

Electronics



W^m Thornton
3206 T.S. Lab

63

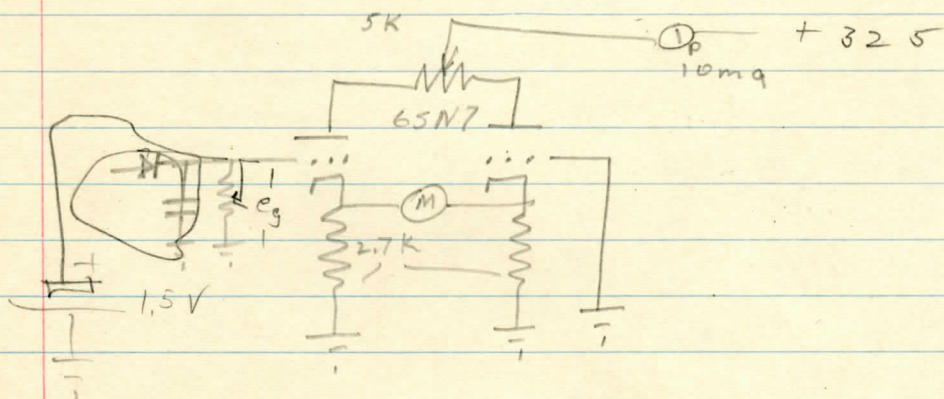
2/Lt W^m Thornton
3206 TSL
Eglin AFB, Fla

ASF

229613.19

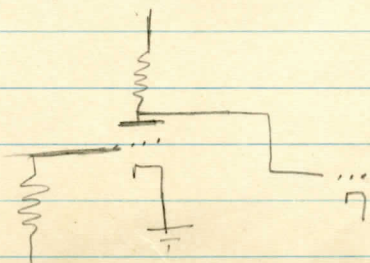
A
E
C
D
E
F
G
H
I
J
K
L
M
M.
N
O
P
Q
R
S
T
U
V
W

To develop a device capable of transforming .2 V rms 400W voltage into a large deflection on a meter—cannot involve more than 1 tube and the indicating device must be capable of with standing surges on the order of 25 V. —

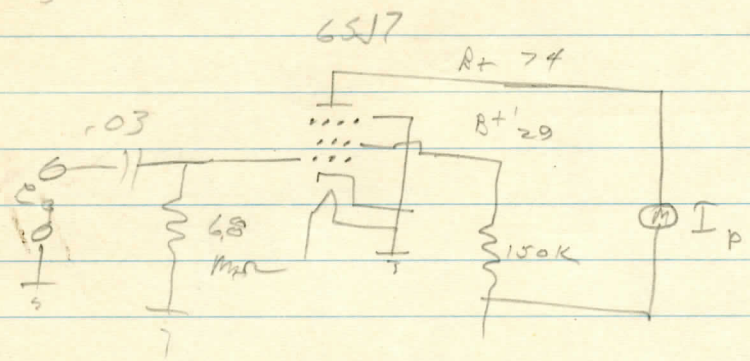


$$I_m = .1 \times 10^{-3} \quad E_g = +.36V$$

On surges current can go as high as 12 ma.

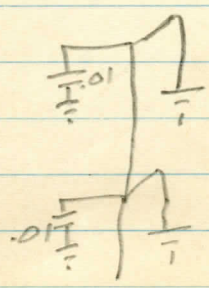
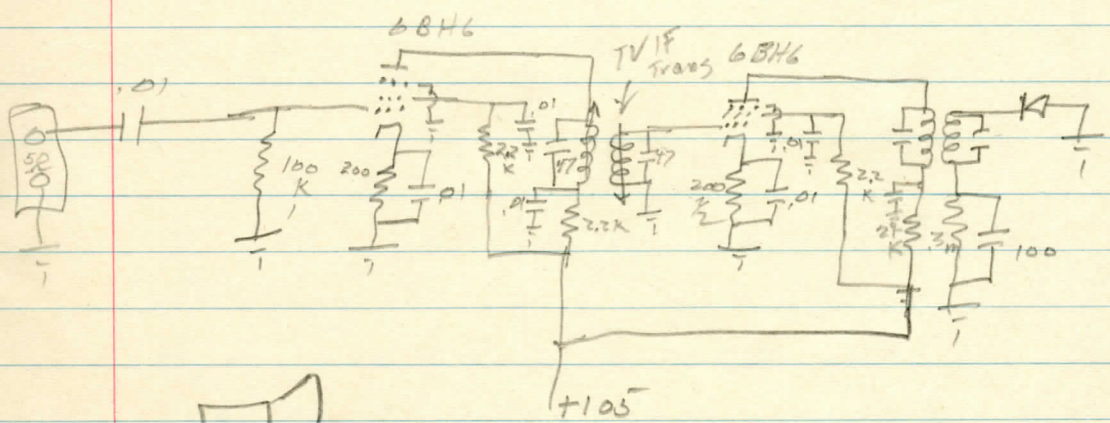


Pentode should be inferior - try it anyway

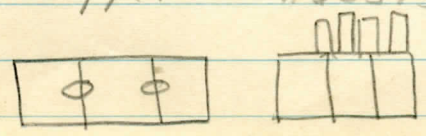


B+ volts	E _g VAC RMS 60W	I _p mA
74	0	1.0
"	.3	.92
"	.6	.8
"	1.	.65

9/1/30 To develop A 4.25 MC. Receiver



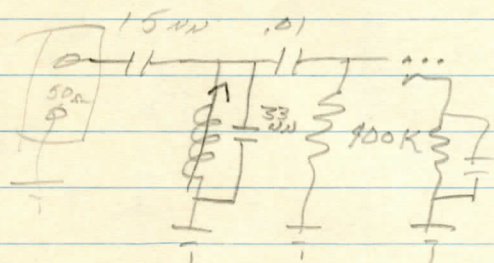
constructed on well shielded copper chassis



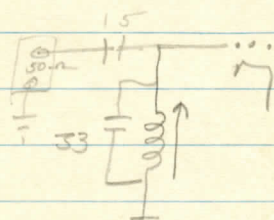
Fairly sensitive 3.5 mV in 5 V out

With tuned ckt set has gain of

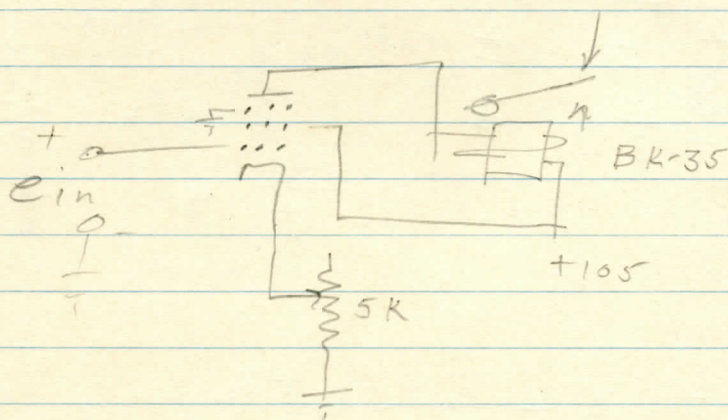
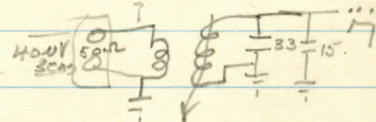
$$\frac{2.8}{200 \times 10^{-6}} = 1.2 \times 10^4$$



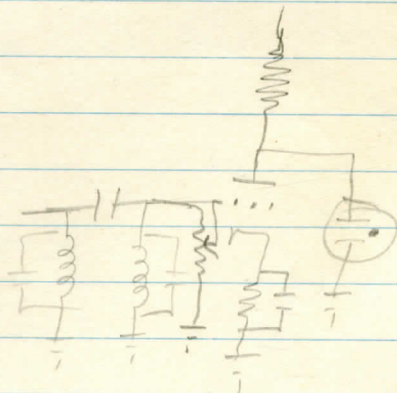
gain of $\approx 2 \times 10^4$



Check relay sensitivities -
try 12 BH6

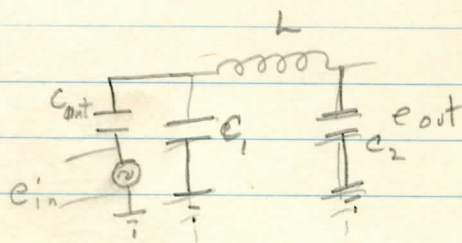


This ckt can be adj easily to the
Following sens. $e_{in} + 1.4V$ pull in $+ .4$ out
When coupled with rec - $26 \mu V$ out / $65 \mu V$ in
Had to shunt a large capacitor across
rec. out to reduce feedback & prevent osc.



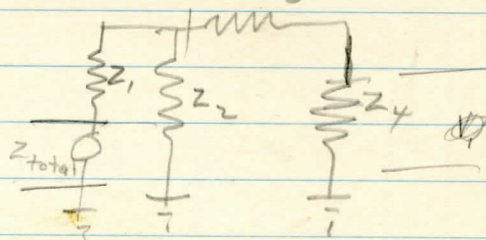
$$f_0 \quad f_i$$

$$127 \quad 100$$



$$\text{Gain} = \frac{e_{in}}{e_{out}}$$

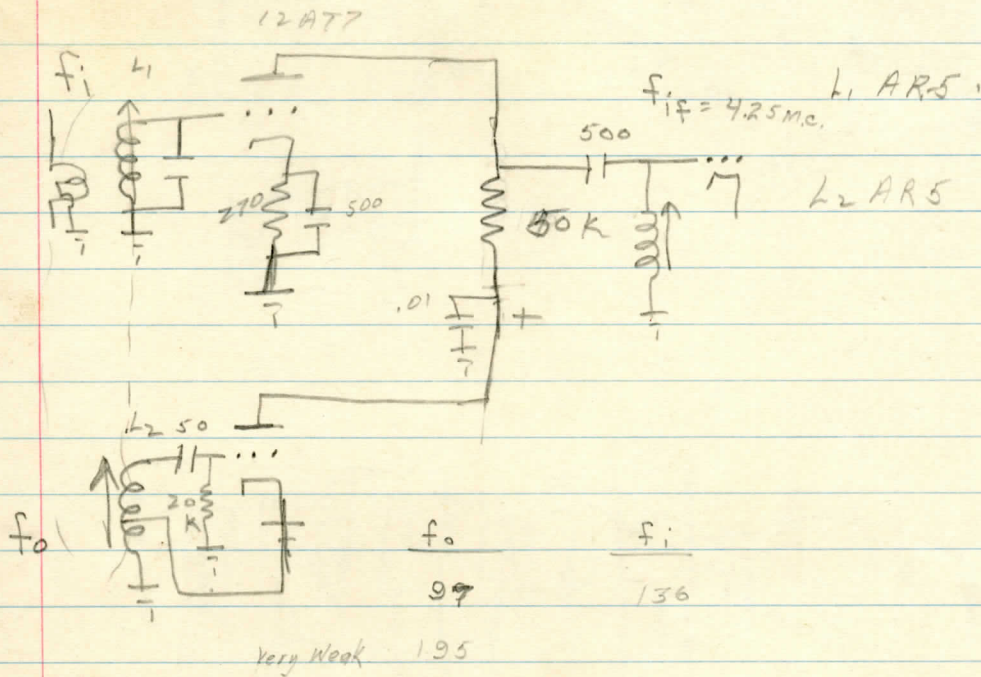
Gain max
diff set to 0



$$V = \bar{Z} I \text{ for } \theta$$

$$Z_{total} = Z_1 + \frac{Z_3 + Z_4 + Z_2}{Z_2(Z_3 + Z_4)}$$

Develop front end for to tune 4.25
mc receiver to 100 mc —

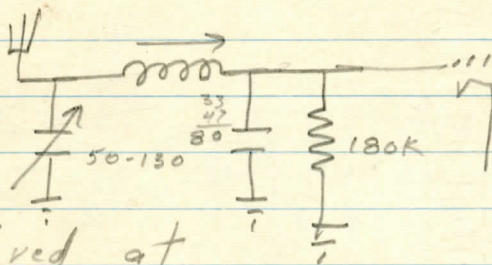


- 12/1/53 1. Adapt ant. ^{input} to short ant. on L.F. Rec.
2. Build VHF Rec.

① Use π input

By ant +

Try the $f_{0\pi}$
values were arrived at
for 6' ant —



②

$$Y_c = \frac{1}{2\pi f_c} = \frac{5 \times 10^{-8}}{c} \quad \vee \quad \frac{5 \times 10^4}{3 \text{ nV}} \times 10^{-2}$$

$$f = 4.3 \times 10^6$$

$$\frac{6.3}{4.3 \times 10^6} = \frac{189}{21.09 \times 10^8}$$

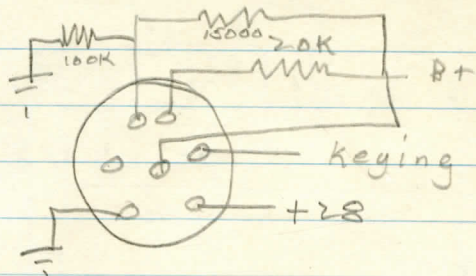
$$X_{c_{\text{sw}}} = \frac{5 \times 10^{-8}}{5} \times 10^{11} = 1 \times 10^3$$

$$R_k = \frac{1}{4 \times 10^{-3}}$$

$$\frac{1}{12.5 \text{ mA} \times 10^{-3}} = 80 \Omega$$

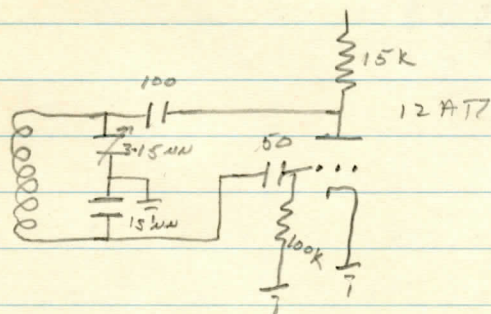
$$\begin{array}{r} 1.14 \\ 1.00 \\ \hline 0.04 \\ 1.00 \\ \hline 1.04 \end{array}$$

4.25 M.C. Xmt'rs

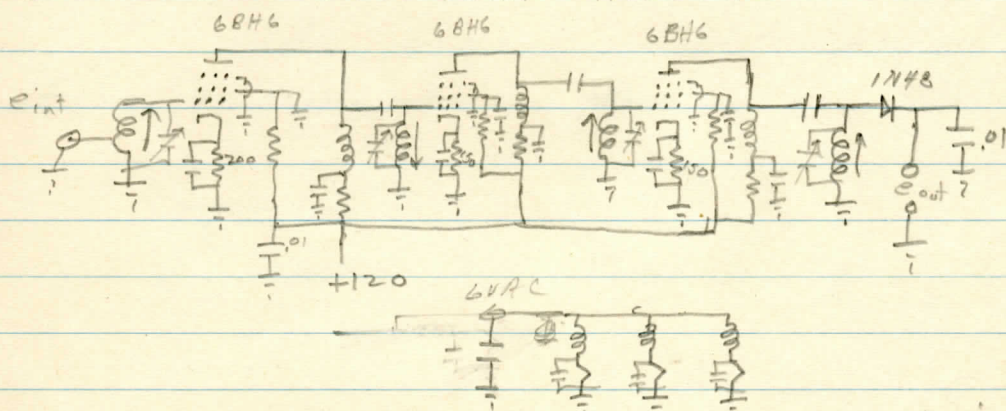


The preceding ckt. was tried with 6BJ6, Pwr in
12 AT7 osc out — $\frac{e_{out}}{e_{in}} = \frac{1V}{1 \times 10^{-6}} = 10^{-6}$

Osc — Colpitts — 104.25 mc.



12/5/53 Build V.H.F. T.R.F. Receiver —



all bypass caps .005 coupling cond 150 ohm trimmers

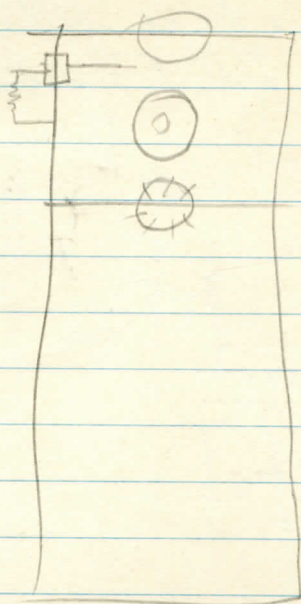
3/2 ceramic tuned inducts — AR55 other 1/2

~ 30 turns #30 enamel air wound 1/4" dia —

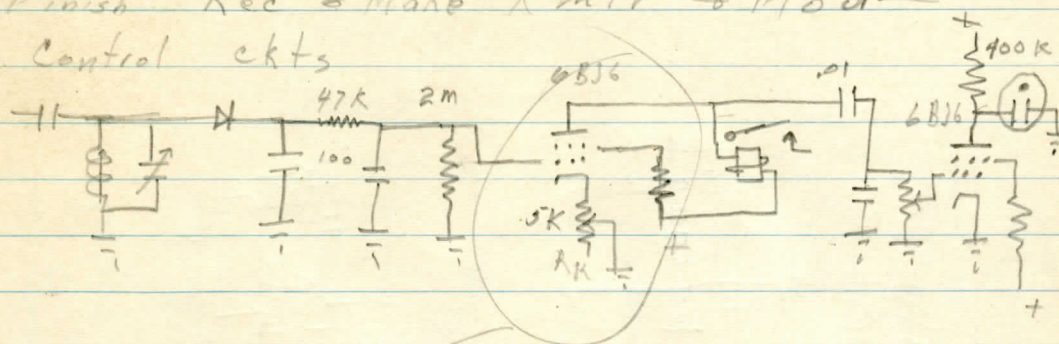
constructed on sheet copper with
some shielding between stages —

Concl Fairly stable for VHF has gain of

$\frac{2V}{3 \times 10^{-3}}$ measured across e_{in} (50 ohm)

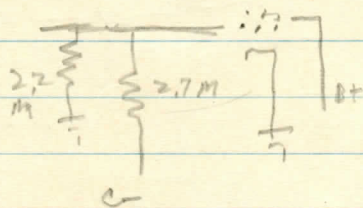


12/8/53 Finish Rec & Make X mtr & Mod -
Control ckts



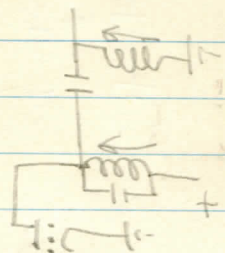
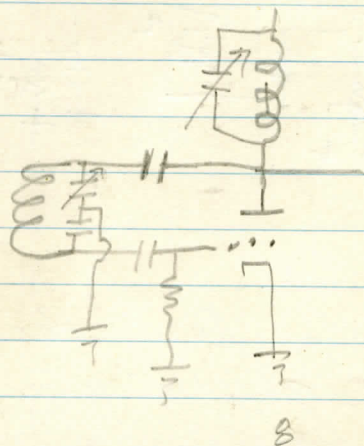
With cathode bias on relay tube the plate current does not increase much after pull - probably due to excessive screen current across R_K -

Try Fixed bias which can be obtained from fil. supply — ~~short~~



current becomes excessive thru tube at H_i signal levels - should incorporate A.V.C. or limiting —

12



2.3.3
3.3.3

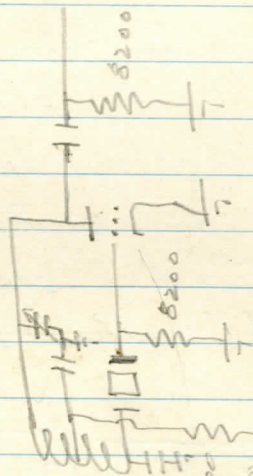
$$\begin{array}{r} 20/300 \\ 425 \overline{) 3800} \\ \underline{3825} \end{array}$$

$$\begin{array}{r} 20 \\ 425 \overline{) 3300} \\ \underline{3300} \\ 000 \end{array}$$

$$425 \overline{) 47}$$

$$\begin{array}{r} 4.25 \\ 7 \overline{) 29.75} \\ \underline{29.75} \\ 000 \end{array}$$

$$\begin{array}{r} 15 \\ 425 \overline{) 64.00} \\ \underline{425} \\ 2150 \end{array}$$



$$\begin{array}{r} 425 \\ +8 \\ \hline 3400 \\ 425 \end{array}$$

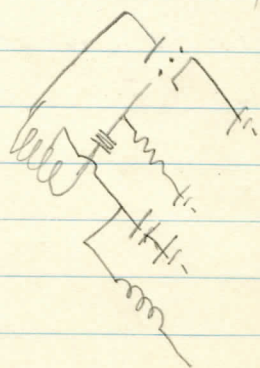
$$\begin{array}{r} 425 \\ 18 \overline{) 3900} \\ \underline{3900} \\ 7850 \end{array}$$

$$\begin{array}{r} 8 \\ 3 \overline{) 24} \\ \underline{24} \\ 425 \end{array}$$

$$\begin{array}{r} 7 \\ 2 \overline{) 14} \\ \underline{14} \\ 425 \end{array}$$

$$\begin{array}{r} 96 \\ 102.00 \end{array}$$

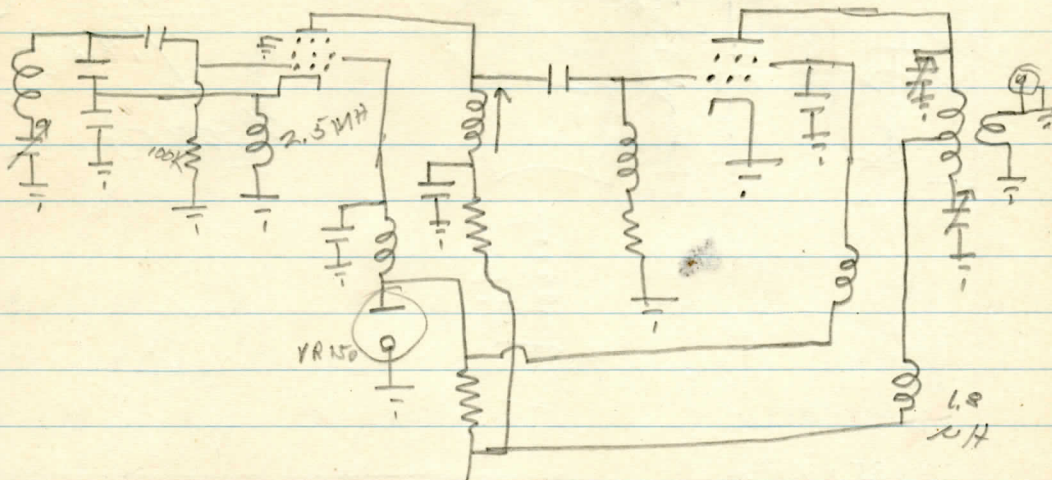
$$\begin{array}{r} 56 \\ 5950 \end{array}$$



Build 90 Mc Xmt

osc

6AG7

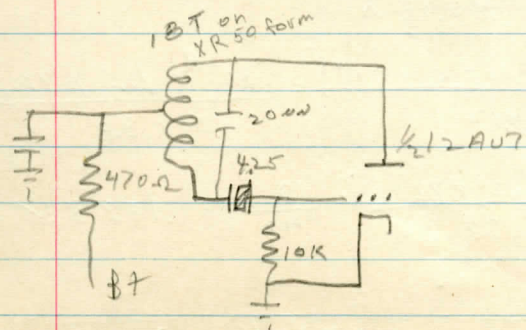


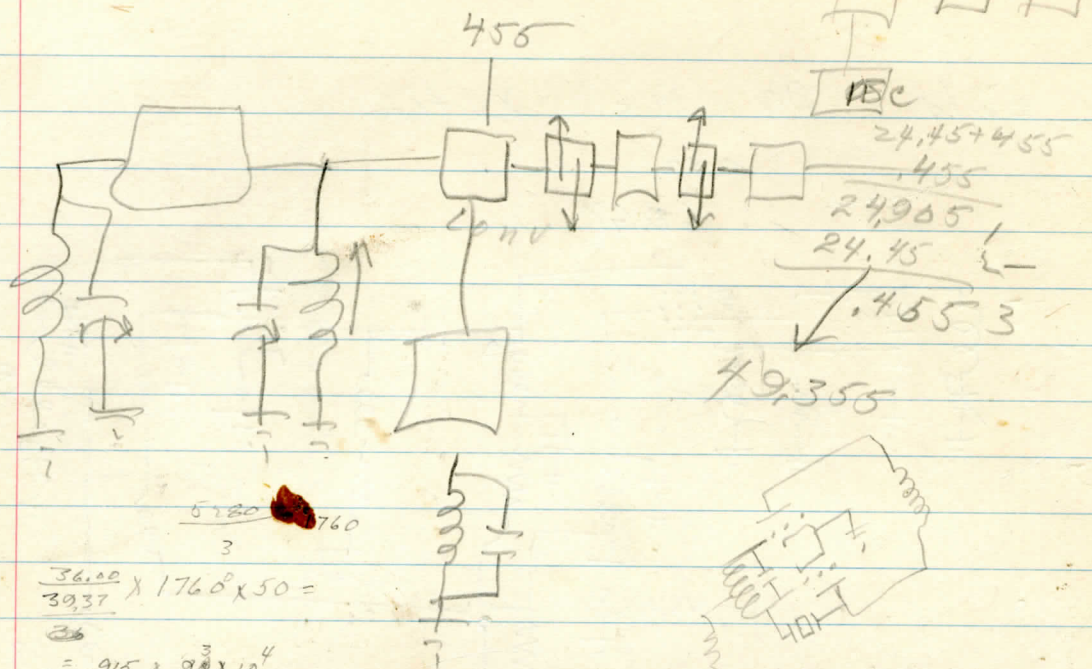
No soap with the osc. too much trouble to tune

Try Xtol — 3X 7X
Try Xtol.

12/12/53

Took off





$$\frac{36.00}{39.37} \times 1760 \times 50 =$$

$$= .915 \times 9.3 \times 10^4$$

$$= 8.5 \times 10^4 \text{ m}$$

Power for 4.25 mc rec

Range - 50 mi - $8.5 \times 10^4 \text{ m}$ $\lambda = \frac{300}{4.25} = 71 \text{ m}$

Power - min 1000V desirable - 5000V

$$P_i = \frac{P_R}{4\pi d^2}$$

$$P_i = \frac{E^2}{R}$$

$$P_i = \frac{P_R \times .13 \lambda^2}{4\pi d^2}$$

$$E^2 = \sqrt{\frac{P_R \times .13 \lambda^2 R}{4\pi d^2}} = \frac{\lambda}{2d} \sqrt{\frac{.13 R P}{\pi}} \quad d = \frac{\lambda}{2E} \sqrt{\frac{.13 R P}{\pi}}$$

$$\frac{E^2}{R} = \frac{P_R \times .13 \lambda^2}{4\pi d^2}$$

$$P_R = \frac{E^2 4\pi d^2}{R \times .13 \lambda^2}$$

$$P_R = \frac{(100 \times 10^{-6})^2}{75 \times .13 \times (71)^2} = \frac{10^{-8} \times 125 \times 72 \times 10^8}{500 \times 9.8 \times 9 \times 1638}$$

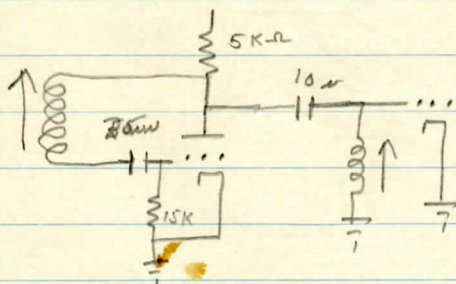
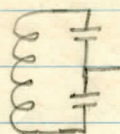
$$= \frac{12.5 \times 72}{4900} = \frac{1.25 \times 72}{49} = \frac{9}{49} = .182 \times 25 = 4.6$$

$$P_i = \frac{2}{12.5 \times (8.5 \times 10^4)^2} = \frac{2}{12.5 \times 72 \times 10^8} = \frac{2}{12.5 \times 72 \times 10^{10}} = \frac{2}{9 \times 10^{10}} = .22 \times 10^{-10} \text{ W/m}^2$$

$$A = .13 \times \lambda^2 = .13 \times (71)^2 = 13 \times 515 \times 67 = 167 \times .22 \times 10^{-10} \times 75 = 14.7 \times 75 \times 10^{-5} =$$

Try VFO

Colpitts

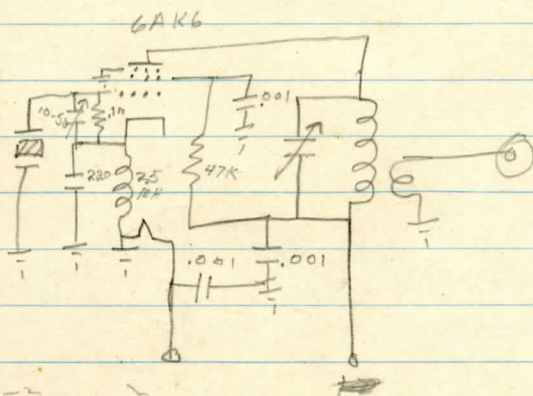


Circuits are unstable for lack of suitable shielding no punche, etc. for working with Cu suspend til Monday -

Build 4.25 mc Xmtr + finish 100 mc Receiver -

Reqs. for Xmtr. 2 watts out put modulated as heavily as possible -

Try 6AK6



Hot!

$$P = \frac{E^2}{R} = \frac{10^2}{100} = 1W$$

130

$$\frac{32.4 \times 10^{-5}}{\sqrt{1050}}$$

Circuit is very good - With air wound coil [B&W (3016)] it has output of 1 watt with input of 230 volts + 12 ma -

$$\frac{64}{66} \quad \frac{100}{66}$$

$$\frac{10^4}{1.5 \times 10^3} \quad \frac{10}{15}$$

$$X_c = \frac{1}{2\pi f C}$$

$$\frac{X_c}{10} = \frac{10}{6.3}$$

$$f = 100 = \frac{10}{6.3 \times 3 \times 10^3}$$

.02

1 1/2 15

$$\begin{array}{r} 111 \\ 111 \\ 111 \\ 111 \\ \hline 12321 \\ 15 \end{array}$$

$$95 \quad \begin{array}{r} 12 \\ 12 \overline{)12} \end{array}$$

$$\frac{9}{10} = \frac{100}{X}$$

$$9 \overline{)1000}$$

 $\times 10^3$

11

$$\frac{12106}{13300}$$

 3×10^3

$$C = \frac{10}{6.3 \times 3 \times 10^3 \times 7 \times 10^2} \quad 18V$$

$$= \frac{10}{18.9 \times 7 \times 10^5}$$

$$= \frac{10}{13.2 \times 10^6}$$

$$= .76 \mu fd.$$

$$\frac{12.5 \times 10^3}{1.5 \times 10^3}$$

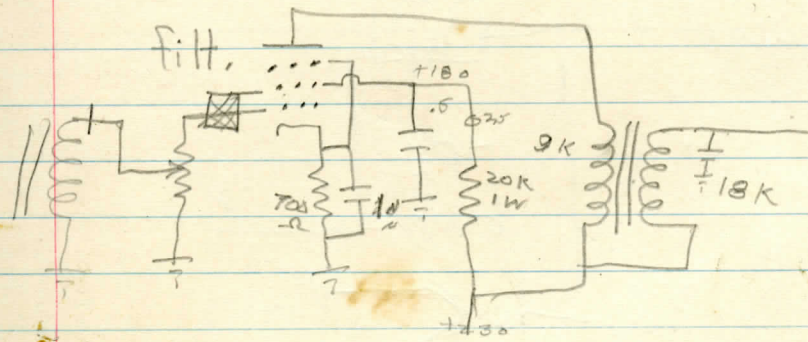
1 KC

$$2.5 \overline{)50.0} \quad \frac{20 \times 10^3}{50.0}$$

by raising screen voltage this can be upped to over 1.5 watts - With coil wound on X-50 Form 40 T #22 power drops to $\frac{40}{66}$ W. - Even tho this does not have the two watts its too good to pass up -

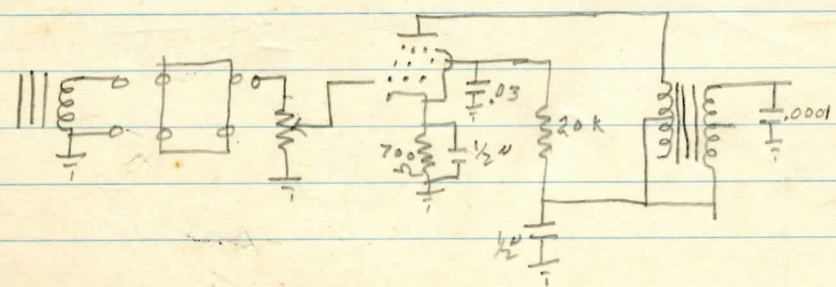
Modulator Audio Power must be $\frac{E_b I_b}{2} = \frac{12.5 \times 10^{-3} \times 230}{2}$
 $= \frac{2.85}{2} = 1.45$ watts for 100% mod

Amp o.p. tube res = $\frac{230}{12.5 \times 10^{-3}} = 18.4 \times 10^3 \Omega$



3K Ω
 $2.5 \overline{) 500.}$
 200
 250
 250

 0
 $150 \times 10^{-3} / 1.5$



3A5- 110 m a 2.8 V

230

, 0/2

$$\begin{array}{r} 18 \\ 18 \\ \hline 4 \end{array}$$
$$\frac{3.25}{20} = 4 \text{ watts}$$

Modulator

230

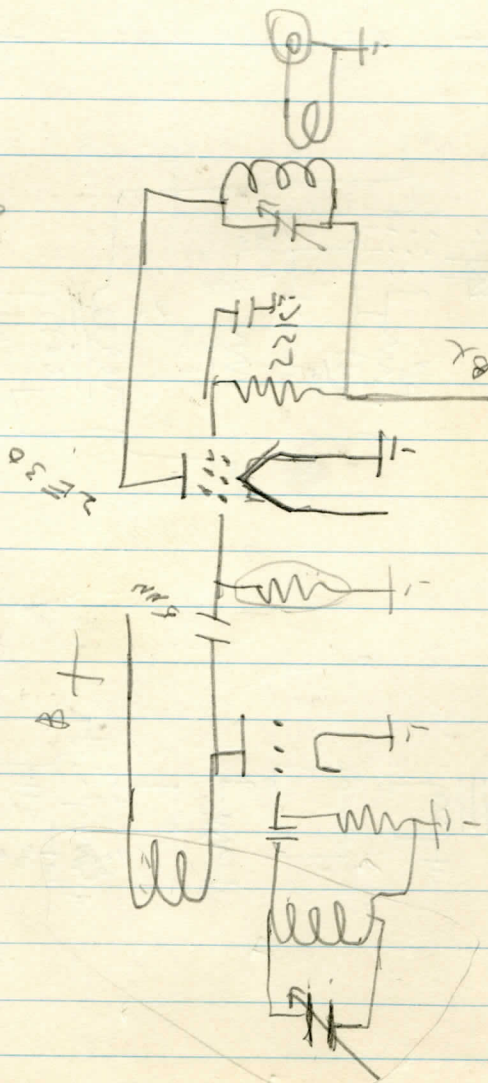
$$\frac{.3}{6.90} = .58$$

61

1.12 watts

9,5

9.5

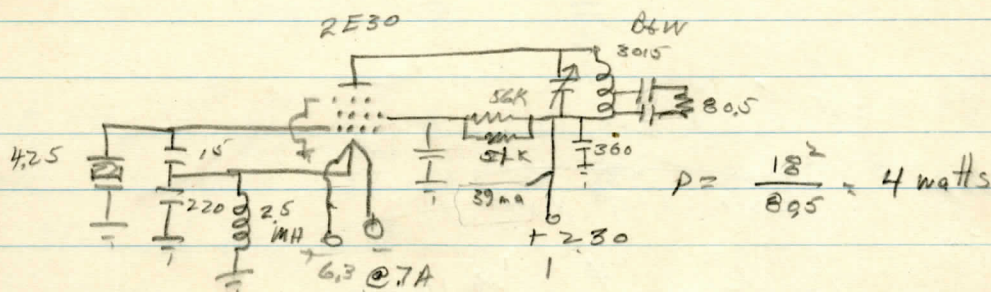


12/14/53

Check Q of coils for Xmt.

Coil	Freq	Q X1.5	Cap of Pm.
XR50 wound with 240 T litz slug in	4.25 mc	112-	56.
" slug out	"	93	100
XR50 form wound slug in with 30 T #2 enamel	7.2 mc	65	100
" slug out	"	97	166
" 30 T #22 cc. slug out	6.4 mc	75	100
" " slug in - 6.4 "	65	56	
60 T enamel on 1/2 Poly	4.25	85	30
XR50 slug out	"	70	130
40 T #30 enamel	"	70	71
" slug in.	"	70	

Try 2E30



$$\begin{array}{r} 230 \\ 4 \\ \hline 920 \end{array}$$

17

230

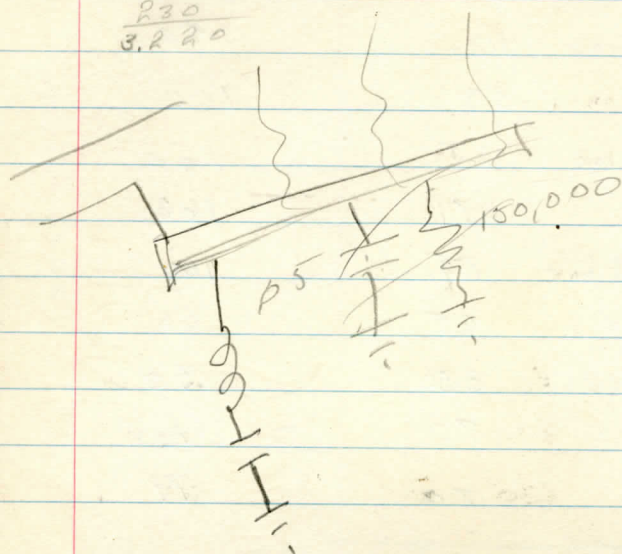
14

121

1,5

920

$$\begin{array}{r} 230 \\ 3.220 \end{array}$$



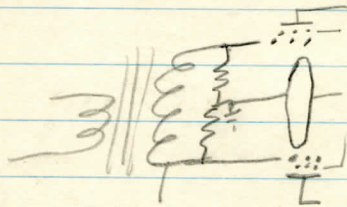
$$\begin{array}{r} 3600 \\ 5600 \end{array}$$

$$\begin{array}{r} 56 \times 51 \\ 56 + 51 \end{array}$$

$$7 \sqrt{4.0}$$

$$\begin{array}{r} 26 \\ 107 \overline{) 285} \\ \underline{214} \\ 710 \end{array}$$

$$\begin{array}{r} 1280 \\ .017 \overline{) 230000} \\ \underline{17} \\ 60 \\ \underline{34} \\ 16 \end{array}$$



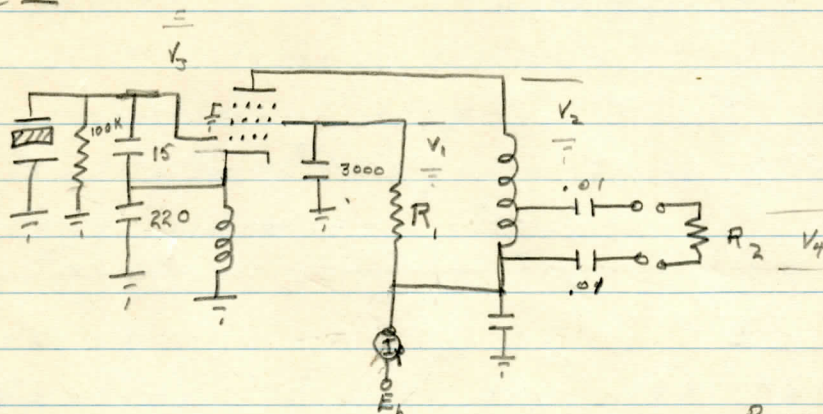
$$\begin{array}{r} 230 \\ 165 \\ \hline 65 \end{array} \quad \begin{array}{r} 65 \\ 65 \\ \hline 325 \\ 200 \\ \hline 4225 \\ 27500 \end{array}$$

$$r_c = \frac{1}{4.3 \times 3 \times 10^4 \times 10^4}$$

$$= \frac{1}{1.8} \times 10^4 \times \frac{1}{2} \times 10000$$

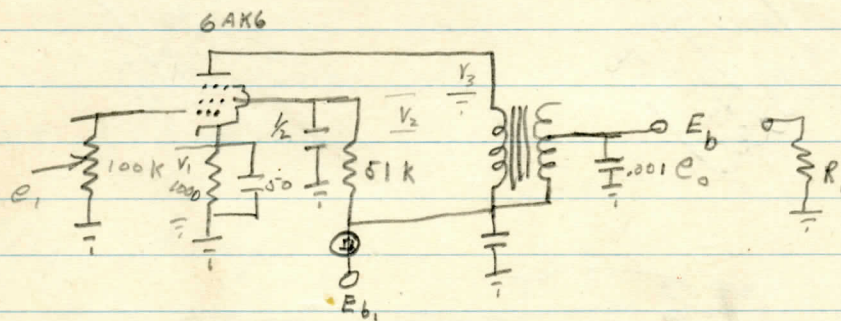
Mod II Xmtr.

Osc -



I_A	R_1	E_b	V_3	V_1	V_2	V_4	R_2	Power in out
.014	51K	230	32	130	230	9.3	80.5	3.22 1.075
.017	$\frac{1}{52} \times \frac{1}{51} = 26K$	230	37	165	230	11.2	80.5	3.91 1.51

Modulator



I_b	E_b	C_{p-p}	C_o	R_1	V_1	V_2	V_3	P_{out}	P_{in}
.011	230	10	52	5.6K	10	150	215	$\frac{2100}{5600} = 4.8$	2.53

62

Max out put .69

H.V. probe

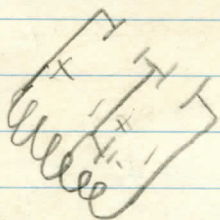
3 KV

$$\frac{3 \times 10^3}{3 \times 10^{-4}} = 1 \times 10^7$$

$$\frac{3 \times 10^3}{10^7} = 3 \times 10^{-4}$$

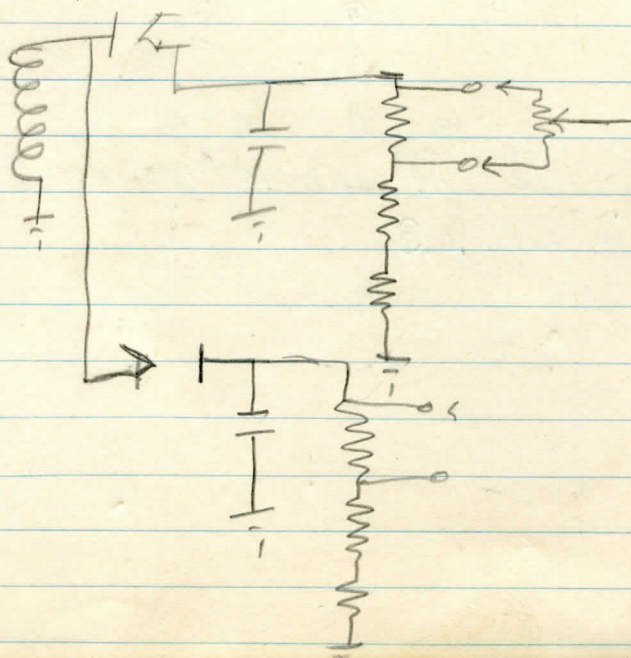
$$\frac{10^3}{10^7} = 10^{-4}$$

$$\frac{1 \times 10^3}{2 \times 10^7} = .5 \times 10^{-4}$$



$$\begin{array}{r} 480 \\ 1.3 \\ \hline 1440 \\ 480 \\ \hline 6240 \end{array}$$

$$\begin{array}{r} 12 \\ 60 \\ \hline 720 \\ 3 \\ \hline 2160 \\ 360 \\ \hline 29600 \\ 6480 \\ \hline 72760 \end{array}$$



1/5/54

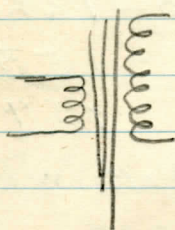
Design + Build Small A-Scope12 μ sec linear ^{triggered} sweep $\frac{1}{2}$ " " time fiducial

hi resolution scope

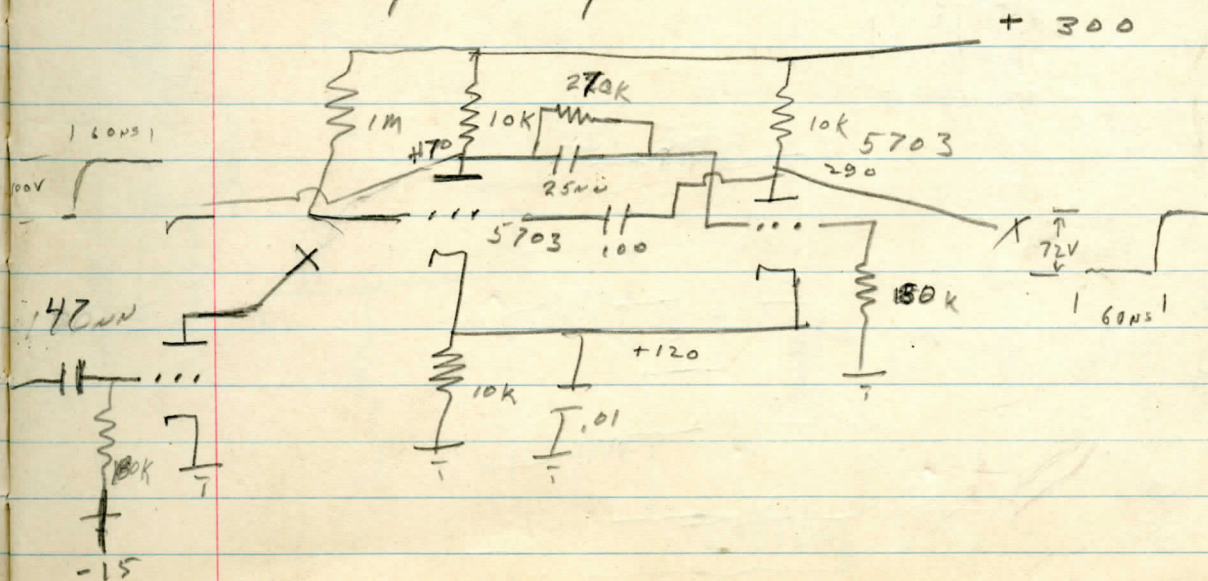
inputs - 2 μ sec + 25V pulse from M/B

25 V video -

Indicator -

Wasting time for lack of
photographic data on
scopes -Try sub miniatures to determine
drive etc -

Flip Flop



2 ea rectifier selenium 1 ph Half wave
ckt 2 ferrule stock # 3370-687000-
-1775

4 ea rectifier metallic selenium 1 ph $\frac{1}{2}$ wave
ckt 2 ferrule stock # 3370-687100-1215

Rectifier selenium 1 ph half wave ckt
2 Ferrule tom

10 ea stock # 3370-687000-1221

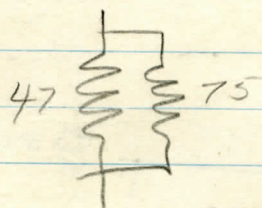
10 " " 3370-687000-1535

10 ea " 3370-687000-1545

Rectifier selenium 1 ph half wave ckt
2 solder lug term Mp

10 ea stock # 3370-688000-1265

$$\frac{250}{25 \times 10^3} \quad 10 \times 10^{-3} \quad 10^{-2} \quad .60$$



$$33 \times 10^{-3} \Omega$$

$$\frac{250}{50 \times 10^2} = \frac{1}{2} \times 10^{-2}$$

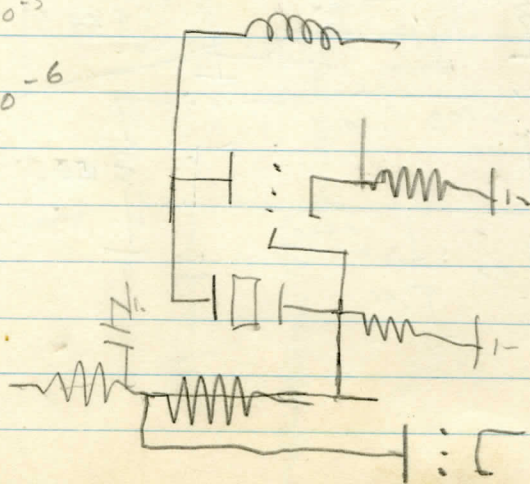
$$= 5 \times 10^{-3}$$

$$\frac{50}{50 \times 10^3} = 1 \times 10^{-3}$$

$$4.25 \times 10^{-6}$$

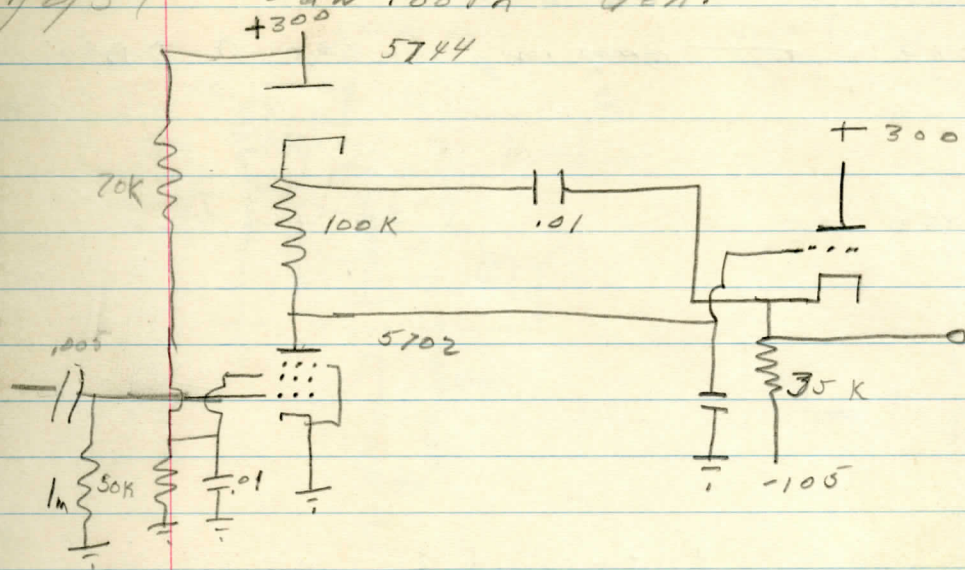
$$\frac{4.25}{.004} = .200$$

order parts
draw scope test
V_{intr-rec}



1/8/54

Saw tooth Gen.

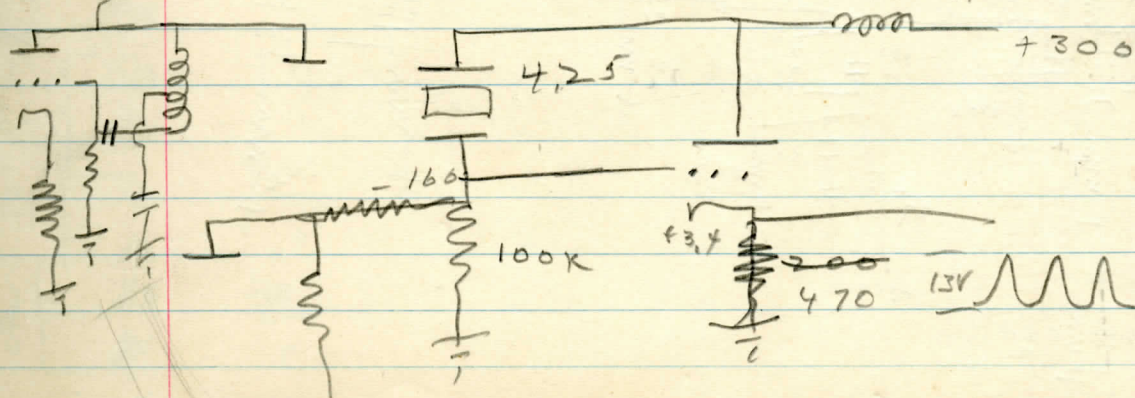


Federal
1159
Mallory
8535

Pulse ckts look fairly good - Tubes
~~are~~ seem to be capable of
operation beyond their ratings -
Saw tooth looks good without
jitter -

Time fiducial —

pulse shape should be sharp
2.5ms



looks good but hard to stop + start

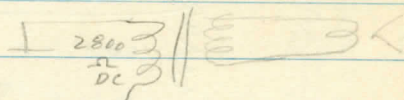
Minifon Recorder

Phone ~~O.P.~~ ~~imp~~ $= 100 \Omega$ O.D.

Resistor code

$$Wh - X 10^5$$

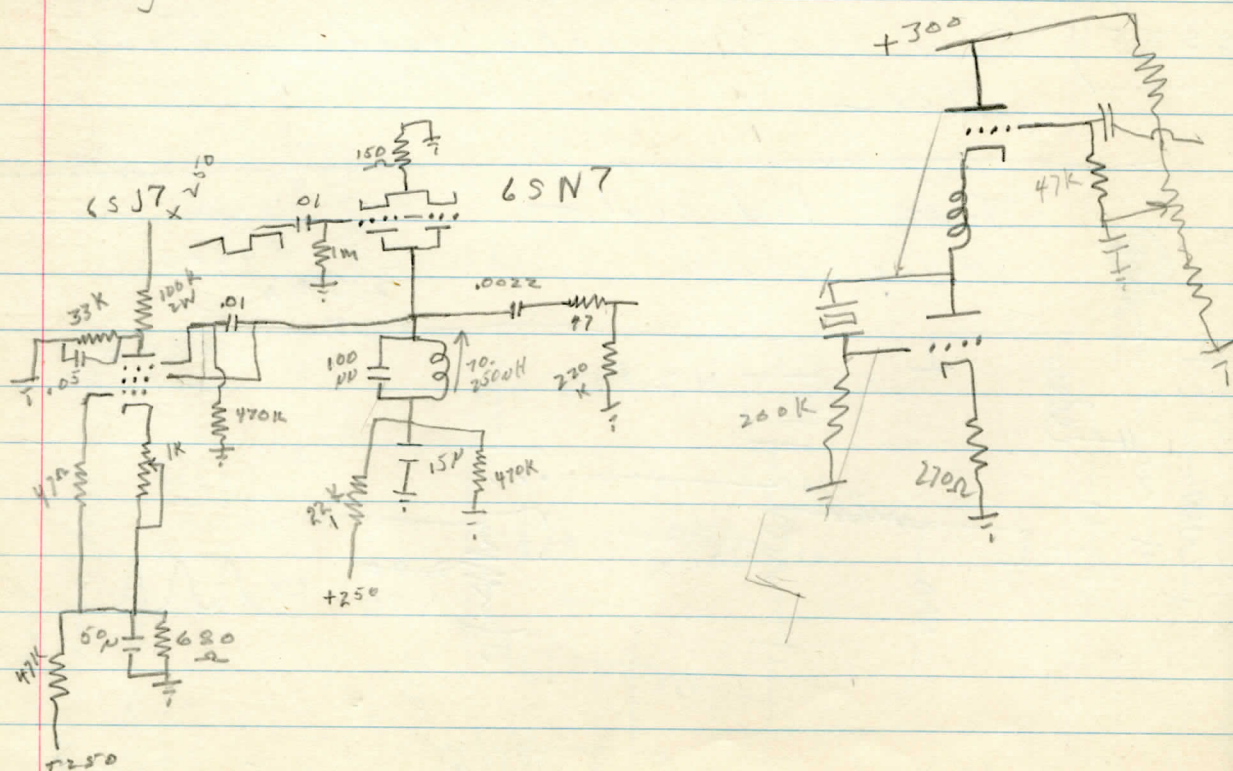
B10-X 10^3



$$\frac{1}{6 \times 10^6} + 6$$

$$1 = 900 \mu\text{sec} \quad 2\text{way} = 450 \mu\text{sec}$$

Try insect markers



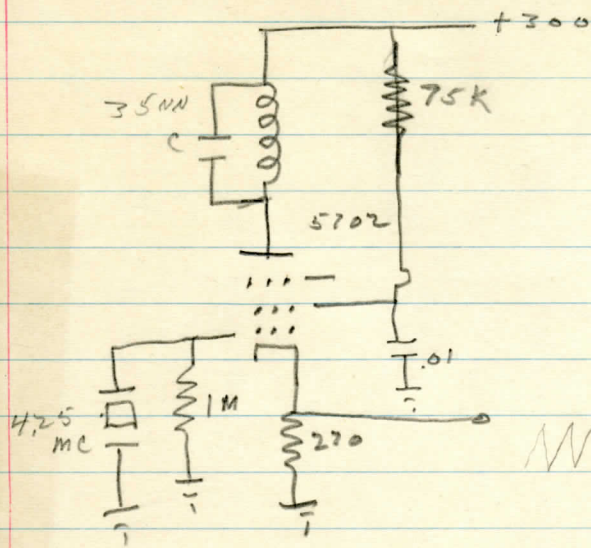
$$\cancel{75 \times 10^{-3} \times} .075 \times .01 .007500$$

$$T = RC$$

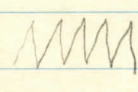
$$\frac{1 \times 10^{-6}}{15 \times 10^{-12}} = \frac{15 \times 10^{-12}}{15 \times 10^{-12}} = 1 \times 10^6$$

$$\frac{12}{4} \times 10^{-6} = 3 \times 10^{-6}$$

	#	Wave form	int	F	time	Film	Swamp rate	timet.
e ₁	18		slight halo	3.6	1/30	L	13 KC	1 wsec
F ₁	19		"	"	"	"	"	"
g ₁	20		"	"	"	"	"	"
g ₂	D		"	"	"	"	"	"
g ₂	#	"	"	"	"	"	"	"
b ₂	2		"	"	"	"	"	"
b ₂	3	"	"	"	"	"	10 cps	"
c ₂	4		"	"	"	"	"	"
c ₂	5	"	"	"	"	"	"	"
c ₂	6	"	"	"	"	"	"	"
d ₂	7		"	"	"	"	"	"
e ₂	8	?	"	"	"	"	"	"
F ₂	9	mm	"	"	"	"	"	300 KC

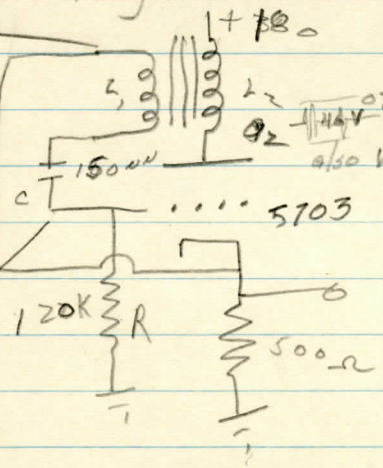


ckt look pretty good
falls out of oscillation
with very low screen
volts + shifts of e_1

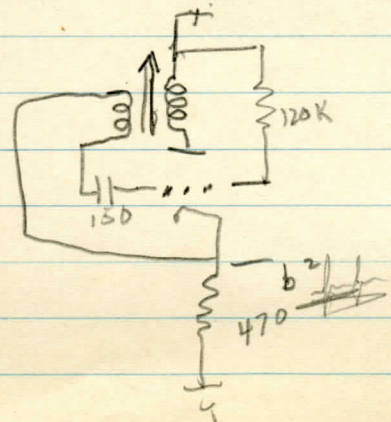
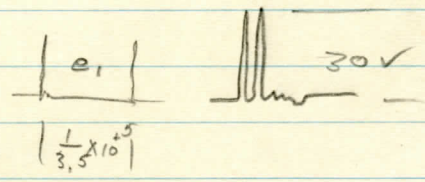
 scope photo e_1

Blocking Osc - 1mc

Nation
slug tuned
coil form
wound with
2 single
layers (50 turns)
#30 enam wire



check various values
of C & R
also waveforms at various points



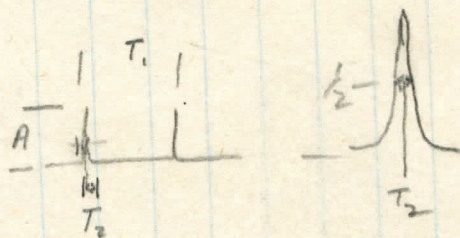
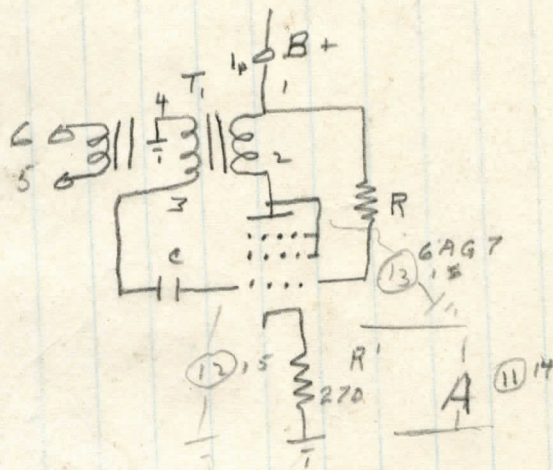
wave forms about the same
freq. increased from $\frac{1}{3} \times 10^5$
to $\frac{1}{4} \times 10^6$

Marker Gen.

Blocking Osc.

obtained B.F. block Xfmr.

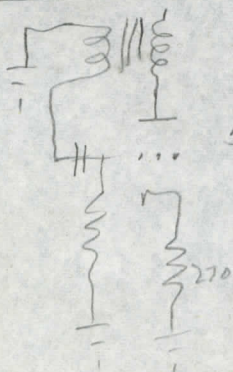
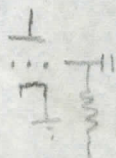
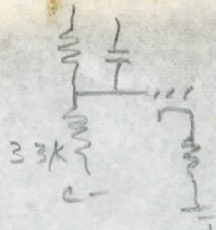
$$T_1 = 7471954$$



B+	R	C	T ₁	A	I _p	T ₂	Picture
200	33K	100n	$\frac{9}{4} \times 10^{-6}$	$\frac{V_{olts}}{62.5}$	35 ma	$\frac{1}{2.5} \times 10^{-6}$	11, 12, 13 F 3.5 $\frac{1}{30}$ L
200	41K	30n	$\frac{9}{4} \times 10^{-6}$	50.0	28 "	$\frac{1}{2} \times 10^{-6}$	14, 15 K "

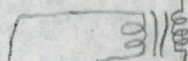
Extremely hard to start + stop - with R+180
it cuts off sharply at -180 cuts in at
-175 - cuts in + out sharply - frequency
shifts drastically as f (voltage)

2.2

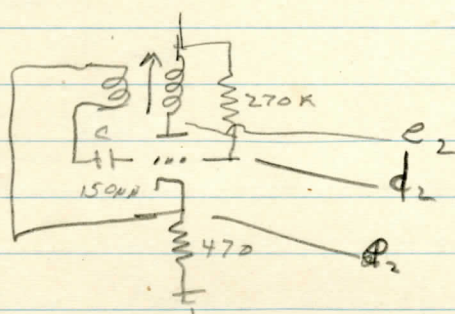


looks about the same as
5703 the same as above ckt
except for proportionat
lower -

biased osc

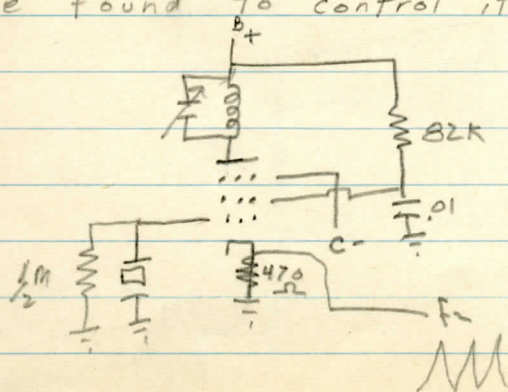


When tube conducts it is accompanied by an oscillation which apparently begins shortly before firing & continues for 5 or 6 cycles ~~and after~~ and is damped out shortly after cutoff - It has an apparent period of $4 \mu\text{sec}$ this freq. seems to be low for osc. of Xfmr which is resonant about 8 mc. -



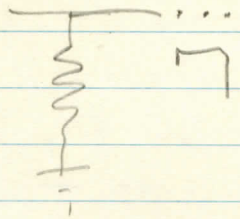
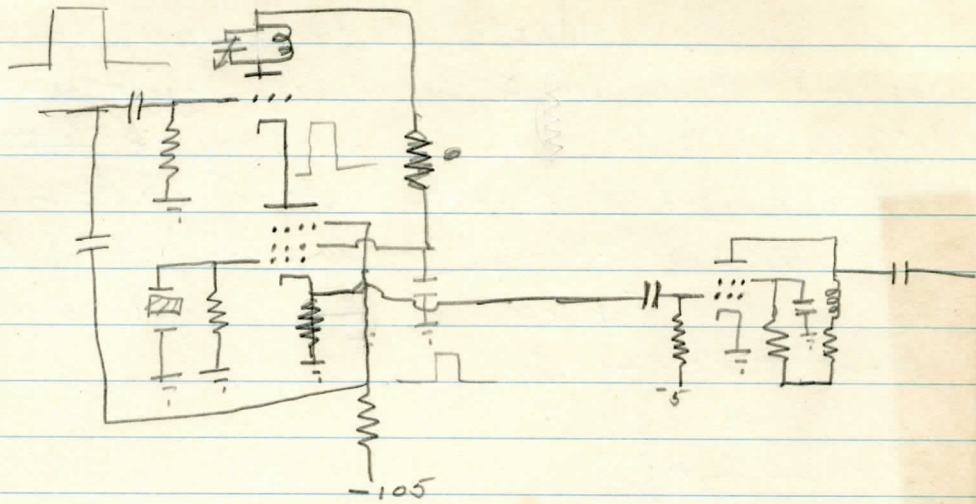
When c is reduced sufficiently ^{to bring RC $\approx$ 1 μsec} , ckt breaks into osc at the frequency noted above - it may be possible to get osc. at this freq but it is extremely difficult with this tube -

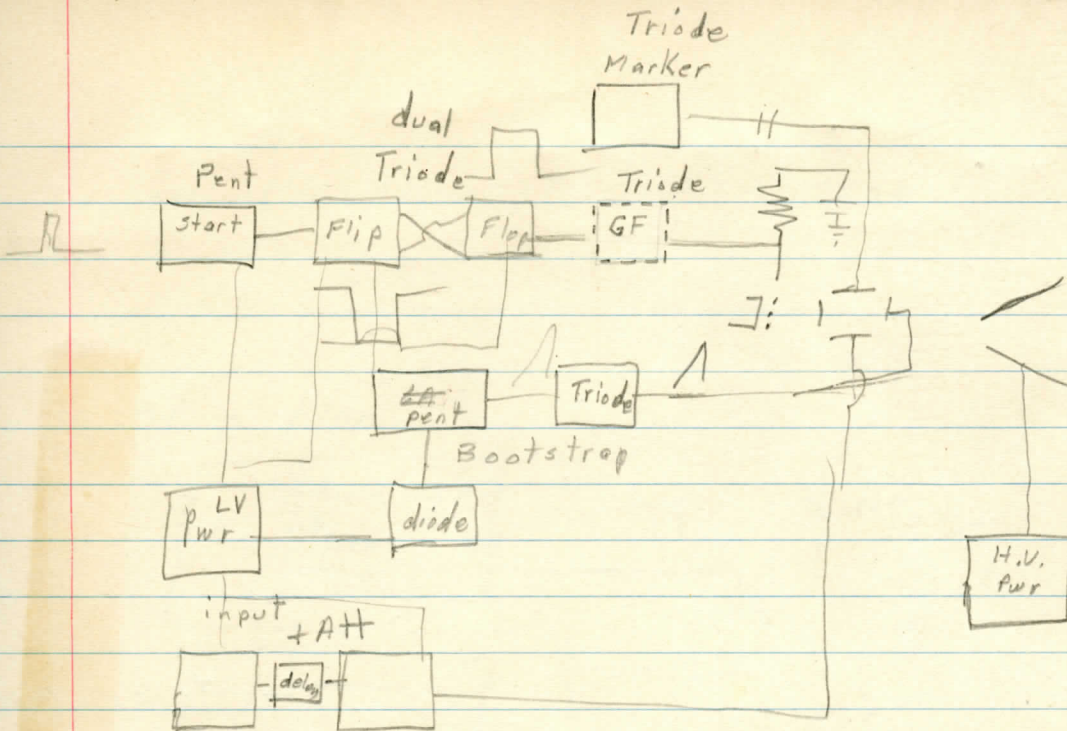
Concl: of all the ckts tried the Xtal. osc looks most promising - some way must be found to control it.



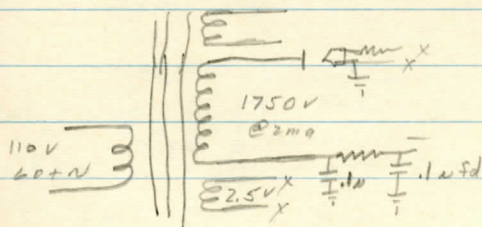
With this ckt. $B+ = 300$
the tube can be cut
off suppressor wire at
-105 - $B+200$ - 90

Trig  Flip flop 





Scope Power Supply



Tubes

1V2

1X2

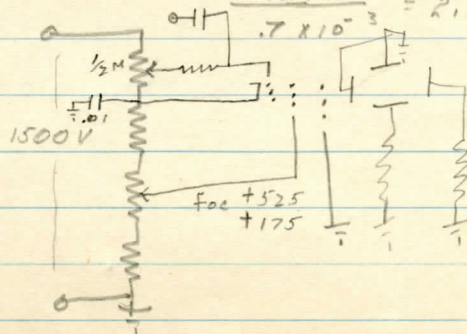
2X2

C.R. Tube ckt-

1.3 ma tube current - Pwr Xfmr. = 2.0 ma.

7 ma bleeder

$$\frac{1.5 \times 10^3}{.7 \times 10^{-3}} = 2.14 \times 10^6 \text{ ohms max.}$$



$$10 \times 10^4 \times 1.5 \times 10^{-12} = \frac{1}{1.5 \times 10^{-8}}$$

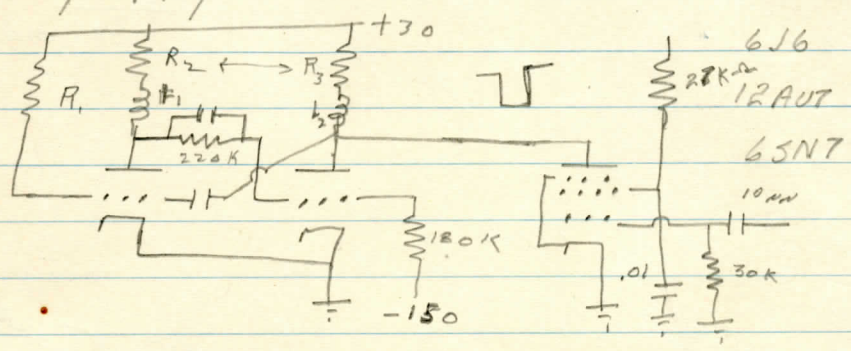
$$= \frac{1}{.015} = .66 \times 10^8 = 66 \text{ M}$$

$$\frac{100}{4.3 \times 10^2} = 2.5 \times 10^3$$

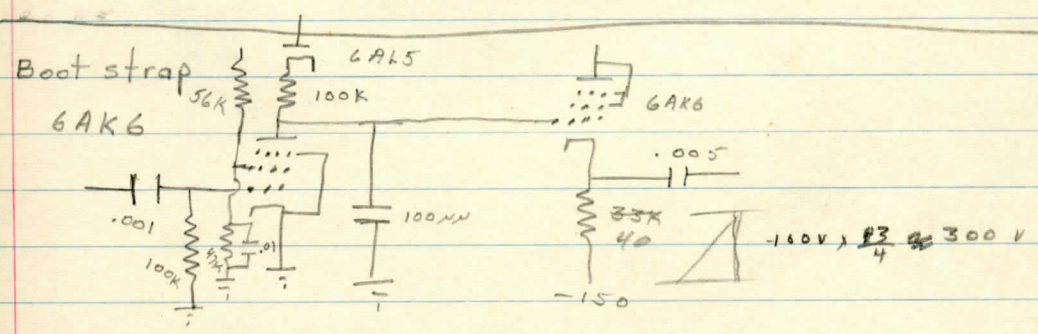
$$.001 \times 1.1$$

deflection factor $70 \frac{V}{KV} \times 1.5 \times 3'' \approx 200 V.$

Flip-flop



Try 6J6's | Varying R_1, R_2, R_3
 + 12AU6's | effects of shunt reactance on μF .

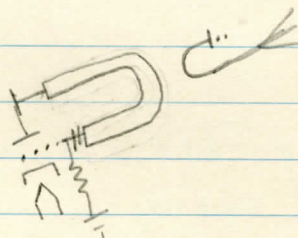


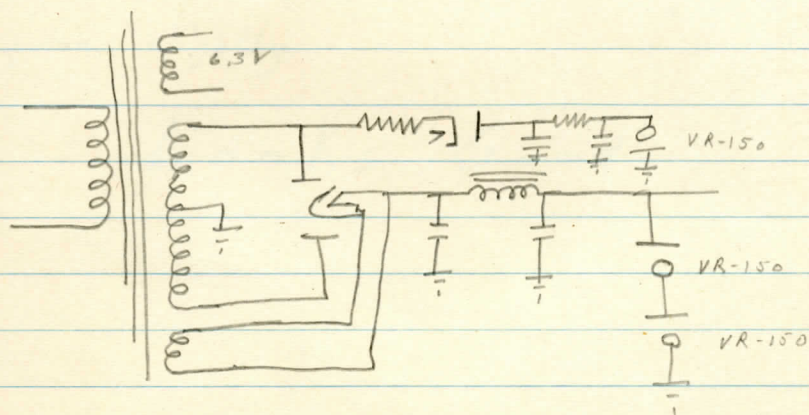
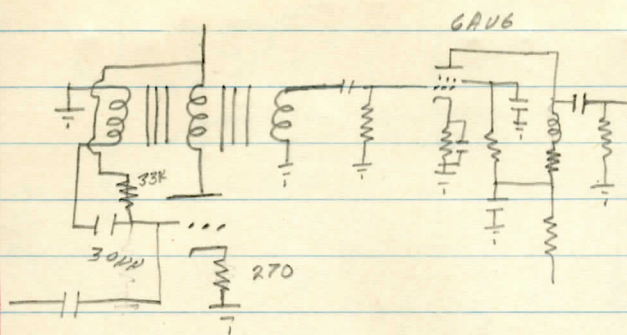
Try 6AK6's in ckt.
 Looks Good —

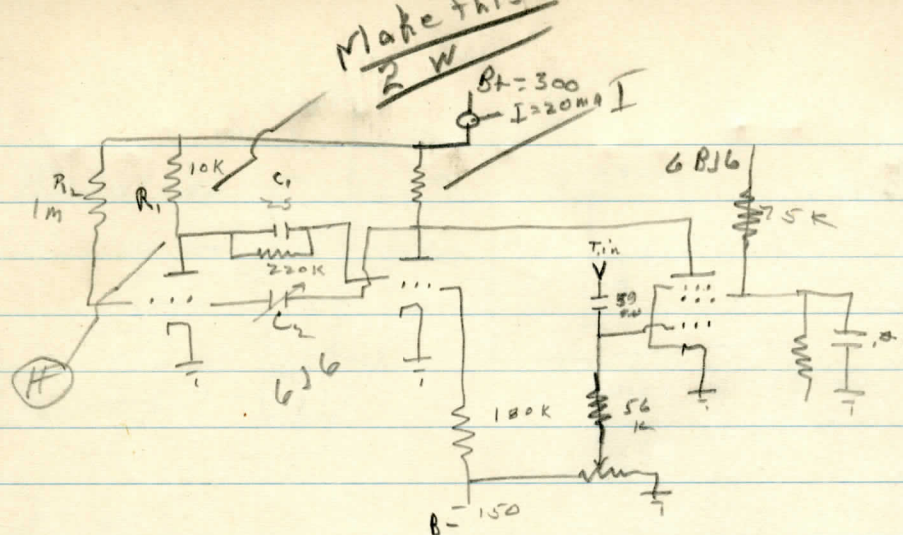
K
L
M
N
O
P
Q
R
S
T
U
V
W

$$\frac{3 \times 10^{-2}}{10} = 3 \times 10^{-3}$$

Flip Flop	15×10^{-3}
Bootstrap	5 x
B. osc.	30 x
Reg	20
axis	10
	80 ma-







Photos #

#18 - C₁ = 25nF

#19 - C₁ = 5nF

#20 - C₁ = 0nF

#21 300nF in

series

#22 with R₁

#23 overdriving

2 with input

#24 normal

500nF

#25 1 present

C₁ = 5nF

#26 " 1

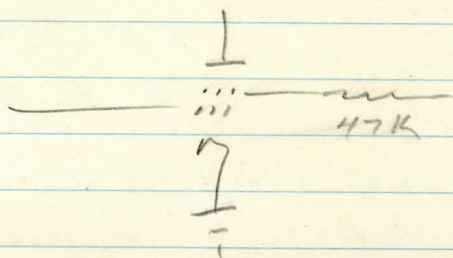
decreasing R₁ shorten pulse (R₁, C₂ becomes smaller)
 a pulse increases slightly in amplitude - has little
 effect except to sharpen leading edge of neg
 pulse slightly

Looks Good

L
M
Mc
N
O
P
Q
R
S
T
U
V
W

Poss.

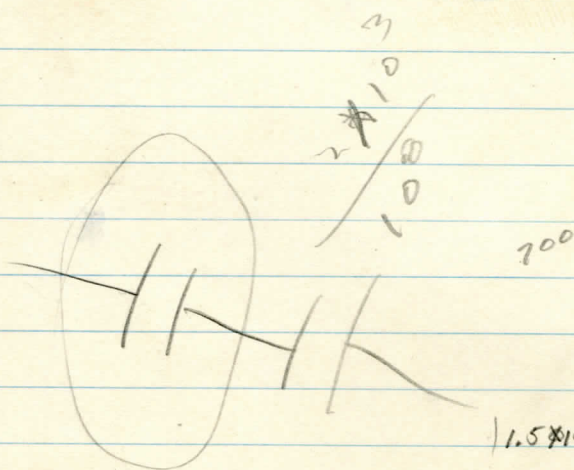
Scaling ckt for trigger -



$$\begin{array}{r} .3 \overline{) 1.0} \\ \underline{.3} \\ .7 \end{array}$$

$$\begin{array}{r} 15 \\ \underline{3.5} \end{array}$$

$$\frac{10^3}{100 \times 10^{-4}} = 10^7$$



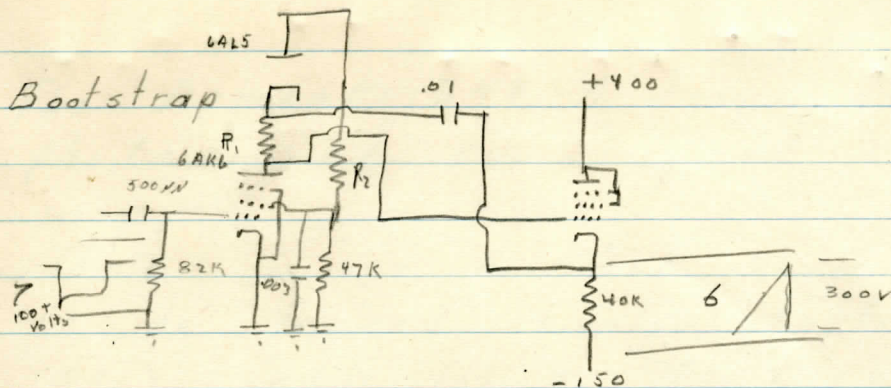
$$\begin{array}{r} 22000 \\ \underline{15000} \\ 7000 \end{array}$$

$$\frac{2 \times 10^2}{2 \times 10^{-3}} = 3.5 \times 10^5$$

$$\begin{array}{r} 2 \times 10^5 \\ \underline{2 \times 10^{-3}} \\ 4000 \end{array}$$

$$1.5 \times 10^3$$

$$\frac{1.5 \times 10^3}{2.5 \times 10^{-3}} = 6 \times 10^6$$

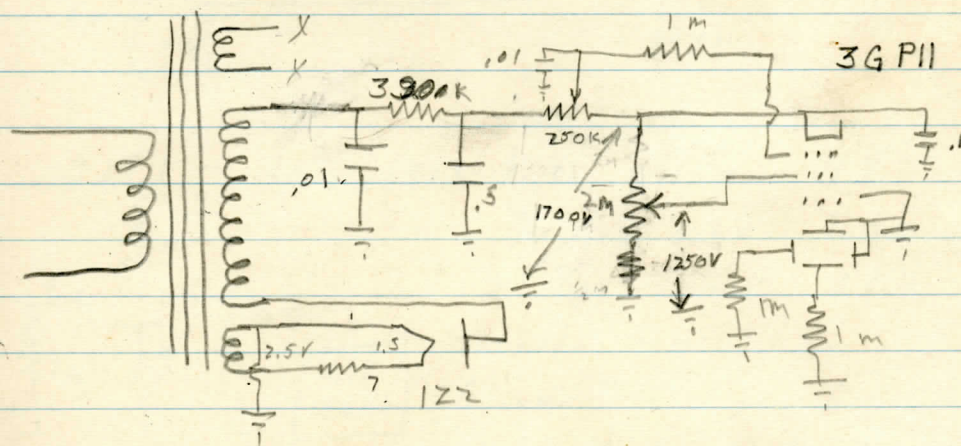


Photos $R_2 = 24$ K

6 - sawtooth

7 - input $\left. \begin{matrix} \text{trig} \end{matrix} \right\}$

Scope Pivr



This tube does not focus very well, trace is fairly bright - ~~Specs call for 350 ± 350v on 1st Anode but 2 tubes would not focus with less than~~ With G.R.

H. speed camera running at approx
300" sec this scope was phot'd
with a 12 μ sec trace + p.r.f. of 2 KC. (class
L film developed in positive fonda)

	Photos	3. Sweep	Phosphor	+ Volt -	Film speed
#1	Rep Rate 2KC	12 μ S	P-1 Bright	2KV 2KV	XX
#2	500 cps	"	" "	" "	XX
#3	2KC	"	" "	2KV to 4KV "	Lin Pan
#4	"	"	" "	" 2KV	Photo Fluor

MC

N

O

P

Q

R

S

T

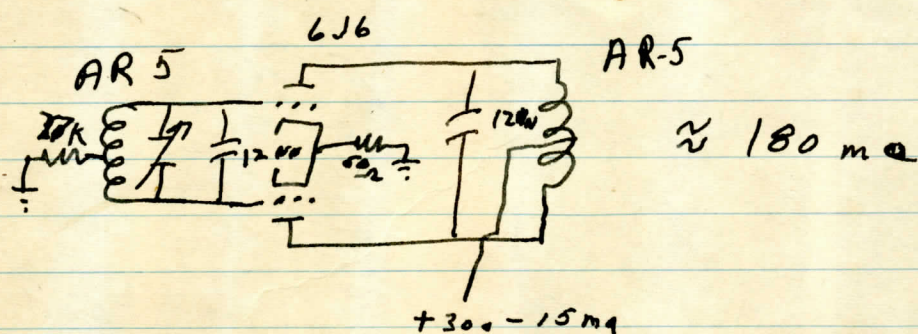
U

V

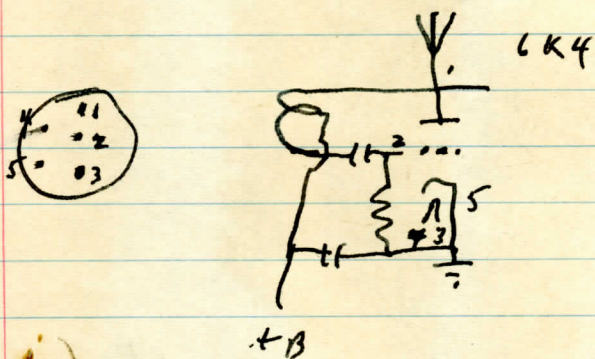
W

CKT. does not ~~seem~~ to work with this ~~BU~~.
 " is sens to changes in cap in grid -
 Meth: Beat a 1cc BFO against it -

Try 6J6 at 100 m.c. - FM with Cap
 p.u.



Picked it up with S-27 rec - circuit was
 stable - tube more microphonic than
 microphone - mika sensitive only if
 tapped on diaphragm - Larger Mike?



A

B

C

D

E

F

G

1/20/54

GSAP c/l

Film devel.

in positive

fanda.

31 P1 scope

with 4 KV

acc. pot

12 μ sec

sweep

with prf

of 2 K.C.

stationary

targets

f-2.7

low inten

Hi inten

32 fps

32 fps

16 fps

16 fps

16 fps

Med inten

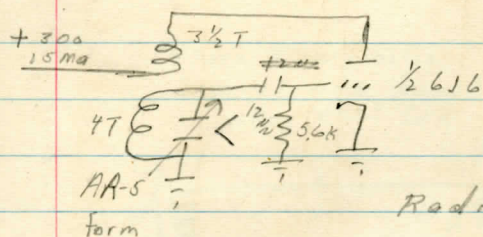
Hi inten

low inten

Med inten

Hi inten

1/18/54 Threw an FM ckt together



Had transducer Air Gap Reduced
to 10^{-3} —

CKT looks good Fair

Radiates all kinds of harmonics still

Strong to the 5th — Fund. $\approx$ +70 mc

Pick up is fairly sensitive —

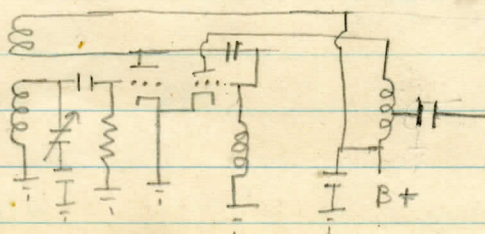
Repair M-1 A scope

Repaired A' scope - Insulation was breaking
down on Hi-Voltage - Relocated Components -

A queer defect arose - on short sweeps (1-4 μ secs)
the beam can be focused precisely but on longer
sweeps it defocuses as a function of
sweep length - Everything looks good -
took photos with APS-23 - see op. page
changed cameras

Less than 1 week to build Xmr
+ rec for S.P.U.

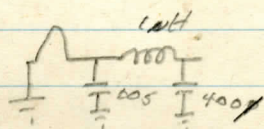
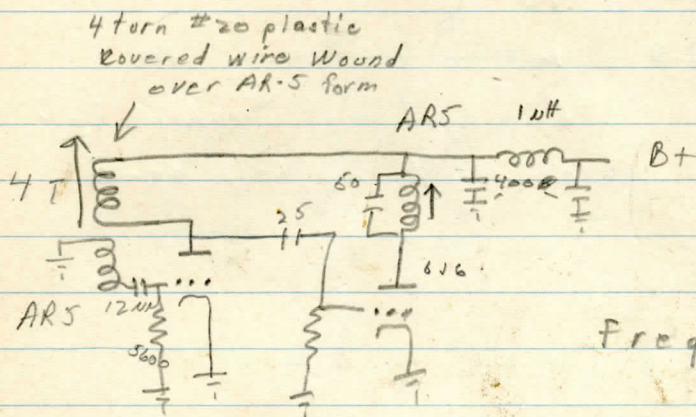
F.M. Xmr. for 89.5 Mc.



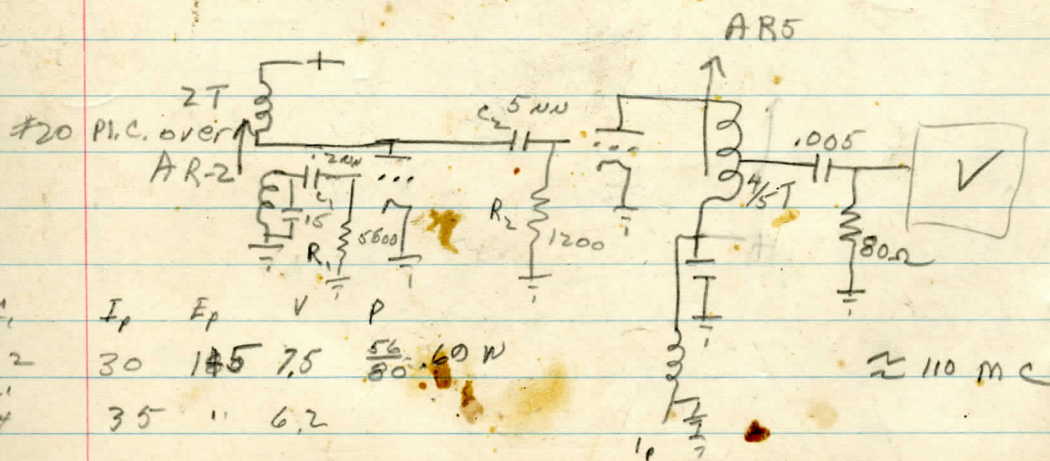
N
O
P
Q
R
S
T
U
V
W

1/22/53

Investigate properties of various components
for F.M. T.T. Xmr., configuration etc-



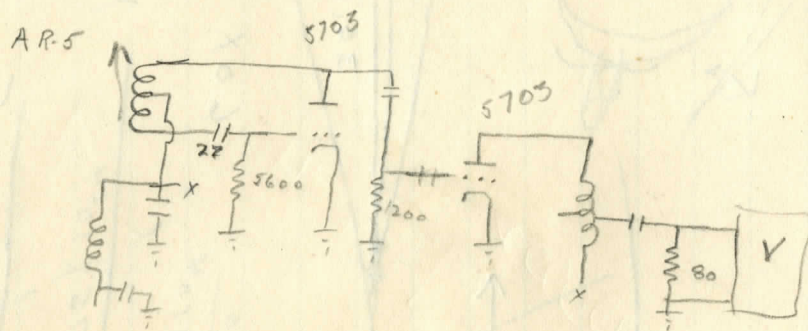
osc seems to work O.K. ~~with~~ but trouble
in obtaining appreciable power output
only about .25 watt with 185 V-



	C	I _p	E _p	V	P
180	12	30	145	7.5	$\frac{56}{80} = .60$ W
.03					
5.40	C				
	24	35	"	6.2	
	6	31	"	5.8	
R ₁					
12800		32	"	8.2	$\frac{67.5}{80} = .845$
R ₂					
5600		22	"	5.6	
R ₂					
5600		30	190	8.4	

N
O
P
Q
R
S
T
U
V
W

Try different coil arrangement on Xmtr.



Varying ^{reactance} loads on output cause drastic Freq. changes -
Power o.p. high - 130 V @ 30 ma in - $\frac{1.1}{80} = \frac{1.21}{80} = 1.5 \text{ watts}$

Built same ckt using a pair of 5703's pwr + in 130V @
out $\frac{10^2}{72}$ eff $\frac{1.39}{3.9} = 35.6\%$

$$\begin{aligned} & \frac{1}{2\pi f C} \\ & = \frac{1}{6.3 \times 10^8 \times 280} \\ & = \frac{1}{12 \times 10^8} \end{aligned}$$

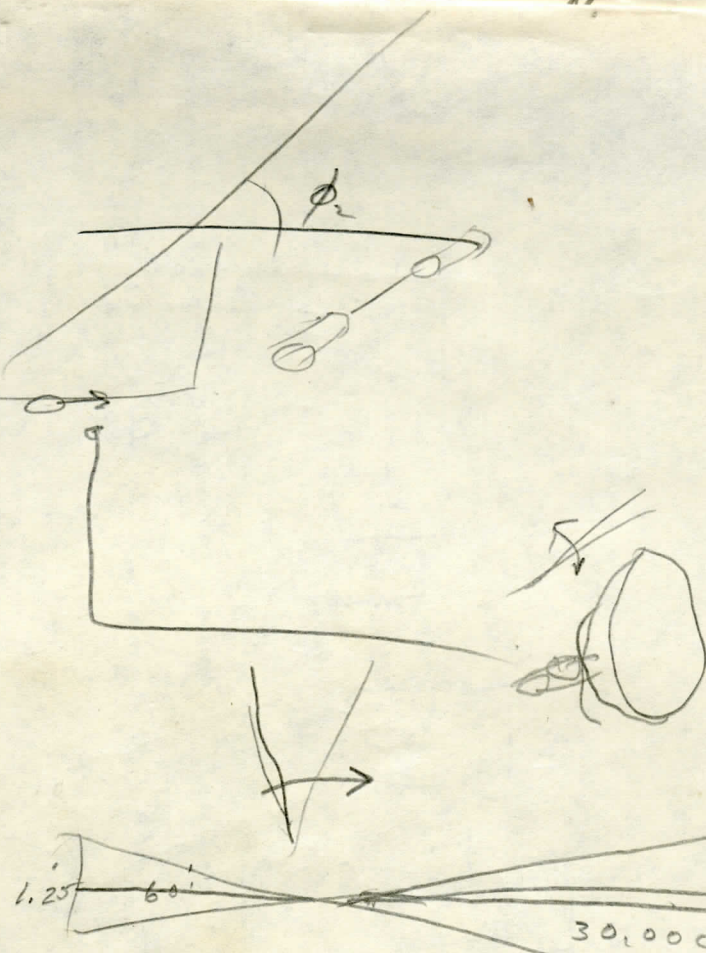
$\frac{1}{23/54}$

$\frac{V}{R} = \frac{I}{\omega L}$

6.4	26	145
7.7	30	170
7.2	29	145

101

FF
-
10
p



$$\begin{array}{r} 5 \times 2 \\ \hline 3 \times 10^4 \end{array}$$

$$1.25'' \frac{1.25''}{x} = \frac{6.0}{3 \times 10^4}$$

$$60X = \frac{1.25 \times 3 \times 10^4}{100}$$

$$60X = \frac{1}{3.75 \times 10^4}$$

$$X = \frac{3,75}{60}$$

5×10^5

110

$$x = \frac{1}{6 \times 3.75 \times 10^5}$$

$$= .05 \times 10^4$$

$\times 10^5$

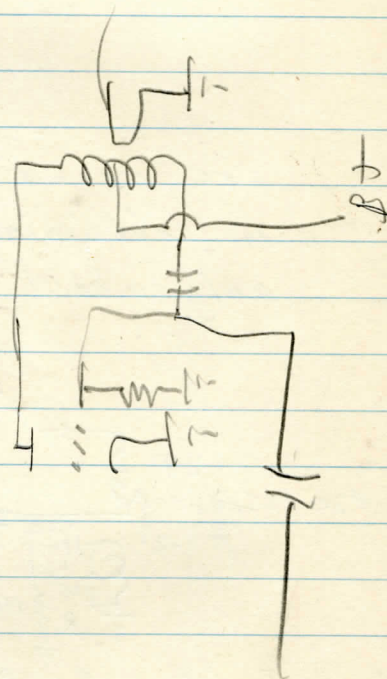
$$\frac{5104}{21} \times 10$$

$.044 \times 10^{-5}$

1500

Power out watts	V Volts	$\frac{1}{m\mu}$ osc per Tot	K_p ohms	K_1, K_2 var	C_1, C_2 var
6.4		26	145	3000	
7.7		30	170		
7.2		29	145		Var

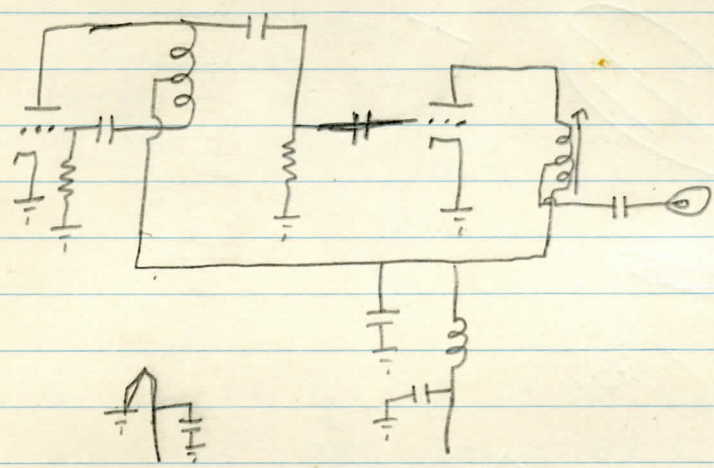
5 var seems to be optimum value for C_2 - inserting inductance in series with r_2 helps some



$$\begin{aligned}
 & \frac{1}{12} \times 10^{-12} \\
 & \frac{1}{6.3 \times 10^{-12}} \times 2 \times 10^{-12} \\
 & \frac{1}{2 \times 10^{-12}}
 \end{aligned}$$

Build practical ckt-

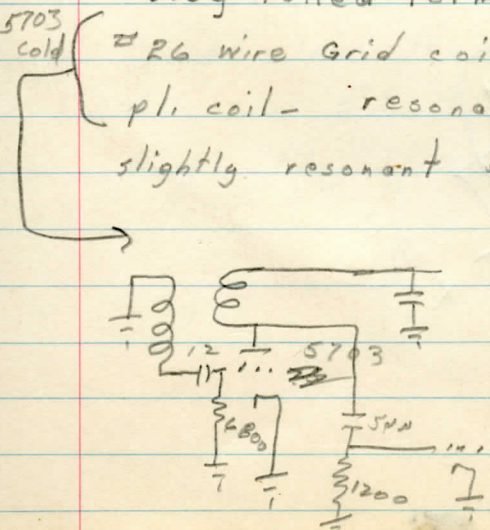
Use sub miniatures for spatial considerations, ruggedness,
+ absence of microphonics



Everything's wrong - osc. at 200 mc. No power unstable - Tapped ckt's - exhibit all sorts of tricks at least on this bread board -

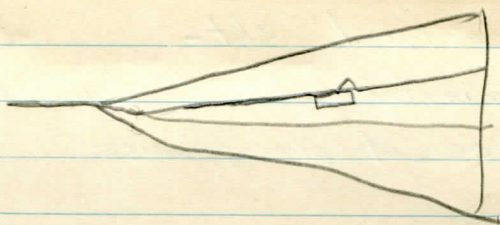
Try different coil forms + configurations slug tuned form $\approx$ 3 cm long - 1 cm dia 5 turns

5703 cold $\approx$ 26 wire Grid coil interwound with 5 + for pl. coil - resonant strongly at 61 mc slightly resonant at 95 mc - no other peaks present

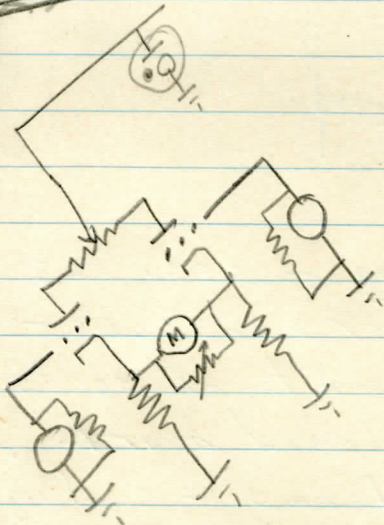
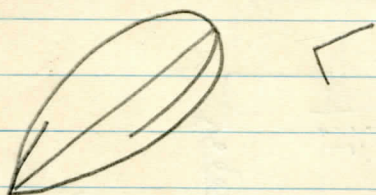


tubes cold with 500 + grid res + tube grid - sharp deep peak at 48 mc other 105 230 200 had peaks - same with tubes hot + cold -

P
Q
R
S
T
U
V
W



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

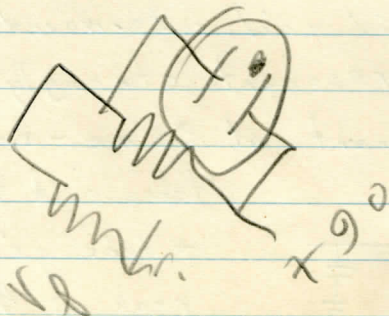
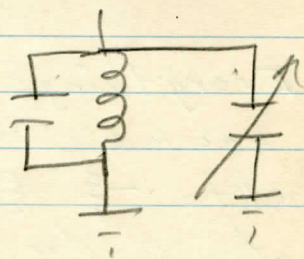


$$\begin{array}{r} 71 \\ 71 \\ 71 \\ \hline 497 \\ 5041 \\ \hline 73 \end{array}$$

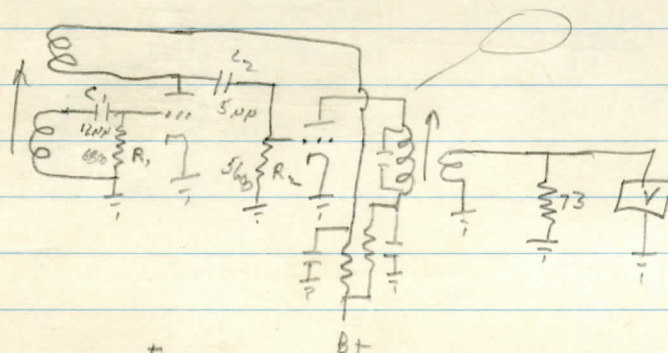
$$E = IR$$

$$E = \frac{3}{7 \times 10^4} = \frac{1}{10}$$

$$\begin{array}{r} 8 \times 10^{-2} \\ 64 \times 10^{-2} \\ \hline 73 \\ 192 \\ \hline 448 \\ 4572 \\ \hline 1 \end{array} \quad \begin{array}{r} 121 \\ 73 \\ \hline 363 \\ 847 \\ \hline 8833 \end{array}$$

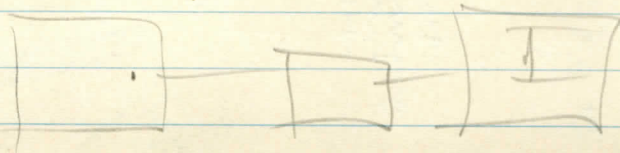
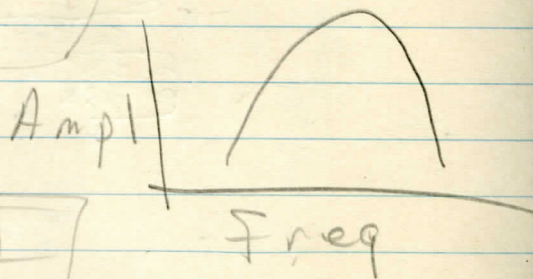
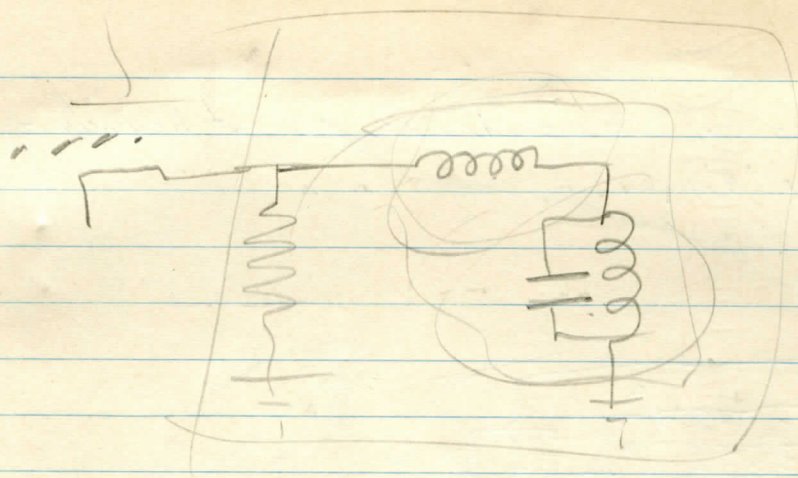


oscillates at 58 mc draws current heavily - clean on other freqs.



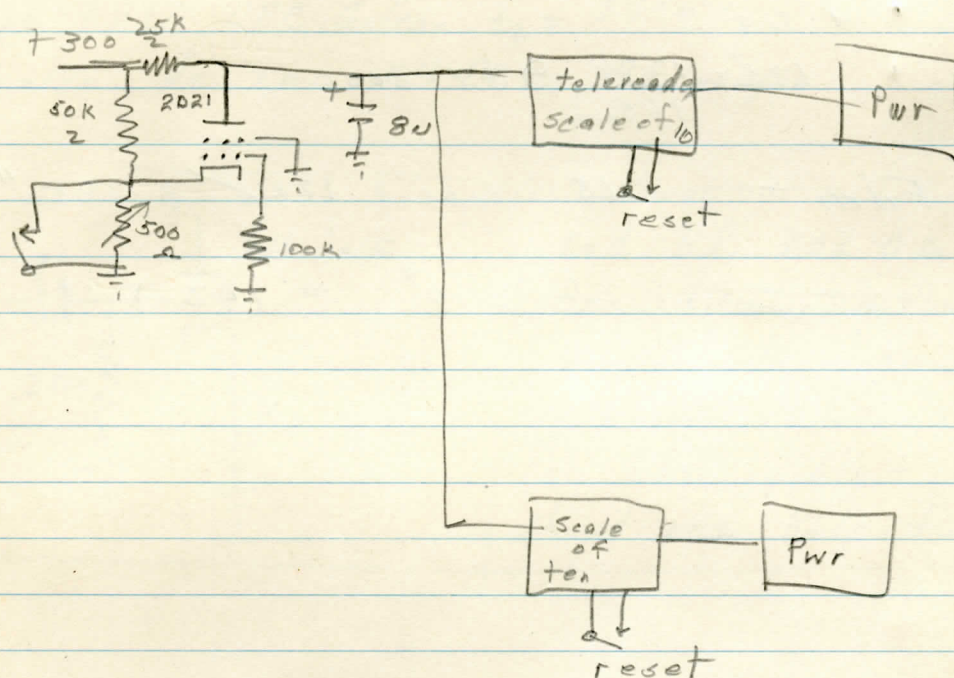
	V	$\frac{E^2}{R}$	I_p	Osc	RF	Tot m_a	R_1	C_1	R_2	C_2	B^+	e_{g1}	e_{g2}
Reduced osc 9 coil 1 turn	6.8					35	6.8K	12	0.6K	5	115	-26	-12
	6.8					36	"					30	18
	6.4					34				12		-27.5	-30

After all changes + adj. for optimum performance with condenser mike freq ≈ 50 mc ($B^+ 105 - A 6V \leftarrow$ dunk battery) pwr out ≈ 9 watts
 $B^+ 120$ pwr out 1.5 W - 1 dunk battery lasted less than 2 hrs - when ^{2 were} paralleled they run 5 hr + - B^+ lasts longer than A - they probably can be seriesed.



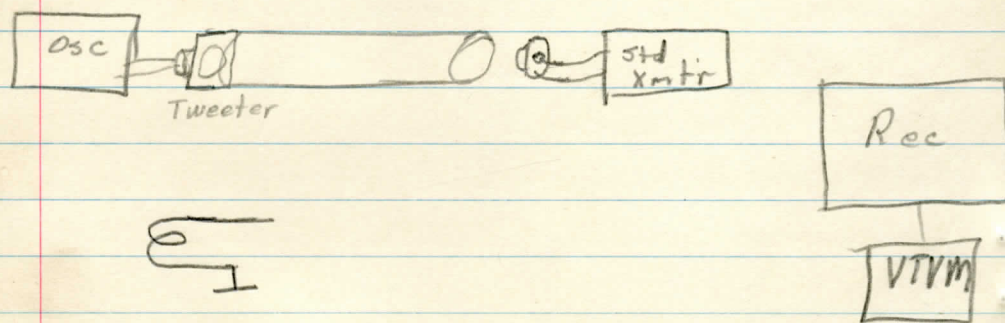
1/6/54

Set up Flip Flops as follows for demo. for camera timing -



Monday -

Test Freq response of mike



Redesign Mikes ✓

Test Freq. Response of osc. ✓

Build + Test Filters -

Tape

$$\frac{.016''/\text{sec}}{4} \times 1.7 \times 10^{-2} \text{ sec} = 27.2 \times 10^{-2}'' = .27''$$

$$125' \times \frac{12''/\text{ft}}{16''/\text{sec}} = 93.7 \text{ sec}$$

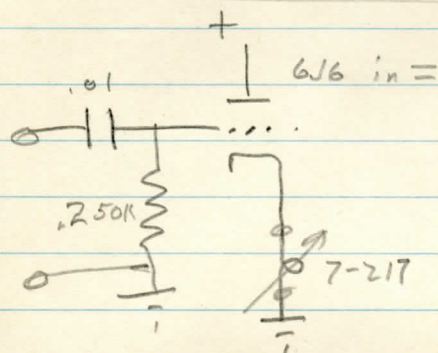
$$\text{Film} - 1.15 \text{ in}/\text{sec} \times 17 \times 10^{-2} = 1.95''$$

$$\frac{1}{70 \times 10^{-6}} = \frac{1}{.7} \times 10^4 = 1.43 \times 10^4$$

Run Tests to determine Freq. resp. of osc.

Type 7-217 CEC Galvo - $f_n = 3300 \text{ cps}$

Galvo dc res 24Ω - $40 \text{ m}\Omega/\text{in}$



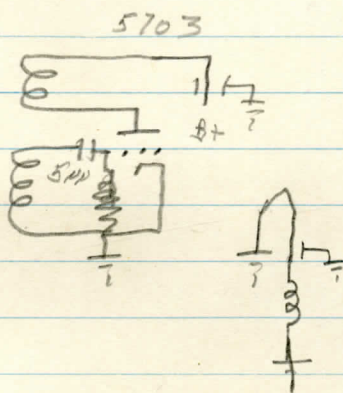
Fed H.P. 202 S.G. into
Osc. + visually observed
Amplitude - Response
to above 10 KC but
fell off rapidly - low
shunt res. helped -

Firm up on mikes

Construct standard ~~rec~~^{osc} -

Run freq dev. tests on various mike configurations -

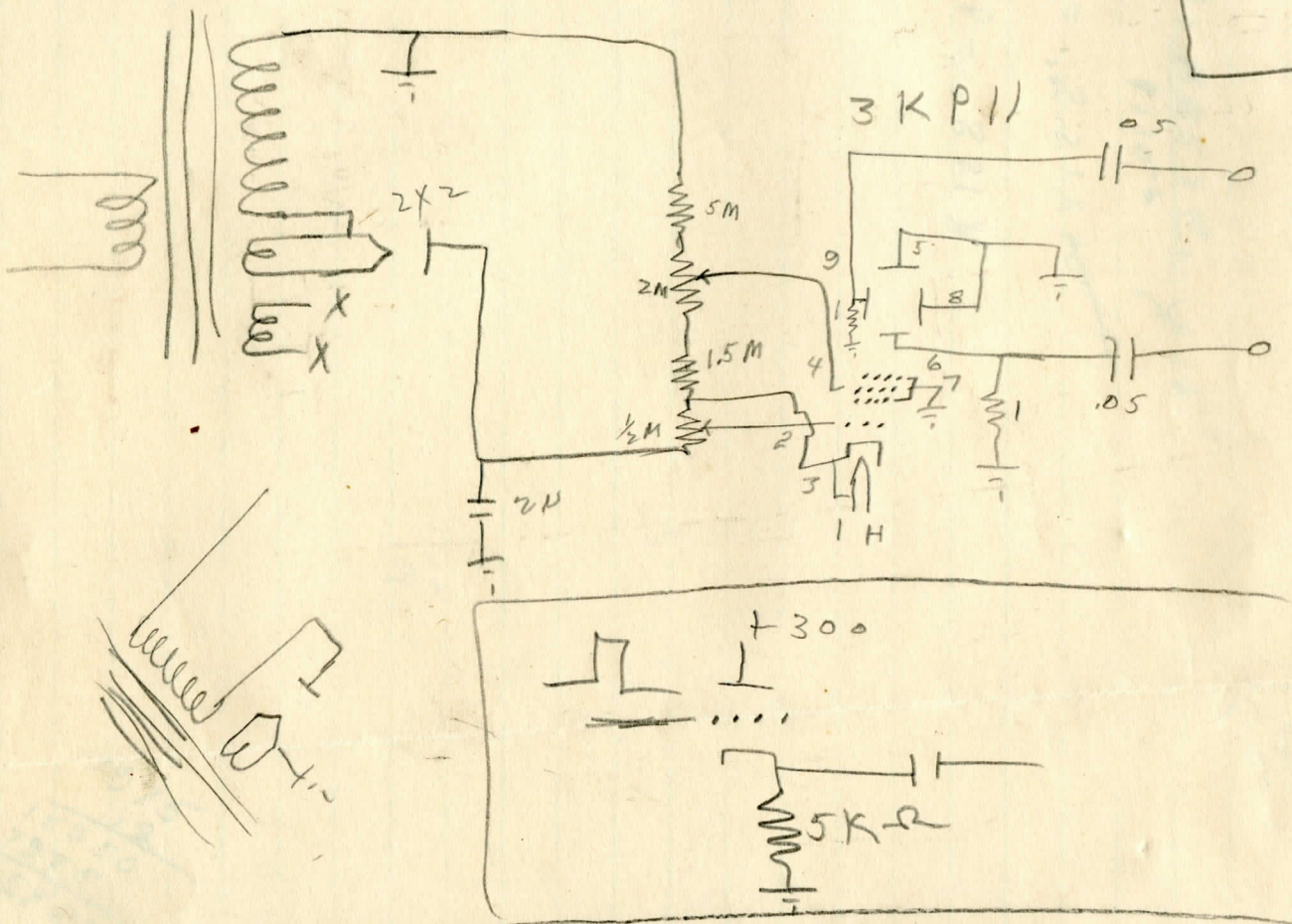
Stand - osc



$$\frac{25 \times 10^3}{10^4} = 2.5 \times 10^{-1}$$

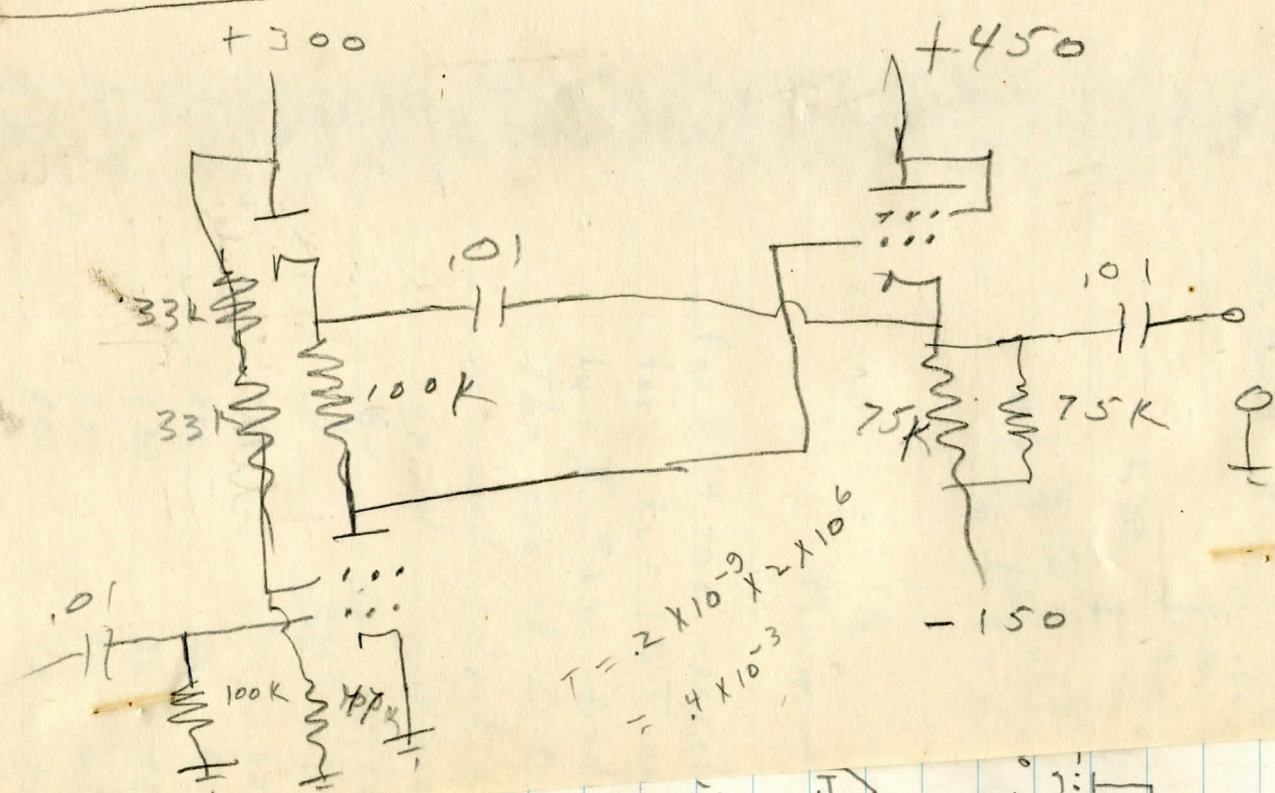
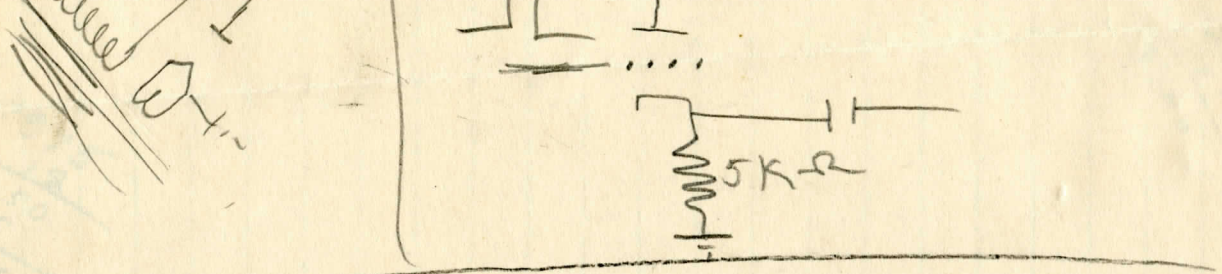
$$\frac{5 \times 10^3}{5 \times 10^{-5}} = 1 \times 10^8$$

Not
brilliant
enough



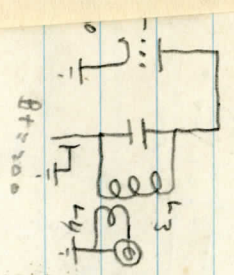
+ 300

+ 450



$$T = 2 \times 10^{-9} \times 2 \times 10^6$$

$$= 4 \times 10^{-3}$$



SPU M

ion $L_1 = 3\frac{1}{2} T$
 $\frac{1}{2}$ " dia & w L
 P.C.
 coils Has free
 efficiency -

at 50.5 A
 load
 .6 Watt
 1.2 "
 2.3 "
 3.1 "
 3.6 "
 4.6 "

Order Parts
5703 tubes

$$\begin{array}{r} 32 \\ 32 \\ \hline 64 \\ 96 \\ \hline 1024 \\ \hline 5600 \end{array}$$

$$P = \frac{8.85 \times 10^{-7}}{4 \times 10^{-6}}$$

$$= .2.21 \times 10^{-1}$$

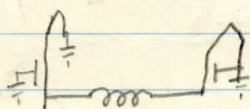
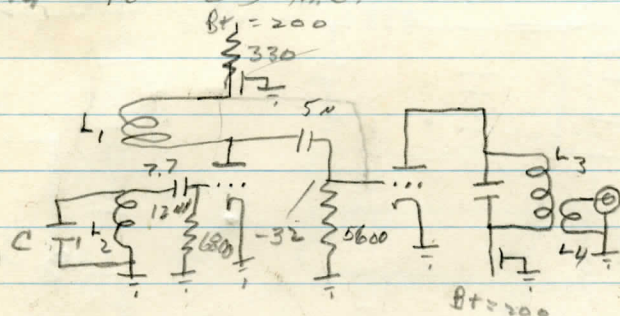
$$P = .221 \%$$

$$\begin{array}{r} 100 \\ 101 \end{array}$$

$$\begin{array}{r} 7975 \\ 15950 \\ \hline 29750 \\ \hline 95700 \end{array}$$

ReBuild to 89 mc.

SPU MII



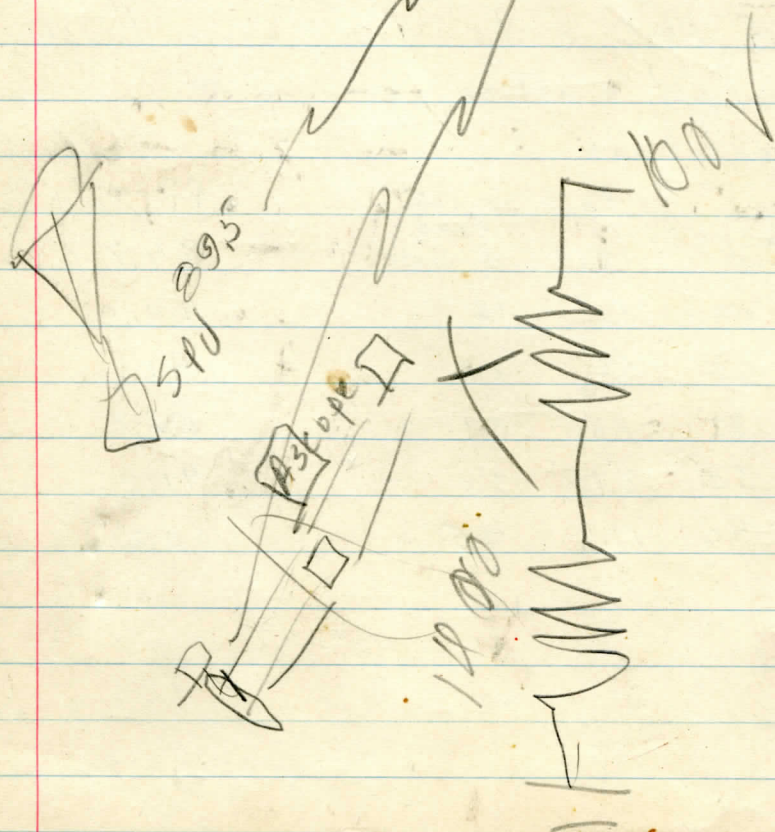
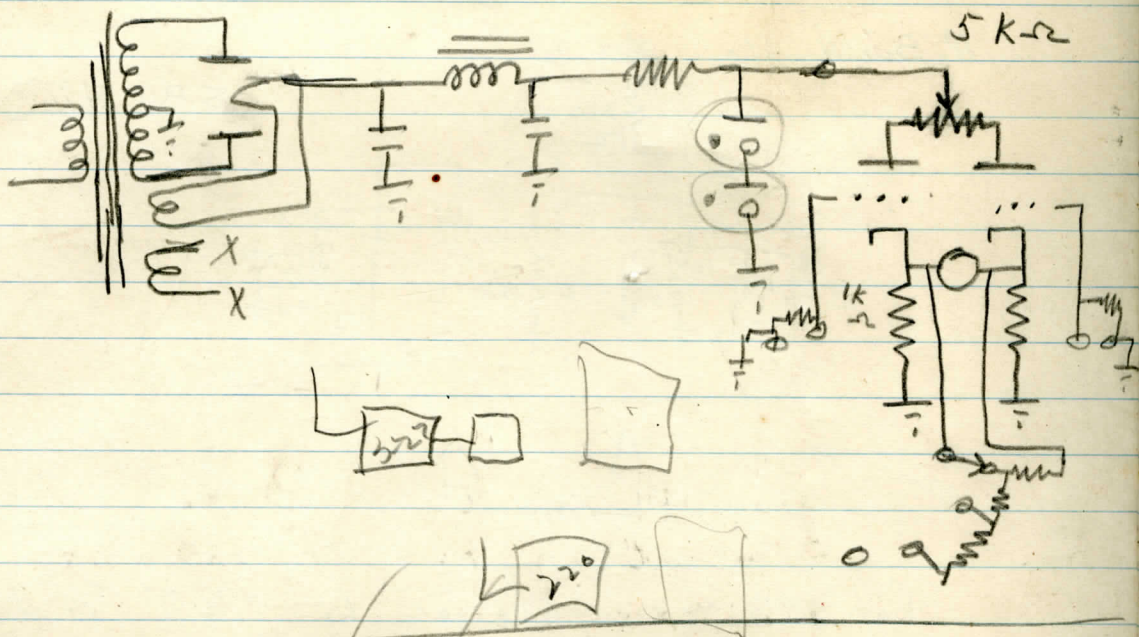
For 89 mc operation $L_1 = 3\frac{1}{2} T$ $\frac{3}{4}$ " dia On B+W
for $L_2 = 1\frac{1}{4} T$ on $\frac{1}{2}$ " dia B+W $L_3 = 7\frac{1}{2} T$ on $\frac{1}{2}$ " B+W
 $L_4 = \pi$ #22 strand, P.C.

The use of Hi Q coils Has tremendously increased output + efficiency -

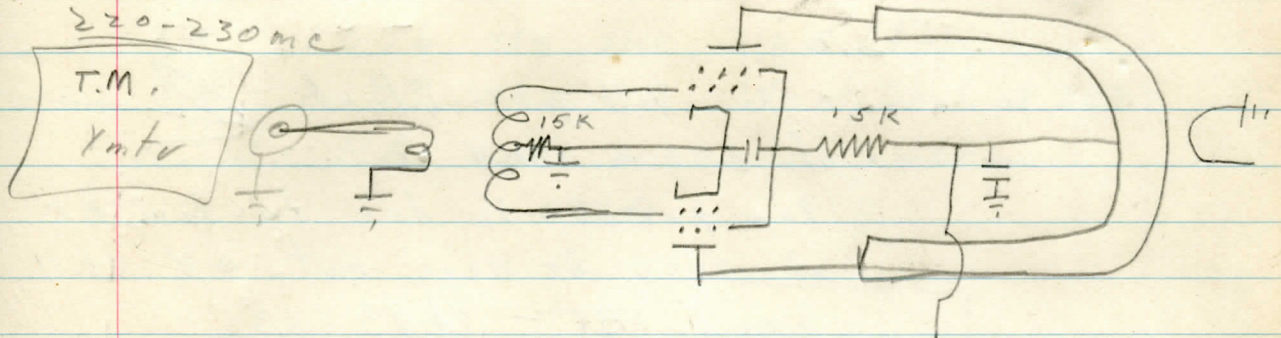
Typical conditions

B+	I_p	P_{in}	P_{out}	50.5 Ω load	eff %
V	$\times 10^{-3}$			Watt	
115	15	1.725	.6	Watt	34.7
150	20	3.0	1.2	"	40.0
200	28	5.6	2.3	"	41.1
230	32	7.36	3.1	"	42.2
250	35	8.75	3.6	"	41.2
280	40	11.2	4.6	"	40.2

R
S
T
U
V
W

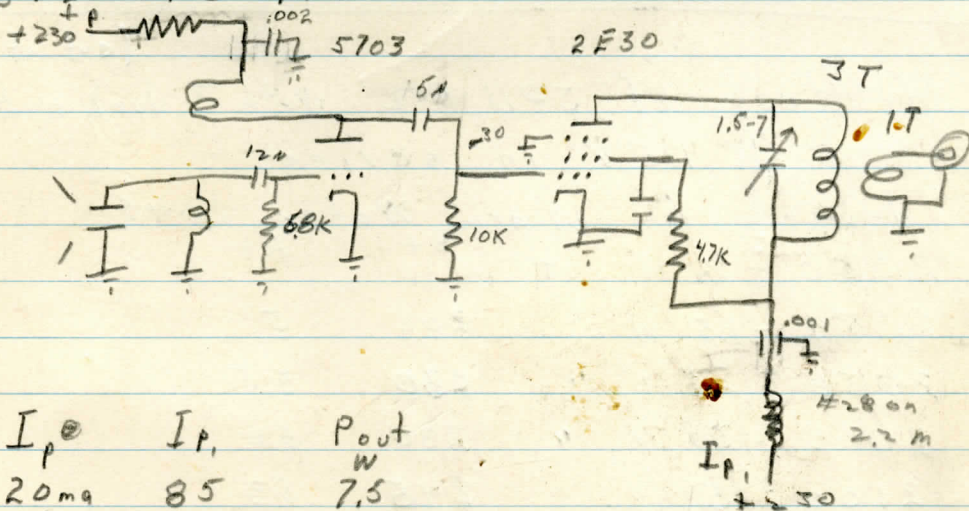
$2 \times \frac{1}{13}$


Build Pwr Op Stage For T.M. Xmitter



Q-bars of $\frac{1}{2}$ " Cu tubing were hard to set up Using lumped inductance 10W was obtained

Test JPU-M.3



R
S
T
U
V
W

$\frac{1}{2} \times 10^{-6} \times 12 \times 10^6 \times 3$
 $\frac{1}{36} \times 10^3$

$10^{-3} \times 25 \times 10^6$
 25×10^3

Voltage stabilized
at 6.25 + 190 V

low power is due to low Bt
at 2036 Bt went out 6V still
good 6.3V - 2049 6.3

2201 6.3

2256 6.25

2220 6.20

2235 6.00

(out of newly opened
life test of SPU M-2 with 3 dunk batteries carton)
6V in 11 115V in series

dunked in Warm Water 2045

2050 - 1/2 W out Bt At

2054 - 1.5 W " 205 5

2056 - 2.5 " " 230 5.5

2058 - 3.5 " " 230 5.6

2100 - 5 " " 245 5.9

2102 - 6.5 " " 250 6.

2103 - 7.5 " " 265 6.15

2105 - 8.5 " " 270 6.2

2108 - 9.75 " " 272 6.2

2100 - 11.00 " " 280 6.3 4.7K res going west

2113 - 9.00 " " 286 6.3 3 repl res.

2117 - 12.5 " " 280 6.4

280
115

20
102
15.000
440

Life Test of SPU with 2 dunk batteries -
 dunked at 2035 1st O.P. Pwr Ind 2045

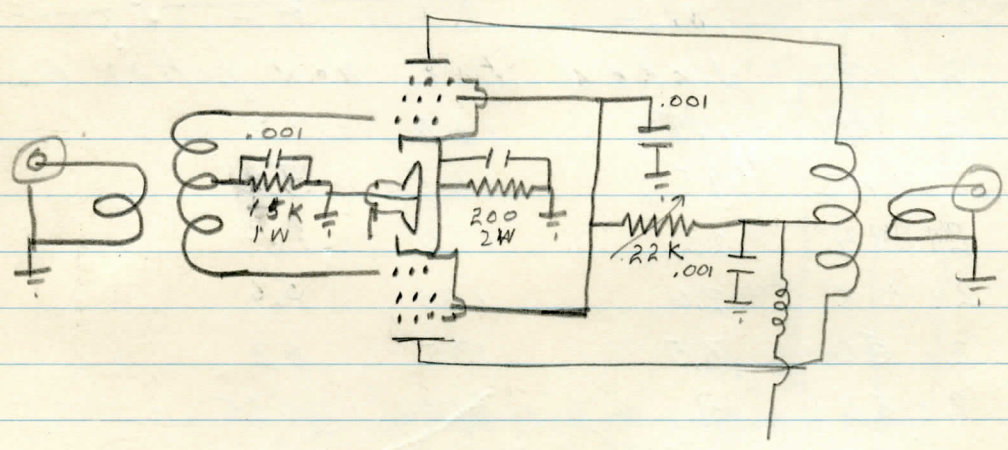
1 W - 2050 4W - 2110 4.6 W 2034

2 W - 2056 4.5 W - 2115 3.0 W 2036

3 W - 2103 4.8 W - 2120 Went Shot at 2037

Build P.A. For 220 m.c. xmtr -

832A



$$P_r = P_o \cos \phi$$

$$P_t = P_r \cos \phi$$

 W_{out}

2120	9,5	275	6,5
2125	9,0	265	6,5
2127	8,0	265	6,5
2130	7,5	265	6,5
2135	2 W	B+	shot



	W_{out}	B+	A+
2135	dunked two new batter 6V 11 B+ series		
2141	.5	165	4,2
2142	1,5	165	5,0
2144	2,2	170	5,3
2145	2,6	180	5,6
2150	3,5	195	6,2
2153	4	200	6,25
2157	4,5	200	6,3
2200	4,6	210	6,3
2201	4,7		
2203	4,9	210	6,35
2206	6	205	
2210	6	200	6,5
2215	5,7	210	6,5
2223	5,6	208	6,6
2225	5,6	208	6,6
2230	5,4	205	6,6
2235	5,0	200	6,6
2237	3 W	B+	shot

changed to
ph. tube

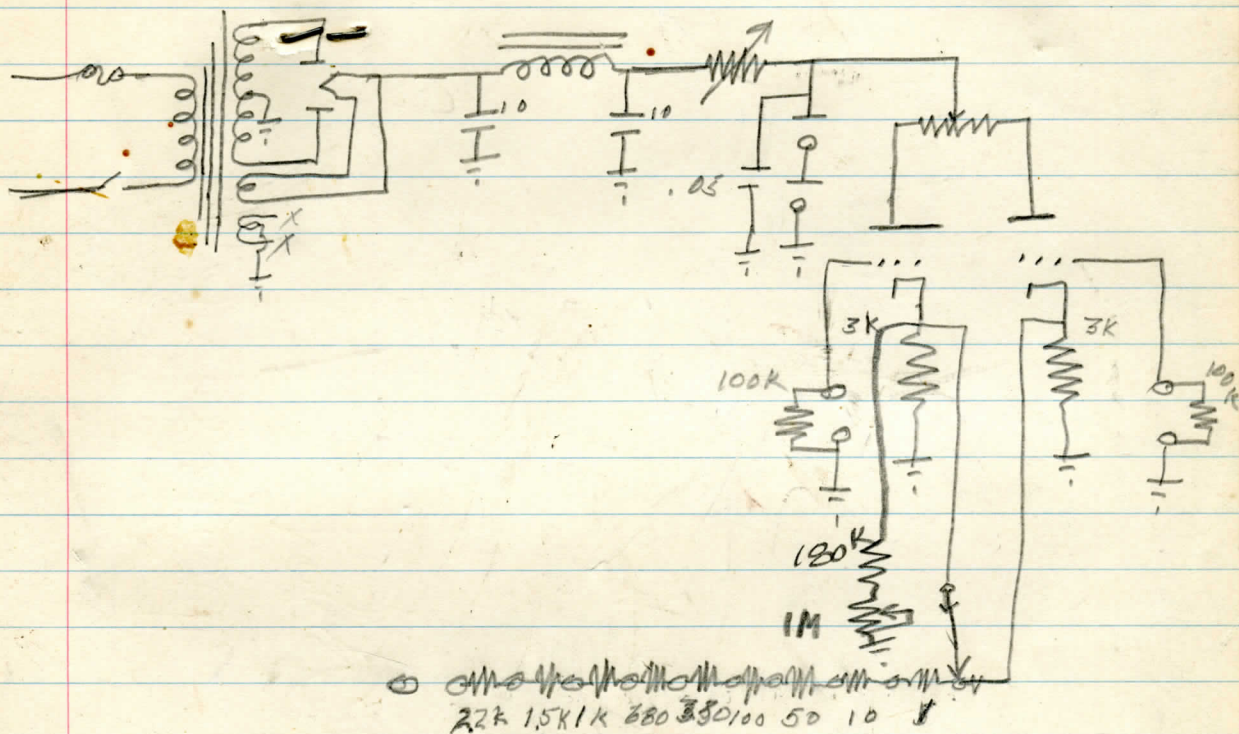
7-17792

DL 2500
50,00A

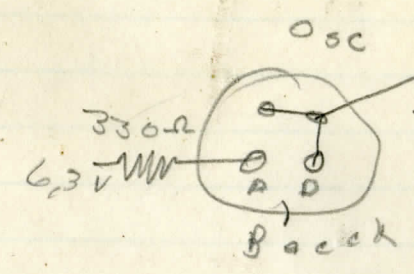
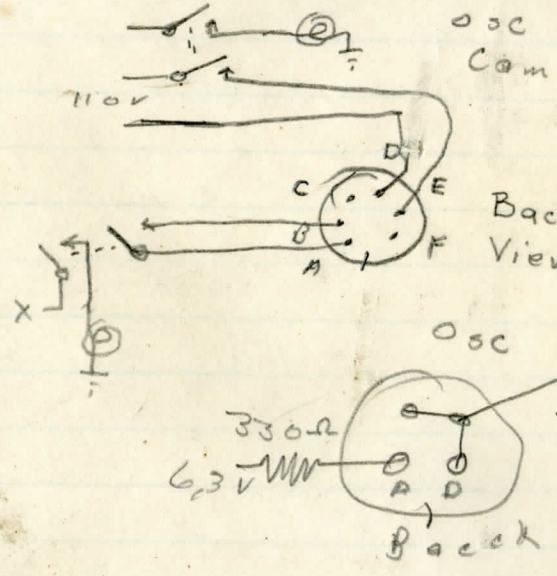
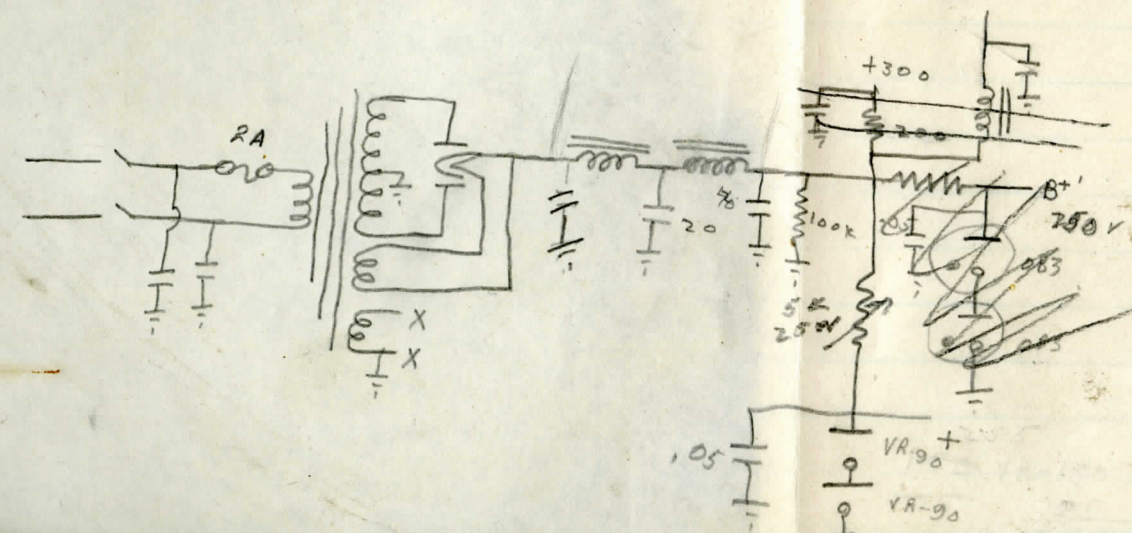
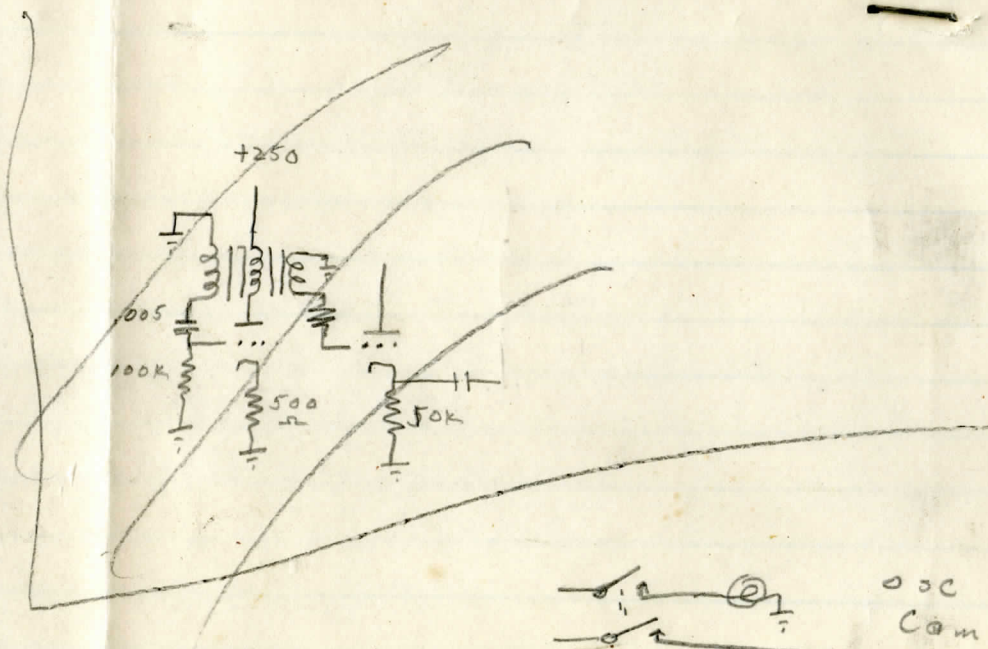
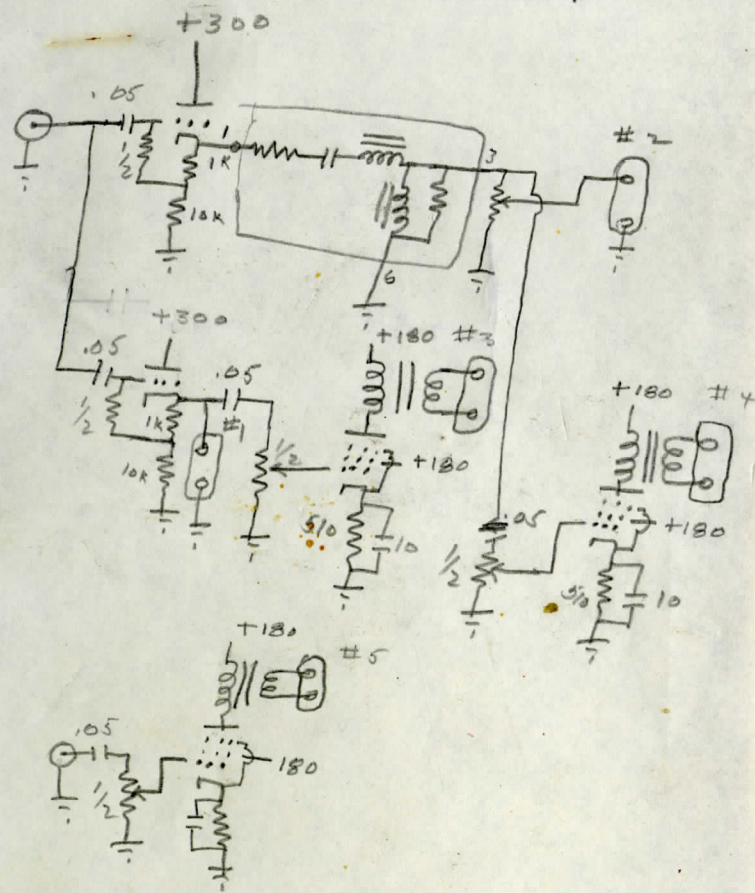
300
250
60

20

T stop calibrator



looks good when used with
Weston cell



with 56 ohm res. load - 81
 disc overloads add 10V above 25K

	disc C.F.		Filt C.F.	Galvo Amp		
6.	20.0	18.6	9.2	21.0	14.0	20.7
6.5	20.0	18.5	9.2	21.0	14.0	20.8
7.0	20.0	18.6	9.1	21.5	14.2	20.8
7.5	20.0	18.7	8.7	21.5	13.2	20.8
8.0	20.0	18.5	8.1	21.5	12.5	20.8
8.5	20.0	18.6	7.5	21.5	12.0	20.8
9.0	20.0	18.6	6.9	21.5	11.0	20.8
9.5	20.0	18.6	6.2	21.5	9.5	20.8
10.0	20.0	18.6	5.1	21.5	9.5	20.8
10.5	20.0	18.5	5.0	21.5	8.8	20.8
11.0	20.0	18.5	4.0	21.5	8.0	20.8
12.0	20.0	18.5	3.7	21.5	6.5	21.0
13.0	20.0	18.5	3.1	21.5	5.5	21.3
14.0	20.0	18.5	2.5	21.5	4.5	21.3
15.0	20.0	18.6	2.1	21.5	4.0	21.3
16.0	20.0	18.5	1.9	21.0	3.2	21.5
17.0	20.0	18.6	1.6	21.0	2.8	21.5
18.0	20.0	18.6	1.3	20.5	2.3	21.6
19.0	20.0	18.5	1.1	20.3	2.0	21.7
20.0	20.0	18.5	1.0	20.2	1.7	21.5
22.5	20.0	18.5	.6	19.8	1.1	21.2
25.0	20.0	18.5	.4	19.0	.7	20.8
27.5				18.2	.4	20.2
30.0		18.5	0	17.5	.1	18.5
35.0		18.5	.1	16.5	.3	18.5
40.0		18.5	.3	15.0	.4	16.0
45.0		18.5	.4	13.0	.5	14.0
50.0		18.5	.6	11.5	.5	13.0

over
loads
above
5.5V
at
50K
C

T
U
V
W

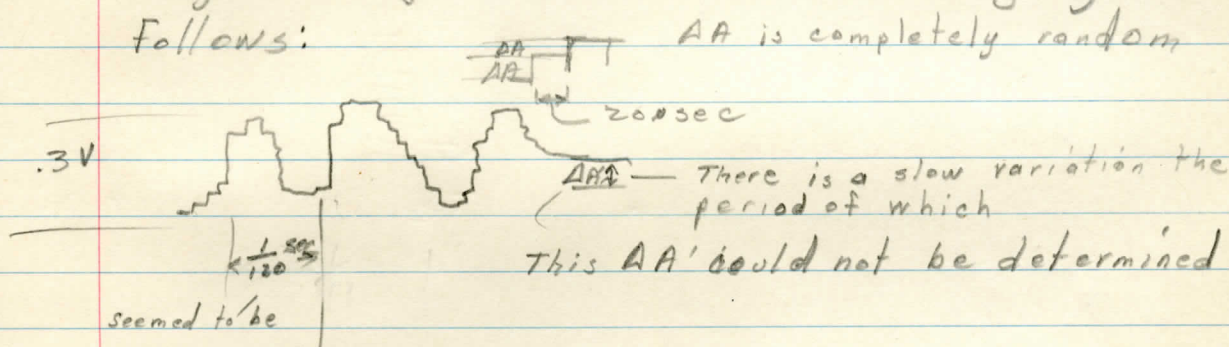
3/6/54 Develop Range Rate Meter & Range Meter
 Characteristics of APG 30 radar range Volt.
 output - Unlocked - No Voltage
 measured at
 range OK lock locked min range + 12.5

$$\begin{array}{r} 50 \overline{) 102} \\ \underline{100} \\ 2 \end{array}$$

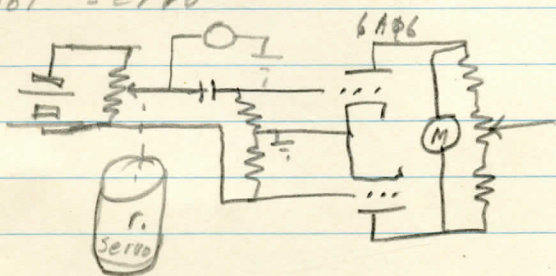
Max range + 55.0

$$\text{Range slope } \frac{\Delta V}{\Delta X} = \frac{2V}{100 yds} = \frac{dx}{dt} = .02 \text{ Volts/yd}$$

There is an A.C. or pulse component on the
 range voltage on 1 set was roughly as
 follows:

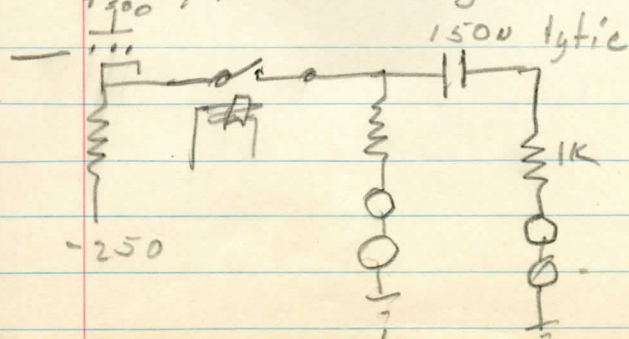


First method tried by Lab was the use
 of pot servo

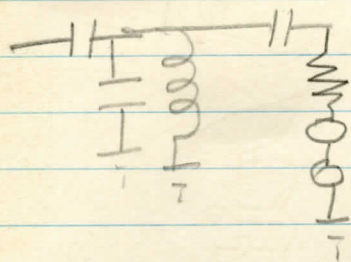


Probably OK but
 servo hunted
 Awkward Method
~~servo hunting~~

Next use range volt directly



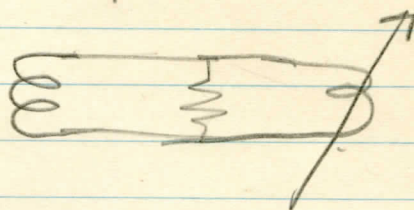
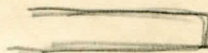
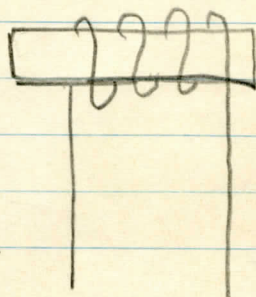
random fluctuations
 seem to foul this
 Up put in
 Low pass
 Filter



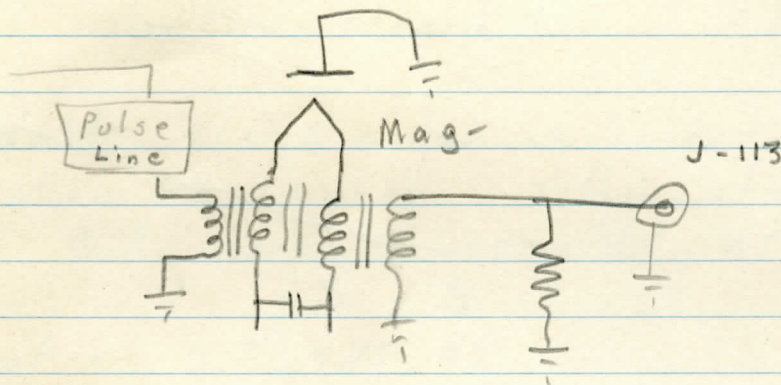
Put in low pass filter
that cut off at 2 cps.
Improved ckt but no soap
on flights acted like leaky
condensers

Copied Range Rate ckt from G-33

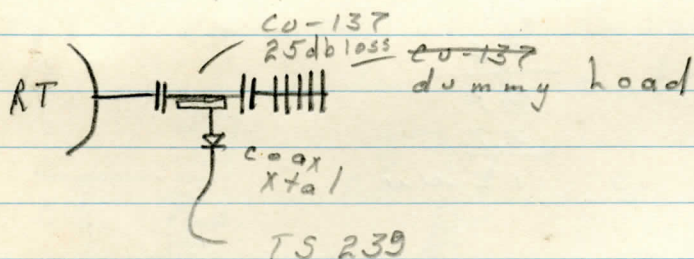
$$\begin{array}{r} 4 \\ 1300000 \overline{) 250} \\ 5 \end{array}$$



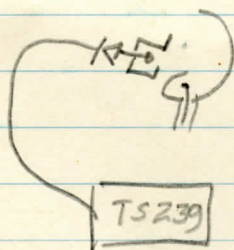
Det. Max. Reduction of pulse width with APG 30

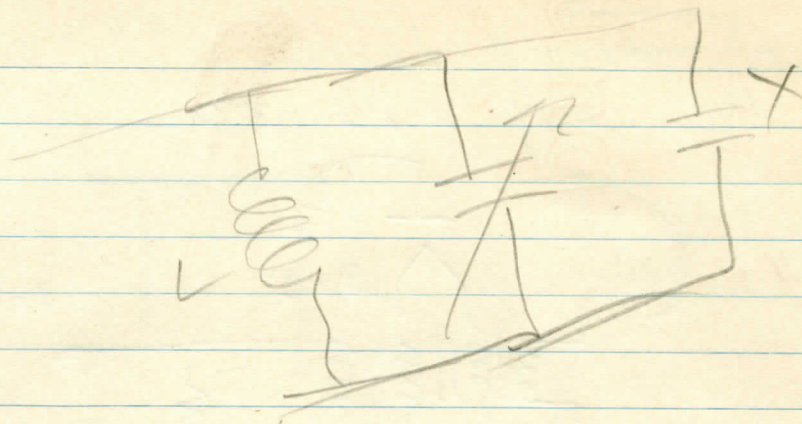


Check Equipment with APS-23



With APS-23 A small trace of reasonable looking shape appeared when set up as above also when set up as follows however moving probe changed wave shape





$$\begin{array}{r} 4,7 \\ 3,6 \\ \hline 8,3 \\ 3,7 \\ \hline 12 \text{ u.u.} \end{array}$$

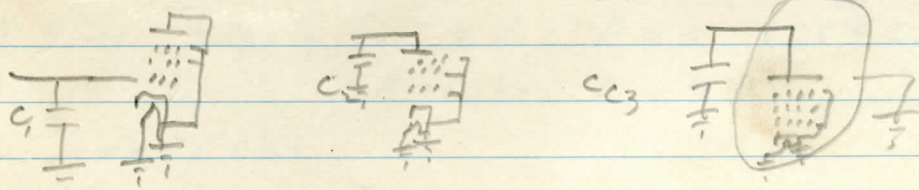
3/25/54

Prelim. work for Wide band Video
Det. Cap (interstage) for 5702

~~Method~~ - Use Q meter + internal cap.
for calib - this agrees within a few %
of G.R. prigs - measured at 32 mc

C_1 cold -	1	2	3
C_2 input -	4.7	4.75	4.6
C_3 output w/o shield	2.67	2.66	2.76
" w shield	3.88	3.6	3.78

cap. of coil with slug $\frac{1}{2}$ in = 3.1 $\mu\mu$ 
" " " " " out = 2.3 "



slug all in 6.2 $\mu\mu$

tie pteon coil to gnd = 6 $\mu\mu$

A-scope ^{supply}
2 eqC.R. Tubes 5JP11, 5R P11, 5X P11 } ordered 4/26
Tubes 829 B 12BH7 6AU5 }3 K Ω 4 W $\checkmark$ 700 Ω 20 W $\checkmark$ 75 Ω 5 W $\checkmark$ 43 K 1 W $\checkmark$ 3.9 K 1 W $\checkmark$ 920 Ω $\checkmark$ 3 K Ω 10 W WW 3.9 K 2 W 2 - 430 Ω

100 nF d rect filt. 500 ma rect

$$\frac{1}{390} = \frac{1}{580} + \frac{1}{R} \quad \frac{1}{R} = \frac{.00256}{1.42} = .00179$$

$$\frac{1}{200} = \frac{1}{750}$$

$$\begin{array}{r} .00143 \\ 700 \overline{) 1.000} \\ \underline{700} \\ 3000 \\ \underline{2800} \\ 2000 \end{array}$$

$$\begin{array}{r} .00 \\ 750 \overline{) 1.0000} \end{array}$$

4/24/54 3 weeks wasted for Edyy's ignorance
~~ego~~ ego and associated crap —

Perfect
 Complete A scope using G-30 as
 rapidly as possible —

Build first model for installation in B4
 data box —

1. Build osc. and video amp. using
 R.L. video ckt.
2. Design and build I.F.'s for G-30

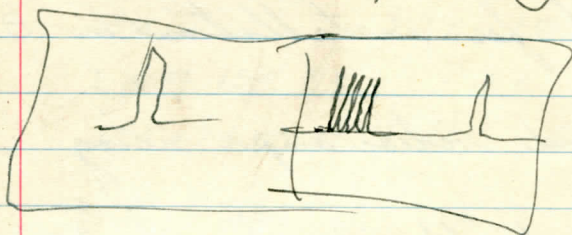
1.

- A. Power supply for Video Amp. 225 V @ .3 A (V @ 7A)
- B. " " C.R. tube 2 + 4 KV
- C. Sweep Ckt.
- D. Pwr. supply for sweep.

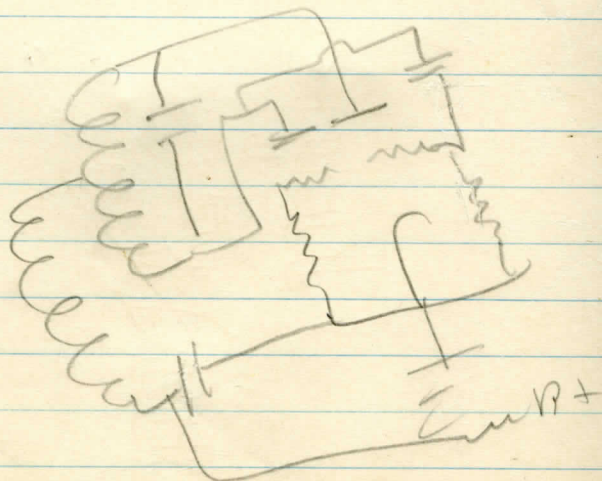
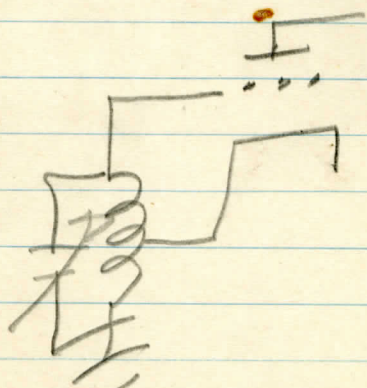
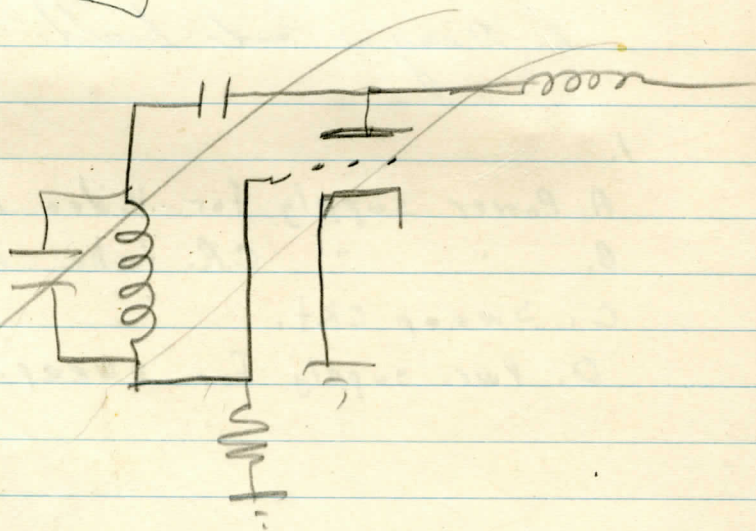
Tues-

Get Chassis for scope, pwr., sweep -

Range to crossover 275 yd to 850 yds
 Northrop day 75% 400 to 600 "



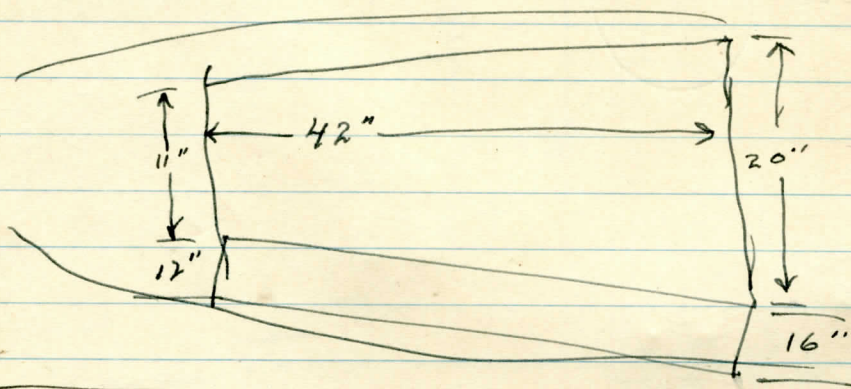
850
 275



7/26 Talked with Manly - He suggested that scope cover range to 3×10^3 ft. This gives sweep time of $\frac{10^3}{1.86 \times 10^2} \mu s = 10 \times .532 = 5.3 \mu s$. This can be lowered to $4.5 \mu s$ safely giving a writing speed of $1 \text{ in}/\mu s$ which in turn gives a pulse width of possibly .05 in. or $.05 \times 2.5 \text{ mm} = 1.25 \text{ mm}$. This is within tube resolution limit but of .65 mm, but is on the ragged side. Some sweep delay should be incorporated if possible.

See Bill Rush to make sure it is not necessary to have absolute range

B4-G

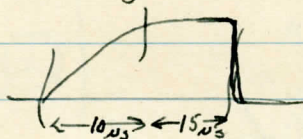


5.5t. A

B/O

4-22-15128	-	4-3093
4-22-15130		4-3092
4-22-15129		4-3091

4/26/54 Rep-M-1 A scope & install in 970
 Scope operates int. control will have to be repl.
 as will X axis atten.
 Pulses to C.R. grid & sweep are 20 μ sec
 Sweep-

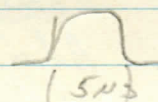
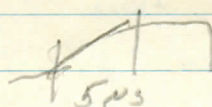


Set scope as follows

186
 5
 930
 3

Photos -

	sweep vel.	screen	volt	F	S	double exp.
I a	100 μ s/cm	95	13.2	3.5	1/30	1. screen + tr 2. Volt & Screen how
b.		Full	13.2	"	"	
c.	title Boresight			"	"	1. Volt w/o ser. 2. tracer
II a	1	full	38V	"	"	atrace & 0 volt
b	title					



16
 186 3000
 186
 1140
 5
 186 1000
 930

III All shots same Plate of Flip Flop

IV

Para drop

T.O. - 0930 C-47 15K ft. - oxy

T.O. - 1000 970

Fat Chance

CNX

Mfg. Coils for Video Amp -

Used G.R. twin T

$$\text{Admittance } (Y) = \frac{1}{\text{impedance } (Z)} \quad Y = G + jB$$

$$\text{Conductance } (G) = \frac{1}{\text{resistance } (R)} \quad Z = R + jX$$

$$\text{Susceptance } (B) = \frac{1}{\text{reactance } (X)}$$

$$B = \omega AC$$

$$X = \frac{-B}{G^2 + B^2} \quad R = \frac{G}{G^2 + B^2}$$

$$1 \mu H \text{ coil} - f = 10^7 \text{ Hz} \quad C_1 = 8365 C_2 = 976.3$$

$$B_x = 2\pi \times 10^7 \times 139.8 \times 10^{-12} \times 10^6 \quad \frac{8365}{139.8}$$

$$= 2\pi \times 139.8 \times 10 = -6280 \mu \text{ mhos}$$

$$G_x = 116 \mu \text{ mhos}$$

$$L_{PX} = \frac{10^6}{2\pi \times 10^7 \times (-6280) \times 10^6 \times 10^6} =$$

$$L_x = \frac{1}{(2\pi)^2 f^2 C} = \frac{1}{38.2 \times 10^{14} \times 139.8 \times 10^{-12}}$$

$$= \frac{1}{.382 \times 1.40 \times 10^6} = 1.87 \times 10^{-6} \text{ H (I)}$$

Was not 10 me.

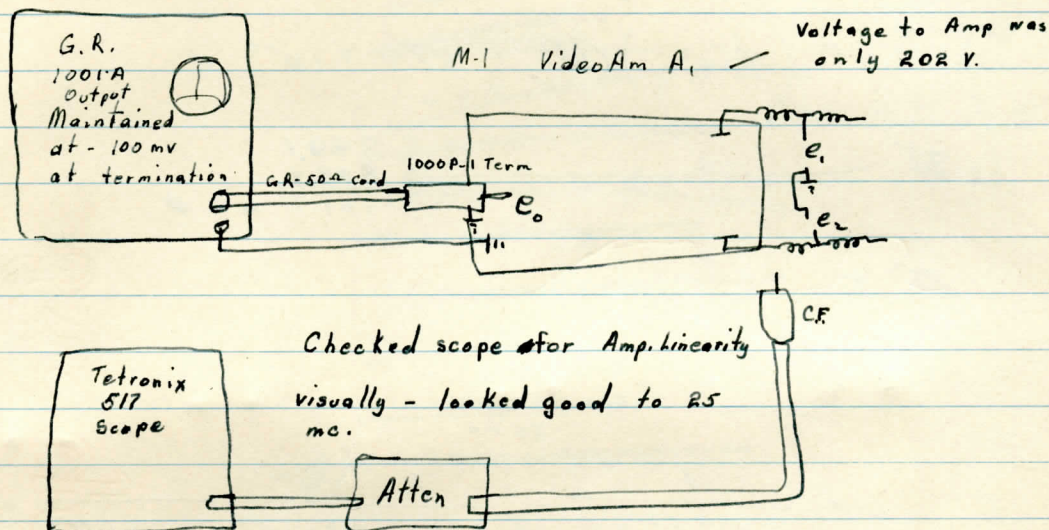
4/29/54

Finished Mod II Video Amp A₁

See app. page

Calib.

Used Mod. 1001 A G.R. R.F. Gen.



Input Freq.	Volt	Out Volt	Gain
5 KC	.1	11.75 x 8 = 94.00	940
10 KC	.1	= 94.00	940
20 "	.1	94.00	940
40 "	.1	94.00	940
80 "	.1	97.6	976
160 "	.1	8 x 12.2 = 94.00	940
320 "	.1	13.8 x 8 = 110.4	110.4
640 "	.1	13.3 x 8 = 106.4	106.4
1.2 mc	.1	14 x 8 = 112	112.0
2 mc	.1	14 x 8 = 112	112.0
3 mc	.1	112	112.
4 mc	.1	112	112
5 mc	.1		

Varied with Atten

no

Xfmr. —

115V 60W

600V 300mA

525V 325mA

7.5V tap. at 6.3V 3A

6.3V ct @ 3A

UTC 542

Parts 22K $\frac{1}{2}$ W -1

Mtg. nuts for pots.

A # 40498 3.1

cond

395

$1.43 \times 10^{-12} \times 10^6$

1

$3.25 \times 35 \times 394 \times 10^6$

$= 1.77$

$= 8.98 \times 10^{-3}$

cond

$$L = \frac{1}{(2\pi)^2 f^2 C} \quad C_2 = 1005.$$

$$C_1 = \frac{836.5}{881.0} \quad C_1 = \frac{972.}{33}$$

$$\frac{1031.2}{888.44}$$

$$142.8$$

395

$$L = \frac{1}{(2\pi)^2 (10^7)^2 \times 1.43 \times 10^{-12}} = \frac{1}{39.4 \times 10^{14} \times 1.43 \times 10^{-12} \times 10^6}$$

$$= \left(\frac{1}{.564} \right) \times 10^{-6} = 1.77 \times 10^{-6} \text{ H.}$$

$$L_X \text{ II} \longrightarrow \frac{989.1}{888.4}$$

101.7 AC

II

$$25 \times 10^6 \text{ n}$$

$$C_2 = 785$$

$$C_1 = \frac{750 \text{ nF}}{35 \text{ nF}}$$

$$L = \frac{1}{(2\pi)^2 f^2 C} = \frac{1}{39.4 \times (25)^2 \times 10^{12} \times 35 \times 10^{-12}} = \frac{1}{6.25 \times 35 \times 39.4 \times 10^6}$$

$$\frac{1}{.86} = 1.15$$

142.7

$$L_{PX} = \frac{10^6}{2\pi \times 25 \times 10^6 \times 35}$$

$$L = \frac{1}{39.4 \times 10^{14} \times 142.7 \times 10^{-12}} = \frac{1}{1.43 \times 39.4 \times 10^6} = 1.77$$

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

$$B_X = 2\pi \times 10^7 \times 143. \times 10^{-12} \approx 6.28 \times 1.43 \times 10^{-3} = 8.98 \times 10^{-3}$$

$$L_{PX} = \frac{10^6}{2\pi \times 10^7 \times 8.98 \times 10^{-3}} = \frac{1}{5.64 \times 10^4}$$

In. Volt held
at .1 volt
Input freq $\times$ out
Vott G

7.5

-5 KC

last. M-1 A'scope on 970

try to eliminate pulse str.

Try J306

J 1206 is detector C.F.

$$X_L = 2\pi fL = 6.28 \times 10^7 \times 10^{-6} = 6280 \Omega \quad G = \frac{1}{X_L} = .00159$$

$$AC = 142.6 \quad B_X = 2\pi \times 10^7 \times 143 \times 10^{-12} \times 10^6 = 6.28 \times 1.43 \times 10^3 = 8980 \mu\text{mho}$$

$$L_{10mc} = \frac{1}{4\pi^2 f^2 C} = \frac{1}{3.94 \times 10^{14} \times 1.43 \times 10^{-12}} = \frac{1}{5.63 \times 10^5}$$

$$L_{15mc} = \frac{1}{39.4 \times 59.6 \times 2.25} = \frac{1}{5.77}$$

$$C = 59.6$$

$$L_{5mc} = \frac{1}{394 \times 25 \times 567} = \frac{1}{5.80} = \frac{1}{5.60}$$

$$\frac{81.2}{2.60} = 56.7$$

$$L = \frac{1}{2\pi f} = 45$$

~~2-47K 100W~~

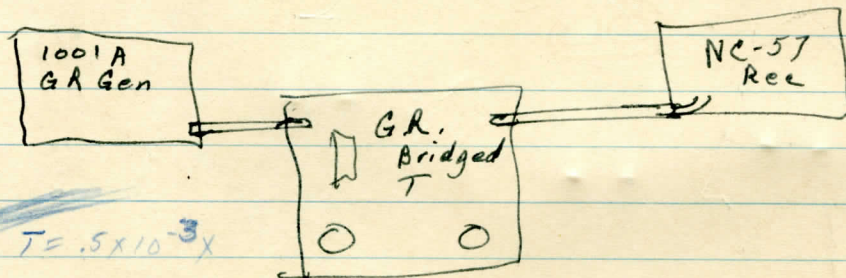
~~1 to 1/2 ufd 1KV~~

~~250W 1KV~~

~~2-02~~

~~3X10 ufd~~

Check of bridged 'T'



I. substituted 10 ufd. Std- GR 107J #4182

C_2 $f = 10 \times 10^6 \text{ Hz}$

C_1 ~~400.0~~

No balance at 10mc for 1mc
Looks screwy

5/1/54

Started Work on Sweep + unblank. using Tetronix 517 ckt.

Parts

~~2-15K 10W~~

W.W.

~~2-120K 1W~~

1-15K-2W

~~1-1K 25W~~
non ind.

+5.6K 2W

+6.8K 2W

+150 Ω ~~5-470 $\frac{1}{2}$ W~~

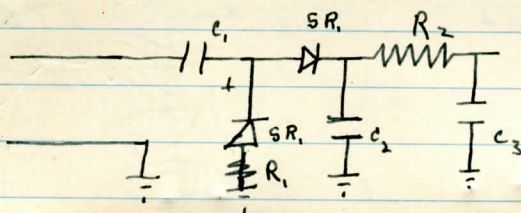
1-100K 1W

+3K-10W

##

5/4/54

Breadboard pwr. supply for M-1 A scope Video Amp.

SR_{1,2} Seletron 500ma rect.C_{1,2,3} 30 μ fd 450V condR₁ = 10 Ω R₂ = 65 Ω

ckt. had sufficient voltage ≈ 220 when connected to the Amp which drew. Present ckt had 1V ripple at output - With R₁ = 5 Ω Bt 228

Run Response curve on V. amp. using this supply

freq.	Input Volt	Out Att	cal.	G	12.5mc	15mc	18	4x11.2	out 50.8	503
3-56 $\frac{1}{2}$ W	5Kc	1.12x1.26x4	X 11.2	=63	-630	15mc	1.12x2x1.41x11.2	50.8	503	35.5
1-22 $\frac{1}{2}$ W	10Kc	1		630	+7.5	18	4x11.2	44.8	44.8	
1-10K 10W	20Kc			630	20	42x4x2	x11.2	35.05	= 351	
2-470K $\frac{1}{2}$ W	40Kc			630	23.5	1.41x1.12x11.2		177	= 177	
	100Kc	1	1.41x4x11.2	632	25	18	4x11.2		= 112	
	200Kc	1	1.12x1.12x4x11.2	707	707					
	400Kc			707						
	8mc			707						
	1.6 "			707						
	3.2 "			707						
	6.4			707						
	10mc		4x126x11.2	= 665	665					

see following page
for test cond

X
Y

Test induct $f = 107\text{m}$ 75- Ω $\frac{.3}{.3}$

$$C_2 = 543.0$$

$$C_1 = \frac{400.2}{142.8}$$

$$L = \frac{1}{\omega^2 C} = \frac{1}{(2\pi)^2 10^4 \times 1.43 \times 10^{-10}} = \frac{1}{39.4 \times 1.43 \times 10^4}$$

$$\frac{1}{39.4 \times 1.43 \times 10^4} = \frac{1}{.563} \times 10^{-6} = 1.78 \mu\text{H}$$

Check with ϕ meter

$$L_1 = 1.75$$

$$L_2 = 1.69$$

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

$$f = 10^7 \text{ beat w. G.R. Gen.}$$

$$f = 10^7$$

$$C = 145$$

$$C = 150$$

$$L_2 = \frac{1}{39.4 \times 10^4 \times 150 \times 10^{-12}}$$

$$= \frac{1}{39.4 \times 1.5 \times 10^6} = 1.69$$

With Br. T $L_1 = 1.82$

$$L_2 = 1.74$$

$$f = 10^7$$

$$C_2 = 539.6$$

$$C_2 = 544.9$$

$$C_1 = \frac{400.0}{139.6}$$

$$C_1 = \frac{400.0}{144.9}$$

Rewind chokes to 1 μH

$$C_{\text{total}} = \frac{1}{39.4 \times 10^4} = 254 \mu\text{H}$$

$$G = 240$$

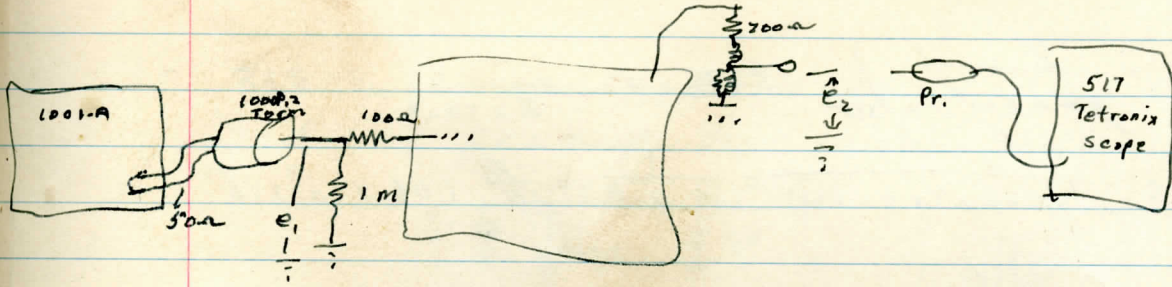
$$C_2 = 655.6$$

$$C_1 = \frac{400.0}{255.6}$$

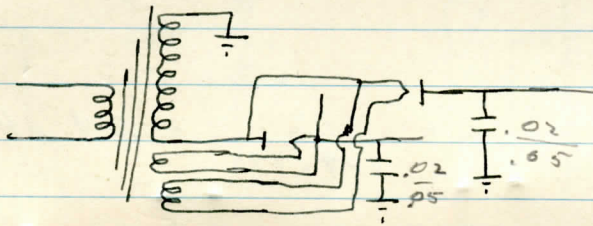
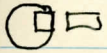
$$B = 6.28 \times 10^7 \times 250. = \frac{1609}{240} = 6$$

$$L_1 = \frac{1}{2.56 \times 394} = .994 \mu\text{H}$$

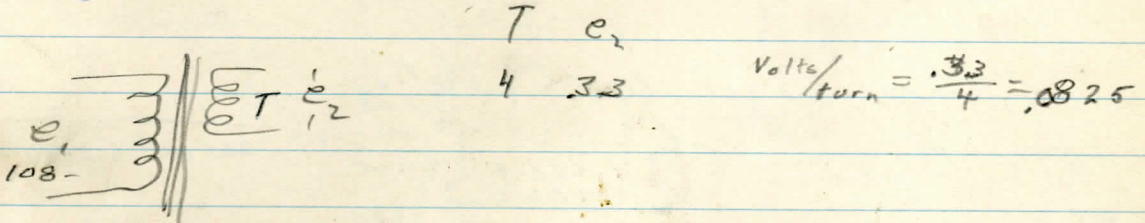
Right side of BE29



Hi. V-Pwr supply



Using 122's - Wind Fil, Xfmr,

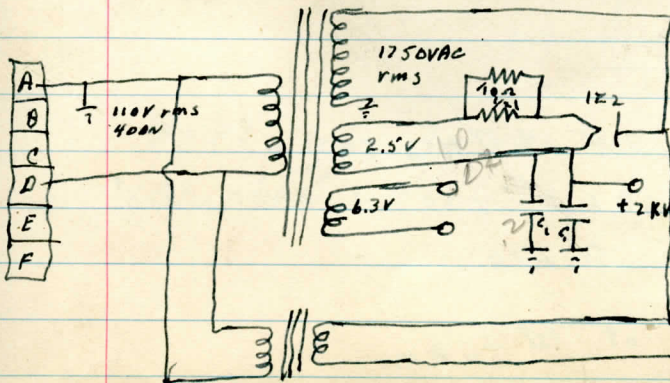


Used frame + pri. winding of 6.3V 1A xfmr,

122 Fil, 1.5V @ .3A

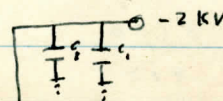
Nec. Turns. $\frac{1.5}{.0825} = 18.2$

5/7/54 Final Ckt.



Built in 3"X5"X7" mini-box

$C = .01 \mu F \text{ } 2500V$



$$C = \frac{1}{39.4 \times 10^{-14} \times 2.5 \times 10^{-6}} = \frac{1}{985} = 31.8$$

$$C = \frac{1}{39.4 \times 10^{-14} \times 2.5 \times 10^{-6}} = \frac{1}{985} = 1.01 \times 10^{-9} \times 10^{12}$$

$$L_2 = \frac{1}{94 \times 394} = 2.64$$

Left side

$$\frac{1}{39.4 \times 28} = 0.1 \mu H \text{ too much}$$

$$= 8.04 \mu H$$

$$\frac{1}{31.6 \times 394}$$

L₃

$$C_1 = \frac{657}{275} \mu F$$

$$L = \frac{1}{39.4 \times 275} = 0.4 \mu H \text{ L side of term board}$$

$$L_4 = \frac{1}{39.4 \times 31.2} = 8.14 \mu H \text{ R. side}$$

Comparison of Q F = 10⁷ cy

$$L_1 =$$

$$C_2$$

$$L_1 = \frac{1}{39.4 \times 10^{-14} \times 260 \times 10^{-12}} = .975 \times 10^{-6}$$

$$C_1 = \frac{660.4}{400.0} = 260$$

$$G = 350$$

$$\frac{394}{5}$$

$$165$$

$$B = 2\pi f C = 6.28 \times 10^7 \times 260 \times 10^{-12} \times 10^6 = 6.28 \times 260 \times 10^0 = 1630$$

$$\frac{853.4}{2}$$

$$Q = \frac{1630}{350} =$$

$$\frac{736.4}{400}$$

$$354$$

$$1085$$

$$400$$

$$685$$

$$685$$

$$L = \frac{1}{39.4 \times 335}$$

Coil wound on 1W 4.7 meg res.

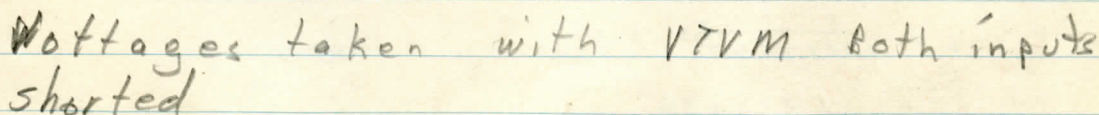
$$463.4 \times 10^4$$

$$B = 6.28 \times 10^7 \times 508 \times 10^{-12} \times 10^6 = 3190 \times 10^0$$

$$Q = \frac{B}{G} = \frac{3190}{410} = 8 \text{ G H10}$$

plate of 1st tube

Pulled preamp from front console



$$L_6 = \frac{1}{165 \mu \times 394} = 154$$

$$B = 6.28 \times 165 = 965 \mu \text{mho}$$

$$Q = \frac{B}{G} = \frac{965}{150} = 6.4$$

$$G = 150 \mu \text{mho}$$

series grid coil of 2nd stage

$$L_7 = \frac{1}{264 \times 394} = 962 \mu \text{H}$$

$$B = 6.28 \times 264 = 1656$$

$$G = 285 \mu \text{mho}$$

$$Q = \frac{1656}{285} = 5.8$$

Grid Series of 3rd stage

94.5

$$L = \frac{1}{39.4 \times 254} = 254 \mu \text{H}$$

$$G = 25 \mu \text{mho}$$

$$C_2 = 400, B = 6.28 \times 99 = 620$$

$$C_1 = \frac{400}{24 \times 99}$$

$$Q = \frac{620}{76.8} = 8.2$$

Grid inductance of ph. inv.

$$C = \frac{1}{39.4 \times 6.8} = 373 \mu \text{F}$$

$$B = 6.28 \times 375 = \frac{2350}{350} = 6.7$$

G

$$L = \frac{1}{39.4 \times 375} = .678 \mu \text{H}$$

Pl. ind of G.F. driver

$$C = \frac{1}{39.4} K = 254 \mu \text{F}$$

$$L = \frac{1}{39.4 \times 254.3} K = 1.001$$

$$B = 254.3 \times 6.28$$

Pl. induct. of C.P. driver

$$L = \frac{1}{39.4} K \frac{1}{256} = 1.000$$

$$Q = \frac{B = 1600}{G = 205 \mu \text{mho}} = 7.96$$

~~Q =~~

$$Q = \frac{B = 6.28 \times 256 \times 1620}{G = 221} = 7.6$$

5/6/54

Run Curve on Mod 4 Hammond Organ
Pre amp - Used H.P. 200 A Gen & HP 400C AC/DC

Dt - 250

Vib sect with 68K across input
V_{in} V_{out}

F _r	V _{in}	V _{out}	$\frac{V_{out}}{V_{in}}$
35	5	5	5
50	5	5	5
75	5	5.1	5.1
100	5	5.1	5.1
150	"	5.2	5.2
200	"	5.2	5.2
300	"	5.2	5.2
400	"	5.3	5.3
500	"	5.2	5.2
600	"	5.3	5.3
750	"	5.25	5.25
1K	"	5.3	5.3
1.5K	"	5.3	5.3
2	"	5.3	5.3
2.5"	"	5.3	5.3
3	"	5.3	5.3
3.5"	"	5.3	5.3
4.0"	"	5.25	5.25
5.0"	"	5.25	5.25
7.5"	"	5.2	5.2
10"	"	5.0	5.0
12.5"	"	5.0	5.0
15"	"	4.8	4.8
	5	3.8	3.8

Grid induct. For G.F. driver

$$C = \frac{1}{2.5 \times 39.4} K = 98.5 \mu\mu \quad Q = \frac{B = 6.28 \times 980}{G = 801} = \frac{6150}{801} = 7.68$$

$$L = \frac{1}{39.4 \times 98.5} K = 2.57 \mu H$$

Grid induct. from pl. of p.h. inv. driver

$$C = \frac{1}{2.6 \times 39.4} K = \frac{97.8}{20.4} \mu\mu$$

$$Q = \frac{B}{G} = \frac{6.28 \times 101 \times K}{95} = \frac{6350}{95} = 6.68$$

R I R II R III

$$L = \frac{1}{39.4 \times 101 \times K} = 2.51 \mu H$$

1/4 2 us

100 us

1/8 us

100x 2x10⁴



Can
dri
tha
we
long
of

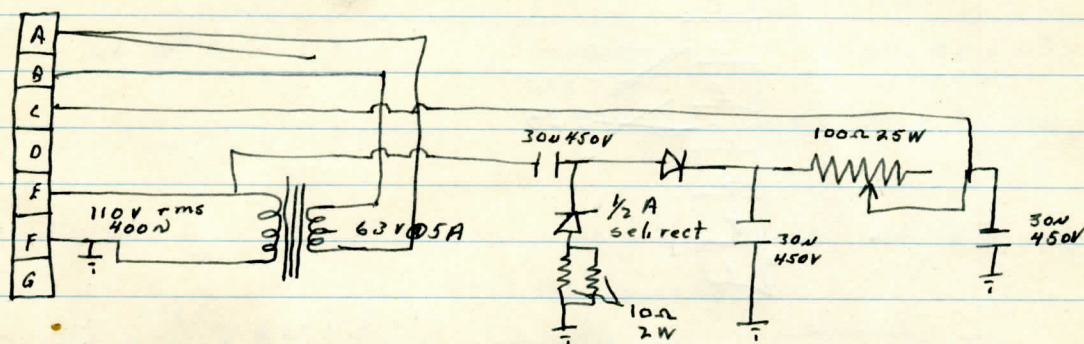
Op
←

5/7/54

Lo. Volt. + Fil. supply For Video

Built in 3"X5"X7" mini-box

Camera oriented so that traces were ll to long. axis of film



Run test of oscillographic camer constr. by Keith

Run I. XX film 5XP11 @ 24 KV intensity turned up until steady spot almost appears Rep. rate - 100 eps.

$\frac{4}{3} \times 254$

254 = 3.88 $\frac{12KV}{250ns/cm}$ speed 500 $\frac{12KV}{250ns/cm}$ - 250 $\frac{24KV}{ns/cm}$ f 2.3 FD-12"

.206 $\frac{ns}{cm}$

Ran 15-20 sec + jam med r

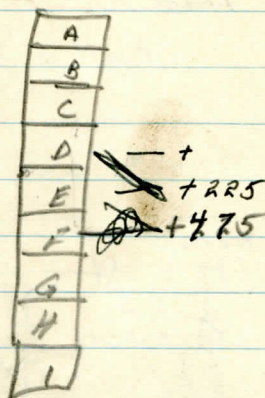
See Opp-Page
Opened + camera ran freely - side of case presses against feed spool when cover is closed - attempted to clear this

Run II same as above ran 1st part at 12 KV $\frac{250m}{500ns/cm}$ f 2.3 FD-12"
2nd part at 24 KV $\frac{500m}{250ns/cm}$ Camera ran well -

Run III same as above ran 1st part at 12 KV + 500 $\frac{ns}{cm}$
2nd 12 KV + 200 $\frac{ns}{cm}$ - 3rd 24 KV + 200 $\frac{ns}{cm}$ - 4th 24 KV 500 $\frac{ns}{cm}$

All runs had 25 KC Volt. calib pulse - at 12 KV these pulses were $\frac{1}{2}$ cm. High - defocusing occurred when switching to 24 KV + was not corrected

Cannon Plug connections on A sweep ckt. on M-2
A.S.



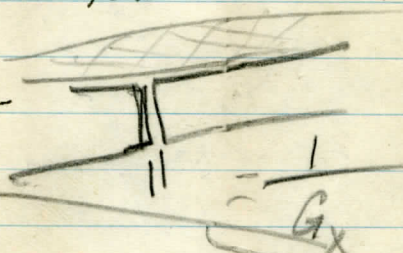
56 + 68k in series 2 470K 11
Parts - 120K 1/2 or 1W 220K 1/2 or 1
150Ω 1W 5.6K 2W 6.8K 2W 15K 5W
Wire for winding coils 150K 2W 75K series

Hi. Value resistors for winding coils on

500 Hi. Volt coil 100μF 22Ω 1/2 W

1 51 + 25 μF 10K 10W

Term strips 256Ω 447Ω



4 x 10⁶

200 5-2000 .5 1KV

470Ω 1/2 .001 - 1KV

5/8/54

Wind 280 uft choke — use variable video peaking coil
det. induct. with Br. T

$$C = \frac{1}{280^2 L} = \frac{1}{39.4 \times 10^{12} \times \cancel{280} \times 280} = \frac{1}{39.4 \times 280 \times 10^{12} \times 10^{12}}$$

$$= \frac{1}{1.04 \times 10^4} = .96 \times 10^{-4} = .000094 = 94 \text{ nH}$$

Lo of coil as is

Put this coil in grid ckt of unblank

in M-2 A.S. sweep

$$C_2 = 279.5$$

$$C_1 = 200 \text{ nH}$$

$$79.5 \text{ nH}$$

$$f = 10^6 \quad L = \frac{1}{\omega^2 C} = \frac{1}{39.4 \times 79.5 \times 10^{-12} \times 10^{12}}$$

$$= \frac{1}{39.4 \times 79.5 \times 10^3} = 3.19 \times 10^{-3}$$

checked 100 kA GR against

WWV dial Vern
99 3.15

$$= .000319$$

partly
After unwinding coil made another run

$$C_2 = 281.15$$

$$Q = \frac{B}{G} = \frac{575}{23} = 25$$

$$C_1 = \frac{200 \text{ nH}}{91.5}$$

$$L = \frac{1}{39.4 \times 91.5} \text{ k} = 279 \text{ nH}$$

$$B = 6.28 \times 10^6 \times 91.5 \times 10^{-12} \times 10^6 = 575.$$

Measure L of 1 KW. 25 W. res

$$C_2 =$$

$$f = 10 \text{ mc}$$

$$C_1 =$$

couldn't measure

Meas. L of Hand wound coil — Wind it to 10 uH on tun. form

$$C_2 = 398 \text{ nH}$$

$$C_1 = \frac{200 \text{ nH}}{98}$$

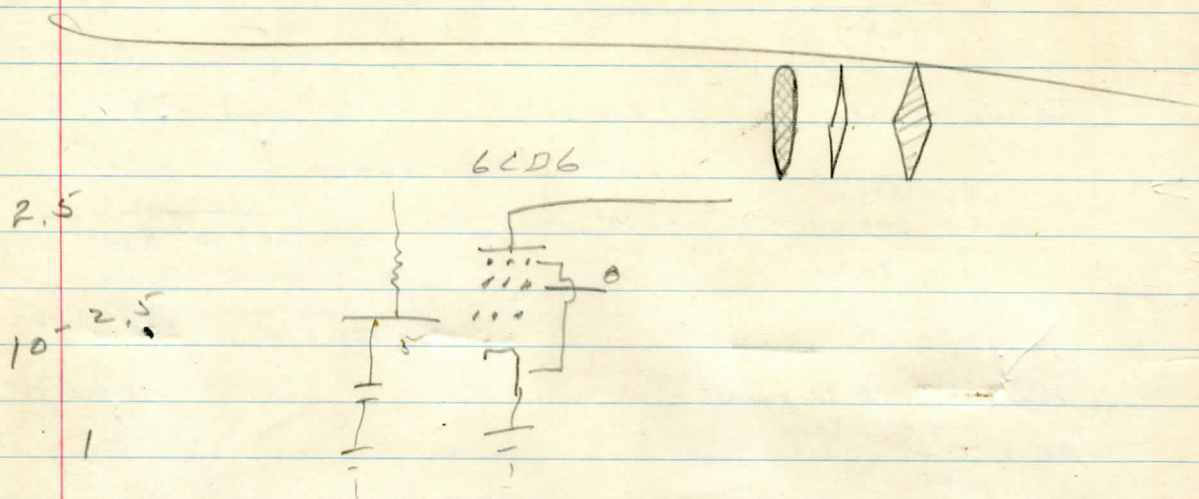
$$L = \frac{1}{\omega^2 C} = \frac{1}{39.4 \times 98 \times 10^{-12} \times 10^{14}} = \frac{1}{39.4 \times 98 \times 10^3} = \frac{1}{3.86} \times 10^{-3}$$

$$= 25.95 \times 10 = 2.6 \text{ uH}$$

Model 51-T1871

Picture shrank horiz. when First turned on, opened up & slowly shrank again stretched Vert. Horiz & Vert sync unstable at one point time & defocused at same point

5963



ADA 49 A

Feb 15 APG Wants 20 gliders From AFAC-

5 on F15 5 on M1 & 10 on middle M

Thompson 5264

Miller 22275

Coils for sweep for M-2 A-5

Wind Induct-

$f = 10^7$ 10 μ H center induct 6.3 to 13 μ H

40/1.00

$$C = \frac{1}{1mc \omega^2 L} = \frac{1}{39.4 \times 10^{-12} \times 10^{-5}} = 0.252 \times 10^7$$

51

$$C = \frac{1}{10mc \omega^2 L} = \frac{1}{39.4 \times 10^{-12} \times 10^{-5}} = .0252 \times 10^{-9}$$

Wound coil on ^{#30 enam.} 1cm dia coil 3 cm long with Cu + Fe slug

1133

Min induct

$$L_2 = 447.9$$

$$Q = \frac{B}{G} = \frac{6.28 \times 47.9 \times 10^{7-12}}{113.3 \mu mho} = \frac{3 \times 10^{+3}}{113.3 \mu mho} = 26.5$$

$$C = \frac{400.0}{47.9}$$

$$6.28 \times 10^7 \times 47.9 \times 10^{-12}$$

$$L = \frac{1}{39.4 \times 47.9 \times 10^{-12} \times 10^{+4}} = 5.3 \times 10^{-6}$$

100/3000

Max induct

$$C_2 = 414.4$$

$$C_1 = 400.0$$

$$L = 14.4$$

$$L = \frac{1}{39.4 \times 14.4} K = 44.9$$

$$Q = \frac{6.28 \times 11.4 \times 716}{G = 40} = 17.8$$

5 μ H coil ^{#30} enam. wire on 4.7 M. 1W res

$$C_2 = 450.5$$

$$C_1 = \frac{400.0}{50.5}$$

$$L = \frac{1}{39.4 \times 50.5} K = 50.5 \mu H \quad Q = \frac{B}{G} = \frac{6.28 \times 50.5}{67.5} = \frac{317}{67.5} = 4.5$$

22 μ H coil 4.7 M res for form #30 enam

F

$$L_2 =$$

$$C_1 = 400$$

$$L = K \frac{L}{39.4 \times 10.5}$$

$$C = K \frac{1}{39.4 \times 9}$$

$$L = \frac{1}{39.4 \times 11} = 22.3 \mu H$$

$$Q = \frac{B}{G} = \frac{6.28 \times 11}{53} = \frac{69.2}{53} = 1.3$$

$$C = \frac{1}{39.4 \times 22} = 11.55$$



2.5

33
14
132
3
46,2

14
12

35
11

35
35
385

28
14
168
2.5 $\times 10^3$
840

336
420.0

11) 23.0

86
240
33
36

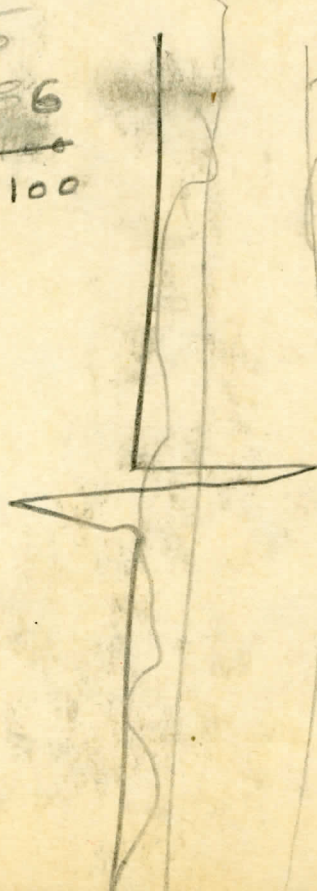
11) 400
33
70

Muzzle Vel

94 89 86
200 116 100

24

12) 286
24
46



11

*

*

11

*

11