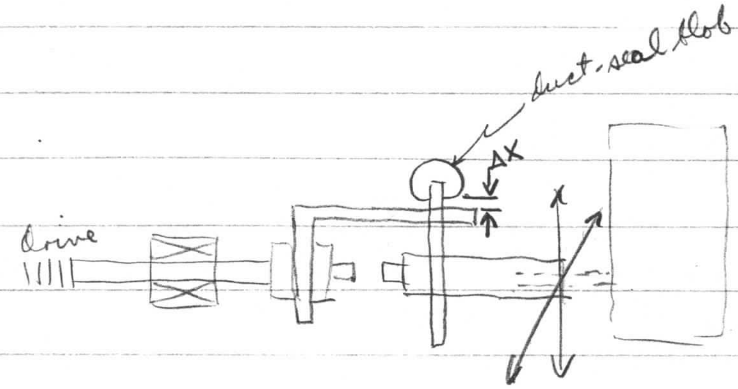
3/13/65 Test pattern films show evidence of erratic line pairing - as though the traverse drive were sticking and jumping. I sanded the track and put on a brushed coating of talcium. Primarily it was relatively large grains of sand in the track - relatively deep scoring was obvious.

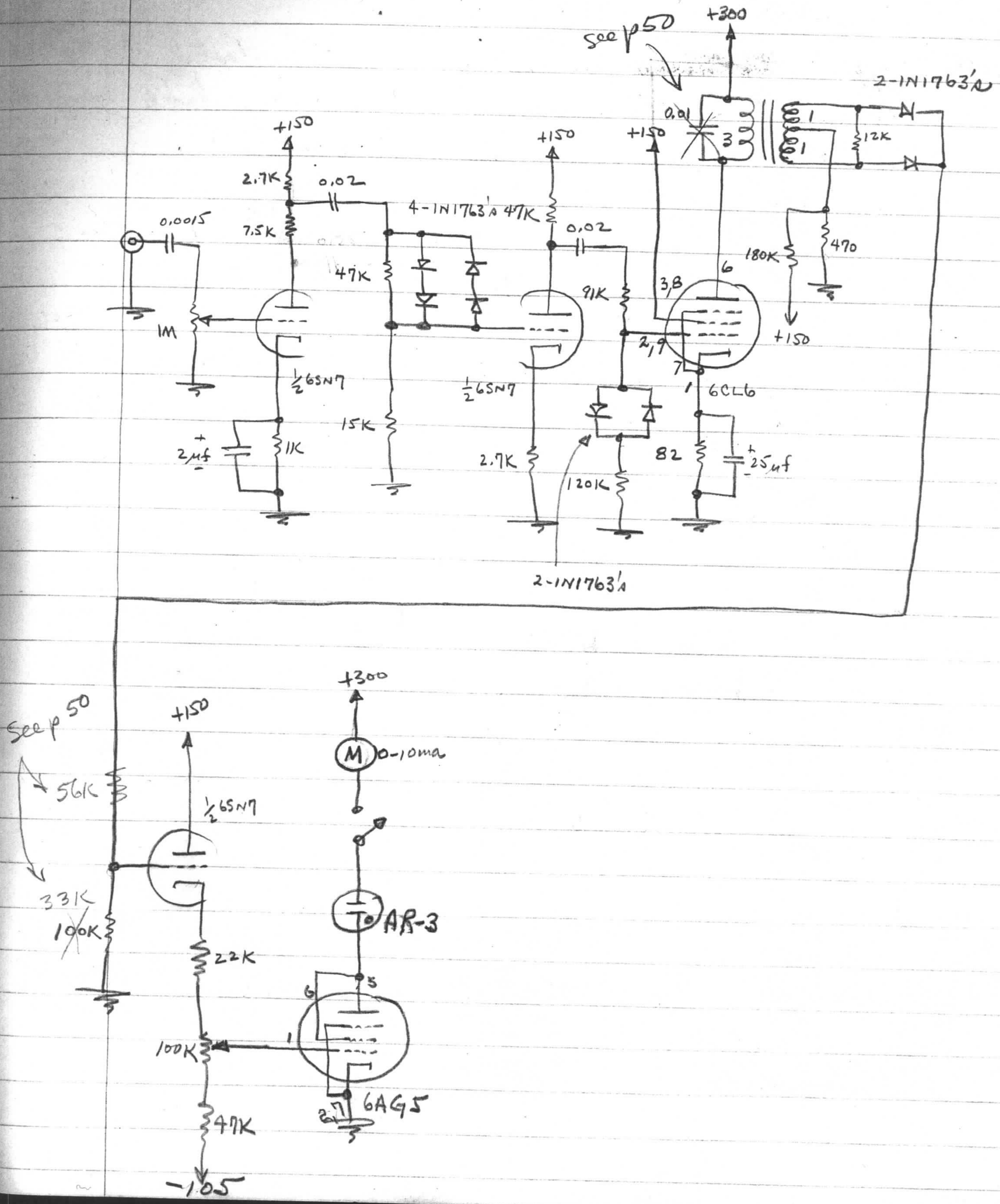
48RPM gives grouping of lines $\frac{4 \text{ lines/sec} \times 60 \frac{\text{sec}}{\text{min}}}{48 \text{ rev/min}} = 5$ lines/revolution



adjusted motor position to give equal ΔX top & bottom, right & left

Took 3/13/65 (A) - Smoothest traverse ever!

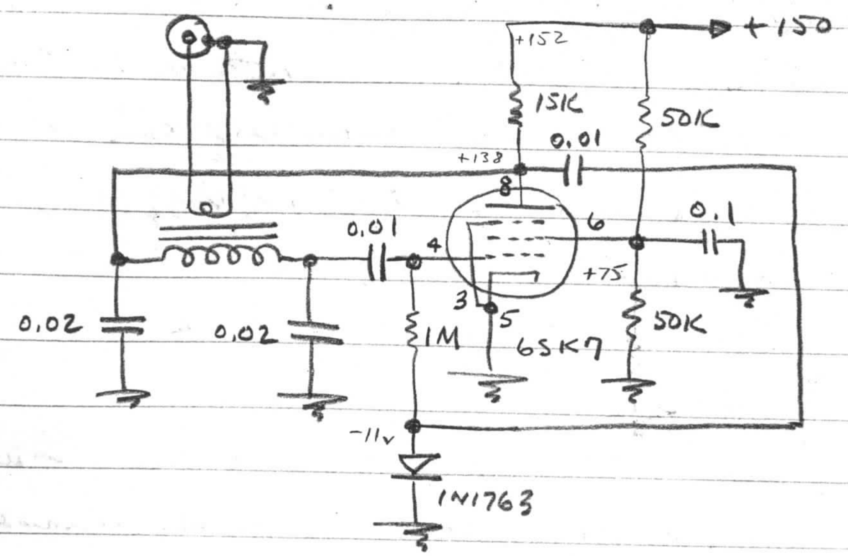
Then removed the boxcar, using only rectifier, no filtering. This is 3/13/65 (B)


see p50
+300
2-1N1763'A
0.01
3
1
1
12K
+150
+150
+150
2.7K
0.02
4-1N1763'A
47K
0.0015
7.5K
0.02
47K
91K
3,8
6
180K
470
1M
+150
2,9
1/2 6SN7
1/2 6SN7
7
1
6CL6
15K
2μf
1K
2.7K
82
25μf
120K
2-1N1763'A
+300
See p 50
+150
M
0-10ma
56K
1/2 6SN7
AR-3
33K
100K
22K
6
5
1
100K
47K
2
7
6AG5
-105

3/14/65 Listening on 9.900 mc. Picture started about 2:10 PM. From the video it looks like a line drawing — perhaps a map. Seems to be locked with the 60 ~ line
Sync again 3:05 PM pix 3:10 PM I did not monitor 4:10 but on again 5:10. QRM built up badly — heard again at 7:10 and ready to record but QRM very bad. From the discriminator output, it is apparent that the QRM is very far away compared to peak deviation: the bandwidth is too high.

3/15/65 Yesterday I tried using the IF of the SX-25 to drive the outboard chassis. Did not use the last IF stage (in the outboard for normal AM etc). Had some oscillation, alignment is not too good. Interference still bad but by the time I finished, about 7:30, propagation was very bad.

Built audio oscillator, most shaggy construction, but works pretty well — waveshape is not too good but adequate for carrier use in recording.



Using the Γ expander of page 2 as an audio carrier modulator. Previous "input from tape recorder" is now audio carrier input.
6BN6 grid #4 input is "receiver output"
This is not a balanced modulator – it is a normal AM type. I interchanged the input pots – 50K for carrier input, 1M receiver output, – to prevent receiver loading.

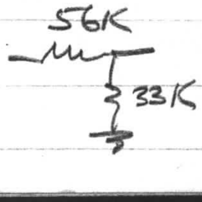
~~It could be made into a balanced modulator by feeding one grid #4 instead of both.~~
Would require a second pair of 6BN6's.

3/20/65 Monitoring 9.9mc. Carrier but no signal 9:40 → 100 PM
Signal at 1:05 PM Started recording late – wrong speed – Shifted to 3 3/4 at 110 PM
070 on counter signal ends 213 on ctr 123 PM
I turned recorder off and it started again
Frame at 459 on ~~ctr~~

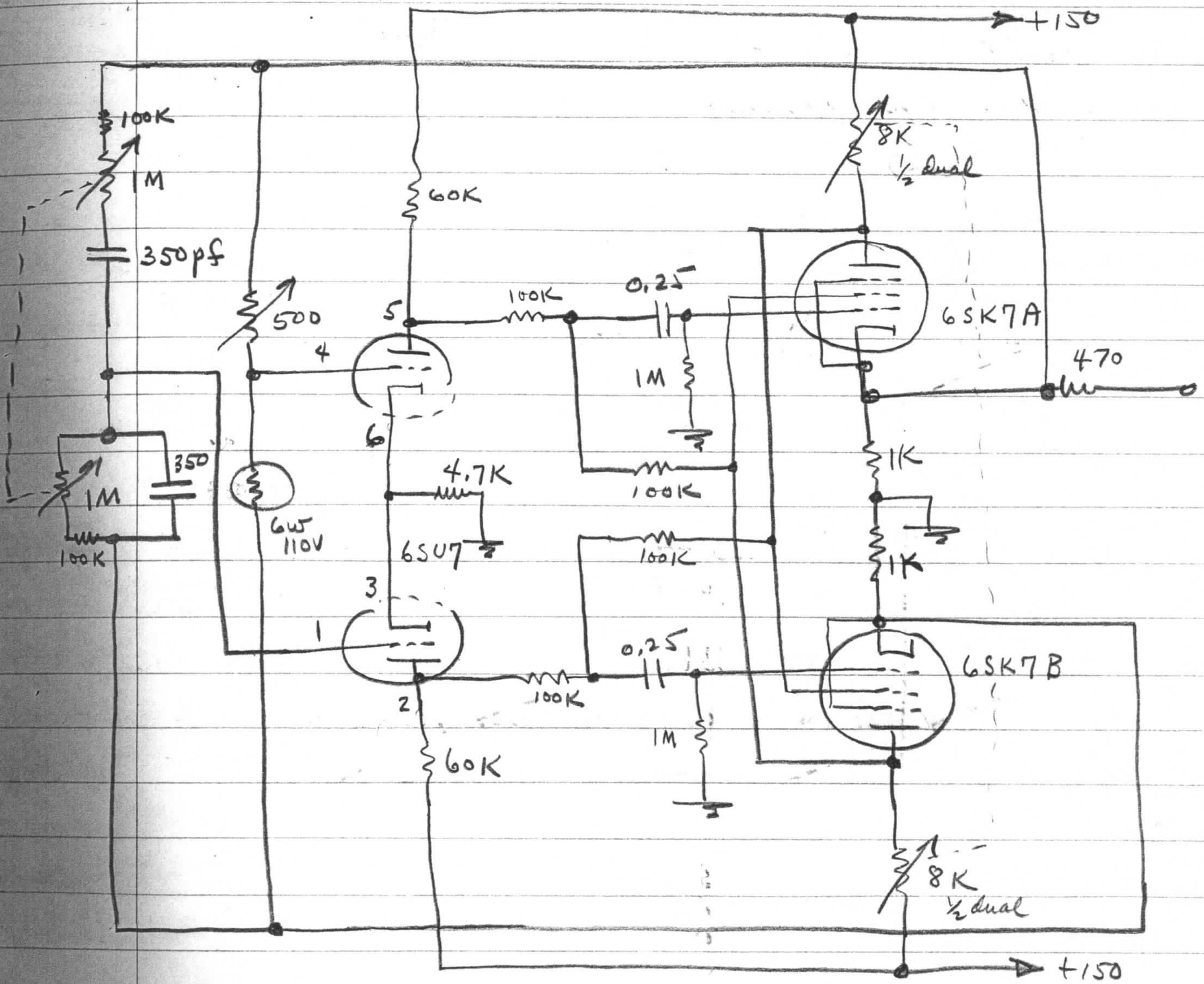
CFH identification at 1400 exactly – Video stopped before CW ident and blanking began immediately after.

4/23/65 Have had a meeting with Ed Fima and Hal Swartzberg of AED re: QST article. Ed has built a countdown circuit to go from the 2400 cps subcarrier to 4 pps. I could probably recover pictures from my first tapes if I made a 2400 ~ to 60 ~ countdown.

I found that the .015 μf capacitor across the audio driver transformer causes the signal to start to roll off about 1 KC giving practically no output at 3 KC and up. This was measured by using a new audio oscillator.

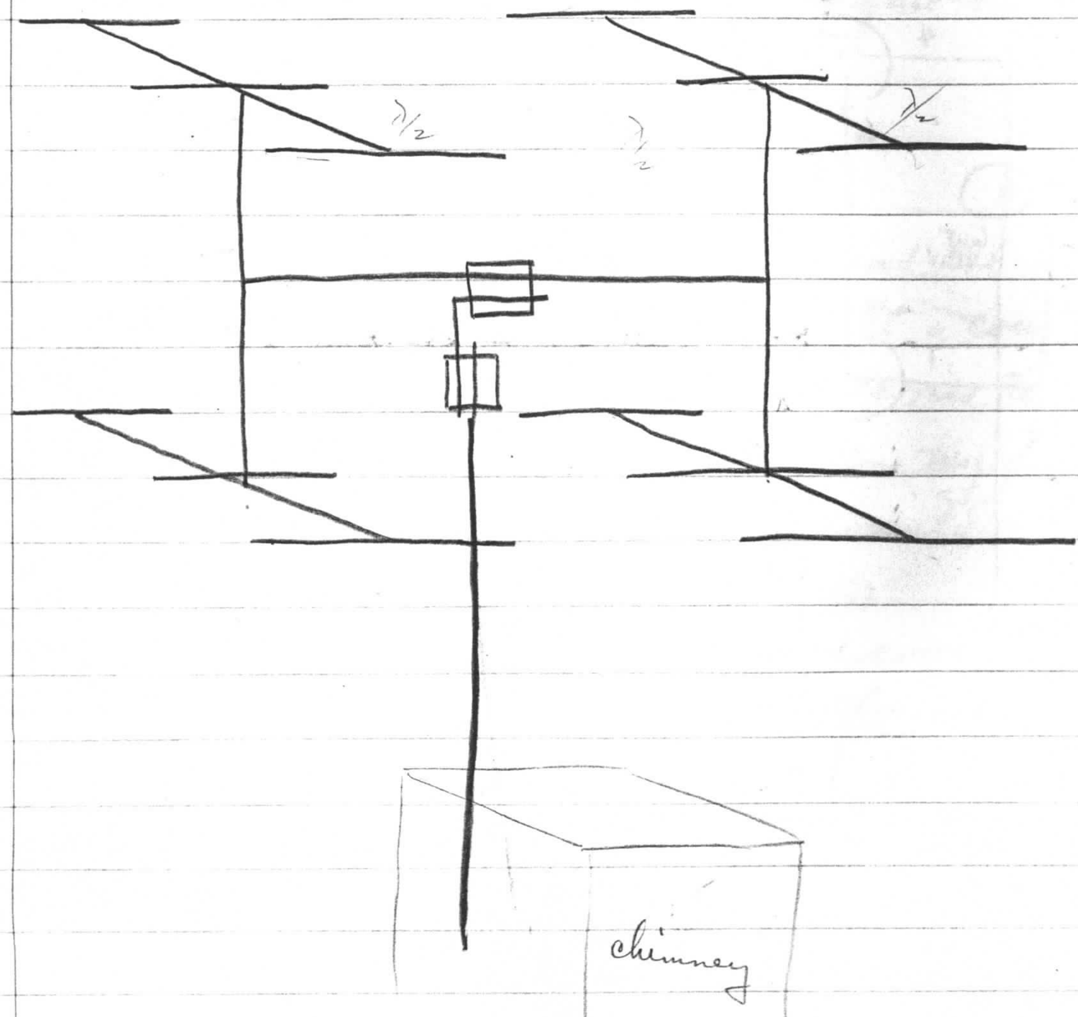
Had to put in 

divider on output of rectifier to make 10 v @ S give 7 ma in argon bulb



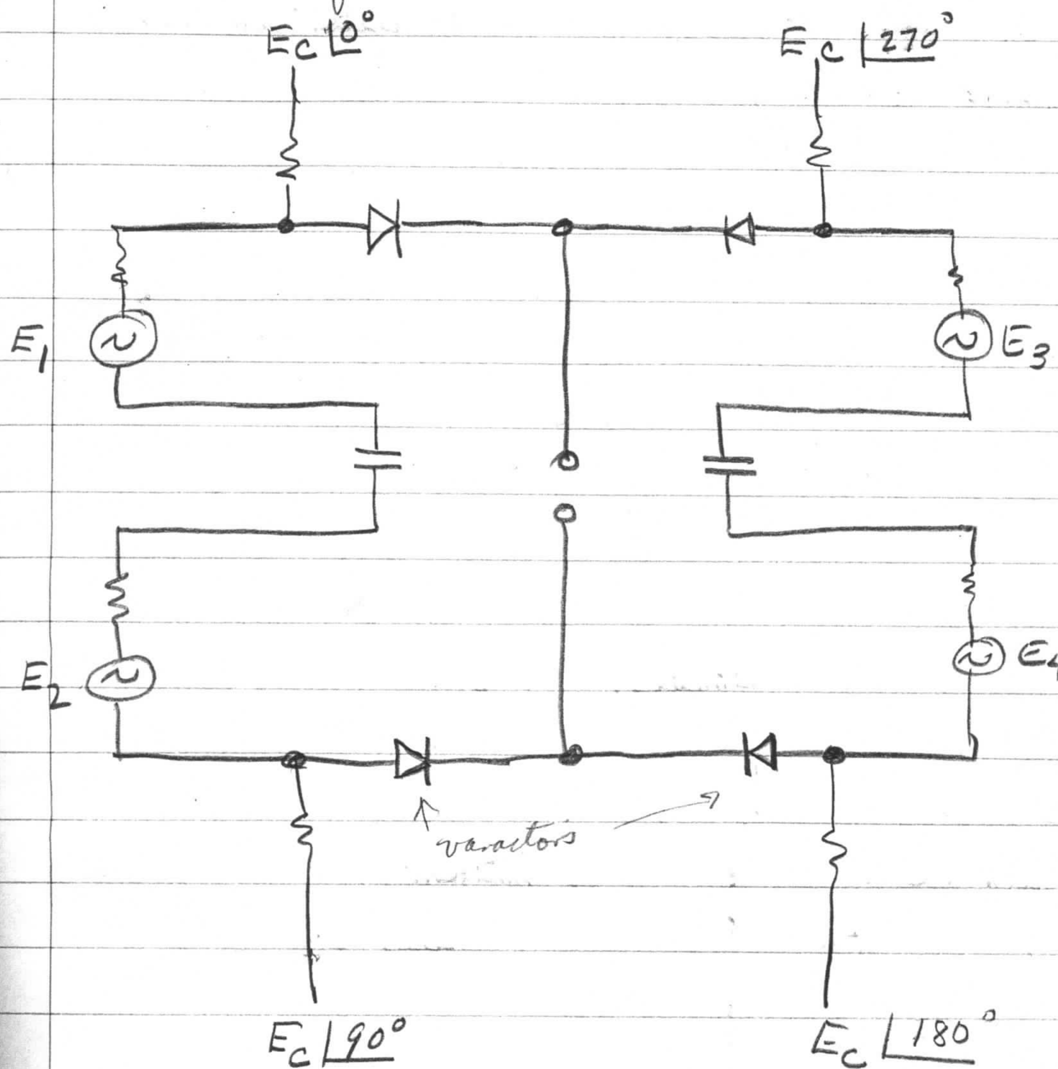
300~ — 4200~ audio oscillator

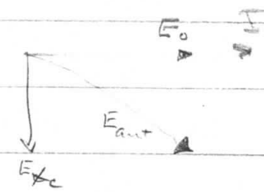
The various sources at AED agree that TOS is circularly polarized. The sense is different depending on direction of view. ∴ horizontal linear polarization looks best definitely.



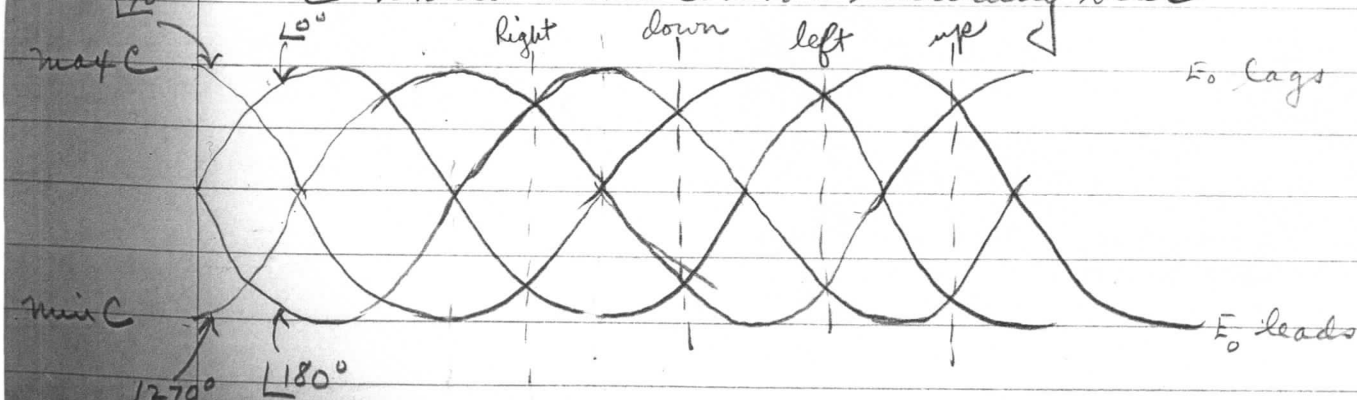
This looks like an f6 arrangement

With 300 Ω feed lines

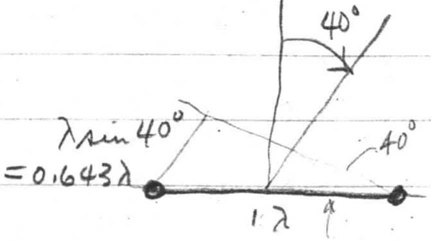




Ec varactor diode control including bias

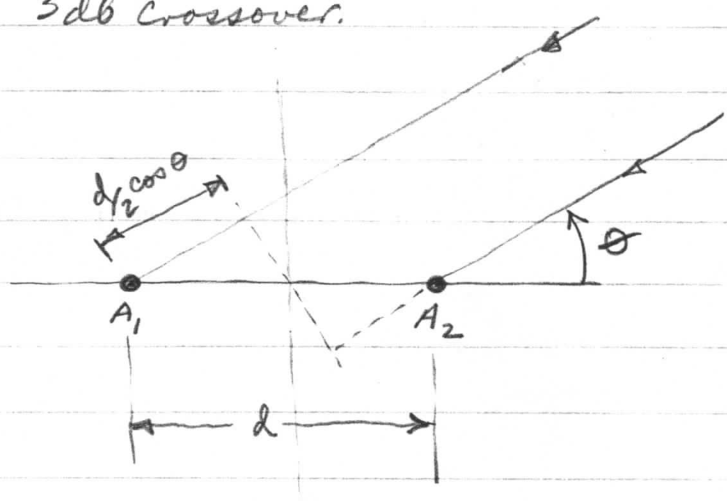


Phase centers are 1λ apart. Beamwidth is probably about 40 degrees so squint should be about the same.



delay of 0.643λ = 0.643(360°) = 232° (too much for varactor phase shifter)

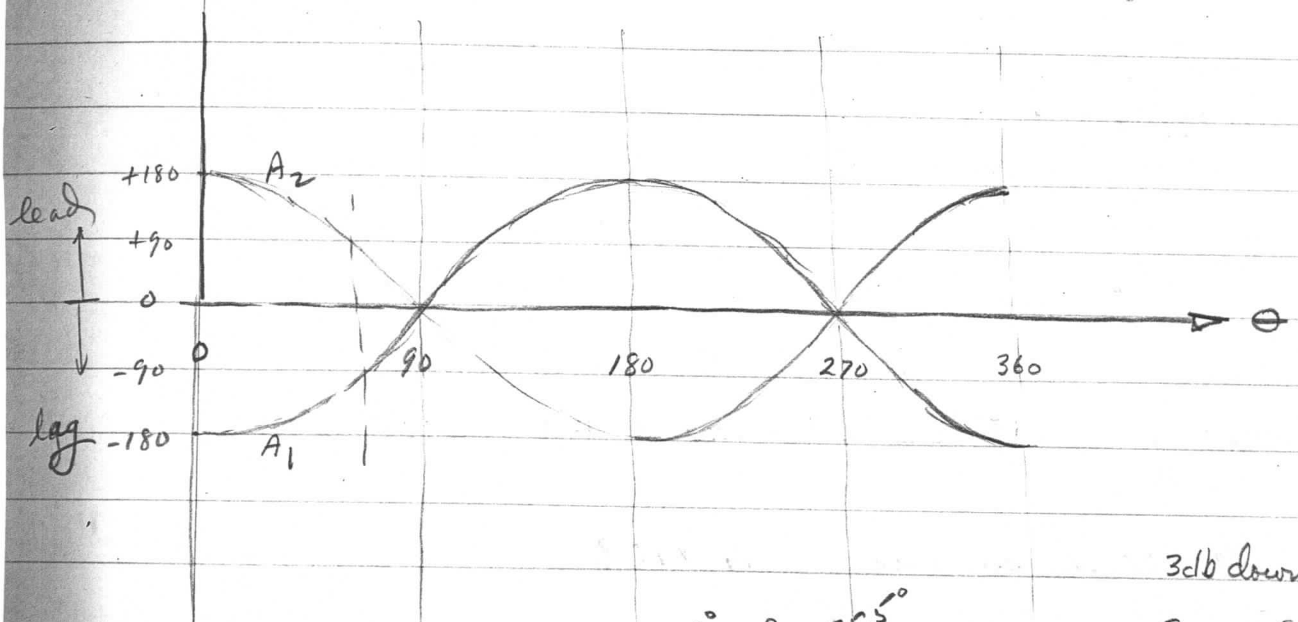
4/24/65 Note that 180° of delay is equivalent to feeding the radiators out of phase. At this point steering to the left and steering to the right are indistinguishable. The error here is in assuming that the squint should be so large. The pattern of the two radiators is not that broad — also squint should be ½ of the beamwidth in each direction to give 3db crossover.



$e_R = e_{A_1} + e_{A_2}$ for in-phase feed

$$e_R = E \angle -\frac{d}{2}\frac{(\cos\theta)\,360^\circ}{\lambda} + E \angle +\frac{d}{2}\frac{(\cos\theta)\,360^\circ}{\lambda}$$

For $\lambda = d$

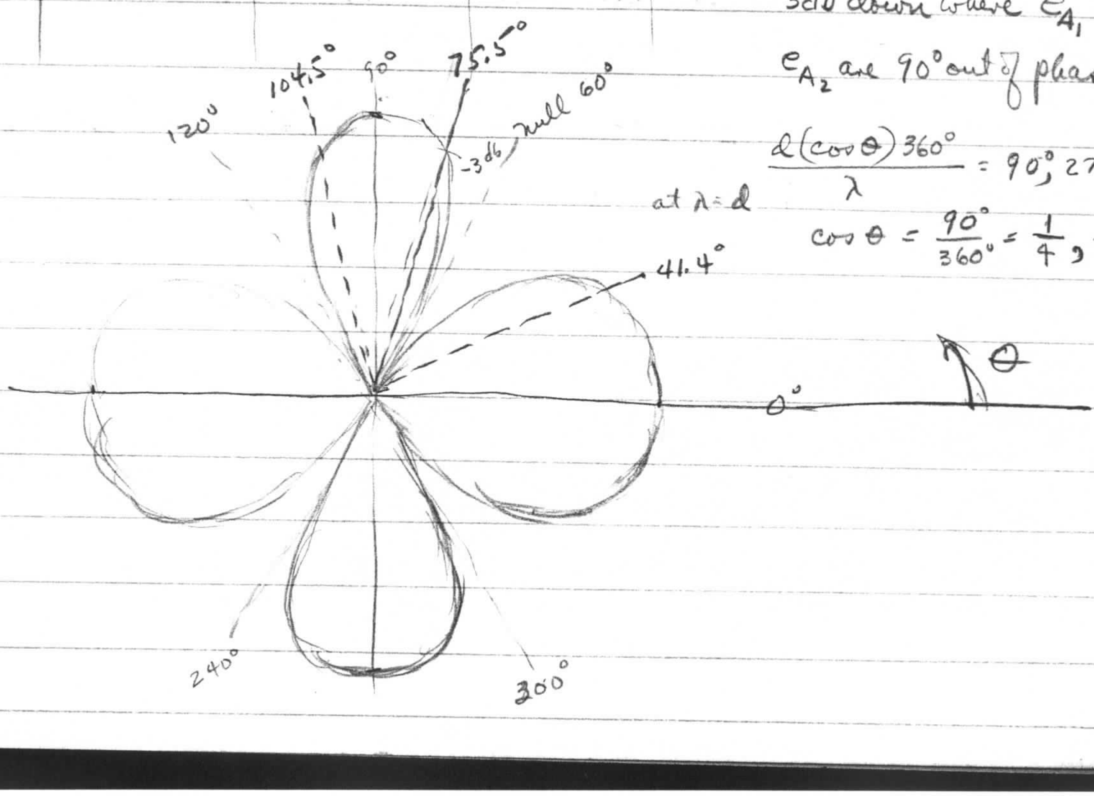


3db down where e_{A_1} & e_{A_2} are 90° out of phase.

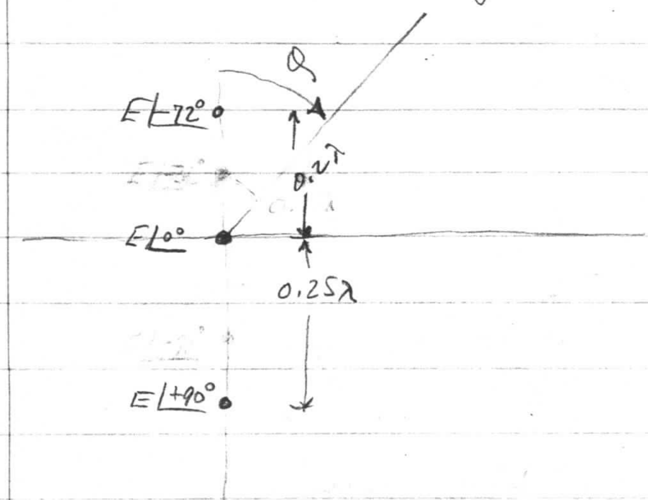
$$\frac{d(\cos\theta)\,360^\circ}{\lambda} = 90^\circ, 270^\circ$$

at $\lambda = d$

$$\cos\theta = \frac{90^\circ}{360^\circ} = \frac{1}{4}, \frac{3}{4}$$

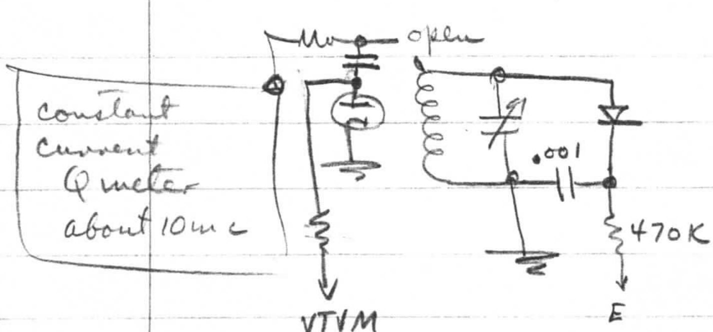


But this is superimposed on the element pattern.
In the horizontal plane, this is the dipole pattern
multiplied by a 3 element endfire array pattern of omni's
In the vertical, this is only the 3 element omni array.



$$E_R = E\angle -72° + 72° \cos\theta + E\angle 0° + E\angle +90° - 90° \cos\theta$$

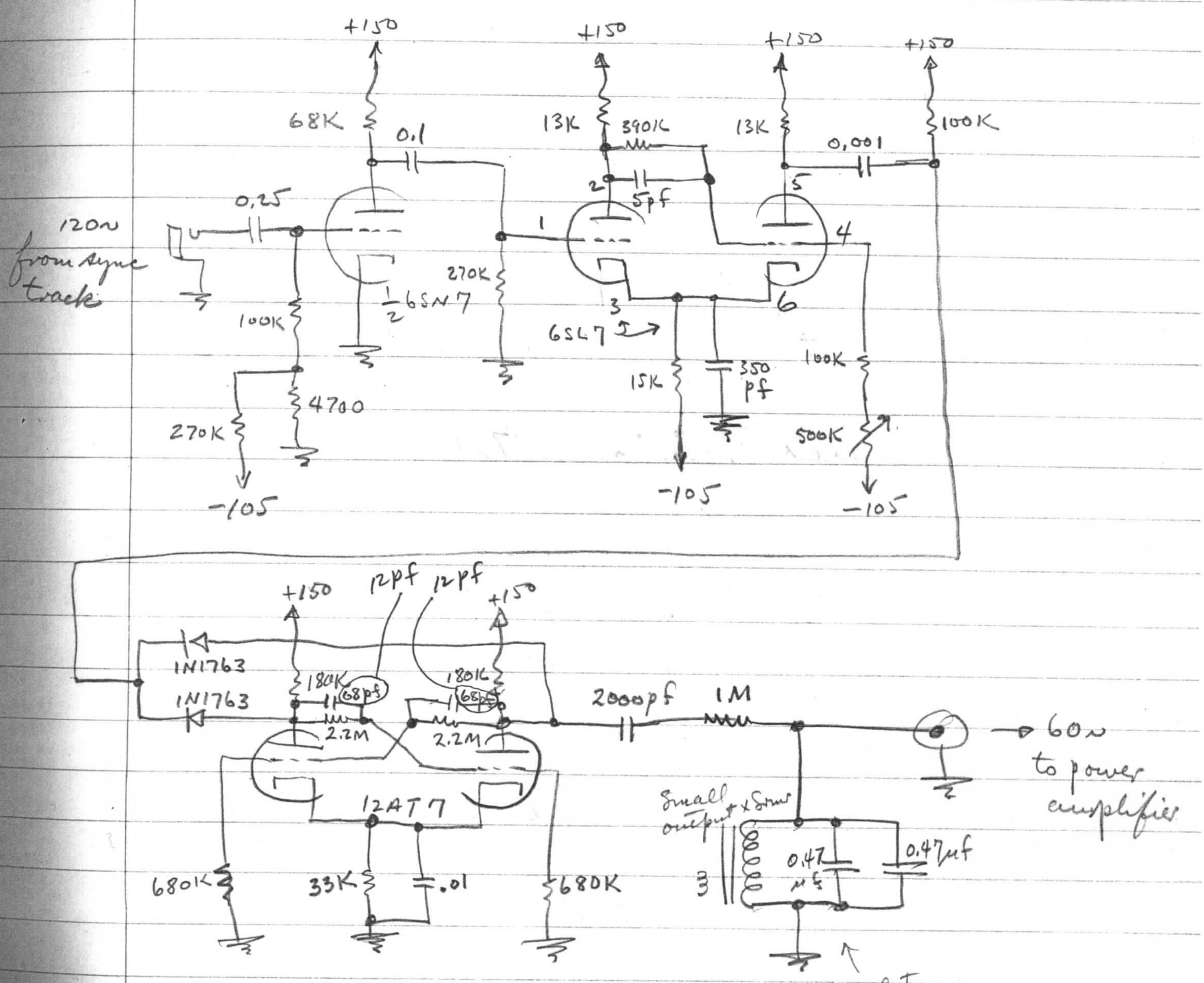
4/27/65 Varactor action with the IN1763



Capacitance around 5pf at 75V
increasing to 15 or 20pf at 4.5V.
Q is lowered at low voltage but still quite good
More careful measurements
needed. Perhaps I can
use an RX meter at work.

[See p 72] and p 83-84

5/1/65 The circuit used for ÷ 2 for use with the CFH 9.9 mc transmissions recorded at $3\frac{3}{4}$ ips and playback at $7\frac{1}{2}$ ips. The 60 ~ sync track is then 120 ~ and is ÷ 2.



5/3/65 The 65pf's used for crossovers were much too large - Getting spurious triggering apparently - Replaced with 12pf's and operation of the counter is vy fb.

Yesterday I built a 2400 cps countdown circuit to take the subcarrier and get 60~ for the drum spin motor. The operation was very good on the test oscillator down to very low input levels. It failed miserably on actual video - The noise, and perhaps the modulation, kept it from giving any 60~ output. Since it may not loose as much as a single pulse in 10 minutes, this is completely unacceptable.

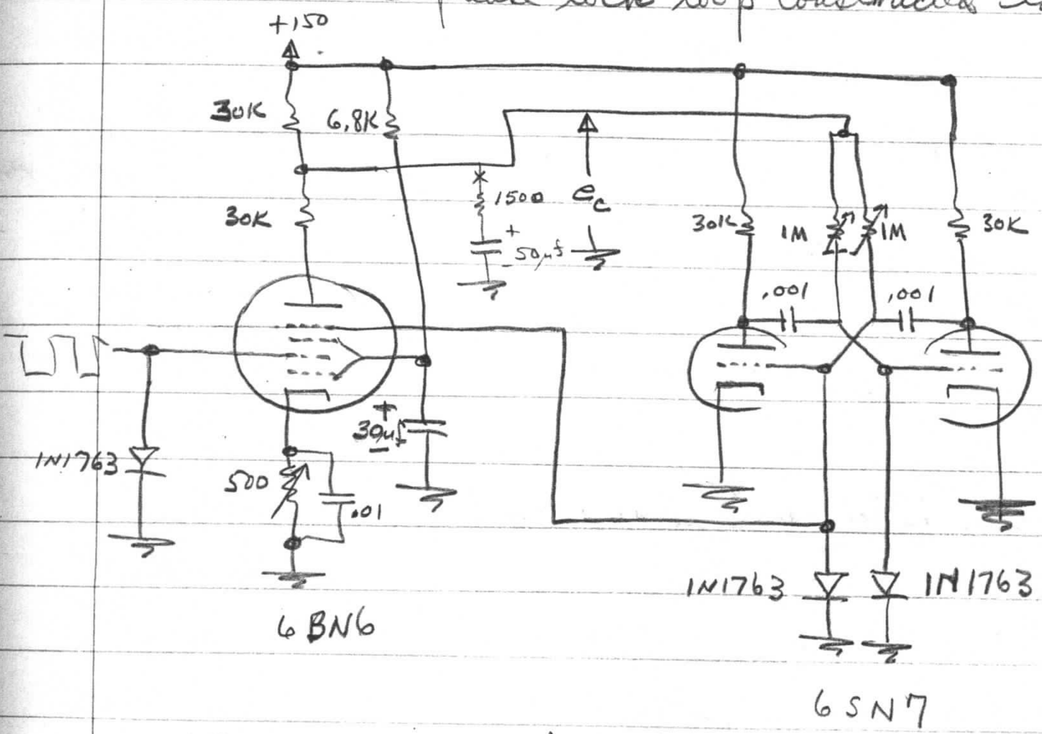
I will try to use a phase locked oscillator to give a clean input to the countdown. It may also provide a better synchronizing means.

One of the problems with the subcarrier countdown approach is the absence of subcarrier at the beginnings of the frame.

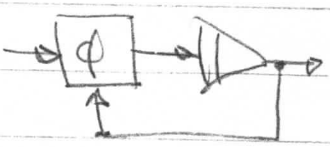
The countdown circuit and phase locked loop must not allow drift during the framing interval. It should also have good memory in the presence of signal fades.

5/6/65

The basic phase lock loop constructed is



(see p 64)



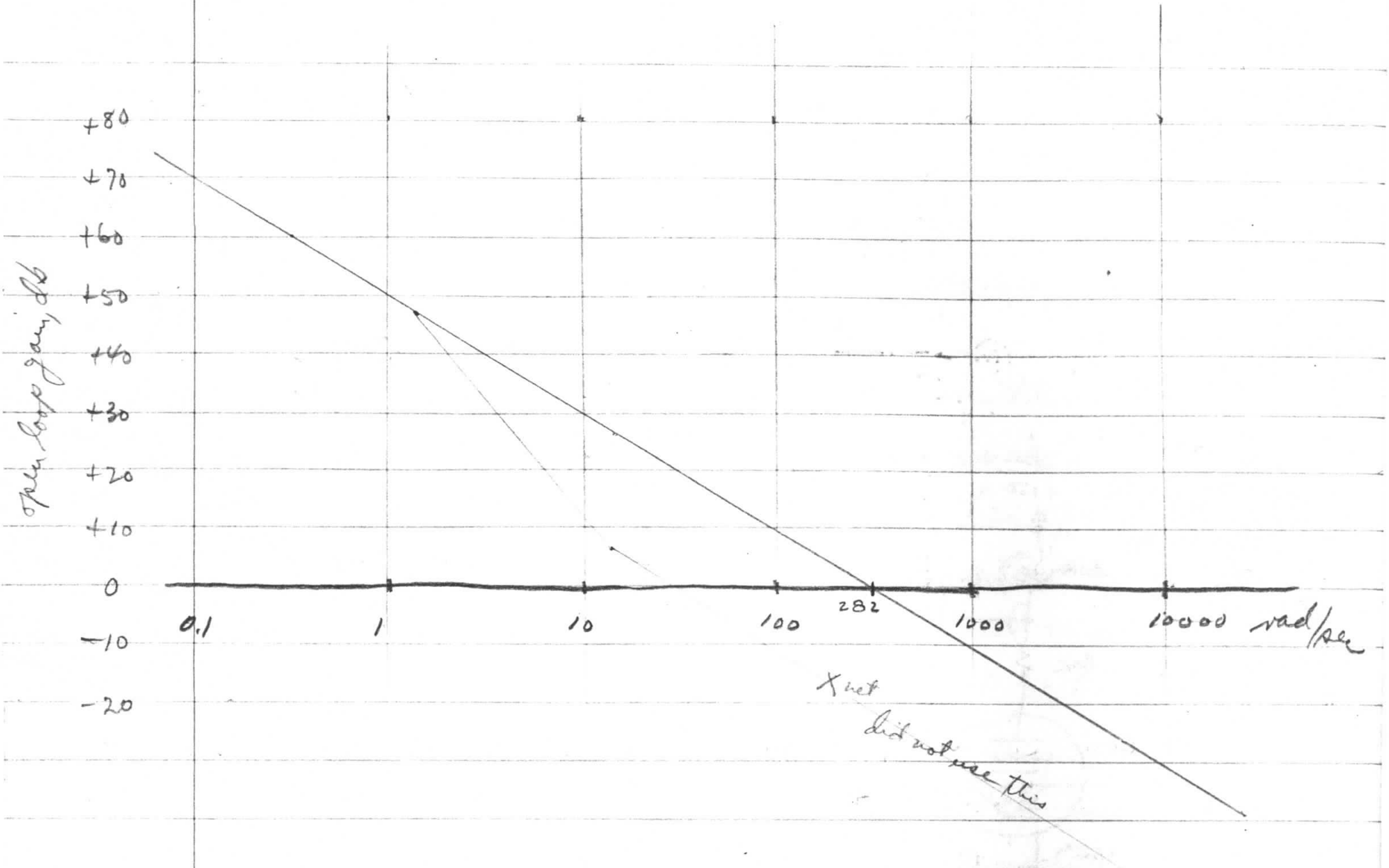
$$\frac{\partial f}{\partial e_c} = \frac{750 \text{ ∿/sec} \times 2\pi \frac{\text{rad}}{\text{∿}}}{53\text{v}} = 89 \frac{\text{rad/sec}}{\text{volt}}$$

e_c	f	
121 V	2500 ∿	6BN6 out
68 V	1750 ∿	6BN6 plate pin short to gnd

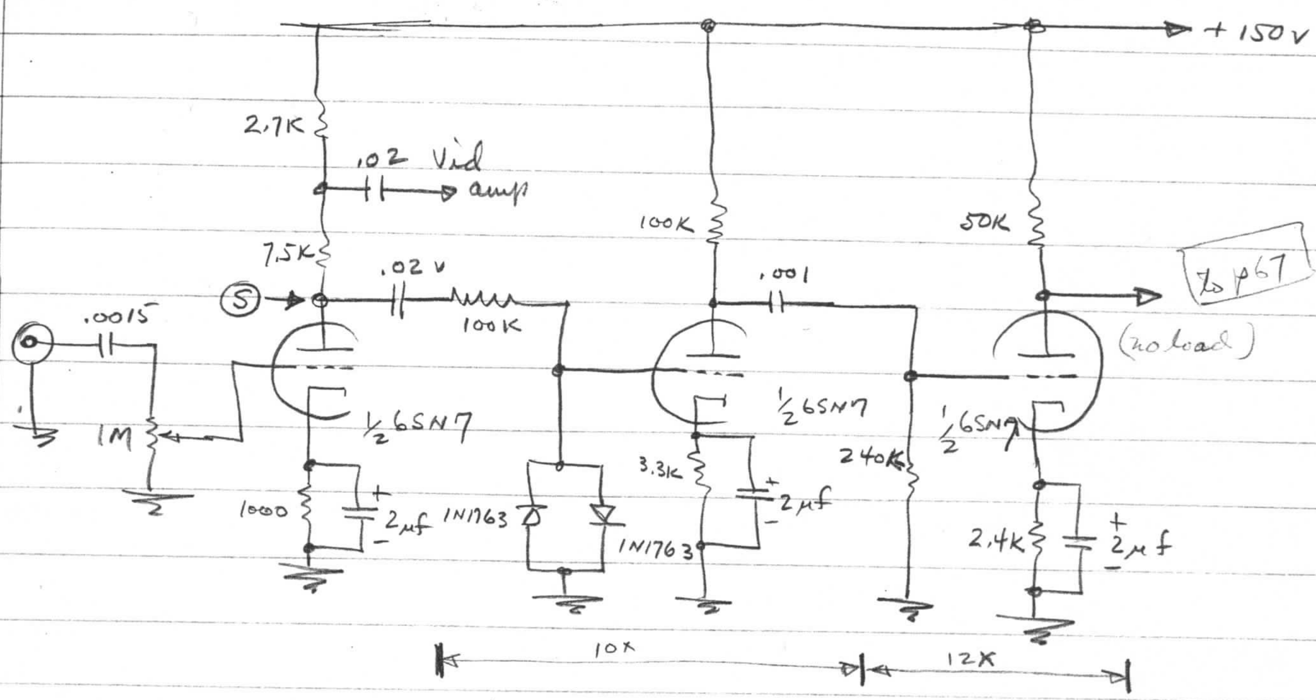
$$\frac{\partial e_c}{\partial \varphi_\varepsilon} = \frac{10\text{v}}{180^\circ} \times \frac{180^\circ}{\pi \text{ rad}} = 3.2 \text{ V/rad}$$

Loop gain $= 3{,}2 \text{ V/rad} \times 89 \frac{\text{rad/sec}}{\text{volt}} = 282/\text{sec}$ (45 cps gain crossover)

total hold in range $= 10\text{V} \; \frac{750 \text{∿}}{53\text{v}} = 140 \text{∿}$

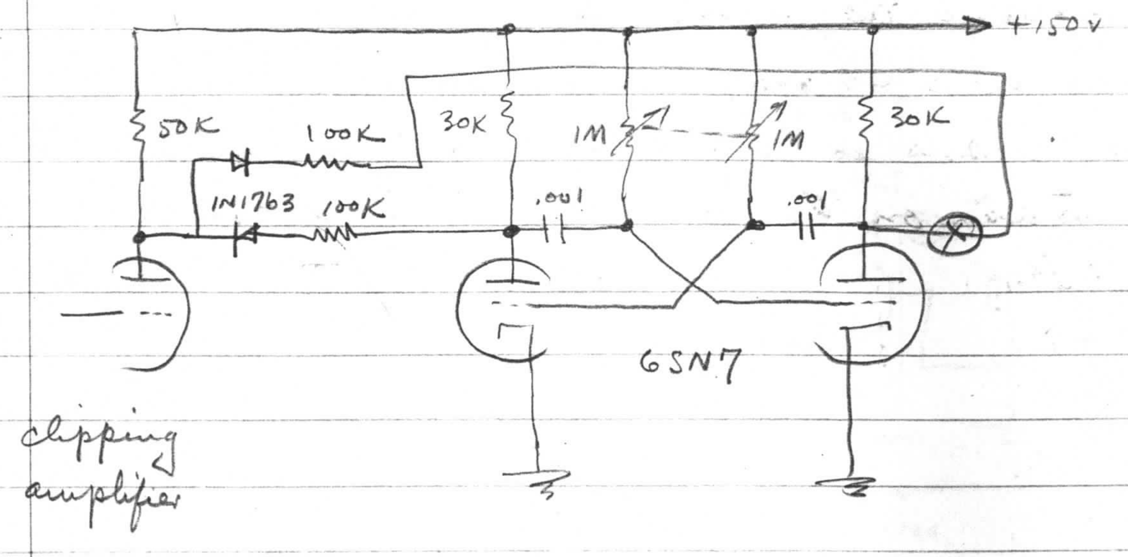


Hold-in range is too small to be useful.
If the 500Ω pot in the 6BN6 cathode is set to give center frequency operation of the MV without control signal and midrange of the control characteristic at with control, then the phase discriminator output is about 1 volt p-p.



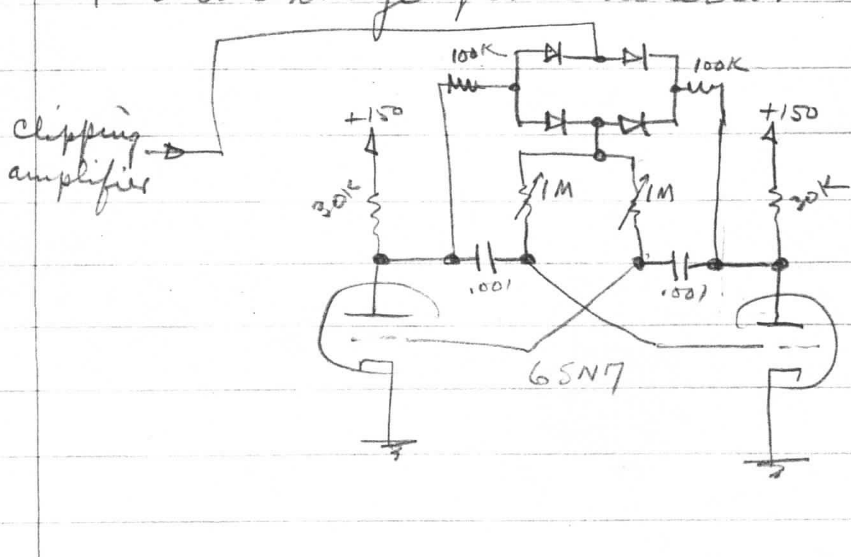
clipping amplifier changed to operation with +150V (see p 40)
Point (S) is set at 10V p-p video subcarrier to match Γ circuits of the video amplifier section.
(S) signal of 0.8V p-p saturates the output at 95V p-p output. The two triodes give a gain of about 120.

output tube develops 2V of grid bias with applied signal,
Cathode bias drops from 3.7v to 3.3V w/ " ".



MV syncs to 2400cps at 0.1v p-p at (5) with careful adjustment of 1M dual pot - Does not hold for long. at 0.2V locked at 9:30PM. unlocked 9:35

This was an outgrowth of trying to make a 4-diode bridge phase detector



It locked up solid and couldn't be shaken over half the rotation of the pot before I got the grid pots off +150v when I was trying to measure discriminator slope. All previous locking schemes (with 6BN6) had less than about 1/2 degree of rotation on the pot to completely unlock.

volts pp at (S)	f_{low}	f_{high}	with (X) connected f_{low}	f_{high}	no diodes one 100K	
0.2v	2400	2500				
0.3v	2400	2600	2400	2500		
0.4v	2400	2650				
0.5v	2400	2800			2300	2500
5.5v	2400	3700	2400	3600	2300	3800

These were with pot set to free run at 2400.

Apparently this scheme can only increase the frequency except for a minor capability with resistance coupling. This generally follows the rule for sync'd free running MV's. This also applies to the ÷4 and ÷5 stages, of course and is perhaps a rationale for a bistable MV countdown and a phase locked loop.

→ This scheme did not work as a phase locked loop — direct sync was far more effective than the loop and the discriminator stayed at max neg output corresponding to the inphase condition.