HAROLD E. EDGERTON

PAPERS

MC 25

Series III

Laboratory Notebooks

Number T-5

Dated Oct. 27 1934 to Aug. 27, 1935

Massachusetts Institute of Technology

COMPUTATION BOOK

NAME	Number
HAROLD E. EDGERTON.	T-5

Course .....

Used from Oct. 27. 1934, to Aug 27 1935.

Leica no 85309

Elmar 1:3.5 F 50 mm lens
132064.

Page 73 Strobotac circuit.
123 548 oscillator.
124 Relax osc. theory.

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 BRANCH

HARVARD CO-OPERATIVE SOCIETY

76 Massachusetts Ave., Cambridge, Massachusetts

Harold E. Edgerton.

October 27, 1934.

Mass. Inst. of Tech.

Room 4-111.

Oct 27 1934
H.E. Edgerton

Arranging to leave on the Century tomorrow with people from Lenz Bros co. for South Bend Indiana for ~~inf~~ suit trial. I was to go to New Bedford to talk to the Brooks Club but this was shifted so that Germeshausen and Brier would go. Vande Graaff will talk.

Nov. 19, 1934.

Spent Oct 28 – nov 6 in South Bend. Ind.

Nov 11 went to Syracuse and talked to Technology club at Onondaga Hotel on nov. 12. about 300 pres.

Emil Pfleiderer
J. Craig Pres A.S.M.E.
E.E. Trump (Solvay).

Nov 13. McBaxter Whitney, Mr. May, and another man called in afternoon to discuss the use of the stroboscope for studying woodworking machinery.

Nov 14 Dr. Mackey from Dupont Co. Burnside laboratory was here from 10 am until 5 p.m. discussing ballistic problems and the use of the stroboscope.

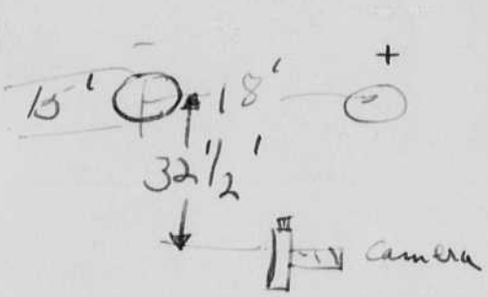
Nov. 15. H.E. Brier accompanied me to Round Hill South Dartmouth where we took pictures of the progress of the sparks between spheres on the Vande Graaff generators. We used the drum camera (1 ft in diam) which was run about 5000 – 6000 r.p.m. for most of the pictures.

Res. for data taken at Round Hill

N. E. Erie 11/15/34

Data on Spark Pictures

#	Speed	Remarks
1	0	For determination of top
2	5250	Film not spliced Broke
3	5020	Both Moving + Still
4	4900-5200	35 shots about 18' gap
5	5690-5800	27 shots
6.	6000	Film Broke
7.	5300-5810	12' spark 30 shots



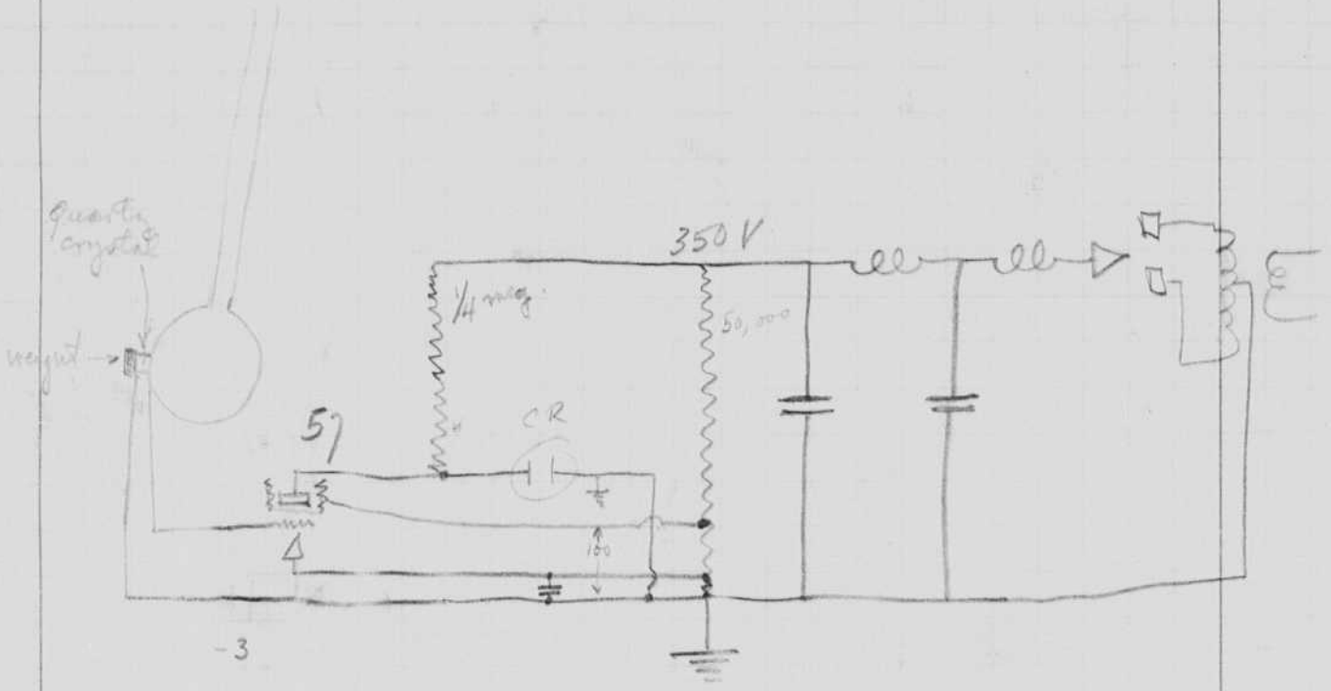
Camera lens 3' 6" from rod 2' sparks is 11/15/34
Sparks to be 18' ½ out)
for removed

Probable displacement of sparks on Ball circle of 1 ft radius to move out of field

1/m Broke

Nov. 17 1934
H. E. Edgerton.

Stress - Strain Curves of materials during dynamic conditions.



Nov. 19 1934
Washington.

Enlargements made from films #3, 5, 7, and 8.

Enlargement on film = 3.07 times.

speed of the film = $\frac{50}{16} \times \frac{R.P.M.}{60}$ = 3.12 × (Speed in R.P.S)

(50 frames on circumference)
(16 " per foot).

from Film No 5.

18' = 3.15" on film. 1" on film = 5.72 ft.

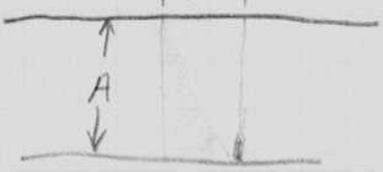
time axis for film no 3

(260 ft/sec × 3.07) 12 = 9590 inch/sec.

= .959 × 10^{+4} in/sec.

≠ 10^{-4} sec. = .959 inch.

1" on film = 1.042×10^{-4} sec.



D measured on film #4 from several pictures

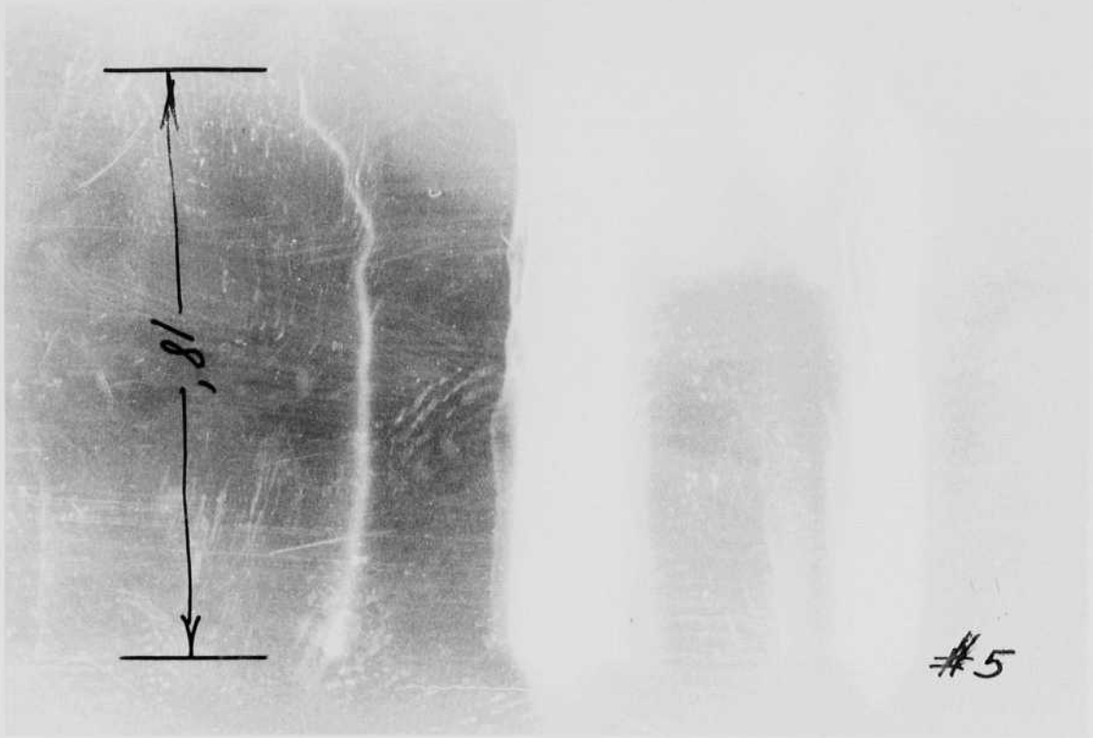
D	D/.959 × 10^{-4} sec.	A	A × 5.72 ft.	ft./sec.
.8	.834 × 10^{-4}	1.8	10.3	1.24 × 10^5
1.09	1.14 × 10^{-4}	1.8		.905
1.0	1.04 × 10^{-4}	1.8		.99
1.12	1.17 × 10^{-4}	1.8		.881
1.0	1.04 × 10^{-4}	1.8		.99

124,000.0

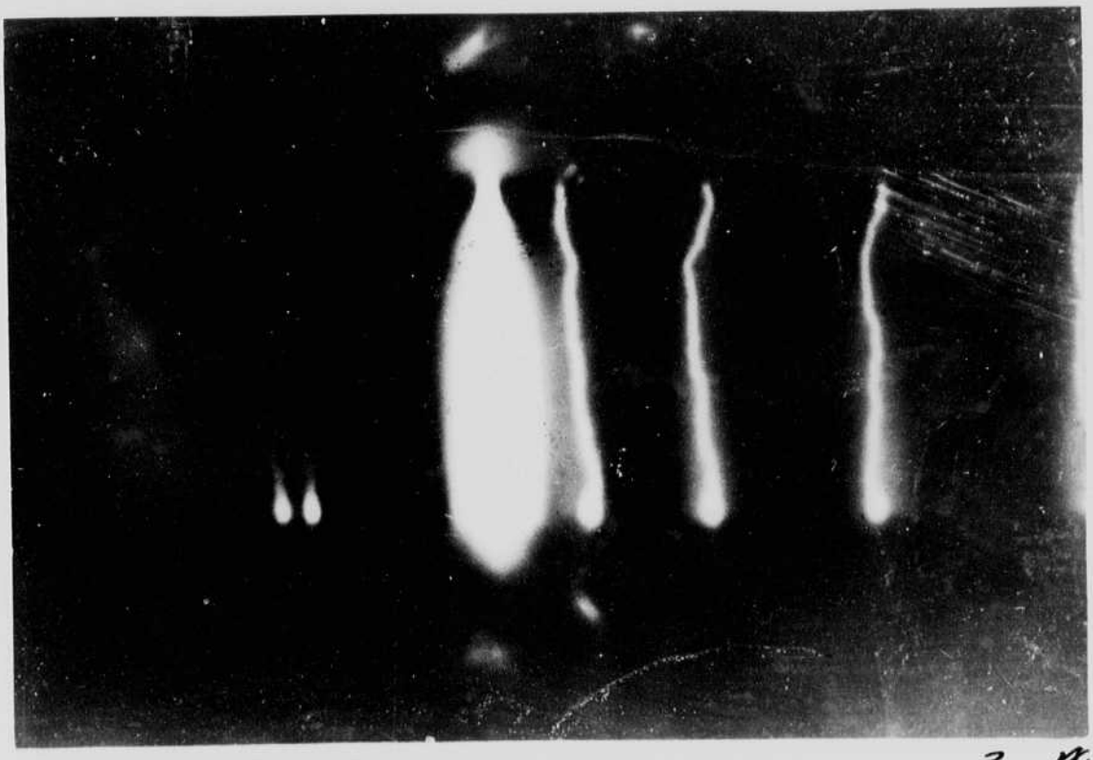
$1 \times 10^5 \times 2.54 \times 12$
$= 3.0 \times 10^6$
cm/sec.

Film No 8 Gap = .8 × 5.72 = 4.575 ft gap. (prob. too long because of Halation on film)

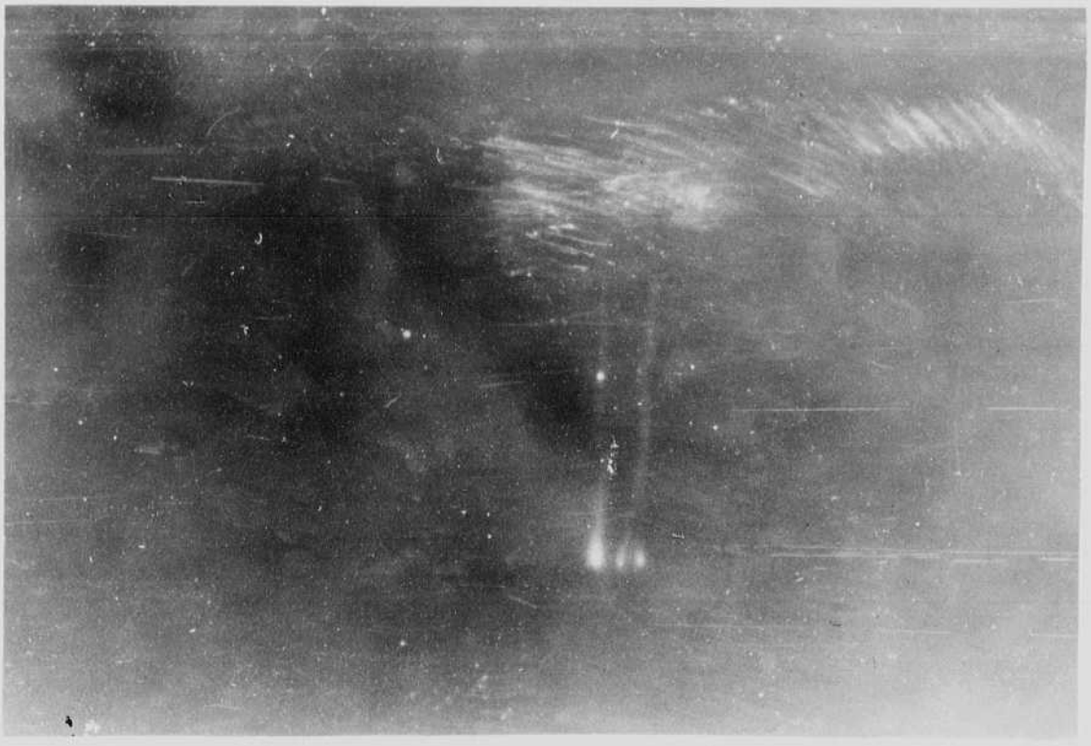
trailer 3.2" × $1.042 \left(\frac{5200}{5500}\right) \times 10^{-4}$ = 3.15×10^{-4} sec.


18"
#5


3



3 ※



2

Nov 22 1934

Hobbyists.

Gerry Isaacson returned from a 10 day trip to Columbus Ohio taking with him photos of glass being blown into fibers.

Mr. E. Pugsley of Winchester was here and discussed the reports on the shot dropping and the barrel vibration work. He brought a shot gun and some shells for us to photograph.

Herb Grier and I went up to Harwood and took some snap shots of a foot ball game picked to show distortion of ball. Mr. Bingham was there. The kicker was a fellow from Ohio State (last years team).

H. Grier

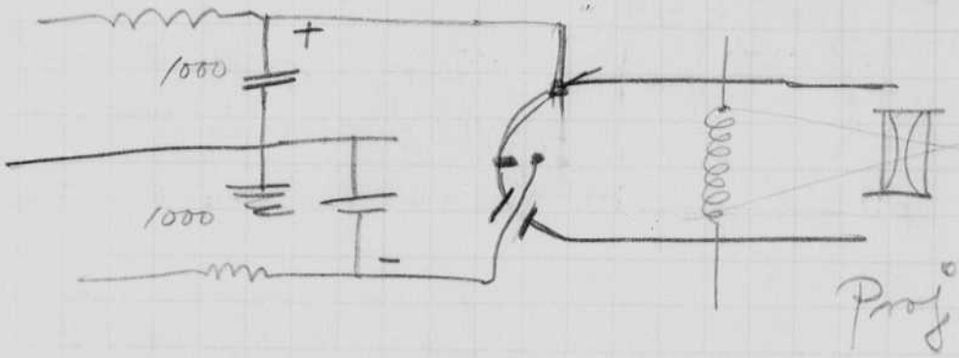
Jake Draper.

Geo Bartley →

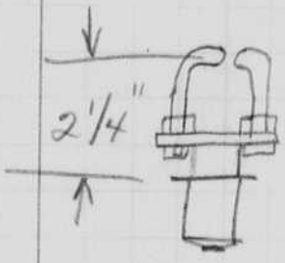
Photograph taken at the airport by Wyatt (Alfred) Anthony while the prop. was being painted white

Nov 22 1934

Spark Projector for demonstration of stroboscopic subjects enlarged on screen for Public or Lecture.



Replace the 500 watt lamp in the Spencer Lineascope with a spark gap.



Prefocus socket.

Nov 23 1934
Worked for Winchester

Nov 24 1934
Ditto. In the afternoon we went out to the air port and took pictures of an airplane propeller for Stark Draper.

Nov 25 1934. In a.m. took Winch pict of shotgun.

Nov 22 1934
[illegible]

George [illegible] returned from a 10 days trip to Columbus Ohio taking up the photos of glass being blown into fibers.

Mr. E. Pugsley of Winchester was here and we discussed the reports on the shot dropping and the barrel vibration work. He brought a shot gun and some shells for me to photograph.

Hal Grier and I went up to the field and took some spark photos of a foot ball being kicked to show distortion of the ball. Mr. Bingham was there. The kicker was a fellow from Ohio State (last years team).

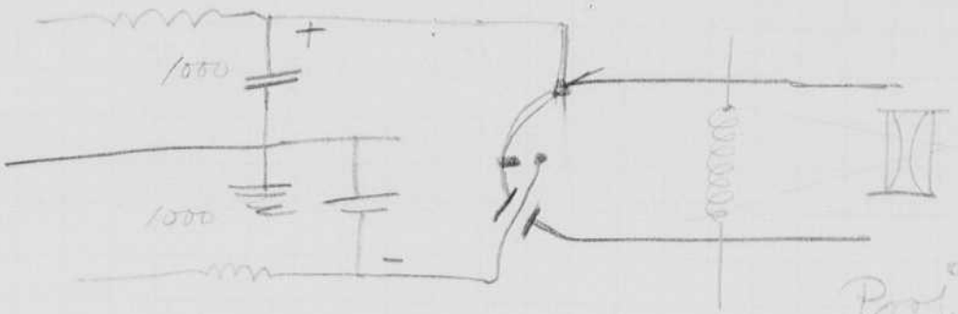
H. Grier Stark Draper.

Geo. [illegible] →

Photograph taken again at the airport by Wyatt (Alfred) Anthony while the prop. was being painted white

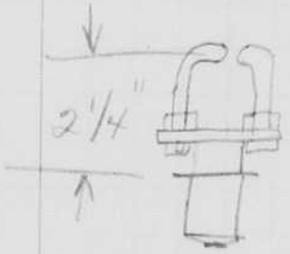
Nov 22 1934

Spark Projector for demonstration of stroboscopic subjects enlarged on screen for Public or B lecture.



Projector

Replace the 500 watt lamp in the Spencer Kalinascope with a spark gap.



Projector socket.

Nov 23 1934
Worked for Winchester

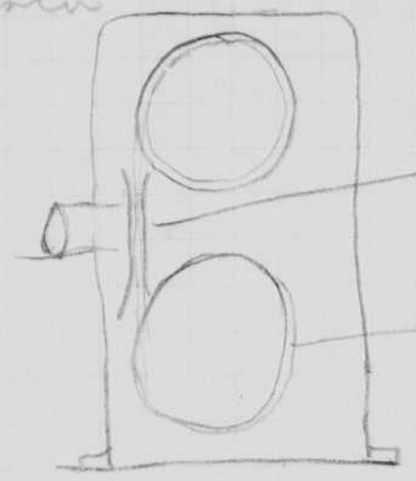
Nov 24 1934
Sitting. In the afternoon we went out to the air port and took pictures of an airplane propeller for Stark Draper.

Nov 25 1934. Draft took Winch picture of shotgun.

Nov. 26, 1934

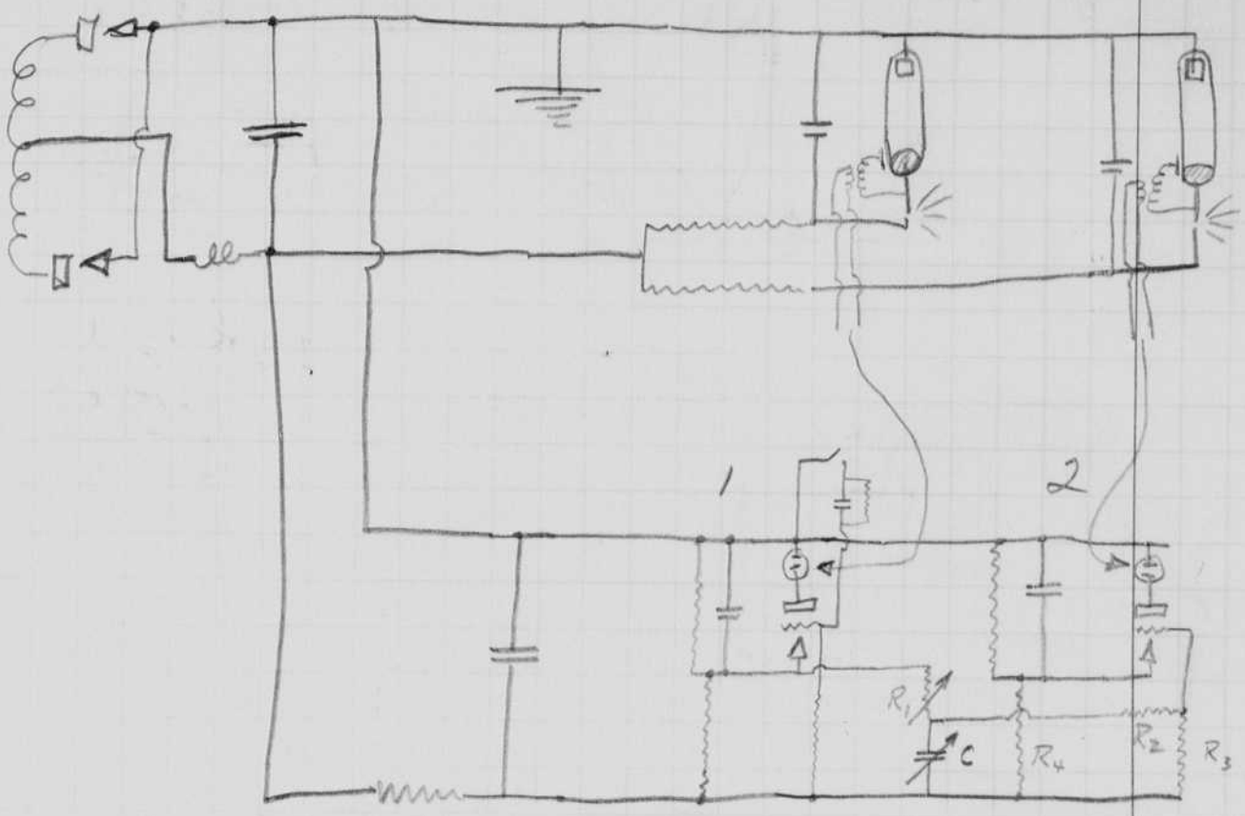
Re Egerton

High speed camera.



Nov 29 1934

Discussed a circuit with Dick Evans yesterday for observing sound waves by means of a spark. The idea was to use one spark to set up a sound wave and a second to produce light so that it could be seen. The time lag between the two sparks was to be made variable so that the different portions of the wave could be seen. Proposed circuit on the next page. Most of the apparatus was found in our lab and Evans is going to set it up.



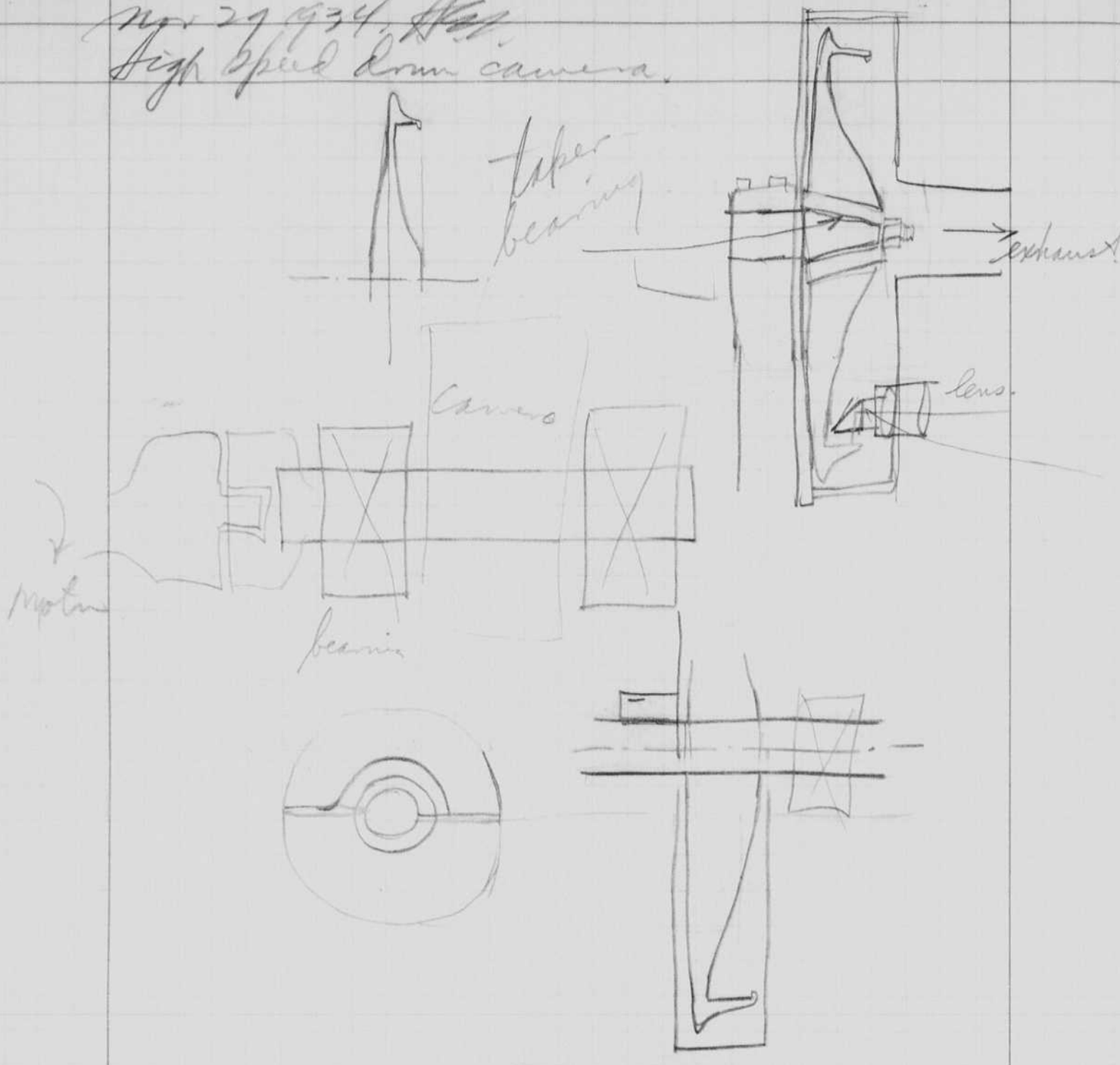
Adjustment of R_1 R_2 R_3 R_4 and C change the time lag of circuit no 2 following circuit no. 1. R_2 R_3 and R_4 will probably be fixed and R_1 and C variable for adjustment.

Circuit no 1. will set up the sound wave and circuit no 2 will furnish light to show the resulting sound wave.

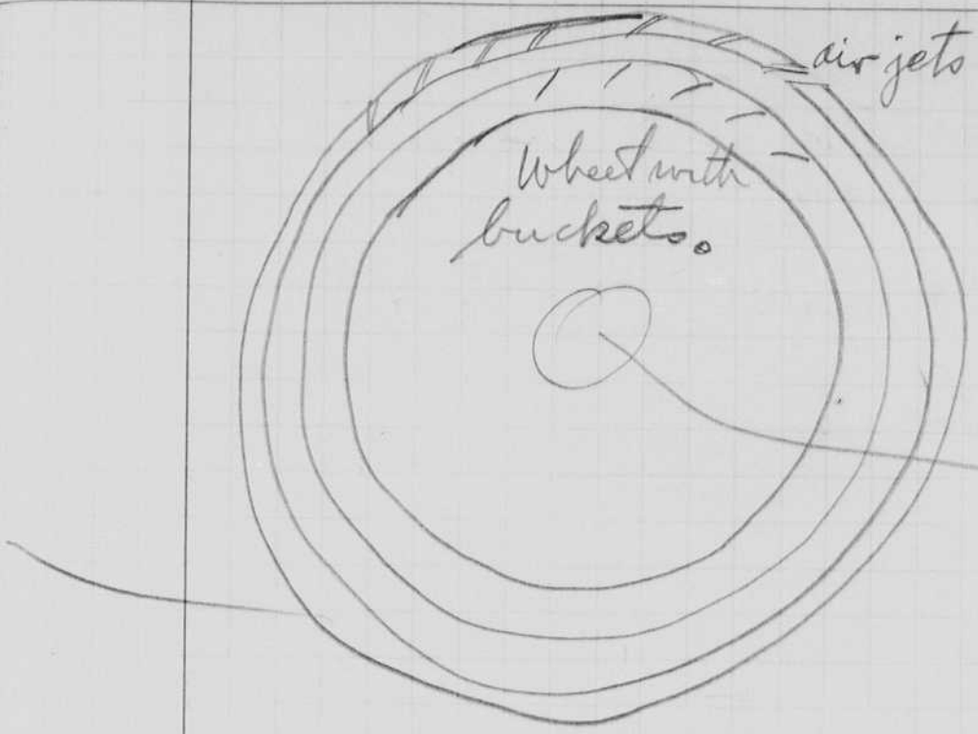
If sufficient light is available it may be possible to project the image of the waves on the wall.

Nov. 27 1934. Sketch

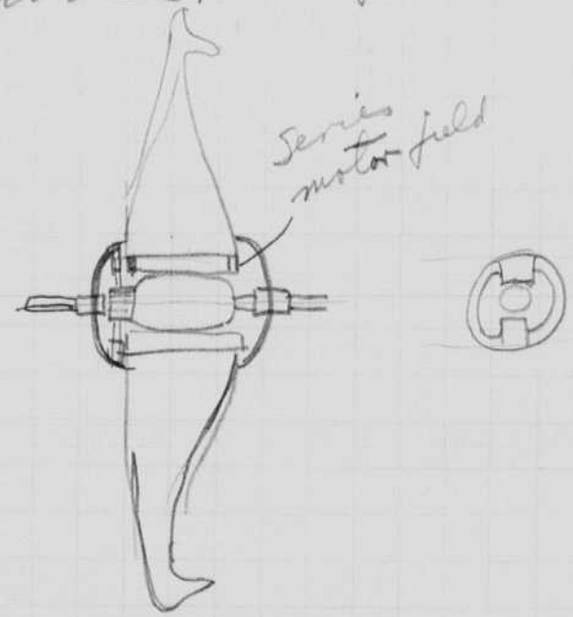
High Speed Drum camera.



An outside bearing makes it difficult to get the can off and on of the wheel.



Another method of driving is to use a motor right in the hub of the wheel.



Nov 21 1934
Edgerton.

Ted Taylor was at lab. yesterday and we took a high-speed movie of an arrow leaving a bow.

Frequency of flash - 2000 per second obtained by a commutator run at 3600 r.p.m. by a synchronous motor.

60 r.p.s. x 30 = 1800 P.P.S
32 = 1920 "
34 = 2040. "

~~An~~ elliptical reflector 11 with a single lamp ~~tube~~ was used. The tube a 20 mm 12" long tube iron anode.

Capacity 1 mf.
Resistance 400 ohms.
10 kw power pack
(Spark + Hg lamp load).
Special spark coil
12,100 turns 36 nichrome.

Kicked by W. E. Jesler. Harvard Coach.

Nov 21 1934
S. P. Expt. [illegible]

Ted Taylor was at Tech. yesterday and we took a high-speed movie of an arrow leaving a bow.

frequency of flash – 2000 per second obtained by a commutator run at 3600 r.p.m. by a synchronous motor.

60 cycles x 30 = 1800 f.p.s
32 = 1920
34 = 2040.

An elliptical reflector with a single lamp [illegible] was used. The tube a 20 mm 12" long tube in a [illegible].

capacity 1 uf.
Resistance 400 ohms.
10 kw power pack
(Spark + Hg lamp [illegible]).
Special spark coil
12,100 turns 36 nichrome.

Kicked by W. E. Tesker. Harvard Coach.

Dec. 4, 1934.

Grier and I went down to Round Hill on Sunday afternoon and took further photographs upon the moving film camera of the discharge between the big balls.

12/2/34

H.E. Edgerton
H.E. Grier
V. Van Atta
C. Van Atta
Vanderhoef.

Lots of Spark Pictures at Round Hill

Continuation of data taken about 11/2/34

10" hemispheres on each ball
gap length 10'
2 leica shots
#1 f 3.5
#2 f 9

Moving Film On Drum Camera

	Speed	Remarks
#20	3600	14' f 1.4

3 Leica pictures at f 3.5

#21	1800	14' f 1.4 about 35 pics.
#22+	4050 on tach. 3600	11' f28
#23	4100 on tach 3600	11' f8

On 20-21-22+ there is a bright spot about 2' from the negative ball
On 23 there is a tendency for a brush

12/2/31 (2) N E Glen.

corona discharge and on the negative before + between the sparks. The bright spot has moved to the center of the sparks.

film numbers on the trailing end of the film.

Sparks lengths are 10" less than values given because of 10" hemispheres attached to big balls

#24 4100 on tach
3600 8½ ft f4

on #24 the bright spot was about 18" from the negative ball.

Physical dimensions of the set. up are the same as before

2 leica shots 1 at 3.5 1 at 6.3
1 leica at 12.5

Dec. 6. 1934
H. E. Edgerton.

Today (this a.m.) was spent in the Hydraulics laboratory at M.I.T. taking high speed movies of cavitation in the small machine (expanding ~~orifice~~ venturi).

Speed 2040 cycles per second

Shadow pictures.

1 of 1/12" Hg lamp used tracing ~~paper~~ cloth between lamp and subject.

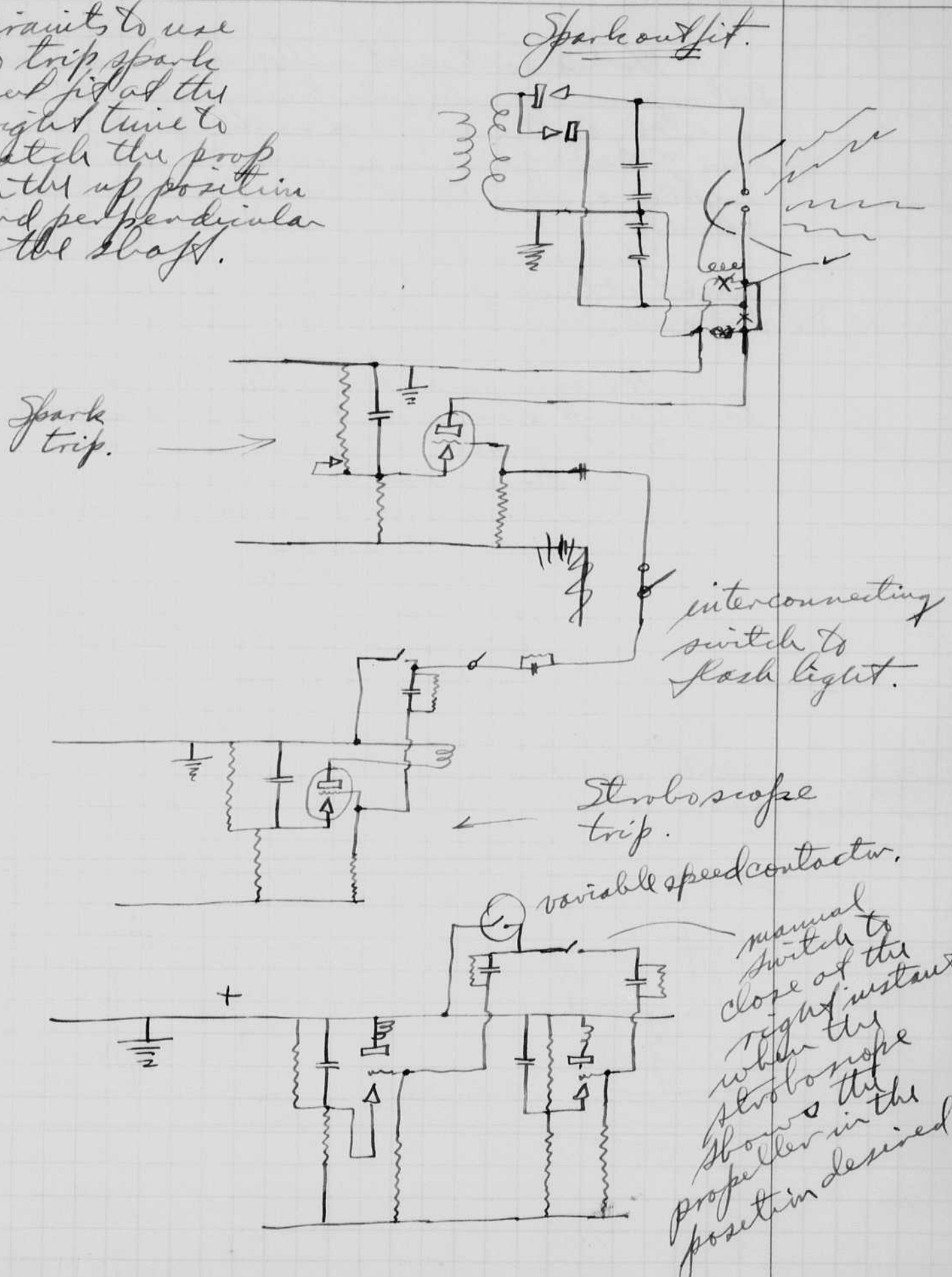
Last night we were at Worcester to talk to the Worcester Engineering Society and others. There was a crowd of about 1200 - 1500 there and the show lasted about 1 1/2 hours. at the dinner before the meeting.

J.A. Johnston Div. Engineer Public Works.

Prof. A.J. Knight Wor. Tech. Civil Eng.
D.E. Webster Norton Co.
J.E. Woodbury Printing chemist.
Fred Crosby Morgan Cons Co. Elect Eng.
Dr. Jennings Chemical Wor. Tech.
Ralph Whitney P.F. Marsh Co. Cons Co.
Ed Morgan Head of Elect. Eng. Wor. Tech.
Leavitt Power Co.
Hugo Beth Norton Co. Manager.

On Monday at 2 a meeting was held in the office of Fay Taylor to discuss the proposed photography of the distortion of an airplane propeller. Prof. Taylor laid out a schedule to get pictures, further pictures, to see if the method was of use for measuring the distortions.

circuits to use to trip spark out fit at the right time to catch the prop on the up position and perpendicular to the shaft.



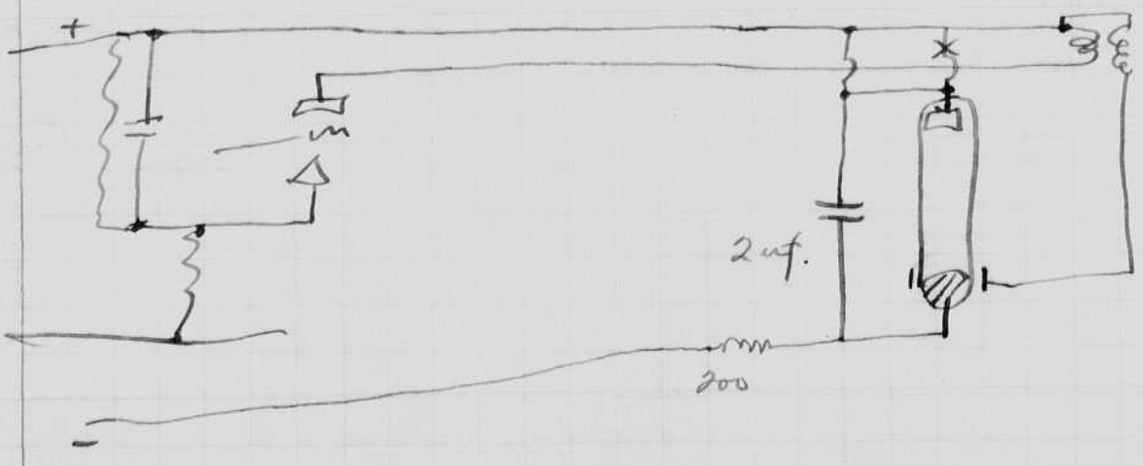
Dec. 8, 1934. asw.
H.E. Edgerton.

Worked last night on the 30 KW Raytheon Delta power pack which was wired up recently by Lawrence in the shop. A new tube (6 phase) was given to us to replace one that was broken last Spring.

This new tube ran perfect last night although it was only about 1/4 loaded.

We experimented with the seven tube lamp house that was just to getting by Gen. Radio. A spark coil recently made by Grier was used with
- 12000 turns #36 wire advance.
- 175 " Pri.
- 1" on sec high
- 1/4 " pri.
- 3/8" inside core with primary on the out side.

Also tore out cable and replaced with lamp cord with two wires from each condenser to each lamp.



Dec 8 1934 evening.
HE Edgerton.

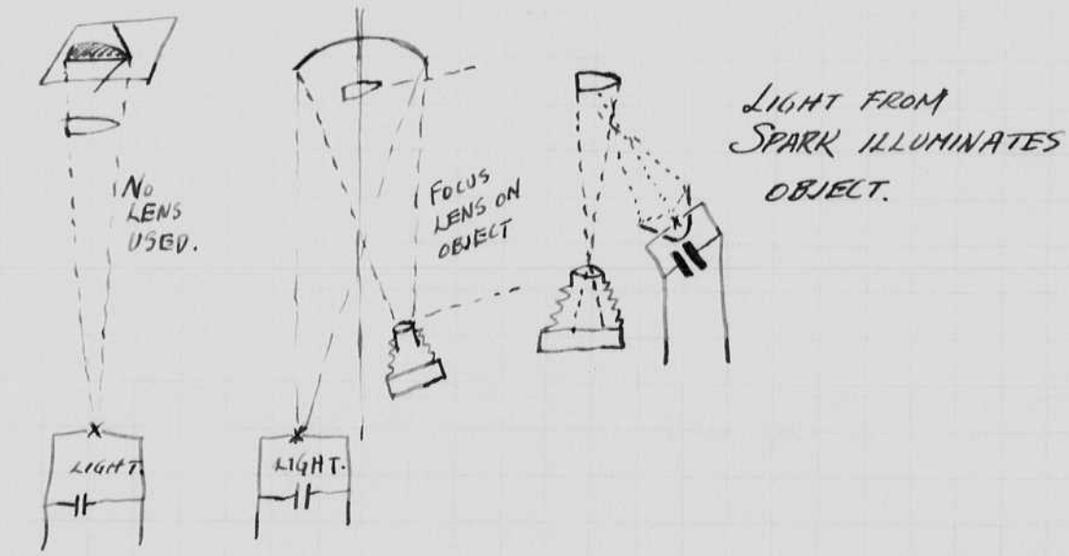
The capacitor for energizing the spark coil was increased from 0.1 mf to 0.25 mf and the firing of the tubes was greatly improved. The tube holder was cut away to prevent spark over. The Hg tubes do not hold over even with 200 ohms in the charging circuit to 2 mf capacitors.

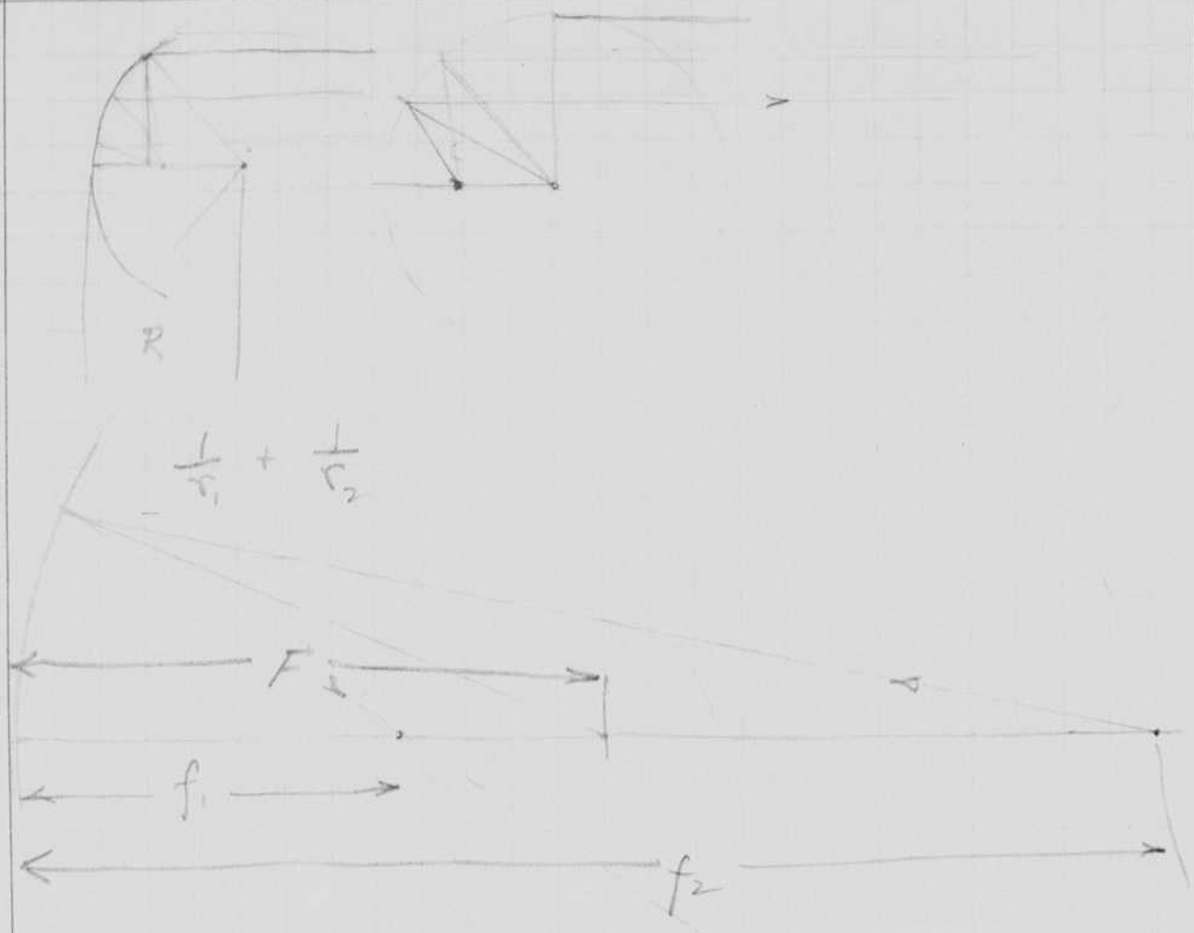
Three methods of photography used in high speed.

Shadow ~~Doorak~~.

Schlieren Toepler.

Direct Worthington. A.M.



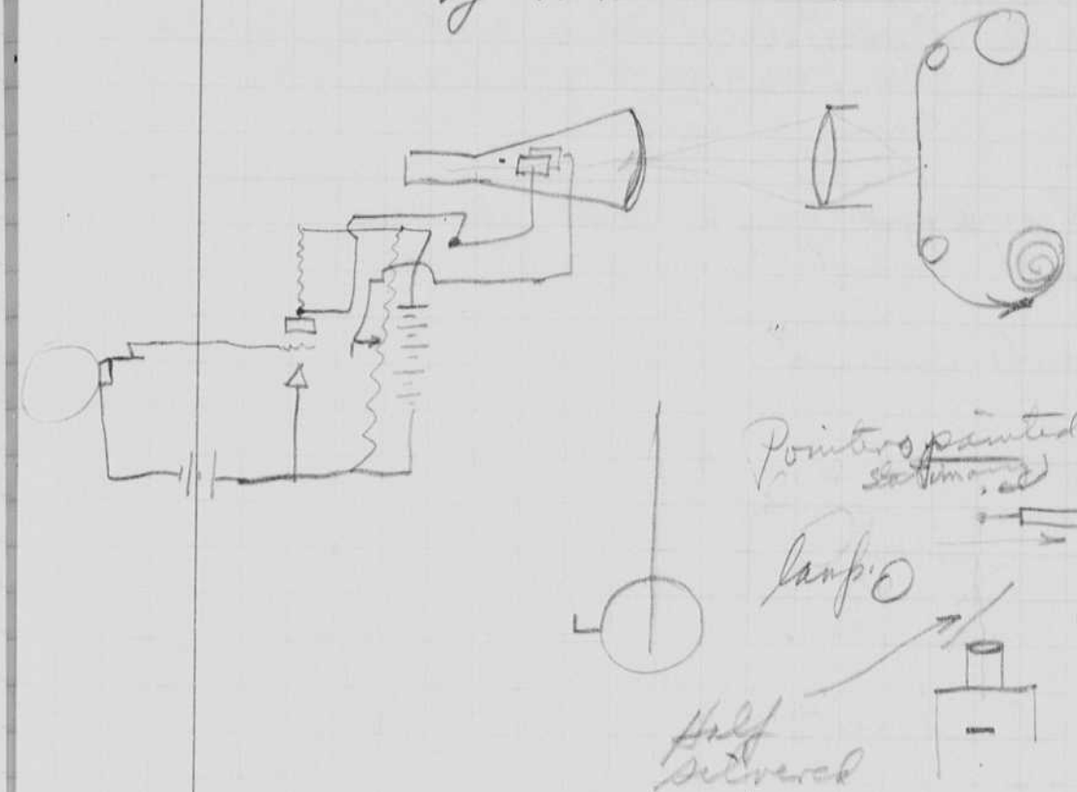


$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{2}{F}$$

18" diameter. 40"
24" " " 52
30" " " 64.

Dec 9 1934
H. E. Edgerton

Dynamic Stress strain curves of materials.



The film will show two records one of the displacement and the other of force from which a stress strain curve can be plotted directly.

It would be fine if the cathode ray tube could have the stress strain curve right on it but this seems difficult to accomplish.

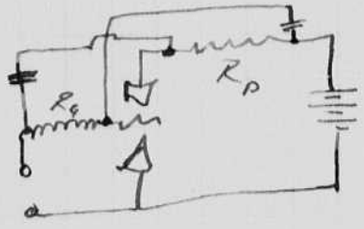
(Permanent) It might be possible to put a magnet on the pendulum that would move the spot linearly as a function of displacement during impact.

Dec. 11, 1934.
H. E. Edgerton.

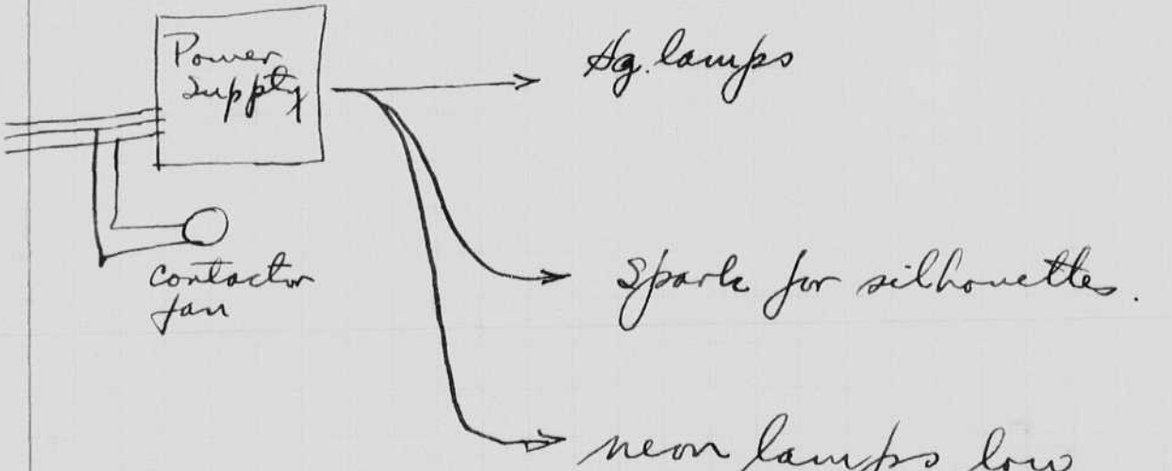
My trip to Philadelphia on December 13 to address the Franklin Institute upon "Stroboscopic Light and some of its uses" was a pleasure. Welch Pogue came down from New York.

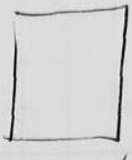
Spent weekend working on power supply and lamp banks.

Feedback circuit



Camera and circuits to use with it.





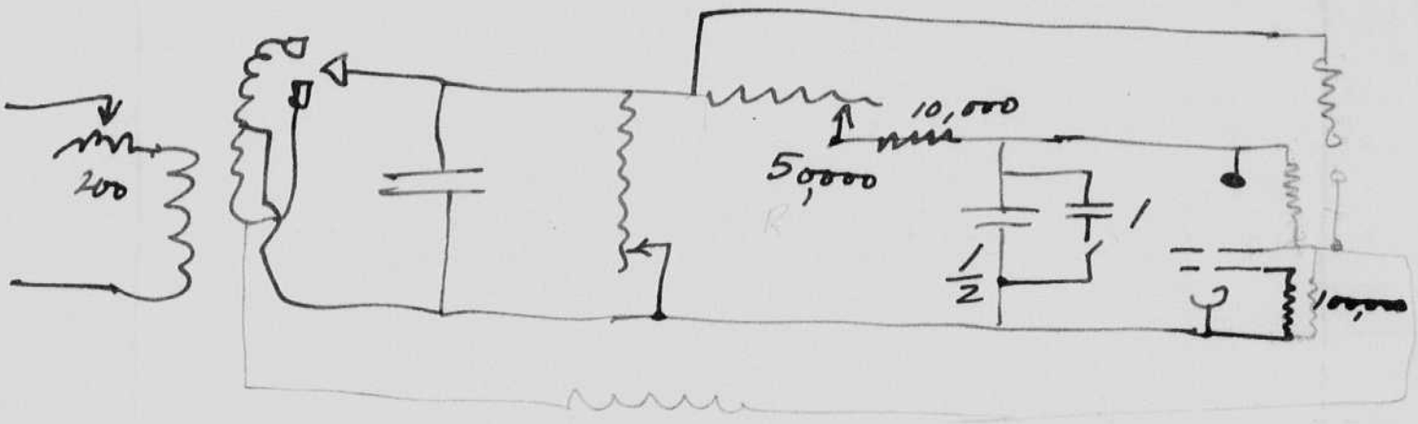
Single spark unit fit.

Decided over the weekend to build all lamp houses with condensers in them close to the lamps, eliminating the cables to the lamps. Three new lamp houses were designed by Brier and will be assembled at once. The spark circuit is also being rebuilt.

Dec 18 1931

~~A. E. Squier~~

The formation of the cathode spots in the Hg lamps may be caused by electrostatic charges set up by the motion of the Hg against the glass walls of the tubes. Last sunday I again noticed the violent vibrations in the Hg. that were set up by the high voltages on the out side of the glass ~~tube~~



Strobo tach circuit discussed with Germeshausen on Dec 17. To be built by General Radio.

Three connections.

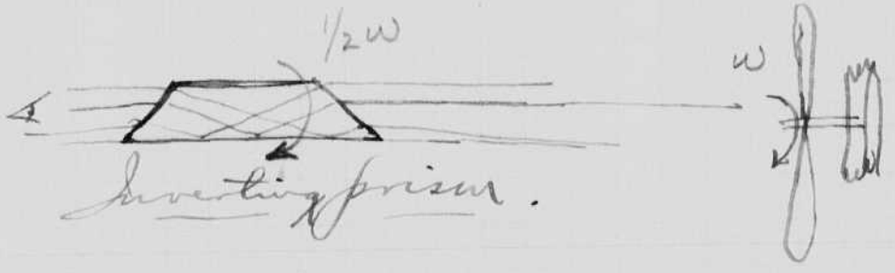
1. Contactor
2. 60 cycle (also 30, 15 and 7.5 by changing res.)
3. Selfoscillator with calibrated resistance dial and with double range.

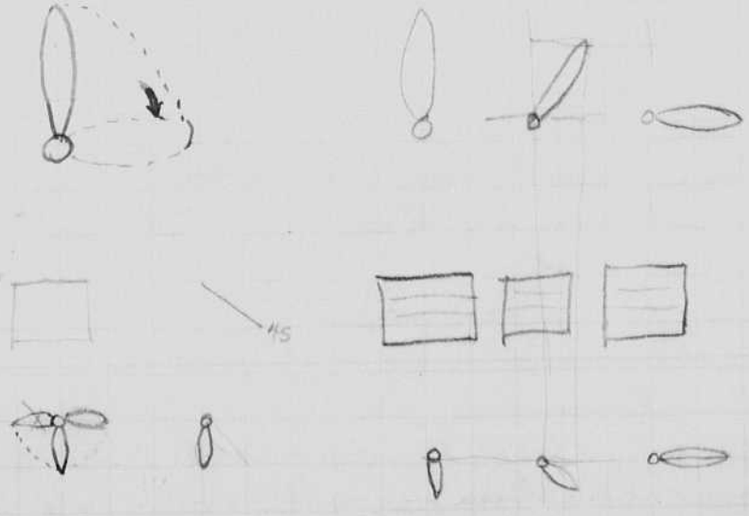
Dec 25, 1934

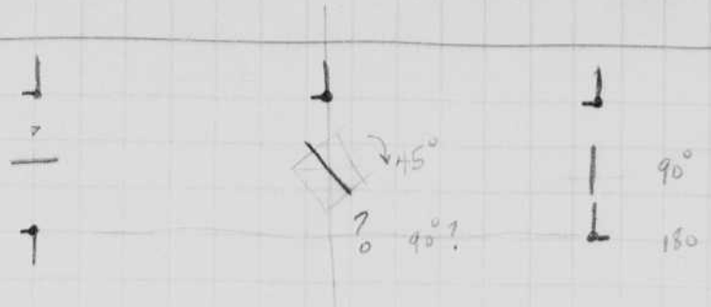
Method of observation of the flutter of any aero plane propeller with a double stroboscope scheme. I read of this first in the P.E. Review 1928? by a man who observed a spinning that was mounted on a turbine governor.

An optical method is first used to take out the rotational speed and then a stroboscope is used to show up the flutter. By this way the frequency of the flutter should be measurable.

An optical method that accomplishes this is like shown below.







Mr. Mertiss of "Time" sent 2000 ft of film most of it was shot upon foot ball kicks basket ball bounces, squash, and tennis racquets. H.E. Brier took the undeveloped negative to New York for development.

Dec 27. 1934.

Gems and I spent yesterday taking high speed shots of splashes, a coffee percolator, and of the wing motion of a homing pigeon furnished by Dr. Eliot Hubbard.

Data taken on 3 phase 30 Kw power supply.

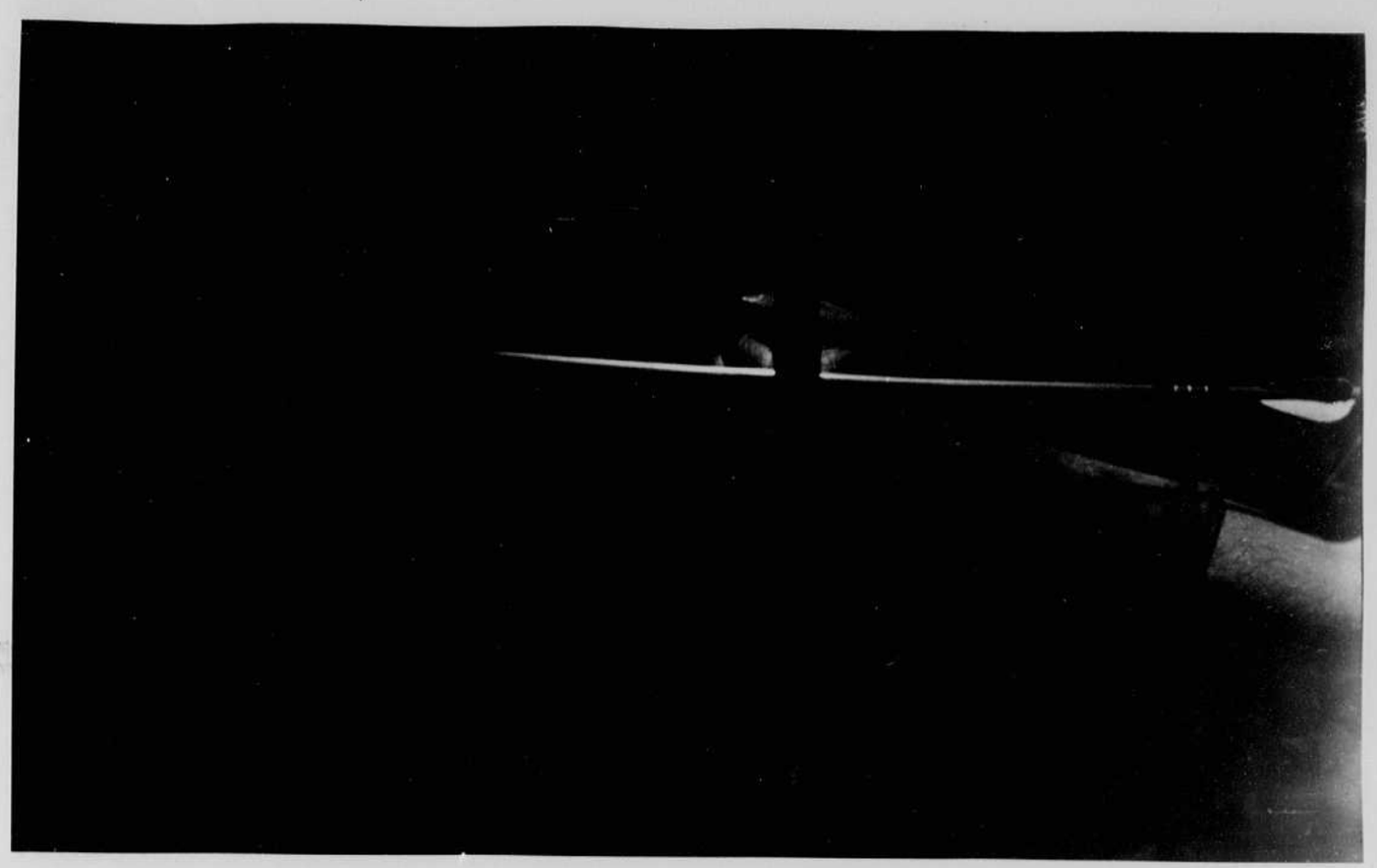
232 volts input 1230 v dc output no load.

220 ? ± 2 volts. 1050 v 30 amps dc.

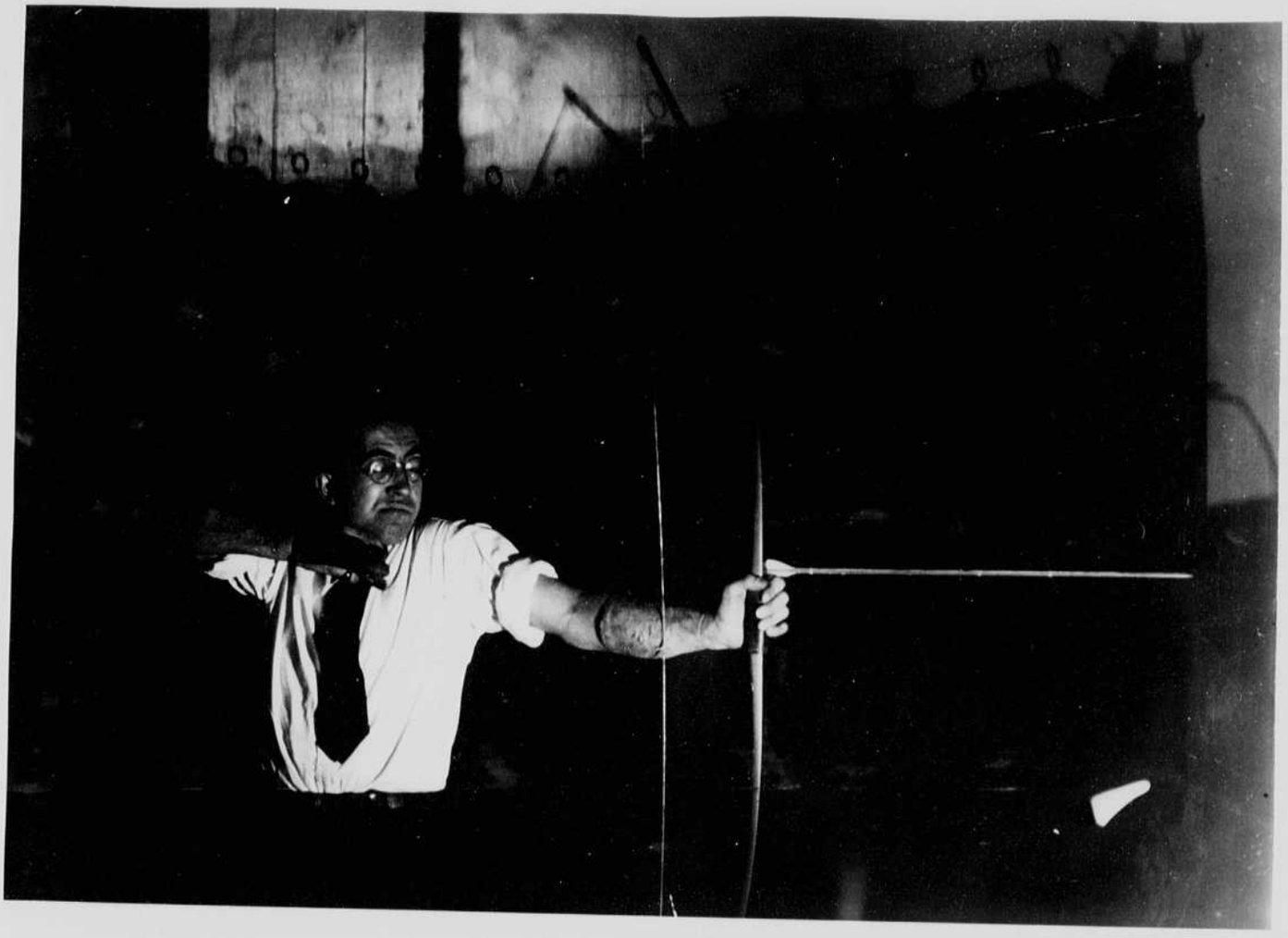
Loaded with three lamp banks 4 lamps each 2 mf per tube at 960 c.p.s.

Saw Bush about advertising pictures as per Dec 19 letter of Mr Stevens of A. D. Little for Battey Taylor Durstine and Osborn. (Ref. Ethyl Gasoline corp.) He said ok as far as the substitute was concerned.

Ted Taylor.



Bend of arrow around bow.

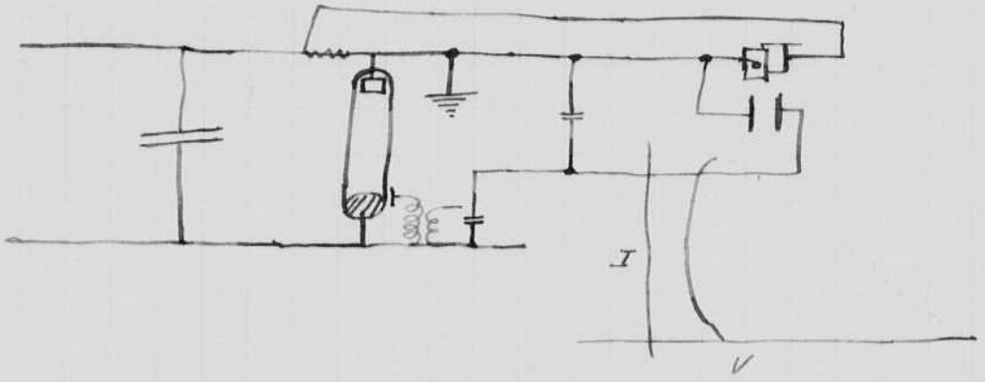


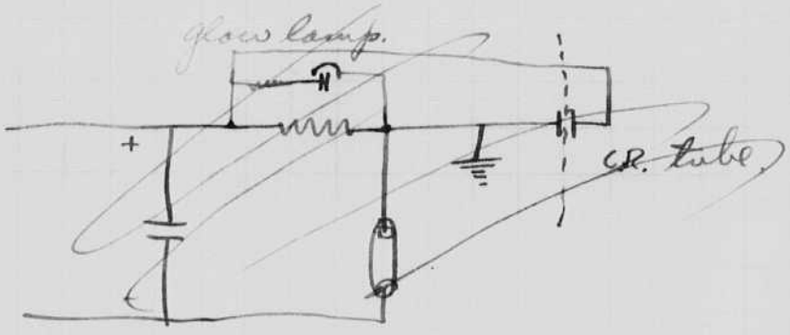
Ted Taylor.

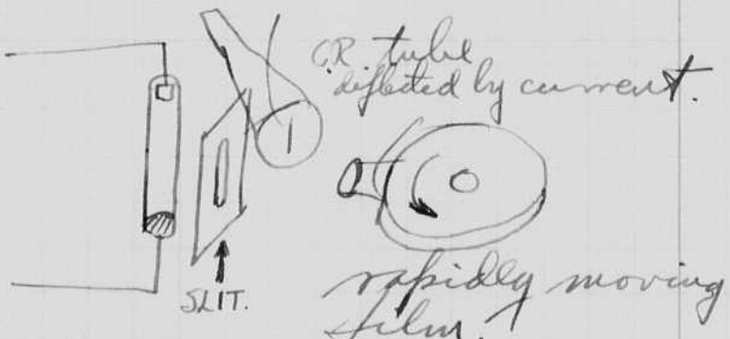
Bend of arrow around bow.

Dec. 31, 1934.

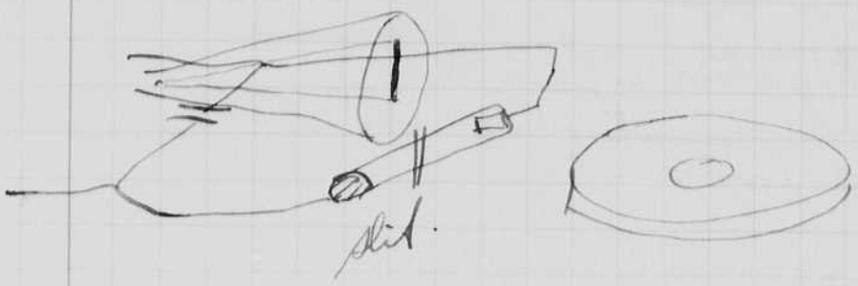
Proposed volt-ampere study of the characteristics of mercury-arc stroboscope tubes. Also light-current relationships to show if the trailer is due to current or to ionization in the tube.







Experiment to show if glow and current in the tube are related.



Jan 2, 1935. H.E. Edgerton and H.E. Grier.

Test of 3 phase induction motor which is to be used to drive the metal propeller for the General arts Lecture ~~on~~ Jan 11 12 and 13 th.

Blocked test.

V	I	W_1	W_2
58	16.9	7.70 x100	-1.85 x100.
57	16.7	7.05	-1.70

Running light at no load.

149	4.2	1.85 x200	-.8 x200	1790 r.p.m.

Ratio test.

230 ± 127 v. secondary.

7.05
1.70
5.25 = 3 | 5.25. watts.
1.75. watts/phase.

assume wye. $R_1 + r_2 = \frac{175}{(16.7)^2} = 0.627$ ohms per phase

$Z = \frac{V}{I} = \frac{58\sqrt{3}}{16.7} = 1.98$ ohms / phase.

max power $= \frac{E^2}{2(x_1 + x_2)} = \frac{3\left(\frac{220}{\sqrt{3}}\right)^2}{2 \cdot 1.98} = \frac{220^2}{4} = 12100$ watts. 12 kw.

$\frac{220}{\sqrt{3}} \frac{1}{2} = 63$ amp. at max load $\cong$ 40 amp.

$2\pi n T$ = Power = 12 kw. = 12 x 737.6 foot-pounds/sec. = 883.

$T = \frac{883}{2\pi 30} = 4.7$ foot pounds. 2.53 ft pounds at 1800

Pop Sci Lecture Jan 11, 12, 13

Jan 19 1935
H. E. Edgerton.

Investigation of trailer in 12" 20 mm mercury stroboscopic tubes. 2 microfarads capacity.

No 1. Hold over first. 5.5. Pan.
1020 per second hot second shot. 3000 rpm

no 2. Tube hot as used in service. 2 mf. 3KW Power ⊖ 3900.?

no 3. Blanks. 3550 r.p.m.

no 4. tube cold 2 mf 3450 r.p.m.

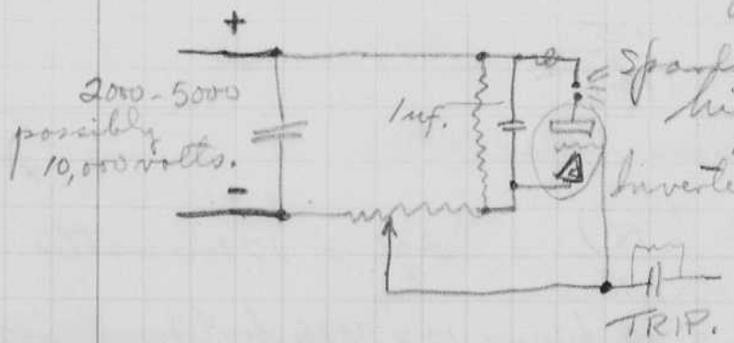
→ Pictures show that trailer travels up the tube from the cathode after the discharge. Tried to get pictures at higher temp and with more capacity in the afternoon without success) due to film difficulties.

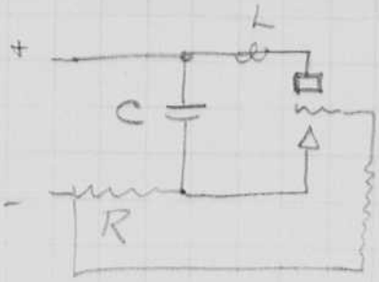
A
C
after glow
TIME

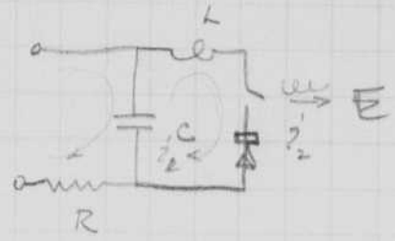
The first picture of no 4 cold tube shows spots on the glass. These can be seen by eye when the speed is slow. Cold tube, high voltage (1200 v) and large capacity.

Jan 20 1935
H E Edgerton

High Speed Silhouette Photographs.







$$E = \frac{1}{C}\int i_1' dt + (i_1' + i_2')R$$

$$\frac{1}{C}\int i_1' dt = L\frac{di_2'}{dt}$$

Initial conditions $\frac{1}{C}\int i\,dt = E$

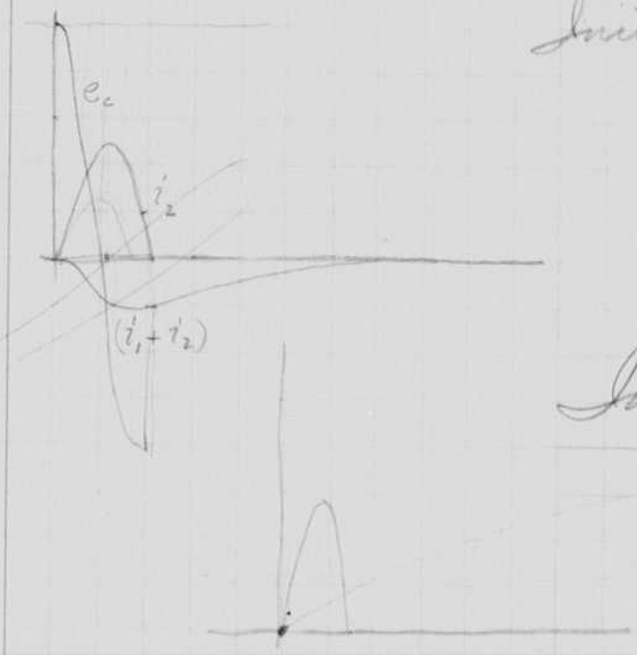
Condenser fully charged,

$i_2' =$ zero,

close switch

Rectifier in series with i_2^0

Impress $-E$ at switch



$$\frac{i_1'}{Cp} = Lpi_2'$$

$$i_1' = LCp^2 i_2'$$

$$E = \frac{1}{CR} LCp^2 i_2' + RLCp^2 i_2' + i_2' R.$$

$$= (Lp + RLCp^2 + R) i_2'$$

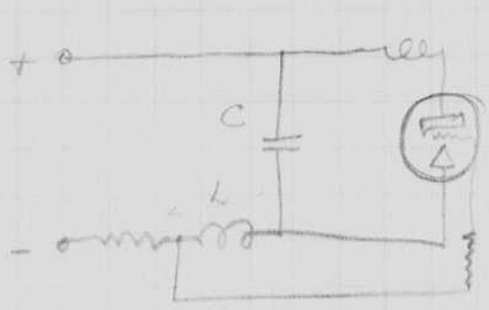
$$0 = \left(p^2 + \frac{L}{RLC}p + \frac{R}{RLC}\right)$$

$$p = -\frac{1}{2RC} \pm \sqrt{\left(\frac{1}{LC}\right) - \left(\frac{1}{2RC}\right)^2}$$

$ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{4ac - b^2}}{2a}$$

Jan 21, 1935
K.T. Eldridge Constant Speed Inverter.



L and C should determine the frequency.

As C charges up on the first surge and the current swings back a reverse voltage appears across which turns off the thyratron.

Jan 30 1935.

Spent last evening on 3000 for see pictures of the shot gun. no success due to several difficulties.

Mr. Pugsley of Wm. was here in the morning and we discussed the problems at hand.

Bush gave us $500 for apparatus and for making a new film for use of the Alumnae.

Meeting of the Dept today to discuss grades etc.

I was in New York on Wednesday and Thursday last week at the A.I.E.E. Convention. Big snow storm! Stayed with Welch Payne at the Alberton house Wed night. Saw Mother Mary Ellen and her family on Thurs night coming home on the "Owl" at 1230 p.m. at midnight!

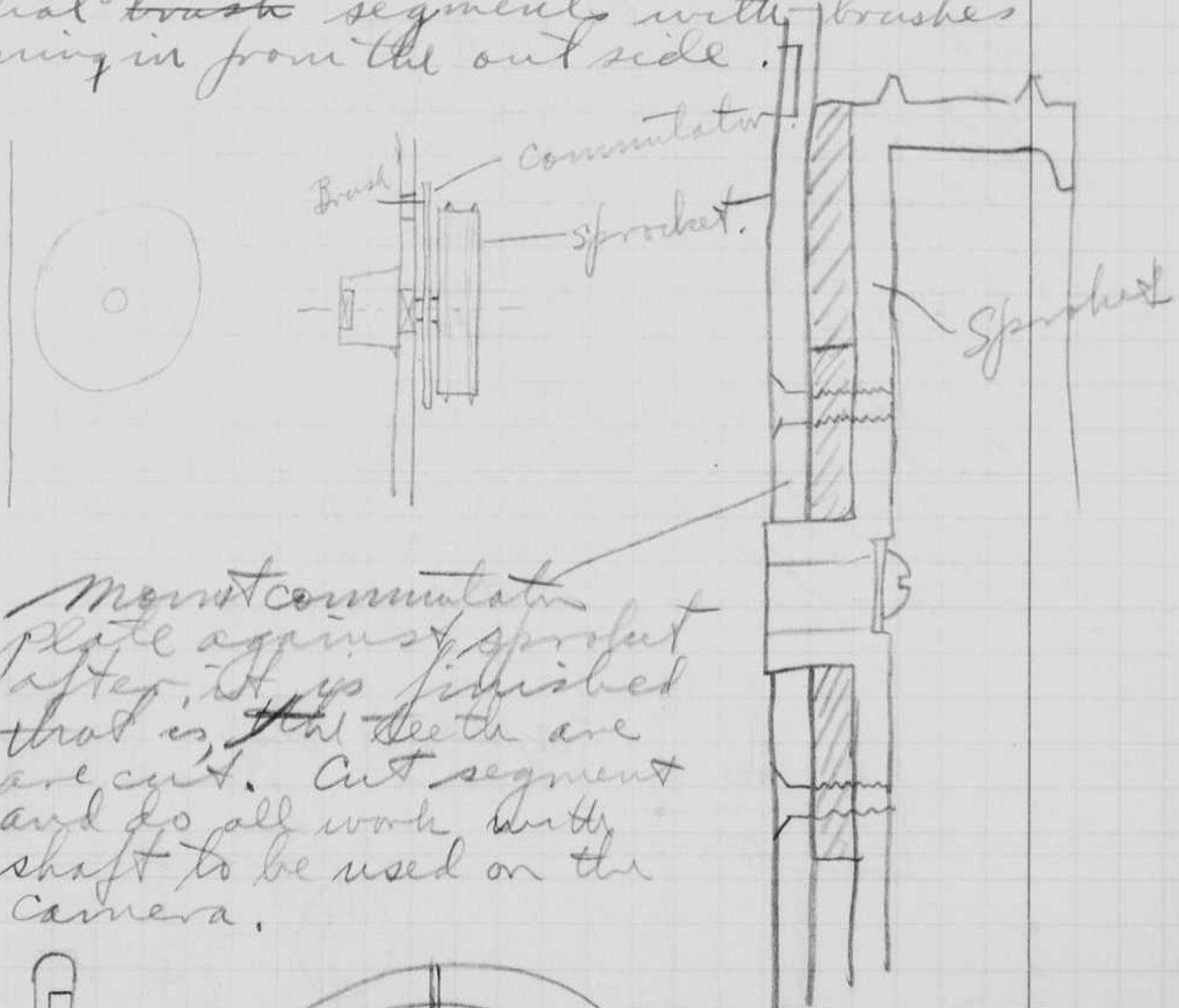
Feb. 8, 1935.

Second term has started. teaching 6.39 again. Newton Men's Club on Feb 6 - gave a talk. D.R. Strobo brought over ~~last~~ yesterday by Gernsbacker from D.R. This one has outlets for two lamps.

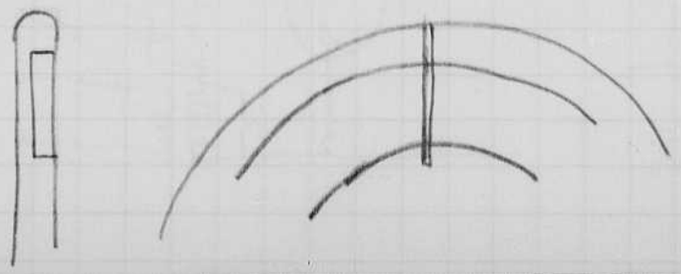
Feb 10 1935. Drier is working hard on the Navy Vibration Spark outfit. One lamp house is done and ~~this~~ power unit is being assembled.

Proposed assembley for camera.

Put commutator inside of the box instead of out side as we have it now. Radial ~~track~~ segments with brushes coming in from the out side.



Mount commutator Plate against sprocket after it is finished that is, ~~the~~ teeth are are cut. Cut segment and go all work on the shaft to be used on the camera.



Feb 18 1935.

I am trying to pep up my class in 639 by giving them some demonstrations of the things that I discuss in class.

Feb. 22, 1935.

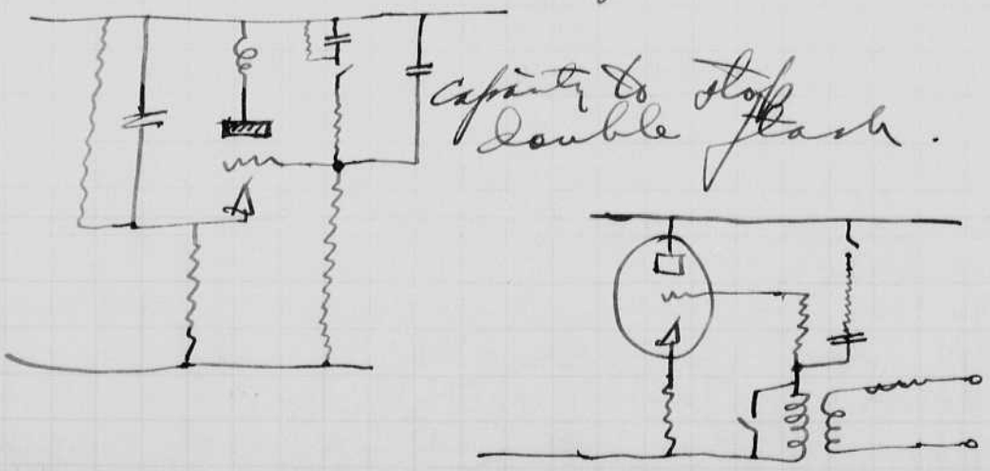
Worked most of day with Demerbauer taking pictures (movies) of camera lights etc for a new reel showing the camera and examples.

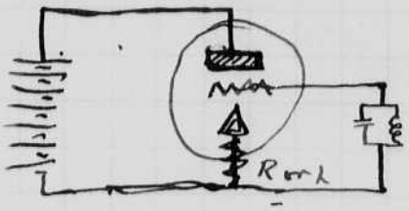
Dier went to N.Y. for the weekend in Pease's car with Laird.

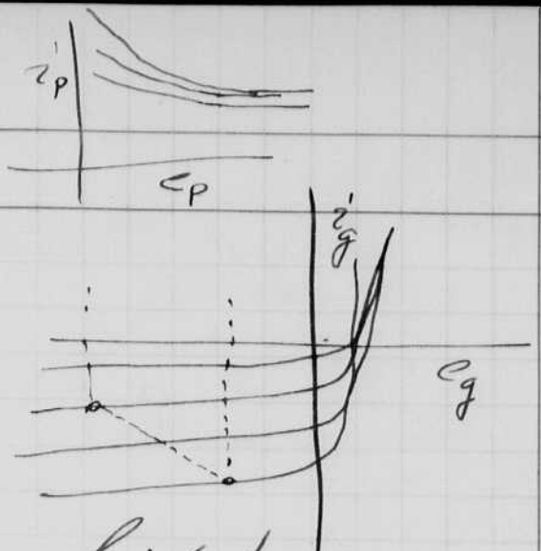
A man (Gorsuch?) from the adv. end of McGraw Hill co was in and talked to us about oil pictures.

Dr. Pratt and Miss Reed from Evans Memorial Hospital have been over three times to take movies through the microscope of muscle fibers (at high speed) during or following stimulation. Some movies were obtained at 1,500 per sec. not known accurately, since the belt in the camera slipped) with about 15 x enlargement.

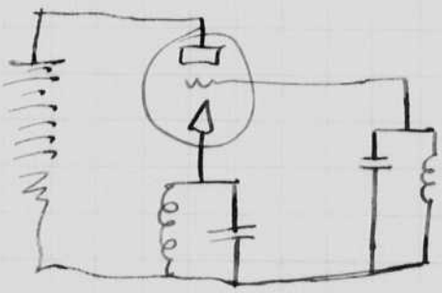
The D.R. stroboscope shows some tendency to trip on the break as well as the make of the trip contacts. Also some difficulty arises from the transformer in the grid circuit.

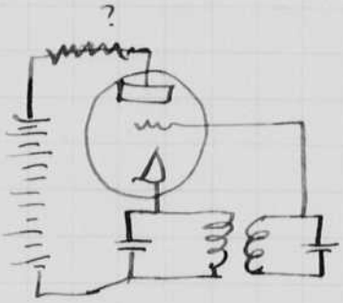




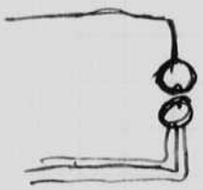


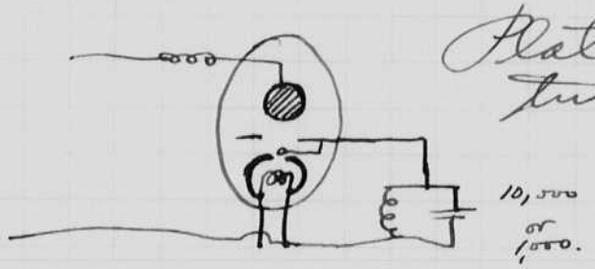
Method of obtaining high frequency oscillations with a gas-filled tube!

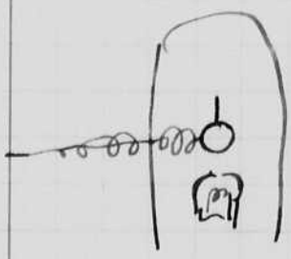




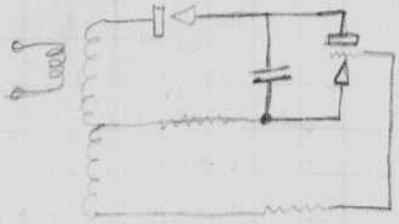
Short wave.
Plate is the tuned circuit.

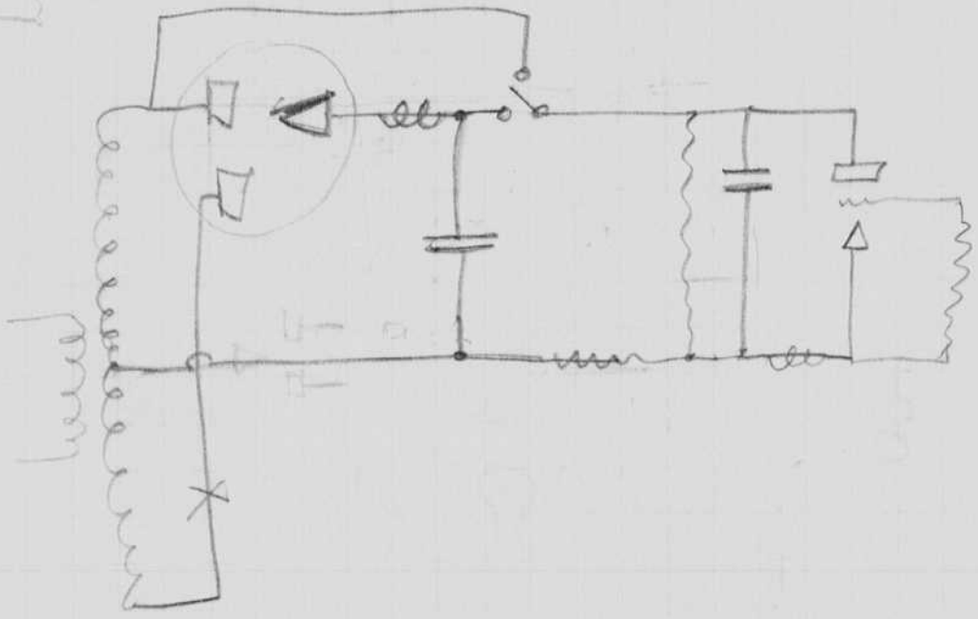


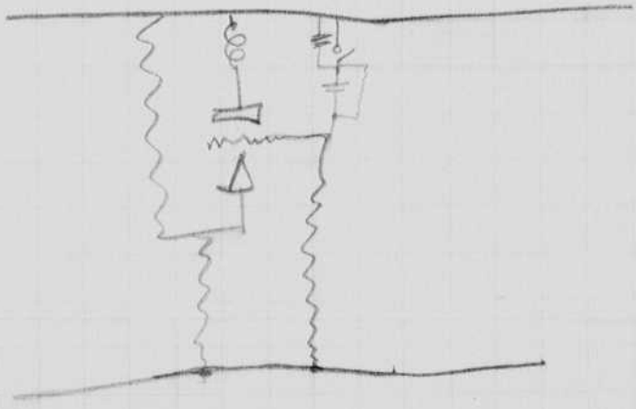




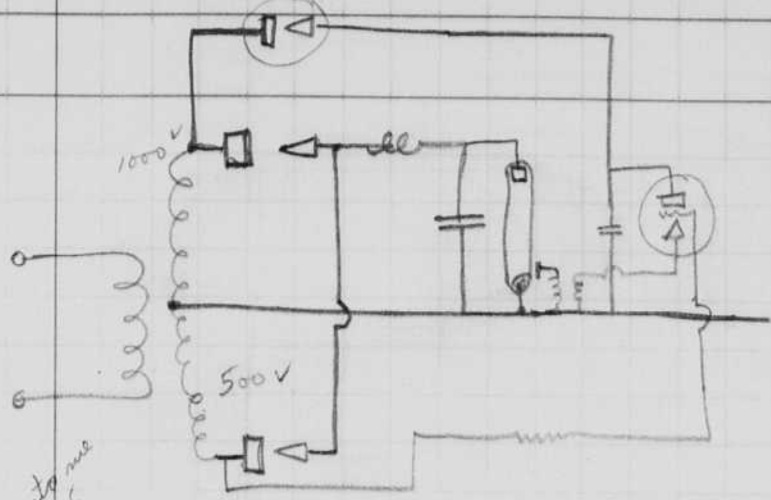
60 cycle Stroboscope







Feb 24 1935
H. E. Edgerton

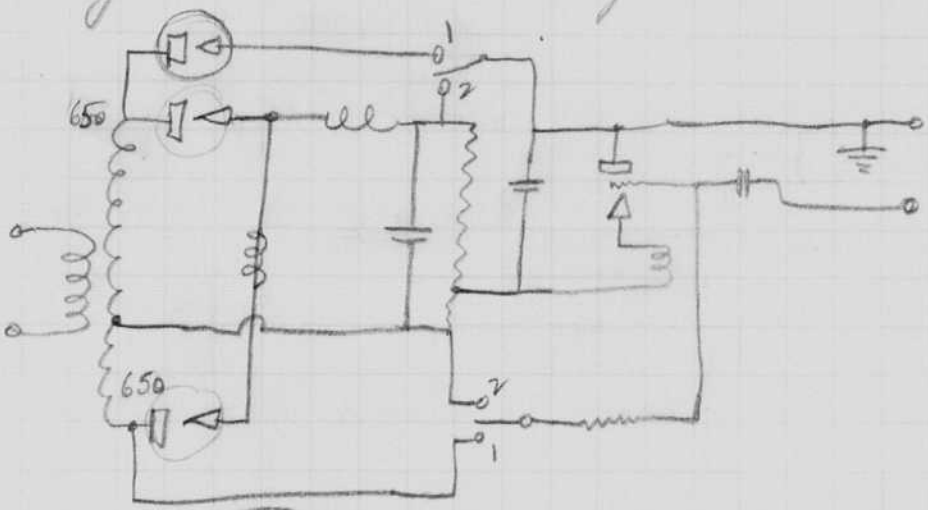


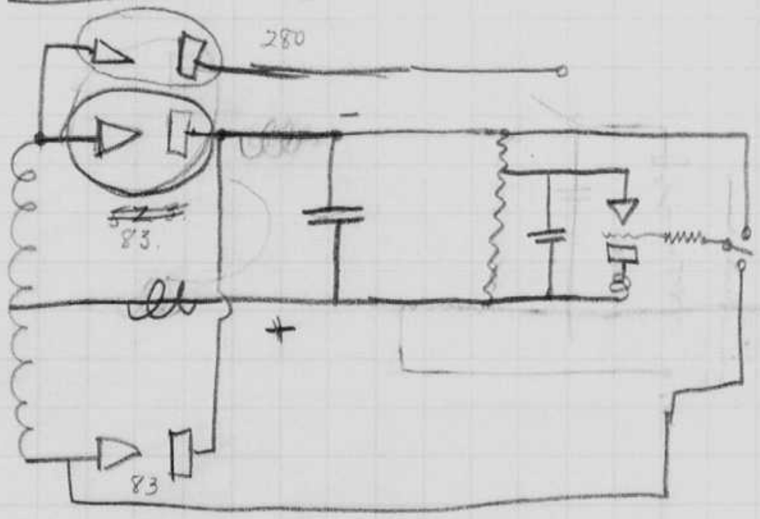
Shown to me Mar 16, 1935 [illegible]

Advantage!

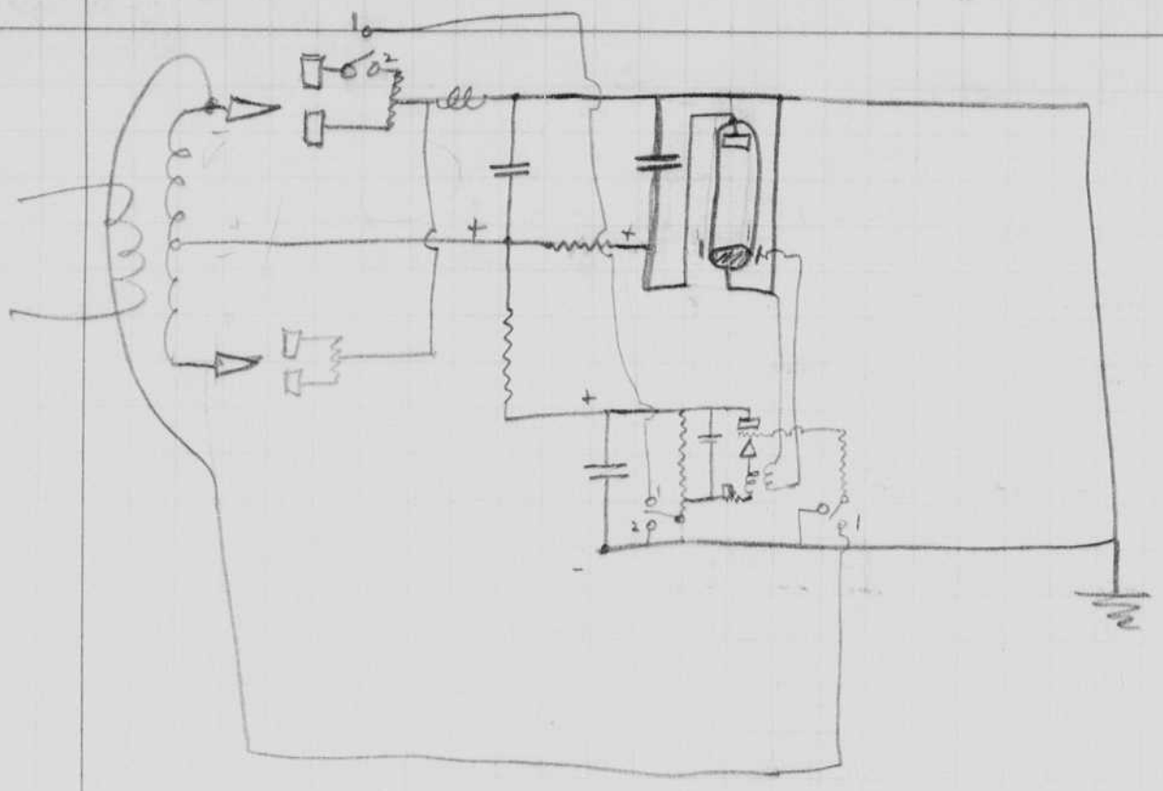
The power to charge the main condenser flows from each half cycle instead of during 1 half cycle.

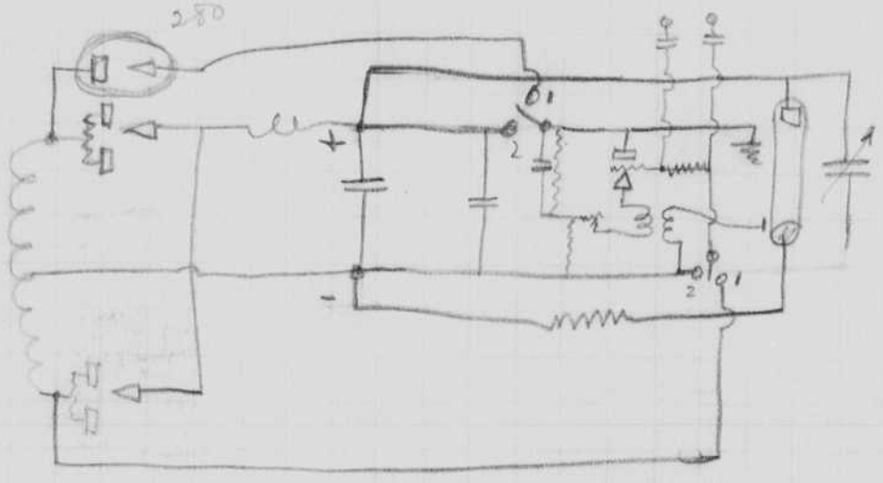
For combination trip in case of low speed say less than 30 cycles.

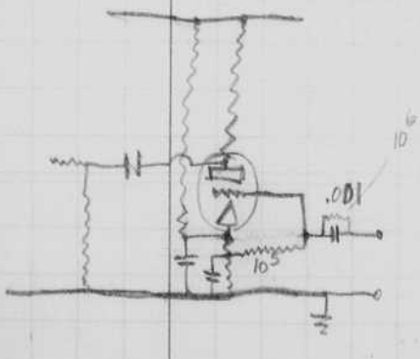


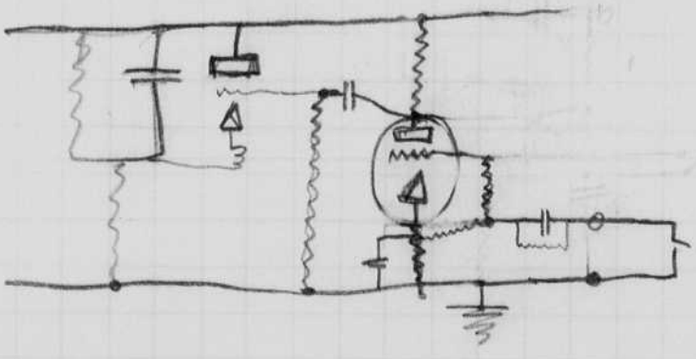


Polarity wrong.



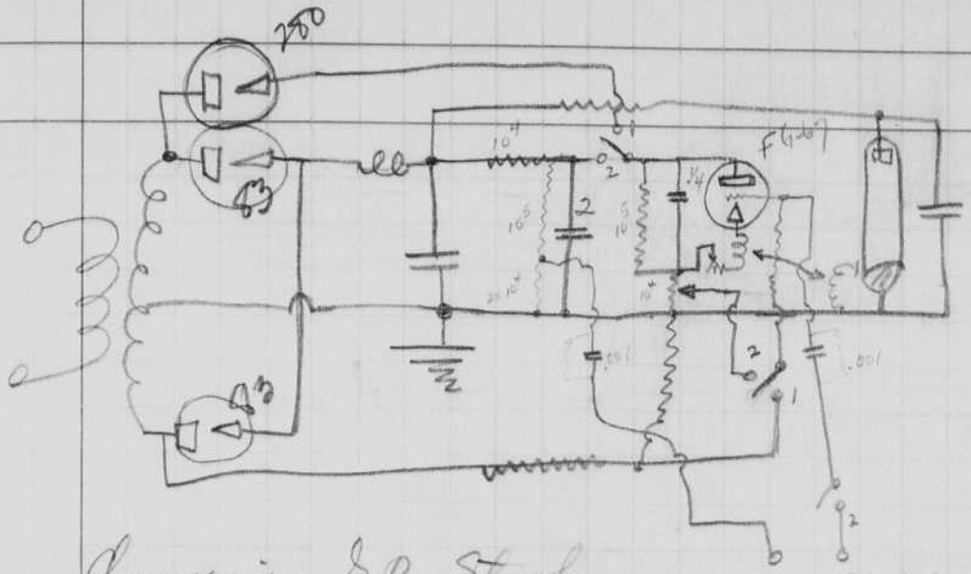






$.001 \times 10^{-6} \times 10^{5} = .0001$ sec.

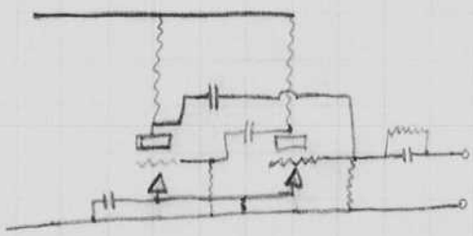
Feb 24 1935

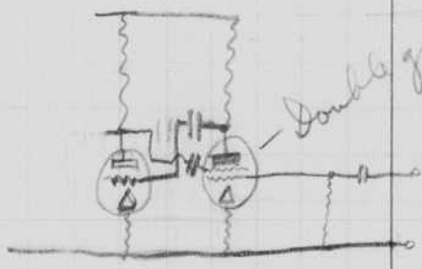


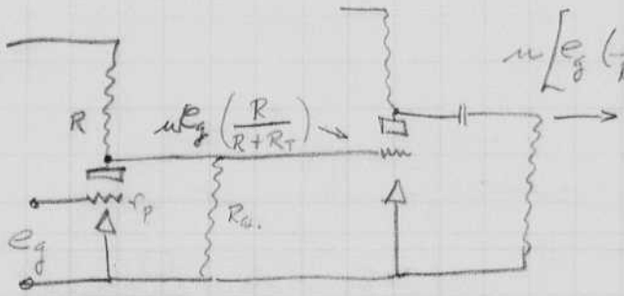
Changes in S.P. Strobo.

contactor or oscillator input

1. use FG 67 ~~leave off time switch~~,
2. Leaveoff time switch
3. Ground ~~neutral~~ negative.
4. Two lamps.
5. Amplifier.





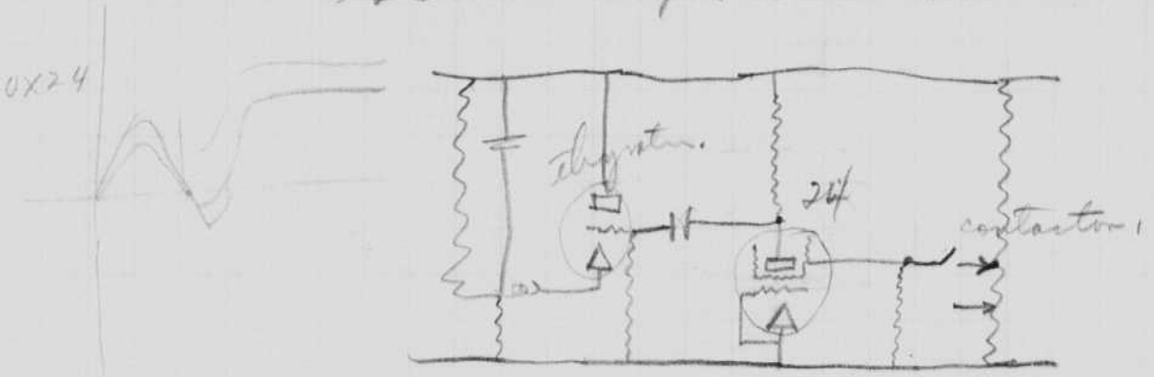


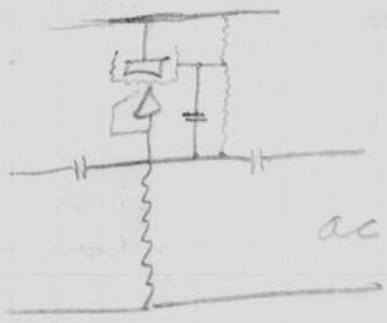
$$R_T = \left(\frac{1}{\frac{1}{r_p} + \frac{1}{R_{G_2}}}\right)$$

Feb 26 1935

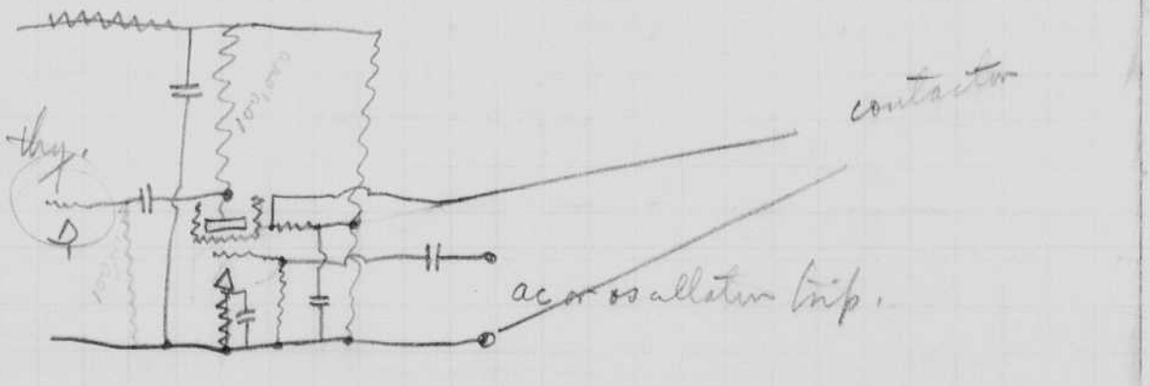
H E Edgerton.

Use of a Cyratron to trip the thyratron in the ~~thyratron~~ circuit





A pulse is produced when the ac voltage input passes through the neg voltage portion of the tube characteristic.



Dynatron oscillator effect would also be useful for self test of the stroboscope.

range 15 to 45 cycles a/sec.

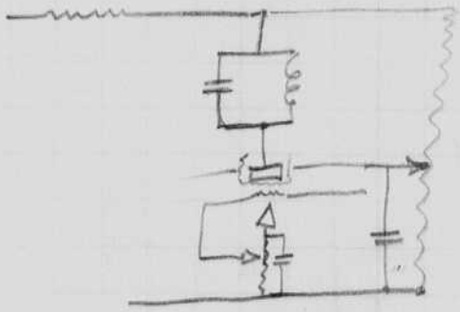
$f = \frac{1}{2\pi}\frac{1}{\sqrt{LC}}$

C or L to have $\frac{9}{2}$ range.

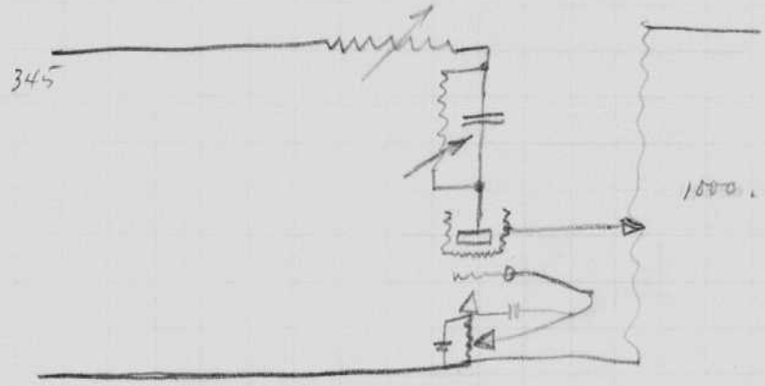
$B = \frac{1}{\sqrt{6}}$

$9 = \frac{1}{C}$

rather large range.

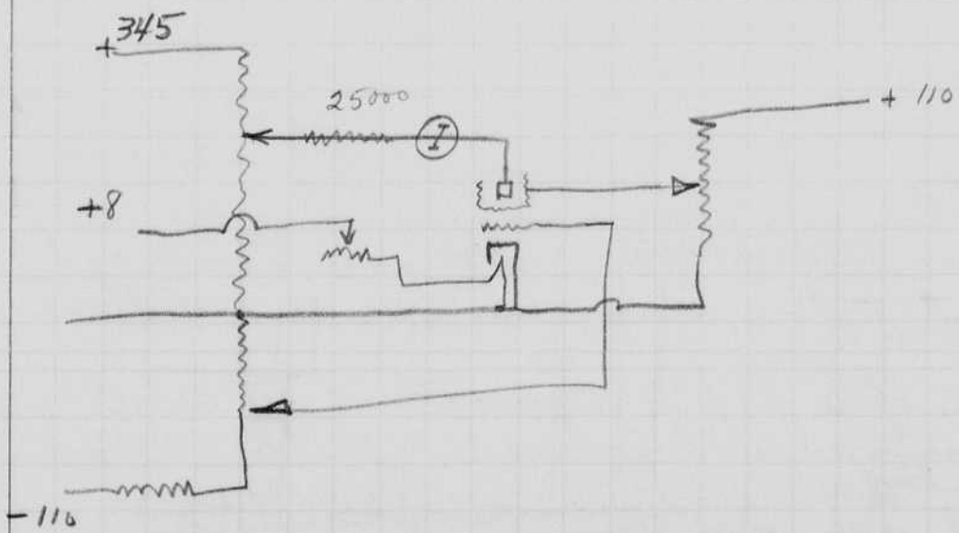


Relaxation oscillator type



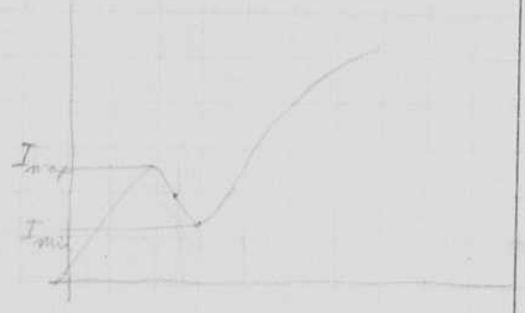
Works O.K. with Inductance but not with 24. resistance and capacity.

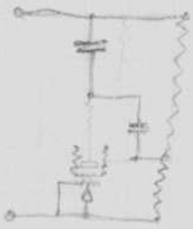
Probably do not have the right combination.

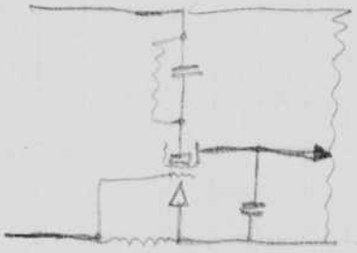


UX224

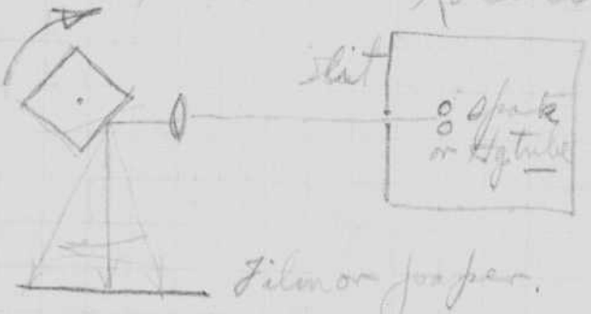
	I_{max}	I_{min}	
M18	2.2 ma	.5 ma.	Grid voltage 0
M358	2.3	1.5	S.G. " 70 volts
M1	1.7	.9	fil. 1.8 amps.
M359	2.3	1.7	







March 2 1935. Rotating mirror.



8" ◊ —— 24" ——→

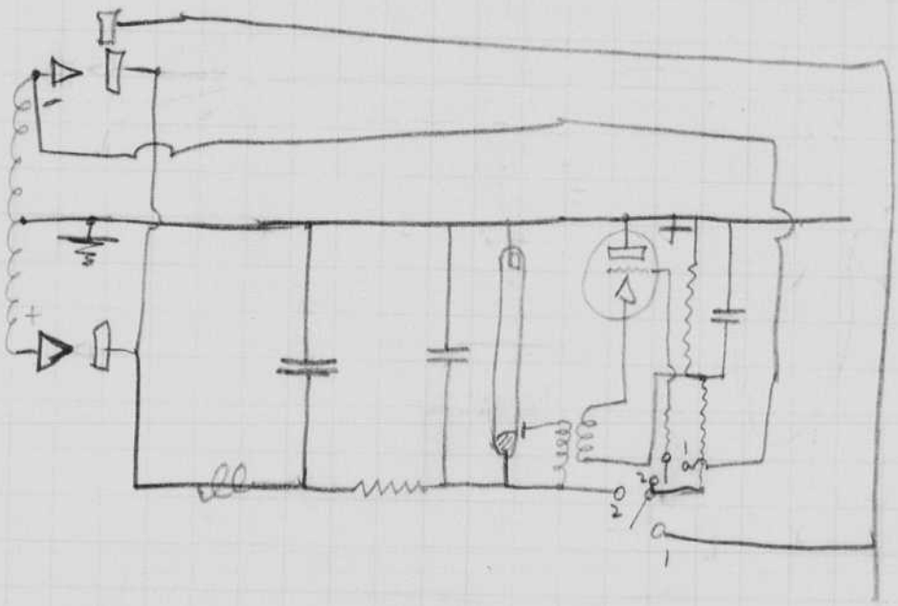
$\frac{1}{8} + \frac{1}{24} = \frac{1}{F} = \frac{32}{192}$ or $F = \frac{192}{32} = 6$" lens.

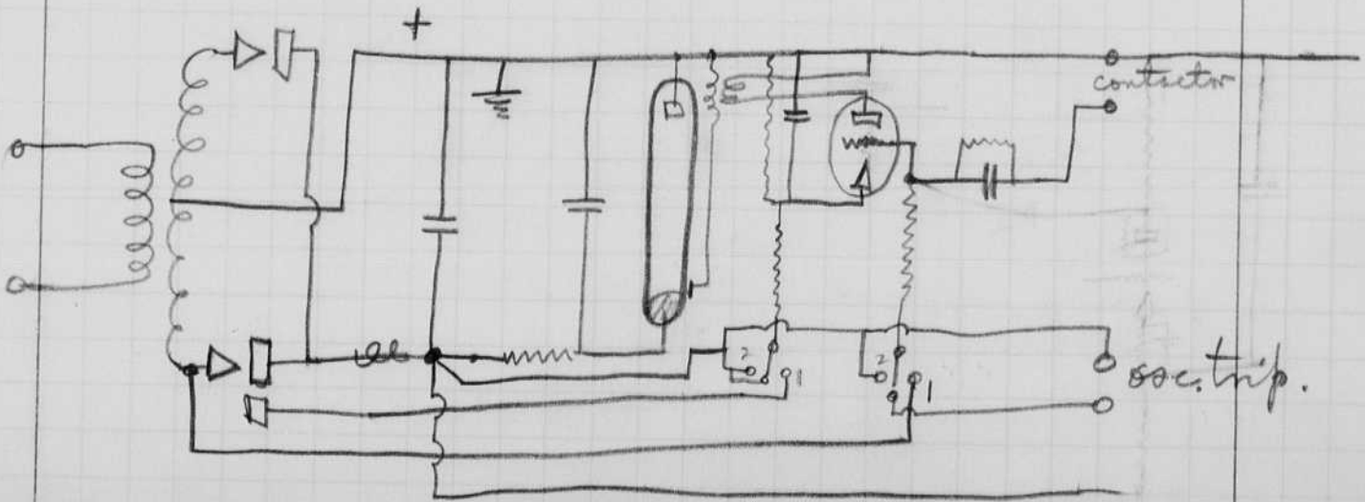
Sketch made from "Stanwell and Livingood Exp. Atomic physics. Mc Graw Hill

1000 r.p.s. of the top is equivalent to 2000 r.p.s. of an equivalent wheel. With 6" radius. Velocity of throw = $\frac{2\pi 6}{12} \times 2000 = 6280$ ft/sec.

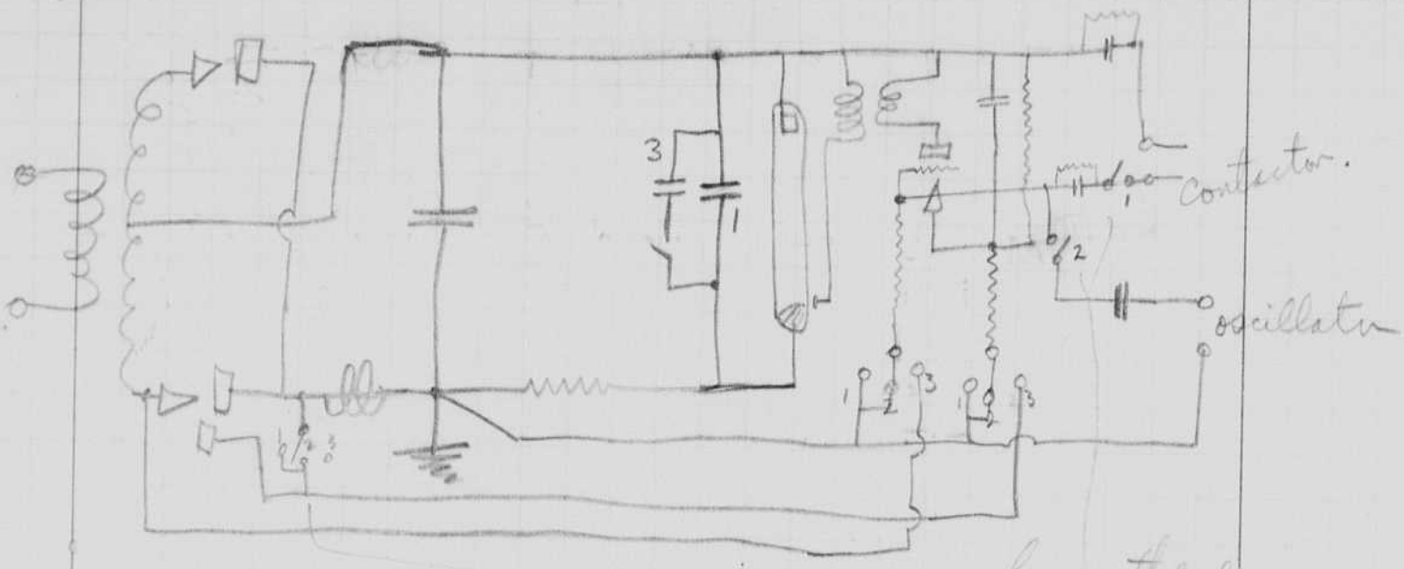
60 ~ 540
120 600 ~
180 660
240 720
300 780
360 840
420 900
480 960.
1020. – 16

March 4 1935.
R. Siegerling.
At Harvard today with Nottingham to hear 4.45 meeting. Dr. J. Hardy also. McAdam showed slides to show extension course.



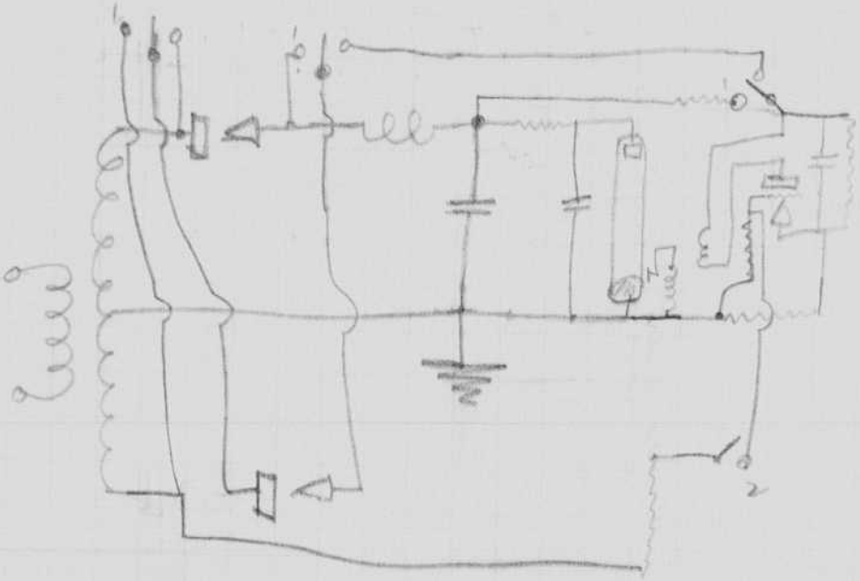


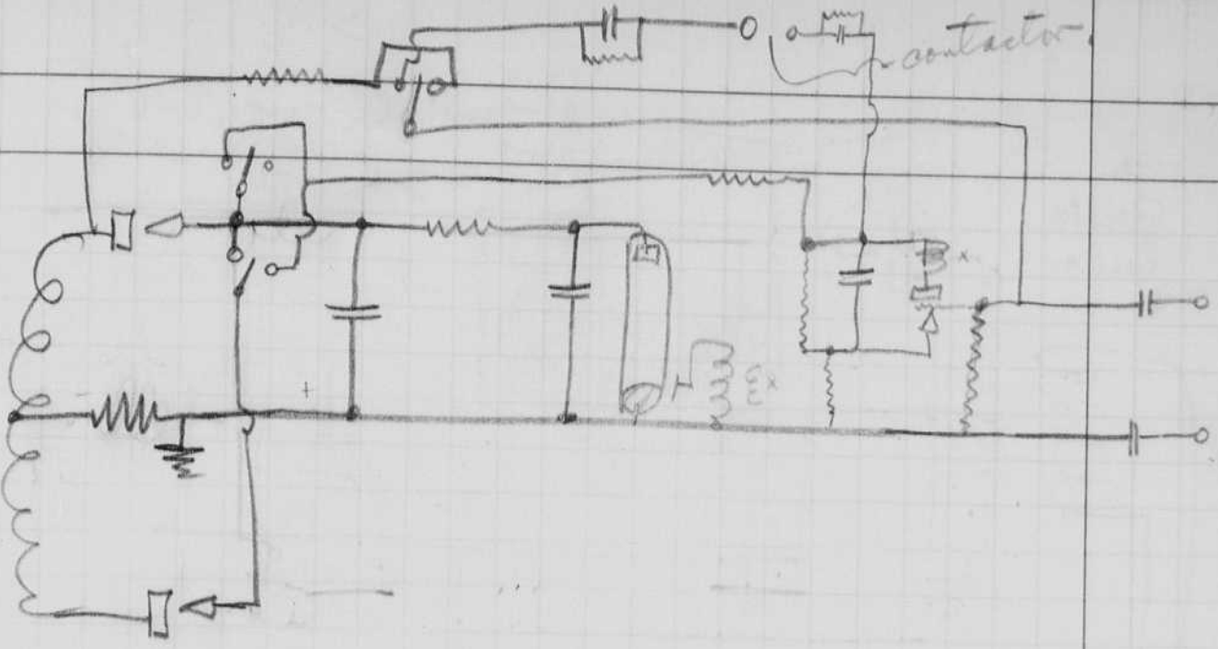
Cont'd.

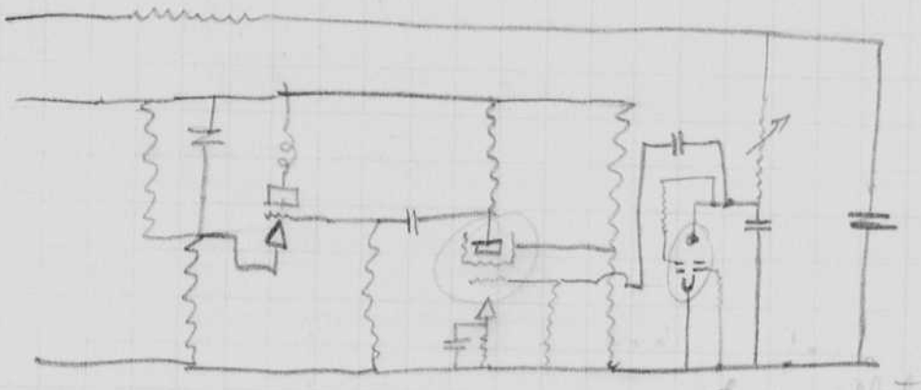


$.25 \times 10^{-6} \times 10^{5} = .25 \times 10^{-1} = .025$ sec.

leave these two switches out?
also this?



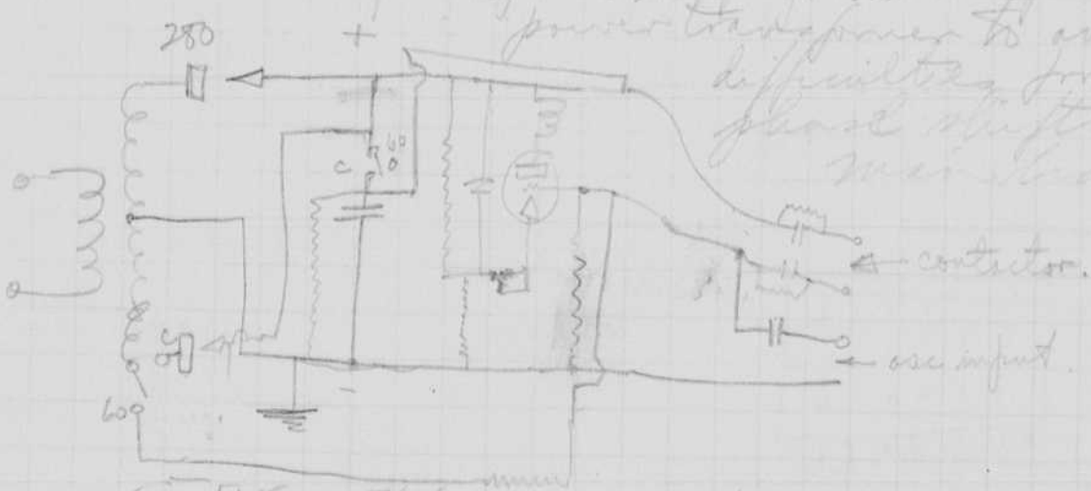




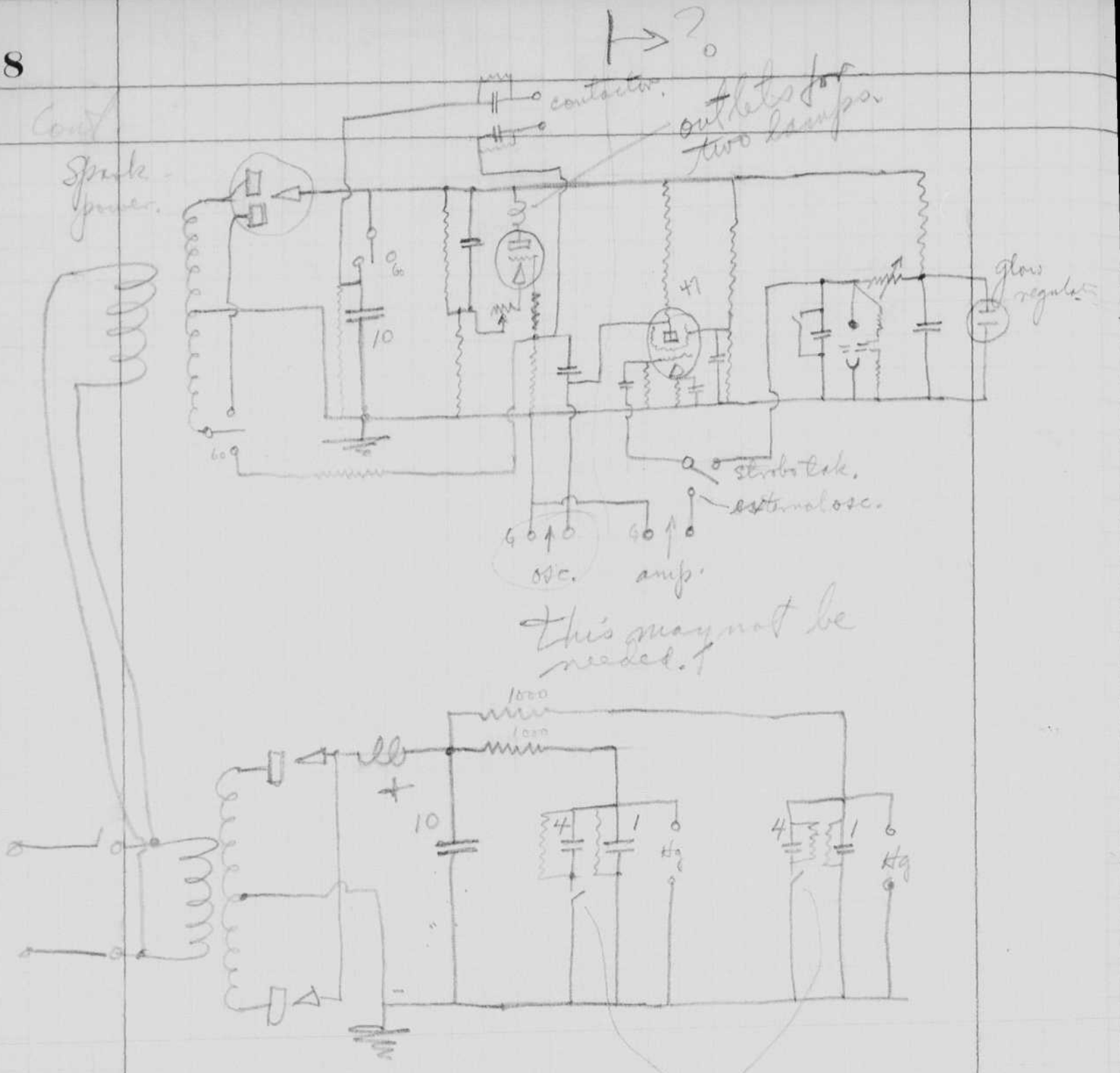
grow oscillator.

Mar 5/35
[illegible]

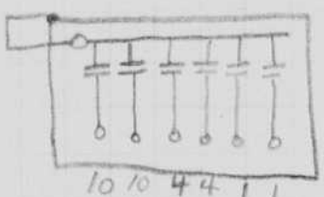
60 cycle spark supply. Use isolated power transformer to avoid difficulty from phase shifts in power line.



E 5V 45a, FG67
E 5V 6amp 83s.
E 5v 2amp 80
E 2.5V 2amp 24.



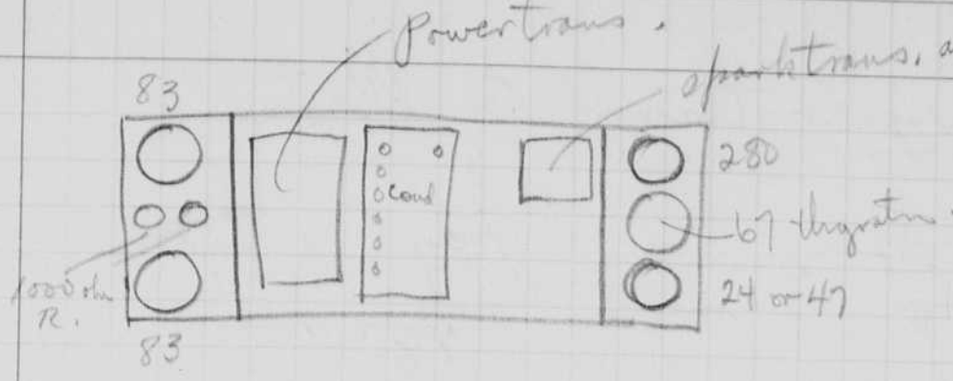
This may not be needed.?



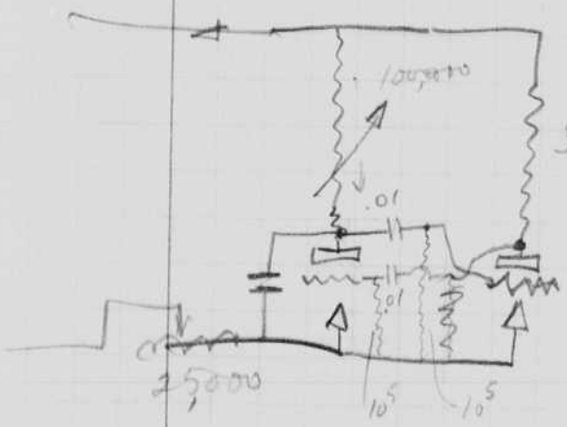
all in one can

these to operate together.

2
?
filter for spark.



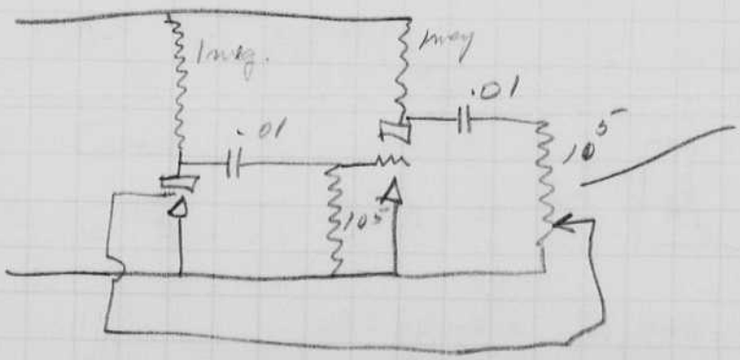
UX 53 twin triod power amplifier as relaxation osc.



1.0 ma.
350 / .1
5×10^5
50

$7 \times 5{,}000$
350 V

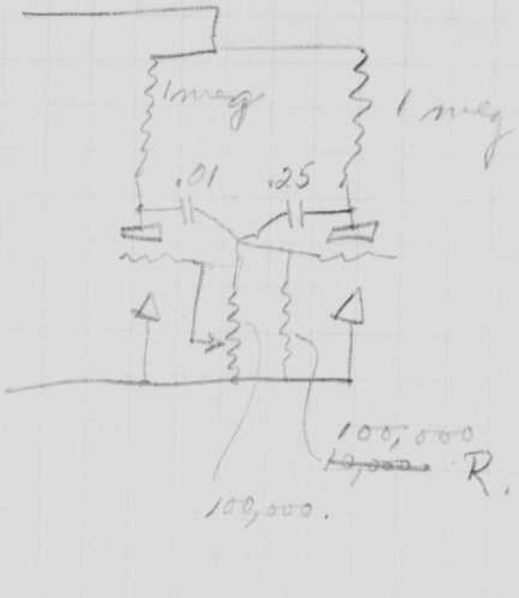
March 5 1935
HEE. Hooked up UX53 twin triod oscillator and it works fine.



a good way to change the frequency.

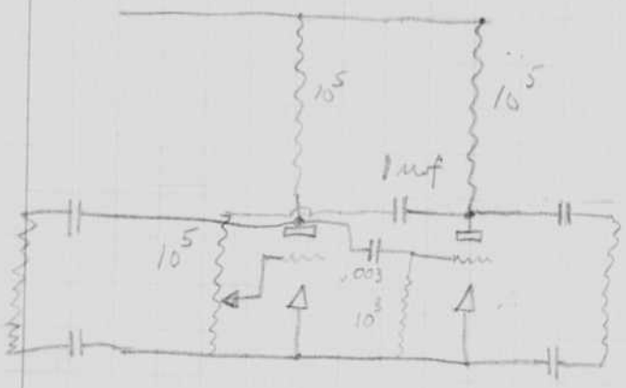
cont.

Unsymmetrical Oscillator

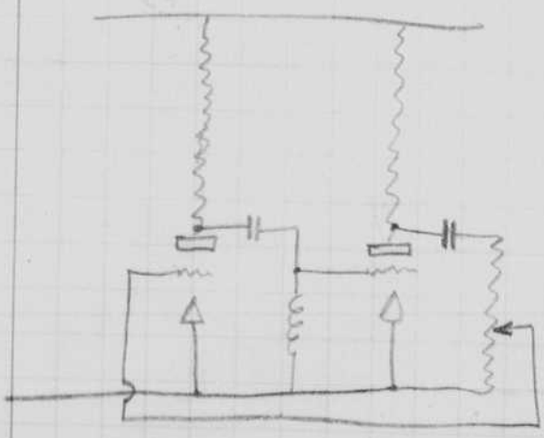


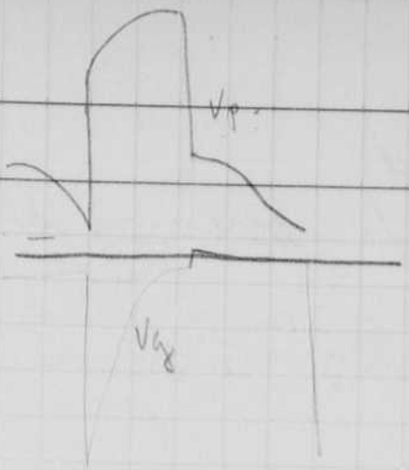
Freq range
40 - 400
Change R to 10,000,
200 - 1000.

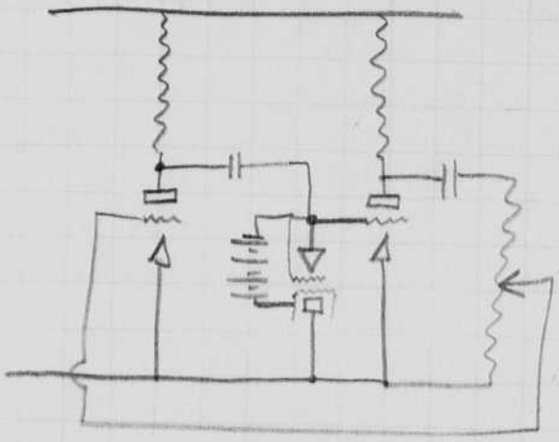
Lop sided

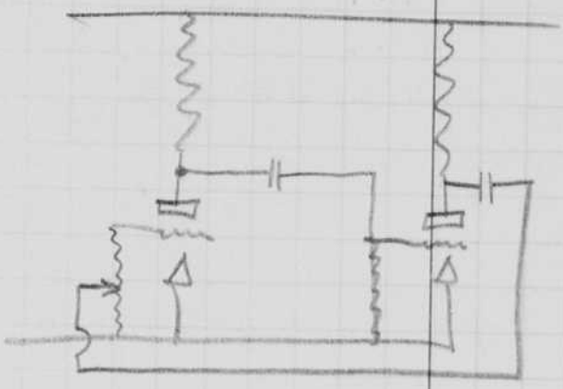


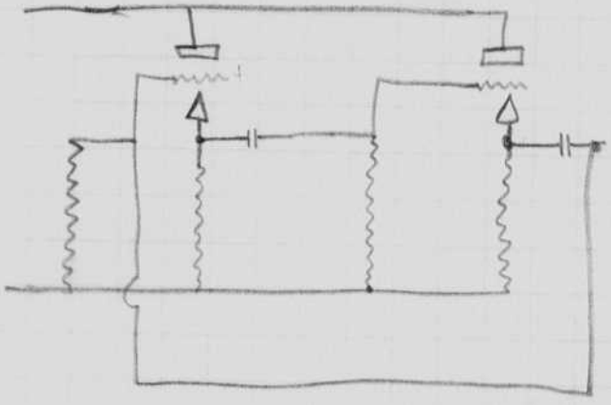
Save about inductance

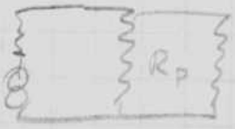




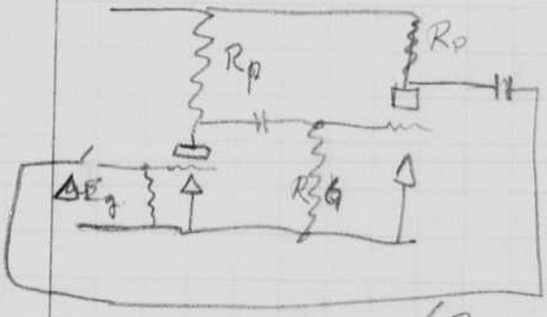








$$R_L = \frac{R_p R_g}{R_g + R_p}$$



$$\Delta E_{g_2} = \Delta E_{g_1} \mu \left(\frac{R_L}{r_p + R_L} \right)$$

$$\Delta E_{g_1} = \Delta E_{g_2} \mu \left(\frac{R_L}{r_p + R_L} \right) = \Delta E_{g_1} \mu^2 \left(\frac{R_L}{r_p + R_L} \right)^2$$

critical values.

$\frac{\mu R_L}{r_p + R_L} \geq 1$ to oscillate $\quad \mu R_L = r_p + R_L$

$\mu = 15$

$R_L = 50,000$

$r_p = 20,000$

$15 \times 50,000 = 70,000$

$750,000 =$

$\frac{15 \; 50,000}{70,000} = 11$

Cont.

Frequency from Terman p 274.

$$freq. = \frac{1}{R'C' + R'C''}$$

15 – 65 cycles. range of oscillation.

$$cycles\ 15 = \frac{1}{10^5 C'}$$

Make $R''C''$ very small compared to $R'C'$

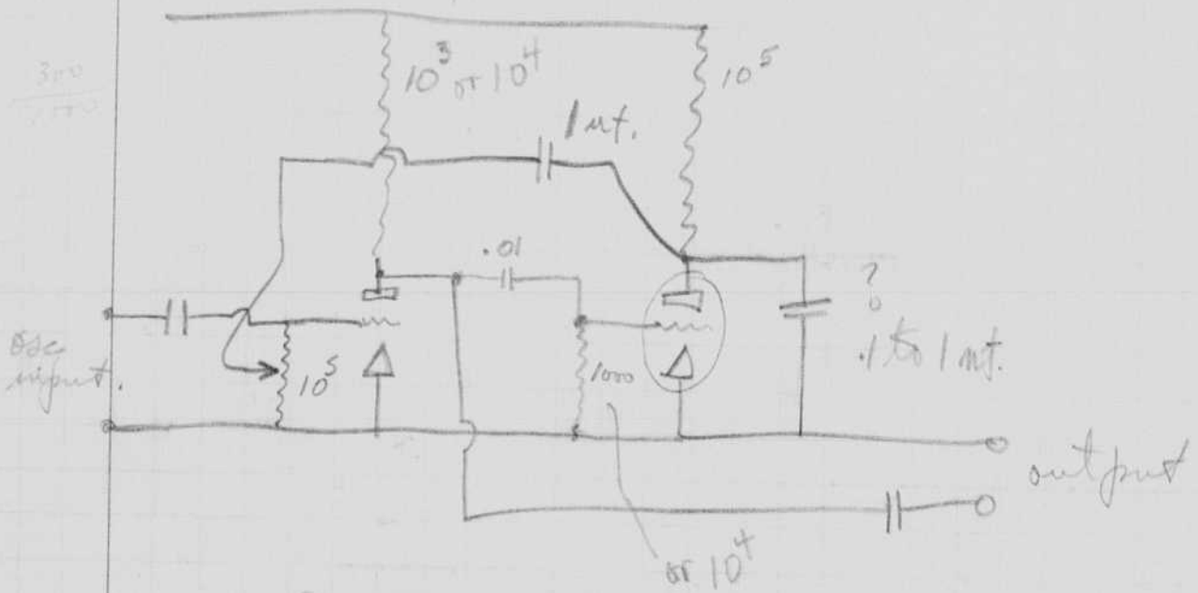
$$C' = \frac{1}{15 \times 10^5} = .67 \times 10^{-6} \text{ farads.}$$

for 65 cycles.

$$65 = \frac{1}{.67 \times 10^{-6} R} \qquad R = \frac{1}{.67 \times 10^{-6}\ 65}$$

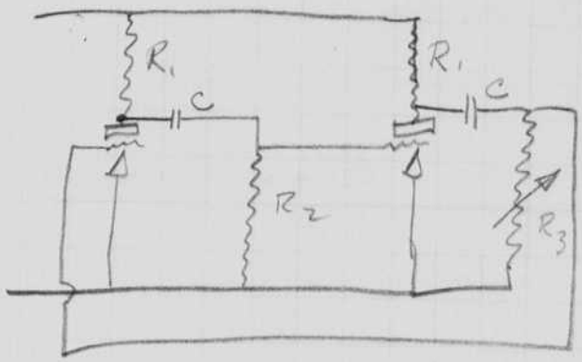
$$\cong 20{,}000 \text{ ohms.}$$

Circuit to try tomorrow



March 8, 1935.
~~H~~ E Edgerton

Worked this afternoon with twin triode relaxation oscillator which is nearly independent of supply voltage. John Byrne and Bennes Hansen also.

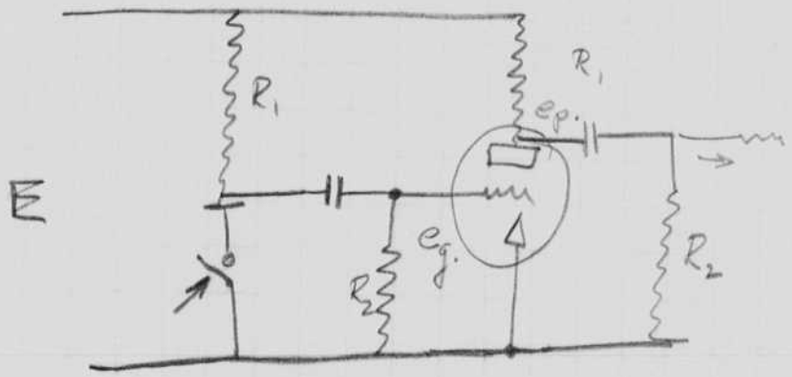


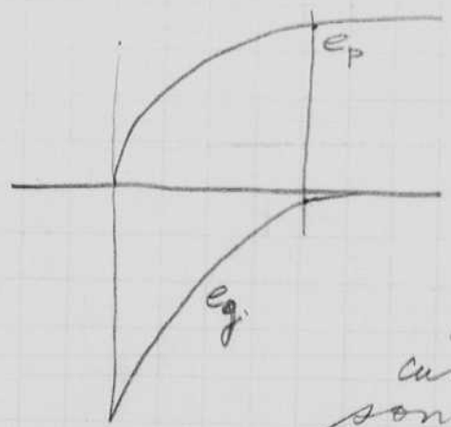
R_1 { 10,000 / 100,000 / 1,000,000.

$C = .05$ mf.

$R_2 = 10^5$

$R_3 = 10^5$ ↗





$$e_p = \frac{E}{R_1}\left(1 - \varepsilon^{-t/R_1C}\right)$$

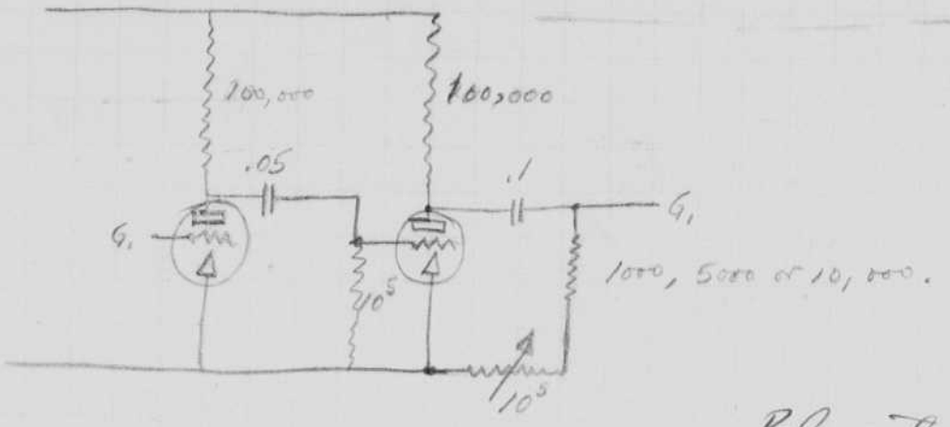
$$e_g = -\frac{E}{R_2}\,\varepsilon^{-t/R_2C}$$

the tube ~~snaps~~ or when current ~~starts~~ to flow at some critical value of conditions such that

$$\mu e_g \geq e_p.$$

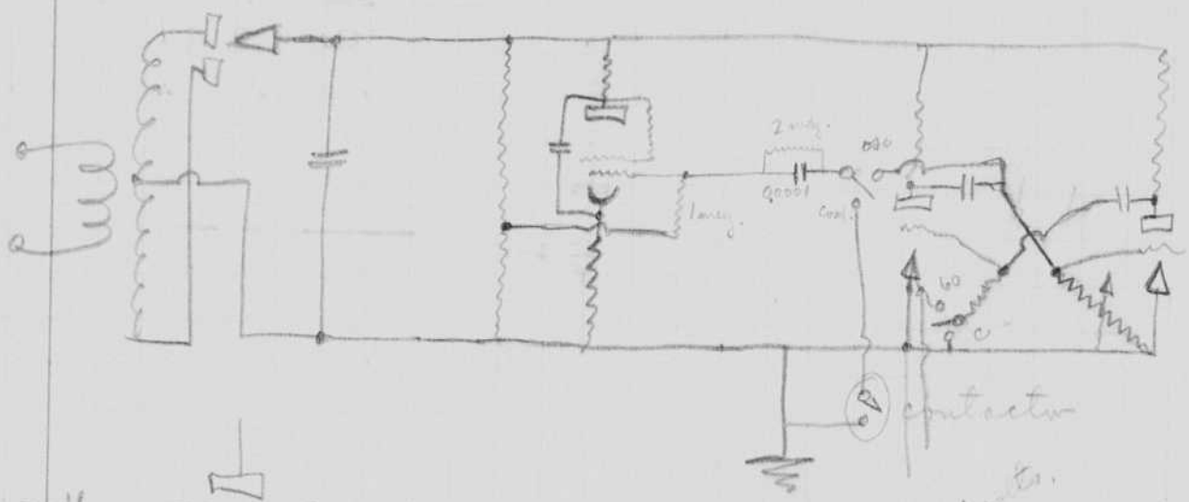
E cancels out of this expression!

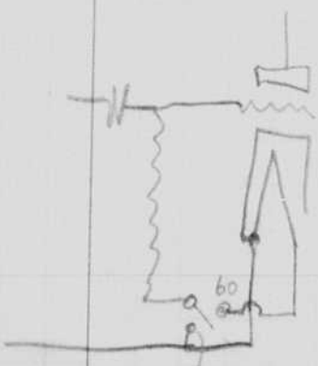
$$\mu \geq \frac{e_p}{e_g} = \frac{\frac{E}{R_1}\left(1 - \varepsilon^{-t/R_1C}\right)}{-\frac{E}{R_2}\,\varepsilon^{-t/R_2C}} =$$



Relaxation oscillator
0X53.

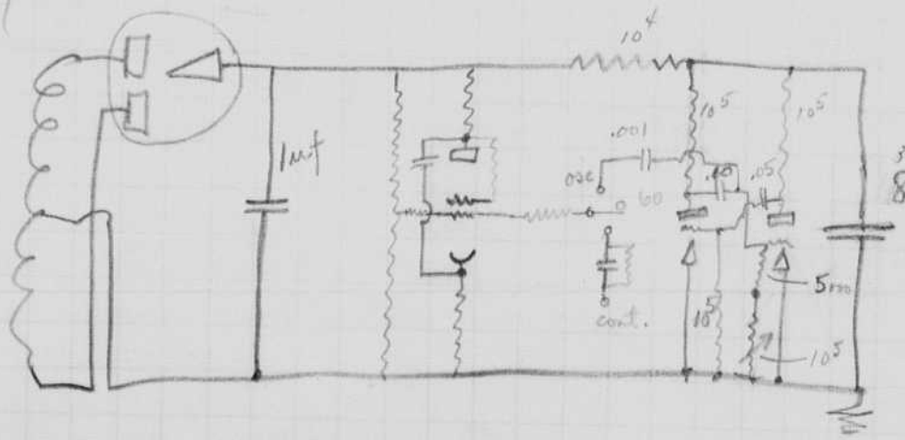
Shown to me Mar 16, 1933 Tolman

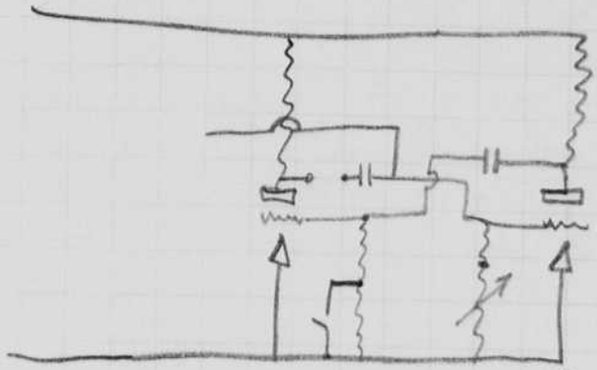


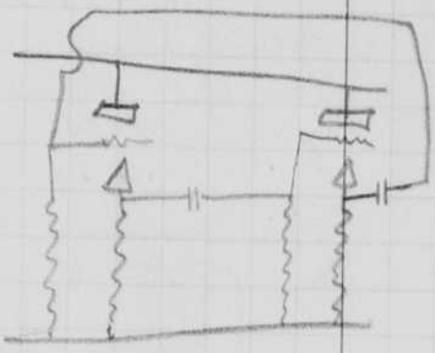


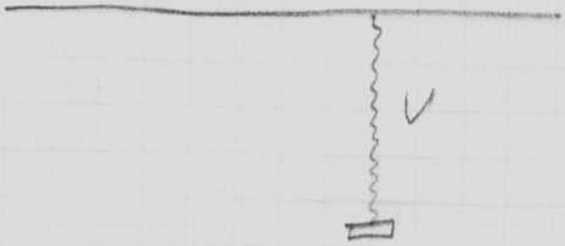
.00.300 mm
10^5

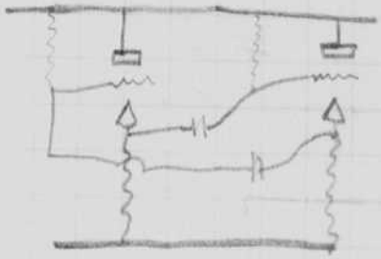
RC = 1x10^-6 x .5x10^5
= .5 x 10^-1 sec.
.05 sec.





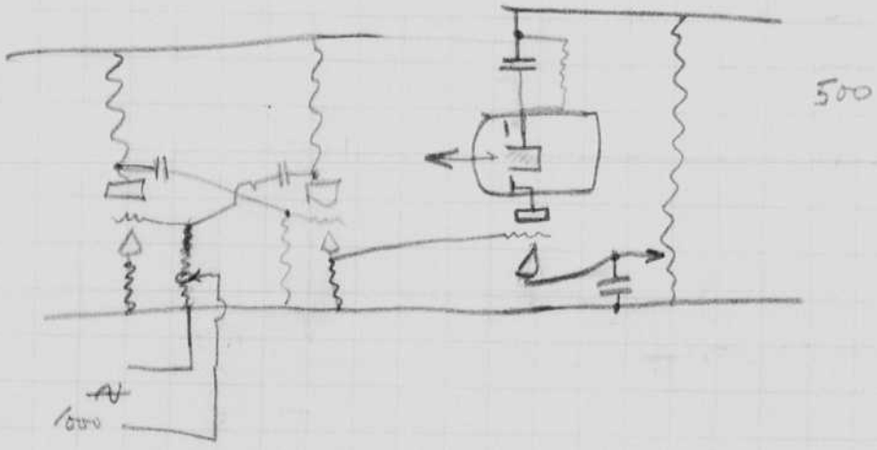






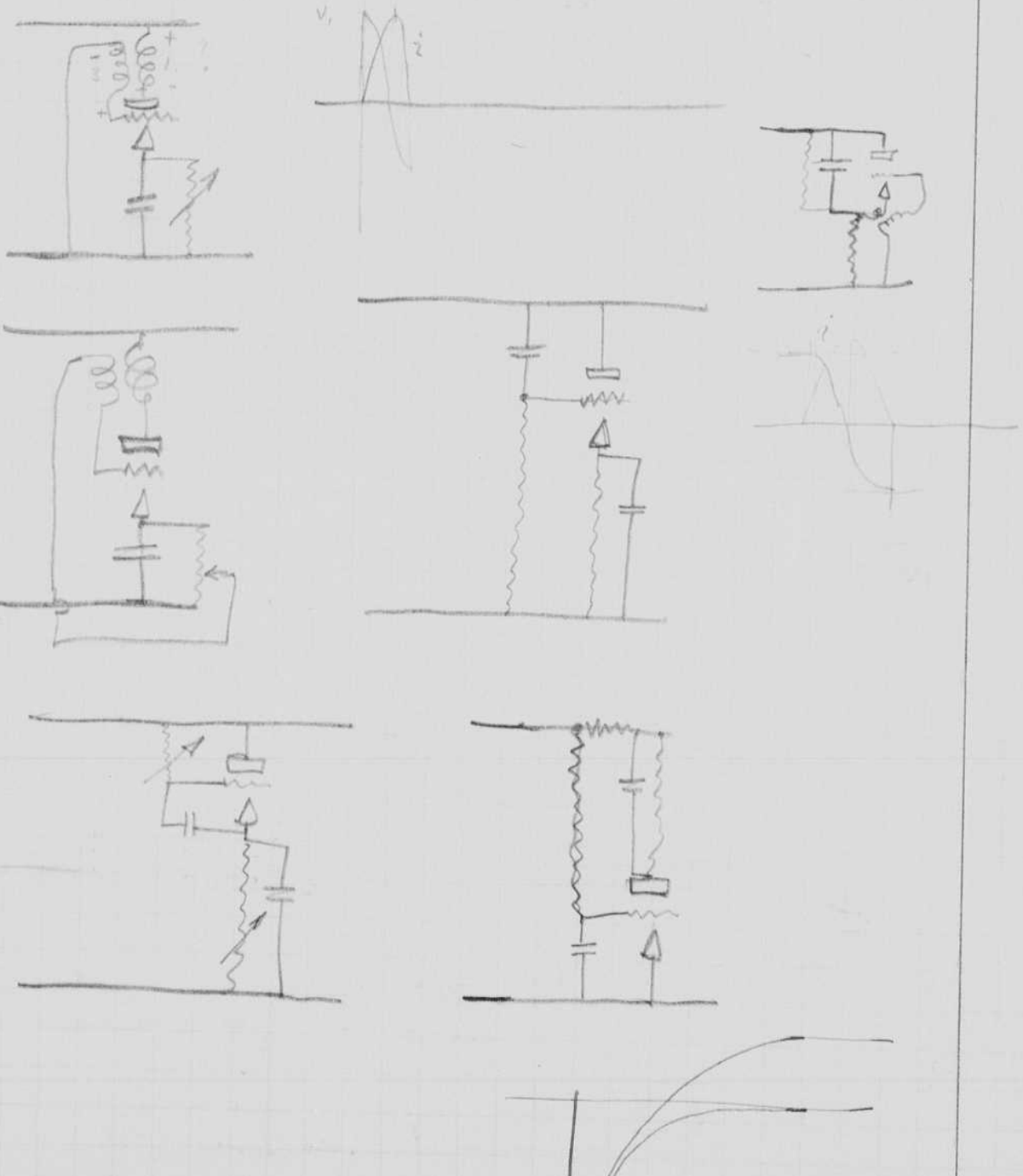
$$\frac{1}{RC + RC}$$

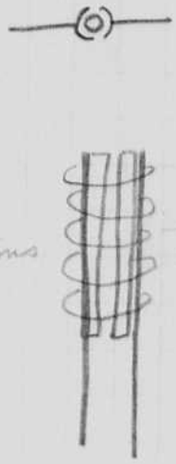
Timing wave oscillator.



Mar. 12 1935.

Jesse hit some golf balls for us [illegible] yesterday. More work on the oscillator for the Strobotak. Saw Walking [illegible] about the scale for the Strobotak.



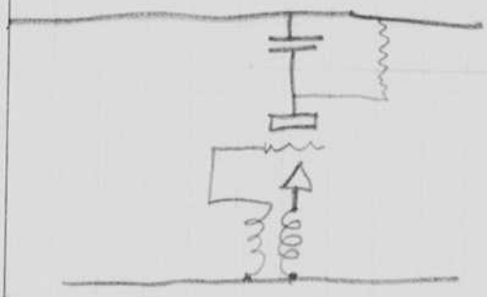


Split plate anode.
Magnetron.

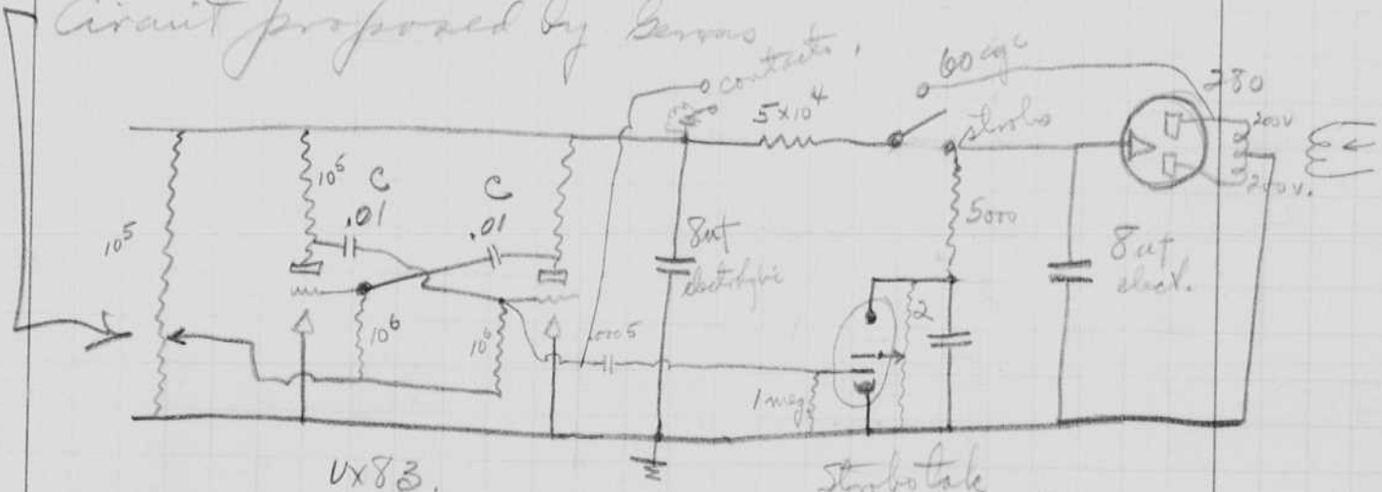
$$H = \frac{2\pi n I}{10 L}$$

n turns —

Special tube N.G.
Better to use standard tube.



Circuit proposed by Gerrard.



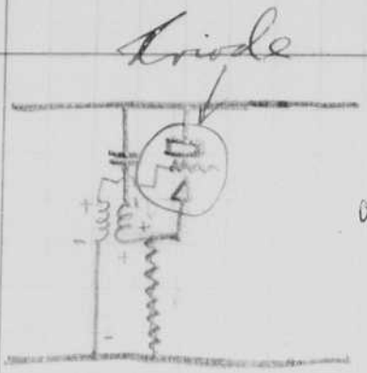
Explained to me March 6, 1935 Kilgsby

UX83.
Double triode.

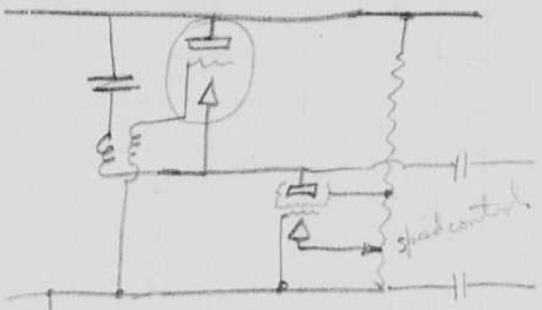
Stroboscope

Speed range 900 – ~~4000~~ 2400 ? r.p.m.
with C = .02 " 600 – 2400 ?

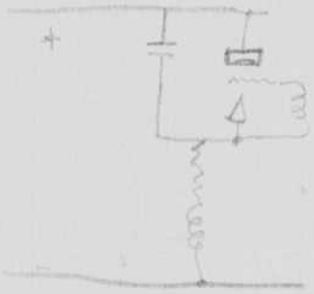
Tried today and working great.
John Byrne helped on these experiments.
Wesley Fiesler and Tamor were helping us this morning. Got compression pictures.



applied to me
Mar. 16, 1935
V. E. Straw



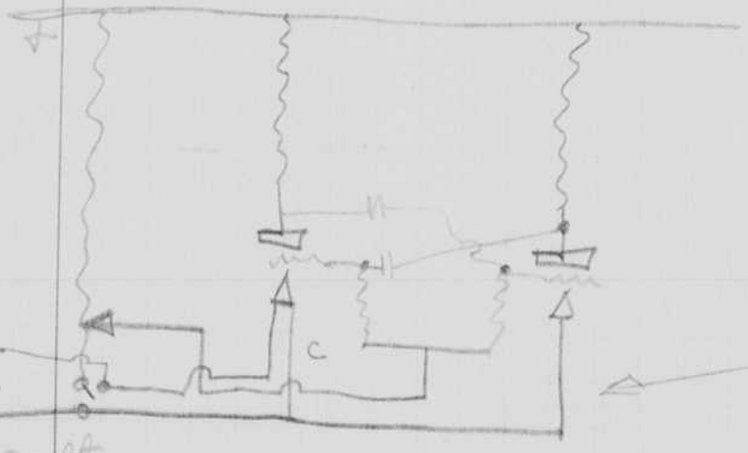
Sweep circuit.



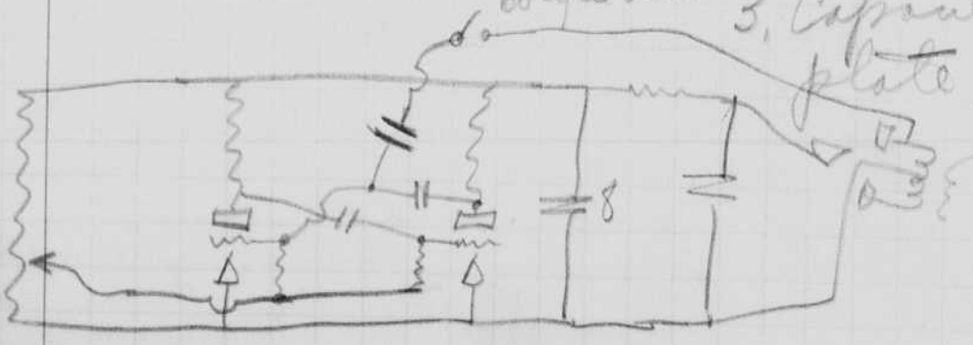
Possibilities

60 cycle tie in

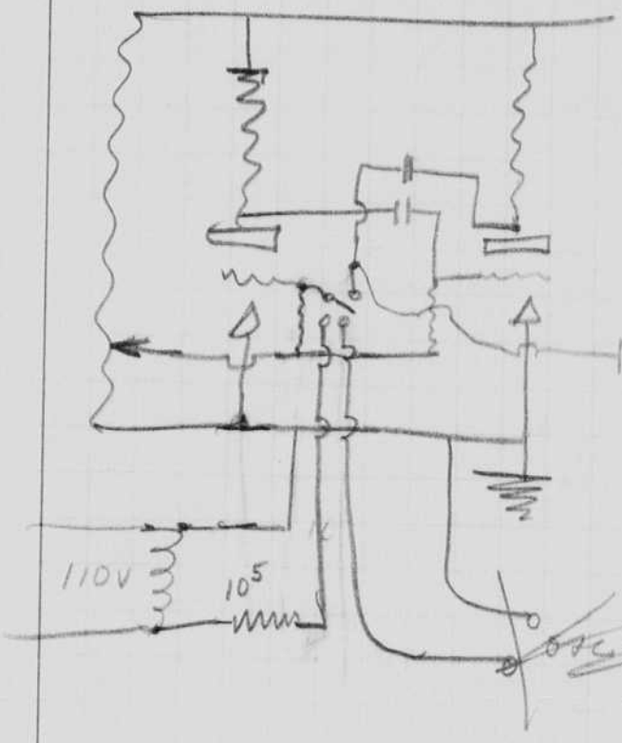
1. Decouple filter or oscillator.



2. Put 2½ volts ac in series with grid (2½ volt from cathode heater).



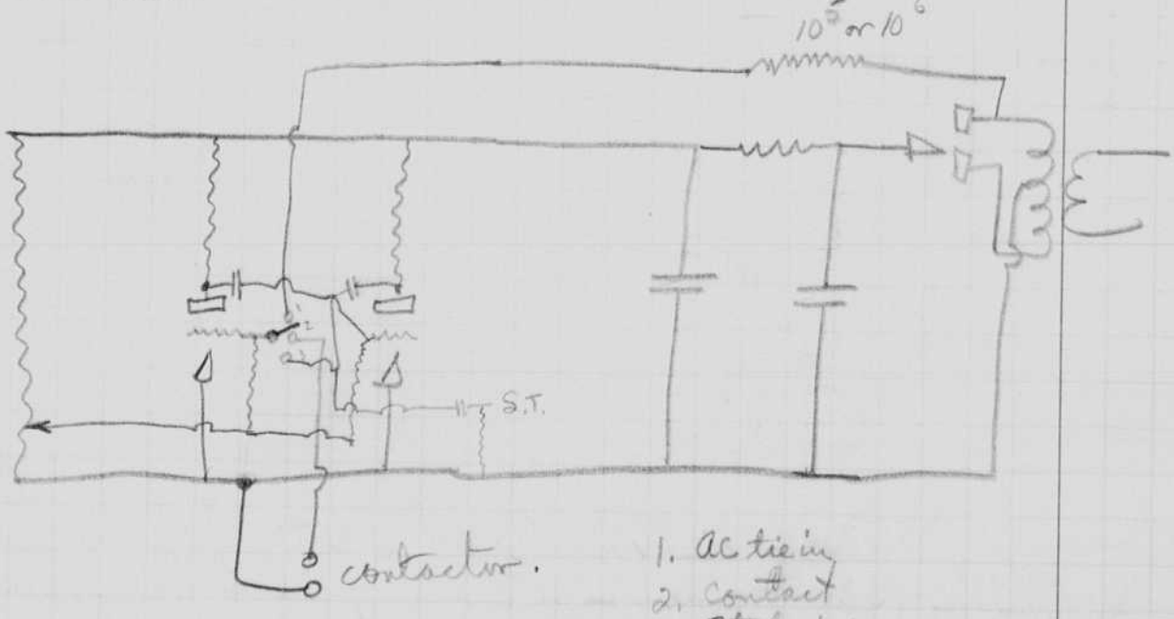
3. Capacity tie in to plate supply.



Strobotak trip.

~~osc control.~~ no? needed.
Yes!
Amplifier control.
Contact?

3 60 cycle tie in
1 Strobotak.
2 Contact



contactor.

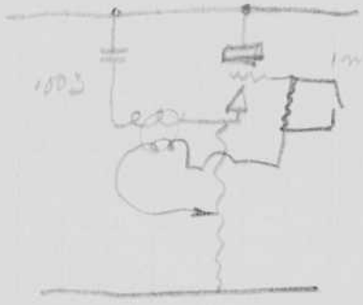
1. AC tie in
2. Contact
3. Strobotak.

Mar. 13, 1935

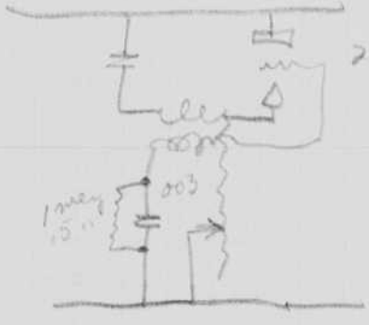
H. E. Edgerton.

Tried these circuits

oscillates violently at high frequency.



Relaxation osc on some values of bias.



oscillates, circuit has jitter.

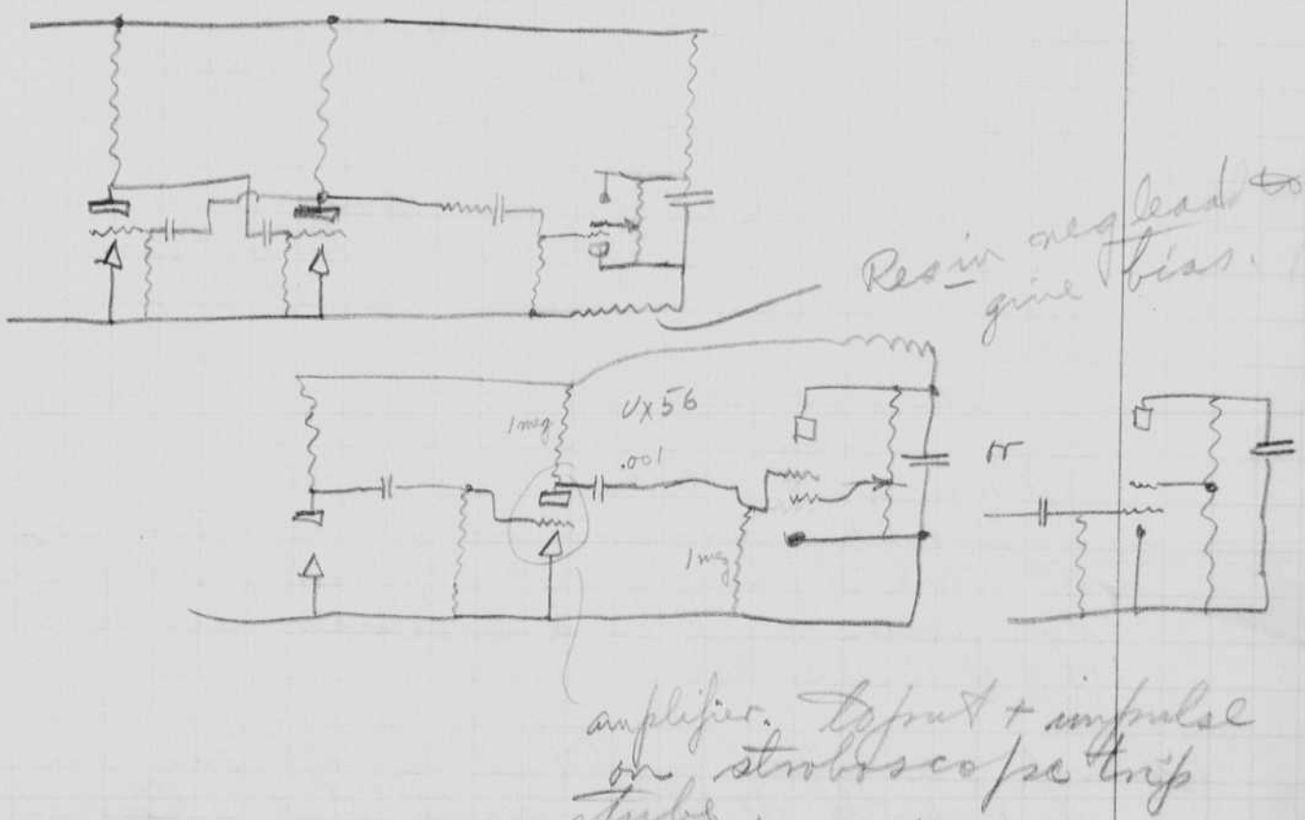
Shown to me March 13, 1935 Whitney

Showed this last one to Johnson and Fallo (639 students). They plan to experiment with the arrangement.

March 16 1935
~~Headquarters~~

Brier and I showed the mens club at Pagon Park Cong. church the stroboscope and movies last night. about 200 there and very enthusiastic.

Germeshausen wired up a strobe tak yesterday with a special transformer built by G.R. (Mr. Elkins). Calibrated condensers were used to give a 4:1 speed range. Works fine except for a few fine points, there is not quite enough output from the oscillator to make the operation definite at all speeds over the input voltage variation.



amplifier. Output + impulse on stroboscopic trip tube.

A UX 30 might be used with a resistor in series with the filament for 10 ohms .06 amp.

March 21, 1935.
H. E. Edgerton.

On March 18 Gemesharen and I took the stroboscope on the bread board over to E.K. and demonstrated its performance to Wilkins and Burke. I left Monday night for Philadelphia to talk to the Engineers club on Tuesday the 19th. In the morning called on Longyear at K.K.A. Saw Morton and Judd while there.

At lunch at the engineers club I saw Mr. Chase, Boslin, Sanford, and heard a speech by Mr. Ball.

At Leeds and Northrup in the afternoon to see Peters.

Stopped again at the Franklin Institute on the way to town and Dr. Barnes helped me with the stroboscope which I used that evening for a talk to the Engineers Club. Present at the dinner before the meeting Mr. Chase, Pohl, Prof Moodey of Princeton, Peters, Swoboda, Sanford Funk Boslin and others.

On Wed morning I went to Washington and called on Edward P. Smith. Gaylord, Captain Eggert, Kelsey, and others. Saw their Heraldic work and other things. At five I found Margaret (Mrs Treganza Robinson) and had dinner with them at the Occidental.

March 23. Last night at the Algonquin Club with Wilbur and Pres Compton. I sat by Gen. Cole and by Mr. Forbes.

Notebook # T-5

Filming and Separation Record

____ unmounted photograph(s)

____ negative strip(s)

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

was/were filmed where originally located between page __62__ and __63__.

Item(s) now housed in accompanying folder.

March 21, 1935.
D. C. Edgerton.

On March 18 Gemeshausen and I took the stroboscope on the bread board over to E & R. and demonstrated its performance to Wilkins and Burke. I left Monday night for Philadelphia to talk to the Engineers club on Tuesday the 19th. In the morning called on Young[illegible] at R.C.A. Saw Morton and Buck while there.

At lunch at the engineers club I saw Mr. Chase, Boslin, Sanford, and heard a speech by Mr. Ball.

At Leeds and Northrup in the afternoon to see Peters.

~~Stopped again~~ at the Franklin Institute on the way to town and Dr. Barnes helped me with the stroboscope which I used that evening for a talk to the Engineers Club. Present at the dinner before the meeting Mr. Chase, Pohl, Prof Moodey of Princeton, Peters, Swoboe, Sanford Funk Boslin and others

On Wed morning I went to Washington and called on Edward P. Smith. Gaylord, Captain Eggert, Kelsey, and others. Saw their ~~Hydraulic~~ work and other things. At five I found Margaret (Mrs Evenson) Robinson and had dinner with them at the Occidental.

March 23. Last night at the Algonquin Club with Wilkes, and Pres Compton. I sat by Gen. Cole and by Mr. Forbes.

Notebook # T-5

Filming and Separation Record

____ unmounted photograph(s)

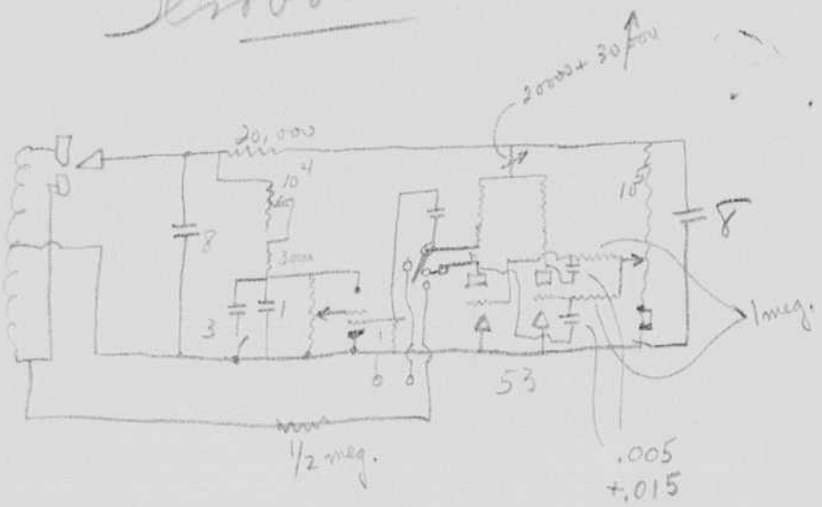
____ negative strip(s)

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

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

Item(s) now housed in accompanying folder.

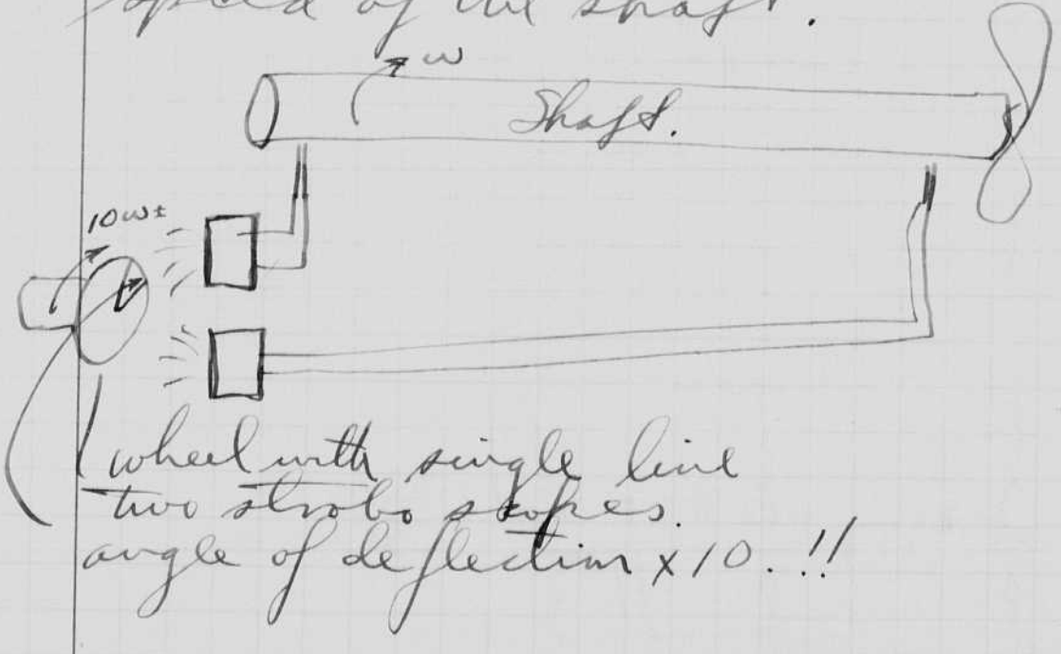
Strobotak.



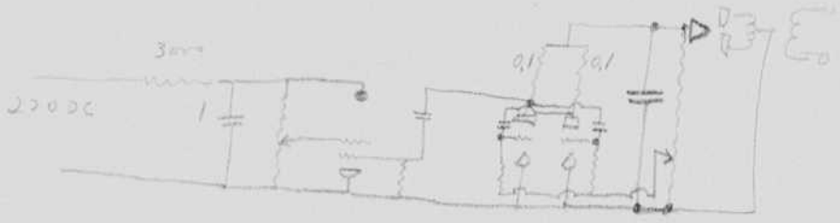
March 23 1935. H.E. Edgerton.

When in Washington I discussed a torque measuring device with Commander Gayhart and others. This method uses stroboscopic light and an angle amplifying device.

Put two commutators on the shaft one at each end and adjust them so that they give a pulse or contact at the same instant when the shaft is at rest. Use two stroboscopic lamps to look at a wheel that is driven at a speed that is an exact multiple of the speed of the shaft. The two stroboscopes will show a single white line as two lines and the angle between them can be measured. It will be the angle of the deflection of the shaft multiplied by the speed of rotation of the wheel divided by the speed of the shaft.



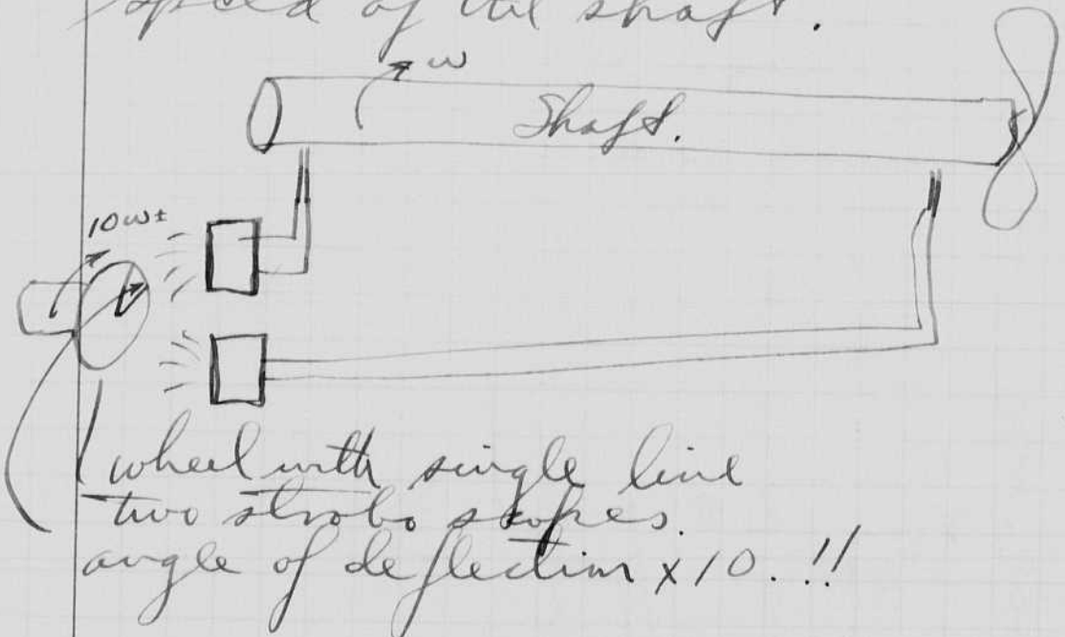
wheel with single line
two strobo scopes.
angle of deflection x 10. !!


3mA
220 DC
1
0,1
0,1

March 23 1935. H.E. Edgerton.

When in Washington I discussed a torque measuring device with Commander Gayhart and others. This method uses stroboscopic light and an angle amplifying device.

Put two commutators on the shaft one at each end and adjust them so that they give a pulse or contact at the same instant when the shaft is at rest. Use two stroboscopic lamps to look at a wheel that is driven at exactly a speed that is an exact multiple of the speed of the shaft. The two stroboscopes will show a single white line as a two lines and the angle between them can be measured. It will be the angle of the deflection of the shaft multiplied by the speed of rotation of the wheel divided by the speed of the shaft.



wheel with single line
two stroboscopes.
angle of deflection x 10. !!

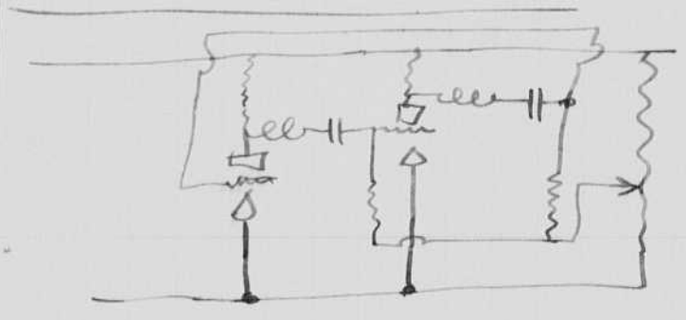
cont.

An automatic arrangement would be desirable to keep the wheel going at exactly the same ratio of speed to the shaft speed.

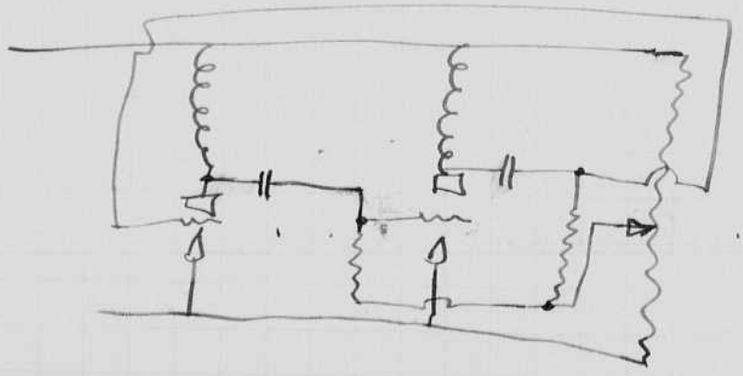
Possibly a gear teeth could be cut into the shaft and meshed with a gear driving a small generator.

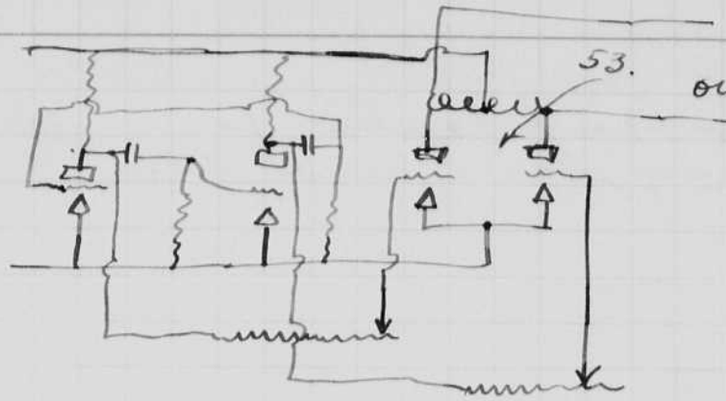
A belt driving a small ac generator with an adjustable pulley on the generator. Hand adjustment with a small stroboscope.

Put permanent magnent poles into the shaft by tapping in a screw thread. Amplify the signal up to a strength where it could run the motor.



Pg. 196-97.

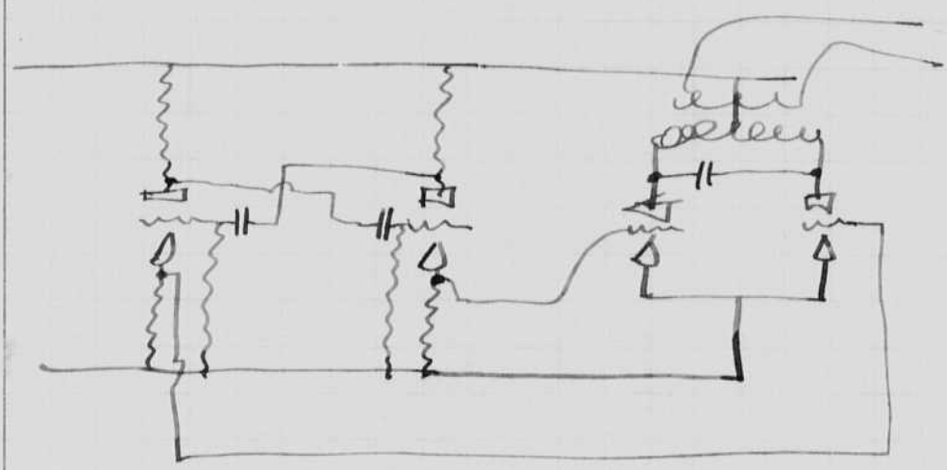


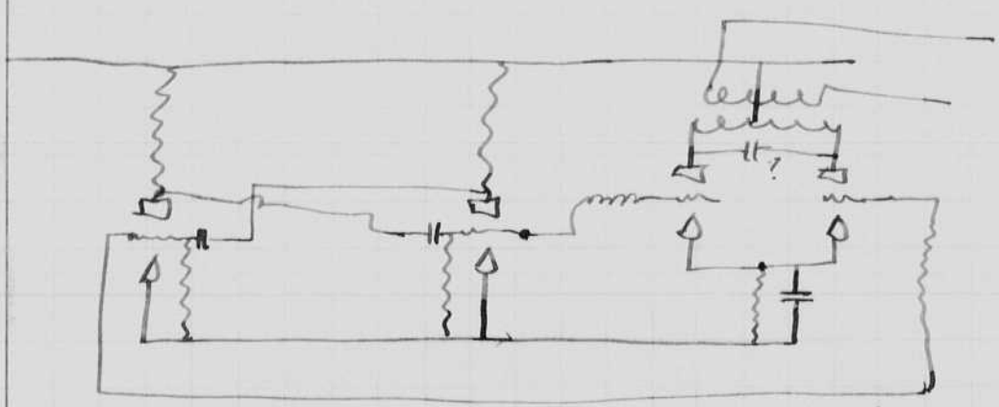


Output class B
53 type tube.

100 volts 2 watts.

100 x .02 amps.
probably .6 amps. ac.



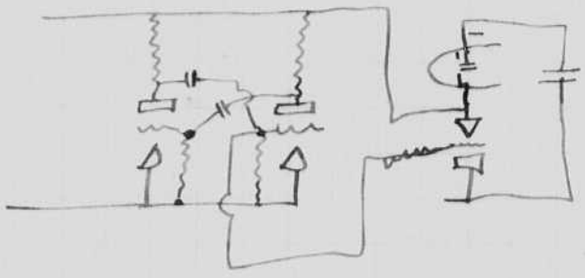


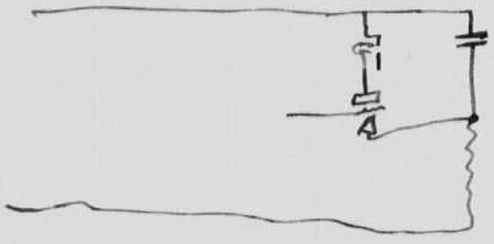
Relaxation
oscillator.

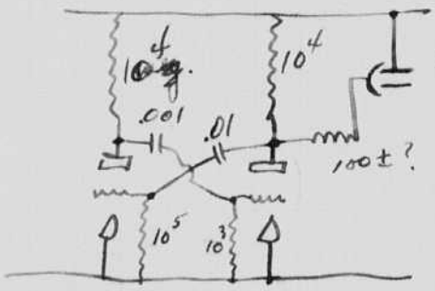
amplifier
stage.

Mar. 25, 1935.
H. E. Edgerton

Glow ~~oscillator~~ lamp exciter for producing a timing wave on a film.





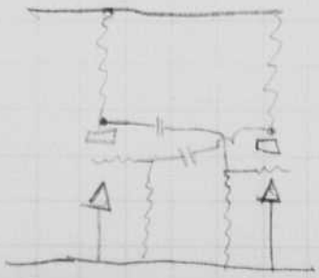


Recording lamp.

Unsymmetrical oscillator to give a short flash on the glow lamp side.

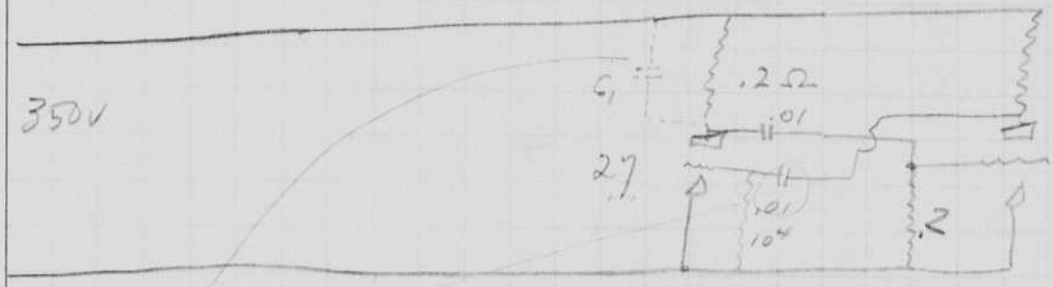
Mar 26 1935.

The above circuit will be used for frequencies up to the characteristics of the glow lamp. I believe that and amplifier tube is necessary



Mar 27 1935.
B Edgerton.

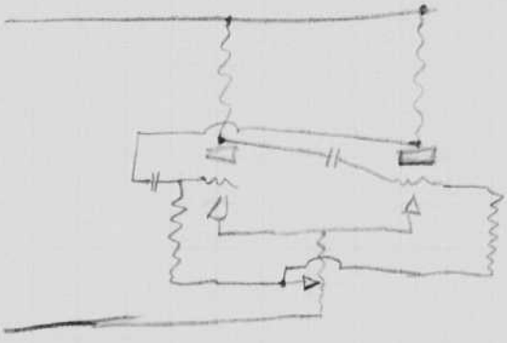
Further experiments with Relaxation oscillator.

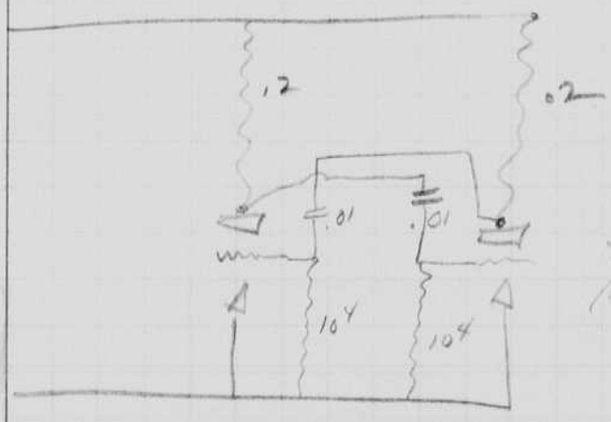


$C_1 = 0$ — $C = .01$ frequency = 640 cycles.

$C_1 =$ ⌀ $C = .003$ " = 1600.

$C_1 = .01$ $C = .003$ " = ~~2000~~ 1950





53 tube

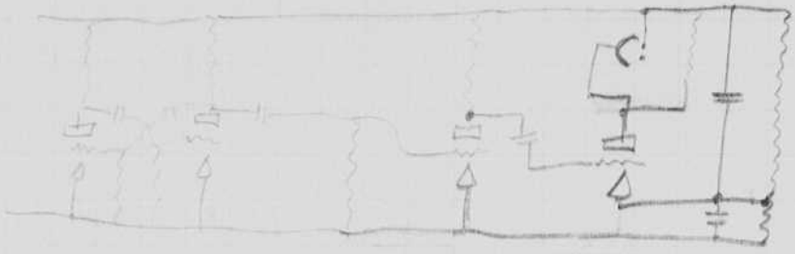
operates at 1080 cycles

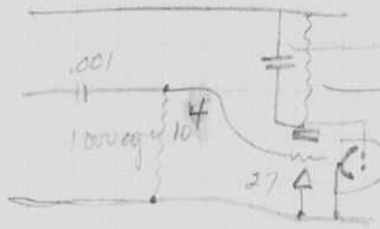
$2 \times (.01 \times 10^{-6})\, 10^4 = .02 \times 10^{-2}$

$.0002$

$f = \frac{1}{.0003} = 5000$ cycles.

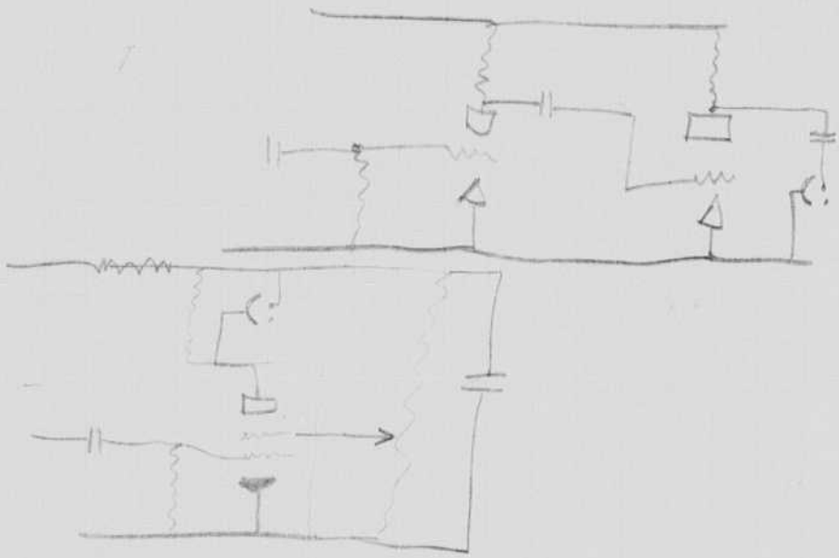
cont.

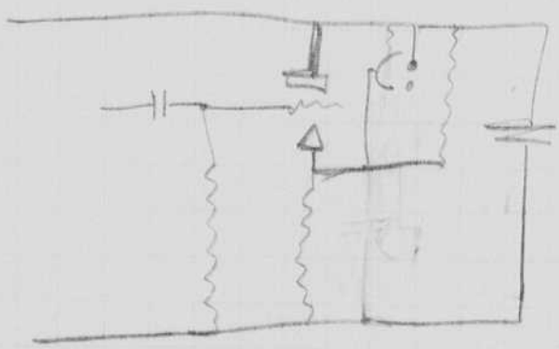


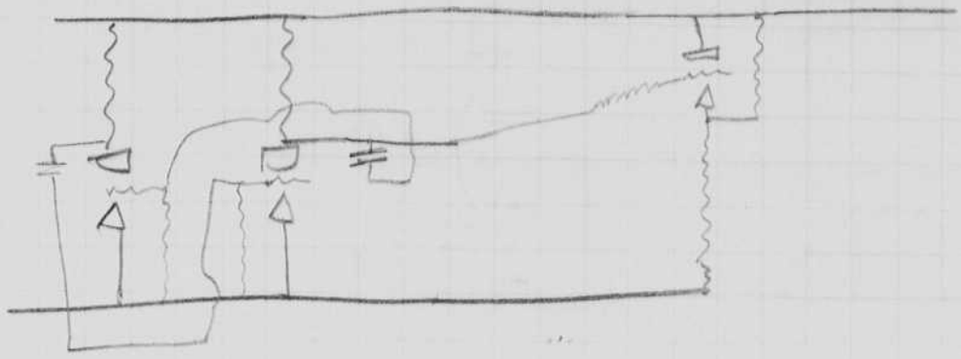


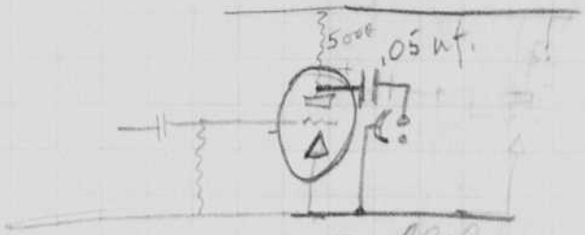
$RC = \frac{1}{2\pi f}$

$R = \frac{1}{2\pi f} \frac{10^8}{0.1}$ 5000.



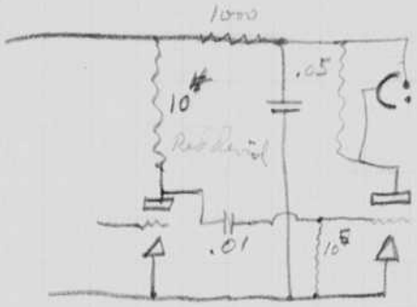






~~2-53 plates as grids in parallel.~~

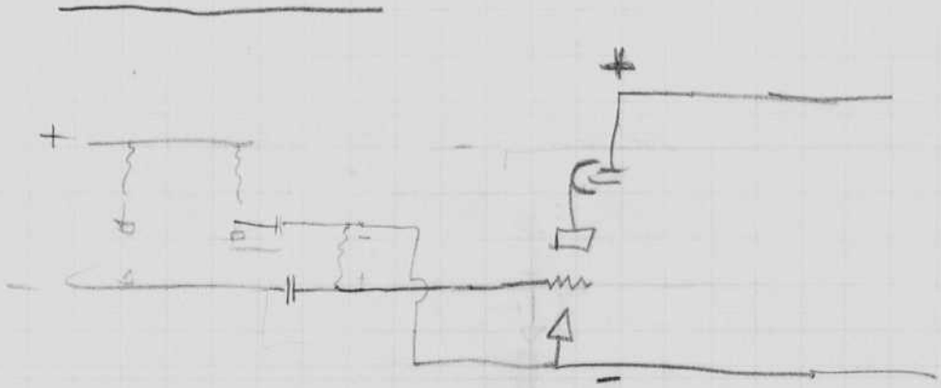
.1 245



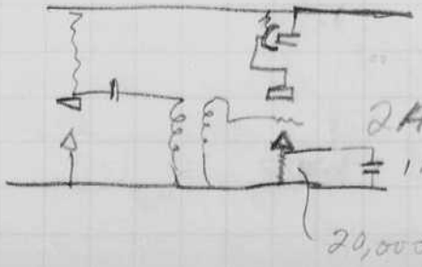
53 tube!

35 ma.

.00350 / 10 = 350 / 350 / 10,000 = 10 watts.

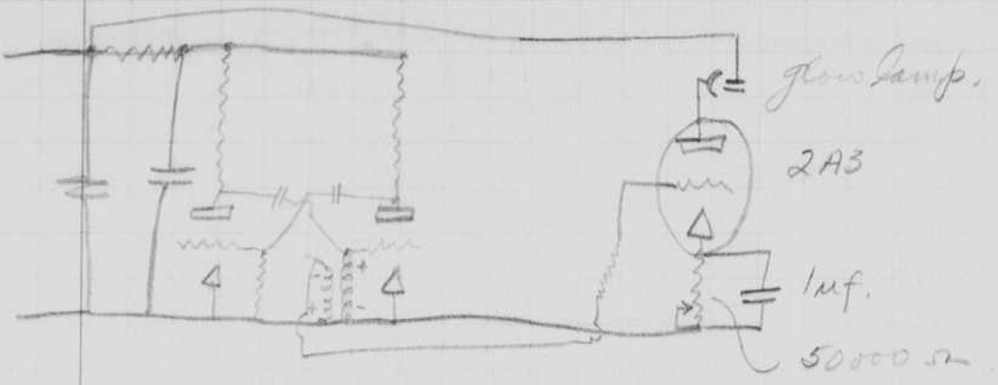


10 ma. —100 volts bias
10,000 ohms.

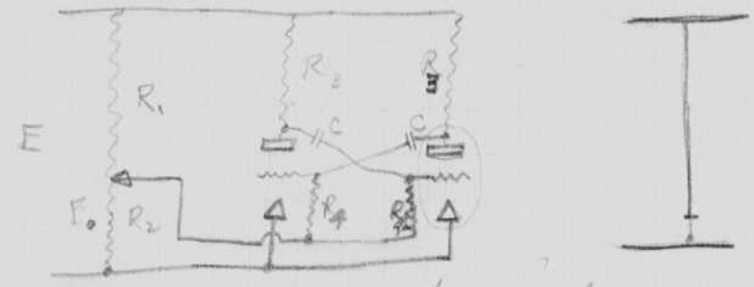


5 ma. —100 volts bias
100 / 5 = 20,000 ohms.

Cont.



On Tuesday morning I discussed the sawtooth with Wilkins. At this time he was discussing the circuit and construction with Locke and with Burke. Five weeks is the estimated time before the first model will be out. Two weeks to get the material and 3 weeks to wind up the first one.



Assumption. 1. The drop across the tube is zero when I_p flows.

Grid voltage equation

$$e_g = E_0 - (E_0 + E)\varepsilon^{-\frac{1}{(R_1+R_4)C}t} \qquad E_0 = E\frac{R_4}{(R_1+R_2)}$$

Plate voltage.

$$e_p = E\left(1 - \varepsilon^{-\frac{t}{R_3 C}}\right)$$

In order to have the frequency depend upon the R_4 then R_3C should be short compared to $(R_3+R_4)C$.

$$R_3 > R_4.$$

Notebook # T-5

Filming and Separation Record

____ unmounted photograph(s)

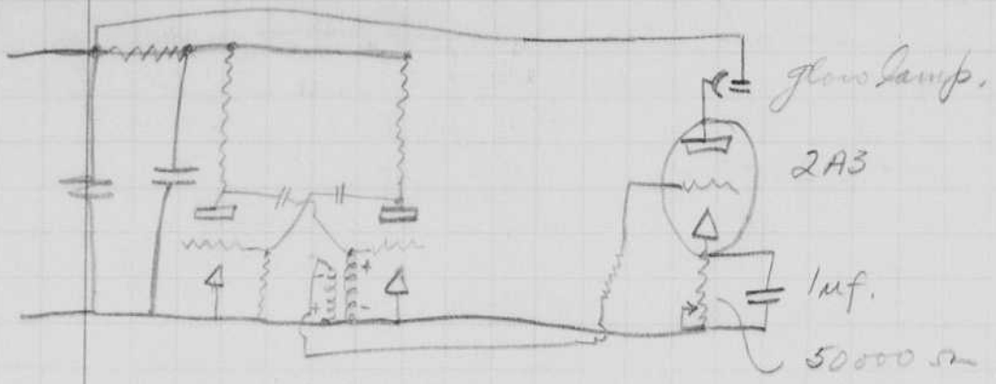
____ negative strip(s)

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

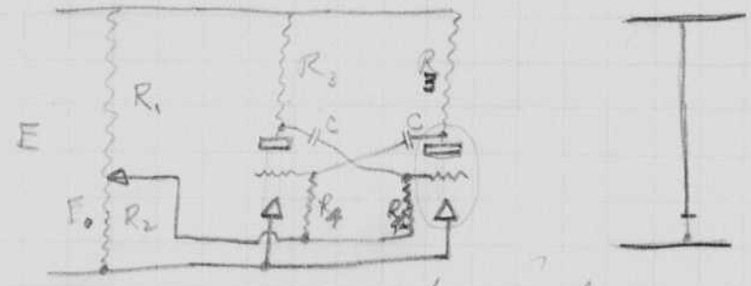
was/were filmed where originally located between page 70 and 71.

Item(s) now housed in accompanying folder.

Cont.



On Tuesday morning I discussed the storage stack with Wilkins. At this time he was discussing the circuit and construction with Locke and with Burke. Five weeks is the estimated time before the first model will be out. Two weeks to get the gyro mid and 3 weeks to wind up the first one.



Assumptions. 1. The drop across the tube is zero when I_p flows.

Grid voltage equation

$$e_g = E_0 - (E_0 + E)\varepsilon^{-\frac{1}{(R_1+R_4)C}t} \qquad E_0 = E\frac{R_2}{(R_1+R_2)}$$

Plate voltage.

$$e_p = E\left(1 - \varepsilon^{-\frac{t}{R_3 C}}\right)$$

In order to have the frequency dependent upon the R_4 then R_3C should be short compared to $(R_3+R_4)C$.

$$R_3 > R_4.$$

Notebook # T-5

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 70 and 71.

Item(s) now housed in accompanying folder.

d. 70 –

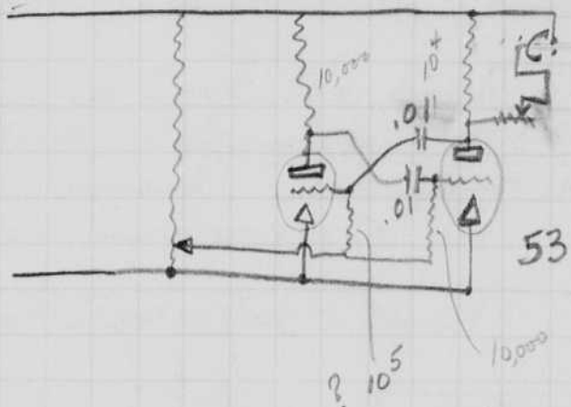
Exhibit 9

3

$R_3 > R_4$

cont

Unsymmetrical circuit may work ok to drive glow regarding lamps & circuit without much change in the frequency with different recording lamps.



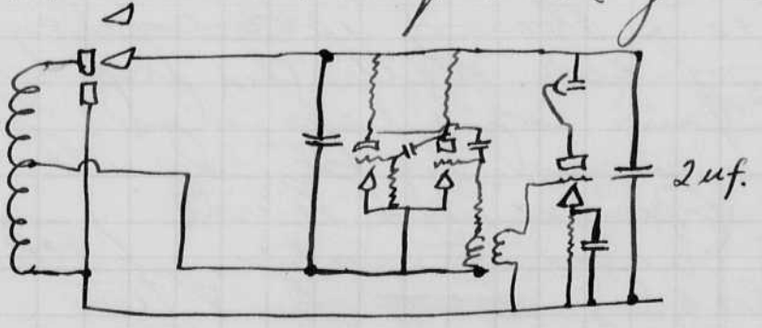
$$1000 = \frac{1}{.91 \times 10^5 \times 10^{-6}} = \frac{1}{.001} = 1000$$

Circuit to try tomorrow! looks great.

March 28 1935
H. E. Edgerton.

Connected up circuit shown on top of page 70 with a 2A3 in the series with the glow lamp. Works OK. but plate voltage should be higher as glow lamps take only 5 ma.

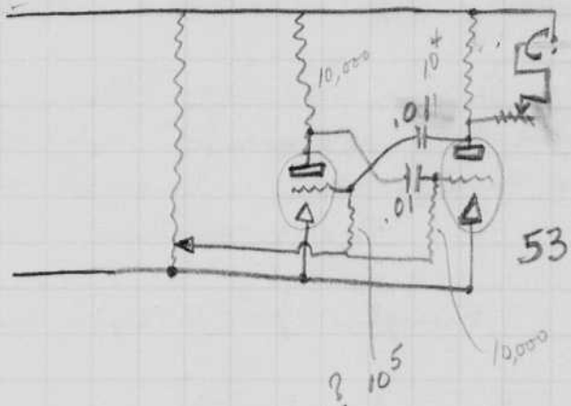
The grid of the 2A3 goes + and this limits the maximum plate current through the glow lamp.



$R_3 > R_4$

cont

Unsymmetrical circuit may work ok to drive glow regarding lamp Circuit without much change in the frequency with different recording lamps.



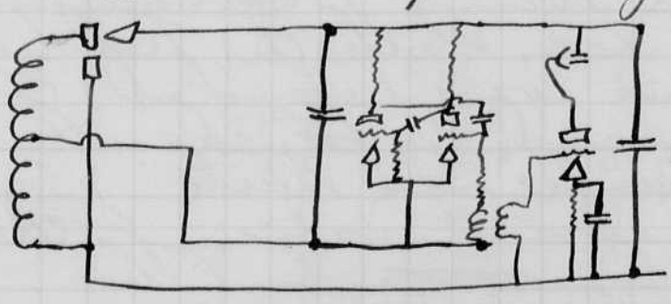
$$1000 = \frac{1}{.91 \times 10^{5} \times 10^{-6}} = \frac{1}{.001} = 1000$$

Circuit to try tomorrow! looks great.

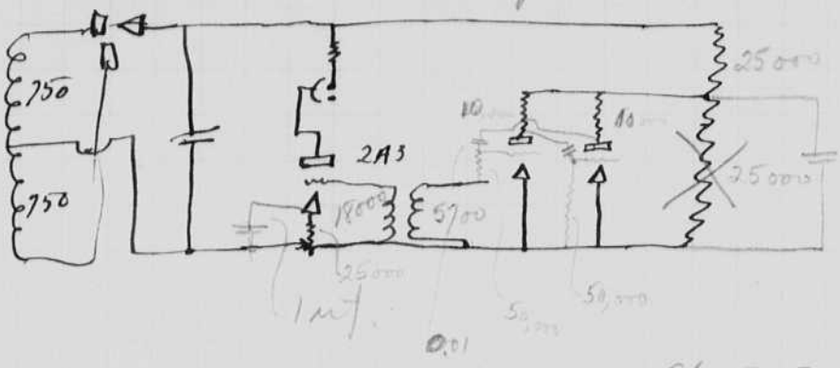
March 28 1935
H. E. Edgerton.

Connected up circuit shown on top of page 70 with a 243 in series with the glow lamp. Works OK. but plate voltage should be higher as glow lamp takes only 5 ma.

The grid of the 243 goes + and this limits the maximum plate current through the glow lamp.



Cont. New stuff. ~~higher~~ transformer voltage.

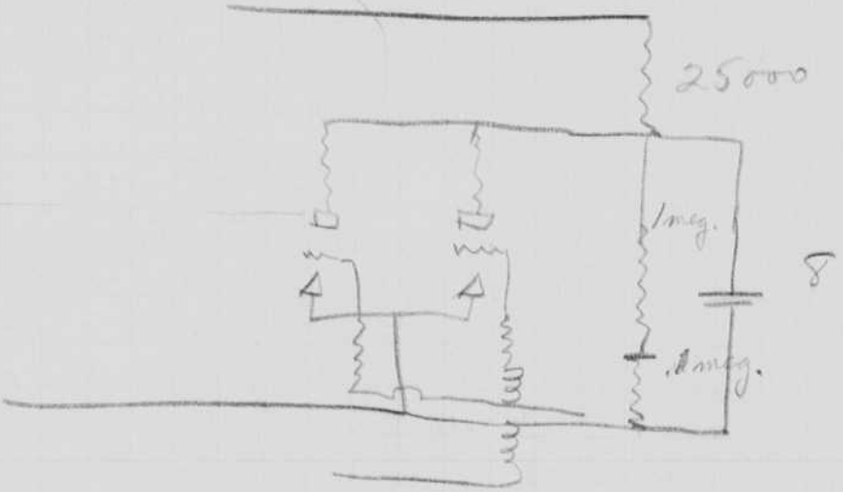


.01 = C

10,000 = R

50,000 R_L

f = 600 cycles.



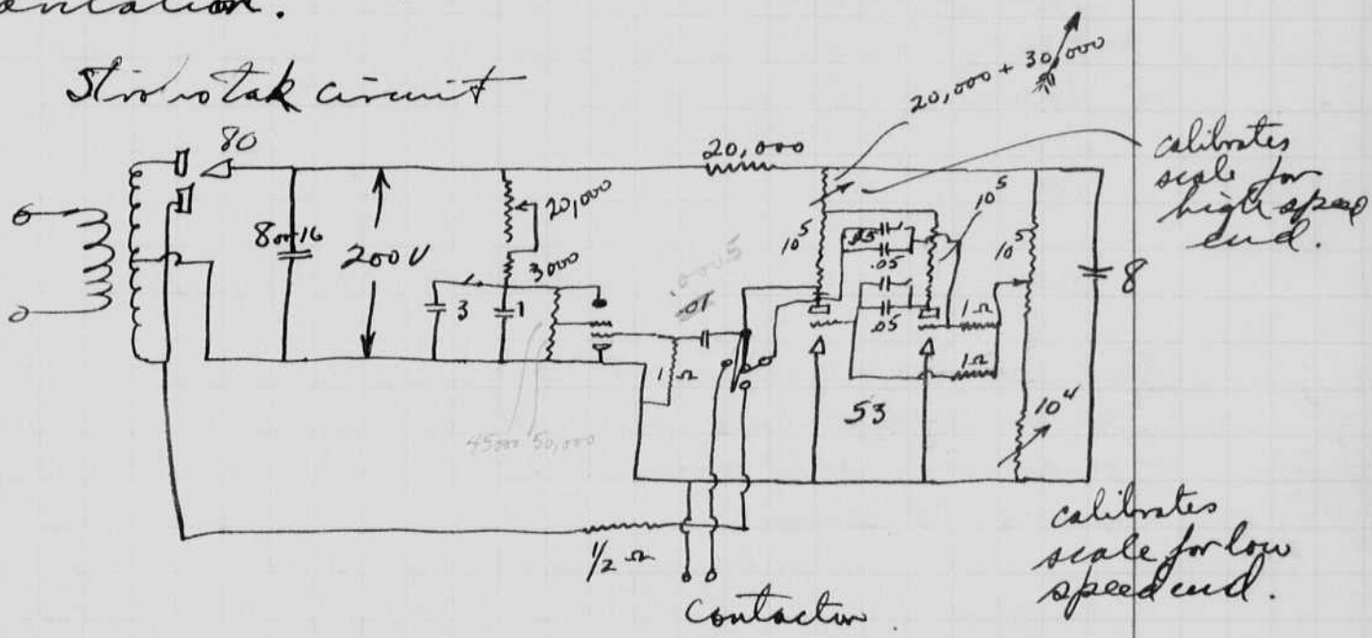
Changed to another UX 53 and the current ran about 1000 cycles instead of 600. With the 83 tube the operation was lopsided. This tube was used by students yesterday (Mabee and White) for taking characteristics of them. They probably ~~[illegible]~~ put too much current through one of the cathodes.

Germs came in this afternoon from a trip to Ohio to the Owens Glass Co. near Columbus.

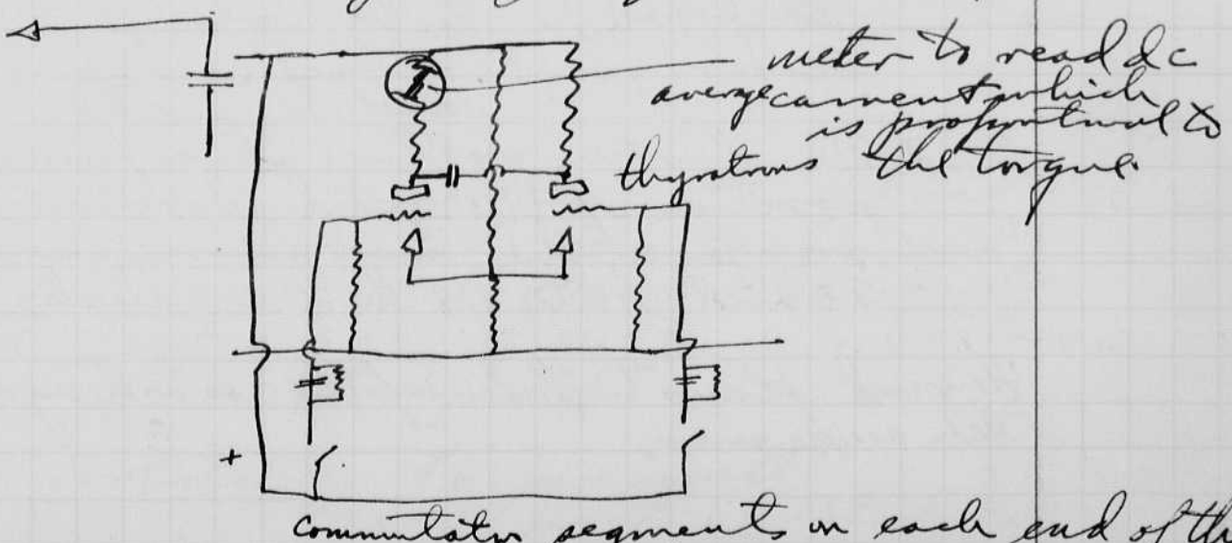
April 4 1935
H. E. Edgerton.

Assembled a 1200 ft 35 mm negative of high-speed shots ~~and~~ of the camera for use by the alumnae of Tech during the last week end. It was taken to the Jarwood Film Foundation this morning for printing. 16 mm

Set up the high speed camera with Grier today in the Hydraulics laboratory for Venard. 2000 per second of small cavitation.



Torque indicator for a boat using distortion of the propeller shaft.



Apr. 4 1935
D. E. Edgerton

Glow Lamp Volt-ampere characteristic.
from Data by Howard.

V volts.	I ma
235	1
275	2
310	3
330	4
355	5
375	6
380	7
385	8
395	9
400	10
460±	50 from a cathode-ray oscillograph record.

Howard, a VI A student is going to Schenectady for 6 weeks and was in today to see about making up the lab work that he is going to miss.

He has been testing stroboscope tubes to find their starting voltage on the external grid and has found some interesting facts.

1. The "grid" voltage is nearly independent of the plate voltage. (that is to start the flash). Tube voltage 300 - 2000 volts. Screen grid voltage to start about 20,000 v. " " must be positive! to cathode.
2. The starting voltage is a function of the position of the grid above the mercury surface, the maximum coming at about 1/16 to 1/8 th of an inch.

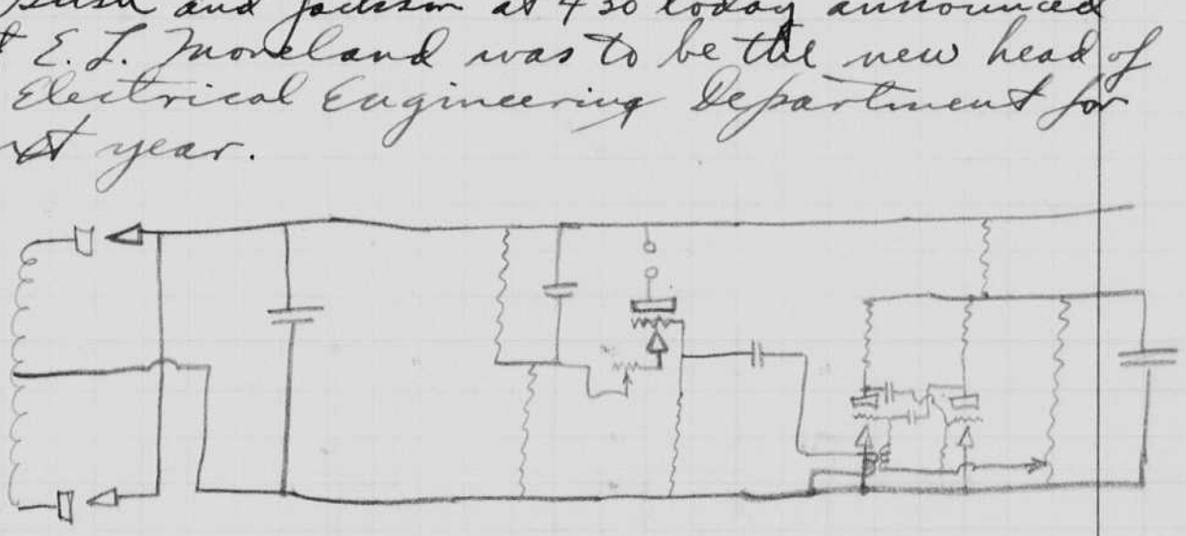
Howard plans to take up the work again in the summer.

April 6, 1935. 32nd Birthday.

Showed two reels of movies of high-speed camera and examples to Langmuir, Hull, Dushman and Taylor who were here visiting Nottingham's course in electronics. Then a dinner at the Miles Standish hotel followed by a lively discussion by these E.E. Physicists upon the defiencies of education. Langmuir objected to the tendency of Physicists to all work on the same thing such as wave mechanics and necular reaction at present. His advice on a method of becoming an authority was to pick out some old subject that no one was investigating and apply new methods to it.

April. 8, 1935.

Bush and Jackson at 4:30 today announced that E. L. Moreland was to be the new head of the Electrical Engineering Department for next year.



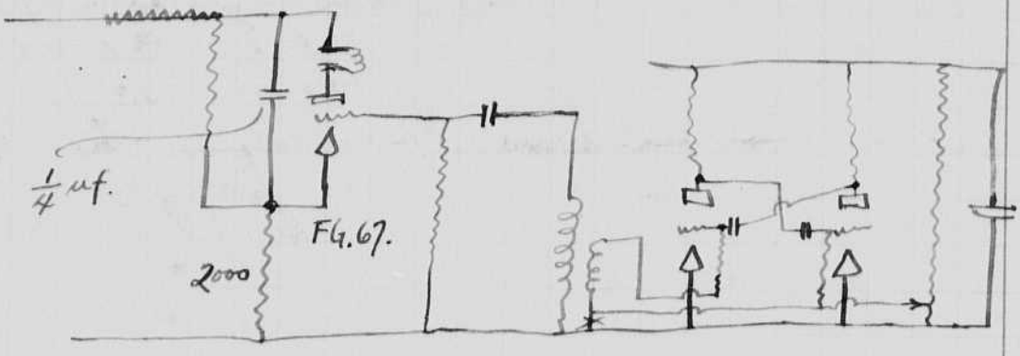
April. 9, 1935.

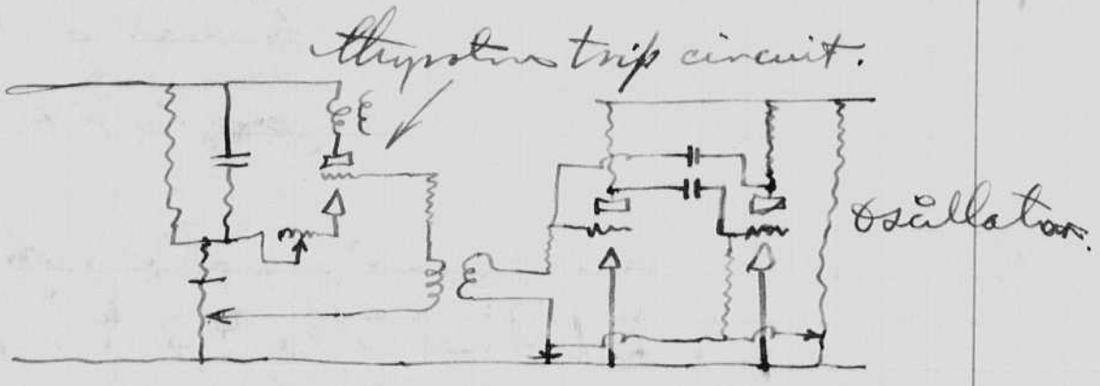
This morning Gernsbacher and I had a long conference with Mr. Richmond and Mr. Burke of the General Radio Co. Result. Boost Royalty of 5% to 15% less tubes. ... after redesigning. ...

Strobotak $6 per unit
+ 3 for tube. Strobotak

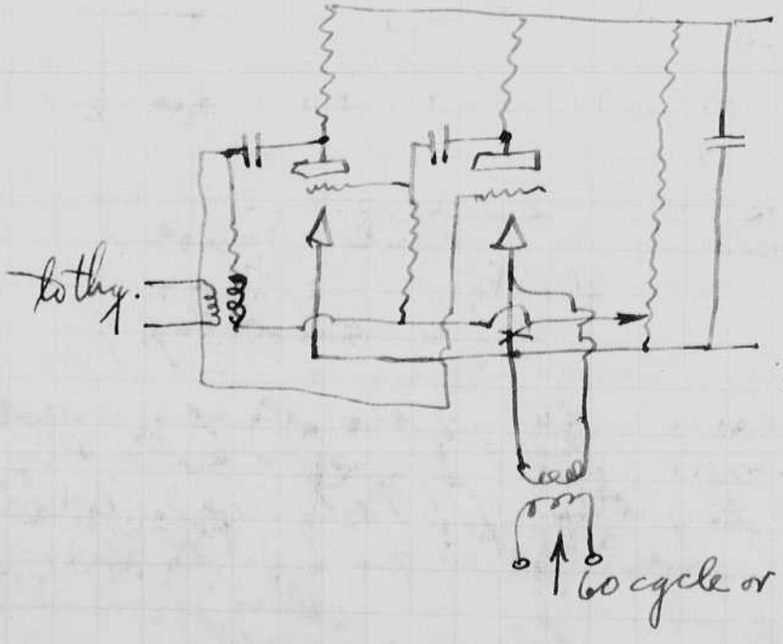
Apr 9 1935
E. E. Egerton.

New 548 Stroboscope.



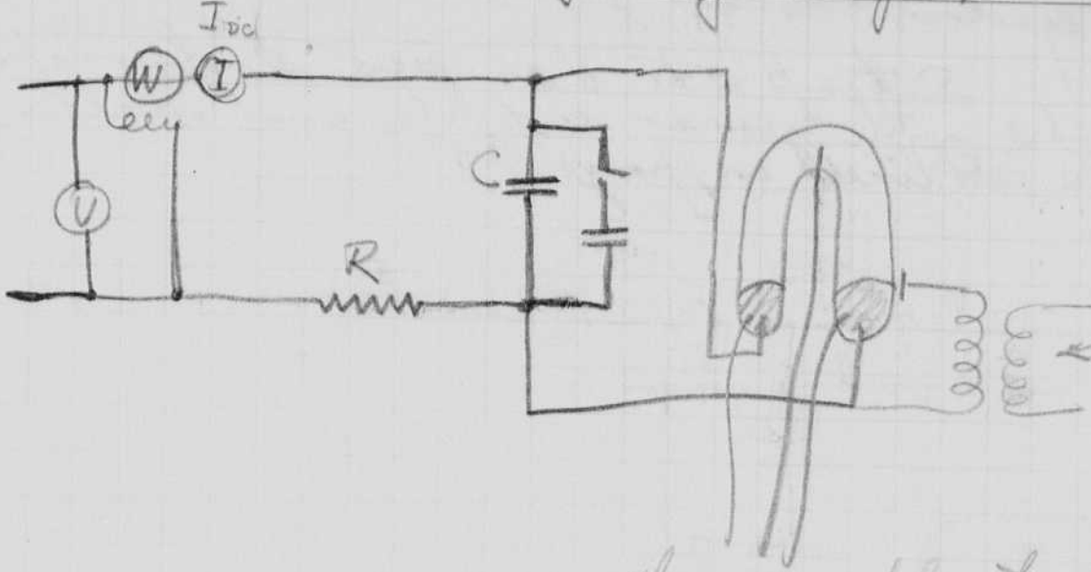


60 cycle and contactor and oscillator input into the relaxation oscillator



Apr 9 '35 Cont.

Power tests for Hg lamps.



Thermocouples to measure temperature as a function of time, capacity, voltage, etc.

Measurement of light also might be useful. Photocell at standard distance from lamp.

$RC = 1 \times 10^{-6} \times R =$ $\frac{1}{400}$ th of a second.

$R = \frac{1}{1100} \times 10^{6} = 2.5 \times 10^{3} = 2500.$ ohms.

power required $= f E^2 C = 200\,(500)^2\,1 \times 10^{-6} =$ 5 watts.

with a capacity of 4 mf.

$4\overline{)200}^{50}$

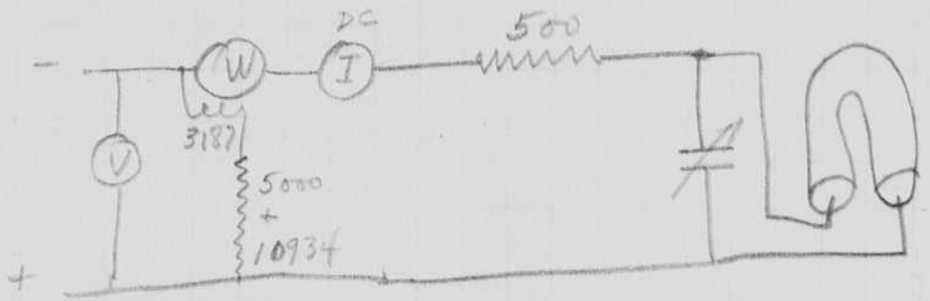
should be at least 60 high range 240 giving 60 watts.

25
25
100
50
50

A resistor in the circuit would tend to reduce spots on the anode and might benefit the action per hour and increase of the kind of flash.

April 10 1935
H.E. Edgerton.

Set up 548. U shaped stroboscope tube with power supply, and meters as outlined on page 77.

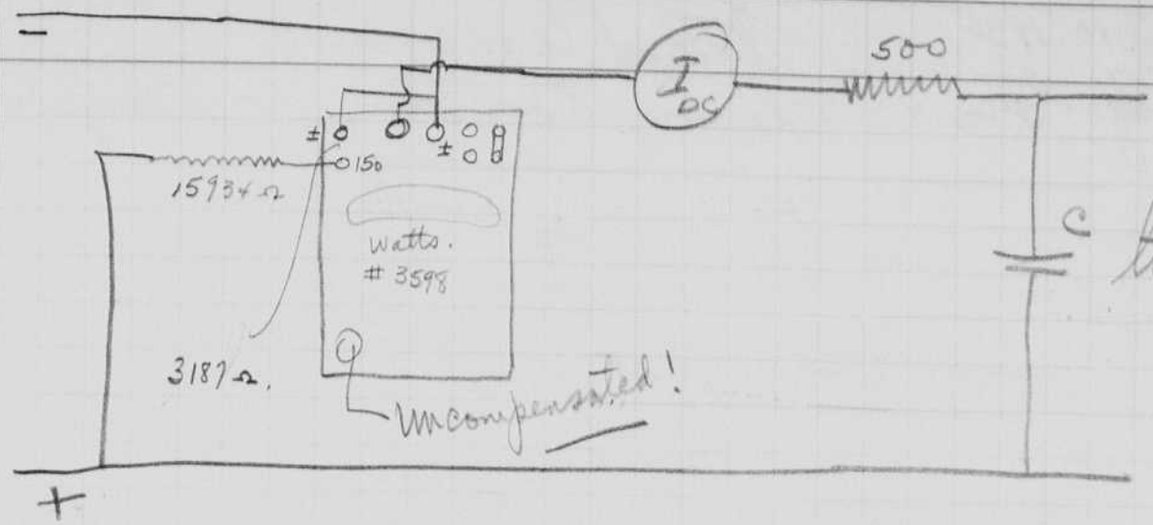


The tube flickers, the neon also especially at ~~60 cycles~~ nearly 50 cycles.

Changed to another contactor. ok. now.

548B Stroboscope.

T	V x4	I DC	W. x10	C x10⁻⁶ farads.	Freq. / sec. Speed. R.P.M.	
7:45	171 684	0				
	153 612	.05				
		.06	1.8 - 2.0 (1.7)	2	1800	
8:00		.04	1.9	2	1800	Wattmeter uncomp.
	160	.023	1.05	2	1000	
	158	.027	1.3	2	1200	
	152	.031	1.55		1400	
	155	.034 .037	1.75		1600	
	154	.04	2.0		1800	
	154	.044	2.2		2000	
	154	.05	2.5 high ?		2200	crowded dump reading
	153	.053	2.6		2400	
	152	.0575	2.82		2600	
	152	.062	3.0		2800	
	152	.066	3.2		3000	
	151 604	.08	3.93 39.3		604	
	150	.087	4.25		60	begins to flicker after about 20 min due to lamp too hot!
					60	



Power pack as shown on Drawing SR Dated 1-31-35.

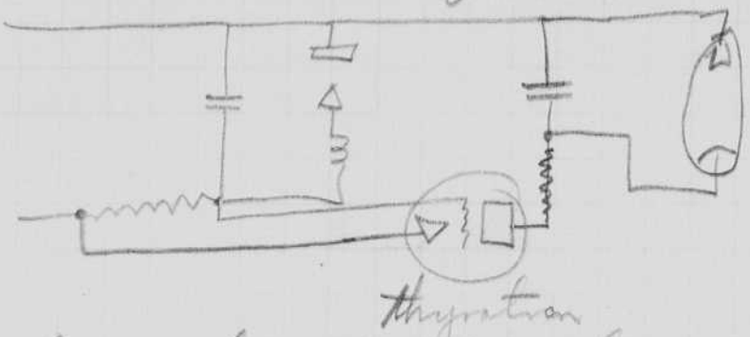
2 #83 mercury tubes for supply.

V	V	I_{DC}	W ×10	W	C	Speed.	
161		.059	2.4		6	800	
157		.0725				1000	
153		.088				1200	
150		.103	4.7			1400	
149		.117				1600	
147		.130				1800	
146		.145				2000	
143		.158	7.13			2200	
144		.17				2400	
143		.183				2600	
142		.194				2800	
140		.207				3000	Runs too hot for continuous duty.
140		.2025	9.1			3000	
149.5		.115	5.22			1500	upper limit for steady operation

transformer cold after an hour run.

April 10, 1935
D. E. Foster.

Method to increase deionization time for lamps

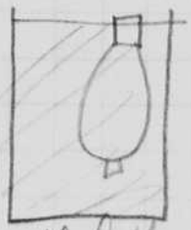


thyratron

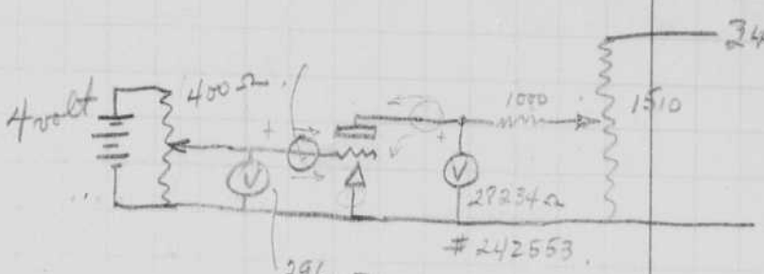
Bias from drop in charging circuit & spark keeps grid condenser from charging for a certain length of time. Then it goes quickly.

Apr. 11 1935
H. E. Ekgerton.
R. C. Burchl.

FG-67 # M202.



oil bath.



296 Ω
3 Volt scale
#23130

PLATE VOLTS.

55.1
54.5
T
51 ± .5
NEW FG 67.
200
T = 65.1
T 74.6
150
60.0 ± .1
new FG 67.
100
50
Ig in ma.
.8
.6
.4
.2
START.
V = 120
V = 105
NEW 67.
GRID VOLTAGE
1.0
-.05
0
0.5
1
1.5
+2

April 12, 1935.

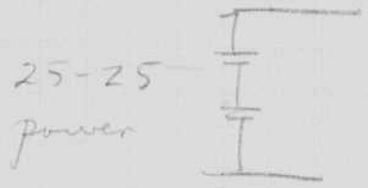
FG-67.

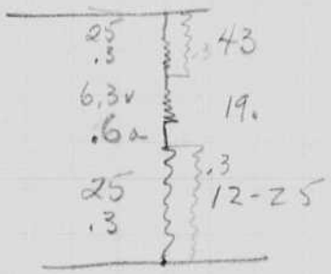
The grid when slightly positive apparently draws the electrons to it and prevents the starting of the discharge.

April 15 1935.

The visiting committee of the Electrical department was all tech today. At the luncheon I sat by Miss Wood who has perfected printing machinery.

April 17 1935.





115
56.3 ✓

58.7
.6 = 100 ohms.

.36. 36 watts.

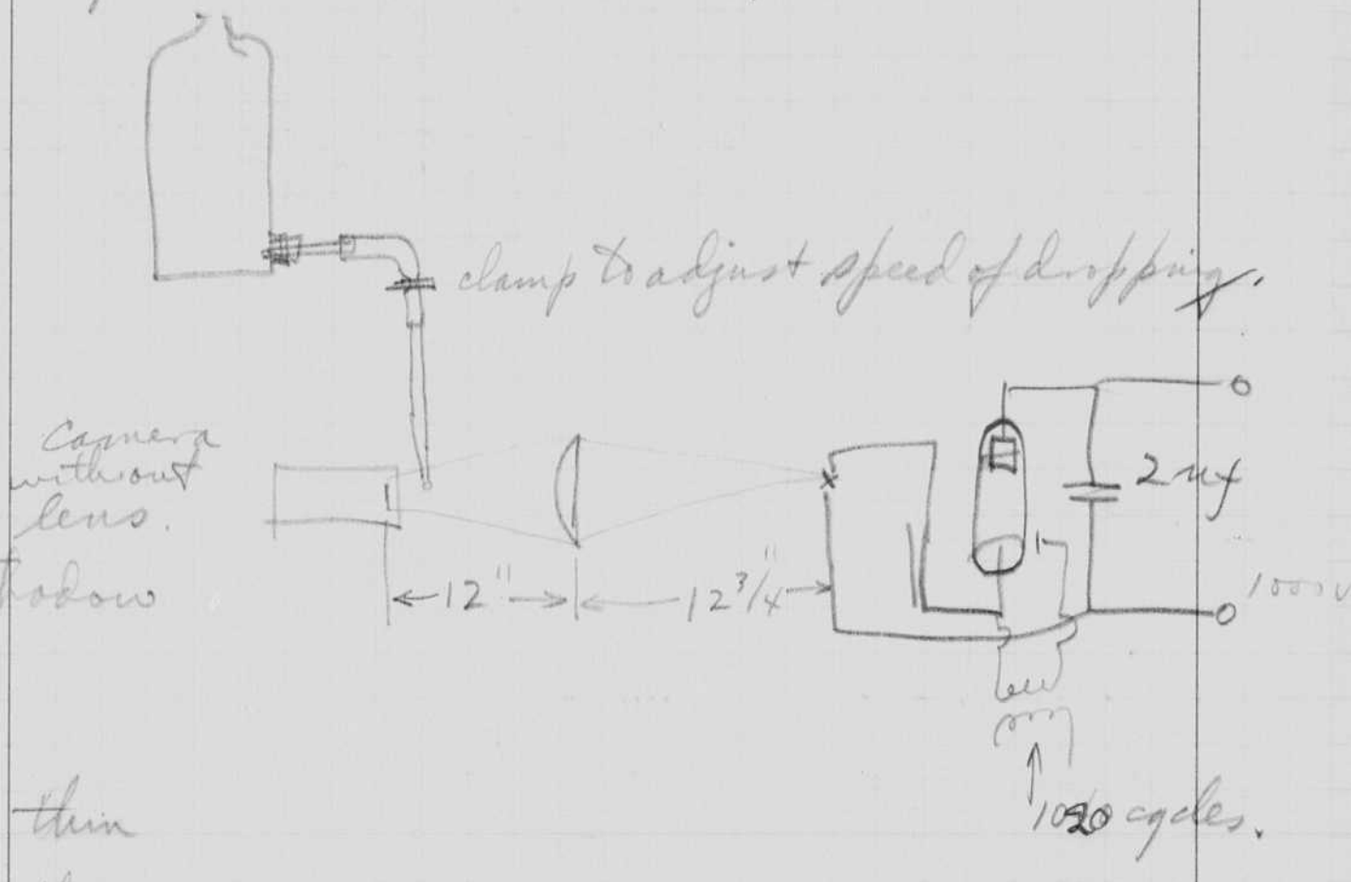
2 # 37 tubes for osc.

or #19 for osc.

April 19 1935
H. E. Edgerton.

Took Mary Louise down to Boston to see the Paul Revere celebration this morning.

Experiments to study the formation of drops of water and the velocity of drops falling in air, also shape of the drops after they reach their equilibrium velocity



#1 thin
#2 thin
#3 ok Dropper in picture.
#4 " Drop falls 6 5/8" to center of photograph.
#5 " " " 35 1/2" "
#6 " " 6' 4 1/2" "

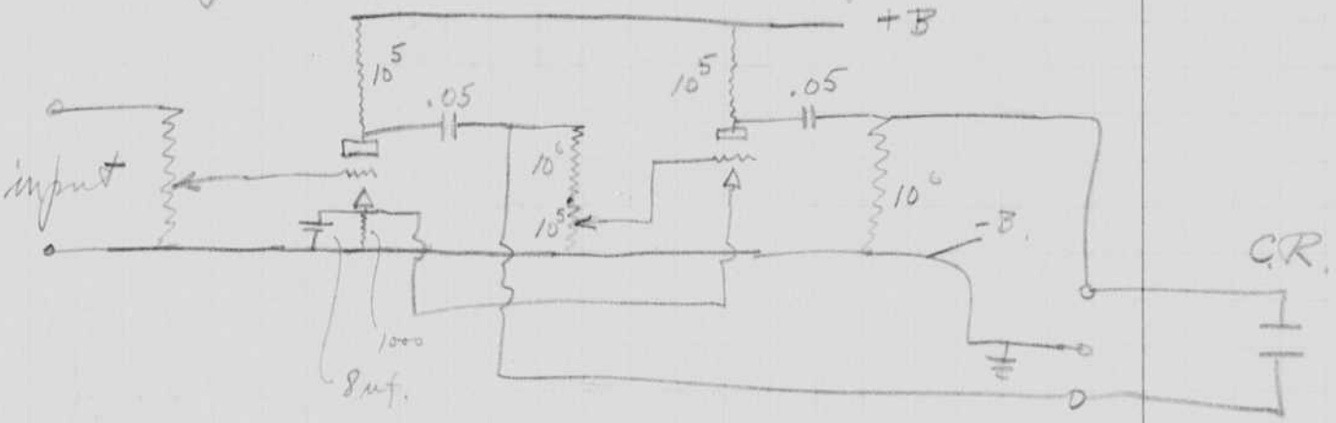
April 28 1935
H.E. Edgerton.

Preparations for Open house Nov 4 are under way.

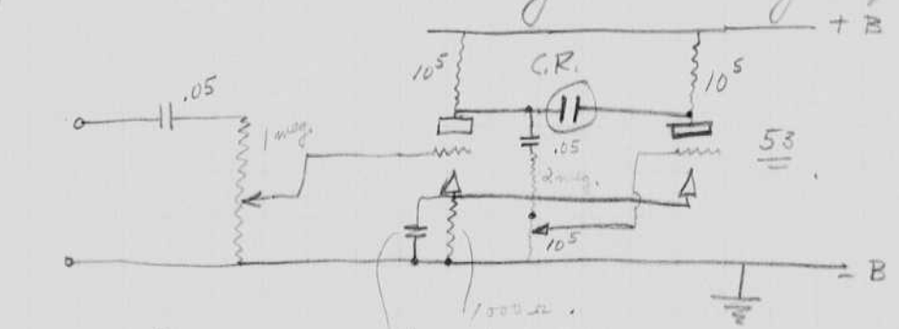
Germeshausen and Grier spent most of week on the assembly of a vacuum system.

Worked Sat and today taking movies at 3000 per second of shot gun shells for Winchester.

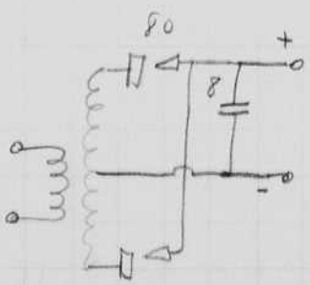
Amplifier for the cathode ray oscillograph set up by Cohen and Abbot for 6.39 lab.



Why not leave blocking condensers out. the additional dc will change the calibration of the cathode ray oscillograph slightly.

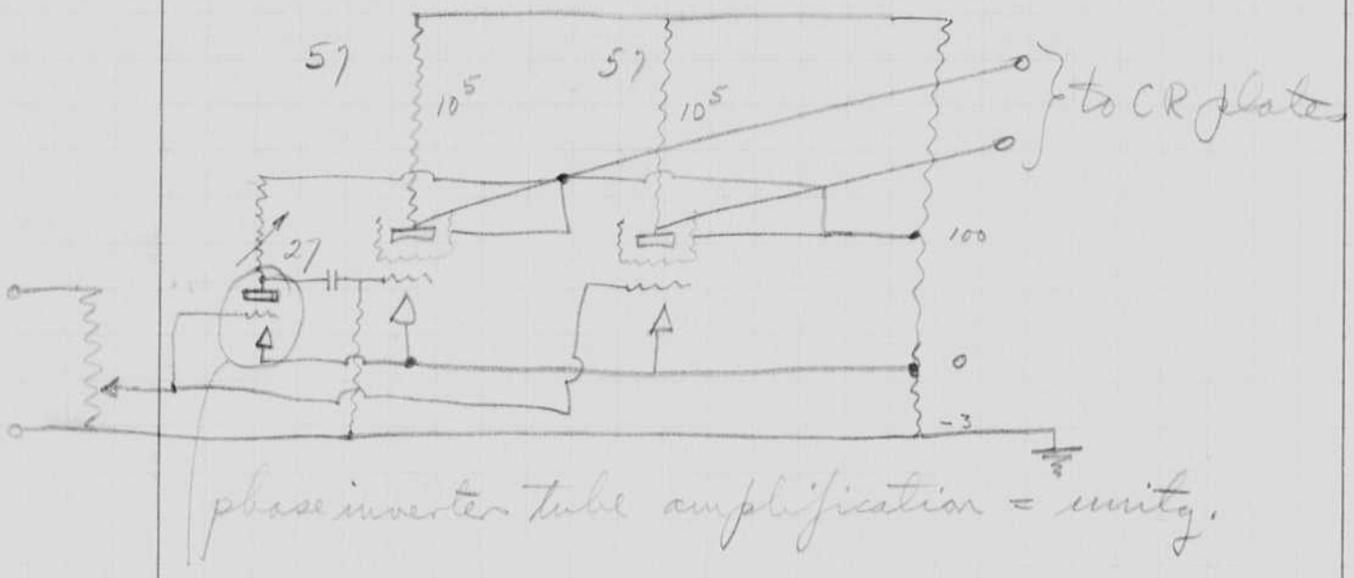


2 mf
4.
1000
4 v.
.01



Apr 29 1935

J. B. Edgerton. Cathode Ray Osc. Amplifier circuit.



phase inverter tube amplification = unity.

$\mu = 1500$

$r_p = 1.5 \times 10^6$

$I_p = 2$ ma. $\quad 2 \times 10^5 \times 10^{-3} = 200$ volts.

$\mu' = \frac{1}{1 + \frac{1.5 \times 10^6}{10^5}} = \frac{1}{16} \times 1500 = 100.$

Notebook # T-5

Filming and Separation Record

____ unmounted photograph(s)

____ negative strip(s)

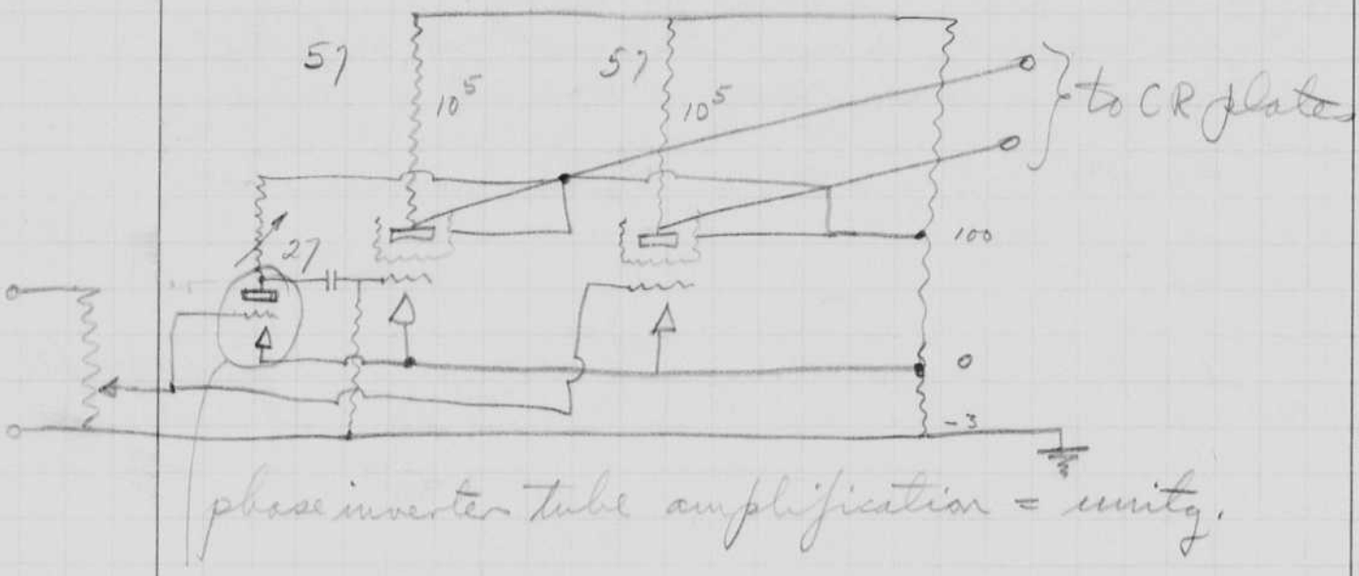
__1__ unmounted page(s)
(notes, drawings, letters, etc.)

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

Item(s) now housed in accompanying folder.

Apr 29 1935

W. H. Edgerton. Cathode Ray Osc. Amplifier Circuit.



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$I_p = 2$ ma. $\quad 2 \times 10^5 \times 10^{-3} = 200$ volts.

$\mu' = \frac{1}{1 + \frac{1.5 \times 10^6}{10^5}} = \frac{1}{16} \times 1500 = 100.$

$\frac{350}{50,000} R = 3 \qquad R = \frac{150,000}{350} = 500.0$

428.

Notebook # T-5

Filming and Separation Record

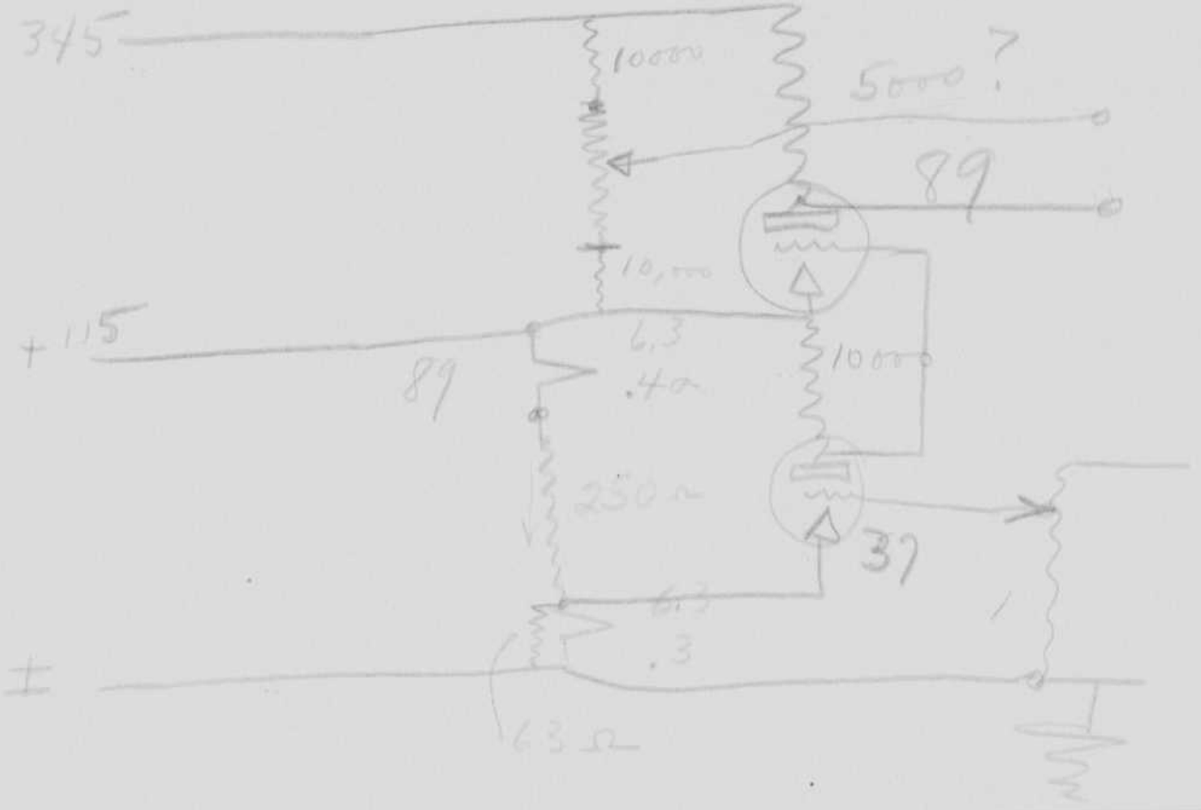
____ unmounted photograph(s)

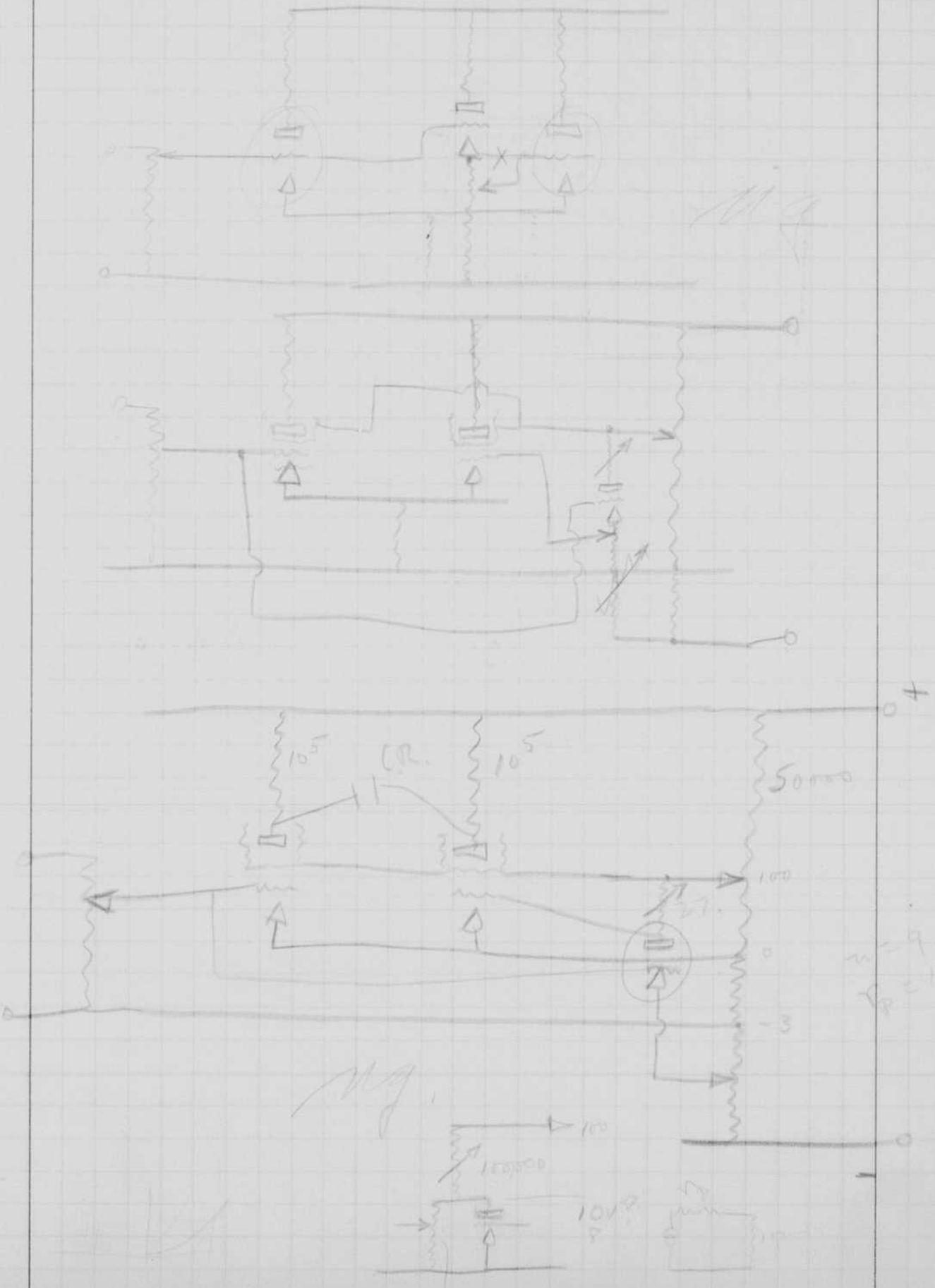
____ negative strip(s)

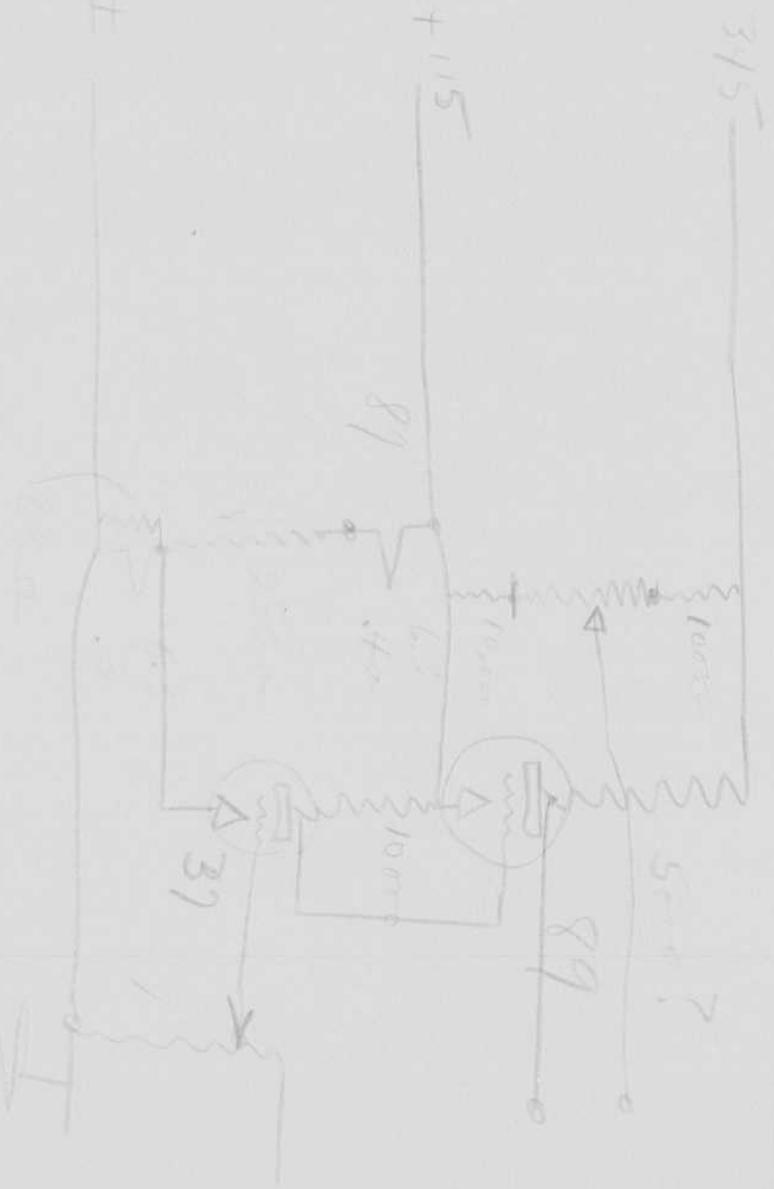
__1__ unmounted page(s)
(notes, drawings, letters, etc.)

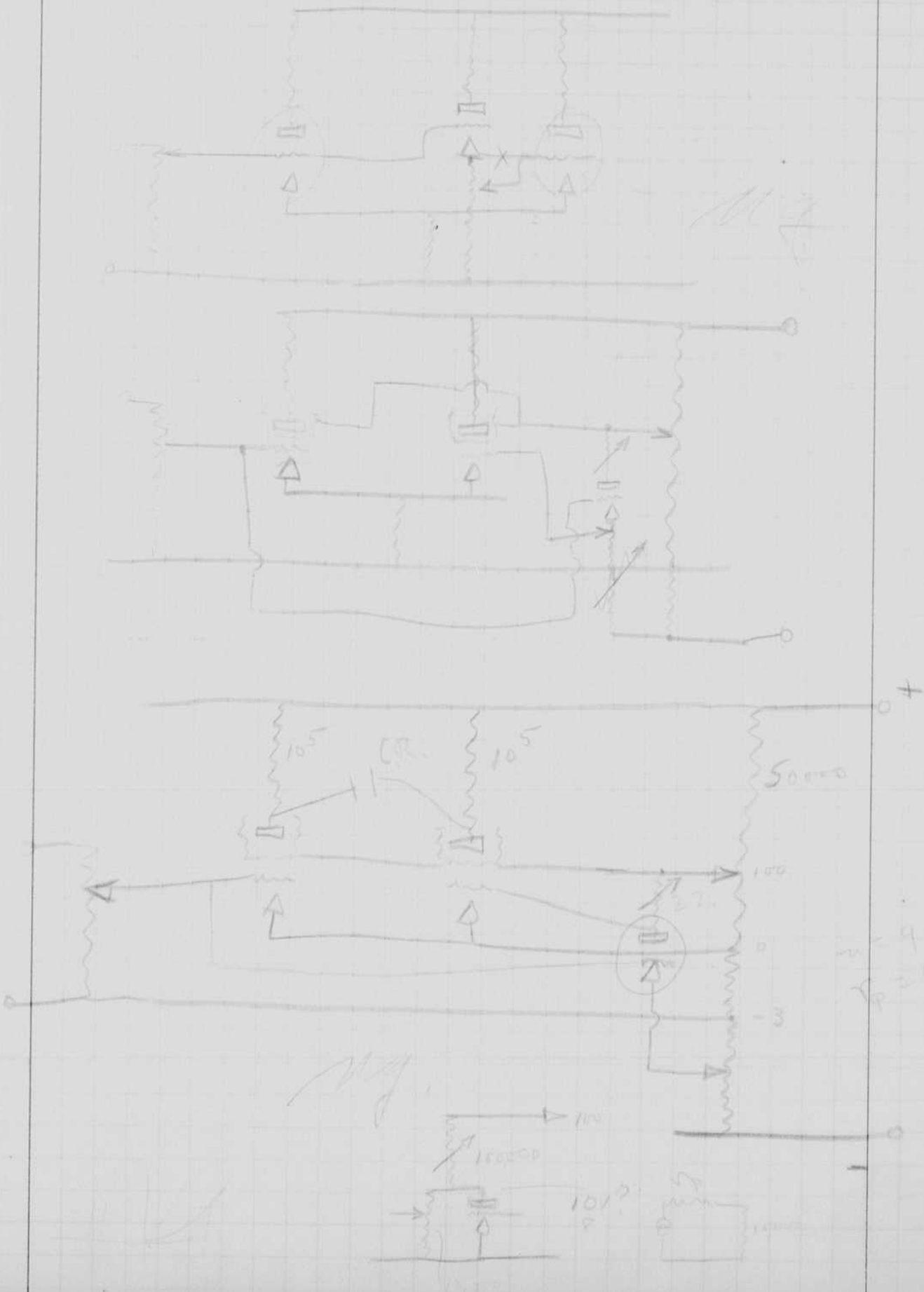
was/were filmed where originally located between page 86 and 87.

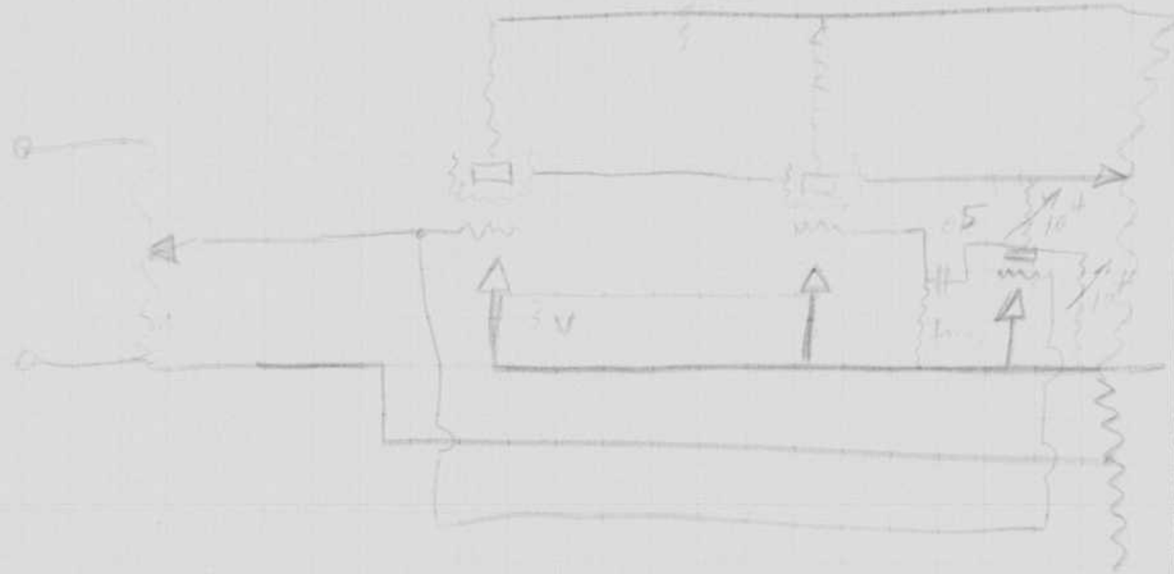
Item(s) now housed in accompanying folder.

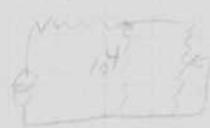

345
1000Ω
5000?
89
10,000
+115
89
6.3
.4a
1000Ω
250Ω
37
6.3
.3
±
63Ω

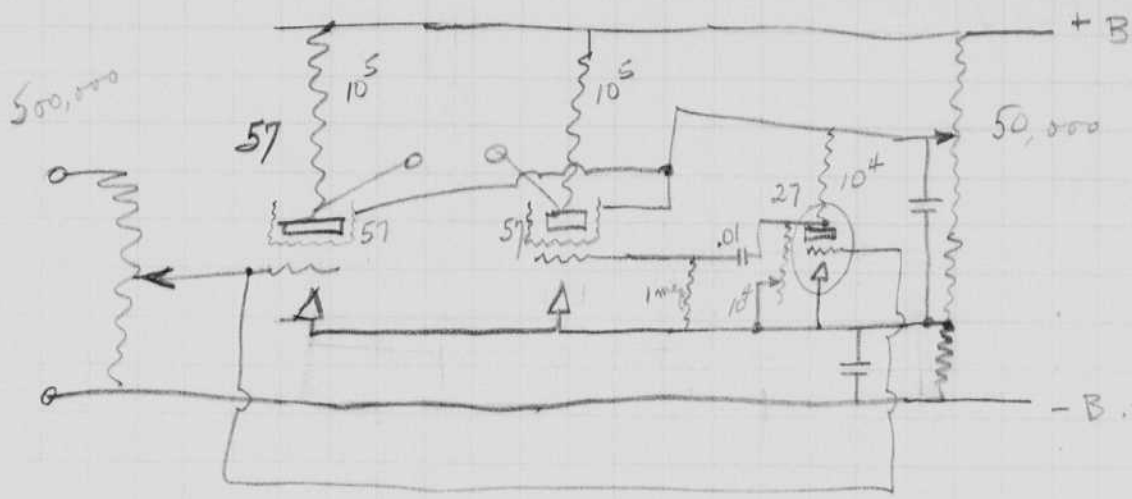

+
10^5
C.R.
10^5
50000
100
0
-3
100
100000
-




+
10^5
CR.
10^5
500Ω
100
0
-3
100
160000
10^{12}







Special Hg tube to catch blast of mercury that comes up from the cathode at each flash.

Try Molybdenum. and Tantalum as materials for the plate.

input. 5 μμf. 10,000 $\frac{1}{6.28\times10^4 \times 5\times10^{-12}} = \frac{10^6}{.30} = 3$ megs.

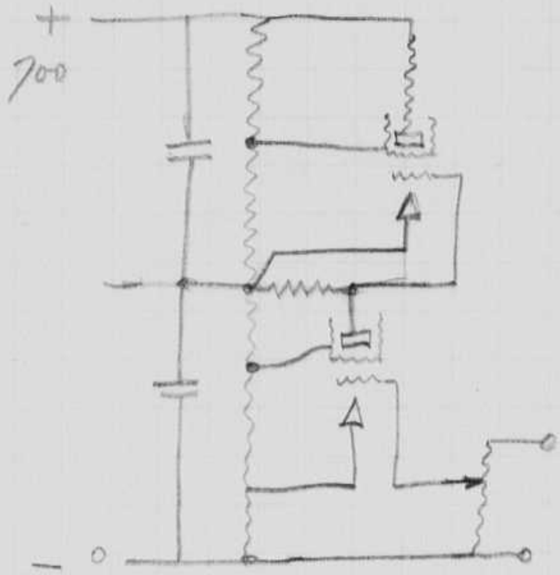
.007 μf.

.7

May 1 1935.

Circuit at top of this page does not work satisfactorily because the form of the cathode ray as is distorted by the i.c. RC coupling is needed.

April 30 1935 Cont
H E Edgerton.

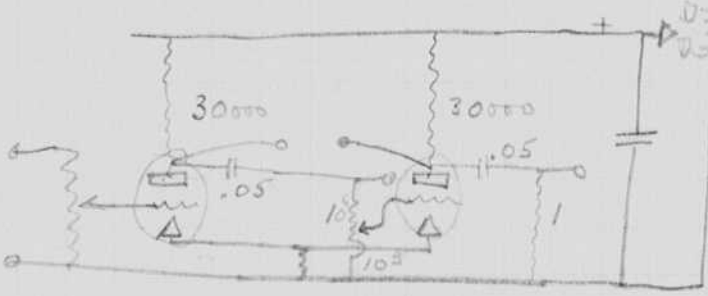


this type of amplifier was discussed today with Lansil.

It is not so good for voltage amplification. It gives good results for a power stage.

#56.

$\mu = 13.8$
$r_p = 9500.$



.005 250 V
−13.5   5 ma.

35000
.005
175.000

350
150
200.

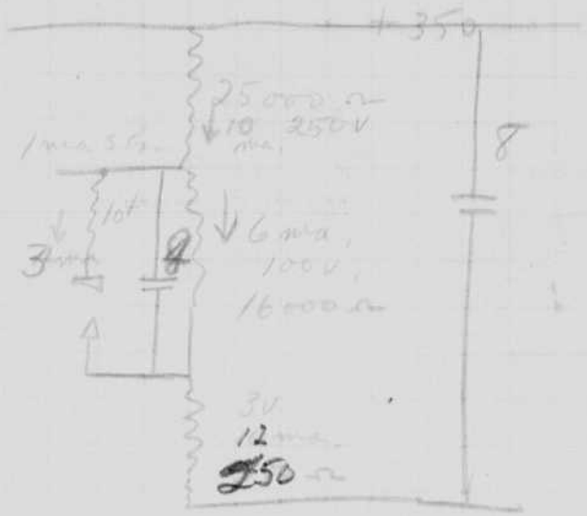
two #56 tubes.
1 #80 "
1 8 uf condenser.
2 .05 "
2 10^6 leaks
1 10^5 "
1 1 meg variable.
1 135 ohm resistor,
1 16 uf. 20 volt.
1 power trans
2 5 prong sockets
1 4 " "

$$\frac{13.8}{1 + \frac{9500}{30000}} = \frac{13.8}{1.3} = 10.3$$

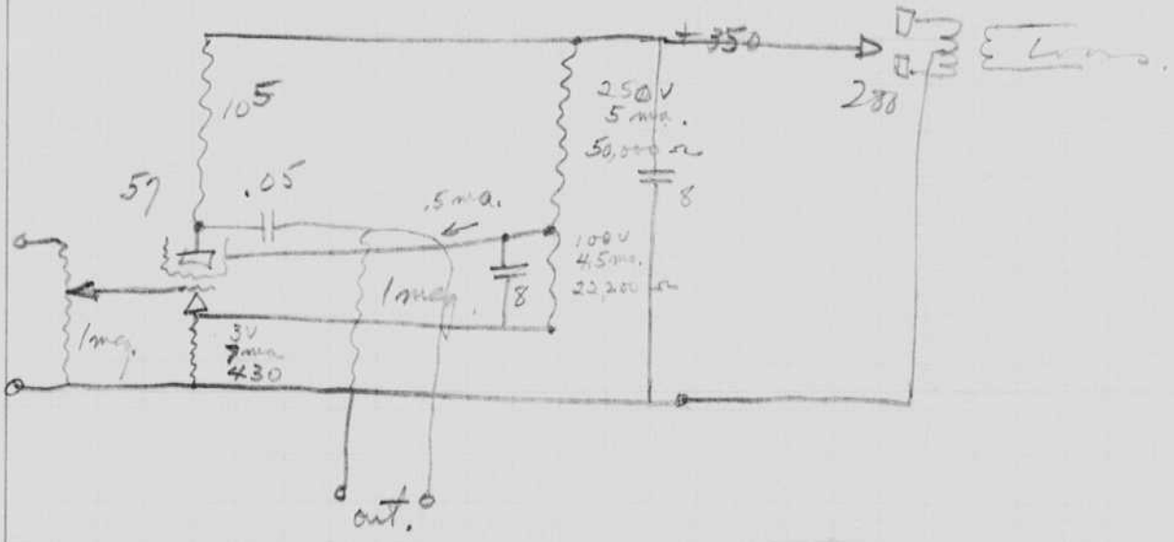
R 10 ma = 13.5 volts

R = 135

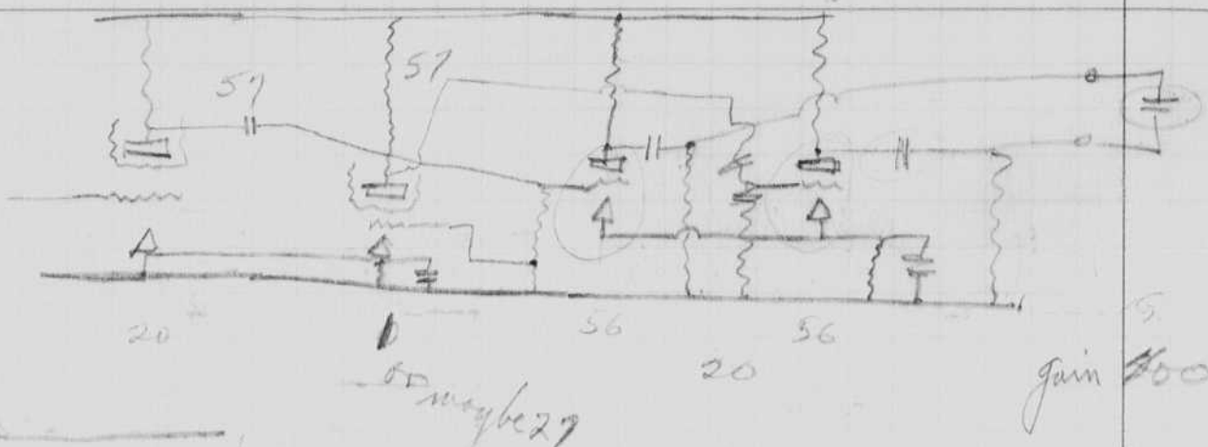
Mag I cont.



Rep about 150 two tubes

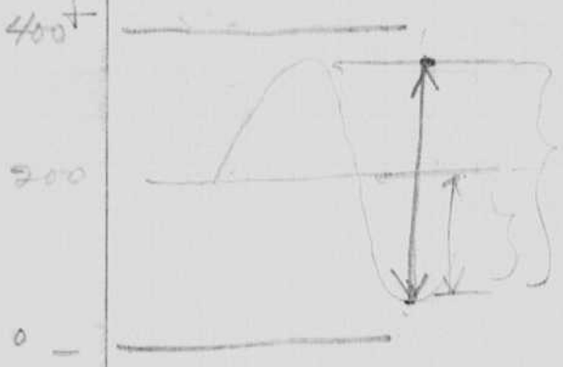


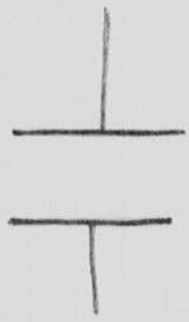
10

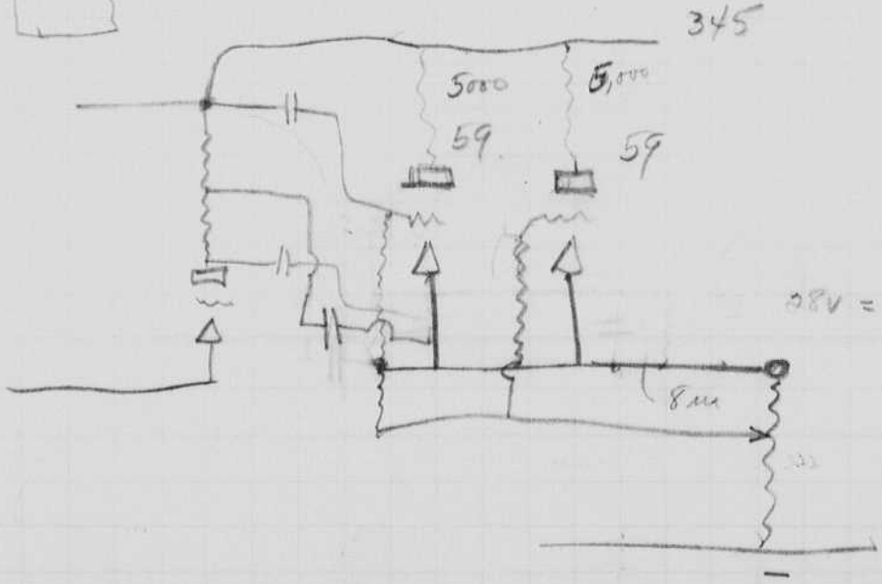


gain 500.

maybe 27.

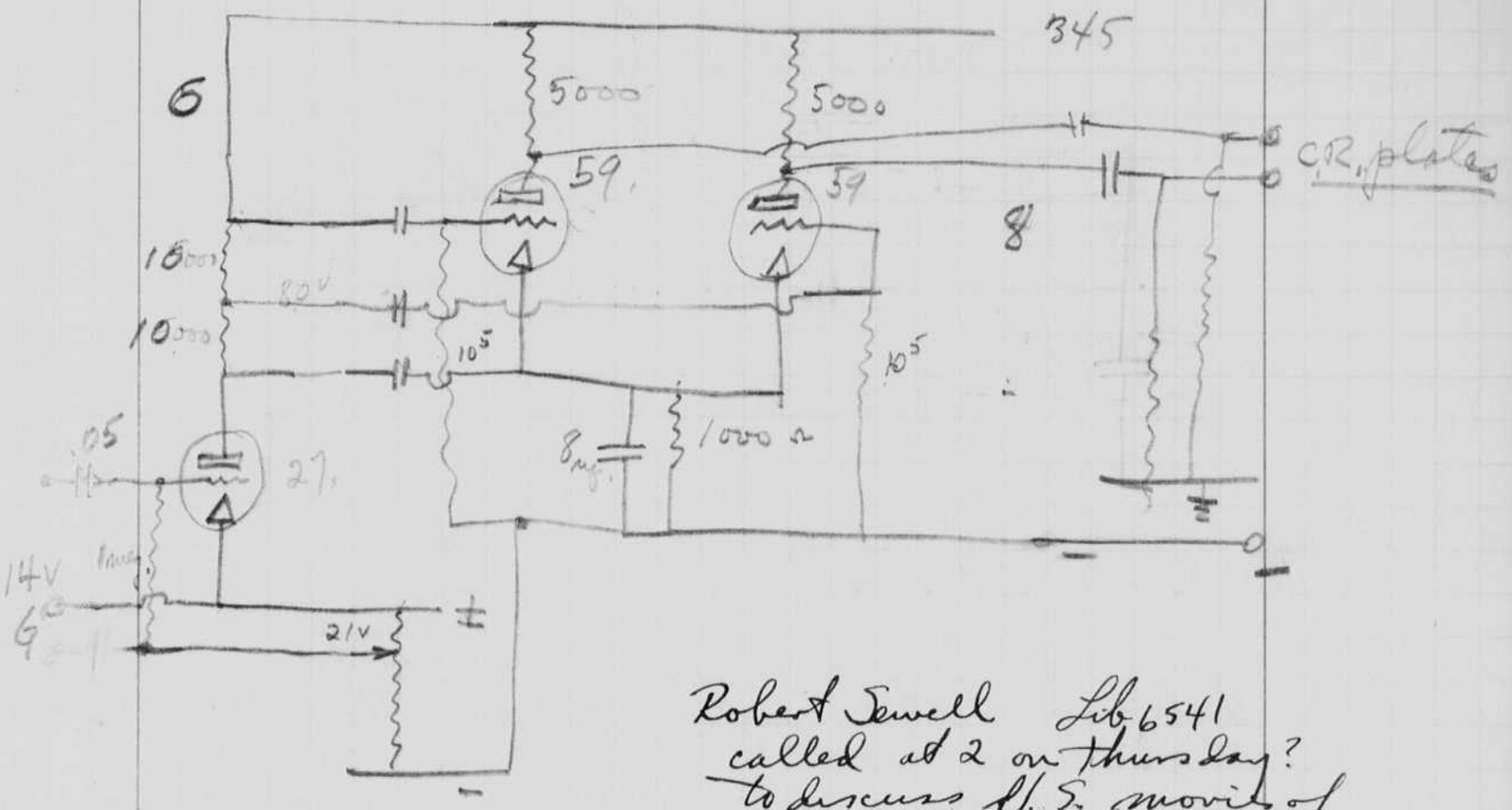




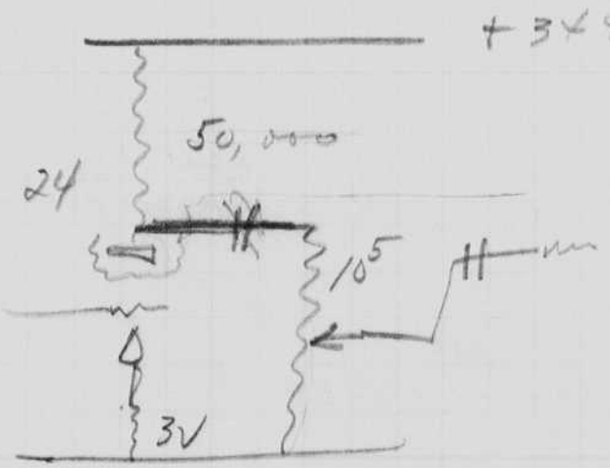


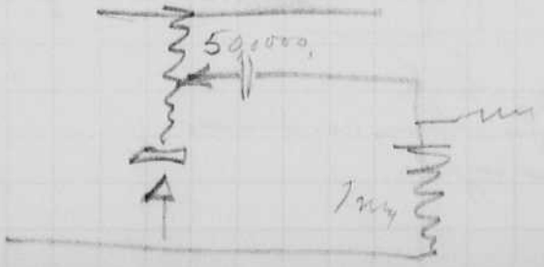
28/50 =

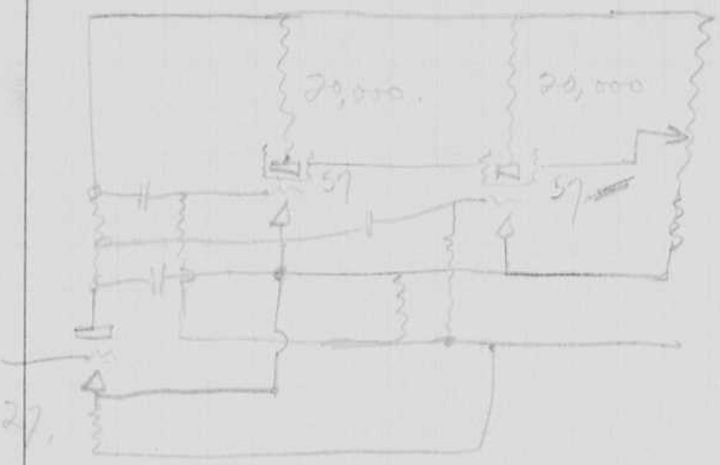
.08V = 560 Ω



Robert Jewell Lib 6541
called at 2 on Thursday?
to discuss U.S. movie of
fighting cocks.







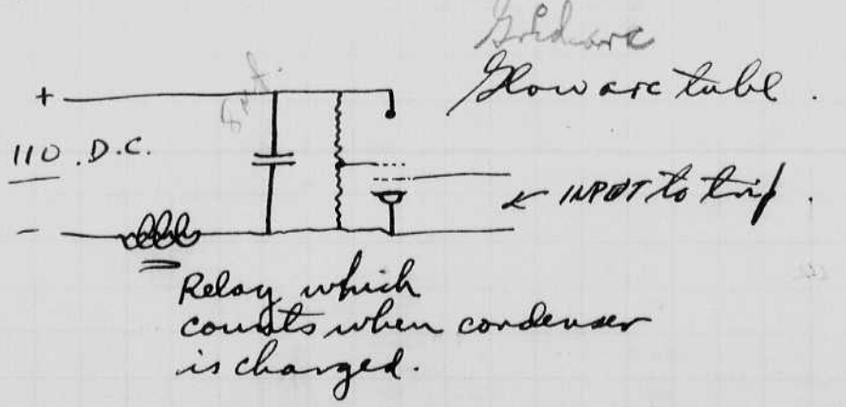
$\mu = 1500$
$r_p = 1.5 \times 10^6$
$\mu = 20 = \frac{1500 R}{1.5 \times 10^6}$
20×10^3
20,000 Ω

May 5, 1935. H.E. Edgerton.

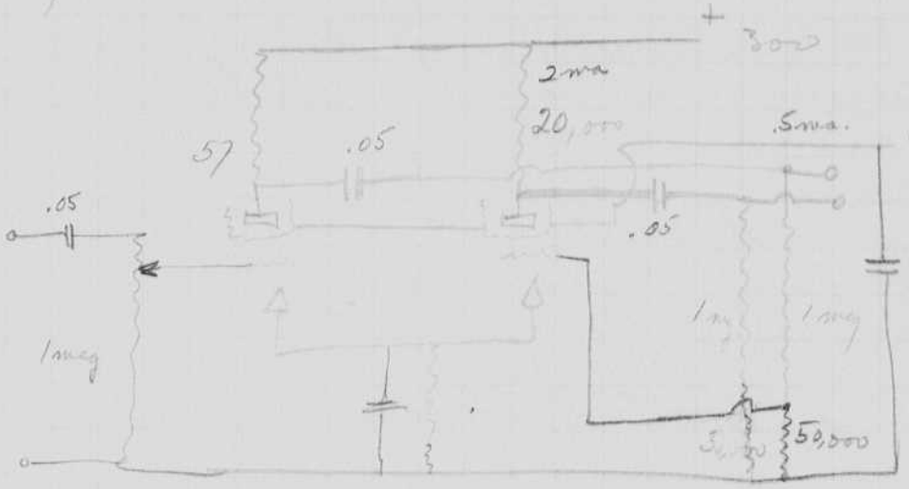
Open House yesterday. Large crowd. Water oscillator and cameras in 4-111 Stroboscopic exhibits of propellers springs etc in 10-160. Red and Blue lights with different frequencies.

Chladni's plates designs with white sand on aluminum plate 12" in diam. I spent this morning taking pictures of the designs and hope to measure the frequency later for the various patterns.

Relay circuit that is being used by Bennett, et all, for counting cosmic rays.



May 7, 1935
H. E. Edgerton



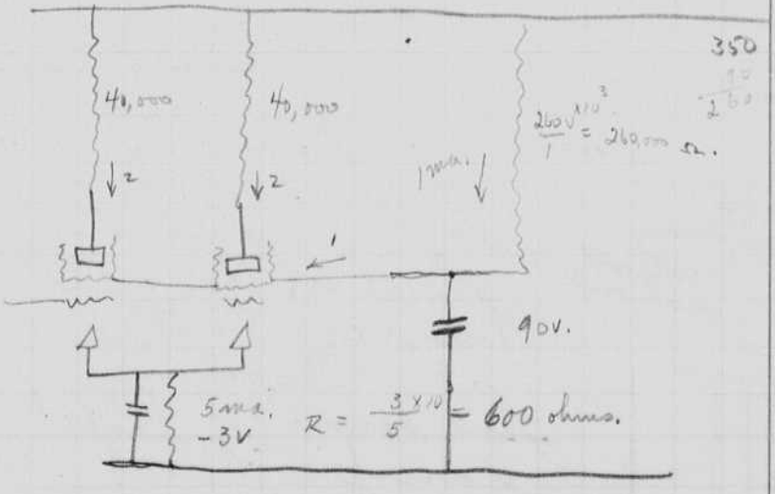
57 $\mu = 1500$ $r_p = 1.5$ meg $\qquad \mu' = \frac{1500}{1 + \frac{1500000}{50000}} = 20.$

$\mu' = 20$ 1 meg tap at $\frac{1}{30}$ meg = 1,05 50,000 ohms.

20 x 2 = 40 amplification.

trying $\mu = 80$ Let $R_2 = 40{,}000$ 2 x 40 = 80 volts.

350 − 80 = 270 volts.

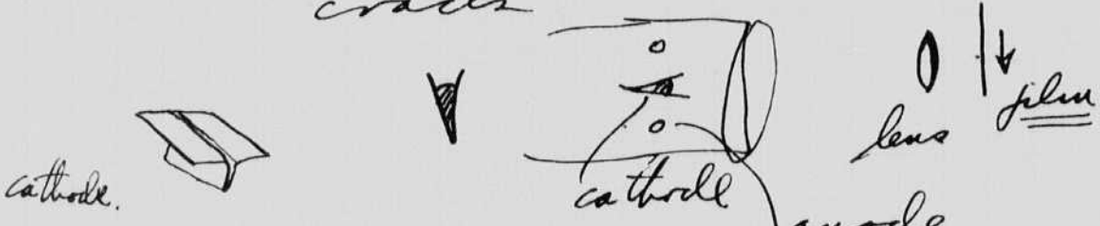


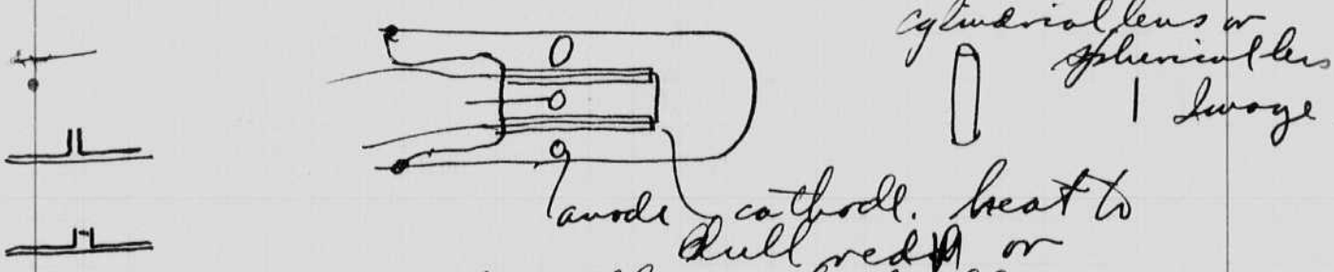
May 9, 1935.
H. E. Edgerton.

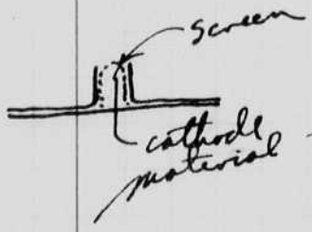
Glow Lamp design for timing on a moving film or for sound recording.

a brilliant line cathode to be focussed on the film by a lens.

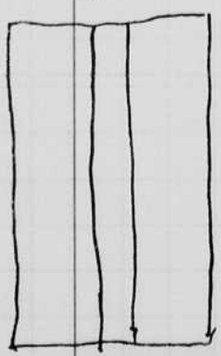
1. Heated filament.
2. Cracks in the cathode. such as a folded piece of metal with rare earths in the cracks







High pressure in the tube so that glow at the cathode will be concentrated there.



Line source of light from a glow lamp.

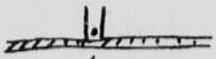
The light from the wire filament could be used to overcome the exposure inertia of the film.

May 10, 1935.
H. E. Edgerton.

Robert Franklin

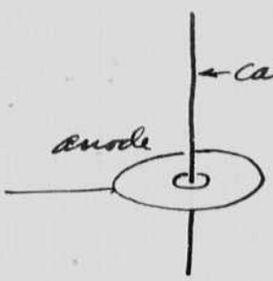
At one oclock today Wyman hospital Cambridge another boy 8½ #.

Glow Recording lamps.

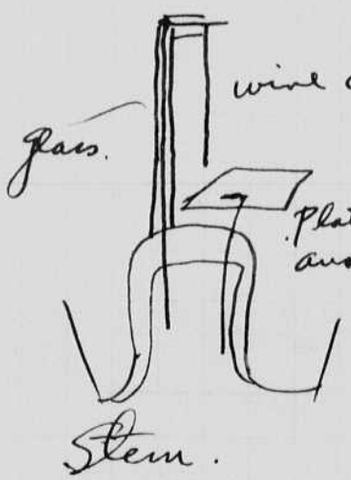


filament wire in a slit with the sides of the slit coated with material to give a good cathode surface.

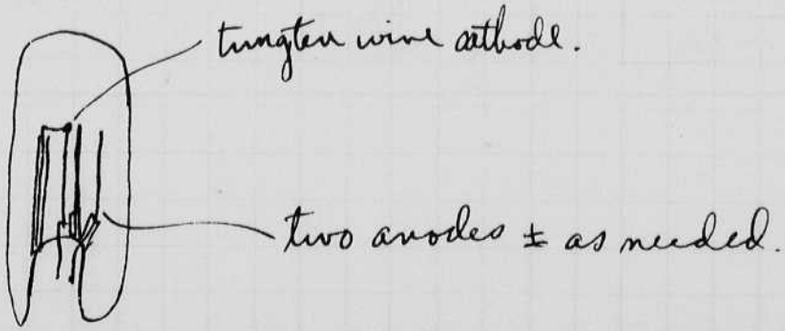
Variable area as contrasted to variable density recording by using a glow discharge at low pressure



Glow climbs up on the cathode proportional to the current

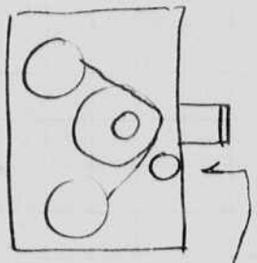


Focus image of the wire cathode on the film.

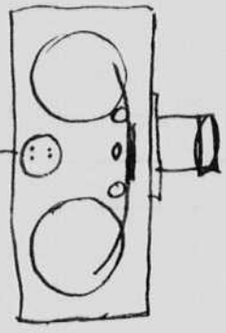


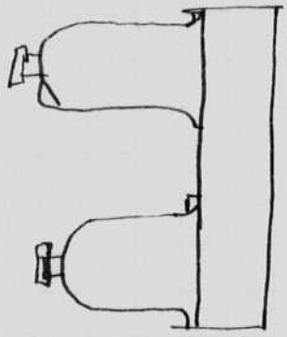
Cont.

Put two or more line cathodes in the same tube so that several things can be recorded with the same lamp.

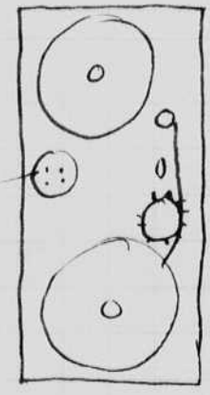


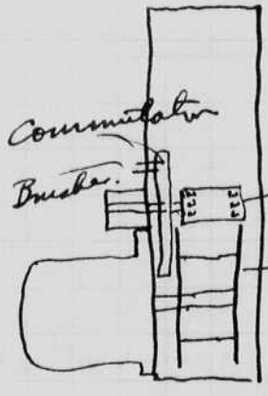
in N.S. camera.
glow lamp.





Motor on top and on bottom.



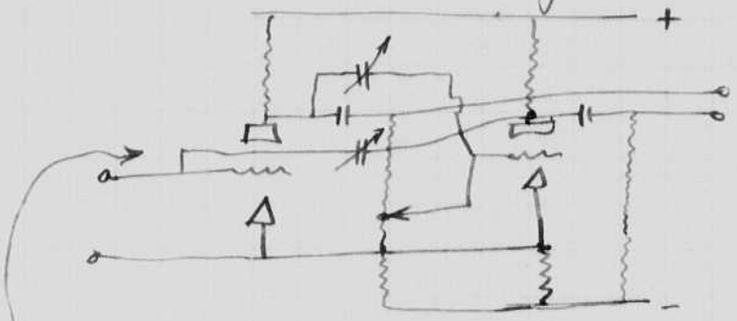


May 14, 1935.

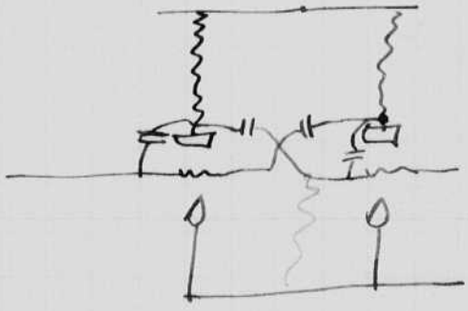
Cathode Ray Oscillograph amplifier.

The frequency response curve of a push-pull amplifier for C.R. work was cut off on the high end due to capacity effects.

The following method of neutralization was discussed with Affel and Cohen the other day in 6.39 conference.



Use of condensers to feed back from the opposite plate.

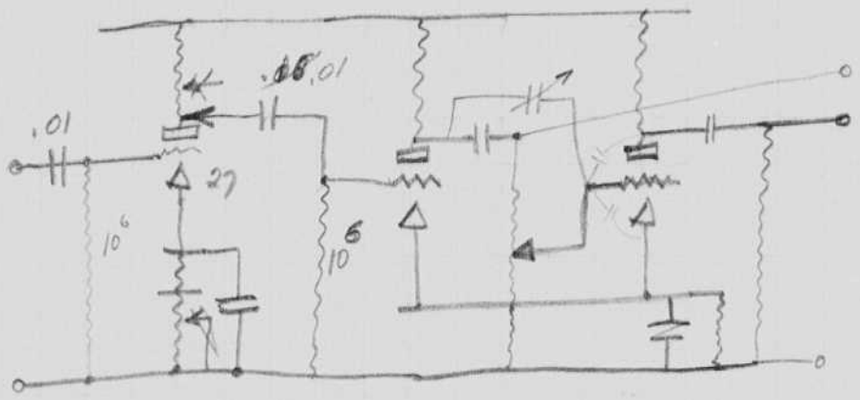


Quite complicated to analyze. Will be set up and tried in the lab.

Feed back condensers will be about the size of the grid-plate capacitance.

May 16/1935
Edgerton.

Cohen and Abbott tried the feed back neutralization scheme shown on the preceding page. The variable condenser coupling the first plate to the second grid was of mica, about 5 mmf square zero angle at 10,000 cycles.

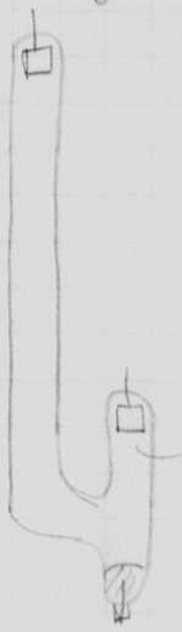


53.

Cont'd.

Hg lamp for high speed movies.

Shown me May 27, 1935 H. E. Gray



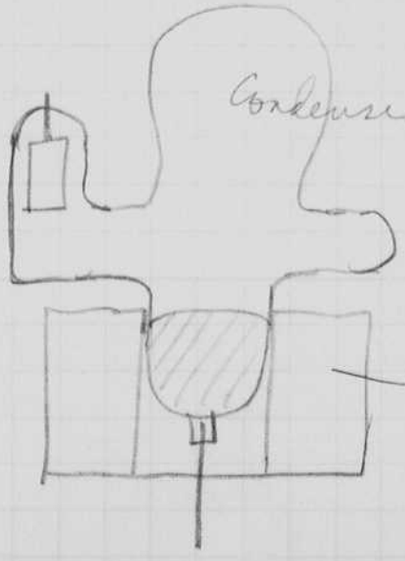
dome to catch blast of Hg vapor. and to condense it.

condenser

glass covered lead.

Spark coil for igniting tube.

Eddy currents in Hg may help to damp the oscillations of potential in the spark voltage.



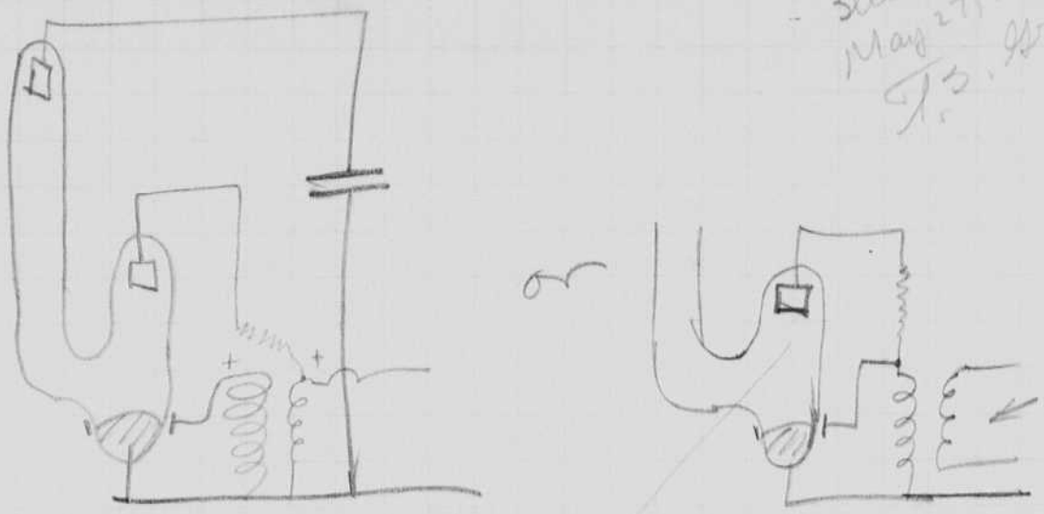
Condenser.

Power rectifier.

Spark coil
Igniter coil.

Cont.

- shown me May 27, 1935 J. S. Gray



conductive here helps to start arc and also helps to damp out oscillation in the spark coil.

May 20 1935
Electron

I built a glow lamp with a tungsten cathode, neon gas 2-4 cm pressure similar to those pictured on page 86 of Saturday.

This tube sputtered some due to overheating while on the pump. It works satisfactorily except that it does not produce much light and the glass is rather large in volume compared to the wire. I ordered some Argon which should be here this week.

Tonight as I worked upon my lecture in 639 for tomorrow I wondered if it was possible to build some amplifier which would be sensitive enough to record the individual impact of the

molecules of gas as they struck a surface, for instance a prism of crystal in a magnum; the lower the vacuum the fewer the impacts. Roughly a vacuum gauge could be built on this principle with a counter in the circuit.

Molecules striking a sq. cm. of surface in 1 sec. is

$\frac{1}{4} n \bar{c}$ Slepian p. 17.

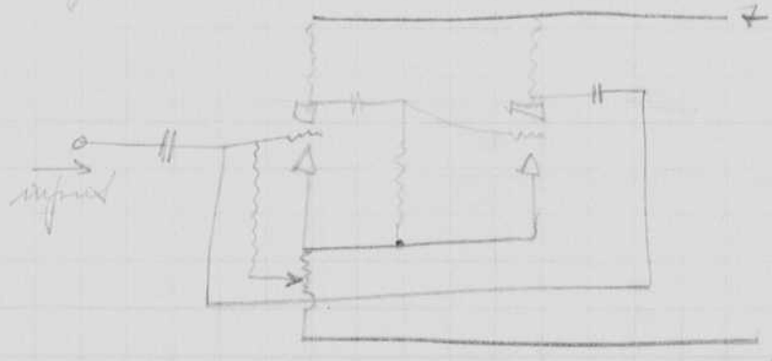
n = number of molecules/cc.

— too many complexities. also mean of path too small.

May 24, 1935
Explorer

Timing circuit for tripping a spark or lamp for timing for velocity measurements.

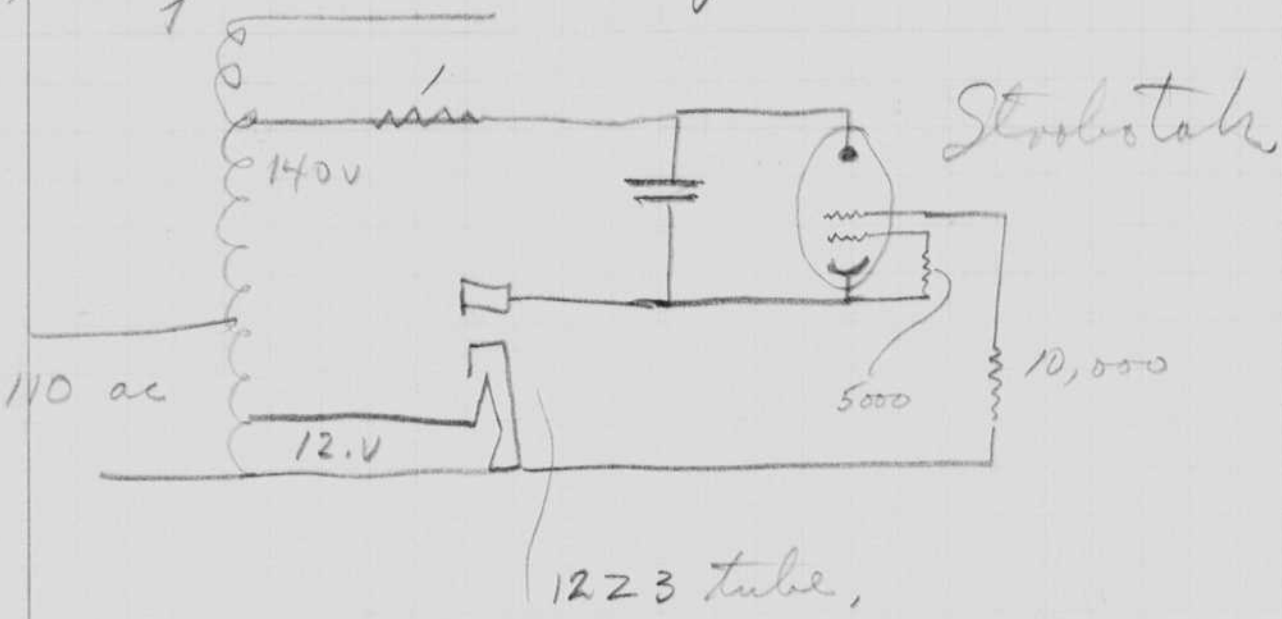
Use a relaxation oscillator biased to cutoff until one tube was tripped.

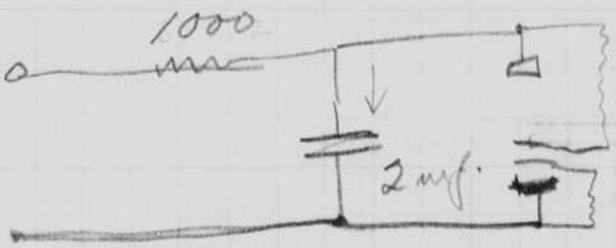


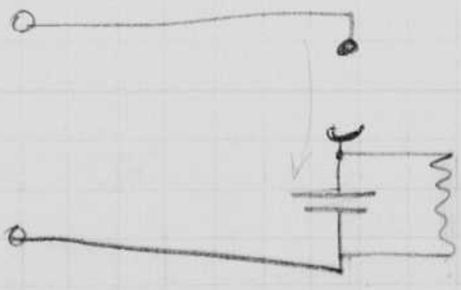
Robert Frank Stone today from the Hospital two wks old.

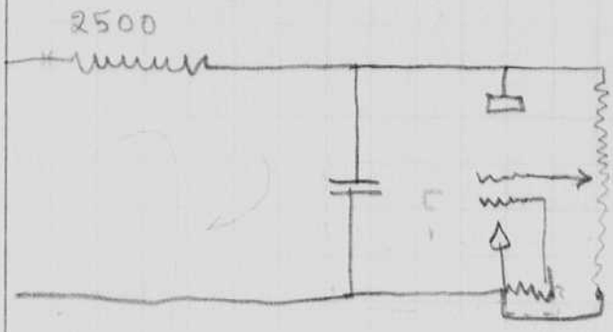
May 25 1935
H. E. Edgerton. 10-111 M.I.T.

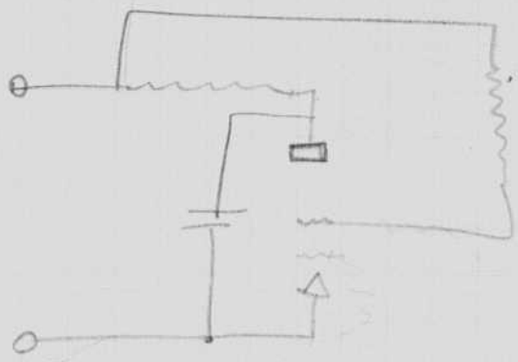
Small 60 cycle stroboscope using Strobotak lamp

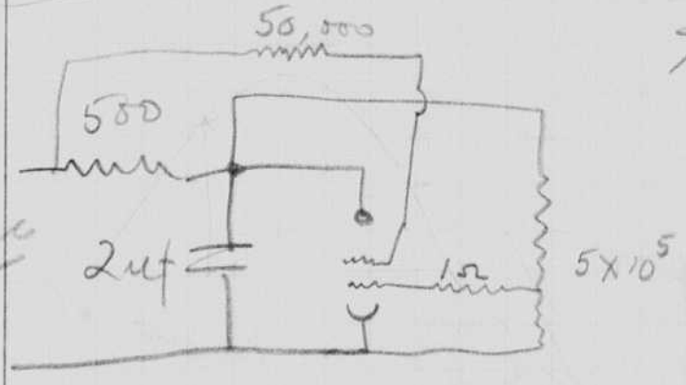




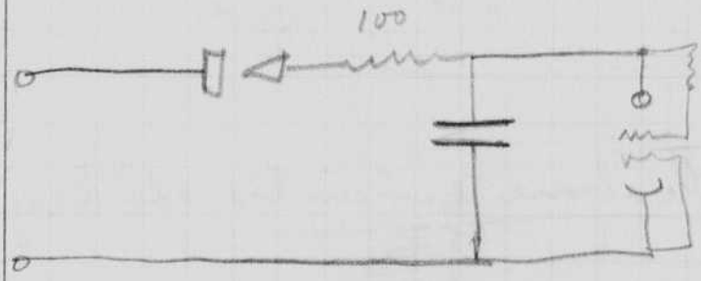


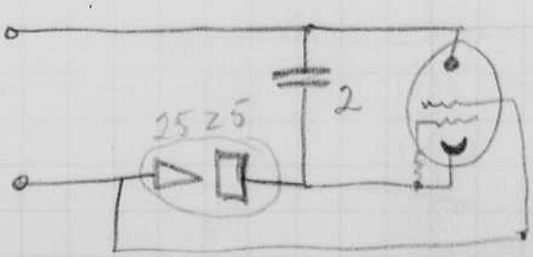


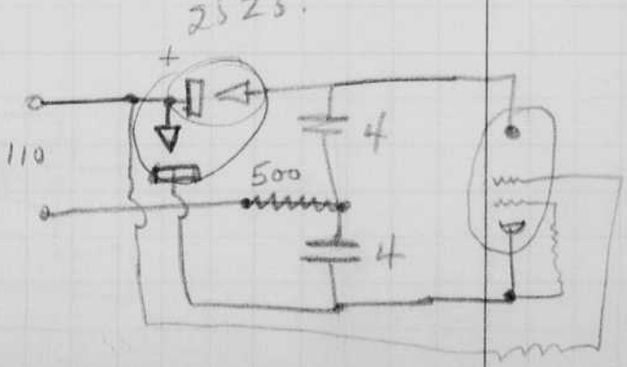


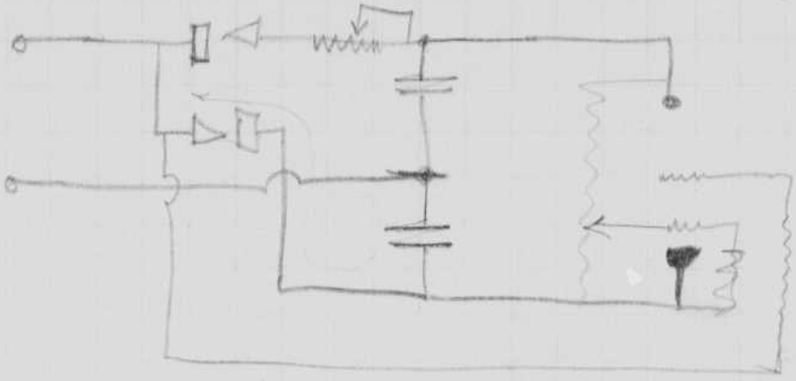


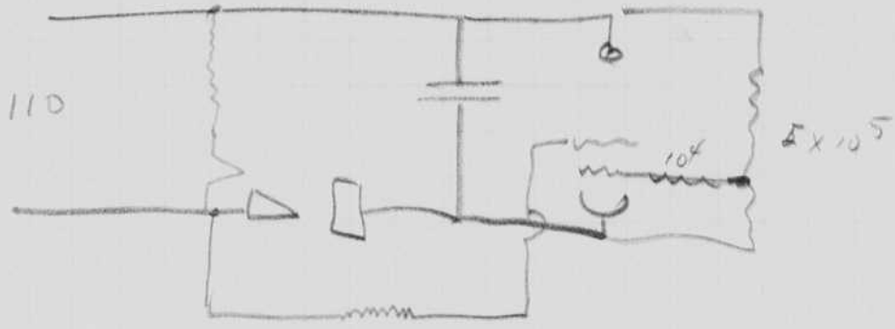
tried and
Works ok but
giving double flash
on the pos. half cycle.



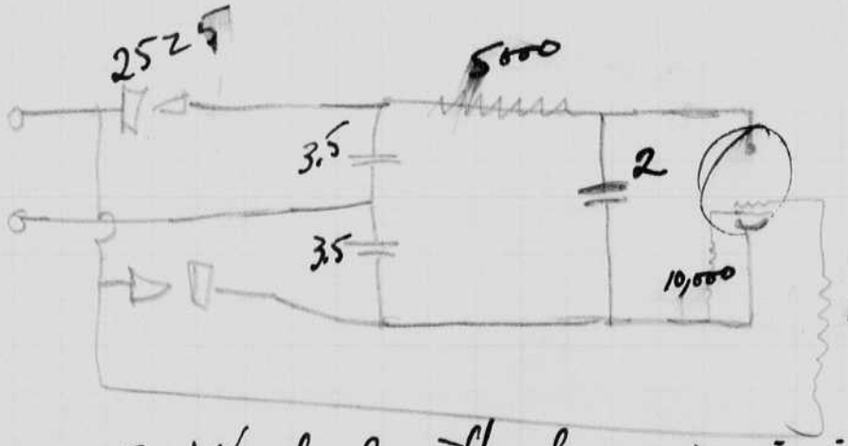








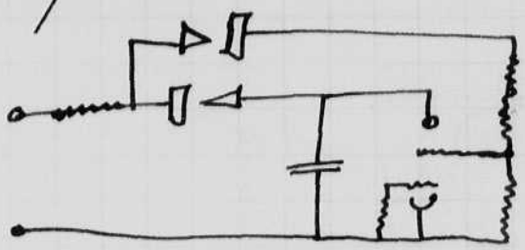
not consistant in breakdown.

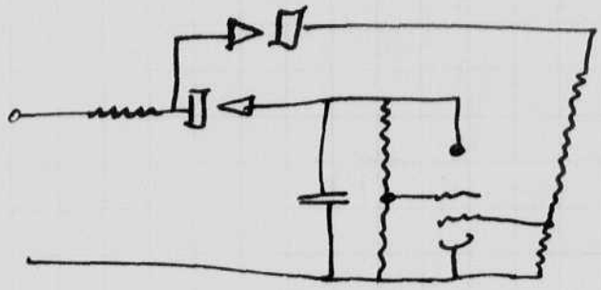


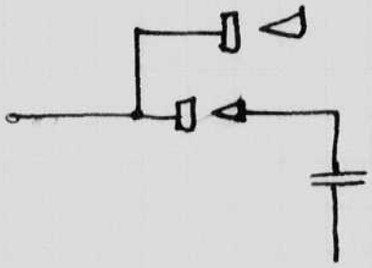
Runs. 60 cycles

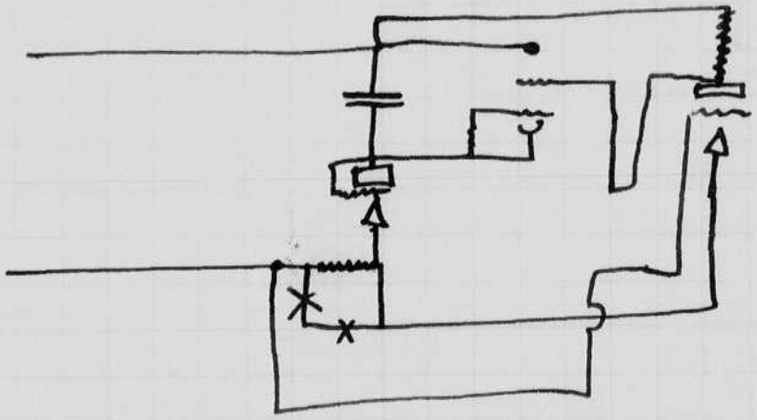
May 27 1935. Worked with above circuits all day.

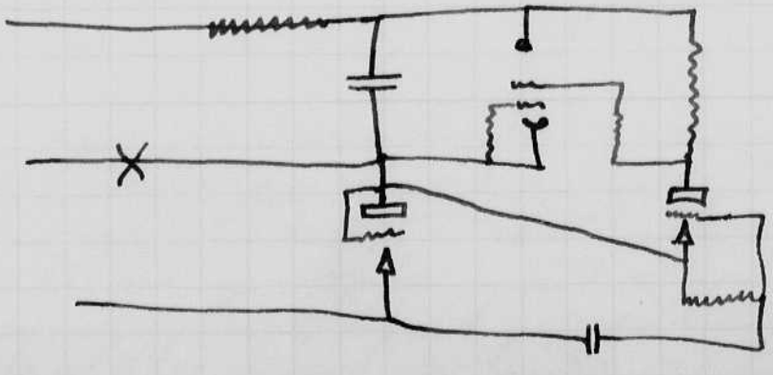
May 28 1935
H. E. Edgerton.

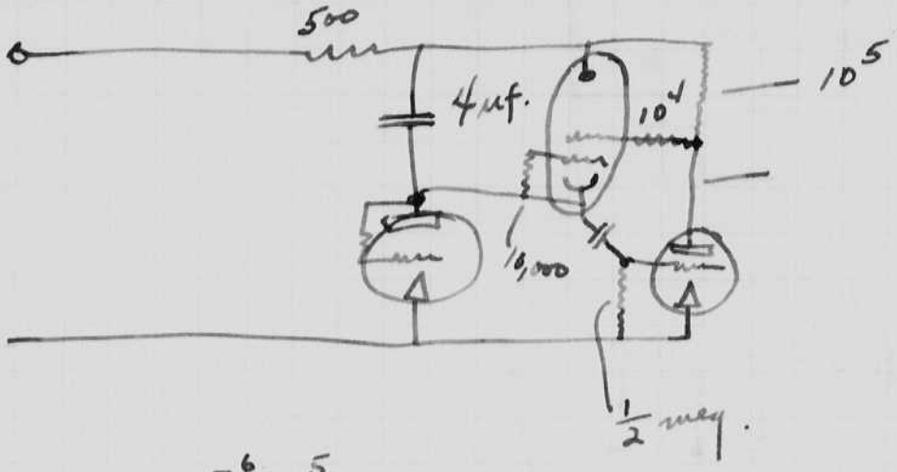








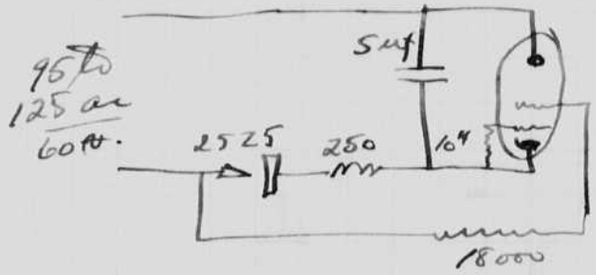




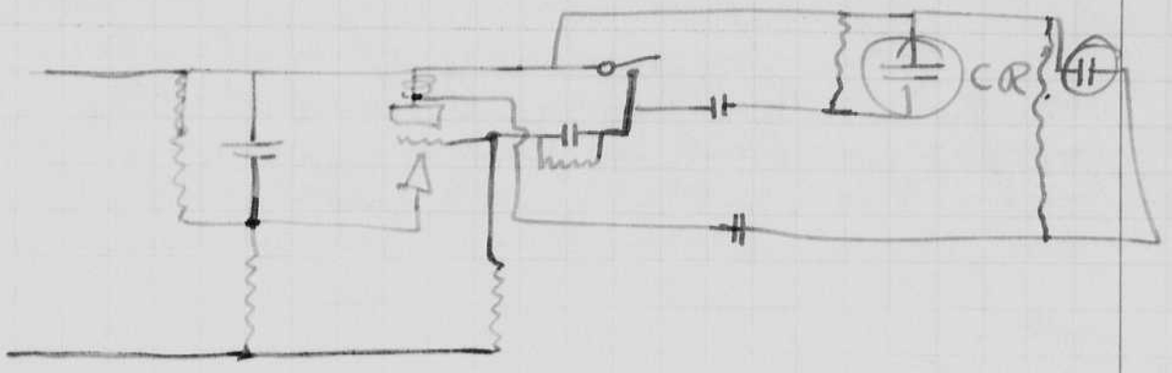
$4 \times 10^{-6} \times 10^{5} = .4$ sec.

June 1 1935.

Changed circuit for 60 cycle stroboscope to



and it works fine.



June 11, 1935.

A method of testing airplane (Postponed metal) propellers for fatigue.

If violent vibrations are set up in an airplane propeller, stresses result which cause failure quite quickly. The following method ida scheme for testing propellers rapidly to determine if they are about to breaks.

As metal fatigues due to excessive stress its elastical coefficient changes and therefore the natural ~~frequency~~ period of oscillation becomes reduced. I propose to measure the natural period of vibration accurately by an oscillator as a function of the life of the prop. and plot it as a function of time. When the frequency drops then it is time to discard the propeller and replace it with a new one.

I visualize the apparatus to be portable and easily attached to the propeller. The vibrator probably will be a magnet and metal armature that is attached to the tip of the prop while on the plane.

Propeller tester. cont.

the frequency of vibration would be changed until the prop reached a maximum vibration at which speed the frequency would be measured.

Explained to me June 11, 1935 Emmett J. Hermelbauer

Explained to me June 11, 1935 G. P. Bentley

3000 - 5000 cyc./min.

~~50~~ - ~~5000~~ 100 " /sec.

I discussed the above with Prof. DeForest and he does not think the method of any use because the frequency will not change until the damage is done.

Considerable work has been done for Brown & Sharpe upon their electric hair clipper (going 120 times a second).

June. 12 1935.

Spent most of the day in Worchester at the Norton Co. Mr. Chas J. Hudson of the Research dept. Mr. Beecher, Mr. Wagner, Mr. Whitcomb Mr. Klein. Discussed experiments upon grinding wheels that have been made to date and made plans for more work.

June 13, 1935
H. E. Edgerton.

When grinding steel some of the sparks go around the wheel apparently being stuck to the grains. It may be possible that the heat is sufficient to melt the bond and combine the iron or iron oxide with the bond, thus weakening it.

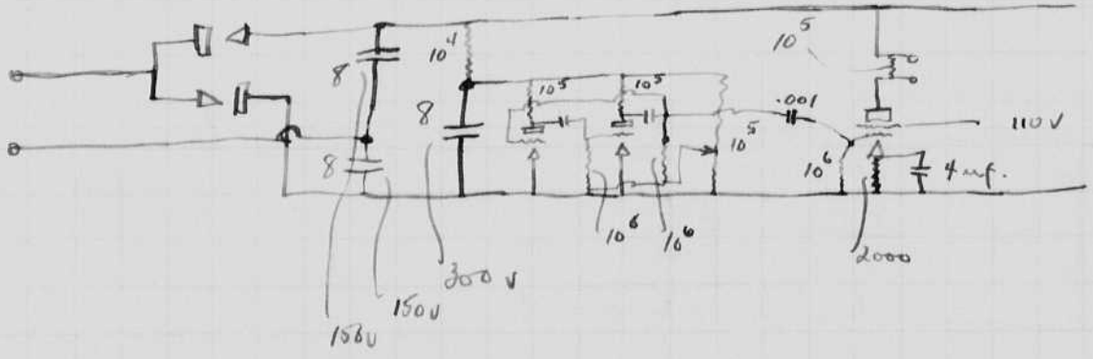
I would like to know if oxidizing has any effect upon the generation of heat. If it has then some non-oxidizing gas might be of use in the grinding area and afterwards a jet of CO_2 might do some good.

June 18, 1935.

For the last few days I have been working on a large spark outfit for Lever Bros Co.

Oscillator to drive
Stroboscope 548.A. fil

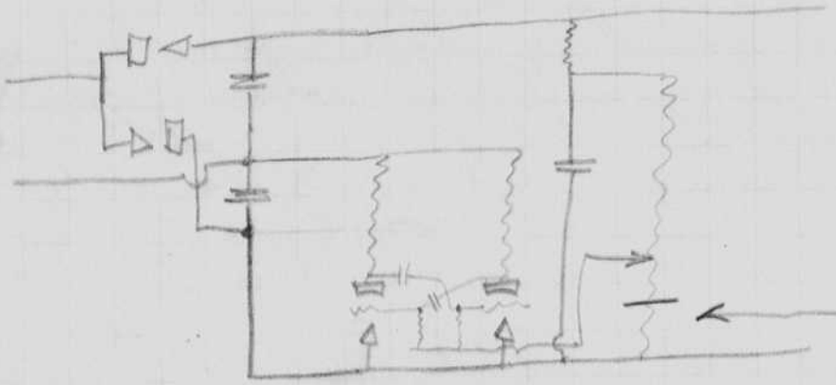
6A6	6.6v	.8 amp
6F7	6.6	.3
19	2.	.26
79	6.3	.6



Spent the afternoon with Summaya, taking pictures of a gauge. He is the Squash coach at Tech and wishes to write a book showing how to do it using these pictures as illustrations.

June 18 1935 cont.

More oscillator circuits.



try to get speed range 600 - 7200 on one dial

or 600 - 3600

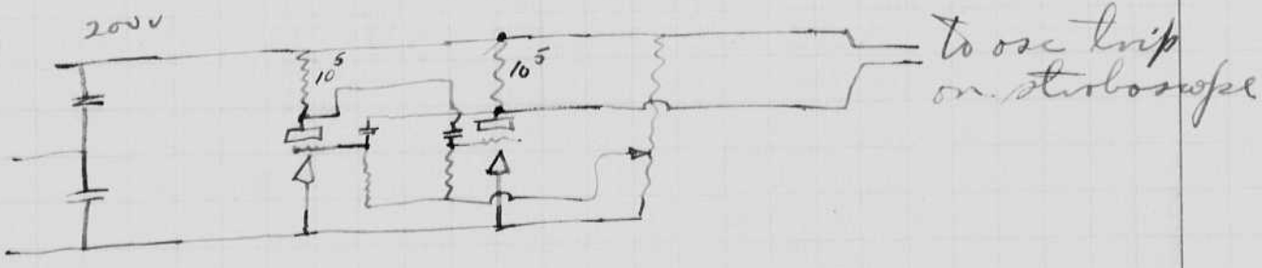
then

3000 - 7200

For this introduce resistance here when changing scale.

Another scheme would be to increase the energy in the oscillator so that it could handle the load without any trouble.

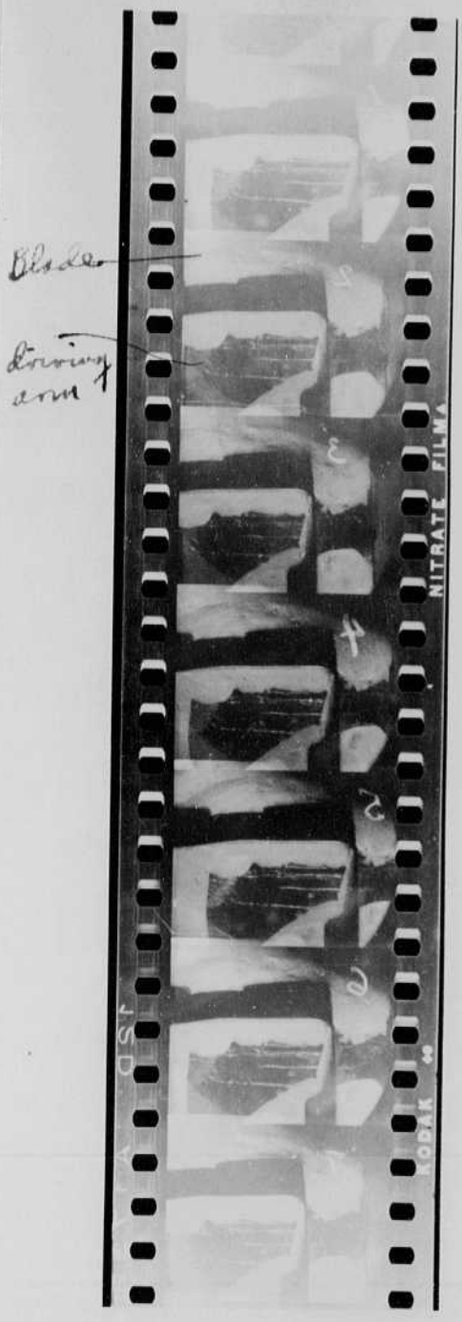
For instance two #76 tubes for an oscillator.



#79 or two #76 tubes.

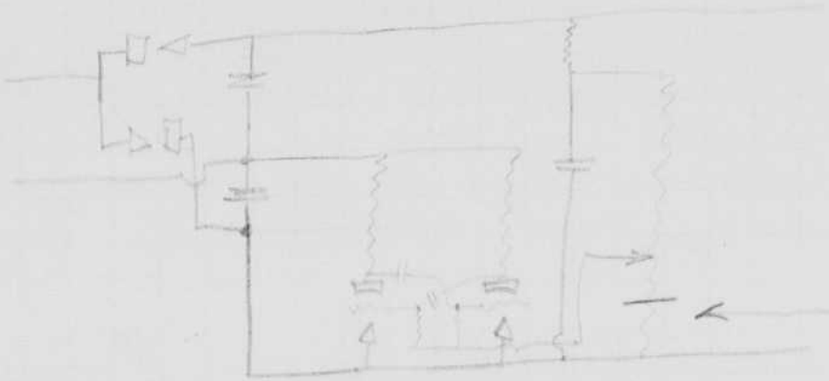
June 19 1935

An enlargement from a high speed film taken through a 32 mm microscope objective of the motion of the arm that drives the blade of a Brown and Sharpe hair clipper.



June 18 1935 cont.

Move oscillator circuits.



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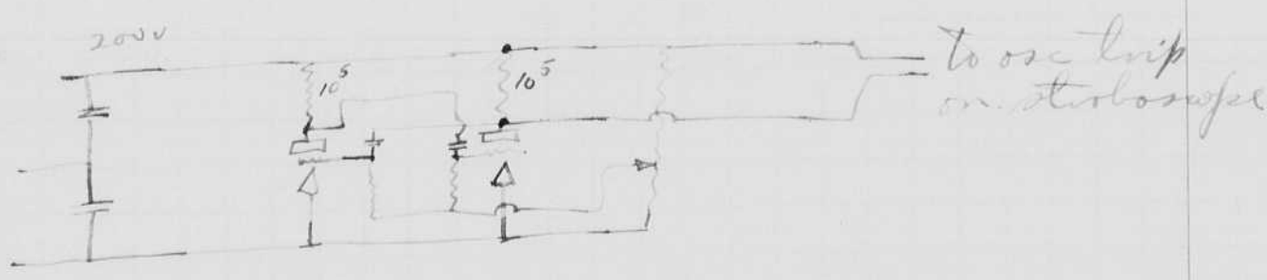
Another scheme would be to increase the energy in the oscillator so that it could handle the load without any trouble.

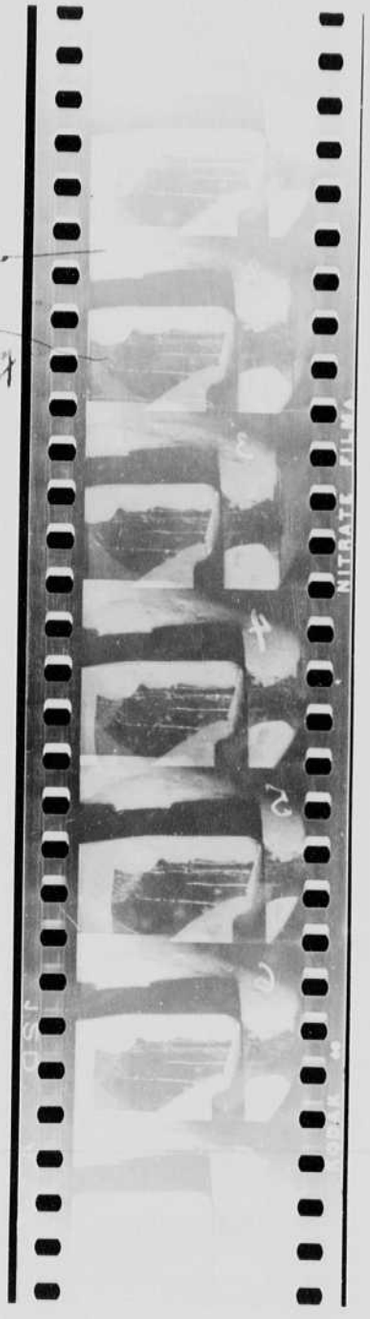
For instance two #76 tubes for an oscillator.



#79 or two #76 tubes.

June 14 1935

An enlargement from a high speed film taken through a 32 mm microscope objective of the motion of the arm that drives the blade of a Brown & Sharpe hair clipper.



June 19, 1935
H. E. Edgerton.

Alfred C. Strasser of Batten Barton Durstine and Osborne Inc 383 Madison Ave. New York was here today and discussed spark pictures for advertising series. Mr. Fogler of A. D. Little Inc showed movies at Tech.

Mr. Shepard of Stow-Woodward Co and Mr. Hill(?) came in and we discussed movies of a golf machine that they own. Also discussed a problem regarding the rollers in a paper making machine.

Mr. Charles and (?) from the Dennison company came over and I showed them the stroboscope and discussed the high-speed motion picture camera and its uses.

Jack Summers came over again this afternoon and we took some snaps of a tennis ball and racquet. I gave him the contact prints which were made yesterday.

June 23 1935. Germeshausen and I spent the last three days taking spark pictures of tennis impact for Ethyl ad.

Prints this morning of golf shots (made two years ago) for Mr. Shepard of Stow Woodward Co.

June 23 1935
M.G. Edgerton.

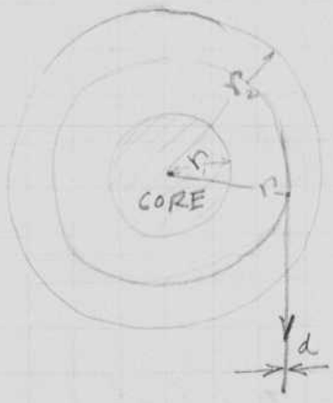
Design camera with series motor to pull film and with rolls arranged so that speed through the gate is about constant.

motor torque = (inertia of motor × acc
+ " " film × acc
+ " " supply × acc of supply.
+ load friction etc.

Approximation - lump load and assume it to be a function of speed.

motor torque − (load) = (as listed above)

The inertia of the rolls of film varies with the amount of film on the reel. Also the radius depends upon the amount going on or off of the reels.



Amount of film on the reel n turns + θ.

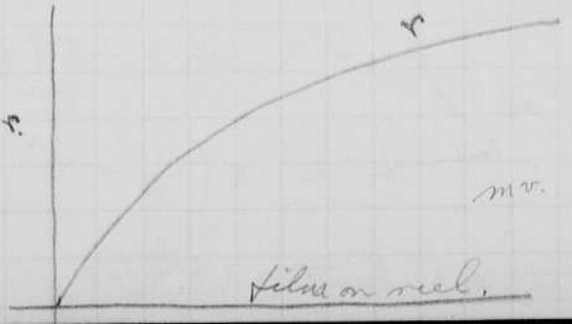
$= 2\pi r_1 + 2\pi(r_1 + d) + 2\pi(r_1 + 2d) + \cdots$

$= 2\pi\left(n r_1 + (d + 2d + 3d + 4d \cdots nd)\right)$

$= 2\pi\left(n r_1 + d(n!)\right]$ $n!$ = factorial $= 1 + 2 + 3 + 4 \cdots n$.

$= 2\pi\left[n r_1 + d(n!) + \left(r_1 + (n+1)d\,\frac{\theta}{360}\right)\right]$ θ in degrees.

This data can best be presented by a curve, likewise the inertia of the reel



$J_p = \pi\,\frac{(r^4 - r_1^4)}{2}$

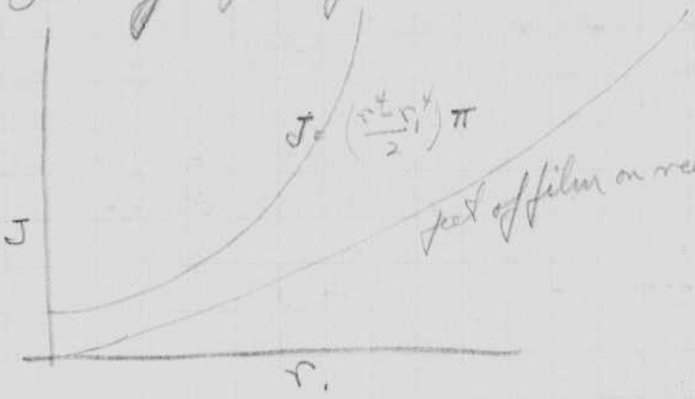
torque = $\frac{d}{dt}$ angular momentum.

$= \frac{d}{dt}\left(J\,\frac{d\theta}{dt}\right)$.

torque $= \frac{d}{dt}\left(J \frac{d\theta}{dt}\right)$ but $J = \pi\left(\frac{r^4 - r_1^4}{2}\right)$ where

r is a function of time. (unknown)

Find graph of r vs J



$$\text{Motor } T = J_{\substack{\text{real} \\ \text{mot}}} \frac{d^2\theta_1}{dt^2} + \frac{d}{dt} J_1 \frac{d\theta_1}{dt} + \frac{d}{dt} J_2 \frac{d\theta_2}{dt}$$

J_1 and θ_1 refer to take up or driver reel

J_2 and θ_2 " " supply reel.

We wish to know the speed of the film

$\frac{d\theta_1}{dt}$ = angular velocity of take up reel in radians per second

area $\pi(r^2 - r_1^2)$

half full area $= \pi(r_h^2 - r_1^2)$

$= \frac{\pi}{2}(r^2 - r_1^2)$ velocity of film $= \frac{r_1}{2\pi}\frac{d\theta_1}{dt}$ units of sec. velocity.

$r_h^2 = \frac{r^2}{2}$

r_h = half full radius

$r_h^4 = \frac{r^4}{4}$

$$\int_t T_m dt = \int_\theta J_m \frac{d\theta}{dt} d\theta_1 + J_1 \frac{d\theta_1}{dt} + J_2 \frac{d\theta_2}{dt}$$

Inertia of ~~film~~ at start when full. $J = \frac{\pi(r^4 - r_1^4)}{2}$

r = radius when full

Inertia of film when half through.

$J = 2 \times \frac{\pi(r_h^4 - r_1^4)}{2}$

r_h = radius when half of film

which is greater? $= \pi\left(\frac{r^4}{4} - r_1^4\right)$

$\frac{(r^4 - r_1^4)}{2} \gtrless \frac{r^4}{4} - r_1^4$

$\left(\frac{8-1}{2}\right) \longleftrightarrow \left(\frac{8}{4} - 1\right)$

$3.5 > 1$ Inertia 3.5 to 1.

Let $r = 2$, $r_1 = 1$

July 6, 1935.
H. H. Edgerton

Trip to A.S.E.E convention June 24 - June 27. Left Watertown via auto at 2 a.m. in Schdy and stopped with Bouchers. in Scotia. Morning in R. E. Plant. Saw Inverters etc in Bldg 16. Left to Ithaca. many others from tech there. Picnic at Sandehook(?) falls. Wed afternoon at Corning glass works where I saw Shaver. On Friday morning I was in Rochester and saw Forgie Tuttle at the Eastman company. also saw Benfield at the research labs. Fri night at Pittsfield and home about 11 am on Saturday.

On Monday July 1 Tuttle was at M.I.T. and saw Harrison about his machine for measuring the lines on plates from the spec. lab.

The Norton Co decided to go ahead with the research work on grinding wheels authorizing an expenditure of $2000.

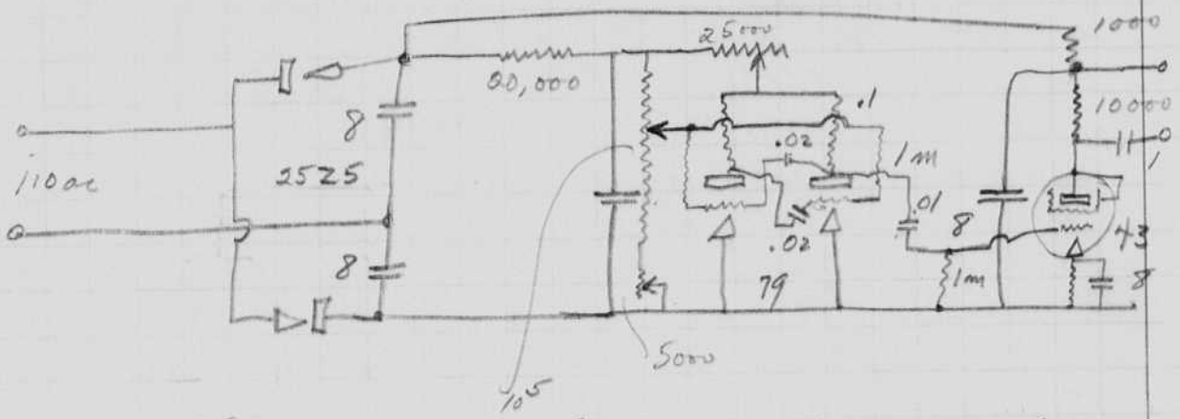
Grier has been taking many pictures of W.P.A. sprayed through nozzles at Lever Bros plant. Grier leaves for a 10 day vacation ~~soon~~ on July 3.

The tennis ball series of three shots were sent by Zogbaum to the advertisers on Tuesday July 2.

The same apparatus was also used for taking some pictures of a baseball thrown by a Bat. Sheldon and Arthur of the Lever Co were over today to bat some.

July 6, 1935
H. E. Edgerton

Experimented with an oscillator that was mixed up by General Radio

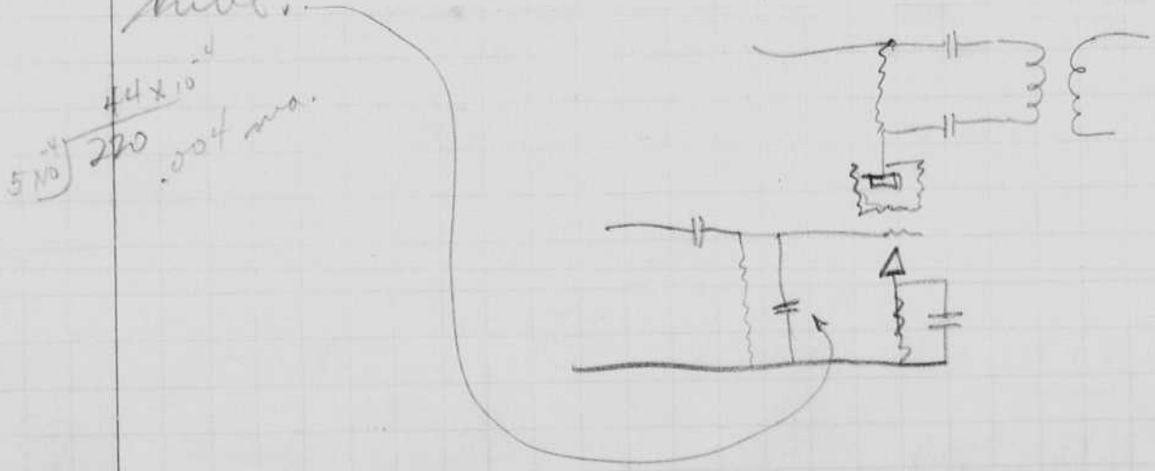


Some tendency to lie in at 30 and 15 cycles

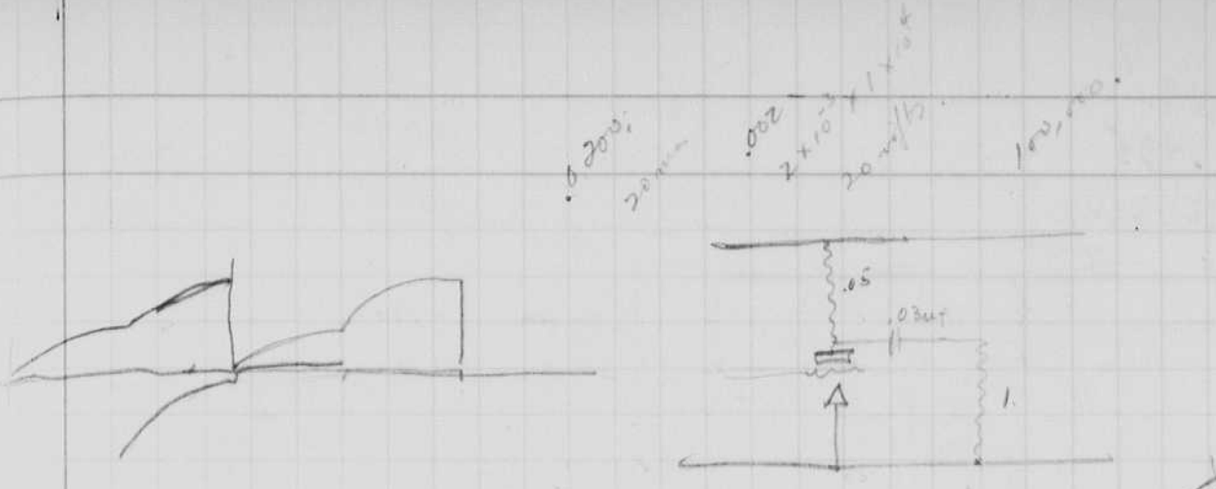
It is a problem to decide upon a range of speeds to be covered by the oscillator.

Desirable range 6 cycles/sec. to 120/sec. 7200 r.p.m.
20 to 1 range.
60 66 72 78 84 90 96 102 108 114 120.

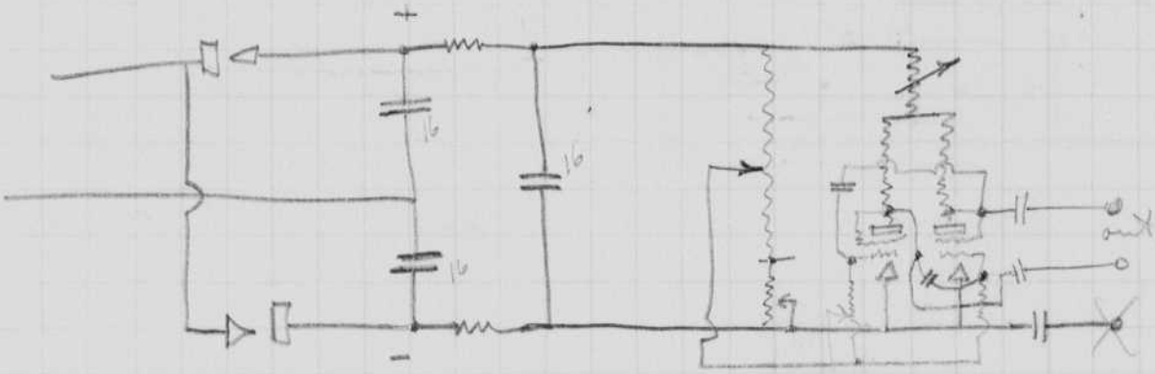
The wave front of the output is too abrupt to effectively get through the transformer. Try capacity to slow up voltage cut off on amplifier tube.



$\frac{44 \times 10^{-6}}{200} = .004$ mo.



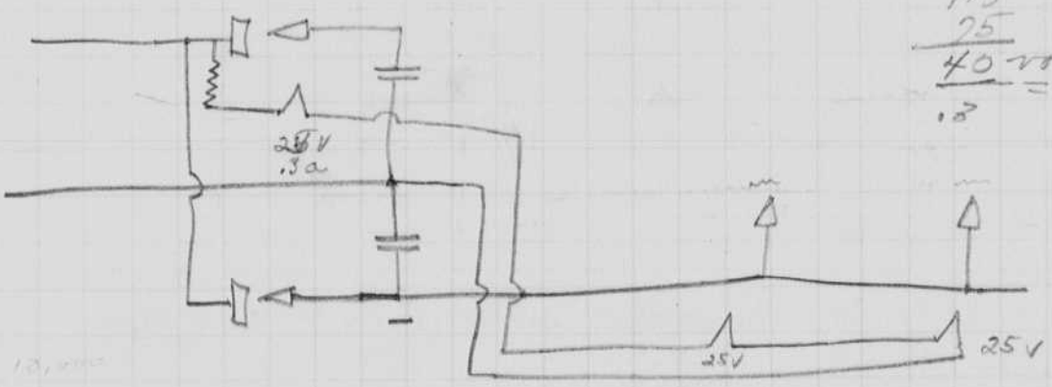
$\frac{1}{RC + RC}$.



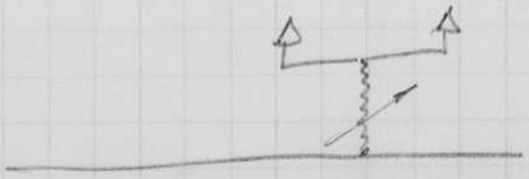
20 ma for each tube, 3 pentode.
220 volts dc for 40 ma.

$\frac{200}{50{,}000} = 4$ ma.

$\frac{200}{.020} =$ 10,000 ohms plate resistance.



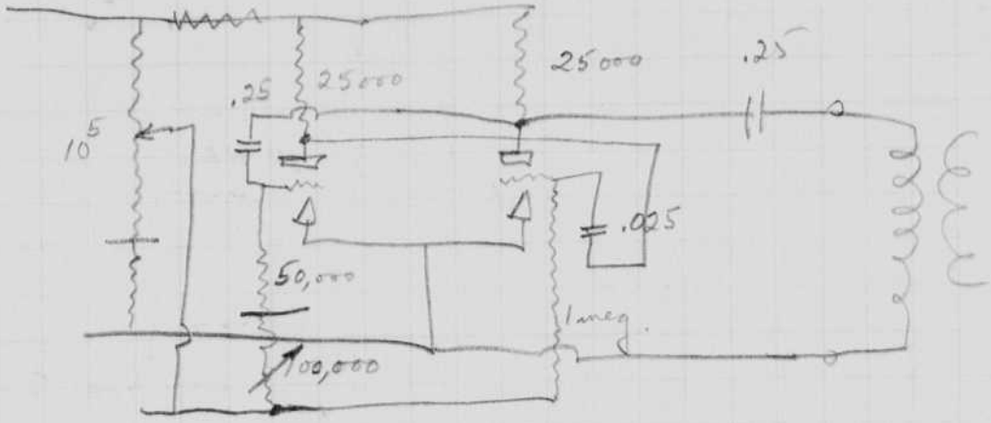
115
25
40 volts.
$\frac{40}{.3} =$ 133 ohms.
40 x .3 = 12. watt.



July 8th 1935

RC

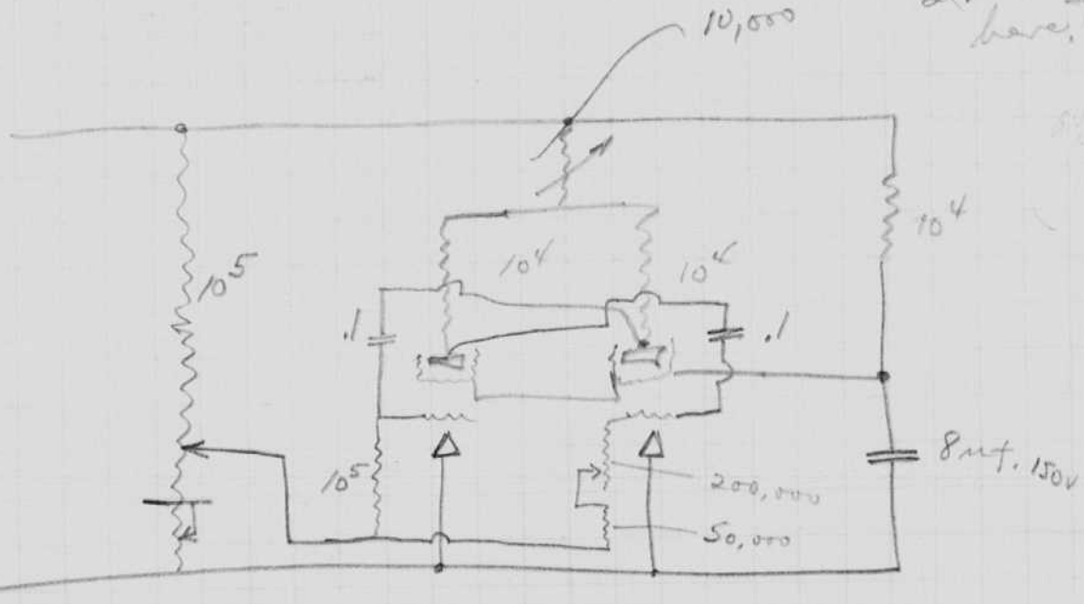
150 x 60 =
60
9000



600 — 1 10 - 200

150/60

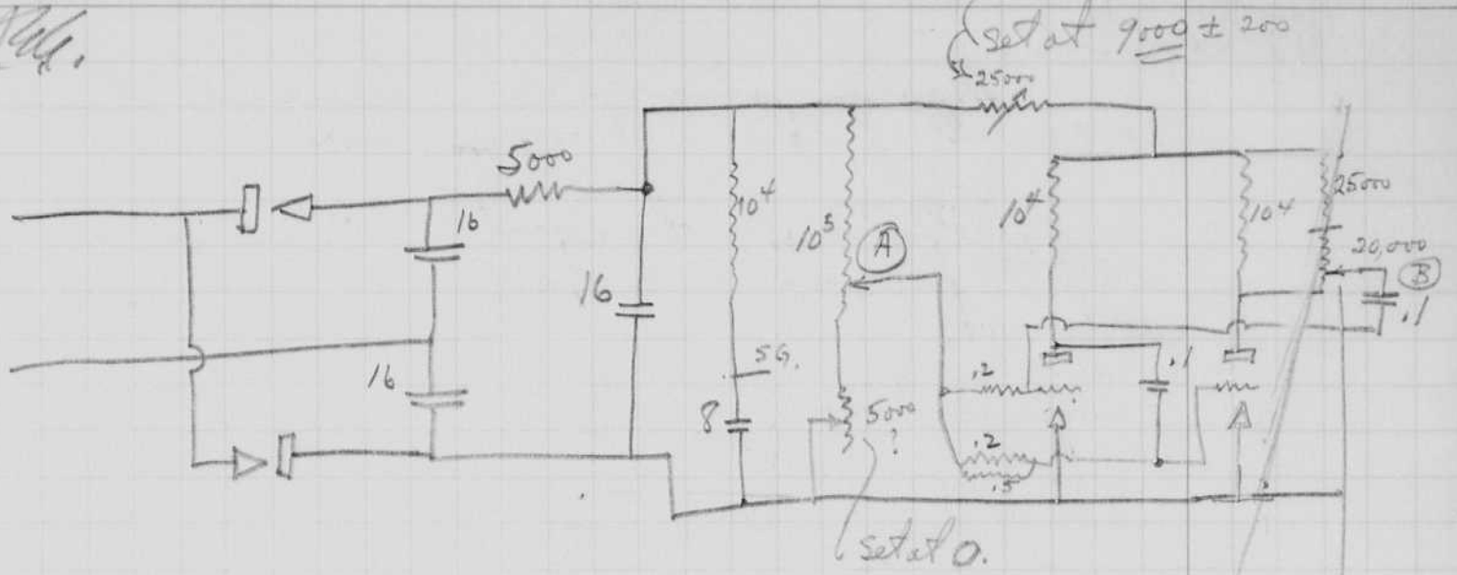
I had 25000 here. to run

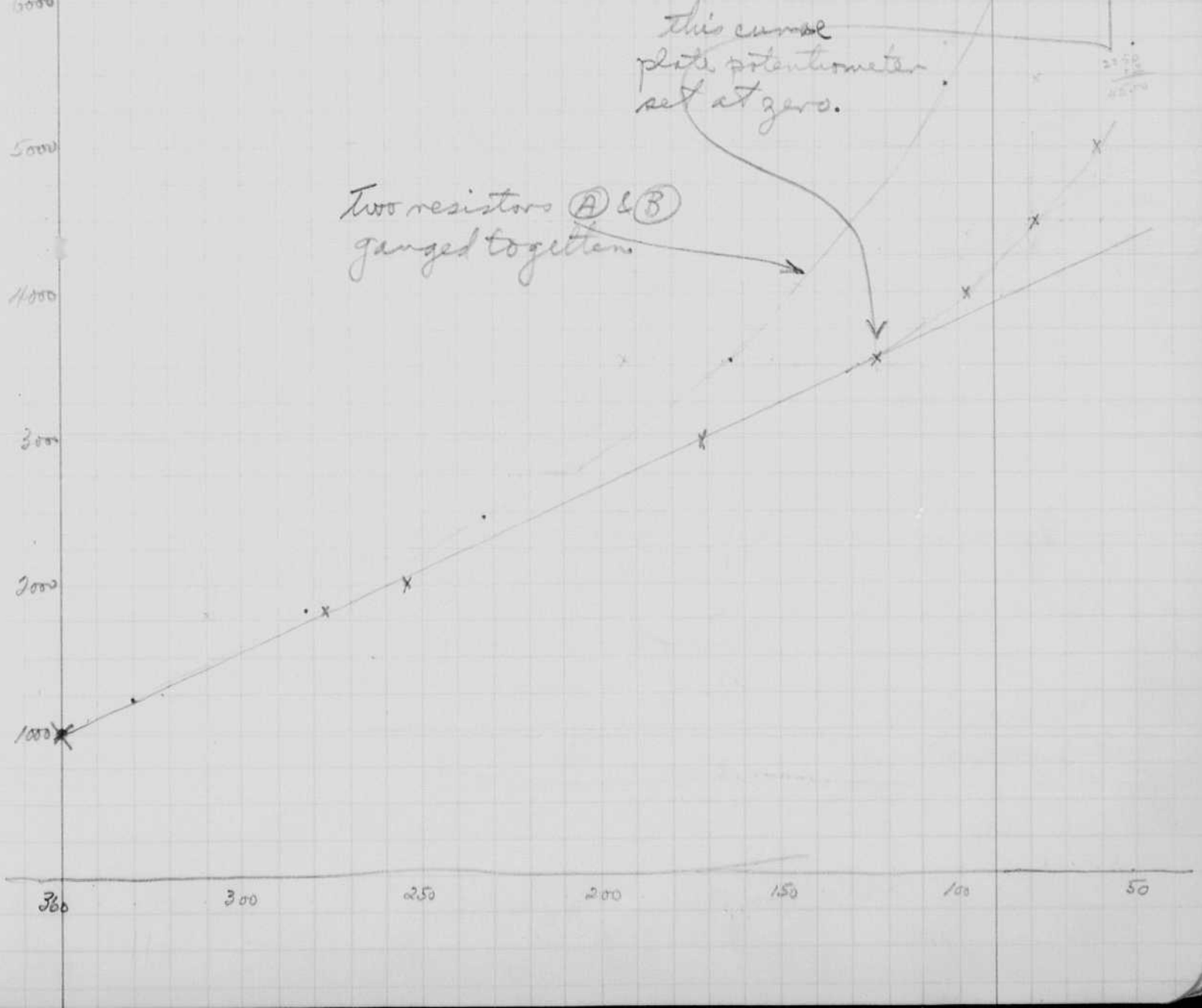


range 30 - 90 cycles with 10^5 in each grid.
variable resistance in Grid gives good range.

1000 to 9000.

July 7 cont'd


(set at 9000 ± 200
25000
5000
16
16
16
10^4
10^5
A
10^4
10^4
25000
20,000
B
.1
56.
8
5000
?
.2
.2
.1
A
.5
set at 0.

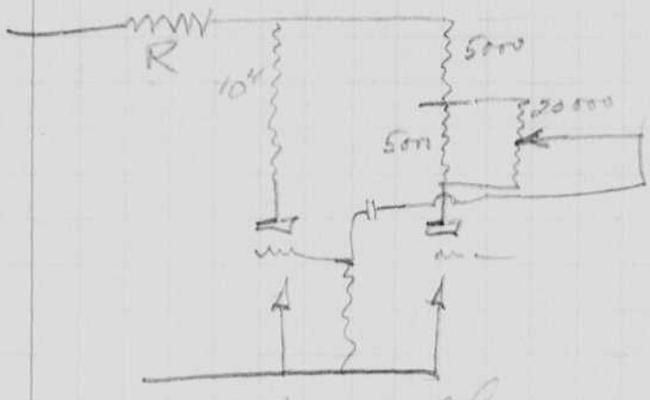

this curve plots potentiometer set at zero.
Two resistors A & B ganged together.
9000
8000
7000
6000
5000
4000
3000
2000
1000
360
300
250
200
150
100
50

July 10 1935

Projector.

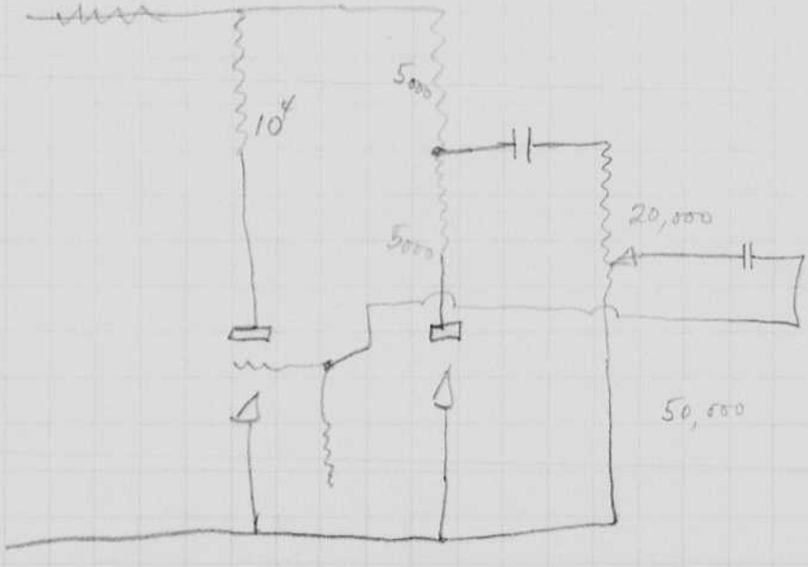
Movies shown to Bodmanand Maxwell of Lever Bros yesterday.

Potentiometer changed slightly from yesterday as follows.



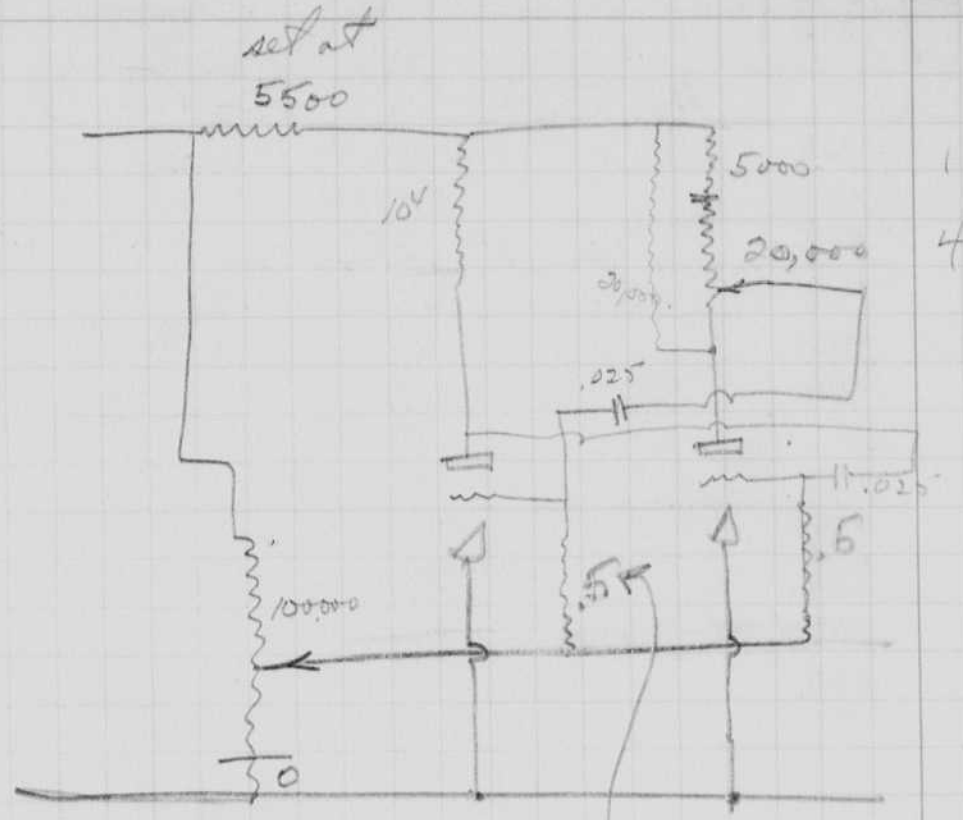
Range about the same 1000 – 9200 r.p.m. slightly less with same rheo. setting on R.

Changed RC values back to .025 mf and 1 meg in the grid circuit.



5x30
150
9100 r.p.m.

6x30 = 180
10.800

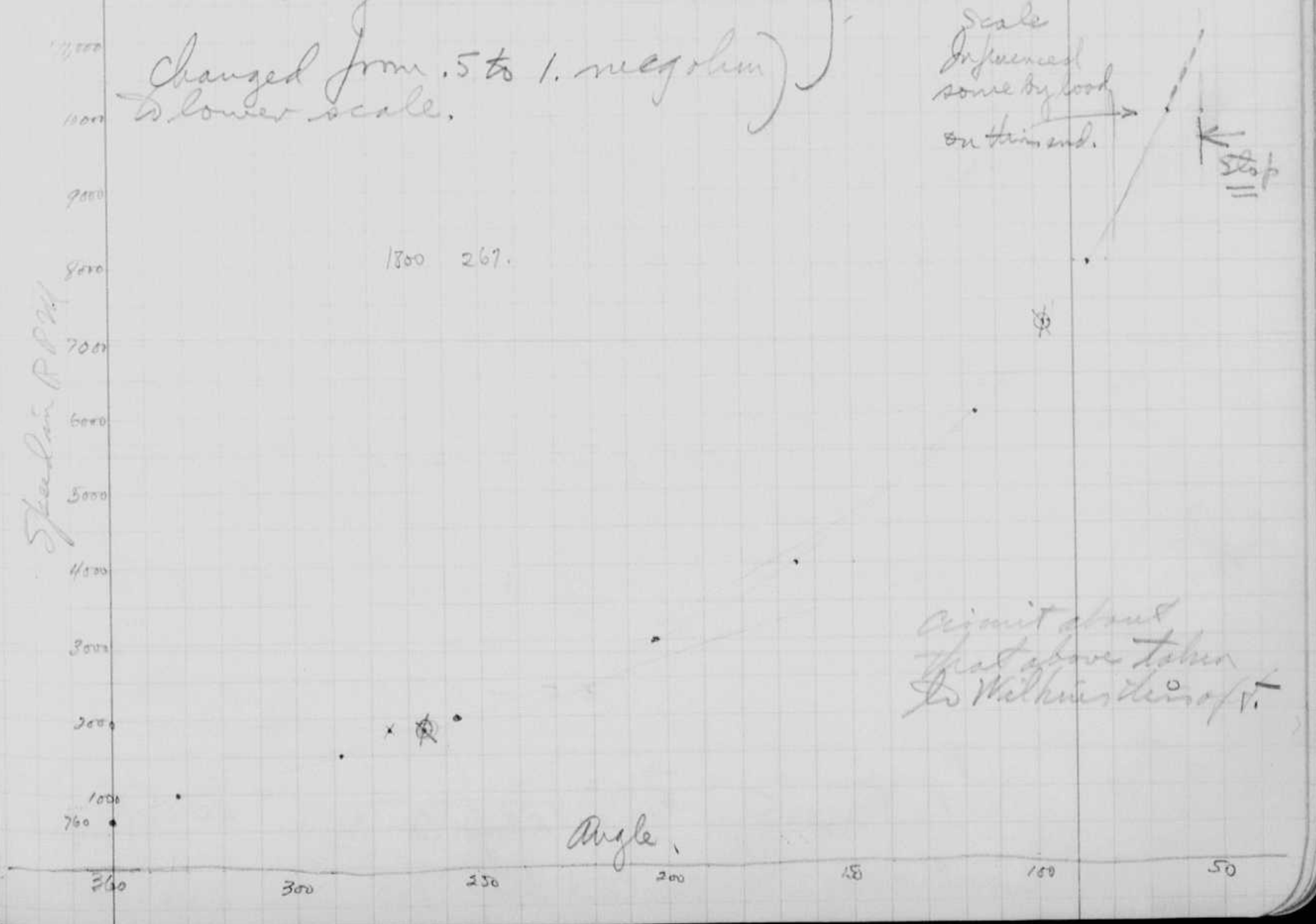


range 1200 — 9000.

Changed from .5 to 1. megohm to lower scale.

Scale influenced some by load on this end.

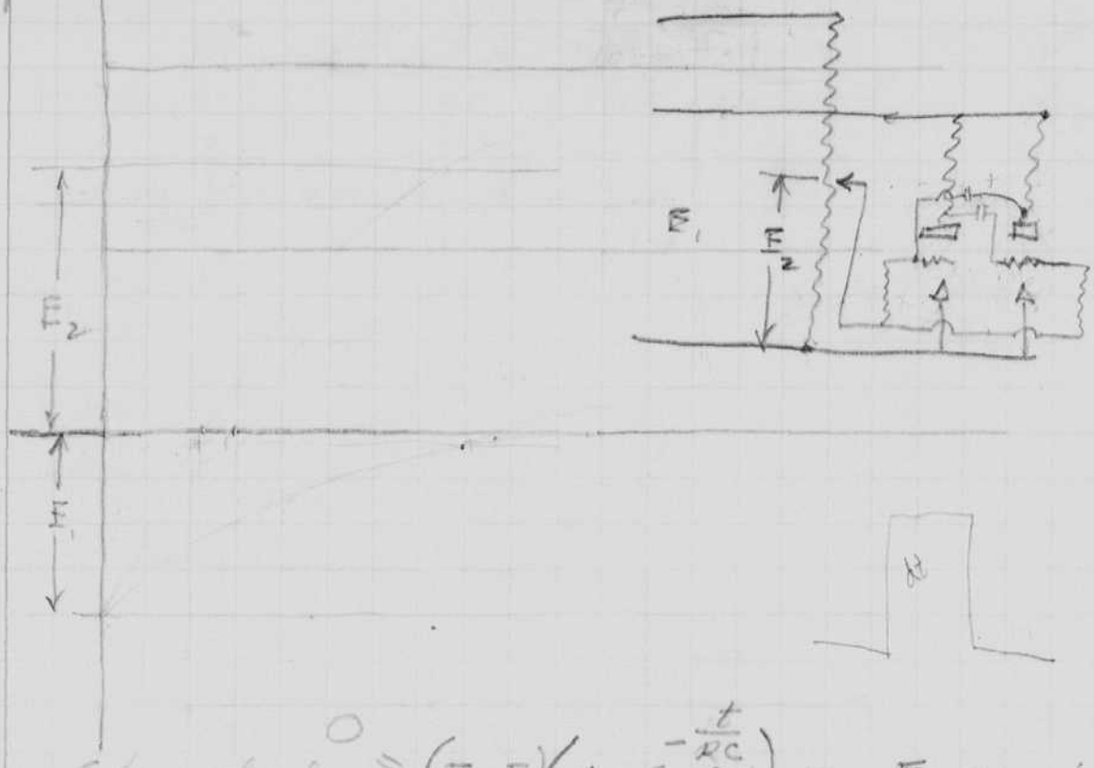
1800 267.



Aimed about that above taken to Milwaukee as of V.

July 10, 1935.

500 ft/sec



Exponential $= (E_1+E_2)\left(1-\varepsilon^{-\frac{t}{RC}}\right) - E_1 =$ grid voltage.

when $(E_1+E_2)\left(1-\varepsilon^{-\frac{t}{RC}}\right) = E_1$

then the other tube fires.

Solve for t. $\left(1-\varepsilon^{-\frac{t}{RC}}\right) = \frac{E_1}{E_1+E_2}$

$$\varepsilon^{-\frac{t}{RC}} = 1-\left(\frac{E_1}{E_1+E_2}\right)$$

$\ln\left(1-\frac{E_1}{E_1+E_2}\right) = \ln\frac{E_1+E_2-E_1}{E_1+E_2} = \ln\frac{E_2}{E_1+E_2}$

$$\ln \varepsilon^{-\frac{t}{RC}} = \ln\left(1-\frac{E_1}{E_1+E_2}\right)$$

$$-\frac{t}{RC} = \ln\left(1-\frac{E_1}{E_1+E_2}\right)$$

$$t = -\underline{\ln\left(1-\frac{E_1}{E_1+E_2}\right) RC.}$$

and frequency $= \frac{1}{t} = \frac{-1}{RC\ln\left(1-\frac{E_1}{E_1+E_2}\right)} = \frac{-1}{RC\ln\left(\frac{E_2}{E_1+E_2}\right)}$

multiply by 2 to get actual freq if circuit is symmetrical

$E_1 = 1$

$\frac{E_2 + E_1}{E_2}$

$\frac{1}{\left(1 - \frac{E_1}{E_2 + E_1}\right)} = \ln(\quad)$

E_2	$\frac{E_1}{E_1+E_2}$			f
1	1/2	2	.69315	1.285
2		3/2 1.5	.4055	2.46
3		4/3 1.33	.285	3.13
4		5/4 1.25	.223	4.0
5		6/5 1.2	.182	4.9
0	1	1	0	
7		8/7 1.14	.131	
8		9/8 1.125	.118	8.47
9		10/9 1.11		
10		11/10 1.1	.0953	10.5
.5		$\frac{1.5}{.5}$ 3	1.098	.91
.1		$\frac{1.1}{.1}$ 11	2.39	.418
.0		∞	∞	0

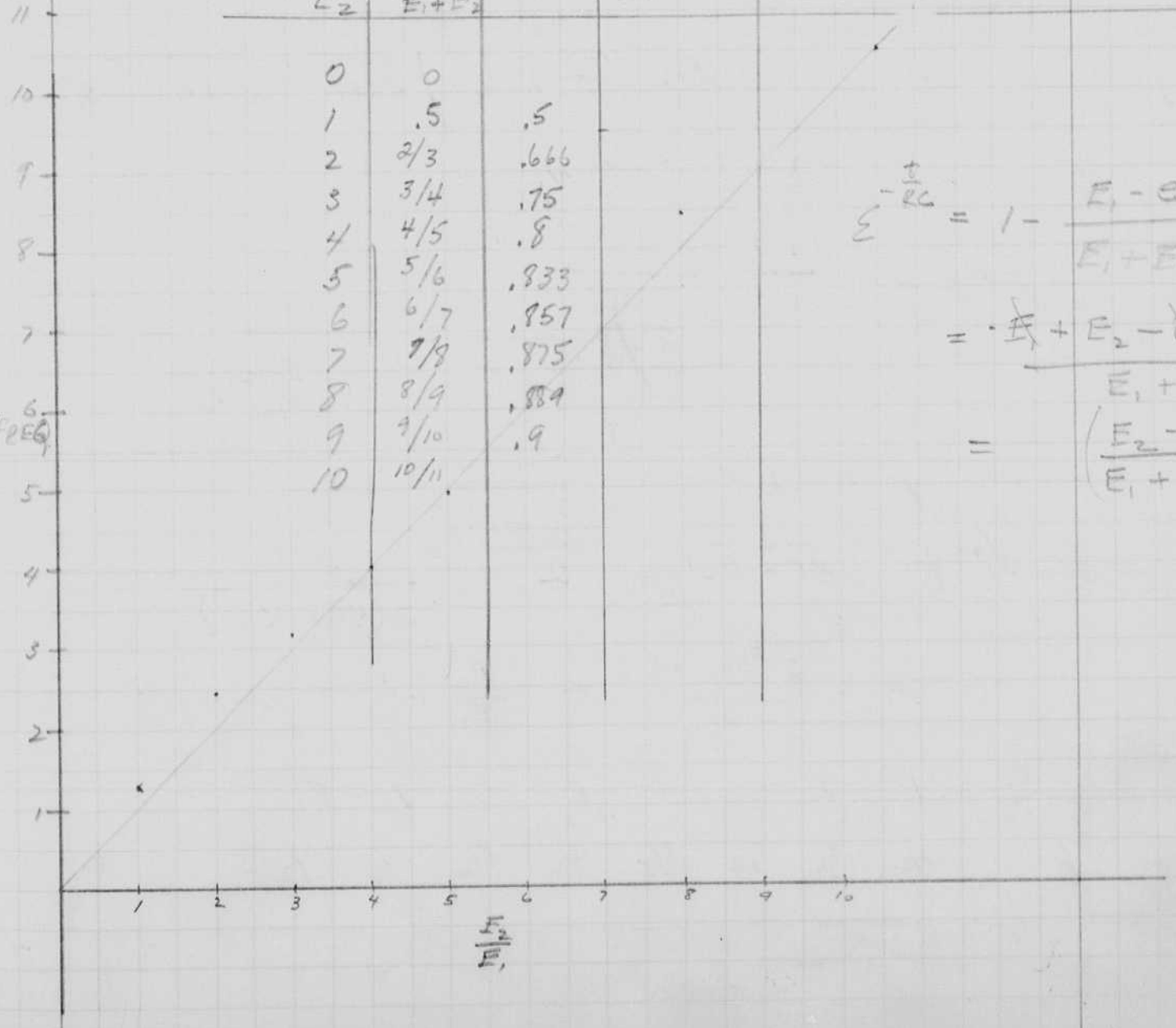
gk.

E_2	$\frac{E_2}{E_1+E_2}$	
0	0	
1	.5	.5
2	2/3	.666
3	3/4	.75
4	4/5	.8
5	5/6	.833
6	6/7	.857
7	7/8	.875
8	8/9	.889
9	9/10	.9
10	10/11	

$$\varepsilon^{-\frac{t}{RC}} = 1 - \frac{E_1 - e}{E_1 + E_2}$$

$$= \frac{E_1 + E_2 - E_1 - e}{E_1 + E_2}$$

$$= \left(\frac{E_2 - e}{E_1 + E_2}\right)$$



$$freq = \frac{-1}{RC+R'C'} \frac{1}{\ln\left(\frac{E_2}{E_1+E_2}\right)} = \frac{1}{RC+R'C'} \frac{1}{\ln\left(\frac{E_1+E_2}{E_2}\right)}$$

$$= \frac{-1}{RC+R'C'} \frac{1}{\ln\left(\frac{E_2/E_1}{1+E_2/E_1}\right)} \qquad = \frac{1}{RC+RC'} \frac{1}{\ln\left(\frac{1+E_2/E_1}{E_2/E_1}\right)}.$$

~~Series expansion for $\ln(x+1) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} \cdots$~~

$$\text{so } freq. = \frac{1}{RC+R'C'} \frac{1}{\frac{E_2}{E_1} - \frac{1}{2}\left(\frac{E_2}{E_1}\right)^2 + \frac{1}{3}\left(\frac{E_2}{E_1}\right)^3 - \cdots}$$

Expansion for $\ln\left(\frac{x}{1+x}\right) = ?$

" " $\ln\left(\frac{1+x}{x}\right) = 2\left[\frac{1}{2x+1} + \frac{1}{3(2x+1)^3} + \frac{1}{5(2x+1)^5} + \cdots\right.$

$\ln N = -\ln \frac{1}{N}.$

$$freq = \frac{1}{RC+R'C'} \frac{1}{2\left[\frac{1}{2\frac{E_2}{E_1}+1} + \frac{1}{3\left(2\frac{E_2}{E_1}+1\right)^3} + \cdots\right.}$$

neglecting second term.

$$freq = \frac{1}{RC+R'C'} \frac{2\frac{E_2}{E_1}+1}{2} = \frac{2\frac{E_2}{E_1}+1}{2(RC+R'C')}$$

$$= \frac{2\,E_2/E_1 + 1}{2} = \left(\frac{E_2}{E_1}\right) + \frac{1}{2} \quad \text{Straight line.}$$

$\frac{E_1}{E_2}$	1	2	3	4	5	6	7	8
f	3/2	5/2	7/2	9/2	11/2	13/2	15/2	17/2

July 11 1935.

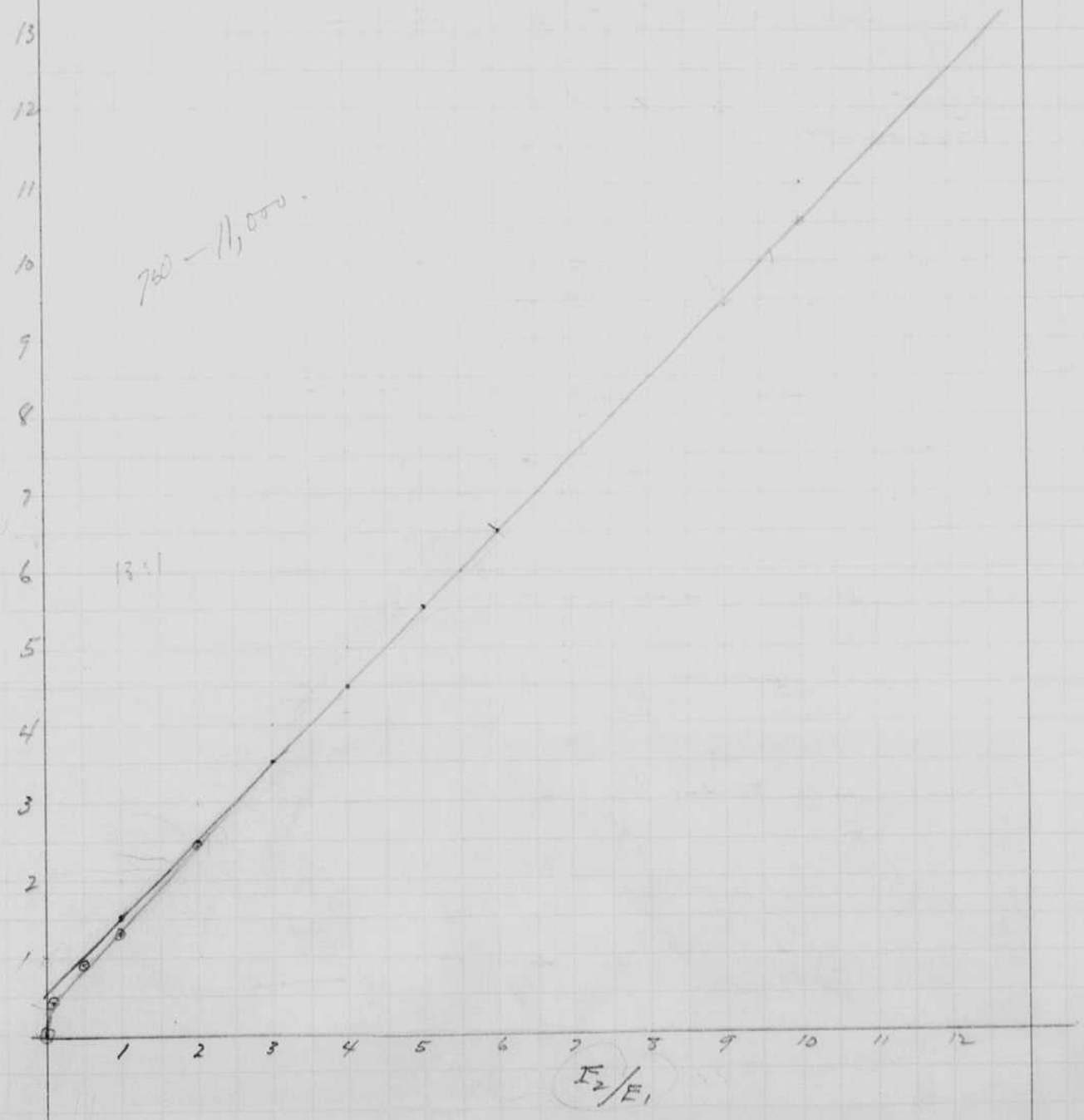
$$\frac{1}{\ln\left(\frac{1+E_2/E_1}{\frac{E_2}{E_1}-e}\right)}$$

e is the voltage ~~on~~ on the grid when the tube ~~fires~~. ~~Its~~ value will depend upon the tube ~~that~~ is used as well as the plate voltage E_1.

600 – 4000.
6.5 : 1

70 – 11,000.

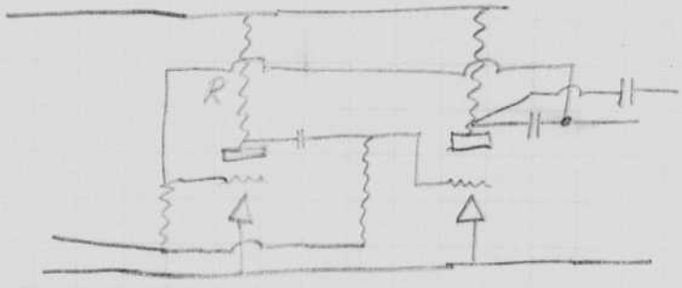
13 : 1

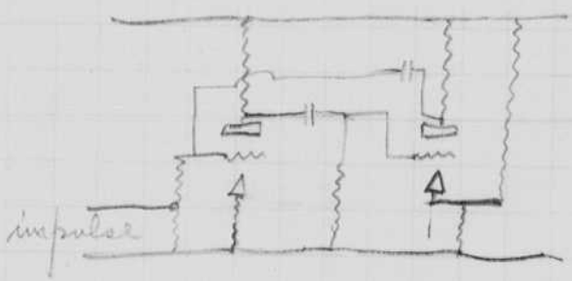


July 11 1932.

I spent part of the morning cleaning up the lab and putting things away. In the afternoon I worked in the glass blowers room. Resistors were put on the exhaust system for heating the mercury tube. The bomb for which was brought from Round Hill on Sunday was pumped in and a cable was ordered for it. Started to seal on the argon gas.

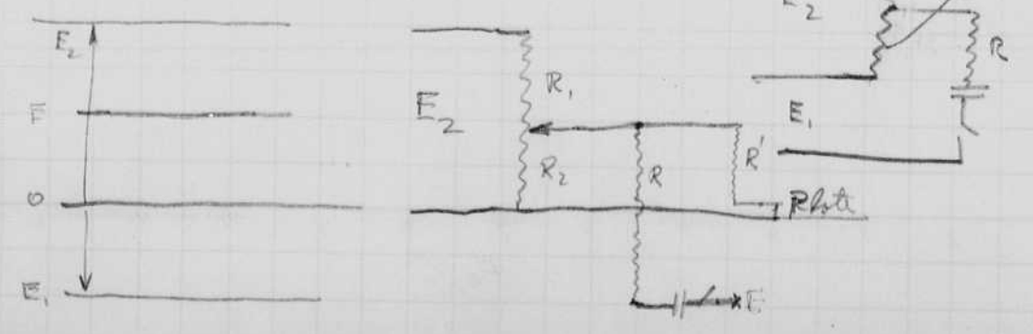
Every telegram from
A. J. Ogden, Hotel Lincoln, New York city.
who wants to see me from 10 to 12 tomorrow.





Interval timer.

$$\frac{1}{\frac{1}{R_2}+\frac{1}{R'}}$$



Cathodes.

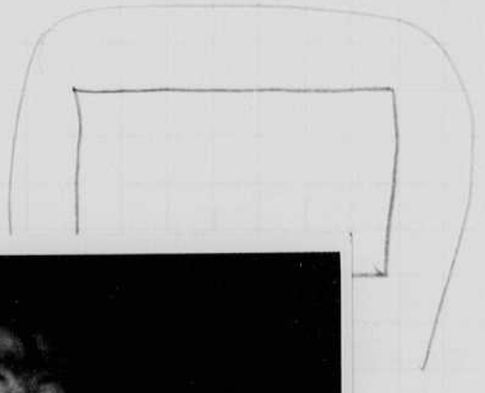
Use mercury salt which will break down with heat at the spot and give mercury vapor. Recombining with other after the tube cools off.

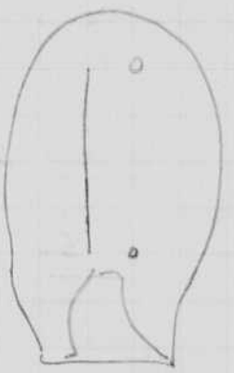
Beryllium ~~salts~~ compounds may be useful. $BeCl_2$
BeF_2.

~~$2Be_2$~~ BeF_2 $2NaF$ Beryllium sodium fluoride.

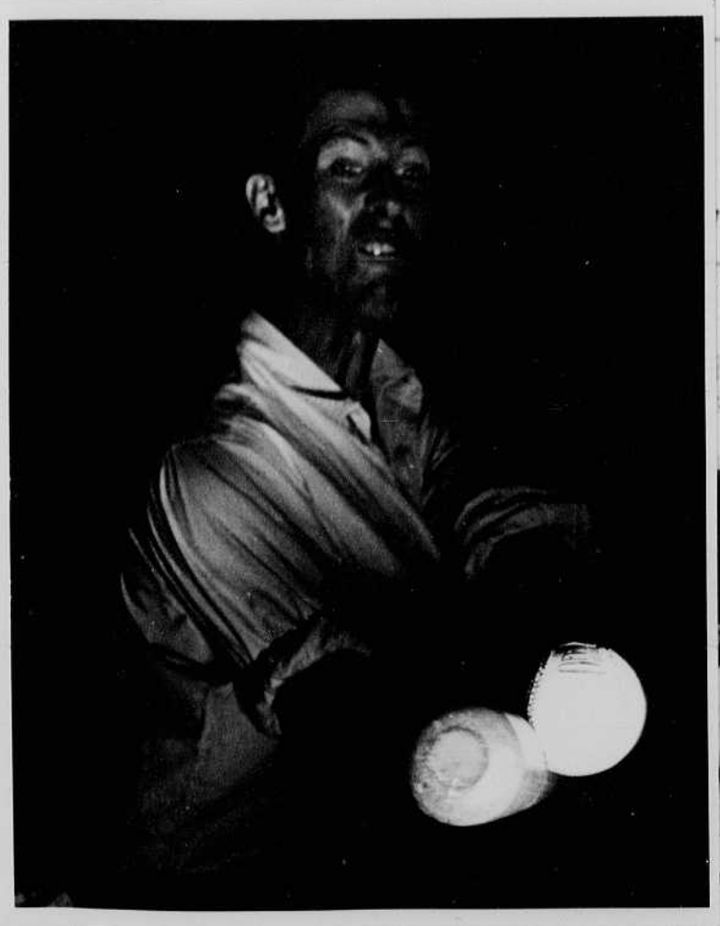
There is probably one like this with Cesium. Discharge when Be atoms is exploded,

$BaCl$.





...ated with a layer of ...ome other Be material. ... to make tube glow and ... across to start spot ...dency.



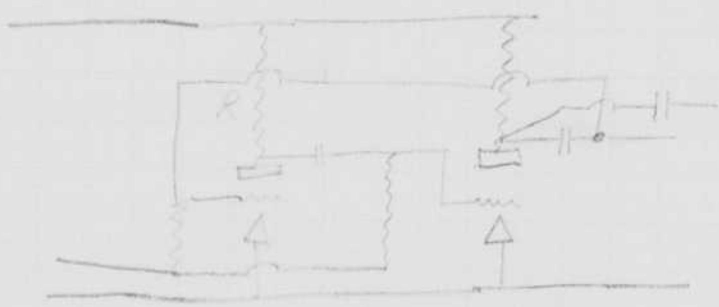
...lkeman and miss King.

Baseball player.

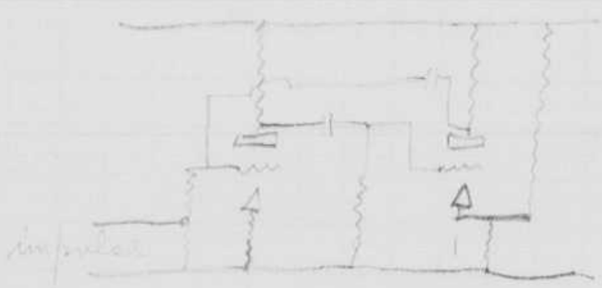
July 11 1932,
[illegible]

I spent part of the morning cleaning up the lab and putting things away. In the afternoon I worked in the glass blowers room. Resistors were put in the exhausting system for treating the mercury tube. The [illegible] which was brought from Round Hill on Saturday was moved in and a cable was ordered for it. Started to seal in the argon gas.

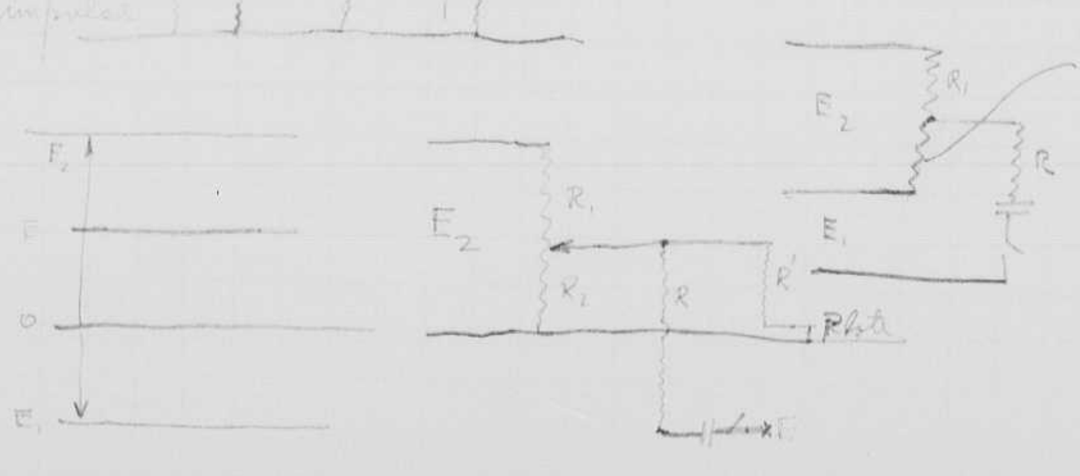
Evening Telegram from A. G. Ogden, Hotel Lincoln, New York City who wants to see me from 10 to 12 tomorrow.



Interval timer.



$$\frac{1}{\frac{1}{R_2}+\frac{1}{R'}}$$



Cathode.

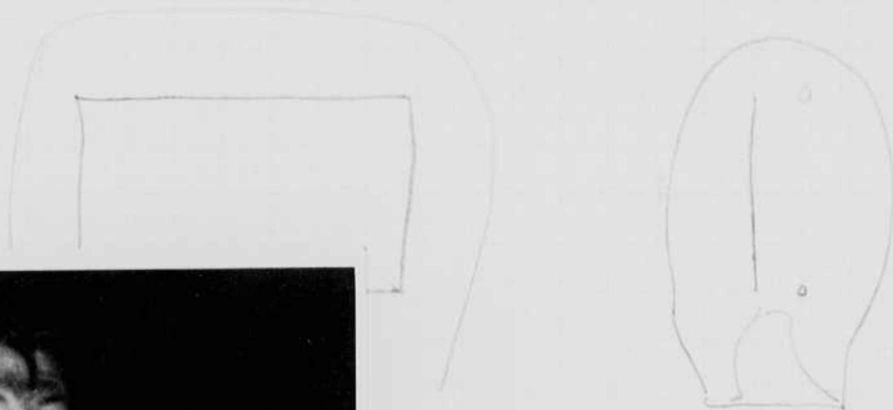
Use mercury salt which will break down with heat at the spot and give mercury vapor. Recombining with other after the tube cools off.

Beryllium ~~salts and~~ compounds may be useful. $BeCl_2$
BeF_2

~~$2B_2$~~ BeF_2 $2NaF$ Beryllium sodium fluoride.

There is probably one like this with Caesium. Discharge when Be alone is applied,

BaCl.



...ated with a layer of
...one other Be material.
...to make tube glow and
...causes to start a spot
...
J.

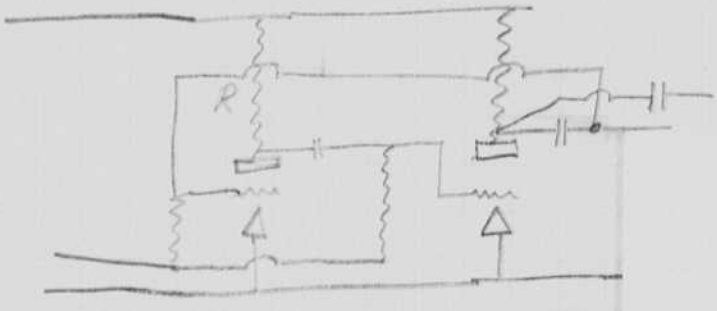
...kemon and Miss King.

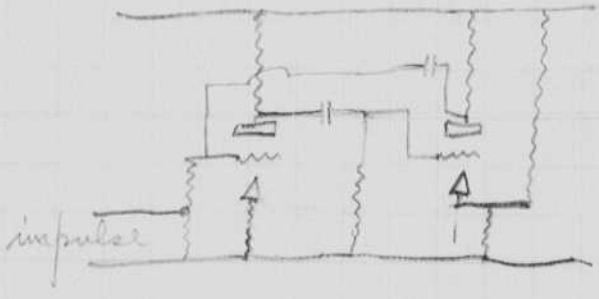
Baseball player.

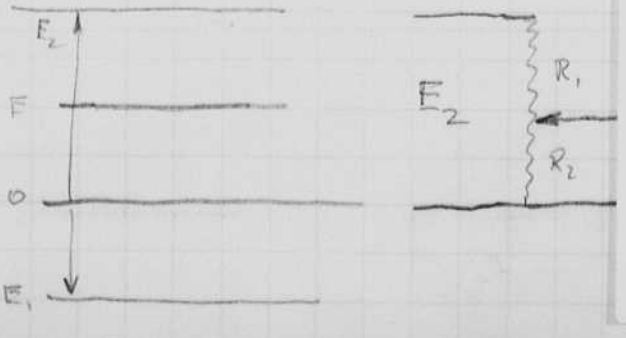
July 11 1935.
D.H.C.

I spent part of the morning cleaning up the lab and putting things away. In the afternoon I worked in the glass blowers room. Resistance pump on the exhaust system for taking the mercury tube. The bombarder which was brought from Round Hill on Sunday was put in and a cable was ordered for it. Started to seal on the argon gas.

Every telegram from A. J. Ogden, Hotel Lincoln, New York, you want to see me from 10 to 1 tomorrow.







Cathodes.

Use a mercury salt which will break down with heat at the spot and give mercury vapor. Recombining with other after the tube cools off.

Beryllium ~~salts may~~ compounds may be useful. $BeCl_2$
BeI_2

~~$2Ba_2$~~ BeF_2 $2NaF$ Beryllium sodium fluoride.

There is probably one like this with ~~Ca~~sium. Discharge when Be alone is exploded,

$BaCl_2$.

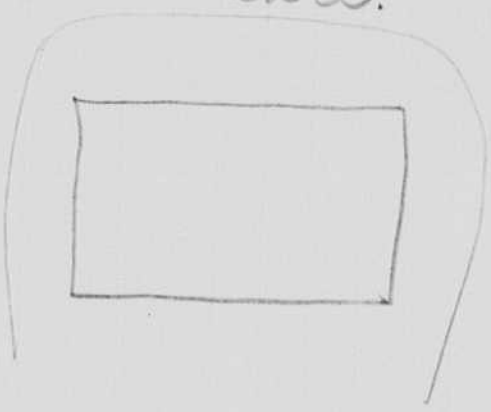


Plate in tube coated with a layer of BaI_2 $2NaF$ ~~or~~ some other Be material. Voltage enough to make tube glow and with capacity across to start spot if there is a tendency.

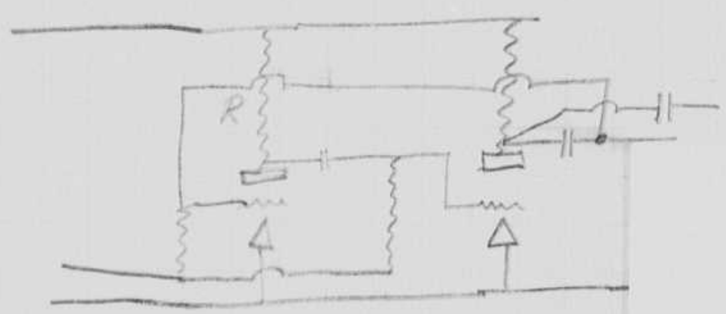
Mr. Blakeman and miss King.

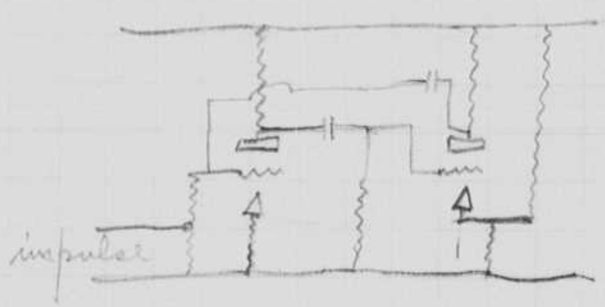
Baseball player.

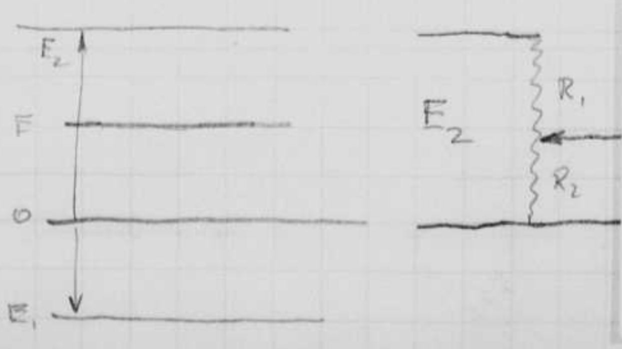
July 11 1935.
H.H.L.

I spent part of the morning cleaning up the lab and putting things aw[ay]. In the afternoon I worked in the vapor glass blowers room. Resistors were put on the exhaust system for treating the mercury tube. The bombarder which was brought from Round Hill on Sunday was [illegible] in and a cable was ordered for. Started to seal on the argon gas

Evening telegram from A. J. Ogden, Hotel Lincoln, New York. He wants to see me from 12 to 1 tomorrow.







Cathodes.

Use mercury salt which will break down with heat at the spot and give mercury. Recombining with other after the tube cools off.

Beryllium ~~salts may~~ compounds may be useful. $BeCl_2$
BeI_2

~~$2Be_2$~~ BeF_2 2 NaF Beryllium sodium fluoride.

There is probably one like this with caesium. Discharge when Be atom is exploded.

BaCl.

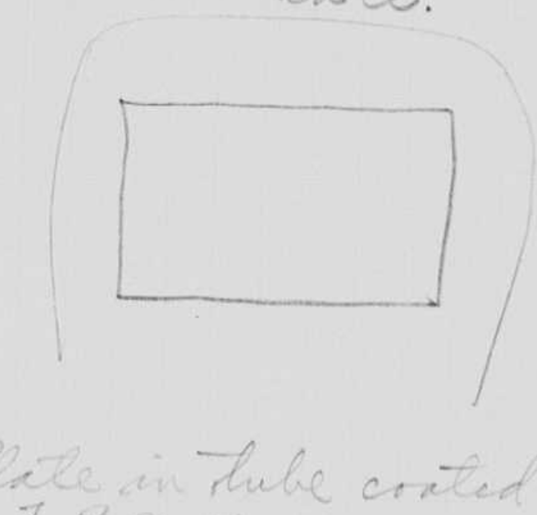
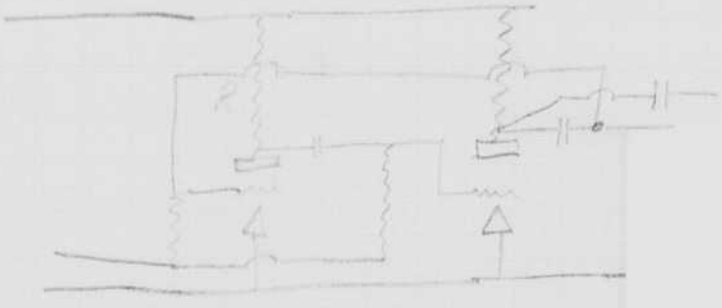
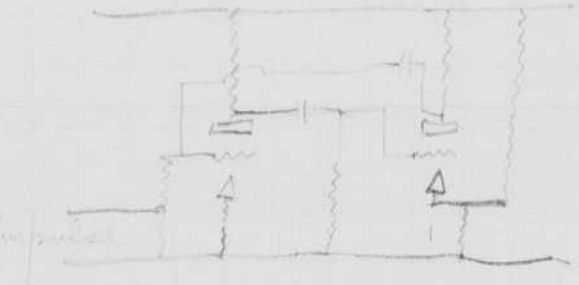
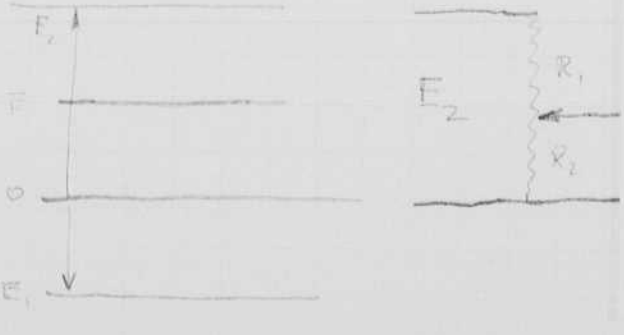


Plate in tube coated with a layer of BeF_2 2 NaF or some other Be material. Voltage enough to make tube glow and with capacity across to start spot if there is a tendency.

Mr. Blakeman and Miss King.
Baseball player.




impulses


E1
E2
R1
R2
V

Cathodes.

Use mercury salt which will break down with heat at the spot and give mercury vapor. Recoat bulb with other after tube cools off.

Beryllium compounds may be useful. $BeCl_2$
BeI_2
BeF_2 $2NaF$ Beryllium sodium fluoride.

There is probably a flash with Cesium. Discharge when Be atom is exploded,

$BeCl_2$.

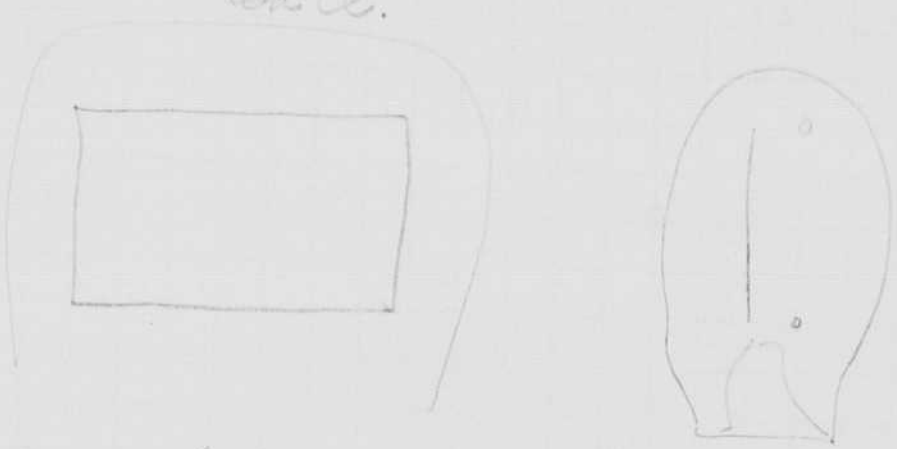


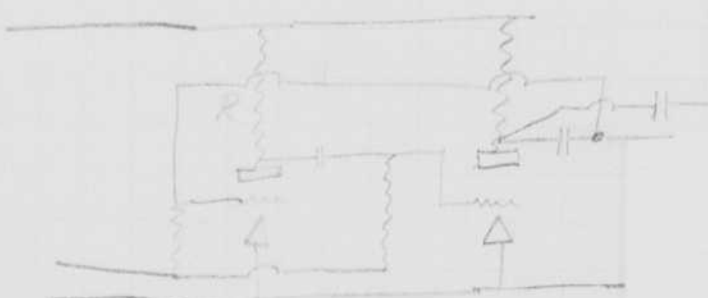
Plate tube coated with a layer of BeI_2 and some Be metal and Voltage enough to make high glow and with capacity enough to burn spot if there is a trouble.

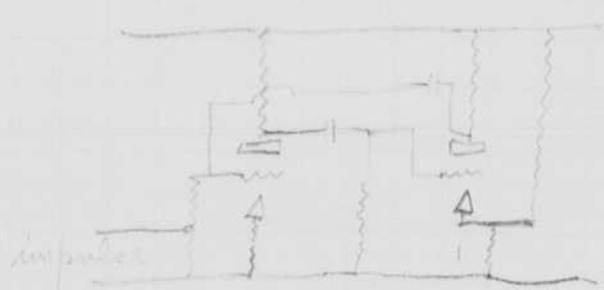
Mr. Blakeman and miss King.
Baseball players.

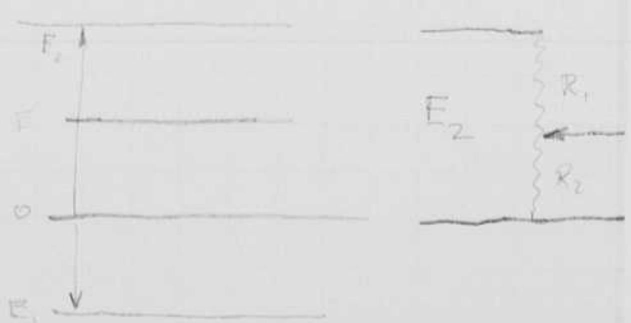
July 11 193[illegible]

I spent part of the morning cleaning up the lab and putting things away. In the afternoon I worked in the glass blowers room. Resistance [illegible] put in the exhausting system for treating the mercury tube. The [illegible] which was brought from Round Hill on Sunday was [illegible] in and a cable was ordered for. Started to seal in the argon gas.

Evening telegram from A. J. Ogden, Hotel Lincoln, New York. [illegible] want to see me from 10 to 1 tomorrow.







Cathode.

Use mercury salt which will break down with heat at the spot and give mercury vapor. Recombining with other after the tube cools off.

Beryllium ~~salts may~~ compounds may be useful. $BeCl_2$
BeI_2

~~$2Be_2$~~ $BeF_2 \; 2NaF$ Beryllium sodium fluoride.

There is probably one like this with Caesium. Discharge when Be atom is exploded.

BaCl.

Plate in tube coated with a layer of $BeF_2 \; 2NaF$ or some other Be material. Voltage enough to make tube glow and with capacity across to start effect if there is a tendency.

Mr. Blakeman and Miss King.
Baseball player.

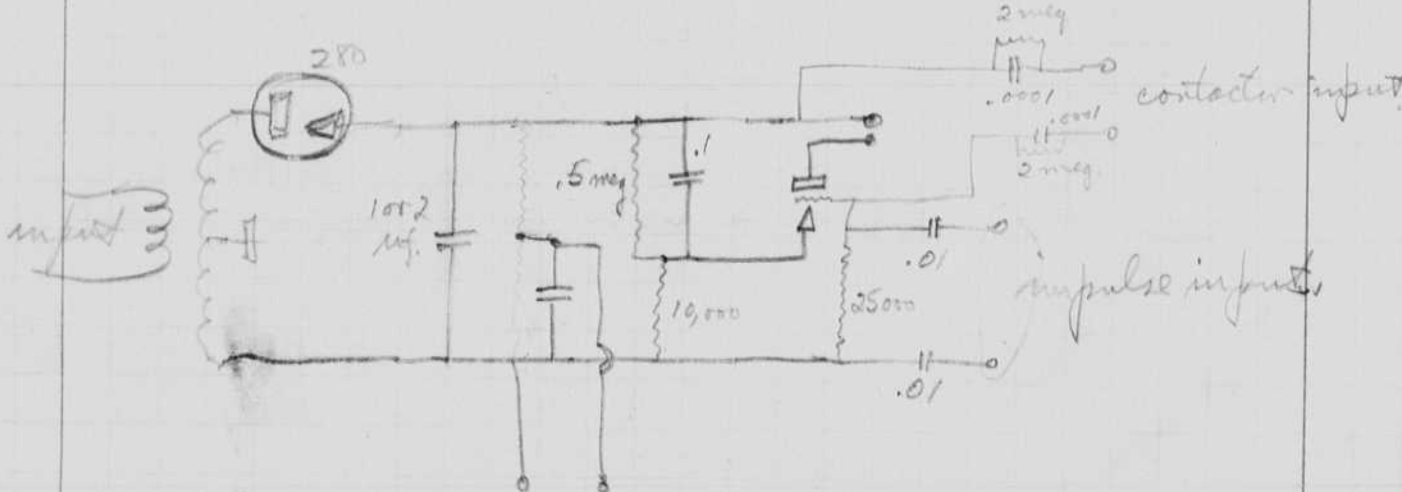
July 16 1935
HE Edgerton.

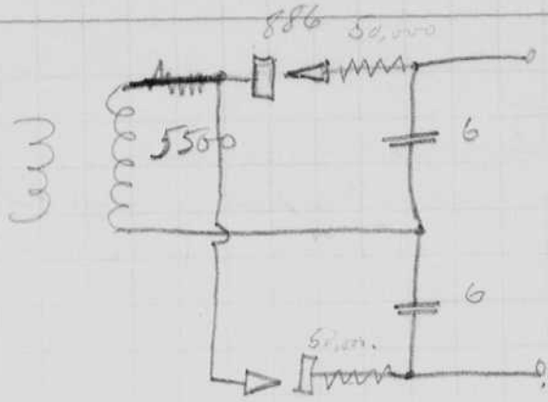
Yesterday took baseball picture. Henry Dunderdale from the carpenter shop did the hitting. Apparently a baseball does not compress like a golf ball.

July 17. All day yesterday again on baseball photos. Ralph Blakeman, Union St ~~Duxbury~~ phone Sanover 7-R2, hit them and was more powerful than ~~Mr.~~ Dunderdale. Mr Corey CD Ettle brought him over.

Mr. Slater of Owen. Ill. Glassco called about the Sports machine we are building for them.

trans.





16000 volts ± for spark gap.

July 21, 1935. H. E. Edgerton.

Typewriter with photographic method of printing.

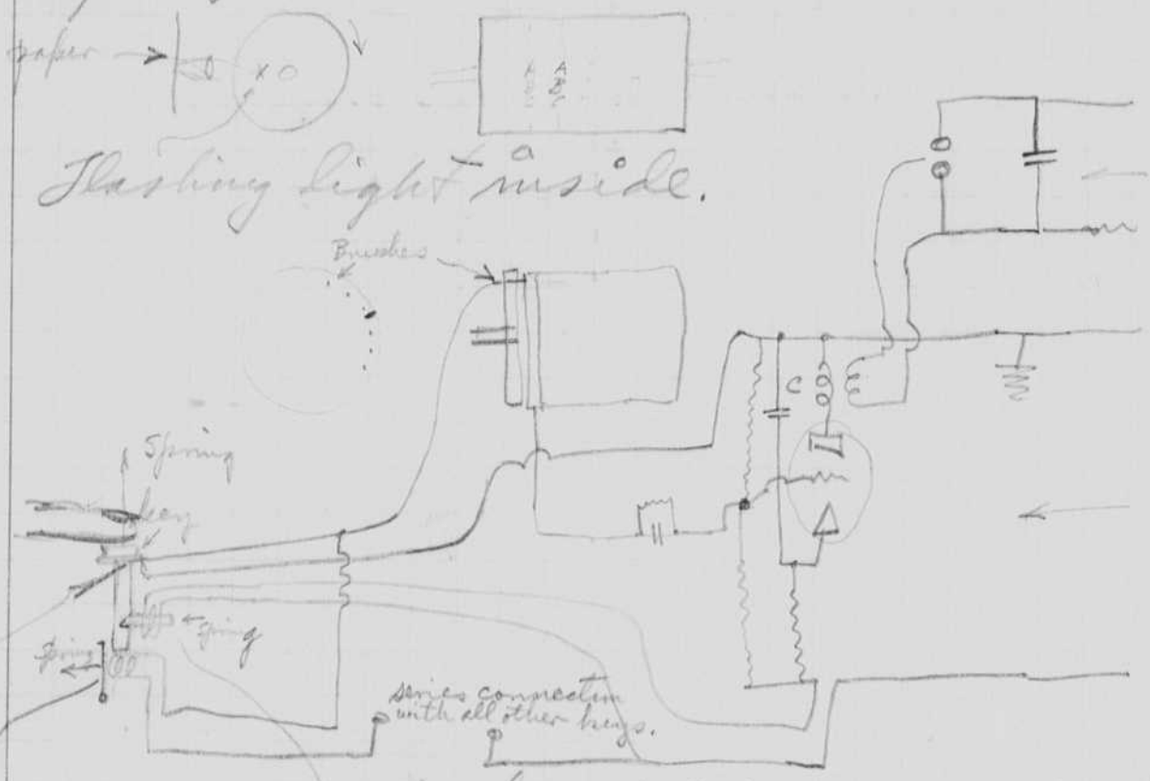
Disc with letters rotates at high speed say 1800 r.p.m. A commutator around the outside of the disc has one segment this ~~for each letter~~ to make contact with a series of brushes. Each brush is so placed that the light will flash when the desired letter is in position.

A method of keeping the contact closed when the key is pressed will be necessary so that there will be no possibility of the contact missing while the wheel is not in position. Also a method will need to be devised to release the key immediately after the letter has been printed. Furthermore the rest of the keys must be arranged so that the ~~locking~~ cannot be effective before the desired letter is printed.

a series of brushes to locate the proper letter at the printing position.

Cont July 21 1935
Electron.

A cylindrical arrangement might be more convenient for multiple type.



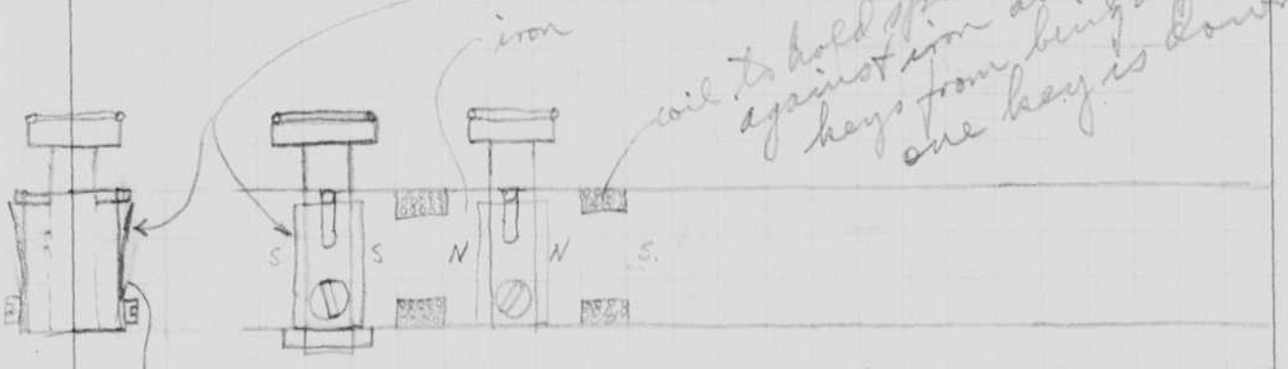
The key is depressed until the locking pin snaps into place and prevents it from going up. The trip circuit is closed through contacts on the key thus making ready for the rotating contact to flash the light at the right instant of time to stop the letter.

After the flash occurs the coil on the locking pin pulls back the pin as the thyratron trip circuit is changed for the next flash.

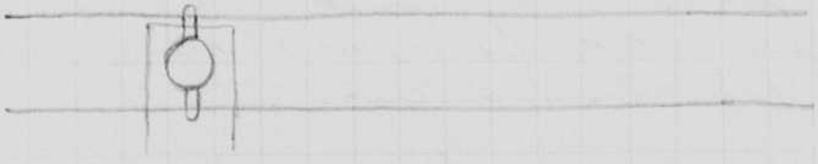
This relay at the key prevents the key from being depressed if any other key is closed. The closed key energizes the trip circuit and at the

same time prevents any other key from going down until the closed key is released after the letter has been photographed.

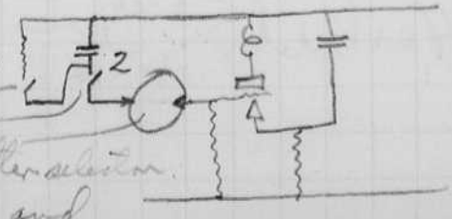
The circuit on the preceding page is not quite right since it is not apt good for several keys unless the hold off relays have many electrically insulated coils. An additional pair of relay contacts on each key would do that job thus separating the holdoff circuit and the letter selector contactor circuit



This spring steel is insulated from the metal frame and a contact is made to energize the coils when the key is depressed.



Eliminate some of the relays by using decimal method. Also the trouble of repeated letters can be eliminated by proper design of the trip circuit.



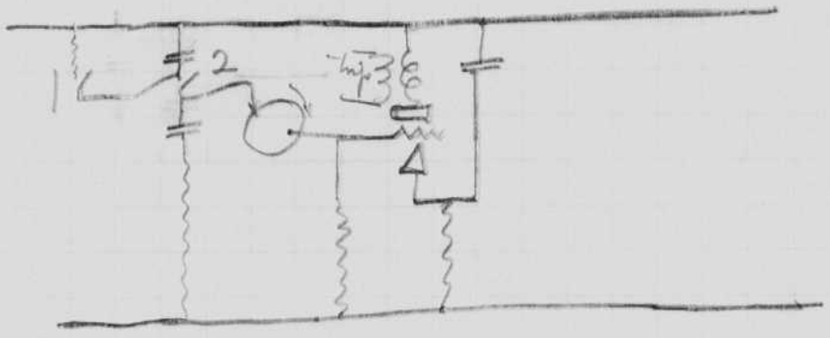
trip only once when closed.

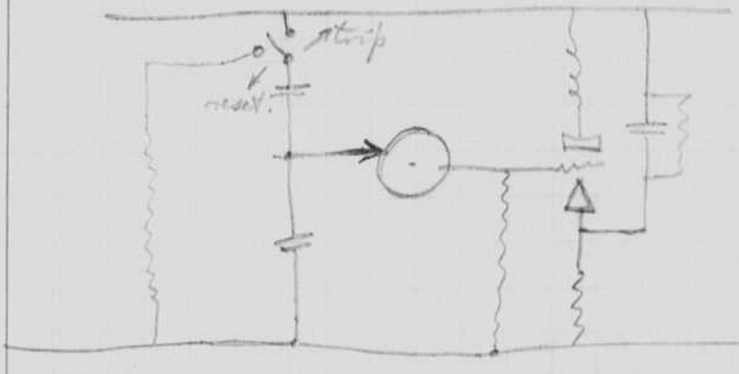
letter selection.

leaks chg. from condenser and sets for next key.

cont.

Key 2 is closed by the bottom of stroke of the key. Key 1 is closed at the top of the stroke. Thus the key has to come completely back to the start position before the next letter is made.





Experiments yesterday showed that a spark with 8 mf and 1000 volts needed to be flashed about 10 times to obtain an exposure.

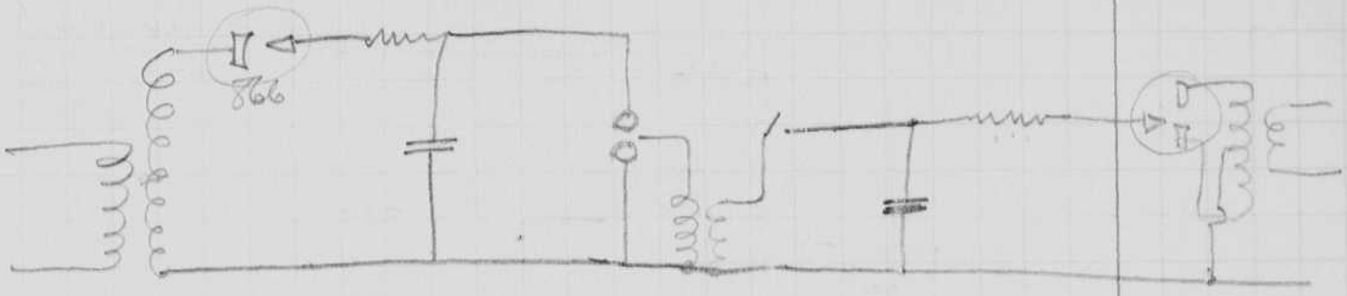
Probably 16 mf at 2000 volts would be O.K. Possibly less would work.

Explained Jul 26, 1935
Herbert S. Grier

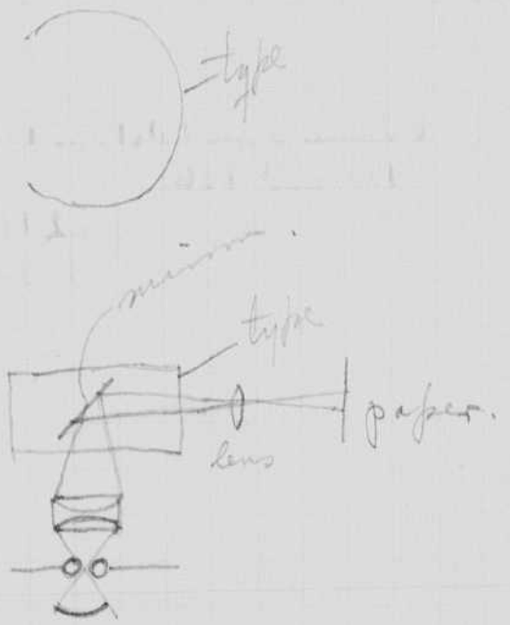
Explained July 26, 1935
Kenneth J. Germershausen

July 22 1935
H. E. Edgerton

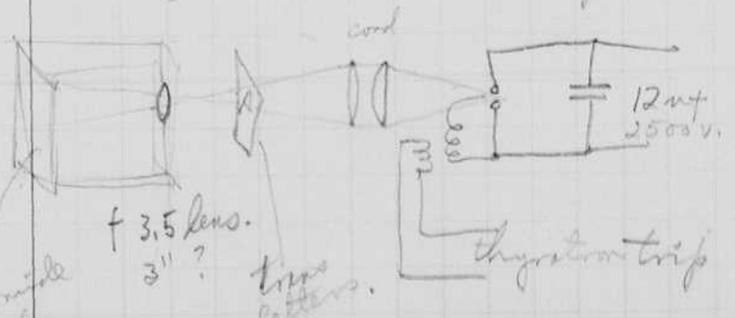
8 mf 2000 volts.



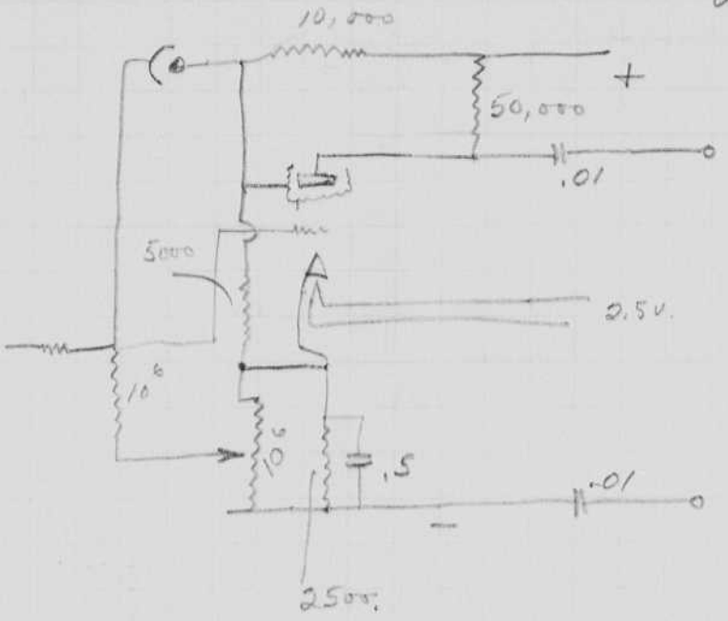
Res. for pictures with spark of type.



Set up a spark gap in a slide projector and take a series of prints on Kodak bromide paper (hard and extra hard). 2500 volts 12 mf.



photocell amplifier circuit given to Prof Harrison Physics dept.



also circuit of the 3 mf 16000 volt spark and the thyratron trip circuit.

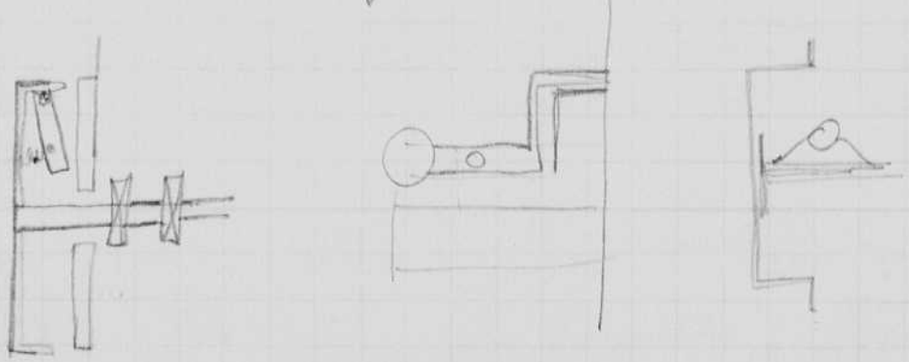
Witnessed pages 131, 132, 133, 134 135 and 136.

July 22, 1935
R. D. Bennett

July 24, 1935.

I spent yesterday breaking goggle glasses with a steel ball for the American Optical Co and Sutherland Abbott advertising agency. R.T. Kriebel. Some interesting pictures were taken.

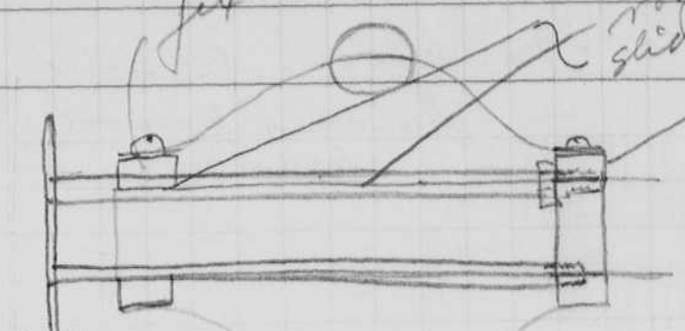
Governor on sprocket wheel.



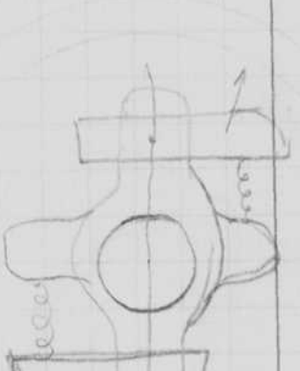
fixed to shaft.

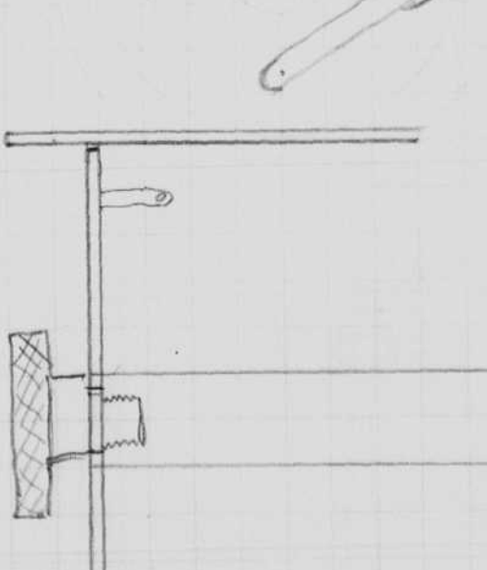
3 rods slide through collar.

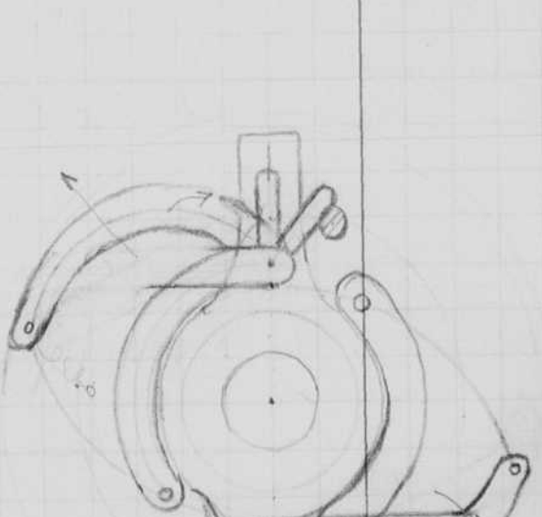
sliding collar



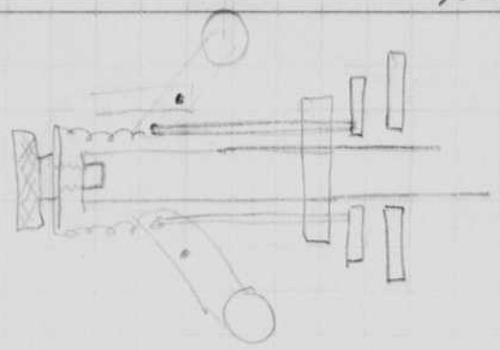
moves against a stationary plate for a brake

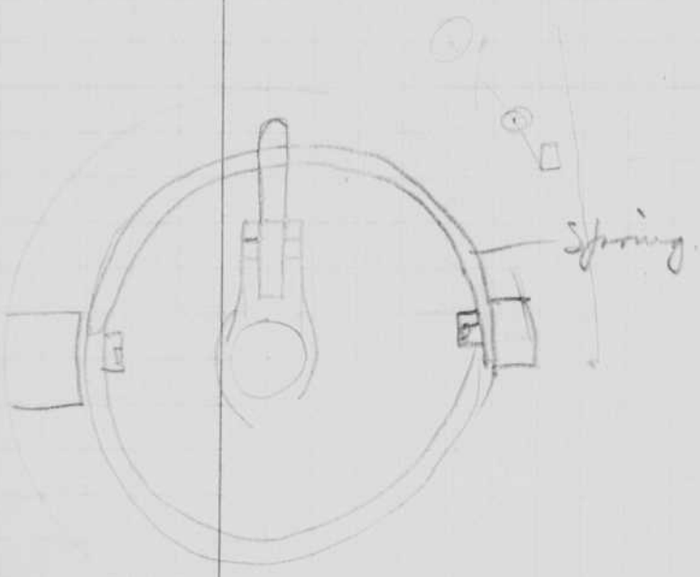


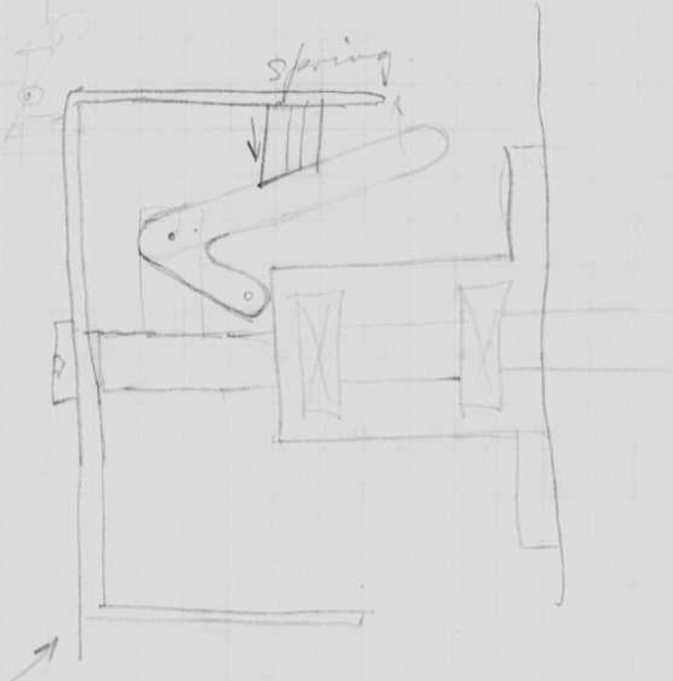




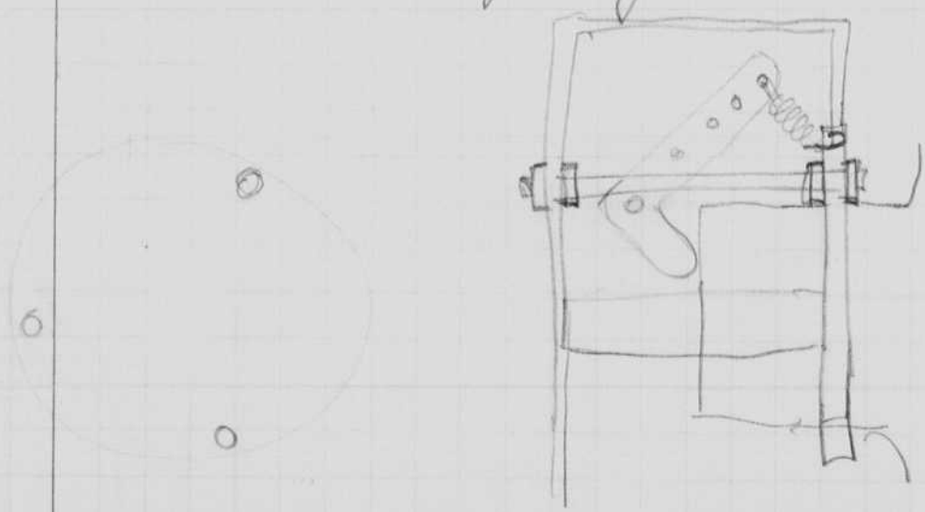
Mechanical governor for holding product speed constant.

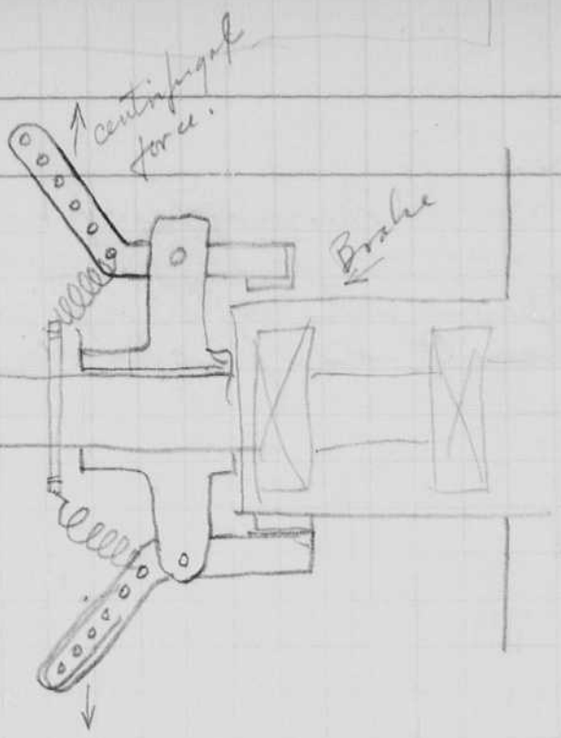


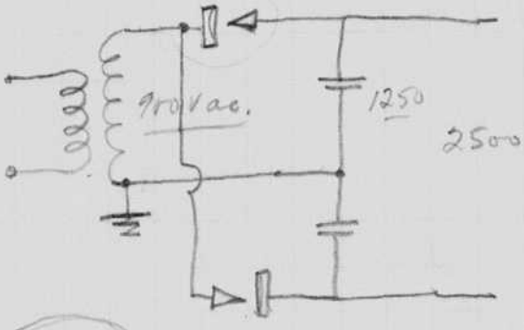




change tension by adjusting this cap which holds the spring.







typewriter power
using sparks.

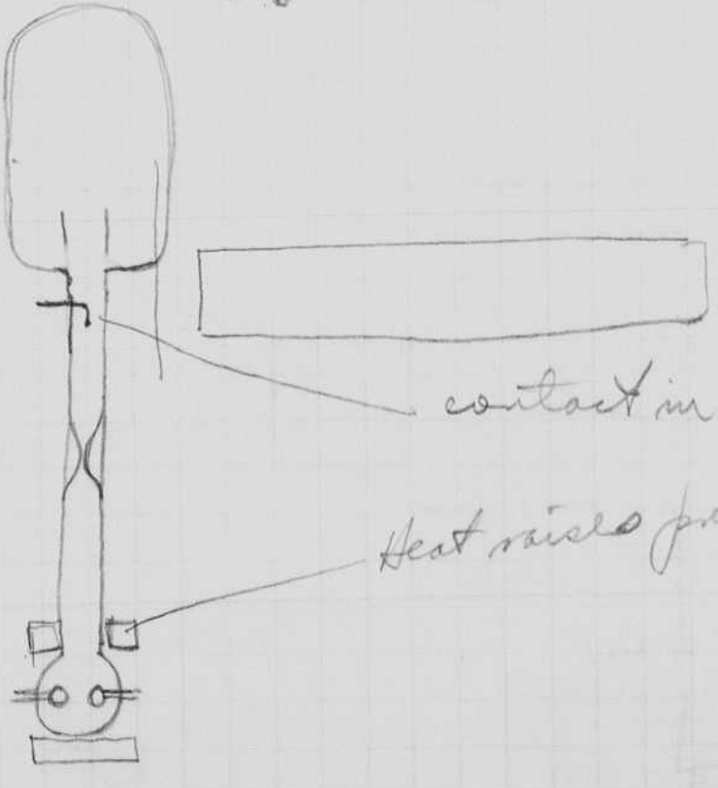
2 1250 900.

10 mf at 2500 v.

$10\ E^2C = 2.5^2 \times 10^6 \times 10 \times 10^{-6} \times 10$

25
125
50
6.25 = 625 watts.

$\frac{625}{2500} = .250$ amp



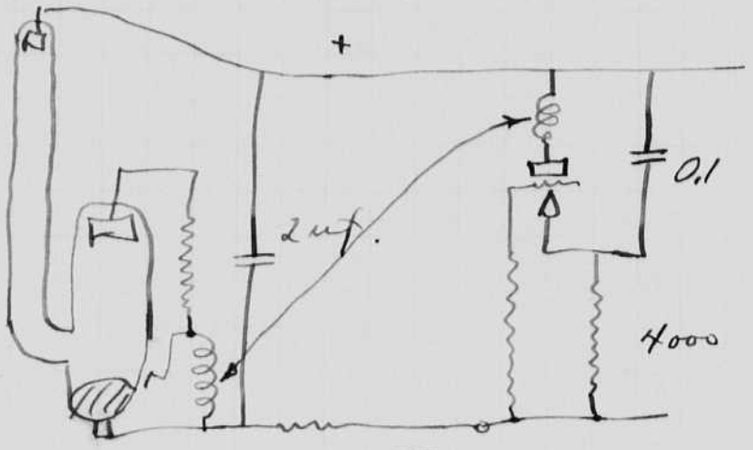
contact in series with heater circuit.

Heat raises pressure

August 1 1935
H. E. Edgerton.

Mercury Lamp

Experiments with special tubes and with method of spark excitation.



1800 ± probably 1200 V.

180 ohms.

Works stably at 120 cycles sometimes.

$2 \times 10^{-6} \times R = \frac{1}{2000}$ sec.

$R = \frac{1}{2000} \times \frac{10^6}{2} = \frac{10^6}{4 \times 10^3} = \frac{10^3}{4} = 2.5 \times 10^2$

$= 250$ ohms.

Alg.

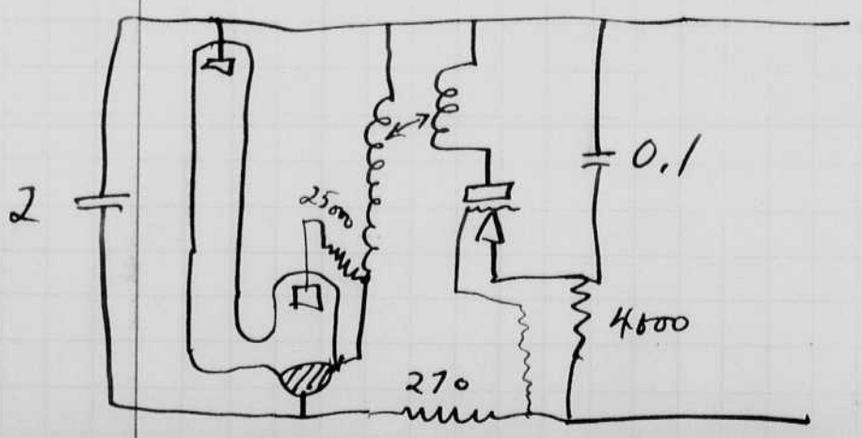
$3\overline{)800}\ 270$
6
20
21.

Spark.

$0.1 \text{ mf} \times R = \frac{1}{2000}$

$R = \frac{1}{2000} \times \frac{10^6}{0.1} = \frac{10^6}{2 \times 10^2} = .5 \times 10^4 = 5000$ ohms.

$0.1 \times 10^{-6} \times 5000 = 5 \times 10^{-4} = \frac{10^{-4}}{.2} = \frac{1}{.2 \times 10^4} = \frac{1}{2000}$ ✓



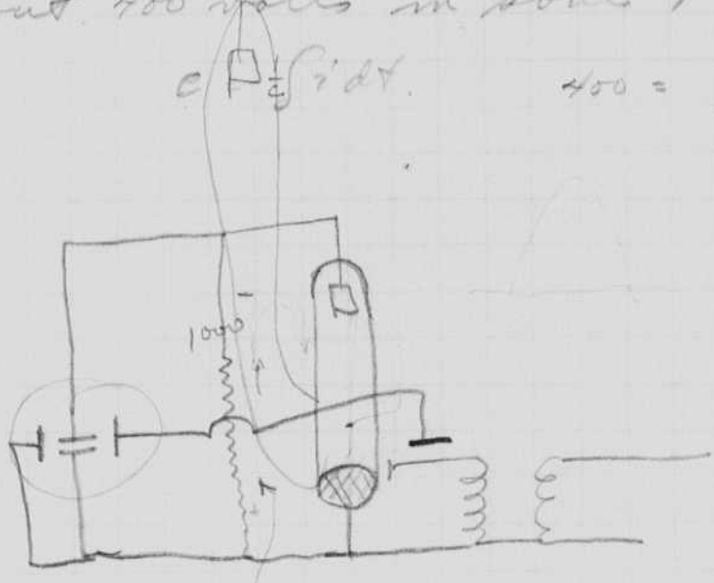
Aug 2 1935

An electrode in a tube with spark excitation on the outside assumes a high negative potential due to electrons (?) going to it. The current is quite considerable since it can charge a 2 mf condenser to about 400 volts in some 1 or 2 seconds.

$C \cdot \frac{1}{C}\int i\,dt$. $\quad 400 = \frac{2' \times \frac{1}{2}}{2 \times 10^{-6}} \quad i' = 400 \times 10^{-6}$ amp. $=$

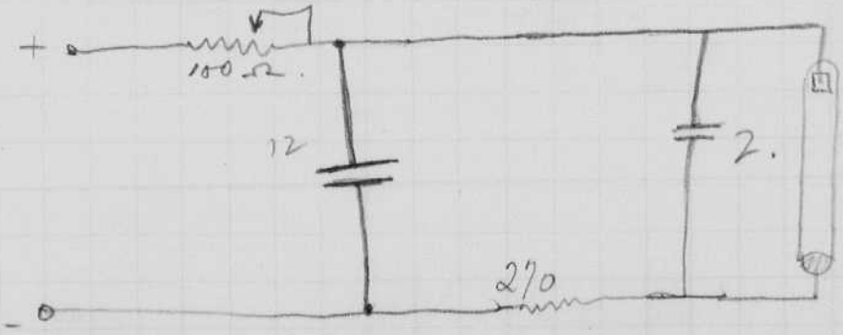
.4 m.a.

400 1000 ohm.

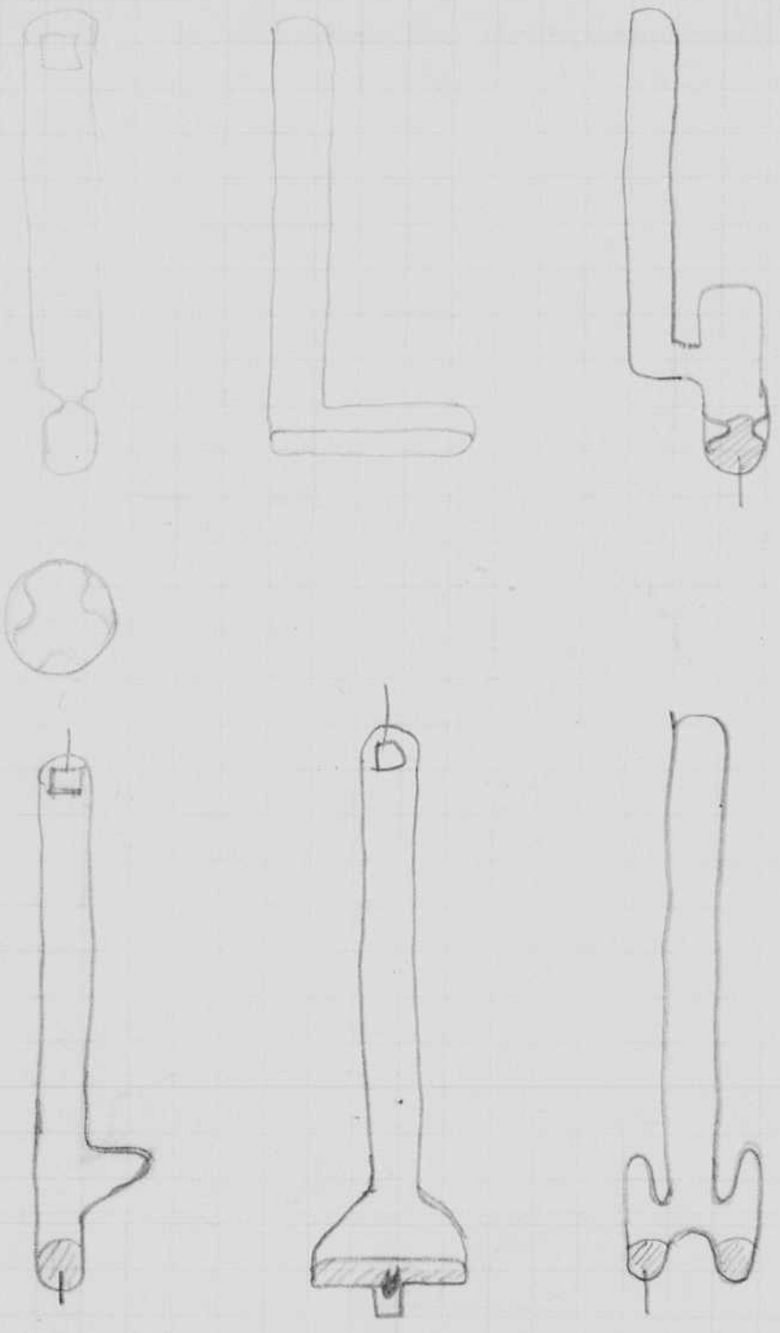


Erratic action when observed as above.

→ due to spark voltage.

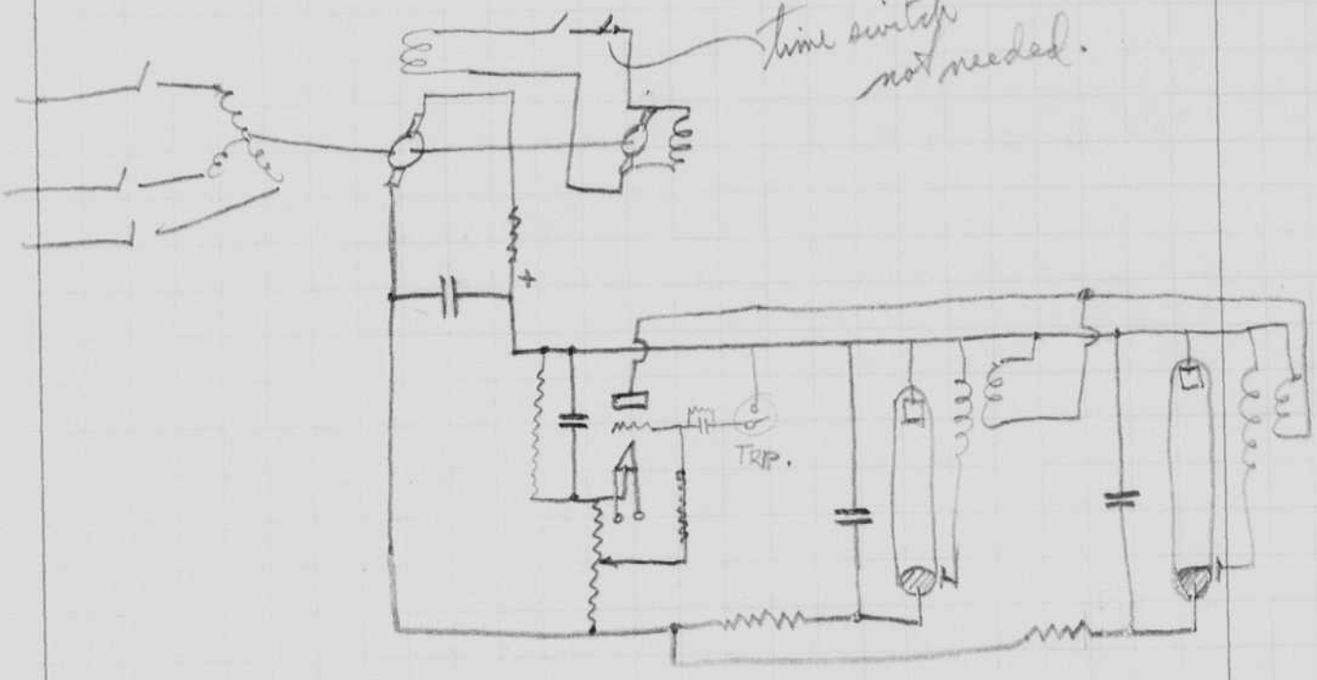


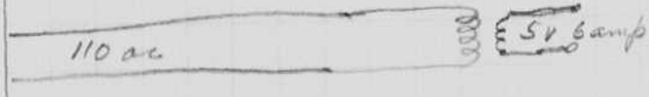
Why not use lower excitation voltage and thinner glass on the tubes.

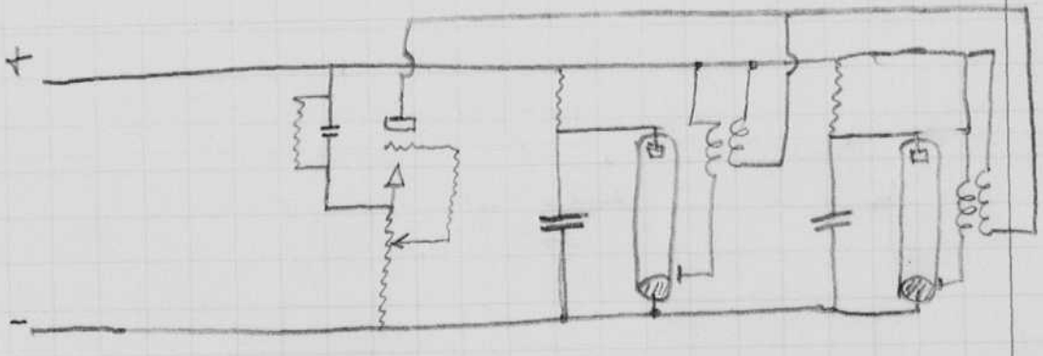


Aug 5, 1935.

Several tubes built but holdover persists.
A 200 ohm resistor pulled the voltage down
to as low as 800 volts, but results
nearly the same. The tube with the bade
reservoir seemed to work best.







try 1 mf and 400 ohms. .00050 or even 500.

" Reducing negative brick on grid.

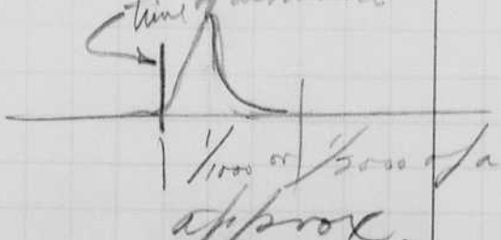
" Photo of tube and CR of plate to cathode voltage.
also of spark voltage and thyratron cathode voltage.

Sept. 12, 1935
H. E. Edgerton.

Several special tubes built during the week. One has a large anode, cylindrical which has not ~~been~~ pitted ~~here~~ to date.

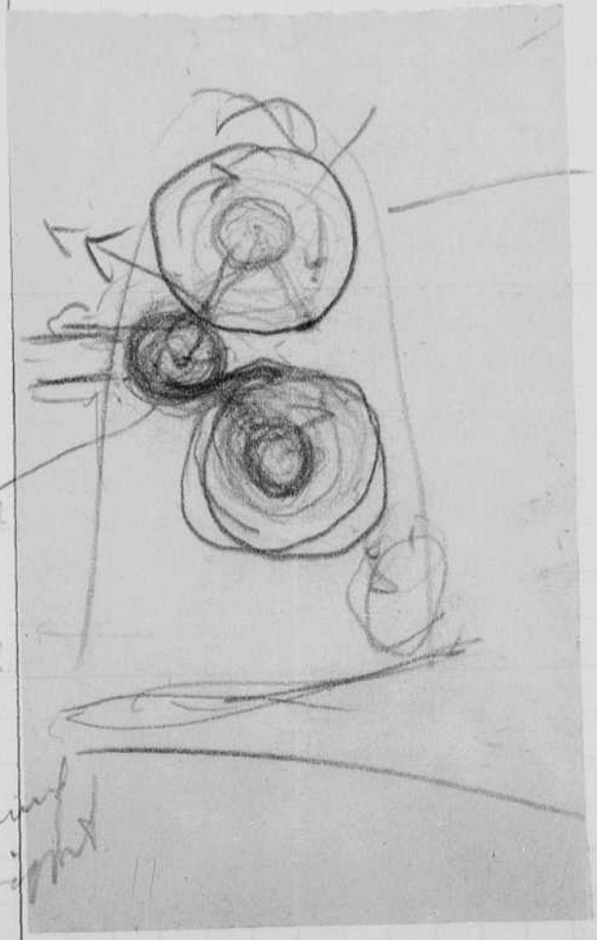
Another type was tried no particular advantage noted for several different uses.

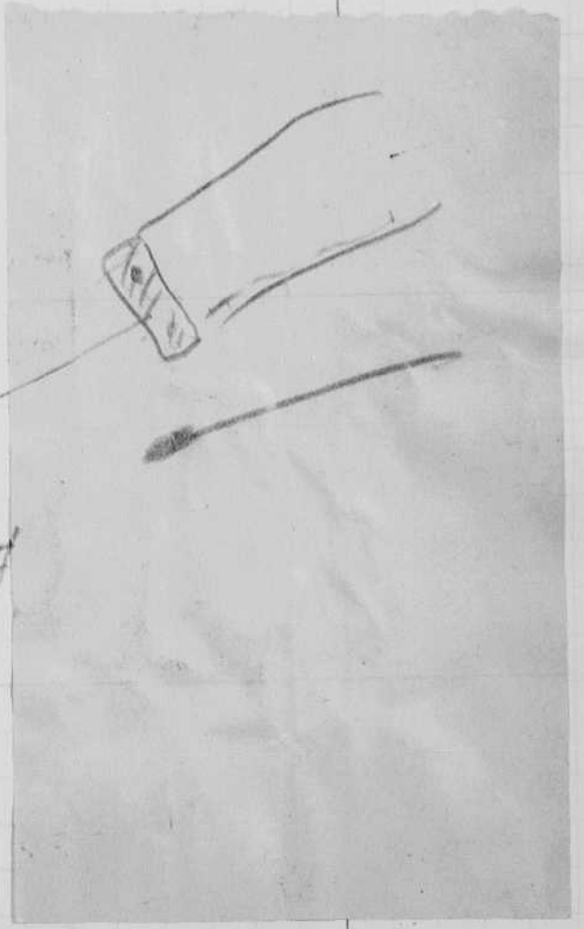
This tube appears to work very well with the steel anode above the pool, isolated. When cold ~~tubes~~ ~~go~~ are cathode spots on this anode. The cathode ray oscillograph shows that the anode above the pool received a positive charge after the discharge. The curve is of this form.



Met a Mr. G. E. Palmer last week at the Gen. Radio Company when on a visit to Wilkins. He had a problem, involving a spark coil which we discussed at some length. I sent him a quote for a model @ $200. Claims he needs 500 units!

Mr. Henry Wise Wood entertained my wife and I sunday at their home Aug 11. Sheep rocks at Annisquam on Cape Ann. Also met Margaret Fitzhue Brown and Hope Dister Mr. Wise's granddaughter. Luncheon then showed movies at Miss Brown's studio. Mr. Wood suggested a type of camera in which the film on the supply reel would be brought up to speed before needed and allowed to run at that speed.





Sept. 12, 1935
W. E. Edgerton.

Several special types built during the week. One has a large anode, cylindrical which has not yet been tested to date.

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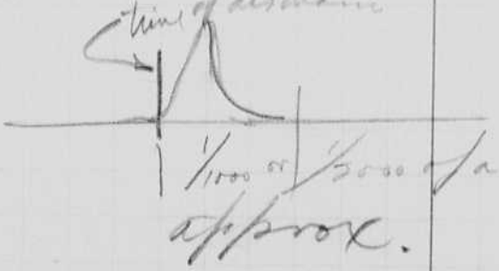

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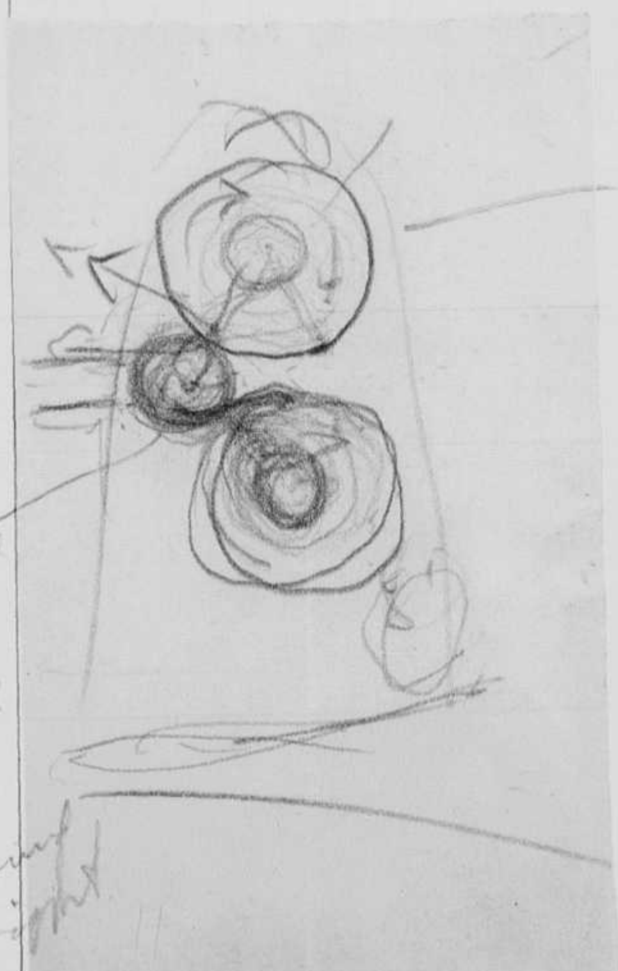
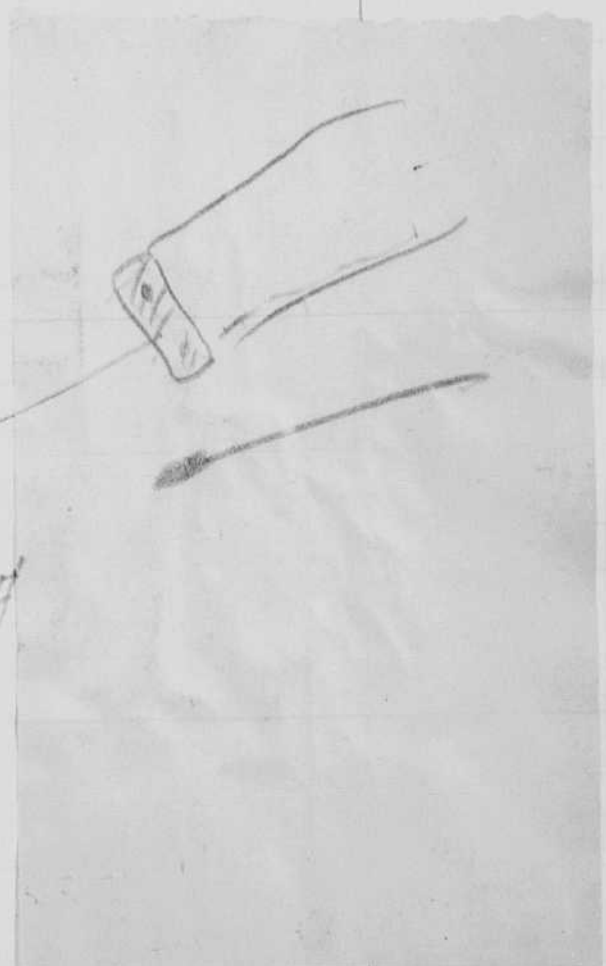
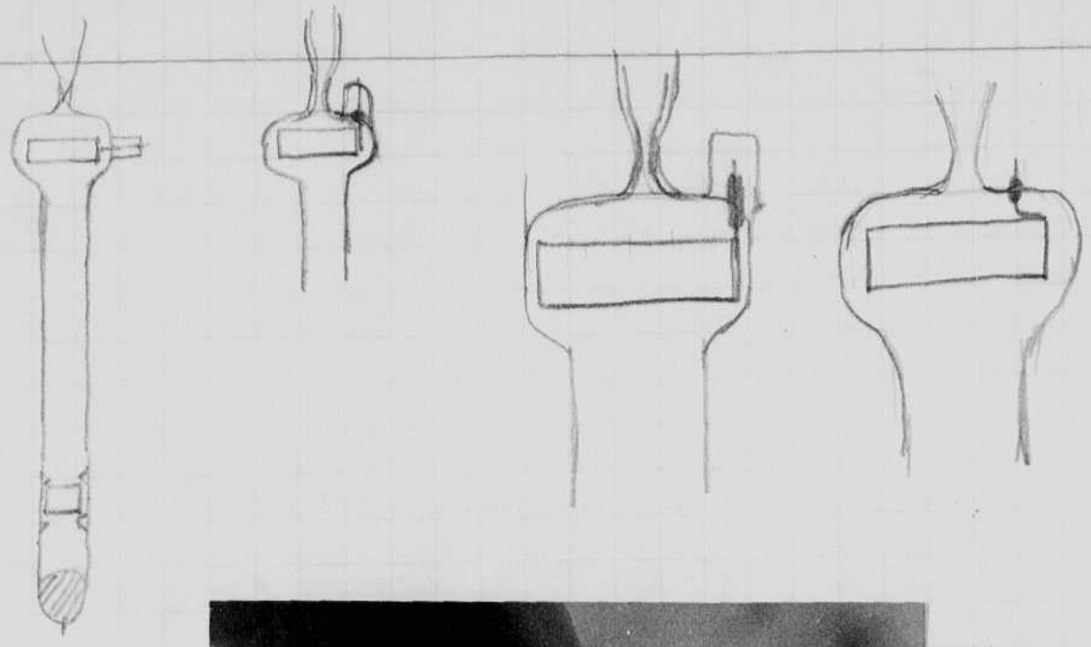


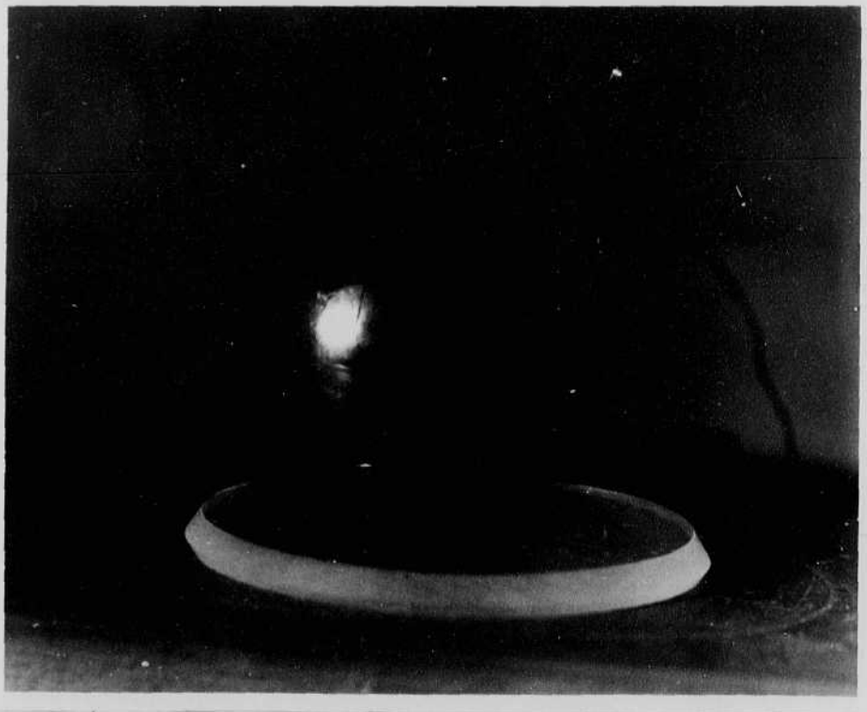
Supply reel.

pendent wheel with magnet to start film around at the right time



film clamp on end of film.

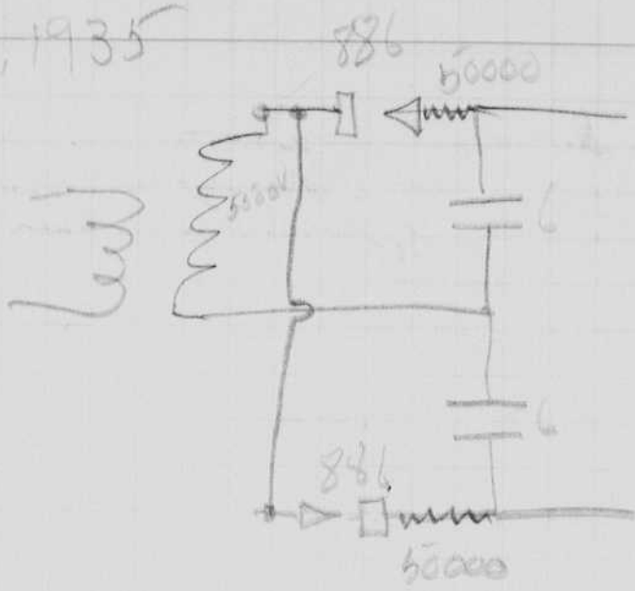




Priebel.
Sutherland &
Abbott. Adv
agency.

↑ cracks in Glass
Flat Goggle Amer. Optical Co.

aug. 14, 1935



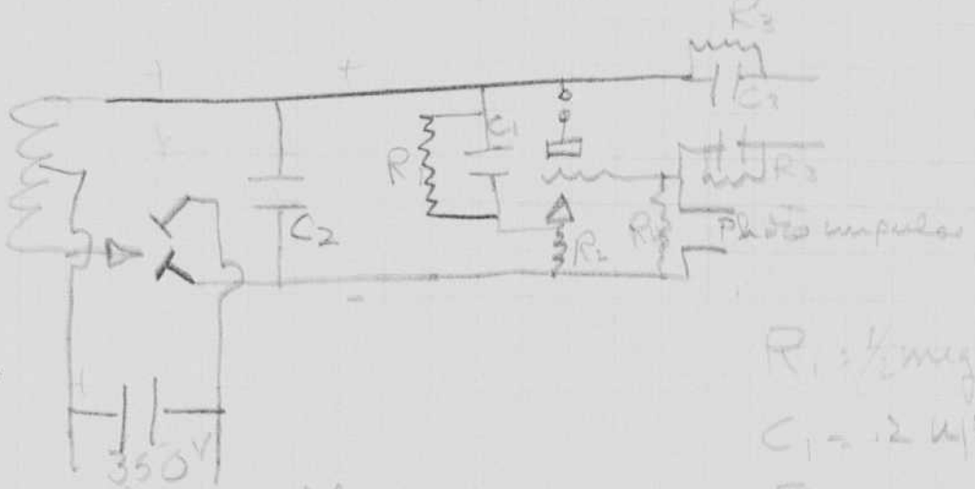
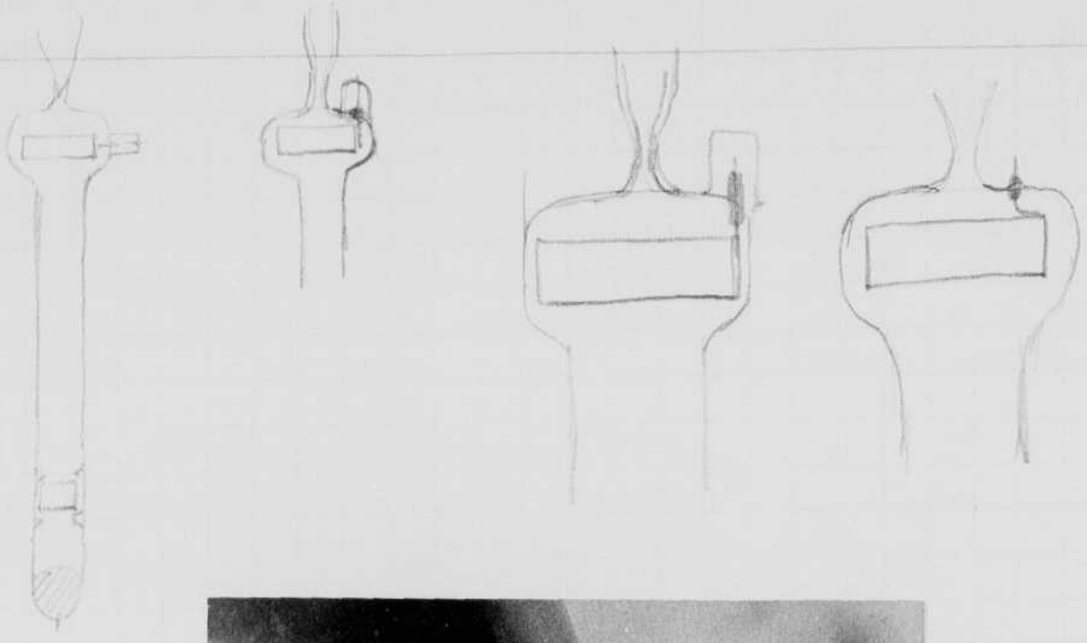


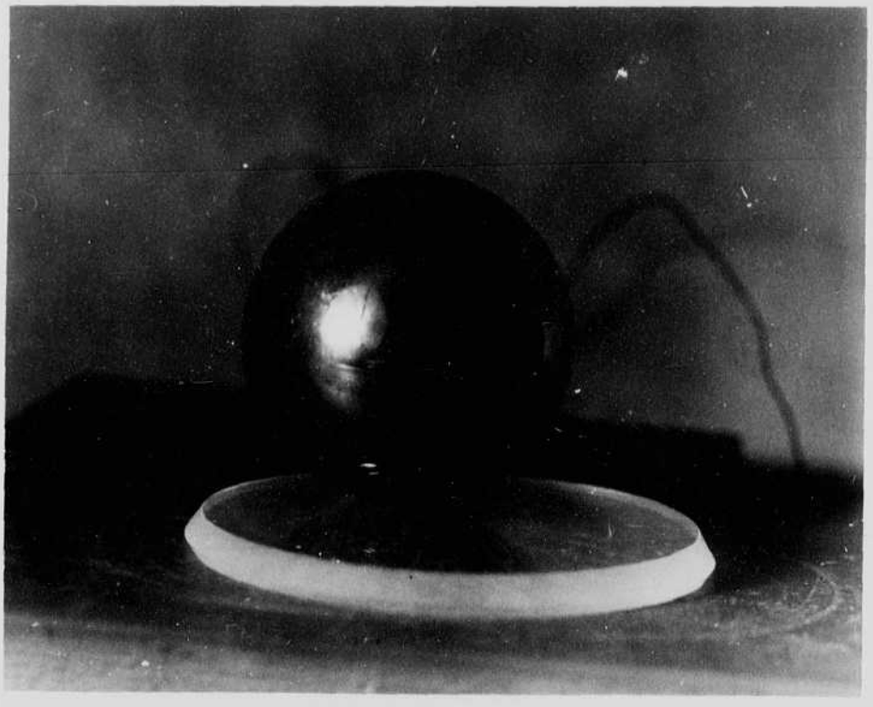
Photo cell power

$R_1 = \frac{1}{2}$ meg
$C_1 = .2\ \mu F$
$R_2 = 100000\ \Omega$
$R_4 = 25000\ \Omega$
$R_3 = 2$ meg
$C_3 = .0001\ \mu F$

Moved August 17 from 15 alden Rd Watertown (Lowerapt.)
mid 6967R.

to 309 Lake St. Arlington Mass.
(house belongs to Clair turner)
Arl. 4975 W.





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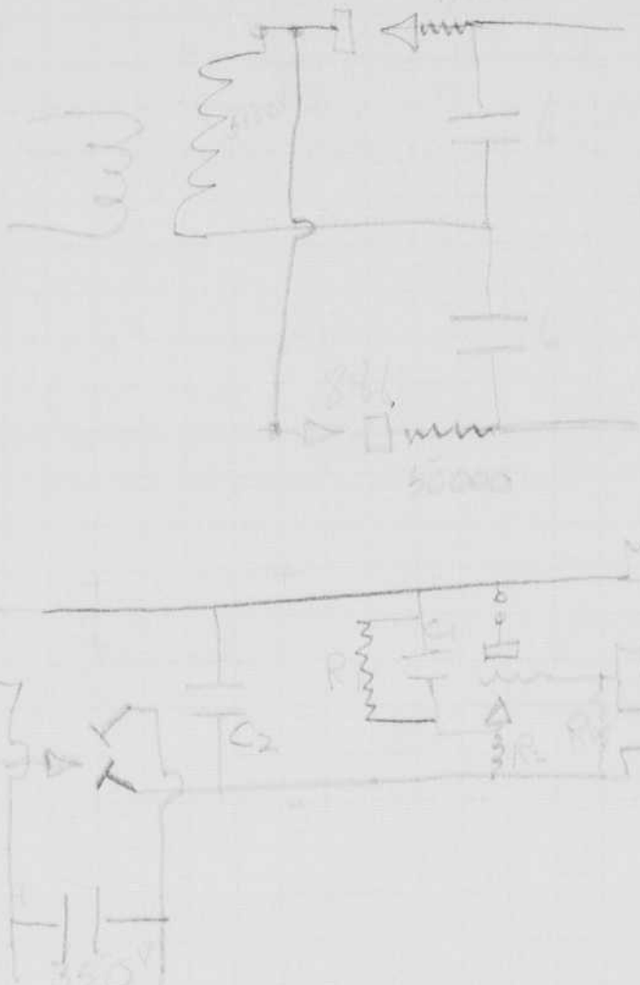


Moved August 17 from 15 alden Rd Watertown (Tower apt.) mid 6967R.

to 309 Lake St. Arlington Mass. (house belongs to Clair turner) Arl. 4975 W.

Aug. 19, 1935.

Spark producing arrangement for G. E. Palmer. Mr. Palmer at M.I.T. Sat. Aug 17 and authorized construction of one unit.

Ford spark coil

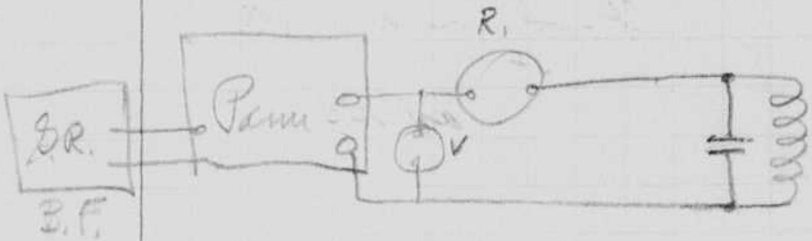
Primary .00055 h .55 mh.

Secondary 2.5 h.

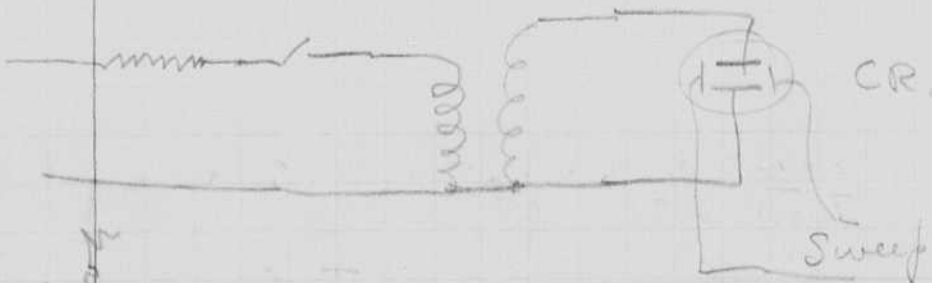
voltage ratio $\frac{2.5}{.55} \times 10^3 = 5. \times 10^3 = \sqrt{5000}$

70
70
$4900.$

300 volt.
.125 uf.



$\frac{7.2}{300} = 24.$ ma.



$E^2 C f$ = 300 300 $.1 \times 10^{-6}$ 800 = 24 watts x 3 = 7.2 watts

primary frequency. $= \frac{1}{2\pi \sqrt{LC}} = \frac{1}{2\pi \sqrt{.1 \times 10^{-6} \; .55 \times 10^{-3}}}$

$= \frac{1}{2\pi \sqrt{.055 \times 10^{-9}}}$ $\frac{1}{2\pi \sqrt{55. \times 10^{-12}}}$

$\frac{1}{.73 \times 10^{-12}}$

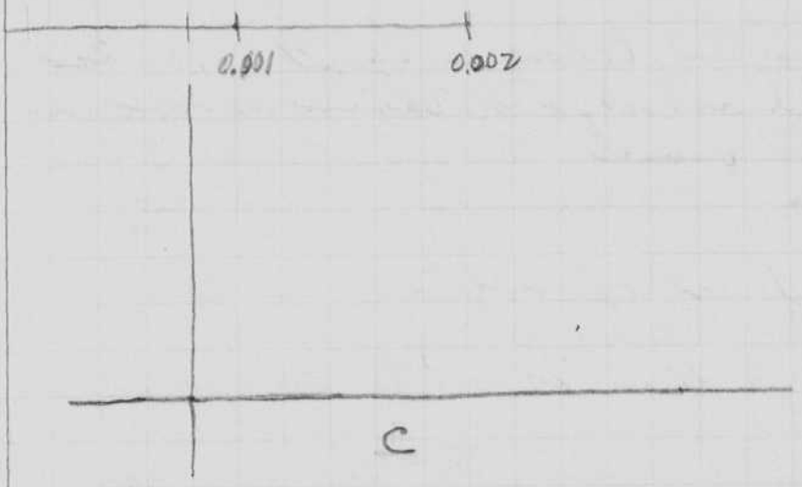
6.28
7.
43.1

2×10^{10} cycles

$LC = .1 \times 550 = 55.$
P156 Chamberlain book freq

freq $\frac{1}{2\pi \sqrt{55 \times 10^{-12}}} = \frac{1}{2\pi \; 7.4 \times 10^{-6}}$ .42 x 10

$= 2.15 \times 10^4 = 21,500$ cycles.



At resonance

$\omega L = \frac{1}{\omega C}$

freq = 5000 ~.
Ind = 2.5 h.

Ford coil. 1925.
as is

$freq = \frac{1}{2\pi\sqrt{LC}} = 5000.$

$2\pi\sqrt{LC} = \frac{1}{5000} = 2 \times 10^{-4}$

$LC = \frac{4 \times 10^{-8}}{(6.28)^2} =$

$C = \frac{4 \times 10^{-8}}{(6.28)^2} \frac{1}{2.5} = 4.05 \times 10^{-10}$ farads.

405×10^{-12} farads.

Critically damped

$R^2C = 4L$. Series

$R = \sqrt{\frac{L}{4C}}$ parallel.

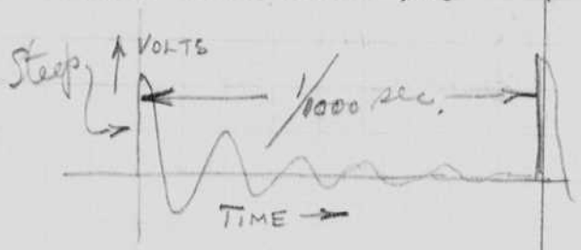
$R = \sqrt{\frac{2.5}{4 \times 405 \times 10^{-10}}} = \sqrt{.156 \times 10^{10}} = .394 \times 10^5$

$.394 \times 10^5$

Aug. 29, 1935
H. E. Edgerton

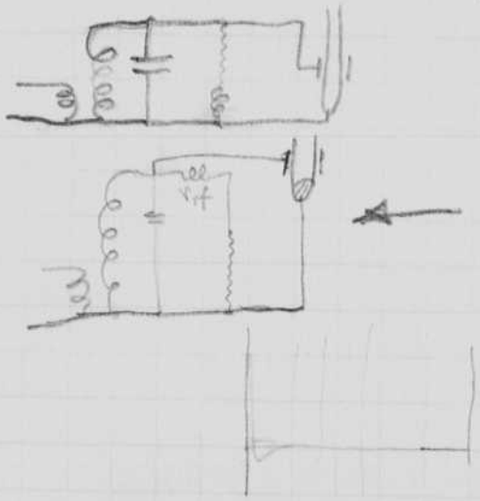
I experimented today with the regular Ford ignition coil which I obtained on Monday for experimenting with Mr. Palmer's circuit arrangement.

The wave front of voltage in the secondary is very steep for the Ford coil and this is due to the close coupling of the primary and secondary windings. The wave on the C.R. is as shown approx.



1/8 mf at about 900 volts gave a ½" spark

I tried damping and found that ½ meg would cut out the oscillation almost entirely. One meg. might be perfectly satisfactory.



A radio frequency choke might be of benefit in keeping the first wave front from getting into the resistor as shown

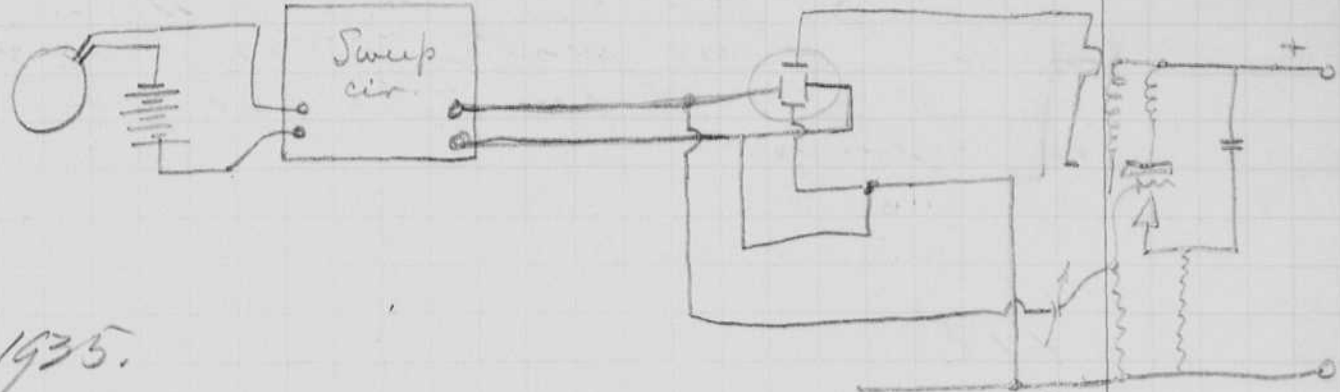
30,000 volts = ½" needle points.

$\frac{1}{20} \quad \frac{E^2}{R} \quad \frac{30{,}000 \times 30{,}000}{5 \times 10^5 \times 3} \quad \frac{10^4}{4\pi} = 90$ watts.

prob. 20 watts.
10 2 watt resistors.
10 – 10^5 Ω resistors.

3 meg at 100,000 cycles.

$\omega L = 3 \times 10^6 \qquad L = \frac{3 \times 10^6}{2\pi \cdot 10^5} = \frac{30}{6.28} = 4$ henries.

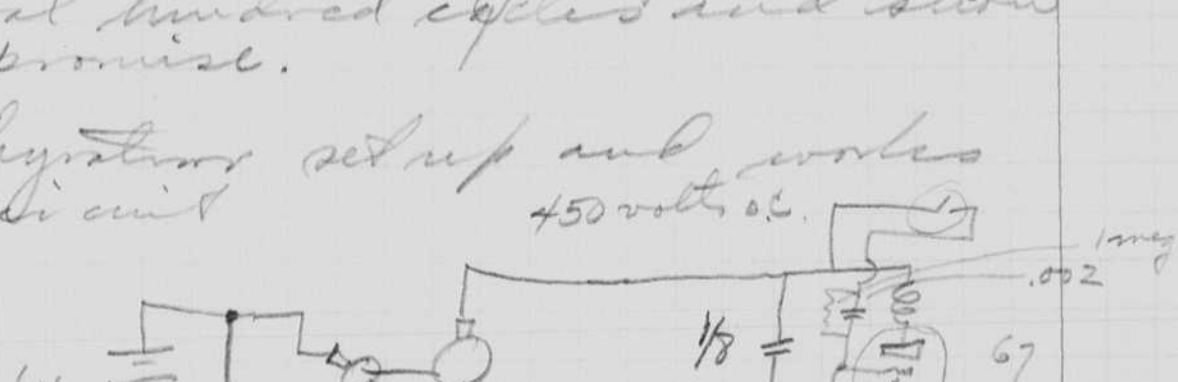


Aug. 24, 1935.

At Braves Field yesterday (at night) took spark photos of Wally Berger. Bob Smith Pitching.

Set up spark driving apparatus for Palmer. Neon and Argon tubes of Germeshausen work fairly well up to several hundred cycles and show some promise.

Thyratrons set up and works ok. Circuit



Operating data

	V	I	Ip.
Cathode only	5.8	3.6	—
Fil + motor gen	5.8	7.2	
" + " at 1000 ~	5.6	13.5	80 ma.

Capacity increased by .05 to .175

Total at 1020 ~	6.	15.1	103

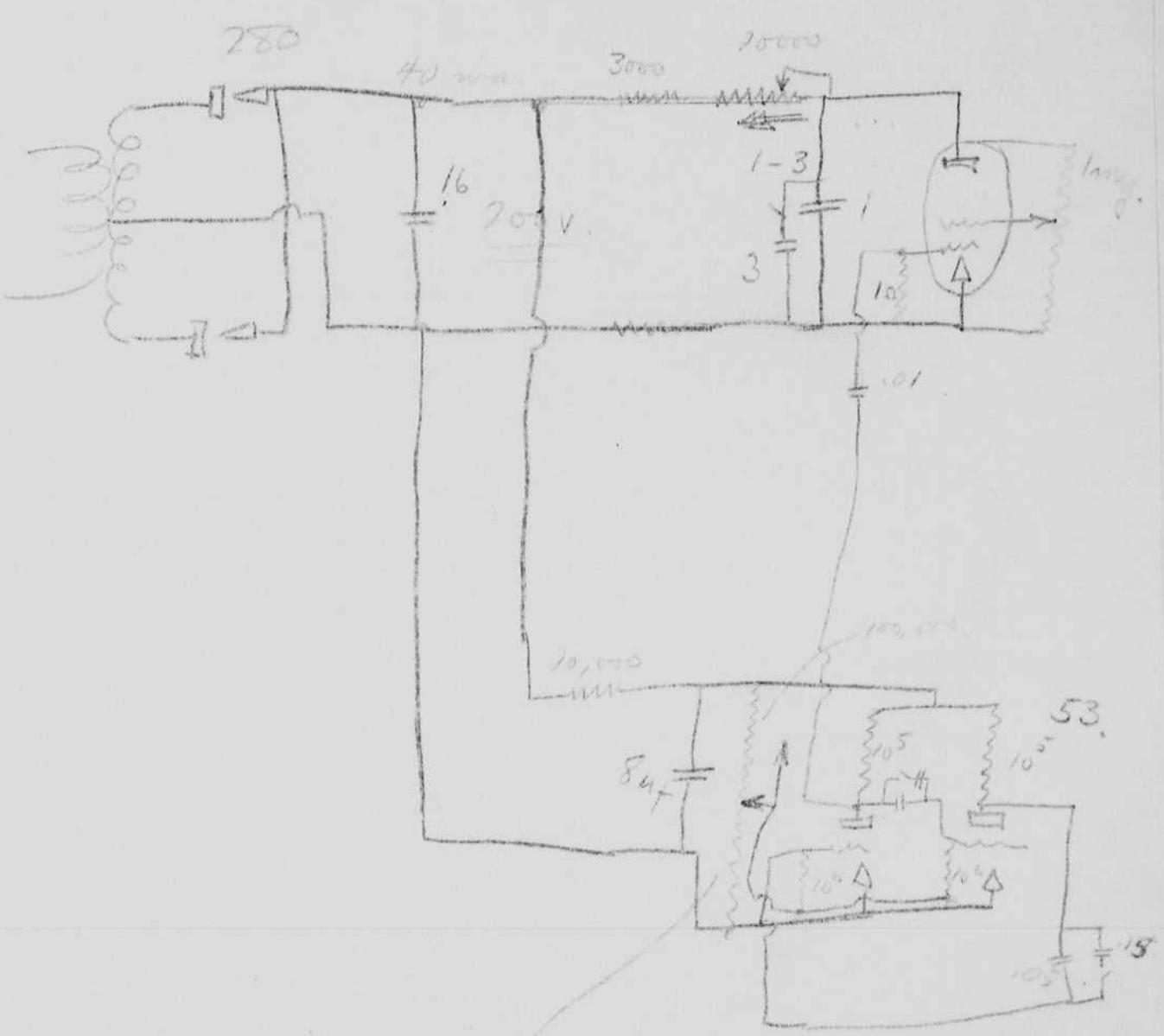
Aug 25

On Aug 22 1935 Thursday we took pictures of a gun for Melville Johnson 10 High St Boston. The pictures were taken at the instant the bullet was about 2 feet from the gun. Photos of the bolt were made. The bolt is pushed back by the explosive force and ejects the shell.

Aug 27 1935

Mr. John L. Parsons from the laboratories of the Hammermill Paper Co Erie Pa came in last night about 5 and we talked about photographs of films of paper as the wires are being formed.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS



freq control.

C. J. LeBel
Aug. 27, 1935

H. S. Hagerman
Aug 27 1935.

from circuit
on page 73.

Suggestions for theses.

Neon signs from dc by relax oscillator.

Vibration tests of materials for fatigue.

Relaxation oscillator freq. stabil and calibration. &c. P. 124.

Intensity time method 10^{-6} or 10^{-7} sec. resolution. –

Fracture of Glass and other materials.

Timing device for short intervals. multiple pictures. /

Piezoelectric accelerometer.

Piezo electric vibration recorder and analyzer.