

1. F. Chassis

10/1/63

1.4 mc input at 223 KC.

Two equal tubes,

$E_B = 165V$

R_K Reference Volts.	15,000- Ω			30,000- Ω		
	Output volts	Total I_K ma	E_G volts	Output Volts	Total I_K ma	E_G volts
6	1.3	1.2	-3.7			
12	1.9	1.9	-2.8	1.0	1.0	-3.5
* 18	2.35	2.6	-2.0	1.35	1.4	-3.0
22 $\frac{1}{2}$	2.25	3.2	-1.4	1.5	1.6	-2.6
28				1.5	2.0	-2.0
34 $\frac{1}{2}$				1.1	2.4	-1.4

- * Choose this condition at $R_K = 15000$ ohms
Blue battery leads to first 1.F. stage
White battery leads to second 1.F. stage

E_G is measured from negative terminal of filament battery (+) to positive terminal of reference battery (-)
A meter of 50,000 ohms internal resistance is used.

Probably more total gain can be secured by a lower R_K , say 10,000 ohms. a lower reference volts will be optimum with less regulation. I_K will increase.

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$Z = 600 - j2 = 6.28 \cdot 2 \cdot 13 \cdot 10^6 L$, $L = \frac{600}{6.28 \cdot 2 \cdot 13} \mu h = 45 \mu h$

If $X_L = 5X_Z$, Required $L = 225 \mu h$.

Winding length = 1.5", Try 15 turns of .020" wire.

80 mc	420
1160 "	1010 pf
75 mc	470 pf

$C_p = \frac{420 - 404}{3} = \frac{16}{3} = 5.3 \text{ pf}$

9, 2 μv ,

$L = 1 / (6.28 \cdot 8 \cdot 10^6)^2 \cdot 425 \cdot 10^{-12}$

$L = 10^3 / 25.2 \cdot 425 = 10^{-3} / 10.7 = 93 \mu h$, 51 turns

$(\frac{225}{93})^{1/2} \cdot 51 = 1.56 \cdot 51 = 79$ turns wire, .019" dia.

Secondary only

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73 turns, .020" wire

$C_o = \frac{273 - 242A}{3} = \frac{10.6}{3} = 3.5 \text{ pf}$

mc	pf	Q
0.7 mc	273	157
1.4	65.6	155
2.1	27.5	136

$L = 1 / (6.28 \cdot 7 \cdot 10^6)^2 \cdot 277 \text{ pf}$

$= 1 / 19.35 \cdot 277 = 10^3 / 5335 = 186 \mu h$.

$(\frac{612}{50})^{1/2} = 3.5:1$ ratio $\frac{73}{3.5} = 21$ turns each half.

With primary over top,

0.7 mc	262	83
1.4	54.5	45
1.8	36.5	29

$C_o = \frac{262 - 218}{3} = \frac{44}{3} = 14.7 \text{ pf}$,

$L = 1 / (6.28 \cdot 7)^2 \cdot 277 \text{ pf} = 186 \mu h$.

Unbalanced 50 ohm to balanced 612 ohm transformer

~~More more food~~

~~.44 to .74V~~

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17.6	16.8	15.9
7.9	7.2	6.9
4.10	4.00	3.75

Overall Performance

Input at 2120 KC

$E_R = 18V$, $R_K = 15,000\Omega$ on all stages

15.6V	16.5V	17.4V	E_B volts
6.90 ma	7.15 ma	7.35 ma	I_B total for Set
.76V	1.00V	1.15V	Relative Output.
		1.15V	

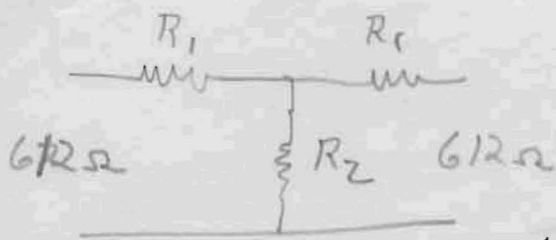
	I_K	I_K	I_K		$\frac{I_{Kmax}}{I_{Kmin}}$
1.91	1.33	2.25	1.35	2.52V	1.37 R.F. E_G 1.03
.60	1.24	1.48	1.30	2.20V	1.35 Mixer E_G 1.09
1.72	1.32	2.05	1.34	2.35V	1.36 1st I.F. E_G 1.03
1.46	1.30	1.77	1.32	2.06V	1.34 2nd I.F. E_G 1.03
	5.19 ma	5.31 ma			5.42 ma Total bias oscillator
	11.71 ma	1.84 ma			10.93 ma Oscillator tube 1.13

Most of the gain variation probably is in mixer.
 Try another tube, also increase R_K by $1K\Omega$

$$3.5:1 = 10.9 \text{ dB}$$

$$2 = 3.5$$

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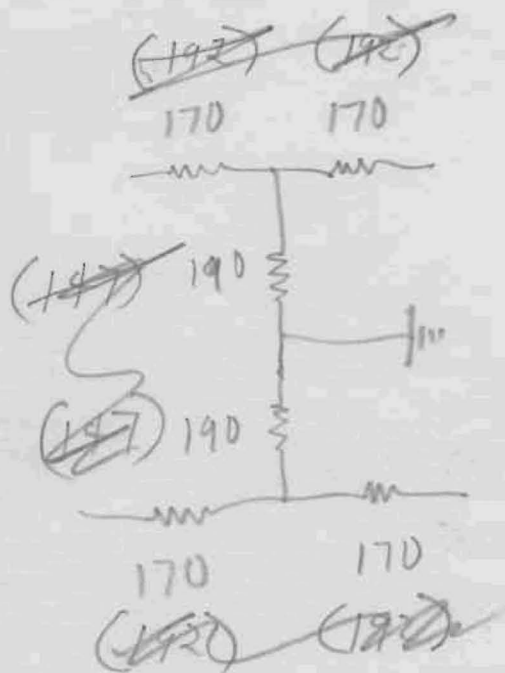
$$R_1 = 612 \left(\frac{3.5-1}{3.5+1} \right) = 612 \frac{2.5}{4.5} = 340 \Omega$$

$$R_2 = 612 \left(\frac{2 \cdot 3.5}{3.5^2 - 1} \right) = 612 \frac{7}{11.25} = 381 \Omega$$

~~$2.306 \log_{10} 3.5$~~

~~$R_1 = 612 \left(\frac{4.37-1}{4.37+1} \right) = 612 \frac{3.37}{5.37} = 383 \Omega$~~

~~$R_2 = 612 \left(\frac{2 \cdot 4.37}{4.37^2 - 1} \right) = 612 \frac{8.74}{18.1} = 295 \Omega$~~



Attenuator for

Signal Gen Trans.
Use extra 35 ohms in series with primary for General Radio Signal Generator

Minor improvements. Measure tubes on tester.
Interchange 1LNS tubes R.F. & 2nd I.F. positions
Raise load on R.F. stage to about 50K ohms.
add 1K ohms to cathode resistor on Mixer

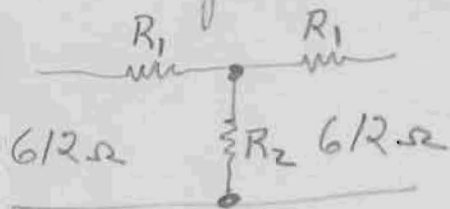
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Antenna Relay

When armature is horizontal it will close on 10 volts requiring 20 ma. However 12 volts at 24 ma is better. Relay coil has 500 ohms resistance. When armature is vertical it requires more than 12 volts to close.

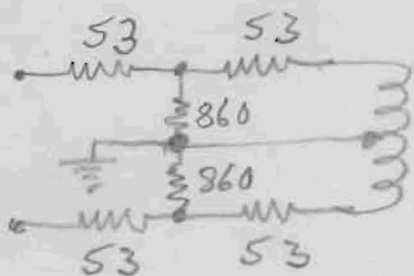
Coil should be rewound to operate on 2 volts, at 144 ma or about 14 ohms.

Input Pad, 3db attenuation, $\alpha = 1.414$



$$R_1 = 612 \frac{.414}{2.414} = 105 \Omega$$

$$R_2 = 612 \frac{2.818}{1} = 1720 \Omega$$



O only used this a few months

Disconnected about time changed from 6 to 12 KC bandwidth

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Test of Regulation on Mixer, Tube # 1

Input to signal grid 0.20 volts at 2100KC
 Output at chassis receptance I.F. cable, 250KC.
~~15000 Ω cathode resistor~~, 18v reference battery

E_B volts	162V	171	180
Oscillator grid connected to oscillator direct 15K Ω cathode resistor			
E_G volts	-1.06V	-1.80	-2.58
I_K ma	1.27 ma	1.32	1.37
Output Volts	.375V	.440	.490
I_K max/ I_K min		1.08	
Output max/min		1.31	

E_G volts	-0.65	-1.20	-1.81
Oscillator grid returned to Fil(t) thru 220K Ω 10K Ω cathode resistor 150pf coupling condenser			
I_K ma	1.87	1.92	1.98
Output Volts	.64	.49	.38
I_K max/ I_K min		1.06	
Output max/min		1.68 (.59)	

E_G volts	-0.76	-1.35	-2.05
Oscillator grid returned to reference thru 220K Ω 10K Ω cathode resistor 150pf coupling condenser.			
I_K ma	1.88	1.94	2.00
Output Volts	.59	.480	.370
I_K max/ I_K min		1.06	
Output max/min		1.60 (.63)	

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Oscillator grid connected to oscillator thru
220K Ω shunted by 150pf.

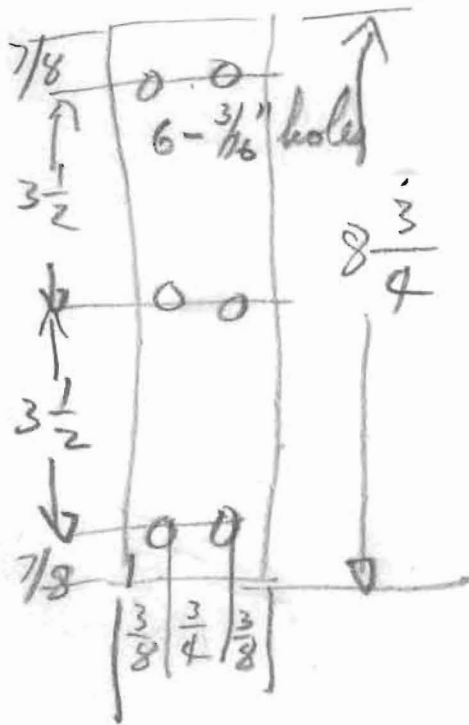
10K Ω cathode resistor

E_G	+1.70	+1.05	+0.35
	1.63	1.70	1.77
Output	.32	.35	.38
		1.09	
Output max/min		1.19	

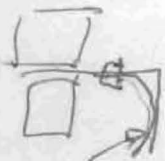
Oscillator grid connected to reference battery thru 220K Ω
& to oscillator by 150pf

E_B	159			168			177		
R_{JK} (K Ω)	10.0	10.5	11.0	10.0	10.5	11.0	10.0	10.5	11.0
E_G (-)	.76	1.13	1.52	1.29	1.71	2.15	1.90	2.38	2.90
I_K	1.88	1.82	1.78	1.93	1.87	1.84	1.99	1.94	1.91
Max/Min.				1.06	1.065	1.07			
Output	.64	.52	.41	.51	.40	.31	.41	.31	.25
Max Min				1.56	1.68	1.64			

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Clamp plate between
R.F. & L.F. chassis.



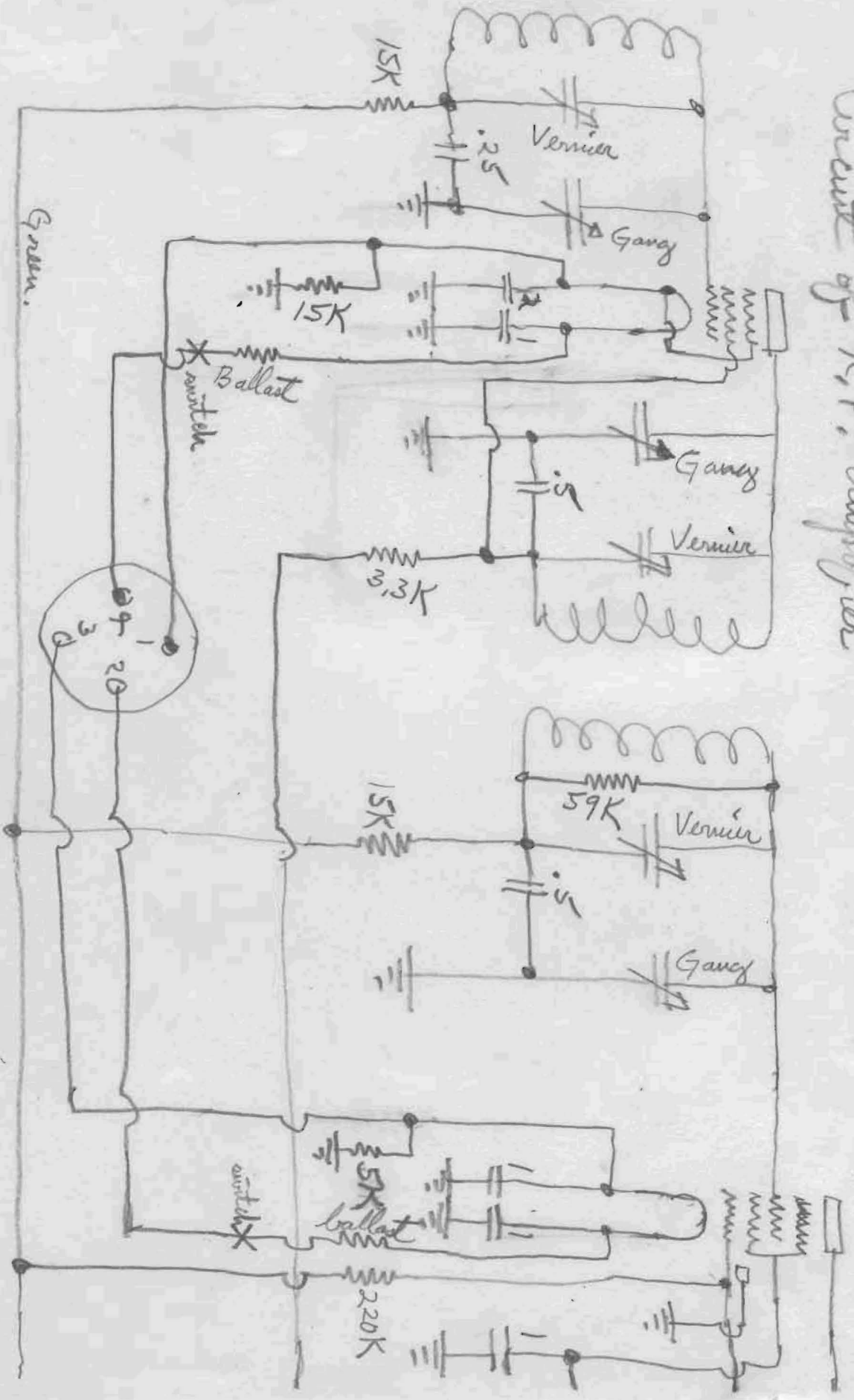
$R_k = 10,000 \Omega$ Continued from previous sheet 18/1/63
 EB 159 150 141
 IK 1.88 1.82 1.76 Tube # 1
 EG -0.76 -0.15 +0.38
~~IK 18.8 18.2~~

Output .64 .79 .99

Changed R.F. load from
 45K Ω to 59K Ω

Interchanged R.F. + 2nd I.F. tubes
 R.F. + both I.F. tubes up to standard.

Circuit of R, F, Amplifier



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Test of Regulation

21/1/63

Input to R.F. Grid. Output at audio cable.

Mixer $R_K = 10,000 \Omega$.

Reference ≈ 18 volts.

Oscillator grid returned to reference voltage thru $220K \Omega$ + coupled to oscillator by $150 pF$.

	E_B	136V	148	154	163	172	
Mixer E_G		+0.94V	+0.44	-0.25	-0.74	-1.27	1A7 Mixer Tube # 1 Weak by 6DB
Mixer I_K							
Output		1.34V	1.16	1.00	.81	.63	
Mixer E_G		-0.55V	-0.96	-1.42	-1.80	-2.27	Tube # 2
Mixer I_K							
Output		1.10V	1.06	1.00	.93	.80	
Mixer E_G		-0.15V	-0.55	-1.08	-1.47	-1.90	Tube # 3
Mixer I_K							
Output		1.00V	1.02	1.00	.96	.85	
Mixer E_G		-0.13V	-0.61	-1.32	-1.64	-1.95	Tube # 4
Mixer I_K							
Output		0.94V	0.99	1.00	1.03	1.00	
I_B		7.0ma	7.2	7.4ma	7.6	7.8	

Apparently the R.F. voltage on oscillator grid rectifies and causes a slight current thru the $220K \Omega$ resistor. This D.C. voltage holds the oscillator grid negative and controls the space current. Its regulating action depends on tube characteristics.

Test of Regulation

21/1/63

Input to R.F. grid. Output at Audio Cable.

Filament negatives all at zero potential, Grid bias -3 volts,
Mixer tube #2.

E_B	136V	145	154	163	172V
I_B	5.2 ma	5.9	6.7	7.4	8.3 ma
Output.	.37V	.65	1.00	1.43	1.87V

Obviously the regulating action of cathode resistor is necessary as this much too poor.

Oscillator grid returned to -3 thru 220K- Ω ↓ coupled to oscillator by 150pf.

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Voltage Regulator Performance 2120KC

Stage	E_B volts	150	159	168	177	186	RK
	I_B ma	7.3	7.5	7.8	8.0	8.2	ohms
R.F.	E_G volts	1.10	1.39	1.70	1.96	2.26	15K
	I_K ma	1.27	1.29	1.31	1.33	1.35	
Mix	E_G volts	0.58	1.05	1.68	1.94	2.50	10K
	I_K ma	1.86	1.91	1.97	1.99	2.05	
1st IF	E_G volts	1.39	1.67	2.00	2.25	2.57	15K
	I_K ma	1.29	1.31	1.33	1.35	1.37	
2nd IF	E_G volts	1.50	1.78	2.09	2.35	2.65	15K
	I_K ma	1.30	1.32	1.34	1.36	1.38	
DC Output	volts	1.17	1.11	1.00	0.85	0.70	

Tube # 4 in Mixer

E_G measured between +18 volts reference (-) and negative of filament battery (+) with a meter having 50K Ω internal resistance