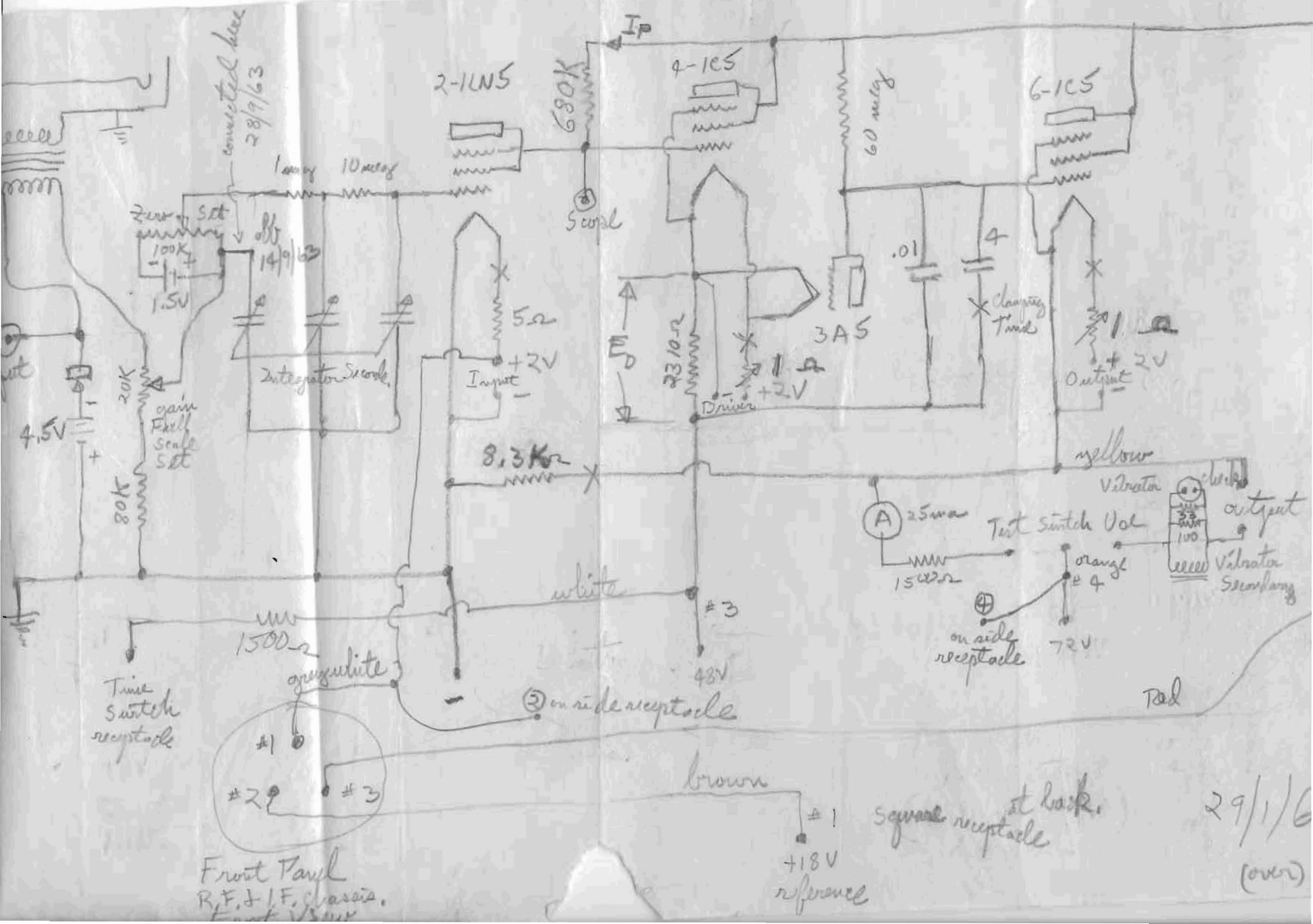
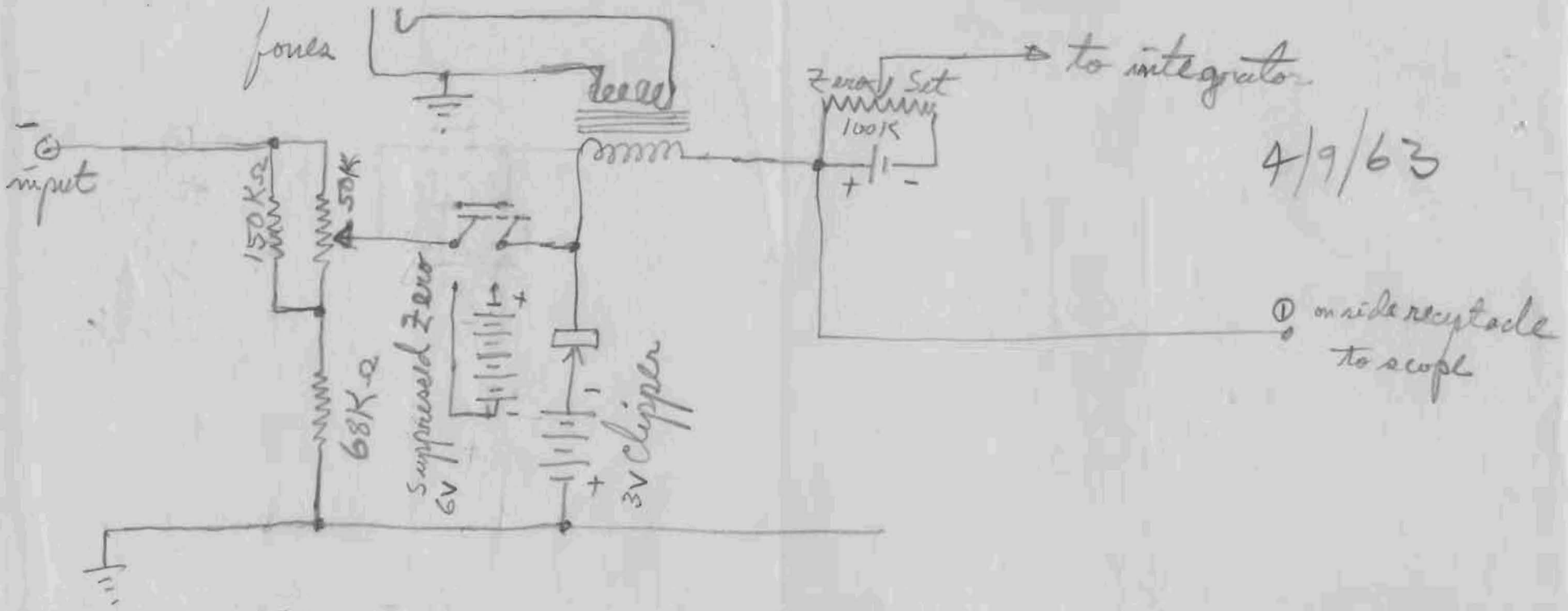


connected here 28/9/63
2-1LN5
680K
Ip
4-1C5
60 meg
6-1C5
1 meg
10 meg
Zero set
100K
1.5V
off 14/9/63
5 scope
5Ω
+2V
Input
Integrator Seconds
20K
gain Full Scale set
4.5V
80K
E0
2310Ω
Driver
+2V
3A5
.01
4
Charging Time
1 Ω
+2V
Output
8.3KΩ
yellow
Vibrator
check
output
A
25ma
Test Switch Vol
15KΩ
orange
#4
Vibrator Secondary
white
#3
1500Ω
Time Switch receptacle
greywhite
48V
2 on side receptacle
4 on side receptacle
72V
Red
#1
#2
#3
brown
#1
Square receptacle at back.
+18V reference
Front Panel
R.F. & I.F. Chassis.
29/1/6
(over)

16/10/63 Changed rise time condenser from 1 to 4 mfd.

also changed integrator ranges .003, .01, .03, .1, .3, 1 sec

Condensers now are .0001, .0003, .001, .003, .01, .03, .1, .3, 1, 3 mfd



4/9/63

Revised input circuit.

$.0005 = 5 \cdot 10^{-10} \times 5 \cdot 10^{4} = 25 \cdot 10^{-6}$ sec

$1/\left(\frac{1}{150} + \frac{1}{50}\right) = \frac{1}{.00667 + .0200} = \frac{1}{.02667} = 37500\ \Omega$

$68000\ \Omega$

$105500\ \Omega$ input resistance

$\frac{68}{105.5} = 3.8$ DB range

25/1/63

Input stage plate resistor 448,000 ohms.
Driver stage cathode resistor 2310 ohms
about 0.02V drop in each lead from battery to socket. Thus the filament will be low by 0.04V due to leads compared to battery voltage.
Filament rheostats on driver & output stage is 2Ω variable in parallel with 1.2Ω fixed = 0.75 ohm
Filament voltage 1.45V at socket terminals when voltage at battery 2.1 volts.

3/2/63

The sensitivity may be increased by decreasing plate voltage on driver and output stages. This may be done by returning cathodes of these stages to respectively 72 and 96 volts above ground. Their plate voltages will be respectively 96 and 72 volts.

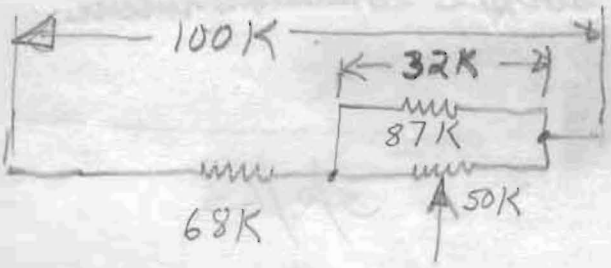
A much larger increase may be secured by changing input stage to pentode operation. The screens of 2-1LN5s may be connected to 96 volts and plates thru a large plate resistor to 168 volts.

(over)

4/2/63

Changed plate resistor on input stage from 498K Ω to 570K Ω. Zero set range increased from −1.5 ma to −2.5 ma with D.C. amplifier operating alone. Diode velocity voltage equals +0.4 ma.

Pen B requires 20.5 ma full scale deflection.



New gain control on input of D.C. Amplifier. It gives 3.35 DB adjustment which overlaps 3 DB steps of attenuator on I.F. amplifier

29/1/63

D.C. Amplifier Performance

E_s volts	ΔE_s volts	I_o ma	ΔI_o ma
0		0	1.3
.5		1.3	1.7
1.0		3.0	1.8
1.5		4.8	1.6
2.0		6.4	1.7
2.5		8.1	1.9
3.0		10.0	1.8
3.5		11.8	1.6
4.0		13.4	1.7
4.5		15.1	1.6
5.0		16.7	1.3
5.5		18.0	0.8
6.0		18.8	0.2
7.0		19.0	0.1
8.0		19.1	0.0
9.0		19.1	

Gain at Full 3v limiter

Gain at Mark 4.5v limiter

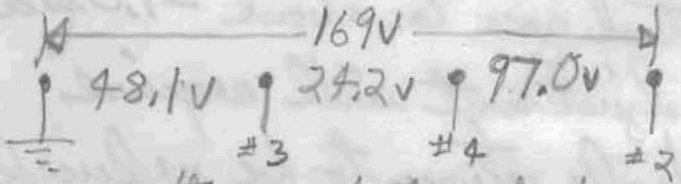
E_s volts	I_o ma	ΔI_o ma
0	0	1.1
	1.1	1.2
1.0	2.3	1.5
	3.8	1.6
2.0	5.4	1.4
	6.8	1.7
3.0	8.5	1.5
	10.0	1.6
4.0	11.6	1.5
	13.1	1.5
5.0	14.6	1.4
	16.0	1.6
6.0	17.4	1.6
	19.0	1.4
7.0	20.4	1.3
	21.7	0.9
8.0	22.6	1.0
9.0	23.6	0.2
10.0	23.8	0.2
12.0	24.0	0.1
15.0	24.1	

D.C. Amplifier Performance

29/1/63

E_s volts	ΔE_s volts	I_p ma	ΔI_p ma	E_p volts	ΔE_p volts	I_o ma	ΔI_o ma
0		298	8	9.1	2.5	0	1.1
.5		290	10	11.6	3.1	1.1	1.3
1.0		280	10	14.7	3.2	2.4	1.5
1.5		270	10	17.9	3.2	3.9	1.5
2.0		260	9	21.1	3.3	5.4	1.5
2.5		251	9	24.4	2.8	6.9	1.4
3.0		242	8	27.2	3.2	8.3	1.6
3.5		234	9	30.4	3.5	9.9	1.8
4.0		225	10	33.9	3.1	11.7	1.4
4.5		215	10	37.0	3.2	13.1	1.7
5.0		205	9	40.2	3.3	14.8	1.4
5.5		196	9	43.5	2.7	16.2	1.3
6.0		187	8	46.2	3.8	17.5	1.6
6.5		179	9	50.0	2.7	19.1	1.4
7.0		170	10	52.7	3.3	20.5	1.6
7.5		160	9	56.0	2.7	22.1	1.3
8.0		151	9	58.7	3.0	23.4	1.3
8.5		142		61.7		24.7	
9.0							

13.9KΩ Initial current resistor on output stage



Battery receptacle at back of chassis.

Input stage plate resistance 448,000 ohms.

Limiter disconnected. Gain set to mark

(over)

Driver starting current = 9.1V/2.31K Ω = 3.94 ma
= 0,985 ma per tube

Output starting current = (48.1+24.2)/13.9K Ω = 5.20 ma
= 0.868 ma per tube

To improve linearity at bottom of range, the starting current on both stages might be raised.

Improved linearity 1/2/63

Changed back current resistor on Output stage to 8.3K Ω. Starting current now 12.3/8.3K = 8.72 ma
= 1.45 ma per tube.

This caused an appreciable increase in starting current of Driver stage also.

The output load resistance is reduced from 1355 Ω to 1270 ohms at DC. The apparent sensitivity of amplifier will be about 1270/1355 = 0.94 times

Now the zero set control goes to about -1.0 ma. To get more negative adjustment will require voltage on driver cathode return to be reduced or a larger plate resistance on input stage or lower driver cathode resistor.

23/5/56

Output Trans ± COL 53 by Rola

10000Ω CT to 2Ω voice coil.

Pri. 29 henry & Q of 2 at 1000 cps.

Tune to 30 cps:

$$C = \frac{1}{\omega^2 L} = \frac{1}{(6.28 \cdot 30)^2 \cdot 29} = \frac{1}{35400 \times 29} = \frac{1}{1030,006} = 1\ \text{mfd}.$$

Grid leak = $10^6\ \Omega$

Grid coupler = $10^5\ \Omega$

$$C = \frac{1}{\omega X} = \frac{1}{6.28 \cdot 30 \cdot 10^5} = \frac{1}{19 \cdot 10^4} = .05\ \text{mfd}.$$

$3 \cdot 10^4 \times 3 \cdot 10 = 1 \cdot 10^5$

Vibrator Oscillator

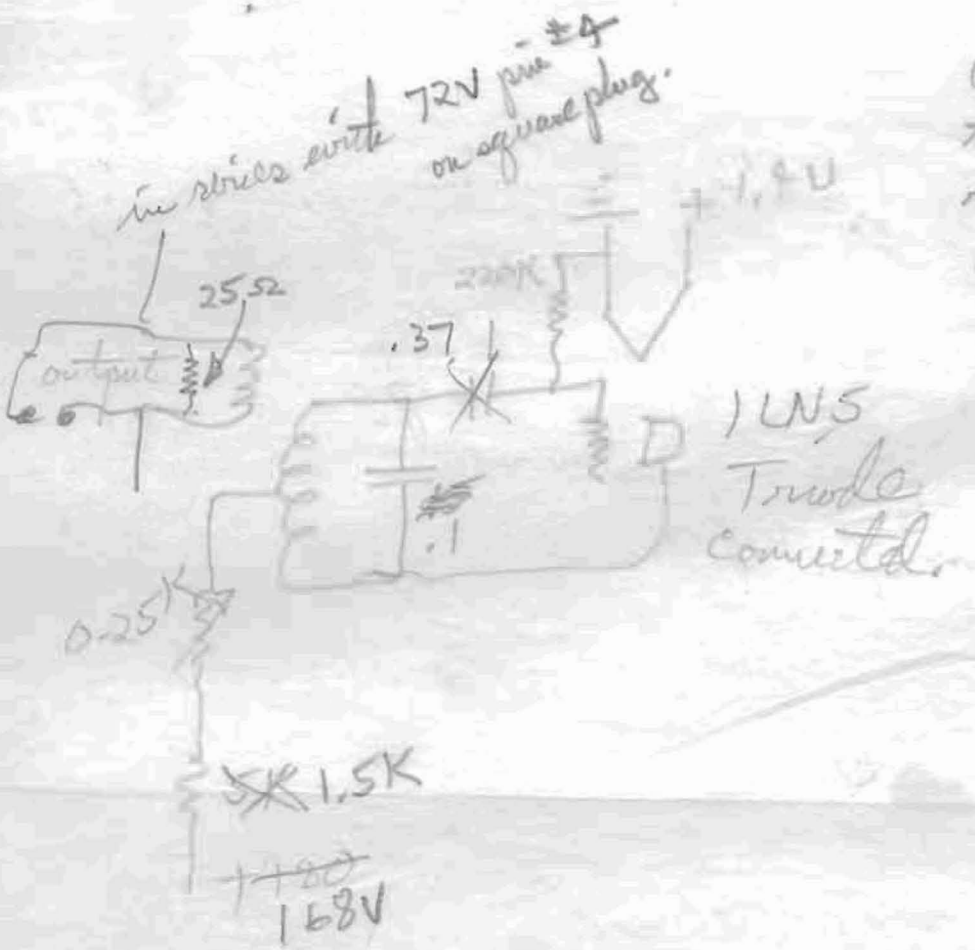
18/8/63

starting time long (5 sec) at 0.1 V
instantaneous (0.5 sec) at 1.1 V

Capacity .1 Freq about 20 cps.

amplitude max 1.1 V, Variation down to 0.1 V,
When set at 0.50 V putting on a 100 Ω shunt
decreases output to 0.22 V
Plate volts 132 V at 2.3 ma on this condition

On 20/7/63
Changed grid condenser to 0.37 mfd.; B+ series resistor to 1.5K Ω. Put load of 25 Ω across secondary for stability.



When tested on receiver it was found that 0.3 volt output was more than ample and produced a significant widening to trace. Even 0.2 volt seemed to be adequate. Thus a four to one voltage divider of 50 and 150 ohms in series should be used across output. This will allow oscillator to operate at higher amplitude