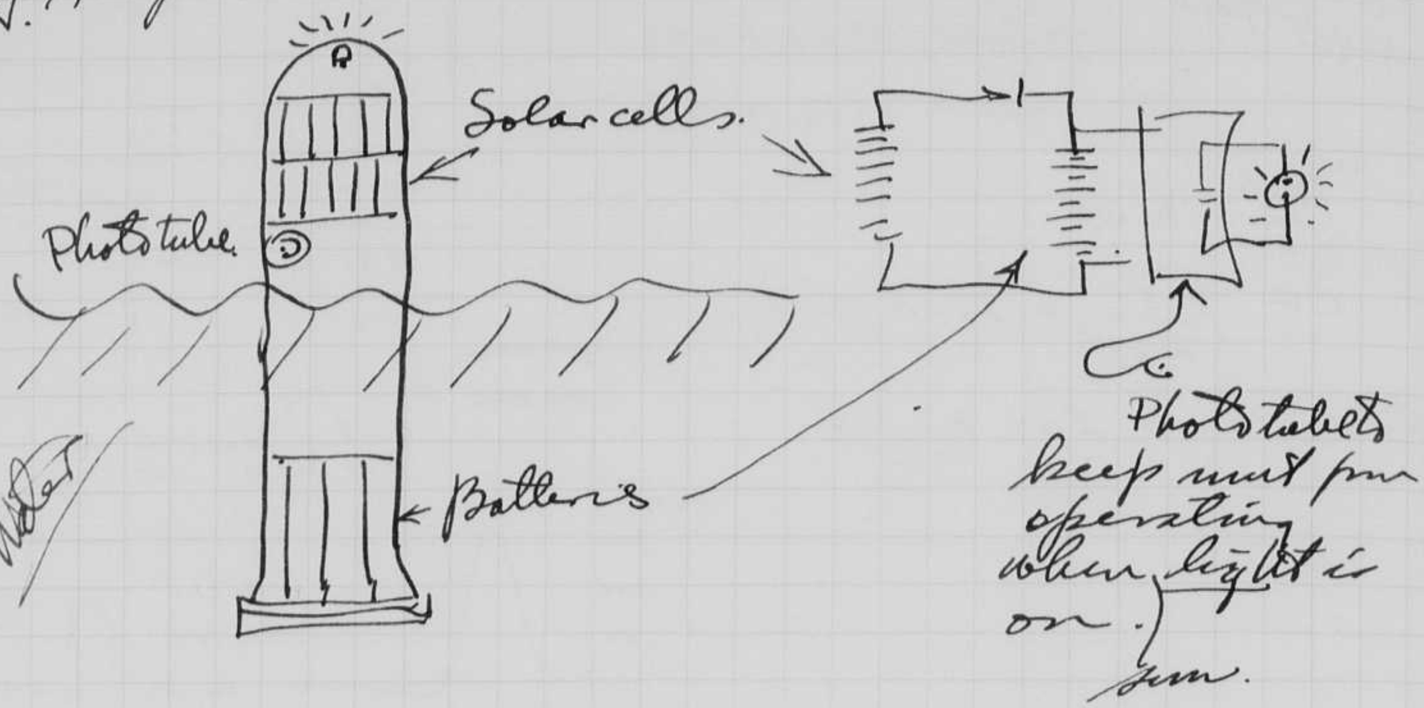


Dotty.
1K.
4'7½"
light

March 15 1962

H. E. Edgerton.

Buoy from Sun charged batteries.



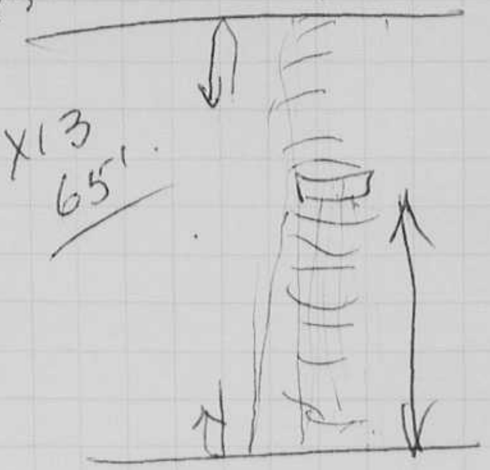
March 18 1963
N. Stegen
Bjorn Conrad

Pool : Test of Mud Penelr

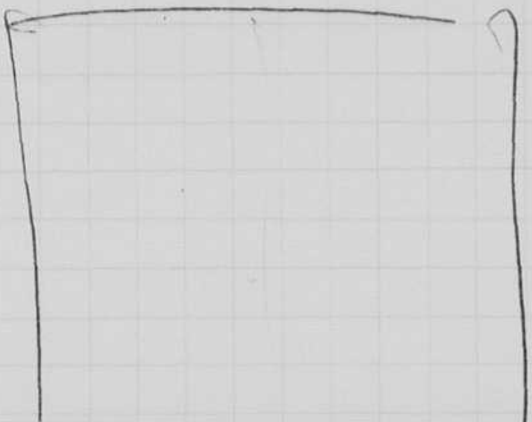
6.5
6.5
78
84.5'
6.5
68.0'

12
9
108'

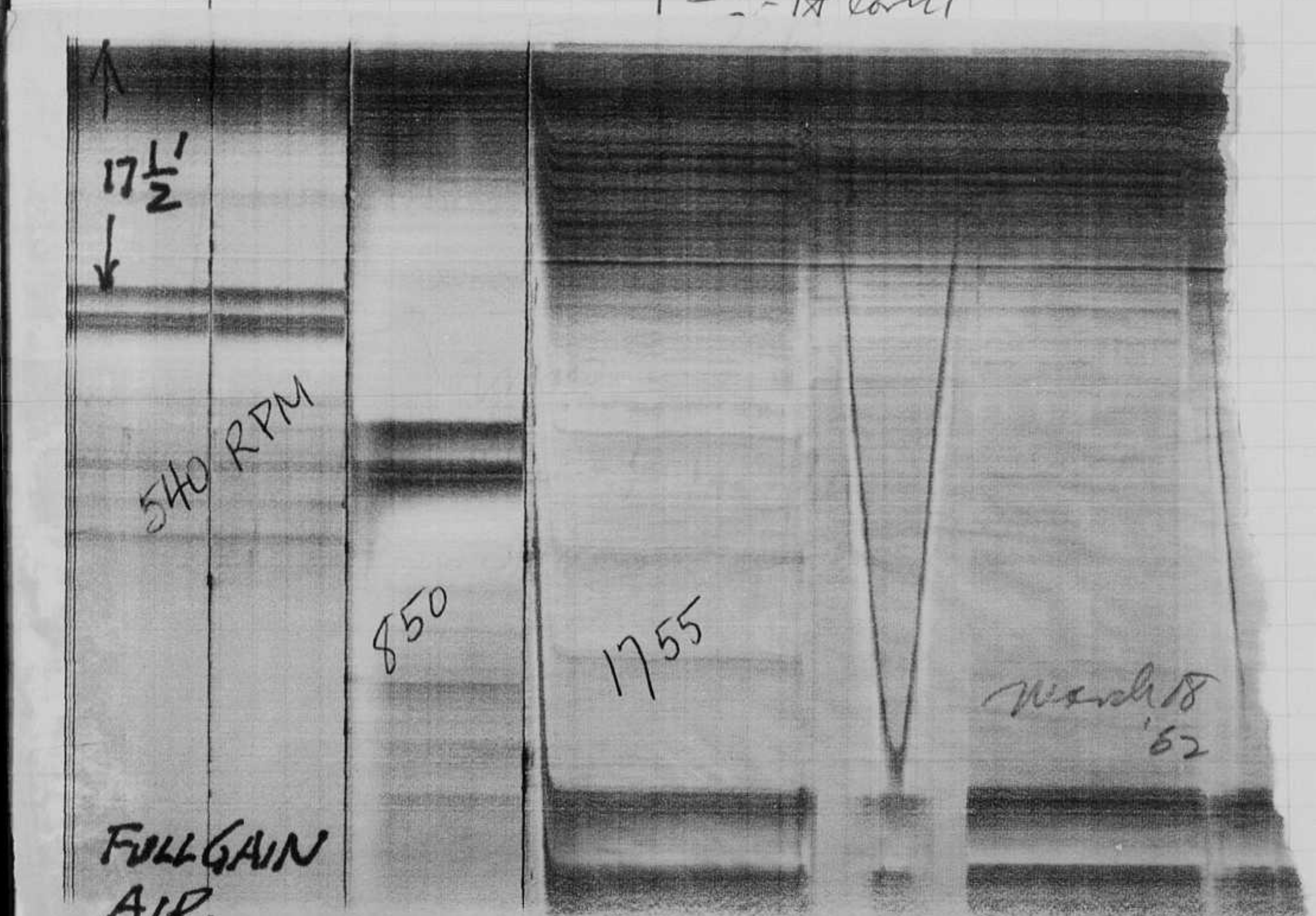
25 x 3 = 75'



5 x 13
65'



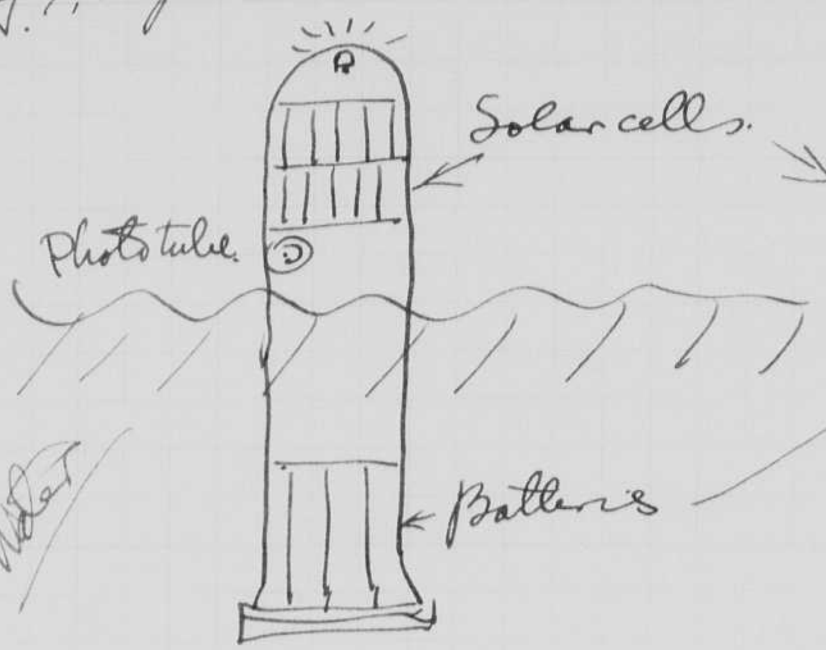
5 x ~~15~~
25 yards.
3 x 3
1st lane

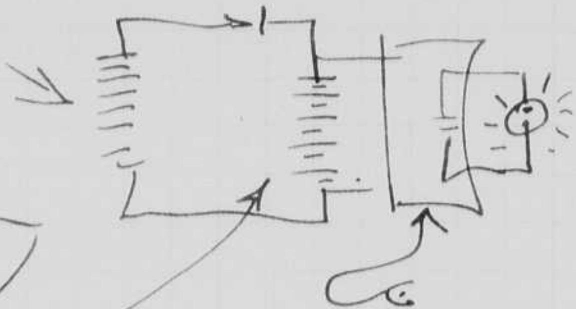


March 15 1962

H. E. Edgerton.

Buoy from Sun charged batteries.



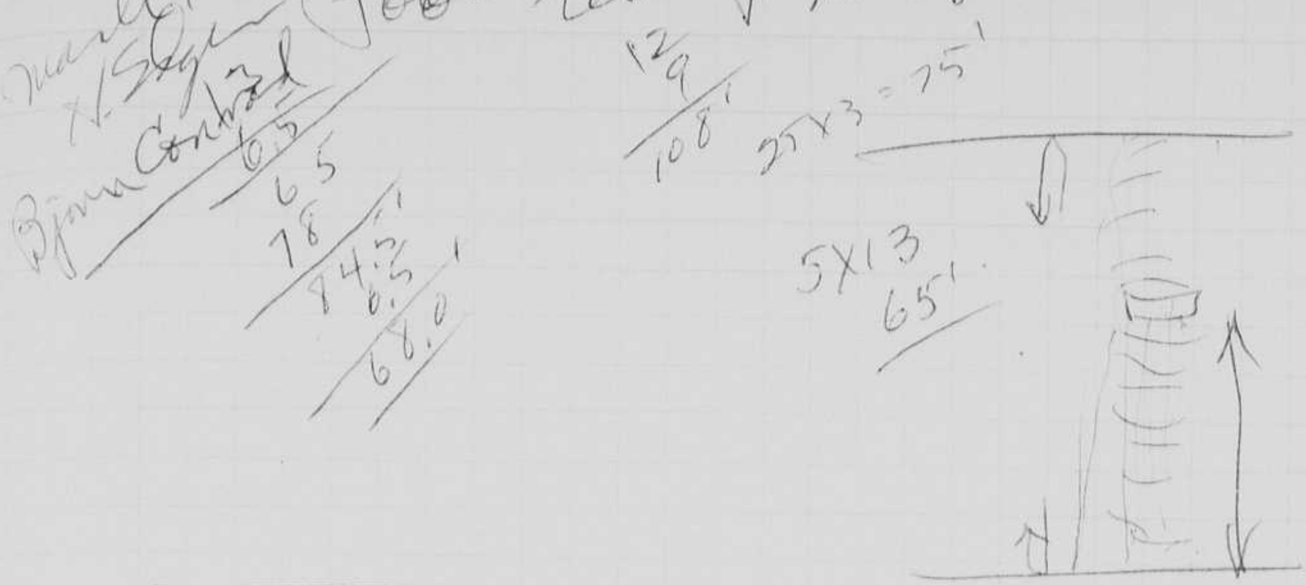


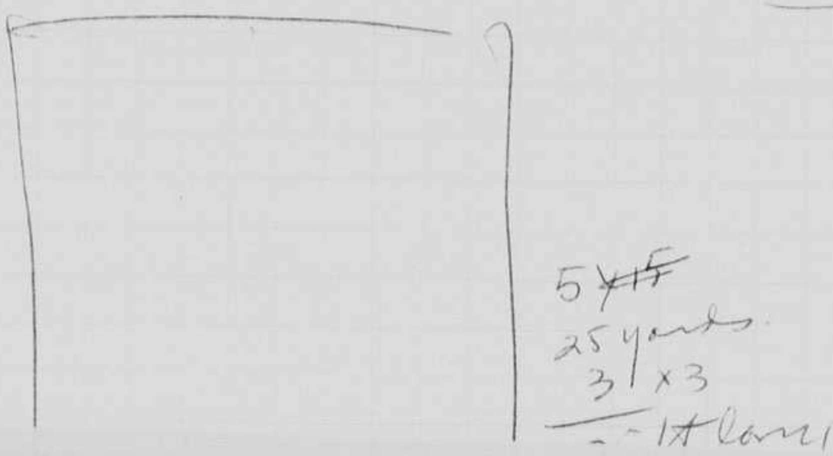
Phototubes keep unit from operating when light is on.

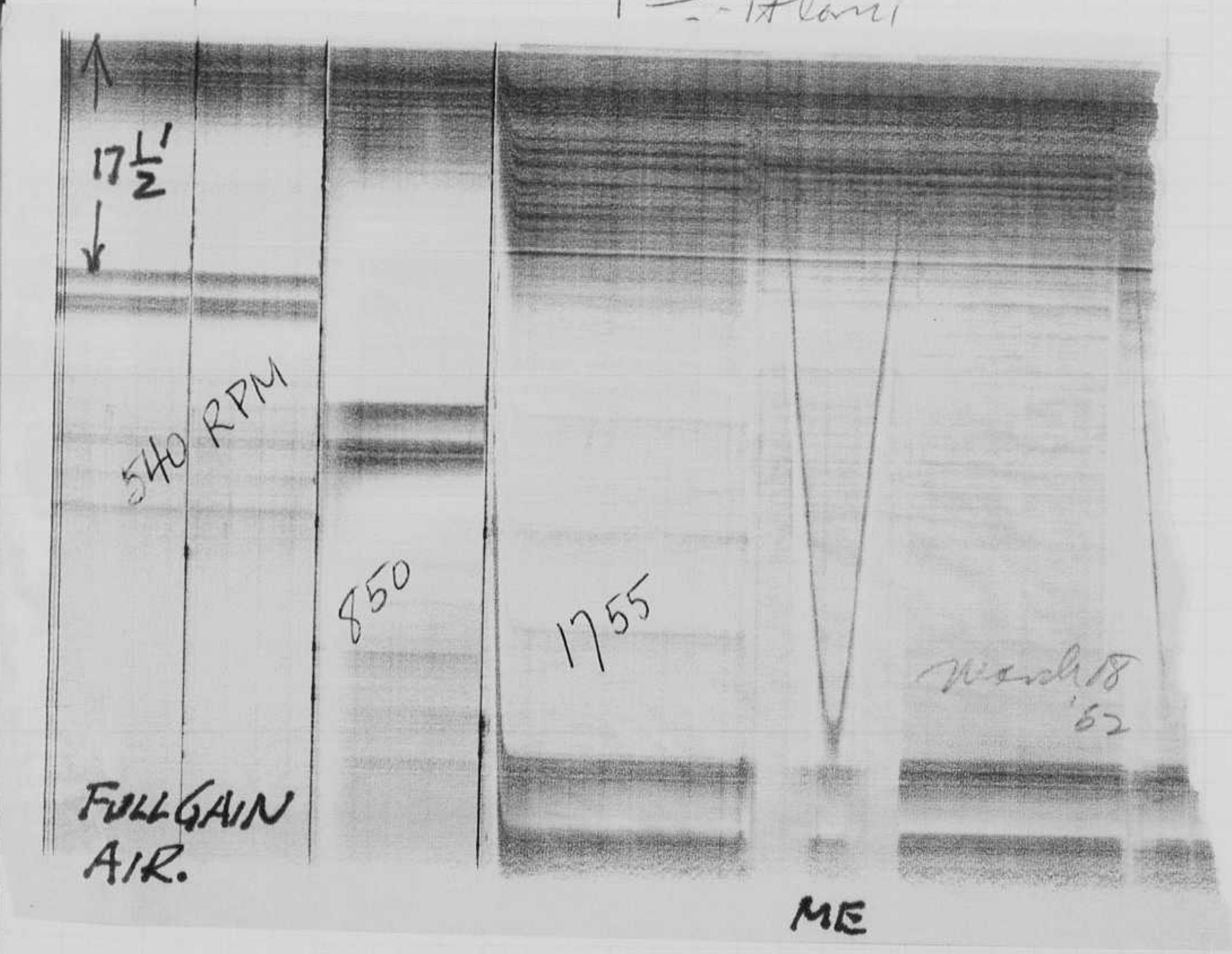
sun.

March 18 1963 Pool Test of Mud Penetr

H. Edgerton
Bjorn Conlrad

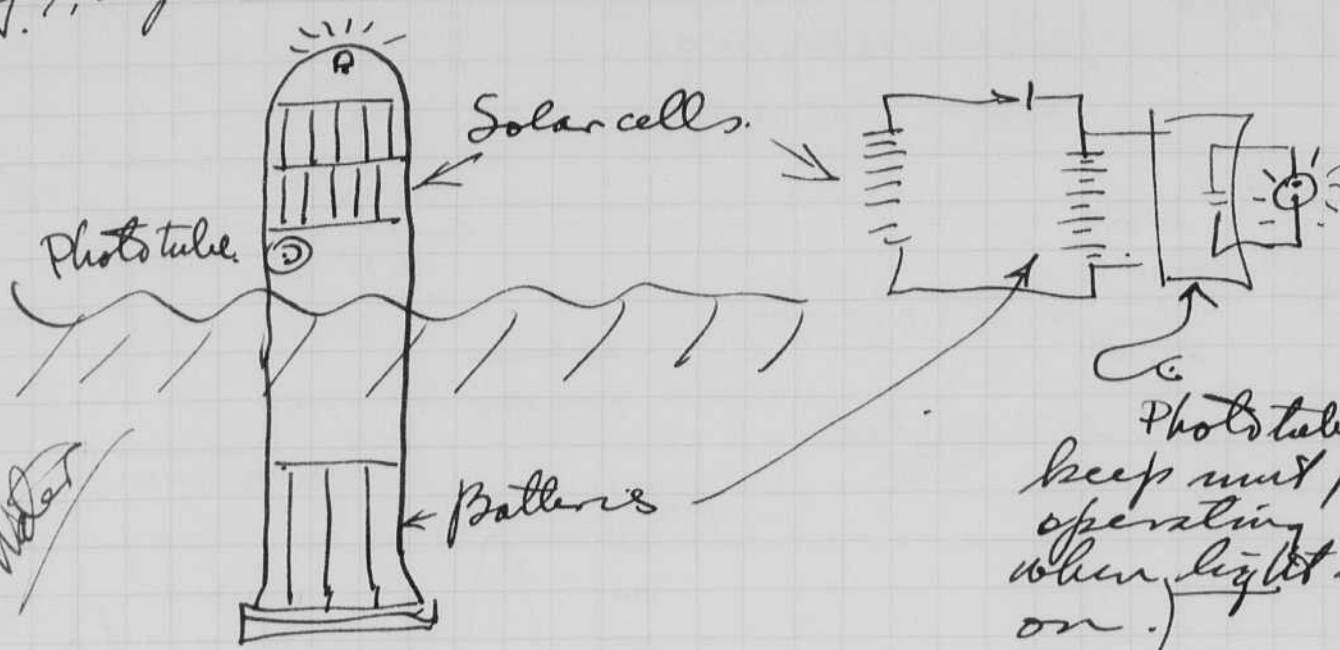






March 15 1962
H. E. Edgerton

Buoy from Sun charged batteries.



Phototubes keep unit from operating when light is on.
sun.

3M

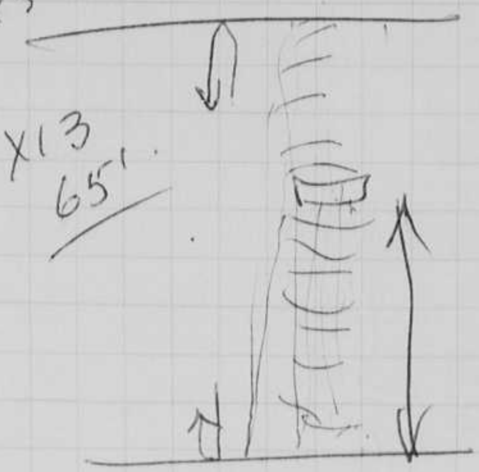
March 18 1963
H. Edgerton
Bjorn Conrad

Pool: Test of Mud Pinger

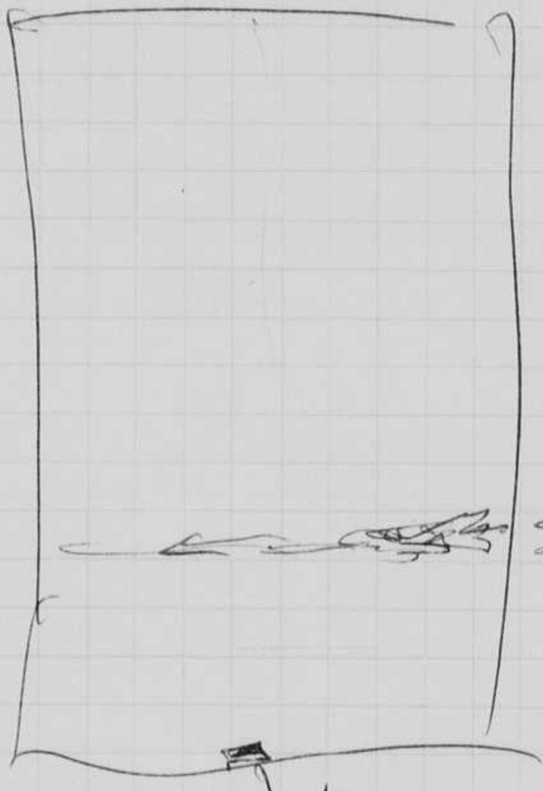
6.5
6.5
78
84.5'
6.5
68.0'

12
9
108'

25×3 = 75'



5×13
65'



~~5×15~~
25 yards
3 ×3
75 ft long

Swimmer

20' out

trans

1:30 fuse blew! 1 amp.
Replaced - Runs OK now. after lunch.

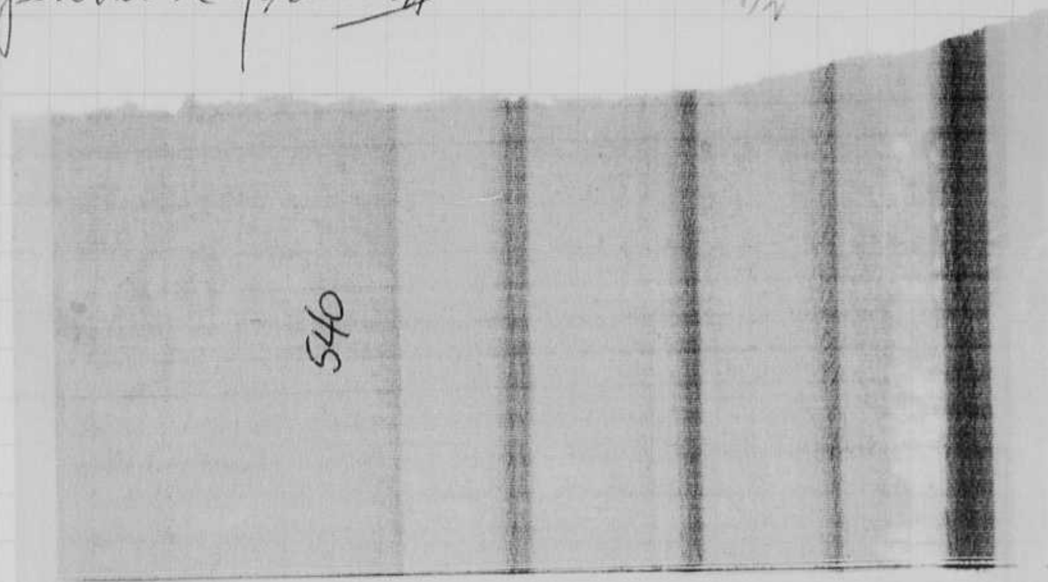
 March 25 1962

Open House Yesterday

$\frac{21}{2} = 10.5$ FT/cm

Mud Penetrator
#2

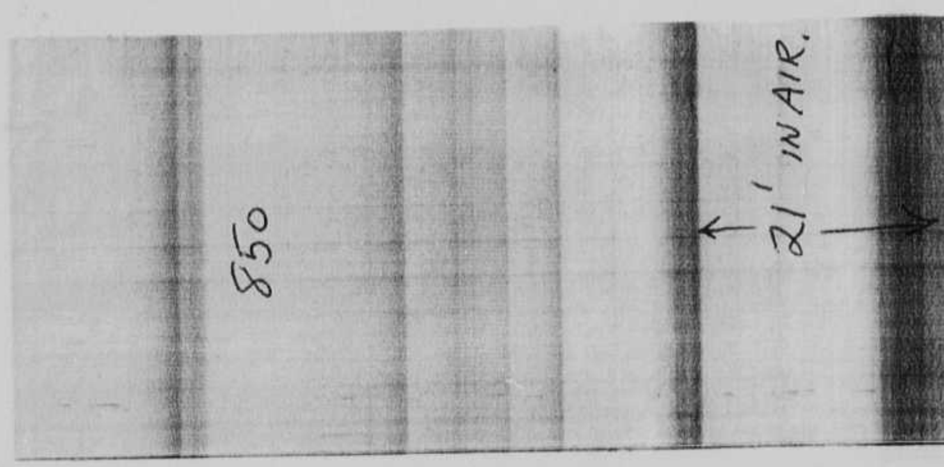
#1 was sent to
Ed Link - Sea Diver
Monaco, on
thursday by
Air freight



540
RPM

AIR

$\frac{21}{3.3} = 6.4$



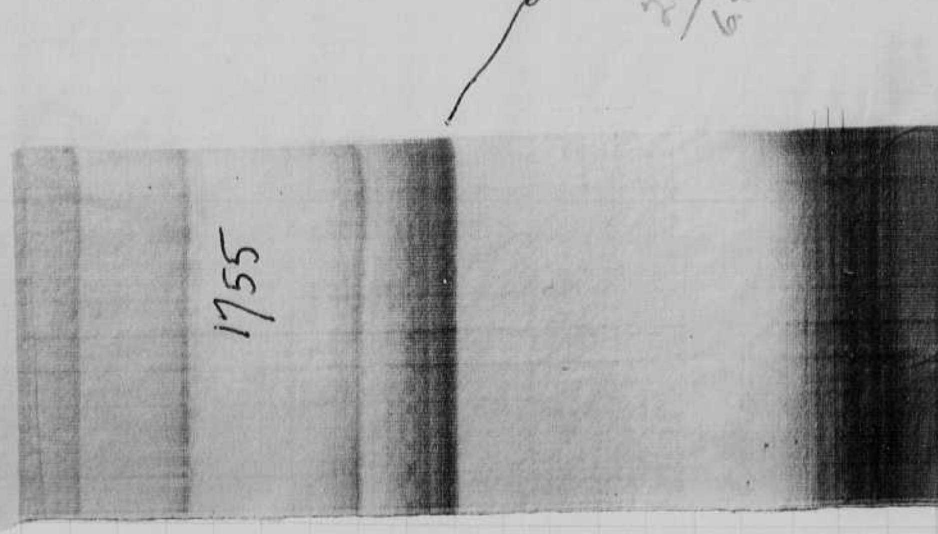
$\frac{850}{540} = 1.57$

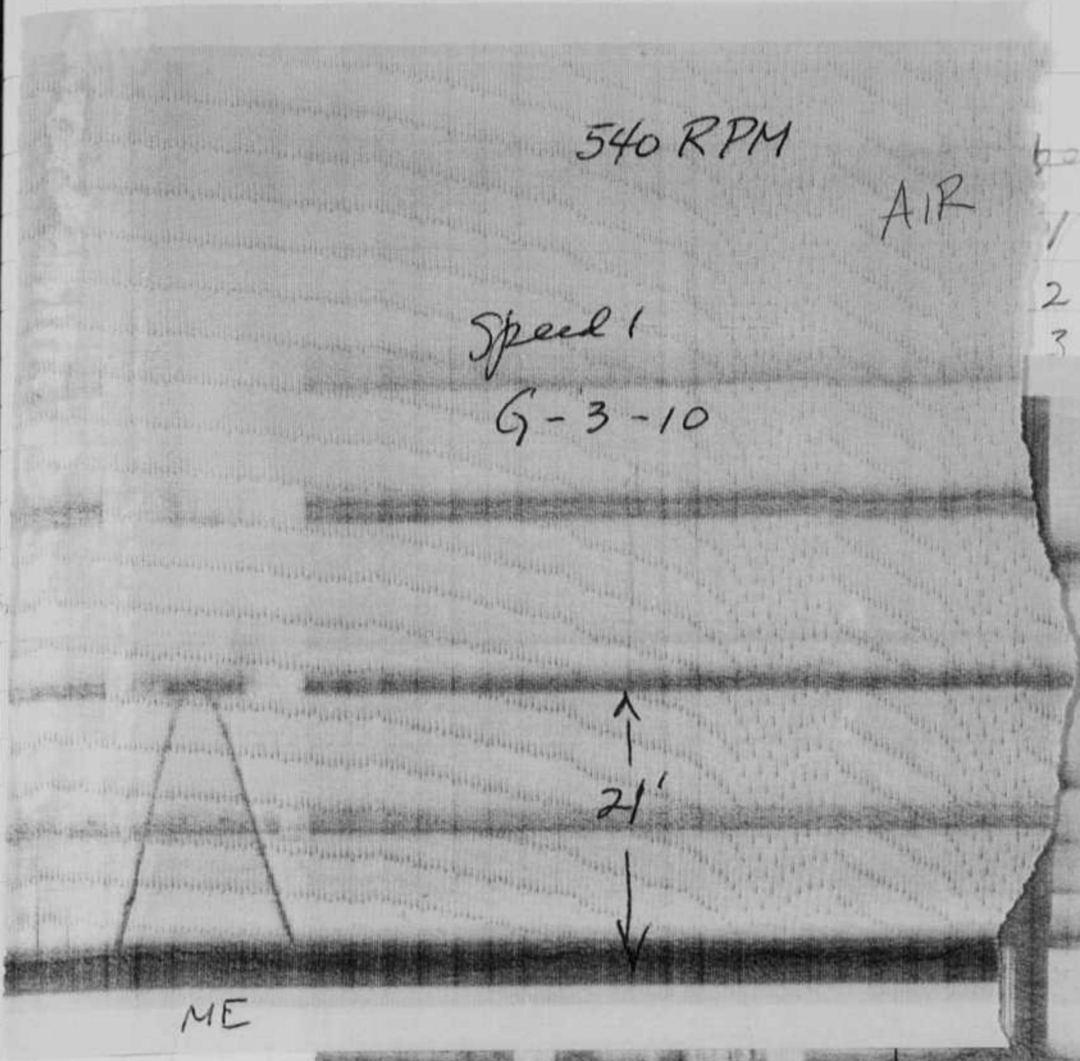
$\frac{1755}{850} = 2.06$

Drum length = 5" = 12.7 cm

$\frac{60}{1755}$ = Time of 1 rev = 3.42×10^{-2}
7.05×10^{-2}
11.1×10^{-2} sec

$\frac{21'}{6.4\,cm} = 3.3$ FT/cm

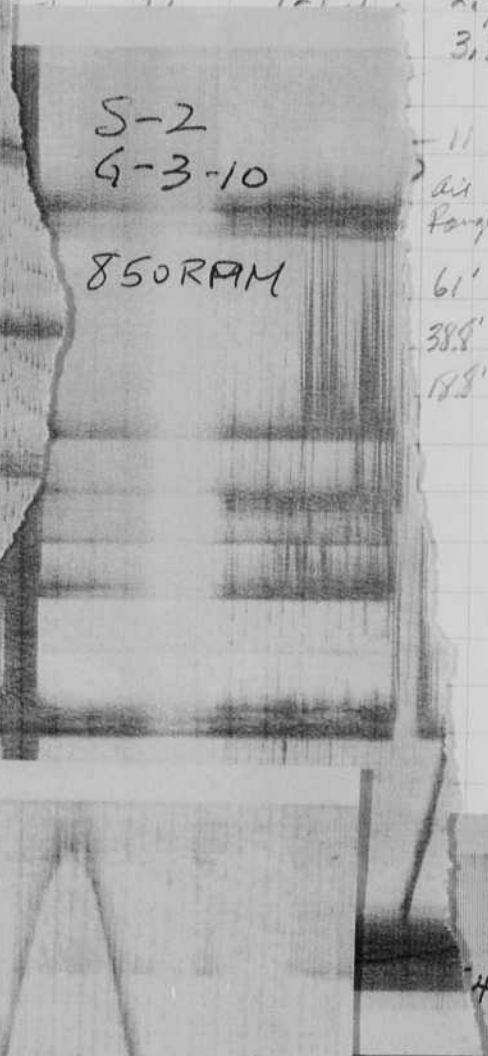


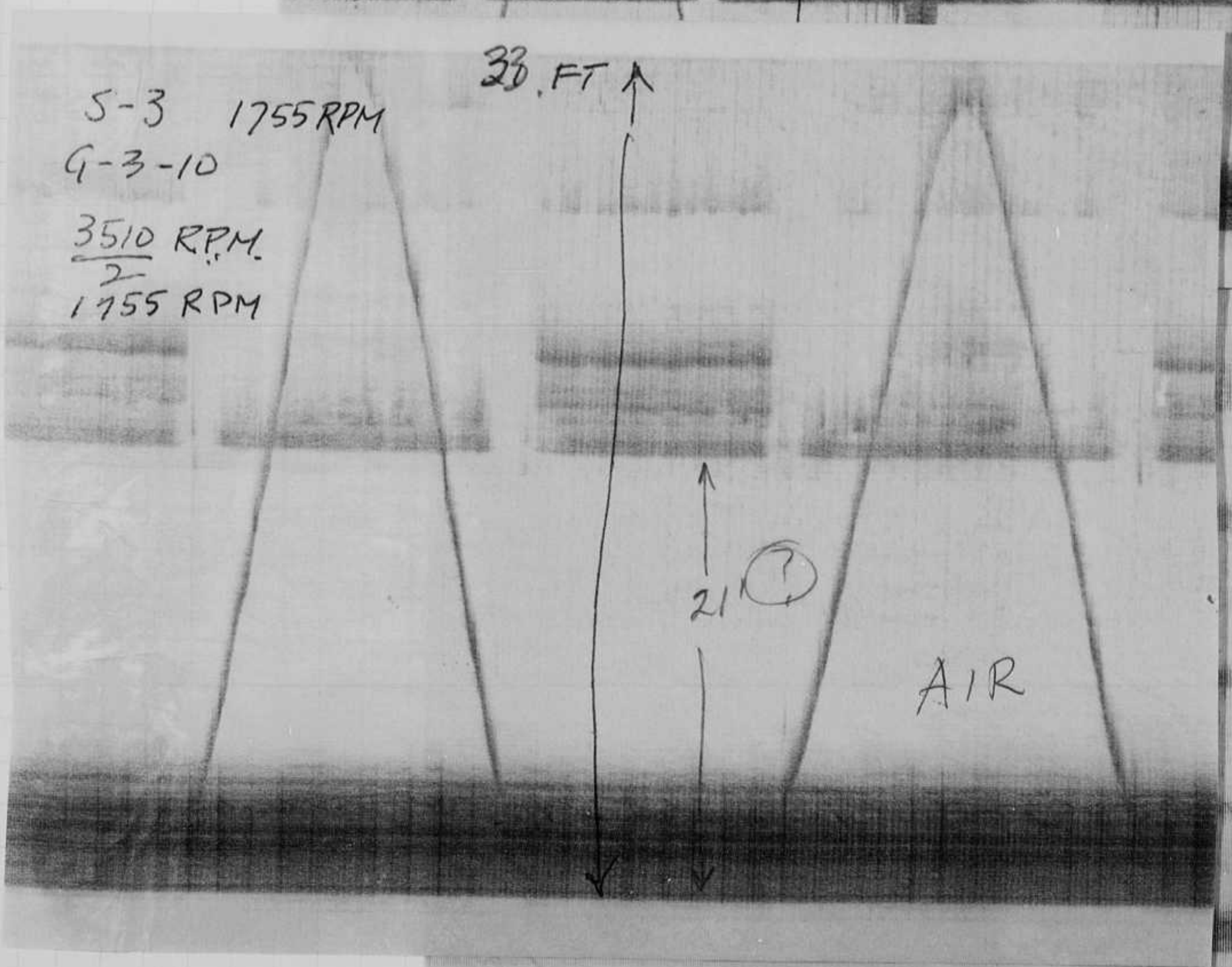


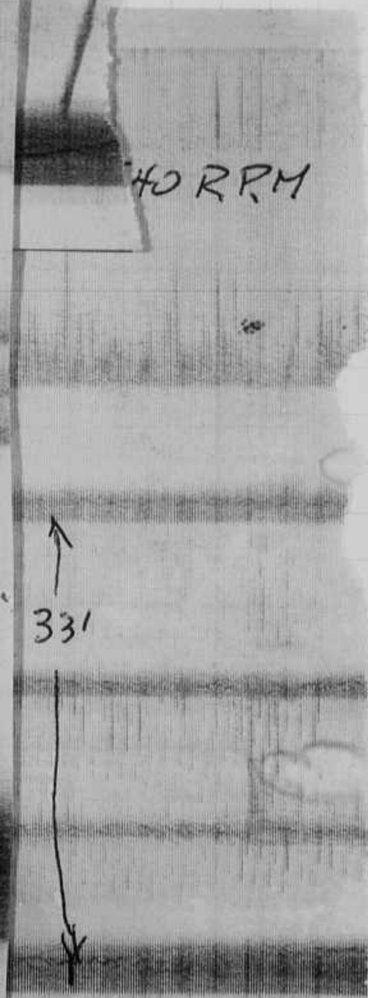
				FT/cm
1	33'	=	6.1 cm	5.4
2	33'	=	9.8	3.4
3	33'	=	12.3	2.7
				3.3

11

Air Range	Water Range	
61'	278'	85M
38.8'	176'	53.7M
18.8'	85.5'	26. M





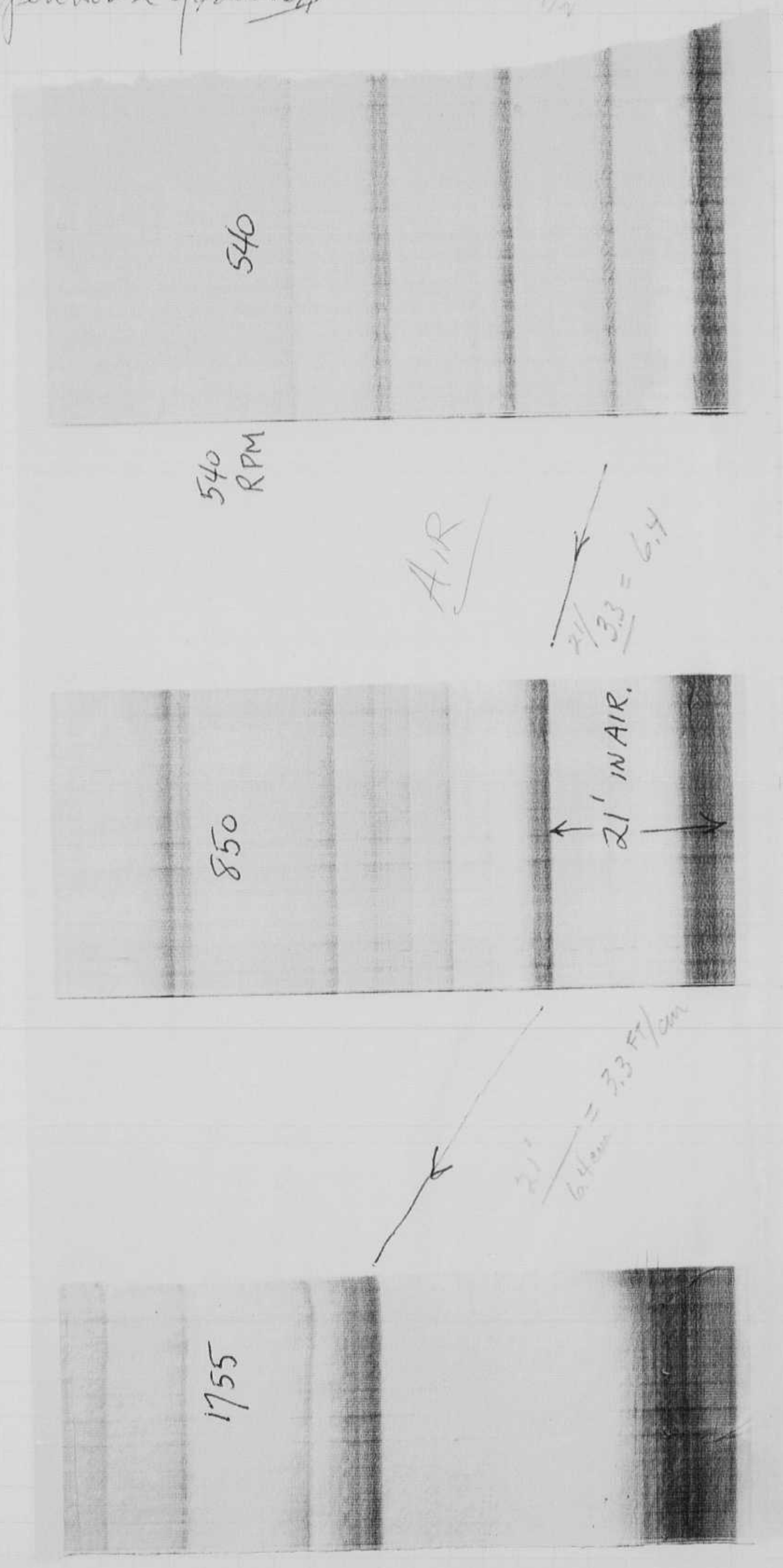


 March 25 1962

Open House Yesterday

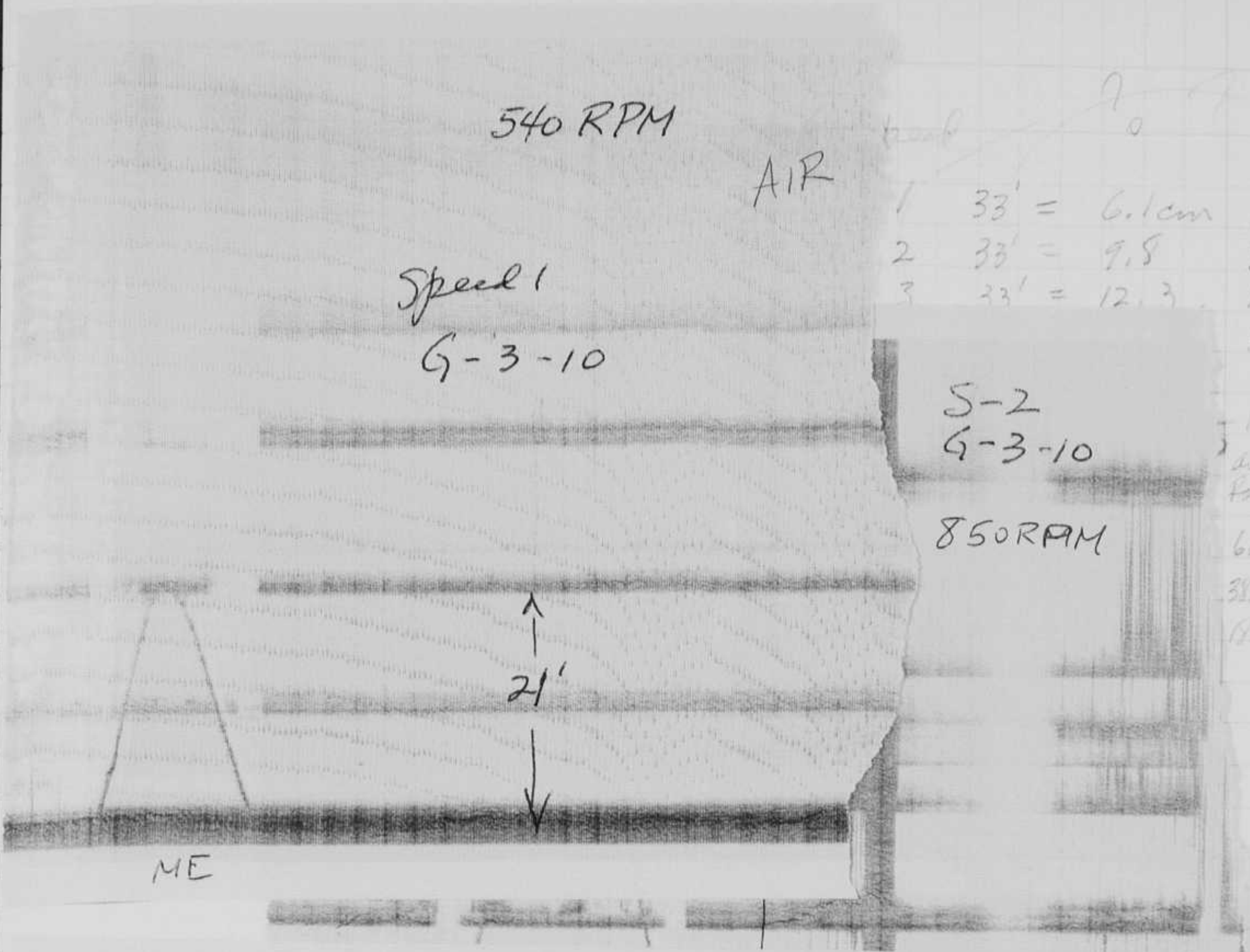
Mud Penetrator #2

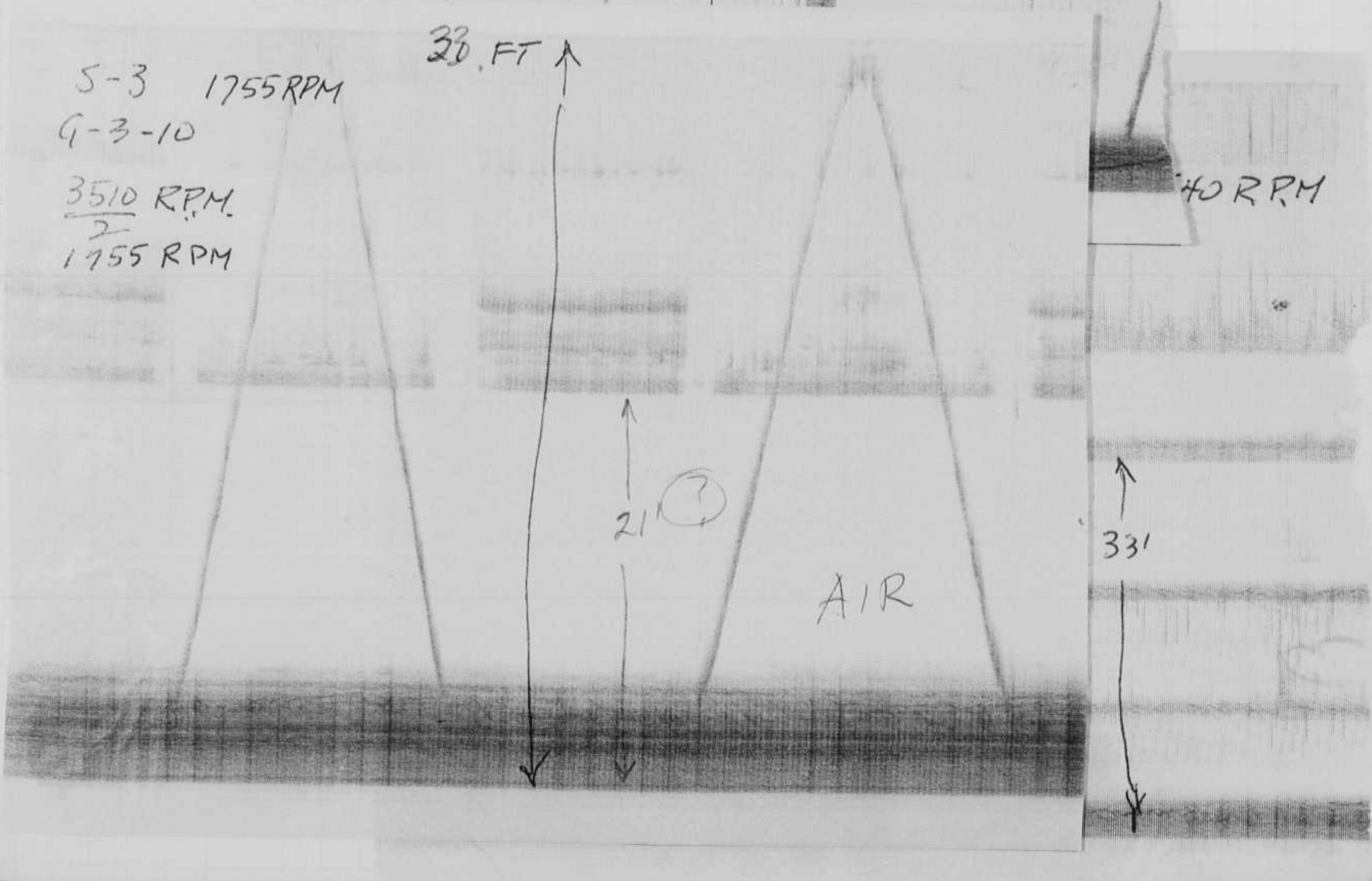
#1 was sent to Ed Link - Sea Diver Monaco, on thursday by air freight



				FT/cm
1	33'	=	6.1cm	5.4
2	33'	=	9.8	3.4
3	33'	=	12.3	2.7
				3.3

Air Range	Water Range	
61'	278'	85M
38.8'	176'	53.7M
18.8'	85.5'	26.M





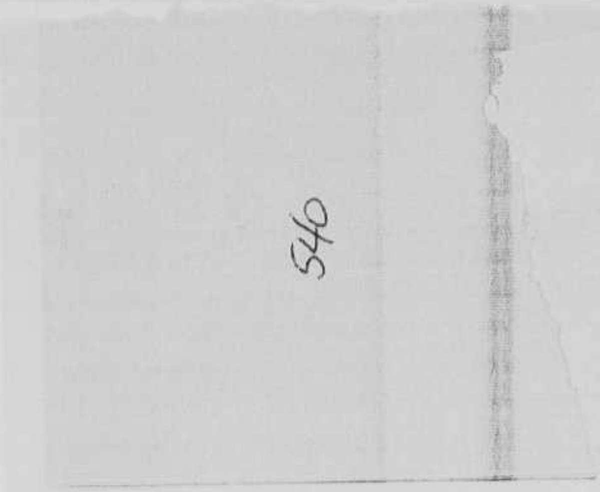
 March 25 1962

Open House Yesterday

Mud Penetrator #2

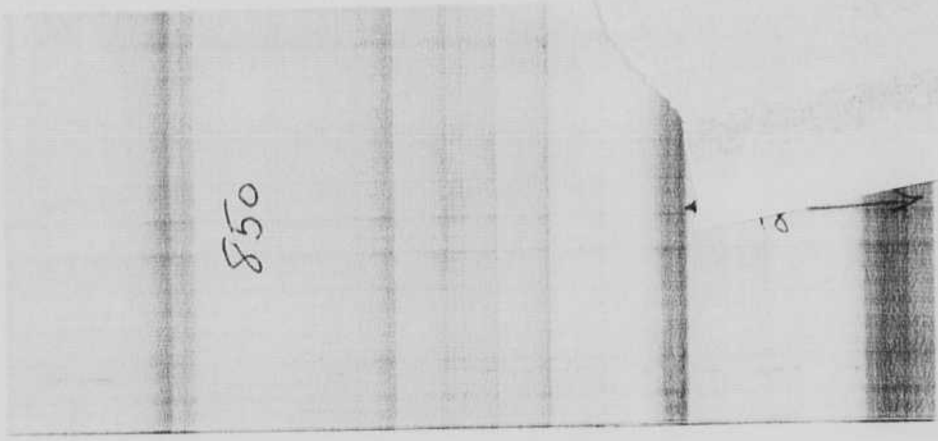
#1 was sent to Ed Link - Sea Diver Monaco, on Thursday by Air freight

$\frac{21}{2} = 10.5$ Ft/cm

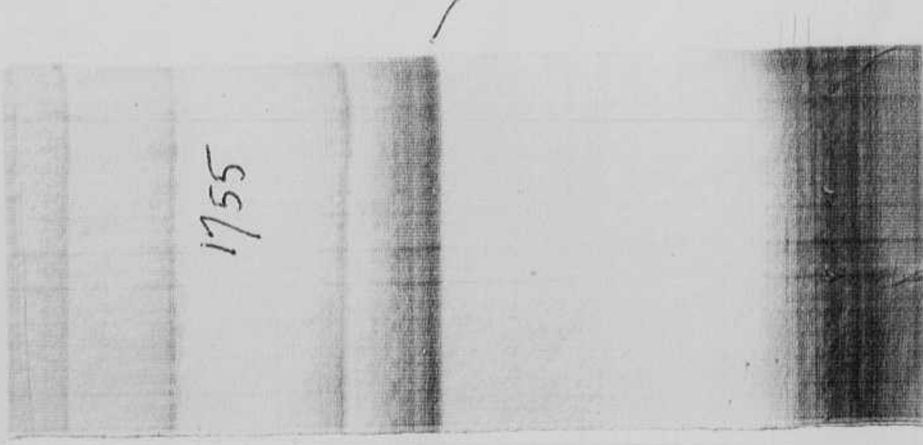


540 RPM

Air

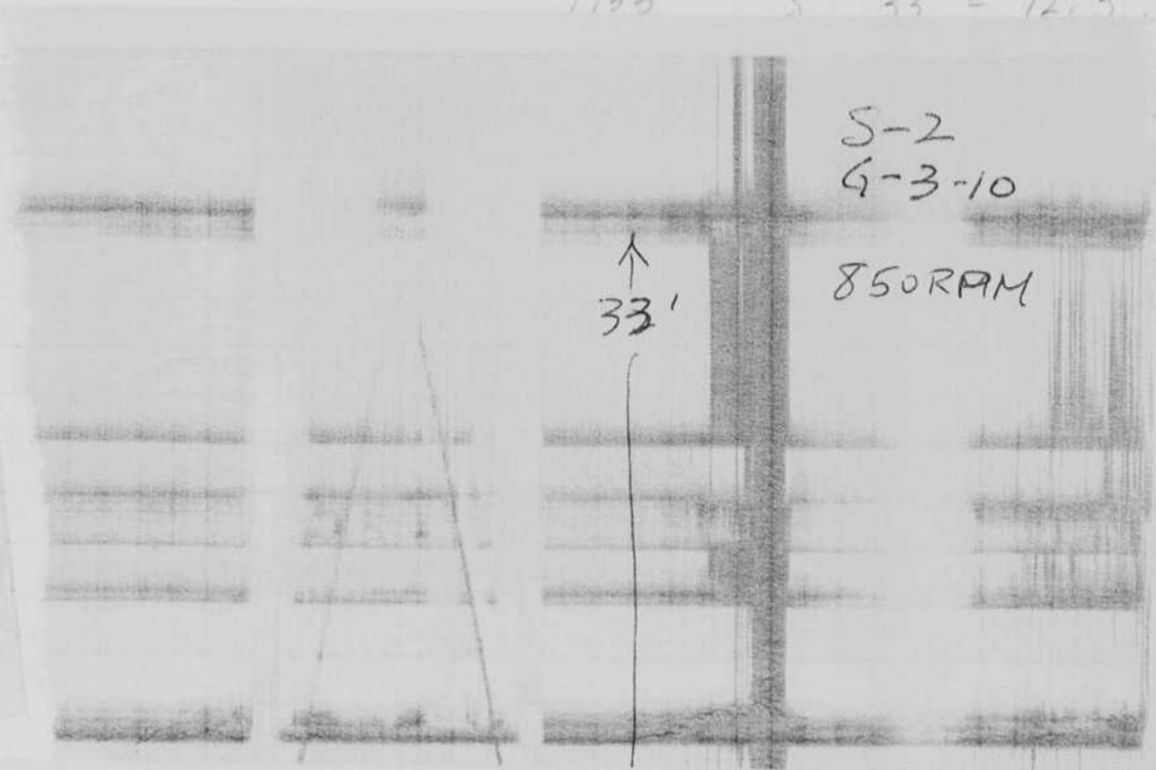


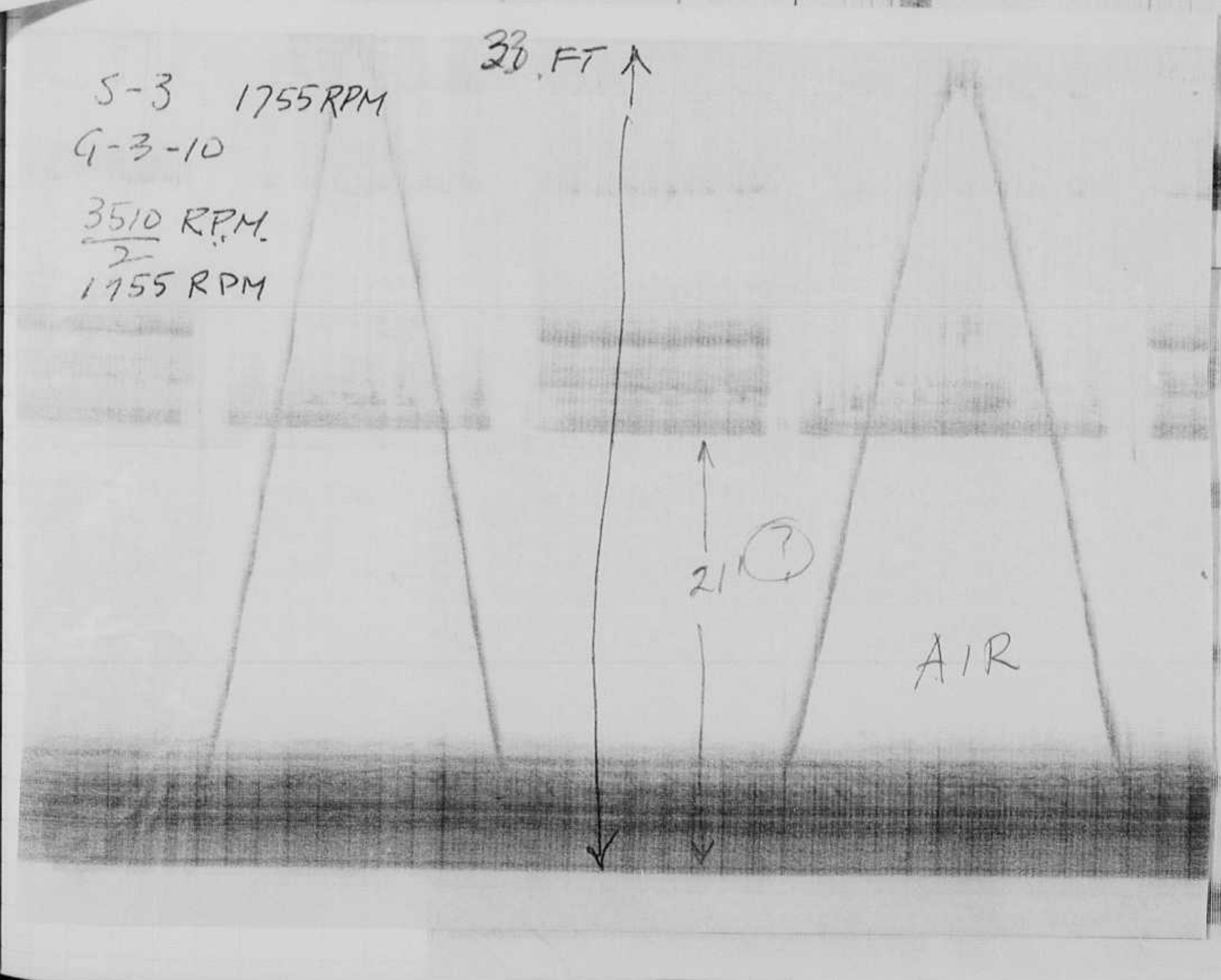
$\frac{21'}{6.4\,cm} = 3.3$ Ft/cm

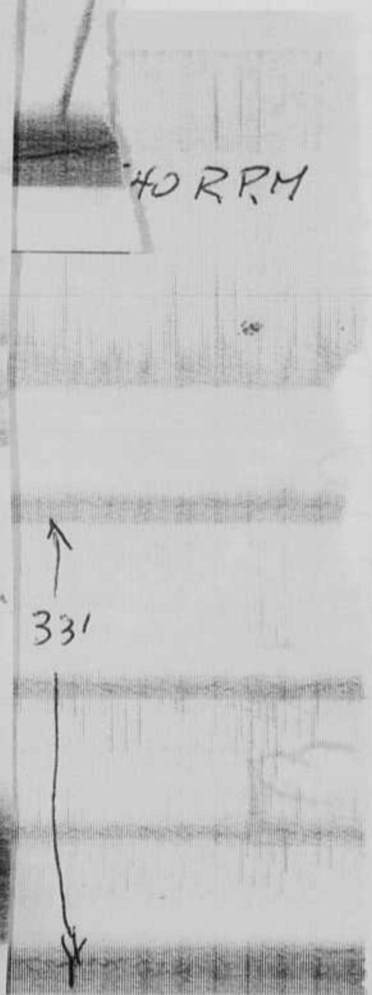


RPM	Speed		FT/cm
540	1	33' = 6.1 cm	5.4
850	2	33' = 9.8	3.4
1755	3	33' = 12.3	2.7
			3.3

Air Range	Water Range	
61'	278'	85M
38.8'	176'	53.7M
18.8'	85.5'	26.M





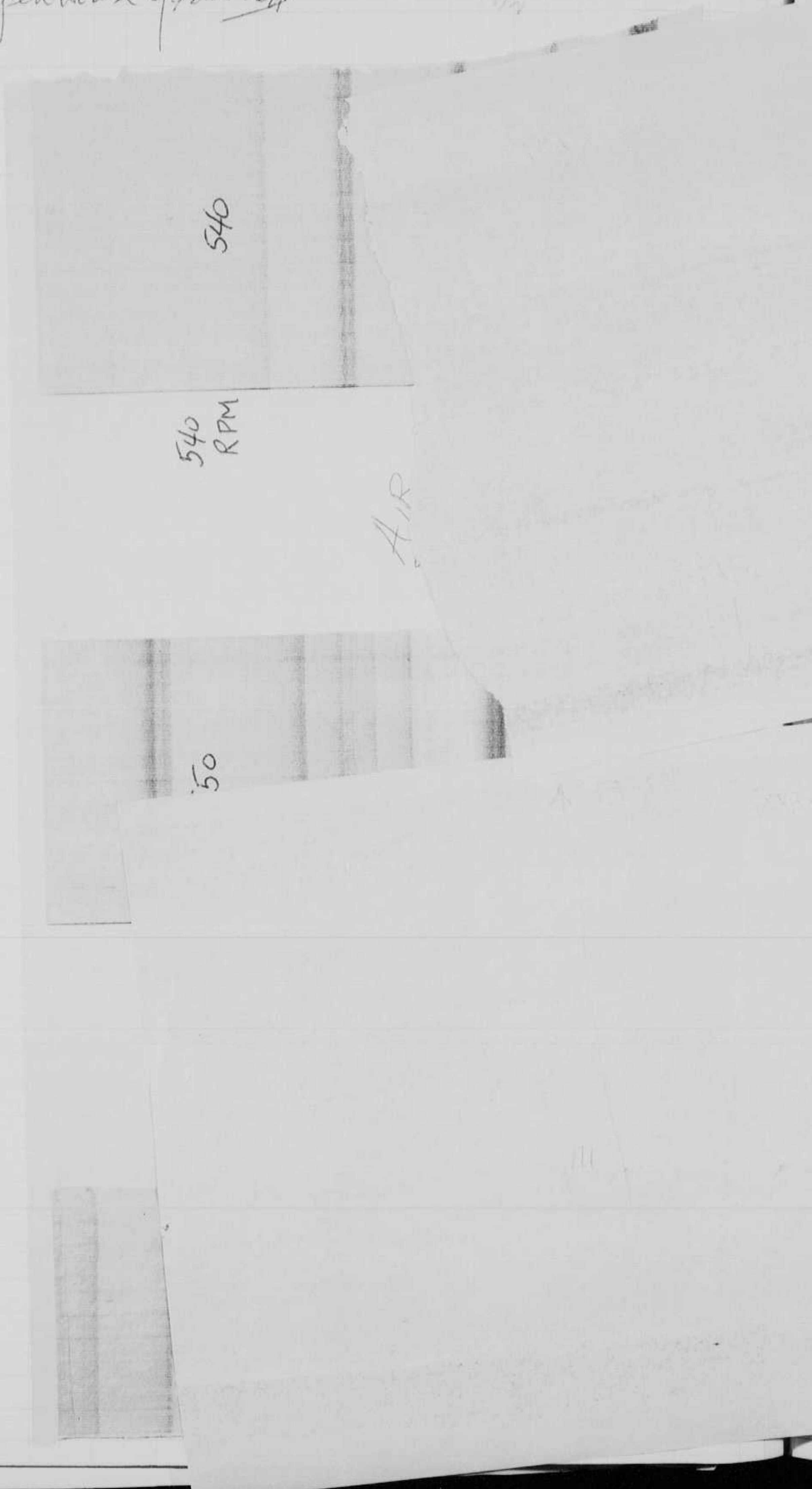


March 25 1962

Open House Yesterday

Mud Penetrator
#2

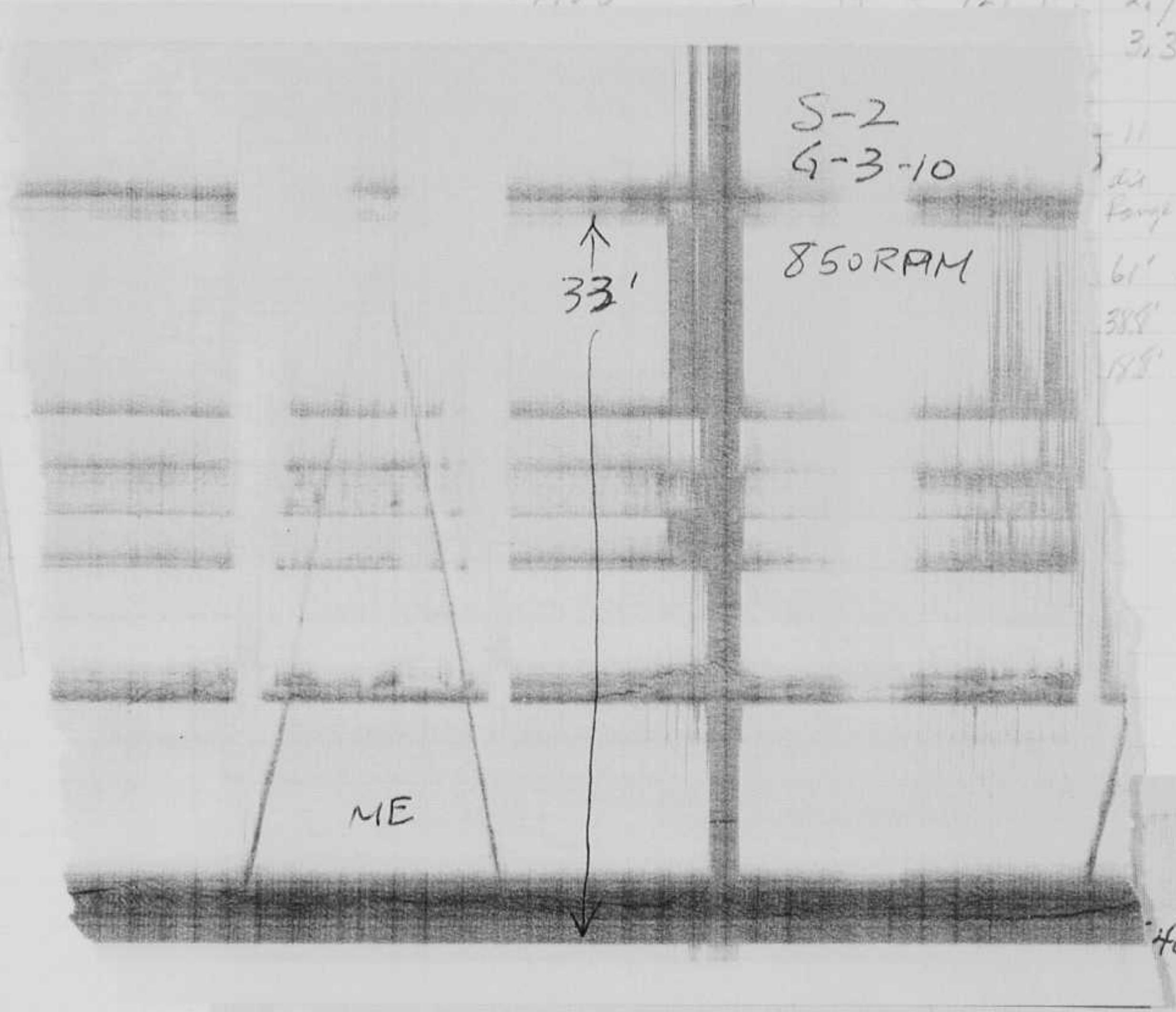
#1 was sent to
Ed Link - Sea Diver
Monaco. on
thursday by
air freight

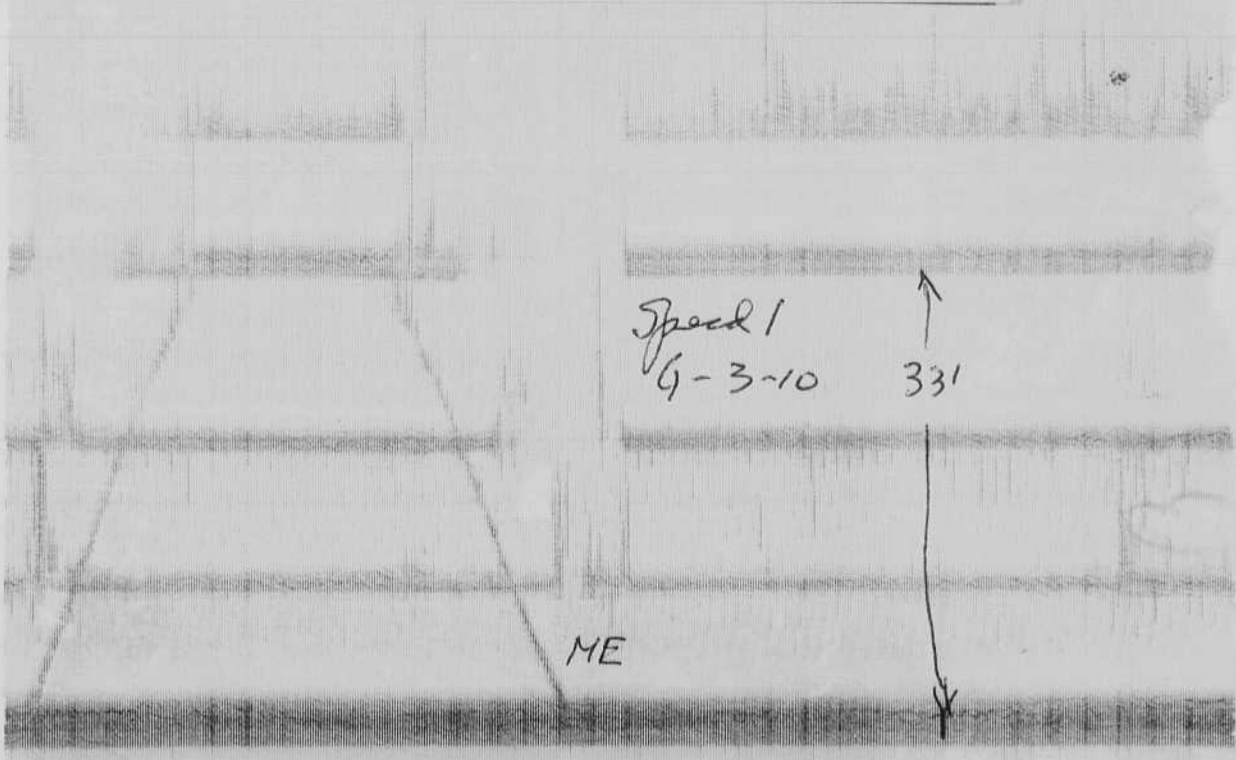


RPM	Speed			FT/cm
540	1	33' =	6.1 cm	5.4
850	2	33' =	9.8	3.4
1755	3	33' =	12.3	2.7
				3.3

11

Air Range	Water Range	
61'	278'	85M
385'	176'	53.7M
188'	85.5'	26.M





 March 25 1962

Open House Yesterday

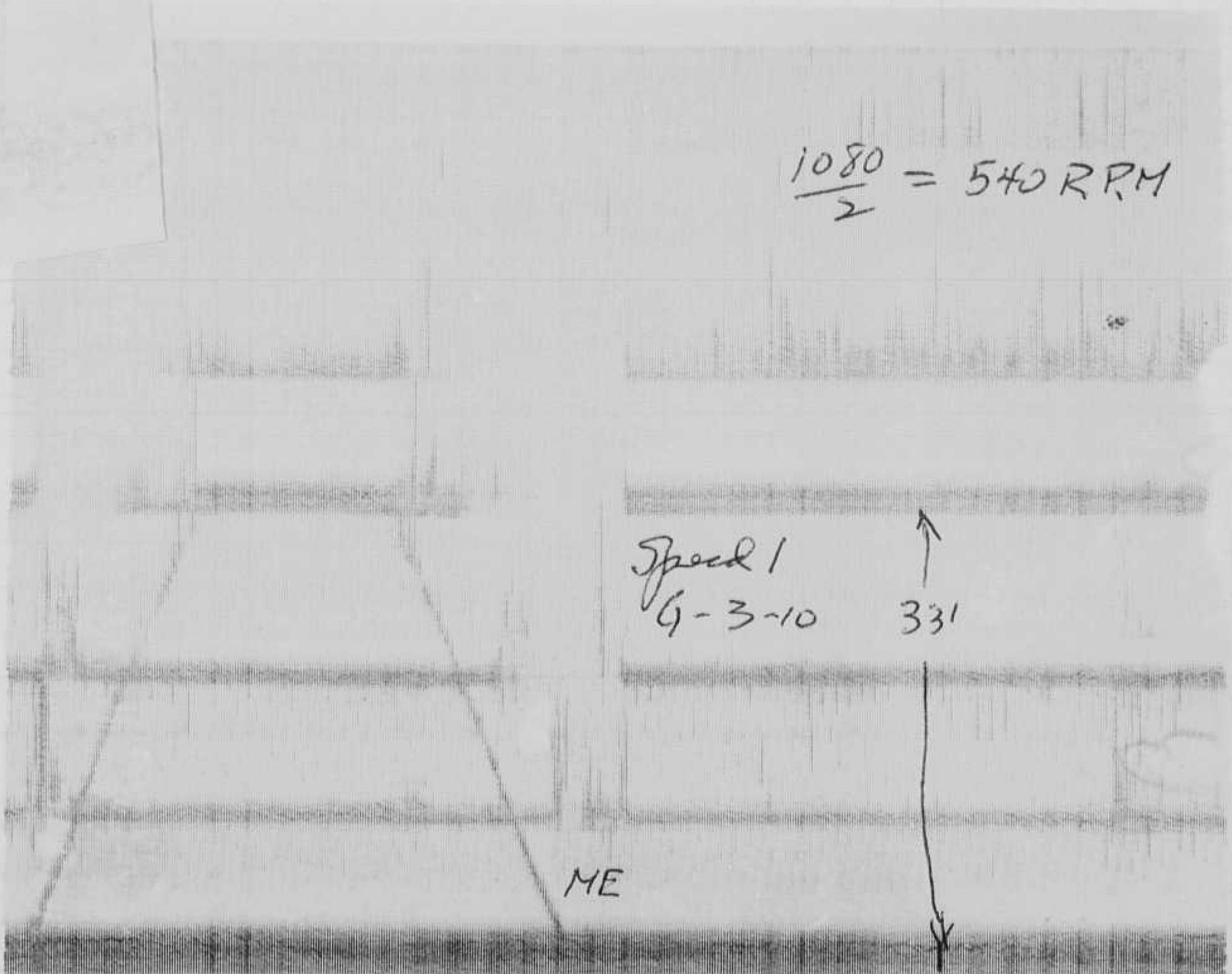
Mud Penetrator
#2

#1 was sent to
Ed Link - Sea Diver
Monaco, on
Thursday by
Air freight

RPM	Speed		τ_0	FT/cm
540	1	33' =	6.1 cm	5.4
850	2	33' =	9.8	3.4
1755	3	33' =	12.3	2.7
		21' =	6.4	3.3

Scale length = 5"

R.P.M.	R.P.S.	$t_{rev.}$	in/sec	Air Range	Water Range	
540	9.0	0.111	45	61'	278'	85M
850	14.1	0.0707	67.2	38.8'	176'	53.7M
1755	29.2	0.0347	146.	18.3'	85.5'	26.M



March 25 1962

Open House Yesterday

$9/2 = 10.5$ FT/cm

Mud Penetrator #2

#1 was sent to Ed Link - Sea Diver Monaco. on thursday by Air freight

$\frac{550}{350} = 1.57$

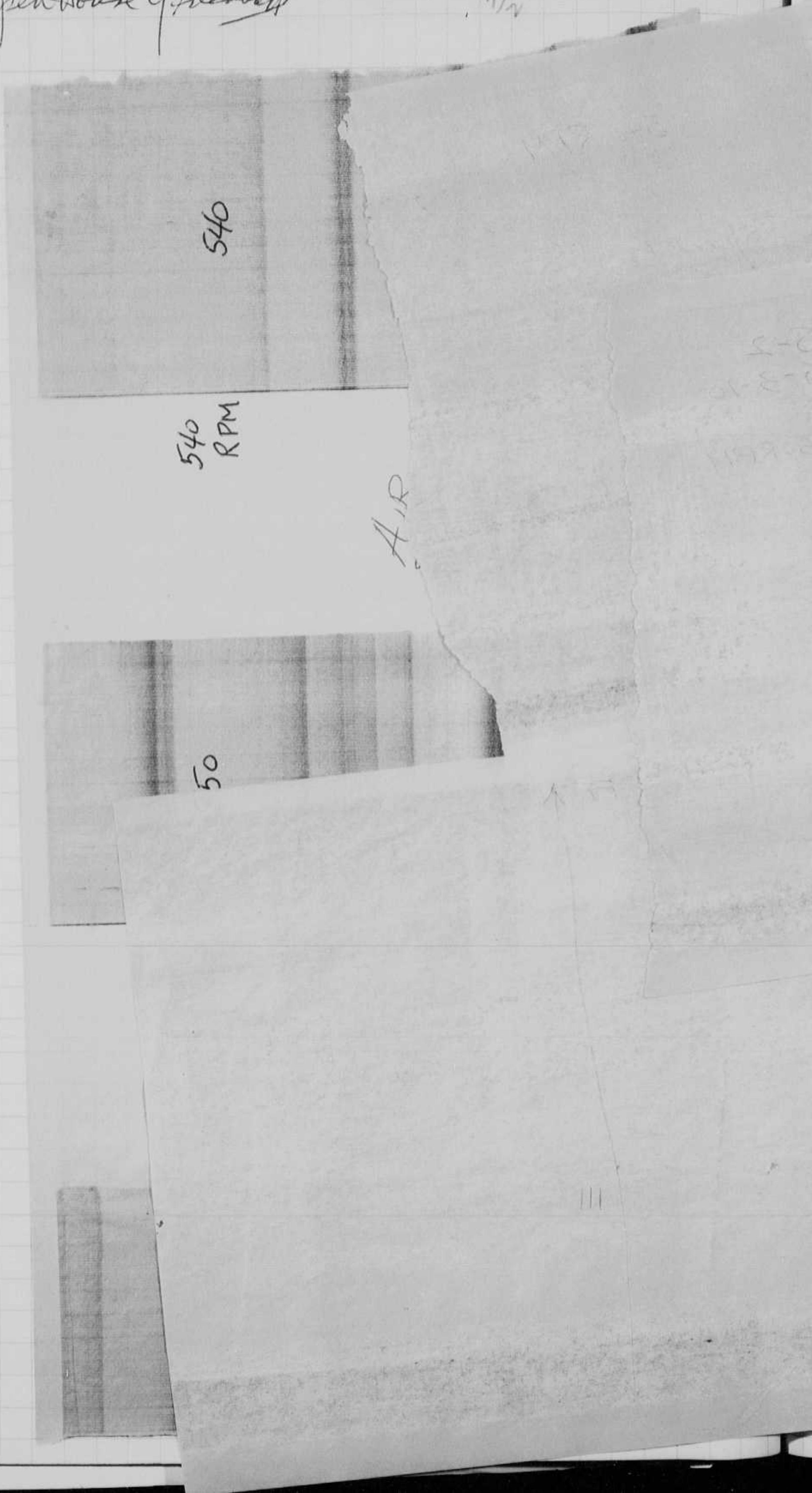
$\frac{1285}{953} = 2.06$

$\frac{60}{1755}$ = time of 1 rev = Drum Diam = 5" = 12.7 cm

3.42×10^{-2} sec

7.83×10^{-2}

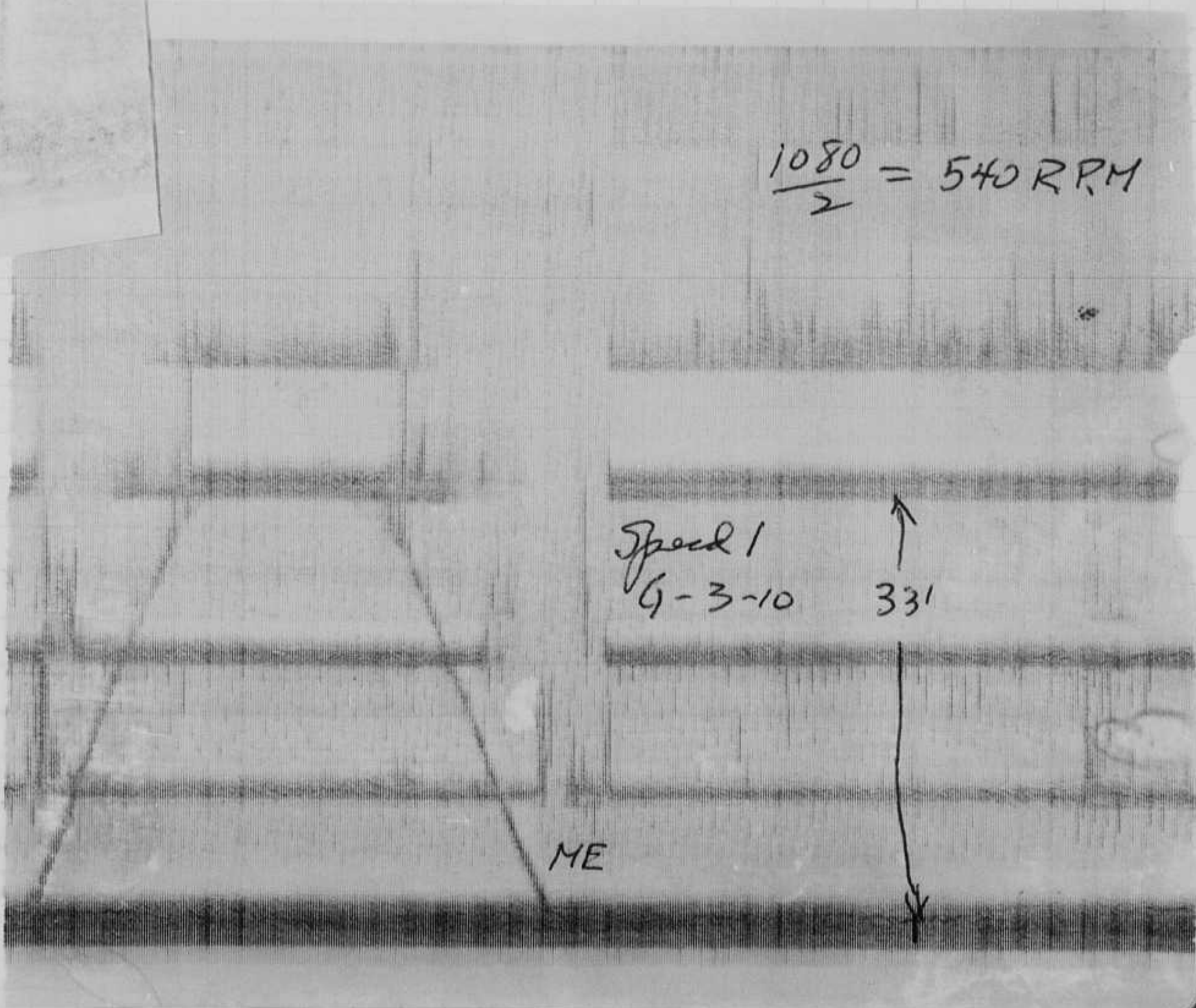
11.1×10^{-2} sec



RPM	Speed		FT/cm
540	1	33' = 6.1 cm	5.4
850	2	33' = 9.8	3.4
1755	3	33' = 12.3	2.7
		21' = 6.4	3.3

Scale length = 5"

R.P.M.	R.P.S.	$t_{rev.}$	in/sec	Air Range	Water Range	
540	9.0	0.111	45	61'	278'	85M
850	14.1	0.0707	67.2	38.8'	176'	53.7M
1755	29.2	0.0342	146.	18.8'	85.5'	26.M



This record was made off the boat dock at M.I.T. on Wed Mar 21 with Gary Hayward. The equipment Mud Penetrator # 1 was sent by Air Freight on the next day at 5pm to the <u>Sea Diver</u> Edwin Link at Monaco.

The equipment will be used for archeological research this summer in Syracuse Harbor

April 4 1962
Cambridge Mass
100 Memorial Drive.

Home today after celebrations in Aurora Nebraska with my parents, Frank & Mary Edgerton, on their 60 anniversary. Lots of friends and relatives were there.

On Apr 3, last night, I gave a talk to the IRE section in Lincoln at the Univ of Nebraska. Norris introduced me to the group of about 150 people in Ferguson Hall. Hollister was there.

I was at the I.R.E. Convention with the mud pinger for 4 days, returning in the middle to Boston to preside at the EG&G annual meeting. We had a lot of trouble with the paper drive, but eventually got it going. Since - it has been rebuilt in a better form so all seems o.k. now

April. 23. 1962

Model #2 has now been rebuilt by Bill MacRoberts and Antony Pastore. It is almost ready to be shipped. #3 is also being made at the same time.

Bill 5 and Mary Anne Dixon (4) have been with us at 100 Memorial Drive since April 4. We took them ~~home to~~ to Washington yesterday where we met Mary Lou, Chas and Janice 7. All had dinner at the Pogues 5204 Kenwood Dr. Chevy Chase Md.

501 Light tests.

Pickup #7 (Daisy) 5-1 Surface

Calibration test. 2.5 million peak c.p.

$c.p. = KVd^2/R$

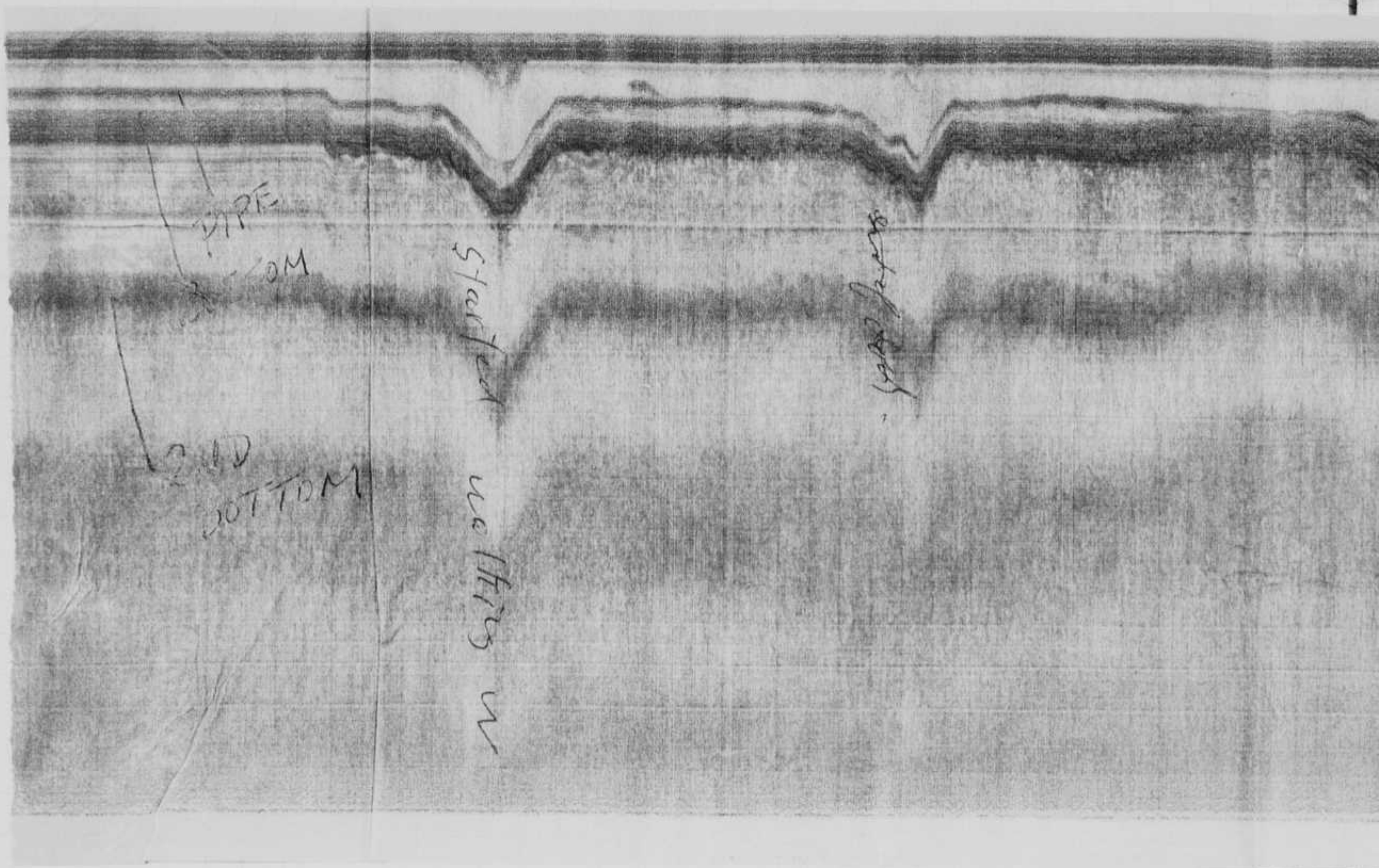
$R = 1000$
$V = \cancel{3.2}\ 2.5$
$K = 22 \times 10^6$
$6'9'' \pm$.
1531 A with reflector.
$f = 60 \sim$.

Now R decreased to 0.1 Kohm
V " to 0.25 volts
check.

Now 501 at 35" $3 \times .2 = .6$ V Start
$2 \times .2 = .4$ V 0.1 sec.

Fx. 2 Bare. $c.p. = 0.6\ 22 \times 10^6 \left(\frac{35}{\cancel{12}\ 9}\right)^2 \times \frac{1}{\cancel{100}} \approx \cancel{0.119\ c.p.}$

C = 0.01 mfd on 507.
1000 cycles.

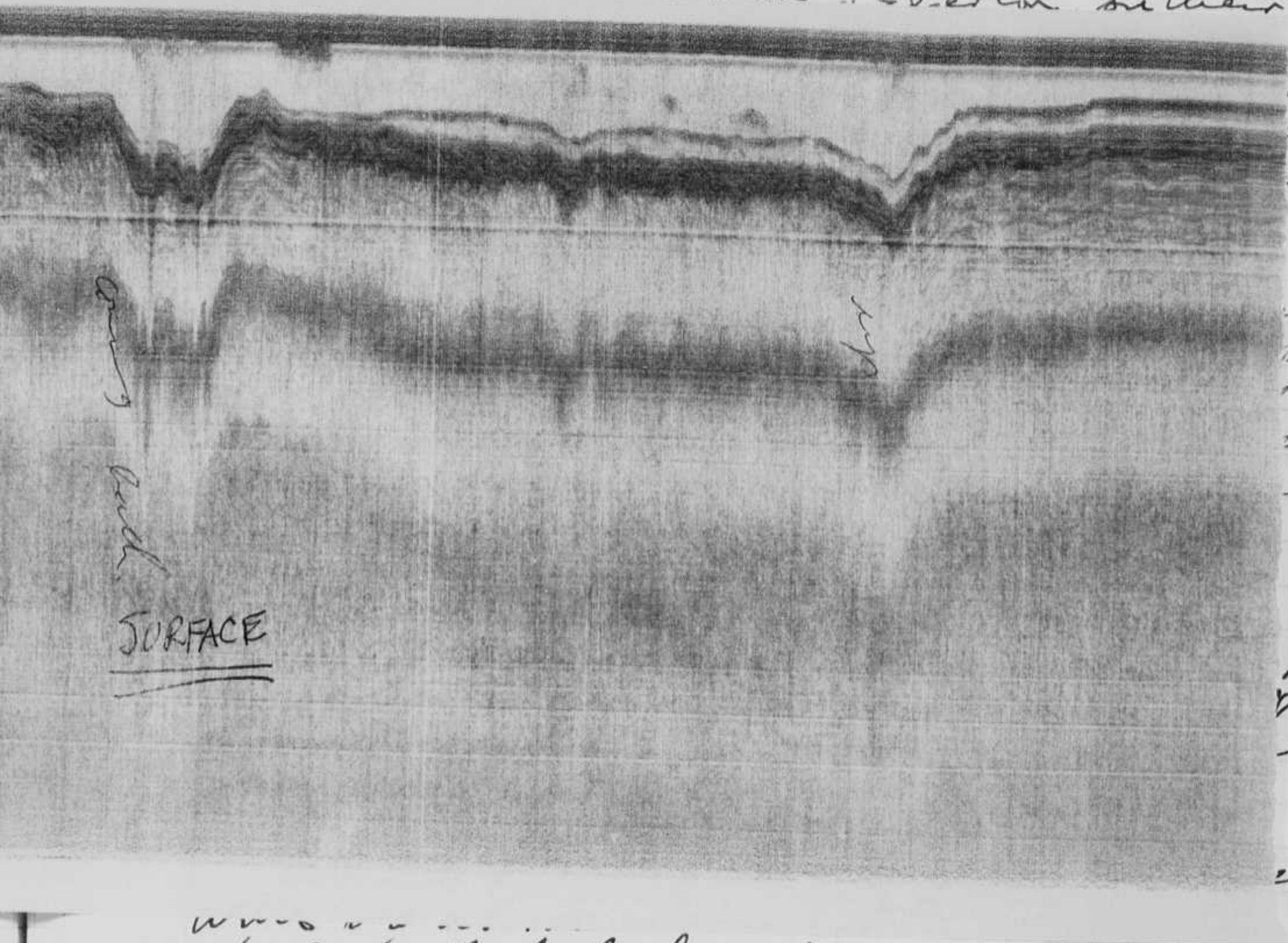


This record was made off the boat dock at M.I.T. on Wed Mar 21 with Gary Hayward. The equipment Mud Penetrator # 1 was sent by Air Freight on the next day at 5pm to the Sea Diver Edwin Link at Monaco.

The equipment will be used for archeological research this summer in Syracuse Harbor.

April 4 1962
Cambridge Mass
100 Memorial Drive.

Home today after celebrations in Aurora Nebraska
to ... Ollerton on their 60



e there.
lien in
me & the
ister was

inger
fireside
trouble
ing.
so

Bill
is
lso

en

April 4. We took them ~~home~~ to Washington yesterday where we met Mary Lou, Chas and Janice ?. All had dinner at the Pogues 5204 Kenwood Dr. Chevy Chase Md.

501 Light tests.

Pickup #7 (Daisy) 5-1 Surface $C.P. = KVd^2/R$

R = 1000
V = ~~3.2~~ 2.5
K = 22×10^6
6'9" ±.
f = 60 ~.

Calibration test. 2.5 million peak C.P.

1531A
with reflector.

Now R decreased to 0.1 Kohm
V " to 0.25 volts
check.

Now 501 at 35" $3 \times .2 = .6$ V Start
$2 \times .2 = .4$ V 0.1 sec.

Fx.2 Board. $C.P. = 0.6 \; 22 \times 10^6 \left(\frac{35}{\cancel{12}\;9}\right)^2 \times \frac{1}{\cancel{100}} \approx 0.119$ c.p.

C = 0.01 mfd on 50?.
1000 cycles.

501 Strobe with
FX-11 1/8" gap
1000 cycles
0.01 mfd.

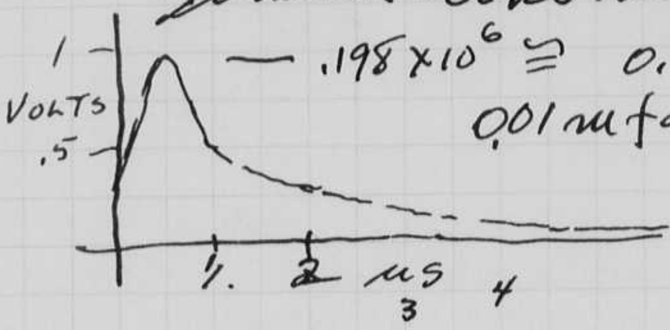
$V = 1$ volt $\pm 20\%$
$R = 1000$
$d = 35''$ 3 ft
$K = 22 \times 10^6$

$$CP = \frac{KVd^2}{R}$$

$$= \frac{22 \times 10^6 \; 1. \; 3^2}{1000} \qquad \begin{array}{r} 22 \\ 9 \\ \hline 198 \end{array}$$

$= .198$ c.p. peak, $\times 10^6$

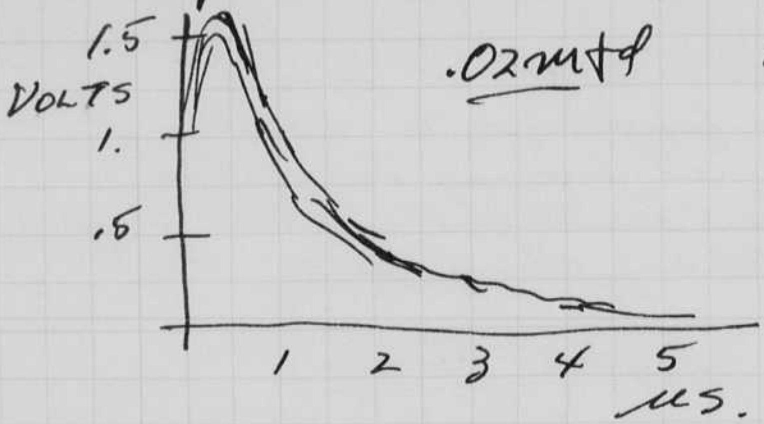
Duration looks slightly shorter than FX-2



— $.198 \times 10^6 \cong 0.2 \times 10^6$ c.p.
0.01 mfd.

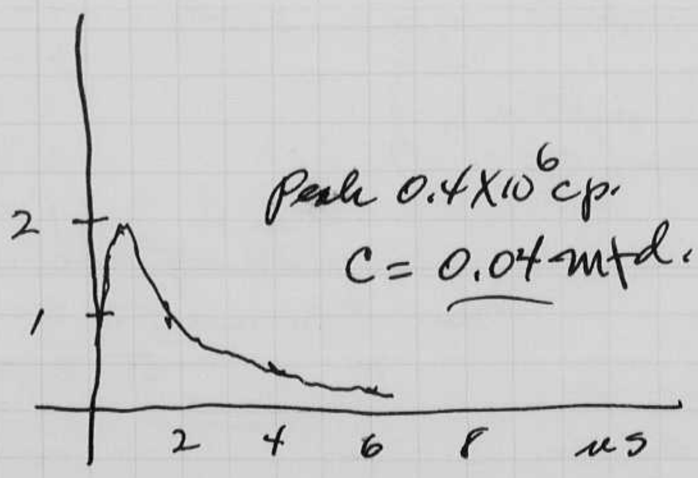
FX-11

Flash capacitance now increased to 0.02 mfd



.02 mfd 0.3×10^6 c.p. peak

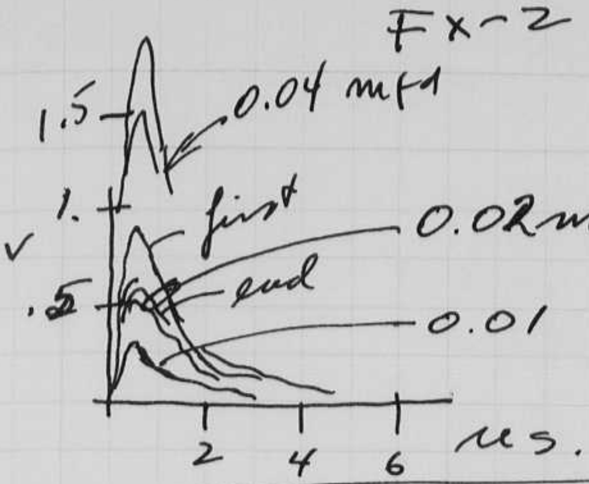
FX-11



Peak 0.4×10^6 cp.
C = 0.04 mfd. 1000 tt. FX-11

$0.4 \times 10^6 \times 3 \times 10^{-6} = 1.2$ c.p.s
then 100 flashes = 120 c.p.s

FX-2



0.02 mfd 0.1 sec. 1000 cycles.
d = 3 ft.

FX-33 1½" gap tried. Light peak down by factor of 4 or 10
0.4 mm tube
Quartz. Duration about 10 us ±

Prof. Bloch was here April 26 to give a lecture on the flow of blood, He showed movies of reptiles at 2000 f.p.s. and of mammals at the same, the mammal blood cells are about ½ the size of the reptile ones.

Dr. ~~Wells~~ Rowe Wells
" Searle Rees
" Fulton.
Merrill
Cham
Molle Christensen

were at the meetin at 3pm in 10-275.

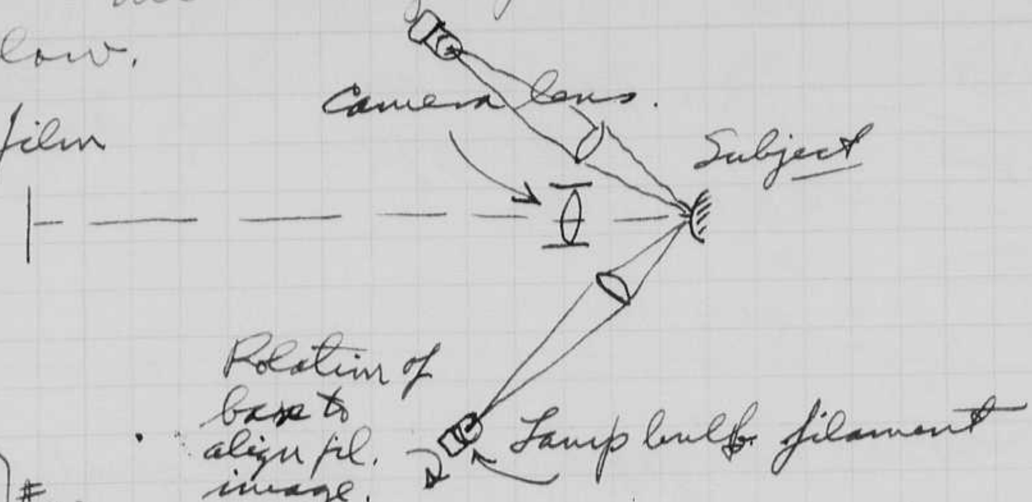
April 30, 1962.

The movies taken of Dr. Row Wells eye last week were quite good, a record of the set up is in my other lab book, more magnification is needed and probably less speed,

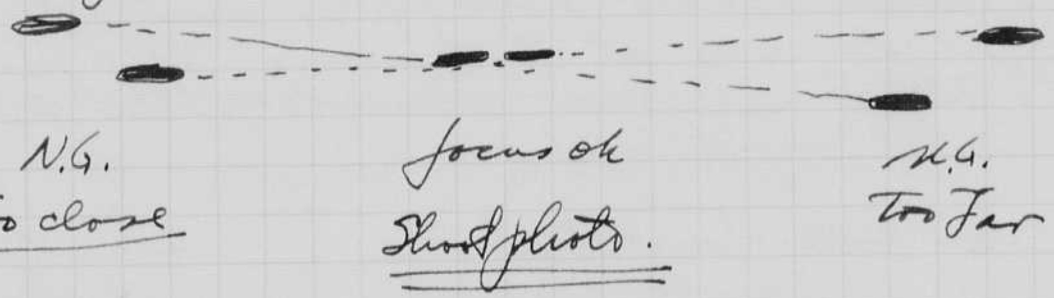
I now have the Millikan camera in the lab. It is being fitted with a 40 mm lens and a cross eyed focus arrangement. Jack Pogue is helping me to put the device together.

 April 30 62 cont.

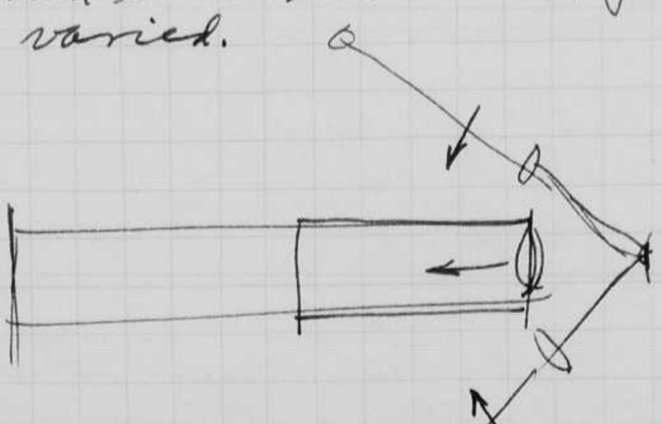
The cross eyed focus unit is described below.



The image of the short straight filament is imaged onto the subject plane first, then the second lamp filament image is caused to fall at the same place. Rather the images are put in a line so that the focus plane can be accurately determined.



The lamps could be slid out and the angles changed automatically with cams so that the image plane would be defined even when the ~~foco~~ focal distance was varied.



May 11, 1962.
Harold Edgerton.

Microscope Illuminator.

Sam Kittrosser.

S.P.S.I. Meeting Convention May 7-11 Somerset Hotel.
Banquet. May. 10. I showed slides and movies.

On May 7 I went to W.H.O.I. Hersey and I
showed pictures and discussed Puerto Rico
photo and dredge efforts.

~~Mon~~ May 8 I talked to the 25 year old club at M.I.T.
in the Campus room. Employees.

May 20 1962

See other book

Movies yesterday with 128 and 400 fps
camera. .01 and .02 mfd on 501 H.T. Strobe
into 1/2" lamp about 1 inch from eye,
75 mm lens about 6 or 8" from film.
931A film was used. Dupont.

Dr. Friedman
Mary Helming
Bob Schildkraut

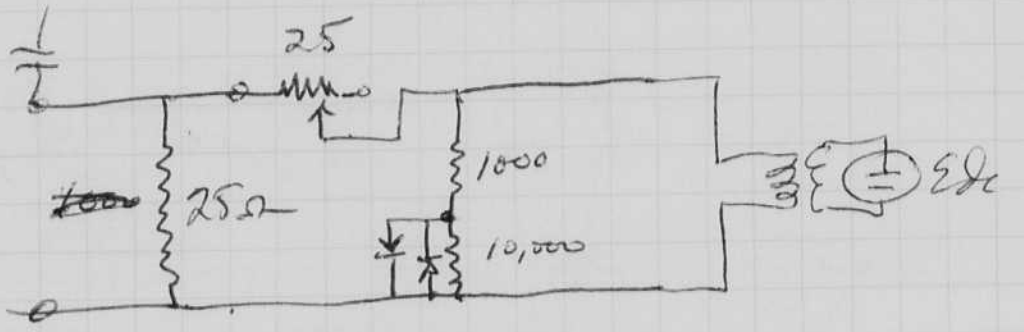
Mud Penetrator

H. E. Edgerton
Mac Roberts
May 20, 1962.

Modifications

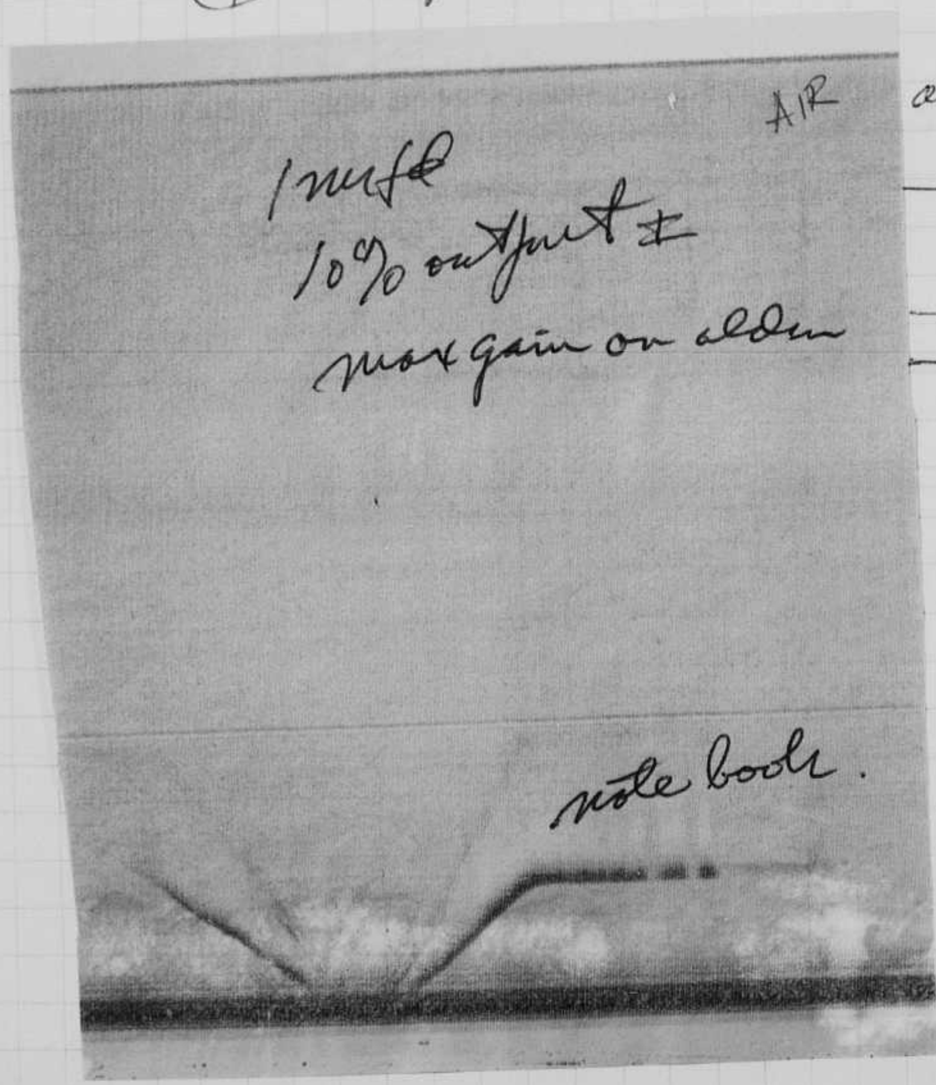
(1) Med gain showed initial light area why? High and low were OK.

(2)

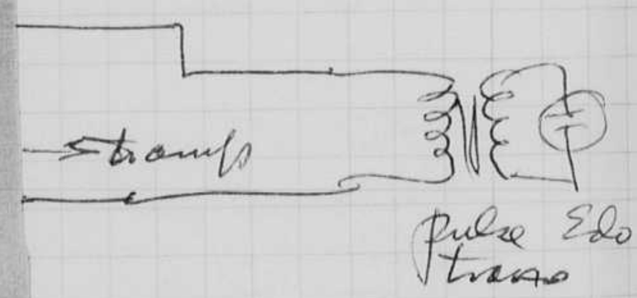


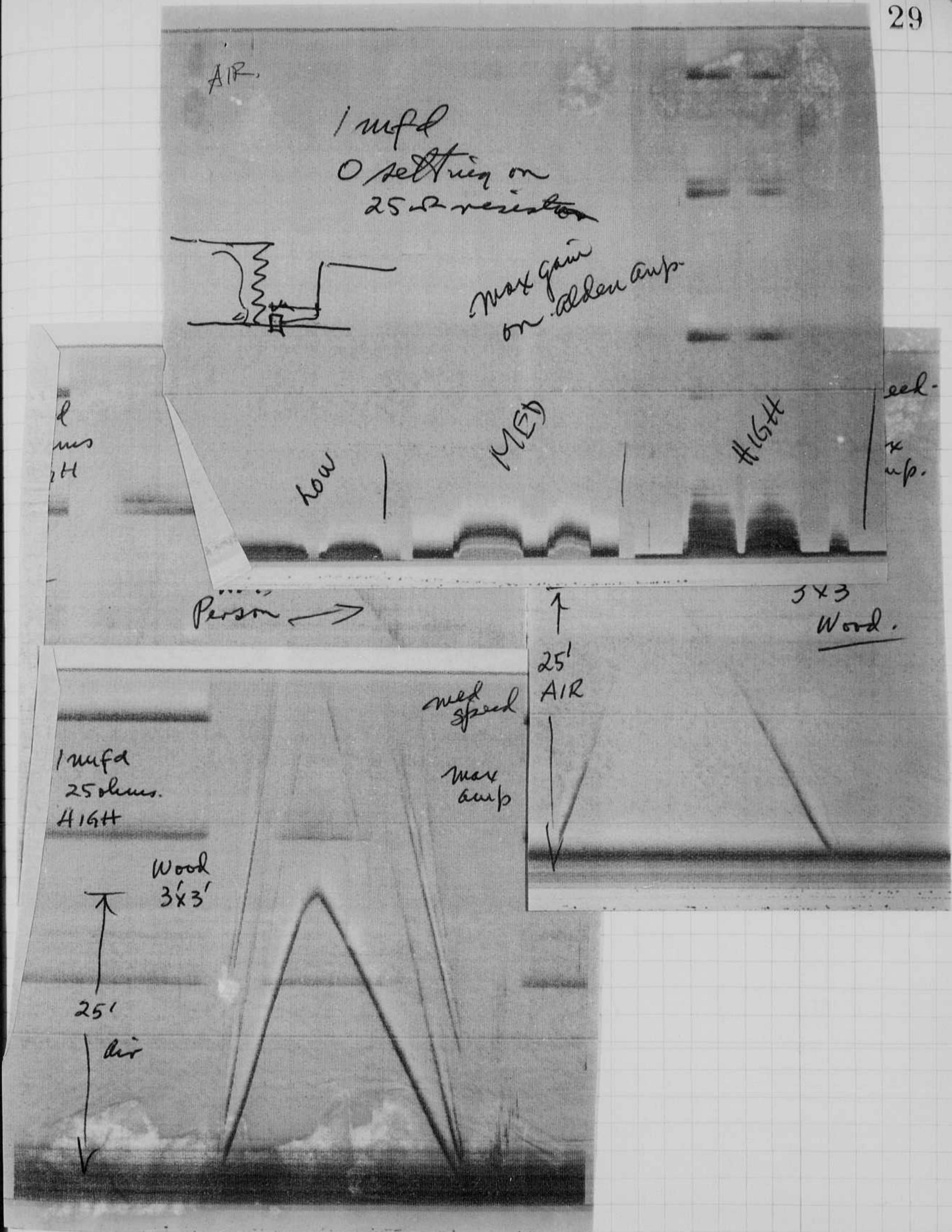
(3) Series Resistor in amp changed from 400 to 200 ohms to increase current into output. makes a darker trace.

(4) Output C now can be either 1 or 2 mfd



above




AIR.
1 mufd
0 setting on
25 Ω resistor
max gain
on alden amp.
LOW
MED
HIGH
Person →
3x3
Wood.
25'
AIR
med
speed
max
amp
1 mufd
25 ohms.
HIGH
Wood
3'x3'
25'
air

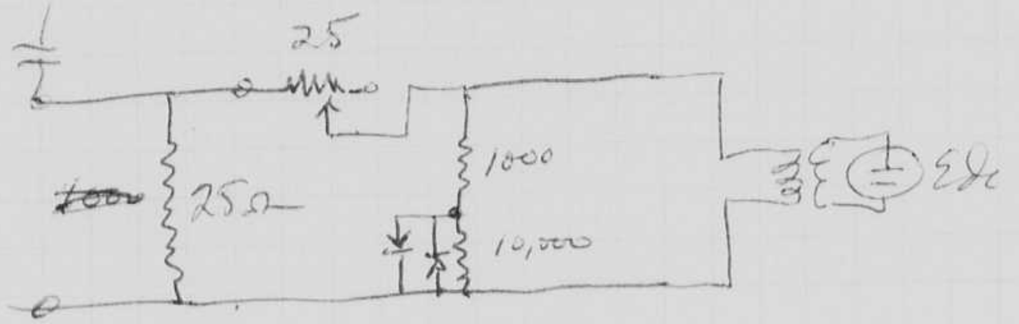
H. Edgerton
Max Roberts
May 20, 1962.

Mud Penetrator

Modifications

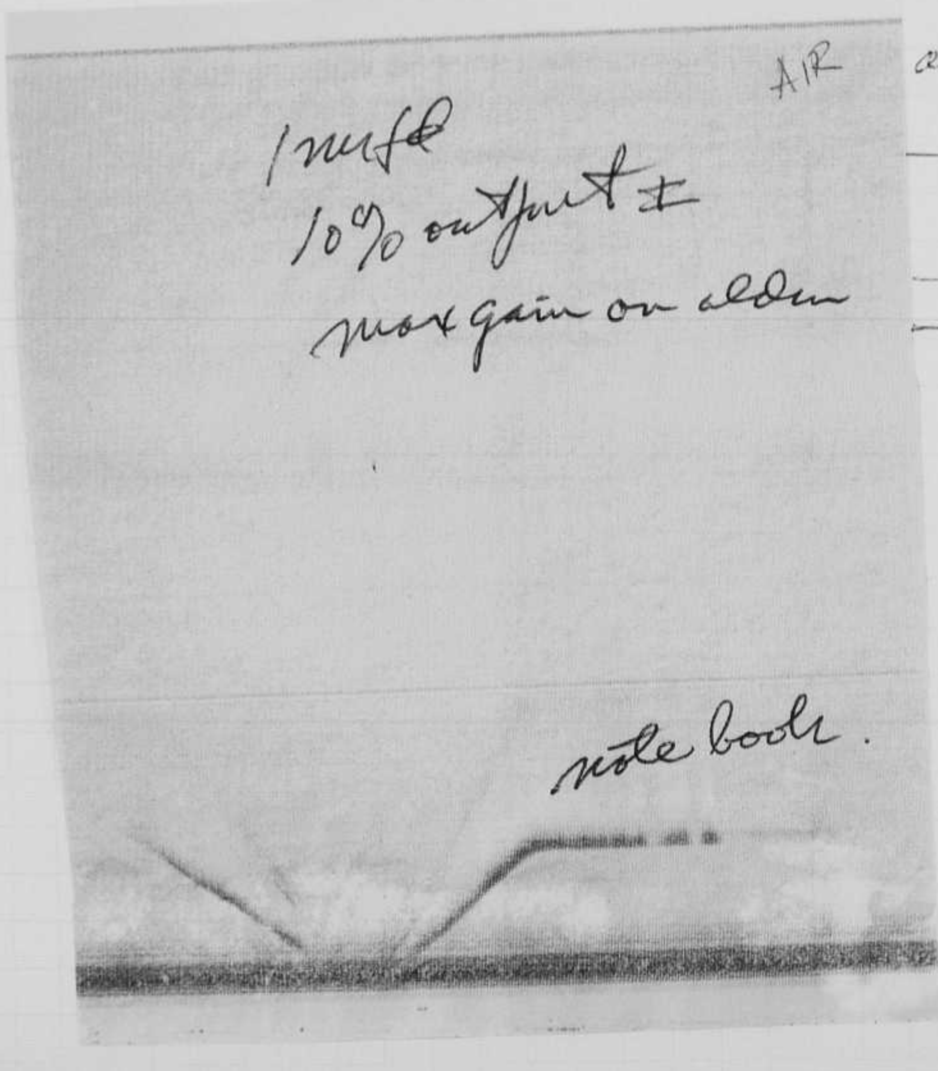
(1) Med gain showed initial light area (?)
High and low were ok.

(2)

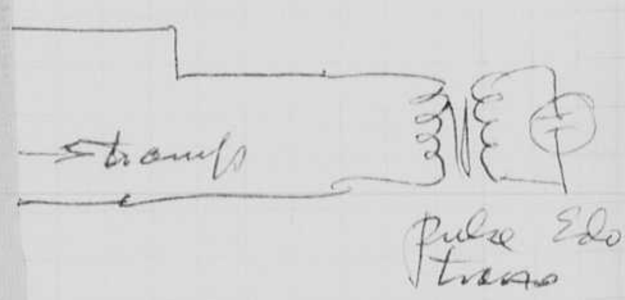


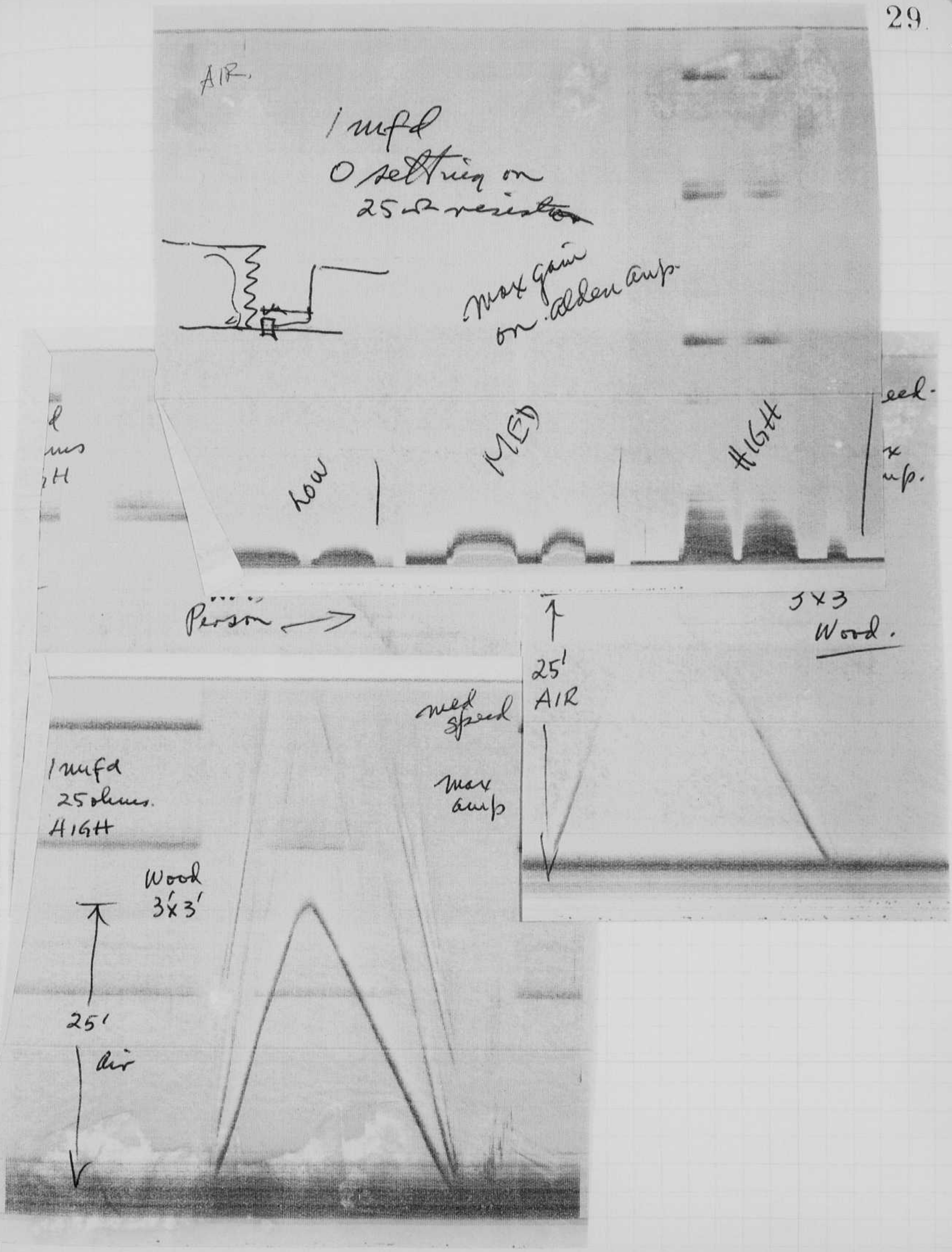
(3) Series Resistor in amp changed from 400 to 200 ohms to increase current into output. makes a darker trace.

(4) Output C now can be either 1 or 2 mfd



above




AIR.
1 mfd
0 setting on
25 Ω resistor
max gain
on alden amp.
LOW
MED
HIGH
Person
3×3
Wood.
25'
AIR
med
speed
max
amp
1 mfd
25 ohms.
HIGH
Wood
3'×3'
25'
Air

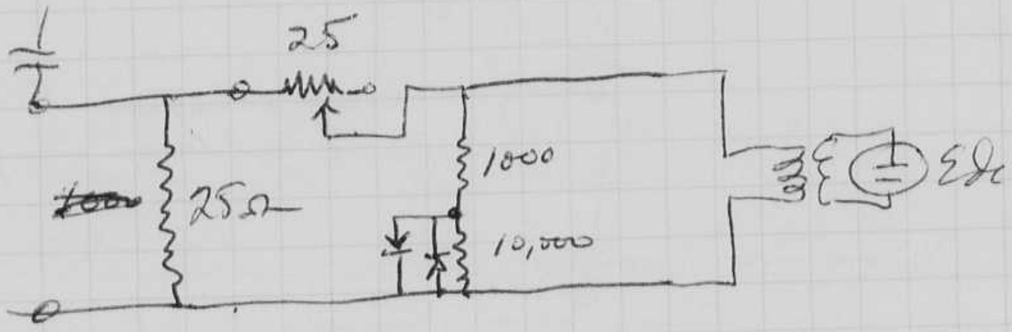
Mud Penetrator

H. E. Edgerton
mac Roberts
May 20, 1962.

Modifications

(1) Med gain showed initial light area. Why?
High and low were OK.

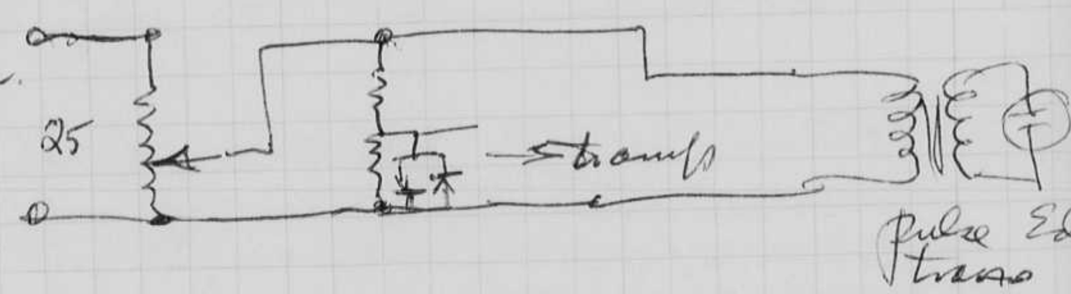
(2)

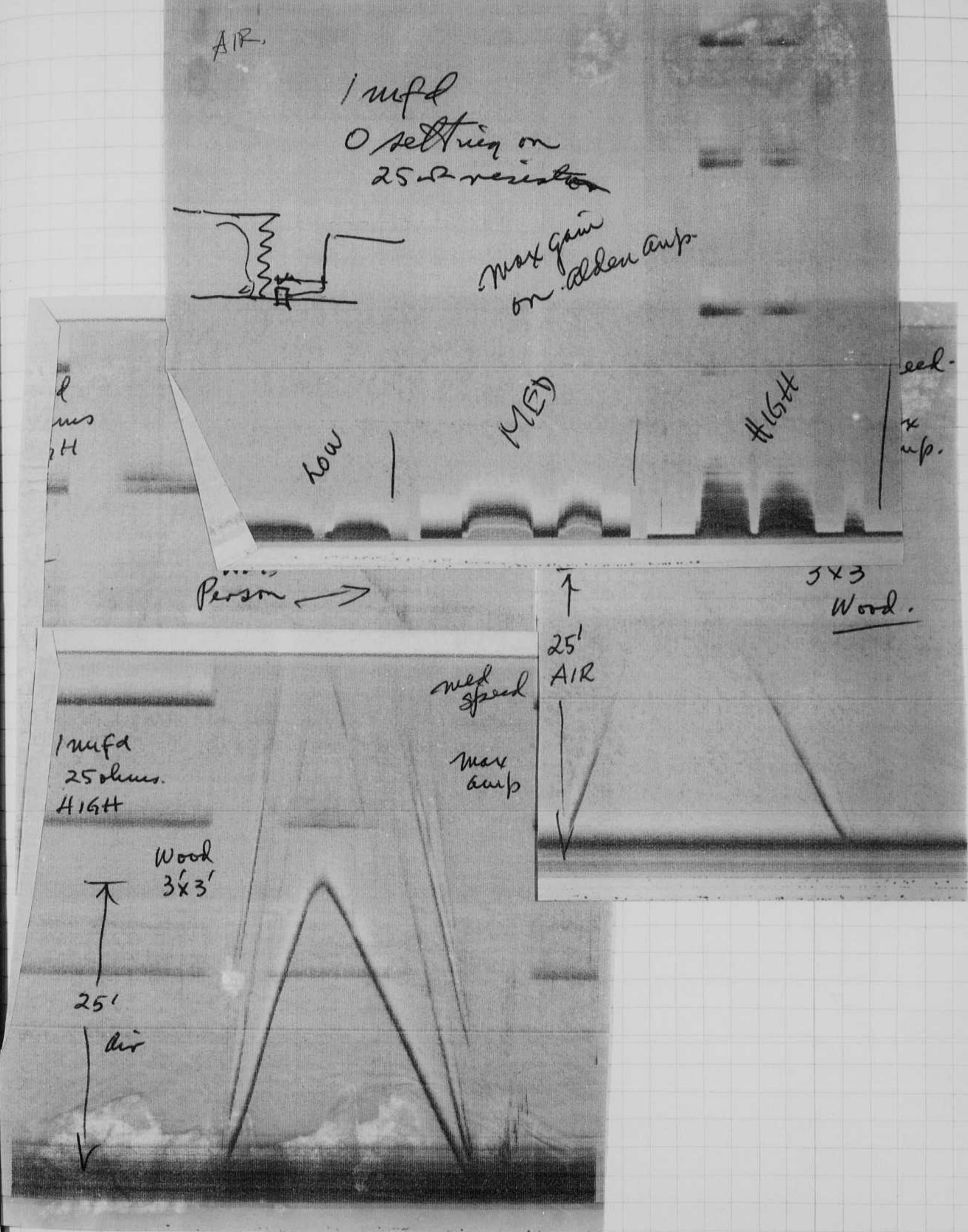


(3) Series Resistor in amp changed from 400 to 200 ohms to increase current into output. makes a darker trace.

(4) Output C now can be either 1 or 2 mfd

(5) 25 ohm resistor as above




AIR.
1 mufd
0 setting on
25 Ω resistor
max gain
on alden amp.
LOW
MED
HIGH
Person
3x3
Wood.
25'
AIR
med
speed
max
amp
1 mufd
25 ohms.
HIGH
Wood
3'x3'
25'
Air

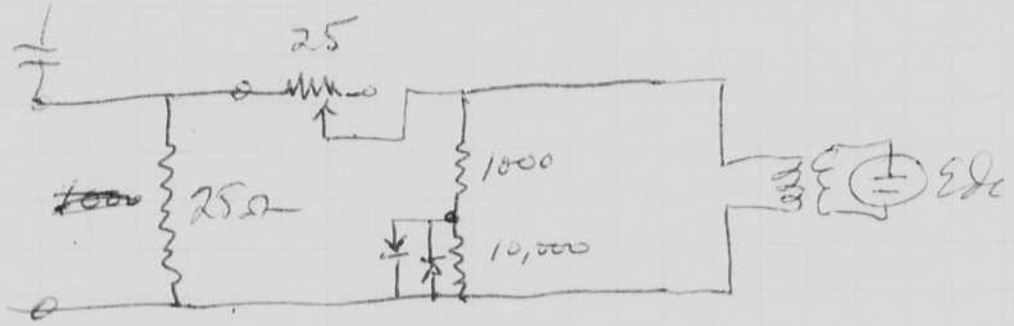
Mud Penetrator

H. E. Edgerton .
Max Roberts
May 20, 1962.

Modifications

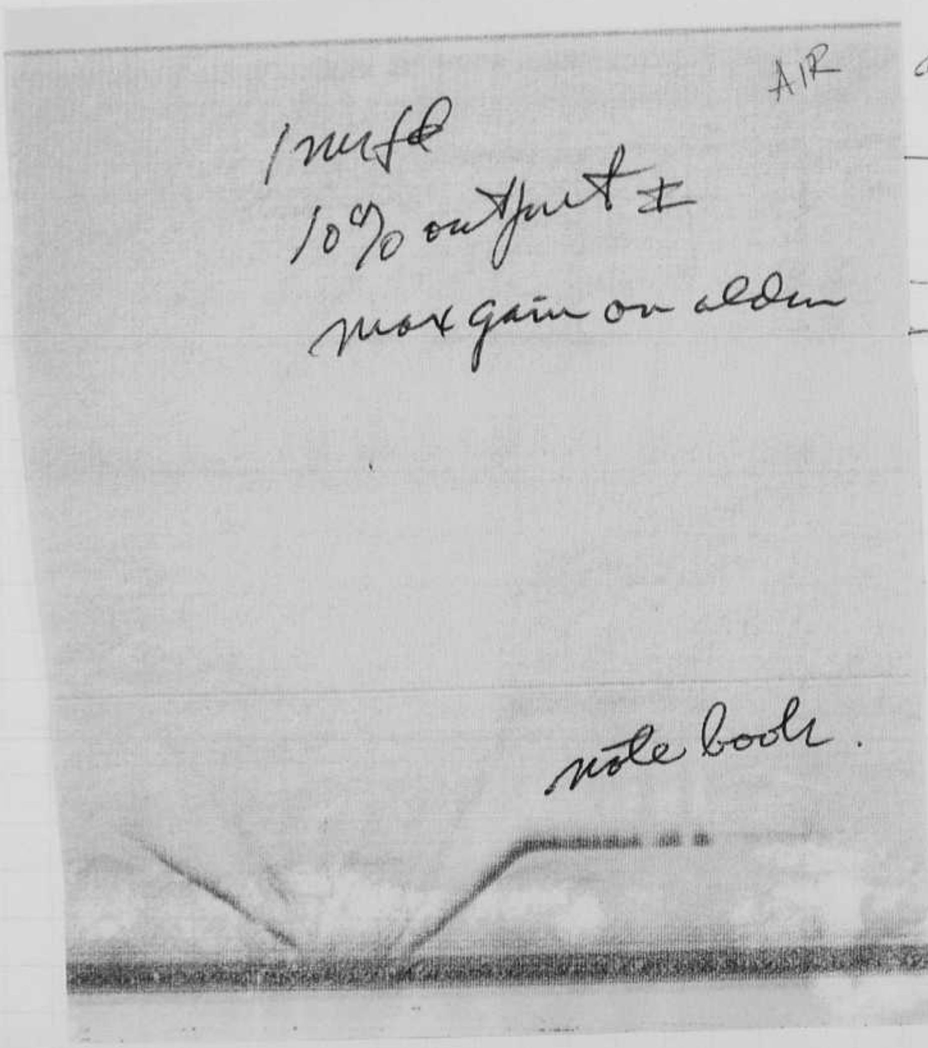
(1) Med. gain showed initial light area okay?
High and low were OK.

(2)

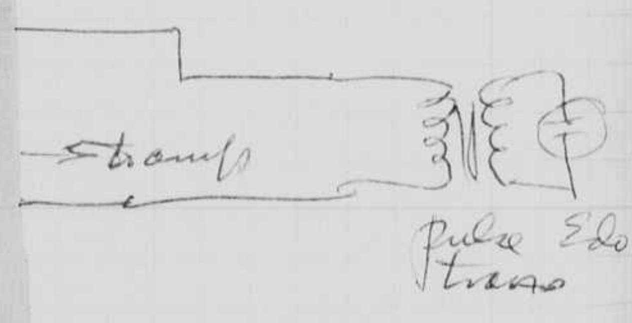


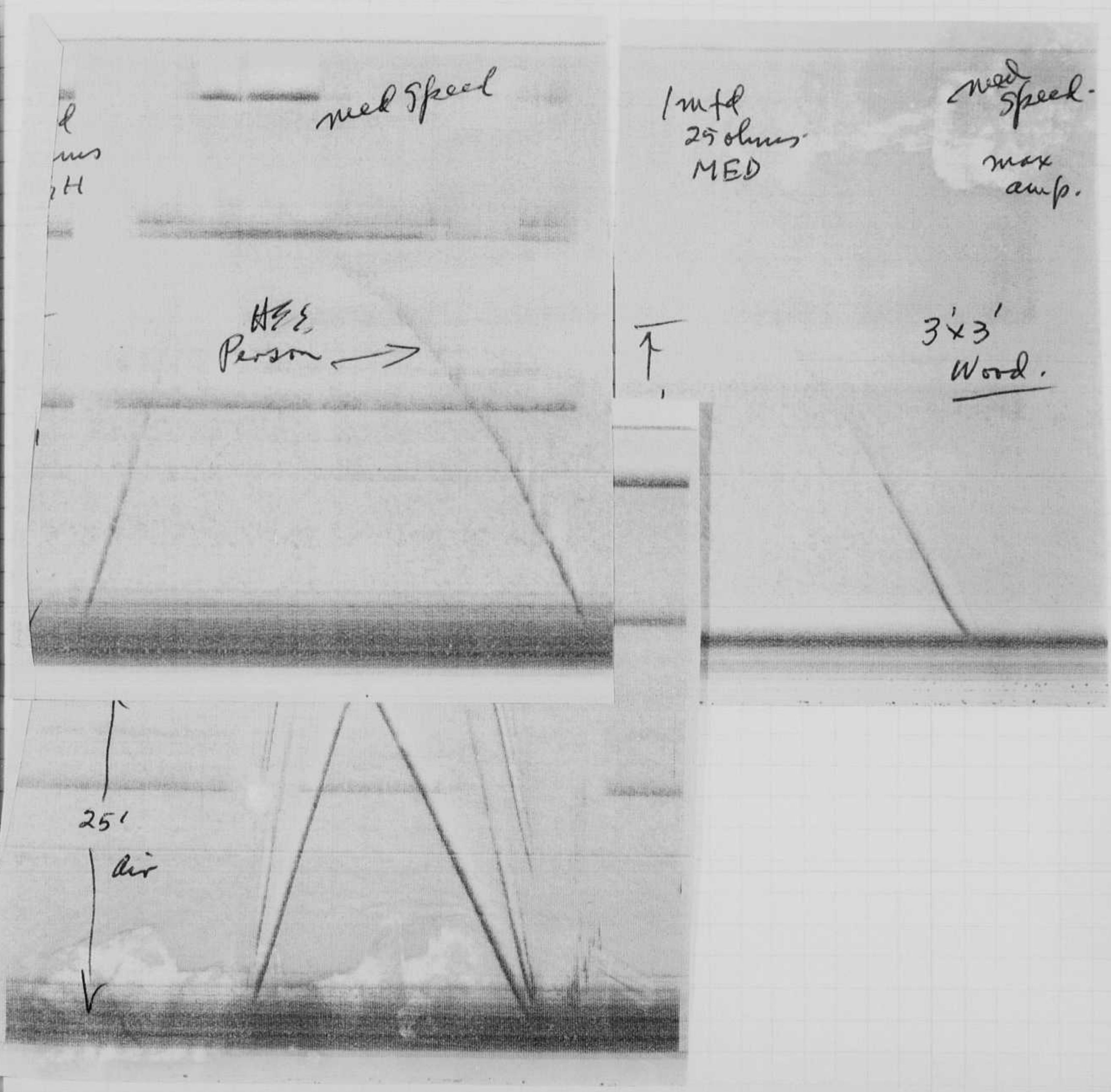
(3) Series Resistor in amp changed
from 400 to 200 ohms to increase
current into output. makes a
darker trace.

(4) Output C now can be either 1 or 2 mfd



above




med Speed
Person
1 mfd
25 ohms
MED
med Speed
max amp.
3'x3'
Wood.
25'
Air

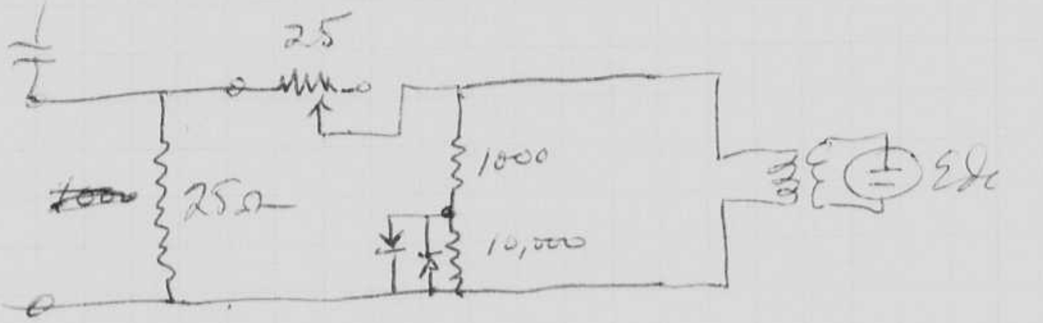
Mud Penetrator

H. Edgerton
MacRoberts
May 20, 1962.

Modifications

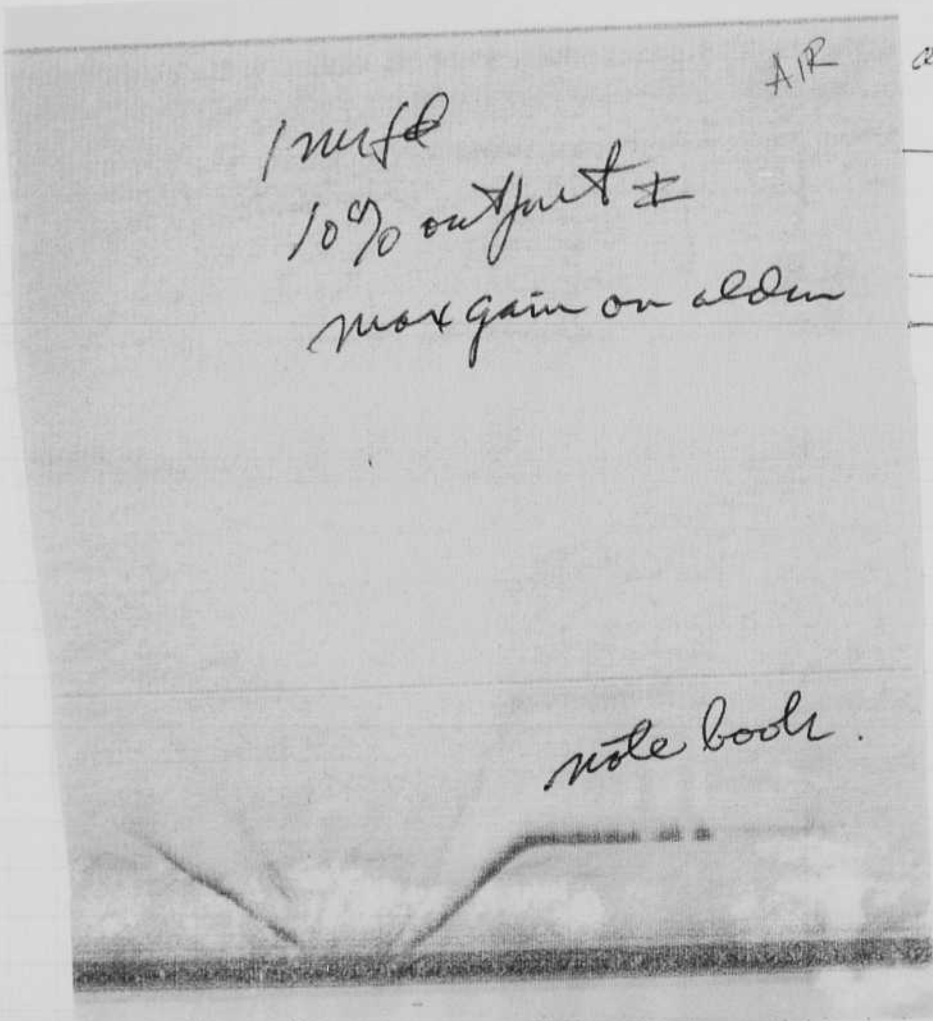
(1) Med gain showed initial light area. Why?
High and low were OK.

(2)

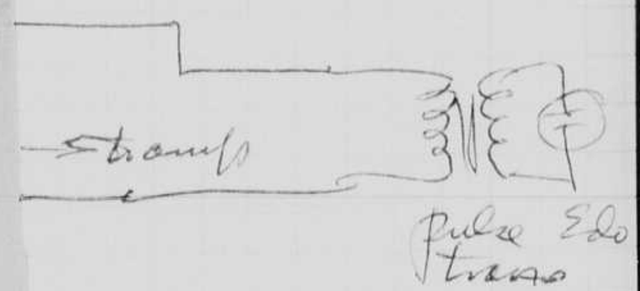


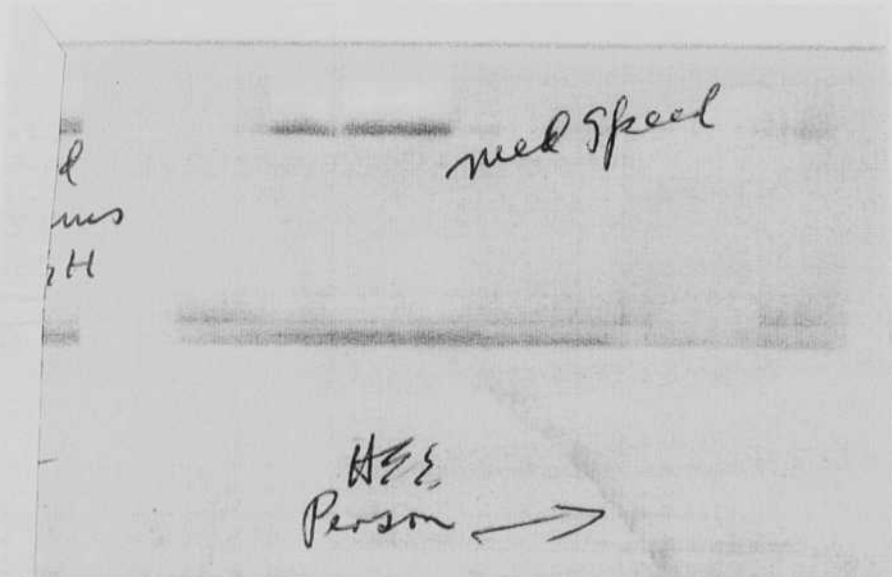
(3) Series Resistor in amp changed from 400 to 200 ohms to increase current into output. Makes a darker trace.

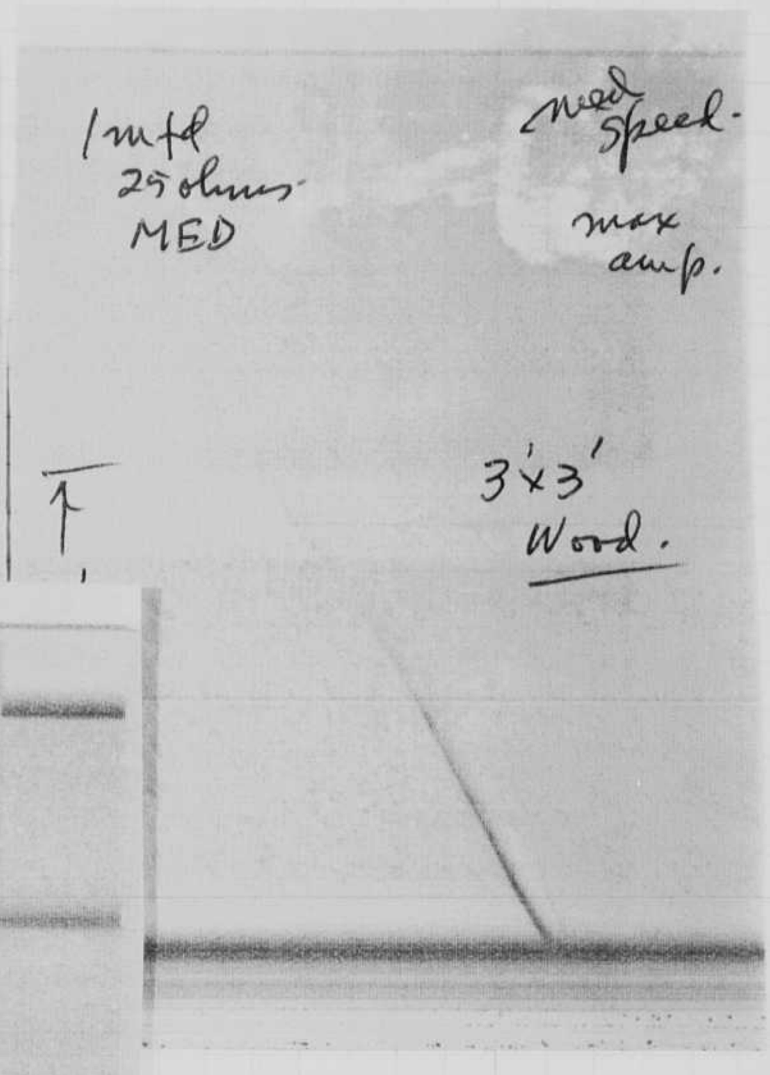
(4) Output C now can be either 1 or 2 mfd

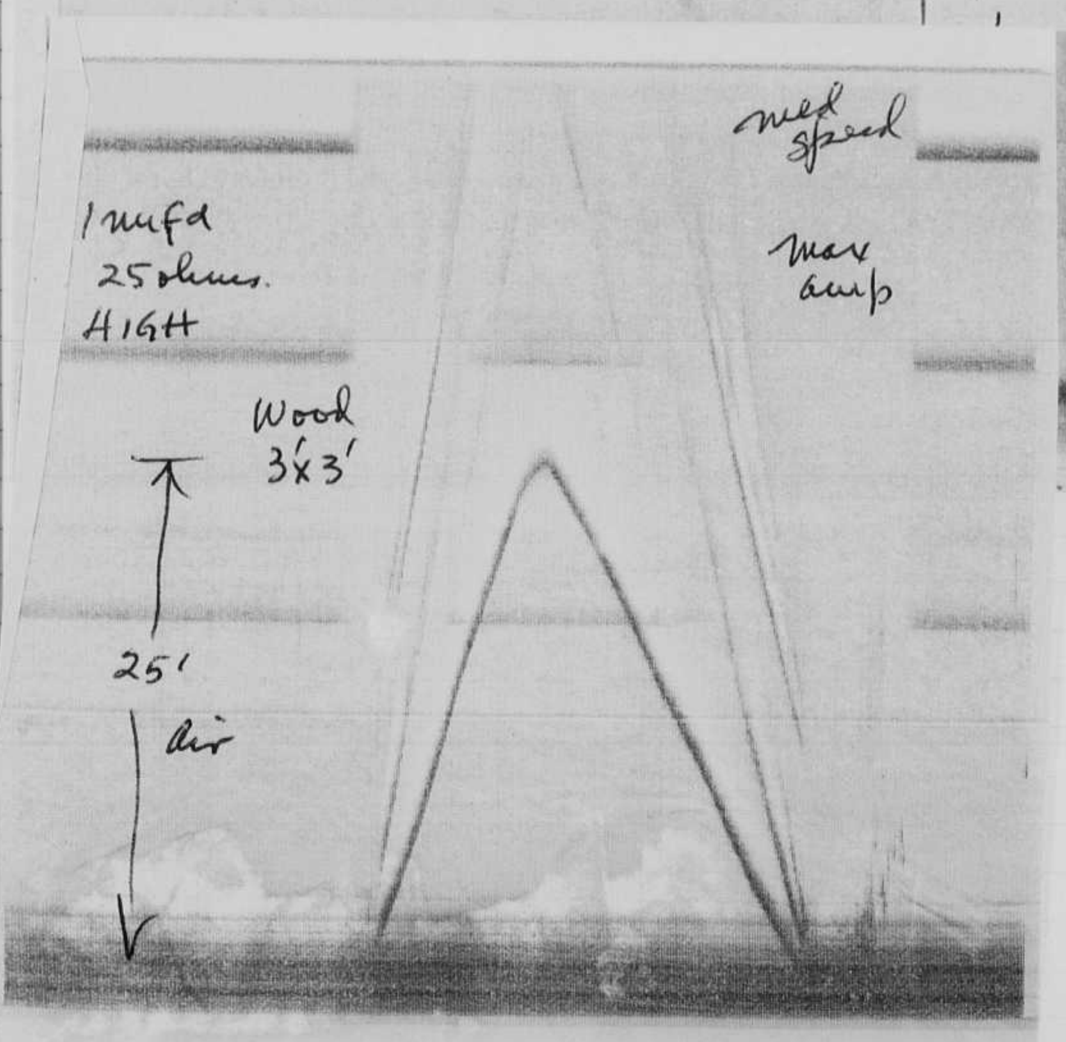


above




med Speed
Person


1 mfd
25 ohms
MED
med Speed
max amp.
3'x3'
Wood.


med speed
1 mfd
25 ohms.
HIGH
max amp
Wood
3'x3'
25'
air

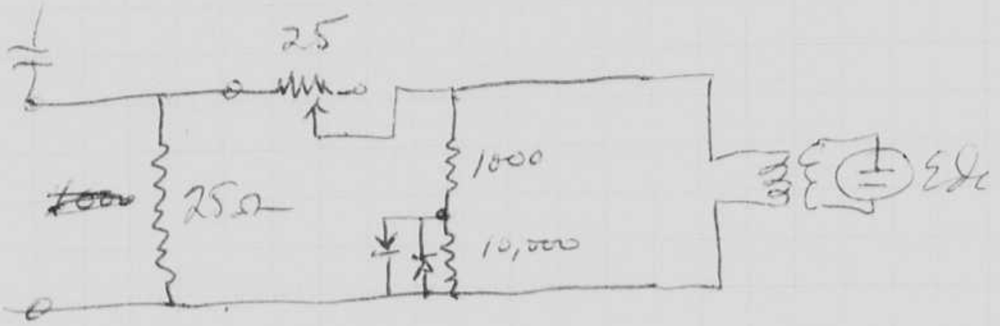
Mud Penetrator

H. Edgerton
MacRoberts
May 20, 1962.

Modifications

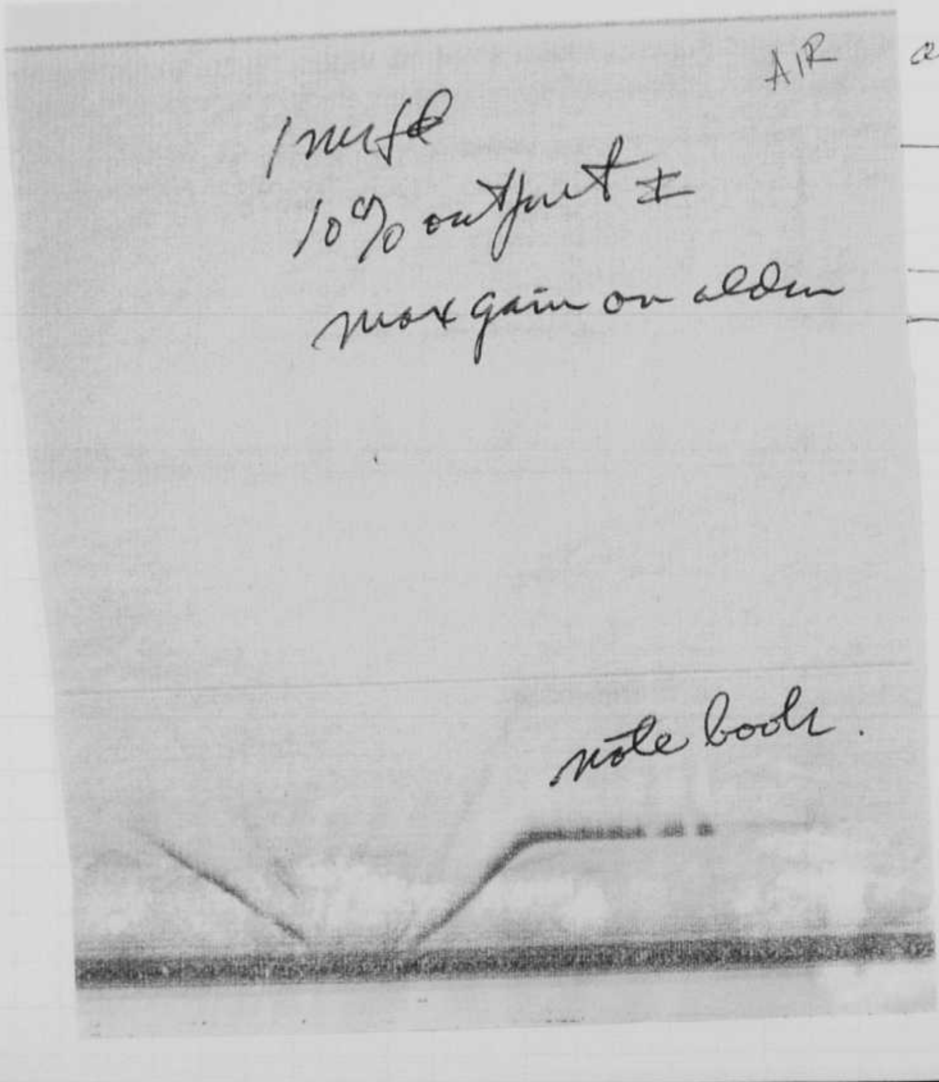
(1) Med gain showed initial light area (deep?). High and low were OK.

(2)

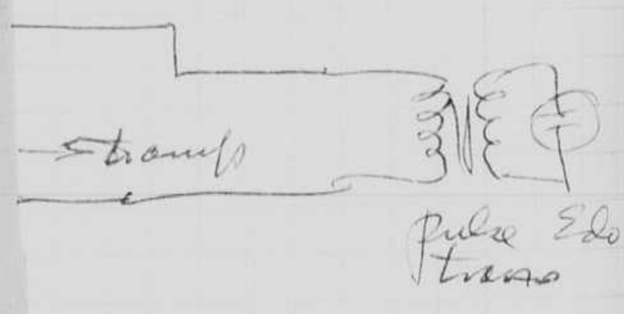


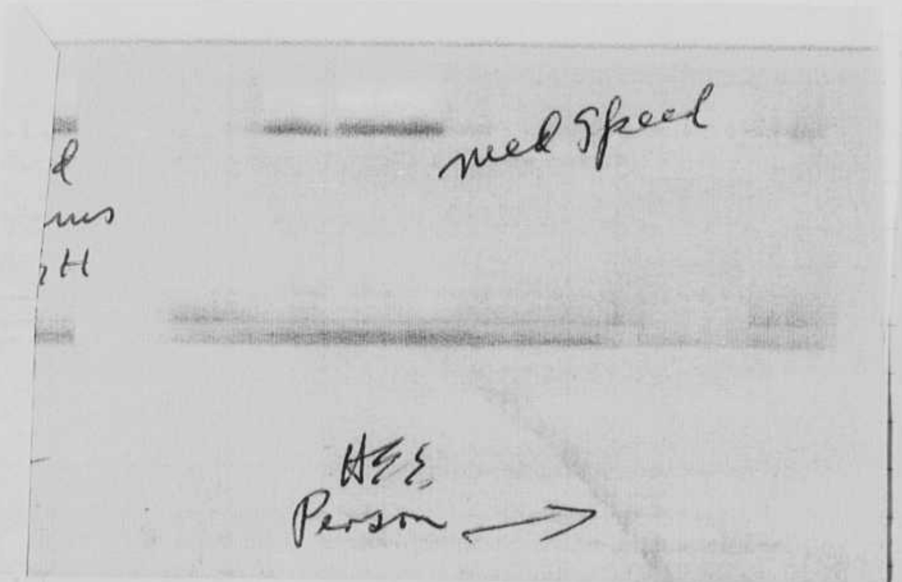
(3) Series Resistor in amp changed from 400 to 200 ohms to increase current into output. makes a darker trace.

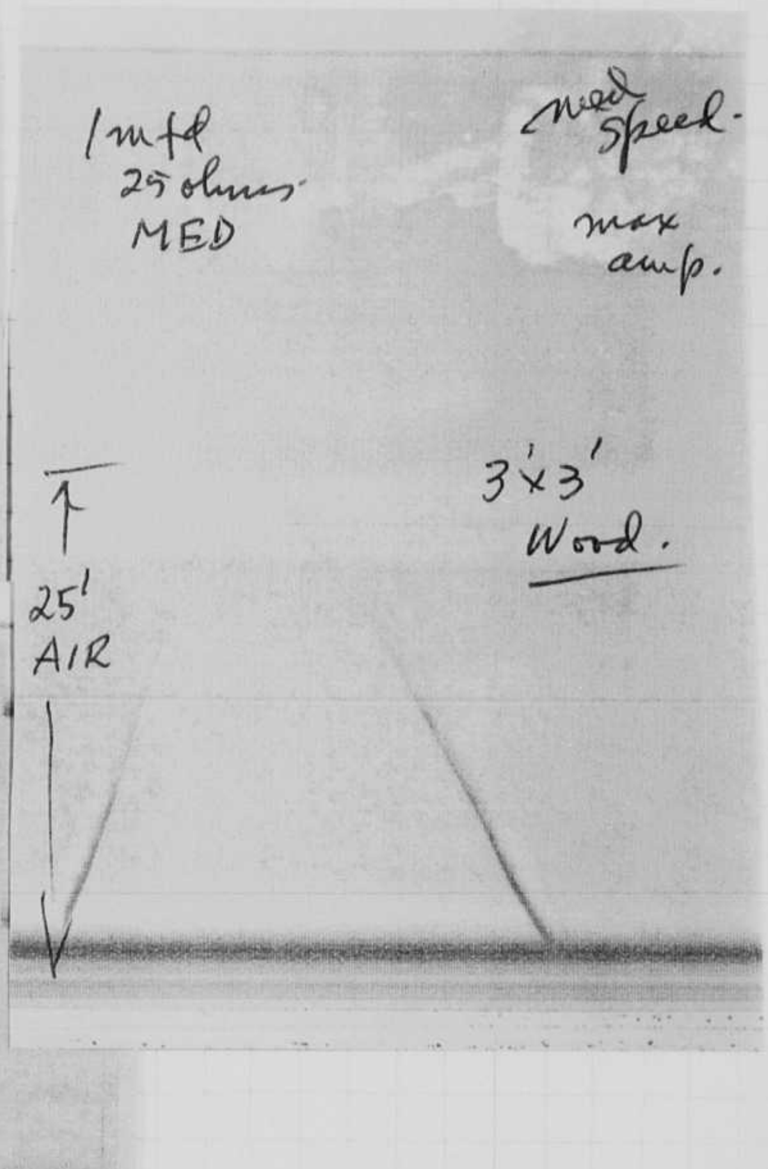
(4) Output C now can be either 1 or 2 mfd

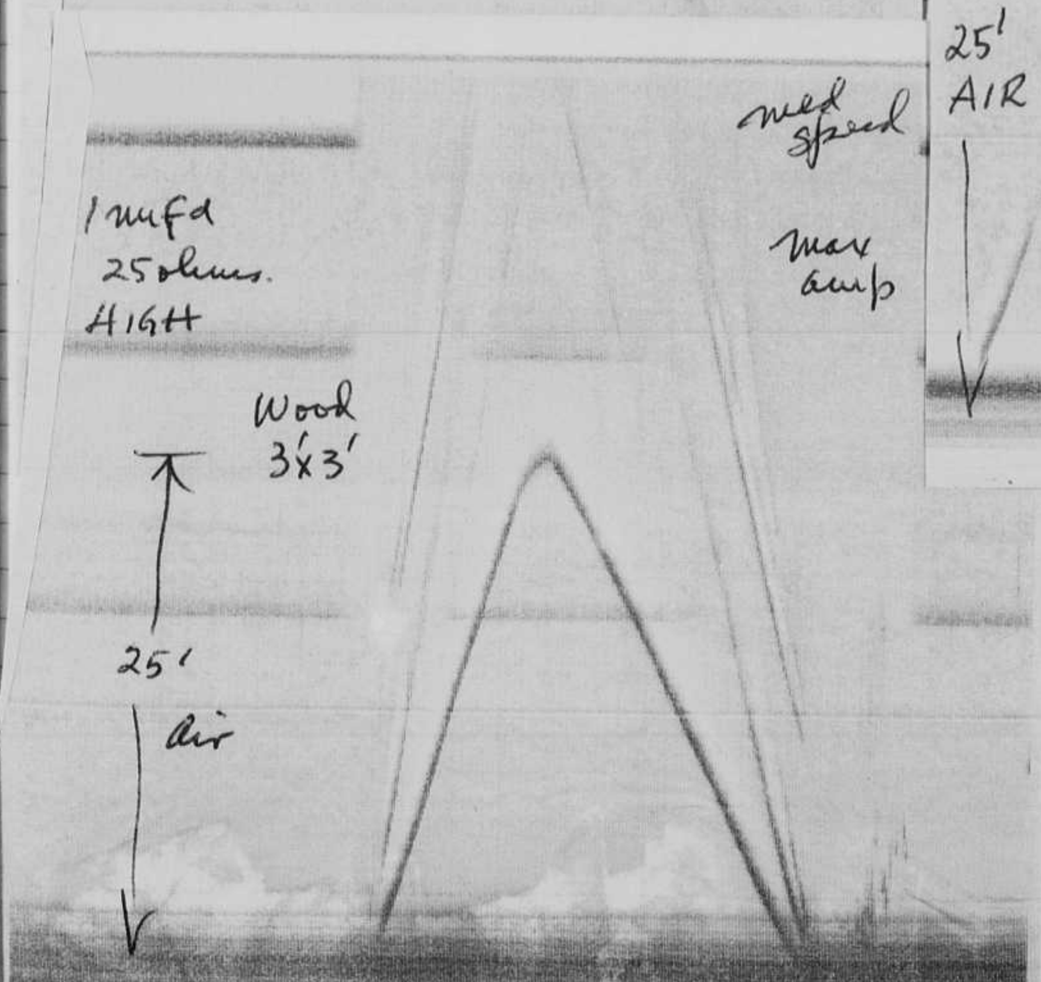


above




med Speed
Person


1 mfd
25 ohms.
MED
med Speed-
max amp.
3'x3'
Wood.
25'
AIR


med speed
1 mfd
25 ohms.
HIGH
max amp
Wood
3'x3'
25'
Air

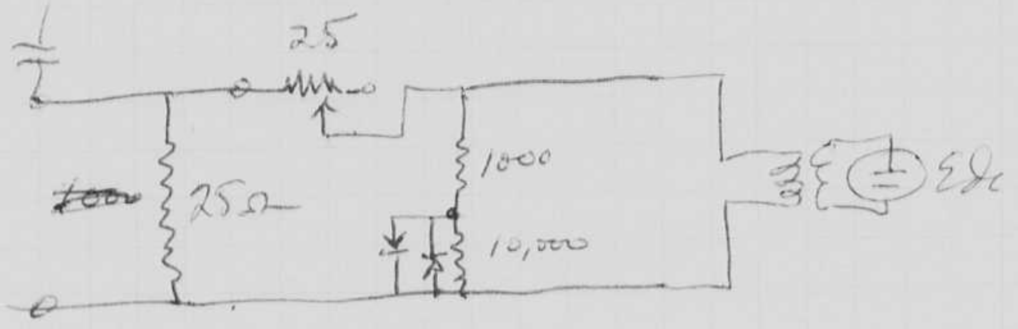
Mud Penetrator

H. Edgerton
Mac Roberts
May 20, 1962.

Modifications

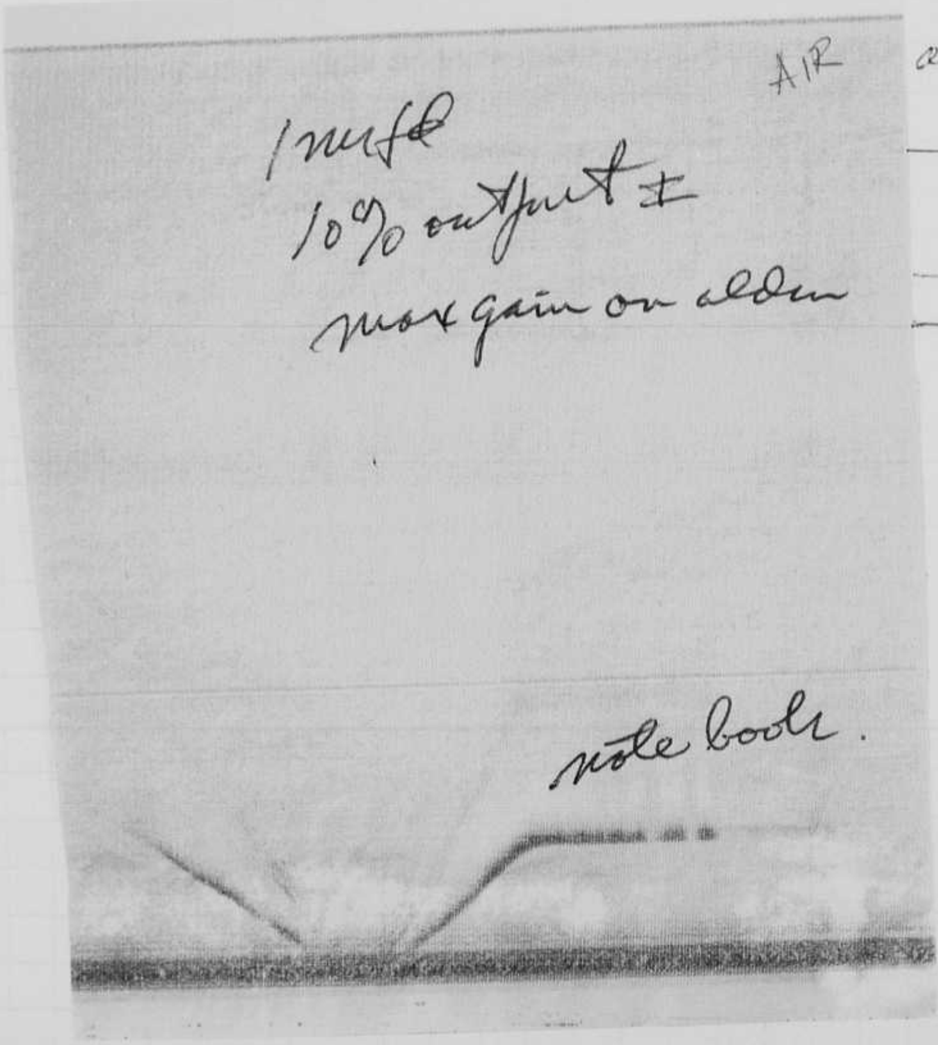
(1) Med gain showed initial light area step? High and low were OK.

(2)

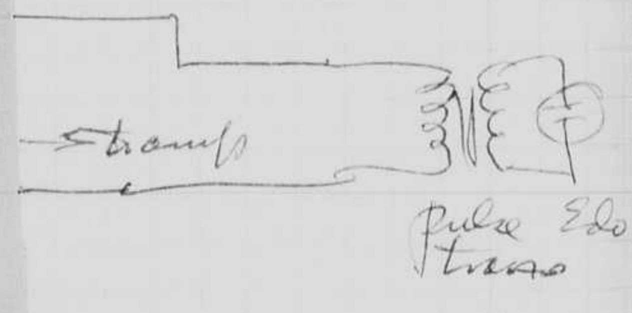


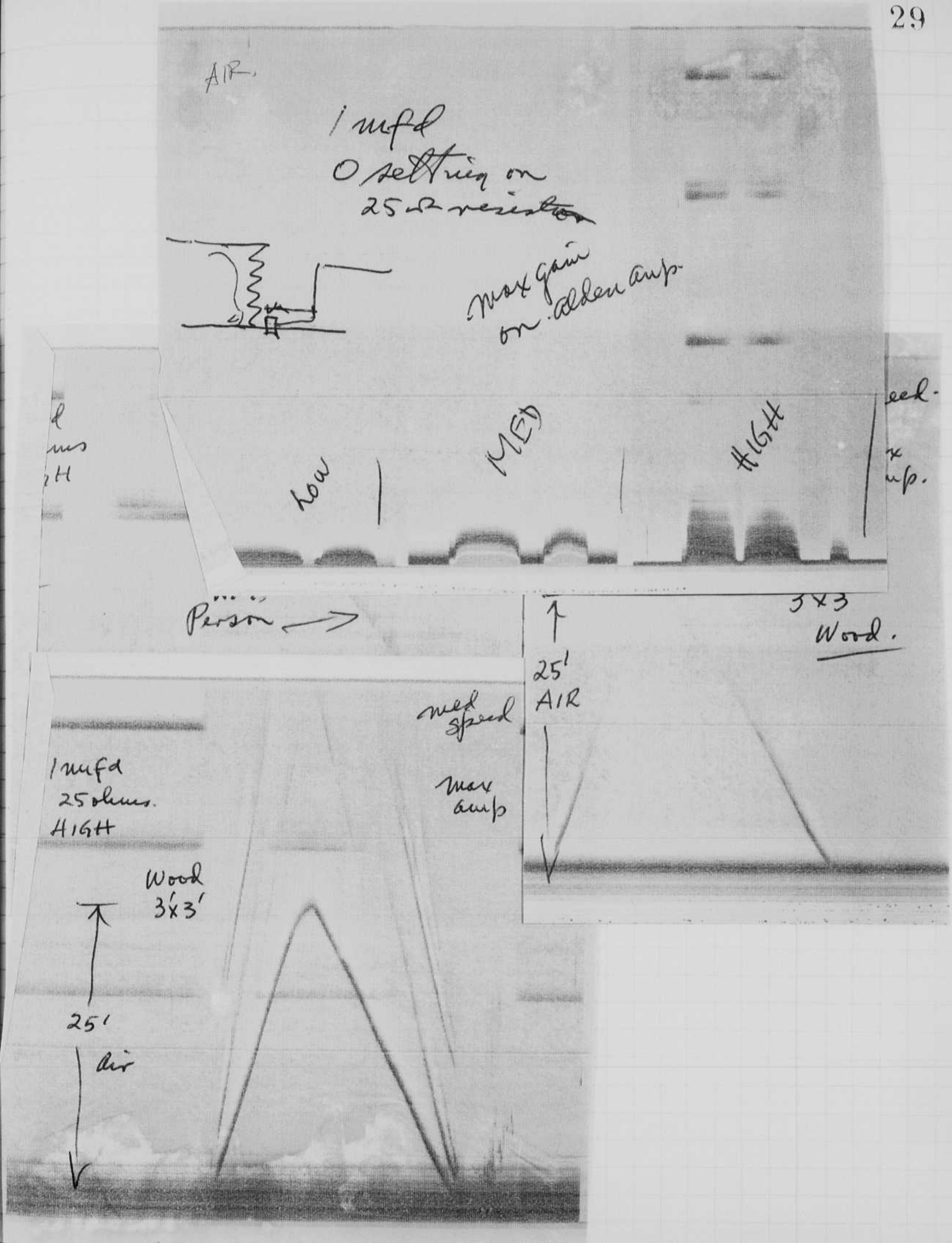
(3) Series Resistor in amp changed from 400 to 200 ohms to increase current into output. makes a darker trace.

(4) Output C now can be either 1 or 2 mfd



above

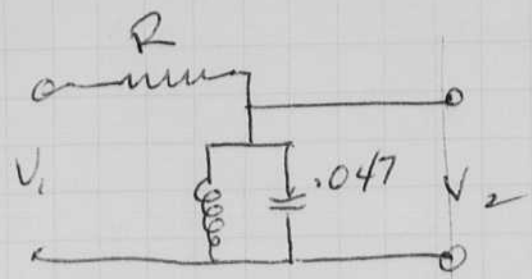



AIR.
1 mfd
0 setting on
25 Ω resistor
max gain
on alden amp.
LOW
MED
HIGH
Person
3x3
Wood.
25'
AIR
med
speed
max
amp
1 mufd
25 ohms.
HIGH
Wood
3'x3'
25'
air

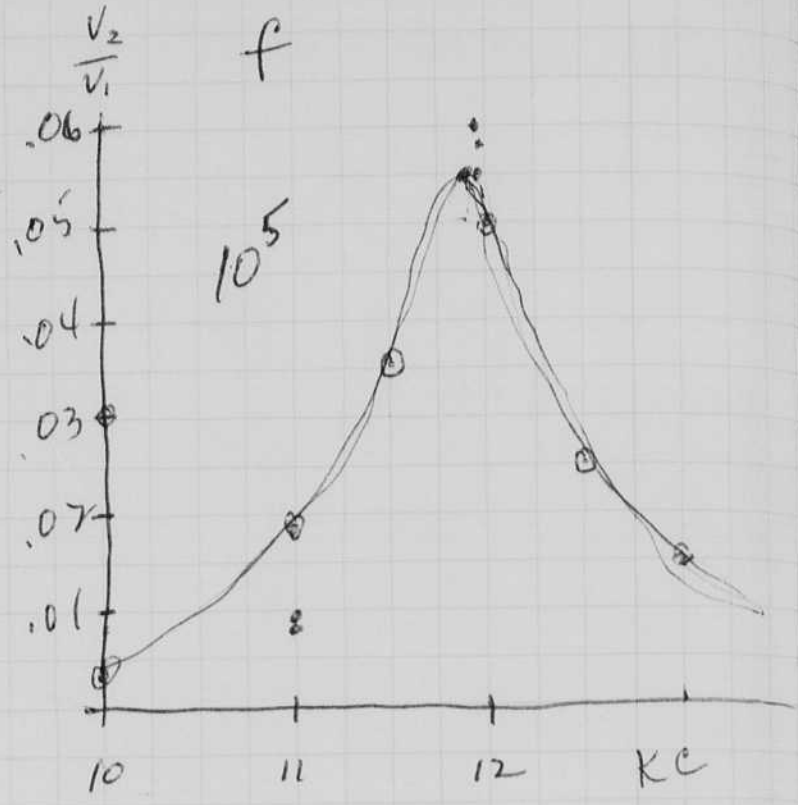
 May 23 1962

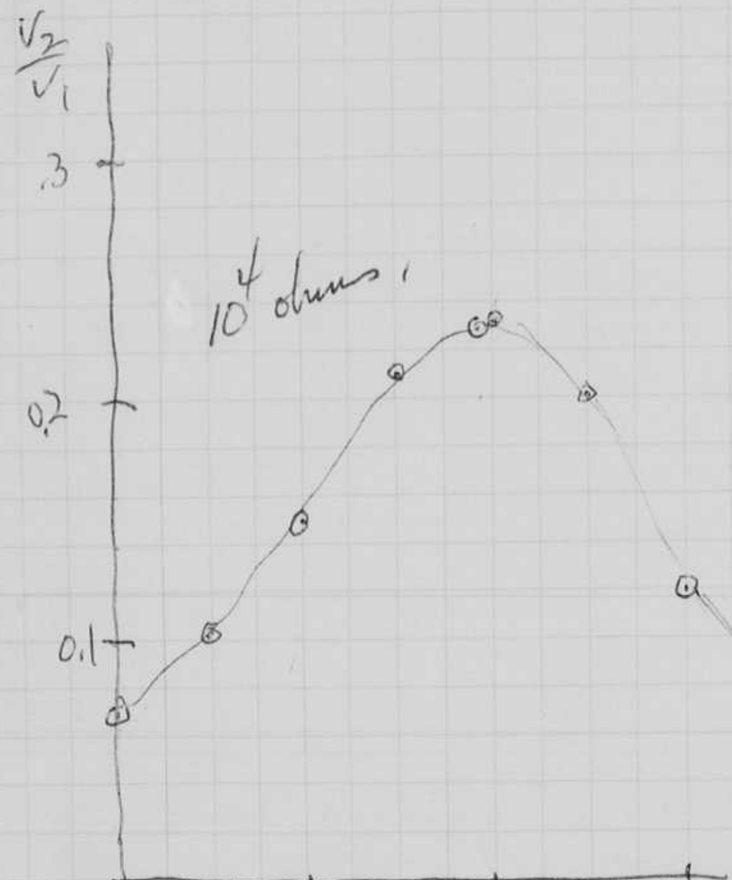
Filter

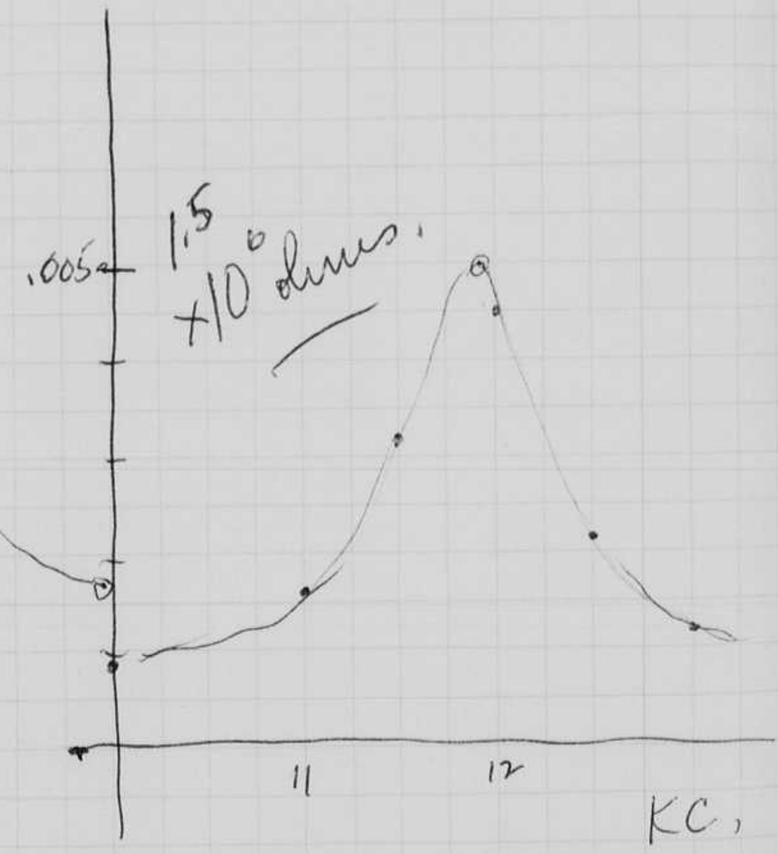
H. Edgerton.



$\frac{V_2}{V_1} = .5$







5x5=25V 6V

in	0.5 mv	Gain.	5 mv	
Low	15	30	500	100
med	250	500	2.5V	500
Hi.	3	6000	5	1000

~~Gain~~ No filter Freq. Gain.

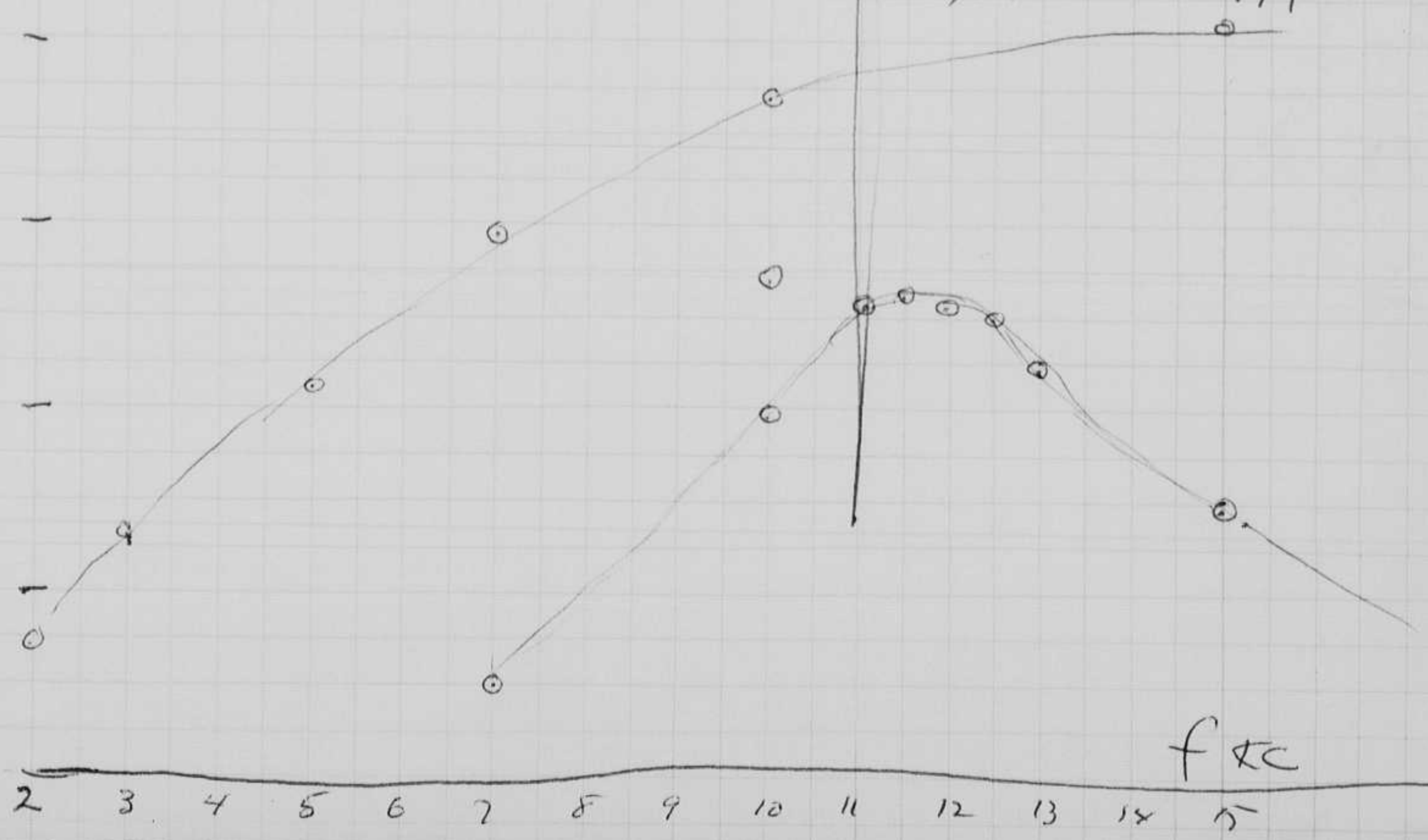
Freq.	Gain
20 K.C.	5.04 volts
15 KC.	5.0 "
10 KC.	4.7 "
7 K.C.	2.9 "
5 K.C.	2.2 "
3 K.C.	1.3 "
2 K.C.	0.7

Marty's Filter Hamarlund coil .07 mfd.

~~11.5 2.8 volts~~
~~11kc. 2.7 volts~~
~~10kc 1.9 volts~~
~~.047 volts~~
~~.02 volts~~

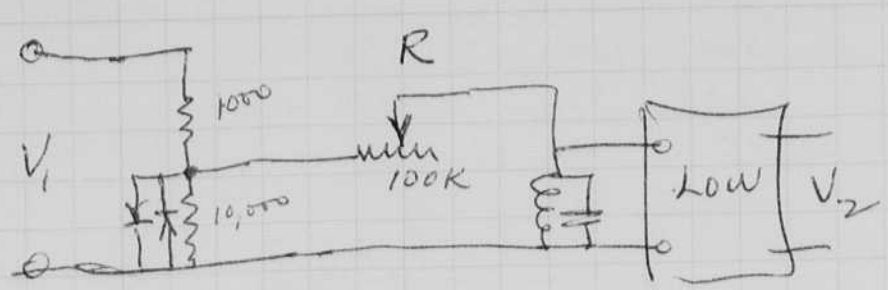
20 K.C.	.42 volts
15 "	.42 "
10 K.C.	.37 "
7 "	.29 "
5 "	.22 "
3 "	.13 "
2 "	.07 "

Freq.	Output
7 K.C.	.05 volts
10 "	.19 "
11 "	.26 "
11.5 "	.27 "
12 "	.26 "
12.5 "	.25 "
13.0 "	.22 "
15.0 "	.14 "



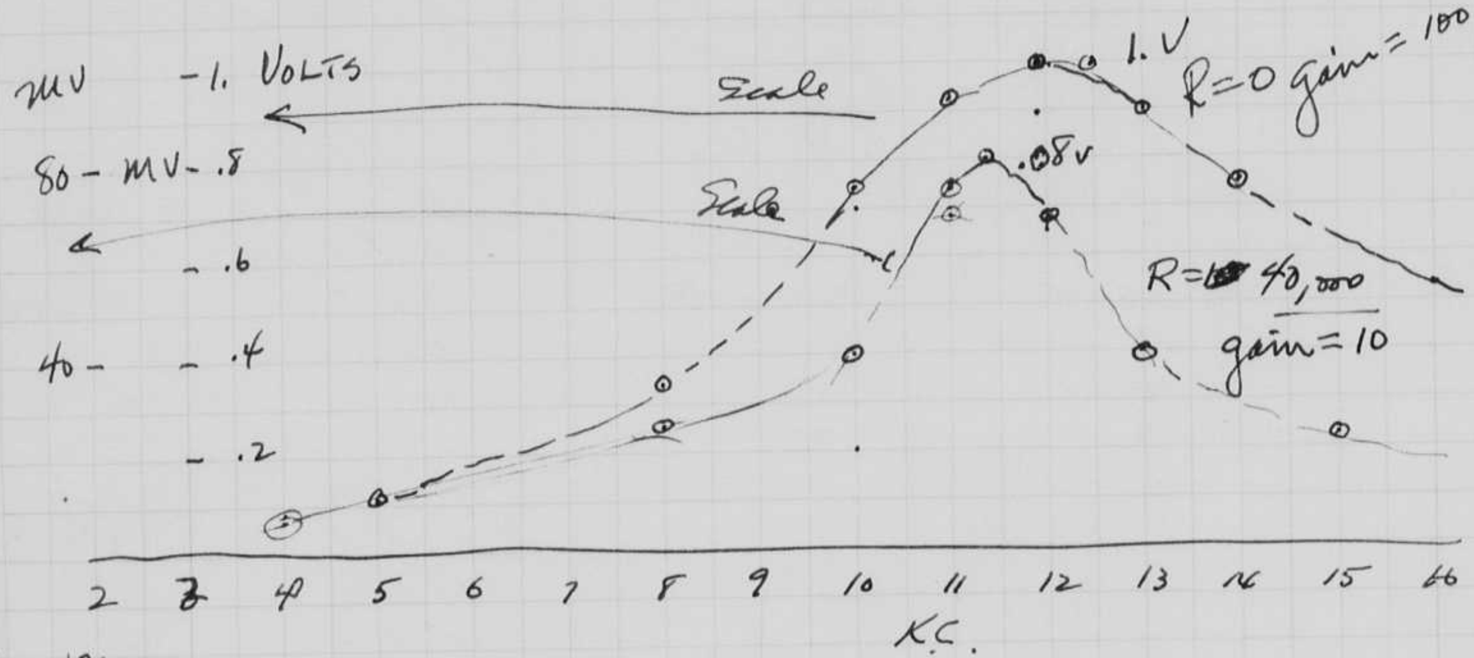
5/22/62

H.E.E.



output = 10 mv.

With R at O. V_1 = 10 mv



37
2
74

3.4
2

1.2
2
2.4

.2
2

3.7

4.6
2

2.7
2
5.4

1.7
2
3.4

9
2

5/23/62

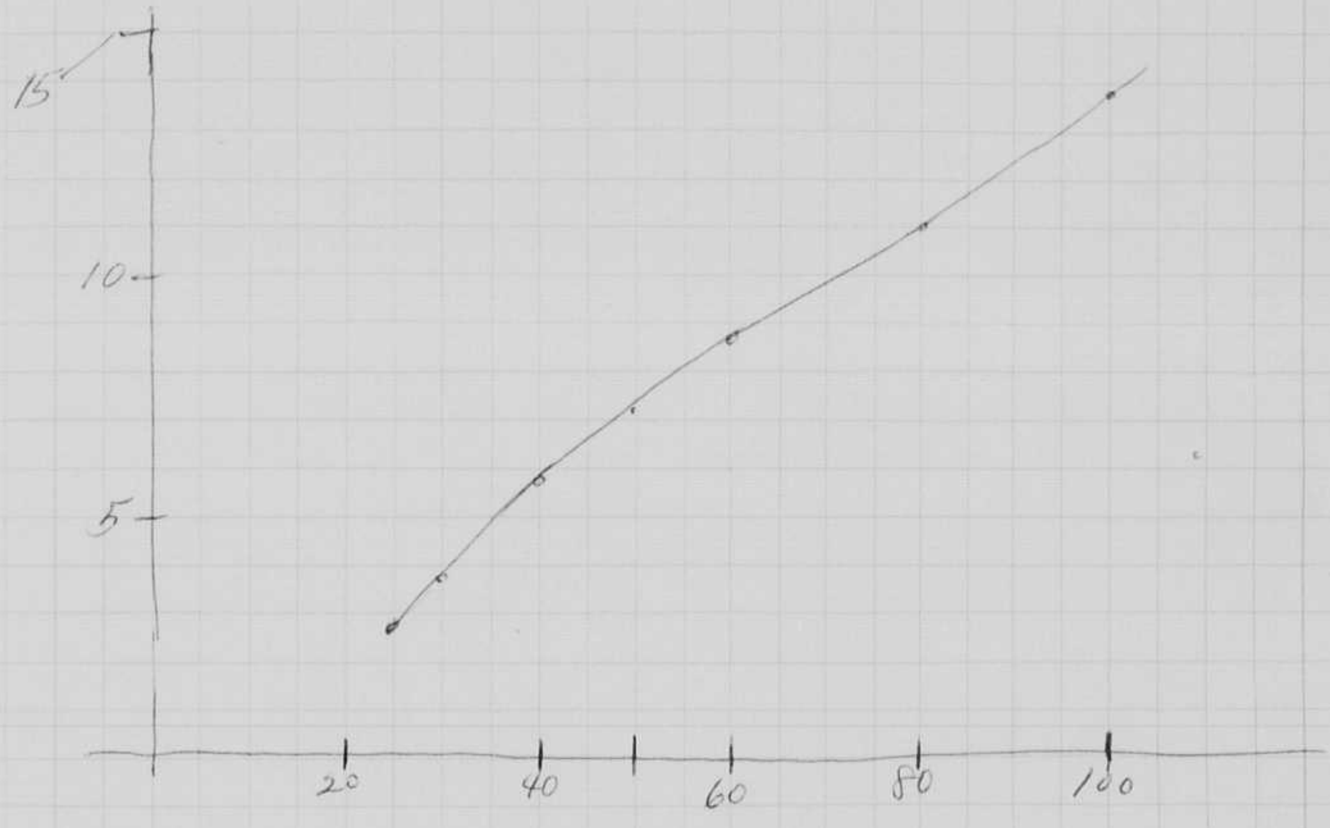
H.E.E.
Earl V.R.
V.E.M.

Mud Penetrator # 3

Paper speed.

Dial.

100	13.75 in/min.
80	11.0 "
60	8.375 "
40	5.25 "
20	Tears.
30	3.75 "
25	2.75 "



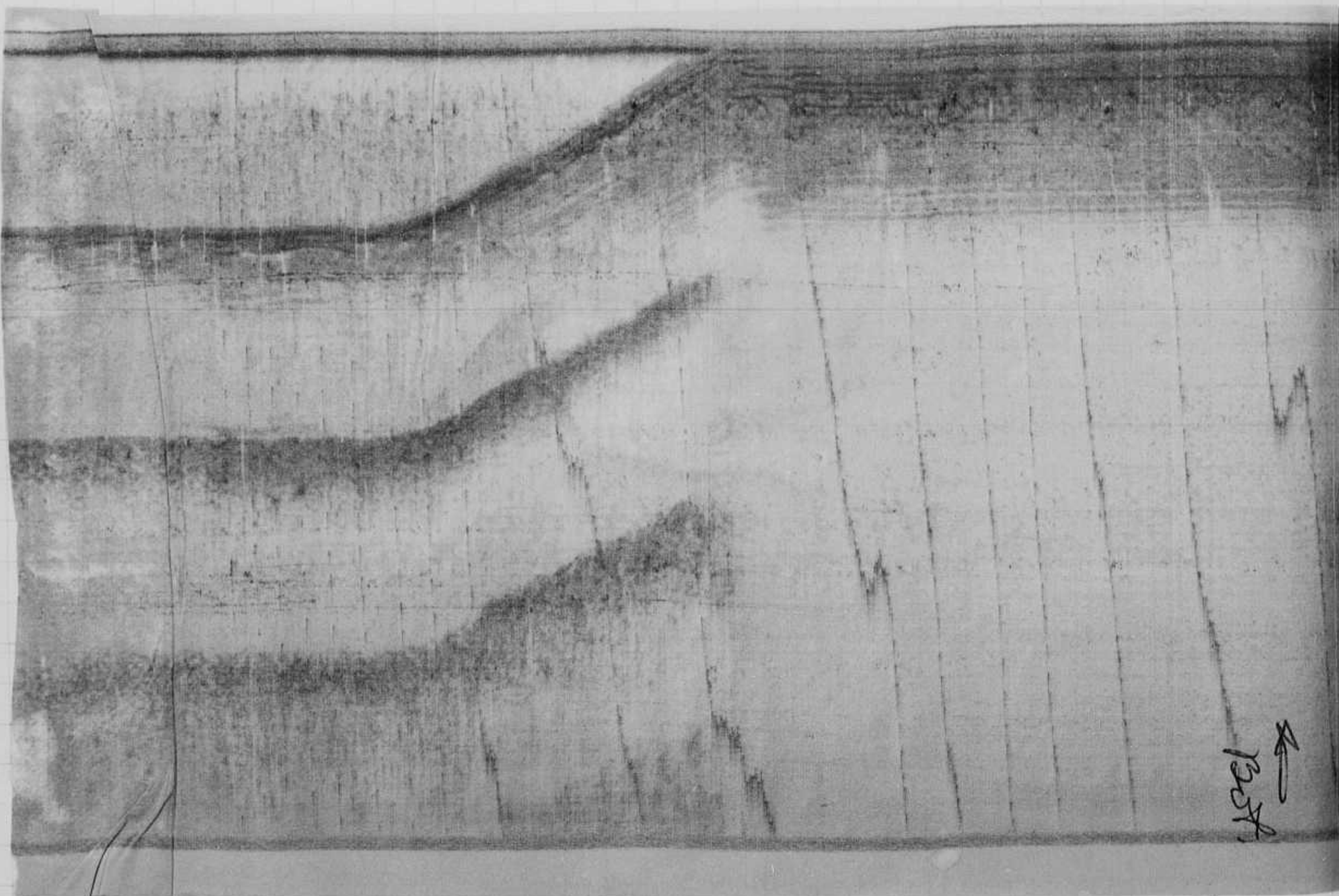
 May 29 1962

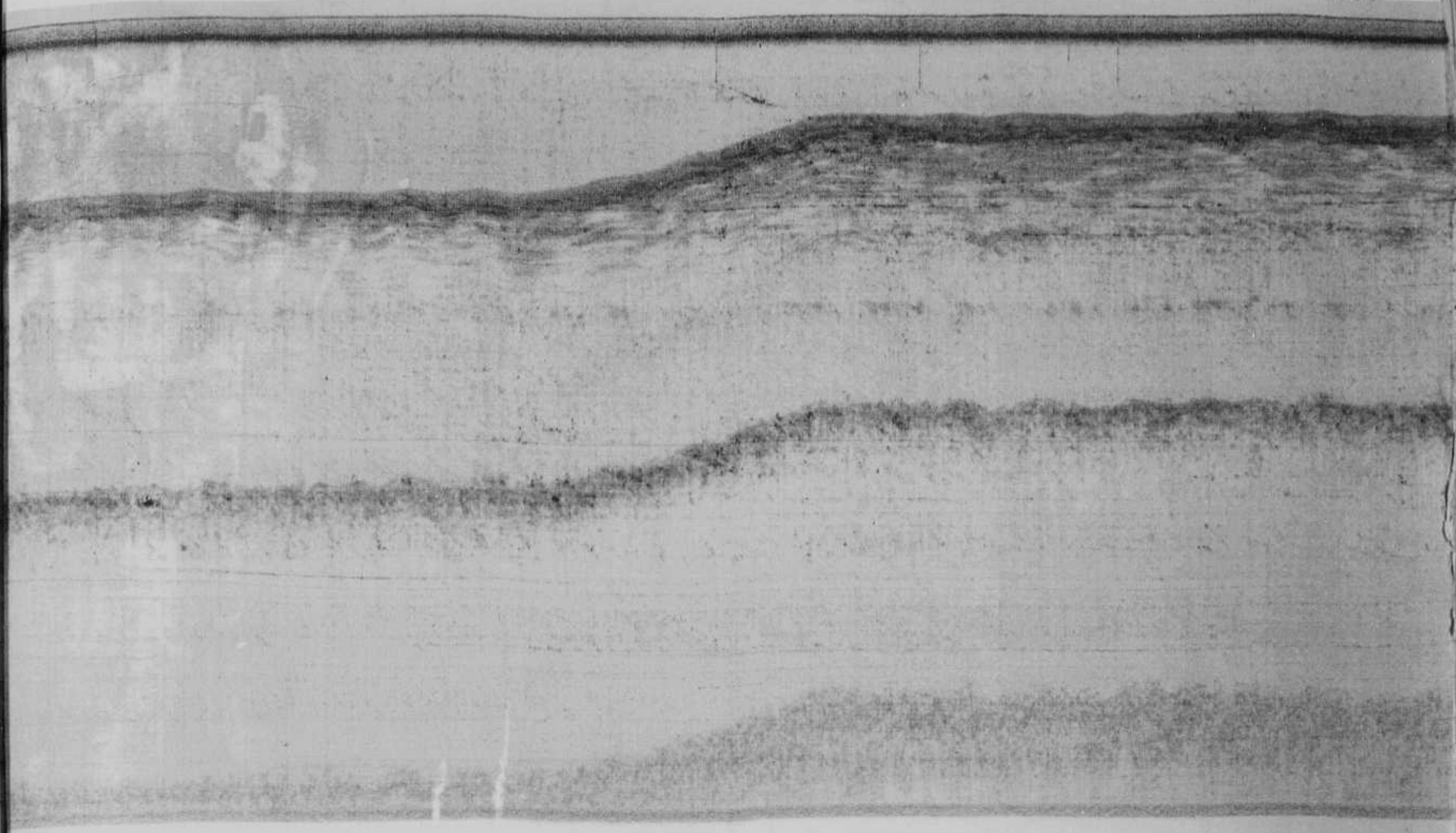
Harold Edgerton

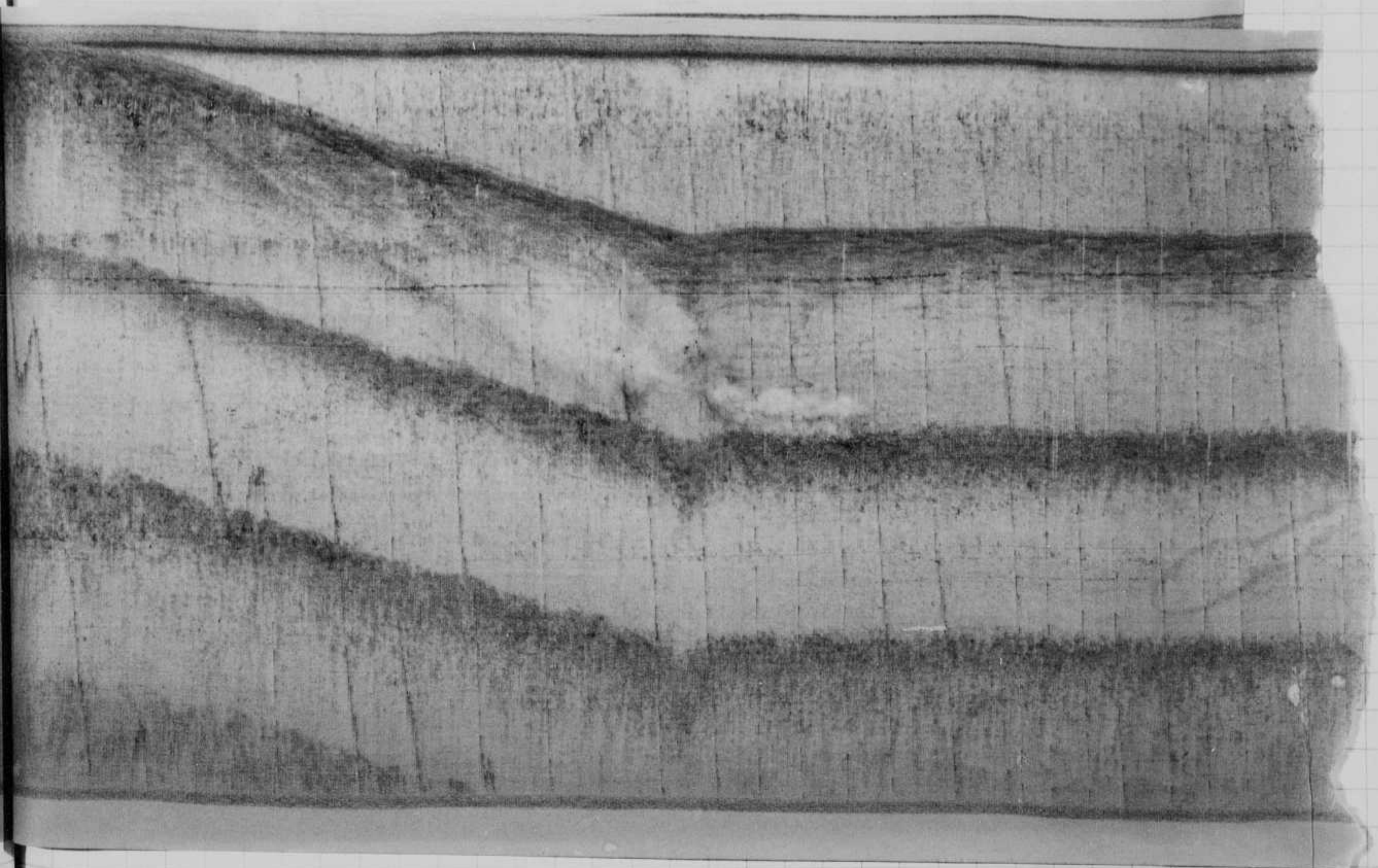
4-405 / M.I.T.

I have been working a lot with the Mud Penetrator the past few weeks. By reducing the pinger output, I have been able to see a lot more.

Yesterday I showed Van Reenan the device in the Charles River. We could see the false







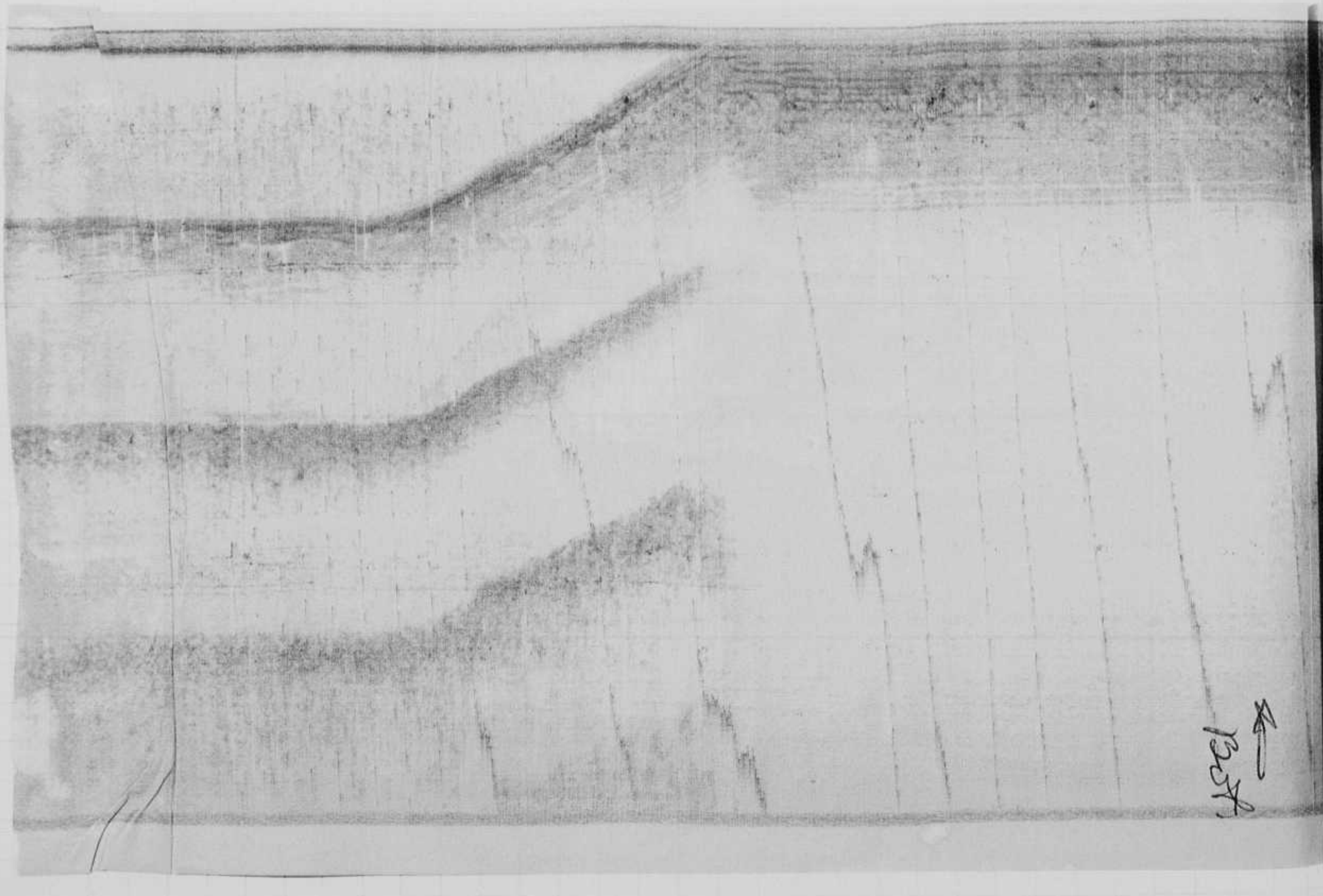
May 29 1962

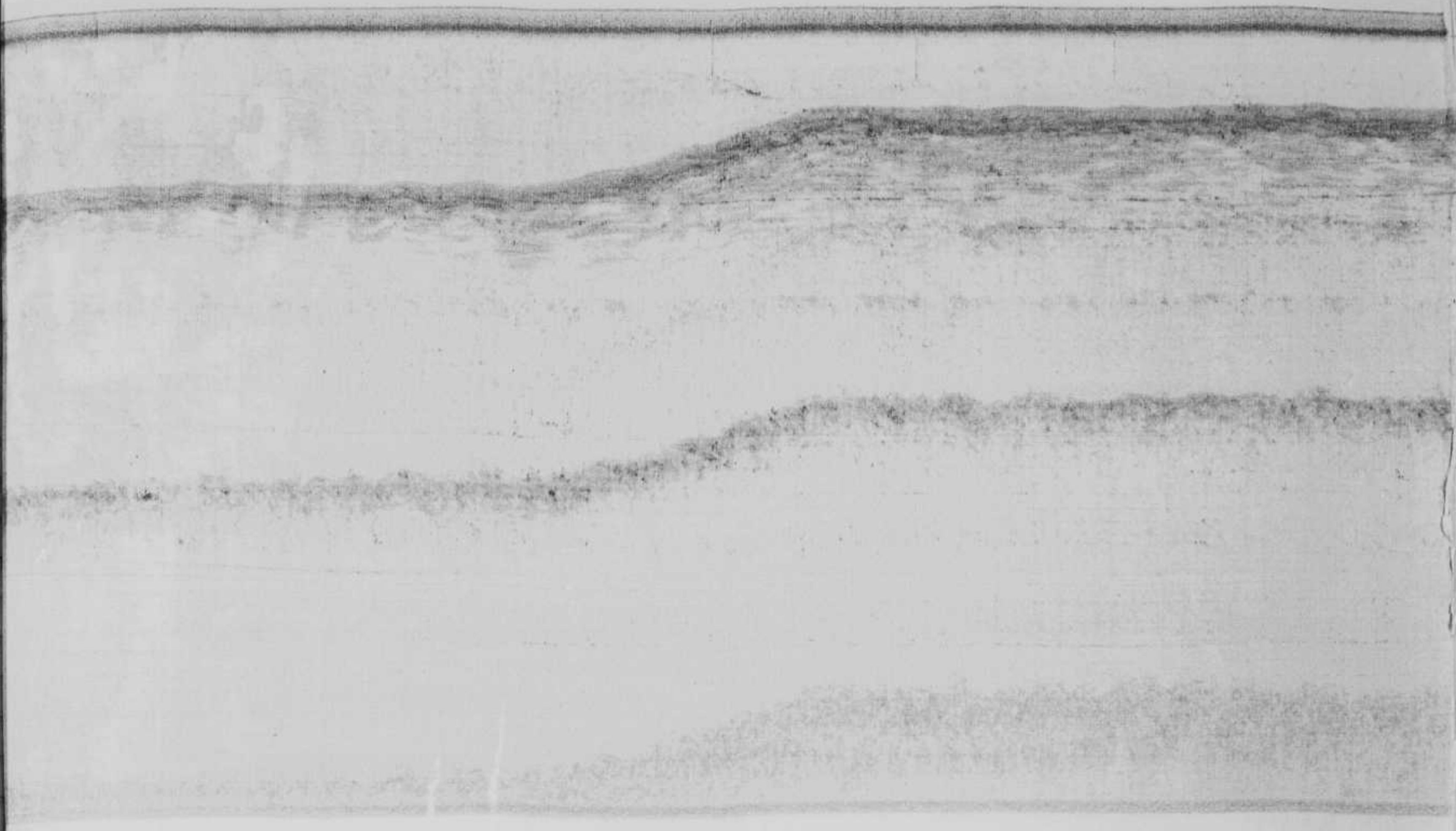
Harold Edgerton

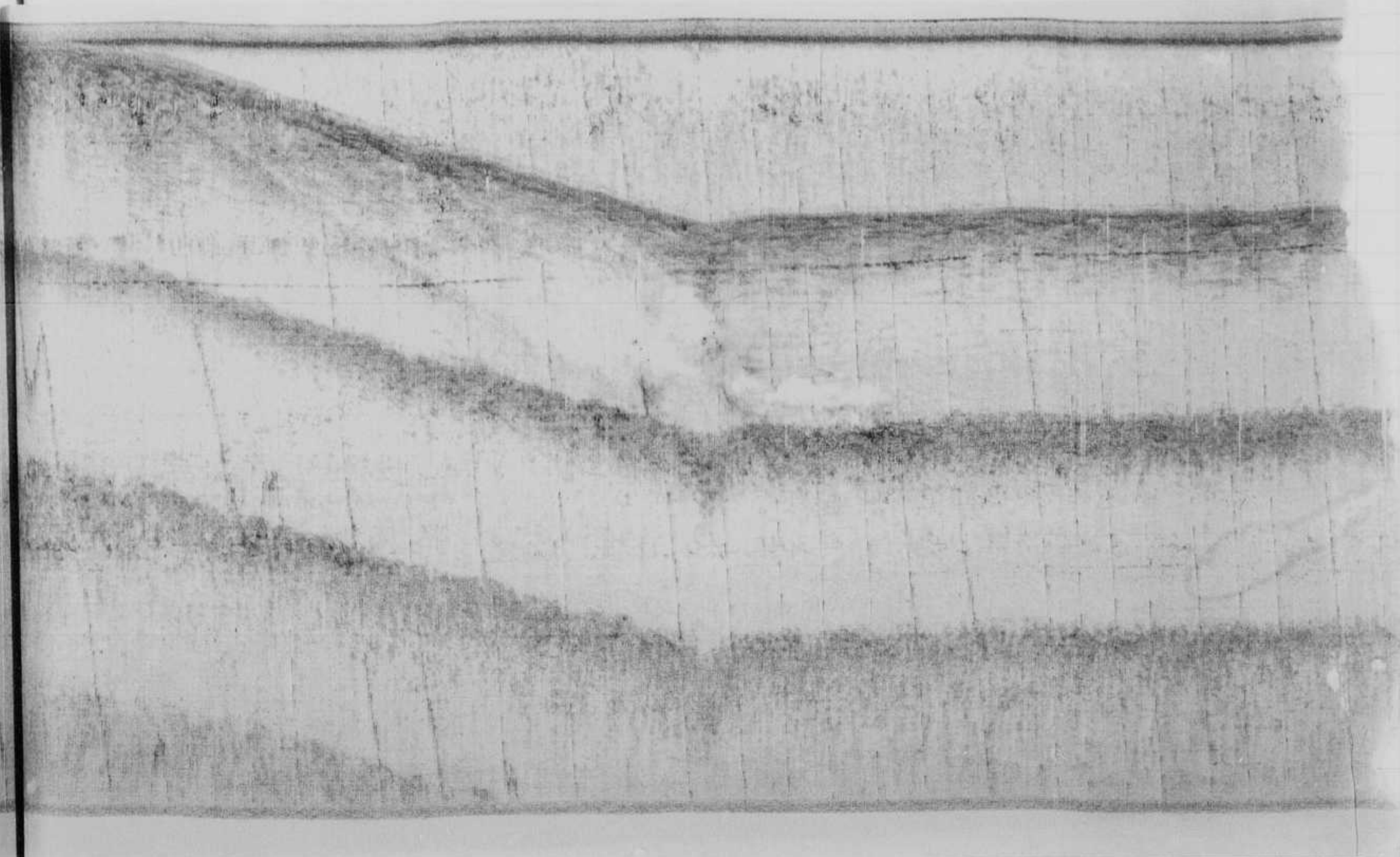
4-405 / M.I.T.

I have been working a lot with the Mud Penetrator the past few weeks. By reducing the pinger output, I have been able to see a lot more.

Yesterday I showed Van Reenan the device in the Charles River. We could see the false





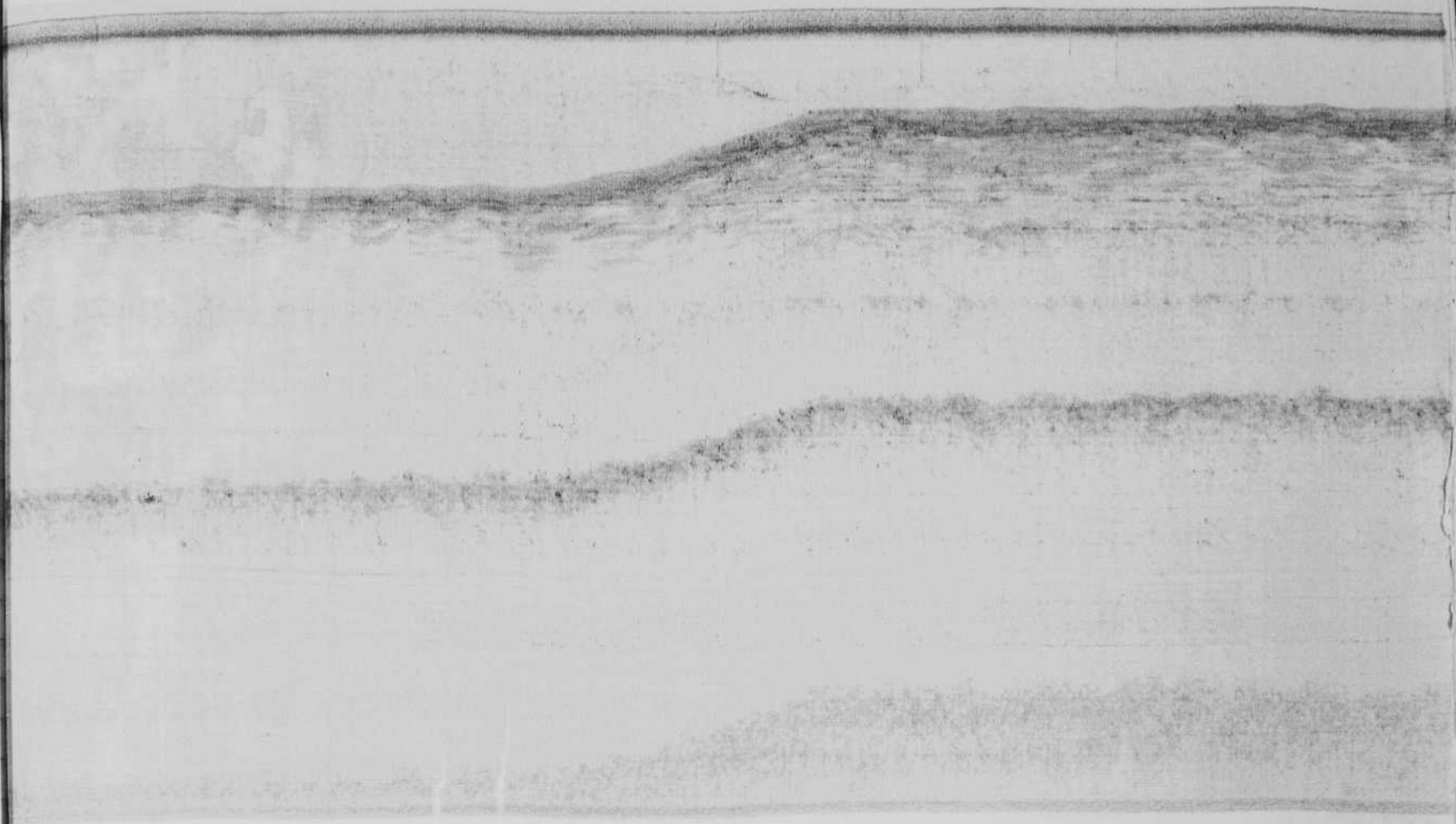


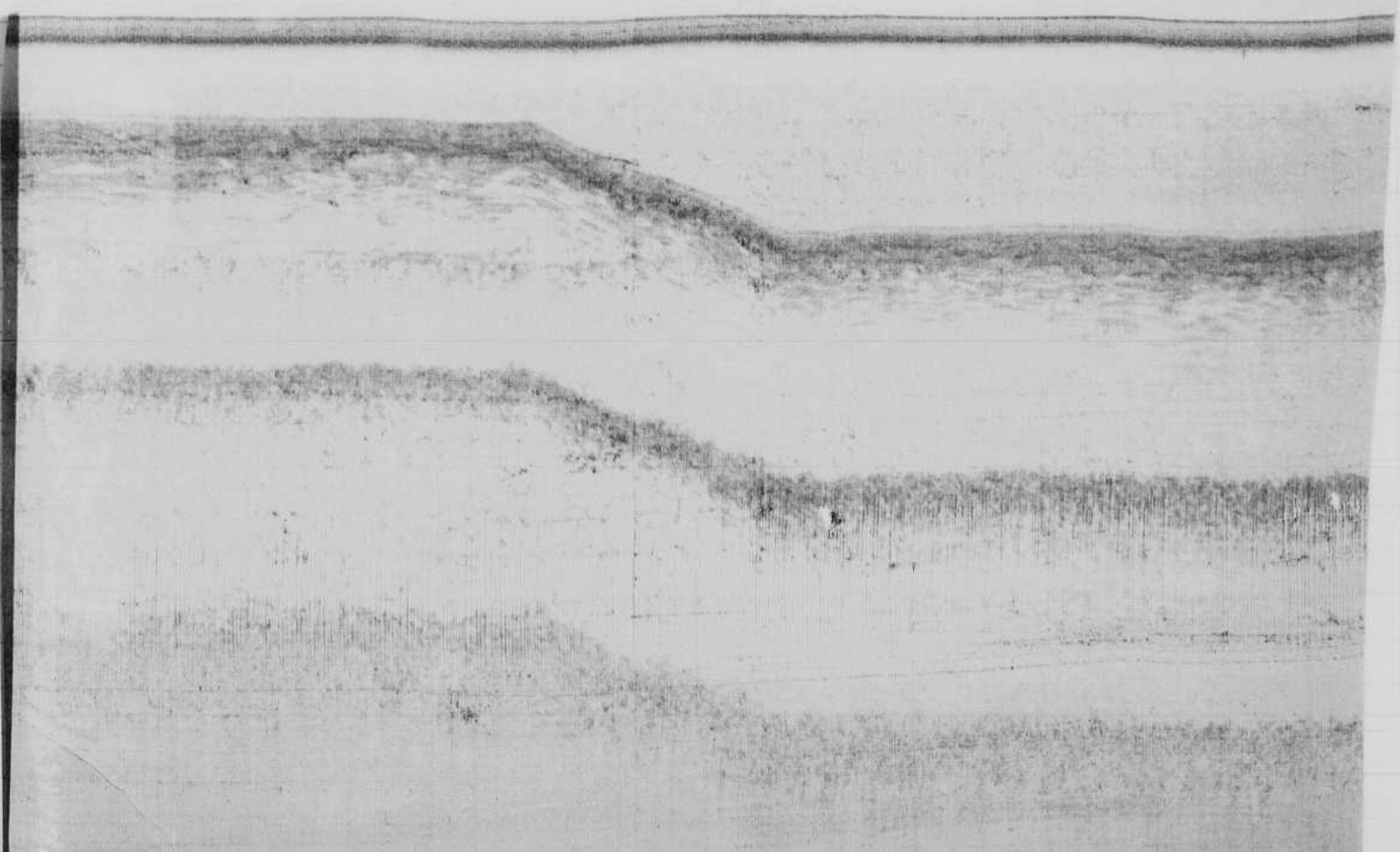
 May 29 1962

Harold Edgerton
4-405 M.I.T.

I have been working a lot with the Mud Pendulum the past few weeks. By reducing the pinger output, I have been able to see a lot more.

Yesterday I showed Van Reenan the device in the Charles River. We could see the false



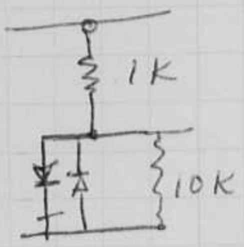


 May 29 1962
HE Edgerton V. MacRoberts
M.I.T. Boat House Sail Pav.

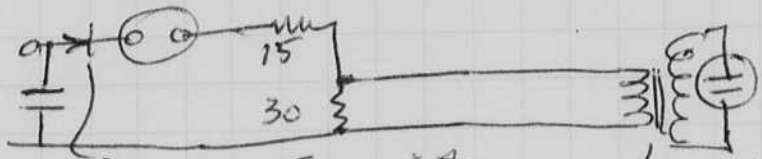
Test at Dock, Transducer lowered 1 ft off center of Instr room.

f / ft
2.0
3.0
10.0

Range 80' 2 mfd voltage 0.2 (1/3) peak to peak
1 mfd " 0.2+ " " "
Shows the condenser is not charging up at 30 times/sec.



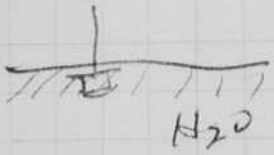
Both tests with 30 ohms in series.



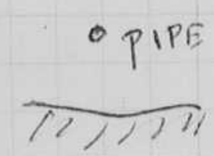
Edo trans

Diode Transitor Coupling trans.

Condenser changed to 0.1 mfd. Resistance takes it down to 2/3. not much effect.
$v = .02$ volts p.p.



Some jitter try 0.5 mfd.
Can't see pipe on Amp low
Can see " " " med.



C = 0.5 mfd e = 0.2 volts again.

PING POWER	M. AMP. LEVEL	GAIN	PAPER SPEED	RANGE
1	10	LOW	62	80

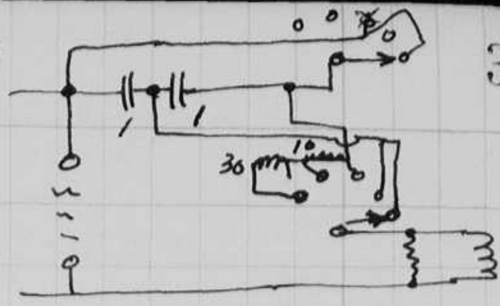
All Ditto but Diode out.

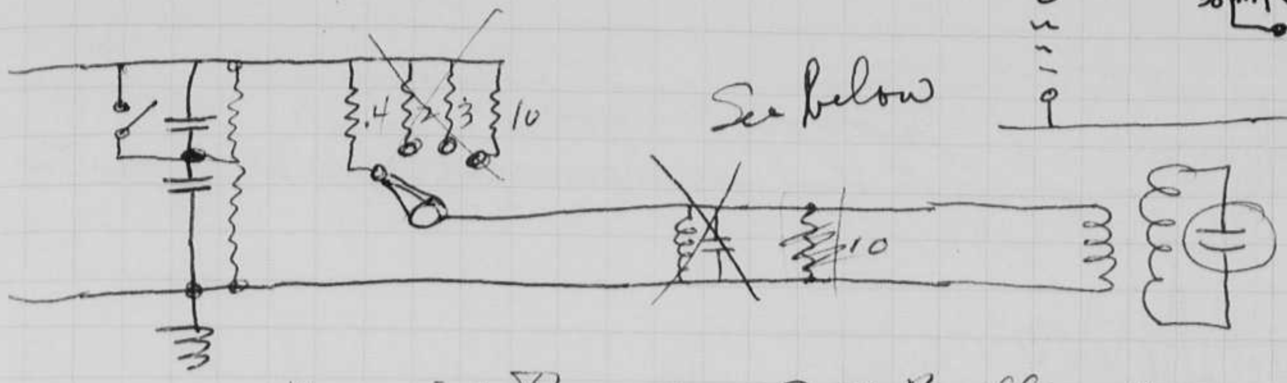
.2 Diode
.15 Diode max

Looks about the same Output in echo 0.1 p-p.
min about the same.

now try to damp by putting 25 ohms in parallel with the 30 ohms, across the transducer

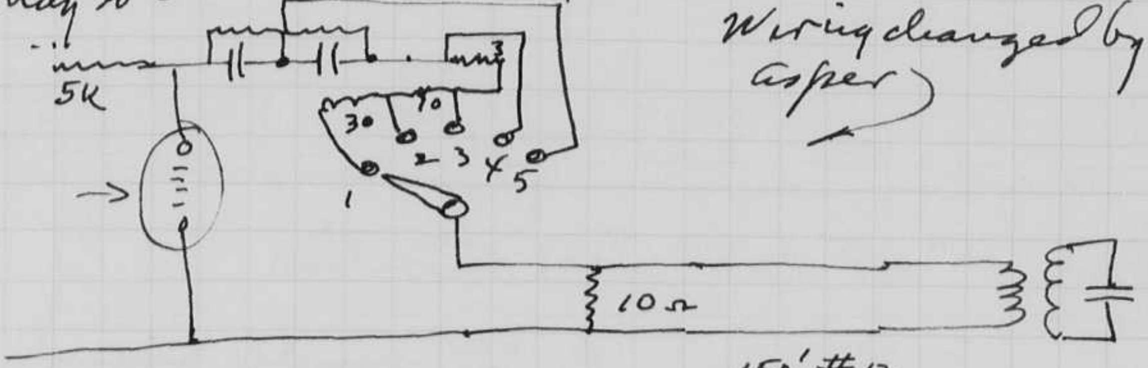
C
2, 1, .5. mfd
10 - 30 Ω.





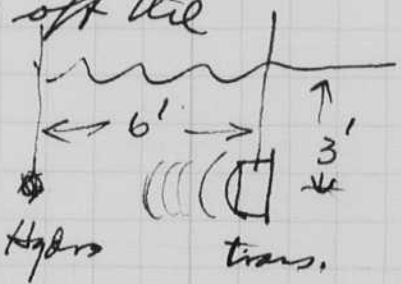
See below

May 30 62 Memorial Day. MIT Sail Pavillion 7am.
Wiring changed by MacRoberts as per

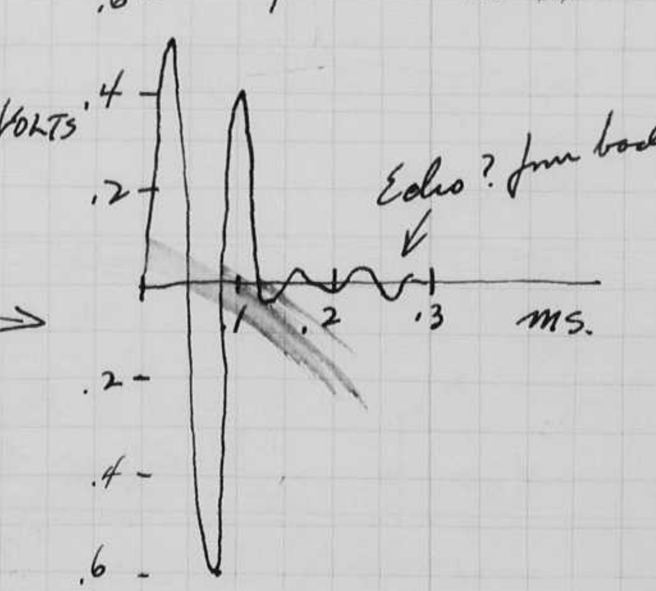


150' #12 cable.

Watchcase hydrophone in water 3' deep off the transducer 6" away.



Ohms	mfd	Position	Volts. P.P.	Wave form.
30	.6	1	.25	
10	.5	2	.5	
3	.5	3	0.60	
0	.5	4	0.65	
0.	1.	5	1.1 volts →	



the ten ohm resistor is used to damp out the oscillations.

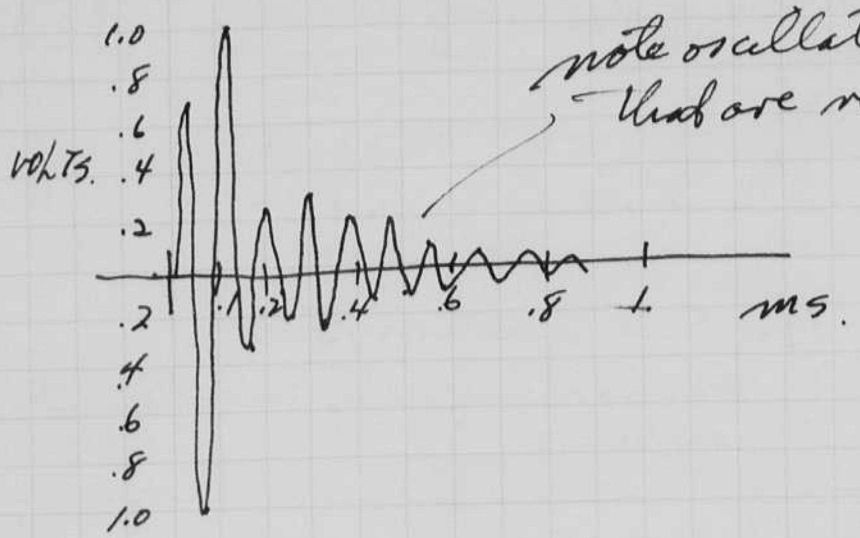
10 ohms removed		
	1	.43
	2	.75
	3	.8-
	4.	.8
	5	1.6

See sketch on next page. note ringing in tail.

6 ms. = 15 ft.
3 ms. = 15

5000 ft/sec.
5 ft / 1 ms.

note oscillations
that are removed by 10 Ω resistor.

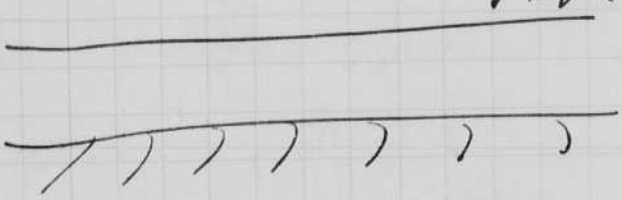


Bottom 16' at M.I.T. Sail Pavilion

See sample record.

R - 80'
P - 1.
G - L.
A - 10
S - 60

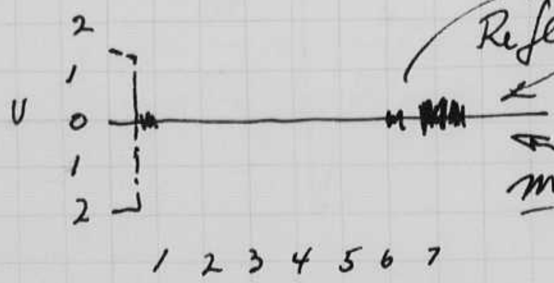
Pipe.



			Ser Par Res
P - 1	.5		30 - 10
2	.5		10 - 10
3	.5		3 - 10
4	0.5	"	0 - 10
5	1 mfd		0 - 10 Ω

P-1 Lowest setting 0.5 mfd 30 - 10 bands.

from Pipe.
Reflection from
Bottom



0.3V peak to peak
from Bottom.
Low-Low setting of Trans

3.5V p. to p. Low.

overloads Med.
on neg side only.

overloads High

Alder amp.

Alder "D" modified circuit, marking amp

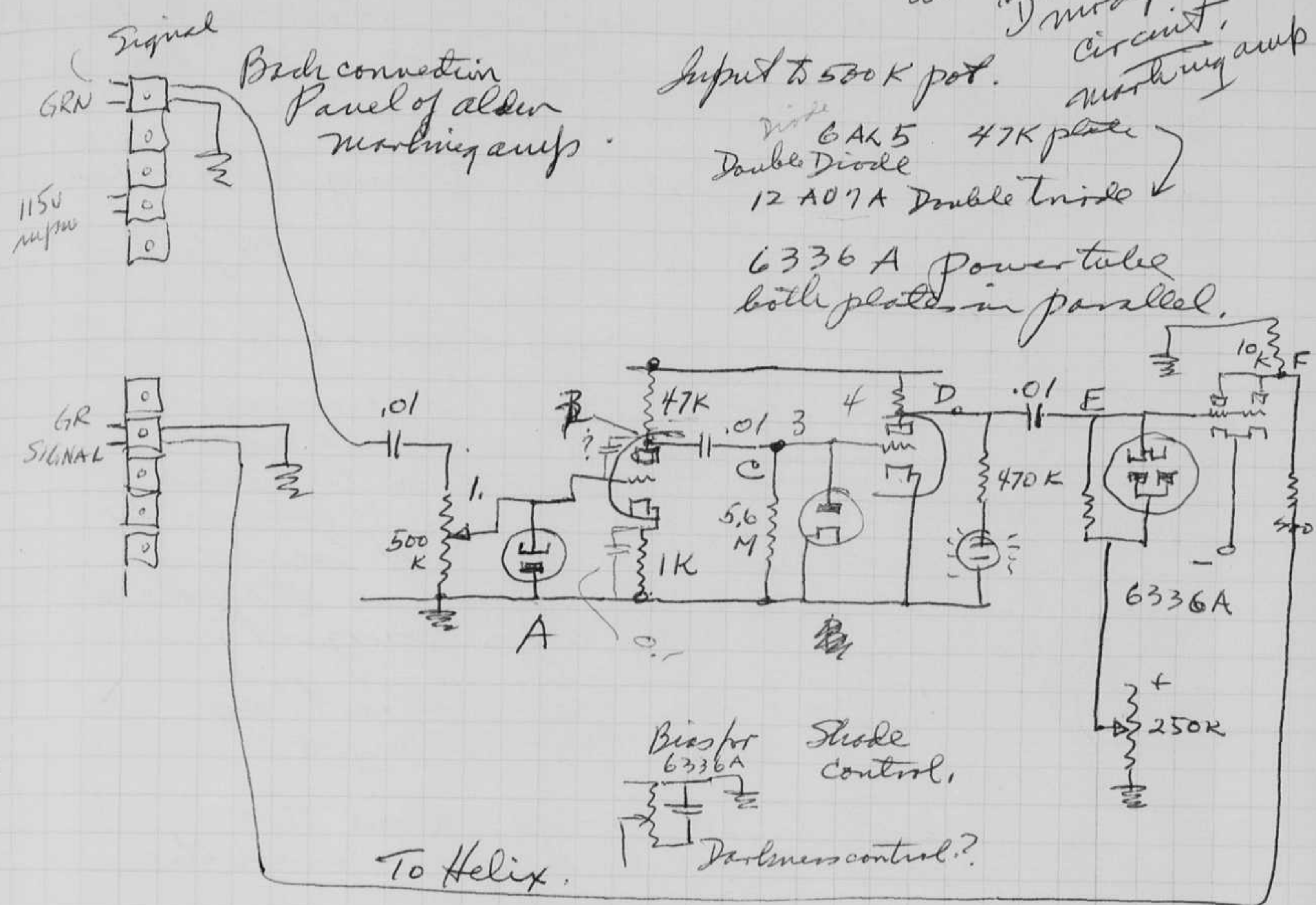
Input to 500K pot.

Diode 6AL5 Double Diode

47K plate

12AU7A Double triode

6336A Power tube both plates in parallel.



Only works with a + going signal, a negative signal is clipped by the Diode A, the other diodes also clip if necessary.

Measure voltage at points and sketch.

1. grid tube 1
2. plate tube 1
3. grid tube 2
4. plate tube 2
5. grid output.
6. output voltage plate
7. " " on paper.

Considerable experience is going to be needed to master the mud penetrator. I hope to point out various methods and examples ~~by~~ by illustration.

M.I.T. Sailing pavillion. Many tests have been made just off the dock in 15 feet of water.

The power in the ping should be made as small as possible so the transistor amplifier will not be over loaded.

I find the #1 position can be used with the Low trans gain and full gain on the Alden marking amplifier. It seems best to use these conditions as standard. these when starting on a project.

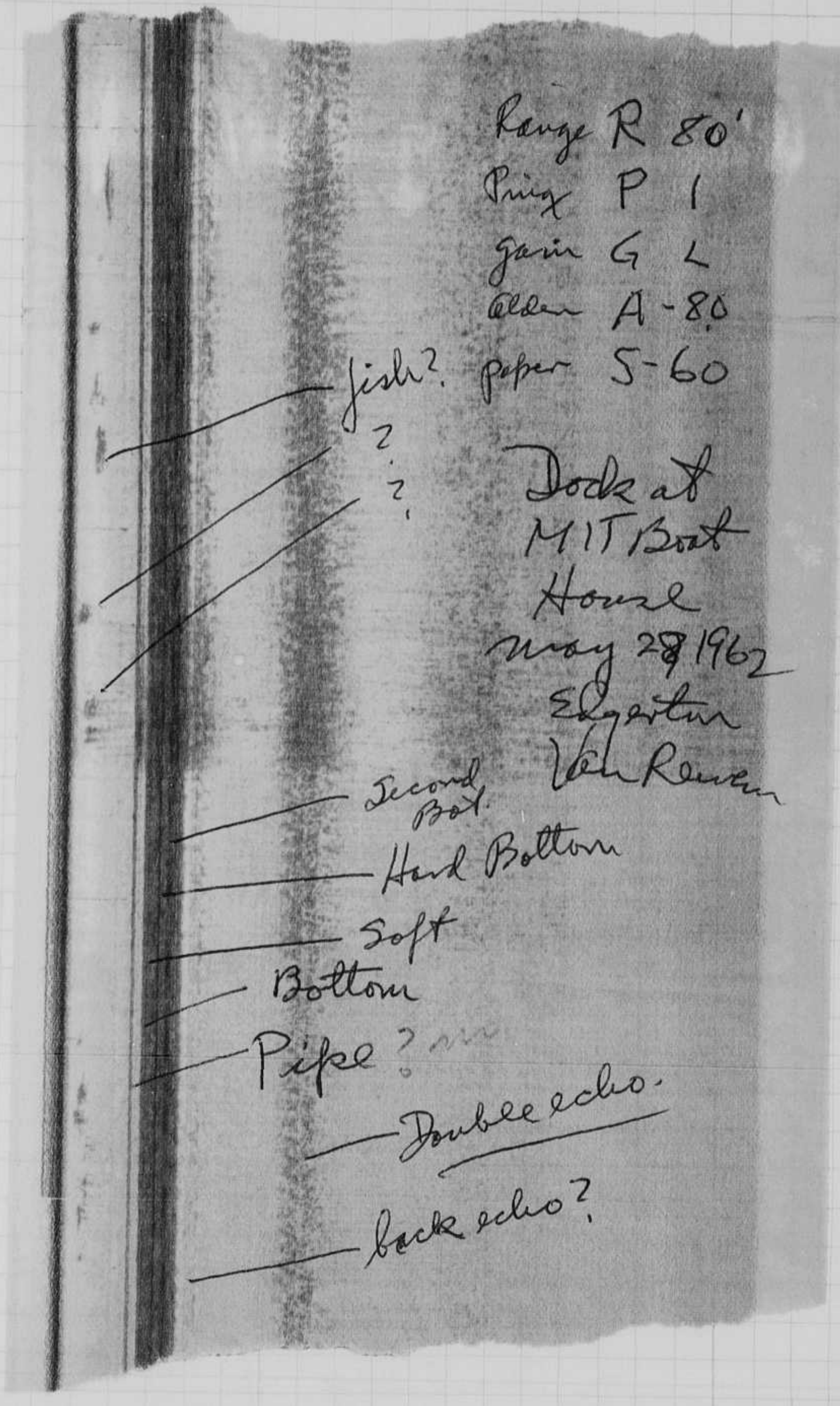
1. Ping weak and "short" as possible. Setting #1.

2. Transistor gain in the Low position or even the (low-low)

3. Alden in setting 10 (or 8 if there is too much clutter.

There is a water pipe located a few feet above the bottom. this is a good target for study. It can be seen in many of the records.

The bottom has a soft surface above two hard layers, the soft one consists of leaves that are decomposing. Many bubbles of gas come up when this layer is disturbed by lowering the transducer into it.



Range R 80'
Ping P 1
gain G L
Alden A -80
paper S-60
fish?
?
?
Dock at
MIT Boat
House
May 28 1962
Edgerton
Van Reuven
Second Bot.
Hard Bottom
Soft
Bottom
Pipe?
Double echo.
back echo?

Considerable experience is going to be needed to master the mud penetrator. I hope to point out various methods and examples ~~by~~ by illustration.

M.I.T. Sailing pavilion. Many tests have been made just off the dock in 15 feet of water.

The power in the ping should be made as small as possible so the transistor amplifier will not be over loaded.

I find the #1 position can be used with the low trans gain and full gain on the Alden marking amplifier. It seems best to use these conditions as standard. these when starting on a project.

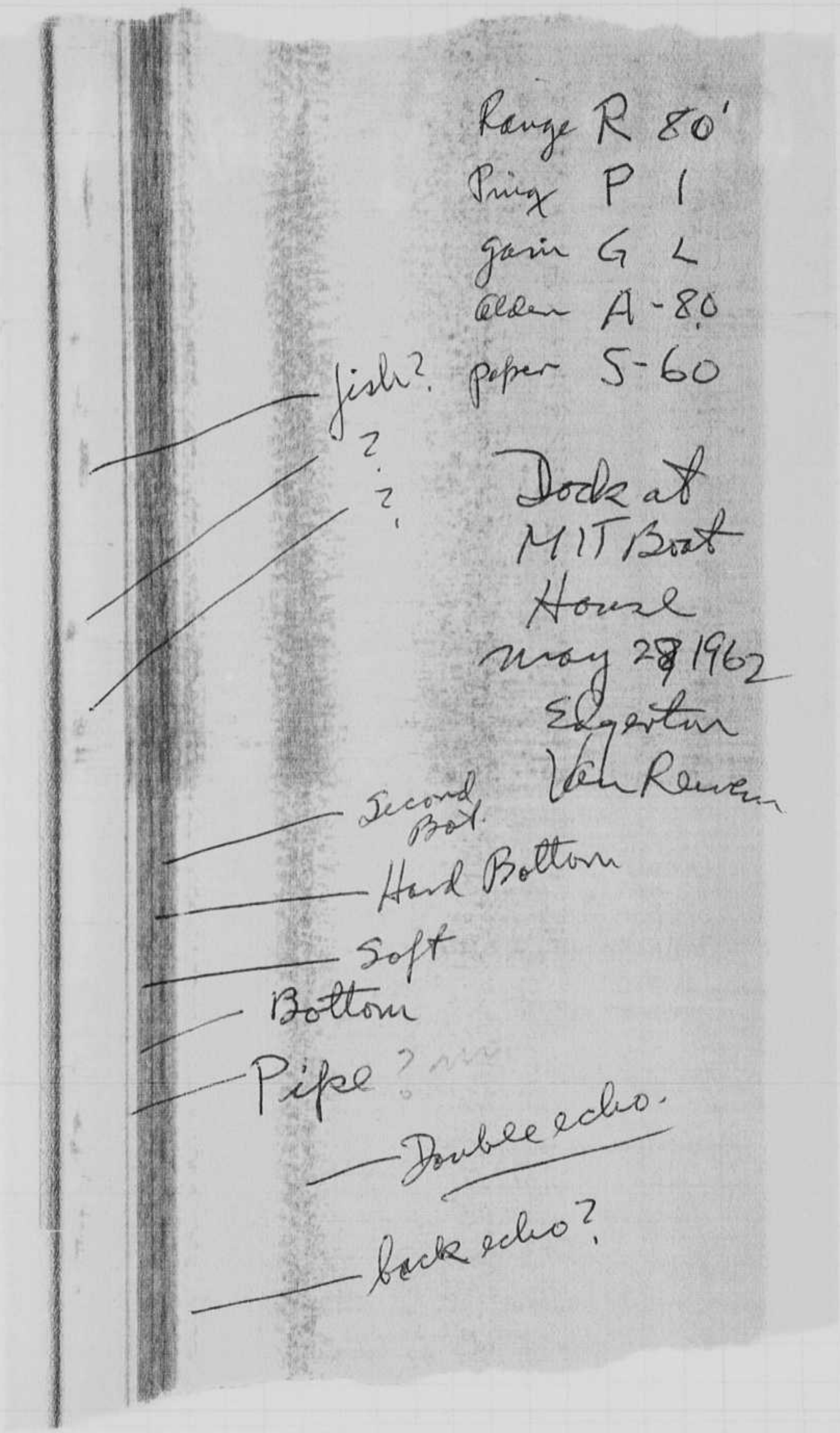
1. Ping weak and "short" as possible. Setting #1.

2. Transistor gain in the Low position or even the (low-low)

3. Alden in setting 10 (or 8 if there is too much clutter.

There is a water pipe located a few feet above the bottom. this is a good target for study. It can be seen in many of the records.

The bottom has a soft surface above two hard layers. the soft one consists of leaves that are decomposing. Many bubbles of gas come up when this layer is disturbed by lowering the transducer into it.

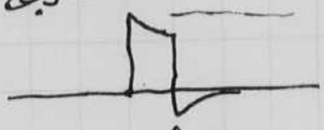

Range R 80'
Ping P 1
gain G L
Alden A-8.0
paper S-60
fish?
?
?
Dock at
MIT Boat
House
May 28 1962
Edgerton
Van Reuven
Second Bot.
Hard Bottom
Soft
Bottom
Pipe?
Double echo.
back echo?

 May 30 1962 cont. Povil at 7 am
H E Edgerton now in Strobe Lab 4-405 3:53 pm.

I found with Input #1 on pinger
0.5 mfd ~~50~~ Ω - ~~10~~ ohms across
- that the gain ~~Low~~ Low Low gave 0.17 p.p. volts
Low 0.8 p p ..
M 1.2 .. overload
High. Hopeless O.L.

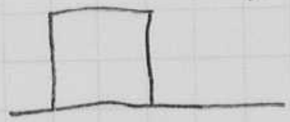
I found that the older requires more than the Low Low to operate. & thus we need about 10 X gain of the amplifier. p 39.

1000 ohm load on older out of case. | 3 volts output. with ~~..~~ across 1000 ohm load. 0.3 input.

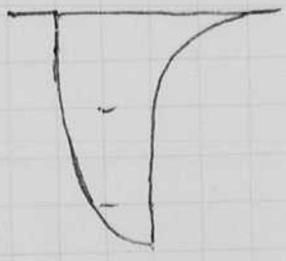


p. 39.

A Input



B output



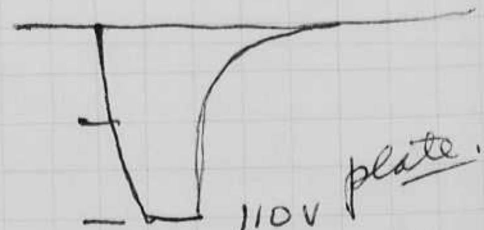
5.V

C. same voltage

D. Second stage

E grid of power tube
looks same as D.

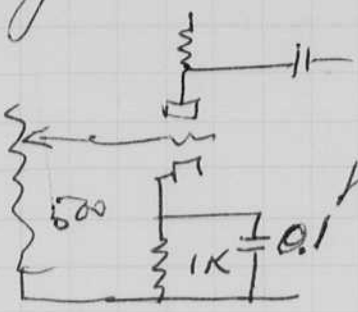
F. output plate



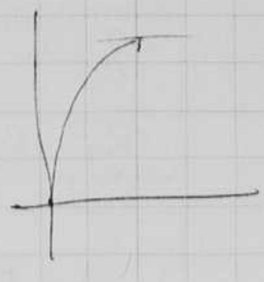
~~95~~ volts into 1000 Ω

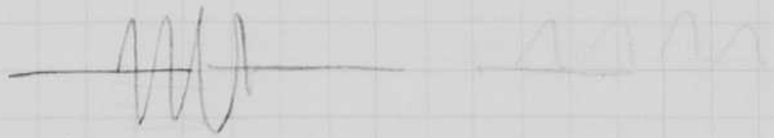
Reduced input to 0.25 volts (10 us.)
Put 0.1 mfd across 1K in ~~plate~~ cathode of first tube.

Gain increases about 50%.



added.





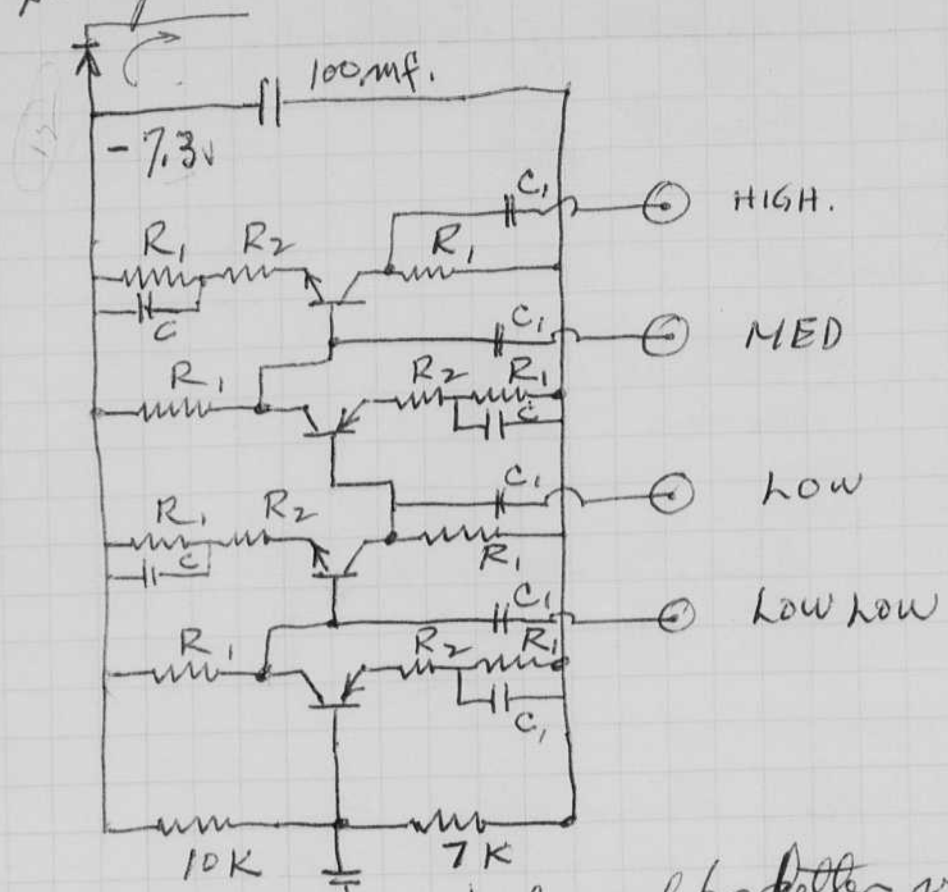
May 31 1962 7:45 am
I then went to the Chas. River Basin again and took a long record going to the M.I.T. crew house and back. Lloyd Breslow and his wife went along for the ride.

There is some improvement in tone record but not much.

Then I brought the amplifier ~~over~~ for study. Dick Shaffner was there to help me with it— He suggested lowering the resistors. Left for home at 10 pm. See next page for amplifier circuit.

 May 31 '62 cont
~~HE Edgerton~~

Libby amplifier.



$R_1 = 10K$
$R_2 = 330$
$C_1 = .01$
$C =$

changed for ~~better~~ voltage conditions
new 7 K

input.

old circle
5.6K,

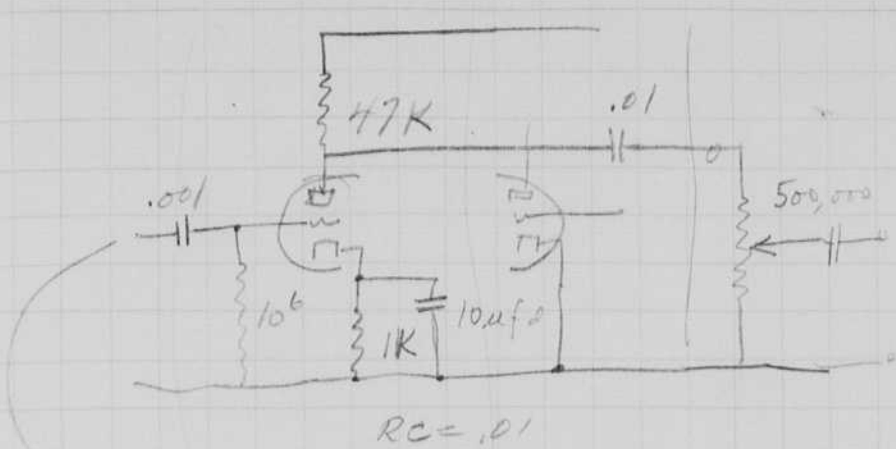
~~1.65~~
1.5

5.95
5.9
1.65
5.5 1.8
5.4 2.2

1.87
5.25
2.26
4.75
2.85.

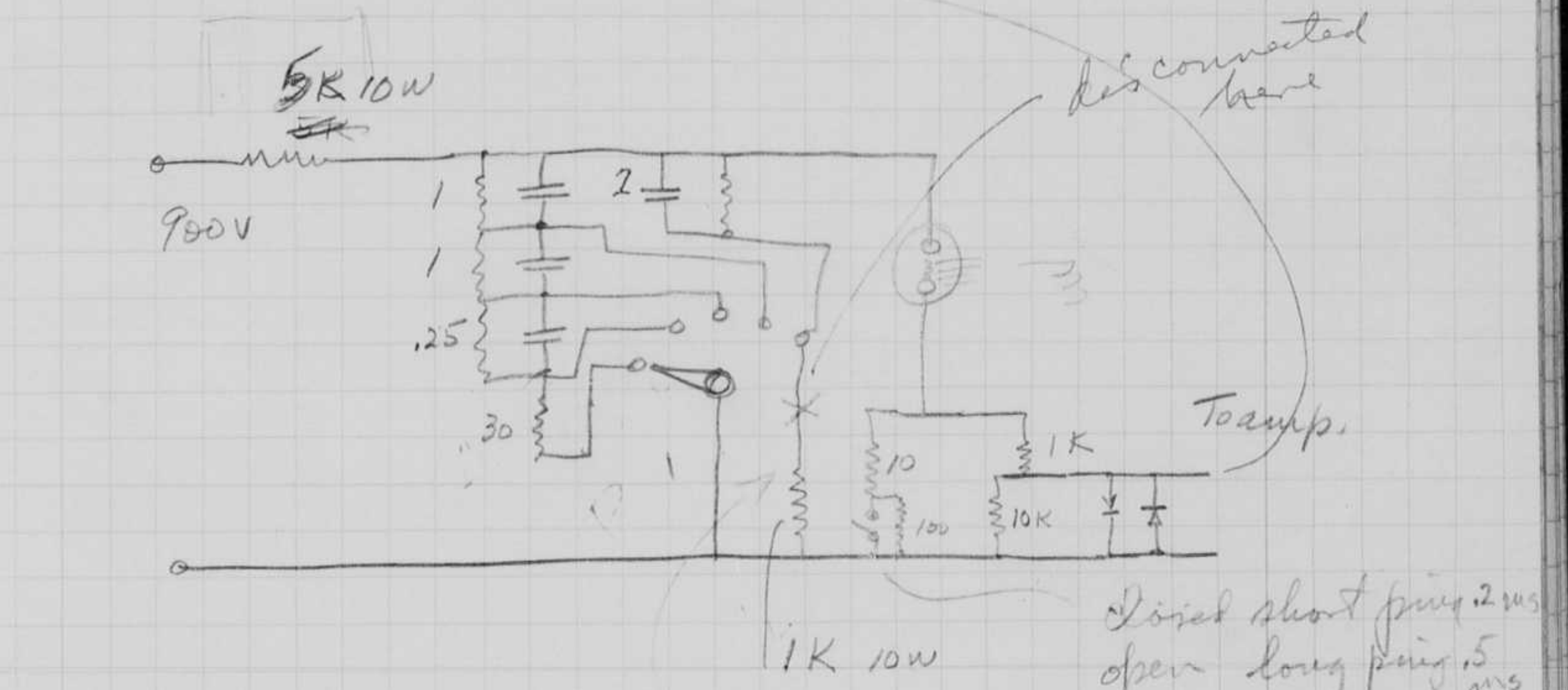
Comment!
needs higher amplifier
voltage or
to prevent cutoff
and overload.

Single Stage 12AU7



RC = .01

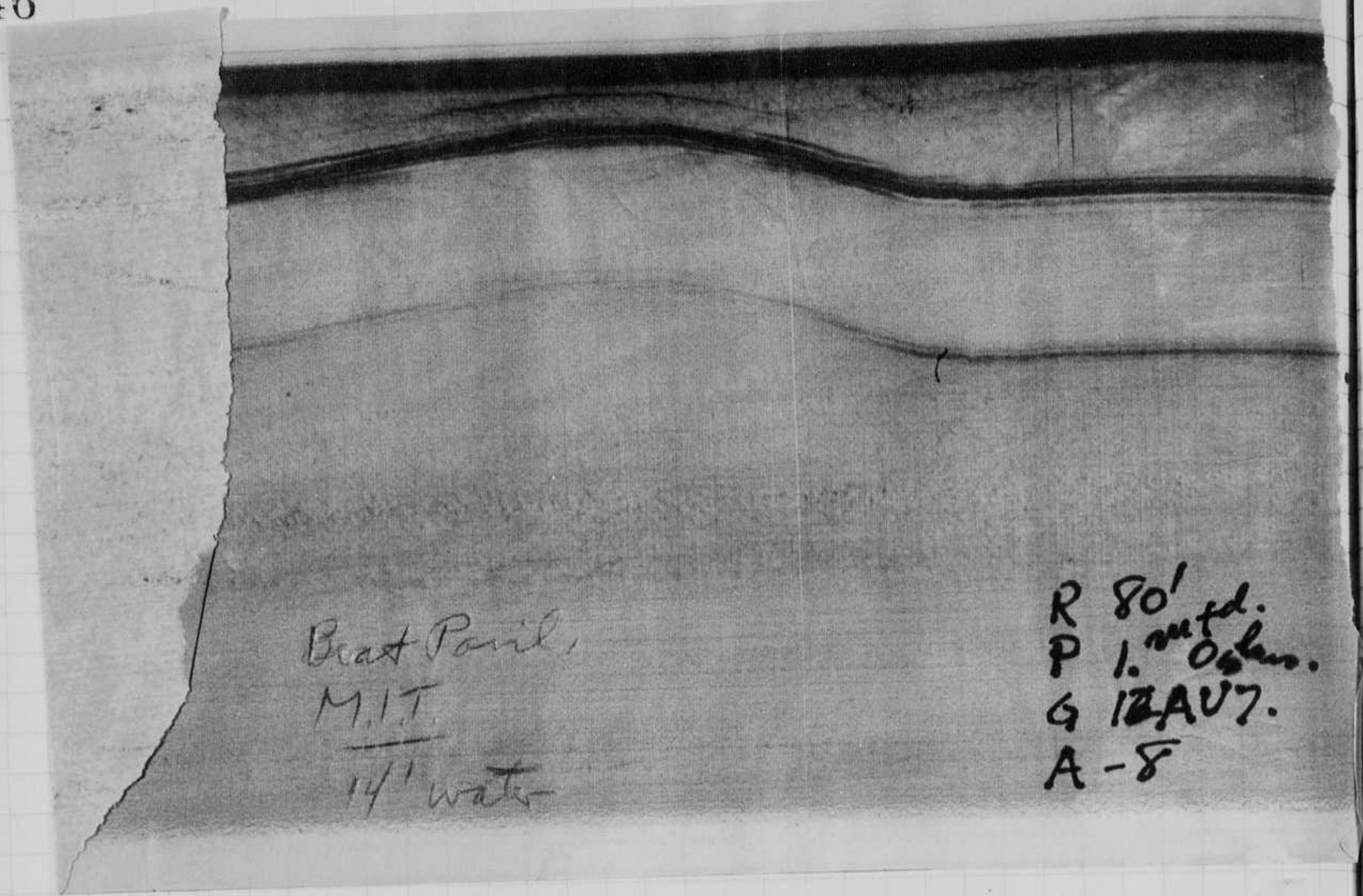
$C = \frac{.01\,000}{1000} = 10\mu fd$

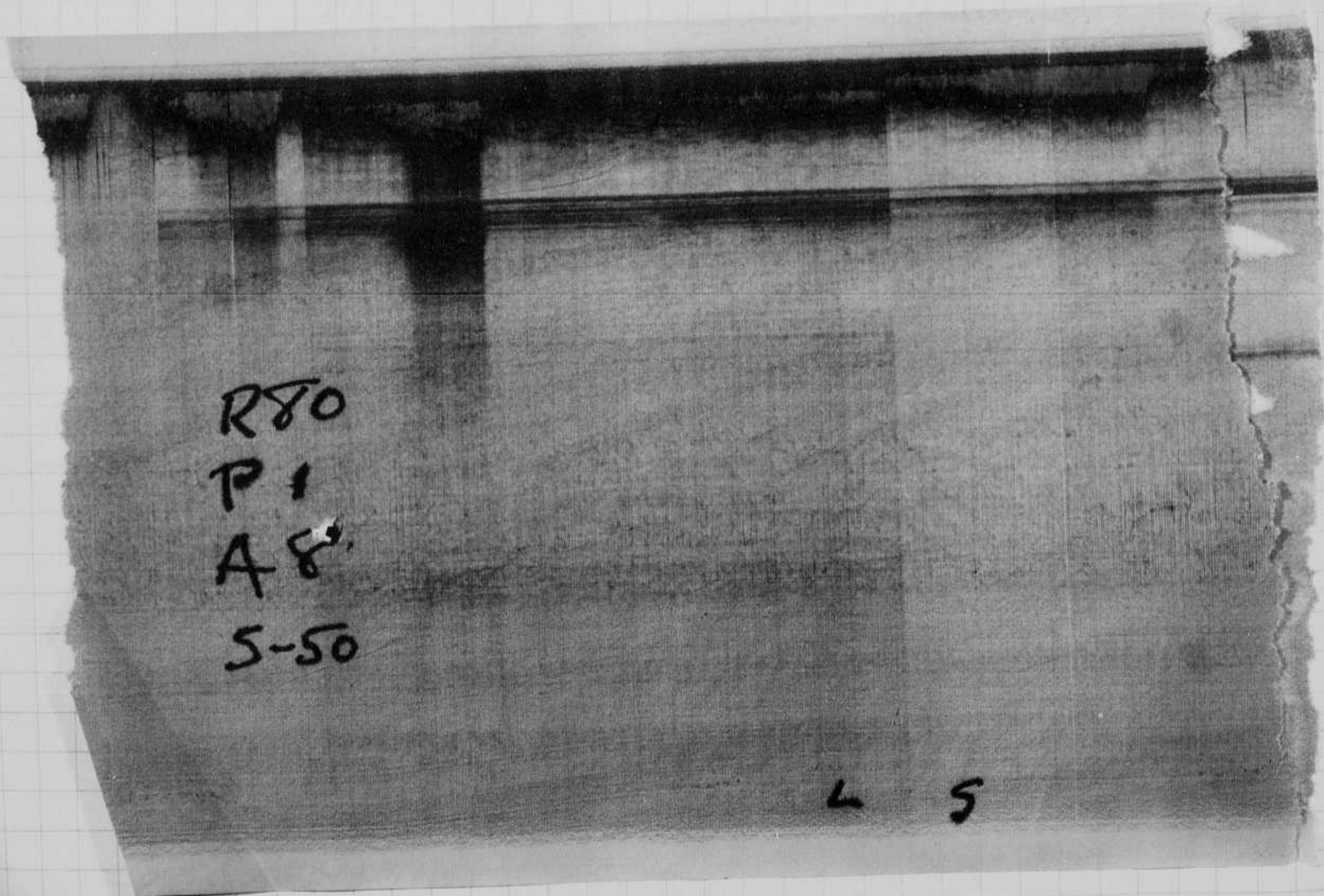


June 1, 1962. Sail Pavillion.
Jim Anderson
12AU7 gain stage added as per above by M. Klein last winter

Holdover in trigger tube. (0.5 mfd) 1. runs ok

Opened 1K wire to 2 mfd ~~stopped~~ holdover.

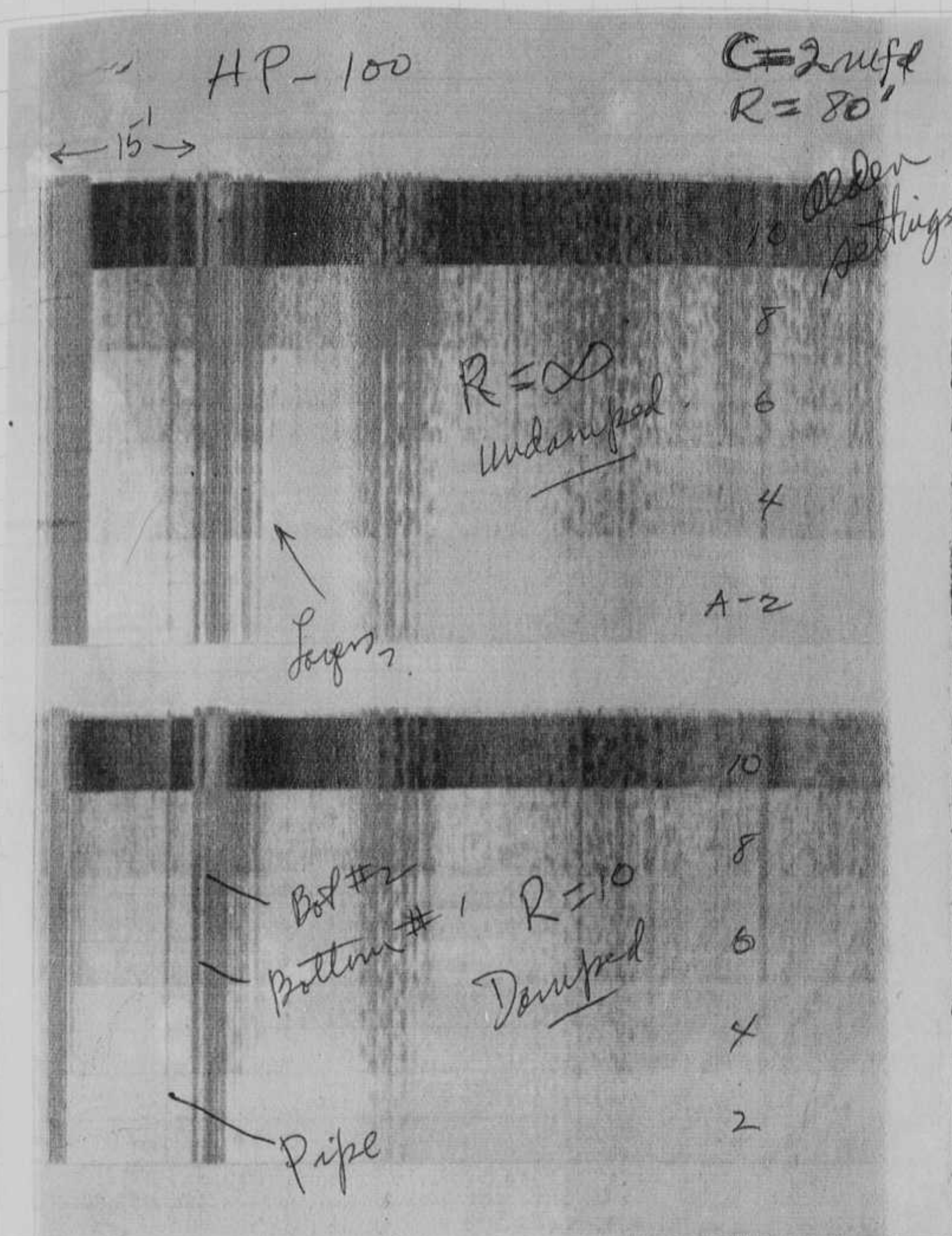

Beast Point,
M.I.T.
14' water
R 80'
P 1. mfd. 0 ohms.
G 12AU7.
A -8

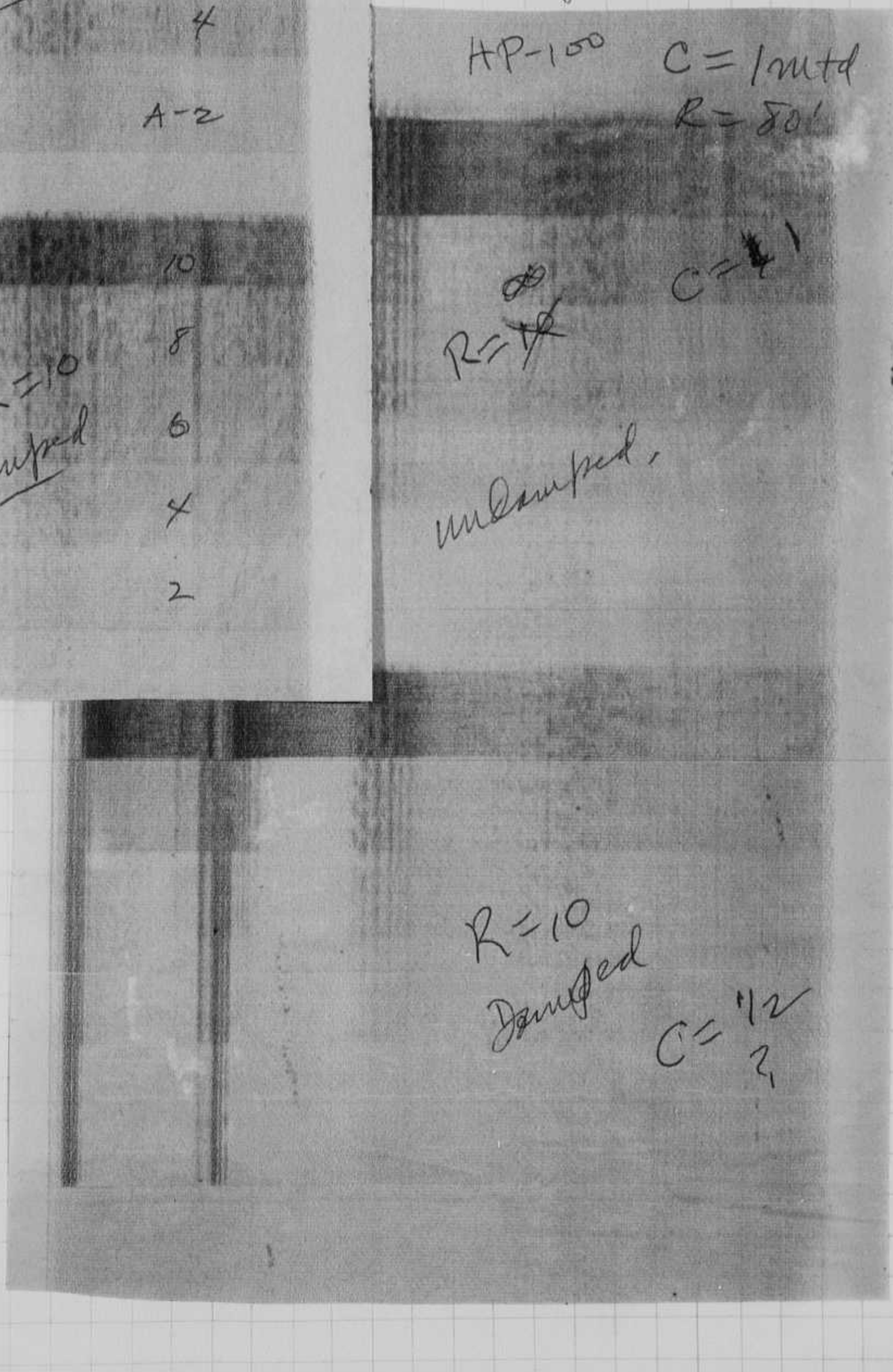

R80
P1
A8
S-50
L S

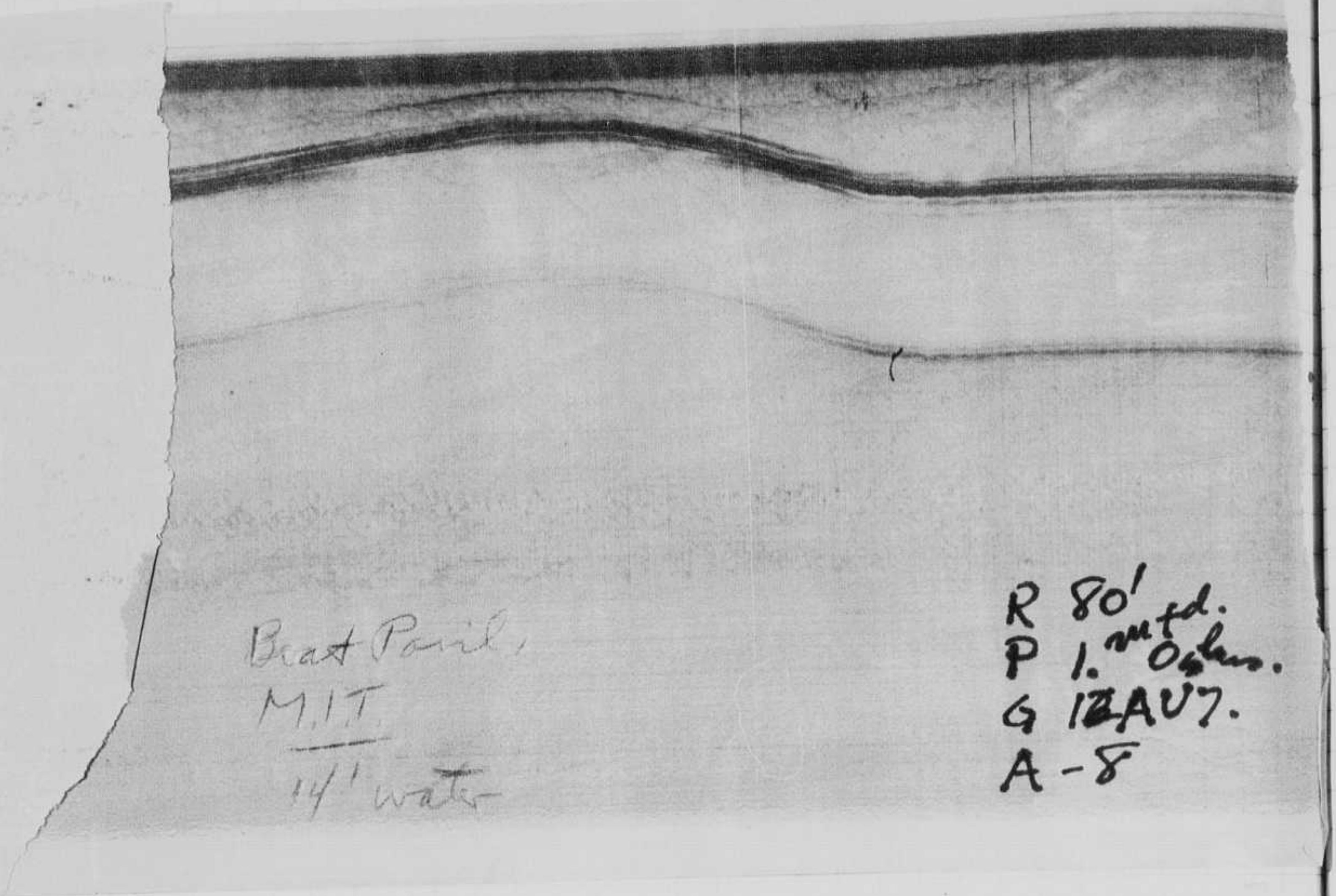
Off MIT Sailing pavilion

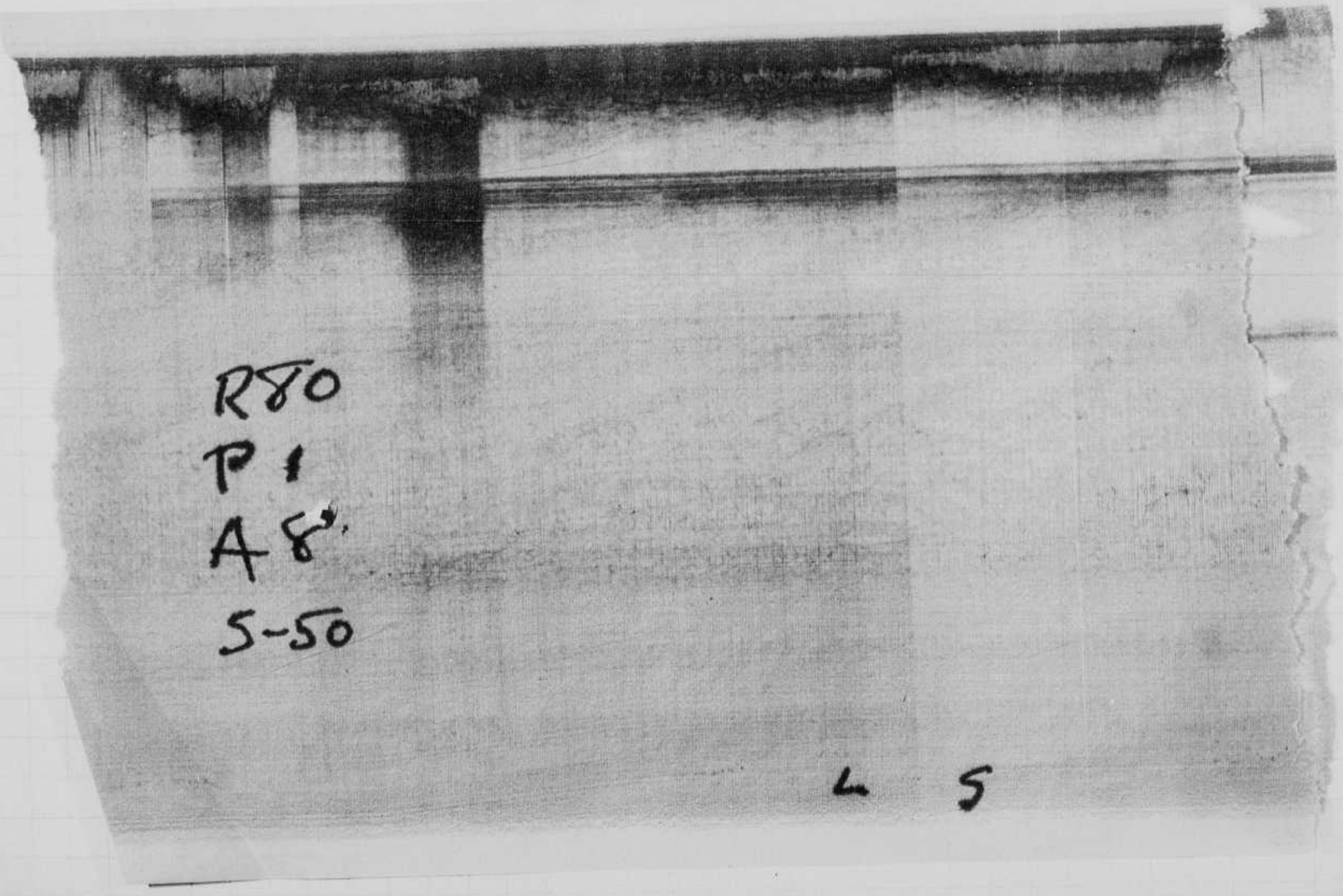
Hewlett Packard amplifier # gain 100.

Best sediment record seen so far!





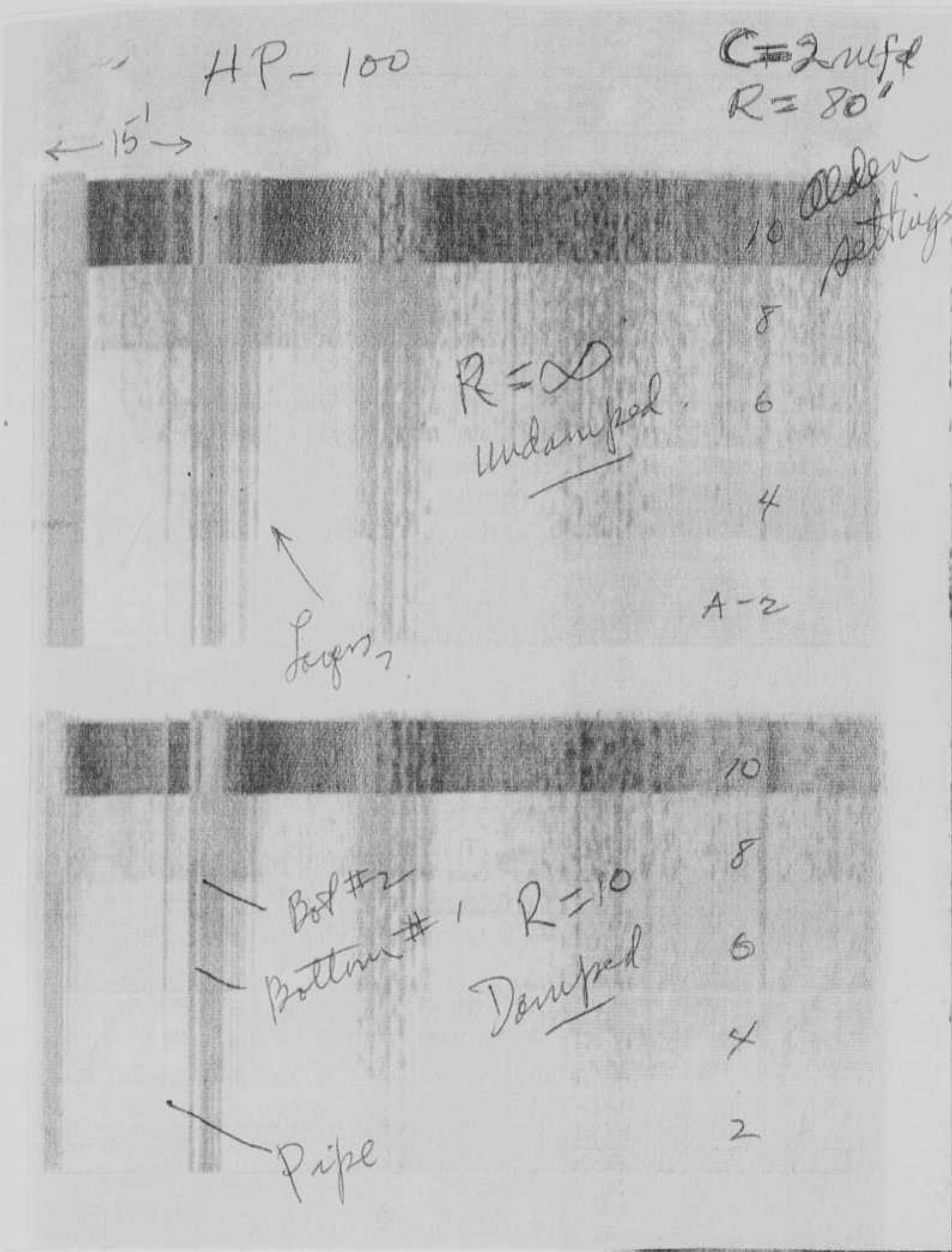

Boat Pond,
M.I.T.
14' water
R 80'
P 1. mfd. Ohms.
G 12AU7.
A -8

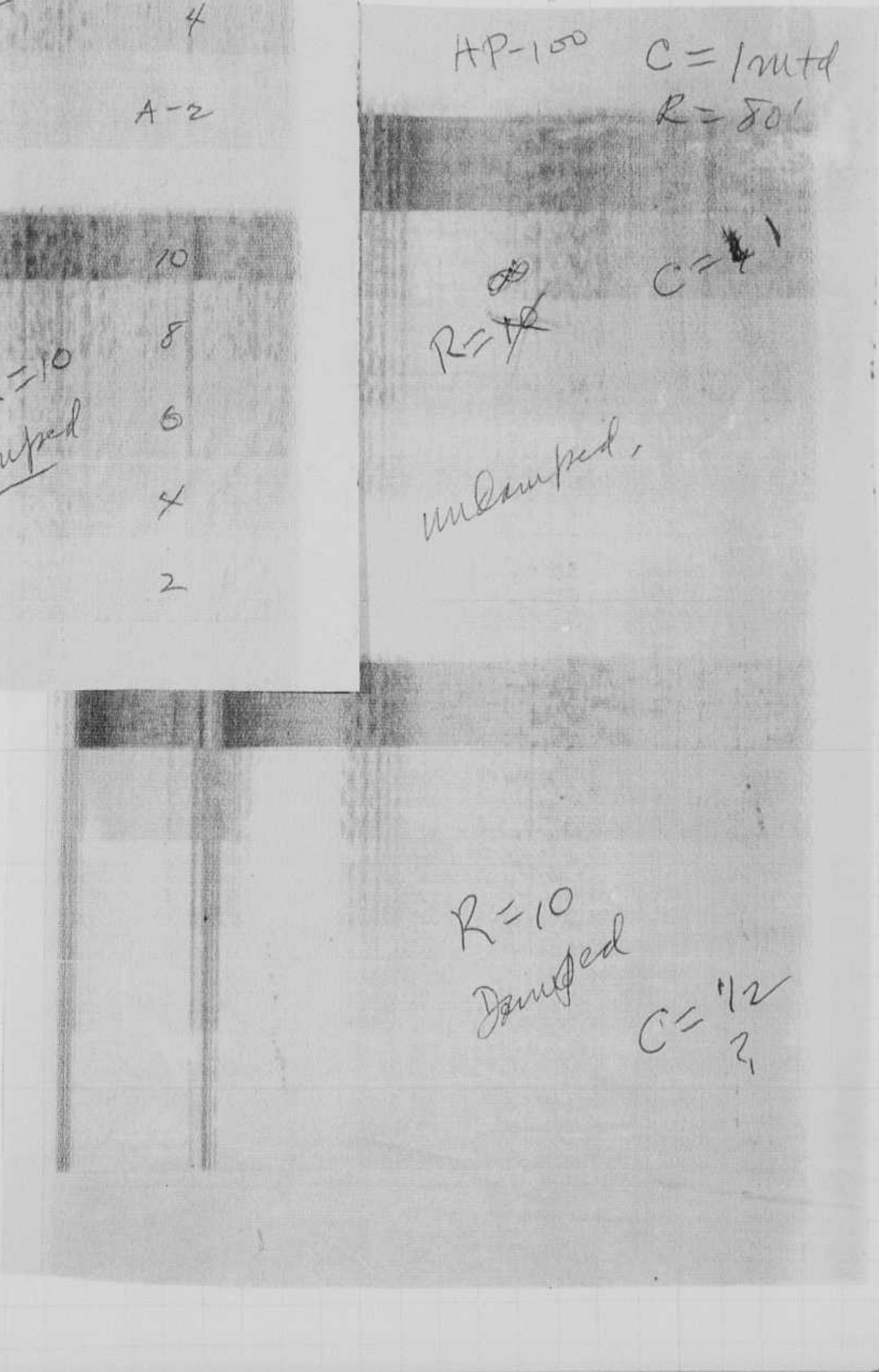

R80
P 1
A 8
S-50
L S

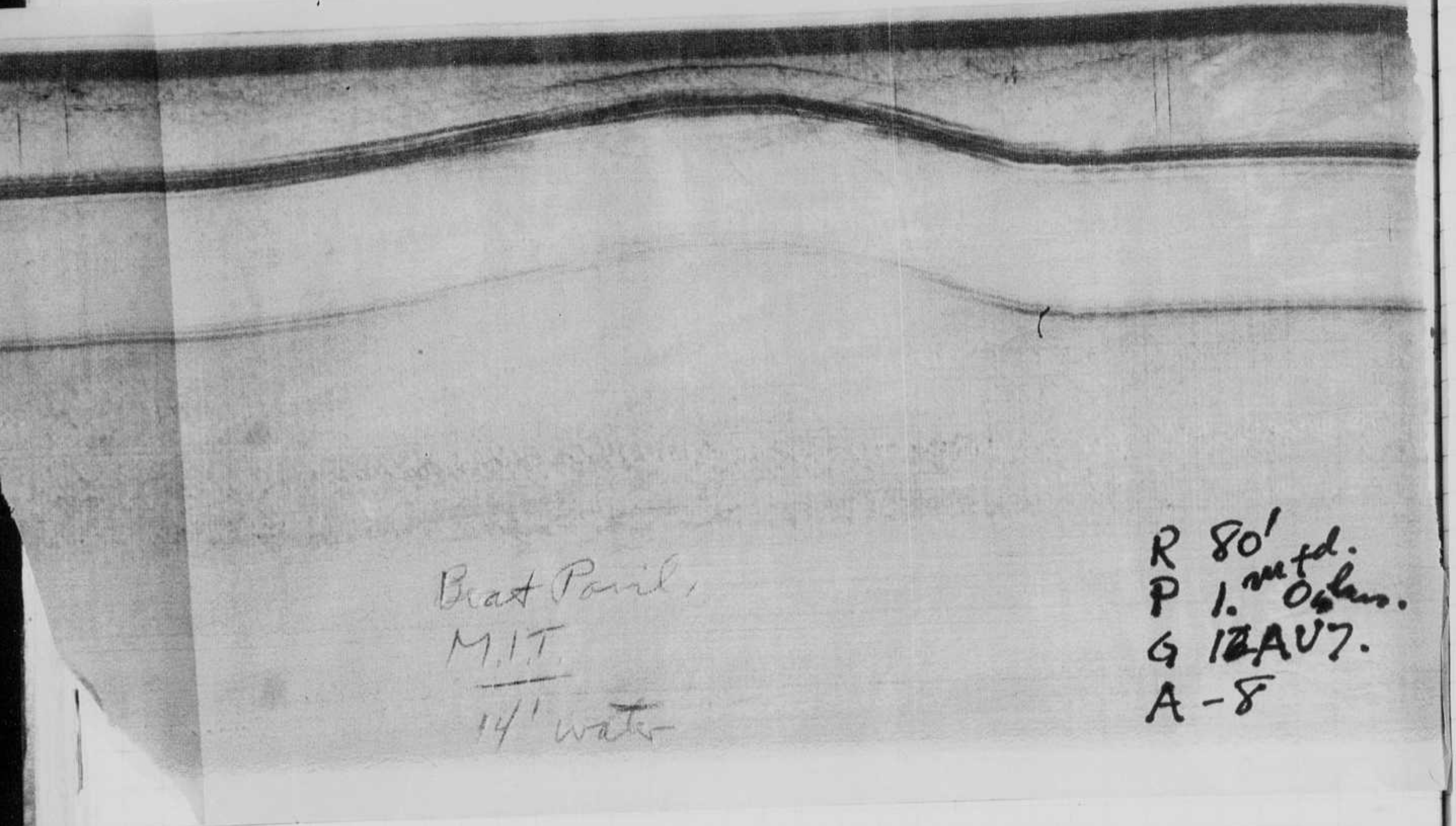
Off MIT. Sailing pavillion

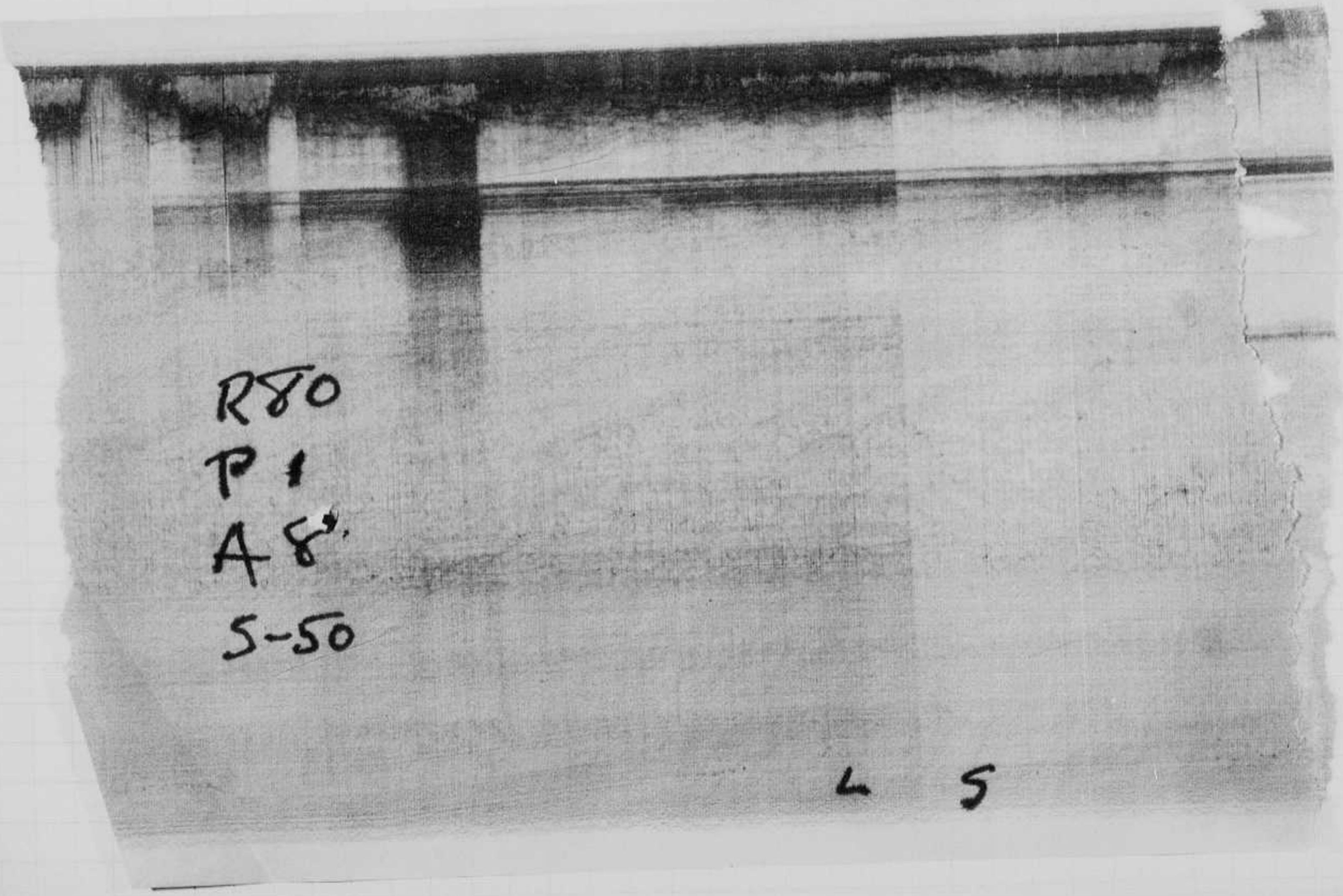
Hewlett Packard amplifier # gain 100.

Best sediment record seen so far!





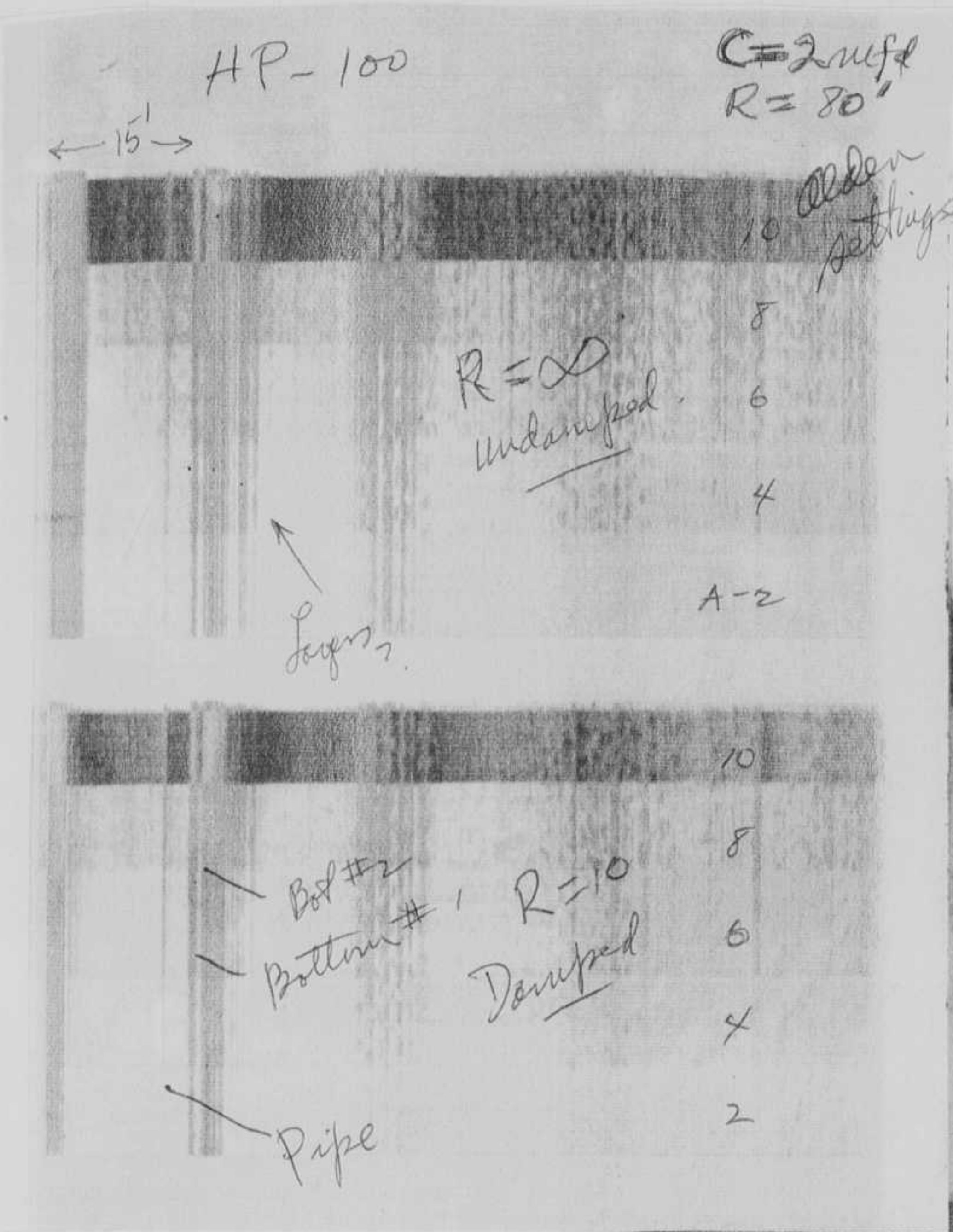

Brant Point,
M.I.T.
14' water
R 80'
P 1. mfd. Ohms.
G 12AU7.
A -8

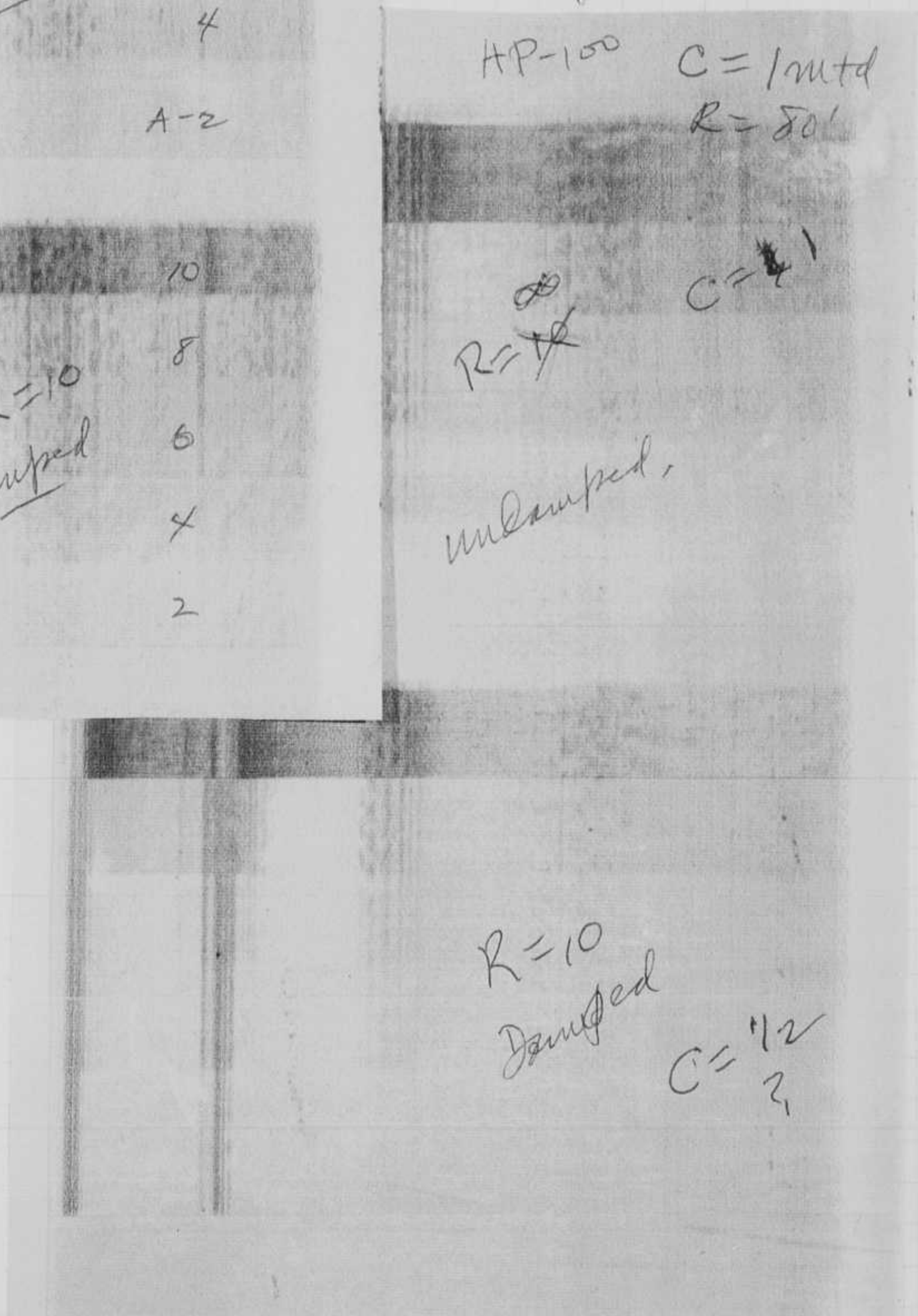

R80
P 1
A 8
S-50
4 5

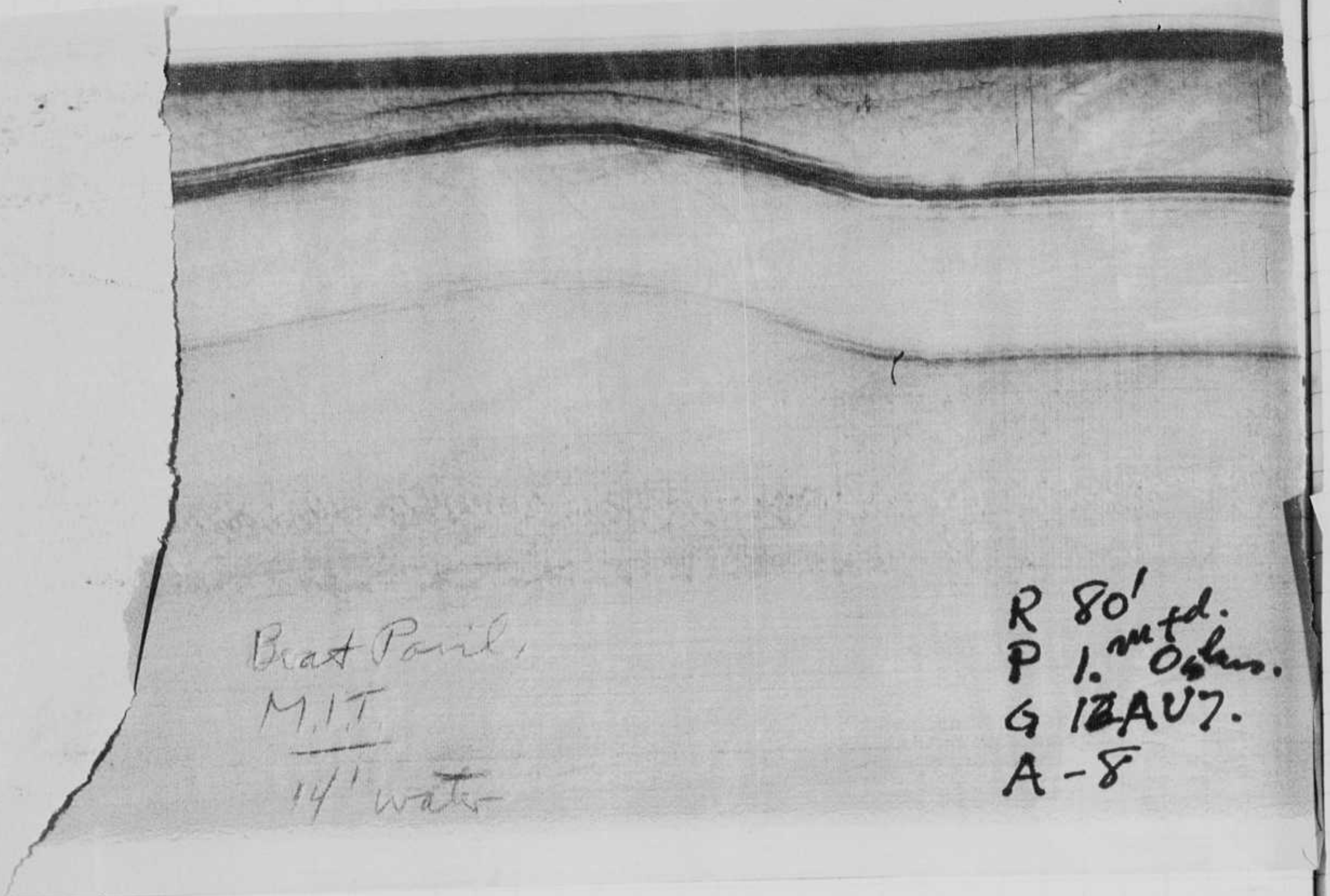
Off MIT.
Sailing pavillion

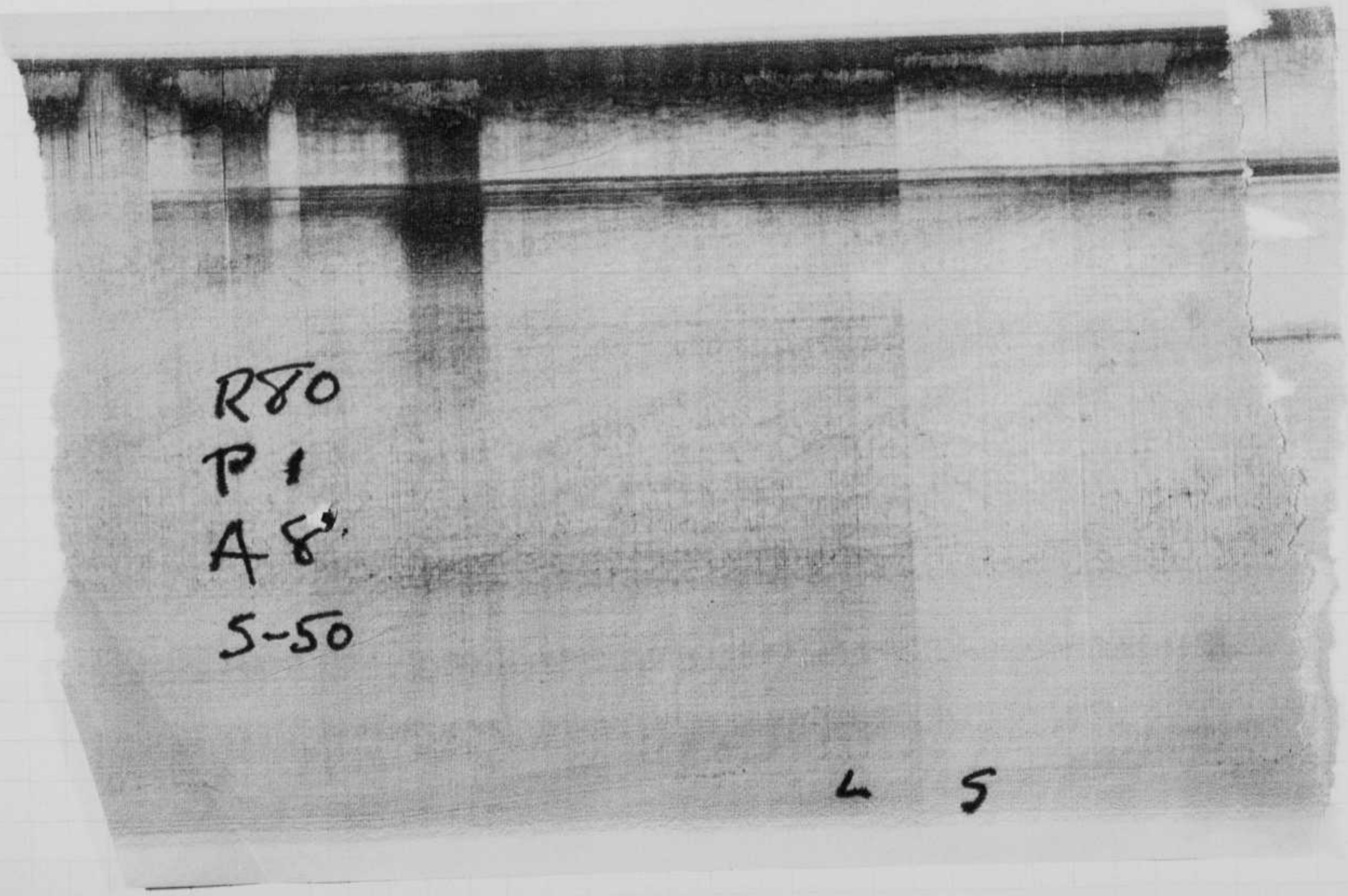
Hewlett Packard
amplifier #
gain 100.

Best sediment record seen
so far!

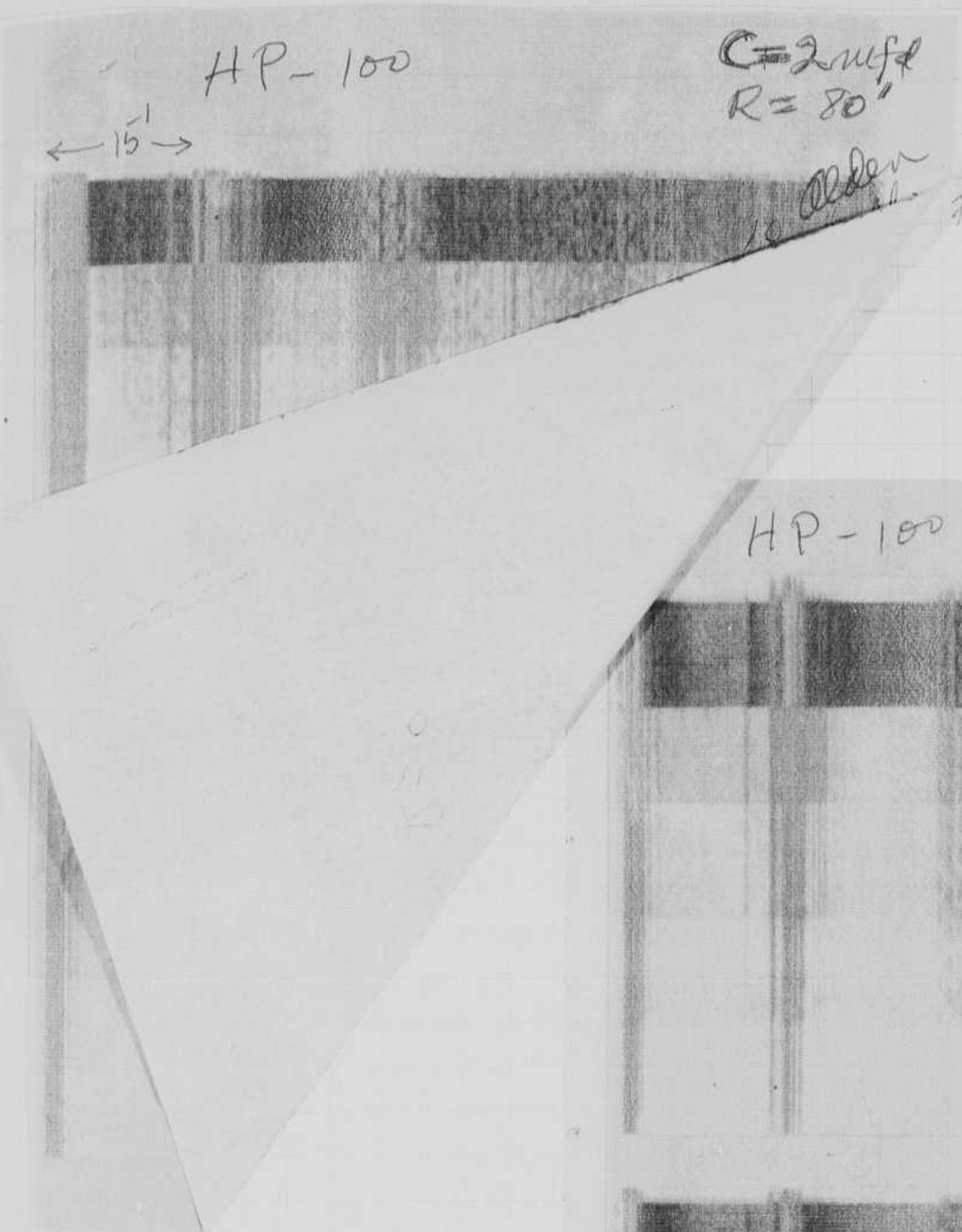





Boat Pond,
M.I.T.
14' water
R 80'
P 1. mfd. 0 ohms.
G 12AU7.
A-8

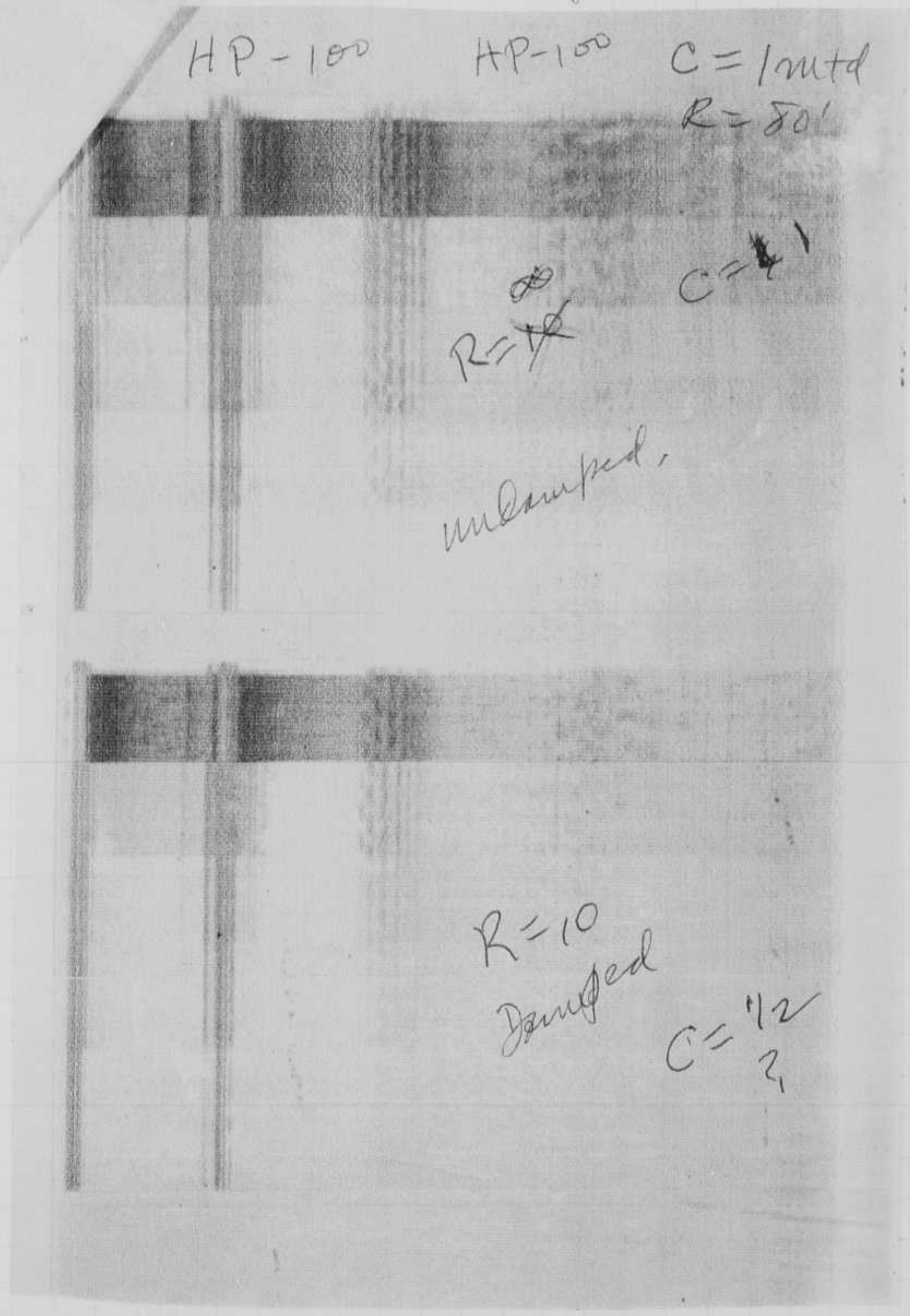

R80
P 1
A 8
S-50
4 5

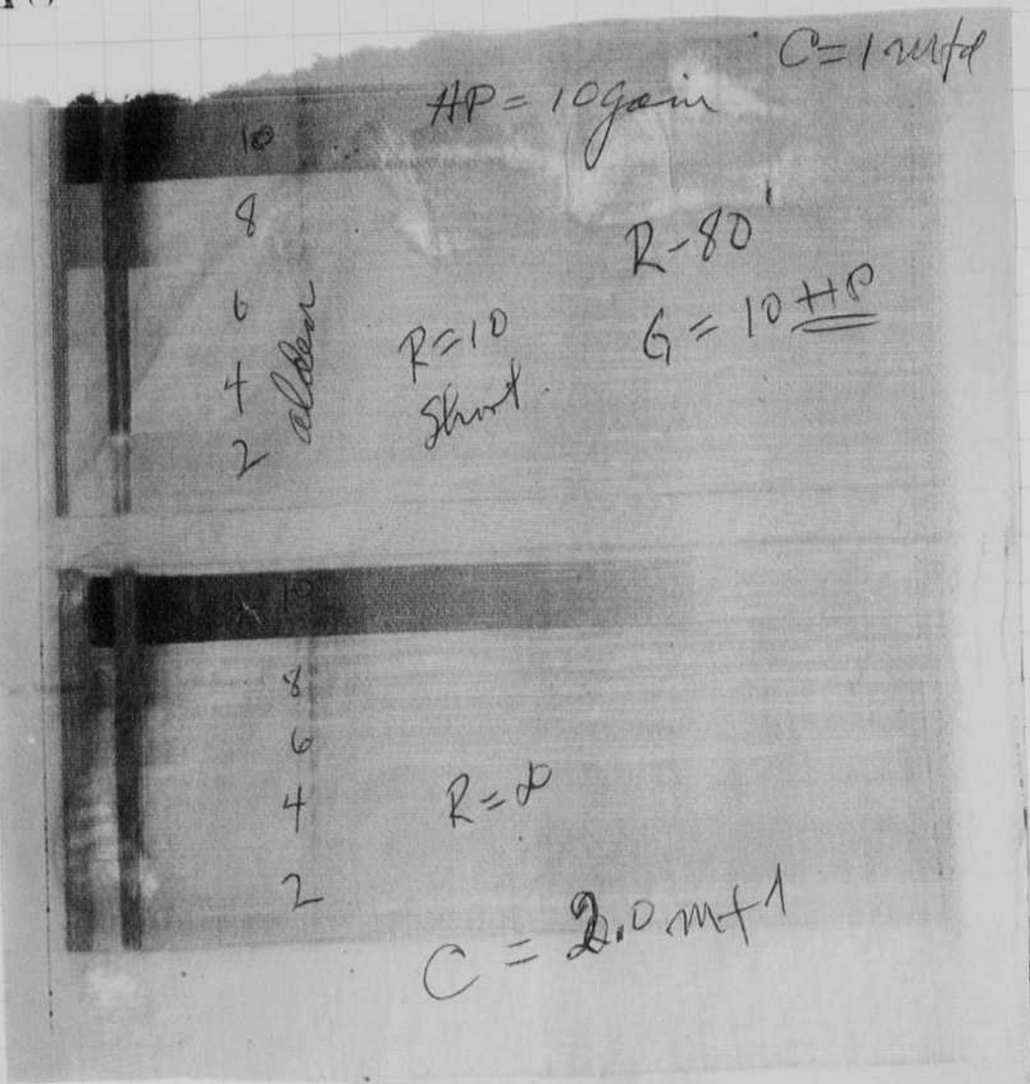
Off M.I.T. Sailing pavillion



Hewlett Packard amplifier #
gain 100.

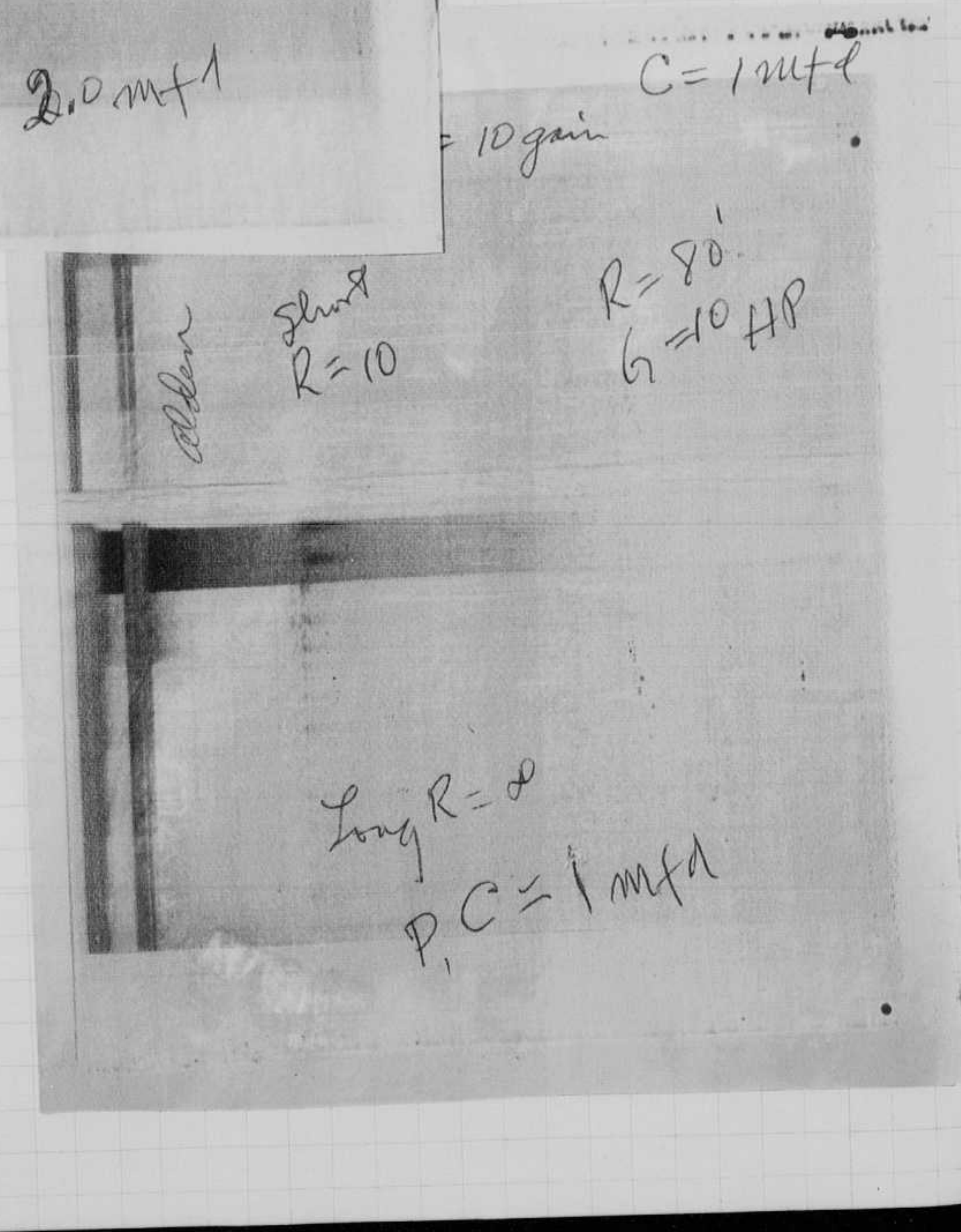
Best sediment record seen so far!



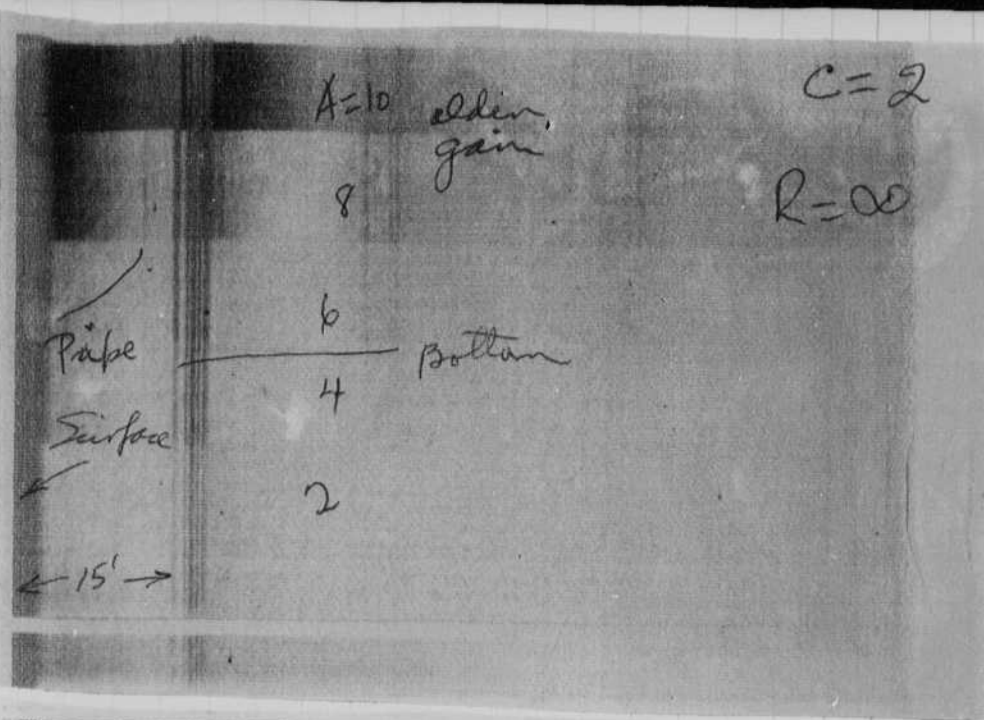


Depth about 15 feet
of water with
transducer about
5' above bottom
Hewlett packard amp
at gain of 20db
(10)

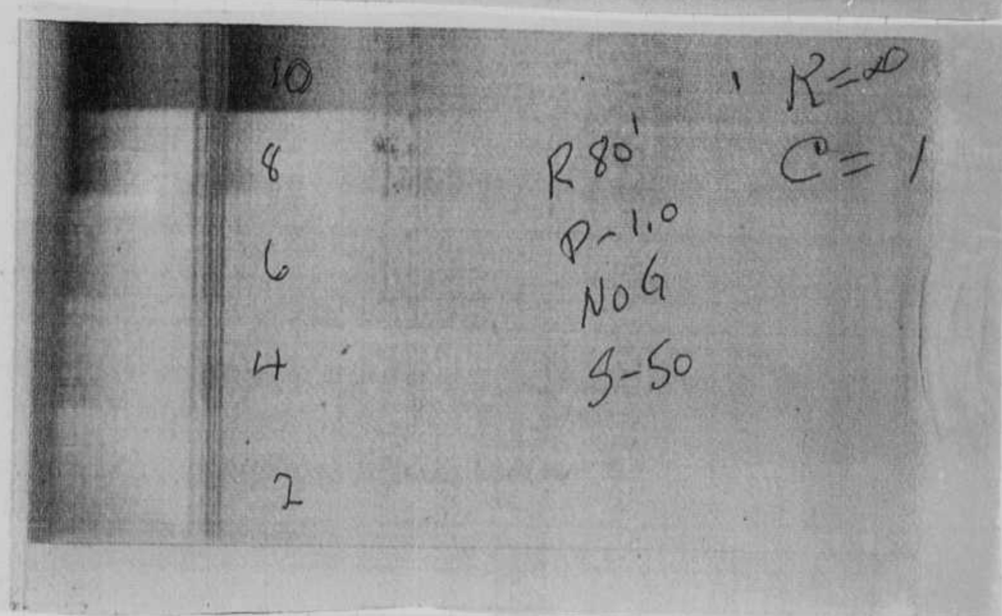
Coupling = .005 mfd
+ in alden



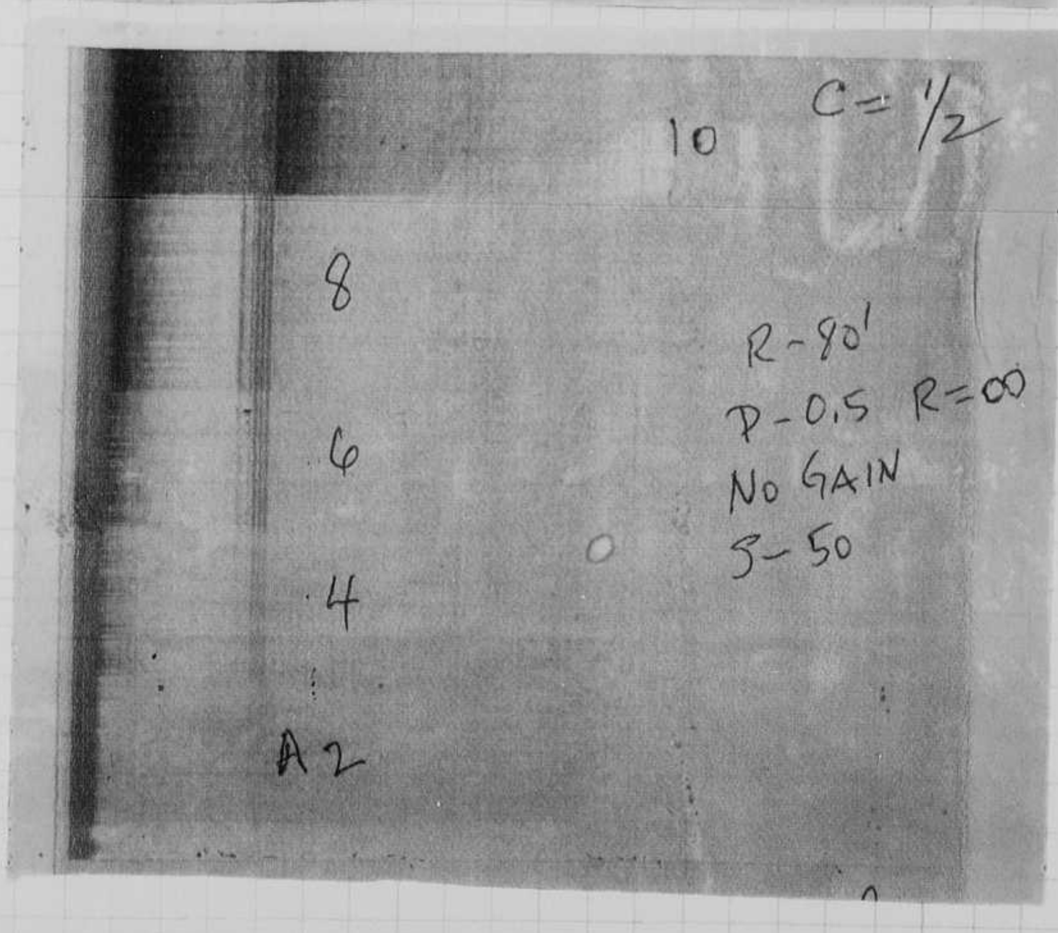
Using Martin Kleins single stage in the alden amplifier

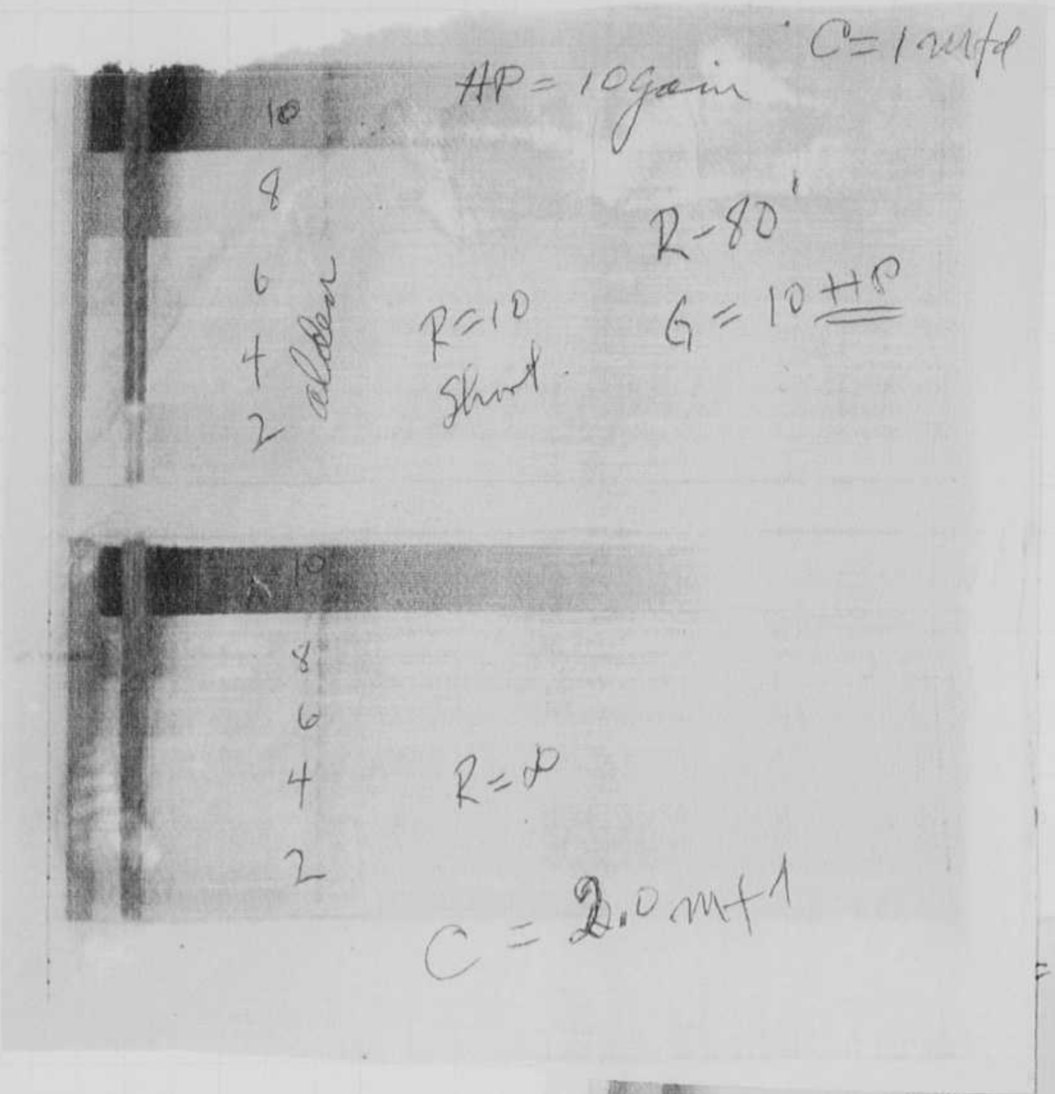


Transducer direct to alden with extra stage



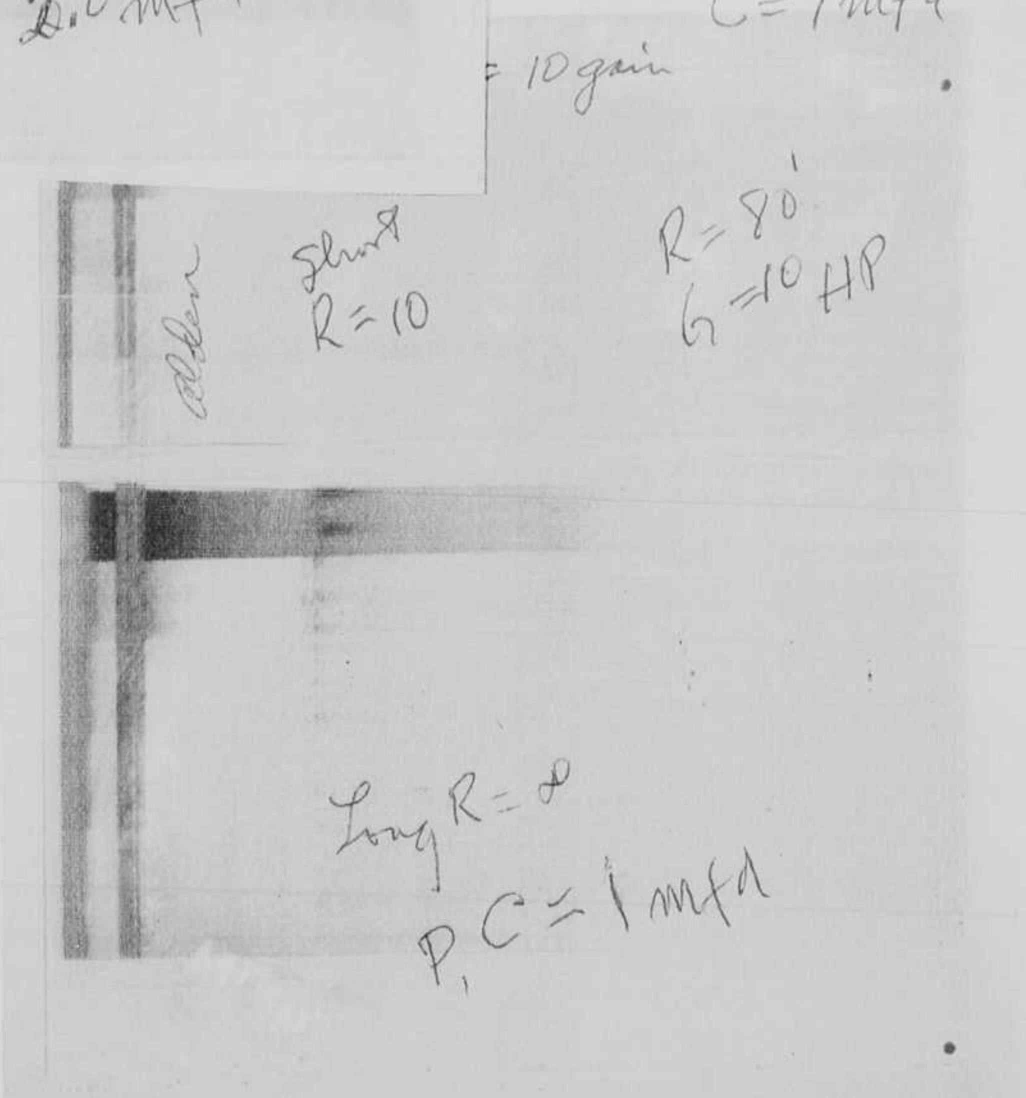
Taken off Dock at MIT Sailing Pavilion



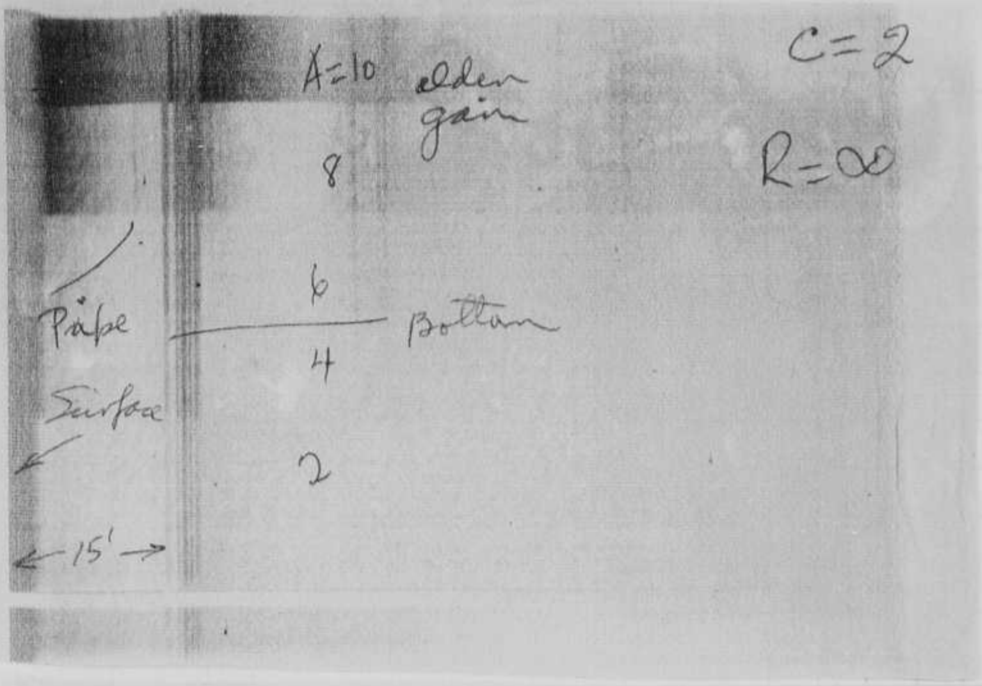


Depth about 15 feet of water with transducer about 5' above bottom Hewlett packard amp at gain of 20db (10)

coupling = .005 mfd to alden

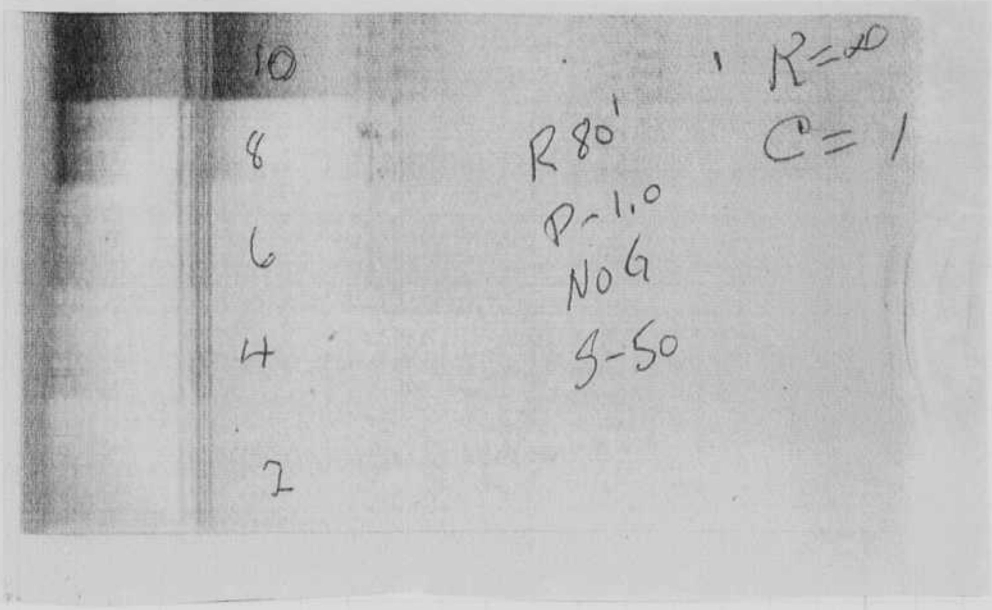


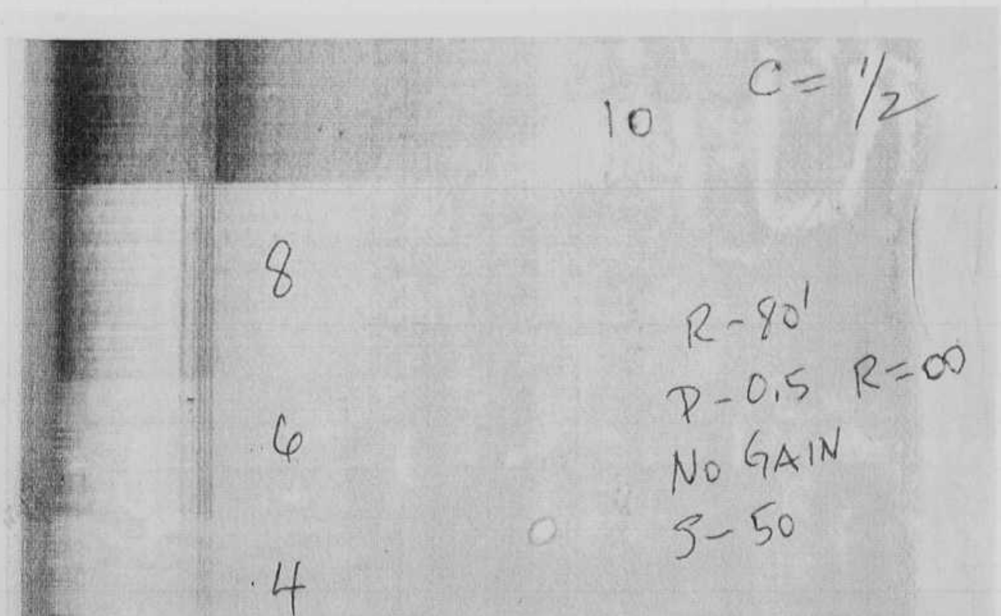
Using Martin Klein's single stage in the alden amplifier

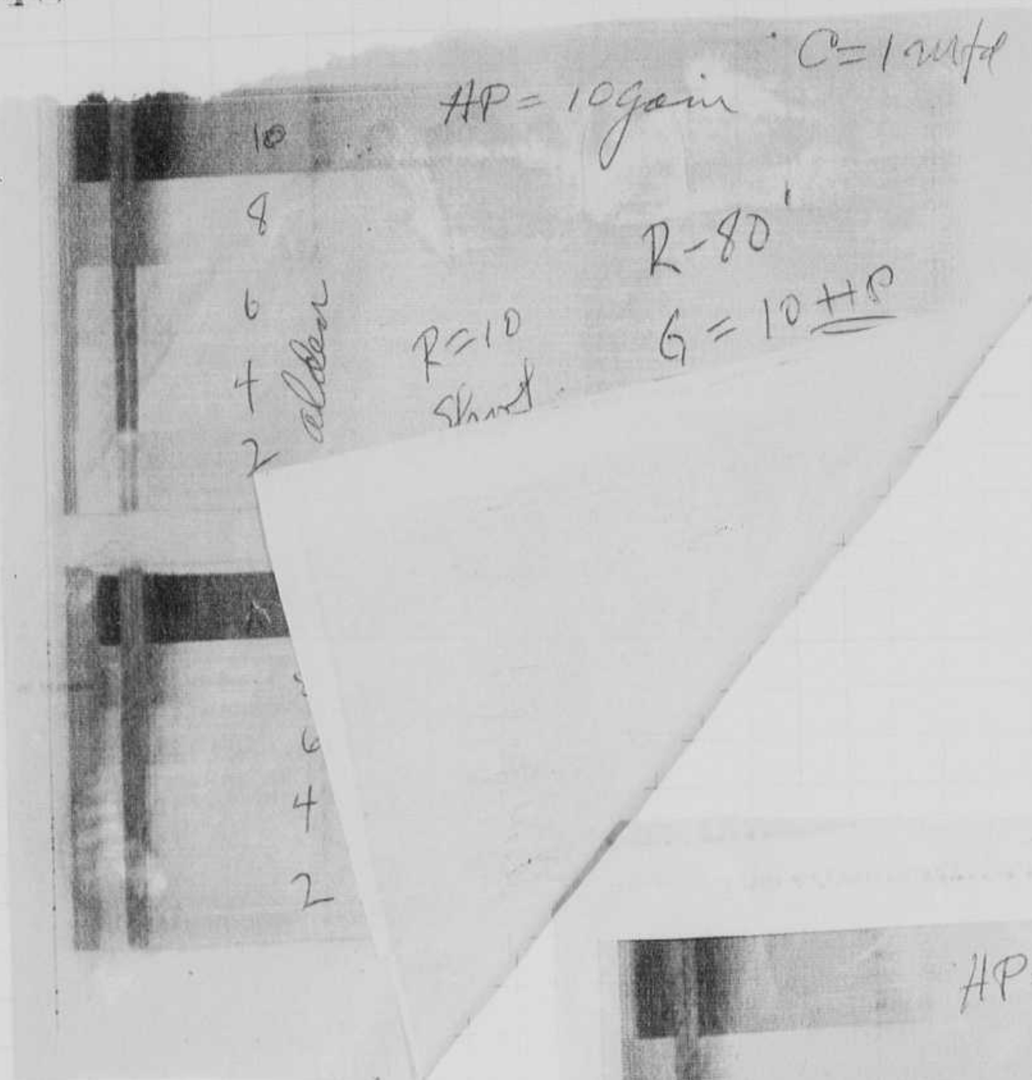


Transducer direct to alden with extra stage

Taken off Dock at MIT Sailing Pavilion



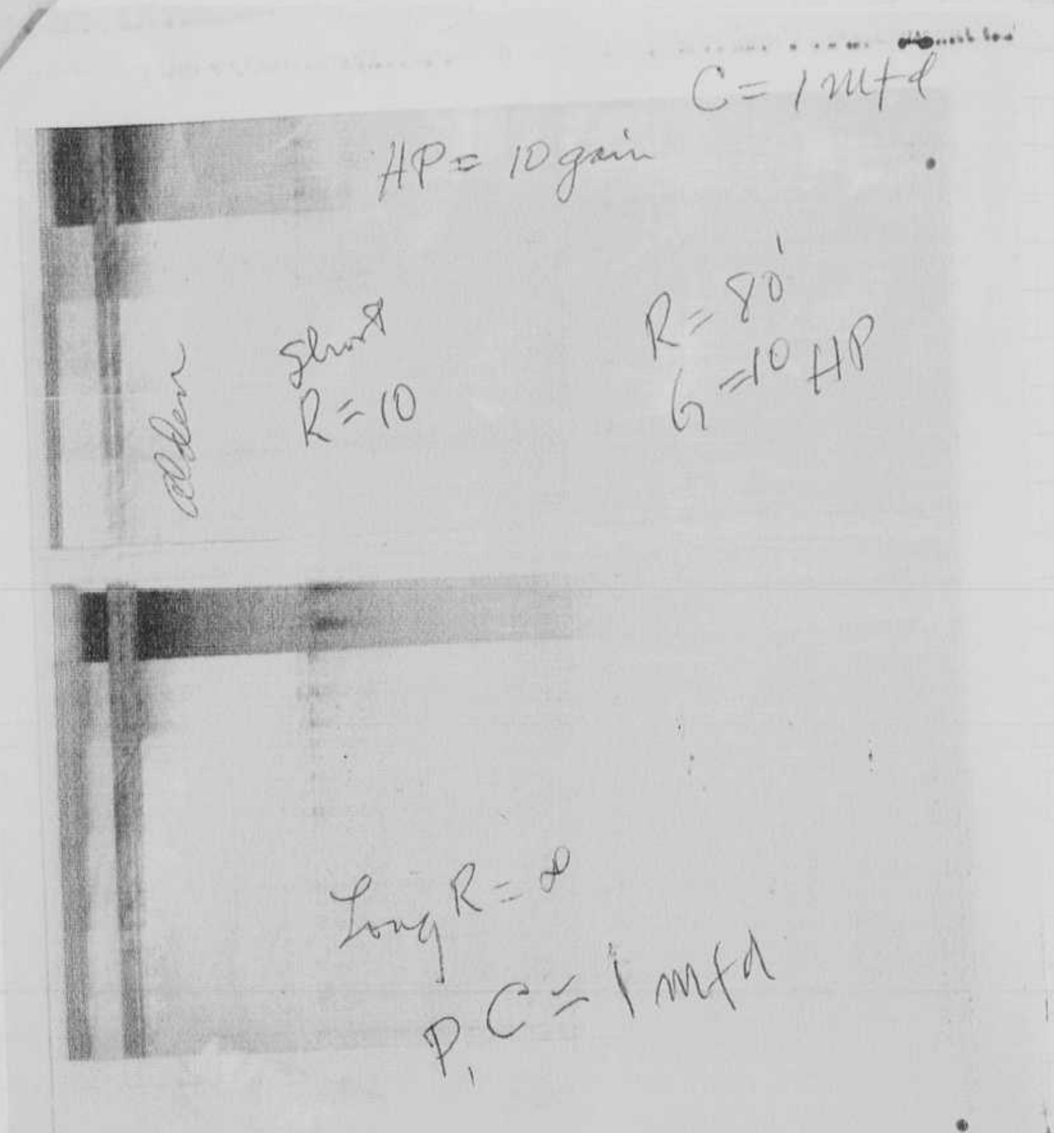




Depth about 15 feet of water with transducer about 5' above bottom

Hewlett Packard amp at gain of 20 db (10)

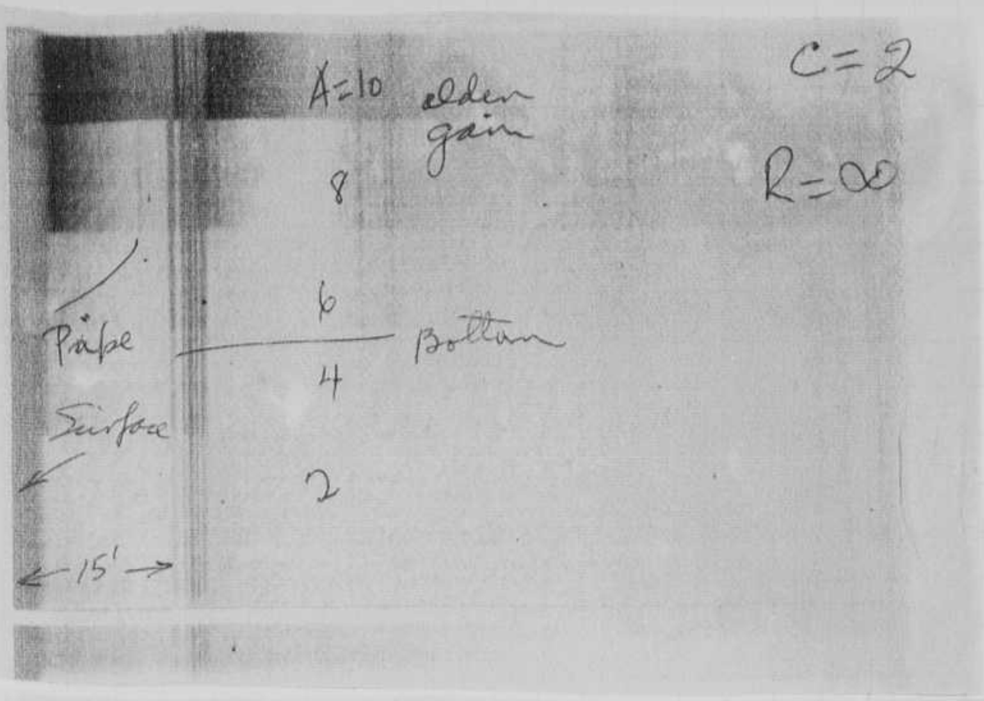
Coupling = .005 mfd at alden

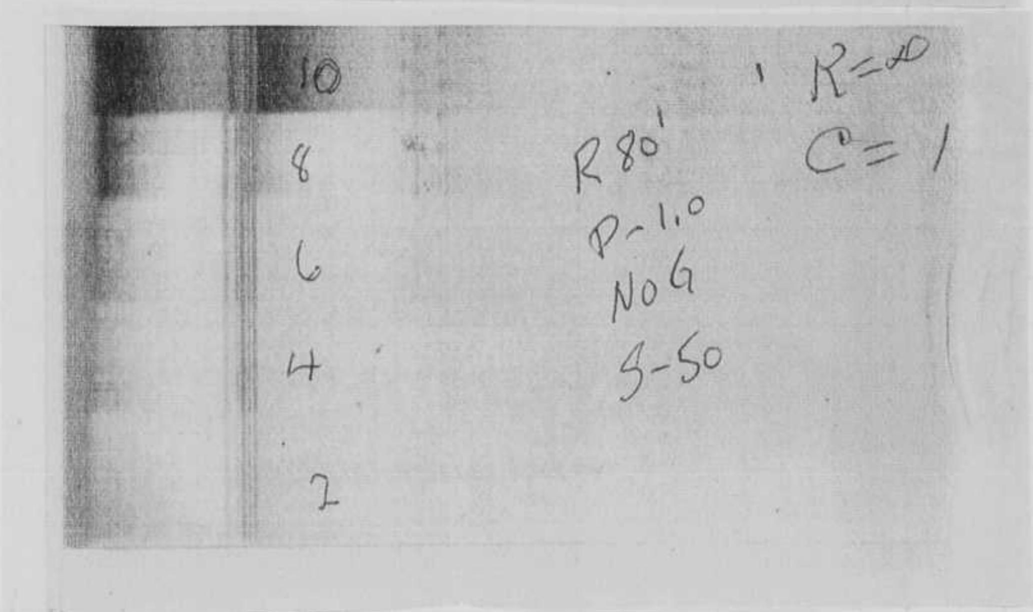


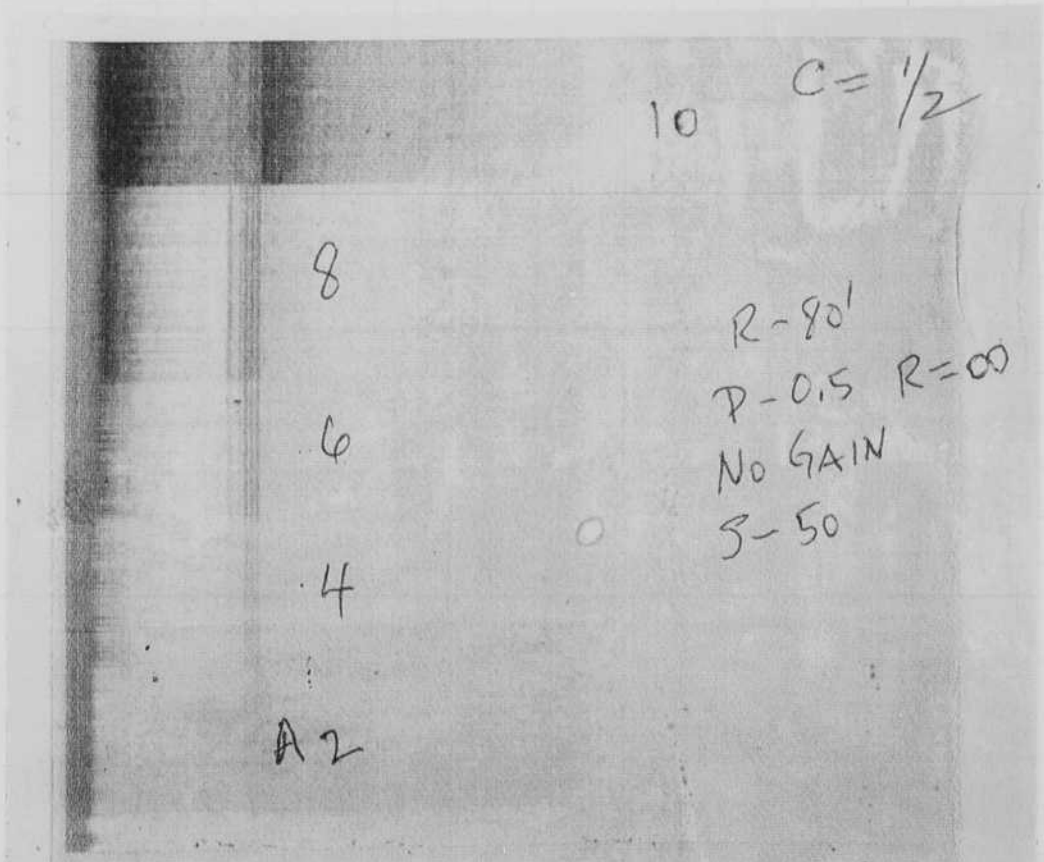
Using Martin Klein's single stage in the Alden amplifier

Transducer direct to Alden with extra stage

Taken off Dock at MIT Sailing Pavilion



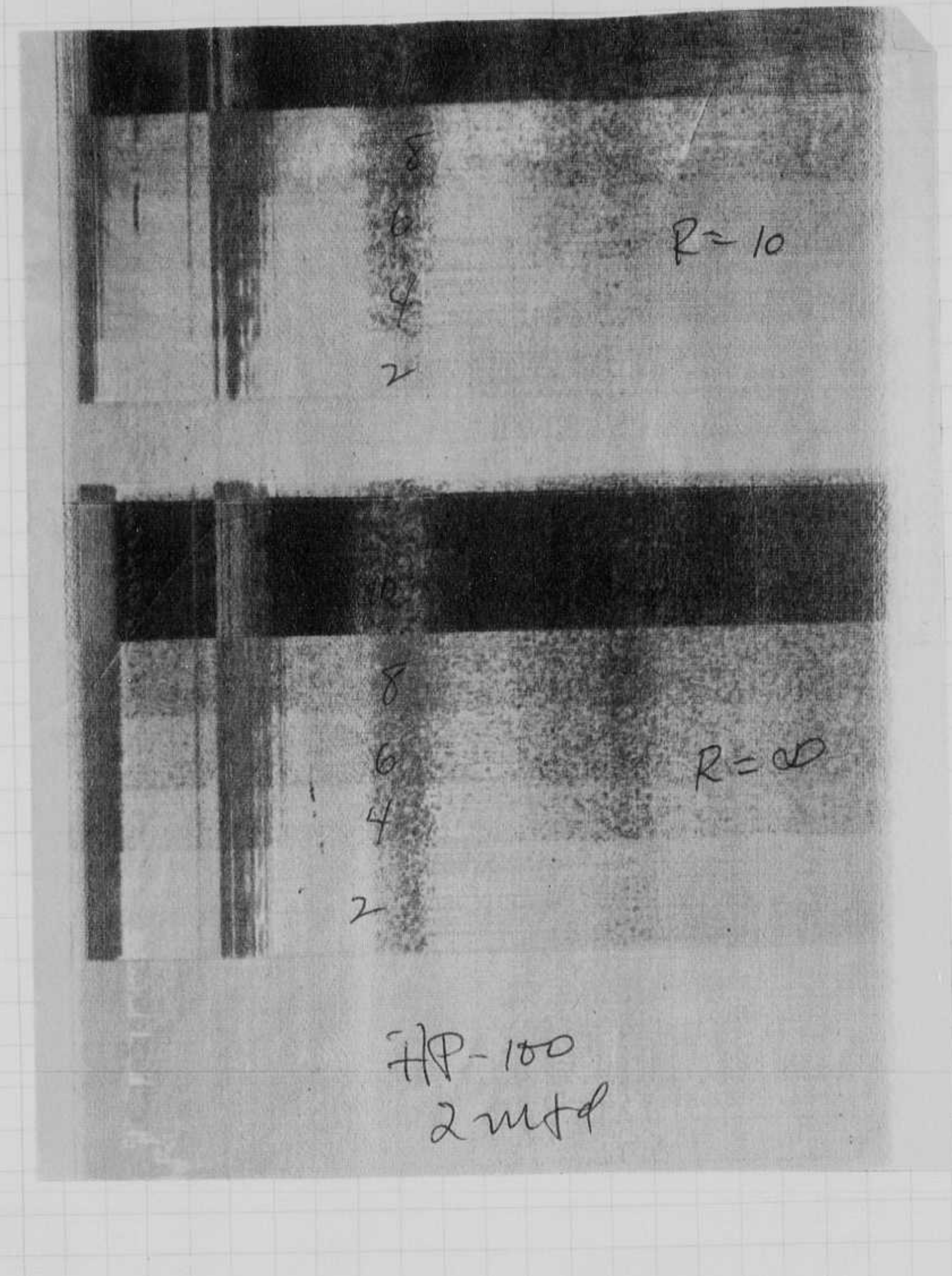




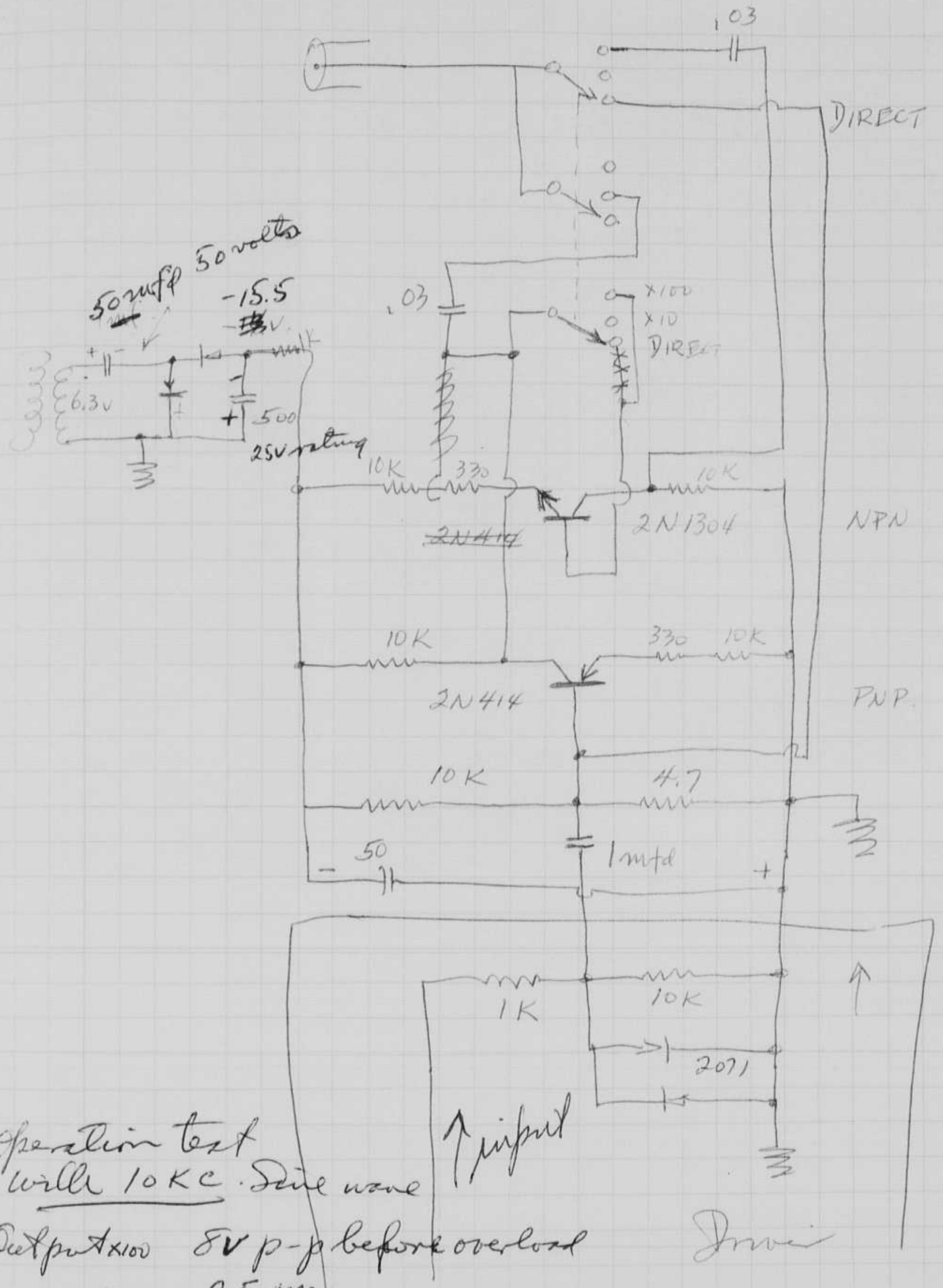
June 3 1962
HE Edgerton
Mike Dobbin.

MIT Bos. Decrease series R in Helix from 300 to 100 ohms to give a darker record on Range 80'

Shows effects of overload



New Transistor amplifier.



Operation test
with 10KC. Sine wave

Output x100 8V p-p before overload
x10 0.5 pp
Dir 0.035 pp input

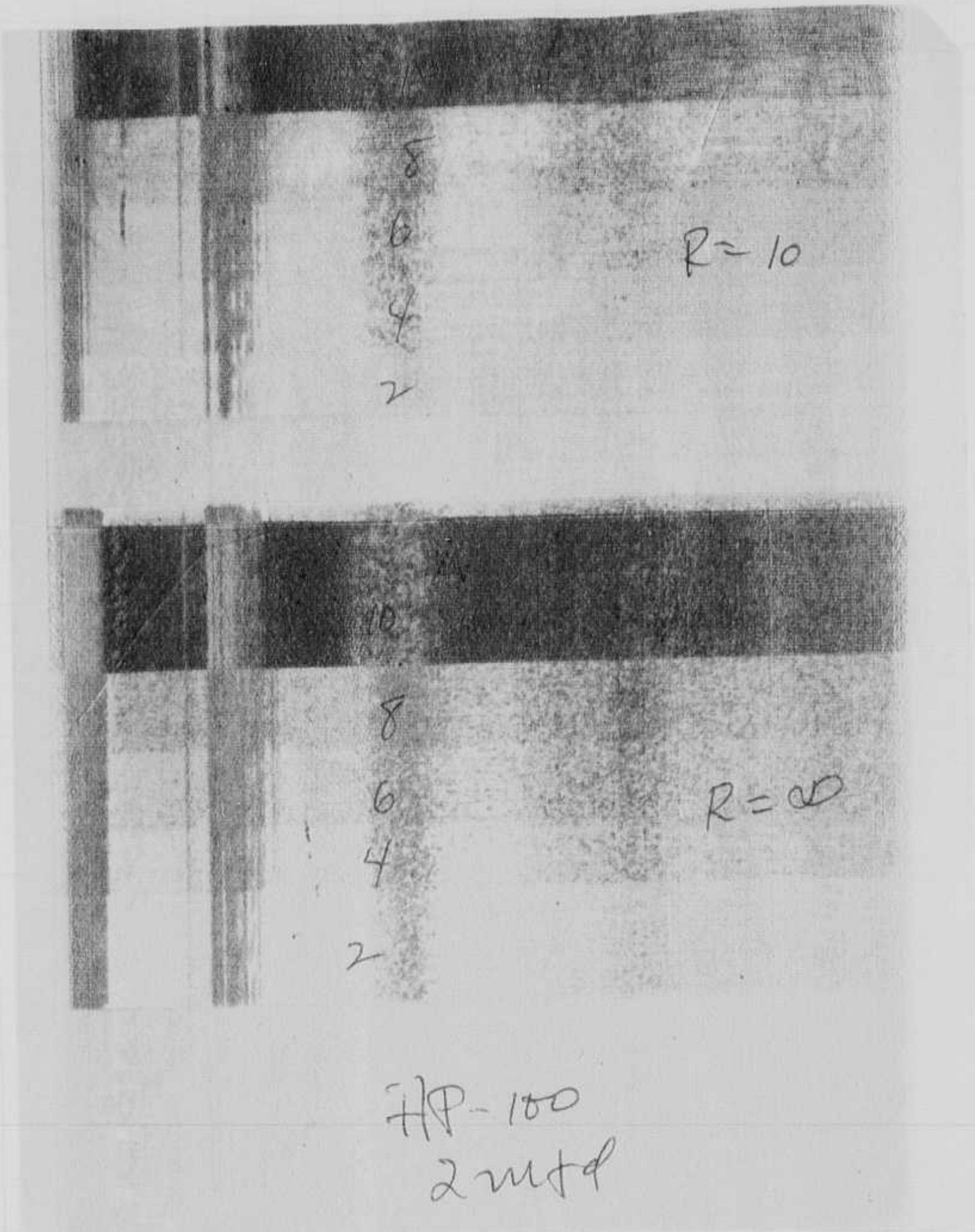
The second stage also overloads at 8 volts plate to peak - 2:28 pm
Sat.

June 3 1962
H. E. Edgerton
Mike Dobbins

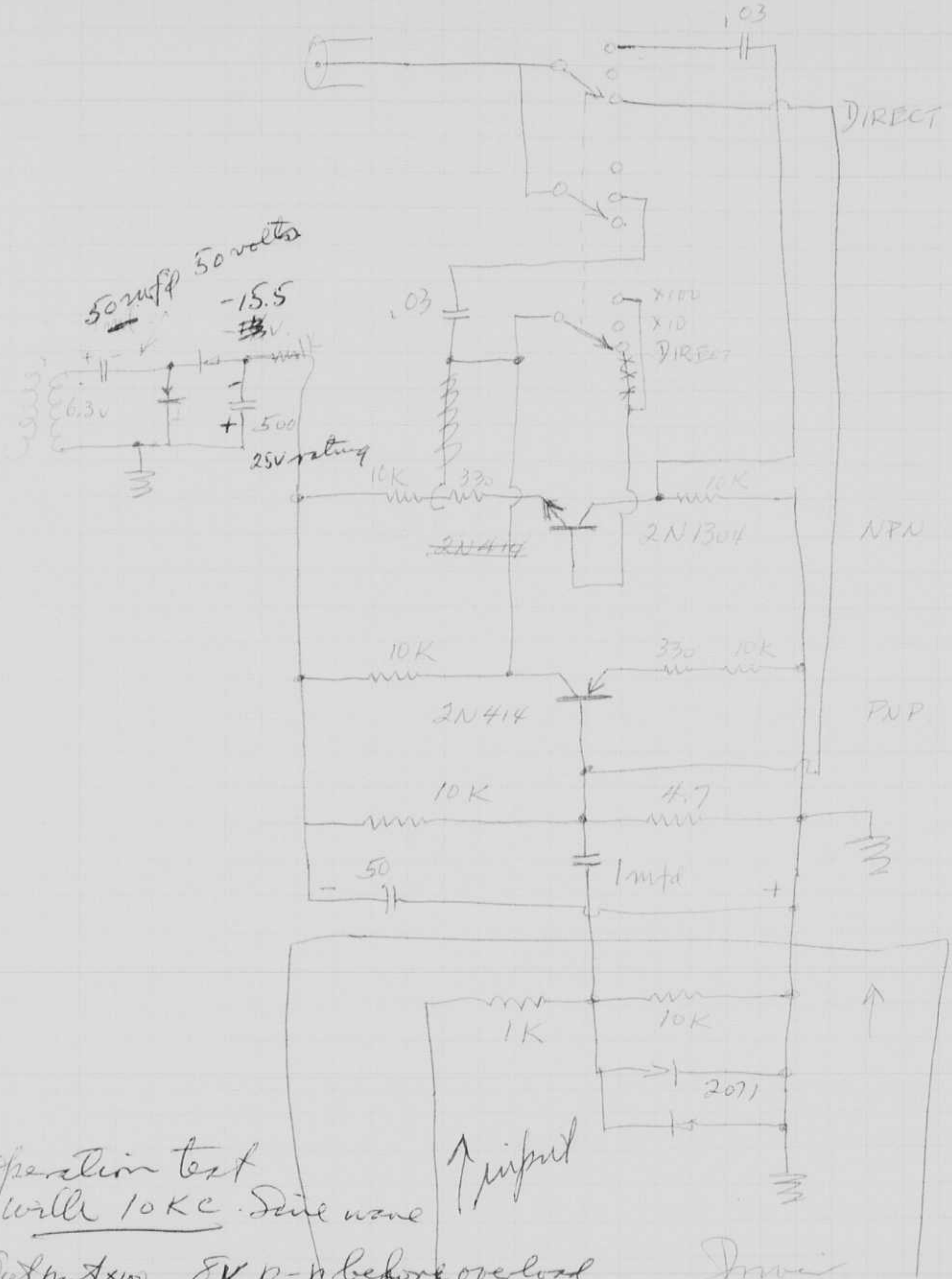
MIT Box.

Decrease series R in Helix from 300 to 100 ohms to give a darker record on Range 80'

Shows effects of overload



New Transistor amplifier.



Operation test with 10KC Sine wave

Output x100 8V p-p before overload
x10 0.5 pp
Dir 0.035 pp input

The second stage also overloads at 8 volts plate to peak. 2 28 pm Sat.

 nickel Ring 9KC²

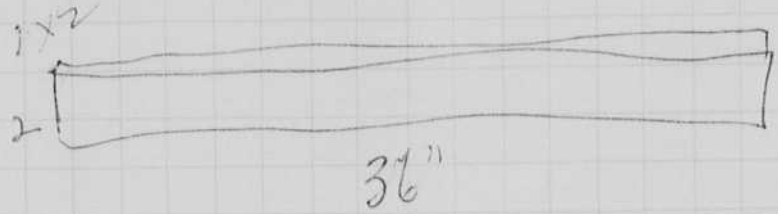
0.6 volts in mike at 6'. 3'ft deck-

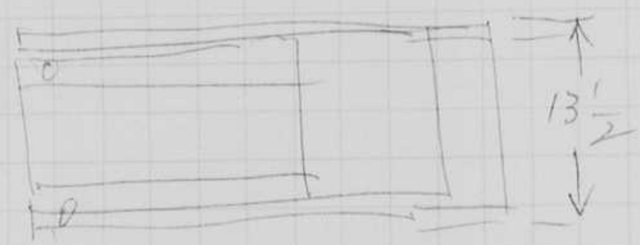
Echo at 6' 2 volts peak to peak.
3 cycles ~~on~~ R = ∞ ~~2~~ volts p-p.
1.5 " on R = 10 1.5 " p-p

Bottom Echo 0.25 volts. in

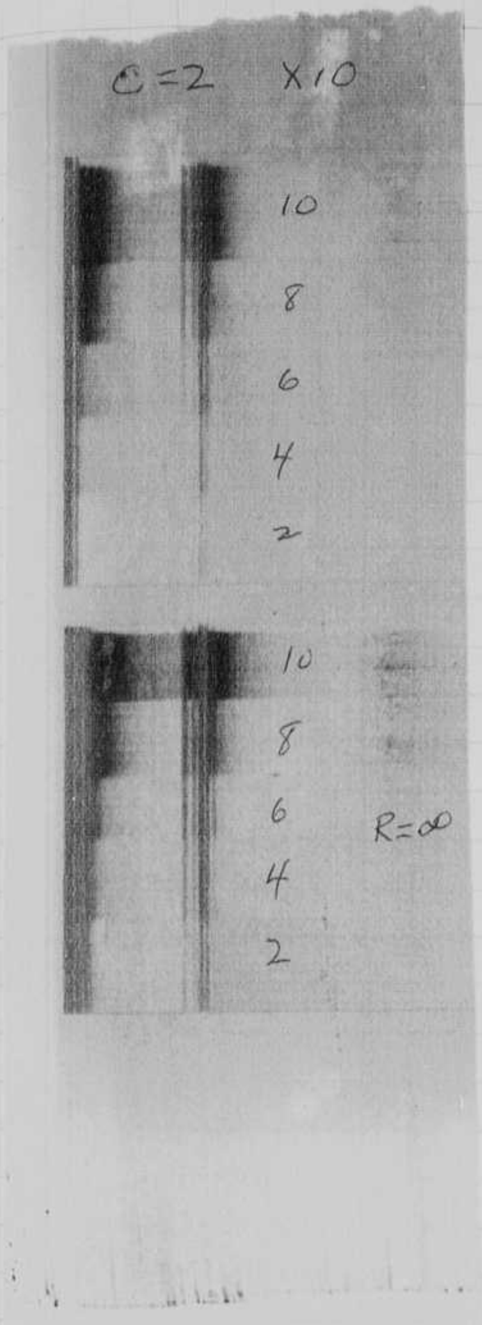
Trip made in River with Mike Devlin, Sheldon, & Divinia.

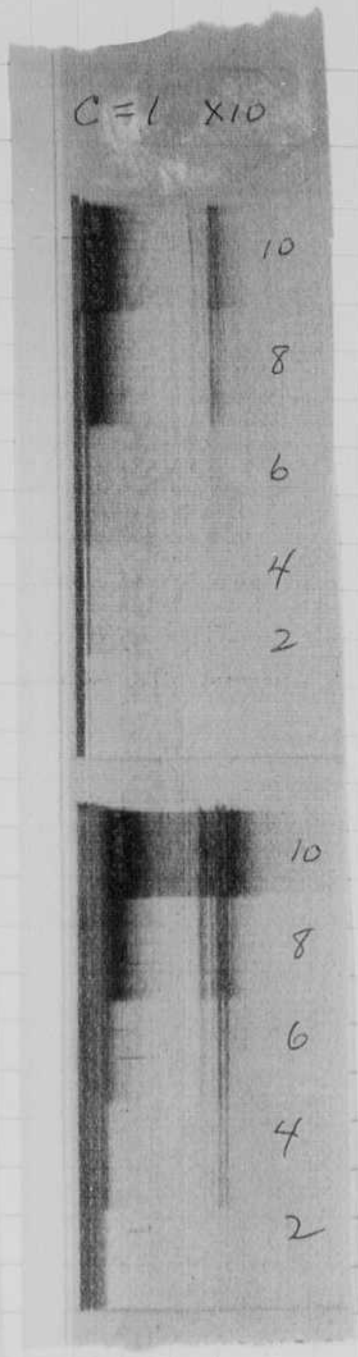
the speed was too great of the boat for the power suspension. We stopped in the 35' hole in the center of the bay and lowered the transducer.

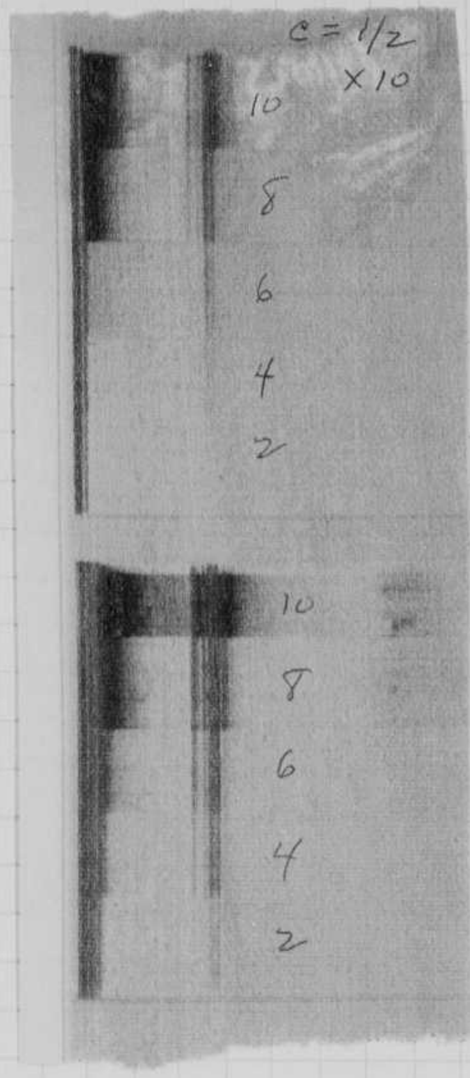




Edo off Sailing Pavillion







nickel King 9KC?

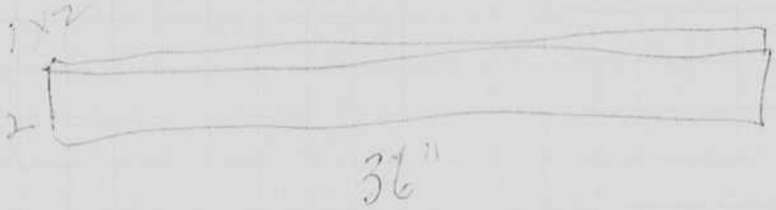
9.0 volts in nike at 6'. 3'/ft decals-

Echo at 6' 2 volts peak to peak.
3 cycles on $R = \infty$ ~~2~~ volts p-p.
1.5 " on $R = 10$ 1.5 " p-p

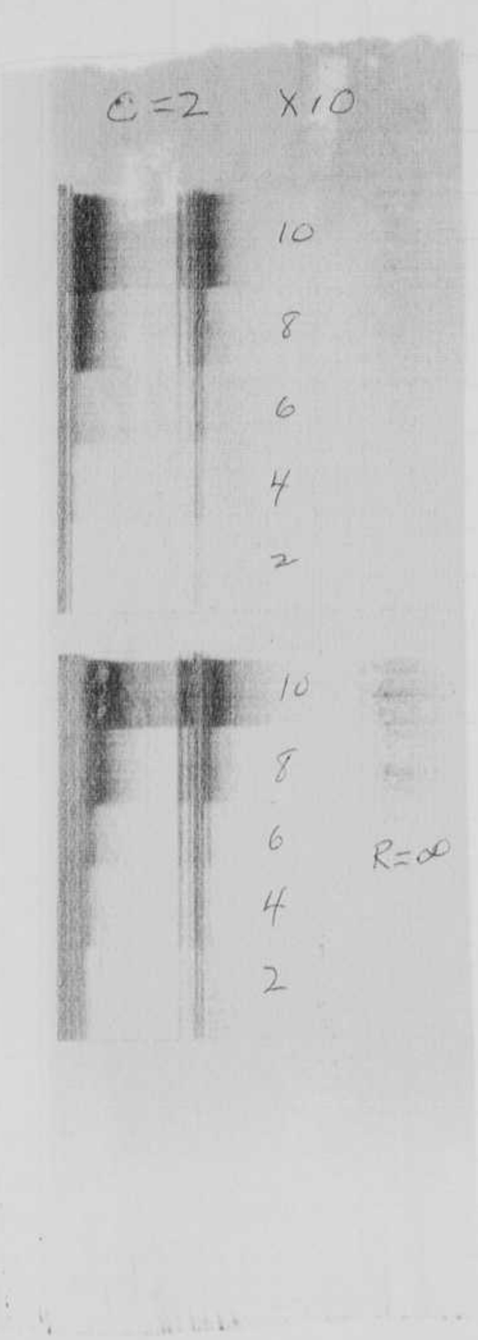
Bottom Echo 0.25 volts. in

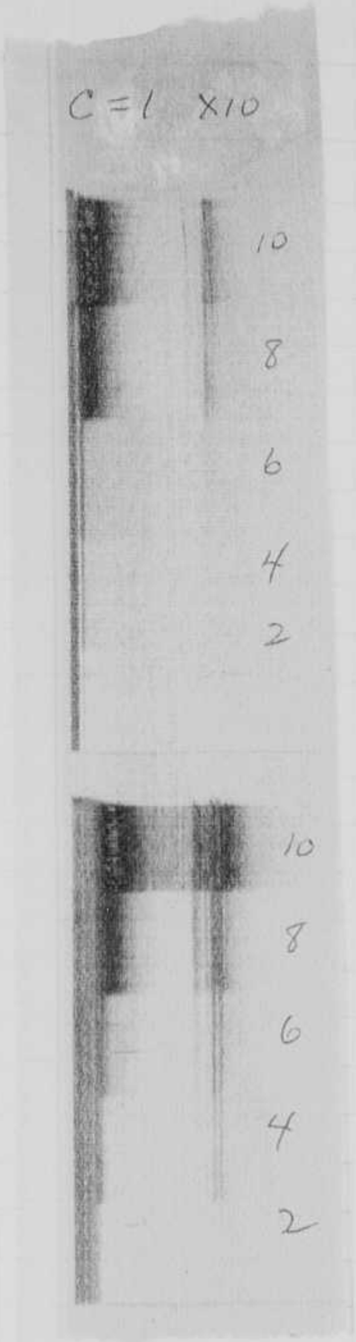
Trip made in River with Mike Devlin, Shaldkramk Dinnis.

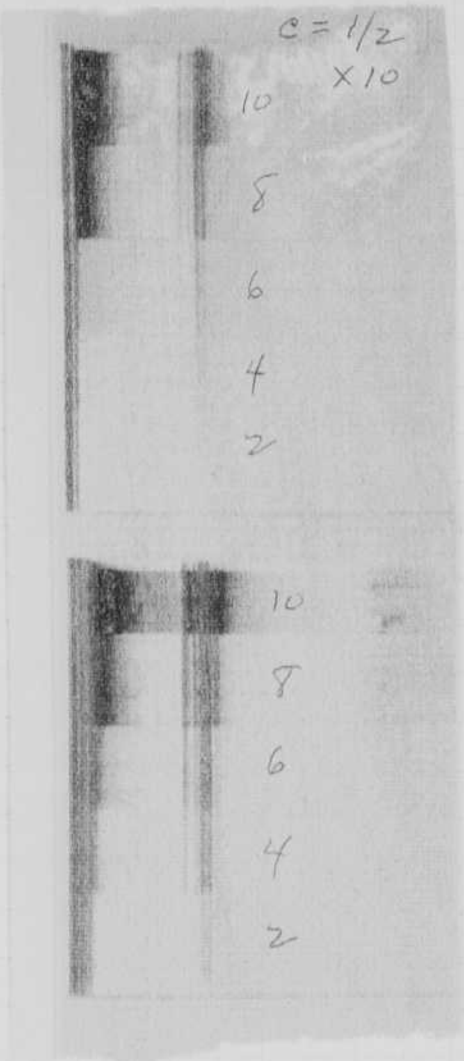
the speed was too great of the boat for the proper suspension. We stopped in the 35' hole in the center of the bay and lowered the transducer.

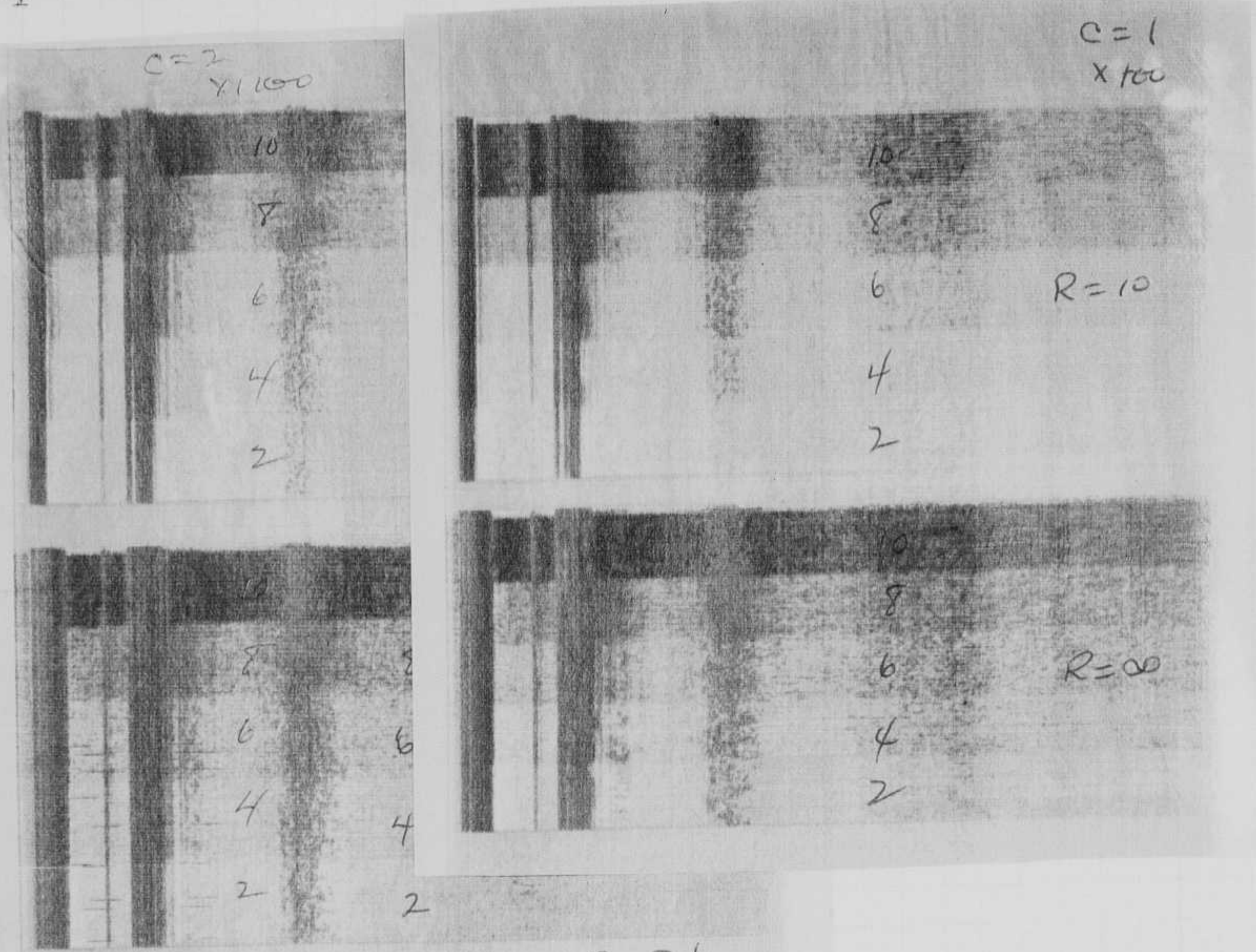


Edo off
Sailing Pavillion



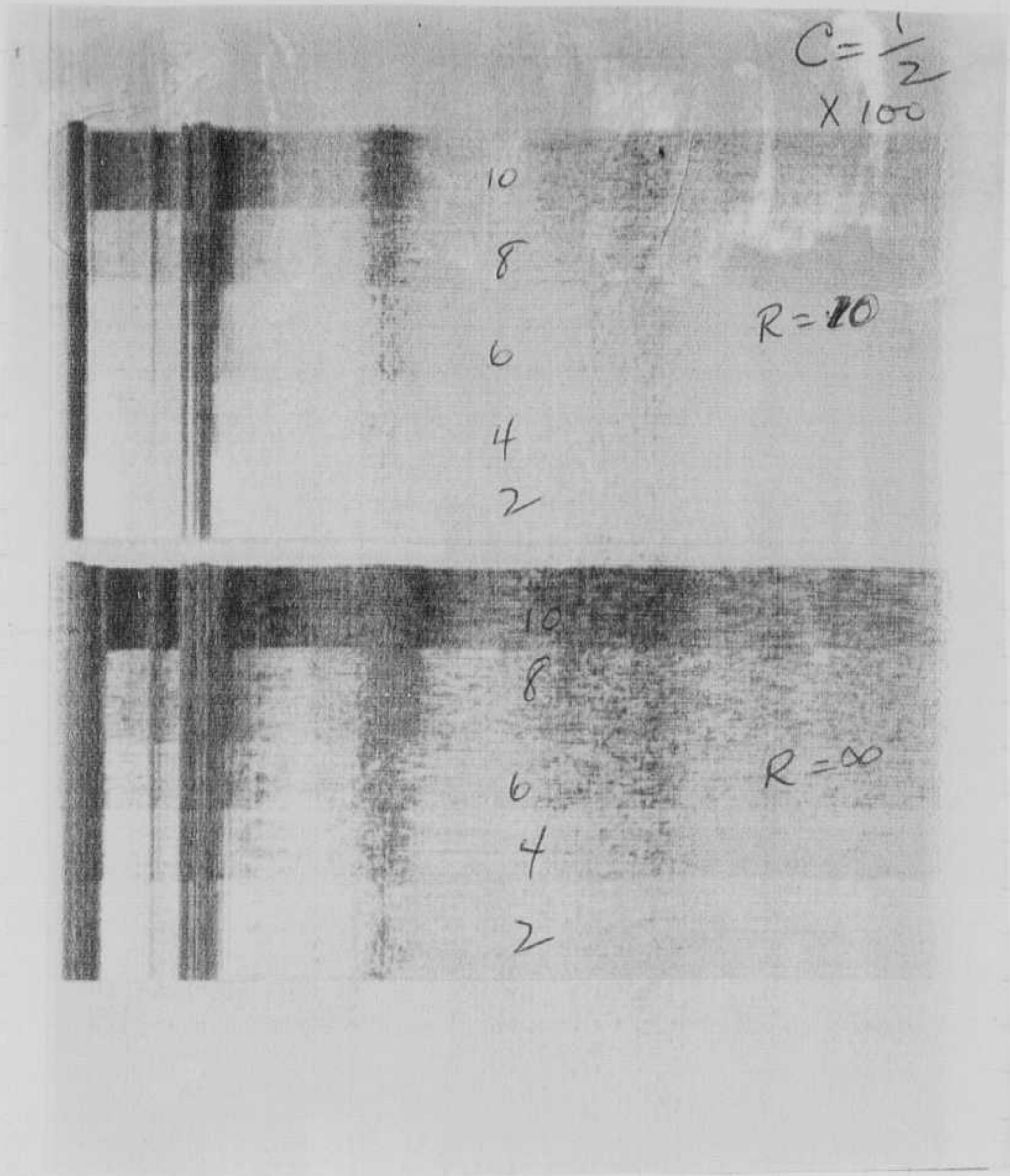






alden.

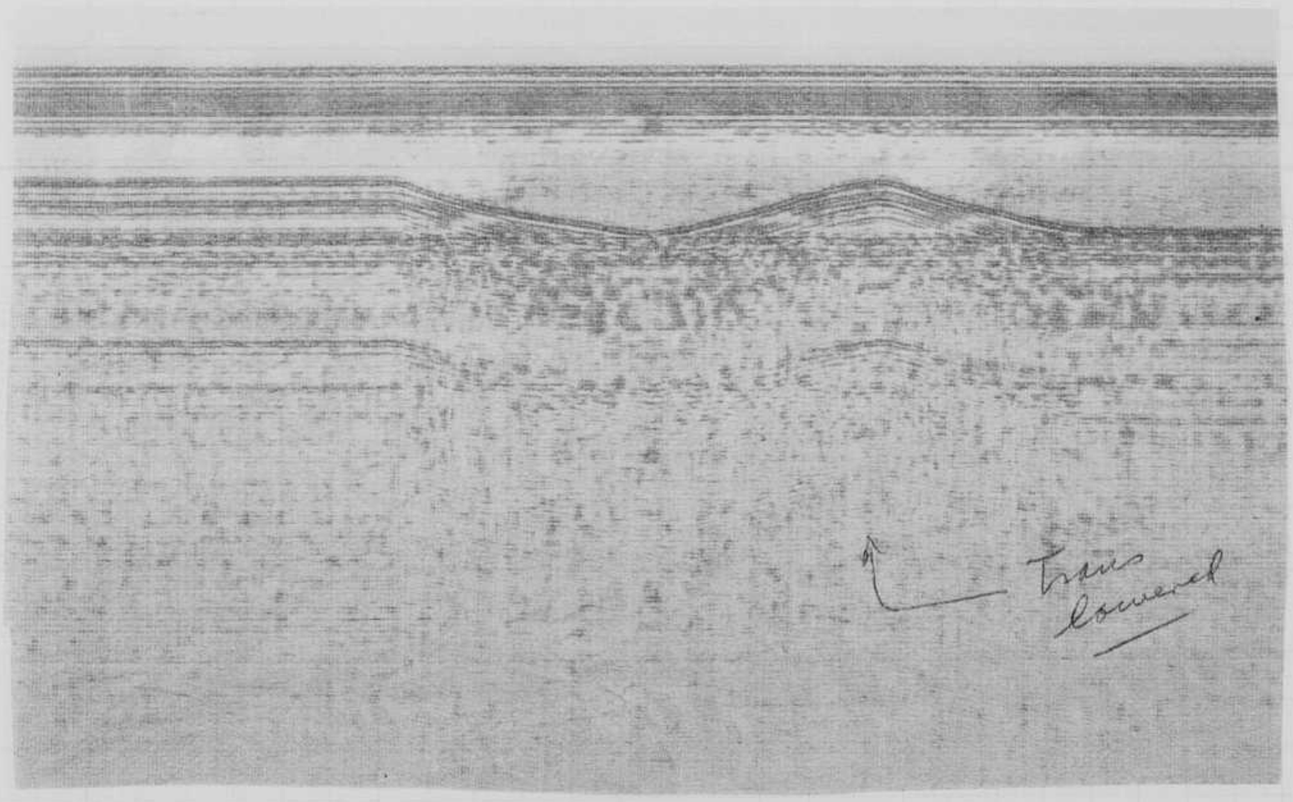
R - 80' 2mfd.
C= ~~100~~
G = 100
S - 60



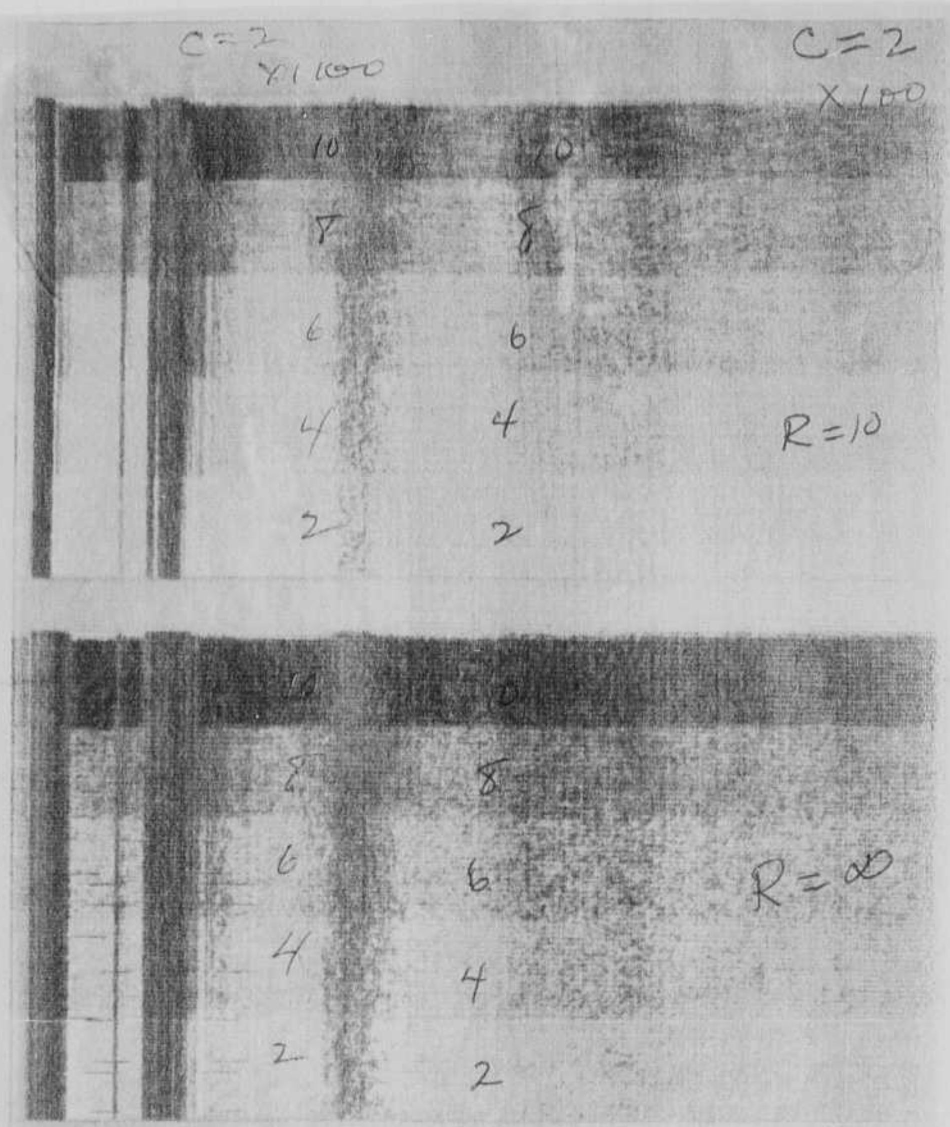
Charles River
MIT Sail
Pavilion
14' water

Range 80'

Nickle ring
transducer

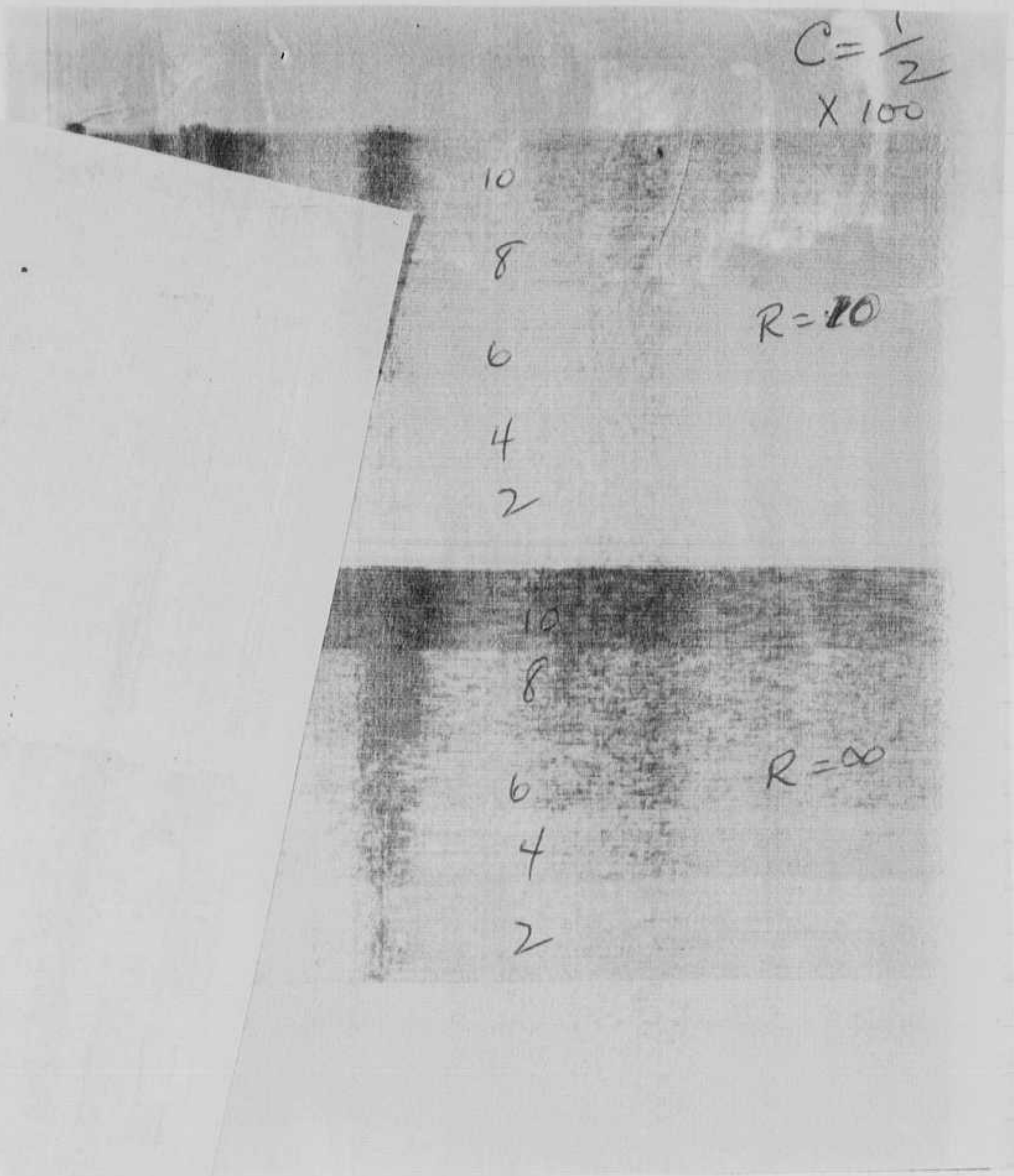


Bottom
echo



alden.

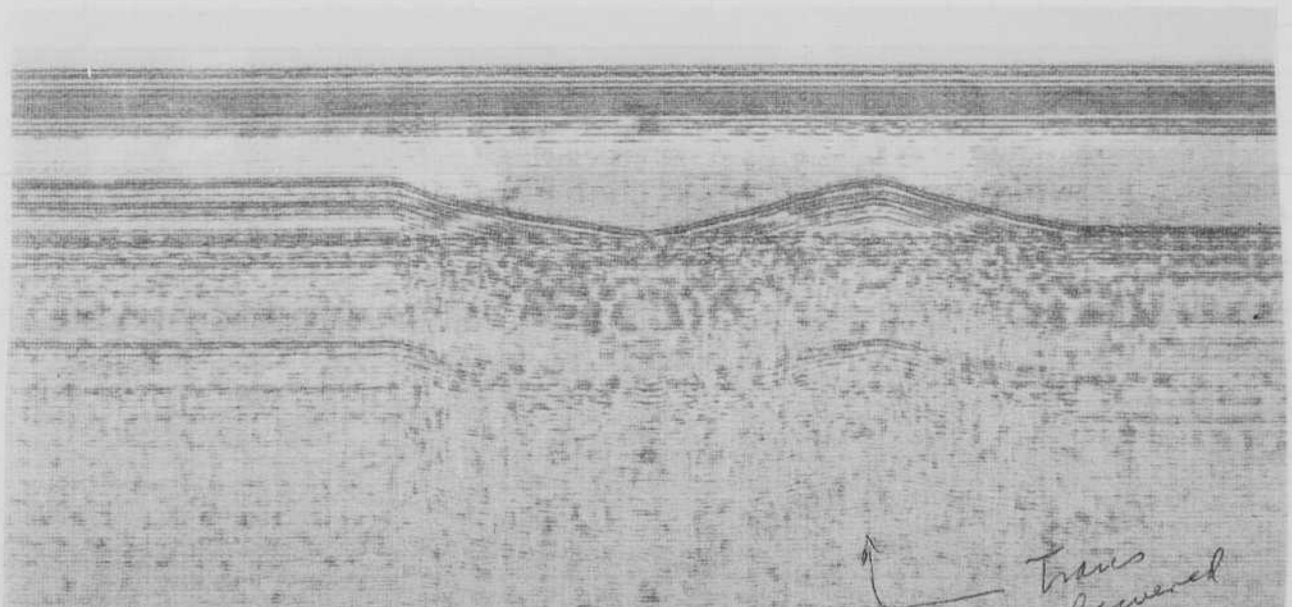
R - 80' 2 mfd.
C = ~~100~~
G = 100
S - 60
1



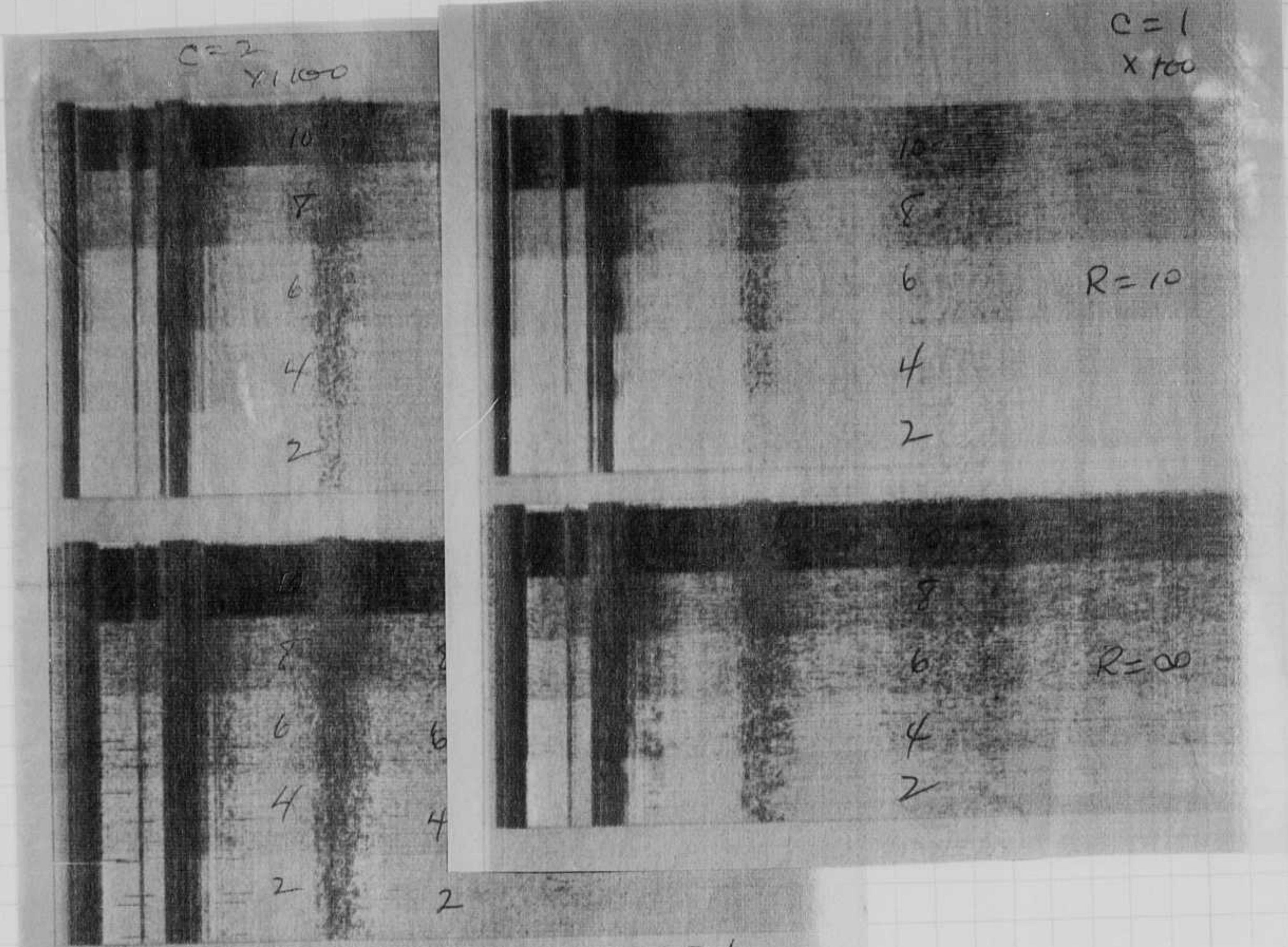
Charles River
MIT Sail
Pavillion
14' water

Range 80'

Nickle ring
transducer

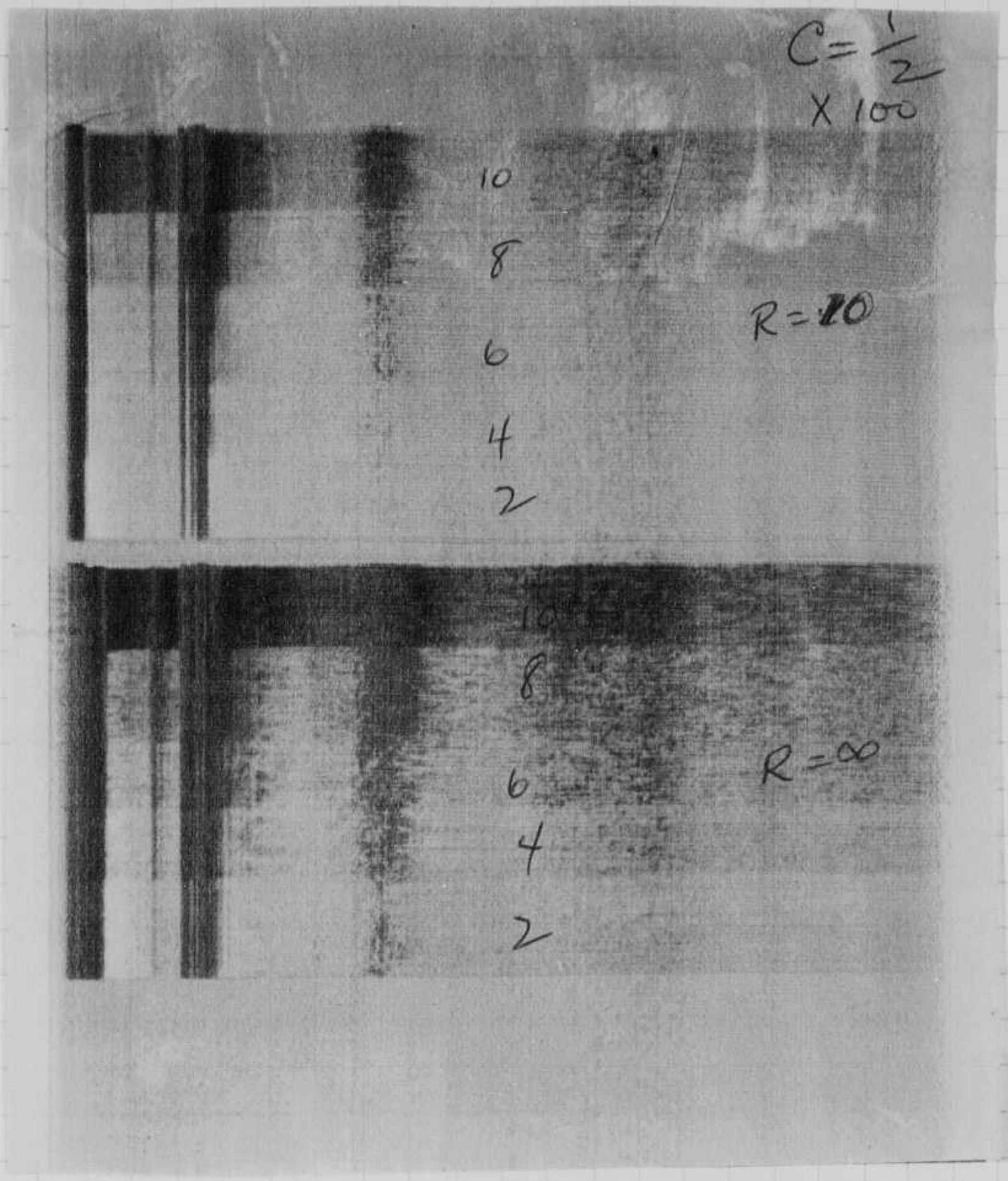


Bottom
echo



alden.

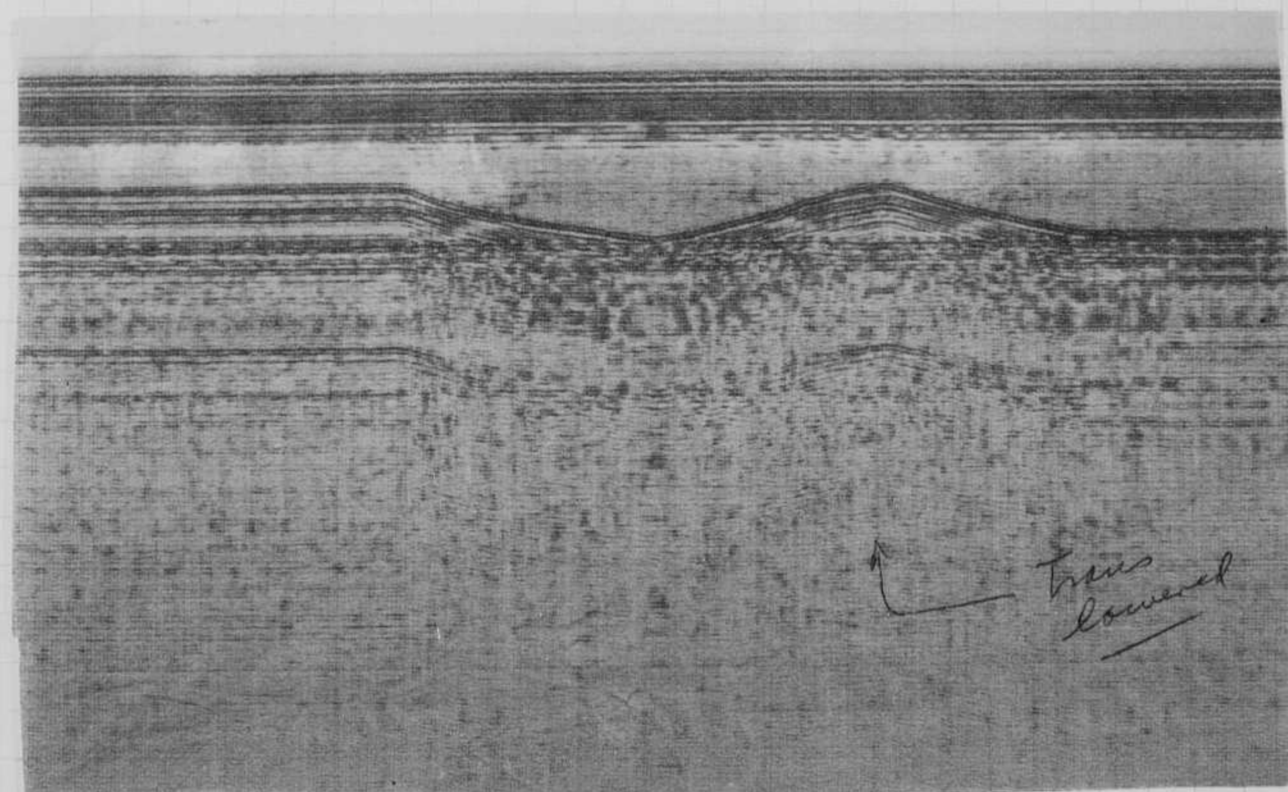
R - 80' 2 mfd.
C = ~~100~~
G = 100
S - 60
1



Charles River
MIT Sail
Pavillion
14' water

Range 80'

Nickle ring
transducer



— Bottom
echo.

June 7, 1962
Harold Edgerton

There was a meeting of the Ind Liason group at M.I.T. yesterday. Shrock gave the adress at the beginning. I was one of the speakers, my remarks were about the U.W. camera, pinger, and boomer.

June 8, 1962. Gunnison from Eastman Kodak was here yesterday to talk cameras lights etc for Ind Tuttle.

I showed him the pinger mud penetration at the M.I.T. Sailing Pavillion. We could see a 4" Batterson cylinder 12" long at 24 feet in the water.

This looks like a good way to show the submersible target and the experimental underwater missiles. 40 ft/sec is the velocity ~~of the~~ missile.

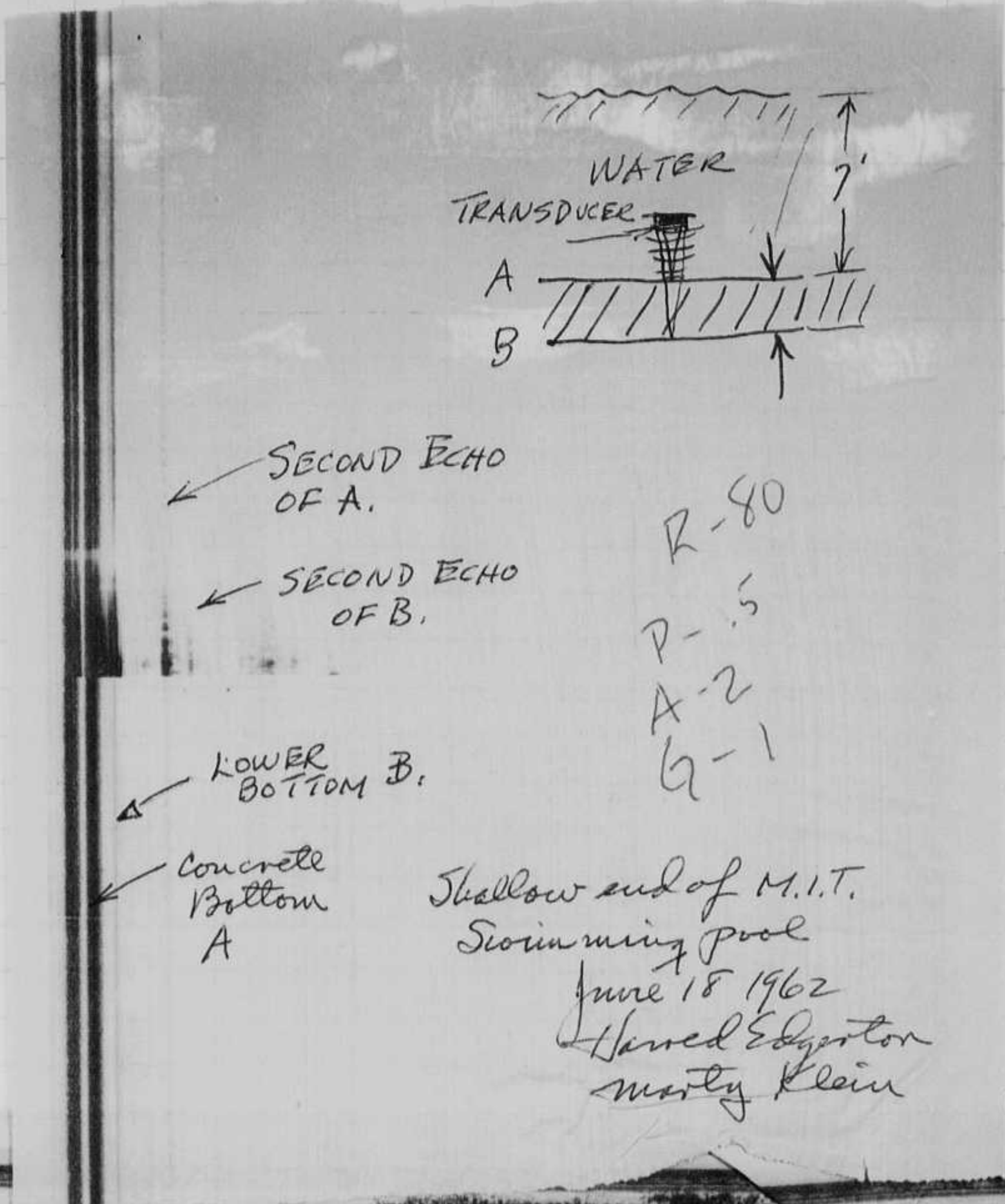
I went to W.H.O.I. in the afternoon yesterday, saw Breslau, Owen, Hays, Knott, ~~Stetson~~, etc.

June 13 1962. Yesterday in Wash at the Lafayette Hotel I met P. Drach, A.B. Hersey, McEwing and ? . We discussed the proposed visit of the bathyscaph in Apr May June 1963 at Puerto Rico.

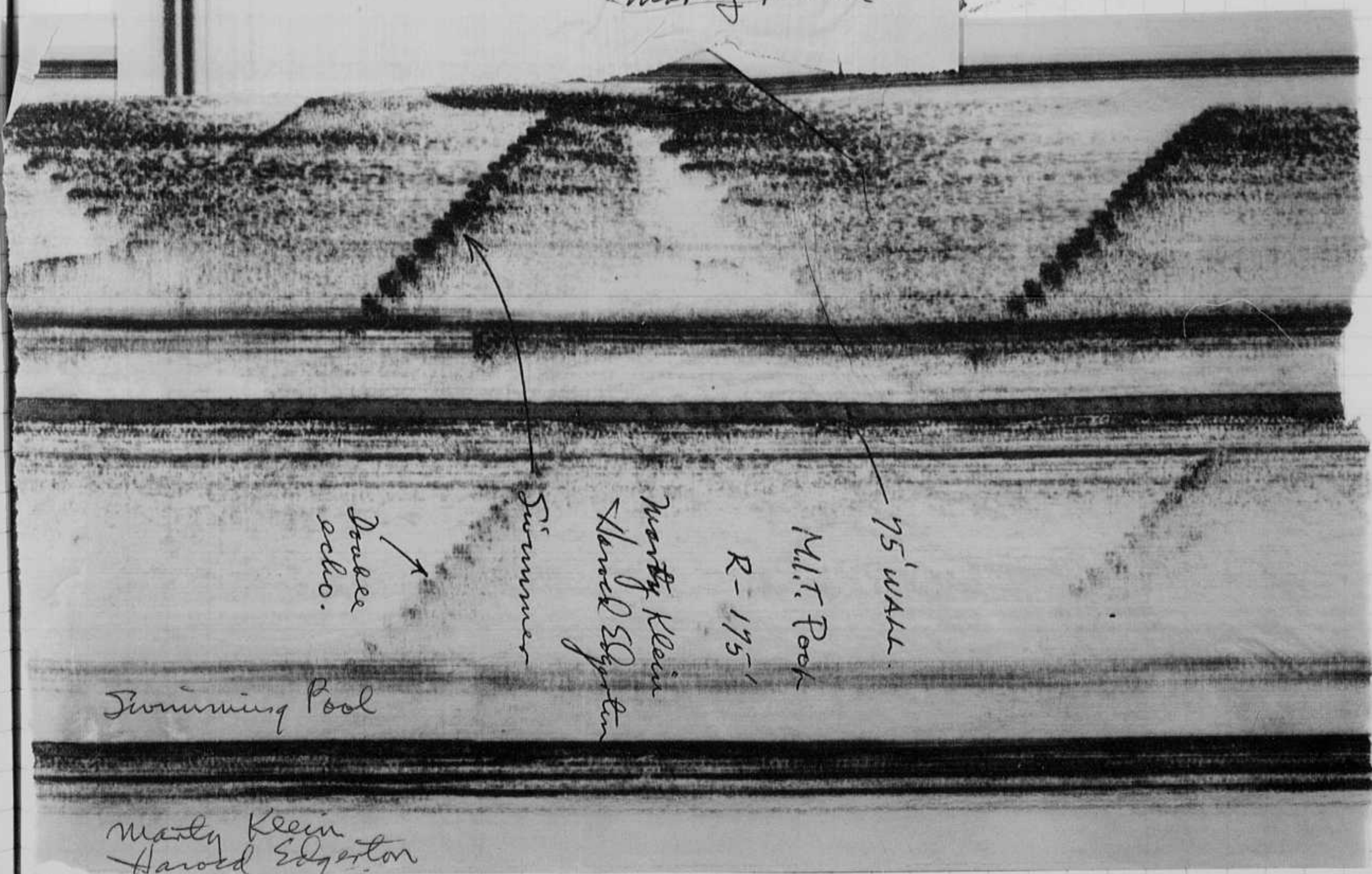
Program Scientific
(1) Sedimentary
Acoustic
Magnetism
Currents
Pressure
Photos

18-20 dives are proposed during a 3 month visit. Enough ballast can be carried for 5 or 6 dives.

Hersey was going to introduce Drach to Maxwell and Jenings at O.N.R. today to discuss further details of the program.



Shows echo from bottom of concrete.



June 7, 1962
Harold Edgerton.

There was a meeting of the Sed Lesson group at M.I.T. yesterday. Shrock gave the adress at the beginning. I was one of the speakers, my remarks were about the U.W. camera, pinger and boomer.

June 8, 1962. Swanison from Eastman Kodak was here yesterday to talk cameras lights etc for Ford Tuttle.

I showed him the pinger mud penetration at the M.I.T. Sailing Pavillion. We could see a 4" Bottom on cylinder 12" long at 24 feet in the water.

This looks like a good way to show the submarine target and the experimental underwater missiles. 40 ft/sec is the velocity ~~of the~~ missile.

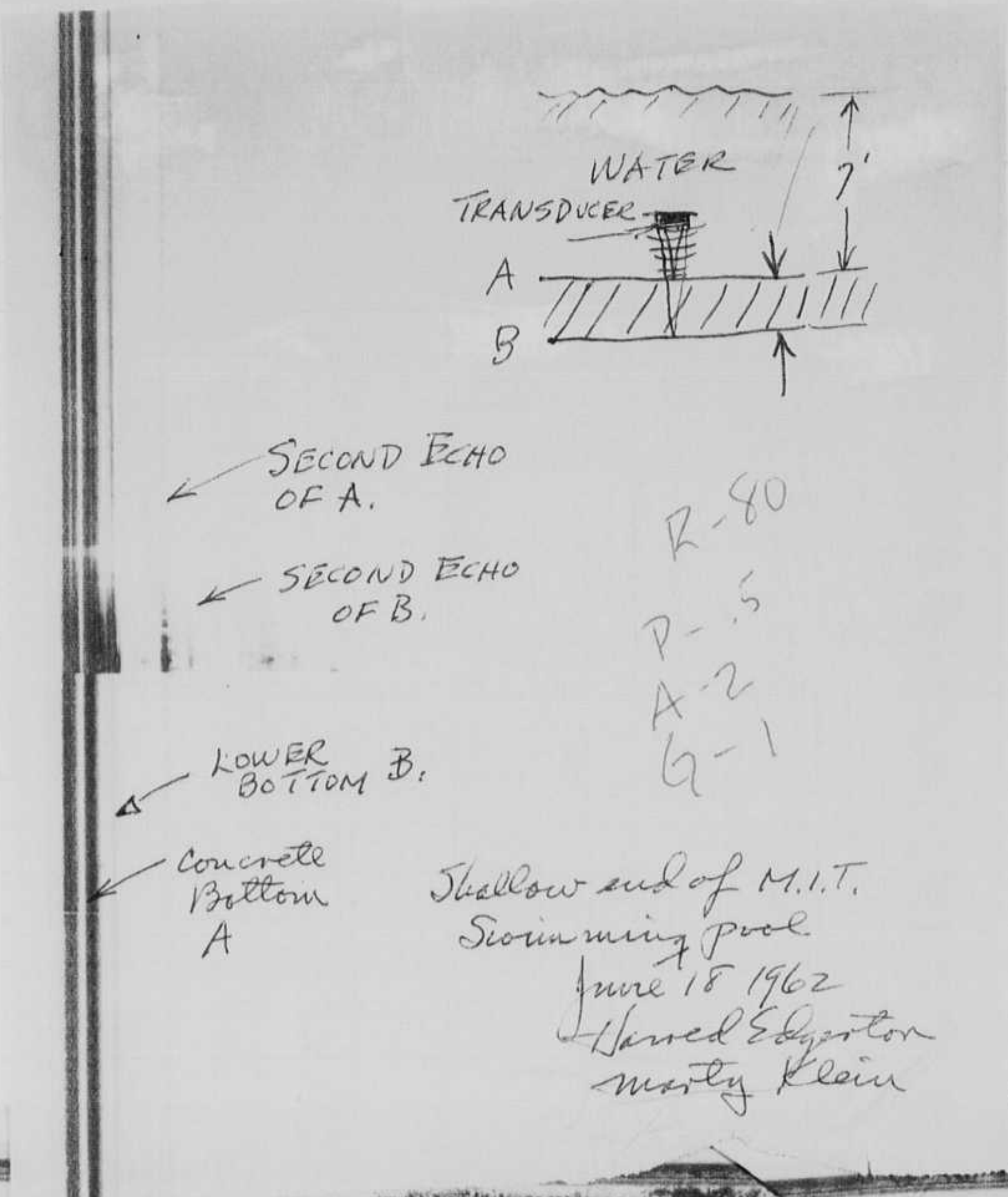
I went to W.H.O.I. in the afternoon yesterday. Saw Breslau, Owen, Hays, Knott, ~~Stetson~~, etc.

June 13 1962. Yesterday in Wash at the Lafayette Hotel I met P. Drach, A.B. Hersey, Mr Ewing and ?. We discussed the proposed visit of the bathyscaph in Apr May June 1963 at Puerto Rico.

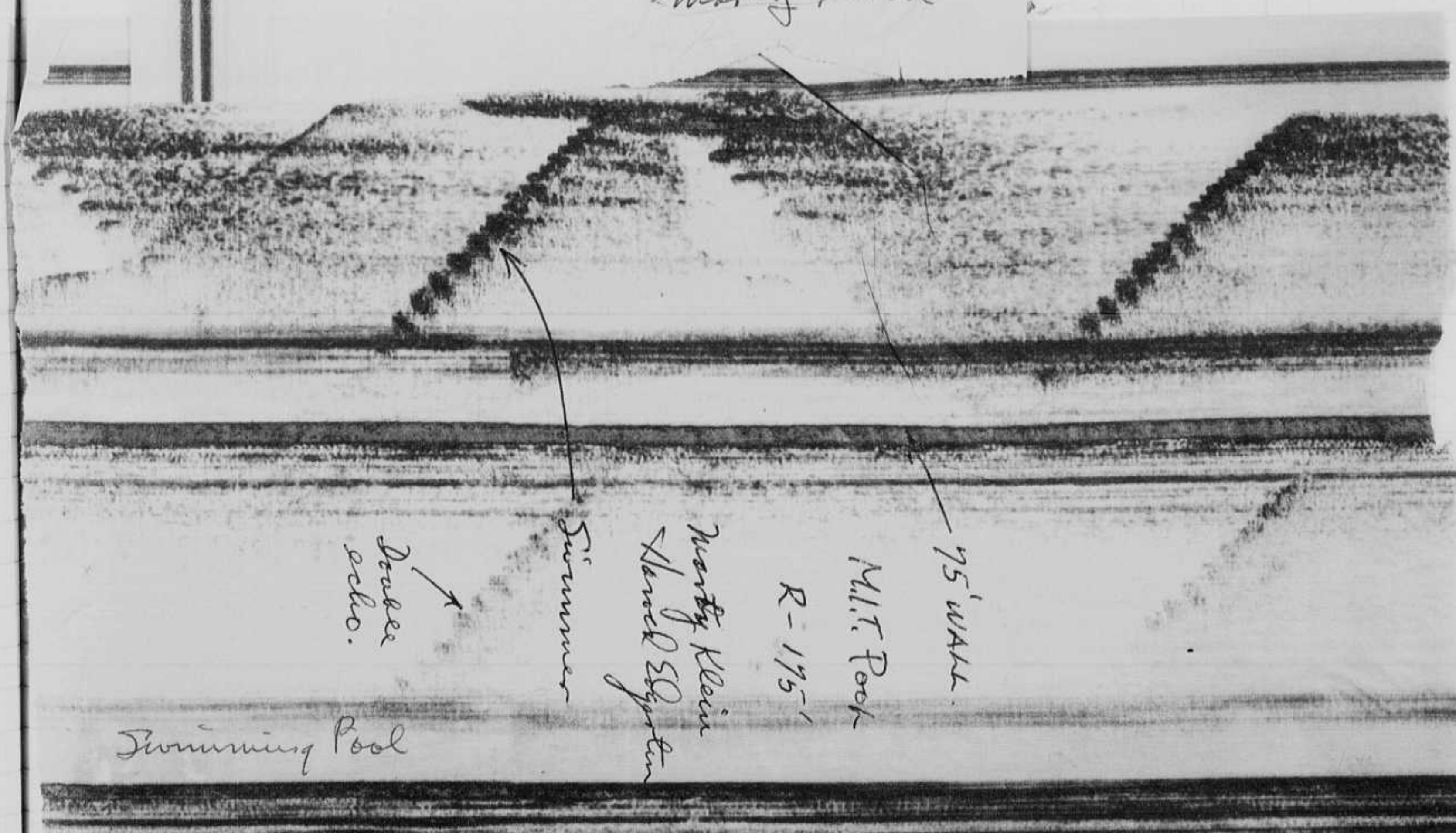
Program Scientific
(1) Sedimentary
Acoustic
Magnetism
Currents
Pressure
Photos

18-20 dives are proposed during a 3 month visit. Enough ballast can be carried for 5 or 6 dives.

Hersey was going to introduce Drach to Maxwell and Jennings at O.N.R. today to discuss further details of the program.



Shows echo from bottom of concrete.



Marty Klein
Harold Edgerton

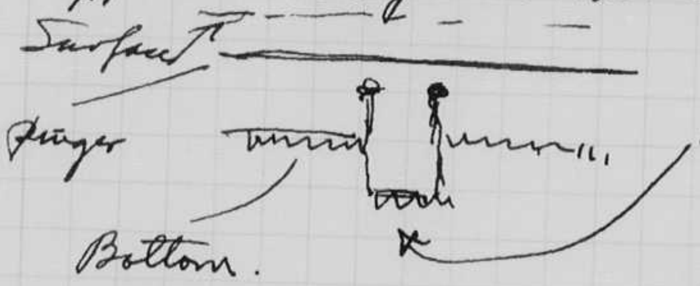
 June 20, 1962.

Harold Edgerton

I was in Los Vegas on June 14 at 300 Wall St to attend the A.E.C. review meeting. I visited the Jackass flats site to see the bomb craters due to underground explosions. Retd to Boston Sunday night after visiting with parents in Aurora Nebraska.

Martin Klein has been tuning up the mud Penetrator circuits while I was gone. He reduced the coupling capacitors in the Alden set. It now writes much better than before.

A run was made in the Charles on Monday or Tues with Klein and Max Roberts. We ran across an interesting object in the water about 200 ~~feet~~ off shore on the south side opposite the first street.



note depressed bottom.
and sides with peaks? Could be a sunken boat?

Gong was here today to try some phosphorus in a tube inside of ~~a~~ 4 flash lamps type 100. We got several excellent vortex rings but could not do so regularly. 100 mfd at 4 000 volts.

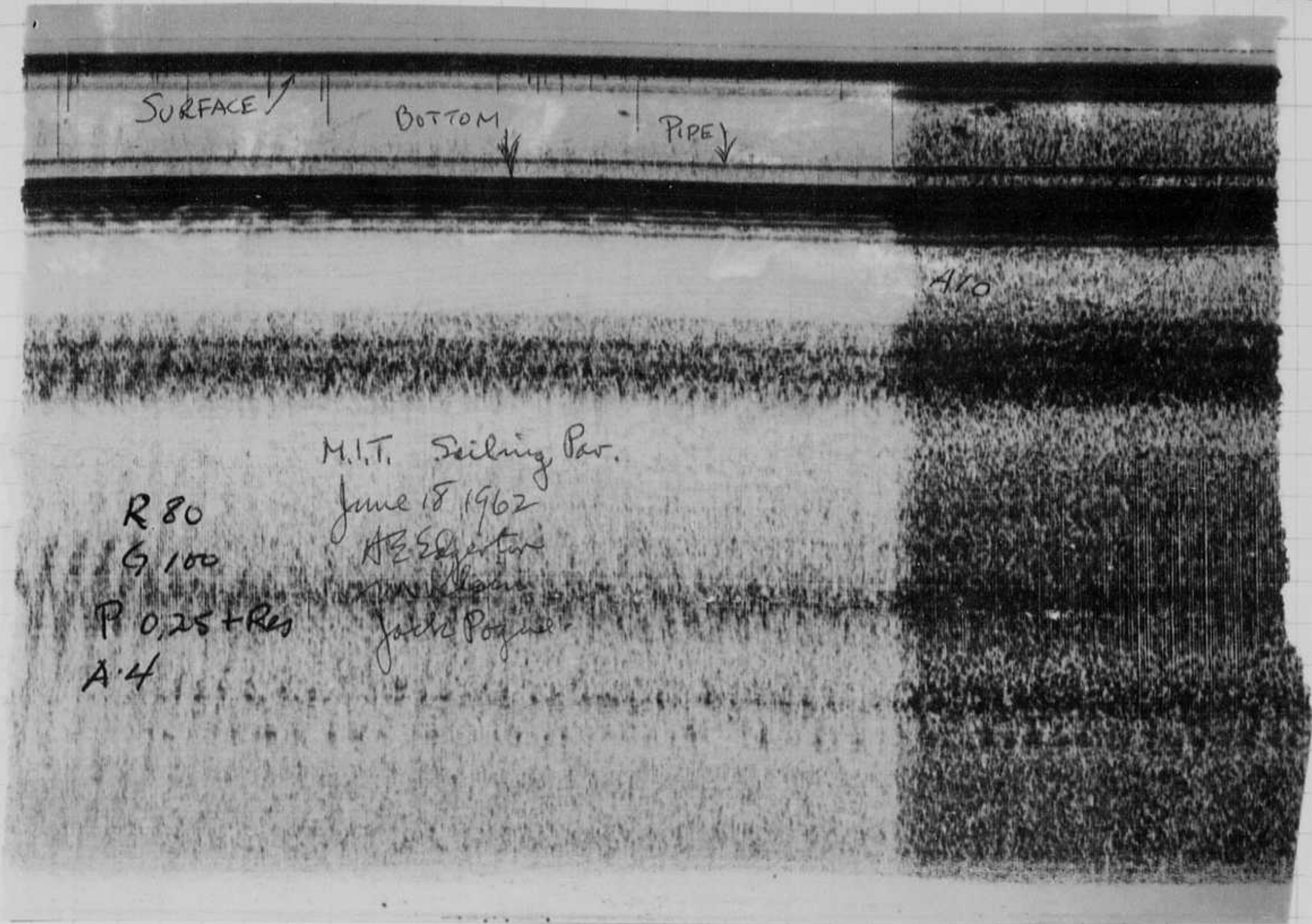
Tonight I tried Sulfur. It gave a big bang and a sulfur ~~sk~~ smell. Just like a fire cracker.

$\frac{4000^2 \times 100}{2} =$ 800 wattsec.

200 per lamp-

$\frac{16\ 50}{80'}$

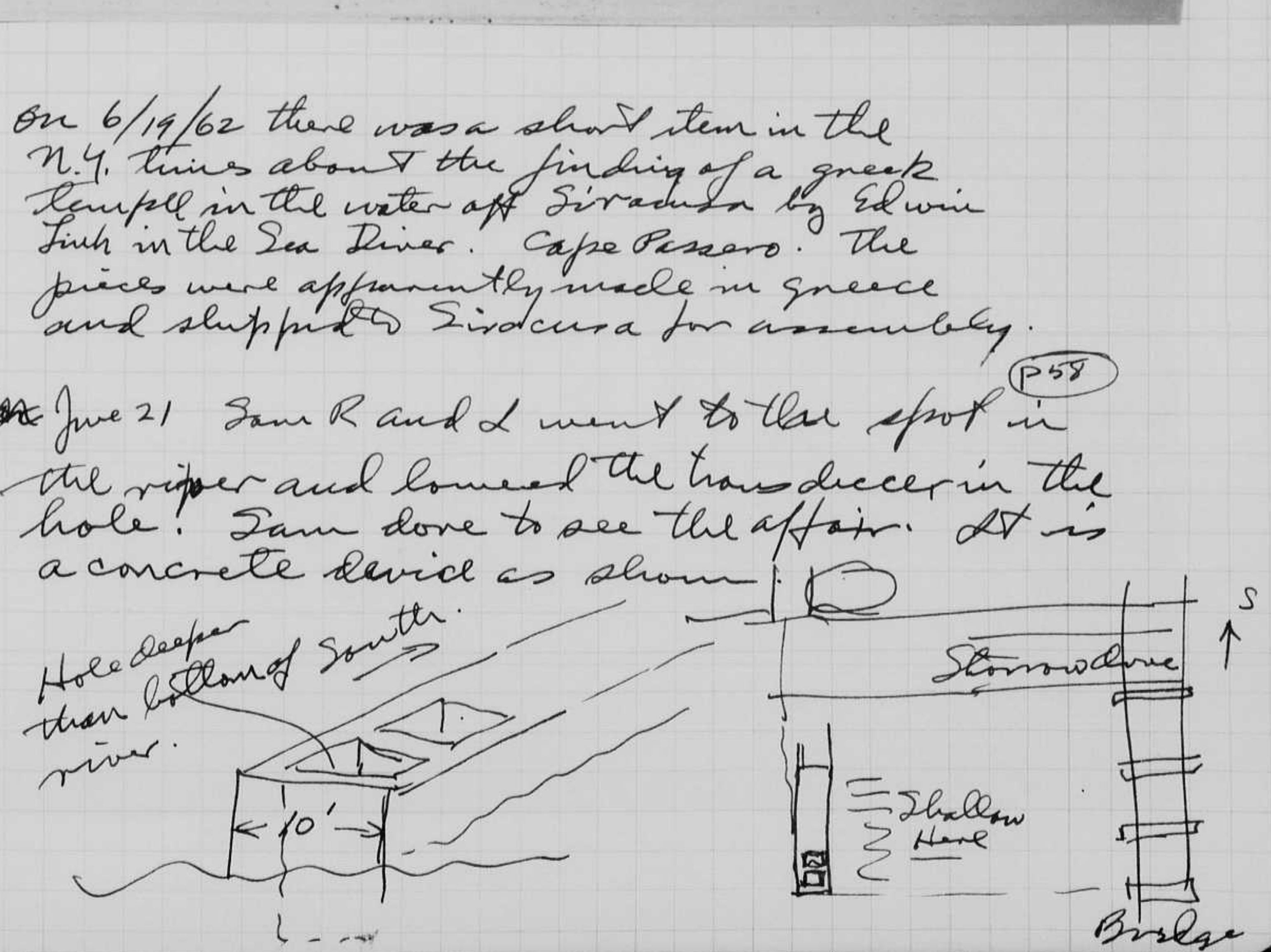
14 feet of water.



On 6/19/62 there was a short item in the N.Y. times about the finding of a greek temple in the water off Siracusa by Edwin Link in the Sea Diver. Cape Passero. The pieces were apparently made in greece and shipped to Siracusa for assembly.

P58

June 21 Sam R and I went to the spot in the river and lowered the transducer in the hole. Sam dove to see the affair. It is a concrete device as shown.



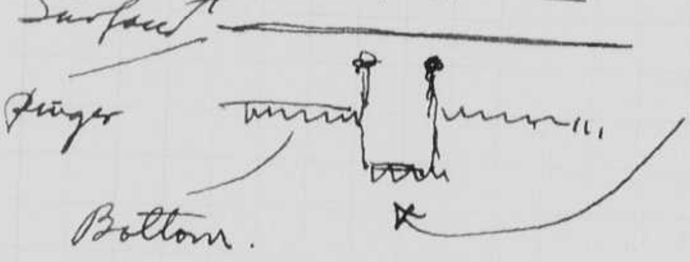
 June 20, 1962.

Harold Edgerton

I was in Los Vegas on June 14 at 300 Wall St to attend the A.E.C. review meeting. I visited the Jackass flats ~~G~~ site to see the bomb craters due to underground explosions. Retd to Boston Sunday night after visiting with parents in Aurora Nebraska.

Martin Klein has been tuning up the mud Penetrator circuits while I was gone. He reduced the coupling capacitors in the Alden set. It now writes much better than before.

A run was made in the Charles on Monday or Tues with Klein and Max Roberts. We ran across an interesting object in the water about 200 feet off shore on the south side opposite the first street.



hole depressed bottom.
and sides with peaks? Could be a sunken boat?

Gong was here today to try some phosphorus in a tube inside of ~~a~~ 4 flash lamps, type 100. We got several excellent vortex rings but could not do so regularly. 100 mfd at 4 000 volts.

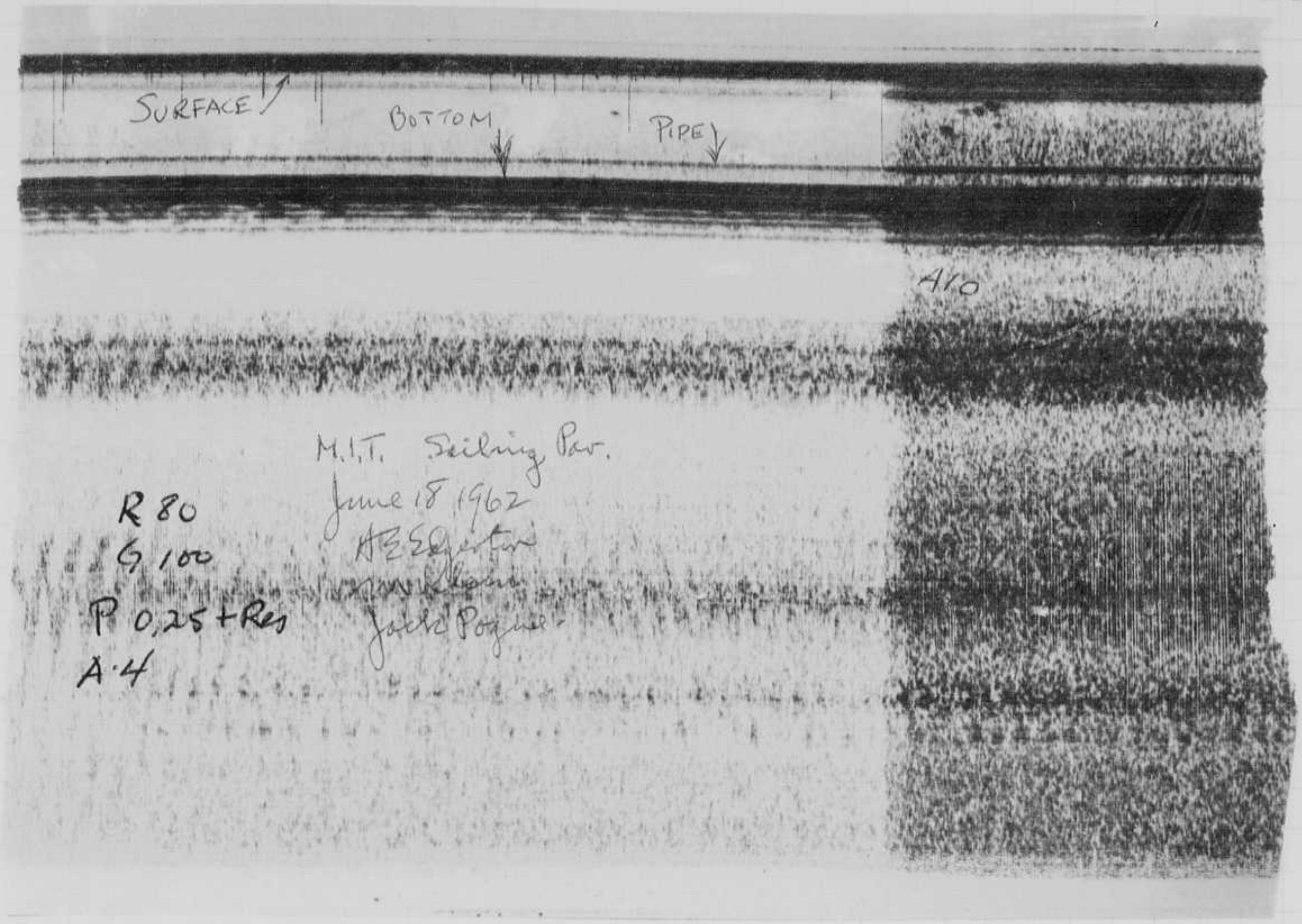
Tonight I tried Sulfur. It gave a big bang and a sulfur ~~sl~~ smell. Just like a fire cracker.

$\frac{4000^2 \times 100}{2} = 800$ watt sec.

200 per lamp -

16
50
801

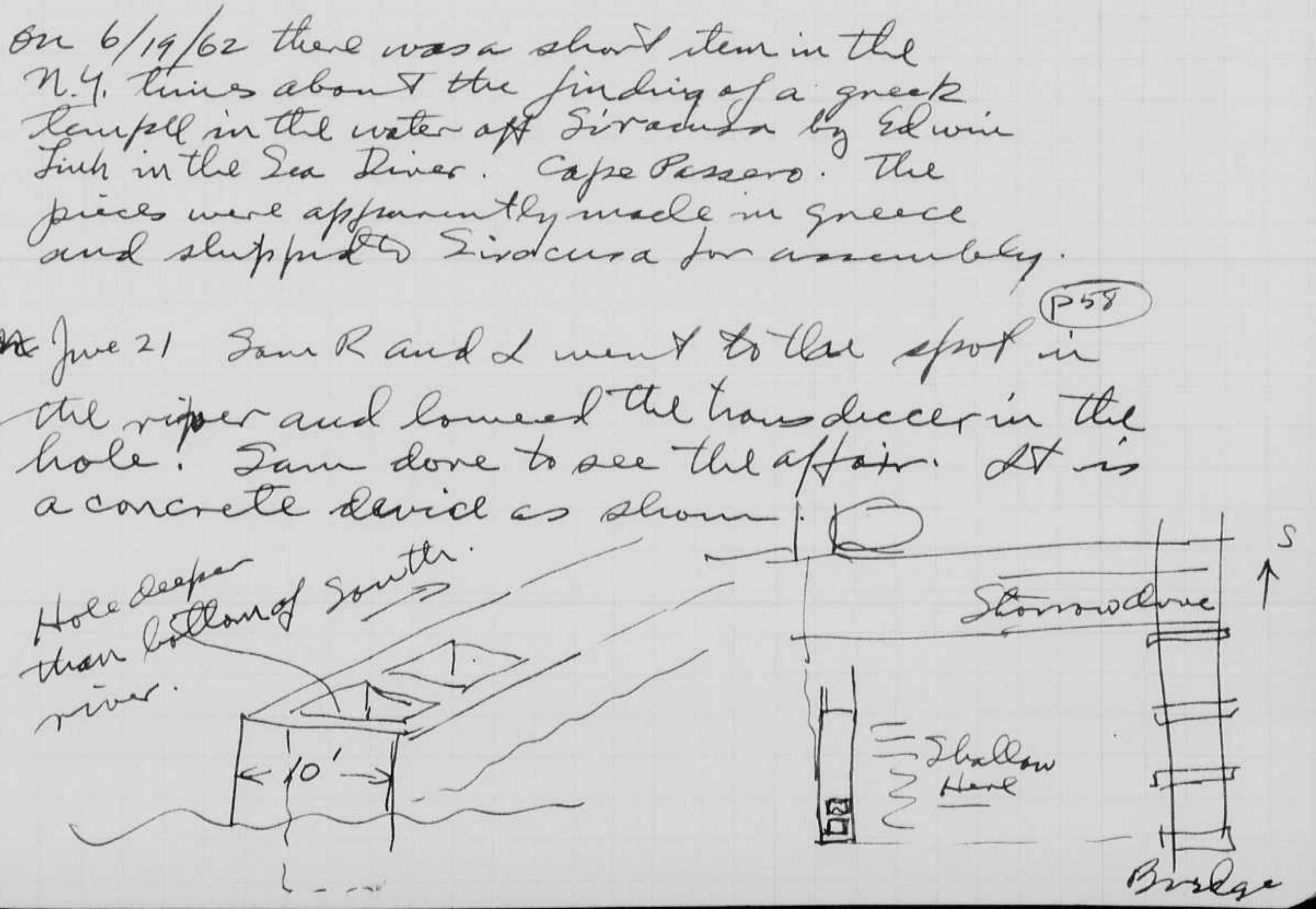
14 feet of water.



On 6/19/62 there was a short item in the N.Y. times about the finding of a greek temple in the water off Siracusa by Edwin Link in the Sea Diver. Cape Passero. The pieces were apparently made in greece and shipped to Siracusa for assembly.

P58

June 21 Sam R and I went to the spot in the river and lowered the transducer in the hole. Sam dove to see the affair. It is a concrete device as shown



Notebook # 27

Filming and Separation Record

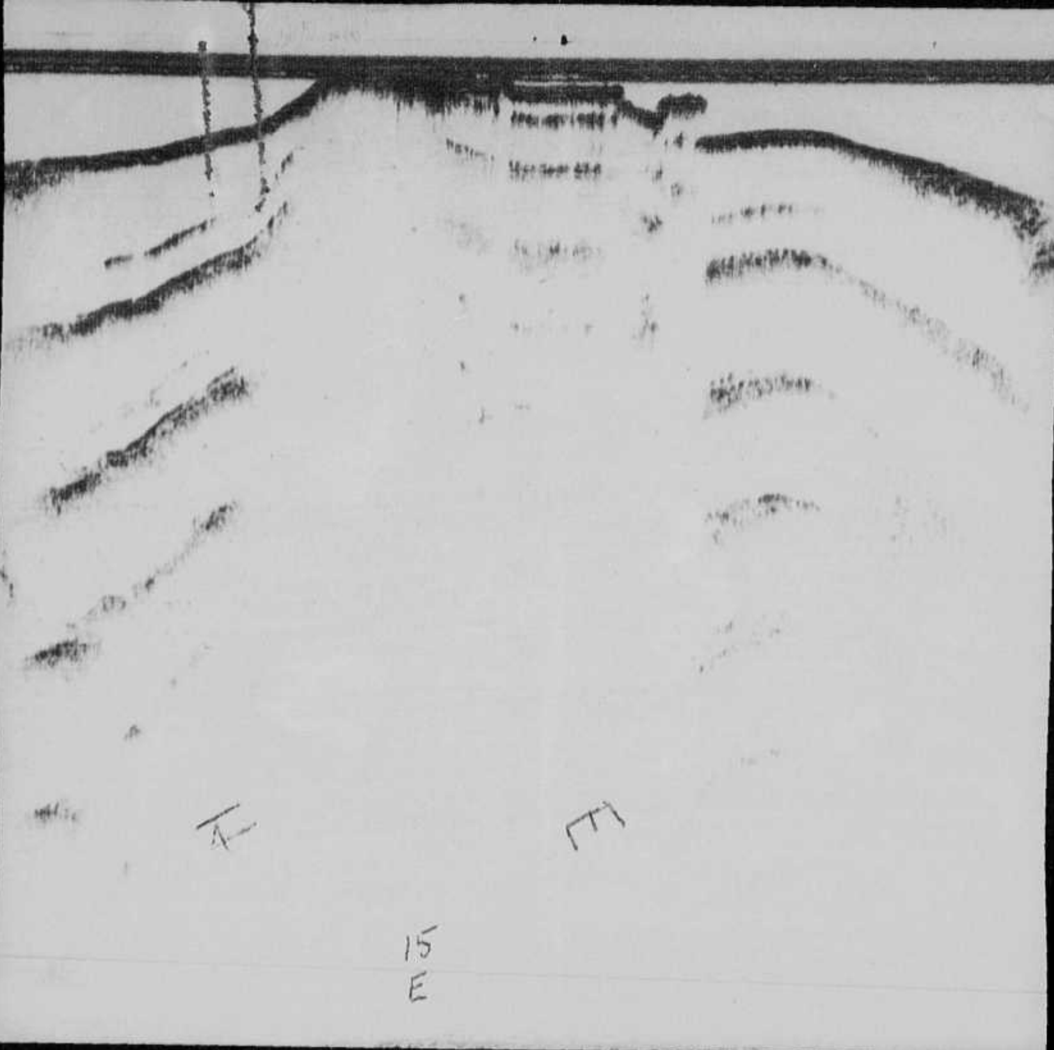
____ unmounted photograph(s)

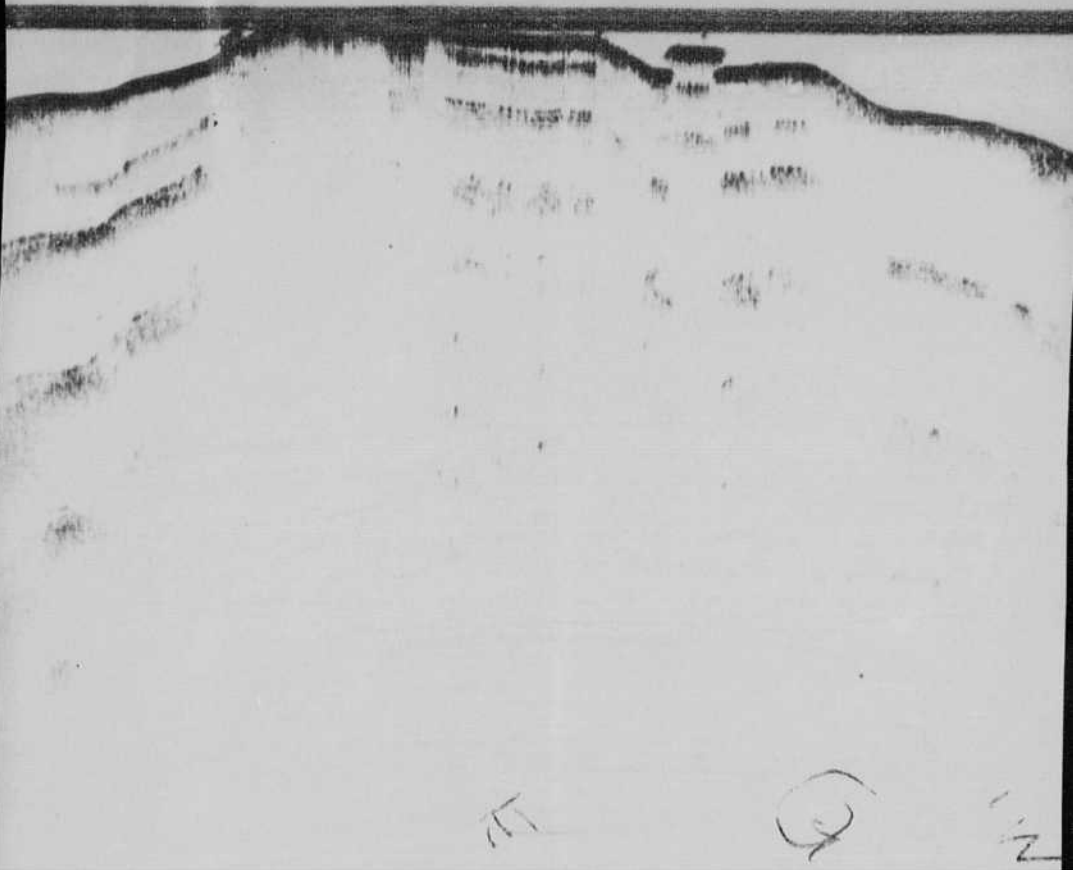
____ negative strip(s)

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

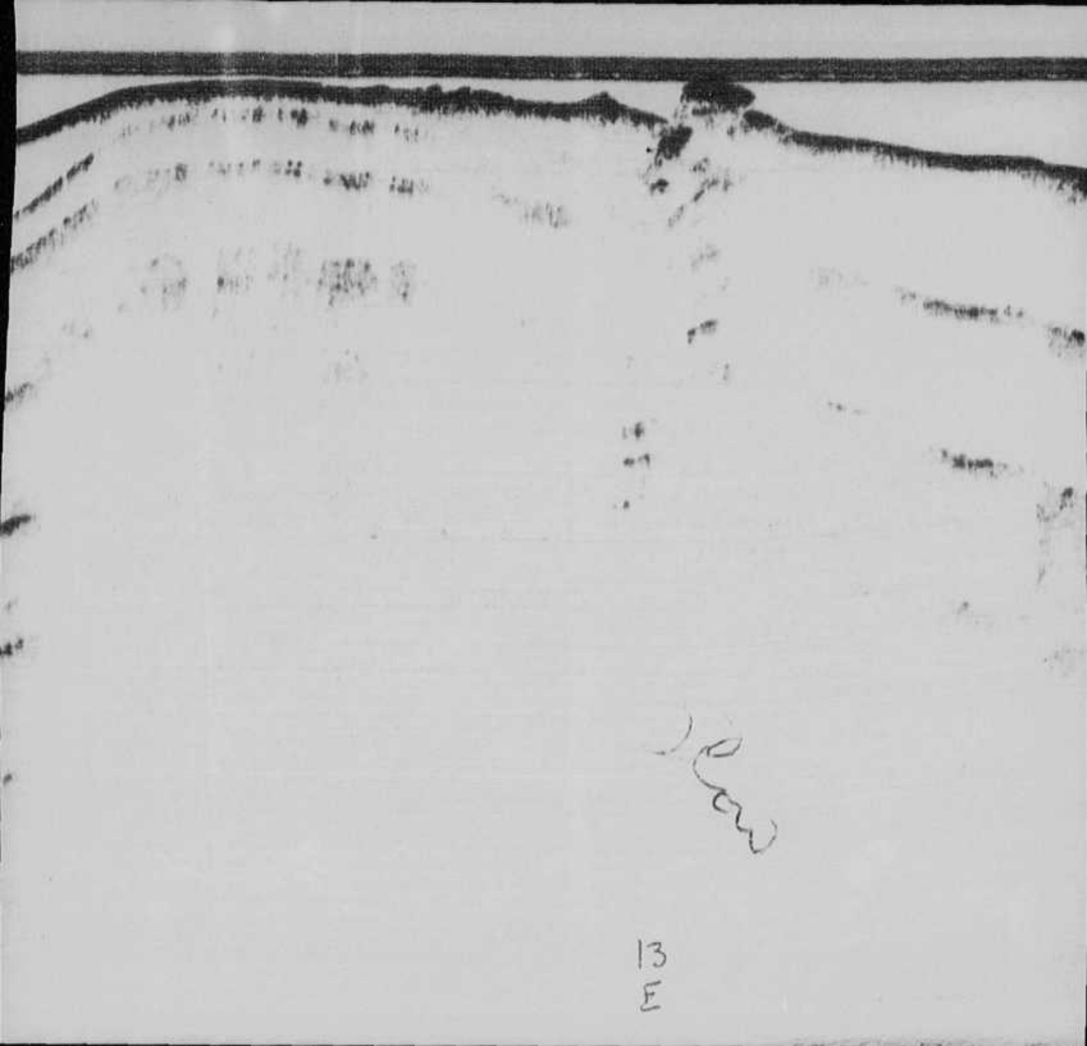
was/were filmed where originally located between page 58 and 59.

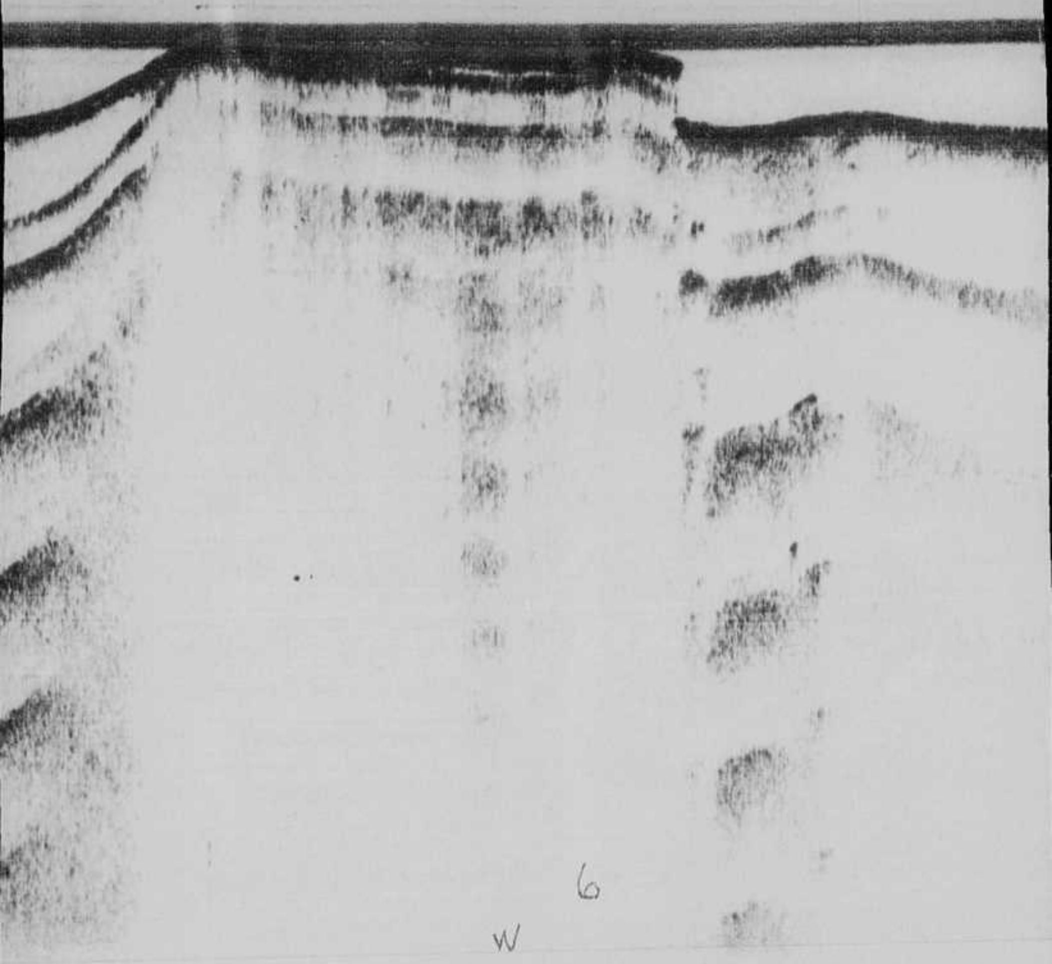
Item(s) now housed in accompanying folder.

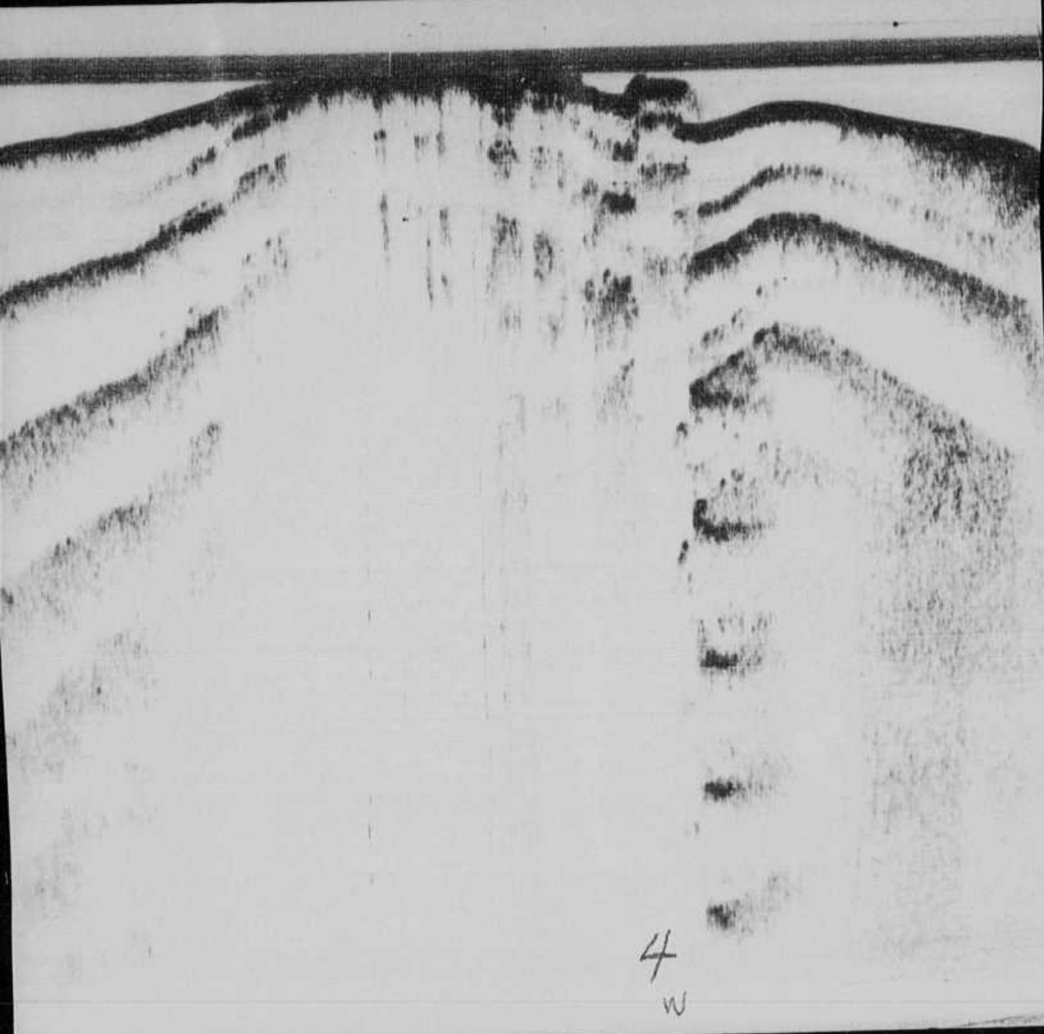

15
E

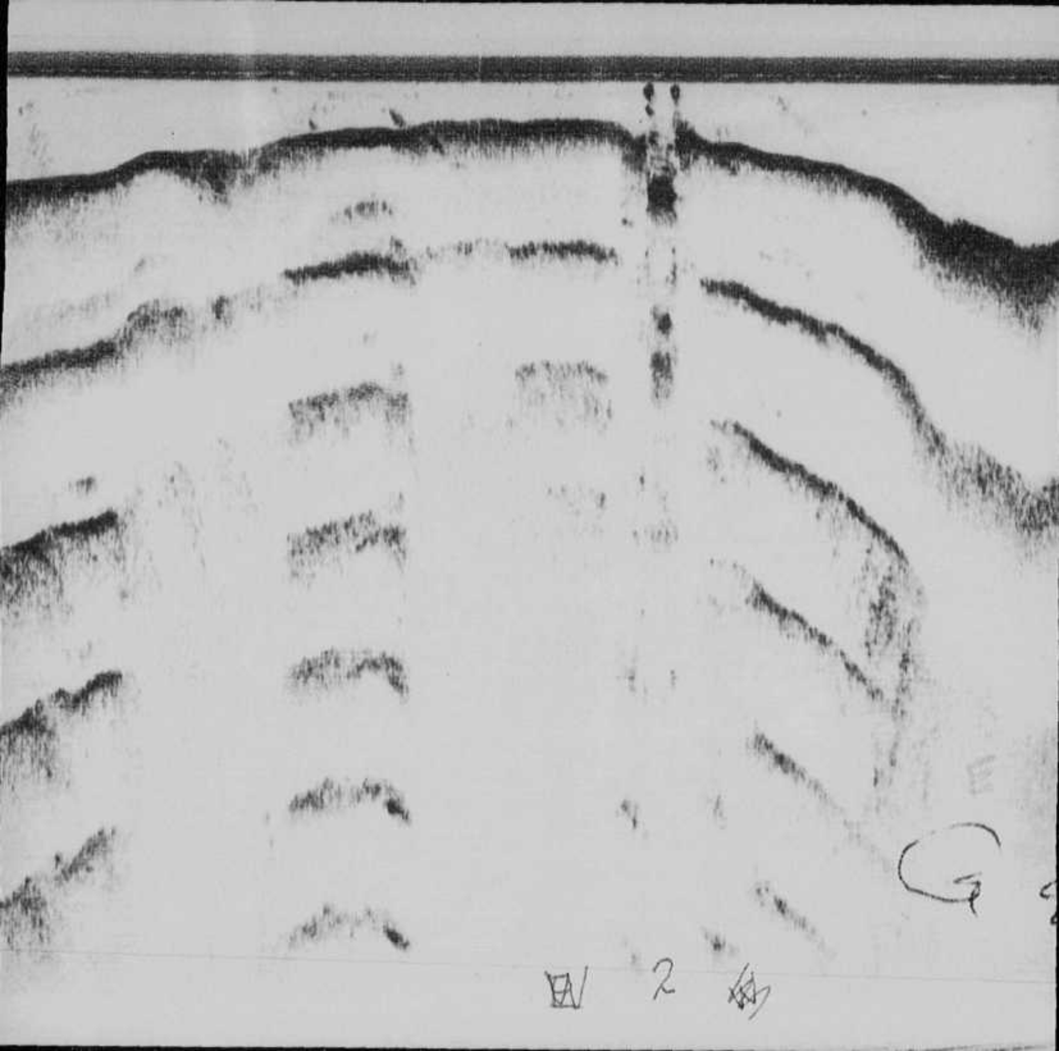


10
W

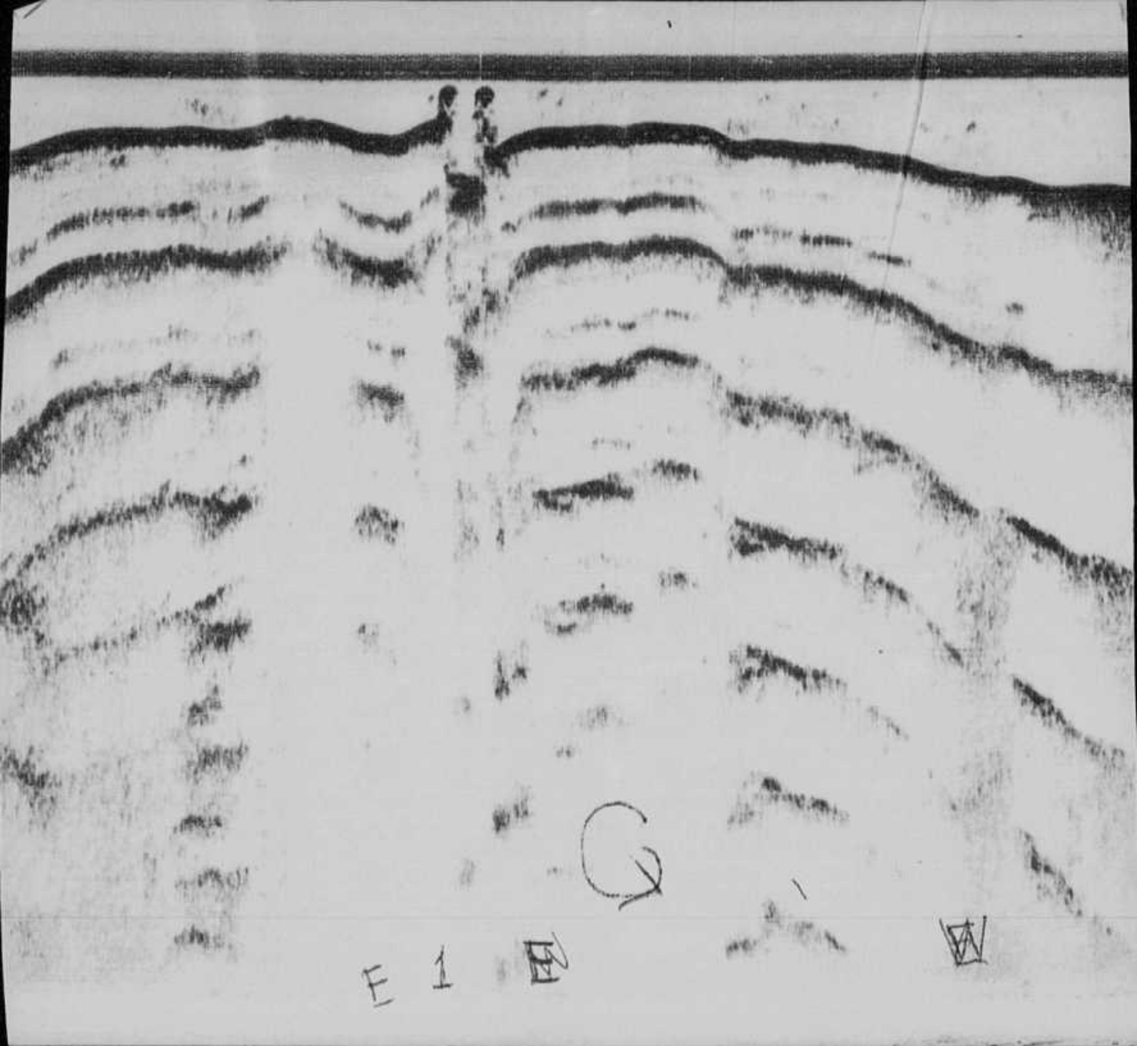

13
E

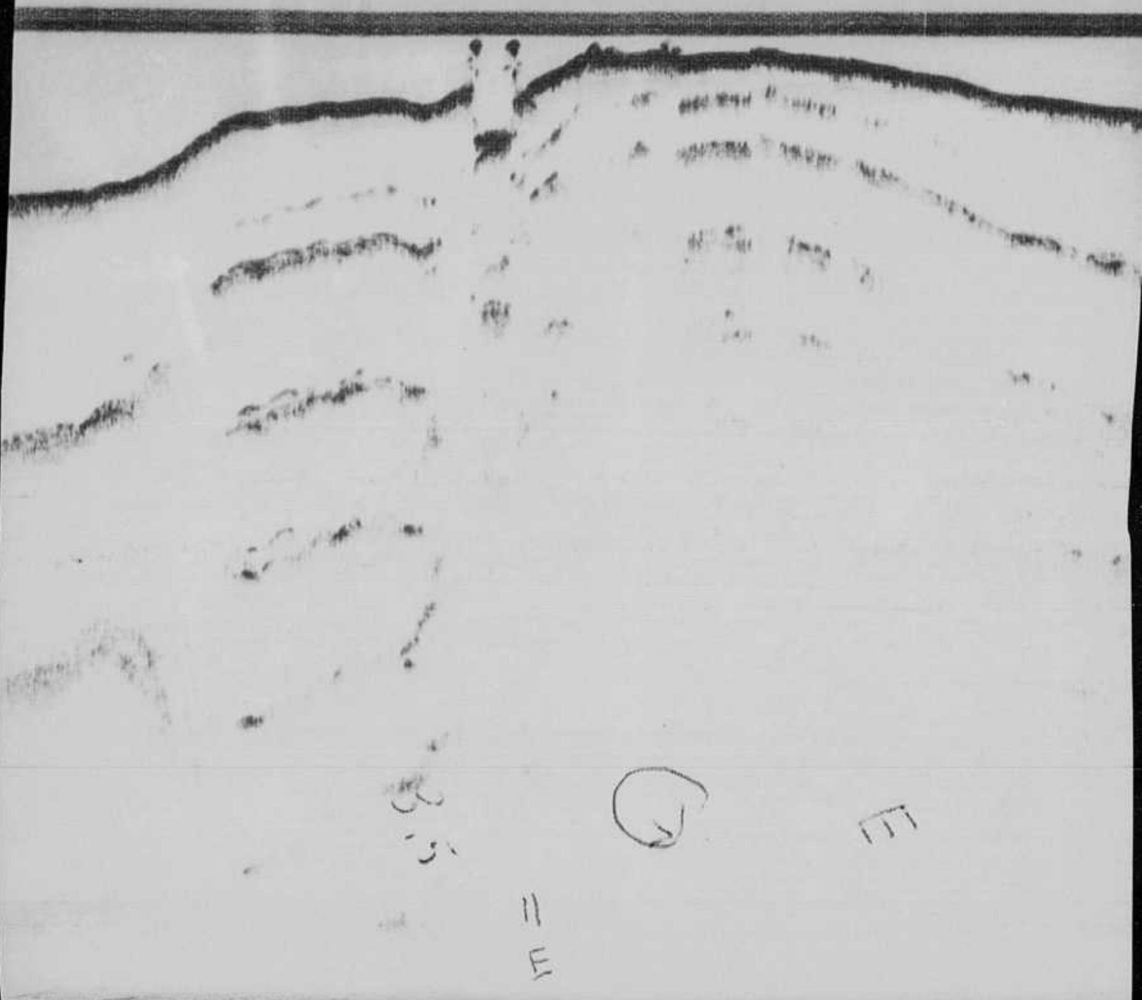

6
W

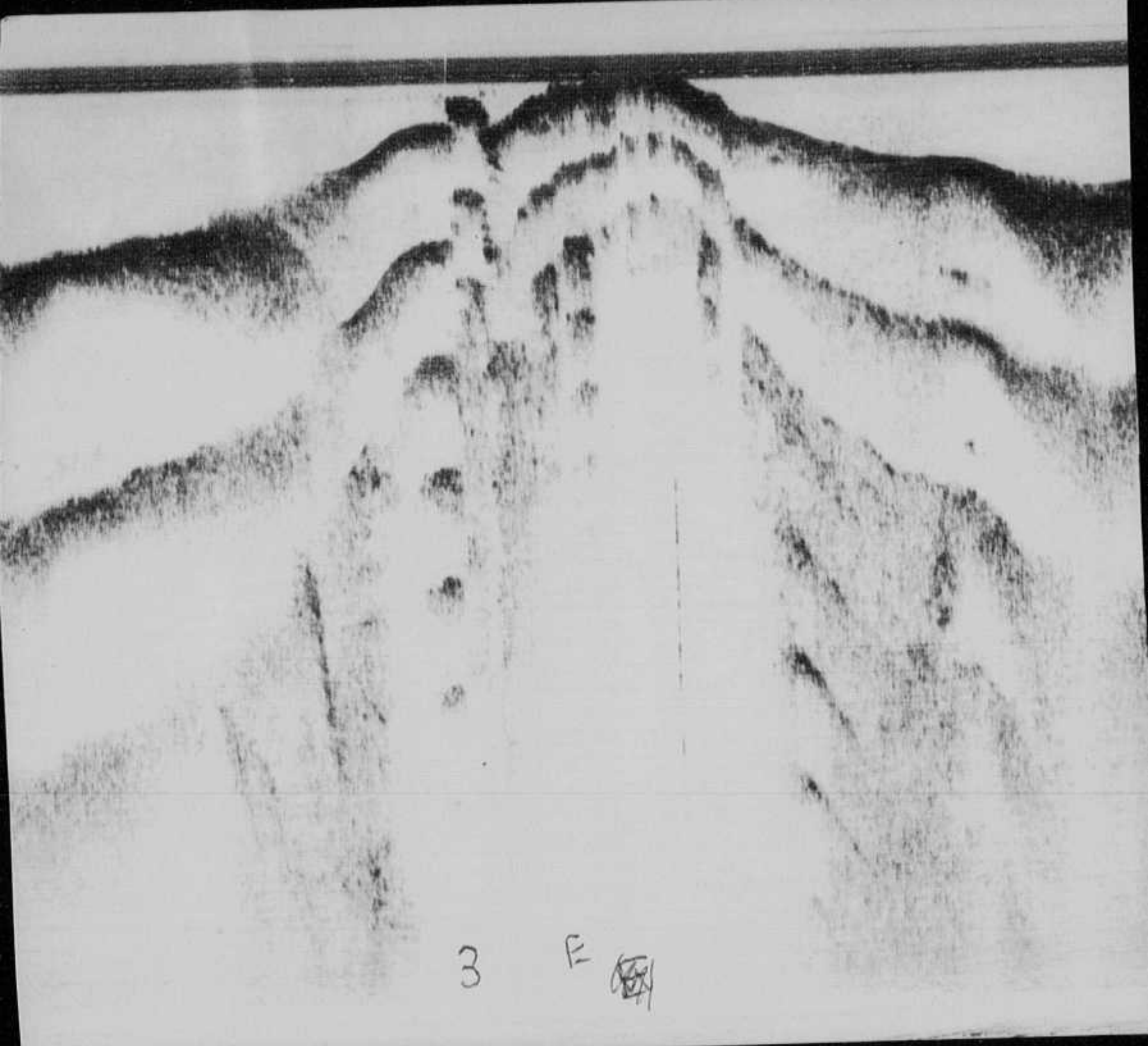

4
W


G

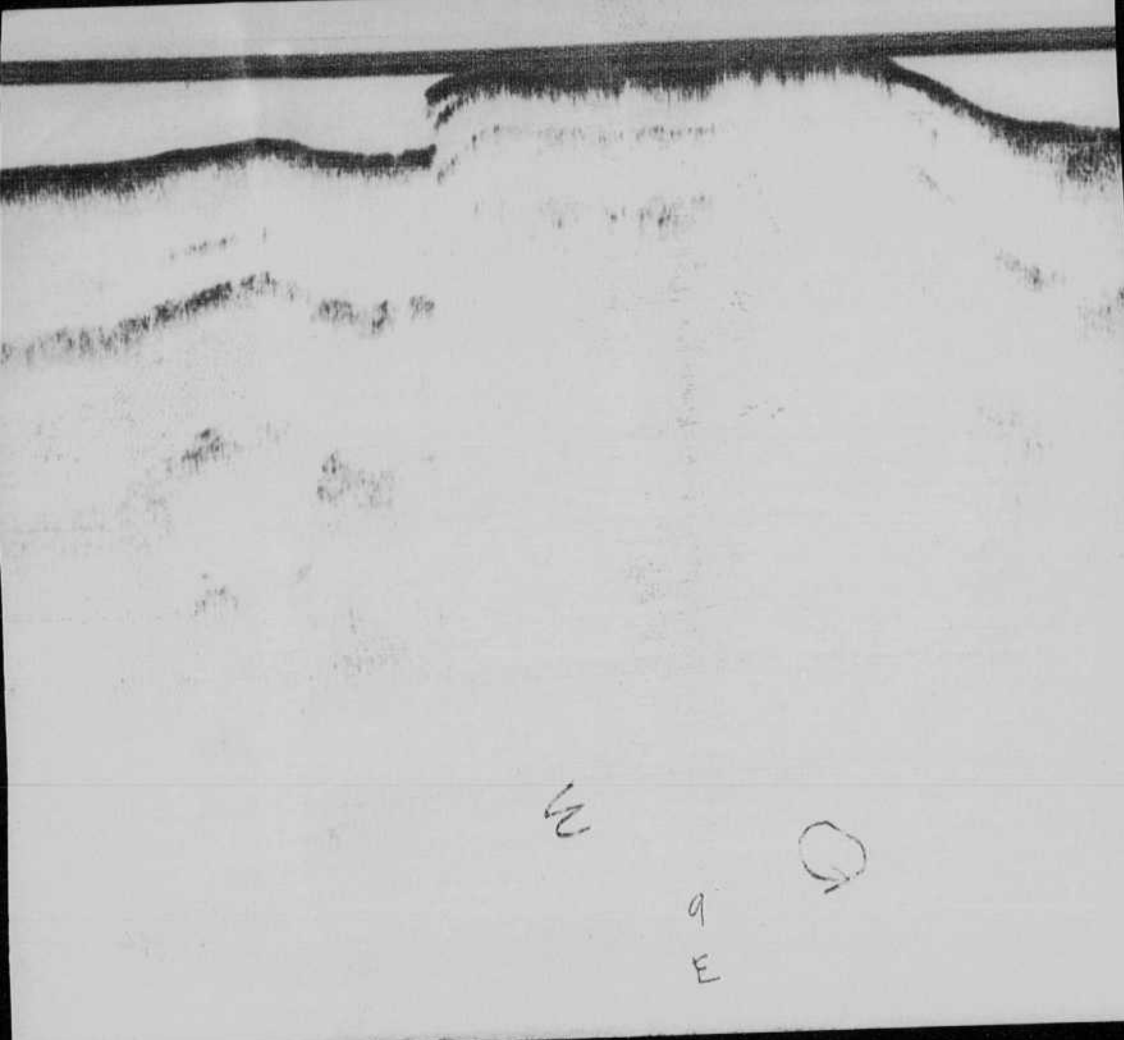
151
Near
Ihon
Kex
8
W

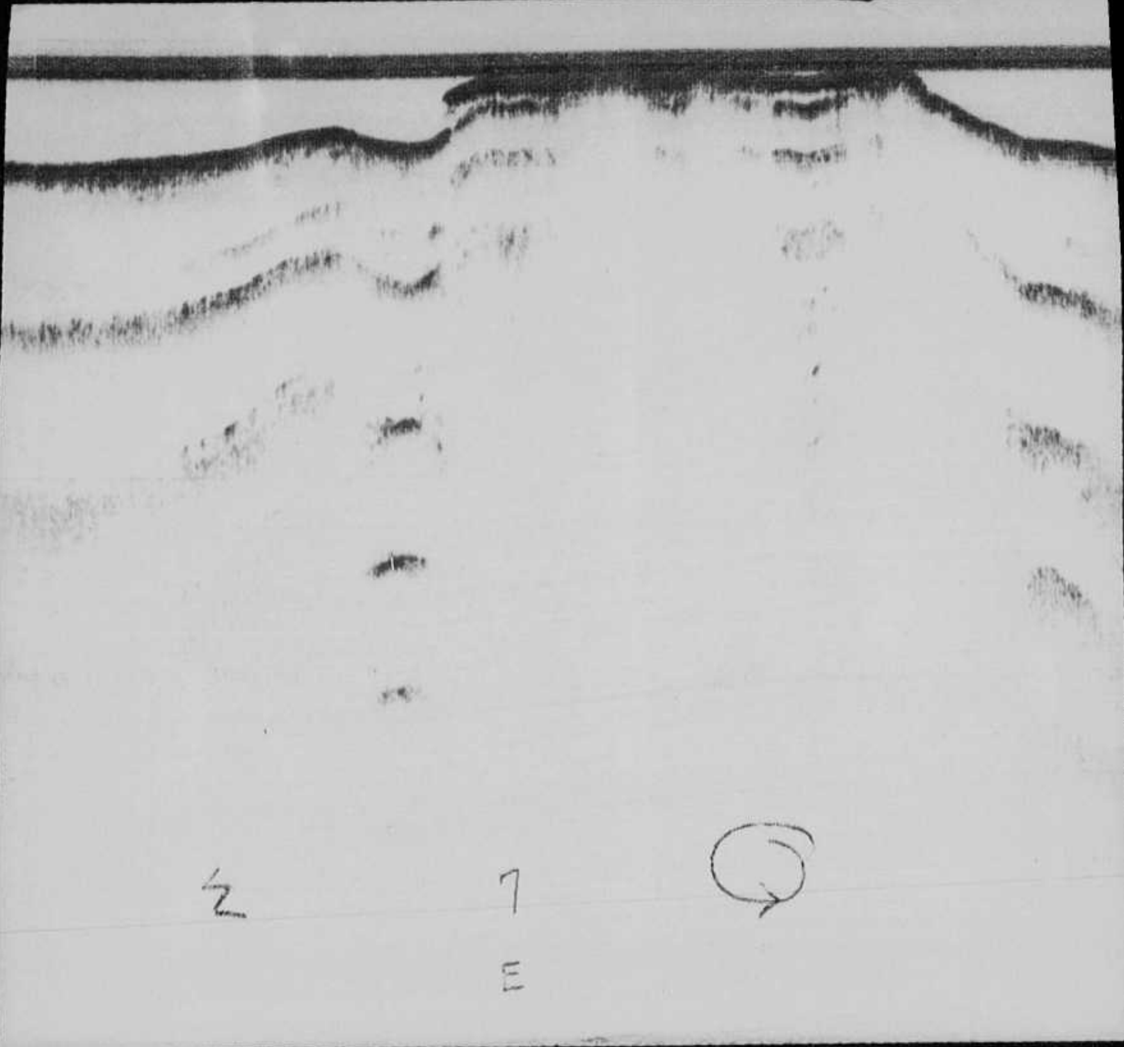

E 1
W

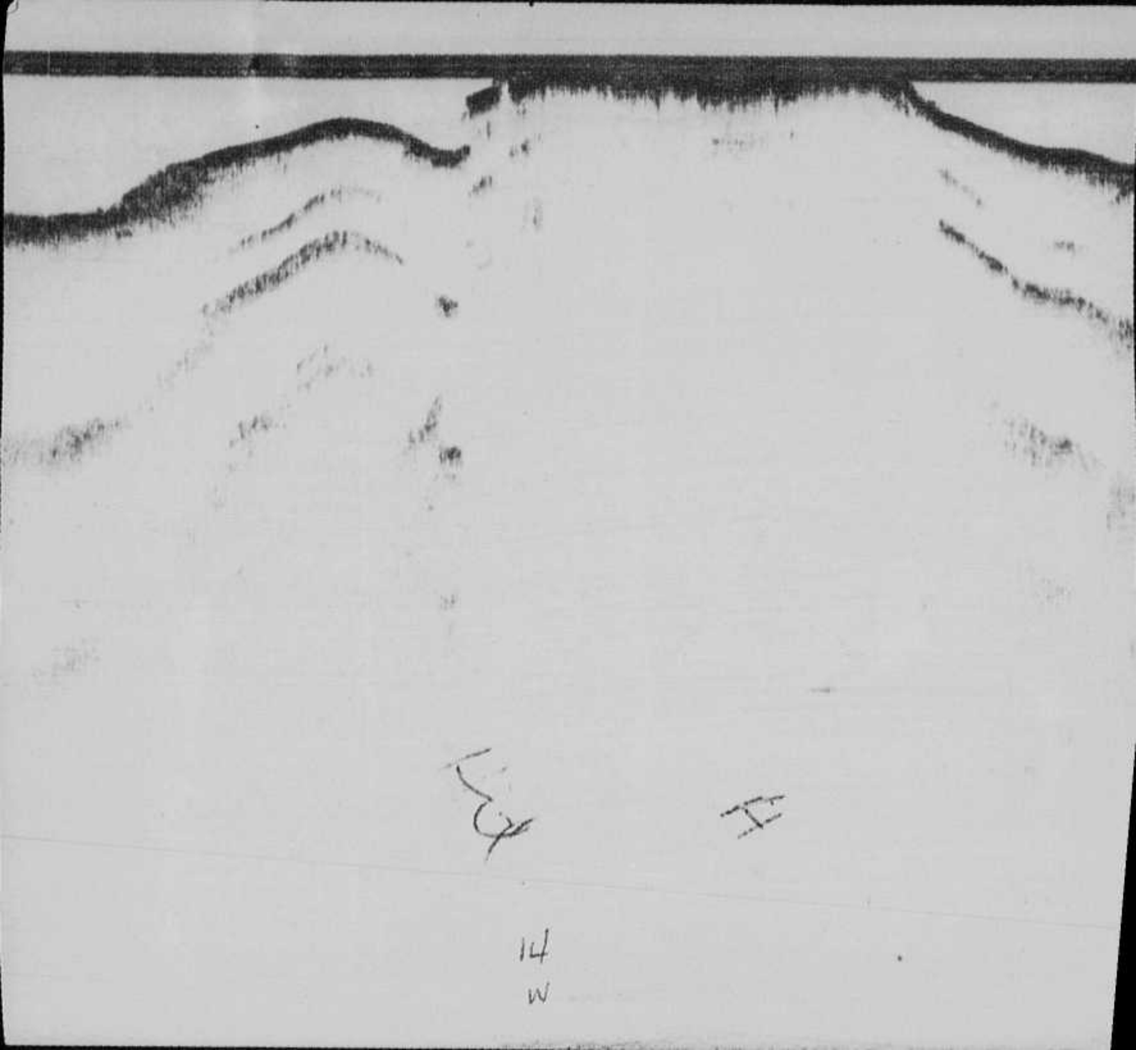


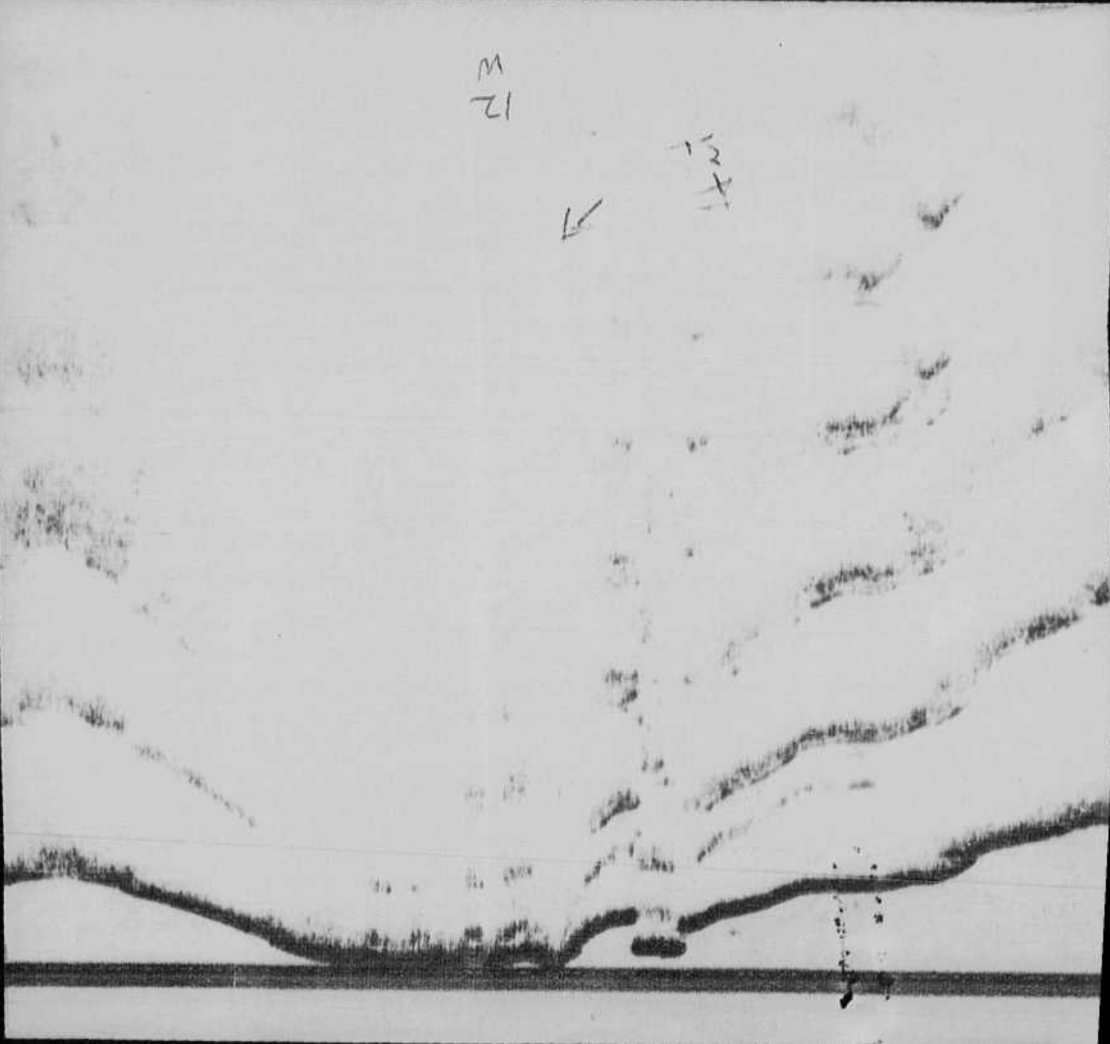

3 E

5E


9
E




14
W



Notebook # 27

Filming and Separation Record

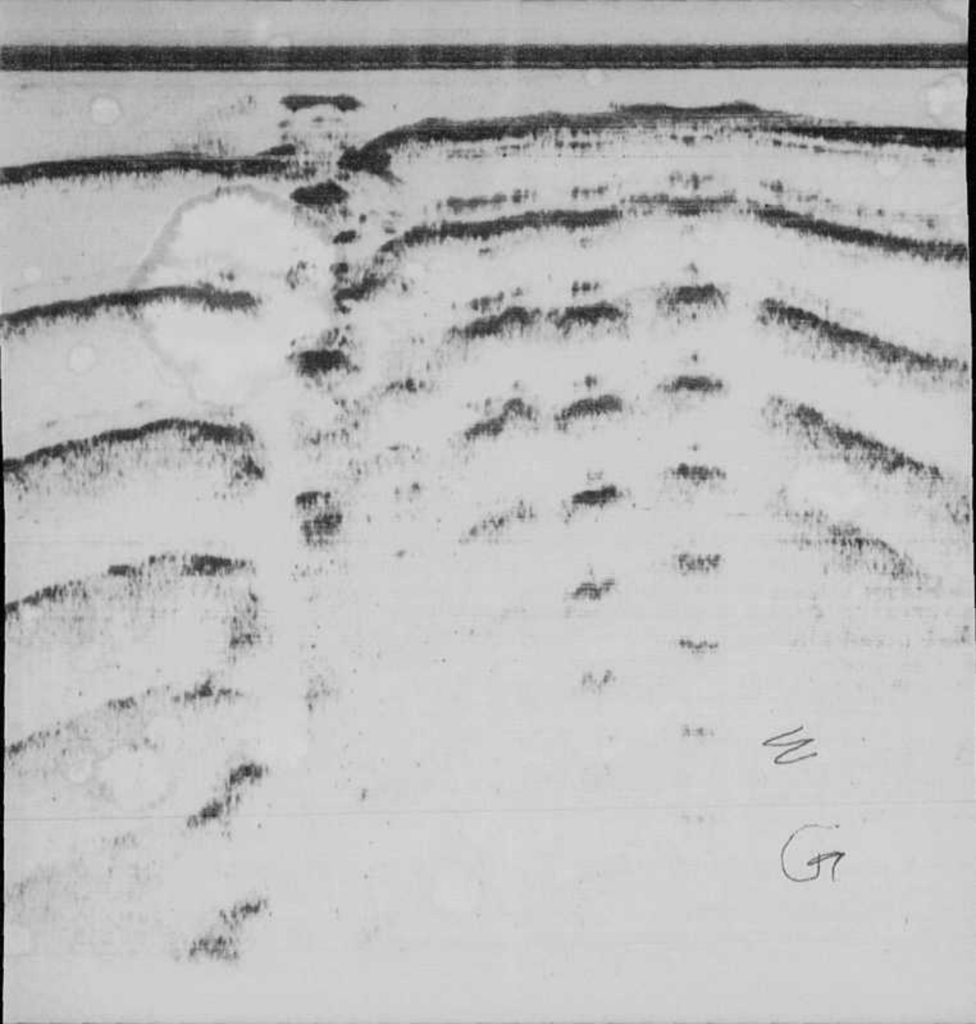
____ unmounted photograph(s)

____ negative strip(s)

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

was/were filmed where originally located between page 60 and 61.

Item(s) now housed in accompanying folder.



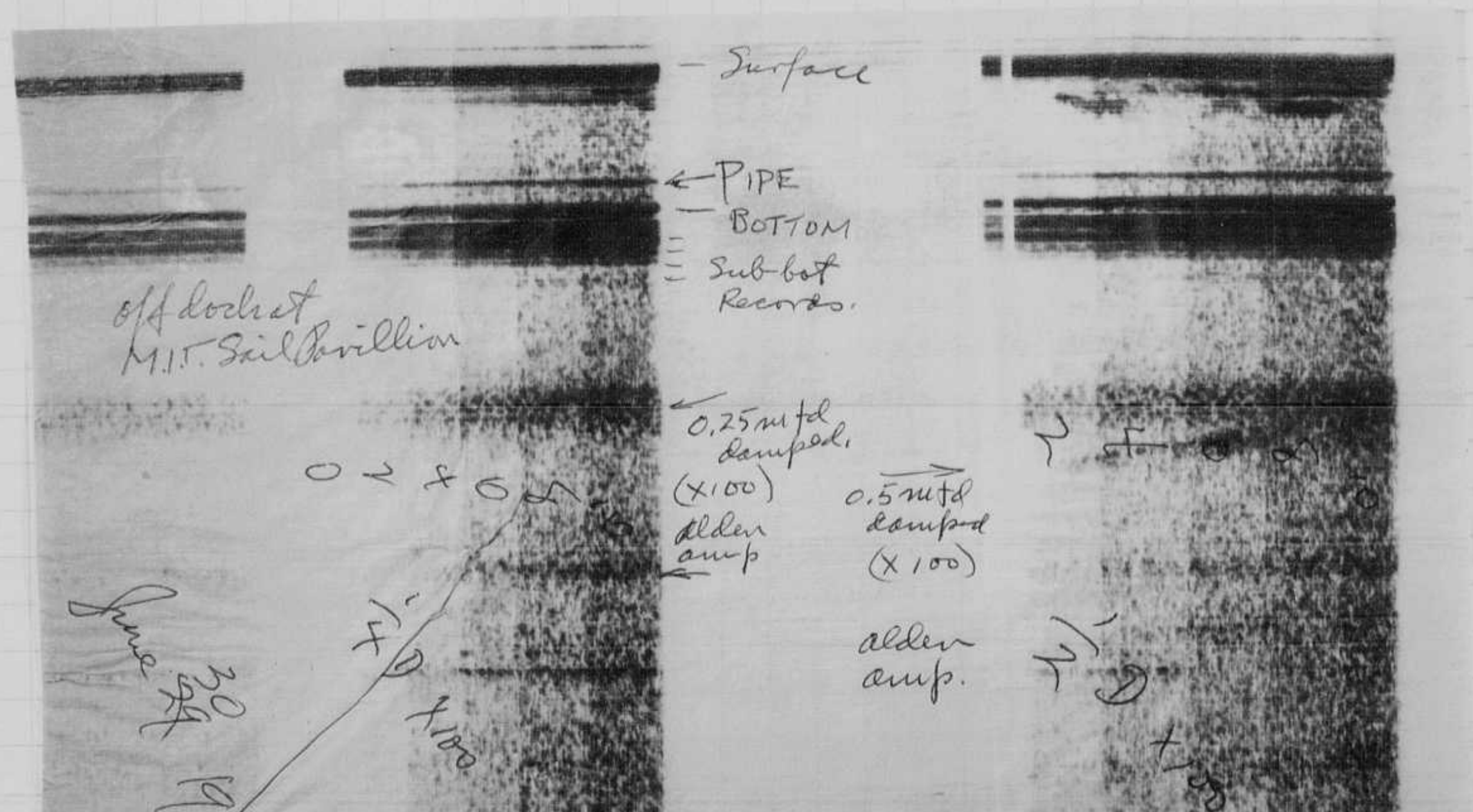
 July 3 1962
Harold Edgerton

Bob Liz and Eric (6 months) were here over the weekend. Bob is writing up his graduate thesis at U of R with a Sept date in view.

Roe Wells was in on Sat morning and yesterday again. We have had trouble with the 501 and the 1/2" flash lamp with transformer. I changed the 4C35 thyratron and things seemed better. I had a 1/4 sec run twice with a stop (not a blow out) with one lamp. Operation was ok with another. I know not why?

See other data book for facts.

The mud penetrator transducer dropped off at the dock on Sunday aft. Sam Raymond dove down to find it and attach a rope. It was hard to pull up since it went head first into the mud and was about 5 feet in. Lucky the accident was at the dock!



Compare this to p 49 46 41 22 etc. Note improved lack of transients due to changes in the amplifiers.

July 5, 1962
H.E. Edgerton

I took the mud. Pen. to the Boston Harbor yesterday. Some very fine records were made of the bottom. In some cases we could see down 30 feet into sub bottom layers. In other places the sound was all absorbed or bounced from the surface of the bottom.

The results of yesterday look very encouraging to me. I am sure that many useful things are going to result from this device.

At E.G. & G., the drawings are being made for the construction of 6 units to be sold.

July 14 1962 HE.

Yesterday I had trouble with hocdover - self flash - cutout etc. etc. I used a large Kytron, the trouble was not with the tube but with a semi short circuit on the trigger circuit, it took MacRoberts and I an entire day to find it!

Today I made some excellent sub bottom records of the two tunnels under the Boston Harbor! They are about 30 feet under if the velocity in mud is the same as water.

Today several came in from various spots to set up their exhibits for the summer course at M.I.T. on high speed photography.

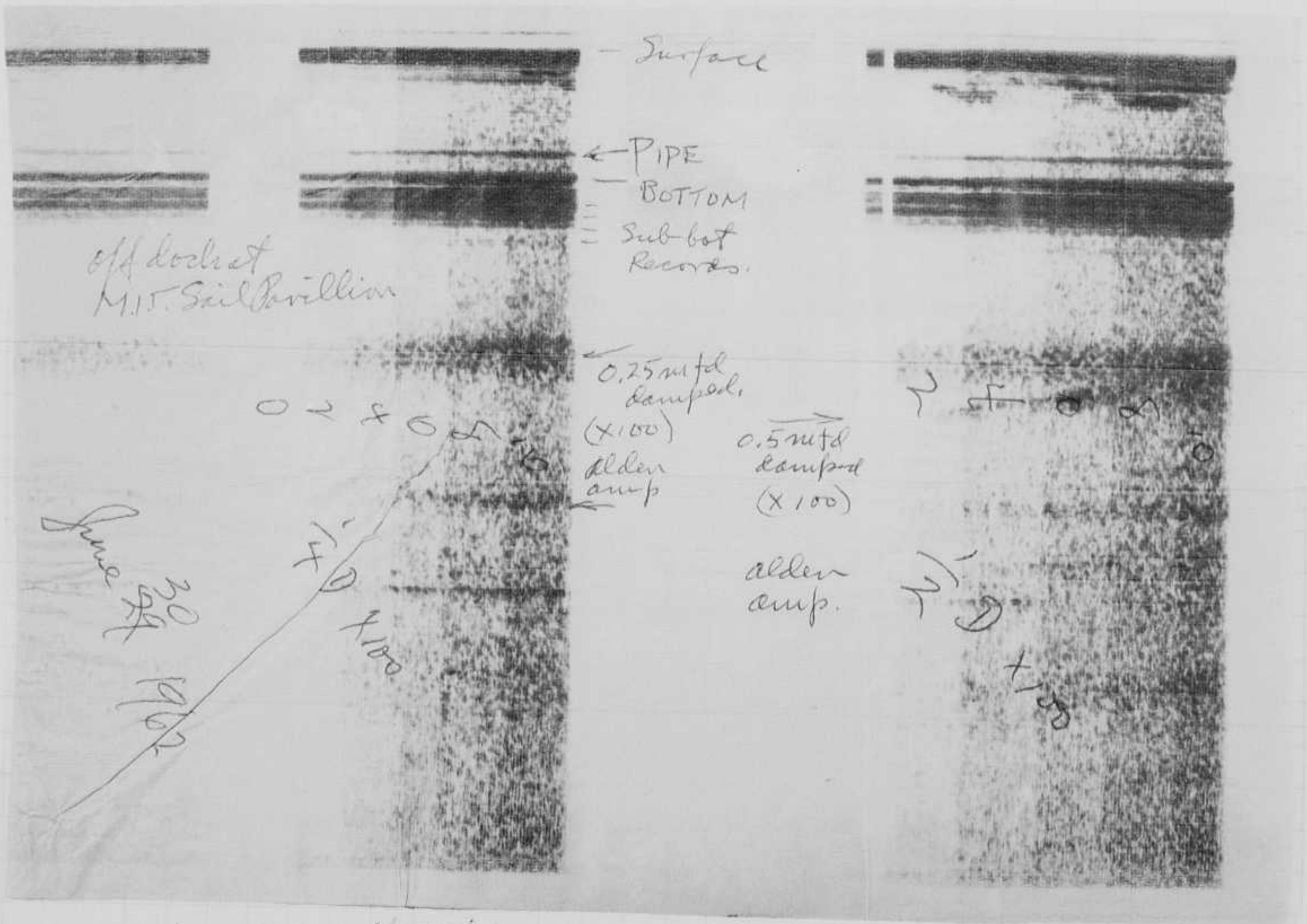
July 3 1962
Harold E. Edgerton

See other data book for photos.

Bob Fitz and Eric (6 months) were here over the weekend. Bob is writing up his graduate thesis at U of R with a Sept date in view.

Roe Wells was in on Sat morning and yesterday again. We have had trouble with the 501 and the 1/2" flash lamp with transformer. I changed the 4C35 thyratron and things seemed better. I had a 1/4 sec run time with a stop (not a blow out) with one lamp. Operation was ok with another. I wonder not why?

The mud penetrator transducer dropped off at the dock on Sunday aft. Sam Raymond dove down to find it and attach a rope. It was hard to pull up since it went head first into the mud and was about 5 feet in. Lucky the accident was at the dock!



Compare this to p49 46 41 22 etc. Note improved lack of transients due to changes in the amplifiers.

July 5, 1962
H.E. Edgerton

I took the mud. Pen. to the Boston Harbor yesterday. Some very fine records were made of the bottom. In some cases we could see down 30 feet into sub bottom layers. In other places the sound was all absorbed or bounced from the surface of the bottom.

The results of yesterday look very encouraging to me. I am sure that many useful things are going to result from this device.

At E.G. & G., the drawings are being made for the construction of 6 units to be sold.

July 14 1962 HE.

Yesterday I had trouble with hookup - self fader - cutout etc etc. I used a large Kytron, the trouble was not with the tube but with a semi short circuit on the trigger circuit. It took Mac Roberts and I an entire day to find it!

Today I made some excellent sub bottom records of the two tunnels under the Boston Harbor! They are about 30 feet under if the velocity in mud is the same as water.

Today several came in from various spots to set up their exhibits for the summer course at M.I.T. on high speed photography.

August 6 1962
Harold E. Edgerton

Retd last night from Louisanna where VanReevan Klein and I had a session with the mud penetrator on the Mississippi River. We checked in on ~~Monday~~ Monday July 29 at the Corp of Engineers in New Orleans.
29 Equipment unpacked and tried on avondale revetment.
30 Went up the river to Donaldsonville
Aug 1. Hospital night to Baton Rouge. – Allendale Revetment.
2 " "
3 Diver. Gil observed break in angle – says the revetment is whole about at 80° angle.

I left ~~for~~ Baton Rouge for New Orleans on Aug 4 then to Hickory N.C. to see my daughter Mary Lou Dixon, Janice, William and Mary Anne.

Aug 5 returned to Boston arrived midnight.

Aug 8, 1962 Wednesday, Left 5.15 am for Newport R.I. to work with the underwater group at the naval station. Carl Morey Gerald Cook, Comd. Max Harrell in charge of diving. Comd. Perelini. ~~Capt~~ Lt Schultz.

1 st contact – Roll of wire
2nd " Barrell
3 " } troughs or grooves in mud.
4 "

No torpedos! Keep trying.

Aug 16 1962
Harold Edgerton.

Aug 20 1962 - Leave for Europe tonight on PAA at 8 30 pm. Esther goes along. Yesterday in Rochester to give Bob my Ford 57 station wagon and to see them - especially Eric.

Aug 18, 19, I was pinging in the Harbor with colleen using 1 mfd with the Edo at 30 P.P.S.

Investigate bump near Buoy Red 2 1/4 of way to Red 2. Also 1/2 way from Red 6 to Red 8. and out about 200 feet. another spot to look at is near the west run way lights at the air port. 200 ft + off S.W. from edge. Looks like a boat upside down. - 10' high off bottom.

Monaco - nice for London BEA104 220 pm ann

Amsterdam Sept 16 - to 22. V high Speed Congress

Notebook # 27

Filming and Separation Record

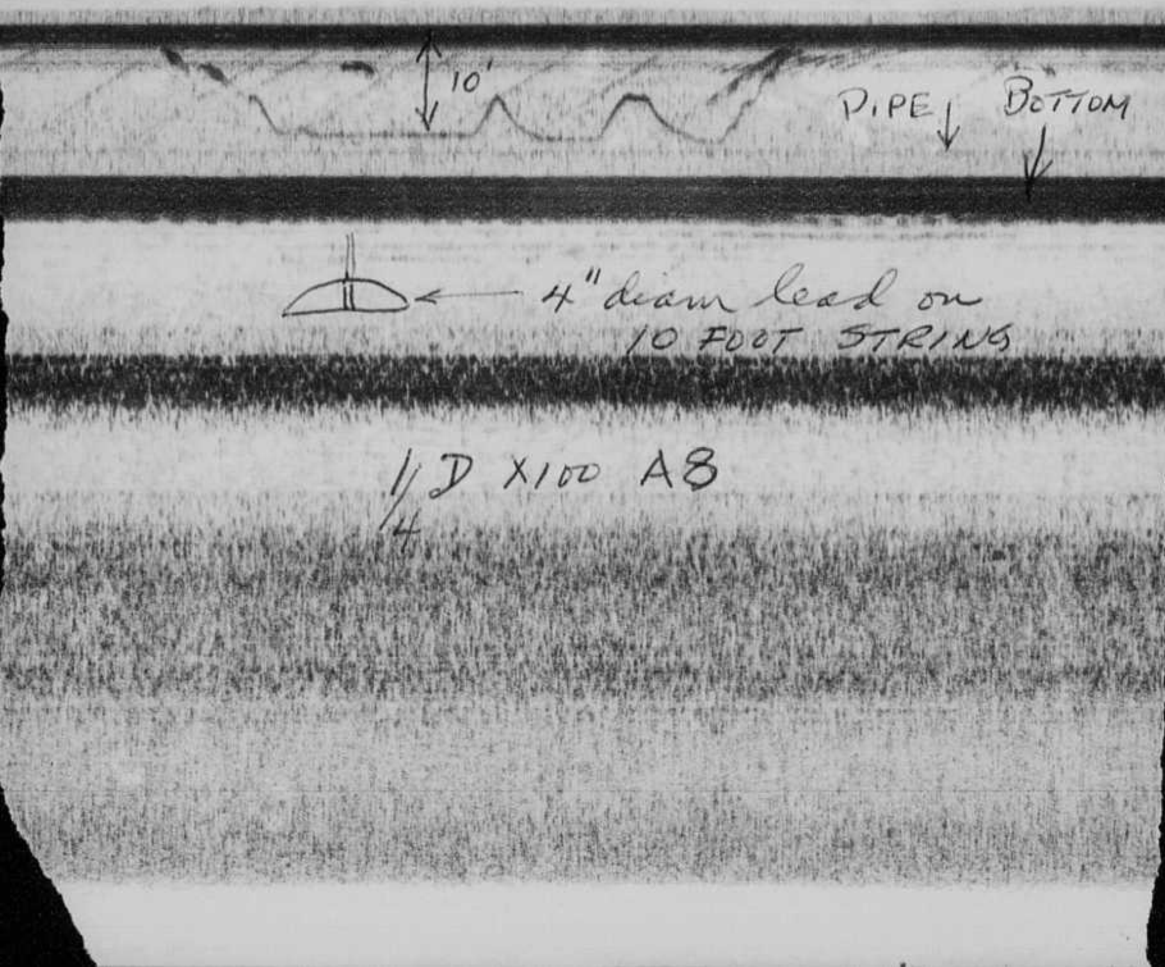
____ unmounted photograph(s)

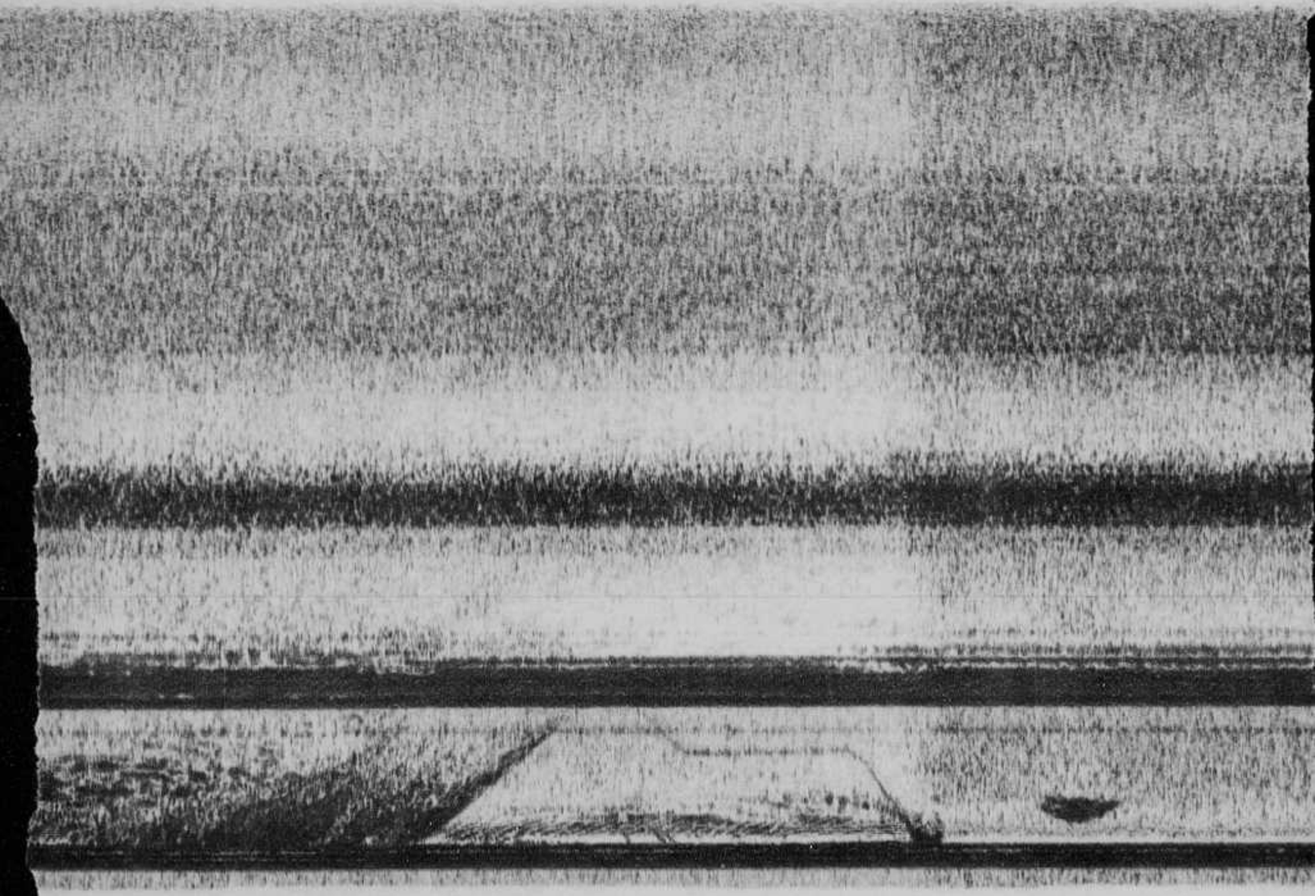
____ negative strip(s)

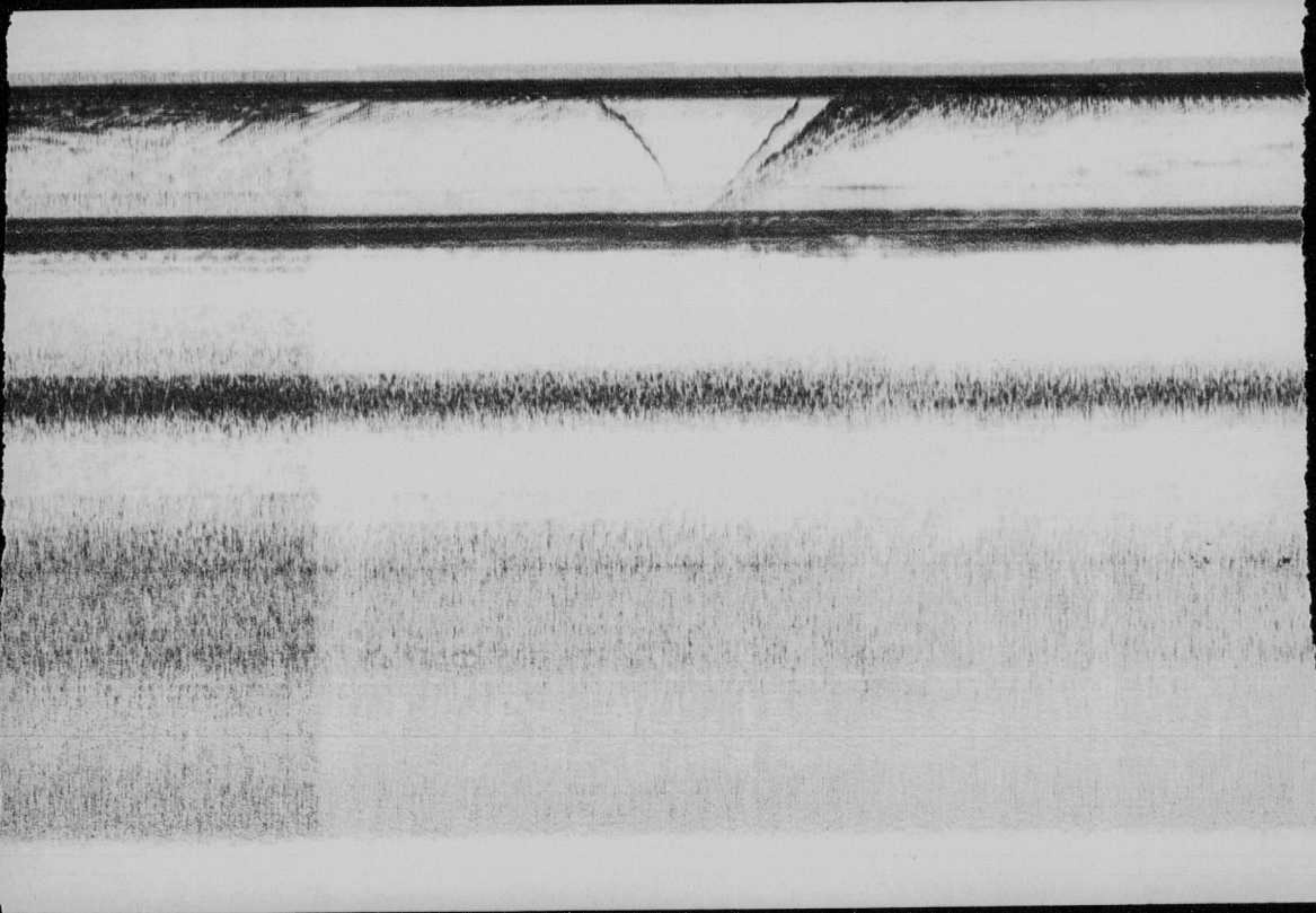
4 unmounted page(s)
(notes, drawings, letters, etc.)

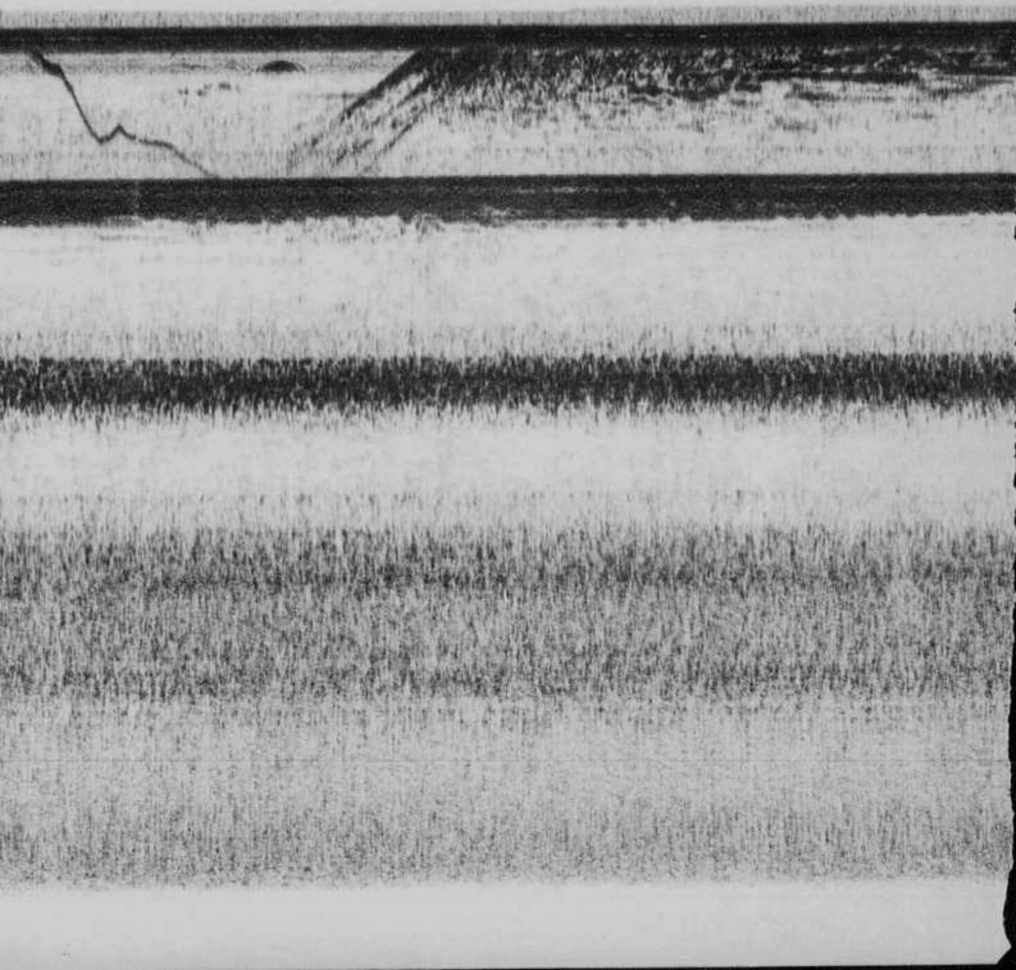
was/were filmed where originally located between page 62 and 63.

Item(s) now housed in accompanying folder.


10'
PIPE
BOTTOM
4" diam lead on
10 FOOT STRING
1/4 D X100 A8



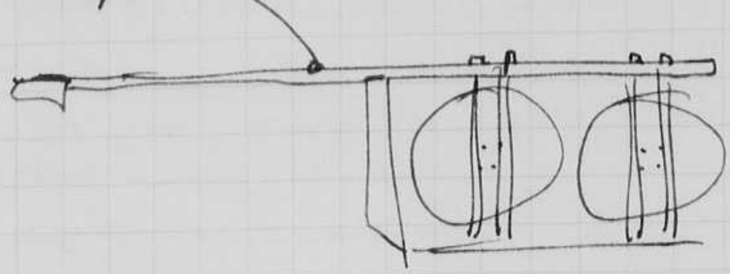


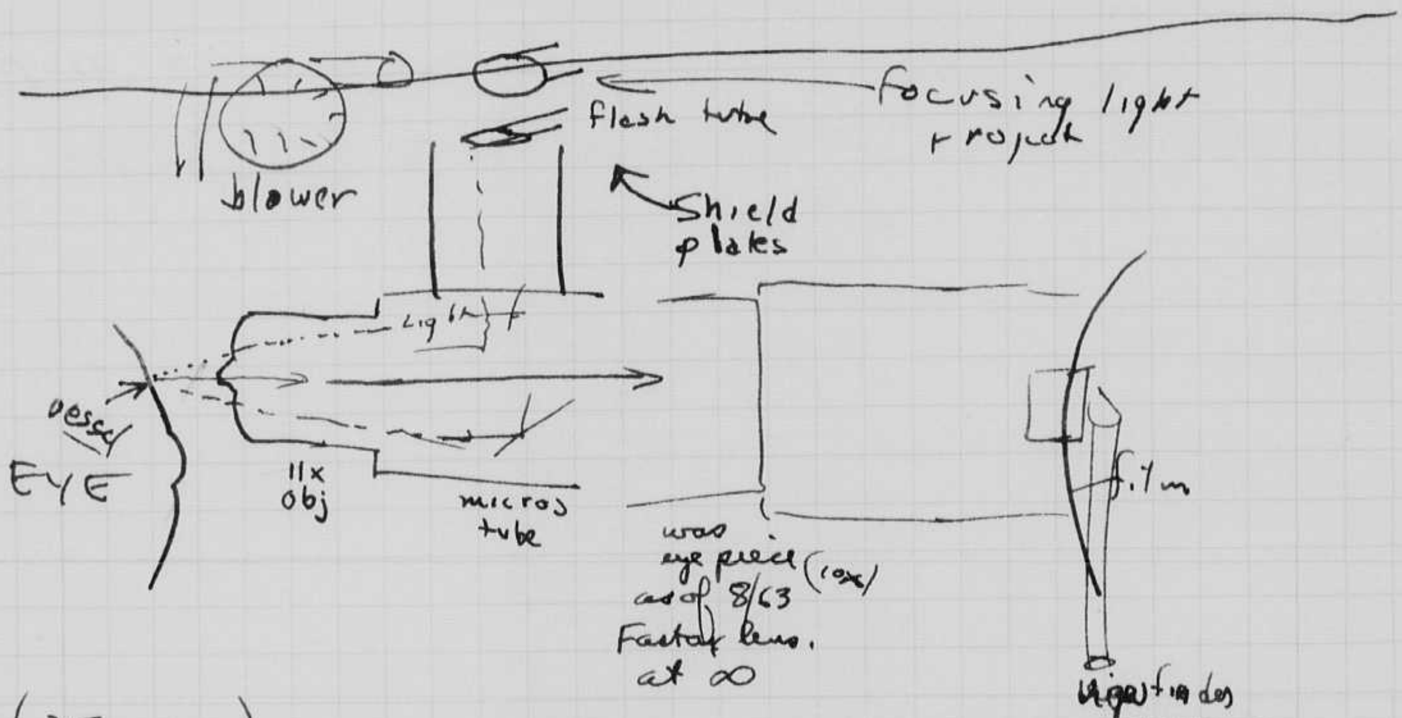


Sept. 29, 1962

~~Harold Edgerton~~ now back almost a week after the long trip. See Nat. Geo. Borneo file for reports etc. 6.702 class has 9 Sem 11 has 12 Lab is going full at M.I.T.

New transducer for Boomer is needed. Suggest double area - Reduce spring (rubber) so cavitation will be weaker. Proposal off to Hersey for transducers for Puerto Rico trip.





(? 50x now)

Problems of 7-10 mo./62

1). Broad obj - eyelashes in way
2) ? Impedance drift of Fx
   ? Thyratron
   ? Heat
   ? ? X.
3) Focus - (short plane)
4. camera jitter. (H.E.E. exclusive)
5.

Point. Red cell is 8μ diam Eye can resolve . or 8μ x 100x

(Math)

Plan: Review + gather old films
Fix flash.

RW/HEE

Sept 30 1962
Harold Edgerton

I studied all the eye photos as taken by movies etc.

conclusions (1) We must first study the optics, lighting and photography to get photos of the ~~eye~~ blood particles in the eye.

Red corpuscles are 4 microns? in diam.
6 ?

I believe that the transparent skin on the eye causes optical distortions that prevent resolution of the individual corpuscles.

(2) Perhaps a glass contact lens is needed, this will work if the problem is in the outer layer of skin. If the skin is variable in depth, then we are licked by the optical problem.

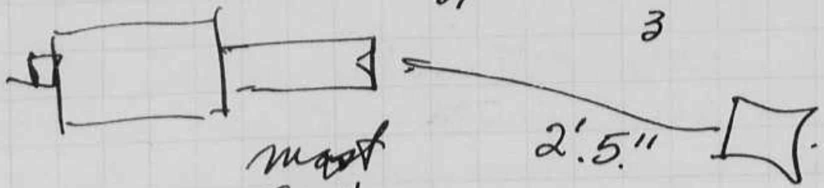
(2) things to do – (a) Rigid mount.
(b) Rigid head rest
(c) method of adjustment for focus!
(d) . —

The best photos were made with a 40 mm lens at 6:1 magnification on plus x film at 400 f.p.s.

Oct 6 1962 5923 Daniel Smith | 1st year students.
H.E. Edgerton . Steve Teichert. |

$.17 = 1.4''$

$34''$ $6'10\frac{3}{4}'' = \frac{6.895}{3.16} = 2.17$
3 $= 2'.5''$

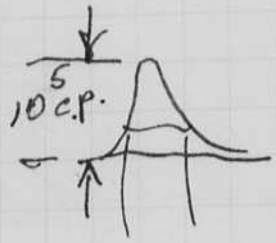


$R_5 = 5$

$C.P. = 2.1 \times 10^6 \frac{V d^2}{R_L}$

$6'\,10\frac{3}{4}''$ $R_L = 100$ c.p. $- 10^6$/cm c.p.
1V/cm.

$2'\,5''$ $R_L = 100$ ~~[illegible]~~ 1 volt. 10^5 c.p.



.2 μ sec/cm − 1.2 cm − .24 μ sec
↕
.1 μ sec/cm − 2.4 cm − .24 μ sec

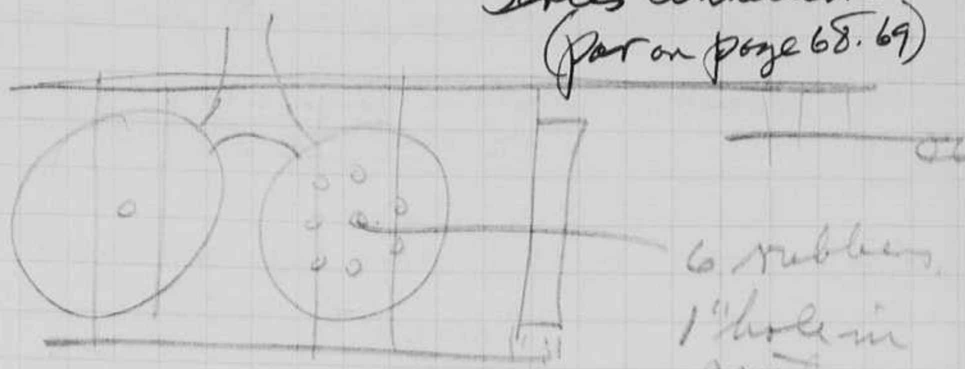
Output $= 10^5 \text{cp} \times .24 \times 10^{-6} = .024$ c.p.s.

$\frac{.024}{D^2} = .01$ $D^2 = 2.4$
$\underline{D = 1.2 \text{ meters}}$. Slow film.

Oct 12 1962
Harold Edgerton
Jay Harford
Colin Holdway
Bob Carr.

Big Boomer
with 30" diam 1/2" plates.

Series connection
(par on page 68. 69)



Inductance of open coil 2.6 mh. ± colin

BC50 Hydrophone 241

2.25 pm with H_2O connect for 3000 W.S.

	#1	3000 WS.	3.7 KV	0.5 V/cm	2. ms/cm.
	#2	5000 WS.	3.7	.5 V/cm	2 ms/cm
	3			.5	2
8	4	5000	3.7	1 V cm	2 ms/cm
1	5	9000	3.7	1 V	2 ms/cm
2	6	13,000	3.7	1 V	2
	7	13000	3.7	1 V	5 ms.

350 Life test started on 2 Big Plates at 15 to 20 sec.
13000 WS 2 power supplies
422 off 32 min at 4 per min 128 Booms

— 2 Retainers on each transducer removed.

8 13000 3.7 1V 5 ms

Oct. 13 1962
Calib 8.3 cm ×2 ms. = 1/60 sec .0167 8.3/2 16.6 time ok ✓
1 volt = 1 cm. volts ok ✓

Notebook # 27

Filming and Separation Record

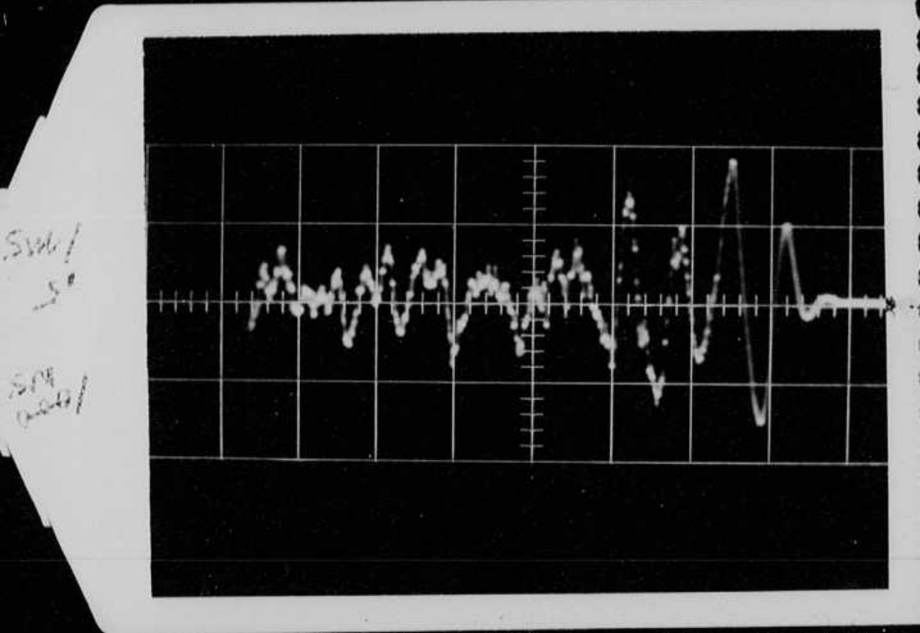
14 unmounted photograph(s)

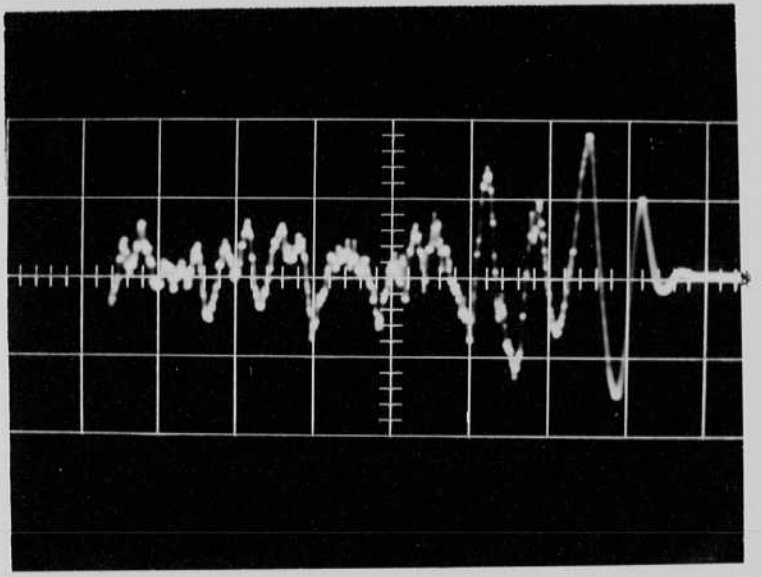
____ negative strip(s)

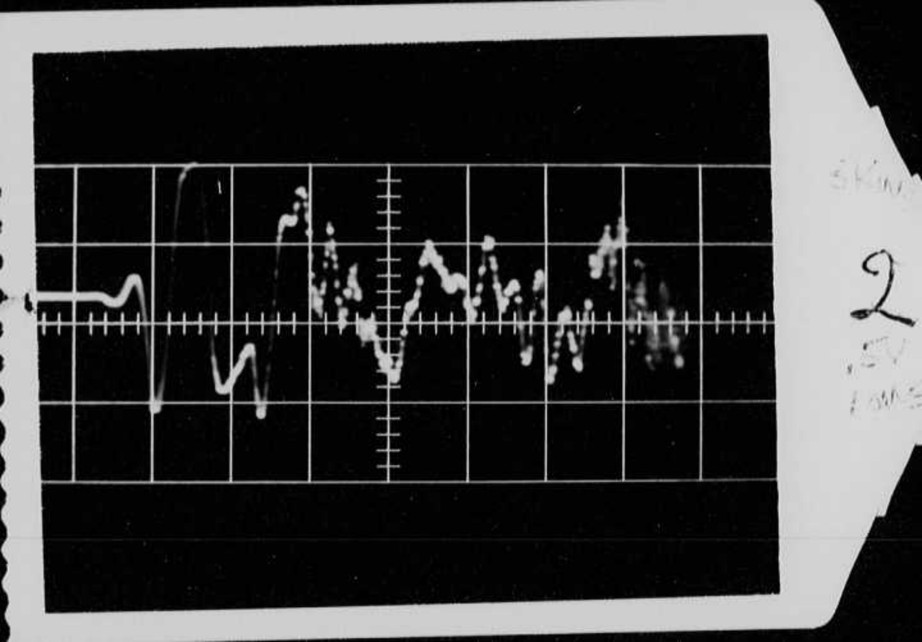
____ unmounted page(s)
(notes, drawings, letters, etc.)

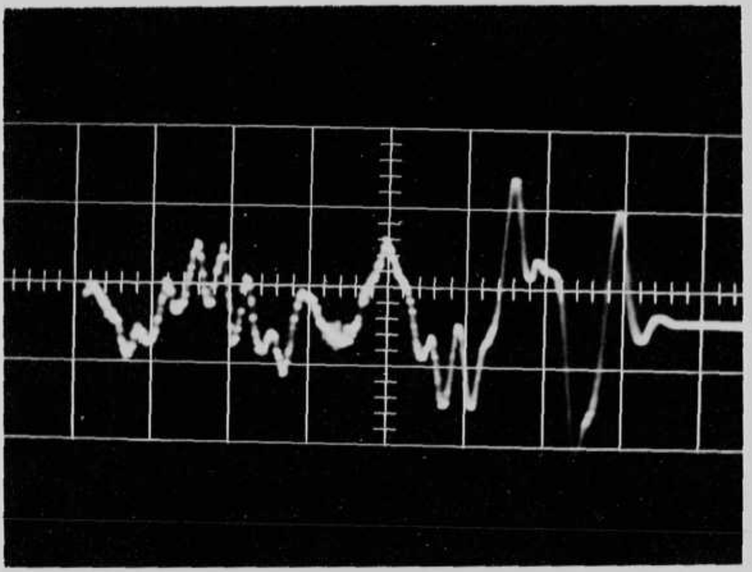
was/were filmed where originally located between page 66 and 67.

Item(s) now housed in accompanying folder.



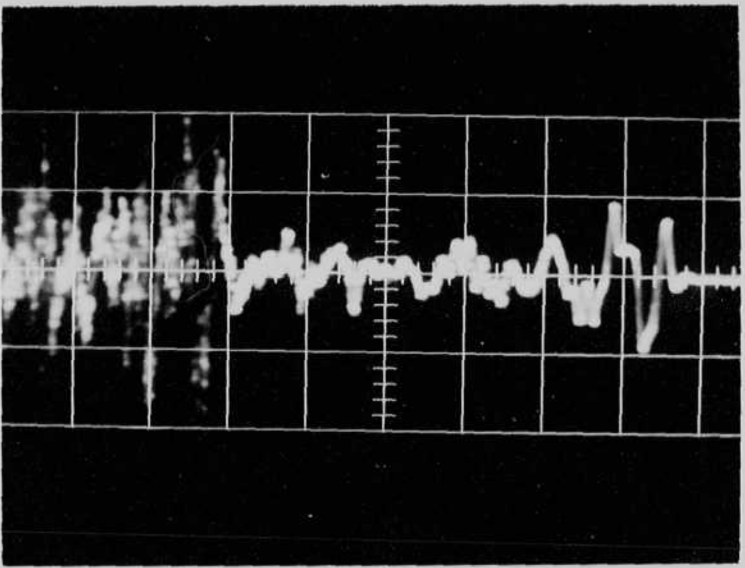


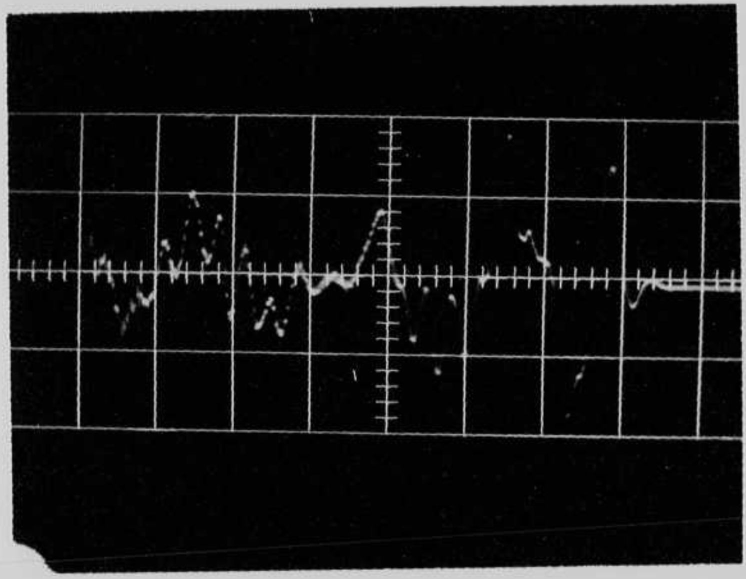

2
.5V

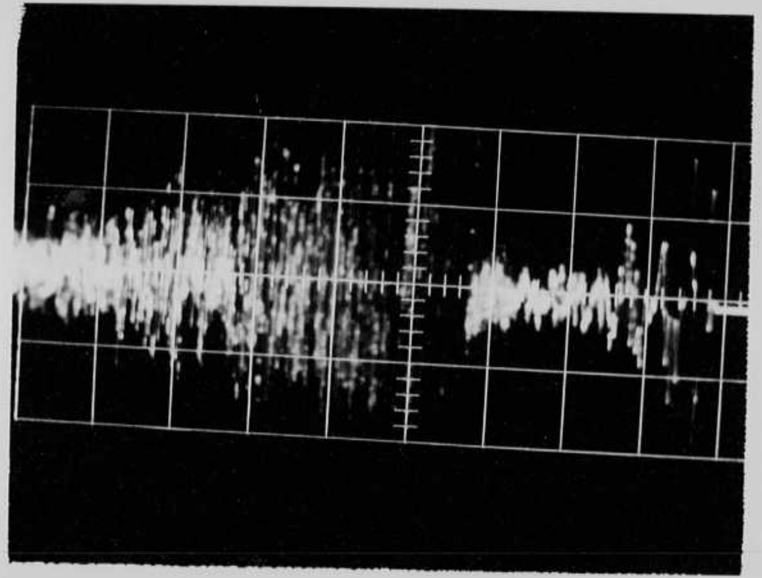


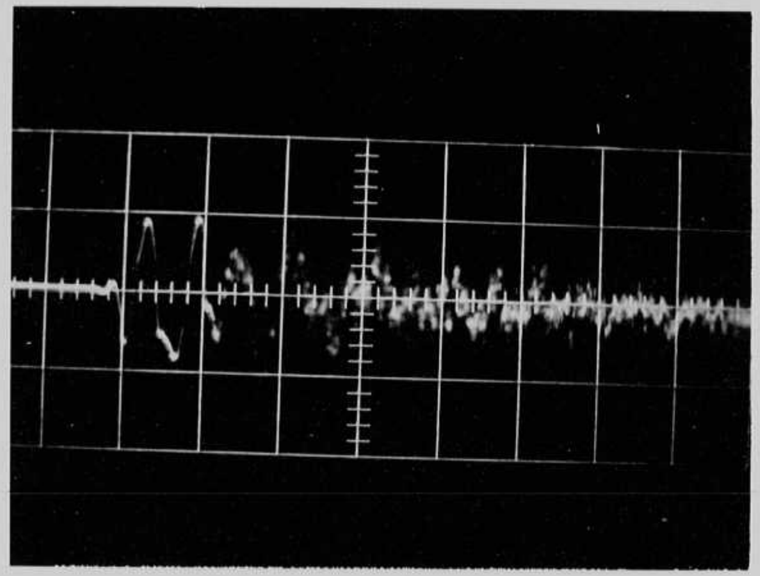
3

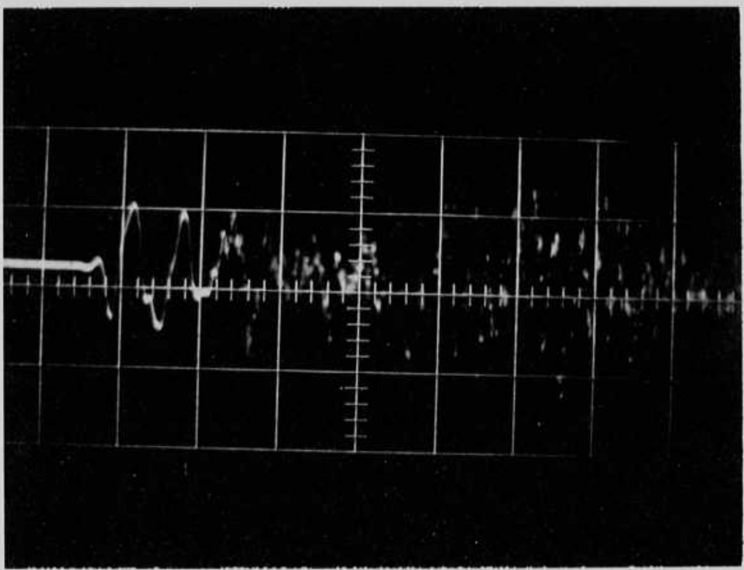
A

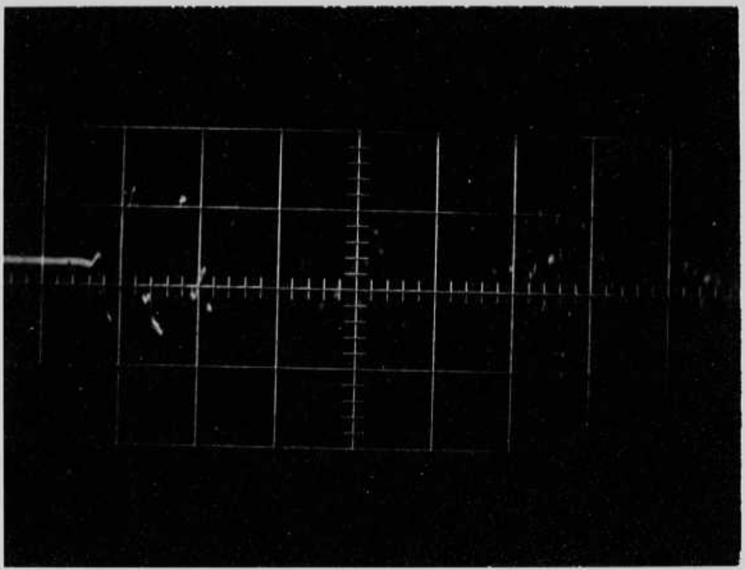


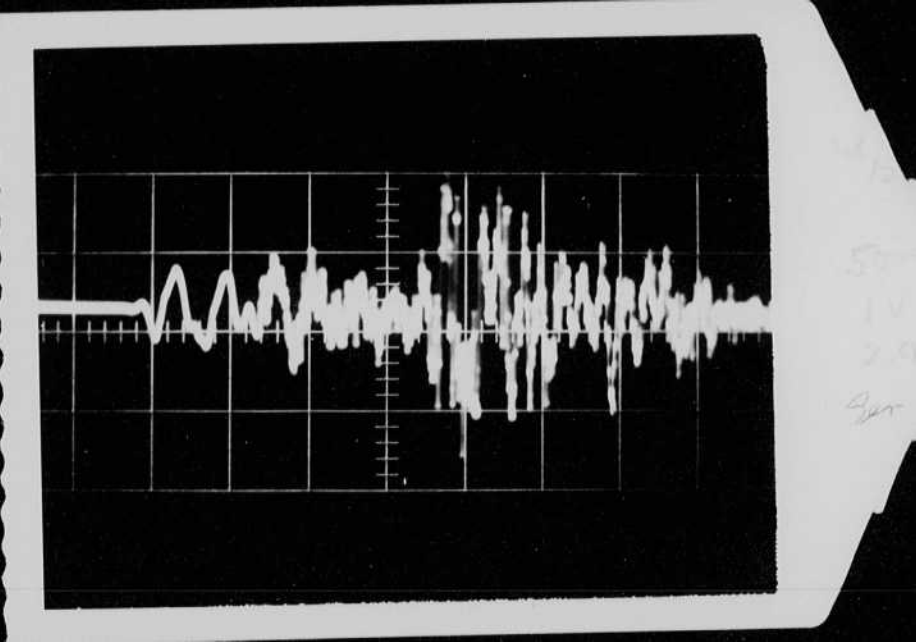


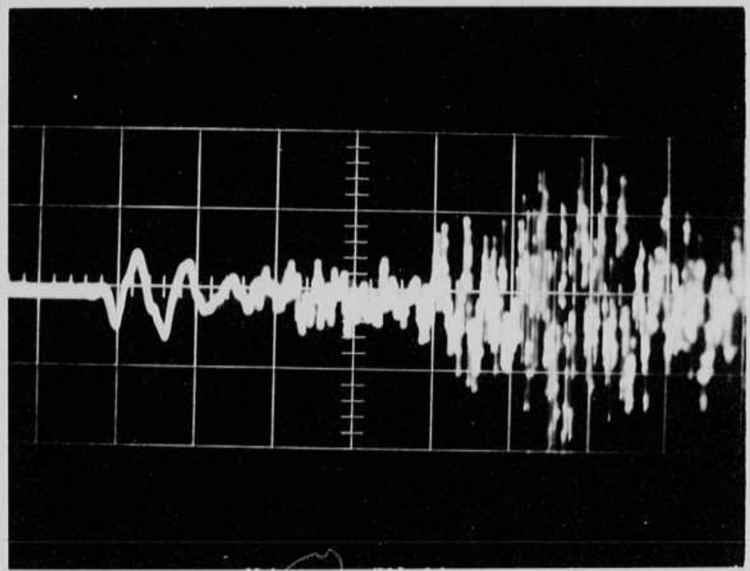


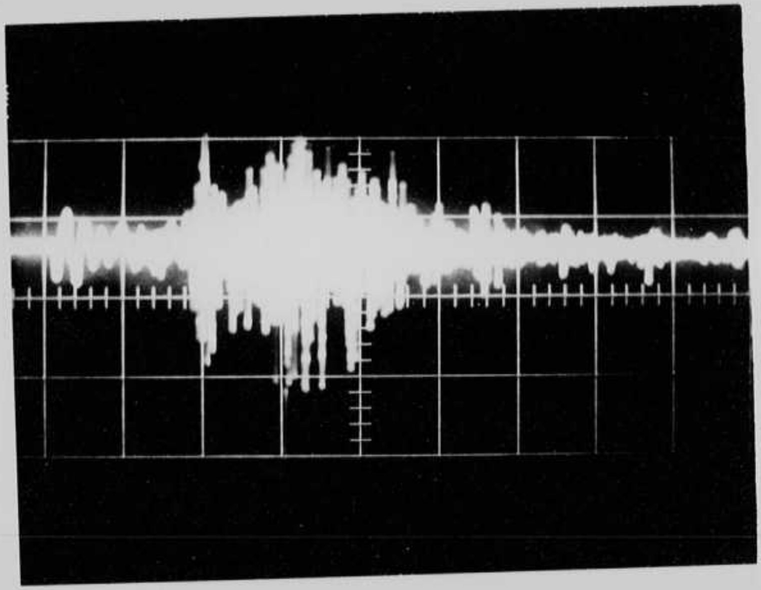


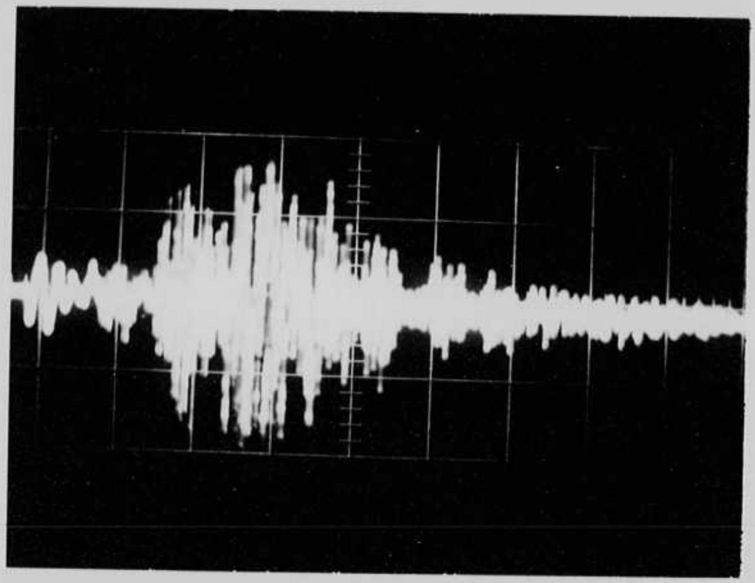


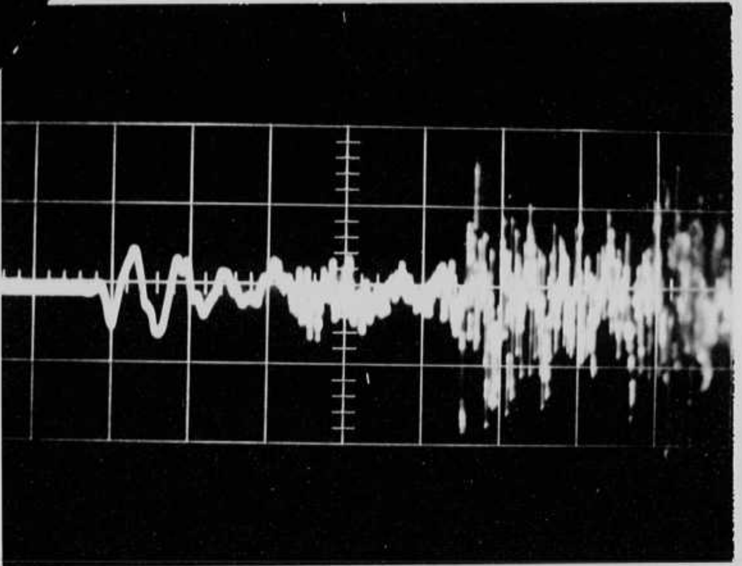












Notebook # 27

Filming and Separation Record

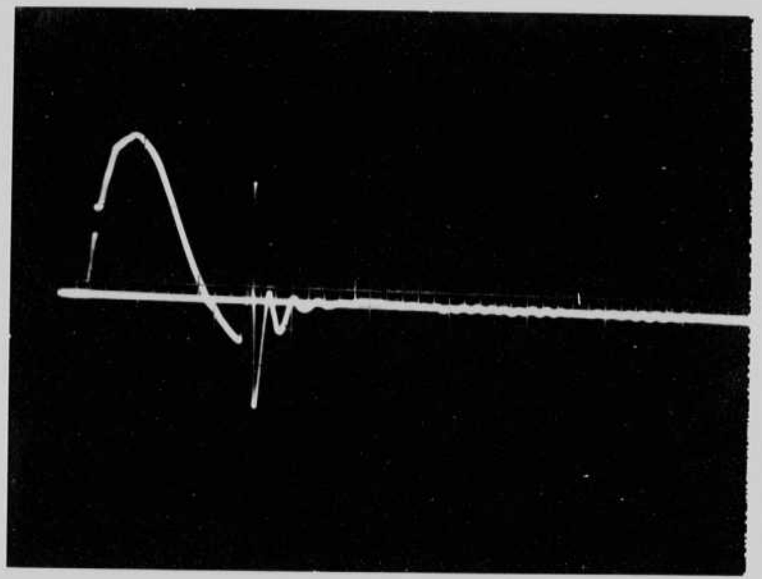
7 unmounted photograph(s)

___ negative strip(s)

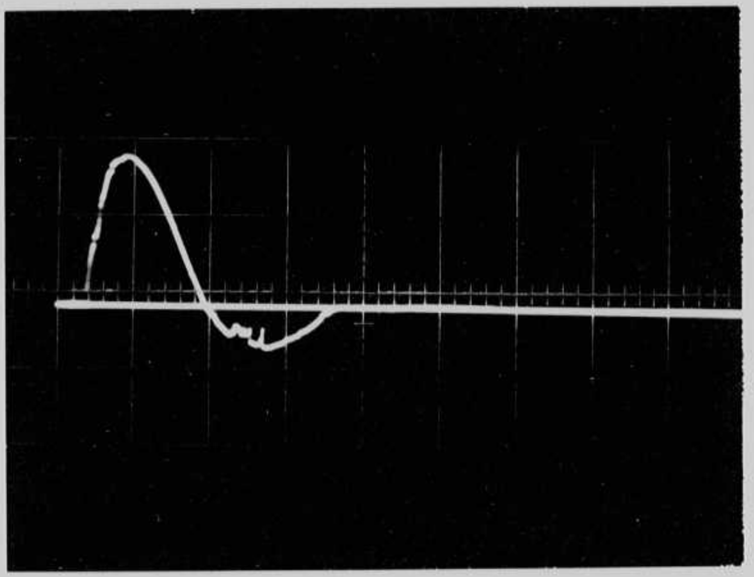
___ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 68 and 69.

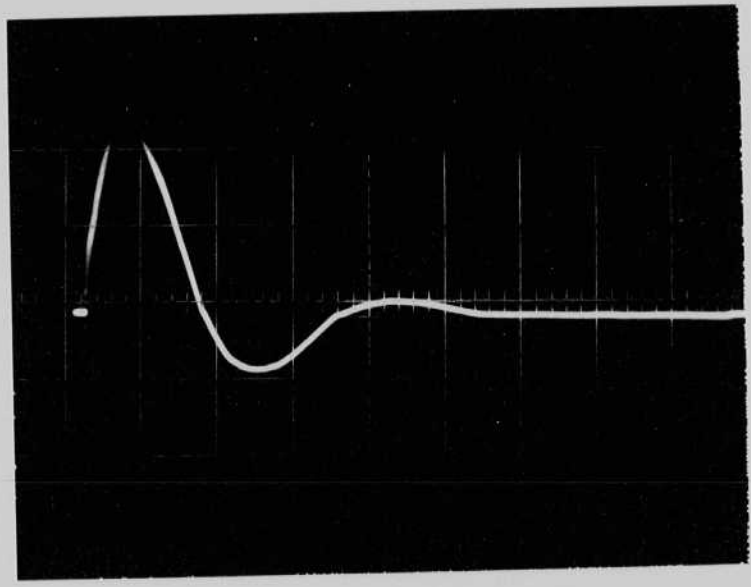
Item(s) now housed in accompanying folder.



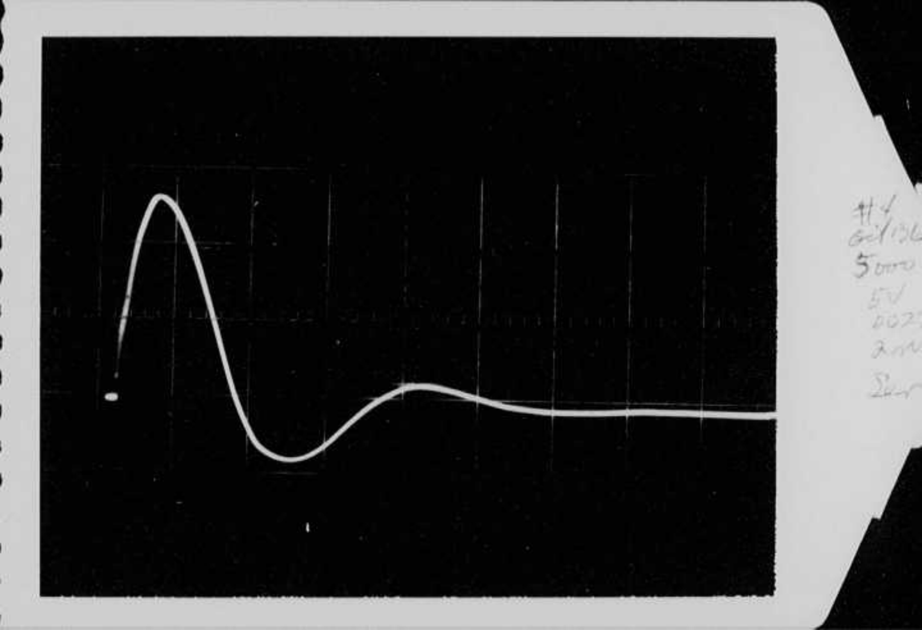
#1
oct 13
500
5 V
2
.002
Se

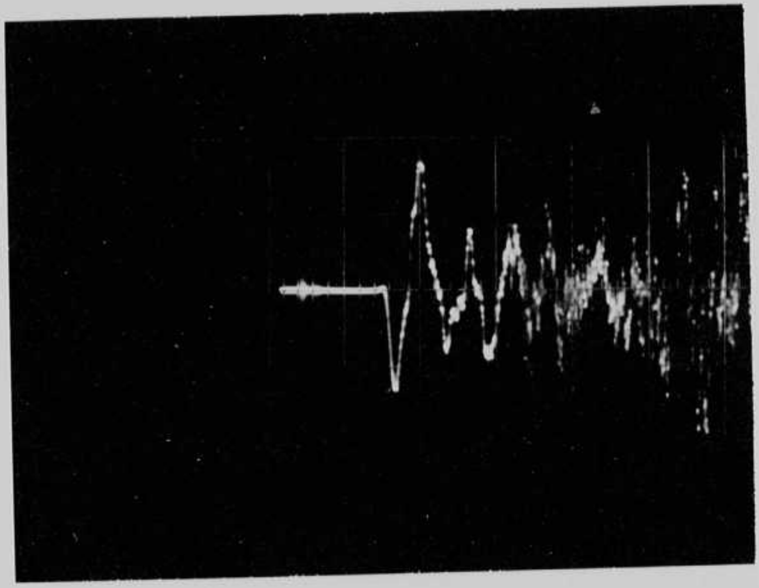


#2
Oct 13
500
5V
.002
2 m

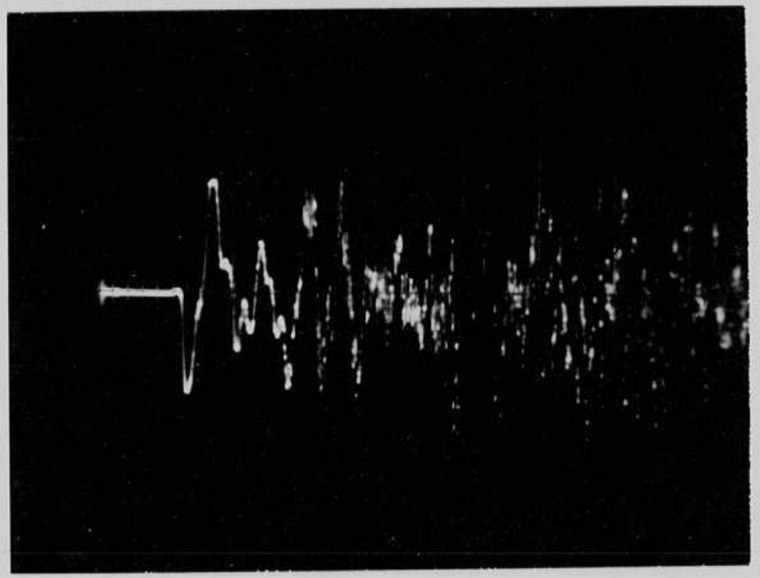


3
Oct 13 62
500u
5V
.002
2m



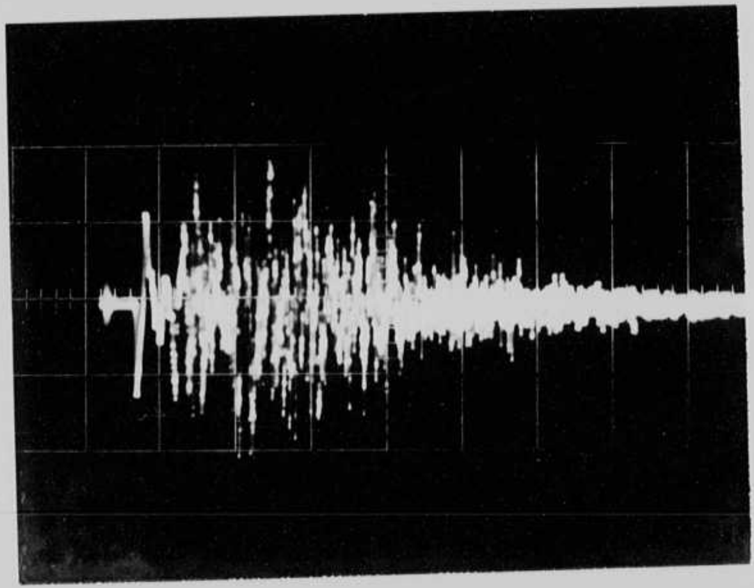


#5
Oct 13
BCE
0.5 V
2 m
5000
Ser



#6
Oct
DC50

0.5V
2m



Oct 13 1962
A. S. Taylor

Oct 13 0,00275 ohms shunt. for current meas.

#1 5 5000 WS 2 coils in Series with large plates.
arc over in gap!

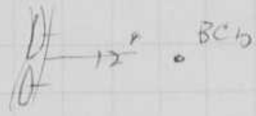
#2 5 5000 2 coils same as #1 except no arc over.

Changed to newtype control gap # 24 trigger as
ne

#3 5 5000 2 coils in series. 5V/cm 2 ms/cm

#4 5 5000 " " " Shifted zero line

#5 5 5000 BC50 at 12 ~~feet~~ from side of plates.



0.5V/cm 2ms/cm.

$\frac{e}{R} = iR$

$5000 \,\|\, \times .002$ ~1 div

#6 5 5000 Ditto of 5 but with axis shifted on camera

Peak current = 2,5×5
12,5 volts / .00275 = i =
~~1000~~
.00 4300

#7 5 5000 Ditto of 5 but with 5ms/div

.00275) 12,000.
~~825~~
~~375~~
1100
1000

4300 amp.
.003
13.900 volts.

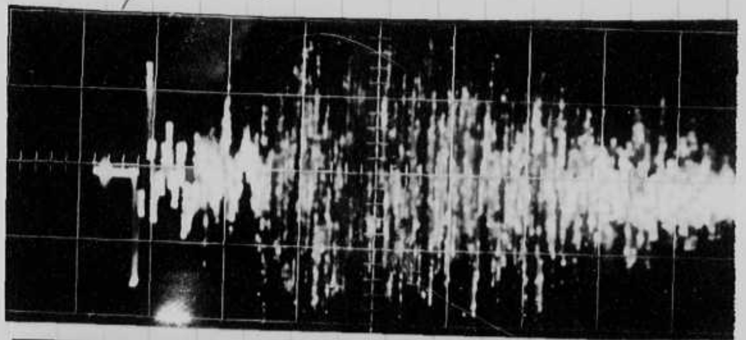
All above at 5000

oct 13 1962 cont

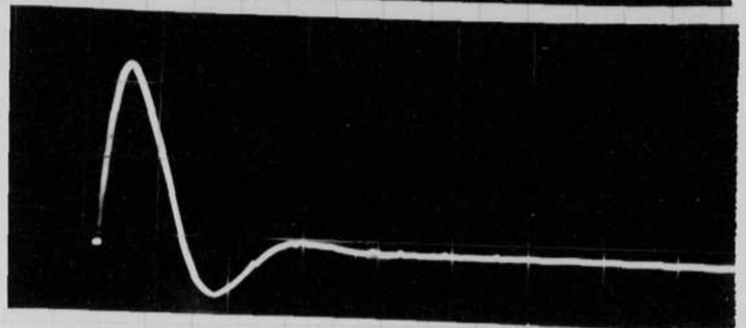
2 Coils in Series. 30" Plates of 1/2" aluminum

#8 13,000 WS 3.5 KV. 0.5V/cm 5 ms/cm.

#9 current Ditto 8 Borrows 10V/cm 5 ms



8
oct 13 62
13000
52 BC
1/2"
0.5V
5 ms
Ser



9
oct 13 62
13000
10V
.00275 Ω
5 ms

Oct 13 1962
A. S. [illegible]

Oct 13 0.00275 ohms shunt. for current meas.

#1 5000 ws 2 coils in Series with large plates.
arc over in gap!

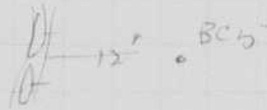
#2 5000 2 coils same as #1 except no arc over.

Changed to new type control gap # 24 trigger as
ne

#3 5000 2 coils in series. 5V/cm
2 ms/cm

#4 5000 " " " Shifted zero line

#5 5000 BC50 at 12 ~~feet~~ from side of plates.



0.5V/cm 2ms/cm.

#6 5000 Ditto of 5 but with axis shifted on camera

#7 5000 Ditto of 5 but with 5ms/div

Peak current = 2,5 × 5

$\frac{12.5 \text{ volts}}{.00275}$ = i =

.0$\cancel{3}$4300

.00275) 12,000.

1100

1000

4300 amp.

.003

13,400 volts.

$\frac{e}{R}$ = iR

5000 × .002 = 1 div

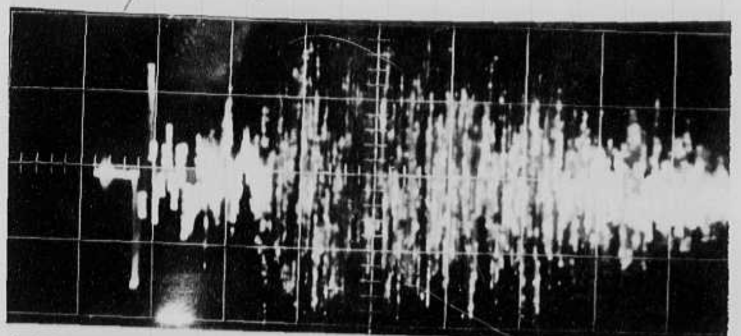
All above at 5000

oct 13 1962 cont

2 Coils in Series. 30" Plates of 1/2" alumin

#8 13,000 WS 3.5 KV. 0.5V/cm 5 ms/cm.

#9 current Ditto 8 13000 WS 10V/cm 5 ms



8
oct 13 62
13000
50 BC
12"
0.5V
5 ms
Ser

9
oct 13 62
13000
10V
.00275 Ω
5 ms

2 coils in Parallel
30" 1/2" al Plates

	5000 WS.				
#10		current	20 V/cm	.00275 Ω	2 ms/div
#11	5000 W	Sound	1 V/cm	BC 50 at 12'	2 ms/div
12	13,000	Sound	2 V/cm	"	5 ms/div
13	1300	Sound	2 V/cm	"	2 ms
			Film UG		
14	13000	Sound	2 V/cm	"	2 ms / div.
15	13000	current	20 V/cm		2 ms/div.

Standard Single Coil

5000 WS Peak current $\frac{50 \text{ volts}}{.00275\,\Omega}$ =

~~Sound~~

16. Current 70 V / .00275 Ω 2 ms

Sound. 0,5 V 2 ms.
BC50 at 12'

17. Sound 2V BC50 at 12' 10 ms shows second pulse.

Current. $\frac{20V}{.00275}$ 10 ms.

18 Sound 2V BC50 at 12' 5 ms
Current $\frac{20V}{.00275}$ 5 ms.

19. Sound 2V BC50 at 12' 5 ms.
only.

Notebook # 27

Filming and Separation Record

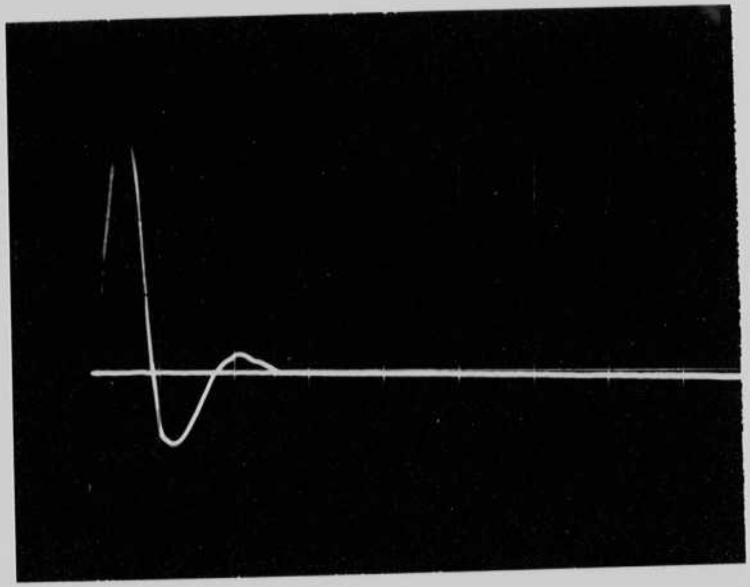
7 unmounted photograph(s)

____ negative strip(s)

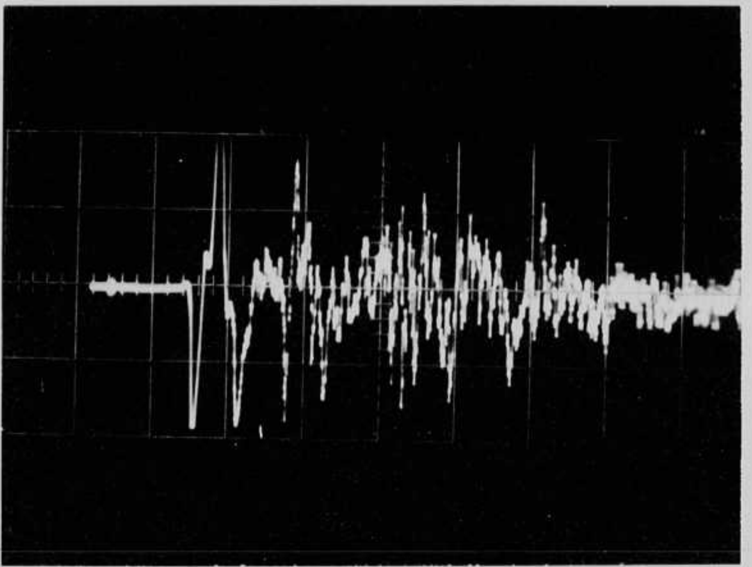
____ unmounted page(s)
(notes, drawings, letters, etc.)

was/were filmed where originally located between page 70 and 71.

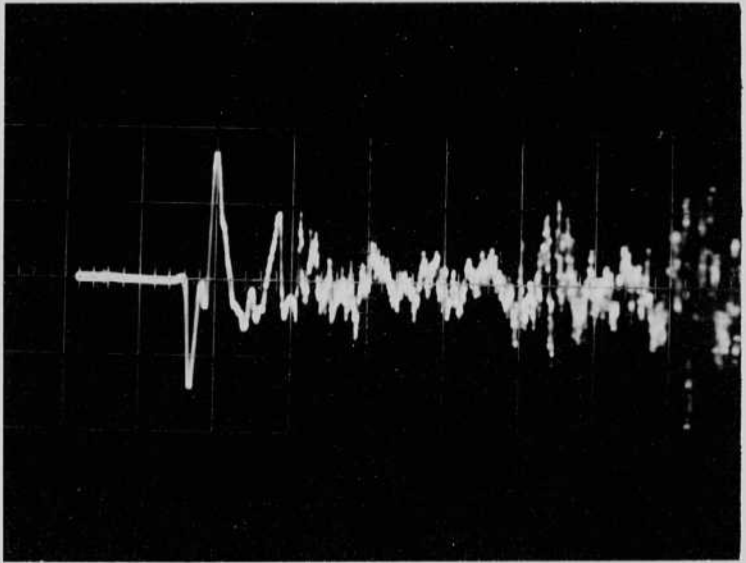
Item(s) now housed in accompanying folder.



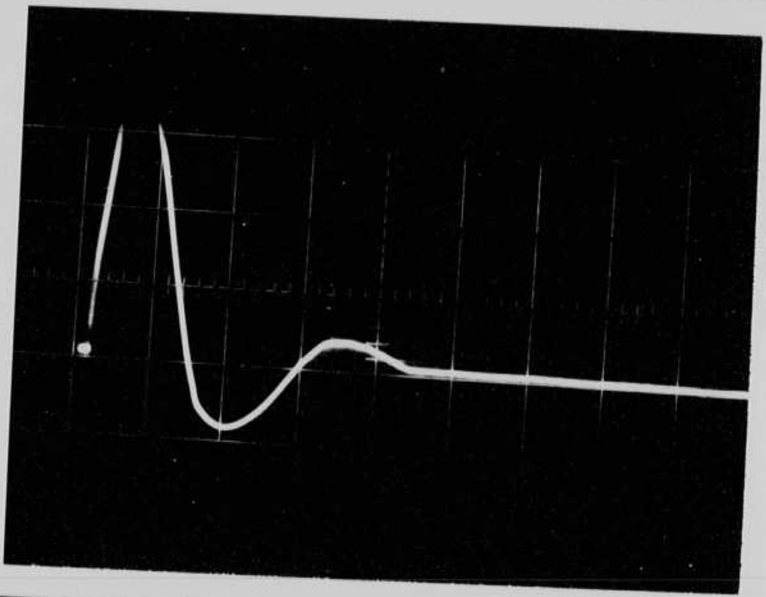
10
Oct 15
500
20 V
.002
2m



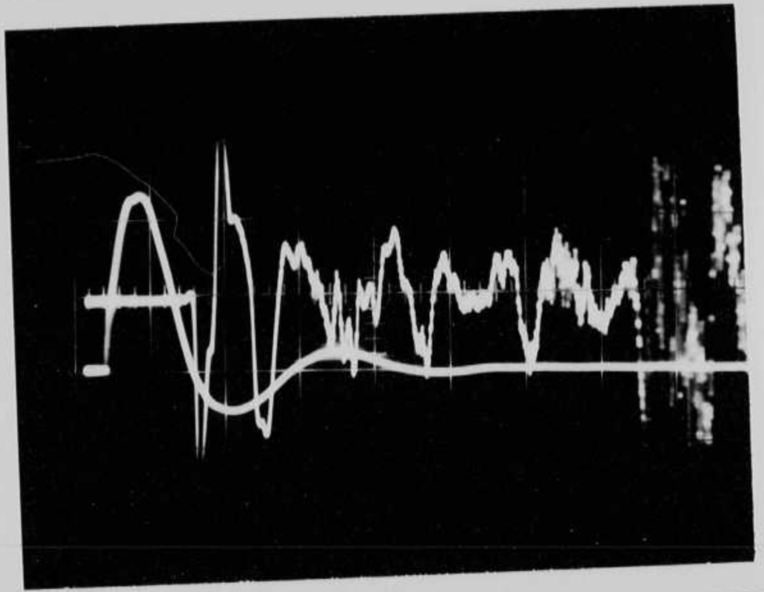
#11
Oct 13 6
500mv
1ms/c
DC 50
2ms
Par



#14
Oct 13
13o
2V/
BC 5
2m
Par



#15
at 13
1300
20K
.00
2m
Por

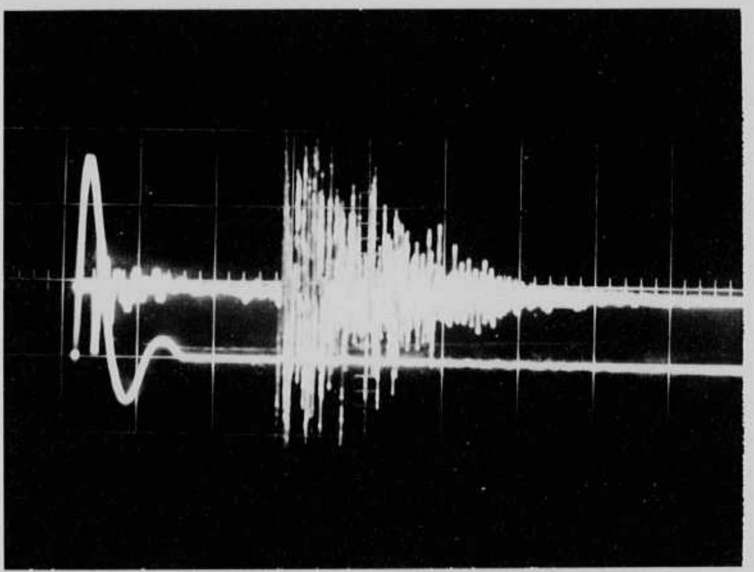


16
Oct 19
5000 V
BC 5
.5 V
2 ms

$$\frac{80{,}000}{.00275} = \underline{29{,}000 \text{ amps}}.$$

$$\frac{2,\cancel{000}^{2}\ \cancel{.00275}}{1,60} \times 2\times10^{-3}$$

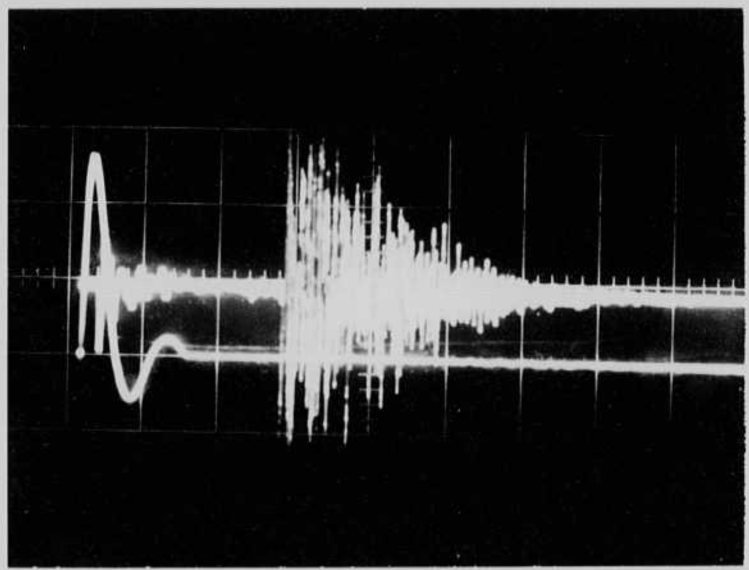
$$\begin{array}{r} 120 \\ 20 \\ \hline 2400 \end{array} \text{ watts.}$$



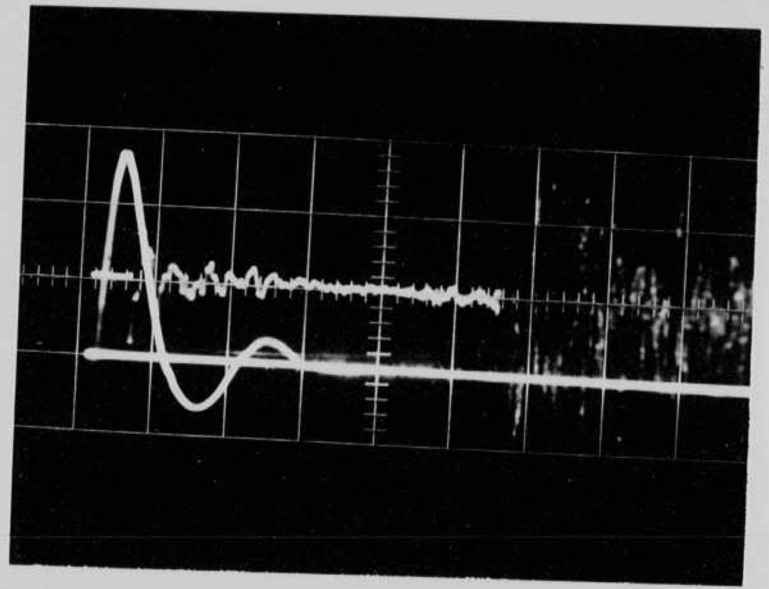
17
1300
10ms

BC50
2V

Curren
20V
.00275



17
10 ms
BC50
2 V
20V
.00275



#18
Oct 13
13000
2V DC
20V
00235
5 ms
Std

Notebook # 27

Filming and Separation Record

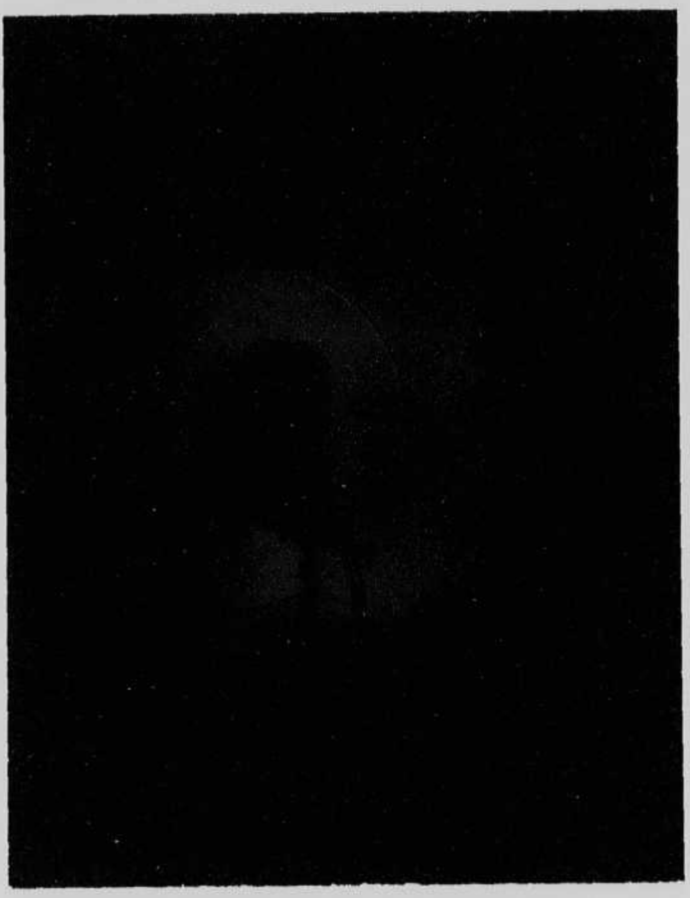
1 unmounted photograph(s)

___ negative strip(s)

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

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

Item(s) now housed in accompanying folder.



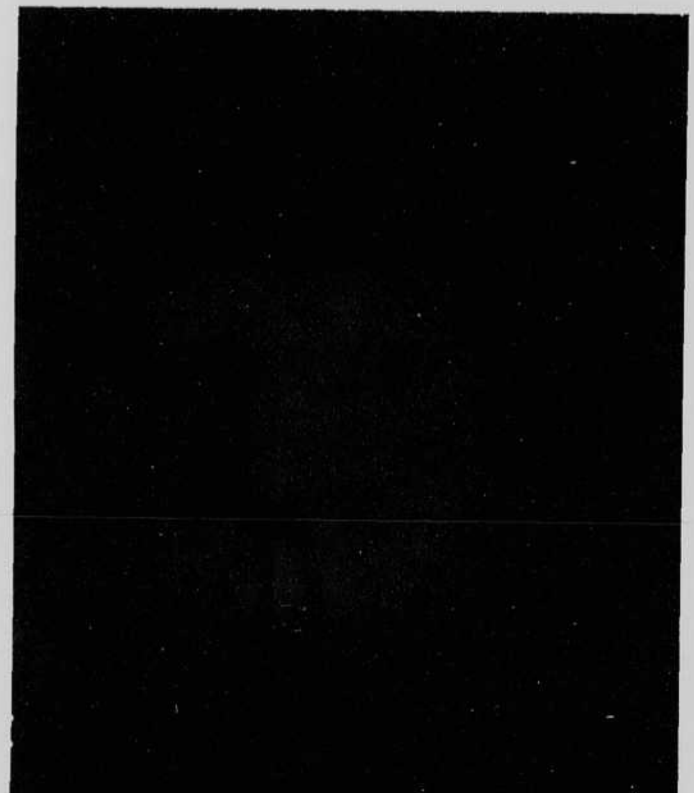
8

Oct. 29, 1962

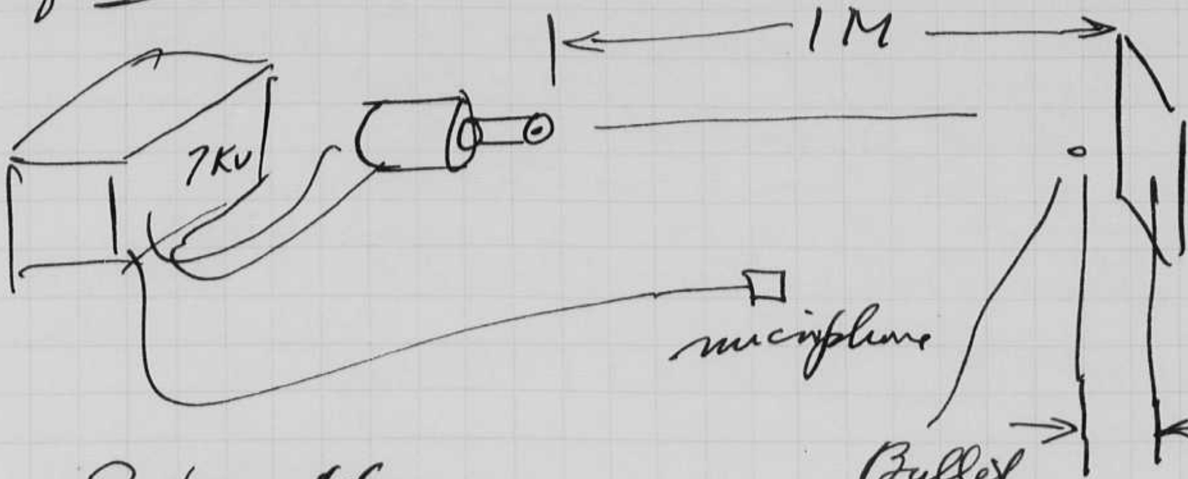
Harold Edgerton

Dr. Hersey phoned on Sat and Sun from the Chain. He reported that the 30 transducers did not produce any 140 or lower frequency. However he said that they also had a short circuit and sparked to ground. I urged him to find the short and fix it with epoxy.

He reported that an improved fish was devised with 200 pounds of weight on the bottom. Speeds of 7 knots were used with no apparent problem. Higher speeds were considered possible.



Nov 3, 1962
#408 MIT. Photo with ~~Mast~~ Spark.
Edgerton & Smith.



See page 66.

10^5 cp
$\times$ 0.24 μs = .024 c.p.s.

10 min in
1 to 1 Dektol
develop
at 72°
Density good
Action good.

Nov 4 1962 Photo with Scotch and Strobotac.
4X5 camera f 4.7
Strobotac #104 on High intensity.

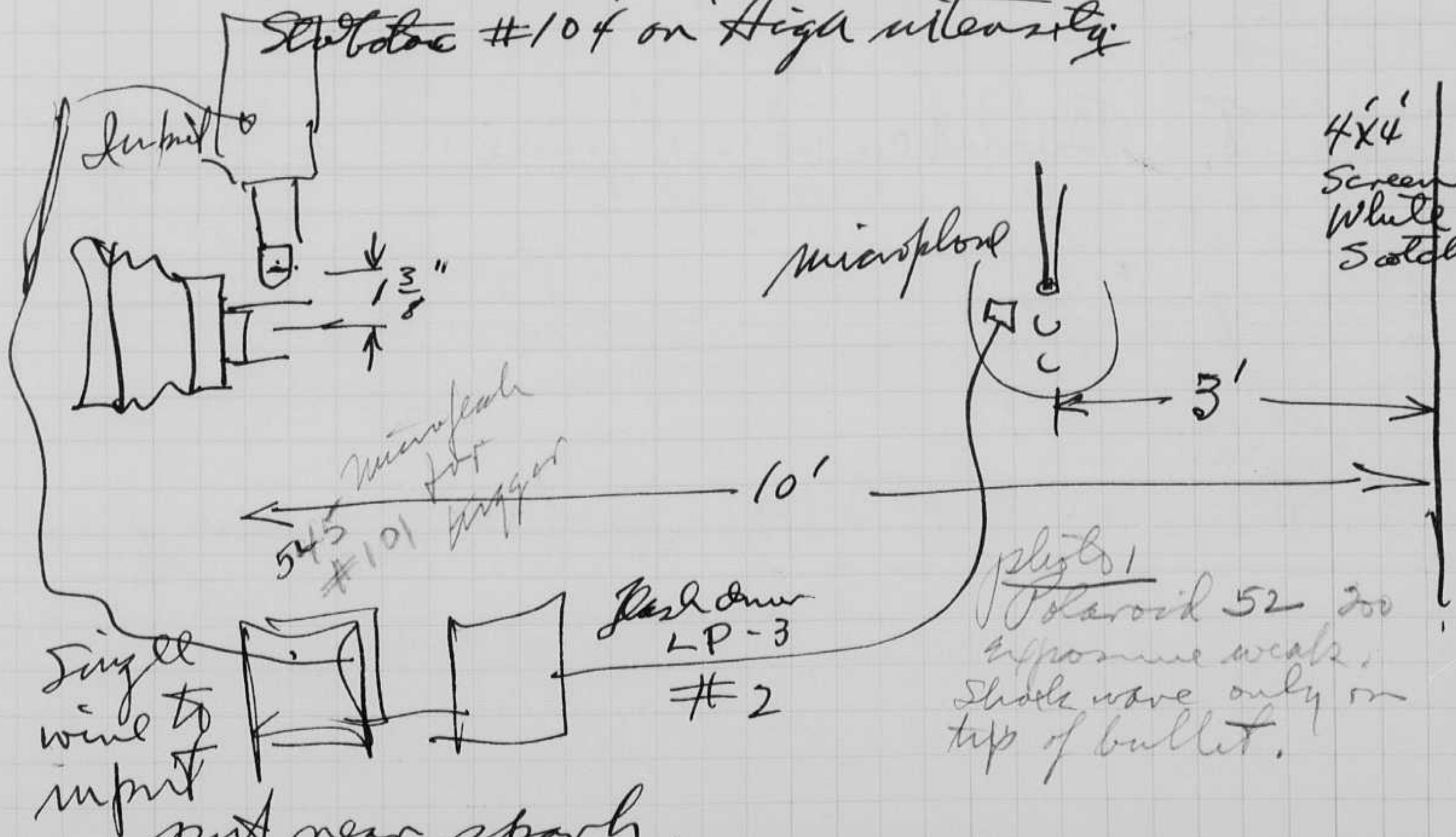


Photo 1
Polaroid 52 200
Exposure weak.
Shock wave only on
tip of bullet.

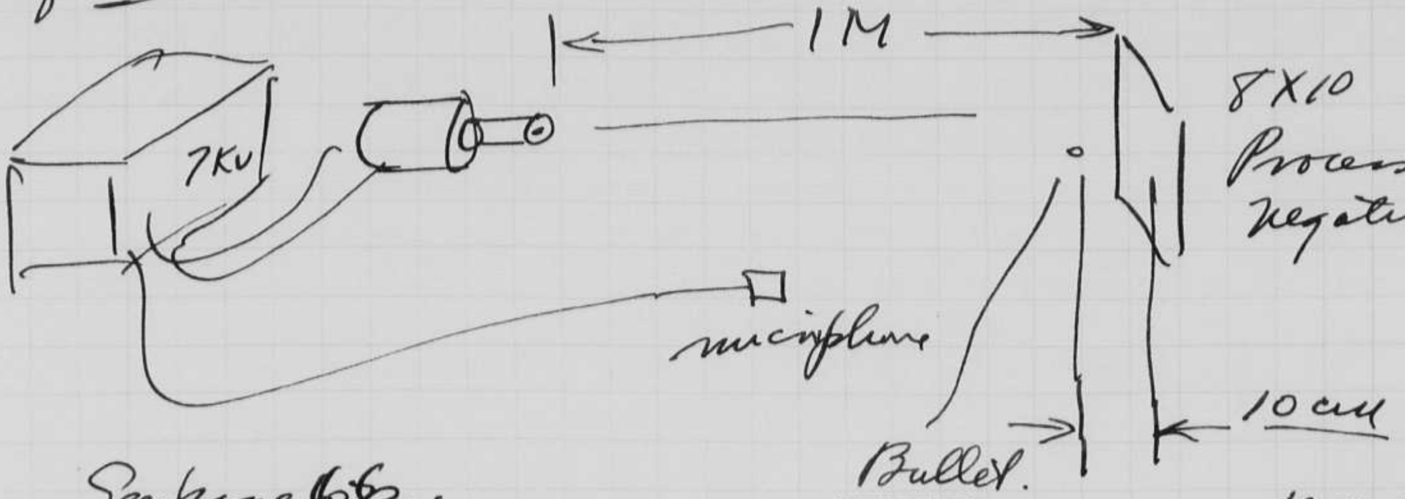
 Oct 29, 1962

Harold Edgerton.

Dr. Hersey phoned on Sat and Sun from the Chain. He reported that the 30 transducers did not produce any 140 or lower frequency. However he said that they also had a short circuit and sparked to ground. I urged him to find the short and fix it with epoxy.

He reported that an improved fish was devised with 200 pounds of weight on the bottom. Speeds of 7 knots were used with no apparent problem. Higher speeds were considered possible.

Nov 3, 1962
#408 MIT. Photo with Mast Spark.
Edgerton & Smith.



See page 66.

10^5 cp
$\times$ 0.24 μs = .024 c.p.s.

10 min in
1 to 1 Dektol
develop
at 72°

Density good
Action good.

Nov 4 1962 Photo with Scotch and Strobolux.
4X5 camera f 4.7
~~Strobolux~~ #104 on High intensity

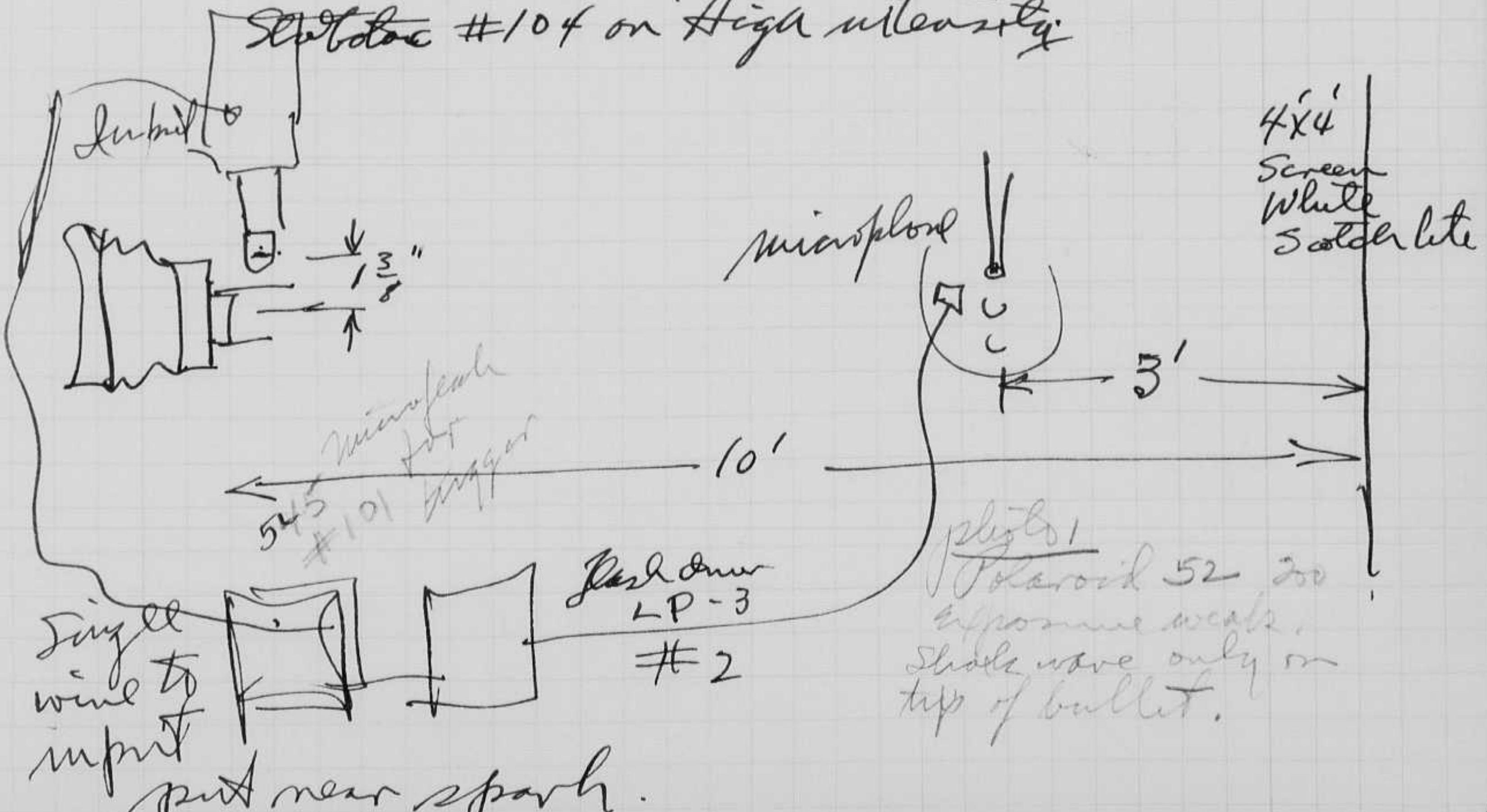


photo 1
Polaroid 52 200
Exposure weak.
Shock wave only on
tip of bullet.

Photo #2 22 Long Rifle
mike closer. Some waves.

3. Screen at 10' Gun at 5'
Shock is somewhat better.

4 Ditto but out further Shock difficult to see

Springfield #167494 model 03A3 US Remington.

#5 30 Caliber Shock wave excellent.
no bullet - too late?

6. Ok but gun slid back on floor,
muzzle does not show.

#7, About same as #1.

8. Bullet on edge of frame.

9. Ok, Speed 200

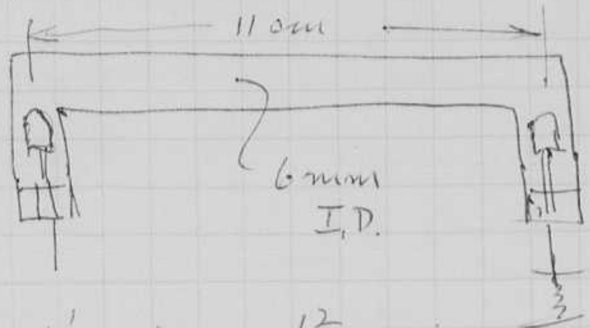
#10 on #55 P/N Speed 100 under exposed,
neg may print ok

Nov 13 1962
H. Edgerton

Yesterday - cleaned up Bldg 20 for installation of Boomer tests in the tank. McMorris, John, is going to work there on a thesis - also two seniors on a project.

In the afternoon I went Pinging with Matthew Fichenbaum. We saw the Harbor Bottom.

Nov. 15 1962
Flash Lamp tests. Test unit A. Electronics Lab.
Lamps.

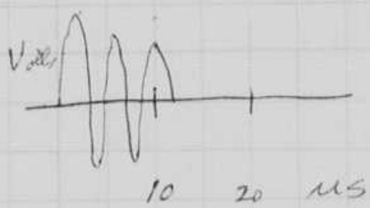


$I = \frac{E}{R} = \frac{14}{.005}$

.005 ohms

$$2.5\overline{)12.0}\;=48$$
$$\frac{100}{200}$$

Spark coil

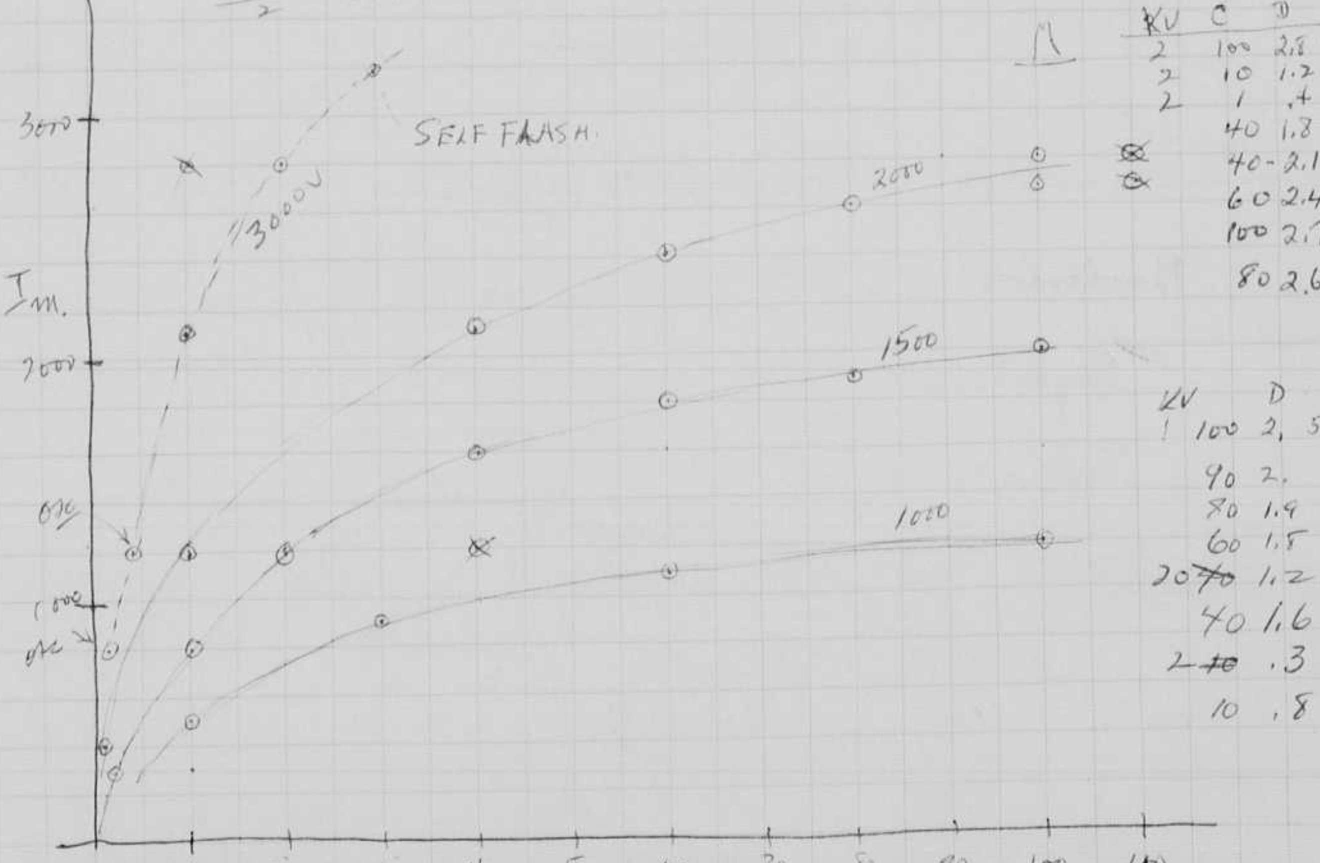


120 us = $2\frac{1}{2}$ cycles
4.8 us = 1 cycle.
$\frac{10^6}{4.8}$ = 20,100 cycles

$\frac{12}{2.5}$ =

110 us = 3 cycles
33. us per cycle
$\frac{1}{33} \times 10^6$ = 30,000

$\frac{2000^2}{2} 100$ = 200 watts

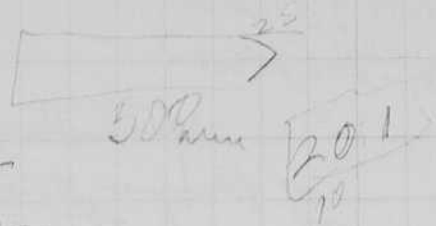


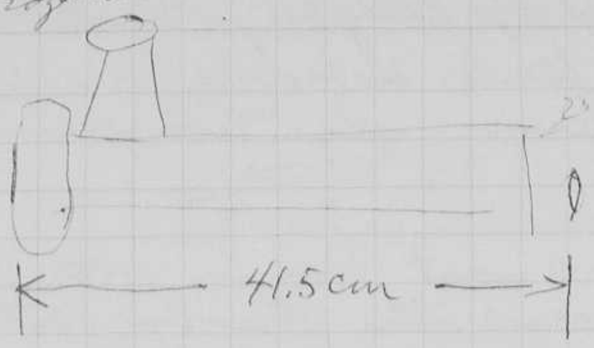
KV	C	D			I
2	100	2.8	5v	14v	2800
2	10	1.2	5	6	1200
2	1	.4	5	2.	400
	40	1.8	9	9	1800
	40 -	2.1	~~8~~	10.5	2100
	60	2.4	~~14~~	12.0	2400
	100	2.7			2700
	80	2.6			2600

KV		D		I
1	100	2,	5v	2000
	90	2.		2000
	80	1.9		1900
	60	1.8		1800
	20 ~~70~~	1.2		1200
	40	1.6		1600
	2 ~~10~~	.3		300
	10	.8		800

Searle Reese
Steve Teicher
Geo Broderick
~~Harold Edgerton~~

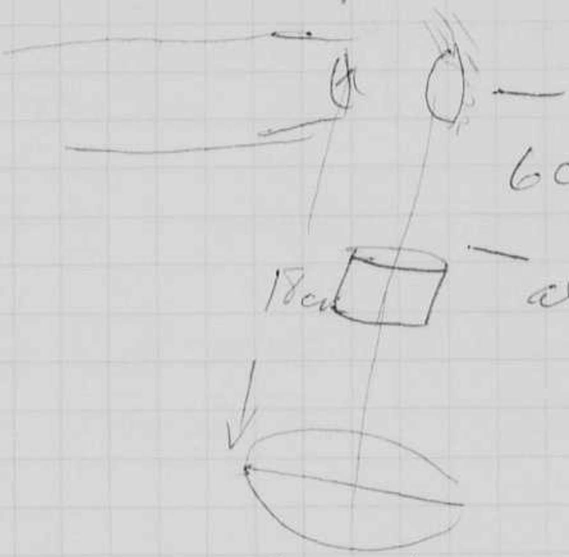
Al Goldman





f 3.5
Leitz
Wetzlar
24 mm f
T 1-12
3.5 22

Focus open at f 3.5
Closed to f 22 when flashed



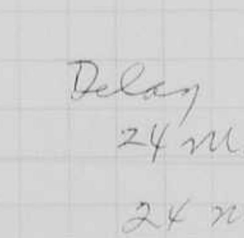
all the way out

Mrs Marcia Burnett – (P. Dr. White.) 8 photos.

Broderick

Edgerton

Teicher.



Double exposures on 1/10 ok but greatly moved.
1/20 show shutter.

Steve & HEE.

Subject	Speed	Delay
Steve	1/20	24 MS.
Edg.	1/20	24 MS.
"	1/10	40 MS

← Some N.G. focus on wrong part of eye.

4-405
Nov 18 1962
H. Edgerton

Film used
P417
Kodak fine grain
Positive

Esther Edgerton Left Eye.

Positive film.

Dave LaForge flash unit. 40 ms delay. 5302-319-45M

Start T-~~6~~ transmission — f 3.5 lens 24 mm
T-1
T6 =
T 12 = f22. ?

then Black and then
T-12 transmission (f 22)

the flash lamp was at a less angle

This roll N.G. because of
Strobe going too fast, I put
a condenser across the
input to get proper action.

11.15 mon. — Repeat - Al Goldman camera.
T-~~6~~ 40 ms

420 pm Lloyd Breslau 27
2" f16 5302 /

24mm f? T-6 "

Nov 19 1962
950 am John Carson 40 mm at 30 Zeiss lens 4 or 5 photos.
Edgerton
John Mooney

Nov 25 1962
H. Edgerton

Mod to Laforge unit.

1. 10,000 ohms in parallel with 10,000 in charging circuits of both capacitors.

2. 10,000 ohms across contacts.

3. 0.016 mfd in parallel with existing .008 in delay cir?

(maybe 0.1 in parallel with .05)

Delay now is 40 ms on point 10 on resistor.

Reese took unit on Nov 24 to hospital. Also took my 40 mm Zeiss lens.

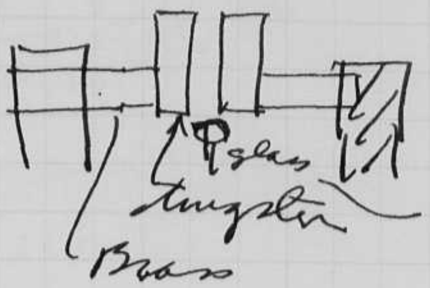
Dec 1, 1962. I was in Wash D.C. yesterday with Adm Galloway & Wood to talk to ~~D~~ James (sick) Adm Stephan, D. Jaffee etc.
Harry Stommel and Kraus

Dec 8 1962
H E Edgerton
V. MacRoberts.

Wells was here 830 to 930 on microwave problems.

Gap experiments for the Boomer.

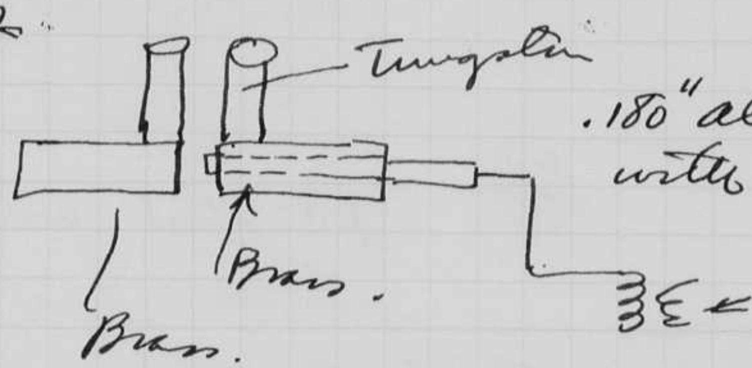
model 1



arc did not climb. in this experiment

The arc did climb with self spark at 4 KV 100 mfd.

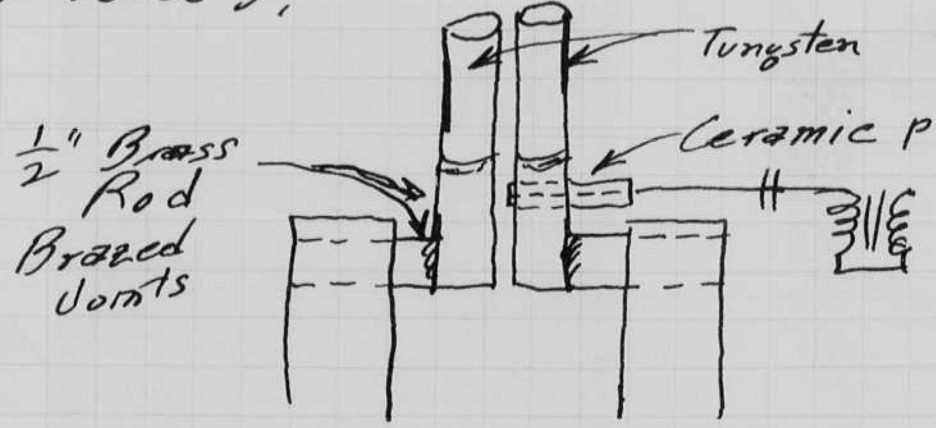
model. 2

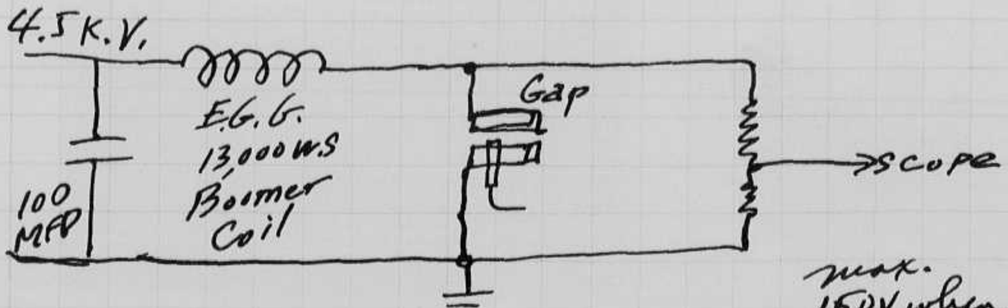


.180" al coors with .06" hole

Arc did not climb.
May be due to position of the ~~tu~~ trigger.

model 3.

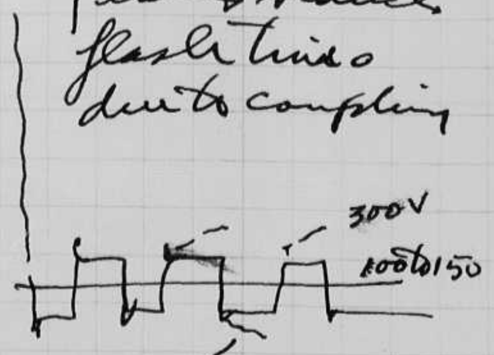




max. 180 V when arc is in gap

300 V → out of gap ~~450~~ 150 V.

Plates reduce flash time due to coupling

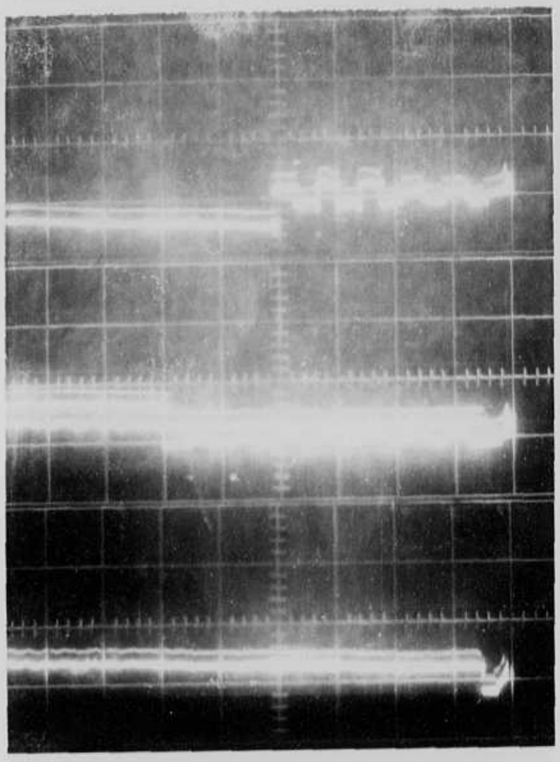


when arc flares up.

Osc #1 Beattie camera 545 Scope
500 volts/div.
5 millisec/cm.

100 mfd.
2500 volts
into Big Boomer coil
with 4x4" plate on each side
.04"

2500 volts
100 mfd



X 1 Start to flare. no plates

X 2 (a) no flare
(b) disc plates.

X 3 Start with plates.

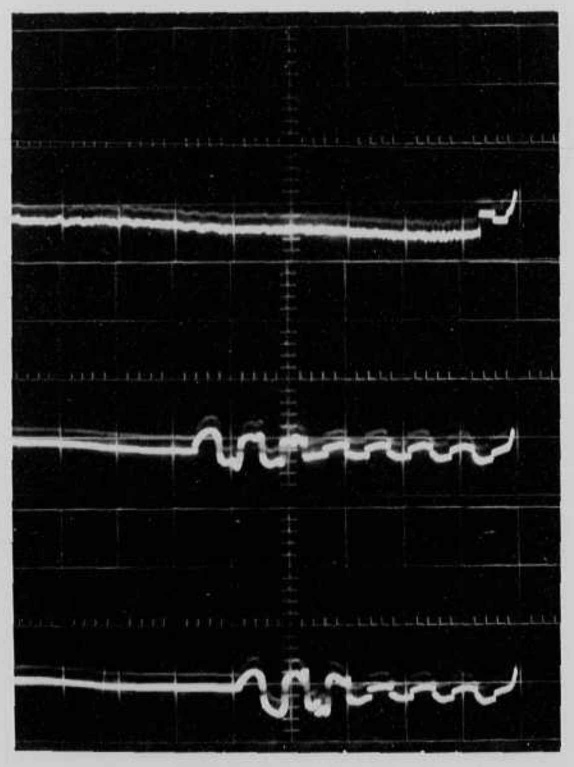
← TIME

1. .04 plates 4KV
100 mfd.
Bent plate.

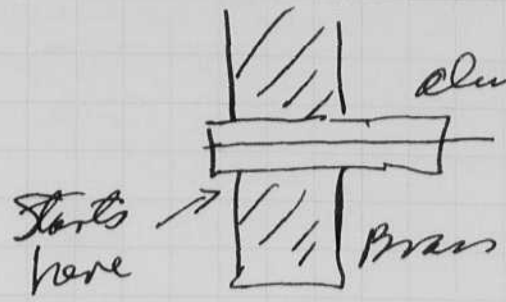
2. no plates

3 no plates.

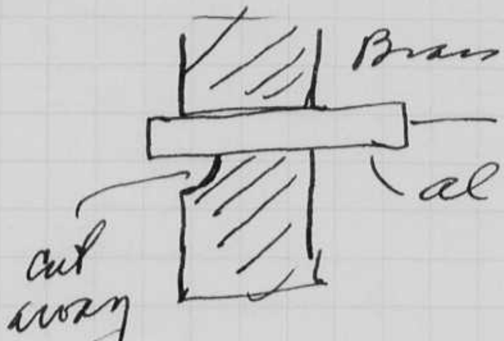
500V/cm
5ms/cm.



The arc does not always climb to the top. why.
We note ~~that~~ the arc starts below the starter

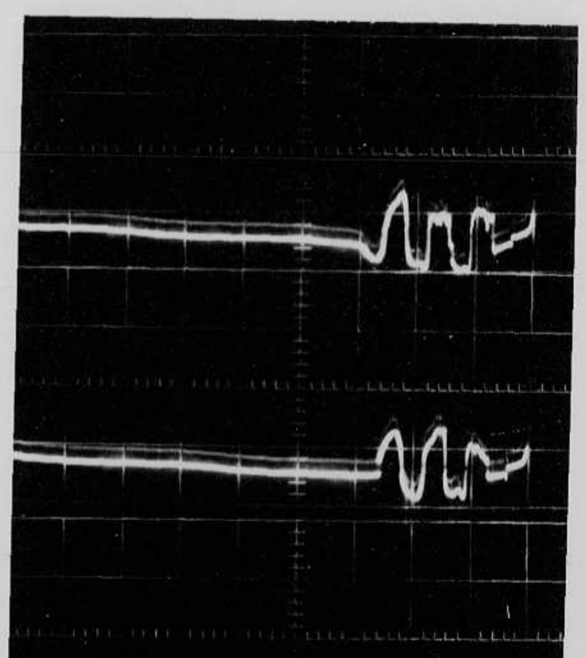


I cut the metal away below the starter wire



now the arc seems to flare to the top of the gap every time!

1. 4000 100 mfd.
2. 3500
3. 3000



← TIME

1. note large drop in gap voltage, 4KV arc went up flare

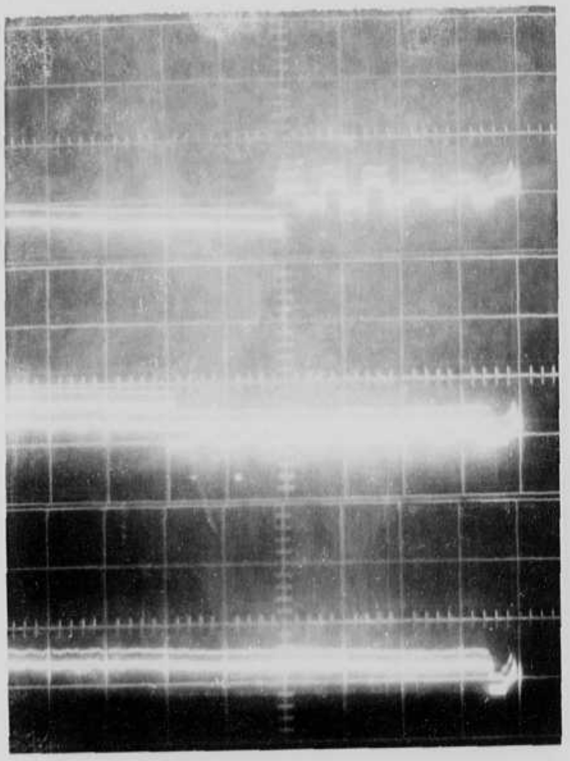
2 3500KV arc went up flare

3 3000KV. arc did not go up.

Osc #1 Beattie camera 545 Scope
500 volts/div.
5 millisec/cm.

100 mfd.
2500 volts
into Big Boomer coil
with 4"x6" plate on each side
.049"

2500 volts
100 mfd



X1 Start to flare. no plates

X2 (a) no flare
(b) disc plates.

X3 Start with plates.

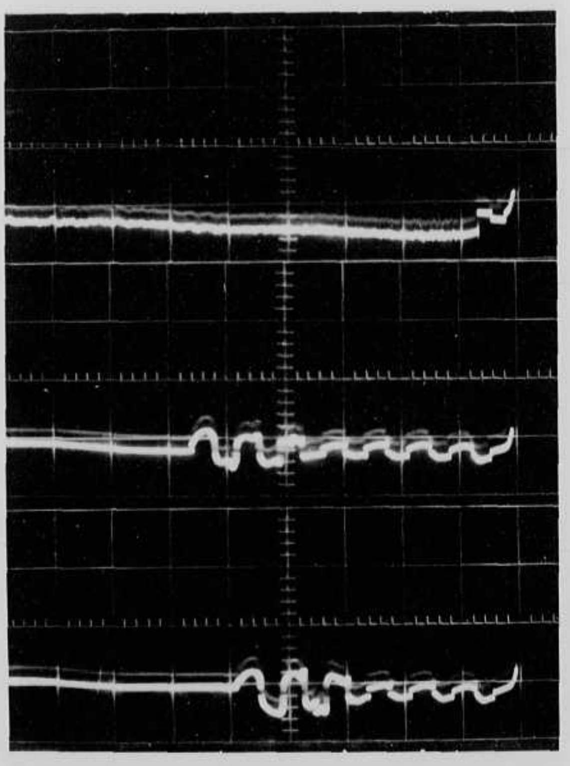
← TIME

1. .04 plates 4KV 100 mfd.
Bent plate.

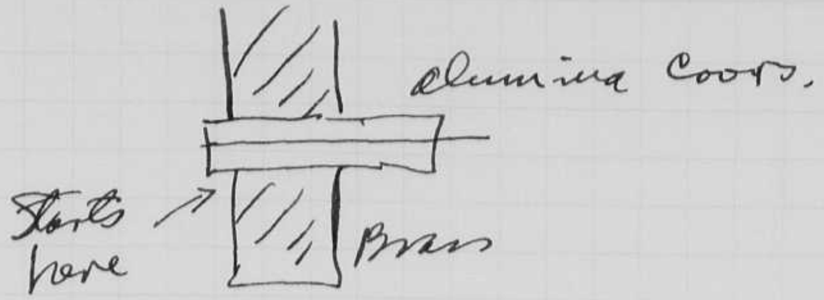
2. no plates

3 no plates.

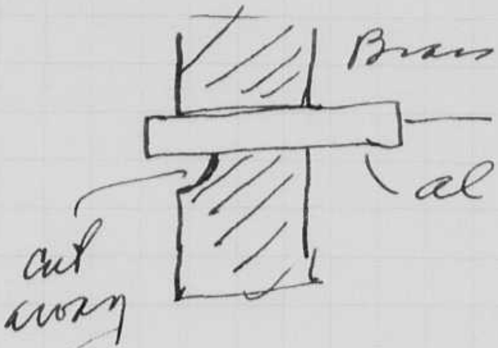
500V/cm
5ms/cm.



The arc does not always climb to the top. Why.
We note that the arc starts __below__ the starter

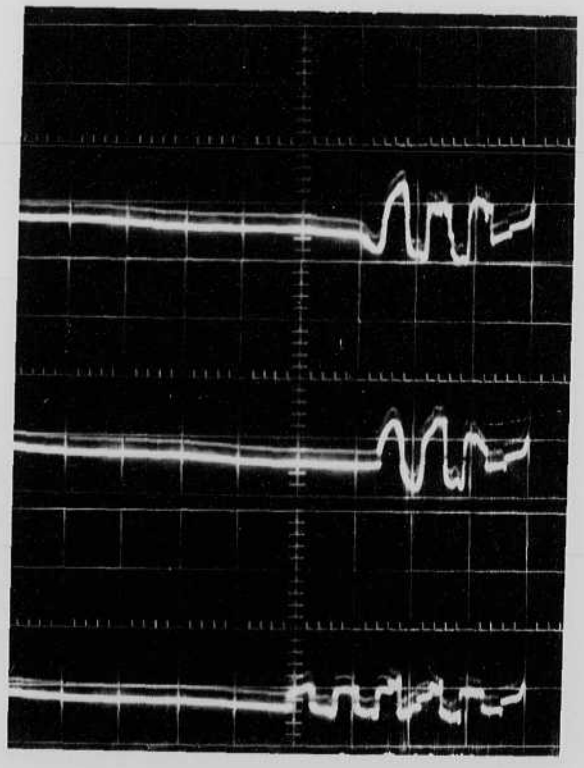


I cut the metal away below the starter wire



now the arc seems to flare to the top of the gap every time!

1. 4000 100 __mfd.__
2. 3500
3. 3000

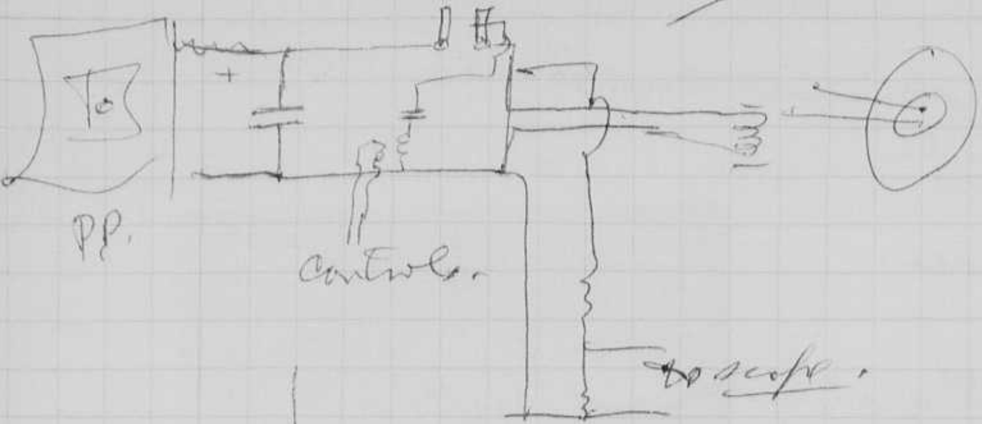


← TIME

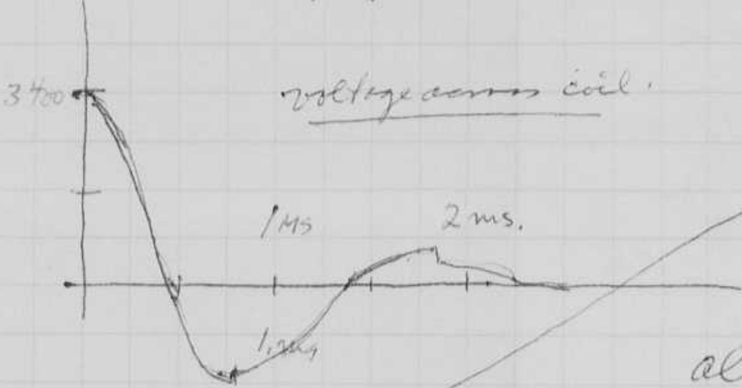
1. __note large drop in gap voltage.__
   4KV arc went up flare
2. 3500KV arc went up flare
3. 3000KV. arc did not go up.

 Dec 8 1962 Cont, 5pm

1000 WS unit

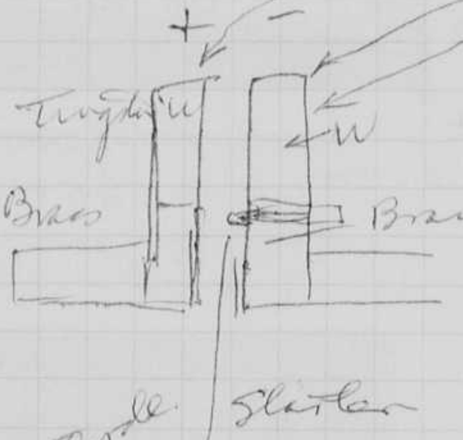


Special transducer with central wire. 1/2" Al Plates with large holes in center.



After 100 flashes.

Anode shows dark surface on tungsten with crystal boundaries outlined. Also some spots show.



Cathode shows no marking on the ~~tungsten~~ tungsten on the way up. There may be some small points on the back side.

The arc seems to go rapidly up the gap to the end and then flare out to the top of the box which is 1½" above the end.

from Dorey.

AD94 Coors

Sillimanite
0.187" OD.
.060" I.D.

Coors

1" long for starter, electrode.

I now removed the electrodes and polished the points off the cathode ends. The anode was left as is.

Dec 9 1962 1000 WS Boomer Tests. cont.

HEEdgerton

current shunt .00275 Ω $e = iR$.

1000 amps = 2.75 V.
2000 5.50 V = 1 cm

Signal. T

~~#1~~ 5V/div. = $\frac{5}{.00275}$ A = 1820 amp. 5 ms/div.

~~#2~~

#1. Light 34" to P.C. 1000 Ω 0.2 V/cm 5 ms/cm Daisy pickup S-3 $\frac{KVD^2}{R_L}$ K = 22×10^6

#2 Current. .00275 Ω 1820 amp/cm. 5 V/cm 5 ms/cm

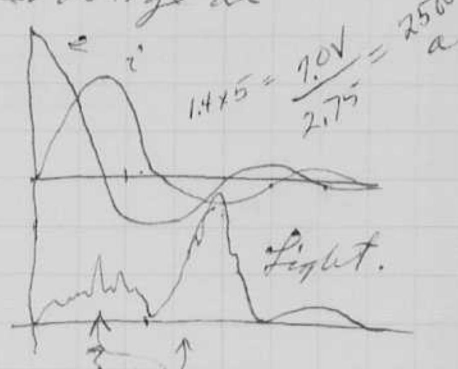
#3 Voltage. 2000 V/cm 5 ms/cm

Film 4, 5, 6, all with light current & voltage on each one.

peak light = .6 V

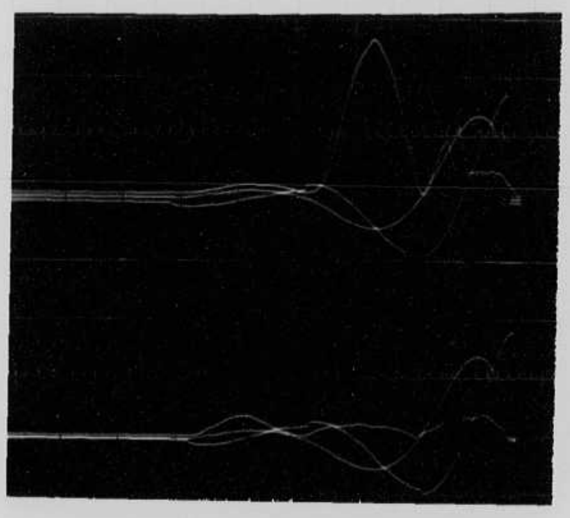
$\frac{22 \times 10^6 \ .6 \ 3^2}{1000} \approx .12 \times 10^6$ cp.
= 120 000 cp.

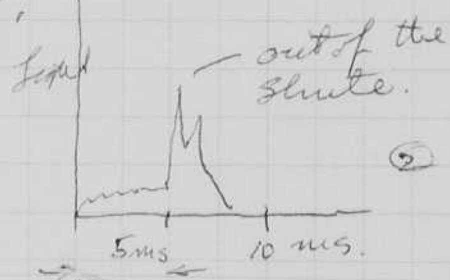
velocity of arc = $\frac{1.5"}{1.5 \text{ ms}}$ = 1"/ms = $\frac{1}{12}$ ft/ms.
= 800 ft/sec

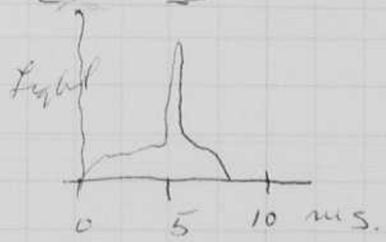


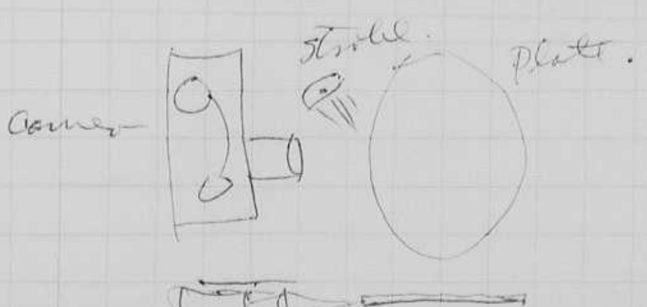
this light occurs when arc comes out of the gap at the top.

9:45 pm started life test
6 sec intervals for 70 flashes
+ 30 guess
changed them to 2 second interval.







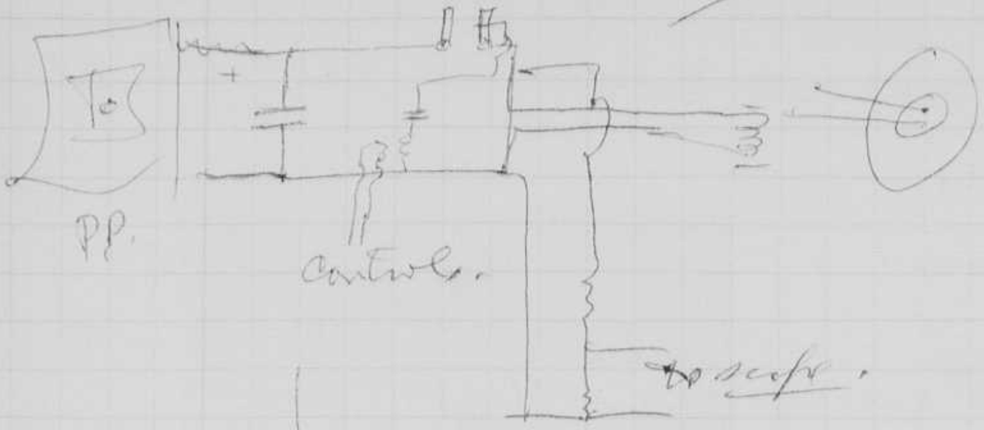


10:25 am going fine at 2 sec
30 min × 120 a min 3600 Bangs.
off again at 11:05 1 hr 20 min
9600 Bangs.

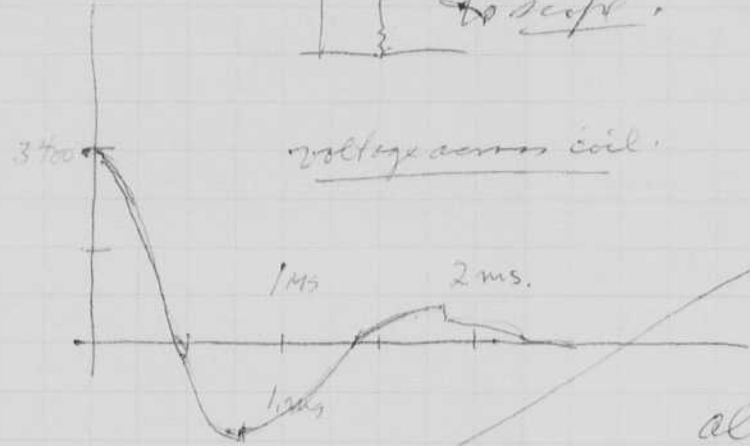
The assembly Boomer is hot to the touch! I had it covered with a cardboard box to cut down the noise

 Dec 8 1962 HEE Cont, 5pm

1000 ws unit

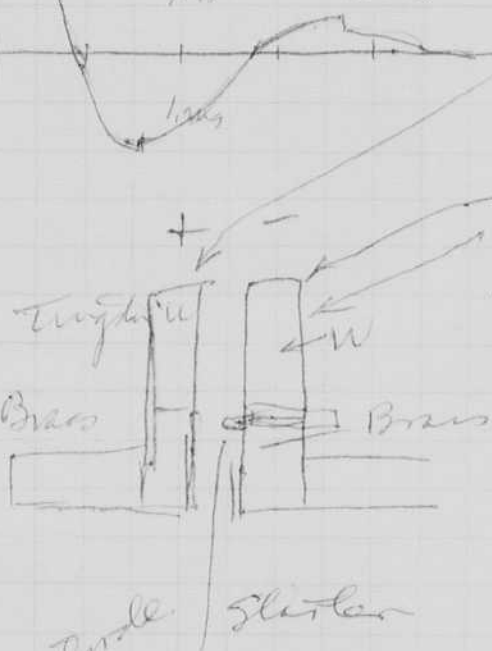


Special transducer with central wire. 1/2" Al plates with large holes in center.



After 100 flashes.

Anode shows dark surface on tungsten with crystal boundaries outlined. Also some spots show.



Cathode shows no marking on the ~~tungsten~~ tungsten on the way up. There may be some small points on the back side.

The arc seems to go rapidly up the gap to the end and then flare out to the top of the box which is 1½" above the end.

From Gomez

AD94 Coors

Sillimanite
0.187" OD.
.060" I.D.
Coors

1" long for starter electrode

I now removed the electrodes and polished the points off the cathode ends. The anode was left as is.

Dec 9 1962 1000 WS Boomer Tests. cont.

HEEdgerton

current shunt .00275 Ω $e = iR$.

1000 amps = 2.75 V.
2000   5.50 V = 1 cm

~~#1~~ Signal. 5 V/div. = $\frac{5}{.00275}$ A = 1820 amp. T 5 ms/div.

~~#2~~

#1. Light 34" to P.C. 1000 Ω 0.2 V/cm 5 ms/cm

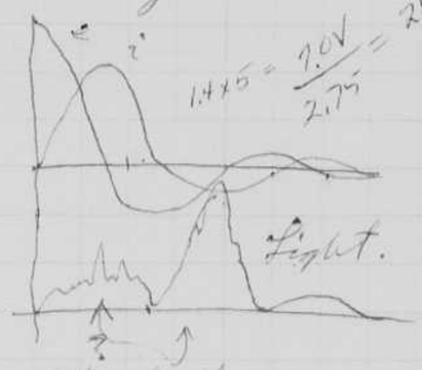
Daisy pickup S-3

$\frac{KVD^2}{R_L}$ K = 22×10⁶

#2 Current. .00275 Ω 1820 amp/cm. 5 V/cm 5 ms/cm

#3 Voltage. 2000 V/cm 5 ms/cm

Film 4. 56, all with light current & voltage on each one.



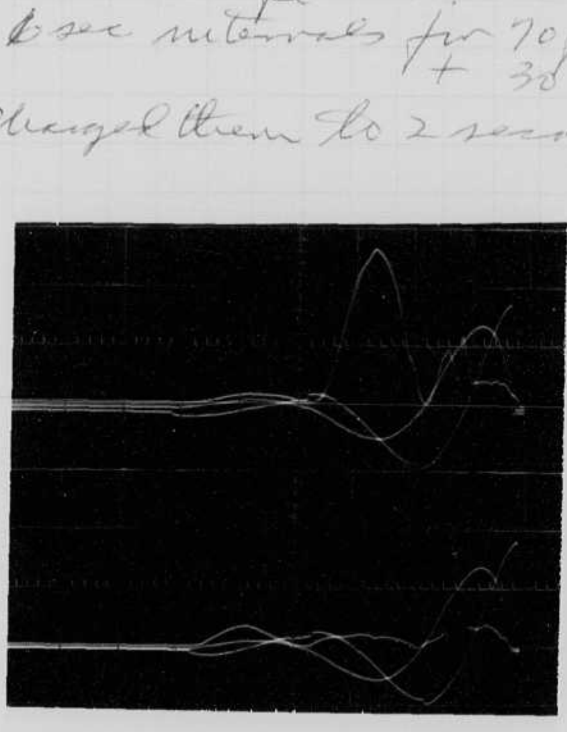
peak light = .6 V

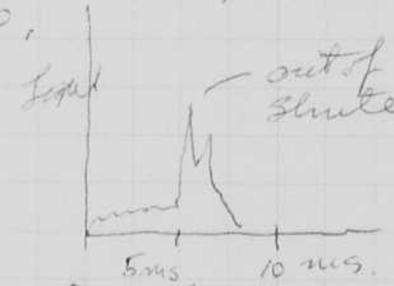
$\frac{22 \times 10^6 \cdot .6 \cdot 3^2}{1000} \cong .12 \times 10^6$ cp.
= 120 000 cp.

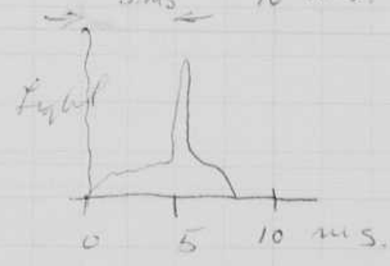
54 / 22 / 108 / 108 / 1188

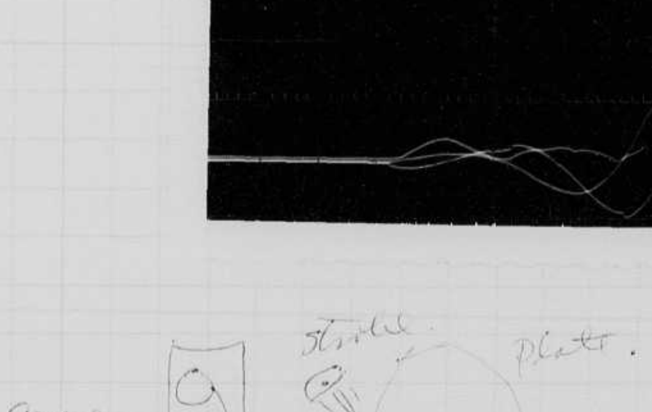
velocity of arc = $\frac{1.5"}{1.5 \text{ ms}}$ = 1"/ms = $\frac{1}{12}$ ft/ms.
= 80 ft/sec

9.45 pm started life test
6 sec intervals for 70 flashes
+ 30 guns
changed them to 2 second intervals.









10.25 am going fine at 2 sec
30 min × 120 a min 3600 Bangs.
off again at 11.05 1 hr 20 min
80 / 120 / 9600   9600 Bangs.
The assembly Boomer is hot to the touch! I had it covered with a cardboard box to cut down the noise

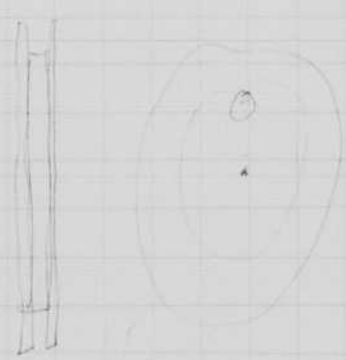
 Photo of the new gap.

1 sec exposure
200 watt spot at 3 ft 1
f 22 plus x film | plus flash from 1000 WS.
Photo was ok.

Then I exposed a photo to show the gap.
cathode shows ~~no~~ smooth surface on the tungsten with some burning of the brass and the brazing solder.

The + anode shows irregular darkening. but not serious from a wear standpoint.

The next step is to increase the energy.

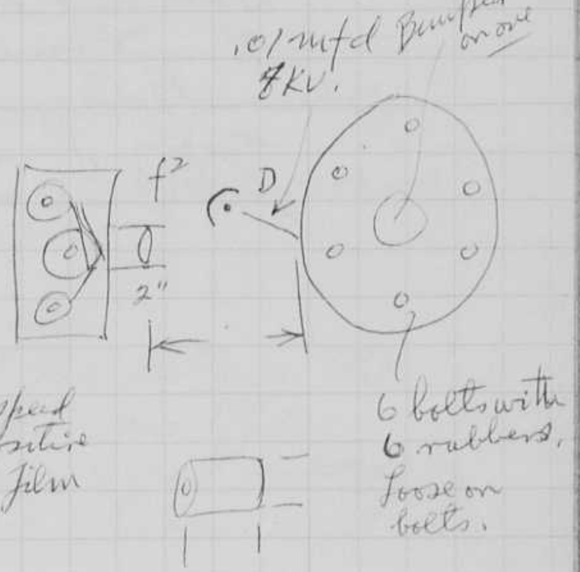


on film
0 13.6 mm

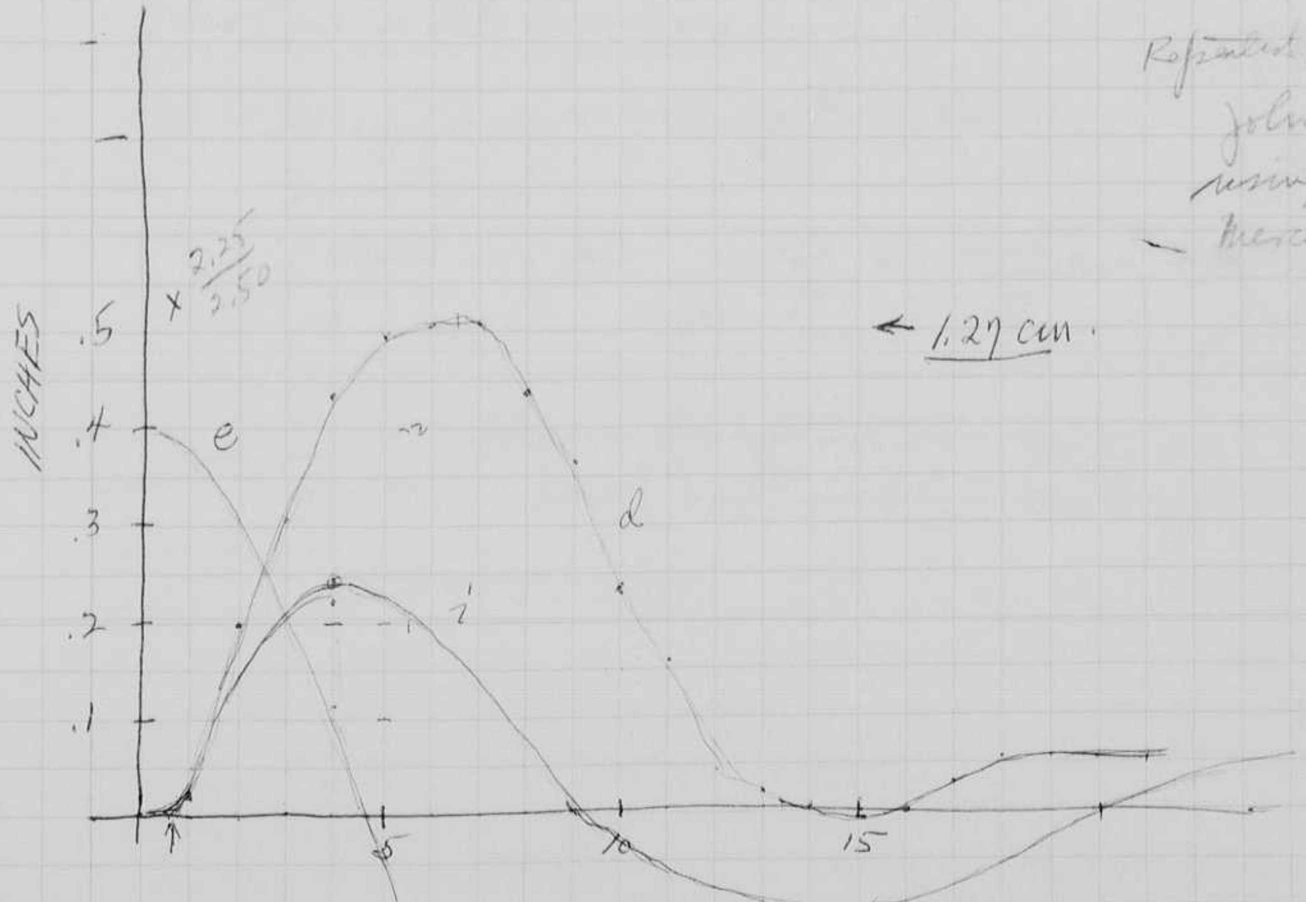
$\frac{2.5}{13.7} \times \Delta d$.

Should be 2.25"

13.7	= 2.5"?	Δd	inches
			0
— 13.7			0
13.8		0.1	.0182
14.8		1.1	.20
15.4		1.7	.31
16.05		2.35	.43
16.40		2.7	.49
16.50		2.8	.51
16.50		2.8	.51
16.05		2.35	.43
15.70		2.00	.365
15.0		1.30	.237
14.55		0.85	.155
13.95		.25	.0455
13.6		— .10	—.0182
13.7		.00	0
13.9		.20	.0365
14.0		.30	.055
14.0		.30	"
14.0		.30	"
14.05		.35	.064



Reprinted Dec 11 1962
John Corson
using old
— Mercury strobe



Notebook # 27

Filming and Separation Record

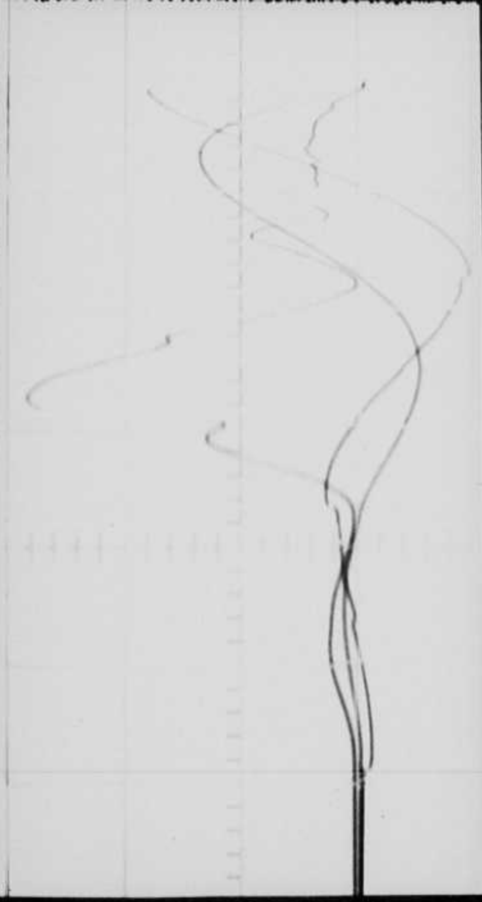
2 unmounted photograph(s) both inside loose envelope located

1 negative strip(s) between page 84 and 85

___ 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.



PHOTOGRAPH(S) MISSING
AT TIME OF FILMING

Jan 7 1963.

Harold Edgerton

Busy last week with production of two 13,000 WS Boomer systems for John Ewing. S. Gerber and J. Bahls were here from Lamont Lab.

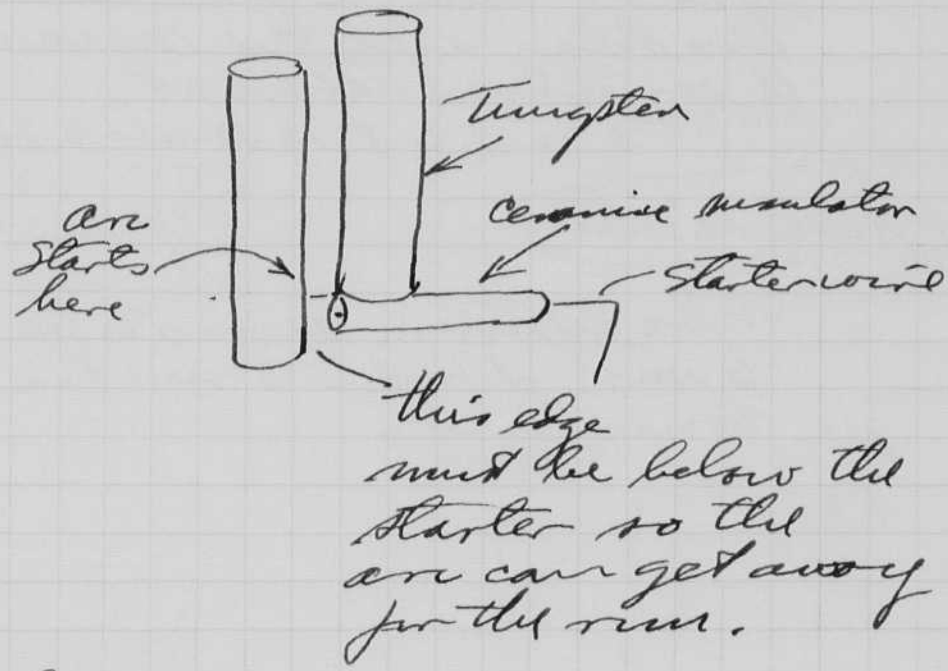
Lots of visitors after the wedding in Chadds Ford at Margaret's house. Chas & Lou Dixon, Janice, Bill & Maryanne Bob and Fiz Edgerton, Eric. We had Christmas Dec 27 at 205 School St. in Belmont Mass. Dave Cahlander was away for a vacation. He and his family live in our house.

Jan. 18, 1963

Harold E. Edgerton

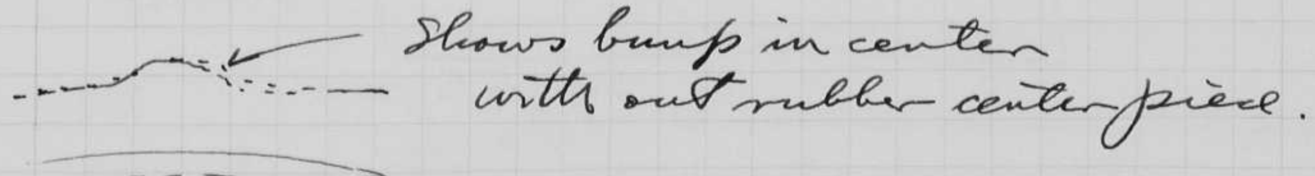
Boomer tests.

Photos of Double plate 20" diam 1/2" thick with 6 Bumpers and bolts. 3000 watt sec into Mac Roberts new arc switches made today using clamps. I suggested the following starter arrangement as per sketch below.



Photos with beads.

Delay time 10 m.s. after spark.
3000 WS
1 coil in air with 6 bolts.
10 min develop time Royal x film.



Jan 19 1963
Harold Edgerton.

Took new gap to 95 Brookline ave to tank for test. Works ok up to 13000 watt sec for 25 min at 6 per minute. I used two transducers, 3 power supplies and 6 cond banks.

Photos of the deflection were made with a 4x5 camera using time delay and the microflash. A series was taken at

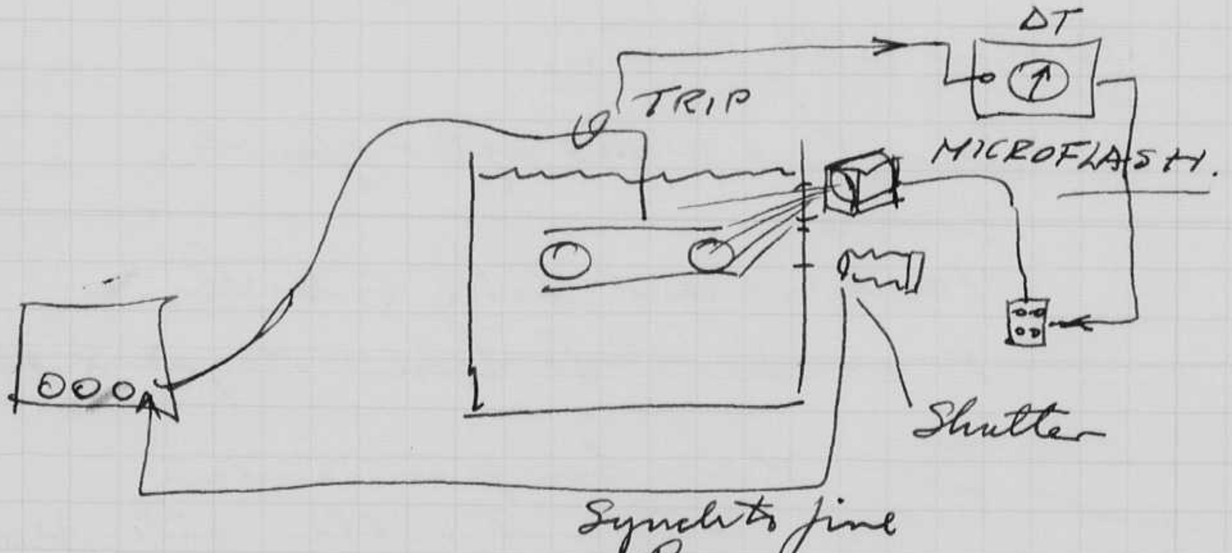
0, 2 4 6 8 10 12 14 16 18 20 22 & 30±.

4 ft deep in water

no photos?

max deflection seems to be between 4 and 6 ms. I hope to make print tomorrow

ms	def TX		def cm
0	5.95	= 7.3	0
5 ~~10~~	5.15	6.3	1.0
20	5.3	6.5	0.8



Jan 20 1963 Analysis of 7000 WS

2 #4 wires into 1 trans 20" diam ½" al.

Enlarger adjusted Rubber = 6 cm for actual.

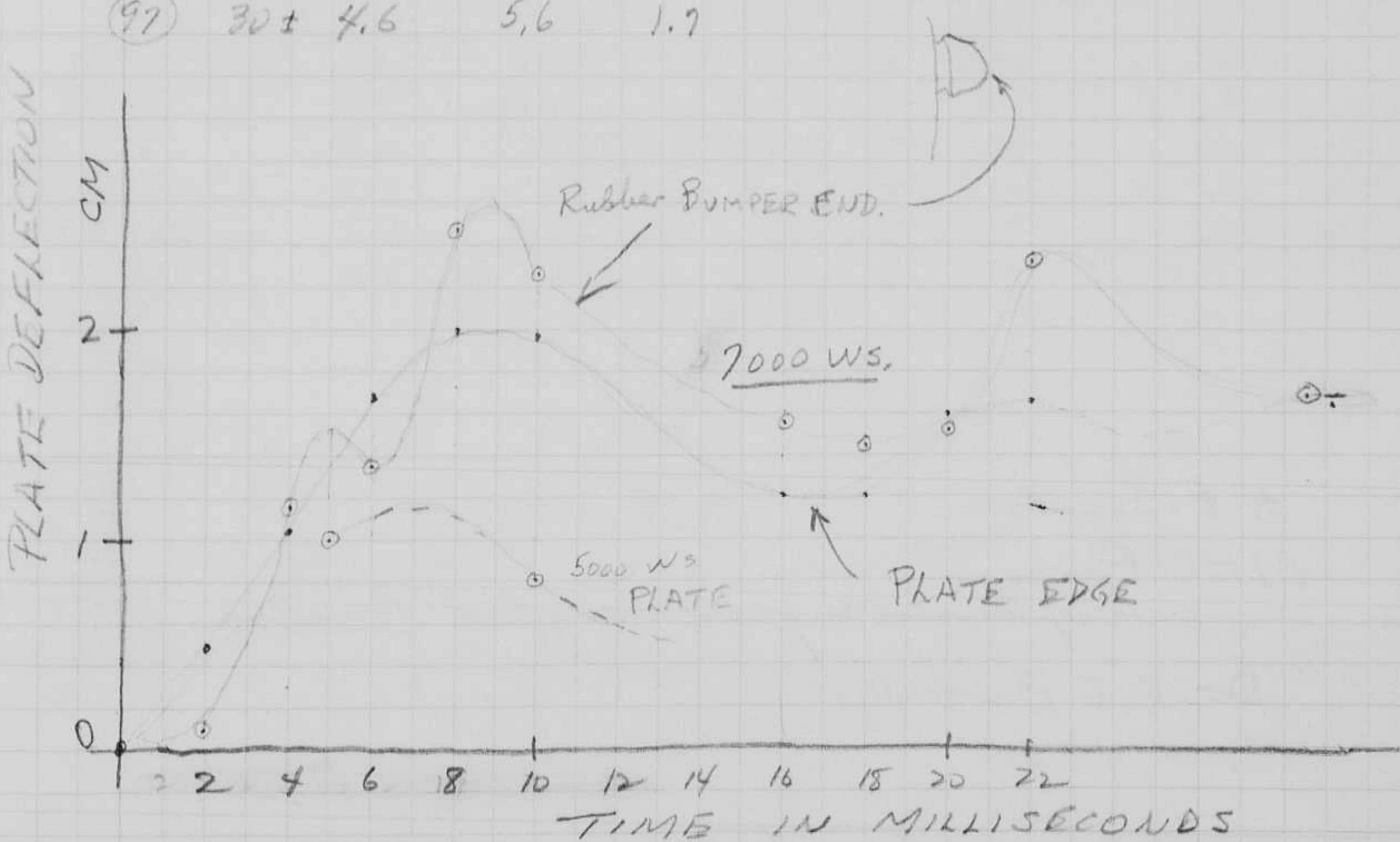
		actual	def cm
0	6 cm	7.3	0
2	5.6	6.8	0.5
4	5.1	6.2	1.1
6	4.6	5.6	1.7
8	4.35	5.3	2.0
10	~~4~~.3	5.2	1.9
12	~~5~~		
14	—		
16	5	6.1	1.2
18	5	6.1	1.2
20	4.7	5.7	1.6
22	4.65	5.65	1.65
97	30± 4.6	5.6	1.7

2 7/8" = 2.876"

= 2.54 ~~XX~~ = 7.3 cm

so 6 cm = 7.3 cm

Trans was about 4 feet deep in fresh water



Center motion of Plate, film 8,3 cm = 11,3 cm actual

1,36

		actual	Def. cm
0	1,2 cm.	1.63	0
2	1,25	1.7	.07
4	2,05	2.8	1.17
6	2,2	3.0	1.37
8	3,0	4.1	2.47
10	2,85	3.9	2.27
16	2,35	3.2	1.57
18	2,25	3.06	1.43
20	2,2	3.00	1.37
22	2,95	4.00	2.37
30±	2,4	3,26	1.63

H. F. Sassoon

MHC Parsons.
Uni of Bristol England Langford Bristol.

Dr. P. F. Burbridge.

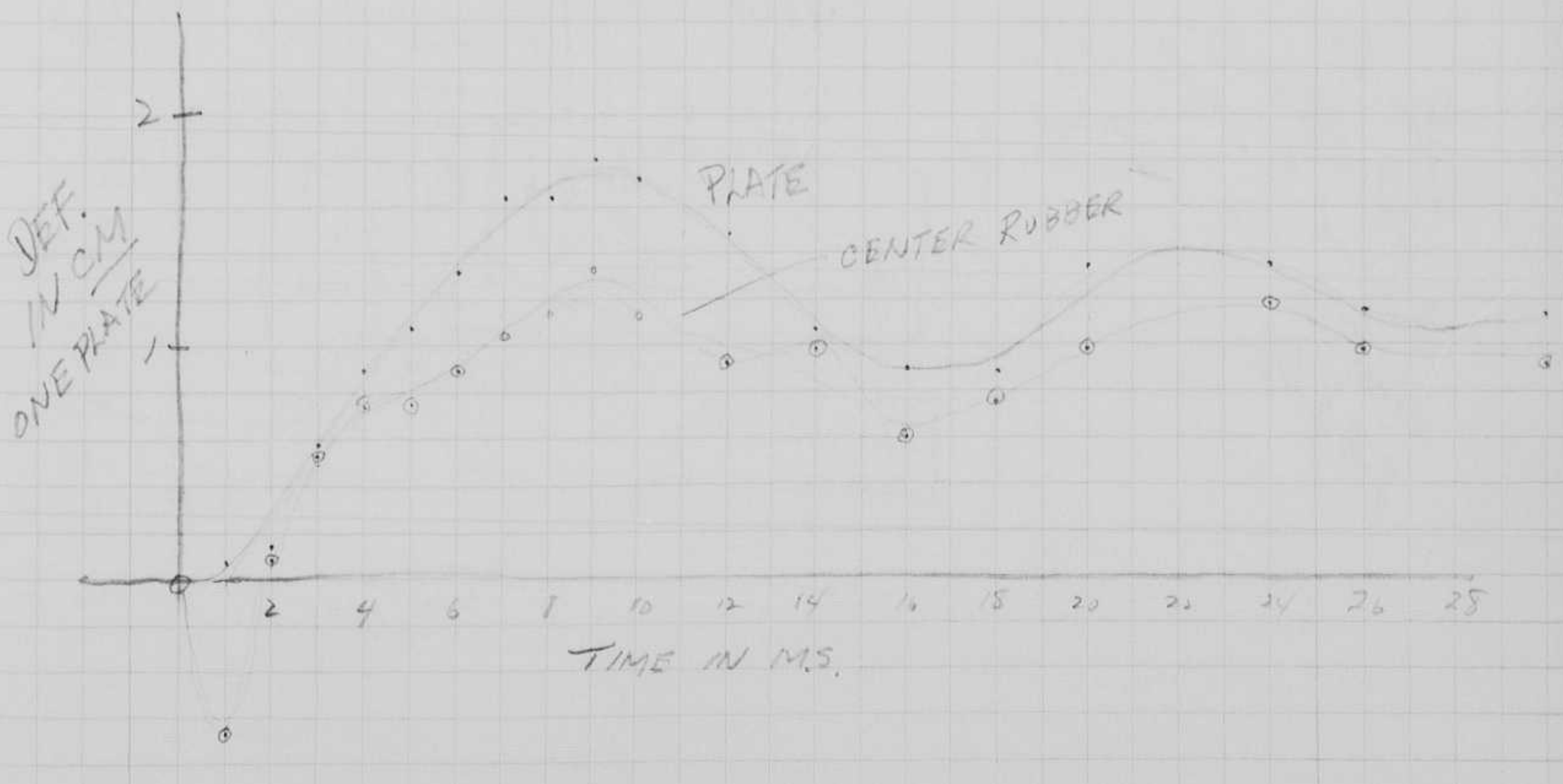
Jan. 24 1963
AE Edgerton

Analysis

13000 WS 2 Trans 85' cable + #4 wire

4.9 cm = 2 7/8" or unit = 2.875" = 7.3 cm. $\frac{73}{49} = 1.49$

Time	Plate	End Rubber	Plate Δ	cm	End Δ	
0	4.9	.6				
1 ms	4.85	.25	.05	.074	−.45	−.67
2	4.8	.65	.1	.149	+.05	.075
3	4.5	1.05	.4	.595	.35	.525
4	4.3	1.10	.6	.895	.50	.75
5	4.2	1.10	.7	1.04	.50	.75
6	4.0	1.2	.9	1.34	.60	.90
7	3.8	1.3	1.1	1.65	.70	1.04
8	3.8	1.35	1.1	1.65	.75	1.12
9	3.7	1.5	1.2	1.80	.90	1.34
10	3.75	1.35	1.15	1.72	.75	1.12
12	3.9	1.15	1.0	~~1.95~~ 1.49	.55	.82
14	4.2	1.05	.7	1.04	.65	.97
16	4.3	1.0	.6	.895	.40	.60
18	4.3	1.1	.6	.895	.5	.75
20	4.0	1.05	.9	1.34	.65	.97
24 ~~22~~	4.0	1.1	.9	1.34	.80	1.19
26	4.1	1.25	.8	1.19	.65	.97
29	4.1	1.15	.8	1.19	.55	.82



 Feb 1, 1963

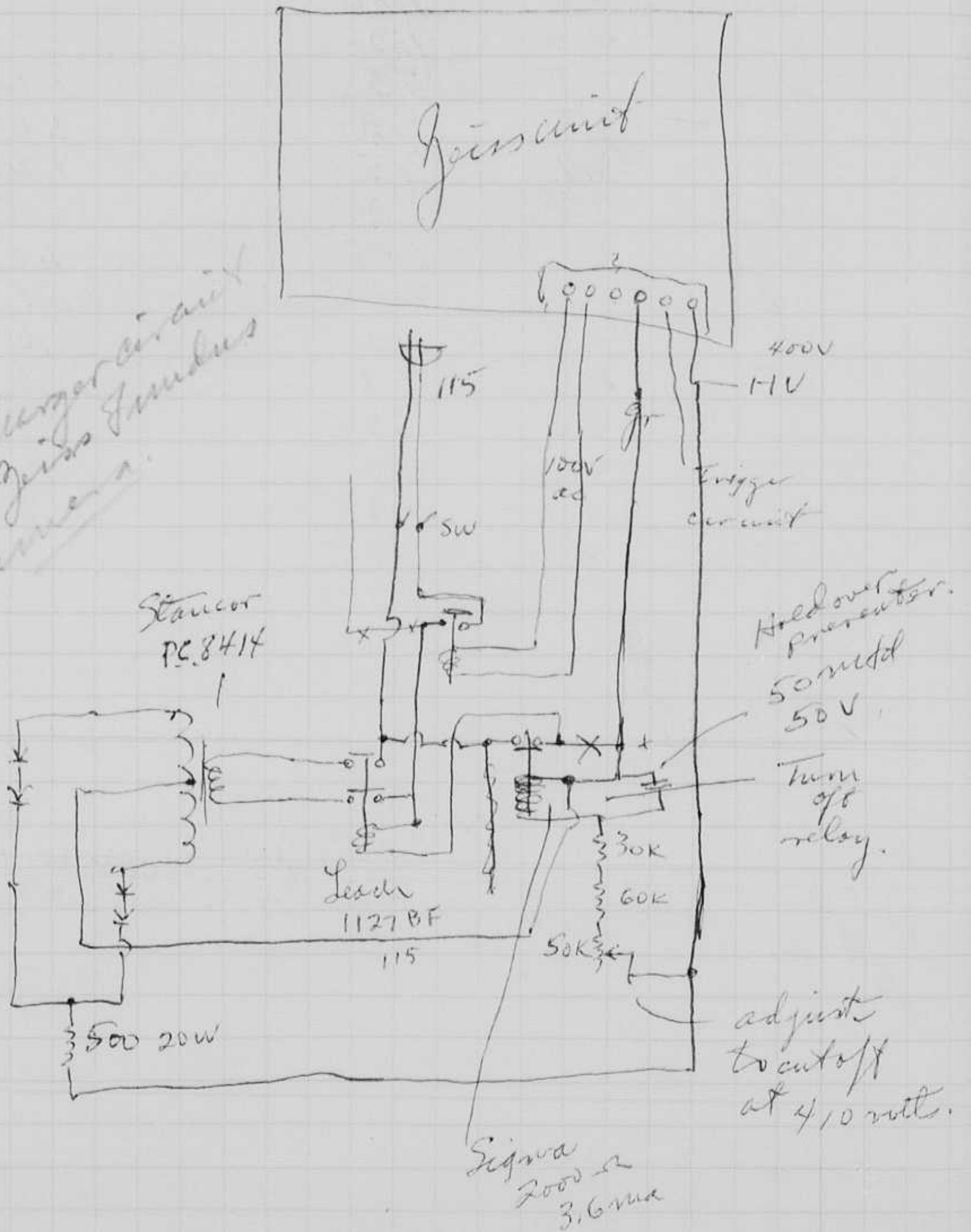
Harold Edgerton.

During the week I got the 1200 watt lamp going under water. It has three 400 watt 24 volt lamps in parallel.

Feb 2 63 9 to 1.30 pm 4½ hours one lamp out.

Carl Zeiss Fundus Camera 13308. Searle Rees.

Test trigger circuit for Zeiss Fundus camera.



Worked first trial; helped to wire and test Feb 2 63

Sangamo Elect Co. : Sample Electrolytic Capacitors.

Pickens S.C. 60 Winter St. Weymouth 88 mass

o 65171-062

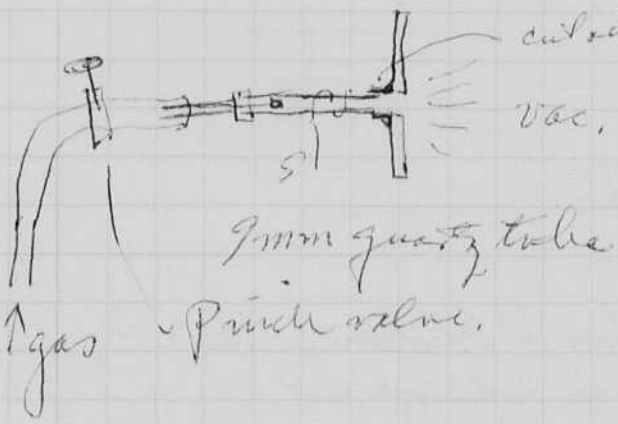
6. 505 100-100 mfd 450v -10 +50 Sample to test with strobe lamps.
Spec 505-3600-01

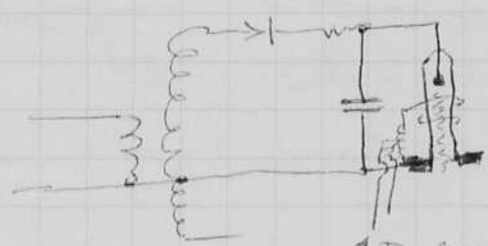
Stamford Conn Potter Jan 25? Friday. Lederle's Chemical Co.

Vac. Spectrograph - Jarrell-Ash.

Dr J.S Brinen showed me several sources for the vac spectrograph. H_2 He and xenon were being tried.

I believe that a leak type tube could be made to work on a strobe circuit for this source.





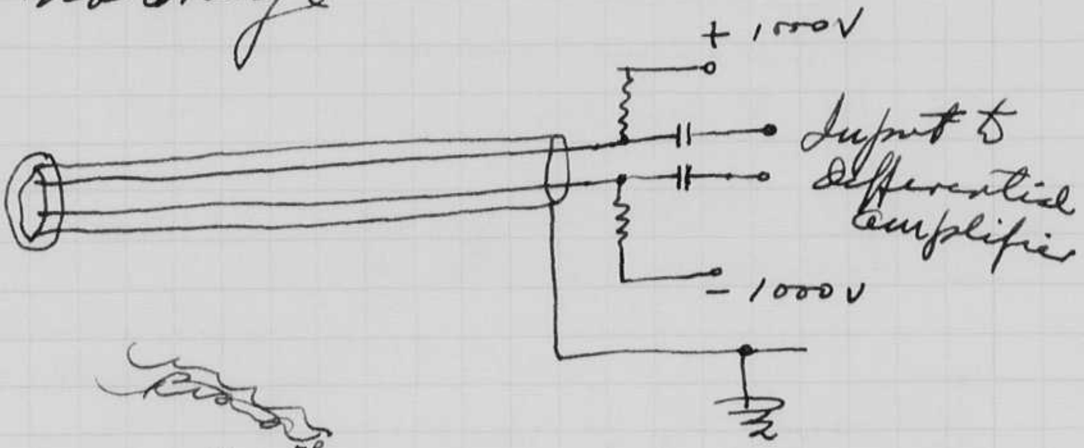
Try various gases such as argon, nitrogen, He, H_2 etc.

 Feb 4 1963
H. Edgerton.

Hydrophone

Condenser type of hydrophone consisting of a long cable with two insulated wires, with a space between that is compressed by the shock wave. This changes the capacity which will give an output voltage

Auto float.



Long cable in water.

Hydrophone Boomer

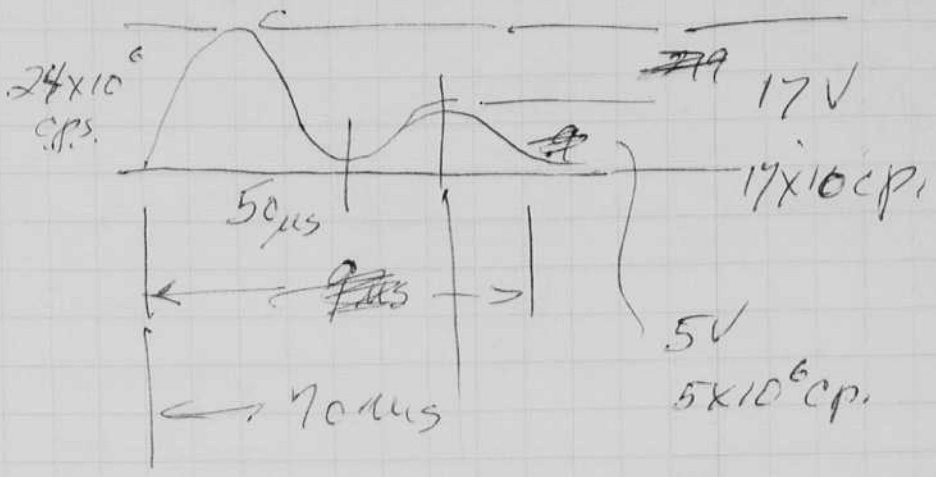
Lloyd Breslau Feb 4, 63
Read and explained.

Alternate design — An unsymmetrical oval shaped tube of gas gives the buoyancy. The compression will be greatest across the shortest axis.

Thomas Perls Nat Bur Stds Elect noise from Instrument cables subjected to shock and vibration
R.S.I. Vol 23 No 6
June 1952 p 674-680

Relay
Price #6225 in place of the other.

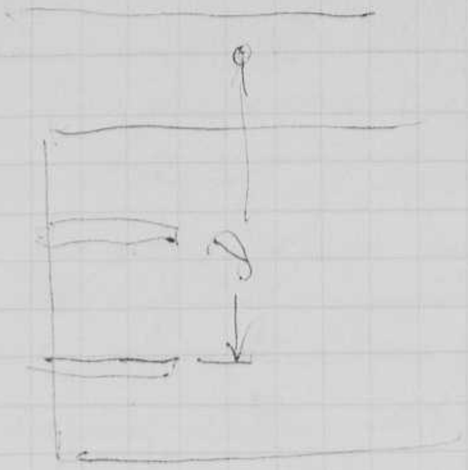
Beam
24 x 10^6 c.p.s.



Lamp to be installed on the Blue Hill ~~Observatory~~.

Feb 1st 1963
H. S. Gr. + Tom
Tim Griswold

Scotch 3270 | 24 1" wide x 50 yds
$16



Scotch.

f4.5

30 ft.

~~Strobitron~~
close as possible.

~~o Bare~~

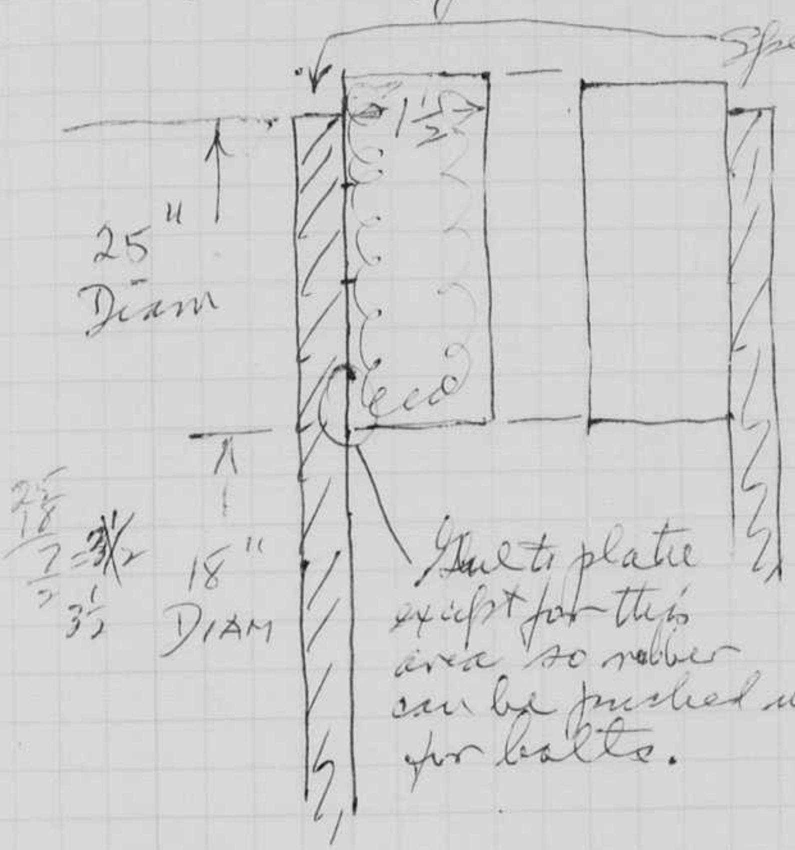
f 4.5 plus X 10 min in DK50 ok. 60 cycles
a bit thin.

f 4.5 plus X 10 min DK50. 10 cycles
Exposure ok.

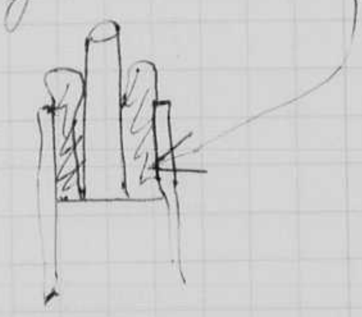
Feb 16 '63 **Boomer at Depth.**

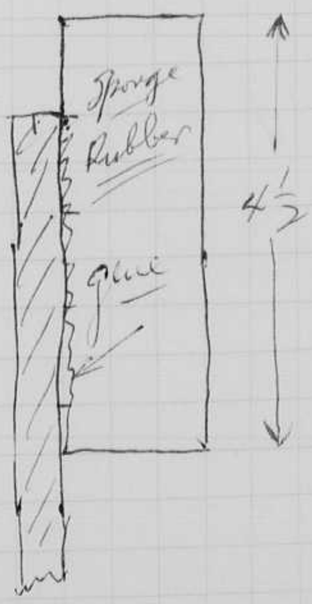
Loss of signal is due to cavitation delay in formation at depth since a greater pressure is required to pull away the plate from the water.

Sponge rubber with sealed in air bubbles of small size will be used in the center and the edges as sketched. Alex Eicher already has samples of 1 5/8" thick material with 5" diam for the center.

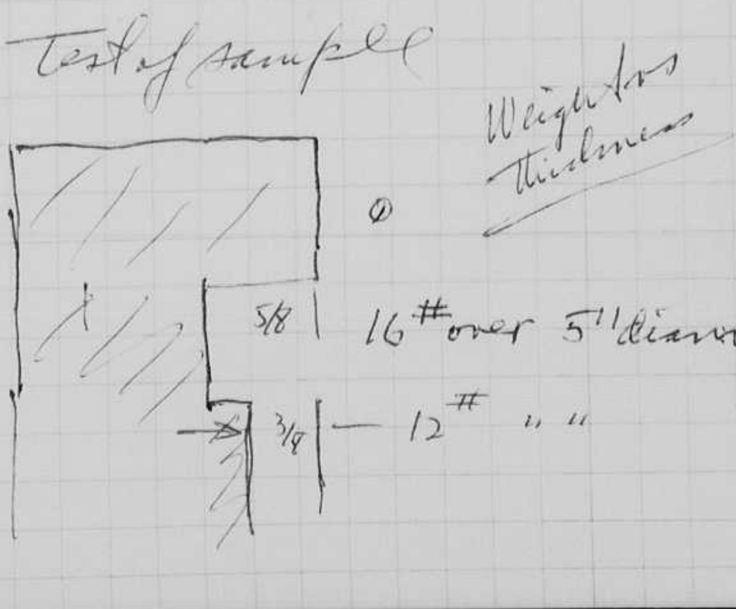


Leads can go through without releasing the sponge due to compression.





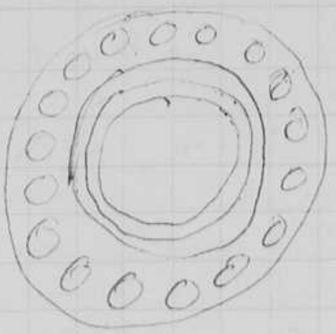
Test of sample

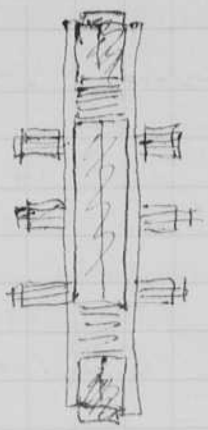


Idea!

make force distance due to both inside and outside equal. Then no energy will be used in rubber cycle!

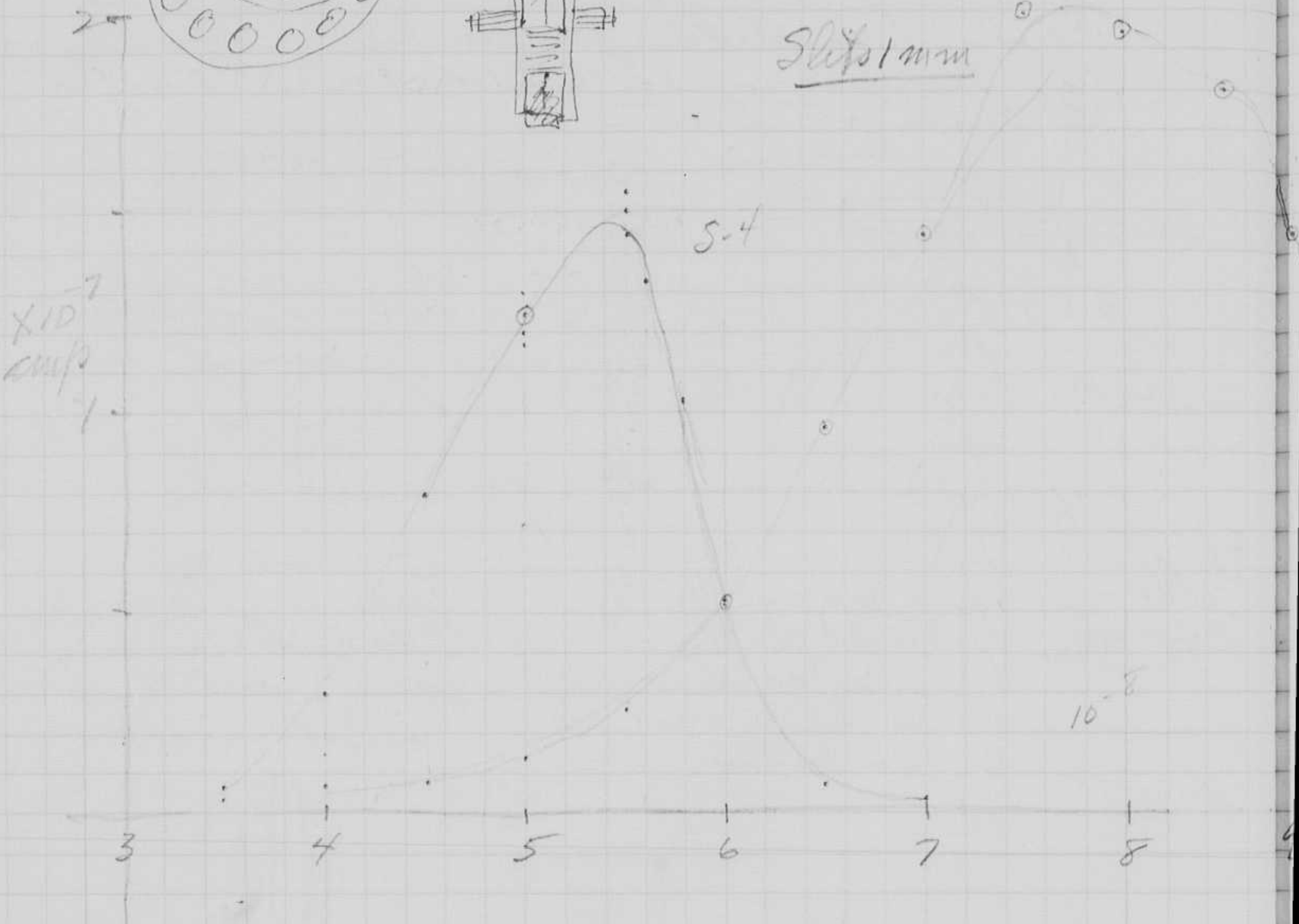
Feb 20 1963





Tungsten

Slits 1mm



S-4 Surface at .5 m.

$i = 1.25 \times 10^{-7}$ amperes. area = 3 sq cm $\quad .417 \times 10^{-7}$ amp/cm^2

from curve $\quad I = .001$ watts/sq cm $\times \left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right) = .00011$ watts/sq cm

$$\text{Sens} = \frac{.417 \times 10^{-7}}{1.1 \times 10^{-4}} \frac{\text{amp}}{\text{watts}} = 0.38 \times 10^{-3} \text{ amp/watt.}$$

1 amp = 1.59×10^{-19} ~~[illegible]~~ unit electrons

$e = 1.602 \times 10^{-19}$ coulomb.

$i = \cancel{n}e v = n q t \quad n = \frac{1}{1.6 \times 10^{-19}} = .625 \times 10^{19}$ electrons per amp

photon $w = hf. = 6.6 \times 10^{-34}\ 5.5 \times 10^{4} = 36.3 \times 10^{-20}$ joules

$1.1 \times 10^{-4} = nW/\text{sec}$

$$n = \frac{1.1 \times 10^{-4}}{36.3 \times 10^{-20}} = .0303 \times 10^{+16} = 3.03 \times 10^{14}$$

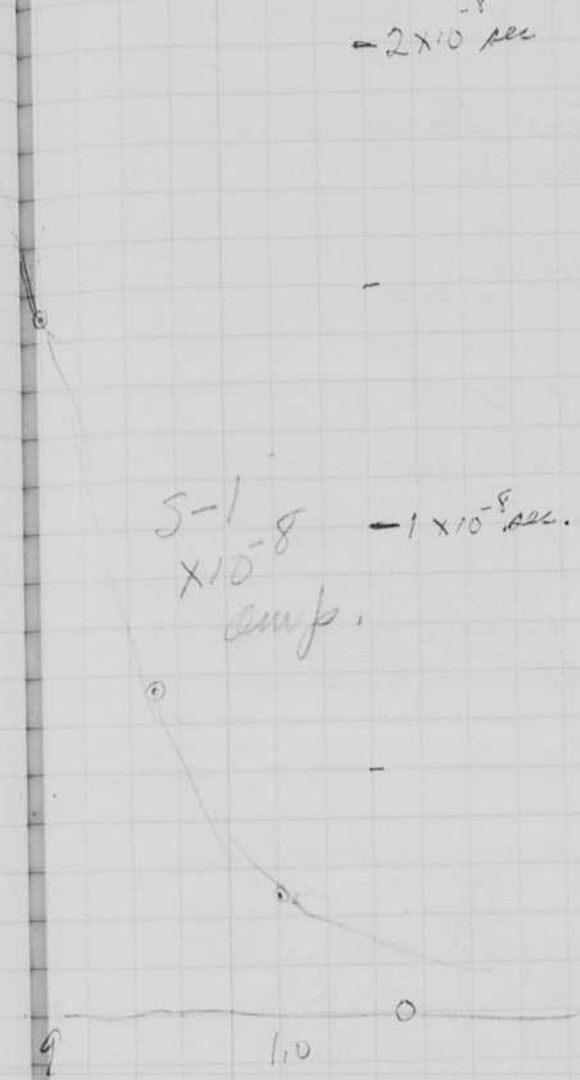
no. of electrons $= .625 \times 10^{19} \times .417 \times 10^{-7}$

$= .26 \times 10^{12}$ ~~amps~~ electrons

$$\text{quantum effy} = \frac{0.26 \times 10^{12} \text{ electrons}}{3.03 \times 10^{14} \text{ quanta}}$$

$= .086 \times 10^{-2}$

$= .86 \times 10^{-3} \doteq 10^{-3}$



 Feb. 23, 1963
H. Edgerton

Type Trans Coils B&G.
Repair with Epoxy

1. Grind out broken down areas.

2. fill with Cummings W19.

3KV
1×10^6
$.04 \times 10^{-3}$ amp.

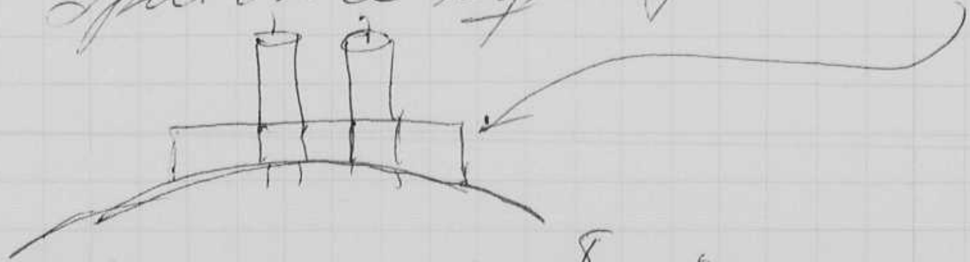
#17. MMM Plastic used in long sparked through area.

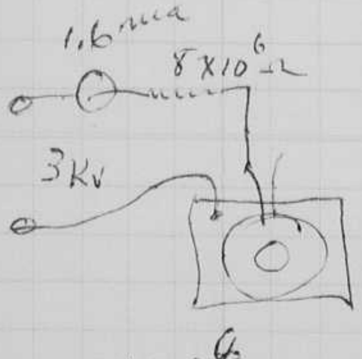
#22 Repair of edge - this was difficult to do. I used white Epoxy two tube kit, There was a leak at the junction with the Black Cumming. Repaired with Red Epoxy Dolphon,
Then another leak since this does not wet the junction!

#15. Terminals broken - one wire broken
Cut back - Spliced,
used Dolphon Epoxy.

There was an electrical leak of 1/2 meg or less
The Dolphon does not wet.

#0 W Seemed to leak at terminals.
I put on a layer of MMM

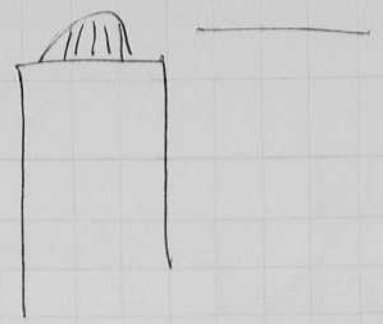




930 am Feb 23 3000 v with 8×10^6 in series
current = 0.16 ma.

1×10^6
$.42 \times 10^{-3}$ amp
$.42 \times 10^3$ volts across resistance

BGG. Ser No. P.S-5

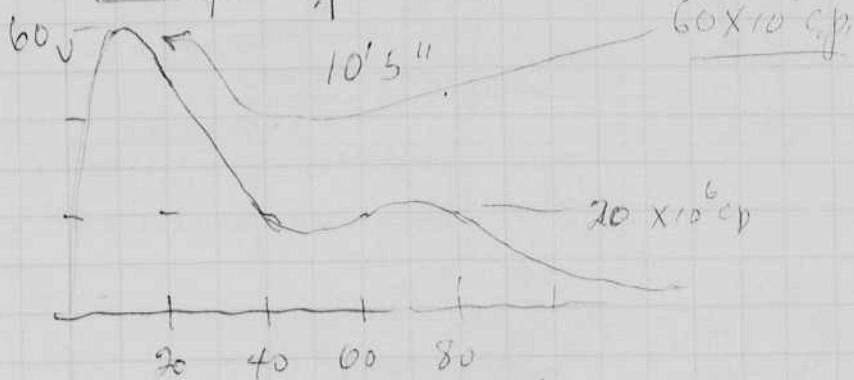


10"

$cp = KV\,ft^2. \quad K = 10^4$

0.4 volts $\quad cp = 10^4\ 0.4\ 1^2 = .4\times10^4 = 4000.$ cp. 8 μs dur.

Beacon for Big Blue Hill



Dotty.

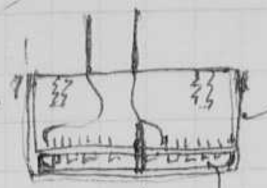
2 volts peak $\quad$ 10 ft. $\quad CP = KV\frac{d^2}{R_L} = \frac{2\times10^2}{100} 47\times10^6$

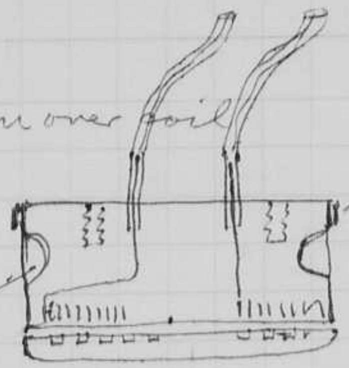
$\cong 10^8$ cp.

This beacon was put up on the top of the Big Blue Hill. Sat Feb 23/1963 in the afternoon
Met Draper & wife 1928 class.

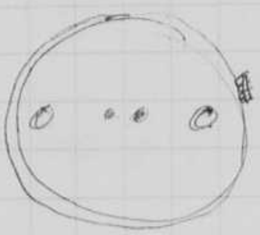
 Boomer - Air job

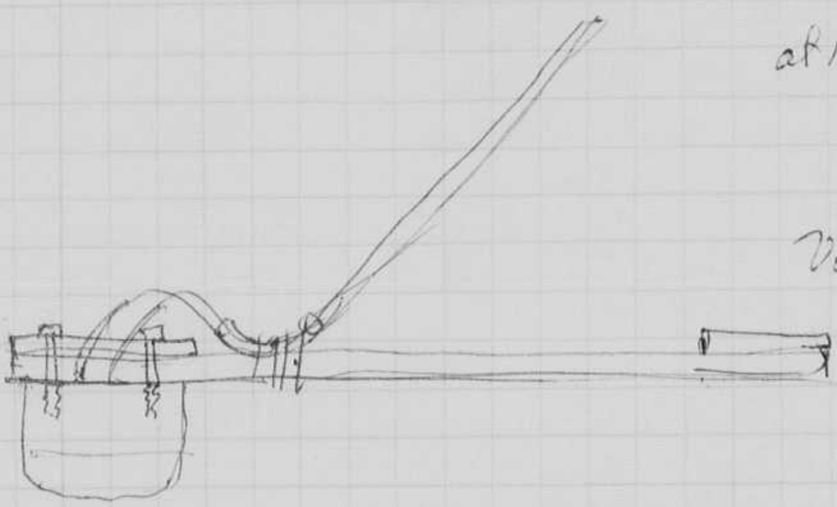
Jan 28 1963
Harold Edgerton

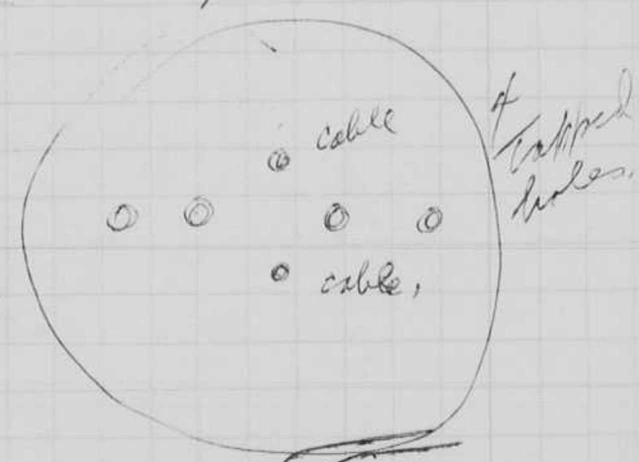


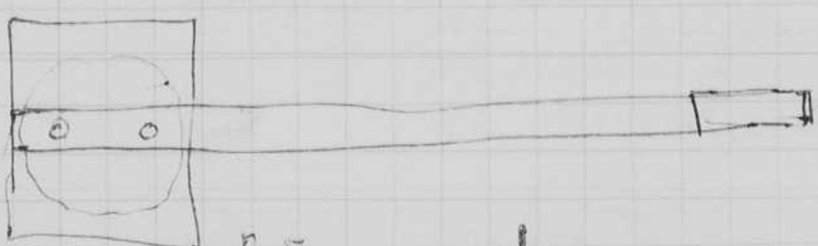


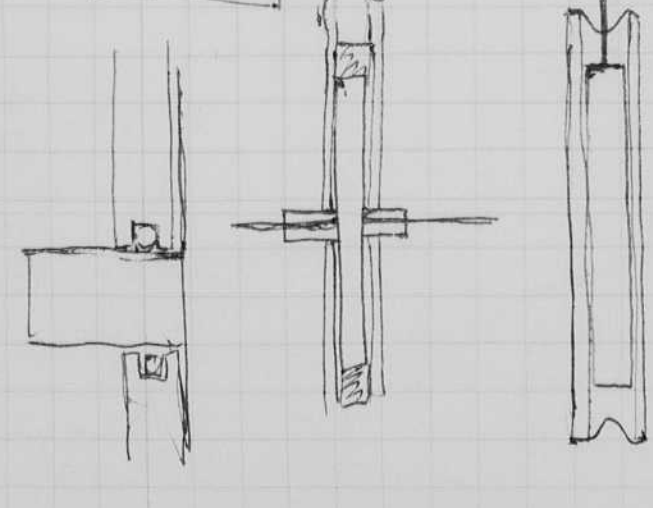
for air compression
when transducer
is lowered into water
32' feet pressure doubles
$PV = kT$.
at 15 feet volume =
$P_1V_1 = P_2V_2$
$1 \cdot 1 = 1.5 \times \left(\frac{1}{1.5}\right)$
Volume $= \frac{1}{1.5} = .666$
$\frac{1-.66}{1} = \frac{.33}{1} = .33$ Shrink

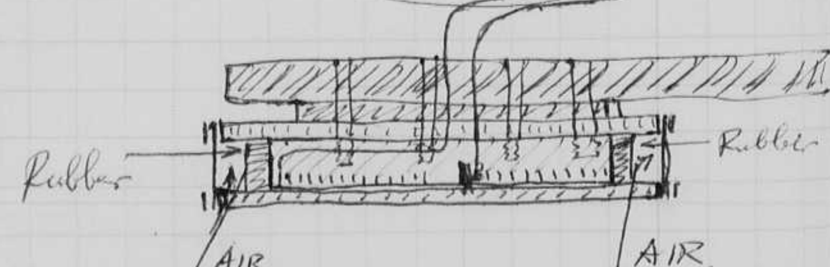


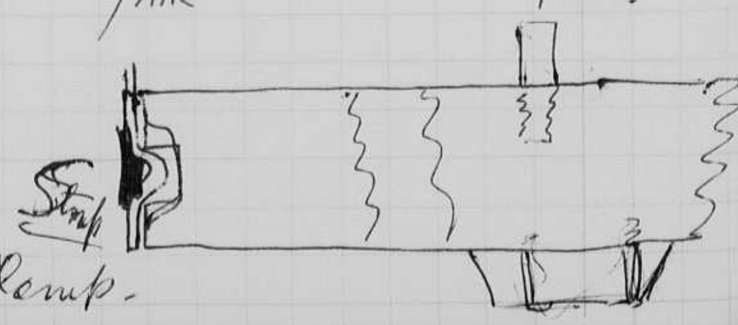






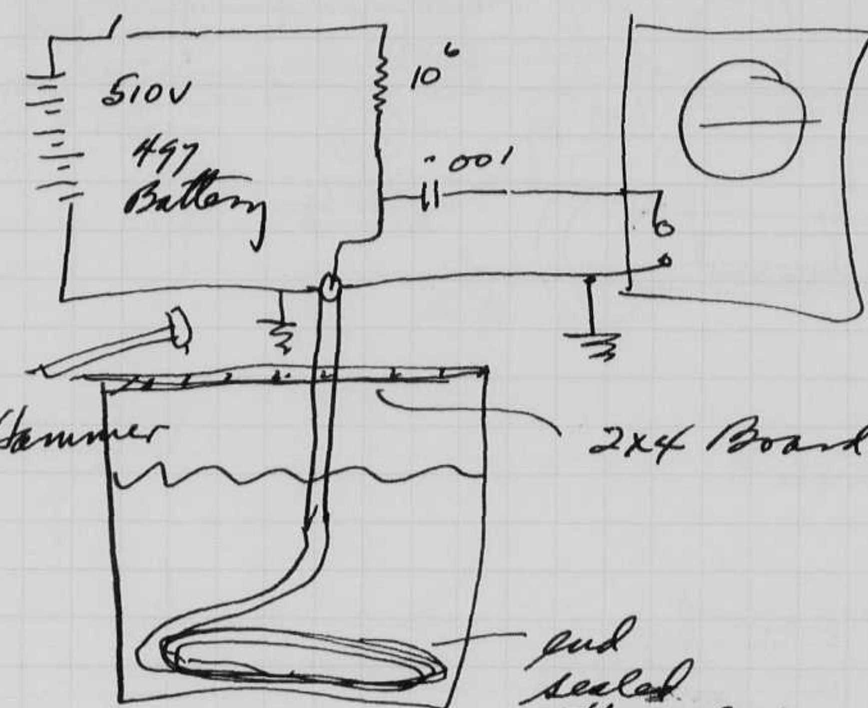






Hydrophone Tests.

8/U cable about 50 feet long



type 503 Scope Techtronic #001982.

Signal
Hammer blow on wood.

Watchcase Hydrophone at center of water gave ±0.4 volts.

cable with 510 volts gave 0.04 volts peak.

cable with 0 volts gave 0.04 volts.

Apparently it's not a variable capacity problem. Either electrostatic charges are created or piezo electric.

So I conclude that it shows some promise. What can we use that gives more noise or pickup.

1000 W.S. unit tested on March 2 at 95 with Klein and Kearsley.
Three transducers used

A 1000 ws at 6 ft to BC 50 on wall 2 v/cm 0.5 ms
Shows 1/4 ms time and 4 volt peak.

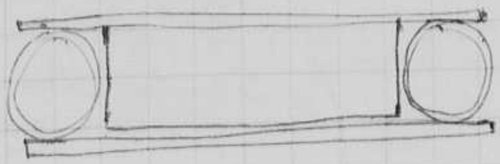
B Single 7" plate with grooves and rubber.
1/4 ms time and 3 volts peak.

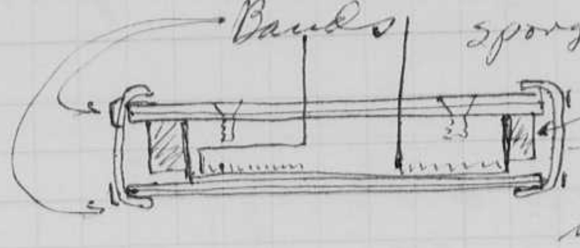
(C) Double plate 7" with center wires and Rubber cover.
1/4 + ms and 2 volt peak.

To be sent to A. Bergquist Texas, San Antonio Petty Geophys Lab.

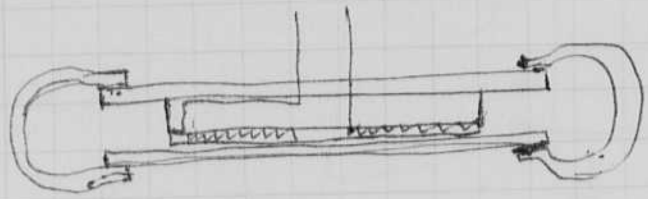
Transducer Design.

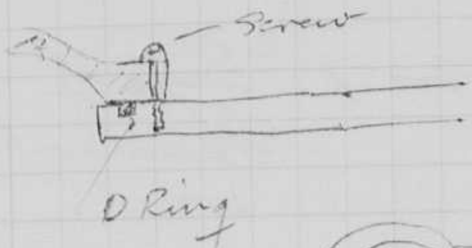
Apr 3/63
A. [illegible]

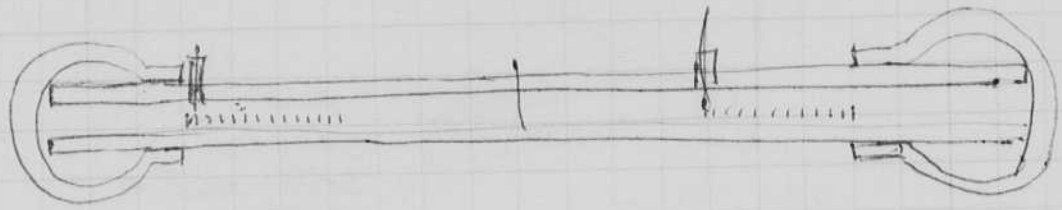


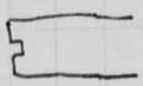


Rubber tire.





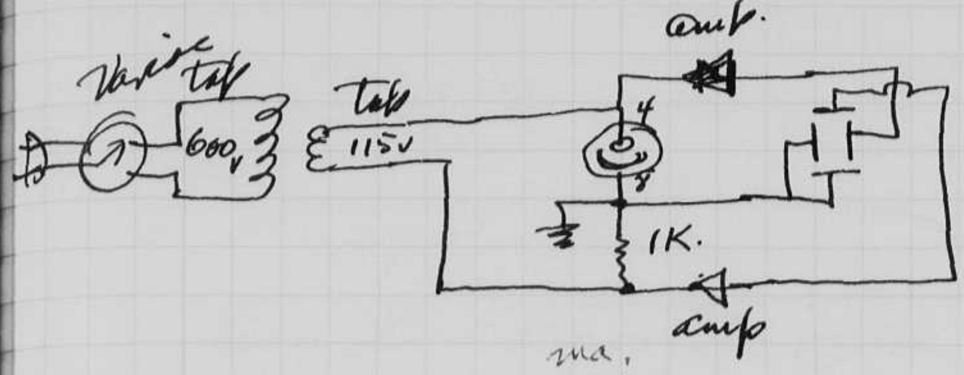


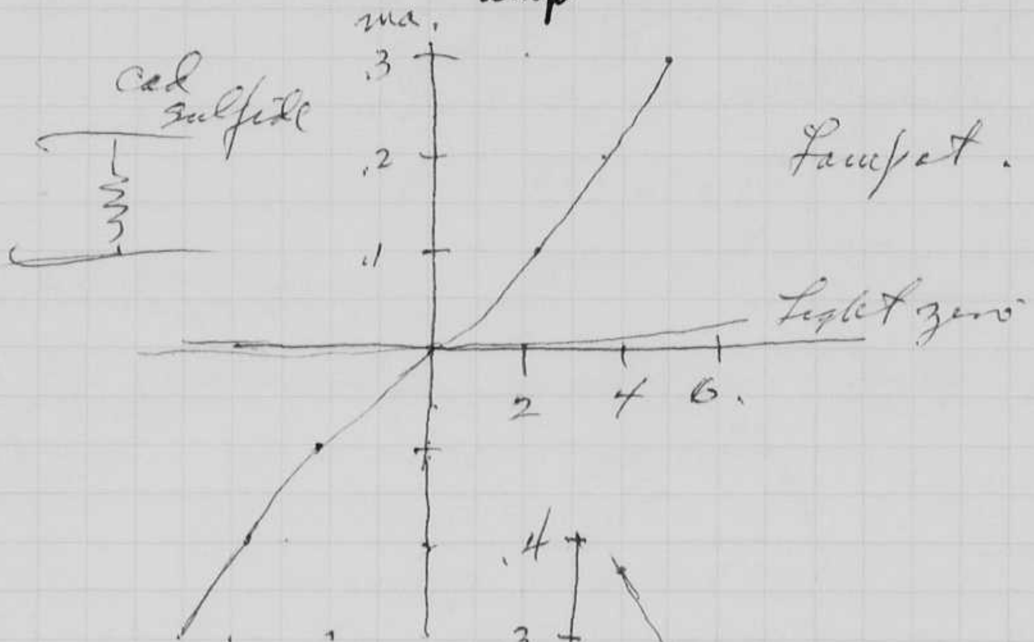


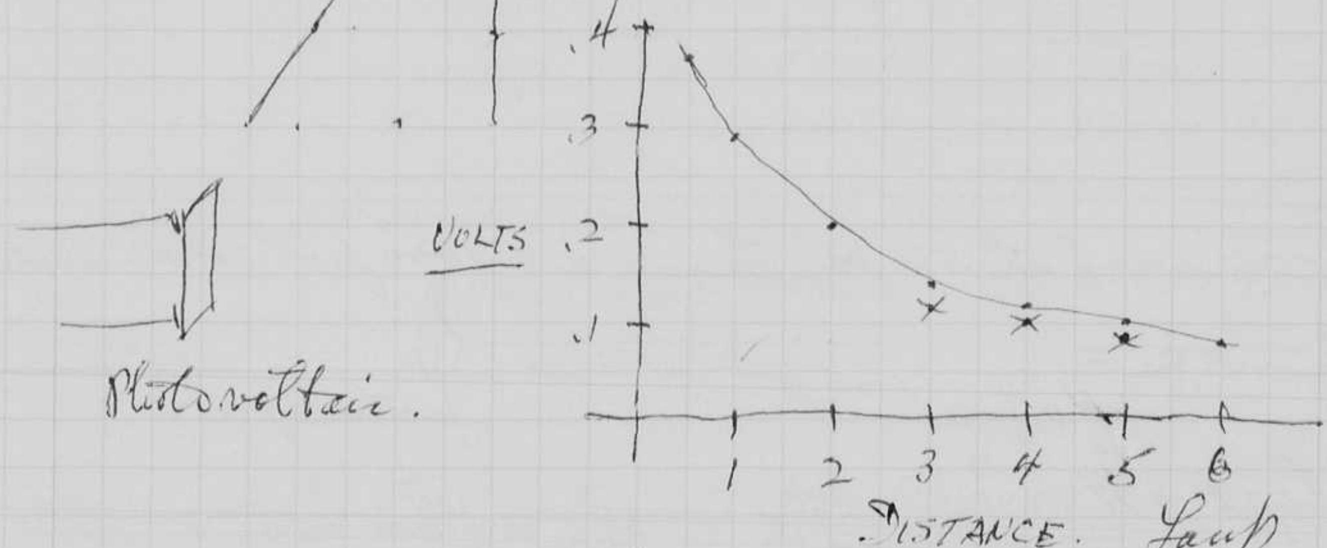
Mar 4 1963
H. Edgerton

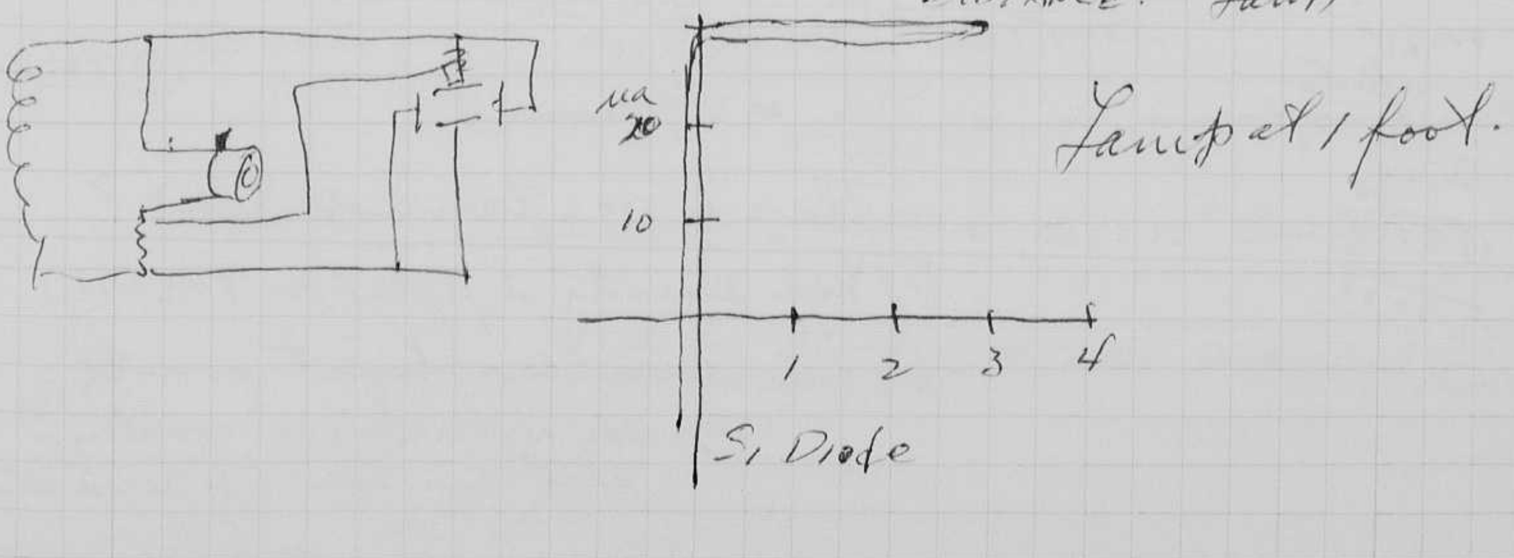
6.202 Experience

Photo Pickups.

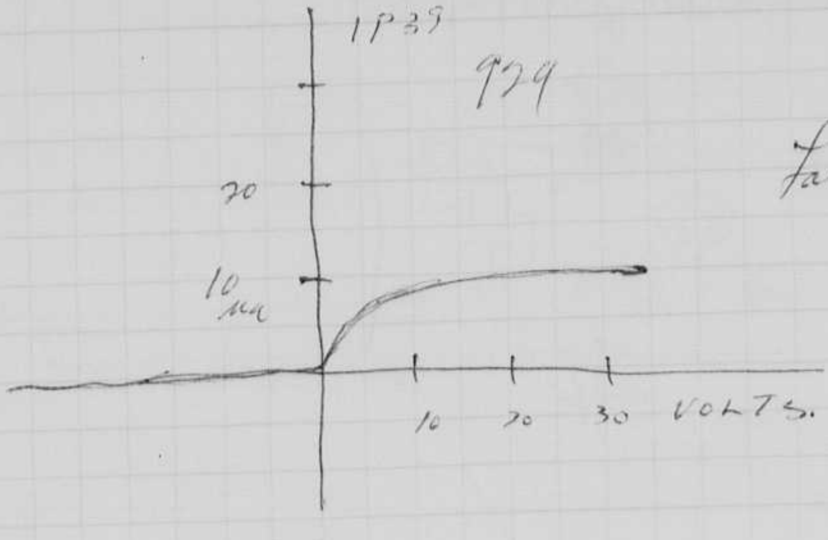






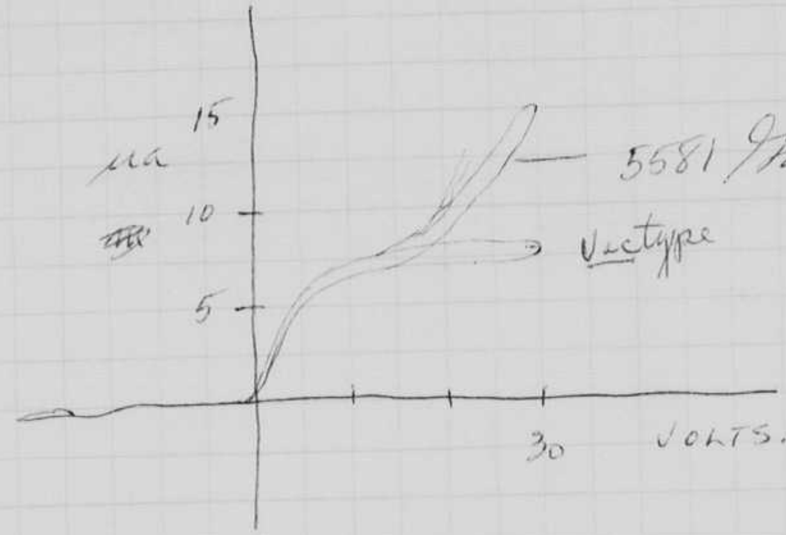


929
Vac



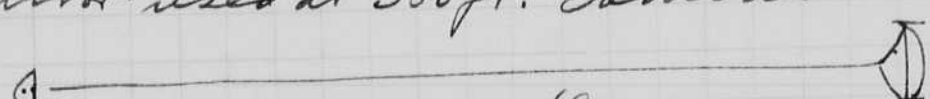
Lamp at 1 foot.

5581
Gas



Lamp at
1 foot

Mirror used at 500 ft. Same as 1000 foot total distance



factor of 1000

$$\text{Light} = \frac{2700 \times \overset{\text{Reflector}}{70}}{1000^2} \times \left(\frac{25}{2}\right)^2 \pi = \frac{590{,}000}{10^6} \text{ lumens.}$$

on 25" reflector at 1000 ft.

$$= .59 \text{ lumens}$$

.00465 lumens

$$\begin{array}{r} 2700 \\ 70 \\ \hline 189000 \\ 3 \\ \hline 567{,}000 \end{array}$$

There is 100 x too much light?

(1) Use Density 2 filter on P.M. tube.

(2) Use smaller light source FX-6A with higher voltage and smaller H.f. capacitor.

March 11 1963 — P.M. tests.

H. Edgerton
4-405 4-409.

PM (931A) in a small box with resistors and 10^3 ohm load. 10^6 resistors in tray.
Cable 30 mmf,
Input 20 mmf

P.C.
935

Neon Strobotac at 60 cycles with reflector

2 ft

$.05 \times .4 = .02$ volts peak. $I_m = 20$ ~~mamp~~

$CP = .02 \times 2^2 \times 10^4$

$= .0800 \times 10^4 = 800$ c.p.

1531-A Strobotac ~~25,000~~ 60 cycles f.p.m. - ~~bare~~ c

$1.3 \times .2 = .26$ volts

$D = 3$ ft.

$C.P. = 0.26 \times 9 \times 10^4 = 23000$

$= 2.3 \times 10^4 = 23{,}000$ c.p.

1531-A at 25,000 f.p.m. bare

Reflector of 70 factor

$0.6 \times .05 = .03$ volts. $C.P. = .03 \times 9 \times 10^4$

$D = 3$ ft. $= 2700.$

now used at 45 feet into 931A pm tube

500 volts on pm tube.

$0.7 \times .05 = .035$ volts.

$I = \frac{.035}{1000} = 35$ microamperes.

Light $= \frac{2700}{45^2} \times \frac{1}{144} \times \frac{1}{2} = \frac{2700}{580{,}000} = .465 \times 10^{-2}$ lumens.

$\frac{I}{L} = \frac{35}{.465 \times 10^{-2}} = 7500$ microamp/lumen.

288
40
12000
40
480,000

Factor of reflector.

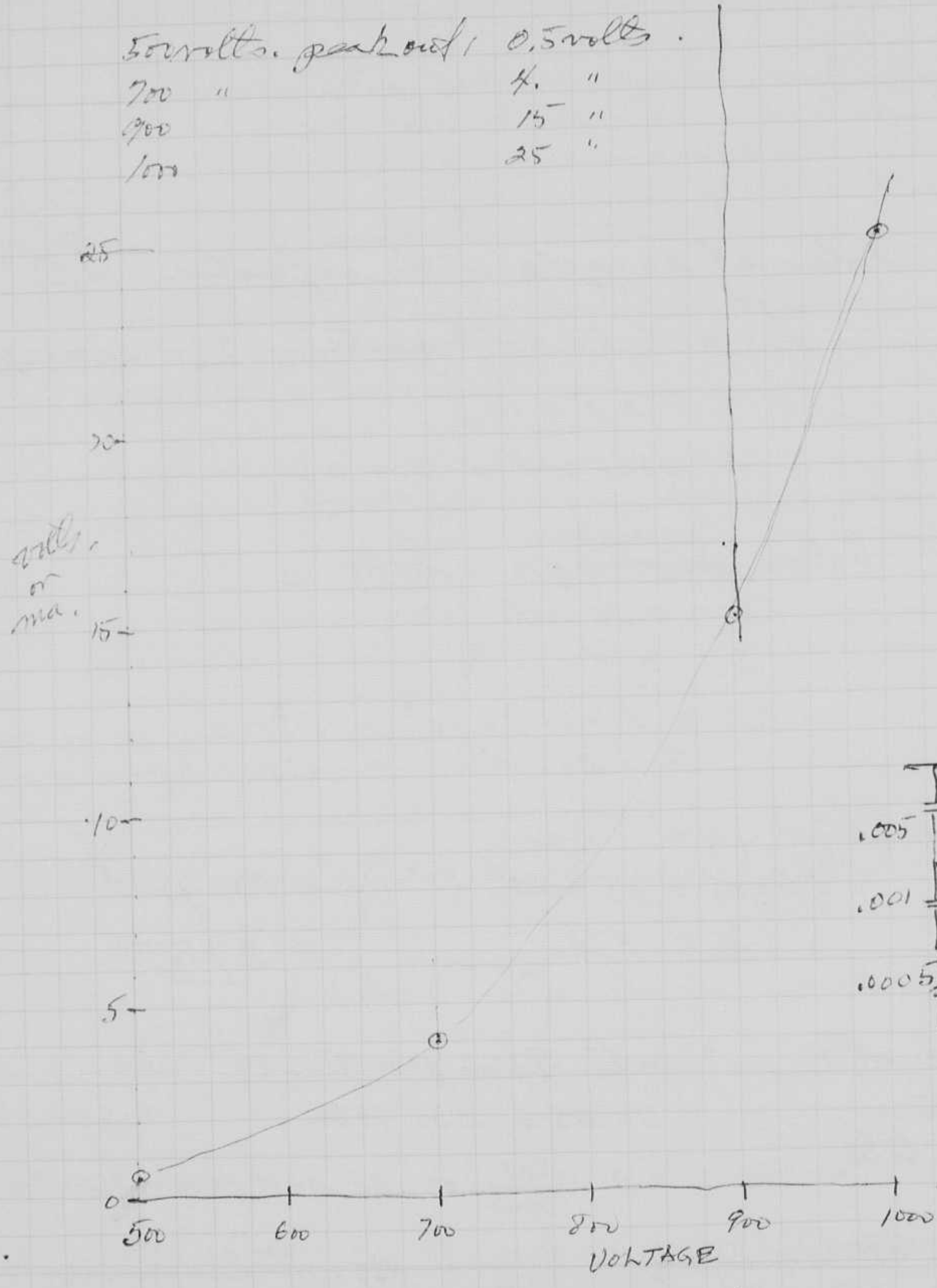
25" diam
$\frac{1}{2}$ sq inch.

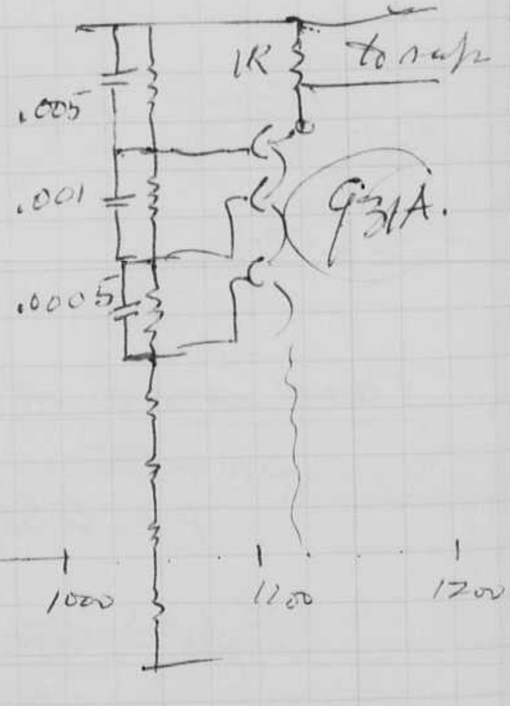
$\frac{\left(\frac{25}{2}\right)^2 \pi}{1/2''} = \frac{490}{.5} = 1000$

Mar. 12 1963
[illegible]
Bill MacR
Kamen

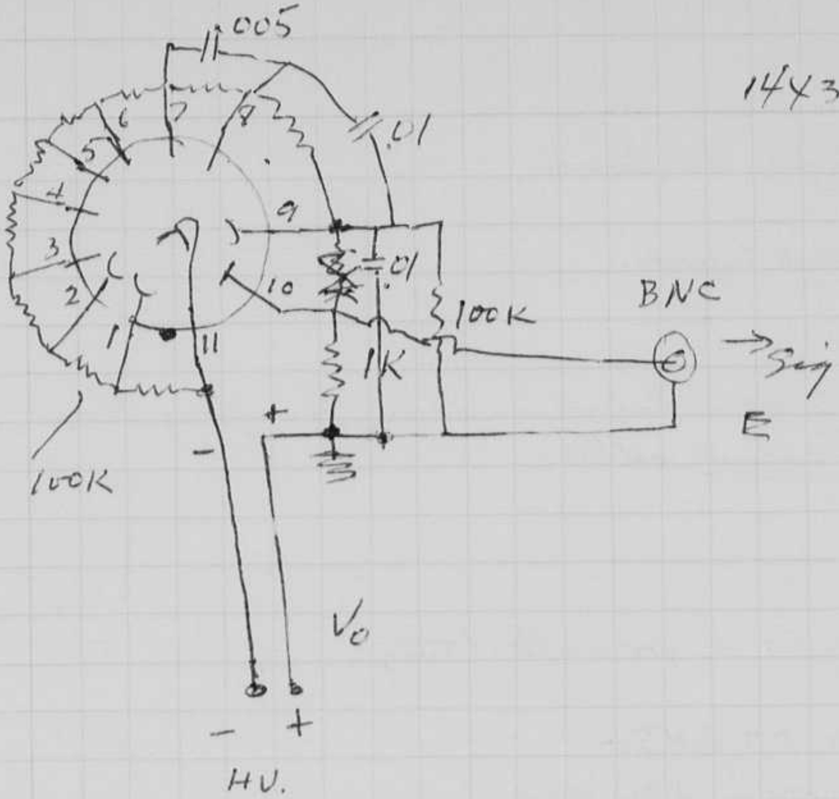
Kamen's pm tube shows the following with a 1000 ohm load resistor. Strobotac at 35000 f.p.m. Bare, at 45 feet

500 volts. peak out	0.5 volts.
700 "	4. "
900	15 "
1000	25 "





apparently the tube of page 107 lacks capacitors across the end stages. Kamen has .005 MFd
We could use .001 in the last stage.
down by factor of 5 on stages before.



1443 = 42 feet.

2500 fpm stroboloc at 42 feet. Bare 2500 fp

V_0 volts	E volts	I ma	D=1 I.
500	2.5	2.5	
600	8.5	8.5	.85
700	18	18	2.5
800	25	25	Distortion 5.5
500	2.6	2.6	.23
400	0.6	.6	.05
300	.09	.09	
250	.025	.025	

D-1 filter

400	.05

Noise.

900	.02 volts peak to peak
1000 V	.05 volts.
1000	.01 + .05 peak to peak.
1100	.035 + ~~.04~~ " " "
1200	.05 .30

1.7
.3
1.4

← [illegible] desk lamp in lab. Low freq Flash.
peaks of .6 volts.

At ~~1100~~ 1000 volts on 9 stages = 100 volts/stage

8 ma with D2 filter
current $\bar{c}$ 8 x 100 = 800 ma.

$$\text{Light} = \frac{2500}{(42^2)} \times \frac{1}{2} \times \frac{1}{144} \text{ lumens}$$

42
42
84
168
1764

$$= \frac{2500}{1764} \cdot \frac{1}{\times 2 \times 144} =$$

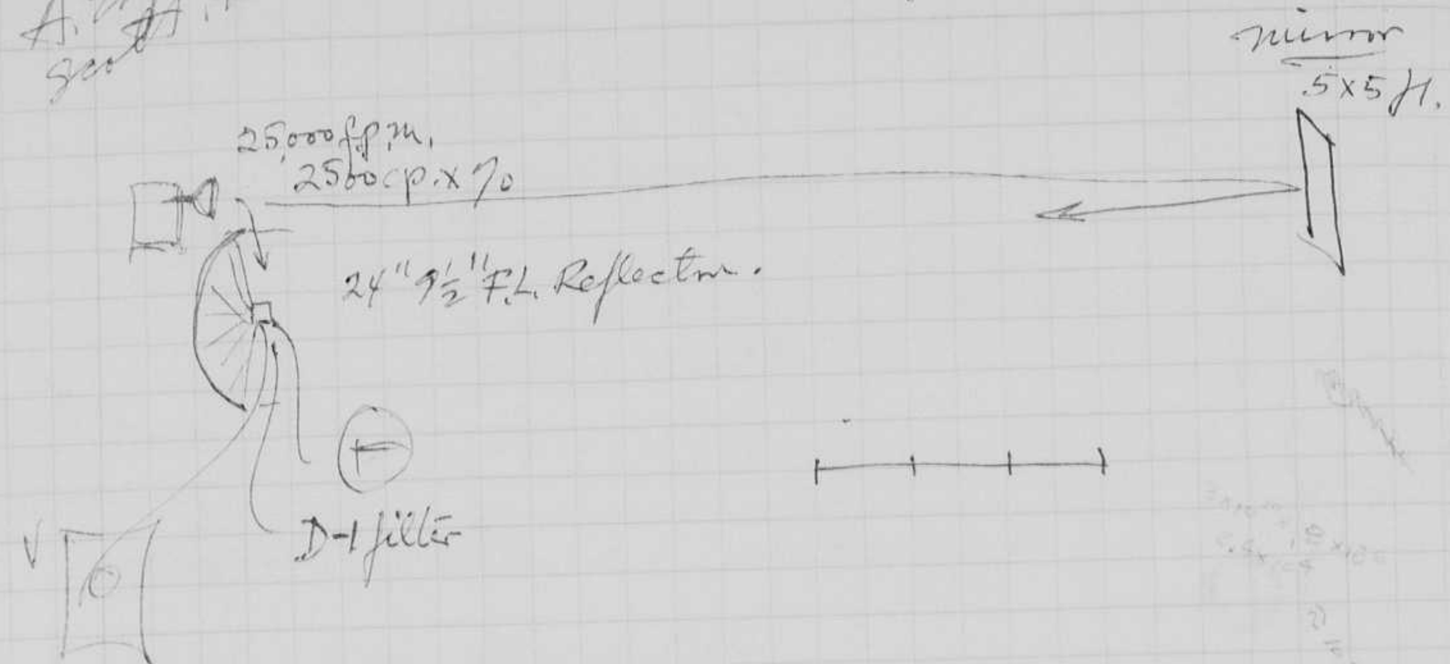
50 f candles Tungsten

800 on p.m. .05 volts / = 50 ua.
.33 volts / 1000 330 ua


VOLTS ACROSS 1000 Ω
MA.
Current in last stage.
1000 ohm load resistor
15
10
5
noise 10%
D1 ×10
D2 ×100
D4
× 10,000
Second filter
NOISE
0
100
200
400
600
800
1000
1200
1400
VOLTS.

Mar 16 1963
A. Edgerton
Scott A. R.

Sunshine ... 10 ...
20 foot ...



V	Filt	E_v	I
500	D1	.2	.2 ma.
700 v	2.	.6	.6 ma.

1.6 x
.5
.80 µs

Scotch screen adds about 50%

2500 cp. at 42'

931A test.	V	Filter	E	I_{ma}	noise
#1	1000	Den 2	1.9 v	1.9	
	1200 v	"			.2 v
A	750	"	2.3 v	2.3	shows "tail"
A	850	"			unstable edge.
B	1000		0.36	.36	
	1200		1.2		noise less than .01 volts
C	1000		2.8		
	1100		—		unstable.
	900 ±		20. v.		unstable now! goes into glow??
D	1000		0.1		Increase ↑ noisy
	1100		.16 ± .03		noisy.
	1200		.3 ± .05		"
E	750		.29		unstable
	800		.		unstable limits
F	1000		1.0		
	1100		1.9		
	1200		3.2		noise .05 or less.
G	750		0.1		unstable.
H	1000		2.3		

3+ volts.

Sensations

			amp/lum
#1	1.9 ma		39
B	.36		~~30~~ 7.35
C	2.8	gassy?	57
D	0.1		205
F	1.0		20.5
H	2.3		47

unstables gassy!

A = 850V

C = 900V ?

E = 750

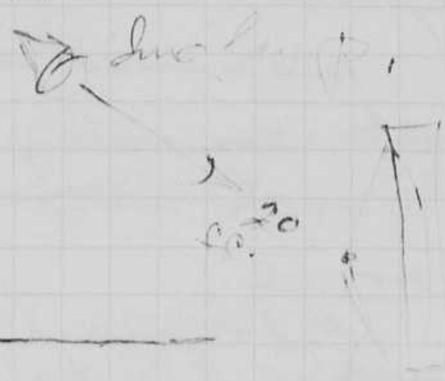
G = 750.

$\frac{25 cp}{(42)^2} \times \frac{1}{2} \times \frac{1}{144}$ lumens. $\frac{25}{510,000} = 49. \times 10^{-6}$ lumens.

$\frac{1900 \, \mu a}{49 \times 10^{-6}} = 39. \times 10^{6} \, \mu a$/lumen

= 39 amps/lumen.

$\frac{39 \times 36}{1.9} = 7.35$



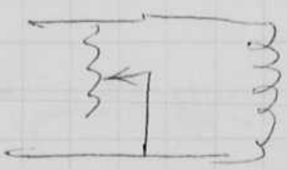
800V

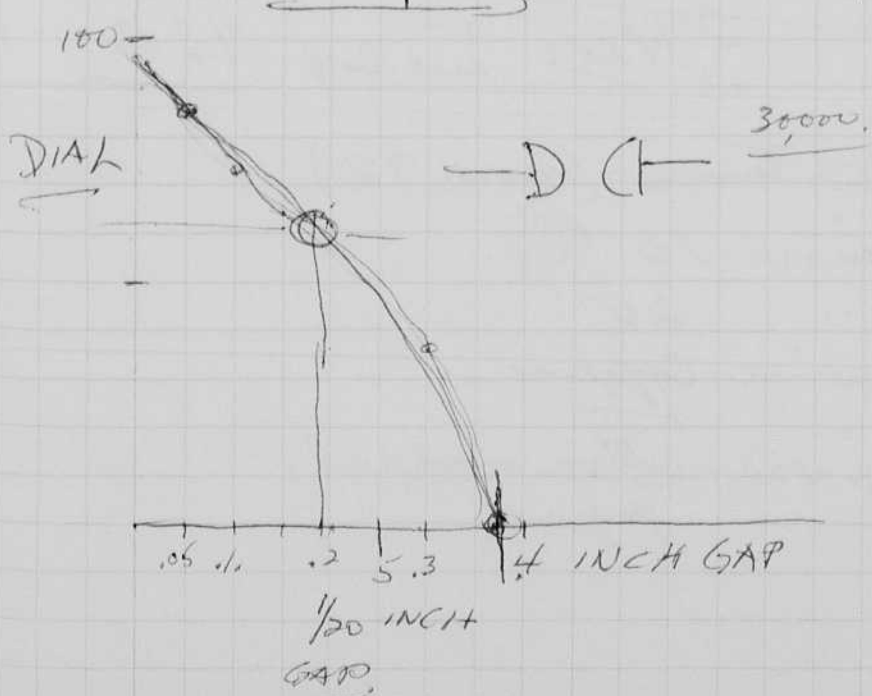
700 volts

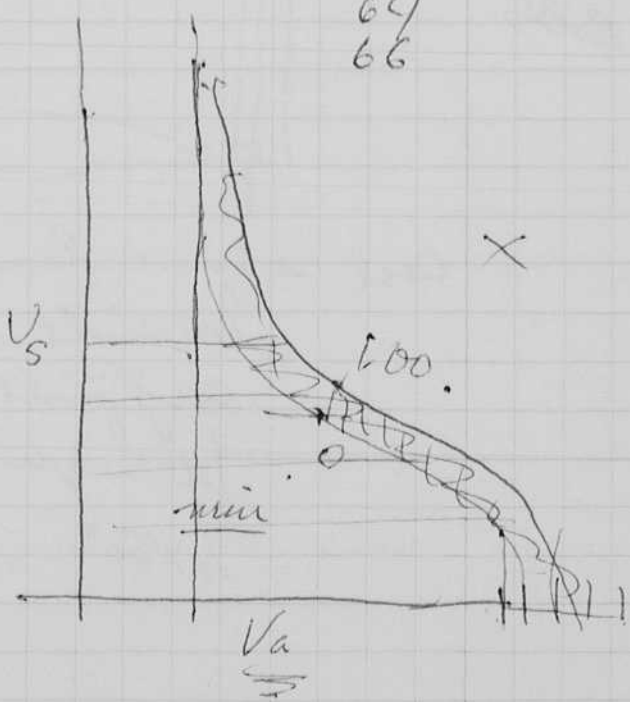
Mar. 20, 1963. HZ.

Vac system.

Gap distance Turns	Dial
4	62
6 —	37
7 1/3	~~100~~ 0
1	84
2	72
3	64
4	66







Mar. 22, 1963
H. Edgerton

One plate 25" Boomer plate.

L = 2.7 mh
Q = 0.65
without plate

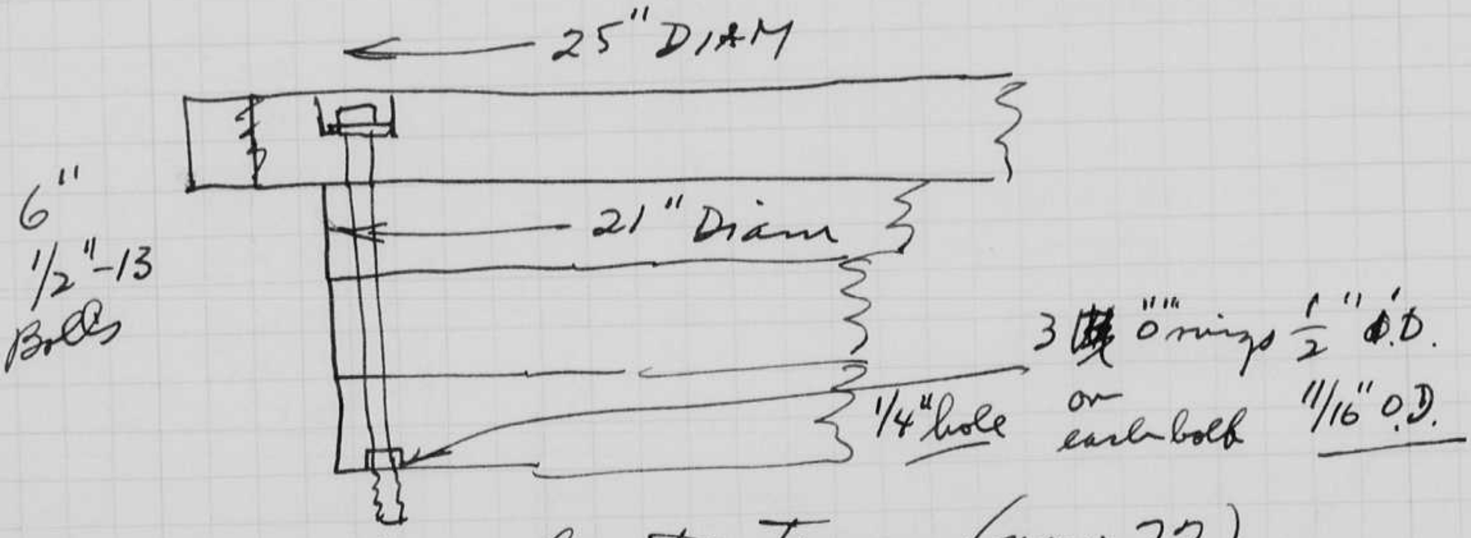
with
1/2" Al plate 6061 → L = 0.34 mh.
Q = 1.0

Mar. 23 1963
H. Edgerton

Measured output of 8 ball transducer with Kearsley at MIT pool at 1030 am. .01 volts into 70 foot cable at 6 knots ± noise.

Hydrophone picked up noises in water due to impact of foot or hand against the side of the pool.

Worked with MacRoberts on the air coil for 50 foot depth.



Coil above less two turns (now 72).
Inside diam 10"
outside " 20"
1/4" high wire Copper.

wire. 1/4 X .050" $\frac{1}{4} \times .050$ cotton wrapped. paper.

The bolts had the head shortened to 1/4" - in length. Hysol epoxy (white) was put under the washers and heads. After tightening all was sealed with Epoxy on the tops of the 7 bolts.

Then the coil was put down with ~~Em~~ Emerson & Cummings #19 with #9 catalyzer 100% and 15%.

The 1/16" Bakelite plate was made 21 less 1/4 inches in diameter with a 5" hole in the center.

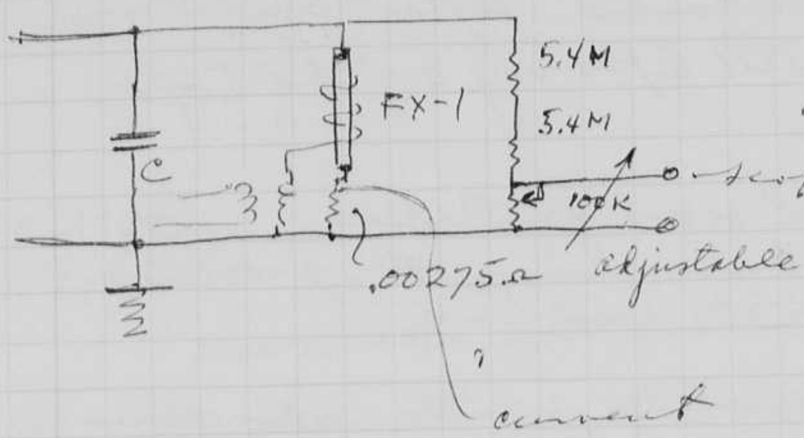
This was held with weights under mylar strips to prevent sticking.

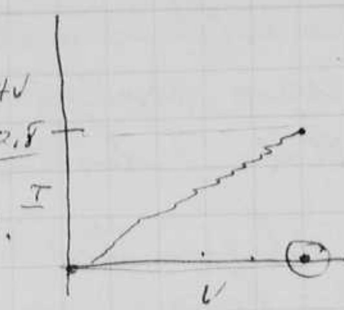
Air Trans X401-A no 1 with Oslo was on a sign put in the center hole.

A few bits of glass cloth were put in for strength around the wire connections.

Apr. 1. 1963.
H. E. Edgerton

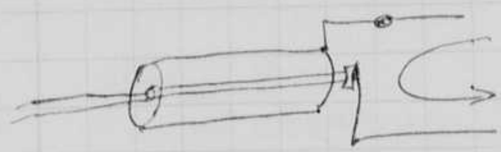
V-I Experience for 6.202   4-409.

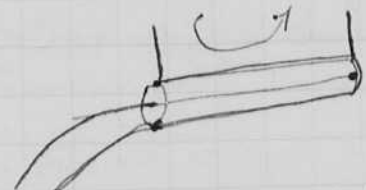




$I = \frac{1.4}{.00275} =$

150
2000
130





Floyd Minx.
Scope. current shunt.

0.00275 Ω

Apr. 6. 1963 60 today Birthday party yesterday
Lots of cards, Cake, Ice cream. Plutarchs
Lives. Gold Boomer Plate etc.

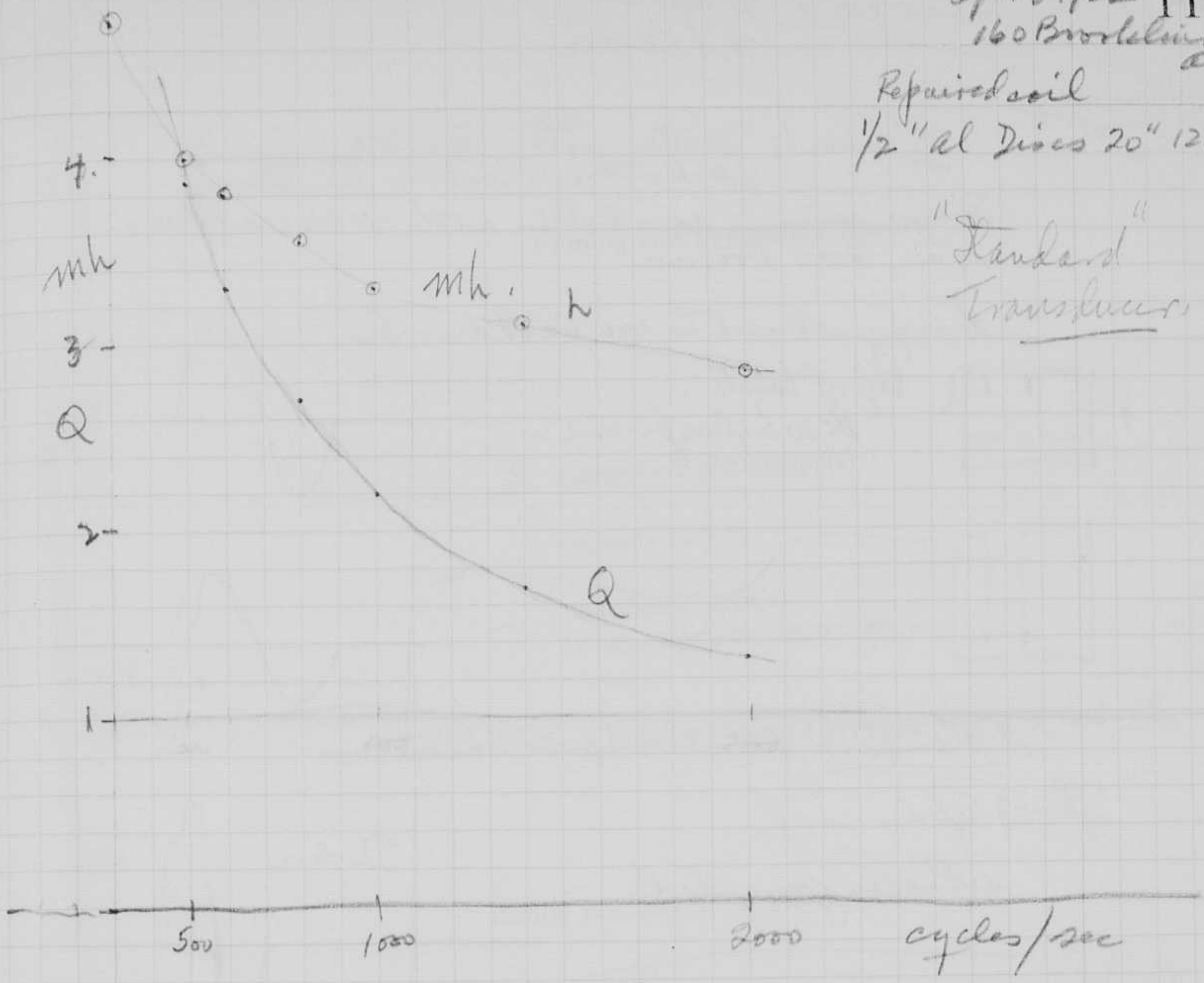
Data from T. Taylor,
Sangamo type 505 3.06 Ω.
Sprague " 29013 0.77 ohm.

Boomer? L = 0.33 mh DQ = 2 with 1/2" al plates
#22 L = 2.72 mh DQ = 10+? no plates.

Apr 8 1962
160 Brookline Ave.

Repaired coil
1/2" al Discs 20" 12 holes.

"Standard"
Transducer.



f	mh.	Q
2000	2.85	1.3
4	2.5	.8
6	2.35	.6
8	2.25	0.50
12	2.2	.36
20	2.05	.26
30	2.	.19
40	1.95	.15
60	1.9	.1
100	1.9	.06

L x 0.1?

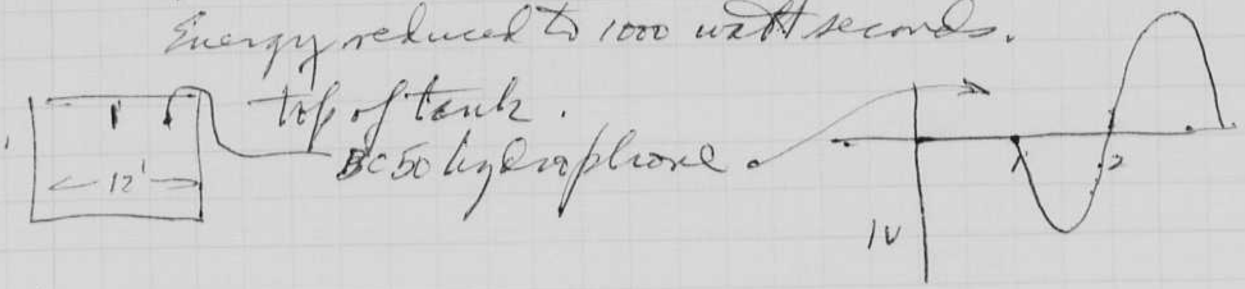
Apr 8, 1963
160 Brookline ave.
Boston

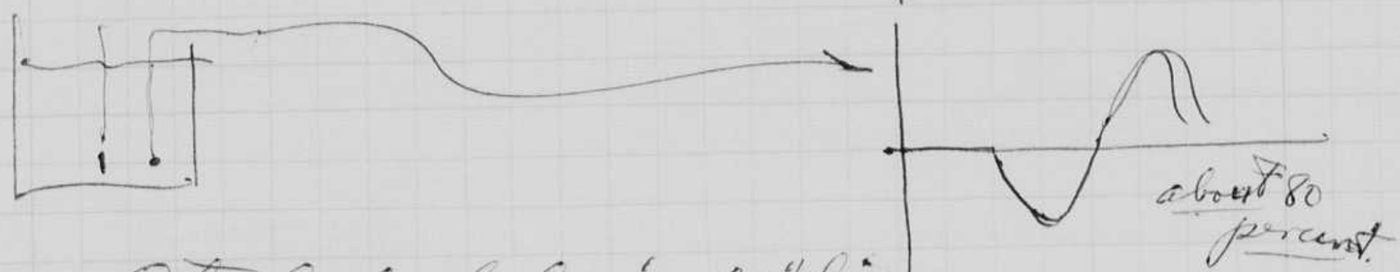
Boomer tests H Edgerton
M. Klein

25" diam 1/2" plates with smooth edges.
and without rubber bumpers.

Shows serious cavitation with 11 000 watt sec
after 2000 Booms.

Energy reduced to 1000 watt seconds.

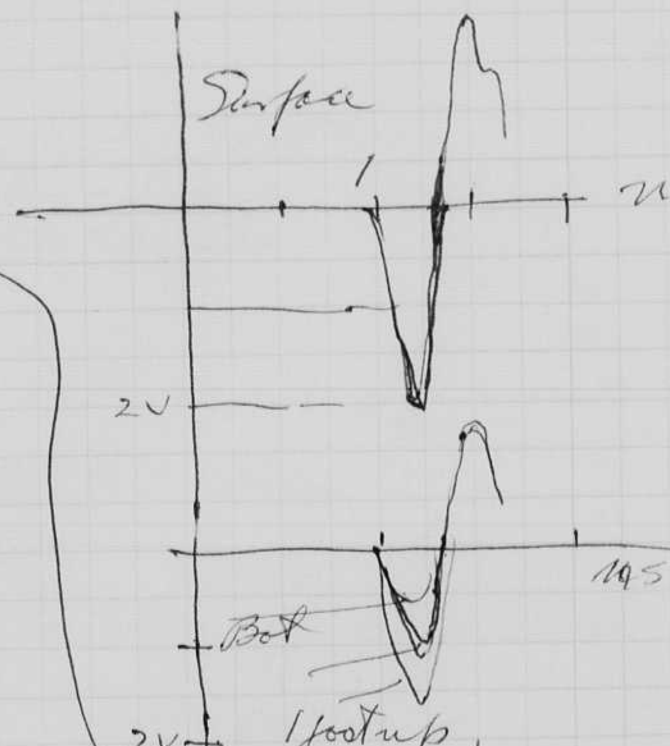




A standard plate is 20" diam

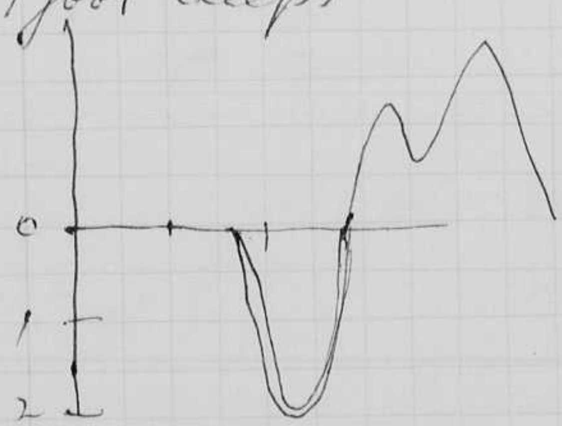
Apr 63 Repair unit

Plates parallel.



Q = 2.4
L = .355 mh.

25" Single plate air job.
1 foot deep.



Osc #1. Depth 1/2 way down 1000 ws, BC 50 2 1/2 ft from wall
center of tank. 0,5 ms/cm 2 volts/cm.

Osc #2 Same but 3000 ws. 0.5 ms/cm 5 volts/cm.
#3 Same but 5000 ws 0.5 ms/cm 5 volts/cm.

#4 20" Std Boomer Parallel 1/2 way to Bot at center of tank.
1/2 ms/cm. 5 volts/cm.

#5. 20" Std. Boomer Vertical view to 

25" Air Boomer. 

Notebook # 27

Filming and Separation Record

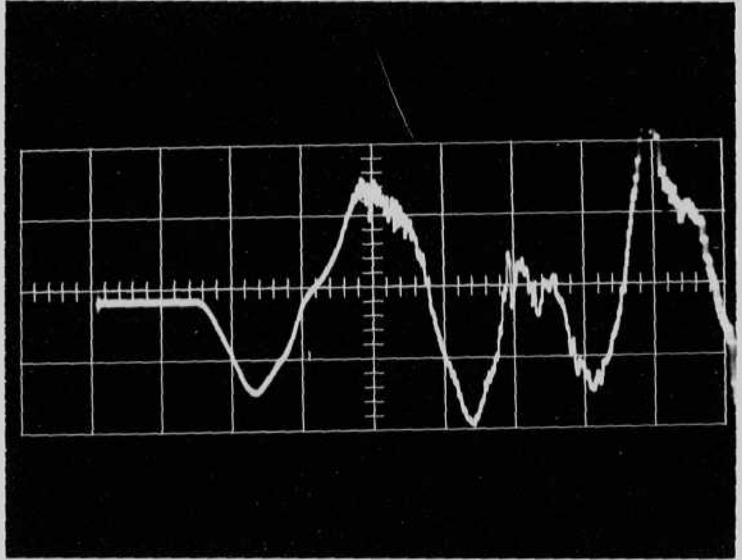
5 unmounted photograph(s)

____ negative strip(s)

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

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

Item(s) now housed in accompanying folder.



1/2 ms.

Notebook # 27

Filming and Separation Record

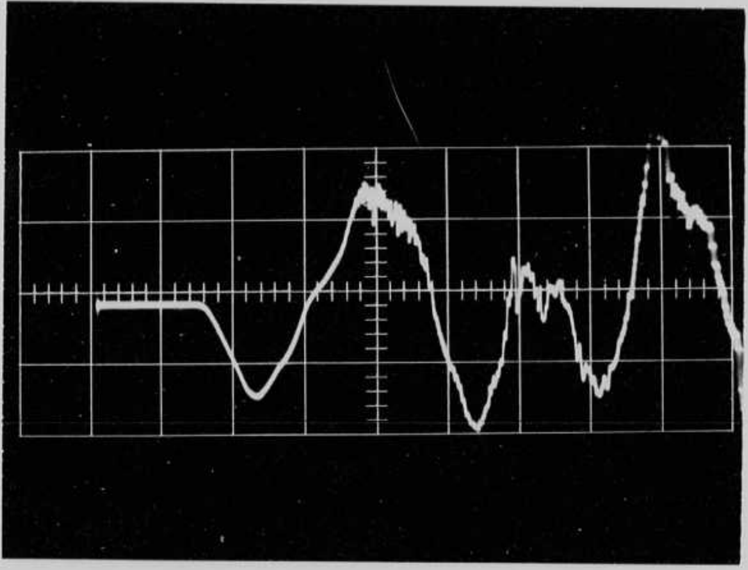
5 unmounted photograph(s)

___ negative strip(s)

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

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

Item(s) now housed in accompanying folder.

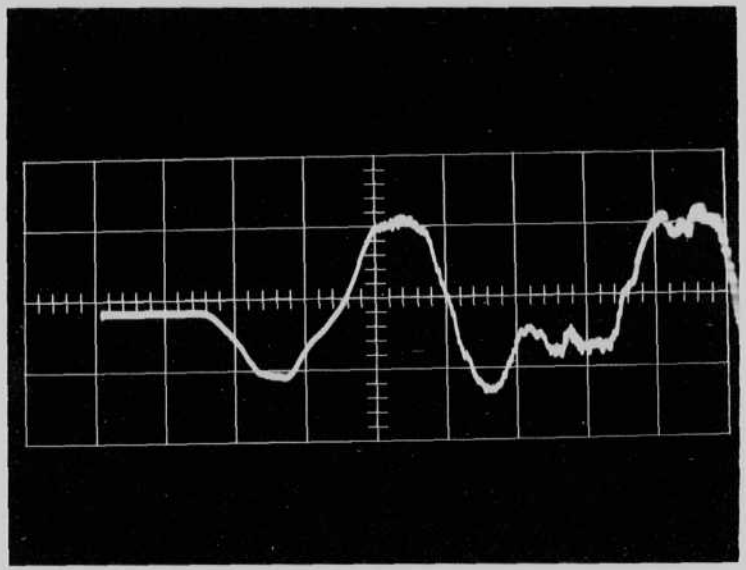


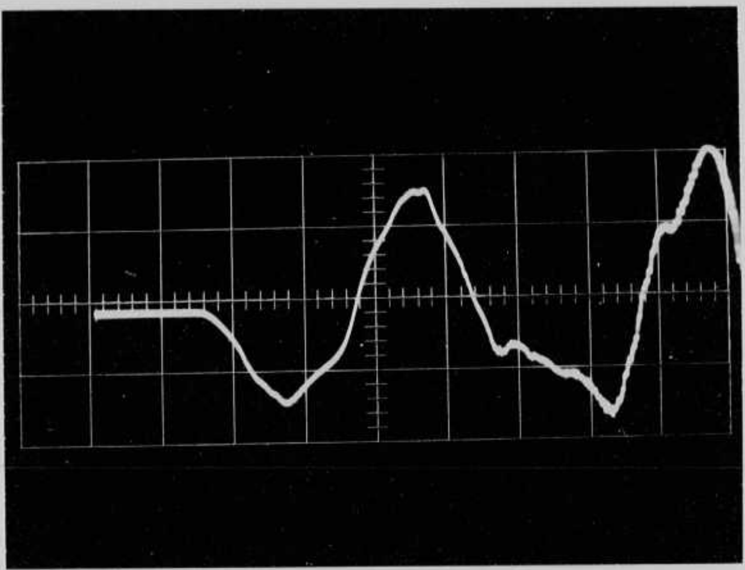
1

1/2 ms.

15

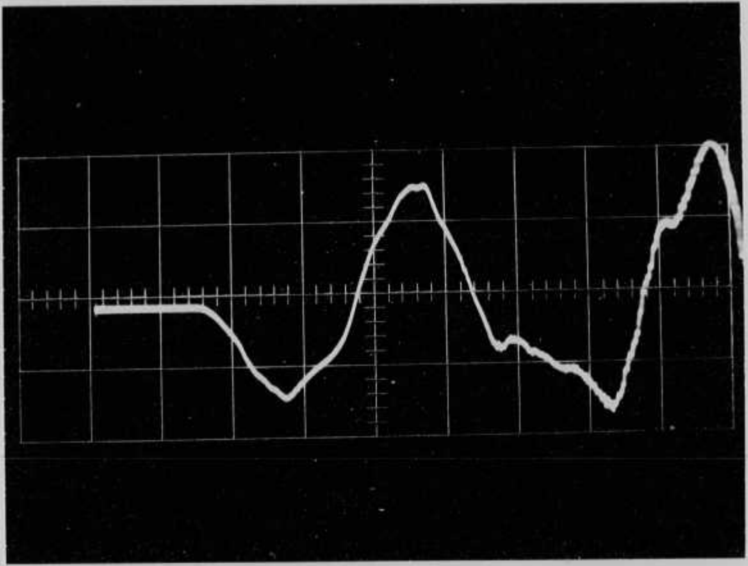
BC-50
air boomer
1 KWS
2 V/cm
$\frac{1}{2}$ mt/cm


2
5V



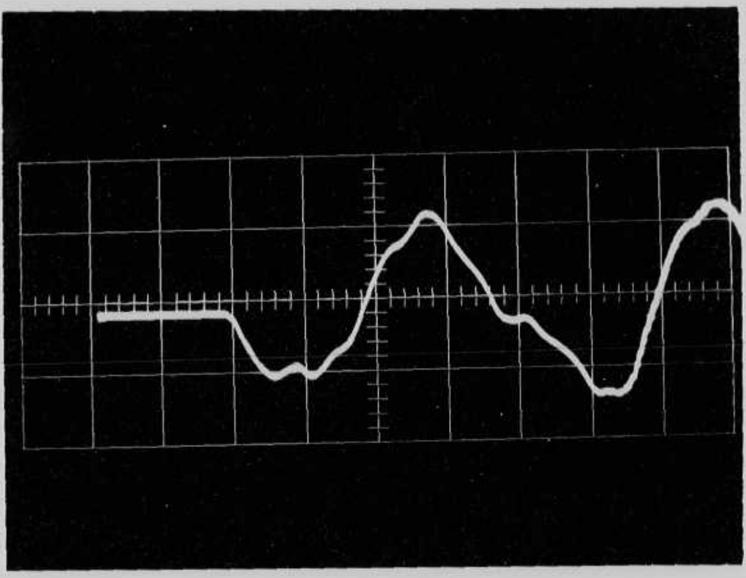
3
1/2 m
5V

500



3
1/2 m
5 V

500

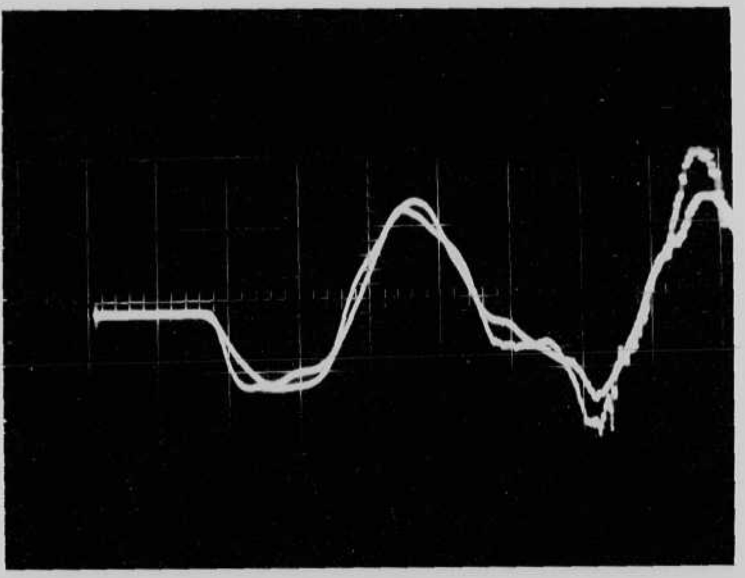


4

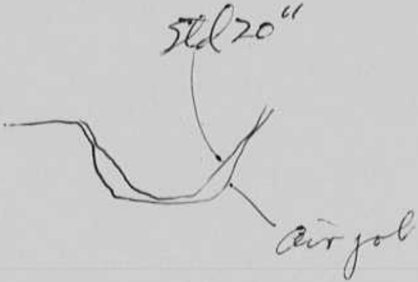
1/2 ms

5V

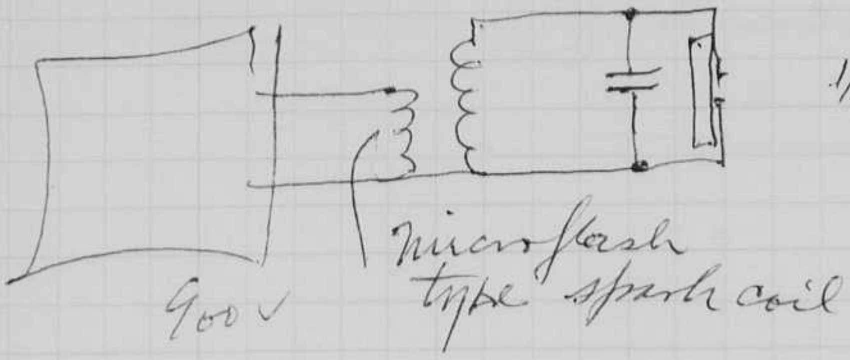
50



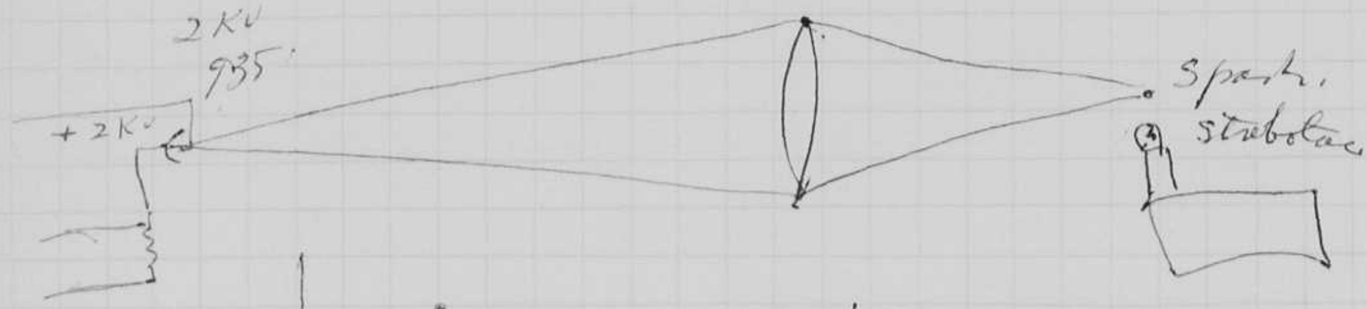
#5
½ m
5 Vol
5 c

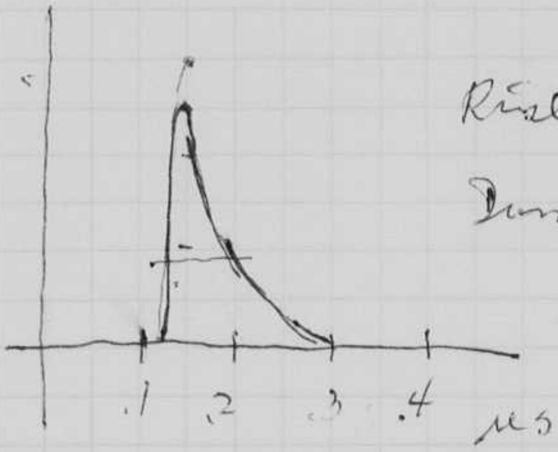

Std 20"
Air fol

Spark gap.



1/4" less gap on glass, Flat Pointed electrodes.





Rise time = 0.02 µs

Duration .08 µs

Peak light

$= 4000 \times \left(\frac{2.7}{.6}\right)$ cp.

Bare Strobotac used as standard lamp. assumed 4000 cp at 25000 f.p.m.

Norton

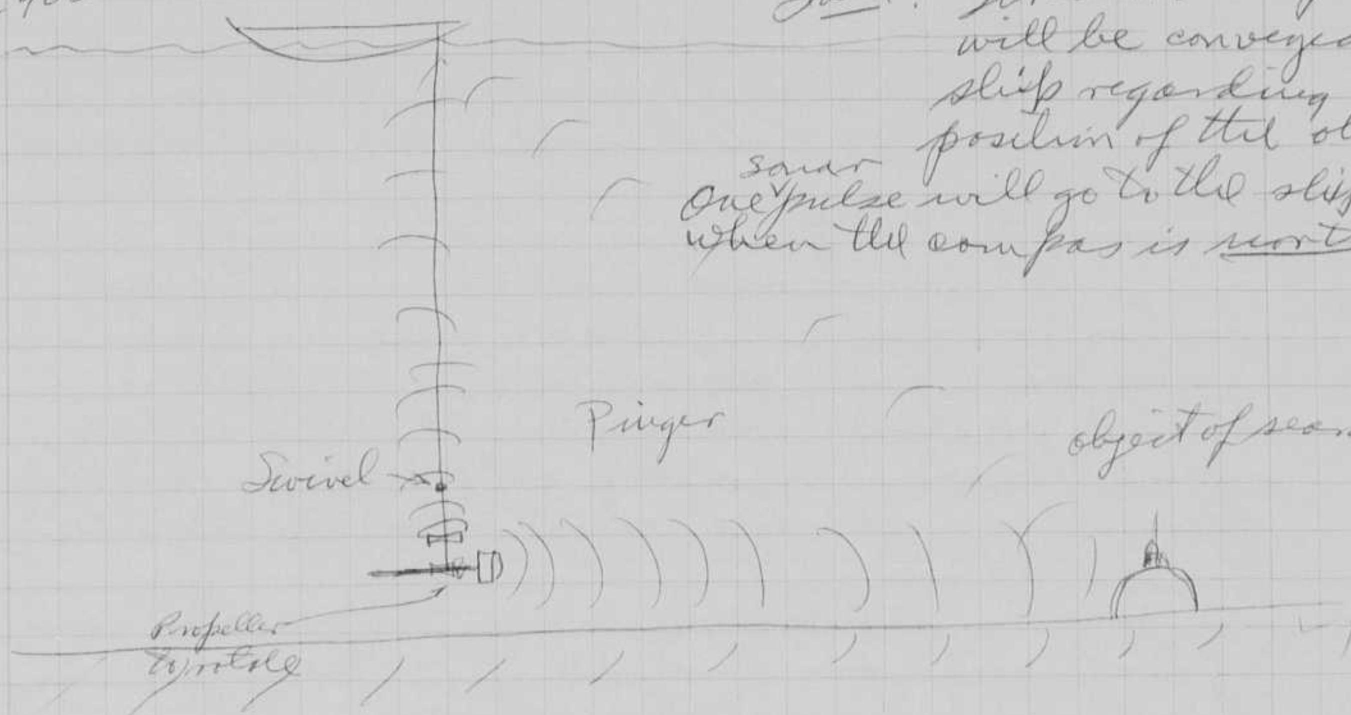
#A300

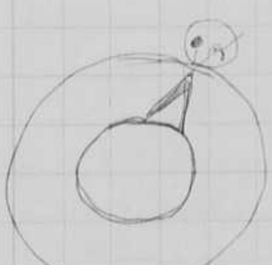
May 3, 1963
Harold Edgerton
4-405 M.I.T.

Bottom Photography device

Idea. Directional information will be conveyed to the ship regarding the position of the object.

One sonar pulse will go to the ship when the compass is north.





Speeds of Pinger Mud Pen #1 as used May 4, 1963 in Charles river basin

		rps	Range	Range.
Speed 1.	570 rpm	9.5.	~~1050 ft.~~	263' feet
	900 "	15.0		166'
	1980 "	29.6	~~338. feet~~	84
	215	35.8		700'

~~Range = T × vel × v~~
~~= $2 \frac{1}{rps} \times vel$~~
~~= 10,000~~
~~v = 5000 ft/sec.~~

Range = $\frac{2VT}{2}$

$2R = TV$

$R = \frac{TV}{2} = \frac{5000}{2} \times \frac{1}{rps}$

 May 7, 1963 Sideways pinger

Harold Edgerton

Experiments May 3, 4, 5, 6 showed excellent results.

The sea wall in front of MIT can be seen at 1200 + feet near the center of the bridge.

John Yules and I went into the harbor on Sunday May 5. The results were terrific. It will contribute to his thesis. We had motor trouble and then a squall. Towed by Bill Pendergast 405 N St South Boston in Sea Breeze.

Donald Keach was here yesterday. We took him for a ride in Colleen in the Chas River. The echoes from the wall and bridge were excellent even if the wind was blowing.

Plan a Friday expedition in the harbor on his ship. Then the plan will be for the Trieste installation & look for the Thresher.

May 11 1963

Weather was bad on Friday but we went out anyway. Strong East wind and cold. Some results - Transducer was not held against ship.

Planned for Sat expedition. Again same storm. Kearsley & Curley were at Naval Annex at 7 am to meet Keach and Martin. McKenzie discussed sound ~~Plan~~ Plans for Trieste Installation.

Two transducers to work side ways into water.

1200 foot scale 2 per second pulses.

angle about 10 degrees for 1000 feet 50 ft high

May 15, 1963

H.E. Edgerton : Geo Jobert & Henri Delauze.

Mar - May 1964 date for Archimede to come to Puerto Rico for dives at canyon 30 miles north.

May 21, 1963. Last day of term. Gjon Mili here from New York.

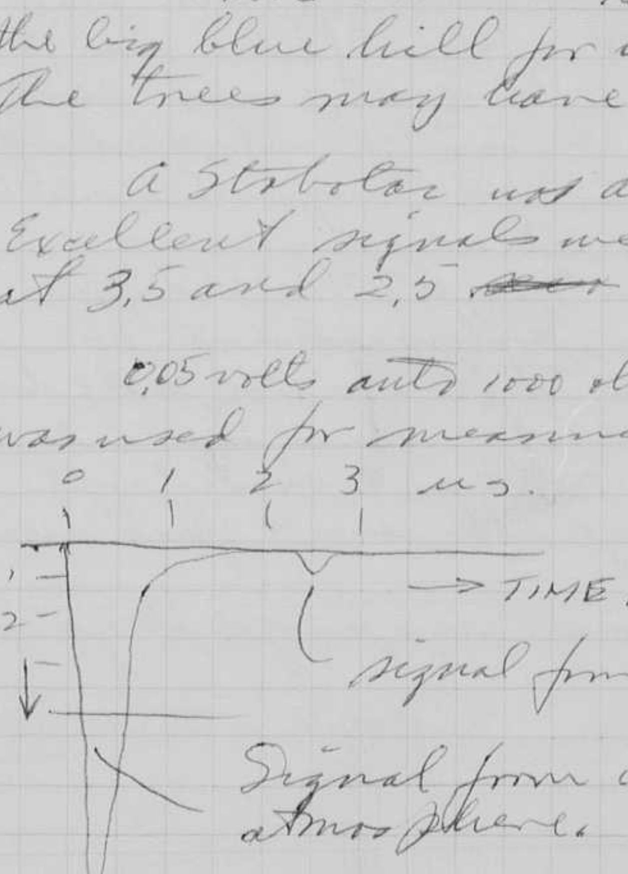
Work on side way pinger is almost finished for the Trieste. Comd Don Keach is due back from Calif. Installation of double beam unit is scheduled for next week.

Worked at Harvard Agassiz observatory last night with 60 inch search lights.
(5164) Overbeck has two of these for observing cosmic ray flashes.

Noxon OX 81251 turned on a strobe at the big blue hill for us. We could not see it the trees may have been in the way.

A Strobolux was aimed up at 30 ft away. Excellent signals were obtained from clouds at 3.5 and 2.5 ~~sec~~ microseconds.

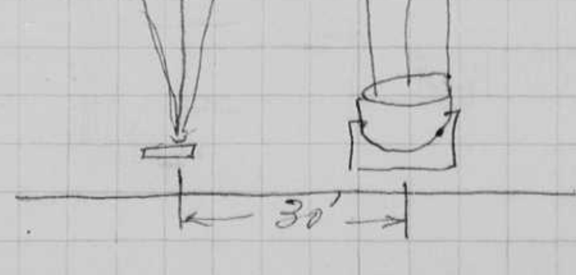
0.05 volts into 1000 ohms with 12 foot cable was used for measurement. Each time is [illegible]



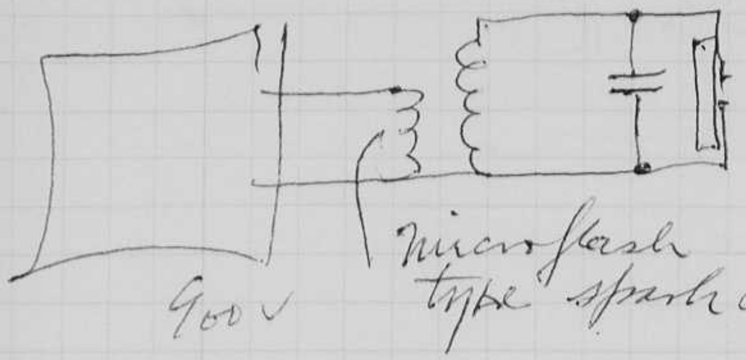
signal from cloud. Thin

Signal from close back scatter in atmosphere.

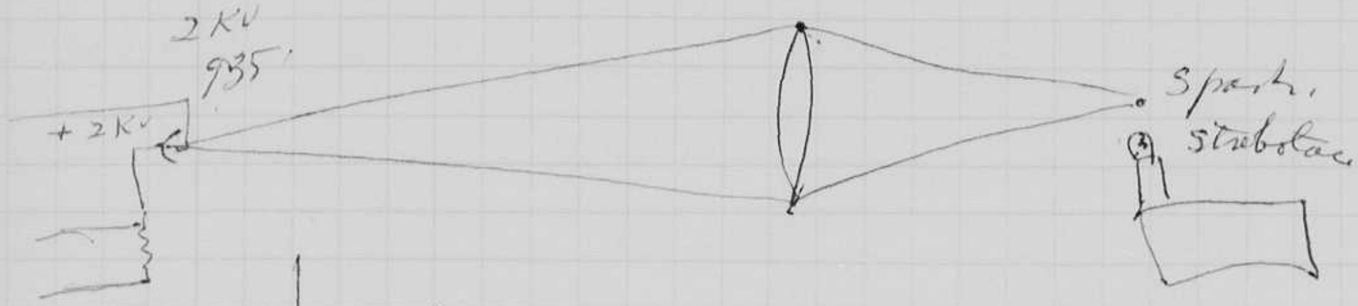
This looks like a very powerful way to look at clouds and scatter effects.

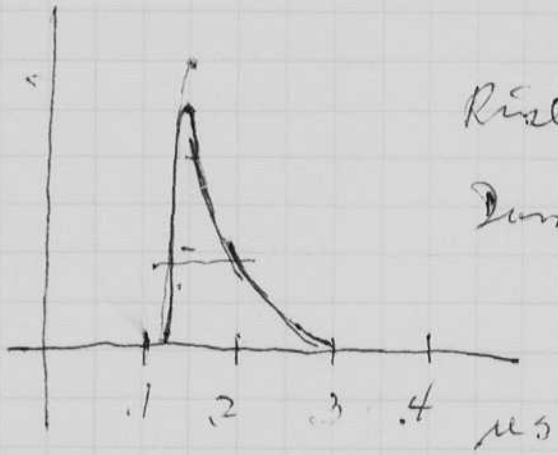


Spark gap.



1/4" brass gap on glass, Flat Pointed electrodes,





Rise time = $\underline{0.02\ \mu s}$

Duration .08 μs

Peak light

$= 4000 \times \left(\frac{2.7}{.6}\right)$ cp.

Bare Strobotac used as standard lamp. assumed 4000 cp at 25000 f.p.m.

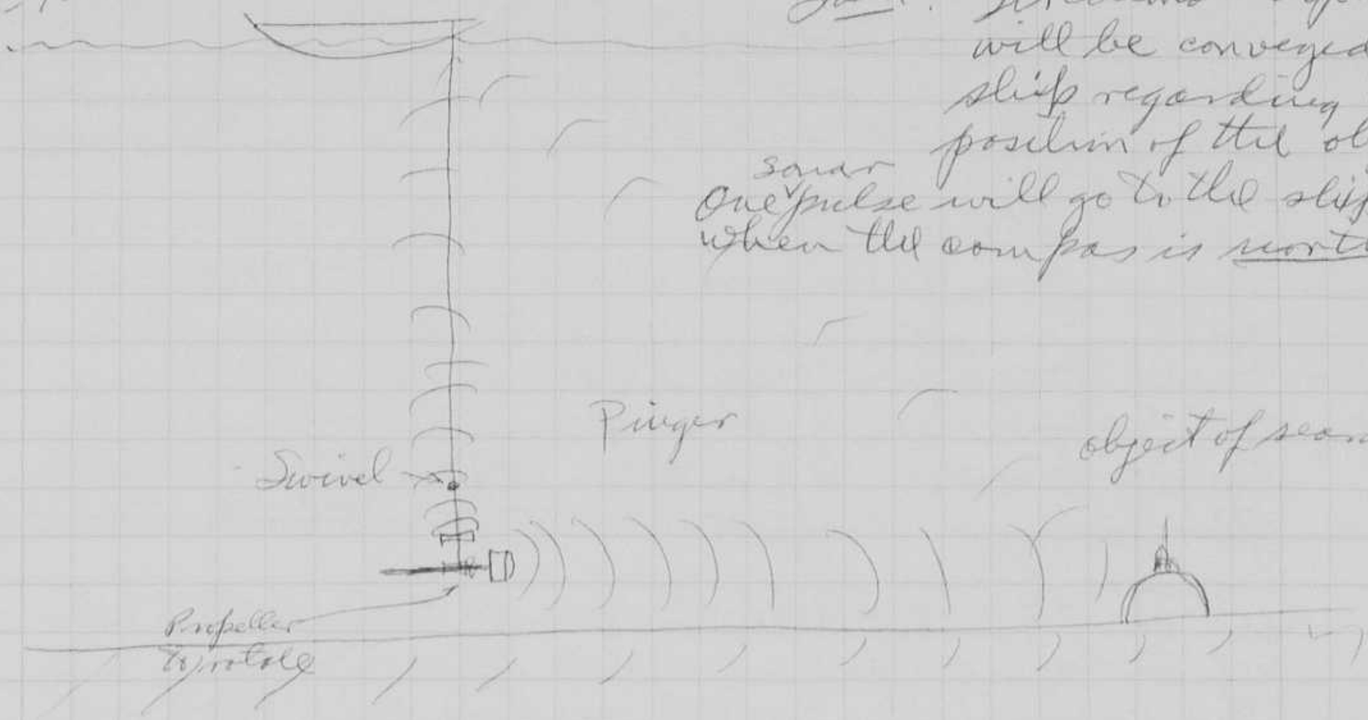
Norton

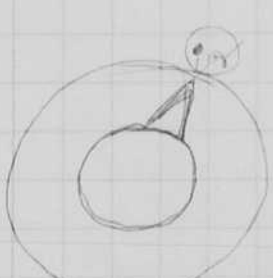
H.A 300

May 3, 1963
Harold Edgerton
4-405 M.I.T.

Bottom Photography device

Idea. Directional information will be conveyed to the ship regarding the position of the object.
One sonar pulse will go to the ship when the compass is north.





Speeds of Pinger Mud Pen #1 as used May 4, 1963 in Charles river basin

		rps	Range	Range
Speed 1.	570 rpm	9.5.	~~1050 yd.~~	263' feet
	900 "	15.0		166'
	1780 "	29.6	~~338. feet.~~	84
	215	3.58		700'

~~Range = T x vel x 2~~
~~= 2 $\frac{1}{rps}$ x vel~~
~~= 10,000~~
~~v = 5000 ft/sec.~~

Range = $\frac{2VT}{2}$

$2R = TV$

$R = \frac{TV}{2} = \frac{5000}{2} \times \frac{1}{rps}$

May 7, 1963 — Sideways pinger

Harold Edgerton

Experiments May 3, 4, 5, 6 showed excellent results.

The sea wall in front of MIT can be seen at 1200 + feet near the center of the bridge.

John Yules and I went into the harbor on Sunday May 5. The results were terrific. He will write these up in his thesis. We had motor trouble, and then a squall. Towed by Bill Pendergast 405 N St South Boston, in Sea Breeze.

Donald Keach was here yesterday, we took him for a ride in Colleen in the Chas River. The ideas from the wall and bridge were excellent even if the wind was blowing.

Plan a Friday expedition in the harbor on his ship. Then the plan will be for the Trieste installation to look for the Thresher.

May 11 1963

Weather was bad on Friday but we went out anyway. Strong East wind and cold. Some results - Transducer was not held against ship.

Planned for Sat operation, again same storm. Kearsley & Curley were at Naval Annex at 7 am to meet Keach and Martin. McKenzie discussed sound ~~Plan~~ Plans for Trieste Installation

Two transducers to work side ways into water.

1200 foot scale 2 per second pulses.

Angle about 10 degrees for 1000 feet 50 ft high

May 15, 1963

Henri
H. E. Edgerton : Geo Jobert & Delauze.
Mar – May 1964 date for Archimede to come to Puerto Rico for dives at canyon 20 miles north.

May 24, 1963. Last day of term. Gjon Mili here from New York.

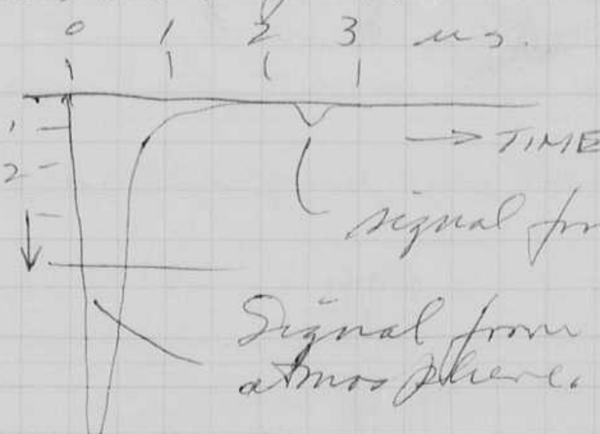
Work on side way pinger is almost finished for the Trieste. Comd Don Keach is due back from Calif. Installation of double beam unit is scheduled for next week.

Worked at Harvard Agassiz observatory
last night with 60 inch search lights.
5164 Overbeck has two of these for observing
cosmic ray flashes.

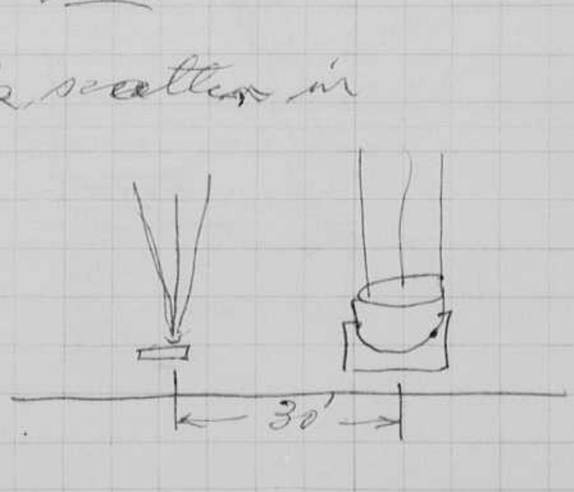
Noxon OX 81251 turned on a strobe at the big blue hill for us. We could not see it the trees may have been in the way.

A Strobolar was aimed up at 30 ft away. Excellent signals were obtained from clouds at 3.5 and 2.5 ~~[illegible]~~ microseconds.

0.05 volts into 1000 ohms with 12 foot cable was used for measurement, Tek time is up



This looks like a very powerful way to look at clouds and scatter effects.



May 26 1963.
H E Edgerton.

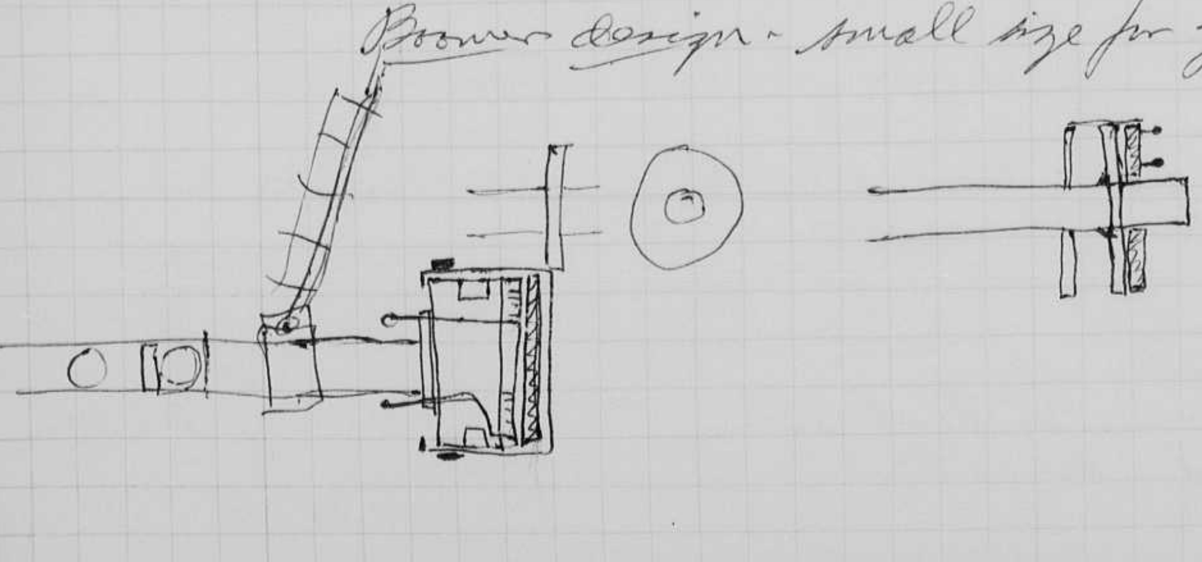
The Mud Penetrator has been rebuilt for insertion into the Trieste for searching for the Thresher submarine. This sub was lost 230 miles east of Boston on April 10. A very concentrated search for the wreck has been under way for a long time. A few photos of material which could have come from the sub was obtained on the ATLANTIS about a week ago.

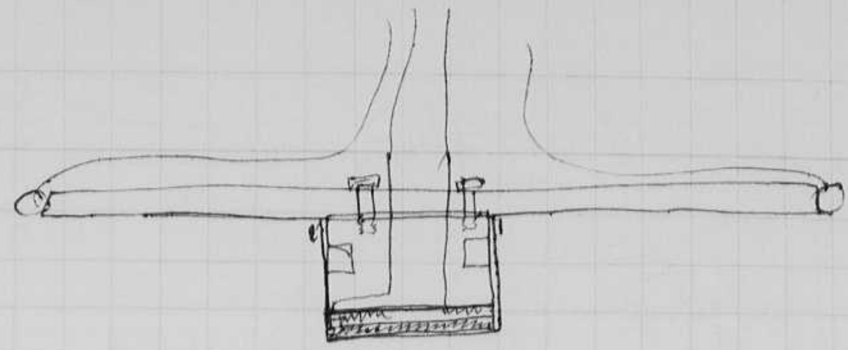
I was out in the Boston Harbor today, yesterday and the day before, practising with a side way looking pinger. I think it will ~~f~~ work fine at 1000 feet away on a subject that projects out of the mud.

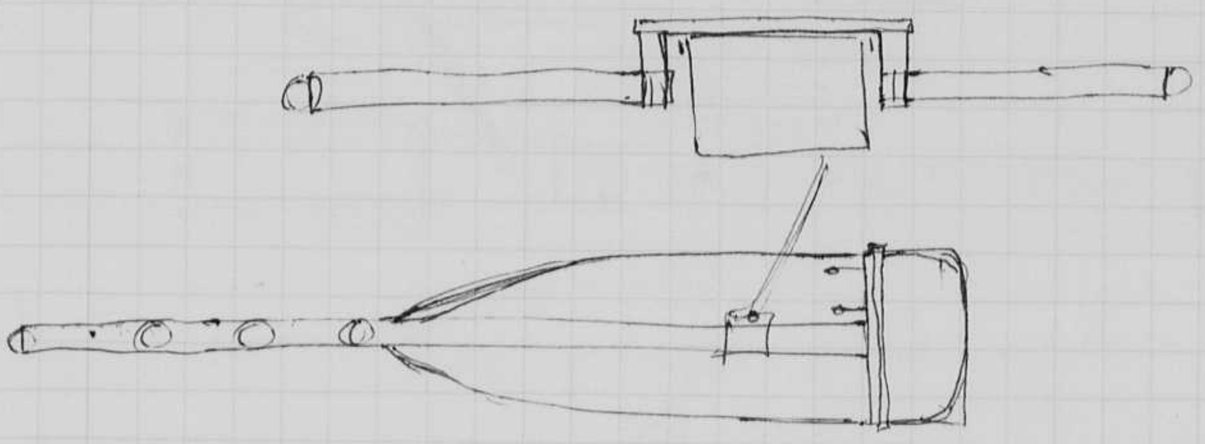
May 30 1963 I have put in a lot of time with the mud penetrator both in the Charles River and in the Boston Harbor. The results are most interesting especially in the side looking mode. John Yules helped on Tuesday. We went to the west side of the Harvard Bridge - South end near the center. Several "objects" gave good side echos but poor top echos.

Yesterday I was on "Kay G" with Wayne, Curley, Klein, Jules, Jack Wood and Joe Lenehan(?) to test the two beam side looking search system that was designed for the Bathyscaphe, Trieste. It gave excellent signals from a barge at 1000+ feet away.

Boomer design - small size for geophysical research.



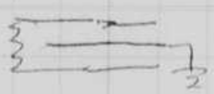




Grass amplifier Model ~~5~~ P5A,
Ser No. ~~F100B8~~
F190R8

Push pull output to type 503 oscillograph.
1 cyc – 30 kc limits on grass amp,
28000 gain 0 db atten.

Output noise 0.2 volts peak to peak
Input



180 ohms (meas 200 on ohmmeter)

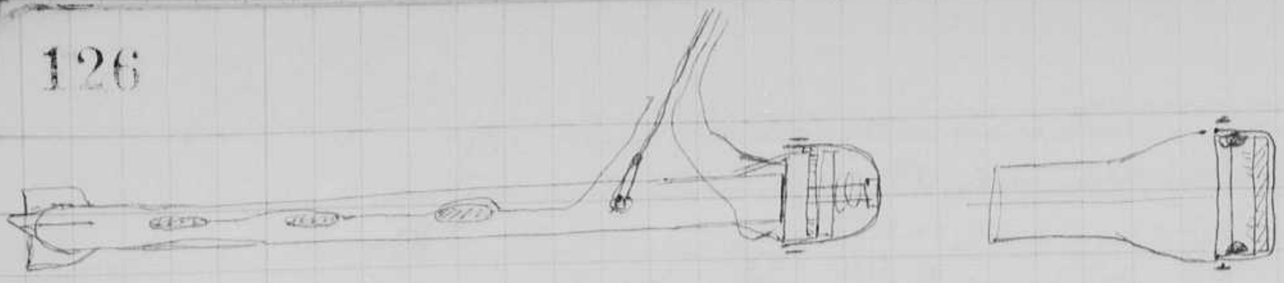
∞ ohms about same except for lower freqs.

Noted 40 volts output when cable hit. overloads into single ended input
less on push pull.
28000 gain

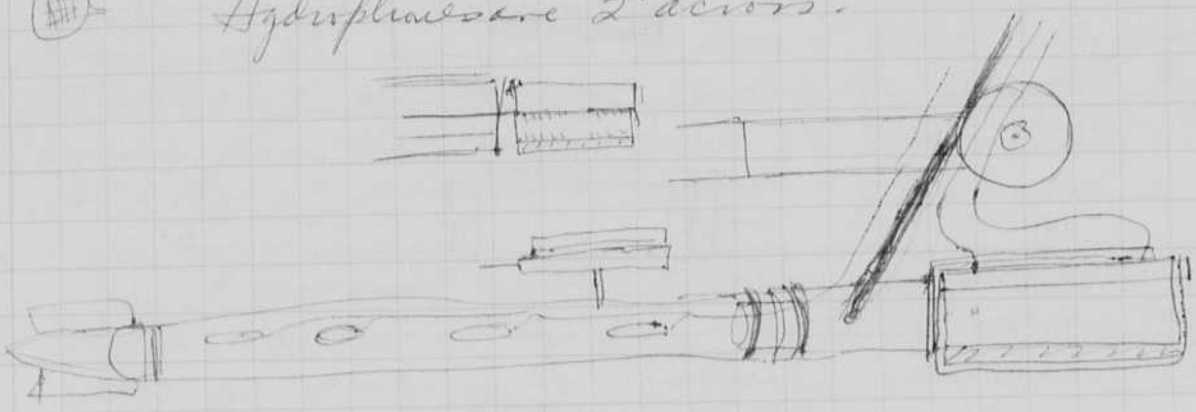
$\frac{40}{28000} = \frac{1}{600}$ volt from cable due to microphonics.
600

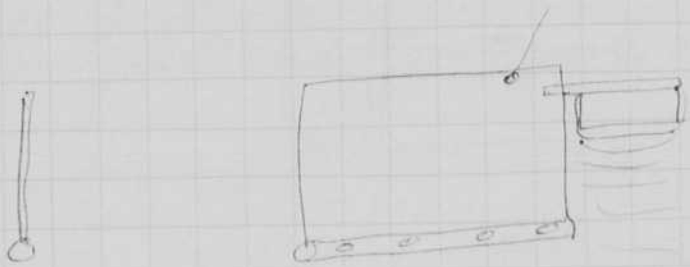
6L7U same output I

8 ball Hydrophone
Watchcase both tried, slightly better 8 ball best. Maybe
more pickups (60 cyc) in the watch case.



Hydroplanes are 2" across.





1/4" plate

$L = 336\,uh$
$Q = 2.35$
$R = 0.28$
} #1 5000 WS Bormer coil

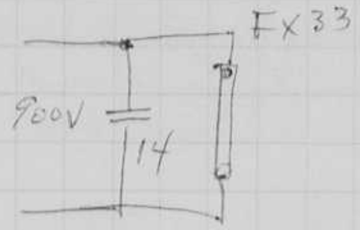
200' cable 0.1 ohms each length.

July 15 1965

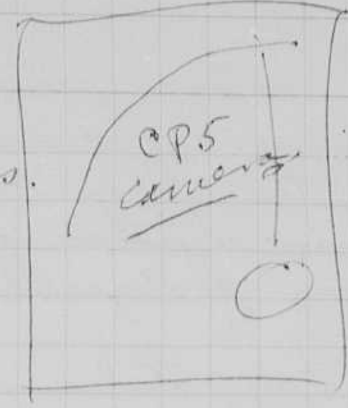
was by Colin Holdway.

June 12 1963 4-405
HEEdgerton
William Davidson
Geoffrey Foster

#1



Blue filter 2" lens f16



28 pictures
3 synch
1 to 1 mag.
19 mm diam.
Speed of 2 KCS.

Plus X film
CP ~~7504~~
C.P. 5904 opt System

frame rate
$1.6 \times 10^6 \times \frac{1}{2.75}$
$= 0.58 \times 10^6$ f.p.s.

---

2 2000V 1400 mfd
FX33

Blue filter
f 16.

1.6×10^6 fps.
1/2 µs.
15%

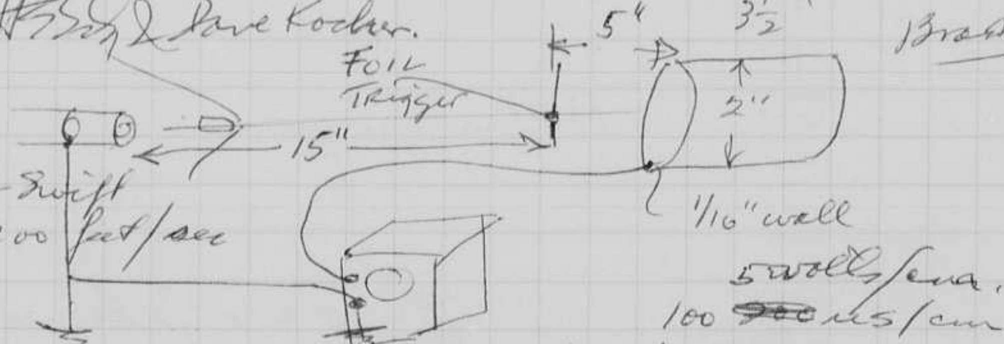
#3 Strobe High intensity
FX6A

f 8
no filter.

1.5×10^6
1/2 µs. 94 p.

June 15, 1963 HEEdg & Dave Kocher.

Brass cylinder



4.2 ft/ms.
.004 ft/µs.
.048 inches/µs.
.48" for 10 µs.
4.8" for 100 µs
9.6" for 200 µs.

Experiment #1 1000 µs total volts less than 1
only 60 cycle signal
This was NG probably due to pick up
from the coil that triggers the gun.

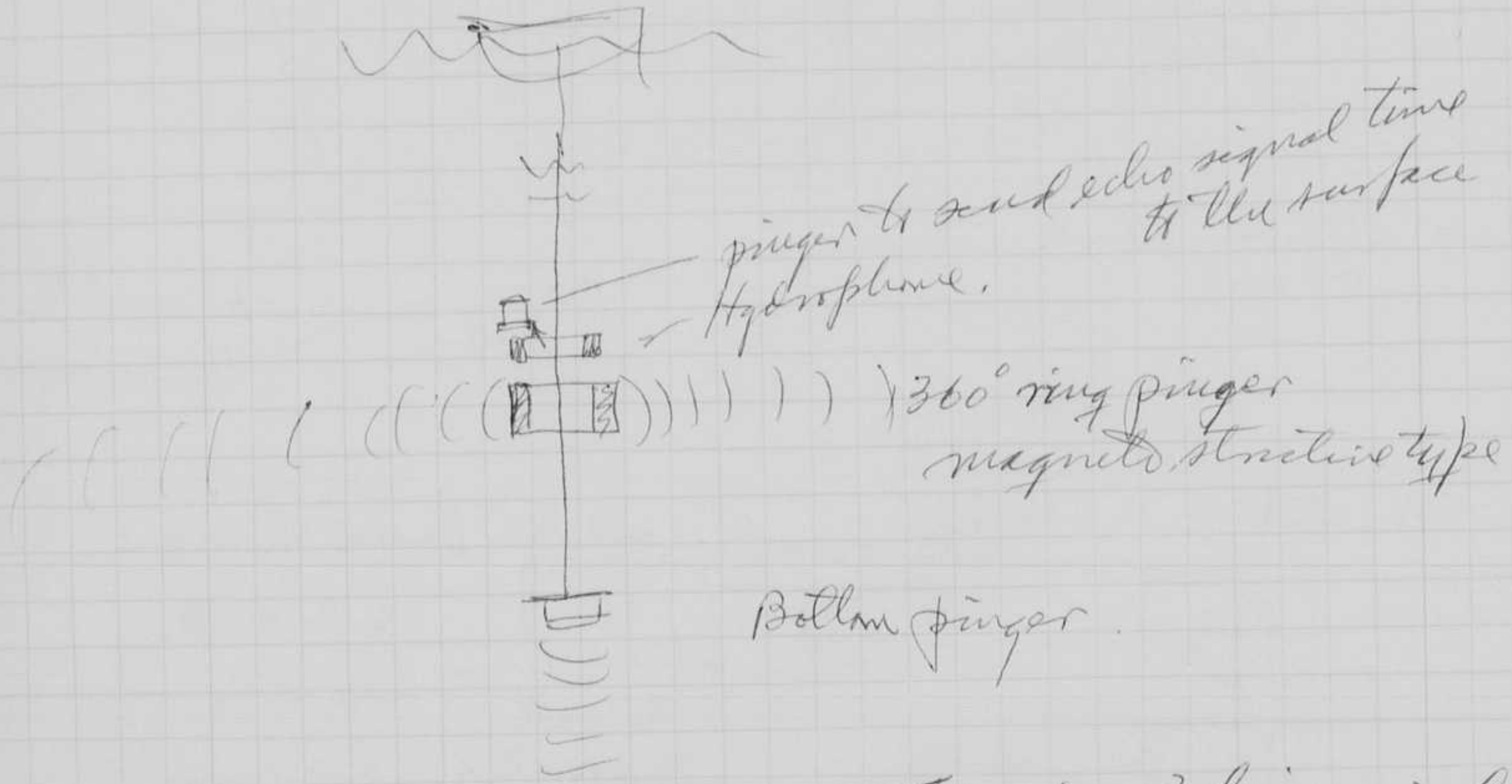
Exp #2 Same result less than 0.1 volt.

Trigger did not cause pickup.

June 19, 1963
Harold Edgerton

Ed Fink was here yesterday. We spent a lot of time discussing the search for the Thresher. Fink is on a committee appointed by Stephan (navy) for developing systems of search, location, and recovery of objects in the sea.

I suggested a system of pingers to enable the ship crew to know where their subject was. The camera would carry a side pinger of 360° signal output as well as the bottom pinger. Then the back echo would be amplified and sent to the surface as another signal.



1. Height — There is a 3 dimensional problem. The Bottom pinger solves the z axis location.

2. Range — The ring transducer gives the range.

3. angle, — The angle is found by the ship operator through trial and error.

June 22, 1963 Sat

~~HE~~ Edg, A Vernon MacRoberts.

Small Boomer

Conversion of Boomer to smaller size during week.
14 mfd 28 mfd or 56 mfd.

Brass amplifier <u>P5A</u> <u>F 190 R 8</u> 28,000 gain output 1 volt p to p

June 29 1963.
Harold Edgerton

$\boxed{\text{Cont July 15 '63}}$

Tues June 24 at WHOI with ~~Graham~~ Giese ~~at Wellfleet~~ in Green Dory. Transverse in Bay west of Fish and Wild life Service. Shows some bottom layering. Great Harbor.

Two runs were made. We could see some layers 5 to 10 feet down in some places.

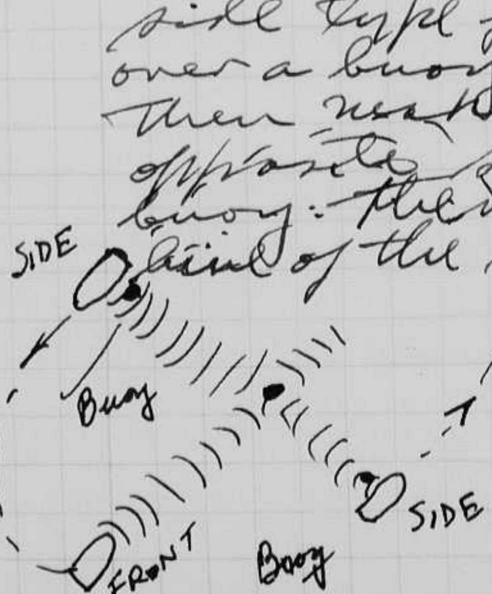
We took the dory to Wellfleet on June 25 and made a run out of the harbor across NW the sand bar. Noticed channel in harbor. Some layering 5 feet to 10 feet could be seen in the sand in some places. Masses of sea weed stopped some of the signals.

June 30 Lt WHOI on Atlantis at 1800 with John Yules and Fritz Hess. Floyd Breslau. Retd on Wed July 3 at 1600. We tested deep 500 WS boomer.

July 4 left for Phil for Under Water Conv.

July 10 left on Asterias for Narragansett Bay. 3 hours at Cuttyhunk island on west side looking for Vineyard light ship. July 11 in Narra-Bay. Interesting sub bottom south of Quonset air field. Wreck north east of Fox island, 1000 feet ±.

July 13. In Boston Harbor and Charles river with John Yules and Wilson Lamb. Scanned with front and side sonar also down in conventional manner. The side and front techniques are very interesting to use. I prefer the side type ~~front~~ for search. Then leave over a buoy at a given distance. Then make another run from the opposite side and leave another buoy. Then use front scan along the line of the buoys.



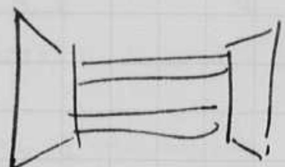
July 14 with Bradford ~~Luther~~ Luther Fairhaven Mass and John Yules on wreck hunt with Pinger.

We planned to look for the Vineyard Haven but the fog was bad, so we went to the cape cod canal east end and looked for ~~the~~ the Pottstown. After looking at this wreck with the sonar we went to another ~~site~~ site south. the sonar located a big rock on the bottom. Brad had sent a diver down to look at this before.

John Yules left on the Ocean Pearl for Gulf of Maine on Johnson's ship to look for the effect of the eclipse of the sun on July 20 in Maine on the D.S.L. (Deep scattering layer) the gulf of maine is not too deep so the scattering layer may not be normal!

July 18 1963. Visit to Harris Trans Co Rt 1 South Harold Farr. Ted Mapes Robt Bonner (Boss). Discussed pingers especially 8 KC model.

Harris Co will make me a simple model for test. 8 KC using standard ends and nickel strip. There will be no permanent magnet used.

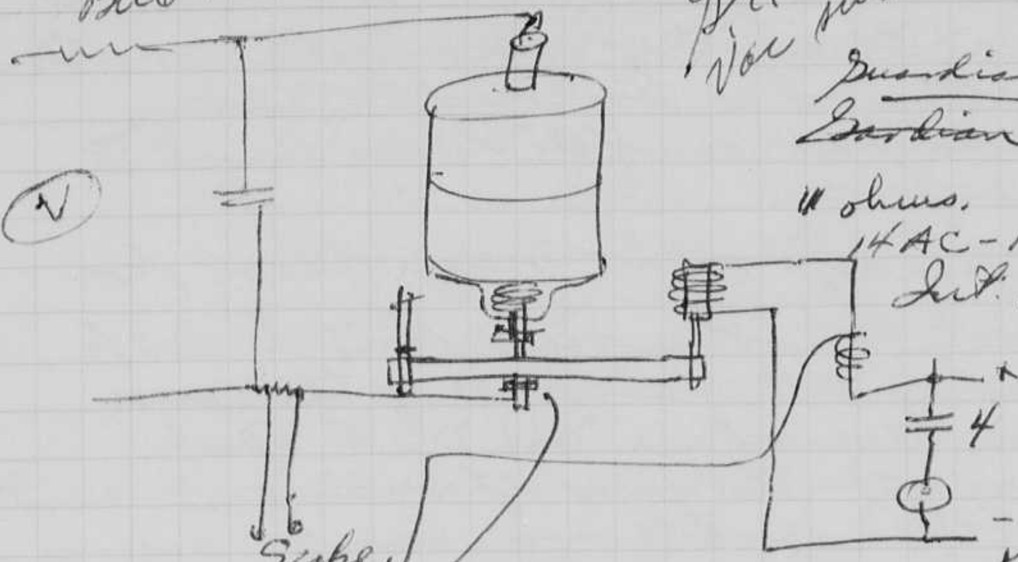


The faces are about 4 x 4".

Bob Evans not there.

July 19 1963
H. Edgerton
Bill MacRoberts.

Vacuum Switch D.C.



V	Delay	mfd	Load.		Imax.
1000	7.8 ms.	4	1 mfd	1000 v	~~[illegible]~~ volt
	7.0	4	"	2000	1.6 x 1 volts .00275
	7.5	4	"	1000	.8 volts.
	6.5-7			3	2.4
Cont	6-6.5			4	3.2

July 22 1963

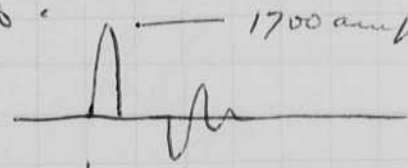
Load 1000 volts 100 mfd into Boomer Double coil + 2 plates in air.

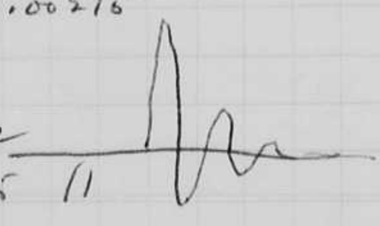
The contactor (Vac) stuck on the first try.
Then the spacing was increased by 1/32 inch.
Worked ok.

16x5

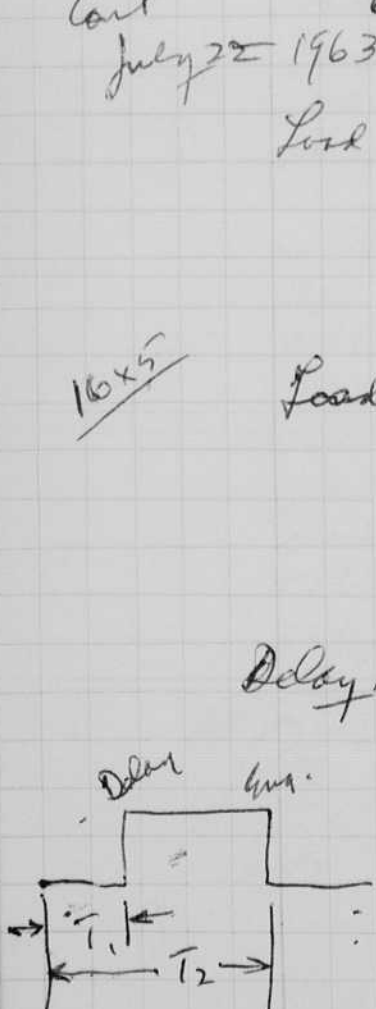
~~Load~~ increased to 4000 volts 500 w.s. $500 = \frac{C\,4000^2}{2}$ $C = \frac{1000}{16.00} \times 10^{-6}$

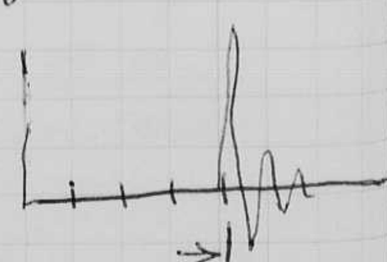
works well. — 1700 amps. $\frac{5 \text{ volts}}{.00275} =$ 80 mfd





	T_1					T_2		
Delay.	4.4	4.1	4.3	ms.	End.	10	11.5	11
	3.	3.	4.4			11	11	12
	4.6	4.1	4.4			10	11.5	10
	4.4	3.8	4.2			11.5	12.+	11.5
	4.6	3.8	4.3			11	11.5	12
	4.5	3.8	4.2			12	10	12
	4.2	4.1	3.8			12	10	10
	4.2	4.2	4.2			10.5	11	12

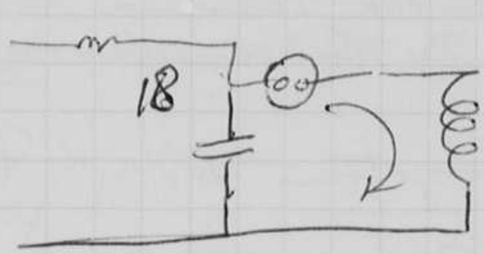


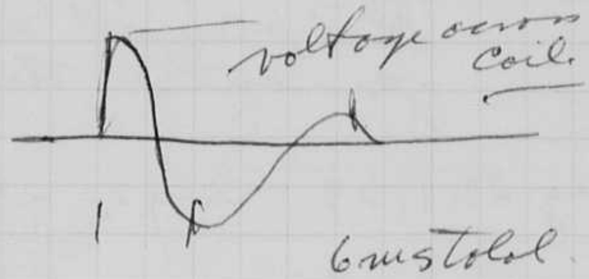


Cap increased to 160 mfd 4KV. opened travel.
30 flashes into coil and plate trans
Stuck.
Spring tension increased 1 turn.

Pull adjusted to 18 mfd 900 volts into magnet
1/16 inch throw. (We had contact stick with 1/32" gap)
6 ms delay. Peak current. $3.4 \times 2 = \frac{6.8V}{.00275} =$
1 2 second interval.
Some come at 4 ms.

Bushed hole with nylon around screw, Seems to work better.
Delay now 5 ms ± 1 ms.





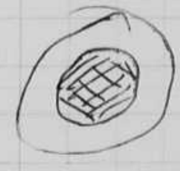
Set for 6 sec now. Switch has 4 ± .8 ms delay.
July 23 1963
Moran & McCarty Heiland minn. oscillograph.

6:20 pm Disconnected for assembly in a box for tests at Higher Energy.

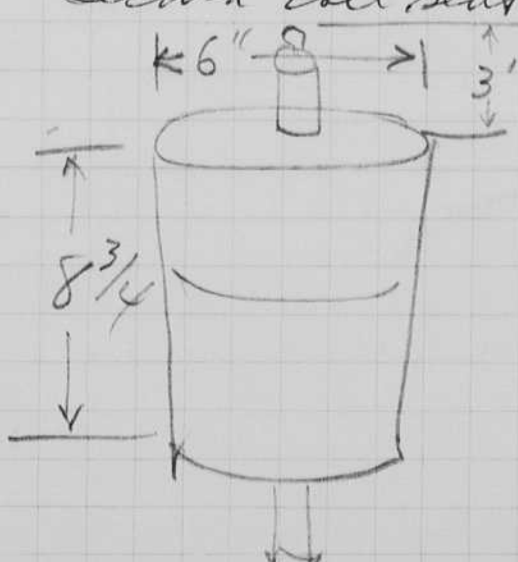
July 24 63
Finished 5000 WS Single plate Boomers

R = 2 cable
R = 2.8 coil

336 μh 2.35 Ω coil #1
47 μh 1.7 Ω cable 200 ft



Second coil sent to EG&G today
Mr. Vac. Switch



This ran all night Thurs July 25, 1962.
at 7000 WS into a single transducer.

Notebook # 27

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 132 and 133.

Item(s) now housed in accompanying folder.

$L = 336\ \mu h$

$Q = 2.35$

$R = .28$ ohms

each 200' length of cable is .1 ohms D.C.R.

$L = 336\,\mu h$

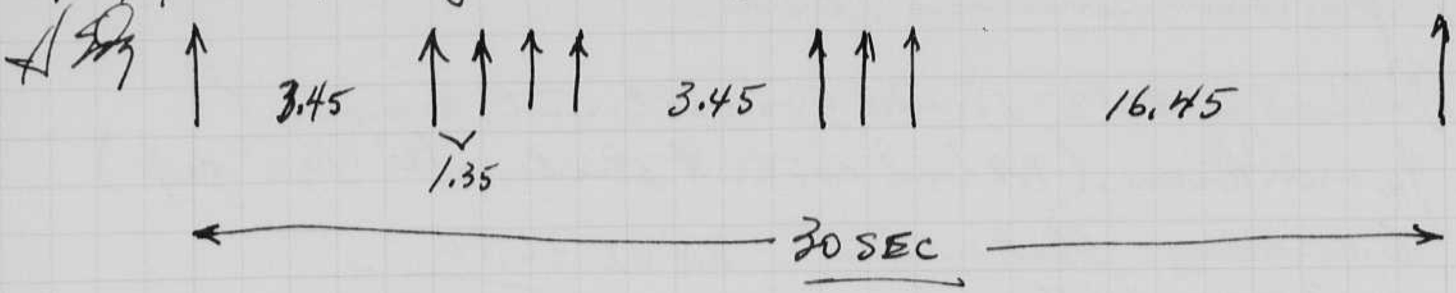
$Q = 2.35$

$R = .28$ ohms

each 200' length of cable is .1 ohms D.C.R.

Lighthouse timing

July 31, 1963 from John Doncy.



August 13, 1963

I returned yesterday at 5 pm from the west, Left Aug 1. from Boston for Los Angeles stopping at Nebraska, Aurora to see my parents. then to the Ambassador Hotel.

Aug 22 1963. Aug 21 at Kingstown with H. Payson
"Billie" John Yules.
Bill Go ?
Stan Spinks.

Voc Switch 200,000 Boom at 5000 watt sec.
Phone call from colin Holdway. B.C.G.

Aug. 28 1963 Monday.

Further tests of the Seismic Recorder of Ed Curley.
We tested this at Narragansett bay out of Kingstown Harbor
on Fri Aug 25 on the Billy (Stan Spinks capt)
Wm Dillon - R.I. Univ Dave Owen W.H.O.I.
H. Payson. Ed Curley H. Edgerton aboard.

Aug. 28, 1963.
H. Edgerton.

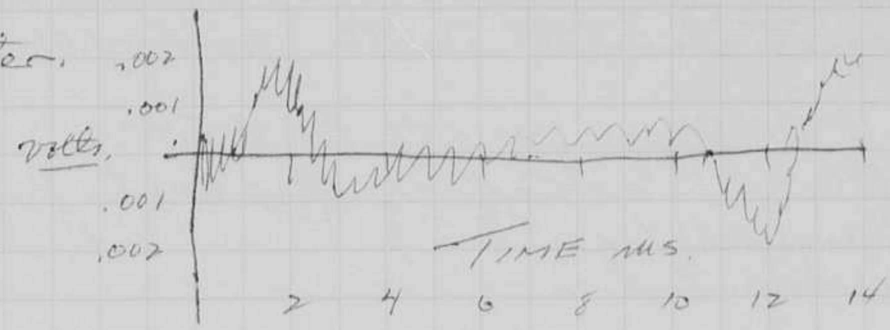
Small Boomer tests

Jameson for ultrasonics

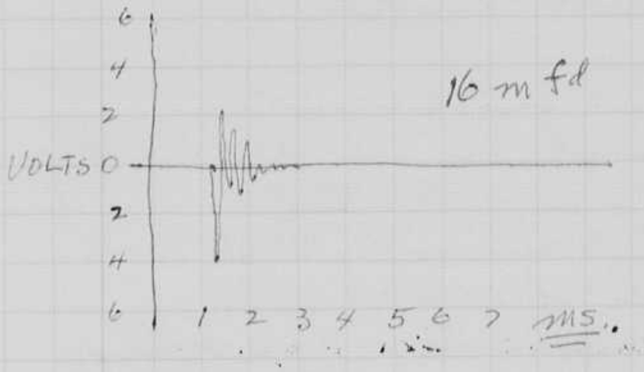
M.I.T. Sailing pavillion. ~~—~~ 16, 32, & 64 mfd at 4 KV at 1 per sec.

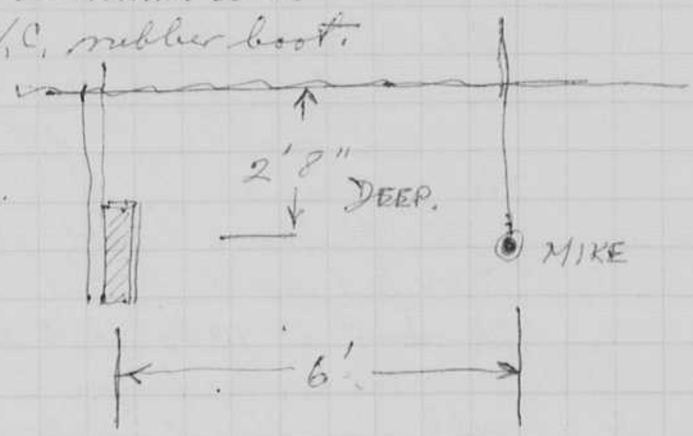
Noise in Water.
508 Scope.

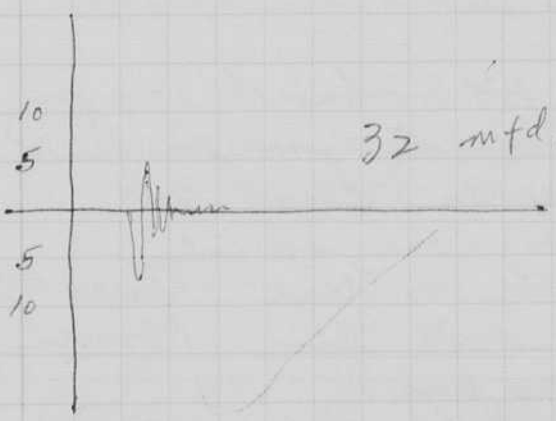
Clevelite A224
89.7 db.

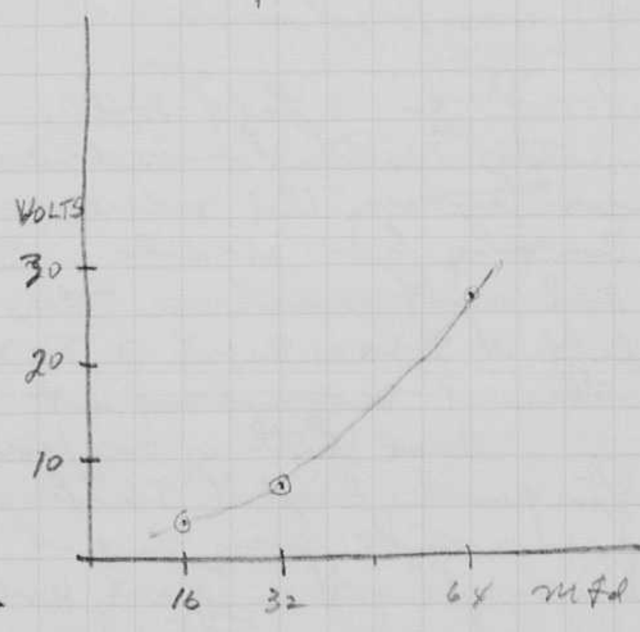


1/4" copper strip 1/8" aluminum disc
P.V.C. rubber boot.









 H. Edgerton
Sept 4, 1963

Aug 31? or Wed? this with Ken Emery at WHOI working over Oyster Pond with the Pinger in a Row Boat. Max depth about 20 feet. Many rocks - some penetration in south part of the lake.

Friday Aug 29 with Brad Luther on AVS 83 Wainwright / Lt Cmdr. McCaffrey ~~to~~ look for the Vineyard light ship. Found it but fog prevented a good fix.

Sat - Sunday Sept. 1 on Charles River with Small Boomer and Pinger. Excellent records with Ed Curley's new 11" Recorder. I could see the north wall all the way across the river, about 2000 feet. Scott Graham went along to help.

On Monday, Sept 2 I went with Curley to Fairhaven and made records on the ASV 82 Hilgard of the Vineyard light ship. She was located 1000 feet west of the charted position on C&GS 1210. We used a 1200 foot scale for the search.

We looked for another wreck at a place off Gay Head without obtaining a contact.

Sept. 13, Friday. Left for W.H.O.I. Sept 5 about 330 pm with Scott Graham and equipment for testing the new recorder ~~that~~ Ed Curley has made. Storm on so we did not sail on the 6th either. Finally left at 230 on Sept 7 Sat. out Sun - Mon returned Tuesday at 330 pm.

Brad Luther reports finding of Vineyard light ship with help of chart from side ping chart. (Sept 9 dive.) He brought up a port hole.

I was in Fairhaven to see Luther on Sept 12, also saw McCaffery on the Wainwright C&GS. He wants to look for the remains of the Texas tower off Long Island. Fire Island anchorage 30 fathoms H_2O Babylon Bay shore $\boxed{\text{Sept 24 Oct 5}}$

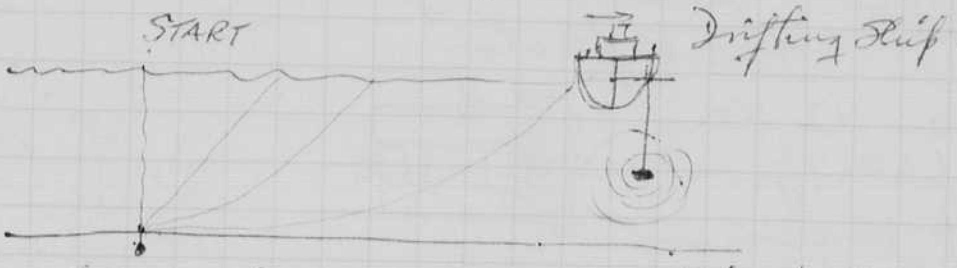
Sept 14 63 Philippe Cousteau arrived to enter WPI on the 16

Sept 15 1963
[signature]

Several weeks ago I lowered an "Oyster" electric hydrophone into the bottom of the Charles River in some 40 feet of water. The signals from a Boomer (100 ws) 8" disk were being received as the hydrophone was lowered. At the bottom, the character of the received signal suddenly changed. I suppose the hydrophone had penetrated the layer of mud at the bottom and in doing so, the higher frequency sound was filtered out of the signal.

Then I allowed the ship to drift slowly with the wind. The various signals changed slightly in arrival time indicating that some refraction was being experienced.

Yesterday I obtained an 8 ball hydrophone from Van Reenan of E.G.G. and attached to it about 150' of shielded cable. This will be used for another series of tests in the Charles River.



The next experiment would be to lower the transducer into the bottom so that it penetrates the thin mud layer.

Eventually a radio link would be useful from the hydrophone position to the ship.

Van Reenan is especially interested in this experiment for shallow water covered areas.

Side pinger Wayne Kearsley and Ed Curley hooked up a separate Edo transducer as a receiving hydrophone for the side pinger probe. The performance was striking! I guess that 3 or maybe 4 times as much distance was obtained in air. This should be very good in water.

I plan to use this in New York at the MIT display at the Engineers Bldg when the new N.Y. Club opens. Then maybe Klein will take it to Long Island (Fire Island) to meet the Wainwright.

138 Sept 30 1963

~~Harold Edgerton~~

T.V. tape made ~~Thursday~~ Friday Sept 20. at noon with Fitch WHDH Dateline Boston. Freshman at M.I.T. in afternoon about 3pm.

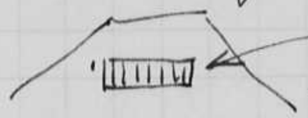
Regis Sept 23. First Classes Sept 24

N.Y. Sept 26 in afternoon for opening of the M.I.T. Exhibit. M. Klein also went to demonstrate the new Recorder. I sent the compass and binicall from the Vineyard Light-ship to New York for the exhibit.

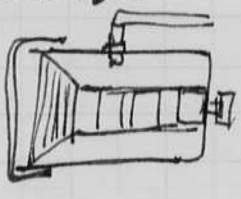
Met with ~~Ebel~~ Noel McLean at Edo on Friday morning.

Discussed transducers.

6.5 Kcyc. cylinder for penetration



Also 12 Kc.
oil filled for deep pressure.



Hannan Color Prod. Inc
605 Lincoln Road
Miami Beach
Florida
Je: 8-2923

Oct 5 1963

Nature photo equipment. Walter Kindler was in yesterday with Joyce Giorione (Educational Council MIT) to talk about nature photography equipment.

He wants 2 meter at f16 lighting for Kod II Portable - 2 lamps. Exposure time 100 us.

$DA = \cancel{.2}\,6 \times 16 = \cancel{32}\,96 = \sqrt{(BCPS)\ \tfrac{32}{32}}$ = 32, 32, 64, 64

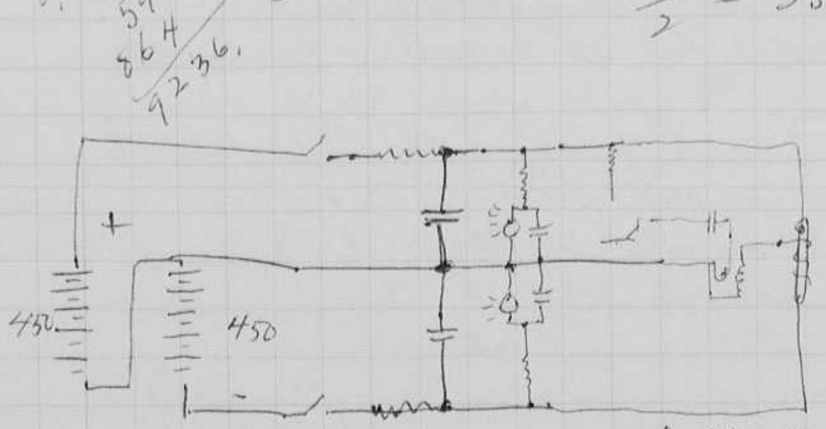
BCPS = ~~700~~ (9240)

Lit M = 10 CPS = 70

$\eta = 2$ wattsec = 35.

16
6 /
96
96 /
576
864 /
9236.

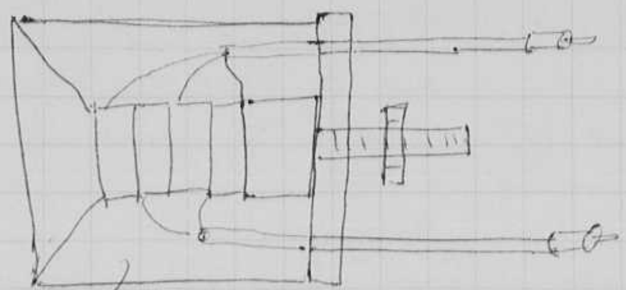
500 volts $\frac{CE^2}{2} = 35$ $C = \frac{70}{.25 \times 10^{6}} = 280 \times 10^{-6}$



515 volt batts.

2 neon bulbs to show that both halves are ok.

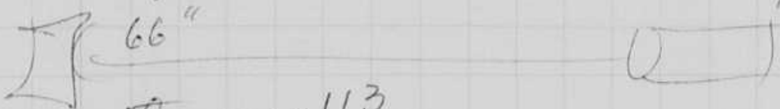
P.V.C. plate



Plastic filled, Rubber type that remains soft when cold.

Oct 5 1963

Test of U.W. unit for Carlton Ray.



meter no. 113.

A.R. type.

H.E. Edgerton

Philippe Cousteau

$\frac{515'}{~~478'~~} = \frac{30^2}{~~27~~}$ on chg time

	#1	$67 \times \left(\frac{66}{12}\right)^2 = 30^2$	2000 ~~3000~~		30 sec + ch
	#2	65	= 1960 ~~1435~~		30 sec +
71%	#3	48	= 1450 ~~1060~~		5 chg.
30 degrees		22	= 660 ~~440~~		30 sec +
15 "		36	1080 = BCPS	1080 ~~700~~	30 sec
zero "		60	= 1800 ~~1320~~		30 sec

Tested with plus x in air and in H_2O

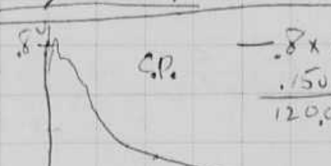
Focus ok as marked.

Lamp works fine.

U.S. Aquarium Coney Island Carlton Ray. CO.6.8500.

Manhattan " " OR.7.0692

250 mfd 450 V Sprague FX33 at 2 ft. $32\frac{1}{4} \frac{25}{~~32~~}^2 \times 2^2 = 128$ BCPS.

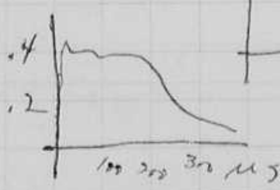


$-.8 \times 10^6$ cp.

$.150 \times 10^6$

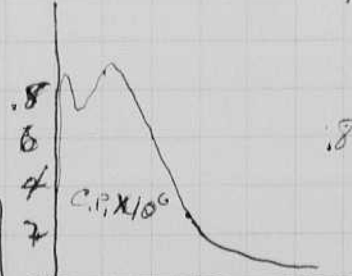
120,0 c.p.s ✓

2x 250 mfd 450 V Sprague FX33 at 300 volts with Scope.



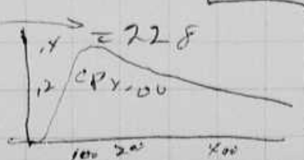
500 mfd 400 V $55 \times 2^2 = 220$ BCPS
$\frac{4}{520}$

450 $72\frac{}{4}$ = 288 BCPS



$.8 \times 300 = 240$ c.p.s. Duration 300 μs

500 450 with FT-120 for check $\frac{57 \times 4}{8} = 228$



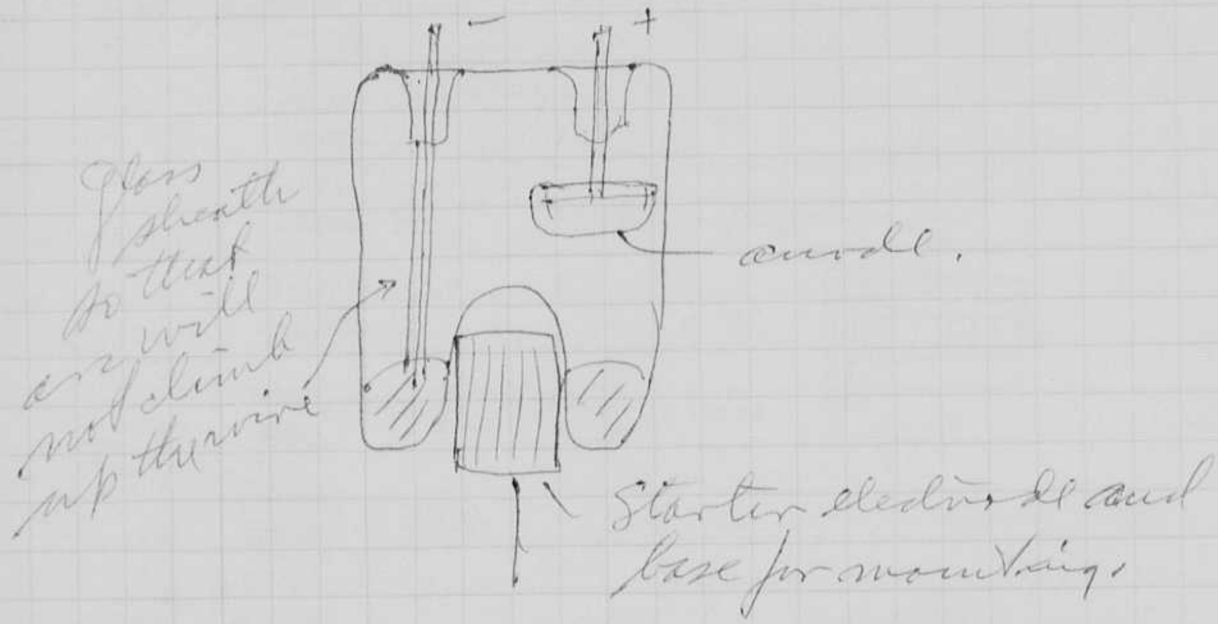
new FX-37 $67\frac{}{4}$ 268 BCPS.

 Cont Oct 6 1963

Harold Edgerton. Improved mercury switch of the capacitron triggered type.

Present mercury control tubes have problems with sparks over to the cathode. Also the tubes are difficult to mount because of the electrodes.

I propose that we use a mercury trigger tube with the electrodes, except the starting band at the bottom. A sketch shows what I have in mind.



Oct 9 1963. EG&G catalog discussed with McCarthy.
Strobe line discussed with Jim Hern.
Saw photos being taken of Sound House.

Yesterday Frank Scalli and Brad Luther went with the pool for me to test the calypso camera and flash.

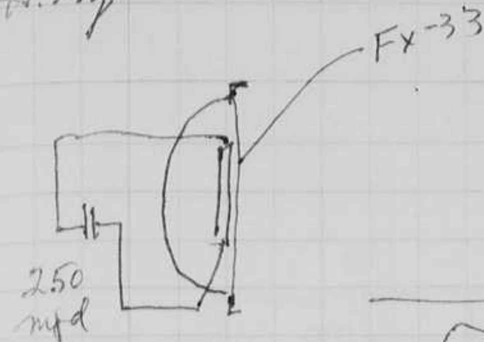
Sensitivity of flash with L-7 G.E. light trigger.

140,000 c.p. peak at 3 ft.

$\frac{140,000}{3^2}$ = 14,000 lumens/ft² 1 microsecond.

Oct 10 1963 4-405
H. E. Edgerton

Radio. Bob Sanders. 3161 Baker House



		GR no 113.	D.	BCPS.
450 V	250 mf.	115 x 2 230	3+	
450	250	180 x 2	3'	
450	250	185 x 2	3'.	3240 BCPS

180
9
1620
2
3240.

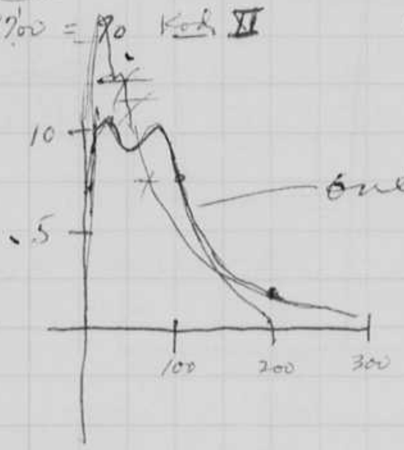
2 lamps. $DA = \sqrt{6400 \frac{25}{25}} = 75$

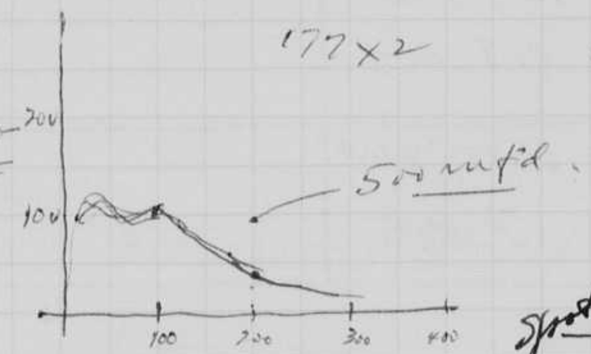
$f = \frac{75}{3} = 25$

450 V	500	200 x 4	3'	
450 -	500 -	82 x 4	5'	
450	500	87 x 4	5'	8700
450	500	165 x 2		
		177 x 2	5'	

one lamp 2 cap.

$DA = \sqrt{8700} = 90$ Kod. XX





Photos of Moscow Circus Oct 12 '63 multiflash. 2 Reflectors 25 mfd 30 ft at f 6.
Spot.

Oct. 24, 1963 Thurs. night
4 lamps similiar to FX-33 above but with 1" long gaps instead of 1½" were delivered today from EG&G.

Oct 25 1963 Fri Cont.

Pickup #6
Square Scale P.S.

	C	V	x10⁶ C.P.	μs Dur	
1" Flash Lamp.	10 μ	1000	8	15.	
	10	500	1.5	15	
	40	500	6	30	
1½ FX-33	40	500	3	3.5	Longer flash?
	100	500	10.5	50 ±	
	250 e	450	11.5	160	
1"	250 e	450	15.3	130	
	"	"	15.5	120	
	"	"	40.0	120	in U.W. Reflector. Diffuse
FX-33 1½	"	"	60.	120	in 5½" Reflector

2.1 x 5 / 106 2.3 5 / 11.5

 Oct 19 1963 Harold Edgerton

FX6A in square unit.

Light out put.
"Slow" Scale

C	0		100	
1/4	.019 x 10^6 C.P. 3 us		.021 x 10^6	Goes up
1 1/4	.05 x 10^6 4.2 us		.08 x 10^6	Light goes up.
4 1/4	.09 x 10^6 6.8 us			Goes down
5 1/4	0.115 x 10^6 7 us			

		C	V	#6 Light x10^6 cp.	Dur.	no ~~reflector~~
Cont fm page 141	1" gap	250	450	1.5V	6'4"	

$\frac{60}{1.5} = 40$ Thus the reflector factor is about ~~20~~ 40

$\frac{1200}{7200}$ BCPS = ~~[illegible]~~ for 5 1/2" reflector. Seems high Blame on filter.

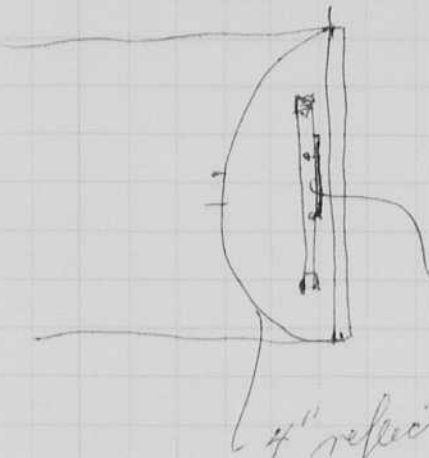
Light meter 113.

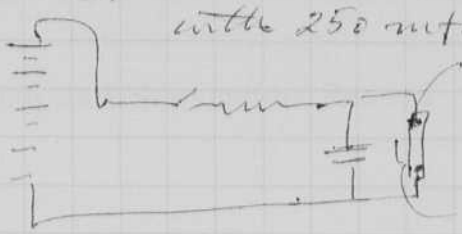
Bare 1" tube 250 uf 450 V	~~2~~ ft	25 =	$2^2 \times 25 = 100$ HCPS	Ref factor = 36
Same with Reflector.	6'	100	36 x 100 = 3600	
500 mfd 450V	6'	110 x 2	36 x 220 $\frac{720}{\frac{220}{7920.0}}$ = 7920 BCPS	

Oct 28 1963
H. Edgerton

J. Y. Cousteau – Simone – Philippe ~~were~~ here Sat & Sunday.

Bird unit. – Same ~~as~~ as under-water but with 250 mfd instead of 500.





1" gap xenon lamp.

4" reflector Amesbury metal Products.

Oct 31 1963
H. Edgerton

Bat unit. 3 lamps. FX-33 $1\frac{1}{2}$" xenon lamps.

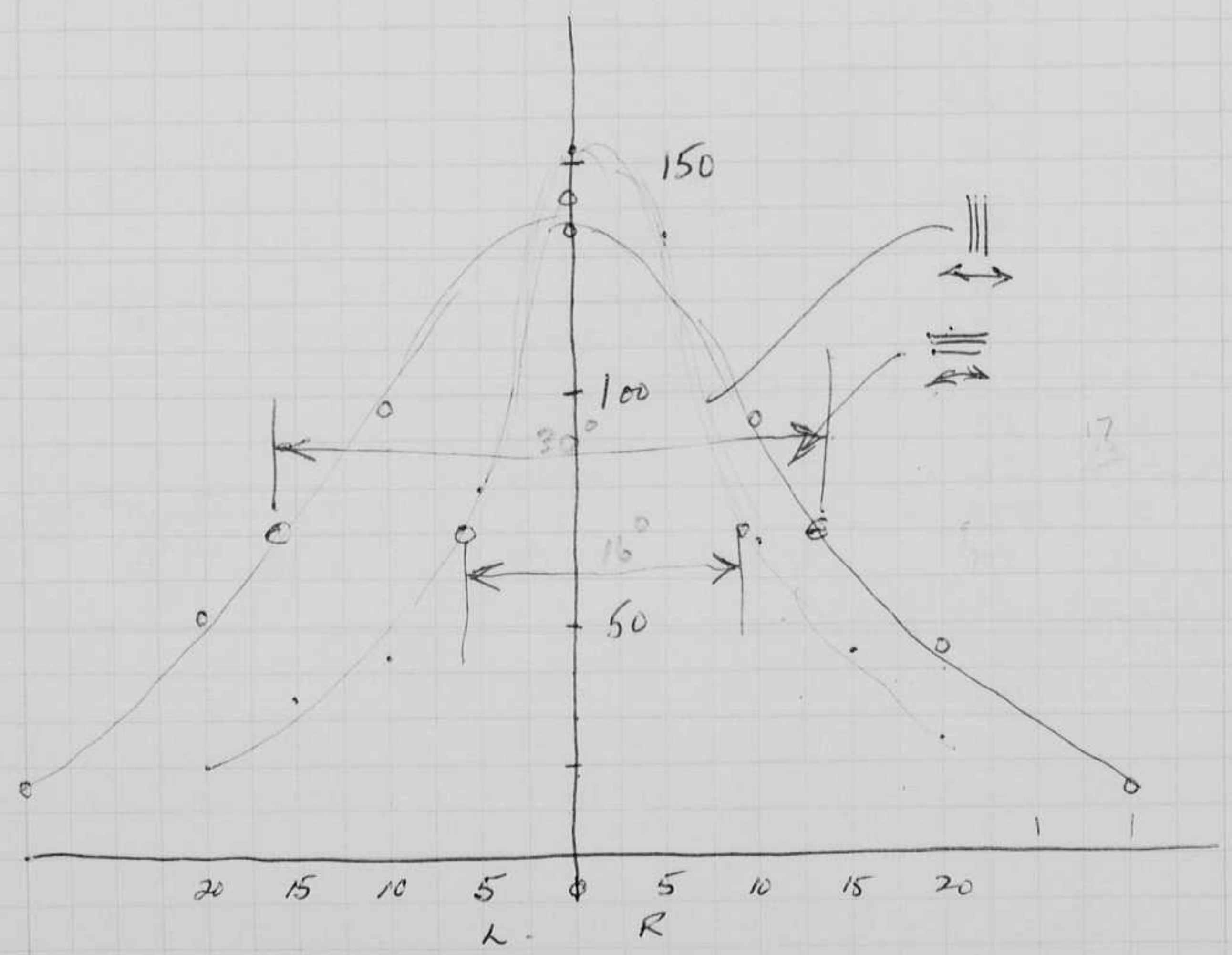
D	angle	L	D^2L BCPS.
5'	0	130	3250
		143	
		132	
20 Sec.		127	
30		132	
15		110	
15		125	
10		98	
15		105	
30		142	
30	10°R	94	
30	20°R	43	
	30°R	13	
	0°	137	
	10°L	97	
	20°L	51	
	30°L	16	
	0	145	

3 FX-33 in 4" Spec Ref with 2-250 mfd in Series on each lamp.

 Bat unit

3 FX-33 lamps in parallel each with $\frac{250}{2}$ mfd at 800 volts.

Time	Angle	L	D	$L.D^2$
0 +	0	157	25	
30 sec	0	153	25	
	10'R	69		
	20R	25		
	5 R	135		
	10 R	68		
	15 R	43		
	5 L	80		
	10 L	43		
	15 L	33		
	20 L	20.		



11/1/63 Modified Calypso Unit 2 P.M.

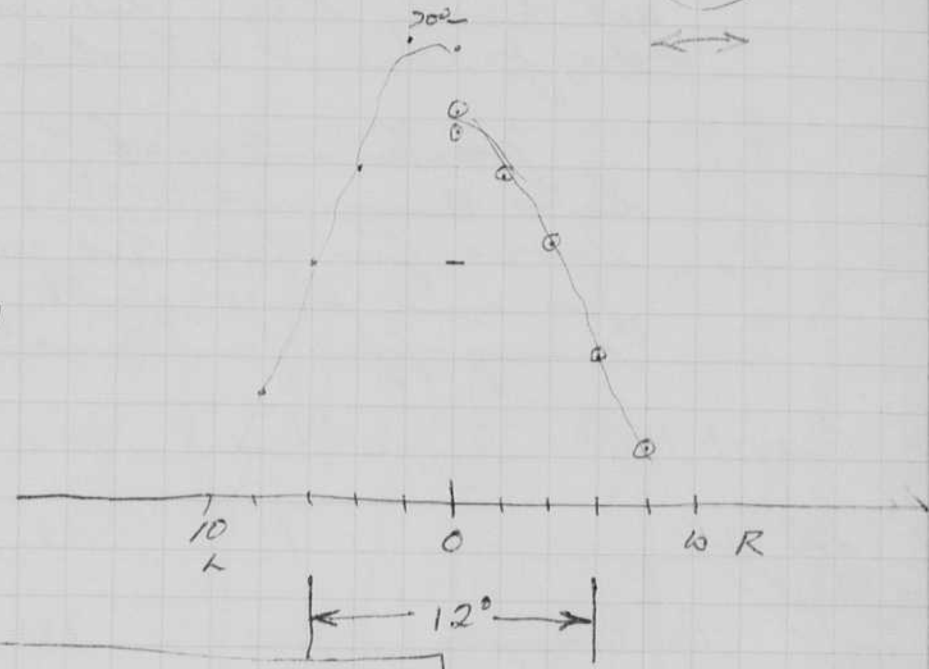
Has 1" gap tube in Bat unit Reflector

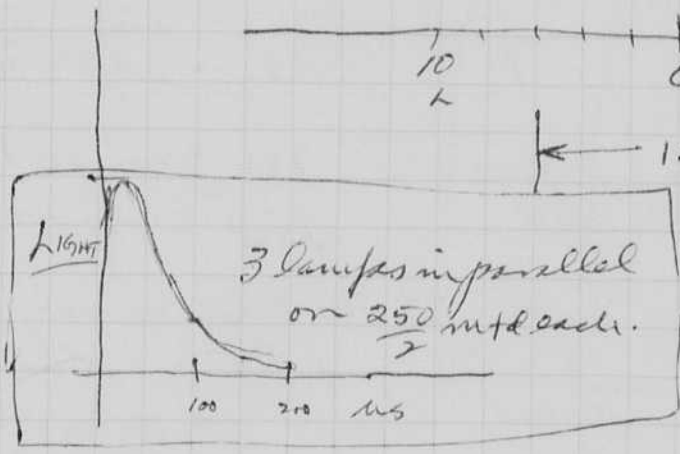
Time	Angle	L	D	BCPS
minutes	0	190	7'	9210
	2°L	194	7	
	4°L	140		
10-15 sec.	6°L	100		
,,	8°L	45		
,,	0	154		
	2 R	138		
,,	4 R	108		
,,	6 R	61		
,,	8 R	23		
	0°	161		
,,	4°L	126		
	6°L	89		
,,	8°L	33		
	2°L	168		
,,	0°	165		
	2°R	136		
,,	4°R	105		
,,	6°R	56		
,,	8°R	24		
,,	0°	153		

one - 1" Gap lamp. 250 mfd at .

lamp axis vertical

510V Battery powered

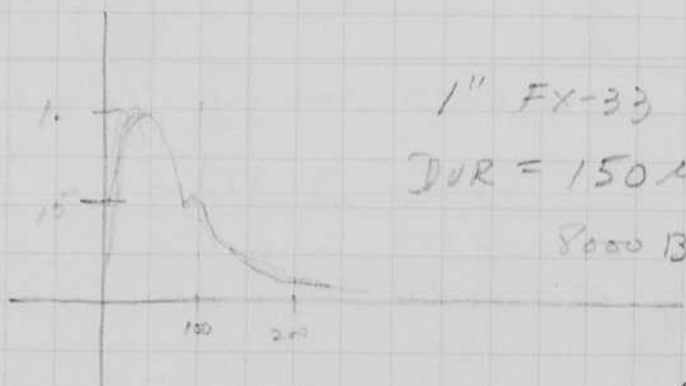




3 lamps in parallel on $\frac{250}{2}$ mfd each.

Duration about 80 µS.

3200 BCPS ?



1" FX-33 500MFD.

DUR = 150 µS.

8000 BCPS. 12°

?

165
50
8250 BCPS.

L	D	BCPS
153	$\times 7^2$	7500
142		7000
137		6700
139.		6800

1" Lamp 500 mfd 450V

150 µS

BCPS. 6800

140
50
7000

75	7^2	3670	3 $1\frac{1}{2}$ lamps with $\frac{250}{2}$ mfd each 800 V
64	7	3140	

80 µS

Notebook # 27

Filming and Separation Record

____ unmounted photograph(s)

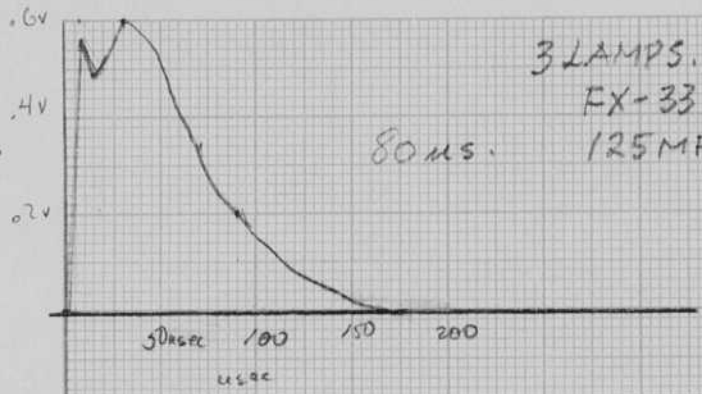
____ negative strip(s)

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

was/were filmed where originally located between page 144 and 145.

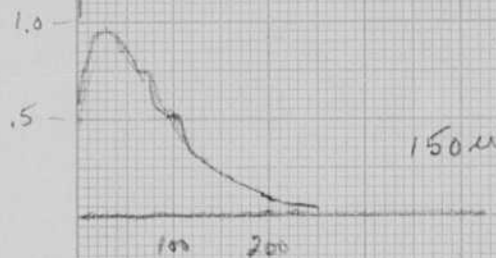
Item(s) now housed in accompanying folder.

chg time
20 secs
at 52 inches
filter of 2.0
1000Ω adj.



3 LAMPS.
FX-33
80 μs. 125 MFD 800 V (EACH).

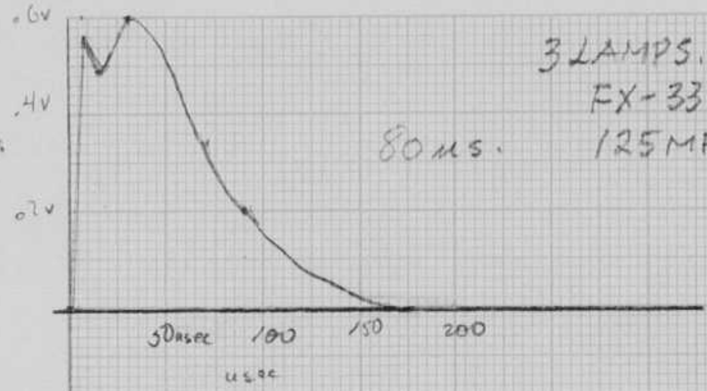
$\times 200 \times 9^2 \times \frac{1.8 \times 10^6}{100}$



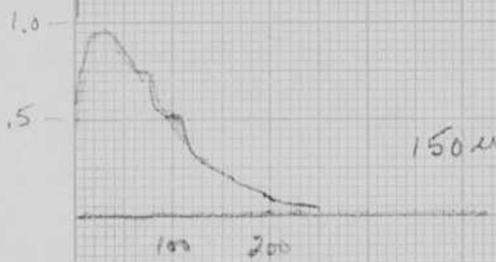
150 μs.

1" TUBE
500 mfd.
450 V

chg time
20secs
at 52 inches
filter of 2.0
1000 adj



3 LAMPS.
FX-33
80 µs. 125 MFD 800 V (EACH).



$$\times 200 \times 9^2 \times \frac{1.8 \times 10^6}{100}$$

150 µs.

1" TUBE
500 µfd.
450 V

 Nov. 4, 1963

HE Edgerton. many ballet photos (30 cal) taken yesterday. Cousteau and wife were here over the weekend.

MacKenzie was here last week to discuss the Battery supplie. I proposed a dry battery supply for the strobes to get away from the noise caused by the present strobes.

MacRobertson and I believe that 11 bats Burgess #5308 (45v each) should serve for two 200 WS flash units for one dive, with perhaps enough energy for two dives.

Nov. 6. 1963 Dry batteries 497 - 510 Hilands

491 - 240 ← 4 Bats weigh. 3# 2 oz.

?, 482 - 225 Strobe research

Prof Page Stanford Cal.

Bob Bonazolli - Sylvania DXN 3400° 16 hour. Lamp 1000 W

Samples to be sent DXW 3200 100 hour " " "

Nov. 8 1963 Tests of Mallory PF 491 ~~Bats~~ 240 volts (4 in series)

Life test of battery.

3# FX33 with $\frac{250}{2}$ mfd each on 900 V 24

Time	Voltage	flashes		
8:40 am.	940 volts.			
.41	920.	1		
8.47	910	2		
8.49	898		42338	motor trip at 1 flash per minute
56	865			
941	800		42393	$\frac{93}{38}$ 55 flashes.
10.05	795		42417	
10.19 off flashes but circuit on.	790		42431	
10.30	835		42431	
11.00	860		42431	
11.38	870		42431	
12.05	870+		42431	
12.25	875		42431	
3.15 PM	875		42431	32
5.10 P.M	875		42432	$\frac{38}{94}$ flashes.
807 am.	860	~~Start flashes 1 min rate~~		On all night 10 second intervals.
	800			
?	800		443	

	✓ 30501 Simson	counter
8.08	770	449
8.09	750	453
8.10	735	460
8.11	725	466
8.12	715	472
8.13	710	478
8.14	700	484
8.20	695	491
8.21	690	497
8.22	690	503

flashes. Page

03
43
60 60 60

flash off - Circuit on.

8.23	715	503
8.28	760	503.
34	790	

		Rest
10.00	843	503
10.01	810 / 800 (10 sec interval)	504
03±	750	516
10.17	660	598
10.18	655	603

off now for flash circuit on

10.18	680	603
10.28	745	
10.41	775	
12.12	830	603
12.17	830	
12.18 10 sec	770	606
22	710	627
23	700	633
26	690	648
12.29	660	666
30	650	674+
33	630	690
35	615	703
35+	off.	704

circuit on no flash

36	645	704	
37	680	704	
40	700	704	
12:45	720	"	Batteries slightly warm
53	735	"	Lamps show no discoloration.

3.53 + Batt each measure 200+ volts on open circuit.

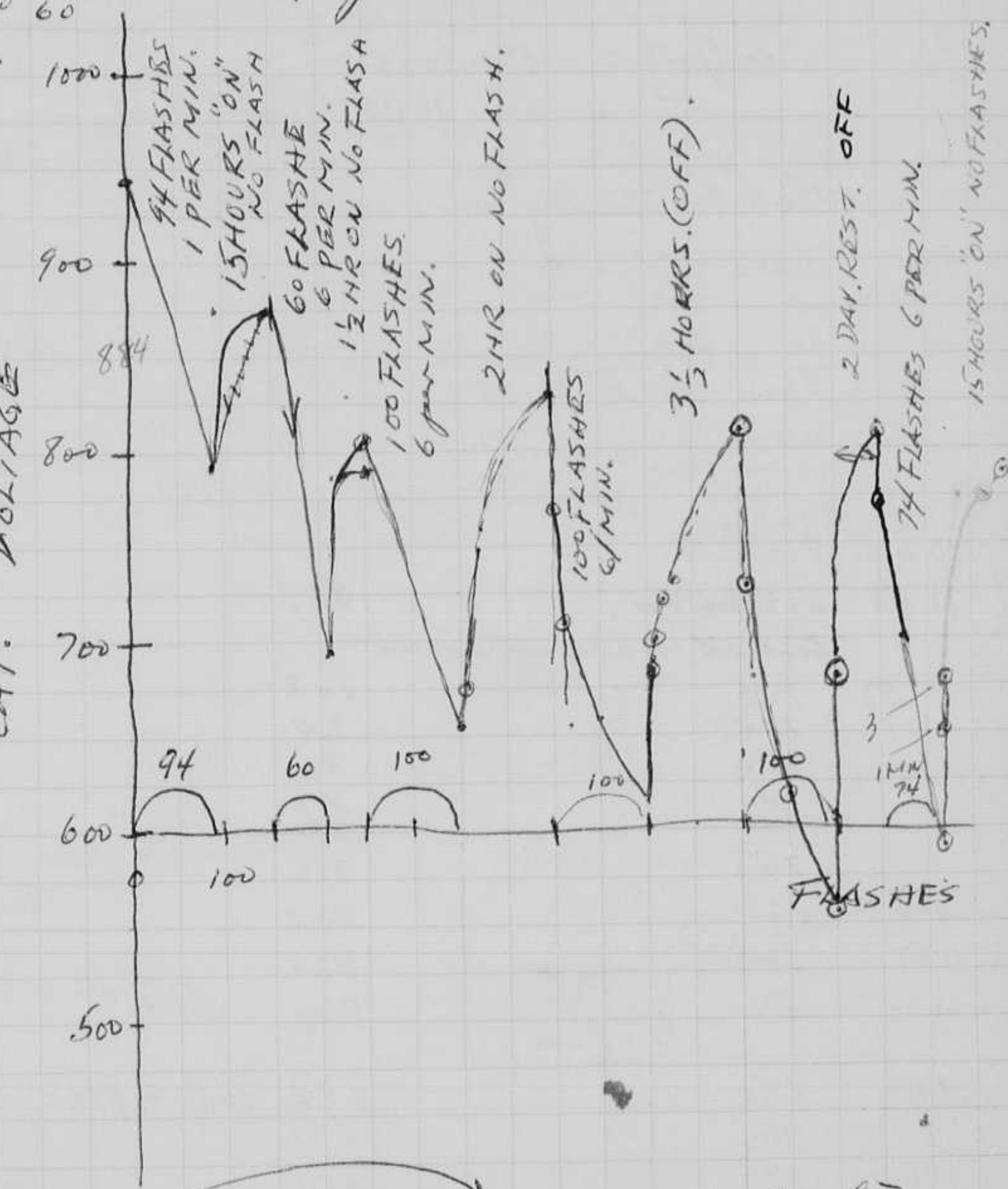
4 00	815	704	
4 01	815	705	Start at 10 sec flash rate.
4 02	730	712	
4 05	680	730	
4 10	620	759	
4 16	570	796	
4 17	560 off.	804	Flashes off circuit on

Spores from Drug growth

100 microns diam
velocity = 10 microns / 1 microsecond

Requires 1 μs light to stop motion

I loaned him a strobolac to ~~measure~~ take photos of the spores.



Time	volts	counter
4:26 pm	680	804
4:29	680	

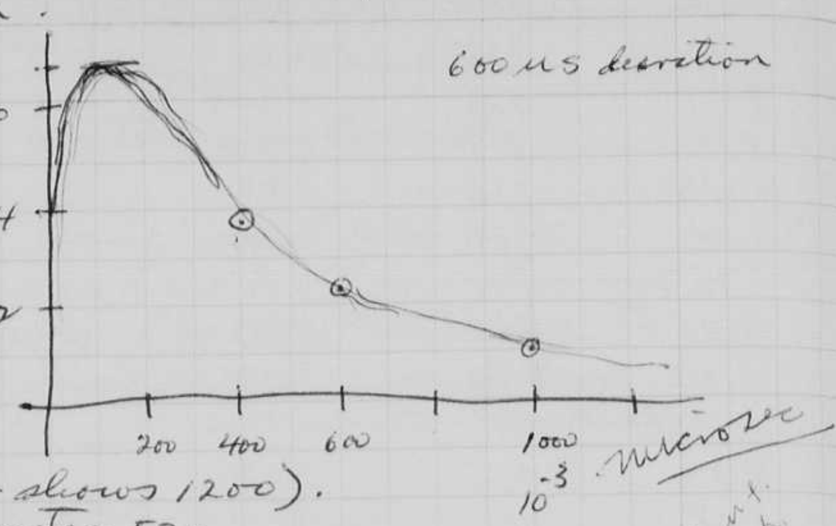
Turned off for weekend test.

Under Water Flash unit.

FX-120 [illegible] Lamp.
500 mfd 450 v

Nov 9 1963
H. E. Edgerton

Flash Duration.



D V
5 ft. $\cancel{3}$.5x2 $\cancel{65}$ 7 volts.

$= KVD^2$

$= 10^4 \, 7 \, 25 = 1,050,000$

$= 10^6$ cp.

$\frac{25}{7}$
105

Output $= 10^6 \times 600 \times 10^{-6}$

$= 600$ BCPS. (meter shows 1200).

RR meter 539.

16 mt.
.04 mt.
.64 x 10
.4 x 10
.6 x 10

Nov 11 1963 "on Standby" now reads 325 volts.

930 am 5 sec 780 volts
10 800 "
30 810 " flash (805) sec

at one minute interval.

5 sec. 700	5	680	5	690	
10 sec 760	10	770	10	760	
15 sec 800	30	775. (806)	30	790	807

Standby
10 am 810 volts.

11 52	815 volts.	807
	Start at 10 sec interval.	
		808
53	770	809
	765	
	750	810
	740	810
	740	811
	730	816
1155	720	820
11.57	700	828
1205	590	879
1206	650	880
1 40 pm	765	881
245 pm	775	881.
412	780	881
	overnight "on"	
Nov 12 '63. 745 am	790	881
Nov 14 9.10	775	881
1/2 min	730	882

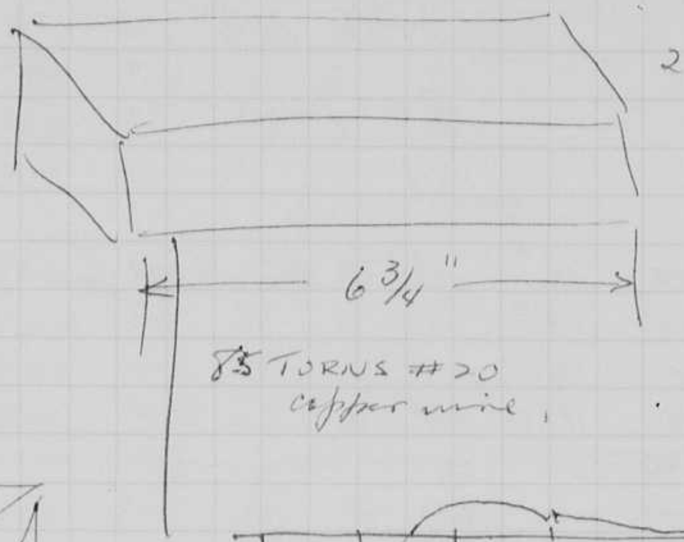
81
$\frac{7}{74}$ flashes

off flash on bat.

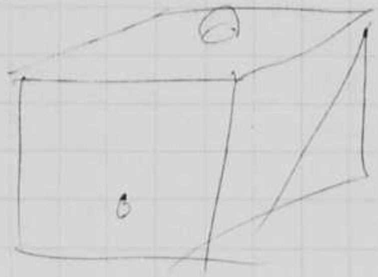
plot on
See prev page.

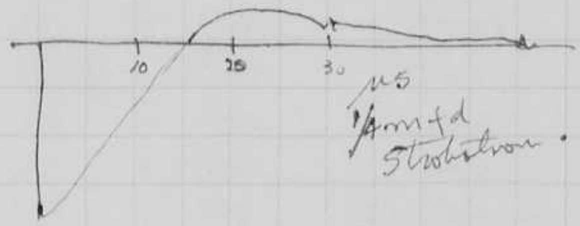
Nov 11 1963
H Edgerton
Ed Lamon.

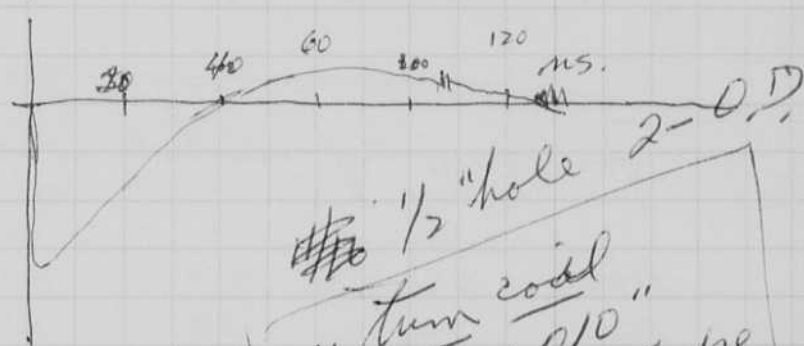
2" Square nickel Transducer



Strobotron Driver







1/2" hole

46 turn coil
alum 0.010"
15/32" high tape
Tape .005
(2 thickness).

4-405 MIT
Nov. 16 1963
H E Edgerton & Bill MacRoberts

plate 6.	~~100~~ 94 mfd	900 v	22"
2.75 oz	94	500	2 1/2
	94	700	8"
	94	800	14
	94	800	14
	94	1000	32
	94	1100	~~38~~ 41
		1	
	94	700	ceiling 50¢
	94	550	ceiling less 4"
5/8 02	94	650	ceiling Small

1¢ hits ceiling with 850 V

{Studies in optics
A A Michelson
Univ of Chicago Press

Coil #2 11/16" I.D.
3 3/8 O.D.
90 Turns. $\frac{15}{32}$ alumin tape
0.01"
plus .005" Insulator.

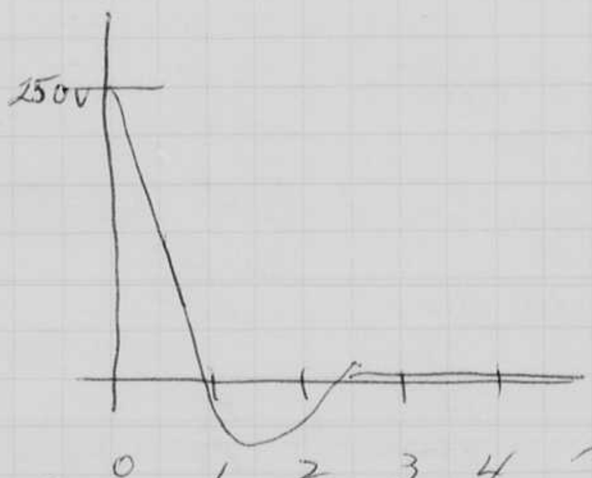
mfd		height	
94	700	16"	plate "6" 500 tow
	700	18"	
	800	29-30	
2 3/4 oz.	900	4x12 48"	
	1000	66	
	1000	66	
	1100	ceiling ~~78+~~ 78+	
	600	10"	
	500	4".	
	400	2"	

2.75 oz. al plate 5"

this coil at 800 volts is $\left(\frac{30}{14}\right)$ times better than the 46" coil.

Sprague capacitor 1000 mfd rated plate "6"

1000.	250	9"
1000	200	6"
1000	150	1"
1000	300	19

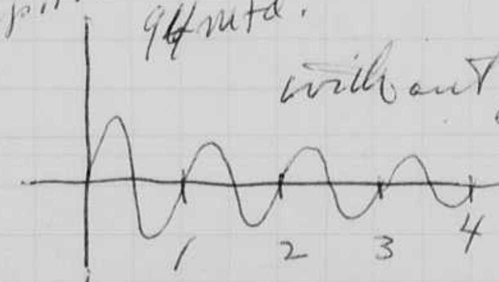


mercury Relay Elkhart, Ind.
Adams & Westlake
Relay 1140-45-11 (DC)
2600 ohms
30 amp 115v 60 ~

110 v	65 ~~ms~~ millisec delay.
150	55 ms
200	45 ms.

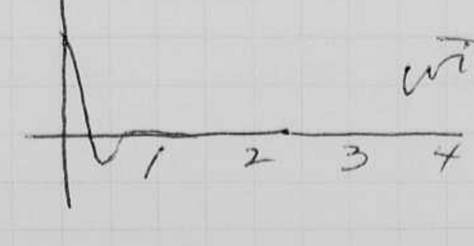
94 mfd.

without plate.



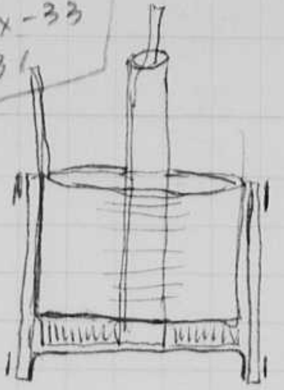
f = 1000 ~ without

with plate.
2000 ~ with.



Nov 17 1963

1" FX-33 #0031



1" FX-33 4mm Xenon.

Sum D 30501

V	C	M	D	MD^2 B'PS	
450	300	13	2	52.	
460	300	13.5	2	54.0	
400	300	10	2	40	
450	300	27.5	2	110.0	
460	300	31	2	124.	
420	300	25	2	100.	
400	300	23	2	92.	

Old FX-33 1½"
#109.

450	600	33	2	172.	
440	600	37	2	148.	
400	600	30	2	120.	
350	600	21	2	84.	
380	600	25	2	100.	80 volt residual
380	300	13.5	2	54.0	
400	300	12.5	2	50.0	
400	300	13.0	2	52.	
380	300	11	2	44.	
420	300	13.5	2	54.0	
440		16.		64.	
450		17.		68.	
450	300/2	6	2	24.	
750	"	18		72.	
800	"	23		92.	
900	"	29		116.	

1" FX-33 # 0031

450 Hard start. ?

~~600~~	~~300/2~~	~~11~~	~~2~~	~~44.~~
700		12		48.
600		8		32.
800		14		56.
900		18		72.

Oscar.

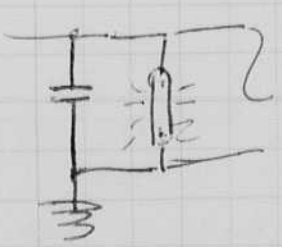
All above on S.R. meter Serial 118

FX33 1" and 1½" with Sprague (250 mfd capacitor) measured 300 mfd

Meter	Lamps.	C	V	$\frac{CV^2}{2}$	M	D	MD^2	$\frac{h.c.p.}{watt}$ η.		C.P.S / length
306	1"	300/2	900	61.7	31	2				
"			900	61.7	26					
113			900	61.7	27					
113.			900	61.7	27					
306	1"		900		27	2				
113	1"	600	450	61.7	170±	1'	170			
	1"	600	450	61.7	48_4	2	172	27.9		.
	1"	600	450	61.7	48_4	2	172	27.9		172.
	1"	300	450	30.8	23_4	2	~~134~~ 92	~~435~~	2.99	92.
	1½"	300	450	30.8	28_4	2.	112	3.64		74.7
	1½	600	450	61.7	61_4	2	244	3.96		163.
	1½"	300/2	900	61.7	44	2	176	2.85		117
	1"	300/2	900	61.7	3_4	2	124.	2.02		124 ~~2.02~~

It appears that the 1" lamp is brighter than the 1½" lamp for all conditions as measured with a 929 phototube.

This should be repeated with an S-1 surface phototube to see if the red component is also increased



(1) Measure drop in electrolytics. at first instant of flash.

(2). measure flash duration.

(3) output with S-1 phototube.

Notebook # 27

Filming and Separation Record

____ unmounted photograph(s)

____ negative strip(s)

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

was/were filmed where originally located between page 152 and end.

Item(s) now housed in accompanying folder.

		C.P.S.		CPS / LENGTH		DUR M.S.	
W.S.	VOLTS	1"	1.5"	1"	1.5"	1"	1.5"
31	450	92	112	92	74.7		
62	450	172	244	172	163	150	
62	900	124.	176	124	117		80

		CPS		C.P.S./LENGTH	
V	W.S.	1"	1.5"	1"	1.5"
450	62	172	244	172	163
450	31	92	112	92	74.7
900	62	124	176	124.	117